

## SAB details:

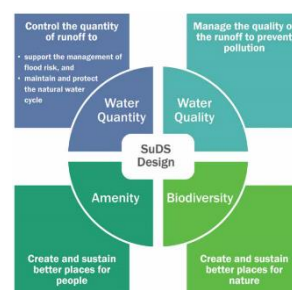


SuDS Approving Body  
Flood & Water Management Team, Environment Department  
Wrexham County Borough Council  
Abbey Road South  
Wrexham, LL13 9PW

## Flood & Water Management Act 2010

### Schedule 3 Sustainable Drainage

### SuDS Scheme Application for SuDS Approving Body (SAB) Approval – Wales



## Application Form for Full Application Approval of SuDS on new developments, in accordance with The Sustainable Drainage (Approval and Adoption Procedure) (Wales) Regulations 2018

| Full Application Structure                                                                                                                          |                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <a href="#">Full Application Form</a>                                                                                                               | (To complete & return) |
| <a href="#">Guidance on Completing the Full Application Form</a> – including specific information and evidence required to support the application. | (For guidance)         |

(Use hyperlinks above to directly access the Form and Guidance)

## **Full Application Form**

This form is based on the requirements provided by Welsh Government for the sole purpose of submitting information to the SuDS Approving Body (SAB) in accordance with the legislation detailed on this form and other relevant items of primary and subordinate legislation.

Please be aware that once you have downloaded this form, the SAB and Welsh Government will have no access to the form or the data you enter into it. Subsequent use of this form is solely at your discretion, including the choice to complete and submit it to the SAB in agreement with the declaration section.

Upon receipt of this form and any supporting information, it is the responsibility of the SAB to inform you of its obligations in regard to the processing of your application. Please refer to its website for further information on any legal, regulatory and commercial requirements relating to information security and data protection of the information you have provided.

### **Please Note:**

1. **This form is for a Full SuDS Scheme Application for SAB approval ONLY;**
2. Approval of this application will be based on compliance with the [Statutory National Standards for Sustainable Drainage Systems \(SuDS\) for Wales](#), and [Statutory Instruments](#);
3. Once this application is made to SAB, it will be determined solely on the written technical and other information submitted with the full application;
4. You are strongly advised to have previously submitted a Pre-Application form to SAB, and engaged early, and directly, with the SAB, the LPA and all other relevant organisations that may have an interest in your SuDS scheme proposal, including the SAB statutory consultees listed below:
  - a. Sewerage undertaker
  - b. National Resources Wales
  - c. Highway Authority
  - d. Canal & River Trust
  - e. Internal Drainage Districts (NRW);
5. **For a valid SuDS Scheme Full Application to the SAB, all sections of this form MUST be fully completed; and**
6. **You are also required to provide technical information as indicated in the [Guidance](#) (or as otherwise directed by the SAB during Pre-Application discussions).**

We will process the information you provide so that we can deal with your application. We may also process or release the information to offer you documents or services relating to environmental matters and consult the public, public organisation and other organisations; provide information from the public register to anyone who asks or prevent anyone from breaking environmental law, investigate cases where environmental law may have been broken and take any action that is needed, and respond to requests for information under the Freedom of Information Act 2000 and the Environmental

Information Regulations 2004 (if the Data Protection Act allows).

Please ensure that the information you submit is accurate and correct and does not include personal or sensitive information. If you require any further clarification, please contact the SAB directly.

If printed, please complete using block capitals and black ink prior to submitting to the SAB.

Please read through the [Guidance](#) and complete this application form carefully ensuring all boxes are completed fully. If you fill in the application form correctly first time, the SAB can process it quicker.

**Prior to the submission of this Full Application, applicants are strongly advised to make a Pre-Application submission to discuss their proposals with the SAB and ensure that an acceptable SuDS scheme is submitted. Please note that pre-application fees may apply.**

Submissions made in support of this application shall be based upon current legislation and industry best practice including documents referenced in [Guidance on Making SuDS Applications for SAB Approval](#).

Proposals submitted should be developed by a competent and suitability qualified professional, experienced in drainage/ SuDs / flood risk management design.

Where applicable, the LPA planning reference or unique identifier must be included.

Applicants should complete this form and submit it, together with the necessary supporting documents, to Wrexham County Borough Council SAB. Details for the payment of the Full Application fee will be provided upon confirmation of receipt of a valid application. This confirmation will include a unique reference (SAB/FUL/20XX/XXX) that must be quoted on all future correspondence. Your valid application will not be processed until the application fee is received and cleared in full.

***Payment of the Full Application fee can be made via:***

**Cheque:** *Made payable to 'Wrexham County Borough Council'*

**Cash:** *At '16 Lord Street, Wrexham, LL11 1LG'*

**Debit or Credit Card Payment:** *Please contact us on 01639 686906 to make a payment using this method quoting the application reference number and/or address of the application site.*

*(The Authority does **NOT** accept American Express).*

**BACS:** *If paying by BACS please contact us on 01639 686906 so that details of Bank Name, Sort Code and Account No. can be given. When making a BACS payment a remittance advice must also be sent in Referencing 'S.A.B. Payment' to [accounts@npt.gov.uk](mailto:accounts@npt.gov.uk) in conjunction with a notifying email to [hdc@npt.gov.uk](mailto:hdc@npt.gov.uk)*

***Your application will not be processed until the application fee is received and cleared in full.***

**When you have completed the application form please submit the form and associated documents to:**

**Electronically: [SAB@wrexham.gov.uk](mailto:SAB@wrexham.gov.uk)**

**Postal: SuDS Approving Body**

**Flood & Water Management Team**

**Environment Department**

**Wrexham County Borough Council**

**Abbey Road South**

**Wrexham, LL13 9PW**

If you are not sure about anything contained in the application form, please contact us.

## **Content**

ALL sections of this form MUST be fully completed

- 1. Applicant Details**
- 2. Site Details**
- 3. Interest in Land**
- 4. Application**
- 5. Application Fee**
- 6. Environmental Impact Assessment (EiA) Statement**
- 7. Compliance with Statutory National Standards for Sustainable Drainage Systems (SuDS)**
- 8. Assessment of Flood Risk**
- 9. Surface Water Discharge Hierarchy**
- 10. Infiltration Assessment**
- 11. Non-performance Bond, Adoption, Operation & Maintenance**
- 12. SuDS Scheme Application Checklist**
- 13. Declaration**

**1. Applicant Details****Applicant Name and Address**

|                                  |               |                                |
|----------------------------------|---------------|--------------------------------|
| <b>Title and Name</b>            |               | Mr Carl Sheffield              |
| <b>Company</b>                   |               |                                |
| <b>Suffix (unit/name/number)</b> |               | Plas Power Home Farm Buildings |
| <b>Address line 1</b>            |               | Ruthin Road                    |
| <b>Address line 2</b>            |               |                                |
| <b>Address line 3</b>            |               |                                |
| <b>Town</b>                      |               | Coedpath                       |
| <b>County</b>                    |               | Wrexham                        |
| <b>Postcode</b>                  |               | LL11 8BP                       |
| <b>Phone number</b>              | <b>Mobile</b> | 07966464536                    |
|                                  | <b>Works</b>  |                                |
|                                  | <b>Home</b>   |                                |
| <b>e-mail address</b>            |               | shefleys@yahoo.co.uk           |

**Agent Name and Address**

|                                  |               |                               |
|----------------------------------|---------------|-------------------------------|
| <b>Title and Name</b>            |               | Mr. Oliver Harvey             |
| <b>Company</b>                   |               | Ambiental                     |
| <b>Suffix (unit/name/number)</b> |               |                               |
| <b>Address line 1</b>            |               | Sussex Innovation Centre      |
| <b>Address line 2</b>            |               | Science Park Square           |
| <b>Address line 3</b>            |               |                               |
| <b>Town</b>                      |               | Brighton                      |
| <b>County</b>                    |               | East Sussex                   |
| <b>Postcode</b>                  |               | BN1 9SB                       |
| <b>Phone number</b>              | <b>Mobile</b> | 07518 711684                  |
|                                  | <b>Works</b>  | 0203 857 8540                 |
|                                  | <b>Home</b>   |                               |
| <b>e-mail address</b>            |               | Oliver.harvey@ambiental.co.uk |

|                          |           |         |
|--------------------------|-----------|---------|
| <b>Preferred contact</b> | Applicant | Agent x |
|--------------------------|-----------|---------|

## 2. Site Details

A general description of site location supported by a plan specifying the construction area and the extent of the drainage system for which approval is sought MUST be submitted. Plans shall be at a scale of 1:2500. All plans MUST show the direction of North.

|                                     |                   |
|-------------------------------------|-------------------|
| <b>Name of proposed development</b> | Plas Power Estate |
|-------------------------------------|-------------------|

|                                  |                   |               |
|----------------------------------|-------------------|---------------|
| <b>Grid Reference (E/N)</b>      | <b>330397</b>     | <b>350623</b> |
| <b>Suffix (unit/name/number)</b> |                   |               |
| <b>Address line 1</b>            | Plas Power Estate |               |
| <b>Address line 2</b>            |                   |               |
| <b>Address line 3</b>            |                   |               |
| <b>Town</b>                      | Coedpoeth         |               |
| <b>County</b>                    | Wrexham           |               |
| <b>Postcode</b>                  | LL11 3BP          |               |

|                                                                                                                 |                                                         |                                        |
|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|----------------------------------------|
| <b>Description of proposed development</b>                                                                      | Change of use from a barn to 3 x residential dwellings. |                                        |
| <b>Total application site area (Ha)</b>                                                                         | 0.605Ha                                                 |                                        |
| <b>Is the existing site currently developed i.e. Brownfield or is it currently undeveloped i.e. Greenfield?</b> | Brownfield                                              |                                        |
| <b>Existing use</b>                                                                                             | Farm buildings                                          |                                        |
| <b>Proposed use</b>                                                                                             | 3 x Residential dwellings                               |                                        |
| <b>Does the site cross more than one SAB area?</b>                                                              | Yes <input type="checkbox"/>                            | No <input checked="" type="checkbox"/> |

**If “Yes”, please confirm the proportionate area in each SAB below:  
(The main contact will be the SAB that has most of the surface water drainage system within its boundary.)**

| SAB | % of Site Area |
|-----|----------------|
|     |                |

### 3. Interest in the Land

| What interest do you have in the land? |                              |                                        |
|----------------------------------------|------------------------------|----------------------------------------|
| Owner                                  | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> |
| Prospective Owner                      | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> |
| Other (please provide details)         | Agent for owner              |                                        |

### 4. Application

|                                                                                                                                                           |  |                              |                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------|----------------------------------------|
| Has any prior advice been sought from the SAB about this application?                                                                                     |  | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> |
| If Yes, please complete the following information about the advice you were given. This will help the SAB to deal with this application more efficiently. |  |                              |                                        |
| Officer Name                                                                                                                                              |  |                              |                                        |
| Reference number                                                                                                                                          |  | Date                         | DD MM YYYY                             |
| Details of pre-application advice received                                                                                                                |  |                              |                                        |

|                                                                         |                              |                                        |
|-------------------------------------------------------------------------|------------------------------|----------------------------------------|
| Does this application relate to any other SAB application already made? | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> |
| If "Yes", please provide SAB Reference number                           |                              |                                        |

|                                                                                                                              |                              |                                        |
|------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------------------------|
| Is this application part of a phased approach to development of the site, or one of multiple applications for the same site? | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> |
|------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------------------------|

|                                               |  |
|-----------------------------------------------|--|
| <b>If “Yes”, please provide brief details</b> |  |
|-----------------------------------------------|--|

|                                                                                                                                                                  |                              |                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------------------------|
| <b>Is this application one of two or more applications made at the same time, each setting out an alternative proposal for construction of a drainage system</b> | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> |
| <b>If “Yes”, please provide details of other applications made at the same time (include SAB Reference number if available)</b>                                  |                              |                                        |

## 5. Application Fee

It is recommended you contact the SAB directly to ensure the correct fee is paid with the application.

|                                                                            |               | Area of Land (Ha) | Fraction | Fees    |
|----------------------------------------------------------------------------|---------------|-------------------|----------|---------|
| <b>Application fee</b>                                                     |               | N/A               | N/A      | £350.00 |
| <b>Each 0.1ha or fraction of 0.1ha, for first 0.5ha</b>                    | <b>£70.00</b> | 0.5ha             |          | £350.00 |
| <b>Each 0.1ha or fraction of 0.1ha, from 0.5ha up to and including 1ha</b> | <b>£50.00</b> | 0.105ha           | 105/100  | £50.00  |
| <b>Each 0.1ha or fraction of 0.1ha, from 1ha up to and including 5ha</b>   | <b>£20.00</b> |                   |          |         |
| <b>Each additional 0.1ha or fraction of 0.1ha above 5Ha.</b>               | <b>£10.00</b> |                   |          |         |

|                                                                                                                          |                                            |         |
|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|---------|
| <b>Is the applicant a town/community council?</b>                                                                        | If yes, application fee is half the amount |         |
| <b>If applicable – reduction of 50% application fee due to this being an alternative proposal made at the same time.</b> |                                            |         |
| <b>If applicable – application fee adjustment due to cross-SAB area approvals needed.</b>                                |                                            |         |
| <b>Total Fees</b>                                                                                                        |                                            | £750.00 |

## 6. Environmental Impact Assessment (EiA) Statement

|                                                                                                                                                                                                     |                                 |                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-------------------------------------------|
| <b>Does this application relate to a development that is the subject of an EiA application under the Town &amp; Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017(1)?</b> | Yes<br><input type="checkbox"/> | No<br><input checked="" type="checkbox"/> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-------------------------------------------|

## 7. Compliance with Statutory National Standards for Sustainable Drainage Systems (SuDS)

All sustainable drainage systems **MUST** comply with the [Statutory National Standards for Sustainable Drainage Systems \(SuDS\) for Wales](#). You are advised to refer to the detailed text in the Standards that relate to the information required below. The Standards are re-produced, in the [Guidance](#) to assist in completing this application form.

### Standard Principles

The Principles listed below will underpin the design of surface water management schemes to meet the Statutory National Standards. Please provide a brief summary in each of the boxes below relating to each of the bulleted Standard Principles and itemised Standards 1 to 6, showing how your proposed drainage scheme complies with this statutory requirement.

| <b>Compliance with Standard Principles</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| My proposed surface water drainage scheme will comply in the following way/s:                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <ol style="list-style-type: none"> <li>1. The full surface water runoff from the site for all events up to and including 100 +40%CC would be infiltrated in the ground via multiple soakaways, keeping the water relatively shallow and as close to the source as possible.</li> <li>2. The existing building does have a surface water sewer connection however to keep water as close to the source as possible, soakaways will be used to infiltrate surface water runoff from the roof areas.</li> </ol> |

3. 6 soakaways are proposed to manage the runoff from the proposed roof area. This will be located at least 5m from the foundations of the proposed dwelling.
4. Water butts could be implemented to collect roof water to provide some betterment proposed. The water butts would have an overflow towards the proposed soakaways.
5. Residential roof runoff is considered to be largely uncontaminated while other treatment for other hardstanding areas would be provided through permeable pavement. This would treat the runoff to an acceptable standard prior to infiltration
6. The proposal is for full infiltration of the runoff for all events up to and including 100-year +40%CC. As such, there would be no offsite flows for all events up to and including 1:100-year +40%CC.
7. A climate change uplift to the rainfall intensity of 40% has been applied to the 100-year storm event. The proposed roof areas on site are measured to be 736m<sup>2</sup>. (Appendix 3, Calculations).
8. For the proposed roof areas, the runoff would be filtered through crushed stone prior to entering the soakaways. This is designed to remove sediments and boost the longevity of the soakaways.
9. The area surround the house will be of permeable construction to allow infiltration.
10. There will also be a gravel filled trench running parallel to the path on the eastern side of the site to promote infiltration and mitigate any runoff reaching/waterlogging the pathway.
11. As the proposal is for infiltration and the due to the topography on site, pumping would not be required for the surface water runoff.
12. A maintenance plan is provided in Appendix 4.

Relevant items of supporting information (e.g. evidence, technical documents, plans and drawings etc.), as shown in [Table A](#) and [Table B](#) of this Guidance **MUST** be listed below, and all relevant material submitted.

1. Drawing "Plas Power-09 Prop Site Plan" (Drg No: PD165/09) – Appendix 1
2. Drawing "05 GF Units 1 & 2" (Drg No: PD165/05) – Appendix 1
3. Drawing "05A GF Units 3" (Drg No: PD165/05A) – Appendix 1
4. Drawing "5386-DR01" – proposed drainage layout – Appendix 2
5. Drawing "5386-DR02" – proposed drainage details – Appendix 2
6. Calculations – Appendix 3
7. Maintenance plan – Appendix 4
8. Infiltration test results – Appendix 5

## Standards 1 to 6

### Compliance with Standard S1 - Surface water runoff destination

My proposed surface water drainage scheme will comply in the following way/s:

Priority Level 1: The proposal would utilise water butts for parts of the roof runoff. Water from the water butts could be used for watering the plants within the soft landscape areas of the proposals.

Priority Level 2: The roof runoff that has not been used on site would be directed to geocellular soakaways. Road runoff is infiltrated using permeable pavement. The soakaways are designed to manage all runoff from roof areas up to and including 100-year +40%.

Relevant items of supporting information (e.g. evidence, technical documents, plans and drawings etc.), as shown in [Table A](#) and [Table B](#) of this Guidance **MUST** be listed below, and all relevant material submitted.

1. Drawing "Plas Power-09 Prop Site Plan" (Drg No: PD165/09) – Appendix 1
2. Drawing "05 GF Units 1 & 2" (Drg No: PD165/05) – Appendix 1
3. Drawing "05A GF Units 3" (Drg No: PD165/05A) – Appendix 1
4. Drawing "5386-DR01" – proposed drainage layout – Appendix 2
5. Drawing "5386-DR02" – proposed drainage details – Appendix 2
6. Calculations – Appendix 3

### **Compliance with Standard S2 - Surface water runoff hydraulic control**

My proposed surface water drainage scheme will comply in the following way/s:

1,2,3,4: There would be no surface water runoff for all events up to and including 100-year +40%. The runoff for these events would be infiltrated in the ground.

5. The proposal is for a change of use from a Barn to 3 x residential dwellings. As such, the development is considered a Highly Vulnerable development under the TAN15 guidance. Therefore, the risk from events greater than 100-year +40% may be considered to have the potential for social disruption and risk to life. Upon investigation of the surface water flood maps, although the site is in flood zone A, there is a risk of flooding from surface water on site during a low risk event at the southern edge of the main building and garage according to the detailed flood risk map on the Natural Resources Wales website. The site slopes North-west to South-east towards the path on the eastern site boundary, the impact to the building could be considered minimal. Nevertheless, the building would be raised roughly 150mm above external ground levels, to minimise the impact on the buildings (See Appendix 1 for site plans).

6. In the event of drainage system failure under extreme rainfall events (exceeding 100-year +40%) or blockage, flooding may occur within the site. In the event of the development's drainage system failure, the runoff flow will be dictated by topography on site. The topographic survey shows that the proposed dwelling is located on the highest part of the site, with levels dropping approximately 1.5m (according to 2m LiDAR data) down towards the south-

eastern site boundary. There will be a land drain constructed along the eastern site boundary to mitigate flooding along the pathway which should catch runoff to infiltrate into the ground. As such, exceedance flow routes will naturally be directed away from the proposed replacement dwelling. Furthermore, the building is raised above external ground levels which would mitigate against surface water flows into the building.

Relevant items of supporting information (e.g. evidence, technical documents, plans and drawings etc.), as shown in [Table A](#) and [Table B](#) of this Guidance **MUST** be listed below, and all relevant material submitted.

