

**Drainage Design**

Corn Farm, Devauden

On Behalf of

Powell Property Developments Ltd

# Quality Management

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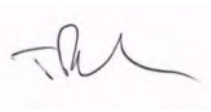
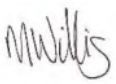
| **Prepared by:** | Tom Paltridge<br>BSc MSc FGS |  |
| **Reviewed by:** | Mike Willis<br>BSc MSc FGS |  |
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# 1 Introduction

## 1.1 Background

This Drainage Design Report provides details of the method that will be used to discharge the surface water runoff in accordance with the six standards requiring evaluation as part of a SuDS Approval Body (SAB) application, for development at Corn Farm, Devauden, Monmouthshire (the Site).

It is recognised that consideration of flood issues should not be confined to the floodplain. The alteration of natural surface water flow patterns through developments can lead to problems elsewhere in the catchment, particularly flooding downstream. For example, replacing vegetated areas with roofs, roads and other paved areas can increase both the total and the peak flow of surface water runoff from the development site. Changes of land use on previously developed land can also have significant downstream impacts where the existing drainage system may not have sufficient capacity for the additional drainage.

## 1.2 Standards

This Drainage Design report complies with the principles of SuDS presented in the 'Statutory Standards for Sustainable Drainage Systems – Designing, constructing, operating and maintaining surface water drainage systems'.

The six standards that need to be met are as follows:

- S1 – Surface water runoff destination
- S2 – Surface water runoff hydraulic control
- S3 – Water Quality
- S4 – Amenity
- S5 – Biodiversity
- S6 – Designing drainage for construction, operation, maintenance and structural integrity

## 1.3 What are SuDS?

A sustainable drainage system (SuDS) is designed to replicate, as closely as possible, the natural drainage from a site (before development) to ensure that the flood risk downstream of the site does not increase as a result of the land being developed.

SuDS can also significantly improve the quality of water leaving a site and can enhance the amenity and biodiversity that a site has to offer.

## 1.4 Climate Change

Projections of future climate change, in the UK, indicate more frequent, short-duration, high intensity rainfall and more frequent periods of long duration rainfall. The recommended national precautionary sensitivity range for peak rainfall intensity is 40%.

# 2 Location & Development Description

## 2.1 Site Location and Topography

The Site is located at Corn Farm, Old Quarry Road, Devauden, Chepstow, Monmouthshire, NP16 6NS. The national grid reference for the Site is 347612, 200883.

The location of the Site has been shown in Figure 2-1 and the planning site boundary has been shown in Figure 2-2. The Site is located towards the top of the west facing slope on the (B4293 road) ridge from Llanishen to Devauden.

The property is at an elevation of approximately 155mAOD, the land rises east to the B4293 ridge at 214mAOD, and falls steeply to the west to around 65mAOD.

A topographic survey of the Site has been attached at Appendix A.

***Figure 2-1 Site location***

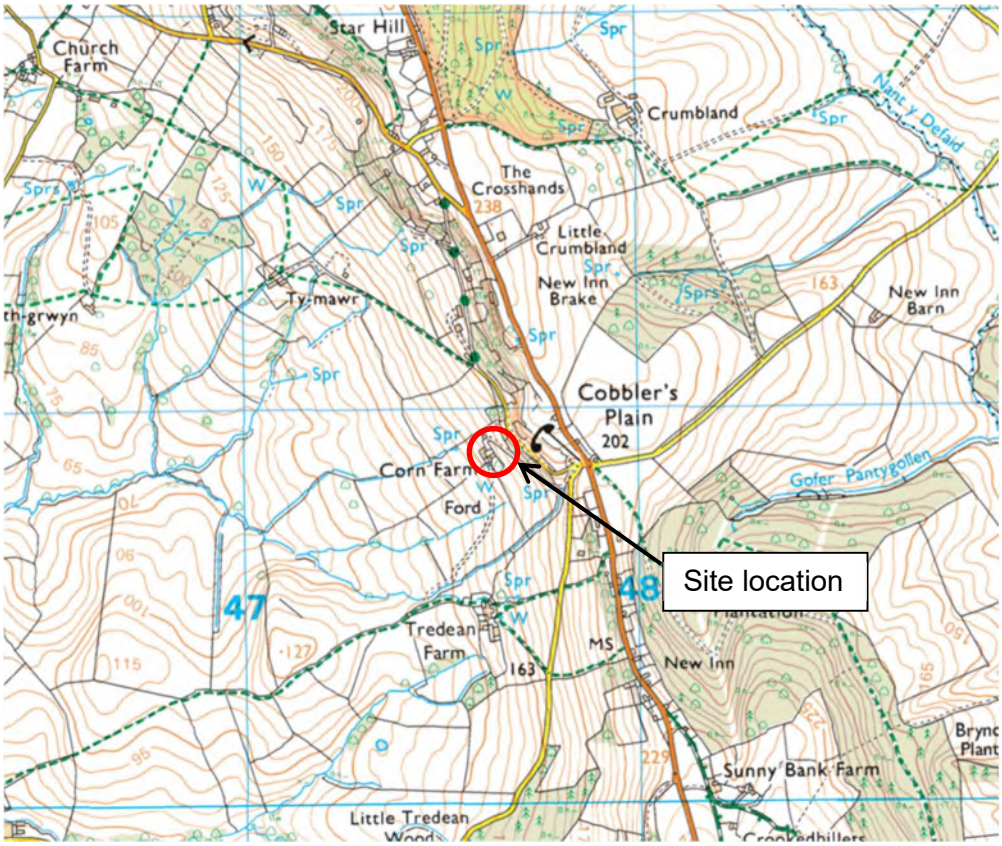


***Figure 2-2 Planning site boundary***




## 2.2 Existing Development

The Site currently comprises a stone barn with a slate roof. The Site is surrounded by modern agricultural buildings and undeveloped agricultural fields. The Site is approximately 0.06ha in size and is located on the west-facing slope of a north-south orientated ridge, with woodland to the adjacent upper eastern slope and undeveloped agricultural land to the adjacent lower western slope.

The undeveloped grassy land to the west falls under the property ownership of Corn Farm but falls outside the planning boundary marked in red in Figure 2-2.

## 2.3 Proposed Development

The proposed development falls under the following application with Monmouthshire Council:

- Reference DM/2021/01384: Conversion and alteration of barn to dwelling.

The proposed development includes the conversion of the long narrow stone barn structure into a separate single 3 bed residential dwelling with garden area. 3 no. parking spaces are to be located to the east of the property.

The alterations to the Site will have an effect on the surface water drainage, and the development will require a SAB application for a Sustainable Drainage System (SuDS).

The most recent plan of the proposed development at the Site has been attached at Appendix B.

## 2.4 Catchment Hydrology and Hydrogeology

Available Ordnance Survey (OS) mapping has been used to determine the surface water features in the vicinity of the Site. Additionally, Hydrogeo visited the Site on 27/06/2022 to confirm the existing drainage and surface water features.

A total of 3 no. springs are mapped within 250m of the site boundary, the closest located 70m west. These are likely associated with the bedrock geology, discussed in Section 2.6. A well is recorded on the southern edge of the site. Streams are mapped flowing west, downslope from the springs. OS mapping also indicates that a significant number of other springs are located within 2km north and south of the Site at approximately the same elevation along the ridge.

The exact discharge point for surface water runoff collected from positively drained areas of the Site such as roofs is not known but it is understood that water discharges informally to the soil to the west of the property.

A drainage ditch was identified during the site walkover, shown in Figure 2-3. The ditch follows the topography and falls to the west.

***Figure 2-3 Drainage ditch located to the west of the site***

Surface water in the wider catchment is collected in Pill Brook and then flows into the River Usk approximately 9.3km south west of the Site.

## 2.5 Public Sewers

It is understood that no public sewers are located within the vicinity of the Site and therefore surface water connection to a sewer is not a viable option. Dwr Cymru (Welsh Water) has no duty to keep records of private sewers, and there are no comprehensive records kept elsewhere.

## 2.6 Geology

The BGS geology map sheet 250 Chepstow (1:50,000), Sold and Drift (1981) has been used to determine geological information at the Site, along with available online BGS records (Drawing 1).

### Artificial Geology

BGS data indicate that there is no artificial geology at the Site.

### Superficial Geology

BGS data indicate that there are no superficial deposits at the Site.

### Bedrock Geology

BGS data indicate that 2 no. bedrock units are present at the Site:

The Brownstones Formation is present on the hillside above the Site to the east, dipping towards the east at approximately 10°. The Brownstones Formation comprises sandstone formed in a fluvial environment during the Devonian Period, approximately 393 to 419 million years ago.

Underlying the Brownstones Formation, and underlying the planning boundary, is the St Maughans Formation. The conformable boundary between the two units approximately follows the access lane immediately uphill from the property.

The St Maughans Formation comprises argillaceous rocks and sandstones formed in a fluvial environment during the Devonian Period, approximately 393 to 419 million years ago.

The relatively permeable Brownstones Formation will retain some groundwater. At the underlying contact with the St Maughans Formation many local springs form, including at the Site, due to the lower permeability of this formation.

## 2.7 Flooding Risk

Flooding data from NRW has been used to summarise the flood risk to the Site, as detailed below. A plan of the Flooding risk to the Site has been shown in Figure 2-4.

### Flooding Risk from Rivers

The Site is located in a Flood Zone 1 and therefore the risk of flooding from Rivers is considered to be **not significant.**

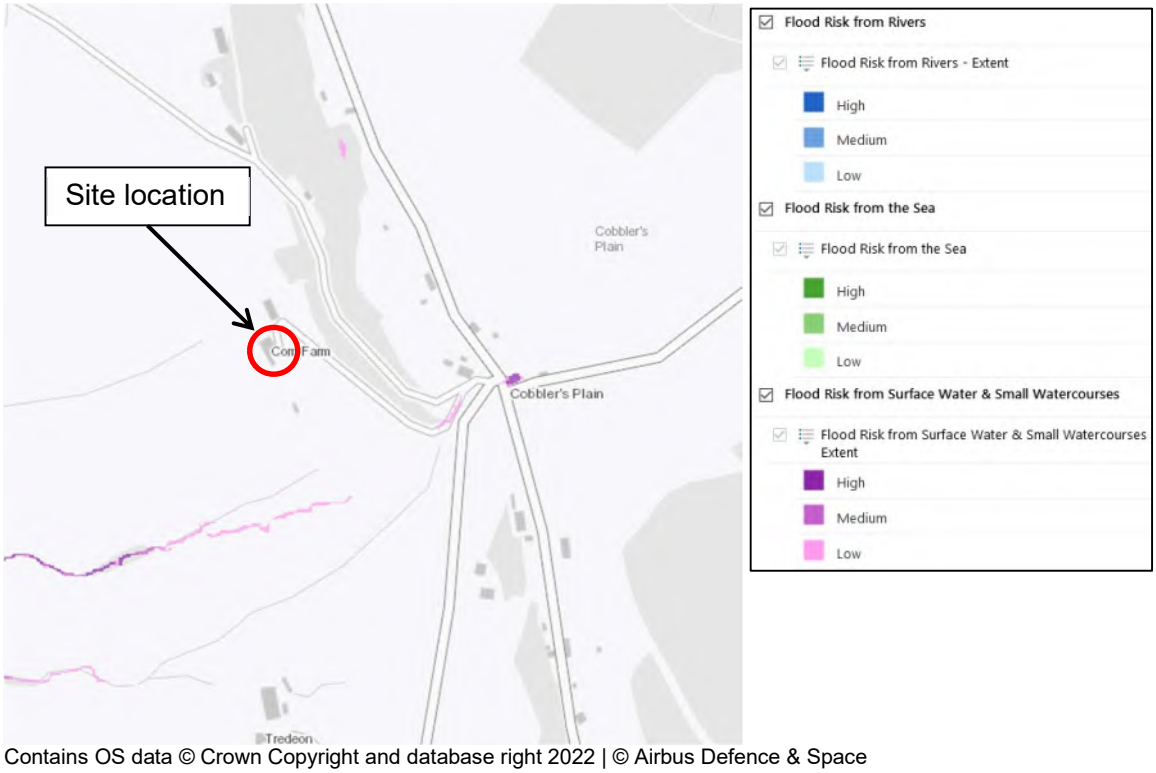
### Flooding Risk from the Sea

The Site is located significantly inland and above sea level. The risk of flooding from the sea is considered to be **not significant**.

### Flooding Risk from Surface Water

There are no areas within the boundary of the Site which are indicated to be at risk of surface water flooding. The risk of flooding from surface water is considered to be **not significant.**

***Figure 2-4 NRW Flood risk map***

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# 3 Site Visit

## 3.1 Introduction

Hydrogeo attended site for a walkover and to investigate the ground conditions on the 27th June 2022.

