Pentre Barn, Llangattock Lingoed

Mr A and Mrs A Collins

Drainage Strategy Technical Note

OCT 2022

Document Control

Job No.	22-0427	
Project Name	Pentre Barn, Llangattock Lingoed	
Document Title	Drainage Strategy Technical Note	
Status	For Planning	
Client	Mr A and Mrs A Collins	
	Name	Date
Prepared By	Paul Graham	Oct 2022
Checked By	Kris Tovey	Oct 2022
Approved By	Kris Tovey	Oct 2022

Record of Revisions

Revision	Date	Details	Made By

Rappor Consultants Ltd
A: CTP House, Knapp Road, Cheltenham, GL50 3QQ
W: www.rappor.co.uk
T: 01242 523696
E: hello@rappor.co.uk

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Appendix F – Storage Calculations
Appendix H – Package Treatment Works Certificate

1 Introduction

1.1 Rappor provide expert Infrastructure and Environmental consultancy services throughout the UK.

1.2 Rappor were appointed by Mr A and Mrs A Collins to provide drainage consultancy in support of a planning application and SAB advice to support a SAB application.

1.3 The development consists of the demolition of an existing steel framed barn building and the construction of a new residential dwelling with a patio and parking.

1.4 **Appendix A** shows a set of architectural drawings for the development.

1.5 This Technical Note will cover the existing drainage arrangement, the proposed foul and surface water drainage arrangement, and demonstrate compliance with the principles of Sustainable Drainage Systems (SuDS).

2 Existing Site Conditions

Topography

2.1 The existing site contains an existing steel barn area and outbuilding located to the east of existing access road. A topographical survey is provided in **Appendix B.**

2.2 The site falls from the northwest to the southeast with levels varying between 50mAOD and 45mAOD within the vicinity of the development. It should be noted that the wider agricultural area, which is also in the ownership of the developer, has a larger fall to the south.

2.3 The existing buildings have floor levels of approximately 46.5mAOD.

Geology

2.4 Mapping provided by the British Geological Survey (BGS) shows the site as being underlain by St Maughan's Formation (Sandstone).

2.5 The Cranfield Soil and Agrifood Institute's 'Soilscapes' mapping tool shows the local underlying soils as being predominantly 'slightly acid loamy and clayey soils with impeded drainage'.

2.6 Given the nature of the underlying bedrock and the overlying soils, it is unlikely that infiltration will be viable at the application site.

2.7 Two infiltration tests were carried out at the site by PDJ Groundworks on 7th September 2022. Results are included in **Appendix C;** however, water levels did not drop enough for an infiltration rate to be calculated**.** Infiltration is not a viable option of surface water disposal at the application site.

Drainage

2.8 Asset Plans were requested from DCWW. DCWW confirmed that there are no adopted sewers within the vicinity of the application site. Asset plans are provided in **Appendix D.**

2.9 The existing dwelling buildings do not appear to have any positive drainage systems for either foul or surface water infrastructure.

2.10 There is an existing drainage ditch located to the southeast of the proposed new development, across land which is also under the applicant's control.

2.11 There are highways gullies within the road network to the west of the site. It is assumed these are owned and operated by the Highways Authority.

3 Proposed Drainage Strategy

Surface Water – Wales Government SuDS requirements

3.1 A proposed drainage strategy is set out in **Appendix E**.

3.2 The proposed scheme meets the requirements laid out in the Welsh Government's document 'Statutory Standards for Sustainable Drainage Systems'.

3.3 **S1)**. The standards give a five-level priority list for the destination of surface runoff, which is as follows:

1) **Surface water runoff is collected for use**;

   In the first instance, rainwater butts will be used at rainwater downpipes for the proposed residential dwelling. Given the nature of the development, there is good potential for rainwater reuse across the wider application site. Rainwater butts should be designed in accordance with BS8515:2009.

2) **Surface water runoff is infiltrated to ground**;

   Infiltration testing was carried out at the site by PDJ Groundworks in September 2022. The testing in the infiltration pit was carried out to BS6297 on site recorded no falling head so was abandoned. Testing to BRE365 was intended to be carried out subsequently, however, the testing to BS6297 indicated that the ground was made up of clay and no percolation or infiltration would have been viable. Infiltration to ground is not deemed acceptable as a method of surface water disposal at the application site.

3) **Surface water runoff is discharged to a surface water body**;

   There is an existing drainage ditch which runs from north to the southeast of the application site, across land also under the applicant's control, in existing conditions run off from the site would naturally flow over land and enter the system via this network. It is proposed that surface water from the site shall be discharged to this location limited as close as reasonably practicable to the greenfield rate.

4) **Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system;**

   Not applicable, although there are noted to be highway drains within the adjacent road network.

5) **Surface water runoff is discharged to a combined sewer.**

   Not applicable

3.4 **S2)** In addition to the above hierarchy, the standard also gives a set of principles for SuDS schemes. For surface water hydraulic control, these are as follows**:**

- To manage water on or close to the surface and as close to the source of the runoff as possible, rainwater harvesting, and an attenuation basin will manage surface water as close to source as practicable.
- Interception of the first 5mm will be met by the provision of rainwater harvesting. Parking areas will also be constructed in gravel to mimic existing conditions and intercept the first 5mm.
- The proposed impermeable areas of the development is 245m^2. The greenfield runoff rate for the impermeable areas is calculated to be 0.1l/s. It is proposed to limit flows from the site to the lowest rate reasonably practicable whilst maintaining an orifice that can be maintained. Therefore, it is proposed to limit flows from the site to 2l/s for all events up to the Q100 + 40% Climate Change Event. It should be noted that the existing site contains some areas of hard standing and areas which would alter the time of concentration of precipitation falling on the site.
- The total area to be drained includes the plot area and a small tarmac area at the site entrance and totals 245m^2. The remaining areas of parking will be gravel and will not be positively drained. The attenuation for the site will be via an attenuation basin with a downstream hydrobrake to limit flows. The volume of storage required to limit flows to 2l/s for the Q100+40% Climate Change event is 5.6m^3. This will be via the attenuation basin as shown in **Appendix E.**
- Calculations are provided in **Appendix F** and **Appendix G.**

3.5 **S3)** Water quality will be managed on site as follows:

- Interception of the first 5mm will be met by the provision of rainwater harvesting and a detention basin.
- The pollution hazard level on the site does not exceed “Low” under the Simple Index Approach with the requirements of the Simple Index Approach set out below

		Pollution Hazard Indices		
Runoff Area Land Use Description	*Hazard Level*	Suspended Solids	Metals	Hydrocarbons
Individual driveway	Low	0.5	0.4	0.4
Landuse Pollution Hazard Index	**Low**	**0.5**	**0.4**	**0.4**

- All areas of the site will drain through an attenuation basin and then discharge to a watercourse so that "the SuDS management train" requirement is met, as below.
- The site is not located in a Groundwater Source Protection Zone so there are no additional specific sensitivities.

