



Consulting Civil Engineers

## Surface Water Drainage Report

**Magnolia Cottage, Eastergate**

**Planning Reference Number: BN/4/21/HH**

**For**

**Lester Pena**

Rev - C

Reference **C1674**

Date **10<sup>th</sup> March 2022**

| Revision | Date of Issue | Comments      | Prepared By | Checked By |
|----------|---------------|---------------|-------------|------------|
| P        | 10.03.22      | Initial Issue | LH          | CS         |

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## 1 Introduction

- 1.1.1 CGS Civils Ltd have been appointed by Lester Pena to undertake a drainage strategy report for a proposed development at Magnolia Cottage, Eastergate.
- 1.1.2 The purpose of this drainage strategy is to demonstrate how the development area can be satisfactorily drained without increasing flood risk onsite and elsewhere.
- 1.1.3 The existing site consists of an existing single domestic dwelling. The proposed development will consist of an extension to the north-western elevation of the dwelling.
- 1.1.4 The total green line boundary is approximately 0.105 Ha, and the proposed development will result in an increase of 0.0023 Ha of impermeable area.
- 1.1.5 The proposed floor plan can be found in **Appendix A**.

Fig 1. Site Location

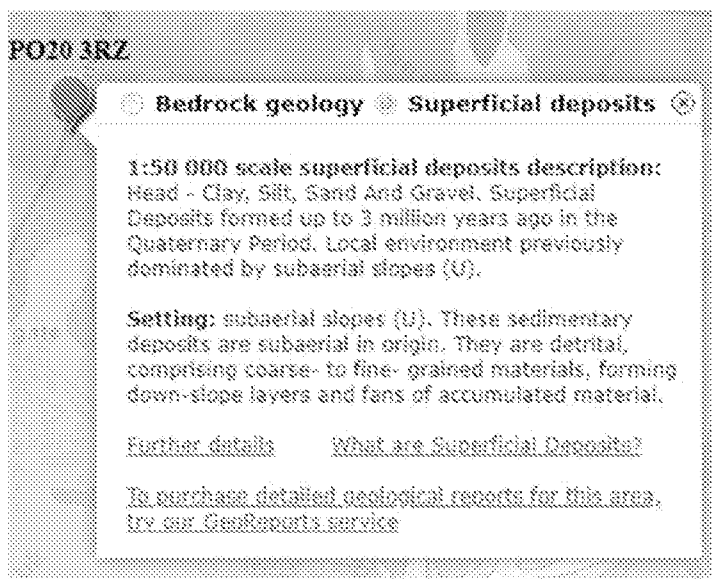
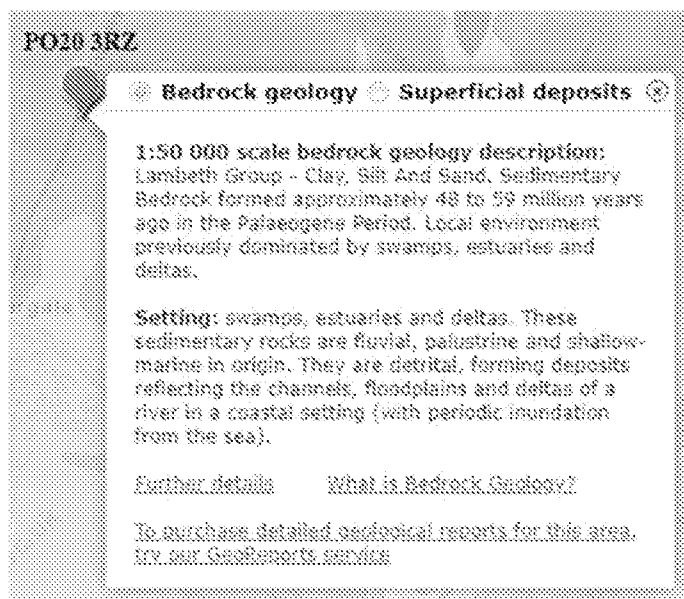


## 2 Site Geology

### 2.1 British Geological Survey information

- 2.1.1 The British Geological Survey confirms the bedrock geology to be made up of Lambeth Group i.e., Clay, Silt and Sand. Superficial deposits were noted as Head i.e., Clay, silt, sand, and gravel.
- 2.1.2 The British Geological survey also holds records of historical boreholes near the site which give some insight into the ground geology.
- BGS ID: 434302: BGS Reference: SU90NW75 (Located approx. 250m West of the site) – Brickearth i.e., Clays, silts, and pebbles

Fig 2. British Geological Survey



### 2.2 Geological Assessment

- 2.2.1 An onsite infiltration test to BRE365 was undertaken by CGS Civils on 11<sup>th</sup> February 2022. A Trial pit with the dimensions 300x1000x900mm deep was dug and filled with water until 75% full. The time it took for the water to soakaway from 75% to 25% full was noted and recorded and performed three times.
- 2.2.2 In addition to the soakaway test pit, a borehole was dug to a depth of 1.5m using a hand auger. This was covered and monitored over 48 hours and remained dry.
- 2.2.3 The results were calculated which confirmed an infiltration rate of 7.41x10<sup>-5</sup>m/s, this rate will be used for the proposed design. A copy of this test can be found in **Appendix E**.

## 3 Existing Drainage

- 3.1.1 It is not currently known how the existing site discharges surface water runoff. However due to the recorded infiltration rate, it can be safely presumed it discharges to ground via infiltration.

## 4 Proposed Drainage Strategy

### 4.1 SuDS Hierarchy

- 4.1.1 All options for the destination of run-off generated on site have been assessed in line with the SuDS hierarchy as set out in Building Regulations Part H document and DEFRA's Draft National Standards for SuDS.

| Discharge Destination            |                                                                      |
|----------------------------------|----------------------------------------------------------------------|
| Discharge to Ground              | Yes – Recorded Infiltration rate of $7.41 \times 10^{-5} \text{m/s}$ |
| Discharge to Watercourse         | N/A                                                                  |
| Discharge to Surface Water Sewer | N/A                                                                  |
| Discharge to Other Sewer         | N/A                                                                  |

### 4.2 Surface Water Drainage

- 4.2.1 In order to follow the SuDS hierarchy, the use of soakaways was investigated and an onsite infiltration test to BRE365 was carried out. This test yielded an infiltration rate of  $7.41 \times 10^{-5} \text{m/s}$  which is a good rate and infiltration will be possible. It is therefore proposed that all surface water runoff is to be discharged to ground via infiltration; all roof areas are to be collected into a positive drainage network before being discharged to ground via infiltration through the use of geocellular soakaway. The geocellular soakaway has been designed to cater for the 1 in 100-year +40% storm.
- 4.2.2 Hydraulic calculations have been carried out which can be found at **Appendix C**.

### 4.3 Water Quality

- 4.3.1 A key requirement of any SuDS system is that it protects the receiving water body from the risk of pollution.
- 4.3.2 Frequent and short duration rainfall events are those that are most loaded with potential contaminants (silts, fines, heavy metals, and various organic and inorganic contaminants) Therefore the first 5-10mm of rainfall should be adequately treated with SuDS.
- 4.3.3 The new SuDS Manual (Ciria C753, November 2015) introduces slightly different approach compared to the previous version for the water quality management of surface water. The Manual describes risks posed by the surface water runoff to the receiving environment as a function of:
- The pollution hazard at a particular site (i.e., the pollution source)
  - The effectiveness of SuDS treatment components in reducing levels of pollutants to environmentally acceptable levels
  - The sensitivity of the receiving environment
- 4.3.4 The EA website indicates that the site does not lie within a Source Protection Zone.
- 4.3.5 The recommended approaches for water quality risk management are given in the SuDS Manual Table 26.1.

**Fig 5. Approaches to Water Quality Risk Management**

| Table 26.1 Approaches to Water Quality Risk Management |                                                                                                                                                             |                                                                                                                                                                                                           |                                                                                                                  |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| Design method                                          | Hazard Characterisation                                                                                                                                     | Risk Reduction                                                                                                                                                                                            |                                                                                                                  |
|                                                        |                                                                                                                                                             | For Surface Water                                                                                                                                                                                         | For Groundwater                                                                                                  |
| Simple Index Approach                                  | Simple pollution hazard indices based on land use (Table 26.2)                                                                                              | Simple SuDS hazard mitigation indices (Table 26.3)                                                                                                                                                        | Simple SuDS hazard mitigation indices (Table 26.4)                                                               |
| Risk Screening                                         | Factors characterising traffic density and extent of infiltration likely to occur (Table 26.5)                                                              | N/A                                                                                                                                                                                                       | Factors characterising unsaturated soil depth and type, and predominant flow type through the soils (Table 26.5) |
| Detailed Risk Assessment                               | Site specific information used to define likely pollutants and their significance                                                                           | More detailed, component specific performance information used to demonstrate that the proposed SuDS components reduce the hazard to acceptable levels                                                    |                                                                                                                  |
| Process-based treatment modelling                      | Time series rainfall used with generic pollution characteristics to determine statistical distributions of likely concentrations and loadings in the runoff | Models that represent the treatment processes in the proposed SuDS components give estimates of reductions in even mean discharge concentrations and total annual load reductions delivered by the system |                                                                                                                  |

- 4.3.6 As per Table 26.1 Simple Index approach will be used as a design method for this site.
- 4.3.7 Table 26.2 will provide hazard classification of different land uses. The land uses for the surface water drainage for this site are.
- Residential Roofs
  - Individual Property driveways and residential car parks
  - Low traffic roads
- 4.3.8 To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index for each contaminant type that equals or exceeds the pollution hazard index for each contaminant type. Therefore, the following must be achieved for the surface running off the site.

