



Project Title

Flood Risk Assessment

At

Redisher Finishing Techniques
Limited Holcombe Brook,
Ramsbottom,
Bury,
BL0 9SA

For

Finishing Techniques Limited

PG Consulting
108 Ack Lane West
Cheadle Hulme
Cheshire
SK8 7ES

Tel: 07710 758971

Mail: Paul@pgcl.co.uk

Paul Graveney Consulting Ltd Trading as PG Consulting
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Executive Summary

The proposal is for the construction of a residential development on a Brownfield site with associated access roads, car parking and landscaping known as Holcombe Brook, Ramsbottom, Bury, BL0 9SA.

According to the Environment Agency (EA) Indicative flood maps for planning, the development area holds a Flood Zone 1 classification, i.e. land assessed as having less than a 1 in 1000 annual probability of fluvial flooding (<0.1%) in any year. Immediately to the north of the site is an overland Flood Zone 2 Classification, i.e. land assessed as having greater than a 1 in 1000 (>0.1%) but less than a 1 in 100 (<0.1%) annual probability of fluvial flooding in any year.

The development target has been assessed against the NPPF 'Sequential Test'. Taking into consideration that the application is for a residential development in Flood Zone 1, Tables 1, 2 & 3 of the NPPF Technical Guidance have been appraised to confirm that development is 'Appropriate'. The 'Exception Test' is consequently not required.

This Flood Risk Assessment has considered all forms of flooding and overall, has found that the development is at low risk of flooding from all other sources.

The finished ground levels of the residential units have been raised 1.78m above the flood water levels of the adjacent Holcombe Brook to prevent overland flood flow risk and also 0.6m above the existing retained highway levels at the front.

During the extreme flood events safe egress for the occupiers is assured for higher order storm events up to and including the 100-year event due flood water being retained 'in channel'. For the extremely rare occurrence of a culvert collapse beneath Bolton Road West, safe egress is assured to the higher levels of the properties.

The peak storm water runoff rate from the development to the adjacent watercourse will reduce by 50% by inclusion of grassed garden areas, and Sustainable Drainage Systems (SuDS) in the form of water butts, permeable surfacing and on-line piped attenuation with a flow restricting device.

There is no residual flood risk from the development site to the surrounding district due to the reduction in storm water flow rates to the watercourse. The development does not therefore increase the risk of flooding to other adjacent neighbourhoods. Out of chamber or gully flooding for the extreme 100 year plus climate change event may occur within and around the development site and is classed as exceedance flows. Flood water from this event will be contained within the development site and directed away from the buildings to the external hard and soft landscaped areas.

Foul water generated from the new development will discharge into a individual treatment plants located at the front of each plot. The clean output from the treatment plants will flow by gravity along the front of the units where it will discharge to the redirected culverted watercourse at a peak runoff rate of 5l/s The foul discharge does not present an increased flood risk to the surrounding district.

1.0 Introduction

- 1.1 Finishing Techniques Limited has instructed this Flood Risk Assessment to support a Planning Application for a new residential development at the existing Finishing Techniques Ltd building adjoining Holcombe Brook, to the outskirts of the town of Ramsbottom. The assessment has been undertaken in line with Section 10 of the 'National Planning Policy Framework' plus the accompanying Technical Guidance on Flood Risk.
- 1.2 This Flood Risk Assessment (FRA) has been commissioned by Finishing Techniques Limited and is specific to their interests in the residential development proposals as described by the site plan in Appendix A. This report may not be assigned.
- 1.3 The report has been commissioned to identify any flood related issues associated with the proposed development and any likely constraints that could be imposed. The following issues have been addressed within this report;
- Identify available data relating to flood risk at the site.
 - Determine whether the site is at risk from flooding, including from breach or overtopping of any existing flood defences, surface water flooding and/or ground water flooding.
 - Determine any the current surface water drainage regime and assess any potential increase in surface water runoff as a result of the proposed development.
 - Discuss if required Sustainable Drainage Systems (SuDS) as an option for reducing surface water flood risk. Determine any potential increase in surface water runoff as a result of the proposed development.
 - Devise an appropriate outline foul and surface water drainage strategy to deal with any increase in surface water runoff and include for climate change.
 - Consider the recommendations of Bury Metropolitan Borough Council Strategic Flood Risk Assessment (SFRA).
 - Prepare the Flood Risk Assessment and Surface Water Drainage Strategy report.
 - Assess mitigation measures & off-site impacts and define any residual risks.

2.0 Development Description and Location

2.1 Site Location

The site is referenced in Table 1, and a site location map is provided in Appendix A.

Table 1: Site Referencing Information

Item	Brief Description
Site name	Redisher Finishing
Site address and location	Holcombe Brook, Ramsbottom, Bury, BL0 9SA
Council Area	Bury Metropolitan Borough Council
Approximate Grid Reference	OS: 378940, 416547
General Locality	The development is located outside the village of Ramsbottom, some 5km to the northwest of Bury Town Centre.

2.2 Existing site Description

- 2.2.1 The Finishing Techniques development site (Red Line Boundary) encompasses two existing buildings and existing hard standing for parking. The total area is some 0.063 Hectares.
- 2.1.2 The site is located in a off a small unmade highway leading off Bolton Road West, to the rear of the Hare and Hounds Public House. The highway leading down past a single dwelling into a 'hollow' where the finishing Techniques Building is located to the north at the lowest lying point. The highway then leads up and around to the north where it enters a short cul-de-sac (known as Redisher Croft), encompassing some four residential properties and constructed circa 2000.
- 2.1.3 Opposite the development site and on the south side of the highway is the open section of Holcombe Brook. Classed by the Environment Agency as 'Main River', this watercourse flows generally in a south easterly direction outfalling into the River Irwell. Upstream of the site the Brook is culverted for several hundred metres as it passes beneath the existing industrial buildings. It then returns to an open channelised section as it passes the site before returning to culvert as it passes beneath Bolton Road West.
- 2.1.4 Figure 1 below identifies the overall site location details with the two photographs providing an indication of the sites low lying position. Further details of the existing layout can be seen on the Red Line Plans in Appendix A.

2.3 Local Hydrology

- 2.3.1 The closest identified watercourse is Holcombe Brook which is located immediately to the south of the site in a small length of open section before heading into a culvert beneath Bolton Road West and flowing in an easterly direction towards the River Irwell located a further 600m to the east.

2.4 Topography

- 2.4.1 A review of the topographical survey would indicate the current area to be relatively flat with a moderate fall in an easterly direction of 156.20m AOD for the existing building towards the open section of Halcombe Brook at 155.80m AOD. Further details can be identified on the Topographical survey in Appendix B.

2.5 Photographs and Location Plan

Figure 1: Photograph Viewing West Across Site from Eastern Boundary.

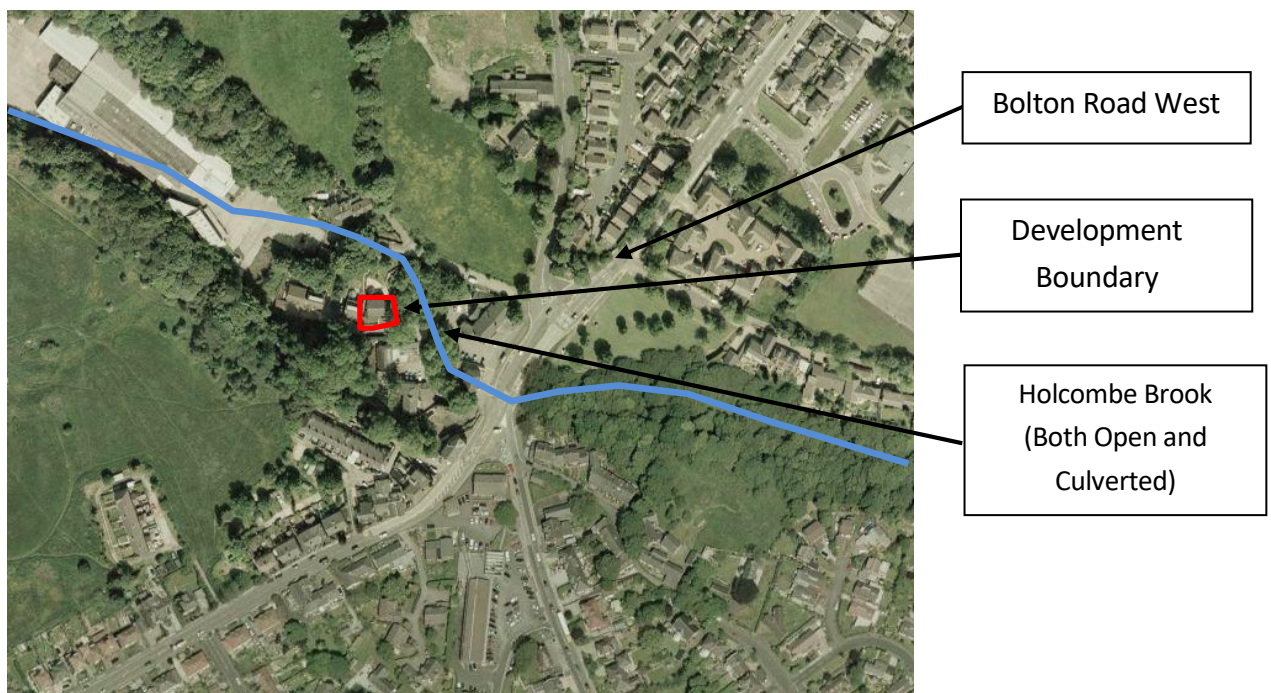


Photo 1 – Existing Site from NE



Photo 2 – Existing Site from SE

Figure 2: Location Plan



2.6 Development Proposals

- 2.6.1 This report has been prepared to support a full planning application for a proposed residential development at the location of the current Finishing Techniques Building.
- 2.6.2 The current outline Architectural site Master Plan as indicated in Appendix A provides an indication of the proposed residential development with direct access off the existing highway. The existing Finishing Techniques Buildings will be removed to facilitate the new development.
- 2.6.3 Finished floor levels have also been defined on this drawing at 156.390.

