# Environmental Statement

# Appendix 11.1: Flood Consequences Assessment and Drainage Strategy

## Land at Lower Berse Farm, Wrexham

On behalf of Redrow Homes Ltd

July 2024



# Lower Berse Farm, Ruthin Road, Wrexham

## Flood Consequences Assessment & Drainage Strategy

**July 2024**



Waterco

Assessment | Modelling | Design

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| Approval Record | |
|---|---|
| Author: | Paige Blundell BSc (Hons) PGCE MSc |
| Checker: | Aled Williams BSc (Hons) MCIWEM C.WEM |
| Approver: | Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM |

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This report will remain valid for a period of twelve months (from the date of last issue) after which the source data should be reviewed in order to reassess the findings and conclusions on the basis of latest available information.

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## Introduction

Waterco has been instructed to prepare a Flood Consequences Assessment (FCA) and Drainage Strategy in respect of a proposed residential led development at land south of Ruthin Road, Wrexham, LL11 3BW.

The purpose of this report is to outline the potential flood risk to the site, the impact of the proposed development on flood risk elsewhere, and the proposed measures which could be incorporated to mitigate the identified flood risk. This report has been prepared in accordance with the guidance contained in Planning Policy Wales (PPW) and Technical Advice Note 15 (TAN15): Development and Flood Risk.

This report also includes a Sustainable Drainage Strategy. The aim of the Sustainable Drainage Strategy is to identify water management measures, including Sustainable Drainage Systems (SuDS), to provide surface water runoff reduction and treatment. This report has been prepared in accordance with the Welsh Government 'Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems' (2018) – herein referred to as 'the Statutory Standards for SuDS'.

## Existing Conditions

The site covers an area of approximately 72.85ha and is centred on National Grid Reference (NGR) 331500, 349700. A location plan and an aerial image are included in Appendix A.

Online mapping (including Google Maps / Google Streetview imagery, accessed July 2024) shows that the majority of the site comprises agricultural land. Notable features on site include Lower Berse Farm in the north-western extent, a watercourse (unnamed) flowing east through the northern extent of the site and a bridleway crossing the centre of the site. Berse Lane intersects the site in the south-western extent. The site surrounds an existing telecommunications mast in the south-western extent.

The site is bordered by the A525 (Ruthin Road) to the north, agricultural land, Brickfield Rangers Football Club and Homestead Lane to the east, the B5099 (Bersham Road) to the south, commercial units to the south-west, and the A483 (road) to the west. Access to the site is provided from Ruthin Road, Berse Lane and Bersham Road.

### Local Topography

A topographical survey has been undertaken by RJP Surveying Consultants Ltd in December 2013. The topographical survey shows that the site slopes from 87.03 metres Above Ordnance Datum (m AOD) in the south-east to 110.97m AOD in the north-west.

Topographic levels to m AOD have also been derived from a 1m resolution Natural Resources Wales (NRW) composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM). The LiDAR data generally corroborates with the topographical survey. A LiDAR extract is provided as Appendix B.

## Ground Conditions

### Published Geology

The British Geological Survey (BGS) online mapping (1:50,000 scale) indicates that the central extent of the site is underlain by superficial deposits of Devensian Till, comprising diamicton. The eastern and western extents of the site are identified as being underlain by superficial Devensian Glaciofluvial Sheet Deposits comprising sand and gravel. A small extent of the site at the northern boundary is identified as being underlain by superficial deposits of Alluvium, comprising clay, silt, sand and gravel.

The superficial deposits are identified as being underlain by the Etruria Formation comprising mudstone and the Pennine Lower and Middle Coal Measures Formations comprising mudstone, siltstone and sandstone.

The geological mapping is available at a scale of 1:50,000 and as such may not be accurate on a site-specific basis.

### Ground Investigations

Ground investigations have been undertaken by E3P between 27th July and 3rd August 2021 to establish ground conditions at the site and to assess the infiltration potential. In total, 23no. trial pits were excavated to depths of between 1.8 and 2.9 metres below ground level (m.bgl), soakaway testing was undertaken at each location. 10no. windowless sample boreholes were also excavated at the site to depths of between 4.45-5.45m.bgl.

The soakaway test results, borehole logs and an exploratory location plan are included in Appendix C.

#### Geology

The geology identified in the windowless sample boreholes and trial pits generally comprised a mixture of sand, clay and gravel. The clay content within the trail pits varied across the site.

Made Ground was encountered within 2no. trial pits in the land parcel west of Berse Lane (trial pits 115 and 116). Made Ground generally comprised brown very gravelly sand and clay with fine to coarse, subangular to angular mudstone and sandstone and occasional coal fragments and cobbles.

#### Infiltration Testing

Infiltration testing in accordance with the BRE3655 specification was carried out within the 23no. trial pits. The infiltration test results show the ground to be of mixed permeability. At SA102 (north-western extent), SA103 (northern extent), SA108 (central extent) and SA123 (south-western extent) no reduction in water level was recorded after 48 hours and the infiltration tests failed. This is due to localised clay content within the trial pits. The infiltration rates for the remaining trial pits ranged from $6.35 \times 10^{-3}$ m/s to $9.80 \times 10^{-6}$ m/s.

### Hydrogeology

According to NRW's Aquifer Designation data, obtained from the BGS GeoIndex's online mapping [accessed July 2024], the underlying Devensian Till is classified as a Secondary A Aquifer. Secondary A Aquifers are '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. These are generally aquifers formerly classified as

minor aquifers'. The Devensian Glaciofluvial Sheet Deposits are classified as Secondary Undifferentiated Aquifers. Secondary Undifferentiated Aquifers are assigned in 'cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type'.

The underlying Etruria Formation and Pennine Lower and Middle Coal Measures Formations are also classified as Secondary A Aquifers.

### Local Drainage

Public sewer records have been obtained from Dŵr Cymru Welsh Water (DCWW) and are included in Appendix D. The DCWW sewer records show that there is a public combined sewer crossing the site flowing south-east. The public combined sewer varies in diameter across the site and is a maximum of 600mm.

There is no record of a formal drainage system serving the site.

## Development Proposals

An outline planning application is being submitted for residential development in the region of 1,450 dwellings, plus associated roads, open space, community facilities and a site for a primary school. An illustrative masterplan is included in Appendix E.

## Flood Zone Category and Policy Context

### Flood Zone Category

The Welsh Government Development Advice Map, included in Appendix F, shows that the majority of the site is located within Flood Zone A – an area considered to be at little or no risk of fluvial or tidal flooding, with a less than 0.1% (1 in 1000) annual probability of flooding.

Land at the north-eastern boundary adjoining Ruthin Road is identified as being located within Flood Zone C2 – an area considered at flood risk, without significant defence infrastructure, with a 0.1% (1 in 1000) or greater annual probability of flooding. The Flood Zone C2 extent in this location is associated with the unnamed watercourse which crosses the northern extent of the site and becomes culverted beneath Ruthin Road. The flood extent is shown immediately upstream of the Ruthin Road culverts indicating that the culverts are not of sufficient capacity to accommodate flood flows.

Land in the north-western extent of the site is also shown within Flood Zone C2. The Flood Zone C2 extent in this location is associated with the unnamed watercourse which crosses the northern extent of the site and generates as a result flood flows backing up behind an existing culvert beneath an agricultural land crossing.

Land immediately adjacent to the Flood Zone C2 extent is shown within Flood Zone B – an area known to have flooded in the past evidenced by sedimentary deposits.

The NRW 'Flood Risk from Rivers' map (Appendix F), shows that the majority of the site is outside of the extreme flood extent, meaning it has a less than 0.1% annual probability of flooding. Land at the north-eastern boundary adjoining Ruthin Road is identified is shown at 'high' risk of flooding from rivers, with a 3.3% (1 in 30) or greater annual probability of fluvial flooding. The high risk flood extent concurs with the Flood Zone C2 extent.

Land in the north-western extent of the site (concurring with the Flood Zone C2 extent) is shown at low risk of fluvial flooding, with between a 1% (1 in 100) and 0.1% annual probability of flooding.

## Development Vulnerability Classification

The proposed residential development is considered to be 'highly vulnerable' development in accordance with Figure 2 of the Welsh Government's Technical Advice Note 15 – Development and Flood Risk (TAN15).

TAN15 states that highly vulnerable development is considered appropriate in Flood Zone A subject to not increasing flood risk elsewhere.

TAN15 states that highly vulnerable development is not considered appropriate within Flood Zone C2. As part of the development, the following flood mitigation measures are proposed to ensure that all development will be located outside of the 0.1% annual probability (Flood Zone C2) extent:

- Maintain a flood storage area south-east of the Ruthin Road culvert.
- Raise the proposed access road off Ruthin Road (which will cross through the Flood Zone C2 extent) so that it is flood free during the 1% annual probability plus climate change and 0.1% annual probability events. Flood relief culverts (a box culvert) will be required beneath the raised access road to enable flood flows to be conveyed from the watercourse to the flood storage area in the north-eastern corner of the site.
- Size culverts beneath new access road crossings appropriately as to maintain the existing flow capacity of the channel.

## Local Policy

The Wrexham Unitary Development Plan 1996-2011 (adopted February 2005) is the current development plan for the county and contains the following policies relating to flood risk & drainage:

***'Policy GDP1 – Development Objectives***

*All new development should:…*

*i) Ensure that development does not result in, or is subject to, flooding, soil erosion, landslides or contamination either on or off the site…*

***Policy EC12 – Development and Flood Risk***

*Development (including the raising of land) within defined flood plains will only be permitted if it:*

*a) Would not be subject to an unacceptable risk of flooding on-site; and/or*

*b) Does not result in an unacceptable risk of flooding on or off-site; and/or*

*c) Does not adversely affect flood management or maintenance schemes.*

***Policy EC13 – Surface Water Runoff***

*Development which would result in an unacceptable adverse impact on the water environment due to additional surface water run-off will not be permitted.*

***Policy EC14 – Protection of Controlled Waters***

*Development which would have an unacceptable adverse impact upon the capacity, flow, quality or availability of controlled waters and associated land will not be permitted.'*

Draft policies from the emerging Local Development Plan pertaining to flood risk include:

***'Policy SP19: Climate Change***

*To mitigate against the effects of climate change and adapt to its impacts, development proposals will need to demonstrate that they have taken into account the following:*

*vi) Avoiding areas susceptible to flood risk in the first instance in accordance with the sequential approach set out in national guidance*

*vii) Preventing development that increases flood risk, and*

*vii) Assesses the potential effects of climate change when preparing a Flood Consequences Assessment for the site.*

***Policy DM1: Development Management Considerations***

*Development Proposals, where relevant, must:*

*i) Not increase the risk of flooding but makes adequate provision for sustainably dealing with foul and surface water drainage and not result in an unacceptable impact upon the water environment.'*

Local guidance documents including the Wrexham County Borough Council (WCBC) Preliminary Flood Risk Assessment (PFRA) (June 2011 and its 2017 addendum) have been reviewed and inform this report.

## Consultation

A pre-planning opinion request was submitted to NRW in April 2021. In their response (Appendix F), NRW have stated that:

***'Flood Risk Management***

*We understand the proposal is for highly vulnerable development housing and access roads. Our Flood Risk Map confirms the site to be partially within Zone C2 of the Development Advice Map (DAM) contained in TAN15.*

*We refer you to Section 6 of TAN15 and the Chief Planning Officer letter from Welsh Government, dated 9 January 2014, which affirms that highly vulnerable development and emergency services should not be permitted in Zone C2 (paragraph 6.2 of TAN15). The justification tests in paragraph 6.2 of TAN15 do not apply to highly vulnerable development or emergency services in Zone C2.*

*In consideration of the above, we will not provide any pre-application advice regarding flood risk, unless we receive written confirmation from the Planning Authority that there are overriding reasons for them to consider the proposals despite the site's location within Zone C2. In such circumstances, we would then review any submitted FCA. If the FCA fails to demonstrate that the consequences of flooding can be acceptably managed over the lifetime of the development, then we would object to the application.*

*Finally, as you may be aware, under the Town & Country Planning (Notification) (Wales) Direction 2012 and more specifically Category I relating to Flood Risk Area Development, where the Planning Authority is minded to grant permission, there is a requirement to refer applications for emergency services or highly vulnerable development within Zone C2 to Welsh Government.*

***Watercourses***

*An un-named ordinary watercourse runs through the site. An Ordinary Watercourse Consent may be required from the Lead Local Flood Authority for any works in, over, under or near an ordinary watercourse'.*

A meeting was held between Waterco, the Lead Local Flood Authority (LLFA) (Wrexham County Borough Council) and Redrow on 13th March 2024 to discuss concerns raised by the LLFA with regards to flooding and drainage. A summary of the meeting is provided below:

- It was acknowledged that the north-easternmost extent of the site (land within Flood Zone B and C2) is prone to frequent flooding, as recently as January 2024, and that flood water (surface water flooding) remains within this area (a known topographical depression) for several days following prolonged rainfall, or an extreme rainfall event.

