

Chipping Lane, Longridge

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**FLOOD RISK ASSESSMENT  
& SUSTAINABLE DRAINAGE ASSESSMENT**

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For

Barratt Homes  
BDW Trading Limited  
Barratt House, Cartwright Way,  
Forest Business Park, Bardon Hill,  
Coalville,  
Leicestershire,  
LE67 1UF




**March 2016**

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**Chipping Lane, Longridge  
FLOOD RISK ASSESSMENT  
& SUSTAINABLE DRAINAGE ASSESSMENT**


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## EXECUTIVE SUMMARY

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This Flood Risk Assessment (FRA) & Sustainable Drainage Assessment has been prepared for a proposed **residential development** and associated infrastructure located at **Chipping Lane, Longridge**. The site is located within **Flood Zone 1** according to the Environment Agency's (EA's) online flood maps. The National Planning Policy Framework (NPPF) requires a FRA for sites greater than 1 ha. The proposals are 'residential' in nature, classified as 'more vulnerable' in Table 2 within the Technical Guidance to the NPPF. This type of development is appropriate in Flood Zone 1.

This FRA has identified the site to be at **low risk** from all sources of flooding including; fluvial, tidal, pluvial, groundwater, sewer related and flooding from artificial sources. The development is accessible during times of extreme flooding as the site is within Flood Zone 1.

The development proposal was granted outline planning application (N<sup>o</sup> 3/2014/0764) on the 29<sup>th</sup> October 2015. This FRA has built upon the FRA submitted with the application completed by RSK (March 2015, Ref: 880500-R1). The previous FRA proposed that run-off rates will be restricted to QBar. In this report, **QBar** is calculated as **8.3 l/s/ha**. See Appendix C for Hydrological Calculations. Any discrepancy between this QBar and the previous figure is due to refined FEH catchment characteristics being utilised within the ICP SuDS method.

The existing site is classed as greenfield. Surface water runoff from the existing site flows overland in a north-westerly direction before outfalling to a land drainage ditch/ordinary watercourse situated along the northern border. This ditch flows west before outfalling via a 600mm dia pipe to contribute to the Higgin Brook catchment.

The ground investigation report carried out by Soiltechnics (Feb 2016, Ref: STN3505NM-G01) indicates that infiltration is **not viable** at this site.

Surface water will outfall via the existing pathways (i.e. to the on-site ordinary watercourse) at a maximum rate of QBar (l/s). The restriction of runoff rates on increased impermeable areas will create storm water storage volumes. These will be retained on-site for events up to and including the 1 in 100 year event plus an allowance for climate change. Sustainable Drainage Systems (SuDS) could be incorporated into the planning layout which will assist in the reduction of surface water runoff from areas of hardstanding.

The nearest public foul sewers are located within Inglewhite Road to the south-east of the site. The conveyance route of foul flows will be determined during detailed design. A pumped solution will likely be required and early liaisons with UU regarding adoptable pump design are recommended.

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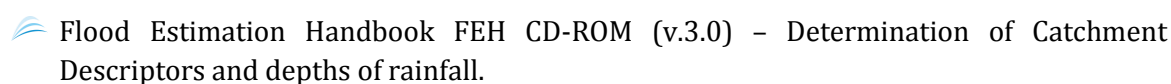
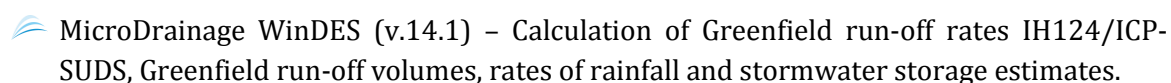
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## Specialist Software

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## Abbreviations & Acronyms

AEP	Annual Exceedance Probability	mAOD	Metres Above Ordnance Datum
BGL	Below Ground Level	NGR	National Grid Reference
BGS	British Geological Survey	NPPF	National Planning Policy Framework
CC	Climate Change	NSRI	National Soil Resources Institute
EA	Environment Agency	OS	Ordnance Survey
FEH	Flood Estimation Handbook	PFRA	Preliminary Flood Risk Assessment
FRA	Flood Risk Assessment	PPS	Planning Policy Statement
FZ	Flood Zone	QSE	Quick Storage Estimate
Ha	Hectare	QBAR	Mean Annual Flood
IDB	Internal Drainage Board	SFRA	Strategic Flood Risk Assessment
LLFA	Lead Local Flood Authority	SuDS	Sustainable Drainage Systems
LPA	Local Planning Authority	UU	United Utilities

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## **1.0 INTRODUCTION**

- 1.1.1 The impact of flooding on the natural and built environment are material planning considerations. The NPPF sets out the Government's objectives for the planning system, 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 NPPF and the supporting Technical Guidance.
- 1.1.2 The NPPF requires a FRA for sites greater than 1 ha. The proposals are 'residential' in nature, classified as 'more vulnerable' in Table 2 within the Technical Guidance to the NPPF. This type of development is appropriate in Flood Zone 1.
- 1.1.3 The development proposal was granted outline planning application (N<sup>o</sup> 3/2014/0764) on the 29<sup>th</sup> October 2015. This FRA has built upon the FRA submitted with the application completed by RSK (March 2015, Ref: 880500-R1).
- 1.1.4 The NPPF advises that the LPA should consult with the EA for advice on flood issues at a strategic level and in relation to planning applications.

