Flood Consequences Assessment & Drainage Strategy

Verlon Farm, Montgomery

Prepared for Powis Estates

Prepared by:

SLR Consulting Limited

3rd Floor, Brew House, Jacob Street, Tower Hill, Bristol, BS2 0EQ

SLR Ref.: 416.065277.00001

22 November 2024

Revision: 01

Basis of Report

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Appendices

1.0 Introduction

Authorisation

1.1 SLR has been instructed by Powis Estates to prepare a Flood Consequences Assessment (FCA) and Drainage Strategy to support an outline planning application and SuDS Approval Body (SAB) pre-application associated with a proposed residential development at Verlon Farm, Montgomery.

Background

1.2 The greenfield site is site is allocated within the Powys Local Development Plan for residential purposes.

1.3 According to the Natural Resources Wales (NRW) Flood and Coastal Erosion Risk Maps, the site is not susceptible to flooding from rivers or the sea.

1.4 It is proposed to develop the site for residential purposes. The proposed site plan is enclosed in Appendix A.

1.5 This FCA and Drainage Strategy has been undertaken in accordance with the guidelines set out in the Statutory National Standards for Sustainable Drainage Systems (SuDS) for Wales.

Objectives

1.6 The purpose of this report is coordinate the various technical pieces of information that have been used to support the SAB pre-application.

1.7 This is an interim version of the report, which has been prepared to support the pre-application consultation (PAC). The content is subject to change, once these initial stages are complete.

1.8 It is also intended that this report will be submitted to support the forthcoming planning application.

1.9 The objectives of this FCA and Drainage Strategy are to:

- Undertake a desk-based review of the available data for the site to assess drainage issues.
- Undertake a desk-based review of the available flood risk information to assess past, current and future flood risk issues, taking into consideration the anticipated impacts of climate change.
- Identify flood mitigation requirements, to ensure the development is safe from flooding, without impacting third parties.
- Review the relevant planning policy documents to ensure that the development is in accordance with these and other relevant regional and local guidance.
- Assess whether the development will result in an increase of surface water runoff and how this can be mitigated through the application of SuDS.
- Append key technical drawings, calculations and preliminary designs.
- Evaluate a conceptual foul water drainage solution.

2.0 Site Description

Site Location and Description

2.1 The site currently consists of several fields used for grazing, which is approximately 2.9 ha in size and is in north Montgomery. The approximate National Grid Reference of the site is SO222971. A site location plan is presented in Figure 1.

2.2 Existing residential development is located to the east, whilst the wider surrounding areas largely consist of fields and woodland. The B4388 forms the east site boundary.

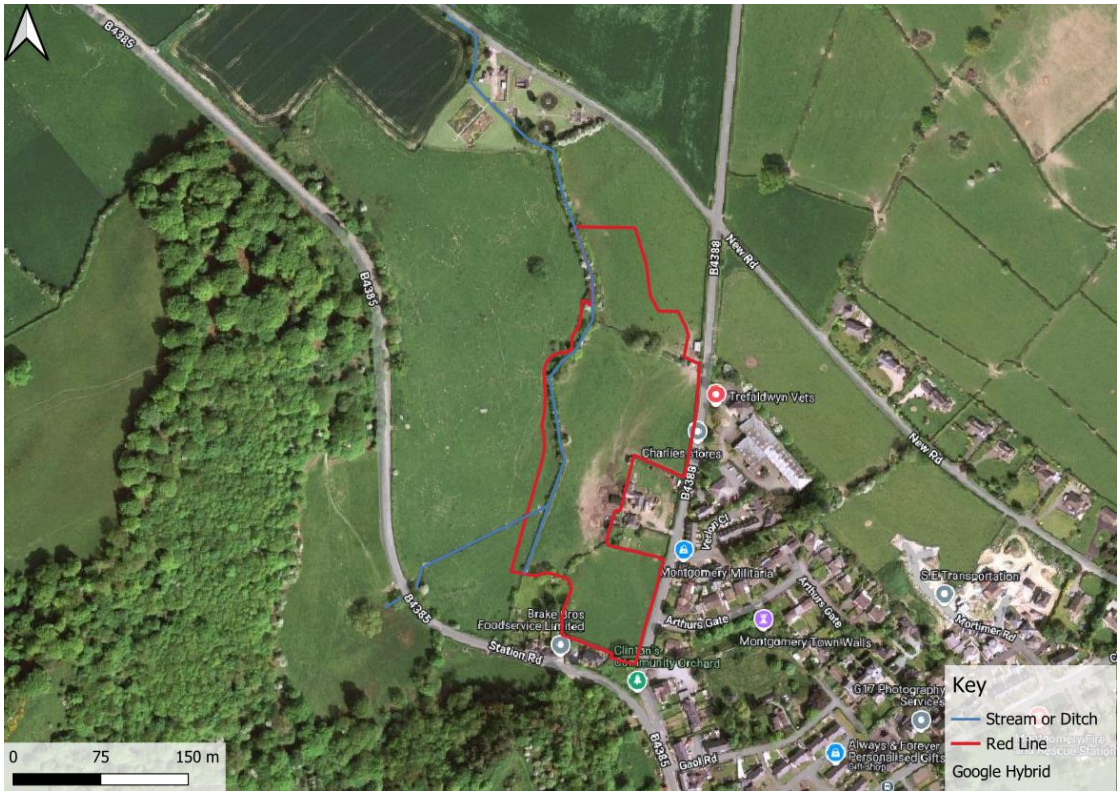

Figure 1: Site Location and Stream Network

Site Topography

2.3 A topographical survey of the site is enclosed in Appendix B. It shows that the ground levels on the site falls from south to north. The highest point recorded on the site is approximately 130 metres Above Ordnance Datum (m AOD); the lowest point recorded is approximately 107 m AOD.

Geology and Hydrogeology

2.4 The 1 in 50,000 scale British Geological Survey (BGS) online mapping indicates that the bedrock underlaying the site consists of the Forden Mudstone Formation. Superficial deposits are shown to occupy the whole site, which consist of Till.

2.5 Infiltration testing was completed in July 2024 (refer to Appendix C). Four infiltration test pits were excavated across the site. All pits were found to drain well with the slowest rate recoded at 1.36 x 10^{-5} m/s.

Hydrology and Existing Drainage

2.6 A small stream flows through the west part of the site (see Figure 1). The ditch is a tributary of the River Severn.

2.7 Hafren Dyfrdwy sewer plans are enclosed in Appendix D. These show a network of public surface water and combined water sewer that pass through the site.

3.0 Flood Risk and Consequences

Flooding from the Sea

3.1 The site is located inland and is elevated at least 107 m AOD and is therefore not susceptible to flood risk from the sea.

Flooding from the Rivers

3.2 According to the Development Advice Maps (DAMs), as shown in Figure 2, the site is in Zone A. Land in Zone A is considered to be at little or no risk of flooding from rivers.

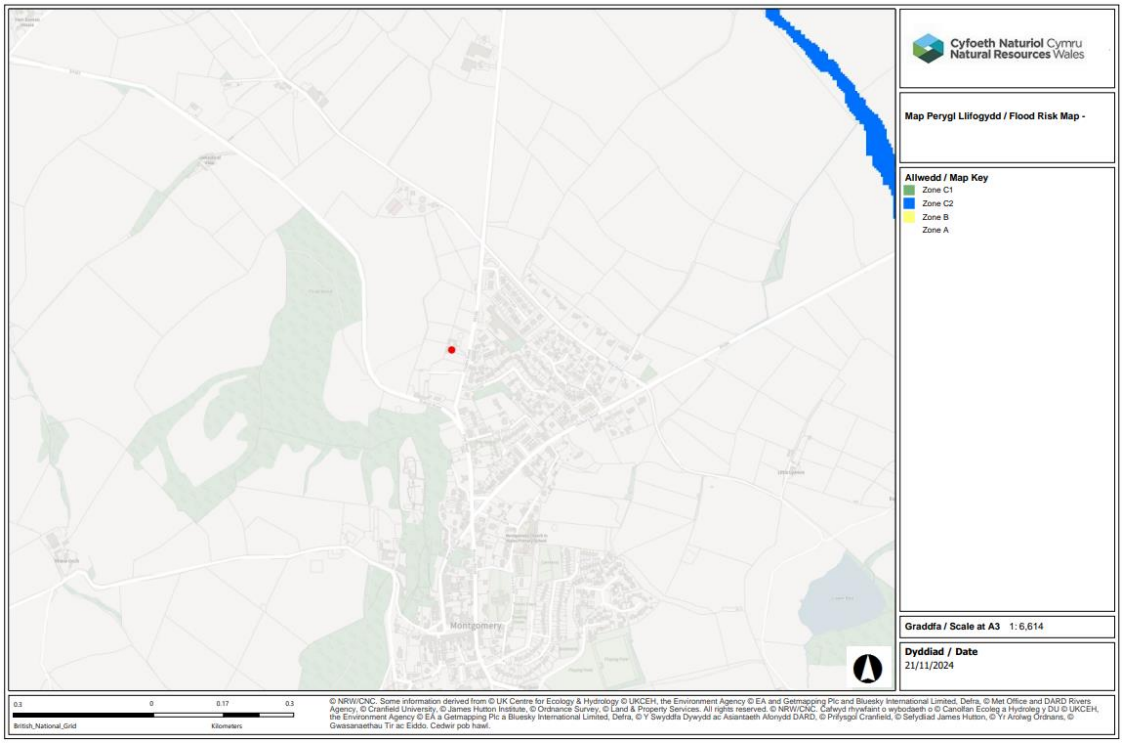

Figure 2: Development Advice Maps

Flooding from Surface Water

3.3 According to the NRW Flood and Coastal Erosion Risk Maps, part of the site is susceptible to surface water flooding, as shown in Figure 3.

3.4 The main surface water flood flow path originates from the existing residential to the southeast of the site. The flow path is shown to spill into the site from the B4388. It subsequently passes through the site in a northwest direction. In reality, a hedgerow is present that is likely to influence where the water flows into the site. If this flow path was to occur, it is more likely to enter the site at the existing vehicular access point.

3.5 The modelling carried out to derive these surface water flooding maps is not accurate at the site scale and does not account for the presence of existing local drainage systems, such as gullies, sewers and culverts, nor does it account for the full channel conveyance capacity.

These inaccuracies can cause significant variance on the actual extent of surface water flood risk to an area and the generally the mapping overestimates the impacts.

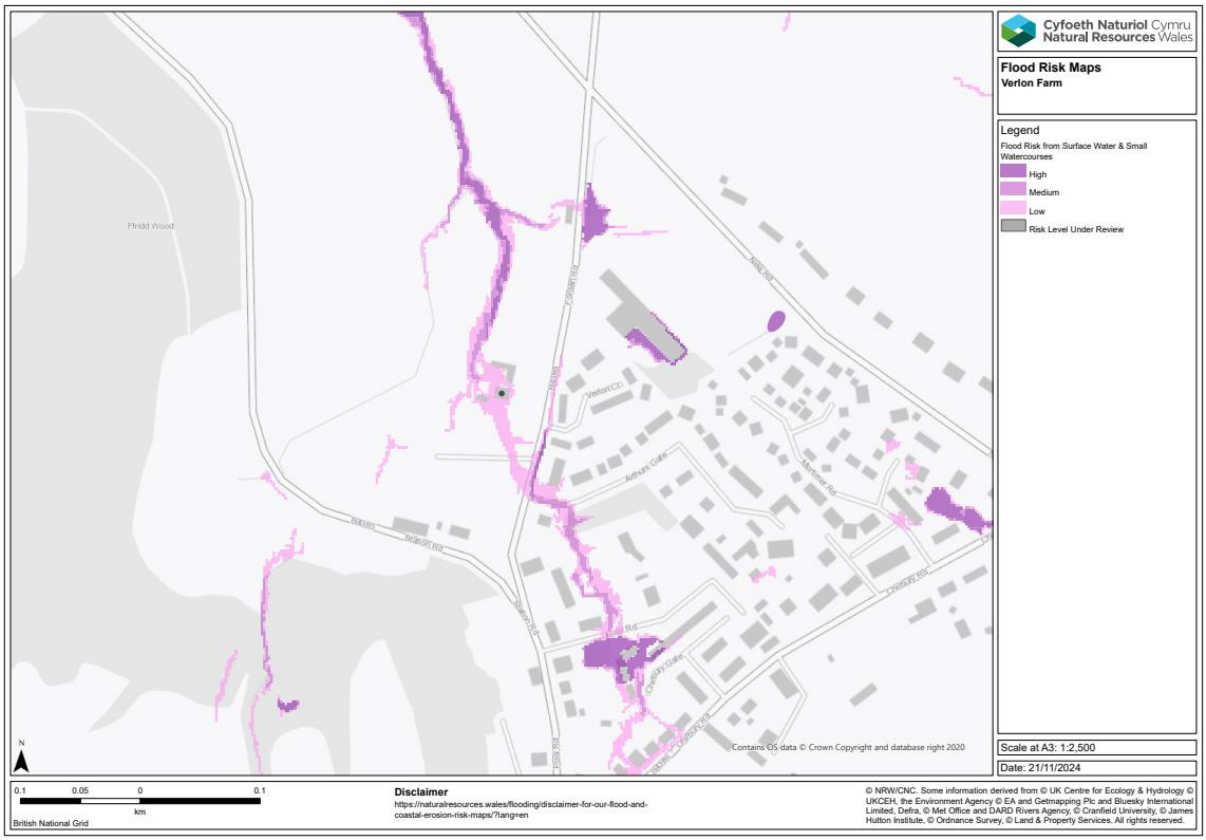

Figure 3: Flood Risk Map

3.6 Figure 4 overlays the surface water flood extent on the proposed site plan. The flow path introduces an area of low, medium and high risk. These risk categories are defined as follows:

- Low means that each year, this area has a chance of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%).
- Medium means that each year, this area has a chance of flooding between 1 in 100 (1%) and 1 in 30 (3.3%).
- High means that each year, this area has a chance of flooding of greater than 1 in 30 (3.3%).

