Drainage (Foul and Surface Water) Strategy

Proposed One Bedroomed Custom Self Build Dwelling at Land Opposite Caenwood on Howle Hill, HR9 5SP

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1. Introduction

1.1. Purpose of this Report

This report is prepared following the pre-application advice report received on 1st July 2024 and presents a Foul Drainage (Foul and Surface Water) Strategy for a proposed one bedroomed highly insulated custom self build (104m2) dwelling with a bespoke Biologic Design Wetland Ecosystem Treatment (WET) system on the land opposite Caenwood on Howle Hill, HR9 5SP.

1.2. Background

A previous application (P232500/F) was withdrawn by the applicants on advice from the planning officer so additional surveys could be obtained and the application be resubmitted within a 12 month period. The applicants sought pre-application advice on 11th November 2024.

This application remains the same as P232500/F except for the red boundary line which has been redrawn and is now closer to the dwelling.

The site is located in Flood Zone 1 so a flood risk assessment is not required. However, due to the unique concept of the Biologic Design Wetland Ecosystem Treatment (WET) system, assurances for nutrient neutrality are included in this report particularly in relation to any environmental impact.

There is currently no water supply on site. The applicants store rainwater off the roofs of the greenhouse, a garden tool shed and a small lean to shed into three IBCs and separate water butts in order to water their garden. There is no public sewerage system to connect to, as illustrated in Appendix 3.

1.3. Sources of Information and Consultation

This Report has been informed by the following documents:

- Location and site plans
- Pre-planning geo-environmental desk study report, Wilson Associates (May 2024)
- Walford Neighbourhood Development Plan (2011 – 2031), January 2023

National Policy and/or Advisory Notes

- National Planning Policy Framework (NPPF)
- Building Regulations Part G4; 4.19 b composting toilet
- Building Regulations Part H
- Environmental Agency: Position Statement (MWRP PS 036 2011): using composting toilets and the resulting compost
- Department for Environment, Food & Rural Affairs (DEFRA) and Environment Agency: Your sewage – Your environment: Important information for households and businesses with septic tanks and small sewage treatment plants
- Public Health, England and Wales (No.1263) The Sludge (Use in Agriculture) Regulations 1989
- SuDS Manual (susdrain.org)

- suds_manual_faqs.pdf (susdrain.org)
- Government published flood data maps
- NE785 Revised Edition 3 Natural England Water Quality and Nutrient Neutrality Advice (16 March 2022) updated_PL.pdf
- Nutrient pollution: reducing the impact on protected sites - GOV.UK (www.gov.uk)

Herefordshire Council:

- Herefordshire Council Sustainable Urban Drainage Systems Handbook (2018)
- Herefordshire Council - River Wye Nutrient Management Plan Phosphate Action Plan (herefordshire.gov.uk)
- Willow wetland systems - Nutrient neutrality private mitigations – Herefordshire Council
- Herefordshire Council Interim Phosphate Delivery Plan Stage 2 Report

Research publications:

- Biological Wastewater Treatment Series, Volume Seven: Treatment Wetlands (ufsc.br)
- Zero-discharge of nutrients and water in a willow dominated constructed wetland - PubMed (nih.gov)

Ireland (EU):

- Code of Practice for Domestic Waste Water Treatment Systems (epa.ie)

1.4. Structure of this Report

The Report has been structured in order to deal with the key drainage related issues, and also relate to the NPPF Practice Guide.

The principal sections are as follows.

- Section 1 presents the introduction, purpose and structure of the report
- Section 2 refers to the site location, fluvial and surface water flood risk
- Section 3 details the soil analysis and percolation
- Section 4 outlines the schematic design of the WET system
- Section 5 provides an explanation on the maintenance of the drainage system
- Section 6 describes the significant benefits of a nature-based drainage system
- Section 7 outlines how the system meets local, county and national policies and directives

Additional Appendices are provided that deal with the following.

- Appendix 1: Percolation Test
- Appendix 2: Calculation of Surface Water Run-off for a roof of 154m2

2. Site Location

The site is a 0.38 ha field in the centre settlement of Howle Hill. Grid reference 360343, 220503 marks the approximate centre of the proposed dwelling.

2.1. Flood Risk – Low Probability

Figure 1 indicates that the site is located within the low probability Flood Zone 1. Therefore, and in accordance with the Environment Agency standing advice – because the development is less than 1 hectare – it does not need to be supported by a Flood Risk Assessment.

