



Unit 3, 22 -26 Halifax Road, Liversedge, WF15 6JQ

NPPF: Flood Risk Assessment

For Little Rainbows

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Unit 3, 22 -26 Halifax Road, Liversedge, WF15 6JQ

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CONTENTS

CONTENTS	i
TABLES & FIGURES	iii
EXECUTIVE SUMMARY	iv
1.0 INTRODUCTION	7
1.1 Background	7
1.2 National Planning Policy Framework (NPPF)	7
1.3 Report Structure	7
2.0 SOURCES OF INFORMATION	9
2.1 Discussion with Regulators	9
2.1.1 Environment Agency	9
2.1.2 Kirklees Council	9
2.1.3 Yorkshire Water	9
3.0 LOCATION & DEVELOPMENT DESCRIPTION	10
3.1 Site Location	10
3.2 Existing Development	10
3.3 Proposed Development	10
3.4 Ground Levels	10
3.5 Access and Egress	11
3.6 Catchment Hydrology	11
3.7 Geology	11
3.8 Groundwater	11
3.9 Source Protection Zone	11
3.10 Soil	11
4.0 FLOOD RISK	12
4.1 Climate Change	12
4.2 Sources of Flooding	12
4.2.1 Fluvial (river) Flooding	12
4.2.2 Tidal (coastal) Flooding	13
4.2.3 Groundwater Flooding	13
4.2.4 Surface Water (pluvial) Flooding	13
4.2.5 Sewer Flooding	14
4.2.6 Flooding from Artificial Drainage Systems/Infrastructure Failure	15
4.3 Historic Flooding	15
4.4 Existing and Planned Flood Defence Measures	16
4.5 Environment Agency Flood Zones	16
4.6 Flood Risk Vulnerability	17
4.7 Site Specific Flood Risk Assessment	18
5.0 SURFACE WATER DRAINAGE	19
5.1 Surface Water	19
5.2 Surface Water Runoff Rates	19
6.0 RISK MANAGEMENT	20
6.1 Introduction	20
6.2 Site Layout	21
6.2.1 Sequential Approach	21
6.2.2 Finished Floor/Threshold Level	21
6.2.3 First Floor Accommodation	21
6.3 Flood Resilience and Resistance	21
6.4 Flood Warning and Evacuation	21

6.5	Flood Plan	22
6.6	Safe Access and Egress Routes	22
6.7	Flooding Consequences	23
7.0	SEQUENTIAL APPROACH	24
7.1	Sequential and Exception Tests	24
8.0	SUMMARY AND CONCLUSIONS	25
8.1	Introduction	25
8.2	Flood Risk	25
8.3	Surface Water Drainage	25
8.4	Risk Management	26
8.5	Sequential Approach	27
8.6	Conclusion	27
APPENDICES		28
APPENDIX 1 – Proposed Site Layout		29
APPENDIX 2 – Topographical Survey		30

TABLES & FIGURES

Figure 1 - Site Location.....	10
Table 1 - Peak River Flow Allowances by River Basin District (use 1961 to 1990 baseline)	12
Table 2 - Peak Rainfall Intensity Allowance in Small and Urban Catchment (use 1961 to 1990 baseline).....	12
Figure 3 - Environment Agency Surface Water Flood Map	14
Figure 4 - Environment Agency Flood zones.....	16
Table 3 - Environment Agency Flood Zones and Appropriate Land Use	17
Table 4 - Flood Risk Vulnerability and Flood Zone 'Compatibility'	17
Table 5 - Risk Posed by Flooding Sources	18
Table 6 - Property Level Protection Measures.....	20
Table 7 - Probability and Consequences of all Sources of Flooding	27

EXECUTIVE SUMMARY

This FRA demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of the NPPF.

The development should not therefore be precluded on the grounds of flood risk.

The site is unlikely to flood except in extreme conditions. The primary, but unlikely, flood risk to the site is from fluvial flooding from the River Spen. The site is located within Flood Zone 2 and therefore has a 'medium probability' of flooding, with a chance of between 1 in 1000 (0.1%) and 1 in 100 (1%) years. The risk of flooding from the River Spen is considered to be of **medium significance**.

A number of secondary flooding sources have been identified which may pose a **low significant** risk to the site. These are:

- Surface Water Flooding
- Sewer Flooding

The flooding sources will only inundate the site to a relatively low water depth and water velocity, will only last a short period of time, in very extreme cases and will not have an impact on the whole of the proposed development site. The flood risk at the site will be further mitigated by using a number of property level protection measures to manage and reduce the overall flood risk at the site.

The proposed uses of the site are classified as 'more vulnerable', 'more vulnerable' uses are appropriate within Flood Zone 2. The proposed development will actually reduce the vulnerability of the site to flooding. The proposed development will improve the buildings resilience, resistance to flooding and by using property level protection measures to protect the site from flooding the vulnerability of the site will be improved.

The proposed development will have no impact on the movement of floodwater across the site. The overall direction of the movement of water will be maintained within the developed site and surrounding area. The conveyance routes (flow paths) will not be blocked or obstructed. There will be no increase in the flood water levels due to the proposed development.

Paragraph 10 of the Technical Guidance to the NPPF confirms that minor developments such as this are unlikely to raise significant flood risk issues.

The pre-application site is constructed entirely from impermeable surfaces with no permeable surfaces located on the site. The post-application site will increase the permeable surfaces on the site by including areas of soft landscaping.

Therefore, the amount of impermeable surfaces will not increase post-application compared to pre-application. The surface water runoff will not increase post-application compared to pre-application and there will be no increase in surface water flood risk to the site and off-site locations. No changes to the current surface water network are proposed.

The flooding sources will be managed and mitigated on the site by using a number of techniques, and mitigation strategies to manage and reduce the overall flood risk at the site. This will ensure the development will be safe. Measured used:

Site Layout - Sequential Approach: The sequential approach has been applied within the site by locating the most vulnerable elements of the development in the lowest risk areas. The most vulnerable uses (e.g. multi-function room with emphasis on technology, out of school club, admin room etc.) have been situated on the first floor of the site at a lower risk of flooding with the more flood-compatible (e.g. wet play, room, wet room, kitchen etc.) being situated on the ground floor at a higher risk of flooding.

Site Layout - Finished Floor/Threshold Level: Raising the finished floor and threshold levels of the building will be used to mitigate the effects of flooding at the site. The proposed finished floor level will match the existing finished floor level of the building and will be located above the existing external ground level by a minimum of 150mm.

It is recognised however that owing to limited headroom constraints, massing, planning policy and Building Regulations it is considered impractical to raise the finished floor levels further. Therefore, in order to further mitigate against this, it is recommended that the occupants of the building implement a flood evacuation plan to a safe area away from the building during times of flood. It is also proposed that flood protection measures are employed within the building design to reduce the overall risk to the occupants. This is discussed below.

Site Layout - First Floor Accommodation: Accommodation will be located on the first floor as well as the ground floor of the building. This will allow occupants to retreat to higher floor levels if needed. The levels of the first floor are located approximately 2.65m above the ground floor finished floor level well above any flood water levels.

This provides a 'safe haven' above any flood water levels assuming the flood defences are overtopped/breached. This will enable rapid escape should flooding occur which is unlikely. The upper floors are accessed via internal stairs and are sufficient in size to safely house all occupants of the building. The 'safe haven' will only be required in very extreme events or if a flood warning has not been received.

Flood Resilience and Resistance: To make the building more resistant to seepage the following measures will be incorporated. Sealant will be used around external doors and windows. All external doors and windows will be constructed from durable materials and the walls of the building will be thick. All windows will be a minimum of 1000mm above the ground level.

To improve the buildings resilience to flooding the following measures will be incorporated. All electrical wiring, switches, sockets, socket outlets, electrical, and gas meters etc. will be located a minimum of 600mm above the 1 in 100 year (plus climate change) water level.

Flood Warning and Evacuation: The site is located in a flood risk area therefore; the site will participate in the Environment Agency flood warning telephone service. The site will register contact details with the Environment Agency' Flood Warnings Direct Service (Floodline 0845 988 1188) in order to receive Flood Alerts.

Flood Plan: A Flood Plan outlining the precautions and actions you should take when a flood event is anticipated to help reduce the impact and damage flooding may cause will be developed.

Safe Access and Egress Routes: A safe access and egress routes, including emergency access can be maintained for vehicles and/or by foot via Halifax Road to the south of the site then to the west along Halifax Road where flood depths are lower. The ground level of Halifax Road at the entrance to the site is 60.60mAOD. Halifax Road rises to the west of the site with a ground level of 62.40mAOD approximately 100m to the west of the site.

Halifax Road and the site is located within Flood Zone 2 with an annual probability of river flooding between 1 in 1000 (0.1%) and 1 in 100 (1%) years. Therefore, safe access and egress can be maintained for all events up to and including the 1 in 100 year (plus climate change) events in accordance with the NPPF and Environment Agency Guidance. People should make their way to areas outside of the flood zone.

The Sequential and Exception Tests will not need to be undertaken as part of this planning application. The development proposals should therefore be considered by the LPA to satisfy the Sequential and Exception Tests as set out in the NPPF.

