Flood Risk Assessment

St James School, Clitheroe
Proposed classroom block

Final Report

S03 - P02

1st September 2023

Prepared for:
Diocese of Blackburn

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THE CHURCH OF ENGLAND IN LANCASHIRE

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Prepared by	Peter Barber MEng
	Analyst
Reviewed by	Gavin Hodson BSc FdSc
	Chartered Senior Analyst
Authorised by	Mark Bentley BSc CEng CEnv FCIWEM C.WEM
	Project Director

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JBA Project Manager	Gavin Hodson
Address	1 Broughton Park, Old Lane North, Skipton, BD23 3FD
JBA Project Code	2023s0663

This report describes work commissioned by Sam Johnson, on behalf of the Diocese of Blackburn, by an instruction dated 15/05/2023. Gavin Hodson and Peter Barber of JBA Consulting carried out this work.

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Abbreviations

1D	One-Dimensional
2D	Two-Dimensional
AEP	Annual Exceedance Probability
CC	Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
DTM	Digital Terrain Model
EA	Environment Agency
FM	Flood Modeller
FMfP	Flood Map for Planning
FRA	Flood Risk Assessment
FZ	Flood Zone
HDBDY	High-Density Boundary
JBA	Jeremy Benn Associates
LiDAR	Light Detection and Ranging
mAOD	Metres Above Ordnance Datum
NGR	National Grid Reference
NPPF	National Planning Policy Framework
PPG	Planning Practice Guidance
QH	Flow-Head
ReFH	Revitalised Flood Hydrograph
TUFLOW	Two-Dimensional Unsteady FLOW model

1 Introduction

1.1 Overview

JBA (Jeremy Benn Associates) was commissioned by The Diocese of Blackburn to prepare a Flood Risk Assessment (FRA) for a proposed new classroom at St James School, Clitheroe. Hydraulic modelling of the Mearley Brook has been undertaken as part of the study.

1.2 Location

St. James School is situated off Greenacre Street in Clitheroe, Lancashire, with coordinates NGR: 374,152mE 441,315mN. The school site is bisected by Mearley Brook, with classrooms, playgrounds, and facilities on both sides of the Brook. Access across the brook is provided by a footbridge located within the school premises.

Mearley Brook is classified as a Main River and falls under the responsibility of the Environment Agency (EA). The watercourse runs along its entire length of the school grounds and is fed by Plimlico Brook, Worston Brook, Page Brook, and Shaw Brook. It eventually joins Pendleton Brook (NGR: 373703 440643) approximately 800m downstream from the school. The location plan is shown in Figure 1-1.

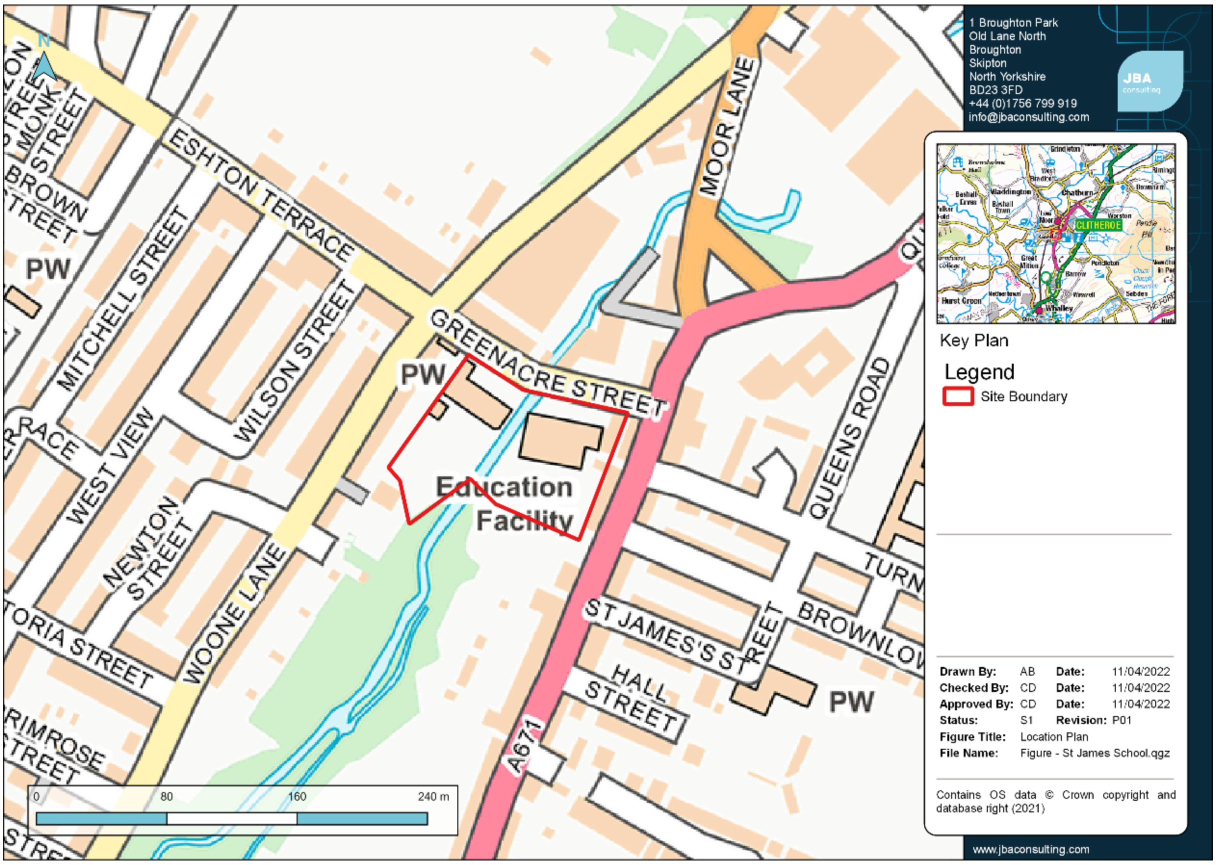

Figure 1-1: Location Plan

1.3 Proposed Development

The proposed new school building will be situated on the right bank adjacent to the existing playground (Appendix A). The building will be orientated parallel to the school boundary wall at Woone Lane, with foot and wheelchair access from the playground. The proposed school building will feature; four classrooms, 11 toilet cubicles, covered walkway to retained building (nursery) and a canopy. Access to the proposed school building will be via a staircase or ramp that connects to the playground.

The current land use at the location of the proposed new building is greenfield space/grass. The grass land is banked and raised above the playground and other nearby school buildings.

In addition to the construction work, the existing right bank school building along Greenacre Street is scheduled for demolition, see Figure 1-2.

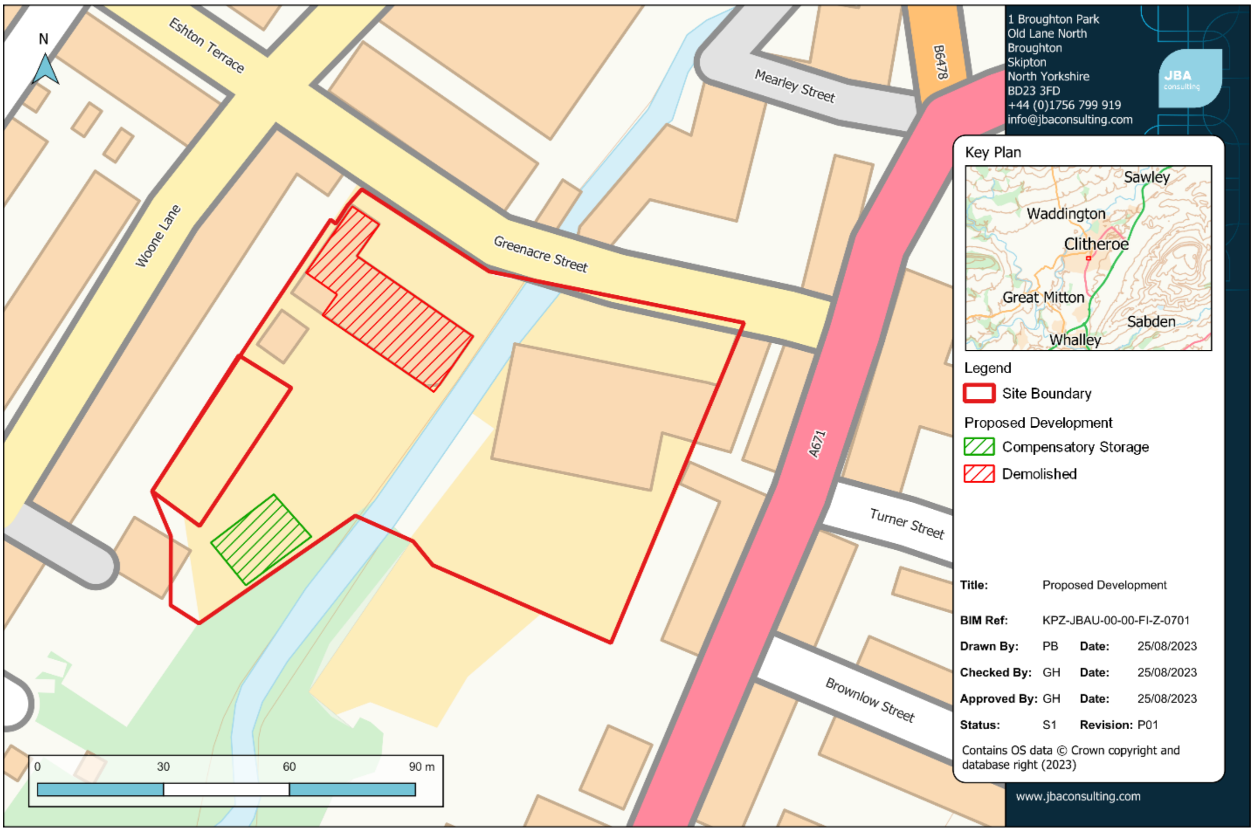

Figure 1-2: Proposed Development

1.4 Context

The proposed development is located within Flood Zone 2 (FZ2) and borders FZ3 along the north-east boundary, as indicated by the Environment Agency's Flood Map for Planning (FMfP). Flood Zone 2 is defined by the National Planning Policy Framework (NPPF) Planning Practice Guidance (PPG) as having a medium risk of flooding.

The flood extents shown in the FMfP have been generated using the EA Mearley Brook Model developed by JBA in 2016. However, since the development of this model, there have been improvements in the quality of available data, particularly the availability of new LiDAR data.

