



Wrexham County Borough Council

RESIDENTIAL DEVELOPMENT AT NANT SILYN

Flood Consequence Assessment and Drainage
Strategy



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WSP

Wrexham Office

Opus House

Yale Business Park

Wrexham

LL13 7YL

Phone: +44 1978 368100

WSP.com

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Prepared by	J. Russell	J. Russell		
Signature	<i>J. Russell</i>	<i>J. Russell</i>		
Checked by	V. Mohun	V. Mohun		
Signature	<i>V. Mohun</i>	<i>V. Mohun</i>		
Authorised by	N. Jones	N. Jones		
Signature	<i>N. Jones</i>	<i>N. Jones</i>		
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1.0 INTRODUCTION

1.1 COMMISSION

WSP were appointed by Wrexham County Borough Council to undertake a Flood Consequence Assessment (FCA) and Drainage Strategy (DS) to support the proposed residential development at Nant Silyn, Wrexham.

This FCA and DS focuses on assessing the flood risk issues at the site and includes the following:

- Liaison with Natural Resources Wales (NRW), Wrexham County Borough Council (WCBC) and Dwr Cymru Welsh Water (DCWW) to obtain information relating to local flood risk issues for the site.
- Assessment of the existing consequences of flooding at the site and the potential impact of the proposals.
- Identification of all the potential sources of flooding at the site (i.e. fluvial, tidal, highways, groundwater, reservoir, sewers, canal, surface water).
- Consideration of the flood consequence implications, taking into account the potential allowance for climate change over the lifetime of the development and the identification of the measures to mitigate flood risk, if required.
- Foul drainage and surface water runoff management for the proposed development.

1.2 POLICY CONTENT

This FCA and DS has been prepared in accordance with the relevant national, regional and local requirements and guidance of the following publications and organisations:

- Technical Advice Note (TAN) 15: Development and Flood Risk dated October 2004 issued by Welsh Government
- Wrexham County Borough Council
- Building Regulations 2010 (Part H3)
- Sewers for Adoption 7th Edition
- Planning Policy Wales (Edition 9, November 2016) issued by Welsh Government
- Wrexham County Borough Councils local planning guidance note “Management of Surface Water Generated from New Development”
- Wrexham County Borough Council Local Flood Risk Management Strategy April 2013
- Welsh Ministers Standards for Foul Sewers and Lateral Drains
- The new Sustainable Drainage Systems (SuDS) Manual C753, CIRIA
- RainScape – Dwr Cymru Welsh Water
- SuDS Wales

To complete this FCA and DS, the following stakeholders have been consulted:

- Natural Resources Wales (NRW)
- Dwr Cymru Welsh Water (DCWW)
- Wrexham County Borough Council (WCBC) as Lead Local Flood Authority (LLFA)

1.3 PLANNING POLICY WALES VULNERABILITY AND TECHNICAL ADVICE NOTE 15

The general approach of the Planning Policy Wales (PPW), supported by the Technical Advice Note 15 (TAN15) is to follow a precautionary framework approach when determining the suitability of land for development in flood risk areas, with the intention of steering development away from areas of high risk of flooding to the lowest flood risk areas.

When development has to be considered in high risk areas (zone C) only those developments which can be justified on the basis of the tests outlined in section 6 and section 7 of the TAN15 guidance are to be located within such areas.

Table 2 of TAN15 guidance confirms the 'Flood risk vulnerability classification' of a site, depending on the proposed usage. This classification is subsequently applied to Development Advice Map (DAM) containing three zones (A, B and C with subdivision into C1 and C2) to determine whether:

- The proposed development is suitable for the zone in which it is located.
- The appropriate planning tests that need to be demonstrated in relation to the proposed development.

1.4 LIMITATIONS

The findings and opinions conveyed via this report are based on information obtained from a variety of sources, as detailed, which WSP believes are reliable. Nevertheless, WSP cannot and does not guarantee the authenticity or reliability of the information it has relied upon from these sources.

This report has been written on behalf of the Client and no responsibility is accepted to any Third Party for all or any part. This report should not be relied upon or transferred to any other parties without the express written authorisation of WSP. If any unauthorised third party comes into possession of this report, they rely on it at their own risk and the authors owe them no duty of care or skill. WSP disclaims any responsibility to the Client and others in respect of any matters outside the scope of the above contract.

This report has been prepared by WSP with all reasonable skill and care within the terms of the Contract with the Client and taking into account of the information made available by the Client, as the manpower and resources devoted to it by agreement with the Client.

It should be noted that the insurance market applies different tests to properties in relation to both determining premiums and, more fundamentally, determining the insurability of properties for flood risk. Those undertaking development in areas which may be at risk of flooding are advised to contact their insurers or the Association of British Insurance (ABI) to seek further guidance prior to commencing development. WSP do not warrant that the advice in this report will guarantee the availability of flood insurance either now or in the future.



The findings of this FCA have been based on data available at the time of the study and on the review of available information that has been undertaken to date. They relate to the current development proposals as outlined in **Appendix 6.1**. Should the proposed end use of the site change after the completion of this assessment, then the findings of this report will need to be reviewed and updated accordingly.

2.0 EXISTING SITE AND DEVELOPMENT PROPOSALS

2.1 SITE LOCATION

The proposed development site is located to the north of the residential street Pont Wen in Wrexham. The site has an approximate area of 0.444ha, of which 0.1935ha is impermeable and is centred within National Grid Reference 334359E, 349880N.

The site is roughly rectangular in shape and is bounded to the north by the River Gwenfro, to the east by Queensway Terrace and public open space, to the south by residential properties and Pont Wen and to the west by public open space. The existing site location plan is shown in **Figure 1.0** below.

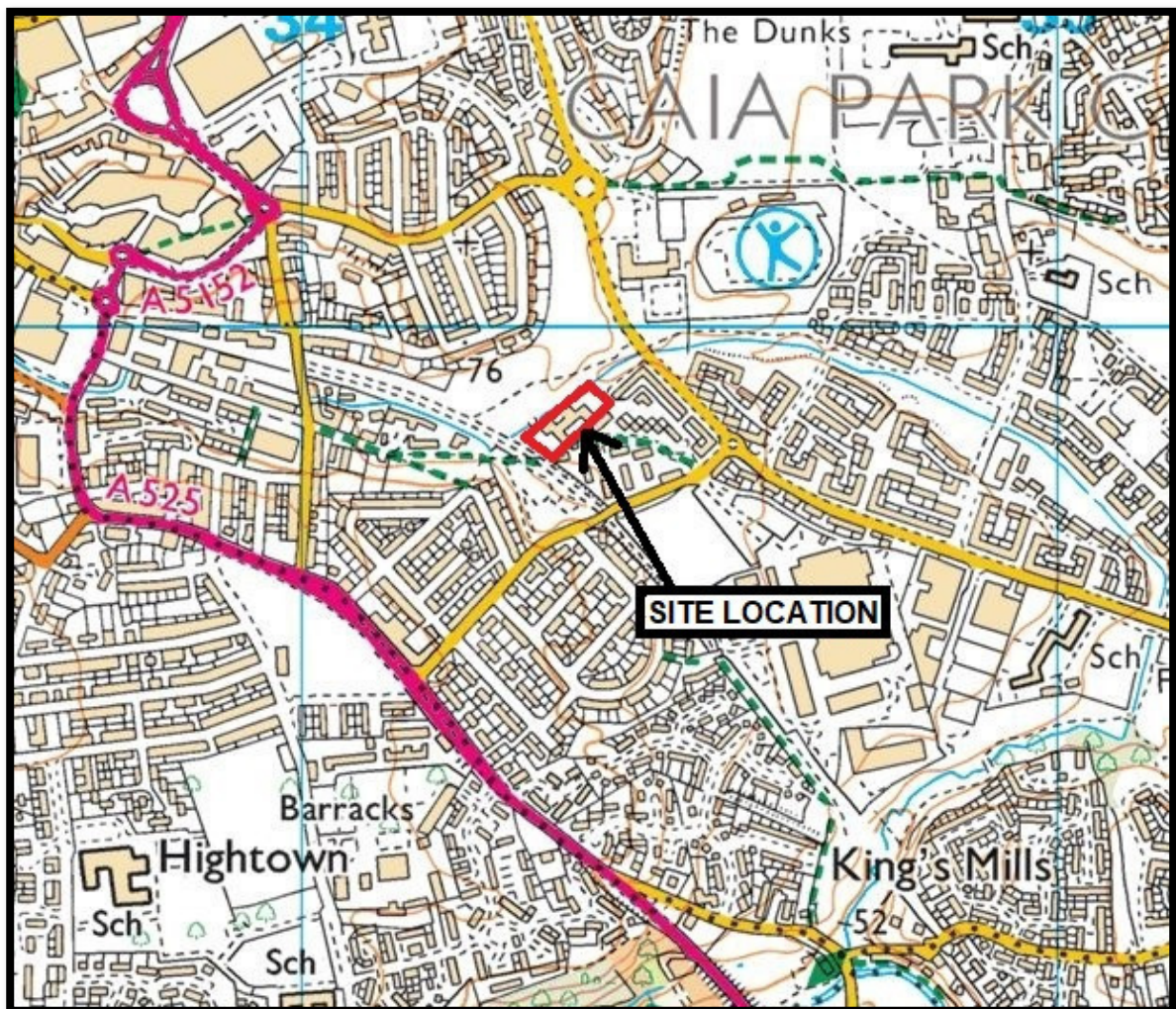


Figure 1.0: Site Location Plan (Source: Ordnance Survey Map
License Number WL100018294)

2.2 SITE DESCRIPTION

A topographical survey provided by the Client has been reviewed as part of this assessment and is included in **Appendix 6.2** of this report. The survey indicates that the site has a high point in the south western corner of 68.840 mAOD and a low point in the north east corner of 62.950mAOD with levels

of 65.200mAOD and 64.960mAOD in the northwest and south east corners respectively. The northern boundary to the site is bounded by the River Gwenfro. There is an embankment that falls towards the river which is separated from the site by a fence line that runs parallel with the river approximately 2m-7m away. The previous use of the site was a residential assisted living residence with associated car parking areas which comprised the majority of the site. The remainder of the site is occupied by shrubs and numerous trees.

2.3 PROPOSED DEVELOPMENT

The scheme consists of the demolition of the existing residential assisted living residence and then the construction of 15 units which comprise of 8 number 1 bedroom (2 person apartments), 6 number 2 bedroom (4 person houses) and 1 number 3 bedroom fully adapted bungalow.

Based upon latest development plans the approximate impermeable area generated by the proposals will be within the region of 0.205Ha which represents an increase of 0.0115Ha in impermeable area, as shown on the impermeable area plan included on drawing 0799-100-01 in **Appendix 6.3**.

The development proposals are shown on the Development Plan enclosed within **Appendix 6.1**.

