

APPENDIX I: PROPOSED PLANNING LAYOUT

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Proposed residential development at
Hollingworth Road, Littleborough

April 2024

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APPENDIX J: PFRA/SFRA PLANNING EXTRACTS

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**BURY ROCHDALE AND OLDHAM
STRATEGIC FLOOD RISK ASSESSMENT**

VOLUME II – Level 1 SFRA

November 2009

FINAL REPORT

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Figure 2-4: The 1936 canal breach from the North Bank



http://en.wikipedia.org/wiki/File:Manchester_Bolton_and_Bury_Canal_breach.jpg

2.8 Historical Flooding

Records of past flooding are useful for looking at the sources, seasonality, frequency and intensity of flooding. Table 2-4 provides an overview of significant historical flood events in Rochdale, Bury and from the River Beal in Oldham. Historical records are often anecdotal and incomplete and it can be difficult to determine accurately the frequency and consequences of events, but they are useful for providing background information. More recent gauged records and registers of flooded properties are more valuable for estimating flood frequency and severity at different locations.

Flood risk can change over time because of natural variations in climate, changes in land use and the changes in flood risk management activity. Over the last few hundred years, developments have been increasingly built on the floodplain and farming practices that promote rapid run-off of rainwater into rivers have become widespread. Due to these changes, flood risk might be higher today than it was in the past, although any flood risk management work that is undertaken helps to reduce this.

Table 2-4: Historical flood events

Date	Council	Source	Consequences	Data source
2008	Bury	Elton Reservoir	70 properties flooded	River Irwell CFMP (Environment Agency, 2008) Bury MBC
2008	Rochdale	River and surface water	Estimated 1 in 25 year event in Rochdale and 1 in 50 year event in Littleborough. Flood defences overtopped in Littleborough. Property flooding in Littleborough and Rochdale	Review River Roch FAS (Hydrology and Hydraulics) (Environment Agency, 2009)
2007	Bury	Surface water	Bury and Summerseat, gardens and roads flooded	Bury Times
2006	Bury	Surface water	Basements and gardens flooded in Bury and Ainsworth	Bury Times
2006	Rochdale	Surface water	20 properties flooded in Heywood	River Irwell CFMP Rochdale MBC Manchester Evening News

Date	Council	Source	Consequences	Data source
2004	Rochdale	Surface water	Flooding in Heywood	Manchester Evening News
2004	Rochdale	River Irk	Properties flooded in Middleton	Manchester Evening News
2004	Bury	Surface water	Homes and a pub flooded	Comments from EA
1995	Rochdale	River Roch	36 properties flooded in Rochdale	River Irwell CFMP
1995	Bury	River Irwell	Property flooding in Ramsbottom. 15 properties flooded in Radcliffe (Pioneer Mills)	River Irwell CFMP River Irwell Model Review and Update (Environment Agency, 2007)
1992	Oldham	River Beal	Property flooding	Oldham MBC
1992	Bury	Ramsbottom	Property flooding in Ramsbottom	River Irwell Model Review and Update
1991	Oldham	River Beal	Flooding in Shaw	River Roch and Tributaries FMS (Environment Agency, 2007)
1991	Rochdale	River Roch	81 properties flooded in Rochdale	River Irwell CFMP
1984	Rochdale	River Beal	3 properties flooded in Milnrow	River Roch and Tributaries FMS
1983	Oldham	River Beal	Flooding in Shaw	River Roch and Tributaries FMS
1980	Bury	River Irwell	Property flooding in Bury	River Irwell FMS
1980	Oldham	River Beal	Flooding in Shaw	River Roch and Tributaries FMS
1978	Oldham	River Beal	Flooding in Shaw	River Roch and Tributaries Flood Mapping
1975	Bury	River Irwell	Flooding of properties in Radcliffe	River Irwell Model Review and Update
1967 and 1968	Oldham	River Beal	Flooding in Shaw	Beal, Roch and Tributaries FMS
1965	Rochdale	River Roch	Flooding of properties in Rochdale	River Irwell CFMP
1965	Bury	River Irwell	Property flooding in Bury	River Irwell Model Review and Update
1964	Oldham	River Beal	350 properties flooded or evacuated in Shaw	River Irwell CFMP
1964	Bury	Ramsbottom	Property flooding in Ramsbottom	River Irwell Model Review and Update
1959	Bury	Surface water	Whitefield - localised surface water flooding	BHS Database
1954	Bury	River Irwell	Flooding of properties in Radcliffe (Pioneer Mills)	River Irwell Model Review and Update
1930	Bury	Manchester, Bury and Bolton Canal	Canal flooding due to embankment failure	River Irwell Model Review and Update
1927	Rochdale	River Irk and Rochdale Canal	Localised flooding	BHS Database

Date	Council	Source	Consequences	Data source
1923	Bury	River Irwell	Flooding of properties in Bury	BHS Database
1852	Rochdale	River Roch	Flooding in Heywood	River Irwell Model Review and Update

The Environment Agency also maintains a National Historic Flood Map which records known flood extents. In addition to the above, Bury MBC has maintained a register of flooded properties which records flood events in Ramsbottom, Bury and Radcliffe. Oldham MBC also maintains a similar register, but this does not record any flooding locations in the River Beal catchment. Analysis of the available historic flooding information shows that:

2.8.1 Bury

There has been significant flooding in Ramsbottom in the past. There has been fairly frequent flooding in Radcliffe in low lying areas, such as Pioneer Mills, but this has not generally affected large numbers of properties. There are recorded incidents of surface water flooding in both Ramsbottom and Radcliffe. Flooding in Bury itself is less common. There are incidents of reservoir and canal flooding but these are less common.

2.8.2 Rochdale

There has been significant flooding in the past in Rochdale and Littleborough in 1965, 1991 and most recently 2008, where some of the flooding was caused by surface water. There is a known risk of surface water flooding in Littleborough. Flooding in Heywood is mostly attributed to surface water.

2.8.3 Oldham

There has been frequent flooding in the past in Shaw, with the most significant event affecting 350 properties following a localised storm event in 1964.

2.9 Flood Defences

The condition of existing flood defences and whether they will continue to be maintained and/or improved in the future is an issue than needs to be considered as part of the risk based sequential approach and in the light of this, whether proposed land allocations are appropriate and sustainable. In addition, detailed FRAs will need to explore the condition of defences thoroughly, especially where these defences are informal and contain a wide variation of condition grades. A number of proposed development sites depend of the presence of flood defence assets to minimise flood risk. It is important that all of these assets are maintained in a good condition.

As part of this Level 1 SFRA, an asset database was created for Bury and Rochdale Councils and the Beal catchment within Oldham Council area that builds on NFCDD. NFCDD was reviewed to identify key Environment Agency and privately owned assets on the River Roch and Irwell systems through Rochdale, Ramsbottom and Bury-Radcliffe, as these were identified as the locations with the highest flood risk and development pressures. In order to verify and improve the database an asset survey was undertaken by a JBA Chartered Engineer.

The sites that were visited included the River Roch through the lower section of Littleborough and the centre of Rochdale. Inspections of the tributaries to the Roch included Ash Brook, Buckley Brook/Hey Brook, Stanney Brook and the River Spodden. Inspections of the River Irwell in Ramsbottom, Bury and Radcliffe included Dearden Brook, Cross Bank Brook, Parr Brook and Crow Trees Farm Brook tributaries.

Asset locations were visually inspected for the general surrounding topography, a general impression of the flood risk to the nearby proposed development sites, the areas benefitting from the defences and the natural floodplain. Notes were made of the general impression of the structure condition using the Environment Agency ratings identified in the BRO SFRA User Guide.

Record photographs of key structures were taken. Notes were also made of the watercourse condition in the vicinity of the structures where weed growth, sediment deposition or a lack of channel maintenance was evident.

For some assets where it was considered that defence overtopping could be a possibility during an extreme flood event or that a structure could fail under flood loading, the consequential overland flood flow paths were noted. These notes were used as a cross check against predictions from the river modelling within the BRO Level 2 SFRA.



**BURY ROCHDALE AND OLDHAM
STRATEGIC FLOOD RISK ASSESSMENT**

VOLUME III – Level 2 SFRA

November 2009

FINAL REPORT

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- Over 2m flood depths at Close Park
- 1.5-2m flood depths at Paper Mill site

3.3.3 Undefended 1 in 1000 year flood event

- 1.5-2m flood depths around commercial and residential areas of Warth Mills
- 1.5-2m flood depths at commercial units between the River Irwell and Swan Lodge
- Over 2m flood depths south of Dumers Lane
- 0.5-1.5m flood depths surrounding residential areas north of Dumers Lane
- Over 2m flood depths at East Lancs Paper Mill site

3.3.4 Flood Hazards

- During the 1 in 100 year event, flood hazards throughout the Bury-Radcliffe area are 'Dangerous to Most'. Some key flow paths along Warth Road and around Redvales are 'Dangerous for All'
- During the 1 in 1000 flood year event almost the entire natural floodplain is classified as 'Dangerous for All'. Hazards reduce towards the extent of the floodplain where depths reduce

3.4 Littleborough

Littleborough is situated in the north east extent of Rochdale. The main source of flood risk to Littleborough is fluvial flooding from the River Roch. Smaller watercourses such as Ealees Brook, Featherstall Brook, Lydgate Brook and Town House Brook also contribute to the overall fluvial risk in the area.

Currently, the Environment Agency Flood Zone 3 is confined to areas directly adjacent to Town House Brook, small sections of the A6033 and Stubley Mill Road. Flood Zone 2 is more extensive, covering a number of properties in the area. As part of the BRO Level 1 SFRA, the Flood Zones were updated using a detailed ISIS-TUFLOW model and updated hydrology (using the undefended scenario). The 1 in 100 year flood event extent is more extensive along the Roch in Littleborough, especially in the areas along the A6033 and the confluence of the Roch with Ealees Brook. The 1 in 1000 year flood event extent remains similar to the current Environment Agency Flood Zone 2, with small reductions in extent along Queen Street and Stockton Street.

The risk of fluvial flooding in Littleborough is mainly residual as there are a number of Environment Agency raised defences spanning the River Roch, Town House Brook and Ealees Brook. The defences along the River Roch provide a 1 in 100 year SOP and have a number of associated ABDs. There are also some defences with a 1 in 50 year SOP; however this is often the default value used in the Environment Agency's NFCDD and so this is unconfirmed. There are a number of Environment Agency defences downstream of Green Vale Brook's confluence with the Roch which have a 1 in 25 year or lower SOP. Littleborough is also covered by the Environment Agency Flood Warning system.

The flood depth and hazard maps for all scenarios are presented at the back of this Volume.

During the 1 in 100 year defended scenario, the majority of Littleborough remains dry due to defences with a 1 in 100 year SOP. However, those defences identified with lower SOPs are overtopped on both banks with flood waters entering commercial buildings which flow down the A6033 to Church Street. Flood depths are below 0.5m along this flow path and between 0.5-1m at the A6033/Church Street junction.

During the 1 in 100 year plus climate change event, floodwaters downstream of the Roch confluence with Ealees Brook remain in bank due to the presence of defences. There is also a limited impact on flood depths from defence overtopping further upstream, with peak depths, remaining below 1m.

In a 1 in 1000 year defended scenario the defences further downstream around Stubley are overtopped, causing flood depths of around 1m to 1.5m to properties off William Street. The junction of the A6033 with Church Street and Victoria Street becomes a key risk area as a number of flow paths converge resulting in flood depths reaching up to 1.5m.

Approximate flood depths are presented below. These have been extracted over large areas and for more detailed depths, the Level 2 SFRA maps should be referred to.

3.4.1 Defended 1 in 100 year flood event

- 0.5m flood depths along the A6033
- 1m flood depths at the junction of the A6033, Victoria Street and Church Street
- 0.5m flood depths along Ebor Street
- Defences with a 1 in 100 year SOP are not overtopped

3.4.2 Defended 1 in 100 year plus climate change flood event

- Little change in flood depths throughout
- Extent of shallow flooding increases adjacent to the railway
- 1m flood depths at the junction of the A6033, Victoria Street and Church Street
- 1m flood depths along Ebor Street
- Flood depths also increase around the B6225 over Ealees Brook.

3.4.3 Defended 1 in 1000 year flood event

- 1.5m flood depths along the A6033
- Defences along the Roch at Church Street are exceeded
- 1.5m flood depths around the train station area
- Defences along Cultard Way are overtopped
- 0.5m flood depths at Atherstall Road and Cultart Way
- 1.5m flood depths along William Street

3.4.4 Flood Hazards

- During to 1 in 100 year defended event, flood hazards are relatively low (from 'Very Low Hazard' to 'Dangerous to Some'). Deep floodwaters are likely to pose the highest flood hazard
- Flood hazards increase during the 1 in 1000 year defended scenario. The A6033 becomes 'Dangerous for Most' as well as the area at Stubley and Church Street where defences are overtopped

3.5 Rochdale

According to the current Environment Agency Flood Zones provided in the BRO Level 1 SFRA, Flood Zone 2 and 3a are extensive throughout Rochdale, placing a number of commercial and residential areas at risk. Sections of open land upstream of Albert Royds Street, Mayfield and the allotment gardens off Kellett Street in East Rochdale are also designated as Functional Floodplain.

The 1 in 100 and 1 in 1000 year flood extents were updated in the BRO Level 1 SFRA using the detailed ISIS-TUFLOW model and updated hydrology developed for the SFRA. Both the 1 in 100 and 1 in 1000 year (undefended) flood events have been significantly reduced throughout Rochdale, especially land over the Esplanade Culvert and areas surrounding Ramsey Street and Entwisle Road.

There are a number of Environment Agency maintained flood defences along the Roch through Rochdale. The majority of these have been designed to a 1 in 100 year standard apart from those at the allotment gardens which have been designed to exceed for events greater than 1 in 2 years. There are also a few defences along Buckley Brook and Stanney Brook where the SOP is unknown (shown as a standard 1 in 50 years in NFCD). As discussed in Section 2.2, there are a number of possible breach and spill locations in Rochdale. These include:

- A possible breach upstream of the Esplanade Culvert,
- A missing defence at Buckley Road, and
- Entwisle Road culvert.

