



Proposed Development at Hollingworth Road and Rakewood Road, Littleborough

Environmental Statement

Volume 4: Rakewood Road Land Parcel Appendices

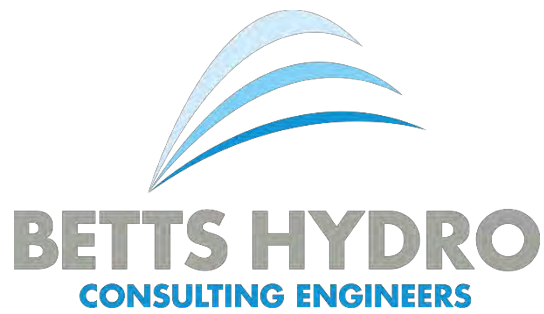
On behalf of **Bloor Homes North West**



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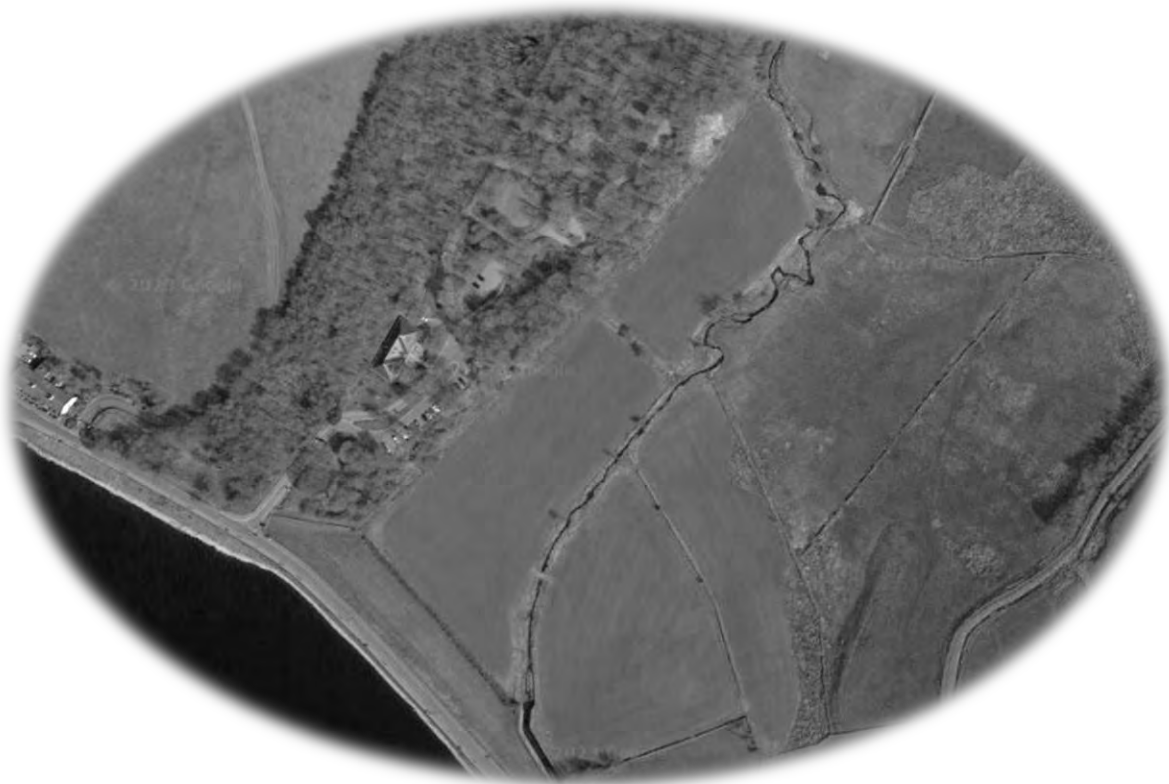
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Appendix D Flood Risk Assessment and Drainage Management Strategy



LAND OFF RAKEWOOD ROAD LITTLEBOROUGH

FLOOD RISK ASSESSMENT AND DRAINAGE MANAGEMENT STRATEGY



For

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DECEMBER 2023

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**LAND OFF RAKEWOOD ROAD
LITTLEBOROUGH**

**FLOOD RISK ASSESSMENT AND
DRAINAGE MANAGEMENT STRATEGY**

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EXECUTIVE SUMMARY

This Flood Risk Assessment and Drainage Management Strategy was commissioned by Bloor Homes referred to hereafter as 'the client'. This report has been prepared to support a planning application for the construction of a replacement carpark on land north of Rakewood Road in Littleborough. The proposals are confirmed to be 'less vulnerable' within the National Planning Policy Framework; the Planning Practice Guidance confirms that this type of development is appropriate within Flood Zone 1, providing there is no increase in flood risk as a result.

Flood Risk

This report has reviewed all sources of flood risk both to and resulting from the proposed development. Consultation with the Environment Agency, United Utilities, and Rochdale Metropolitan Borough Council has not identified any historical flooding at the site or within the wider area. To summarise, the proposals are at 'low' risk from the flood sources reviewed as part of this assessment. Any residual surface water flood risk will be sustainably managed post-development, following the implementation of a sustainable surface water management regime, any residual risks can be managed by appropriate levels design.

Drainage Strategy

Given the low flood risks identified, the key focus of this assessment is on the sustainable management of surface water run-off to ensure no increased flood risk results from the development proposals. The surface water run-off management options have been assessed in accordance with the sustainable drainage hierarchy, which is to discharge to ground, followed by a waterbody or finally the public sewer.

Based on the ground conditions identified by the published online datasets and the soil classifications; it is likely that infiltration would not offer a full viable drainage management solution due to the cohesive nature of the underlying strata and therefore, other surface water discharge methods have been reviewed.

It is understood that the wider site drains naturally with the topography towards Hollingworth Brook in the north-eastern corner of the site. This watercourse flows in a north-easterly direction, joining with Shore Lane Brook to form Ealees Brook. The proposals are therefore to mimic the existing regime and continue to discharge surface water run-off into Hollingworth Brook located along the northern boundary of the site. The proposals are to utilise a combination of Sustainable Drainage Systems including permeable surfacing, bio-filtration tree pits, along with a conveyance swale to outfall where feasible.

In accordance with the SuDS Manual (CIRIA) and the Non-Technical Standards for SuDS (March 2015) all sites should endeavour to achieve as close to pre-development greenfield rates as is viable. Based on the development area, the pre-development greenfield rate (QBar) is calculated to be 4.2l/s (7.0l/s/ha).

In order to restrict the rate of discharge from the site a standard flow control device would typically be utilised. Typically, the lowest rate restriction applied by the orifice plate diameter would be 5.0l/s to avoid maintenance liabilities and adoption concerns associated with lower rates. The LLFA (RMBC) will need to be consulted as part of the proposals to provide agreement that the proposed drainage strategy including rates of discharge conform to their requirements.

Restricting the rate of discharge will generate a requirement to provide onsite stormwater storage for the extreme rainfall events. The surface water scheme for the development will be designed to cater for the surface water run-off generated in the events up to and including the 1 in 100yr return period event with a 30% allowance for Climate Change. Detailed design will confirm with accuracy the technical details for the proposed drainage strategy detailed within this assessment.

Detailed design will need to be carried out to confirm whether a site wide gravity solution can be achieved, however given the existing ground levels and existing drainage situation a gravity system is understood to be feasible. Consent and formal agreement will be required from the Environment Agency and Rochdale Metropolitan Borough Council (Lead Local Flood Authority) for any works to the Main River network. The Lead Local Flood Authority will also need to agree to the proposed rates of discharge.

This Flood Risk Assessment and Drainage Management Strategy has been prepared in consultation with the relevant interested parties and incorporates their comments where possible. The report is commensurate with the scale and nature of the development proposals and in summary, the development can be considered appropriate in accordance with the Planning Practice Guidance.

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Specialist Software

-  MicroDrainage WinDES (v.2020.1.3) – Calculation of Greenfield run-off volumes, rates of rainfall and stormwater storage estimates.

Abbreviations & Acronyms

BGS	British Geological Survey
CC	Climate Change
CSAI	Cranfield Soil and Agrifood Institute
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
GMCA	Greater Manchester Combined Authority
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
mAOD	Metres Above Ordnance Datum
NGR	National Grid Reference
NPPF	National Planning Policy Framework
OS	Ordnance Survey
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
QSE	Quick Storage Estimate
QBAR	Mean Annual Flood
RMBC	Rochdale Metropolitan Borough Council
SfA	Sewers for Adoption
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
TWL	Top Water Level
UU	United Utilities

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1.0 INTRODUCTION

1.1 Planning Policy Context

- 1.1.1 All forms of flooding and their impact on the natural and built environment are material planning considerations. The revised National Planning Policy Framework (NPPF) sets out the Government's objectives for the planning system, and how planning should facilitate and promote sustainable patterns of development, avoiding flood risk and accommodating the impacts of climate change. Government policy with respect to development in flood risk areas is contained within the revised NPPF and the supporting Planning Practice Guidance (PPG) (refer to extracts in **Appendix A**).
- 1.1.2 A Flood Risk Assessment and Drainage Management Strategy (FRA&DMS) has been completed in accordance with the revised NPPF and the PPG to review all sources of flood risk both to and from the proposed development. The report also considers the most appropriate drainage management options including the implementation of Sustainable Drainage Systems (SuDS) in line with national policy.
- 1.1.3 The proposals are residential in nature which is identified to be 'less vulnerable' in Annex 3: Flood Risk Vulnerability Classification, within the NPPF. The PPG confirms that this type of land-use is appropriate for Flood Zone 1, providing there is no increase in flood risk elsewhere due to the proposals.

1.2 Site Context

- 1.2.1 This FRA&DMS has been prepared to support a planning application for the construction of a replacement car park, on land located north of Rakewood Road in Littleborough. The proposals will be complete with access, boundary fencing and drainage.

1.3 Consultation

- 1.3.1 The NPPF advises that Rochdale Metropolitan Borough Council as the Local Planning Authority (LPA) should consult with the EA who will provide advice and guidance on flood issues at a strategic level and in relation to planning applications. The preparation of this report has been undertaken in consultation with the Environment Agency (EA), United Utilities (UU), and Rochdale Metropolitan Borough Council (RMBC). Consultation responses can be seen in **Appendix B, C, and D** respectively.

2.0 EXISTING SITE LOCATION

2.1 Location

- 2.1.1 The development site is located on land north of Rakewood Road in Littleborough. The Ordnance Survey National Grid Reference for the site is E: 394007, N: 415274 and the nearest postcode is OL15 0AQ (see Location Plan in **Appendix E**). The total site covers 3.348ha and is edged in red in **Figure 1**. In terms of the development area this is shown by the red dotted line in **Figure 1**, this equates to 0.598ha.
- 2.1.2 In terms of the surrounding land-use, the site is bounded to the north and east by Hollingworth Brook, with undeveloped land located beyond. Located to the south-west of site is Rakewood Road, which separates the site from Hollingworth Lake reservoir. Finally, to the west of site is the Hollingworth County Park and associated car parking, as illustrated in **Figure 1**.



2.2 Existing and Historical Land Use

- 2.2.1 The site is currently greenfield and comprises of low-density vegetation, with larger trees and shrubs along the natural field boundaries. No other historical uses have been identified during the preparation of this report.

2.3 Topography

- 2.3.1 A topographic survey has been undertaken and included within **Appendix F**. The onsite ground levels range from approximately 162.48mAOD in the south-eastern corner of the site, down to a level of 158.19mAOD in the northern corner of the site. The arrows shown in **Figure 1** indicate the general fall across the site.

3.0 DEVELOPMENT PROPOSALS

3.1 Nature of the development

- 3.1.1 This assessment is to support to a planning application for the construction of a replacement car park on land located north of Rakewood Road in Littleborough. The car park is required to replace a smaller facility located on land to the north of Hollingworth Lake which is to be used to support another development scheme by the client. The proposals will be complete with access, car parking, boundary fencing and drainage. The proposed planning layout is included in **Figures 2** and **3** below (see full layout in **Appendix G**).



Figure 2: Proposed Planning Layout – Sheet 1 (Stantec, 2023)

- 3.1.2 The wider site covers 3.348ha and is 100% permeable at present, however, the development area will cover a smaller 0.598ha. Due to the scale and nature of the development, the impermeable areas have the potential to increase to 84% of the development area (where permeable surfacing is not used). This equates to 0.502ha.



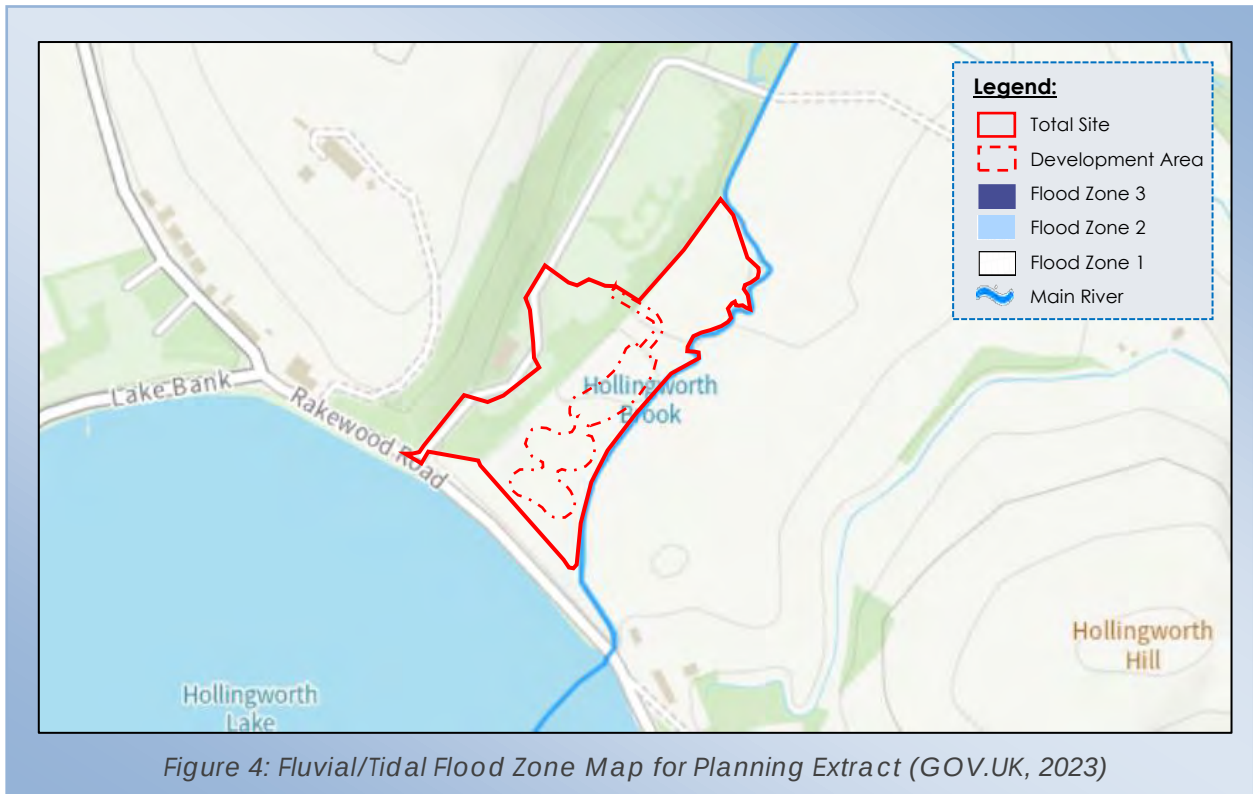
Figure 3: Proposed Planning Layout – Sheet 2 (Stantec, 2023)

- 3.1.3 Hollingworth Brook is confirmed by the EA as a designated Main River. The EA will therefore require an 8m offset to be maintained from the top of the bank. This offset should provide clear and unimpeded access for future maintenance purposes. From the planning layout shown in **Figures 2 and 3**, this offset has been allowed for in the design. An Environmental Permit would also be required from the EA for any works being undertaken within 16m of a Main River.
- 3.1.4 National and local policy identifies that SUDS should be incorporated into new development where feasible. Opportunities to provide soft landscaping on the site would provide added benefits to water quality and ecology. Furthermore, betterment in the form of permeable surfaces should also be considered during detailed design to reduce the surface water run-off generated. Refer to Section 5.0 for the outline drainage strategy.

4.0 SOURCES OF FLOOD RISK

4.1 Fluvial Flood Risk

- 4.1.1 Information relating to flood risk at the site has been obtained from the Environment Agency and from the Gov.uk website. An extract of the EA's Flood Zone Map for Planning is shown in **Figure 4**, which illustrates that the site is located solely within Flood Zone 1. Flood Zone 1 is an area considered to be at little or no flood risk from rivers and/or the sea (as defined by the EA).



Main Rivers

- 4.1.2 The nearest Main River to site is Hollingworth Brook, which flows parallel to the north-eastern and southern boundaries of the site. It is understood based on the proximity to the site, and the surrounding topography, that the risk from this Main River is low. This is reflected in the national mapping datasets (see full mapping in **Appendix B**).
- 4.1.3 Given the proximity of the Main River to the site, consultation with the EA has been undertaken to obtain the most up-to-date flood risk information to be obtained. The EA have confirmed that they only hold JFLOW data along Hollingworth Brook and that JFLOW data is not suitable to support a Flood Risk Assessment. That being said, the JFLOW data provided shows no flooding on the site, flooding is only shown to be associated with Hollingworth Brook downstream of the development site.
- 4.1.4 Further consultations have therefore been undertaken with both the EA and UU to obtain information regarding the hydraulic interactions between Hollingworth Lake and Hollingworth Brook. Observations onsite show Hollingworth Brook to be linked upstream of the site directly to Hollingworth Lake via a concrete overflow channel (as

shown in **Figure 5**). The EA have confirmed they do not hold any additional information regarding this interaction, and a response is currently outstanding from UU (see correspondence in **Appendix B** and **C**). As the site is located within Flood Zone 1, and the proposals are 'less vulnerable' in nature, it is understood that a standard Flood Risk Assessment can be completed based on the data available at this time, as no flooding at the site as a result of Hollingworth Brook has been identified.



Figure 5: Concrete Overflow Channel – Hollingworth Brook (Google, 2023)

- 4.1.5 Initial consultation with the EA, UU, and RMBC has failed to highlight any historical flooding directly to the development area or the surrounding area because of fluvial sources (see correspondence in **Appendix B, C, and D**). This is further supported by the review of Rochdale Metropolitan Borough Council's Strategic Flood Risk Assessment (SFRA), and the more recent Greater Manchester Combined Authority (GMCA) SFRA which does not identify the site to be at risk from fluvial sources.

4.2 Tidal Flood Risk

- 4.2.1 The Northwest Coastline is located over 65km west of the development site. Due to the distance from site, the tidal flood risk from these sources is 'low'. This is supported by the EA's Flood Zone Map for Planning also for the site being in Flood Zone 1.

4.3 Flood Risk Vulnerability Classification and Flood Zone Compatibility

- 4.3.1 The proposals are for the construction of a car park, and therefore considered to be 'less vulnerable' development in Annex 3: Flood Risk Vulnerability Classification, within the NPPF. The PPG confirms that this type of land-use is appropriate for Flood Zone 1, providing there is no increase in flood risk elsewhere due to the proposals.

4.4 Surface Water Flood Risk

- 4.4.1 Surface water flooding occurs when rainwater is unable to drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead. The risk associated with surface water flooding is indicated by the long-term flood mapping (extract shown in **Figure 6**).
- 4.4.2 The site is shown to be predominantly at 'very low' risk from surface water flooding, although there are some channels within the site area shown to be at greater risk. Generally, on undeveloped sites the areas at highest risk of surface water flooding correspond with either existing watercourses, conveyance features, or low-lying depressions.
- 4.4.3 In this case the areas at highest risk correspond with Hollingworth Brook located adjacent to the northern and eastern boundaries of the wider site, and also the low-lying areas adjacent to the western boundary of the site. The development area itself is mostly at very low to low risk from surface water flooding, although there is an area of greater flood risk along the northern boundary which is a naturally low-lying area within the wider site.
- 4.4.4 Any residual flood risks associated with surface water will be reduced through appropriate onsite levels design and the implementation of formal surface water drainage infrastructure. Any potential exceedance of the post-development flows from the proposed surface water drainage network, will be considered and contained onsite to ensure no increased risk to others.



Pluvial (Overland run-off) Flood Risk

- 4.4.5 Intense rainfall that is unable to soak into the ground or enter drainage systems can run-off land and result in flooding. Local topography and the land-use can have a strong influence on the direction and depth of flow. The topography of the site and

surrounding undeveloped areas means that there is potential for the site to be impacted by overland pluvial flows from the south, and west of site. Though the land to the east falls toward the site, this drains naturally to Hollingworth Brook and therefore will not impact the site. Due to the nature of the development, the proposals will not be impacted by pluvial flows.

- 4.4.6 The volume and rate of overland flow from land can be exacerbated, if development increases the percentage of impermeable area. Any overland flows generated by the development must be carefully controlled with safe avenues directing overland flow away from adjacent development being advised.

Sewer Flood Risk

- 4.4.7 In urban areas, rainwater is frequently drained into surface water sewers or sewers containing both surface and wastewater known as 'combined sewers'. Foul water flooding often occurs in areas prone to overland flow and can result when the sewer is overwhelmed by heavy rainfall and will continue until the water drains away.
- 4.4.8 United Utilities sewer records have identified very limited sewer infrastructure within proximity of the site. Consultation with United Utilities has been undertaken and has confirmed that there are no current records of sewer flooding within the vicinity of the proposed development (see **Appendix C** for correspondence and sewer records). It should also be noted that anecdotal correspondence in the area did not identify any historical flooding from the public sewer network.

4.5 Groundwater Flood Risk

- 4.5.1 High groundwater levels are usually the key source of groundwater flooding, which occurs when excess water emerges at the grounds surface (or within manmade underground structures such as basements). Groundwater flooding is often more insistent than surface water flooding and would typically last for weeks/months rather than days meaning the result to property is often more severe.
- 4.5.2 In general terms groundwater flooding can occur from three main sources:
- If groundwater levels are naturally close to the surface, then this can present a flood risk during times of intense rainfall.
 - Seepage and percolation occur where embankments above ground level hold water. In these cases, water travels through the embankment material and emerges on the opposite side of the embankment.
 - Groundwater recovery / rebound occurs where the water table has been artificially depressed by abstraction. When the abstraction stops the water, table makes a recovery to its original level. There is the potential for groundwater flooding in low lying areas where groundwater levels have been depressed below their pre-pumping conditions, where these were at or close to ground level.
- 4.5.3 The mapping data for groundwater shows that the site is underlain by a Secondary A Bedrock Aquifer with Secondary A superficial deposits. The site is also located within a Medium Groundwater Vulnerability Zone. No historical groundwater flooding of the site has been identified during consultation with the Environment Agency.

- 4.5.4 No groundwater flood risk has been identified during consultation with RMBC. Review of the RMBC SFRA, and the more recent GMCA SFRA did not identify any specific flood risk to the site associated with groundwater flooding (see extracts in **Appendix H**). Irrespective, it is advised that external levels fall away from the proposed carpark (where feasible) to minimise the flood risk from a variety of sources.

4.6 Artificial Sources of Flood Risk

- 4.6.1 National policy states that an FRA should consider the potential risks from a variety of other flood sources including artificial sources (such as risks from reservoirs and canals).

Reservoirs

- 4.6.2 The EA recognises reservoirs as bodies of water over 25,000cu.m and the long-term flood mapping is included in **Appendix B**. The mapping shows the extents of flooding which could potentially affect the proposed development site and the wider surrounding area in the event of a dam failure.
- 4.6.3 The reservoir is Hollingworth Lake, located less than 50m upstream of the site. This reservoir is elevated in comparison to the existing ground levels onsite and there are observations that an overflow structure is present from the reservoir into Hollingworth Brook at the upstream point on the wider site boundary. The flood risk mapping shows that the whole site would be susceptible to flooding associated with a failure in Hollingworth Lake, this is due to the site's close proximity to the reservoir, as illustrated in **Figure 7** (see full mapping in **Appendix B**).



- 4.6.4 The Reservoirs Act 1975 means that the EA ensure reservoirs (over 25,000cu.m) are regularly inspected and safety work is carried out thus meaning a failure or breach in one of these assets is highly unlikely. Although reservoir flooding is 'extremely unlikely',

if a failure was to occur there would be little or no warning therefore preparedness is key to ensure resilience.

- 4.6.5 In the case of emergency the LLFA often prepare emergency plans in collaboration with the EA and other stakeholders to assist with improving community resilience to residual risks such as reservoir flooding.
- 4.6.6 Initial enquiries with the reservoir owner (UU) and review of the PFRA/SFRA did not identify any historic flooding of the development site related to reservoir flooding. It is advised that the future carpark owner prepare a Flood Plan, which should detail the procedures and measures to take in the event of a flood incident which could potentially impact the site. Should a flood event resulting from the reservoir (using the overflow structure) be scheduled, then it is recommended that the carpark remain closed for the duration.

Canals

- 4.6.7 The nearest canal is the Rochdale Canal, located 850m north-west of the site, due to proximity the flood risk associated with canals is 'low'.
- 4.6.8 Irrespective, it is advised that external levels fall away from the proposed car park, to minimise the flood risk from a variety of sources. By keeping the carpark elevated relative to the surrounding land, this should help create overland flood flow routes in the event of a breach or any other source of flooding that could lead to overland flows, including reservoir or canal flooding.

4.7 Historical and Anecdotal Flooding Information

- 4.7.1 No historical flooding of the site has been identified during our review of online sources, including review of RMBC's SFRA, and the more recent GMCA SFRA (see general mapping extracts in **Appendix H**).
- 4.7.2 Consultation with the Environment Agency was undertaken, which identified records of flooding in Littleborough in March and July 2019, however, this did not impact on the site. Consultation with United Utilities, and Rochdale Metropolitan Borough Council also failed to identify any historic flooding directly to the site from the variety of sources reviewed (see **Appendix B, C, and D** for correspondence).
- 4.7.3 It was noted during the Places for Everyone Joint DPD Examination (February 9th, 2023) that the wider site may potentially be utilised by United Utilities when there is overspill from Hollingworth Lake reservoir. Further discussion with UU is currently being undertaken to better understand the interaction between Hollingworth Lake and Hollingworth Brook, however, a response is currently outstanding (see correspondence in **Appendix C**). No historical flooding at the site has been identified as part of the consultations carried out thus far.

4.8 Flood Risk Mitigation Measures & Residual Risks

- 4.8.1 The site is located wholly within Flood Zone 1 and are at little risk of fluvial/tidal flooding. To observe a conservative approach however, mitigation measures have been proposed below to safeguard against other potential residual sources of flood risk. The

mitigation measures also consider the uncertainties of climate change in accordance with the revised NPPF and PPG.

Mitigation Measures

- 4.8.2 Hollingworth Brook is located adjacent to the northern and eastern boundaries of the site and this watercourse has been confirmed by the EA as a designated Main River. The EA will therefore require an 8m offset to be maintained from the top of the bank. This offset should provide clear and unimpeded access for future maintenance purposed. Based on the current planning layout, this offset has been allowed for in the design. An Environmental Permit would also be required from the EA for any works being undertaken within 16m of a Main River.
- 4.8.3 It is advised that levels fall away from the proposed car parking spaces, where practical to minimise the flood risk from a variety of sources. By keeping the carpark elevated relative to the surrounding land, this should help create overland flood flow routes in the event of a breach or any other source of flooding that could lead to overland flows, including reservoir or canal flooding.
- 4.8.4 Any overland flows generated by the development must be carefully controlled. Safe avenues directing overland flow way from any existing buildings is advised.
- 4.8.5 To minimise the flood risk to the neighbouring areas it is recommended that the surface water run-off generated by the proposals be managed effectively with the peak rates of run-off being restricted to the equivalent of the pre-development situation (with betterment where required).
- 4.8.6 The proposed onsite surface water drainage system will need to be sized to contain exceedance from storm events up to and including the 1 in 100yr return period storm event with 30% allowance for climate change being contained onsite.
- 4.8.7 As with any drainage system blockages within either the foul or surface water system have the potential to cause flooding or disruption. It is important that should any drainage systems not be offered for adoption to either UU or RMBC then an appropriate maintenance regime should be scheduled with a suitably qualified management company for these private drainage systems.

