



Outline Drainage Strategy

Hanmer Arms, Hanmer

Carlton Holdings Ltd

MAN.244.002.HY.R.001.A



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Hanmer Arms, Hanmer

Project:	Outline Drainage Strategy
For:	Carlton Holdings Ltd
Status:	Issued
Date:	September 2019
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Executive Summary

This report presents an Outline Drainage Strategy exercise for a proposed holiday lodge development, located on land north of the Hanmer Arms, Hanmer.

The report has included an assessment of the surface water drainage requirements of the Site, and details the flood risk and how this could be managed and mitigated to allow the Site to be developed in support of the outline planning application. The FRA has demonstrated the following:

- The 1.5ha Site comprises of an agricultural (arable) field, bordered by hedgerows and mature trees.
- The soils and geology indicate a low infiltration potential. It is assumed that drainage is primarily via overland flow, following the topography of the Site to the topographic low points (unnamed land drain). Infiltration-based SuDS should be utilised in the first instance however the infiltration potential suggests they would not be feasible on this Site (this would need confirming through soakaway testing).
- The unnamed land drain conveys flows northwest along the north-eastern Site boundary. A positive outfall to watercourse would be feasible.

The Drainage Strategy has considered the potential impact of the development on surface water runoff rates, given the increase in impermeable areas post-development. These rates have been calculated, and it has been demonstrated that surface water can be managed, such that flood risk to and from the Site following development will not increase. This will be achieved through restricted discharge rates and an appropriately sized detention basin with an outfall to the on-site land drain.

Foul water will discharge to the foul sewer within Hanmer Road to the south east of the Site at a discharge rate of 0.8l/s.

The report demonstrates that the proposed development would be operated with minimal risk from flooding and would not increase flood risk elsewhere. The development should therefore not be precluded on the grounds of flood risk, as well as surface water and foul drainage.

1.0 Introduction

1.1 Background

- 1.1.1 Enzygo Ltd was commissioned by Carlton Holdings Ltd to carry out an Outline Drainage Strategy for a proposed holiday lodge development located on land north of Hanmer Arms, Hanmer (the 'Site').

1.2 Purpose

- 1.2.1 The purpose of this report is to understand the baseline conditions and drainage issues, advise of additional works that may be required in support of the proposed development and identify potential constraints and opportunities when considering the wider development area.

1.3 Scope of Works

- 1.3.1 The scope of work includes:
- Site walkover to observe current land use, topography and drainage features.
 - Undertake a desktop study of OS mapping, soils and geology map, borehole records and flood/catchment mapping.
 - Review online drainage policy and guidance documents.
 - Consult with the LLFA/SAB.
 - Obtain Welsh Water asset plans [including manhole/invert levels and pipe sizes].
 - Undertake a pre-development enquiry with Welsh Water if an outfall to sewer is pursued. The pre-development enquiry is required to agree a point of outfall and allowable discharge rate.
 - Obtain catchment descriptors from the Flood Estimation Handbook [FEH] Web Service.
 - Undertake an assessment of the potential surface water and foul drainage from the proposed development that will aim to identify: an appropriate discharge rate; discharge point[s]; storage requirement; pipe sizes and Sustainable Drainage System [SuDS] options.
 - Develop an outline drainage strategy for the proposed development.

1.4 Report Structure

1.4.1 This report is structured as follows:

- Section 2 provides a summary of national, regional and local drainage policy/guidance.
- Section 3 describes the baseline conditions for the existing Site.
- Section 4 scopes the baseline surface water drainage arrangement, potential impacts of the proposed development on surface water drainage and potential mitigation for those effects; and
- Section 5 presents a summary, conclusions and recommendations.

2.0 Planning Context

2.1 Introduction

- 2.1.1 This section sets out the national, regional and local planning policy and guidance relevant to the management of surface water and flooding applicable to the proposed development.

2.2 National Policy & Guidance

- Welsh Government (2016) *Flood Consequence Assessments: Climate Change Allowances*. Making an allowance for climate change in a Flood Consequence Assessment will help to minimise vulnerability and provide resilience to flooding and coastal change in the future. The climate change allowances are produced by the Natural Resources Wales and are predictions of anticipated change for:
 - peak river flow by river basin district
 - peak rainfall intensity
 - sea level rise
 - offshore wind speed and extreme wave height

They are based on climate change projections and different scenarios of carbon dioxide (CO₂) emissions to the atmosphere. There are allowances for different periods of time over the next century.

- Welsh Government (2018) *Planning Policy Wales (PPW)*. The PPW was published in December 2018; it sets out the Government planning policies for Wales and outlines how these are expected to be applied. Paragraphs 6.6 of the PPW is relevant to flooding and drainage.

Welsh Assembly Government (2004) *Planning Policy Wales Technical Advice Note 15: Development and Flood Risk*. Technical guidance which supports policy set out in PPW and provides framework for flooding from rivers and the sea.

2.3 Regional/Local Policy and Guidance

- Wrexham County Borough Council (2013) *Local Flood Risk Management Strategy*.

2.4 Best Practice and Guidance

- *UK Sustainable Drainage Guidance*. The UK SUDS Tools website <http://www.uksuds.com/drainagecalculation-tools/greenfield-runoff-rate-estimation> provides estimation tools for the design and evaluation of surface water management systems. The website has been developed and is supported by HR Wallingford. The website provides estimates for greenfield runoff and storage analysis.
- *BS 8582:2013 Code of practice for surface water management for development sites*. The British Standard gives recommendation on the planning, design, construction and maintenance of surface water management systems for new development and redevelopment sites in minimizing and/or mitigating flooding and maximizing the social and environmental benefits.

- *Welsh Government Sustainable Drainage (SuDS) Statutory Guidance* (2019). For local authorities on the implementation of Schedule 3 to the Flood and Water Management Act 2010, the mandatory use of SuDS on new developments and approval and adoption by the SuDS approving body (the SAB).
- *CIRIA SUDS Manual (C753), 2015*. This guidance document provides comprehensive information on the all aspects of the life cycle of sustainable drainage from initial planning, design through to construction and management including landscaping, waste management and costs.
- *BRE Digest 365 (2016) Soakaway Design*. Provides guidance for designers to support planning and development applications.
- *WRc (2012) Sewers for Adoption (7th Edition)*: Contains guidance for the design and construction of sewers that are adoptable by Sewerage Undertakers in England and Wales in accordance with Section 104 of the Water Industry Act 1991. In areas covered by Water and Sewerage Companies where Section 42 of the Flood and Water Management Act has not been implemented, the existing Sewers for Adoption 6th edition is still applicable.

3.0 Site Location and Description

3.1 Location

3.1.1 The Site is located on land north of the Hanmer Arms, Hanmer, SY13 3DE and is centred on National Grid Reference (NGR) 345438, 339975.