Based on the published geology and the presence of several springs in the local area, infiltration was not expected to be a viable option at the Site. The main objective of the site walkover was to better understand the surface water features and site layout in preparation for an expected discharge to surface water.

## 3.2 Ground Conditions

Ground conditions at the site have not been observed as no extrusive investigations were advanced. It is likely that the soil at the site would have a high clay content due to the presence of mudstone beneath the site. Due to the presence of springs nearby, a high groundwater level is expected at the site.

## 3.3 Soakaway Testing

Soakaway testing has not been undertaken at the site. It is deemed that discharge to ground is not viable due to the presence of springs and likelihood of a high water table at the site.

## 3.4 Slope Stability

Geotechnical assessment of the Site for engineering purposes falls outside the scope of this report.

No evidence of land slips or scars has been identified in available aerial photography between 2004 and 2020, and BGS mapping does not indicate the presence of significant bedrock faulting in the vicinity of the Site.

The Site slopes downwards towards the west. BGS mapping data indicates that the dip of the bedrock in the vicinity of the Site is 10° towards the east, into the hillside. This is likely to reduce the chance of stability issues within the bedrock.

No superficial deposits are recorded at the Site by the BGS or identified during trial pitting by Hydrogeo, therefore the risks associated with more loosely consolidated deposits is considered to be low.

## 3.5 Contaminated Land

Based on historic mapping it is not considered likely that significant quantities of anthropogenic material are present in the soil at the Site.

Any anthropogenic material present would likely be small in quantity and associated with the residential and agricultural use of the land: a house, garden, driveway, outbuildings and fields.

There is not considered to be a significant contamination risk associated with the soil at the Site.

# 4 S1: Surface Water Runoff Destination

## 4.1 Surface Water Runoff Destination

As part of the SuDS Standards the management of runoff from developments should be prioritised as to the choice of discharge destination. The priority hierarchy is listed below:

1) Collect for re-use;
2) Infiltrate to ground;
3) Discharge to a surface water body;
4) Discharge to a surface water sewer/highway drain; and
5) Discharge to a combined sewer.

## 4.2 Collect for re-use

The reuse of water from roofed areas to provide grey (non-potable) water can reduce storm runoff without the need for treatment or oil separators, since the risk of spillage or contamination is low. It is understood that the Client has a daily usage of up to 3,000l ($3m^3$) for livestock drinking water and general agricultural purposes.

In order for a rainwater harvesting system to provide adequate surface water runoff attenuation for a site calculation of the yield to demand ratio is necessary. If the yield significantly exceeds the demand, then a rainwater harvesting system will offer very little surface water runoff attenuation benefit, and further SuDS attenuation features will be required at the Site.

The runoff yield and demand have been calculated using Section 11.3 of the SuDS Manual.

**Runoff Yield Calculation**

Box 11.2 of the SuDS Manual details the runoff yield calculation, as listed below. The methodology used is the intermediate method, water conservation (supply) only.

$$Y_R = A \times e \times AAR \times \eta \times 0.05$$

Where;

$Y_R$ = annual runoff volume (yield) (l/year)

$A$ = collecting runoff area ($m^2$)

$e$ = runoff (yield) coefficient

$AAR$ = average annual rainfall depth (mm)

$\eta$ = hydraulic filter efficiency (ratio)

The calculation has been shown in Table 4-1.

***Table 4-1 Runoff yield calculation (intermediate method: water supply only)***

| Input | Value |
|---|---|
| **A** - roof area ($m^2$) | 180 (inc. 10% urban creep) |
| **e** - runoff (yield) coefficient* | 1.0 (tiled pitched roof) |
| ***AAR*** - average annual rainfall depth (mm) | 1,420 (inc. 40% climate change) |
| **η** - hydraulic filter efficiency | 0.9 (default) |
| $Y_R$ – annual runoff volume (yield) (l/year) | **11,502** |

* Runoff yield coefficient takes into account initial losses associated with wetting (Table 11.5 of SuDS Manual).

**Runoff Demand Calculation**

Box 11.3 of the SuDS Manual details the water demand ($D_N$) calculation however this is for standard domestic such for flushing WCs and use in washing machines. The demand at the Site relates to agricultural use for livestock drinking water and other agricultural purposes. The Client has identified an average daily use of up to 3,000l.

In this scenario **$D_N$ = average daily demand x 365 days per year**

Therefore, $D_N$ = 1,095,000l/year.

**Yield to Demand Ratio**
The yield to demand ratio is given as,

$$Y_R / D_N$$

Where,

$Y_R$ = runoff volume (yield) (l)

$D_N$ = total annual demand for non-potable water (l)

Therefore, the yield to demand ratio for the Site is 0.01.

**Rainwater Tank Sizing**
For yield to demand ratios of less than 0.9 the SuDS manual discusses 3 no. methods: the 'simple method', the 'intermediate method' and the 'detailed method'.

The simple method is appropriate for use where $Y_R/D_N$ = <0.7 as shown in Box 11.4 of the SuDS Manual.

The total tank size calculation is given as,

$$V_{SC} + Y_R$$

Where;

$V_{SC}$ = storm event storage volume ($m^3$)

$Y_R$ = 5% of the annual volume (yield) (Table 4-1)

The storage volume is given as,

$$V_{SC} = (A \times R_d \times \beta \times \eta) / 1{,}000$$

Where;

$V_{SC}$ = storm event storage volume ($m^3$)

$A$ = contributing runoff area ($m^2$)

$R_d$ = design storm event rainfall depth (mm)

$\beta$ = design storm event runoff coefficient

$\eta$ = hydraulic filter efficiency

The calculation has been shown in Table 4-2

***Table 4-2 Rainwater harvesting tank size calculation***

| Input | Value |
|---|---|
| **A** - roof area ($m^2$) | 180 (inc. 10% urban creep) |
| $R_d$ – design storm event rainfall depth (mm) | 92mm (6-hour, 100 year, FEH13, inc. 40% climate change) |
| $\beta$ – design storm event runoff coefficient | 0.9 |
| $\eta$ – hydraulic filter efficiency (ratio) | 0.9 |
| $V_{SC}$ – storm event storage volume ($m^3$) | 13.414 |
| $Y_R$ – 5% of annual volume (yield) (l/year) | 575 |
| $D_N$ – 5% of annual demand (l) | 54,750 |
| $Y_R/D_N$ – yield / demand ratio | 0.01 |
| $V_{SC} + Y_R$ – total storage volume (l) | **13,989** |

**Rainwater Harvesting Viability**
Based on the calculations in the Sections above it is considered that rainwater harvesting is a viable method of surface water runoff control at the Site. The demand significantly exceeds the yield, at a $Y_R/D_N$ ratio of 0.01.

The minimum tank size has been calculated at 13,989l.

It is understood that the Client will be installing rainwater harvesting tanks with a total capacity of 20,000l, split between 2 no. tanks. This will result in a considerable volume of storage, taking into account the surface water runoff attenuation volume for a 1 in 100 year storm which is built into the calculations in Table 4-1 and Table 4-2.

## 4.3 Infiltrate to ground

The anticipated ground conditions suggest infiltration SuDS techniques such as soakaways will not work as a primary means of discharge.

Sufficient water storage will be provided by the 20,000 rainwater harvesting tanks to be installed at the Site; therefore, a discharge to ground is not necessary.

## 4.4 Discharge to a surface water body

A drainage ditch is located approximately 10m southwest of the site boundary and is considered to be the most viable option for discharging any excess surface water runoff at the Site. The land upon which the stream is located falls under the same ownership as Corn Farm.

It should be noted that any discharge to the drainage ditch would only be as an overflow in rare cases: the rainwater harvesting tanks have been sized in excess of what is required for a 1 in 100 year rainfall event.

The overflow discharge from the tanks will connect to this existing ditch via traditional sub-surface pipework.

## 4.5 Discharge to a surface water sewer

Due to the distance between the Site and any public sewers, this option has been deemed as unpractical at this stage. If required, this option should be explored further.

## 4.6 Discharge to a combined sewer

Due to the distance between the Site and any public sewers, this option has been deemed as unpractical at this stage. If required, this option should be explored further.

# 5 S2: Surface Water Runoff Hydraulic Control

## 5.1 Site Areas

The total area of the Site has been calculated at 633m$^2$.

The positively drained surfaces at the Site comprise only the dwelling roof, at 164m$^2$.

The vehicular and pedestrian access and parking areas to the north east and south west of the dwelling are to remain gravel hardstanding, as present, and therefore will not be provided with formal drainage.

The area to the south east of the dwelling is proposed as soft landscaping and therefore will not be provided with formal drainage. It is expected that incident rainfall at these areas will infiltrate the topsoil/gravel.

## 5.2 Surface Water Runoff Rates and Volume Control

Roof runoff from the dwelling is to be fed into a rainwater harvesting tank system with a total capacity of 20,000 litres.

The capacity is in excess of what is required to provide the Client with the expected demand for non-potable agricultural use and for surface water runoff attenuation during a 1 in 100 year storm event. The surface water runoff attenuation takes into account a 40% increase in rainfall intensity due to climate change and a 10% increase in surface area due to urban creep.

The tank sizing calculations have been shown in Section 4.2 and are based on the methodology outlined in the SuDS Manual. The calculated minimum tank size is 13,989 litres however the Client intends to install tanks with a total capacity of 20,000 litres.

Because there is sufficient storage provided for demand and rainfall events, there is no requirement to restrict runoff from the roof to greenfield rates. Under all normal conditions there is not expected to be any surface water runoff from the developed surface (the dwelling roof) leaving the site boundary.

Exceedance events outside the 1 in 100 year storm event, and instances of drainage failure are discussed in Section 5.5.

## 5.3 Drainage Design

The objective of this drainage design is to ensure that a sustainable drainage solution can be achieved which manages and reduces the flood risk posed by the surface water runoff from the Site.

The drainage design takes into account the following principles:

- No increase in the volume or runoff rate of surface water runoff from the Site.
- No increase in flooding to people or property off-site as a result of the development.
- No surface water flooding of the Site.

- The design takes into account a 40% increase in rainfall intensity due to climate change during the next 100 years.
- The design takes into account a 10% increase in the impermeable areas due to urban creep.

In line with adopting a 'management train' it is recommended that water is managed as close to source as possible. This will reduce the size and cost of infrastructure further downstream and also shares the maintenance burden more equitably.

The drainage design layout has been shown on Drawing 2, with a section through the proposed features shown on Drawing.3. Further design detail has been shown on Drawing 4.

Surface water runoff from the roof of the dwelling will be collected in traditional guttering and rainwater downpipes, before being conveyed below the surface to the rainwater harvesting tanks by pipework.

Following discussion with the Client two 10,000 litre Ecosure ECO10000UND below-ground rainwater harvesting tanks (or similar approved) are proposed to be installed in the soft landscaping area to the south east of the dwelling to provide the desired 20,000 litre capacity. Product and installation information for the Ecosure tanks has been attached at Appendix C.

It is expected that the Client will use a submersible pump or gravity to collect water from the tanks. The specification of a lift pump falls outside the scope of this report.

Polypipe UG437A non-adoptable inspection chambers (or similar approved) will be used where pipes come together, to allow maintenance access. Product information for the Polypipe inspection chambers has been attached at Appendix D.

A high-level overflow will be provided from the tanks for exceedance events, which are expected to be rare owing to the significant yield to demand ratio. The overflow pipe will convey water to a filter drain to dissipate energy prior to flowing into the existing drainage ditch to the south west of the Site, on land owned by the Client.

Due to the fall at the Site and the location of the SuDS components, water will be drained under gravity; no pumping will be required other than by the Client for water re-use.

## 5.4 Interception

The Welsh SuDS Standards confirm that rainwater harvesting systems can provide the interception requirement.

It should be noted that no surface water runoff from the dwelling roof is expected to leave the Site boundary under normal conditions. The capacity of the tank exceeds the expected demand for non-potable water use by the Client and the 1 in 100 year rainfall event.

The other surfaces at the Site will either remain as existing (gravel hardstanding) or will comprise soft landscaping. In each case interception for these surface types is assumed.

## 5.5 Designing for Local Drainage System Failure/Design Exceedance

When considering residual risk, it is necessary to make predictions as to the impacts of a storm event that exceeds the design event, or the impact of a failure of the local drainage

system. The drainage design applies a safe and sustainable approach to discharging rainfall runoff from the Site and this reduces the risk of flooding however, it is not possible to completely remove the risk. This section is therefore associated with the way the residual risk is managed.

As part of the drainage design it must be demonstrated that the flooding of property would not occur in the event of local drainage system failure and/or design exceedance. It is not economically viable or sustainable to build a drainage system that can accommodate the most extreme events. Consequently, the capacity of the drainage system may be exceeded on rare occasions, with excess water flowing above ground[1].

The drainage design has been designed to accommodate the runoff generated during a 1 in 100 year, 6-hour design rainfall event.

