



**CHURCH COMMISSIONERS
FOR ENGLAND**

**PROPOSED RESIDENTIAL
DEVELOPMENT AT
LAND SOUTH OF DARTON
LANE, DARTON, STAINCROSS**

**FLOOD RISK ASSESSMENT
AND DRAINAGE STRATEGY**

Travis Baker Ltd
Trinity Point
New Road
Halesowen
West Midlands
B63 3HY

Tel: 0121 550 8037
Fax: 0121 550 8047

info@travisbaker.co.uk
www.travisbaker.co.uk



DOCUMENT CONTROL

Project title: Land South of Darton Lane, Darton, Staincross

Document type: Flood Risk Assessment

Job number: 16081

Date	Revision	Comments	
18/8/16		Draft Issue	
		Prepared by	Checked by
	Name	Ted Wake	Rob Travis
Date	Revision	Comments	
13/9/16	A	Final Issue	
		Prepared by	Checked by
		Ted Wake	Rob Travis
Date	Revision	Comments	
12/06/19	B	Flood Risk Assessment updated to suit revised Drainage Strategy to include Pre-Development Enquiry response from Yorkshire Water	
		Prepared by	Checked by
		James Cross	Rob Travis
Date	Revision	Comments	
24/06/19	C	Wording amended to suit client comments.	
		Prepared by	Checked by
		James Cross	Rob Travis
Date	Revision	Comments	
09/09/2019	D	Section 2.4.1 and 5.4.5 amended.	
		Prepared by	Checked by
		James Cross	Rob Travis
Date	Revision	Comments	
13/09/2019	E	Wording amended to suit client comments	
		Prepared by	Checked by
		James Cross	Rob Travis

This document has been prepared by Travis Baker Limited for the exclusive use by the commissioning party in accordance with the terms and conditions of the contract between Travis Baker Limited and the commissioning party. No other party may use, make use or rely on the contents of this report without the prior written consent of Travis Baker Limited. No liability is accepted by Travis Baker Limited for any use of this report other than for the purpose for which it was originally prepared. This document may contain and rely on information provided by Third Parties; no verification of such information has been undertaken and Travis Baker Limited accept no responsibility for any inaccuracies within such information. No part of this report may be copied or reproduced by any means without written permission from Travis Baker Limited.

The consultant's liability to the client arising out of or in connection with this document whether under the law of contract in tort (including negligence), in equity, or under statute or otherwise shall be limited to the fee paid for the preparation of this document. The consultant shall not be liable to the client in respect of any consequential or indirect loss or damage. The consultant shall be deemed to have been discharged from all liability in respect of this document whether under contract, in tort (including negligence), under statute or otherwise, on the expiration of 1 year from the completion of this document.

CONTENTS

1.0	INTRODUCTION	1
1.1	Commission	1
1.2	Background	1
1.3	Flood Risk Assessment Methodology	1
1.4	Aims and Objectives	2
1.5	Sources of Information	2
1.6	Consultees	2
2.0	SITE SETTING	3
2.1	Site Description	3
2.2	Topography	3
2.3	Local Drainage Features	3
2.4	Proposed Development	3
3.0	FLOOD RISK PLANNING POLICY	5
3.1	National Planning Policy Framework (NPPF)	5
3.2	Sequential Test and Exceptional Test	6
4.0	FLOOD RISK – TO DEVELOPMENT	7
4.1	Fluvial Flood Risk	7
4.2	Tidal Flood Risk	7
4.3	Pluvial Flood Risk	7
4.4	Groundwater Flood Risk	8
4.5	Flood Risk from Artificial Sources	8
4.6	Flood Risk from Sewers	9
4.7	Summary	10
5.0	FLOOD RISK – FROM DEVELOPMENT	11
5.1	Current Policy	11
5.2	Climate change	11

5.3	Existing Surface Water Runoff	11
5.4	Proposed Surface Water Management Principles	12
5.5	Proposed Foul Drainage	13
6.0	RESIDUAL RISK	14
6.1	Assessment of Flooding Consequences	14
6.2	Access and Egress	14
7.0	CONCLUSIONS	15
7.1	Flood Risk – To Development	15
7.2	Flood Risk – From the Development	15
7.3	Flood Mitigation Measures	15
7.4	Residual Risk – Flood Consequences	15
	Appendix I – Topographic Survey	16
	Appendix II – BGS Borehole Log	17
	Appendix III – Rural Run-off Calculation	19
	Appendix IV – MicroDrainage Flood Storage Estimates	20
	Appendix V – Surface Water Drainage Strategy	21
	Appendix VI – Stakeholder Correspondence	22
	Appendix VII – Yorkshire Water Pre-Planning Sewerage Enquiry	23
	Appendix VIII – Yorkshire Water Sewer Records	24

1.0 INTRODUCTION

1.1 Commission

1.1.1 Travis Baker Limited have been commissioned by the Church Commissioners for England, to prepare a Flood Risk Assessment (FRA) to be submitted with an outline planning application for the proposed development of Land South of Darton Lane, Darton, Staincross.

1.2 Background

1.2.1 The proposal is for the construction of up to 73 new residential dwellings plus associated roads and infrastructure.

1.2.2 In accordance with current Environment Agency guidelines, an FRA must be undertaken for all sites over one hectare, located within in flood zone 1 and any site located in flood zone 2 or greater. The FRA must demonstrate the development will be safe for its proposed lifetime. A suitable FRA will also consider the risk of flooding from sources other than fluvial or tidal, and make an assessment of the potential of the proposed development to increase flooding elsewhere through changes in the generation and management of surface water.

1.2.3 This document is based on the best available and most up to date flood risk information provided by the Government. The Governments Flood Zone Map, an extract of which is reproduced in Figure 2, shows the site to be located in Flood Zone 1.

1.2.4 Areas located within Flood Zone 1 are classified as 'low risk' of flooding from fluvial or tidal sources, and have an associated annual probability of flooding of less than 0.1% (1 in 1000) in any year.

1.3 Flood Risk Assessment Methodology

1.3.1 The aim of an FRA is to assess the risks of all forms of flooding to and from a development. The Environment Agency emphasises the need for a risk-based approach to be adopted by Local Planning Authorities through the application of the Source-Pathway-Receptor model. Travis Baker's approach to a flood risk assessment is based on the Source-Pathway-Receptor model.

1.3.2 The Source-Pathway-Receptor model firstly identifies the causes or 'sources' of flooding to and from a development. The identification is based on a review of local conditions and consideration of the effects of climate change. The nature and likely extent of flooding arising from any one source is considered, e.g. whether such flooding is likely to be localised or widespread.

1.3.3 The presence of a flood source does not always imply a risk. The exposure pathway or 'flooding mechanism' determines the risk to the receptor and the effective consequence of exposure. For example, the presence of a sewer does not necessarily increase the risk of flooding unless the sewer is local to the site and ground levels encourage surcharged water to accumulate.

1.3.4 The varying effect of flooding on the 'receptors' depends largely on the sensitivity of the target. Receptors include any people or buildings within the range of the flood source, which are connected to the source by a pathway.

1.3.5 In order for there to be a flood risk all the elements of the model must be present. Furthermore, effective mitigation can be provided by removing one element of the model, for example by removing the pathway or receptor.

1.3.6 A desk-based review of available information has been undertaken to establish the likely flooding sources and mechanisms for the site. Once the flood risk has been established, mitigation measures are proposed (where necessary) and residual risks explained.

1.4 Aims and Objectives

The aims and objectives of this FRA are as follows:

- Collect and review existing flood risk data including topographical data, surface water drainage strategy, public sewerage records, ground investigation report, scheme proposals and any relevant Strategic Flood Risk Assessments;
- Assess and interpret available information to identify potential sources of flood risk including groundwater, sewers, surface water and infrastructure failure;
- Summarise the proposed surface water drainage strategy to demonstrate that surface water from the site can be managed in a sustainable manner, including appropriate allowances for climate change;
- Provide recommendations for appropriate flood risk mitigation measures (where applicable);
- Produce an FRA to accompany the planning application for the proposed development.

1.5 Sources of Information

1.5.1 The following information has been used to inform the flood study:

- Land Surveys Topographical Survey 7816/1
- Government Flood mapping data
- Barnsley Metropolitan Borough Council Preliminary Flood Risk Assessment
- BGS National Geoscience Data Centre collection of onshore boreholes.
- Yorkshire Water Sewer Records
- Yorkshire Water Pre-Planning Sewerage Enquiry

1.6 Consultees

Organisations consulted during the preparation of this report have included:

- Wastewater Services - Yorkshire Water Ltd

2.0 SITE SETTING

2.1 Site Description

2.1.1 The site is accessed off Darton Lane to the north of the site. The site is approximately 3.7ha in size and is currently vacant pasture land. It is partially bounded by the embankment of the former North Gawber Colliery Railway to the south of the study site.

2.1.2 The site location plan below identifies the site in context with its surrounding.

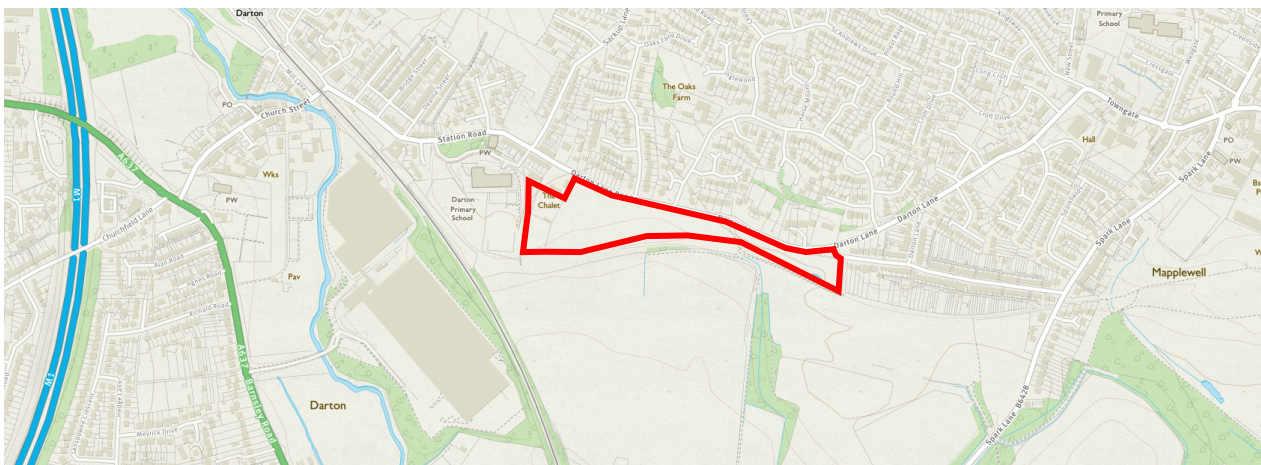


Figure 1 - Site Location Plan

2.2 Topography

2.2.1 A site specific topographical survey has been undertaken and is included within Appendix I of the report. The site has significant falls across it, generally falling from north to south, with the lowest ground level at the southern boundary opposite Oaks Farm Drive.

2.3 Local Drainage Features

2.3.1 The site has an informal ditch course at the low point with an outfall to an existing culvert draining south beneath the former railway embankment to an open watercourse to the south.

2.3.2 There are two informal ponds at the sites south eastern boundary, formed by existing topography with no identifiable inlets or outlets.

2.3.3 Inspection chamber covers located across the site indicate the presence of below ground drainage infrastructure traversing the site.