1.0 INTRODUCTION

1.1 Background

This Flood Risk Assessment (FRA) has been prepared by KRS Environmental Limited at the request of Little Rainbows to support a planning application for the proposed development at Unit 3, 22 -26 Halifax Road, Liversedge, WF15 6JQ. This FRA includes an assessment of the existing and proposed surface water drainage of the site.

This FRA has been carried out in accordance with guidance contained in the National Planning Policy Framework (NPPF)¹ and associated Planning Practice Guidance². This FRA identifies and assesses the risks of all forms of flooding to and from the development and demonstrates how these flood risks will be managed so that the development remains safe throughout the lifetime, taking climate change into account.

It is recognised that developments which are designed without regard to flood risk may endanger lives, damage property, cause disruption to the wider community, damage the environment, be difficult to insure and require additional expense on remedial works. The development design should be such that future users will not have difficulty obtaining insurance or mortgage finance, or in selling all or part of the development, as a result of flood risk issues.

1.2 National Planning Policy Framework (NPPF)

One of the key aims of the NPPF is to ensure that flood risk is taken into account at all stages of the planning process; to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk.

It advises that where new development is exceptionally necessary in areas of higher risk, this should be safe, without increasing flood risk elsewhere, and where possible, reduce flood risk overall.

A risk based approach is adopted at stages of the planning process, applying a source pathway receptor model to planning and flood risk. To demonstrate this, an FRA is required and should include:

- whether a proposed development is likely to be affected by current or future flooding from all source;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;
- if necessary provide the evidence to the LPA that the Sequential Test can be applied; and
- whether the development will be safe and pass part c) of the Exception Test if this is appropriate.

1.3 Report Structure

This FRA has the following report structure:

- Section 2 details the sources of information that have been consulted;

¹ Department for Communities and Local Government (2012) National Planning Policy Framework.

² Communities and Local Government (2014) Planning Practice Guidance - Flood Risk and Coastal Change.

- Section 3 describes the location area and the existing and proposed development;
- Section 4 outlines the flood risk to the existing and proposed development;
- Section 5 details the proposed surface water drainage for the site and assesses the potential impacts of the proposed development on surface water drainage;
- Section 6 outlines mitigation measures to reduce the overall level of flood risk;
- Section 7 details the sequential and exception tests; and
- Section 8 presents a summary and conclusions.

2.0 SOURCES OF INFORMATION

2.1 Discussion with Regulators

Consultation and discussions with the relevant regulators have been undertaken during this FRA including the Environment Agency, the Local Planning Authority (LPA), Lead Local Flood Authority (LLFA) and Sewerage Undertakers.

2.1.1 Environment Agency

The Flood and Water Management Act 2010 gives the Environment Agency a strategic overview role for all forms of flooding and coastal erosion. They also have direct responsibility for the prevention, mitigation and remediation of flood damage for main rivers and coastal areas. The Environment Agency is the statutory consultee with regards to flood risk and planning.

Environment Agency Flood Risk Standing Advice for England, the NPPF and Technical Guidance to the NPPF has been consulted and reviewed during this FRA. This has confirmed the level of FRA required and that a surface water drainage assessment is to be undertaken. Information regarding the current flood risk at the application site and local flood defences has been obtained from the Environment Agency.

2.1.2 Kirklees Council

Kirklees Council is the LPA and the LLFA and has responsibilities for 'local flood risk', which includes surface runoff, groundwater and ordinary watercourses. Planning guidance written by Kirklees Council regarding flood risk was consulted to assess the mitigation policies in place.

The Kirklees Council Strategic Flood Risk Assessment (SFRA) and the Kirklees Council Preliminary Flood Risk Assessment (PFRA) which cover the site have been reviewed.

2.1.3 Yorkshire Water

Yorkshire Water is responsible for the disposal of waste water and supply of clean water for this area. Information with regards to sewer and water main flooding contained within the Kirklees Council SFRA and the Kirklees Council PFRA have been consulted. All Water Companies have a statutory obligation to maintain a register of properties/areas which are at risk of flooding from the public sewerage system, and this is shown on the DG5 Flood Register.

3.0 LOCATION & DEVELOPMENT DESCRIPTION

3.1 Site Location

The site is located at Unit 3, 22 -26 Halifax Road, Liversedge, WF15 6JQ (see Figure 1). The National Grid Reference (NGR) of the site is 420608, 423771.

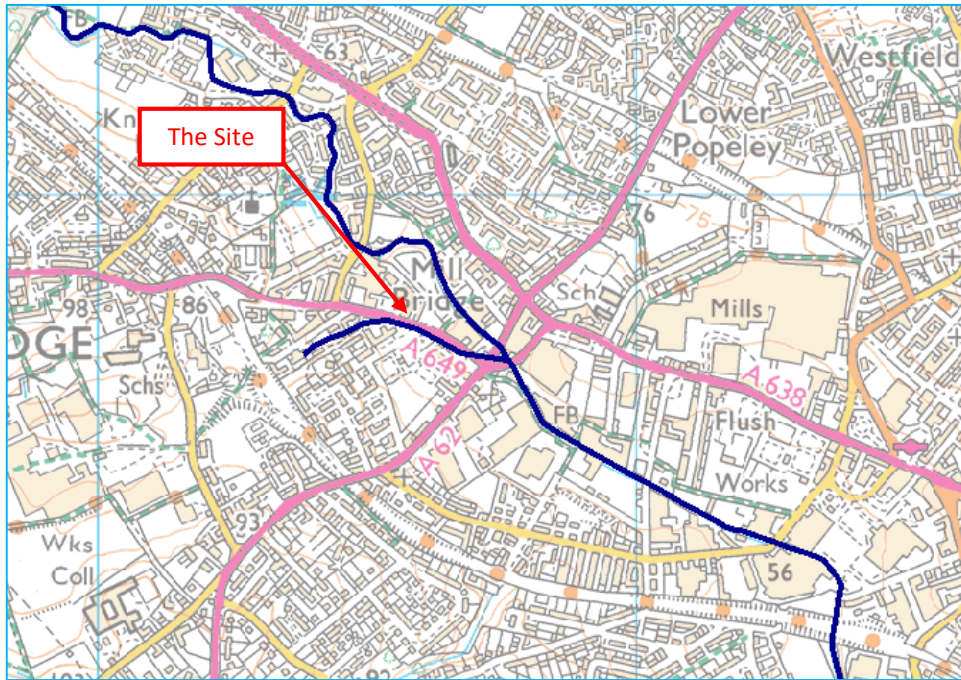


Figure 1 - Site Location

3.2 Existing Development

The current site consists of a discussed factory, offices and laboratory with car parking.

3.3 Proposed Development

It is understood that the proposals are for a change of use to a nursery (see Appendix 1). Further details with regard to the proposed development can be found in the accompanying information submitted with the planning application.

3.4 Ground Levels

A topographical survey has recently been undertaken to arbitrary datum (see Appendix 2). The site is relatively flat with ground levels of approximately 0.60m above the level of Halifax Road which is 60.60 metres Above Ordnance Datum (mAOD). Therefore, the site ground level is a minimum of 61.20mAOD with a finished floor level of approximately 61.35mAOD.

The finished floor level of the development will not change and that will be slightly higher than the existing pedestrianized area, allowing easy access to and from the unit. The existing finished floor level is located a minimum of 150mm above the external ground level.

3.5 Access and Egress

The premises will be served from the existing access from Halifax Road the south of the site. The ground level of Halifax Road at the entrance to the site is 60.60mAOD. Halifax Road rises to the west of the site with a ground level of 62.40mAOD approximately 100m to the west of the site.

3.6 Catchment Hydrology

The River Spen is located approximately 40m to the north east of the site (see Figure 1). The normal water level of the River Spen is approximately 0.80m below the ground level of the site (see Appendix 1). A small, mainly culverted, tributary of the River Spen is located immediately to the south of Halifax Road. There are no other watercourses evident either on, or within the vicinity of the site.

3.7 Geology

The British Geological Survey (BGS) Map indicates that the bedrock underlying the site consists of the Pennine Lower Coal Measures Formation - Mudstone, Siltstone and Sandstone. Sedimentary Bedrock formed approximately 312 to 313 million years ago in the Carboniferous Period. Local environment previously dominated by swamps, estuaries and deltas. The superficial deposits consist of Alluvium - Clay, Silt, Sand and Gravel. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by rivers. It is also anticipated that Made Ground will underlay the site.

3.8 Groundwater

The Environment Agency has designated the bedrock deposits as a Secondary A Aquifer - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers. The superficial deposits are designated as Unproductive Strata - these are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

3.9 Source Protection Zone

The site is not located within an Environment Agency Source Protection Zone.

3.10 Soil

Information from the National Soil Resource Institute³ details the site area as being situated on slowly permeable seasonally wet acid loamy and clayey soils.

³ <https://www.landis.org.uk/soilscapes/>

4.0 FLOOD RISK

4.1 Climate Change

Projections of future climate change, in the UK, indicate more frequent, short-duration, high intensity rainfall and more frequent periods of long duration rainfall. Guidance included within the NPPF recommends that the effects of climate change are incorporated into FRA. Recommended precautionary sensitivity ranges for peak rainfall intensities and peak river flows are outlined in the associated Planning Practice Guidance to the NPPF⁴.

Table 1 peak river flow allowances by river basin district and Table 1 shows the anticipated changes in extreme rainfall intensity in small and urban catchments.