The flood depth and hazard maps for all scenarios are presented at the back of this Volume.

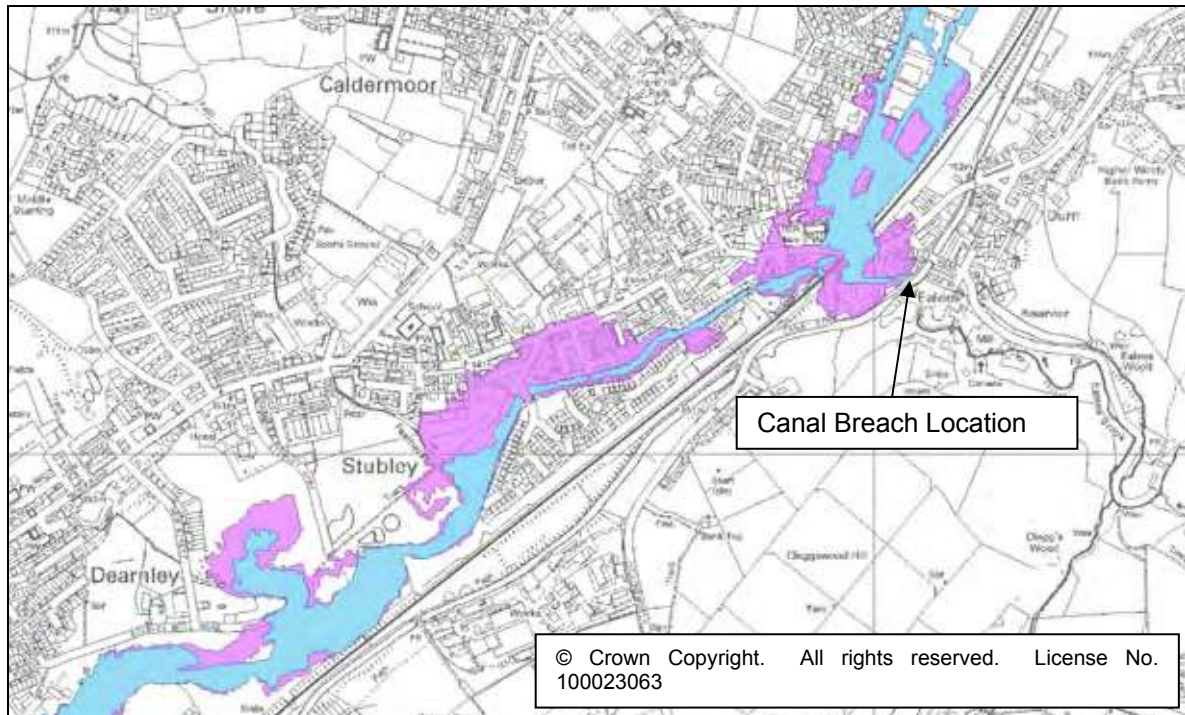
During the 1 in 100 year defended scenario (actual risk), peak water levels along the Roch remain in bank apart from those areas designated as functional floodplain. Depths in these areas reach up to 1.5m. During the same event, Buckley Brook overtops its banks at the missing defences at Buckley Road, where flood waters flow south down Buckley Road and onto Park Road. This becomes a

developing over 5 minutes) was tested at breach locations at Littleborough (Figure 4-1) and Smithy Bridge (Figure 4-2).

The assessment showed that for this scenario, peak flow was 83.5 m³/s with a total volume of 143,070 m³ passing through the breach. The resulting hydrograph was then included in the 1 in 100 year event along the Roch using the ISIS-TUFLOW model as above. This was used to investigate the immediate impact of a breach on the surrounding area and the potential increases in water levels downstream. The breach scenarios were run separately and their immediate impact on flood extents is shown in Figure 4-1 and Figure 4-2. The impact of a breach on water levels in the River Roch at a number of key locations is shown in Table 4-1.

Figure 4-1: Impact of canal breach on 1 in 100 year flood extent in Littleborough

(A larger inundation map is provided at the back of this report)



The impact of a canal breach in Littleborough is evident along the Roch (pink outline) when compared to the 1 in 100 year modelled outline (blue outline). The worst affected areas are directly adjacent to the breach due to the sudden inundation of canal water on the Ealees Brook system and the Roch. Due to the velocity and volume of the flood water and the lack of capacity in the Roch through Littleborough, raised defences along the right hand bank are exceeded, flooding areas around Church Street, Victoria Street and Howard Street. Further downstream the impacts are still present as the increase in volume again exceeds raised defences on the right bank, flooding properties off Church Street and William Street around Stubley. The impact on flood extents is seen as far down the Roch as Dye House Road Bridge in Howarth Cross. The impact on water levels is shown in Table 4-1.

Table 8-4: Risk of flooding in Littleborough

Community	Littleborough, Rochdale			
Catchment	Roch			
Main Source of Flood Risk	River Roch, Ealees Brook and Farm House Brook			
Secondary Sources of Flood Risk	Surface Water and Rochdale Canal			
	Number of Sites	Total area	Sites in Flood Zone 3a	Area in Flood Zone 3a
Housing Sites	58	15.13ha	5	0.54ha
Employment Sites	1	0.49ha	0	0.00ha

Map Illustrating General Community Area

1 in 100 year undefended fluvial event

0 - 0.5m
0.5 - 1.0m
1.0 - 1.5m
1.5 - 2.0m
> 2.0m

Areas susceptible to surface water flooding

High
Medium
Low

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Understanding Flood Risk		
Significant Risk during 1 in 100 year Event?	Yes	No
Consistent Standard of Protection?	Yes	No
Consistent Condition Standard?	Yes	No
Significant Risk of Assets Breaching?	Yes	No
Could Assets Overtop with Climate Change?	Yes	No
Could Assets Overtop in an Extreme Event?	Yes	No
Significant Residual Risk?	Yes	No
Is Residual Risk a Significant Proportion of Flood Zones?	Yes	No
Issues of Surface Water Flooding?	Yes	No
Is Flood Risk an Environmental Constraint?	Yes	No
Managing Flood Risk		
Does Development Need to be Considered Strategically?	Yes	No
Can Development Proceed in a Piecemeal Basis?	Yes	No
Flood Risk Management Strategy Required?	Yes	No
Likelihood of Passing Exception Test		
Will there be off Site Effects?	Yes	No
Will Flood Risk be an Urban Design Issue?	Yes	No
Can Residual Risk be Successfully Managed?	Yes	No
Could Development Reduce Risk?	Yes	No

APPENDIX K: SURFACE WATER RUN-OFF CALCULATIONS

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SURFACE WATER RUN-OFF CALCULATION SHEET



Development	HOLLINGWORTH ROAD, LITTLEBOROUGH
Project No.	HYD760

Revision	C	Completed by	HB
Date	14/02/2024	Checked by	KH

Areas			
Total Site	19.200	ha	
Development Area ¹	12.388	ha	
Contributing Catchment	1.010	ha	
Existing Impermeable	0.000	ha	
Existing Impermeable ²	0.000	ha	
Existing Pervious	19.200	ha	
Existing Pervious ²	0.000	ha	
Proposed total impermeable	6.813	ha	55%

Catchment Characteristics			
SAAR	1205	mm	
SPR	0.47		
BFI	0.403		
i_1	18.4	mm/hr	d_1 22.8 mm
i_{30}	34.5	mm/hr	d_{30} 52.9 mm
i_{100}	44.5	mm/hr	d_{100} 68.4 mm

Run-off Rates - (FEH Method)			
<i>Pre-development Based on the Canal Contributing Catment Area 1.01ha</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	11.7	l/s
	30yr	22.9	l/s
	100yr	28.1	l/s
	QBar ⁵	13.5	l/s
Total -----	1yr	11.7	l/s
	30yr	22.9	l/s
	100yr	28.1	l/s
<i>Post-development (without control)</i>			
Impermeable ⁶ -----	1yr	348.2	l/s
	30yr	652.9	l/s
	100yr+45%CC	1221.1	l/s

Volumes			
<i>Pre-development Based on the Canal Contributing Catment Area 1.01ha</i>			
Impermeable -----	1yr	0.0	cu.m
	30yr	0.0	cu.m
	100yr	0.0	cu.m
Pervious ⁴ -----	1yr	132.4	cu.m
	30yr	264.1	cu.m
	100yr	354.7	cu.m
Total -----	1yr	132.4	cu.m
	30yr	264.1	cu.m
	100yr	354.7	cu.m
<i>Post-development (without control)</i>			
Impermeable ⁶ -----	1yr	1553.4	cu.m
	30yr	3604.1	cu.m
	100yr	4660.1	cu.m

Based on Greenfield run-off Qbar for the existing catchment area contributing to direct run-off into the canal				
Microdrainage Quick Storage Estimates (using FEH catchment data)				
Return Period	Rate	lower	upper	mean
1yr	13.5 l/s*	1792	3747	2769.5 cu.m
30yr	13.5 l/s*	3895	6925	5410 cu.m
100yr+45%CC	13.5 l/s*	9062	13675	11368.5 cu.m

*Rate restricted as agreed with Canals & Rivers Trust

- 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 (W5-074/A/TR1/1 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)

Calculated by:

Site name:

Site location:

Site coordinates

Latitude:

Longitude:

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Reference:

Date:

Methodology

FEH Statistical

Site characteristics

Total site area (ha)	1.01
----------------------	------

Methodology

Qmed estimation method	Calculate from BFI and SAAR
BFI and SPR estimation method	Specify BFI manually
HOST class	15
BFI / BFIHOST	0.403
Qmed (l/s)	13.26
Qbar / Qmed Conversion Factor	1.08

Hydrological characteristics

	Default	Edited
SAAR (mm)	1246	1246
Hydrological region	10	10
Growth curve factor: 1 year	0.87	0.87
Growth curve factor: 30 year	1.7	1.7
Growth curve factor: 100 year	2.08	2.08

Notes:

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

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

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

Greenfield runoff rates

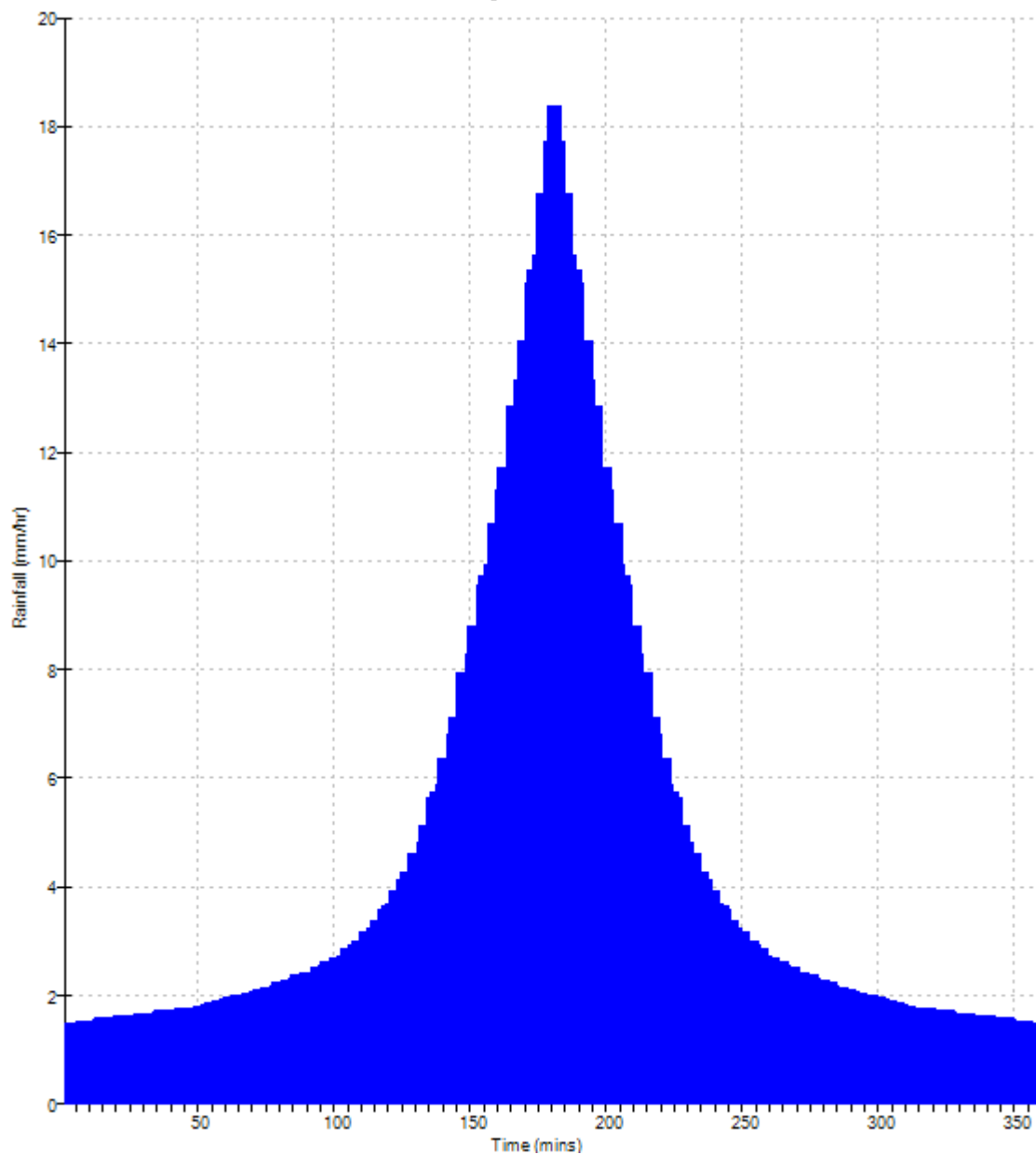
	Default	Edited
Qbar (l/s)	14.25	13.48
1 in 1 year (l/s)	12.4	11.73
1 in 30 years (l/s)	24.23	22.92
1 in 100 years (l/s)	29.65	28.05

Betts Associates Ltd		Page 1
Old Marsh Farm Barns Welsh Road Sealand Flintshire CH5 2LY	HOLLINGWORTH ROAD LITTLEBOROUGH	
Date 04/01/2019 File	Designed by MB Checked by DK	
Micro Drainage	Network 2018.1	