Residual Risks

- 4.8.8 If an extreme rainfall event exceeds the design criteria for the drainage system it is likely that there will be some overland flows that are unable to enter the system, it is important that these potential overland flows are catered for within the development site if the capacity of the drainage system is exceeded.
- 4.8.9 It is advised that the future carpark owner prepare a Flood Plan, which should detail the procedures and measures to take in the event of a flood incident which could potentially impact the site. Should a flood event resulting from the reservoir (using the overflow structure) be scheduled, then it is recommended that the carpark remain closed for the duration.

5.0 SURFACE WATER MANAGEMENT

- 5.0.1 The wider site covers 3.348ha and is 100% permeable at present, however, the development area will cover a smaller 0.598ha. It is understood that the wider site drains naturally with the topography via overland run-off toward Hollingworth Brook in the north-eastern corner of the wider site. This watercourse flows in a north-easterly direction, joining with Shore Lane Brook to form Ealees Brook downstream.
- 5.0.2 The peak rates and volumes of run-off generated by the development area have been calculated for the peak events shown in **Table 1** (full details **Appendix I**). The surface water run-off rates have been calculated using the FEH Statistical Method. The full calculations in **Appendix I** are based on an area of 1ha and these rates and volumes are calculated pro-rata for the proposed development area of 0.598ha.

Dev. Area	Run-Off Rates				Run-Off Volumes	
	1 In 1 Year	1 In 30 Year	1 In 100 Year	QBar	1 In 1 Year	1 In 100 Year
0.598ha	3.7l/s	7.1l/s	8.7l/s	4.2l/s	79.0cu.m	212.6cu.m

Table 1: Pre-Development Surface Water Run-Off Rates (Betts Hydro, 2023)

5.2 Post Development Surface Water Run-Off

- 5.2.1 As previously discussed, based on the planning layout we have estimated that the impermeable areas post-development will increase to 84% (equating to 0.502ha). The unrestricted post-development run-off rates have been detailed in **Table 2**.

Proposed Imp. Area	Run-Off Rates			Run-Off Volumes	
	1 In 1 Yr	1 In 30 Yr	1 In 100 Yr + 30% CC	1 in 1yr	1 in 100yr
0.502ha	25.8l/s	48.8l/s	81.9l/s	122.2cu.m	335.8cu.m

Table 2: Post-Development Un-Restricted Run-Off Rates (Betts Hydro, 2023)

- 5.2.2 In accordance with national and local planning policies it is necessary to restrict surface water run-off rates where at all practical to mimic a pre-development greenfield situation. The proposals will therefore be to discharge surface water run-off from site mimicking the pre-development greenfield situation (**Table 1**).

5.3 Sustainable Drainage Systems (SuDS)

- 5.3.1 In accordance with national and local planning policy, peak surface water discharge rates from new development should be appropriately managed and where possible reduced. To manage surface water run-off policy shows that preference should always be given to Sustainable Drainage Systems (SuDS) over the traditional methods of buried sewers wherever possible and practical.
- 5.3.2 SuDS can (if designed and situated appropriately) address the four key sustainability objectives embedded in planning policy including providing space for water (water quantity), improving water quality and biodiversity, along with providing valuable

amenity/recreational space within new development sites. These benefits depend on the type of SuDS features being proposed, some examples are illustrated in **Figure 8**.



- 5.3.3 Opportunities should, as with all new development, be taken to provide soft landscaping where at all possible on site to minimise surface water run-off. In this case the proposals are for a new car park and there is a requirement to provide functional parking spaces for future users. However, it would be recommended that permeable surfacing and bio-filtration (tree pits) be considered where at all feasible. By including these measures, the surface water run-off is being dealt with at source which will assist locally with surface water management (subject to ground conditions). If infiltration is not feasible then a connection into the main drainage system is needed, but the presence of the above features will still allow the first 5mm of rainfall to be dealt with at source as recommended in the SuDS Manual (CIRIA 753).
- 5.3.4 Given the nature of the planning proposals, there will likely be scope to implement multiple types of permeable surfacing (including the potential for grasscrete (or similar) for parking bays where feasible). Bio-filtration (tree pits) have also been considered on the site to assist with reducing run-off generated and improving the water quality of discharge from the site. Furthermore, the proposals are to include some sort of swale onsite (subject to detailed design) to assist with conveyance of any run-off unable to drain to ground directly. These proposed methods provide assistance in dealing with surface water run-off at source, and using a combination of features proposed will also provide additional improvements to water quality (treatment train), where designed appropriately in accordance with the guidance set out in the SuDS Manual (CIRIA 753).

5.4 Methods of Surface Water Management

- 5.4.1 There are three methods that have been reviewed for the management and discharge of surface water. These may be applied individually or collectively to form a complete strategy and should be applied in the order of priority listed subsequently:
- Discharge via infiltration
 - Discharge to watercourse
 - Discharge to public sewerage system

5.5 Discharge via Infiltration

- 5.5.1 Any impermeable areas that can drain to soakaway or an alternative method of infiltration would significantly improve the sustainability of any surface water system onsite. At this time there has been no onsite infiltration testing to support this assessment, therefore the ground conditions have been identified based on the online datasets.
- 5.5.2 The online Cranfield Soil and AgriFood Institute (CSAI) Soilscape viewer identifies slowly permeable, seasonally wet acid loamy and clayey soils. The British Geology Survey (BGS) mapping data indicates that the bedrock geology consists of Pennine Lower Coal Measures Formation (mudstone, siltstone, and sandstone), with superficial deposits of alluvium (clay, silt, sand, and gravel). Given the potential for coal measures and underlying clays it would be recommended that onsite ground investigations confirm the underlying ground condition within the main proposed development area.
- 5.5.3 The underlying strata appears to suggest that permeability is low to medium, however, the FEH soil factor of 0.47 suggests a low permeability for the area (based on a scale of 0.1 being very high permeability and 0.5 being very low). To confirm that infiltration will not be feasible in its entirety, it is recommended that Soakaway Testing (to BRE365) is undertaken at an early stage within the proposed development area. This will ascertain the specific onsite underlying ground conditions and suitability of such to achieve a full formal infiltration-based drainage solution at the site.
- 5.5.3 Based on the ground conditions identified above by the published online datasets and the soil classifications; it is likely that infiltration would not offer a full viable drainage management solution due to the cohesive nature of the underlying strata and therefore, other surface water discharge methods have been reviewed.

5.6 Discharge to Watercourse/Waterbody

- 5.6.1 Assuming infiltration will not offer a full surface water management solution for the proposals, then the next method in the sustainable drainage hierarchy is discharge surface water run-off generated by the proposals to a nearby watercourse or waterbody.
- 5.6.2 As discussed previously, it is understood that the wider site drains naturally with the topography via overland run-off toward Hollingworth Brook. This watercourse flows in a north-easterly direction, joining with Shore Lane Brook to form Ealees Brook. The proposals are to mimic the existing situation and continue to discharge surface water run-off into Hollingworth Brook, via a new connection located along the northern boundary of the wider site. A Preliminary Drainage Layout has been prepared, which confirms that a site wide gravity solution is viable, as illustrated in **Figure 9** (see full plan in **Appendix J**).
- 5.6.3 The proposals are to utilise permeable surfaces across the site where practical; even if a full infiltration solution is not viable, the permeable surfaces will be lined with a connection to the proposed main drainage serving the new development area. The presence of the permeable surfaces will still allow the first 5mm of rainfall to be dealt with at source in accordance with the guidance set out in the SuDS Manual (CIRIA 753).

- 5.6.4 Detailed design will need to be carried out to confirm whether a site wide gravity solution can be achieved, however given the existing ground levels and existing drainage situation a gravity system is understood to be feasible. Consent and formal agreement will be required from the EA and RMBC (Lead Local Flood Authority) for any works to the Main River network.

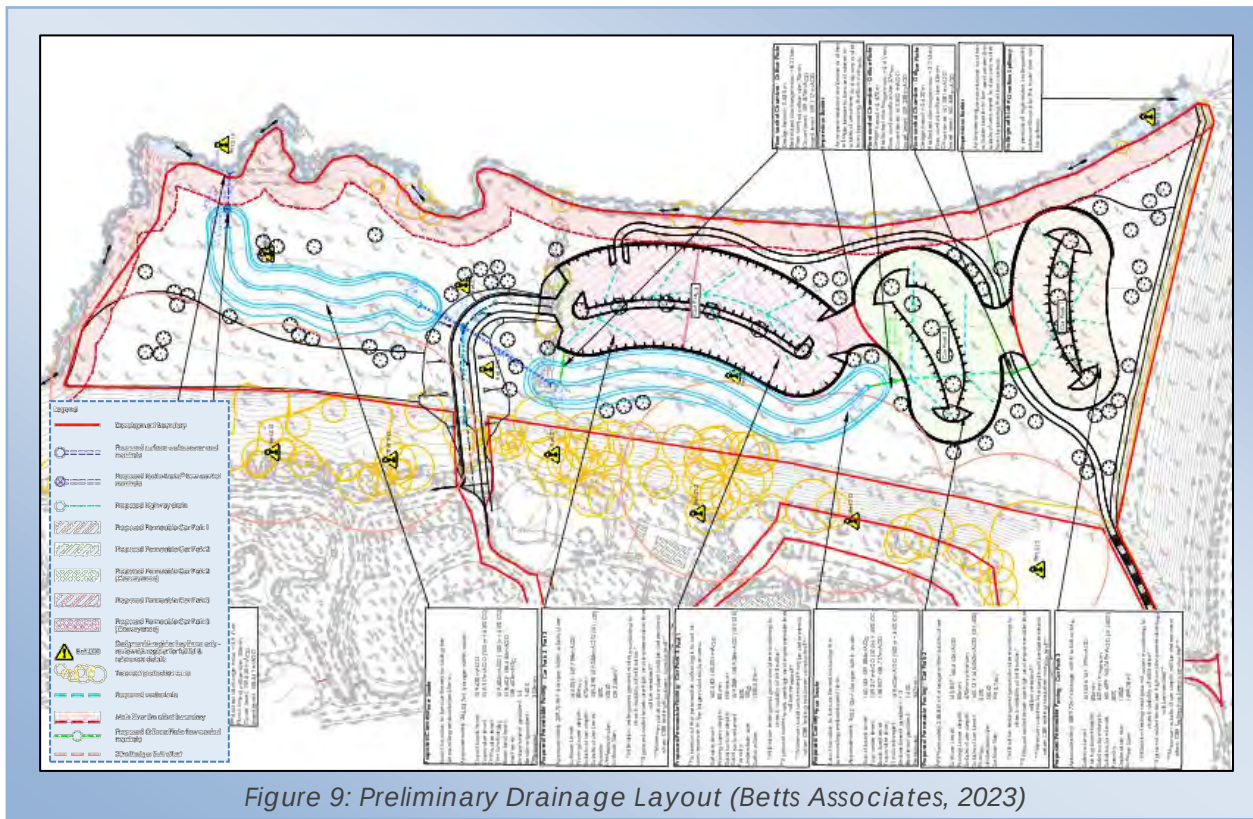


Figure 9: Preliminary Drainage Layout (Betts Associates, 2023)

Proposed Discharge Rates

- 5.6.5 In accordance with the SuDS Manual (CIRIA) and the Non-Technical Standards for SuDS (March 2015) all sites should endeavour to achieve as close to pre-development greenfield rates as is viable. Based on the development area, the pre-development greenfield rate (QBar) is calculated to be 4.2l/s (7.0l/s/ha).
- 5.6.6 In order to restrict the rate of discharge from the site a standard flow control device would typically be utilised. Typically, the lowest rate restriction applied by the orifice plate diameter would be 5.0l/s to avoid maintenance liabilities and adoption concerns associated with lower rates. The LLFA (RMBC) will need to be consulted as part of the proposals to provide agreement that the proposed drainage strategy including rates of discharge conform to their requirements.
- 5.6.6 Restricting the rate of discharge will generate a requirement to provide onsite stormwater storage for the extreme rainfall events. The stormwater storage figures quoted in **Table 3 (Appendix K)** are estimates only. Detailed design will determine with accuracy the attenuation requirements.

Proposed Imp. Area (0.502ha)	1 In 1 Year	1 In 30 Year	1 In 100 Year + 30% CC
Restricted Run-Off Rate	5.0l/s	5.0l/s	5.0l/s
Estimated Stormwater Storage Volume	44cu.m-101cu.m	130cu.m-235cu.m	276cu.m-486cu.m

Table 3: Estimated Stormwater Storage Requirements (Betts Hydro, 2023)

- 5.6.7 Given the scale and nature of the development this will be provided via underground storage; the specific means are to be determined during the detailed design stage. The proposals are to incorporate permeable surfacing, tree pits, and swales onsite as part of the proposed surface water drainage scheme. The surface water infrastructure for the development will need to be designed to cater for the surface water run-off generated in the events up to and including the 1 in 100yr return period event with a 30% allowance for climate change.

5.7 Discharge to Public Sewer Network

- 5.7.1 UU sewer records have identified limited public surface water sewers within the vicinity of site that may be suitable for surface water run-off connections, however if infiltration is not feasible then the surface water run-off should discharge into the nearest watercourse or waterbody and not the public sewer network.

5.8 Climate Change

- 5.8.1 There are indications that the climate in the UK is changing significantly, and it is widely believed that the nature of climate change will vary greatly by region. Current opinion indicates the likelihood that future climate change would produce more frequent short duration and high intensity rainfall events with the addition of more frequent periods of long duration rainfall. An increase in flood water levels means that future flooding events will occur more frequently and will have a greater impact.
- 5.8.2 In accordance with the Irwell Management Catchment peak rainfall allowances, the central allowance (**Table 4**) for the 2070's has been utilised (based on development with a lifetime between 2061 and 2125).

PROJECTIONS	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE 2070'S
Upper End Allowance	45%
Central Allowance	30%

Table 4: Change to Peak Rainfall Compared to 1981-2000 Baseline (Environment Agency, 2022)

6.0 SUMMARY AND CONCLUSIONS

- 6.1 This report has been prepared to support a planning application for the construction of a replacement carpark on land north of Rakewood Road in Littleborough. The proposals are confirmed to be 'less vulnerable' within the NPPF; the PPG confirms that this type of development is appropriate within Flood Zone 1, providing there is no increase in flood risk as a result.

Flood Risk

- 6.2 This report has reviewed all sources of flood risk both to and resulting from the proposed development. Consultation with the Environment Agency, United Utilities, and Rochdale Metropolitan Borough Council has not identified any historical flooding at the site or within the wider area.

- 6.3 To summarise, the proposals are at 'low' risk from the flood sources reviewed as part of this assessment. Any residual surface water flood risk will be sustainably managed post-development, following the implementation of a sustainable surface water management regime, any residual risks can be managed by appropriate levels design.

Drainage Strategy

- 6.4 Given the low flood risks identified, the key focus of this assessment is on the sustainable management of surface water run-off to ensure no increased flood risk results from the development proposals. The surface water run-off management options have been assessed in accordance with the sustainable drainage hierarchy, which is to discharge to ground, followed by a waterbody or finally the public sewer.
- 6.5 Based on the ground conditions identified by the published online datasets and the soil classifications; it is likely that infiltration would not offer a full viable drainage management solution due to the cohesive nature of the underlying strata and therefore, other surface water discharge methods have been reviewed.
- 6.6 It is understood that the wider site drains naturally with the topography towards Hollingworth Brook in the north-eastern corner of the site. This watercourse flows in a north-easterly direction, joining with Shore Lane Brook to form Ealees Brook. The proposals are therefore to mimic the existing regime and continue to discharge surface water run-off into Hollingworth Brook located along the northern boundary of the wider site.
- 6.7 Given the nature of the planning proposals, there will likely be scope to implement multiple types of permeable surfacing (including the potential for grasscrete (or similar) for parking bays where feasible), bio-filtration (tree pits) and a swale onsite (subject to detailed design). These proposed methods provide assistance in dealing with surface water run-off at source, and using a combination of features proposed will also provide additional improvements to water quality (treatment train), where designed appropriately in accordance with the guidance set out in the SuDS Manual (CIRIA 753).
- 6.8 In accordance with the SuDS Manual (CIRIA) and the Non-Technical Standards for SuDS (March 2015) all sites should endeavour to achieve as close to pre-development greenfield rates as is viable. Based on the development area, the pre-development greenfield rate (QBar) is calculated to be 4.2l/s (7.0l/s/ha).

- 6.9 In order to restrict the rate of discharge from the site a standard flow control device would typically be utilised. Typically, the lowest rate restriction applied by the orifice plate diameter would be 5.0l/s to avoid maintenance liabilities and adoption concerns associated with lower rates. The LLFA (RMBC) will need to be consulted as part of the proposals to provide agreement that the proposed drainage strategy including rates of discharge conform to their requirements.
- 6.10 Restricting the rate of discharge will generate a requirement to provide onsite stormwater storage for the extreme rainfall events. The surface water scheme for the development will be designed to cater for the surface water run-off generated in the events up to and including the 1 in 100yr return period event with a 30% allowance for Climate Change. Detailed design will confirm with accuracy the technical details for the proposed drainage strategy detailed within this assessment.
- 6.11 Detailed design will need to be carried out to confirm whether a site wide gravity solution can be achieved, however given the existing ground levels and existing drainage situation a gravity system is understood to be feasible. Consent and formal agreement will be required from the Environment Agency and Rochdale Metropolitan Borough Council (LLFA) for any works to the Main River network. The LLFA will also need to agree to the proposed rates of discharge.
- 6.12 This Flood Risk Assessment and Drainage Management Strategy has been prepared in consultation with the relevant interested parties and incorporates their comments where possible. The report is commensurate with the scale and nature of the development proposals and in summary, the development can be considered appropriate in accordance with the Planning Practice Guidance.

7.0 RECOMMENDATIONS

- 7.1 Hollingworth Brook is located adjacent to the northern and eastern boundaries of the site and this watercourse has been confirmed by the EA as a designated Main River. The EA will therefore require an 8m offset to be maintained from the top of the bank. This offset should provide clear and unimpeded access for future maintenance purposed. Based on the current planning layout, this offset has been allowed for in the design. An Environmental Permit would also be required from the EA for any works being undertaken within 16m of a Main River.
- 7.2 It is advised that levels fall away from the proposed car parking spaces, where practical to minimise the flood risk from a variety of sources. By keeping the carpark elevated relative to the surrounding land, this should help create overland flood flow routes in the event of a breach or any other source of flooding that could lead to overland flows, including reservoir or canal flooding.
- 7.3 Any overland flows generated by the development must be carefully controlled. Safe avenues directing overland flow way from any existing buildings is advised.
- 7.4 To minimise the flood risk to the neighbouring areas it is recommended that the surface water run-off generated by the proposals be managed effectively with the peak rates of run-off being restricted to the equivalent of the pre-development situation (with betterment where required).
- 7.5 The proposed onsite surface water drainage system will need to be sized to contain exceedance from storm events up to and including the 1 in 100yr return period storm event with 30% allowance for climate change being contained onsite.
- 7.6 As with any drainage system blockages within either the foul or surface water system have the potential to cause flooding or disruption. It is important that should any drainage systems not be offered for adoption to either UU or RMBC then an appropriate maintenance regime should be scheduled with a suitably qualified management company for these private drainage systems.
- 7.7 If an extreme rainfall event exceeds the design criteria for the drainage system it is likely that there will be some overland flows that are unable to enter the system, it is important that these potential overland flows are catered for within the development site if the capacity of the drainage system is exceeded.
- 7.8 It is advised that the future carpark owner prepare a Flood Plan, which should detail the procedures and measures to take in the event of a flood incident which could potentially impact the site. Should a flood event resulting from the reservoir (using the overflow structure) be scheduled, then it is recommended that the carpark remain closed for the duration.

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APPENDIX A: NPPF & PPG EXTRACTS

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14. Meeting the challenge of climate change, flooding and coastal change

152. The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.

Planning for climate change

153. Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures⁵³. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.
154. New development should be planned for in ways that:
- a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and
 - b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.
155. To help increase the use and supply of renewable and low carbon energy and heat, plans should:
- a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);
 - b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

⁵³ In line with the objectives and provisions of the Climate Change Act 2008.

- c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.
156. Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.
157. In determining planning applications, local planning authorities should expect new development to:
- a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
 - b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.
158. When determining planning applications for renewable and low carbon development, local planning authorities should:
- a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and
 - b) approve the application if its impacts are (or can be made) acceptable⁵⁴. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

Planning and flood risk

159. Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.
160. Strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards.

⁵⁴ Except for applications for the repowering of existing wind turbines, a proposed wind energy development involving one or more turbines should not be considered acceptable unless it is in an area identified as suitable for wind energy development in the development plan; and, following consultation, it can be demonstrated that the planning impacts identified by the affected local community have been fully addressed and the proposal has their backing.

161. All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by:
- a) applying the sequential test and then, if necessary, the exception test as set out below;
 - b) safeguarding land from development that is required, or likely to be required, for current or future flood management;
 - c) using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding, (making as much use as possible of natural flood management techniques as part of an integrated approach to flood risk management); and
 - d) where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations.
162. The aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.
163. If it is not possible for development to be located in areas with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in Annex 3.
164. The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. To pass the exception test it should be demonstrated that:
- a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and
 - b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
165. Both elements of the exception test should be satisfied for development to be allocated or permitted.
166. Where planning applications come forward on sites allocated in the development plan through the sequential test, applicants need not apply the sequential test again. However, the exception test may need to be reapplied if relevant aspects of the proposal had not been considered when the test was applied at the plan-

making stage, or if more recent information about existing or potential flood risk should be taken into account.

167. When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment⁵⁵. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:
- a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
 - b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;
 - c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
 - d) any residual risk can be safely managed; and
 - e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.
168. Applications for some minor development and changes of use⁵⁶ should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 55.
169. Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:
- a) take account of advice from the lead local flood authority;
 - b) have appropriate proposed minimum operational standards;
 - c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
 - d) where possible, provide multifunctional benefits.

Coastal change

⁵⁵ A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

⁵⁶ This includes householder development, small non-residential extensions (with a footprint of less than 250m²) and changes of use; except for changes 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.

170. In coastal areas, planning policies and decisions should take account of the UK Marine Policy Statement and marine plans. Integrated Coastal Zone Management should be pursued across local authority and land/sea boundaries, to ensure effective alignment of the terrestrial and marine planning regimes.
171. Plans should reduce risk from coastal change by avoiding inappropriate development in vulnerable areas and not exacerbating the impacts of physical changes to the coast. They should identify as a Coastal Change Management Area any area likely to be affected by physical changes to the coast, and:
- a) be clear as to what development will be appropriate in such areas and in what circumstances; and
 - b) make provision for development and infrastructure that needs to be relocated away from Coastal Change Management Areas.
172. Development in a Coastal Change Management Area will be appropriate only where it is demonstrated that:
- a) it will be safe over its planned lifetime and not have an unacceptable impact on coastal change;
 - b) the character of the coast including designations is not compromised;
 - c) the development provides wider sustainability benefits; and
 - d) the development does not hinder the creation and maintenance of a continuous signed and managed route around the coast⁵⁷.
173. Local planning authorities should limit the planned lifetime of development in a Coastal Change Management Area through temporary permission and restoration conditions, where this is necessary to reduce a potentially unacceptable level of future risk to people and the development.

⁵⁷ As required by the Marine and Coastal Access Act 2009.

(<http://www.legislation.gov.uk/ukxi/2015/596/article/4/made>) to require planning permission to be sought in each case.

Paragraph: 075 Reference ID: 7-075-20220825

Revision date: 25 08 2022

How can neighbourhood plans and neighbourhood development/community right to build orders take account of coastal change?

In any instance where a Neighbourhood Area is proposed in a Coastal Change Management Area, careful attention should be paid to the guidance on [what development would be appropriate in such an area](#), including whether [time-limiting planning permissions](#) are needed. The local planning authority will need to be consulted about existing and anticipated levels of risk, and the types of development that may or may not be appropriate.

See related policy in [paragraphs 170 to 173 of the National Planning Policy Framework](#) (<https://www.gov.uk/guidance/national-planning-policy-framework/14-meeting-the-challenge-of-climate-change-flooding-and-coastal-change>).

Paragraph: 076 Reference ID: 7-076-20220825

Revision date: 25 08 2022

Flood Zone and flood risk tables

- Table 1: Flood Zones
- [National Planning Policy Framework Annex 3 - Flood risk vulnerability classification](#) (<https://www.gov.uk/guidance/national-planning-policy-framework/annex-3-flood-risk-vulnerability-classification>)
- [Table 2: Flood risk vulnerability and flood zone 'incompatibility'](#)

Paragraph: 077 Reference ID: 7-077-20220825

Revision date: 25 08 2022

Table 1: Flood Zones

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 0.1% annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b)
Zone 2 Medium Probability	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual

Flood Zone	Definition
	probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise: • land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or • land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding). Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Note: The Flood Zones shown on the Environment Agency's Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding. Reference should therefore also be made to the [Strategic Flood Risk Assessment](https://www.gov.uk/guidance/local-planning-authorities-strategic-flood-risk-assessment) (<https://www.gov.uk/guidance/local-planning-authorities-strategic-flood-risk-assessment>) when considering location and potential future flood risks to developments and land uses.

Paragraph: 078 Reference ID: 7-078-20220825

Revision date: 25 08 2022

Table 2: Flood risk vulnerability and flood zone 'incompatibility'

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	X	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	X	X	X	✓ *

Key:

✓ Exception test is not required

X Development should not be permitted

Notes to table 2:

- This table does not show the application of the [Sequential Test](#) which should be applied first to guide development to the lowest flood risk areas; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;
- The Sequential and [Exception Tests](#) do not need to be applied to those developments set out in [National Planning Policy Framework footnote 56](#) (<https://www.gov.uk/guidance/national-planning-policy-framework/14-meeting-the-challenge-of-climate-change-flooding-and-coastal-change>). The Sequential and Exception Tests should be applied to ‘major’ and ‘non major’ development;
- Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

“†” In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

“*” In Flood Zone 3b (functional floodplain) essential infrastructure that has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- remain operational and safe for users in times of flood;

- result in no net loss of floodplain storage;
- not impede water flows and not increase flood risk elsewhere.

Paragraph: 079 Reference ID: 7-079-20220825

Revision date: 25 08 2022

Site-specific flood risk assessment: Checklist

1 - Development site and location

You can use this section to describe the site you are proposing to develop. It would be helpful to include, or make reference to, a location map which clearly indicates the development site.

- a. Where is the development site located? (e.g. postal address or national grid reference)
- b. What is the current use of the site? (e.g. undeveloped land, housing, shops, offices)
- c. Which Flood Zone (for river or sea flooding) is the site within? (i.e. Flood Zone 1, Flood Zone 2, Flood Zone 3). As a first step, you should check the [Flood Map for Planning \(https://flood-map-for-planning.service.gov.uk/\)](https://flood-map-for-planning.service.gov.uk/). Check the Strategic Flood Risk Assessment for the area available from the local planning authority to identify if the site is within Flood Zone 1 but at increased risk of flooding in future due to climate change
- d. Also check the Strategic Flood Risk Assessment to identify if there are any other sources of flooding that may affect the site now or in the future.

2 - Development proposals

You can use this section to provide a general summary of the development proposals. It would be helpful to include, or make reference to, an existing block plan and a proposed block plan, where appropriate.

- a. What are the development proposal(s) for this site? Will this involve a change of use of the site and, if so, what will that change be?
- b. In terms of vulnerability to flooding, what is the vulnerability classification of the proposed development? See [National Planning Policy Framework Annex 3 \(https://www.gov.uk/guidance/national-planning-policy-framework/annex-3-flood-risk-vulnerability-classification\)](https://www.gov.uk/guidance/national-planning-policy-framework/annex-3-flood-risk-vulnerability-classification) for an explanation of the vulnerability classifications.
- c. What is the expected or estimated lifetime of the proposed development likely to be (e.g. 100 years or 75 years)? See [paragraph 006](#) of this guidance for further advice on how to assess the lifetime of developments for flood risk and coastal

APPENDIX B: EA INFORMATION & CORRESPONDENCE

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Hannah Buchanan

From: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>
Sent: 23 February 2023 09:16
To: Hannah Buchanan
Subject: GMMC299154AB Response 2 attached from the Environment Agency

Dear Hannah,

Thank you for your enquiry which was received on 21/2/23.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

Our officer has provided the model reports which makes mention of this part of the catchment.