An exceedance of the surface water drainage system (>1 in 100 year event) would result in water being conveyed to the existing drainage ditch via the high-level unrestricted overflow from the tanks.

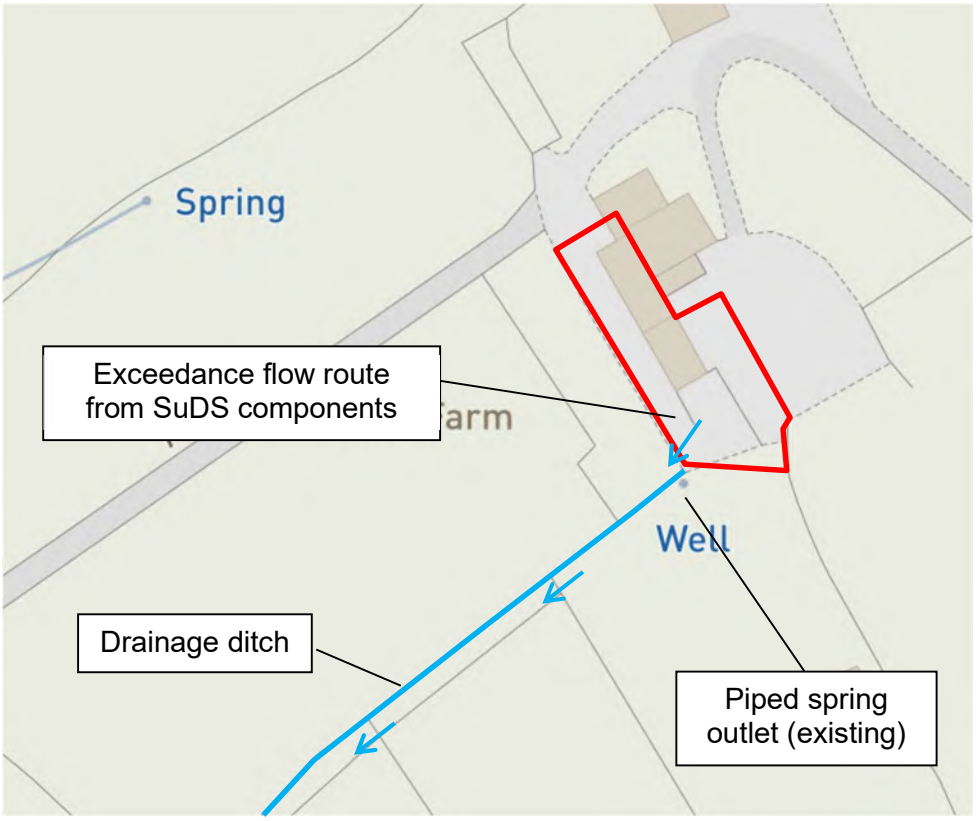
Failure of one/any of the drainage system components would cause water to flow over the surface at the soft landscaping area. The fall of this area, and the Site more widely, is towards the south west and therefore water would flow away from the proposed dwelling. Water is expected to either flow of the agricultural field surface or into the existing drainage ditch to the south west of the Site. There are no dwellings or other buildings down-slope of the Site prior to Pill Brook at the bottom of the valley.

Consequently, the risk to the Site and off-site property as a result of an exceedance event is considered to be low.

The exceedance flow routes have been shown in Figure 5-1.

[1] CIRIA (2006) Designing for exceedance in urban drainage – good practice.

***Figure 5-1 Exceedance flow routes***



# 6 S3: Water Quality

## 6.1 Water Treatment

According to the SuDS Standards (see Table 6-1), the proposed development is defined as a low hazard (roof water).

***Table 6-1 Level of hazard***

| Hazard | Source of hazard |
|---|---|
| Low | Roof drainage |
| Medium | Residential, amenity, commercial, industrial uses including car parking spaces and roads |
| High | Areas used for handling and storage or chemicals and fuels, handling of storage and waste (incl. scrap-yards). |

Residential roofs have a 'very low' pollution hazard level as per Table 26.2 of the SuDS Manual.

The pollution hazard indices for the roof have been shown in Table 6-2.

***Table 6-2 Pollution hazard indices***

| Land use | Pollution hazard level | Total Suspended Solids (TSS) | Metals | Hydrocarbons |
|---|---|---|---|---|
| Residential roofs | Very low | 0.2 | 0.2 | 0.05 |

* Indices values range from 0-1

For a SuDS scheme where surface water runoff is discharged to the environment either to ground, to a surface waterbody, or to a combined sewer then appropriate SuDS mitigation indices can be assigned to various treatment features.

The SuDS scheme proposed at the Site has been sized to allow the capture of a design rainfall event and still facilitate the expected demand from the Client for non-potable water for agricultural use. Under all normal circumstances it is expected that no surface water runoff generated by the developed surface at the Site (the dwelling roof) would leave the site boundary.

Under an exceedance event it is acknowledged that water will enter the environment at the adjacent drainage ditch, likely via the overflow pipe. There is considered to be a low risk to the environment from the overflow water; principally due to the very low pollution hazard level of residential roof water.

In a typical SuDS scheme where water is intended to be discharged to the environment it is reasonable to expect the treatment features to be bypassed during an exceedance event. Therefore, an exceedance event at the Site is not considered to represent any higher risk than for any other similar SuDS scheme.

Although no SuDS mitigation indices are applied to water filter chambers, the presence of the chamber prior to the rainwater harvesting tanks is expected to reduce the total suspended solids component of the runoff under all circumstances.

# 7 S4 Amenity

The proposed development at the Site includes the creation of soft landscaping to the south east of the dwelling in an area where there is presently gravel and a ‘rubble mound’, as shown on the topographic plan attached at Appendix A.

The creation of soft landscaping in this area represents significant betterment over the current land use, and affords significant amenity benefit to the site ends users.

The proposed soft landscaping area has been shown on the proposed layout and landscape plan attached at Appendix B.

# 8 S5 Biodiversity

The proposed development at the Site includes the creation of soft landscaping to the south east of the dwelling in an area where there is presently gravel and a ‘rubble mound’, as shown on the topographic plan attached at Appendix A.

The creation of soft landscaping in this area represents significant betterment over the current land use, and affords significant biodiversity benefit to the site ends users.

The proposed soft landscaping area has been shown on the proposed layout and landscape plan attached at Appendix B.

Planting at the soft landscaping area is proposed to include variety of native species of local provenance to ensure opportunities for biodiversity and sustain habitat within the development. Carrying out grass cuts and removing from the Site will also improve biodiversity of the landscaped area.

Plant species have been selected for both their suitability to thrive in the prevailing Site conditions and their enhancement of biodiversity through provision of habitat, food and pollen.

# 9 S6: Designing Drainage for Construction, Operation, Maintenance and Structural Integrity

## 9.1 Construction Phase Surface Water Impacts

The proposed development has the potential to introduce contaminants from the associated machinery, infrastructure, transportation, importation of construction materials and maintenance and storage of plant equipment as discussed below:

*Excavated Ground and Exposed Ground*

Recently disturbed and vegetation-free ground allows for relatively low velocity runoff to erode the surface. This leads to increased runoff and sedimentation of adjacent land and, at greater distance, receiving waters; thereby increasing flood risk/potential impacts on water quality.

*Stockpiles*

Rainfall could lead to erosion of material should a stockpile be left uncovered. This could lead to siltation of drainage for receiving watercourses and therefore an increase in flood risk/potential impact on water quality.

*Oils and Hydrocarbons*

The use of oils and hydrocarbons on construction sites provide a risk of leakages and spillages, leading to pollution incidents. This could affect the water quality in drainage/ receiving watercourses and aquifers.

## 9.2 Construction Phase Surface Water Management Plan

The following section provides detail on site drainage during the construction phase; this will reduce the potential for vehicle movement on wet ground, which can increase the potential for silt runoff.

In summary, the withdrawn Pollution Prevention Guidance[2] (PPG) and Government guidance[3] states that the following methods of surface water management should be put in place during the construction phase to ensure pollution, sediment and erosion control:

**Excavated Ground and Exposed Ground**
To limit the volume of runoff reaching the exposed ground, runoff diversion or interception devices / bunds can be placed upstream of exposed ground. To help control sediment in runoff from leaving the Site or entering drainage, silt fences, bunds, hay bales or ditches can be placed downstream of exposed ground to intercept runoff.

[2] Pollution Prevention Guidelines PPG1: Understanding Your Environmental Responsibilities (July 2013).
Pollution Prevention Guidelines PPG6: Working at construction and demolition sites (March 2012).
Pollution Prevention Guidelines PPG7: The safe operation of refuelling facilities (July 2011).
Pollution Prevention Guidelines PPG8: Safe storage and disposal of used oils (February 2004).
Pollution Prevention Guidelines PPG13: Vehicle washing and cleaning (July 2007).
Pollution Prevention Guidelines PPG21: Incident Response Planning (March 2009).
Pollution Prevention Guidelines PPG22: Dealing with spills (April 2011).
[3] https://www.gov.uk/guidance/storing-oil-at-a-home-or-business, May 2015.
https://www.gov.uk/guidance/manage-waste-on-land-guidance-for-land-managers, May 2014.

**Stockpiles**
Soil stockpiles will be located away from any drainage systems and measures to intercept runoff will be incorporated, such as a silt fence or small perimeter bunds around the base of the stockpiles.

**Access Track**
Any construction phase access tracks or internal haul roads will be designed so that the length is kept to a minimum, but they still serve their purpose. The gradient will be as shallow as possible to prevent increasing runoff velocity and, if possible, bunds and / or discrete ditches constructed to intercept the runoff.

If required access tracks will be sprayed regularly to keep down dust. If any section of access tracks are hard surfaced, then they will be swept on a regular basis to prevent accumulation of dust and mud.

**Oils and Hydrocarbons**
Simple measures can be taken to prevent oil and hydrocarbons becoming pollutants, such as:

- Maintenance of machinery and plant
- Drip trays
- Regular checking of machinery and plant for oil leaks
- Correct storage facilities
- Check for signs of wear and tear on tanks
- Care with specific procedures when refuelling
- Designated areas for refuelling
- Emergency spill kit located near refuelling area
- Regular emptying of bunds
- Tanks located in secure areas to stop vandalism

**Ground Compaction**
In order to minimise ground compaction, the following measures will be implemented if required;

- Vehicle movements on bare soil will be minimised.
- Vehicle movements on wet ground will be minimised.

The pollution, sediment and erosion control mitigation measures as detailed above will ensure that the effects on receptors during the construction phase are negligible.

## 9.3 Construction Phasing

The surface water drainage scheme will be installed and fully operational before occupation of the Site occurs.

The construction phasing has been described in the sections below.

**Phase 1 - Construction Preparation**
The exact nature of this phase is dependent on the Client's plans and the proposed construction, however the phase is likely to include the following, where applicable:

- Erect fence barriers for site access safety
- Dig foundations for development
- Pour concrete foundations
- Block work to damp course
- Pour concrete slab

**Phase 2 - Main Construction**
The exact nature of this phase is dependent on the Client's plans and the proposed construction, however the phase is likely to include the following, where applicable:

- Erect scaffolding
- Roofs works; steel construction framework, rafters, metal clad roof system
- Block work
- Install windows and doors
- Drainage for surface water (roof)
- Drainage for waste
- Stone work

**Phase 3 - Internal Works**
The exact nature of this phase is dependent on the Client's plans and the proposed construction, however the phase is likely to include the following, where applicable:

- Insulation
- Plaster boarding
- Plastering
- First fix electrics
- First fix plumbing
- First fix sprinkler systems
- Internal joinery
- Second fix
- Internal finishing

**Phase 4 - Exterior and Drainage Works**
The main SuDS components will be installed at this final stage of the development. No later significant construction works are proposed therefore the SuDS features will be

protected from the risk of compaction, damage and siltation from machinery and/or materials.

- Dismantling scaffolding
- Install retaining walls where required
- Excavate and/or build up levels to create soft landscaping area
- Excavate void and install rainwater harvesting tanks, pipes and chambers
- Install filter drain scour protection at the overflow pipe outlet to existing drainage ditch
- Landscaping and planting

A CDM design risk assessment has been attached at Appendix F.

**Phase 5 - Handover**
Following completion of all development construction works at the site the SuDS Management and Maintenance Plan (Section 9.4 and Appendix G) will be handed over to the owner in order to ensure ongoing maintenance of the drainage system. The SuDS Management and Maintenance Plan will be passed on to any future owners of the Site.

- Handover booklet / information to include Management and Maintenance Plan for SuDS features
- Any completion certificates
- Instruction manuals for property systems

## 9.4 Operation / Maintenance and Structural Integrity

This section of the drainage design report provides detail on site drainage during the operational phase.

