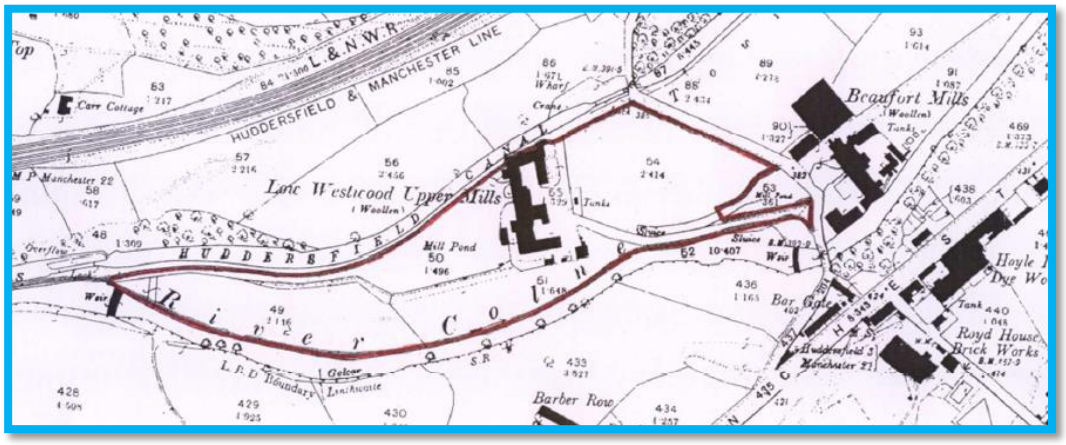
clive onions
consulting civil engineer

Westwood Wilson Ltd

Westwood Mill, Linthwaite, Kirklees, HD7 5RR

Flood Risk Assessment



Historic map supplied by Westwood Wilson Ltd

31st January 2020 V9

This report is based on the instructions given by our client. It is not intended for use by a third party, and no responsibility will be given to any third party.

The consultant has followed accepted procedure in providing the services, but given the residual risk associated with any prediction and the variability which can be experienced in flood conditions, the consultant takes no liability for and gives no warranty against actual flooding of any property (client's or third party) or the consequences of flooding in relation to the performance of the services.

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Appendices

(This report to be read in conjunction with all the issued drawings and surveys)

Report prepared by Clive Onions – BSc CEng FICE FCIWEM MIStructE MCIHT
Flood Modelling Report has been undertaken by Edenvale Young (EVY)

Version history

Version	Date	Prepared by	Comment
V3	11.01.16	CO	Updated following Flood Modelling Report completion
V6	30.06.16	CO	Updated following EA review of 20th May 2016 RA/134183
V7	05.09.16	CO	Minor amendments
V8	20.01.20	CO	Updated to suit latest flood data and Addendum
V9	27.01.20	CO	Minor amendments

Issue history

Version	Date	Issued to	Method
V3	11.01.16	Westwood Wilson Ltd, EVY	Email pdf
V6	30.06.16	EA, Kirklees, WWL, EVY	Ditto
V7	05.09.16	Westwood Wilson, Westwood, EVY	Ditto
V8	20.01.20	Ditto	Ditto
V9	27.01.20	Ditto	Ditto

1. Introduction

Westwood Wilson Ltd (WWL) is promoting the redevelopment of Westwood Mill, a Grade II* Listed building, and the surrounding land for residential purposes.

The Mill is now derelict and includes a disused large Mill Pond with other associated water features to manage the works and the water flows through the site for industrial purposes. The current Environment Agency (EA) Flood Risk Map for Planning shows the majority of the Mill site to be partly in Flood Zone 3 and Flood Zone 2, so at high and medium risk of flooding respectively.

The site has complex levels and walls which require careful and detailed consideration in a flood model, and a detailed topographic survey has been undertaken and used to inform a new site-specific flood model, based on information from the EA. A Flood Modelling Report was prepared by specialist flood modelling consultants, Edenvale Young, and this was submitted for pre-application consultations.

Since preparing our Flood Risk Assessment (FRA) in 2016, the EA has updated their flood model and provided the latest model in December 2019. Edenvale Young has prepared an Addendum based on the new information, which has informed this V8 of the FRA.

The development layout has also been revised since the 2016 FRA, and the new model has been analysed to inform the Addendum. The revised predicted flood levels for a variety of return periods (and climate change allowances) resulting from the slightly higher predicted flows have informed the safe building levels and safe access for the new layout.

This FRA should therefore be read in conjunction with the Flood Modelling Report dated January 2016 and the Addendum dated January 2020, which have been produced by Edenvale Young.

The Mill is of significant historical importance, and the Planning Authority and Conservationists wish to see it restored. Some years ago, planning permission was granted for a scheme to restore the Mill and incorporate new housing on the site.

This FRA has been prepared to accompany a new detailed planning application. The information in this report uses the output from the Addendum, which in turn relies on the Flood Modelling Report.

The Flood Modelling Report and FRA V5 have been reviewed by the Environment Agency which has made comments in their letter dated 20th May 2016 Ref: RA/2016/134183/02-L01. This FRA has been amended to respond to the Agency comments and to incorporate the more detailed information in the revised Flood Modelling Report. The key points are as follows:

- Flood Zones have been harmonised to show existing Flood Zones 1 and 2 (Section 6).
- The Council has accepted that the proposal passes the Sequential Test (Section 10).
- The Exception Test is described in Section 10.
- The FRADS proposes minimum floor levels 600mm above the modelled 1 in 1000 year level. These levels are well above the Agency recommendation for levels to be 600mm above 1 in 100 Colne and Holme model level, so at lower risk. (Flood Modelling Report Rev F).
- The 600mm thick historic wall will be inspected and restored to continue to act as a robust shallow defence. The management company set up for maintaining the common unadopted parts of the site will be responsible for maintenance. (Section 13).

- The wall has been given a height in the model based on the actual height and the extended wall, rather than glass-walled (see Flood Modelling Report Rev F).
- Kirklees Council has been consulted with regard to Flood Zone 3b (Section 6).
- Consultations are being held with the Environment Agency to seek agreement that the flood model is deemed 'Fit for Purpose'.
- We understand that works within 8m of the existing river will require an Environment Permit under the new Environmental Permitting Regulations.

Since the FRA was issued and the Modelling Report prepared, the Environment Agency has issued Climate Change Allowances for Planners (19th February 2016), and the Modelling Report and the FRA were adjusted to allow for the new climate change guidance.

And this FRA V8 incorporates the results of the Addendum, which relies on the December 2019 model data provided by the EA.

A separate Surface and Foul Water Drainage Report describes the management of the surface water drainage using SuDS techniques. It ~~and~~ shows that the foul drainage design will be separate and will remove surface water intrusion from the existing foul drainage system. The report is site-specific and responds to the checklist in the West Yorkshire Combined Authority SuDS Guidance.

2. Site Location and Setting

The site is located at Westwood Mill, Linthwaite, Huddersfield, HD7 5RR, and is in Kirklees Council.

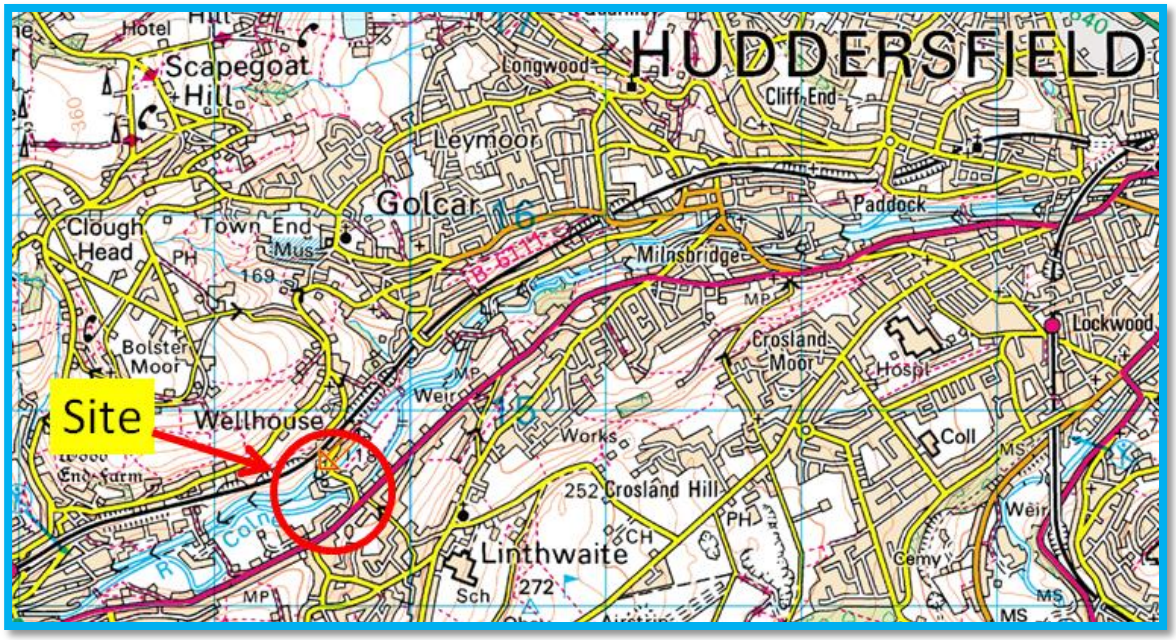

Fig 1 Site location (Streetmap).

The site is located approximately 5.2km southwest of the centre of Huddersfield in a steeply sided valley, which has a history of industry and contained many mills in the past, many of which have been renovated and are used for residential and other purposes. The valley is formed by the River Colne and also incorporates the Huddersfield Narrow Canal. The site is approximately triangular in shape, approx. 125m north-south and 535m east-west, with an area of about 6.5ha. It slopes from 118.5m AOD in the west to 115m AOD in the east, giving an average gradient of 1 in 150.

The site setting is as follows:

- Northwest of the site is the towpath and restored Huddersfield Narrow Canal, beyond which the land rises steeply comprising open space, woodland and fields, with a railway and main road crossing the slope.
- Northeast of the site is Low Westwood Lane, at a higher level than the Mill site, beyond which is a large renovated multi-storey Titanic Mills building containing residential flats and spa with associated parking. A prominent clear flat valley runs northeastwards into Huddersfield.
- Southeast of the site is the River Colne, in a well-defined channel formed with walls along the banks, with weirs at east and west ends of the Mill site. The land rises beyond the river through open storage type development into residential areas, intercepted by the Huddersfield Road. Works were being undertaken on the south side of the river during a site visit (28th October 2015).
- Southwest of the site is a large modern industrial development (pharmaceuticals) within the valley, beyond which are open fields and more commercial developments within the valley, increasing in density towards Slaithwaite.