It is important to note that the FMfP provides a general indication of flood risk rather than a detailed representation at a site-specific scale. Therefore, the NPPF stipulates that applications for development in Flood Zones 2 or 3 according to the FMfP must be supported by a detailed Flood Risk Assessment (FRA).

To conduct a site-specific study of flooding at St. James School, a detailed modelling study was undertaken by JBA in 2022 as part of application NO/2021/113750/05-L01. This study revealed that certain aspects of the 2016 model no longer accurately represented the current local conditions at the site, and the model was therefore revised and updated for site-scale analysis in 2022. However, the modelling work conducted in 2022 was not approved for use by the EA. This FRA utilises the hydraulic modelling outputs from the site-specific 2022 study, as they best represent the flooding conditions at the site. The areas of concern raised by the Environment Agency (EA) do not relate to that part of the model in the vicinity of the school, but were located a considerable distance from the site and remained unchanged from the 2016 model. Therefore, areas of concern identified by the EA are still present in both data sets.

Since the previous application, the proposed development has been relocated from the left bank to the right bank. The previous application featured an L-shaped building situated entirely within Flood Zone 3 in the south-west corner of the left bank playground.

2 National Planning Policy Framework

2.1 Overview

the proposed development has been assessed in accordance with the NPPF. The assessment shows that:

- The school grounds are located within Flood Zones 2 and 3, and a small portion of the site lies within Flood Zone 1, according to the FMfP.
- All new development will principally take place within Flood Zone 2 according to the EA FMfP.
- For this site, the proposed building is categorised as 'More Vulnerable' in accordance with the NPPF (Annex 3) Flood Risk Vulnerability Classification.
- The site meets the criteria of the NPPF Sequential Test and no Exception Test is required with regard to flood risk.

2.2 Flood Zone Classifications

The majority of the development lies within Flood Zone 2 (see Figure 2-1) which represents the medium probability flood zone (land having between a 1% and 0.1% annual probability of river flooding. Further definition of the Flood Zones is included in 1.

NPPF Annex 3: Flood Risk Vulnerability classification, defines " *Non–residential uses for health services, nurseries and educational establishments* " as 'more vulnerable'. The development will mainly take place within Flood Zones 1 and 2 which would be acceptable according to NPPF PPG Table 2 'Flood risk vulnerability and flood zone 'incompatibility', reproduced as Table 2-2 below.

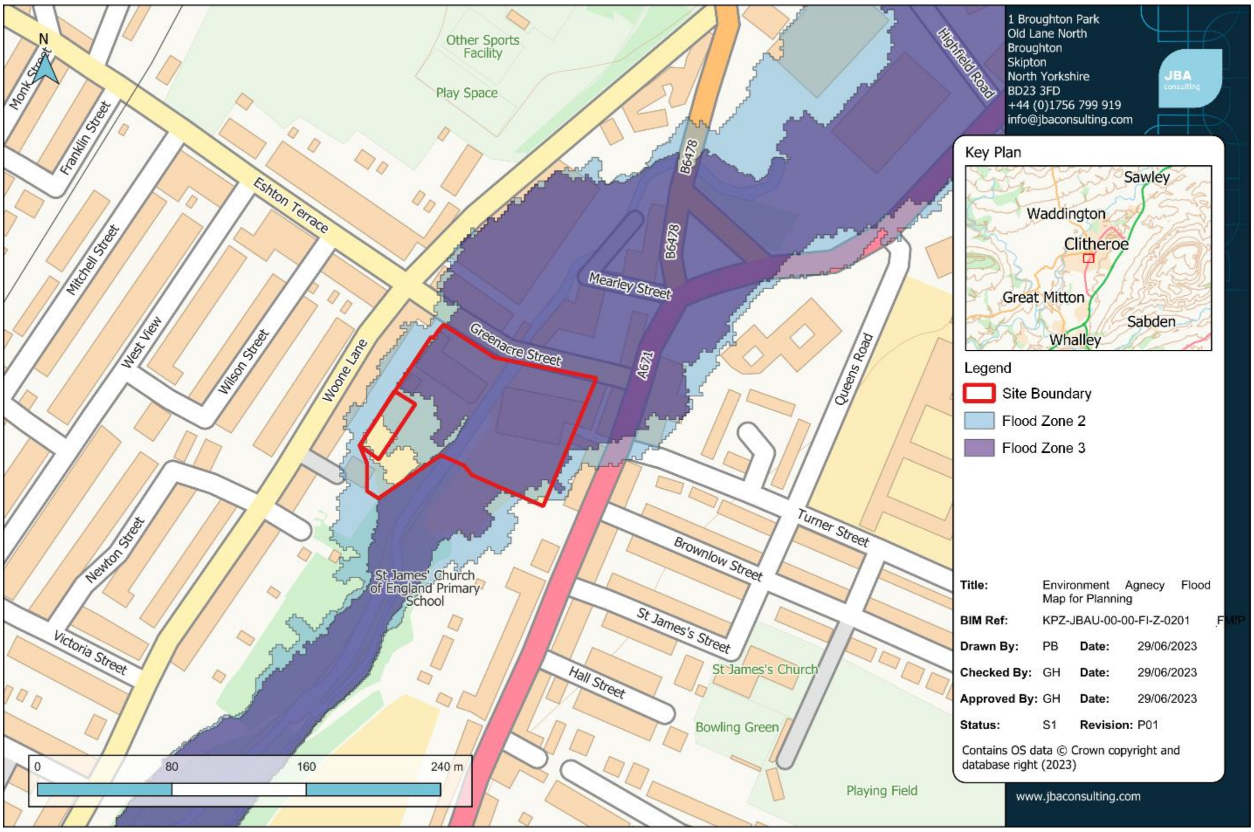

Figure 2-1: Environment Agency - Flood Map for Planning

Table 2-1: Flood Zone Classifications

Zone	Description
Zone 1 (Low Probability)	Land having a less than 0.1% annual probability of river or sea flooding (shown as 'clear; on the Flood Map - All land outside Zones 2 and 3)
Zone 2 (Medium Probability)	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding (land shown in light blue on the Flood Map)
Zone 3a (High Probability)	Land having a 1% or greater annual probability of river flooding or land having a 0.5% or great annual probability of sea flooding (land shown in dark blue on the Flood Map)

Zone	Description
Zone 3b (The Functional Floodplain)	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. Functional floodplain will normally comprise: • land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or • land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).

Table 2-2: Flood Risk Vulnerability and flood zone 'incompatibility'

Flood Zones	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	×	Exception Test required	✓	✓
Zone 3b	Exception Test required	×	×	×	✓
✓ Exception test is not required × Development should not be permitted					

2.3 Sequential Test

The Sequential Test is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk.. However, the NPPF PPG advises that '*… a pragmatic approach needs to be taken where proposals involve comparatively small extensions to existing premises (relative to their existing size), where it may be impractical to accommodate the additional space in an alternative location'*.

Initially, the development was planned to be constructed on the left bank. However, after conducting hydraulic/flood modelling work and reviewing the findings (which showed the left bank area to lie within FZ3), a sequential approach was adopted, resulting in the relocation of the development to the area of FZ2 on the right bank. Figure 2-2 illustrates the two proposed locations for the site.

The school can only construct new buildings within its school grounds, and it is not practical to consider alternative locations outside of the school grounds. The school is demolishing an old building, which lies within FZ3, and developing a new one in an area of FZ2 therefore, providing a betterment in terms of flood risk.

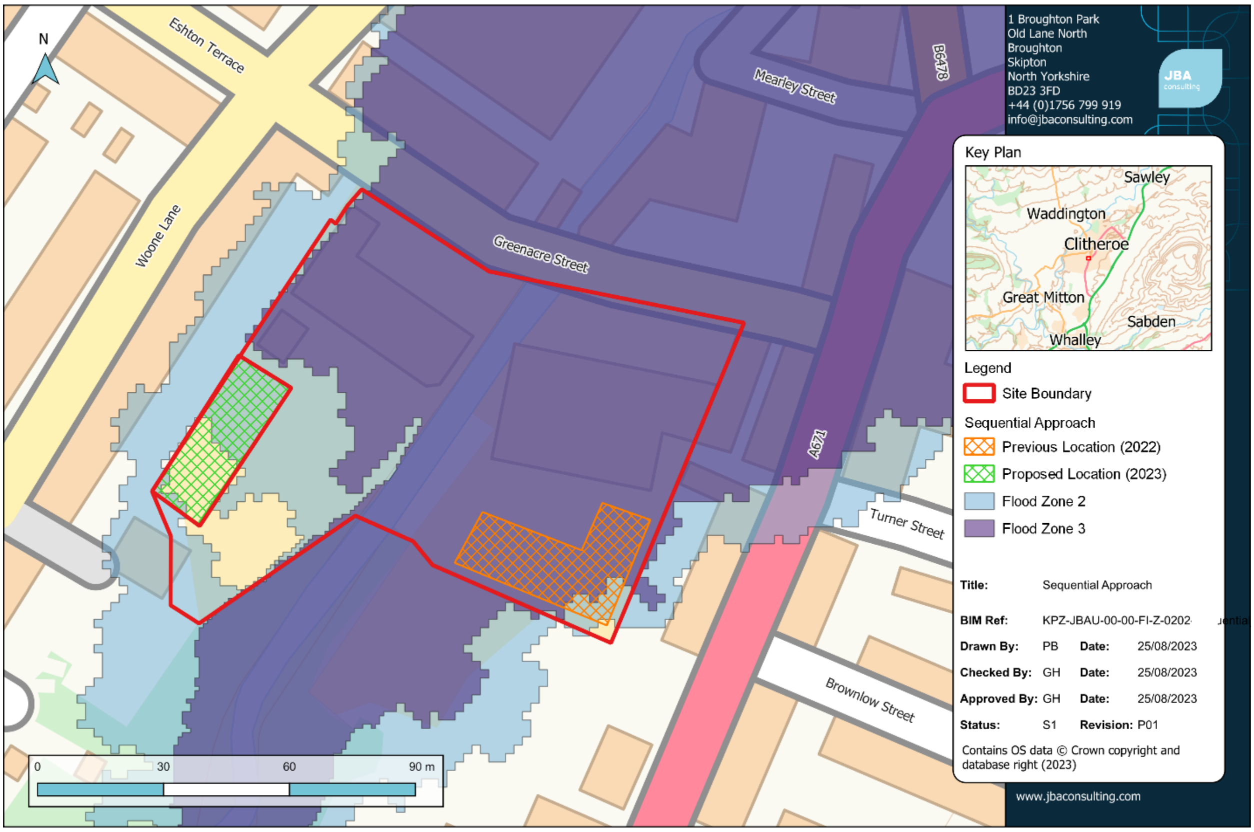

Figure 2-2: Sequential approach

2.4 Exception Test

Table 2-2 states the development is permissible in FZ2. Therefore, no exception test is required.