3.7 The surface water flow path must be managed. Informal liaison was undertaken with the Lead Local Flood Authority (LLFA). Further details are discussed later in this chapter.

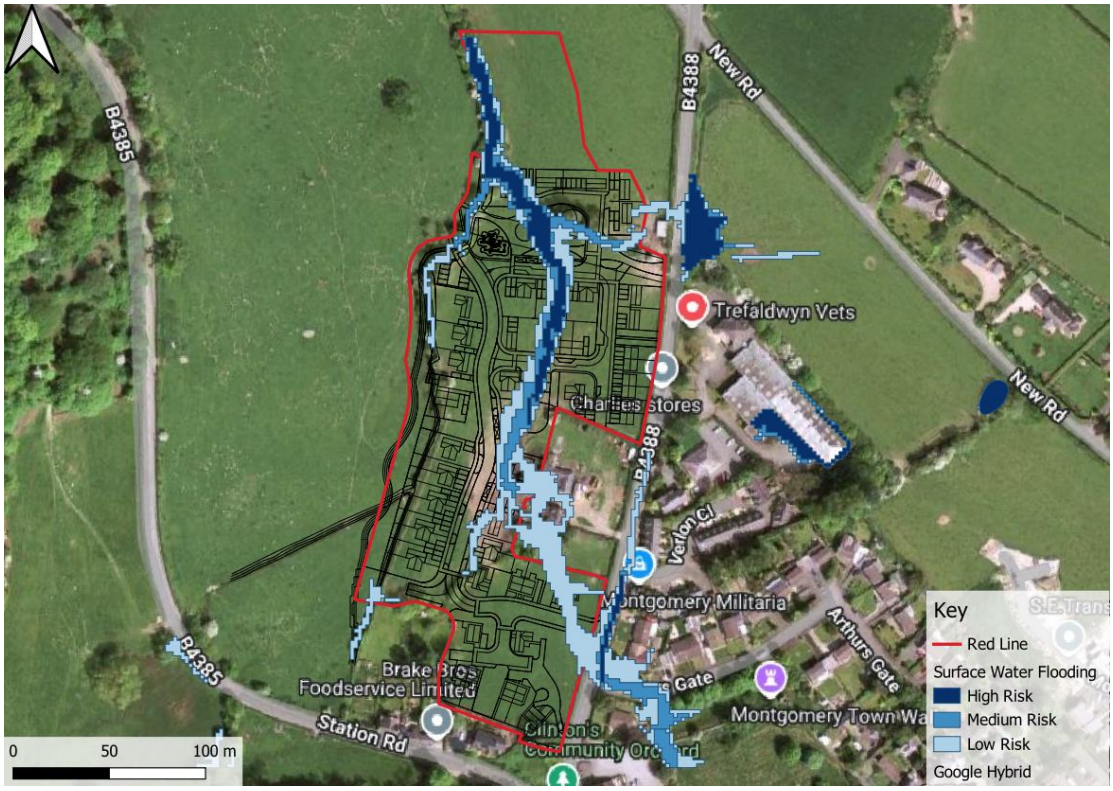

Figure 4: Surface Water Flooding

Flooding from Groundwater

3.8 Groundwater flooding occurs when the level of groundwater increases sufficiently so it rises above the level of the ground and causes flooding. It is often dependant on the underlying geology of an area and occurs following heavy rainfall.

3.9 The Mid Wales – Strategic Flood Consequences Assessment (2022) includes an extract of the JBA Groundwater Map, which defines the likely groundwater depth. This mapping is enclosed in Appendix E. Groundwater is not indicated to be shallow beneath the site and the dataset suggests that the site is not susceptible to this source of flood risk. The risk of groundwater flooding is therefore considered to be low.

Other Sources of Flooding

3.10 There is a network of public sewers on site. As discussed in Chapter 6, these will be realigned and positioned beneath the new highway. Whilst these sewers could introduce a source of flood risk, the mitigation measures used to manage the surface water flow path will also mitigate any potential consequence of sewer flooding.

3.11 A desktop review has not identified any other potential significant sources of flood risk at the site.

Flood Mitigation

3.12 During a conversation with the LLFA, it was agreed that the surface water flow path would be allowed to enter the site via the B4388 and immediately redirected to the stream

towards the west site boundary. This would minimise the length of the flow path through the site and any potential disturbance, should it materialise.

3.13 The highway alignment and vertical profile was designed so that adjacent finished floor levels were at least 0.5 m above the adjacent highway level. To prevent the floodwater from following the highway in a north direction and maintain the westerly direction (into the stream), meant that the road level also needed to rise by 0.5 m just after turning to the north. To achieve this, it was discovered that land would need to be raised by up to approximately 3.0 m on the highway, and 3.5 m on adjacent plots. This was because existing ground levels fall steeply to the north. Drawings are enclosed in Appendix F, which illustrative this impact. These drawings are now obsolete. Land raising to this extent was not considered to be a practical option from a cost and landscape perspective.

3.14 Consequently, highway levels have been designed to convey the surface water flow path into the stream further downstream (see Figure 5). This mimics the existing direction more closely and does not require significant land raising. However, adjacent finished floor levels will remain at least 0.5 m above the adjacent highway level. Drawings are enclosed in Appendix G, which illustrative this preferred arrangement.

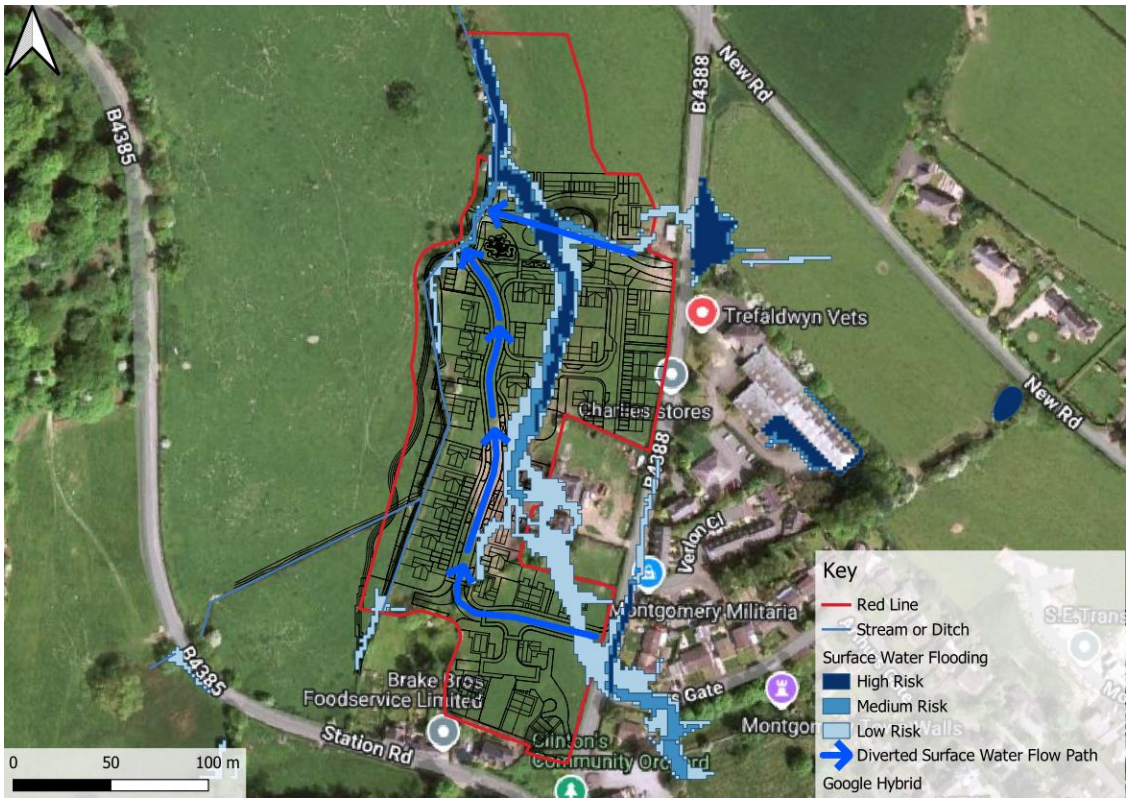

Figure 5: Diverted Surface Water Flooding

4.0 Surface Water Management

Overview

4.1 It is well understood that one of the effects of development is typically to reduce the permeability of the site and consequently to change its response to rainfall. Therefore, a suitable surface water drainage strategy is required to ensure that the surface water runoff regime is managed appropriately so that there will be no increase flood risk to third parties.

4.2 A fundamental principle of sustainable development is the reduction of surface water runoff. Surface water drainage arrangements for any development site must ensure that volumes and peak discharge rates leaving the site are no greater than those for the site prior to development. Any increase in surface water run-off above the pre-development volumes must also be controlled on site.

4.3 The Statutory National Standards for Sustainable Drainage Systems (SuDS) for Wales outline the key standards that must be met when managing surface water runoff from a new development site. This has informed this SuDS Strategy.

Proposed Surface Water Discharge Receptor

4.4 The drainage hierarchy presented in the Statutory National Standards for Sustainable Drainage Systems (SuDS) for Wales states that the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable:

- Collected for use,
- into the ground (infiltration),
- to a surface water body,
- to a surface water sewer, highway drain, or another drainage system,
- to a combined sewer.

4.5 The nature of the development (i.e. small private roof surfaces) is not conducive to an economic rainwater harvesting system. Water butts will be used and runoff from roof surfaces and paved areas will be harvested informally to supply water for vegetation in rain gardens.

4.6 Infiltration testing demonstrated that the site offers some infiltration potential. There is also a stream present on site. Therefore, a dual solution is proposed, with a detention basin that will allow infiltration, but will also retain the existing connectivity to the stream (at greenfield rates).

Greenfield Runoff Rates

4.7 The FEH method has been used to calculate the greenfield runoff rates for the site. The parameters utilised and the calculated rates are provided in Table 1 and 2, respectively. Full results are provided in Appendix H.

Table 1: Calculation Parameters

Parameter	Value	Unit
Area	1	ha
SAAR	765	mm
BFI HOST 19	0.435	-
Region	4	-

Table 2: Greenfield Rates

Return Period	Peak Greenfield Discharge (l/s/ha)
QBAR	4.99
Q1	4.14
Q30	9/99
Q100	12.83

4.8 The QBAR discharge rate of 4.99 l/s/ha has been adopted and all storms up to and including the 1 in 100 year plus climate change event will be restricted to this rate.

Proposed Surface Water Drainage Strategy

4.9 The surface water management strategy proposed for the site has been derived based upon the principles of sustainable drainage as detailed in the CIRIA SuDS Manual (2015) and the Statutory National Standards for Sustainable Drainage Systems (SuDS) for Wales.

4.10 SuDS will be utilised to manage surface water runoff from the site. Where practical, roof surfaces will drain to rain gardens, which will subsequently connect into a pipe system. Private parking areas will be constructed using permeable surfaces, which will also subsequently connect into a pipe system. The adopted highway will drain into a pipe system. The various source control SuDS will be located throughout the development and will offer interception of smaller rainfall events. The pipe system will lead to a detention basin, which will provide interception, attenuation storage and a final water quality treatment. The basin will release runoff into the stream at greenfield rates. This will be achieved using a hydrobrake (or similar approved) fitted within a manhole downstream of the basin.