2.4 GEOLOGY AND HYDROGEOLOGY

The geology of the site has been reviewed from the British Geological Survey (BGS) online geology maps and the following reports provided by the Client:

- Preliminary Risk Assessment: Nant Silyn – Final Report for Wrexham County Borough Council, ESI Environmental Consultants, March 2012.
- Ground Investigation Report, carried out at Nant Silyn, Wrexham, LL13 8SQ, February 2018

The desk study reports that the site is comprised of the following:

- Solid Geology – *Salop formation – Mudstone, Sandstone and Conglomerate. Sedimentary Bedrock formed approximately 272 to 310 million years ago in the Permian and Carboniferous Periods.*
- Drift Geology - *Alluvium – Clay, Silt, Sand and Gravel. Superficial Deposits formed up to 2 million years ago in the Quaternary Period, and River Terrace Deposits (undifferentiated) – Sand and Gravel. Superficial Deposits formed up to 3 million years ago in the Quaternary Period.*
- *Both the alluvium and sand and gravel deposits are Secondary A aquifers. Secondary A Aquifers (alluvium, sand and gravel deposits, Salop Formation) – sediments/rocks with permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.*
- *The depth of groundwater beneath the site is unknown; however given the granular nature of the superficial deposits and the proximity of the river, shallow groundwater might be present.*
- *The granular nature of the superficial deposits is unlikely to offer any significant protection to the underlying aquifer.*
- *No licenced groundwater abstractions have been identified within 1km of the site and the site is not located within a **Source Protection Zone**.*

The geological log from a borehole (SJ34NW254) located 20m to the south-east of the site (**Appendix 6.4**) describes 2m of made ground (clay and ash fill) over sands and gravel deposits. No water was encountered until 3.65m below ground level.

The geological log from a borehole (SJ34NW3) located 150m to the south-east of the site (**Appendix 6.4**) describes up to 26m of sand and gravel deposits over the Salop Formation.

Any in-filled materials or Made Ground which is present on the Site (including that which may be associated with the operation and demolition of the former sewage works) could be a source of historical contamination present with the Site boundaries. Made Ground materials are currently exposed to the north of the site along the banks of the river. A former landfill is located to the north of the River Gwenfro and a former gravel pit was located to the east of the Site. Waste materials placed within the landfill or former gravel pit could be a source of historical site contamination. Other than these no other potential contaminant sources have been identified close (within 50m) of the site boundaries.

Any potential contamination within the ground may prohibit the use of infiltration methods for surface water drainage on the proposed development.

The ground investigation reports the following:

- The sequence encountered generally comprises of made ground up to depth of 1.40m overlying natural strata of coarse soils of sand and gravel and localised fine soils of clay and silt.*
- The proposed building will be underlain by variable soil types including soft clay, silt and loose sand up to depth 5.00m. These variations in soil thickness and characteristics may result in variable bearing capacity and settlement characteristics across the development.*
- Ground improvement may be carried out to increase bearing characteristics at shallow depth and unify settlement characteristics. Alternatively, piled foundations may be utilised to limit differential settlements across the building footprint. Design Sulphate Class may be taken as DS-1. An ACEC class for the site of AC-1 would be appropriate.*
- Analytical testing indicated all the contaminants concentrations to be below their respective Guidance Levels. No asbestos was detected. Therefore, no significant contamination risks to human health are considered to be associated with the proposed development of the site. This assessment is based on one soil sample as required by WCBC in the scope of works. Additional soil sampling and analysis may be required to determine variation across the site.*
- Groundwater was encountered at approximately 3.0m bgl and rose between 2.20 and 2.60m bgl after 20minutes.*

The scope of the ground investigation report did not include BRE365 soakaway tests and there is no information about the infiltration potential of this site for surface water management on the site. It is therefore recommended that, before the detailed design stage, soakaway testing is undertaken in accordance with BRE365 guidance to verify the on-site infiltration potential of the underlying ground.

2.5 HYDROLOGY

The site is located adjacent to the River Gwenfro. This is shown in **Figure 2.0** below. The River Gwenfro is located to the north of the site, it is an “ordinary watercourse” flowing in an easterly direction and is a tributary of the River Clywedog.

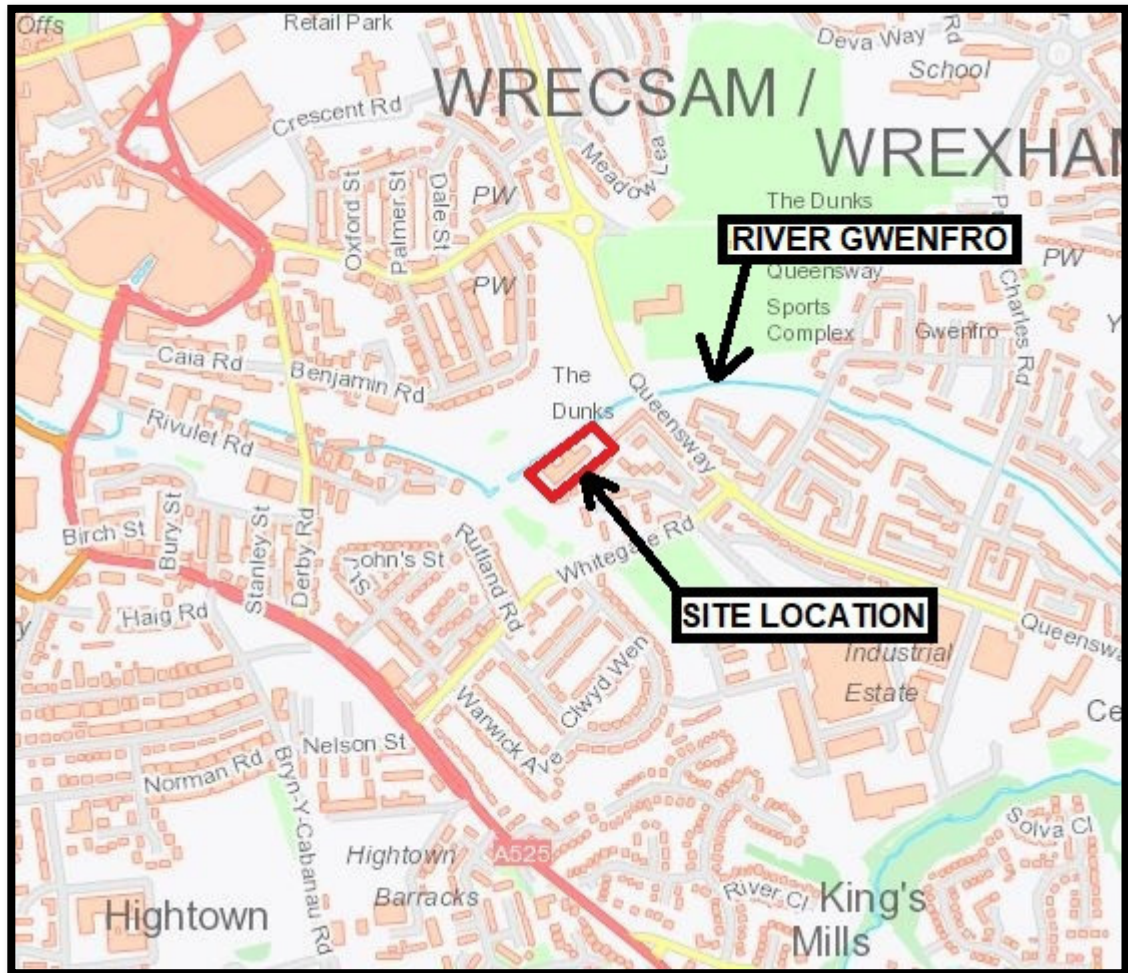


Figure 2.0: Hydrology Plan (Source: Natural Resources Wales)

The following desk study has been reviewed as part of this assessment:

- Preliminary Risk Assessment: Nant Silyn – Final Report for Wrexham County Borough Council, ESI Environmental Consultants, March 2012.

The following has been noted:

- *Natural Resources Wales monitor water quality in the River Gwenfro 600m to the west (upstream) and 750m to the east (downstream) close to the confluence with the River Clywedog. Available data suggests that in both upstream and downstream locations chemical water quality was good and biological water quality was fair to fairly good between 2005 and 2009.*

- *There is a consent to discharge sewage from storm overflows (relating to a sports complex located 200m to the north east) to the river immediately downstream of the site. There are also similar discharge consents 150m upstream of the site.*
- *Given the close proximity of the River Gwenfro it is a relevant receptor of concern. However, available information suggests that the route of the river has been artificially engineered in the reach directly adjacent to the site. Any artificial lining within the river may limit the degree of hydraulic connection with shallow groundwater.*

2.6 EXISTING DRAINAGE

2.6.1 PUBLIC SEWERS

A copy of DCWW's sewer records has been reviewed as part of this assessment and is included in **Appendix 6.5** of this report. There is an existing 450mm diameter public Combined Sewer Overflow (CSO) which flows from Pont Wen in a northerly direction through the eastern part of the site prior to discharging to the River Gwenfro. There are also existing 300mm and 375mm diameter public combined sewers which converge at a manhole adjacent to the western boundary of the site from where the flows are conveyed in a 600mm diameter combined sewer heading in an easterly direction towards a manhole within Pont Wen.

2.6.2 EXISTING SITE DRAINAGE ARRANGEMENTS

The topographic survey provided by the Client indicates the existing drainage arrangements of the site's previous use. The survey shows that the foul drainage network flows in a south westerly direction along the south facing perimeter of the building, before discharging in a westerly direction towards the location of a private foul pumping station shown on DCWW sewer records. This private foul pumping station is believed to serve the previous site usage.

The survey shows that the surface water drainage network serves the hardstanding area to the south east of the building before flowing in a north westerly direction under the building before discharging into the River Gwenfro via an existing headwall.

2.7 CONSULTATION WITH STATUTORY AUTHORITIES

2.7.1 CONSULTATION WITH WREXHAM COUNTY BOROUGH COUNCIL (WCBC)

The Lead Local Flood Authority (LLFA) of WCBC has been consulted as part of this assessment. The following information was provided in their response and is included within **Appendix 6.6**:

- *There are minimal surface water issues at this location*
- *There are no historical surface water flooding issues at the site*
- *There is no data regarding groundwater flooding or emergence issues or information about local groundwater infiltration potential of the general area.*
- *There are no known highway flooding issues*
- *The site does not lie near or within a Critical Drainage Area*
- *There are no known culverted watercourses on site or within its vicinity.*
- *We have no information regarding feasibility for soakaways.*

- *Please refer to WCBC's local planning guidance note "Management of Surface Water Generated from New Development" for guidance on potential surface water discharge rate to local watercourse, use of SuDS and climate change allowance for use if future surface water drainage design.*

Flood risk maps are available from NRW's website which show that there are no defences or storage areas in this area.