2.4 Proposed Development

2.4.1 The proposal is for the construction of up to 73 new residential dwellings. The scheme involves formation of a new access off Darton Lane and new access roads and footways to serve the new properties. The estate roads will be constructed to adoptable standards and shall be designed not to increase the flood risk to the development to the existing highway network. Proposed external levels will be designed to ensure that existing low-lying areas will be removed. The proposed attenuation basin will



Church Commissioners for England
Land South of Darton Lane, Darton, Staincross

be sufficiently sized to cater for the 100 year + 40% climate change storm event. The storm water drainage will out fall to the south of the site so no additional storm water volume will out fall to the existing sewers located within Darton Lane.

3.0 FLOOD RISK PLANNING POLICY

3.1 National Planning Policy Framework (NPPF)

3.1.1 The NPPF sets out the government's national planning policy for consideration of aspects of flood risk for new developments. To support the NPPF, a technical guidance document has also been published to ensure the NPPF is effectively implemented.

3.1.2 The technical guidance document classifies different forms of development into higher or lower levels of vulnerability depending on the perceived consequences of being flooded. Policy outlines the types of development that may be permitted in areas of differing levels of flood risk. Details of the vulnerability classification for different types of development are listed below.

Vulnerability Classification	Development Type
Essential Infrastructure	Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly Vulnerable	Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "essential infrastructure")
More Vulnerable	Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in "more vulnerable", and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water Compatible	Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves. • Navigation facilities. • Ministry of Defence defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

3.2 Sequential Test and Exceptional Test

3.2.1 The Sequential Test is designed to steer new development to areas with the lowest probability of flooding. The exercise compares the Flood Zone of the development area (as discussed in Section 1) against the vulnerability classification of the type of development.

3.2.2 The vulnerability classifications previously outlined indicates that the development type can be classified as 'More Vulnerable'.

3.2.3 The following table summarises the types of development that can be considered appropriate for any given Flood Zone.

	Vulnerability Classification	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	x	Exception Test required	✓
	Zone 3b	Exception Test required	✓	x	x	x

- ✓ Appropriate development
- x Development should not be permitted

3.2.4 As the site is classed as More Vulnerable and located within Flood Zone 1 it can be considered as appropriate for development. Therefore the requirement to undertake the Sequential Test and Exceptional Test need not apply.

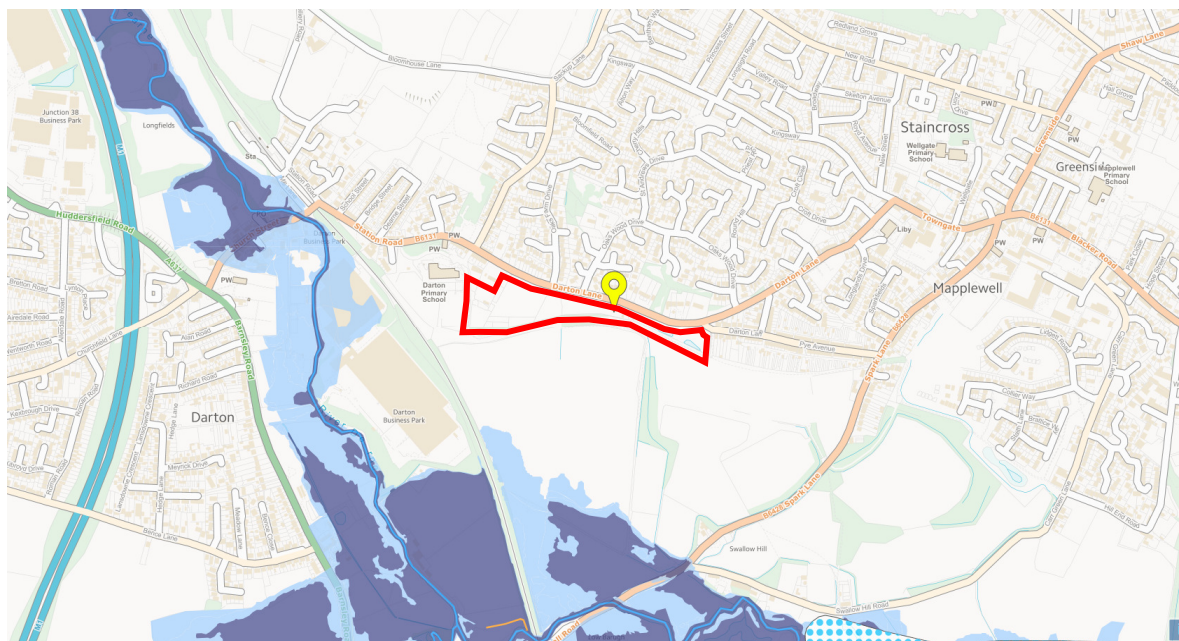


Figure 2 - Flood Zone Map

4.0 FLOOD RISK – TO DEVELOPMENT

4.1 Fluvial Flood Risk

4.1.1 Current guidance requires that all potential sources of flooding that could affect the proposed development are considered. The current Government's Flood Zone Map for the site, provided as Figure 2 within the report, indicates that the site lies within Flood Zone 1. The definitions of each zone are outlined in table 4-1.

Table 4-1: Flood Zone Definitions

Flood Zone Definitions		
Flood Zone 1	Low Probability – less than 1 in 1000 annual probability of river or coastal flooding	Appropriate for all land uses
Flood Zone 2	Medium Probability – between 1 in 100 and 1 in 1000 annual probability of river flooding or 1 in 200 and 1 in 1000 annual probability of coastal flooding	Essential infrastructure and the water-compatible, less vulnerable and more vulnerable uses are appropriate in this zone. The highly vulnerable uses are only appropriate in this zone if the Exception Test is passed.
Flood Zone 3a	High Probability – having a greater than 1 in 100 year annual probability of river flooding or 1 in 200 year probability of coastal flooding.	The water-compatible and less vulnerable uses of land are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone. The more vulnerable uses and essential infrastructure should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.
Flood Zone 3b	Functional Floodplain - having a greater than 1 in 20 year annual probability of river flooding or 1 in 200 year probability of coastal flooding	Only the water-compatible uses and essential infrastructure that has to be there should be permitted in this zone. It 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. Essential infrastructure in this zone should pass the Exception Test.

4.1.2 As the site has probability of annual flooding from fluvial sources of less than 1 in 1000 or 0.1%. The site can be considered to be at a very low risk.

4.2 Tidal Flood Risk

4.2.1 As the site is not coastal or in a low lying area, the risks of tidal flooding have been discounted for the purposes of this assessment.

4.3 Pluvial Flood Risk

4.3.1 In assessing the flood risk to development site, consideration shall be given to the risk of flooding from overland run-off in the event that the local drainage networks capacity is exceeded.

4.3.2 Figure 3 below indicates the perceived risk to the site based on pluvial flood map data obtained from the Government. The extract indicates the presence of an overland flood route that follow the natural topography of the existing ground within the development site. Surface water flood routes appear to be partially impounded by the embankment of the former railway at the southern boundary of the site.

The pluvial flood risk is considered to be moderate and will need some consideration in the drainage strategy for the development.



Figure 3 - Extract from Government's Surface Water Flood Maps

4.4 Groundwater Flood Risk

4.4.1 Sites susceptible to flooding from groundwater after prolonged or intensive bouts of rain are likely to be in low lying areas, overly aquifers or on steeply sloped sites prone to groundwater seepage.

4.4.2 Barnsley Metropolitan Borough Council's Preliminary Flood Risk Assessment assessed the current flood risk based on the Areas Susceptible to Ground Water Flooding (AStGWF) dataset supplied by the Environment Agency. The council has no other local information which provides evidence of future groundwater flood risk. The site is not overlying chalk deposits which might be considered susceptible to fluctuations in groundwater levels and is therefore not considered to be at risk.

4.4.3 The risk of groundwater flooding is considered to be low, however some consideration of groundwater should be made in the development drainage strategy wherever retaining structures or property basements are proposed.

4.5 Flood Risk from Artificial Sources

4.5.1 Artificial flood sources included raised channels such as canals or storage features such as ponds and reservoirs. Flood Data obtained from the Government indicate that the River Dearne to the west of the site is at risk in the event of a catastrophic fault of the Bretton Park Lakes upstream.

4.5.2 However, there is no risk to the development site, which is located approximately 10m above the River Dearne.



Figure 4 - Extract from Government's Reservoir Flood Maps

4.5.3 Flood data for reservoir breaches is prepared by the Government and indicates the worst case flood extent in the case of catastrophic failure although reservoirs are well maintained and breaches are extremely rare. Given the above, the risk of flooding from reservoirs is considered to be extremely low.

4.6 Flood Risk from Sewers

4.6.1 Barnsley Metropolitan Borough Council SFRA includes details of approximate location of recorded sewer flooding incidents taken from Yorkshire Water's DG5 register. The locations indicated make no distinction between surface or foul flood incidents or whether flooding was as a consequence of failures of insufficient capacity.

4.6.2 There are no recorded incidents within 3km of the study site. Therefore, the risk of flooding from sewers can be considered to be low.

4.6.3 Modern drainage systems are designed to accommodate the 1 in 30 year annual probability storm event, therefore in any storms greater than this sewers can be expected to surcharge. However, older sewer systems were not subject to these design standards (introduced by Sewers for Adoption) and the risk of flooding from such systems is difficult to quantify.

4.6.4 There are existing Yorkshire Water (YW) assets located within the site. Any proposal that require cover levels to the existing sewers to be reduced has the potential to increase that flood risk from sewers and should not be undertaken without the approval of the water company. Details of the local sewerage and highway drainage infrastructure is shown on the sewer records which are included in the Appendix VII.

4.7 Summary

The table below summarises the potential risk to the development from sources outside of the site prior to any mitigation measures.

Potential Sources of Flooding	Flood Risk				Description
	Low	Moderate	High	None	
Fluvial	x				Located in FZ 1
Tidal				x	Inland site
Pluvial		x			Overland routes near or through the site
Groundwater	x				Not recorded at shallow depths
Artificial Sources				x	No risk to the site
Sewers	x				No DG5 properties near the site.

5.0 FLOOD RISK – FROM DEVELOPMENT

5.1 Current Policy

5.1.1 Current Policy states that as well as assessing the risk to a development, a suitable flood risk assessment should consider the risk of flooding arising from a development.

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

5.2 Climate change

5.2.1 The design of the storm water system will need to take into account the anticipated increase in rainfall intensity as well as the piped drainage system. In accordance with the table below, design flows have been increased by 40% to accommodate the anticipated effects of climate change. Provision is therefore made to manage the risk of climate change in accordance with current government guidance.

5.2.2 Table 5-1: Recommended precautionary sensitivity ranges for peak rainfall intensities in small and urban catchments.

Allowance Category	2015to 2039	2040 to 2069	2070 to 2155
Upper End	+10%	+20%	+40%
Central	+5%	+10%	+20%

5.3 Existing Surface Water Runoff

5.3.1 As described previously, the site has significant falls with run-off directed toward the natural low point of the site and its outfall to the existing culvert. The site is currently undeveloped and will generate flows comparable to greenfield rates.

5.3.2 YW sewer records indicate existing combined and surface water sewers traversing the site. It is believed the existing public sewers will have easements associated that will need to be respected by the development proposals.

5.3.3 Existing ponds located at the south east corner of the development site are understood to be generated by existing topography only, perching locally collected surface run-off which spills to existing culvert some 8m below. No inlets or outlets have been identified from these features.

5.4 Proposed Surface Water Management Principles

5.4.1 New surface water drainage provision will need to be made for all new dwellings and the associated highway infrastructure and under the requirements of the Building Regulations, disposal of surface water run-off by means of ground infiltration shall be investigated as a primary means of disposal before any outfall to a watercourse or sewer shall be considered.

5.4.2 BGS Borehole data obtained under Open Government License for a nearby location indicates underlying mudstone bedrock, indicating that ground infiltration is unlikely to be viable. Any in-situ soil testing undertaken at the site shall be make an assessment of the soil porosity to confirm this assumption.