Following the sequential test the site has been situated in the lowest possible area of flood risk possible, after previous options were explored. The proposed classroom block can only be developed within the school grounds.

The classrooms provide a much-needed improvement on existing facilities. Through the delivery of the proposed classroom block this will enhance all the school and its facilities to provide a better setting for education.

2.5 Climate Change

To ensure compliance with the latest climate change guidance, it is important to adhere to the guidance at https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances.. As the site is located within the Ribble Management Catchment, the peak river flow allowances specified in Table 2-3 must be taken into consideration.

Table 2-3: Peak River Flow Allowances

Allowance category	Total potential change anticipated for ‘2020s’	Total potential change anticipated for ‘2050s’	Total potential change anticipated for ‘2080s’
Central	16%	23%	36%
Higher	19%	29%	46%
Upper	27%	44%	71%

3 Topographic Data Review

3.1 Overview

There are three topographic datasets that have been assessed as part of this study, see Table 3-1.

Table 3-1: Topographic Data Overview

Name	Year	Comment
Mearley1m.asc	Unknown (pre-2016)	LiDAR used in the original and 2022 Mearley Brook modelling study. Date of original data unknown but must precede 2016.
1m Composite	2018	Latest available LiDAR data from the DEFRA online portal.
10512-Proposed_Site_Plan	October 2021	Topographic Survey conducted by Cassidy and Ashton

3.2 Model LiDAR - 2016

The Mearley1m.asc LiDAR dataset used is a 1m resolution LiDAR obtained prior to 2016. Table 3-2 presents the key statistics derived from the model LiDAR, and Figure 3-1 depicts the LiDAR plan. The site is situated on an elevated grassland area, while the surrounding low-lying region corresponds to the playground hardstanding.

Table 3-2: Model LiDAR - Mearley 1m 2016 - Key Statistics

	Min (mAOD)	Max (mAOD)	Mean (mAOD)
Proposed Development	71.79	72.36	72.20
School Grounds	69.16	73.13	71.54

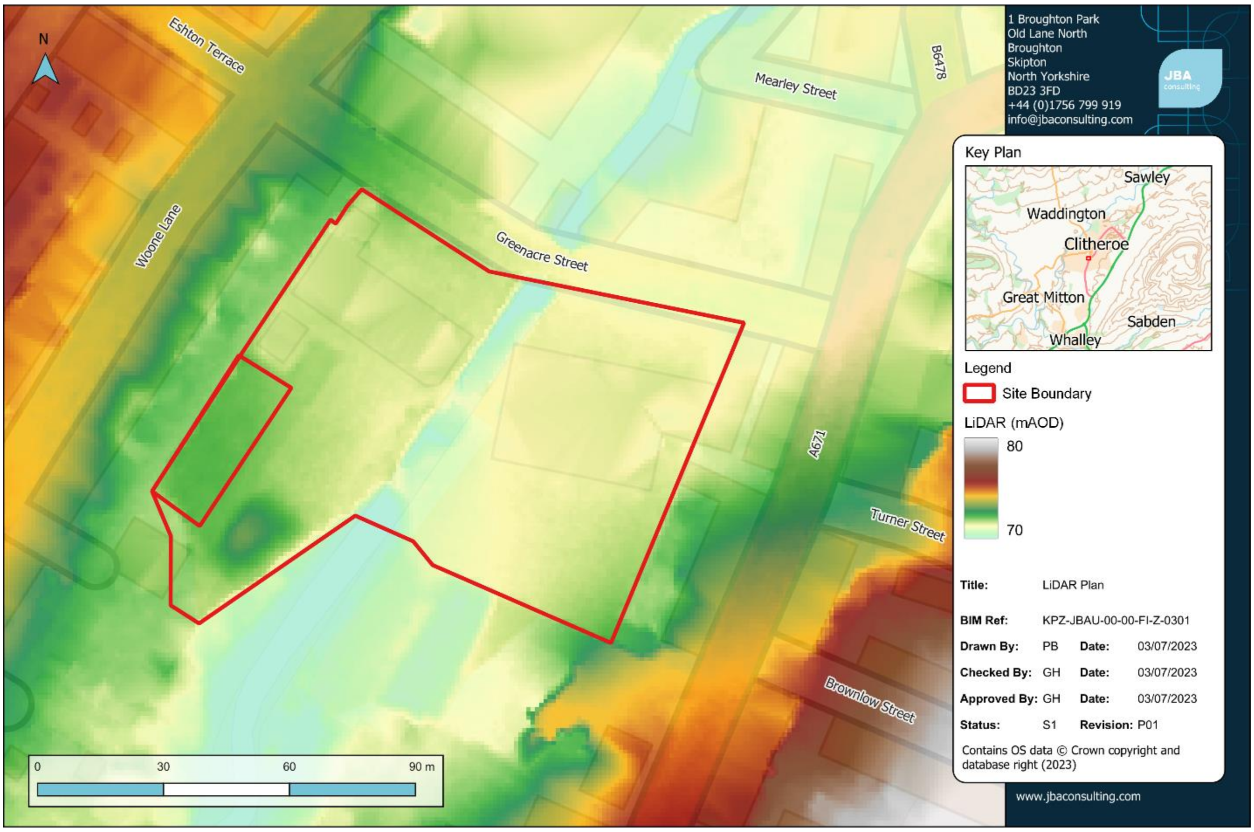

Figure 3-1: Model LiDAR Plan - Mearley1m 2016

3.3 LiDAR - 2018

Although a more recent LiDAR dataset called the 1m Composite 2022 DTM is available, the LiDAR data currently accessible for the site dates back to 2018. This is due to the fact that the area was not covered in the most recent national plan for LiDAR data gathering.

The key statistics are presented in Table 3-3. The average level at the proposed development site is significantly higher than the model LiDAR (2016 dataset) by 0.31m. A visual comparison of the LiDAR data is shown in Figure 3-2. In the figure, red areas indicate where the composite 2022 data is higher than the Mearley 1m data, while blue indicates the reverse. Notably, based upon the 2022 DTM, the area around the school is generally characterised by higher levels compared to the 2016 DTM. If used for modelling purposes, the 2022 DTM would indicate a reduced presence of flooding in the school grounds.

Table 3-3: Model LiDAR - 1m Composite 2022 - Key Statistics

	Min (mAOD)	Max (mAOD)	Mean (mAOD)
Proposed classroom block	72.04	72.33	72.51
School Grounds	69.96	73.24	71.68

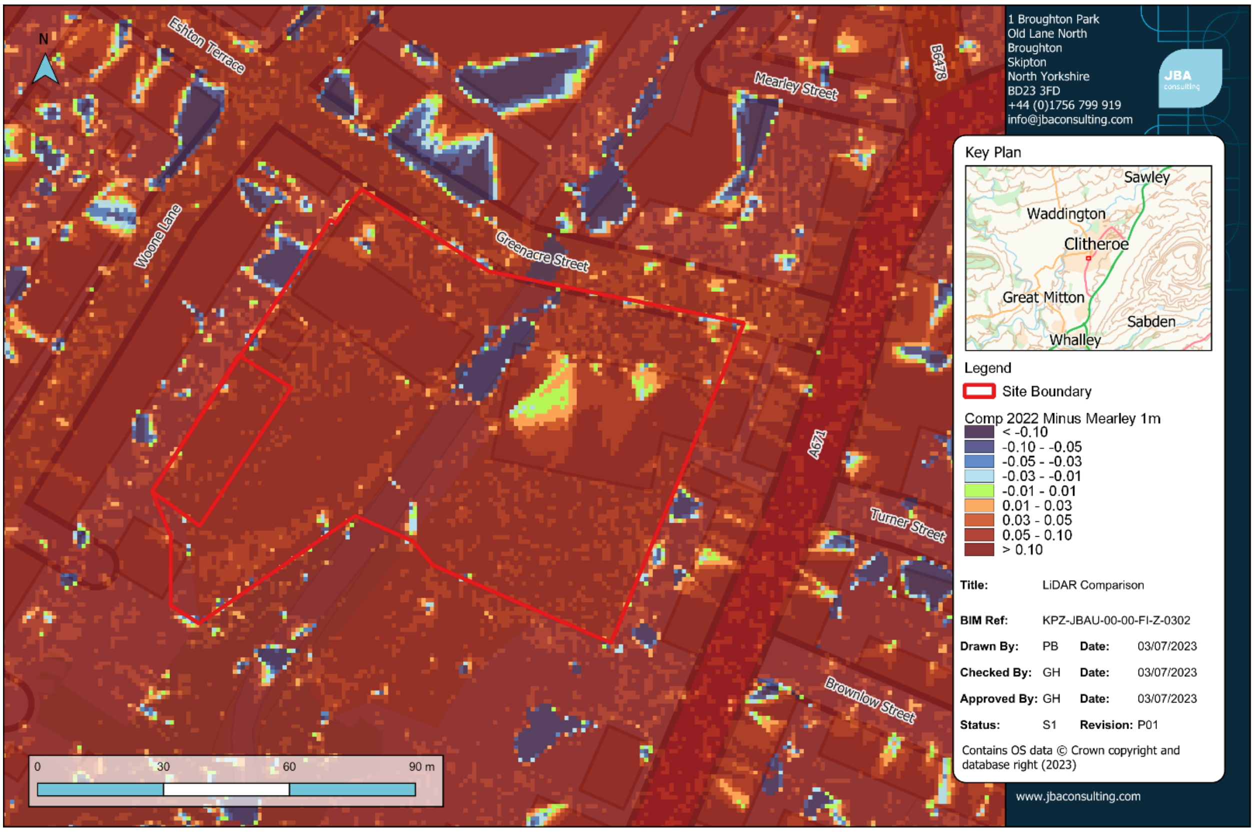

Figure 3-2: LiDAR Comparison

3.4 Topographic Survey Analysis

The topographic survey is attached in Appendix B. The survey was commissioned by Cassidy and Ashton and carried out in 2021.

The survey reveals that levels within the site boundary vary from 72.00 to 72.33 mAOD. When comparing spot levels, the survey shows an increase in development levels compared to the 2016 LiDAR but not to the extent shown by the 2018 LiDAR. In general, the survey better aligns with the 2016 LiDAR, with regard to the levels at the proposed classroom block. Without sufficient topographic survey data, it is not possible to determine if the latest LiDAR overestimates levels elsewhere within the catchment.