3.1.2 The 1.5ha Site location is shown in Figure 3.1.

3.2 Land Use

3.2.1 The land use is comprised of an agricultural (grazing) field, bordered by hedgerows and mature trees (Figures 3.1 and 3.2).

3.2.2 The Site is bounded by the A539 to the northwest, Hanmer Village Road to the northeast, a road leading to Hanmer Arms to the southeast and agricultural land to the southwest.

3.2.3 Access is currently via gated access off the A539 to the northwest of the Site.

3.2.4 A Site walkover was undertaken during July 2019 to confirm the above observations and descriptions throughout this report.

Figure 3.1: Aerial Image of the Site

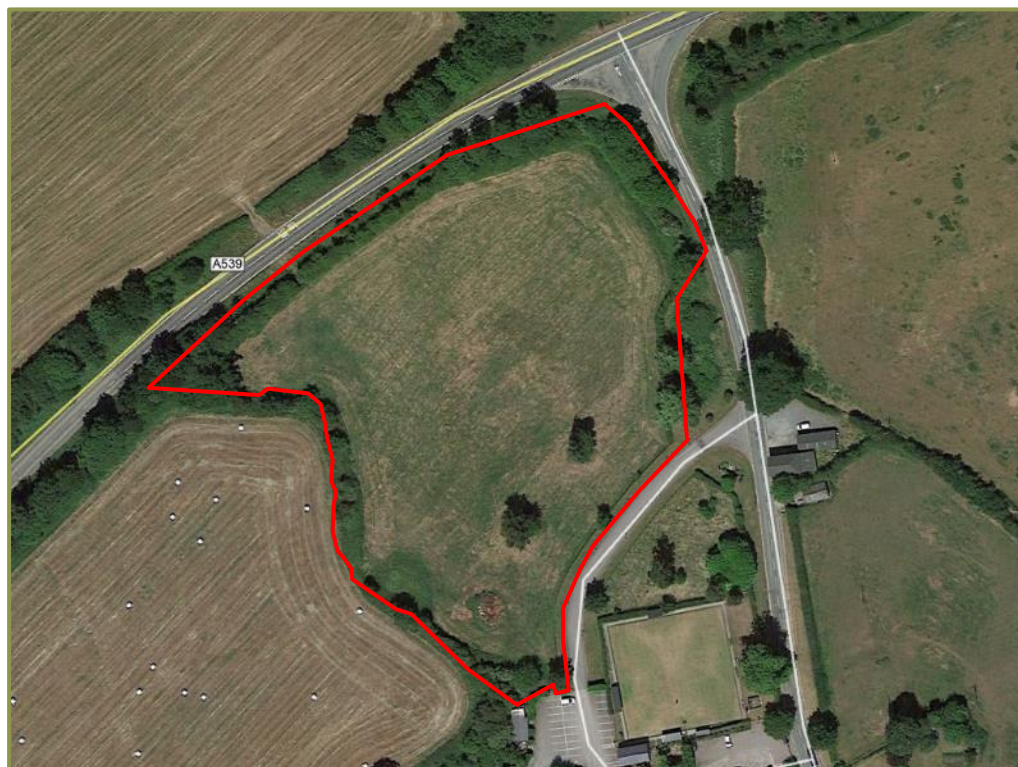


Image © 2019 Digital Globe.

Figure 3.2: General Photographs of the Site

Top: View looking north from southern Site entrance. **Bottom:** View looking south from central northern boundary

3.3 Topographic Information

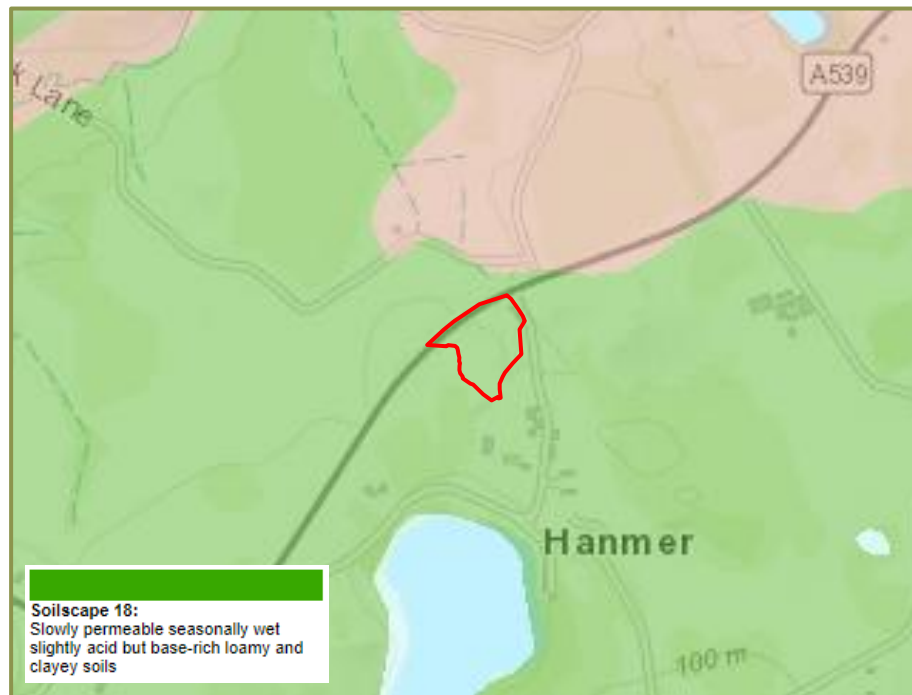
- 3.3.1 A detailed topographic survey was carried out during September 2018 and a copy is included as (Appendix 1). The Site has a topographical high point within the north west corner of the Site at 83.04m metres Above Ordnance Datum (m AOD) from here the Site slopes in an easterly direction to a depression within the north west of the Site at 78.95mAOD. A fall of 4.09m over 40m (1:10). The Site climbs to a second peak of 82.18m within the north centre of the Site.
- 3.3.2 The Site slopes west, east and south from the peak. Overall the Site slopes east from here to a low point of 75.45 mAOD (north east corner) The fall of 6.73m over 90m gives a gradient of 1:13.

3.4 Soils and Geology

Soils Mapping

- 3.4.1 The Soilscape online soils map viewer (Figure 3.3) shows the Site is underlain by slowly permeable, seasonally wet loamy and clayey soils. The soils are indicative of low infiltration potential.

