LAND ADJOINING CHURCH STREET, BRIERLEY

Drainage Strategy

Issue: 1

Author: Mark Taylor

Date: 14/10/ 2024

flow
DRAINAGE DESIGN

RECORD OF REVISIONS

Rev	Date	Description	By
1	14/10/24	First Issue	MT

CONTENTS

Appendices

1. INTRODUCTION

1.1. The following report summarises our findings and recommendations in relation to the foul and surface water drainage systems to serve the proposed new development on Land Adjoining Church Street, Brierley, near Barnsley.

1.2. The Local Authority Drainage Engineer will wish to see a Sustainable Drainage Strategy (SUDS) implemented for surface water disposal at the site, based on the following hierarchy:

- Infiltration/soakaway drainage
- Discharge to a watercourse at greenfield rates
- Discharge to a surface water sewer at rates agreed with the overseeing Water Authority
- Discharge to a combined sewer at rates agreed with the overseeing Water Authority

1.3. Infiltration rates in the area are expected to be good, and it is planned to provede infiltration drainage for the whole site, however, no tests have been carried out at the time of writing.

1.4. If against expectations the infiltration rates are found to be poor, or infiltration drainage is not viable due to other adverse conditions such as contamination, then the site will adopt an attenuated discharge to the nearby combined sewer at a rate agreed with the Water Authority.

1.5. In this way it can be determined that a SUDS compliant solution is viable, regardless of ground conditions.

1.6. There are no public or private sewers within the site but public sewers are available nearby in Church Street. New private sewers will be laid to allow connectivity with the local public foul sewer network.

2. SITE LOCATION , TOPOGRAPHY AND WATER ENVIRONMENT

2.1. The site is located on land to the north of Brierley Methodist Church in the northern end of Brierley, and is shown on *Figure 1* below. The site is centred on Ordnance Survey grid reference SE 409112 and co-ordinates: E440911 , N411240.

Figure **1***: Site Location*

2.2. The site currently contains 2 existing dwellings and some farm buildings.

2.3. The plot sits on top of a hill and and falls gently from 106.5m AOD at the rear boundary, southwest to 105.5m AOD on Church Street.

2.4. There are no adjacent watercourses, the nearest being the Hemp Dyke and Frickley Dyke about 800m to the north.

2.5. An aerial photograph and topographical survey of the site are found in *Appendix B.*

2.6. There are private sewers serving the existing dwellings but no public sewers within the site. A 150mm diameter combined public sewer exists in the adjacent public highway, Church Street.

3. ANTICIPATED GROUND CONDITIONS

3.1 A review of the local geology and descriptions within the British Geological Survey record Brierley Rock (Sandstone) across the site. There are no records of the superficial geology.

3.2 The soilscape website reviews shallower soil conditions and shows freely draining, slightly acidic loamy soils.

3.3 Given the elevated position within the landscape and the permeable nature of the bedrock, groundwater is expected to reside at considerable depth.

4. PROPOSED SCHEME

4.1. The proposed scheme comprises the construction of 10 new dwellings with associated access road, driveways and gardens.

4.2. A plans showing the layout of the proposals is included in *Appendix A*.

5. SURFACE WATER DRAINAGE STRATEGY

5.1. The following chapter describes the drainage strategy that will be adopted. Copies of the calculations referred to are found in Appendix D.

OPTION 1 – Infiltration

5.2. For the purposes of design an infiltration rate of $5x10^{-5}$m/s has been used. This is reflective of a moderate infiltration rate. Actual rates on site are expected to be good, so this is considered a conservative approach.

5.3. The proposals will include a new access road, driveways, patios and paths. It is proposed to use porous construction for all pavements. Self draining permeable pavements will work well, up to the design standard, with infiltration rates far lower than the estimated rate.

5.4. Roof water from the houses will be collected in conventional gutters and downpipes and will then be directed to chamber soakaways in their gardens.

5.5. As such the site will drain entirely by infiltration and will discharge surface water at the pre-development greenfield rate after construction.

5.6. The results of the soakway designs are found in Appendix D. The calculation sheets give a utilisation factor for each saoakaway for the 1 in 100 year rainfall event, over a range of storm durations, plus a 40% allowance for future climate change.

5.7. For a valid design the utilisation factor must be less than, or equal to, 1.0. The proposals achieve a utilisation factor of 0.90 or better, therefore all design rainfall events up to the 100 year (plus climate change) storm are contained below ground.

5.8. The systems must also drain quickly enough to be ready for subsequent storm events, with a 'Half Drain' time below 24 hours. The calculations indicate an acceptable maximum half drain time of 0.98 hours.

5.9. To summarise:

House Type	Drained Area (m2)	Details	Number Required	Utilisation Factor	½ Drain Time (hr)
A	127	1.5m deep 1500mm dia chamber 3000mm dia pit	2	0.95	0.97
B	113	1.5m deep 1500mm dia chamber 2750mm dia pit	3	0.95	0.99
C	67	1.5m deep 1200mm dia chamber 2000mm dia pit	3	0.95	0.89
D	127	1.5m deep 1500mm dia chamber 3000mm dia pit	2	0.95	0.97

5.10. The systems must also be maintained correctly to ensure they remain operational for their intended lifetime. A comprehensive maintenance plan is found in Appendix F.

5.11. Detailed construction drawings are found in Appendix E.

OPTION 2 – Attenuation

5.12. It seems likely that infiltration drainage will be viable at this site. Should it be found, however, that infiltration is not suitable for use at this site there is a 150mm diameter combined sewer in Church Street, directly alongside the site.

5.13. Option 2 will still use porous paving for the road, however in this scenario it will be given an impermeable lining to create a 'tanked' system. All surface water will be directed into the tanked porous paving and discharge will be via a flow control devise to the sewer, at a rate agreed with the Water Authority.

5.14. The total roof area on site is 1048m2 and the permeable access rad and parking areas amount to 1202m2. Giving a total drained area of 2250m2.

5.15. The Source Control module of the Microdrainage design software gives a value of Qbar of 1.75 l/s/ha, and therefore a site discharge rate (0.23ha) of 0.40l/s.

5.16. It is usually accepted that such low flow rates are impractical to achieve as control devices are too small and liable to blockage, increasing the risk of flooding. It is therefore proposed to limit flows to 1l/s, thereby providing a robust and durable system with flows as close as practicable to the greenfield rate.

5.17. The attached calculation sheet shows that a storage volume of 169.50m3 is required to accommodate the 100 year (+40%) rainfall event with a peak discharge rate of 1l/s.

5.18. The storage can be provided within the porous sub-base, which at 1202m2 and 470mm deep with a 30% void ratio would provide 169.80m3.

5.19. It is proposed to provide a simple orifice flow control device to attenuate flows to 1.0l/s.

Exceedance Flows

5.20. In any surface water design scenario it is possible that the peak design storm could be exceeded or the system could fail through damage or blockage. The exceedance flow route indicates how water will behave in this event, and must ensure that it is dispersed safely, without risk to property or persons.

5.21. All infiltration or attenuation systems will be positioned at lower elevations than the houses and exceedance flows will follow the local topography, falling to the southwest, away from the dwellings and onto the public highway.

5.22. This would replicate precisely the current situation should the ground become saturated, the water will either infiltrate naturally where it can as it follows the topography, or continue overland to the southwest onto the public highway and flow west out of the village, away from all existing dwellings.

6. FOUL WATER DRAINAGE STRATEGY

6.1. Foul water flows will be directed to the public combined sewer in Church Street to the west. A copy of the public sewer record is found in Appendix C.

6.2. An application will be made to Yorkshire Water for consent to connect in due course.

7. CONCLUSIONS AND RECOMMENDATIONS

SURFACE WATER

7.1. Infiltration rates are expected to be good across the site.

7.2. All pavements will be constructed in permeable systems.

7.3. Surface water generated from the roof areas will be directed to soakaways in the gardens of the dwellings.

7.4. Soakaway designs are based on an estimated infiltration rate of $5x10^{-5}$ m/s, which is considered moderate, and a conservative approach at this site. Self draining permeable pavement will work well with the estimated infiltration rate.

7.5. The soakaways have been checked and found to accommodate the 1in100 year storm with, an appropriate allowance for future climate change (currently 40%), without surface flooding.

