

**CERI ENVIRONMENTAL
CONSULTING LTD**

Specialists in Waste & Environmental Management

SAWMILLS COTTAGE
SAWMILLS, KERRY
NR NEWTOWN,
POWYS SY16 4LL
Tel/Fax: 01686 670546
email: enquiries@cerienviromental.co.uk

**AN RICHARDS LTD
HGV WORKSHOP AND MOT CENTRE
WHITEHURST
CHIRK
WREXHAM
LL14 5AN**

**SuDs ASSESSMENT
August 2023**

Contents

- 1) Non Technical Summary
- 2) Introduction
- 3) Site Location and Layout
- 4) Proposed Development
- 5) Geological Setting
- 6) Flood Risk Zones
- 7) Assessment of Rainfall Data
- 8) Description of the Development and SuDs Features
- 9) Sustainable Drainage Systems Standards for Wales
 - 9.1) Standard 1 – Surface Water Runoff Destination
 - 9.2) Standard 2 – Surface Water Hydraulic Control
 - 9.3) Standard 3 - Water Quality Management
 - 9.4) Standard 4 – Amenity
 - 9.5) Standard 5 – Biodiversity
 - 9.6) Standard 6 – Design of Drainage for construction, Operation and Maintenance

Appendix 1 *Plans*

Location Plan

Flood Risk Map

Surface Water Drainage Layout

Appendix 2 *Calculations*

1.) NON TECHNICAL SUMMARY

The site is currently used for parking HGV Vehicles and the proposal is to develop an HGV workshop and MOT Testing Centre. The site is currently a mix of concreted areas and hardstanding. The new building and associated parking areas will be drained via a SuDS compliant system to an area of grassland to the North West of the new building using pipework to an infiltration detention basin fitted with an exceedance flow outlet to a small stream. The geological setting will allow for infiltration into the base of the detention basin but also allowing water to infiltrate into the ground. The drained area covers 0.0276ha. The stream does not flow during dry spells.

The geological setting is described by the BGS as “*Glaciofluvial Deposits, Devensian - Sand and gravel. Sedimentary superficial deposit formed between 116 and 11.8 thousand years ago during the Quaternary period*”. Groundwater was found at a depth of 1.8m below ground level and this is around the same level as the adjacent stream.

The base of the detention basin will be at least 1m above the groundwater level in the area.

The area is not in a zone 2 or 3 flood risk area and is outside the zones identified as being subject to flooding. The SuDS features are also located above the extent of flooding identified on the Flood Risk Maps.

The development area to be drained covers an area of 0.0276 hectares and the SuDS scheme has been developed to drain the development in a controlled manner and transport the water via pipework into a detention basin prior to infiltration through the base area and a controlled discharge for exceedance events into the stream. The detention basin will be capable of holding the volume of water generated in the 1 in

100 year event and the exceedance pathway will only be required for events greater than the 1 in 100 +40% for Climate Change drained in a controlled manner with a design criteria of coping with the 1 in 100 year event and discharging at green field runoff rates (Q_{BAR}). An assessment has also been carried out to show that the 1 in 100 year event plus 40% for Climate Change will be managed effectively and this is achieved.

The SuDs features have been selected to treat the water for any pollutants and convey the water to the discharge point by providing interception and without causing erosion and the associated suspended solids that would be generated.

The SuDs features utilised are summarised as follows:

Building and Associated Parking

Roof water and water from new impermeable parking areas will be collected and piped to a detention basin to the Northwest of the building.

Final Discharge

Water collected in the detention basin will infiltrate into the ground and the exceedance flow pathway will only be needed if water in the basin reaches a height above the 1 in 100 plus 40% Climate Change 6 hour event. This will be into a chamber and flow out into the stream via a 100mm pipe. The stream will be reinforced with stone to prevent erosion for 2m along from the discharge point.

Infiltration from percolation tests is estimated at 0.12m/hr

All the SuDs attenuation features have been designed to drain to half of their capacity within 24 hours using infiltration.

Amenity and Biodiversity

The SuDs scheme has been designed so that the detention basin will only contain significant water during heavy rainfall but these features will provide a more diverse environment that can be exploited by a range of species, with tough sedges colonising the basal area forming microhabitats. Around the site it is planned to plant native trees, which will increase biodiversity.

The amenity and biodiversity values will be significantly improved by the landscape and SuDs scheme.

Operation and Maintenance

The system is all gravity fed and there are no pumps needed to achieve the objectives. The design has concentrated on low maintenance options and reducing the risk of blockages. A maintenance and inspection schedule has been developed to identify any problems and rectify as necessary.

2.) INTRODUCTION

Ceri Environmental Consulting Ltd has been commissioned to undertake an SuDs assessment for land at Whitehurst, Chirk, Wrexham, LL14 5AN.

3.) SITE LOCATION AND LAYOUT

The site is located off the B5605 in the Dee Valley.

All water from the development area will eventually drain to the nearby River Dee.

4.) PROPOSED DEVELOPMENT

The proposal is to develop a building to form the HGV Workshop and MOT Testing Centre. There is also additional drained parking spaces for cars adjacent to the building.