1. Drawing "Plas Power-09 Prop Site Plan" (Drg No: PD165/09) – Appendix 1
2. Drawing "05 GF Units 1 & 2" (Drg No: PD165/05) – Appendix 1
3. Drawing "05A GF Units 3" (Drg No: PD165/05A) – Appendix 1
4. Drawing "5386-DR01" – proposed drainage layout – Appendix 2
5. Drawing "5386-DR02" – proposed drainage details – Appendix 2
6. Calculations – Appendix 3

### Compliance with Standard S3 – Water Quality

My proposed surface water drainage scheme will comply in the following way/s:

Adequate treatment must be delivered to the water runoff to remove pollutants through SuDS devices, which are able to provide pollution mitigation. Pollution Hazards and the SuDS Mitigation have been indexed in the specialized literature CIRIA 753 'The SUDS Manual'. This is determined by the following restriction:

$$\text{Total SuDS Mitigation Index} \geq \text{Pollution Hazard Index}$$

The Pollution Hazard Indices are summarized in Table Amb1 below (reference: Table 26.2.CIRIA SuDS Manual 2015)

| POLLUTION HAZARD INDICES FOR DIFFERENT LAND USE CLASSIFICATIONS |                        |                              |        |               |
|-----------------------------------------------------------------|------------------------|------------------------------|--------|---------------|
| LAND USE                                                        | Pollution Hazard Level | Total suspended Solids (TSS) | Metals | Hydro-carbons |
| Residential roads                                               | Very Low               | 0.2                          | 0.2    | 0.05          |

*Table Amb1: Summary of Pollution hazard Indices for different Land Use*

Runoff from residential roof areas is considered to be generally uncontaminated, although sediment traps should be considered on the underground drainage to prevent impacts on the storage structure from sedimentation. Additionally, water would be treated by a layer of 2-6mm crushed stone laid under the base of the geocellular soakaway, including a Permafilter or similar oil intercepting filter. This is designed to provide further filtration of the runoff prior to infiltrating in the ground.

Relevant items of supporting information (e.g. evidence, technical documents, plans and drawings etc.), as shown in [Table A](#) and [Table B](#) of this Guidance **MUST** be listed below, and all relevant material submitted.

1. Drawing “5386-DR01” – proposed drainage layout – Appendix 2
2. Drawing “5386-DR02” – proposed drainage details – Appendix 2

### **Compliance with Standard S4 – Amenity**

My proposed surface water drainage scheme will comply in the following way/s:

The proposal is for change of use from a barn to 3 x residential dwellings. As such the potential for enhancing amenity could be considered greater. Amenity will be improved by retaining over 3000m<sup>2</sup> of soft landscaping on the developed site in the form of garden/grassy areas. These areas will be privately maintained by the land owners.

Relevant items of supporting information (e.g. evidence, technical documents, plans and drawings etc.), as shown in [Table A](#) and [Table B](#) of this Guidance **MUST** be listed below, and all relevant material submitted.

3. Drawing “Plas Power-09 Prop Site Plan” (Drg No: PD165/09) – Appendix 1
4. Drawing “5386-DR01” – proposed drainage layout – Appendix 2
5. Drawing “5386-DR02” – proposed drainage details – Appendix 2

### **Compliance with Standard S5 – Biodiversity**

My proposed surface water drainage scheme will comply in the following way/s:

The proposal is for change of use from a barn to a residential dwelling. As such the potential for enhancing amenity could be considered greater. Amenity will be improved by retaining over 3000m<sup>2</sup> of soft landscaping on the developed site in the form of garden/grassy areas. These areas will be privately maintained by the land owners.

Relevant items of supporting information (e.g. evidence, technical documents, plans and drawings etc.), as shown in [Table A](#) and [Table B](#) of this Guidance **MUST** be listed below, and all relevant material submitted.

1. Drawing “Plas Power-09 Prop Site Plan” (Drg No: PD165/09) – Appendix 1
2. Drawing “05 GF Units 1 & 2” (Drg No: PD165/05) – Appendix 1
3. Drawing “05A GF Units 3” (Drg No: PD165/05A) – Appendix 1
4. Drawing “5386-DR01” – proposed drainage layout – Appendix 2
5. Drawing “5386-DR02” – proposed drainage details – Appendix 2

### **Compliance with Standard S6 – Design of drainage for Construction and Maintenance and Structural Integrity**

My proposed surface water drainage scheme will comply in the following way/s:

1. Each soakaway will drain runoff from a different section of roof area which. Keeping excavations as shallow as practical has been a major design consideration in order to reduce risk and allow easy, safe, cost-effective and time efficient construction. Road runoff is infiltrated using permeable pavement.
2. It is proposed for the developer to consider soakaway systems made of recycled polypropylene. This would reduce the embodied carbon of the proposed drainage system. The feasibility of such a system must be confirmed with a manufacturer whilst considering the relatively confined nature of the site.
3. Maintenance of the proposed systems is provided in Appendix 4. As all elements are relatively shallow and accessible, maintenance can be conducted in an easy, safe, cost effective and timely manner.

Relevant items of supporting information (e.g. evidence, technical documents, plans and drawings etc.), as shown [Table A](#) and [Table B](#) of this Guidance **MUST** be listed below, and all relevant material submitted.

1. Drawing "Plas Power-09 Prop Site Plan" (Drg No: PD165/09) – Appendix 1
2. Drawing "5386-DR01" – proposed drainage layout – Appendix 2
3. Drawing "5386-DR02" – proposed drainage details – Appendix 2
4. Maintenance plan – Appendix 4

## 8. Assessment of Flood Risk

|                                                                                                                                                                                                                                  |                                     |                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-----------------------------------------------|
| <b>Is the site within an area at risk of flooding?</b> Refer to Natural Resources Wales Development Advice maps. ( <a href="#">Natural Resources Wales / Development and flood risk</a> )                                        | Yes<br><br><input type="checkbox"/> | No<br><br><input checked="" type="checkbox"/> |
| If the proposed development is within the area at risk of flooding, you will need to consider whether it is appropriate to submit a flood consequences assessment. (Refer to <a href="#">Technical Advice Note 15 (TAN15)</a> ). |                                     |                                               |

|                                                                                                                                                                               |                                                |                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-----------------------------------------------|
| <b>Is the site located within an area susceptible to surface water flooding?</b> Refer to <a href="#">NRW Surface Water Flood Maps</a> . <i>Low Surface Water Flood Risk.</i> | Yes<br><br><input checked="" type="checkbox"/> | No<br><br><input type="checkbox"/>            |
| <b>Is the site located within an area susceptible to groundwater flooding?</b> <i>limited potential for groundwater flooding to occur' (BGS, 2020)</i>                        | Yes<br><br><input type="checkbox"/>            | No<br><br><input checked="" type="checkbox"/> |
| <b>Is there a watercourse</b> (as defined under <a href="#">Section 72 Land Drainage Act 1991</a> ) <b>located within 20m of the proposed development?</b>                    | Yes<br><br><input type="checkbox"/>            | No<br><br><input checked="" type="checkbox"/> |

## 9. Surface Water Discharge Hierarchy

Surface water drainage arrangements shall demonstrate the proposed surface water drainage complies with National SuDS Standards. As much of the runoff as possible should be discharged to each hierarchy element before a lower hierarchy element is considered. Collection and infiltration methods of drainage are required to be considered in the first instance. With reference to the hierarchy levels below, please indicate your proposed drainage arrangements.

| Level                             | Yes                                 | No                                  |
|-----------------------------------|-------------------------------------|-------------------------------------|
| 1. Collect for use                | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
| 2. Infiltration                   | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
| 3. To watercourse                 | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| a. Is it an Ordinary Watercourse? | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| b. Is it a Main River?            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| 4. To surface water sewer         | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| a. Is it a Highway drain?         | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| b. Is it a public sewer?          | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| c. Is it a private sewer?         | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| d. Other                          | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| 5. To combined sewer              | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |

|                                                      |                              |                                        |
|------------------------------------------------------|------------------------------|----------------------------------------|
| <b>Has advice been sought from the asset owners?</b> | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> |
| <b>Has advice been sought from the land owners?</b>  | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> |

## 10. Infiltration Assessment

Where infiltration drainage is proposed, testing should be carried out to a methodology agreed with the SAB e.g. [Infiltration Drainage - Manual of Good Practice \(CIRIA R156\)](#) and [BRE Soakaway Design \(DG 365 – 2016\)](#), and be used to inform the design, construction, maintenance, testing and assessment of infiltration systems.

|                                                                                                      |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |
|------------------------------------------------------------------------------------------------------|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| <b>Has infiltration testing been carried out?</b>                                                    |                  | Yes <input checked="" type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | No <input type="checkbox"/> |
| <b>Analysis of development Geology</b> (including both bedrock and superficial deposits where known) |                  | Infiltration tests show good infiltration rates of approx. 0.3m/hr (see appendix 5).<br>Superficial Deposits: Till, Devensian – Diamicton.<br>Bedrock identified as Mudstone, Siltstone and Sandstone deposits as a Sedimentary Bedrock formation (Source: BGS).<br>Soil described as being slowly permeable seasonally wet acid loamy and clayey soils (Source: Soilscales Online).<br>BGS borehole records (SJ35SW478) in the area describe the soils as having varying amounts of gravels, sands, clays and silt stretching to depth of roughly 7m bgl. See attached borehole records and infiltration testing in Appendix 5 |                             |
| <b>Depth to groundwater (metres)</b>                                                                 |                  | Groundwater was not struck in the borehole to 7m depth.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                             |
| <b>Borehole testing</b>                                                                              | <b>Reference</b> | LL11 3BP Woodside Barn                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |
|                                                                                                      | <b>Date</b>      | 11-16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 02 2020                     |

|                                                                    |                              |                                        |
|--------------------------------------------------------------------|------------------------------|----------------------------------------|
| <b>Has a Contaminated Land Assessment been undertaken?</b>         | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> |
| <b>Is the infiltration drainage proposed on contaminated land?</b> | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> |

|                                 |                             |
|---------------------------------|-----------------------------|
| <b>Infiltration test result</b> | 8.37 x 10 <sup>-5</sup> m/s |
|---------------------------------|-----------------------------|

## 11. Non-performance Bond, Adoption, Operation & Maintenance

What are your proposals regarding cost of works, adoption and maintenance of the SuDS scheme?

|                                                                    |                                                     |
|--------------------------------------------------------------------|-----------------------------------------------------|
| <b>Non-performance Bond – Estimated cost of work</b>               |                                                     |
| <b>Adoption (including land agreements etc)</b>                    | The proposed drainage systems would remain private. |
| <b>Funded Maintenance Plan for the lifetime of the development</b> | Maintenance plan attached in the Appendix 4         |

## 12. SuDS Scheme Application Checklist

Please complete the following checklist and make sure you have read the [Guidance on Making SuDS Applications for SAB Approval](#), the [Guidance on completing the Full Application Form](#), and provided all the necessary information in support of your application:

|                                      |                                         |
|--------------------------------------|-----------------------------------------|
| <b>Correct Full Application fee.</b> | Yes <input checked="" type="checkbox"/> |
|--------------------------------------|-----------------------------------------|

|                                                                                                                                                                                                   |                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| <b>Completed, signed and dated Full Application form.</b>                                                                                                                                         | Yes <input checked="" type="checkbox"/> |
| <b>Plan/s specifying the construction area and the extent of the drainage system for which approval is sought. All plan/s shall be at a scale of 1:2500 and MUST show the direction of North.</b> | Yes <input checked="" type="checkbox"/> |
| <b>Taken account of SAB <a href="#">Guidance</a> on technical information to be submitted to enable SAB to assess your Full Application.</b>                                                      | Yes <input checked="" type="checkbox"/> |

### 13. Declaration

I/ we hereby apply for SuDS Approval as described in this form and the accompanying plans/drawings and additional information. I confirm that I have read and complied with the National SuDS Standards and, to the best of my knowledge, any facts stated are true and accurate and any opinions given are the genuine opinions of the persons giving them.

This form has been completed using evidence from the Flood Consequences Assessment where applicable, surface water drainage strategy and site plans and associated documents.

This form has been completed using accurate information. It can be used as a summary of the detailed surface water drainage proposals on this site, and clearly shows that these drainage proposals conform to the National SuDS Standards for Wales.

|                                                                             |                                                                                   |
|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| <b>Form completed by</b>                                                    | Mark Naumann                                                                      |
| <b>Signature</b>                                                            |  |
| <b>Qualification of person responsible for signing off this application</b> | BEng(Hons) CEng MICE                                                              |
| <b>Company</b>                                                              | Ambiental                                                                         |
| <b>On behalf of (Client's details)</b>                                      | Mr Spencer Cullis, site owner                                                     |
| <b>Date</b>                                                                 | 29/04/2020                                                                        |

#### Disclaimer

Information provided on this form and in supporting documents may be published on the SABs SuDS register and website and be made publicly available.

## **Guidance on completing the Full Application Form**

This guidance comprises:

- [General comments](#)
- [Detailed questions to be answered to show compliance with Statutory National Standards for Sustainable Drainage Systems \(SuDS\);](#)
- [Table A - Information and evidence;](#) and
- [Table B – Plans and drawings.](#)

### **General comments**

Applications for approval must be submitted using this **Full Application** form provided by the SAB. **USE OF THIS FORM IS MANDATORY** as it has been developed to ensure your application has due regard to the statutory requirements.

This form is for SAB approval ONLY, and you are also advised to engage early, and directly, with the LPA and all other relevant organisations that may have an interest in your SuDS scheme proposal, including the SAB statutory consultees listed below:

- Sewerage undertaker;
- Natural Resources Wales;
- Highway Authority;
- Canal & River Trust; and
- Internal Drainage Districts (NRW).

You are advised to commence **Pre-Planning Application discussions** with the LPA at the earliest opportunity and undertake discussions with both the SAB and the LPA simultaneously.

Development on site should not commence until formal Planning Approval AND Full SAB Approval has been given.

It is important that you keep SAB officers and planning officers informed of progress and decisions with regard to the planning application and the SAB application, as they are separate applications, with different requirements, timescales and approval bodies.

Engaging in **Pre-Application discussions** with the SAB at the outset of your SuDS concept design is strongly advised. Effective **Pre-Application discussions** and **Master Planning** can ensure a robust, cost effective and viable surface water management strategy and SuDS scheme design. SAB can help you determine the optimum SuDS solution for your site by providing an early indication of what may or may not comply with the National SuDS Standards.

Please provide as much technical information as possible to the SAB to enable a considered and reasoned response to be given at both the **Pre-Application and Full**

**Application stages.** i.e. the more information provided at the **Pre-Application stage**, the more detailed technical advice can be given.

The site-specific surface water drainage assessment and SuDS requirements should be integrated with the **Flood Consequences Assessment (FCA)**, and an integrated **Flood and Surface Water Drainage Report** provided to both the LPA and the SAB.

Please refer to key national and local documents prior to, and during the concept design, detailed design, SAB and LPA approvals, construction, adoption, operation & maintenance of a SuDS scheme. A list of, and links to, these documents are provided in the [Guidance on Making SuDS Applications for SAB Approval](#).

With specific regard to the **Full Application**:

- To ensure a **Valid Application**, all questions on the form MUST be answered, and ALL supporting material MUST be submitted as indicated in the [Guidance on completing the Full Application Form](#) (or as otherwise agreed with the SAB);
- Your response to questions should be comprehensive and reflect the specific requirements of the Statutory National Standards;
- Once your application form together with any supporting material has been submitted to the SAB, it will be **validated**;
- **Please be aware that if the questions have not been answered as indicated on the form and by the requirements above, your application will be automatically refused;**
- If deemed to be a **valid application**, your submission will be technically assessed by the SAB;
- Once a **Full SuDS Scheme Application** is received, the SAB will determine it solely on the written technical and other information submitted with the full application;
- Only in exceptional circumstances, will SAB contact you during its assessment of the **Full SuDS Scheme Application**, therefore it's essential that any technical uncertainties or issues are dealt with by all parties as part of the Pre-Application process, and prior to the **Full Application** being submitted;
- In accordance with the statutory requirements, SAB will notify you of the outcome of its technical assessment of your **Full Application**; and
- The **Full Application** may be **Approved** subject to **Conditions** or it may be **Refused**, in which case you will be informed of the reasons why.

Please provide three hard copies and one electronic copy sent to [hdc@npt.gov.uk](mailto:hdc@npt.gov.uk).

Please refer to the relevant [Ciria SuDS Manual C753](#) chapters, and additional references indicated.

## **Detailed questions to be answered to show compliance with Statutory National Standards for Sustainable Drainage Systems (SuDS)**

For **each of the Standards**, relevant items of supporting information (e.g. evidence, technical documents, plans and drawings etc.), as shown in [Table A](#) and [Table B](#) of this Guidance, **MUST** be listed on the application form and all relevant material submitted.

### **Standard Principles**

The Principles listed below underpin the design of surface water management schemes to meet the [Statutory National Standards for Sustainable Drainage Systems \(SuDS\) for Wales](#). Where possible, please provide a brief summary relating to each Principle, showing how your proposed surface water drainage scheme complies with this statutory requirement.

#### **Compliance with Standard Principles**

The SuDS scheme requirements are shown below:

1. How do you propose to manage water on or close to the surface and as close to the source of the runoff as possible?  
(see **Standard S1** and **Standard S2**)
2. How do you propose to treat rainfall as a valuable natural resource?  
(see **Standard S1** and **Standard S2**)
3. How do you propose to ensure pollution is prevented at source, rather than relying on the drainage system to treat or intercept it?  
(see **Standard S3**)
4. How do you propose to manage rainfall to help protect people from increased flood risk, and the environment from morphological and associated ecological damage resulting from changes in flow rates, patterns and sediment movement caused by the development?
5. How do you propose to take account of likely future pressures on flood risk, the environment and water resources such as climate change and urban creep?
6. How do you propose to use the SuDS Management Train, using drainage components in series across a site to achieve a robust surface water

|                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>management system (rather than using a single “end of pipe” feature, such as a pond, to serve the whole development)?<br/>(see <b>Standard S1</b>, <b>Standard S2</b> and <b>Standard S3</b>)</p>                                |
| <p>7. How do you propose to maximise the delivery of benefits for amenity and biodiversity?<br/>(see <b>Standard S4</b> and <b>Standard S5</b>)</p>                                                                                 |
| <p>8. How do you propose to make the best use of available land through multifunctional usage of public spaces and the public realm?</p>                                                                                            |
| <p>9. How do you propose that the SuDS scheme performs safely, reliably and effectively over the design life of the development taking into account the need for reasonable levels of maintenance?<br/>(see <b>Standard S6</b>)</p> |
| <p>10. How do you propose to avoid the need for pumping where possible?</p>                                                                                                                                                         |
| <p>11. How do you propose to ensure the scheme is affordable, taking into account both construction and long-term maintenance costs and the additional environmental and social benefits afforded by the system?</p>                |
| <p>12. Applications should be accompanied by proposals for a maintenance plan and the means of funding for the scheme for its design life.</p>                                                                                      |

## Standard S1 - Surface water runoff destination

The requirements of Standard S2 listed below address the use of surface water by the development and where it should be discharged. The aim is to ensure that runoff is treated as a resource and managed in a way that minimises negative impact of the development on flood risk, the morphology and water quality of receiving waters and the associated ecology. This will ensure that early consideration is given to the use of rainwater harvesting systems to both manage runoff and deliver a source of non-potable water for the site where practical. Where it is not, prioritisation should be given to infiltration. Discharges to sewerage systems should be limited where possible.

As much of the runoff as possible (subject to technical or cost constraints) should be discharged to each destination before a lower priority destination (level) is considered.

Depending on the site characteristics, drainage from different parts of the site could have different drainage destinations.

Depending on the quantity of runoff and the potential for a particular destination to manage that runoff, small events may discharge to a higher level while larger events may need to make use of lower priority destinations.

### Compliance with Standard S1 - Surface water runoff destination

Priority Level 1 is the preferred (highest priority) and 4 and 5 should only be used in exceptional circumstances.

Proposed drainage scheme runoff destinations, and the reasons for proposing these, **MUST** be indicated as shown below. If/where Priority Level 1 or Priority Level 2 run off destination/s are unable to be achieved, the reasons for this **MUST** also be provided.

Priority Level 1: Surface water runoff is collected for use.

Priority Level 2: Surface water runoff is infiltrated to ground.

Note: If any runoff is not infiltrated to ground, and a lower priority level of surface water runoff destination is proposed, "Exception Criteria" **MUST** be demonstrated and evidence provided.

Priority Level 3: Surface water runoff is discharged to a surface water body.

Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system.

Priority Level 5: Surface water runoff is discharged to a combined sewer.

Note: Strong presumption against discharge to a combined sewer.

### Standard S2 - Surface water runoff hydraulic control

The aim of Standard S2 listed below is to manage the surface water runoff from, and on a site, to protect people on the site from flooding from the drainage system for events up to a suitable return period. Also, to mitigate any increased flood risk to people and property downstream of the site as a result of the development, and to protect the receiving water body from morphological damage.

### Compliance with Standard S2 - Surface water runoff hydraulic control

The SuDS scheme **MUST** comply with the following:

1. Surface water should be managed to prevent, so far as possible, any discharge from the site for the majority of rainfall events of less than 5mm.