7.6. Should infiltration drainage prove unviable due to some unforeseen factor such as contamination, then an alternative attenuated drainage approach will be adopted, with flow limited to 1l/s, to replicate as closely as possible the greenfield run-off rate.

7.7. In this way it can be demonstrated that a SUDS compliant design is possible, regardless of ground conditions.

7.8. In the event of failure by blockage, or an event greater than the design storm, exceedance flows will flow safely away from the proposed dwellings and any nearby properties.

7.9. It is therefore concluded that sustainable drainage systems are practical and can be implemented at this site in line with the Building Regulations SUDS hierarchy and current planning policy.

7.10. Calculations and drawings are found an Appendices D and E.

FOUL WATER

7.11. Foul water flows will be directed to the public combined sewer in Church Street, to the southwest.

APPENDIX A
DRAWINGS

Site Layout

House Type:	House No.	Details	GIA m²
House Type A	1	2 Storey, 4 Double Bed 2 En-suite House, Internal Garage	198.6m²
House Type B	2	2 Storey, 4 Double Bed 3 En-suite House,	189.5m²
House Type B - Mirror	3	2 Storey, 4 Double Bed 3 En-suite House, Internal Garage	189.5m²
House Type B - Mirror	4	2 Storey, 4 Double Bed 3 En-suite House, Internal Garage	189.5m²
House Type A - Mirror	5	2 Storey, 4 Double Bed 3 En-suite House, Internal Garage	198.6m²
House Type D	6	2 Storey, 4 Double Bed 3 En-suite House, Internal Garage	198.6m²
House Type C	7	2 Storey, 1 Attic Room, 3 Double Bed, 1 En-suite	135.6m²
House Type C - Mirror	8	2 Storey, 1 Attic Room, 3 Double Bed, 1 En-suite	135.6m²
House Type C	9	2 Storey, 1 Attic Room, 3 Double Bed, 1 En-suite	135.6m²
House Type D	10	2 Storey, 4 Double Bed 3 En-suite House, Internal Garage	198.6m²

Devlopment Boundary

Ownership Boundary

PLANNING STATUS

A - Planning Issue **/**/24

AMENDMENTS:

client

project

PEAR TREE FARM, MASTER PLAN,
CHURCH STREET,
BRIERLEY, BARNSLEY

drawing

PROPOSED SITE PLAN

date JUNE 24 **drawn** LK **checked** DR

scale 1:500@A1 **drawer no** **dwg no** 4038-03-A

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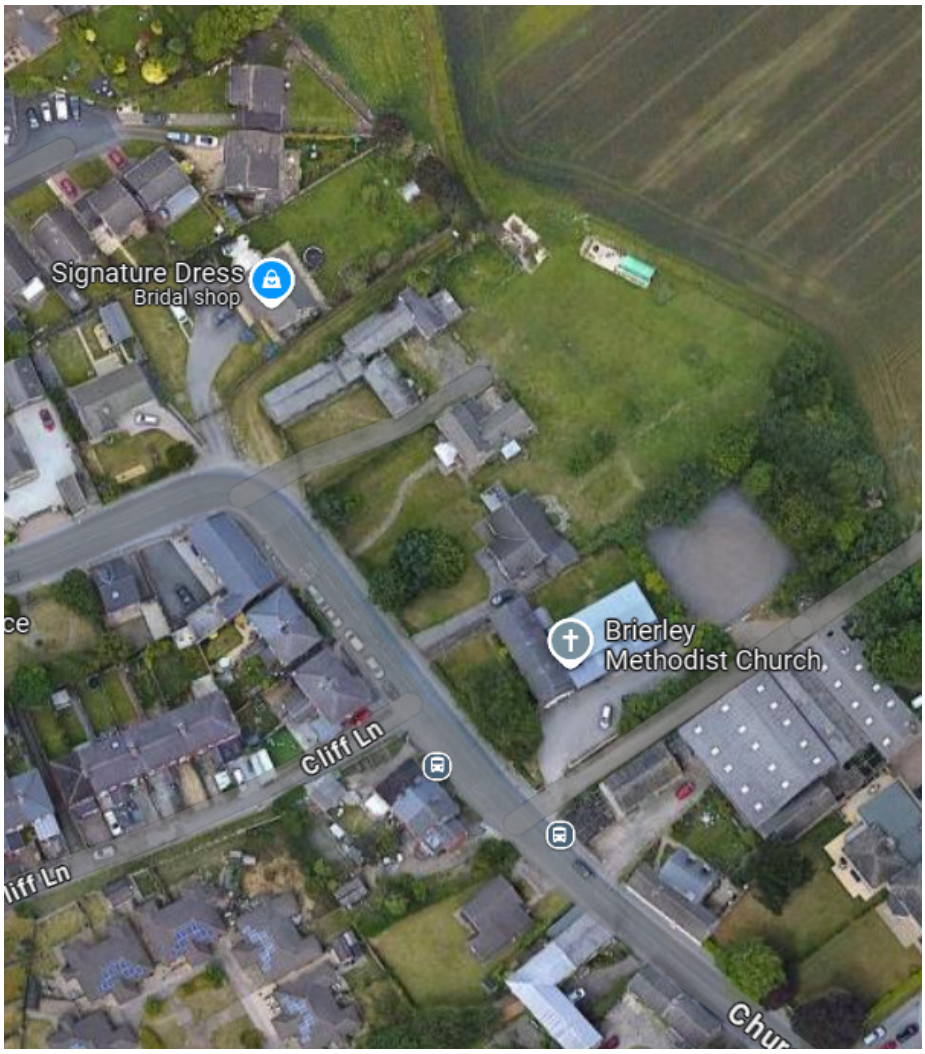
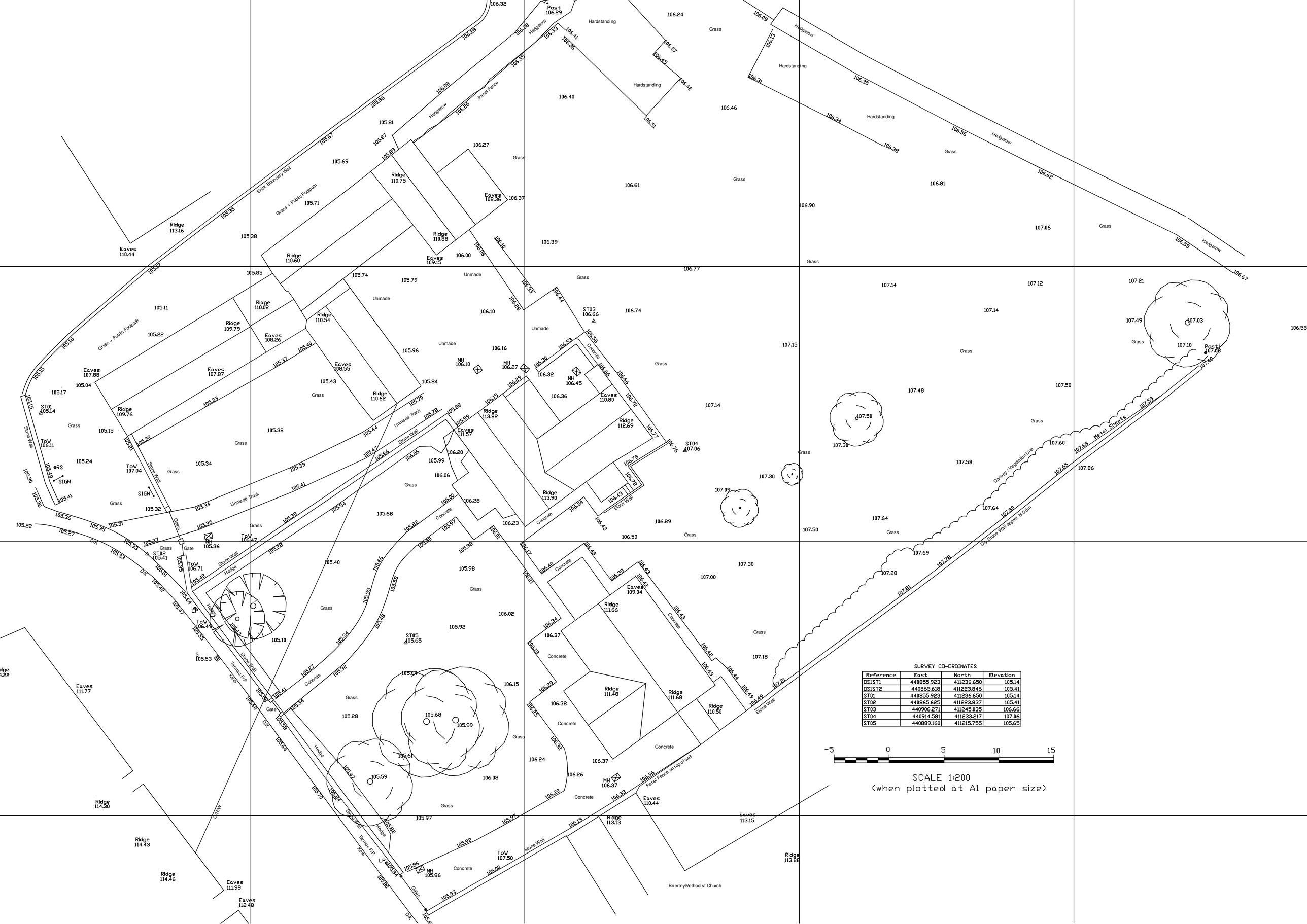
Building Link Design Limited
Company reg. 4377549