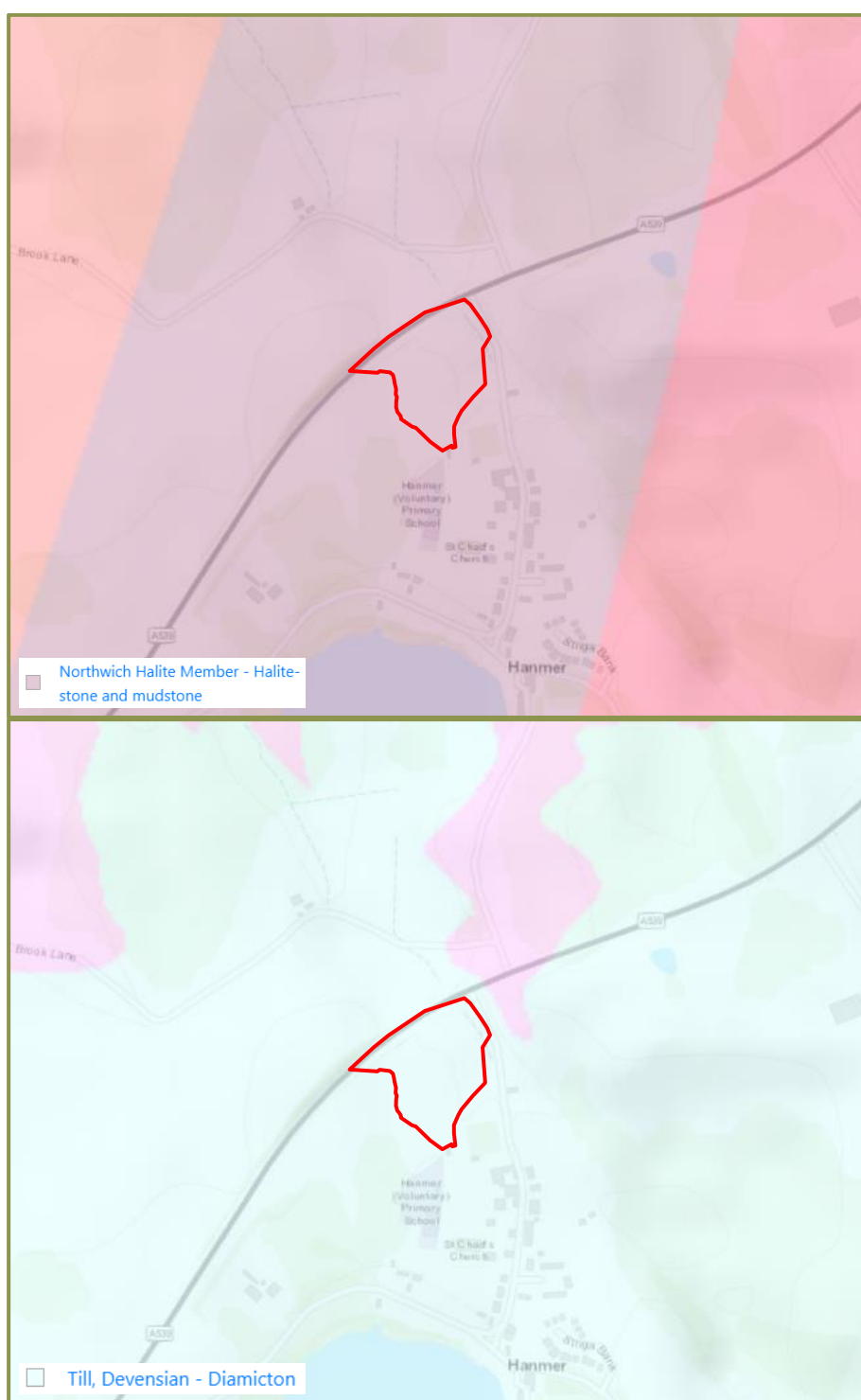
Figure 3.3: Soils Mapping



Soils Data © Cranfield University (NSRI) and for the Controller of HMSO [2019].

Geology Mapping

- 3.4.2 The Geology of Britain online map viewer (Figure 3.4) shows the Site is underlain by Till, Devensian - Diamicton superficial deposits.
- 3.4.3 The bedrock beneath the Site (Figure 3.4) is Northwich Halite Member - Halite-stone and mudstone.
- 3.4.4 It is recommended that trial pits and geology logging is undertaken as part of any onsite soakaway testing to confirm the onsite geology.

Figure 3.4: Geology Mapping

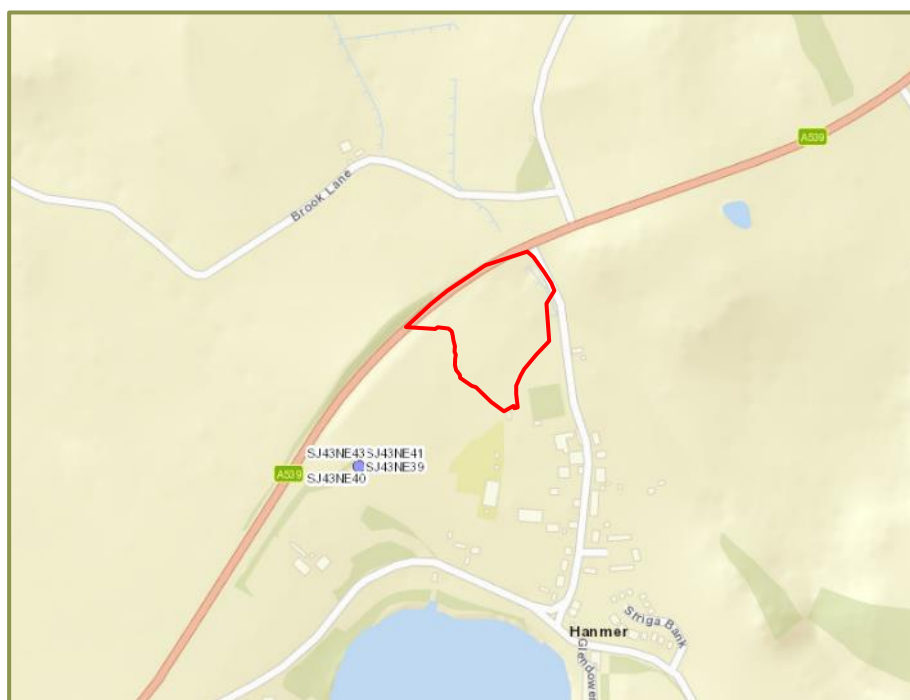
Top: Bedrock Geology Bottom: Superficial Deposits. Contains British Geological Survey materials © NERC [2019].

BGS Borehole Logs

- 3.4.5 The Geology of Britain online map viewer (Figure 3.5) shows there are no records of boreholes within the Site boundary.
- 3.4.6 The nearest five boreholes are located to the southwest of the Site, within the same mapped superficial deposits and bedrock as the Site. A summary of the borehole logs is included in

Table 3.1 and a copy of the logs are included in Appendix 2. The mudstone bedrock was not encountered any of the boreholes to depths of 3.66mbgl.