The following lists the SuDS components and features which are proposed at the site:

- **Rainwater Harvesting Tanks:**
    - Two connected 10,000 litre rainwater harvesting tanks will store surface runoff from the roof of the dwelling. The tanks will be located below soft landscaping area to the south east of the dwelling.
    - The tanks have been sized on the runoff generated during a 1 in 100 year, 6-hour duration event, and will provide sufficient storage for the expect demand for non-potable agricultural water use.
    - During exceedance events an overflow pipe will convey runoff to the existing drainage ditch via a filter drain to dissipate energy.
- **Traditional drainage:**
    - Inspection chambers and rodding eyes will be used on bends or where pipes come together. They allow access and cleaning to the system if necessary.

- Inlet structures such as rainwater down pipes. They should be free from obstruction at all times to allow free flow through the drainage network.

The SuDS scheme has been designed for easy maintenance to comprise:

- Regular care (as required) – 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.
- Remedial Work – repairing damage where necessary.

As far as is reasonably practicable the surface water drainage system has been designed so that the SuDS features can be constructed easily, safely, cost effectively and in a timely manner.

The surface water drainage scheme will be installed and fully operational before use of the Site occurs. The surface water drainage scheme will be regularly maintained. The key maintenance requirements are regular inspection of inspection chambers, pipework and the rainwater harvesting tanks, with removal of sediment and debris as required.

The structural integrity of the drainage components will be designed to withstand the anticipated usage conditions over the design life of the development, accounting for reasonable levels of maintenance. The maintenance will be the responsibility of the owner of the Site.

The SuDS Management and Maintenance Plan has been attached at Appendix G and a health and safety risk assessment has been attached at Appendix H.

## 9.5 Design Life

The design life of the development is likely to exceed the design life of each of the SuDS components listed above. During the routine inspections of any SuDS components, it may become apparent that they have reached the end of their functional lifetime. In the interest of sustainability repairs should be the first-choice solution where practicable. If this is not the case, then it will be necessary to undertake complete replacement of the component in question.

When undertaking maintenance, repairs or replacement, all drawings used in the design, construction and installation of the SuDS components should be referred to for construction and specification details. This will help to ensure satisfactory performance of each of the SuDS components.

## 9.6 Spillage – Emergency Action

Most spillages on developments are of compounds that do not pose a serious risk to the environment if they enter the drainage in a slow and controlled manner with time available for natural breakdown in a treatment system. Therefore, small spillages of oil, or other known organic substances should be removed where possible using soak mats as recommended by Natural Resources Wales, with residual spillage allowed to bioremediate in the drainage system.

In the event of a serious spillage, either by volume or of unknown or toxic compounds, then isolate the spillage with soil, turf or fabric and block outlet pipes from chamber(s)

downstream of the spillage with a bung(s). A bung for blocking pipes may be made by wrapping soil or turf in a plastic sheet or closely woven fabric.

Contact Natural Resources Wales immediately. Tel: 0300 065 3000.

# 10 Summary and Conclusions

## 10.1 Introduction

This Drainage Design Report provides details of the method that will be used to discharge the surface water runoff in accordance with the six standards requiring evaluation as part of a SuDS Approval Body (SAB) application, for development at Corn Farm, Devauden, Monmouthshire.

## 10.2 Drainage Design

This drainage design ensures that a sustainable drainage solution can be achieved which reduces the peak discharge rate to manage and reduce the flood risk posed by the surface water runoff from the Site.

The drainage design takes into account the following principles:

- No increase in the volume or runoff rate of surface water runoff from the Site.
- No increase in flooding to people or property off-site as a result of the development.
- No surface water flooding of the Site.
- The design takes into account a 40% increase in rainfall intensity due to climate change during the next 100 years.
- The design takes into account a 10% increase in the impermeable areas due to urban creep.

In line with adopting a 'management train' it is recommended that water is managed as close to source as possible. The drainage design will take the form of:

- Two connected 10,000 litre rainwater harvesting tanks located beneath the surface of the soft landscaping area, sized based on the runoff generated during a 1 in 100 year, 6-hour duration rainfall event and the expected water re-use demand. The tank will collect roof runoff primarily for re-use as drinking water for livestock at the farm.
- Traditional sub-surface drainage pipes conveying water from the dwelling roof downpipes to the tanks via a filter chamber. Pipes should be free from obstruction at all times to allow free flow.
- Inspection chambers and rodding eyes are to be used on bends or where pipes come together, allowing access and cleaning to the system if necessary.
- An exceedance event overflow pipe from the tanks to the existing drainage ditch south west of the Site via a filter drain to dissipate energy.

The drainage design layout has been shown on Drawing 2, with a section through the proposed features shown on Drawing.3. Further design detail has been shown on Drawing 4.

The remainder of the Site that is not formally drained will be permeable, i.e., landscaped areas and existing gravel hardcore surfacing at vehicular areas. Incident rainfall onto these areas is expected to soak into the topsoil/surfacing.

The SuDS methods proposed in this report will reduce peak flows and the volume of runoff, and will provide a suitable SuDS solution for the Site.

In adopting these principles, it has been demonstrated that a scheme can be developed that does not increase the risk of flooding to the Site and properties in the vicinity of the Site.

## 10.3 Conclusion

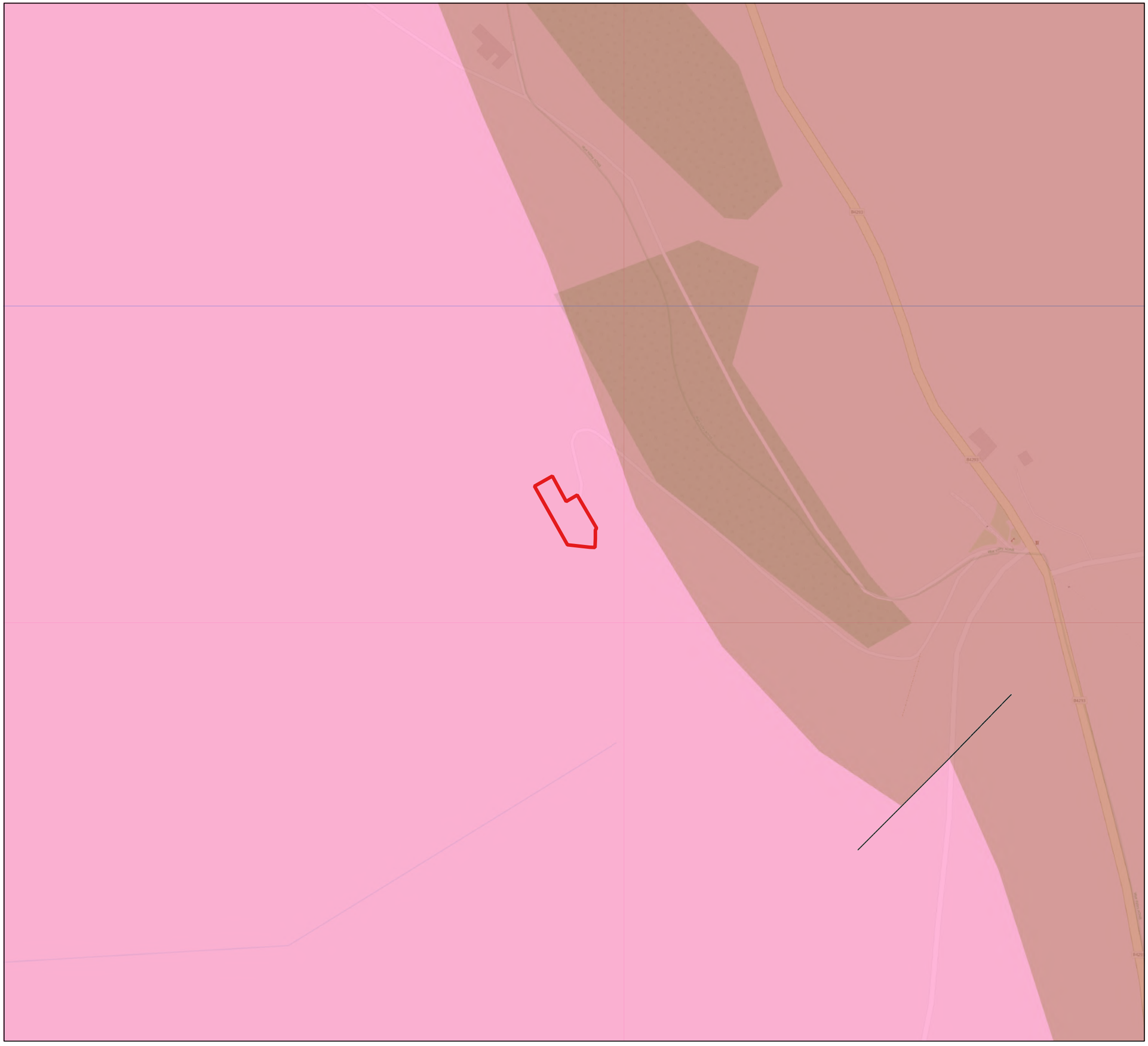
This drainage design demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of the SuDS Standards.

This drainage design complies with the principles of SuDS presented in the 'Statutory Standards for Sustainable Drainage Systems – Designing, constructing, operating and maintaining surface water drainage systems.

# Drawings

# Drawing 1

## Bedrock geology map



HYDROGEO
Groundwater and Environment

HYG1072 Corn Farm, Devauden

**DRAWING 01**

Bedrock Geology Map

**KEY**

- Site Boundary
- Fault
- Brownstones Formation - Sandstone
- St Maughans Formation - Argillaceous Rocks and (Subequal/Subordinate) Sandstone, Interbedded



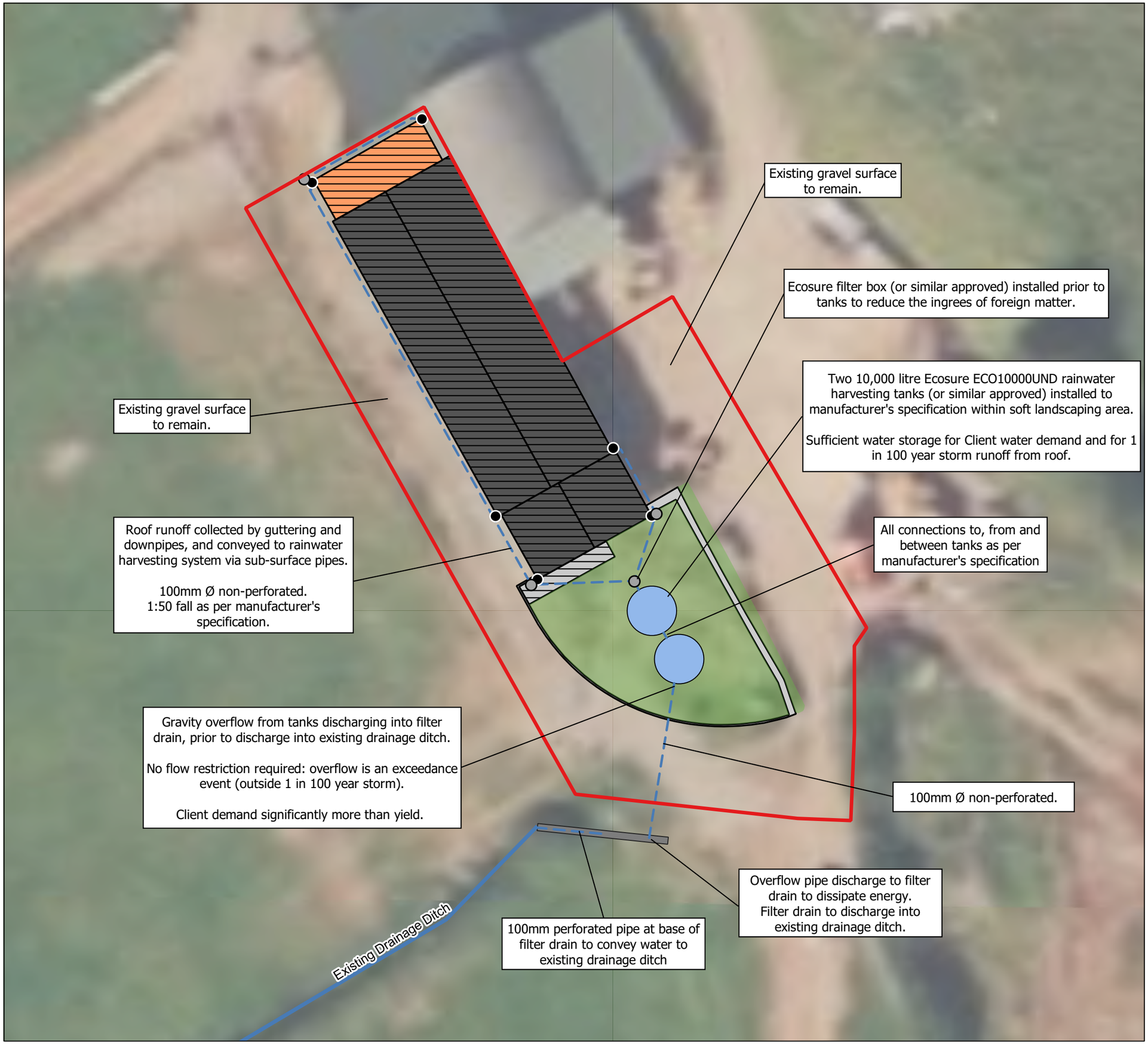
50 0 50 100 m

N

| Date | By | Paper | Scale | Rev |
|---|---|---|---|---|
| 27 07 2022 | JW | A3 | 1:2,000 | 0 |