3.0 Planning Policy and Consultation

3.1 National Planning Policy Framework

3.1.1 The flood maps provided by the Environment Agency locate the site within Flood Zone 1. i.e. land as having an annual probability of flooding of less than 1 in 1000 in any year (<0.1%). Immediately to the north of the site is an overland Flood Zone 2 Classification, i.e. land assessed as having greater than a 1 in 1000 (>0.1%) but less than a 1 in 100 (<0.1%) annual probability of fluvial flooding in any year.

3.1.2 As a requirement of the NPPF (2021), Annex D, the proposed development should satisfy the requirements of the Sequential Test and where applicable the Exception Test.

3.2.2 Sequential & Exception Test:

Under the NPPF (2021), Flood Zone 1 is defined as low probability flood risk. The proposed development is for a residential development, which in line with Table 2 is classified as 'More Vulnerable'.

Placing both these criteria into Table 3 (Flood Risk Vulnerability and Flood Zone 'Compatibility'), More Vulnerable development in Flood Zone 1 determines that the 'Development is Appropriate' and that the Exception Test is not applicable to this development proposal.

3.2 Strategic Flood Risk Assessment (SFRA)

3.2.1 SFRA's assess the risk associated with all types of flooding and provide the information required to identify the amount of development permitted in an area, how drainage systems in the area should function and also how risks in vulnerable areas can be reduced and/or mitigated. The NPPF states that regional planning bodies (RPB's) or Local Planning Authorities should prepare SFRA's in consultation with the EA.

3.2.2 The building sits within the coverage of the Greater Manchester Level 2 Hybrid SFRA Final Report May 2010. The published SFRA identifies current and future broad scale flood related issues within the full Greater Manchester area, but also covers Bury. The purpose of the SFRA is to assess and map all known sources of flood risk including fluvial, surface water, sewer, groundwater and all impounded water bodies, taking into account future climate change predictions.

3.2.3 A summary of the main elements from the SFRA associated with the district is detailed below. The full report can be obtained from the Bury Metropolitan Borough Council website.

- SFRA provides a detailed understanding of flood risks across all areas from all sources.
- SFRA maps indicate the site to be at low risk of fluvial flooding (FZ1).
- Full sequential and exception tests to be carried out (where applicable).
- Development should be designed so that there is no flooding to the development in a 1 in 30-year event and so that there is no property flooding in a 1 in 100 year plus climate change event. Where possible sustainable drainage should be incorporated.

4.0 Definition of Flood Hazard

Flood risk to the proposed development building is considered from all sources of flooding, as defined by the NPPF.

4.1 Sources of information

The following section defines the flood risk receptors and anticipated flood risk. Section 4.7 then summarises the probability of flooding and the likely impacts. Table 2 defines the main sources of information used in the identification of flood risk.

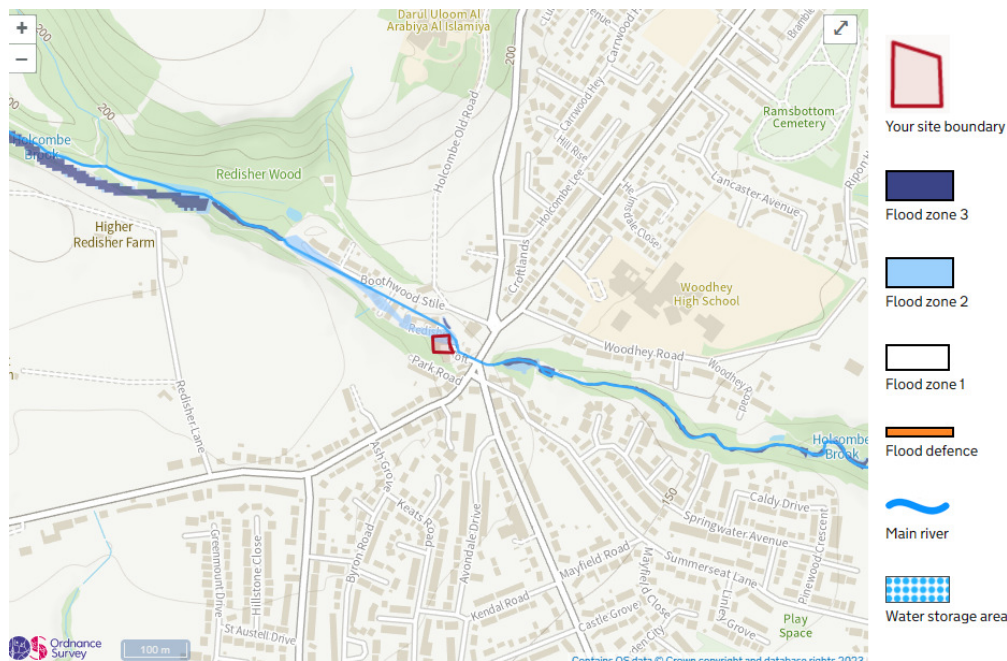
Table 2: Sources of information used in the identification of flood risk

Source of Information	Details
Environment Agency	Flood Map and Product 4 Flood Data
United Utility	Sewer Records
Bury MBC	SFRA Report & Various Maps

4.2 Flooding from River (Fluvial)

- 4.2.1 Figure 3 below locates the site on the Environment Agency's indicative floodplain map. It is clear from this that the red line boundary sits outside of a fluvial generator of flood water from any identified waterbody or river. It is considered that the site is located outside of the active 100-year and extreme event floodplains, thus situated within 'Flood Zone 1 Classification' in accordance with the NPPF Technical Guidance, i.e. probability of annual fluvial flooding significantly less than 1 in 1000 in any one year (<0.1%). Immediately to the north of the site is an overland Flood Zone 2 Classification, i.e. land assessed as having greater than a 1 in 1000 (>0.1%) but less than a 1 in 100 (<0.1%) annual probability of fluvial flooding in any year.
- 4.2.2 The risk from fluvial flood water therefore requires further consideration. Refer to Section 5 for details.

Figure 3 – The EA's Indicative 100-year Fluvial Floodplain Map



4.3 Flooding from Land and Surface Waters (Overland Flow)

4.3.1 The EA descriptions for the High, Medium and Low risk scenarios for surface water flooding are as follows:

- High risk means that each year this area has a chance of flooding of greater than 3.3%.
- Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%.
- Low risk means that each year this area has a chance of flooding of between 0.1% and 1%.
- Very Low risk means that each year this area has a chance of flooding of less than 0.1%.

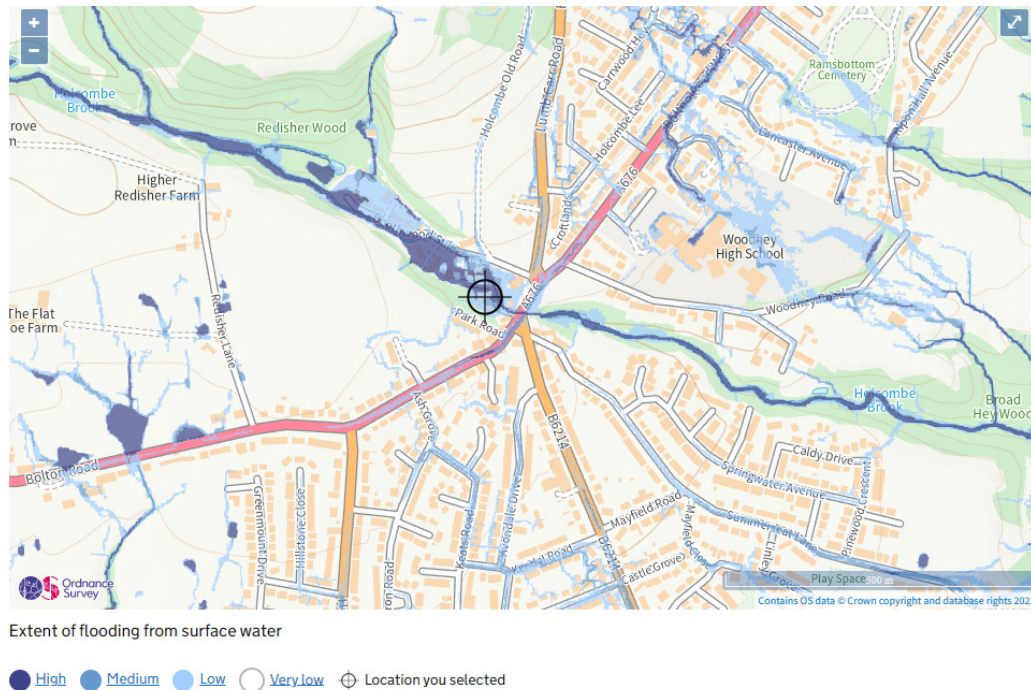
4.3.2 The general area within and surrounding the proposed development falls in a north west to south easterly direction where it then enters the open section of Halcombe Brook. The unnamed road immediately to the north would pass any overland flows away from the development site due to the raised masonry wall.

4.3.3 The Environment Agency's surface water flood maps (refer to Figure 4) show the site area to be at low to medium risk of surface flooding and are associated with topographical low points. The EA maps don't take account that the actual overland water would pass back into the watercourse and in reality does not flood the area as extensive as the maps imply.

4.3.4 There are no actual existing surface water flow routes through the site that would need to be maintained.

- 4.3.5 In mitigation and to reduce the flood risk, the new residential units will be raised up above existing levels such that the potential overland flood water would pass back into the brook before reaching the levels of the units, thus posing a low risk. The new surface water drainage will also be designed and installed in accordance with the latest guidance and climate change allowances to ensure no surface water ponding will occur.

Figure 4 – Extract EA Flood Risk Mapping - Flood Risk from Surface Water



4.4 Flooding from Sewers and Private Drainage

- 4.4.1 The United Utilities (UU) sewer records have been reviewed (refer to Appendix E) and confirm that there are no public sewers within the site boundary. The nearest public sewer is a 225mm diameter surface water sewer outfalling to Halcombe Brook immediately to the north.
- 4.4.2 The current site drains unrestricted to the adjacent Halcombe Brook via a 300mm diameter culverted watercourse passing through the north of the site.
- 4.4.3 The UU adopted sewers and private drainage networks serving the surrounding urban district ensures that the development footprint is protected from the impact of both upstream and downstream runoff. It is speculated that complete protection may well exist beyond a storm event equivalent to the 30-year statistical event. Beyond this projection, there may be a small degree of peripheral 'Exceedance' flooding within the areas above the sewers. However, this is expected to be localised and restricted to the location of specific manhole covers located outside the development footprint. Thus, flood risk to the site from sewers is diminished to acceptable levels.