<https://ea.sharefile.com/d-s5f78081104f04d80b974d9737eb7d127>

The ShareFile links contains the following data:

Rochdale and Littleborough 2013 Reports (P5)

Please note that the link will expire in 30 days from 21/02/23. It is therefore advisable to save this data to your own system.

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3. We have restricted use of the Information as a result of legal restrictions placed upon us to protect the rights or confidentiality of others. In this instance it is because of third party data. If you contact us in writing (this includes email) we will, as far as confidentiality rules allow, provide you with details including, if available, how you might seek permission from a third party to extend your use rights.
- 4.1 The Information may contain some data that we believe is within the definition of "personal data" under the Data Protection Act 1998 but we consider that we will not be in breach of the Act if we disclose it to you with conditions set out in this condition and the conditions above. This personal data comprises names of individuals or commentary relating to property that may be owned by an individual or commentary relating to the activities of an individual.
- 4.2 Under the Act a person who holds and uses or passes to others personal data is responsible for any compliance with the Act and so we have no option but to warn you that this means you have responsibility to check that you are compliant with the Act in respect of this personal data.
- 5 The location of public water supply abstraction sources must not be published to a resolution more detailed than 1km2. Information about the operation of flood assets should not be published.
- 6 .1 Where we have supplied model data which may include model inputs or outputs you agree to supply to the Environment Agency copies of any assessments/studies and related outputs, modifications or derivatives created pursuant to the supply to you of the Information, all of which are hereinafter referred to as "the Data".
- 6.2 You agree, in the public interest to grant to the Environment Agency a perpetual royalty free non-exclusive licence to use the Data or any part thereof for its internal purposes or to use it in

any way as part of Environment Agency derivative products which it supplies free of charge to others such as incorporation into the Environment Agency's Open Data mapping products.

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Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Kind regards,

Anne Ball
Customer and Engagement Officer
Greater Manchester, Merseyside and Cheshire
Email: InfoRequests.gmmc@environment-agency.gov.uk

From: Hannah Buchanan <hannahbuchanan@betts-associates.co.uk>
Sent: 21 February 2023 15:25
To: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>
Cc: Kirsty Halliday <kirstyhalliday@betts-associates.co.uk>
Subject: RE: GMMC299154AB Response attached from the Environment Agency

Good afternoon Anne,

Thanks for the prompt response on this one – I do have a query about the Main River shown underneath Hollingworth Lake. As I understand it, Longden End Brook flows in a northerly direction before outfalling into Hollingworth Lake. Does this then join with Hollingworth Brook which flows in a north-easterly direction through our site?

Please could you send across the model report for the modelled data downstream of the site? We just need a bit of clarity on how this system works if at all possible please.

Kind Regards,

Hannah Buchanan BSc (Hons) MSc GradCIWEM
Graduate Flood Risk Analyst

BETTS HYDRO

Consulting Engineers

Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire, CH5 2LY
Chester +44 (0) 1244 289041

hannahbuchanan@betts-associates.co.uk
www.betts-associates.co.uk

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From: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>

Sent: 21 February 2023 15:08

To: Hannah Buchanan <hannahbuchanan@betts-associates.co.uk>

Subject: GMMC299154AB Response attached from the Environment Agency

Dear Hannah,

Thank you for your enquiry which was received on 17/2/23.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

I enclose the data requested.

There are no 2D levels available for this site.

There is modelled data available downstream of the site to the north which we can provide if required, but as the site is in Flood Zone 1 the data from this model does not impact the site.

There are no flood defences in the vicinity of the site.

We have no records of flooding affecting the site. However, this does not mean flooding has not occurred in the past or that it will not flood in future. We recommend that you also contact United Utilities and Rochdale District Council who may hold additional information (the former especially in relation to sewer flooding).

Although there is no recorded flooding outlines at the site, we have provided a map to show previous flooding nearby.

Please be aware you can check your risk of flooding on our external website <https://flood-warning-information.service.gov.uk/long-term-flood-risk/>

Here are some useful links below:

<https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities>

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

For surface water information please use link: <https://check-long-term-flood-risk.service.gov.uk/map?easting=362125.07&northing=388310.97&map=SurfaceWater>

Please refer to the [Open Government Licence](#) which explains the permitted use of this information.

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Kind regards,

Anne Ball

Customer and Engagement Officer

Greater Manchester, Merseyside and Cheshire

Email: inforequests.gmmc@environment-agency.gov.uk

Office address: Richard Fairclough House, Knutsford Road, Latchford, Warrington, WA14 4UW

From: Hannah Buchanan <hannahbuchanan@betts-associates.co.uk>

Sent: 17 February 2023 08:43

To: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>

Subject: Flood Risk Information Request - Products 4, 5, 6 & 7

To whom it may concern,

Replacement Car Park, Rakewood Road, Littleborough

Please could you confirm whether you have any information (Products 4, 5, 6, and 7 where appropriate) that you feel would be valuable to a Flood Risk Assessment and Drainage Management Strategy for the above site (location plan attached), including details of historical flooding and specific drainage requirements; this would be greatly appreciated. If there are any other specific requirements that you require in a scope of works for this site, please can you advise at this stage so that it can be fully incorporated into the proposals at an early stage.

Just to clarify, we would like data for the whole site, which includes the red and blue line boundaries in the attached location plan. Please do not hesitate to contact me on the details below to discuss further should you require additional information or clarification.

Kind Regards,

Hannah Buchanan BSc (Hons) MSc GradCIWEM
Graduate Flood Risk Analyst

BETTS HYDRO

Consulting Engineers

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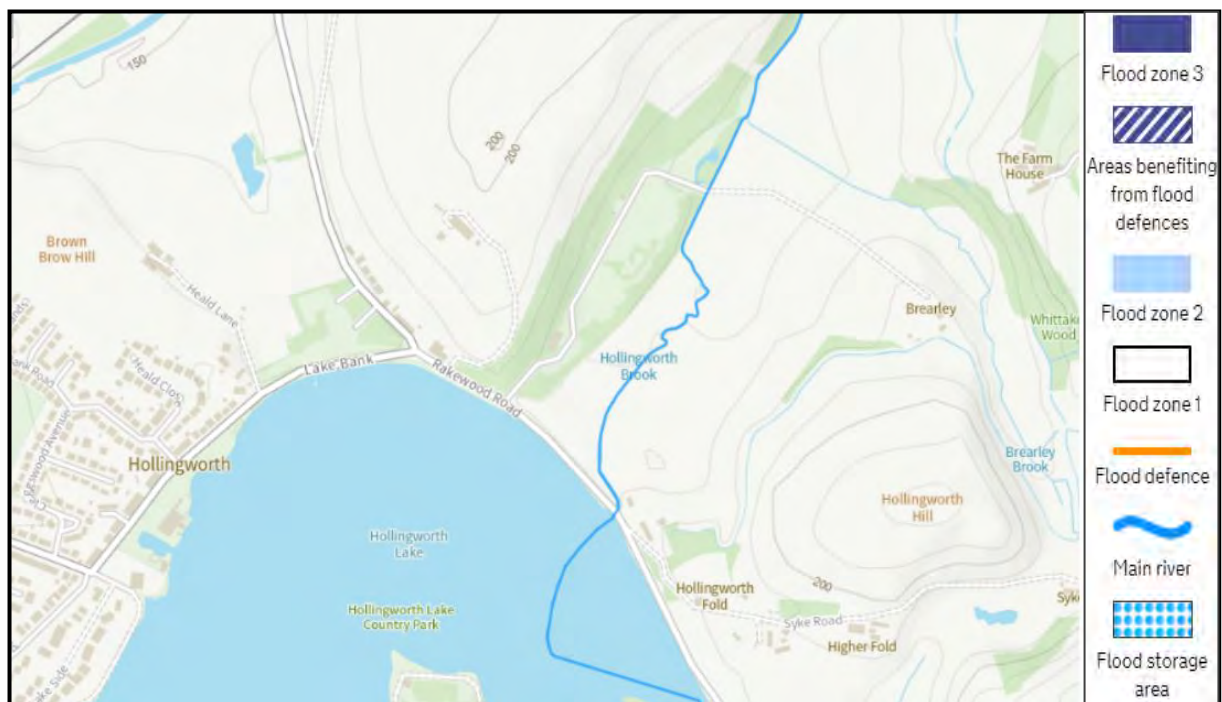
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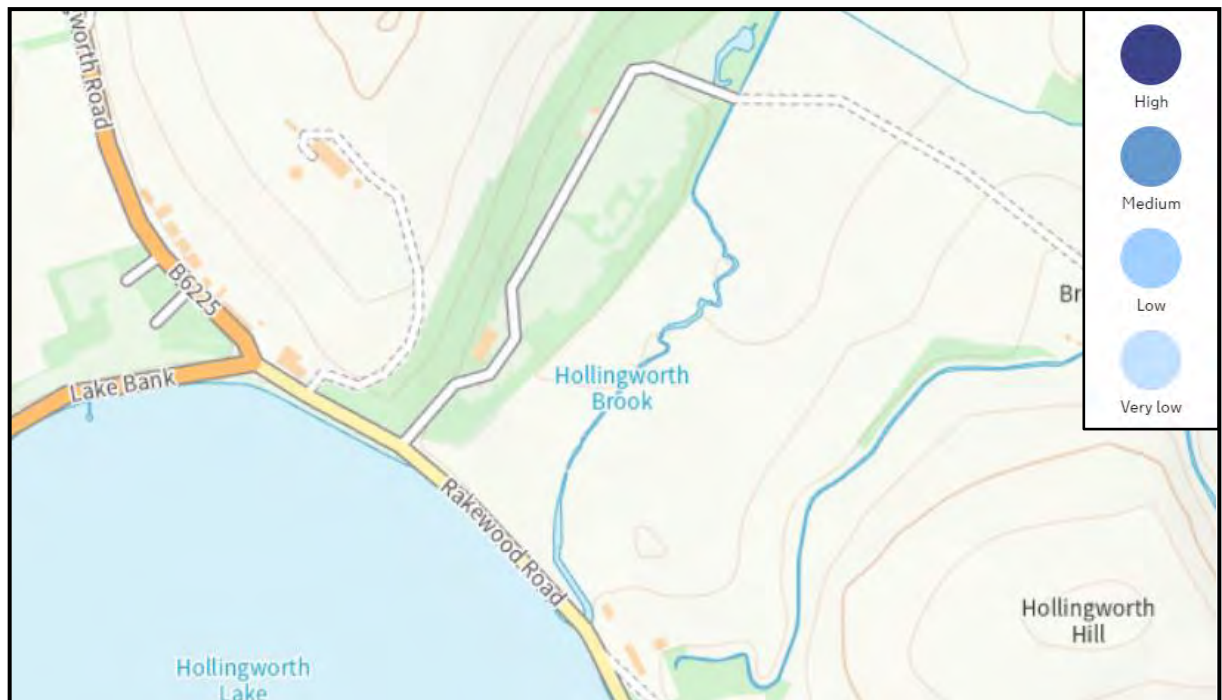
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NATIONAL FLOOD MAPPING

Flood Map for Planning



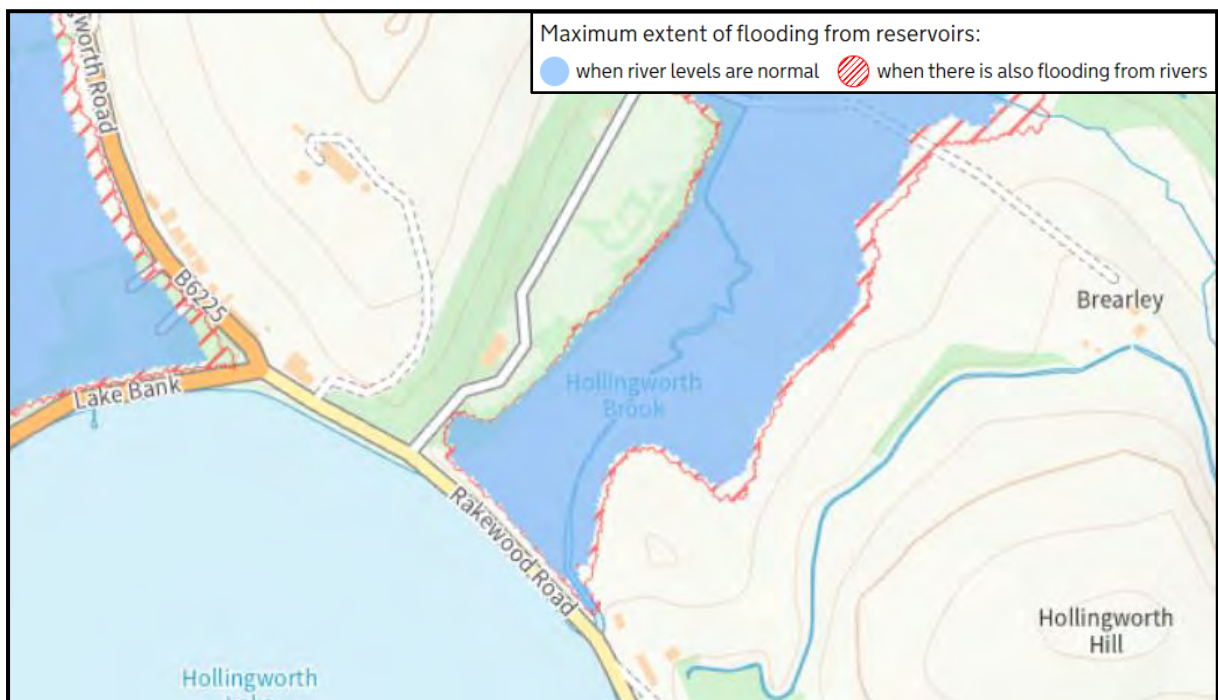
Long Term Flood Risk – Rivers or Sea



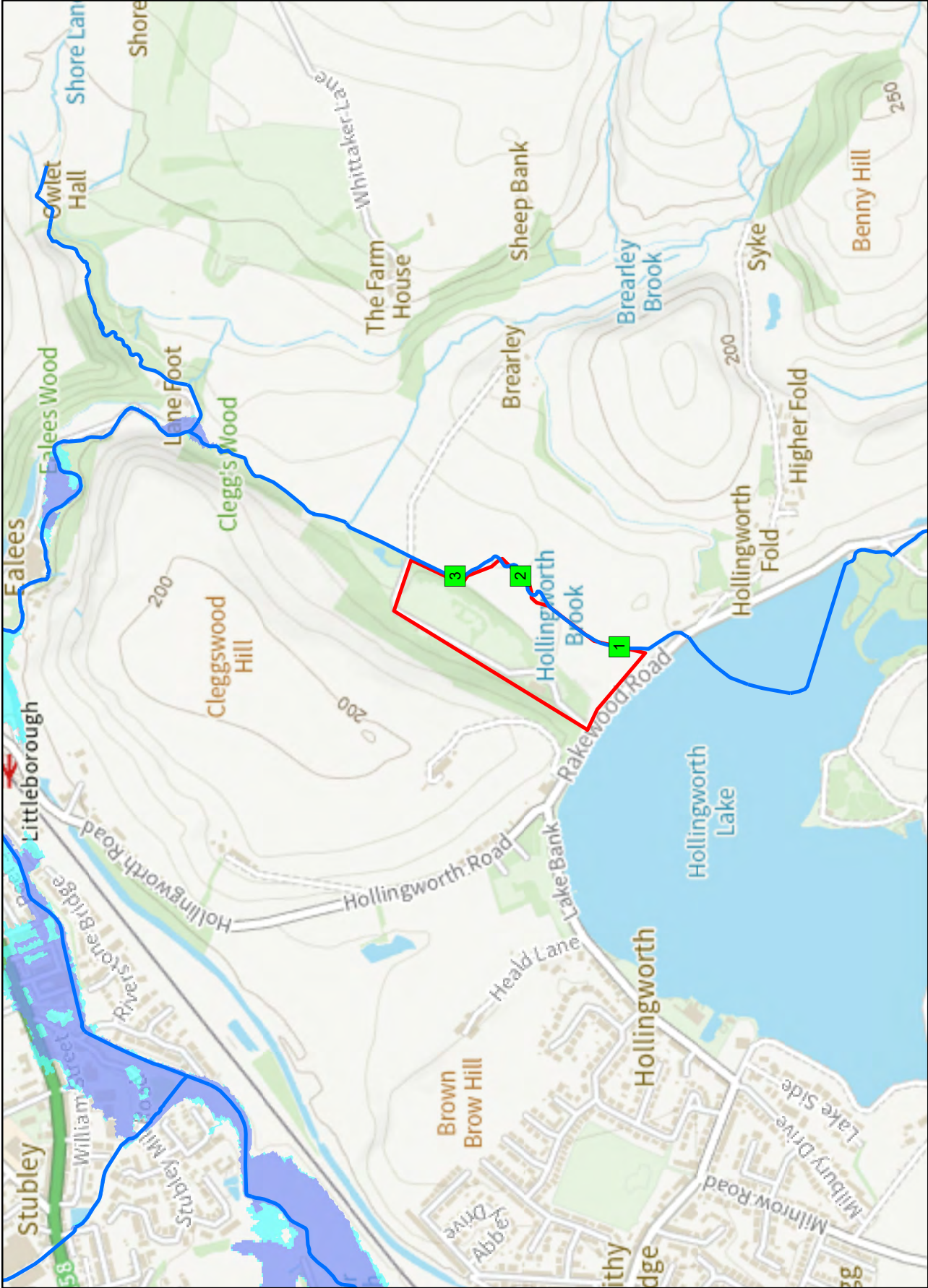
Long Term Flood Risk – Surface Water



Long Term Flood Risk - Reservoirs



Detailed Flood Map Centred on Rakewood Road, Littleborough, OL15 0AQ.
Created 21/02/2023 [GMMC299154AB]



1:10,001

N

Legend

- Site Location
- JFlow
- Main River
- Flood Zone 3
- Flood Zone 2

Map Reference	Model Node Reference	Easting	Northing	Data	Undefended	
1	JFlow	394051	415138	Modelled Water Level (m aodN)	1 % AEP (1 in 100 year)	0.1 % AEP (1 in 1000 year)
2		394182	415318	Modelled Water Level (m aodN)	162.93	163.15
3		394182	415438	Modelled Water Level (m aodN)	159.65	159.78
				Modelled Water Level (m aodN)	159.30	159.30

Model data taken from National Generalised Modelling (JFlow) 2004

AEP - Annual Exceedence Probability

m aodN - metres above ordnance datum Newlyn

cumeecs - cubic metres per second

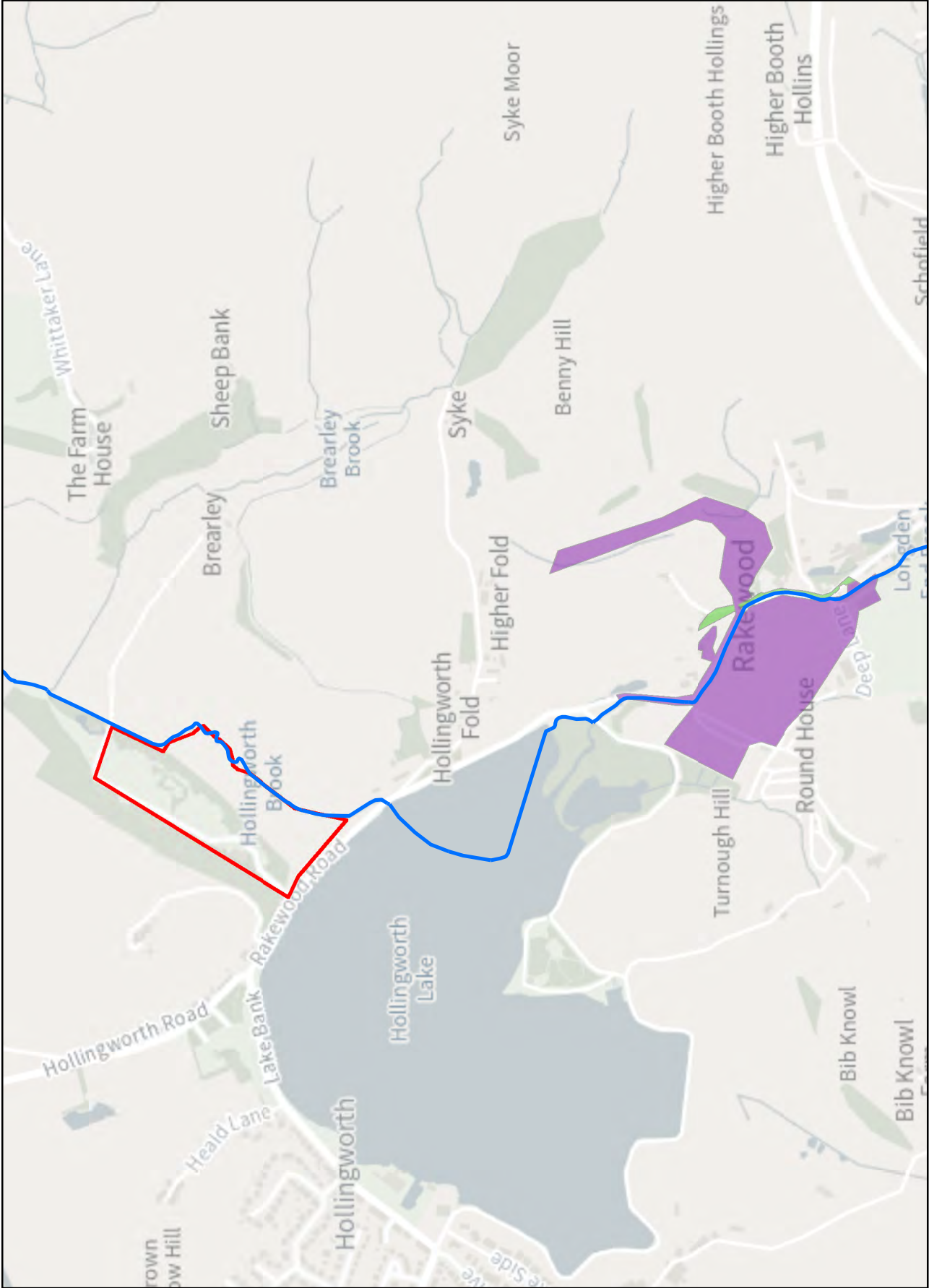
Notes:

Please note: J-Flow is broadscale National Generalised Modelling and as such is not sufficiently accurate for use in Flood Risk Assessments.

Recorded Flood Outlines

Flood Event Code	Name	Start Date	End Date	Source of Flooding	Cause of Flooding
4085998	Rakewood Road	16/03/2019	16/03/2019	unknown	unknown
4087045	LITTLEBOROUGH	28/07/2019	31/07/2019	unknown	unknown

Recorded Flood Outline Map Centred on Rakewood Road, Littleborough, OL15 0AQ.
Created 21/02/2023 [GMMC299154AB]



1:10,001

N

Legend

- Site Location
- Main River

Recorded Flood Outline

START DATE

- 16/03/2019
- 28/07/2019

APPENDIX C: UU CORRESPONDENCE

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Hannah Buchanan

From: Hannah Buchanan
Sent: 22 March 2023 14:30
To: 'wastewaterdeveloperservices@uuplc.co.uk'
Cc: Kirsty Halliday
Subject: RE: Our reference - 03718522

Importance: High

Good afternoon Amanda,

Apologies for the quick follow-up on this one. I have another query that I was wondering if you could assist with please?

Recently, there was a Places for Everyone Joint DPD Examination (February 9th 2023), and as part of this, an individual representing the Greenbelt Group mentioned that the site (shown in the location plan) may be deliberately flooded by United Utilities when the reservoir (Hollingworth Lake) is at capacity. Please could you confirm whether this is or is not the case?

Kind Regards,

Hannah Buchanan BSc (Hons) MSc GradCIWEM
Graduate Flood Risk Analyst

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Consulting Engineers

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hannahbuchanan@betts-associates.co.uk
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From: Hannah Buchanan
Sent: 17 March 2023 10:34
To: wastewaterdeveloperservices@uuplc.co.uk
Subject: RE: Our reference - 03718522

Good morning Amanda,

Thank you for your response this morning. I have consulted with the EA who unfortunately do not hold any modelled data for Hollingworth Brook.

It is my understanding that Hollingworth Lake is maintained by United Utilities. For the avoidance of doubt, please can you confirm whether you have any information regarding specifically Hollingworth Lake and Hollingworth Brook that would be beneficial in the preparation of a Flood Risk Assessment and Drainage Management Strategy?

Kind Regards,

Hannah Buchanan BSc (Hons) MSc GradCIWEM
Graduate Flood Risk Analyst

BETTS HYDRO

Consulting Engineers

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Chester +44 (0)1244 289041

hannahbuchanan@betts-associates.co.uk
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From: wastewaterdeveloperservices@uuplc.co.uk <wastewaterdeveloperservices@uuplc.co.uk>

Sent: 17 March 2023 10:04

To: Hannah Buchanan <hannahbuchanan@betts-associates.co.uk>

Subject: Our reference - 03718522



Good Morning Paula

Thank you for contacting United Utilities with regards to the above site.

Hollingworth Brook and Longden Brook are not United Utilities assets, we only own and maintain the watermains and public sewers in the area. The Environment Agency would be a first point of contact for information regarding watercourses.

With regards to the sewer flooding, I can confirm that we have no current record of sewer flooding within the vicinity of the proposed development.

Please note that United Utilities Water Limited (UW) can only record and check flooding events which are reported to us and we have to comply with our Regulators instructions on the qualification of flooding events to place on the register.

Our response does not include:

- any sewer flooding events caused by blockages or collapses which are the result of third party actions, natural events or other actions over which UW has no control and not a facet of sewer capacity; or
- any historical sewer flooding events that have been removed from the register as a result of investment in our infrastructure.

As with all development sites, we recommend you liaise with our water and wastewater engineers by contacting our Developer Services team so the details of your development proposal can be considered further. Details can be found at the following link.

<https://www.unitedutilities.com/services/builders-developers/>

Should you require any further information please do not hesitate to contact me.

Kind regards

	Amanda Harding Customer Advisor Advanced Developer Services & Metering Customer Services Direct Tel: 01925 233186 Tel: 0345 072 6067 unitedutilities.com
---	--

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----- Original Message -----

From: Hannah Buchanan [hannahbuchanan@betts-associates.co.uk]

Sent: 07/03/2023 08:50

To: wastewaterdeveloperservices@uuplc.co.uk

Subject: Sewer Flood Risk Information Request & Hollingworth Lake Query

EXTERNAL EMAIL This email originated outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

To whom it may concern,

We are looking at a site that is located adjacent to Hollingworth Brook in Littleborough (see location plan attached). It is my understanding that the lake is primary fed by Longden End Brook, which flows in a northerly direction before outfalling into Hollingworth Lake. Does this watercourse then join with Hollingworth Brook, which flows north-east adjacent to our site? If you have any information about the operation of this system that would be useful to include within a Flood Risk Assessment and Drainage Management Strategy, please could this be sent across to us? We just need a bit of clarity on how this system works if at all possible.

Please could you also confirm whether you have any records of sewer flooding impacting on the site?

Kind Regards,

Hannah Buchanan BSc (Hons) MSc GradCIWEM

Graduate Flood Risk Analyst

BETTS HYDRO

Consulting Engineers

Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire, CH5 2LY

Chester +44 (0)1244 289041

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APPENDIX D: LPA/LLFA CORRESPONDENCE

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Hannah Buchanan

From: Hannah Buchanan
Sent: 09 March 2023 09:36
To: strategic.planning@rochdale.gov.uk
Subject: Historic Flood Risk Information Request
Attachments: Location Plan.pdf

To whom it may concern,

Please forward on to the appropriate department if required;

Replacement Car Park, Rakewood Road, Littleborough

Please could you confirm whether you have any information that you feel would be valuable to a Flood Risk Assessment and Drainage Management Strategy for the above site (location plan attached), including details of historical flooding and specific drainage requirements; this would be greatly appreciated. If there are any other specific requirements that you require in a scope of works for this site, please can you advise at this stage so that it can be fully incorporated into the proposals at an early stage.