5.4.3 The drainage strategy for the site proposes to integrate sustainable drainage features with traditional drainage systems for buildings and roads which will drain to a new attenuation basin. Controlled outfalls will discharge to the existing culvert.

5.4.4 Although the greenfield run-off rate for the development equates to 3.4l/s, the development will be restricted to 5l/s. The reasoning for this is that the flow control devise requires a minimum opening size of 100mm. A flow rate of 5l/s gives an opening size of 103mm in accordance with Sewers for Adoption 6th Edition Section C4 – Flow Attenuation for Surface Water Systems sub-section 3B.

5.4.5 As ponding occurs in some low-lying areas of the current land, proposed external levels will be designed to ensure that these low-lying areas will be removed and that the attenuation basin will be sufficiently sized to cater for the developments flood storage needs.

5.4.6 The table above indicates the estimated attenuation volumes required for a site outfall with a rate restricted to the QBAR, 1 year and 100 year (plus climate change) equivalent. Any detailed proposal that stages out flow rates to the 1, 30 and 100 year equivalents shall demonstrate that the development includes sufficient long term storage to ensure that run-off volumes do not increase the flood risk to the surrounding area. Details of the estimated attenuation volumes are detailed on the Drainage Strategy included as Appendix VI of this report.

5.4.7 Sewers serving multiple properties are to be offered for adoption by Yorkshire Water subject to their design and construction to water company standards. It is not current policy for adoption of the attenuation pond to be accepted by either Yorkshire Water or the local authority. Therefore suitable arrangements will need to be in place to ensure the long term maintenance of SUDS features, such as a private management company.

5.4.8 Surface levels shall be designed to ensure that run-off is not directed toward properties or off site in the event that the drainage system fails or its design capacity is exceeded. Low points or depressions shall ensure that the flood volumes generated by critical storm events for the 1 in 100 year return period, plus climate change allowance shall be retained on site and not impose a flood risk to any property.

5.4.9 The detailed master planning process for the development shall consider the existing pluvial overland flood flow routes identified across the site. The natural flow path shall be maintained as a 'green corridor' to ensure that any overland flows do not put properties at risk or enter the development drainage system. Finished surface levels shall be designed to ensure the overland flow path does not adversely affect any open attenuation features and the available storage capacity within it.

5.4.10 Detailed Drainage proposals shall demonstrate that two forms of water quality treatment are proposed for run-off collected from external pavements and at least one form of water quality treatment is proposed for run-off collected from roofs.

5.5 Proposed Foul Drainage

5.5.1 Preliminary study of the existing topography indicates that the site can drain to the existing combined sewer traversing the site by means of gravity.

5.5.2 YW should be consulted to confirm the available capacity within the existing network, prior to commencement of any detailed design proposals for the development. A copy of YW's sewer records are included within Appendix VII of the report.

6.0 RESIDUAL RISK

The need to manage residual risks is identified within current guidance. Residual risks are the risks to the proposed development should the existing and/or proposed flood mitigation measures fail to perform as intended. Examples of residual flood risk include:

- The failure of flood management infrastructure such as a breach of a raised flood defence, blockage of a surface water conveyance system, failure of a flap-valve, overtopping of an upstream storage area, or failure of a pumped drainage system;
- A severe flood event that exceeds a flood management design standard.

6.1 Assessment of Flooding Consequences

6.1.1 It is considered that the measures described in Section 5.4 provide adequate protection against flooding. In the unlikely event that an extreme rainfall event exceeds the capacity of the rainwater collection systems, ground modelling will ensure that overland flows are directed away from the buildings. Wherever applicable, external levels shall generally be 150mm lower than finish floor levels at ground floor.

6.1.2 Although risk of groundwater flooding is considered to be low, some consideration of groundwater should be made in the development drainage strategy wherever retaining structures are proposed.

6.1.3 It is therefore considered that the consequences of flooding and the possibility of flooding are minimal and acceptable within the standards set.

6.2 Access and Egress

6.2.1 Current guidance required that, where required, safe access and escape is available to/from new developments in flood risk areas.

6.2.2 As the development affected area is situated within flood zone 1 and is of a type compatible with this flood zone, and therefore not at risk of flooding from any watercourse, dry access has not been considered in further detail.

7.0 CONCLUSIONS

Following the completion of this flood risk assessment, in line with the recommendations of current guidance, the following conclusions can be made:

7.1 Flood Risk – To Development

7.1.1 This flood risk assessment concluded that the proposed development is at a low risk of flooding from tidal, fluvial, overland flow, drainage flooding, groundwater flooding and flooding from artificial sources. Under normal circumstances the site is at low risk of flooding as having a less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%).

7.2 Flood Risk – From the Development

7.2.1 The proposed development represents an increase in impermeable, positively drained areas over the pre-development condition. Flood risk to the site and the surrounding area would increase without the mitigation measures proposed in Section 7.3 being put in place.

7.3 Flood Mitigation Measures

7.3.1 The proposed development will discharge to the existing culvert at a rate of 5l/s. The surface water drainage system shall be designed to ensure that flood storage volumes are retained onsite for critical storm events up to the 1 in 100-year return period plus 40% climate change event.

7.3.2 To further mitigate the flood risk to properties in the event of a failure within the drainage system, surface levels will be designed to ensure that flood flows are not directed toward dwellings. The design shall make due consideration of the existing surface water flow paths from off site that traverse to study site. External levels surrounding dwellings shall generally 150mm below ground floor levels.

7.3.3 The detailed master planning process shall ensure that the existing pluvial overland flood flow path is respected and designed such that any flood flows do not enter the development drainage system.

7.4 Residual Risk – Flood Consequences

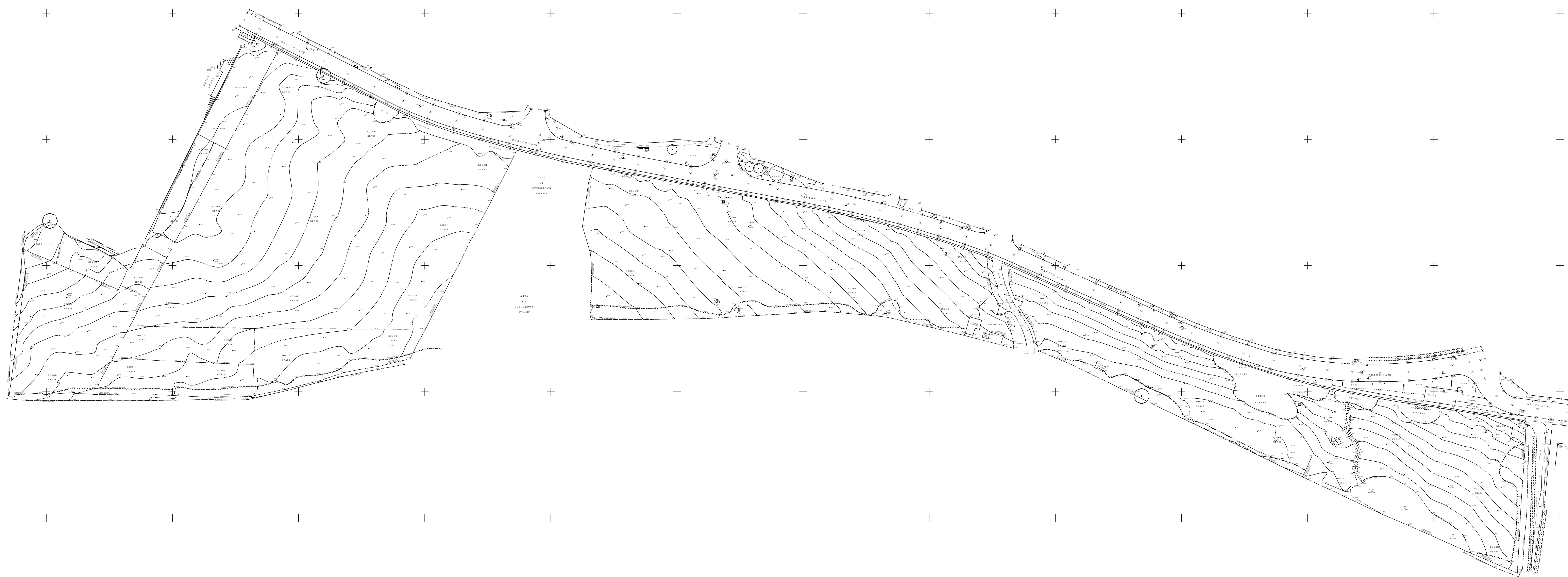
7.4.1 It is considered that the proposed development will not result in any detrimental impact onto the existing surrounding properties.

7.4.2 It is considered that the proposed drainage scheme will neither result in nor cause an increase of flood risk to surrounding properties or the development site.

7.4.3 It is therefore considered that Planning Consent should not be withheld on flood risk grounds.



Appendix I – Topographic Survey



The map displays the Darton area in Glasgow, with a red-outlined site boundary. Key features include:

- Streets:** Darton Lane, Oak Wood Drive, Broom Close, Round Hill, Upper High Roads, Lower High Roads, Darton Lane (bottom right), and Darton Lane (middle right).
- Landmarks:** Darton Primary School, Darton Business Park, and a large green area (possibly a park or sports field) to the left of the site boundary.
- Planning Applications:** Numerous applications are marked with dots and labels, including SE31SW188, SE31SW193, SE31SW194, SE31SW195, SE31SW200, SE31SW201, SE31SW204, SE31SW206, SE31SW216, SE31SW218, SE31SW214, SE31SW215, SE31SW216, SE31SW218, SE31SW219, SE31SW220, SE31SW221, SE31SW222, SE31SW223, SE31SW224, SE31SW225, SE31SW226, SE31SW227, SE31SW228, SE31SW229, SE31SW230, SE31SW231, SE31SW232, SE31SW233, SE31SW234, SE31SW235, SE31SW236, SE31SW237, SE31SW238, SE31SW239, SE31SW240, SE31SW241, SE31SW242, SE31SW243, SE31SW244, SE31SW245, SE31SW246, SE31SW247, SE31SW248, SE31SW249, SE31SW250, SE31SW251, SE31SW252, SE31SW253, SE31SW254, SE31SW255, SE31SW256, SE31SW257, SE31SW258, SE31SW259, SE31SW260, SE31SW261, SE31SW262, SE31SW263, SE31SW264, SE31SW265, SE31SW266, SE31SW267, SE31SW268, SE31SW269, SE31SW270, SE31SW271, SE31SW272, SE31SW273, SE31SW274, SE31SW275, SE31SW276, SE31SW277, SE31SW278, SE31SW279, SE31SW280, SE31SW281, SE31SW282, SE31SW283, SE31SW284, SE31SW285, SE31SW286, SE31SW287, SE31SW288, SE31SW289, SE31SW290, SE31SW291, SE31SW292, SE31SW293, SE31SW294, SE31SW295, SE31SW296, SE31SW297, SE31SW298, SE31SW299, SE31SW300, SE31SW301, SE31SW302, SE31SW303, SE31SW304, SE31SW305, SE31SW306, SE31SW307, SE31SW308, SE31SW309, SE31SW310, SE31SW311, SE31SW312, SE31SW313, SE31SW314, SE31SW315, SE31SW316, SE31SW317, SE31SW318, SE31SW319, SE31SW320, SE31SW321, SE31SW322, SE31SW323, SE31SW324, SE31SW325, SE31SW326, SE31SW327, SE31SW328, SE31SW329, SE31SW330, SE31SW331, SE31SW332, SE31SW333, SE31SW334, SE31SW335, SE31SW336, SE31SW337, SE31SW338, SE31SW339, SE31SW340, SE31SW341, SE31SW342, SE31SW343, SE31SW344, SE31SW345, SE31SW346, SE31SW347, SE31SW348, SE31SW349, SE31SW350, SE31SW351, SE31SW352, SE31SW353, SE31SW354, SE31SW355, SE31SW356, SE31SW357, SE31SW358, SE31SW359, SE31SW360, SE31SW361, SE31SW362, SE31SW363, SE31SW364, SE31SW365, SE31SW366, SE31SW367, SE31SW368, SE31SW369, SE31SW370, SE31SW371, SE31SW372, SE31SW373, SE31SW374, SE31SW375, SE31SW376, SE31SW377, SE31SW378, SE31SW379, SE31SW380, SE31SW381, SE31SW382, SE31SW383, SE31SW384, SE31SW385, SE31SW386, SE31SW387, SE31SW388, SE31SW389, SE31SW390, SE31SW391, SE31SW392, SE31SW393, SE31SW394, SE31SW395, SE31SW396, SE31SW397, SE31SW398, SE31SW399, SE31SW400, SE31SW401, SE31SW402, SE31SW403, SE31SW404, SE31SW405, SE31SW406, SE31SW407, SE31SW408, SE31SW409, SE31SW410, SE31SW411, SE31SW412, SE31SW413, SE31SW414, SE31SW415, SE31SW416, SE31SW417, SE31SW418, SE31SW419, SE31SW420, SE31SW421, SE31SW422, SE31SW423, SE31SW424, SE31SW425, SE31SW426, SE31SW427, SE31SW428, SE31SW429, SE31SW430, SE31SW431, SE31SW432, SE31SW433, SE31SW434, SE31SW435, SE31SW436, SE31SW437, SE31SW438, SE31SW439, SE31SW440, SE31SW441, SE31SW442, SE31SW443, SE31SW444, SE31SW445, SE31SW446, SE31SW447, SE31SW448, SE31SW449, SE31SW450, SE31SW451, SE31SW452, SE31SW453, SE31SW454, SE31SW455, SE31SW456, SE31SW457, SE31SW458, SE31SW459, SE31SW460, SE31SW461, SE31SW462, SE31SW463, SE31SW464, SE31SW465, SE31SW466, SE31SW467, SE31SW468, SE31SW469, SE31SW470, SE31SW471, SE31SW472, SE31SW473, SE31SW474, SE31SW475, SE31SW476, SE31SW477, SE31SW478, SE31SW479, SE31SW480, SE31SW481, SE31SW482, SE31SW483, SE31SW484, SE31SW485, SE31SW486, SE31SW487, SE31SW488, SE31SW489, SE31SW490, SE31SW491, SE31SW492, SE31SW493, SE31SW494, SE31SW495, SE31SW496, SE31SW497, SE31SW498, SE31SW499, SE31SW500, SE31SW501, SE31SW502, SE31SW503, SE31SW504, SE31SW505, SE31SW506, SE31SW507, SE31SW508, SE31SW509, SE31SW510, SE31SW511, SE31SW512, SE31SW513, SE31SW514, SE31SW515, SE31SW516, SE31SW517, SE31SW518, SE31SW519, SE31SW520, SE31SW521, SE31SW522, SE31SW523, SE31SW524, SE31SW525, SE31SW526, SE31SW527, SE31SW528, SE31SW529, SE31SW530, SE31SW531, SE31SW532, SE31SW533, SE31SW534, SE31SW535, SE31SW536, SE31SW537, SE31SW538, SE31SW539, SE31SW540, SE31SW541, SE31SW542, SE31SW543, SE31SW544, SE31SW545, SE31SW546, SE31SW547, SE31SW548, SE31SW549, SE31SW550, SE31SW551, SE31SW552, SE31SW553, SE31SW554, SE31SW555, SE31SW556, SE31SW557, SE31SW558, SE31SW559, SE31SW560, SE31SW561, SE31SW562, SE31SW563, SE31SW564, SE31SW565, SE31SW566, SE31SW567, SE31SW568, SE31SW569, SE31SW570, SE31SW571, SE31SW572, SE31SW573, SE31SW574, SE31SW575, SE31SW576, SE31SW577, SE31SW578, SE31SW579, SE31SW580, SE31SW581, SE31SW582, SE31SW583, SE31SW584, SE31SW585, SE31SW586, SE31SW587, SE31SW588, SE31SW589, SE31SW590, SE31SW591, SE31SW592, SE31SW593, SE31SW594, SE31SW595, SE31SW596, SE31SW597, SE31SW598, SE31SW599, SE31SW600, SE31SW601, SE31SW602, SE31SW603, SE31SW604, SE31SW605, SE31SW606, SE31SW607, SE31SW608, SE31SW609, SE31SW610, SE31SW611, SE31SW612, SE31SW613, SE31SW614, SE31SW615, SE31SW616, SE31SW617, SE31SW618, SE31SW619, SE31SW620, SE31SW621, SE31SW622, SE31SW623, SE31SW624, SE31SW625, SE31SW626, SE31SW627, SE31SW628, SE31SW629, SE31SW630, SE31SW631, SE31SW632, SE31SW633, SE31SW634, SE31SW635, SE31SW636, SE31SW637, SE31SW638, SE31SW639, SE31SW640, SE31SW641, SE31SW642, SE31SW643, SE31SW644, SE31SW645, SE31SW646, SE31SW647, SE31SW648, SE31SW649, SE31SW650, SE31SW651, SE31SW652, SE31SW653, SE31SW654, SE31SW655, SE31SW656, SE31SW657, SE31SW658, SE31SW659, SE31SW660, SE31SW661, SE31SW662, SE31SW663, SE31SW664, SE31SW665, SE31SW666, SE31SW667, SE31SW668, SE31SW669, SE31SW670, SE31SW671, SE31SW672, SE31SW673, SE31SW674, SE31SW675, SE31SW676, SE31SW677, SE31SW678, SE31SW679, SE31SW680, SE31SW681, SE31SW682, SE31SW683, SE31SW684, SE31SW685, SE31SW686, SE31SW687, SE31SW688

Borehole results

- SE31SW378 – STATION ROAD DARTON 2
431540,410010 Depth: 10m.
 [Scan available](#)
[View online](#)
- SE31SW377 – STATION ROAD DARTON 1
431540,410010 Depth: 20m.
 [Scan available](#)
[View online](#)
- SE31SW379 – STATION ROAD DARTON TP A
431540,410010 Depth: 1.3m.
 [Scan available](#)
[View online](#)
- SE31SW380 – STATION ROAD DARTON TP B
431540,410010 Depth: 1.2m.
 [Scan available](#)
[View online](#)
- SE31SW381 – STATION ROAD DARTON TP C

Church Commissioners for England
Land South of Darton Lane, Darton, Staincross

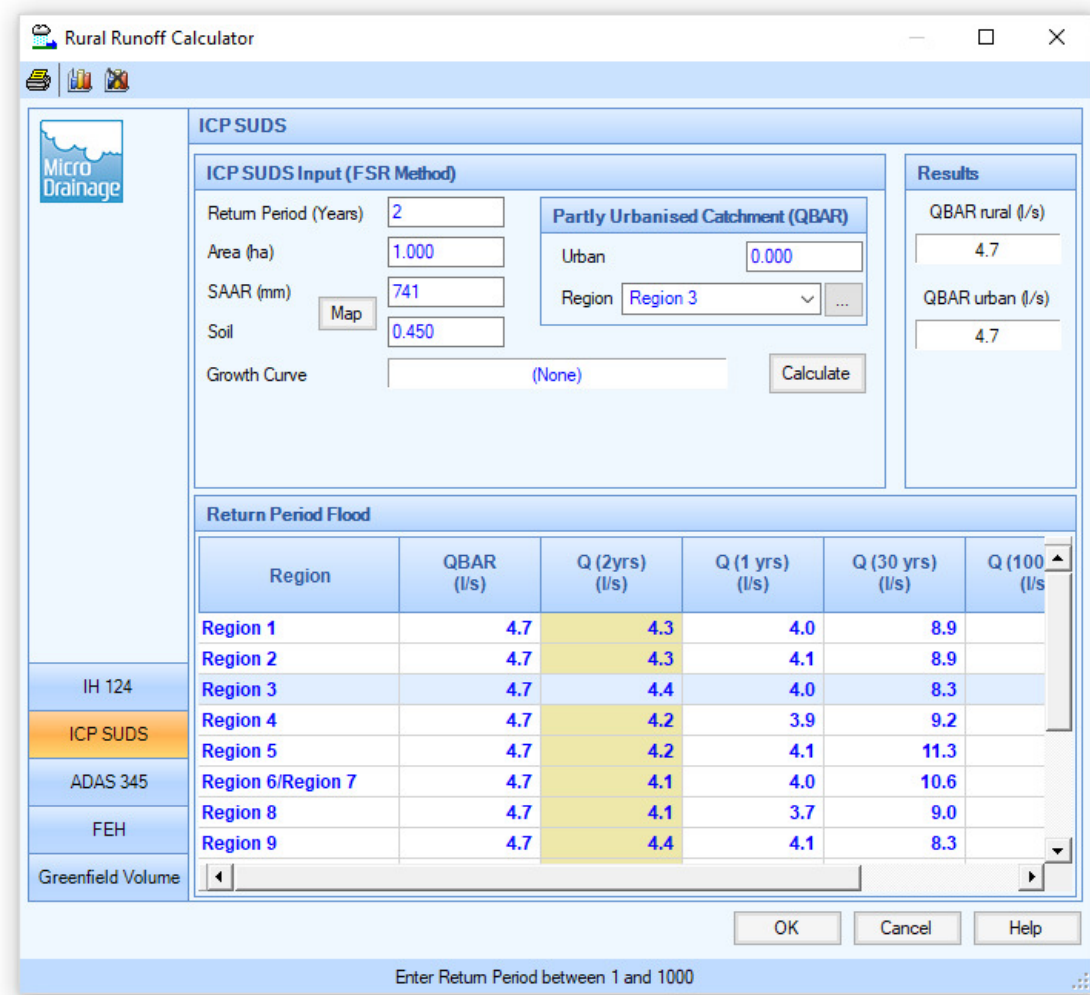
Norwest Holst Soil Engineering Ltd.						Borehole No. 2	
BOREHOLE LOG							
Contract No. FB032		Location Station Road DARTON		Sheet 1 of 1		Chainage 63.0m:10.0mS	
Client BARNSTLEY M.B.C.		Method of Boring Rotary coring		Ground Level 104.91 m.A.O.D.		Date 16 & 17/11/88	
Diameter of Borehole 76mm core							

Description of Strata	Legend	Depth Below G.L. (m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/R.Q.D. %	Daily Progress
MADE GROUND: Concrete and sandstone setts	✖	0.20	104.71				
Light grey brown very thinly bedded highly to moderately weathered very silty MUDSTONE very weak to moderately weak ...with very closely spaced iron stained jointing ...bedding dips $\approx 45^\circ$	✖				OPEN HOLE		
	✖				TCR (%)	SCR (%)	
	✖				3.00		17/11
	✖				75	8	5
	✖	4.50	100.41				
Grey laminated moderately to highly weathered MUDSTONE weak ...bedding dips at 40° reducing to 20° with depth	✖				5.00		
	✖				38	2	0
	✖				7.00		
Black laminated moderately weathered carbonaceous MUDSTONE weak ...with very closely spaced discontinuities, some polished	✖	8.50	96.41				
	✖				50	3	0
Grey laminated moderately weathered MUDSTONE weak ...with closely spaced jointing ...bedding dips at 35°	✖	9.50	95.41				
	✖	10.00	94.91		10.00		

Type of Sample S.P.T. Undisturbed C.P.T. Vane Jar Water Bulk Piezometer	Remarks (Observations of Ground Water etc.) Borehole dry during drilling
---	--

Water levels are subject to seasonal or tidal variations and should not be taken as constant.