According to Balfour Beatty Living Places (BBLP) consultation report for P232500/F dated 16 October 2023, *"an ordinary watercourse flows approximately 525m to the west of the site".* With the redefined boundary (red line) - the topography of the site slopes from north-east to the boundaries of the south-east proposed forest garden and pond by approximately 1m.

Figure 1: Environmental Agency Flood Map for Planning (Rivers and Seas) October 2023

2.2. Surface Water Flood Risk

In addition, BBLP's consultation report states the Environment Agency (EA) Surface Water Risk map (Figure 2) … *"indicates the site is not located within an area at risk of surface water flooding. The area of low to high risk of surface water ponding to the east of the site but this does not enter the red line site boundary. The proposed dwelling location is not directly down gradient of the mapped surface water ponding which is appropriate"*

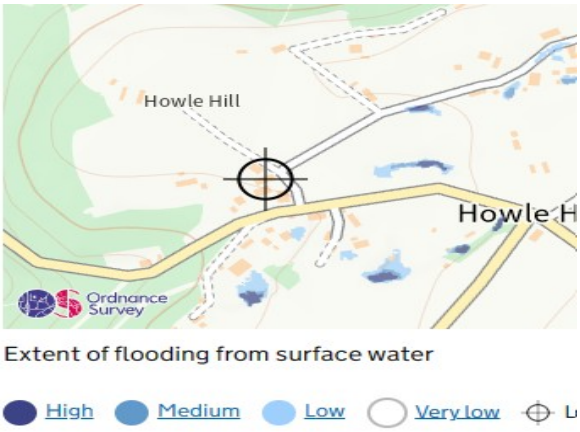


Figure 2: Environment Agency Surface Water Risk map

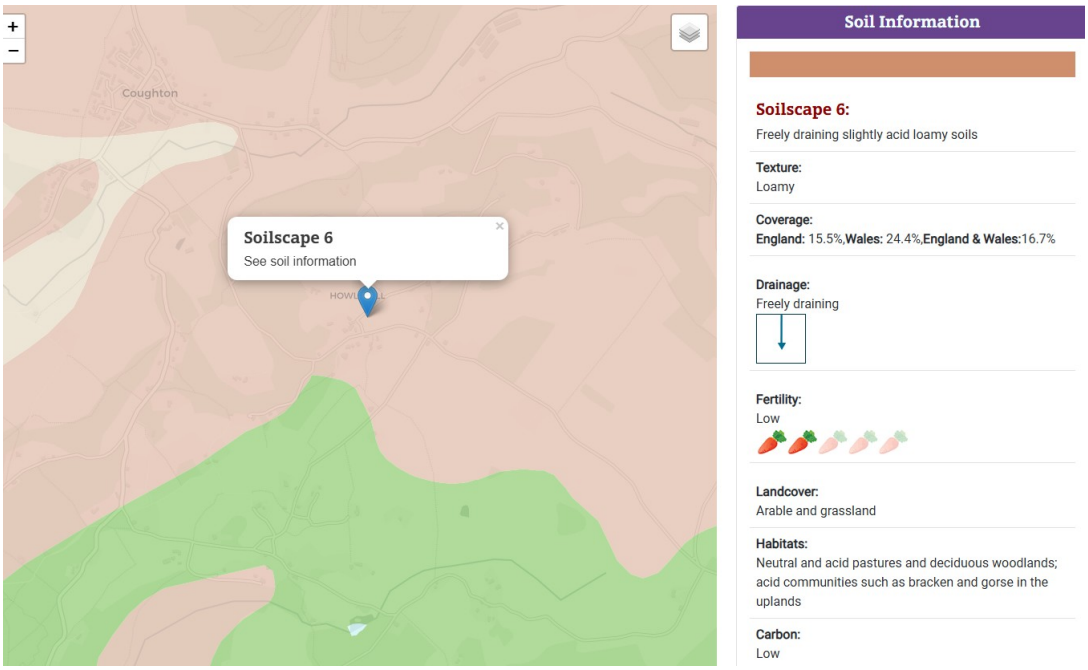
The applicants and their Drainage Consultant (Jay Abrahams of Biologic Design) have taken onboard BBLP's comment (October 2023 report) that *"... the risk of surface water flooding from higher land and to consider the likely flow routes in the vicinity of the proposed development site".* Consequently, they are proposing to use the eastern near side of the vegetable garden as a natural flow route for the waste water from the dwelling to feed a geo-textile lined Wetland Ecosystem Treatment (WET) and a geo-textile clay lined pond for the surface (roof) run off[1].

