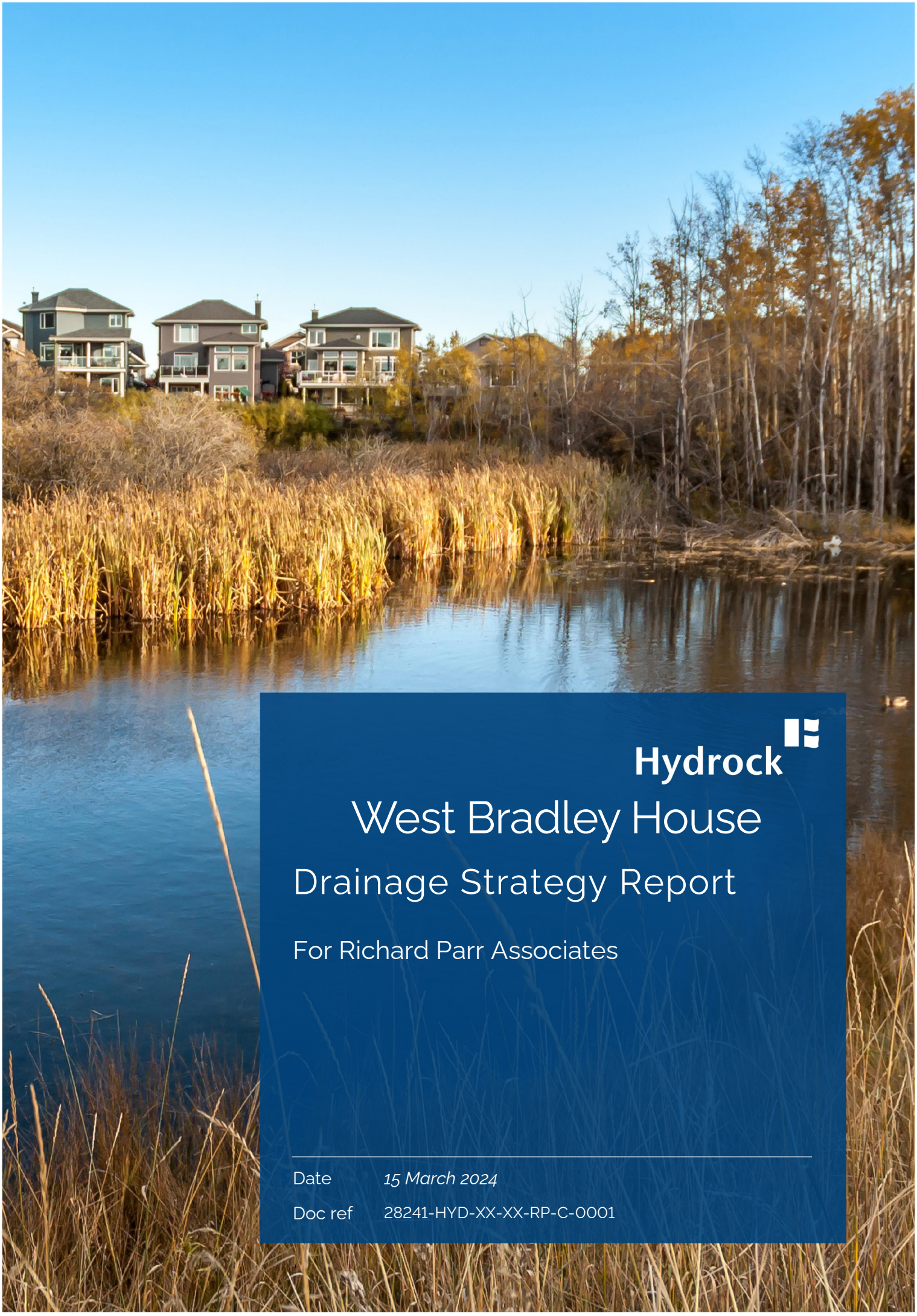

Hydrock

West Bradley House

Drainage Strategy Report

For Richard Parr Associates

Date	*15 March 2024*
Doc ref	28241-HYD-XX-XX-RP-C-0001

Document control sheet

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P01	S2	19.12.2023	First issue
P02	S2	07.02.2024	Drainage layout drawing updated (Appendix A)
P03	S2	21.02.2024	Drainage layout drawing updated (Appendix A) for inclusion of Dew Pond. Section 5.4 updated.
P04	S2	15.03.2024	Landscape plan layout updated on drawing appendices

Contents

1. Introduction

1.1 Overview

This Drainage Strategy Report has been prepared by Hydrock Consultants Limited (Hydrock) on behalf of our client Richard Parr Associates in support of a Planning Application for the development of West Bradley House, Glastonbury. This report has been prepared to address the requirements for storm and foul water discharge and provide guidance on how the proposed development site could effectively drain through on-site sustainable drainage techniques and on-site foul drainage infrastructure.