	Pollution Mitigation Indices		
SuDS Component Description	Suspended Solids	Metals	Hydrocarbons
Detention basin	0.5	0.5	0.6

3.6 **S4)** Amenity value will be added to the site as follows:

- The attenuation basin offers amenity for the site whilst also doubling as attenuation and water quality benefits.
- The use of rainwater butts will encourage use of green spaces.

3.7 **S5)** Biodiversity value will be added to the site as follows:

- Planting within the attenuation basin will be confirmed at detailed design stage and will offer the opportunity to add biodiversity value. As well as this, the use of rainwater butts on the site encourages uses such as gardens which would have a biodiversity net gain.

3.8 **S6)** Operation and maintenance:

- The rainwater butts and permeable paving will be operated and maintained by the plot owner as per Table 2 below.

Drainage Component	Required Action	Typical Frequency
Pipework, manholes, inspection chambers, catch pit chambers and silt traps	Stabilise adjacent areas	As required
	Remove weeds	As required
	Clear any poor performing structures.	As required
	Inspect all structures for poor operation	Six monthly, 48 hours after large storms in first six months
	Monitor inspection chambers. Inspect silt accumulation rates and determine silt clearance frequencies	Annually
	Inspect catch pits and filter baskets. Dispose of accumulated material.	Three-monthly, and 48 hours after large storms
Attenuation Basin	Remove litter and debris	Monthly (or as required)
	Cut the grass – public areas	Monthly (during growing season)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first three years)	Monthly (at start, then as required)
	Inspect inlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May – October)
	Inspect silt accumulation rates and establish appropriate removal frequencies; undertake contamination testing once some build up has occurred, to inform management and disposal options.	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above the pond base; include max 25% of pond surface)	Annually
	Repair erosion or other damage	As required
	Replant, where necessary	As required
	Aerate when signs of eutrophication are detected	As required
	Repair/rehabilitate inlets, outlets and overflows	As required
	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required
Flow Control Chamber	Monitor flow performance within chamber	During extreme events

	Clear out any silt from chamber and clean orifice plate chamber	Six monthly, 48 hours after large storms in first six months

Foul Strategy

3.9 A proposed drainage strategy is set out in **Appendix E**.

3.10 There are no public foul sewers within the vicinity of the site.

3.11 It is proposed that foul drainage generated from the development shall be collected via a traditional below-ground gravity system and conveyed into Kingspan BioDisc with Chemical Dosing, prior to discharge to the watercourse. The BioDisc will require dosing with either Aluminium or Iron Salts and the management of this dosing should be carried out by the landowner. The wastewater treatment plant shall be designed in accordance with BSN 12566 and the general binding rules.

3.12 Using the Wye Phosphate loading calculator, a standard septic tank (11.6mg TP/year) in current conditions and an assume occupancy of 4 people, the existing scenario would generate 2.44kg TP/annum.

3.13 Using the Wye Phosphate loading calculator, the BioDisc specified above which has a certified 0.3mg TP/year (refer to **Appendix H)**, an occupancy of 4 people, the proposed loading would be 0.06kg TP/annum.

3.14 The discharge to the watercourse will require either an Environmental Permit or registration with Natural Resources Wales prior to discharge to the watercourse.

4 Summary

4.1 Surface water from the site will discharge to a stream to the southeast of the site at a flow rate of 2l/s for all events up to the Q100 + 40% Climate Change event. To achieve the connection, a sewer will be required across land also under the applicant's control.