bld ARCHITECTS

APPENDIX B

Aerial Photograph & Topographical Survey




Brick Boundary Wall
Grass + Public Footpath
Hedgerow
Hardstanding
Grass
Unmade
Unmade Track
Concrete
Panel Fence
Panel Fence on top of Hedge
Stone Wall
Dry Stone Wall approx H.0.5m
Metal Sheets
Canopy / Vegetation Line
Tarmac F/P
Kerb
Hedge
Gate
Gates
Block Wall
Brierley Methodist Church
Post
Eaves
Ridge
ToW
MH
LP
SIGN
ST01 105.14
ST02 105.41
ST03 106.66
ST04 107.06
ST05 105.65
SURVEY CO-ORDINATES
Reference | East | North | Elevation
BSIST1 | 440855.923 | 411236.650 | 105.14
BSIST2 | 440865.618 | 411223.846 | 105.41
ST01 | 440855.923 | 411236.650 | 105.14
ST02 | 440865.625 | 411223.837 | 105.41
ST03 | 440906.271 | 411245.035 | 106.66
ST04 | 440914.581 | 411233.217 | 107.06
ST05 | 440889.160 | 411215.755 | 105.65
-5 0 5 10 15
SCALE 1:200
(when plotted at A1 paper size)

APPENDIX C

Public Sewer Records

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 45o 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 (Diversionary 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.

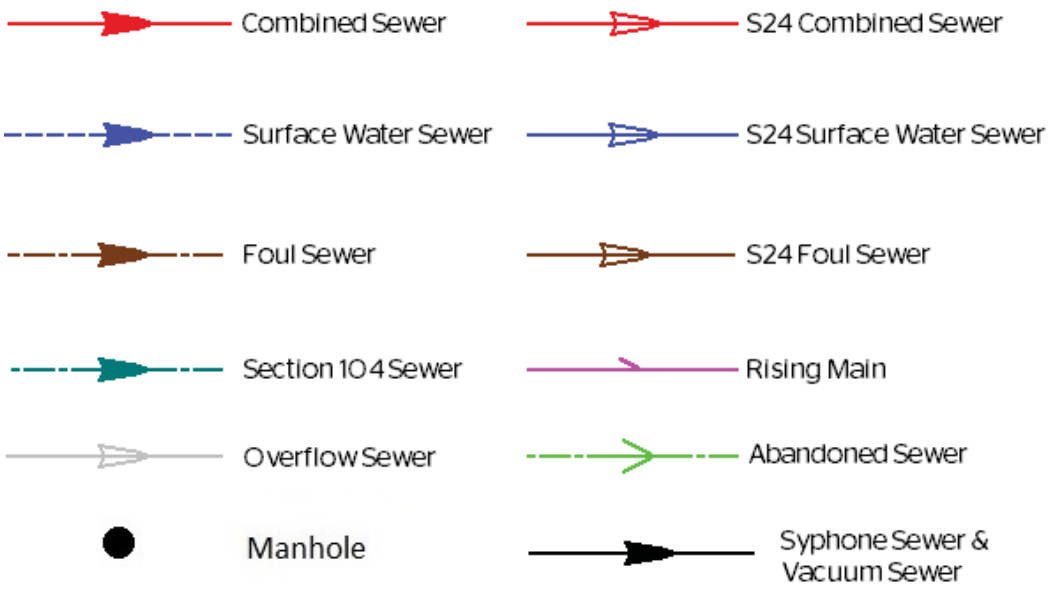
Private pumping stations will also transfer during the period 1 October 2011 – 1 Oct 2016. Records of these assets may not yet be shown on the existing mains record drawing(s). If you encounter any of these assets you must inform Yorkshire Water Services Ltd (YWS).

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 AC0000857457.

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 trail 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.