4.11 A Preliminary Surface Water Drainage Layout is enclosed in Appendix I, which present the SuDS that are proposed.

4.12 A Causeway Flow calculation has been prepared to inform the design of the detention basin. This has been undertaken based on the parameters identified in Table 3. A 10% urban creep allowance has been applied to roof surfaces. An upper end 40% climate change allowance has been adopted, as required by national guidance. The discharge rate was estimated based on current impermeable surface area (i.e. 1.334 x 4.99 = 6.7 l/s). Given full BRE365 testing was not undertaken, the infiltration rate used is smaller than that recorded on site.

Table 3 – Detention Basin Storage Parameters

Parameter	Values	Units
Roof area	0.291	ha
Paved area	0.921	
Basin area	0.122	ha
Total current impermeable area (including basin)	1.334	ha
Urban creep	10	%
Future impermeable area	1.363	ha
Discharge rate	6.7	l/s
Infiltration rate	1×10^{-5}	m/s
Climate change allowance	40	%
Basin average side slope	1:4	-

4.13 The calculations are enclosed in Appendix H. Table 4 identifies details of the detention basin, which was found to be required. These details are also shown on the Preliminary Surface Water Drainage Layout (Appendix I).

Table 4: Preliminary Basin Design Details

Total Basin Depth (m)	Basin Area (m^2)	Attenuation Storage Volume (m^3)	Freeboard Depth (m)
1.3	1,195	830	0.3

4.14 Additional space has also been allocated around the detention basin for earthworks and maintenance access requirements. However, this is subject to more detailed design and a 3D earthworks analysis.

Exceedance

4.15 Surface water flow paths in extreme events, known as exceedance events (i.e. events in excess of the design criteria i.e. the 1 in 100 year plus climate change event), should be steered away from properties and to provide better protection to people and property. Exceedance routes are shown on the Preliminary Surface Water Drainage Layout enclosed in Appendix I.

Water Quality

4.16 In accordance with the CIRIA SuDS Manual (2015), SuDS components must have a total pollution index that equals or exceeds the pollution hazard index for different land use classifications. It is considered that the SuDS provided as part of the surface water drainage strategy would offer sufficient mitigation for the land use classification.

4.17 This has been undertaken for different land use categories and the SuDS that have been proposed for certain components of the site. Table 5 shows the pollution hazard indices for paved surfaces. All paved surfaces will drain through a detention basin, which provides adequate mitigation (see Table 6). These tables are informed by Table 26.2 and 26.3 of the CIRIA SuDS Manual (2015)).

4.18 In reality, some paved areas will also drain through permeable paving, which will provide further pollution mitigation.

Table 5: Pollution Hazard Indices for Paved Surfaces

Land Use	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Individual property driveways, residential car parks, low traffic roads and non-residential car parking with infrequent change	0.5	0.4	0.40

Table 6: SuDS Mitigation Indices for Paved Surfaces

Type of SuDS	Mitigation Indices		
	TSS	Metals	Hydrocarbons
Detention basin	0.5	0.5	0.6

4.19 Table 7 shows the pollution hazard indices for roof surfaces. All roof surfaces will drain through a detention, which provides adequate mitigation (see Table 8). These tables are informed by Table 26.2 and 26.3 of the CIRIA SuDS Manual (2015)).

4.20 Some roof surfaces will also drain through a rain garden, which will provide further pollution mitigation.

Table 7: Pollution Hazard Indices for Roof Surfaces

Land Use	TSS	Metals	Hydrocarbons
Residential roof surfaces	0.2	0.2	0.05

Table 8: SuDS Mitigation Indices for Roof Surfaces

Type of SuDS	Mitigation Indices		
	TSS	Metals	Hydrocarbons
Detention basin	0.5	0.5	0.6

5.0 Foul Water Drainage

5.1 A pre-planning enquiry is to be submitted to Hafren Dyfrdwy, seeking their views on the capacity of the network of assets and infrastructure to accommodate the proposed development.

6.0 Other Considerations

Diversion of Public Sewers

6.1 There is an extensive network of public surface water and foul water sewers on the site. Given the easement requirements, development of the site would be impractical without the diversion of these sewers. The Preliminary Surface Water Drainage Layout enclosed in Appendix I shows how these constraints could be overcome.

Stream Improvement

6.2 Most of the stream length on site is very straight. It is at the headwaters of the catchment and is assumed to be an artificial feature to improve drainage. It is proposed to realign the straight length of the stream to allow sufficiently size gardens to adjoining dwellings. This will also allow a corridor alongside the stream to provide access for maintenance purposes.

6.3 A gently sinuous form will be introduced as part of the stream improvements. This will help to maximise its ecotone potential, reduce speed of water flow, and create a more natural riparian environment.

7.0 Conclusions

7.1 SLR has been instructed by Powis Estates to prepare a Flood Consequences Assessment (FCA) and Drainage Strategy to support an outline planning application and SuDS Approval Body (SAB) pre-application associated with a proposed residential development at Verlon Farm, Montgomery.

7.2 This has been undertaken in accordance with the guidelines set out in the Statutory National Standards for Sustainable Drainage Systems (SuDS) for Wales.

7.3 A desktop study has concluded that most of the site is not susceptible to flood risk. However, a surface water flow paths impacts the part of site. It is proposed that this flow path will be managed through the site using the highway alignment, which will ultimately allow it to spill into a stream.

7.4 The surface water drainage strategy includes an extensive network of SuDS, including rain gardens, permeable paving and a detention basin.

7.5 An attenuation-based surface water drainage strategy has been proposed to manage surface water generated from the proposed impermeable surfaces, which will subsequently discharge to the stream network on site at a controlled rate.

7.6 The SuDS have been designed to also permit the localised interception of rainfall during the smaller storm events.

7.7 Foul water will be discharged to the public sewer network, which is subject to further consultation with Hafren Dyfrdwy.

7.8 The drainage strategy is subject to detailed drainage design and SAB full application, prior to construction.

Appendix A Site Plans

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Any discrepancies should be reported immediately.

Any surveyed information incorporated within this drawing cannot be guaranteed as accurate unless confirmed by a fixed dimension. All dimensions are in millimetres unless noted otherwise.

Approach road to finish at site boundary to provide future development opportunity.

On-street parking for units to be broken up by feature trees

Green corridor for biodiversity provides natural separation across the site

Area surrounding new watercourse to be densely planted with trees and shrubbery within a 5 metre buffer

Zone for road to be retained for future development opportunity.

Area for additional surface water attenuation. Refer to details from SLR

Public open space with dense shrubbery and trees to limit impact of site upon adjacent roadside and existing dwellings opposite

Site access from B4388

New road to incorporate one-way system. Refer to drawing 103 for further details

New road to incorporate one-way system. Refer to drawing 103 for further details

Large formal Public Open Space with pathway through to provide additional pedestrian access to the site. To be surrounded my dense vegetation and treeline. Provision for children's play area, seating area.

New active travel routes through site to provide multiple pedestrian access points and permeable pathways

6 metre easement ('No-build') zone adjacent to existing 'high-voltage' power line.

Road moved to allow for existing tree RPZ

Proposed Site Plan

1 : 500

Application Site Boundary

Land under ownership of applicant

(North)

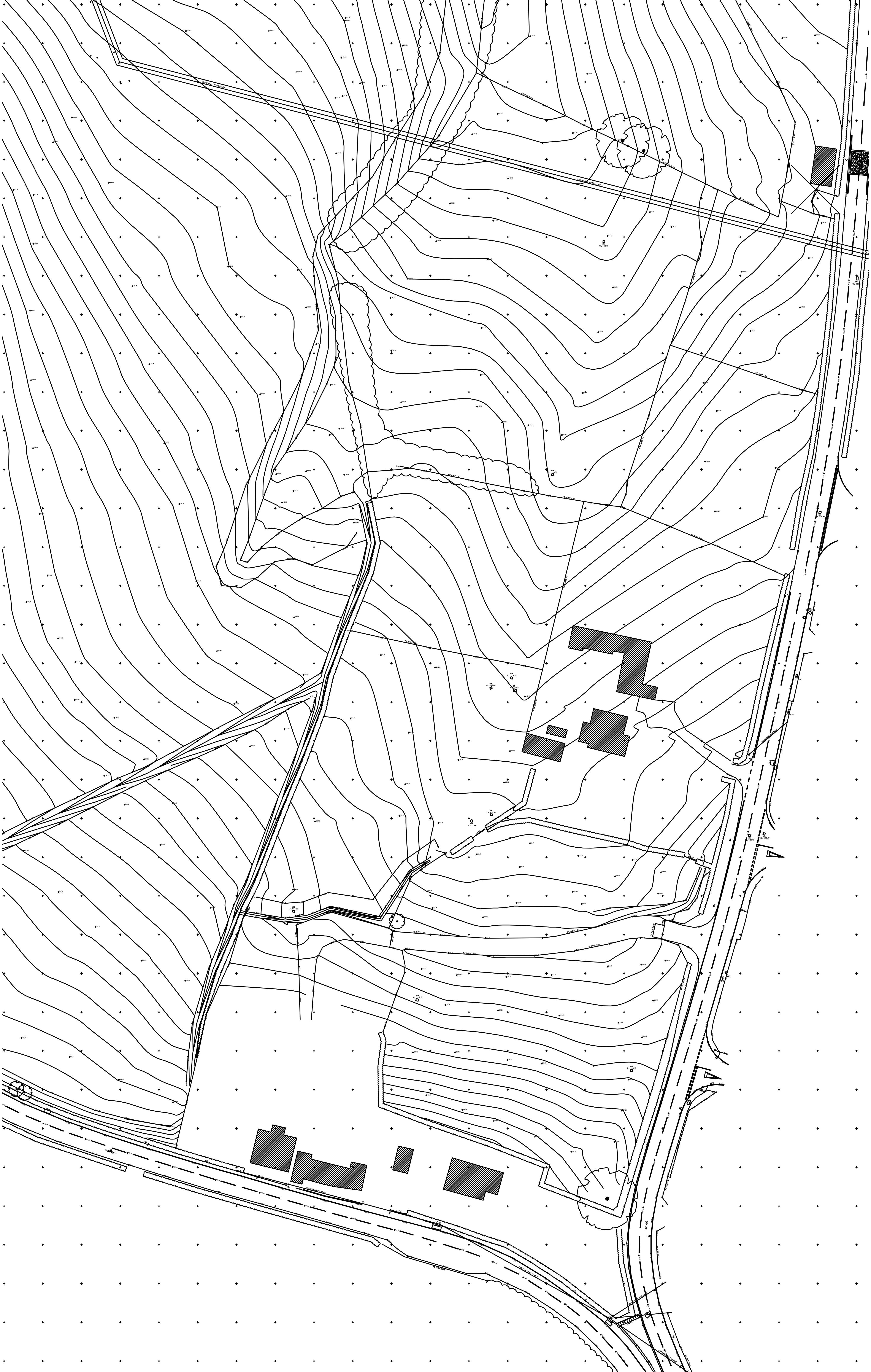
HUGHES ARCHITECTS

Head Office
29 Broad Street
Newtown
Powys
SY16 2BQ
T - 01686 610311
w - www.hughesarchitects.co.uk

F - KT - Revised Following LFS Landscape Design - 30.10.24
E - OO - Updates following LFS comments - 14.10.24
D - KT - Revised Following Receipt of SLR Information - 01.10.24
C - KT - Revised Road Layout and Reposition of Unit - 25.09.24
B - Road Layout Revised - 19.09.24
A - HB - Revised Following Client Comments - 20.05.21

Project :- Proposed Residential Development adj. Forden Road, Montgomery, SY15 6QX			
Drawing Status :- Stage 3a		Drawing Title :- Proposed Site Plan	
Scale :- 1 : 500	Date :- 14.08.24	Drawing No :- Z006.3a. 1.100	Rev :- F
Drawn by :- KT	Checked :- OO		

Appendix B Topographical Survey



Appendix C Soakaway Investigation

Nick Bosanko

From: Nick.Bosanko@slrconsulting.com
Subject: RE: Z006 - Verlon

From: Kieran Thomas <kieran.thomas@hughesarchitects.co.uk>
Sent: 10 July 2024 09:55
To: Oliver O'Neill <Oliver.ONeill@hughesarchitects.co.uk>; Doug Hughes (HA) <Doug.Hughes@hughesarchitects.co.uk>; Nick Bosanko <Nick.Bosanko@slrconsulting.com>
Cc: Projects <Projects@hughesarchitects.co.uk>; Hamza El-Adnany <Hamza.ElAdnany@slrconsulting.com>; Hollie Bumford <hollie.bumford@hughesarchitects.co.uk>
Subject: Re: Z006 - Verlon

Good morning, all,

I hope you're well.