Figure 3.5: Borehole Mapping



Contains British Geological Survey materials © NERC [2019].

Table 3.1: BGS Borehole Data

Reference	Summary of Strata	Depth (m bgl)	Groundwater Depth (m bgl)
SJ43NE39	0.00 - 0.56m = topsoil. 0.56 - 3.66m = sand.	3.66	Not encountered
SJ43NE40	0.00 - 0.41m = topsoil. 0.41 - 3.66m = sand and gravel.	3.66	Not encountered
SJ43NE41	0.00 - 0.15m = topsoil. 0.15 - 3.66m = sand.	3.66	Not encountered
SJ43NE42	0.00 - 0.18m = topsoil. 0.18 - 3.66m = sand.	3.66	Not encountered
SJ43NE43	0.00 - 0.25m = topsoil. 0.25 - 3.66m = sand.	3.66	Not encountered

Contains British Geological Survey materials © NERC [2019].

3.5 Hydrogeology

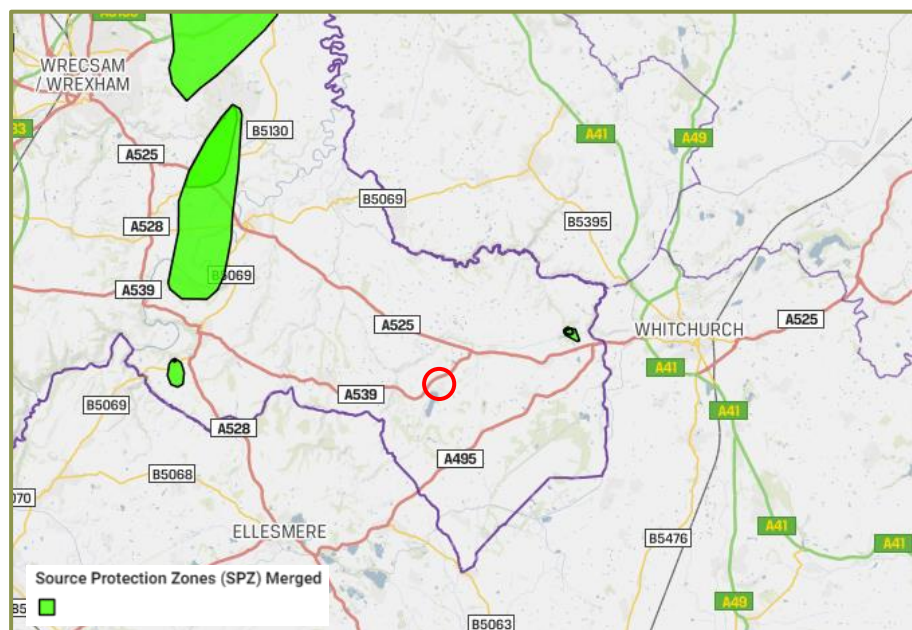
Borehole Logs

- 3.5.1 Groundwater ingress was not encountered in the nearest five borehole logs (Figure 3.5 and Table 3.1).
- 3.5.2 The infiltration potential of the soils and geology is likely to be low given the mudstone bedrock and till superficial deposits, however this would need to be confirmed through soakaway testing.

Defra Magic Map

- 3.5.3 Natural Resources Wales online mapping (Figure 3.6) shows the Site is not located in a groundwater Source Protection Zone (SPZ). These zones show the risk of contamination to public water supply (PWS) from any activities that might cause pollution in the area. The closer the activity, the greater the risk. The risk to any PWS is assessed as negligible.

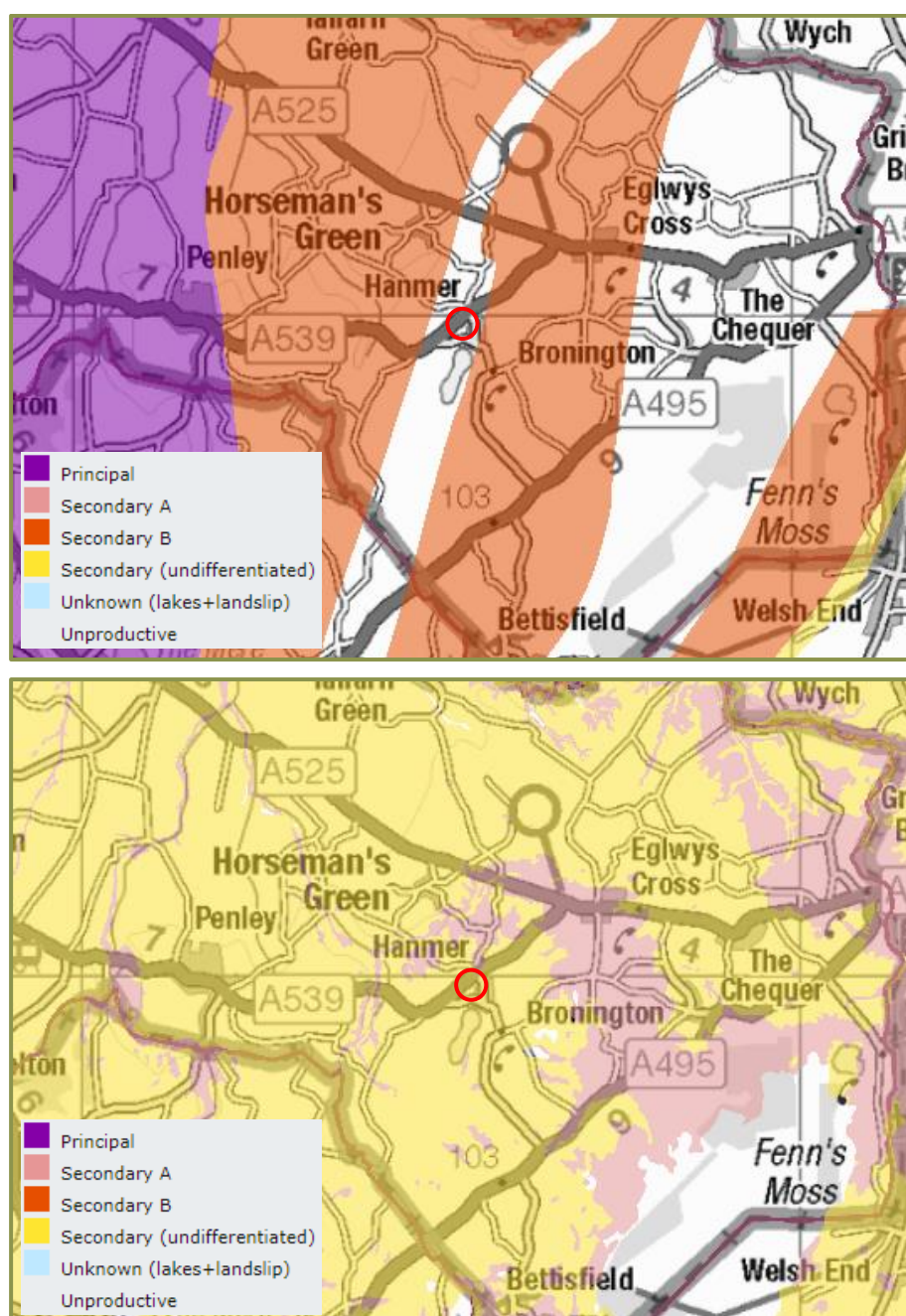
Figure 3.6: Source Protection Zone Map



Contains Natural Resources Wales information © Natural Resources Wales and database right.