**Total SuDS mitigation index  $\geq$  pollution hazard index**

4.3.9 Pollution Hazard Indices are given for different land uses in Table 26.2 of the SuDS manual;

**Fig 6. Pollution Hazard Indices for Different Land Use Classifications**

| Land Use                                                                                                                                                                                                                                                                                                     | Pollution Hazard Level | Total Suspended solids (TSS) | Metals                                                                     | Hydro-Carbons |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------------------|----------------------------------------------------------------------------|---------------|
| Residential roofs                                                                                                                                                                                                                                                                                            | Very Low               | 0.2                          | 0.2                                                                        | 0.05          |
| Other roofs (Typically commercial/industrial roofs)                                                                                                                                                                                                                                                          | Low                    | 0.3                          | 0.2 (up to 0.8 where there is potential for metals to leach from the roof) | 0.05          |
| Individual property driveways, residential car parks, low traffic roads (e.g., cul-de-sacs, homezones and general access roads) and non-residential car parking with infrequent change (e.g., schools, offices) i.e., < 300 traffic movements/day                                                            | Low                    | 0.5                          | 0.4                                                                        | 0.4           |
| Commercial yard and delivery areas, non-residential car parking with frequent change (e.g., hospitals, retail), all roads except low traffic roads and trunk roads/motorways                                                                                                                                 | Medium                 | 0.7                          | 0.6                                                                        | 0.7           |
| Sites with heavy pollution (e.g., haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways | High                   | 0.8                          | 0.8                                                                        | 0.9           |

4.3.10 From Table 26.2 the following information is tabulated in Table 1

**Table 1: Pollution hazard index and destination of runoff for the proposed site**

| Land Use         | Destination of Runoff | Pollution Hazard Level | Total Suspended Solids | Metals | Hydrocarbons |
|------------------|-----------------------|------------------------|------------------------|--------|--------------|
| Residential Roof | Ground Water          | Very Low               | 0.2                    | 0.2    | 0.05         |

4.3.11 As noted in the above statement – section 4.2.1 – there are no treatment measures in place on the proposed drainage network, however, the pollutants that will be discharged into the groundwater will be negligible due to it being only residential roof runoff and all TSS will be caught within the silt trap within the network.

## 5 Maintenance

### 5.1 Introduction

- 5.1.1 During construction, the Contractor will be responsible for maintaining the drainage and SuDS (Sustainable Drainage Systems). Upon handover, the occupier will take on the responsibility of these duties as laid out in this report.
- 5.1.2 The maintenance schedule for the proposed development will be split down into two separate categories; SuDS features and regular private drainage.

### 5.2 SuDS at Magnolia Cottage, Eastergate

- 5.2.1 As listed above, in section 5.1.2, the SuDS features used on site will be **Geocellular Soakaway**
- 5.2.2 The SuDS features have been designed for easy maintenance and comprise:
- Regular Day-to-Day care – litter collection, regular gardening to control vegetation growth and checking inlets where water enters the SuDS features
  - Occasional tasks – checking the SuDS features and removing any silt that builds up in the SuDS feature
  - Remedial work – repairing damage where necessary

### 5.3 SuDS Drainage Maintenance Specification

#### 5.3.1 Soakaway

In order to maintain the functioning of the attenuation tanks, the following maintenance requirements should be adhered to:

| Table 21.3 Operation and maintenance requirements for attenuation storage tanks/Soakaways |                                                                                                                                                                                                         |                                     |
|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| Maintenance Schedule                                                                      | Required Action                                                                                                                                                                                         | Typical Frequency                   |
| Regular Maintenance                                                                       | 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                             |
|                                                                                           | For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae, or other matter; remove and replace surface infiltration medium as necessary. | Annually                            |
|                                                                                           | Remove sediment from per-treatment structures and/or internal forebays                                                                                                                                  | Annually, or as required            |
| Remedial Actions                                                                          | Repair/rehabilitate inlets, outlet, overflows and vents                                                                                                                                                 | As required                         |
| Monitoring                                                                                | Inspect/check all inlets, outlets, vents, and overflows to ensure that they are in good condition and operating as designed                                                                             | Annually                            |
|                                                                                           | Survey inside of tank for sediment build-up and remove if necessary                                                                                                                                     | Every 5 years or as required        |

## 5.4 General Drainage Maintenance Specification

### 5.4.1 Inlet Structures and Inspection Chambers

- Inlet structures such as rainwater downpipes, road gullies and channel drains should be free from obstruction at all times to allow free flow through the SuDS
- Inspection Chambers and Rodding Eyes are used on bends or where pipes come together. They allow access and cleaning to the system if necessary.

| Inlet Structures and Inspection Chambers                                                                                                                                                                                                                                       |              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Regular Maintenance                                                                                                                                                                                                                                                            | Frequency    |
| <b>Inlet Structures</b><br><br>Inspect rainwater downpipes, channel drains and road gullies, removing obstructions and silt as necessary. Check that there is no physical damage.<br><br>Trim vegetation 1m min surround to structures and keep area free from silt and debris | Monthly      |
| <b>Inspection Chambers and below ground control chambers.</b><br><br>Remove cover and inspect, ensuring that the water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt.<br><br>Undertake inspection after leaf fall in Autumn      | Annually     |
| <b>Occasional Maintenance</b><br><br>Check topsoil levels are 20mm above edges of chambers to avoid mower damage.                                                                                                                                                              | As necessary |
| <b>Remedial Work</b><br><br>Repair physical damage if necessary                                                                                                                                                                                                                | As required  |

## 5.4.2 Below ground drainage pipes

- Below ground drainage pipes convey water to the SuDS system. They should always be free from obstruction to allow free flow.

| Below Ground Drainage Pipes                                                                                 |                                    |
|-------------------------------------------------------------------------------------------------------------|------------------------------------|
| Regular Maintenance                                                                                         | Frequency                          |
| 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 inlet structures and inspection chambers.                                | Annually or as required            |
| Maintain vegetation to designed limits within the vicinity of below ground drainage pipes and tanks.        | Monthly or as required             |
| Remedial Work                                                                                               |                                    |
| Repair physical damage if necessary                                                                         | As required                        |
| Monitoring                                                                                                  |                                    |
| Inspect all inlets, outlets and vents to ensure that they are in good conditions and operating as designed. | Annually                           |
| Survey inside of pipe runs for sediment build up and remove if necessary.                                   | Every 5 years or as required       |

## 6 Summary and Conclusions

- 6.1.1 CGS Civils has been instructed by Mrs S Towers to produce a Drainage statement under National Planning Policy Framework (NPPF) to support the Planning Application for the extension of an existing domestic property.
- 6.1.2 The Surface Water will discharge to ground via infiltration through the use of a soakaway that has been designed to cater for the 1 in 100-year +40% storm.
- 6.1.3 The report has demonstrated that the proposed drainage measures ensure that suitable means of surface water and foul drainage can be achieved for the proposed development.

## **7 Appendices**

### **7.1 Appendix A – Floor Plans**

Notes

CDM REGULATIONS 2015  
The client must abide by the Construction Design and Management Regulations 2015. The client must appoint a contractor, if more than one contractor is to be involved, the client will need to appoint (in writing) a principal designer (to plan, manage and coordinate the planning and design work) and a principal contractor (to plan, manage and coordinate the construction and ensure there are arrangements in place for managing and organising the project).

Domestic clients  
The domestic client is to appoint a principal designer and a principal contractor when there is more than one contractor, if not your duties will automatically transferred to the contractor or principal contractor.

The designer can take on the duties, provided there is a written agreement between you and the designer to do so.

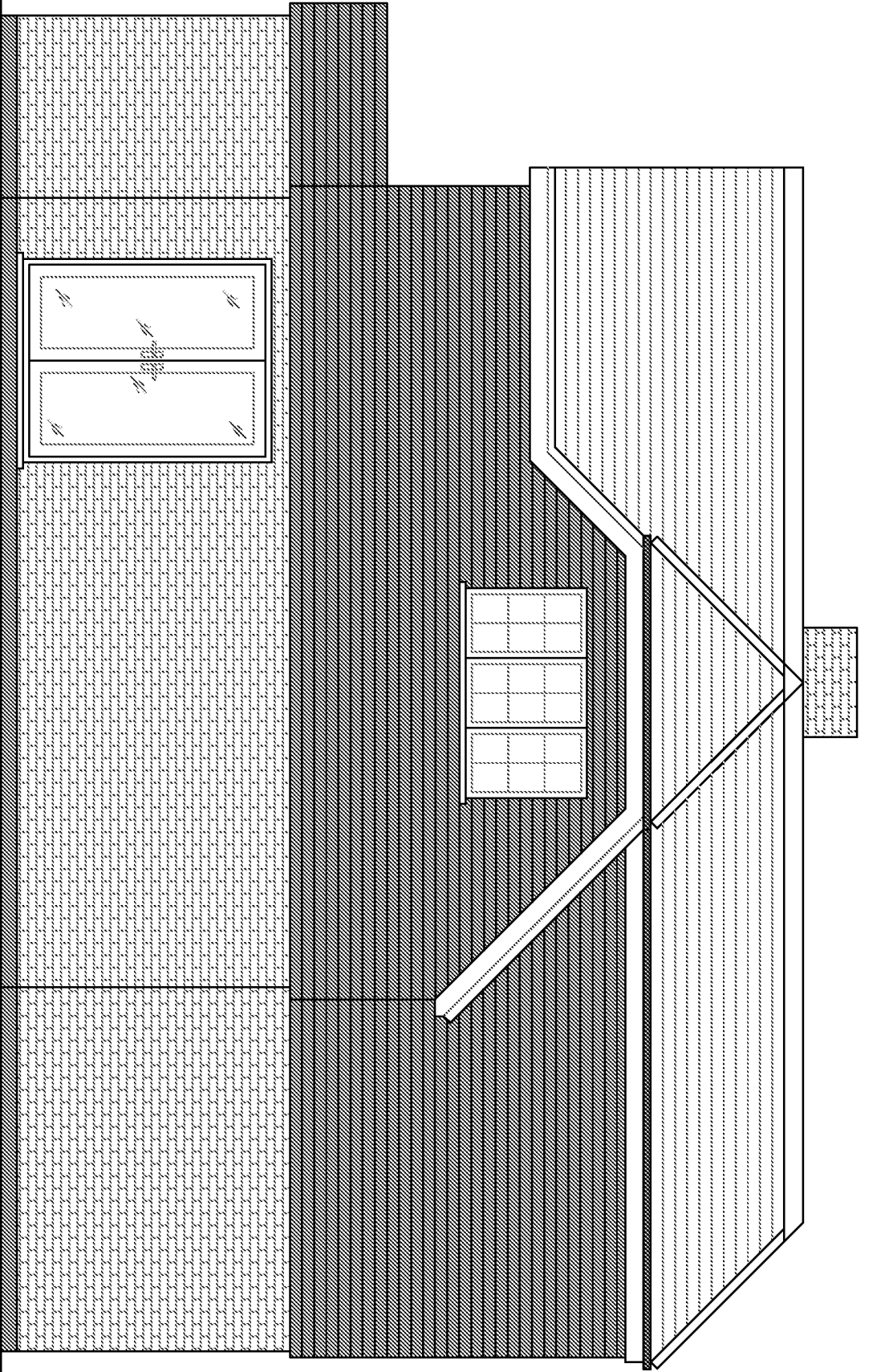
The Health and Safety Executive is to be notified as soon as possible before construction work starts if the works:

(a) Last longer than 30 working days and has more than 20 workers working simultaneously at any point in the project.