- It was agreed that no residential development will be proposed within the existing flood extent in the north-eastern corner of the site and that the proposed access road which encroaches into the flood extent will be raised so that it is flood free during all considered flood events up to and including the 0.1% annual probability plus 45% climate change event. The access road is required in this location due to highway reasons (it is located at an existing field access and in the location of existing traffic signals on Ruthin Road).

- It was acknowledged that box culverts are preferred for all proposed access road crossings and that box culverts should be used beneath the proposed access road off Ruthin Road to link the existing watercourse in the northern extent of the site to the flood storage area in the north-eastern extent of the site.
- It was acknowledged that provision of a sustainable drainage system restricting runoff rates to the 1 in 1 year greenfield runoff rate for all events up to and including the 1 in 100 year plus 40% climate change event will reduce the surface water and fluvial flood risk in the north-eastern extent of the site during more extreme events i.e. the 1 in 30 and 1 in 100 year events.
- The flood risk in the north-eastern extent of the site can further be reduced through use of this area for public open space and planting, thereby reducing soil compaction and improving the drainage characteristics when compared to the current agricultural use.
- An ordinary watercourse consent will be required for all proposed watercourse access road crossings (new culverts).
- The existing culverts beneath Ruthin Road will be cleared of silt / debris and the inlets will be formalised with headwalls for ease of maintenance access.

## Sources of Flooding and Probability

### Fluvial

An unnamed watercourse flows east through the northern extent of the site and is culverted beneath Ruthin Road. The unnamed watercourse flow north-east beyond the site and joins the River Gwenfro approximately 385m north-east of the site. There is also an unnamed watercourse crossing the south-western extent of the site flowing south-east. The location of this watercourse is identified on the NRW 'Flood Risk from Surface Water and Minor Watercourses' map in Appendix F.

Other watercourses in the area include the River Clywedog which is located approximately 30m south of the site at its nearest point. The River Clywedog flows north-east in this location.

Fluvial flooding could occur if the unnamed watercourses overtopped their banks during or following an extreme rainfall event. The flood risk from the River Clywedog is considered to be very low. The site is situated approximately 10m above the River Clywedog and is outside of the extreme 0.1% annual probability flood extent associated with the River Clywedog.

The NRW 'Historic Flood Risk' map (Appendix F) indicates that there are no records of fluvial flooding affecting the site. However anecdotal information and online records (from social media posts and news articles) shows that flooding has previously occurred on Ruthin Road north of the site (north of the Flood Zone C2 extent on site). Frequent flooding is also recorded in the north-easternmost extent of the site (corresponding to land in Flood Zone C2), however the source is understood to be surface water flooding.

## Modelled Outputs

A hydraulic modelling study of the unnamed watercourses which cross the northern and south-western extents of the site has been undertaken by Waterco. Modelled outputs have been processed to create flood depth, velocity, hazard and water level mapping. Modelled outputs are provided for the existing (baseline) scenario and the development scenario (with proposed access road crossing culverts). Modelled output mapping is provided in Appendix G.

### *Existing Scenario*

As shown in Figure 1, during the 1% Annual Exceedance Probability (AEP) plus 20% climate change (CC) event, flooding is shown behind an existing culvert towards the centre of the site and is constrained to a wooded area. The Ruthin Road culverts are also shown to exceed their capacity with flood water collecting in the north-eastern extent of the site. The maximum water level in the north-eastern extent of the site is 93.86m AOD. The water level is sufficient for flood water to spill onto Ruthin Road.

Land in the north-eastern extent of the site currently shown at flood risk will be free of any development (proposed as an area of open space) and the existing flood storage function will be retained as part of the proposed development.

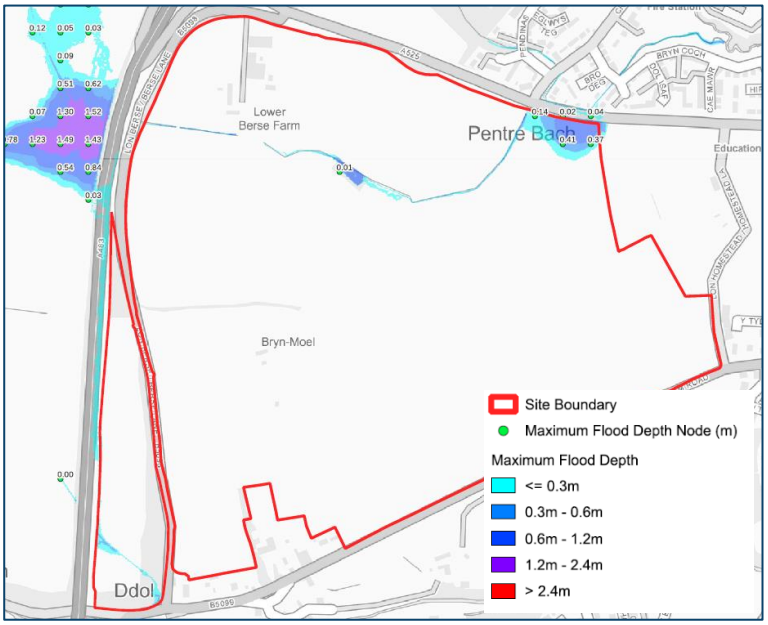



**Figure 1** – Existing Scenario 1% AEP plus 20% CC Event – Flood Depths (m)

As shown in Figure 2, during the 1% AEP plus 45% CC event, the flood extent is marginally increased when compared to the 1% AEP plus 20% CC event. The maximum water level in the north-eastern extent of the site increases to 93.89m AOD.

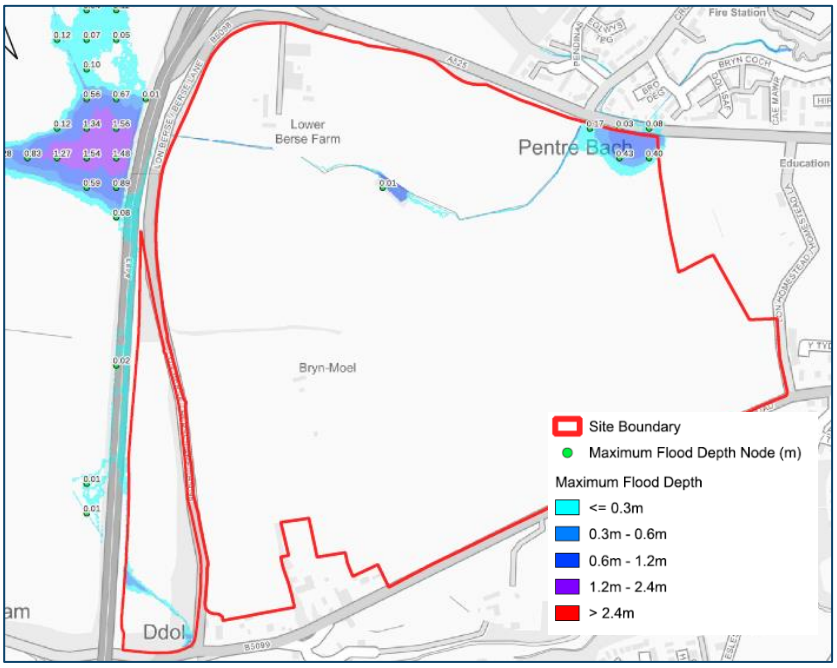



**Figure 2** – Existing Scenario 1% AEP plus 45% CC Event – Flood Depths (m)

Modelled outputs (Appendix G) show that during the 0.1% AEP event, the water level in the north-eastern extent of the site increases to 93.9m AOD. The water level increases slightly to 93.92m AOD during the 0.1% AEP plus 20% CC event and 93.93m AOD during the 0.1% AEP plus 45% CC event.

During all considered events, the flood mechanism is similar and flood flows are contained in the north-eastern corner of the site (which will be free of any built development) and in an area of existing woodland (which will be retained) towards the centre of the site.

The risk of flooding from the watercourse which crosses the south-western extent of the site has also been considered in the Waterco hydraulic modelling. As shown on the model outputs (Appendix G), flood flows are generally constrained to land immediately adjacent to the channel. No flooding is estimated in the location of the proposed development. An extract of the 0.1% AEP plus 45% CC flood depth map focusing on the watercourse in the south-western extent of the site is provided as Figure 3.




**Figure 3** – Existing Scenario 0.1% AEP plus 45% CC Event - South-Western Watercourse – Flood Depths (m)

### *Existing Blockage Scenario*

A number of blockage scenarios have been run for the existing scenario with outputs provided as Appendix G. Blockages have been simulated for the A483 Road Culvert west of the site, an existing 450mm culvert (which is to be retained) in the north-western extent of the site, and the Ruthin Road culverts. A 67% blockage amount has been applied.

As shown on the modelled outputs (Appendix G), a 67% blockage of the A483 road culvert and a 67% blockage of the existing 450mm culvert in the north-western extent of the site results in no increase in flood extents and depths within the site during all considered events. A 67% blockage of the Ruthin Road culverts results in an increased depth of flooding in the flood storage area in the north-eastern extent of the site and results in additional flood water spilling onto Ruthin Road.

### *Development Scenario*

As part of the proposed development, the following measures are proposed:

- Raise the proposed access road off Ruthin Road so that it is flood free during all considered events. The level of the proposed access off Ruthin Road has been set at to 95.36m AOD within the hydraulic model as to be flood free whilst also tying in with the existing level of Ruthin Road. 6no. 300mm pipes have been placed beneath the raised access road in the model to enable flood flows to be conveyed from the watercourse to the flood storage area in the north-eastern corner of the site. The culvert arrangement beneath the proposed access road will be reviewed further at the detailed design stage with preference given to the use of box culverts.

- Provide improvements to the watercourse channel within the site (re-profiling upstream of the Ruthin Road culvert) as to maximise the flood storage capacity on site.

- Introduce new culverts beneath new access road watercourse crossings on site. Land raising will be required adjacent to the access road watercourse crossings as to provide suitable ground cover above the proposed culverts. Box culverts are preferred for all new access road crossings.

The flood storage area south-east of the Ruthin Road culvert will be retained. The existing Ruthin Road culverts will also be retained to ensure no additional flow is conveyed downstream. The existing Ruthin Road culverts will be extended southward into the site beneath the proposed access road. New headwalls will be formed for ease of maintenance access.

A plan showing the flood mitigation measures / modifications proposed as part of the development is included as Appendix H. Modelled outputs for the proposed development scenario, inclusive of the proposed flood mitigation measures, are included in Appendix G.

With outline planning permission being sought and no information available at this stage in relation to final proposed site levels, the development scenario modelling of the proposed flood mitigation measures is considered conceptual and is provided as proof of concept. The development scenario modelling will be further refined at the reserved matters stage when proposed site levels are known and following detailed design of the proposed flood mitigation measures.

As shown in Figure 4, during the development scenario 1% AEP plus 20% CC event, the flood extent is similar to the existing scenario, however additional flood storage is shown within the watercourse channel on site. This is due to the proposed re-profiling of the channel to increase flood storage capacity on site. All proposed roads and properties are flood free. The flood extent and depths are similar (within 100mm) during the 1% AEP plus 45% CC event, 0.1% AEP event and 0.1% AEP plus 20% CC event.




**Figure 4 -** Development Scenario 1% AEP plus 20% CC Event – Flood Depths (m)

As shown in Figure 5, during the development scenario 0.1% AEP plus 45% CC event, the majority of the site is flood free. Minimal flooding encroachment is shown in the location of a proposed attenuation pond immediately south-west of the site access off Ruthin Road. The flood extents and depths to the proposed attenuation pond will be reviewed at the reserved matters stage once final site levels are known.

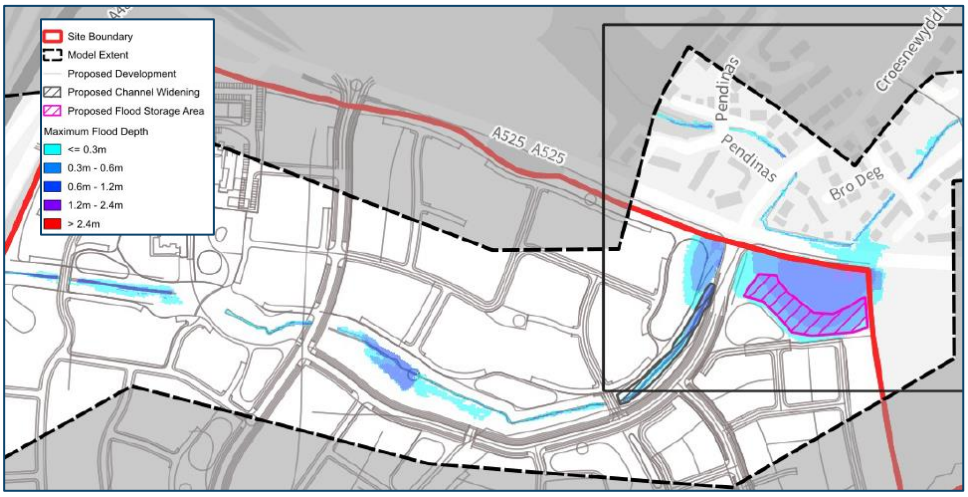



**Figure 5 -** Development Scenario 0.1% AEP plus 45% CC Event – Flood Depths (m)

When accounting for the proposed flood mitigation measures, it can be concluded that the risk of fluvial flooding to all developable areas of the site is very low. The north-eastern extent of the site, south-east of the Ruthin Road culvert, will be retained as a flood storage area.