The drainage strategy is a guide on how compliant drainage scheme could be designed on site in accordance with the Flood and Water Management Act 2010, National Planning Policy Framework (NPPF), the Lead Local Flood Authority (LLFA) and Local Planning Authority (LPA) requirements.

This report is to be read in accordance with the Flood Risk Assessment, prepared by Hydrock, document reference 13668-HYD--XX-XX-RP-FR-0001 P03.

The information received is summarised within this report. In the event that the information is relied upon and is subsequently found to be incorrect, Hydrock Consultants Ltd accepts no responsibility for any direct and/or consequential loss that may occur as a result.

The information has been reviewed against the following industry design standard to ensure the drainage is compliant;

- Building regulations Part H: Drainage & Waste Disposal;
- Sewers for Adoption/Design and Construction Guidance;
- The requirements of Wessex Water;
- CIRIA C753: The SuDS Manual; and
- Lead Local Flood Authority requirements;
- BS EN 752 - Drain and Sewer Systems Outside Buildings.
- Local Authority Guidance.
- National Planning Policy Framework (NPPF).
- DEFRA Non-Statutory Technical Standards for Sustainable Drainage.

1.2 Proposed development

The works include refurbishment and alterations to Grade II listed building and adjoining structures, demolition of storage buildings and replacement with new ancillary residential buildings, refurbishment and conversion of storage barn/farm office to residential use, alterations to landscape and access. A new internal swimming pool will also form part of these works. In addition, new external paving areas are proposed along the development, including also landscaping areas.

The residential dwelling accommodates 5 suites and the following outbuildings: -

- Reb Brick barn. Open space masonry barn.
- Apple Barn.
- The Cart shed.
- Tractor Sheds.

2. Site information

2.1 Location

The existing site is located to the north of Bradley Lane, Glastonbury. To the south of the site the lower farm offices and West Bradley church is located. Bradley brook flows from east to west at the north of the site. A series of interconnected ponds and ditches are to the south. Orchards surround the site to the north.

The site address and Ordnance Survey Grid Reference is provided in Table 1 with the site location included in Figure 1.

SITE REFERENCING INFORMATION	
Site address	West Bradley House, Glastonbury, BA6 8LT
Grid Reference	355845, 136946

Table 1 - Site referencing information

Figure 1 - Site location

2.2 Topography

The site comprises an area of land of approximately 4.00 Ha in size. The primary site entrance is from Bradley Lane with a second entrance through the Orchard to the West. The topographical survey indicates that the existing ground level within the existing site goes from 28.00m to 35.00 from West to East and from 32.00 to 30.00 from North to South relating to Ordnance Survey National Grid levels.

The are three existing ponds one at high level (+32.00m) a middle pond at +29.90 and the low pond at +27.00m approximately.

2.3 Existing geology

A geological report has been carried out by Hydrock. The ground conditions are reported as Langport Member, Blue Lias & Charmouth Mudstone Formation Langport Member, slightly sandy silty clay / silty clay of varying consistency. Between depths of 1.30m - 2.70m, this transitioned into extremely weak grey / dark grey mottled brown mudstone (excluding TP04 at which mudstone was encountered at 0.10m bgl).

Groundwater was encountered at depths between 0.80m below ground level (bgl) and 2.70m bgl during the investigation. Water levels recorded post-fieldwork ranged from 1.40m bgl to 1.99m bgl

The ground conditions are not suitable for the use of a foul water drainage field due to poor porosity and subsequent inadequate infiltration rates and also ground water levels. Infiltration rates were unable to be calculated due to the slow infiltration. This has been mentioned in the geological report, please refer to 28421-HYD-XX-XX-RP-GE-1001.