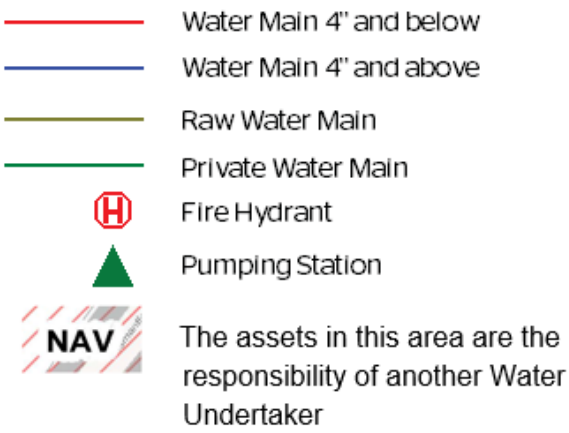
Property Identfier

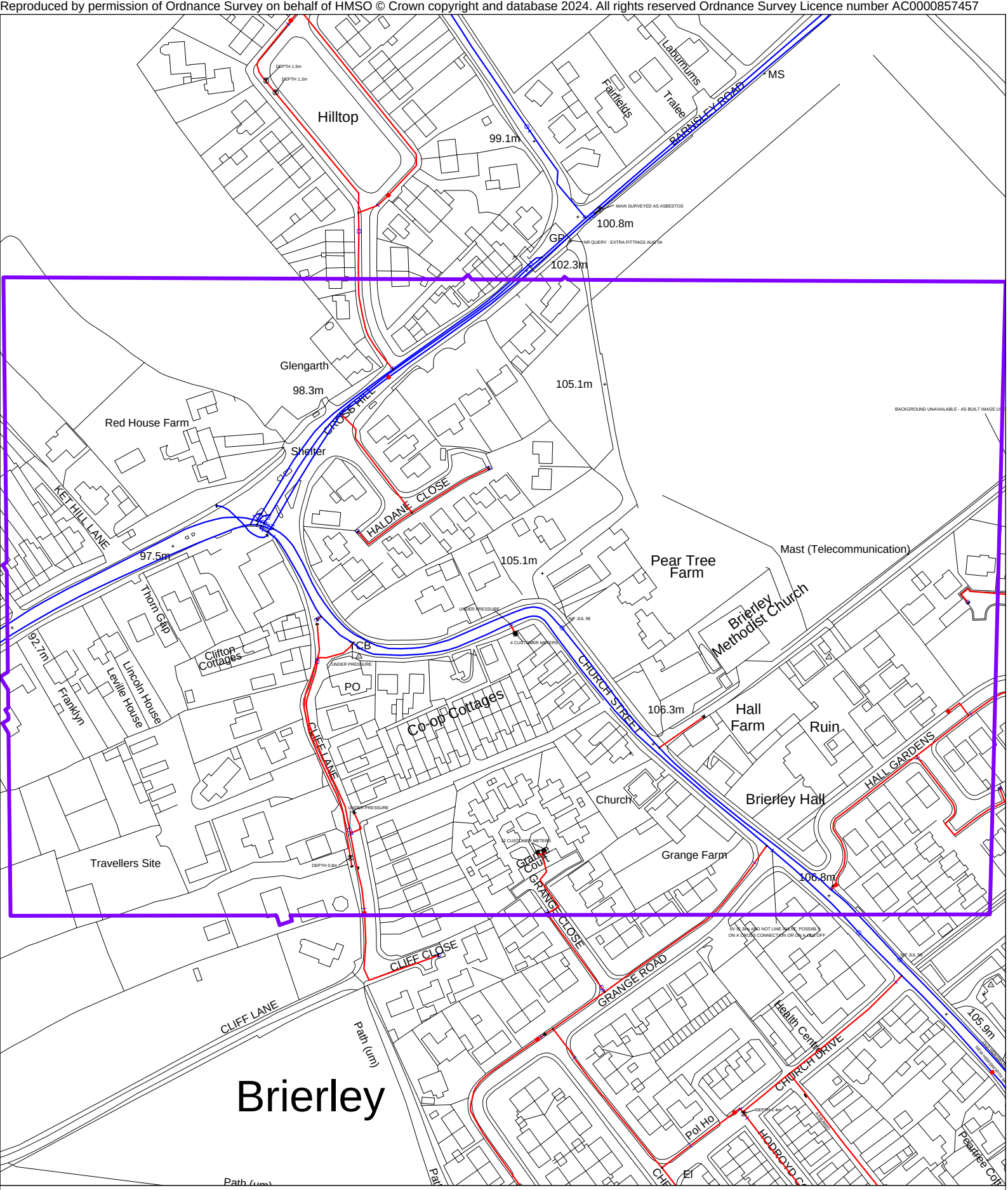
Sewer Legend



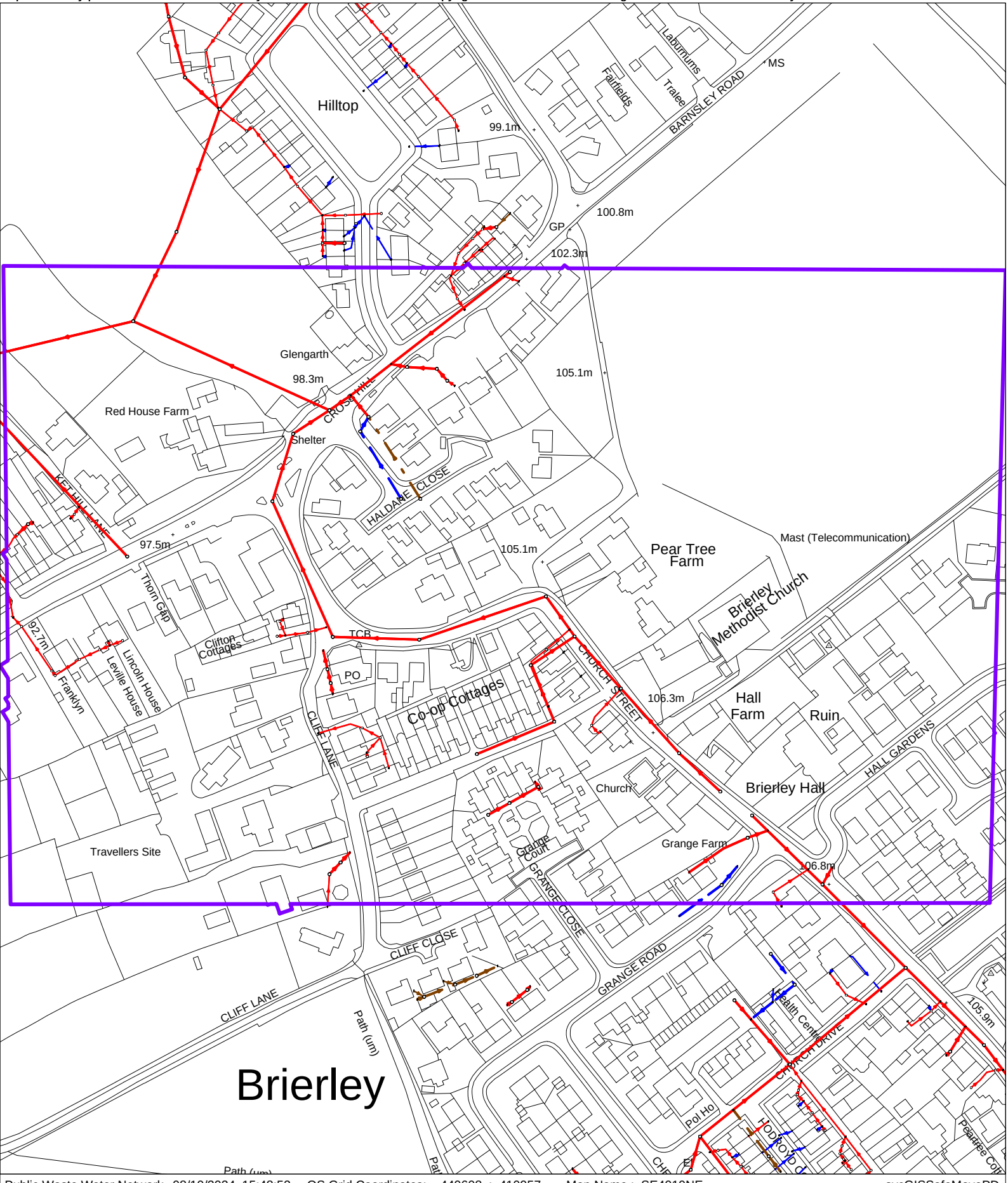
Please note that the direction of flow arrows may not always appear depending on the scale of the map.

Water Legend





Public Clean Water Network 08/10/2024 15:48:50 OS Grid Coordinates: 440608 : 410957 Map Name : SE4010NE svcGISSafeMovePD



Public Waste Water Network 08/10/2024 15:48:52 OS Grid Coordinates: 440608 : 410957 Map Name : SE4010NE svcGISSafeMovePD

APPENDIX D

CALCULATIONS

Date 10/10/2024 09:33	Designed by Mark
File	Checked by
Micro Drainage	Source Control 2016.1.1

IH 124 Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	50.000	Urban	0.000
SAAR (mm)	676	Region Number	Region 3

Results	l/s
QBAR Rural	87.5
QBAR Urban	87.5
Q100 years	182.0
Q1 year	75.2
Q2 years	82.5
Q5 years	109.3
Q10 years	126.8
Q20 years	143.7
Q25 years	149.2
Q30 years	153.8
Q50 years	165.7
Q100 years	182.0
Q200 years	206.4
Q250 years	214.3
Q1000 years	265.9

Qbar 50 ha = 87.5l/s

Qbar 1ha = 87.5/50 = 1.75l/s

Qbar 0.23ha = 0.23 x 1.75 = 0.4l/s

Flow Drainage Design
info@flowdrainagedesign.co.uk
Tel: 07837685280

Church Street

		Revision	
Job No:	**2493**	Page:	**C/01**
Section: **Soakaways - Type A**	Prepared By:	**MT**	Date: **14/10/2024**

ALTERNATIVE SOAKAWAY SIZES

	trench soakaways		
width of trench *[mm]*:	**450**	**600**	**900**
required trench length *[m]*:	15.49	12.54	9.20
	ring soakaways		
diameter of ring *[mm]*:	1350	1800	2100
required pit diameter *[m]*:	3.03	2.68	2.35

** Based on effective depth and number of pits as in Soakaway Data table*

SUMMARY OF CALCULATIONS

critical design rainfall duration 't_{crit}' =	60	*min*
required storage volume 'V_{req}' =	4.67	m^3
provided storage volume 'V_{prov}' =	4.93	m^3
utilisation factor =	**0.95**	***.OK***
required time to discharge 50% 't_{50}' =	0.97	*hours*
utilisation factor =	**0.04**	***.OK***

GENERAL DATA

site location:	**England and Wales**
soakaway type:	**perforated concrete ring**
pit shape:	**circular pit around ring**
impermeable area drained to soakaway 'A' *[m^2]* =	**127**
60 min rainfall depth of 5 year return period 'R' *[mm]* =	**20**
M5-60 to M5-2d rainfall ratio 'r' =	**0.45**
allowance for climate change:	**40%**