2. The surface water runoff rate for the 1 in 1-year return period event (or agreed equivalent) should be controlled to help mitigate the negative impacts of the development runoff on the morphology and associated ecology of the receiving surface water bodies.
3. The surface water runoff (rate and volume) for the 1% (1 in 100 year) return period event (or agreed equivalent) should be controlled to help mitigate negative impacts of the development on flood risk in the receiving water body.
4. The surface water runoff for events up to the 1% (1 in 100 year) return period (or agreed equivalent) should be managed to protect people and property on and adjacent to the site from flooding from the drainage system.
5. The risks (both on site and off site) associated with the surface water runoff for events greater than the 1% (1 in 100 year) return period should be considered. Where the consequences are excessive in terms of social disruption, damage or risk to life, mitigating proposals should be developed to reduce these impacts.
6. Drainage design proposals should be examined for the likelihood and consequences of any potential failure scenarios (e.g. structural failure or blockage), and the associated flood risks managed where possible.

### Standard S3 – Water Quality

Standard S3 shown below addresses the drainage design requirements to minimise the potential pollution risk posed by the surface water runoff to the receiving water body.

#### Compliance with Standard S3 – Water Quality

The SuDS scheme **MUST** comply with the following:

1. Surface water runoff should be treated to prevent negative impacts on the receiving water quality and/or protect downstream drainage systems, including sewers.

### Standard S4 – Amenity

Standard S4 shown below addresses the design of SuDS components to ensure that, where possible, they enhance the provision of high quality, attractive public space which can help provide health and wellbeing benefits, they improve liveability for local

communities and they contribute to improving the climate resilience of new developments.

#### **Compliance with Standard S4 – Amenity**

The SuDS scheme **MUST** comply with the following:

1. The design of the surface water management system should maximise amenity benefits.

#### **Standard S5 – Biodiversity**

Standard S5 shown below addresses the design of SuDS to ensure that, where possible, they create ecologically rich green and blue corridors in developments and enrich biodiversity value by linking networks of habitats and ecosystems together. Biodiversity should be considered at the early design stage of a development to ensure the potential benefits are maximised.

#### **Compliance with Standard S5 – Biodiversity**

The SuDS scheme **MUST** comply with the following:

1. The design of the surface water management system should maximise biodiversity benefits.

#### **Standard S6 – Design of drainage for Construction and Maintenance and Structural Integrity**

Standard S6 shown below deals with designing robust surface water drainage systems so that they can be easily and safely constructed, maintained and operated, taking account of the need to minimise negative impacts on the environment and natural resources.

#### **Compliance with Standard S6 – Design of drainage for Construction and Maintenance and Structural Integrity**

The SuDS scheme **MUST** comply with the following:

1. All elements of the surface water drainage system should be designed so that they can be constructed easily, safely, cost-effectively, timely manner, and with the aim of minimising the use of scarce resources and embedded carbon (energy).
2. All elements of the surface water drainage system should be designed so that maintenance and operation can be undertaken (by the relevant responsible

body) easily, safely, cost-effectively, in a timely manner, and with the aim of minimising the use of scarce resources and embedded carbon (energy).

3. The surface water drainage system should be designed to ensure structural integrity of all elements under anticipated loading conditions over the design life of the development site, taking into account the requirement for reasonable levels of maintenance.

**Note:**

**Information provided may be published on the SABs SuDS register and website and be made publicly available.**

## **TABLE A: Specific information and evidence required for the Full Application**

### **Flood Consequences Assessment (FCA)** – (See [Technical Advice Note 15: Development and Flood Risk \(TAN15\)](#))

**REASON:** To show existing and future flood risks to and from the site, and how these will be managed to ensure people and property remain safe for the lifetime of the development. The assessment will include:

- The requirements of TAN 15; and
- Frequent references and links to relevant planning conditions, reserved planning matters, and to the FCA.

### **Detailed Geotechnical Factual and Interpretive Report** – (See also specific [Ciria SuDS Manual C753](#) Chapters 13 & 25)

**REASON:** To show existing on site and relevant off-site physical properties of soils, rocks and features, and demonstrating that the proposed method of surface water drainage is appropriate for the geology of the site; and will continue to perform to its design criteria for the lifetime of the development. The report will include:

- Topography, geology & site history;
- Significant constraints (incl. soluble rocks, landslides, shallow mining, shallow groundwater, made ground, contaminated land);
- Drainage potential (incl. depth to water table, permeability of superficial deposits, thickness of superficial deposits, permeability of bedrock, presence of floodplains);
- Ground stability (incl. soluble rocks, landslides, shallow mining, running sands, swelling clays, compressible ground, collapsible ground);
- British Geological Survey BGS GeoSure Maps (incl. artificial deposits, superficial deposits, bedrock);
- Borehole & trial pit locations, monitoring & any related information;
- Detailed infiltration assessment (incl. evidence of soil types, soil infiltration coefficients & Standard Percentage Run-off (SPR) calculations);
- Where pervious pavements are proposed in certain soil types, soaked CBRs are required;
- Laboratory work;
- Where possible, detailed evidence of groundwater table levels over recent 12-month period or other validated evidence; and
- Groundwater levels and location of, and impacts on:
  - Surface Water Safeguard Zones
  - Groundwater Safeguard Zones,
  - Water Protection Zones, and/or
  - Groundwater Nitrate Vulnerable Zones.

### **Detailed Whole Site SuDS Drainage Design Proposals** – (See also all [Ciria SuDS Manual C753](#) Chapters)

**REASON:** To confirm that the proposed drainage solution is appropriate for the location, type, scale and nature of the site and development proposed; and to demonstrate that flood risk will be reduced, to ensure people and property remain safe for the lifetime of the development. The proposals will include:

- Drainage Strategy;
- Masterplan;
- Reference and alignment to the Local Flood Risk Management Strategy (LFRMS);
- Approved Flood Consequences Assessment (FCA) including:
  - existing hydrology,
  - greenfield & brownfield runoff rate calculations,
  - critical duration rainfall events,
  - simulation results for design storm RP, 1 in 1 RP, 1 in 2 RP, 1 in 30 RP and 1:100 RP,
  - appropriate % allowance for climate change and urban creep,
  - historical flood events and groundwater levels,
  - risks (both on site and off site) associated with surface water runoff for events greater than the 1% (1 in 100 year) return period,
  - descriptions of existing drainage assets and features,
  - current and future flood risks including:
    - surface,
    - groundwater,
    - other sources,
    - exceedance flood flow paths,
    - discharges,
- Existing and proposed impermeable and permeable areas (runoff betterment required of min 30% or equivalent to greenfield on existing brownfield areas);
- Models (as appropriate) and detailed hydraulic calculations;
- Detailed SuDS design including:
  - Interception incl. mechanisms and summer and winter interception compliance targets (e.g. summer 80% & winter 50%),
  - Treatment,
  - Conveyance,
  - peak flow and volume control (1:100y - 6 hr rainfall event for peak volume control),
  - surface storage (long-term and attenuation),
  - underground storage,
  - use of vegetation and trees,
  - exceedance routes and components (for 1:100y rainfall event or greater),
  - demonstration that the required storages and conveyance flows can be delivered on site,
  - minimum throttle outlet flow rates (i.e. 1-2 l/s/ha or 5 l/s/ha where risk of blockage and no other viable alternative),
  - risks and consequences of design failure scenarios,
- Surface water storage; calculations including time to discharge from full to half full;
- Infiltration calculations including:
  - stated safety factor,
  - stated infiltration rate at  $1 \times 10^{-5}$  m/s or higher,
- Outfalls & discharges (normally 2 l/s/ha is considered an appropriate rate so as not to increase flood risk downstream);

- Specifications for all materials used in the design;
- Components can be constructed, operated and maintained easily, safely and cost effectively;
- Components retain structural integrity for the lifetime of the development;
- Components demonstrated to resist all imposed design loadings with specified factors of safety;
- Evidence to enable SAB to calculate the Non-performance Bond value incl. unit rates for each SuDS component;
- Drainage related flood risk mitigation measures, stating their location, type and features (i.e. roads & access areas protected to 1:30y rainfall, internals & critical infrastructure protected to 1:100y rainfall or greater, appropriate freeboard);
- Multiple use of SuDS benefits incl. temporary flooded areas; and
- Future ownership of surface water drainage assets and adoptions.

**Detailed SuDS Assets Maintenance Plan** – (See also specific [Ciria SuDS Manual C753 Chapter 32 & Appendix B](#))

**REASON:** To confirm that the SuDS management train and individual SuDS components will be effectively maintained (including asset replacement where necessary), to perform to their design criteria for the lifetime of the development. The plan shall include:

- Information on how SuDS will be managed & maintained, & who will do it;
- Details of future vehicular & pedestrian access arrangements;
- Information on the various human, plant & materials resources needed & broad timescales as to when; and
- Sympathetic to the need to promote the biodiversity supported by the SuDS system.

**Amenity and Biodiversity Plan** – (See also specific [Ciria SuDS Manual C753 Chapters 5 & 6](#))

**REASON:** To demonstrate how the SuDS will protect and enhance amenity and biodiversity for the lifetime of the development. The plan shall include:

- How the amenity value from a SuDS scheme for the development will be maximised for the local and wider community;
- Amenity providing clean water, SuDS legibility, safe access, multiple functionality and attractive spaces, social value and adaptable to change;
- Bio-diversity providing clean water, connectivity along the management train and habitat creation;
- Details of amenity and biodiversity value, and the linkages between them; and
- Proposals to benefit priority habitats and maintain or enhance others where possible.

**Unstable and Contaminated Land Reports** – (See also specific [Ciria SuDS Manual C753 Chapters 4 & 26](#))

**REASON:** To identify the presence, location and nature of any unstable and/or contaminated land on or close to the site; and how this has been taken account of in the

SuDS scheme design, and how it will be managed and maintained for the lifetime of the development. The reports shall include any pollution remediation strategies.

**Water Quality Treatment and Pollution Prevention Strategy and Plan** – (See also specific [Ciria SuDS Manual C753](#) Chapters 4,26 & 27)

**REASON:** To show how the SuDS proposal will avoid or minimise the generation of pollutants and how it will prevent pollutants mixing with runoff before it enters the drainage system. The plan shall include:

- Supporting current or future quality objectives for the water body over the lifetime of the development;
- Evidence of pollution risk screening and that the minimum water quality management requirements have been considered & are able to be met (using SuDS Manual (Table 4.3), CIRIA 2015;
- Information on type & strength of contaminants & polluting materials;
- How have these potential contaminants been managed close to the source & on the surface;
- Details of what SuDS components have been provided in series (the SuDS train) to cleanse flow prior to point of discharge;
- Information on how sediment is trapped & retained on site (for rainfall events greater than 1:1-year return period);
- Details of accessibility to undertake sediment cleansing & other maintenance activities;
- Details of how the impacts from accidental spills been addressed; and
- Written evidence of discussion & agreement with Natural Resources Wales.

**Landscape Plan** – (See also specific [Ciria SuDS Manual C753](#) Chapter 29)

**REASON:** To show how the proposed soft landscape features work in harmony with the overall objectives of SuDS, and how the landscape supports and enhances flood risk reduction, improved water quality, amenity and biodiversity. The plan shall include:

- Detailed overall layout, ground contouring, planting, hard, soft & water features;
- Detail landscape elements to improve water quality;
- Show how the design achieves effective attenuation, flow control & exceedance;
- Improvements to ecology & biodiversity;
- Detailed consideration of effective routine & periodic maintenance activities;
- Full understanding of the sites character: slope, gradient, ground modelling, geology, soils types, natural drainage patterns;
- Show existing features to be preserved, enhanced, removed &/or replaced; and
- Details of any soils stabilization/reinforcement & erosion control.

**Construction Management Plan** – (See also specific [Ciria SuDS Manual C753](#) Chapter 31 & Appendix B, and [CIRIA report C768 - Guidance on the construction of SuDS](#))

**REASON:** To provide a structured approach to the construction activities and temporary works deployed for constructing SuDS, ensuring that key construction site issues such as drainage, flooding, sediment control, pollution prevention, compression of infiltration areas,

storage of materials & existing amenity and natural habitats etc. are sensitively and effectively managed until the site construction is complete. The plan shall include:

- Details of the nature of the work to be completed;
- Site plans & full scheme drawings, where required to support the method of approach;
- Consents & reinstatement requirements;
- Access points & details;
- Any site-specific ecological issues, or features that require protection &/or consideration;
- Pollution control arrangements & any likely water quality issues resulting from the highways & SuDS construction;
- Proposed strategy for sediment control, erosion control & site drainage during the construction of the development; where this impacts on the SuDS proposed for the site, it should identify any potential impacts on the final performance of the drainage system & any necessary protection measures or remedial works; and
- Measures to prevent the inadvertent access across the completed or partially completed SuDS.

**Construction Phasing Plan** – (See also specific [Ciria SuDS Manual C753](#) Chapter 31 & Appendix B, and [CIRIA report C768 - Guidance on the construction of SuDS](#))

**REASON:** To clearly state how the development and/or phase/s of the development will drain during the construction and occupation of the development prior to adoption. The plan shall include:

- The sequencing of phases of the development and how the drainage systems (permanent or temporary) connect to an outfall (temporary or permanent) during the construction and occupation of the development prior to adoption.

**Information and communications plan** (where appropriate) – (See also specific [Ciria SuDS Manual C753](#) Chapter 34)

**REASON:** To provide a structured approach to engagement with the local community and set out the engagement stages, how they are delivered, the resources available to deliver them, and the timescale within which an outcome needs to be delivered. The plan shall include:

- communication with and education of existing residents;
- communication with and education of new residents;
- site and SuDS component specific information boards; and
- local community education and education strategies (eg through schools).

**Construction (Design and Management) CDM Regulations 2015 File** – (See also specific [Ciria SuDS Manual C753](#) Chapter 36 & Appendix B)

**REASON:** To ensure that SuDS designs fulfil regulatory and legal requirements, and SuDS health and safety risk assessments are in line with BS EN 31010:2010. The file shall include:

- Risk assessments for the design, construction, operation and maintenance of the highway and drainage system.

### **Statutory consents and permissions**

**REASON:** To provide evidence that all necessary consents, written agreements in principle, and permissions have been obtained. These shall include:

- Discharge consents & licenses to watercourses;
- Rights to lay pipes on third party land/easements;
- Easement details;
- Permission from riparian owner to discharge;
- Water Industry Act 1991 Section 104 (adoption);
- Agreement in Principle from Statutory Undertaker; and
- Land drainage consent & management company drainage agreements.

### **Title documents**

**REASON:** To ensure all legal interests and ownership etc. in land and buildings associated with the SuDS are identified, and can be communicated for legal transfers, acquisitions and responsibilities. These shall include

- Up-to-date coloured Copy Entries of Title or Epitome of Title to the land in question.

## **TABLE B: Plans and drawings containing relevant information required for the Full Application**

### **Drawing number issue sheet**

**Outline or Full Planning Permission Notice** and approved layout drawing (where applicable).

**Site location plan** (Scale 1:2500) supported by recent photographs.

**Natural and artificial drainage catchment and sub-catchment plan** (Scale 1:2500) showing:

- Land contours;
- Topography;
- Watercourses; and
- Current flood risk areas, both within, above and below, impacting on the site.

**Concept drawings** (Scale 1:2500) of the proposed development layout (and/or layout options), appropriate and proportionate evidence showing:

- Contoured flood routing plan showing exceedance flows;
- Outline sizing of site areas and land use zones;
- Conceptual SuDS calculations and design including:
  - interception,
  - treatment,
  - conveyance,
  - peak flow and volume control,
  - storage (long-term and attenuation),
  - exceedance routes and components,
  - demonstration that the required indicative storages and conveyance flows can be delivered on site,
  - protection and enhancement of:
    - water quality,
    - amenity,
    - bio-diversity,
    - landscape.
- Location of roads, buildings and sustainable drainage features (including water quality measures);
- Potential flood risk protection features that may be required; and
- Initial thoughts on SuDS adoption & maintenance responsibilities.

**General engineering layout coloured drawings** (Scale 1:500 & 1:1250) showing:

- Areas of proposed SuDS submitted for SAB approval & offered for adoption – coloured

green with solid red outline;

- Site Boundaries;
- Existing buildings (on and around the site);
- Positions of all carriageways, footways, footpaths, cycleways, verges, service strips, traffic calming features;
- Existing and proposed foul and surface water drainage, highway drainage to be offered for adoption by the Highway Authority, & any highway drainage not to be adopted, need to be identified in different colours & clearly labelled;
- Where applicable, each dwelling draining private surface water to the highway SuDS, should be clearly identified on the plan and coloured differently;
- Watercourses;
- Finished building ground floor levels;
- Manholes;
- Storage/attenuation devices, chambers and systems;
- Outfalls/headwalls;
- Other ancillary systems/features;
- Existing trees and proposed locations;
- Easements to be coloured blue;
- Position of dwellings, garaging and/or parking spaces, structures; and
- Falls and cross-falls of SuDS components, footways and carriageways.

**Longitudinal section coloured drawings** (Scale 1:500 Horizontal & 1:100 Vertical)

showing:

- Existing and proposed road levels for the centre line, channels, gradients and vertical curves;
- Surface and foul water drainage profiles, including positions of chambers, gradients, pipe diameters, cover and invert levels and protection;
- Highway drainage should be identified in a different colour;
- Pipe material;
- Pipe strength;
- Bedding classification and details; and
- Ground water and watercourse levels.

**Cross section drawings and standard detail drawings** (Scale 1:100, 1:50, 1:20 & 1:10) showing items in the general engineering layout drawings, at intervals of no greater than 30 metres.

**Landscaping layout drawing** (Scale 1:500)

showing:

- Details of planting, trees species /size/positions;
- Any existing trees to be retained;
- Tree pit details;
- Grassed areas play grounds and equipment;
- Fencing and, walls; and
- Confirmation of land ownership.

**Specialist drawings** (Scale 1:1250)

showing:

- Bridges, Culverts, any pipework over 600mm diameter, headwalls, retaining walls and any other constructed features; and
- Existing Statutory Services and utility plans showing surrounding location of proposed development.

The *following note* shall be incorporated on all drawings submitted:

- 1) *“The specification in all respects shall be in accordance with the current NPTCBC Specification and Construction publication in force in the county at the time of construction.”*

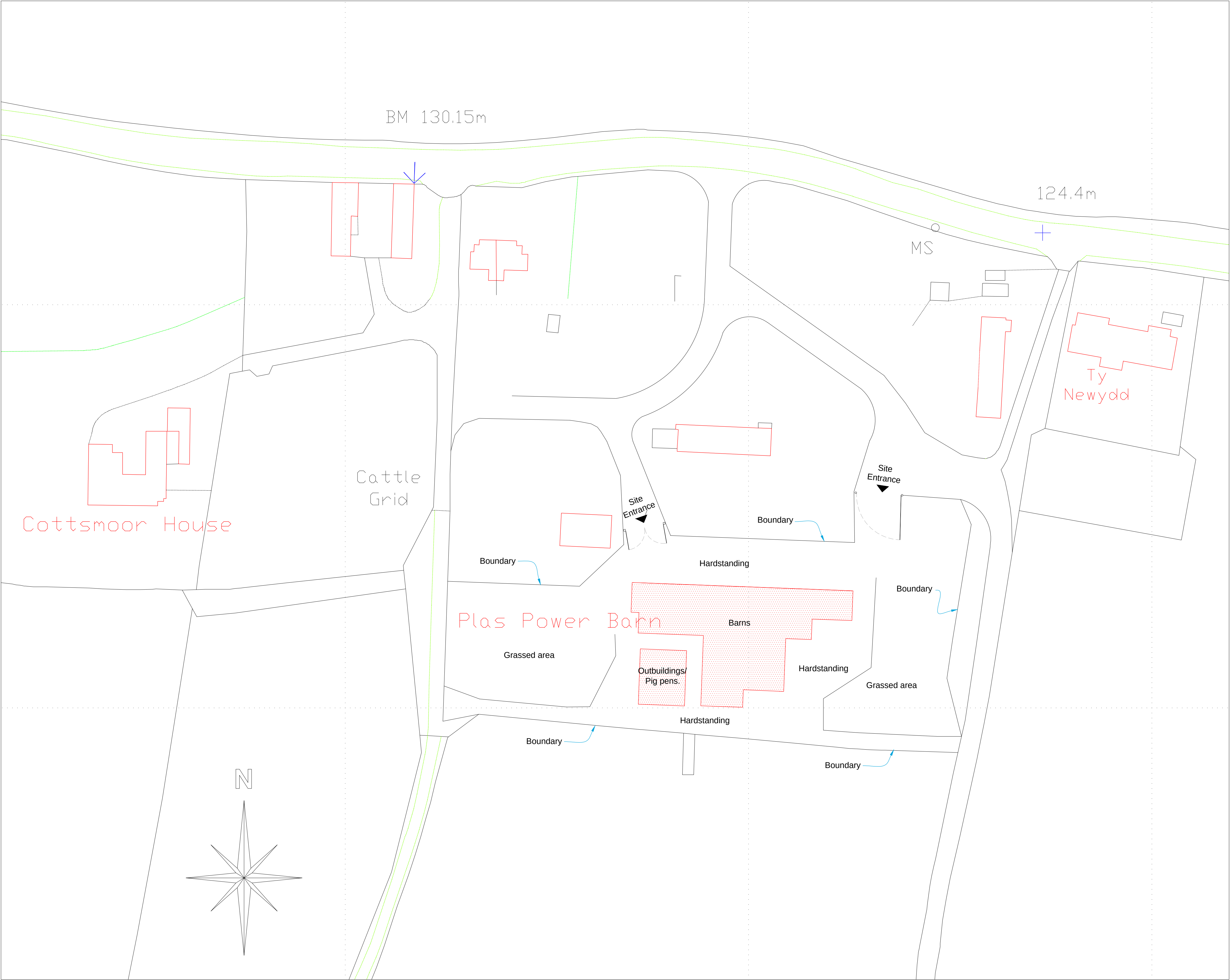
It should be noted that:

- Should the developer wish to submit AutoCAD files, he should attach the relevant pen setting files (ctb).
- Plans should be folded to A4 size.
- 3 hardcopies and an electronic copy shall be submitted of all drawings and documents.