2.4 Existing drainage

The Bradley Brook runs to the North of the premises. A ditch runs along the southern boundary from the upper pond towards the adjoining Church gardens. This is used predominantly for over flow from the upper ponds. During a site visit in the summer months this ditch was in constant flow. A secondary ditch/culvert arrangement caters predominantly for over flow from the middle pond discharging to the lower pond. See arrangement below on Figure 2.

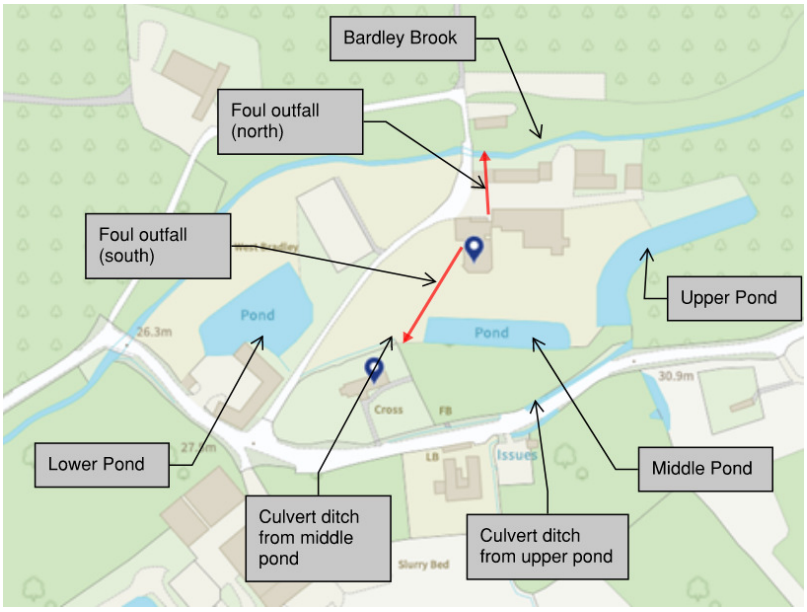


Figure 2 - Listed Buildings (extract from Historic England)

A drainage survey has been carried out by Solum Surveying Ltd in July 2023 at the premises to determine the foul water arrangement and outfall from site. The following was concluded: -

1. There are no foul sewers within the site or local area
2. There are no treatment plants, septic tanks or cesspits on the premises
3. Foul water from the main house discharges to 2.no outfalls.
    a. To the north of the property, the foul drain outfalls directly to the brook
    b. To the east of the property the foul drainage discharges to the culvert from the overflow drain of the middle pond.

The historical barns and out buildings also have drains and above ground foul drains discharging to Bradley Brook. Refer to Appendix J for the drainage survey.

3. Flood Risk

The Environment Agency flood risk mapping as shown within Appendix F of this report shows the site is located within flood risk zone 1 which is a low probability of flooding.

- The site is bigger than 1 hectare (ha)
- The site is not in an area with critical drainage problems as notified by the Environment Agency
- The site is not identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- The site is not at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Based on the above information **further flood risk assessments are required**. Refer to the Flood Risk Assessment, prepared by Hydrock, document reference 13668-HYD--XX-XX-RP-FR-0001 P03.

Figure 3 - Surface water flooding map

4. Foul water management strategy

4.1 Proposed Foul Water Network

Foul water drainage is to use a gravity system to drain to a foul water treatment plant to the east for the majority of the site. The treatment plant is to be located 10m beyond the habitable dwelling and 10m away from the water course. It has also been located within 30m of maintenance vehicle parking location to allow for maintenance. The treatment plant has been sized for 24 people. The outfall of the treatment plant is to discharge the clean water into Bradley Brook using a headwall.

A pump has been proposed to the north of the Apple Barn which connects into the gravity system. This pump is shown indicatively as the strategy is subject to confirmation of the FFL of the apple barn.

A secondary foul pump is required within the basement for minor quantities of condensed water from proposed plant,

The foul drainage layout and arrangement is shown in Appendix A.

A detailed phosphate report has been completed by Hydrock, which was issued to Mendip District County Council Local Planning Authority. The report concluded a betterment in total phosphorous load with an increase in population with the introduction of a treatment plant.

Refer to Appendix H, for the Phosphates neutrality assessment and strategy.

4.2 Proposed Pool Backwash Network

It has been proposed to provide a separate system to collect and store the foul water involved in the pool backwashing system. The pool drainage is to discharge to the outfall connection (designed by pool specialist) and which is pumped to a gravity system. The gravity system falls towards the east, where a Chlorine Separation Tank has been placed to allow for vehicle access. This tank is to be emptied by a vacuum tank, with the frequency dependant on the frequency of back washing. The discharge is not to enter the foul treatment plant or water course to the north.