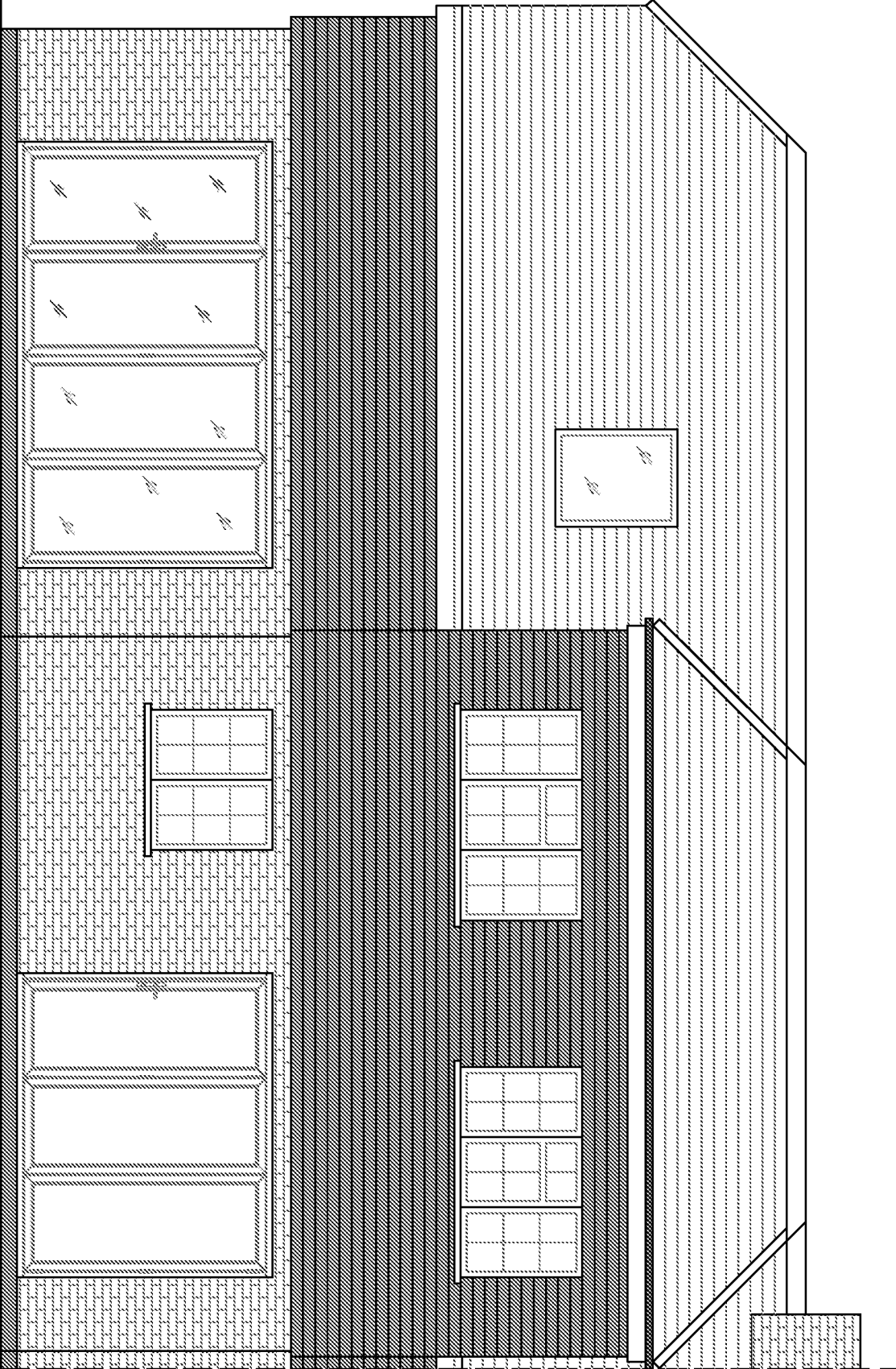
Or:

(b) Exceeds 500 person days.

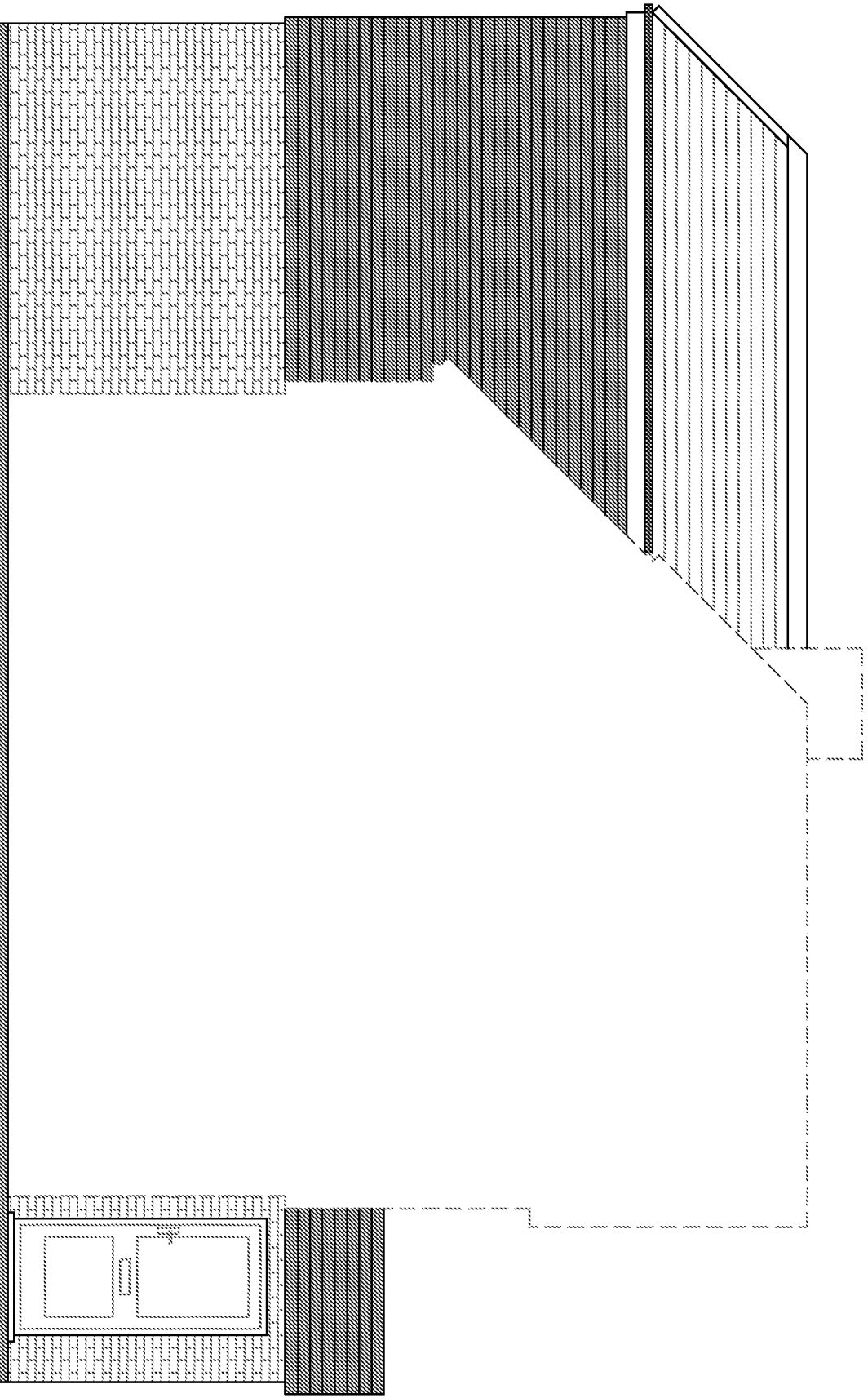
All contractors/sub-contractors must ensure that they are in possession of the currently issued drawings and details before commencing the relevant work stage. All measurements to be checked before work begins, any discrepancies must be reported to the principal designer and alterations can be made prior to commencement of building works.