## **2.0 EXISTING SITE LOCATION**

### **2.1 Location**

- 2.1.1 The site is located on land off Chipping Lane, Longridge, PR3 2NA. The OS NGR is 360073E, 437980N.
- 2.1.2 The site is surrounded by greenfield land to the north, east and west and by residential areas to the south. Chipping Lane forms the western site boundary.

### **2.2 Existing and Historical Land Use**

- 2.2.1 The site is currently classed as greenfield. No other land uses have been identified as part of this report.

### **2.3 Topography**

- 2.3.1 The site slopes in a north-westerly direction with levels ranging from around 121m AOD near the eastern border to 102m AOD in the north-west.

### 3.0 DEVELOPMENT PROPOSALS

#### 3.1 Nature of the development




3.1.1 The nature of the development is residential and comprises of residential units associated infrastructure. A copy of the development layout for Phase I is included in Appendix A.

### 4.0 SOURCES OF FLOOD RISK

#### 4.1 Fluvial Flood Risk

4.1.1 The flood risk of the site has been assessed using EA online Flood Maps.



-  Flood Zone 1 – Low Risk (<0.1%)
-  Flood Zone 2 – Medium Risk (1% – 0.1% fluvial, 0.5% – 0.1% tidal)
-  Flood Zone 3 – High Risk (>1% fluvial, >0.5% tidal)

**Figure 1:** EA Flood Map for Planning (Rivers and Sea).

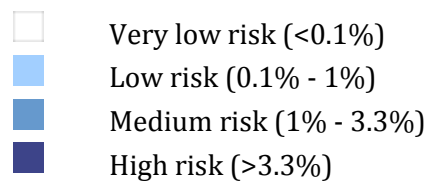
4.1.2 Figure 1 shows that the site is within Flood Zone 1, which would indicate a **low risk** from fluvial flooding.

#### 4.2 Tidal Flooding

4.2.1 As there is no coastline or tidal river near to the site, tidal flood risk is deemed **low**.

### 4.3 Pluvial Flood Risk

- 4.3.1 Pluvial (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.
- 4.3.2 Pluvial flood risk as indicated by the EA map (Figure 2) shows that the site is predominantly at **very low to low** risk.



**Figure 2:** The EA's Indicative Surface Water Flood Risk Map.

- 4.3.3 There are some areas of low to medium risk that appear to follow the direction of overland flow. There is a singular area of medium to high risk located centrally to the site that is indicative of a topographic low point.
- 4.3.4 The development proposals, although increasing the impermeable area of the site, will provide a betterment on the pre-existing scenario in that any exceedance flows for storm events up to and including the 100 year event plus 30% climate change, will be attenuated on-site prior to a restricted outfall.
- 4.3.5 Finished floor levels will be raised at least 150mm above the external levels and external areas of hardstanding will comply with building regulations and divert water away from the proposed dwellings. This will further mitigate pluvial flood risk.
- 4.3.6 Therefore the pluvial flood risk to the development is overall considered to be **low**.

## 4.4 Sewer Related Flood Risk

- 4.4.1 Rainwater is sometimes drained into combined sewers. Foul water flooding can occur in areas prone to overland flow when the sewer is overwhelmed by heavy rainfall and will continue until the water drains away. It can also occur when the sewer becomes blocked or is of inadequate capacity, this could lead to there being a high risk of internal property flooding with contaminated water.
- 4.4.2 United Utilities records indicate that there is a 375mm diameter surface water pipe from the eastern site boundary which cuts through the site before outfalling to Higgin Brook near the centre of the site. A 3m easement will apply from this SWS in accordance with UU guidelines.
- 4.4.3 New sewers will be designed and constructed in accordance with Sewers for Adoption and put up for adoption by United Utilities as part of the detailed design (stc).
- 4.4.4 Flood Risk from sewer related sources is considered to be **low**. See Appendix B for UU sewer records.

## 4.5 Groundwater Flood Risk

- 4.5.1 In general terms groundwater flooding can occur from three main sources: - raised water tables, seepage and percolation and groundwater recovery or rebound.
- ☞ 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.
- 4.5.2 The online BGS maps show that the underlying geology consists of the Bowland Shale Formation, whilst the Soilscales online Map indicates that the soil has impeded drainage. The presence of surface water flood lines in the direction of overland flow in Figure 2 is also indicative of the presence of poorly permeable underlying clay soils.
- 4.5.3 Groundwater flood risk is therefore considered to be **'low'**, this will be further mitigated by the increase in Finished Floor Levels by at least 150mm above existing external levels.

## 4.6 Artificial Sources of Flood Risk

4.6.1 The site is partially at risk of flooding from the 'Dilworth Upper' reservoir, yet the risk designation is yet 'to be determined' according to the EA online maps and information. Reservoir flooding is extremely rare, therefore the flood risk from artificial sources is deemed **low**.

## 4.7 Flood Risk Mitigation Measures & Residual Risks

4.7.1 Finished Floor Levels will be a minimum of 150mm above the external levels (following any re-grade). External levels within proximity will fall away from proposed dwellings in accordance with building regulations.

4.7.2 Surface water run-off rates will be restricted through the use of vortex flow control devices. The increased volume of run-off for storms greater than the 30 year event can be mitigated through the use of SuDS (evapotranspiration/bio-retention/rainwater re-use).

4.7.3 The development is considered accessible during the extreme storm events as the site is within Flood Zone 1.

## 5.0 SURFACE WATER MANAGEMENT

### 5.1 Pre-Development Surface Water Run-off

5.1.1 The previous FRA completed by RSK (March 2015, Ref: 880500-R1) proposed that run-off rates will be restricted to QBar. In this report, QBar is calculated as 8.3 l/s/ha. See Appendix C for Hydrological Calculations. Any discrepancy between this QBar and the previous figure is due to refined FEH catchment characteristics being utilised within the ICP SuDS method.