Refer to Appendix A for the Pool Backwash layout and arrangement.

5. Surface water management strategy

5.1 Objective

The objective of the concept drainage strategy is to provide guidance on how the proposed development site could effectively drain through on-site sustainable drainage techniques and to off-site drainage infrastructure, based on the drainage and ground condition information collected and reviewed to date. This document includes a fixed and calculated drainage strategy, in line with current legislation. The design of a successful compliant drainage system for this site is entirely dependent on sustainable drainage principles and requirements being fully incorporated into the site layout to meet the provisions of the Local Planning Authority and the Flood and Water Management Act 2010.

5.2 Suitable Run-off Destinations

An appraisal has been undertaken to confirm the most suitable and sustainable method for managing surface water runoff from the development in accordance with the following hierarchy as highlighted in Part H of Building Regulations and the National Planning Policy Framework (NPPF). This assesses the different surface water management techniques that can avoid, reduce, or delay the surface water discharge from site. The options of discharging storm water off site in order of priority is as follows:

1. Infiltration to the ground using a sustainable drainage system.
2. If this is not feasible, discharge to a watercourse or river; generally, at a controlled rate unless it does not affect flood risk e.g., if to the sea or an estuary.
3. Discharge at a controlled rate to a surface water sewer or drain.
4. Discharge at a controlled rate to a combined sewer system, with the approval from the Water Authority.
5. Only if the above have all been investigated and it has been proved that none of these options are suitable will discharge at a controlled rate to a foul sewer system, with the approval from the Water Authority.

Method	Reasoning	
Interception / Re-use	Deemed inappropriate	X
Infiltration	Ground is unsuitable for infiltration methods	X
Surface water body	The proposed storm water network will discharge to Bradley Brook to the North	✓
To dedicated surface water sewer (public, highways or otherwise)	Discharge to existing Wessex Water storm sewer is deemed appropriate	X
To a combined sewer	Not required	X
To a foul sewer	Not required	X

Table 2 - Run-off destinations hierarchy assessment

The techniques consider the use of soakaways in accordance with the Building Regulations Approved Document H order of priority. As mentioned in Section 2.3, the existing ground conditions are not suitable for the use of soakaways. It has deemed unfeasible to discharge the storm water to the existing ponds to the south due to level constraints via a gravity system. The water level in the pond has been monitored all year round showing the water level to be at the top of the embankment; so, there is insufficient capacity to discharge the proposed runoff.

5.3 Greenfield Run-off Rates

5.3.1 Tennis court and Little stone barn

It is a requirement that on new developments that consideration be given to limit discharge as close as reasonably practical to the equivalent 'Greenfield' rate for the corresponding storm event. The following table considers what the maximum surface water discharge from the site would be if the site was 'Greenfield'. This is based on the proposed roof and hardstanding areas only (0.066 ha). Refer to Appendix C for Microdrainage ICP SUDS Mean Annual Flood calculation.

Storm Event	Maximum discharge rate (l/s) Greenfield
1 in 1 Year	0.2
1 in 30 Year	0.5
1 in 100 Year	0.6
QBAR	0.3

Table 3 - Greenfield runoff rate for tennis court

5.3.2 *Apple barn, Leisure barn, hardstanding and access road*

Similar to the above, the remainder of site's storm water discharge will be restricted to the greenfield run-off rate. The proposed area is 0.308 ha. Refer to Appendix C for Microdrainage ICP SUDS Mean Annual Flood calculation.

Storm Event	Maximum discharge rate (l/s) Greenfield
1 in 1 Year	1.9
1 in 30 Year	4.2
1 in 100 Year	5.0
QBAR	2.4

Table 4 - Greenfield runoff for Apple barn, leisure barn, hardstanding and access road

5.4 Suitability of Sustainable Drainage Systems (SuDS) Components

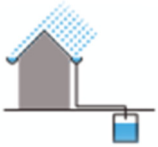
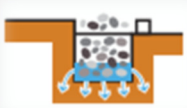
There is now a mandatory requirement to provide a sustainable drainage system throughout the development and not just at the "end" of the drainage system via length of pipe work. It is highly unlikely that the traditional "pipe and tank" system will be accepted by the LLFA and Local Planning Authority. The key points of the surface water drainage strategy will be to:

- Utilise the external areas of the site that will be subject to rainfall to treat and improve the water quality and to store the surface water flows as close to source as possible.
- Minimise the runoff from all impermeable areas through the widespread use of open SuDS drainage features.
- To enhance the biodiversity and amenity value by incorporating suitable SuDS features into the development.
- Avoid hard engineered pipes and tanks. The strategy described in this report is based on the principles of the CIRIA SuDS Manual C753

The implementation and selection of SuDS techniques is largely dependent on the site layout and context. Some SuDS techniques may be more appropriate than others.