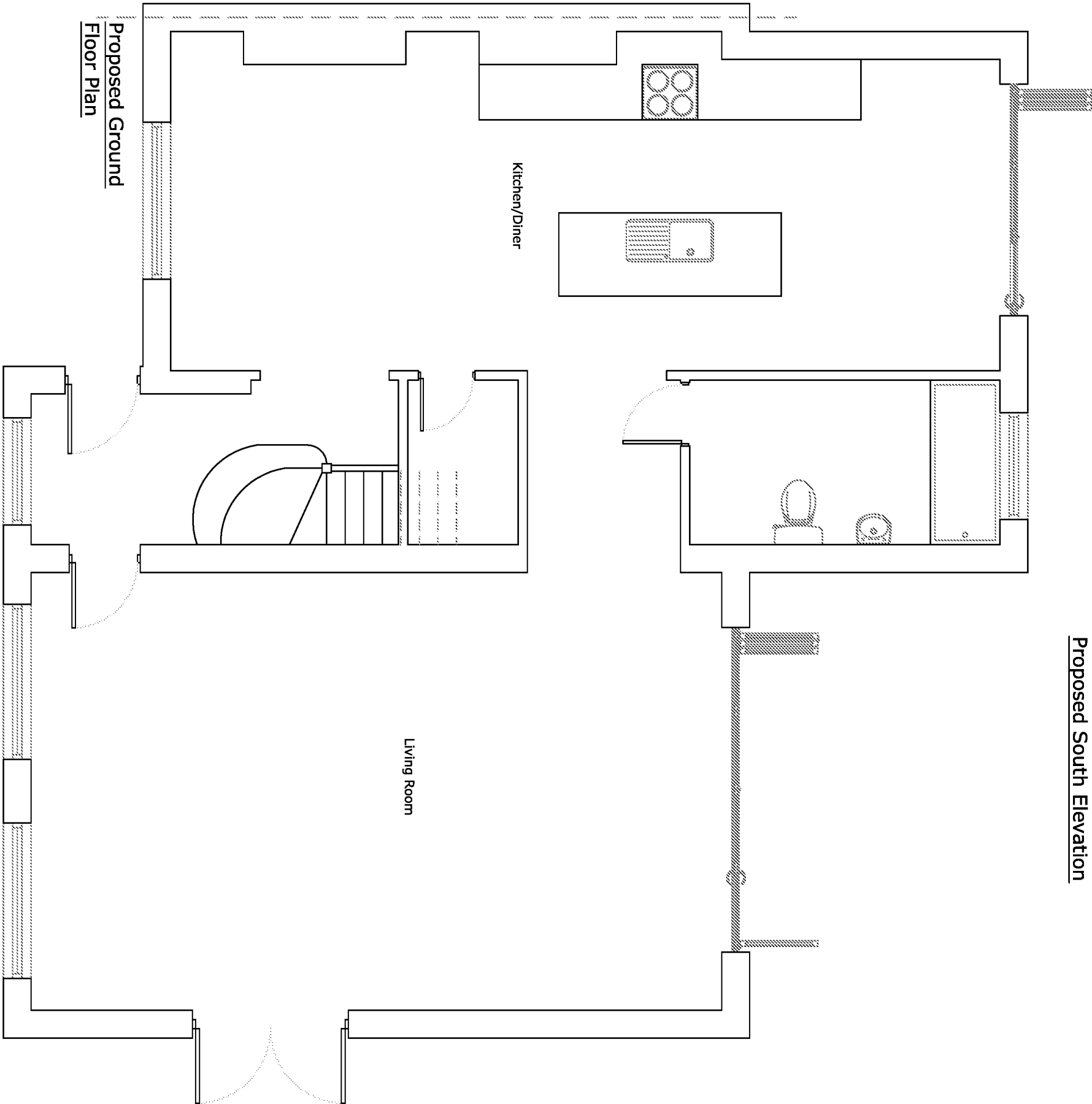
Proposed North Elevation



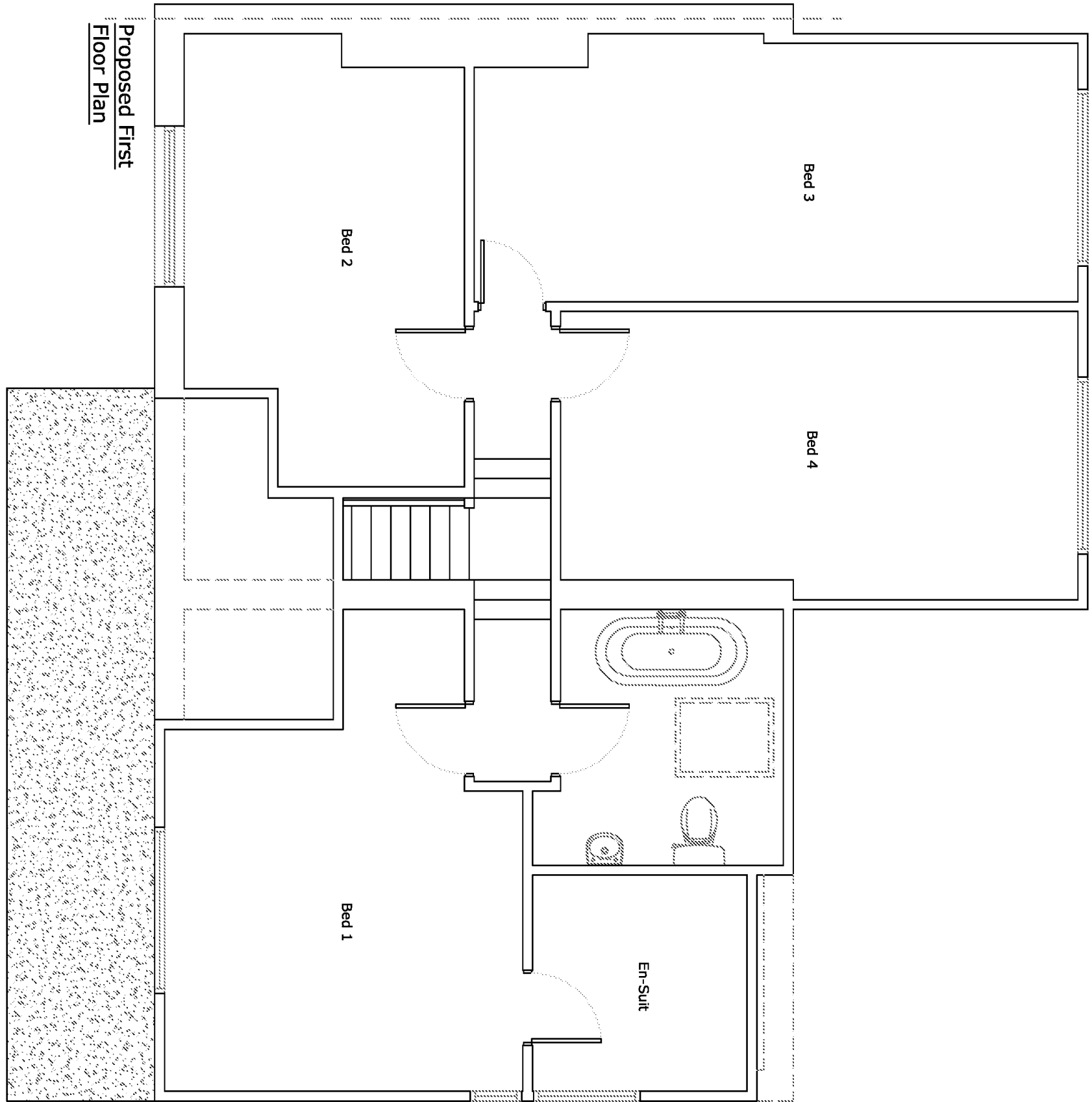
Proposed West Elevation



Proposed South Elevation



Proposed Ground Floor Plan



Proposed First Floor Plan

| No. | Revision/Issue | Date. |
|-----|----------------|-------|
|     |                |       |
|     |                |       |



MULBERRY ARCHITECTURE LTD  
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Bognor Regis  
PO21 2LN  
info@mulberrybg.co.uk  
01243 824814

Magnolia Cottage  
2 Fortwell Avenue  
Eastergate  
Chichester  
PO20 3RZ

|                         |
|-------------------------|
| Proposed Rear Extension |
| Planning                |
| Date                    |
| January 2021            |
| Scale                   |
| 1:50                    |

## 7.2 Appendix B – Drainage Layout

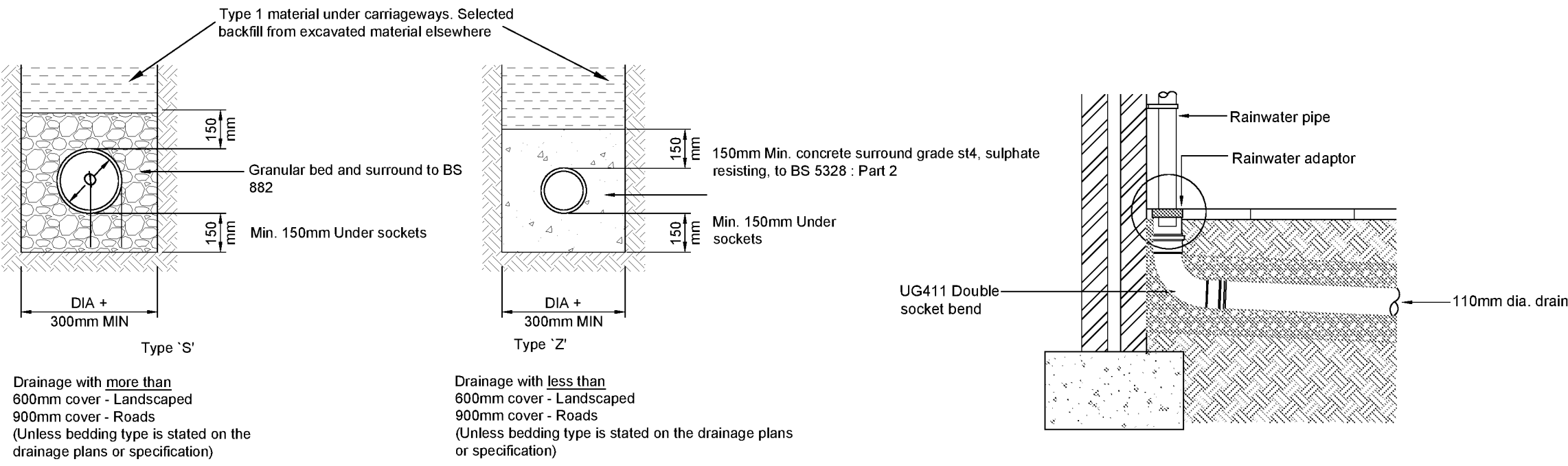
Richard Collier House, Lion Street, Chichester, West Sussex, PO19 1JW