# Drawing 2

## Drainage design layout




HYDROGEO

HYG1072 Corn Farm, Devauden

**DRAWING 02**

Drainage design layout

**KEY**

- Site Boundary

**Proposed development**

- Pathway
- Retaining wall
- Roof
- Soft landscaping
- Terrace

**Drainage features**

- Rainwater Harvesting Tank
- Filter drain
- Existing drainage ditch
- Drainage pipe
- Inspection chambers
- Rainwater downpipe



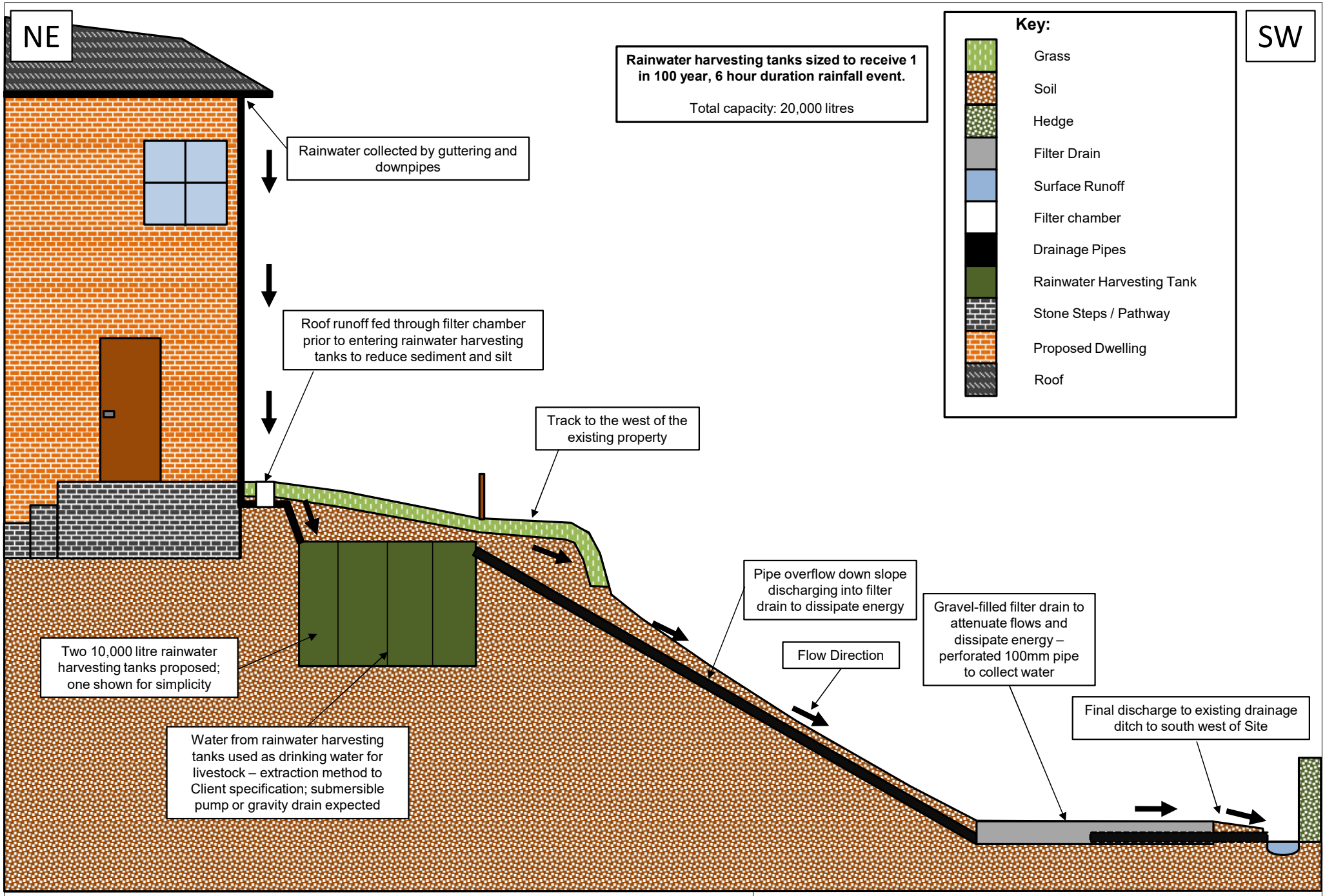
5 0 5 10 m

N

| Date | By | Paper | Scale | Rev |
|---|---|---|---|---|
| 11 2022 | TP | A3 | 1:200 | 1 |

# Drawing 3

## Drainage design section




DRAWING 03 – Drainage design cross section

Notes:
Drawing not to scale and elevation exaggerated

Client: Powell Property Developments Ltd

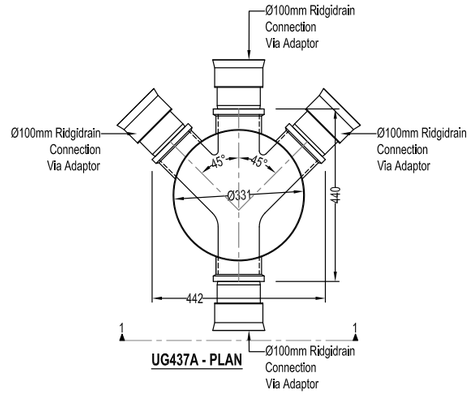
Project: Corn Farm, Devauden Ref: HYG1072

Date: October 2022 Drawn By: TP Checked: CB

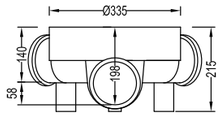
HYDROGEO Telephone:01873 856813 Email:chris@hydrogeo.co.uk Web:www.hydrogeo.co.uk

# Drawing 4

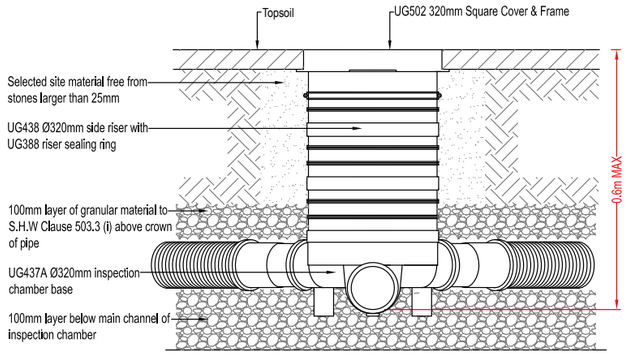
## Design detail




UG437A - PLAN




UG437A - ELEVATION 1-1



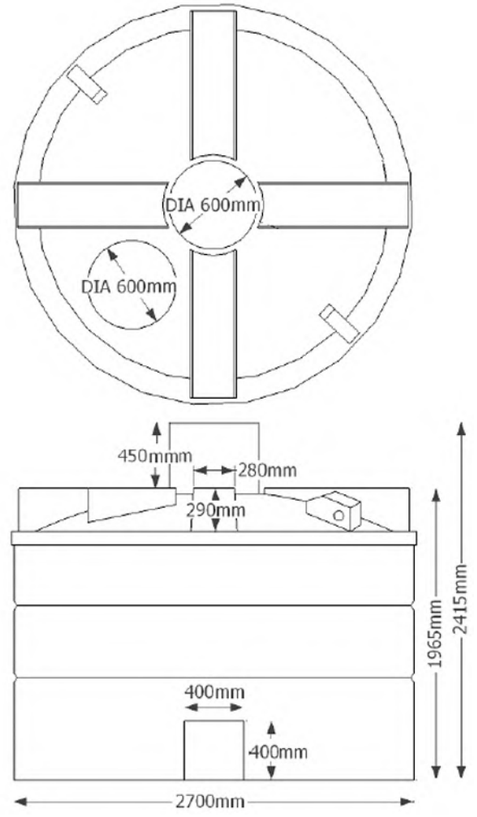

UG437A - TYPICAL INSTALLATION

| COVER AND FRAME | PRODUCT CODE |
|---|---|
| 320mm (square) cover & frame PVC Non-vehicular traffic only | UG502 |

**ANCILLARY NOTES**

UG438 - Side Riser
UG388 - Riser Sealing Ring
UG445 - Ø110mm Spare Blanking Plug
Adaptors and sealing ring included with this chamber base

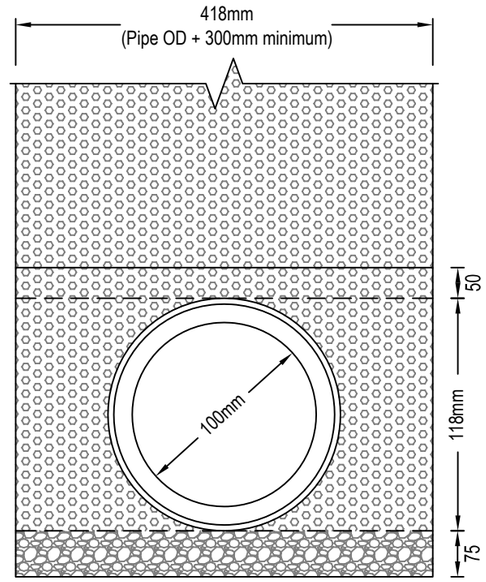
Polypipe Ridgidrain UG437A - Non-adoptable Surface Water System Inspection




Ecosure ECO10000UND Rainwater Harvesting Tank




External rodding eye detail




## TYPE H FILTER DRAINS

Scale (1:10)

Type B filter material to S.H.W clause 505

Type A or C filter material to S.H.W clause 505 or granular material to S.H.W clause 503.3 (i)

Filter drain detail


HYDROGEO LTD
Unit 4 Waddington House
Llanover Business Centre
Llanover
Abergavenny
Monmouthshire
NP79HA


| | | | |
|---|---|---|---|
| Project: | HYG1072 Corn Farm | | |
| Client: | Powell Property Developments Limited | | |
| Drawing Title: | Component detail | | |
| Date: | October 2022 | | |
| Drawing No: | 4 | Revision: | Version 1 |
| Scale: | NTS | | |
| Drawn: | TP | | |

# Appendices

# Appendix A

## Topographic survey

MACHINERY BARN
INCOMPLETE
DM/2019/00477

LIVESTOCK BARN

EAVE +165.97m

RIDGE +167.63m

EAVE +166.36m

G+162.41m

CONC

ACCESS DRIVEWAY

1.1 PBW

SOFT LANDSCAPING

TRAILER BARN

EAVE +160.72m

HAY BARN

EQUIPMENT BARN

LONG BARN

CORRUGATED SHEET

skylight

CONC

TAR

ST.RET

0.3ST,RET

0.8IR

HIS

rubble mound

HARD STANDING

SOFT LANDSCAPING

APPLICATION SITE 0.058HA

N

Notes

Do NOT scale off this drawing. Use dimensioned values only.
Measured Building Survey carried out by others.
Check dimensions before use and notify the Architect
of any discrepancies immediately.



Revisions

REV A: HD: 21/09/2020 - First Issue
REV B: HD: 16/07/2021 - Revised Issue
REV C: HD: 12/08/2021 - Planning Issue

Job Title
**CORN FARM, Devauden**
**Barn Conversion**

Drawing Title
**As Existing: Site Plan with roof**

| Drawn | Checked | Date | Scale |
|---|---|---|---|
| HD | | 15.07.2021 | 1:100@A1 |

Graham Frecknall Architecture & Design
9 Agincourt Street Monmouth Monmouthshire NP25 3DZ
Tel 01600 716418 Fax 01600 714507 E-mail@gfarchitects.co.uk

| Job Number | Work Stage | |
|---|---|---|
| 1660.20 | PLANNING | |

Drawing Number: **AL.P.011** Rev. **C**

# Appendix B

## Proposed layout and landscaping plan

New Open Fronted 'Log Store' Bat Mitigation

Log Store to be located directly adjacent to tree line at rear


MACHINERY BARN
INCOMPLETE
DM/2019/00477

LIVESTOCK BARN

TRAILER BARN

HAY BARN

EQUIPMENT BARN

LONG BARN

STANDING SEAM METAL ROOF

terrace

ACCESS DRIVEWAY

SOFT LANDSCAPING

HARD STANDING

CONC

TAR

1.2PCL

1.1 PBW

EAVE=166.37m

RIDGE=167.63m

EAVE=166.35m

G=162.41m

EAVE=160.72m

dwelling parking spaces x 3

surface treatment to be retained as existing

soft landscaped boarder

existing stone retaining wall

PRIVATE GARDEN
soft landscaping & lawn

1.2m heigh timber post and rail boundary garden treatment

paving to steps & path

surface treatment to be retained as existing

6.6m
9m
12m
5m
9m
12.8m
24.6m
3.8m

L1
L2
L3

## PROPOSED EXTERNAL LIGHTING KEY


external light type 1:
wall mounted, above or beside door opening down light


external light type 2:
low level recessed wall mounted, step down light


external light type 3:
lower level wall mounted, terrace

APPLICATION SITE 0.058HA

Notes
Do NOT scale off this drawing. Use dimensioned values only.
Measured Building Survey carried out by others.
Check dimensions before use and notify the Architect of any discrepancies immediately.