The development will be designed with a SuDs approach to drainage and the design will ensure that direct runoff will not be increased and will be allowed to slowly infiltrate into the land or be attenuated and slowly released to prevent additional water being directed to the highways drains. The system will meet to the Sustainable Drainage Standards for Wales (2018).

5.) GEOLOGICAL SETTING

Superficial deposits exist across the entirety of the site, with much of the area covered with concrete and made ground. The area where is detention basin will be developed is a field. The superficial deposits are described by the BGS as *Glaciofluvial Deposits, Devensian - Sand and gravel. Sedimentary superficial deposit formed between 116 and 11.8 thousand years ago during the Quaternary period*".

The bedrock is described as *Cefn-y-fedw Sandstone Formation - Sandstone and argillaceous rocks, interbedded. Sedimentary bedrock formed between 330.9 and*

320 million years ago during the Carboniferous period. A limited site investigation was carried out to determine whether or not a soakaway would be appropriate. The ground comprised of gravelly, sandy deposits with medium clay content. However, as groundwater was encountered at a depth of 1.8m there was insufficient depth to install a soakaway, allowing for the fall of the conveyance pipe, whilst maintaining a 1m unsaturated zone.

Percolation testing carried out at shallow depths showed the ground to be suitable for infiltration for the treated foul water from the package treatment plant. Using these results and applying a factor of safety of 2 infiltration rates in the order of 0.05m/hour demonstrates that the ground will be suitable for infiltration using a detention basin

6.) FLOOD RISK ZONES

The flood risk maps have been reviewed and the development is outside of the low medium and high risk areas identified. The SuDs conveyance and control systems are all located on land higher than the risk areas identified. The table below summarises the risks from flooding. The resulting assessment is that the overall flood risk for the development is low.

Table 1

Risk	Assessed Risk	Mitigation Required
River and Coastal Flooding	Very Low	No
Groundwater Flooding	Very Low	No
Surface water Flooding	Very Low	No
Overall Risk of flooding to the development	Very Low	No

The Flood Risk map for the area is included in Appendix 1 of this report.

In order to prevent the development of the land from causing increased flooding off site by direct discharges a SuDs scheme will be implemented to ensure that the greenfield runoff will not be exceeded during the 1 in 100year event plus 40% for climate change.

The extent of flood zones is shown on the Flood Risk Map. With climate change it would be expected that these zone could become larger in the future but as the site is approximately 8.0m higher than the Llangollen Canal and the river is at a lower elevation, the extent of Zone 2 extent the probability of flooding from Rivers is very low.

Given the location of the site there is no risk from tidal flooding of the River Dee.

7.) ASSESSMENT OF RAINFALL DATA

Rainfall data has been obtained from the UK Centre of Ecology and Hydrology via the FEH Web service. SAAR for the catchment is 882mm

Table 2 6Hour Rainfall Events

6 Hour event

Event	Total Rainfall 6 hr rainfall event mm
Winter	
1 in 10 year	41.90mm
1 in 30 year	55.40mm
1 in 50 year	62.44mm
1 in 100 year	73.01mm
1 in 100 plus 40% Climate Change	102.21mm

Table 2 shows the rainfall expected for a number of scenarios. These figures have been used to calculate the storage volumes required.

8.) DESCRIPTION OF THE DEVELOPMENT AND SuDS FEATURES

The new building will provide workshop facilities and an HGV MOT testing facility. changing facilities. The building will provide containment for any spillages within the building and all liquids contained in drums will be stored in bunded areas. Small volumes of liquids used will be stored in suitable lockers. Any spillages will be cleaned up immediately and larger spillages will drain into the inspection pit.

The risk of spillages flowing out from the building are low.

Throughout the design phase for the facility SuDs components have been identified and incorporated where possible.

All pipework will be laid and constructed in accordance with the requirements of the Building Regulations Part H

Detention Basin

All water collected from the roof and new parking areas shown on the planning application drawing in Appendix 2 will be collected and conveyed via a 150mm pipe at a fall of 1 in 80 to the detention basin. The detention basin has a basal area of 100m² to allow a larger area for infiltration to take place. During construction any areas which are predominantly clay will be removed and replaced with stone or gravelly material from the excavated material.

The side slopes are 1 in 4 to allow for easy maintenance. The depth of the basin will be 400mm at the lowest point but due to the slight slope to the Northeast the area to the depth to the Southwest will be deeper. The exceedance flow height is above the predicted head caused by the 1 in 100 plus 40% climate change volume. And will discharge into the stream via a chamber. The inlet to the exceedance drain shall be covered with rocks to prevent debris blocking the outlet.

Discharge Point

Water from the exceedance flow will be covered with larger rocks to prevent the ingress of debris and animals. This water will flow into the stream over rocks to protect the base and then flows eventually to the River Dee.

9.) SUSTAINABLE DRAINAGE SYTEMS STANDARDS FOR WALES

9.1) Standard 1 Surface Water Runoff Destination

The Sustainable Drainage Systems Standards for Wales sets priority levels for the discharge of surface water, with priority level 1 being the preferred option through to priority level 5 being the least preferred option.