2.7.2 CONSULTATION WITH NATURAL RESOURCES WALES (NRW)

Consultation has been undertaken with NRW and their response is included within **Appendix 6.7**. NRW stated the following in their initial response:

20/07/18

- *Based on the information submitted to us, we have significant concerns with the proposed development. On this basis, we would recommend to the local authority that they should only grant planning permission if the scheme can meet the following requirement and the conditions listed below are attached to the planning permission. Otherwise, we would object to this planning application.*
 - *An FCA should be prepared which demonstrates that flood risk can be appropriately managed in accordance with TAN15.*
 - *The applicant confirms that the foul drainage will be connected to the mains sewer, otherwise demonstrate it is not feasible to connect to the main sewer.*
- *The site is located partially within Zone B and Zone C2 as defined by the Development Advice Map (DAM) of TAN 15 and existing nursing home is located on the top of the wooded right bank of the Afon Gwenfro.*
- *In line with TAN 15 requirements, the proposed redevelopment of a nursing home into a new residential development of 15 units, will need to consider flood risks. It will need to assess how the extreme outline of a fluvial event (0.1% annual exceedance probability (AEP) against the site levels in Zone B to determine if a flood consequence assessment is required. TAN 15 sets out a strong policy presumption against highly vulnerable development in Zone C2.*
- *The recent modelling study undertaken by Wrexham Council Lead Local Flood Authority (LLFA) on the Gwenfro should provide suitable outputs for use within an FCA. The applicant should contact Neil Taunt at Wrexham Council for further information on the modelling study and any local flooding history for the site.*
- *The indicative site plan indicates proposed development within 5 metres from the top of the bank. This development plus any temporary works involving the demolition of the existing nursing home and within 8 metres of the bank top (and not the edge of the river) will require a flood risk activity permit.*
- *The site lies within a publicly sewered area and the proposal must discharge to the public sewerage system. It is recommended that consultation takes place with the sewerage undertaker to confirm that connection is available.*

- *The installation of private sewage treatment facilities within publicly sewerage areas is not considered environmentally acceptable. We would therefore be opposed to such facilities unless it can be demonstrated that it is not reasonable to connect the public system.*
- *Lack of capacity or plans to improve capacity in the sewer is not a valid reason for a sewerage undertaker to refuse connection under Section 106 of the Water Industry Act 1991 and we may refuse to issue an Environmental Permit or exemption for private treatment facilities in such circumstances.*

However, subsequent email correspondence received from NRW regarding the recent modelling study undertaken by WCBC LLFA (in **Appendix 6.7**), stated the following:

- *There is no requirement to update the model or agree a modelling methodology for this site because the existing River Gwenfro model was completed in 2016 and shows that this site is not at fluvial flood risk. There are no updates required to the hydrology or climate change allowances at this time and the assessment of blockage has been undertaken at key structures. The nearest structure to this site is unlikely to be subject to blockage.*
- *We would recommend the fluvial mapping outputs of the existing model which show the impacts of climate change for the Afon Gwenfro are used to assess the requirements for a flood consequence assessment.*

WSP have therefore undertaken high level review of the existing hydraulic model for the River Gwenfro with the proposed development to assess the current and future flood risk. This is discussed in more detail in Section 3.2 of this report.

2.7.3 CONSULTATION WITH DWR CYMRU WELSH WATER (DCWW)

The pre-planning advice received from DCWW can be found in **Appendix 6.8**, in which DCWW stated the following:

- *The proposed development site is crossed by a 300mm and 600mm diameter combined gravity public sewers and a 450mm combined storm overflow with their approximate positions being marked on the attached Statutory Public Sewer Record. Under the Water Industry Act 1991 Dwr Cymru Welsh Water has rights of access to its apparatus at all times. No part of any building will be permitted within 3 metres either side of the centreline of the public sewers and the combined storm overflow.*
- *Our strong recommendation is that your site layout takes into account the location of the assets crossing the site and should be referred to in any master-planning exercises or site layout plans submitted as part of any subsequent planning application. Further information regarding Asset Protection is provided in the attached Advice & Guidance note.*
- *Foul flows only from the proposed development can be accommodated within the public sewerage system. We advise that the flows should be taken to the 600mm combined public sewer at or beyond manhole SJ34493805 which crosses the site.*
- *With reference to the surface water flows from the proposed development, you are required to fully exhaust all technical options outlined under Sections 3.2 and 3.4 of Part H of the publication 'Building Regulations 2000; Disposal should be made through the hierarchical approach, preferring infiltration and, where infiltration is not possible, disposal to watercourses in liaison with the Land Drainage Authority and/or Natural Resources Wales.*

- *Given the close proximity of Afon Gwenfro to the development site and given that we have recorded flooding instances downstream of the site, we wouldn't allow surface water runoff to discharge directly or indirectly into the combined public sewerage system. Please refer to further detailed advice relating to surface water management included in our attached Advice & Guidance note.*
- *In addition, please note that no highway or land drainage run-off will be permitted to discharge directly or indirectly into the public sewerage system.*
- *No problems are envisaged with the Waste Water Treatment Works for the treatment of domestic discharges from this site.*

3.0 ASSESSMENT OF FLOOD RISK

3.1 FLOODING HISTORY

NRW, WCBC and DCWW have been consulted regarding the flooding in this area. It was stated within the Opus “**River Gwenfro Flood Risk Management OBC Report**”, March 2018 that:

“The Caia Park area has experienced flooding in 1979 & 1983 which is believed to be due to hydraulic capacity issues within the highway culverts at Y-Wern and Prince Charles Road, with flooding occurring to the properties along the left bank of the river looking downstream.”

Additionally Figure 1-4 River Gwenfro Flood History Information from the 2016 **River Gwenfro Model Update** produced by **JBA Consulting** (shown in **Appendix 6.9**) stated the following:

“Fluvial flooding to properties on Rivulet Road and Hightown Road (approx. 500m to the west of the site) in 2012 and 2013.”

“Fluvial flooding to properties in September 2012. Surface water flooding on road near Queensway Sports Centre (approx. 800m to the east of the site) in January 2016.”

As can be seen, from the information reviewed and consultations undertaken to date, there are no recorded flooding incidents at this site.

3.2 FLUVIAL FLOOD RISK

The Opus “**River Gwenfro Flood Risk Management OBC Report**”, March 2018 indicates that floodwater is predicted to remain within the banks of the River Gwenfro in events up to the 0.1%AEP and therefore, the site is at little or no risk of fluvial flooding. **Figure 3.0** below shows an extract from the report.

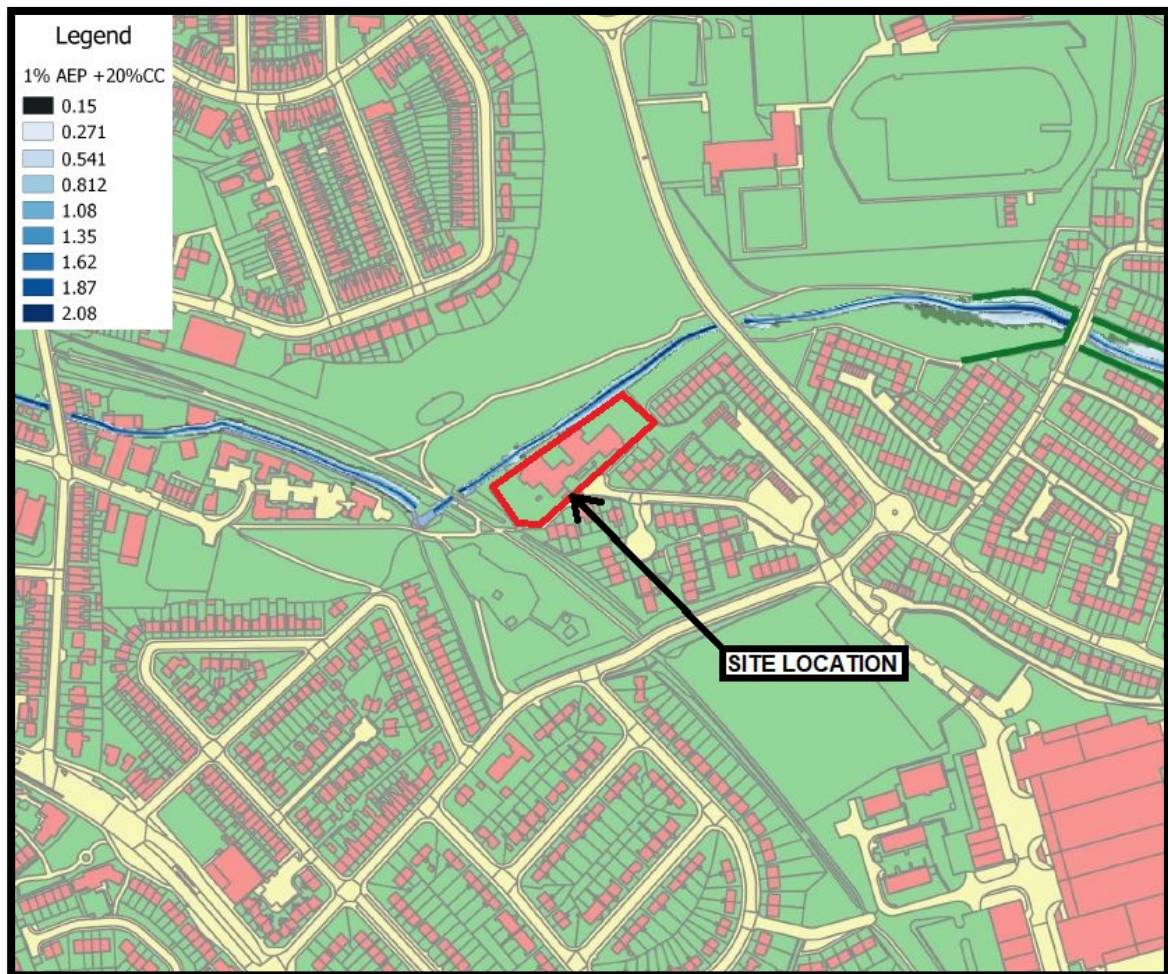


Figure 3.0: Hydrology Plan 1% AEP+20%CC (Source: the Opus **River Gwenfro Flood Risk Management OBC Report**, March 2018)

Further review of the hydraulic model for the River Gwenfro (obtained from WCBC under licence) also confirmed that the existing site and the proposed development are not affected by fluvial flooding from the River Gwenfro in the 1 in 100+20% climate scenario. These are shown in **Figures 3.1** and **3.2** below:

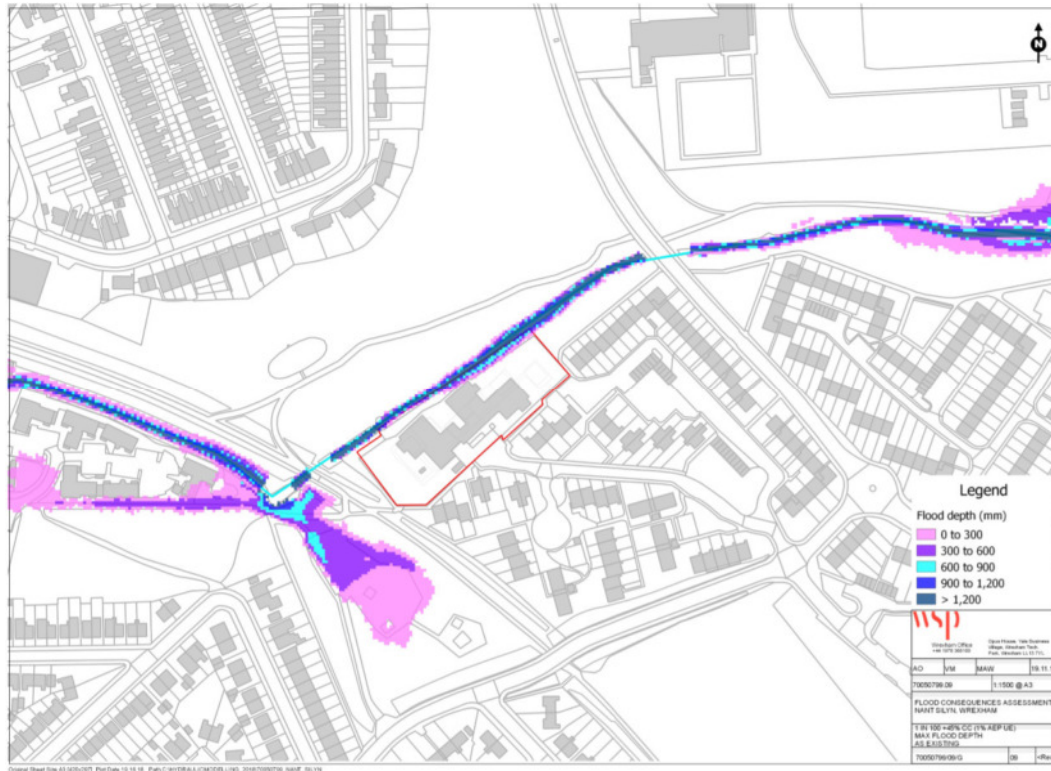


Figure 3.1: Existing Scenario during 1 in 100 + Climate Change Flood Outline

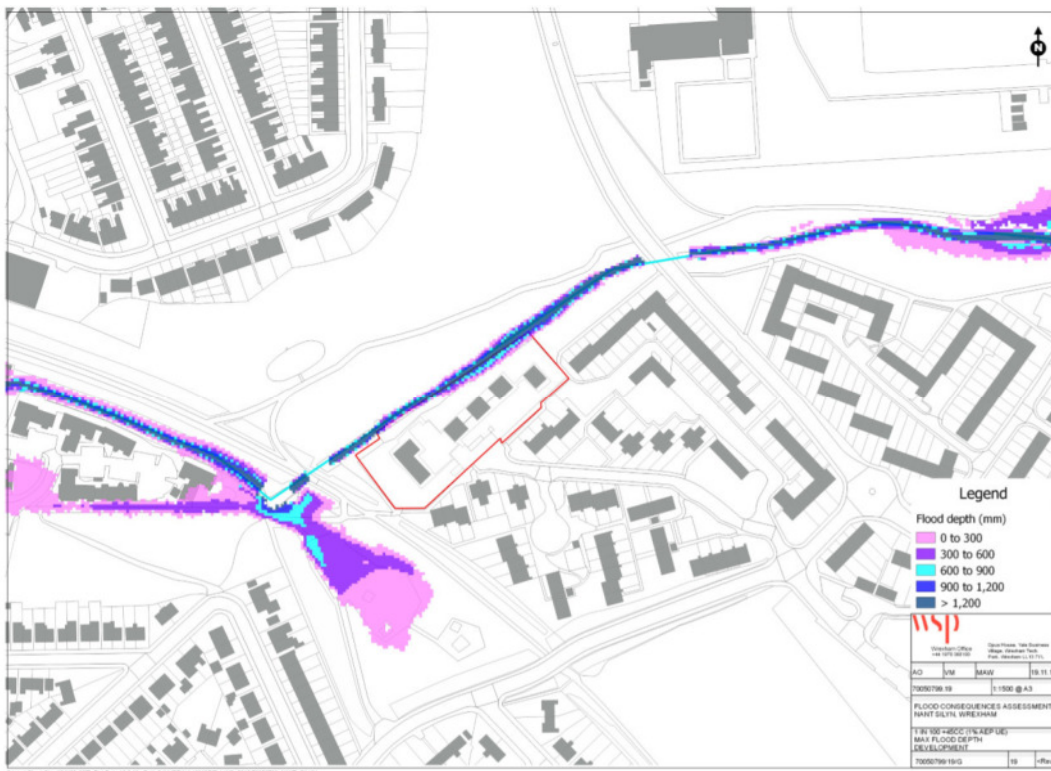


Figure 3.2: Proposed Development during 1 in 100 + Climate Change Flood Outline

As can be seen, the River Gwenfro does not affect the proposed development site during 1 in 100 plus climate change scenario. On this basis the risk of flooding to the proposed development is

considered to be “Very low” and in accordance with the requirements of TAN15, the proposed residential development (highly vulnerable development category) is suitable on this site and will not be required to pass the Justification Test.

3.3 SURFACE WATER FLOODING

Surface water flooding happens when rainwater does not drain away through the normal drainage systems or infiltrate into the ground, but lies on or flows over the ground instead. **Figure 3.3** below shows the NRW surface water flood map:

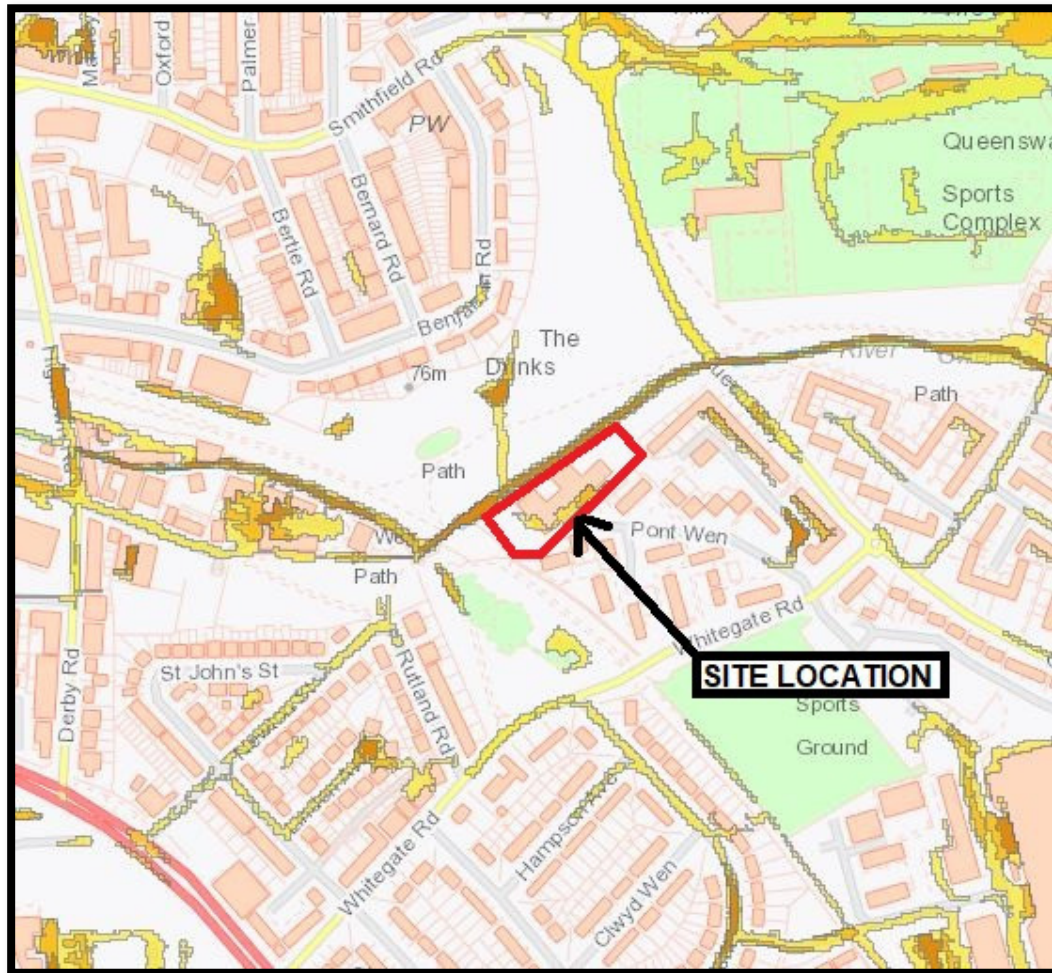


Figure 3.3: Surface Water Flooding Map (Source: Natural Resources Wales Floodmap, December 2018)

The above information indicates that a very small percentage of the site located to the south and west of the existing building is currently at a “medium” and “low” risk of surface water flooding from overland flows caused by intense rainfall. NRW define “medium” and “low” surface water flood risk as:

- “Low” risk means that each year, the area has a chance of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%)
- “Medium” risk means that each year, the area has a chance of flooding between 1 in 100 (1%) and 1 in 30 (3.3%)

It is likely that the “medium” and “low” risk characterisation of the site shown within **Figure 3.3** is as a result of the site topography and a sub-standard positive drainage system within the site. The proposed development will include a positive drainage system to serve the site with appropriate on site attenuation and flow controls. This will ensure that surface water is managed on site so that there is no flood risk to the development or elsewhere. This is discussed in more detail in **Section 4.0** of this report.

3.4 FLOODING FROM THE SEA

The site is located inland and is not within proximity of a tidally influenced watercourse. On this basis, the risk of flooding from the sea or high tides to the proposed development is “Negligible”.

3.5 FLOODING FROM CANAL

There are no canals within the vicinity of the site. On this basis, the risk of canal flooding to the proposed development is considered to be “Negligible”.

3.6 GROUNDWATER EMERGENCE AND FLOODING

Given the granular nature of the superficial deposits and the proximity of the River Gwenfro it is likely that shallow groundwater will be present on site. The ground investigation results provided by the Client have indicated that the ground water level was between 2.2m bgl and 2.6m bgl. The risk of groundwater flooding is therefore assessed to be “Low”.

It is recommended that prior to the design stage further testing/monitoring of the groundwater movement is undertaken to ascertain any residual risk.

3.7 FLOODING FROM RESERVOIRS

The NRW reservoir flooding map indicated that the site does not lie within a reservoir flood outline. On this basis, the risk of reservoir flooding to the proposed site is “Negligible”.

3.8 FLOODING FROM SEWERS

Consultation has been undertaken with WCBC regarding the sewer flood risk and their response is included in **Appendix 6.6**. WCBC have stated that within the site:

- There are minimal surface water issues at this location
- There are no historical surface water flooding issues at the site

It has to however be acknowledged that there are existing 450mm diameter and 600mm diameter sewers crossing the site and due to their presence the risk of flooding from sewers to the proposed site is considered to be “Medium”.

It is therefore recommended to liaise with DCWW regarding potential diversions of these sewers to ensure that there is adequate easement and access to these sewers for future repairs and maintenance. This could reduce the risk of sewer flooding to the proposed residential development.

3.9 FLOODING FROM HIGHWAY

At this stage, there is no detailed highway drainage survey information serving this site and additional correspondence with WCBC has stated that within the site:

- *There are no known highway flooding issues*



A review of the topographical survey shows the majority of the site to be lower than road levels along Pont Wen. Although there are existing gulleys along Pont Wen, it is recommended to ensure that they are fully operational and maintained properly to prevent any runoff from the highway onto the proposed development site.