SOAKAWAY DATA

number of ring soakaways:	**1**
circular pit diameter 'D' [m] =	**3.00**
soakaway ring internal diameter 'D_{int}' *[mm]* =	**1500**
total depth from ground level 'D_b' *[m]* =	**1.50**
depth to drain invert level 'D_d' *[m]* =	**0.00**
soakaway effective depth 'D_{eff}' *[m]* =	1.50
free volume in infill aggregate *[%]* =	**30**

SOIL INFILTRATION DATA

allowance for infiltration through soakaway base:	**100%**
available on-site infiltration test results:	○ Yes ◉ No
soil infiltration rate 'f' *[m/s]* =	**5.00E-05**

REQUIRED STORAGE CAPACITY PER RAINFALL DURATION

rainfall duration *[min]*	rainfall factor Z1	**M5-D** rainfalls *[mm]*	**M10-D** Z2	**M10-D** rainfalls *[mm]*	**M10-D** inflow *[m^3]*	**M50-D** Z2	**M50-D** rainfalls *[mm]*	**M50-D** inflow *[m^3]*	**M100-D** Z2	**M100-D** rainfalls *[mm]*	**M100-D** inflow *[m^3]*	outflow from soakaway *[m^3]*	required storage *[m^3]*
5	0.39	7.80	1.21	13.18	1.67	1.61	17.59	2.23	1.86	20.28	2.58	0.21	2.36
10	0.54	10.80	1.22	18.49	2.35	1.66	25.07	3.18	1.92	29.07	3.69	0.42	3.27
15	0.65	13.00	1.23	22.42	2.85	1.68	30.58	3.88	1.96	35.64	4.53	0.64	3.89
30	0.82	16.40	1.24	28.47	3.62	1.71	39.22	4.98	2.00	45.95	5.84	1.27	4.56
60	1.00	20.00	1.24	34.72	4.41	1.73	48.44	6.15	2.03	56.84	7.22	2.54	**4.67**
120	1.19	23.80	1.24	41.32	5.25	1.72	57.39	7.29	2.01	67.13	8.53	5.09	3.44
240	1.38	27.60	1.23	47.51	6.03	1.71	66.06	8.39	1.99	76.86	9.76	10.18	0.00
360	1.51	30.20	1.22	51.56	6.55	1.70	71.83	9.12	1.97	83.22	10.57	15.27	0.00
600	1.68	33.60	1.21	56.88	7.22	1.68	78.95	10.03	1.94	91.31	11.60	25.45	0.00
1440	2.03	40.60	1.19	67.57	8.58	1.64	93.01	11.81	1.89	107.15	13.61	61.07	0.00

** Z2 is growth factor from M5 rainfalls*

Flow Drainage Design
info@flowdrainagedesign.co.uk
Tel: 07837685280

Church Street

		Revision	
Job No:	**2493**	Page:	**C/01**
Section: **Soakaways - Type B**		Prepared By:	**MT**	Date:	**14/10/2024**

ALTERNATIVE SOAKAWAY SIZES

	trench soakaways		
width of trench *[mm]*:	**450**	**600**	**900**
required trench length *[m]*:	13.77	11.14	8.17
	ring soakaways		
diameter of ring *[mm]*:	1350	1800	2100
required pit diameter *[m]*:	2.78	2.40	2.05

** Based on effective depth and number of pits as in Soakaway Data table*

SUMMARY OF CALCULATIONS

critical design rainfall duration 't_{crit}' =	60	*min*
required storage volume 'V_{req}' =	4.19	m^3
provided storage volume 'V_{prov}' =	4.42	m^3
utilisation factor =	**0.95**	***.OK***
required time to discharge 50% 't_{50}' =	0.99	*hours*
utilisation factor =	**0.04**	***.OK***

GENERAL DATA

site location:	**England and Wales**
soakaway type:	**perforated concrete ring**
pit shape:	**circular pit around ring**
impermeable area drained to soakaway 'A' *[m^2]* =	**113**
60 min rainfall depth of 5 year return period 'R' *[mm]* =	**20**
M5-60 to M5-2d rainfall ratio 'r' =	**0.45**
allowance for climate change:	**40%**

SOAKAWAY DATA

number of ring soakaways:	**1**
circular pit diameter 'D' [m] =	**2.75**
soakaway ring internal diameter 'D_{int}' *[mm]* =	**1500**
total depth from ground level 'D_b' *[m]* =	**1.50**
depth to drain invert level 'D_d' *[m]* =	**0.00**
soakaway effective depth 'D_{eff}' *[m]* =	1.50
free volume in infill aggregate *[%]* =	**30**

SOIL INFILTRATION DATA

allowance for infiltration through soakaway base:	**100%**
available on-site infiltration test results:	○ Yes ◉ No
soil infiltration rate 'f' *[m/s]* =	**5.00E-05**

REQUIRED STORAGE CAPACITY PER RAINFALL DURATION

rainfall duration *[min]*	rainfall factor Z1	**M5-D** rainfalls *[mm]*	**M10-D** Z2	**M10-D** rainfalls *[mm]*	**M10-D** inflow *[m^3]*	**M50-D** Z2	**M50-D** rainfalls *[mm]*	**M50-D** inflow *[m^3]*	**M100-D** Z2	**M100-D** rainfalls *[mm]*	**M100-D** inflow *[m^3]*	outflow from soakaway *[m^3]*	required storage *[m^3]*
5	0.39	7.80	1.21	13.18	1.49	1.61	17.59	1.99	1.86	20.28	2.29	0.19	2.11
10	0.54	10.80	1.22	18.49	2.09	1.66	25.07	2.83	1.92	29.07	3.29	0.37	2.91
15	0.65	13.00	1.23	22.42	2.53	1.68	30.58	3.46	1.96	35.64	4.03	0.56	3.47
30	0.82	16.40	1.24	28.47	3.22	1.71	39.22	4.43	2.00	45.95	5.19	1.12	4.07
60	1.00	20.00	1.24	34.72	3.92	1.73	48.44	5.47	2.03	56.84	6.42	2.24	**4.19**
120	1.19	23.80	1.24	41.32	4.67	1.72	57.39	6.49	2.01	67.13	7.59	4.47	3.12
240	1.38	27.60	1.23	47.51	5.37	1.71	66.06	7.46	1.99	76.86	8.69	8.94	0.00
360	1.51	30.20	1.22	51.56	5.83	1.70	71.83	8.12	1.97	83.22	9.40	13.41	0.00
600	1.68	33.60	1.21	56.88	6.43	1.68	78.95	8.92	1.94	91.31	10.32	22.35	0.00
1440	2.03	40.60	1.19	67.57	7.64	1.64	93.01	10.51	1.89	107.15	12.11	53.65	0.00

** Z2 is growth factor from M5 rainfalls*

Flow Drainage Design
info@flowdrainagedesign.co.uk
Tel: 07837685280

Church Street

Revision

Job No:	**2493**	Page:	**C/01**
Section: **Soakaways - Type C**	Prepared By:	**MT**	Date: **14/10/2024**

ALTERNATIVE SOAKAWAY SIZES

	trench soakaways		
width of trench *[mm]*:	**450**	**600**	**900**
required trench length *[m]*:	8.12	6.53	4.76
	ring soakaways		
diameter of ring *[mm]*:	1050	1350	1500
required pit diameter *[m]*:	2.07	1.82	1.66

** Based on effective depth and number of pits as in Soakaway Data table*

SUMMARY OF CALCULATIONS

critical design rainfall duration 't_{crit}' =	60	*min*
required storage volume 'V_{req}' =	2.39	m^3
provided storage volume 'V_{prov}' =	2.51	m^3
utilisation factor =	**0.95**	***.OK***
required time to discharge 50% 't_{50}' =	0.89	*hours*
utilisation factor =	**0.04**	***.OK***

GENERAL DATA

site location:	**England and Wales**
soakaway type:	**perforated concrete ring**
pit shape:	**circular pit around ring**
impermeable area drained to soakaway 'A' *[m^2]* =	**67**
60 min rainfall depth of 5 year return period 'R' *[mm]* =	**20**
M5-60 to M5-2d rainfall ratio 'r' =	**0.45**
allowance for climate change:	**40%**