Rainfall profile

Storm duration (mins) 360

FEH Data
 FEH Rainfall Version 2013
 Site Location GB 392867 415636
 Data Type Point
 Peak Intensity (mm/hr) 18.377
 Ave. Intensity (mm/hr) 4.688
 Return Period (years) 2.0

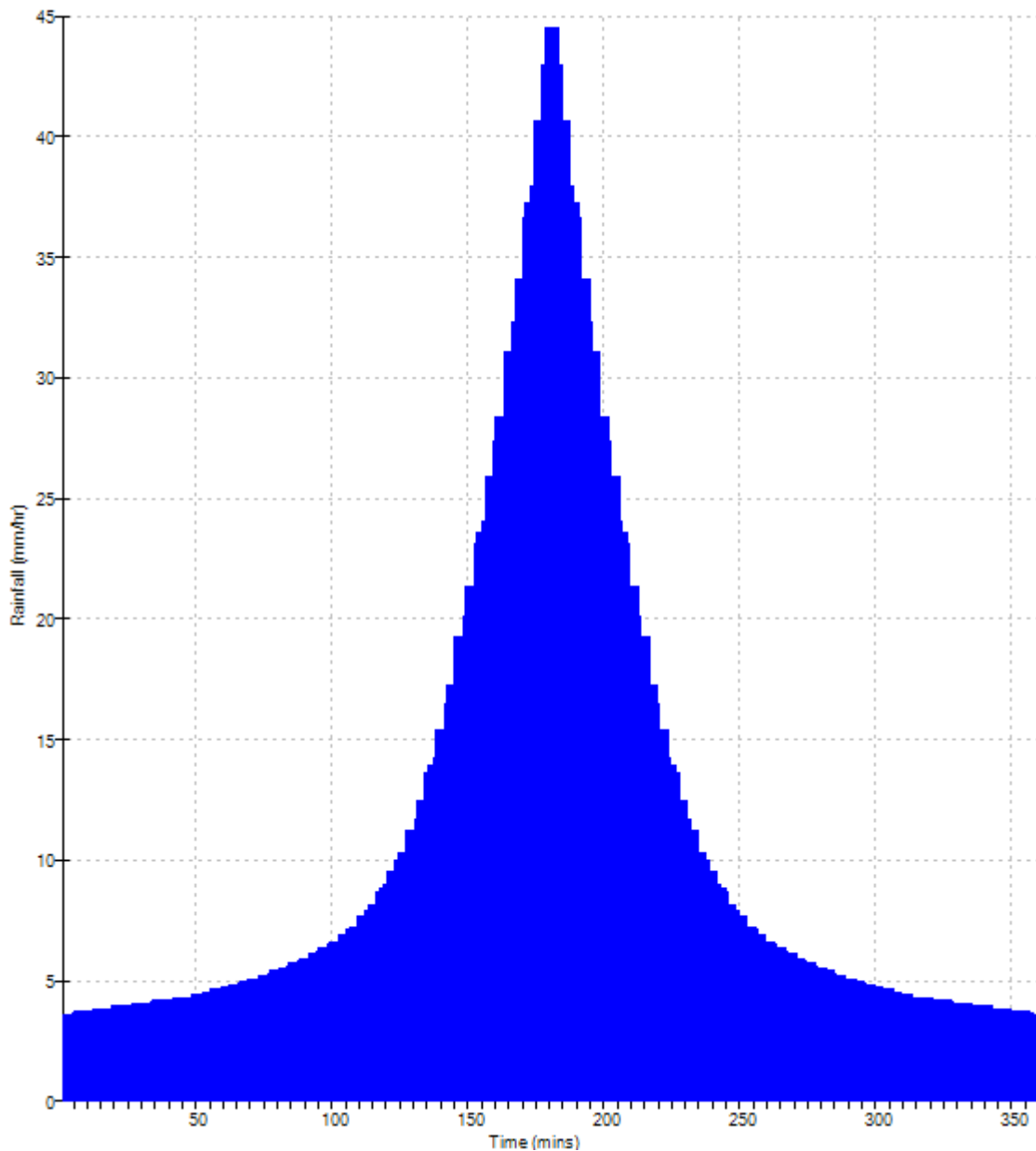


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Old Marsh Farm Barns Welsh Road Sealand Flintshire CH5 2LY	HOLLINGWORTH ROAD LITTLEBOROUGH	
Date 04/01/2019 File	Designed by MB Checked by DK	
Micro Drainage	Network 2018.1	

Rainfall profile

Storm duration (mins) 360

FEH Data
 FEH Rainfall Version 2013
 Site Location GB 392867 415636
 Data Type Point
 Peak Intensity (mm/hr) 44.534
 Ave. Intensity (mm/hr) 11.361
 Return Period (years) 100.0

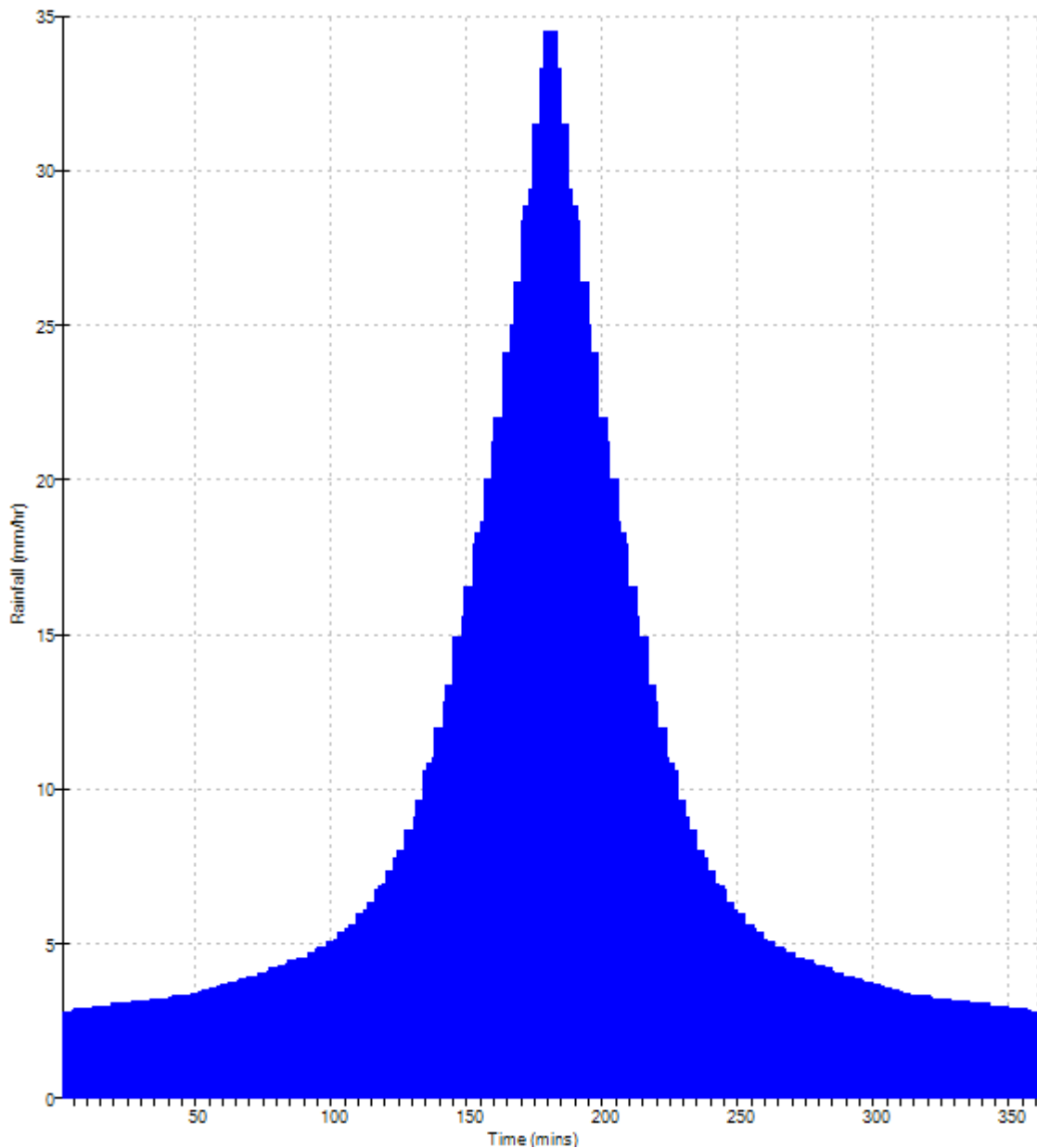


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Old Marsh Farm Barns Welsh Road Sealand Flintshire CH5 2LY	HOLLINGWORTH ROAD LITTLEBOROUGH	
Date 04/01/2019 File	Designed by MB Checked by DK	
Micro Drainage	Network 2018.1	

Rainfall profile

Storm duration (mins) 360

FEH Data
 FEH Rainfall Version 2013
 Site Location GB 392867 415636
 Data Type Point
 Peak Intensity (mm/hr) 34.515
 Ave. Intensity (mm/hr) 8.805
 Return Period (years) 30.0



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Old Marsh Farm Barns	Hollingworth Road	
Welsh Road	Littleborough	
Sealand Flintshire CH5 2LY		
Date 13/02/2024	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 393275 415468
Data Type	Point
Areal Reduction Factor	1.00
Area (ha)	12.388
SAAR (mm)	1205
CWI	123.824
SPR Host	47.000
URBEXT (1990)	0.0000

Results

Percentage Runoff (%)	46.71
Greenfield Runoff Volume (m³)	1624.339

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Old Marsh Farm Barns	Hollingworth Road	
Welsh Road	Littleborough	
Sealand Flintshire CH5 2LY		
Date 13/02/2024	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 393275 415468
Data Type	Point
Areal Reduction Factor	1.00
Area (ha)	12.388
SAAR (mm)	1205
CWI	123.824
SPR Host	47.000
URBEXT (1990)	0.0000

Results

Percentage Runoff (%)	51.38
Greenfield Runoff Volume (m³)	4350.600

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Old Marsh Farm Barns	Hollingworth Road	
Welsh Road	Littleborough	
Sealand Flintshire CH5 2LY		
Date 13/02/2024	Designed by HB	
File	Checked by KH	
Micro Drainage	Source Control 2020.1.3	

Greenfield Runoff Volume

FEH Data

Return Period (years)	30
Storm Duration (mins)	360
FEH Rainfall Version	2013
Site Location	GB 393275 415468
Data Type	Point
Areal Reduction Factor	1.00
Area (ha)	12.388
SAAR (mm)	1205
CWI	123.824
SPR Host	47.000
URBEXT (1990)	0.0000

Results

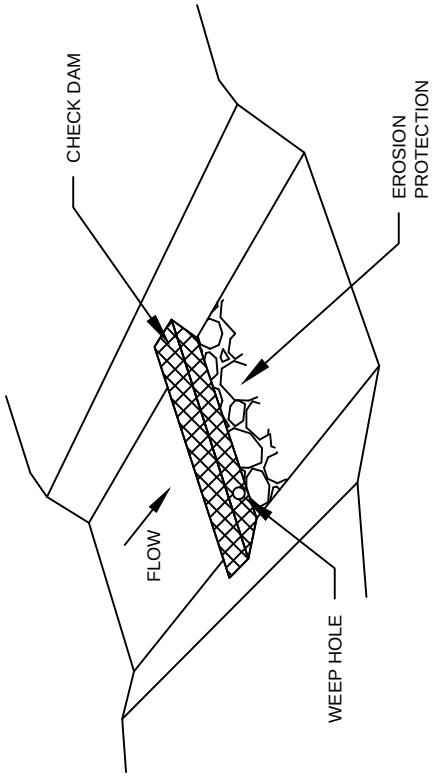
Percentage Runoff (%)	49.41
Greenfield Runoff Volume (m³)	3239.746

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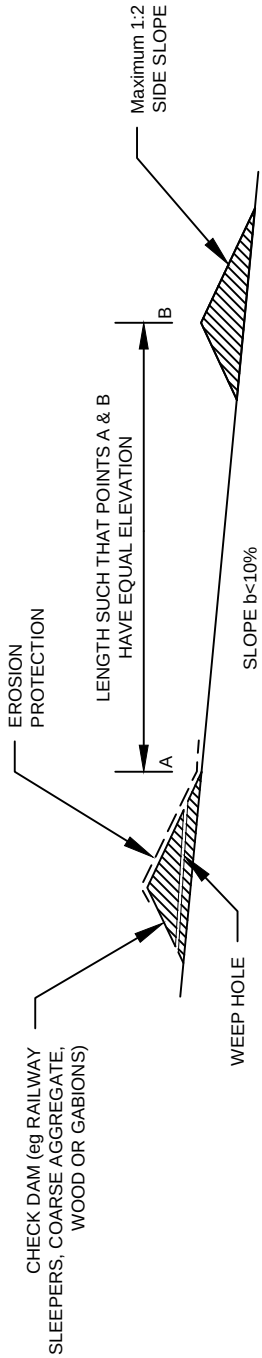
APPENDIX L: TYPICAL SUDS DETAILS