## Tidal

The site is situated at a minimum of 87.03m AOD and is significantly above sea level. It can therefore be concluded that there is no risk from tidal flooding.

## Surface Water

Surface water flooding occurs when rainwater does not drain away through the normal drainage system or soak into the ground. It is usually associated with high intensity rainfall events but can also occur with lower intensity rainfall or melting snow where the ground is saturated, frozen or developed, resulting in overland flow and ponding in depressions in topography. Surface water flooding can occur anywhere without warning. However, flow paths can be determined by consideration of contours and relative levels.

The NRW 'Flood Risk from Surface Water and Minor Watercourses' map (Appendix F) shows that the majority of the site is at very low risk of surface water flooding, meaning it has a less than 0.1% annual probability of flooding. Isolated topographical low points within the site are shown at risk of surface water flooding.

There are no distinct flow routes in the area which would direct any potential off-site surface water flooding towards the site.

Surface water flooding is known to occur in a topographical low point the north-easternmost extent of the site (corresponding to land in Flood Zone C2). Flood water is known to pool for several days in this location following prolonged rainfall or an extreme rainfall event. No development is proposed within the surface water flood extent in the north-easter extent of the site.

The flood risk associated with surface water ponding within isolated low points will be removed or reduced post-development through provision of a sustainable drainage system which will limit surface water discharge to the 1 in 1 year greenfield runoff rate during all storm events up to and including the 1 in 100

year plus 40% climate change event.

It can therefore be concluded that the risk of surface water flooding is very low across all developable areas of the site.

### Sewer

Flooding from sewers can occur when a sewer is overwhelmed by heavy rainfall, becomes blocked, is damaged, or is of inadequate capacity. Flooding is mostly applicable to combined and surface water sewers.

The DCWW sewer records show that there is a public combined sewer of varying diameter crossing the site. There are also public sewers serving adjacent urbanised areas.

There are no records of sewer flooding at or near to the site. The site forms a relative high point within the wider local topography and there are no distinct flow routes in the area which would direct any potential sewer flooding towards the site.

It can be concluded that the risk of sewer flooding is very low.

### Groundwater

Groundwater flooding occurs when water levels underneath the ground rise above normal levels. Prolonged heavy rainfall soaks into the ground and can cause the ground to become saturated. This results in rising groundwater levels which leads to flooding above ground.

During ground investigations, groundwater strikes were encountered within 6 of the windowless sample boreholes and 1no. trial pit. Groundwater strikes were generally encountered as seepages, varying in depths of between 2m.bgl and 4m.bgl.

The PFRA states that *'there were no records of past groundwater flooding within WCBC; this is due to the topography and geology of the area'.*

It can therefore be concluded that the risk of groundwater flooding is low.

### Artificial Sources

There are no canals in the immediate vicinity of the site. The NRW 'Flood Risk from Reservoirs' map (Appendix F) shows that the site is not at risk of flooding from reservoirs.

It can therefore be concluded that the risk of flooding from artificial sources is very low.

### Summary of Potential Flooding

It can be concluded that fluvial flooding is the main potential source of flood risk at this site. The associated risk has been used to inform mitigation design.

## Mitigation

As part of the development the following flood mitigation measures are proposed to ensure all development will be located outside of the 0.1% annual probability (Flood Zone C2) extent:

- Raise the proposed access road off Ruthin Road so that it is flood free during all considered events. Culverts (box culverts) will be placed beneath the raised access road to enable flood flows to be conveyed from the watercourse to the flood storage area in the north-eastern corner of the site.
- Provide improvements to the watercourse channel within the site (re-profiling immediately upstream of the Ruthin Road culvert) as to maximise the flood storage capacity on site.
- Introduce new box culverts beneath new access road watercourse crossings on site. Land raising will be required adjacent to the access road watercourse crossings as to provide suitable ground cover above the proposed culverts.

The flood storage area south-east of the Ruthin Road culvert will be retained. The diameter of the existing Ruthin Road culverts will also be retained to ensure no additional flow is conveyed downstream. The existing Ruthin Road culverts will be extended southward into the site beneath the proposed access road.

All properties and roads will be flood free during the 0.1% AEP plus 45% CC event A flood free safe access / egress is available to all properties during this event. The mitigation measures will ensure that the development is compliant with Sections A1.14 and A1.15 of TAN15.

## Impact on Flood Risk Elsewhere

In order to quantify the impact of the development on flood risk elsewhere, a series of flood level difference maps have been created comparing the flood depths between the existing (baseline) and proposed development scenario modelling. Flood depth difference mapping is provided in Appendix G and has been produced for the 1% AEP plus 20% CC, 1% AEP plus 45% CC, 0.1% AEP, 0.1% AEP plus 20% CC and 0.1% AEP plus 45% CC events.

As shown in Figure 6, during the 0.1% AEP plus 45% CC event, a reduction in flood risk is noted to Ruthin Road. There is also a reduction in the in-channel water level downstream of the site. There is also a reduction in flood risk to Ruthin Road and downstream in-channel water levels during the 0.1% AEP and 0.1% AEP plus 20% CC events.

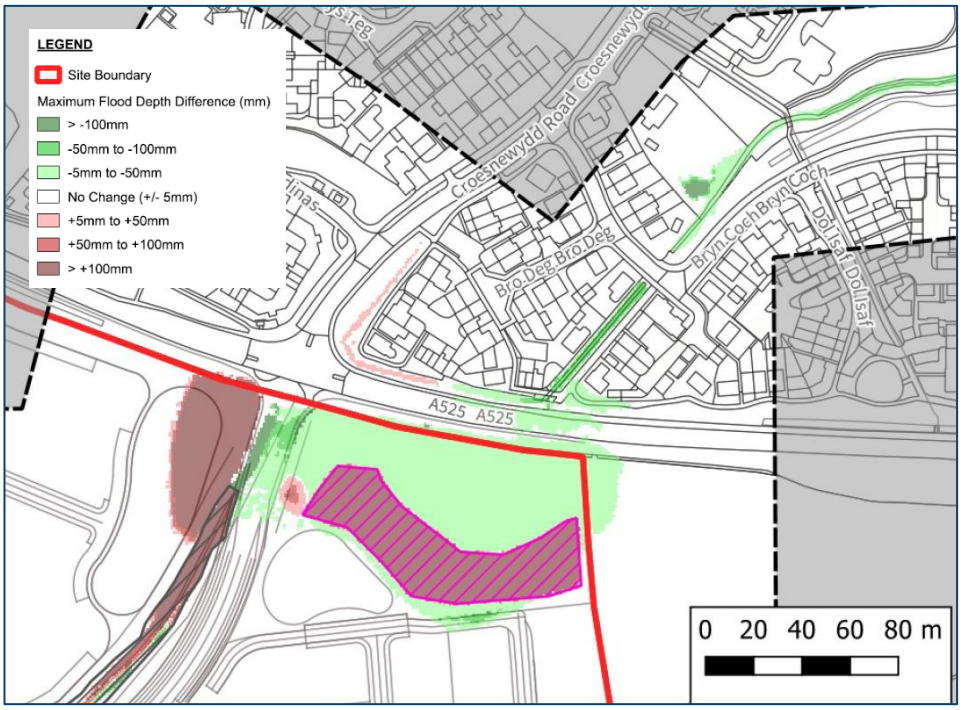



**Figure 6** – 0.1% AEP plus 45% CC Depth Difference

During the 1% AEP plus 20% CC event, the flood extent off-site remains unchanged, however a minimal increase (9mm) in flood depth is shown to a small section of Ruthin Road. There is no increase in flood risk to private land or property downstream (no increased flood risk to dwellings or their curtilage). Existing flood depths to Ruthin Road during the 1% AEP plus 20% CC event are generally less than 90mm. A similar scenario is shown during the 1% AEP plus 45% CC event.

As previously discussed, the impact on flood risk elsewhere will be further reviewed at the reserved matters stage when details of proposed site levels are known and following the detailed design of the proposed flood mitigation measures (channel re-profiling). Mitigation measures will ensure that there is no increase in flood risk to third party property or land.

## Surface Water Management

In accordance with TAN15, new development should not create additional runoff when compared with the undeveloped situation. In order to ensure the proposed development will not increase flood risk elsewhere, surface water discharge from the site will be controlled.

### Discharge Method

Standard S1 of the Statutory Standards for SuDS sets out the following hierarchy of drainage options:

*Priority Level 1: Surface water runoff is collected for use;*

*Priority Level 2: Surface water runoff is infiltrated to ground;*

*Priority Level 3: Surface water runoff is discharged to a surface water body;*

*Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system;*

*Priority Level 5: Surface water runoff is discharged to a combined sewer.*

#### Priority Level 1: Surface water runoff collected for use

In line with section G1.4 of the Statutory Standards for SuDS, rainwater harvesting is not proposed for this site as:

1. There is no foreseeable need to harvest water at the site as DCWW water resources and drought management plans do not identify potential stresses on mains water supplies;

2. The use of rainwater harvesting is not a viable/ cost-effective part of the solution for managing surface water runoff on the site, taking account of the potential water supply benefits of such a system.

With regards to point 2 above, section G1.6 of the Statutory Standards for SuDS states that; in most cases, rainwater harvesting alone will not be adequate to deal with the site drainage and provision will be required for an overflow to a Level 2 or lower priority runoff destination. As downstream provision of attenuation storage will be required to accommodate for rainwater harvesting system overflows, rainwater harvesting is not considered a cost-effective solution for managing surface water runoff.

Water butts will be used as to encourage external water re-use.

#### Priority Level 2: Surface water runoff is infiltrated to ground

Ground Investigations have been undertaken by E3P between 27th July and 3rd August 2021 to establish the infiltration potential. The infiltration test results show the ground to be of mixed permeability. At SA102, SA103, SA108 and SA123 no reduction in water level was recorded after 48 hours and infiltration techniques would therefore not be suitable in these locations.

The infiltration rates for the remaining trial pits range from 6.35 x $10^{-3}$ m/s to 9.80 x $10^{-6}$ m/s and appear

sufficient to support infiltration drainage techniques.

Where ground conditions allow, infiltration techniques such as individual property soakaways and permeable driveways will be utilised. Targeted infiltration testing should be undertaken at the reserved matters stage to inform the suitability and design of infiltration techniques.

Soakaways should be located a minimum of 5m from buildings and will be designed to accommodate the 1 in 100 year plus 40% climate change event.

### Priority Level 3: Surface water runoff is discharged to a surface water body

Where infiltration techniques are not suitable, a connection to watercourse is the next consideration.

Unnamed watercourses cross the northern and south-western extents of the site and form a suitable point of gravity discharge for runoff from the development in the northern and south-western extents of the site. To facilitate gravity drainage, development in the southern extent of the site would need to drain to the River Clywedog. It is understood that landowner agreement is in place to form a new piped connection for surface water flows from the site to the River Clywedog.

### Proposed Discharge Rates

In order to ensure the proposed development does not increase flood risk elsewhere, discharge to watercourse will be made at a limited discharge rate.

In order to establish the proposed limited discharge rate, the existing greenfield runoff rates have been estimated using the Revitalised Flood Hydrograph Model (ReFH2) method. A summary of the greenfield runoff rates for a range of events is provided as Appendix G. A summary of the 1 in 1 year greenfield runoff rate for each development parcel is included in Table 1.

**Table 1 - Greenfield Runoff Rates**

| Development Area (Taken from Masterplan) | Total Area (ha) | 1 in 1 Greenfield Runoff Rate (l/s) |
|---|---|---|
| Development Parcel A | 2.57 | 4.7 |
| Development Parcel B | 0.79 | 1.4 |
| Development Parcel C | 3.12 | 5.7 |
| Development Parcel D | 5.95 | 10.1 |
| Development Parcel E | 1.27 | 2.3 |
| Development Parcel F | 3.51 | 10.7 |
| Development Parcel G | 0.89 | 2.6 |

| | | |
|---|---|---|
| Development Parcel H | 1.52 | 2.8 |
| Development Parcel I | 1.84 | 3.4 |
| Development Parcel J | 3.53 | 6.4 |
| Development Parcel K | 3.74 | 6.9 |
| Development Parcel L | 2.15 | 3.9 |
| Development Parcel M | 2.94 | 5.4 |
| Development Parcel N | 1.89 | 3.5 |
| Development Parcel O | 2.39 | 4.4 |
| School | 1.62 | 3 |
| Local Centre Re-development | 1.46 | 2.7 |
| | | Total greenfield runoff rate = 79.9 l/s |

The overall discharge rate from the site will be limited to 79.9 l/s. This will provide significant runoff reduction during extreme storm events such as the 1 in 30 year event and 1 in 100 year plus 40% climate change event.