The site can be described as a typical mill site within an important industrial valley reliant upon river and canal, where the character of land use is changing to support our modern society.

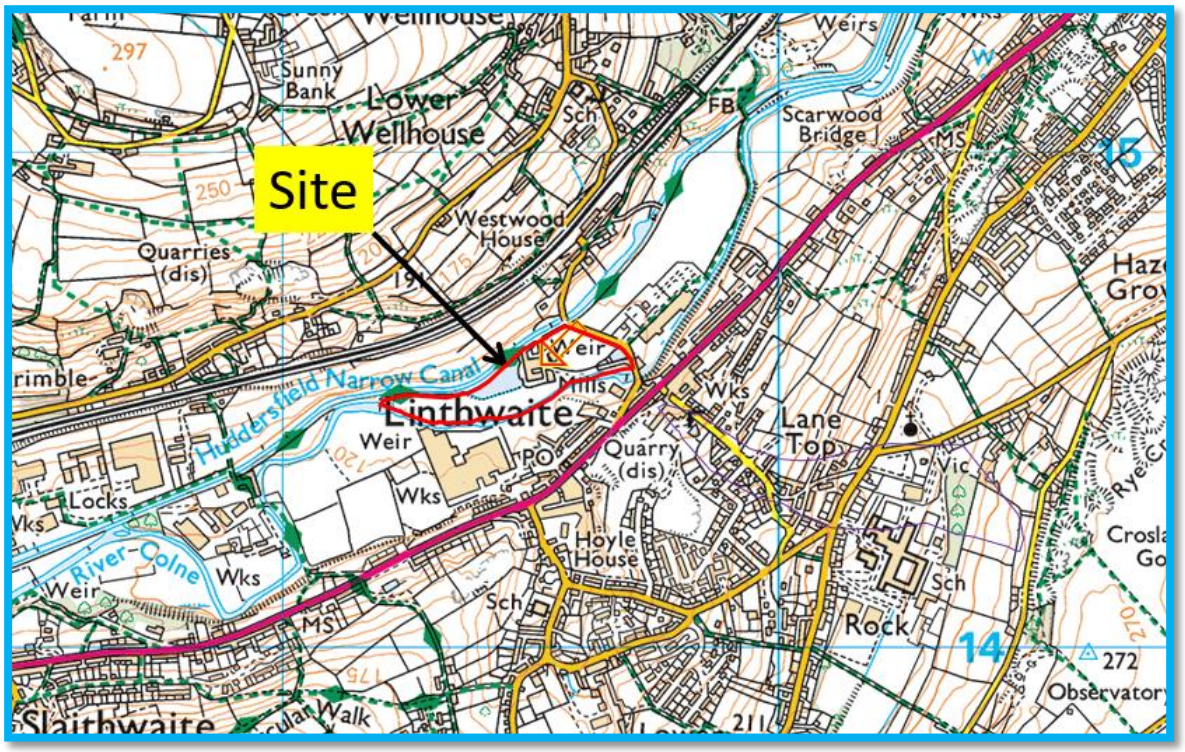

Fig 2 Site Location (Streetmap).

Fig 3 Satellite view of site highlighted in red, showing development along valley (Google Earth).

3. Existing Development and Ground Conditions

The existing development comprises a derelict Grade ll* Listed Mill building with associated buildings, ponds and water infrastructure and has developed and changed over the years – it is recorded as a significant building even on the 1854 Ordnance Survey maps. Its historical importance is due to the phased development over the years, which has led to a rare insight into the changing industrial architecture.

A weir on the River Colne at the west end of the site adjoins a narrow artificial Leat with sluice gates at its entrance. The Leat leads along the north of the site, adjacent to the Huddersfield Narrow Canal, opening into a large Mill Pond formed by earth banks, to the east of which are the main mill buildings. To the east of the mill is a large open area up to Low Westwood Lane, which is slightly raised above the site, and separated by a boundary dry-stone wall, which has doorway openings and is partly collapsed.

The Mill Pond has outlet sluices serving large walkable culverts which pass under the building and to the southeast. An open channel leads to a more modern settling pond system with concrete walls and baffles, and discharges into the River Colne below another weir, which is just upstream of Bargate Bridge.

The main Mill Pond and artificial Leat is overgrown and dry, and the remaining land forming the western part of the site is open space with scrub, Japanese Knot Weed, Himalayan Balsam, etc.

Low Westwood Lane and the track which accesses the site are at a slightly raised level compared to the eastern part of the site.

The boundaries of the site are formed by the Huddersfield Narrow Canal to the north, with clearly defined well–maintained towpath, Low Westwood Lane to the east and the River Colne to the south in a partly tree lined corridor. The site comes to a point in the west.

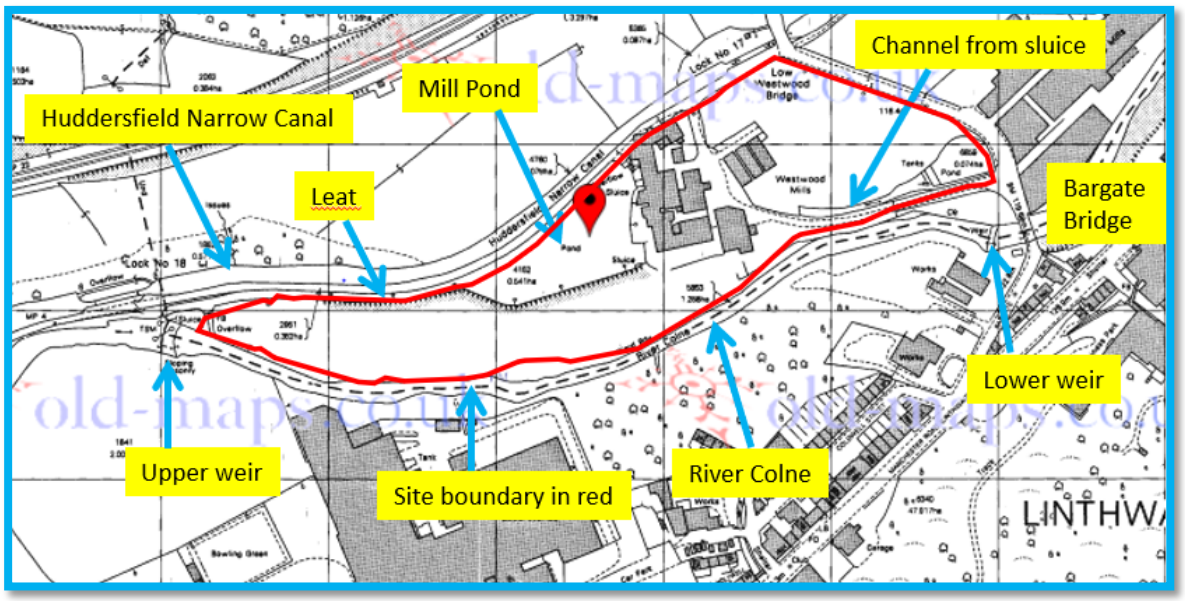

Fig 4 Key site features based on Old-Maps.co.uk dated 1992. The southern boundary is in reality the centreline of the river.

The British Geological Survey Viewer describes the soil as Alluvium, comprising clay, silt, sand and gravel. The ground is therefore likely to provide low permeability, but there might be localised areas suitable for infiltration. Groundwater level is likely to be related to the long term water level in the river.

Fig 5 Satellite view of site within red outline. Note extent of buildings. The boundary line is taken from the OS map base, but in reality, the boundary is the centreline of the River Colne, along the length of the site (GoogleEarth).

Fig 6 Satellite view with greater detail of buildings, and dry Mill Pond to west. (Google Earth).

4. Proposed Development

The proposed residential development includes the restoration of the Grade II* Listed Westwood Mill buildings and associated boundary walls which form part of the historic works. The proposal also includes blocks of new terraced housing laid out in a sympathetic form to maximise the virtues of the site; the layout has been informally agreed by Historic England/Kirklees Council.

An inherent part of the proposal is to retain the artificial Leat and Mill Pond. The Leat, Mill Pond and associated culverts will be cleared, inspected and maintained to ensure their safe operation for the lifetime of the development. The internal slopes of the Mill Pond will be slackened for safety to a slope of 1 in 3 or 1 in 4 by adding fill to the internal slopes and depths generally of 1.2m. These are important steps to reduce the risk to public and liabilities to the occupiers of the site and Management Company (see later).

No water flows through the Leat at present; it is blocked with debris and through neglect. The sluices which allow the flow from the river into the artificial Leat will be restored, and a 'sweetening' flow allowed to pass through to maintain water quality in the Mill Pond. The top water level of the Mill Pond will be reduced from 18.6m AOD to about 17.5m AOD, and the pond reduced in volume by slackening the sides. The controlled outlet from the pond will utilise the existing outlet in the southeast corner, which discharges into the River Colne. The culverts under the Mill buildings, where the turbines operated, will be inspected and restored, but not used for primary water flows. The treatment of the culverts will be managed by the Structural Engineers for the Mill.

The wall along the southern boundary of the Mill will be restored to continue as it formed part of the historic Mill buildings.

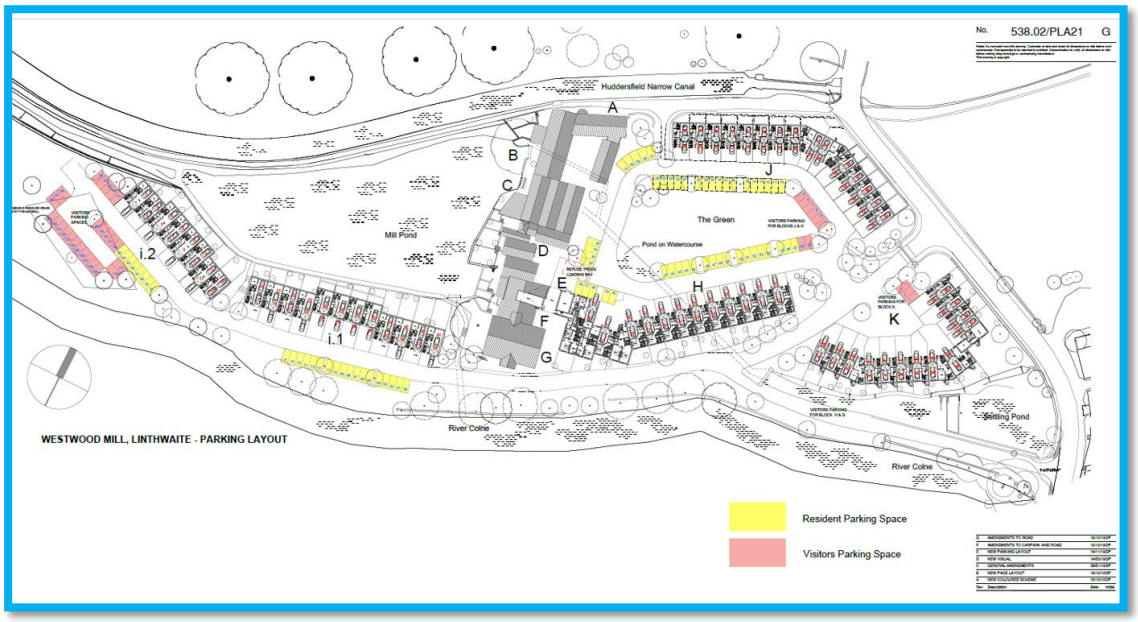

Fig 7 Proposed layout showing reuse of mill building, with terraces of new houses to the east and west. Note that most buildings tend to have car garaging at ground level, although some buildings in the east (which are safely above predicted flood levels), include habitable space at ground level.