Please see the attached plan along with the infiltration rates for each pit below:

Pit 1
0.099 m/hr

Pit 2
0.095 m/hr

Pit 3
0.049 m/hr

Pit 4
0.091 m/hr

Any queries, please let me know.

Kind Regards

Kieran

Kieran Thomas
Architectural Technologist

NEWTOWN – WELSHPOOL - ABERYSTWYTH - LLANDRINDOD WELLS
T: 01686 610311
E: kieran.thomas@hughesarchitects.co.uk

W: www.hughesarchitects.co.uk


1
2
3
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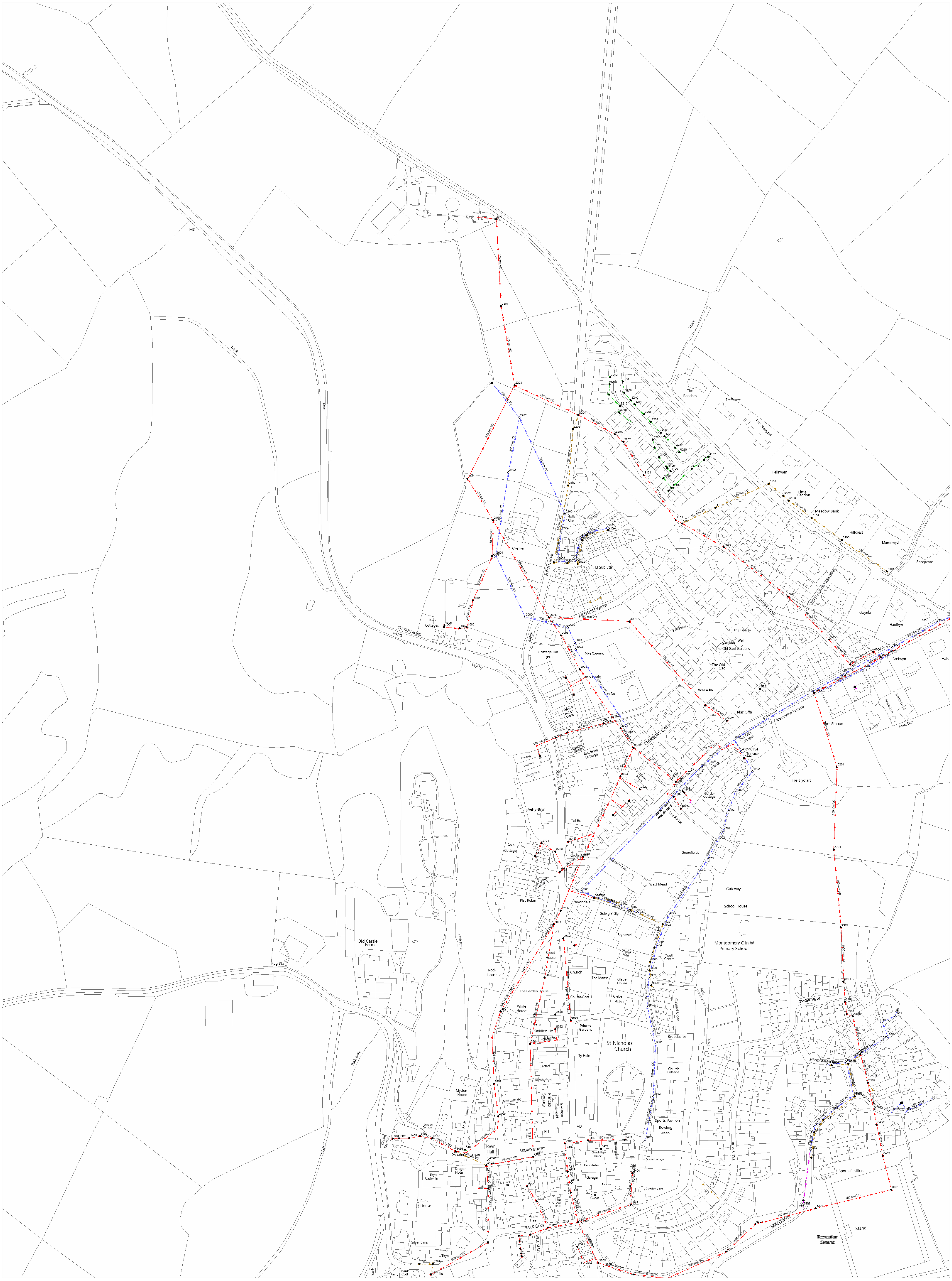
Appendix D Sewer Plans



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Data updated: 14/09/24

Scale: 1:1250
Map Centre: 322200,297000
Date: 24/09/24
Our Ref: 1576779 - 1
Wastewater Plan A0
Powered by digdat

Public Foul Gravity/Lateral Drain		Highway Drain		Manhole Foul	
Public Combined Gravity/Lateral Drain		Overflow Pipe		Manhole Surface	
Public Surface Water Gravity/Lateral Drain		Disposal Pipe		Abandoned Pipe	
Pressure Foul		Culverted Water Course		Chamber	
Pressure Combined		Pumping Station		Section 104 sewers are shown in green	
Pressure Surface Water		Fitting		Private sewers are shown in magenta	

nick.bosanko@slrconsulting.com

Montgomery

HAFREN DYFRDWY
severn dee

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GENERAL CONDITIONS AND PRECAUTIONS TO BE TAKEN WHEN CARRYING OUT WORK ADJACENT TO SEVERN TRENT WATER'S APPARATUS

Please ensure that a copy of these conditions is passed to your representative and/or your contractor on site. If any damage is caused to Hafren Dyfrdwy (HD) apparatus (defined below), the person, contractor or subcontractor responsible must inform HD immediately on: **0800 085 8033 (24 hours)**

a) These general conditions and precautions apply to the public sewerage, water distribution and cables in ducts including (but not limited to) sewers which are the subject of an Agreement under Section 104 of the Water Industry Act 1991(a legal agreement between a developer and HD, where a developer agrees to build sewers to an agreed standard, which HD will then adopt); mains installed in accordance with an agreement for the self-construction of water mains entered into with HD and the assets described at condition b) of these general conditions and precautions. Such apparatus is referred to as "HD Apparatus" in these general conditions and precautions.

b) Please be aware that due to The Private Sewers Transfer Regulations June 2011, the number of public sewers has increased, but many of these are not shown on the public sewer record. However, some idea of their positions may be obtained from the position of inspection covers and their existence must be anticipated.

c) On request, STW will issue a copy of the plan showing the approximate locations of HD Apparatus although in certain instances a charge will be made. The position of private drains, private sewers and water service pipes to properties are not normally shown but their presence must be anticipated. This plan and the information supplied with it is furnished as a general guide only and HD does not guarantee its accuracy.

d) STW does not update these plans on a regular basis. Therefore the position and depth of HD Apparatus may change and this plan is issued subject to any such change. Before any works are carried out, you should confirm whether any changes to the plan have been made since it was issued.

e) The plan must not be relied upon in the event of excavations or other works in the vicinity of HD Apparatus. It is your responsibility to ascertain the precise location of any HD Apparatus prior to undertaking any development or other works (including but not limited to excavations).

f) No person or company shall be relieved from liability for loss and/or damage caused to HD Apparatus by reason of the actual position and/or depths of HD Apparatus being different from those shown on the plan.

In order to achieve safe working conditions adjacent to any HD Apparatus the following should be observed:

1. All HD Apparatus should be located by hand digging prior to the use of mechanical excavators.

2. All information set out in any plans received from us, or given by our staff at the site of the works, about the position and depth of the mains, is approximate. Every possible precaution should be taken to avoid damage to HD Apparatus. You or your contractor must ensure the safety of HD Apparatus and will be responsible for the cost of repairing any loss and/or damage caused (including without limitation replacement parts).

3. Water mains are normally laid at a depth of 900mm. No records are kept of customer service pipes which are normally laid at a depth of 750mm; but some idea of their positions may be obtained from the position of stop tap covers and their existence must be anticipated.

4. During construction work, where heavy plant will cross the line of HD Apparatus, specific crossing points must be agreed with HD and suitably reinforced where required. These crossing points should be clearly marked and crossing of the line of HD Apparatus at other locations must be prevented.

5. Where it is proposed to carry out piling or boring within 20 metres of any HD Apparatus, HD should be consulted to enable any affected HD Apparatus to be surveyed prior to the works commencing.

6. Where excavation of trenches adjacent to any HD Apparatus affects its support, the HD Apparatus must be supported to the satisfaction of HD. Water mains and some sewers are pressurised and can fail if excavation removes support to thrust blocks to bends and other fittings.

7. Where a trench is excavated crossing or parallel to the line of any HD Apparatus, the backfill should be adequately compacted to prevent any settlement which could subsequently cause damage to the HD Apparatus. In special cases, it may be necessary to provide permanent support to HD Apparatus which has been exposed over a length of the excavation before backfilling and reinstatement is carried out. There should be no concrete backfill in contact with the HD Apparatus.

8. No other apparatus should be laid along the line of HD Apparatus irrespective of clearance. Above ground apparatus must not be located within a minimum of 3 metres either side of the centre line of HD Apparatus for smaller sized pipes and 6 metres either side for larger sized pipes without prior approval. No manhole or chamber shall be built over or around any HD Apparatus.

9. A minimum radial clearance of 300 millimetres should be allowed between any plant or equipment being installed and existing HD Apparatus. We reserve the right to increase this distance where strategic assets are affected.

10. Where any HD Apparatus coated with a special wrapping is damaged, even to a minor extent, HD must be notified and the trench left open until the damage has been inspected and the necessary repairs have been carried out. In the case of any material damage to any HD Apparatus causing leakage, weakening of the mechanical strength of the pipe or corrosion-protection damage, the necessary remedial work will be recharged to you.

11. It may be necessary to adjust the finished level of any surface boxes which may fall within your proposed construction. Please ensure that these are not damaged, buried or otherwise rendered inaccessible as a result of the works and that all stop taps, valves, hydrants, etc. remain accessible and operable. Minor reduction in existing levels may result in conflict with HD Apparatus such as valve spindles or tops of hydrants housed under the surface boxes. Checks should be made during site investigations to ascertain the level of such HD Apparatus in order to determine any necessary alterations in advance of the works.

12. With regard to any proposed resurfacing works, you are required to contact HD on the number given above to arrange a site inspection to establish the condition of any HD Apparatus in the nature of surface boxes or manhole covers and frames affected by the works. HD will then advise on any measures to be taken, in the event of this a proportionate charge will be made.

13. You are advised that HD will not agree to either the erection of posts, directly over or within 1.0 metre of valves and hydrants,

14. No explosives are to be used in the vicinity of any HD Apparatus without prior consultation with HD.

TREE PLANTING RESTRICTIONS

There are many problems with the location of trees adjacent to sewers, water mains and other HD Apparatus and these can lead to the loss of trees and hence amenity to the area which many people may have become used to. It is best if the problem is not created in the first place. Set out below are the recommendations for tree planting in close proximity to public sewers, water mains and other HD Apparatus.

15. Please ensure that, in relation to HD Apparatus, the mature root systems and canopies of any tree planted do not and will not encroach within the recommended distances specified in the notes below.

16. Both Poplar and Willow trees have extensive root systems and should not be planted within 12 metres of a sewer, water main or other HD Apparatus.

17. The following trees and those of similar size, be they deciduous or evergreen, should not be planted within 6 metres of a sewer, water main or other HD Apparatus. E.g. Ash, Beech, Birch, most Conifers, Elm, Horse Chestnut, Lime, Oak, Sycamore, Apple and Pear. Asset Protection Statements Updated May 2014

18. HD personnel require a clear path to conduct surveys etc. No shrubs or bushes should be planted within 2 metre of the centre line of a sewer, water main or other HD Apparatus.

19. In certain circumstances, both HD and landowners may wish to plant shrubs/bushes in close proximity to a sewer, water main of other HD Apparatus for screening purposes. The following are shallow rooting and are suitable for this purpose: Blackthorn, Broom, Cotoneaster, Elder, Hazel, Laurel, Privet, Quickthorn, Snowberry, and most ornamental flowering shrubs.