SOAKAWAY DATA

number of ring soakaways:	**1**
circular pit diameter 'D' [m] =	**2.00**
soakaway ring internal diameter 'D_{int}' *[mm]* =	**1200**
total depth from ground level 'D_b' *[m]* =	**1.50**
depth to drain invert level 'D_d' *[m]* =	**0.00**
soakaway effective depth 'D_{eff}' *[m]* =	1.50
free volume in infill aggregate *[%]* =	**30**

SOIL INFILTRATION DATA

allowance for infiltration through soakaway base:	**100%**
available on-site infiltration test results:	○ Yes ◉ No
soil infiltration rate 'f' *[m/s]* =	**5.00E-05**

REQUIRED STORAGE CAPACITY PER RAINFALL DURATION

rainfall duration *[min]*	rainfall factor Z1	**M5-D** rainfalls *[mm]*	**M10-D** Z2	**M10-D** rainfalls *[mm]*	**M10-D** inflow *[m^3]*	**M50-D** Z2	**M50-D** rainfalls *[mm]*	**M50-D** inflow *[m^3]*	**M100-D** Z2	**M100-D** rainfalls *[mm]*	**M100-D** inflow *[m^3]*	outflow from soakaway *[m^3]*	required storage *[m^3]*
5	0.39	7.80	1.21	13.18	0.88	1.61	17.59	1.18	1.86	20.28	1.36	0.12	1.24
10	0.54	10.80	1.22	18.49	1.24	1.66	25.07	1.68	1.92	29.07	1.95	0.24	1.71
15	0.65	13.00	1.23	22.42	1.50	1.68	30.58	2.05	1.96	35.64	2.39	0.35	2.03
30	0.82	16.40	1.24	28.47	1.91	1.71	39.22	2.63	2.00	45.95	3.08	0.71	2.37
60	1.00	20.00	1.24	34.72	2.33	1.73	48.44	3.25	2.03	56.84	3.81	1.41	**2.39**
120	1.19	23.80	1.24	41.32	2.77	1.72	57.39	3.85	2.01	67.13	4.50	2.83	1.67
240	1.38	27.60	1.23	47.51	3.18	1.71	66.06	4.43	1.99	76.86	5.15	5.65	0.00
360	1.51	30.20	1.22	51.56	3.45	1.70	71.83	4.81	1.97	83.22	5.58	8.48	0.00
600	1.68	33.60	1.21	56.88	3.81	1.68	78.95	5.29	1.94	91.31	6.12	14.14	0.00
1440	2.03	40.60	1.19	67.57	4.53	1.64	93.01	6.23	1.89	107.15	7.18	33.93	0.00

** Z2 is growth factor from M5 rainfalls*

Flow Drainage Design
info@flowdrainagedesign.co.uk
Tel: 07837685280

Church Street

		Revision	
Job No:	**2493**	Page:	**C/01**
Section: **Soakaways - Type D**		Prepared By:	**MT**	Date:	**14/10/2024**

ALTERNATIVE SOAKAWAY SIZES

	trench soakaways		
width of trench *[mm]*:	**450**	**600**	**900**
required trench length *[m]*:	15.49	12.54	9.20
	ring soakaways		
diameter of ring *[mm]*:	1350	1800	2100
required pit diameter *[m]*:	3.03	2.68	2.35

** Based on effective depth and number of pits as in Soakaway Data table*

SUMMARY OF CALCULATIONS

critical design rainfall duration 't_{crit}' =	60	*min*
required storage volume 'V_{req}' =	4.67	m^3
provided storage volume 'V_{prov}' =	4.93	m^3
utilisation factor =	**0.95**	***.OK***
required time to discharge 50% 't_{50}' =	0.97	*hours*
utilisation factor =	**0.04**	***.OK***

GENERAL DATA

site location:	**England and Wales**
soakaway type:	**perforated concrete ring**
pit shape:	**circular pit around ring**
impermeable area drained to soakaway 'A' *[m^2]* =	**127**
60 min rainfall depth of 5 year return period 'R' *[mm]* =	**20**
M5-60 to M5-2d rainfall ratio 'r' =	**0.45**
allowance for climate change:	**40%**

SOAKAWAY DATA

number of ring soakaways:	**1**
circular pit diameter 'D' [m] =	**3.00**
soakaway ring internal diameter 'D_{int}' *[mm]* =	**1500**
total depth from ground level 'D_b' *[m]* =	**1.50**
depth to drain invert level 'D_d' *[m]* =	**0.00**
soakaway effective depth 'D_{eff}' *[m]* =	1.50
free volume in infill aggregate *[%]* =	**30**

SOIL INFILTRATION DATA

allowance for infiltration through soakaway base:	**100%**
available on-site infiltration test results:	○ Yes ◉ No
soil infiltration rate 'f' *[m/s]* =	**5.00E-05**

REQUIRED STORAGE CAPACITY PER RAINFALL DURATION

rainfall duration *[min]*	rainfall factor Z1	M5-D rainfalls *[mm]*	M10-D Z2	M10-D rainfalls *[mm]*	M10-D inflow *[m^3]*	M50-D Z2	M50-D rainfalls *[mm]*	M50-D inflow *[m^3]*	M100-D Z2	M100-D rainfalls *[mm]*	M100-D inflow *[m^3]*	outflow from soakaway *[m^3]*	required storage *[m^3]*
5	0.39	7.80	1.21	13.18	1.67	1.61	17.59	2.23	1.86	20.28	2.58	0.21	2.36
10	0.54	10.80	1.22	18.49	2.35	1.66	25.07	3.18	1.92	29.07	3.69	0.42	3.27
15	0.65	13.00	1.23	22.42	2.85	1.68	30.58	3.88	1.96	35.64	4.53	0.64	3.89
30	0.82	16.40	1.24	28.47	3.62	1.71	39.22	4.98	2.00	45.95	5.84	1.27	4.56
60	1.00	20.00	1.24	34.72	4.41	1.73	48.44	6.15	2.03	56.84	7.22	2.54	**4.67**
120	1.19	23.80	1.24	41.32	5.25	1.72	57.39	7.29	2.01	67.13	8.53	5.09	3.44
240	1.38	27.60	1.23	47.51	6.03	1.71	66.06	8.39	1.99	76.86	9.76	10.18	0.00
360	1.51	30.20	1.22	51.56	6.55	1.70	71.83	9.12	1.97	83.22	10.57	15.27	0.00
600	1.68	33.60	1.21	56.88	7.22	1.68	78.95	10.03	1.94	91.31	11.60	25.45	0.00
1440	2.03	40.60	1.19	67.57	8.58	1.64	93.01	11.81	1.89	107.15	13.61	61.07	0.00

** Z2 is growth factor from M5 rainfalls*

Flow Drainage Design	Church Street		
info@flowdrainagedesign.co.uk		Revision	
Tel: 07837685280	Job No: 2493	Page:	C/01
Section: **Attenuated Discharge to Combined Sewer**	Prepared By: MT	Date:	14/10/2024

GENERAL DATA		
site location:	England and Wales	
60 min rainfall depth of 5 year return period 'R' *[mm]* =	20	
M5-60 to M5-2d rainfall ratio 'r' =	0.50	
proposed discharge rate 'v_1' *[litre/s]* =	1.00	
proposed discharge rate 'v_2' *[litre/s]* =	0.00	
allowance for climate change:	40%	

SUMMARY OF CALCULATIONS		
required storage volume for discharge rate 'v_1' =	169.46	m^3
required storage volume for discharge rate 'v_2' =		m^3

AREA DATA		impermeability *[%]*	effective area *[m^2]*
impermeable area 'A_1' *[m^2]* =	2250	100.00	2250
landscaping and/or green roof area 'A_2' *[m^2]* =		80.00	0
other partially permeable area 'A_3' *[m^2]* =		20.00	0
AREA DRAINED TO ATTENUATION TANK =			**2250 m^2**