4.5 Flooding from Groundwater

- 4.5.1 Groundwater flooding occurs when the water table, the level of water below the ground, rises above the ground surface or into cellars and basements. Groundwater flooding is most likely to occur in low lying areas underlain by permeable rocks (aquifers). These may be extensive, regional aquifers, such as chalk or sandstone, or may be localised sands or river gravels in valley bottoms underlain by less permeable rocks.
- 4.5.2 No site investigation has been carried out at the site. British Geological Survey mapping confirmed that the bedrock strata for the whole site is designated as a Secondary A Aquifer. The Superficial Drift part of the site is designated as a Secondary Undifferentiated Aquifer and Secondary A Aquifer.
- 4.5.3 The DEFRA 'MAGIC Map' defines the area has having a medium to low risk (<25%) of groundwater flooding.
- 4.5.4 The Strategic Flood Risk Assessment (SFRA) maps for the area would indicate that the site is not at risk of groundwater flooding.

4.6 Flooding from Other Water Features

- 4.6.1 There are no other artificial water bodies in close proximity.

4.7 Summary

Below is a table summary of the flood risks associated with the development site.

Table 3 – Flood Risk Summary

Source	Probability of Flood Risk	Impacts	Remarks
Tidal	Low	Low	The development building is not influenced by Tidal flood risk.
Fluvial (Watercourse)	Low-Medium	Low (with Mitigation and raised FFL's)	The development is located in low flood risk zone 1 and on the periphery of Flood Zone 2.
Surface (Overland Flood Flow)	Medium	Low (with Mitigation and raised FFL's)	The development is located within a Low & Medium Risk Zone
Sewers & New Drainage	Low	Low	No sewers in close proximity. New private drainage will serve the properties, all designed to current guidance with any exceedance flooding located away from the units.
Groundwater	Low	Low	No indication through SFRA or local borehole records that ether site is at risk of groundwater flooding.
Artificial Sources	Low	Low	No artificial sources in close proximity.

5.0 Assessment of Flood Risk on Proposed Development

5.1 Summary

- 5.1.1 As discussed in Section 3, the development site has been categorised in accordance with the SFRA and EA Flood Maps as being located within a low to medium flood risk area from fluvial flooding. This is related to flood risk from Halcombe Brook to the north and east.
- 5.1.2 Other flood risk sources such as groundwater, sewer and overland flows have been considered and have been found not to be a flood risk generator to the site.

5.2 Flooding From Halcombe Brook

- 5.2.1 Halcombe Brook, designated by the EA as Main River, is located approximately 15m to the east of the site and flows generally in a south easterly direction.
- 5.2.2 The EA have been consulted via a Product 4 flood data request and have subsequently provided flood level data adjacent the development site boundary as taken from Halcombe Brook 2009 Study. Refer to Appendix E for full details.
- 5.2.3 Table 4 provides the various flood level data for the nearest node point adjacent the development site from this model (node 3) for the various storm events with climate change also taken into account.

Table 4. Peak Flood Level at from Halcombe Brook

1 in 100 year Undefended (1% AEP)	1 in 100 year + 35% CC Undefended (1% AEP + 35%)	1 in 1000 year Undefended (0.1 AEP)
154.33m AOD	154.58m AOD	154.86m AOD

- 5.2.4 The Environment Agency data provided refers to the application of updated climate change allowances for peak river flows for catchments across the UK in February 2016, however further updates were released in 2021.
- 5.2.5 Based on the 'More Vulnerable' land use assuming a design life in excess of 100 years; the central allowance should be assessed; +35%.
- 5.2.6 When assessing these flood levels against the site-specific topographical survey has confirmed that the flood extent from both the 1 in 100 year and 1 in 1000 year from Halcombe Brook would not pass out of bank at the location of the development and thus very similar from that shown on the EA maps.
- 5.2.7 To mitigate against the risk of flooding further, the finished floor levels of the new residential buildings will be set at a minimum of 156.36m AOD. This level is a minimum 1.78m higher than the 1 in 100 year + 35% climate change flood levels. Thus there is no flood risk to the proposed buildings or to the future occupiers.

5.0 Outline Drainage Strategy

5.1 Existing Drainage

- 5.2.1 As per Section 4.4, the United Utilities sewer records have been reviewed and confirms there are no sewers in close proximity. The current site drains unrestricted to the adjacent watercourse.

5.2 Existing Runoff

- 5.2.1 The site is currently fully developed and can be classed as brownfield.
- 5.2.2 Brownfield discharge calculations have been undertaken for the site. Figure 5 below provides a summary of the existing brownfield runoff rates based on an area of 0.05ha.

Figure 5: Existing Brownfield Runoff Rates

Area	Brownfield Runoff Rates (l/s)		
	1 yr (30mm/hr)	30yr (65mm/hr)	100yr (95mm/hr)
0.05	4.2	9.0	13.2

5.3 Geology

- 5.3.1 No site-specific intrusive Phase 2 Site Investigation has been carried out at the site. A review of the geology on the BGS website would indicate that there is no superficial geology, with the bedrock geology comprising Halcombe Brook Grit – Sandstone. The solid nature of the underlying geology precludes the use of soakaways on the site.

5.4 Hydrological Assessment

- 5.5.1 As discussed in previous sections, a review of the topographical survey, OS Maps and a site visit would indicate the closest surface water feature is the open section of Halcombe Brook immediately to the east of the site.

5.5 Sustainable Drainage Systems (SuDS) Assessment

5.5.1 SuDS Objectives

Sustainable drainage developed in line with the ideals of sustainable development is collectively referred to as Sustainable Drainage Systems (SuDS). At a particular site, these systems are designed both to manage the environmental risks resulting from the urban runoff and to contribute wherever possible to environmental enhancement. SuDS objectives are therefore to minimise the impacts from the development on the quantity and quality of the runoff and maximise amenity and biodiversity opportunities (CIRIA C753, 2015).

5.5.2 SuDS Design Themes

The 'Management Train Approach' should be central to the surface water drainage strategy of the proposed site. The main objective is treatment and control of runoff as near to the source as possible protecting downstream habitats and further enhancing the amenity value of the site. This concept uses a hierarchy of drainage techniques to incrementally reduce pollution, flow rates and volumes of storm water discharge from the site, and is as follows:

- i. **Prevention** – The use of good site design and housekeeping measures to prevent runoff and pollution and includes the use of rainwater reuse / harvesting.
- ii. **Source Controls** – Control of runoff at source or as close to source as possible (e.g. soakaways, green roofs, pervious pavements).
- iii. **Site Control** – Management of water in a local area and can include below ground storage / attenuation, detention basins, large infiltration devices.
- iv. **Regional Control** – Management of water from a site or various sites and can include wetlands and balancing ponds.

5.5.3 SuDS Site Constraints

SuDS techniques are suitable for all sites; therefore an assessment of the existing site is required so that SuDS limitations can be determined.

- *Land Use Characteristics:* The size and type of development enables the potential range of prevention, source control and site control SuDS devices to be considered above and below ground.
- *Site Characteristics:* No site investigation has been carried out at the site. Findings from a review of the BGS maps indicate that the ground strata is solid and that infiltration techniques would not be suitable.
- *Catchment Characteristics:* The site is currently classed for drainage purposes as 'Brownfield' and so for surface water runoff purposes off site, the runoff rates would be reduced by 50% on existing runoff rates.
- *Environmental and Amenity Performance:* The inclusion of SuDS within the overall development is a key driver in providing both amenity and habitat creation. All types of SUDs will be considered and blended into the landscaping zone, if possible. Safety to all future users is paramount and so best practice guidance will be incorporated so that there is no requirement for significant safety precautions. Maintenance plans will be prepared for all SuDS devices that are included.

5.5.4 SuDS Methods

Table 6 & 7 on the following pages provide an assessment of various above and below ground SuDS methods that can provide water quality treatment and management of flows to reduce runoff rates and volumes and whether they can be suitably incorporated at this development site. The purpose of this assessment is to set out options to be considered at the planning stage with consideration to time constraints, viability and lifetime maintenance of the residential development.

Table 6: Surface SuDS Methods

Method	Comment	Suitability for Development
Green Roofs	Can be used on suitable low-rise buildings to provide retention, attenuation and treatment of rainwater Promotes evaporation and local biodiversity.	<u>Not suitable:</u> Architectural proposals for the development and maintenance issues deem this unsuitable.
Water Butts	Plastic tanks placed at the base of rainwater down pipes to collect rainwater runoff from the roof areas.	<u>Suitable:</u> Can be located at base of rainwater downpipes. Subject to Client approval.
Rainwater Harvesting	Rainwater harvesting reduces the total runoff volume from the developed site and reduces treated water consumption.	<u>Not Suitable:</u> - Additional costs of installation would have severe effect on viability of development. - Running and maintenance costs would not be acceptable to client and future occupiers.
Infiltration Options	Reduces total run off volume from the development.	<u>Not Suitable:</u> Presence of solid strata mean soakaways are not viable for use on the site.
Permeable Surfacing (Infiltration)	- Reduces total run off volume from the development. - Can be used to enhance water quality.	<u>Not Suitable:</u> Presence of solid strata mean soakaways are not viable for use on the site.
Permeable Surfacing (Standard)	- Can be used to enhance quality of runoff water. - Sub-base provides 'source' storage and reduces the volume of storage downstream. - The storage can be created with selection of the stone fill or use of plastic box stems. - Impermeable membrane at base of construction to prevent impact on pavement stability.	<u>Suitable:</u> Private driveways have the potential to attenuate and filter surface water flows through the use of permeable surfacing (subject to confirmation from architect on surface finishes and client/developer).
Swales, basins and ponds	- Provide areas for above ground surface runoff storage. - Swales also improve water quality through filtration.	<u>Not Suitable:</u> The size of the development restricts the use of above ground surface runoff storage.
Bio-Retention	Collect and retain run-off to help improve water quality, prior to discharge in piped system on infiltration.	<u>Not Suitable:</u> The size of the development restricts the use of above ground surface runoff storage.