The suitability of SuDS components has been assessed as follows:

Hierarchy	Description	Setting	Required area	Implemented	
Green roofs 	A planted soil layer is constructed on the roof of a building to create a living surface. Water is stored in the soil layer and absorbed by vegetation.	Building	Building integrated.	No. Recommend for Architect to include where possible.	X
Rainwater harvesting	Rainwater is collected from the roof of a building or from other paved surfaces and stored in an over ground or underground tank for treatment and reuse locally. Water could be	Building	Water storage (Underground or above ground).	No. Insufficient space and not cost effective.	X

Hierarchy	Description	Setting	Required area	Implemented	
	used for toilet flushing and irrigation.				
Soakaway 	A soakaway is designed to allow water to quickly soak into permeable layers of soil. Constructed like a dry well, an underground pit is dug filled with gravel or rubble. Water can be piped to a soakaway where it will be stored and allowed to gradually seep into the ground.	Open space	Dependent on runoff volumes, water table and soils.	No. Not suitable due to existing ground conditions	X
Filter Strips 	Filter drains are shallow stone filled trenches that provide attenuation, conveyance, and treatment of runoff	Open space	Dependent on runoff volumes	Yes, filter strip to provide attenuation from road surface runoff	✓
Permeable paving 	Paving which allows water to soak through. Can be in the form of paving blocks with gaps between solid blocks or porous paving where water filters through the block itself. Water can be stored in the sub-base beneath or allowed to infiltrate into ground below.	Street / open space	Can typically drain double its area.	Yes, permeable paving in car park	✓
Bioretention area or Raingardens 	A vegetated area with gravel and sand layers below designated to channel, filter, and cleanse water vertically. Water can infiltrate into the ground below or drain to a perforated pipe and be conveyed elsewhere. Bioretention systems can be integrated with tree-pits or gardens.	Street / open space	Typically, surface area is 5-10% of drained area with storage below.	Yes for numerous rain water downpipes	✓

Hierarchy	Description	Setting	Required area	Implemented	
Swale/Raingarden 	Swales and raingardens are shallow depressions designed to convoy and filter water. These can be 'wet' where water gathers above the surface, or 'dry' where water gathers in a gravel layer beneath. Can be lined or unlined to allow infiltration.	Street / open space	Account for width to allow safe maintenance typically 2–3 metres wide.	No. Insufficient space and topography restrictions	X
Hardscape storage 	Hardscape water features can be used to store run-off above ground within a constructed container. Storage features can be integrated into public realm areas with a more urban character.	Street / open space	Could be above or below ground and sized to storage need.	No. Additional underground storage not required	X
Pond / Basin 	Ponds can be used to store and treat water. 'Wet' ponds have a constant body of water and run-off is additional, while 'dry' ponds are empty during periods without rainfall. Ponds can be designed to allow infiltration into the ground or to store water for a period before discharge.	Open space	Dependent on runoff volumes and soils.	Yes, located east end of site for leisure barn roof area	✓
Wetland 	Wetlands are shallow vegetated water bodies with a varying water level. Specially selected plant species are used to filter water. Water flows horizontally and is gradually treated before being discharged. Wetlands can be integrated with a natural or hardscape environment.	Open space	Typically, 5–15% drainage area to provide good treatment.	No. Insufficient space and topography restrictions.	X

Hierarchy	Description	Setting	Required area	Implemented	
Underground storage 	Water can be stored in tanks, gravel, or plastic crates beneath the ground to provide attenuation.	Open space	Dependent on runoff volumes and soils.	Yes. Underground cellular attenuation crates will be used	✓

The use of SuDS systems such as attenuation ponds, ditches, swales etc is not feasible due to the limited land space available and the nature of the development – attenuation is therefore provided in the form of cellular storage located within the yard areas.