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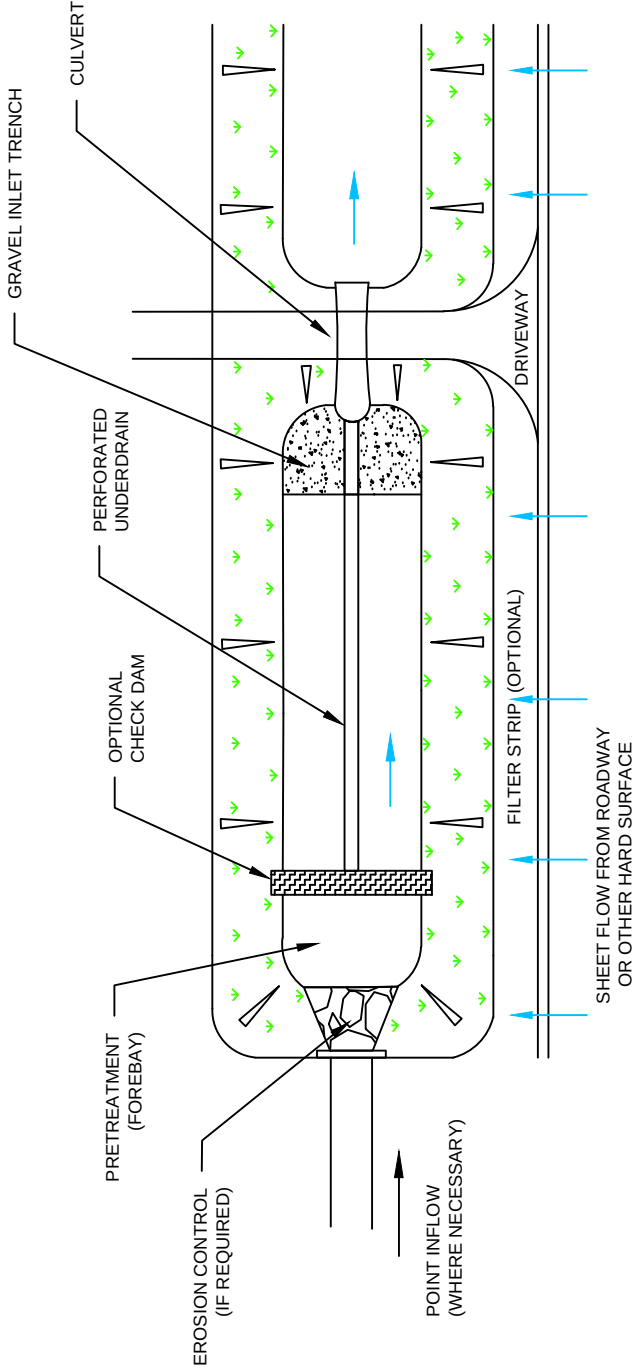


SCHEMATIC



ELEVATION

CHECK DAM



ENHANCED DRY SWALE

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY



BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Banns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

PROJECT:

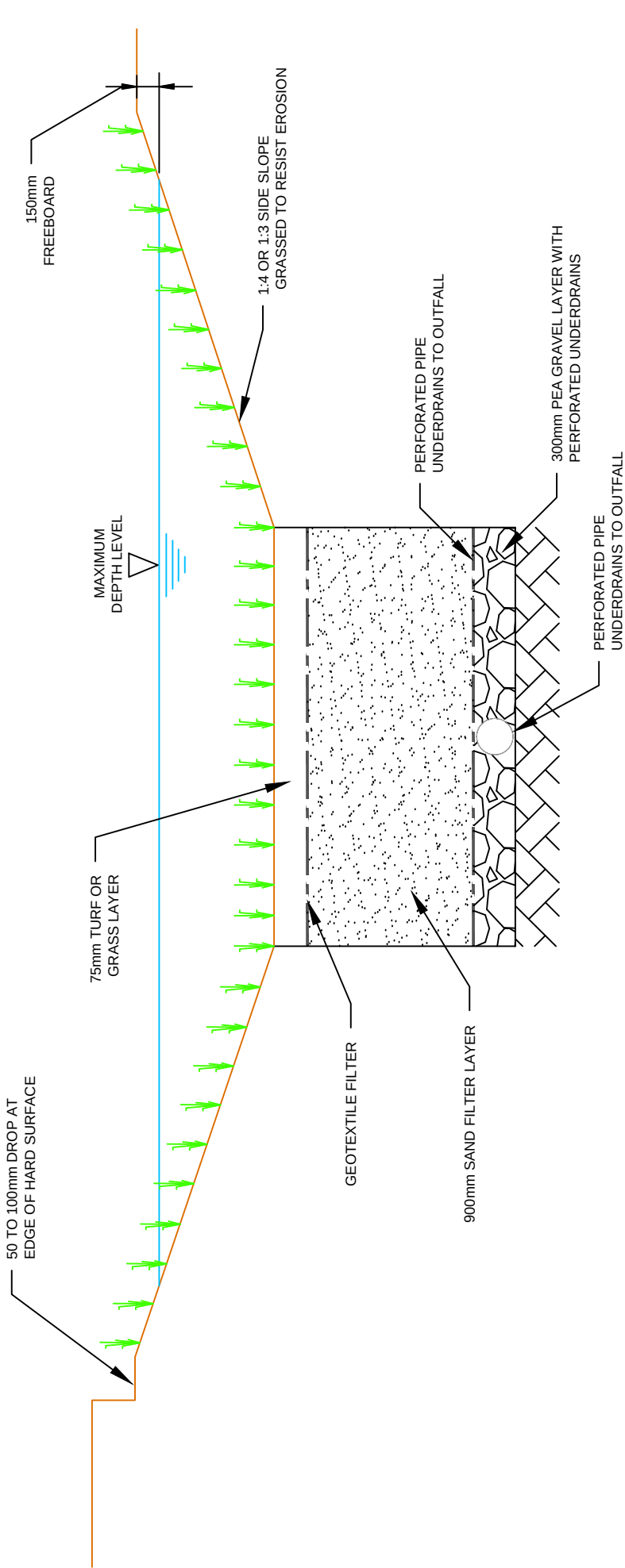
TYPICAL SUDS DETAIL

TITLE:

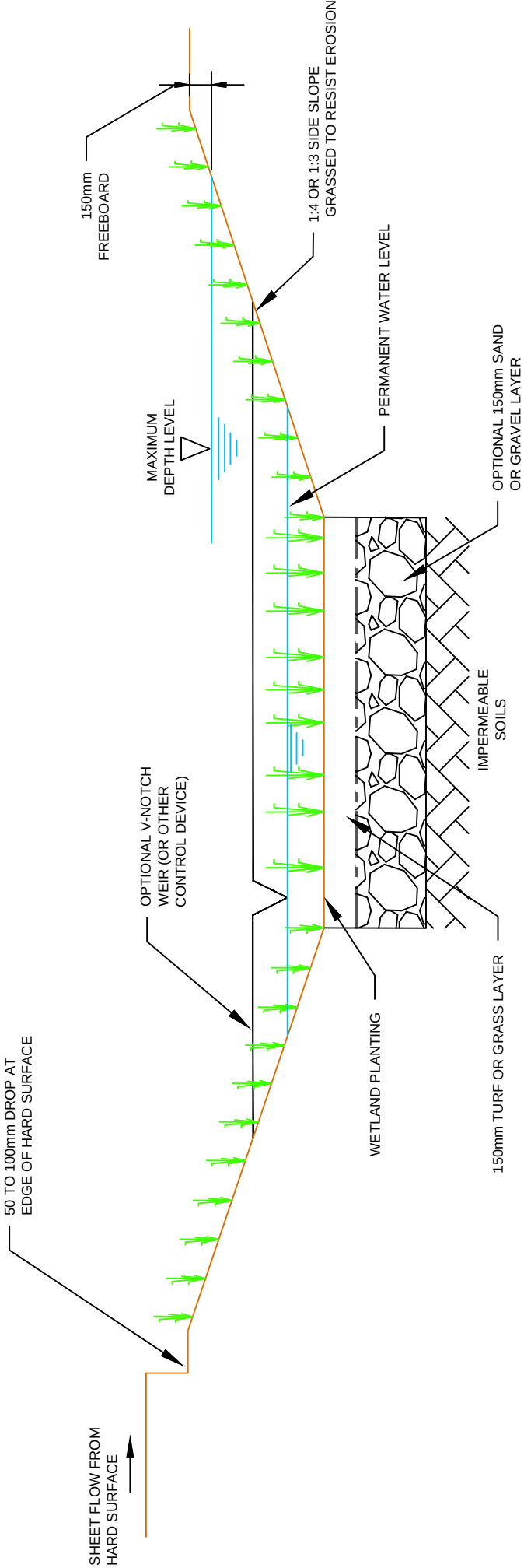
SWALES
(2 of 2)

DATE: SEP 2014	SCALE @ SIZE: @ A3	DRAWN: CP	CHECKED: RDN
PROJECT No: BETTS	DRAWING No: 104	REV: A	

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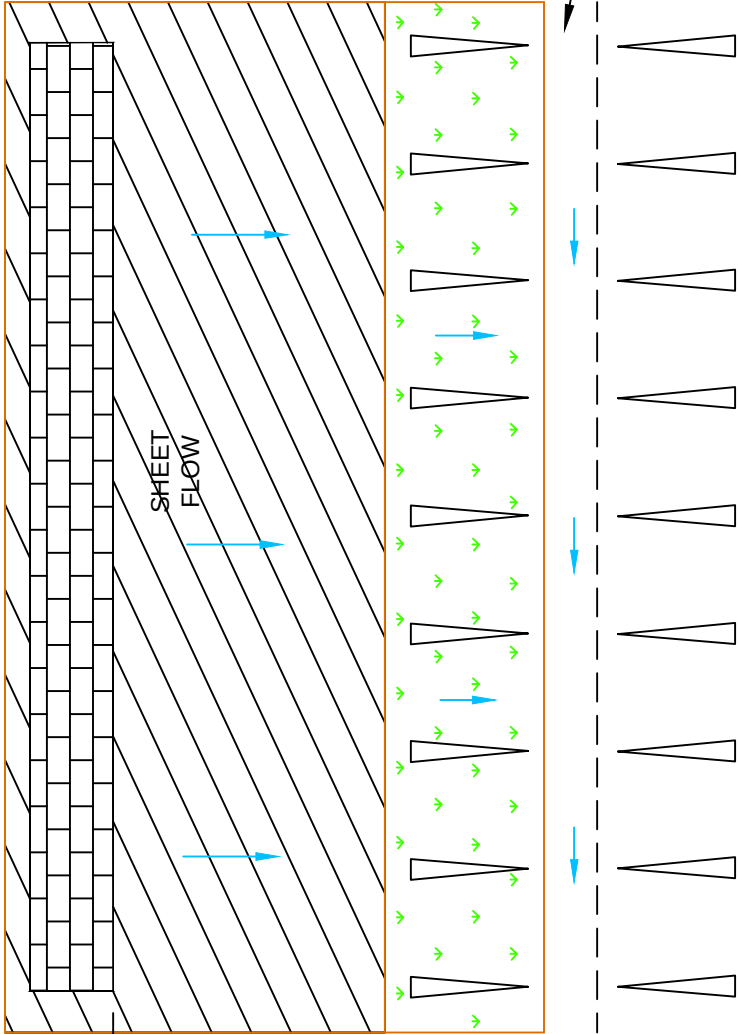
DRY SWALE



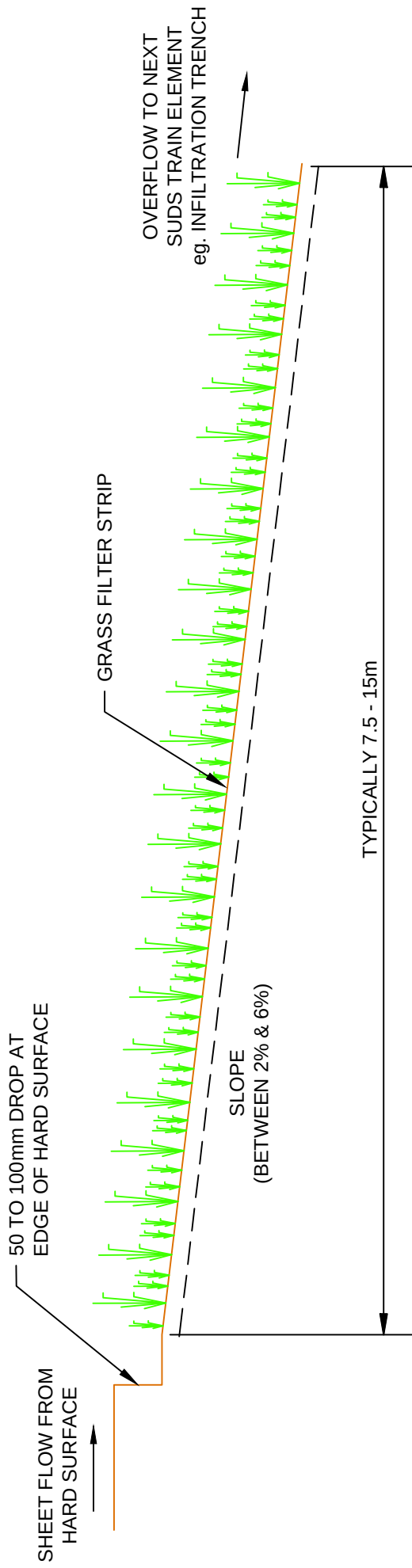
WET SWALE

REV	DATE	BY	DESCRIPTION	CHK	
DRAWING STATUS:					PRELIMINARY
 BETTS ASSOCIATES CIVIL AND STRUCTURAL ENGINEERS Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk					
PROJECT:					
TYPICAL SUDS DETAIL					
TITLE:					
SWALES (1 of 2)					
DATE: SEP 2014	SCALE @ A3	SIZE: A3	DRAWN: CP	CHECKED: RDN	
PROJECT No: BETTS		DRAWING No: 103		REV: A	

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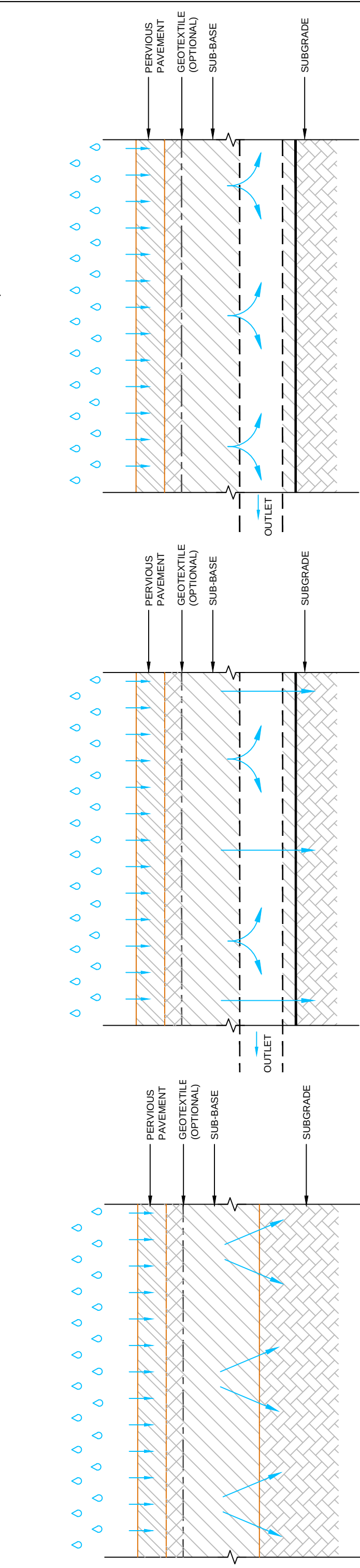
PLAN