BBLP's review of the EA's Groundwater map indicated that the site is not located within a designated Source Protection Zone or Principle Aquifer.

3. Soil Analysis

The published Soilscapes mapping indicates that the soil at the site is freely draining loamy soils (Figure 3).

Figure 3: Soilscapes dataset for Grid Reference: 360343, 220503.



The Soilscapes Dataset also identified groundwater contamination with nitrate; siltation and nutrient enrichment of streams from soil erosion on certain of these soils.

There will be no groundwater contamination because of the proposed plans for the waste water system in this application (see Figure 4 below).

1 *Please refer to Biologic Design's report: 'Overview of the Wetland Ecosystem Treatment (WET) System for Regenerative Wastewater Purification at Caenwood (July 2024)*

3.1. Percolation Test

The following site analysis sketch shows where the percolation test A) and where the trial tests (B&C) were carried out in relation to the whole site under the ownership of the applicants. Photographs in this subsection provide visual information of soil structure. Test results are also provided.

Figure 4: Site Analysis

A hole of 1m long and 0.5m wide and 1.5m deep was dug as per the diagram (marked as A). The hole is 3.5 metres from the nearest boundary. The location can be found on the following photo (to the left next to the squash plants and marked with a blue bandana).

The hole consisted of

- 20cm of top soil with small limestone stones. (easy digging)
- 30cm of light coloured clay and stones (like breaking into concrete)
- 70cm of dark coloured clay and larger rocks (hard digging)
- 30cm of soft dark clay and stones (easy digging)

3.1.1. Photos of the Hole A:

3.1.2. Photos of the materials found in Hole A:

3.1.3. Results of the Percolation Tests

There was not much rain during the digging period but what did fall did not collect in the hole. Whilst there is a test record sheet it proved largely unnecessary as the water flowed out very quickly. Two 1,000 litre IBCs were used to flood the hole simultaneously. Please note videos were taken of tests 2 and 3, and are available to view if required.

a) Test 1, 28th September 2022 at 14:11. Weather dry

- Water level reached 1.1m before the outflow exceeded the inflow. Both IBCs were approximately half full at this stage, meaning 1,000 litres of water entered the hole.
- Water level of 0.3m was reached after 2 minutes and the hole was empty after 3 minutes.

b) Test 2, 28th September 2022 at 16:00. Weather dry

- Water level reached 0.9m before the outflow exceeded the inflow. Both IBCs were approximately half full at this stage, meaning 1,000 litres of water entered the hole.
- The hole was empty after 3 minutes and 15 seconds.

c) Test 3, 29th September 2022 at 10:30. Weather damp, rain overnight

- Water level reached 1.0m before the outflow exceeded the inflow. Both IBCs were approximately half full at this stage, meaning 1,000 litres of water entered the hole.
- The hole was empty after 3 minutes and 40 seconds.

4. Design of the WET System

The Wetland Ecosystem Treatment or WET System created by Biologic Design is a regenerative, nature-based water purification system; a horizontal plug-flow, multi-species, soil biome-based, constructed as a wet woodland and forest garden/orchard.

The WET System comprises a productive tree-based water purification system that integrates wastewater purification with both biomass resource production (willows) and enhanced biodiversity, through the creation of a lush, species-rich, diversely planted wetland habitat of fruit bushes and nut trees.

The design for the Wetland Ecosystem Treatment (WET) system is described in detail in the report from Biologic Design: Overview of the Wetland Ecosystem Treatment (WET) System for Regenerative Wastewater Purification at Caenwood (July 2024). Schematic plans of Biologic Design's WET system are given in Figures 5 and 6 below.

Figure 5 outlines Biologic Design's WET System in relation to the dwelling.

