

**YSGOL HAFOD Y WERN,
WREXHAM
NEW SCHOOL BUILDING**

Flood Consequence Assessment

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Document History

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Summary Statement of Flood Risks

Site Name and Address

Ysgol Hafod Y Wern Community Primary School,
Wrexham, LL13 9HD

Coordinates

X: 334840, Y: 350344

Size 3.75 ha

Current Use

Greenfield ☐

Brownfield disused ☐

Brownfield operational ☐

Residential ☐

Commercial ☐

Industrial ☐

Other ☒

Proposed Use

Residential ☐

Commercial ☐

Industrial ☐

Other ☒

Comment

Education

Comment

Education

Flood Zone

Z1

Vulnerability

No

Exception Test

N/A

Sequential Test

N/A

Other
Existing flood risk:

The site is located within the EAW Flood Zone 1, which means that the site is within an area with little or no risk (0.1% probability or less) of flooding from fluvial or tidal sources. The existing drainage systems on the site appear to operate effectively. An area to the south west of the site is said to be boggy and is prone to flooding. In lieu of the site investigation results it is unknown whether this is due to overland flows or high groundwater. Currently the risk of flooding from one of these sources is considered medium to high.

Effect on flooding of the proposal for change of the use of the units:

The additional surface water runoff due to the increase of surface coverage should be managed through appropriate flow balancing techniques and/or other suitable SUDS techniques. The overland flow routes for exceedance flows with allowance for climate change will be incorporated into the design. Flooding due to proposed artificial drainage and infrastructure failure is a low probability provided water supply and drainage systems are designed and installed in accordance with current guidelines and regulations. Cut off drains should be installed in order to divert overland flows. If it is found the site has a high water table ground water lowering will be required to reduce the risk to the site.

The overall assessment is that the proposed development does not present an increased flood risk at the site or elsewhere and that any residual flood risk can be managed through the implementation of suitable mitigation measures as recommended.

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GLOSSARY OF TERMS

Term	Meaning / Definition
bgl	Below ground level
CFMP	Catchment Flood Management Plan
CIRIA	Construction Industry Research and Information Association
DCWW	Welsh Water
EAW	Environment Agency Wales
EFO	Extreme Flood Outline (Boundary of floodplain associated with a flood event with a probability of occurrence of 0.1%)
FFL	Finished Floor Level
FCA	Flood Consequence Assessment
GPZ	Groundwater Protection Zone
LDF	Local Development FCamework
LPA	Local Planning Authority
m AOD	metres above Ordnance Datum
OS NGR	Ordnance Survey National Grid Reference
NPPF	National Planning Policy FCamework
PPS	Planning Policy Statement
SFCA	Strategic Flood Risk Assessment
SPZ	Source Protection Zone
SUDS	Sustainable Drainage Systems
WCBC	Wrexham County Borough Council

Flood Zone 1: Low Probability – comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).

Flood Zone 2: Medium Probability – comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of flooding from the sea (>0.5%) in any year.

Flood Zone 3: High Probability – comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

1 Introduction

1.1 National planning policy

The land use planning system regulates development and land use in the public interest, with the aim of ensuring sustainable development which balances environmental, economic and social needs of society both now and in the future. In England, a series of planning policy guidance statements provide advice on a number of subjects. Recently published National Planning Policy Framework (NPPF) (2012) replaced the existing Planning Policy Statement (PPS) 25 "Development and Flood Risk" (Dec 2006). It aims to reduce, or at the very least avoid increasing, flood risk, by ensuring an integrated approach to land use planning and flood risk management. To achieve this, local authorities are responsible for controlling development, including that in the floodplain which may be affected by flooding or affect flood risk elsewhere, or where changes in runoff may increase flood risk elsewhere.

Developers are required to provide an assessment demonstrating the following:

- ◆ Whether the proposed development is likely to be affected by flooding,
- ◆ Whether the proposed development will increase flood risk elsewhere,
- ◆ That the measures proposed to deal with the risks and effects can be successfully managed with minimum environmental effect,
- ◆ That the site can be developed and occupied safely.

1.2 Environment Agency Wales Requirements

The detail and complexity of a flood risk assessment should reflect the level of risk to the proposed development. Guidance is available in the EAW suite of guidance notes "Guidance on the minimum requirements for undertaking a flood risk assessment for planning applications". Inspection of the EAW flood risk mapping published on the EAW's website confirms that the site proposed for development of the Ysgol Hafod Y Wern School, is situated within Flood Zone 1. As the proposed site is less than 1 ha, the EAW guidance indicates that planning applications does not need to be accompanied by a Flood Consequence Assessment (FCA) that is submitted to the Local Planning Authority (LPA).

1.3 BREAM Assessment

This document has been produced to support the application for BREEAM accreditation of the proposed development.

1.4 CIRIA guidance

Guidance on flood risk assessment has been issued by CIRIA in 2004. The guidance recommends undertaking a three-level approach to flood risk assessment:

- ◆ **Level 1 FCA Screening study** - recommended for all development sites, to identify all potential flood risks and agree with the local

planning authority which aspects need to be addressed by a more detailed flood risk assessment.