Priority Level 1 - Surface water is collected for use

There is a no need for non-potable water and the water use in the building.

For the reasons above rainwater harvesting for the development is not considered to be beneficial at this site and the small amounts needed would only be a small proportion of the water being drained.

Priority Level 2 - Surface water Runoff is infiltrated into the Ground

The geological setting of the site is sands and gravels with a moderate clay content.

An investigation to determine the potential for discharging to soakaway found the groundwater level to be too high to maintain a 1m freeboard between the base of the soakaway and the groundwater level. The ground is considered to be suitable for infiltration from percolation tests carried out in the area.

The design to meet infiltration has used a 100m² basal area for an infiltration detention basin, which can be installed at a higher level than a soakaway and maintain the 1m freeboard required in the Sustainable Drainage standards for Wales. The 100m² area is larger than required to meet interception criteria but gives an added Factor Of Safety as a larger area is provided for efficient infiltration to take place.

Priority Level 3 – Surface Water is Discharged to a Surface Water Body

The stream to the Northwest of the building will only be used for exceedance scenarios. Given the size of the basin the exceedance flow is only likely to be required during long periods of heavy rainfall above the design criteria of 1 in 100 year 6hour plus 40% for climate change

.

Priority level 4 and 5 – Discharge to Surface Water Sewer, Other Drainage System or Combined Sewer.

Not Required

Conclusion

Surface water will be infiltrated via a detention basin and exceedance flows to the nearby stream.

9.2) Standard 2 – Surface Water Hydraulic Control

There are no known restrictions in place for the site or receiving waters placed by the Local Flood Risk Management Strategy. The hydraulic control of the water, will however, ensure that the runoff rate will not be increased from the site as a whole.

Drain down Time

Vp to m/hr										
Average Vp	75.5	Minutes for 150mm				Factor of Safety				
Vp/150		0.503 minutes/mm				Drain Down Time				
x1000		503.333 minutes/m			Water	1.00	2.00	3.00	4.00	FOS
60/min per m		0.119 m/hr			Depth	0.12	0.06	0.04	0.03	m/hr
				Event	m					
				1in100	0.13	1.09	2.18	3.27	4.36	hours
				1in100CC	0.18	1.51	3.02	4.53	6.04	hours

The drain down time from percolation tests show that for the 1 in 100 plus 40% climate change even at a factor of safety of 4 water will drain away in just over 6 hours. In any event there is additional capacity of an additional 20m³ water capacity within the basin.

Future Considerations

In preparing the volumes of water generated the design criteria is the 1 in 100 year event. In addition an assessment has been made using the 1 in 100 year event plus 40% for Climate Change. The design of the detention basin has been calculated to create a 0.13m head for the 1 in 100 year event and a 0.18m head for the 1 in 100 year event plus 40% Climate Change without water being drained out through the base. The basin has additional volume available of around 20m³ before the exceedance criteria is met. Volumes above this level would discharge via an exceedance pathway created by a pipe outlet to the stream.

Urban creep is not considered to be likely on the site given the nature of the development. Any extensions to the development would require additional planning consent and the drainage would need to be reassessed.

Attenuation Features

As water collected will be drained by infiltration no other attenuation features are required. There are no underground storage tanks proposed for the development. All of the system has been designed in accordance with the criteria specified in the SuDs Manual (CIRIA 753).

Risk of Blockages

The risk of blockages is low as there is no direct access for debris etc to enter the flow control chambers. There is also a maintenance and inspection regime proposed to ensure that the system operates as designed. Outlets into the stream will be protected using stone, which will prevent debris entering the system. The detention basin outlet will be protected by stone to prevent debris blocking the outlet. All the flow control chambers can be accessed to clean the system if needed and this will be determined by the inspection regime.

Interception of Runoff

The first 5 -15mm of rainfall can be the most polluting period as pollutants such as PAH's and suspended solids can be washed from surfaces. Roofwater and drainage from the car park are conveyed to the detention basin prior to discharge. The whole area has been assessed in terms of the interception assessment shown in table 5 below.

Table 5

Feature	Area m²	Achieves Interception	Interception Provided By	Comments
Building Roof/Car parking	276	No	Detention Basin	
Detention Basin Base	100	Yes	Interception by Infiltration meets standards also detention basin will provide additional interception exceeding the standards	Provides Interception of 5 times the base area =500m ²

Interception capacity has been provided by the use of infiltration. In addition the detention basin basal area exceeds the standards by 224 m². The standard for interception has therefore been exceeded.

Runoff Rate into SuDs Features

Water collected from the building will be conveyed to the detention basin via a 150mm surface water drain laid to a 1 in 80 slope which provides a flow rate when full of 20l/s. This will be adequate for the volumes of water generated during the storm events.

Table 6

1 in 100 rainfall

0.073 m

1in 100year		
Area	Impermeable Area Drained	Vol Generated (m3)
Discharge Building Roof	276	20.15
Totals	276	20.15

A detention basin has been designed with a basal area of 100m² and a top water surface area of 116.76m² based on 1 in 4 side slopes and a max water level of 0.35m. For the 1 in 100 year 6 hour event the water volume generated would fill the basin to a head of 0.13m (without allowing for a basal discharge during filling).