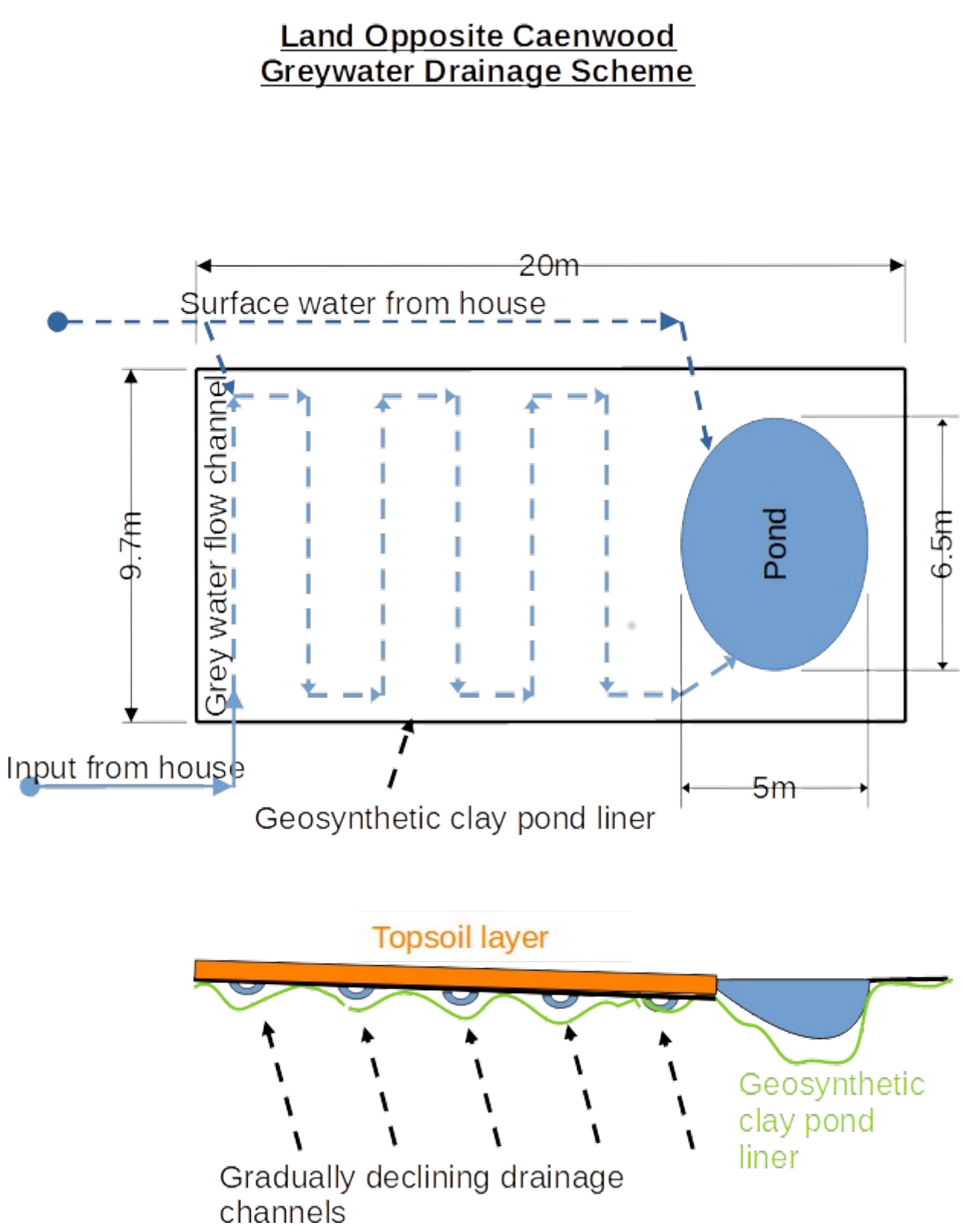


Figure 6 outlines the construction of Biologic Design's WET System

5. Maintenance Plan of the WET System

The beauty of the Wetland Ecosystem Treatment (WET) system is its simplicity in design. The applicants will be able to follow waste water from its source into the geo-textile lined WET system. Therefore, be able to immediately spot signs and regularly check for pollution such as smells, pools of water, sludge, foam in the WET system.

All the 'waste water' from the dwelling is a resource that is feeding the production of biomass (willow) and food (nuts and soft fruit trees). Therefore, no fats, oils or chemicals will be put down the drain as these will kill the bacteria needed to feed the willow, soft fruit bushes and nut trees in the WET System.

The applicants are conscious environmentalists who only use no-phosphate (non-biologic and natural) detergents that are kinder to the environment. Their practice will continue within the new dwelling.

As an extra precaution to prevent any small items of food entering the drain, the kitchen will have a professional kitchen trap to collect any food items which will be composted.

After the waste water has gone through the kitchen trap, the 'filtered' water will then enter a 30 gallon (perforated) drum that is situated on top of the geotextile clay lined WET system at the entrance to the WET system. The 30 gallon perforated drum will have a base layer of gravel, mid layer of sand and a top level of mulch which will be regularly changed (at least once a month) to prevent any build up of food solids. This mulch will be composted.