Just to clarify, we would like data for the whole site, which includes the red and blue line boundaries in the attached location plan. Please do not hesitate to contact me on the details below to discuss further should you require additional information or clarification.

Kind Regards,

Hannah Buchanan *BSc (Hons) MSc GradCIWEM*
Graduate Flood Risk Analyst

BETTS HYDRO

Consulting Engineers

Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire, CH5 2LY
Chester +44 (0) 1244 289041

hannahbuchanan@betts-associates.co.uk
www.betts-associates.co.uk

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APPENDIX E: LOCATION PLAN

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LOCATION PLAN

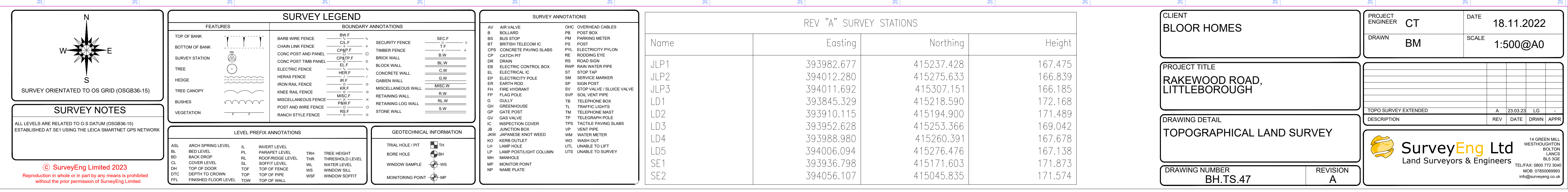
Replacement Car Park, Rakewood Road, Littleborough



OS X (Eastings)	394007
OS Y (Northings)	415274
Nat Grid	SD940152 / SD9400715274
Nearest Post Code	OL15 0AQ
Lat (WGS84)	N53:38:02 (53.63395351523769)
Long (WGS84)	W2:05:32 (-2.0921055526405534)
Lat, Long (WGS84)	53.63395351523769, -2.0921055526405534
Lat (OSGB36)	N53:38:01 (53.63372119782959)
Long (OSGB36)	W2:05:26 (-2.090642037270972)
Lat, Long (OSGB36)	53.63372119782959, -2.090642037270972

APPENDIX F: TOPOGRAPHIC SURVEY

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APPENDIX G: PROPOSED PLANNING LAYOUT

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	H1 - Gravel in cellular grate system		P1 - Native woodland scrub mix refer to 35025-RG-LD-01 sheet 3 for planting maintenance and schedules
	H2 - Self binding gravel path		P2 - Native hedge mix refer to 35025-RG-LD-01 sheet 3 for planting maintenance and schedules
	H3 - Tarmac access road to engineers detail		P3 - Native groundcover mix refer to 35025-RG-LD-01 sheet 3 for planting maintenance and schedules
	S1 - Conveyance swale		P4 - EM1 - Erosogate general purpose meadow mixture refer to 35025-RG-LD-01 sheet 3 for planting maintenance schedules
	E1 - Railway sleeper edge refer to 35025-RG-LD-04 for detail		-Tree existing with root protection zone
	E2 - Timber edge to gravel path refer to 35025-RG-LD-04 for detail		-Tree to be removed
	F1 - Post and rail fence refer to 35025-RG-LD-04 for detail		-Tree proposed, refer to 35025-RG-LD-01 sheet 3 for planting maintenance and schedules
	Clear maintenance zone for brook 9m from top of bank		-Ecological constraint
	Indicative headwall to engineer specification		Section line, refer to 35025-RG-LD-02 for illustrative sections

 **Stantec**
 Stantec UK Limited
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 RG1 3BE
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stantec.co.uk

GENERAL PLANTING SPECIFICATION

Where any deviation from the landscape proposals or specification occurs within a scheme, the contractor shall request the relevant detail or agreement from the designer prior to proceeding.

All planting operations shall be carried out in accordance with: Trees from nursery to independence in the landscape BS 8545, and General landscape operations BS 4428.

- Material Sourcing.** Plant material to conform to the National Plant Specification. All plant stock to originate from within the UK. Plant handling and planting operations to be in accordance with HTA 'Handling and Establishing Landscape Plants', Parts I-III.
- Ground Preparation.** Planting beds and tree pits shall be weed free prior to the commencement of planting operations. Hand weed or apply an approved translocated systemic herbicide to the manufacturers instructions and to 1997 Control of Pesticides Regulations and 2003 COSHH regulations.
- Ground Preparation.** Topsoil to be fertile with maximum 35% clay content and 5% minimum organic content, pH 5.8 - 7.5 and to be free of perennial weeds, weed seeds and contamination. Maximum stone content 20% (20mm+ particle size), maximum size of stones 50mm in any direction. Existing topsoil to be ameliorated and/or screened if necessary to achieve this specification.
- Ground Preparation.** The identification of topsoil and subsoil resources on site will be required to inform the detailed design of tree pits and planting beds, including the depth of topsoil horizons and the requirement for amelioration of the growing medium, prior to planting. All site/ existing topsoil/ subsoils will be subject to detailed testing in accordance with BS 3882 & BS 8601. All storage/ stripping to comply with the British Standard. If modifications to the soil are necessary, soil ameliorants will be used sparingly. Ideally the soil dug from the excavated pit should be used as the backfill medium and as far as practicable, replicate the horizons within the original soil profile.
- Suggested Soil testing:** Tim O'Hare Associates LLP, Howbery Park, Wallingford, Oxfordshire, OX10 8BA, T: +44 (0)1491 822653.
- Ground Preparation.** Imported topsoil to be to BS 3882:2015 Multi Purpose Grade, from an approved source, and to accord with the above specification. Refer to the landscape drawings for specific purpose topsoils.

TREES:

- Planting.** Trees in planting areas to be planted in pits minimum 1200 x 1200-backfilled with topsoil mixed with peat free organic tree planting compost and Sierrablen Flora® slow release fertiliser or equal approved, as required in accordance with manufacturers instructions. Refer to soft planting details for staking / underground guying. Backfilling of tree pits will be carried out in layers, using the backfilling medium specified. As backfilling proceeds the tree pit walls will be broken down to a distance of 500 mm beyond the edge of the rootball in all directions, thoroughly watered to expel air pockets and with due allowance being made for subsequent settlement. The natural thickening between the trunk and the root flare shall be at the finished top surface of the planting medium and shall not be buried by excess soil. The nursery grade should be the finish planting level.
- Ground Preparation.** Trees in grass areas to be surrounded by 1000mm Ø circle of bark mulch, 75mm depth. The root flare and base of the stem should be maintained free from mulch.
- Planting.** All nursery standard trees are to be fitted with irrigation pipe and inlet, sized as appropriate.
- Planting.** No trees are to be planted within 3m of sewers or services (or other easement recommended by the relevant statutory undertaker) without the use of tree root barriers, eg. 'Greenleaf Reroot 600 /100 or equal approved placed between the tree and services. The top edge of the root barrier should finish 10mm above any growing media or be encapsulated into the concrete haunch of the adjacent edgings. Contractor to ascertain the location of all sewers and services prior to tree planting.
- Tree Form.** Trees are to be of uniform size and uniform clear stem. Unless tree is a multi-stem then it should have a clearly defined central leader, with a clear stem height defined in NPS. Trees to be planted in line with recommendations in BS 8545 Trees from nursery to independence in the landscape

PLANTING BEDS:

- Planting.** Planting beds to have a minimum depth of 450mm topsoil over 150mm broken up existing ground with all stones over 50mm removed. If importing soils a minimum of 550mm multipurpose subsoil is required below the topsoil layer.
- Ground Preparation.** Soil conditioner: Sanitized and stabilised compost to BS1 PAS 100. Apply 50mm depth even coverage and incorporate into topsoil during cultivation operations, to a minimum depth of 150mm. Compost to be Compost Association certified, or from an approved supplier conforming to this specification. If no local supplies are available an alternative organic peat free compost may be specified, subject to the Landscape Architect's approval.
- Planting.** Shrubs to be planted in pits 150mm wider and deeper than root spread backfilled with excavated topsoil/compost, mixed with 'Sierrablen Flora® slow release fertiliser or equal approved, quantity in accordance with manufacturer's recommendations.
- Ground Preparation.** All planting beds to be mulched with matured coniferous bark, with an even particle size between 15 - 50mm, to a minimum depth of 75mm over weed free soil after completion of all planting and watering operations. Mulch to be free of pests, diseases, fungus and weeds, and with no fines or dust. Mulch source and sample to be approved.
- Planting.** Native hedge planting to be protected from rabbit damage with Biodegradable Plastic-Free Shrub Spiral Guards and stakes (or equal and approved). Net guards for bushy shrub species or post and wire rabbit proof fence as indicated.

HEDGE PLANTING:

- Setting out.** The hedge line shall be set out using 38 x 38 x 1200 stakes and all herbaceous material within 500mm of the centreline shall be sprayed out using an approved herbicide at least two weeks before planting. A 600mm wide and 300-400mm deep trench shall be dug and the backfill mixed with slow-release fertiliser. (For double staggered rows) Planting shall be set out as per planting plan.
- Planting.** Plants shall be notch or pit planted as appropriate. All hedge plants shall be protected with 600mm proprietary shelters secured with a stake/cane and ties as recommended by the manufacturer. Upon completion hedge trenches are to be mulched with 75mm depth bark mulch.

NATIVE SCRUB TRANSPLANTS:

- Ground Preparation and Setting Out.** The extent of the planting area shall be set out using 38 x 38 x 1200 timber stakes at maximum 10m intervals. All herbaceous material within the proposed planting area shall be sprayed out using an approved herbicide at least two weeks before planting and the ground shall be cultivated to a depth of 150mm (bed preparation).
- Planting.** Proposed native shrub planting is to be planted on an informal 1m grid (up to 1.5m for larger species such as Hazel). To avoid straight lines each planting station can be adjusted by up to 300mm in any direction. All planting stock to be protected from rabbit damage using approved Biodegradable Plastic-Free Tree or Shrub Spiral Guards secured with stakes and ties as advised by the manufacturers. Planting to bund: Plants shall be notch or pit planted as appropriate. Planting to bund to be planted through coir matting/protection layer.

WILDFLOWER MEADOW AND GRASSES:

- Sourcing and preparation.** Wildflower Emorsgate EM 1 sown at 40kg/ha or 4g/m² (or equal approved) in bare/new areas into prepared ground as per the plans.
- Top soil stripping of proposed wildflower grassland areas.** Prior to receipt of excavated soils, topsoil from the areas to receive wildflower seed to be stripped (depth to be confirmed following detailed soil analysis - e.g 20-25cm). Topsoil to be stored in accordance with the earthworks strategy for use elsewhere on site. Tracked machinery will be used with access routes planned and suitably protected to minimize soil compaction.
- Wildflower Meadow soil profile.** Following removal of topsoil, a soil profile will be established to give finished levels (depth to be confirmed following soils analysis). The revised soil profile will utilise subsoil from previous sub-soil stockpiles and low fertility topsoil removed from other areas of the site. The top soil shall be free from stone, rubbish of any kind, roots of perennial weed or any other injurious matter.
- Preparation for seeding.** During any fallow period prior to sowing, the tilth shall be maintained free from weeds. No seed shall be sown until the cultivation and preparatory works have been completed. Areas of existing weeds shall be sprayed out with an approved herbicide no less than 24 hours prior to cultivations to create a stale seed bed (for bare/new areas). Soil cultivation around established trees and hedges should only receive shallow cultivation. Areas to be seeded shall be cultivated to a depth of 100mm, and all weeds, deleterious material and stones exceeding 25mm diameter removed. Areas to be seeded shall have an even surface, be lightly consolidated and raked to a fine tilth to receive the seed. All areas of existing grass to be over seeded with wildflowers shall be heavily scarified to create areas of bare earth prior to seeding with wildflowers only mixes; bare areas to be prepared as per amenity grass.
- Sowing.** Sowing shall be undertaken between April and October within a wet/warm period, dry or cold periods to be avoided. Sowing shall be carried out during calm, weather and not when the ground is frost bound or waterlogged. Seed shall be sown in two equal sowings in transverse directions at the rates as specified. After sowing the contractor shall lightly rake the seed into intimate contact with the soil (if advised by the supplier). Any failures due to neglect and especially seeding out of season shall be the responsibility of the contractor.
- Establishment.** For Spring sown areas, mow the developing meadow throughout the first growing season to weaken / control any annual weeds as the seeded perennials establish. For Autumn sown areas, do not mow until late Summer/Autumn. Removing all arising.

TIMES OF YEAR FOR PLANTING:

- Planting.** Deciduous trees and shrubs: Late October to late March. Conifers and evergreens: September/ October or April/ May. Herbaceous plants (including marginal): September/ October or March/ April. Container grown plants: At any time if ground and weather conditions are favourable. Watering and weed control: Provide as necessary. Dried bulbs, corms and tubers: September/ October. Colchicum (crocus): July/ August. Green bulbs: After flowering in spring. Grass seeding: April to October
- Planting.** Any stock planted outside the recognised planting season to be containerised.
- Planting.** Containerised plant stock will have a fully developed root system within the specified pot size.

MAINTENANCE NOTES:

- Maintenance.** Maintenance operations to be carried out as specified until planting becomes established (year 5 after planting).
- Maintenance.** Trees - inspect soil around newly planted trees should be regularly inspected for soil capping and compaction. Remedial action should be taken as necessary. Check stakes and ties and adjust if necessary in summer and winter. Remove stakes when no longer required, i.e. after 3 years. Prune out damaged branches or deadwood, cutting back so as not to affect branch collar. Progressively raise canopies of new trees to provide clearance for vehicles and pedestrians.
- Maintenance.** Shrubs - Weed control measures to continue until canopy of shrubs is closed. Weeds to be cleared by hand or by application of translocated herbicide, with inspections made regularly through the growing season. Prune back any badly damaged shrubs to sound growth. Cut back plants adjacent to paths and access ways where necessary, retaining a balanced shape. Clear litter and debris from planted areas and cut leggy growth hard back to promote bushy growth.
- Maintenance.** Mulches - replenish to original depth and hand-weed as necessary, at least once annually.
- Maintenance.** Watering - In periods of dry weather apply sufficient water to maintain healthy growth. Allow 10L/m² to planting beds and 20L per tree, twice a week, during the growing season (based on 800mm dia. rootball). Irrigation operations to be carried out for two full growing seasons. In accordance with BS 8545.
- Maintenance.** Refriming - Ensure that all trees and shrubs are firmly bedded in the ground after strong winds, frost heave or other disturbances.
- Maintenance.** Proposed Hedges - Prune hedge annually during winter period to shape and/or promote bushy growth. All hedgerows adjoining the public highway must be of a maximum 0.6m height to ensure compliance with highway safety in Manual for Streets. All hedges in residential areas and properties to be maintained at a 0.6m height to ensure site lines. Apply compost / fertiliser twice yearly (years 1-3). Remove guards / stakes at end of year 5
- Maintenance.** Grass Areas - Remove litter, twigs and debris prior to first cut of each Spring. Mow lawn areas regularly, cutting to a height of 35mm, allowing 16 cuts per season. Wildflower meadows and areas under tree canopies to be cut 4 times to a height of 50mm or greater in the first season, and thereafter 3 times. Second growing season onwards cut in October, March and August after flowering to a height of 50 - 75 mm. Meadow grassland is not cut from spring through to late July/August to give the sown species an opportunity to flower. After flowering in July or August take a 'hay cut': cut back with a scythe, petrol strimmer or tractor mower to c 50mm. Leave the 'hay' to dry and shed seed for 1-7 days then remove from site. All arisings to be removed.
- Maintenance.** Biorentation Areas - Remove litter, weeds and debris. Weeds to be cleared by hand, with inspections made regularly through the growing season. During winter, remove any dead or un-tidy plants, although it is good to leave some dead stems and seed heads for wildlife.
- Protection/Reinstatement** - Regularly inspect all planting and grassed areas, eg. once a month, for any pest damage or vandalism/damage caused by others. Any damaged to be reported to the Employer and rectified in the next available season by replacement planting or reseedling/ turfing, and protective measures if required.

MANAGEMENT NOTES:

- Management.** Existing trees to be retained are to be protected by fencing to BS 5837:2012, erected prior to construction commencing and maintained during building operations.
- Management.** Tree surgery to be carried out by an approved contractor in accordance with BS 3839:2010 and with the prior permission of the Local Authority. Existing trees are to have major deadwood and broken branches removed for safety reasons. Refer to Tree Survey.

GENERAL NOTES:

- Trees and Plants substitution.** Should tree and plants species and size not be available as specified an equal substitute will be agreed with the LPA.

TREES					
Code	Species	Common name	Size	Specification	No.
Qr	<i>Quercus robur</i>	Oak	14-16cm girth	Heavy standard	10
Ag	<i>Alnus glutinosa</i>	Alder	16-18cm girth	Heavy standard	11
Bp	<i>Betula pubescens</i>	Downy Birch	18-20cm girth	Extra heavy standard	18
Sc	<i>Salix caprea</i>	Goat Willow	3 metres high	Multistem	6
Cb	<i>Carpinus betulus</i>	Hornbeam	14-16cm girth	Heavy standard	6
Sa	<i>Sorbus aucuparia</i>	Rowan	14-16cm girth	Heavy standard	12
Tc	<i>Tilia cordata</i>	Lime	14-16cm girth	Heavy standard	11
Cl	<i>Crataegus laevigata</i>	Midland Hawthorn	3 metres high	Multistem	3
Un	<i>Ulmus 'New Horizon'</i>	Elm	14-16cm girth	Heavy standard	7
Total					84

P1 - NATIVE WOODLAND SCRUB MIX			
Tree Species	Common Name	% Mix	Specification
<i>Alnus glutinosa</i>	Alder	5	1+2: Branched: 3 Brks: BR
<i>Betula pendula</i>	Silver Birch	10	1+2: Branched: 3 Brks: BR
<i>Betula pubescens</i>	Downy Birch	10	1+2: Branched: 3 Brks: BR
<i>Carpinus betulus</i>	Hornbeam	5	1+2: Branched: 3 Brks: BR
<i>Fagus sylvatica</i>	Beech	5	1+2: Branched: 3 Brks: BR
<i>Prunus avium</i>	Wild Cherry	10	1+2: Branched: 3 Brks: BR
<i>Quercus robur</i>	Oak	5	1+2: Branched: 3 Brks: BR
Tree species to be allowed to grow to a mature size in line with best woodland management practice. To be planted on an informal 1.5m grid.			
Shrub Species	Common Name	% Mix	Specification
<i>Corylus avellana</i>	Hazel	10	1+2: Branched: 3 Brks: BR
<i>Crataegus monogyna</i>	Midland Hawthorn	10	1+2: Branched: 3 Brks: BR
<i>Euroynmus europaeus</i>	European Spindle	3	1+2: Branched: 3 Brks: BR
<i>Ilex aquifolium</i>	Holly	2	1+2: Branched: 3 Brks: BR
<i>Salix aurita</i>	Eared Willow	3	1+2: Branched: 3 Brks: BR
<i>Salix cinerea</i>	Grey Willow	2	1+2: Branched: 3 Brks: BR
<i>Sambucus nigra</i>	Elder	10	1+2: Branched: 3 Brks: BR
<i>Viburnum lantana</i>	Wayfaring Tree	5	1+2: Branched: 3 Brks: BR
<i>Viburnum opulus</i>	Guelder Rose	5	1+2: Branched: 3 Brks: BR
Shrub species to form a mixed canopy height substorey in line with best woodland management practice. To be planted on an informal 1m grid (up to 1.5m for larger species such as Hazel)			

P2 - NATIVE MIXED SPECIES HEDGE		
% Mix	Species	Common Name
15	<i>Acer campestre</i>	Field maple
20	<i>Corylus avellana</i>	Hazel
20	<i>Crataegus monogyna</i>	Hawthorn
10	<i>Ilex aquifolium</i>	Holly
5	<i>Prunus spinosa</i>	Blackthorn
5	<i>Quercus robur</i>	Oak
10	<i>Rosa canina</i>	Dog Rose
15	<i>Viburnum lantana</i>	Wayfaring Tree
1.8m high Hedge; All planting to be double staggered rows, 500mm between plants and rows in groups of 9 to 12		

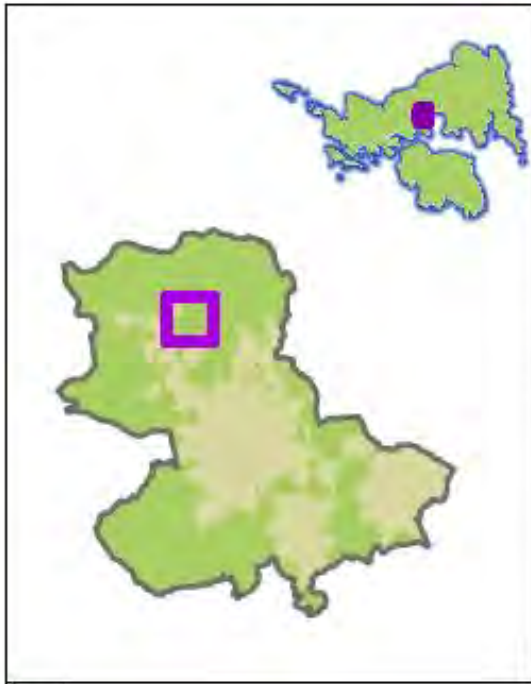
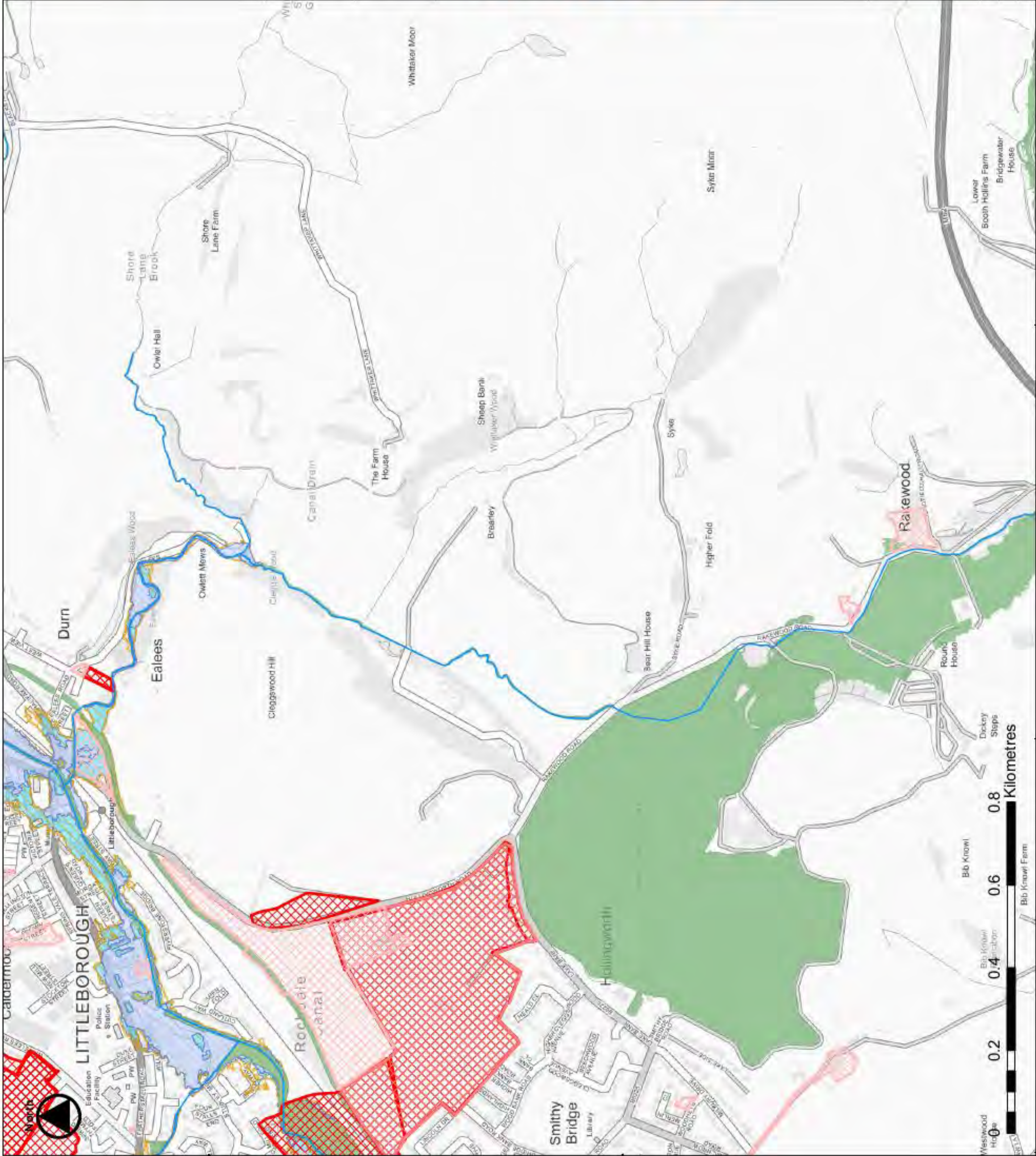
P3 - NATIVE GROUNDCOVER MIX		
% Mix	Species	Common Name
5	<i>Carex pendula</i>	Pendulous Sedge
15	<i>Dryopteris affinis</i>	Scaly Male Fern
25	<i>Iris foetidissima</i>	Stinking Iris
25	<i>Luzula nivea</i>	Snowy Wood Rush
30	<i>Luzula sylvatica</i>	Great Wood Rush
Species to be planted at a density of 5 per m ² in naturalistic drifts of 7.9 or 12 with exception of Carex pendula which should be planted in groups of 1 or 3.		