ELEVATION

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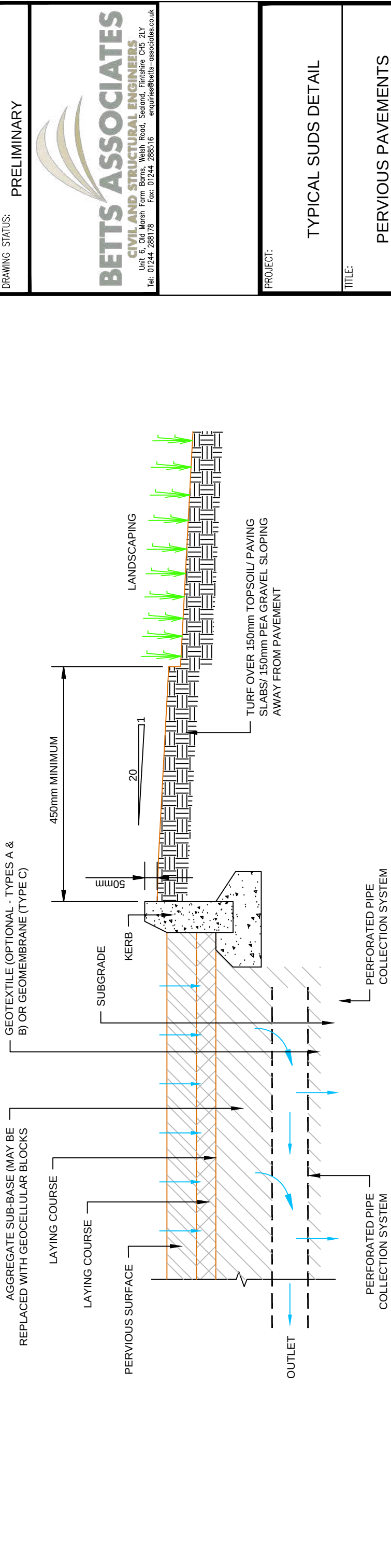
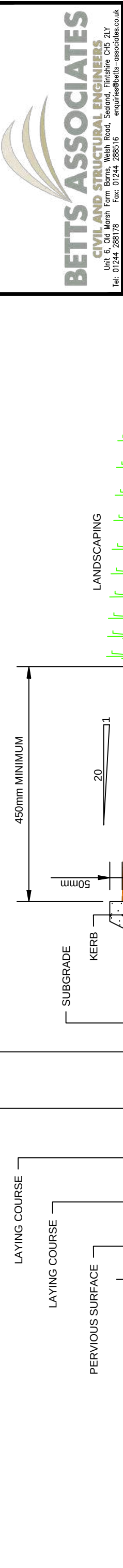
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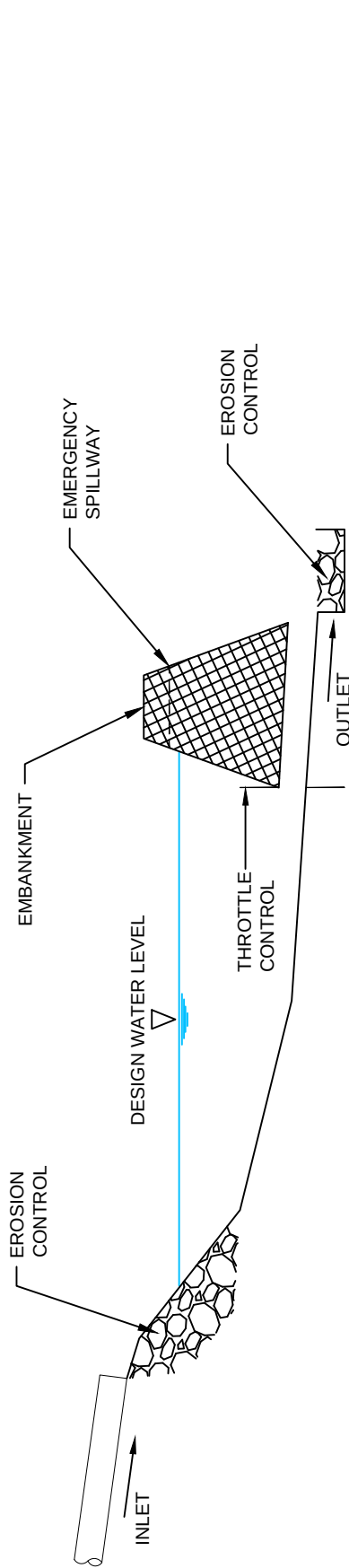
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TYPE C: NO INFILTRATION

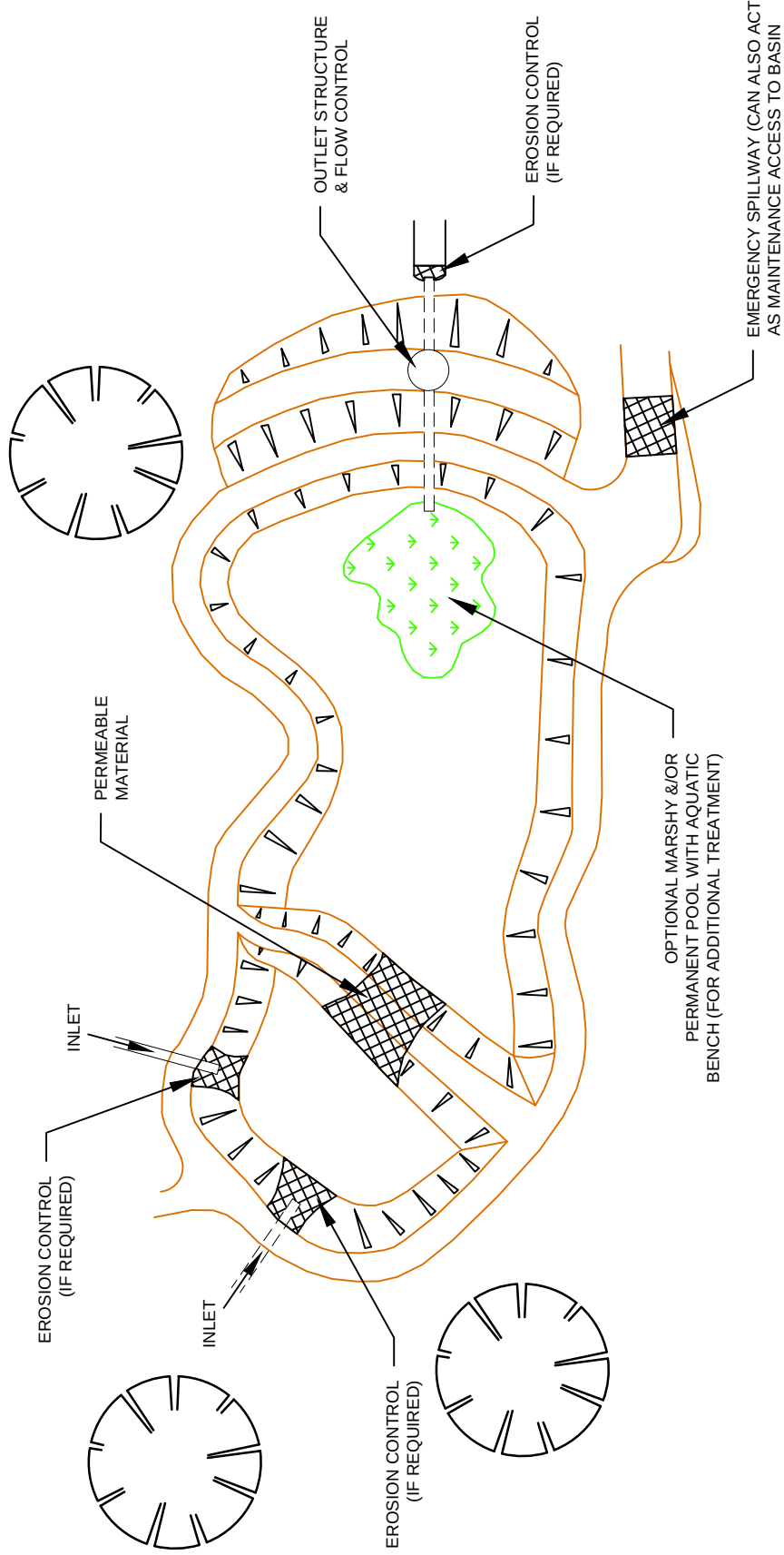
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PROJECT No:		DRAWING No:		REV:
BETTS		105		A

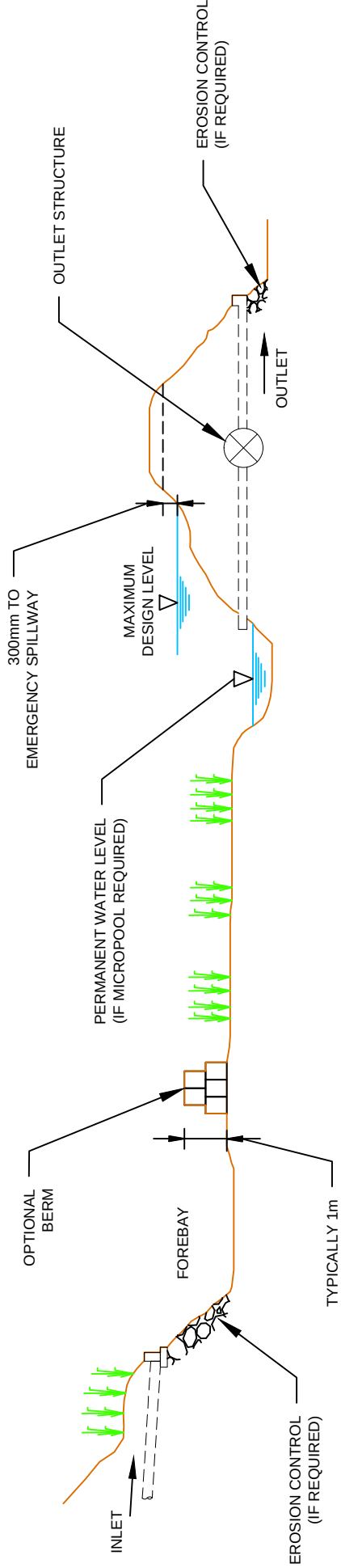
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SCHEMATIC OF DETENTION
BASIN PROFILE



PLAN VIEW



ELEVATION

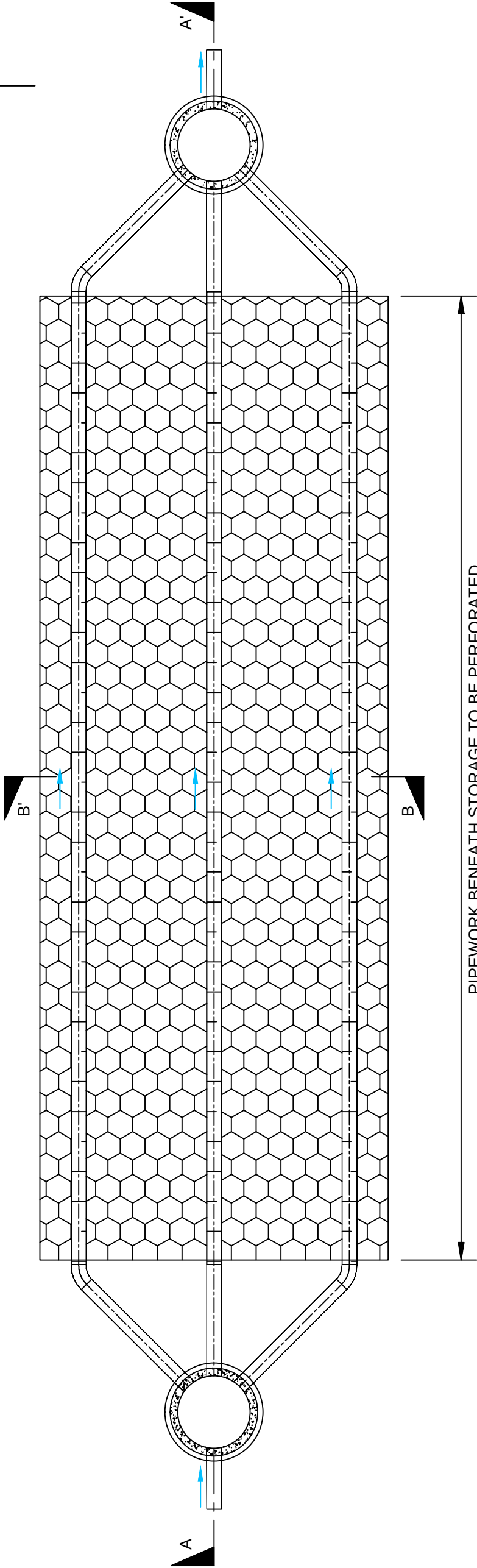
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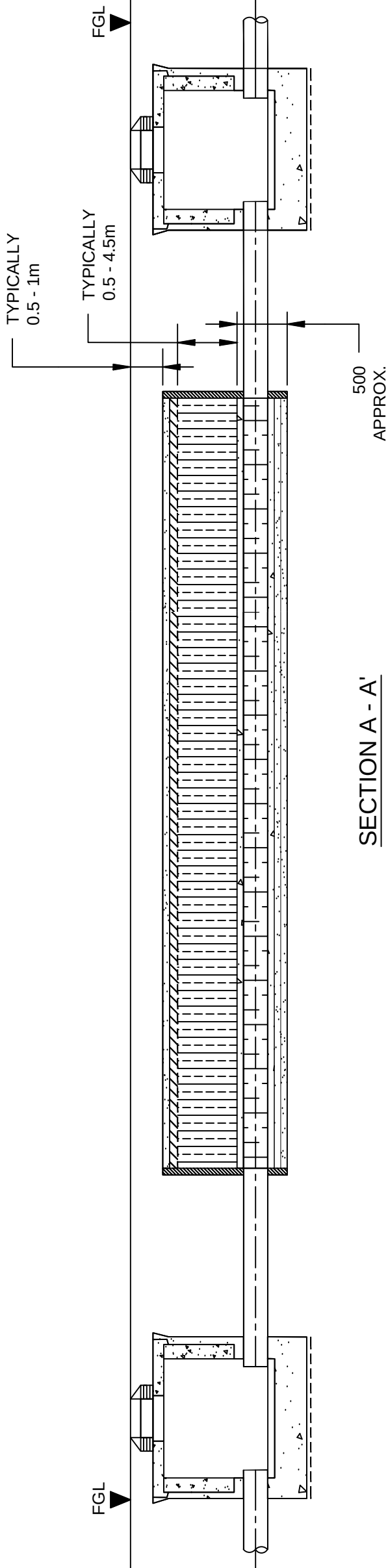
BETTS ASSOCIATES
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Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