Appendix III – Rural Run-off Calculation



ICP SUDS

ICP SUDS Input (FSR Method)

Return Period (Years)

Area (ha)

SAAR (mm)

Soil

Growth Curve

Partly Urbanised Catchment (QBAR)

Urban

Region

Results

QBAR rural (l/s)

QBAR urban (l/s)

Return Period Flood

Region	QBAR (l/s)	Q (2yrs) (l/s)	Q (1 yrs) (l/s)	Q (30 yrs) (l/s)	Q (100 yrs) (l/s)
Region 1	4.7	4.3	4.0	8.9	
Region 2	4.7	4.3	4.1	8.9	
Region 3	4.7	4.4	4.0	8.3	
Region 4	4.7	4.2	3.9	9.2	
Region 5	4.7	4.2	4.1	11.3	
Region 6/Region 7	4.7	4.1	4.0	10.6	
Region 8	4.7	4.1	3.7	9.0	
Region 9	4.7	4.4	4.1	8.3	

OK Cancel Help

Enter Return Period between 1 and 1000

Qbar Calc based on 1 hectare.
Assumed 60% developable area = 1.32ha

1.32ha x 4l/s = Total Site Run-off Rate of 5.3l/s



Appendix IV – MicroDrainage Flood Storage Estimates

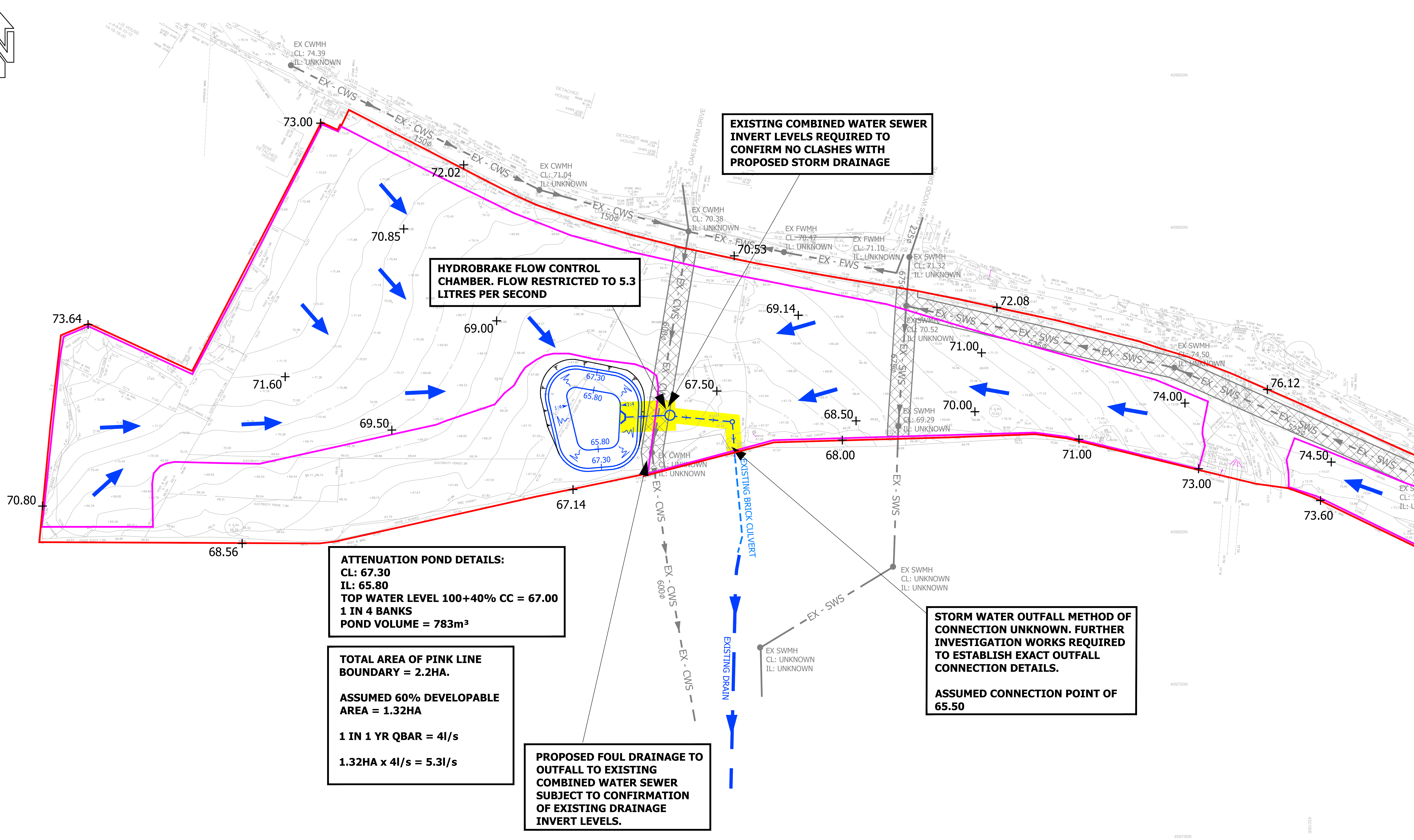
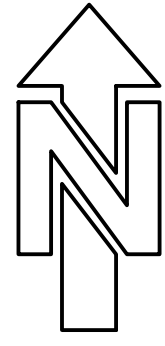
Travis Baker			Page 1		
Trinity Point New Road Halesowen West Midlands B63 3HY		16081 - Darton, Barnsley Attenuation Pond Sizing			
Date 10th June 2019 File POND SIZING.SRCX		Designed by JC Checked by			
Micro Drainage		Source Control 2014.1.1			
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	66.331	0.531	5.3	193.2	O K
30 min Summer	66.470	0.670	5.3	257.8	O K
60 min Summer	66.605	0.805	5.3	325.9	O K
120 min Summer	66.726	0.926	5.3	392.6	O K
180 min Summer	66.784	0.984	5.3	426.4	O K
240 min Summer	66.816	1.016	5.3	445.5	O K
360 min Summer	66.849	1.049	5.3	465.7	O K
480 min Summer	66.862	1.062	5.3	474.1	O K
600 min Summer	66.864	1.064	5.3	475.3	O K
720 min Summer	66.859	1.059	5.3	472.2	O K
960 min Summer	66.841	1.041	5.3	460.7	O K
1440 min Summer	66.803	1.003	5.3	437.7	O K
2160 min Summer	66.748	0.948	5.3	405.4	O K
2880 min Summer	66.692	0.892	5.3	373.6	O K
4320 min Summer	66.563	0.763	5.3	303.9	O K
5760 min Summer	66.429	0.629	5.3	237.9	O K
7200 min Summer	66.310	0.510	5.3	184.1	O K
8640 min Summer	66.209	0.409	5.3	141.9	O K
10080 min Summer	66.126	0.326	5.3	109.1	O K
15 min Winter	66.384	0.584	5.3	217.0	O K
30 min Winter	66.535	0.735	5.3	290.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	124.758	0.0	198.7	22	
30 min Summer	83.832	0.0	267.0	37	
60 min Summer	53.779	0.0	342.7	66	
120 min Summer	33.321	0.0	424.7	126	
180 min Summer	24.814	0.0	474.5	186	
240 min Summer	19.989	0.0	509.6	244	
360 min Summer	14.690	0.0	561.8	364	
480 min Summer	11.803	0.0	601.8	482	
600 min Summer	9.952	0.0	634.3	602	
720 min Summer	8.652	0.0	661.7	720	
960 min Summer	6.932	0.0	706.9	840	
1440 min Summer	5.062	0.0	766.7	1098	
2160 min Summer	3.688	0.0	846.4	1496	
2880 min Summer	2.943	0.0	900.2	1912	
4320 min Summer	2.137	0.0	980.5	2724	
5760 min Summer	1.700	0.0	1040.4	3456	
7200 min Summer	1.423	0.0	1088.6	4176	
8640 min Summer	1.232	0.0	1130.5	4840	
10080 min Summer	1.090	0.0	1167.6	5544	
15 min Winter	124.758	0.0	222.5	22	
30 min Winter	83.832	0.0	299.1	37	
©1982-2014 XP Solutions					

Travis Baker				Page 2	
Trinity Point New Road Halesowen West Midlands B63 3HY		16081 - Darton, Barnsley Attenuation Pond Sizing			
Date 10th June 2019 File POND SIZING.SRCX		Designed by JC Checked by			
Micro Drainage		Source Control 2014.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	66.681	0.881	5.3	367.4	O K
120 min Winter	66.813	1.013	5.3	443.6	O K
180 min Winter	66.877	1.077	5.3	483.4	O K
240 min Winter	66.914	1.114	5.3	506.7	O K
360 min Winter	66.955	1.155	5.3	533.1	O K
480 min Winter	66.975	1.175	5.3	546.1	O K
600 min Winter	66.982	1.182	5.3	551.0	O K
720 min Winter	66.982	1.182	5.3	550.9	O K
960 min Winter	66.968	1.168	5.3	541.6	O K
1440 min Winter	66.920	1.120	5.3	510.6	O K
2160 min Winter	66.850	1.050	5.3	466.4	O K
2880 min Winter	66.773	0.973	5.3	420.0	O K
4320 min Winter	66.587	0.787	5.3	316.6	O K
5760 min Winter	66.374	0.574	5.3	212.5	O K
7200 min Winter	66.200	0.400	5.3	138.1	O K
8640 min Winter	66.070	0.270	5.2	88.4	O K
10080 min Winter	65.983	0.183	5.0	57.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	53.779	0.0	383.8	66	
120 min Winter	33.321	0.0	475.7	124	
180 min Winter	24.814	0.0	531.5	182	
240 min Winter	19.989	0.0	570.9	240	
360 min Winter	14.690	0.0	629.4	356	
480 min Winter	11.803	0.0	674.1	472	
600 min Winter	9.952	0.0	710.6	584	
720 min Winter	8.652	0.0	741.4	696	
960 min Winter	6.932	0.0	790.9	912	
1440 min Winter	5.062	0.0	787.7	1154	
2160 min Winter	3.688	0.0	948.0	1620	
2880 min Winter	2.943	0.0	1008.4	2076	
4320 min Winter	2.137	0.0	1098.3	2980	
5760 min Winter	1.700	0.0	1165.5	3640	
7200 min Winter	1.423	0.0	1219.4	4320	
8640 min Winter	1.232	0.0	1266.3	4928	
10080 min Winter	1.090	0.0	1307.5	5544	
©1982-2014 XP Solutions					