5.1.2 The pre-development (greenfield) runoff rates are shown in Table 1. The ICP SuDS method was utilised using FEH catchment characteristics.

Storm Event	Greenfield Rate (l/s/ha)
Q1 year	7.2
QBar	8.3
Q30 years	14.0
Q100 years	17.2

**Table 1:** Greenfield Run-off Rates (ICP SuDS)

### 5.2 Post-Development Surface Water Run-off

5.2.1 The impermeable area will increase as a result of the development and increased run-off rates will be restricted to QBar (l/s/ha) thereby providing **significant betterment** to the downstream catchment for all storm events greater than the average annual event.

- 5.2.2 Rates will be restricted through the use of a vortex flow control device. Increased run-off volumes for storms greater than the 30 year event can be reduced through the use of SuDS (evapotranspiration/bio-retention/rainwater reuse).
- 5.2.3 Storm-water storage volumes will be attenuated on-site prior to outfall. Table 2 indicates the estimated volumes of storm-water storage that will be required if flows are restricted to variable discharge rates.
- 5.2.4 The impermeable area is estimated to be 60% of the total site area. This is a conservative estimation that considers gardens, permeable driveways and landscaped areas.

Storm Event	Storage Estimate (m <sup>3</sup> /ha)
Q1 year	32 - 73
QBar (~ 2.3 years)	45 - 96
Q30 years	141 - 249
Q100 years + cc	327 - 507

**Table 2:** Quick Storage Estimates

- 5.2.5 Hydrological Calculations are included within Appendix C. The above figures are estimates only and will be recalculated during detailed design.

### 5.3 Sustainable Drainage Systems (SuDS)

- 5.3.1 In accordance with the NPPF, SuDS should be used wherever possible to manage surface water and reduce the impact on downstream watercourses and sewers.
- 5.3.2 SuDS have the ability to address four core objectives; water quantity, water quality, amenity and biodiversity. With the appropriate system specified, all four core objectives can be satisfied. Where possible, peak surface water discharge rates to watercourses and sewers should be reduced.
- 5.3.3 Preference should always be given to practical SuDS over conventional pipe systems. Opportunities should be taken to provide soft landscaping on site to minimise surface water run-off, improve bio-diversity and increase visual enhancement.
- 5.3.4 The ground investigation report carried out by Soiltechnics (Feb 2016, Ref: STN3505NM-G01) indicates that infiltration is **not viable** at this site.
- 5.3.5 There is potential to utilise SuDS on this site, with large areas of POS provided within the layout at the lowest points of the site. Due to the level gradient of the site, shallow SuDS would be preferable to systems such as deep ponds or detention basins. Suitable SuDS would include the use of swales and bio-retention areas.

- 5.3.7 It is important that SuDS is seen as a multi-use commodity, and that areas that benefit from SuDS, and the additional environmental and aesthetic enhancement they can bring if designed properly, are open to the public.

## 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 detailed below; these may be applied individually or collectively to form a complete strategy. They should be applied in the order of priority listed below.
- 5.4.2 **Discharge via Infiltration** - The ground investigation report carried out by Soiltechnics (Feb 2016, Ref: STN3505NM-G01) indicates that infiltration is **not viable** at this site.
- 5.4.3 **Discharge to Watercourse** – There are several on-site watercourses which the site currently drains to. These are designated ‘ordinary watercourses’ and ordinary watercourse consent should be applied for with Lancashire County Council prior to any on-site works. As the watercourses are not designated as ‘Main River’, a 3-5m easement is considered appropriate.
- 5.4.4 **Discharge to Public Sewer** – Surface water will not outfall to a public sewer.

## 5.5 Climate Change

- 5.5.1 The UK climate is changing significantly will vary greatly by region with more short duration and high intensity rainfall events as well as more periods of long duration rainfall.
- 5.5.2 The NPPF Technical Guidance states that the recommended national precautionary sensitivity ranges for increase of peak rainfall intensity is 30% until 2115. The impact of climate change means there is likely to be a long term increase in average sea levels.
- 5.5.3 An increase in flood water levels means that flooding events will occur more frequently and have a greater impact. Any increase flood risk to the site from climate change is likely to be related to the increase in rainfall intensity and duration.
- 5.5.4 An additional 30% to accommodate climate change will be incorporated into the design of the stormwater storage attenuation.

## 5.6 Foul Water Management

- 5.6.1 The nearest public foul sewers are located within Inglewhite Road to the south-east of the site. The conveyance route of foul flows will be determined during detailed design. A pumped solution will likely be required and early liaisons with UU regarding adoptable pump design are recommended. Sewers will be designed and constructed in accordance with Sewers for Adoption.

## 6.0 SUMMARY

### 6.1 Conclusion and Recommendations

- 6.1.1 This report has been prepared for a development proposal of residential dwellings and associated infrastructure. The site lies within Flood Zone 1. The residential proposals are classified as 'more vulnerable'. This type of development is considered to be appropriate in accordance with the NPPF.
- 6.1.2 The report has indicated that the site is at **low** risk of flooding from fluvial, tidal, sewer related and artificial sources. There is some medium indicative risk of pluvial flooding which will be reduced and mitigated by the implementation of the development proposal. Flood risk to the surrounding area as a result of the development will be significantly reduced due to the restriction of proposed run-off rates to mimic the existing rate for the average annual event (QBar).
- 6.1.3 Attenuation will be provided on-site for storm events up to and including the 1 in 100 year event + 30% climate change.
- 6.1.4 Any residual or unforeseen flood risk to the proposed development will be further mitigated by raising finished floor levels to at least 150mm above external levels. External levels will fall away from dwellings in accordance with Building Regulations.
- 6.1.5 Applications for sewer adoption will be discussed and submitted during detailed design.