PROJECT:	TYPICAL SUDS DETAIL			
TITLE:	DETENTION BASINS			
DATE: SEP 2014	SCALE @ A3	SIZE: CP	DRAWN: RDN	CHECKED: RDN
PROJECT No: BETTS	DRAWING No: 110	REV: A		

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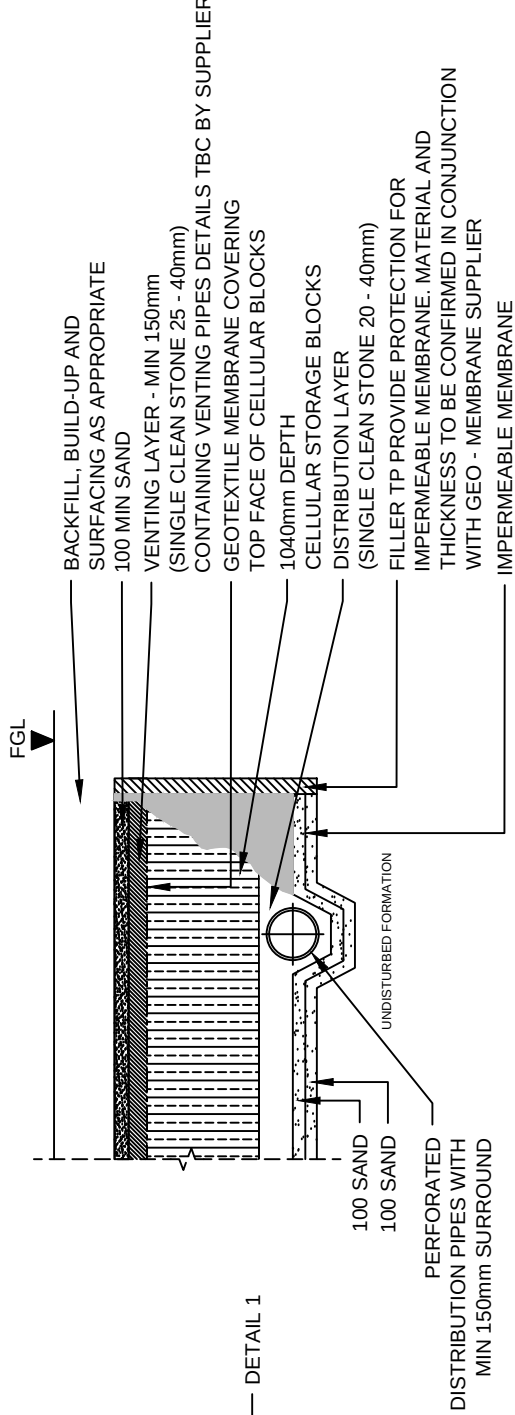
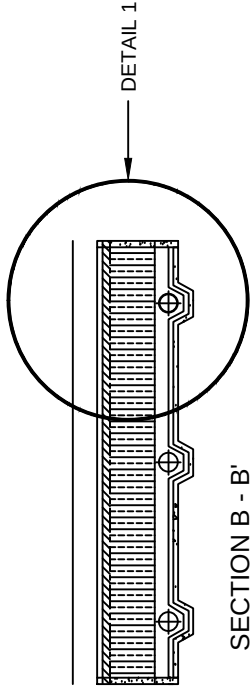


PLAN



SECTION A - A'

ALL DIMENSIONS AND DEPTHS DEPENDENT ON REQUIRED VOLUME AND LOCAL GROUND CONDITIONS



DETAIL 1

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY



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

PROJECT: TYPICAL SUDS DETAIL				
TITLE: CELLULAR STORAGE				
DATE: SEP 2014	SCALE @ SIZE: @ A3	DRAWN: CP	CHECKED: RDN	REV: A
PROJECT No: BETTS		DRAWING No: 113		REV: A

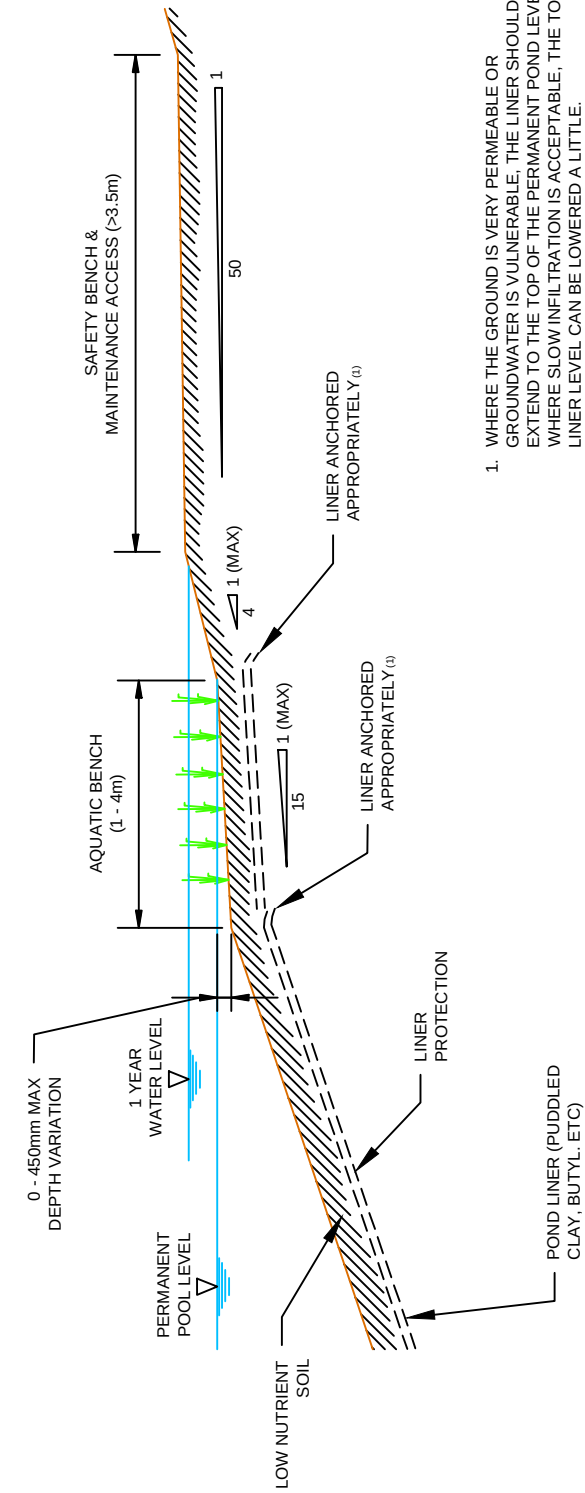
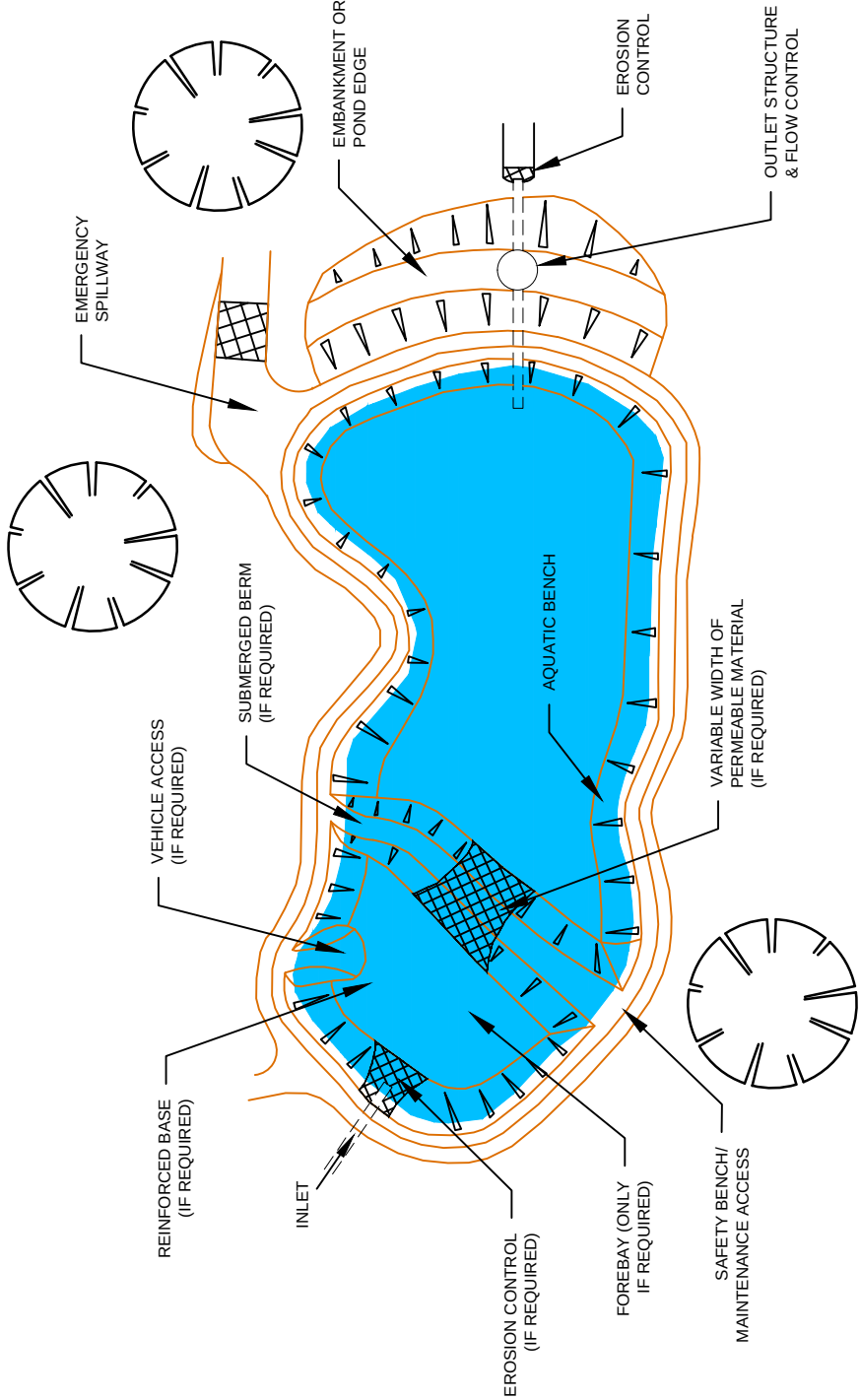
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TITLE: BIORETENTION APPLICATIONS
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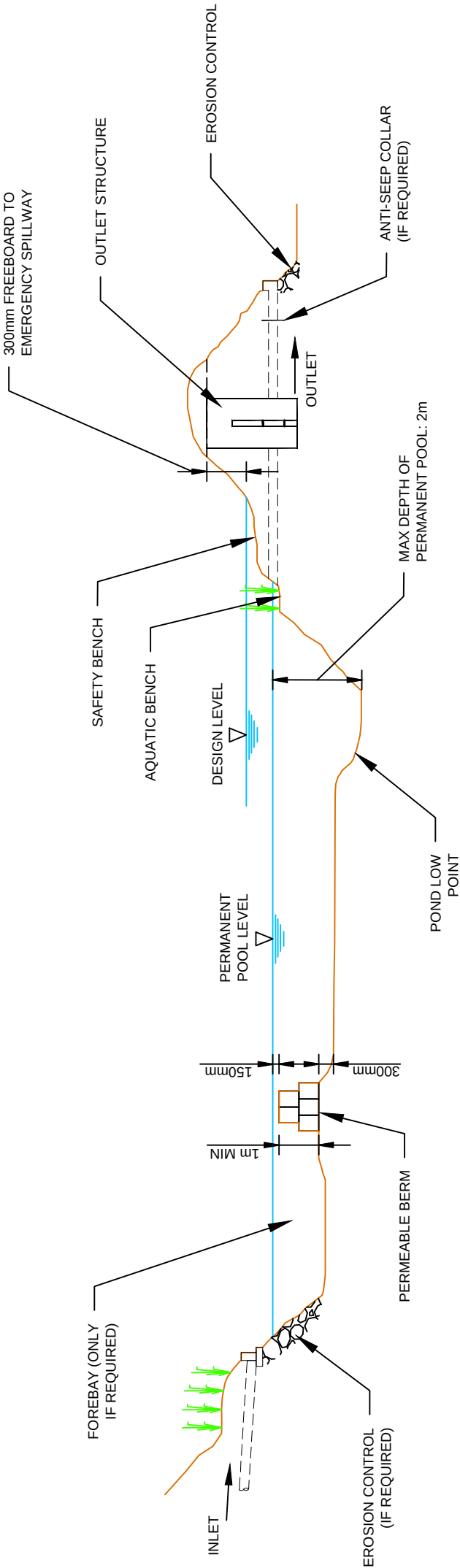
DATE: SEP 2014	SCALE @ SIZE: @ A3	DRAWN: CP	CHECKED: RDN
PROJECT No: BETTS		DRAWING No: 112	REV: A