On the basis of the above, the risk of highway flooding to the proposed development is considered to be "Low".

4.0 DRAINAGE PROPOSALS

4.1 FOUL DRAINAGE

The foul drainage disposal is proposed to be in compliance with the requirements of Building Regulations 2010 Part H (2015 Edition), Drainage and Waste Disposal and Sewers for Adoption 7th Edition.

Part H1 of the above document contains the following requirements:

“An adequate system of drainage shall be provided to carry foul water from appliances within the building on to the following, listed in order of priority.”

- a) A public sewer or where that is not reasonably practicable
- b) A private sewer communicating with a public sewer, or where that is not reasonably practicable,
- c) Either a septic tank which has appropriate form of secondary treatment or another wastewater treatment system; or, where that is not reasonably practicable,
- d) A cesspool

4.1.1 CONNECTION TO PUBLIC SEWER

The proposed peak foul discharge generated by the development has been calculated based upon an occupancy rate of 2 persons per 1 bedroom apartment, 4 persons per 2 bedroom apartment and 3 persons per 3 bedroom houses which equates to approximately 43 persons and allowing a conservative usage of 200 l/person/activity/day over a 24 hour day with a peaking factor of 6, which generates a peak flow in the region of 0.6l/s.

Although it is not possible to calculate the existing peak foul discharge from the site, due to unknown previous occupancy figures, it is likely that the peak foul flows from the proposed development will be similar to those of its previous use.

A pre-development enquiry response has been received from DCWW, who confirmed that foul flows only from the proposed development can be accommodated within the public sewerage system. DCWW advised that the flows should be discharged to the 600mm combined public sewer at or beyond manhole SJ34493805 which crosses the site.

In light of the above, a separate foul drainage system is required to serve the proposed development in accordance with all statutory requirements. It is likely that the foul flows generated by the development will need to be pumped prior to connecting to the existing public sewer network. Indicative proposals of the foul drainage are shown on drawing 0799-500-01 enclosed within **Appendix 6.10**. If this is the case, then due to the number of properties being served by the pumping station, this pumping station will need to be designed to comply with the requirements of DCWW and Sewers for Adoption 7th Edition. Consideration will need to be given to the siting and sizing of this pumping station before it is offered to DCWW for Adoption.

4.2 SURFACE WATER DRAINAGE

4.2.1 SURFACE WATER DRAINAGE GUIDANCE AND POLICY

The **Welsh Government Planning Policy Wales** guidance states the following “*flood risk is a material planning consideration*” and the **Technical Advice Note 15: Development and Flood Risk (TAN15, 2004)** also states that “*surface water is a material consideration and explains that development should not create additional runoff compared with the undeveloped situation and re-development schemes should also aim to reduce run-off where possible.*”

The aim of a surface water drainage strategy is to focus on the capture and management of surface water within the site boundary and ensure compliance with the requirements and guidance of the following publications and organisations:

- Technical Advice Note (TAN) 15: Development and Flood Risk dated October 2004 issued by Welsh Government
- Wrexham County Borough Council
- Building Regulations 2010 (Part H3)
- Sewers for Adoption 7th Edition
- Planning Policy Wales (Edition 9, November 2016) issued by Welsh Government
- Wrexham County Borough Councils local planning guidance note Management of Surface Water Generated from New Development
- Wrexham County Borough Council Local Flood Risk Management Strategy April 2013
- Welsh Ministers Standards for Foul Sewers and Lateral Drains
- The new Sustainable Drainage Systems (SuDS) Manual C753, CIRIA
- RainScape – Dwr Cymru Welsh Water
- SuDS Wales

In accordance with the above, surface water drainage systems are required to consider quantity, quality, amenity and biodiversity whilst preventing any likelihood of flooding to the site or adjacent sites. Part H3 of the Building Regulations 2010 guidance recommends that surface water runoff shall discharge to one of the following, listed in order of priority:

- Discharge to the ground
- Discharge to a surface water body
- Discharge to a surface water sewer
- To a combined sewer where there are absolutely no other options and only where agreed in advance with the relevant sewerage undertaker.

It is necessary to identify the most appropriate method of controlling and discharging surface water. The design should seek to improve the local run-off profile by using systems that can either attenuate run-off and reduce peak flow rates or positively impact on the existing flood profile.

4.2.2 DISCHARGE TO THE GROUND

As previously mentioned in Section 2 of this report, there is no BRE365 soakaway test information available. It is therefore recommended to undertake the BRE365 soakaway test prior to detail design stage for this development. At this stage the use of infiltration techniques to drain the site is therefore discounted.

4.2.3 DISCHARGE TO SURFACE WATER BODY

Assuming the use of infiltration techniques will not be suitable, it is proposed to discharge surface water flows at a controlled rate to the nearest surface water body subject to approval from the LLFA at WCBC. The nearest watercourse is the River Gwenfro, which is located directly adjacent to the site boundary and the site currently discharges to this watercourse via an existing outfall.

4.2.3.1 EXISTING GREENFIELD RUN-OFF RATE

The surface water drainage system for the development will discharge to the River Gwenfro, at a maximum agreed discharge rate which complies with the requirements of the LLFA.

The existing Greenfield run-off rates for the site have been calculated using the ICP SuDS method in Microdrainage Windes these are summarised in the table below and are also attached within **Appendix 6.11**.

EXISTING GREENFIELD DISCHARGE RATES	
Return Period	Existing Discharge Rates (l/s)
Qbar	1.0
1 in 30 year	1.8
1 in 100 year	2.3

Table 1.0: Summary of Existing Greenfield Discharge Rates

4.2.3.2 PROPOSED DISCHARGE RATE

In order to reduce the impact of developments on existing surface water drainage infrastructure, run-off rates for all brownfield sites, should be as close as practically possible to the Greenfield run-off rate, which in this instance is 1.0l/s.

- To achieve a discharge rate of 1.0 l/s the orifice diameter will be less than 50mm for any vortex flow control device with a design head greater than 0.6m, this would greatly increase the risk of blockage and flooding. To reduce these risks, the diameter of the orifice is required to be in excess of 75mm.
- Given the proposed development is situated within a built-up area, it is not recommended to install a drainage system which has any potential to increase flood risk elsewhere.
- HR Wallingford Civil Engineering and Environmental Hydraulics Organisation states that: "Where flow rates are less than 5l/s consents are usually set at 5l/s if blockages from vegetation and other materials is possible".

In light of the above, a discharge rate of 5l/s is proposed for the development site. This is in accordance with the guidelines provided by WCBC's LLFA as shown in the document titled "*Management of Surface Water Generated from New Development*".

4.2.3.3 SCHEME PROPOSALS

Form a review of the existing drainage survey information provided by the Client, it is considered that the existing surface water outfall to the River Gwenfro is not suitable as the invert level depth is too shallow to provide suitable positive drainage for the whole site. There is another existing outfall as part of a DCWW designated Combined Sewer Overflow (CSO). It is therefore recommended that the surface water drainage system discharges to the River Gwenfro via a newly constructed outfall. This new outfall will require a flood risk activity permit (previously known as a Flood Defence Consent) from WCBC's LLFA. The surface water drainage system should be designed in accordance with all statutory standards with all surface water flows up to a 1 in 100 year storm event plus climate change allowance attenuated on site. This discharge rate is subject to confirmation with the relevant statutory authority (WCBC) before detail design.

It is recommended that both the existing 600mm diameter combined sewer and the existing 450mm diameter public Combined Sewer Overflow (CSO) are diverted around the proposed building locations and the new alignments agreed with DCWW before the detail design stage.

The attenuation requirements have been determined using Microdrainage Windes for the 100 year + 20% climate change events. It has been determined that an attenuation tank within the region of approximately 11.2 x 5.6 x 1.01 m providing approximately 64m³ of storage volume would be required to provide suitable capacity for the proposed impermeable area, but this will be subject to detailed design. Indicative proposals are shown on drawing 0799-100-02 and the calculations are shown in **Appendix 6.12**.

The proposed surface water system may require a non-return valve system or a flap valve at its outfall to prevent any flooding from the River Gwenfro entering the proposed development.

Following soakaway testing to BRE365 criteria, it may be possible to review the size of the required attenuation and if it is found that the ground is suitable for infiltration then possibly reduce the required volume by utilising a partial infiltration based system.

4.2.3.4 WATER QUALITY

The new SuDS Manual (CIRIA C753, November 2015) introduced a slightly different approach compared to the previous version for the water quality management of surface water. The Manual describes risks posed by the surface water runoff to the receiving environment as a function of:

- The pollution hazard at a particular site (i.e. the pollution source).
- The effectiveness of SuDS treatment components in reducing levels of pollutants to environmentally acceptable levels (i.e. the pollutant pathway).
- The sensitivity of the receiving environment (the environment receptor).

The proposed land uses requiring surface water drainage for this site are as follows:

- Roof areas – surface water discharge to roof sump gulleys before discharging to the River Gwenfro.
- Car parking area and access roads – surface water discharge to linear drainage channel with sump before discharging to the River Gwenfro.

Table 26.2 of the SuDS Manual C753 assigns pollution hazard indices for different land use classification. The roof water and car parking areas pollution have hazard levels ranging from very

low to low, with low levels of contamination. The proposed sump gullies and catch pit manholes are deemed to be sufficient to remove the suspended sediments from the roof and car park surface water for a development of this size and nature.

4.2.3.5 RESIDUAL RISKS AND EXCEEDENCE FLOWS AND RUNOFF IN EXCESS OF DESIGN CRITERIA

The outline surface water drainage scheme for this development is proposed to comply with the requirements of Sewers for Adoption, i.e. no surcharge in the 1 in 1 year event and no flooding in the 1 in 30 year event.

It is difficult to completely guard against flooding since extreme events greater than the design standard event are always possible. It is practicable to minimise the risk by careful design of the layout of the development such that internal flooding is avoided. Areas of hardstanding can be laid to fall away from buildings with flows directed to areas where damage and disruption to buildings, assets and operations will be minimized.

The amenity and landscaped areas could also be used to accommodate residual flows beyond the design 1 in 100 year plus climate change event, without causing flooding elsewhere.

4.2.3.6 GENERAL MAINTENANCE REGIMES

The surface water drainage proposals for this site should include the following maintenance measures:

- Cleaning the sump of the road gullies, linear drainage channels and roof sump gullies to improve the quality of the water.
- Cleaning the sump of the roof sump gullies to improve the quality of water.
- Cleaning and maintenance of flow control device and its sump to maintain effective drainage.
- Cleaning and maintenance of the foul pump chamber to maintain effective drainage (if a foul pumping station is required).
- Inspection, cleaning and maintenance of the below ground attenuation systems to remove any silt and debris in accordance with the manufacturer's instructions.
- Maintenance of the proposed outfall to the River Gwenfro.

The frequency of the cleaning and maintenance inspections will be agreed with the site owner/operators maintenance team.