## **BIBLIOGRAPHY & REFERENCES**

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CIRIA 523: Sustainable urban drainage systems – best practice manual (2001).  
CIRIA 609: Sustainable drainage systems. Hydraulic, structural and water quality advice (2004).  
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Planning Policy Statement 25: Development and Flood Risk (2006).  
Sewers for Adoption 7th Edition, WRc (2012).  
Technical Guidance to the National Planning Policy Framework, CLG (2012).

### **Web-based References**

- Bingmaps – [www.bing.com/Maps](http://www.bing.com/Maps)  
British Geological Survey – [www.bgs.ac.uk/opengeoscience/home.html](http://www.bgs.ac.uk/opengeoscience/home.html)  
CIRIA – [www.ciria.org](http://www.ciria.org)  
Cranfield University – [www.landis.org.uk/soilscapes](http://www.landis.org.uk/soilscapes)  
Environment Agency – [www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)  
Flood Forum – [www.floodforum.org.uk](http://www.floodforum.org.uk)  
Google Maps – [www.maps.google.co.uk](http://www.maps.google.co.uk)  
Streetmap – [www.streetmap.co.uk](http://www.streetmap.co.uk)

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## Appendix A: Site Plans

<b>Identifier</b>	<b>Descriptor</b>
Betts Associates Ltd	Location Plan
Barratt Homes	Proposed Planning Layout (Phase I)
Betts Associates Ltd	Indicative Drainage Strategy

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## LOCATION PLAN



OS X (Easting) 360073

OS Y (Northing) 437980

Nearest Post Code PR3 2NA

Lat (WGS84) N53:50:12 (53.836529)

Long (WGS84) W2:36:30 (-2.608205)