The proposed residential development has involved consultations with Historic England/Kirklees Conservation who have informally agreed to the layout.

5. Existing Hydrology

The site is located on the north bank of the River Colne. The River Colne is Main River in this area, and drains an area extending from Close Moor about 9km to the west.

The Environment Agency (EA) has provided their December 2019 flood model to Edenvale Young, and Edenvale Young have applied the site topographic survey and river cross-sections to produce site specific flood level information. The information is presented in their Addendum Rev C, issued separately.

The flood risk is likely to occur following prolonged heavy rain in the upland valley and would tend to flood quickly if there is heavy rain over a wet catchment.

In terms of historical records, there is no evidence of the site having flooded, and in discussions with local people and those who worked at the site, no one can recall the site ever being flooded.

A detailed topographic survey was undertaken of the site, prepared by Land Survey Consultants, dated December 1999. This shows the key features and levels of the site (See Appendix 1).

It is clear from the site-specific data that the EA Flood Map for Planning is not site-specific (acknowledged by the EA), and that is the whole reason for preparing site-specific modelling and a site-specific FRA to comply with the requirements of the NPPF. This site-specific FRA, based on the Addendum, properly reflects the Mill Pond, Mill and other raised features on the site, when compared with the observations from a site inspection and the topographic site survey and sections.

The December 2019 Flood Model has therefore been obtained from the EA. A digital terrain survey, with sections along the river, has been incorporated into the model. This has been tied into the Lidar survey which extends outside the site area and extent of the terrestrial survey. The hydrology has also been reviewed.

The River Colne in this location gathers flows from a number of tributaries in the area, which all affect the flooding characteristics on the site, and these have been incorporated into the wider EA model.

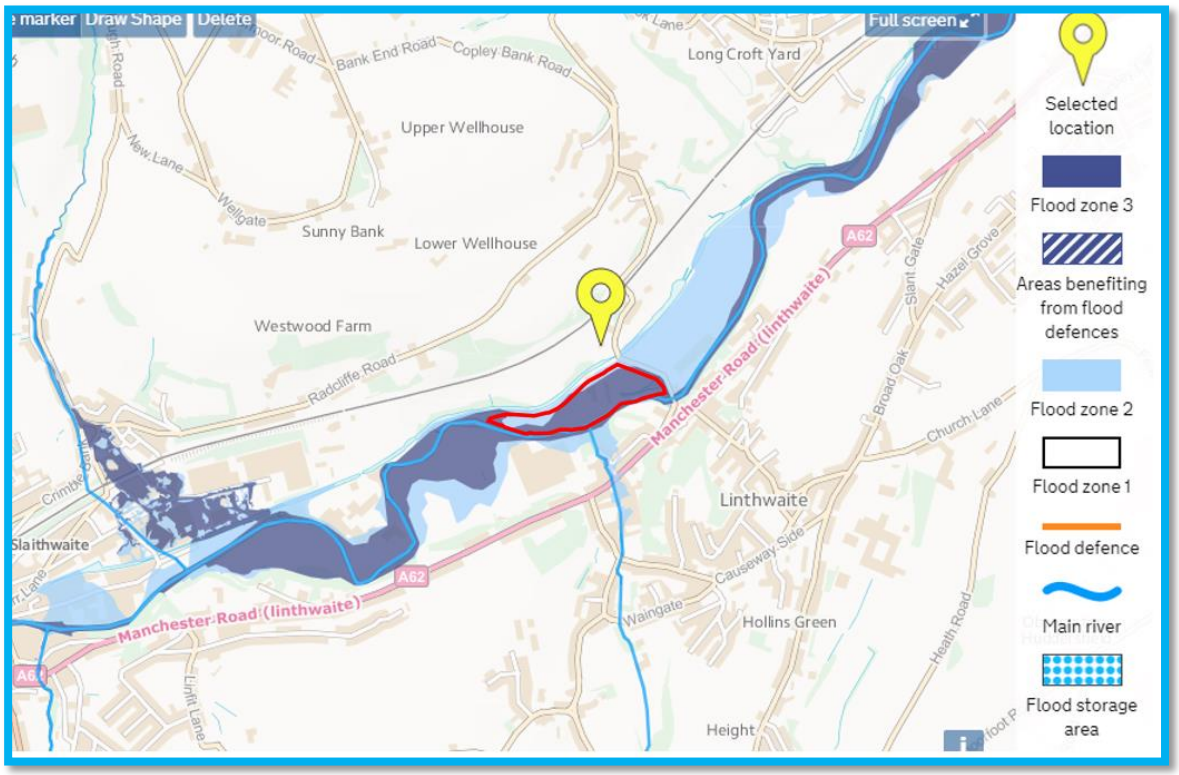

Fig 8 Flood Risk Map for Planning showing the site in the context of the general extent of flood risk along the valley.

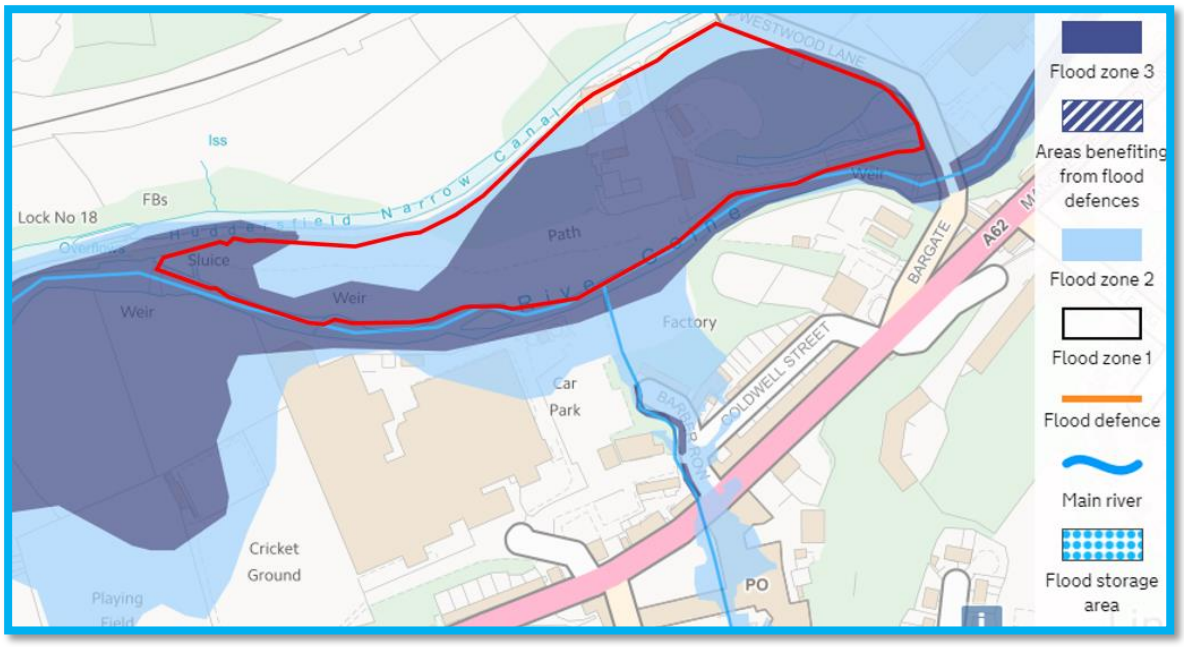

Fig 9 Expanded view of EA Flood Map for Planning with the site highlighted in red. It can be seen that Low Westwood Lane, to the east of the site appears to form a noticeable significant barrier to flow, although it is only 400mm higher than the site in places according to the detailed topographic survey. This situation has been analysed in the new flood model.

6. Results of New Flood Model

The new Edenvale Young Flood Model has revealed that the River Colne does not overtop the entrance to the artificial Mill Leat, nor does it overtop the banks to the Mill Pond, which confirms informed observation on site. The normal entrance to the Leat appears to be silted up and blocked, and whilst the brackets remain for the sluices, the sluices appear to have fallen off.

Fig 10 Stone structure with slot for sluices, showing brackets.

The river flow does not enter the artificial Leat or Mill Pond, and the Mill Pond appears dry with no evidence of receiving water since it fell into disuse.

Fig 11 View within Mill Pond.

The mechanism of extreme flows is that water does flow out of bank of the River Colne through the site, but is forced back into the river by rising ground and the presence of a weir prior to Bargate Bridge, which draws the water down.

The new Climate Change Allowances for Planners has been considered, and for residential development (more vulnerable) in Flood Zone 3a in the Humber catchment Higher and Upper end allowances should be considered, which in this case are +30% and +50% additional flow (referred to as 30%CC and 50%CC in this report).

The effect of the site features can be seen in the 1 in 100 + 50%CC flood map below. The blue triangle in the east is the lower settlement mill pond and channel.

The following images are copied from the Edenvale Young Addendum and provide images of the flood extent for a range of flood events. Note that the blocked Leat results in the Leat and Mill Pond excluding water in the ‘existing’ scenario.