Table 1 - Peak River Flow Allowances by River Basin District (use 1961 to 1990 baseline)

River basin district	Allowance category	2015 to 2039	2040 to 2059	2060 to 2115
Humber	Upper end	+ 20%	+ 30%	+50%
	High central	+ 15%	+ 20%	+ 30%
	Central	+ 10%	+ 15%	+ 20%

Table 2 - Peak Rainfall Intensity Allowance in Small and Urban Catchment (use 1961 to 1990 baseline)

Parameter	2010 to 2039	2040 to 2059	2060 to 2115
Upper end	+ 10%	+ 20%	+ 40%
Central	+ 5%	+ 10%	+ 20%

4.2 Sources of Flooding

All sources of flooding have been considered, these are; Fluvial (river) Flooding, Tidal (coastal) Flooding, Groundwater Flooding, Surface Water (pluvial) Flooding, Sewer Flooding and Flooding from Artificial Drainage Systems/Infrastructure Failure.

The key consequences of flooding are death/personal injury, extensive damage to property, properties uninhabitable for long periods, properties cannot be sold, insurance unavailable or too expensive, expense of installing flood resilience measures and business interruptions.

4.2.1 Fluvial (river) Flooding

The River Spen is located approximately 40m to the north east of the site (see Figure 1). A small, mainly culverted, tributary of the River Spen is located immediately to the south of Halifax Road. Therefore, fluvial flooding from the River Spen poses the primary flood risk to the site.

The flood risk to the site from River Spen can be considered to be limited any overbank flow would follow the contours of the surrounding area and would flow to the south east away from the site rather than flowing towards the site. The flood risk can also be considered to be limited due to the difference in elevations. The ground levels of the site are considerably above the normal water level of River Spen. The normal water level of the River Spen is approximately 0.80m below the ground level of the site (see Appendix 1).

⁴ <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#high-allowances>.

The flooding will only inundate the site to a relatively low water depth and water velocity, will only last a short period of time, in very extreme cases and will not have an impact on the whole of the proposed development site. The actual risk of flooding caused by overtopping of the river bank during a fluvial flood event on the drainage ditch will be reduced compared to the extent of flooding shown in the Environment Agency Flood Zones.

It is anticipated that water depths of less than 300mm and water velocities of less than 0.25m/s may be experienced, in extreme conditions. Using a conservative estimate of water velocity of 0.25m/s and a maximum water depth of 300mm any flooding would result in a 'low' flood hazard with a 'flood zone with shallow flowing water or deep standing water' as per the Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purpose - Clarification of the Table 13.1 of FD2320/TR2 and Figure 3.2 of FD/2321/TR1. It should be noted that this is the most conservative estimate of flood risk posed by a surface water flooding as flow would be held in adjacent areas and would enter the road drains.

The site is located where the onset of flooding is gradual as per Flood Risk Assessment Guidance for New Development Phase 2, R&D Technical Report FD2320/TR2. The debris will be limited due to the low water depths being less than 0.50m, as per the guidance in Flood Risks to People, FD2321/TR1.

The actual flood risk posed to the site is low each year with a chance of between 1 in 1000 (0.1%) and 1 in 100 (1%) years. The risk of fluvial flooding is considered to be **medium significance**. The risk from this source will be further mitigated by using a number of property level protection measures to manage and reduce the overall flood risk at the site (see Section 6.0).

4.2.2 Tidal (coastal) Flooding

The site is not located within the vicinity of tidal flooding sources and the risk of tidal flooding is considered to be **not significant**. Therefore, flooding from this source has not been considered further within this FRA.

4.2.3 Groundwater Flooding

Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

Groundwater flooding tends to occur sporadically in both location and time. When groundwater flooding does occur, it tends to mostly affect low-lying areas, below surface infrastructure and buildings (for example, tunnels, basements and car parks) underlain by permeable rocks (aquifers).

Site conditions (see Section 3.6 to 3.9) suggest a low probability of groundwater flooding. Also no below surface infrastructure and buildings are proposed for the site. The risk of flooding from groundwater flooding is considered to be **not significant**. T

4.2.4 Surface Water (pluvial) Flooding

Surface water flooding tends to occur sporadically in both location and time such surface water would tend to be confined to the streets around the development. The site is not situated near to large areas of poor permeability or areas with the geology may result in surface water flooding. The majority of rainfall will infiltrate into the soil substrate and will not runoff as surface water.

The Environment Agency Surface Water flood map shows that the site has a very low risk of surface water flooding (see Figure 2) with a chance of flooding of less than 1 in 1000 (0.1%) years. The Kirklees Council SFRA does not identify the site as being at risk of surface water flooding.

The risk of flooding from surface water flooding is considered to be of **low significance**. The risk from this source will be further mitigated by using a number of property level protection measures to manage and reduce the overall flood risk at the site (see Section 6.0).

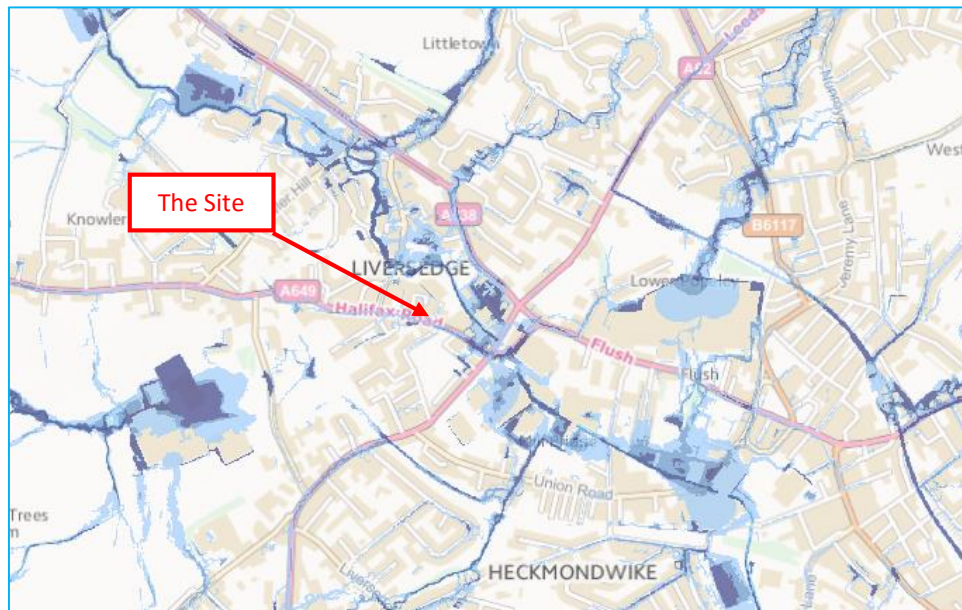


Figure 3 - Environment Agency Surface Water Flood Map

4.2.5 Sewer Flooding

Sewer flooding occurs when urban drainage networks become overwhelmed and maximum capacity is reached. This can occur if there is a blockage in the network causing water to back up behind it or if the sheer volume of water draining into the system is too great to be handled. Sewer flooding tends to occur sporadically in both location and time such flood flows would tend to be confined to the streets around the development.

There are existing sewers located within the vicinity of the site and these will inevitably have a limited capacity so in extreme conditions there would be surcharges, which may in turn cause flooding. Flood flows could also be generated by burst water mains but these would tend to be of a restricted and much lower volume than weather generated events and so can be discounted for the purposes of this assessment.

Given the design parameters normally used for drainage design in recent times and allowing for some deterioration in the performance of the installed systems, which are likely to have been in place for many years, an appropriate flood risk probability from this source could be assumed to have a return period in the order of 1 in 10 to 1 in 20 years. The provision of adequate level difference between the ground floors and adjacent ground level would reduce the annual probability of damage to property from this source to 1 in 100 years or less.

There are no reported incidents of sewer flooding within the vicinity of the site. Sewer flooding poses a flood risk to the site. Therefore, the risk of flooding from sewer flooding is considered to be of **low significance**. The risk from this source will be further mitigated by using a number of property level protection measures to manage and reduce the overall flood risk at the site (see Section 6.0).

4.2.6 Flooding from Artificial Drainage Systems/Infrastructure Failure

Park Dam reservoir (NGR 414888, 428426) is located upstream of the site. The Environment Agency Reservoir flood map shows that the site is at risk of reservoir flooding (see Figure 3). This map shows the largest area that might be flooded if a reservoir were to fail and release the water it holds.



Figure 3 - Environment Agency Reservoir Flood Map

The Environment Agency Reservoir flood map has been prepared for emergency planning purposes and for this reason they reflect a worst case scenario. Since this is a prediction of a worst case scenario, it's unlikely that any actual flood would be this large.

Reservoir flooding is extremely unlikely; reservoirs in the UK have a very good safety record. There has been no loss of life in the UK from reservoir flooding since 1925. Since then reservoir safety legislation has been introduced to make sure reservoirs are well maintained.

A flood plan should have been developed for the reservoirs which includes: identifying the extent and severity of flooding which could result from an uncontrolled release of water (i.e. breaching or failure), an on-site plan setting out what the undertaker would do in an emergency to try and contain and limit the effects of the incident and a communication plan with external organisations, mainly the emergency services.

The hazard is well managed through effective legislation and it is unlikely that the impact zone downstream of the identified reservoirs should preclude the proposed development. The risk of flooding from reservoir flooding is considered to be **not significant**. The risk from this source will be further mitigated by using a number of property level protection measures to manage and reduce the overall flood risk at the site (see Section 6.0).