4 Model Build

4.1 Overview

The model build section is to summarise modelling work carried out as part of the 2022 JBA Mearley Brook modelling study.

Table 4-1 details all the model runs that have been completed as part of this study. The baseline runs simulate the range of events required by the EA for a modelling study. The events 3.3%, 1.0% and 0.1% correspond to the EA Flood Zones.

Table 4-1:Model Run List

Scenario	Description	AEP
Baseline	Present-day	50%
		20%
		10%
		5.0%
		2.0%
		1.0%
		0.1%
	Climate change	1.0% + 36%CC
		1.0% + 46%CC
Sensitivity	Manning's n +20%	1%
	Manning's n -20%	1%
	Downstream Boundary - 20%	1% - 20%
	Downstream Boundary + 20%	1% + 20%

4.2 Hydrology

The hydrology has remained unchanged from the original modelling study. An Urban Revitalised Flood Hydrograph (ReFH) was the preferred approach for the hydrological estimates for Mearley Brook as it takes account of the flow contribution and timing of flows from urban areas. Although the urban landscape is a relatively small proportion of the overall catchment, the study area itself is largely urbanised. A statistical approach to the hydrology would only provide a peak flow, and relative timings of inflow hydrographs would be difficult to represent. By using urban ReFH, the critical duration of different parts of the catchment could be assessed. Testing indicated that the critical storm duration for Mearley Brook is seven hours.

The hydrological inflows have been incorporated into the model by employing 21 Flood Modelled ReFH HDBDY boundaries.

Regarding the downstream boundary, it is situated at the confluence of Pendleton Brook and the River Ribble. The model's downstream boundary is defined using a rated Flow-Head (QH) boundary.

4.2.1 Climate Change

Climate change was represented in the model by increasing all fluvial inflows by the respective climate change allowance factor. There is a total of 21 ReFH HDBDY inflows, only the hydrograph scaling multiplier was changed to represent climate change. The scaling percentages applied were 36%CC and 46%CC.

4.3 1D Model

The 1D model was constructed using Flood Modeller (FM) software. The 1D domain encompassed a significant portion of the floodplain, especially in proximity to the site. However, the positioning of the 1D/2D schematization in this area was incorrect, resulting in an inaccurate representation of both domains. To rectify this issue, the deactivation panel markers were updated. As a result, the 1D domain now accurately represents the area covered by the watercourse defences, while the land on either side of the defences is represented by the 2D domain. This adjustment ensures that water does not spill outside of the defences erroneously.

4.4 2D Model

The 2D model was represented using TUFLOW. The changes made to the 2D domain are detailed in Table 4-2.

Table 4-2: 2D Model Updates

TuFLOW model updates	Description
MearleyBrook_002.tgc	Previously: MearleyBrook_001.tgc Grid changed from 4m to 2m. The finer grid will accurately represent the narrow flow paths such as bridges and roads of the urban catchment.
MearleyBrook_003.trd	Previously: MearleyBrook_002.trd 2D timestep changed from 2 seconds to 1 second. This is due to the grid size change.
1d_nodes_MearleyBrook _003_P.shp	Previously: 1d_nodes_MearleyBrook_002_P.shp

TuFLOW model updates	Description
	Inclusion of the two nodes PEBR_02705d and PEBR_02705u. The 1D representation of these nodes (.dat) is unchanged.
2d_code_MearleyBrook _006_R.shp	Previously: 2d_code_MearleyBrook_003_R.shp The 2D Code Layer (HXE) has been adapted to conform to the updated HXI line. The code layer has also been extended to include bridge decks which were not previous represented in 2D, Greenacre Street (374159, 441326) & Moor Lane Car Park (374243, 441438).
2d_bc_hxi_MearleyBrook _010_L.shp	Previously: 2d_bc_hxi_MearleyBrook_005_L.shp The HXI line have been changed to better represent the interface between the 1D and 2D domain.
2d_zline_MearleyBrook_ Banks_003_P.shp	Previously: 2d_zline_MearleyBrook_Banks_002_P.shp 2 bank points changed, suspected anomalies that cause local low points.
2d_zline_MearleyBrook_ Defences_005_P.shp 2d_zline_MearleyBrook_ Defences_005_R.shp	Previously: 2d_zline_MearleyBrook_Defences_001_P.shp 2d_zline_MearleyBrook_Defences_001_R.shp Defence levels and positions have been changed to better reflect actual the AIMS defence. Also, the inclusion of the hole in the defence north of Greenacre Street.
2d_zsh_MearleyBrook_ TopoAdjust_005_P.shp 2d_zsh_MearleyBrook_ TopoAdjust_005_R.shp	Previously: 2d_zsh_MearleyBrook_TopoAdjust_001_P.shp 2d_zsh_MearleyBrook_TopoAdjust_001_R.shp Changed the polygon shape and reference point of previous topography adjustments at bridges, as well as the addition of 3 other topography adjustments to represent the level at2D domain.
2d_fcsh_MearleyBrook_ Buildings_002_R.shp	Previously: 2d_fcsh_MearleyBrook_Buildings_001_R Certain building outlines changed to better represent the building with the finer 2m grid.

5 Fluvial Flood Mapping

5.1 EA Flood Map for Planning

As stated in Section 2.2, the site is situated within Flood Zone 2, which corresponds to land having between a 1% and 0.1% annual probability of river flooding. However, the proposed site location is adjacent to areas classified as Flood Zone 3, indicating a 1.0% or higher annual probability of flooding from rivers.

5.2 Modelled Flood Extents

The flood extents derived from the model were generated as part of the original modelling study completed by JBA in 2022. Further details regarding the updates made to the original Environment Agency (EA) model from 2016 are provided in Section 4.

Figure 5-1 illustrates all modelled AEP events, which represent baseline (i.e. 'as existing') scenarios and do not account for any modifications related to the proposed development within the model.

Flooding within the school premises begins in the 5% AEP scenario, where water surpasses the playground bridge deck and inundates the lower-lying left playground.

In the 1.0% AEP scenario the flood extent is very close to the site boundary, this is because the low-lying path surrounding the existing building becomes flooded. It is important to note that the proposed building will be located on an area of elevated ground. The 0.1 % AEP event, which represents the FZ 2, totally inundated the proposed classrooms, with only a small area of the right bank not at risk of flooding.

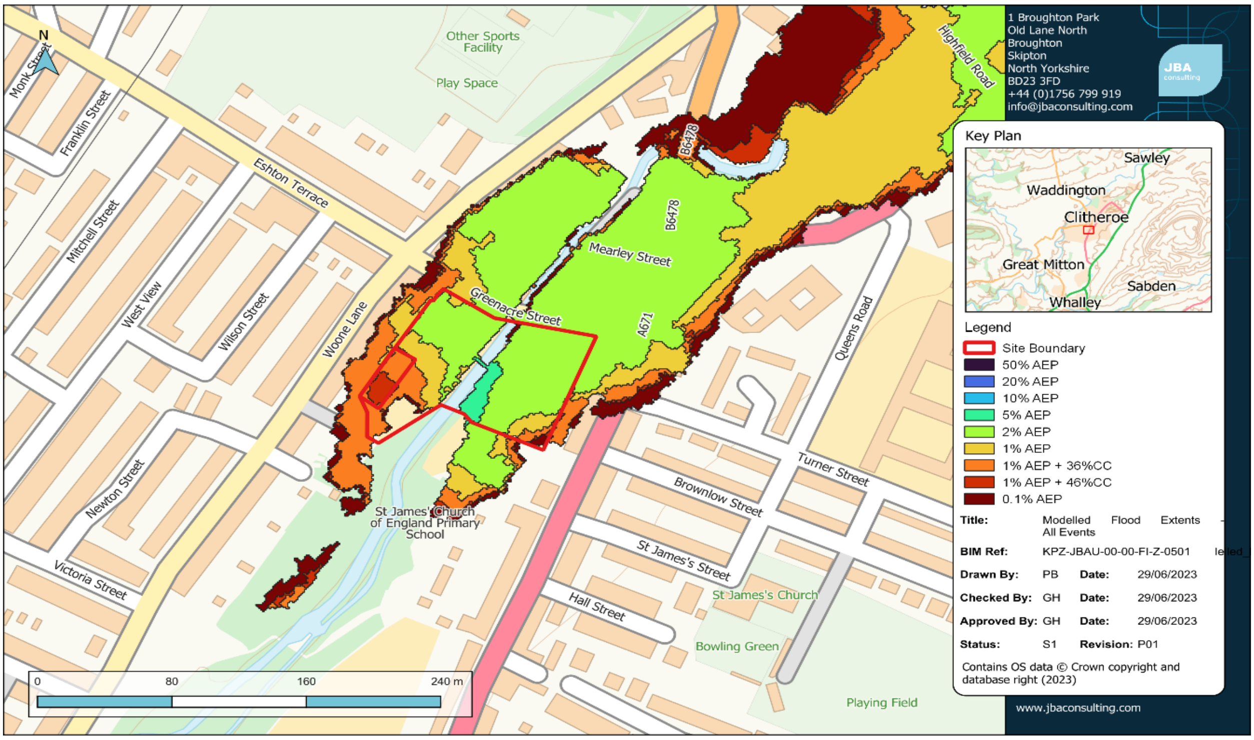

Figure 5-1: Modelled Flood Extents - All Events

The modelled flood depths for the 1.0%AEP and 0.1%AEP scenarios are shown in Figure 5-2 and Figure 5-3 respectively.