4.2 Attenuation for the site will be achieved through an attenuation basin with a volume of 5.6m^3.

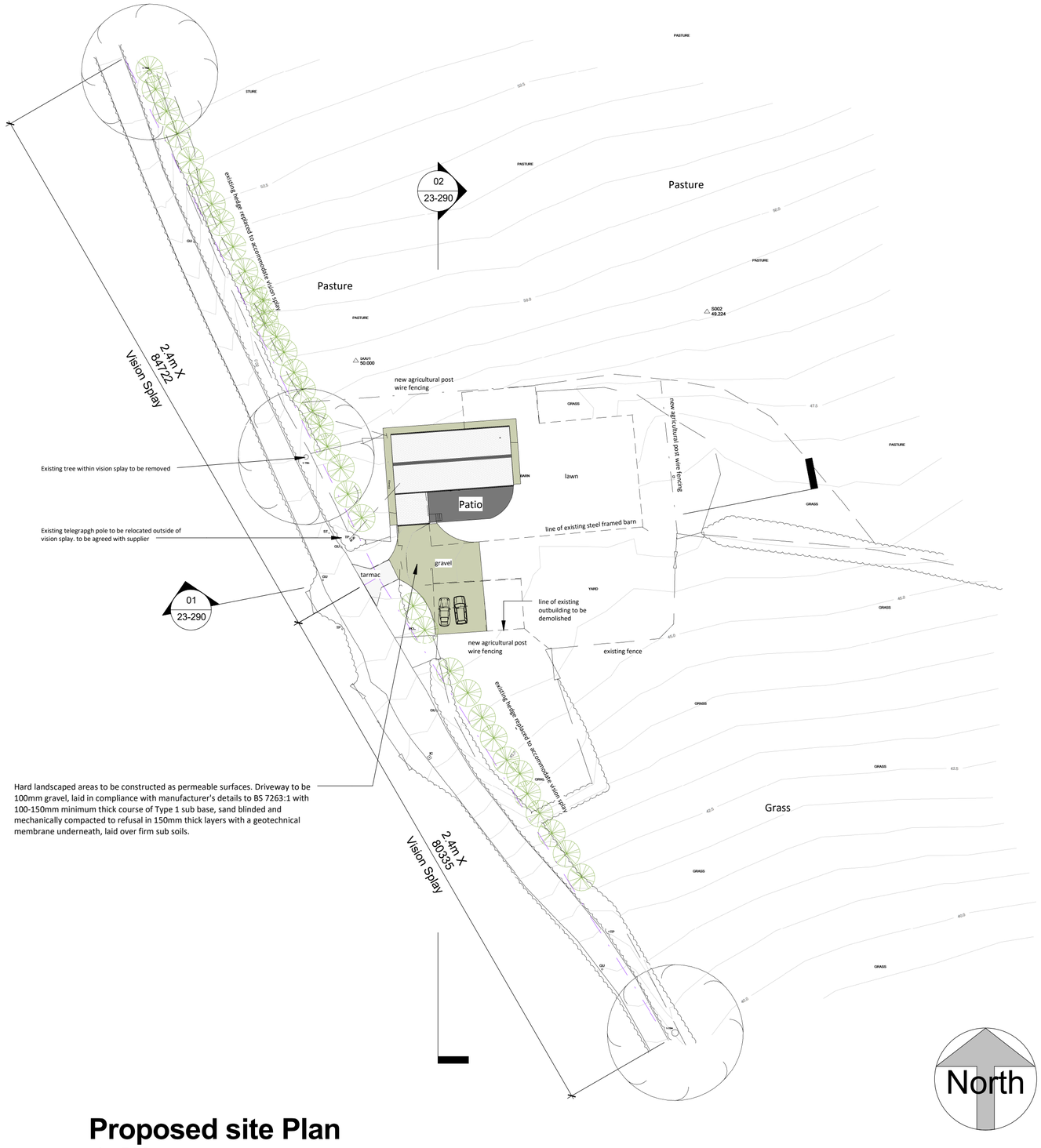
4.3 Discharge to the watercourse will require a Land Drainage Consent.

4.4 Rainwater butts will be used to encourage water re-use on site.

4.5 Foul from the site will be discharged to a wastewater treatment plant prior to discharge to the watercourse.

4.6 An Environmental Permit or registration with NRW will be required for the discharge of foul flows.

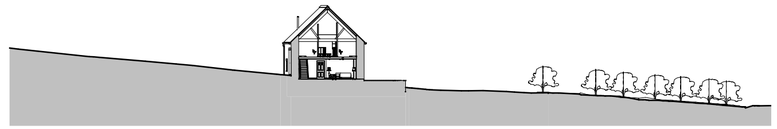
Appendix A – Site Plans



Hard landscaped areas to be constructed as permeable surfaces. Driveway to be 100mm gravel, laid in compliance with manufacturer's details to BS 7263:1 with 100-150mm minimum thick course of Type 1 sub base, sand blinded and mechanically compacted to refusal in 150mm thick layers with a geotechnical membrane underneath, laid over firm sub soils.

Proposed site Plan
1 : 500

Site Section 01
1 : 500



Site Section 02
1 : 500

HEDGEROW PLANTING SPECIFICATION

Hedging plants are to be 60-80 cm high, 1+1, bare-root, healthy and vigorous transplants to be planted in a double staggered row, 450mm apart, with 5 plants per linear metre.
All transplants shall be protected with a 400mm high plastic spiral rabbit guard supported by a 750mm stake or cane. Stock proof fencing should be erected to protect hedging from grazing as required.
The hedge is to be maintained for a period of 5 years following planting, ensuring adequate watering and fertilising is carried out to ensure good establishment and that all dead, diseased or damaged plants are replaced annually where required.

Species mix to be as follows:

30% Hawthorn (Crataeagus monogyna)

20% Hazel (Corylus avellana)

20% Blackthorn (Prunus spinosa)

10% Dogwood (Cornus sanguinea)

10% Field Maple (Acer campestre)

10% Holly (Ilex aquifolium)

5 0 5 10 15 20 25
SCALE 1:500 m

No.	Description	Date

OWEN TOMS ARCHITECTS
ARCHITECTURE & DESIGN
E: enquiries@owentomsarchitect.com
T: 01600 750832 **M:** 07811946172