Table 7: Sub-Surface SuDS Methods

Method	Comment	Suitability for Development
Geocellular Storage	- Suitable for sites with insufficient space for basins etc. - Suitable for sites where topography prevents the use of open basins etc.	<u>Suitable:</u> Subject to detailed design and drainage layout.
Large Diameter Pipes, Culverts or Tanks	- Suitable for sites with insufficient space for basins etc. - Provide a volume of below ground storage with a high void ratio and good man entry provision to allow for future maintenance and cleaning. - Generally be suitable for adoption by the statutory water company (e.g. United Utilities).	<u>Not Suitable:</u> More suited to larger residential developments.

5.5.5 SuDS Hierarchal Approach

Based on the SuDS assessment in Tables 6 & 7, plus an assessment of the local site conditions, the SuDS hierarchal approach for discharge of surface water at the development site is considered in greater detail below:

Table 8: SuDS Hierarchal Approach

Method	Suitability	Suitability for Development
Infiltration to Ground	No	A review of the BGS website and local boreholes have indicated that the underlying solid strata would not be suitable for infiltration options.
Connection to Watercourse	Yes	Connection to the adjacent Halcombe Brook at Restricted rates.
Connection to Surface Water Sewer	No	No surface water sewers in close proximity.
Connection to a Combined Sewer	No	No combined water sewers in close proximity.

5.5.6 SuDS Design Philosophy

SuDS assessment and hierarchal approach discussed in Table 6, 7 and 8 above has defined the overall SuDS strategy. Thus, the SuDS philosophy for the development site is the promotion of prevention, Source Control and Site Control techniques with discharge to the local ditch network.

The following design philosophy is proposed:

- Surface water treatment using the 'Management Train' approach to remove and isolate contamination at all SuDS facilities prior to conveyance to the existing drainage infrastructure.
- Prevention in the form of water butts.
- Source control in the form of potential permeable paving for private driveways.
- Site control in the form of a flow control.
- Aim to limit where possible the impermeable fraction of development.
- The site will discharge into the existing watercourse at a peak rate of 5.0l/s.

5.7 Climate Change

- 5.7.1 In May 2022, the Environment Agency released updated climate change allowances for peak rainfall intensities which should be applied to new developments. Rather than nation wide allowances, each area will have its own peak rainfall allowances. In the case of the Ramsbottom area, this is the Irwell Management Catchment peak rainfall allowances.
- 5.7.2 Based on the nature of the development, a lifespan of circa 100 years is anticipated. Therefore, the potential climate change allowance for the 2070's Upper End Allowance for residential developments is 45%, which will be included in the hydraulic calculations.

5.8 Outline Surface Water Drainage Strategy

- 5.8.1 The general principal of the surface water drainage strategy is to collect the runoff from the roofs of the new units and direct it to a new below ground surface water drainage network. This will flow by gravity along the front of the units where it will discharge to the directed culverted watercourse at a peak runoff rate of 5l/s. Due to the reduced impermeable areas, the online pipework and manholes will act as the attenuation measures. The private driveways will encompass permeable paving and water butts will be installed at each property, subject to Client approval and confirmation on surface finishes.
- 5.8.2 The proposed drainage layout for the new development site will be designed in accordance with Design & Construction Guidance (DCG), BS EN 752: 2008 and Building Regulations Part H guidance, i.e. up to the 30-year storm return period criterion and tested for the 1 in 100-year return period including a 40% increase to account for climate change to confirm that there is no flood risk to the properties.
- 5.8.3 Flooding can occur on a local scale beyond the 30yr criterion due to runoff exceeding the capacity of the minor system during extreme events and it can only be addressed on a site-specific basis. Guidance states that development should be protected against flooding from extreme events (1 in 30 year) and that flood pathways are identified when the drainage system is exceeded.

- 5.8.4 In the case of this development, exceedance flows will be all those over and above the 30-year design criterion set by Design & Construction Guidance. Using storage within the external areas would be achievable and would direct flood water away from the proposed properties, with flows directed back into the surface water drainage network as water levels in the drainage network receded. The exceedance flows and volumes can be calculated for the new development drainage layout. In the case of this development and due to the fall across the site, consideration will be given to make sure all water is controlled so that it does not impact on any adjoining properties.
- 5.8.5 Although it is envisaged that Prevention and Source Controls measures could be included in the final scheme, this strategy will assume for outline calculations purposes that only Site Control methods are incorporated. A full detailed hydraulic surface water network has been simulated in the Microdrainage Design Software. This takes into account the peak discharge rate of 5l/s and assumes no prevention & source control measures are incorporated and no infiltration to ground is possible. A 45% allowance for climate change has been incorporated into the 100-year return period event. It is noted that these rates and volumes are preliminary for this outline assessment and are likely to alter at detailed design stage when more site-specific information is made available.
- 5.8.6 Drawing PGC765-C-001 in Appendix C indicates the Drainage Strategy based on the Architects masterplan intent, with the hydraulic calculations in Appendix D.

5.9 Volume Control

- 5.9.1 The impermeable area of the application site will be reduced as a result of the development and therefore the volume of run-off in the 100-year 6-hour storm event will also be reduced.
- 5.9.1 The rate of run-off will also be reduced to a maximum of 5l/s for all storm events up to and including the 1 in 100-year event plus climate change allowance.

5.9 Pollution Control

- 5.10.1 Runoff from roofs is generally considered to be clean and will be discharged directly into the surface water network. Runoff from the private driveways will be directed through the permeable paving; this will help to remove pollutants prior to connection to the drainage network. Silt and debris will also be prevented from entering the drainage system by the use of trapped gullies and silt boxes.

5.10 Maintenance

The long-term maintenance of the new drainage and SuDS infrastructure will be with the owner of the development through a management and maintenance company in line with best practice guidance. Annual inspections will need to be carried out and clearing of gullies, channel drains and catchpits.

Typically the maintenance regime will be in line with Table 9 below.

Table 9: Outline Management and Maintenance Strategy

Future Maintenance of the Drainage System			
Responsibility	Feature	Maintenance	Frequency
Owner / Occupier	Drainage Channel.	Regular maintenance / removal of blockages and silts.	Ad-hoc flushing/jetting and emptying of silt traps required.
	Rainwater gutters, downpipes and above ground drainage.	Regular maintenance and inspections.	Ad-hoc sweeping and emptying of silt and debris required. Annual visual inspections to check for damage/leaks.
	Flow control chambers.	Regular maintenance / removal of blockages and debris.	Annual inspection and following significant rainfall events.
	Permeable Paving	Brushing and Vacuuming, removal of weeds	Annual inspection and following significant rainfall events.
	Pipes, sewers, manholes, outfall headwall.	Regular maintenance / removal of blockages and debris.	Annual inspection and removal of silts if required.

5.11 Foul Water Drainage

5.11.1 Foul drainage generated from the new development will discharge into a individual treatment plants located at the front of each plot. The clean output from the treatment plants will flow by gravity along the front of the units where it will discharge to the directed culverted watercourse at a peak runoff rate of 5l/s.

5.11.2 An indicative foul water drainage layout can be found on the drainage strategy drawing in Appendix C.

6.0 Management Measures, Off Site Impacts and Residual Risk

6.1 Flood Risk Management Measures

- 6.1.1 The assessment has determined that the finished floor level of the new residential units will be located over 1.78m above the 1.0% AEP (1 in 100 year) event level plus a 35% increase in climate change and also above the 0.1% AEP (1 in 1000 year) event.
- 6.1.2 During the extreme flood events safe egress for the occupiers is assured for higher order storm events up to and including the 1000-year event to the higher ground levels to the south of the site.
- 6.1.3 The surface water drainage strategy for the new development site will be to limit the surface water runoff to below existing Brownfield discharge rates with attenuation measures incorporated. The new surface water network will be designed in line with current British Standard guidance up to the 100-year storm return period including an allowance for climate change.
- 6.1.2 The use of SuDS in the form of Prevention, Source Control and Site Control measures will help to minimise the flood risk impact to the surrounding watercourses.
- 6.1.3 There will be a site management health and safety document prepared in respect of the final development. This will include the required maintenance regime for the on-site drains and drainage facilities such as the channels, gullies, pipes, manholes and all SuDS facilities.
- 6.1.4 The property owners will be responsible for site cleanliness, gully emptying and drain cleansing to ensure that the surface water drainage system will always operate at its maximum efficiency.