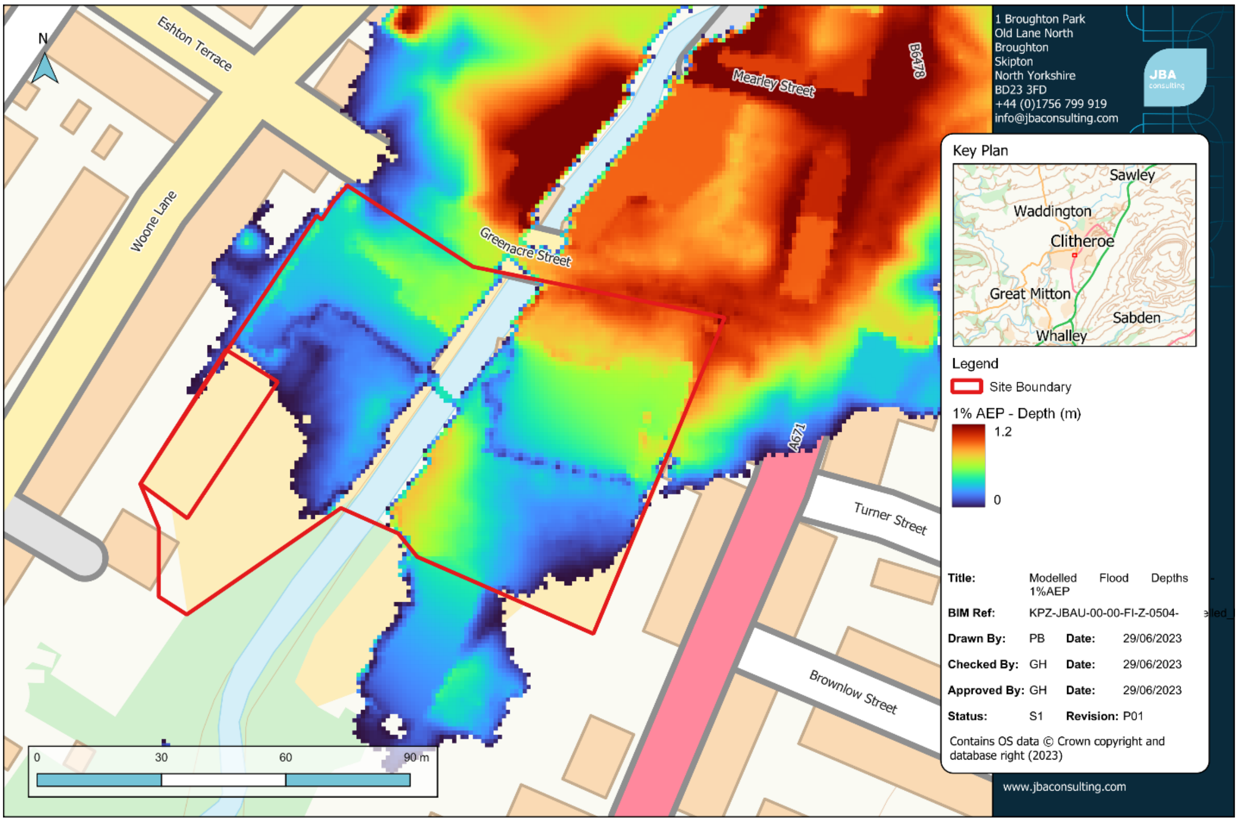

Figure 5-2: Modelled Flood Depths - 1.0% AEP

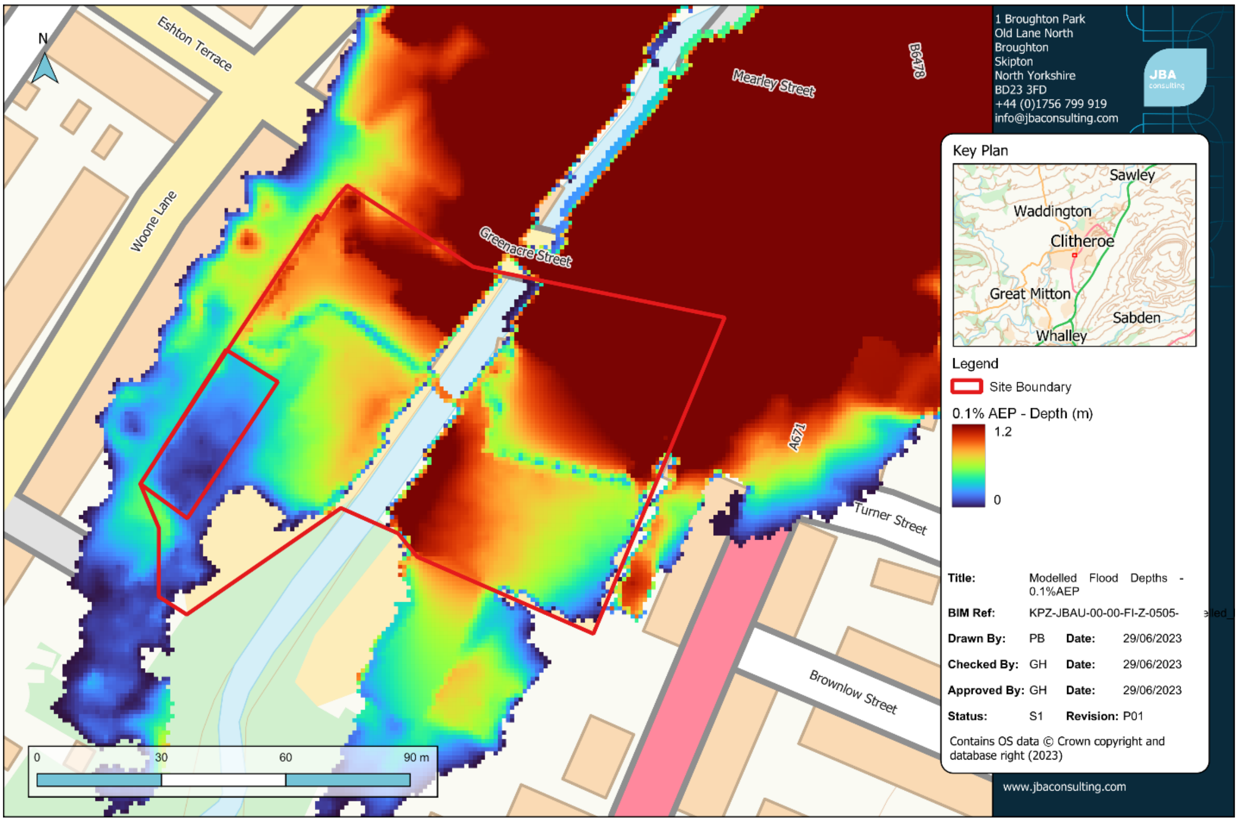

Figure 5-3: Modelled Flood Depths - 0.1% AEP

5.3 Climate Change Scenarios

The 1% AEP climate change scenarios are shown in Figure 5-4. Both climate change scenarios are shown to encroach within the footprint of the proposed classroom block. The 1% AEP + 36%CC scenario enters the south site boundary through the entrance way at the southwest corner of the school grounds.

The climate change depth maps are shown in Figure 5-5 and Figure 5-6. The water maximum flood depths within the proposed class room are 0.37m and 0.40m, for the +36% CC and +46%CC event respectively.