Travis Baker		Page 3																																																																																																			
Trinity Point New Road Halesowen West Midlands B63 3HY	16081 - Darton, Barnsley Attenuation Pond Sizing																																																																																																				
Date 10th June 2019 File POND SIZING.SRCX	Designed by JC Checked by																																																																																																				
Micro Drainage Source Control 2014.1.1																																																																																																					
Model Details Storage is Online Cover Level (m) 67.300 Tank or Pond Structure Invert Level (m) 65.800 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>292.0</td><td>1.500</td><td>792.0</td><td>1.510</td><td>0.0</td></tr></tbody></table> Hydro-Brake Optimum® Outflow Control Unit Reference MD-SHE-0102-5300-1400-5300 Design Head (m) 1.400 Design Flow (l/s) 5.3 Flush-Flo™ Calculated Objective Minimise upstream storage Diameter (mm) 102 Invert Level (m) 65.750 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200 Control Points <table><thead><tr><th></th><th>Head (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td>Design Point (Calculated)</td><td>1.400</td><td>5.3</td></tr><tr><td>Flush-Flo™</td><td>0.418</td><td>5.3</td></tr><tr><td>Kick-Flo®</td><td>0.858</td><td>4.2</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>4.6</td></tr></tbody></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><thead><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td>0.100</td><td>3.4</td><td>1.200</td><td>4.9</td><td>3.000</td><td>7.5</td><td>7.000</td><td>11.3</td></tr><tr><td>0.200</td><td>4.8</td><td>1.400</td><td>5.3</td><td>3.500</td><td>8.1</td><td>7.500</td><td>11.6</td></tr><tr><td>0.300</td><td>5.2</td><td>1.600</td><td>5.6</td><td>4.000</td><td>8.6</td><td>8.000</td><td>12.0</td></tr><tr><td>0.400</td><td>5.3</td><td>1.800</td><td>5.9</td><td>4.500</td><td>9.1</td><td>8.500</td><td>12.4</td></tr><tr><td>0.500</td><td>5.2</td><td>2.000</td><td>6.2</td><td>5.000</td><td>9.6</td><td>9.000</td><td>12.7</td></tr><tr><td>0.600</td><td>5.1</td><td>2.200</td><td>6.5</td><td>5.500</td><td>10.0</td><td>9.500</td><td>13.0</td></tr><tr><td>0.800</td><td>4.6</td><td>2.400</td><td>6.8</td><td>6.000</td><td>10.5</td><td></td><td></td></tr><tr><td>1.000</td><td>4.5</td><td>2.600</td><td>7.1</td><td>6.500</td><td>10.9</td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	292.0	1.500	792.0	1.510	0.0		Head (m)	Flow (l/s)	Design Point (Calculated)	1.400	5.3	Flush-Flo™	0.418	5.3	Kick-Flo®	0.858	4.2	Mean Flow over Head Range	-	4.6	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	3.4	1.200	4.9	3.000	7.5	7.000	11.3	0.200	4.8	1.400	5.3	3.500	8.1	7.500	11.6	0.300	5.2	1.600	5.6	4.000	8.6	8.000	12.0	0.400	5.3	1.800	5.9	4.500	9.1	8.500	12.4	0.500	5.2	2.000	6.2	5.000	9.6	9.000	12.7	0.600	5.1	2.200	6.5	5.500	10.0	9.500	13.0	0.800	4.6	2.400	6.8	6.000	10.5			1.000	4.5	2.600	7.1	6.500	10.9		
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)																																																																																																
0.000	292.0	1.500	792.0	1.510	0.0																																																																																																
	Head (m)	Flow (l/s)																																																																																																			
Design Point (Calculated)	1.400	5.3																																																																																																			
Flush-Flo™	0.418	5.3																																																																																																			
Kick-Flo®	0.858	4.2																																																																																																			
Mean Flow over Head Range	-	4.6																																																																																																			
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																																														
0.100	3.4	1.200	4.9	3.000	7.5	7.000	11.3																																																																																														
0.200	4.8	1.400	5.3	3.500	8.1	7.500	11.6																																																																																														
0.300	5.2	1.600	5.6	4.000	8.6	8.000	12.0																																																																																														
0.400	5.3	1.800	5.9	4.500	9.1	8.500	12.4																																																																																														
0.500	5.2	2.000	6.2	5.000	9.6	9.000	12.7																																																																																														
0.600	5.1	2.200	6.5	5.500	10.0	9.500	13.0																																																																																														
0.800	4.6	2.400	6.8	6.000	10.5																																																																																																
1.000	4.5	2.600	7.1	6.500	10.9																																																																																																
©1982-2014 XP Solutions																																																																																																					



Appendix V – Surface Water Drainage Strategy



EXISTING COMBINED WATER SEWER
INVERT LEVELS REQUIRED TO
CONFIRM NO CLASHES WITH
PROPOSED STORM DRAINAGE

HYDROBRAKE FLOW CONTROL
CHAMBER. FLOW RESTRICTED TO 5.3
LITRES PER SECOND

ATTENUATION POND DETAILS:
CL: 67.30
IL: 65.80
TOP WATER LEVEL 100+40% CC = 67.00
1 IN 4 BANKS
POND VOLUME = 783m³

TOTAL AREA OF PINK LINE
BOUNDARY = 2.2HA.

ASSUMED 60% DEVELOPABLE
AREA = 1.32HA

1 IN 1 YR QBAR = 4l/s

1.32HA x 4l/s = 5.3l/s

PROPOSED FOUL DRAINAGE TO
OUTFALL TO EXISTING
COMBINED WATER SEWER
SUBJECT TO CONFIRMATION
OF EXISTING DRAINAGE
INVERT LEVELS.

STORM WATER OUTFALL METHOD OF
CONNECTION UNKNOWN. FURTHER
INVESTIGATION WORKS REQUIRED
TO ESTABLISH EXACT OUTFALL
CONNECTION DETAILS.

ASSUMED CONNECTION POINT OF
65.50

1. DO NOT SCALE FROM THIS DRAWING. IF IN DOUBT CONTACT TRAVIS BAKER LIMITED.
2. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS RELATING TO THIS PROJECT.
4. ALL DIMENSIONS SHOULD BE CHECKED ON SITE PRIOR TO CONSTRUCTION. ANY DISCREPANCIES SHOULD BE IMMEDIATELY NOTIFIED IN WRITING TO TRAVIS BAKER LIMITED.
5. THE CONTRACTOR SHALL PRIOR TO CONSTRUCTION CHECK AND VERIFY THAT THE DETAILS SHOWN ON THIS DRAWING ARE FULLY COMPATIBLE WITH ANY AS CONSTRUCTED DIMENSIONS OR LEVELS. ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY IN WRITING TO TRAVIS BAKER LIMITED.
6. THIS DRAWING HAS BEEN PREPARED FOR THE EXCLUSIVE USE OF THE COMMISSIONING PARTY AND UNLESS AGREED IN WRITING BY TRAVIS BAKER LIMITED NO OTHER PARTY MAY USE OR RELY ON ITS CONTENTS. NO LIABILITY IS ACCEPTED BY TRAVIS BAKER LIMITED FOR ANY USE OF THIS DRAWING OTHER THAN FOR THE PURPOSE FOR WHICH IT WAS ORIGINALLY PREPARED.
7. IT SHOULD BE NOTED THAT THIS DRAWING MAY INCLUDE DATA PROVIDED BY THIRD PARTIES. NO LIABILITY IS ACCEPTED BY TRAVIS BAKER LIMITED AS TO THE ACCURACY OF THIS DATA.
8. THIS DRAWING SHALL NOT BE REPRODUCED IN ANY WAY WITHOUT THE WRITTEN PERMISSION OF TRAVIS BAKER LIMITED.

ALL INFORMATION SHOWN IS
INDICATIVE ONLY SUBJECT TO
DETAILED DESIGN

KEY

- 69.14+ EXISTING GROUND LEVEL
- EX - CWS EXISTING COMBINED WATER SEWER
- EX - FWS EXISTING FOUL WATER SEWER
- EX - SWS EXISTING SURFACE WATER SEWER
- EXISTING DRAIN
- EXISTING BRICK CULVERT
- EXISTING SEWER EASEMENT
- INDICATIVE SITE BOUNDARY
- PROPOSED SURFACE WATER FLOWS
- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED BANKING
- PROPOSED DEVELOPABLE AREA BOUNDARY
- PROPOSED SEWER EASEMENT

B	PROJECT TITLE AMENDED TO SUIT CLIENT COMMENTS	13.09.19	JC	RWT
A	PROJECT TITLE AMENDED TO SUIT CLIENT COMMENTS	17.06.19	JC	RWT

Travis Baker
Trotty Road
New Road
Halesowen
Worcestershire
B63 3HT

Tel: 0121 550 8037
Fax: 0121 550 8047
info@travisbaker.co.uk
www.travisbaker.co.uk

CLIENT
CHURCH COMMISSIONERS FOR
ENGLAND

PROJECT
LAND SOUTH OF DARTON LANE,
DARTON, STAINCROSS

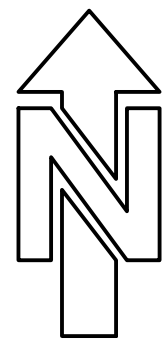
TITLE
DRAINAGE STRATEGY
SHEET 1 OF 2

DRAWN JC	AUTHORISED RWT	SCALE 1:500@A0	DATE 12.06.19
-------------	-------------------	-------------------	------------------

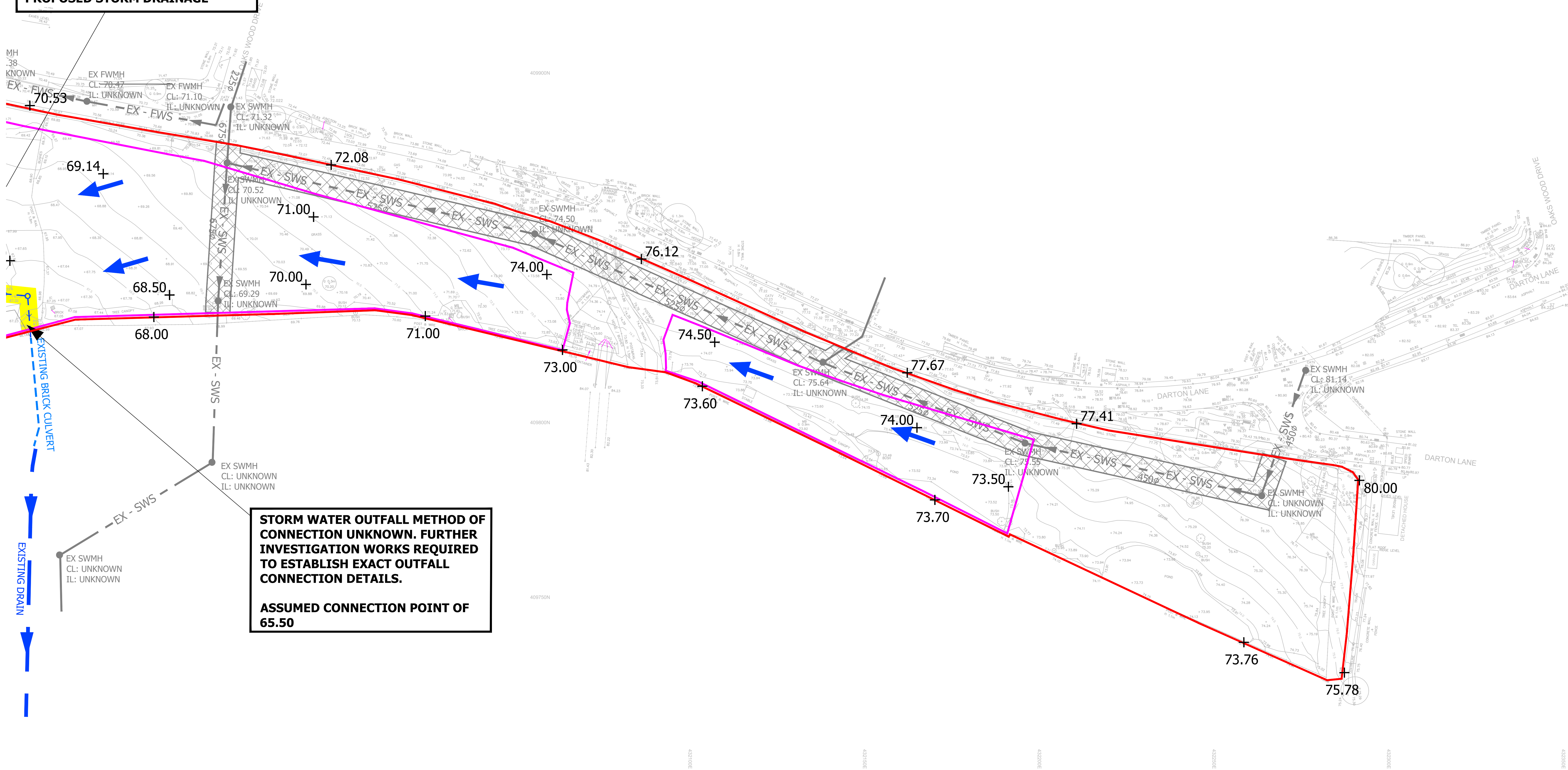
PROJECT NO. 16081	DRAWING NO. 3	REV B
----------------------	------------------	----------

STATUS
INDICATIVE ONLY

COPYRIGHT TRAVIS BAKER LIMITED. ALL RIGHTS RESERVED.