4.3 Historic Flooding

The local area was flooded in 2007 however, there are no records of anecdotal information of flooding at the site. The British Hydrological Society "Chronology of British Hydrological Event⁵" has no information on flooding within the vicinity of the site.

⁵ <http://www.dundee.ac.uk/geography/cbhe/>

4.4 Existing and Planned Flood Defence Measures

It is understood that there are no formal flood defences within this area which protect the site against flooding. Also property level protection measures will be used to protect the site from flooding, these are discussed in Section 6.0.

4.5 Environment Agency Flood Zones

A review of the Environment Agency's Flood Zones indicates that the site is located within Flood Zone 2 with a 'medium probability' of flooding, with between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) in any year as shown in Figure 4.

The Flood Zones are the current best information on the extent of the extremes of flooding from rivers or the sea that would occur without the presence of flood defences, because these can be breached, overtopped and may not be in existence for the lifetime of the development. The Flood Zones show the worst case scenario.

The Environment Agency Flood Zones and acceptable development types are explained in Table 3. Table 3, shows that most development types are generally acceptable in Flood Zone 2.

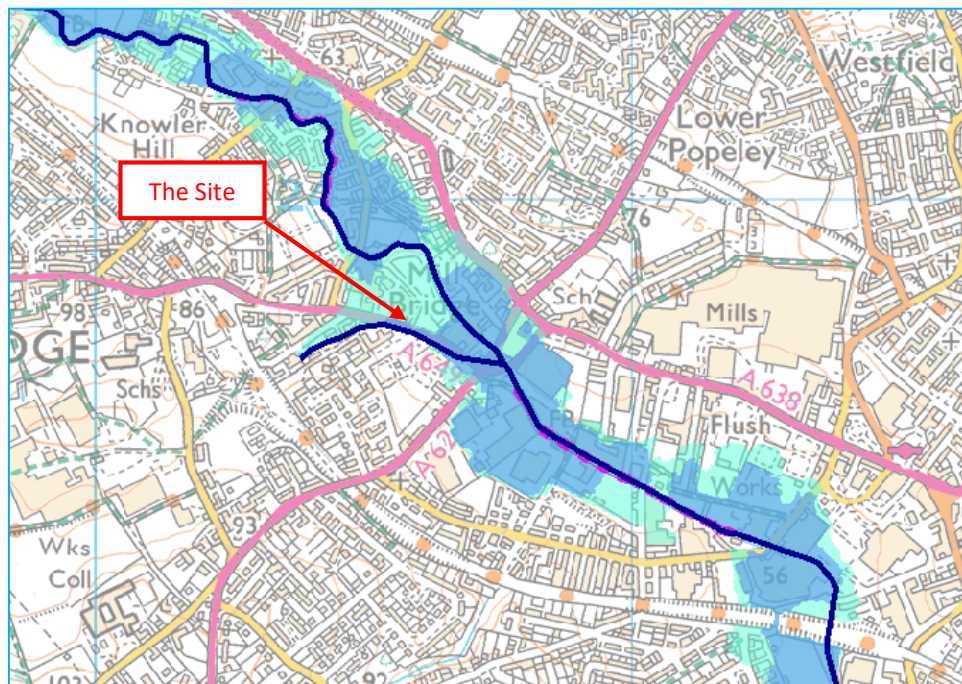


Figure 4 - Environment Agency Flood zones

Table 3 - Environment Agency Flood Zones and Appropriate Land Use

Flood Zone	Probability	Explanation	Appropriate Land Use
Zone 1	Low	Less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)	All development types generally acceptable
Zone 2	Medium	Between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year	Most development type are generally acceptable
Zone 3a	High	A 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year	Some development types not acceptable
Zone 3b	'Functional Floodplain'	Land where water has to be flow or be stored in times of flood. SFRAs should identify this zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1% flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes)	Some development types not acceptable

4.6 Flood Risk Vulnerability

In the Planning Practice Guidance appropriate uses have been identified for the Flood Zones. Applying the Flood Risk Vulnerability Classification in the Planning Practice Guidance, the proposed use of the site is 'more vulnerable'.

The proposed development will actually reduce the vulnerability of the site to flooding. The proposed development will improve the sites resilience, resistance to flooding and by using property level protection measures to protect the site from flooding the vulnerability of the site will be improved (see Section 6.0). Tables 3 and 4 of this report and the Planning Practice Guidance state that 'more vulnerable' uses are appropriate within Flood Zone 2 after the completion of a satisfactory FRA.

Table 4 - Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability Classification	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception test required	✓	✓
Zone 3a	Exception test required	✓	✗	Exception test required	✓
Zone 3b 'Functional Floodplain'	Exception test required	✓	✗	✗	✗

Key:

✓ : Development is appropriate, ✗: Development should not be permitted.

4.7 Site Specific Flood Risk Assessment

A summary of the sources of flooding and a review of the risk posed by each source at the site is shown in Table 5.

Table 5 - Risk Posed by Flooding Sources

Sources of Flooding	Potential Flood Risk	Potential Source	Probability/Significance
Fluvial Flooding	Yes	River Spen	Medium
Tidal Flooding	No	None Reported	None
Groundwater Flooding	No	None Reported	None
Surface Water Flooding	Yes	Poor Permeability	Low
Sewer Flooding	Yes	Sewers	Low
Flooding from Artificial Drainage Systems/Infrastructure Failure	Park Dam	None Reported	None

The site is unlikely to flood except in extreme conditions. The primary, but unlikely, flood risk to the site is from fluvial flooding from the River Spen. The site is located within Flood Zone 2 and therefore has a 'medium probability' of flooding, with a chance of between 1 in 1000 (0.1%) and 1 in 100 (1%) years. The risk of flooding from the River Spen is considered to be of **medium significance**.

A number of secondary flooding sources have been identified which may pose a **low significant** risk to the site. These are:

- Surface Water Flooding
- Sewer Flooding

The flooding sources will only inundate the site to a relatively low water depth and water velocity, will only last a short period of time, in very extreme cases and will not have an impact on the whole of the proposed development site. The flood risk at the site will be further mitigated by using a number of property level protection measures to manage and reduce the overall flood risk at the site.

The proposed uses of the site are classified as 'more vulnerable', 'more vulnerable' uses are appropriate within Flood Zone 2. The proposed development will actually reduce the vulnerability of the site to flooding. The proposed development will improve the buildings resilience, resistance to flooding and by using property level protection measures to protect the site from flooding the vulnerability of the site will be improved (see Section 6.0).

The proposed development will have no impact on the movement of floodwater across the site. The overall direction of the movement of water will be maintained within the developed site and surrounding area. The conveyance routes (flow paths) will not be blocked or obstructed. There will be no increase in the flood water levels due to the proposed development.

Paragraph 10⁶ of the Technical Guidance to the NPPF confirms that minor developments such as this are unlikely to raise significant flood risk issues.

⁶ Paragraph 10 of the Technical Guidance to the NPPF confirms that minor developments are:

- Minor non-residential extensions: industrial/commercial/leisure etc. extensions with a footprint less than 250m².

5.0 SURFACE WATER DRAINAGE

5.1 Surface Water

It is recognised that consideration of flood issues should not be confined to the floodplain. The alteration of natural surface water flow patterns through developments can lead to problems elsewhere in the catchment, particularly flooding downstream. For example, replacing vegetated areas with roofs, roads and other paved areas can increase both the total and the peak flow of surface water runoff from the development site. Changes of land use on previously developed land can also have significant downstream impacts where the existing drainage system may not have sufficient capacity for the additional drainage.

A surface water management strategy for the site proposals has been developed to manage and reduce the flood risk posed by the surface water runoff from the site. An assessment of the surface water runoff rates has been undertaken, in order to determine the surface water options and attenuation requirements for the site. The assessment considers the impact of the development compared to current conditions. Therefore, the surface water attenuation requirement for the developed site can be determined and reviewed against existing arrangements.

The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development, unless specific off-site arrangements are made and result in the same net effect.

5.2 Surface Water Runoff Rates

The current site consists of a discussed factory, offices and laboratory with car parking. It is understood that the existing drainage infrastructure at the site efficiently and effectively manages surface water runoff generated at the site. As there is no history of surface water flooding at the site it is likely that the current drainage system is sufficient for the current and proposed site use. It is understood that the proposals are for a change of use to a nursery with areas of soft landscaping (see Appendix 1).

The pre-application site is constructed entirely from impermeable surfaces with no permeable surfaces located on the site. The post-application site will increase the permeable surfaces on the site by including areas of soft landscaping.

Therefore, the amount of impermeable surfaces will not increase post-application compared to pre-application. The surface water runoff will not increase post-application compared to pre-application and there will be no increase in surface water flood risk to the site and off-site locations. No changes to the current surface water network are proposed.

-
- Alterations: development that does not increase the size of buildings e.g. alterations to the external appearance.
 - Householder development: e.g. sheds, garages, games rooms etc. within the curtilage of the existing dwelling in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats.

6.0 RISK MANAGEMENT

6.1 Introduction

The flood risk at this location is considered suitable for 'more vulnerable' developments within the NPPF. In this flood zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout, form of the development and the use of flood mitigation measures including SUDS techniques.