Lat,Long 53.836529,-2.608205

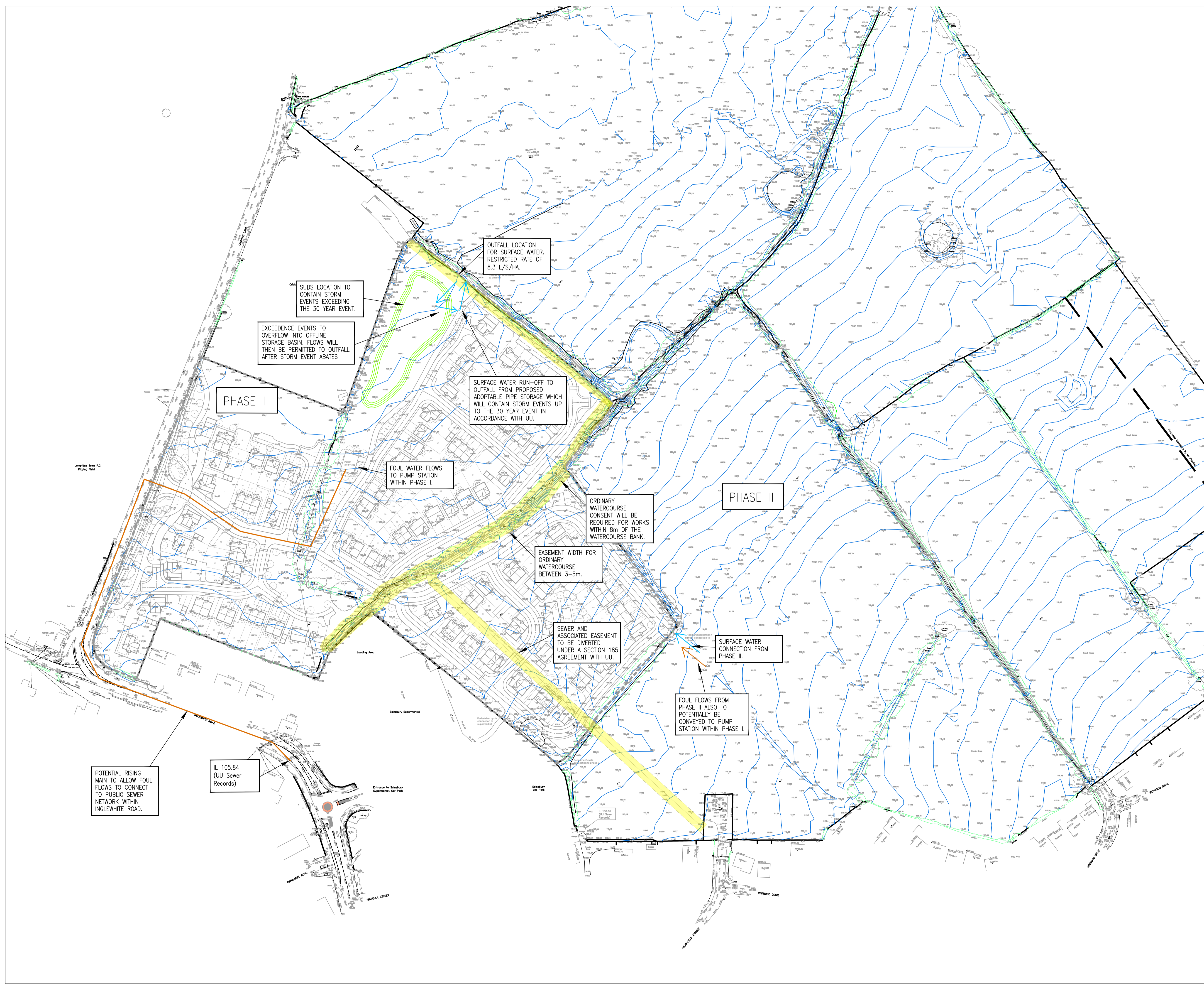
Nat Grid SD600379 / SD6007337980

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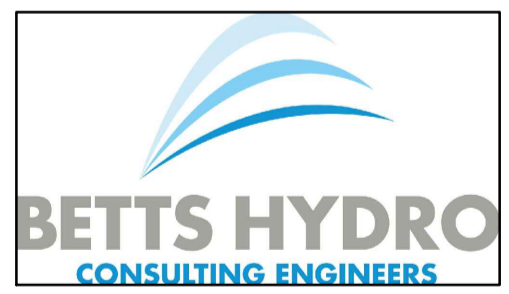
KEY

-  INDICATIVE SURFACE WATER CONVEYANCE ROUTE
-  INDICATIVE FOUL WATER CONVEYANCE ROUTE
-  INDICATIVE SUDS POTENTIAL
-  WATERCOURSE/SEWER EASEMENT



A	03.03.16	HPJ	PRELIMINARY ISSUE FOR REVIEW	RDN
REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: INDICATIVE



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PROJECT: CHIPPING LANE LONGRIDGE

TITLE: INDICATIVE DRAINAGE STRATEGY

DATE: MARCH 16	SCALE & SIZE: 1:1000 @ A1	DRAWN: HPJ	CHECKED: RDN
PROJECT No: HYD068	DRAWING No: 001	REV: A	

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**GENERAL ACCREDITATION**

Category	Item	Value	Unit
TOTAL COST	Construction	1000000	£
	Professional Fees	100000	£
	Marketing	50000	£
	Contingency	50000	£
TOTAL VALUE	Construction	1000000	£
	Professional Fees	100000	£
	Marketing	50000	£
	Contingency	50000	£

**MARKETING FEES**

Category	Item	Value	Unit
TOTAL COST	Construction	1000000	£
	Professional Fees	100000	£
	Marketing	50000	£
	Contingency	50000	£
TOTAL VALUE	Construction	1000000	£
	Professional Fees	100000	£
	Marketing	50000	£
	Contingency	50000	£

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## Appendix B: Sewer Records

<b>Identifier</b>	<b>Descriptor</b>
United Utilities	Sewer Records

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Node	Count	Count	Invert	Cover	Flow	Material	Shape	Length	Cost
5901	124	104	0	CI	VC	8.67			
5902	192	74	375	CI	CO	55.93		27	
5903	118	8	628	CI	CO	48.67			
5904	122	39	101	CI	VC	12.29		46	
5905	118	8	225	CI	VC	86.84		95	
5906	118	8	225	CI	VC	86.84		95	
5907	118	8	225	CI	VC	86.84		95	
5908	118	8	225	CI	VC	86.84		95	
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5915	118	8	225	CI	VC	86.84		95	
5916	118	8	225	CI	VC	86.84		95	
5917	118	8	225	CI	VC	86.84		95	
5918	118	8	225	CI	VC	86.84		95	
5919	118	8	225	CI	VC	86.84		95	
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5923	118	8	225	CI	VC	86.84		95	
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5926	118	8	225	CI	VC	86.84		95	
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5929	118	8	225	CI	VC	86.84		95	
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5957	118	8	225	CI	VC	86.84		95	
5958	118	8	225	CI	VC	86.84		95	
5959	118	8	225	CI	VC	86.84		95	
5960	118	8	225	CI	VC	86.84		95	

### WASTE WATER SYMBOLLOGY

Foot	Surface	Combined	Overflow	Manhole
...	...	...	...	Manhole, Site Entry
...	...	...	...	Main sewer, Public
...	...	...	...	Main sewer, Private
...	...	...	...	Rising Main, Public
...	...	...	...	Rising Main, Private
...	...	...	...	Rising Main, SDA
...	...	...	...	Highway Drain, Private

### LEGEND

MANHOLE FUNCTION	SEWER SHAPE	SEWER MATERIAL
FD Foot	CI Concrete	AC Asbestos Cement
SW Surface Water	TR Trapezoidal	BR Brick
CO Combined	AR Arch	PE Polyethylene
OV Overflow	BA Barrel	RFP Reinforced Plastic Matrix
...	FT Flat Top	CO Concrete
...	RE Rectangular	CSB Concrete Segment Bolted
...	HO Horseshoe	CSU Concrete Segment Unbolted
...	UN Unspecified	GC Concrete Box Culverted
...	...	PSC Plastic/Steel Composite
...	...	GRC Glass Reinforced Concrete
...	...	GRP Glass Reinforced Plastic
...	...	DI Ductile Iron
...	...	PVC Polyvinyl Chloride
...	...	CI Cast Iron
...	...	SI Spun Iron
...	...	ST Steel
...	...	VC Vitred Clay
...	...	PP Polypropylene
...	...	PF Pitch Fibre
...	...	MAC Masonry, Coursed
...	...	MAR Masonry, Random
...	...	LI Unspecified