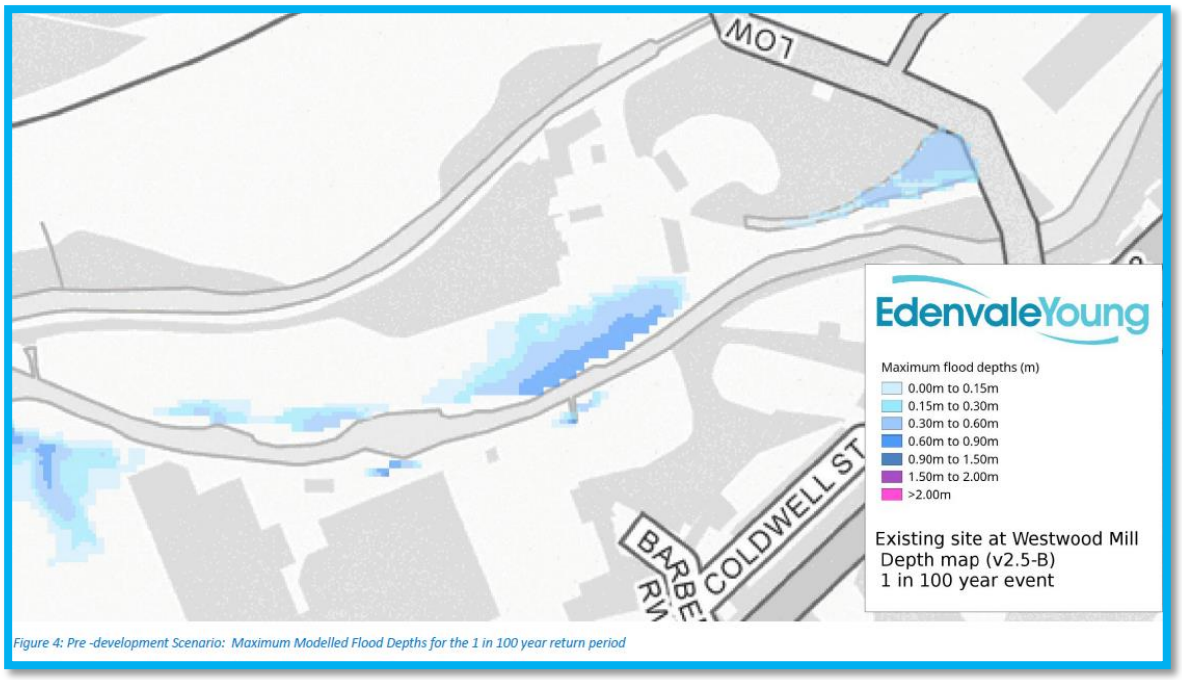

Fig 12 Extent of current day 1 in 100 year flood map by Edenvale Young (equivalent to Flood Zone 3a).

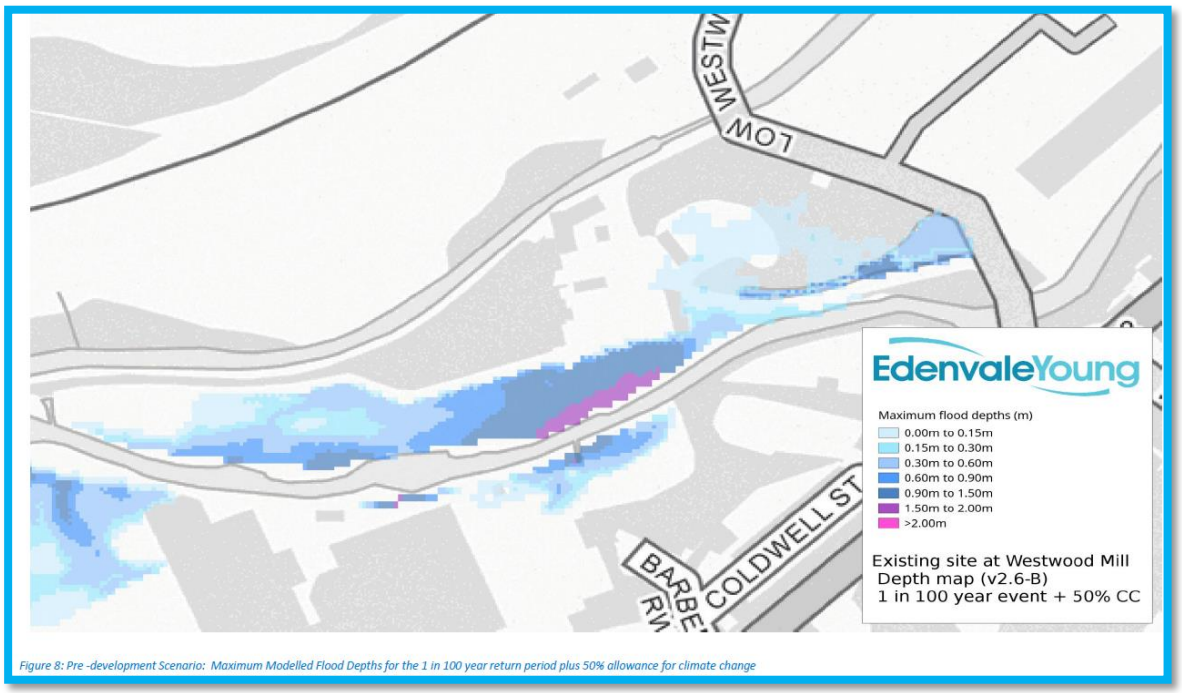

Fig 13 Extent of 1 in 100 + 50% CC floodplain produced by Edenvale Young.

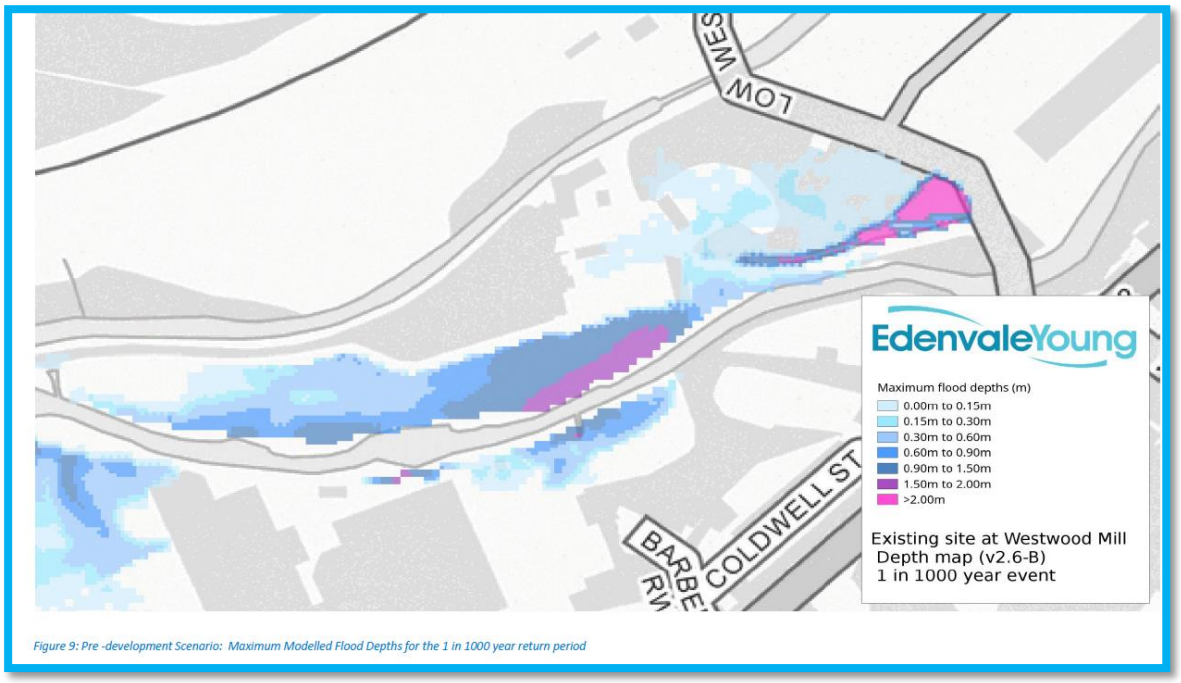

Fig 14 Extent of 1 in 1000 year flood map produced by Edenvale Young, with spot levels of water at key locations (equivalent to Flood Zone 2). These have informed the proposed building floor levels. Note this event is slightly more extreme than the 1 in 100 + 50%CC event, and the levels are consequently higher.

The Environment Agency has considered the DRAFT Flood Risk Assessment through a pre-application process, and has recommended that floor levels are located 600mm above the Agency's 1 in 100 year flood levels or 300mm above the 1 in 100 year +30%CC.

As the site slopes from west to east the levels related to Ordnance Datum vary. Edenvale Young have used the above criteria and their model to inform the design ground floor levels of the proposed buildings.

The land tends to rise away from the River Colne and up to the Mill Pond bank. The western Blocks I1 and I2 are built against the bank of the Mill Pond, with upper floor access onto the 'towpath' of the Mill Pond to add to the amenity of the development. The ground level is therefore raised approx. 300mm at the entrance (to avoid excavating at the foot of the bank) and used for parking. All habitable accommodation is located at first floor level. The habitable floor levels are therefore significantly above the highest predicted flood level.

The car parks will therefore be at very low risk of flooding, except for the seven easternmost properties, near the Mill building, which will be at increasing depth of flooding. The deepest flood has been calculated at 870mm in the 1 in 100 + CC30%. The construction techniques and utility entries will all be formed in water resilient construction and 'water entry'.

Fig 15 Image of Block I2 showing ground floor parking and access to the Mill Pond towpath at upper levels. All habitable accommodation will be on the upper levels.

Table 3| Proposed Ground Floor Levels to Block I (Non Residential Accommodation) 1 in 100 year return period with a 30 % climate change allowance (Figure 13 shows the reference points used)

Block	Maximum Water Level (m AOD)	Existing Ground Level (m AOD)	Proposed Ground Floor Level (m AOD)
I1	117.07	116.20 to 116.67	117.32 to 117.37
I2	117.35	117.03 to 117.14	117.52 to 117.65

Table 4| Proposed Finished Floor Levels to Block E to K (Residential Accommodation) 1 in 100 year return period with a 30 % and 50% climate change allowance

Block	1 in 100 + 30% CC (m AOD)	Minimum FFL Criteria 1 (m AOD)	1 in 100 + 50% CC (m AOD)	Minimum FFL Criteria 2 (m AOD)
E to H	116.88	117.18	117.15	117.15
K	113.30	113.60	114.60	114.60

Fig 16 Table of levels from Edenvale Young Addendum – the green figures are the recommended floor levels (worst case).

All habitable spaces (including the Mill) will therefore be above the criteria specified as safe and acceptable by the EA.