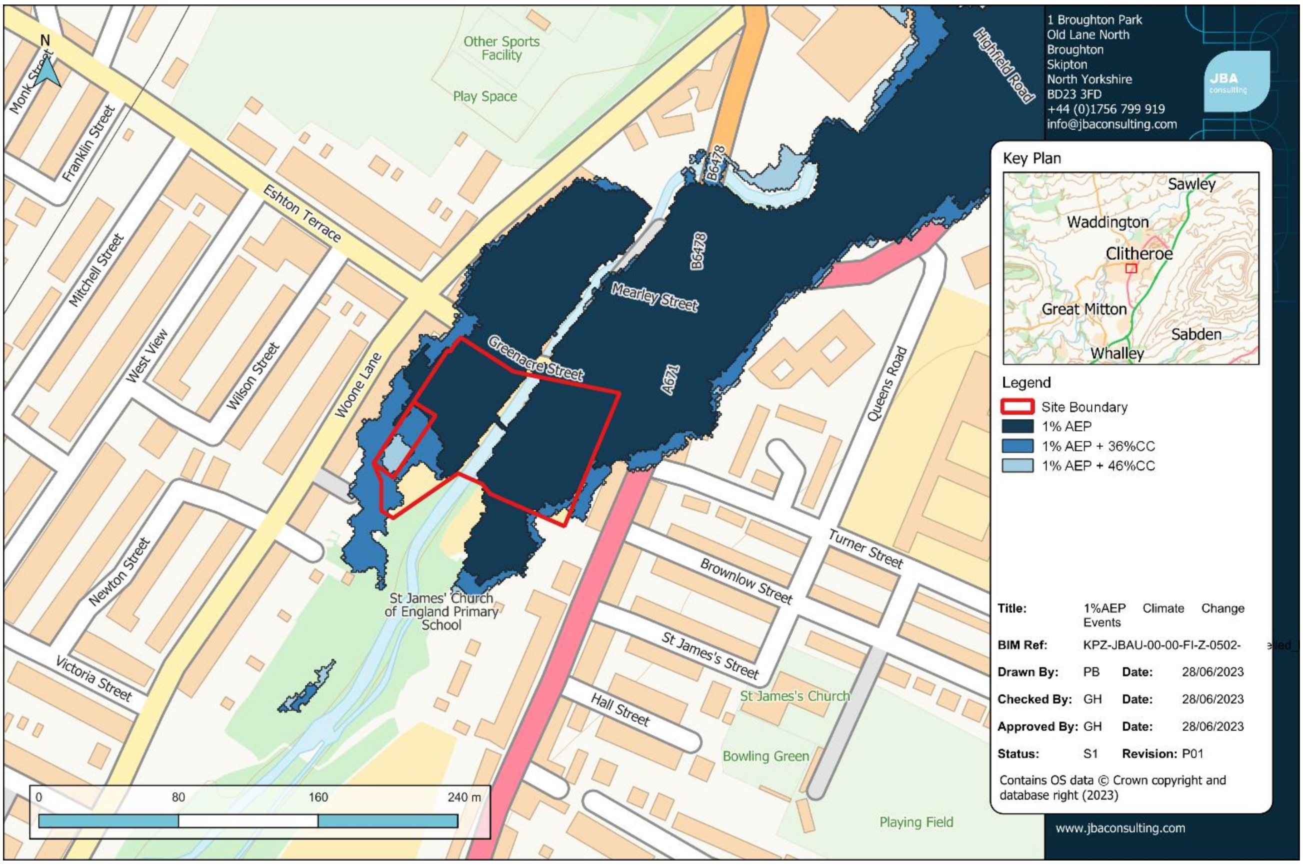

Figure 5-4: Modelled Flood Extents - 1% AEP and Climate Change events

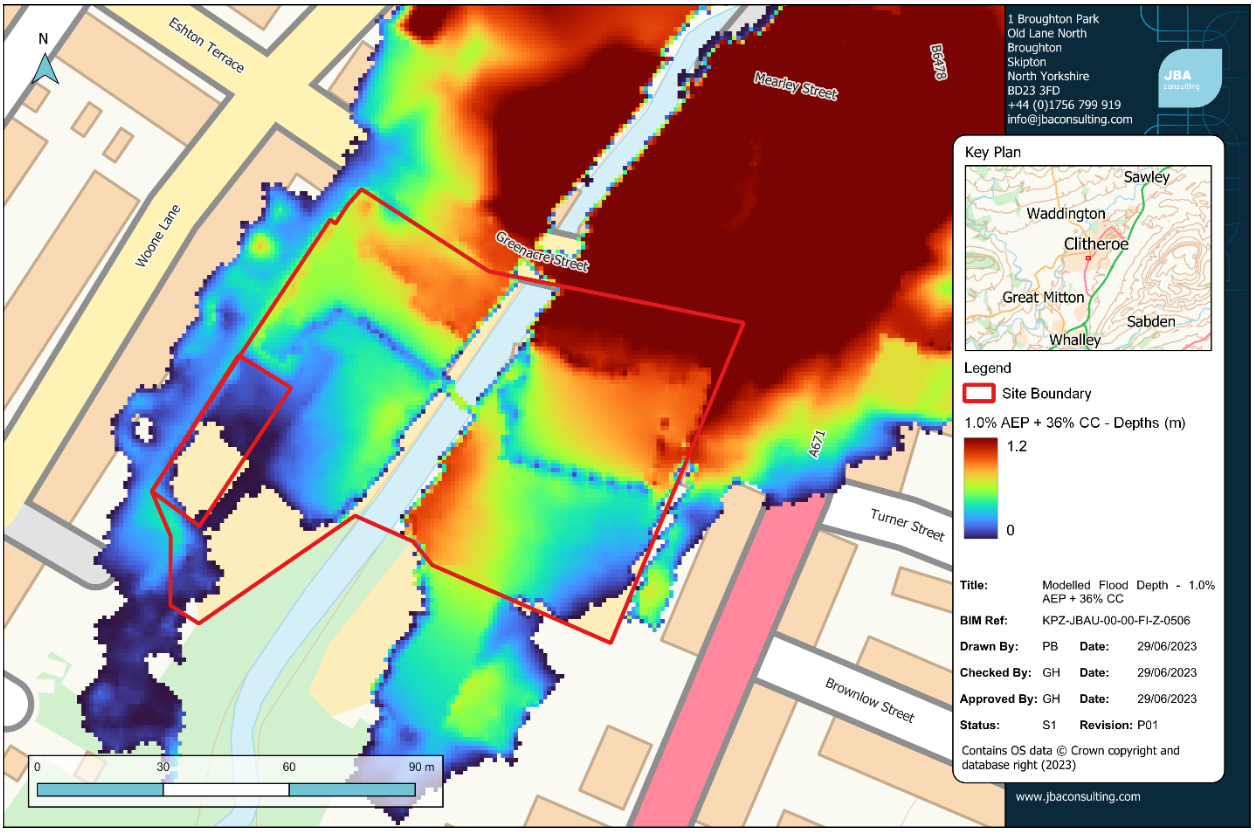

Figure 5-5: Modelled Flood Depths - 1.0% AEP + 36% Climate Change

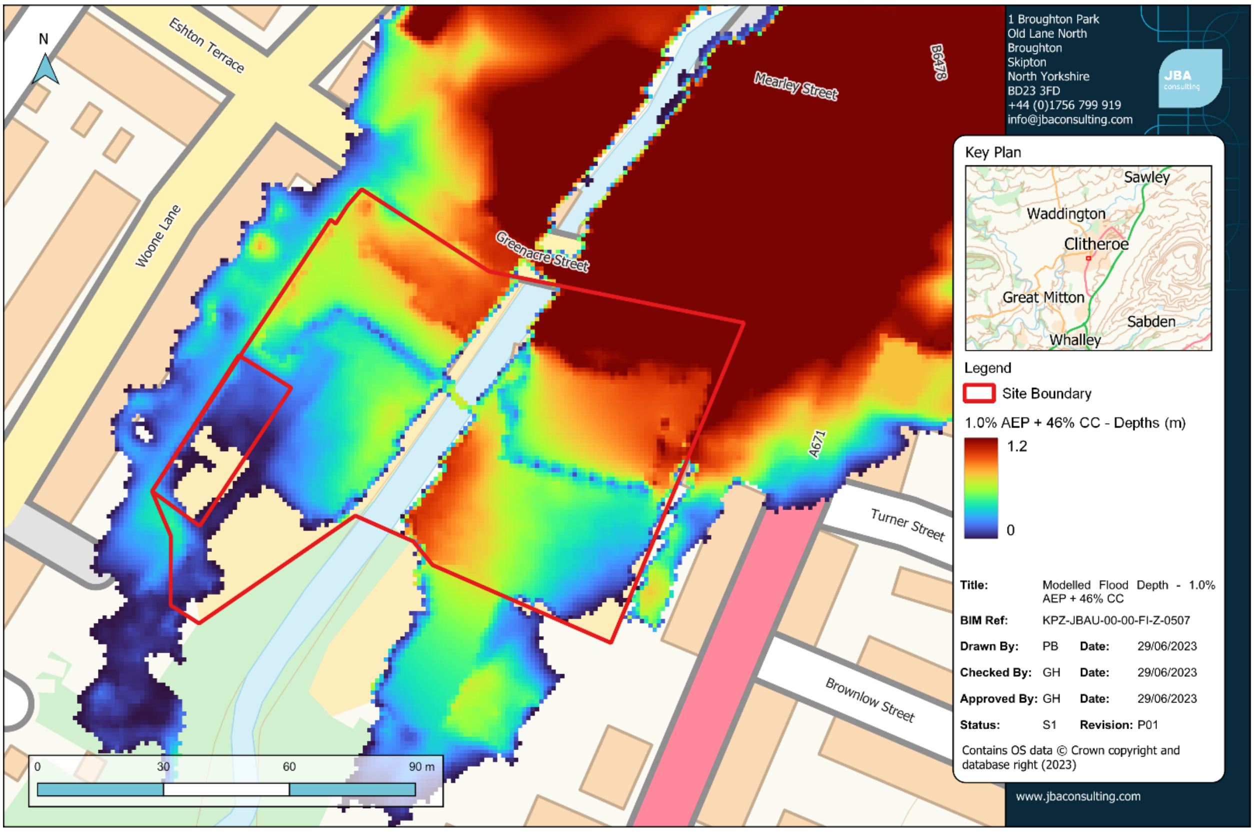

Figure 5-6: Modelled Flood Depths - 1.0% AEP + 46% Climate Change

5.4 Modelled Water Levels

The peak water level within the proposed development boundary is shown in Table 5-1. The majority of the site is elevated 0.21m above the 1.0% AEP scenario flood level. However, both 1% AEP climate change events are greater than the mean ground level, flooding the majority of the proposed building with shallow water, apart from a small region of higher land which is not flooded.

Table 5-1:Peak Water level

Ground Level (mAOD)	1.0% AEP (mAOD)	1.0% AEP + 36CC (mAOD)	1.0% AEP + 46CC (mAOD)	0.1% AEP (mAOD)
Min: 71.79 Max: 72.36 Mean:72.20	71.99	72.27	72.30	72.42

6 Flood Risk from Other Sources

6.1 Surface Water

Surface water flood risk represents rainwater that does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead.

6.1.1 Extents

The surface water flood extents encroach onto the boundary of the proposed building in a 1.0% AEP surface water flood event (a 100-year or greater chance of surface water flooding) this represents a medium chance of flooding. The surface water present at the site likely originated from water coming out of bank further upstream and flowing past the site. In the south-west corner of the site there is an access gate which is represented as a break in the wall allowing water to enter the site. There is also surface water flooding in a 0.1%AEP event to the north of the site of the proposed building.

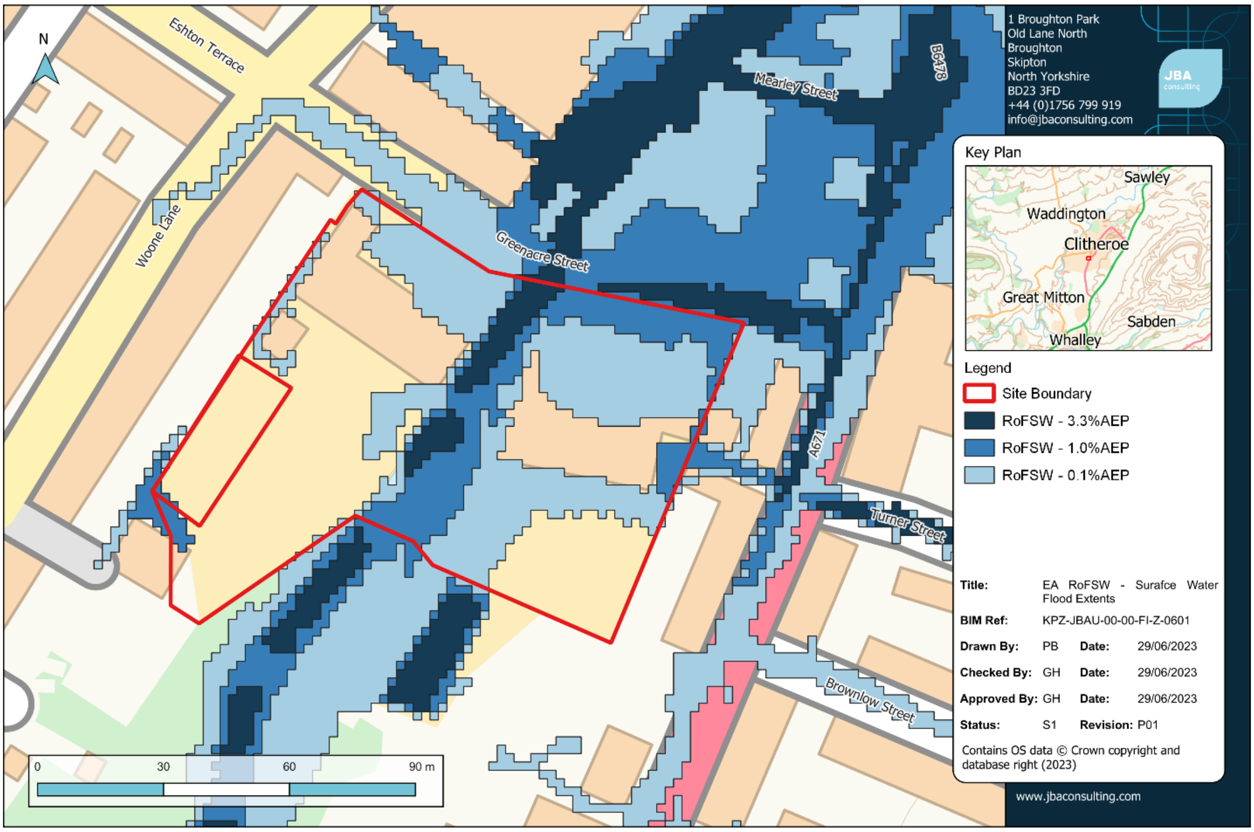

Figure 6-1: RoFSW Extent Map

6.1.2 Depths

Surface water depths present at the site in a 1.0%AEP event are shown in Figure 6-2. The maximum flood depth immediately adjacent to the site boundary is 0.15-0.30m. The 0.1% AEP surface water flooding depth is shown in Figure 6-3. Areas of Deep water (0.6m or greater) are constrained to the watercourse.