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 Scale: 1: 1250 Date: 10/11/2015  
 158 Nodes  
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Node	Code	Material	Flow	Flow Direction	Flow Rate	Flow Velocity	Flow Area	Flow Slope	Flow Length	Flow Cost
0901	114	FC	0	0	0	0	0	0	0	0
0902	114	FC	0	0	0	0	0	0	0	0
0903	114	FC	0	0	0	0	0	0	0	0
0904	114	FC	0	0	0	0	0	0	0	0
0905	114	FC	0	0	0	0	0	0	0	0
0906	114	FC	0	0	0	0	0	0	0	0
0907	114	FC	0	0	0	0	0	0	0	0
0908	114	FC	0	0	0	0	0	0	0	0
0909	114	FC	0	0	0	0	0	0	0	0
0910	114	FC	0	0	0	0	0	0	0	0
0911	114	FC	0	0	0	0	0	0	0	0
0912	114	FC	0	0	0	0	0	0	0	0
0913	114	FC	0	0	0	0	0	0	0	0
0914	114	FC	0	0	0	0	0	0	0	0
0915	114	FC	0	0	0	0	0	0	0	0
0916	114	FC	0	0	0	0	0	0	0	0
0917	114	FC	0	0	0	0	0	0	0	0
0918	114	FC	0	0	0	0	0	0	0	0
0919	114	FC	0	0	0	0	0	0	0	0
0920	114	FC	0	0	0	0	0	0	0	0
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0925	114	FC	0	0	0	0	0	0	0	0
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0928	114	FC	0	0	0	0	0	0	0	0
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0990	114	FC	0	0	0	0	0	0	0	0
0991	114	FC	0	0	0	0	0	0	0	0
0992	114	FC	0	0	0	0	0	0	0	0
0993	114	FC	0	0	0	0	0	0	0	0
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0995	114	FC	0	0	0	0	0	0	0	0
0996	114	FC	0	0	0	0	0	0	0	0
0997	114	FC	0	0	0	0	0	0	0	0
0998	114	FC	0	0	0	0	0	0	0	0
0999	114	FC	0	0	0	0	0	0	0	0
1000	114	FC	0	0	0	0	0	0	0	0

### WASTE WATER SYMBOLOLOGY

**Flow** Surface Combined Overflow

**Manhole** Manhole, Side Entry Manhole w/c, Public Manhole w/c, Private Rising Main, Public Rising Main, Private Rising Main, SS14 Highway Drain, Private

**Flow Meter** Head of System Hydrant / Vortex

**Flow Meter** Inspection Chamber Bifurcation Checkgate Contaminated Surface Water WW Pumping Station Sludge Pumping Station Sewer Overflow T Junction/Saddle Lampshade Odourtrap Penstock Pump Roddingeye Soakaway Summit Valve Valve Chamber Washout Chamber Dropshaft WW Treatment Works Septic Tank Vent Column Network Storage Tank Orifice Plate Vortex Chamber Penstock Chamber Windmill

**Flow Meter** Control Kiosk Unspecified

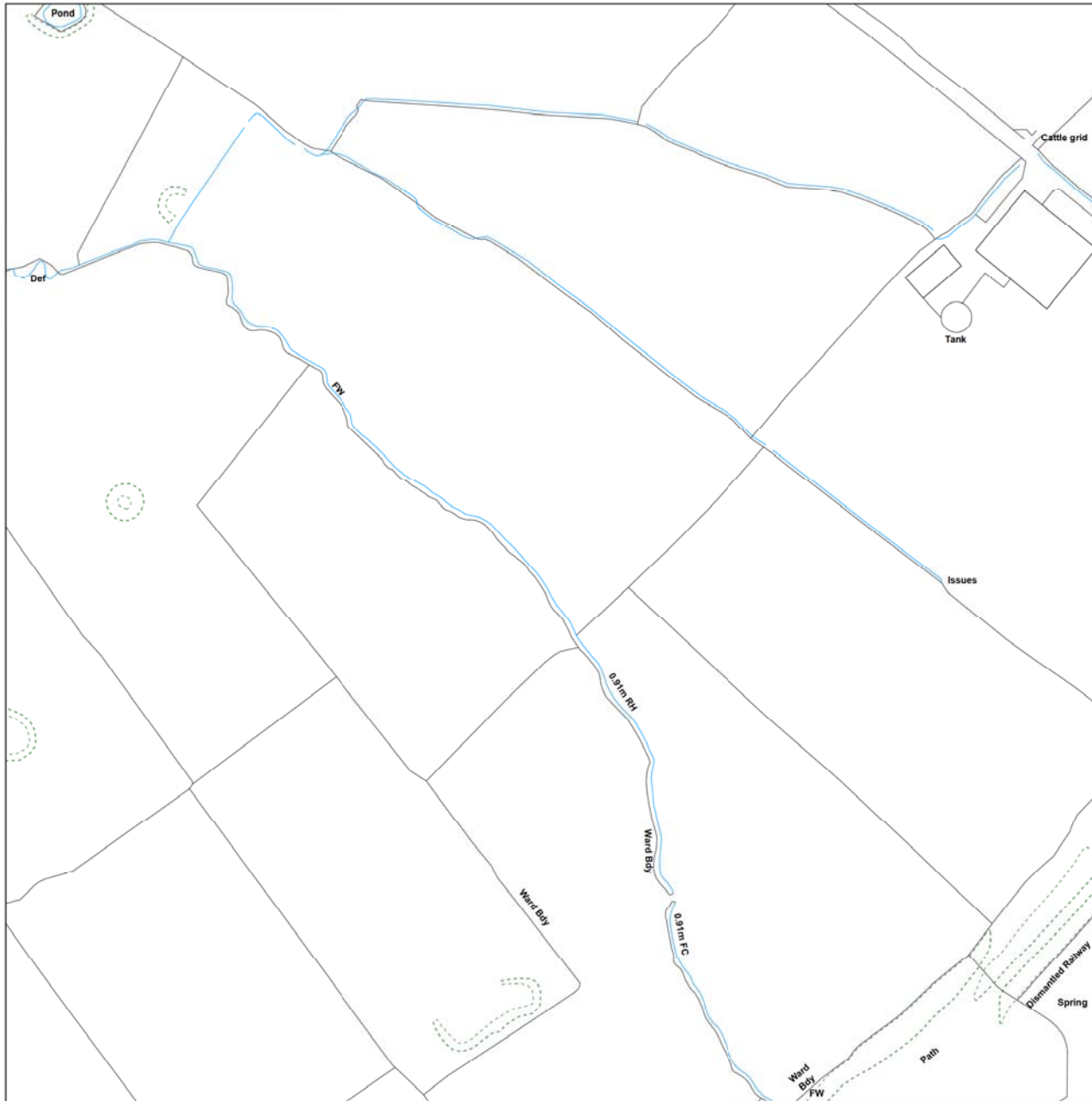
**ABANDONED PIPE** Mainsewer Rising Main Highway Drain Sludge Main