An exceedance flow pathway to the nearby stream is set at 0.35m above the base level.

Outlet Flow Rate

To meet the standard in G2.30 2 of the Sustainable Drainage Systems Standards For Wales there is a requirement that the flow shall be 2l/sec/ha or Q_{bar} whichever is greater. As the scheme relies on infiltration this has only been assessed for information.

ASSESSMENT OF $Q_{BAR(rural)}$

$Q_{BAR(rural)}$ is the mean annual flood (a return period of 2.3 years) and is determined by the following equation using the IoH124 Method

$$Q_{BAR(rural)} = 1.08^{0.89} SAAR^{1.17} SPR^{2.17}$$

Where

Area Is the catchment area in km^2 (minimum $0.5km^2$ or 50 hectares)

SAAR Is the Standard Average Rainfall for the period 1941 to 1970 in mm

SPR Is the Soil Runoff Coefficient

Parameter	Value	Units	Comments
Area	0.5	Km^2	Minimum 50 ha site
SAAR	882	mm	From Catchment data
SPR	0.3		Soil runoff coefficient

Table 4

$Q_{BAR(rural)}$	=	119.41	l/s for 50ha site
$Q_{BAR(rural)} / 50$ to scale down	=	2.39	l/s/ha
Actual Area of site	=	0.07	l/s (0.0276 ha site)

$Q_{BAR(rural)}$ is an important parameter in assessing the compliance of a system and is used in setting the standard in runoff volume control for discharges in the

Sustainable Drainage Systems Standards for Wales. For this site $Q_{BAR(rural)}$ is

relatively high, mainly because the underlying geology is glacial clay and the soils are derived from this and are relatively impermeable. This in addition to the high rainfall results in a high $Q_{\text{BAR (rural)}}$ value.

The area to be developed and drained covers an area of 0.0276 hectares. The $Q_{\text{BAR(rural)}}$ flow for this area is $2.39 \text{ l/s/ha} \times 0.0276 \text{ hectares} = 0.07 \text{ l/s}$

The detention basin has a capacity which exceeds the 1 in 100 event and the 1 in 100 plus 40% Climate Change. The total volume at 350mm depth is 55.4m^3 .

Extreme Events

The detention basin has been designed with a maximum head of 0.35m and with a storage volume of 55.4m^3 . This exceeds the volumes calculated during the generation of water during the 1 in 100 year 6hr event and the 1 in 100year 6 hr event by 32.25m^3 and 27.3m^3 respectively. The large area does however provide a larger area for infiltration. In the event of the detention basin being filled by a larger event then water would flow over the exceedance route with a direct to the discharge point to the nearby stream.

Overtopping of the detention basin is considered to be a low risk due to the factor of safety provided by the additional volume and the relatively high infiltration rates.

Impact of Failure of Parts of the System

The main risk is flooding around the building due to the collection pipework not being able to cope with the volumes of water due to debris preventing water to flow into the pipework. A blockage at the point where the pipe enters the detention basin could also cause water to flow around the building. This discharge point will be protected

with stone to prevent entry by animals. Maintenance of the system will prevent blockages occurring.

Pipe blockages are considered to be a low risk but if the outlet pipe from the detention basin became blocked then eventually water would flow over the exceedance route.

Water overtopping the detention basin would flow towards the stream

Standard S3 Water Quality Management

The proposal is to develop an existing industrial area used for lorry parking. The development area consists of a building with roof water drained to SuDS and additional parking areas for cars.

Land Use

The proposed building will be used for the maintenance and MOT testing of HGVs. All chemicals and oils are stored within the building within bunded areas or for smaller quantities with cabinets. Any spillages would be confined within the building.

The River Dee at its closest point is >550m away from the development. The river is designated as SAC and SSSI.

There are no groundwater source protection zones within the area.

Assessment of Pollution Potential

The land use shows that the site falls into the low pollution hazard level of table G3.1 of the Sustainable Drainage Systems for Wales. A simple index approach is therefore required. Using the method described in Section 26.7.1 of the SuDS manual, where

Total SuDs Mitigation $\geq$ Pollution Hazard Index For each hazard.

Table 7

SuDs Mitigation	TSS	Metals	Hydrocarbons
Detention basin	0.5	0.5	0.6
Total	0.5	0.5	0.6
Pollution for Low Risk	0.5	0.4	0.4
Acceptable	Yes	Yes	Yes

From table 8, it can be seen that the SuDs measures exceed the requirements for pollution control.

SuDS Management Train

As the scheme relies on infiltration via the base of the detention basin no additional SuDS features will be required to ensure that the water quality objectives are met.

9.4 Standard S4 Amenity

The site is on private land with no public access. The existing use as a lorry parking area around the new building adds little to the amenity value. The detention basin will add some visual interest to the field used for the detention basin. The SuDS area will be fenced off from the lorry parking area. blend into the natural landscape.

In summary the SuDs features have been designed to blend in with the overall landscaping scheme to improve the amenity value of the site visually.