## Attenuation Storage

In order to achieve a limited discharge rate, attenuation storage will be required. Attenuation storage estimates have been provided using MicroDrainage and are included in Appendix H. The attenuation storage estimates are based on the 1 in 100 year plus 40% Climate Change (CC) design event, storage within a pond structure and hydro-brake flow control.

In absence of a detailed site layout, a contributing drainage area equivalent to 40% of the area of each residential development parcel has been applied. For the proposed school site, a contributing drainage area of 50% of the entire development parcel has been applied. For the proposed local centre, a contributing drainage area of 80% of the entire development parcel has been applied.

A summary of the estimated attenuation storage volume for each development parcel is provided in Table 2.

**Table 2 - Attenuation Storage Estimates**

| Development Area | Contributing Drainage Area (ha) | Attenuation Storage Required ($m^3$) |
|---|---|---|
| Development Parcel A | 1.03 | 1,122 |
| Development Parcel B | 0.31 | 341 |
| Development Parcel C | 1.25 | 1,364 |
| Development Parcel D & G | 2.73 | 2,983 |
| Development Parcel E | 0.51 | 553 |
| Development Parcel F | 1.4 | 1,528 |
| Development Parcel H | 0.61 | 660 |
| Development Parcel I | 0.74 | 797 |
| Development Parcel J | 1.41 | 1,538 |
| Development Parcel K | 1.5 | 1,631 |
| Development Parcel L | 0.86 | 1,382 |
| Development Parcel M | 1.18 | 1,274 |
| Development Parcel N | 0.76 | 819 |
| Development Parcel O | 0.956 | 1037 |
| School | 0.81 | 916 |
| Local Centre Re-development | 1.17 | 1,454 |
| | | Total attenuation storage required = 19,399$m^3$ |

The attenuation volumes are provided for indicative purposes only and should be reviewed at the reserved matters stage.

## Sustainable Drainage Systems

Where infiltration techniques are not feasible, attenuation storage should be provided in the form of Sustainable Drainage Systems (SuDS) where practical. It is proposed to utilise attenuation ponds within each development parcel for attenuation storage purposes. Swales will be used for flow conveyance and treatment along the main site access spine roads.

A summary of the proposed attenuation features and surface water discharge locations is provided in Table 3.

**Table 3 – SuDS Summary & Surface Water Discharge Locations**

| Development Area | SuDS Type and Location | Surface Water Discharge Location |
|---|---|---|
| Development Parcel A | Attenuation pond in northern extent | Watercourse crossing the northern extent of site |
| Development Parcel B | Attenuation pond in north-western extent | Watercourse crossing the northern extent of site |
| Development Parcel C | Attenuation pond in north-eastern extent | Watercourse crossing the northern extent of site |
| Development Parcels D and G<br><br>Attenuation will be split due to the large contributing drainage area. | Attenuation ponds in the eastern and southern extent of Parcel D | Watercourse crossing the northern extent of site |
| Development Parcel E | Attenuation pond in north-eastern extent | Watercourse crossing the northern extent of site |
| Development Parcel F. | Attenuation ponds in the north-eastern extent | Watercourse crossing the northern extent of the site |
| Development Parcel H | Attenuation pond in the south-eastern extent | Watercourse crossing the northern extent of site |
| Development Parcel I | Attenuation pond in the eastern extent | Watercourse crossing the northern extent of site |
| Development Parcel J<br><br>Attenuation will be split due to the large contributing drainage area and split topography | Attenuation ponds in the north-eastern and south-eastern extents | Watercourse crossing the northern extent of site & the River Clywedog (via tributary) |

| | | |
|---|---|---|
| Development Parcel K | Attenuation ponds in the southern extent | River Clywedog (via tributary) |
| Development Parcel L | Attenuation pond in the western extent of Parcel 0 | River Clywedog (via tributary) |
| Development Parcel M | Attenuation pond in the south-eastern extent | River Clywedog (via tributary) |
| Development Parcel N | Attenuation pond in the southern extent | Unnamed watercourse crossing southern extent of development parcel |
| Development Parcel O | Attenuation pond in the western extent | River Clywedog (via tributary) |
| Primary School | Permeable Paving, below ground storage (attenuation tank), rain gardens | River Clywedog (via tributary) |
| Local Centre Re-development | | Watercourse crossing the northern extent of site |

A plan showing the route of the proposed piped connection to the River Clywedog, via a small tributary of the River Clwyedog south of the site, is included in Appendix I. Based on discharge at the limited 1 in 1 year greenfield runoff rate, up to 26.8 l/s will be discharged to the River Clywedog. A 300mm pipe diameter is likely to be sufficient. A 3m standoff (protection strip) should be provided either side of the proposed pipe discharging to the River Clywedog.

## Concept Surface Water Drainage Scheme

Where feasible, infiltration drainage techniques will be used in the form of individual property soakaways and permeable paving on private driveways.

Where infiltration techniques are not feasible, surface water runoff will be discharged to the unnamed watercourses crossing the site and the River Clywedog (via an unnamed tributary). Discharge will be made at the limited 1 in 1 year greenfield runoff rate. Attenuation storage will be required to accommodate storm events up to and including the 1 in 100 year plus 40% CC allowance event. Attenuation storage in the form of attenuation ponds will be distributed across the site. Swales will be utilised alongside the main access spine roads.

The proposed surface water drainage scheme will ensure no increase in runoff over the lifetime of the development.

## Exceedance Event

Storage will be provided for the 1 in 100 year plus 40% CC event. Storm events in excess of the 1 in 100 year plus 40% CC event should be permitted to produce temporary shallow depth flooding within access roads

and public open spaces.

## Surface Water Treatment

The Statutory Standards for SuDS sets out the following guidance for surface water treatment:

***S3 - Surface water quality management***

*Treatment for surface water runoff should be provided to prevent negative impacts on the receiving water quality and/or protect downstream drainage systems, including sewers.*

In accordance with the CIRIA C753 publication 'The SuDS Manual' (2015), residential roofs have a 'very low' pollution hazard level, with roads (with greater than 300 traffic movements per day) classified as having a 'medium' pollution hazard level. Other roofs (applicable to the school and local centre), individual property driveways and low traffic roads are classified as having a 'low' pollution hazard level. Table 4 shows the pollution hazard indices for each land use.

**Table 4 – Pollution Hazard Indices**

| Land Use | Pollution Hazard Level | Total Suspended Solids (TSS) | Metals | Hydrocarbons |
|---|---|---|---|---|
| Residential roofs | Very Low | 0.2 | 0.2 | 0.05 |
| Other roofs (typically commercial/industrial roofs) | Low | 0.3 | 0.2 | 0.05 |
| Individual property driveways, residential car parks, low traffic roads and non-residential car parking with infrequent change i.e. <300 traffic movements/day | Low | 0.5 | 0.4 | 0.4 |
| All roads except low traffic roads and trunk roads | Medium | 0.7 | 0.6 | 0.7 |

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.2

* Indices values range from 0-1.

Runoff from roofs and roads within individual development parcels will be directed to attenuation ponds. Runoff from the main site access spine roads will be directed to swales and attenuation ponds. Table 5 demonstrates that ponds and swales will provide sufficient treatment.

**Table 5 – SuDS Mitigation Indices**

| | Mitigation Indices | | |
|---|---|---|---|
| **Type of SuDS** | **Total Suspended Solids (TSS)** | **Metals** | **Hydrocarbons** |
| Swale | 0.5 | 0.6 | 0.6 |
| Pond | 0.7 | 0.7 | 0.5 |
| Swale & Pond in Series | 0.5 + (0.7 x 0.5) = 0.85 | 0.6 + (0.7 x 0.5) = 0.95 | 0.6 + (0.5 x 0.5) = 0.75 |

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.3

### Amenity

The Statutory Standards for SuDS provide the following guidance in relation to Standard S4 – Amenity:

*'The design of the surface water management system should maximise amenity benefits.'*

The proposed development will include attenuation ponds, swales and other SuDS features which will maximise the amenity value of the proposed drainage system.

### Biodiversity

The Statutory Standards for SuDS provide the following guidance in relation to Standard S5 – Biodiversity:

*'The design of the surface water management system should maximise biodiversity benefits.'*

The proposed development will include attenuation ponds, swales and other SuDS features which will maximise the biodiversity value of the proposed drainage system.

## Construction, Operation and Maintenance

Standard S6 of the Statutory Standards for SuDS states:

***S6 – Design of drainage for Construction, Operation and Maintenance***

1) All elements of the surface water drainage system should be designed so that they can be constructed easily, safely, cost-effectively, in a timely manner, and with the aim of minimising the use of scarce resources and embedded carbon (energy).

2) All elements of the surface water drainage system should be designed to ensure maintenance and operation can be undertaken (by the relevant responsible body) easily, safely, cost-effectively, in a timely manner, and with the aim of minimising the use of scarce resources and embedded carbon (energy).

3) The surface water drainage system should be designed to ensure structural integrity of all

elements under anticipated loading conditions over the design life of the development site, taking into account the requirement for reasonable levels of maintenance.

All drainage systems will be readily accessible for maintenance access. The proposed drainage system will be offered to the SAB for adoption.

Maintenance schedules for an attenuation pond, swales and permeable paving are included in Appendix J.

## Foul Drainage

Foul flows will be discharged to the public sewer which crosses through the site, or at a point downstream of the site. The connection point(s) have been agreed with DCWW through completion of a Hydraulic Modelling Assessment (HMA). The HMA has identified options for upgrading the sewer network (with options including both off-site upgrades and on-site upgrades) in order to ensure foul flows generated by the development do not cause detriment elsewhere. Upgrades to the public sewer network will be made prior to first occupation of the proposed dwelling.

It is understood (from discussion with DCWW) that the DCWW Five Fords wastewater treatment works can provide sufficient phosphate reduction. This enables connections from new developments to be made without the requirement for developers to provide on or off-site phosphate mitigation. DCWW have advised that the Five Fords wastewater treatment works will be upgraded in the next AMP (Asset Management Plant) cycle (between 2025 and 2030) to increase its capacity, ensuring foul flows from the proposed development will not increase spill volumes at the treatments works overflow (CSO).

## Other Considerations

Maintenance access to the unnamed watercourses should be retained. Maintenance access can be ensured by providing an 8m buffer either side of the watercourse.

An ordinary watercourse consent will be required for any new access road crossings (culverts) over existing watercourses within the site.

New headwalls will be required on the Ruthin Road culvert as to improve ease of maintenance. The existing culverts will require jetting / clearance to remove siltation.

The public combined sewer crossing the site will be diverted as part of the development. The diversion design and route will be agreed with DCWW.

## Conclusions

An outline planning application is being submitted for residential development in the region of 1,450 dwellings, plus associated roads, open space, community facilities and a site for a primary school.

### Flood Risk

The majority of the site is located within Flood Zone A on the Welsh Government Development Advice Map – an area considered to be at little or no risk of fluvial or tidal flooding, with a less than 0.1% (1 in 1000) annual probability of flooding.

Land at the north-eastern boundary adjoining Ruthin Road is identified as being located within Flood Zone C2 – an area considered at flood risk, without significant defence infrastructure, with a 0.1% (1 in 1000) or greater annual probability of flooding. The Flood Zone C2 extent in this location is associated with the unnamed watercourse which crosses the northern extent of the site and becomes culverted beneath Ruthin Road. The flood extent is shown immediately upstream of the Ruthin Road culvert indicating the culvert is not of sufficient capacity to accommodate flood flows.

Land in the north-western extent of the site is also shown within Flood Zone C2. The Flood Zone C2 extent in this location is associated with the unnamed watercourse which crosses the northern extent of the site and generates as a result flood flows backing up behind an existing culvert beneath an agricultural land crossing.

The risk of flooding from all sources has been assessed. The main potential source of flooding at this site is fluvial flooding from the unnamed watercourse which flows through the northern extent of the site. There is also a risk of surface water flooding (from rainfall ponding) within an isolated topographical low point in the north-eastern extent of the site (corresponding to land in Flood Zone C2). Surface water flooding in this location occurs frequently.

Detailed hydraulic modelling of the watercourse which crosses through the northern extent of the site has been undertaken.

As part of the development the following flood mitigation measures are proposed to ensure all development will be located outside of the 0.1% annual probability (Flood Zone C2) extent and compliant with A1.14 and A1.15 of TAN15:

- Raise the proposed access road off Ruthin Road so that it is flood free during all considered events. Box culverts will be placed beneath the raised access road to enable flood flows to be conveyed from the watercourse to the flood storage area in the north-eastern corner of the site.
- Provide improvements to the watercourse channel within the site (re-profiling upstream of the Ruthin Road culvert) as to maximise the flood storage capacity on site.
- Introduce new culverts beneath new access road watercourse crossings on site. Some land raising will be required adjacent to the access road watercourse crossings as to provide suitable ground cover above the proposed culverts.