- 3.5.4 Defra Magic Map online mapping (Figure 3.7) shows the Site is located above a Secondary Undifferentiated aquifer (superficial deposits).

Figure 3.7: Aquifer Designation Map



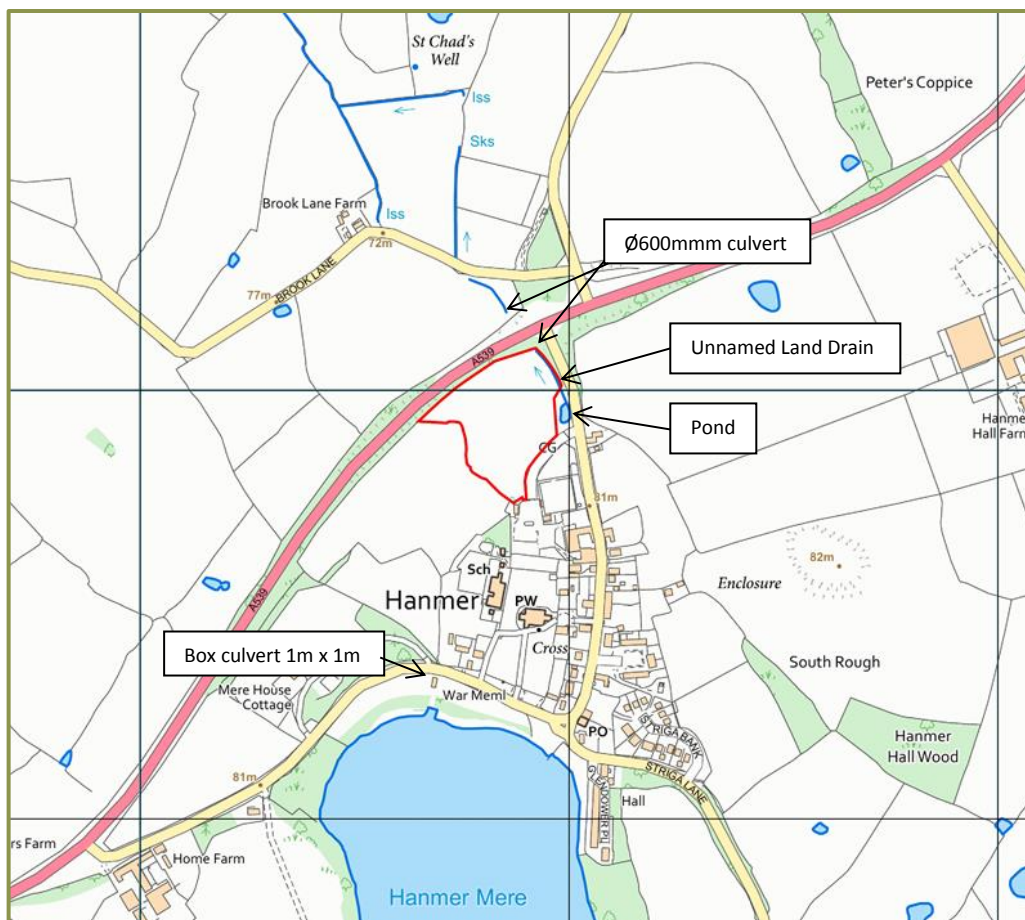
Top: Aquifer Designation (bedrock). Bottom: Aquifer Designation (superficial deposits). From Magic Map. Contains Natural Resources Wales information © Natural Resources Wales and database right [2019].

3.6 Catchment Hydrology

OS Mapping

- 3.6.1 OS mapping (Figure 3.8) shows an unnamed land drain conveying flows northwest along the north-eastern Site boundary. The land drain appears to convey flow from a small pond which is located just outside the south eastern boundary. The land drain appears to culvert under the A539 and continue to convey flow north.
- 3.6.2 OS mapping also shows Hanmer Mere, which is located 230m south of the Site. The mere may have a connection to the pond / land drain.

Figure 3.8: Map of Watercourses



Site Walkover Observations

- 3.6.3 A Site walkover was undertaken during July 2019. Below is a summary of the Site walkover observations, supported by photographs.
- 3.6.4 The land drain identified on OS mapping was observed along the eastern Site boundary (Figure 3.9). The drain was heavily vegetated carrying low flows (~150mm). The drain was approximately 1.5m deep, with a 0.5m bed width and 1:2 side slopes.
- 3.6.5 The land drain originated from a pond just outside the south east of the Site (Figure 3.11).

- 3.6.6 At the northern boundary the land drain entered a Ø600mm culvert (Figure 3.10) which conveyed flow beneath the A539. On the northern side of the A539 the channel outfalls through a Ø600mm culvert and continues to convey flow north in open channel.
- 3.6.7 Hanmer Mere is located 230m to the south of Site. The mere enters a 1x1m box culvert covered with a trash screen on its northern boundary. It is not known if this has connectivity to the pond / land drain within the Site.

Figure 3.9: Land drain along eastern boundary



Figure 3.10: Ø600mm culvert conveying flow beneath A539.



Figure 3.11: Pond outside south eastern boundary.