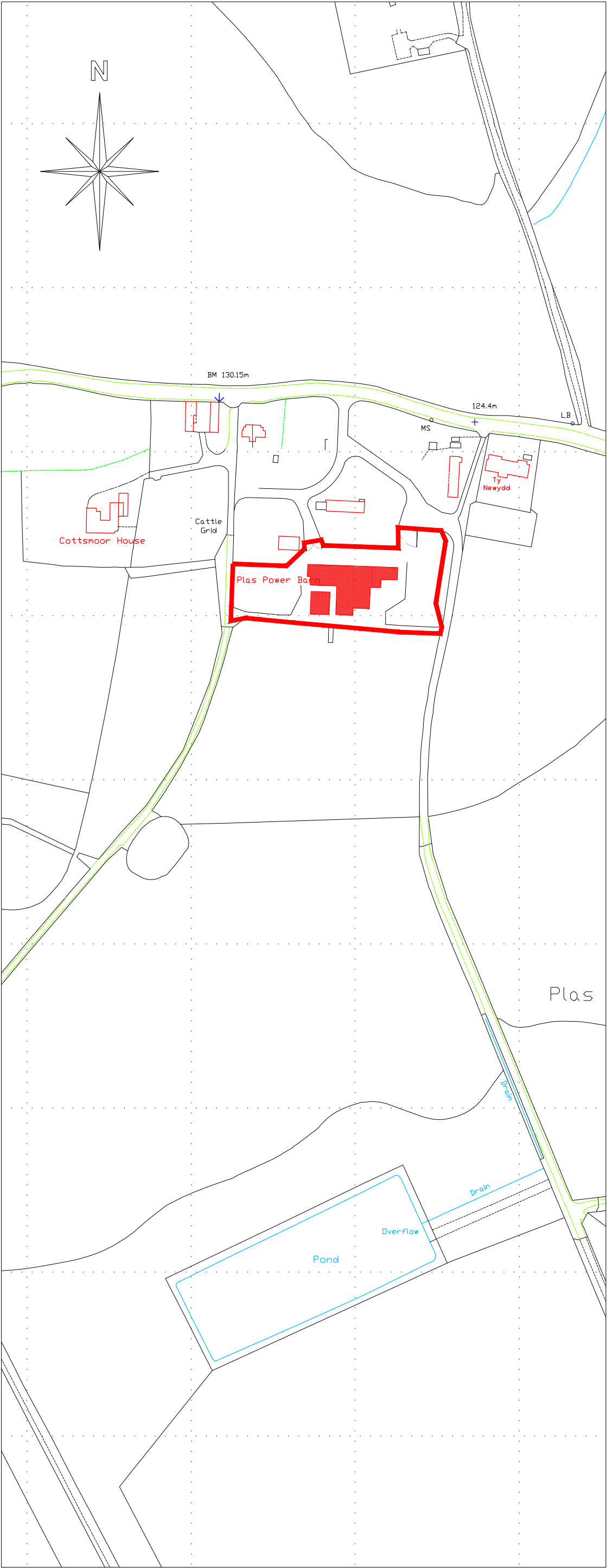
## Appendix 1 – Plans by Architect

# PLAS POWER HOME FARM BARNS

Architects Copyright

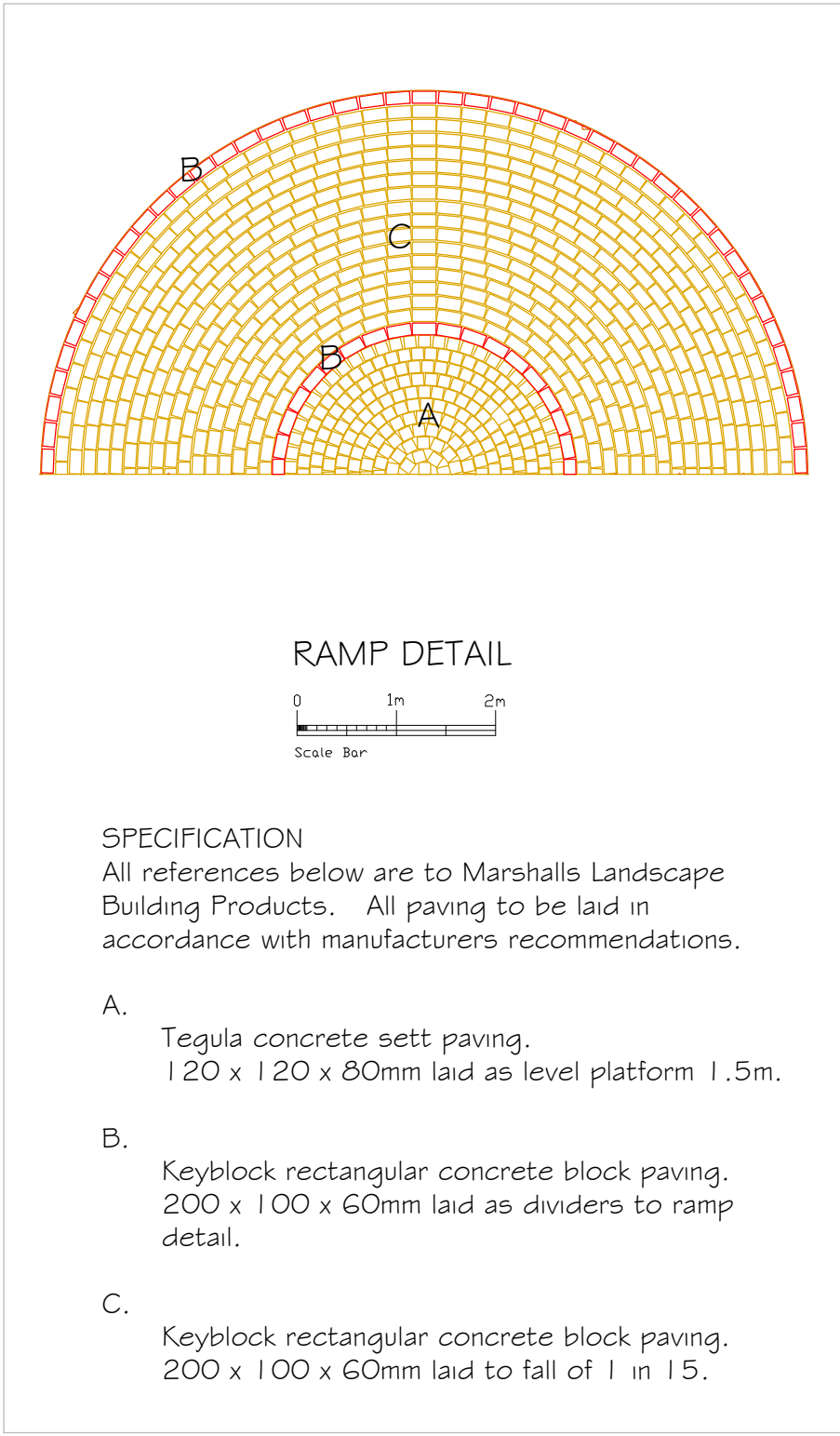


Existing Site Plan  
Scale 1:500



Location Plan  
Scale 1:2500

|                                                                                                                                                                                                                                                      |                                                                                               |                                                                                  |                             |      |                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-----------------------------|------|-------------------|
| <br>CELLIS-ARCHITECTURAL-DESIGN<br>25 Sunningdale Close<br>Wrexham<br>North Wales<br>LL13 9QU<br>T 01978 264376<br>M 07791 480768<br>E ajones540@btinternet.com | <br>LABC | Client: Mr. C. Sheffield.                                                        |                             |      |                   |
|                                                                                                                                                                                                                                                      |                                                                                               | Drawing Title: Existing Site & Location Plan.                                    |                             |      |                   |
|                                                                                                                                                                                                                                                      |                                                                                               | Job Title: Proposed Barn Conversion to Plas Power Home Farm Building, Ruthin Rd. |                             |      |                   |
|                                                                                                                                                                                                                                                      |                                                                                               | Date: April 2019                                                                 | Scale: 1:500 & 1:2500 at A1 | Rev: | Proj No: PD165/01 |



# Proposed Ground Floor Plans

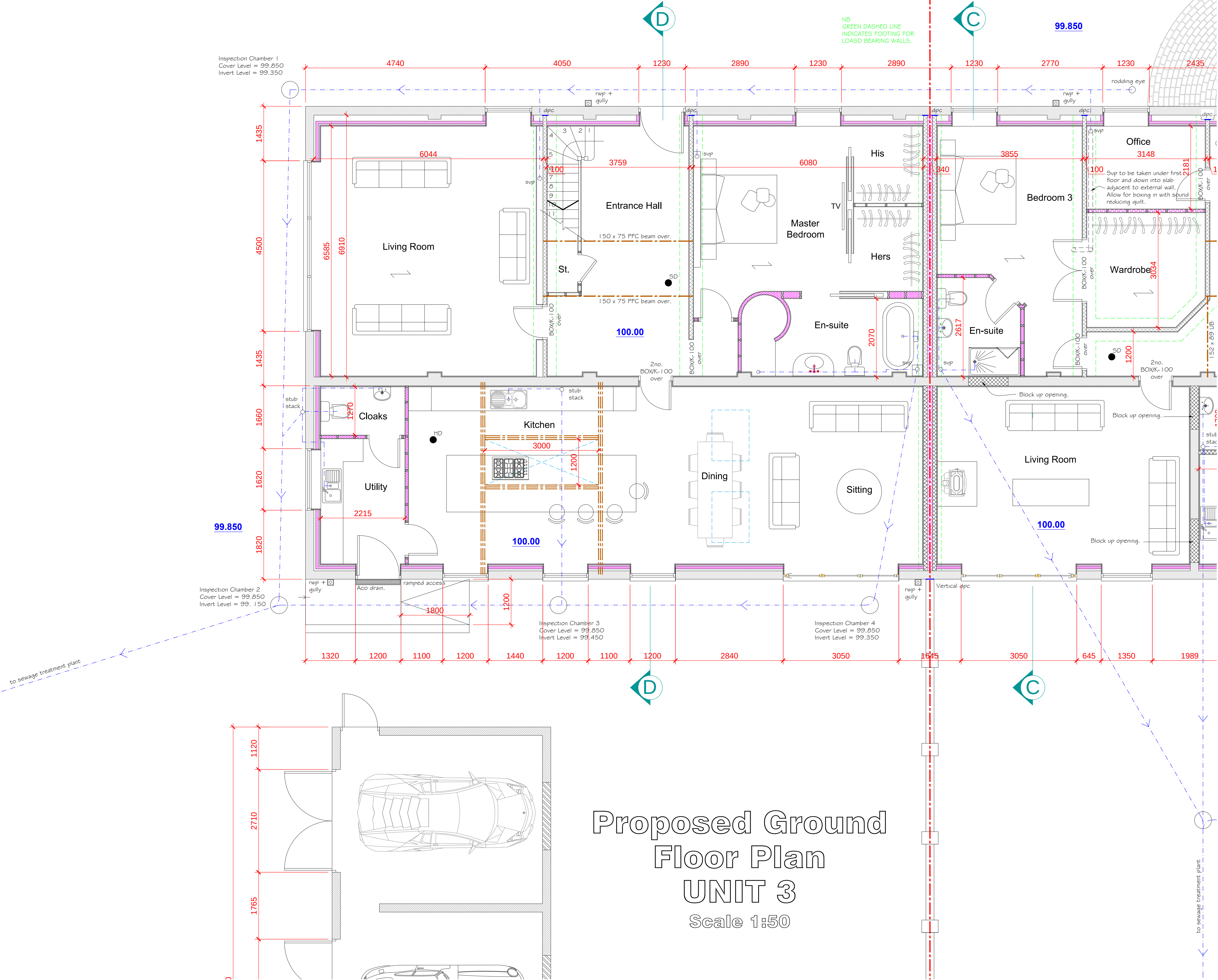
## UNITS 1 & 2

Scale 1:50

THESE DRAWINGS ARE TO BE READ IN STRICT CONJUNCTION WITH STRUCTURAL ENGINEERS DRAWINGS AND SPECIFICATION. ANY DEVIATIONS MUST BE APPROVED BY THE STRUCTURAL ENGINEER PRIOR TO WORK TAKING PLACE ON SITE.  
ALL STRUCTURAL QUERIES TO BE ADDRESSED TO A. HANNET - 07761 346542

UNIT 3

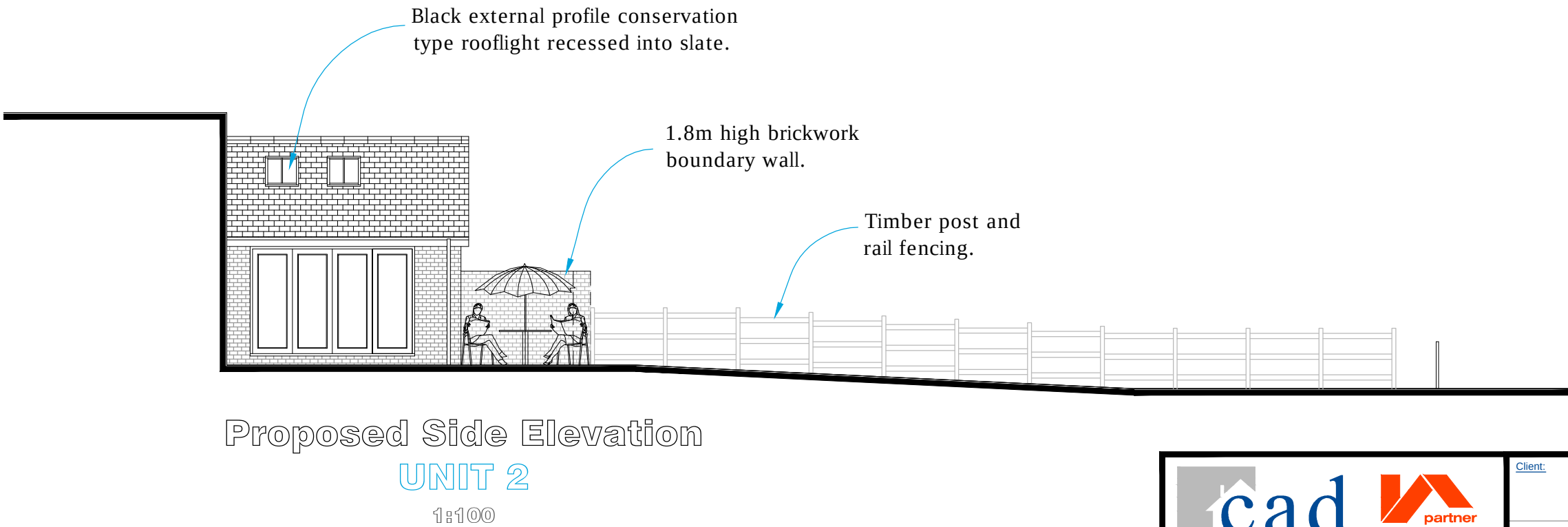
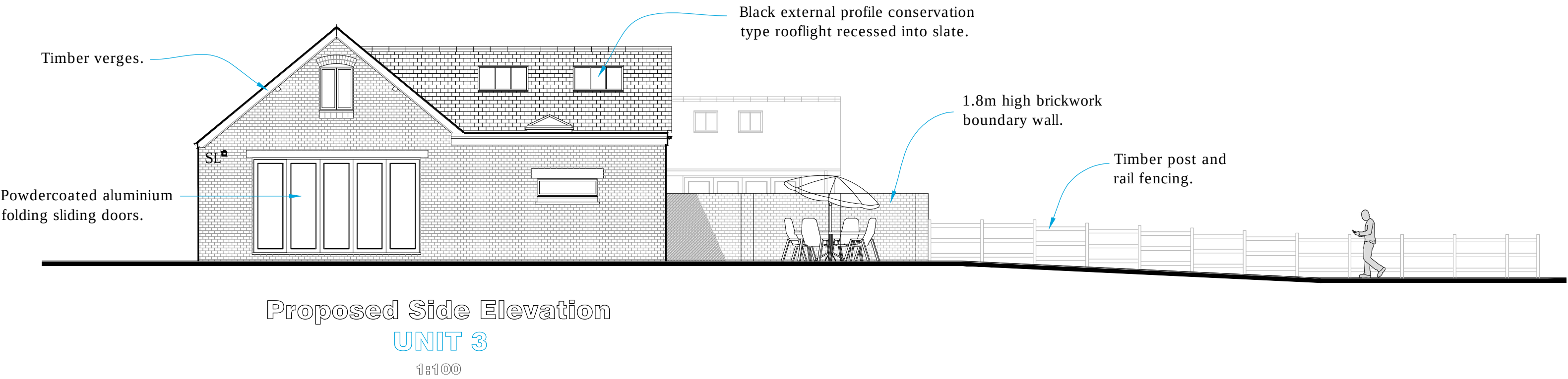
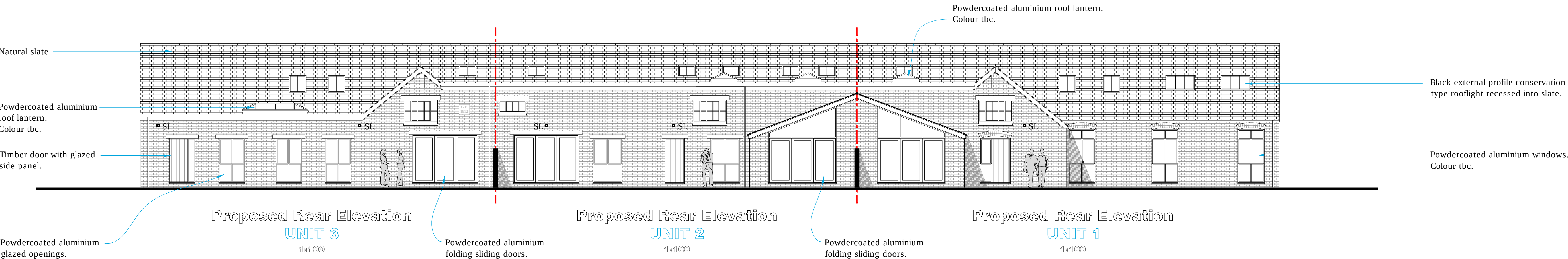
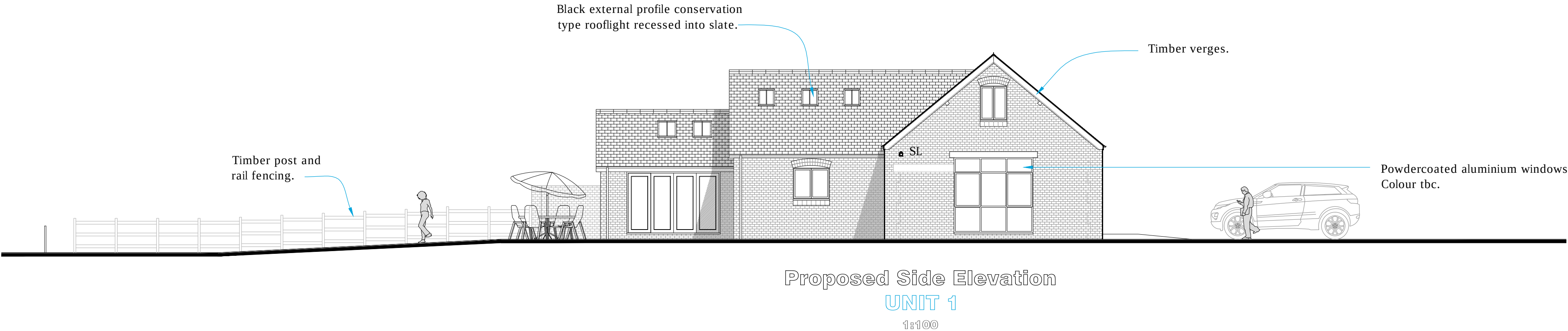
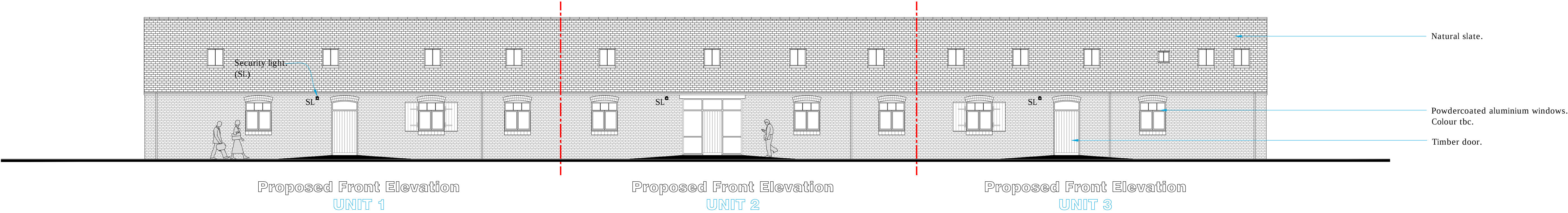
UNIT 2