The flood storage area south-east of the Ruthin Road culvert will be retained. The diameter of the existing Ruthin Road culverts will also be retained to ensure no additional flow is conveyed downstream. The existing Ruthin Road culverts will be extended southward into the site beneath the proposed access road.

The impact of the proposed development on flood risk elsewhere has been considered by comparing modelled outputs for the existing (baseline) and proposed development scenarios. The proposed development does not increase flood risk elsewhere during the 0.1% AEP, 0.1% AEP plus 20% CC and 0.1% AEP plus 45% CC events. During the 1% AEP plus 20% CC event and the 1% AEP plus 45% CC event, no impact is shown to private land or properties.

### Drainage

The proposed development will introduce impermeable drainage area in the form of buildings and access roads. This will result in an increase in surface water runoff. In order to ensure the increase in surface water runoff will not increase flood risk elsewhere, sustainable drainage systems will be used to accommodate storm events up to and including the 1 in 100 year plus 40% climate change event on site.

All methods of surface water discharge have been assessed. Ground investigations including infiltration testing shows that infiltration techniques appear feasible in a number of locations on site. However, due to clay content across parts of the site, infiltration techniques will not be suitable to accommodate surface water runoff from the entirety of the site.

Where infiltration techniques are feasible, individual property soakaways will be used together with permeable surfacing on private driveways.

Where infiltration techniques are not feasible, surface water runoff will be discharged to the unnamed watercourses crossing the site and the River Clywedog. Discharge will be made at the limited 1 in 1 year greenfield runoff rate during all events up to and including the 1 in 100 year plus 40% CC event, thereby providing flood risk reduction during extreme rainfall events over the current scenario. Attenuation storage will be required to accommodate storm events up to and including the 1 in 100 year plus 40% CC allowance event. Attenuation storage in the form of attenuation ponds. Swales will be placed along the main site access spine roads to provide flow conveyance and treatment.

Foul flows will connect to the public sewer subject to upgrades of the public sewer system and timely completion of the DCWW Five Fords wastewater treatment works upgrades.

A Concept Designer's Risk Assessment (cDRA) has been prepared to inform future designers of any identified hazards associated with the scheme. The cDRA has been included in Appendix K.

## Recommendations

1. Submit this Flood Consequences Assessment and Drainage Strategy to the Planning Authority in support of the Planning Application.

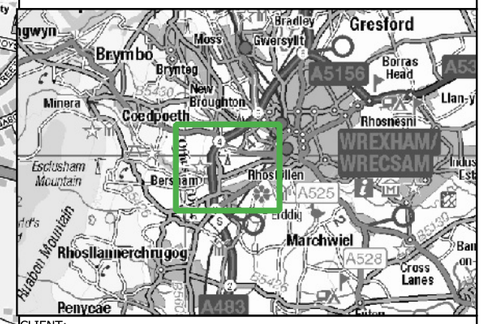
2. Verify the attenuation volumes included in this report when undertaking detailed drainage design.
3. Undertake targeted infiltration testing in accordance with the BRE365 specification at the reserved matters stage as to determine the potential for infiltration drainage techniques.
4. Submit an Ordinary Watercourse Consent for any proposed access road crossings (new culverts).

# Appendix A Location Plan and Aerial Image

Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

**LEGEND**

- Site Boundary
- Area not included within site bounadary
- Watercourses




CLIENT:
Redrow Homes Ltd

waterco
www.waterco.co.uk

SCHEME:
Ruthin Road, Wrexham

PLOT TITLE:
Location Plan

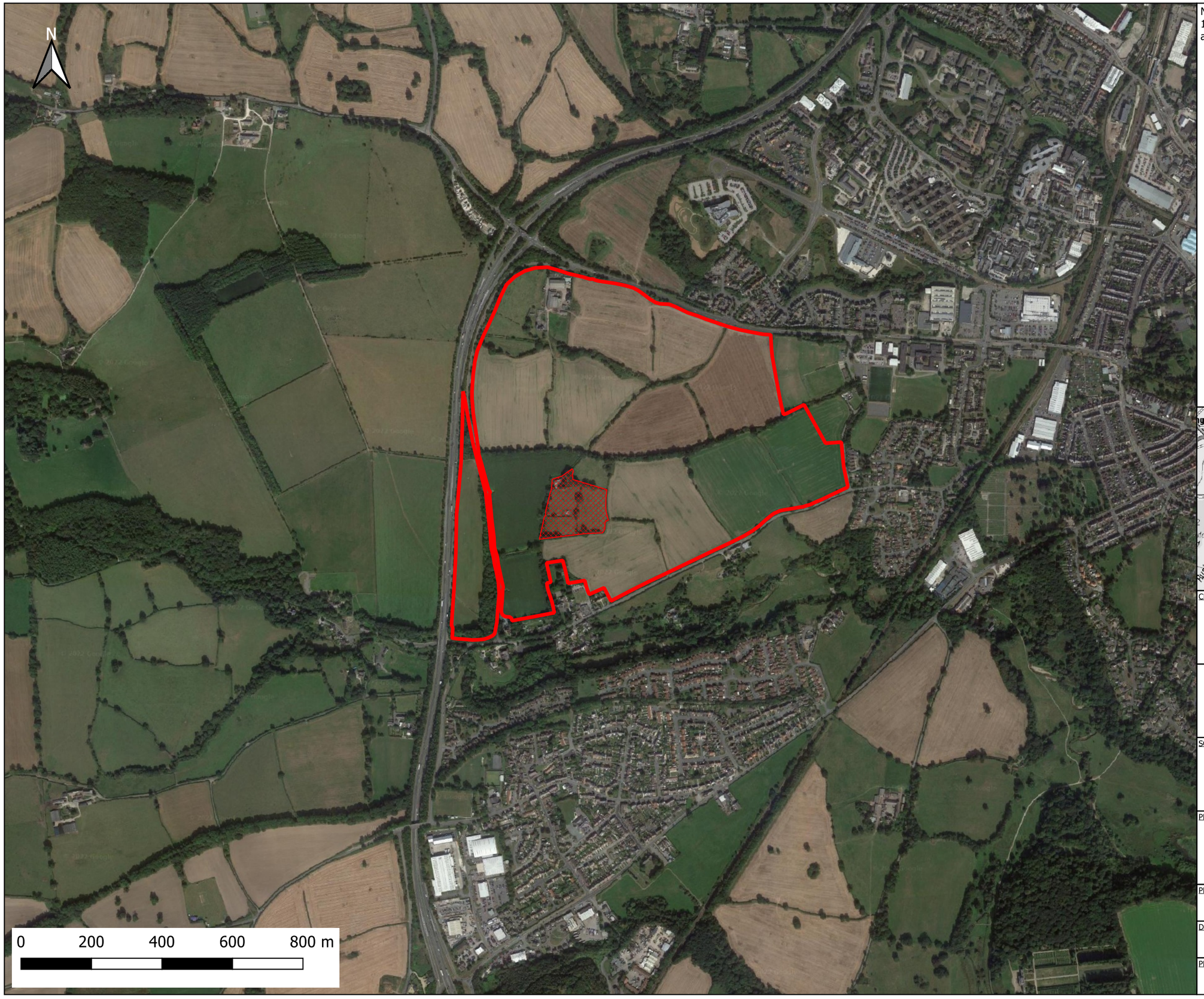
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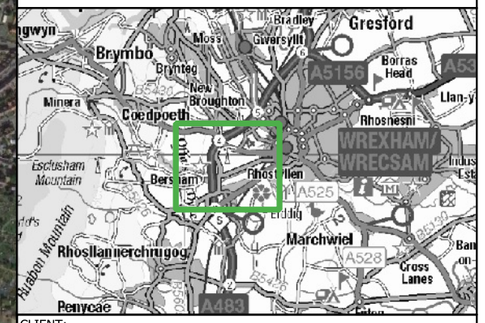
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Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

**LEGEND**

- Site Boundary
- Area not included within site bounadary




CLIENT:
Redrow Homes Ltd

waterco
www.waterco.co.uk

SCHEME:
Ruthin Road, Wrexham

PLOT TITLE:
Aerial Plan

| PLOT STATUS: | DATE: |
|---|---|
| FINAL | 06-12-2022 |

| DRAWN: | CHECKED: | APPROVED: | PLOT SCALE AT A3: |
|---|---|---|---|
| PB | AW | NJ | 1:10400 |

| PLOT NAME: | REVISION: |
|---|---|
| 13840_Aerial_Plan | - |

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# Appendix B Topographical Data

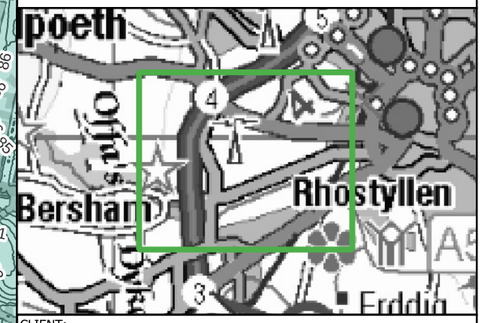
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

**LEGEND**

- Site Boundary
- Area not included within site boundary
- Site Levels (m AOD)

Ground Elevations (m AOD)

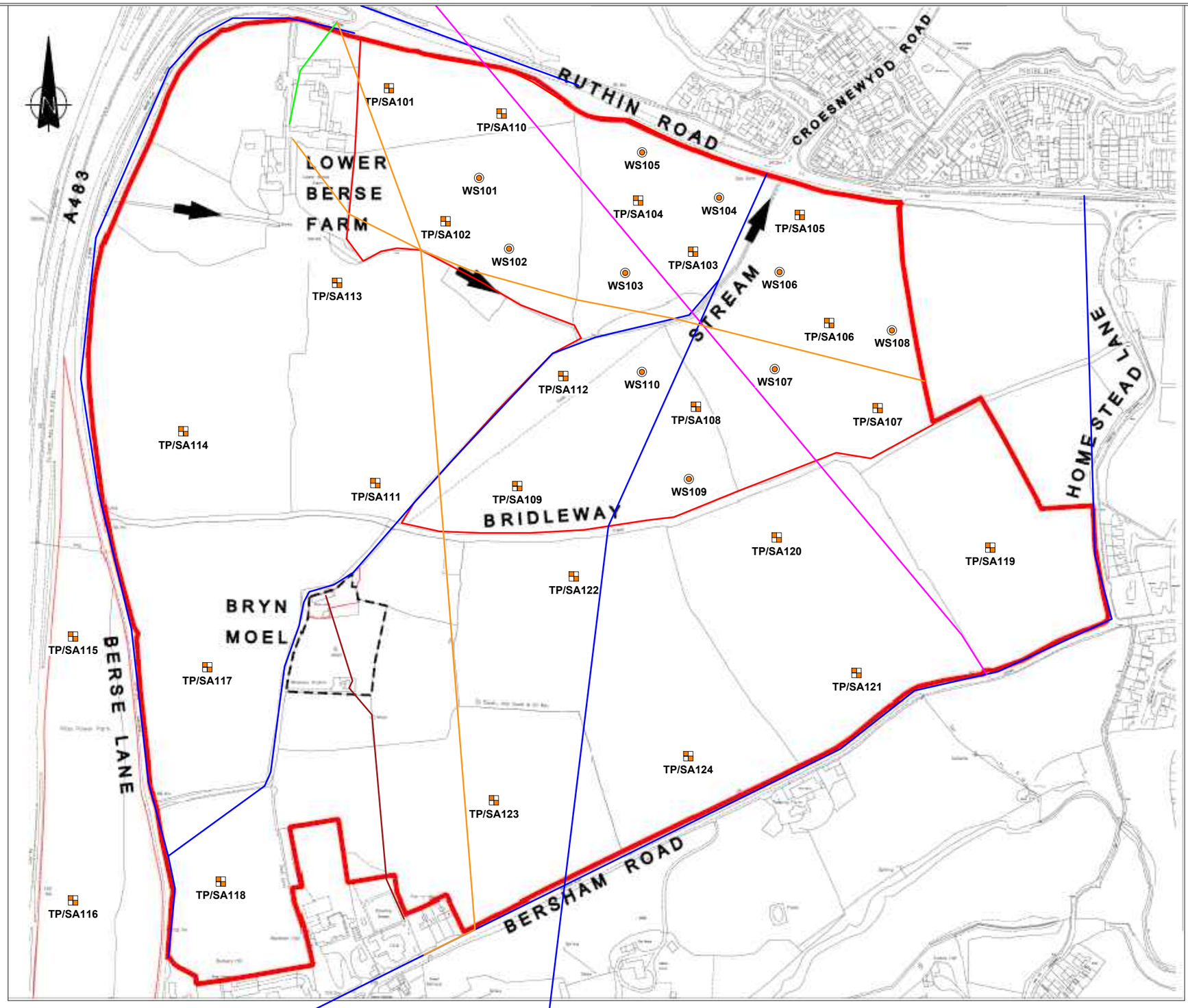
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- 80 - 90
- 90 - 100
- 100 - 110
- > 110




| | |
|---|---|
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| | www.waterco.co.uk |
| SCHEME: | Ruthin Road, Wrexham |
| PLOT TITLE: | LiDAR Plan<br>1m Resolution<br>Data from Natural Resources Wales |
| PLOT STATUS: FINAL | DATE: 06-12-2022 |
| DRAWN: PB / CHECKED: AW / APPROVED: NJ | PLOT SCALE AT A3: 1:7500 |
| PLOT NAME: 13840_LiDAR_Plan | REVISION: - |