Revisions
REV A: HD: 16/07/2021 - First Issue
REV B: HD: 12/08/2021 - Planning Issue
REV C: HD: 17/01/2021 - Revised Planning Issue - Log Store location amended, Notes added

Job Title
**CORN FARM, Devauden Barn Conversion**

Drawing Title
**Proposed Landscape Plan with lighting**

| Drawn | Checked | Date | Scale |
|---|---|---|---|
| HD | | 15.07.2021 | 1:100@A1 |

Graham Frecknall Architecture & Design
9 Agincourt Street Monmouth Monmouthshire NP25 3DZ
Tel 01600 716418 Fax 01600 714507 E-mail@gfarchitects.co.uk

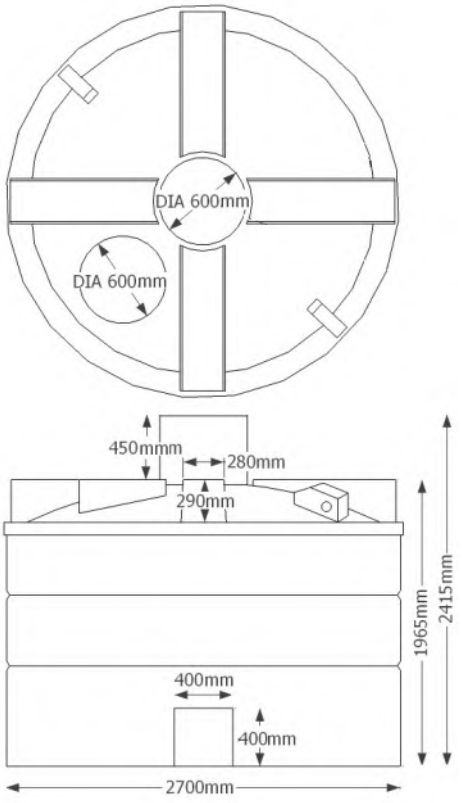
Job Number **1660.20**
Work Stage **PLANNING**
Drawing Number **AL.P.113**
Rev. **C**

# Appendix C

## Ecosure 10,000 litre rainwater harvesting tank

# ECO10000UND

## Product description: underground 10,000 water tank




| Product Information | | | | |
|---|---|---|---|---|
| Height (without neck) | Height (with neck) | Diameter | Access | Weight |
| 1965mm | 2415mm | 2700mm | 600mm aperture | 280kg |

Sizes approximate, owing to shrinkage

**Product Notes:**

- Please ensure that the Installation Guidelines have been read and understood before commencing installation
- Only lift when empty
- This tank must be **fully encased in concrete**
- Designed to take pedestrian traffic only; if required to carry vehicular traffic, a structural engineer's design is required
- Top of the tank must not finish any more than 450mm below ground level without design consideration from a structural engineer
- Without a structural engineer's design, tank must not be located adjacent to foundations, raised banks, patios or walls
- Pipe-falls should be a minimum of 2:100 in the direction of water-flow, i.e. rainwater pipe and service duct towards the tank and the overflow away from the tank

**Product Details:**

- Made from virgin polymer
- Tank made from one piece mould for extra strength
- 545mm extended neck; can be cut down
- Designed and manufactured in the UK

**Optional Extras:**

- Filter box
- Range of pumps
- Tank connectors
- MDPE pipe

**Benefits:**

- Lifting lugs for easy manoeuvring
- Rotationally moulded for strength and durability
- High capacity water storage

Scan to view our full range of water tanks

Etills Ltd,
Unit 1 Whiting Way,
Melbourn,
Royston,
SG8 6NA

ISO 9001 : 2015 REGISTERED Cert No. 14123320

## Call 01763 261781

These guidelines are designed to cover the installation of Ecosure underground water tanks with a capacity up to 7,000 litres. Separate guidelines are available for larger tanks.

***Please note**: responsibility for the tank passes to the buyer once unloading commences; it is therefore important that the buyer accepts the condition of the tank on arrival before attempting to move it.*

Ecosure underground water tanks are designed to be lifted and manoeuvred only when empty. Under no circumstances should they be lifted or manoeuvred when containing water.

It is recommended that these tanks be unloaded, moved around site and lowered into position by attaching lifting chains and appropriately sized D-shackles to the lifting points provided, or by use of lifting straps around the whole tank. However, some initial swing should be anticipated. This must be stabilised before the tank is moved further. To stabilise the tank when moving around the site, guide-ropes should be attached to the chains, enabling operatives to control the load from a safe distance.

## IMPORTANT INFORMATION – ADDITIONAL PRECAUTIONS

Ecosure underground water tanks are designed to be installed in accordance with these guidelines, taking additional precautions in the special circumstances identified in the following table:

| SPECIAL CIRCUMSTANCES | ADDITIONAL PRECAUTIONS REQUIRED |
|---|---|
| Clay soil | Fill with water and completely encase in c220mm concrete |
| High water table | Fill with water and completely encase in c220mm concrete |
| Traffic bearing | Approved[1] arrangements |
| Adjacent foundations | Approved[1] arrangements |
| Non-standard install depth | Approved[1] arrangements |

[1] Designed and signed off by a structural engineer

If site personnel are faced with any of the conditions noted in the table above, they must seek supervisory advice before commencing tank installation.

**Please note:**

- The tank is designed to take pedestrian traffic only.
- The top of the tank must not finish any more than 500mm below ground level.
- The tank must not be located where root matter can disturb the concrete surround.
- Pipe-falls should be a minimum of 2:100 in the direction of water-flow, i.e. rainwater pipe and service duct towards the tank and the overflow away from the tank.

## BEFORE DELIVERY

Please ensure that

- suitable access and parking arrangements have been made for the delivery vehicle
- plant is available to unload the tank
- a clear route has been designated between the delivery vehicle and the installation site
- a risk assessment and method statement for unloading and manoeuvring have been prepared and signed off
- the installation site is level and clear of obstacles and site debris

Ideally:

- the water ingress pipework should be complete and ready for connection
- the water overflow pipework should be complete, ready for connection and itself connected to the surface water management system (soak-away, storm drain or attenuation as appropriate)
- the service duct is ready for connection

Before starting the installation, confirm no added precautions (see table above) apply and there is no requirement to:

- Install in heavy clay (in which case it is necessary to encase the tank in approximately 220mm concrete)
- Install in a high water table (in which case, encase the tank in approximately 220mm concrete)
- Carry the weight of vehicular traffic (in which case, a structural engineer's design is required)
- Locate closer than 4 meters to adjacent foundations (in which case, a structural engineer's design is required)
- Install adjacent to an earth bank or raised patio (in which case, a structural engineer's design is required)

## INSTALLATION GUIDELINES

The following guidelines apply when no added precautions are required (see table above).

### EXTERNAL WORKS

The installation of the Ecosure rainwater storage tank and its connection to the water supply, water overflow and service duct pipes should be undertaken at the same time as the overall underground works for the project.

The tank should be sited to provide the straightest possible service duct run between the tank and the dwelling as other pipe-work and cabling etc. need to be fed through this duct at a later stage.

### Excavation

- Allow 100-150mm all-round the tank.
- The top of the tank must be no more than 500mm below ground level.
- Use suitable planking and strutting as necessary
- Dig out trenches for pipe work and inline filters.

Once installed, the position of the tank is to be clearly marked and driving vehicles within 2 meters of a tank edge is strictly forbidden.

### The Base

The following guidelines apply when no added precautions are required (see table above).

- The tank must be installed on a firm, smooth, level concrete base built in accordance with good building standards and engineering principles.
- **The depth of concrete used must be appropriate to the size of the tank and soil conditions.**

### Installing the Tank

- Once the concrete base has dried, lower the tank into the hole. Make sure that the tank is sitting flat and true before filling it with any water.
- If you have been supplied with a neck ring, this should be cut to length to finish flush with the ground. If the neck ring is loose, position it and apply a good bead of silicon seal around the joint. ***Please note that the tank lid is designed to withstand foot traffic only.***
- Backfill a minimum of 450-460mm deep around the base of the tank with concrete.
- Once the concrete has set, backfill any remaining space with pea shingle and surround materials, bringing connectors and pipework into final alignment.
- Under no circumstances
  - Tamp-down the infill with machinery
  - Tamp-down finished ground level with machinery
  - Drive vehicles over tanks installed as above
- Connect all pipework
- Mark out an exclusion zone 2 metres outside the original excavation footprint. Superimposed loads must NOT be allowed within the protection area. If this is not possible, a reinforced concrete slab must be designed and installed by a qualified civil or structural engineer so that no loads are transmitted directly on to the tank.

**WARNING**

## Exceptional Conditions/Added Precautions

When exceptional conditions are experienced (see table above), tanks must be installed in accordance with the design and instructions of a qualified structural engineer who takes responsibility for the integrity of the installed tank.

When the tank has to be encased in concrete:

- Fill the tank with approximately 300mm of water before starting the concrete back fill.
- Back fill evenly around the tank with concrete in 150 mm layers. Do not use vibrating pokers to consolidate the concrete and do not discharge concrete directly onto the tank.
- Progressively fill the tank with water, ensuring that the level of the water in the tank is approximately 300mm above the level of the concrete backfill

## Installation Tip

Installation of the tank and effecting connections with the inlet pipework, the outlet pipework, and the service duct, will normally be undertaken by ground-workers as part of the underground drainage works; this work should include:

- Leaving in place a draw cord in the service duct for subsequent use by the plumber and or electrician
- Feeding the supply pipe through the service duct, section by section as the service duct is installed

## Aftercare

Most underground water tanks do not need aftercare immediately. If the water is undisturbed for a period of time, it may become stagnant. Over years of use the tank may require cleaning, which can be done using a mop.

## Filter Box Installation

- The filter box can be installed anywhere along the inlet pipe *between the tank and the down pipe*. Ensure you can gain access to the filter for cleaning. *Please note that the filter box lid is designed to withstand foot traffic only.*
- Run your pipe work, ensuring that the inlet from the filter has an adequate drop to ensure water flow. A fall of 2:100 is recommended.
- Ensure the inlet pipe from the down pipe, is fitted to the 4" connector on the filter box with the 90° elbow on it.
- Back fill the area around the filter box with pea shingle.
- More detailed instructions are available on a separate sheet.

## Fitting a Pipe to Underground Water Tanks – 1100 - 2800 litres

- Slip a 110 straight joiner over drilled spigot on tank.

## Fitting a 4" Pipe to Underground Water Tanks – 3500-7000 litres

- Drill out the hole for the pipe using a 108mm hole cutting saw.
- Cut the 110mm pipe square, using a fine tooth saw.
- Chamfer the end of the pipe, using a medium file or rasp.
- Remove dust and filings from the end of the pipe.
- Push the pipe into the hole drilled in the tank. The end of the pipe can be lubricated.