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
	C		0	0
	C		0	0
	C		0	0
	C		0	0
	C		0	0
	C		0	0
	C		0	0
1001	C	125.12	123.41	1.71
1002	C	130.06	128.19	1.87
1003	C	131.24	129.37	1.87
1004	C	131.46	130.21	1.25
1005	C	131.68	130.43	1.25
1101	C	119.8	117.51	2.29
1301	C	180.01	177.13	2.88
1400	C		0	0
1404	C		0	0
1405	C		0	0
1406	C		0	0
1407	C		0	0
2004	C	126.07	123.18	2.89
2005	C	127.04	124.53	2.51
2006	C	121.4	119.32	2.08
2101	C	119.4	118.03	1.37
2203	C	111.7	109.85	1.85
2301	C	166.81	164.77	2.04
2301	C	111.59	109.13	2.46
2303	C	167.08	165.46	1.62
2401	C		0	0
2401	C	108.79	107.96	0.83
2402	C	170	167.2	2.8
2403	C	170.98	168.62	2.36
2404	C	168.52	166.05	2.47
2405	C		0	0
2406	C		0	0
2421	C		0	0
2501	C	162.83	161.28	1.55
2503	C	166.04	164.57	1.47
2504	C	166.3	165.18	1.12
2522	C		0	0
2601	C	153.5	150.75	2.75
2602	C		0	0
2603	C		0	0
2701	C	153.05	150.35	2.7
2702	C	149.07	147.05	2.02
2703	C	148.38	147.77	0.61
2704	C	151.5	150.76	0.74
2721	C		0	0
2801	C	132.91	132.01	0.9
2802	C	134.02	133.13	0.89
3001	C	128.97	127.93	1.04
3101	C	123.51	121.32	2.19
3201	C	118.59	117.15	1.44
3202	C		0	0
3204	C	117.04	114.91	2.13
3301	C	159.14	157.47	1.67
3302	C	161.47	159.83	1.64
3303	C	165.65	163.49	2.16
3304	C	171.53	170.71	0.82
3321	C		0	0
3401	C	167.77	165.49	2.28
3402	C	170.61	169.07	1.54
3403	C	173.65	173.05	0.6
3404	C	172.39	171.53	0.86
3421	C		0	0
3503	C	165.33	164.56	0.77
3705	C	152.06	151.24	0.82
3706	C	146.7	144.26	2.44
3723	C		0	0
3802	C	132.43	131.04	1.39
3803	C	133.59	132.53	1.06
3823	C		0	0
3903	C	128.67	127.46	1.21
3904	C	132.09	130.04	2.05
3905	C	132.16	130.95	1.21
4001	C	128.67	124.62	4.05
4102	C	125.42	122.39	3.03
4103	C	123.62	122.06	1.56
4301	C	156.4	155.41	0.99
4800	C		0	0
4806	C	136.84	134.09	2.75
4807	C	137.19	136.67	0.52
4808	C		0	0
4821	C		0	0
4822	C		0	0
4901	C	133.82	132.84	0.98
4921	C		0	0
5003	C	130.48	125.3	5.18
5301	C	148.93	147.42	1.51
5302	C	155.1	152.92	2.18
5501	C	140.65	139.22	1.43
5601	C	140.2	138.4	1.79
5603	C	140.7	139.15	1.54
5604	C	0	138.17	0
5701	C	137.8	136.15	1.65
5801	C	135.66	134.03	1.63
5902	C	133.13	131.62	1.51
5921	C		0	0
5922	C	129.91	125.92	3.99
6401	C		0	0
6402	C	144.61	142.77	1.84
6903	C	129.44	126.72	2.72
6905	C	130.32	126.26	4.06
6906	C	129.39	126.47	2.92
	F		0	0
1302	F	180	179.49	0.51
1303	F	182.09	181.6	0.49
1403	F	174.52	172.75	1.77
1408	F		0	0
2007	F	123.55	121.16	2.39
2008	F	123.61	120.87	2.74
2103	F	119.61	118.01	1.59
2506	F		0	0
3002	F	123.64	121.26	2.38
3100	F		0	0
3102	F	123.05	121.79	1.26
3103	F	123.29	121.53	1.76
3104	F	123.32	121.6	1.72
3200	F		0	0
3203	F	117.39	115.85	1.54
3205	F		0	0
3206	F		0	0
3207	F		0	0
3208	F		0	0
3209	F		0	0
3210	F		0	0
3211	F		0	0
3212	F		0	0
3213	F		0	0
3214	F		0	0
3215	F		0	0
3216	F		0	0
3604	F	160.05	159.4	0.65
3605	F	161.35	160.74	0.61
3606	F	162.02	161.42	0.6
3607	F	163.79	162.79	1
3707	F	158.55	158.04	0.51
4100	F		0	0
4101	F	125.01	123.3	1.71
4104	F		0	0
4105	F		0	0
4106	F		0	0
4107	F		0	0
4108	F		0	0
4109	F		0	0
4110	F		0	0
4111	F		0	0
4200	F		0	0
4201	F		0	0
4202	F		0	0
4203	F		0	0
4602	F	159.18	158.29	0.89
5101	F	126.15	124.74	1.41
5102	F	126.95	125.72	1.23
5103	F	127.58	126.13	1.45
5104	F	130.08	128.48	1.6
5105	F		0	0
5401	F	146.91	145.34	1.57
5402	F	146.01	144.48	1.53
5403	F	145.35	143.5	1.85
5503	F	143.92	141.52	2.4
6001	F	133.31	131.75	1.56
6403	F	143.56	141.95	1.61
6501	F	140.7	139.25	1.45
6502	F	143.05	141	2.05
6503	F	143.9	142.02	1.88
6504	F	141.98	140.22	1.76
6505	F	142.61	140.7	1.91
1401	S	172.65	0	0
1402	S	175.11	0	0
2001	S	121.26	120.12	1.14
2002	S	126.17	123.87	2.3
2003	S	126.68	125.48	1.2
2009	S	123.53	120.66	2.87
2102	S	116.49	114.81	1.68
2104	S	121.7	120.25	1.45
2105	S	120.54	119.44	1.1
2202	S	113.07	111	2.07
2407	S	168.56	0	0
2408	S	167.79	0	0
2409	S	169.85	0	0
3003	S	123.47	121.21	2.26
3004	S	123.62	121	2.62
3105	S	123.06	121.74	1.32
3106	S	123.26	121.51	1.75
3107	S	123.32	121.47	1.85
3306	S	161.11	0	0
3307	S	165.55	0	0
3405	S	172.63	171.58	1.05
3406	S	167.77	0	0
3501	S	169.16	167.92	1.24
3502	S	170.74	169.41	1.33
3601	S	159.97	158.84	1.13
3602	S	163.06	162.04	1.02
3603	S	166.56	165.62	0.94
3701	S	160.34	159.26	1.08
3702	S	157.03	156.27	0.76
3703	S	152.52	151.52	1
3704	S	150.02	149.02	1
3801	S	131.99	130.32	1.67
3901	S	126.99	125.87	1.12
3902	S	128.45	127.47	0.98
3910	S	132.21	129.87	2.34
4601	S	159.25	158.04	1.21
4701	S	146.5	146.01	0.49
4702	S	148.92	148.31	0.61
4703	S	152.86	152.25	0.61
4704	S	154.51	153.43	1.08
4705	S	158.84	157.66	1.18
4801	S	136.58	135.43	1.15
4802	S	139.71	138.18	1.53
4803	S	140.8	139.53	1.27
4804	S	142.97	141.43	1.54
4805	S	138.06	136.48	1.58
4809	S	136.72	135.79	0.93
5303	S	149.67	0	0

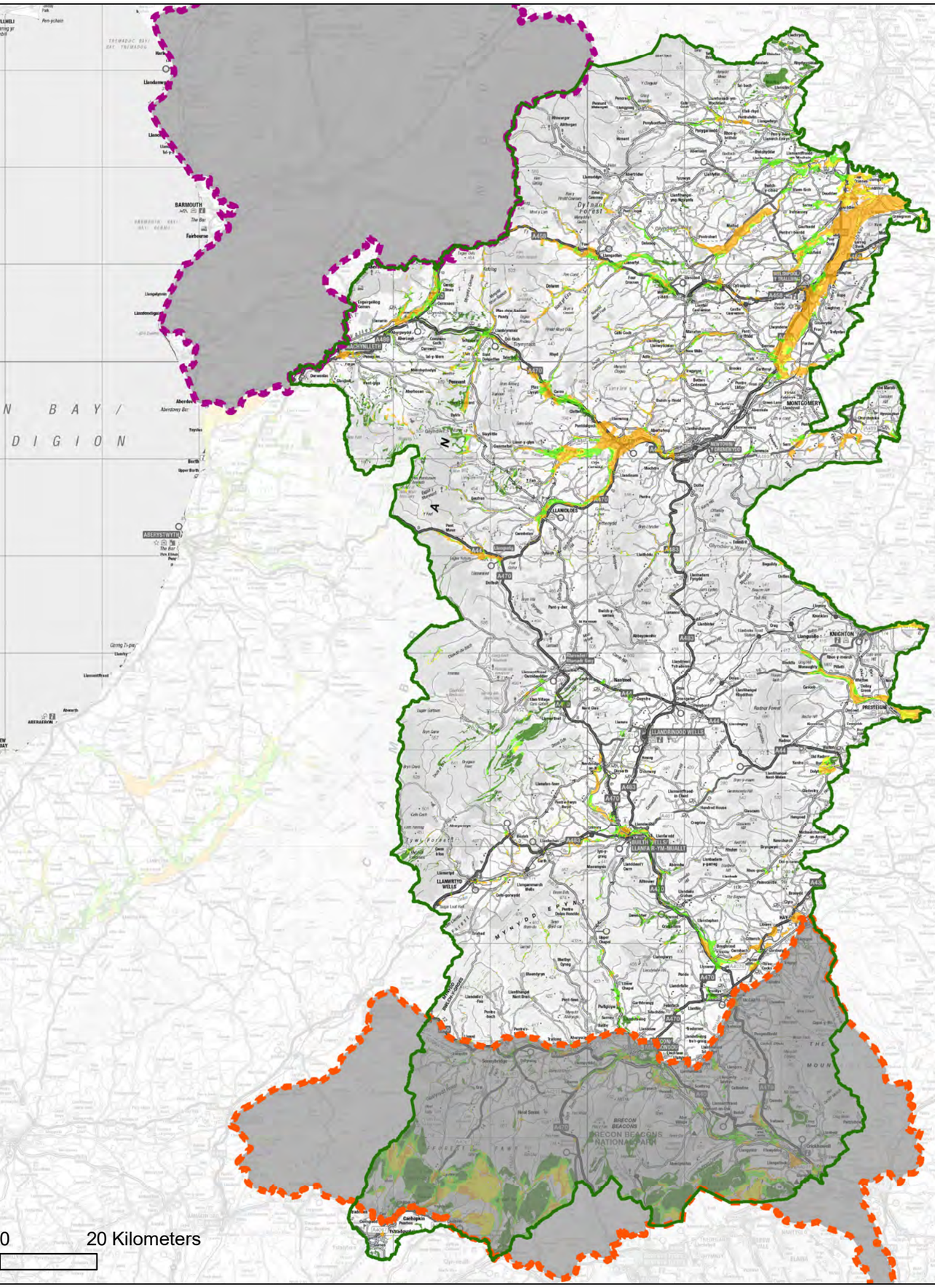
Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
5404	S	146.76	145.26	1.5
5405	S	145.82	144.43	1.39
5406	S	144.95	143.7	1.25
5502	S	144.34	141.97	2.37
5901	S	132.97	132.19	0.78
5903	S	133.54	131.87	1.67
6002	S	130	127.72	2.28
6404	S	143.73	142.09	1.64
6405	S	143.41	141.96	1.45
6506	S	143.96	142.51	1.45
6507	S	142.62	141.01	1.61
6508	S	140.99	139.44	1.55
6509	S	140.82	139.15	1.67
6510	S	140.42	139.04	1.38
6511	S	139.95	138.96	0.99
6514	S	143.12	142.17	0.95
6901	S	129.29	127.92	1.37
6902	S	129.42	128.49	0.93
6904	S	130.16	129.58	0.58

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Appendix E SFRA MAPPING



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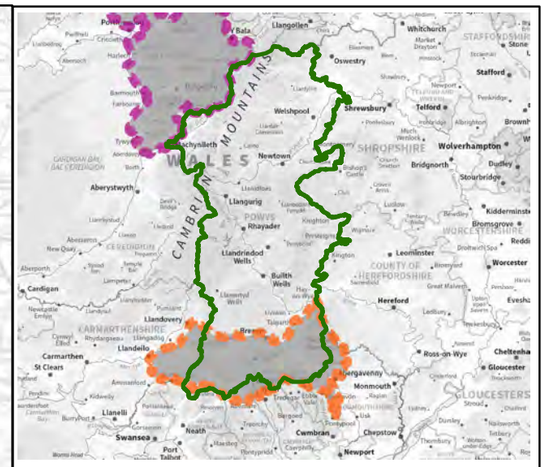

KEY

- Powys County Council
- Brecon Beacons National Park Authority- see separate mapping
- Snowdonia National Park Authority

Groundwater Depth

Indicative Groundwater depth

- Groundwater levels are at least 5m below the ground surface.
- Groundwater levels are between 0.5m and 5m below the ground surface.
- Groundwater levels are between 0.025m and 0.5m below the ground surface.
- Groundwater levels are either at or very near (within 0.025m of) the ground surface.