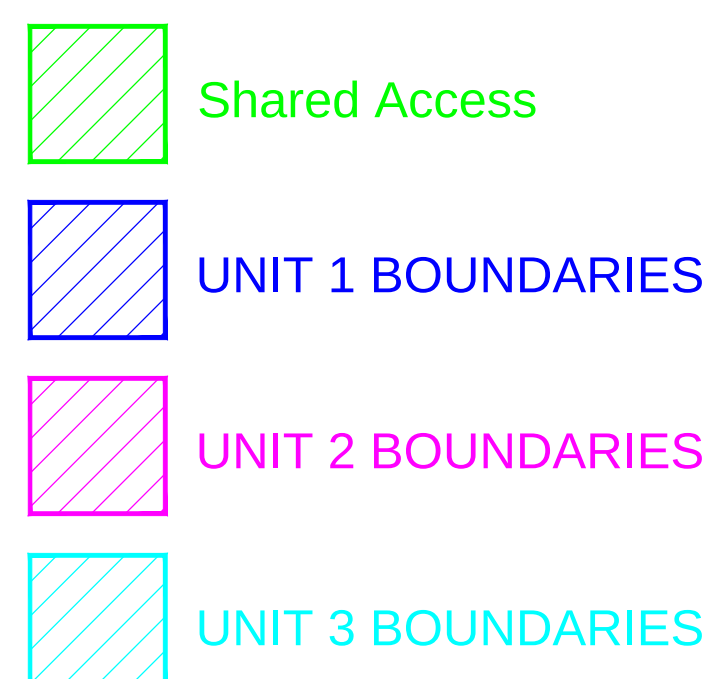
Proposed Ground Floor Plan  
UNIT 3  
Scale 1:50

PLAS POWER HOME FARM BARN

Architects Copyright



|                                                                                                                                                                 |                |                                                                       |      |          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------|------|----------|
| <br>CELLIS-ARCHITECTURAL-DESIGN<br>25 Sunningdale Close<br>Wrexham<br>North Wales<br>LL13 9QU<br>T 01978 264376<br>M 07791 480768<br>E ajones540@btinternet.com | Client:        | Mr. C. Sheffield.                                                     |      |          |
|                                                                                                                                                                 | Drawing Title: | Proposed Elevations.                                                  |      |          |
|                                                                                                                                                                 | Job Title:     | Proposed Barn Conversion to Plas Power Home Farm Building, Ruthin Rd. |      |          |
|                                                                                                                                                                 | Date:          | Scale:                                                                | Rev: | Draw No: |
|                                                                                                                                                                 | May 2019       | 1:100 at A1                                                           |      | PD165/07 |



Planting Specification - The hedge shall comprise blackthorn *Prunus spinosa* (5%), hawthorn *Crataegus monogyna* (80%), dog rose *Rosa canina* (5%), field maple *Acer campestre* (5%), hazel *Corylus avellana* (5%) - British provenance 60-80cm bare rooted 1+1 transplants, with spiral rabbit guards. They shall be planted in 2 staggered rows, 45cm apart with plants at 30cm spacing. Species are to be planted in same species groups of 3 to 7 plants and the hedge will be protected with stock proof post and wire/netting erected 1m from planting, with planting on the public side of any boundary. Planting shall be watered to full ground capacity on completion, maintained weed free within the first 3 years, any dead dying or failing to thrive planting replaced annually within the first 5 years and fencing maintained for a minimum of ten years.

## Appendix 2 – Drainage Drawings

attle  
Grid

Drawing No: C:\Users\Sam.L\Box\WAT-DW-AEA-General\PROJECTS\5386\_Culils\_Wrexham\CAO\5386\_DR01\_V2.dwg



1. GENERAL

a. THIS DRAWING IS NOT TO BE SCALED, WORK TO FIGURED DIMENSIONS ONLY, CONFIRMED ON SITE.

b. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTURAL DRAWINGS, DETAILED SPECIFICATIONS WHERE APPLICABLE AND ALL ASSOCIATED DRAWINGS IN THIS SERIES.

c. ANY DISCREPANCY ON THIS DRAWING IS TO BE REPORTED IMMEDIATELY TO THE PARTNERSHIP FOR CLARIFICATION.

d. THE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS AND FOR THE STABILITY OF THE WORKS IN PROGRESS.

e. CDM REGULATIONS 2015. ALL CURRENT DRAWINGS AND SPECIFICATIONS MUST BE READ IN CONJUNCTION WITH THE DESIGNER'S HAZARD RISK AND ENVIRONMENT ASSESSMENT RECORD. DESIGN HAS BEEN PRODUCED BASED ON INFORMATION PROVIDED BY THE CLIENT/PRINCIPLE DESIGNER AVAILABLE AT TIME OF ISSUE. CONTRACTOR TO REVIEW DRAWING AND SPECIFICATION IN CONTEXT WITH THE WIDER SITE AND SPECIFIC SITE INVESTIGATION, CONTAMINATION ASSESSMENT, ASBESTOS SURVEY, ENVIRONMENTAL SURVEY, UXO SURVEY AND ANY OTHER RELEVANT INFORMATION AND MANAGE RISKS RELATING TO THE WORKS OUTLINED IN THE DRAWINGS AND SPECIFICATION. PRINCIPLE CONTRACTOR TO MAKE DESIGNER AND CLIENT AWARE OF SITE SPECIFIC RISKS THAT MAY AFFECT THE DRAWING AND SPECIFICATION.

f. CDM REGULATIONS 2015. FOR GENERIC MAINTENANCE AND MANAGEMENT RISKS REFER TO CHAPTER 36 OF CIRIA 752 SUDS MANUAL FOR PROPRIETARY SYSTEMS SEE MANUFACTURER'S MANAGEMENT AND MAINTENANCE DETAILS AND RISK ASSESSMENT WITH REGARDS TO MAINTENANCE OF PROPRIETARY SYSTEMS.

LEGEND

- PRIVATE SURFACE WATER DRAIN
- PERFORATED SURFACE WATER DRAIN
- PUBLIC SURFACE WATER DRAIN
- EXISTING SURFACE WATER DRAIN
- HIGHWAY DRAIN
- SLOT/CHANNEL DRAIN
- TYPE 2 MANHOLE
- TYPE 3 INSPECTION CHAMBER
- TYPE 4 INSPECTION CHAMBER
- RODDING EYE
- RAIN WATER PIPE
- ROAD GULLY
- BOTTLE GULLY
- PERMEABLE PAVING
- ATTENUATION SYSTEM
- OVERLAND FLOW
- OF PERMEABLE CONSTRUCTION

| REV | DATE       | BY | APPD | DESCRIPTION                                                     |
|-----|------------|----|------|-----------------------------------------------------------------|
| 1   | 19/05/2020 | SL | CKD  | PRELIMINARY DRAWING FOR INFORMATION ONLY. NOT FOR CONSTRUCTION. |

Client

CLIENT

**AMBIENTAL**  
ENVIRONMENTAL ASSESSMENT

a company of **Royal HaskoningDHV**

Project

Plas Power Estate  
Wrexham, LL11 3BP

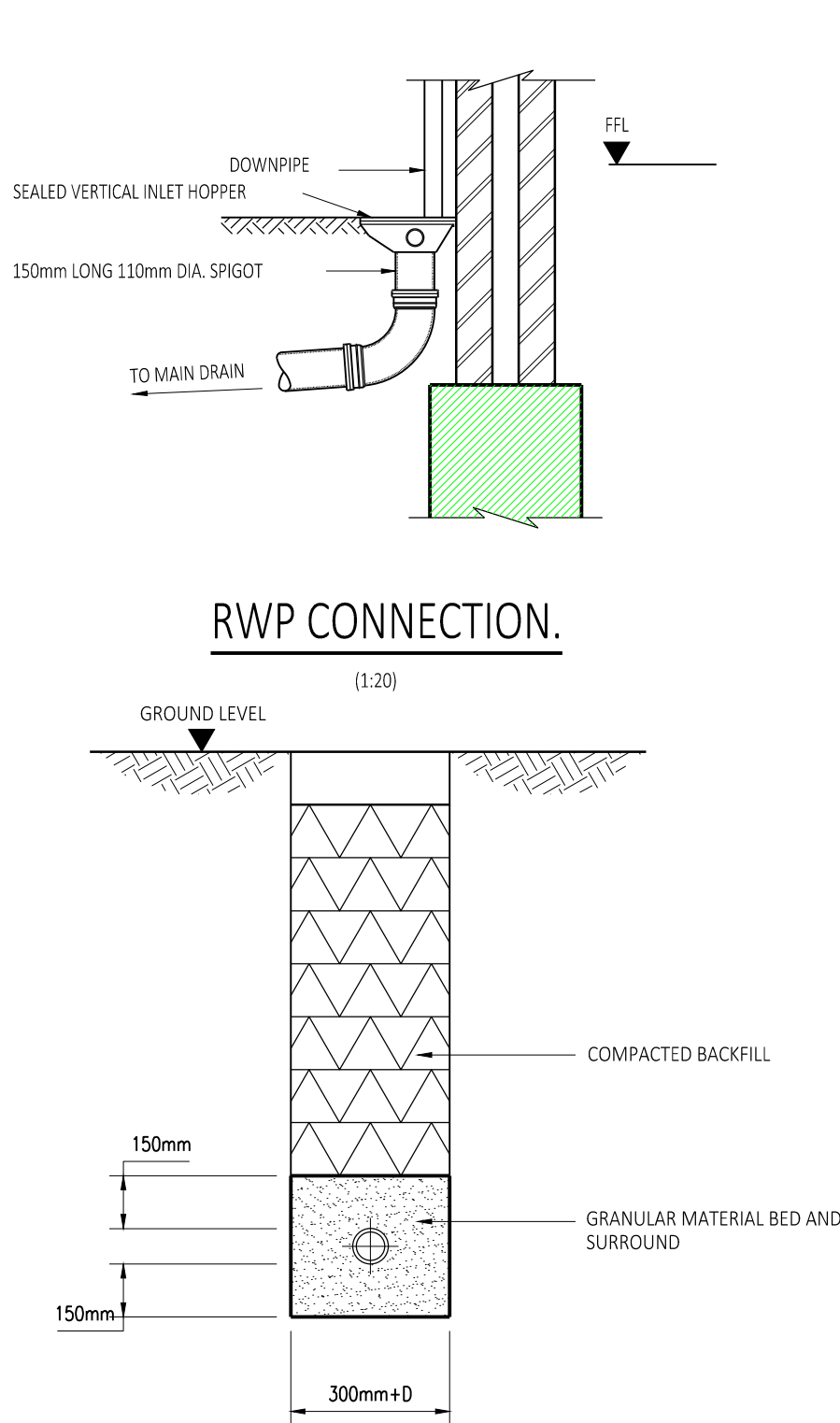
Drawing

SURFACE WATER DRAINAGE STRATEGY

Drawn by: SL Date: 19/05/2020

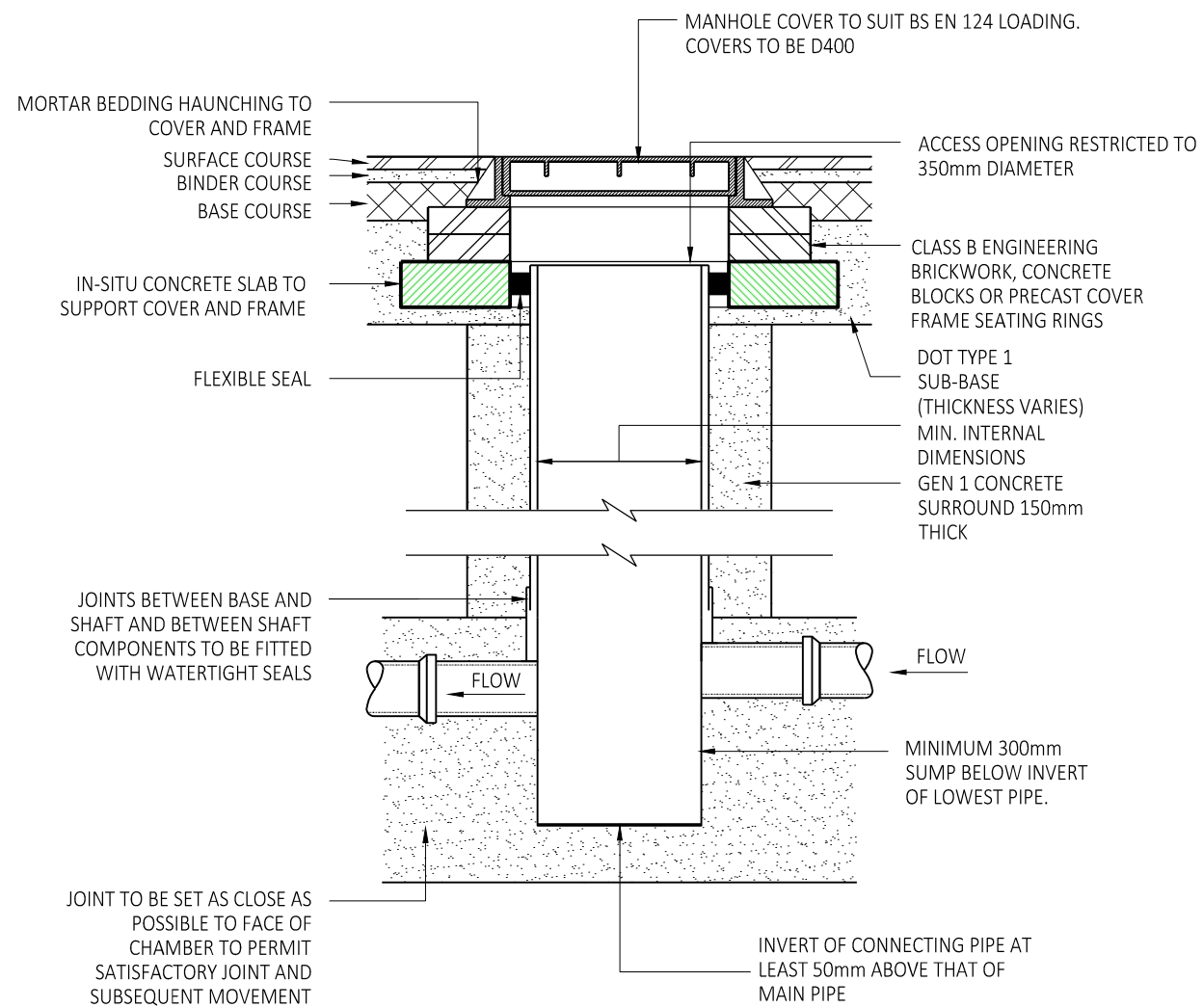
Drawing No: 5386\_DR01 Revision: -

Drawing Scale: 1:250 @ A1  
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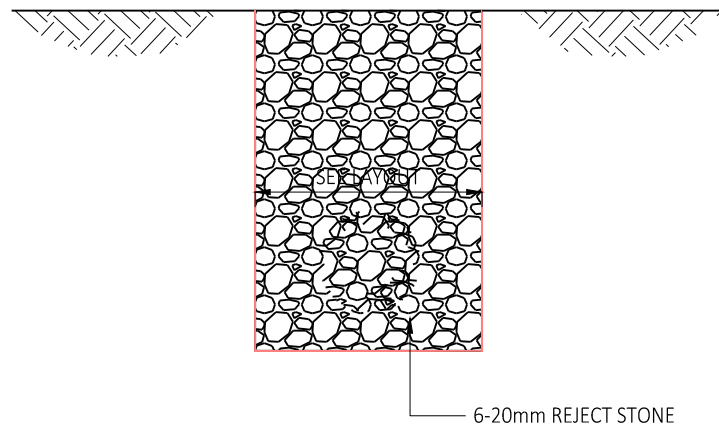


### GRANULAR BEDDING DETAIL

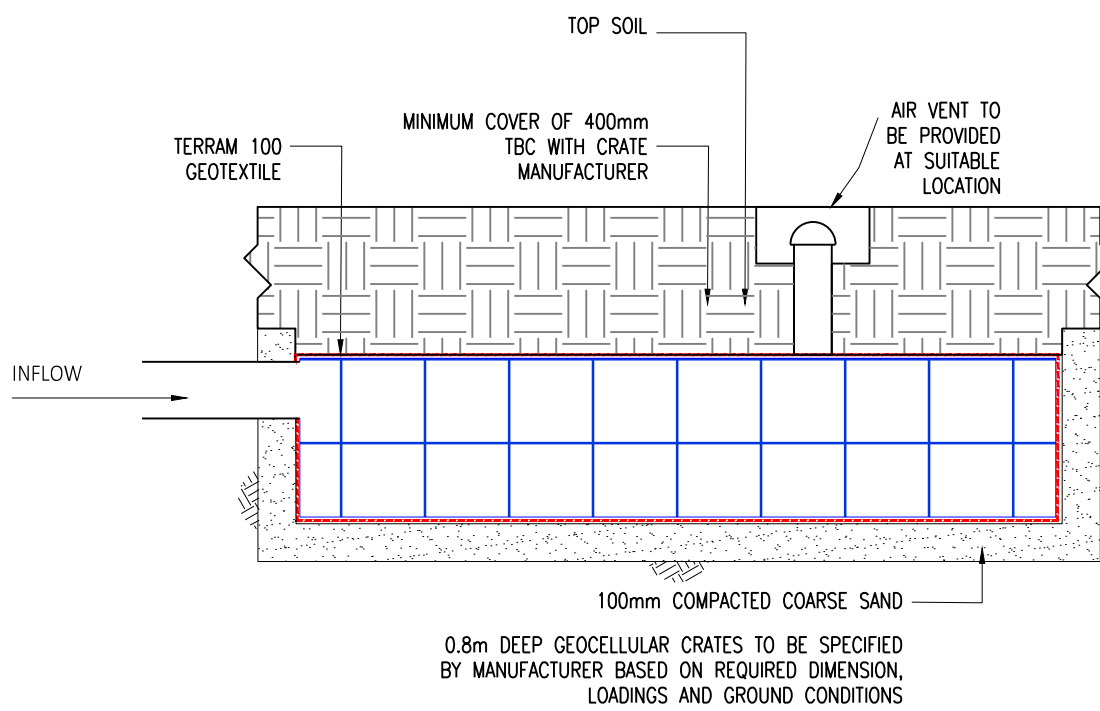
WHERE COVER >600mm in non-trafficked areas;  
or  
WHERE COVER >900mm in trafficked areas  
(1:20)