Client
MR & MRS COLLINS

Project Title
PENTRE BARN, LLANGATTOCK

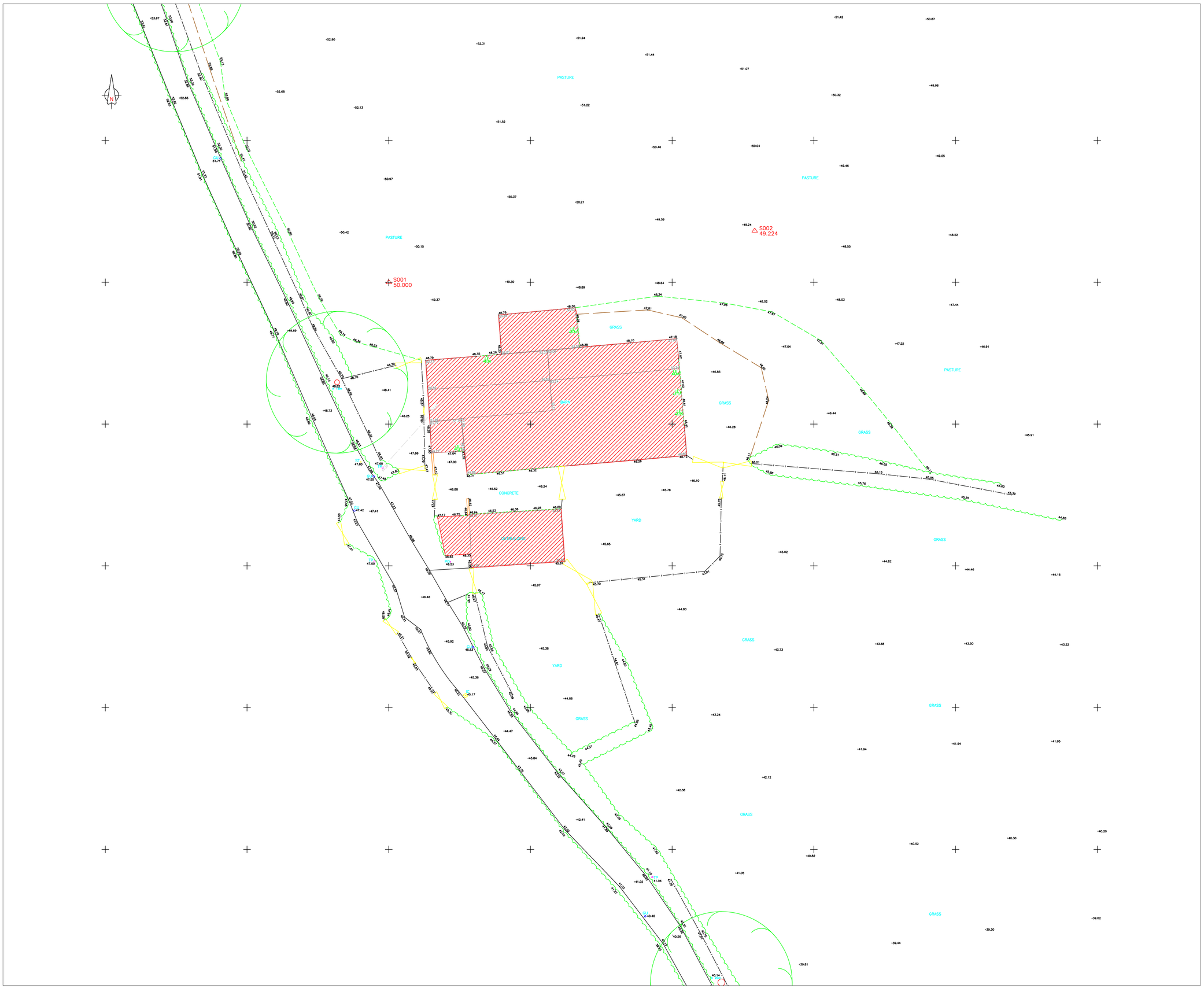
Drawing No.
23-290

Rev.

Proposed Site Plan

Project number 3197
Date 11.08.2022
Drawing Status
Scale 1 : 500 @A2

Appendix B – Topographical Survey



Key Plan:

1. Some layers are frozen.

2. The survey has been orientated to a local grid. The level datum has been assumed.

3. Station Co-Ordinates

Station	Easting	Northing	Level
S001	5000.000	2000.000	50.000
S002	5051.646	2007.258	49.224

4. Wall heights have been surveyed as string information.

5. Trees are positioned accurately, Boles & Canopys are to scale.

6. All dimensions are in metres.

7. All dimensions / levels should be checked on site prior to design and construction.

Survey Key:

The following are a list of codes used to identify various street furniture and surfaces for Monument Surveys. Service covers have an outline to define the size/orientation.

General Abbreviations

AB	Air Brick	MH	Manhole
AV	Air Valve	MK	Marker Post
BB	Belisha Beacon	MO	Mooring
BE	Bench	MS	Mile Stone
BH	Bore Hole	OBM	Bench Mark
BI	Bin	PB	Post Box
BO	Bollard	PI	Existing Pin
BS	Bus Stop Sign	PO	Post
BT	British Telecom	PM	Parking Meter
BX	Junc Box etc.	PS	Private Sign
CA	Camera	PU	Petrol Pump
CB	Crash Barrier	RD	Ridge Heights
CE	Cellar	RE	Rodding Eye
CU	Culvert (Invert)	RP	Reflector Post
DP	Down Pipes	RS	Road Sign
DPC	Damp Proof Course	SD	Steps Down
DR	Drains	SO	Soffit Level
EA	Eave Heights	SP	Sign Post
EC	Electricity Cover	ST	Stop Tap
EP	Electricity Pole	SU	Steps Up
ER	Earth Rod	SV	Stop Valve
SVP	Soil/Vent Pipe	FH	Fire Hydrant
SY	Stay	FL	Flood Light
TAP	Water Tap	TB	Telephone Call Box
FP	Flag Pole	TH	Water Trough
GA	Gas Valve	TK	Storage Tank
GB	Gauge Board	TM	Telephone Mast
GP	Gate Post	TP	Telegraph Pole
GU	Gully	TL	Traffic Light
IC	Inspection Cover	TV	Cable TV Cover
INV	Invert Level	VP	Vent Pipe
KI	Kerb Inlet	WL	Water Level
LBX	Traffic Loop Box	WM	Water Meter
LE	Spot Level (Threshold)	WO	Wash Out
LP	Lamp Post		

Surface Abbreviations

BP	Block Paving
BR	Bricks
CB	Cobbles
CO	Concrete
GR	Grass
SL	Slabs
TA	Tarmac
TC	Tactile Paving

Fence Abbreviations

BWF	Barb Wire
CBF	Close Board
CLF	Chain Link
PAF	Palisade (Security)
PCF	Post & Chain
PRF	Post & Rail
PWF	Post & Wire
WPF	Wooden Panel

Trees

Diameter of Bole / Canopy / Species
Approx. Tree Height

Tree Stumps

S1 to S5 – 0.1 dia. to 0.5 dia.

Pipes (Invert Level)

P1 to P5 – 0.1 dia. to 0.5 dia.