- ◆ **Level 2 FCA Scoping study** – undertaken if the Level 1 study indicates that the site may be at risk from flooding, may affect maintenance access to existing or future flood defences, or may increase flood risk elsewhere due to loss of flood storage or increased runoff. This level of study should involve a review of existing information, and a qualitative assessment of potential flood risk due to the development and resulting from the development.
- ◆ **Level 3 FCA Detailed study** – undertaken if the Level 2 study shows that quantitative assessment is required. This study should assess the flood risk to the development and resulting from the development, as well as the effectiveness of any mitigation measures.

It is considered that there is sufficient information already available to complete an FCA appropriate to the scale and nature of the development. Therefore, the content of this FCA is based on a Level 2 FCA.

1.5 Supplementary Guidance

1.5.1 Catchment Flood Management Plans (CFMPs)

To quote from EAW's CFMP: The site is within CFMP boundary of the River Dee. Based on the CFMP (2010), the site is part of the Wrexham sub area. It covers mainly urban areas of Wrexham and outlying communities. The River Gwenfro runs from east to west across the catchment, connecting to the River Clwydog to the south east of Wrexham. The main source of flooding to Wrexham town centre is the River Gwenfro. Locations to the southwest of the town, such as Five Fords and Bowling Brook experience flooding from the River Clywedog. Many urban locations within Wrexham and outlying towns experience flooding from surface water run-off and local sewer systems. This affects property and roads. The current number of properties at risk for a 1% annual probability event is approximately 250.

The key message from the CFMP for the area is that the flood risk is considered to be low, medium and high; dependent upon the part of the sub-area, but it is considered that the flood risk is being managed effectively. Further action may need to be taken to keep pace with climate change.

The area is being managed under policy option 4 'areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change. Our vision includes improved integration of actions by all parties to manage all sources of flood risk. We will continue to maintain our defences, but it may not be justifiable to increase their height in the future. Our vision also includes:

- Increased emphasis on actions to manage the consequences of flooding;
- Increased community and individual awareness of their flood risks and adoption of actions both can take to help themselves.

2 Existing site

2.1 Introduction

Ysgol Hafod Y Wern Community Primary School is situated within an urban, residential area approximately 1km east of Wrexham.

The School is bounded:

- ◆ to the west by the Prince Charles Road;
- ◆ to the north by Deva Way;
- ◆ to the east and south by grasses areas including sports pitches called The Dunk.

The site location, approximate shape and aerial views are shown in Figure 2-1.



Figure 2-1 Site Location Plan

The location of the proposed new school building is to the south of the site.

2.2 Topography

A topographic survey of the site was undertaken in September 2007. The topographic survey is presented in Appendix A.

The site slopes from north to south. The northern boundary of the site is approximately 4m higher than the southern boundary. The Infant School to the north of the site had a ground level of approximately 67.20m and the Junior School, towards the centre of the site has a ground level of approximately 66.50m. There is a low spot towards the south west corner of the site, a level of

63.99m is recorded which is approximately 600mm lower than the level at the southern boundary.

The highest point on the site is at 68.71m AOD along the northern boundary of the site and the lowest point is at 63.99m AOD near the south west corner of the site.

2.3 Land use

Historic OS maps date from 1874. They indicate the site was primarily agricultural; Abenbury Lodge bounded the northern edge of the existing school site. This was the situation until sometime post 1937 and pre 1958 on which the school is first shown. By this time the area was predominantly residential. During the 1960's and 1970's a landfill was in operation immediately south of the site (Partially overlapping the southern boundary).

2.4 Watercourses

The nearest main river is River Gwenfro which is located approximately 300m south of the site across. The River Gwenfro runs from west to east across Wrexham, and connects to the River Clywedog approximately 2km south of the site.

On older maps, drains and streams, serving as tributaries to the River Gwenfro, are shown to the west and south of the site. In the 1960's these streams and drains are no longer shown. It is assumed that these watercourses have either been re-routed or culverted during development in the area.

2.5 Other Water Bodies

There are no other water bodies in the vicinity of the site.

2.6 Structures affecting local hydraulics

There is no evidence of other structures that would affect the local hydraulics in the vicinity of the site or impact on flood risk at the site.

2.7 Artificial Drainage Systems and Other Water Related Infrastructure

2.7.1 Private Drainage

The existing site is assumed to be drained by separate sewers.

A small number of surface water sewers are shown on the site topographical survey. These private surface water sewers are shown draining south to a manhole in the south west corner. A 225mm diameter outfall pipe is shown leaving the site. It is assumed to connect to a culverted watercourse to the south of the site.

There are no private foul drains shown on the topographical survey. The Welsh Water Sewer plans show a public foul pumping station and rising main to the west of the Junior School. It is assumed that this pumping station serves some or all of the existing school. There is a public combined sewer to which parts of the school building could drain. Further investigation of the existing drainage system is recommended

2.7.2 Public Sewers

Welsh Water sewer plans show that a public combined sewer crosses the site from east to west. A public foul sewer connects to the combined sewer and is laid beneath the Infant School. There is a public pumping station and rising main to the west of the junior school which is thought to accept flows from the private foul drainage system serving all or part of the school.