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# Appendix C Ground Investigation Results




*Location Symbols*

- Approximate Window Sample Probehole Location
- Approximate Trial Pit and Soakaway Test Location

*Utilities*

- Electricity - Low Voltage
- Electricity - High Voltage
- BT
- Gas - Medium Pressure
- Water Main

*Notes:*

*Client:* Redrow

*Job No:* 14-854

*Date:* 17.08.2021

*Drawing No:* 005

*Scale:* NTS@ A3

| | | | | |
|---|---|---|---|---|
| P1 | REVA | 17.08.2021 | EB | AR |
| Phase | Issue | Date | Drawn | Checked |

*Job Title:* Ruthin Road, Wrexham

*Drawing Title:* Exploratory Hole Location Plan


Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk



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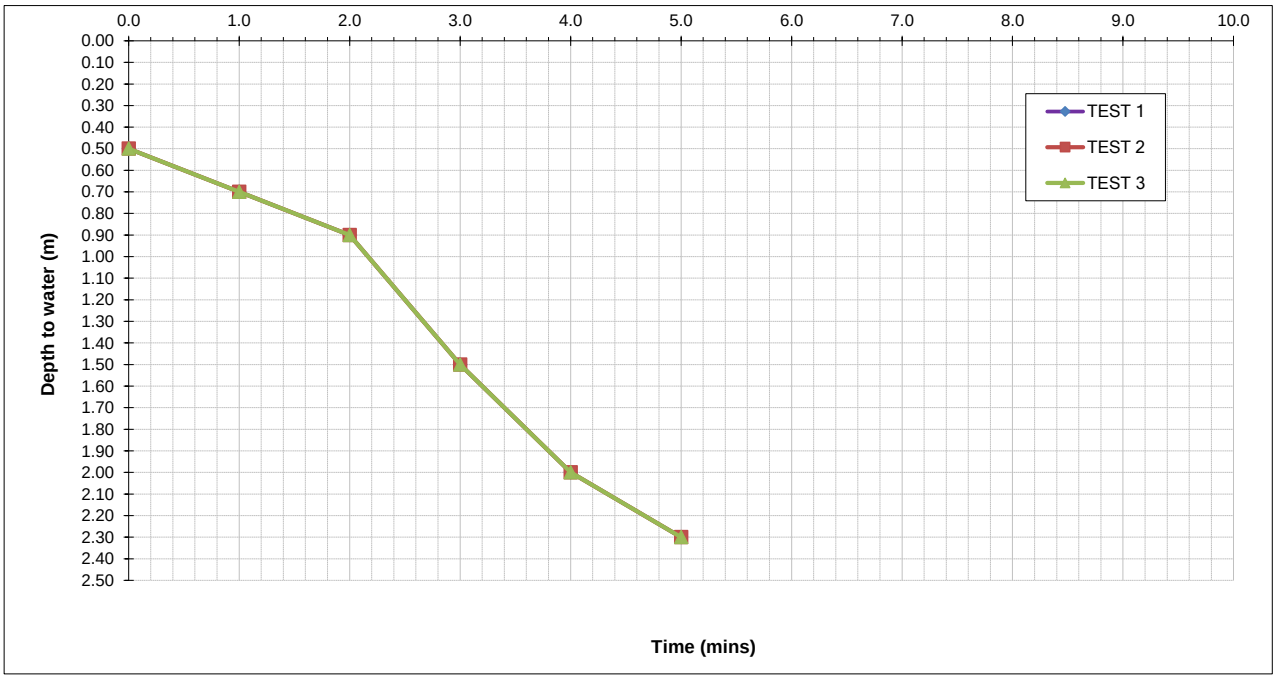
| | | | |
|---|---|---|---|
| e3p | **Site:** Ruthin Road, Wrexham<br>**Job Number:** 14-854<br>**Date of Test:** 30/07/2021 | **Trial Pit Number:** | SA101 |
| | | **Length:** | 2.30 m |
| | | **Width:** | 0.70 m |
| | | **Depth:** | 2.30 m |
| | | **Groundwater Level:** | N/A m |

Soakaway locaiton could not be completely filled as water began to soakaway during filling. 3 tests completed with 1000l into each test all completely soaked away within 5 minutes

| | TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|---|
| | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| | 0 | 0.50 | 0 | 0.50 | 0 | 0.50 |
| | 1 | 0.70 | 1 | 0.70 | 1 | 0.70 |
| | 2 | 0.90 | 2 | 0.90 | 2 | 0.90 |
| | 3 | 1.50 | 3 | 1.50 | 3 | 1.50 |
| | 4 | 2.00 | 4 | 2.00 | 4 | 2.00 |
| | 5 | 2.30 | 5 | 2.30 | 5 | 2.30 |

| | | | | |
|---|---|---|---|---|
| Effective Storage Depth | m | 1.80 | 1.80 | 1.80 |
| 75% Effective Storage Depth | m | 1.35 | 1.35 | 1.35 |
| (i.e. depth below GL) | m | 0.95 | 0.95 | 0.95 |
| 25% Effective Storage Depth | m | 0.45 | 0.45 | 0.45 |
| (i.e. depth below GL) | m | 1.85 | 1.85 | 1.85 |
| Effective Storage Depth 75%-25% | m | 0.90 | 0.90 | 0.90 |
| Time to fall to 75% effective depth | mins | 2.10 | 2.10 | 2.10 |
| Time to fall to 25% effective depth | mins | 3.70 | 3.70 | 3.70 |
| V (75%-25%) | m3 | 1.45 | 1.45 | 1.45 |
| a (50%) | m2 | 7.01 | 7.01 | 7.01 |
| t (75%-25%) | mins | 1.60 | 1.60 | 1.60 |
| **SOIL INFILTRATION RATE** | m/s | **2.15E-03** | **2.15E-03** | **2.15E-03** |

| | |
|---|---|
| **DESIGN SOIL INFILTRATION RATE, f** | **2.15E-03** |



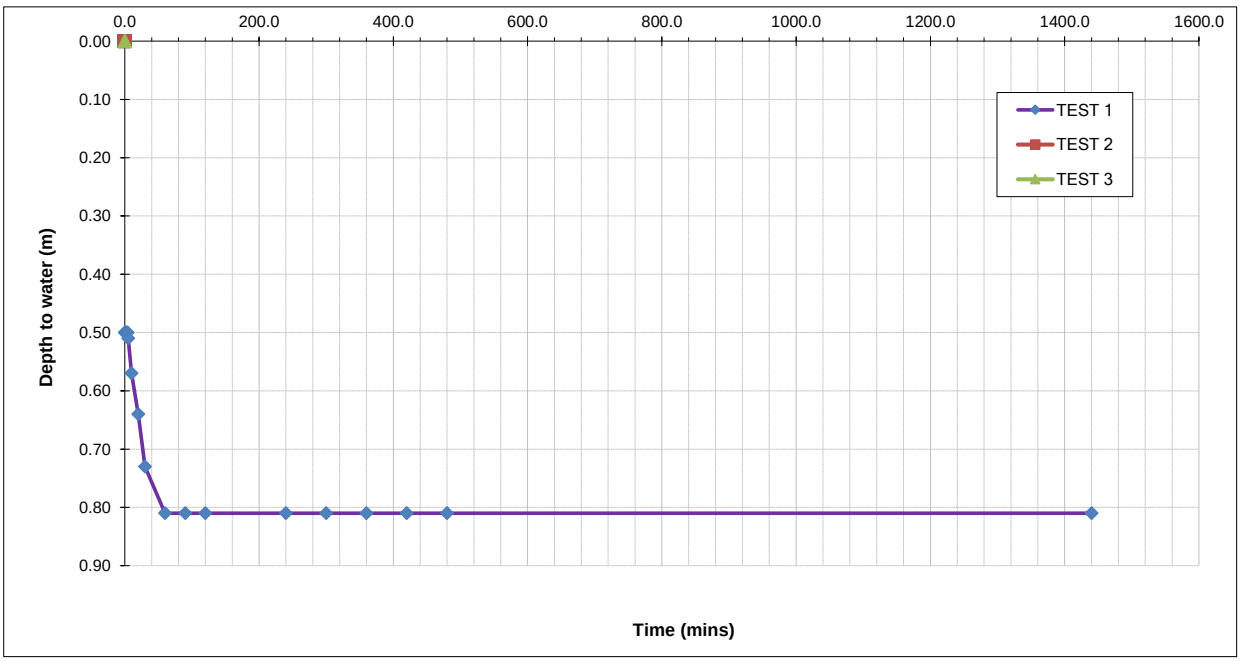
| | | | |
|---|---|---|---|
| e3p | **Site:** Ruthin Road, Wrexham<br>**Job Number:** 14-854<br>**Date of Test:** 30/07/2021 | **Trial Pit Number:** SA102<br>**Length:** 2.20 m<br>**Width:** 0.70 m<br>**Depth:** 2.50 m<br>**Groundwater Level:** N/A m | |

Soakaway test did not fall below 75% or 25% effective storage over the full monitoring period.

| TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|
| Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| 0 | 0.50 | | | | |
| 1 | 0.50 | | | | |
| 2 | 0.50 | | | | |
| 3 | 0.50 | | | | |
| 4 | 0.50 | | | | |
| 5 | 0.51 | | | | |
| 10 | 0.57 | | | | |
| 20 | 0.64 | | | | |
| 30 | 0.73 | | | | |
| 60 | 0.81 | | | | |
| 90 | 0.81 | | | | |
| 120 | 0.81 | | | | |
| 240 | 0.81 | | | | |
| 300 | 0.81 | | | | |
| 360 | 0.81 | | | | |
| 420 | 0.81 | | | | |
| 480 | 0.81 | | | | |
| 1440 | 0.81 | | | | |

| | | | | |
|---|---|---|---|---|
| Effective Storage Depth | m | 2.00 | | |
| 75% Effective Storage Depth | m | 1.50 | | |
| (i.e. depth below GL) | m | 1.00 | | |
| 25% Effective Storage Depth | m | 0.50 | | |
| (i.e. depth below GL) | m | 2.00 | | |
| Effective Storage Depth 75%-25% | m | 1.00 | | |
| Time to fall to 75% effective depth | mins | N/A | | |
| Time to fall to 25% effective depth | mins | N/A | | |
| V (75%-25%) | m3 | 1.54 | | |
| a (50%) | m2 | 7.34 | | |
| t (75%-25%) | mins | N/A | | |
| **SOIL INFILTRATION RATE** | m/s | **N/A** | | |

**DESIGN SOIL INFILTRATION RATE, f** **N/A**



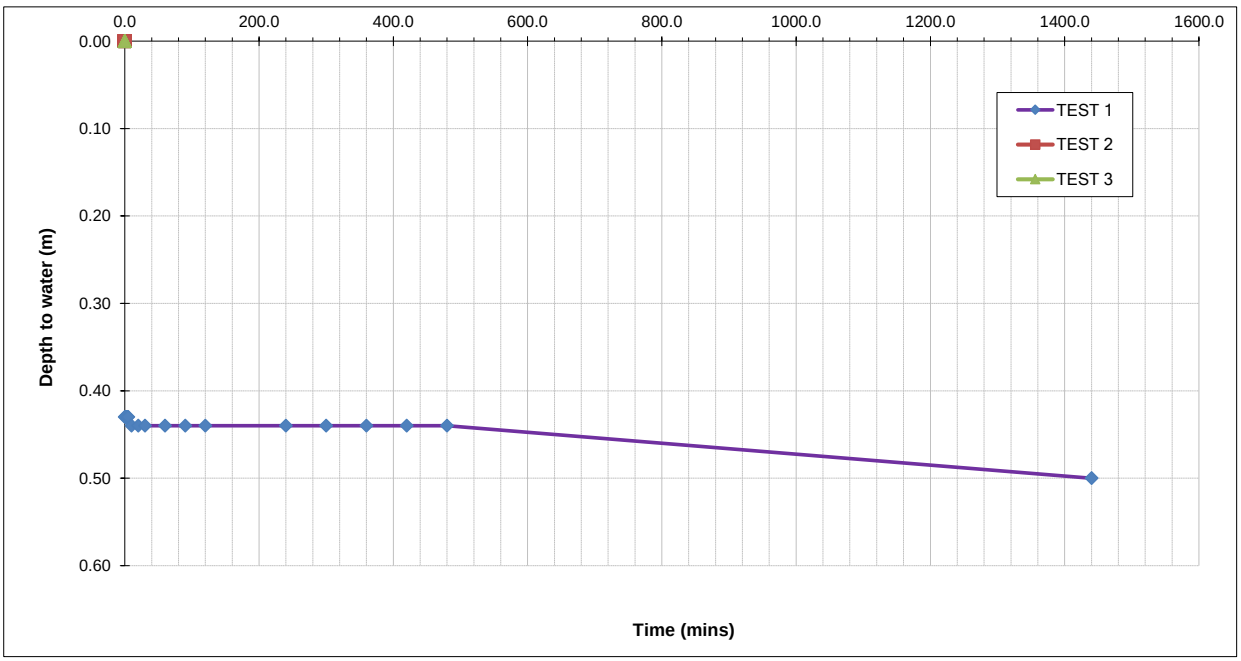
| | | | |
|---|---|---|---|
| e3p | **Site:** Ruthin Road, Wrexham<br>**Job Number:** 14-854<br>**Date of Test:** 30/07/2021 | **Trial Pit Number:** | SA103 |
| | | **Length:** | 2.90 m |
| | | **Width:** | 0.70 m |
| | | **Depth:** | 2.50 m |
| | | **Groundwater Level:** | N/A m |