REQUIRED STORAGE VOLUME PER RAINFALL DURATION FOR DISCHARGE RATE v_1

rainfall duration *[min]*	rainfall factor Z1	M5-D rainfalls *[mm]*	M10-D Z2	M10-D rainfalls *[mm]*	M10-D inflow *[m^3]*	M20-D Z2	M20-D rainfalls *[mm]*	M20-D inflow *[m^3]*	M100-D Z2	M100-D rainfalls *[mm]*	M100-D inflow *[m^3]*	outflow from attenuation tank *[m^3]*	required storage *[m^3]*
5	0.39	7.80	1.21	13.18	29.65	1.39	15.16	34.10	1.86	20.28	45.63	0.30	45.33
10	0.54	10.80	1.22	18.49	41.61	1.41	21.39	48.13	1.92	29.07	65.41	0.60	64.81
15	0.65	13.00	1.23	22.42	50.45	1.43	25.99	58.48	1.96	35.64	80.18	0.90	79.28
30	0.82	16.40	1.24	28.47	64.06	1.44	33.13	74.54	2.00	45.95	103.38	1.80	101.58
60	1.00	20.00	1.24	34.72	78.12	1.45	40.60	91.35	2.03	56.84	127.89	3.60	124.29
120	1.19	23.80	1.24	41.32	92.96	1.44	48.06	108.14	2.01	67.13	151.05	7.20	143.85
240	1.38	27.60	1.23	47.51	106.90	1.43	55.24	124.29	1.99	76.86	172.94	14.40	158.54
360	1.51	30.20	1.22	51.56	116.00	1.42	60.00	135.01	1.97	83.22	187.25	21.60	165.65
600	1.68	33.60	1.21	56.88	127.98	1.41	66.12	148.77	1.94	91.31	205.46	36.00	**169.46**
1440	2.03	40.60	1.19	67.57	152.04	1.38	78.30	176.18	1.89	107.15	241.10	86.40	154.70

** Z2 is a growth factor from M5 rainfalls*

REQUIRED STORAGE VOLUME PER RAINFALL DURATION FOR DISCHARGE RATE v_2

rainfall duration *[min]*	rainfall factor Z1	M5-D rainfalls *[mm]*	M10-D Z2	M10-D rainfalls *[mm]*	M10-D inflow *[m^3]*	M30-D Z2	M30-D rainfalls *[mm]*	M30-D inflow *[m^3]*	M100-D Z2	M100-D rainfalls *[mm]*	M100-D inflow *[m^3]*	outflow from attenuation tank *[m^3]*	required storage *[m^3]*
5	0.39	7.80											
10	0.54	10.80											
15	0.65	13.00											
30	0.82	16.40											
60	1.00	20.00											
120	1.19	23.80											
240	1.38	27.60											
360	1.51	30.20											
600	1.68	33.60											
1440	2.03	40.60											

** Z2 is a growth factor from M5 rainfalls*

Church Street 10/10/2024

Orifice Discharge

Q=Cd(1/4*3.142*D2)SQRT(2gh)

Cd	0.6	Sharp orifice
D	0.022	m
g	9.81	
h	1	m
Q	0.001010398	m3/s
	1.0	l/s

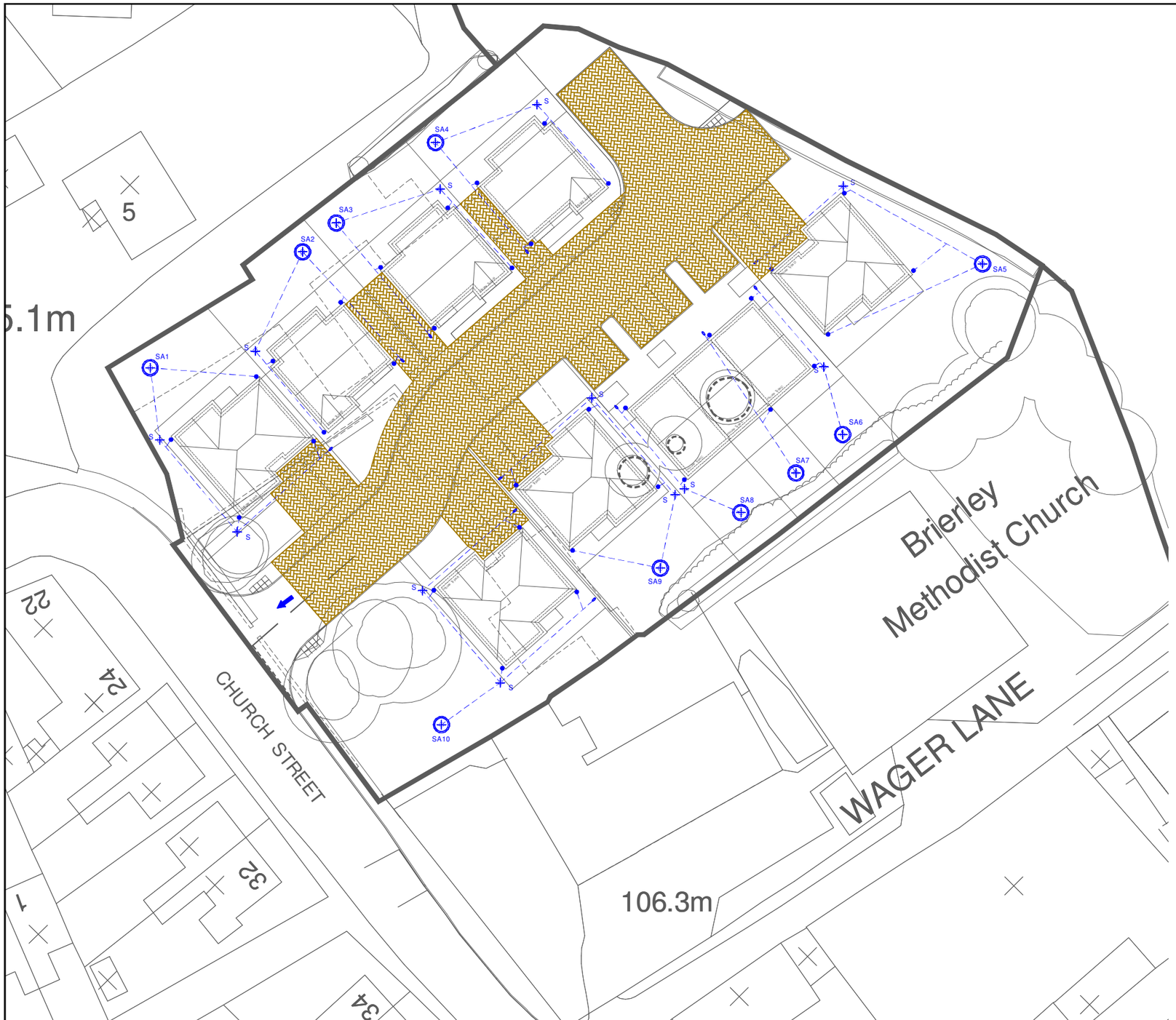
22mm orifice = 1.0l/s discharge

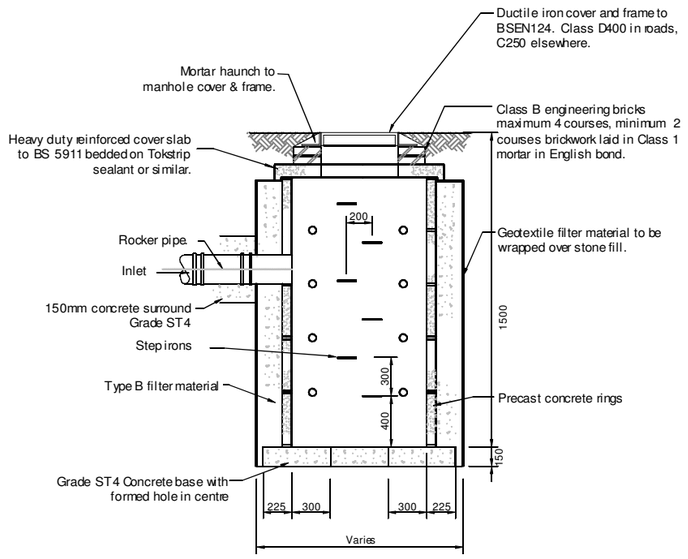
Storage Volume - Porous Paving

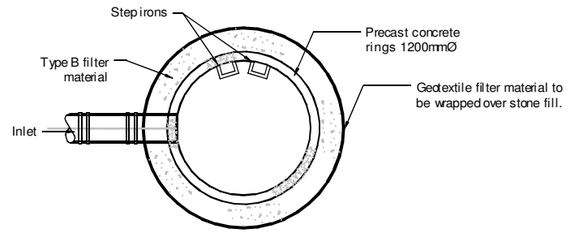
Width	16.5	m
Length	73.0	m
Depth	0.47	m
Void	30	%
Volume =	169.83	m3

APPENDIX E

DRAINAGE STRATEGY DRAWINGS
2493 / 01 & 02







CHAMBER SOAKAWAY DETAILS

KEY

- Surface water sewer
- Rain water pipe
- Rodding eye
- S — Surface water Catch Pit
- SA3 — Chamber Soakaway
- Surface water distribution tank
- Porous Paving
- Exceedance Flow Path

Surface Water Drainage Strategy: OPTION 1 - INFILTRATION

Access road and parking areas to be constructed in porous paving and roof water discharging soakaways in rear gardens.