On an annual basis, applicants will maintain and regularly check:

- **clear all pipework (inlets and outlets)** from the dwelling into the WET System
- **check flow** (from collection to distribution plumbing)
- **flush natural salt build up** in pipes with rainwater from IBCs
- **coppice willows, harvest and prune fruit bushes** and so remove nutrients from the system

6. Benefits of a Wetland Ecosystem Treatment (WET) System

In addition to its simplicity in the design, there are other benefits and these are listed below:

6.1. No Foul Water System is Required

The highly insulated custom self build one bedroom dwelling will not be equipped with a water-based, flush-toilet system, and therefore has no requirement for a foul sewerage system i.e. to treat wastewater containing toilet wastes (sewage).

The dwelling will have a toilet that separates the liquid (urine) from the solids (faeces) sited outside of the living space so the waste can be removed from the premises without carrying it through any living space or food preparation areas (including the kitchen) in accordance with Building Regulations (part G).

The waste from the compost toilet will be used and processed on the land as a fertiliser. Sawdust or wood shavings will be added to reduce odour and aid the degradation process[2]. The urine will feed the compost bins whereas the solid will be used as a fertiliser on trees close to the woodland. No foul or toilet waste is leaving the site.

6.2. Productive Use of Grey Water

Biologic Design's WET System is a fully-lined purification system. It will not contain any toilet wastes, only water from the kitchen sink, bathroom sink and shower.

6.3. Retains Surface Run-off Water

The WET System is a fully-lined and landscaped, surface run-off system, a Sustainable Drainage and SuDS System. It incorporates a constructed rainwater retention pond that will attenuate and harvest the run-off flowing from the roof.

Surface run-off from the roof will fill two holding tanks (large water butts) next to the house. The outfall from these will flow, by gravity pipework, directly into the large rainwater retention pool. If this pond was to ever overflow – it would feed the hedgerow to the east, the vegetable garden to the west and woodland to the south.

6.4. Feeds a Productive Food System

This nature-based drainage system incorporates key elements of the Environment Agency's Rural Sustainable Drainage System.

It is a self-contained system where wastewater and wastes are not perceived as 'problems' to be got rid of, but as resources to be used. Grey Water will be used to feed the topsoil, and to water willows, soft fruit trees and bushes and nut trees.

6.5. Provides a Beneficial Ecological Niche

The rainwater retention pool adds a wetland ecotone in an area of freely draining soil thus creating a wetland oasis in an otherwise dry land environment. It will provide a special resource for invertebrates, amphibians, reptiles, birds, bats and mammals.

6.6. Satisfies Relevant Policies

This Drainage (Foul and Surface Water) Strategy meets the following policies and directives:

Herefordshire Council Core Strategy (2011 - 2031),	SD4, paragraph 5.3.70	*"Sustainable forms of water treatment such as reed beds may be used as alternatives to or in combination with foul water treatment and disposal. Full details should be provided to show these*

2 *MWRP PS 036 2011*

		will achieve the required standard of discharge into the natural drainage system".
Walford NDP	Policy WALF8: Wastewater Drainage, page 44	*"Developers should utilise or contribute to wet systems where this is practicable, including measures to support biodiversity".*
Building Regulations	H1(c) page 6	allows it as *"another wastewater treatment system".*
Building Regulations	G4.19	*"Suitable arrangements can be made for the disposal of the waste either on or off the site; and the waste can be removed from the premises without carrying it through any living space or food preparation areas (including a kitchen); and no part of the installation would be installed in any places where it might be rendered ineffective by the entry of flood water."*
Public Health England and Wales Act 12 (1989)		*"The sludge shall be used in such a way that account is taken of the nutrient needs of the plants and that the quality of the soil and of the surface and ground water is not impaired".*

Since 2011, Herefordshire Council has approved 23 compost toilets and it has approved 14 WET systems since 2002. Therefore, Herefordshire Council as the Local Planning Authority recognises the establishment of WET systems throughout the county in many planning consents. For example:

"WET systems are successfully established in this county and across England with over 140 installed. WET systems fulfil the definition of sustainable development and are supported by the National Planning Policy Framework in conserving and enhancing the natural environment and helping to meet the effects of climate change and flood risk." (P131754)

"The National Planning Policy Framework (NPPF) supports sustainable development, and also seeks to further healthy communities (section 8), PF1 rural economies (section 3), meeting climate change (section 10), and the natural environment (section 10). WET systems are inherently compatible with all of these." (P123560)

"WET Systems are successfully established in this county and across England, with over 140 installed. The process is a biological sustainable drainage solution." (P123560)

7. Summary and Conclusion

The proposed Wetland Ecosystem Treatment (WET) system alongside a compost toilet that is situated in the utility space of the dwelling is acceptable in principle under the relevant local plan, building regulations, and the Environment Agency.