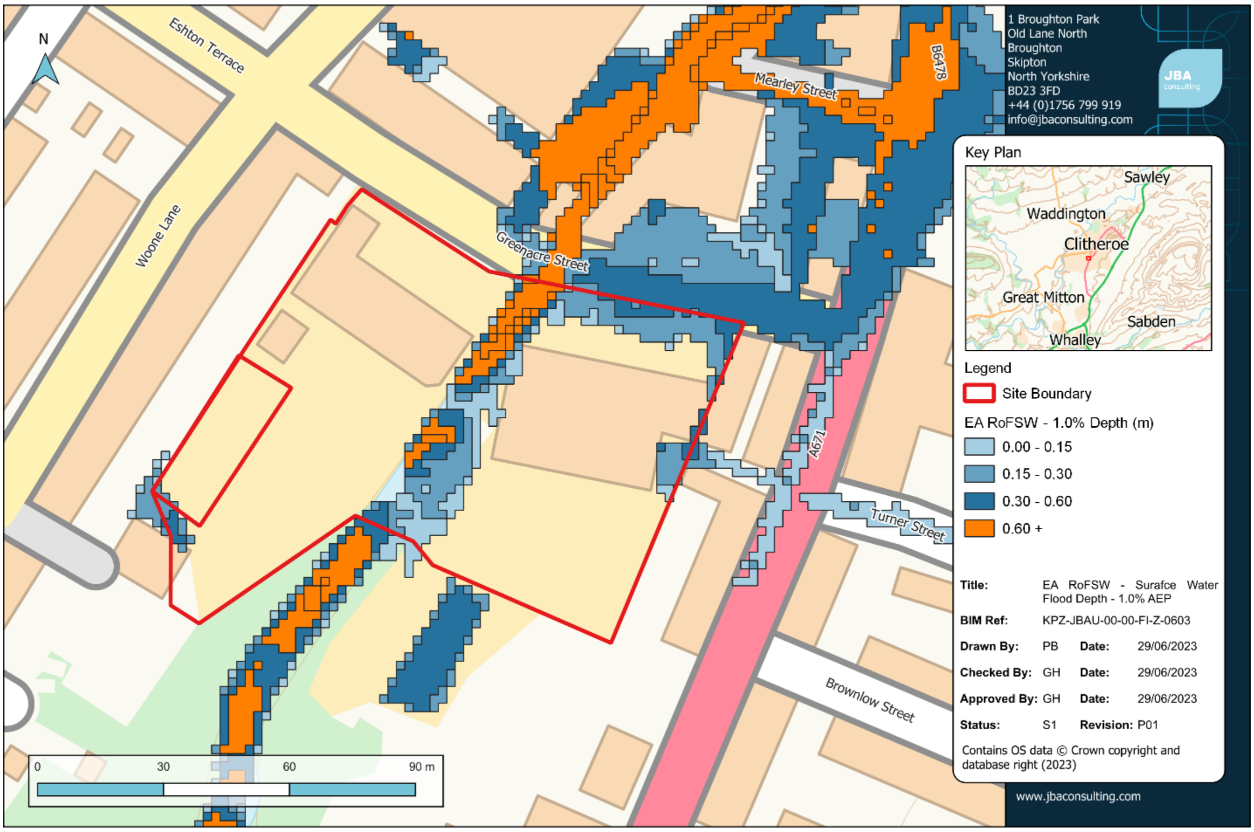

Figure 6-2: RoFSW Depth - 1.0%AEP

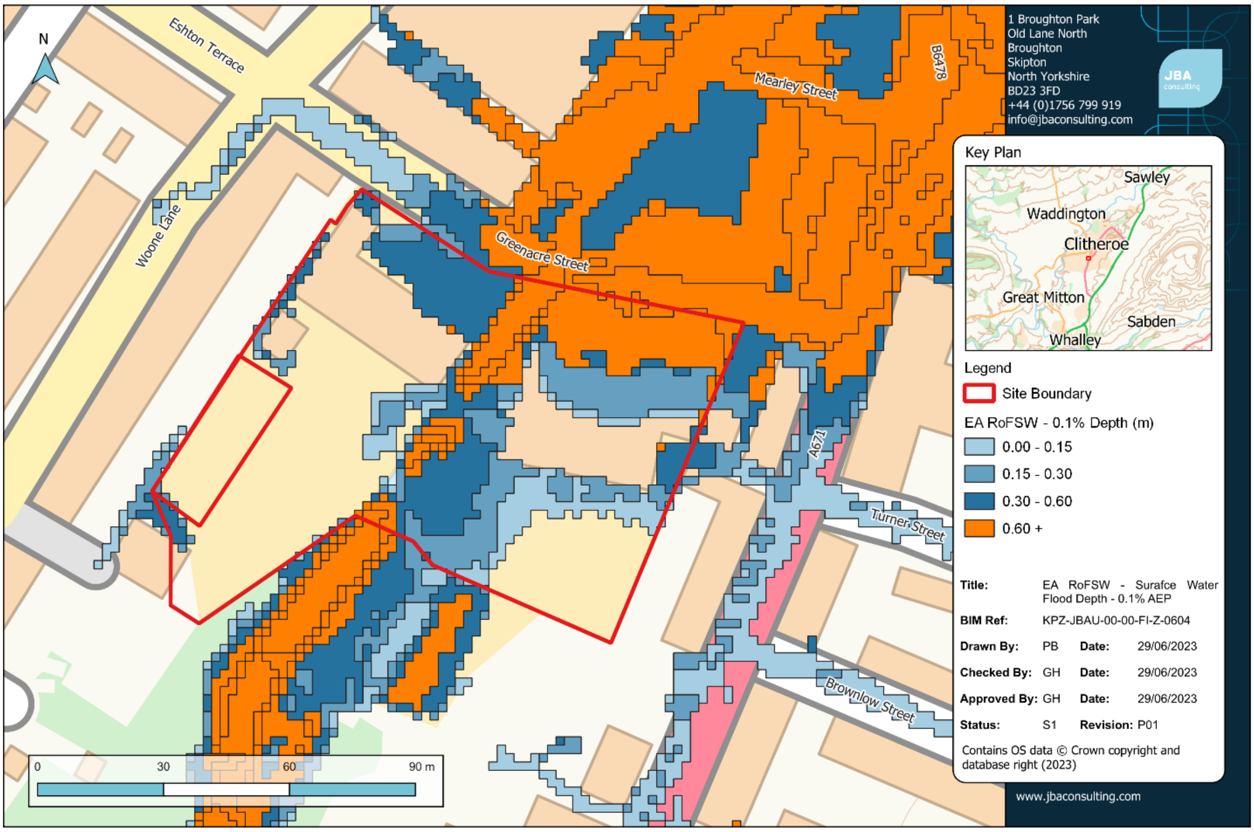

Figure 6-3: RoFSW Depth - 0.1%AEP

It should be noted that this map is generated using a broad methodology applied at the national scale. The model utilises generalised information on infiltration, sewerage infrastructure, rainfall events and catchment topography to route rainfall over a ground surface model. As such, the analysis does not generally take account of site-scale factors/characteristics that may exert an influence upon surface water flood depths and extents. The map therefore only provides a guide regarding the areas that may be vulnerable to this source of flooding.

6.2 Reservoir Flood Risk

The site is not at risk from flooding from reservoirs according to the EA Long-Term Flood Risk Map (https://check-long-term-flood-risk.service.gov.uk/)

6.3 Groundwater

An assessment of the BGS Geology Viewer[2] and Landis Soils[3] shows the following:

- Bedrock geology - Clitheroe Limestone Formation and Hodder Mudstone Formation - Mudstone. Sedimentary bedrock formed between 346.7 and 337 million years ago during the Carboniferous period.
- Superficial Deposits - Alluvium - Clay, silt, sand and gravel. Sedimentary superficial deposit formed between 11.8 thousand years ago and the present during the Quaternary period.
- Soil Description - Slowly permeable seasonally wet acid loamy and clayey soils

The SFRA (2010) for the Ribble Valley states " *Following consultation with the EA, no evidence of groundwater flooding in the area has been identified. While no risk has been demonstrated, this is not to say that unrecorded groundwater flooding events may have taken place or that groundwater flooding may not occur in the future, but using the best available information they are not considered to be a significant risk at this time.* "

The proposed development does not include any basements or ground lowering activities, and therefore, it will not increase the risk of groundwater flooding. The development is primarily exposed to fluvial and surface water flood risks, with groundwater expected to have a minor impact in comparison.

[2] BGS - Geology Viewer
[3] http://www.landis.org.uk/

7 Development Flood Risk Mitigation

7.1 Overview

The revised development plan has taken into consideration the risk of flooding from the Mearley Brook, see Appendix A. The proposed classroom finished floor levels are to be elevated above 1.0%AEP + 36%CC water levels. There is also an area of designated compensatory storage in the south west of the site, see Figure 7-1.