Figure 3.12: View of Hanmer Mere and Box Culvert to the north of the mere



Left: Hanmer Mere **Right:** 1m x 1m Box Culvert to north of mere

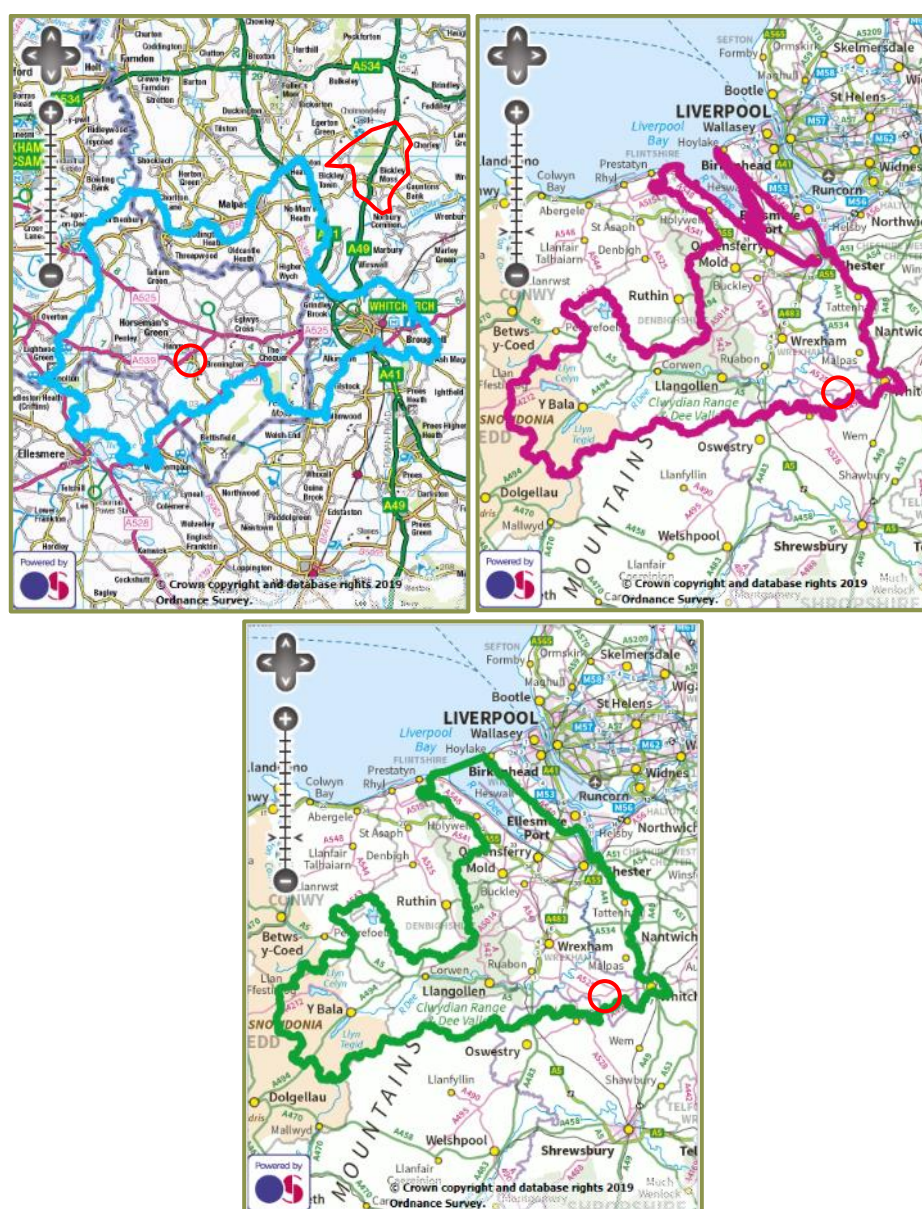
Main River Map

- 3.6.8 The Natural Resources Wales main river map (Figure 3.13) shows no Main Rivers within the Site or its immediate vicinity (within 1km).

Environment Agency Catchment Data Explorer Mapping

- 3.6.9 Natural Resources Wales mapping shows that the Site is in the Worthenbury Operational Catchment, Dee Management Catchment and Dee River Basin District (Figure 3.13).

Figure 3.13: Catchment Data Explorer



Top Left: Worthenbury Operational Catchment. Top Right: Dee Management Catchment. Bottom: Dee River Basin District. Contains Natural Resources Wales information © Natural Resources Wales and database right [2018].

Climate Change Allowances

3.6.10 The climate change allowances applicable to peak river flows in the Dee River Basin District are included in Table 3.2. These apply to peak flows within the onsite and nearby watercourses.

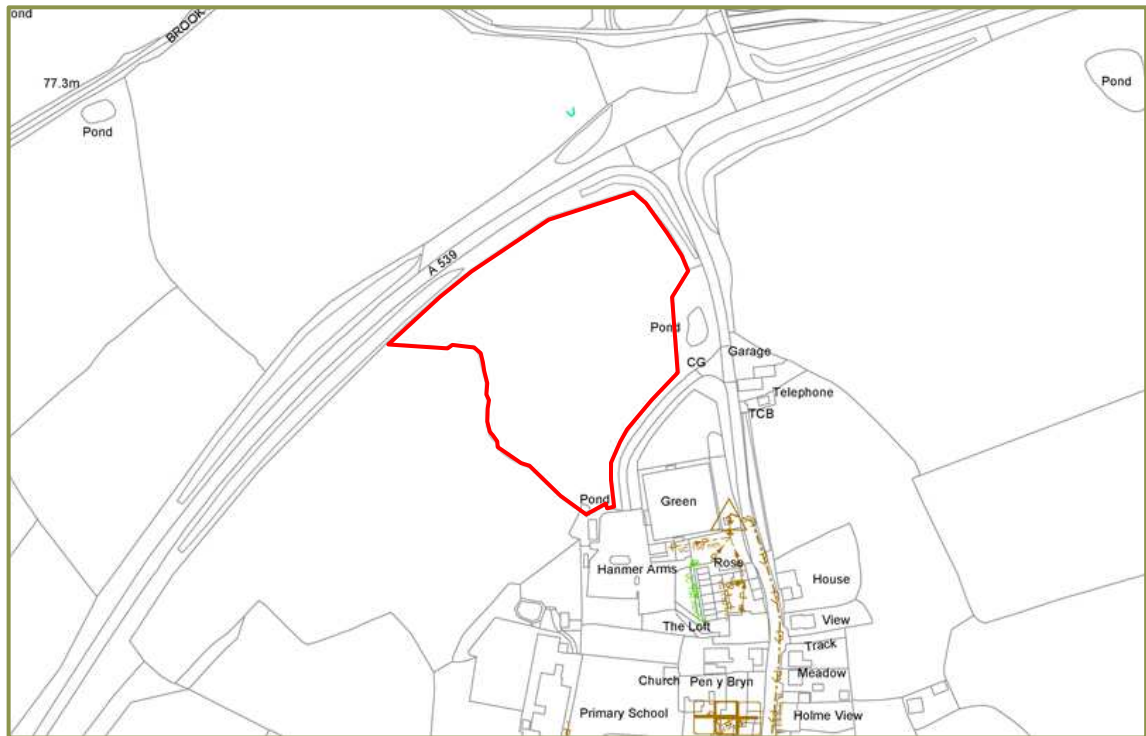
Table 3.2: Peak River Flow Allowances

Allowance Category	Total Potential Change Anticipated for the '2080s' (2070 to 2115)
Upper End	45%
Central	20%

3.7 Sewerage Assets

- 3.7.1 Welsh Water sewer asset plans (Figure 3.14 and Appendix 3) show that there is private foul sewer conveying flow south 100m south east of the Site. There are no surface water sewers within the immediate vicinity of the Site.