Client

Monument Geomatics Limited
The Carlson Suite, Vantage Point Business Village, Mitcheldean, GL17 0DD
Tel +44 (0)1594 546324 Fax +44 (0)1594 541333
Email enquiries@monumentgeomatics.co.uk
www.monumentgeomatics.co.uk

Project

PENTRE BARN
LLANGATTOCK

Drawing

EXISTING LAYOUT
3D ANNOTATED
TOPOGRAPHICAL SURVEY

Drawn by: RM	Date: JUN 22
Checked by: CJ	Date: JUN 22
Approved by: MONUMENT GEOMATICS	Date: JUN 22

Drawing No. MG2474_S1

Revision

Drawing Scale: 1:250 @ A1

Key Plan:

1. Some layers are frozen.

2. The survey has been orientated to a local grid. The level datum has been assumed.

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BO	Bollard	PI	Existing Pin
BS	Bus Stop Sign	PO	Post
BT	British Telecom	PM	Parking Meter
BX	Junc Box etc.	PS	Private Sign
CA	Camera	PU	Petrol Pump
CB	Crash Barrier	RD	Ridge Heights
CE	Cellar	RE	Rodding Eye
CU	Culvert (Invert)	RP	Reflector Post
DP	Down Pipes	RS	Road Sign
DPC	Damp Proof Course	SD	Steps Down
DR	Drains	SO	Soffit Level
EA	Eave Heights	SP	Sign Post
EC	Electricity Cover	ST	Stop Tap
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SVP	Soil/Vent Pipe	FH	Fire Hydrant
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Tree Stumps

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Pipes (Invert Level)

P1 to P5 – 0.1 dia. to 0.5 dia.

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Tel +44 (0)1594 546324 Fax +44 (0)1594 541333
Email enquiries@monumentgeomatics.co.uk
www.monumentgeomatics.co.uk

Project

PENTRE BARN
LLANGATTOCK

Drawing

EXISTING LAYOUT
TOPOGRAPHICAL SURVEY
WITH CONTOURS

Drawn by: RM	Date: JUN 22
Checked by: CJ	Date: JUN 22
Approved by: MONUMENT GEOMATICS	Date: JUN 22

Drawing No.	Revision
MG2474_S2	

Drawing Scale: 1:250 @ A1

Appendix C – Infiltration Results

Building Regulation H2/H3

Method for Determining Soil Infiltration Rate

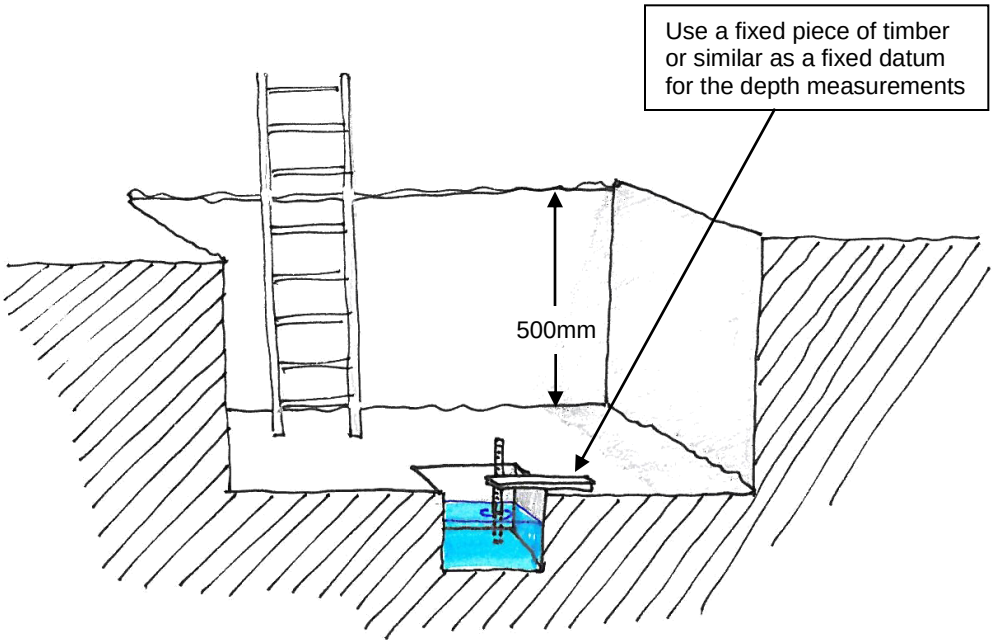
1. Excavate a pit large enough to gain access for digging a smaller pit in the bottom of the excavation as shown in diagram below. The depth of the larger pit should be the depth of the proposed incoming drain to the soakaway. For safety reasons ensure that the hole is covered/edge protected to prevent falls into the pit when it is unattended. Ensure that there is no route for surface water to enter the pit during the tests.

2. Dig the smaller hole in the base of larger excavation to dimensions of 300mm square by 300mm deep with straight clean sides.

3. Set up a fixed datum point with a piece of timber as shown, then refill the small hole with water. Monitor the time it takes to seep away i.e. check it every few minutes and make a note of time and depth below the datum. If possible, accurately measure the time the level takes to drop between 75mm below the datum to 225mm below the datum. These are the crucial measurements needed.

4. Repeat the test 3 times.

5. Plot the results for each of the three tests using the following chart:



DOMESTIC SOAKAWAY TEST PIT

Building Regulation H2/H3

Method for Determining Soil Infiltration Rate

Soakaway Test Record			
Location	Pentre Barn	Test Pit Number	300 x 300
		Test Number	1 of 3
		Date	7/9/2022
Weather during test:	Dry		

Depth versus time measurements			
Depth below datum (mm) START HERE ⇩	Time (minutes)	Depth below datum (mm) CONTINUE HERE ⇩	Time (minutes)
	0 (start of test)	110	3h 35m
70	10		
80	20		
85	30		
85	40		
90	50		
95	60		
95	1h 10m		
95	1h20m		
95	1h 35m		
100	1h 50m		
105	2h 5m		
105	2h 20m		
110	2h 35m		
110	2h 50m		
110	3h 5m		
110	3h 20m		

Building Regulation H2/H3

Method for Determining Soil Infiltration Rate

Soakaway Test Record			
Location	Pentre Barn	Test Pit Number	1M
		Test Number	2 of 3
		Date	7/9/2022
Weather during test:	Dry		