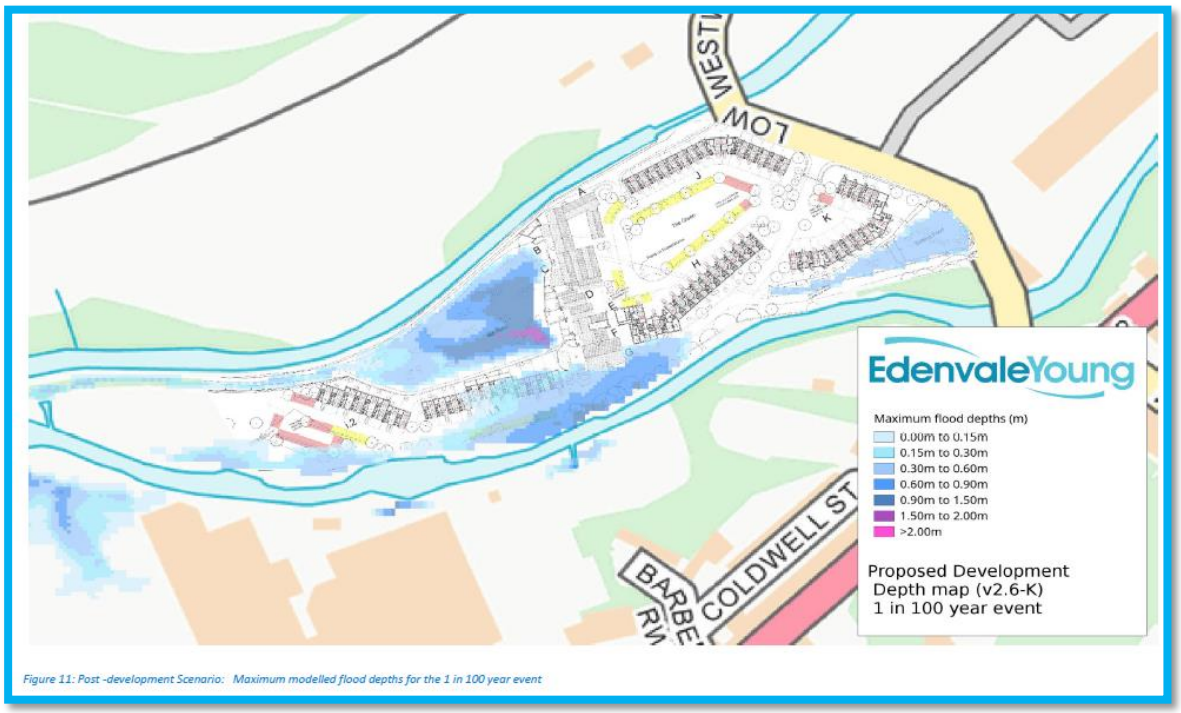

Fig 17 Predicted 1 in 100 year predicted flood level, based on new EA model data. Note that the pond is shown containing water because the Leat has been 'opened' for a sweetening flow in the model.

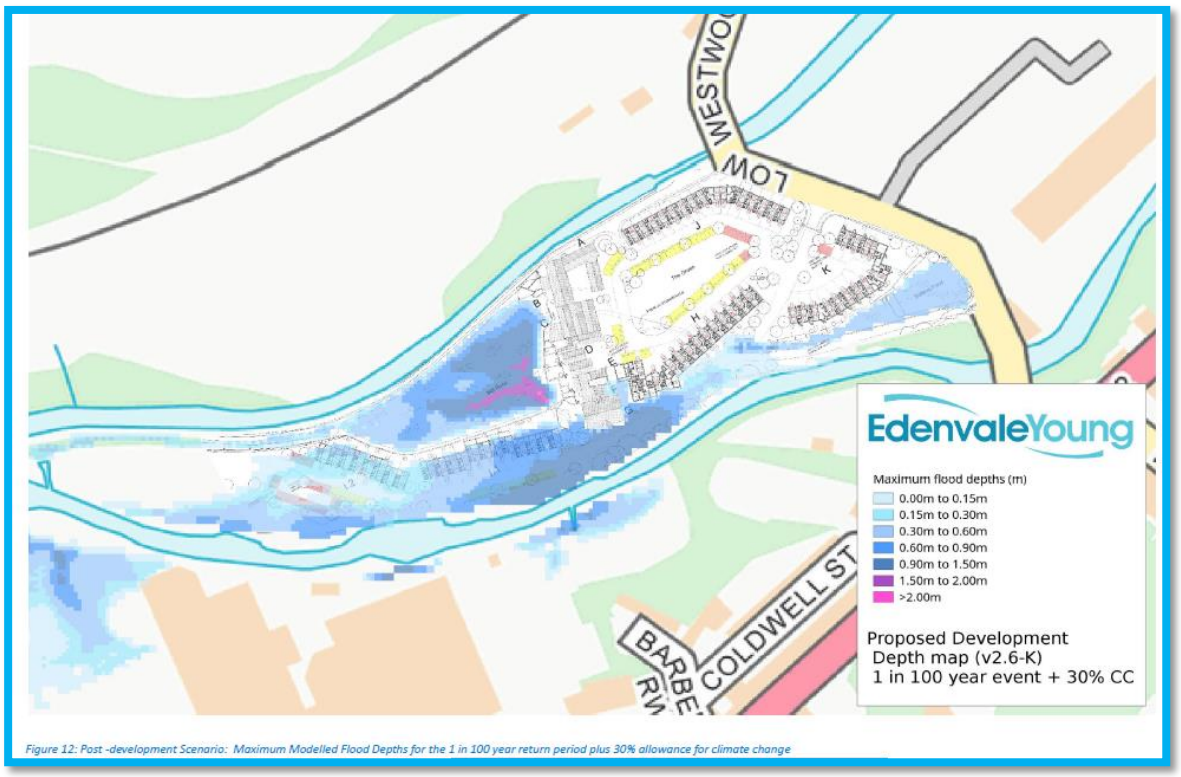

Fig 18 Predicted 1 in 100 year + 30%CC, showing The Mill and blocks to the east protected from flooding in this event.

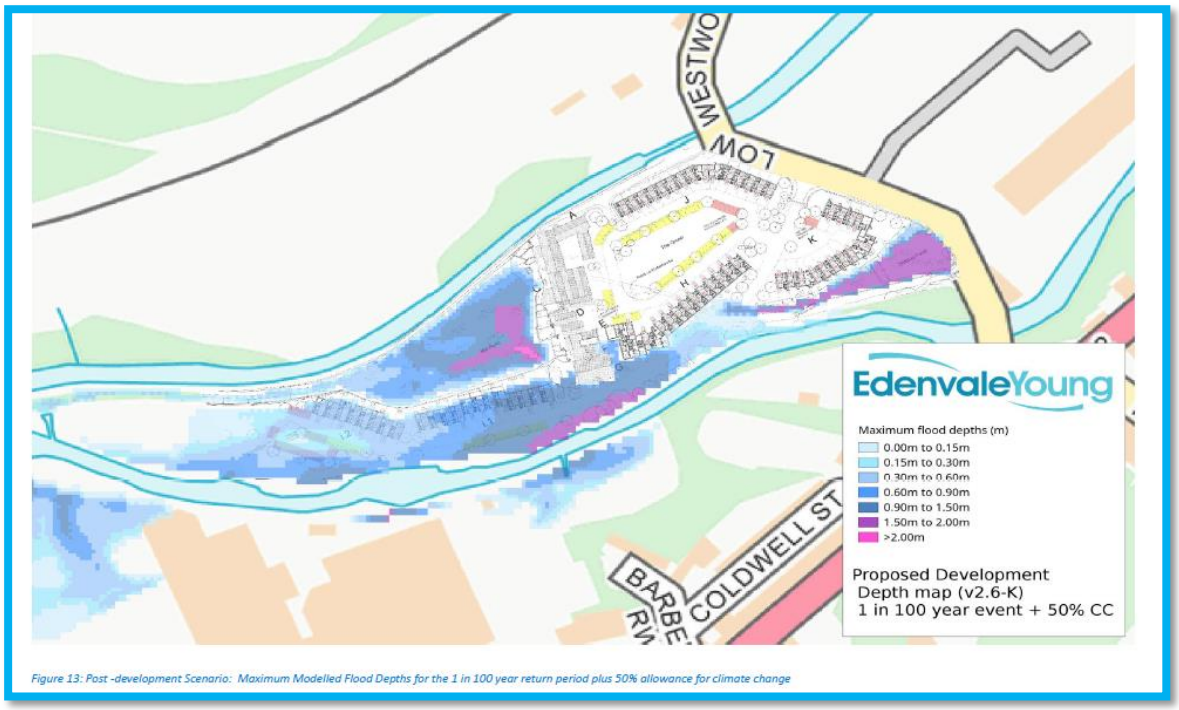

Fig 19 Predicted 1 in 100 year +50%CC showing Mill and blocks to the east safe from flooding, based on Edenvale Young's recommended floor level. The blocks south of The Mill Pond have all habitable accommodation at first floor level.

Consultations have been held with Kirklees Council and the EA with regard to the Flood Zones, who have confirmed that in this area Flood Zone 3b, functional floodplain, is based on the 1 in 25 year fluvial event (not the usual 1in 20 year predicted event elsewhere in the UK). The model has therefore been used to determine the Flood Zone 3b outline.

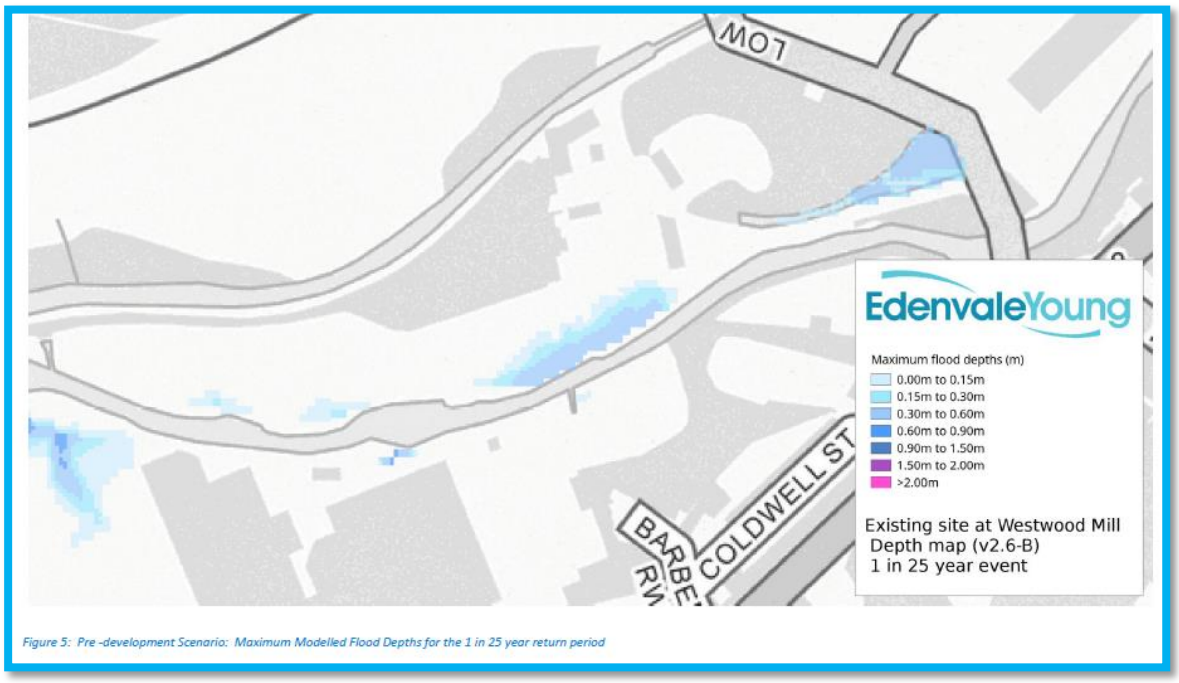

Fig 20 Areas flooded in 1 in 25 year event using Edenvale Young model, defined as the Flood Zone 3b areas by Kirklees Council.