- STANDARD DRAINAGE NOTES
- DO NOT SCALE FROM THIS DRAWING. REFER TO FIGURED DIMENSIONS ONLY. THE CONTRACTOR SHOULD CHECK ALL DIMENSIONS ON SITE.
  - ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS ARE IN METERS UNLESS NOTED OTHERWISE.
  - THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECT AND ENGINEERING DETAILS, DRAWINGS AND SPECIFICATIONS.
  - ANY DISCREPANCIES SHOULD BE REPORTED TO THE ARCHITECT AND/OR ENGINEER IMMEDIATELY, SO THAT CLARIFICATION CAN BE SOUGHT PRIOR TO THE COMMENCEMENT OF WORK.
  - ALL DRAINAGE WORKS SHOULD COMMENCE AT THE PROPOSED DOWNSTREAM CONNECTION POINT. THE WORKS CONTINUING UPSTREAM FOLLOWING CONFIRMATION OF THE TIE-IN INVERT LEVELS TO THE ENGINEER. CONNECTIONS TO MANHOLES OR LARGER SIZED PIPES ETC. SHOULD BE SOFFIT TO SOFFIT UNLESS OTHERWISE INSTRUCTED BY THE ENGINEER. IF THIS IS NOT POSSIBLE INFORM THE ENGINEER IMMEDIATELY.
  - COVER LEVELS SHOWN ARE APPROXIMATE. COVERS AND FRAMES SHALL BE SET TO FINISHED GROUND LEVELS AND FALLS.
  - ALL UN-REFERENCED PIPES ARE ASSUMED TO BE 100mm DIA
  - ALL PRIVATE DRAINAGE TO BE IN ACCORDANCE WITH THE BUILDING REGULATIONS APPROVED DOCUMENT PART-H, AND TO THE SATISFACTION OF THE BUILDING CONTROL INSPECTOR
  - THE CONTRACTOR IS TO KEEP A RECORD OF ANY VARIATIONS MADE ON SITE, INCLUDING THE RELOCATION OF SEWERS OR DRAINS, SO THAT AN AS CONSTRUCTED DRAWING CAN BE PREPARED UPON COMPLETION OF THE PROJECT.
  - IF ANY SUB SOIL DRAINAGE SYSTEMS ARE UNCOVERED DURING THE WORKS CONTACT THE ENGINEER FOR INSTRUCTIONS. SUB SOIL DRAINS ARE TO BE DIVERTED AROUND NEW WORKS AND CONNECTED INTO THE SURFACE WATER.
  - NO PRIVATE AREAS ARE TO DRAIN ONTO ADOPTABLE AREAS AND VICE VERSA.
  - ALL EXISTING MANHOLE COVER'S, GULLIES, ETC. ARE TO BE RAISED/LOWERED TO SUIT NEW LEVELS.
  - IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONFIRM THE LOCATION AND DEPTH OF ALL EXISTING SERVICES AND UTILITIES THAT MAY BE PRESENT
  - UPON COMPLETION BUT PRIOR TO HANDOVER, CONTRACTOR TO CARRY OUT FULL CCTV SURVEY OF DRAINAGE SYSTEM WHICH IS TO BE REVIEWED BY ENGINEER TO ENSURE SATISFACTORY INSTALLATION
  - MANHOLE AND CHAMBER COVER GRADES:

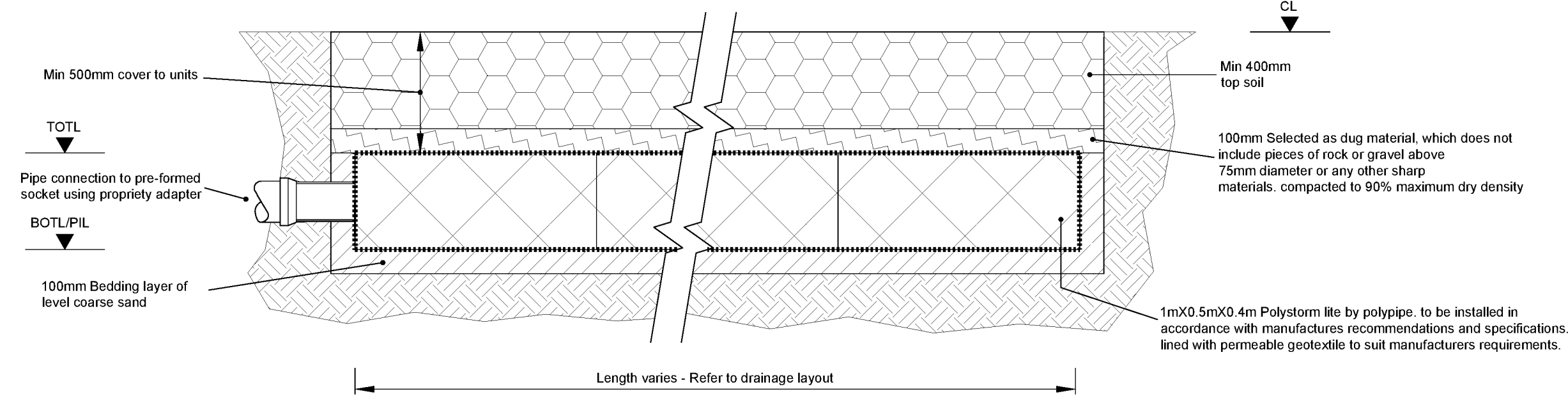
- 'A15' IN ALL LANDSCAPED AREAS AND ON FOOTPATHS
- 'B125' IN ALL DRIVEWAYS
- 'C250' IN PRIVATE PARKING AREAS
- 'D400' IN CARRIAGEWAY/ACCESS ROAD

DESIGN SUBJECT TO THE APPROVAL OF:  
PLANNING AUTHORITY  
BUILDING CONTROL

DESIGN SUBJECT TO THE CONFIRMATION OF:  
EXTERNAL LEVELS DESIGN  
LOCATION AND DEPTH OF EXISTING UTILITIES  
ROOT PROTECTION AREAS

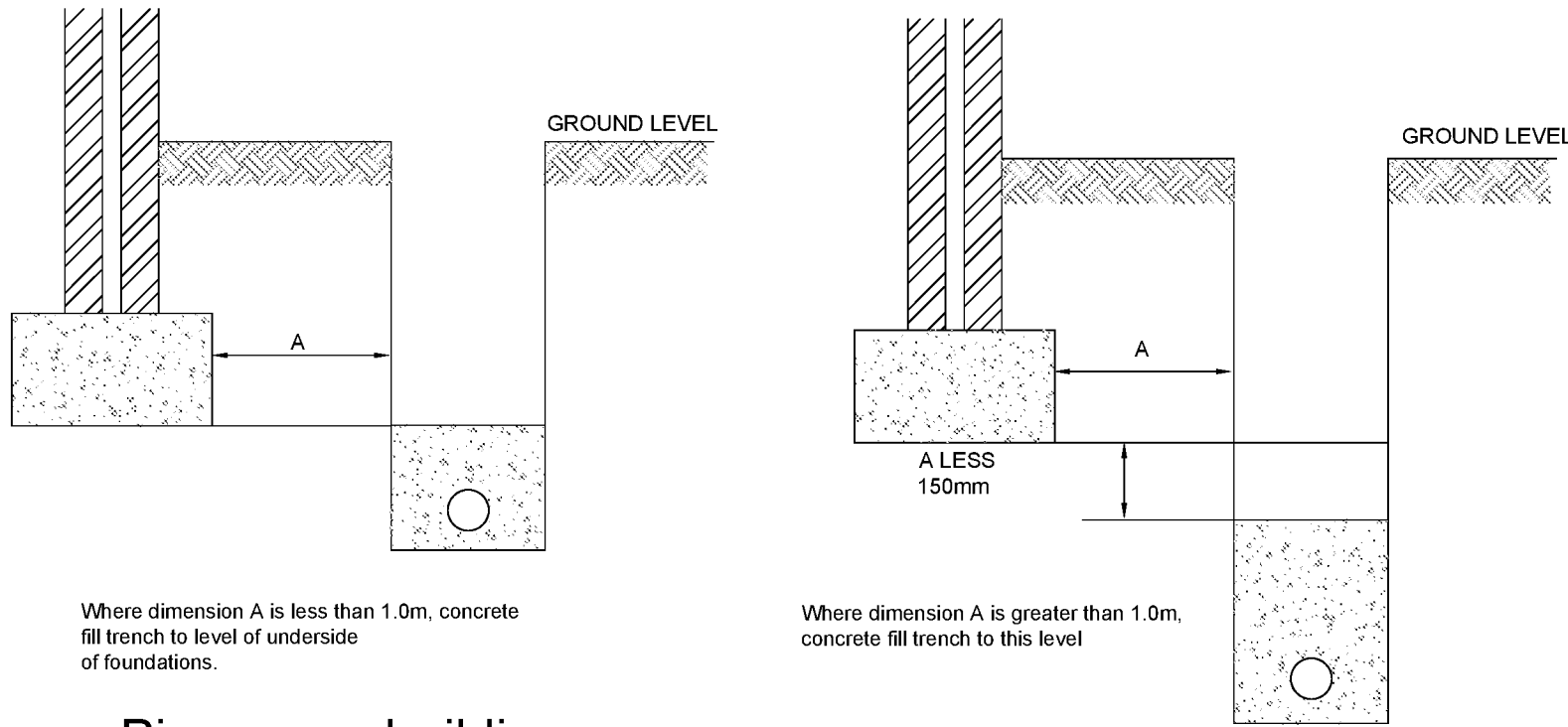


Pipe bedding details in private Areas



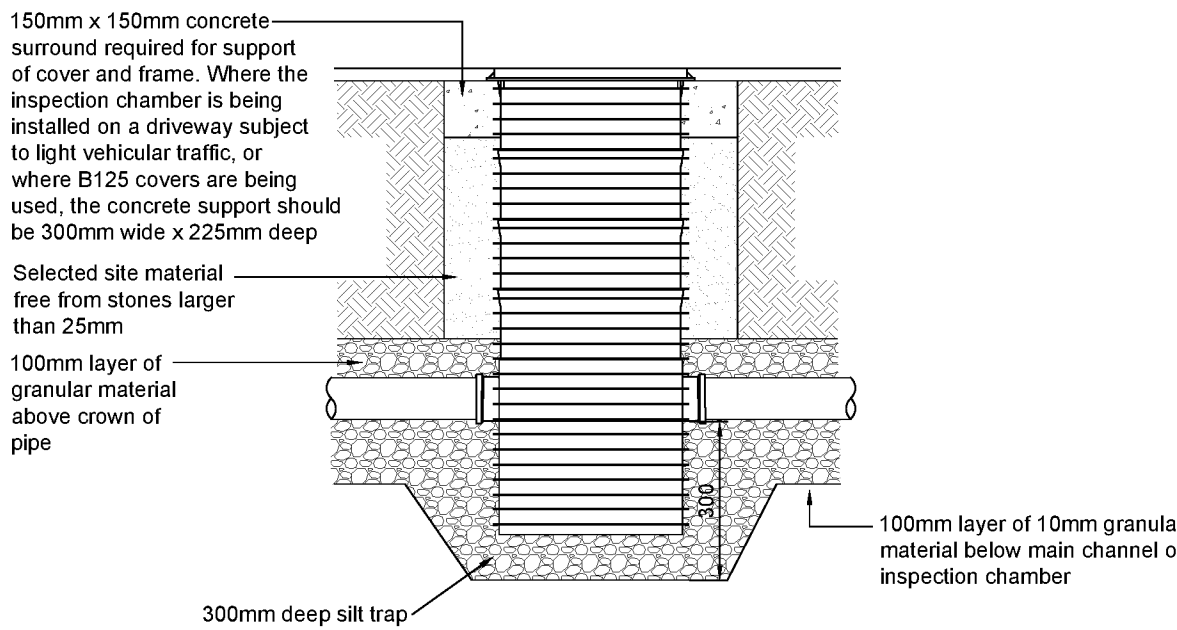
Trench soakaway using Polystorm Lite Geomodular units  
Landscaped areas only  
0.4m deep