**EXISTING COMBINED WATER SEWER
INVERT LEVELS REQUIRED TO
CONFIRM NO CLASHES WITH
PROPOSED STORM DRAINAGE**



1. DO NOT SCALE FROM THIS DRAWING. IF IN DOUBT CONTACT TRAVIS BAKER LIMITED.
2. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS RELATING TO THIS PROJECT.
4. ALL DIMENSIONS SHOULD BE CHECKED ON SITE PRIOR TO CONSTRUCTION. ANY DISCREPANCIES SHOULD BE IMMEDIATELY NOTIFIED IN WRITING TO TRAVIS BAKER LIMITED.
5. THE CONTRACTOR SHALL PRIOR TO CONSTRUCTION CHECK AND VERIFY THAT THE DETAILS SHOWN ON THIS DRAWING ARE FULLY COMPATIBLE WITH ANY AS CONSTRUCTED DIMENSIONS OR LEVELS. ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY IN WRITING TO TRAVIS BAKER LIMITED.
6. THIS DRAWING HAS BEEN PREPARED FOR THE EXCLUSIVE USE OF THE COMMISSIONING PARTY AND UNLESS AGREED IN WRITING BY TRAVIS BAKER LIMITED NO OTHER PARTY MAY USE OR RELY ON ITS CONTENTS. NO LIABILITY IS ACCEPTED BY TRAVIS BAKER LIMITED FOR ANY USE OF THIS DRAWING OTHER THAN FOR THE PURPOSE FOR WHICH IT WAS ORIGINALLY PREPARED.
7. IT SHOULD BE NOTED THAT THIS DRAWING MAY INCLUDE DATA PROVIDED BY THIRD PARTIES. NO LIABILITY IS ACCEPTED BY TRAVIS BAKER LIMITED AS TO THE ACCURACY OF THIS DATA.
8. THIS DRAWING SHALL NOT BE REPRODUCED IN ANY WAY WITHOUT THE WRITTEN PERMISSION OF TRAVIS BAKER LIMITED.

**ALL INFORMATION SHOWN IS
INDICATIVE ONLY SUBJECT TO
DETAILED DESIGN**

KEY

- 69.14+ **EXISTING GROUND LEVEL**
- - EX - CWS - - **EXISTING COMBINED WATER SEWER**
- - EX - FWS - - **EXISTING FOUL WATER SEWER**
- - EX - SWS - - **EXISTING SURFACE WATER SEWER**
- EXISTING DRAIN**
- EXISTING BRICK CULVERT**
- EXISTING SEWER EASEMENT**
- INDICATIVE SITE BOUNDARY**
- PROPOSED SURFACE WATER FLOWS**
- PROPOSED SURFACE WATER DRAINAGE**
- PROPOSED BANKING**
- PROPOSED DEVELOPABLE AREA BOUNDARY**
- PROPOSED SEWER EASEMENT**

B	PROJECT TITLE AMENDED TO SUIT CLIENT COMMENTS	13.09.19	JC	RWT
A	PROJECT TITLE AMENDED TO SUIT CLIENT COMMENTS	17.06.19	JC	RWT

REV	DESCRIPTION	DATE	BY	AUTH
-----	-------------	------	----	------

Travis Baker
Trinity Road
New Road
Halesowen
Walsley
B63 3HY

Tel: 0121 560 8037
Fax: 0121 560 8047
info@travisbaker.co.uk
www.travisbaker.co.uk

CLIENT
**CHURCH COMMISSIONERS FOR
ENGLAND**

PROJECT
**LAND SOUTH OF DARTON LANE,
DARTON, STAINCROSS**

TITLE
**DRAINAGE STRATEGY
SHEET 2 OF 2**

DRAWN	AUTHORISED	SCALE	DATE
JC	RWT	1:500@A0	12.06.19

PROJECT NO.	DRAWING NO.	REV
16081	4	B

STATUS
INDICATIVE ONLY

COPYRIGHT TRAVIS BAKER LIMITED. ALL RIGHTS RESERVED.



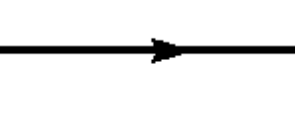
Appendix VI – Stakeholder Correspondence

YORKSHIRE WATER PROTECTION OF MAINS AND SERVICES

1. The position of Yorkshire Water Services Ltd (YWS) apparatus shown on the existing mains record drawing(s) indicates the **general** position and nature of our apparatus and the accuracy of this information cannot be guaranteed. Any damage to YWS apparatus as a result of your works may have serious consequences and you will be held responsible for all costs incurred. Prior to commencing major works, the exact location of apparatus must be determined on site, if necessary by excavating trial holes. The actual position of such apparatus and that of service pipes which have not been indicated must be established on site by contacting the Customer Helpline on 0845 124 24 24 for both water and sewerage.
2. The public sewer and water network is lawfully retained in its existing position and the sewerage and water undertaker is entitled to have it remain so without any disturbance. The provisions of section 159 of the Water Industry Act 1991 provides that the undertaker may "inspect, maintain, adjust, repair or alter" the network. Those rights are given to enable the undertaker to perform its statutory duties. Any development of the land or any other action that unacceptably hindered the exercise of those rights would be unlawful. The provisions contained in Section 185 of the Water Industry Act 1991 state that where it is reasonable to do so, a person may require the water supply undertaker to alter or remove a pipe where it is necessary to enable that person to carry out a proposed change of use of the land. The provisions contained in Section 185 also require the person making the request to pay the full cost of carrying out the necessary works.
3. Ground levels over existing YWS apparatus are to be maintained. Sewers in highways will **generally** be laid to give 1200mm of cover from finished ground level working to kerb races, other permanent identification of the limits of the road or to an agreed line and level. Substantial increases or decreases to this 1200mm depth of cover will result in the sewer being re-laid at your expense. Water mains and services will **generally** be laid with a minimum of 750mm depth of cover however some mains and services usually those installed over 50 years ago may have less ground cover.
4. If surface levels are to be decreased / increased significantly the effects on existing water supply apparatus will be carefully considered and if any alterations are necessary, the costs of the alterations will be recharged to you in full. Outlets on fire hydrants must be no more than 300mm below the new levels and all surface boxes must be adjusted as part of the scheme.
5. To enable future repair works to be carried out without hindrance; any pipe, cable, duct, etc. installed parallel to a water main or service pipe should not be installed directly over or within 300mm of a water main or service pipe or 1000mm of a waste water asset. Where a pipe, cable, duct, etc. crosses a main or service it should preferably cross perpendicular or at an angle of no less than 45° and with a minimum clearance of 150mm. These requirements apply to activities within an existing highway and are relevant to the installation of pipes, cables, ducts, etc. up to and including 250mm in diameter (*see illustration below*). Necessary protection measures for installations greater than 250mm in diameter and/or in private land will need to be agreed on an individual basis. Installations within a new development site must comply with the National Joint Utilities Group publication Volume 2: NJUG Guidelines On The Positioning Of Underground Utilities Apparatus For New Development Sites.
6. All excavation works near to YW apparatus should be by hand digging only.
7. Backfilling with a suitable material to a minimum 300mm above YW apparatus is required.
8. Adequate support must be provided where any works pass under YW apparatus.
9. Jointing chambers, lighting columns and other structures must be installed in such a way that future repair or maintenance works to YW apparatus will not be hindered.
10. Apparatus such as; railings, sign posts, etc. must not be placed in such a way that they prevent access to or full operation of controlling valves, hydrants or similar apparatus. YWS surface boxes must not be covered or buried. Any adjustment, alteration or replacement of manhole covers must be agreed on site prior to the commencement of the works with a YWS Inspector who may be contacted via our Call Centre on 0845 124 24 24.
11. Explosives shall not be used within 100 metres of any Yorkshire Water Services apparatus or installations.
12. Vibrating plant should not be used directly over any apparatus. Movement or operation by vehicles or heavy plant is not to be permitted in the immediate vicinity of YWS plant or apparatus unless there has been prior consultation and, if necessary, adequate protection provided without cost to YWS.
13. **Under no circumstances** should thrust boring or similar trenchless techniques commence until the actual position of the Company's mains/services along the proposed route have been confirmed by trial holes.
14. Any alterations to the highway should be notified following the procedures outlined in the New Road and Street Works Act 1991 Code of Practice; Measures Necessary Where Apparatus Is Affected By Major Works (Diversions Works).