The flooding sources will be mitigated on the site by using a number of techniques, and mitigation strategies to manage and reduce the overall flood risk at the site. This will ensure the development will be safe and there is:

- Minimal risk to life;
- Minimal disruption to people living and working in the area;
- Minimal potential damage to property;
- Minimal impact of the proposed development on flood risk generally; and;
- Minimal disruption to natural heritage.

The flood risk at the site will be reduced by property level protection measures (see Table 5); these are discussed in more detail below. The proposed development will improve the sites resilience, resistance to flooding and by using property level protection measures to protect the site from flooding the vulnerability of the site will be improved and reduced.

Table 6 - Property Level Protection Measures

Measure	Details	Description
Site Layout	1. Sequential Approach 2. Finished Floor/Threshold Levels	Prevents water ingress and reduce vulnerability of occupants to flooding
Flood Resistance/ Flood Resilience	1. Thick walls 2. Sealant used around external doors and windows 3. Hard tiled floor surfaces 4. Raised utility entry points, ceiling down electrical circuits and electrical systems distributed at a high level	Prevents water ingress
Safe Access and Egress Routes	1. Safe access and escape route to areas outside of floodplain	Reduce vulnerability of occupants to flooding
Flood Warning	1. Warning so the property can be safely evacuated and mitigation measures to be put in place	Reduce vulnerability of occupants to flooding
Flood Plan	1. Outlines precautions and actions taken when a flood event is anticipated	Reduce vulnerability of occupants to flooding and makes them aware of the mechanisms of flooding at the site

6.2 Site Layout

6.2.1 Sequential Approach

The sequential approach has been applied within the site by locating the most vulnerable elements of the development in the lowest risk areas. The most vulnerable uses (e.g. multi-function room with emphasis on technology, out of school club, admin room etc.) have been situated on the first floor of the site at a lower risk of flooding with the more flood-compatible (e.g. wet play, room, wet room, kitchen etc.) being situated on the ground floor at a higher risk of flooding.

6.2.2 Finished Floor/Threshold Level

Raising the finished floor and threshold levels of the building will be used to mitigate the effects of flooding at the site. The proposed finished floor level will match the existing finished floor level of the building and will be located above the existing external ground level by a minimum of 150mm.

It is recognised however that owing to limited headroom constraints, massing, planning policy and Building Regulations it is considered impractical to raise the finished floor levels further. Therefore, in order to further mitigate against this, it is recommended that the occupants of the building implement a flood evacuation plan to a safe area away from the building during times of flood. It is also proposed that flood protection measures are employed within the building design to reduce the overall risk to the occupants. This is discussed below.

6.2.3 First Floor Accommodation

Accommodation will be located on the first floor as well as the ground floor of the building. This will allow occupants to retreat to higher floor levels if needed. The levels of the first floor are located approximately 2.65m above the ground floor finished floor level well above any flood water levels.

This provides a 'safe haven' above any flood water levels assuming the flood defences are overtopped/breached. This will enable rapid escape should flooding occur which is unlikely. The upper floors are accessed via internal stairs and are sufficient in size to safely house all occupants of the building. The 'safe haven' will only be required in very extreme events or if a flood warning has not been received.

6.3 Flood Resilience and Resistance

The development of the layout should always consider that the site is potentially at risk from an extreme event and as such the implementation of flood resilience and resistance methods should be assessed.

To make the building more resistant to seepage the following measures will be incorporated. Sealant will be used around external doors and windows. All external doors and windows will be constructed from durable materials and the walls of the building will be thick. All windows will be a minimum of 1000mm above the ground level.

To improve the buildings resilience to flooding the following measures will be incorporated. All electrical wiring, switches, sockets, socket outlets, electrical, and gas meters etc. will be located a minimum of 600mm above the 1 in 100 year (plus climate change) water level.

6.4 Flood Warning and Evacuation

The site is located in a flood risk area therefore; the site will participate in the Environment Agency flood warning telephone service. The site will register contact details with the Environment Agency'

Flood Warnings Direct Service (Floodline 0845 988 1188) in order to receive Flood Alerts for the following Flood Alert area:-

- Liversedge including Knowler Hill to Wormald Street, roughly bounded by Bradford Road, Halifax Road and Knowler Way.

The Environment Agency operate a free flood warning service providing alerts by phone, text or email when flooding is anticipated providing an opportunity for home owners to take necessary precautions, giving enough time for the building to be safely evacuated and mitigation measures to be put in place.

All occupants/visitors of the site will be made aware of the Environment Agency Floodline telephone number (Call Floodline on 0345 988 1188 or 0845 988 1188 to get more information) and the three Flood Warning Codes and their meaning.

The owner/manager of the site will carry out the role of Flood Warden for the site and ensure they have an understanding of the flood mechanisms of the site and will ensure that the safety of the occupants and visitors will not be compromised.

The Environment Agency uses three Flood Warnings Codes. They can be issued in any order, usually ending with an 'all clear'. They are issued by the Environment Agency through their website⁷ and Floodline Warning Direct.

The flood warning will be passed onto the occupier/visitors of the site verbally, by telephone and/or in person. It will be ensured that everyone receives the flood warnings when required.

6.5 Flood Plan

A Flood Plan outlining the precautions and actions you should take when a flood event is anticipated to help reduce the impact and damage flooding may cause will be developed.

Sensible precautions would include raising electrical items, irreplaceable items and sentimental items off the ground or where possible moving them to a higher floor, rolling up carpets and rugs and turning off utilities. In addition, consider what actions you would take should the property need to be evacuated including access and egress routes and preparing a flood kit in advance containing warm clothing, medication, a torch, food and wellingtons.

The Flood Plan is a 'living' document and therefore should be periodically reviewed and updated to provide advice and guidance to occupants in the event of an extreme flood. The Flood Plan will therefore reduce the vulnerability of the occupants to flooding and makes them aware of the mechanisms of flooding at the property.

The Flood Warden will monitor flood levels and keep occupants and visitors informed and will decide whether to initiate the Flood Plan. If required a 'safe haven' (see Section 6.2.3) can also be maintained and may be required in very extreme events if a flood warning has not been received.

6.6 Safe Access and Egress Routes

The NPPF requires that, where required, safe access and escape is available to/from new developments in flood risk areas. Access routes should be such that occupants can safely access and exit their dwellings/buildings in design flood conditions. These routes must also provide the

⁷ Available at <http://www.environment-agency.gov.uk/homeandleisure/floods/31618.aspx>. Where specific information can be found by entering the house postcode or address.

emergency services with access to the development during a flood event and enable flood defence authorities to carry out any necessary duties during the period of flood.

A safe access and egress routes, including emergency access can be maintained for vehicles and/or by foot via Halifax Road to the south of the site then to the west along Halifax Road where flood depths are lower. The ground level of Halifax Road at the entrance to the site is 60.60m AOD. Halifax Road rises to the west of the site with a ground level of 62.40m AOD approximately 100m to the west of the site.

Halifax Road and the site is located within Flood Zone 2 with an annual probability of river flooding between 1 in 1000 (0.1%) and 1 in 100 (1%) years. Therefore, safe access and egress can be maintained for all events up to and including the 1 in 100 year (plus climate change) events in accordance with the NPPF and Environment Agency Guidance. People should make their way to areas outside of the flood zone.

There may be large areas that are flood free located nearer and within the vicinity of the site than the Flood Zones shown in Figure 4. Facilities such as community centres, shops etc. are located to the west of the site which may be used in the event of a flood event.

In the event of a Flood Warning, vital belongings, including waterproof clothing, necessary medication and essentials for infants and children will be collected. It should be ensured that all occupiers and visitors to the site are accounted for, and then exit the site.

6.7 Flooding Consequences

The property level mitigation measures detailed above show that the flood risk can be effectively managed and therefore the consequences of flooding are acceptable.

The site is unlikely to flood except in extreme conditions. The overall risk of flooding at the site, is medium however, further property level protection measures are used to manage and mitigate the flood risk to a low level of flood risk.

7.0 SEQUENTIAL APPROACH

7.1 Sequential and Exception Tests

The risk-based Sequential Test in accordance with the NPPF aims to steer new development to areas at the lowest probability of flooding (i.e. Flood Zone 1). Paragraph 104 of the NPPF states that:

‘Applications for minor development and changes of use should not be subject to the Sequential or Exception Tests⁸ but should still meet the requirements for site-specific flood risk assessments’.

Therefore, the Sequential and Exception Tests will not need to be undertaken as part of this planning application. The development proposals should therefore be considered by the LPA to satisfy the Sequential and Exception Tests as set out in the NPPF.

⁸ Except for any proposal involving a change of use to a caravan, camping or chalet site, or to a mobile home or park home site, where the Sequential and Exception Tests should be applied as appropriate.

8.0 SUMMARY AND CONCLUSIONS

8.1 Introduction

This report presents a FRA in accordance with the NPPF for the proposed development at Unit 3, 22 - 26 Halifax Road, Liversedge, WF15 6JQ.

This FRA identifies and assesses the risks of all forms of flooding to and from the development and demonstrates how these flood risks will be managed so that the development remains safe throughout the lifetime, taking climate change into account.