Figure 3.14: Sewer Asset Plans



3.8 Designated Sites

- 3.8.1 The DEFRA Magic Map (England and Wales) (Figure 3.15) shows the Midland Meres & Mosses (Site of Special Scientific Interest [SSSI] and Ramsar site) is located within the east of the Site associated with the pond / watercourse. Consequently, it is proposed that surface water quality is improved through the utilisation of SuDS features (see Section 6). The Hanmer Mere SSSI is also located 220m to the south of the Site, upstream of the Site.
- 3.8.2 The fact the SSSI / Ramsar site is shown to extend from Hanmer Mere to the pond / watercourse suggests that there is connectivity between the two.

Figure 3.15: Designated Sites



From Magic Map. Contains Natural Resources Wales information © Natural Resources Wales and database right [2019].

4.0 Site Drainage

4.1 Surface Water Drainage

- 4.1.1 The alteration of natural surface water flow patterns through developments can lead to problems elsewhere in a catchment, particularly flooding downstream; and replacing permeable vegetated areas with low permeability roofs, roads and other paved areas will increase the speed, volume and peak flow of surface water runoff. The reception will be built on foundations however the lodges will be built on a series of concrete pads and therefore the majority of the Site will remain permeable.
- 4.1.2 A surface water management strategy for the development is proposed to manage and reduce the flood risk posed by surface water runoff from the Site. The developer will be required to ensure that any scheme for surface water should build in sufficient capacity for the entire Site.
- 4.1.3 The surface water drainage arrangements for any development Site should be such that the volume and peak flow rates of surface water leaving a developed Site are no greater than the rates prior to the proposed development, unless specific off-Site arrangements are made and result in the same net effect.
- 4.1.4 An assessment of the surface water runoff rates was undertaken to determine the surface water options and attenuation requirements for the Site.

4.2 Existing Drainage System

- 4.2.1 The 1.5ha Site land use comprises an agricultural (grazing) land.
- 4.2.2 The Site is underlain by impermeable soils and bedrock. It is likely that drainage is predominantly via overland flow, following the topography of the Site to the topographic low points, with a small amount of infiltration to bedrock, and throughflow to watercourse.
- 4.2.3 There is currently no foul water discharging from the undeveloped Site.

4.3 Developable and Impermeable Areas

- 4.3.1 The proposal is for 19 holiday lodges with an associated reception building. A figure of 20% impermeable area was calculated for the 1.5ha Site (Drawing 003). The existing and proposed impermeable areas are shown in Table 4.1.
- 4.3.2 The proposed development will increase the impermeable surfaces and therefore increase the amount of runoff (see Drawing 004).

Table 4.1: Impermeable Area

Area	Existing Buildings and Hardstanding	Proposed Buildings and Hardstanding	Difference
Area (ha)	0	0.3	+0.3
Percentage of Total Site Area (%)	0	20	+20

4.4 Greenfield Runoff Rates

- 4.4.1 An assessment of greenfield runoff rates was undertaken to determine the attenuation requirements for the proposed development.
- 4.4.2 The runoff rates were calculated using the FEH method using HR Wallingford Software using the current 'industry best practice' guidelines as outlined in the Interim Code of Practice for SuDS¹, and the Environment Agency Report SC030219 – Rainfall runoff management for developments. This is a recommended methodology for Sites up to 50ha in area.
- 4.4.3 The following parameters were used in the runoff calculations:
- Impermeable Area: 0.3ha;
 - Average Annual Rainfall (SAAR): 703 mm/year;
 - BFIHOST: 0.500
 - Region No.: 9
- 4.4.4 Table 4.2 shows the calculated greenfield runoff rates from the impermeable areas of the Site. Extracts from HR Wallingford calculations are included in Appendix 4.

Table 4.2: Greenfield Runoff Rates

Annual Probability (Return Period, years)	Greenfield Runoff Rate (l/s)
QBAR	0.96
100% (1)	0.84
3.33% (30)	1.70
1% (100)	2.09
1% + Climate Change	2.93

Note: 40% added to the data to account for long-term climate change as stated in PPG ID: 7. The 1-year, 30-year and 100-year annual probability events are of importance to the Water Companies and the Natural Resources Wales when looking at sewage discharge and flood risk.

- 4.4.5 The 1 in 1-year greenfield runoff rate is calculated as 0.84l/s. It is however noted that 5 l/s is normally the recommended minimum rate as per the current best practice guidance contained within 'Preliminary rainfall runoff management for developments, R&D Technical Report W5-074/A/TR/1, Revision E'. As such, 5l/s is used in this report as the recommended minimum rate.

4.5 Sustainable Drainage Options (SuDS)

Feasibility of SuDS

- 4.5.1 The soils and geology mapping are indicative of low infiltration potential. It is therefore assumed that the use of infiltration-based SuDS would not be feasible. This assumption would need to be confirmed through soakaway testing.

¹ Office of the Deputy Prime Minister, National SuDS Working Group, July 2004, Interim Code of Practice for sustainable drainage systems.

Choice of SuDS Options

- 4.5.2 Sustainable water management measures should be used to control the surface water runoff from the proposed development Site, thereby managing the flood risk to the Site and surrounding areas from surface water runoff. These measures will also improve the quality of water discharged from the Site.
- 4.5.3 Current guidance promotes sustainable water management using SuDS. Options applicable to this Site are identified in Table 4.3.

Table 4.3: SuDS Options

Green roofs	Infiltration basins
Water butts	Detention basins
Permeable paving	Oversized pipes
Rainwater harvesting	Brown roofs
Filter strips	Swales
Wetland Areas	Cellular Storage

Note: SuDS appropriate to the development are highlighted green.

- 4.5.4 A hierarchy of SuDS techniques is identified²:
- 1. Prevention** – the use of good Site design and housekeeping measures on individual Sites to prevent runoff and pollution (e.g. minimise areas of hard standing).
 - 2. Source Control** – control of runoff at or very near its source (such as the use of rainwater harvesting).
 - 3. Site Control** – management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole Site).
 - 4. Regional Control** – management of runoff from several Sites, typically in a detention pond or wetland.
- 4.5.5 Using SuDS as opposed to conventional drainage systems provides several benefits by:
- reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
 - reducing the volumes and frequency of water flowing directly to watercourses or sewers from developed Sites;
 - improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources;
 - reducing potable water demand through rainwater harvesting;
 - improving amenity through the provision of public open spaces and wildlife habitat; and
 - replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

² CIRIA (2004) Report C609, Sustainable Drainage Systems – Hydraulic, Structural and Water Quality advice.