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TYPICAL POND EDGE GEOMETRY

PLAN VIEW



PROFILE

REV	DATE	BY	DESCRIPTION	CHK
DRAWING STATUS: PRELIMINARY				



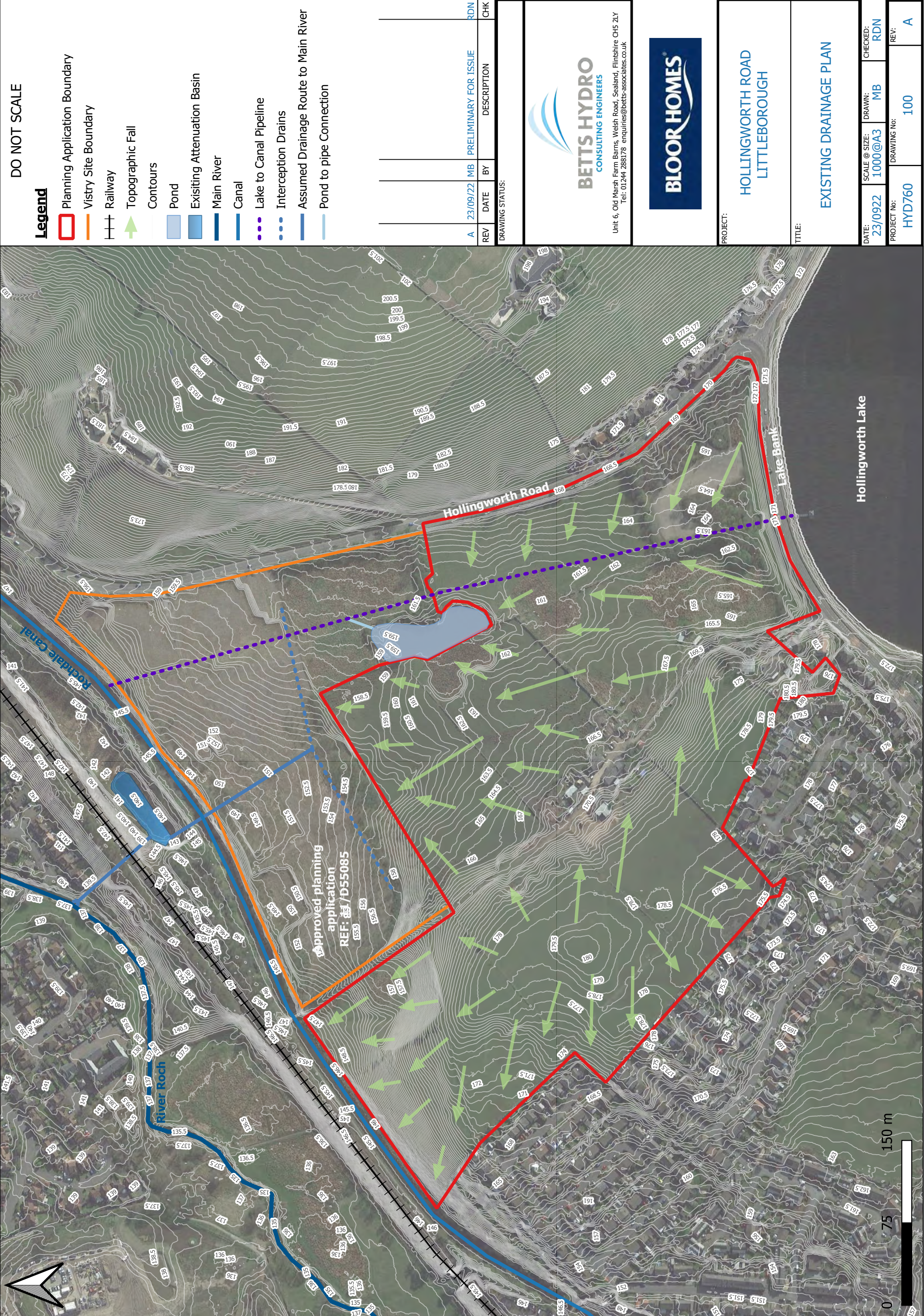
BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Borris, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516
enquiries@betts-associates.co.uk

PROJECT: TYPICAL SUDS DETAIL				
TITLE: WET PONDS				
DATE: SEP 2014	SCALE @ SIZE: @ A3	DRAWN: CP	CHECKED: RDN	REV: A
PROJECT No: BETTS		DRAWING No: 111		REV: A

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APPENDIX M: DRAINAGE PLANS

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Legend

- Planning Application Boundary
- Vistry Site Boundary
- Railway
- Topographic Fall
- Contours
- Pond
- Existing Attenuation Basin
- Main River
- Canal
- Lake to Canal Pipeline
- Interception Drains
- Assumed Drainage Route to Main River
- Pond to pipe Connection

REV	DATE	BY	DESCRIPTION	CHK
A	23/09/22	MB	PRELIMINARY FOR ISSUE	RDN
DRAWING STATUS:				

Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 enquiries@betts-associates.co.uk

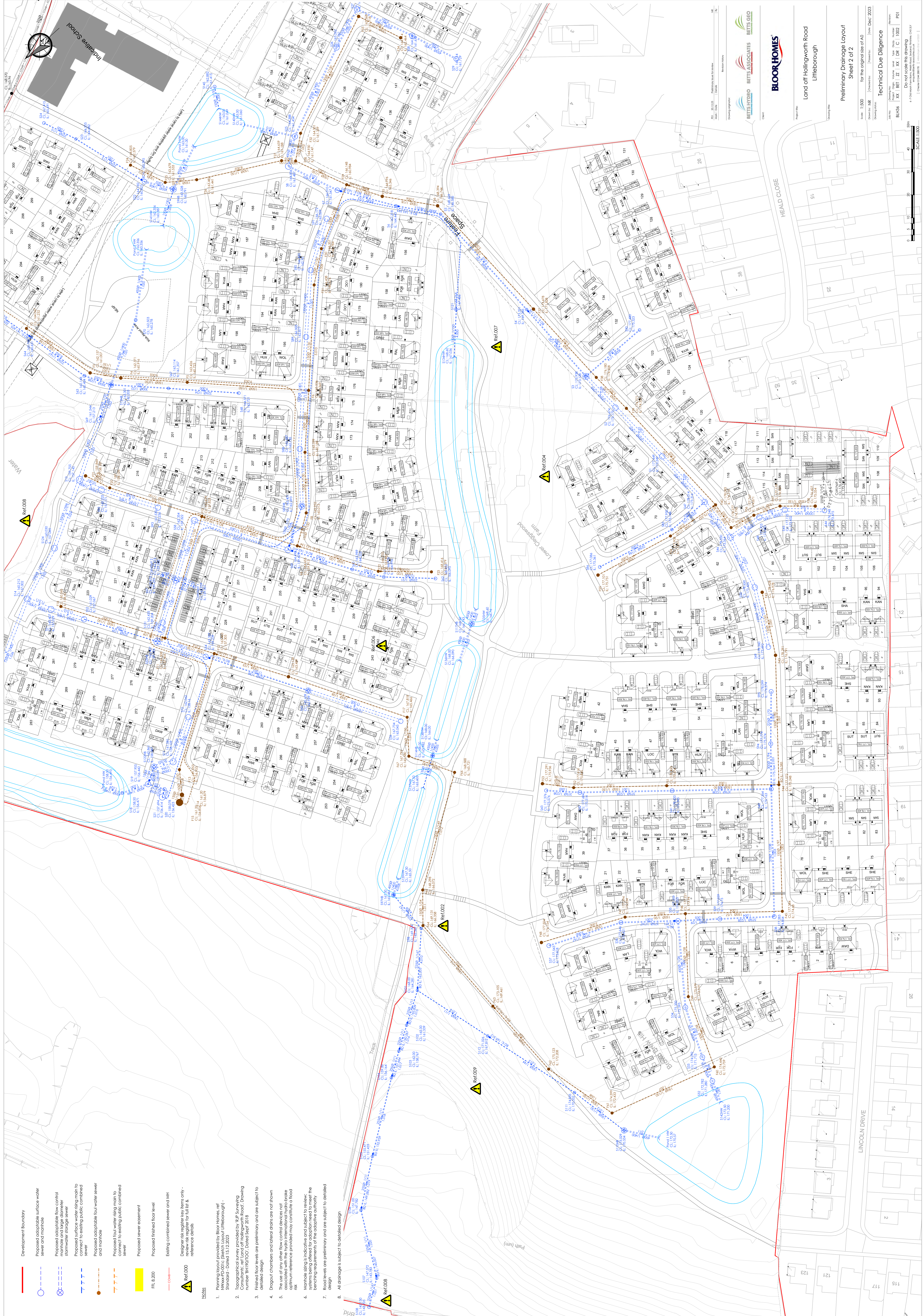
PROJECT:

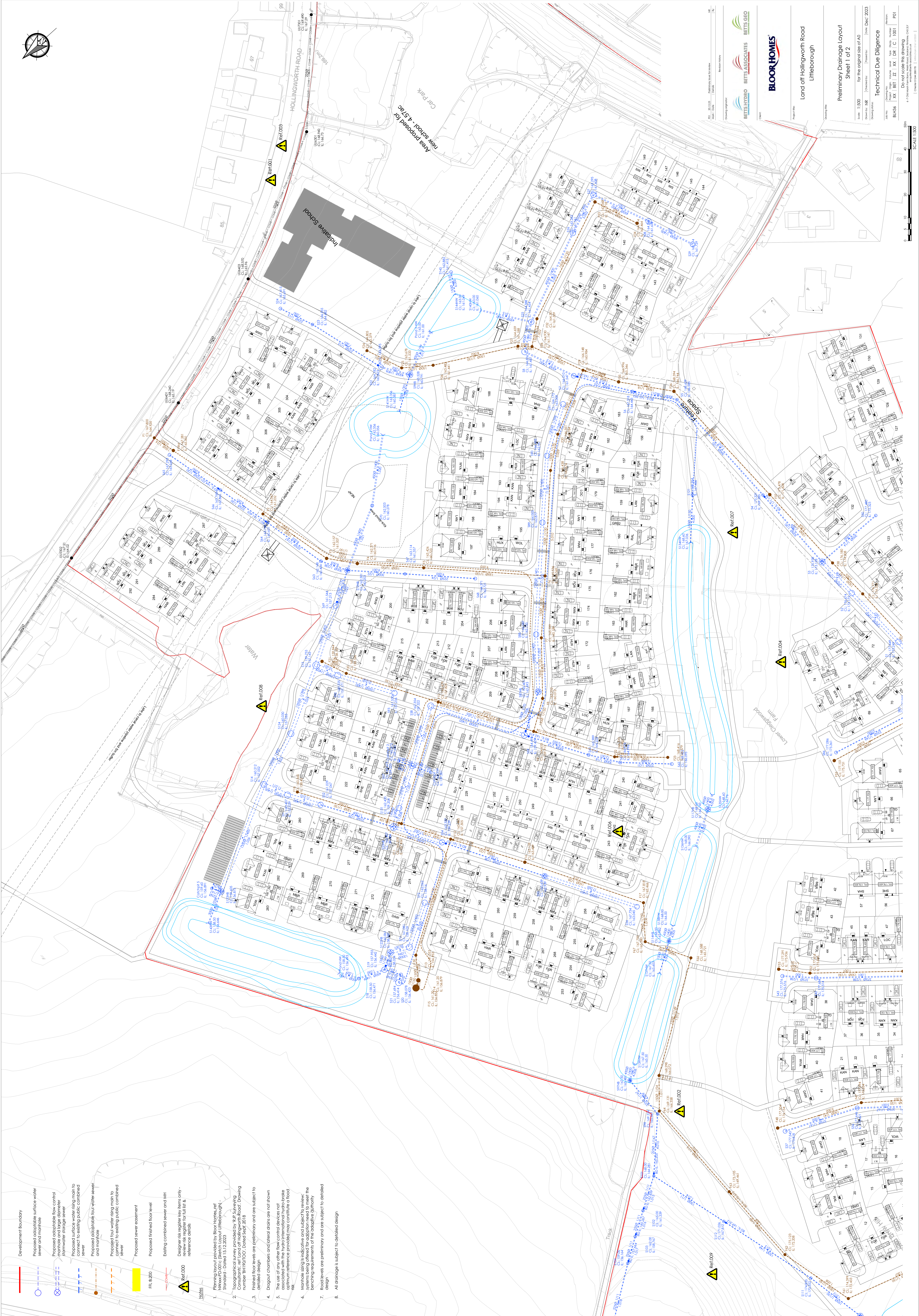
HOLLINGWORTH ROAD
LITTLEBOROUGH

TITLE:

EXISTING DRAINAGE PLAN

DATE:	23/0922	SCALE @ SIZE:	1000@A3	DRAWN:	MB	CHECKED:	RDN
PROJECT No:	HYD760	DRAWING No:	100	REV:	A		





APPENDIX N: STORMWATER STORAGE ESTIMATES

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QUICK STORAGE ESTIMATES

HOLLINGWORTH RD, LITTLEBOROUGH

1 YEAR RETURN PERIOD STORM EVENT

Variables	
FEH Rainfall	Cv (Summer) 0.750
Return Period (years) 2	Cv (Winter) 0.840
Version 2013 Point	Impervious Area (ha) 6.813
Site GB 393275 415468	Maximum Allowable Discharge (l/s) 13.5
	Infiltration Coefficient (m/hr) 0.00000
	Safety Factor 2.0
	Climate Change (%) 0

Results	
Global Variables require approximate storage of between 1792 m ³ and 3747 m ³ .	
These values are estimates only and should not be used for design purposes.	

30 YEAR RETURN PERIOD STORM EVENT

Variables	
FEH Rainfall	Cv (Summer) 0.750
Return Period (years) 30	Cv (Winter) 0.840
Version 2013 Point	Impervious Area (ha) 6.813
Site GB 393275 415468	Maximum Allowable Discharge (l/s) 13.5
	Infiltration Coefficient (m/hr) 0.00000
	Safety Factor 2.0
	Climate Change (%) 0

Results	
Global Variables require approximate storage of between 3895 m ³ and 6925 m ³ .	
These values are estimates only and should not be used for design purposes.	