### TYPE 3 CATCHPIT MANHOLE. (PREFORMED POLYPIPE RIGIDRAIN 600Ø CATCHPIT MANHOLE OR SIMILAR), MAX. DEPTH 3m, NON-ENTRY) (1:20)



### FILTER STRIP



### GEOCELLULAR SOAKAWAY - INDICATIVE SECTION DETAIL 1 (1:20)

- GENERAL  
a. THIS DRAWING IS NOT TO BE SCALED, WORK TO FIGURED DIMENSIONS ONLY, CONFIRMED ON SITE.  
b. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTURAL DRAWINGS, DETAILED SPECIFICATIONS WHERE APPLICABLE AND ALL ASSOCIATED DRAWINGS IN THIS SERIES.  
c. ANY DISCREPANCY ON THIS DRAWING IS TO BE REPORTED IMMEDIATELY TO THE PARTNERSHIP FOR CLARIFICATION.  
d. THE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS AND FOR THE STABILITY OF THE WORKS IN PROGRESS.  
e. CDM REGULATIONS 2015. ALL CURRENT DRAWINGS AND SPECIFICATIONS MUST BE READ IN CONJUNCTION WITH THE DESIGNER'S HAZARD RISK AND ENVIRONMENT ASSESSMENT RECORD. DESIGN HAS BEEN PRODUCED BASED ON INFORMATION PROVIDED BY THE CLIENT/PRINCIPLE DESIGNER AVAILABLE AT TIME OF ISSUE. CONTRACTOR TO REVIEW DRAWING AND SPECIFICATION IN CONTEXT WITH THE WIDER SITE AND SPECIFIC SITE INVESTIGATION, CONTAMINATION ASSESSMENT, ASBESTOS SURVEY, ENVIRONMENTAL SURVEY, UXO SURVEY AND ANY OTHER RELEVANT INFORMATION AND MANAGE RISKS RELATING TO THE WORKS OUTLINED IN THE DRAWINGS AND SPECIFICATION. PRINCIPLE CONTRACTOR TO MAKE DESIGNER AND CLIENT AWARE OF SITE SPECIFIC RISKS THAT MAY AFFECT THE DRAWING AND SPECIFICATION.  
f. CDM REGULATIONS 2015. FOR GENERIC MAINTENANCE AND MANAGEMENT RISKS REFER TO CHAPTER 36 OF CIRIA 752 SUDS MANUAL. FOR PROPRIETARY SYSTEMS SEE MANUFACTURERS' MANAGEMENT AND MAINTENANCE DETAILS AND RISK ASSESSMENT WITH REGARDS TO MAINTENANCE OF PROPRIETARY SYSTEMS.
- CONSTRUCTION NOTE  
a. THE MAIN CONTRACTOR IS RESPONSIBLE FOR THE DESIGN OF ALL TEMPORARY WORKS, AND IS ALSO RESPONSIBLE FOR THE SAFE MAINTENANCE AND STABILITY OF EXISTING BUILDINGS AT ALL TIMES.  
b. THE MAIN CONTRACTOR IS RESPONSIBLE FOR ALL OCCURRENCES OF GROUND WATER DURING THE CONSTRUCTION PERIOD.  
c. ANY INFORMATION GIVEN REGARDING EXISTING UNDERGROUND SERVICES IS GIVEN IN GOOD FAITH AFTER CONSULTATION WITH THE RELEVANT AUTHORITY. HOWEVER ACCURACY IS NOT CERTAIN. THE MAIN CONTRACTOR IS RESPONSIBLE FOR CHECKING ALL INFORMATION ON SITE PRIOR TO WORK COMMENCING AND TAKING DUE CARE AND ATTENTION WHILST UNDERTAKING THE WORKS.  
d. THE CONTRACTOR MUST COMPLY WITH ALL CURRENT LEGISLATION RELATING TO HEALTH & SAFETY.  
e. ALL PRODUCTS SPECIFIED SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS AND INSTRUCTIONS. IF THERE ARE DISCREPANCIES BETWEEN THAT INFORMATION AND THE DETAILS ON ANY AMBIENTAL DRAWINGS, THE MANUFACTURERS INSTRUCTIONS MUST BE USED.
- BELOW GROUND DRAINAGE  
a. PIPEWORK TO BE UPVC-U PIPES TO BS 4660 : 2000 AND INSPECTION CHAMBERS TO BS 7158 : 2001.  
b. ALL ADAPTABLE DRAINAGE TO BE CONSTRUCTED IN ACCORDANCE WITH 'SEWERS FOR ADOPTION' 7TH EDITION AND THE RELEVANT COUNCIL DESIGN GUIDE.  
c. ALL PRIVATE SURFACE WATER SEWERS TO BE LAID AT 1 IN 100 UNLESS OTHERWISE STATED ON THE DRAWING.  
d. ALL PRIVATE FOUL WATER SEWERS TO BE LAID AT 1 IN 40 AT THE HEAD OF PIPE RUNS AND 1 IN 80 ELSEWHERE UNLESS OTHERWISE STATED.  
e. ALL PRIVATE FOUL SEWER PIPES TO BE 150MM DIAMETER UNLESS OTHERWISE STATED ON THE DRAWING. ALL PRIVATE SURFACE WATER SEWER PIPES TO BE 100MM DIAMETER FROM DOWNPIPES AND 150MM DIAMETER ELSEWHERE UNLESS OTHERWISE STATED ON THE DRAWING.  
f. ALLOW FOR RODDING ACCESS ABOVE GROUND WHERE RAINWATER DOWNPIPES DO NOT HAVE A DIRECT CONNECTION TO AN INSPECTION CHAMBER. EXISTING SEWER PIPE TO BE RE-USED TO BE SURVEYED AND LEVELLED PRIOR TO COMMENCEMENT OF THE DRAINAGE WORKS AND REFURBISHED IF NECESSARY.  
g. CONNECTIONS TO AN ADOPTED SEWER ONLY TO BE MADE FOLLOWING APPROVAL FROM THE RELEVANT ADOPTING AUTHORITY.  
h. ALL DRAINS, SEWER PIPES AND MANHOLES TO BE CLEANED AND TESTED FOR WATER TIGHTNESS ON COMPLETION OF CONSTRUCTION.
- MANHOLE COVERS AND FRAMES  
a. MANHOLE COVERS TO BE CLASS D400 IN HIGHWAYS, CLASS B125 IN FOOTWAYS AND VERGES, CLASS A15 IN NON-TRAFFICKED AREAS.  
b. MANHOLE COVER AND FRAME TO BE BEDDED AND SURROUNDED IN 1:3 MORTAR.

| #   | XX.XX.XX | .. | ..   | ..   |
|-----|----------|----|------|------|
| REV | DATE     | BY | CHKD | APPD |

PRELIMINARY DRAWING  
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Project  
Plas Power Estate  
Wrexham, LL11 3BP

Drawing  
SURFACE WATER DRAINAGE  
STANDARD DETAIL

Drawn by: SL Date: 19/05/2020

Drawing No.  
5386\_DR02

Drawing Scale: 1:100 @ A1  
0 1m 2m 3m 4m 5m

## Appendix 3 – Calculations

## Design Settings

|                       |                   |                                      |               |
|-----------------------|-------------------|--------------------------------------|---------------|
| Rainfall Methodology  | FSR               | Maximum Time of Concentration (mins) | 30.00         |
| Return Period (years) | 100               | Maximum Rainfall (mm/hr)             | 50.0          |
| Additional Flow (%)   | 40                | Minimum Velocity (m/s)               | 1.00          |
| FSR Region            | England and Wales | Connection Type                      | Level Soffits |
| M5-60 (mm)            | 20.000            | Minimum Backdrop Height (m)          | 0.200         |
| Ratio-R               | 0.400             | Preferred Cover Depth (m)            | 1.200         |
| CV                    | 0.750             | Include Intermediate Ground          | ✓             |
| Time of Entry (mins)  | 4.00              | Enforce best practice design rules   | ✓             |

## Circular Link Type

Shape Circular | Barrels 1 | Auto Increment (mm) 75 | Follow Ground x

## Available Diameters (mm)

100 | 150

## Nodes

|   | Name       | Area<br>(ha) | T of E<br>(mins) | Cover<br>Level<br>(m) | Node<br>Type | Manhole<br>Type | Diameter<br>(mm) | Depth<br>(m) |
|---|------------|--------------|------------------|-----------------------|--------------|-----------------|------------------|--------------|
| ✓ | Soakaway 1 |              |                  | 10.000                | Junction     |                 |                  | 0.862        |
| ✓ | Roof Area  | 0.006        | 4.00             | 10.000                | Manhole      | Adoptable       | 1200             | 0.800        |

## Links

| Name    | US Node   | DS Node    | Length (m) | ks (mm) / n | Velocity Equation | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | Link Type | T of C (mins) | Rain (mm/hr) |
|---------|-----------|------------|------------|-------------|-------------------|-----------|-----------|----------|-------------|----------|-----------|---------------|--------------|
| ? 1.000 | Roof Area | Soakaway 1 | 5.000      | 0.600       | Colebrook-White   | 9.200     | 9.138     | 0.062    | 80.0        | 150      | Circular  | 4.07          | 50.0         |

| Name    | US Node   | DS Node    | Vel (m/s) | Cap (l/s) | Flow (l/s) | US Depth (m) | DS Depth (m) | Minimum Depth (m) | Maximum Depth (m) | Σ Area (ha) | Σ Add Inflow (l/s) | Pro Depth (mm) | Pro Velocity (m/s) |
|---------|-----------|------------|-----------|-----------|------------|--------------|--------------|-------------------|-------------------|-------------|--------------------|----------------|--------------------|
| ? 1.000 | Roof Area | Soakaway 1 | 1.125     | 19.9      | 1.1        | 0.650        | 0.712        | 0.650             | 0.712             | 0.006       | 0.0                | 24             | 0.609              |

## Simulation Settings

|                      |                   |                   |        |                            |      |
|----------------------|-------------------|-------------------|--------|----------------------------|------|
| Rainfall Methodology | FSR               | Summer CV         | 0.750  | Drain Down Time (mins)     | 2880 |
| FSR Region           | England and Wales | Winter CV         | 0.840  | Additional Storage (m³/ha) | 20.0 |
| M5-60 (mm)           | 20.000            | Analysis Speed    | Normal | Check Discharge Rate(s)    | x    |
| Ratio-R              | 0.400             | Skip Steady State | x      | Check Discharge Volume     | x    |

## Storm Durations

|    |    |    |     |     |     |     |     |     |     |     |      |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| 15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|-----------------------|-----------------------|-----------------------|-----------------------|
| 100                   | 40                    | 0                     | 0                     |

## Node Soakaway 1 Soakaway Storage Structure

|                             |         |                           |       |                |       |                 |   |
|-----------------------------|---------|---------------------------|-------|----------------|-------|-----------------|---|
| Base Inf Coefficient (m/hr) | 0.15000 | Porosity                  | 0.95  | Pit Width (m)  | 1.000 | Inf Depth (m)   |   |
| Side Inf Coefficient (m/hr) | 0.30000 | Invert Level (m)          | 8.500 | Pit Length (m) | 1.500 | Number Required | 1 |
| Safety Factor               | 2.0     | Time to half empty (mins) | 83    | Depth (m)      | 0.800 |                 |   |

### Rainfall

| Event                              | Peak<br>Intensity<br>(mm/hr) | Average<br>Intensity<br>(mm/hr) | Event                               | Peak<br>Intensity<br>(mm/hr) | Average<br>Intensity<br>(mm/hr) |
|------------------------------------|------------------------------|---------------------------------|-------------------------------------|------------------------------|---------------------------------|
| 100 year +40% CC 15 minute summer  | 488.233                      | 138.153                         | 100 year +40% CC 360 minute summer  | 56.677                       | 14.585                          |
| 100 year +40% CC 15 minute winter  | 342.620                      | 138.153                         | 100 year +40% CC 360 minute winter  | 36.841                       | 14.585                          |
| 100 year +40% CC 30 minute summer  | 320.551                      | 90.705                          | 100 year +40% CC 480 minute summer  | 43.979                       | 11.622                          |
| 100 year +40% CC 30 minute winter  | 224.948                      | 90.705                          | 100 year +40% CC 480 minute winter  | 29.219                       | 11.622                          |
| 100 year +40% CC 60 minute summer  | 214.603                      | 56.713                          | 100 year +40% CC 600 minute summer  | 35.604                       | 9.738                           |
| 100 year +40% CC 60 minute winter  | 142.577                      | 56.713                          | 100 year +40% CC 600 minute winter  | 24.327                       | 9.738                           |
| 100 year +40% CC 120 minute summer | 129.587                      | 34.246                          | 100 year +40% CC 720 minute summer  | 31.433                       | 8.424                           |
| 100 year +40% CC 120 minute winter | 86.094                       | 34.246                          | 100 year +40% CC 720 minute winter  | 21.125                       | 8.424                           |
| 100 year +40% CC 180 minute summer | 97.729                       | 25.149                          | 100 year +40% CC 960 minute summer  | 25.432                       | 6.697                           |
| 100 year +40% CC 180 minute winter | 63.526                       | 25.149                          | 100 year +40% CC 960 minute winter  | 16.847                       | 6.697                           |
| 100 year +40% CC 240 minute summer | 75.977                       | 20.078                          | 100 year +40% CC 1440 minute summer | 18.055                       | 4.839                           |
| 100 year +40% CC 240 minute winter | 50.477                       | 20.078                          | 100 year +40% CC 1440 minute winter | 12.134                       | 4.839                           |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%**

| Node Event                     | US Node    | Peak (mins)  | Level (m)  | Depth (m)     | Inflow (l/s)   | Node Vol (m³) | Flood (m³)    | Status     |
|--------------------------------|------------|--------------|------------|---------------|----------------|---------------|---------------|------------|
| 180 minute winter              | Soakaway 1 | 164          | 9.797      | 0.659         | 0.8            | 1.1407        | 0.0000        | OK         |
| 180 minute winter              | Roof Area  | 156          | 9.797      | 0.597         | 1.0            | 0.7648        | 0.0000        | FLOOD RISK |
| Link Event<br>(Upstream Depth) | US Node    | Link         | DS Node    | Outflow (l/s) | Velocity (m/s) | Flow/Cap      | Link Vol (m³) |            |
| 180 minute winter              | Soakaway 1 | Infiltration |            | 0.2           |                |               |               |            |
| 180 minute winter              | Roof Area  | 1.000        | Soakaway 1 | 0.8           | 0.521          | 0.042         | 0.0880        |            |

## Design Settings

|                       |                   |                                      |               |
|-----------------------|-------------------|--------------------------------------|---------------|
| Rainfall Methodology  | FSR               | Maximum Time of Concentration (mins) | 30.00         |
| Return Period (years) | 100               | Maximum Rainfall (mm/hr)             | 50.0          |
| Additional Flow (%)   | 40                | Minimum Velocity (m/s)               | 1.00          |
| FSR Region            | England and Wales | Connection Type                      | Level Soffits |
| M5-60 (mm)            | 20.000            | Minimum Backdrop Height (m)          | 0.200         |
| Ratio-R               | 0.400             | Preferred Cover Depth (m)            | 1.200         |
| CV                    | 0.750             | Include Intermediate Ground          | ✓             |
| Time of Entry (mins)  | 4.00              | Enforce best practice design rules   | ✓             |

## Circular Link Type

Shape Circular | Barrels 1 | Auto Increment (mm) 75 | Follow Ground x

## Available Diameters (mm)

100 | 150

## Nodes

|   | Name       | Area<br>(ha) | T of E<br>(mins) | Cover<br>Level<br>(m) | Node<br>Type | Manhole<br>Type | Diameter<br>(mm) | Depth<br>(m) |
|---|------------|--------------|------------------|-----------------------|--------------|-----------------|------------------|--------------|
| ✓ | Soakaway 1 |              |                  | 10.000                | Junction     |                 |                  | 0.862        |
| ✓ | Roof Area  | 0.023        | 4.00             | 10.000                | Manhole      | Adoptable       | 1200             | 0.800        |

## Links

| Name    | US Node   | DS Node    | Length (m) | ks (mm) / n | Velocity Equation | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | Link Type | T of C (mins) | Rain (mm/hr) |
|---------|-----------|------------|------------|-------------|-------------------|-----------|-----------|----------|-------------|----------|-----------|---------------|--------------|
| ? 1.000 | Roof Area | Soakaway 1 | 5.000      | 0.600       | Colebrook-White   | 9.200     | 9.138     | 0.062    | 80.0        | 150      | Circular  | 4.07          | 50.0         |

| Name    | US Node   | DS Node    | Vel (m/s) | Cap (l/s) | Flow (l/s) | US Depth (m) | DS Depth (m) | Minimum Depth (m) | Maximum Depth (m) | Σ Area (ha) | Σ Add Inflow (l/s) | Pro Depth (mm) | Pro Velocity (m/s) |
|---------|-----------|------------|-----------|-----------|------------|--------------|--------------|-------------------|-------------------|-------------|--------------------|----------------|--------------------|
| ? 1.000 | Roof Area | Soakaway 1 | 1.125     | 19.9      | 4.4        | 0.650        | 0.712        | 0.650             | 0.712             | 0.023       | 0.0                | 48             | 0.904              |

## Simulation Settings

|                      |                   |                   |        |                            |      |
|----------------------|-------------------|-------------------|--------|----------------------------|------|
| Rainfall Methodology | FSR               | Summer CV         | 0.750  | Drain Down Time (mins)     | 2880 |
| FSR Region           | England and Wales | Winter CV         | 0.840  | Additional Storage (m³/ha) | 20.0 |
| M5-60 (mm)           | 20.000            | Analysis Speed    | Normal | Check Discharge Rate(s)    | x    |
| Ratio-R              | 0.400             | Skip Steady State | x      | Check Discharge Volume     | x    |

## Storm Durations

|    |    |    |     |     |     |     |     |     |     |     |      |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| 15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|-----------------------|-----------------------|-----------------------|-----------------------|
| 100                   | 40                    | 0                     | 0                     |

## Node Soakaway 1 Soakaway Storage Structure

|                             |         |                           |       |                |       |                 |   |
|-----------------------------|---------|---------------------------|-------|----------------|-------|-----------------|---|
| Base Inf Coefficient (m/hr) | 0.15000 | Porosity                  | 0.95  | Pit Width (m)  | 3.500 | Inf Depth (m)   |   |
| Side Inf Coefficient (m/hr) | 0.30000 | Invert Level (m)          | 8.500 | Pit Length (m) | 3.500 | Number Required | 1 |
| Safety Factor               | 2.0     | Time to half empty (mins) | 159   | Depth (m)      | 0.800 |                 |   |

### Rainfall

| Event                              | Peak<br>Intensity<br>(mm/hr) | Average<br>Intensity<br>(mm/hr) | Event                               | Peak<br>Intensity<br>(mm/hr) | Average<br>Intensity<br>(mm/hr) |
|------------------------------------|------------------------------|---------------------------------|-------------------------------------|------------------------------|---------------------------------|
| 100 year +40% CC 15 minute summer  | 488.233                      | 138.153                         | 100 year +40% CC 360 minute summer  | 56.677                       | 14.585                          |
| 100 year +40% CC 15 minute winter  | 342.620                      | 138.153                         | 100 year +40% CC 360 minute winter  | 36.841                       | 14.585                          |
| 100 year +40% CC 30 minute summer  | 320.551                      | 90.705                          | 100 year +40% CC 480 minute summer  | 43.979                       | 11.622                          |
| 100 year +40% CC 30 minute winter  | 224.948                      | 90.705                          | 100 year +40% CC 480 minute winter  | 29.219                       | 11.622                          |
| 100 year +40% CC 60 minute summer  | 214.603                      | 56.713                          | 100 year +40% CC 600 minute summer  | 35.604                       | 9.738                           |
| 100 year +40% CC 60 minute winter  | 142.577                      | 56.713                          | 100 year +40% CC 600 minute winter  | 24.327                       | 9.738                           |
| 100 year +40% CC 120 minute summer | 129.587                      | 34.246                          | 100 year +40% CC 720 minute summer  | 31.433                       | 8.424                           |
| 100 year +40% CC 120 minute winter | 86.094                       | 34.246                          | 100 year +40% CC 720 minute winter  | 21.125                       | 8.424                           |
| 100 year +40% CC 180 minute summer | 97.729                       | 25.149                          | 100 year +40% CC 960 minute summer  | 25.432                       | 6.697                           |
| 100 year +40% CC 180 minute winter | 63.526                       | 25.149                          | 100 year +40% CC 960 minute winter  | 16.847                       | 6.697                           |
| 100 year +40% CC 240 minute summer | 75.977                       | 20.078                          | 100 year +40% CC 1440 minute summer | 18.055                       | 4.839                           |
| 100 year +40% CC 240 minute winter | 50.477                       | 20.078                          | 100 year +40% CC 1440 minute winter | 12.134                       | 4.839                           |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%**

| Node Event                     | US<br>Node | Peak<br>(mins) | Level<br>(m) | Depth<br>(m)     | Inflow<br>(l/s)   | Node<br>Vol (m³) | Flood<br>(m³)    | Status     |
|--------------------------------|------------|----------------|--------------|------------------|-------------------|------------------|------------------|------------|
| 120 minute winter              | Soakaway 1 | 114            | 9.412        | 0.274            | 4.6               | 9.3162           | 0.0000           | OK         |
| 120 minute winter              | Roof Area  | 114            | 9.412        | 0.212            | 4.6               | 0.3613           | 0.0000           | SURCHARGED |
| Link Event<br>(Upstream Depth) | US<br>Node | Link           | DS<br>Node   | Outflow<br>(l/s) | Velocity<br>(m/s) | Flow/Cap         | Link<br>Vol (m³) |            |
| 120 minute winter              | Soakaway 1 | Infiltration   |              | 0.7              |                   |                  |                  |            |
| 120 minute winter              | Roof Area  | 1.000          | Soakaway 1   | 4.6              | 0.892             | 0.231            | 0.0880           |            |