5.5 Proposed Interception Storage

Interception can be defined as the capture and retention on site of the first 5mm of the majority of all rainfall events. Interception mechanisms have been assessed to show the site is compliant for zero run-off from the first 5mm for 80% of events during the summer and 50% in winter. (Ciria)

Systems	Reasoning	
Green roofs	All surfaces that have green / blue roofs	X
Rainwater harvesting	All surfaces drained to RWH systems designed whether for surface water management or just water supply, provided the RWH system design is based on regular daily demand for non-potable water	X
Soakaways / infiltration	Areas of the site drained to systems that are designed to infiltrate run-off for events greater than a 1 month return period.	X
Permeable pavements	All permeable pavements, whether lined or not, can be assumed to comply, provided there is no extra area drained to the permeable pavement.	✓
Filter strips / swales	Roads drained by filters strips / swales, where the longitudinal gradient of the vegetated area is less than 1:100, are suitable for interception delivery for impermeable areas up to 5 times the base of the vegetated surface area receiving the runoff.	✓
Infiltration trenches	Roads drained by infiltration trenches can be considered to provide interception	X
Detention basins	Areas of the site drainage to detention basin with a flat base can be assumed to comply. The area of the basin that is assumed to contribute to interception of run-off should be below the outlet of the basin.	X
Bioretention / rain gardens	Areas of the site drainage to unlined bioretention components can be assume to comply where the impermeable area is less than 5 times the vegetated surface area receiving run-off/ They can be designed to deliver interception for larger areas, where suitable infiltration capacity is available.	X
Ponds	Areas drained by ponds (with a permanent water pool that is effectively maintained by the outlet structure) are not assumed to deliver interception	✓

5.6 Proposed Strategy

The proposed strategy incorporates two separate systems, both discharging to Bradley Brook. The first system includes the impermeable area from the tennis court and little stone barn to the north and is to drain via gravity. The tennis court consists of a permeable asphalt surface with a type 3 sub-base with a minimum void content of 30%. A series of filter drains will run along the length of the pitch within the sub-base, to channel the storm water. This system is controlled using a flow control chamber, restricting the discharge to 1.0 l/s; utilising the type 3 sub-base as storage. This network progress to another flow control chamber which intakes the runoff from the roof and hardstanding of the little stone barn. This system discharge into the Bradley Brook.

The second network includes the impermeable area from the roof area and hardstanding of the Main House, Apple Barns. Leisure Barn and Cart Sheds. The drainage network is a gravity system which outfalls to the east in Bradley Brook. A flow control chamber is situated upstream of the headwall into the water course, which will restrict the runoff to the greenfield rate. Cellular storage crates have been proposed to accommodate the storage requirements of the system, with a required volume of 171 m^3. A pump has been proposed for the main house for basement wall drainage, which connects back into the gravity system. Permeable paving has been proposed to the east of the main house, which will be system B – allowing for partial infiltration. A series of perforated pipes will be laid at the top of the subgrade to collect excess water. A filter drain surrounds the north of the permeable paving to be used as a secondary measure to collect surface runoff.

The network has been modelled using Microdrainage for all storm events up to and including the 1in100yr+40% climate change storm water event with the results shown within Appendix D of this report. The modelling shows no flooding for all events with the restricted discharge

The storm network is subject to approval from the Lead Local Flood Authority and the EA.

5.7 Exceedance Routes

Surface levels will be designed to ensure finished levels fall away from the building to ensure excessive amount of surface water bypass the building and flow towards the southern boundary of the filed towards the watercourse, or off site to the highway to the eastern boundary.

It should be noted that all surface water from hardstanding areas will be positively drained into the storm water system and not discharge onto the public highway or adjacent land.

Refer to Appendix E for exceedance routes.