9.5 Standard S5 – Biodiversity

As the site is currently agricultural and used for growing grass the biodiversity value is low. The scheme for the development of the site as a whole includes the planting of native trees (Hawthorn, Holly, Mountain Ash and Hornbeam) around the site boundary. The SuDs feature will create some wet features where water ponds temporarily in the detention basin. The feature will be mostly dry except during rainfall events but as they are designed to mimic the natural runoff, they will not be permanently wet. The base of the detention basin will be planted with patches of tough sedges to form microhabitats.

The landscape scheme and the development of the detention basin will improve biodiversity significantly by more diverse planting and habitat creation features.

9.6 Standard 6 Design of Drainage for Construction Operation and Maintenance

The detention basins will be constructed at an early stage of the development to allow for vegetation to become established in excavated areas. A final design drawing and method statements will be produced prior to construction taking account of any comments from the SAB and other consultees.

The operation of the drainage scheme will be the responsibility of the landowner.

The landowner will keep all the drawings and operation manual on site and ensure that the inspection regime and any remedial works are carried out.

Inspection and Maintenance Schedule

Table 8 below shows the routine inspections to be carried out to ensure that the system is operating as designed and will be refined considering experience of operating the system and any issues arising.

In any event the site shall be inspected after a period of very heavy rainfall where significant water collected in the detention basin.

Table 8 Operation and Maintenance Requirements for Detention Basins

Maintenance Schedule	Required Action	Frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during the growing season) or as required
	Cut Grass – Meadow grass in and around the basin	Half yearly (spring – before nesting season and autumn)
	Manage other vegetation and remove nuisance plants	Monthly at start and then as required
	Inspect inlets, outlets and overflows for blockages and clear as required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and base of basins for silt accumulation. Establish appropriate silt removal frequencies	Monthly (for first year), then annually or as required.
	Check flow controls	Annually
	Remove sediment from inlets and outlets and base	Annually (or as required)
	Tidy all dead growth before start of the growing season	Annually
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every two years or as required
	Remove sediment from inlets outlets and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial Actions	Repair erosion or other damage by reseeding or re turfing	As required
	Realignment of inlets, outlets and overflows	As required
	Relevel uneven surface and reinstate design level	As required