P4 - EM1 –EMORSGATE GENERAL PURPOSE MEADOW MIXTURE		
EM1 is a mix suitable for a wide range of soil types with a range of robust and showy flowers with a backing of fine, slow growing grasses.		
%	Species	Common name
0.3	<i>Achillea millefolium</i>	Yarrow
1.6	<i>Centaurea nigra</i>	Common Knapweed
1.6	<i>Leucanthum vulgare</i>	Oxeye Daisy
1.6	<i>Malva moschata</i>	Musk Mallow
1.6	<i>Plantago lanceolata</i>	Ribwort Plantain
1.6	<i>Poterium sanguisorba spp sanguisorba</i>	Salad Burnet
0.7	<i>Ranunculus acris</i>	Meadow Buttercup
0.5	<i>Rhinanthus minor</i>	Yellow Rattle
0.5	<i>Daucus carota</i>	Wild Carrot
Grasses		
%	Species	Common name
9	<i>Agrostis capillaris</i>	Common Bent
31.5	<i>Cynosurus cristatus</i>	Crested Dogtail
27	<i>Festuca rubra</i>	Red Fescue
4.5	<i>Phleum bertolonii</i>	Smaller Cat's-tail
18	<i>Poa pratensis</i>	Smooth-stalked Meadow-grass

Notes:
Refer to BLPH1-RWD-BET-ZZ-XX-DR-C-1001- PQ2 for drainage information
Refer to 35025-RG-LD-01 sheets 1 and 2 for general arrangement
Refer to 35025-RG-LD-02 for illustrative sections
Refer to 35025-RG-LD-03 for illustrative masterplan
Refer to 35025-RG-LD-04 for typical details

APPENDIX H: PFRA/SFRA PLANNING EXTRACTS

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LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

For
ROCHDALE BOROUGH COUNCIL

Please select a data type from the dropdown menu below that you wish to view:

Flood Zones

Watercourse

Proposed Development Sites

GMSF 2019 Strategic Locations

2018 GMSF Call for Sites

2019 GMSF Allocations

2018 Baseline Land Supply

Residential

Industry / Warehousing

Offices

Flood Zone 3b

Flood Zone 3a

Climate Change Outline (+70%)

Flood Zone 2

Residential

Industry / Warehousing

Offices

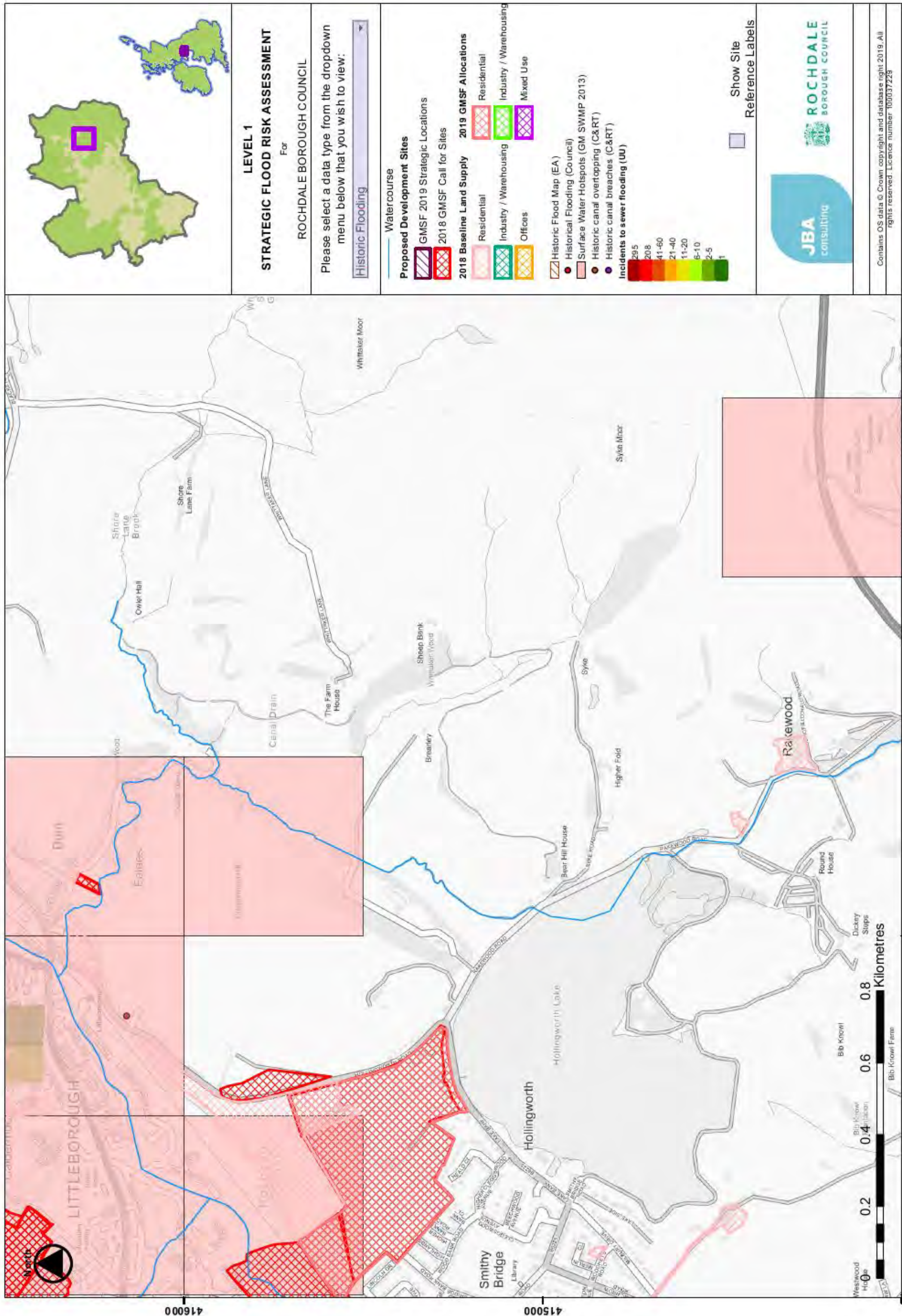
Residential

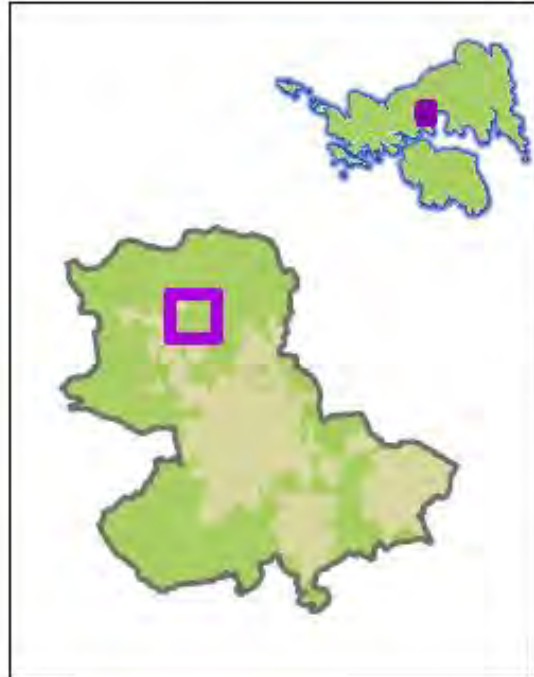
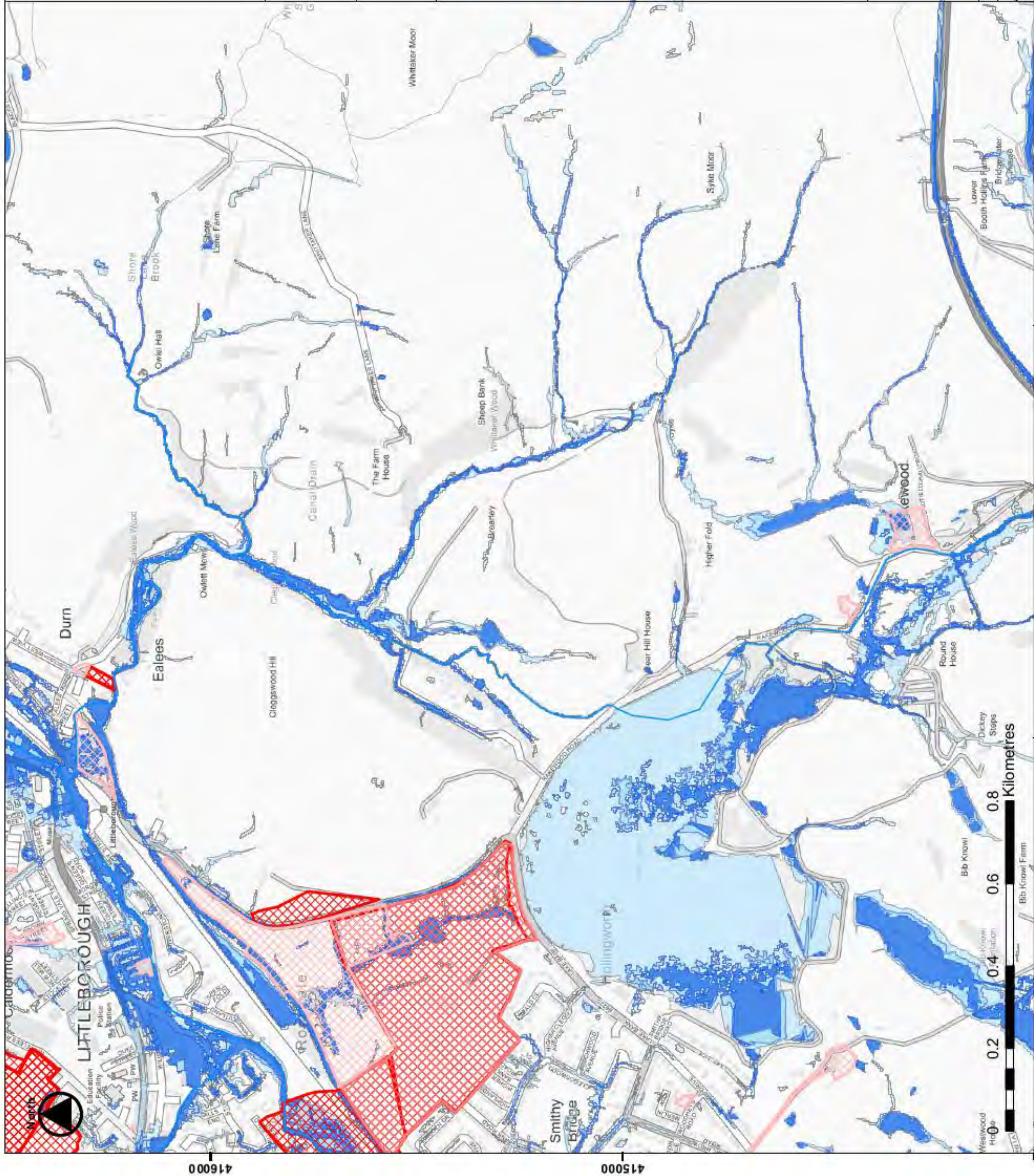
Industry / Warehousing

Mixed Use

Show Site

Reference Labels





LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

For
ROCHDALE BOROUGH COUNCIL

Please select a data type from the dropdown menu below that you wish to view:

Risk of Flooding from Surface Water

Watercourse

Proposed Development Sites

GMSF 2019 Strategic Locations

2018 GMSF Call for Sites

2019 GMSF Allocations

2018 Baseline Land Supply

Residential

Industry / Warehousing

Offices

High Risk

Medium Risk

Low Risk

Residential

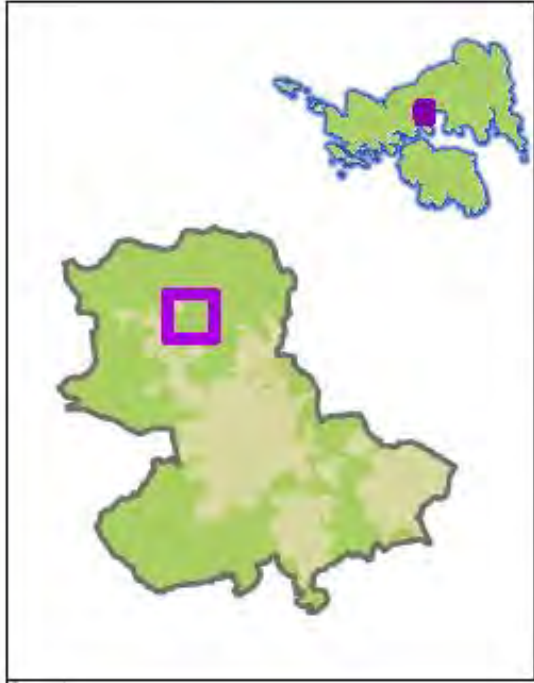
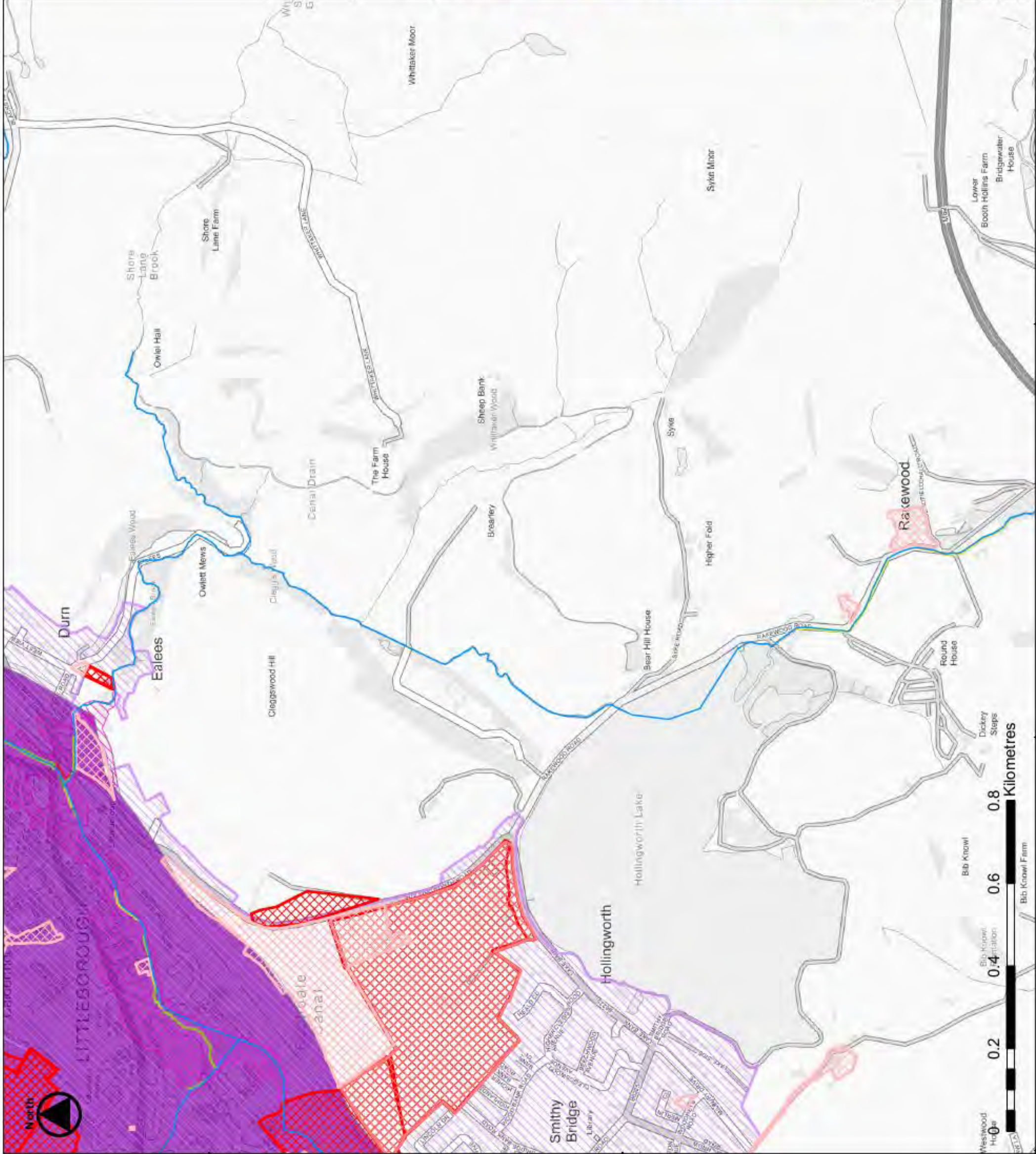
Industry / Warehousing

Offices

Mixed Use

Show Site

Reference Labels



LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

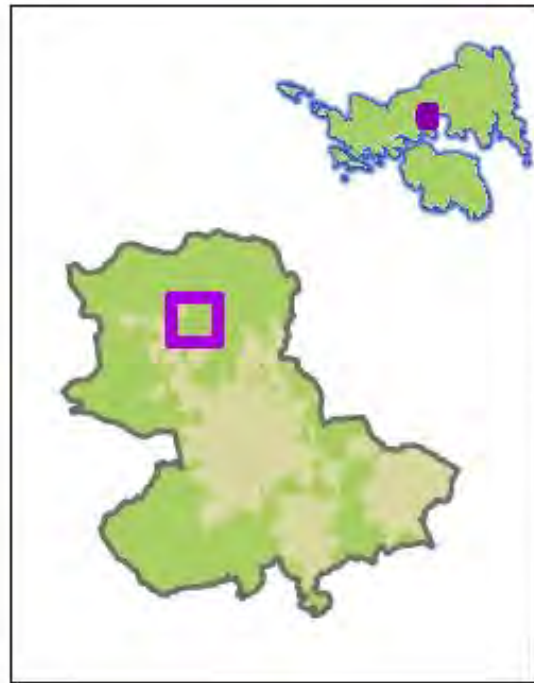
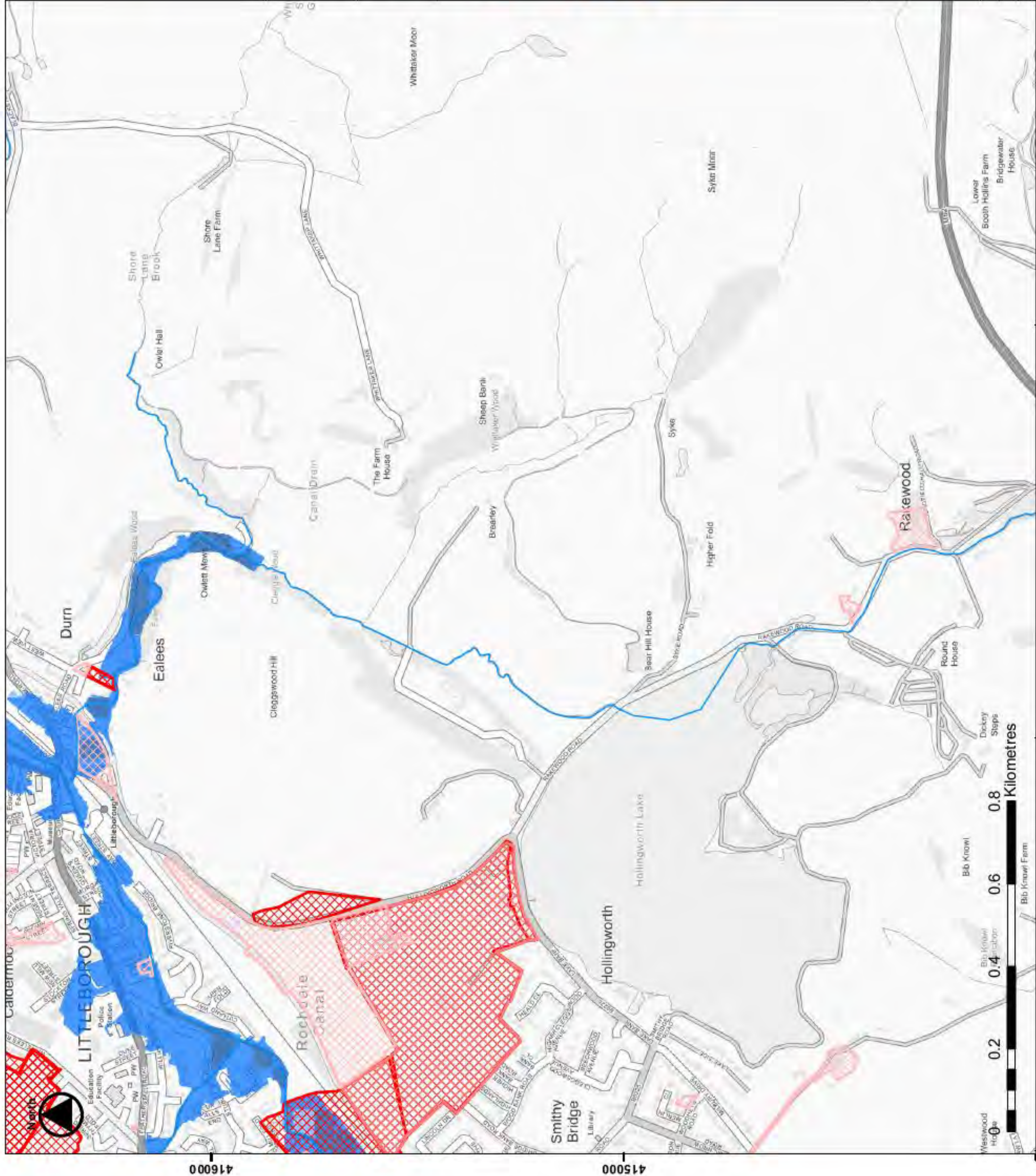
For
ROCHDALE BOROUGH COUNCIL

Please select a data type from the dropdown menu below that you wish to view:

Flood Risk Management

- Proposed Development Sites**
- GMSF 2019 Strategic Locations
 - 2018 GMSF Call for Sites
 - 2019 GMSF Allocations
- 2018 Baseline Land Supply**
- Residential
 - Industry / Warehousing
 - Offices
- 2019 GMSF Allocations**
- Residential
 - Industry / Warehousing
 - Mixed Use

- Flood wall / embankment (EA)**
- Condition**
- 1 / Very Good
 - 2 / Good
 - 3 / Fair
 - 4 / Poor
 - 5 / Very Poor
- Area Benefiting from Flood Defences (EA)**
- Flood Storage Area (EA)
 - Flood Warning Area (EA)
 - Critical Drainage Area
 - Opportunity areas for critical drainage management
- Show Site**
- Reference Labels**



LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

For
ROCHDALE BOROUGH COUNCIL

Please select a data type from the dropdown menu below that you wish to view:

Risk of Flooding from Rivers & Sea

Proposed Development Sites

GMSF 2019 Strategic Locations

2018 GMSF Call for Sites

2019 GMSF Allocations

2018 Baseline Land Supply

Residential

Industry / Warehousing

Offices

Residential

Industry / Warehousing

Offices

Mixed Use

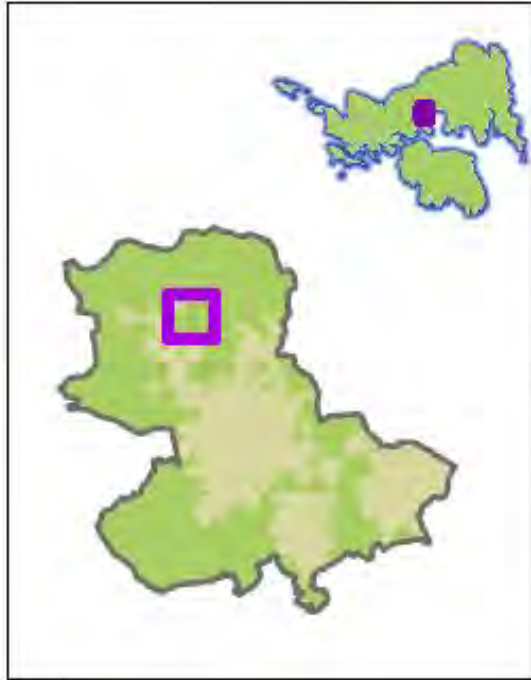
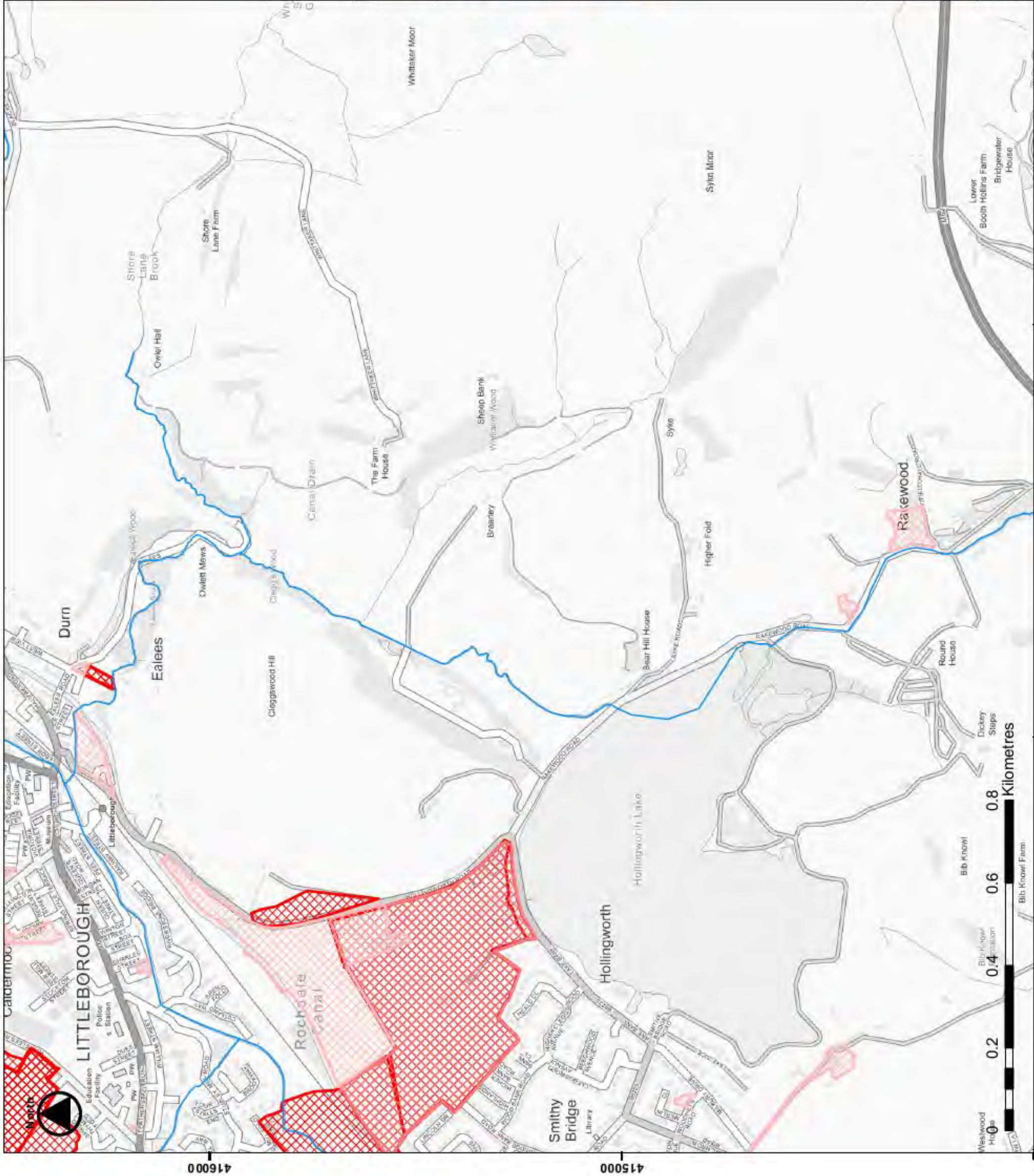
High Risk

Low Risk

Medium Risk

Very Low Risk

Show Site Reference Labels



LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

For
ROCHDALE BOROUGH COUNCIL

Please select a data type from the dropdown menu below that you wish to view:

Reservoir Extent (EA) ▼

Watercourse

Proposed Development Sites

GMSF 2019 Strategic Locations

2018 GMSF Call for Sites

2019 GMSF Allocations

2018 Baseline Land Supply

Residential

Industry / Warehousing

Offices

Mixed Use

Residential

Industry / Warehousing

Offices

Mixed Use

Reservoir Extent (EA)

Show Site
Reference Labels



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APPENDIX I: SURFACE WATER RUN-OFF CALCULATIONS

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Greenfield runoff rate estimation for sites

www.ukstds.com | Greenfield runoff tool

Calculated by:

Site name:

Site location:

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:

Longitude:

Reference:

Date:

Runoff estimation approach

Site characteristics

Total site area (ha):

Methodology

Q_{MED} estimation method:

BFI and SPR method:

HOST class:

BFI / BFIHOST:

Q_{MED} (l/s):

Q_{BAR} / Q_{MED} factor:

Hydrological characteristics

	Default	Edited
SAAR (mm):	1281	1214
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

Default Edited

Q_{BAR} (l/s):		7.04
1 in 1 year (l/s):		6.12
1 in 30 years (l/s):		11.96
1 in 100 year (l/s):		14.63
1 in 200 years (l/s):		16.67

SURFACE WATER RUN-OFF CALCULATION SHEET



Development	Land off Rakewood Road, Littleborough
Project No.	HYD822

Revision	C	Completed by	HB
Date	18/12/2023	Checked by	KH

Areas			
Total Site	3.348	ha	
Development Area ¹	0.598	ha	
Existing Impermeable		ha	
Existing Impermeable ²		ha	
Existing Pervious	3.348	ha	
Existing Pervious ²	0.000	ha	
Proposed total impermeable	0.502	ha	84%

Catchment Characteristics			
SAAR	1214	mm	
SPR	0.47		
BFI	0.598		
i_1	18.5	mm/hr	d_1 24.3 mm
i_{30}	35.0	mm/hr	d_{30} 53.9 mm
i_{100}	45.1	mm/hr	d_{100} 66.9 mm