8.2 Flood Risk

The site is unlikely to flood except in extreme conditions. The primary, but unlikely, flood risk to the site is from fluvial flooding from the River Spen. The site is located within Flood Zone 2 and therefore has a 'medium probability' of flooding, with a chance of between 1 in 1000 (0.1%) and 1 in 100 (1%) years. The risk of flooding from the River Spen is considered to be of **medium significance**.

A number of secondary flooding sources have been identified which may pose a **low significant** risk to the site. These are:

- Surface Water Flooding
- Sewer Flooding

The flooding sources will only inundate the site to a relatively low water depth and water velocity, will only last a short period of time, in very extreme cases and will not have an impact on the whole of the proposed development site. The flood risk at the site will be further mitigated by using a number of property level protection measures to manage and reduce the overall flood risk at the site.

The proposed uses of the site are classified as 'more vulnerable', 'more vulnerable' uses are appropriate within Flood Zone 2. The proposed development will actually reduce the vulnerability of the site to flooding. The proposed development will improve the buildings resilience, resistance to flooding and by using property level protection measures to protect the site from flooding the vulnerability of the site will be improved.

The proposed development will have no impact on the movement of floodwater across the site. The overall direction of the movement of water will be maintained within the developed site and surrounding area. The conveyance routes (flow paths) will not be blocked or obstructed. There will be no increase in the flood water levels due to the proposed development.

Paragraph 10 of the Technical Guidance to the NPPF confirms that minor developments such as this are unlikely to raise significant flood risk issues.

8.3 Surface Water Drainage

The pre-application site is constructed entirely from impermeable surfaces with no permeable surfaces located on the site. The post-application site will increase the permeable surfaces on the site by including areas of soft landscaping.

Therefore, the amount of impermeable surfaces will not increase post-application compared to pre-application. The surface water runoff will not increase post-application compared to pre-application.

and there will be no increase in surface water flood risk to the site and off-site locations. No changes to the current surface water network are proposed.

8.4 Risk Management

The flooding sources will be managed and mitigated on the site by using a number of techniques, and mitigation strategies to manage and reduce the overall flood risk at the site. This will ensure the development will be safe. Measures used:

Site Layout - Sequential Approach: The sequential approach has been applied within the site by locating the most vulnerable elements of the development in the lowest risk areas. The most vulnerable uses (e.g. multi-function room with emphasis on technology, out of school club, admin room etc.) have been situated on the first floor of the site at a lower risk of flooding with the more flood-compatible (e.g. wet play, room, wet room, kitchen etc.) being situated on the ground floor at a higher risk of flooding.

Site Layout - Finished Floor/Threshold Level: Raising the finished floor and threshold levels of the building will be used to mitigate the effects of flooding at the site. The proposed finished floor level will match the existing finished floor level of the building and will be located above the existing external ground level by a minimum of 150mm.

It is recognised however that owing to limited headroom constraints, massing, planning policy and Building Regulations it is considered impractical to raise the finished floor levels further. Therefore, in order to further mitigate against this, it is recommended that the occupants of the building implement a flood evacuation plan to a safe area away from the building during times of flood. It is also proposed that flood protection measures are employed within the building design to reduce the overall risk to the occupants. This is discussed below.

Site Layout - First Floor Accommodation: Accommodation will be located on the first floor as well as the ground floor of the building. This will allow occupants to retreat to higher floor levels if needed. The levels of the first floor are located approximately 2.65m above the ground floor finished floor level well above any flood water levels.

This provides a 'safe haven' above any flood water levels assuming the flood defences are overtopped/breached. This will enable rapid escape should flooding occur which is unlikely. The upper floors are accessed via internal stairs and are sufficient in size to safely house all occupants of the building. The 'safe haven' will only be required in very extreme events or if a flood warning has not been received.

Flood Resilience and Resistance: To make the building more resistant to seepage the following measures will be incorporated. Sealant will be used around external doors and windows. All external doors and windows will be constructed from durable materials and the walls of the building will be thick. All windows will be a minimum of 1000mm above the ground level.

To improve the buildings resilience to flooding the following measures will be incorporated. All electrical wiring, switches, sockets, socket outlets, electrical, and gas meters etc. will be located a minimum of 600mm above the 1 in 100 year (plus climate change) water level.

Flood Warning and Evacuation: The site is located in a flood risk area therefore; the site will participate in the Environment Agency flood warning telephone service. The site will register contact details with the Environment Agency' Flood Warnings Direct Service (Floodline 0845 988 1188) in order to receive Flood Alerts.

Flood Plan: A Flood Plan outlining the precautions and actions you should take when a flood event is anticipated to help reduce the impact and damage flooding may cause will be developed.

Safe Access and Egress Routes: A safe access and egress routes, including emergency access can be maintained for vehicles and/or by foot via Halifax Road to the south of the site then to the west along Halifax Road where flood depths are lower. The ground level of Halifax Road at the entrance to the site is 60.60mAOD. Halifax Road rises to the west of the site with a ground level of 62.40mAOD approximately 100m to the west of the site.

Halifax Road and the site is located within Flood Zone 2 with an annual probability of river flooding between 1 in 1000 (0.1%) and 1 in 100 (1%) years. Therefore, safe access and egress can be maintained for all events up to and including the 1 in 100 year (plus climate change) events in accordance with the NPPF and Environment Agency Guidance. People should make their way to areas outside of the flood zone.

8.5 Sequential Approach

The Sequential and Exception Tests will not need to be undertaken as part of this planning application. The development proposals should therefore be considered by the LPA to satisfy the Sequential and Exception Tests as set out in the NPPF.

8.6 Conclusion

Table 7 summarises the probability and consequence of flooding for the site with and without mitigation measures.

This FRA demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of the NPPF.

The development should not therefore be precluded on the grounds of flood risk.

Table 7 - Probability and Consequences of all Sources of Flooding

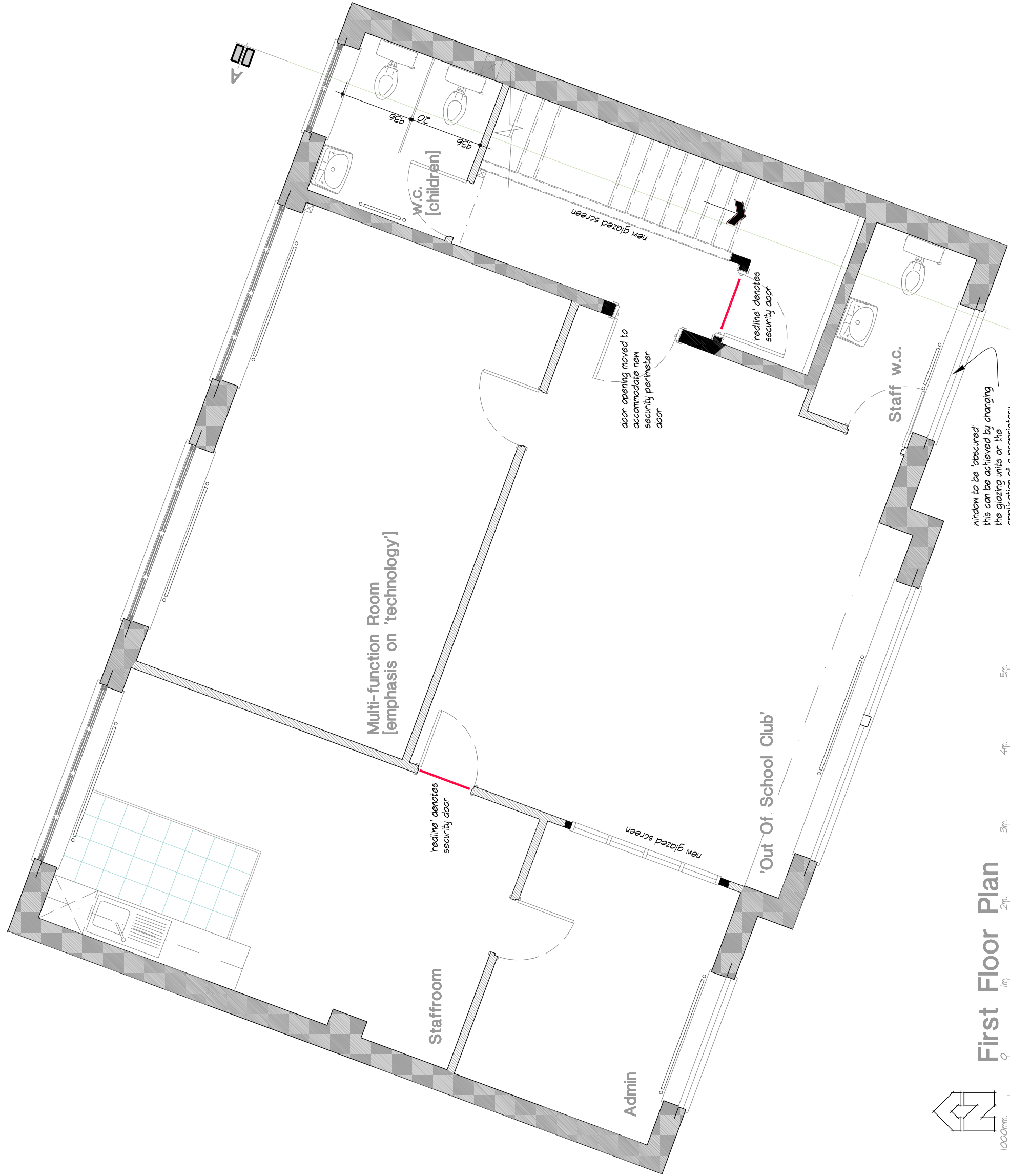
Sources of Flooding	Potential Source	Probability	Consequence & Impact Without Mitigation	Consequence & Impact With Mitigation	Comment
Fluvial Flooding	River Spen	Medium	Medium	Low	Mitigation Measures Used
Tidal Flooding	None Reported	None	Negligible	Negligible	None
Groundwater Flooding	None Reported	None	Negligible	Negligible	None
Surface Water Flooding	Poor Permeability	Low	Low	Negligible	Mitigation Measures Used
Sewer Flooding	Sewers	Low	Low	Negligible	Mitigation Measures Used
Flooding from Artificial Drainage Systems/Infrastructure Failure	Park Dam	None	Negligible	Negligible	None