SuDS Maintenance

- 4.5.6 A detention basin will form the main attenuation feature within the development Site.
- 4.5.7 Maintenance of the SuDS features would be in line with the SuDS Manual (CIRIA C753, 2015), as detailed in Figure 4.1. The maintenance would be undertaken by a private maintenance company.
- 4.5.8 It is standard for SuDS features within a new development to be maintained by a private maintenance company, unless the council adopt it. If the maintenance company goes into administration, the Site will be contracted to a new maintenance company. Residents will pay a surcharge to the maintenance company and a number of them would be appointed to its board. This will ensure maintenance throughout the lifetime of the development.
- 4.5.9 Details of other SuDS features, and maintenance would be considered further at detailed design, when a detailed layout has been produced. The level of detail provided within this FRA should be sufficient at outline stage to demonstrate that SuDS would be deliverable.

Figure 4.1: Detention Basin Operation and Maintenance Requirements (Table 22.1 of the SuDS Manual)

TABLE 22.1 Operation and maintenance requirements for detention basins		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay 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 reseedling or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

4.6 Surface Water Management Strategy

Hierarchy of Discharge

4.6.1 In accordance with requirement H3 of the Building Regulations 2003 rainwater runoff must discharge to one of the following, listed in order of priority:

- 1. An adequate soakaway or some other adequate infiltration system; or, where that is not reasonably practicable:** The use of infiltration-based SuDS is not feasible due to low infiltration potential (to be confirmed by soakaway testing).
- 2. A watercourse; or where that is not reasonably practicable:** An unnamed land drain conveys flows south-west along the south-east boundary.

³ Office of the Deputy Prime Minister, The Building Regulations 2000.

3. A sewer: There are no public surface water sewers located within the immediate vicinity of the Site.

- 4.6.2 The potential route to discharge from the existing Site will be by outfall to the unnamed land drain.

Drainage Design

- 4.6.3 Surface water runoff would be directed to the drainage system through drainage gullies located around the perimeter of the buildings and through contouring of the hardstanding areas.
- 4.6.4 Landscaped areas should be incorporated into the layout where possible, and unit will allow a proportion of the rainfall to infiltrate into the soil substrate.
- 4.6.5 Surface water will be directed to an onsite detention basin, positioned to achieve a gravity fed connection to the land drain.
- 4.6.6 An indicative drainage layout is in Drawing 004.

Water Quality

- 4.6.7 The surface water will discharge into an unnamed land drain. The unnamed land drain is part of the Hanmer Mere SSSI and Ramsar Site. It is proposed that the water quality associated with the development runoff is managed through the following treatment train before it discharges to the watercourse;
1. Gully Pots on highways – to remove physical sediment and contaminant.
 2. Hydrocarbon interceptor.
 3. Attenuation Pond – residual fine sediment and adsorbed contaminants.
 4. Ordinary Watercourse.
- 4.6.8 Enzygo carried out a Habitat Regulations Assessment Screening Report (HRA) for the above Site. The report outlines mitigation measures required to avoid impact to the designated Site during the construction and operational phases, including those outlined above.
- 4.6.9 The HRA concludes there will be no anticipated significant effect on the proposals on the Midland Meres and Mosses Phase 2 Ramsar (or the overlapping Hanmer Mere SSSI). A full copy of the report can be found in MAN.244.002.EC.R.002.

Attenuation Requirements

- 4.6.10 Attenuation storage is required to reduce the post-application surface water runoff from the Site to calculated greenfield runoff rates, up to and including the 1 in 100-year (+40%CC) rainfall event, assuming no infiltration losses.
- 4.6.11 The following input parameters were assumed in the calculations:
- Impermeable Area: 0.3ha (20%);
 - Cv (proportion of rainfall forming surface water runoff): 75% summer, 84% winter;
 - Infiltration losses: 0.00m/hour;
 - With outfall at 5l/s (Table 6.2).
- 4.6.12 The attenuation volume for the 1 in 100-year event (plus climate change) is 186m³.

- 4.6.13 PDS Flow calculations are included in Appendix 5. The calculated runoff rates and attenuation volumes will be reviewed at detailed design stage.

4.7 Exceedance Routes

- 4.7.1 The detention basin will be designed with a capacity up to a 1 in 100-year (plus 40% climate change) event, with a +300mm freeboard allowance, based on 5l/s discharge rate. This provides a betterment (reduction) in runoff when compared to existing undeveloped conditions, where runoff is uncontrolled across all return periods.
- 4.7.2 A storm event in excess of this design standard would be extreme and would cause the detention basin to overtop (with no sudden deluge) and would then shed overland following the topography (north), as per existing conditions.
- 4.7.3 Finished floor levels will be set above external levels, which will mitigate the residual risk of overtopping.

4.8 Foul Drainage

- 4.8.1 The Site is not currently served by a foul drainage network.
- 4.8.2 It is proposed that foul flow is discharged to either the Ø150mm private foul sewer within the Hanmer Arms (subject to agreement).
- 4.8.3 In accordance with Sewers for Adoption (7th Edition), peak foul water discharge from a residential development is 4,000 litres per property per day. Using this method, peak foul flows are estimated to be 0.8l/s from the 19-unit lodge development. The calculated foul flow rate will be reviewed at detailed design stage.
- 4.8.4 All foul sewerage should be designed in accordance with Building Regulations Part H. In areas where sewers are to be adopted by Welsh Water, sewerage should be designed in accordance with Sewers for Adoption (7th Edition) and supplemented with additional standards provided by Welsh Water. An application to enter into a Section 104 agreement for sewer adoption must be made in writing to Welsh Water prior to any works commencing on Site. A connection point should be agreed with Welsh Water.

5.0 Summary, Conclusions and Recommendations

5.1 Introduction

- 5.1.1 An Outline Drainage Strategy has been undertaken for a proposed holiday lodge development, located on land north of Hanmer Arms, Hanmer.

5.2 Outline Drainage Strategy

- 5.2.1 The Drainage Strategy has identified the following:

- The soils and geology indicate a low infiltration potential. It is assumed that drainage is primarily via overland flow, following the topography of the Site to the topographic low points (unnamed land drain). Infiltration-based SuDS should be utilised in the first instance however the infiltration potential suggests they would not be feasible on this Site (this would need confirming through soakaway testing).
- The unnamed land drain conveys flows northwest along the north-eastern Site boundary. A positive outfall to watercourse would be feasible.
- The proposed development will increase the area of impermeable surfaces and therefore increase the amount of runoff without mitigation.
- Surface water runoff from the Site will be restricted to 5l/s which offers a betterment to existing conditions with uncontrolled runoff across all return periods.
- Surface water runoff from the proposed development would be attenuated on-site up to and including the 1 in 100-year event, plus 40% climate change.
- A SuDS drainage scheme is proposed to manage excess runoff from the development, comprising a detention basin designed to maintain runoff at pre-development rates, with an outfall to the bounding land drain.