The EA has been consulted on the status of the Flood Zone 3b area and the EA has responded as follows:

'*The 1 in 25 year outline used was from a broad scale model and it was recognised that this was indicative at a local level, but there are no EA maintained defences in this area, and as far as we are aware no permanent landform features that would prevent this area from flooding*.'

Edenvale Young has defined the area using the site-specific survey information, and this shows that part of the access road is shown to be within the existing Flood Zone 3b area.

The EA response goes on as follows:

'The main purpose of functional floodplain is to preserve land naturally for flood storage for the future. A robust assessment would need to be carried out for any proposal to the alter the functional floodplain to demonstrate where floodwater will be stored naturally, and that flood storage can be accommodated for up to a 1 in 100 year flood event where development is proposed. As a result of development it might be possible to improve the functional floodplain and make it more beneficial for reducing flood risk to others, so an alteration may be considered on this basis provided it is agreed by the LPA, though it is likely that a precautionary approach would be taken. As a result of development it might be possible to improve the functional floodplain and make it more beneficial for reducing flood risk to others, so an alteration may be considered on this basis provided it is agreed by the LPA, though it is likely that a precautionary approach would be taken.'

The proposal is to ensure that the access road and adjacent development is outside Flood Zone 3b, and to lower the bank of the River Colne to create a two-stage channel, providing a greater level of compensation than is required for the existing Flood Zone 3b and also adding to the amenity and biodiversity of the new channel area.

So, bearing in mind the above advice, detailed consideration has been made of the area shown to be in functional floodplain and affected by the 1 in 25 year flood area.

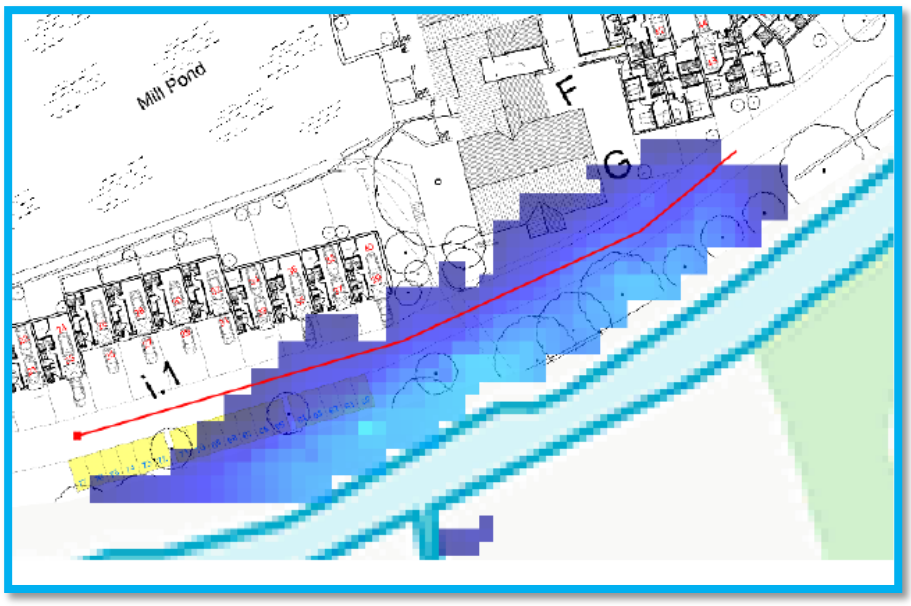

Fig 21 Edenvale Young's Fig 1 from their Addendum, showing current area vulnerable in predicted 1 in 25 year flood event.

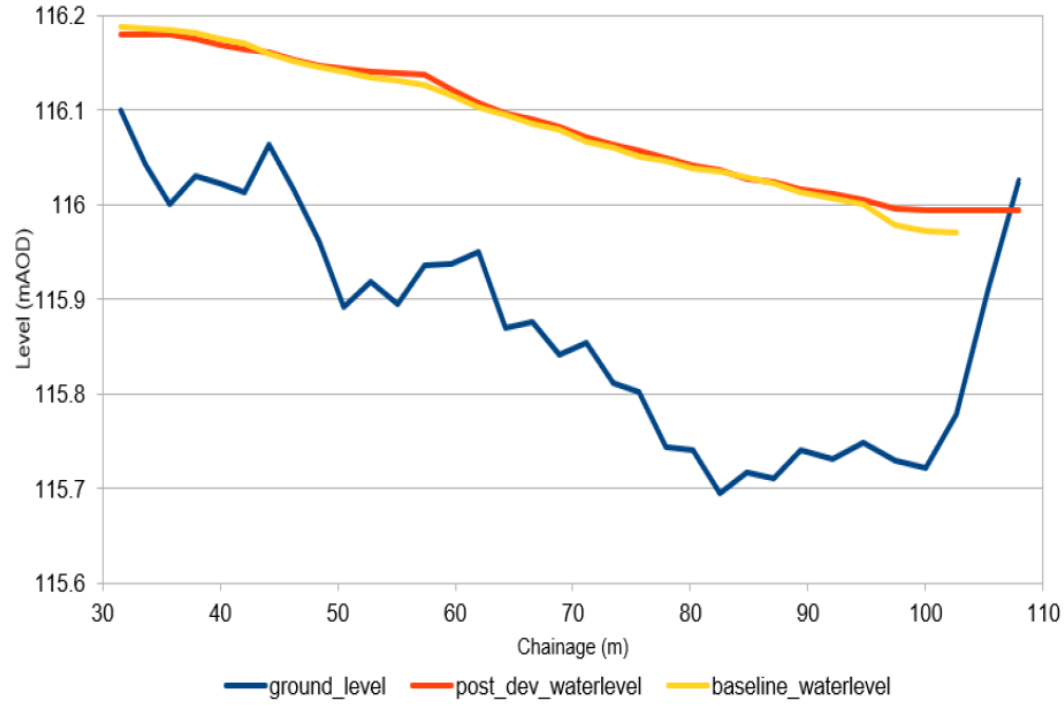

Figure 2: Ground and Maximum Water Levels on Long Section for a 1 in 25 Year Event

Fig 22 Section along red line in plan above, showing that the flood depths vary from about 100mm to 350mm.

Using their flood model Edenvale Young have calculated the volume of the proposed development within the functional floodplain area at 103m3.

It is noted that in this area the land has been protected alongside the river by construction of a modern concrete wall, highlighted on the topographic survey. It is proposed to remove this concrete wall and lower the ground level to match the top of the existing river wall, to form a 2-stage channel, taking the lead from the Environment Agency's guidance.

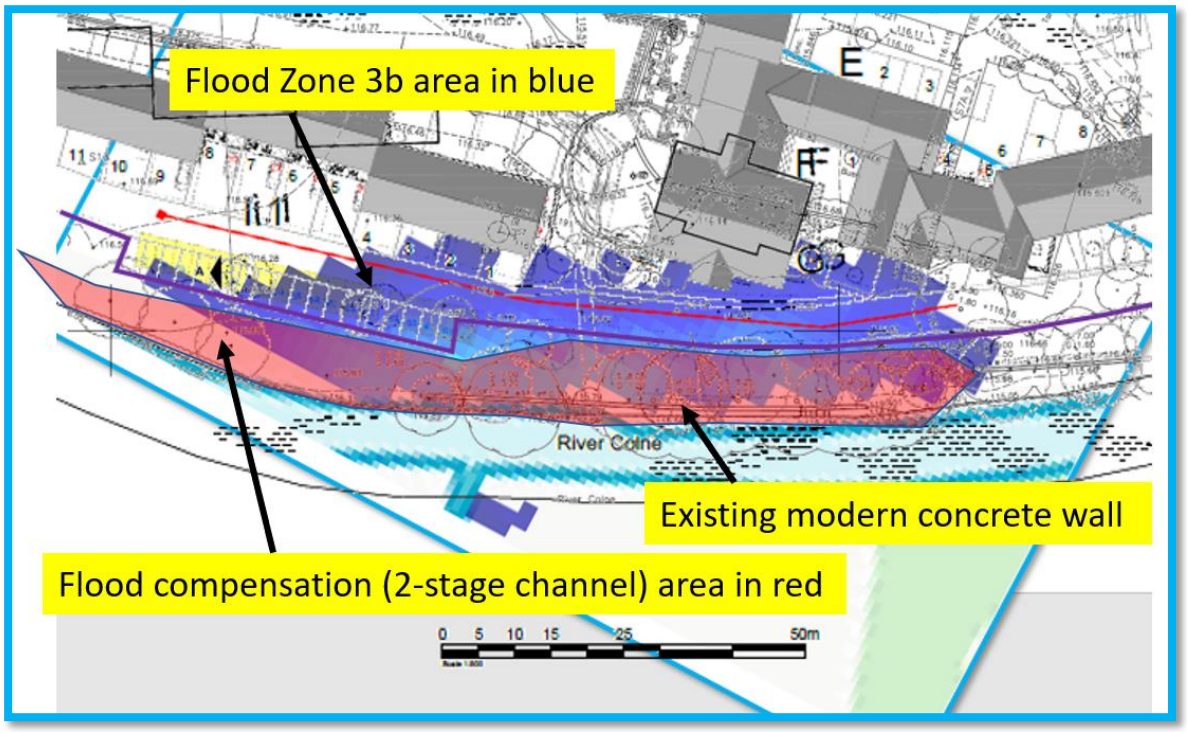

Fig 23 Overlay of Flood Zone 3b, over site layout and topographic survey. The purple line highlights the edge of the proposed road and parking.