2.7.3 Ground Conditions

Review of the British Geological Survey indicates that the area is underlain by Salop formation bedrock, made up of mudstone, sandstone and conglomerate. This bedrock is overlain by Glaciofluvial sheet deposits – Devensian, made up of sands and gravels.

Historic boreholes in the vicinity of the school show that the site could be sand and gravel to a depth of 6m. With ground water at approximately 3m

These ground conditions confirm that there is a potential for infiltration structures at source to store surface water before it is eventually infiltrated into the ground.

3 Proposed development

3.1 Introduction

The scheme involves the construction of a new school building to the south of the site with associated hardstanding (total impermeable area 0.345ha). A new car park is proposed to the east of the site (Total impermeable area 0.35ha).

3.2 Surface Water Drainage

3.2.1 Impermeable Area Assessment

The proposed extension increases the paved areas on site by 6945 m². It comprises of (1) new school building, (2) new car park. That is in addition to the 12,500m² of roof and hardstanding at the existing school.

National Planning Policy Framework and PPS25 indicate that wherever there is an increase in impervious areas, surface water attenuation should be employed, to ensure flows and volumes are maintained at current levels. The proposed surface water drainage systems should typically aim to replicate the existing surface water drainage regimes to ensure that both peak flows and volumes discharging from the site are maintained at current levels. The following sections are detailing that proposal.

3.2.2 Discharge Locations

The Building Regulations - Approved Document H (2002 incorporating 2010 amendments) details a hierarchy of potential methods for disposing of surface water from a site as shown below:

- ◆ An adequate soakaway or some other adequate infiltration system; or where that is not practicable,
- ◆ A watercourse; or where that is not practicable,
- ◆ A sewer.

Following this hierarchy, the infiltration potential will be maximised within the proposed development.

Existing site investigations indicate that infiltration capacity of the underlying soil has good potential to utilising soakaways to dispose surface water from the site.

3.2.3 Peak Flow Rates and Volumes of Runoff

NPPF and PPS25 suggest that once the extent and discharge rates of the existing and proposed drainage systems have been established, the capacity of any necessary storage or other SUDS devices can be determined. The EAW has indicated that the NPPF and PPS25 recommendations relevant to climate change should be taken into account when undertaking drainage design calculations. Specifically, the rainfall intensity value should be increased by 30% for a design life for commercial developments of 100 years. Additionally, peak discharge rates at the end of the design life should be no greater than present day discharge rates.

For the purpose of this report, the peak greenfield runoff rates have been calculated using the Institute of Hydrology Report 124; Flood Estimation for Small

Catchments (1994) in the case that surface water infiltration is exceeded on site and the discharge off-site is required, the site is currently part urbanised (25%).

Table 3-1- Estimated Greenfield Runoff for Various Return Periods

Return period (years)	Greenfield runoff (l/s/ha)
1	6.8
30	12.8
100	14.8

Based on the above rates, the allowable discharge rates from the proposed development would reach 23.5l/s in a 1 in 1 year return period up to 51.1l/s in a 1 in 100 year storm.

The estimated volumes required to be stored have been calculated using the quick storage module of WinDES. The maximum required storages have been calculated for 1 in 30 year storm and 1 in 100 year storm, with allowance of 30% for climate change.

In addition to that, the volume of storage required to retain the first 5 mm of rainfall at source has been calculated. Overflow arrangements might be provided at proposed storage to ensure that volume of 172 m³ of surface water is always retained at source. Bearing in mind that the infiltration capacity of the underlying soil allows unknown, this may not be possible at this development.

Table 3-2- Estimated Volume of Storage

Parameter	Explanation	Estimated Volume of Storage for Stated Return Period (m ³)
5 mm	Required volume to be retained within the site for pollution control	172
44.2l/s	Discharge rate for 1 in 30 year	692
51.1l/s	Discharge rate for 1 in 100 year	1332 (incoming flow increased by 30% to allow for climate change)

Underground attenuation is proposed for volumes of storms up to 1 in 30 years in form of soakaways/underground attenuation tanks towards the south of the site – It is assumed that the existing school has no attenuation at present. The total designed volume of storage provided below ground within the soakaways/attenuation 692m³.