Appendix 1 Plans

Location Plan

Flood Risk Map

Surface Water Drainage Layout

Cross Section

AN RICHARDS LTD HGV WORKSHOP AND MOT CENTRE, CHIRK, LL14 5AN

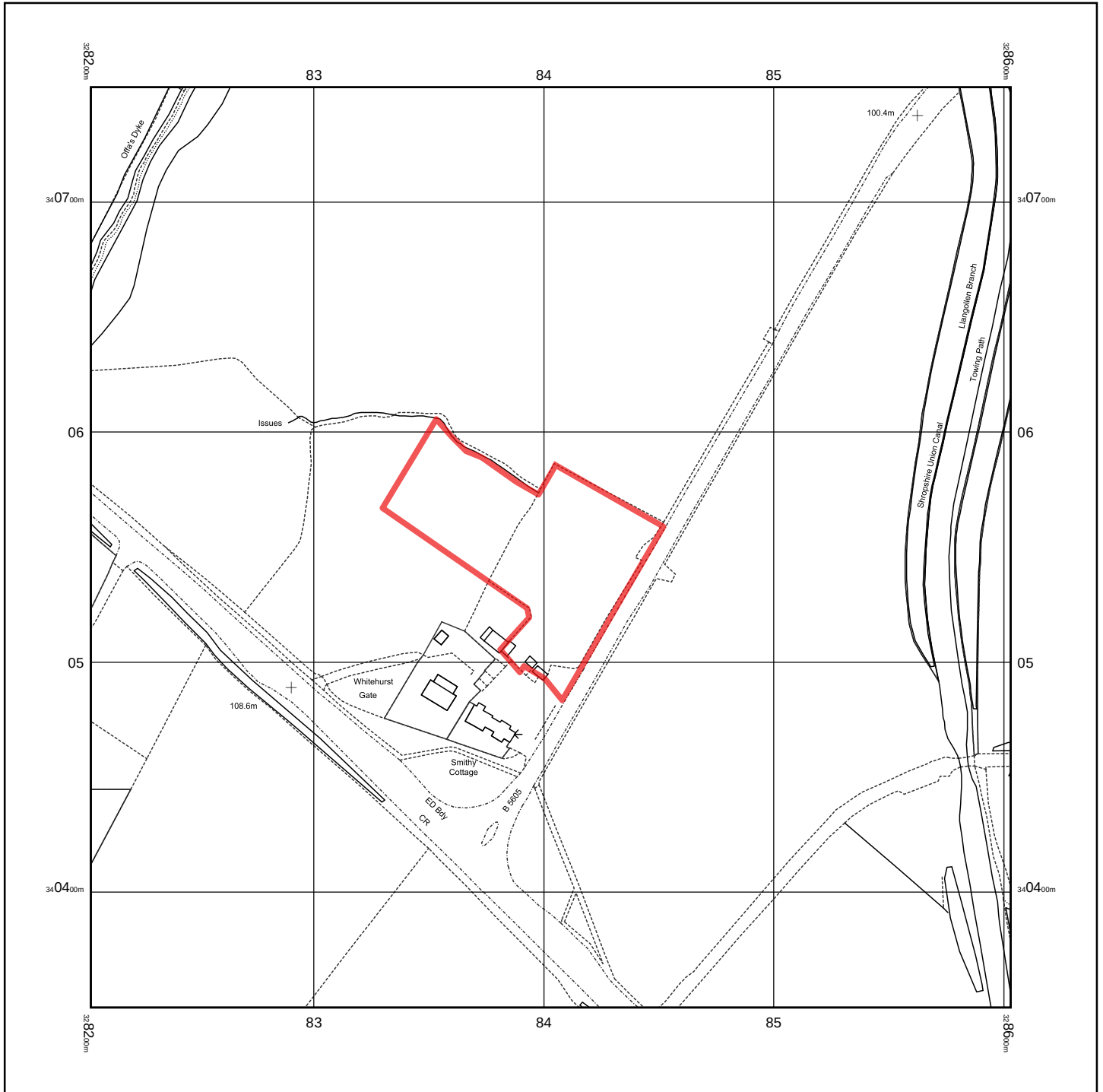
Supplied by: www.ukmapcentre.com

Serial No: 269529

Centre Coordinates: 328403,340550

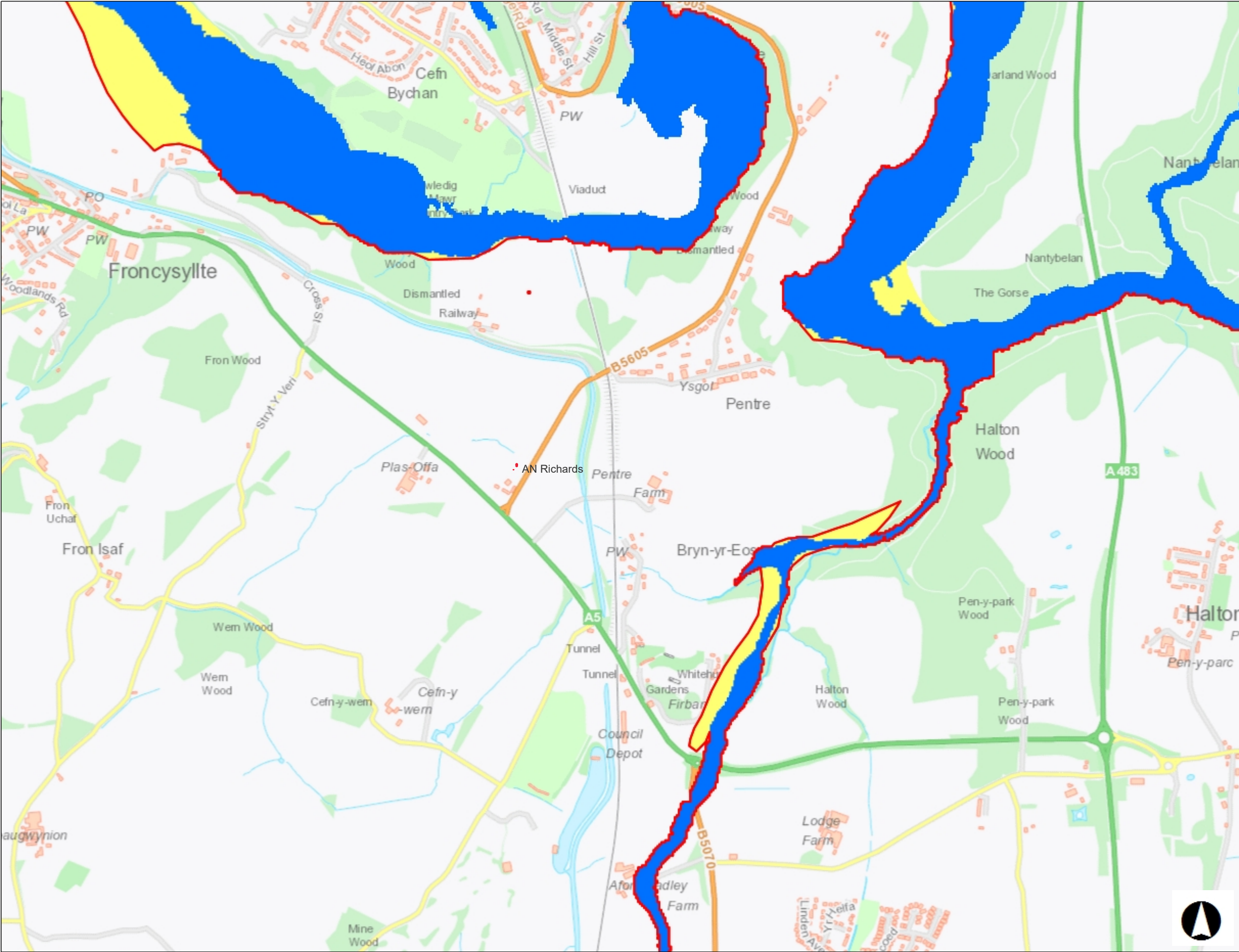
Production Date: 14/08/2023 14:40:08

LOCATION PLAN



© Crown copyright and database rights 2023 Ordnance Survey 100048957. The representation of road, track or path is no evidence of a boundary or right of way. The representation of features as lines is no evidence of a property boundary.