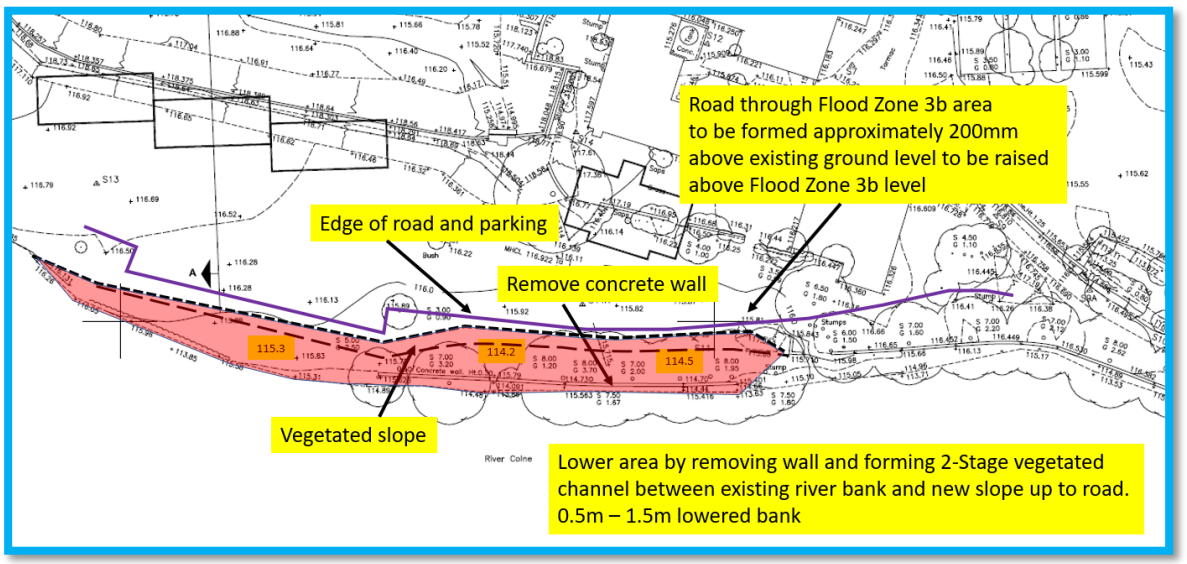

Fig 24 Edge of road in purple, and 2-stage channel area in red shading with levels shown. The levels will drop by up to 1.5m, significantly exceeding the predicted flood depths and volume over the road.

Based on the above assessment, the 2-stage channel provides about 300m3 compensation storage, adjacent to the river, with direct connection to the river. This is significantly more than the 103m3 calculated by Edenvale Young as the water over proposed development area and will become a logical and defined area of enhanced functional floodplain.

The development therefore provides the opportunity for removing a modern concrete wall, enhancing the amenity and allowing the road to be safely above the predicted 1 in 25 year flood level. The increased volume of Flood Zone 3b storage satisfies the EA's advised precautionary approach.

It is recognised that parts of the development infrastructure will be located in existing Flood Zones 2 and 3, and the above assessment shows that the development will be safe for the lifetime of the development and the proposal would need to pass the Sequential Test – this is discussed later.

7. Proposed Development Strategy Related to Flood Risk

The proposed development will involve the following characteristics in relation to flood risk:

- All habitable residential development will be outside Flood Zones 2 and 3 (ie in areas at less risk than 1 in 1000 year return period).
- All floors of new houses will be set a minimum of 600mm above the predicted 1 in 100 year flood level or 300mm above the 1 in 100 + 30%CC.
- The car garages for 7 properties will be vulnerable to flooding in the 1 in 100 +30%CC flood event.
- Floors in the Mill will be retained as existing, and according to the modelling will be at low risk of flooding in all predicted events.
- Private gardens might be within Flood Zones 2 and 3, but would not include significant obstructions; fences would be raised above ground level to allow water to flow through. Covenants will be incorporated in the sales details to ensure that serious obstructions to flow are prevented.
- The sluice at the entrance to the artificial Leat will be reinstated, and set such that it can be controlled, but the maximum possible flow will be restricted to 100 l/s, or as otherwise agreed, to maintain a sweetening flow through the Mill Pond.
- The sluices will be serviceable and closable to permit safe maintenance works to the Mill Pond and surrounds.
- The Mill Pond will be set at a normal top water level of approx. 117m AOD, but with a safe top water level and overflow level of approx. 117.5m AOD. The outlet level from the system will be approximately 117.5m AOD in a 1 in 1000 year event, thus retaining an hydraulic gradient. The levels will be finalised to suit a safe level associated with the buildings, depth of pond etc.
- The outlet from the Mill Pond will utilise the existing outlet in the southeast of the pond, which bypasses the Mill buildings and enters the lower Leat and is then conveyed to the river discharging downstream of the lower weir.
- The artificial Leats will be landscaped to create sinuous watercourses, with varied character and shallow weirs to add amenity to the area. The design will be developed in conjunction with the Ecologist and Landscape Architect.
- The historic walls which form the south of the Mill will be restored and reinstated to reflect what was there previously.

The walls along the artificial Leat, boundary with the canal and the Mill building are currently formed with a sloping batter to reduce their height and improve stability. The walls and batters will be inspected, and the soil slopes restored where necessary to improve the overall stability and reduce the risk of failure and the liability to the Management Company and occupiers.

Fig 25 Note gentle rise of land to low boundary wall with canal towpath. The bank will be retained, and normal water level will leave a vegetated soil sloping edge visible before the wall, for added biodiversity.

The Developer proposes to recreate a shallower Mill Pond within the site of the existing, and make this a key feature of the development, ensuring the banks are safe with shallow slopes and that it becomes an important habitat to support biodiverse ecology.

Artificial Leat

The artificial Leat is approximately 5 - 6m wide (varies), with a narrow flow bed formed by the slopes up to the dwarf edge walls. The site-side (southern bank) will be reduced in height to form a base for housing development, and the slope to the canal side (north) will be inspected and restored to ensure stability in the long term.

A walkway will be created along the southern edge of the artificial Leat and Mill Pond which will be formed in a permeable durable surface to give access and allow maintenance.

8. Flood Compensation

Appendix A of the Edenvale Young Modelling Report illustrates the Differences Maps for the 1 in 25 year, 1 in 100 year + 30%CC, 1 in 100 year +50%CC and 1 in 100 year events. They all show that off site flooding is not affected, except int eh 1in 100 year +50%CC event, which shows some

reduction and less than 25mm increase on the field to the south of the site, which is not significant and therefore acceptable.

It should be noted specifically that in the 1 in 25 year event, for which the 2-stage channel has been formed as advised by the EA, there is a significant reduction in the flooding characteristics in the area, reflecting the benefit of this 2-stage channel.

Fig 26 Differences Map showing positive effect of 2-stage channel in 1 in 25 year event (From Edenvale Addendum Appendix A)

It should be noted that all surface water runoff from the site (apart from parts of the existing Mill) returns to the river in the area between the weir and Bargate Bridge, preventing any potential changes to the flood outline upstream of Bargate Bridge.

9. Escape Routes

The design is arranged to provide a safe escape route from each property above the 1 in 100 +50CC%, which is a similar condition to the 1 in 1000 year event; both outputs are shown in the Addendum.

The analysis has shown that Low Westwood Lane (also called Lowest Wood Land)/Bargate) provides dry access to the site from the main highway network. The Mill building and all the proposed development to the west of the Mill building (ie all houses and parking) has dry access in all events up to and including the 1 in 1000 year event and 1 in 100 + 50%CC event by foot or by car.

The buildings to the west of the Mill will be served by the Huddersfield Narrow Canal towpath, and is a well-maintained walkway. The 'towpath' alongside the artificial Leat and Mill Pond, is shown to be well above the flood level and a safe dry route.

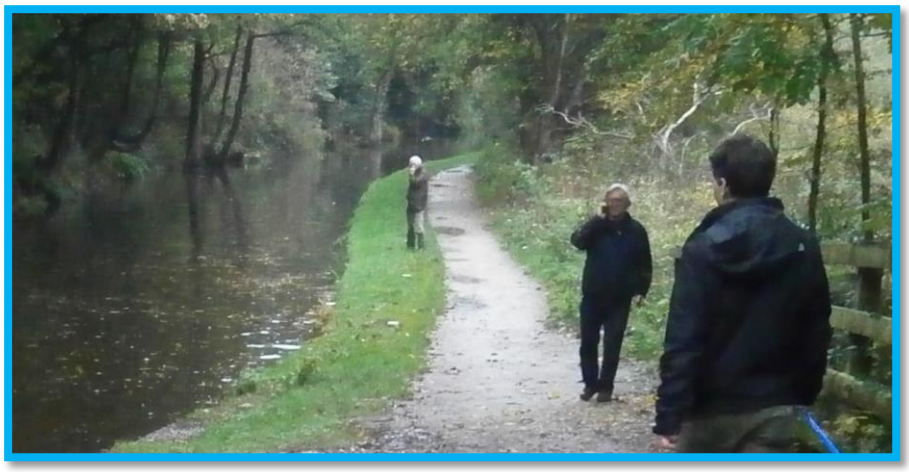

Fig 27 Canal towpath.

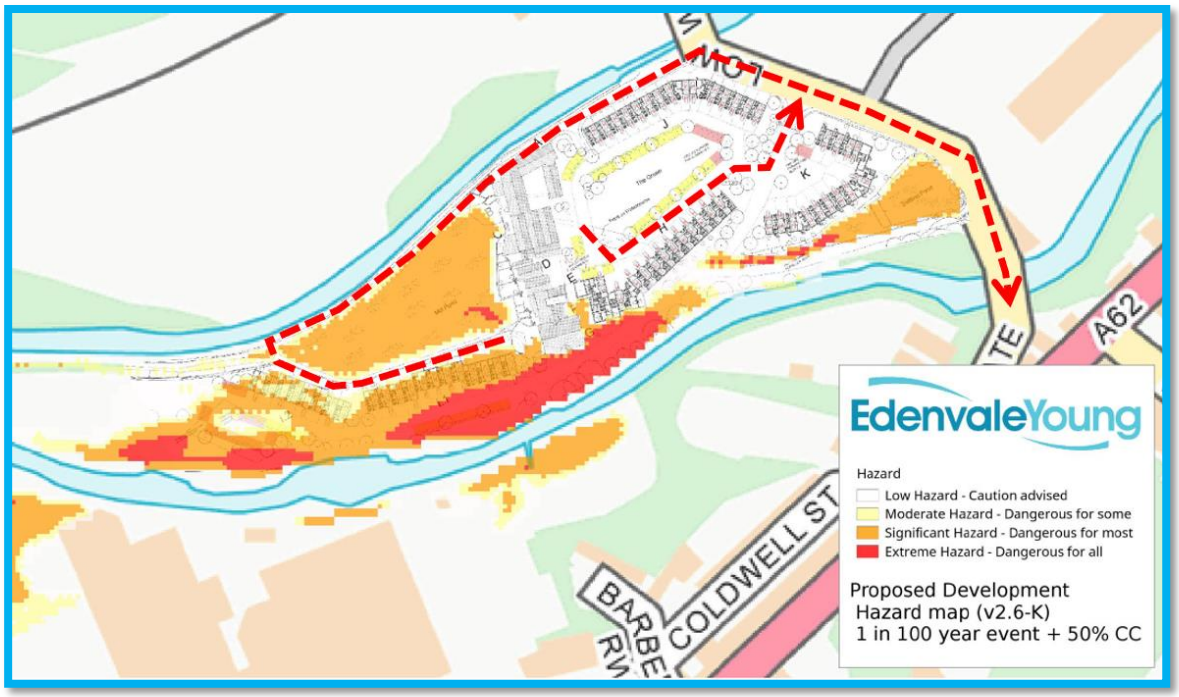

Fig 28 Flood escape routes superimposed on the 1 in 100 + CC50% flood map from Edenvale Young model. This shows the main Low Westwood Lane free from flood risk, giving dry access to the site. The main entrance to the site gives dry access to the car park, Mill building and all proposed residential development to the east of the Mill. Access to the west will be at high level along the Mill Pond embankment and canal towpath.