## For Information

The following example risk assessments are available at www.water-tanks.net in the technical information section:

| | | |
|---|---|---|
| Example risk assessment | – | tank unloading and on-site movements |
| Example method statement | – | tank unloading and on-site movements |
| Example risk assessment | – | tank installation |
| Example method statement | – | tank installation |

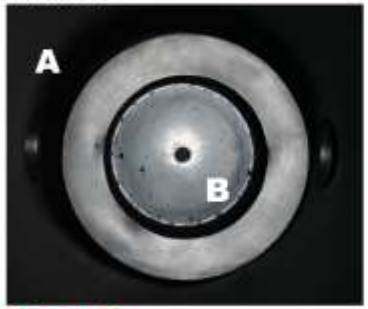
**WARNING**

The risk assessments are examples only, and need to be adapted by a capable person to reflect actual site conditions

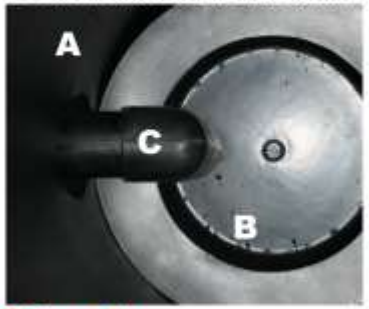
# UNDERGROUND FILTER - SET-UP

**1x A :** Filter chamber
**1x B :** Filter Basket
**1x C :** 90° elbow calmed inlet
**1x D :** Mini filter basket
**1x E :** Lid

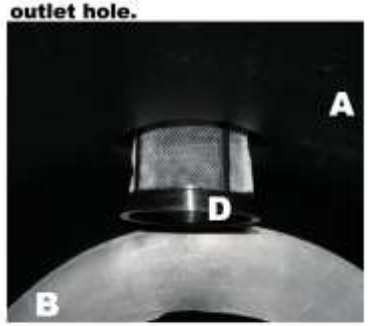

**Step 1**
**Lower the basket filter into the chamber**




**Step 2**
**Insert the calmed inlet elbow in to the smaller of the two holes.**




**Step 3**
**Insert the mini basket filter into outlet hole.**

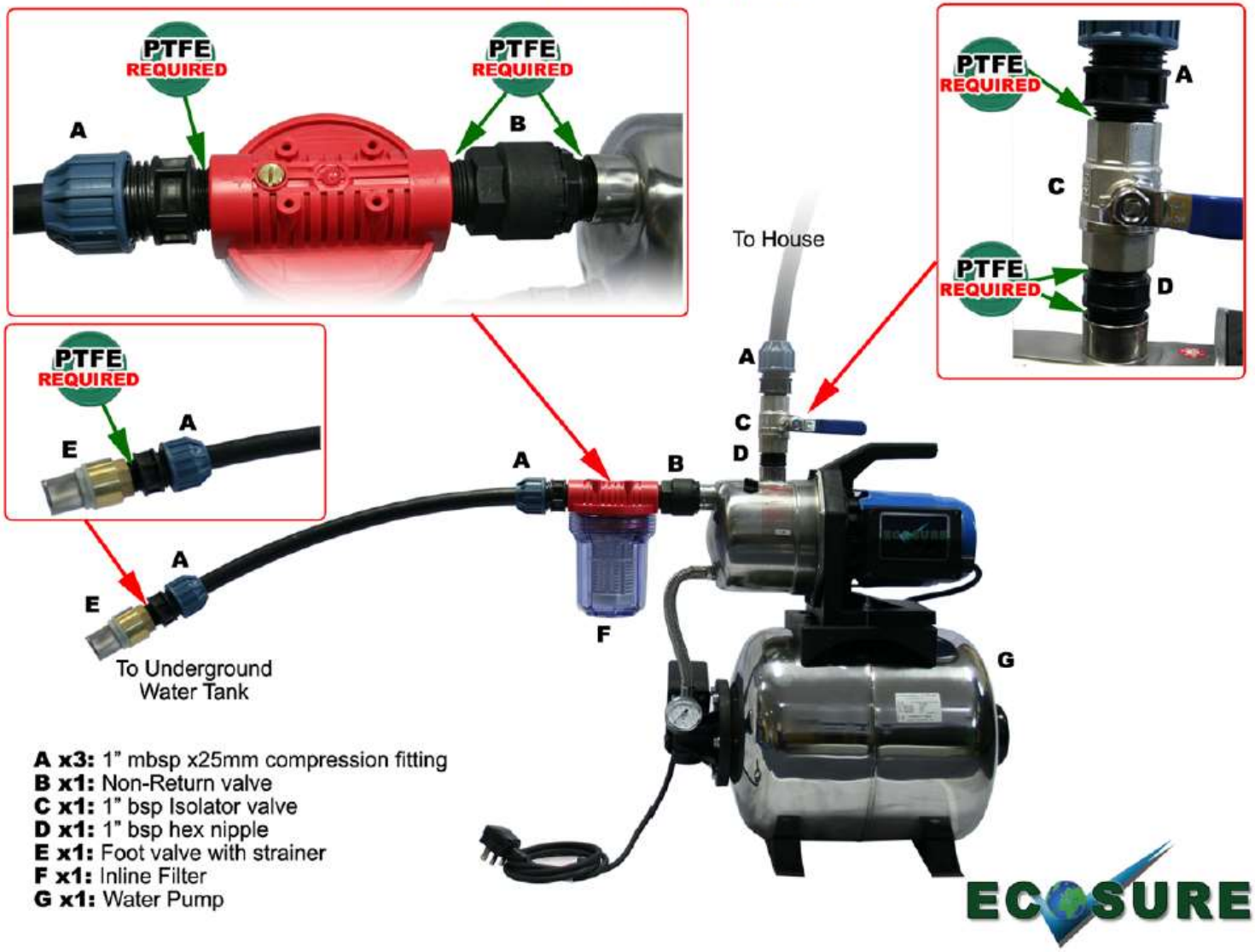



**Step 4**
**Pull the mini basket filter through to expose the filter.**


**Once all the steps above are complete, place the lid (E) on the filter chamber.**

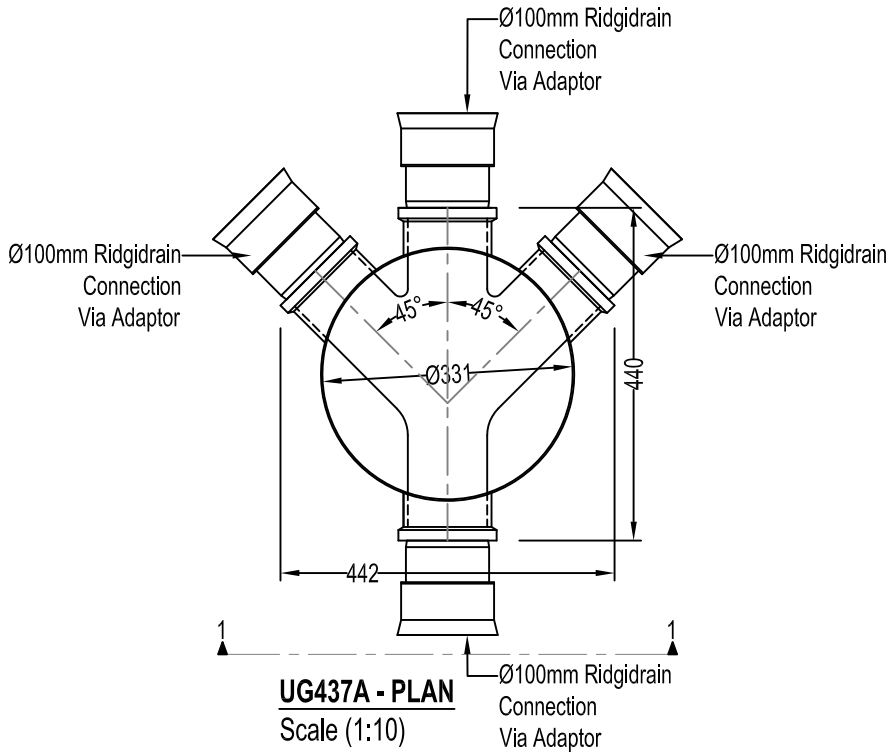
ECOSURE

# PUMP SETUP

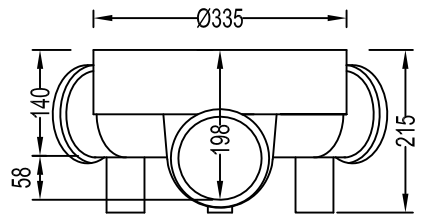

PTFE REQUIRED
PTFE REQUIRED
A
B
PTFE REQUIRED
A
E
PTFE REQUIRED
A
C
D
PTFE REQUIRED
D
To House
A
B
A
E
F
G
To Underground Water Tank
A x3: 1" mbsp x25mm compression fitting
B x1: Non-Return valve
C x1: 1" bsp Isolator valve
D x1: 1" bsp hex nipple
E x1: Foot valve with strainer
F x1: Inline Filter
G x1: Water Pump
ECOSURE

# Appendix D

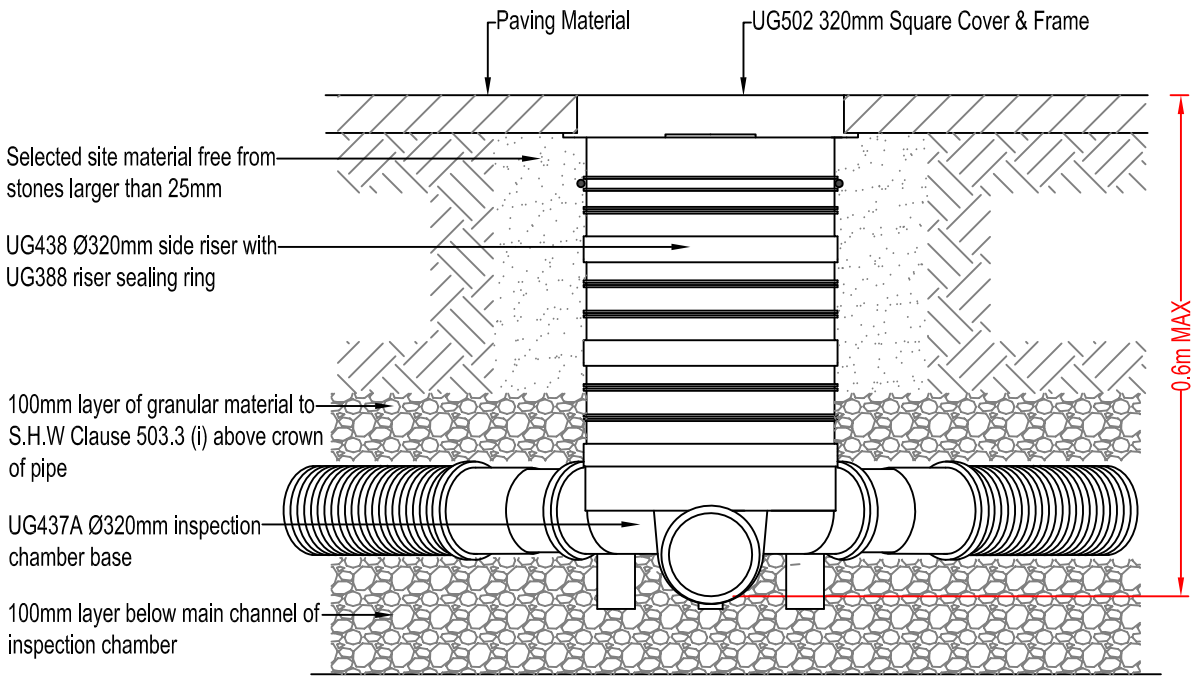
## Polypipe UG437A non-adoptable inspection chambers




**UG437A - PLAN**
Scale (1:10)




**UG437A - ELEVATION 1-1**
Scale (1:10)




**UG437A - TYPICAL INSTALLATION**
Scale (1:10)

| COVER AND FRAME | PRODUCT CODE |
|---|---|
| 320mm (square) cover & frame PVC Non-vehicular traffic only | UG502 |

## ANCILLARY NOTES

UG438 - Side Riser
UG388 - Riser Sealing Ring
UG445 - Ø110mm Spare Blanking Plug
Adaptors and sealing ring included with this chamber base

## DRAWING NOTES

1. Drawings should not be scaled, refer to figured dimensions only.
2. All dimensions in millimetres, unless otherwise stated.
3. All dimensions are nominal and may vary within manufacturing or construction tolerances.
4. All site temporary and enabling works by others.
5. This drawing is intended for guidance only. Confirmation of the information contained within this document should be sought from the consulting engineers before final design or construction activities commence.
6. Inspection Chamber units to be installed in accordance with Polypipe Civils recommendations (refer to Polypipe technical guidance for further information); giving due consideration to the requirements of the organisation who will be taking ultimate ownership of the installation.
7. Unless otherwise stated, all Inspections Chambers are supplied to site without direct means of lifting incorporated. The lift supervisor must assess and plan the lift, in the circumstances of the lift, and provide slings and/or other controls as deemed necessary to ensure a safe lift.

| REV | AMENDMENT | DATE |
|---|---|---|



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PROJECT NAME: INSPECTION CHAMBER STANDARD DETAILS
PROJECT TYPE: UG437A - NON - ADOPTABLE SURFACE WATER SYSTEM

STATUS: FOR INFORMATION
SHEET SIZE: A3
SHEET NO.: 1 of 1
DRAWN BY: JL
SCALE: AS SHOWN
DATE: 26/05/17
DRAWING NO.: PPIC_SD_003
REV.: -