Notes

The map provides an indicative assessment of groundwater depth on a 5m grid.Please refer to Section 4 of the SFCA Report for further detail of the dataset used to define the potential for groundwater emergence.If no data is displayed on the map, or not all features are present, this indicates that the respective source or features are not present within this area.

Powys

JBA consulting

Powys County Council

Stage 1 Strategic Flood Consequences Assessment

Groundwater Depth

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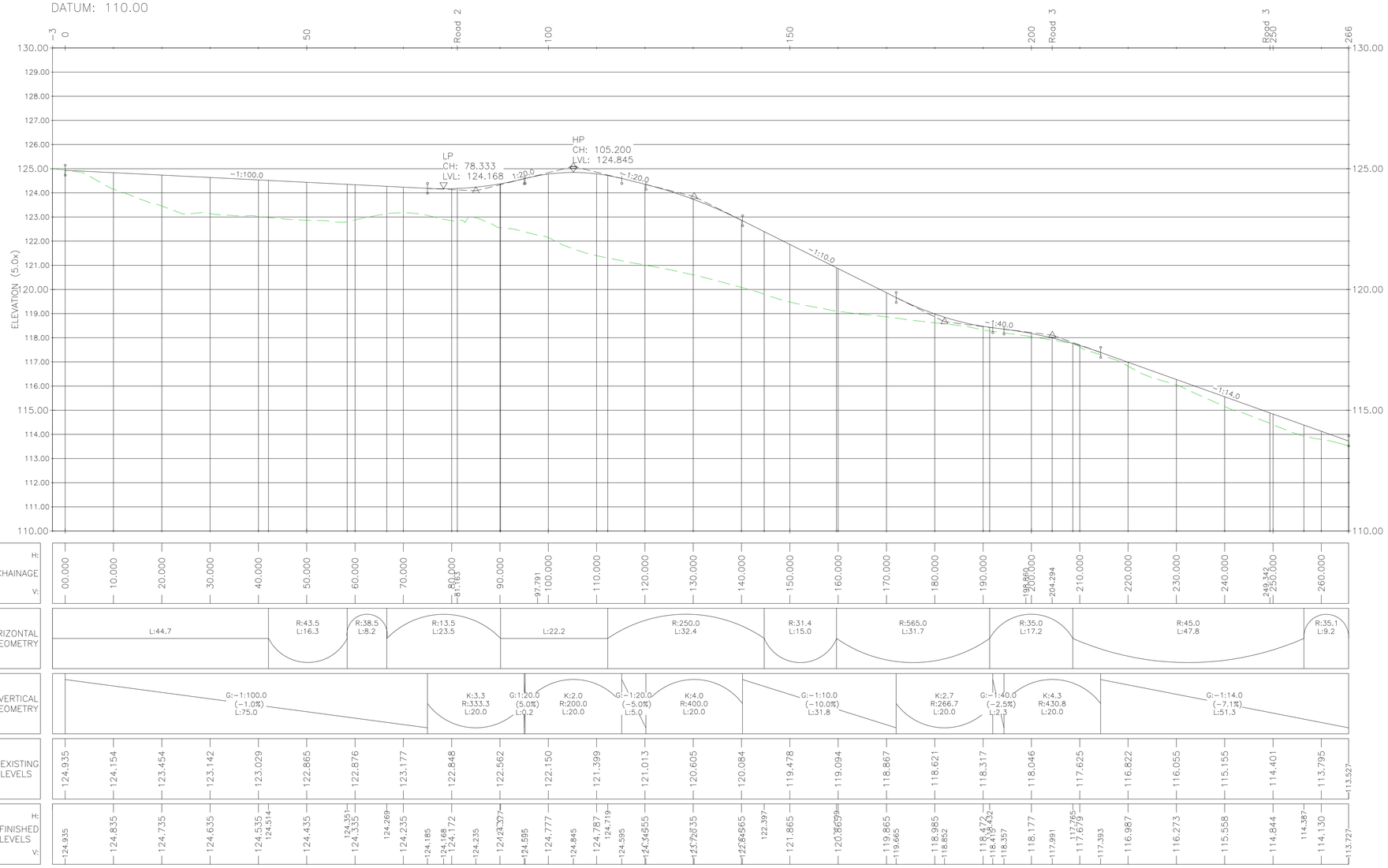
	Drawn	HB	21/09/2022
	Checked	CB	22/09/2022
	Approved	GB	23/09/2022

Appendix F Obsolete Highway Design

LONG SECTION: Road 1
SCALE: H:500, V:100
DATUM: 110.00



0 5 10 20 30
1:500 SCALE (m)

AWAITING TECHNICAL APPROVAL

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All works subject to change through technical review process with relevant approving authorities.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

PLEASE REFER TO THE HEALTH AND SAFETY FILE FOR A FULL LIST OF THE HAZARDS ASSOCIATED WITH THIS WORK - THE FOLLOWING ARE THE MOST SIGNIFICANT ITEMS TO BE AWARE OF.

CONSTRUCTION

1. OPERATIVES TO TAKE PRECAUTIONS WHEN WORKING ADJACENT TO OR WITHIN DEEP EXCAVATIONS. METHOD STATEMENT TO BE PRODUCED BY CONTRACTOR PRIOR TO WORKS COMMENCING.
2. ATTENTION IS DRAWN TO THE EXISTENCE OF BOTH EXISTING UNDERGROUND AND OVERHEAD UTILITIES.

ENVIRONMENTAL

1. EXISTING WATERCOURSES IN CLOSE PROXIMITY TO WORKS. A POLLUTION PREVENTION STRATEGY AND WORKING METHOD STATEMENTS TO BE PRODUCED BY THE CONTRACTOR FOR ALL WORKS.
2. CONSIDERATION GIVEN TO NOISE LEVELS GIVEN PROXIMITY TO EXISTING PROPERTIES.
3. CONSIDERATION GIVEN TO GROUND CONDITIONS. CONTRACTOR TO REVIEW GEOTECHNICAL REPORT PRIOR TO UNDERTAKEN EXCAVATION WORKS.

WORK CAN ONLY BE CARRIED OUT BY SUITABLY TRAINED AND BRIEFED PERSONNEL

now obsolete

Rev	Amendments	Date	By	Chk	Auth
P01	First issue	16.10.24	IO	JAK	JAK

SLR
www.slrconsulting.com

Drawing Status & Suitability Code: FOR STAGE APPROVAL S4

Client: POWIS ESTATES

Project: LAND AT VERLON FARM
POOL ROAD
MONTGOMERY

Drawing Title: HIGHWAYS LONG SECTIONS PLAN

Scale	SLR Project No.
1:500 @ A1	416.065277.00001

Designed	Drawn	Checked	Authorised
IO	IO	JAK	JAK
Date 07.10.2024	Date 07.10.2024	Date 07.10.2024	Date 07.10.2024

Drawing Number: **416.065277-SLR-XXX-XXX-DE-CH-0150** Rev.: **P01**

16/10/2024

I:\JOBS\2024\416.065277.00001 Land at Verlon Farm, Pool Road, Montgomery\2. DESIGN\CAD\416.065277-SLR-XXX-XXX-DE-CH-0150-Highways Long Sections Plan.dwg

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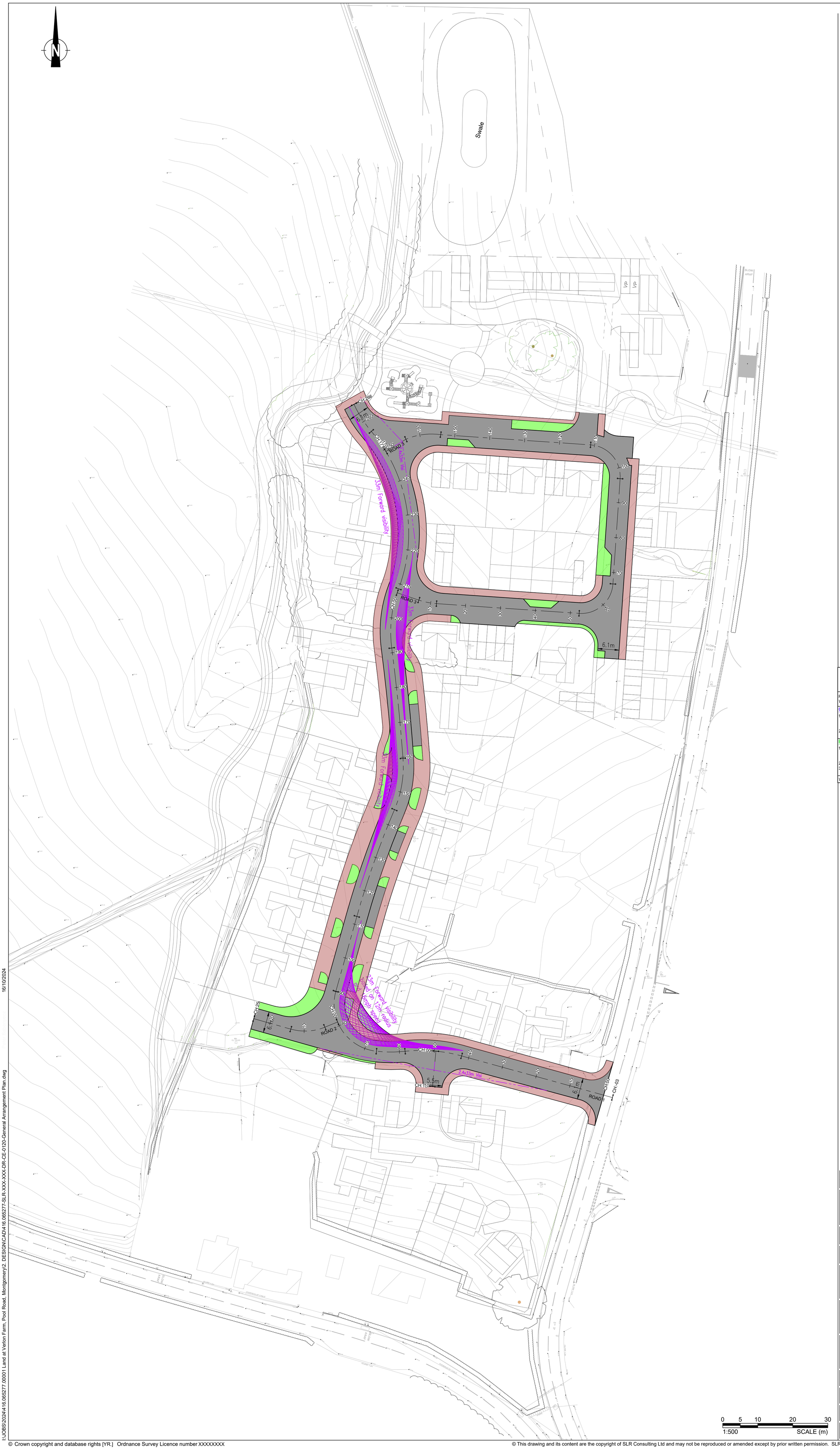

Key:

- Adoptable Major Access Road – Bituminous
- Adoptable Footway – Bituminous
- Adoptable Verge
- 33m Visibility Splay

now obsolete

AWAITING TECHNICAL APPROVAL

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2. ATTENTION IS DRAWN TO THE EXISTENCE OF BOTH EXISTING UNDERGROUND AND OVERHEAD UTILITIES.

ENVIRONMENTAL

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2. CONSIDERATION GIVEN TO NOISE LEVELS GIVEN PROXIMITY TO EXISTING PROPERTIES.
3. CONSIDERATION GIVEN TO GROUND CONDITIONS. CONTRACTOR TO REVIEW GEOTECHNICAL REPORT PRIOR TO UNDERTAKEN EXCAVATION WORKS.