Cut off drains will be provided for drainage of overland flows draining to the south west corner. These could be in the form of swales or infiltration/filter trenches

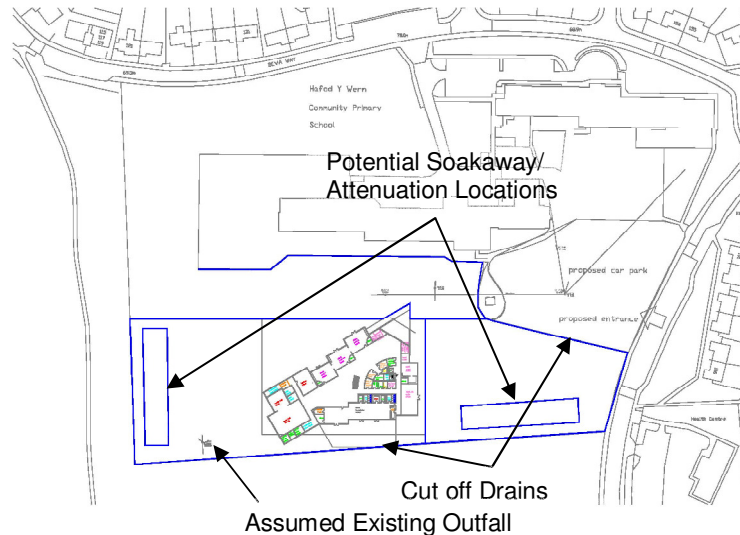


Figure 3-1 Location of Storage (outline)

Temporary storage over the ground could be provided in car parking areas within the kerbs for the runoff volumes above that threshold, but up to 1 in 100 years return period with allowance for climate change. In the vicinity of the outfall, storage could be retained within the cut off drains/swales and in a purpose landscaped overflow area or dry pond. This will ensure that the access road and the building are not affected and the attenuated volume is not spilled over the adjacent sites. For any flows above 1 in 100 years return period a free board of 300mm (green area in Figure 3-2) will be provided across the site to allow for temporary attenuation of exceedance flows. Evacuation of these flows will be provided via the cut-off drains and drainage channels located along the southern site boundary.

3.2.4 Sustainable Drainage Systems (SUDS)

NPPF, PPS 1 (Delivering Sustainable Development) and PPS25 (Development and Flood Risk) require that regional bodies and Local Authorities should promote the use of SUDS. The Flood and Water Management Act require that all new developments will need to consider using SUDS for surface water management on site. The successful implementation of SUDS will require the early consideration of a wide range of issues surrounding their management.

The rates of surface water runoff and volumes of storage on site could be reduced by SUDS techniques. Due to the proposed layout of the site, the following SUDS proposals have been considered:

- ◆ Cut off drains used to divert overland flows towards below ground storage in order to alleviate boggy ground to the south of the site.
- ◆ Pollution mitigation to be considered in car parking areas in order to ensure run off is not polluted with hydrocarbons.

Having in mind that the existing site drainage is private, the maintenance of the proposed drainage and SUDS system will remain the responsibility of the site owner.

4 Flood Risk Assessment

4.1 Introduction

A Flood Risk Assessment (FCA), based on the currently available information, has been undertaken to satisfy the requirements of national Planning Policy Framework (2012) and Planning Policy Statement (PPS) 25 “Development and Flood Risk” (Dec 2006) with the aim to demonstrate that the proposed development will reduce, or at the very least, avoid increasing flood risk. The assessment methodology broadly follows the industry standard guidance, CIRIA Report C624 ‘Development and flood risk – guidance for the construction industry’ (2004), with particular reference to Chapter 6: Flood risk assessment toolkit and Appendix A2: Technical guidance on flood risk assessment.

The FCA will identify:

- ◆ The flooding hazards which may threaten the proposed development or which the development may affect so as to increase flood risk elsewhere,
- ◆ Whether the proposed development could affect the integrity of a flood defence, or obstruct access to watercourses or flood defence assets for operation and maintenance,
- ◆ Whether the development could increase runoff,
- ◆ Suggest mitigation measures, where appropriate, to manage any flood risk resulting from the development of the site.

Information with respect to known flooding, available flood management documents, and existing drainage infrastructure including discharges from the site was sought via consultation with relevant stakeholders. The EAW provided feedback regarding the expected scope of the FCA, PPS25 guidance, discharge rates to include climate change, and use of SUDS.

4.2 Potential flood hazards

The potential flood hazards identified within the screening phase of the FCA process are summarised in Table 4-1(after CIRIA Report C624, Table A2.1). Further information on the potential sources of flood risk, their impact on flood risk at the site and possible mitigation measures that could be implemented to manage or reduce the flood risk is given in Sections 4.2.1 to 4.2.6.