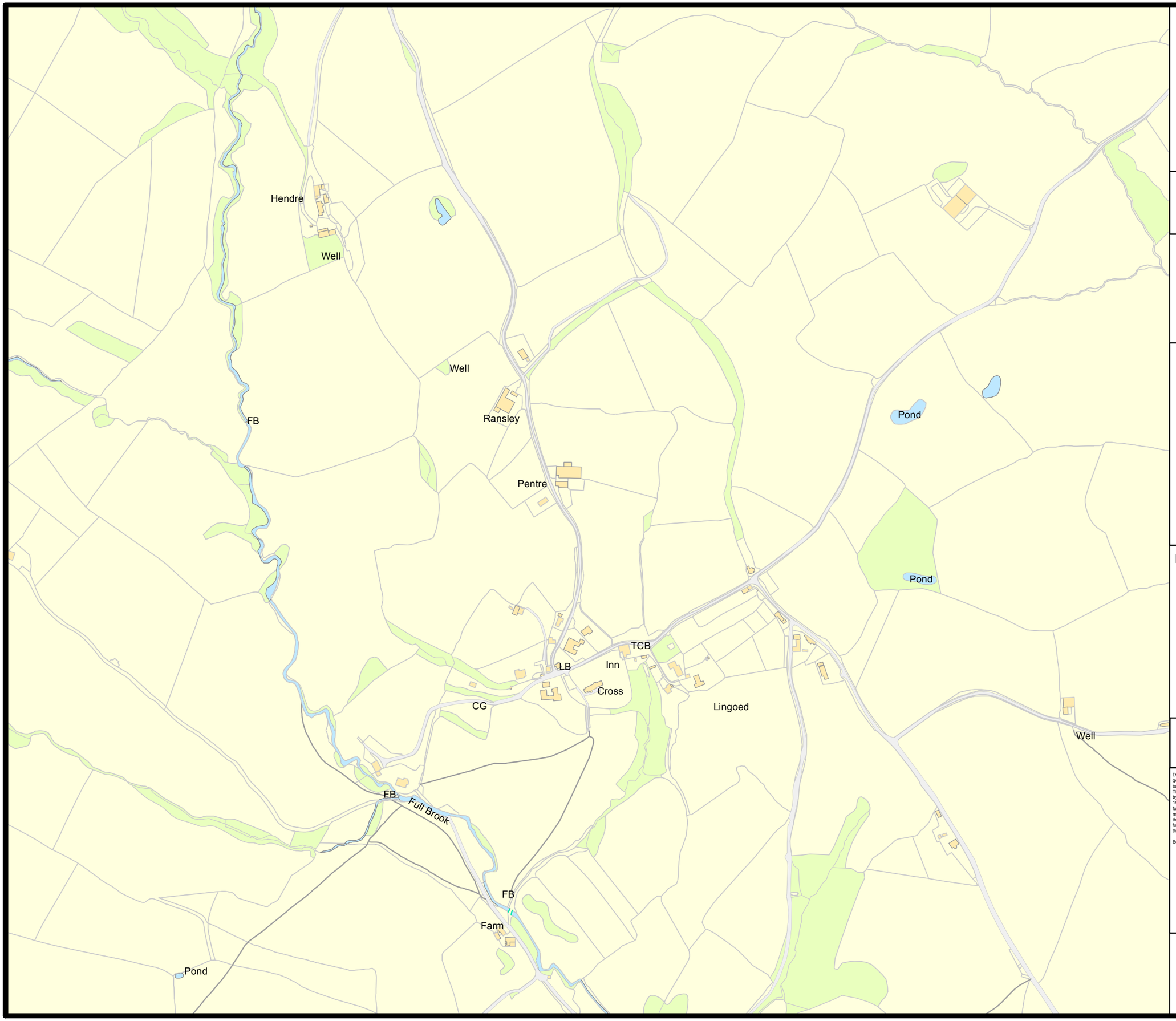
Depth versus time measurements			
Depth below datum (mm) START HERE ⇩	Time (minutes)	Depth below datum (mm) CONTINUE HERE ⇩	Time (minutes)
	0 (start of test)		
5	10		
10	20		
10	30		
10	40		
15	55		
25	1h 10m		
25	1h 25m		
25	1h 40m		
25	1h 55m		
30	2h 10m		
35	2h 25m		
35	2h 40m		
35	2h 55m		
35	3h 10m		
35	3h 25m		
35	3h 40m		

Building Regulation H2/H3

Method for Determining Soil Infiltration Rate

Soakaway Test Record			
Location		Test Pit Number	
		Test Number	3 of 3
		Date	
Weather during test:			
Depth versus time measurements			
Depth below datum (mm) START HERE ⇩	Time (minutes)	Depth below datum (mm) CONTINUE HERE ⇩	Time (minutes)
	0 (start of test)		

Appendix D – DCWW Asset Plans



Dŵr Cymru
Welsh Water

Llangattock Lingoed Monmouthshire

N
W E
S

LEGEND(Representative of most common features)

Waste network:

- Foul chamber
- Surface water chamber
- Combined chamber
- Combined sewer overflow (CO)
- Special purpose chamber (SPC)
- Treatment works
- Pumping station
- Outfall
- Lamphole (LH)
- Storm Overflow
- Rising main
- Gravity sewer
- Private sewer
- Private sewer subject to Sect. 104 adoption agreement (S 104)
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

NB: Sewer symbol colour indicates the type.

RED - Combined
GREEN - Surface Water
BROWN - Foul
Purple - Former S24 sewers (for indicative purposes only)