0m 1cm = 25m 125m
Scale 1:2500



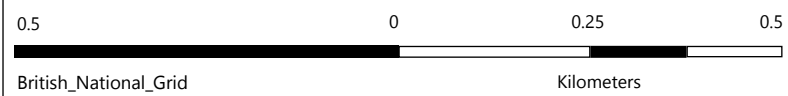
Map Perygl Llifogydd / Flood Risk Map -

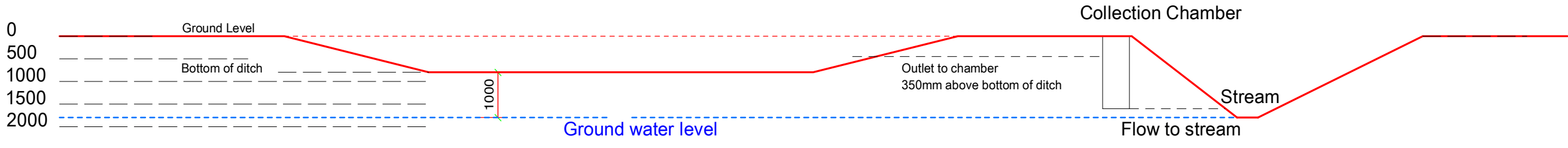
Allwedd / Map Key

- Zone C1
- Zone C2
- Zone B
- Zone A

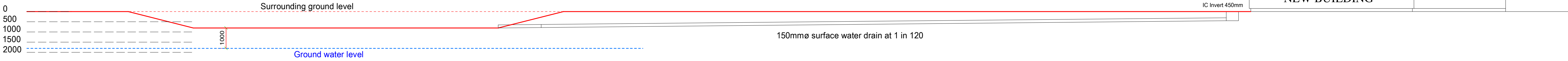
Graddfa / Scale at A3 1: 9,999

Dyddiad / Date
01/08/2023



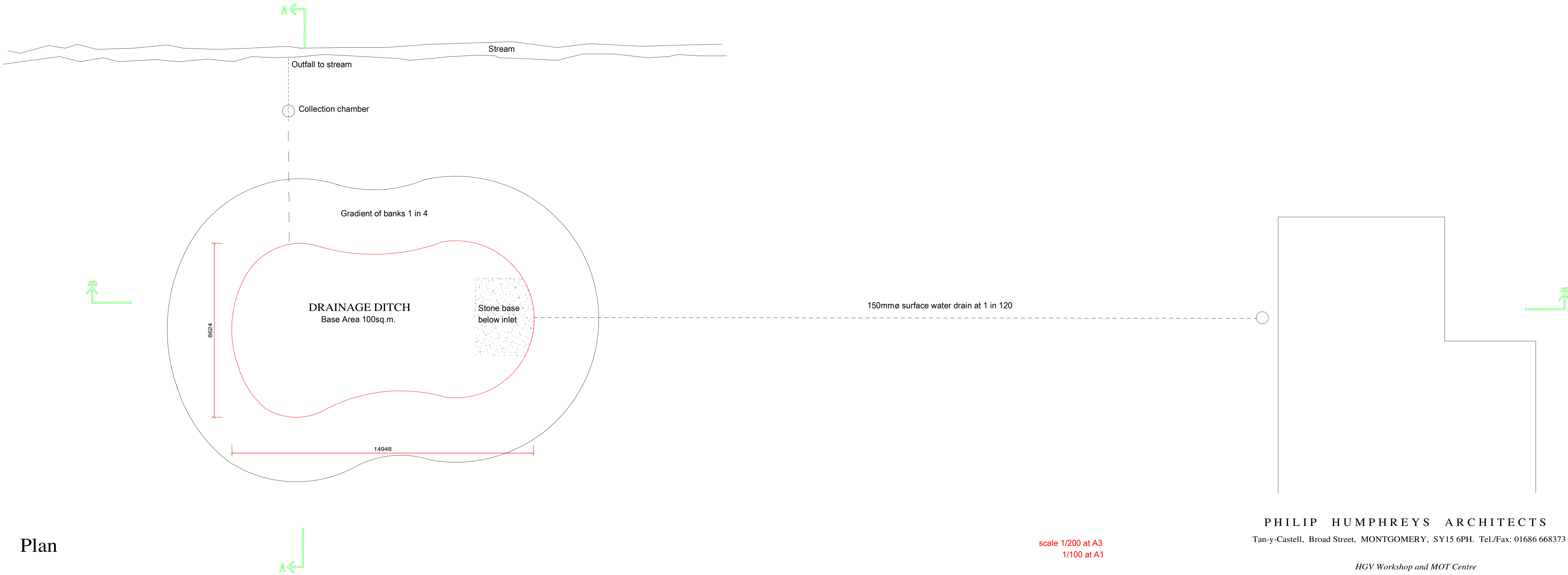


Section A-A



Section B-B

DRAINAGE DITCH



Plan

scale 1/200 at A3
1/100 at A1

PHILIP HUMPHREYS ARCHITECTS
Tan-y-Castell, Broad Street, MONTGOMERY, SY15 6PH. Tel./Fax: 01686 668373