APPENDICES

APPENDIX 1 – Proposed Site Layout

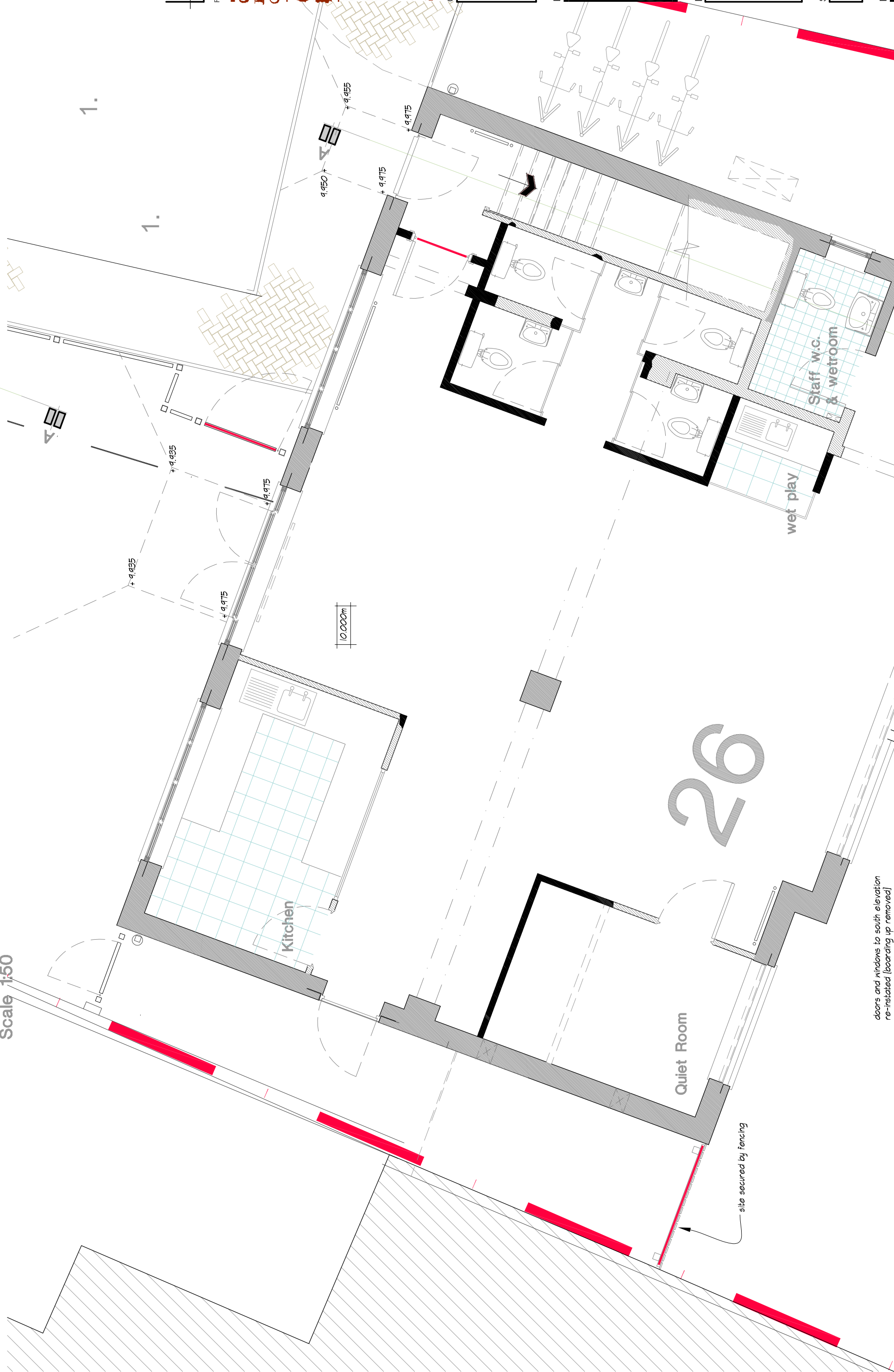
Schedule of Areas	
Ground Floor [GIFA]	104.3m²
First Floor [GIFA]	104.7m²
Floor Area [GIFA]	209m
Footprint	118m

The Gross Internal Floor Area (GIFA) is measured inside the external walls and includes all internal partitions and structural walls. Columns are included as are staircases and any voids above and below.