All storage tank drainage works shall be carried out in accordance with the specifications, method statements and recommendations of Polypipe

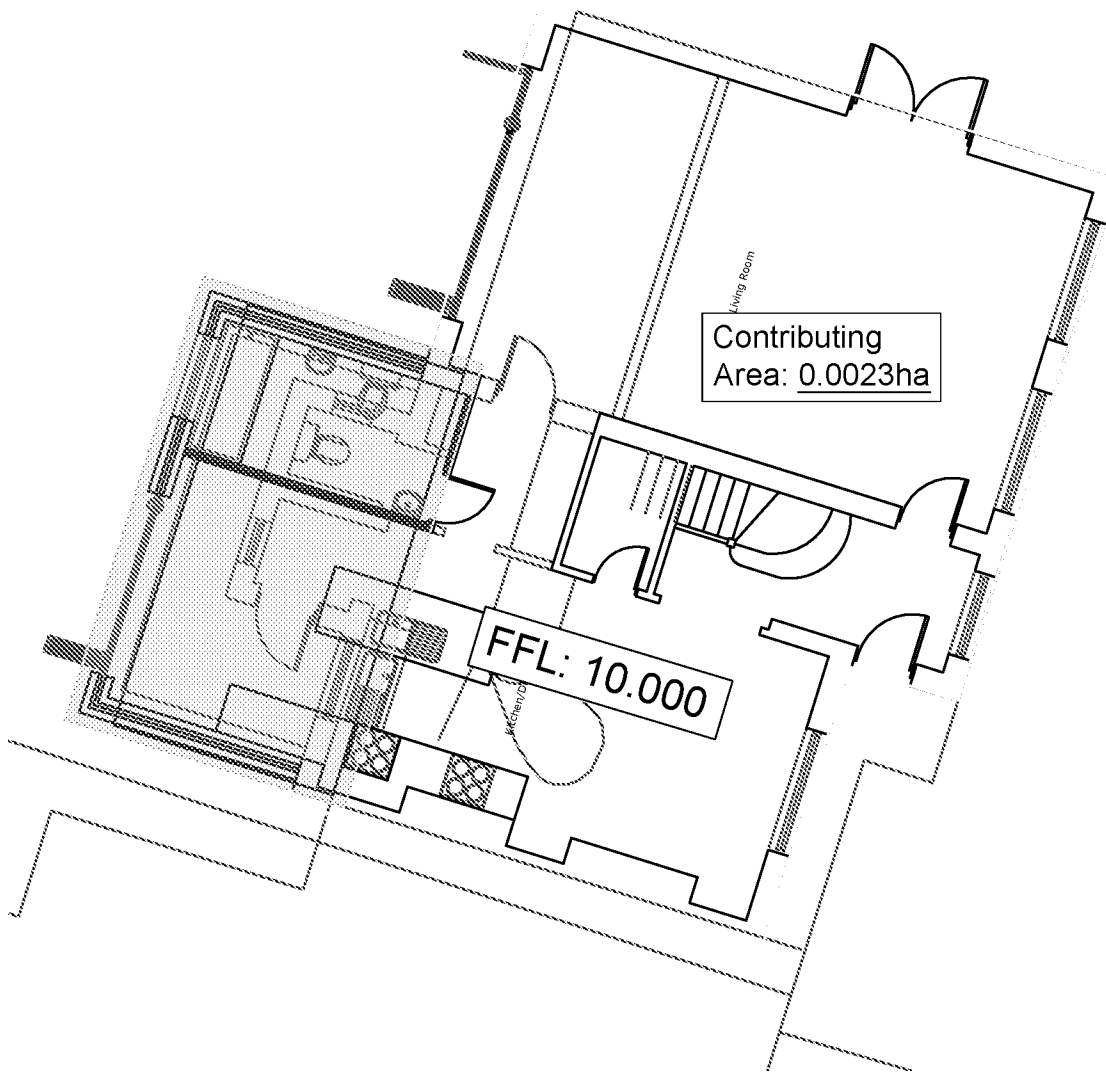
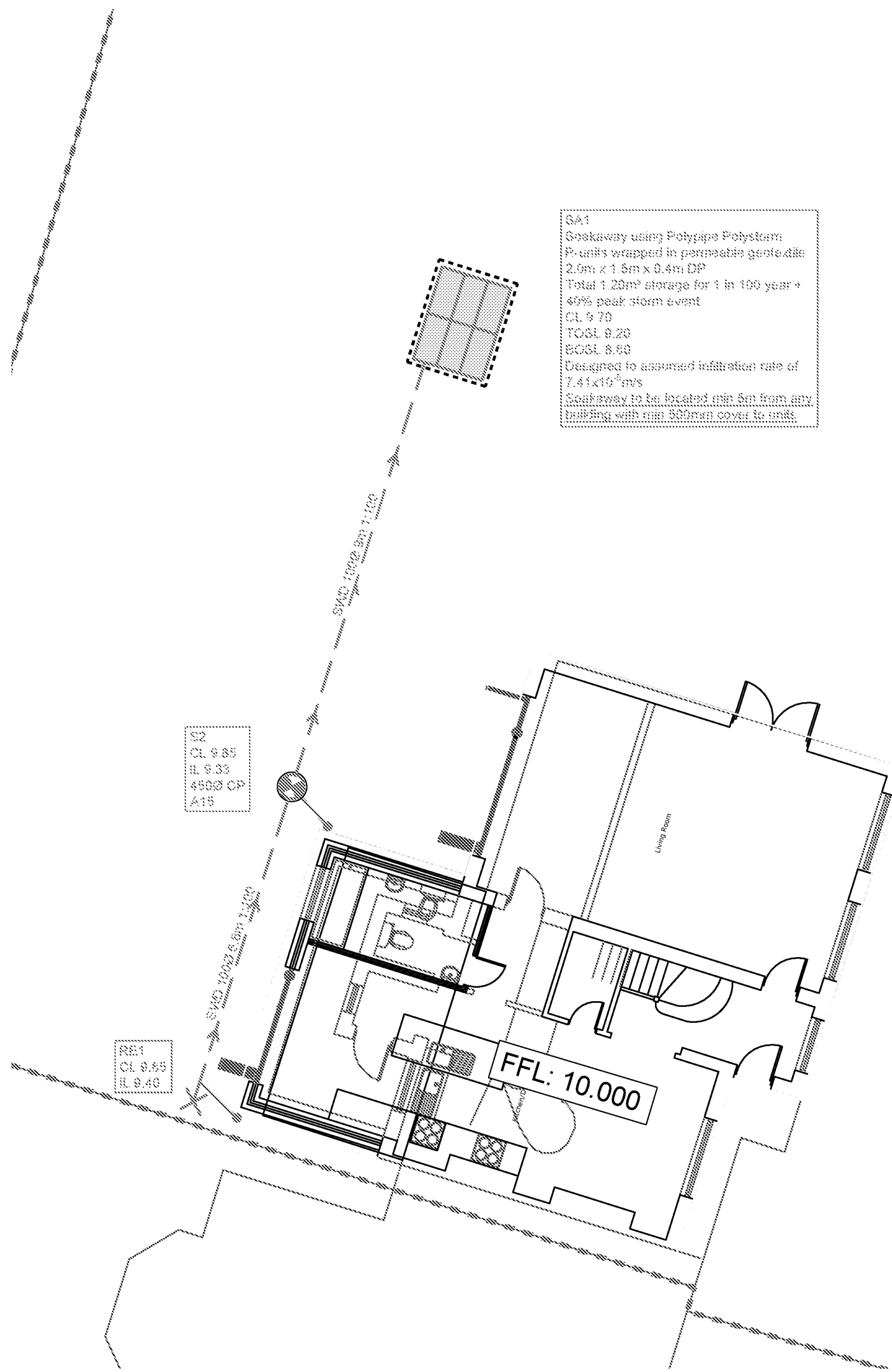