Table 4-1 Significant Flood Hazard Identification

Question	Flood hazard							
	Fluvial	Sea	Estuaries	Groundwater	Overland flow	Artificial drainage systems	Infrastructure failure	Increased run-off
1. Is the development site next to the sea or any watercourse shown on Ordnance Survey maps?	x	x	x					
2. Is the development site, or part of the development site, identified as being at risk of flooding within available documentation?	x	x	x	x	x	x	x	
3. If a strategic flood risk assessment is available, is the development site, or part of the development site, identified as being at risk of flooding?	x	x	x	x	x	x	x	
4. If a flood zone map is available, is the development site, or part of the development site, within a High Risk zone?	x	x	x					
5. If a flood zone map is available, is the development site, or part of the development site, within a Low to Medium Risk zone?	x	x	x					
6. If a flood zone map is not available, is the development site, or part of the development site, situated on alluvium based on consideration of geological maps of the area?	x	x	x					
7. If there is an existing property on, or next to the site at the same level, is the property within a flood warning area?	x	x	x	x				
8. Are the LPA/FDA aware of any existing, historical or potential flooding problems that may affect the site?	x	x	x	x	x	x	x	
9. Do the physical characteristics of the site suggest that it may be prone to flooding?	x	x	x	✓	✓	x	x	
10. If a flood zone map is not available, is the development site, or part of the development site below 10mAOD AND does the FDA consider the development to be at risk of tidal flooding?		x	x					
11. Is the development located within a natural or artificial hollow, or at the base of a valley or at the bottom of a hill slope?				✓	✓			
12. Does examination of historical maps indicate any likelihood of flood risk at the site?	x	x	x	x	x			
13. Do the names of surrounding roads, areas or houses suggest the possibility of seasonal or historical flooding?	x	x	x	x	x			
14. Is the site likely to involve excavation / construction below existing ground levels (excluding foundations)?				x				
15. Is the land use upslope of the site such that the generation of overland flow may be encouraged, and can water from this area flow onto the site?					✓			
16. Are there any artificial drainage systems on or next to the site, at the same level, or upslope of, the site?						✓	x	
17. Is the development site protected by an existing flood defence?	x	x	x			x	x	
18. Is the development site protected by a flood control structure (eg flap valve, sluice gate, tidal barrier etc)	x	x	x			x	x	
19. Is the development site located upstream of a culvert which may be prone to blockage?	x		x	x	x	x	x	
20. Are water levels in a watercourse located in or next to a development site controlled by a pumping station?	x	x	x	x	x	x	x	
21. Is the development site next to or downstream/downslope of a canal?						x	x	
22. Is the development site downstream/downslope of a reservoir or other significant water body?						x	x	
23. Is there an increase in impermeable areas on site?								
Further comments required on flood risk within this FCA?	x	x	x	✓	✓	✓	x	✓

4.2.1 Watercourses (Fluvial, Sea and Estuaries)

The site is located within the EAW Flood Zone 1, which means that the site is within an area with little or no risk (0.1% probability or less) of flooding from fluvial or tidal sources. There is no evidence of flood risk from the Shotwick Brook. No other watercourses are located within a 500m radius of the site.

On the basis of this information, the risk of flooding of the proposed site from watercourses is considered to be insignificant.

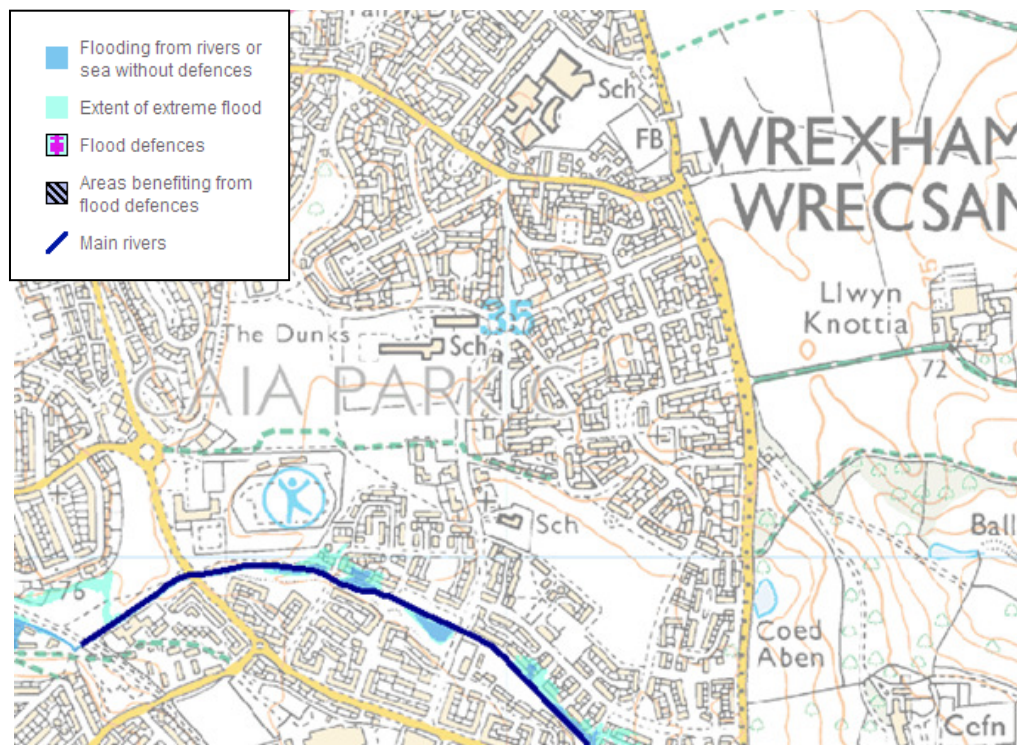


Figure 4-1 Flood Zone Map (EAW)

4.2.2 Groundwater

The south west corner of the site is boggy. This boggy area has been known to flood. It is not known at this stage whether this is due to groundwater at or above ground level or whether this is due to overland flow. Ground investigation results are awaited for the site. Historical bore hole records to the south of the site (Queensway Sports Complex) indicate that ground water is approximately 3m deep. If this is found to be the case within the Hafod Y Wern site then the likelihood of flooding due to groundwater is considered to be low. If the site is found to have high groundwater levels, the risk of flooding from ground water could be considered as medium to high and groundwater lowering may be required to reduce the risk of flooding on the site.