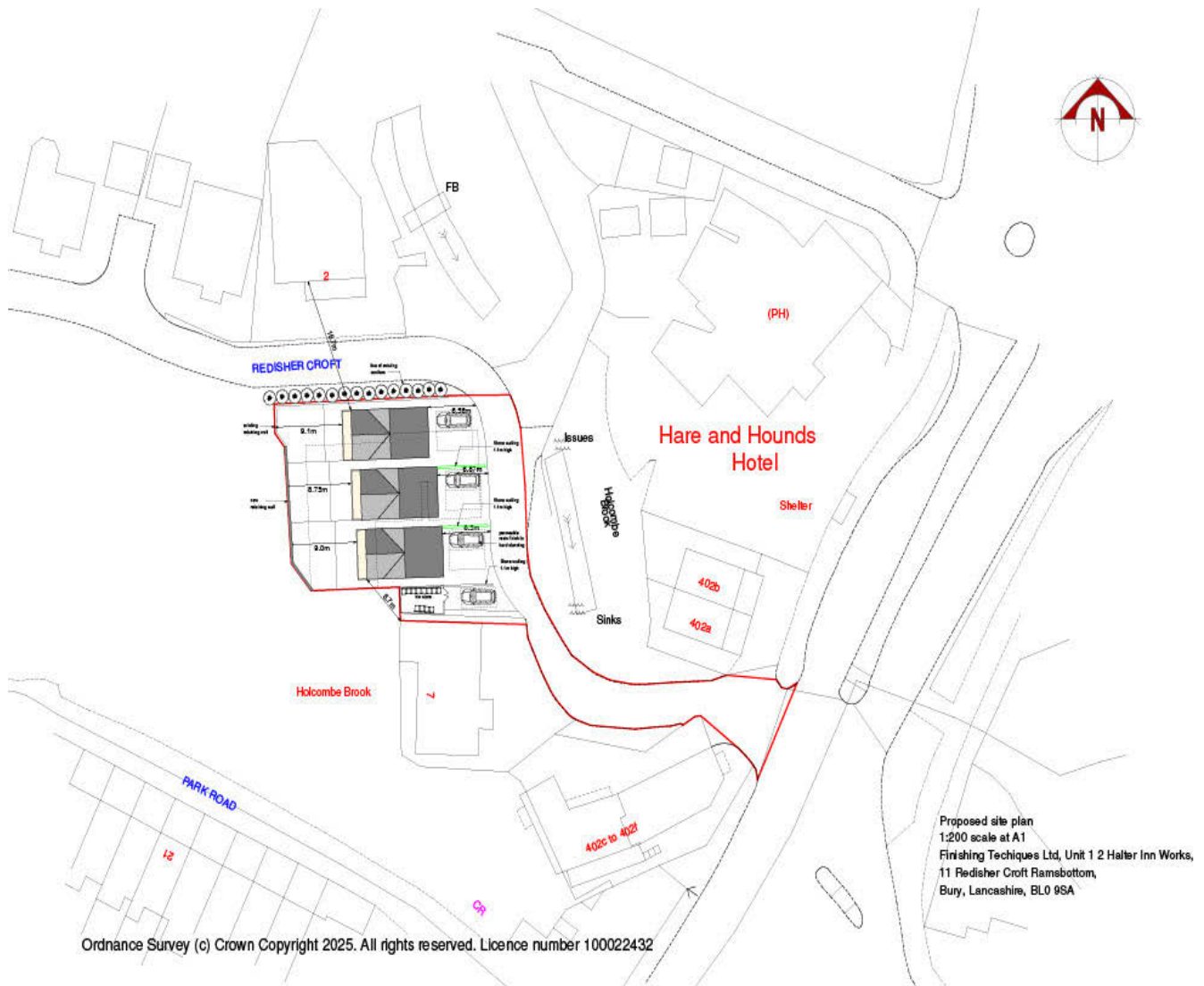
6.2 Off Site Impacts

- 6.2.1 The redevelopment of the site does not impair the hydraulic continuity of any watercourse and the current “local hydraulics” of distributing watercourses / outfalls.
- 6.2.2 Surface water runoff will mimic and for the higher order event reduce from the pre-development regime and utilises SuDS solutions to satisfy the site constraints. This will reduce surface water flooding impact onto the downstream catchment.
- 6.2.3 As there is no flood displacement or increased rate of runoff as part of this proposal into the adjacent watercourse, the proposed development will therefore not increase flood risk onto its locality.

6.3 Residual Risk

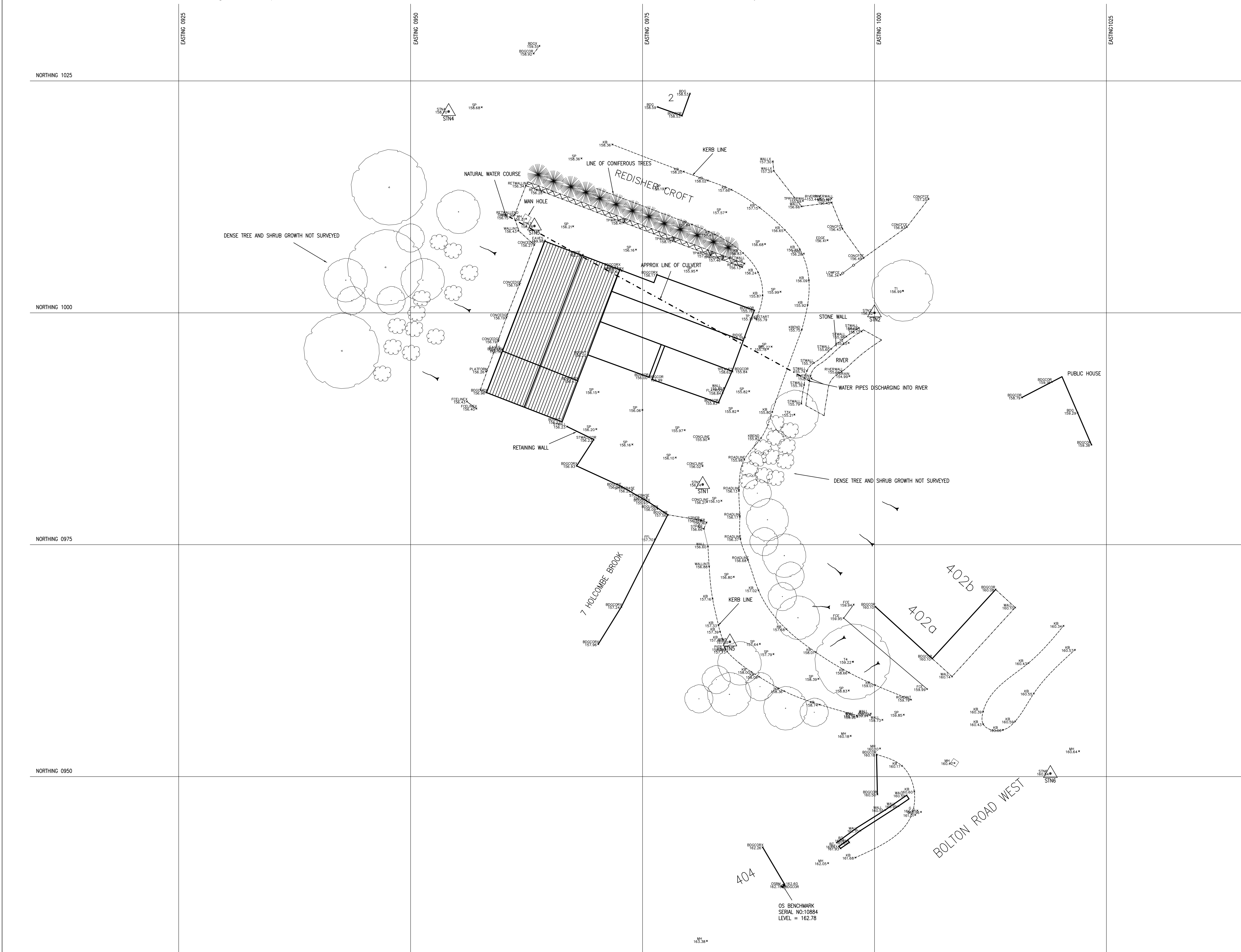
- 6.3.1 Flood risk to people and property can be managed but it can never be completely removed; a residual risk remains after flood management or mitigation measures have been put in place. This relates to a rainfall event beyond what can be fully quantified.

Appendix A – Architects Drawings



Appendix B – Topographical Survey

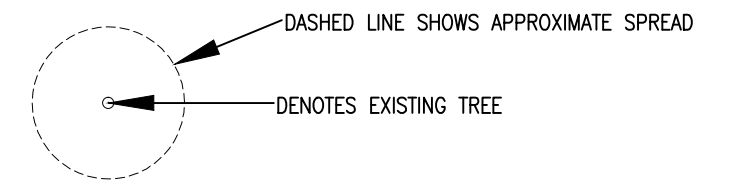
TOPOGRAPHICAL SURVEY AT: Finishing Techniques Ltd, Halter Inn Works, Bolton Road West, Holcombe Brook, Ramsbottom, Bury Lancs BL0 9SA



NOTES~

THE SURVEY WAS UNDERTAKEN ON THE 9th & 15th September 2011 by JMS & AD.

THE SURVEY LEVELS RELATE TO AN ORDNANCE SURVEY BENCHMARK LOCATED ON THE EAST CORNER OF 404 BOLTON ROAD WEST. BENCHMARK = 162.78 (BENCHMARK DATA PROVIDED BY LOCAL AUTHORITY HIGHWAYS DIVISION)



NOTE: SAPLINGS AND TREES WITH A TRUNK DIAMETER OF LESS THAN 300mm HAVE GENERALLY NOT BEEN SURVEYED.