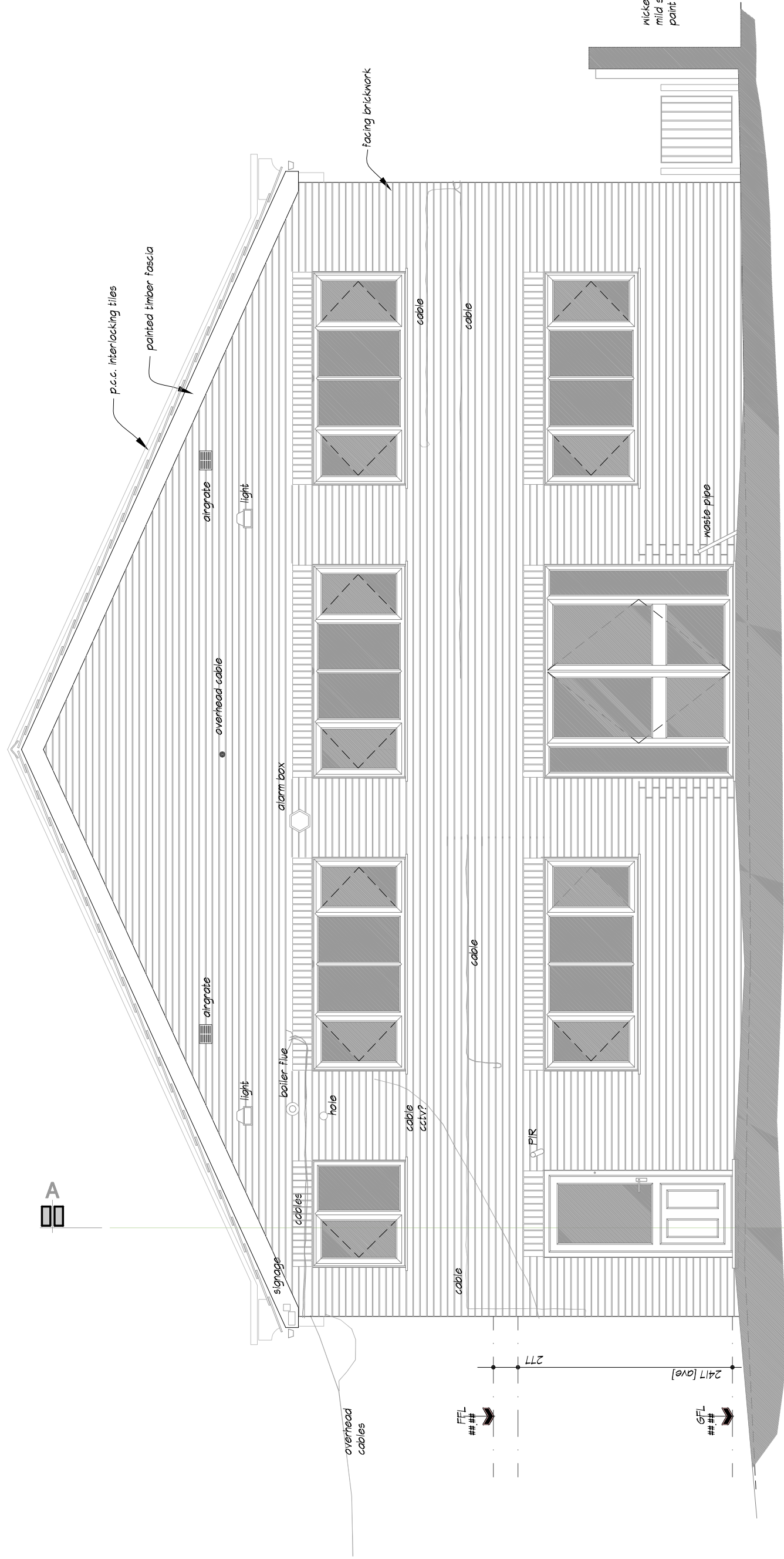
First Floor Plan

Scale 1:50



Ground Floor Plan

Scale 1:50

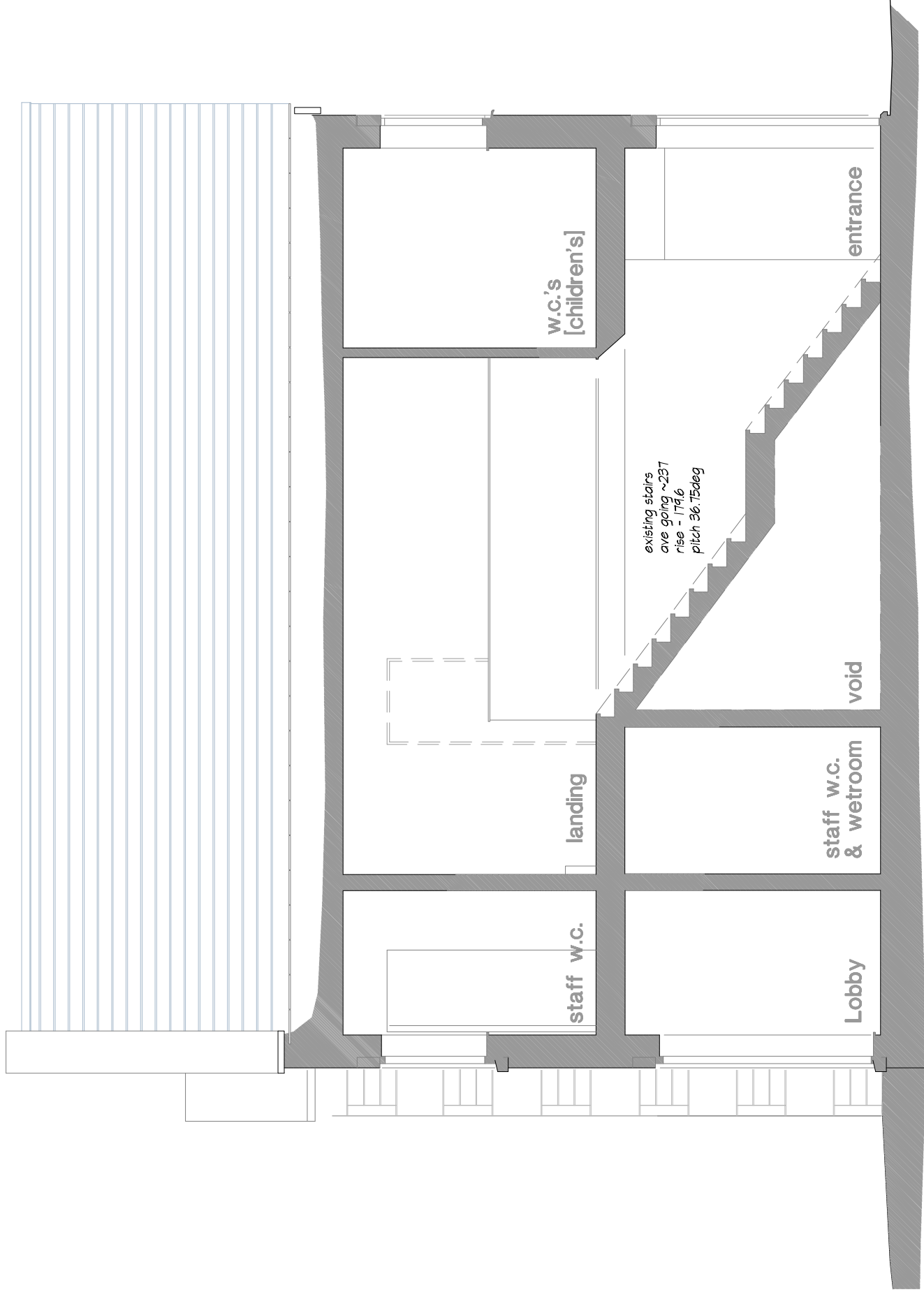


North Elevation

Scale 1:50

Local raising of ground levels at entrances to form 'new' level access with 1m 40 falls away from building. This will provide a drainage slot between landing and threshold ensure horizontal gap is not compromised

Remove existing window frame complete with glazing and fix to new frame. Lower sills to form new French windows. Head up reveals square. New JWC frame in brown to match existing double glazing in laminated safety glass.



Section A-A

Scale 1:50

"Little Rainbows", Liversedge

REV.	DATE	REVISION	INIT.
1	13/06/16	13/06/16	Calum Hunter

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WF15 6JL

PROJECT
Proposed 30 Place Nursery
Little Rainbows
26 Halifax Road
Liversedge
WF15 6JL

DRAWING
As Proposed:
Plans @ Ground & First Floors
Section A-A & North Elevation
"For Approval"

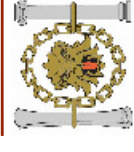
SCALE
1:50
DATE
13/06/16
DRAWN
Calum Hunter

DRAWING No.
602
DWG. No.
[2-] 006
REV.
-

Notes



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PROJECT

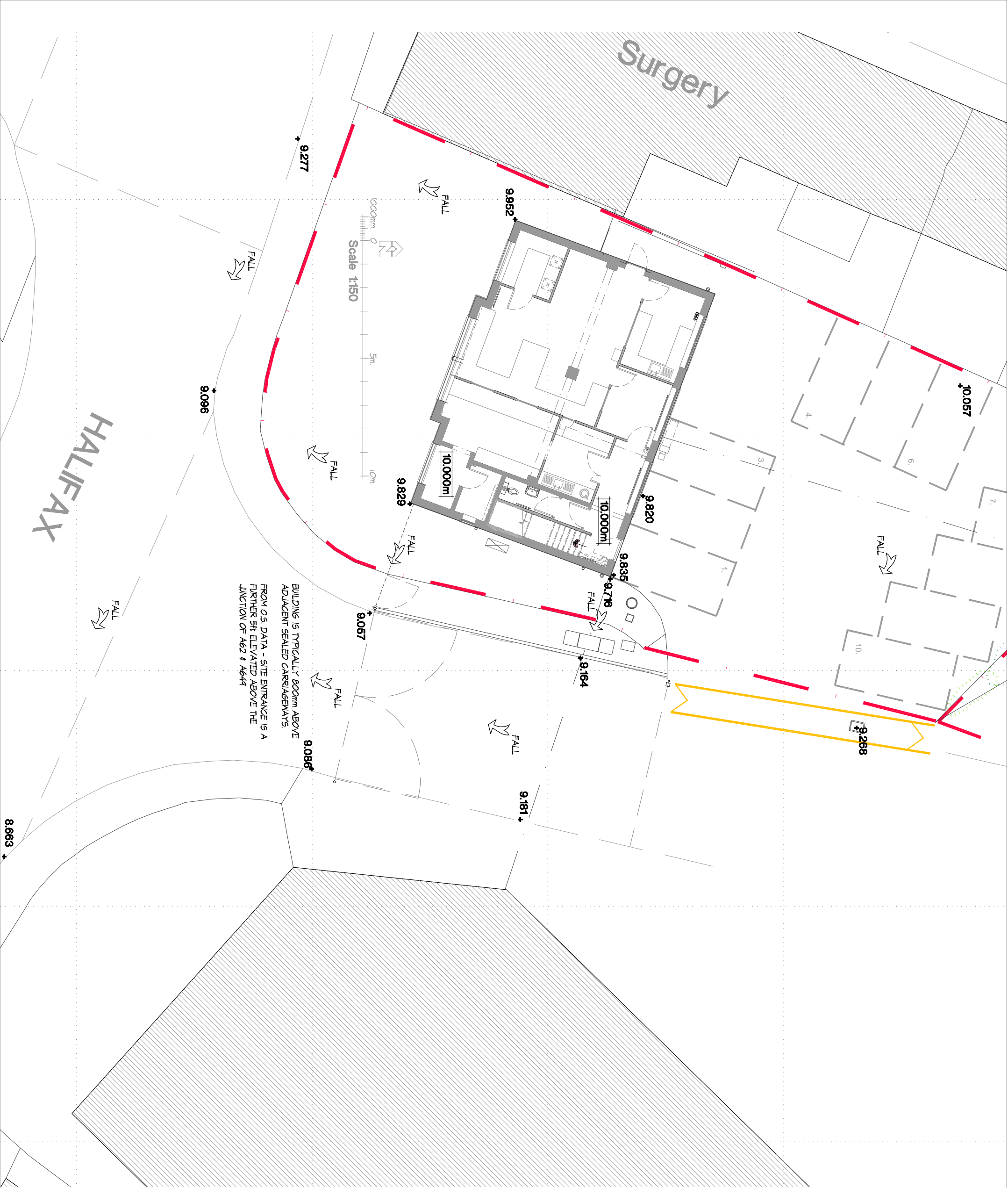
Proposed 30 Place Nursery
Little Rainbows
26 Halifax Road
Liversedge
WF15 6JL

As Proposed: Site Plan	"For Approval"
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DRAWING No.		
JOB No.	DWG. No.	REV.
602	[2-] 005	-

15270

APPENDIX 2 – Topographical Survey



REV.	DATE	REVISION	INT.

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PROJECT
Proposed 30 Place Nursery
Little Rainbows
26 Halifax Road
Liversedge
WF15 6UQ

DRAWING
As Existing
Levels and Falls
"Discussion"

SCALE
1:150
DATE
02/07/16
DRAWN
Calum Hunter

DRAWING No.
602
DWG No.
12-1-008
REV.
-

Notes



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