**MANHOLE FUNCTION** FD Flow SW Surface Water CO Combined OV Overflow

**SEWER SHAPE** CI Circular TR Trapezoidal EO Oval AR Arch OV Oval BA Barrel FT Flat Top HO Horseshoe RE Rectangular UN Unspecified

**SEWER MATERIAL** AC Asbestos Cement DI Ductile Iron BR Brick PVC Polyvinyl Chloride PE Polyethylene CI Cast Iron RPP Reinforced Plastic Matrix SI Spun Iron CO Concrete ST Steel CSB Concrete Segment Bolted VC Vitrified Clay CSU Concrete Segment Unbolted PP Polypropylene CC Concrete Box Culverted PF Pitch Fibre PSC Plastic/Steel Composite MAC Masonry, Coursed GRC Glass Reinforced Concrete MAR Masonry, Random GRP Glass Reinforced Plastic UN Unspecified

The position of underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private pipes, sewers or drains may not be recorded. United Utilities will not accept any liability for any damage caused by the actual positions being different from those shown. United Utilities Water Limited 2014. This plan is based upon the Ordnance Survey Map with the sanction of the Controller of H.M. Stationery Office. Crown and United Utilities copyrights are reserved. Unauthorised reproduction will infringe these copyrights.



Ratio: Cover Face Invert Box x Invert (Shape) Material Length Code Ratio: Cover Face Invert Box x Invert (Shape) Material Length Code