SURVEY STATION COORDINATES

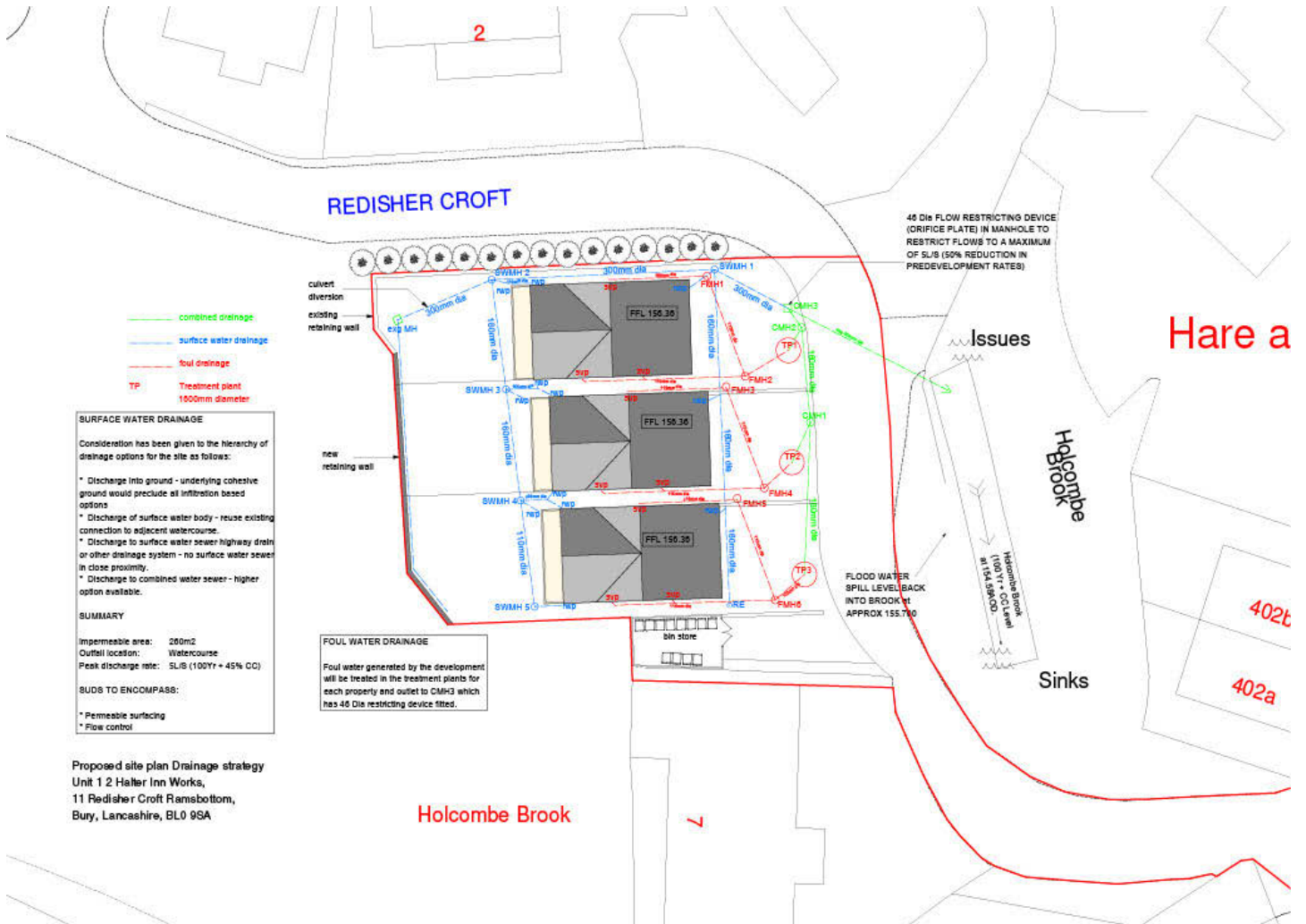
STN	NORTHING	EASTING	ELEVATION(M)	MARKER
1	981.1901	981.4901	156.14	NAIL
2	1000.000	1000.000	156.52	NAIL
3	963.3540	1009.3580	156.28	NAIL
4	954.1001	1021.6982	158.70	NAIL
5	984.4147	964.5245	157.55	NAIL
6	1018.9641	950.3312	160.84	NAIL

<u>Amendments</u>			
<i>Title</i>			
TOPOGRAPHICAL SURVEY OF LAND AT FINISHING TECHNIQUES LTD, HALTER INN WORKS, BOLTON ROAD WEST, HOLCOMBE BROOK, RAMSBOTTOM, BURY LANCs BL0 9SA			
<i>Client</i>			
FINISHING TECHNIQUES LTD			
<i>Dwg. No.</i>			
1411 / TOPO			
<i>Date</i>	<i>Scale</i>	<i>Drawn by</i>	<i>Checked by</i>
26.09.2011	1:200	AD	JPE

TOM MYERSCOUGH & CO LLP
CHARTERED SURVEYORS
 6 School Street, Radcliffe, Manchester, M26 3BP
 Telephone 0161-724-8027 Fax 0161-725-9095

Stockade Fence Chain-Link Fence Stone Wall Barbed Wire Fence	Retaining Wall Railway Track Guard Rail Bridge	Well Bench Mark Marshy Area Lamp Standard	Traffic Sign Station Water Shut Off Hydrant	Telegraph Pole Gully Traffic Flow North Arrow	Bush Tree Building	Steep Banking Service Inspection Chamber Tree/Hedge Line Boundary Post	Bore Hole Trial Hole Contour Line Spot Height	Foul Manhole and Sewer Surface Water Manhole and Sewer Combined Manhole and Sewer Backdrop Manhole	Pumping Station Rising Main -Foul Rising Main -Surface Water Rising Main -Combined	Air Release Valve Hatch Box Emptying Valve	All levels are in metres. +98.765 = Centre SH = Description	Gas Shut Off
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Appendix C – Poposed Drainage Strategy Drawings



Appendix D – Outline Hydraulic Calculations

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	Redisher Finishing SW Network	
Date 24/05/2023 File Redisher Finishing Sw C...	Designed by paulg Checked by	
Innovyze	Network 2017.1.2	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.251	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.022	4-8	0.004

Total Area Contributing (ha) = 0.026

Total Pipe Volume (m³) = 0.597

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	15.000	0.190	78.9	0.012	4.00	0.0	0.600	o	100	Pipe/Conduit	
1.001	13.000	0.150	86.7	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.002	3.000	0.050	60.0	0.005	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.003	17.000	0.170	100.0	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	3.000	0.030	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	4.29	155.540	0.012	0.0	0.0	0.0	0.87	6.8	1.6
1.001	50.00	4.55	155.350	0.012	0.0	0.0	0.0	0.83	6.5	1.6
1.002	50.00	4.60	155.200	0.017	0.0	0.0	0.0	1.00	7.8	2.3
1.003	50.00	4.88	155.100	0.026	0.0	0.0	0.0	1.00	17.8	3.5
1.004	50.00	4.93	154.930	0.026	0.0	0.0	0.0	1.00	17.8	3.5

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	100	SW01	156.240	155.540	0.600	Open Manhole	450
1.001	o	100	SW02	156.240	155.350	0.790	Open Manhole	450
1.002	o	100	SW03	156.240	155.200	0.940	Open Manhole	450
1.003	o	150	SW04	156.150	155.100	0.900	Open Manhole	1200
1.004	o	150	SW05	156.150	154.930	1.070	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	15.000	78.9	SW02	156.240	155.350	0.790	Open Manhole	450
1.001	13.000	86.7	SW03	156.240	155.200	0.940	Open Manhole	450
1.002	3.000	60.0	SW04	156.150	155.150	0.900	Open Manhole	1200
1.003	17.000	100.0	SW05	156.150	154.930	1.070	Open Manhole	1200
1.004	3.000	100.0		156.150	154.900	1.100	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
1.004		156.150	154.900	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs		0	Number of Storage Structures
Number of Online Controls		1	Number of Time/Area Diagrams
Number of Offline Controls		0	Number of Real Time Controls