## Design Settings

|                       |                   |                                      |               |
|-----------------------|-------------------|--------------------------------------|---------------|
| Rainfall Methodology  | FSR               | Maximum Time of Concentration (mins) | 30.00         |
| Return Period (years) | 100               | Maximum Rainfall (mm/hr)             | 50.0          |
| Additional Flow (%)   | 40                | Minimum Velocity (m/s)               | 1.00          |
| FSR Region            | England and Wales | Connection Type                      | Level Soffits |
| M5-60 (mm)            | 20.000            | Minimum Backdrop Height (m)          | 0.200         |
| Ratio-R               | 0.400             | Preferred Cover Depth (m)            | 1.200         |
| CV                    | 0.750             | Include Intermediate Ground          | ✓             |
| Time of Entry (mins)  | 4.00              | Enforce best practice design rules   | ✓             |

## Circular Link Type

Shape Circular | Barrels 1 | Auto Increment (mm) 75 | Follow Ground x

## Available Diameters (mm)

100 | 150

## Nodes

|   | Name       | Area<br>(ha) | T of E<br>(mins) | Cover<br>Level<br>(m) | Node<br>Type | Manhole<br>Type | Diameter<br>(mm) | Depth<br>(m) |
|---|------------|--------------|------------------|-----------------------|--------------|-----------------|------------------|--------------|
| ✓ | Soakaway 1 |              |                  | 10.000                | Junction     |                 |                  | 0.862        |
| ✓ | Roof Area  | 0.006        | 4.00             | 10.000                | Manhole      | Adoptable       | 1200             | 0.800        |

## Links

| Name    | US Node   | DS Node    | Length (m) | ks (mm) / n | Velocity Equation | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | Link Type | T of C (mins) | Rain (mm/hr) |
|---------|-----------|------------|------------|-------------|-------------------|-----------|-----------|----------|-------------|----------|-----------|---------------|--------------|
| ? 1.000 | Roof Area | Soakaway 1 | 5.000      | 0.600       | Colebrook-White   | 9.200     | 9.138     | 0.062    | 80.0        | 150      | Circular  | 4.07          | 50.0         |

| Name    | US Node   | DS Node    | Vel (m/s) | Cap (l/s) | Flow (l/s) | US Depth (m) | DS Depth (m) | Minimum Depth (m) | Maximum Depth (m) | Σ Area (ha) | Σ Add Inflow (l/s) | Pro Depth (mm) | Pro Velocity (m/s) |
|---------|-----------|------------|-----------|-----------|------------|--------------|--------------|-------------------|-------------------|-------------|--------------------|----------------|--------------------|
| ? 1.000 | Roof Area | Soakaway 1 | 1.125     | 19.9      | 1.1        | 0.650        | 0.712        | 0.650             | 0.712             | 0.006       | 0.0                | 24             | 0.609              |

## Simulation Settings

|                      |                   |                   |        |                            |      |
|----------------------|-------------------|-------------------|--------|----------------------------|------|
| Rainfall Methodology | FSR               | Summer CV         | 0.750  | Drain Down Time (mins)     | 2880 |
| FSR Region           | England and Wales | Winter CV         | 0.840  | Additional Storage (m³/ha) | 20.0 |
| M5-60 (mm)           | 20.000            | Analysis Speed    | Normal | Check Discharge Rate(s)    | x    |
| Ratio-R              | 0.400             | Skip Steady State | x      | Check Discharge Volume     | x    |

## Storm Durations

|    |    |    |     |     |     |     |     |     |     |     |      |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| 15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|-----------------------|-----------------------|-----------------------|-----------------------|
| 100                   | 40                    | 0                     | 0                     |

## Node Soakaway 1 Soakaway Storage Structure

|                             |         |                           |       |                |       |                 |   |
|-----------------------------|---------|---------------------------|-------|----------------|-------|-----------------|---|
| Base Inf Coefficient (m/hr) | 0.15000 | Porosity                  | 0.95  | Pit Width (m)  | 1.000 | Inf Depth (m)   |   |
| Side Inf Coefficient (m/hr) | 0.30000 | Invert Level (m)          | 8.500 | Pit Length (m) | 1.500 | Number Required | 1 |
| Safety Factor               | 2.0     | Time to half empty (mins) | 83    | Depth (m)      | 0.800 |                 |   |

### Rainfall

| Event                              | Peak<br>Intensity<br>(mm/hr) | Average<br>Intensity<br>(mm/hr) | Event                               | Peak<br>Intensity<br>(mm/hr) | Average<br>Intensity<br>(mm/hr) |
|------------------------------------|------------------------------|---------------------------------|-------------------------------------|------------------------------|---------------------------------|
| 100 year +40% CC 15 minute summer  | 488.233                      | 138.153                         | 100 year +40% CC 360 minute summer  | 56.677                       | 14.585                          |
| 100 year +40% CC 15 minute winter  | 342.620                      | 138.153                         | 100 year +40% CC 360 minute winter  | 36.841                       | 14.585                          |
| 100 year +40% CC 30 minute summer  | 320.551                      | 90.705                          | 100 year +40% CC 480 minute summer  | 43.979                       | 11.622                          |
| 100 year +40% CC 30 minute winter  | 224.948                      | 90.705                          | 100 year +40% CC 480 minute winter  | 29.219                       | 11.622                          |
| 100 year +40% CC 60 minute summer  | 214.603                      | 56.713                          | 100 year +40% CC 600 minute summer  | 35.604                       | 9.738                           |
| 100 year +40% CC 60 minute winter  | 142.577                      | 56.713                          | 100 year +40% CC 600 minute winter  | 24.327                       | 9.738                           |
| 100 year +40% CC 120 minute summer | 129.587                      | 34.246                          | 100 year +40% CC 720 minute summer  | 31.433                       | 8.424                           |
| 100 year +40% CC 120 minute winter | 86.094                       | 34.246                          | 100 year +40% CC 720 minute winter  | 21.125                       | 8.424                           |
| 100 year +40% CC 180 minute summer | 97.729                       | 25.149                          | 100 year +40% CC 960 minute summer  | 25.432                       | 6.697                           |
| 100 year +40% CC 180 minute winter | 63.526                       | 25.149                          | 100 year +40% CC 960 minute winter  | 16.847                       | 6.697                           |
| 100 year +40% CC 240 minute summer | 75.977                       | 20.078                          | 100 year +40% CC 1440 minute summer | 18.055                       | 4.839                           |
| 100 year +40% CC 240 minute winter | 50.477                       | 20.078                          | 100 year +40% CC 1440 minute winter | 12.134                       | 4.839                           |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%**

| Node Event                     | US Node    | Peak (mins)  | Level (m)  | Depth (m)     | Inflow (l/s)   | Node Vol (m³) | Flood (m³)    | Status     |
|--------------------------------|------------|--------------|------------|---------------|----------------|---------------|---------------|------------|
| 180 minute winter              | Soakaway 1 | 164          | 9.797      | 0.659         | 0.8            | 1.1407        | 0.0000        | OK         |
| 180 minute winter              | Roof Area  | 156          | 9.797      | 0.597         | 1.0            | 0.7648        | 0.0000        | FLOOD RISK |
| Link Event<br>(Upstream Depth) | US Node    | Link         | DS Node    | Outflow (l/s) | Velocity (m/s) | Flow/Cap      | Link Vol (m³) |            |
| 180 minute winter              | Soakaway 1 | Infiltration |            | 0.2           |                |               |               |            |
| 180 minute winter              | Roof Area  | 1.000        | Soakaway 1 | 0.8           | 0.521          | 0.042         | 0.0880        |            |

## Design Settings

|                       |                   |                                      |               |
|-----------------------|-------------------|--------------------------------------|---------------|
| Rainfall Methodology  | FSR               | Maximum Time of Concentration (mins) | 30.00         |
| Return Period (years) | 100               | Maximum Rainfall (mm/hr)             | 50.0          |
| Additional Flow (%)   | 40                | Minimum Velocity (m/s)               | 1.00          |
| FSR Region            | England and Wales | Connection Type                      | Level Soffits |
| M5-60 (mm)            | 20.000            | Minimum Backdrop Height (m)          | 0.200         |
| Ratio-R               | 0.400             | Preferred Cover Depth (m)            | 1.200         |
| CV                    | 0.750             | Include Intermediate Ground          | ✓             |
| Time of Entry (mins)  | 4.00              | Enforce best practice design rules   | ✓             |

## Circular Link Type

Shape Circular | Barrels 1 | Auto Increment (mm) 75 | Follow Ground x

## Available Diameters (mm)

100 | 150

## Nodes

|   | Name       | Area<br>(ha) | T of E<br>(mins) | Cover<br>Level<br>(m) | Node<br>Type | Manhole<br>Type | Diameter<br>(mm) | Depth<br>(m) |
|---|------------|--------------|------------------|-----------------------|--------------|-----------------|------------------|--------------|
| ✓ | Soakaway 1 |              |                  | 10.000                | Junction     |                 |                  | 0.862        |
| ✓ | Roof Area  | 0.017        | 4.00             | 10.000                | Manhole      | Adoptable       | 1200             | 0.800        |

## Links

| Name    | US Node   | DS Node    | Length (m) | ks (mm) / n | Velocity Equation | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | Link Type | T of C (mins) | Rain (mm/hr) |
|---------|-----------|------------|------------|-------------|-------------------|-----------|-----------|----------|-------------|----------|-----------|---------------|--------------|
| ? 1.000 | Roof Area | Soakaway 1 | 5.000      | 0.600       | Colebrook-White   | 9.200     | 9.138     | 0.062    | 80.0        | 150      | Circular  | 4.07          | 50.0         |

| Name    | US Node   | DS Node    | Vel (m/s) | Cap (l/s) | Flow (l/s) | US Depth (m) | DS Depth (m) | Minimum Depth (m) | Maximum Depth (m) | Σ Area (ha) | Σ Add Inflow (l/s) | Pro Depth (mm) | Pro Velocity (m/s) |
|---------|-----------|------------|-----------|-----------|------------|--------------|--------------|-------------------|-------------------|-------------|--------------------|----------------|--------------------|
| ? 1.000 | Roof Area | Soakaway 1 | 1.125     | 19.9      | 3.2        | 0.650        | 0.712        | 0.650             | 0.712             | 0.017       | 0.0                | 41             | 0.828              |

## Simulation Settings

|                      |                   |                   |        |                            |      |
|----------------------|-------------------|-------------------|--------|----------------------------|------|
| Rainfall Methodology | FSR               | Summer CV         | 0.750  | Drain Down Time (mins)     | 2880 |
| FSR Region           | England and Wales | Winter CV         | 0.840  | Additional Storage (m³/ha) | 20.0 |
| M5-60 (mm)           | 20.000            | Analysis Speed    | Normal | Check Discharge Rate(s)    | x    |
| Ratio-R              | 0.400             | Skip Steady State | x      | Check Discharge Volume     | x    |

## Storm Durations

|    |    |    |     |     |     |     |     |     |     |     |      |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| 15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|-----------------------|-----------------------|-----------------------|-----------------------|
| 100                   | 40                    | 0                     | 0                     |

## Node Soakaway 1 Soakaway Storage Structure

|                             |         |                           |       |                |       |                 |   |
|-----------------------------|---------|---------------------------|-------|----------------|-------|-----------------|---|
| Base Inf Coefficient (m/hr) | 0.15000 | Porosity                  | 0.95  | Pit Width (m)  | 3.000 | Inf Depth (m)   |   |
| Side Inf Coefficient (m/hr) | 0.30000 | Invert Level (m)          | 8.500 | Pit Length (m) | 3.000 | Number Required | 1 |
| Safety Factor               | 2.0     | Time to half empty (mins) | 147   | Depth (m)      | 0.800 |                 |   |

### Rainfall

| Event                              | Peak<br>Intensity<br>(mm/hr) | Average<br>Intensity<br>(mm/hr) | Event                               | Peak<br>Intensity<br>(mm/hr) | Average<br>Intensity<br>(mm/hr) |
|------------------------------------|------------------------------|---------------------------------|-------------------------------------|------------------------------|---------------------------------|
| 100 year +40% CC 15 minute summer  | 488.233                      | 138.153                         | 100 year +40% CC 360 minute summer  | 56.677                       | 14.585                          |
| 100 year +40% CC 15 minute winter  | 342.620                      | 138.153                         | 100 year +40% CC 360 minute winter  | 36.841                       | 14.585                          |
| 100 year +40% CC 30 minute summer  | 320.551                      | 90.705                          | 100 year +40% CC 480 minute summer  | 43.979                       | 11.622                          |
| 100 year +40% CC 30 minute winter  | 224.948                      | 90.705                          | 100 year +40% CC 480 minute winter  | 29.219                       | 11.622                          |
| 100 year +40% CC 60 minute summer  | 214.603                      | 56.713                          | 100 year +40% CC 600 minute summer  | 35.604                       | 9.738                           |
| 100 year +40% CC 60 minute winter  | 142.577                      | 56.713                          | 100 year +40% CC 600 minute winter  | 24.327                       | 9.738                           |
| 100 year +40% CC 120 minute summer | 129.587                      | 34.246                          | 100 year +40% CC 720 minute summer  | 31.433                       | 8.424                           |
| 100 year +40% CC 120 minute winter | 86.094                       | 34.246                          | 100 year +40% CC 720 minute winter  | 21.125                       | 8.424                           |
| 100 year +40% CC 180 minute summer | 97.729                       | 25.149                          | 100 year +40% CC 960 minute summer  | 25.432                       | 6.697                           |
| 100 year +40% CC 180 minute winter | 63.526                       | 25.149                          | 100 year +40% CC 960 minute winter  | 16.847                       | 6.697                           |
| 100 year +40% CC 240 minute summer | 75.977                       | 20.078                          | 100 year +40% CC 1440 minute summer | 18.055                       | 4.839                           |
| 100 year +40% CC 240 minute winter | 50.477                       | 20.078                          | 100 year +40% CC 1440 minute winter | 12.134                       | 4.839                           |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%**

| Node Event        | US<br>Node | Peak<br>(mins) | Level<br>(m) | Depth<br>(m) | Inflow<br>(l/s) | Node<br>Vol (m³) | Flood<br>(m³) | Status |
|-------------------|------------|----------------|--------------|--------------|-----------------|------------------|---------------|--------|
| 120 minute winter | Soakaway 1 | 106            | 9.319        | 0.181        | 3.4             | 6.8443           | 0.0000        | OK     |
| 120 minute winter | Roof Area  | 112            | 9.319        | 0.119        | 3.4             | 0.1856           | 0.0000        | OK     |

| Link Event<br>(Upstream Depth) | US<br>Node | Link         | DS<br>Node | Outflow<br>(l/s) | Velocity<br>(m/s) | Flow/Cap | Link<br>Vol (m³) |
|--------------------------------|------------|--------------|------------|------------------|-------------------|----------|------------------|
| 120 minute winter              | Soakaway 1 | Infiltration |            | 0.6              |                   |          |                  |
| 120 minute winter              | Roof Area  | 1.000        | Soakaway 1 | 3.4              | 0.823             | 0.171    | 0.0816           |

## Design Settings

|                       |                   |                                      |               |
|-----------------------|-------------------|--------------------------------------|---------------|
| Rainfall Methodology  | FSR               | Maximum Time of Concentration (mins) | 30.00         |
| Return Period (years) | 100               | Maximum Rainfall (mm/hr)             | 50.0          |
| Additional Flow (%)   | 40                | Minimum Velocity (m/s)               | 1.00          |
| FSR Region            | England and Wales | Connection Type                      | Level Soffits |
| M5-60 (mm)            | 20.000            | Minimum Backdrop Height (m)          | 0.200         |
| Ratio-R               | 0.400             | Preferred Cover Depth (m)            | 1.200         |
| CV                    | 0.750             | Include Intermediate Ground          | ✓             |
| Time of Entry (mins)  | 4.00              | Enforce best practice design rules   | ✓             |

## Circular Link Type

Shape Circular | Barrels 1 | Auto Increment (mm) 75 | Follow Ground x

## Available Diameters (mm)

100 | 150

## Nodes

|   | Name       | Area<br>(ha) | T of E<br>(mins) | Cover<br>Level<br>(m) | Node<br>Type | Manhole<br>Type | Diameter<br>(mm) | Depth<br>(m) |
|---|------------|--------------|------------------|-----------------------|--------------|-----------------|------------------|--------------|
| ✓ | Soakaway 1 |              |                  | 10.000                | Junction     |                 |                  | 0.862        |
| ✓ | Roof Area  | 0.007        | 4.00             | 10.000                | Manhole      | Adoptable       | 1200             | 0.800        |

## Links

| Name    | US Node   | DS Node    | Length (m) | ks (mm) / n | Velocity Equation | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | Link Type | T of C (mins) | Rain (mm/hr) |
|---------|-----------|------------|------------|-------------|-------------------|-----------|-----------|----------|-------------|----------|-----------|---------------|--------------|
| ? 1.000 | Roof Area | Soakaway 1 | 5.000      | 0.600       | Colebrook-White   | 9.200     | 9.138     | 0.062    | 80.0        | 150      | Circular  | 4.07          | 50.0         |

| Name    | US Node   | DS Node    | Vel (m/s) | Cap (l/s) | Flow (l/s) | US Depth (m) | DS Depth (m) | Minimum Depth (m) | Maximum Depth (m) | Σ Area (ha) | Σ Add Inflow (l/s) | Pro Depth (mm) | Pro Velocity (m/s) |
|---------|-----------|------------|-----------|-----------|------------|--------------|--------------|-------------------|-------------------|-------------|--------------------|----------------|--------------------|
| ? 1.000 | Roof Area | Soakaway 1 | 1.125     | 19.9      | 1.3        | 0.650        | 0.712        | 0.650             | 0.712             | 0.007       | 0.0                | 26             | 0.636              |

## Simulation Settings

|                      |                   |                   |        |                            |      |
|----------------------|-------------------|-------------------|--------|----------------------------|------|
| Rainfall Methodology | FSR               | Summer CV         | 0.750  | Drain Down Time (mins)     | 2880 |
| FSR Region           | England and Wales | Winter CV         | 0.840  | Additional Storage (m³/ha) | 20.0 |
| M5-60 (mm)           | 20.000            | Analysis Speed    | Normal | Check Discharge Rate(s)    | x    |
| Ratio-R              | 0.400             | Skip Steady State | x      | Check Discharge Volume     | x    |

## Storm Durations

|    |    |    |     |     |     |     |     |     |     |     |      |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| 15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|-----------------------|-----------------------|-----------------------|-----------------------|
| 100                   | 40                    | 0                     | 0                     |