4.2.3 Overland Flow

As discussed in section 2.2 the site slopes from north to south with a low spot towards the south west corner of the site. On the basis of site observations and the topographic survey, the risk of flooding of in the south west corner of the site from overland flows is considered significant. A land drainage system incorporating cut off drains would need to be installed to reduce the risk of flooding to the south west corner of the site. A point of discharge for this land drainage would need to be found. Infiltration would need to be considered as a

first option. Depending upon the results of the site investigation and the possibility of a medium to high risk of groundwater flooding in the site (see 4.2.3) this might not be the most suitable option. It is assumed that the site discharges to a culverted watercourse to the south of the site, though this would need to be proven. If the discharge to a watercourse can be proven this would be a suitable discharge for the land drainage, which would need to be restricted to Greenfield run off. If the site discharges to a public sewer, obtaining consent to discharge land drainage to the public sewer system could be difficult.

4.2.4 Artificial Drainage Systems Failure

Artificial drainage systems and infrastructure within, or in close proximity to, the site may present a risk of flooding through the capacity of the systems being exceeded or the structural, hydraulic, geotechnical, mechanical or operational failure of the system infrastructure.

In the context of the Ysgol Hafod Y Wern School site, there either exists, or is likely to be installed as part of its development the following systems that may present a flood risk:

- ◆ Private foul and surface water sewers,
- ◆ Public foul sewers and pumping station
- ◆ Water mains within the site and in close proximity to the site,
- ◆ SUDS systems (as discussed in section 3.2.5.) for the collection and conveyance of surface water runoff within the site boundary.

The existing and proposed surface water and foul drainage systems may have a limited capacity and during periods of extremely wet weather could become overloaded leading to the possibility of flooding within the site. No other information, obtained to date, identifies this type of flood risk as a problem specific to the site.

For the purposes of this assessment it is assumed that the proposed foul and surface water runoff collection and conveyance systems to service the proposed development will be designed and installed in accordance with current guidance and regulations. Therefore, the risks of failure of the proposed on site drainage systems is not considered significant.

Residual risk of flooding or overland flows from the failure of artificial drainage systems within the proposed site will always remain. Provided normal building practices are adopted in relation to setting floor levels relative to the surrounding ground and features are incorporated that mitigate any residual risk by providing flow paths which divert flows away from the proposed buildings, on the site then the risk of flooding from failure of the water infrastructure is not considered to be significant.

Any SUDS system should be design in accordance with the CIRIA 697 ('SUDS manual and SUDS construction handbook') design guidance (2007). For the storm events above design standards, an overland flow route needs to be provided in accordance with the CIRIA 635 ('Designing for exceedance in urban drainage - good practice') Manual (2006).

4.2.5 Increased Runoff

The development proposals will increase the coverage of impermeable surface on the site. The additional surface water runoff should be managed through appropriate flow balancing techniques and/or other suitable SUDS techniques.

The ground investigation results are awaited, if the site is suitable, potential for use of infiltration techniques to manage surface water from the site should be utilised. If off-site discharge is required to the existing drainage system, only limited discharge would be allowed, providing adequate capacity within existing drainage system exists. Alternatively, attenuation should be provided to allow for complete infiltration of runoff from the proposed development within the site. Overland flow routes will be incorporated into the design.

5 BREEAM Requirements

This project aspires to achieve high BREEAM score. In that respect, both flood risk and pollution risk from surface water runoff from buildings and hard surfaces should be considered.

5.1 Flood risk

1. The Flood Risk Assessment indicates that there is a significant risk of flooding from overland flows and potentially from groundwater sources (pending the results of the site investigation). If the recommendations of this report are followed these risks can be reduced to a low probability. This will mean that there is a low probability of flooding from all sources

5.2 Flow control

1. Peak runoff rates from predevelopment site (greenfield runoff rates) have been presented in Table 3-1 including 1 in 100 year return period event. The designed drainage system should reduce flow from site to the rates associated with each storm event. An increase in flow of 30% in the 1 in 100 year event should be included to allow a tolerance within the system for climate change
2. Dependent upon the results of the site investigation, where possible infiltration will be utilised in order to reduce volume run off from the site post development.
3. Cut-off drains and drainage channels are proposed as presented in Figure 3-1. to protect the proposed building from exceedance flows and in the event of local drainage system failure and to reduce the risk of flooding on the site from overland flows.

5.3 Pollution control

1. If infiltration rates allow, the first 5 mm of rainfall will be retained within the site to provide pollution control.
2. Cut off drains will be used in areas of low pollution risk run off to divert overland flows.
3. Areas of medium and high risk pollution, such as from oil and petrol should be controlled using separators of appropriate SUDS techniques.
4. All pollution pretension systems should be designed in accordance with PPG3.