# Appendix E

## CDM design risk assessment

## CDM Design Risk Assessment

| Project Element | Hazard | Risk | Control Measure |
|---|---|---|---|
| **Health and Safety Considerations** | | | |
| Plant/material delivery | Limited access to the Site | Collisions and injury/ damage to people/vehicles | 1. Access agreements to be reached with relevant third parties to facilitate the development commencing. |
| | | | 2. Traffic management to be prepared prior to construction activities. |
| | | | 3. Public to be notified of when and where construction activities will take place. |
| Excavations | 1. Services - public and private over ground and underground services | 1. Service strikes/injury/death, damage to infrastructure. | 1. Detailed utility surveys to be carried out prior to construction commencing to confirm the location and details of the existing services and check for any unidentified services. |
| | | | 2. Location of electrical cables to be confirmed using detection equipment before any excavation takes place. |
| | | | 3. Care to be taken when excavating around existing services to minimise the risk of structural damage. |
| | 2. Ground conditions | 2. Falls into excavations/ overturning plant, trench collapse, confined space, injury, damage/ill health; pollution to surface water | 1. Correct PPE to be worn. |
| | | | 2. Environmental management plan to be prepared prior to construction activities commencing and adhered to during construction. |
| | | | 3. Material generated by construction works (e.g., tank void) may require testing for disposal and or re-use. |
| | 3. Groundwater conditions - locally shallow perched water | 3. Inundation | 1. Monitoring during construction works. |
| | 4. UXO | 4. Low bomb risk in this region in line with https://zeticauxo.com/downloads-and-resources/risk-maps/ | 1. Care to be taken when excavating. |
| Construction of outfalls to watercourses | Water, working at height | Inundation, pollution, falls/ drowning | 1. Work to be carried out during low flow conditions adhering to relevant pollution prevention measures. |

| | | | |
|---|---|---|---|
| Maintenance of drainage systems | Water, working at height/ confined spaces/ inundation | Drowning, injury, suffocation | 1. Maintenance work to be undertaken during low flow conditions in the system. |
| | | | 2. Non-man entry inspection chambers used, where possible, to eliminate confined space entry. |
| Failure of drainage systems due to blockage or capacity exceedance | Water/backing up flow | Site inundation | 1. Site/building levels to be set appropriately. |
| | | | 2. Long-term maintenance regime implemented. |
| | | | 3. Exceedance flow routes have been included. |
| General construction activities | 1. Noise, dust, construction traffic | 1. Impact on existing occupants/nearby properties | 1. Environmental management plan to be prepared prior to construction activities commencing and adhered to during construction. |
| | 2. Bacteriological contamination due to construction activities (e.g. basin construction) | 2. Construction workers | 1. Correct PPE to be worn. |
| | | | 2. Environmental management plan to be prepared prior to construction activities commencing and adhered to during construction. |
| | | | 3. Material generated by construction works (e.g., tank void) may require testing for disposal and or re-use. |
| **Environmental Considerations** | | | |
| Excavations/ topsoil strip and general construction activities | Sediment and other contaminants released | Pollution to water resources | 1. Environmental management plan to be prepared prior to construction activities commencing and adhered to during construction. |
| | | | 2. Construction Phase Surface Water Management Plan has been developed. |
| Operational stage | 1. Flood risk | Adverse impact on water flows | 1. Site/building levels to be set appropriately. |
| | | | 2. Long-term maintenance regime implemented. |
| | | | 3. Exceedance flow routes have been included. |
| | 2. Surface water/groundwater quality | Impact on water chemistry | 1. Drainage system has been designed with sufficient treatment trains implemented. |
| | | | 2. Long-term maintenance regime implemented. |

# Appendix F

## SuDS management and maintenance plan

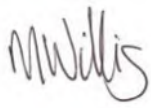
# SuDS Management and Maintenance Plan

Corn Farm, Devauden

On Behalf of

Powell Property Developments Ltd

# Quality Management

| | | |
|---|---|---|
| **Prepared by:** | Tom Paltridge<br>BSc MSc FGS |  |
| **Reviewed by:** | Mike Willis<br>BSc MSc FGS |  |
| **Reviewed and authorised by:** | Chris Betts<br>MSc FGS CGeol |  |
| **Date:** | October 2022 | |
| **Revision:** | Final | |
| **Project Number:** | HYG1072 | |
| **Document Reference:** | Appendix G - HYG1072 M 221026 TP SuDS Management and Maintenance Plan | |
| **Document File Path:** | C:\Users\Tom\mike willis\Mike Willis - Projects\HYG1072 P Corn Farm, Devauden SAB\Reports\Drainage Design\Final\Appendicies\Appendix G - HYG1072 M 221026 TP SuDS Management and Maintenance Plan.docx | |



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# Contents

# Tables

# 1 Introduction

## 1.1 Introduction

This SuDS Management and Maintenance Plan sets out the principles for the long-term management and maintenance of the proposed surface water Sustainable Drainage Systems (SuDS) installed at Corn Farm, Devauden, Monmouthshire (the Site).

The purpose of this document is to set out the basis of the SuDS Maintenance Plan for the development and to ensure that the owner is entrusted with a robust inspection and maintenance programme. It ensures that the optimum operation of the surface water drainage network is continually maintained for the lifetime of the development and to prevent the increased risk of flooding both on and off site in accordance with the 'Statutory Standards for Sustainable Drainage Systems – Designing, constructing, operating and maintaining surface water drainage systems' (2018).

This plan has been comprised of and is directly referenced from the latest technical SuDS guidance within the *CIRIA Report C697 - The Suds Manual* (2015) and other applicable guidance.

The activities listed are generic to the relative SuDS types and represent the minimum maintenance and inspection requirements, however additional tasks or varied maintenance frequency may be instructed by the owner as required. Specific maintenance needs of the SuDS elements should be monitored and maintenance schedules adjusted to suit requirements.

All those responsible for maintenance should follow relevant health and safety legislation for all activities listed within this report (including lone working, if relevant) and risk assessments should always be undertaken.

This report is to be read in conjunction with the accompanying Drainage Design Report for the location of all SuDS features at the Site. There are 3 no. categories of maintenance activities referred to in this report:

**Regular Maintenance, including inspections and monitoring**

- Consists of basic tasks done on a frequent and predictable schedule, including vegetation management, litter and debris removal and inspections.

**Occasional Maintenance**

- Comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (e.g. sediment removal).

**Remedial Maintenance**

- Comprises intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by good design.
- Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict.

## 1.2 SuDS Scheme Checklist

The following lists the SuDS components which are found at the Site.

- **Rainwater Harvesting Tanks:**
    - Two connected 10,000 litre rainwater harvesting tanks will store surface runoff from the roof of the dwelling. The tanks will be located below soft landscaping area to the south east of the dwelling.
    - The tanks have been sized on the runoff generated during a 1 in 100 year, 6-hour duration event, and will provide sufficient storage for the expect demand for non-potable agricultural water use.
    - During exceedance events an overflow pipe will convey runoff to the existing drainage ditch where scour protection will be installed.
- **Traditional drainage:**
    - Inspection chambers and rodding eyes will be used on bends or where pipes come together. They allow access and cleaning to the system if necessary.
    - Inlet structures such as rainwater down pipes. They should be free from obstruction at all times to allow free flow through the drainage network.

## 1.3 SuDS Maintenance Specification

### General Requirements

- Avoid use of weed-killers and pesticides to prevent chemical pollution.
- Avoid de-icing agents wherever possible.
- Protect all below ground drainage through careful selection and placement of hard and soft landscaping.

The general requirements have been described in Table 1-1.

***Table 1-1 General requirements***

| General requirements | Frequency |
|---|---|
| Maintenance activities comprise<br>▪ Regular maintenance<br>▪ Occasional tasks<br>▪ Remedial work | As required |
| ▪ Collect all litter or other debris and remove it from the site at each visit | Monthly |

# 2 SuDS Management and Maintenance

## 2.1 Inlet Structures and Inspection Chambers

Inlet structures include rainwater downpipes and gullies. They 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.

Details of the maintenance requirements are described in Table 2-1.

***Table 2-1 Inlet structures and inspection chambers***

| Maintenance schedule | Required action | Frequency |
|---|---|---|
| Regular maintenance | Inspect rainwater downpipes, channel drains and gullies, removing obstructions and silt as necessary | Monthly |
| | Check there is no physical damage | Monthly |
| | Strim vegetation 1.0m minimum surrounding structures and keep area free from silt and debris | Monthly |
| | Remove inspection chamber covers and inspect, ensuring that the water is flowing freely and that the exit route for water is unobstructed | Annually |
| | Remove debris and silt | Annually |
| Occasional maintenance | Check topsoil levels are 20mm above edges of chambers to avoid mower damage | As required |
| Remedial actions | Repair physical damage if necessary | As required |

## 2.2 Below Ground Drainage Pipes

Below ground drainage pipes convey water to the SuDS system. They should be free from obstruction at all times to allow free flow.

Details of the maintenance requirements are described in Table 2-2.

***Table 2-2 Below ground drainage pipes***

| Maintenance schedule | Required action | Frequency |
|---|---|---|
| Regular maintenance | Inspect and identify any areas that are not operating correctly. If required, take remedial action | Monthly for first 3 months then annually |
| | Remove debris from the catchment surface (where it may cause risks to performance) | Annually or as required |
| | Maintain vegetation to designed limits within vicinity of below ground drainage pipes and tanks to avoid damage to system | Annually or as required |
| Occasional maintenance | Check topsoil levels are 20mm above edges of chambers to avoid mower damage | As required |
| Remedial actions | Repair physical damage if necessary | As required |

## 2.3 Rainwater Harvesting Systems

Maintenance responsibility of individual Rainwater Harvesting Systems falls to the owner of the property. Communal systems will require the participation of the parties served by the system.

Details of the maintenance requirements are described in Table 2-3.

***Table 2-3 Rainwater harvesting system***

| Maintenance schedule | Required action | Frequency |
|---|---|---|
| Regular maintenance | Inspection of the tank for debris and sediment build-up, inlets/outlets/withdrawal devices overflow areas, pumps, filters | Annually, and following poor performance |
| | Cleaning of tank, inlets, outlets, gutters, withdrawal devices, and roof drain filters of silts and other debris | Annually, and following poor performance |
| Occasional maintenance | Cleaning and/or replacement of any filters | Three monthly, or as required |
| Remedial actions | Repair of overflow erosion damage or damage to tank | As required |
| | Pump repairs | As required |

## 2.4 Health and Safety

The surface water drainage system has been designed so that it minimises health and safety risk to the public and to maintenance staff.

In order to comply with the Construction (Design and Management) Regulations (CDM) 2015, SuDS designers must assess all the foreseeable risks during the construction phase and during the ongoing maintenance of the schemes. It is the designer's duty to:

- Eliminate foreseeable health and safety risks to anyone affected by the project;
- Take steps to reduce or control any risks that cannot be eliminated; and
- Communicate, cooperate and coordinate with the client, other designers and contractors involved in the project so that designs are compatible, and health and safety risks are accounted for during construction of the project and beyond.

A Health and Safety risk assessment for the SuDS features is attached at Appendix G of the Drainage Design Report. Contractors and those responsible for future maintenance will be made aware of the risks by the site owner, keeping a record of the key health and safety factors that will need to be managed during future ongoing maintenance works.

All those responsible for maintenance should also take the appropriate health and safety precautions for all maintenance activities, this should additionally include lone working when relevant, and risk assessments should be undertaken for all activities.

Hazards which may potentially impact the construction, operation and maintenance of any future surface water drainage systems, have been identified within a CDM Design Risk Assessment (see Appendix E of the Drainage Design Report). This list therefore should not be considered as exhaustive and a detailed site/services survey should be undertaken prior to commencing construction activities on site.

# Appendix G

## Health and safety risk assessment

## Health and Safety Risk Assessment

| Hazards | Factors which may affect the likelihood and potential consequences | Severity of Hazard (1 = Negligible, 5 = Death) | Likelihood of Hazard (1 = Not likely, 5 = Certain) | Risk Rating (O x A) | Measures to Reduce Risk | Severity of Hazard (1 = Equipment, 5 = Death) | Likelihood of Hazard (1 = Not likely, 5 = Certain) | Risk Rating (O x A) |
|---|---|---|---|---|---|---|---|---|
| Entry into pipes or confined spaces (note this is for inadvertent public access; follow relevant legislation and guidance for worker access) | Pipe diameters<br><br>Access possible | 5 | 2 | **10** | 1. Non man-entry inspection chamber and tank access sizes used where possible.<br><br>2. Gullies, silt trap pits, catch pits and other sumps have been avoided were possible. | 5 | 1 | **5** |
| Water quality – health risk | Level of contamination of publicly accessible water<br><br>Likely contamination from rat urine<br><br>Likely contamination from dog or bird fouling<br><br>Likelihood of toxic algal blooms<br><br>Likelihood of vectors (organisms which carry disease-causing microorganisms from one host to another)<br><br>Public accessibility to any sediment accumulation zones | 5 | 2 | **10** | 1. Source control measures have been included to remove pollutants and sediment therefore, avoiding contamination and disease.<br><br>2. Located in private residential area with no public footpaths so access by general public will be rare | 5 | 1 | **5** |