### WASTE WATER SYMBOLLOGY

#### LEGEND

**MANHOLE FUNCTION**

FD	Foul
SW	Surface Water
CO	Combined
OV	Overflow

**SEWER SHAPE**

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
RD	Round		

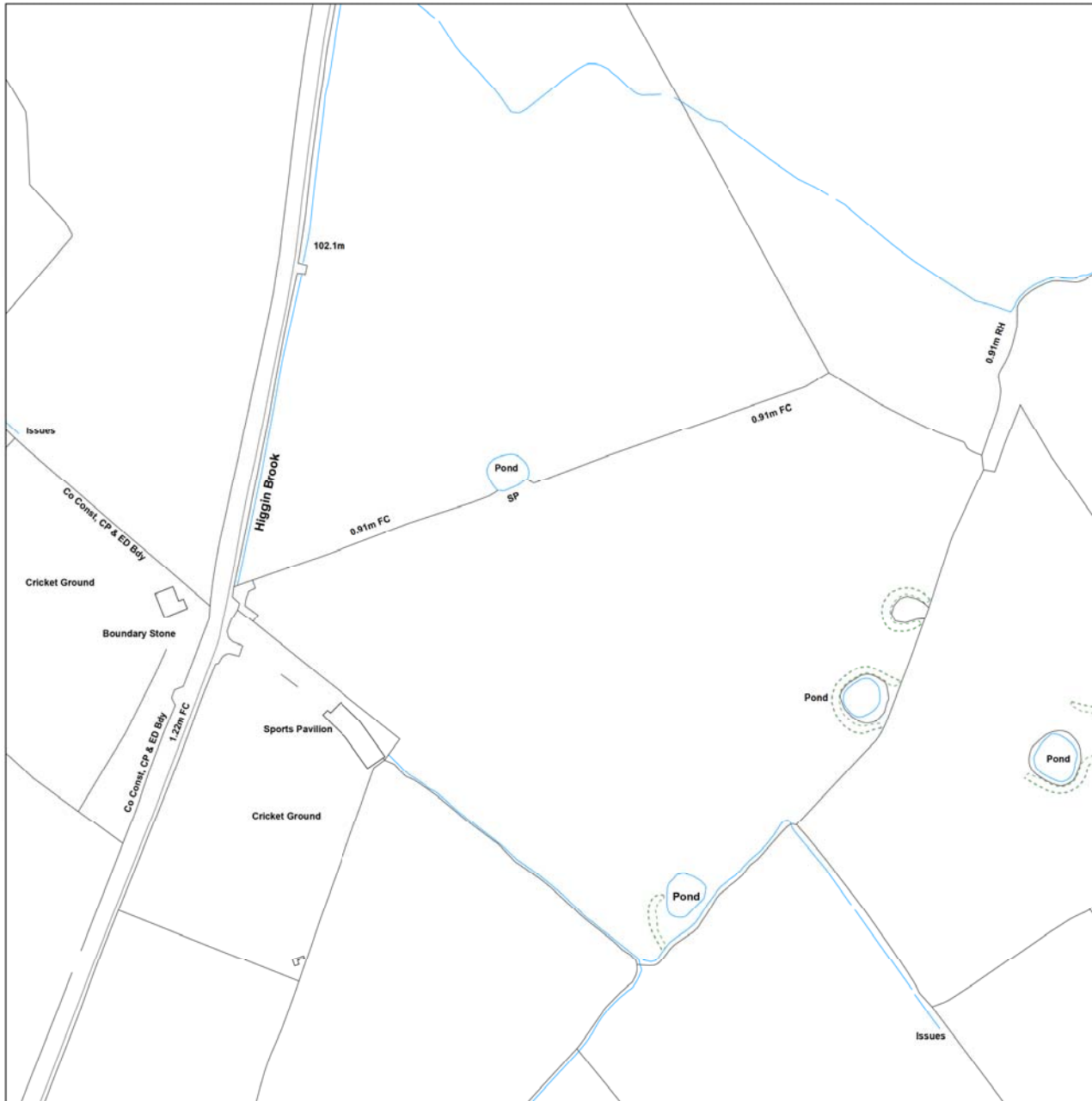
**SEWER MATERIAL**

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RFP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vertifit Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GFP	Glass Reinforced Plastic	U	Unspecified

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OS Sheet No: SD6038SE  
 Scale: 1: 1250 Date: 10/11/2015  
 0 Nodes  
 Sheet 1 of 1





OS Sheet No: SD6038SW

Scale: 1: 1250 Date: 10/11/2015

Printed By: Property Searches

Ratio: Cover Face Invert Box x Inlet (Shape) Fall Length Code Ratio: Cover Face Invert Box x Inlet (Shape) Fall Length Code

**WASTE WATER SYMBOLLOGY**


**LEGEND**

<b>MANHOLE FUNCTION</b>	
FD	Foul
SW	Surface Water
CO	Combined
OV	Overflow
<b>SEWER SHAPE</b>	
CI	Circle
EG	Egg
OV	Oval
FT	Flat Top
RE	Rectangular
HO	HorseShoe
UN	Unspecified
<b>SEWER MATERIAL</b>	
AC	Asbestos Cement
BR	Brick
PE	Polyethylene
RP	Reinforced Plastic Matrix
CO	Concrete
CSB	Concrete Segment Bolted
CSU	Concrete Segment Unbolted
CC	Concrete Box Culverted
PSC	Plastic/Steel Composite
GRC	Glass Reinforced Concrete
GRP	Glass Reinforced Plastic
DI	Ductile Iron
PVC	Polyvinyl Chloride
CI	Cast Iron
SI	Spun Iron
ST	Steel
VC	Vitified Clay
PP	Polypropylene
PF	Pitch Fibre
MAC	Masonry, Coursed
MAR	Masonry, Random
U	Unspecified

The position of underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private pipes, sewers or drains may not be recorded. United Utilities will not accept any liability for any damage caused by the actual positions being different from those shown. United Utilities Water Limited 2014. This plan is based upon the Ordnance Survey Map with the sanction of the Controller of H.M. Stationery Office. Crown and United Utilities copyrights are reserved. Unauthorised reproduction will infringe these copyrights.

OS Sheet No: SD6038SW  
 Scale: 1: 1250 Date: 10/11/2015  
 0 Nodes  
 Sheet 1 of 1





## Appendix C: Hydrological Calculations

<b>Identifier</b>	<b>Descriptor</b>
Betts Associates Ltd	ICP SuDS Greenfield Runoff Rates
Betts Associates Ltd	FEH Catchment Characteristics

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Old Marsh Farm Barns  
Welsh Road  
Sealand Flintshire CH5 2LY



Date 03/03/2016 10:24  
File

Designed by heatherjones  
Checked by

Micro Drainage Source Control 2014.1.1

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	1.000	Urban	0.000
SAAR (mm)	1200	Region Number	Region 10

**Results 1/s**

QBAR Rural	8.3
QBAR Urban	8.3

Q1 year 7.2

Q1 year	7.2
Q30 years	14.0
Q100 years	17.2

VERSION	FEH CD-RO Version	3 exported at	16:20:35 GMT	Mon	08-Feb-16
CATCHMEN GB	360150	438450	SD 60150	38450	
AREA	0.52				
ALTBAR	115				
ASPBAR	325				
ASPVAR	0.65				
BFIHOST	0.417				
DPLBAR	0.77				
DPSBAR	22.3				
FARL	1				
LDP	1.58				
PROPWET	0.51				
RMED-1H	10.5				
RMED-1D	39.7				
RMED-2D	51.6				
SAAR	1200				
SAAR4170	1137				
SPRHOST	35.03				
URBCONC1	0.964				
URBEXT19C	0.1643				
URBLOC19C	1.515				
C	-0.025				
D1	0.40671				
D2	0.33211				
D3	0.41529				
E	0.29629				
F	2.45864				
C(1 km)	-0.025				
D1(1 km)	0.404				
D2(1 km)	0.33				
D3(1 km)	0.417				
E(1 km)	0.296				
F(1 km)	2.453				

## **Appendix D: 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.

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