Pipes near buildings

Pipes near buildings



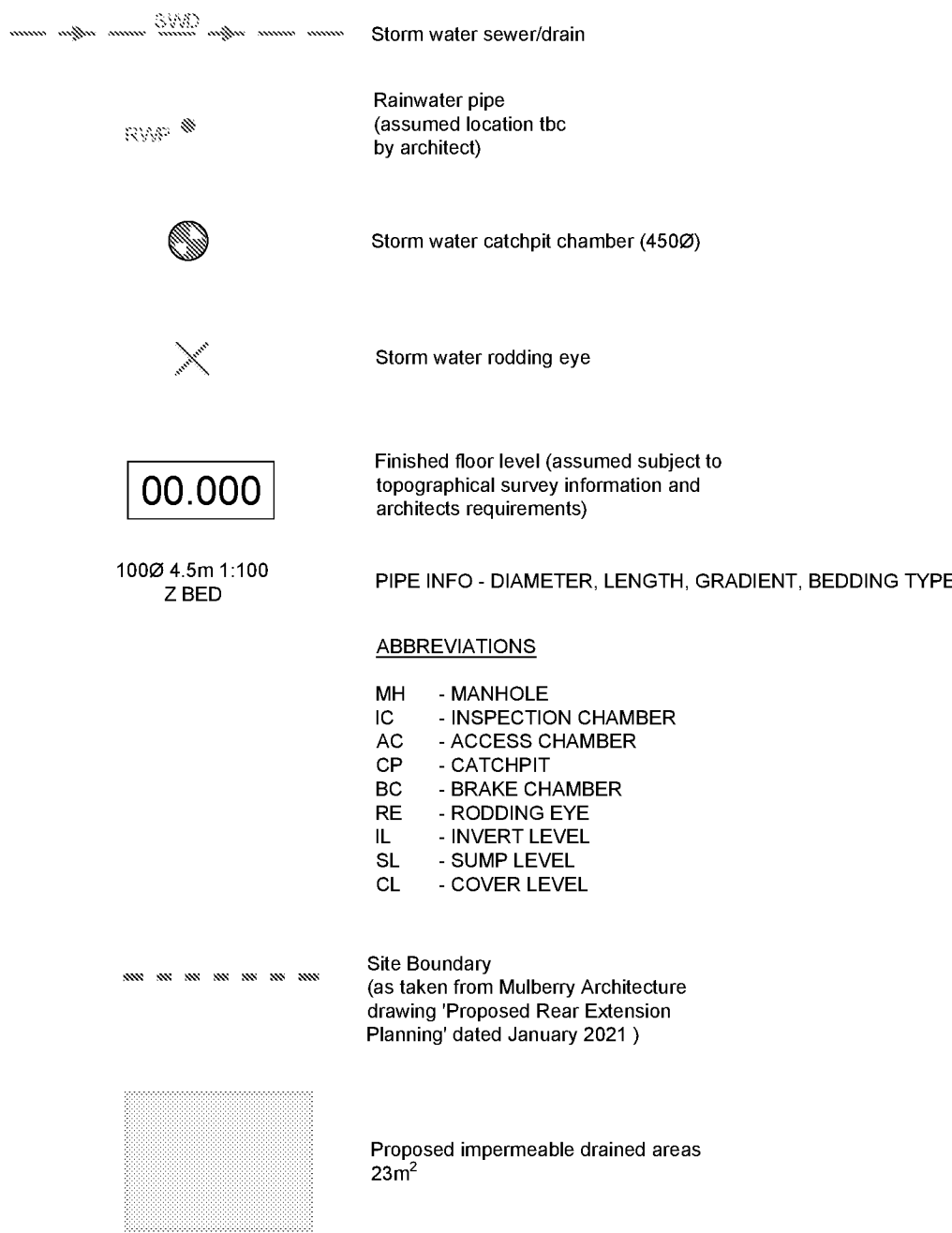
450mmØ POLYPIPE BASIC  
SILT TRAP DETAIL



Drained areas

DRAINAGE LEGEND (1:100)

PROPOSED FEATURES



Prefix to drawing numbers shall signify the following:-

|                  |                                                                          |
|------------------|--------------------------------------------------------------------------|
| PL = PLANNING    | Shall not be used for contract or construction purposes                  |
| P = PRELIMINARY  | Shall not be used for contract or construction purposes                  |
| T = TENDER       | Shall not be used for construction purposes                              |
| C = CONSTRUCTION | These are the only drawings that shall be used for construction purposes |
| R = RECORD       | Record of actual completed work                                          |

FOR PLANNING ONLY

|                                                                                                                                   |          |                     |  |                    |    |                |     |
|-----------------------------------------------------------------------------------------------------------------------------------|----------|---------------------|--|--------------------|----|----------------|-----|
| PL-                                                                                                                               | 08.03.22 | FOR PLANNING ONLY   |  |                    | MR | TZ             | CS  |
| REV                                                                                                                               | DATE     | DESCRIPTION         |  |                    | BY | CHK            | APP |
| <div><p>Consulting Civil Engineers</p></div> |          |                     |  |                    |    |                |     |
| CLIENT<br>LESTER PENNA                                                                                                            |          |                     |  |                    |    |                |     |
| ARCHITECT<br>MULBERRY ARCHITECTURE LTD                                                                                            |          |                     |  |                    |    |                |     |
| JOB TITLE<br>MAGNOLIA COTTAGE, 2 FONTWELL AVENUE, EASTERGATE, CHICHESTER                                                          |          |                     |  |                    |    |                |     |
| DRAWING TITLE<br>PROPOSED SURFACE WATER DRAINAGE STRATEGY                                                                         |          |                     |  |                    |    |                |     |
| DRAWN<br>MR                                                                                                                       |          | ENGINEER<br>TZ      |  | CHECKED<br>CS      |    | APPROVED<br>CS |     |
| DATE<br>MARCH 2022                                                                                                                |          | SCALE @ A1<br>1:100 |  |                    |    |                |     |
| JOB No.<br>C1674                                                                                                                  |          | STATUS<br>PL        |  | DRAWING No.<br>100 |    | REV<br>PL-     |     |

### 7.3 **Appendix C – Surface Water Calculations**

Richard Cobden House, Lion Street, Chichester, West Sussex, PO19 1LW

### Design Settings

|                       |                   |                                      |               |
|-----------------------|-------------------|--------------------------------------|---------------|
| Rainfall Methodology  | FSR               | Maximum Time of Concentration (mins) | 30.00         |
| Return Period (years) | 2                 | Maximum Rainfall (mm/hr)             | 50.0          |
| Additional Flow (%)   | 0                 | 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   | ✓             |

### Nodes

| Name | Area<br>(ha) | T of E<br>(mins) | Cover<br>Level<br>(m) | Diameter<br>(mm) | Easting<br>(m) | Northing<br>(m) | Depth<br>(m) |
|------|--------------|------------------|-----------------------|------------------|----------------|-----------------|--------------|
| RE1  | 0.002        | 4.00             | 9.850                 | 150              | 2006.223       | 979.505         | 0.450        |
| S2   | 0.002        | 4.00             | 9.850                 | 450              | 2008.295       | 985.247         | 0.511        |
| SA1  |              |                  | 9.700                 | 100              | 2012.834       | 997.355         | 0.490        |

### Links

| Name  | US<br>Node | DS<br>Node | Length<br>(m) | ks (mm) /<br>n | US IL<br>(m) | DS IL<br>(m) | Fall<br>(m) | Slope<br>(1:X) | Dia<br>(mm) | T of C<br>(mins) | Rain<br>(mm/hr) |
|-------|------------|------------|---------------|----------------|--------------|--------------|-------------|----------------|-------------|------------------|-----------------|
| 1.000 | RE1        | S2         | 6.104         | 0.800          | 9.400        | 9.339        | 0.061       | 100.0          | 100         | 4.13             | 50.0            |
| 1.001 | S2         | SA1        | 12.931        | 0.600          | 9.339        | 9.210        | 0.129       | 100.0          | 100         | 4.41             | 50.0            |

| Name  | Vel<br>(m/s) | Cap<br>(l/s) | Flow<br>(l/s) | US<br>Depth<br>(m) | DS<br>Depth<br>(m) | Σ Area<br>(ha) | Σ Add<br>Inflow<br>(l/s) | Pro<br>Depth<br>(mm) | Pro<br>Velocity<br>(m/s) |
|-------|--------------|--------------|---------------|--------------------|--------------------|----------------|--------------------------|----------------------|--------------------------|
| 1.000 | 0.763        | 6.0          | 0.3           | 0.350              | 0.411              | 0.002          | 0.0                      | 14                   | 0.381                    |
| 1.001 | 0.769        | 6.0          | 0.5           | 0.411              | 0.390              | 0.004          | 0.0                      | 21                   | 0.479                    |

### Pipeline Schedule

| Link  | Length<br>(m) | Slope<br>(1:X) | Dia<br>(mm) | Link<br>Type | US CL<br>(m) | US IL<br>(m) | US Depth<br>(m) | DS CL<br>(m) | DS IL<br>(m) | DS Depth<br>(m) |
|-------|---------------|----------------|-------------|--------------|--------------|--------------|-----------------|--------------|--------------|-----------------|
| 1.000 | 6.104         | 100.0          | 100         | Circular     | 9.850        | 9.400        | 0.350           | 9.850        | 9.339        | 0.411           |
| 1.001 | 12.931        | 100.0          | 100         | Circular     | 9.850        | 9.339        | 0.411           | 9.700        | 9.210        | 0.390           |

| Link  | US<br>Node | Dia<br>(mm) | Node<br>Type | MH<br>Type | DS<br>Node | Dia<br>(mm) | Node<br>Type | MH<br>Type |
|-------|------------|-------------|--------------|------------|------------|-------------|--------------|------------|
| 1.000 | RE1        | 150         | Manhole      | Adoptable  | S2         | 450         | Manhole      | Adoptable  |
| 1.001 | S2         | 450         | Manhole      | Adoptable  | SA1        | 100         | Manhole      | Adoptable  |

### Manhole Schedule

| Node | Easting<br>(m) | Northing<br>(m) | CL<br>(m) | Depth<br>(m) | Dia<br>(mm) | Connections                                                                         | Link | IL<br>(m) | Dia<br>(mm) |
|------|----------------|-----------------|-----------|--------------|-------------|-------------------------------------------------------------------------------------|------|-----------|-------------|
| RE1  | 2006.223       | 979.505         | 9.850     | 0.450        | 150         |  |      |           |             |
|      |                |                 |           |              |             |                                                                                     | 0    | 1.000     | 9.400       |
|      |                |                 |           |              |             |                                                                                     | 1    | 1.000     | 9.339       |
| S2   | 2008.295       | 985.247         | 9.850     | 0.511        | 450         |  |      |           |             |
|      |                |                 |           |              |             |                                                                                     | 0    | 1.001     | 9.339       |
|      |                |                 |           |              |             |                                                                                     |      |           | 100         |

### Manhole Schedule

| Node | Easting<br>(m) | Northing<br>(m) | CL<br>(m) | Depth<br>(m) | Dia<br>(mm) | Connections | Link | IL<br>(m) | Dia<br>(mm) |
|------|----------------|-----------------|-----------|--------------|-------------|-------------|------|-----------|-------------|
| SA1  | 2012.834       | 997.355         | 9.700     | 0.490        | 100         | 1           | 1001 | 9.210     | 100         |



### Simulation Settings

|                      |                   |                                         |        |
|----------------------|-------------------|-----------------------------------------|--------|
| Rainfall Methodology | FSR               | Analysis Speed                          | Normal |
| FSR Region           | England and Wales | Skip Steady State                       | x      |
| M5-60 (mm)           | 20.000            | Drain Down Time (mins)                  | 240    |
| Ratio-R              | 0.400             | Additional Storage (m <sup>3</sup> /ha) | 20.0   |
| Summer CV            | 0.750             | Check Discharge Rate(s)                 | x      |
| Winter CV            | 0.840             | Check Discharge Volume                  | x      |