5.8 Operation and Maintenance

To ensure longevity and effective operation of SuDS they must be maintained in accordance with

- CIRIA 753 guidance and operation and maintenance
- CIRIA report C768 - Guidance on the construction of SuDS
- Maintenance plan outlined in section 5.2

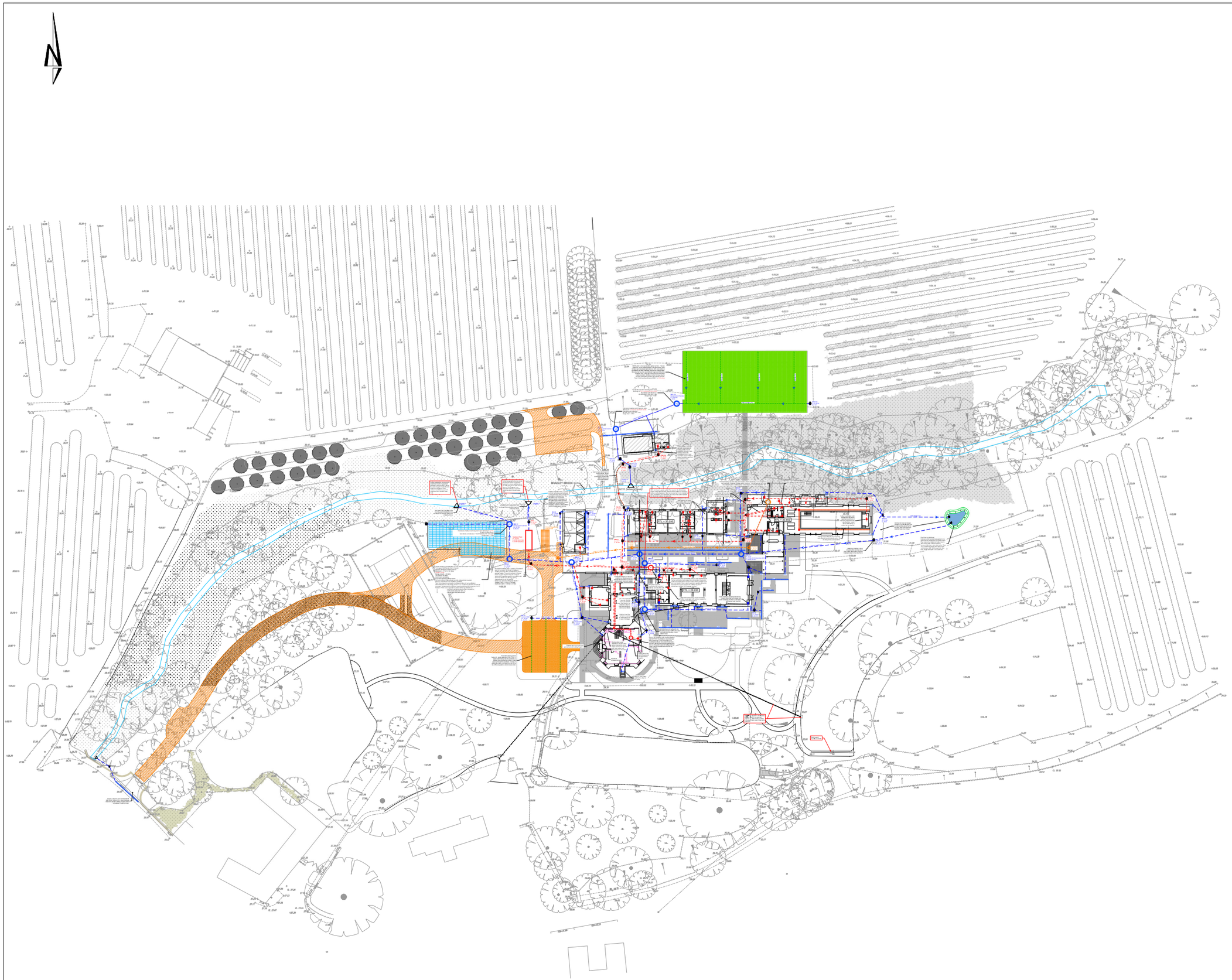
Refer to Appendix G operations and maintenance schedule

6. Conclusion

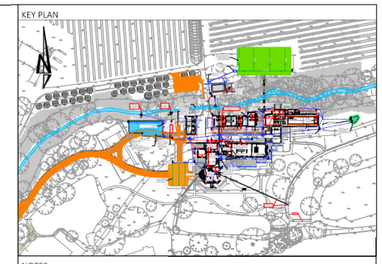
Foul water will pass through a packaged treatment plant and discharge treated water into Bradley Brook.

Storm water will discharge into Bradley Brook at a restricted rate of 2.4 l/s to mimic existing greenfield runoff. A number of SuDS features have been designed in to improve water quality, amenity and provide sufficient attention to provide storage of storm water for storm events up to 1 in 100 years + 40% climate change.