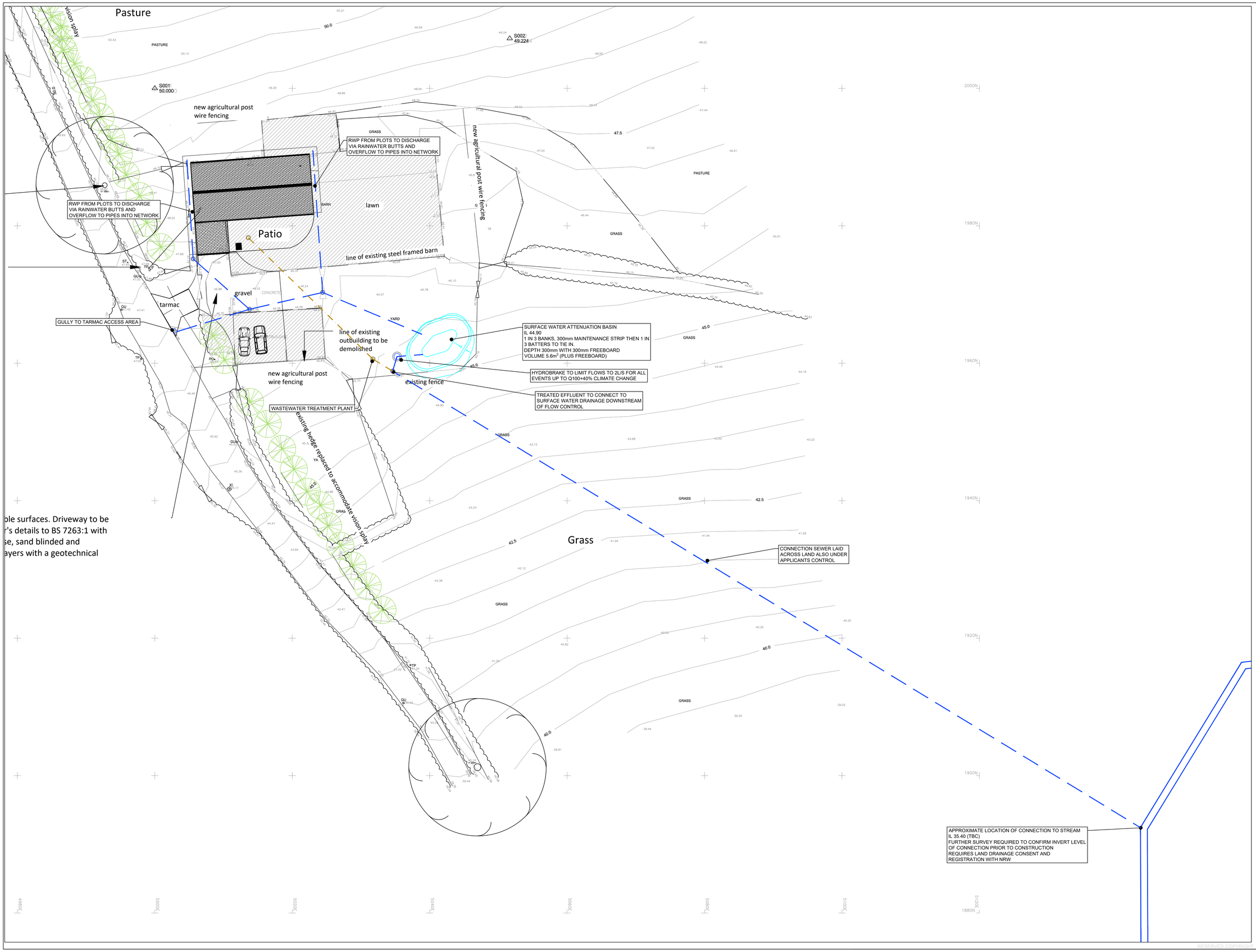
Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF) . It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

Map Ref:	336147,220313
Map scale:	1:4950
Printed by:	Zara Howells
Printed on:	27 Jun 2022

Appendix E – Drainage Strategy Drawing



ble surfaces. Driveway to be
r's details to BS 7263:1 with
se, sand blinded and
ayers with a geotechnical

Notes:

1. Do not scale from this drawing. All dimensions are in metres, unless stated otherwise.
2. Ordnance Survey, (c) Crown Copyright 2020. All rights reserved. Licence number 100022432.
3. Drawing to be read in conjunction with all other drawings. Any discrepancies are to be reported to the engineer 5 working days in advance of undertaking any work.

Key:

- Proposed Surface Water Sewer
- Proposed Foul Sewer

Rev	Date	Details	Drawn by	Checked by
-	-	-	-	-

rappor

Infrastructure and environmental consultants

rappor.co.uk

CLIENT: ANDREW BLOWERS

PROJECT: PENTRE BARN LLANGATTOCK LINGOED

TITLE: DRAINAGE STRATEGY

STATUS: INFORMATION

SCALE @ A1:	DATE:	DRAWN:	CHECKED:	APPROVED:
1:250	06.10.22	PG	KT	KT

JOB NO:	DRAWING NO:	REVISION:
22-0427	C001	-

Appendix F – Qbar Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	0.025	Urban	0.000
SAAR (mm)	1000	Region Number	Region 4

Results l/s

QBAR Rural	0.1
QBAR Urban	0.1
Q100 years	0.2
Q1 year	0.1
Q30 years	0.1
Q100 years	0.2

Appendix G – Storage Calculations

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 24 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	45.106	0.206	0.0	2.0	2.0	3.3	O K
30 min Summer	45.148	0.248	0.0	2.0	2.0	4.3	O K
60 min Summer	45.160	0.260	0.0	2.0	2.0	4.6	O K
120 min Summer	45.148	0.248	0.0	2.0	2.0	4.3	O K
180 min Summer	45.121	0.221	0.0	2.0	2.0	3.7	O K
240 min Summer	45.086	0.186	0.0	2.0	2.0	2.9	O K
360 min Summer	45.009	0.109	0.0	2.0	2.0	1.5	O K
480 min Summer	44.949	0.049	0.0	2.0	2.0	0.6	O K
600 min Summer	44.911	0.011	0.0	2.0	2.0	0.1	O K
720 min Summer	44.900	0.000	0.0	1.9	1.9	0.0	O K
960 min Summer	44.900	0.000	0.0	1.5	1.5	0.0	O K
1440 min Summer	44.900	0.000	0.0	1.1	1.1	0.0	O K
2160 min Summer	44.900	0.000	0.0	0.8	0.8	0.0	O K
2880 min Summer	44.900	0.000	0.0	0.7	0.7	0.0	O K
4320 min Summer	44.900	0.000	0.0	0.5	0.5	0.0	O K
5760 min Summer	44.900	0.000	0.0	0.4	0.4	0.0	O K
7200 min Summer	44.900	0.000	0.0	0.3	0.3	0.0	O K
8640 min Summer	44.900	0.000	0.0	0.3	0.3	0.0	O K
10080 min Summer	44.900	0.000	0.0	0.3	0.3	0.0	O K
15 min Winter	45.132	0.232	0.0	2.0	2.0	3.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	117.263	0.0	5.5	21
30 min Summer	80.979	0.0	7.6	31
60 min Summer	53.483	0.0	10.1	50
120 min Summer	34.050	0.0	12.6	84
180 min Summer	25.686	0.0	14.4	118
240 min Summer	20.855	0.0	15.6	150
360 min Summer	15.567	0.0	17.5	208
480 min Summer	12.625	0.0	18.9	262
600 min Summer	10.720	0.0	20.1	316
720 min Summer	9.373	0.0	21.1	0
960 min Summer	7.574	0.0	22.7	0
1440 min Summer	5.595	0.0	25.2	0
2160 min Summer	4.122	0.0	27.8	0
2880 min Summer	3.312	0.0	29.8	0
4320 min Summer	2.430	0.0	32.8	0
5760 min Summer	1.953	0.0	35.2	0
7200 min Summer	1.649	0.0	37.1	0
8640 min Summer	1.437	0.0	38.8	0
10080 min Summer	1.279	0.0	40.3	0
15 min Winter	117.263	0.0	6.2	22