Run-off Rates			
<i>Pre-development</i>			
Impermeable -----	1yr	0.0	l/s
	30yr	0.0	l/s
	100yr	0.0	l/s
	50mm/hr ³	0.0	l/s
Pervious ⁴ -----	1yr	3.7	l/s
	30yr	7.1	l/s
	100yr	8.7	l/s
	QBar ⁵	4.2	l/s
Total -----	1yr	3.7	l/s
	30yr	7.1	l/s
	100yr	8.7	l/s
<i>Post-development (without control)</i>			
Impermeable ⁶ -----	1yr	25.8	l/s
	30yr	48.8	l/s
	100yr+30%CC	81.9	l/s

Volumes			
<i>Pre-development</i>			
Impermeable -----	1yr	0.0	cu.m
	30yr	0.0	cu.m
	100yr	0.0	cu.m
Pervious ⁴ -----	1yr	79.0	cu.m
	30yr	158.4	cu.m
	100yr	212.6	cu.m
Total -----	1yr	79.0	cu.m
	30yr	158.4	cu.m
	100yr	212.6	cu.m
<i>Post-development</i>			
Impermeable ⁶ -----	1yr	122.2	cu.m
	30yr	270.8	cu.m
	100yr	335.8	cu.m

Stormwater Storage Estimates				
<i>Restricted Rate of 5.0l/s.</i>				
Microdrainage Quick Storage Estimates (using FEH catchment data)				
Return Period	Rate	lower	upper	mean
1yr	5.0 l/s	44	101	72.5 cu.m
30yr	5.0 l/s	130	235	182.5 cu.m
100yr+30%CC	5.0 l/s	276	486	381 cu.m

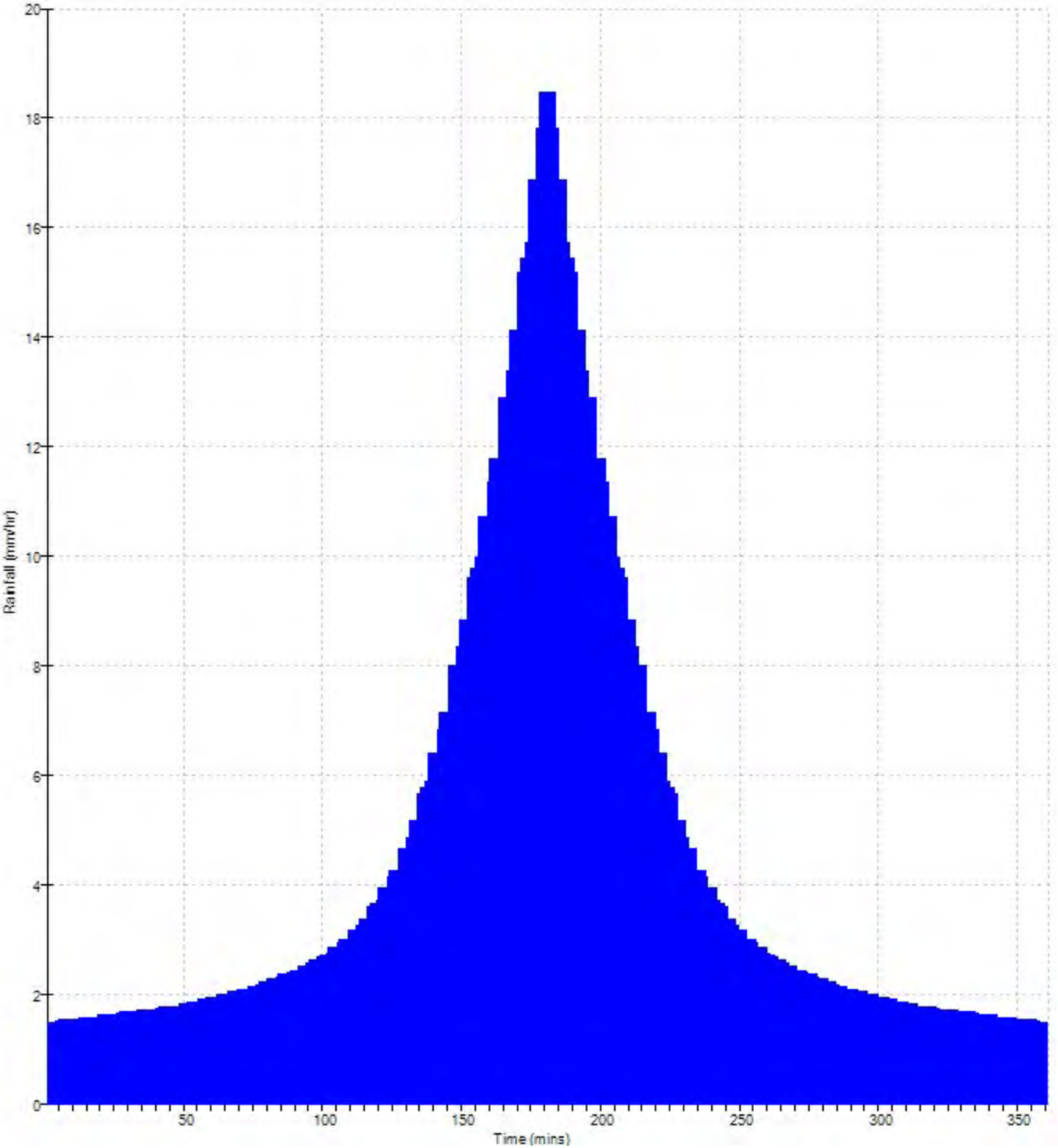
1/ The 'development area' removes areas of POS and/or landscaped areas of the wider site that are to remain as existing.
 2/ On occasion the existing impermeable area cannot be evidenced to connect and a reduction is applied.
 3/ 50mm/hr is used for BRegs calculations and often used by Water Companies when considering allowable post-development rates of discharge. (Rational Method)
 4/ The Greenfield rates and of run-off have been calculated using the UK SUDS Calculator
 5/ QBar is the estimated flood flow for the 2.33yr return period event and is often used as a post-development rate restriction.
 6/ Post-development run-off is only considered from the impermeable area when the proposed post-development impermeable area >50% in accordance with the EA Guidance Preliminary rainfall runoff management for developments (WS-074/ATRI/1 rev E (2012)).

NB. The catchment characteristics are from the FEH catchment, the UK SUDS Calculator and Microdrainage.
 NB. The rainfall intensities and depths are calculated for the 6hr duration rainfall event (peak summer intensity)

Rainfall profile

Storm duration (mins) 360

FEH Data	
FEH Rainfall Version	2013
Site Location	GB 394114 415252 SD 94114 15252
Data Type	Point
Peak Intensity (mm/hr)	18.483
Ave. Intensity (mm/hr)	4.715
Return Period (years)	2.0

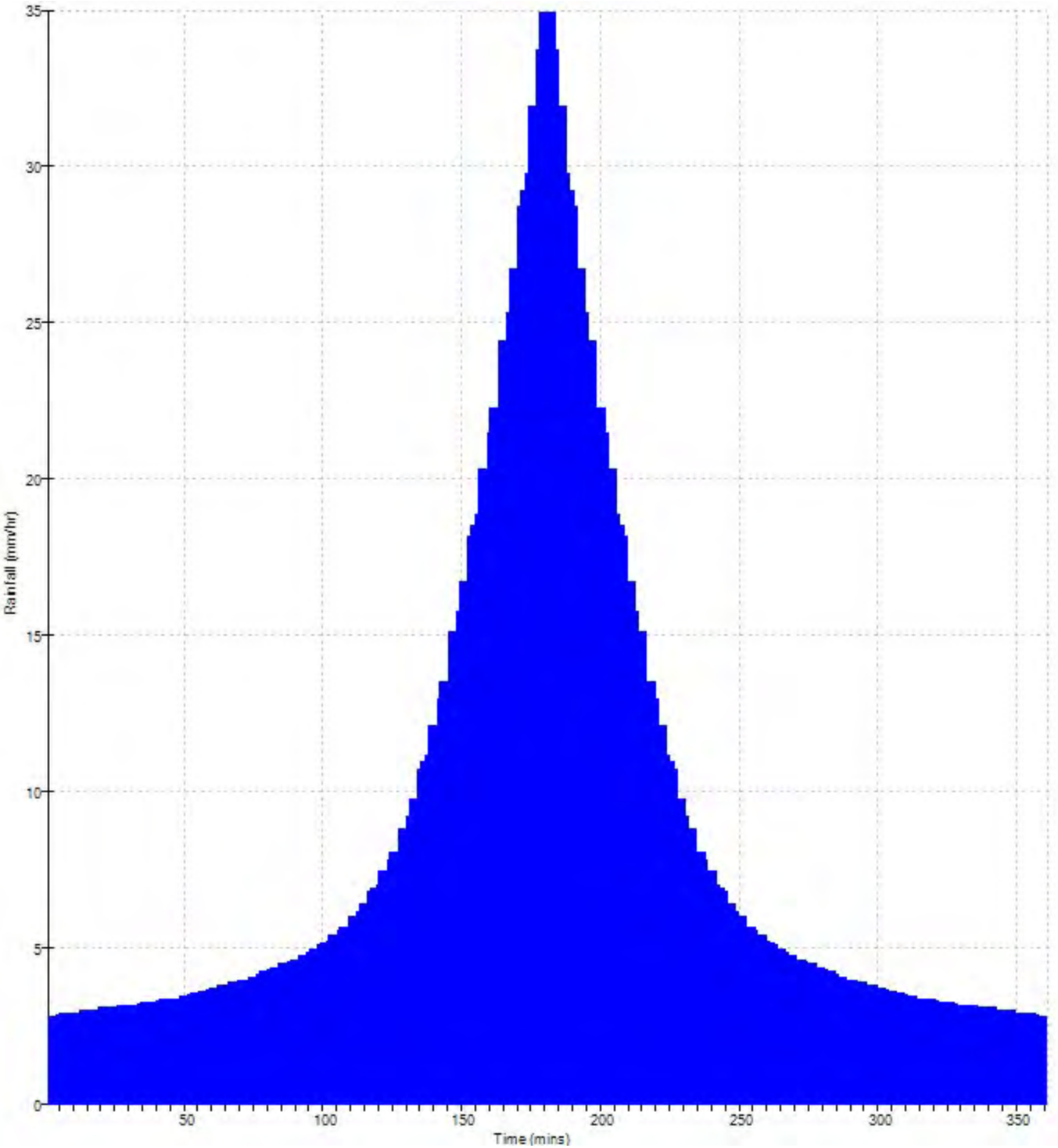


Betts Associates Ltd		Page 1
Old Marsh Farm Barns Welsh Road Sealand Flintshire CH5 2LY	Rakewood Road Littleborough	
Date 17/03/2023	Designed by HB	
File	Checked by KH	
Micro Drainage	Network 2020.1.3	

Rainfall profile

Storm duration (mins) 360

FEH Data	
FEH Rainfall Version	2013
Site Location	GB 394114 415252 SD 94114 15252
Data Type	Point
Peak Intensity (mm/hr)	34.962
Ave. Intensity (mm/hr)	8.919
Return Period (years)	30.0



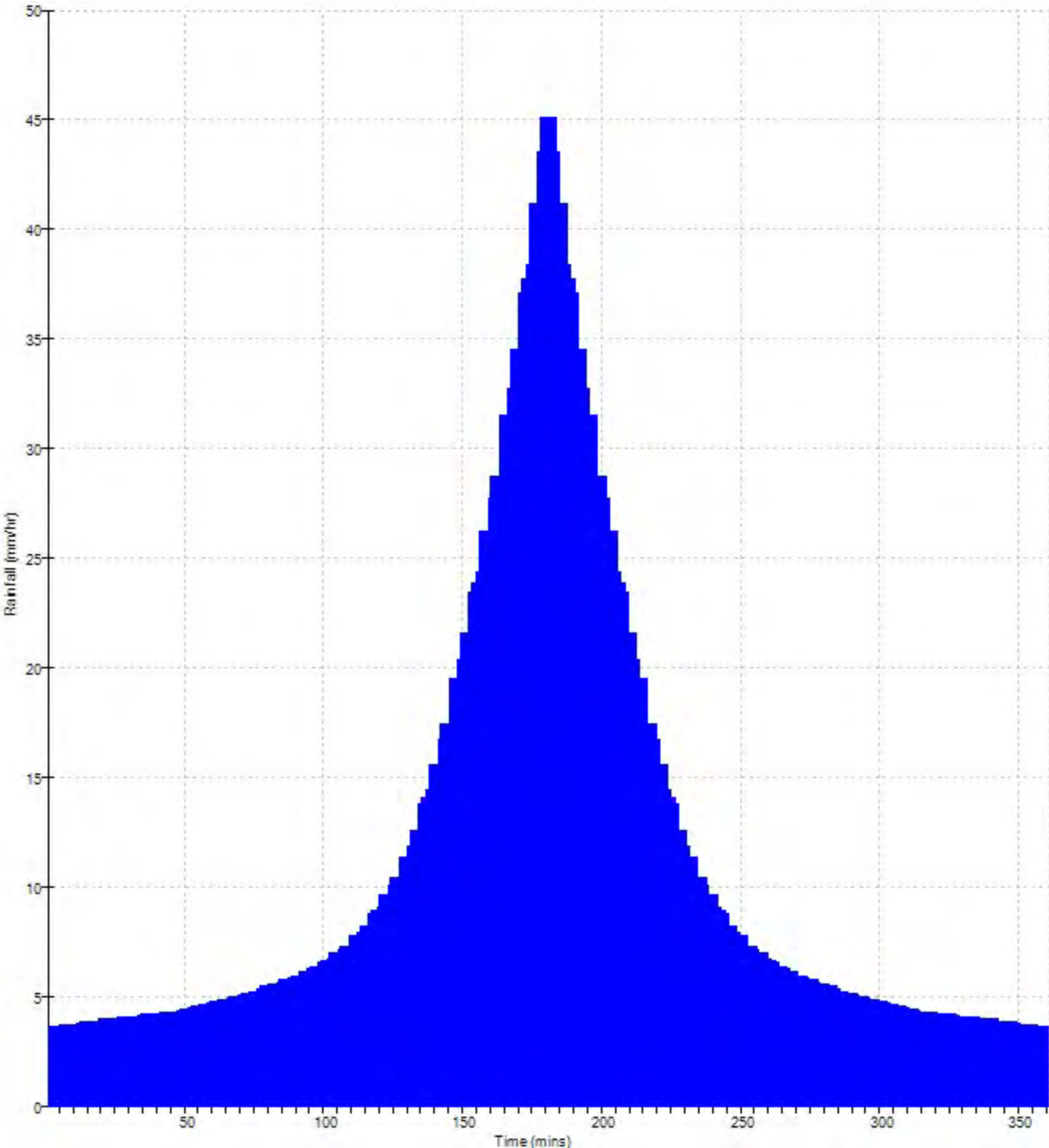
Betts Associates Ltd		Page 1
Old Marsh Farm Barns Welsh Road Sealand Flintshire CH5 2LY	Rakewood Road Littleborough	
	Designed by HB Checked by KH	
Date 17/03/2023	File	
Micro Drainage		Network 2020.1.3

Rainfall profile

Storm duration (mins) 360

FEH Data

FEH Rainfall Version	2013
Site Location	GB 394114 415252 SD 94114 15252
Data Type	Point
Peak Intensity (mm/hr)	45.134
Ave. Intensity (mm/hr)	11.514
Return Period (years)	100.0



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Old Marsh Farm Barns Welsh Road Sealand Flintshire CH5 2LY	Rakewood Road Littleborough	
Date 05/12/2023	Designed by HB	
File	Checked by KH	
Micro Drainage		Source Control 2020.1.3

Greenfield Runoff Volume

FEH Data

Return Period (years)	2
Storm Duration (mins)	360
FEH Rainfall Version	2013
Site Location	GB 394114 415252 SD 94114 15252
Data Type	Point
Areal Reduction Factor	1.00
Area (ha)	0.598
SAAR (mm)	1214
CWI	123.844
SPR Host	47.000
URBEXT (1990)	0.0000

Results

Percentage Runoff (%)	46.71
Greenfield Runoff Volume (m³)	79.022

Greenfield Runoff Volume

FEH Data

Return Period (years)	30
Storm Duration (mins)	360
FEH Rainfall Version	2013
Site Location	GB 394114 415252 SD 94114 15252
Data Type	Point
Areal Reduction Factor	1.00
Area (ha)	0.598
SAAR (mm)	1214
CWI	123.844
SPR Host	47.000
URBEXT (1990)	0.0000

Results

Percentage Runoff (%)	49.50
Greenfield Runoff Volume (m³)	158.391

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Old Marsh Farm Barns Welsh Road Sealand Flintshire CH5 2LY	Rakewood Road Littleborough	
Date 05/12/2023	Designed by HB	
File	Checked by KH	
Micro Drainage		Source Control 2020.1.3

Greenfield Runoff Volume

FEH Data

Return Period (years)	100
Storm Duration (mins)	360
FEH Rainfall Version	2013
Site Location	GB 394114 415252 SD 94114 15252
Data Type	Point
Areal Reduction Factor	1.00
Area (ha)	0.598
SAAR (mm)	1214
CWI	123.844
SPR Host	47.000
URBEXT (1990)	0.0000

Results

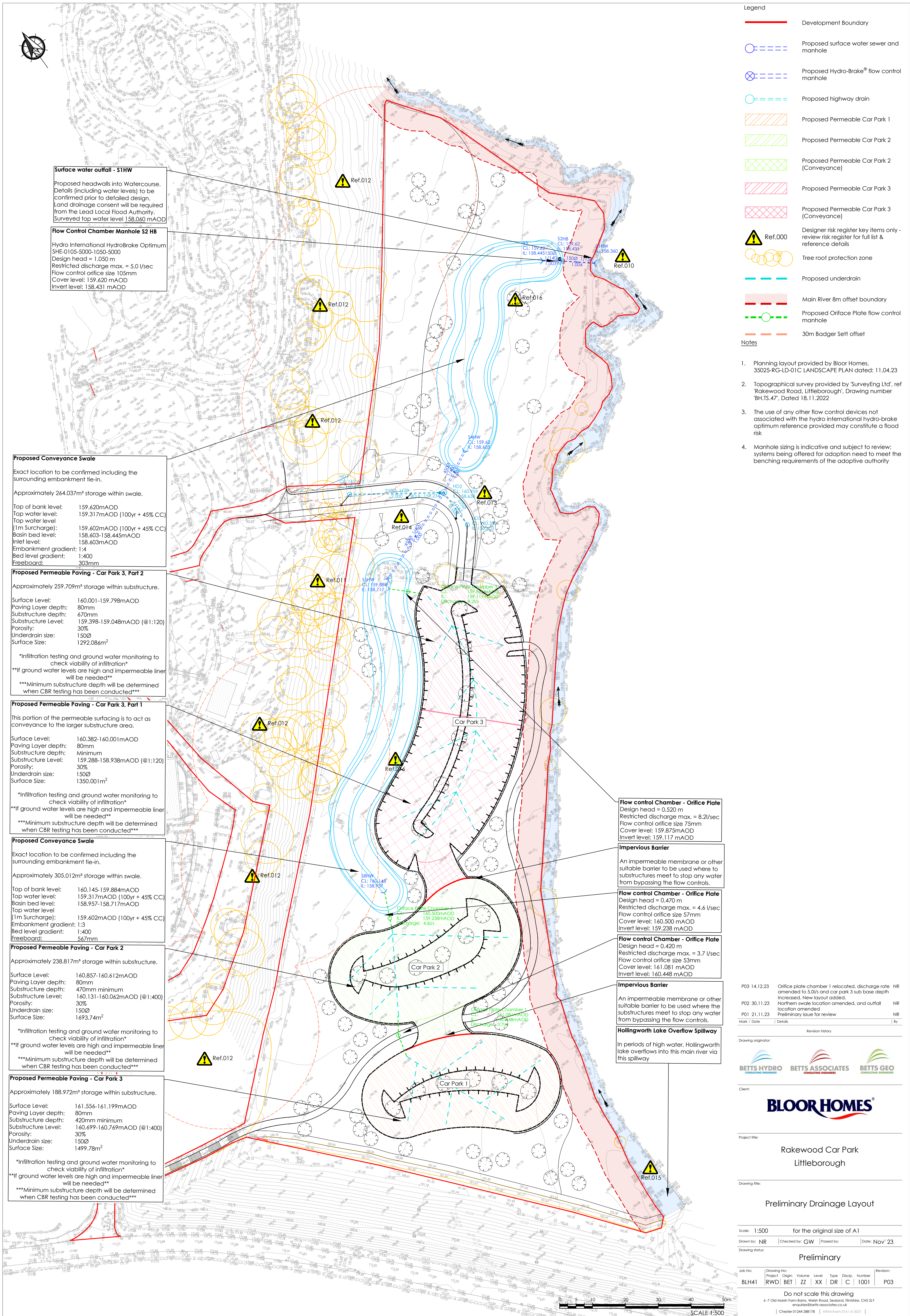
Percentage Runoff (%)	51.47
Greenfield Runoff Volume (m³)	212.643

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APPENDIX J: DRAINAGE PLANS

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APPENDIX K: STORMWATER STORAGE ESTIMATES

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QUICK STORAGE ESTIMATES

RAKEWOOD ROAD, LITTLEBOROUGH

1 YEAR RETURN PERIOD STORM EVENT

Micro Drainage		Variables		
Variables Results Design Overview 2D Overview 3D Vt	FEH Rainfall	Cv (Summer)	0.750	
	Return Period (years)	2	Cv (Winter)	0.840
	Version	2013	Point	...
	Site	GB 394114 415252 SD 94114 15252	Impervious Area (ha)	0.502
			Maximum Allowable Discharge (l/s)	5.0
			Infiltration Coefficient (m/hr)	0.00000
			Safety Factor	2.0
		Climate Change (%)	0	

Micro Drainage		Results
Variables		Global Variables require approximate storage of between 44 m ³ and 101 m ³ .
		These values are estimates only and should not be used for design purposes.

30 YEAR RETURN PERIOD STORM EVENT

Micro Drainage		Variables		
Variables Results Design Overview 2D Overview 3D Vt	FEH Rainfall	Cv (Summer)	0.750	
	Return Period (years)	30	Cv (Winter)	0.840
	Version	2013	Point	...
	Site	GB 394114 415252 SD 94114 15252	Impervious Area (ha)	0.502
			Maximum Allowable Discharge (l/s)	5.0
			Infiltration Coefficient (m/hr)	0.00000
			Safety Factor	2.0
		Climate Change (%)	0	

Micro Drainage		Results
Variables		Global Variables require approximate storage of between 130 m ³ and 235 m ³ .
		These values are estimates only and should not be used for design purposes.

100 YEAR RETURN PERIOD STORM EVENT + 30% CLIMATE CHANGE

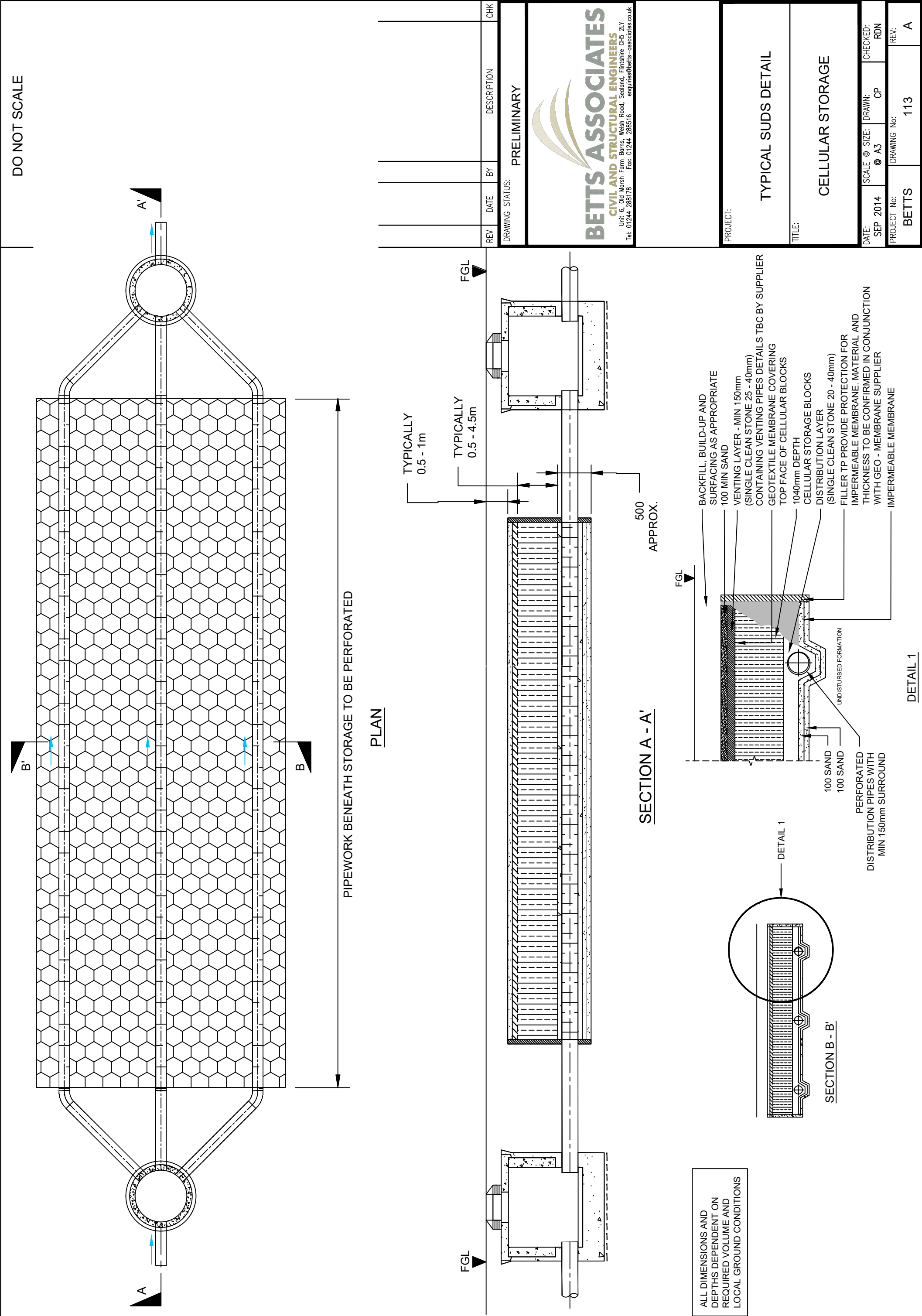
Micro Drainage		Variables		
Variables	FEH Rainfall	Cv (Summer)	0.750	
	Return Period (years)	100	Cv (Winter)	0.840
	Version	2013	Point	
	Site	GB 394114 415252 SD 94114 15252	Impervious Area (ha)	0.502
			Maximum Allowable Discharge (l/s)	5.0
			Infiltration Coefficient (m/hr)	0.00000
Results		Safety Factor	2.0	
Design		Climate Change (%)	30	
Overview 2D				
Overview 3D				
Vt				

Micro Drainage		Results
Variables		Global Variables require approximate storage of between 276 m ³ and 486 m ³ .
		These values are estimates only and should not be used for design purposes.