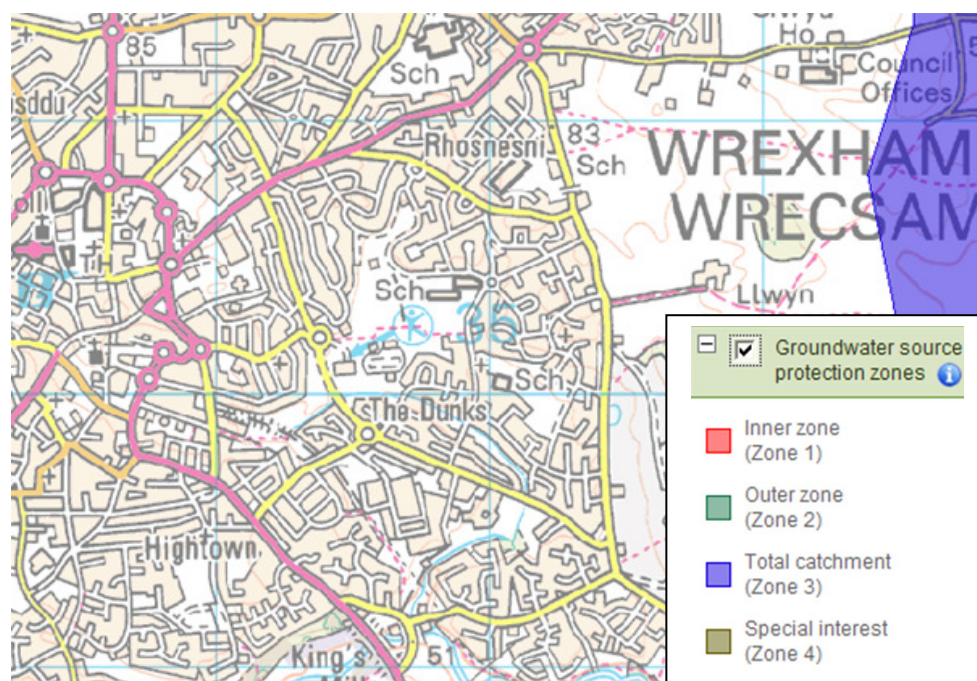


Figure 5-1 Groundwater Protection Zone (EAW)

6 Conclusions and Recommendations

6.1 Conclusions

A Flood Risk Assessment, that satisfies the requirements of national Planning Policy Framework (NPPF) and Planning Policy Statement (PPS) 25 “Development and Flood Risk” (2001), has been carried out for a new school building at Ysgol Hafod Y Wern, Wrexham to determine the potential flood risk associated with proposals to redevelop the site. The process has followed CIRIA guidance, report C624 ‘Development and flood risk – guidance for the construction industry’.

The following conclusions can be drawn from the work completed:

Existing flood risk:

- ◆ On the basis of the current published EAW Flood Zone mapping the site is within an area with little or no risk (0.1% probability or less) of flooding from fluvial or tidal sources,
- ◆ The existing drainage systems on the site should be investigated further to allow for an assessment of the suitability of the existing system.
- ◆ There is anecdotal evidence that the south west corner of the site is prone to flooding. It is assumed that this is either groundwater flooding, or flooding due to overland flows draining to a low spot in the site.

Future flood risk:

- ◆ The development proposals will increase the coverage of impermeable surface on the site. The additional surface water runoff should be managed through appropriate flow balancing techniques and/or other suitable SUDS techniques. As the ground investigation indicates that there is a potential for use of infiltration techniques to manage surface water from the site, this should be maximised providing retention of at least first 5 mm of rainfall within the site for pollution control. Alternatively, attenuation should be provided to allow for complete infiltration of runoff from the proposed development within the site. Overland flow routes and cut off drains should be incorporated into the design.
- ◆ Flooding due to proposed artificial drainage and infrastructure failure is a low probability provided water supply and drainage systems are designed and installed in accordance with current guidelines and regulations. The surface water from the site is managed in accordance with the CIRIA SUDS manual 697.
- ◆ The overall assessment is that the proposed development does not present an increased flood risk at the site or elsewhere and that any residual flood risk can be managed through the implementation of suitable mitigation measures.