5.0 CONCLUSIONS & RECOMMENDATIONS

5.1 CONCLUSIONS

Although the NRW have advised that the site lies partially within Flood Zones B and C2 as defined by the Development Advice Map (DAM) of TAN 15, a review of the Opus River Gwenfro Flood Risk Management OBC Report, March 2018, and the subsequent review of the River Gwenfro hydraulic model has confirmed that the site is not affected by the 1 in 100 plus climate change fluvial flood outline. The proposed development is therefore suitable at this site and does not require the Justification Test.

The Flood Consequence Assessment has also identified the risk of flooding from surface water, groundwater, sewers, highway, canals, reservoir and groundwater to range between “Negligible” and “Medium”.

Subject to further surveys and finalised agreements with DCWW, NRW and WCBC’s LLFA, suitable discharge locations are available for the disposal of foul effluent and surface water run-off generated from the proposed development.

The proposed development is not expected to be affected by general objections in respect to draining the site. There will be suitable conditions imposed to ensure that the drainage proposals are designed and constructed in accordance with relevant statutory requirements, including Building Regulations 2010, Sewers for Adoption and the requirements of WCBC’s surface water management guidance.

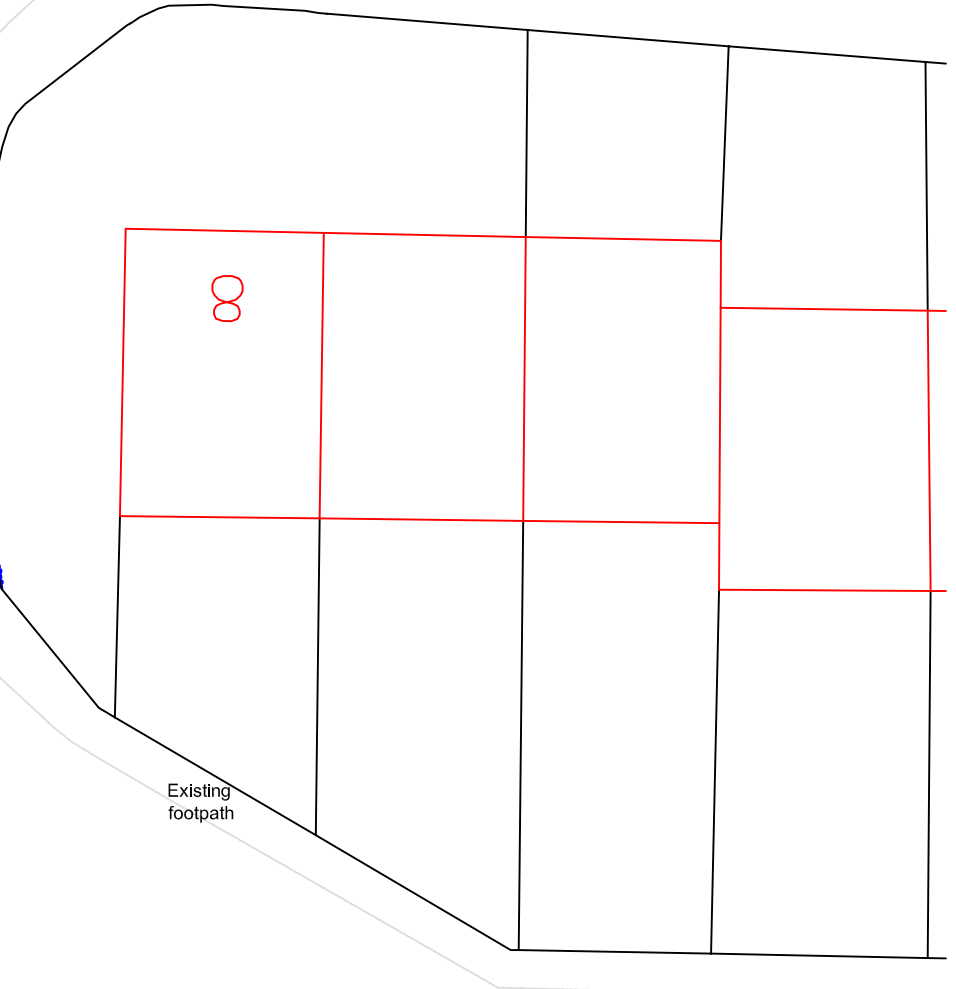
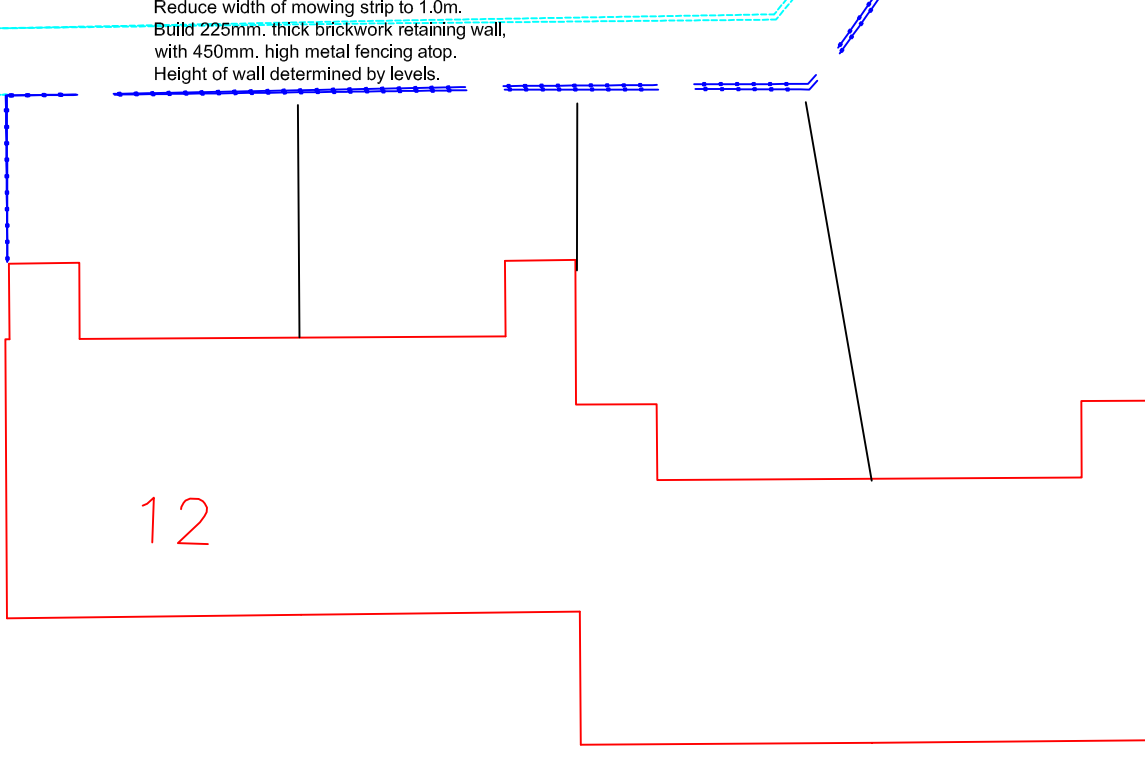
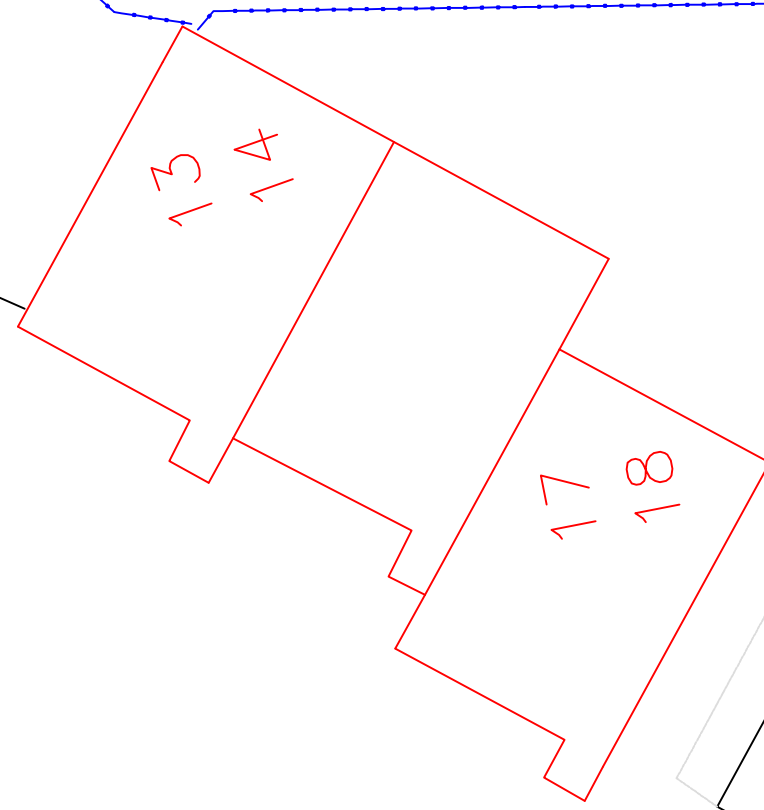
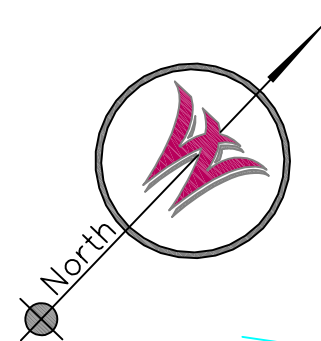
5.2 RECOMMENDATIONS

Before the detailed design stage, it is recommended that soakaway testing is undertaken in accordance with BRE365 guidance to verify the on-site infiltration potential of the underlying ground. Further testing of the ground conditions, monitoring of the ground water movement and presence of any potential ground contamination is also recommended before detail design.

The diversion of the existing sewers will require further consultations with DCWW. A flood risk activity permit will be required from WCBC for the construction of a new outfall along the banks of the River Gwenfro.