Infiltration test to BRE365 required to confirm design.

Rev	Description	Date	Chkd

flow DRAINAGE DESIGN
1 St John's Close, Cherington
Shipston on Stour, CV36 5HR
t: 07837685280, e: info@flowconstructiondesign.co.uk

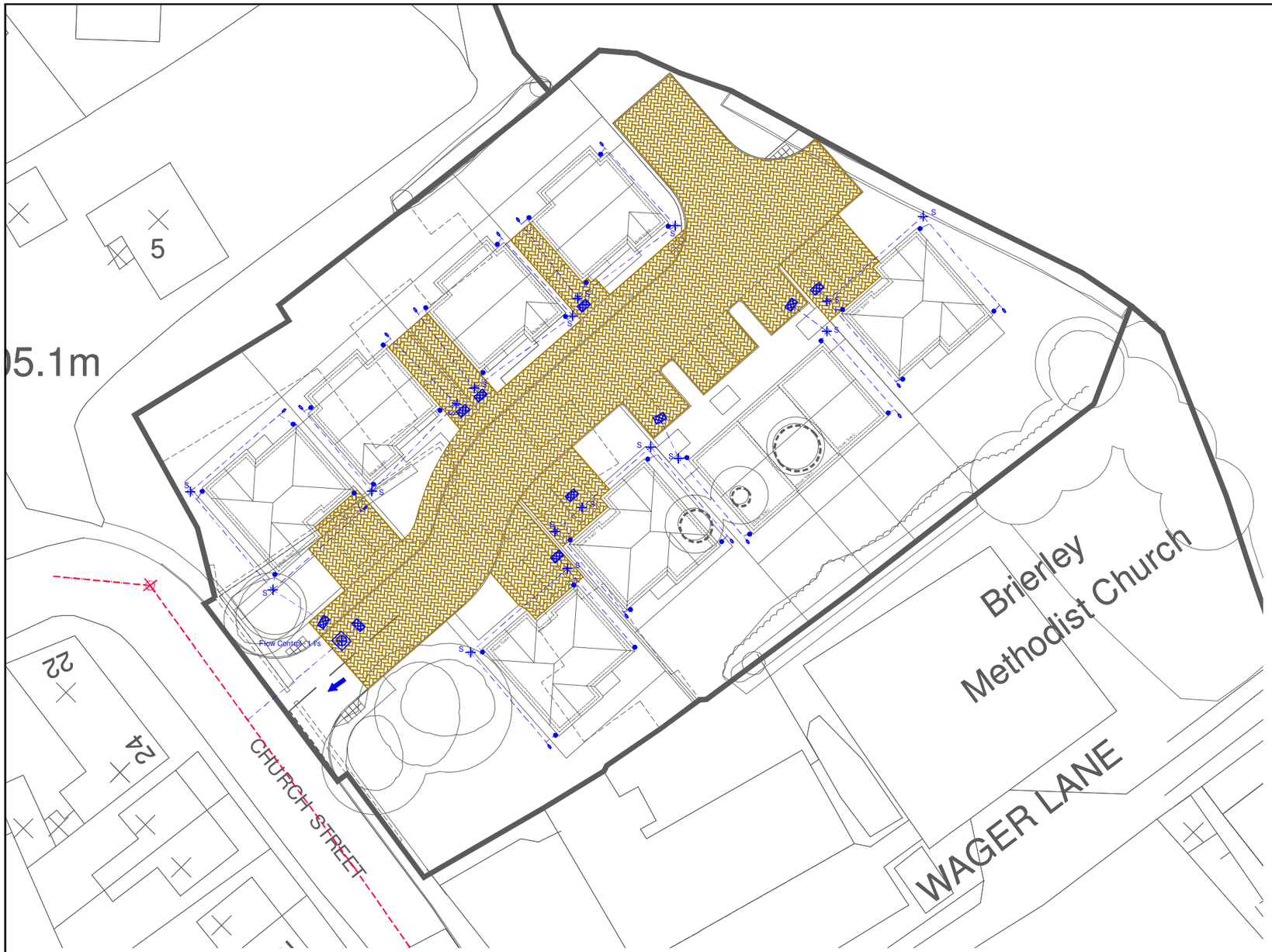
Client: Building Link Design

Project: Church Street, Brierley

Title: Proposed Surface Water Drainage OPTION 1 - Infiltration

Project Engineer:	M. Taylor	Scale:	1:500 @ A3
Project Director:		Date:	Oct 24
Status:	APPROVAL		

Drawing No. 2493 / 01 — Rev



KEY

- Surface water sewer
- Public combined sewer (150mm Ø)
- Rain water pipe
- Rodding eye
- S — Surface water Catch Pit
- Flow Control — Flow Control Chamber. Flow limited to 1.0l/s
- Surface water distribution tank
- Tanked Porous Paving - Sub-base Storage Zone
- Exceedance Flow Path

Surface Water Drainage Strategy: OPTION 2 - ATTENUATION

Access road and parking areas to be constructed in tanked porous paving and roof water discharging via catchpits to porous sub-base.

Storage Volume:

TOTAL REQ = 169.5m3

Sub-Base Storage Zone = 1202m2 x 0.47m deep 30% void = 169.8m3

Discharge via flow control chamber to combined sewer at 1 l/s.

Rev	Description	Date	Chkd

flow DRAINAGE DESIGN
1 St John's Close, Cherington
Shipston on Stour, CV36 5HR
t: 07837685280, e: info@flowconstructiondesign.co.uk

Client : Building Link Design

Project : Church Street, Brierley

Title : Proposed Surface Water Drainage OPTION 2 - Attenuation

Project Engineer :	M. Taylor	Scale :	1:500 @ A3
Project Director :		Date :	Oct 24
Status :	APPROVAL		

Drawing No. 2352 / 02 — Rev

APPENDIX F

SURFACE WATER SYSTEM MAINTENANCE PLAN

Surface Water Drainage System Maintenance Schedule

Project: Church Street

Made by:	Date:	Project No:	Checked by:	Approved by:	Pages	Rev
M Taylor	10/10/24	2493		MT	2	

Ownership and Responsibilities:

The site will be retained by the current owner, and the responsibilities detailed below will be retained by the owner in perpetuity.

Such responsibilities shall be passed on to any future new owner during conveyance, to ensure continuity of maintenance for the lifetime of the system.

General Drainage Infrastructure

Item	Maintenance Operation	Frequency
Pipe network, and chambers	CCTV camera survey, flush, descale, repair as necessary	5 years
Catchpits & Soakaways	Remove silt and debris from sump Inspect chamber and repair as necessary	Annual

POROUS PAVEMENT		
Regular	Raking and weeding. (standard cosmetic maintenance over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site observations of clogging. Pay particular attention to areas where water runs on to pervious surfaces from adjacent impermeable areas as these areas are most likely to collect sediment.
Occasional	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using polyphosphate applied directly into the weeds foliage by applicator rather than spray	As required – once per year on less frequently used pavements
Remedial	Remediate any landscaping which, through vegetation growth or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions or rutting considered detrimental to the structural performance or a hazard to users.	As required
	Rehabilitation of surface and upper substructure by lifting, cleaning and relaying the porous media.	Every 10 to 15 years or as required if infiltration performance is reduced due to clogging.
Monitoring	Initial inspection	Monthly for 3 months after installation
	Inspect for evidence of poor operation and/or weed growth – if required take remedial action detailed above	3 monthly and 48 hours after large storms in the first 6 months
	Inspect silt accumulation rates and establish appropriate raking frequencies	Annually
	Monitor silt traps and inspection chambers	Annually