100 YEAR RETURN PERIOD STORM EVENT + 45% CLIMATE CHANGE

Micro Drainage	
Variables	Variables FEH Rainfall Return Period (years) 100 Version 2013 Point Site GB 393275 415468 Cv (Summer) 0.750 Cv (Winter) 0.840 Impervious Area (ha) 6.813 Maximum Allowable Discharge (l/s) 13.5 Infiltration Coefficient (m/hr) 0.00000 Safety Factor 2.0 Climate Change (%) 45
Results	
Design	
Overview 2D	
Overview 3D	
Vt	

Micro Drainage	
Results	Global Variables require approximate storage of between 9062 m³ and 13675 m³. These values are estimates only and should not be used for design purposes.
Variables	

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APPENDIX O: CATCHMENT HYDROLOGICAL ASSESSMENT

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06th October 2022

Bloor Homes North West
 2 - 4 Whiteside Business Park
 Station Road
 Holmes Chapel
 Cheshire
 CW4 8AA



LAND OFF HOLLINGWORTH ROAD, LITTLEBOROUGH HYDROLOGICAL ASSESSMENT

We have undertaken a hydrological assessment of the site located off Hollingworth Road in Littleborough. The purpose of this exercise is to establish the pre-development hydrological characteristics of the site and to determine any mitigation that might be required to avoid drainage impact that could potentially result from the development proposals.

SITE CONTEXT

The proposed development site is located on land off Hollingworth Road in Littleborough and covers 19.2ha. The Ordnance Survey National Grid Reference (OS NGR) for the site is E:393361, N:415522 and the nearest postcode is OL15 0AE (see Location Plan in Appendix A). The site is bounded to the north by Rochdale Canal and beyond is a railway and the River Roch. To the north-east of site is land that has planning permission for residential development (Ref; 11/D55085) and adjacent to the eastern boundary of site is Hollingworth Road. To the south is Lake Bank (road) with Hollingworth Lake beyond and to the west of site are residential dwellings, as illustrated within Figure 1.

Existing and Historical Land Use

The development site is currently grazed agricultural land with no other historical land-uses being identified during the preparation of this report. The development site currently comprises low-density vegetation and taller shrubs/trees along the site boundaries. There are existing land drainage features such as ponds, located onsite and the Rochdale Canal is located adjacent to the northern boundary.

Topography

A full topographical survey has been carried out and is included in Appendix B. The existing ground levels vary across the site, although there is a general fall from the south-east (179.36mAOD) to the north-west (157.65mAOD).

Site Walkover

A site walkover was undertaken by Betts Hydro in March 2019 and identified that the site is irregular in shape and comprises agricultural grazing land. The eastern third of the site comprises grass with localised areas of reeds and waterlogged ground which increases in frequency as the site topography decreases from Hollingworth Road in the east, as illustrated within Figure 1 (see onsite photographs included within Appendix C).

A track runs through the centre of the site north-south and bisects Lower Cleggs Wood Farm which is located in the centre of the site. The farm comprises a few buildings in various conditions (but generally poor), including a stone farmhouse and outbuildings, timber and steel framed corrugated metal clad outbuildings and sheds. To the north of the farm and to the west of the track a former small earth works/quarry appears to have been used to dispose of general farm waste with plastic sheeting visible at ground surface. The western third of site is covered in grass

Page 1 of 7



Old Marsh Farm Barns
 Welsh Road, Sealand
 Flintshire CH5 2LY
 Telephone: 01244 289 041

and the lack of reeds indicates that this area is better draining, residential housing borders the site to the west, with several roads (future access routes) terminating adjacent to the western boundary including Higher Bank Road and Brown Lodge Drive, as shown in Figure 1.

In the south of the site to the east of the track is a fenced area containing a static caravan and shed type building, to the east of this the land appears to be poorly draining with reeds present. To the south-east is a wooded area which leads into a council owned car park, which sits below the main 'dam' embankment for Hollingworth Lake.



Figure 1: Site Location and Features (Betts Hydro, 2022)

HYDROLOGICAL ASSESSMENT

Geology

The published online datasets of the underlying geology have also been reviewed to identify how favourable the underlying strata is for infiltration and if this would have an impact on the surrounding hydrology. The British Geology Survey (BGS) mapping data indicates the main ground conditions are composed of a bedrock of Pennine Lower Coal Measures Formation with superficial deposits of till, diamicton and sandstone.

The Cranfield Soil and AgriFood Institute (CSAI), Soilscape viewer identifies the soils to be slowly permeable, seasonally wet, acid, loamy and clayey soils. The underlying strata appears to suggest that permeability is low, and the FEH soil factor of 0.4 suggests a low permeability for the area (0.1 is very high and 0.5 is very low permeability). This suggests that the site had a low permeability pre-development and overland flows will occur during periods of prolonged rainfall, which corresponds with observations during the site walkover, as shown in Figure 2.



Figure 2: Photograph showing standing water taken during the walkover (Betts Hydro, 2019)

A ground investigation report undertaken by Betts Geo in 2019 (Ref; 18BLH008/GI) identified the topsoil was made ground comprising soft dark brown very sandy gravel clay. Below the made ground was peat within the area of the historical quarry suggesting the material above was reworked natural material. Soft becoming firm becoming stiff sandy gravelly brown/orange/grey Clay was encountered in the majority of trial pits between the depths of 0.2 and 3.5m+ (depth not encountered in all areas) underlain by weathered Sandstone. Localised bands of sand or

sand and gravel circa 1-2m in depth were encountered some areas within the clay glacial material.

Hydrogeology

High groundwater levels are usually the key source of groundwater flooding, which occurs when excess water emerges at the grounds surface. The EA mapping data for groundwater shows that the site is underlain by a Secondary A Bedrock Aquifer with Secondary (undifferentiated) superficial deposits. The site is also located within a Low Groundwater Vulnerability Zone to a Minor Aquifer.

No historical groundwater flooding of the site has been identified during consultation with the Environment Agency and the LLFA. Review of the councils' Strategic Flood Risk Assessment (SFRA) has not noted any specific flood risk associated with groundwater flooding to the site area.

Hydrology

The nearest Main River to site is the River Roch located 450m to the north of site. The mapping also identified Featherstall Brook (Main River) to be located 500m to the north of site and another Main River as designated by the EA to be located 600m to the south-east of site which is shown to flow through Hollingworth Lake. There are no Ordinary Watercourses located in close proximity to the development site.

Hollingworth Lake (reservoir) is on the southern side of Lake Bank (road) which bounds the site and is elevated in comparison to the majority of the existing ground levels onsite. Review of United Utilities sewer records also identified a LDTM Raw Water Main to cross the site from Hollingworth Lake (adjacent to the southern boundary of site) to the Rochdale Canal, located adjacent to the northern boundary of the site.

There is a pond located adjacent to the north-eastern boundary of the site and was observed during the site walkover; beyond this a 'crown hole' was identified by Betts Geo (Ref; 18BLH008/GI) possibly indicating the collapse of a culvert or drain. The former 'Clough Field Works/Refinery' borders the northeast of the site and is secured by 'heras' type fencing.

From review of the drainage strategy for the adjacent Vistry site (Ref; 11/D55085), the drainage plan for the former Clough Field Works/Refinery and site observations it is currently understood that surface water runs overland from the site north into the Vistry land where it is intercepted by existing slot drains which enter a larger piped network. This network then directs flows under the canal and outfalls into the River Roch, as illustrated in Figure 3 (subsequently).

Supporting photographic evidence and plans have been included within Appendix E. This is further supported by the surface water flood risk mapping which shows areas onsite at high risk from surface water flooding are associated with a naturally low-lying depression acting as a conveyance route through site towards the adjacent Vistry development.



Figure 3: Existing Drainage Plan (Betts Hydro, 2022)

CATCHMENT ANALYSIS

The site has been identified to be located within the catchment area for the River Roch, the FEH point, and catchment data has been obtained for the site via the FEH web service.

The key FEH catchment point data is displayed in Table 1 on the subsequent page.

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Table 1: FEH Catchment Point Data (2022)

Description	Catchment Point Data
SAAR	1205mm
PROPWET	0.57
BFI HOST	0.403

It has however been identified that not all of the site drains into the River Roch, the pre-development catchments for the hydrologically important features have therefore been calculated using a review of the site-specific topographical survey, LiDAR and site observations. From review of the datasets, land adjacent to the northern boundary of site, coloured in yellow in Figure 4, drains via overland run-off into the Rochdale Canal. Areas located adjacent to the Vistry site (coloured in pink in Figure 4) drain into a piped system, which eventually outfalls into the River Roch, as previously discussed.

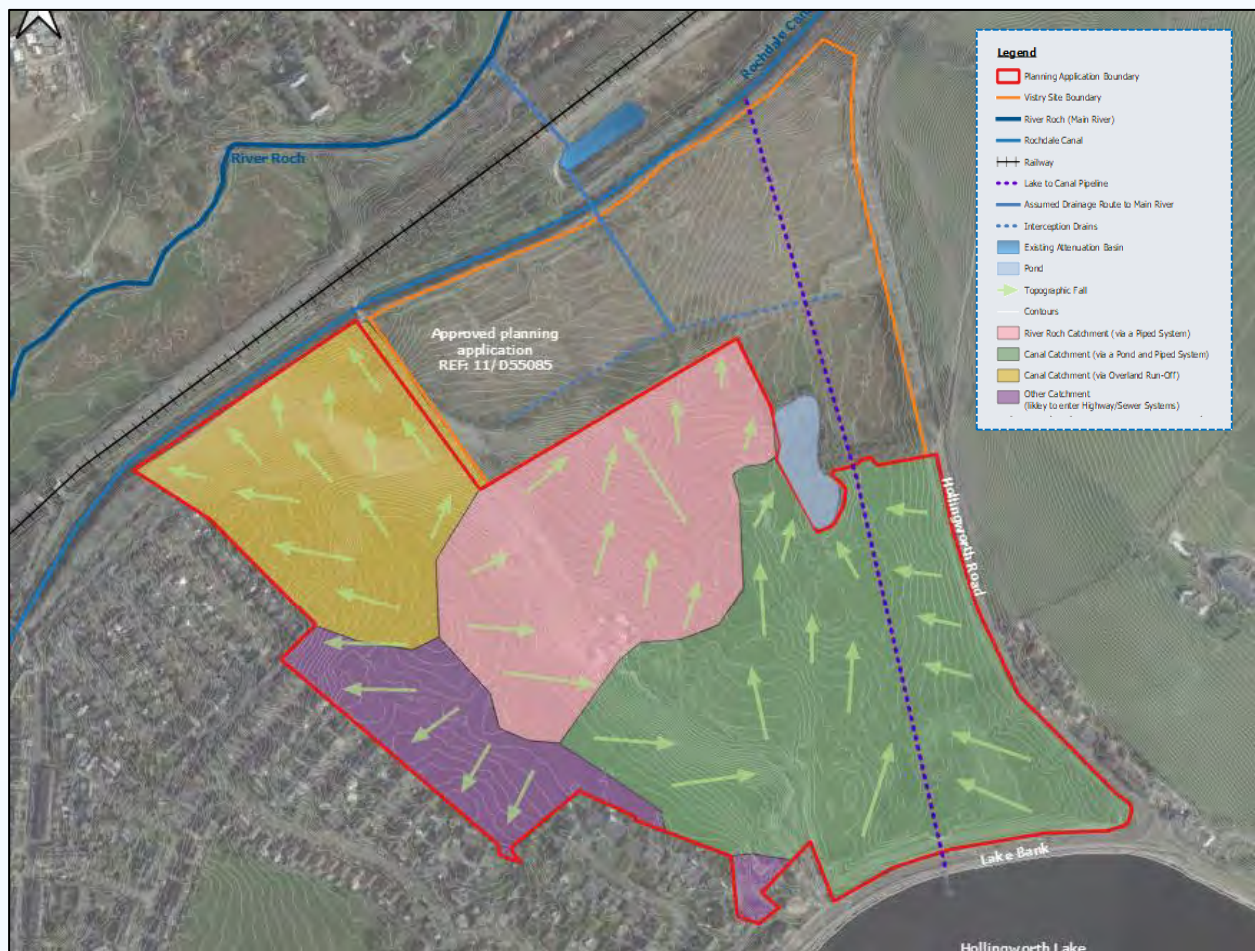


Figure 4: Catchment Analysis Plan (Betts Hydro, 2022)

Land located within the south-east of the site has been identified to drain into the pond located outside of the planning application boundary (coloured in green in Figure 4). This pond may potentially connect into the LDTM Raw Water Main or into the existing drainage network for the adjacent Vistry site, this would need to be confirmed by further drainage investigation. There is also some small areas onsite coloured in purple (Figure 4), which is land that has been identified to fall towards development areas, it is understood that any surface water run-off from these areas would be intercepted by Highway or Sewer Systems.

PROPOSED CHANGES TO HYDROLOGY

Based on the development proposals the impermeable areas onsite will increase to 55% (6.813ha) of the development area (12.388ha). The new positive drainage system proposed to cater for the roads, roofs and areas of hard landscaping will intercept surface water runoff and formally discharge into the adjacent canal at a restricted rate of discharge as agreed in principle with the Canals & Rivers Trust. Any proposed public open space or undeveloped areas will be left to continue to discharge surface water run-off as they currently do so post-development. The proposals mean that there will be no detrimental increase or changes to the current run-off discharging into the downstream canal compared to the existing situation.

SUMMARY

Overall, it has been identified that there are several hydrological features in proximity to site which play an important key factor in the drainage of the existing site. As previously discussed, the proposals are to ensure that the future development proposals on the site consider the existing drainage catchments onsite and propose a sustainable surface water management regime post development.

I trust that the above information has identified that the existing hydrology can be maintained in accordance with policy. If you have any further queries, please do not hesitate to contact us.

Yours sincerely



Megan Berry BSc (Hons) MCIWEM
 Flood Risk Analyst

Attached:

- Appendix A – Location Plan*
- Appendix B – Topographic Survey*
- Appendix C - Site Photographs*
- Appendix D – Drainage Investigations*
- Appendix E – Existing Drainage Plan*
- Appendix F – Catchment Plan and Data*

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APPENDIX A – LOCATION PLAN

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Old Marsh Farm Barns
Welsh Road, Sealand
Flintshire CH5 2LY
Telephone: 01244 289 041

APPENDIX B – TOPOGRAPHIC SURVEY

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