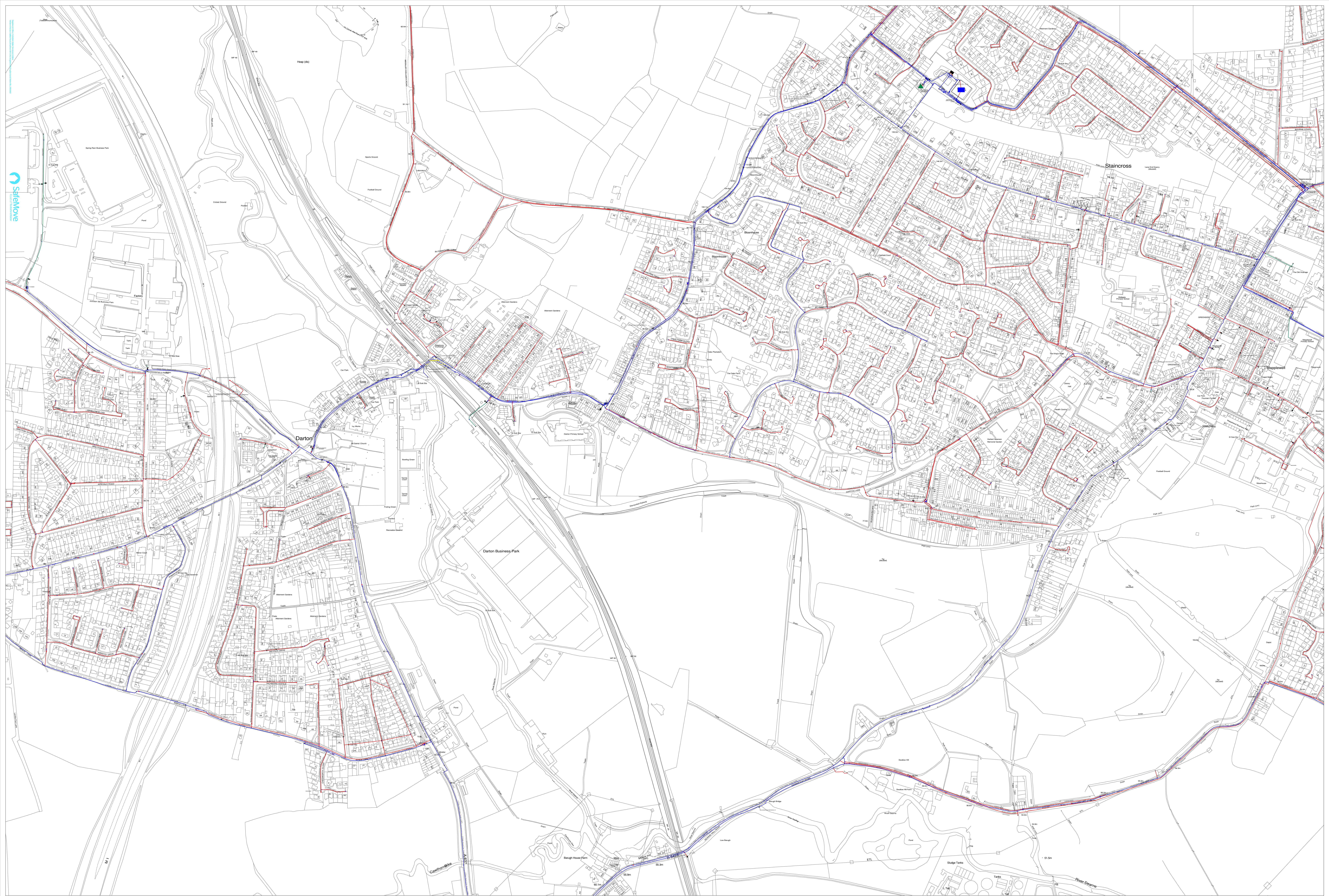
15. You will be held responsible for any damage or loss to YWS apparatus during and after completion of work, caused by yourselves, your servant or agent. Any damage caused or observed to YWS plant or apparatus should be immediately reported to YWS. Should YW incur any costs as a result of non-compliance with the above, all costs will be rechargeable in full.
16. You should ensure that nothing is done on the site to prejudice the safety or operation of YWS employees, plant or apparatus.
17. In accordance with the New Roads and Street Works Act 1991, Chapter 22, Part 3, Section 80. The location of any identified YW asset "*which is not marked, or is wrongly marked, on the records made available*" should be communicated back to Yorkshire Water. The location of the apparatus should be identified on copies of the supplied plans which should be returned to Yorkshire Water (Asset Records Team) with photographic supporting evidence where possible.
18. The Government has decided that responsibility for private sewers serving two or more properties and lateral drains (the section of pipe beyond the boundary of a single property, connecting it to the public sewer) will be transferred to the water companies on Oct 1 2011. Private pumping stations will also transfer during the period 1 October 2011 – 1 Oct 2016. Records of these assets may not yet be shown on the existing mains record drawing(s). If you encounter any of these assets you must inform Yorkshire Water Services Ltd (YWS).
19. Please note that the information supplied on the enclosed plans is reproduced from Ordnance Survey material with the permission of the Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office, © Crown Copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Licence Number 1000019559.
20. This information is for guidance only and the position and depth of any YW apparatus is approximate only. Likewise, the nature and condition of any YW apparatus cannot be guaranteed. YW has no responsibility for recording the locations of privately owned apparatus. As of 1 October 2011, there may be some lateral drains and/or public sewers which are not documented on YW records but may still be present. For the avoidance of doubt, this information is not a substitute for appropriate professional and/or legal advice. YW accepts no responsibility for any inaccuracy or omissions in this information. The actual position of YW apparatus must be determined on site by excavating trial holes by hand. YW requires a minimum of two working days' written notice of the intention to excavate any trial holes before any excavation can be undertaken. If there are any queries in this respect please contact Yorkshire Water on 0845 124 24 24.

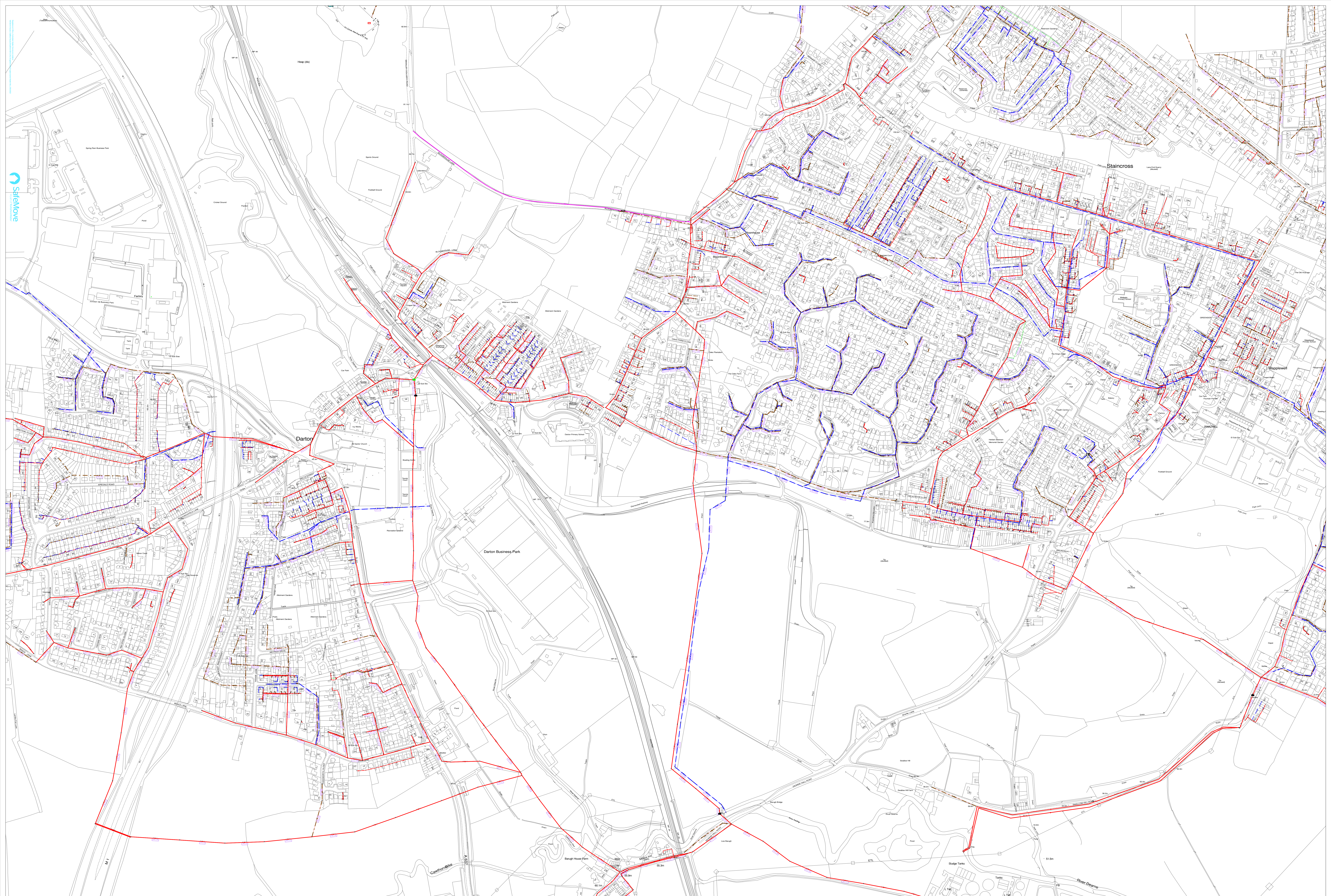
Sewer Legend

	Combined Sewer		S24 Combined Sewer
	Surface Water Sewer		S24 Surface Water Sewer
	Foul Sewer		S24 Foul Sewer
	Section 104 Sewer		Public Rising Main
	Pumping Station		Abandoned Sewer
	Public Sewage Treatment Works		Syphon Sewer & Vacuum Sewer
		+	Property Identifier

Water Legend

	Water Main 4" and below
	Water Main 4" and above
	Raw Water Main
	Private Water Main
	Fire Hydrant
	Pumping Station







Appendix VII – Yorkshire Water Pre-Planning Sewerage Enquiry

Mr J Cross
Travis Baker Ltd
Trinity Point
New Road
Halesowen
B63 3HY

Yorkshire Water Services
Developer Services
Sewerage Technical Team
PO BOX 52
Bradford
BD3 7AY

Tel: 0345 120 8482
Fax: (01274) 372 834

Your Ref:
Our Ref: U018744

Email:
Technical.Sewerage@yorkshirewater.co.uk

For telephone enquiries ring:
Chris Roberts on 0345 120 8482

20th November 2018

Dear Mr T Baker,

Land Off Darton Lane, Barnsley - Pre-Planning Sewerage-Enquiry-Residential T210841

Thank you for your recent enquiry and remittance. Our official VAT receipt has been sent to you under separate cover. Please find enclosed a complimentary extract from the Statutory Sewer Map which indicates the recorded position of the public sewers. Please note that as of October 2011 and the private to public sewer transfer, there are many uncharted Yorkshire Water assets currently not shown on our records.

The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of twelve months.

Existing Infrastructure

There is a 600 mm diameter public combined water sewer recorded crossing the site. No buildings, or other obstructions, are to be erected within 3.5 (three point) metres,

There is a 675 mm diameter public surface water sewer recorded crossing the site. No buildings, or other obstructions, are to be erected within 3.5 (three point) metres,.

There is a 525 mm diameter public surface water sewer recorded crossing the site. No buildings, or other obstructions, are to be erected within 3.5 (three point) metres,

There is a 450 mm diameter public surface water sewer recorded crossing the site. No buildings, or other obstructions, are to be erected within 3.5 (three point) metres,

nor trees planted within 5 (five) metres of this public sewer. It may not be acceptable to raise or lower ground levels over the sewer, nor to restrict access to the manholes on the sewer.

If you wish to have this sewer diverted under Section 185 of the Water Industry Act 1991 an application should be made in writing. To discuss this matter, please telephone 0345 120 84 82.



Foul Water

Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.

Foul water domestic waste should discharge to the 600 mm diameter public combined sewer recorded running through the eastern part of the site.

Surface Water

The developer's attention is drawn to Requirement H3 of the Building Regulations 2000. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order.

Sustainable Drainage Systems (SuDS), for example the use of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SuDS in this instance from the appropriate authorities.

As the proposal site is currently undeveloped no surface water is known to have previously discharged to the public sewer network

As such, the local public sewer network does not have capacity to accept any surface water from the proposed site. If SuDS are not viable, the developer is advised to contact the Environment Agency/local Land Drainage Authority/Internal Drainage Board with a view to establishing a suitable watercourse for discharge.

It is understood that a 525/600 mm culverted watercourse and normal watercourses are located through the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable).

Please note further restrictions on surface water disposal from the site may be imposed by other parties. You are strongly advised to seek advice/comments from the Environment Agency/Land Drainage Authority/Internal Drainage Board, with regard to surface water disposal from the site.

Other Observations

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may obtain an application form from our website (www.yorkshirewater.com) or by telephoning 0345 120 84 82.

An off-site foul and surface water sewer may be required which may be provided by the developer and considered for adoption under Section 104 of the Water Industry Act 1991. Please telephone 0345 120 84 82 for advice on sewer adoptions. Alternatively, the developer may in certain circumstances be able to requisition off-site sewers under Section 98 of the Water Industry Act 1991 for which an application must be made in writing. For further information, please telephone 0345 120 84 82.

Prospectively adoptable sewers and pumping stations must be designed and constructed in accordance with the WRc publication "Sewers for Adoption - a design and construction guide for developers" 6th Edition as supplemented by Yorkshire Water's requirements, pursuant to an agreement under Section 104 of the Water Industry Act 1991. An application to enter into a Section 104 agreement must be made in writing prior to any works commencing on site. Please contact our Developer Services Team (telephone 0345 120 84 82) for further information.

All the above comments are based upon the information and records available at the present time. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith.



YorkshireWater

Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Chris Roberts'.

Chris Roberts
Sewerage Technician
Developer Services



Appendix VIII – Yorkshire Water Sewer Records



Tip
(disused)