Appendix A – Drainage Strategy Plan



KEY PLAN



NOTES

1. All dimensions are to be checkec on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.
2. The DWG file is issued for the purposes of coordination only and do not represent formal drawing issue and are not to be reprinted in any form. Formal issue of drawings is via DWF, Adobe PDF files and/or hard copies and their associated information issue sheets.
3. Note that all care has been taker with the export of DWG files and their content, but we recommend that you make dee dimensional checks before using any DWG file information. Any errors found are to be reported to Hydrock immediately.
4. Levels shown in metres above Ordnance Datum (mAOD).
5. All private drainage to comply with current Building Regulations, BS EN-752 Drain and Sewer systems outside Buildings and other relevant British Standards and Codes of Practices.
6. All external drainage within trafficked areas with less than 1.2m cover to have type Z concrete bed and surround., All external drainage within landscaped areas with cover less than 0.6m to have type Z concrete bed and surround. All drainage with greater cover than the minimum required to have type S bed and surround.
7. All drainage to be laid soffit to soffit unless otherwise shown.
8. The Contractor is to verify the line, level and diameter of existing sewers before commencing drainage works.
9. All foul drainage to be minimum 100mm diameter, all surface water drainage to be minimum 150mm diameter unless otherwise shown.
10. Cover levels shown on this drawing refer to approximate surface levels. It is the contractors responsibility to ensure that access covers and frames are set at the final surface levels.
11. Where possible the contractor is to orientate manhole biscuits and covers to locate them parallel to kerbs and paving.
12. The Contractor should comply with hs(g) 47 "Avoiding Danger from Underground Services" when excavating around existing services.
13. It is the contractors responsibility to determine the location and depth of all existing services, mains and cables prior to construction.
14. Contractor to provide temporary screens in each of the down stream manholes during the construction period of the development in accordance with SFA 2.9,10 and the local sewerage undertakers requirements.
15. All in-situ concrete and precast concrete components to be manufactured using Sulphate Resisting Portland Cement, (SRPC) to BS 4027. If required, subject to soil conditions. Manhole components to be to BS EN 1917:2002.
16. All ironwork to be kite marked by BSI or certified by equal inspection authority.
17. All redundant connections to be capped off and grouted from the down stream manhole.
18. All new drainage pipes to be jetted, CCTV surveyed with DVD recording and any defects highlighted to the supervising officer. Following the rectification of any defects, the drain is to be re-surveyed with CCTV and the recordings made available to the project manager/engineer.
19. Prior to commencing the works the contractor is to confirm details of the existing drainage system as noted on the drawing.
20. Prior to commencing the works the contractor is to undertake the drainage investigation work as noted on the drawing.
21. Cover levels of all drainage shown indicatively. Contractor to ensure cover levels are in accordance with proposed surface level plans.

DESIGN COORDINATION & RISK ITEMS

a. All rwps and soil stacks are shown indicatively. Civil engineering proposals are to be coordinated with the wider design team following receipt of information.
b. Avoidance of existing services and utilities for new proposed drainage has not been completed. This to be detailed. An allowance for diversions to be made for costing purposes.
c. Drains through building slab and foundations shown indicatively. Further coordination with design team required to avoidance of structural foundations.
d. Drainage strategy subject approval from LLFA & Local Authorties. Note whereby it is requested that storm water discharge rates are to be reduced will impact on size of attenuation requirements
e. Foul pump and storage to be design by pump specialist.
f. Swimming pool drainage to be designed by a pool specialist
g. All inspection chambers and manholes within landscaped areas to have recessed covers

REVISIONS

P04	Landscape Plan updated	15.03.24	GJ	GJ | DB
P03	Dew Pond added viewports repositioned	21.02.24	GJ	RH | RH
P02	Updated with comments from Architect 25.01.2024	07.02.24	RS	GJ | GJ
P01	Preliminary Issue	19.12.23	GJ	RS | RS
Rev.	Revision Notes	Date	Drawn By	Checked | Approved

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CLIENT

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PROJECT

WEST BRADLEY HOUSE
GLASTONBURY

TITLE

DRAINAGE LAYOUT
PLAN

HYDROCK PROJECT NO.	SCALE @ A1
28421	1:500

STATUS DESCRIPTION	STATUS
SUITABLE FOR INFORMATION	S2

DRAWING NO.	REVISION
28421-HYD-XX-XX-DR-C-7000	P04