WORK CAN ONLY BE CARRIED OUT BY SUITABLY TRAINED AND BRIEFED PERSONNEL.

Rev	Amendments	Date	By	Chk	Auth
P01	First issue	14.10.24	IO	JAK	JAK

SLR

www.slrconsulting.com

Drawing Status & Suitability Code: FOR STAGE APPROVAL S4

Client: POWIS ESTATES

Project: LAND AT VERLON FARM, POOL ROAD, MONTGOMERY

Drawing Title: GENERAL ARRANGEMENT PLAN

Scale	SLR Project No.
1:500 @ A1	416.065277.00001

Designed	Drawn	Checked	Authorised
IO	IO	JAK	JAK
Date 07.10.2024	Date 07.10.2024	Date 07.10.2024	Date 07.10.2024

Drawing Number: **416.065277-SLR-XXX-XXX-DR-CE-0120** Rev. **P01**

I:\JOBS\2024\416.065277.00001 Land at Verlon Farm, Pool Road, Montgomery\2. DESIGN\CAD\416.065277-SLR-XXX-XXX-DR-CE-0120-General Arrangement Plan.dwg 16/10/2024

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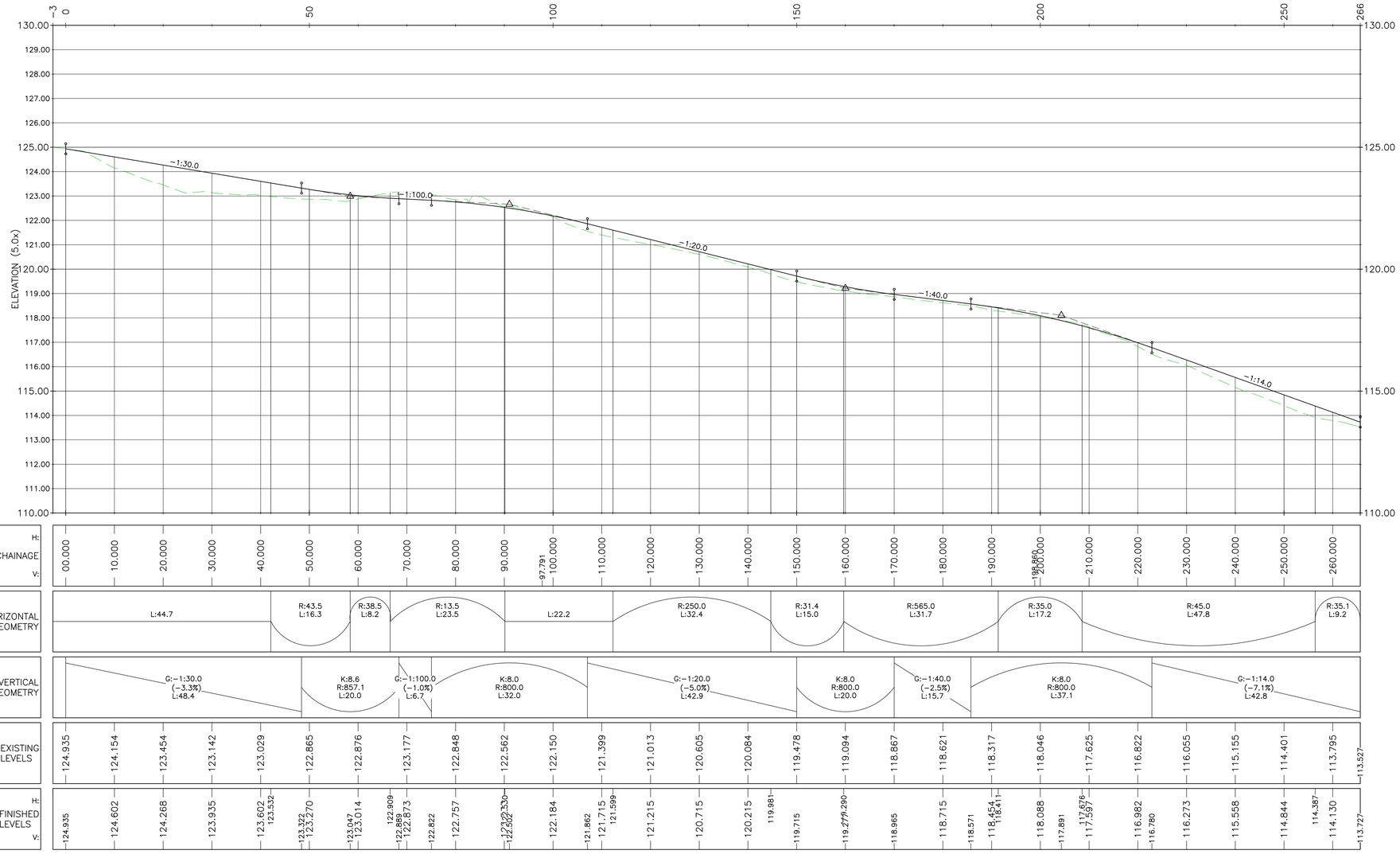
Appendix G Proposed Highway Design

LONG SECTION: Road 1
SCALE: H:500, V:100
DATUM: 110.00



0 5 10 20 30
1:500 SCALE (m)

AWAITING TECHNICAL APPROVAL

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2. CONSIDERATION GIVEN TO NOISE LEVELS GIVEN PROXIMITY TO EXISTING PROPERTIES.
3. CONSIDERATION GIVEN TO GROUND CONDITIONS. CONTRACTOR TO REVIEW GEOTECHNICAL REPORT PRIOR TO UNDERTAKEN EXCAVATION WORKS.

WORK CAN ONLY BE CARRIED OUT BY SUITABLY TRAINED AND BRIEFED PERSONNEL

Rev	Amendments	Date	By	Chk	Auth
P02	Levels updated	18.10.24	IO	JAK	JAK
P01	First issue	16.10.24	IO	JAK	JAK

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Drawing Status & Suitability Code: FOR STAGE APPROVAL — S4

Client: POWIS ESTATES

Project: LAND AT VERLON FARM, POOL ROAD, MONTGOMERY

Drawing Title: HIGHWAYS LONG SECTIONS PLAN

Scale	SLR Project No.
1:500 @ A1	416.065277.00001

Designed	Drawn	Checked	Authorised
IO	IO	JAK	JAK
Date: 07.10.2024	Date: 07.10.2024	Date: 07.10.2024	Date: 07.10.2024

Drawing Number: **416.065277-SLR-XXX-XXX-DE-CH-0150** Rev.: **P02**

I:\JOBS\20241416.065277.00001 Land at Verlon Farm, Pool Road, Montgomery\2. DESIGN\CAD\416.065277-SLR-XXX-XXX-DE-CH-0150-Highway Long Sections Plan.dwg 18/10/2024

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PLOT FINISHED FLOOR LEVELS ARE SUBJECT TO +/-600mm LEVEL CHANGE AT DETAILED DESIGN.

DWELLING ACCESS POINTS HAVE BEEN ADDED BUT ARE SUBJECT TO CONFIRMATION BY THE ARCHITECT.

Kerbs to be designed to allow overland water to flow to the proposed ditch

Key:

- Site boundary
- 79.100 — Finished floor level to house and garage
- +79.10 — Proposed finished level
- × 79.103 — Proposed back of footpath level
- 4 steps — Steps

AWAITING TECHNICAL APPROVAL

This drawing has NOT been technically approved by Local Authority and/or Water Authority.
All works subject to change through technical review process with relevant approving authorities.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

PLEASE REFER TO THE HEALTH AND SAFETY FILE FOR A FULL LIST OF THE HAZARDS ASSOCIATED WITH THIS WORK - THE FOLLOWING ARE THE MOST SIGNIFICANT ITEMS TO BE AWARE OF.

CONSTRUCTION

1. OPERATIVES TO TAKE PRECAUTIONS WHEN WORKING ADJACENT TO OR WITHIN DEEP EXCAVATIONS. METHOD STATEMENT TO BE PRODUCED BY CONTRACTOR PRIOR TO WORKS COMMENCING.
2. ATTENTION IS DRAWN TO THE EXISTENCE OF BOTH EXISTING UNDERGROUND AND OVERHEAD UTILITIES.

ENVIRONMENTAL

1. EXISTING WATERCOURSES IN CLOSE PROXIMITY TO WORKS, A POLLUTION PREVENTION STRATEGY AND WORKING METHOD STATEMENTS TO BE PRODUCED BY THE CONTRACTOR FOR ALL WORKS.
2. CONSIDERATION GIVEN TO NOISE LEVELS GIVEN PROXIMITY TO EXISTING PROPERTIES.
3. CONSIDERATION GIVEN TO GROUND CONDITIONS. CONTRACTOR TO REVIEW GEOTECHNICAL REPORT PRIOR TO UNDERTAKEN EXCAVATION WORKS.

WORK CAN ONLY BE CARRIED OUT BY SUITABLY TRAINED AND BRIEFED PERSONNEL.

0 5 10 20 30
1:500 SCALE (m)

Rev	Amendments	Date	By	Chk	Auth
P01	First issue	18.10.24	IO	JAK	JAK

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Drawing Status & Suitability Code: FOR STAGE APPROVAL S4

Client: POWIS ESTATES

Project: LAND AT VERLON FARM, POOL ROAD, MONTGOMERY

Drawing Title: PROPOSED LEVELS PLAN

Scale	SLR Project No.
1:500 @ A1	416.065277.00001

Designed	Drawn	Checked	Authorised
IO	IO	JAK	JAK
Date: 07.10.2024	Date: 07.10.2024	Date: 07.10.2024	Date: 07.10.2024

Drawing Number: **416.065277-SLR-XXX-XXX-DR-CE-0110** Rev. **P01**

I:\JOBS\2024\416.065277.00001 Land at Verlon Farm, Pool Road, Montgomery\2. DESIGN\CAD\416.065277-SLR-XXX-XXX-DR-CE-0110-Proposed Levels Plan.dwg 18/10/2024

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Appendix H Surface Water Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Hamza El-Adnany
Site name:	Verlon Farm
Site location:	Montgomery

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	52.56658° N
Longitude:	3.14921° W
Reference:	2846599340
Date:	Jul 31 2024 12:44

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha): 1

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Specify BFI manually
HOST class:	N/A
BFI / BFIHOST:	0.435
Q_{MED} (l/s):	
Q_{BAR} / Q_{MED} factor:	1.12

Hydrological characteristics

	Default	Edited
SAAR (mm):	765	765
Hydrological region:	4	4
Growth curve factor 1 year:	0.83	0.83
Growth curve factor 30 years:	2	2
Growth curve factor 100 years:	2.57	2.57
Growth curve factor 200 years:	3.04	3.04

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited

Q_{BAR} (l/s):		4.99
1 in 1 year (l/s):		4.14
1 in 30 years (l/s):		9.99
1 in 100 year (l/s):		12.83
1 in 200 years (l/s):		15.18

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	x
CV	0.750	Connection Type	Level Soffits		
Time of Entry (mins)	5.00	Minimum Backdrop Height (m)	0.200		

Nodes

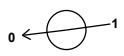
	Name	Area (ha)	T of E (mins)	Cover Level (m)	Depth (m)
✓	Attenuation Basin 01	1.360	5.00	111.500	1.300
✓	SW01 (FC)			111.500	1.351
✓	Outfall			108.000	0.500

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	5.062	100.0	375	1 STANDARD	111.500	110.200	0.925	111.500	110.149	0.976
1.001	13.843	5.2	150	1 STANDARD	111.500	110.150	1.200	108.000	107.500	0.350

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	Attenuation Basin 01		Junction		SW01 (FC)	1350	Manhole	1 STANDARD
1.001	SW01 (FC)	1350	Manhole	1 STANDARD	Outfall	1200	Manhole	1 STANDARD

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
Attenuation Basin 01	322224.248	297339.005	111.500	1.300		Junction		0				
								0	1.000	110.200	375	1 STANDARD
SW01 (FC)	322219.233	297338.319	111.500	1.351	1350	Manhole	1 STANDARD	1	1.000	110.149	375	1 STANDARD
								 0 1				
								0	1.001	110.150	150	1 STANDARD
Outfall	322205.490	297336.656	108.000	0.500	1200	Manhole	1 STANDARD	1	1.001	107.500	150	1 STANDARD
								 1				