6.0 APPENDICES

6.1 DEVELOPMENT PLAN





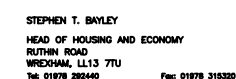
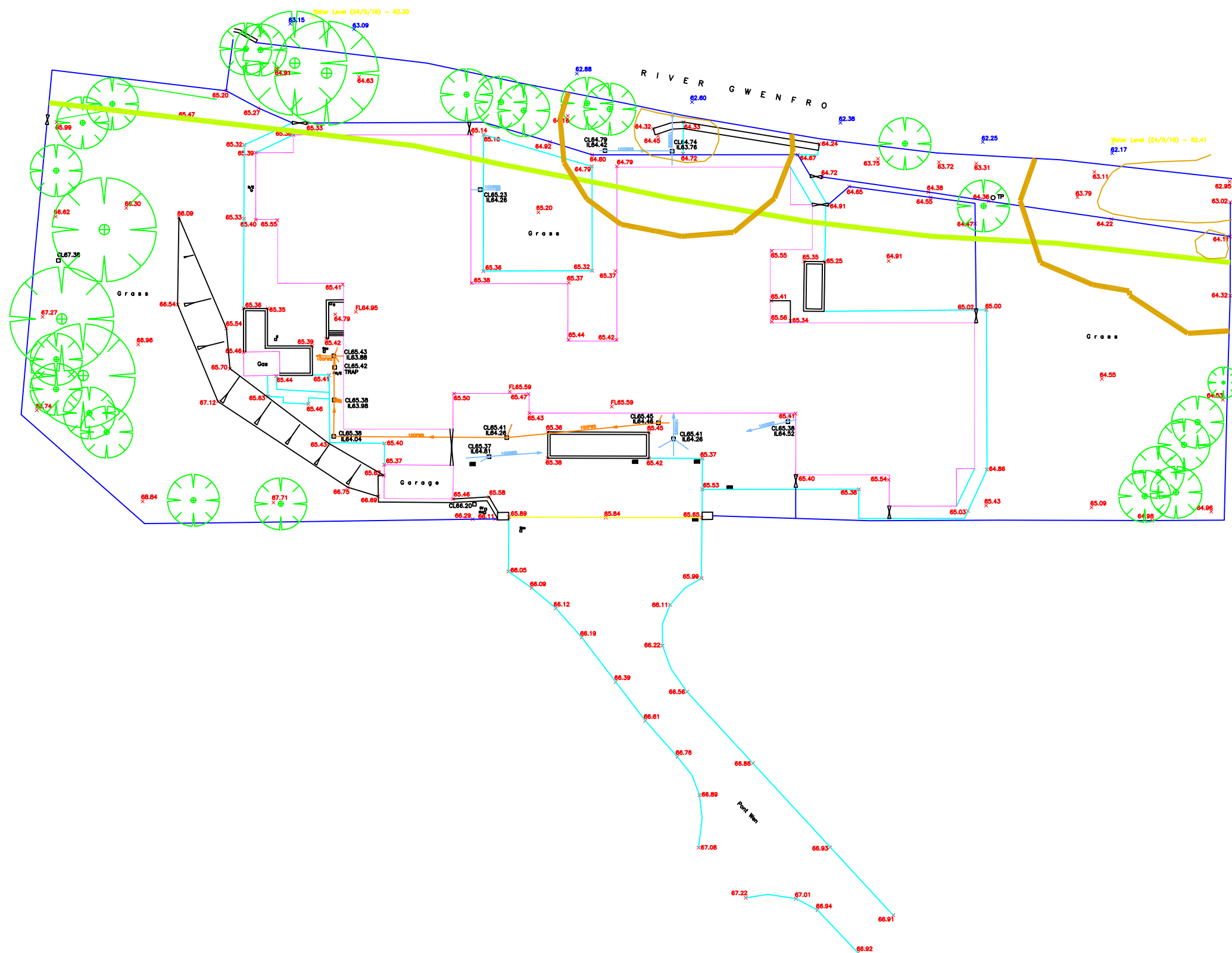
WREXHAM COUNTY BOROUGH COUNCIL.
STEPHEN T. BAYLEY
HEAD OF HOUSING AND ECONOMY,
RUTHIN ROAD,
WREXHAM, LL13 7TL
Tel: (01978) 315620 Fax: (01978) 315320

Project:
Proposed New Council Housing Development

Detail:
Site - Pont Wen - Indicative Layout

Drawn/Checked: GE	Date: April 2018	AutoCad File Ref:
Scale: 1:200 @ A1	Project No: PD2016/020	Dwg No: 01
		Rev:

6.2 TOPOGRAPHICAL SURVEY



Project:		Tel: 01787 290440		Fax: 01787 315320	
NANT SILYN OPH, WREXHAM					
Details:					
All levels to OS Datum.					
Drawn: MJ/RR		Date: 02/02		Print Issue Date:	
Checked:		Section:			
Scale: 1-200@A1		Drawing No:		Rev: 05/16	

6.3 PROPOSED AND EXISTING IMPERMEABLE AREAS

File name: I:\BWXH\100\FAST01\CORP PERMANENT\FAST01\WSPGROUP\COM\070507\X\07050799-100-01-A - EXISTING AND PROPOSED IMPERMEABLE AREA.DWG, printed on 05 December 2018 10:15:49, by Russell, Jason

DO NOT SCALE

DRAWING BACKGROUND IS BASED UPON © CROWN
COPYRIGHT. ALL RIGHTS RESERVED. LICENCE
NUMBER WL100018294



EXISTING SITE (4,440 SQ M)



IMPERMEABLE AREA = 1,935 SQ M
(BUILDINGS AND PAVED AREAS)



PERMEABLE AREA = 2,505 SQ M
(LANDSCAPED AREAS)

PROPOSED SITE



IMPERMEABLE AREA = 2,050 SQ M

P01	07/12/2018	JR	FIRST ISSUE	GNT	WJS
REV	DATE	BY	DESCRIPTION	CHK	APP
DRAWING STATUS:					



Opus House
Yale Business Village
Wrexham Technology
Park
Wrexham
LL13 7YL

T+ 44 (0) 1978 368 100
wsp.com

CLIENT:

PROJECT:

NANT SILYN

ARCHITECT:

TITLE:

EXISTING AND PROPOSED
IMPERMEABLE AREAS

SCALE @ A1:

1:250

CHECKED:

VM

APPROVED:

MW

PROJECT No:

0799

DESIGNED:

VM

DRAWN:

JR

DATE:

07/12/18

DRAWING No:

0799-100-01

REV:

P01

© WSP UK Ltd

1:250
@ A1
0 4 8 12 16 20 24 m

6.4 BOREHOLE LOGS

3.4 BOREHOLE LOGS

Borehole SJ34NE254

25.11.75

Site Investigation Specialist
Mining and Foundation Consultants
British Geological Survey

BOREHOLE RECORD SHEET No. 6

Geo - Civil
(Gustcrest Limited)
Hilton House,
7-11 Bury Road, Radcliffe, Lancs.
Telephone 061-724 6421

Date
Scale
Job No.
Location
Diameter
Ground level

Description of Strata	Legend	Depth	Thick- ness	Sample		SPT 'N' Value	Water levels and General Remarks
				Type	Depth		
SOIL, CLAY AND ASH FILL				SPT	0.91	7	
		2.20	2.20	SPT	1.83	10	
BROWN SAND AND GRAVEL				SPT	2.74	18	
		3.65	1.45				B.H. DRY
		END OF BOREHOLE					

Based upon records provided by British Geological Survey (NERC)

Borehole SJ34NE3

(11932) Wt.80370/0876 10,000 9/89 A.E.H.W.Ltd. Op.685

RECORD OF SHAFT OR BORE FOR MINERALS

60 28 SE / 15

37

34 NW / 3

6th Quarter Sheet 28 S.E.

1" N.S. Geol. Map 121

1" O.S. Geol. Map

Whether Confidential

Name and Number of Shaft or Bore given by Geological Survey:
No. A5 / 1 Borehole, WHITEGATE B.H.

Name and Number given by owner (if different from above):
N.C.B. A5/1 B.H.

Town or Village: Freshham Date of sinking: 25th Aug. - 29th Nov. 1946

Exact site: Whitegate, 250 yds. NE of Whitegate Farm.

Lat: 53° 02' 31" North

Long.: 2° 58' 37" West

Purpose for which made: 64-54 m.

Level at which bore commenced relative to O.D. 211.76' If not down bore, state if horizontal or up

Made by Messrs. John Thom Ltd., Patricroft for Messrs. N.C.B.

Information from Date received

Specimens Dip of strata

A sketch-map or tracing from a large-scale map is desirable.

GEOLOGICAL CLASSIFICATION	GEOLOGIST'S NOTES	BORER'S JOURNAL	THICKNESS	DEPTH
		DESCRIPTION		
	From test tube chippings by F.M. Trotter.			
	25.61	Sand & gravel with some boulders	10.67 35 0	10.67 35 0
GLACIAL DRIFT: To 84 ft.		Boulders, gravel & loose sand	10.87 34 0	21.54 69 0
ERBISTOCK BEDS: 84 ft. to 147 ft.		Gravel with coal streaks	4.57 15 0	25.81 84 0
25.61 44.82		Gravel and sand streaks, some coal	8.23 27 0	33.84 111 0
Red Sandstone		Red marl and sandstone	1.22 4 0	35.06 115 0
84' - 139'		Sandstone and marl	5.83 6 0	36.89 121 0
25.61 47.88		Shale and coal streaks	2.91 3 0	37.80 124 0
Variegated Shale		Grey shale	11.81 39 0	44.51 163 0
139' - 147'		Grey shale and coal streaks	0.71 3 0	50.11 166 0
COED-Y-ALT BEDS: 147' - 892'		Grey shale	3.05 10 0	53.16 176 0
47.18 44.92		Grey shale with very fine traces of coal	9.1 30 0	62.80 206 0
44.82 271.94		Grey shale	3.35 11 0	66.14 217 0
		Grey shale & yellow sandstone	2.74 9 0	68.88 226 0
		Grey shale, coal & fireclay	3.66 12 0	72.54 238 0
		Grey shale, fireclay, slight coal traces	1.83 6 0	74.37 244 0
		Grey sandstone and shale.	0.61 2 0	75.00 246 0
		Coal traces	3.05 10 0	78.05 256 0
		Grey shale and coal traces	0.91 3 0	78.96 259 0
		Grey shale (sandy)	3.66 12 0	82.62 271 0
Fine sandstone with limestone		Grey shale and sandstone	7.62 25 0	90.24 296 0
280' - 283'		Grey sandstone and shale	1.52 5 0	91.77 301 0
85.36 86.78		Sandy shale and marl traces	1.83 6 0	93.60 307 0
Not seen in test-tube chippings		Conglomerate	1.83 6 0	95.43 313 0
		Grey sandstone	3.66 12 0	99.09 325 0
Fireclay with some coal		Grey sandy shales	5.71 19 0	104.80 344 0
343' - 347'		Sandy shale	0.61 2 0	105.41 346 0
104.57 105.79		Coal	0.10 4	105.51 346 4
		Grey sandy shale	3.66 11 8	109.17 358 0
		Grey sandy shale and coal	0.91 3 0	110.08 361 0
		Sandstone	6.40 21 0	116.48 382 0
		Grey shale	2.13 7 0	118.61 389 0

carried forward /

GEOLOGICAL SURVEY AND MUSEUM, SOUTH KENSINGTON, LONDON, S.W.7.

G.S.M. Office File No.