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	45.180	0.280	0.0	2.0	2.0	5.0	O K
60 min Winter	45.191	0.291	0.0	2.0	2.0	5.3	O K
120 min Winter	45.167	0.267	0.0	2.0	2.0	4.7	O K
180 min Winter	45.122	0.222	0.0	2.0	2.0	3.7	O K
240 min Winter	45.057	0.157	0.0	2.0	2.0	2.4	O K
360 min Winter	44.938	0.038	0.0	2.0	2.0	0.5	O K
480 min Winter	44.900	0.000	0.0	1.9	1.9	0.0	O K
600 min Winter	44.900	0.000	0.0	1.6	1.6	0.0	O K
720 min Winter	44.900	0.000	0.0	1.4	1.4	0.0	O K
960 min Winter	44.900	0.000	0.0	1.1	1.1	0.0	O K
1440 min Winter	44.900	0.000	0.0	0.8	0.8	0.0	O K
2160 min Winter	44.900	0.000	0.0	0.6	0.6	0.0	O K
2880 min Winter	44.900	0.000	0.0	0.5	0.5	0.0	O K
4320 min Winter	44.900	0.000	0.0	0.4	0.4	0.0	O K
5760 min Winter	44.900	0.000	0.0	0.3	0.3	0.0	O K
7200 min Winter	44.900	0.000	0.0	0.2	0.2	0.0	O K
8640 min Winter	44.900	0.000	0.0	0.2	0.2	0.0	O K
10080 min Winter	44.900	0.000	0.0	0.2	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	80.979	0.0	8.5	32
60 min Winter	53.483	0.0	11.3	52
120 min Winter	34.050	0.0	14.4	90
180 min Winter	25.686	0.0	16.2	126
240 min Winter	20.855	0.0	17.4	158
360 min Winter	15.567	0.0	19.6	208
480 min Winter	12.625	0.0	21.2	0
600 min Winter	10.720	0.0	22.5	0
720 min Winter	9.373	0.0	23.6	0
960 min Winter	7.574	0.0	25.4	0
1440 min Winter	5.595	0.0	28.2	0
2160 min Winter	4.122	0.0	31.2	0
2880 min Winter	3.312	0.0	33.4	0
4320 min Winter	2.430	0.0	36.7	0
5760 min Winter	1.953	0.0	39.4	0
7200 min Winter	1.649	0.0	41.6	0
8640 min Winter	1.437	0.0	43.4	0
10080 min Winter	1.279	0.0	45.1	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.900	Shortest Storm (mins)	15
Ratio R	0.299	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.025

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.008	4	8	0.008	8	12	0.008

Model Details

Storage is Online Cover Level (m) 46.000

Cellular Storage Structure

Invert Level (m) 44.900 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	11.7	0.0	0.601	0.1	0.0
0.600	46.7	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0076-2000-0400-2000
Design Head (m)	0.400
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	76
Invert Level (m)	44.800
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.400	2.0
Flush-Flo™	0.124	2.0
Kick-Flo®	0.286	1.7
Mean Flow over Head Range	-	1.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0	1.200	3.3	3.000	5.1	7.000	7.6
0.200	1.9	1.400	3.5	3.500	5.4	7.500	7.9
0.300	1.8	1.600	3.8	4.000	5.8	8.000	8.2
0.400	2.0	1.800	4.0	4.500	6.1	8.500	8.4
0.500	2.2	2.000	4.2	5.000	6.5	9.000	8.7
0.600	2.4	2.200	4.4	5.500	6.8	9.500	8.9
0.800	2.7	2.400	4.6	6.000	7.1		
1.000	3.0	2.600	4.7	6.500	7.4		

Appendix H – Package Treatment Works Certificate

Certificate

353.02C02

Kingspan Water & Energy Ltd.
College Road North, Aston Clinton, Aylesbury, HP22 SEW, UK

EN 12566-3, Annex B
Small wastewater treatment systems for up to 50 PT

Small wastewater treatment system BioDisc +P
Rotating Biological Contactor (RBC) in a GRP tank with chemical dosing equipment

Test report PIA2019-353B47.02
This test certificate is a revised version of test certificate no. 353.02C01.

Nominal organic daily load (influent)	0.28 kg BOD5/d		
Nominal hydraulic daily load	0.9 m³/d		
Material	GRP		
Treatment efficiency (nominal sequences)		Efficiency	Effluent
	COD	95.9 %	31 mg/l
	BOD5	98.0 %	6 mg/l
	Nt*	71.1 %	17.9 mg/l
	NH4-N*	92.1 %	3.0 mg/l
	Pges	95.4 %	0.3 mg/l
	SS	95.6 %	15 mg/l
Electrical consumption	1.5 kWh/d		

*determined for temperatures 12 °C in the bioreactor

PIA - Prüfinstitut für Abwassertechnik GmbH
Hergenrather Weg 30
52074 Aachen
Germany

This document replaces neither the declaration of performance nor the CE marking.

PIA - Sustainable Certification
geprüft - tested - testé

Martina Wermter December 2020

Rappor Consultants Ltd

www.rappor.co.uk

Cheltenham
Bristol
London
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Exeter
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