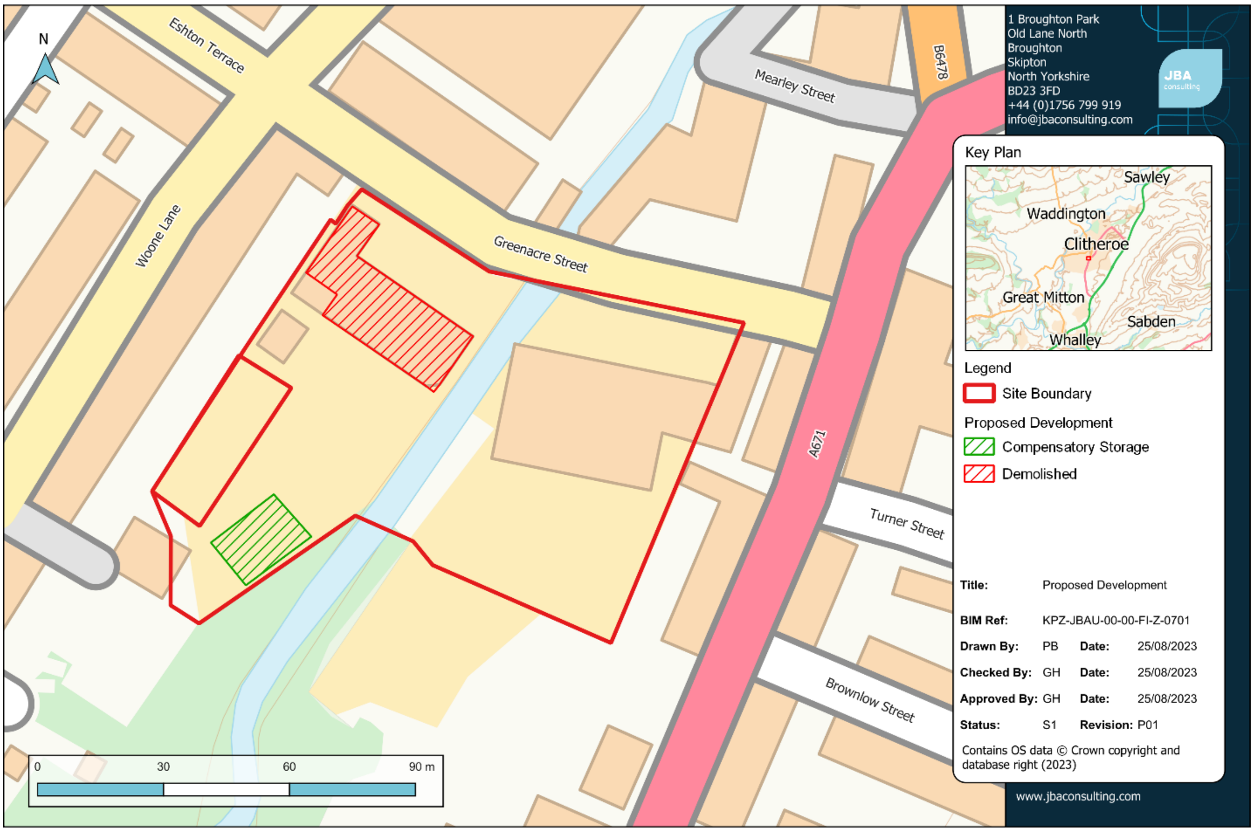

Figure 7-1: Proposed Development Plan

7.2 Evacuation plan

A flood incident preparedness, response and recovery plan should be prepared for the school grounds, in consultation with stakeholders. Amongst other matters, this should set out the actions to be taken following notification of a potential flood event and during and following flood conditions. The plan should identify 'trigger' levels and the roles and responsibilities of staff/facilities managers.

The site lies within an EA Flood warning error (012FWFL318), this means residents should receive alerts when a certain flood warning threshold is reached.

7.3 Compensatory Storage

The proposed development is partly within the 1% AEP + 36% CC flood boundary. Therefore, an equivalent compensatory storage provision must be provided to store an equal volume to the volume of water displaced.

The volume of water within the proposed development footprint has been calculated in GIS and is equivalent to 49.05 m^3, this has been calculated by assuming a uniform depth of 150mm across the entire flood area.

the area of the proposed compensatory storage area is 120m^2. This would result in a uniform depth of 0.48m. The storage area would require sloped sides; therefore, the depth is only to provide a rough estimate.

7.4 Finished Floor Levels

EA standing Advice with regards to Finished Floor Levels (FFL) states:

"*Finished floor levels should be a minimum of whichever is higher of 300mm above the:*

average ground level of the site adjacent road level to the building estimated river or sea flood level"

the FFL include a freeboard to prevent flooding from flowing or ponding storm water near doorways and other ingress routes such as vents and air bricks. In addition, ground levels should be set such that surface water flows are directed away from buildings and towards the formal drainage system or less vulnerable areas such as car parking and open space.

The proposed FFL should therefore be 300mm above the 1% AEP + 36% CC water level.

1% AEP + 36% CC Water Level + 300mm = Finished floor Levels
72.27mAOD + 300mm = 72.57mAOD

The proposed FFLs of the site is 72.60mAOD, which is elevated above the 1% AEP + 36% CC Water Level plus freeboard.

8 Conclusion

8.1 Technical Conclusion

In conclusion, this report presents the findings of a FRA conducted by Jeremy Benn Associates for the proposed new classroom at St James School, Clitheroe, commissioned by The Diocese of Blackburn. The study uses to flood extents from the hydraulic modelling of the Mearley Brook (JBA 2022) to assess flood risk at the site.

The proposed development is located within FZ 2 with a medium risk of flooding, as per the EA FMfP The NPPF requires detailed FRA for developments in flood zones 2 or 3, which was conducted by JBA in 2022 using site-specific hydraulic modelling.

The assessment of the proposed development in accordance with the NPPF indicates that it meets the criteria of the sequential test, as the development was relocated to an area within Flood Zone 2 after conducting modelling work. No exception test is required as development in Flood Zone 2 is permissible.

The topographic data review included the assessment of three data sets, including LiDAR data from pre-2016 and 2018, as well as a topographic survey conducted in 2021. The analysis revealed variations in ground levels, with the 2018 LiDAR data indicating higher levels at the proposed development site compared to the pre-2016 data.

The modelling study found that the site is susceptible to flooding in the 1.0% AEP + 36% CC and +46% CC scenarios. The NPPF states that developments "should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk". Therefore, the development would require mitigation measures to prevent the risk of fluvial flooding in the 1.0% AEP + CC events.

A Proposed Site Plan

Health & Safety Notes

1. Contractor must ensure that all work on site is carried out in a safe & satisfactory manner, in accordance with Health & Safety At Work Act 1974, COSHH Regulations 2002 & requirements of C.D.M

- Application Boundary
- Land in Applicant Ownership
- Proposed Development
- Existing Building for Demolition
- Existing Trees Retained (Indicative Location)
- Proposed New Trees
- Existing Trees removed
- New soft landscape
- Modified reduced soft landscape levels in accordance with flood report
- New vehicular tarmac
- New Pedestrian Tarmac paths
- New outdoor play covered canopy on polyester powder coated metal posts
- 5no Sheffield Cycle Stands
- EV Electrical vehicle charging point
- New 2400mm mesh profiled metal wire fencing - polyester powder coated blue. Pedestrian Gate and Emergency Vehicular Access Gate
- New timber fence and gate
- New Secure Vehicular Metal Gate to match existing
- Existing Pedestrian Access
- New Pedestrian Access & Secure Metal Gate
- Existing & Modified Vehicular Entrance
- Existing Vehicular Entrance

Rev.	Description	Date
P1	Planning issue	03.08.2023

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7 East Cliff, Preston, Lancashire, PR1 3JE 01772 258 356
10 Hunters Walk, Canal Street, Chester, CH1 4EB 01244 402 900

Client: **St James' CoE Primary School Greenacre Street, Clitheroe**

Project: **New Infant School, Demolition & refurbishment**

Drawing Title: **Proposed-Site-Plan**

Drawn by	S0	Checked by	SB/AB	Date	13.08.20
Status	S2	Scale @ A3	1:500		
Job no.	10512	Dwg.no.	STJ-CAA-ZZ-ZZ-DR-A-1002	Rev.	P1

B Topographic Survey

COORDINATED STATIONS

STATION	EASTING	NORTHING	LEVEL (m)
GPS1	374143.665	441334.202	71.606
GPS2	374195.447	441321.263	71.350
A	374177.438	441317.541	71.265
B	374127.371	441336.178	72.074
C	374179.706	441304.758	71.474
D	374178.911	441311.711	71.293
G	374142.715	441306.863	71.638

ABBREVIATIONS

AV	AIR VALVE/VENT	IC	INSPECT CHAMBER
BOL	BOLLARD	IL	INVERT LEVEL
BB	BELISHA BEACON	JKW	JAPANESE KNOTT WEED
BM	BENCH MARK	LH	LAMP HOLE
BL	BED LEVEL	LP	LAMP POST
BS	BUS STOP	NP	NAME PLATE
BT	BRITISH TELECOM	MH	MANHOLE
CL	COVER LEVEL	PS	POST/SIGN POST
Dil	DILAPIDATED	PB	POST BOX
Dis	DISUSED	PX	UNKNOWN SERVICE
EL	EAVES LEVEL	RE	RODDING EYE
ELE	ELEC JUNCT. BOX	RL	RIDGE LEVEL
EP	ELECTRICITY POLE	RS	ROAD SIGN
FH	FIRE HYDRANT	ST	STOP TAP
FL	FLOOR LEVEL	TH	TRIAL HOLE
FOS	FULL OF SEDIMENT	TL	TRAFFIC LIGHT
FP	FLAG POLE	TP	TELEGRAPH POLE
G	GULLY	TV	CABLE TV BOX
GM	GAS METER	Utl	UNABLE TO LIFT
GV	GAS VALVE	WM	WATER METER

SYMBOLS

SURVEY STATION	TREE
— E — O\H ELEC CABLE	BENCH MARK
— T — O\H PHONE LINE	TRIAL PIT
CANOPY\HEDGE	BOREHOLE

NOTES

A) ONLY MANHOLES AND SERVICES VISIBLE AT TIME OF SURVEY SHOWN

B) O/S USED AND ORIENTATED TO TRUE NORTH

C) LEVELS IN METRES RELATED TO G.P.S.

D) DRAINAGE INFORMATION TAKEN FROM LOCAL AUTHORITY RECORDS. INFORMATION MUST BE CHECKED PRIOR TO WORK COMMENCING

Rev	Description	Date

PROPOSED DEVELOPMENT AT GREENACRE ROAD, CLITHEROE

CASSIDY + ASHTON

TOPOGRAPHICAL SURVEY

CA292/TOO		
	Surveyed	A. BAYBUTT
	Drawn	I. GREEN
	Date	JUNE 2021
	Scale	1:500 @ A1

RJP Surveying Consultants Ltd
LAND SURVEYORS & SITE ENGINEERS

AYREFIELD COTTAGE
AYREFIELD ROAD
ROBY MILL
UPHOLLAND
LANCASHIRE
WN8 0QP

TEL: 01257 251554
MOBILE: 07710 308709
WEBSITE : www.rjpsurveyors.co.uk
E-MAIL: mail@rjpsurveyors.co.uk

JBA consulting

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Thirsk
Wallingford
Warrington

Registered Office
1 Broughton Park
Old Lane North
Broughton
SKIPTON
North Yorkshire
BD23 3FD
United Kingdom

+44(0)1756 799919
info@jbaconsulting.com
www.jbaconsulting.com
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