### Storm Durations

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

| Return Period<br>(years) | Climate Change<br>(CC %) | Additional Area<br>(A %) | Additional Flow<br>(Q %) |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1                        | 0                        | 0                        | 0                        |
| 10                       | 0                        | 0                        | 0                        |
| 30                       | 0                        | 0                        | 0                        |
| 100                      | 40                       | 0                        | 0                        |

### Node SA1 Soakaway Storage Structure

|                             |         |                           |       |                 |       |
|-----------------------------|---------|---------------------------|-------|-----------------|-------|
| Base Inf Coefficient (m/hr) | 0.26676 | Invert Level (m)          | 8.800 | Depth (m)       | 0.400 |
| Side Inf Coefficient (m/hr) | 0.26676 | Time to half empty (mins) | 58    | Inf Depth (m)   |       |
| Safety Factor               | 2.0     | Pit Width (m)             | 2.000 | Number Required | 1     |
| Porosity                    | 0.95    | Pit Length (m)            | 1.500 |                 |       |

**Results for 1 year 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 |
|-------------------|------------|----------------|--------------|--------------|-----------------|------------------|---------------|--------|
| 15 minute winter  | RE1        | 11             | 9.415        | 0.015        | 0.3             | 0.0016           | 0.0000        | OK     |
| 15 minute winter  | S2         | 11             | 9.361        | 0.022        | 0.6             | 0.0051           | 0.0000        | OK     |
| 180 minute winter | SA1        | 112            | 8.872        | -0.338       | 0.2             | 0.2049           | 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) |
|--------------------------------|------------|--------------|------------|------------------|-------------------|----------|------------------|
| 15 minute winter               | RE1        | 1.000        | S2         | 0.3              | 0.314             | 0.050    | 0.0060           |
| 15 minute winter               | S2         | 1.001        | SA1        | 0.6              | 0.488             | 0.099    | 0.0158           |
| 180 minute winter              | SA1        | Infiltration |            | 0.1              |                   |          |                  |

**Results for 10 year 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 |
|------------------|------------|----------------|--------------|--------------|-----------------|------------------|---------------|--------|
| 15 minute winter | RE1        | 10             | 9.421        | 0.021        | 0.6             | 0.0023           | 0.0000        | OK     |
| 15 minute winter | S2         | 10             | 9.370        | 0.031        | 1.2             | 0.0072           | 0.0000        | OK     |
| 60 minute winter | SA1        | 54             | 8.979        | -0.231       | 0.6             | 0.5114           | 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) |
|--------------------------------|------------|--------------|------------|------------------|-------------------|----------|------------------|
| 15 minute winter               | RE1        | 1.000        | S2         | 0.6              | 0.374             | 0.099    | 0.0099           |
| 15 minute winter               | S2         | 1.001        | SA1        | 1.2              | 0.589             | 0.194    | 0.0257           |
| 60 minute winter               | SA1        | Infiltration |            | 0.2              |                   |          |                  |

**Results for 30 year 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 |
|------------------|------------|----------------|--------------|--------------|-----------------|------------------|---------------|--------|
| 15 minute winter | RE1        | 10             | 9.423        | 0.023        | 0.7             | 0.0025           | 0.0000        | OK     |
| 15 minute winter | S2         | 10             | 9.372        | 0.033        | 1.4             | 0.0079           | 0.0000        | OK     |
| 60 minute winter | SA1        | 59             | 9.039        | -0.171       | 0.8             | 0.6815           | 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) |
|--------------------------------|------------|--------------|------------|------------------|-------------------|----------|------------------|
| 15 minute winter               | RE1        | 1.000        | S2         | 0.7              | 0.389             | 0.116    | 0.0111           |
| 15 minute winter               | S2         | 1.001        | SA1        | 1.4              | 0.615             | 0.228    | 0.0289           |
| 60 minute winter               | SA1        | Infiltration |            | 0.2              |                   |          |                  |

**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 |
|-------------------|------------|----------------|--------------|--------------|-----------------|------------------|---------------|--------|
| 15 minute winter  | RE1        | 10             | 9.431        | 0.031        | 1.3             | 0.0034           | 0.0000        | OK     |
| 15 minute winter  | S2         | 10             | 9.386        | 0.047        | 2.6             | 0.0112           | 0.0000        | OK     |
| 180 minute winter | SA1        | 124            | 9.353        | 0.143        | 0.6             | 1.1426           | 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) |
|--------------------------------|------------|--------------|------------|------------------|-------------------|----------|------------------|
| 15 minute winter               | RE1        | 1.000        | S2         | 1.3              | 0.458             | 0.215    | 0.0175           |
| 15 minute winter               | S2         | 1.001        | SA1        | 2.6              | 0.726             | 0.427    | 0.0459           |
| 180 minute winter              | SA1        | Infiltration |            | 0.2              |                   |          |                  |

#### 7.4 **Appendix D – Borehole Logs**

SU 90 NW 75

9436 0670

Fontwell Park Race Course

Block G

Surface level +22.2 m

Water struck at +17.9 m

September 1981

Waste  
Bedrock5.4 m  
2.3 m+

LOG

Geological classification

Lithology

Thickness  
m Depth  
m

Soil

0.4 0.4

Brickearth

Clay, brown, silty, with thin pebbly bands

4.1 4.5

Head Gravel

'Very clayey' gravel

0.9 5.4

Gravel: coarse and fine, angular to subrounded;  
flint, some white and porous  
Sand: coarse and fine with medium  
Fines: clayWoolwich and Reading  
Beds

Clay, sandy, silty, reddish brown, laminated

1.2 6.6

Silt, grey

0.1 6.7

Clay, waxy, mottled red and grey

1.0+ 7.7

GRADING

Mean for deposit  
percentagesDepth below  
surface (m)

Percentages

Fines Sand Gravel

Fines

Sand

Gravel

-1/4

+1/4 -1/2

+1/2 -1

+1 -4

+4 -16

+16 -64

+64 mm

39

11

50

4.5-5.4

39

5

2

4

17

33

0

## 7.5 **Appendix E – Soakage Test Results**

Ref: C1674

Lester Pena

10<sup>th</sup> March 2022**Re: Magnolia Cottage, Eastergate – Soakaway Testing – Infiltration Test Result Summary**

Dear Lester

The following investigation was carried out at the above location in accordance with our quotation.

**1. Site Works**

The purpose of the investigation was to supply soakaway test data in general accordance with BRE document 365 (Soakaway Design) at one location which would be the approximate intended location for a possible infiltration device to serve a new extension to an existing property.

In addition to the soakaway test pit, a borehole was dug to a depth of 1.5m using a hand auger. This was covered and monitored over 48 hours and remained dry.

The appended drawing illustrates the position of the test pit. The BRE365 pit was excavated to a depth of 0.9m in line with the approximate depth of the proposed soakaway.

The testing commenced on 11<sup>th</sup> February 2022 with three tests being undertaken in accordance with BRE 365.

**2. BRE 365 Soakaway Test Findings**

Testing of the sub soils which was noted as gravelly, loamy clay produced a BRE 365 design infiltration rate of **7.41x10<sup>-4</sup>m/s**. This rate was the slowest taken from all three tests. This is considered a **good** rate and will be suitable for most infiltration devices.

**3. BRE 365 Soakaway Test Results**

| Test Pit No | Infiltration Rate<br>(1-3 Tests) |                           |                                | Depth of<br>Test | Soil Type            |
|-------------|----------------------------------|---------------------------|--------------------------------|------------------|----------------------|
| SAT1        | 8.97x10 <sup>-5</sup> m/s        | 8.52x10 <sup>-5</sup> m/s | <b>7.41x10<sup>-5</sup>m/s</b> | 0.9m             | gravelly, loamy clay |

## Appendix A – Soakaway Test Location Plan



Richard Cobden House, Lion Street, Chichester, West Sussex, PO19 1LW

**Appendix B – Site Photographs**



## Appendix C – Soakaway Test Results



Consulting Civil Engineers

Job: Magnolia Cottage, Eastergate - Test 1

## Infiltration Calculator

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

$V_{p75-25}$  = Effective storage volume between 75% and 25% effective depth

$a_{p50}$  = Internal surface area of the trial pit up to 50% effective depth and including the base area

$t_{p75-25}$  = The time for the water level to fall from 75% to 25% effective depth

$f$  = Infiltration rate

|                  |   |                |
|------------------|---|----------------|
| Trial pit width  | = | <div>0.3</div> |
| Trial pit depth  | = | <div>0.9</div> |
| Trial pit length | = | <div>1</div>   |

$a_{p50}$  = 

1.32

 m/squared

$t_{p75-25}$  = 

1140

 seconds

$V_{p75-25}$  = 

0.135

 m/cubed

**F** = 

8.97E-05



Consulting Civil Engineers

Job: Magnolia Cottage, Eastergate - Test 2

## Infiltration Calculator

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

$V_{p75-25}$  = Effective storage volume between 75% and 25% effective depth

$a_{p50}$  = Internal surface area of the trial pit up to 50% effective depth and including the base area

$t_{p75-25}$  = The time for the water level to fall from 75% to 25% effective depth

$f$  = Infiltration rate

|                  |   |                |
|------------------|---|----------------|
| Trial pit width  | = | <div>0.3</div> |
| Trial pit depth  | = | <div>0.9</div> |
| Trial pit length | = | <div>1</div>   |

$a_{p50}$  = 

1.32

 m/squared

$t_{p75-25}$  = 

1200

 seconds

$V_{p75-25}$  = 

0.135

 m/cubed

**F** = 

8.52E-05



Consulting Civil Engineers

Job: Magnolia Cottage, Eastergatee - Test 3

## Infiltration Calculator

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

$V_{p75-25}$  = Effective storage volume between 75% and 25% effective depth

$a_{p50}$  = Internal surface area of the trial pit up to 50% effective depth and including the base area

$t_{p75-25}$  = The time for the water level to fall from 75% to 25% effective depth

$f$  = Infiltration rate

|                  |   |                |
|------------------|---|----------------|
| Trial pit width  | = | <div>0.3</div> |
| Trial pit depth  | = | <div>0.9</div> |
| Trial pit length | = | <div>1</div>   |

$a_{p50}$  = 

1.32

 m/squared

$t_{p75-25}$  = 

1380

 seconds

$V_{p75-25}$  = 

0.135

 m/cubed

**F** = 

7.41E-05