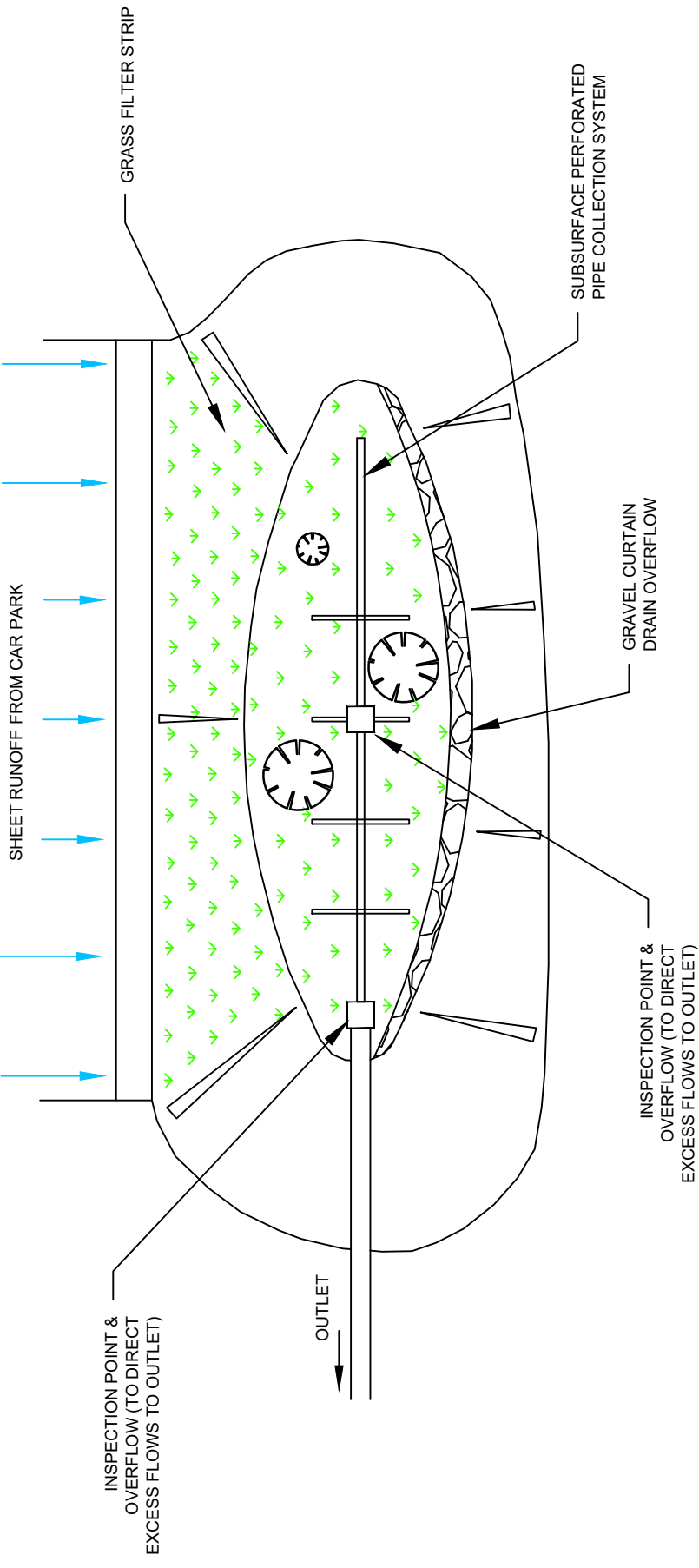
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APPENDIX L: TYPICAL SUDS DETAILS

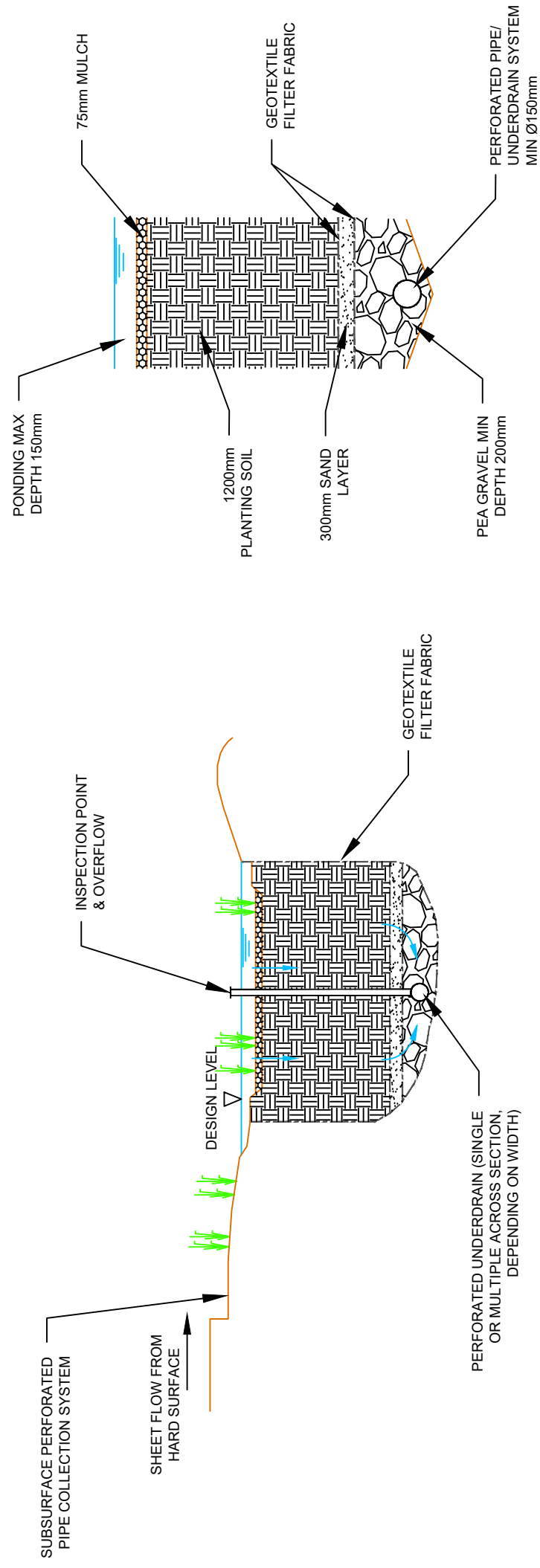
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PLAN VIEW



PROFILE

TYPICAL SECTION

PROJECT:

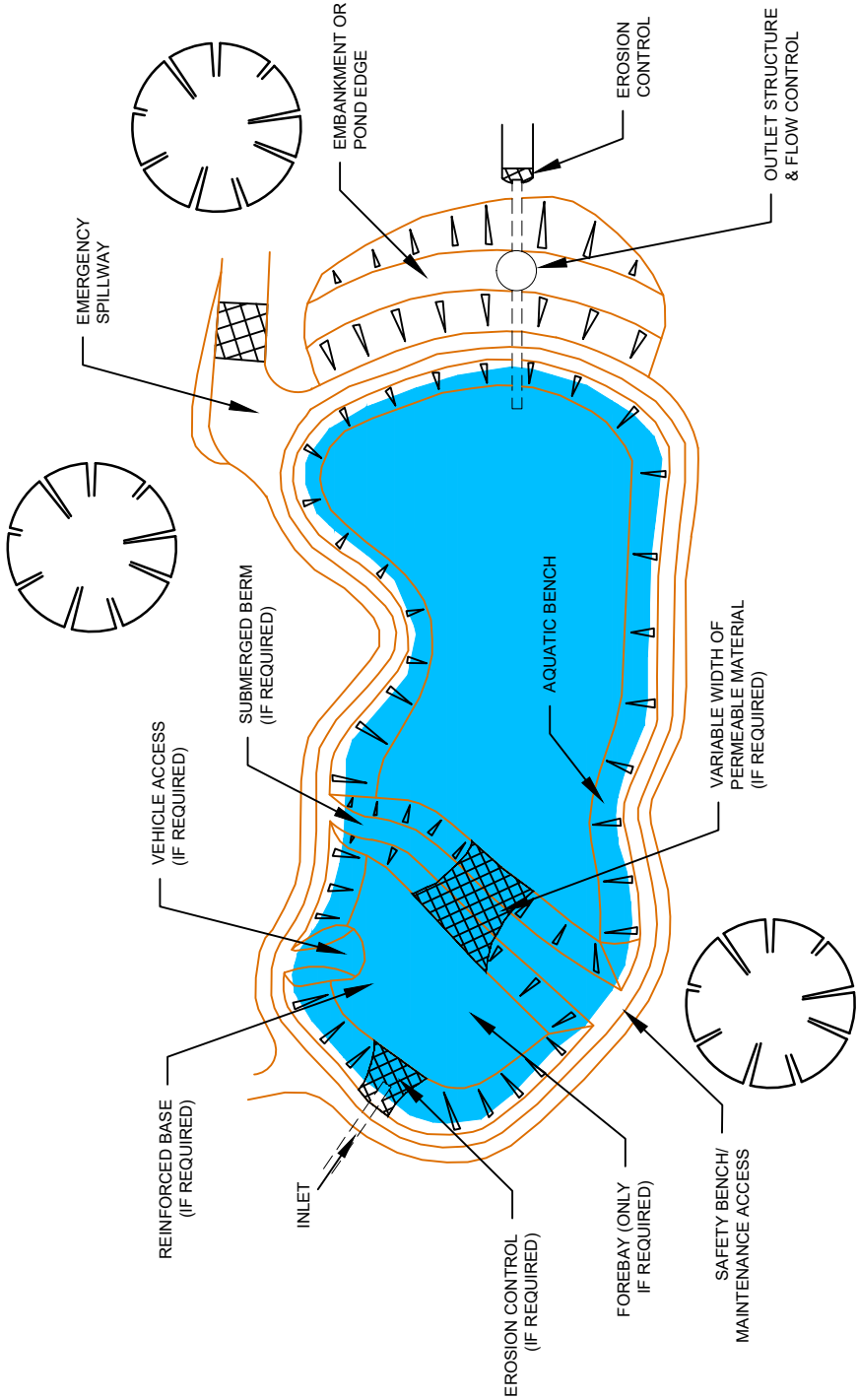
TYPICAL SUDS DETAIL

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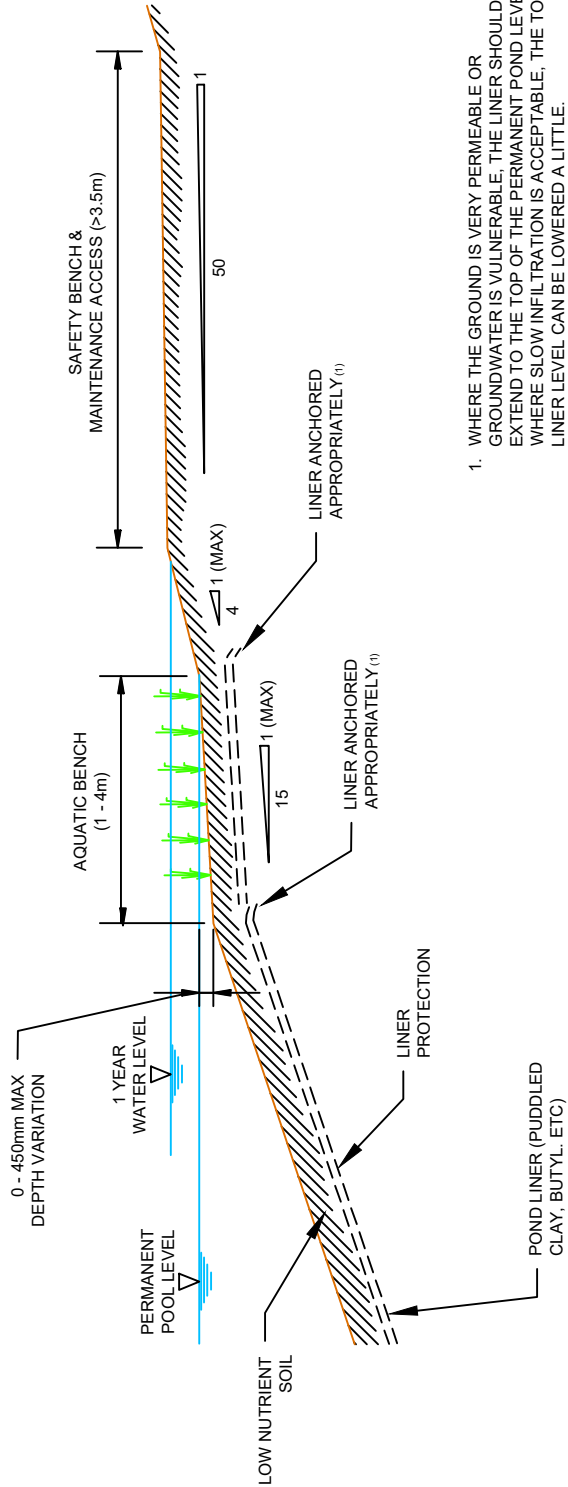
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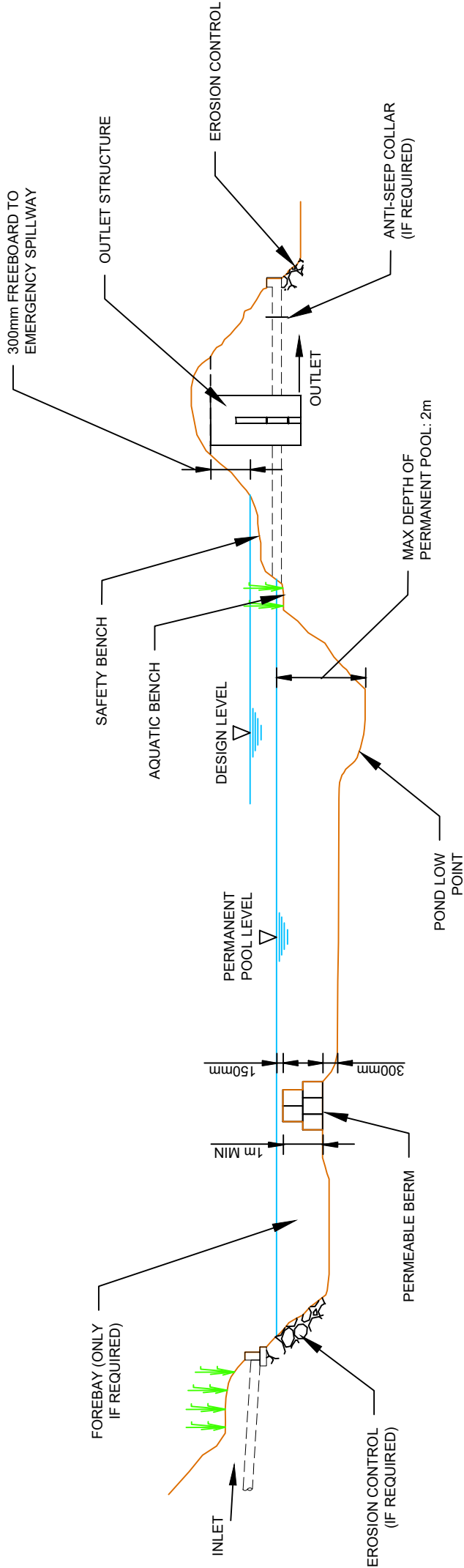
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PLAN VIEW



TYPICAL POND EDGE GEOMETRY



PROFILE

REV	DATE	BY	DESCRIPTION	CHK
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DRAWING STATUS: PRELIMINARY



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Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

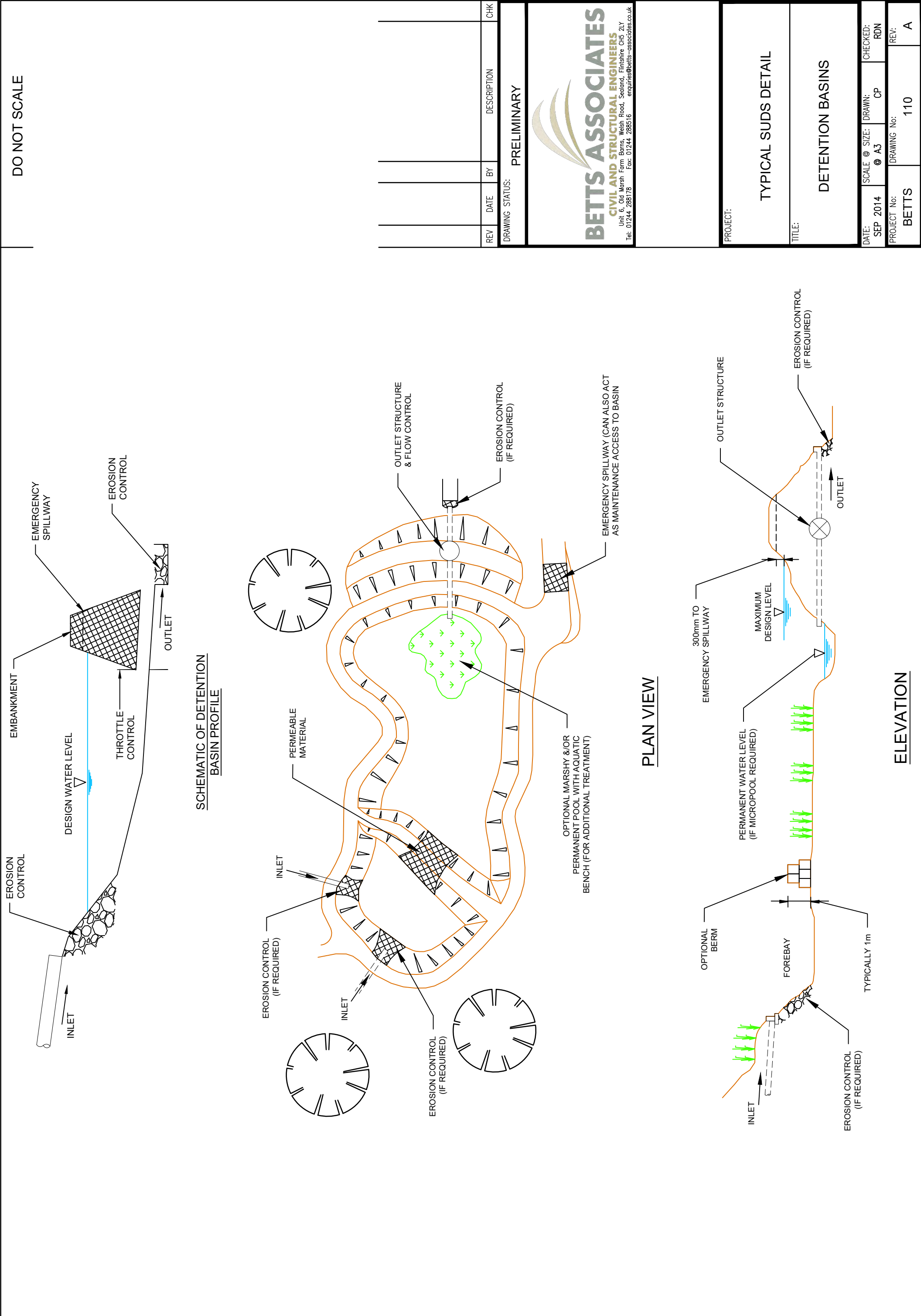
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TYPICAL SUDS DETAIL

TITLE:

WET PONDS

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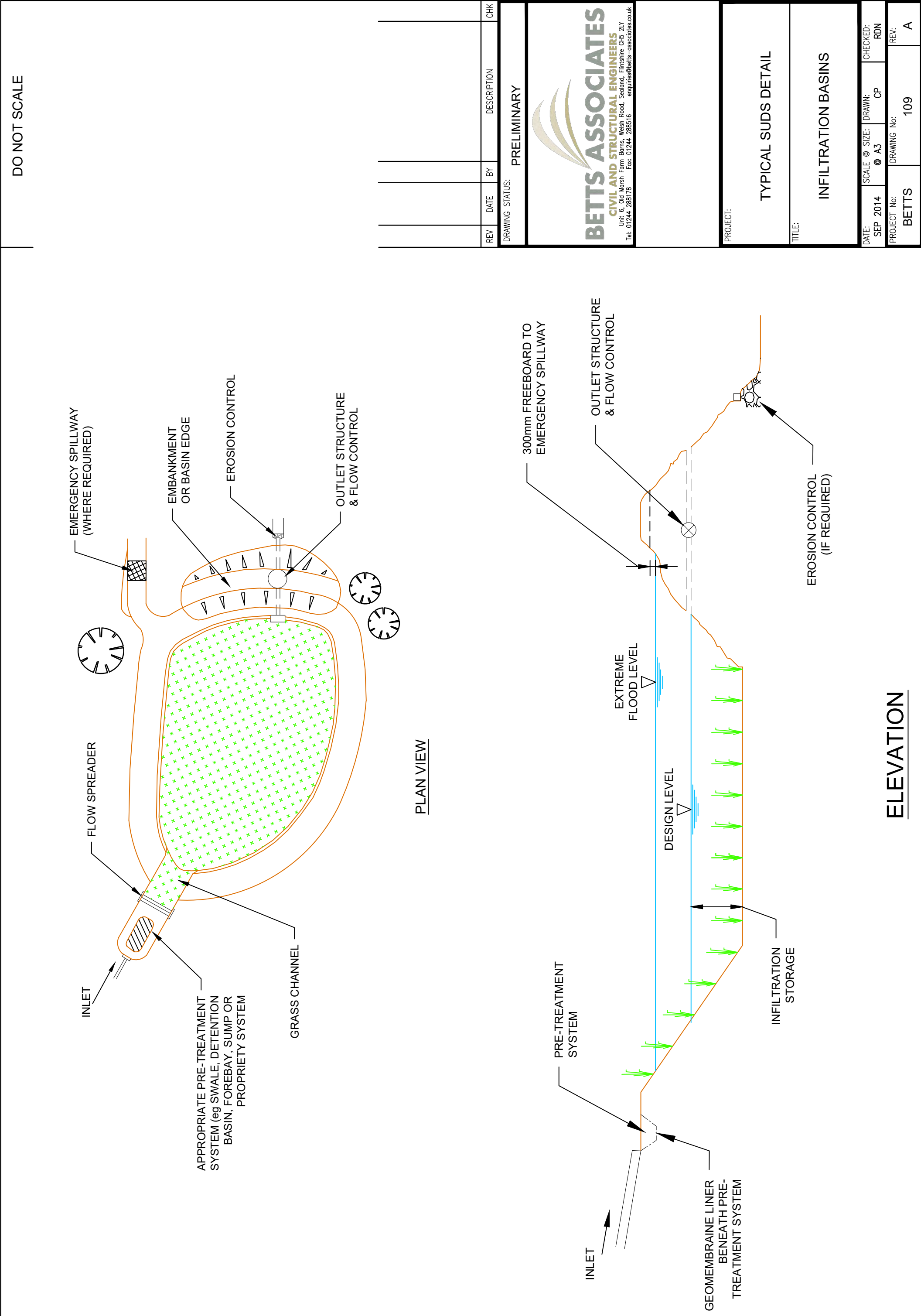
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PROJECT:				
TYPICAL SUDS DETAIL				
DETENTION BASINS				
TITLE:				
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PROJECT No: BETTS		DRAWING No: 110		REV: A



REV	DATE	BY	DESCRIPTION	CHK

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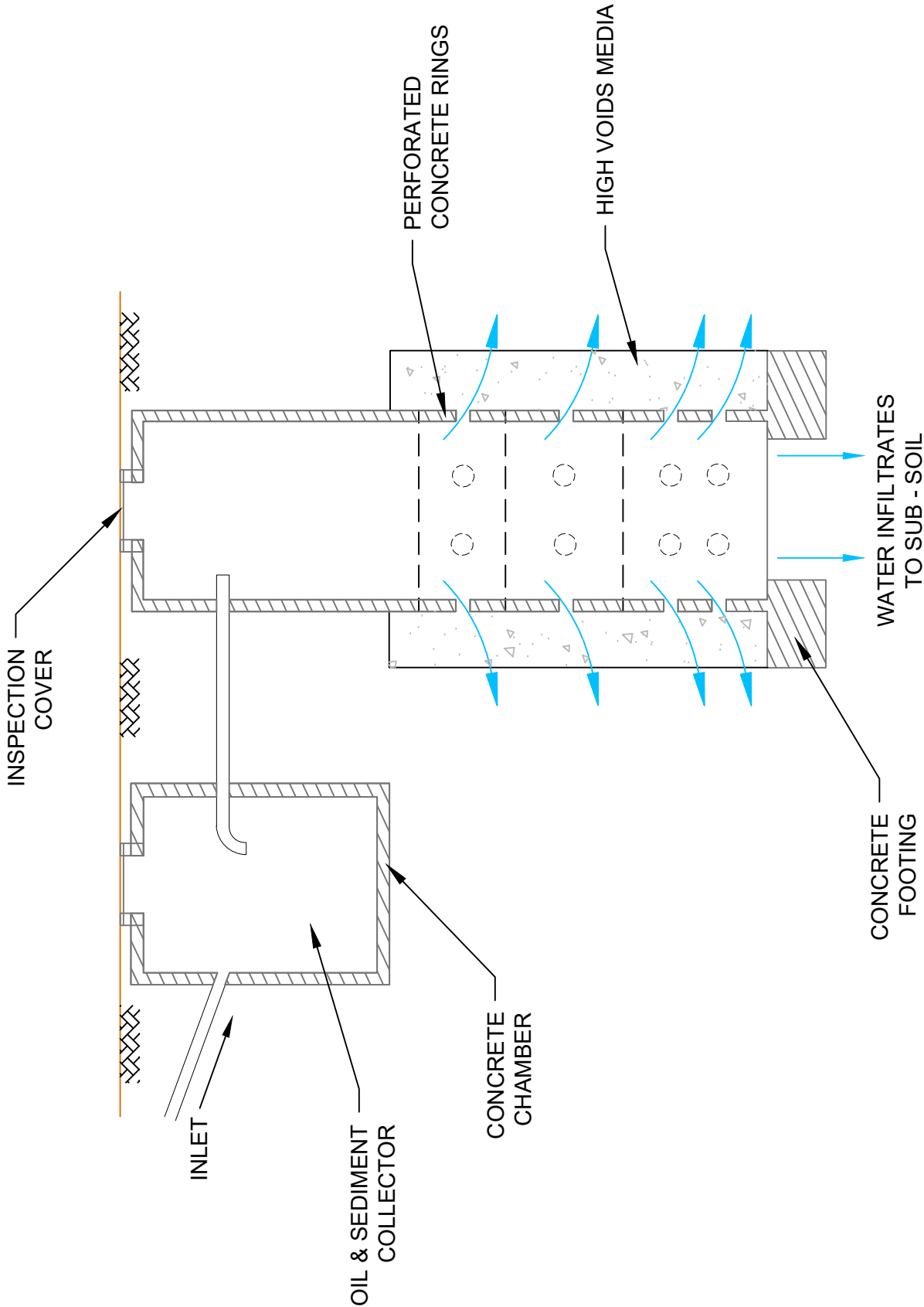
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TYPICAL SUDS DETAIL

INFILTRATION BASINS

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PROJECT No: BETTS		DRAWING No: 109	
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DO NOT SCALE



SOAKAWAY DETAILS
(INCLUDING PRE-TREATMENT DEVICE)