HGV Workshop and MOT Centre

Appendix 2 Calculations

AN Richards Chirk

6 hour summer rainfall events

FEH Rainfall data

STORAGE VOLUMES

	Rainfall 6 hour event mm		m3 / ha	Potential Discharge Rates
1 in 100 yr + 40CC	102.21	0.102 m	1022.1	Rate l/sec M3/hour m3 24hours
1 in 100 year	73.01	0.073 m	730.1	0.07 0.24 5.69522973
1in 30 year	55.4	0.055 m	554	
1 in 10 year	41.9	0.042 m	419	

Qbar Greenfield Runoff rate l/sec/ha

2.39

Greenfield Runoff from developement

0.07 l/sec

1 in 100yr plus 40%Climate Change							
Area	Area Drained	Permeable	Storage Area (m2)	Depth of Storage (m)	Porosity	Vol available for storage (m3)	Vol Generated (m3)
Discharge						0	
Building	236	No				0	24.12
Paking	40	No					4.09
	276		0			0	28.21

1in 100year							
Area	Area Drained	Permeable	Storage Area (m2)	Depth of Storage (m)	Porosity	Vol available for storage (m3)	Vol Generated (m3)
Discharge							
Building	236	No				0	17.23
Parking	40	No					2.92
Totals	276		0			0	20.15

1in 30 year							
Area	Area Drained	Permeable	Storage Area (m2)	Depth of Storage (m)	Porosity	Vol available for storage (m3)	Vol Generated (m3)
Discharge							
Building	236	No				0	13.07
Parking	40	No					2.22
Totals	276		0			0	15.29

1 in 10 year Area	Area Drained	Permeable	Storage Area (m2)	Depth of Storage (m)	Porosity	Vol available for storage (m3)	Vol Generated (m3)
Discharge							
Building	236	No				0	9.89
Parking	40	No					1.68
Total	276		0			0	11.56

Maximum Storage Volume Required = 28.21 m3 Based on 1 in 100 plus 40% for Climate change

Maximum Storage capacity area with a depth depth 400mm but built to 500mm to allow a factor of safety area = 23.0 m2

Max permitted flow = 0.07 based on Qbar of 2.39 /l/s/ha

Greenfield Runoff Calculations loH124 Method

Area ha 50 Minimum 50ha
Area Km2 0.5
SAAR 882 mm FEH
SPR 0.3 Soil run off coefficient FEH

Area Drained

Qbar Rural 119.41 l/s for 50ha site
2.39 l/s ha
Site Area ha 0.0276 0.07 l/s Drained area

Detention basin interception required

Building area drained 276m2
Basin Basal area = 276m2 /5
Basal Area required = 55.2m2

DETENTION BASIN CALCULATOR

AN Richards Chirk

Using Simpsons Rule

Vol = (A1 + A2/2) d		1 in x	Area	Volume	l in 100 year event 0.13m deep, 1in 100 year pluss 40%CC 0.18m deep		
Side slope		4					
	Water Height	Basal Area	Top Area	Vol	Vol removed	Flow rate l/s	Infiltration
Head	in Basin	m2	m2	m3	m3	Cummulative	Empty from 1 drain time
0.4	0.4	100	119.00	63.8	0.0		
0.375	0.375	100	117.84	59.6	4.2	0.0	
0.35	0.35	100	116.76	55.4	4.2	4.2	Exceedance
0.325	0.325	100	115.76	51.3	4.1	8.3	
0.3	0.3	100	114.00	47.1	4.2	12.5	
0.25	0.25	100	112.07	39.0	8.1	20.6	
0.18	0.18	100	111.08	28.0	11.0	31.6	1 in 100plusCC
0.13	0.13	100	111.00	20.2	7.8	39.4	
0.125	0.125	100	110.31	19.4	0.8	40.2	1 in 100
0.07	0.07	100	110.00	10.9	8.5	48.7	Half empty
0	0	100	110.00	0.0	10.9	59.6	

ORIFICE PLATE CALCULATOR

Area Drained 0.0221 ha Greenfield Runoff Rate 0.07l/sec

Orifice Diameter mm 0 mm

Area m2 0

Cd = 0.6

Head m 0.5

Q= 0 m3/sec

0.00 l/sec

Combined infiltration
and outflow via flow
control half empty in <2hours

Vp to m/hr

Average Vp		75.5 Minutes for 150mm	Factor of Safety		
Vp/150		0.503 minutes/mm	Drain Down Time		
x1000		503.333 minutes/m	Water	1.00	2.00
60/min per m		0.119 m/hr	Depth	0.12	0.06
			m		
	Event				
	1in100		0.13	1.09	2.18
	1in100CC		0.18	1.51	3.02

3.00	4.00 FOS
0.04	0.03 m/hr
3.27	4.36 hours
4.53	6.04 hours