## Node Soakaway 1 Soakaway Storage Structure

|                             |         |                           |       |                |       |                 |   |
|-----------------------------|---------|---------------------------|-------|----------------|-------|-----------------|---|
| Base Inf Coefficient (m/hr) | 0.15000 | Porosity                  | 0.95  | Pit Width (m)  | 1.500 | Inf Depth (m)   |   |
| Side Inf Coefficient (m/hr) | 0.30000 | Invert Level (m)          | 8.500 | Pit Length (m) | 1.500 | Number Required | 1 |
| Safety Factor               | 2.0     | Time to half empty (mins) | 97    | Depth (m)      | 0.800 |                 |   |

### Rainfall

| Event                              | Peak<br>Intensity<br>(mm/hr) | Average<br>Intensity<br>(mm/hr) | Event                               | Peak<br>Intensity<br>(mm/hr) | Average<br>Intensity<br>(mm/hr) |
|------------------------------------|------------------------------|---------------------------------|-------------------------------------|------------------------------|---------------------------------|
| 100 year +40% CC 15 minute summer  | 488.233                      | 138.153                         | 100 year +40% CC 360 minute summer  | 56.677                       | 14.585                          |
| 100 year +40% CC 15 minute winter  | 342.620                      | 138.153                         | 100 year +40% CC 360 minute winter  | 36.841                       | 14.585                          |
| 100 year +40% CC 30 minute summer  | 320.551                      | 90.705                          | 100 year +40% CC 480 minute summer  | 43.979                       | 11.622                          |
| 100 year +40% CC 30 minute winter  | 224.948                      | 90.705                          | 100 year +40% CC 480 minute winter  | 29.219                       | 11.622                          |
| 100 year +40% CC 60 minute summer  | 214.603                      | 56.713                          | 100 year +40% CC 600 minute summer  | 35.604                       | 9.738                           |
| 100 year +40% CC 60 minute winter  | 142.577                      | 56.713                          | 100 year +40% CC 600 minute winter  | 24.327                       | 9.738                           |
| 100 year +40% CC 120 minute summer | 129.587                      | 34.246                          | 100 year +40% CC 720 minute summer  | 31.433                       | 8.424                           |
| 100 year +40% CC 120 minute winter | 86.094                       | 34.246                          | 100 year +40% CC 720 minute winter  | 21.125                       | 8.424                           |
| 100 year +40% CC 180 minute summer | 97.729                       | 25.149                          | 100 year +40% CC 960 minute summer  | 25.432                       | 6.697                           |
| 100 year +40% CC 180 minute winter | 63.526                       | 25.149                          | 100 year +40% CC 960 minute winter  | 16.847                       | 6.697                           |
| 100 year +40% CC 240 minute summer | 75.977                       | 20.078                          | 100 year +40% CC 1440 minute summer | 18.055                       | 4.839                           |
| 100 year +40% CC 240 minute winter | 50.477                       | 20.078                          | 100 year +40% CC 1440 minute winter | 12.134                       | 4.839                           |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%**

| Node Event                  | US Node    | Peak (mins)  | Level (m)  | Depth (m)     | Inflow (l/s)   | Node Vol (m³) | Flood (m³)    | Status     |
|-----------------------------|------------|--------------|------------|---------------|----------------|---------------|---------------|------------|
| 120 minute winter           | Soakaway 1 | 106          | 9.706      | 0.568         | 1.4            | 1.7115        | 0.0000        | OK         |
| 120 minute winter           | Roof Area  | 104          | 9.705      | 0.505         | 1.4            | 0.6594        | 0.0000        | FLOOD RISK |
| Link Event (Upstream Depth) | US Node    | Link         | DS Node    | Outflow (l/s) | Velocity (m/s) | Flow/Cap      | Link Vol (m³) |            |
| 120 minute winter           | Soakaway 1 | Infiltration |            | 0.2           |                |               |               |            |
| 120 minute winter           | Roof Area  | 1.000        | Soakaway 1 | 1.4           | 0.627          | 0.070         | 0.0880        |            |

## Design Settings

|                       |                   |                                      |               |
|-----------------------|-------------------|--------------------------------------|---------------|
| Rainfall Methodology  | FSR               | Maximum Time of Concentration (mins) | 30.00         |
| Return Period (years) | 100               | Maximum Rainfall (mm/hr)             | 50.0          |
| Additional Flow (%)   | 40                | Minimum Velocity (m/s)               | 1.00          |
| FSR Region            | England and Wales | Connection Type                      | Level Soffits |
| M5-60 (mm)            | 20.000            | Minimum Backdrop Height (m)          | 0.200         |
| Ratio-R               | 0.400             | Preferred Cover Depth (m)            | 1.200         |
| CV                    | 0.750             | Include Intermediate Ground          | ✓             |
| Time of Entry (mins)  | 4.00              | Enforce best practice design rules   | ✓             |

## Circular Link Type

Shape Circular | Barrels 1 | Auto Increment (mm) 75 | Follow Ground x

## Available Diameters (mm)

100 | 150

## Nodes

|   | Name       | Area<br>(ha) | T of E<br>(mins) | Cover<br>Level<br>(m) | Node<br>Type | Manhole<br>Type | Diameter<br>(mm) | Depth<br>(m) |
|---|------------|--------------|------------------|-----------------------|--------------|-----------------|------------------|--------------|
| ✓ | Soakaway 1 |              |                  | 10.000                | Junction     |                 |                  | 0.862        |
| ✓ | Roof Area  | 0.015        | 4.00             | 10.000                | Manhole      | Adoptable       | 1200             | 0.800        |

## Links

| Name    | US Node   | DS Node    | Length (m) | ks (mm) / n | Velocity Equation | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | Link Type | T of C (mins) | Rain (mm/hr) |
|---------|-----------|------------|------------|-------------|-------------------|-----------|-----------|----------|-------------|----------|-----------|---------------|--------------|
| ? 1.000 | Roof Area | Soakaway 1 | 5.000      | 0.600       | Colebrook-White   | 9.200     | 9.138     | 0.062    | 80.0        | 150      | Circular  | 4.07          | 50.0         |

| Name    | US Node   | DS Node    | Vel (m/s) | Cap (l/s) | Flow (l/s) | US Depth (m) | DS Depth (m) | Minimum Depth (m) | Maximum Depth (m) | Σ Area (ha) | Σ Add Inflow (l/s) | Pro Depth (mm) | Pro Velocity (m/s) |
|---------|-----------|------------|-----------|-----------|------------|--------------|--------------|-------------------|-------------------|-------------|--------------------|----------------|--------------------|
| ? 1.000 | Roof Area | Soakaway 1 | 1.125     | 19.9      | 2.8        | 0.650        | 0.712        | 0.650             | 0.712             | 0.015       | 0.0                | 38             | 0.801              |

## Simulation Settings

|                      |                   |                   |        |                            |      |
|----------------------|-------------------|-------------------|--------|----------------------------|------|
| Rainfall Methodology | FSR               | Summer CV         | 0.750  | Drain Down Time (mins)     | 2880 |
| FSR Region           | England and Wales | Winter CV         | 0.840  | Additional Storage (m³/ha) | 20.0 |
| M5-60 (mm)           | 20.000            | Analysis Speed    | Normal | Check Discharge Rate(s)    | x    |
| Ratio-R              | 0.400             | Skip Steady State | x      | Check Discharge Volume     | x    |

## Storm Durations

|    |    |    |     |     |     |     |     |     |     |     |      |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| 15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|-----------------------|-----------------------|-----------------------|-----------------------|
| 100                   | 40                    | 0                     | 0                     |

## Node Soakaway 1 Soakaway Storage Structure

|                             |         |                           |       |                |       |                 |   |
|-----------------------------|---------|---------------------------|-------|----------------|-------|-----------------|---|
| Base Inf Coefficient (m/hr) | 0.15000 | Porosity                  | 0.95  | Pit Width (m)  | 2.500 | Inf Depth (m)   |   |
| Side Inf Coefficient (m/hr) | 0.30000 | Invert Level (m)          | 8.500 | Pit Length (m) | 2.500 | Number Required | 1 |
| Safety Factor               | 2.0     | Time to half empty (mins) | 133   | Depth (m)      | 0.800 |                 |   |

### Rainfall

| Event                              | Peak<br>Intensity<br>(mm/hr) | Average<br>Intensity<br>(mm/hr) | Event                               | Peak<br>Intensity<br>(mm/hr) | Average<br>Intensity<br>(mm/hr) |
|------------------------------------|------------------------------|---------------------------------|-------------------------------------|------------------------------|---------------------------------|
| 100 year +40% CC 15 minute summer  | 488.233                      | 138.153                         | 100 year +40% CC 360 minute summer  | 56.677                       | 14.585                          |
| 100 year +40% CC 15 minute winter  | 342.620                      | 138.153                         | 100 year +40% CC 360 minute winter  | 36.841                       | 14.585                          |
| 100 year +40% CC 30 minute summer  | 320.551                      | 90.705                          | 100 year +40% CC 480 minute summer  | 43.979                       | 11.622                          |
| 100 year +40% CC 30 minute winter  | 224.948                      | 90.705                          | 100 year +40% CC 480 minute winter  | 29.219                       | 11.622                          |
| 100 year +40% CC 60 minute summer  | 214.603                      | 56.713                          | 100 year +40% CC 600 minute summer  | 35.604                       | 9.738                           |
| 100 year +40% CC 60 minute winter  | 142.577                      | 56.713                          | 100 year +40% CC 600 minute winter  | 24.327                       | 9.738                           |
| 100 year +40% CC 120 minute summer | 129.587                      | 34.246                          | 100 year +40% CC 720 minute summer  | 31.433                       | 8.424                           |
| 100 year +40% CC 120 minute winter | 86.094                       | 34.246                          | 100 year +40% CC 720 minute winter  | 21.125                       | 8.424                           |
| 100 year +40% CC 180 minute summer | 97.729                       | 25.149                          | 100 year +40% CC 960 minute summer  | 25.432                       | 6.697                           |
| 100 year +40% CC 180 minute winter | 63.526                       | 25.149                          | 100 year +40% CC 960 minute winter  | 16.847                       | 6.697                           |
| 100 year +40% CC 240 minute summer | 75.977                       | 20.078                          | 100 year +40% CC 1440 minute summer | 18.055                       | 4.839                           |
| 100 year +40% CC 240 minute winter | 50.477                       | 20.078                          | 100 year +40% CC 1440 minute winter | 12.134                       | 4.839                           |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%**

| Node Event                     | US Node    | Peak (mins)  | Level (m)  | Depth (m)     | Inflow (l/s)   | Node Vol (m³) | Flood (m³)    | Status     |
|--------------------------------|------------|--------------|------------|---------------|----------------|---------------|---------------|------------|
| 120 minute winter              | Soakaway 1 | 114          | 9.881      | 0.743         | 4.1            | 4.7534        | 0.0000        | OK         |
| 120 minute winter              | Roof Area  | 114          | 9.881      | 0.681         | 3.0            | 1.0257        | 0.0000        | FLOOD RISK |
| Link Event<br>(Upstream Depth) | US Node    | Link         | DS Node    | Outflow (l/s) | Velocity (m/s) | Flow/Cap      | Link Vol (m³) |            |
| 120 minute winter              | Soakaway 1 | Infiltration |            | 0.5           |                |               |               |            |
| 120 minute winter              | Roof Area  | 1.000        | Soakaway 1 | 4.1           | 0.795          | 0.208         | 0.0880        |            |

## Appendix 4 – Drainage Maintenance Schedule

| GULLIES, PIPEWORK, INSPECTION CHAMBERS AND CONTROLS                                                                                |                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><u>Required Action</u></b>                                                                                                      | <b><u>Frequency</u></b>                                                                                                                                                                                                                                                                                                      |
| <b>Regular Maintenance</b>                                                                                                         |                                                                                                                                                                                                                                                                                                                              |
| Remove cover and inspect chambers and pipework ensuring water is flowing freely and that the exit route for water is unobstructed. | Annually                                                                                                                                                                                                                                                                                                                     |
| Undertake inspection after leaf fall in autumn, remove leaves from gullies, chambers and pipes                                     | Every autumn                                                                                                                                                                                                                                                                                                                 |
| Inspect silt traps and clear of silt                                                                                               | Every 6 months or as required                                                                                                                                                                                                                                                                                                |
| Inspect catchpits and clear of silt                                                                                                | Every 6 months or as required                                                                                                                                                                                                                                                                                                |
| <b>Remedial work</b>                                                                                                               |                                                                                                                                                                                                                                                                                                                              |
| Remove debris, silt and leaves from inspection chambers and flow control chambers.                                                 | As required                                                                                                                                                                                                                                                                                                                  |
| Remove debris and silt from pipework through high pressure jet washing.                                                            | As required                                                                                                                                                                                                                                                                                                                  |
| Repair physical damage if necessary                                                                                                | As required                                                                                                                                                                                                                                                                                                                  |
| <b>Monitoring</b>                                                                                                                  |                                                                                                                                                                                                                                                                                                                              |
| CCTV survey to establish condition of pipe runs. Cleansing or repair of physical damage to be conducted if necessary               | Every 5 years or as required                                                                                                                                                                                                                                                                                                 |
| PERMEABLE AND POROUS SURFACES                                                                                                      |                                                                                                                                                                                                                                                                                                                              |
| <b><u>Required Action</u></b>                                                                                                      | <b><u>Frequency</u></b>                                                                                                                                                                                                                                                                                                      |
| <b>Regular Maintenance</b>                                                                                                         |                                                                                                                                                                                                                                                                                                                              |
| Brushing and vacuuming (standard cosmetic sweep over whole surface)                                                                | Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment |
| <b>Occasional Tasks</b>                                                                                                            |                                                                                                                                                                                                                                                                                                                              |
| Stabilise and mow contributing and adjacent areas                                                                                  | As required                                                                                                                                                                                                                                                                                                                  |
| Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying              | As required                                                                                                                                                                                                                                                                                                                  |

|                                                                                                                                                                                       |                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| <b>Remedial Work</b>                                                                                                                                                                  |                                                           |
| Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material. | As required                                               |
| Rehabilitation of surface and upper substructure by remedial sweeping                                                                                                                 | Every 10 to 15 years or as required                       |
| If efficiency of water percolating to the sub-base drops, jet washing and suction cleaning could substantially reinstate paving to 90% efficiency (as per recent experience).         | As required                                               |
| <b>Monitoring</b>                                                                                                                                                                     |                                                           |
| Initial inspection                                                                                                                                                                    | Monthly for three months after installation               |
| Inspect for evidence of poor operation and/or weed growth – if required, take remedial action                                                                                         | Three-monthly, 48h after large storms in first six months |
| Inspect silt accumulation rates and establish appropriate brushing frequencies                                                                                                        | Annually                                                  |
| Monitor inspection chambers                                                                                                                                                           | Annually                                                  |
| <b>GEOCELLULAR SOAKAWAY SYSTEM</b>                                                                                                                                                    |                                                           |
| <b><u>Required Action</u></b>                                                                                                                                                         | <b><u>Frequency</u></b>                                   |
| <b>Regular maintenance</b>                                                                                                                                                            |                                                           |
| Inspect and identify any areas that are not operating correctly. If required, take remedial action.                                                                                   | Monthly for 3 months, then annually                       |
| Remove debris from the catchment surface (where it may cause risks to performance).                                                                                                   | Monthly                                                   |
| Remove sediment from pre-treatment structures – all runoff entering the tank will need to have been routed through a catchpit with sediment filter.                                   | Annually or as required                                   |
| <b>Remedial</b>                                                                                                                                                                       |                                                           |
| Repair/rehabilitate inlets and vents                                                                                                                                                  | As required                                               |
| <b>Monitoring</b>                                                                                                                                                                     |                                                           |

|                                                                                                                                                                                                                                                                               |                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| Inspect/check all inlets and vents to ensure that they are in good condition and operating as designed                                                                                                                                                                        | Annually                     |
| If product allows for internal inspection, CCTV survey inside of tank for sediment build-up and remove if necessary (this could be through the Polystorm Access product suitable for the Polystorm Xtra crate system). Manufacturer's specific recommendation to be followed. | Every 5 years or as required |

## Appendix 5 – Infiltration Tests and BGS Borehole

# Percolation test results sheet

Site name:

WOODSIDE BARN  
Contact Telephone number: PLAS FOWER

Location ( Post Code ) :

LL11 3BP

Storm Event (Normally 1:100 Yr):

Climate Change % (Usually 40%):

(Once development has been completed) Roof area.....m<sup>2</sup> Hard standing.....m<sup>2</sup>

## Test Pit 1

| Length | Width | Depth |
|--------|-------|-------|
| 180cm  | 130cm | 150cm |

| Percolation Test (date/start time) |                 | Time taken to drain from 75%-25% |
|------------------------------------|-----------------|----------------------------------|
| 1                                  | 11/2/20 9.30 AM | 20 mins (2.5 hours TOTALLY DRY)  |
| 2                                  | 12/2/20 10 AM   | 37 mins                          |
| 3                                  | 16/2/20 9 AM    | 28 mins                          |

## Test Pit 2

| Length | Width | Depth |
|--------|-------|-------|
| 1.0 m  | 1.0 m | 1.5 m |

| Percolation Test (date/start time) |               | Time taken to drain from 75%-25% |
|------------------------------------|---------------|----------------------------------|
| 1                                  | 13/2/20 9 AM  | 39 mins                          |
| 2                                  | 14/2/20 9 AM  | 45 mins                          |
| 3                                  | 15/2/20 10 AM | 50 mins                          |

## Test Pit 3

| Length | Width | Depth |
|--------|-------|-------|
|        |       |       |

| Percolation Test (date/start time) |  | Time taken to drain from 75%-25% |
|------------------------------------|--|----------------------------------|
| 1                                  |  |                                  |
| 2                                  |  |                                  |
| 3                                  |  |                                  |

LOCATION : 45 Hope Street, Wrexham

5535 SW/478  
BOREHOLE No. Three

DATE OF BORING : 02.09.1985

| Description of Strata                                                                                                                                                                                                               | STRATA CHANGE                                                                     |            | S.P.T.<br>C.P.T.<br>N-VALUE | SAMPLES    |      | WATER<br>LEVEL<br>M | DEPTH<br>of<br>CASING<br>M |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------|-----------------------------|------------|------|---------------------|----------------------------|
|                                                                                                                                                                                                                                     | LEGEND                                                                            | DEPTH<br>M |                             | DEPTH<br>M | TYPE |                     |                            |
| MADE GROUND<br>Concrete ground slab over silty sand,<br>gravel and occasional clay balls,<br>brick, clinker and coal fragments.                                                                                                     |  | 1.00       | 18                          | 1.00       | B    |                     |                            |
| HEAD DEPOSITS<br>Medium, loose, dark red/brown, very<br>silty, coarse sandy CLAY with fine,<br>medium, coarse rounded GRAVEL with<br>angular, crystallised and arenaceous<br>limestones and rounded quartz cobbles<br>and boulders. |  | 2.00       | 23                          | 2.00       | B    |                     |                            |
| GLACIAL SANDS AND GRAVELS<br>Dense to very dense, fine, medium<br>coarse, cobble to boulder size,<br>angular to rounded GRAVEL with medium<br>to coarse SAND.                                                                       |  | 3.00       | 46                          | 3.00       | B    |                     |                            |
|                                                                                                                                                                                                                                     |                                                                                   | 4.00       | 52                          | 4.00       | B    |                     |                            |
|                                                                                                                                                                                                                                     |                                                                                   | 5.00       |                             | 5.00       | B    |                     |                            |
| ~ increase in large gravel.                                                                                                                                                                                                         |                                                                                   |            | 51                          | 5.50       | J    |                     |                            |
|                                                                                                                                                                                                                                     |                                                                                   | 6.00       |                             | 6.00       | B    |                     |                            |
|                                                                                                                                                                                                                                     |                                                                                   | 7.00       | 56                          | 7.00       | J    |                     |                            |
|                                                                                                                                                                                                                                     |                                                                                   | 8.00       |                             |            |      |                     |                            |
|                                                                                                                                                                                                                                     |                                                                                   | 9.00       |                             |            |      |                     |                            |
|                                                                                                                                                                                                                                     |                                                                                   | 10.00      |                             |            |      |                     |                            |

BOREHOLE DIAMETER : 150mm

LINING TUBES : 150mm

GROUND LEVEL : 100.00m

REMARKS : Borehole drilled from existing  
ground level.

X - Water strike  
 W - Water (standing level)  
 W - Water Sample  
 B/L - Bulk/Lar Sample  
 S.P.T. - Standard Penetration Test  
 C.P.T. - Cone Penetration Test  
 (U) - Undisturbed Sample 138mm & 100mm I

Date,  
August, 1985

BOREHOLE LOG

Report No.  
5.611