Site marked on 6" Map by

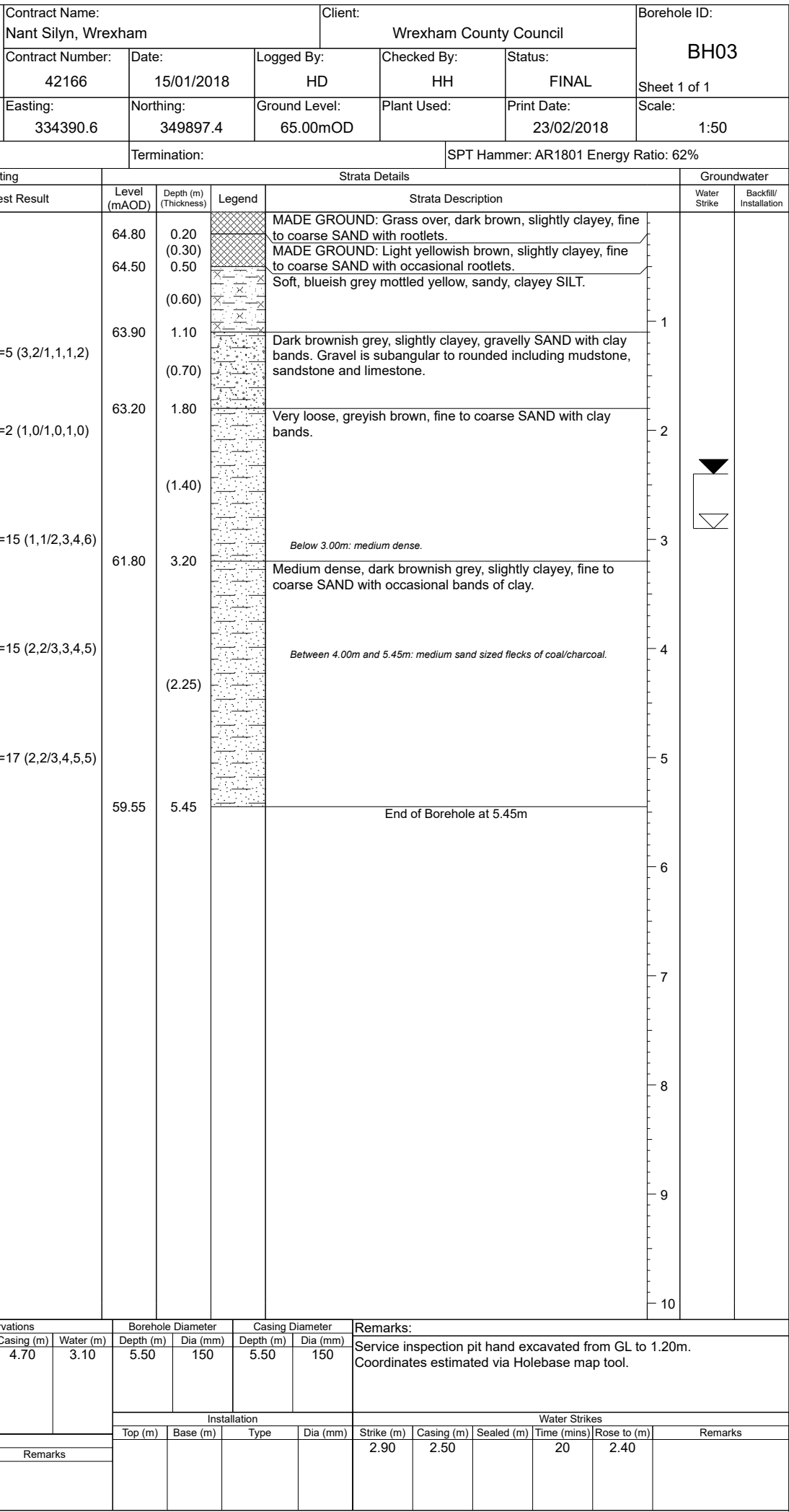
Site marked on 1" Map by

Based upon records provided by British Geological Survey (NERC)

		Contract Name: Nant Silyn, Wrexham			Client: Wrexham County Council			Borehole ID: BH01					
		Contract Number: 42166	Date: 12/01/2018	Logged By: HD	Checked By: HH	Status: FINAL	Sheet 1 of 1						
Cable Percussion Borehole Log		Easting: 334342.5	Northing: 349851.6	Ground Level: 65.40mOD	Plant Used:	Print Date: 23/02/2018	Scale: 1:50						
Weather:			Termination:			SPT Hammer: AR1801 Energy Ratio: 62%							
Samples & In Situ Testing				Strata Details				Groundwater					
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation					
0.20	D2	SPT(S) N=4 (1,3/1,1,1,1)	65.35	0.05		MADE GROUND: Tarmacadam.	1						
0.20	ES1		65.00	0.35		MADE GROUND: Grey, angular to subangular, fine to coarse GRAVEL including limestone.							
0.50	D5			0.40		MADE GROUND: Soft, dark blueish grey mottled black, gravelly, slightly sandy CLAY. Gravel is angular to subrounded, fine to coarse including mudstone, quartzite and tarmacadam.							
0.50	ES3			64.70					0.70				
0.50 - 1.00	B4								(0.70)	MADE GROUND: Soft, dark blueish grey, very gravelly, slightly sandy CLAY with high cobble content. Gravel is angular to subrounded, fine to coarse including mudstone, quartzite and brick. Cobbles are subangular to subrounded including quartzite, mudstone and brick.			
1.00	D7									64.00	1.40	Very loose, dark yellowish brown, slightly sandy, angular to rounded, fine to coarse GRAVEL including mudstone, quartzite and sandstone.	
1.00	ES6												
1.50	B8	SPT(S) N=4 (1,1/1,1,1,1)	62.60	2.80	Loose, dark brown, fine to coarse SAND with some fragments of coal.								
1.50 - 1.95													
2.50	B9 EW16	SPT(S) N=4 (1,1/1,1,1,1)	62.60	2.80	Loose, dark brown, fine to coarse SAND with some fragments of coal.	3							
2.50 - 2.95													
2.60	B10 D11	SPT(S) N=7 (1,1/1,2,2,2)	60.80	4.60	Medium dense, brown, slightly clayey, fine to coarse SAND.	5							
3.50													
3.50 - 3.95	B12 D13	SPT(S) N=15 (1,2/3,3,4,5)	60.80	4.60	Medium dense, brown, slightly clayey, fine to coarse SAND.	5							
3.50 - 3.95													
4.50	B14	SPT(S) N=13 (2,2/3,3,3,4)	59.40	6.00	End of Borehole at 6.00m	6							
4.50 - 4.95													
4.50 - 4.95	B15	SPT(S) N=13 (2,2/3,3,3,4)	59.40	6.00	End of Borehole at 6.00m	6							
5.50													
5.50 - 5.95													
5.95													
Start & End of Shift Observations			Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Service inspection pit hand excavated from GL to 1.20m. Coordinates estimated via Holebase map tool.				
12-01-2018	16:30	6.00	5.50	3.00	6.00	150	5.50	150					
Chiselling					Installation		Water Strikes						
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
								3.00	3.00		20	2.60	

	Contract Name: Nant Silyn, Wrexham			Client: Wrexham County Council			Borehole ID: BH02							
	Contract Number: 42166	Date: 11/01/2018	Logged By: HD	Checked By: HH	Status: FINAL									
Cable Percussion Borehole Log	Easting: 334365.2	Northing: 349873.4	Ground Level: 65.50mOD	Plant Used:	Print Date: 23/02/2018	Sheet 1 of 2 Scale: 1:50								
	Weather:		Termination:		SPT Hammer: AR1801 Energy Ratio: 62%									
Samples & In Situ Testing			Strata Details					Groundwater						
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation						
0.20	D2	56 blows. 80% recovery	65.45	0.05		MADE GROUND: Tarmacadam.	1							
0.20	ES1		65.30	0.20		MADE GROUND: Grey, angular to subangular, fine to coarse GRAVEL including limestone.								
0.50	D5		(0.95)			MADE GROUND: Brown, mottled black, very clayey, sandy, subangular to subrounded GRAVEL including quartzite, mudstone, brick and tarmacadam.								
0.50	ES3													
0.50 - 1.00	B4													
1.00	D7	64.40	1.10		Soft, brownish grey, slightly sandy, silty CLAY. <i>At 1.20m: low strength</i>									
1.00	ES6													
1.20 - 1.65	U8													
1.70	D9	SPT(S) N=11 (1,2/2,2,3,4)	63.60	1.90		2								
2.00	D1													
2.00	ES10													
2.00 - 2.45	B11													
2.00 - 2.45	D13													
2.20	EW14	62.50	3.00		3									
3.00	B15													
3.00 - 3.45	D16													
4.00	B17 D18	SPT(S) N=11 (1,1/2,3,3,3)	60.30	5.20	Medium dense, dark grey, clayey, fine to coarse SAND with bands of clay.	4								
4.00 - 4.45														
4.00 - 4.45														
5.00	B19 D20	SPT(S) N=12 (1,2/2,3,3,4)	60.30	5.20	Medium dense, dark grey, clayey, fine to coarse SAND with bands of clay.	5								
5.00 - 5.45														
5.00 - 5.45														
6.00	B21 D22	SPT(S) N=10 (2,2/1,2,3,4)	60.30	5.20	Medium dense, dark grey, clayey, fine to coarse SAND with bands of clay.	6								
6.00 - 6.45														
6.00 - 6.45														
7.00	D23	SPT(S) N=12 (2,2/3,3,3,3)	57.70	7.80	Medium dense, dark greyish brown, slightly clayey, fine to coarse SAND with bands of clay.	8								
7.50														
7.50 - 7.95														
7.50 - 7.95	B24 D25													
8.50	D26	SPT(S) N=12 (2,2/2,3,3,4)	57.70	7.80	Medium dense, dark greyish brown, slightly clayey, fine to coarse SAND with bands of clay.	9								
9.00														
9.00 - 9.45														
9.00 - 9.45	27 B28													
10.00		SPT(S) N=16 (2,3/3,4,4,5)				10								
Continued next sheet														
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
11-01-2018	16:50	10.50	10.00	4.60	10.50	150	10.00	150	Service inspection pit hand excavated from GL to 1.20m. Coordinates estimated via Holebase map tool.					
					Installation				Water Strikes					
					Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
									3.00	2.80		20	2.20	
Chiselling														
From (m)	To (m)	Duration	Remarks											

[illegible]





6.5 DCWW SEWER PLAN

PPA0003367



LEGEND(Representative of most common features)

Waste network:	Foul chamber	Outfall
Surface water chamber	LH	Lamphole
Combined chamber	Combined sewer overflow	Storm Overflow
Special purpose chamber	Rising main	Gravity sewer
Treatment works	Private sewer	Private sewer subject to Sect. 104 adoption agreement
Pumping station	Private Sewer Transfer	Lateral Drain
NB: Sewer symbol colour indicates the type.	Inspection Chamber	
RED - Combined		
GREEN - Surface Water		
BROWN - Foul		
Purple - Former S24 sewers (for indicative purposes only)		

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation.

Dŵr Cymru Cyfyngedig ('the Company') gives this information as to the position of its underground apparatus by way of general guidance only and on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the company's apparatus. The onus of locating apparatus before carrying out any excavations rests entirely on you. The information which is supplied by the Company, is done so in accordance with statutory requirements of sections 198 and 199 of the Water Industry Act 1991 which is based upon the best information available and, in particular, but without prejudice to the generality of the foregoing, it should be noted that the records that are available to the Company may not disclose the existence of a water main, service pipe, sewer, lateral drain or disposal main and any associated apparatus laid before 1 September 1989, or, if they do, the particulars thereof including their position underground may not be accurate. It must be understood that the furnishing of this information is entirely without prejudice to the provision of the New Roads and Street Works Act 1991 and the Company's right to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

**EXACT LOCATIONS OF ALL APPARATUS
TO BE DETERMINED ON SITE.**

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