The WET System meets SD3 because the drainage system is an integral element of the new development that reduces flood risk, avoids adverse impact on water quality, protects and enhances groundwater resources and enhances biodiversity, health and recreation (gardening).

It meets Local Plan SD4 because it will not have any significant adverse effect on groundwater quality or the River Wye.

The bespoke drainage system for the custom self build one bedroomed dwelling should be a beacon for Herefordshire Council as it demonstrates integrated agriculture within the built environment. It is a development that provides Regenerative Agritecture through its permaculture design to sustain its residents and provides significant value for wildlife and biodiversity in a time of climate change and ecological challenges.

Appendix 1: Percolation Test Results

Percolation test results
Site:

Test Pit No: 1

Pit size
length: 1
width: 0.5
depth: 1.5

diagram

see test report

q1 =	0.001421	m/s	>0.000001	5.116279 m/hr
q2 =	0.001247	m/s	>0.000001	4.490644 m/hr
q3 =	0.001136	m/s	>0.000001	4.090909 m/hr

test 1			
vp25-75 =	0.275 m3	tp75-25 =	90 sec
ap 50 =	2.15 m2		

test 2			
vp25-75 =	0.225 m3	tp75-25 =	97.5 sec
ap 50 =	1.85 m2		

test 3			
vp25-75 =	0.25 m3	tp75-25 =	110 sec
ap 50 =	2 m2		

Time	test 1 depth to water m		test 2 depth to water m		test 3 depth to water m	
0	1.1		0.9		1	
10						
20						
30						
40						
50						
60						
70						
80						
90						
100						
110						
120						
130						
140						
150						
160						
170						
180	0	180 sec				
190						
200			0	195 sec		
210						
220					0	220 sec
230						
240						
250						
260						
270						
280						
290						
300						
310						
320						
330						
340						
350						
360						
370						
380						
390						
400						
410						
420						
430						
440						
450						
460						
470						
480						

test 1		test 2		test 3	
d 72-25	0.55	d 72-25	0.45	d 72-25	0.5
vp25-75 =	0.275	vp25-75 =	0.225	vp25-75 =	0.25
ap 50 =	2.15	ap 50 =	1.85	ap 50 =	2

Appendix 2: Calculation of Surface Water Run-off for a roof of 154m2

terrapermageo	**Project:**	TPG 409 A Taste of Self Sufficiency		**By: BK**
	Calculation:	Soakaway Design- 154 m2 roof		
		BRE 365 Method		**Approved:**
	Sheet Number:	1 **Date:**	12/10/2022	

Catchment Details				
Catchment Area			154	m²
Location			England & Wales	
City/Town			Hereford	
M5-60	19	Override-		
r Ratio	0.39	Override-		
Runoff Coefficient			95	%

Design Storm Details		
Return Period	100	years
Climate Change Allowance	1.4	

Ground Information			
Infiltration Rate	4.09	m/hr	1.14E-03 m/s

Soakaway Design		
Length	2.00	m
Width	1.50	m
Effective Depth	0.80	m
Backfill Porosity	95	%

Results

Storm Duration	Z1	Z2	Rainfall	Inflow	Outflow	Storage Required	%
5	0.37	1.87	18.39	2.69	0.95	1.74	76.1
10	0.52	1.91	26.40	3.86	1.91	1.95	85.7
15	0.63	1.93	32.27	4.72	2.86	1.86	81.5
30	0.80	1.95	41.54	6.08	5.73	0.35	15.4
60	1.00	1.99	52.93	7.74	11.45	0.00	0.0
120	1.21	2.02	64.95	9.50	22.90	0.00	0.0
240	1.46	2.02	78.41	11.47	45.81	0.00	0.0
360	1.62	2.01	86.48	12.65	68.71	0.00	0.0
600	1.82	1.99	96.42	14.11	114.52	0.00	0.0
1440	2.28	1.96	118.87	17.39	274.85	0.00	0.0

Maximum Storage Volume Required:	**1.95** m³ (10 min Storm)	
Storage Volume Provided:	**2.28** m³	Acceptable
Time of Emptying:	**0.10** Hours	Acceptable

Appendix 3 Public Sewer map