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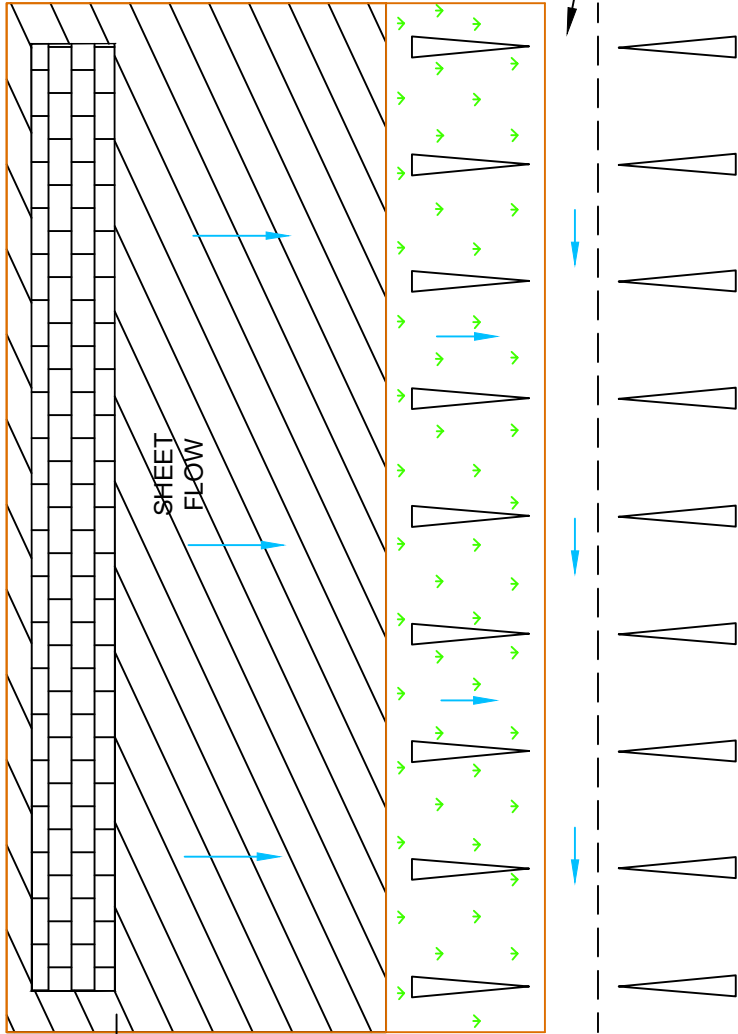
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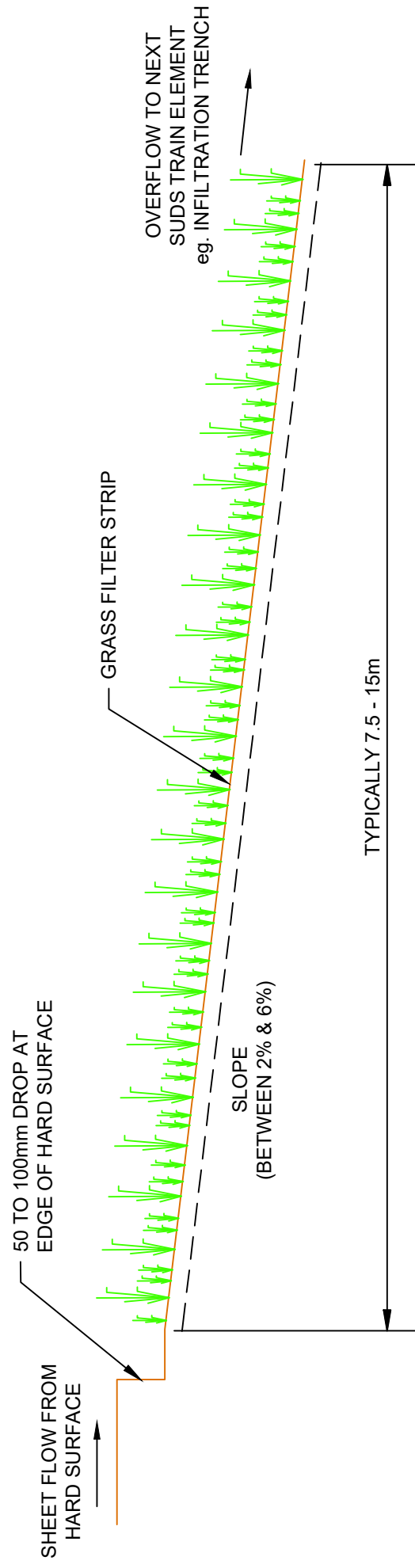
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Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

PROJECT:				TYPICAL SUDS DETAIL			
TITLE:				SOAKAWAYS			
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SEP 2014	@	A3		CP	RDN		
PROJECT No:		DRAWING No:		REV:		A	
BETTS		108					

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PLAN

ELEVATION

REV	DATE	BY	DESCRIPTION	CHK

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PRELIMINARY



PROJECT:

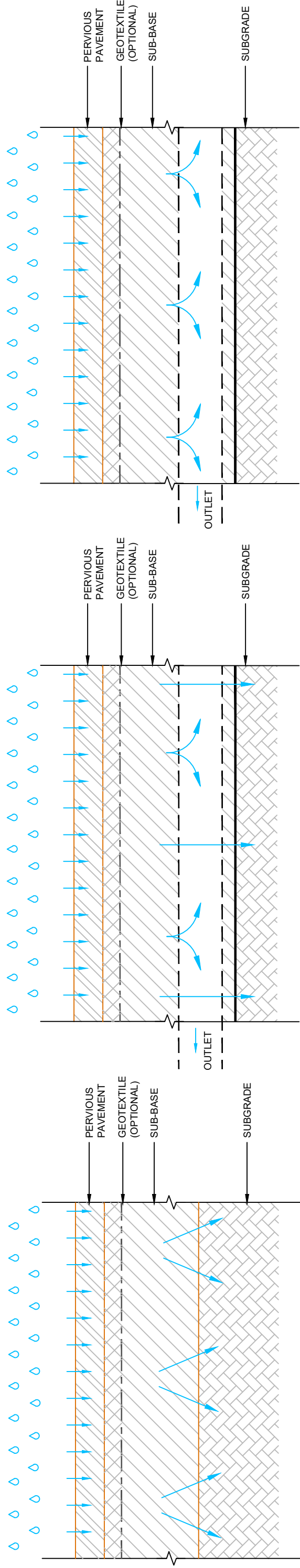
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TITLE:

FILTER STRIPS

DATE: SEP 2014	SCALE @ SIZE: @ A3	DRAWN: CP	CHECKED: RDN
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TYPE A: TOTAL INFILTRATION

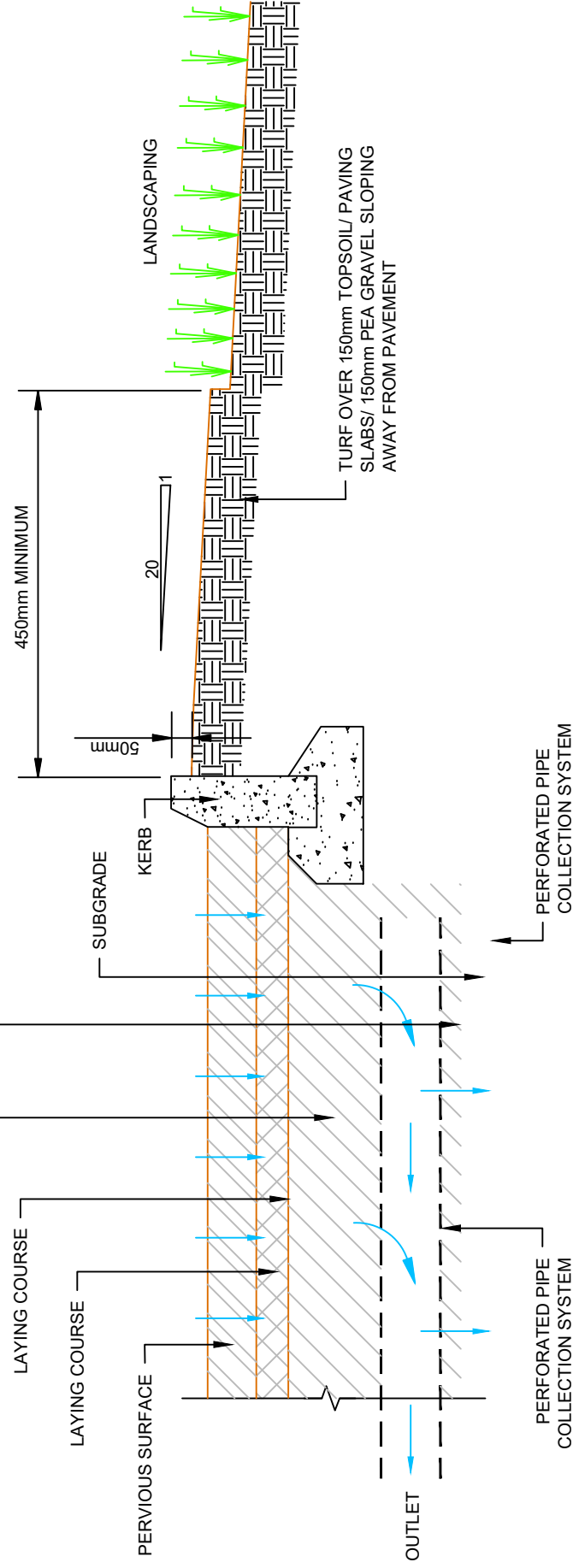
TYPE B: PARTIAL INFILTRATION

TYPE C: NO INFILTRATION

[illegible]

AGGREGATE SUB-BASE (MAY BE REPLACED WITH GEOCELLULAR BLOCKS)

— GEOTEXTILE (OPTIONAL - TYPES A & B) OR GEOMEMBRANE (TYPE C)



LANDSCAPING DETAIL

PRELIMINARY



PROJECT:

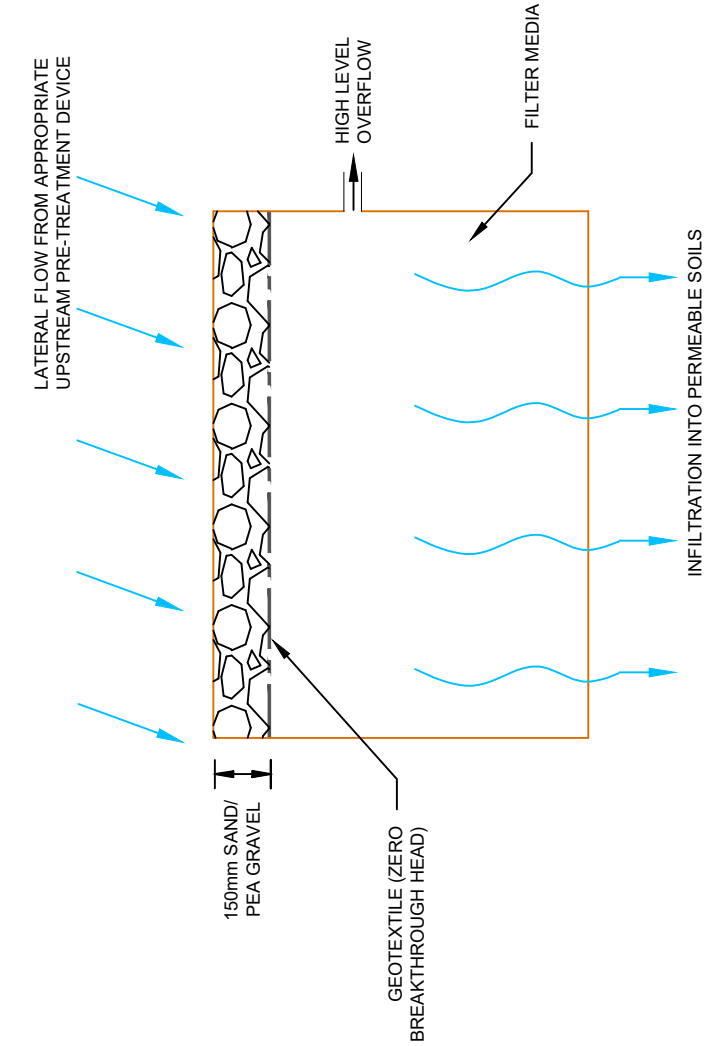
TYPICAL SUDS DETAIL

TITLE:	
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PERVIOUS PAVEMENTS

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DO NOT SCALE



REV	DATE	BY	DESCRIPTION	CHK

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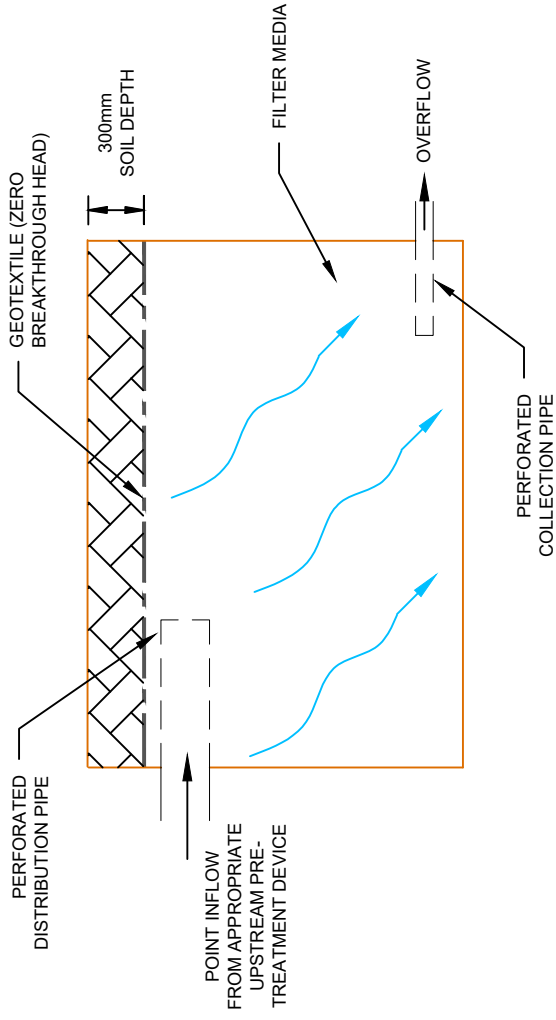
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TITLE:

TRENCHES

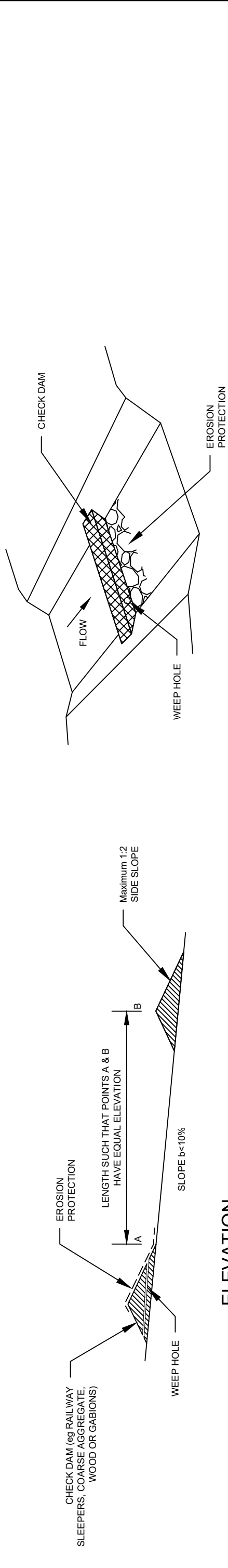
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PROJECT No: BETTS	DRAWING No: 105	REV: A
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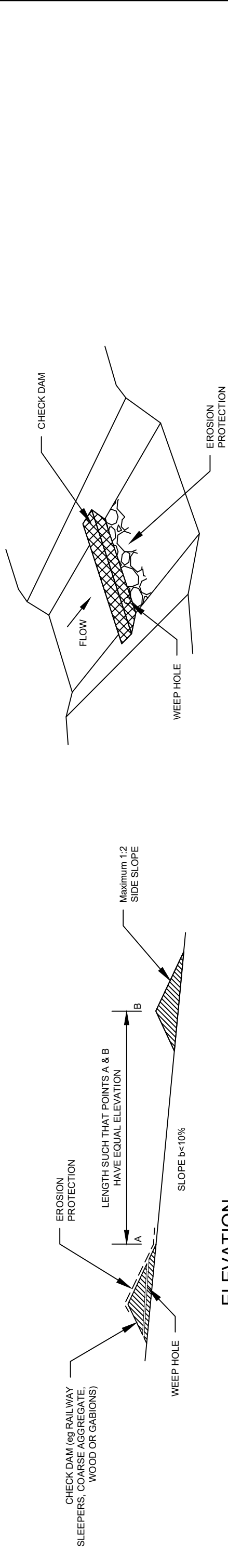


FILTER TRENCH SCHEMATICS

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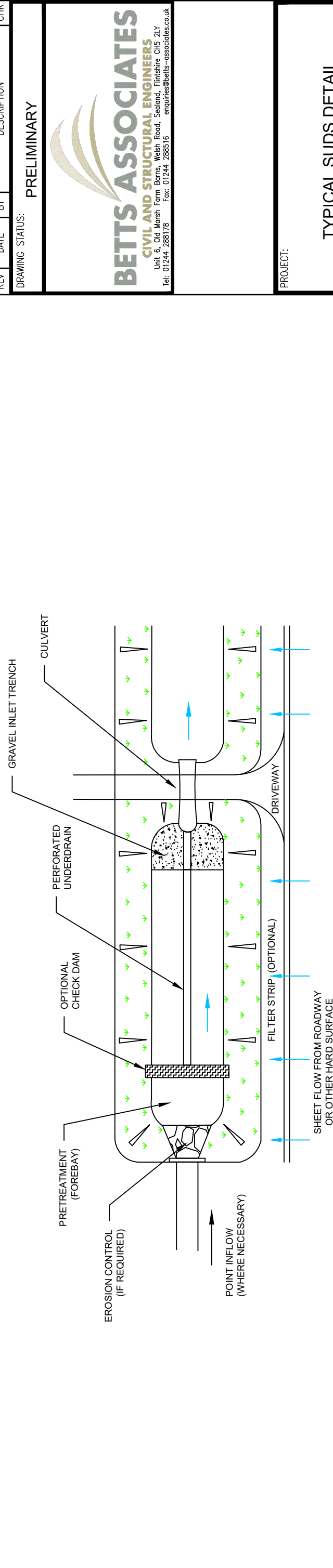


SCHEMATIC



ELEVATION

CHECK DAM



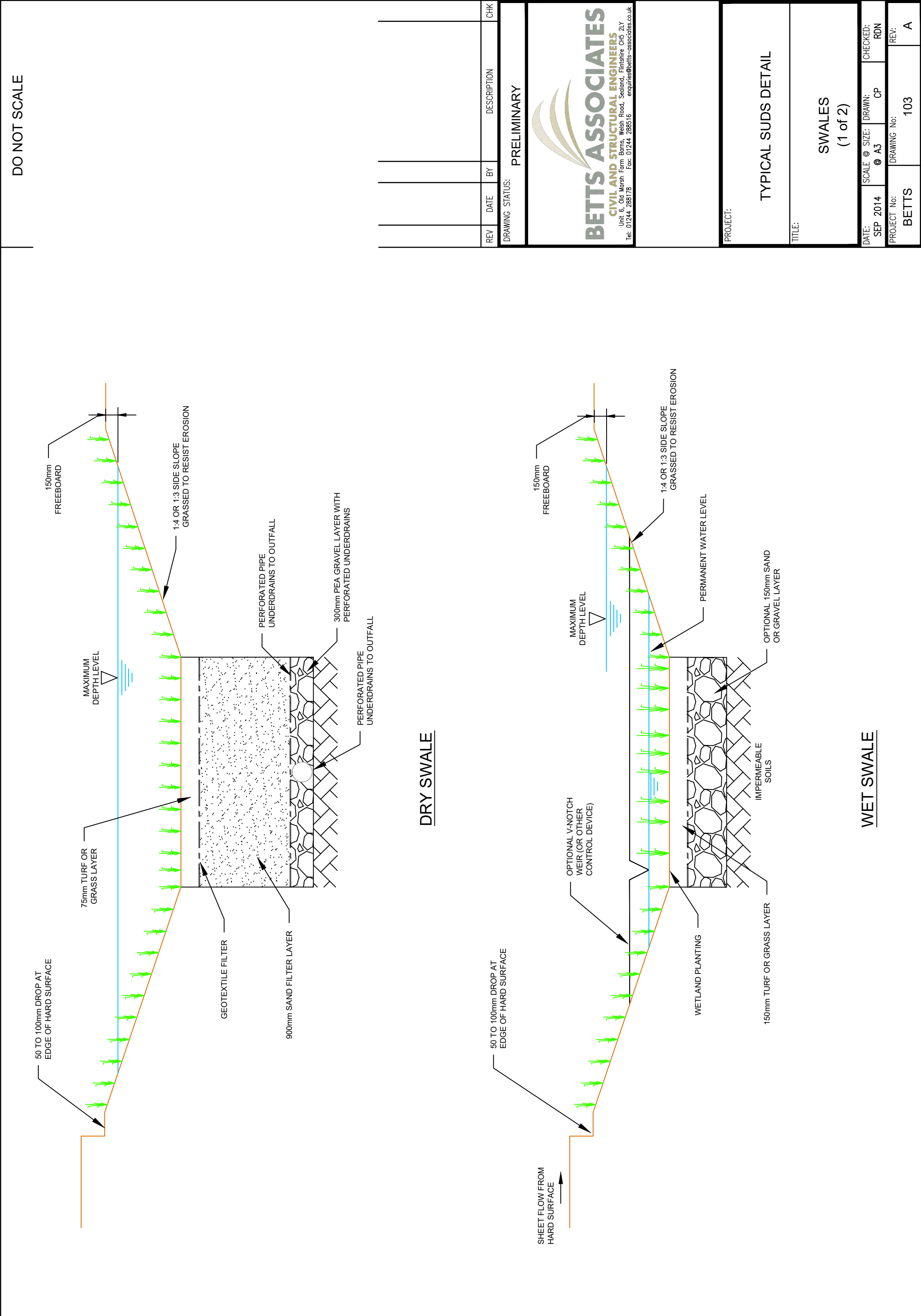
ENHANCED DRY SWALE

TYPICAL SUDS DETAIL

TITLE:

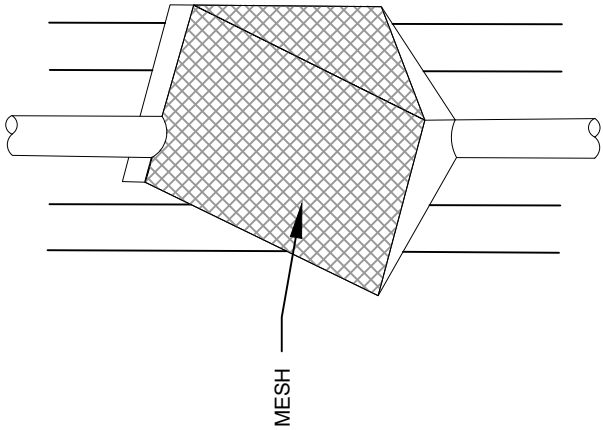
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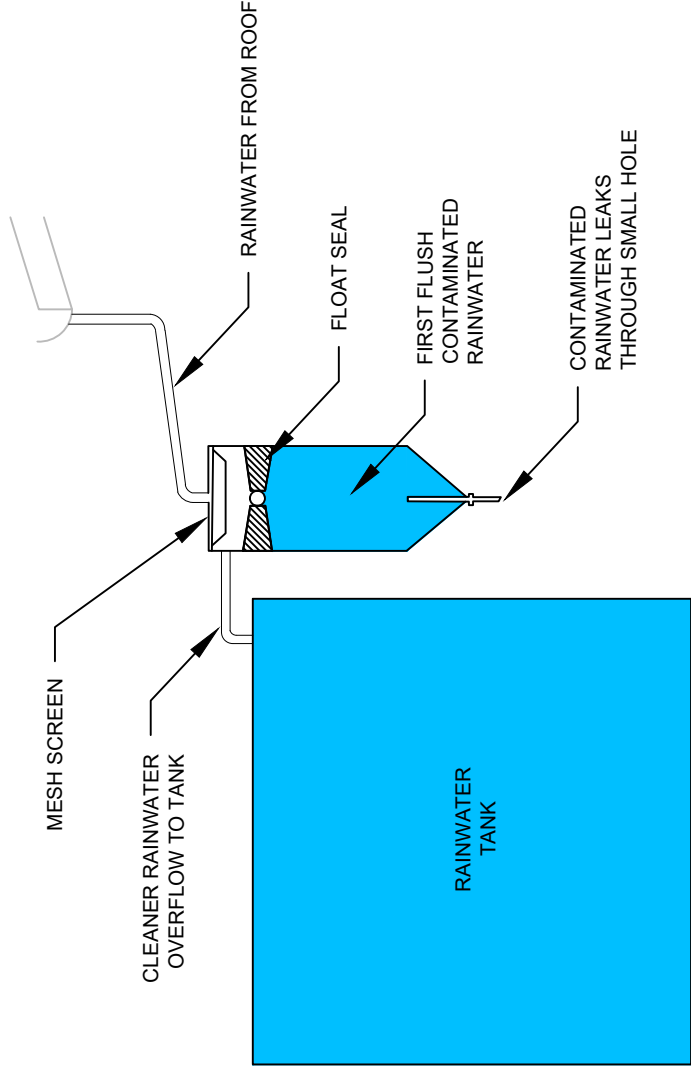


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PROJECT:					
TYPICAL SUDS DETAIL					
TITLE:					
SWALES (1 of 2)					
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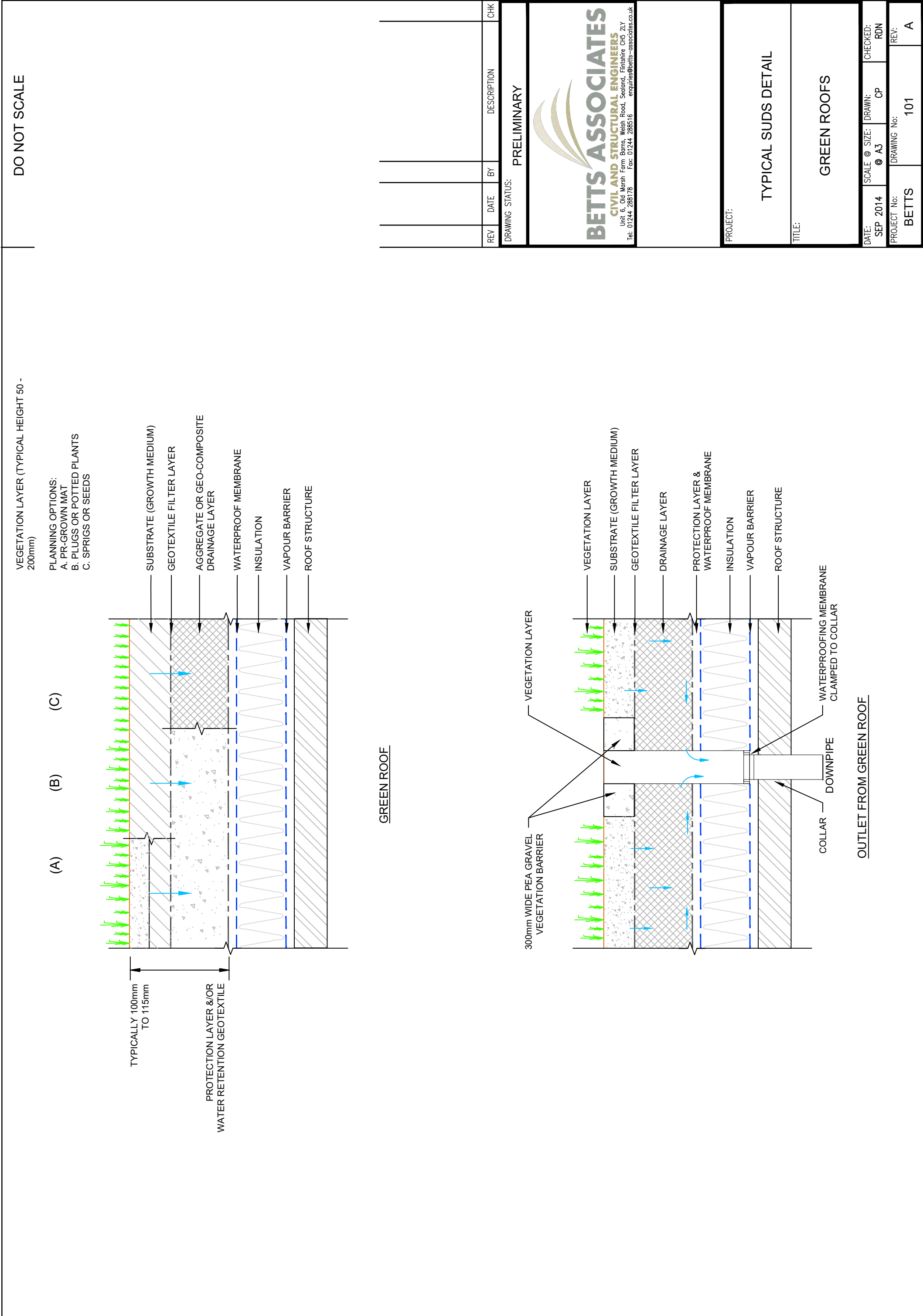


RAINWATER HARVESTING



RAINWATER HARVESTING

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APPENDIX M: NOTES OF LIMITATIONS

The data essentially comprised a study of available documented information from various sources together with discussions with relevant authorities and other interested parties. There may also be circumstances at the site that are not documented. The information reviewed is not exhaustive and has been accepted in good faith as providing representative and true data pertaining to site conditions. If additional information becomes available which might impact our conclusions, we request the opportunity to review the information, reassess the potential concerns and modify our opinion if warranted.

It should be noted that any risks identified in this report are perceived risks based on the available information.

This report was prepared by Betts Hydro Ltd for the sole and exclusive use of the titled client in response to particular instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

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