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.251		

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	Redisher Finishing SW Network	
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<u>Online Controls for Storm</u> <u>Orifice Manhole: SW05, DS/PN: 1.004, Volume (m³): 1.7</u> Diameter (m) 0.046 Discharge Coefficient 0.600 Invert Level (m) 154.930		
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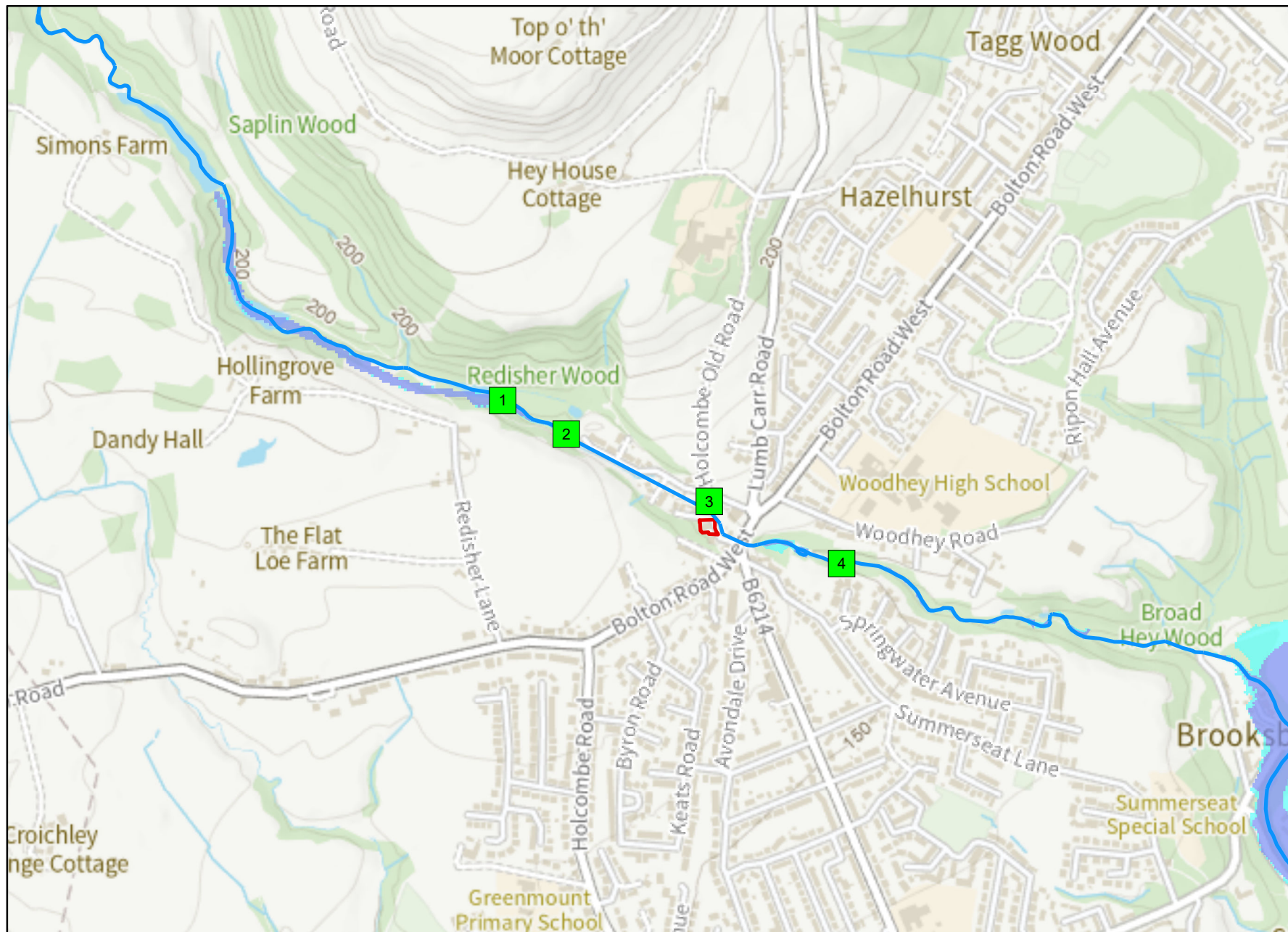
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		Redisher Finishing SW Network						
Date 24/05/2023 File Redisher Finishing Sw C...	Designed by paulg Checked by							
Innovyze		Network 2017.1.2						
<u>1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)</u> <u>for Storm</u>								
Simulation Criteria								
Areal Reduction Factor 1.000		Additional Flow - % of Total Flow 0.000						
Hot Start (mins) 0		MADD Factor * 10m³/ha Storage 2.000						
Hot Start Level (mm) 0		Inlet Coefficient 0.800						
Manhole Headloss Coeff (Global) 0.500		Flow per Person per Day (l/per/day) 0.000						
Foul Sewage per hectare (l/s) 0.000								
Number of Input Hydrographs 0 Number of Storage Structures 0								
Number of Online Controls 1 Number of Time/Area Diagrams 0								
Number of Offline Controls 0 Number of Real Time Controls 0								
Synthetic Rainfall Details								
Rainfall Model FSR		Ratio R 0.251						
Region England and Wales Cv (Summer) 0.750								
M5-60 (mm) 19.000		Cv (Winter) 0.840						
Margin for Flood Risk Warning (mm)		300.0						
Analysis Timestep 2.5 Second Increment (Extended)								
DTS Status		ON						
DVD Status		ON						
Inertia Status		OFF						
Profile(s)		Summer and Winter						
Duration(s) (mins)		15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440						
Return Period(s) (years)		1, 30, 100						
Climate Change (%)		0, 0, 45						
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	SW01	15 Winter	1	+0%	100/15 Summer	100/30 Winter		
1.001	SW02	15 Winter	1	+0%	30/15 Summer			
1.002	SW03	15 Winter	1	+0%	30/15 Summer			
1.003	SW04	15 Winter	1	+0%	30/15 Summer	100/30 Winter		
1.004	SW05	15 Winter	1	+0%	1/15 Summer			
PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	155.572	-0.068	0.000	0.22	1.5	OK	1
1.001	SW02	155.383	-0.067	0.000	0.23	1.4	OK	
1.002	SW03	155.238	-0.062	0.000	0.31	1.9	OK	
1.003	SW04	155.141	-0.109	0.000	0.17	2.8	OK	1
1.004	SW05	155.125	0.045	0.000	0.17	1.8	SURCHARGED	
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		Redisher Finishing SW Network						
Date 24/05/2023		Designed by paulg						
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Innovyze	Network 2017.1.2							
30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm								
Simulation Criteria								
Areal Reduction Factor 1.000		Additional Flow - % of Total Flow 0.000						
Hot Start (mins) 0		MADD Factor * 10m³/ha Storage 2.000						
Hot Start Level (mm) 0		Inlet Coefficient 0.800						
Manhole Headloss Coeff (Global) 0.500		Flow per Person per Day (l/per/day) 0.000						
Foul Sewage per hectare (l/s) 0.000								
Number of Input Hydrographs 0		Number of Storage Structures 0						
Number of Online Controls 1		Number of Time/Area Diagrams 0						
Number of Offline Controls 0		Number of Real Time Controls 0						
Synthetic Rainfall Details								
Rainfall Model		FSR	Ratio R 0.251					
Region England and Wales Cv (Summer)		0.750						
M5-60 (mm)		19.000 Cv (Winter)	0.840					
Margin for Flood Risk Warning (mm)		300.0						
Analysis Timestep 2.5 Second Increment (Extended)								
DTS Status		ON						
DVD Status		ON						
Inertia Status		OFF						
Profile(s)		Summer and Winter						
Duration(s) (mins)		15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440						
Return Period(s) (years)		1, 30, 100						
Climate Change (%)		0, 0, 45						
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	SW01	15 Winter	30	+0%	100/15 Summer	100/30 Winter		
1.001	SW02	30 Winter	30	+0%	30/15 Summer			
1.002	SW03	30 Winter	30	+0%	30/15 Summer			
1.003	SW04	30 Winter	30	+0%	30/15 Summer	100/30 Winter		
1.004	SW05	30 Winter	30	+0%	1/15 Summer			
PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	155.593	-0.047	0.000	0.55	3.5	OK	1
1.001	SW02	155.536	0.086	0.000	0.46	2.8	SURCHARGED	
1.002	SW03	155.523	0.223	0.000	0.52	3.3	SURCHARGED	
1.003	SW04	155.516	0.266	0.000	0.24	3.9	SURCHARGED	1
1.004	SW05	155.501	0.421	0.000	0.30	3.3	SURCHARGED	
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		Redisher Finishing SW Network						
Date 24/05/2023		Designed by paulg						
File Redisher Finishing Sw C...		Checked by						
Innovyze	Network 2017.1.2							
<u>100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>								
Simulation Criteria								
Areal Reduction Factor 1.000		Additional Flow - % of Total Flow 0.000						
Hot Start (mins) 0		MADD Factor * 10m³/ha Storage 2.000						
Hot Start Level (mm) 0		Inlet Coefficient 0.800						
Manhole Headloss Coeff (Global) 0.500		Flow per Person per Day (l/per/day) 0.000						
Foul Sewage per hectare (l/s) 0.000								
Number of Input Hydrographs 0		Number of Storage Structures 0						
Number of Online Controls 1		Number of Time/Area Diagrams 0						
Number of Offline Controls 0		Number of Real Time Controls 0						
Synthetic Rainfall Details								
Rainfall Model FSR		Ratio R 0.251						
Region England and Wales Cv (Summer) 0.750								
M5-60 (mm) 19.000		Cv (Winter) 0.840						
Margin for Flood Risk Warning (mm)		300.0						
Analysis Timestep 2.5 Second Increment (Extended)								
DTS Status		ON						
DVD Status		ON						
Inertia Status		OFF						
Profile(s)		Summer and Winter						
Duration(s) (mins)		15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440						
Return Period(s) (years)		1, 30, 100						
Climate Change (%)		0, 0, 45						
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	SW01	30 Winter	100	+45%	100/15 Summer	100/30 Winter		
1.001	SW02	30 Winter	100	+45%	30/15 Summer			
1.002	SW03	30 Winter	100	+45%	30/15 Summer			
1.003	SW04	30 Winter	100	+45%	30/15 Summer	100/30 Winter		
1.004	SW05	30 Winter	100	+45%	1/15 Summer			
PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	156.240	0.600	0.026	0.66	4.3	FLOOD	1
1.001	SW02	156.206	0.756	0.000	0.60	3.7	FLOOD RISK	
1.002	SW03	156.175	0.875	0.000	0.85	5.3	FLOOD RISK	
1.003	SW04	156.150	0.900	0.181	0.39	6.4	FLOOD	1
1.004	SW05	156.135	1.055	0.000	0.44	4.8	FLOOD RISK	
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Appendix E – EA Product 4 Flood Data

Detailed Flood Map Centred on Holcombe Brook, Ramsbottom, Bury, BL0 9SA. Created 27/04/2023 [GMMC307993AB)



1:10,001



Legend

- Site Location
- Model Measurements
- Main River
- Flood Zone 3
- Flood Zone 2

					Undefended				
Map Reference	Model Node Reference	Easting	Northing	Data	5 % AEP (1 in 20 year)	1 % AEP (1 in 100 year)	1 % AEP (1 in 100 year) + 35% increase in flow	1 % AEP (1 in 100 year) + 70% increase in flow	0.1 % AEP (1 in 1000 year)
1	ea013_Model_HOLM01_1712	377549	415532	Modelled Water Level (m aodN)	166.50	166.79	167.06	167.31	167.35
				Modelled Flow (cumecs)	5.83	8.59	11.60	14.60	14.99
2	ea013_Model_HOLM01_1580h	377667	415469	Modelled Water Level (m aodN)	166.06	166.30	166.52	166.72	166.76
				Modelled Flow (cumecs)	5.82	8.58	11.59	14.56	14.98
3	ea013_Model_HOLM01_1291	377926	415345	Modelled Water Level (m aodN)	154.07	154.33	154.58	154.82	154.86
				Modelled Flow (cumecs)	5.81	8.57	11.57	14.57	14.97
4	ea013_Model_HOLM01_0996n	378168	415233	Modelled Water Level (m aodN)	143.13	143.29	143.45	143.58	143.60
				Modelled Flow (cumecs)	5.80	8.55	11.56	14.58	14.96