6.2 Recommendations

The recommendations of this report are:

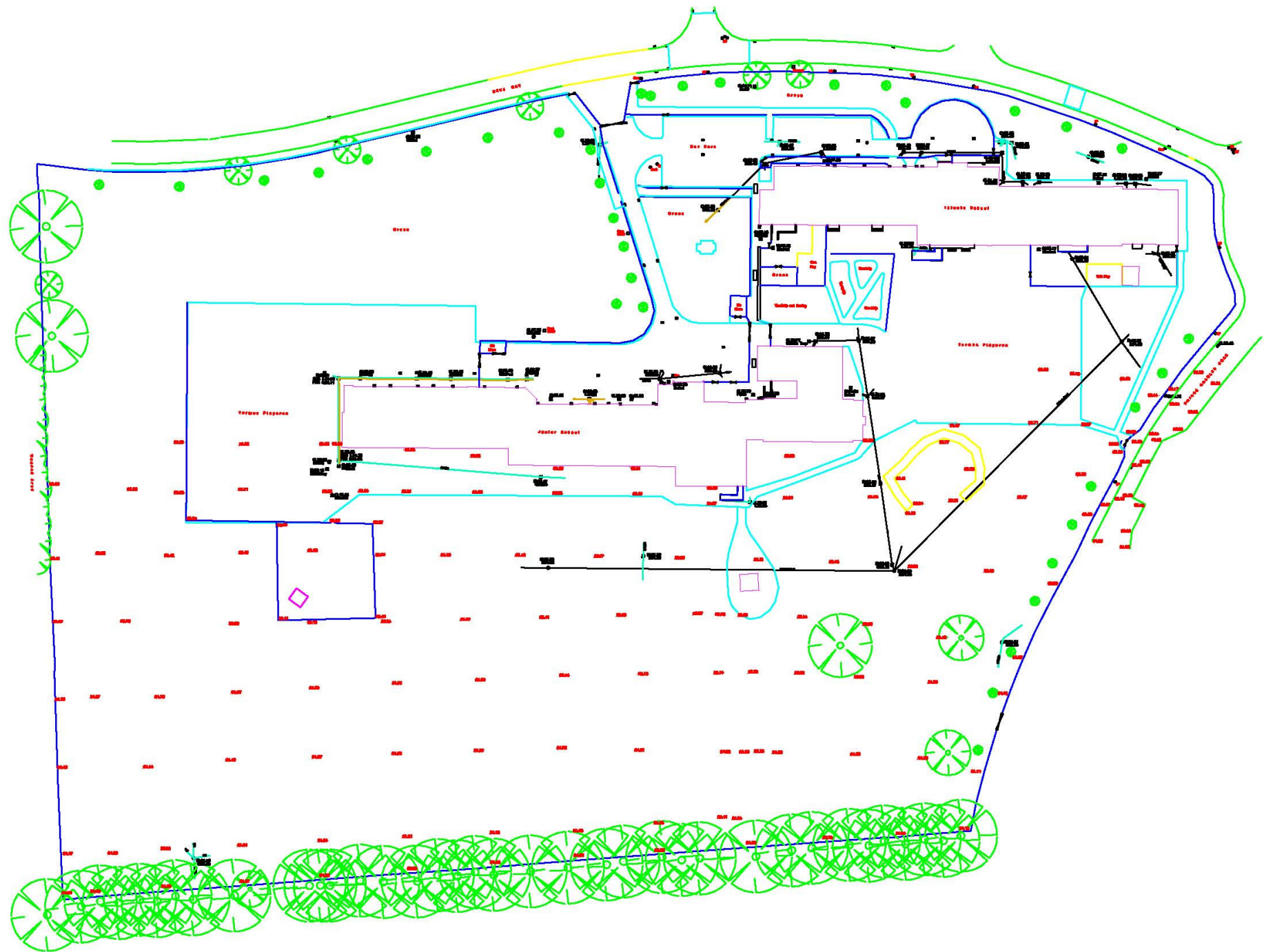
- ◆ Any required restriction in surface water discharges from the developed site should be managed through the implementation of flow balancing and suitable SUDS techniques. Operational management procedures should include robust maintenance regime for the drainage systems. Maintenance manual should be provided to the site maintenance staff to ensure adequate maintenance of SUDS.
- ◆ The nature, extent, and capacity of the existing on-site drainage systems within the site should be confirmed to assess their capacity in future taking into account potential increase of flows due to climate change and adequate measures should be proposed in the case that the insufficient capacity is anticipated. Managed overland flow routes as proposed should be incorporated into the design to avoid flooding of the site in the event of infrastructure failure of the existing drainage.
- ◆ Adequate cut-off drains and drainage channels should be provided to protect proposed building from overland flow during period of exceedance. These systems should provide adequate capacity to protect adjacent sites from overland flows escaping the proposed site.
- ◆ Water infrastructure within the site should be designed and installed in accordance with current guidelines, standards and regulations so it will not pose risk any risk to the adjacent properties due to the failure.
- ◆ As the existing private drainage system remains operational during the redevelopment, construction techniques and methods of working shall ensure that works to alter existing drainage systems and provide new drainage systems do not increase flood and pollution risks during the construction phase of the project.

7 Appendices

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***Appendix A: TOPOGRAPHIC
SURVEY***

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Project:
**HAFOD-Y-WERN CP SCHOOLS
WREXHAM**

Scale:
All levels in metres to assumed datum of 20.00m
taken on STR1 as indicated on plan

Drawn: CD/MAJ	Date: 08/07	Project Name/Date:
Checked:	Reviewed:	
Scale:	Drawing No:	Rev:
1-800	CEP430/CEP431	04/13

***Appendix B: PROPOSED SITE
LAYOUT***

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