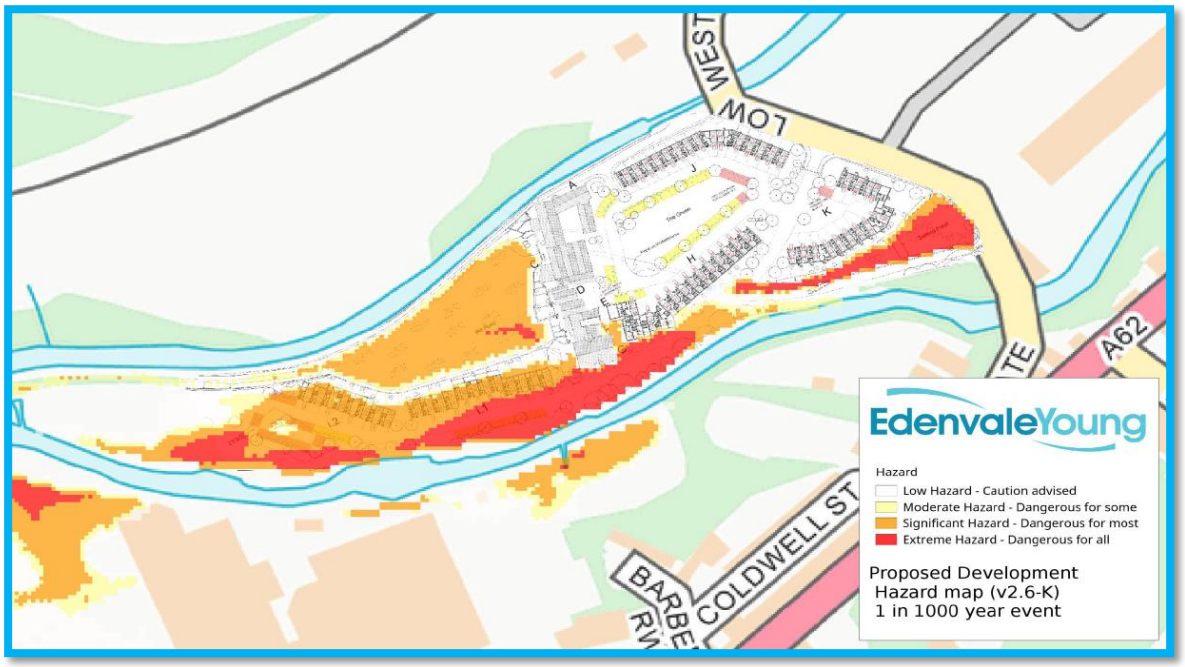

Fig 29 Hazard map for 1 in 1000 year event showing safe access to all property.

10. Sequential Test and Exception Test

The scale of development proposed is promoted as enabling development to facilitate the repair, refurbishment and reuse of the Grade II* Listed Mill.

Therefore in terms of the Sequential Test, the search area will be the boundary of the site itself.

It can therefore be seen that the proposal passes the Sequential Test; the Council has been consulted with regard to the Sequential Test and has agreed that the proposal passes the Sequential Test, and written confirmation is awaited.

Referring to Clause 102 of the National Planning Policy Framework (NPPF), the proposal also passes the Exception Test; the proposal clearly provides wider sustainability benefits by restoring a Grade ll* Listed Mill. The assessment above also shows that the use of the site will be safe for people and property during its lifetime, and will not increase flood risk elsewhere.

11. Surface Water Drainage

A separate Sustainable Drainage Report (V3) has been prepared by Clive Onions Ltd and describes the proposed drainage design using sustainable drainage techniques and complying with the West Yorkshire Combined Authority SuDS Guidance.

Fig 30 View of substantial River Colne bridge supporting Low Westwood Road (Bargate Bridge), downstream of weir.

12. Management and Maintenance

A Management Company will be established by the developer to maintain the common parts of the site.

The developer will prepare a maintenance programme for those areas which need attendance, including the landscaping, private shared roads, car parks, water features and those areas for which there are riparian responsibilities. The maintenance of the existing 600mm thick wall to the south of the Mill, which will be refurbished, will be included in the programme. The Management Company will also ensure that covenants related to restrictions to development in flood sensitive areas are observed. The Management Company will be set up to deliver the maintenance on behalf of the residents.

The maintenance schedule will include the maintenance of the Leats, Mill Pond, culverts etc, so that they operate safely and as intended for the lifetime of the development.

It is important that the sluices etc are inspected, tested and lubricated etc at least once per year, so that if they need to be operated in emergency, they can be relied upon.

Those areas which are not maintained by the residents or the Management Company will be offered for adoption by the utility or highway authority in the usual manner.

13. Policy

Flood Policy relates to the protection of people and property. The National Planning Policy Framework (NPPF) and its technical guidance the Planning Practice Guidance (PPG) give guidance on flood risk and steer development away from areas at risk of flooding.

- Kirklees Council has accepted that the proposal passes the Sequential Test, and written confirmation is awaited.
- This report shows that the Exception Test is passed.
- A detailed terrestrial topographic survey including channel sections has been undertaken and this has been inserted into the Environment Agency's Flood Model, and the hydrology reviewed.
- The new EA model from December 2019 has been used to inform the Addendum by Edenvale Young, upon which this FRA is based.
- The model and site-specific assessment shows that much less of the site is flooded in the 1 in 100 year + 50% and 1 in 1000 year events than is shown on the EA Flood Map for Planning.
- All new buildings are shown to be in safe locations.
- Using the results of the flood modelling, and assuming the EA will accept that the new model is 'fit for purpose', the Flood Zones 1, 2 and 3 areas will be re-defined.
- The floor levels of new residential development will be located 600mm minimum (subject to practicality) above the 1 in 1000 year flood level at their location, and as predicted by the model.
- The new buildings will also be more than 300mm above the 1 in 100 year + 30% climate change allowance as recommended by Kirklees Council.
- The ground floor of the Mill will be above the 1 in 1000 year flood level.
- The 1 in 25 year flood area has been assessed and significantly more compensation provided in accordance with EA guidance, forming a 2-stage channel.
- All property will have safe dry access at or above the 1 in 1000 year flood level onto and along the main highway network.
- All property will also have dry access in the 1 in 100 year + 50% climate change scenario.
- The site is not at risk from surface water flooding, according to the detailed topographic survey.
- A Flood Plan will be prepared prior to occupation to inform those on site not to enter floodwater and to highlight safe routes and procedures etc.
- The proposals will not displace flood water below the 1 in 100 year flood level (with CC50), nor will they divert flood water to cause added nuisance off site. Where possible more space will be provided for flood water below the 1 in 100 + CC50 event.
- Flood risk is made no worse off site as a result of the proposals.
- The site will incorporate enviable sustainable drainage features, with the artificial Leats and Mill Pond providing varied habitats and biodiversity.
- Subject to estate management and control, and appropriate regulations, the site will provide open amenity space for the residents, neighbours and visitors, and will serve as historical record of a working Mill. Information Boards will be installed at suitable points to inform visitors of the site's history and water management.

- The proposals will result in the management of existing Japanese Knotweed and Himalayan Balsam.
- It is recognised that development within 8m of a watercourse requires an Environment Permit. There are no raised structures proposed within this zone, and the access road and parking areas are outside this zone. The 2-stage channel will be within this zone, and appropriate consents will be obtained.
- The restoration of the entrance to the artificial Leat will be agreed with the EA, as this is within 8m, and the appropriate Environmental Permit obtained. The works constitutes maintenance of an existing feature and may be exempt under FRA9 of the Exempt Flood Risk Activities.

The overall proposal will therefore be safe for people and property for the lifetime of the development, does not increase nuisance flooding off site and brings significant benefits to the environment as described above. The proposal therefore satisfies the guidance given in the NPPF and passes the Exception Test.

14. Conclusions and Recommendations

Westwood Mill is a Grade II* Listed building and is identified as being at risk on the Historic England/Kirklees Conservation Buildings at Risk Register.

The scale of enabling development proposed has been justified as being necessary to bring forward the repair, refurbishment and reuse of the Mill for residential development.

Kirklees Council has advised that the development proposal passes the Sequential Test.

A detailed Planning Application is due to be submitted based on the above layout, and this Flood Risk Assessment and Drainage Strategy (FRADS) is prepared to accompany the application. The Mill restoration is in detail, the building locations in detail, and the remaining layout in outline.

The EA site-specific Flood Map for Planning has been considered, and does not reflect the detailed topography of the site.

A detailed terrestrial topographic survey has been undertaken which includes river sections and imported into the EA's flood model, and new outlines of Flood Zones prepared which show flood areas which are more appropriate to the modeller's experience and the features on the ground. A Flood Modelling Report has been prepared and will be submitted as part of the planning application.

The proposal shows that the majority of the infrastructure is outside the area at risk of flooding from a 1 in 1000 year event, and all dwellings and most parking has dry access from the public highway in a 1 in 1000 year event.

A separate foul and surface water drainage system will be introduced and offered for adoption as appropriate. The common site infrastructure, including informal defences, will be maintained by a Management Company.

This FRADS and the associated model work show that the proposed development is safe for people and property, passes the Exception Test and delivers a very high standard of Sustainable

Drainage (SUDS) and amenity. A separate Sustainable Drainage Report will be submitted to accompany the planning application.

This Assessment therefore complies with the guidance given in the NPPF and is appropriate for the Hybrid Planning Application proposed, and there are no reasons for refusal on grounds of drainage or flood risk.

Appendix 1 Topographic Survey