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0	100	40	0	0
30	0	0	0				

Node SW01 (FC) Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	1.001	Sump Available	✓
Replaces Downstream Link	✓	Product Number	CTL-SHE-0121-6700-1050-6700
Invert Level (m)	110.150	Min Outlet Diameter (m)	0.150
Design Depth (m)	1.050	Min Node Diameter (mm)	1200
Design Flow (l/s)	6.7		

Node Attenuation Basin 01 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03600	Safety Factor	2.0	Invert Level (m)	110.200
Side Inf Coefficient (m/hr)	0.03600	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	566.6	566.6	1.300	1195.2	859.6

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Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	92.062	26.050	30 year 360 minute summer	32.464	8.354
2 year 15 minute winter	64.605	26.050	30 year 360 minute winter	21.103	8.354
2 year 30 minute summer	60.993	17.259	30 year 480 minute summer	25.625	6.772
2 year 30 minute winter	42.802	17.259	30 year 480 minute winter	17.024	6.772
2 year 60 minute summer	41.735	11.029	30 year 600 minute summer	20.980	5.738
2 year 60 minute winter	27.728	11.029	30 year 600 minute winter	14.335	5.738
2 year 120 minute summer	28.848	7.624	30 year 720 minute summer	18.666	5.003
2 year 120 minute winter	19.166	7.624	30 year 720 minute winter	12.545	5.003
2 year 180 minute summer	23.329	6.003	30 year 960 minute summer	15.233	4.011
2 year 180 minute winter	15.164	6.003	30 year 960 minute winter	10.091	4.011
2 year 240 minute summer	19.027	5.028	30 year 1440 minute summer	10.886	2.917
2 year 240 minute winter	12.641	5.028	30 year 1440 minute winter	7.316	2.917
2 year 360 minute summer	15.080	3.881	100 year +40% CC 15 minute summer	429.598	121.561
2 year 360 minute winter	9.802	3.881	100 year +40% CC 15 minute winter	301.472	121.561
2 year 480 minute summer	12.137	3.208	100 year +40% CC 30 minute summer	294.127	83.228
2 year 480 minute winter	8.064	3.208	100 year +40% CC 30 minute winter	206.405	83.228
2 year 600 minute summer	10.075	2.756	100 year +40% CC 60 minute summer	205.898	54.413
2 year 600 minute winter	6.884	2.756	100 year +40% CC 60 minute winter	136.794	54.413
2 year 720 minute summer	9.059	2.428	100 year +40% CC 120 minute summer	123.959	32.759
2 year 720 minute winter	6.088	2.428	100 year +40% CC 120 minute winter	82.355	32.759
2 year 960 minute summer	7.508	1.977	100 year +40% CC 180 minute summer	94.869	24.413
2 year 960 minute winter	4.973	1.977	100 year +40% CC 180 minute winter	61.668	24.413
2 year 1440 minute summer	5.508	1.476	100 year +40% CC 240 minute summer	74.977	19.814
2 year 1440 minute winter	3.702	1.476	100 year +40% CC 240 minute winter	49.813	19.814
30 year 15 minute summer	241.791	68.418	100 year +40% CC 360 minute summer	57.222	14.725
30 year 15 minute winter	169.678	68.418	100 year +40% CC 360 minute winter	37.196	14.725
30 year 30 minute summer	163.142	46.164	100 year +40% CC 480 minute summer	44.979	11.887
30 year 30 minute winter	114.486	46.164	100 year +40% CC 480 minute winter	29.883	11.887
30 year 60 minute summer	113.342	29.953	100 year +40% CC 600 minute summer	36.696	10.037
30 year 60 minute winter	75.302	29.953	100 year +40% CC 600 minute winter	25.073	10.037
30 year 120 minute summer	69.248	18.300	100 year +40% CC 720 minute summer	32.549	8.723
30 year 120 minute winter	46.006	18.300	100 year +40% CC 720 minute winter	21.875	8.723
30 year 180 minute summer	53.326	13.723	100 year +40% CC 960 minute summer	26.422	6.958
30 year 180 minute winter	34.663	13.723	100 year +40% CC 960 minute winter	17.503	6.958
30 year 240 minute summer	42.306	11.180	100 year +40% CC 1440 minute summer	18.714	5.015
30 year 240 minute winter	28.107	11.180	100 year +40% CC 1440 minute winter	12.577	5.015

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Results for 2 year Critical Storm Duration. Lowest mass balance: 99.94%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	Attenuation Basin 01	184	110.416	0.216	41.1	138.4501	0.0000	OK
240 minute winter	SW01 (FC)	184	110.416	0.267	16.8	0.3826	0.0000	SURCHARGED
15 minute summer	Outfall	1	107.500	0.000	6.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	Attenuation Basin 01	1.000	SW01 (FC)	16.8	0.510	0.084	0.3794	
240 minute winter	Attenuation Basin 01	Infiltration		3.0				
240 minute winter	SW01 (FC)	Hydro-Brake®	Outfall	6.7				144.6

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.94%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	Attenuation Basin 01	344	110.754	0.554	67.0	400.0562	0.0000	SURCHARGED
360 minute winter	SW01 (FC)	344	110.754	0.605	10.8	0.8662	0.0000	SURCHARGED
15 minute summer	Outfall	1	107.500	0.000	6.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	Attenuation Basin 01	1.000	SW01 (FC)	10.8	0.513	0.054	0.5583	
360 minute winter	Attenuation Basin 01	Infiltration		3.4				
360 minute winter	SW01 (FC)	Hydro-Brake®	Outfall	6.7				204.0

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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.94%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	Attenuation Basin 01	464	111.200	1.000	94.8	829.7153	0.0000	FLOOD RISK
480 minute winter	SW01 (FC)	464	111.200	1.051	14.0	1.5044	0.0000	FLOOD RISK
15 minute summer	Outfall	1	107.500	0.000	6.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute winter	Attenuation Basin 01	1.000	SW01 (FC)	14.0	0.510	0.070	0.5583	
480 minute winter	Attenuation Basin 01	Infiltration		3.9				
480 minute winter	SW01 (FC)	Hydro-Brake®	Outfall	6.7				258.0

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Appendix I Surface Water Drainage Layout

Notes:

1. DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT DOCUMENTS AND SLR DRAINAGE STRATEGY.
2. DRAINAGE STRATEGY IS SUBJECT TO DETAILED DESIGN INCLUDING LEVELS.
3. ALL LEVELS ARE SHOWN IN METRES ABOVE ORDNANCE DATUM.
4. DRAINAGE STRATEGY DESIGN ATTENUATES SURFACE WATER RUNOFF FOR THE 1 IN 100 YEAR EVENT PLUS 40% CLIMATE CHANGE.
5. DISPLAYED ACRONYMS:

- CL - COVER LEVEL
- IL - INVERT LEVEL
- D - DEPTH

Legend:

- SITE BOUNDARY
- EXISTING DITCH
- EXISTING DITCH TO BE ABANDONED / DIVERTED
- DIVERTED DITCH
- EXISTING PUBLIC SURFACE WATER SEWER
- EXISTING PUBLIC COMBINED WATER SEWER
- EXISTING PUBLIC SURFACE WATER SEWER TO BE ABANDONED / DIVERTED
- EXISTING PUBLIC COMBINED WATER SEWER TO BE ABANDONED / DIVERTED
- DIVERTED PUBLIC SURFACE WATER SEWER
- DIVERTED PUBLIC COMBINED WATER SEWER
- PROPOSED SURFACE WATER DRAIN
- PROPOSED HEADWALL
- PROPOSED RAIN GARDEN
- PROPOSED PERMEABLE PAVING WITH UNDERLYING STORAGE SUB-BASE
- PROPOSED ATTENUATION BASIN
- TREE ROOT PROTECTION ZONE
- PROPOSED FLOOD EXCEEDANCE ROUTE
- PROPOSED IMPERMEABLE PAVED SURFACE AREA (0.921HA)
- PROPOSED IMPERMEABLE ROOF SURFACE AREA (0.291HA)

0 10 20 30 40 50 60 70 80 90 100m

Scale 1:1,000

Rev	Amendments	Date	By	Chk	Auth
P02	ARCHITECT LAYOUT UPDATED. DRAINAGE AMENDED TO SUIT.	22.11.23	HE	NB	NB

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Drawing Status & Suitability Code: **FOR INFORMATION**

Client: POWYS ESTATES

Project: VERLON FARM
MONTGOMERY

Drawing Title: PRELIMINARY SURFACE WATER DRAINAGE LAYOUT

Scale	SLR Project No.
1:1,000 @ A1	416.065277.00001

Designed	Drawn	Checked	Authorised
HE	HE	NB	NB
Date: OCT 2024	Date: OCT 2024	Date: OCT 2024	Date: OCT 2024

Drawing Number: **416.065277.00001_PDL_01** Rev.: **P02**

22/11/2024

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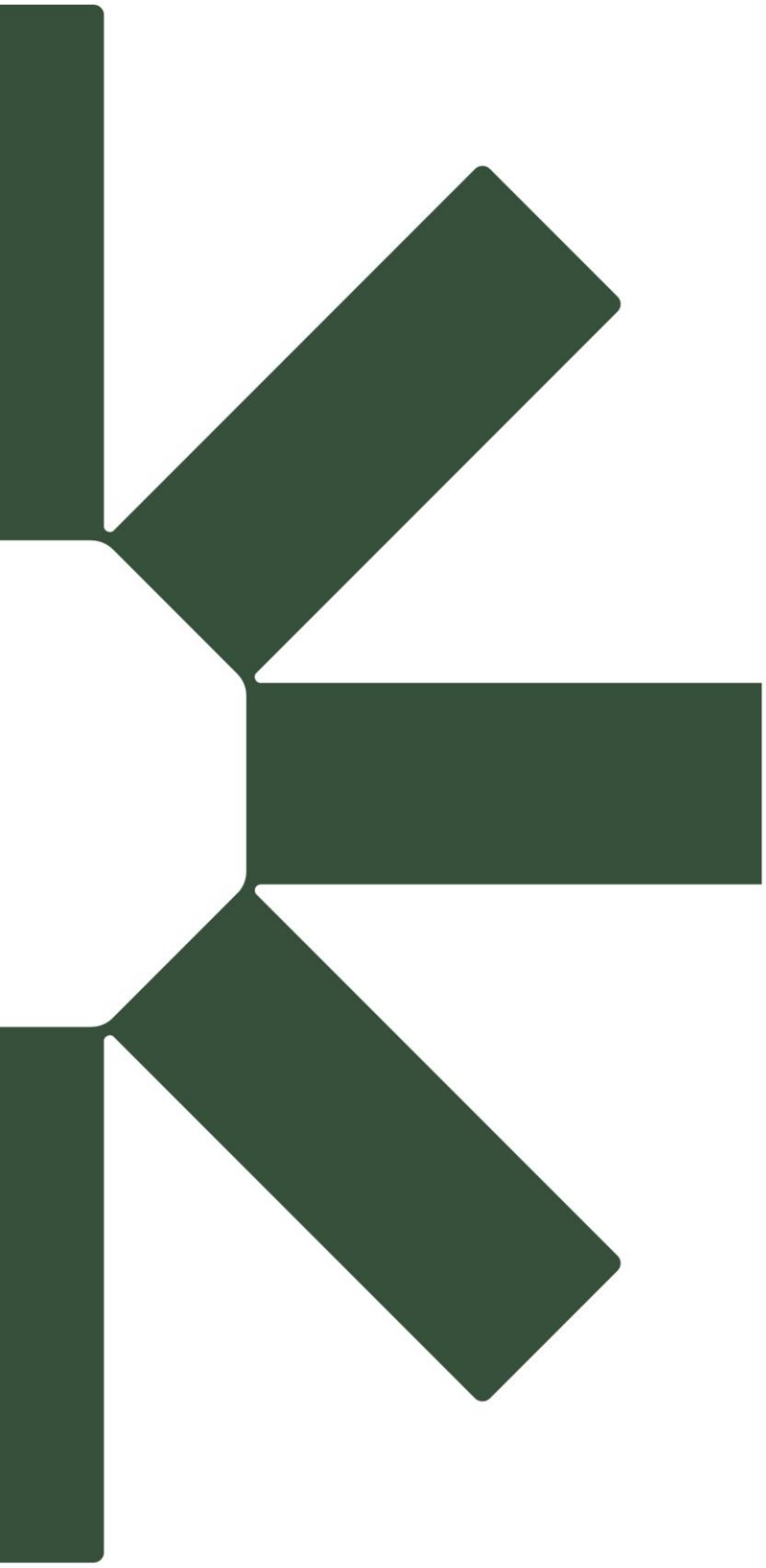

Making Sustainability Happen