Model data taken from Holcombe Brook 2009

AEP - Annual Exceedence Probability

m aodN - metres above ordnance datum Newlyn

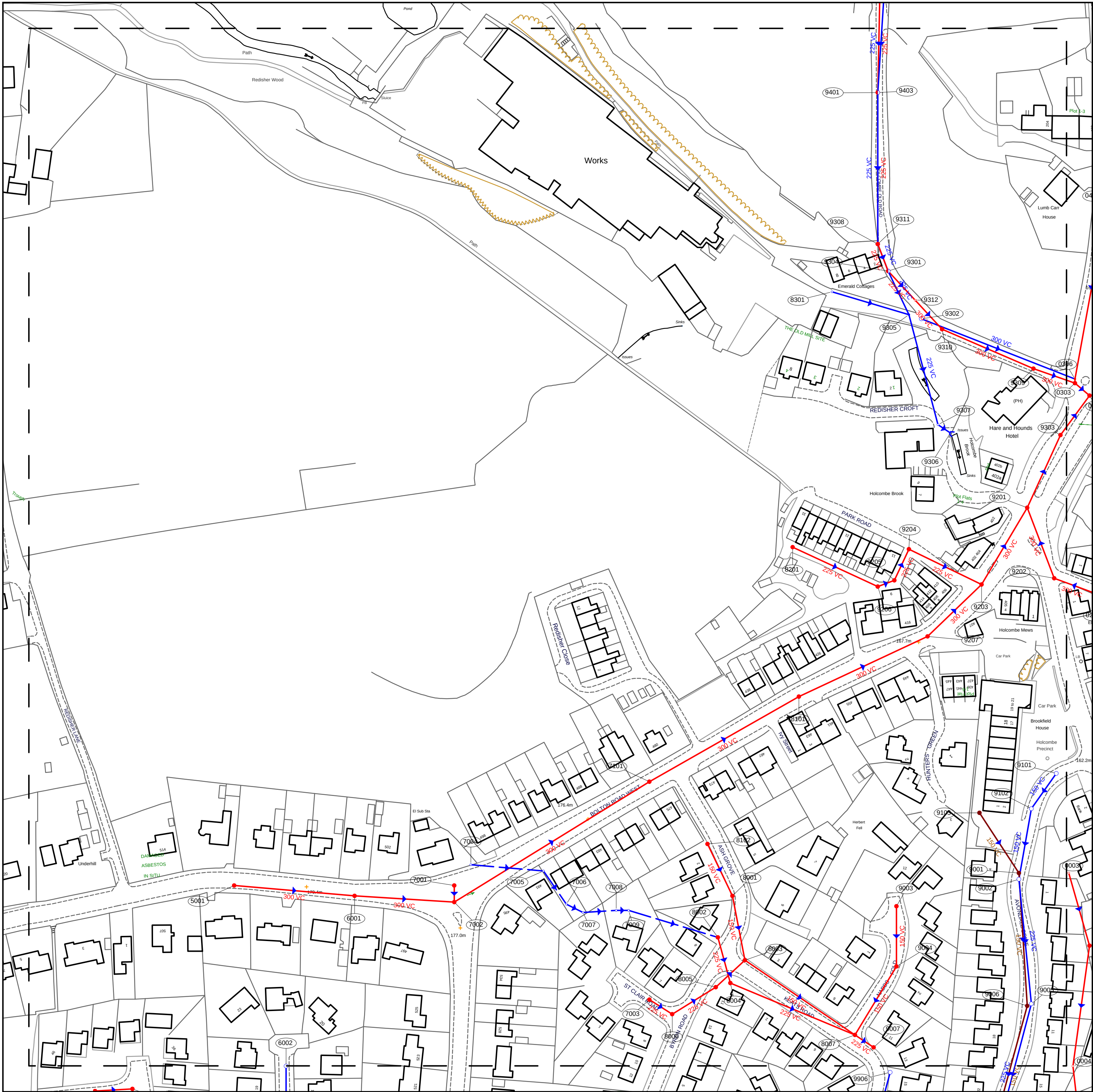
cumecs - cubic metres per second

Notes: *Climate Change Scenario - 35% and 70% increases in flow calculated for the 2080's (2070 - 2115). Please see <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances> for more information regarding the new climate change guidance. The location of the site and the type (vulnerability) of development determine the climate change allowances to consider in any flood risk assessment.

Recorded Flood Outlines

Flood Event Code	Name	Start Date	End Date	Source of Flooding	Cause of Flooding
18093	HOLM	14/06/2002	15/06/2002	main river	obstruction/blockage – culvert
4079761	Redisher Croft, Holcombe	26/12/2015	26/12/2015	main river	channel capacity exceeded (no raised defences)
4093442	Redisher Croft, Holcombe	09/02/2020	09/02/2020	main river	obstruction/blockage – culvert

Appendix F – United Utilities Sewer Records



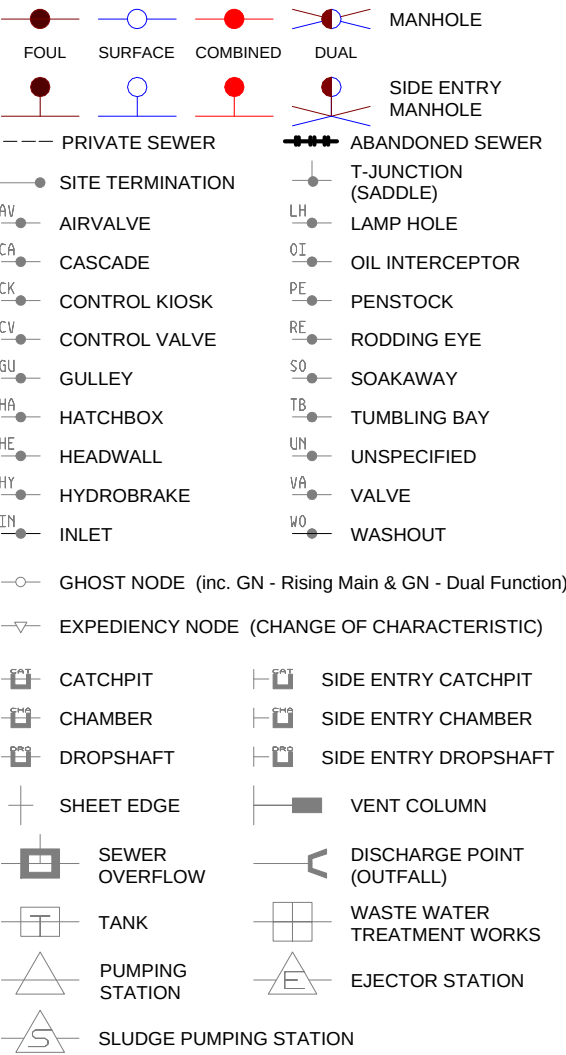
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Printed by: Liz Bywater

Refno Cover Func Type Invert Size.xSize.y ShapeMatl Grad Length

5001	180.02	C	M	300	C	VC	58.22	
6001	178.88	C	M	174.08	300	C	VC	48.09
6002	174.93	S	M	173.46	150	C	VC	64
7001	177.41	C	M	176.36	300	VC	8	
7002	177.66	C	M	300	C	VC	110.45	
7003	168.7	C	M	166.34	225	C	VC	13.04
7004		S	G					35.13
7005		S	G					19.42
7006		S	G					8.94
7007		S	G	225		VC		16.03
7008		S	G	225		VC		6
7009		S	G	225		VC		44.92
7101		C	M	300	C	VC		82.86
8001	168.73	C	M	150	C	VC		31.58
8002	168.74	C	M	225	C	VC		22.8
8003	167.37	C	M	165.25	150	C	VC	25 64.07
8004	167.45	C	M	225	C	VC		65
8005	167.71	C	M	165.46	225	VC	91	19.1
8006	168.17	C	M	225	C	VC		24.7
8007	164.4	C	M	162.53	225	C	VC	24 10.82
8101		C	M	300	C	VC		68.45
8102	171.21	C	M	169.16	150	C	VC	27.73
8201		C	M	225	C	VC		45.19
8301		S	G	225		VC		38.6
9001	161.25	F	M	159.16	150	C	VC	78 64.12
9002	161.2	S	M	159.25	225	C	VC	151 60.3
9003	165	C	M	163.19	150	C	VC	85 29
9004	164.67	C	M	162.85	150	C	VC	214 38.59
9005	160.92	S	M	158.85	225	C	VC	83 70.34
9006	160.93	F	M	158.34	150	C	VC	87 68.41
9007	162.9	C	M					
9101	162.18	S	M	160.88	150	C	VC	24 20.81
9102	161.73	S	M	160.03	150	C	VC	44 34.53
9103	162.66	F	M	159.81	150	C	VC	53 34.67
9201	160.46	C	M	156.51	300	VC		38.48
9202	161.38	C	M	156.99	300	C	VC	76 36.4
9203	164.17	C	M	162.21	300	C	VC	8 43.05
9204	168.13	C	M	166.28	225	C	VC	10 38.91
9205	170.25	C	M	225		C	VC	16.55
9206	170.64	C	M	169.09	225	C	VC	8.54
9207	167.02	C	M	164.96	300	C	VC	13 36.07
9301	167.67	C	D	166.27	225	C	VC	8 19.1
9302		S	M	300		C	VC	79.48
9303		C	M	450		C		23.6
9304	167.67	S	D	165.95	225	C	VC	23.26
9305		S	J	225		C	VC	54.82
9306		S	F					
9307		S	G	225		C	VC	7.21
9308	170.92	S	D	169.33	225	C	VC	4 13.93
9309	162.96	C	M	160.93	300	C	VC	49 21.19
9310	182.67	C	M	161.34	300	C	VC	130 47.93
9311	170.92	C	D	168.65	225	C	VC	4 12.92
9312		C	Q	163.74	300	C	VC	8 19.1
9401	177.08	C	D	175.81	225	C	VC	12 73
9403	177.08	S	D	175.51	225	C	VC	12 73

WASTE WATER SYMBOLOGY



Note - ALL flow direction arrows are BLUE - colour not significant

NODE TABLE ABBREVIATIONS

MANHOLE FUNCTION

F	Foul	T	Transition
S	Surface	O	Overflow
C	Combined	U	Unspecified

MANHOLE / NODE TYPE

M	Manhole	Z	Ghost in Rising Main
J	Junction	C	Cascade
L	Lamphole	Y	Gulley
H	Hatchbox	E	Ejector
R	Rodding Eye	O	Oil Injector
F	Outfall	I	Inlet
V	Combined Sewer Overflow	B	Hydrobrake
T		T	Vent Column
P	Pumping Station	X	Valve
S	Soakaway	U	Unspecified
D	Dual Function Manhole	Q	Expediency Node
W	Treatment Works	G	Ghost (to allow pipe bends)

SEWER SHAPE

C	Circular	T	Trapezoidal
E	Egg	A	Arch
O	Oval	B	Barrel
F	Flat Top	H	Horseshoe
R	Rectangular	U	Unspecified
S	Square		

SEWER MATERIAL

AC	Asbestos Cement
BR	Brick
CI	Cast Iron
SI	Spun (Grey) Iron
CO	Concrete
CS	Concrete Segments (Bolted)
CS	Concrete Segments (Unbolted)
CC	Concrete Box Culvert
DI	Ductile Iron
GR	Glass Reinforced Concrete
GR	Glass Reinforced Plastic
PS	Plastic / Steel Composite
PV	Polyvinyl Chloride
PE	Polyethylene
RP	Reinforced Plastic Matrix
ST	Steel
VC	Vitrified Clay (All Clayware)
PP	Polypropylene
PF	Pitch Fibre
MA	Masonry - In Regular Courses
MA	Masonry - Randomly Coursed
U	Unspecified

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55 Nodes
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