Soakaway test did not fall below 75% or 25% effective storage over the full monitoring period

| TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|
| Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| 0 | 0.43 | | | | |
| 1 | 0.43 | | | | |
| 2 | 0.43 | | | | |
| 3 | 0.43 | | | | |
| 4 | 0.43 | | | | |
| 5 | 0.43 | | | | |
| 10 | 0.44 | | | | |
| 20 | 0.44 | | | | |
| 30 | 0.44 | | | | |
| 60 | 0.44 | | | | |
| 90 | 0.44 | | | | |
| 120 | 0.44 | | | | |
| 240 | 0.44 | | | | |
| 300 | 0.44 | | | | |
| 360 | 0.44 | | | | |
| 420 | 0.44 | | | | |
| 480 | 0.44 | | | | |
| 1440 | 0.50 | | | | |

| | | | | |
|---|---|---|---|---|
| Effective Storage Depth | m | 2.07 | | |
| 75% Effective Storage Depth | m | 1.55 | | |
| (i.e. depth below GL) | m | 0.95 | | |
| 25% Effective Storage Depth | m | 0.52 | | |
| (i.e. depth below GL) | m | 1.98 | | |
| Effective Storage Depth 75%-25% | m | 1.04 | | |
| Time to fall to 75% effective depth | mins | N/A | | |
| Time to fall to 25% effective depth | mins | N/A | | |
| V (75%-25%) | m3 | 2.10 | | |
| a (50%) | m2 | 9.48 | | |
| t (75%-25%) | mins | N/A | | |
| **SOIL INFILTRATION RATE** | m/s | **N/A** | | |

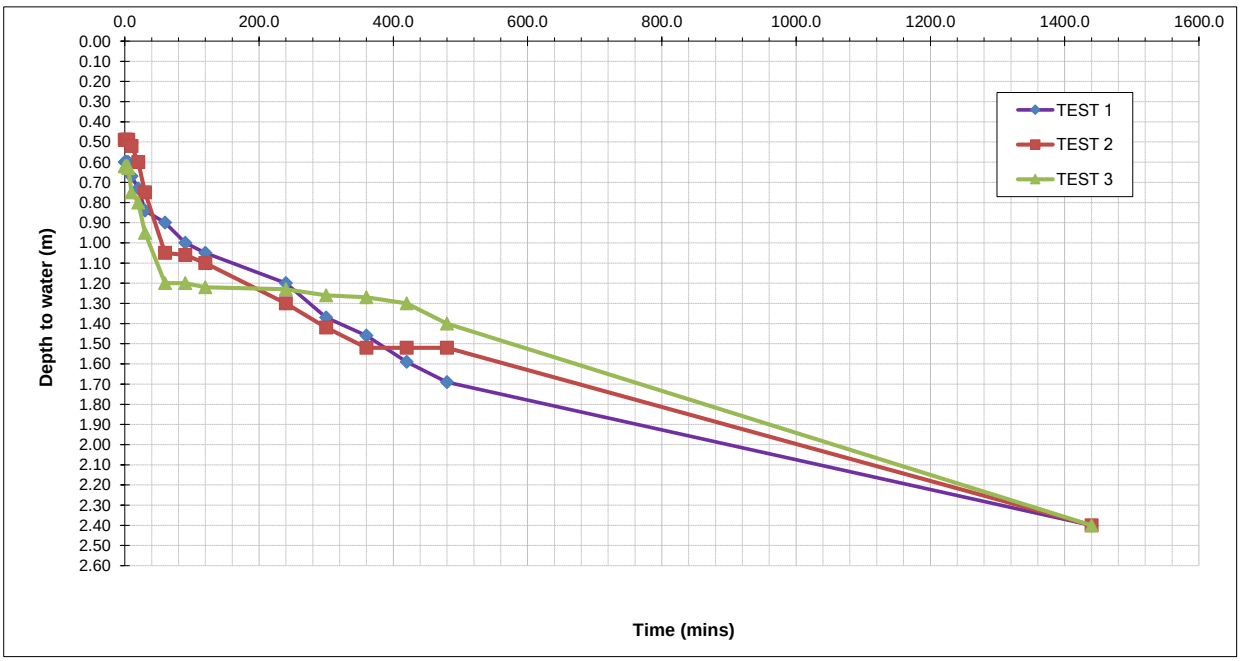
| | |
|---|---|
| **DESIGN SOIL INFILTRATION RATE, f** | **N/A** |



| | | | |
|---|---|---|---|
| e3p | **Site:** Ruthin Road, Wrexham<br>**Job Number:** 14-854<br>**Date of Test:** 30/07/2021 | **Trial Pit Number:** | SA104 |
| | | **Length:** | 2.20 m |
| | | **Width:** | 0.70 m |
| | | **Depth:** | 2.40 m |
| | | **Groundwater Level:** | N/A m |

| | TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|---|
| | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| | 0 | 0.60 | 0 | 0.49 | 0 | 0.62 |
| | 1 | 0.60 | 1 | 0.49 | 1 | 0.62 |
| | 2 | 0.60 | 2 | 0.49 | 2 | 0.62 |
| | 3 | 0.60 | 3 | 0.49 | 3 | 0.62 |
| | 4 | 0.60 | 4 | 0.49 | 4 | 0.62 |
| | 5 | 0.60 | 5 | 0.49 | 5 | 0.63 |
| | 10 | 0.67 | 10 | 0.52 | 10 | 0.75 |
| | 20 | 0.73 | 20 | 0.60 | 20 | 0.80 |
| | 30 | 0.84 | 30 | 0.75 | 30 | 0.95 |
| | 60 | 0.90 | 60 | 1.05 | 60 | 1.20 |
| | 90 | 1.00 | 90 | 1.06 | 90 | 1.20 |
| | 120 | 1.05 | 120 | 1.10 | 120 | 1.22 |
| | 240 | 1.20 | 240 | 1.30 | 240 | 1.23 |
| | 300 | 1.37 | 300 | 1.42 | 300 | 1.26 |
| | 360 | 1.46 | 360 | 1.52 | 360 | 1.27 |
| | 420 | 1.59 | 420 | 1.52 | 420 | 1.30 |
| | 480 | 1.69 | 480 | 1.52 | 480 | 1.40 |
| | 1440 | 2.40 | 1440 | 2.40 | 1440 | 2.40 |
| Effective Storage Depth | m | 1.80 | | 1.91 | | 1.78 |
| 75% Effective Storage Depth | m | 1.35 | | 1.43 | | 1.34 |
| (i.e. depth below GL) | m | 1.05 | | 0.97 | | 1.07 |
| 25% Effective Storage Depth | m | 0.45 | | 0.48 | | 0.45 |
| (i.e. depth below GL) | m | 1.95 | | 1.92 | | 1.96 |
| Effective Storage Depth 75%-25% | m | 0.90 | | 0.96 | | 0.89 |
| Time to fall to 75% effective depth | mins | 100.00 | | 48.00 | | 43.00 |
| Time to fall to 25% effective depth | mins | 840.00 | | 920.00 | | 1020.00 |
| V (75%-25%) | m3 | 1.39 | | 1.47 | | 1.37 |
| a (50%) | m2 | 6.76 | | 7.08 | | 6.70 |
| t (75%-25%) | mins | 740.00 | | 872.00 | | 977.00 |
| **SOIL INFILTRATION RATE** | m/s | **4.62E-06** | | **3.97E-06** | | **3.49E-06** |

| | |
|---|---|
| **DESIGN SOIL INFILTRATION RATE, f** | **3.49E-06** |



| | | | |
|---|---|---|---|
| **Site:** | Ruthin Road, Wrexham | **Trial Pit Number:** | SA105 |
| **Job Number:** | 14-854 | **Length:** | 2.20 m |
| **Date of Test:** | 30/07/2021 | **Width:** | 0.70 m |
| | | **Depth:** | 2.35 m |
| | | **Groundwater Level:** | N/A m |

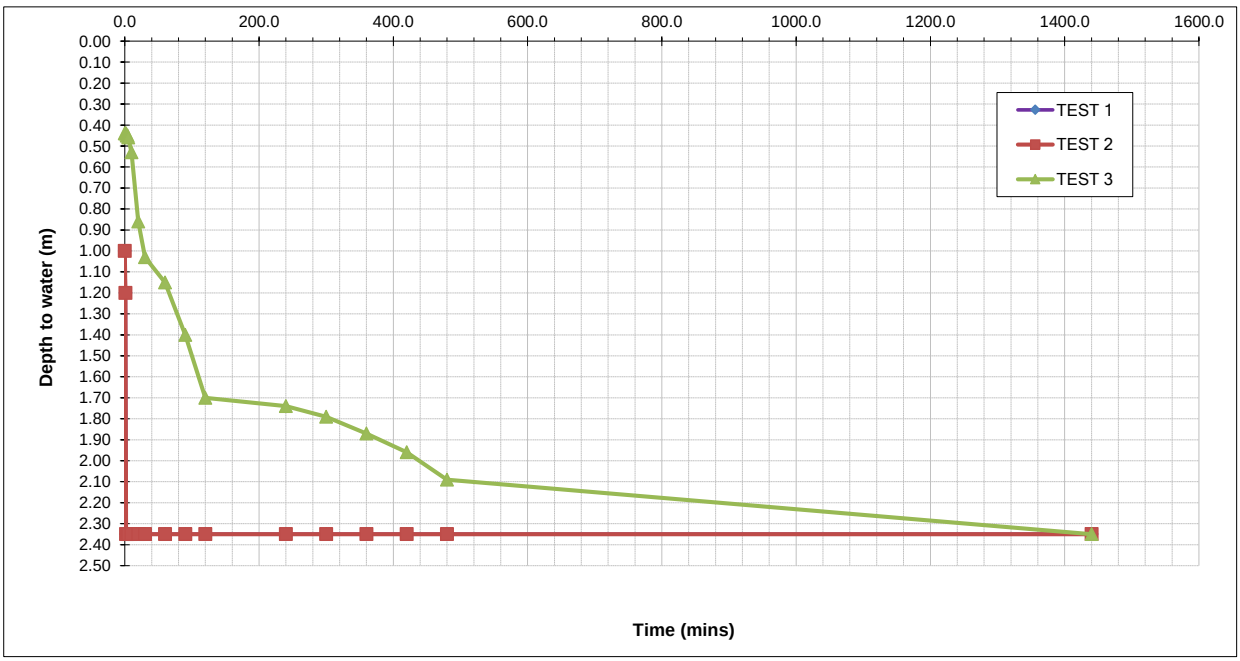
First two tests - Pit could not been filled to top due to soakage - 1000l input

Last test notably slower discharge.

| TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|
| Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| 0 | 1.00 | 0 | 1.00 | 0 | 0.44 |
| 1 | 1.20 | 1 | 1.20 | 1 | 0.44 |
| 2 | 2.35 | 2 | 2.35 | 2 | 0.44 |
| 3 | 2.35 | 3 | 2.35 | 3 | 0.45 |
| 4 | 2.35 | 4 | 2.35 | 4 | 0.45 |
| 5 | 2.35 | 5 | 2.35 | 5 | 0.46 |
| 10 | 2.35 | 10 | 2.35 | 10 | 0.53 |
| 20 | 2.35 | 20 | 2.35 | 20 | 0.86 |
| 30 | 2.35 | 30 | 2.35 | 30 | 1.03 |
| 60 | 2.35 | 60 | 2.35 | 60 | 1.15 |
| 90 | 2.35 | 90 | 2.35 | 90 | 1.40 |
| 120 | 2.35 | 120 | 2.35 | 120 | 1.70 |
| 240 | 2.35 | 240 | 2.35 | 240 | 1.74 |
| 300 | 2.35 | 300 | 2.35 | 300 | 1.79 |
| 360 | 2.35 | 360 | 2.35 | 360 | 1.87 |
| 420 | 2.35 | 420 | 2.35 | 420 | 1.96 |
| 480 | 2.35 | 480 | 2.35 | 480 | 2.09 |
| 1440 | 2.35 | 1440 | 2.35 | 1440 | 2.35 |

| | | | | |
|---|---|---|---|---|
| Effective Storage Depth | m | 1.35 | 1.35 | 1.91 |
| 75% Effective Storage Depth | m | 1.01 | 1.01 | 1.43 |
| (i.e. depth below GL) | m | 1.34 | 1.34 | 0.92 |
| 25% Effective Storage Depth | m | 0.34 | 0.34 | 0.48 |
| (i.e. depth below GL) | m | 2.01 | 2.01 | 1.87 |
| Effective Storage Depth 75%-25% | m | 0.68 | 0.68 | 0.96 |
| Time to fall to 75% effective depth | mins | 1.00 | 1.00 | 19.00 |
| Time to fall to 25% effective depth | mins | 1.50 | 1.50 | 421.00 |
| V (75%-25%) | m3 | 1.04 | 1.04 | 1.47 |
| a (50%) | m2 | 5.46 | 5.46 | 7.08 |
| t (75%-25%) | mins | 0.50 | 0.50 | 402.00 |
| **SOIL INFILTRATION RATE** | m/s | **6.35E-03** | **6.35E-03** | **8.61E-06** |

| | |
|---|---|
| **DESIGN SOIL INFILTRATION RATE, f** | **8.61E-06** |



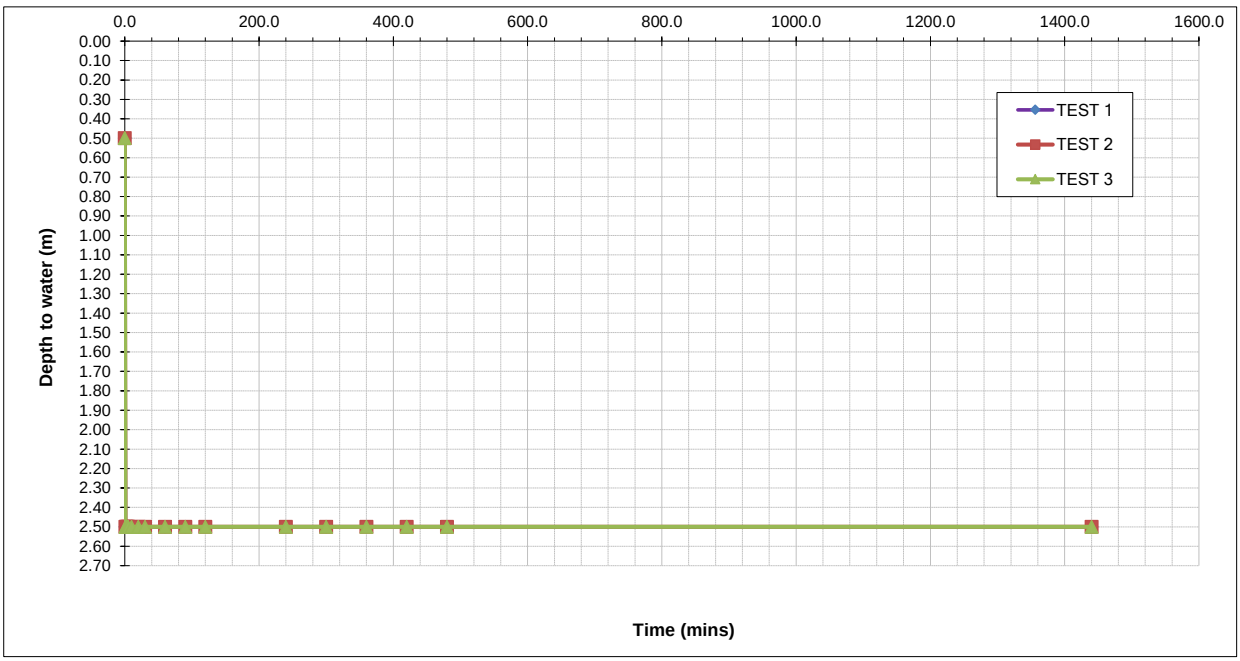
| | | | |
|---|---|---|---|
| e3p | **Site:** Ruthin Road, Wrexham<br>**Job Number:** 14-854<br>**Date of Test:** 30/07/2021 | **Trial Pit Number:** SA106<br>**Length:** 2.40 m<br>**Width:** 0.70 m<br>**Depth:** 2.50 m<br>**Groundwater Level:** N/A m | |

3000L Water placed into test (1000L per test) no water was retainied.

| TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|
| Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| 0 | 0.50 | 0 | 0.50 | 0 | 0.50 |
| 1 | 2.50 | 1 | 2.50 | 1 | 2.50 |
| 2 | 2.50 | 2 | 2.50 | 2 | 2.50 |
| 3 | 2.50 | 3 | 2.50 | 3 | 2.50 |
| 4 | 2.50 | 4 | 2.50 | 4 | 2.50 |
| 5 | 2.50 | 5 | 2.50 | 5 | 2.50 |
| 10 | 2.50 | 10 | 2.50 | 10 | 2.50 |
| 20 | 2.50 | 20 | 2.50 | 20 | 2.50 |
| 30 | 2.50 | 30 | 2.50 | 30 | 2.50 |
| 60 | 2.50 | 60 | 2.50 | 60 | 2.50 |
| 90 | 2.50 | 90 | 2.50 | 90 | 2.50 |
| 120 | 2.50 | 120 | 2.50 | 120 | 2.50 |
| 240 | 2.50 | 240 | 2.50 | 240 | 2.50 |
| 300 | 2.50 | 300 | 2.50 | 300 | 2.50 |
| 360 | 2.50 | 360 | 2.50 | 360 | 2.50 |
| 420 | 2.50 | 420 | 2.50 | 420 | 2.50 |
| 480 | 2.50 | 480 | 2.50 | 480 | 2.50 |
| 1440 | 2.50 | 1440 | 2.50 | 1440 | 2.50 |

| | | | | |
|---|---|---|---|---|
| Effective Storage Depth | m | 2.00 | 2.00 | 2.00 |
| 75% Effective Storage Depth | m | 1.50 | 1.50 | 1.50 |
| (i.e. depth below GL) | m | 1.00 | 1.00 | 1.00 |
| 25% Effective Storage Depth | m | 0.50 | 0.50 | 0.50 |
| (i.e. depth below GL) | m | 2.00 | 2.00 | 2.00 |
| Effective Storage Depth 75%-25% | m | 1.00 | 1.00 | 1.00 |
| Time to fall to 75% effective depth | mins | 0.50 | 0.50 | 0.50 |
| Time to fall to 25% effective depth | mins | 1.00 | 1.00 | 1.00 |
| V (75%-25%) | m3 | 1.68 | 1.68 | 1.68 |
| a (50%) | m2 | 7.88 | 7.88 | 7.88 |
| t (75%-25%) | mins | 0.50 | 0.50 | 0.50 |
| **SOIL INFILTRATION RATE** | m/s | **7.11E-03** | **7.11E-03** | **7.11E-03** |

| | |
|---|---|
| **DESIGN SOIL INFILTRATION RATE, f** | **7.11E-03** |



| | | | |
|---|---|---|---|
| | **Site:** | Ruthin Road, Wrexham | |
| | **Job Number:** | 14-854 | |
| | **Date of Test:** | 30/07/2021 | |

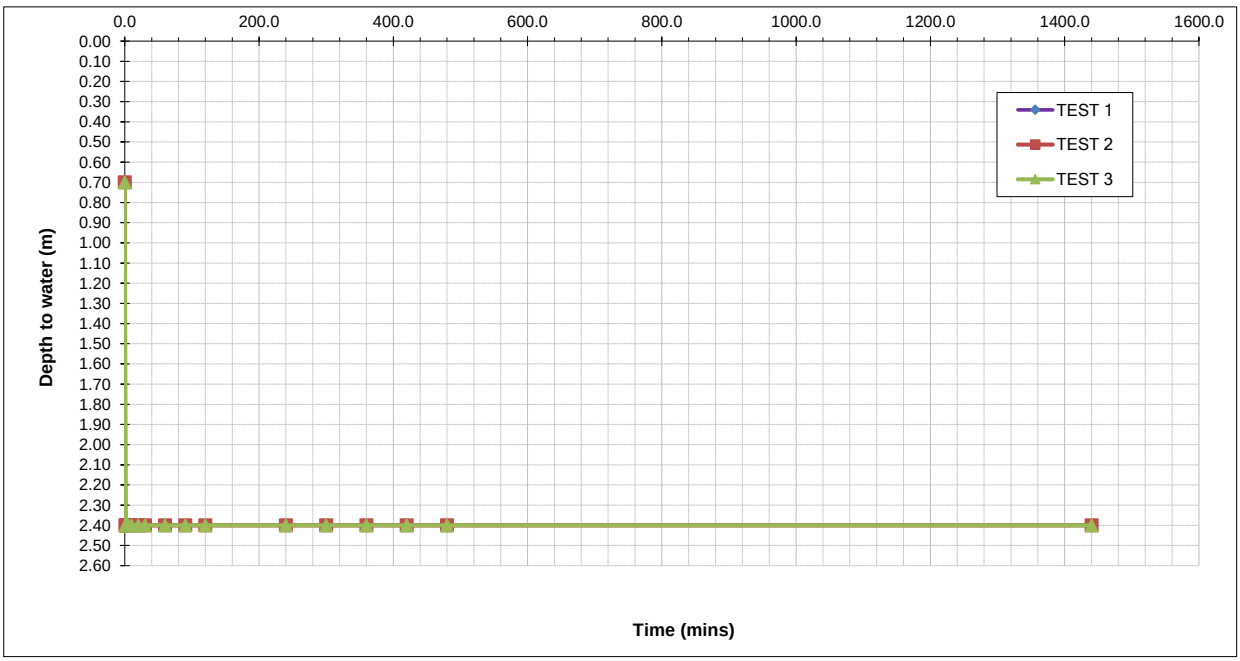
| | | |
|---|---|---|
| **Trial Pit Number:** | SA107 | |
| **Length:** | 2.40 | m |
| **Width:** | 0.70 | m |
| **Depth:** | 2.40 | m |
| **Groundwater Level:** | N/A | m |

1000L water placed into pit per test - no water retained

| TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|
| Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| 0 | 0.70 | 0 | 0.70 | 0 | 0.70 |
| 1 | 2.40 | 1 | 2.40 | 1 | 2.40 |
| 2 | 2.40 | 2 | 2.40 | 2 | 2.40 |
| 3 | 2.40 | 3 | 2.40 | 3 | 2.40 |
| 4 | 2.40 | 4 | 2.40 | 4 | 2.40 |
| 5 | 2.40 | 5 | 2.40 | 5 | 2.40 |
| 10 | 2.40 | 10 | 2.40 | 10 | 2.40 |
| 20 | 2.40 | 20 | 2.40 | 20 | 2.40 |
| 30 | 2.40 | 30 | 2.40 | 30 | 2.40 |
| 60 | 2.40 | 60 | 2.40 | 60 | 2.40 |
| 90 | 2.40 | 90 | 2.40 | 90 | 2.40 |
| 120 | 2.40 | 120 | 2.40 | 120 | 2.40 |
| 240 | 2.40 | 240 | 2.40 | 240 | 2.40 |
| 300 | 2.40 | 300 | 2.40 | 300 | 2.40 |
| 360 | 2.40 | 360 | 2.40 | 360 | 2.40 |
| 420 | 2.40 | 420 | 2.40 | 420 | 2.40 |
| 480 | 2.40 | 480 | 2.40 | 480 | 2.40 |
| 1440 | 2.40 | 1440 | 2.40 | 1440 | 2.40 |

| | | | | |
|---|---|---|---|---|
| Effective Storage Depth | m | 1.70 | 1.70 | 1.70 |
| 75% Effective Storage Depth | m | 1.28 | 1.28 | 1.28 |
| (i.e. depth below GL) | m | 1.13 | 1.13 | 1.13 |
| 25% Effective Storage Depth | m | 0.43 | 0.43 | 0.43 |
| (i.e. depth below GL) | m | 1.98 | 1.98 | 1.98 |
| Effective Storage Depth 75%-25% | m | 0.85 | 0.85 | 0.85 |
| Time to fall to 75% effective depth | mins | 0.50 | 0.50 | 0.50 |
| Time to fall to 25% effective depth | mins | 1.00 | 1.00 | 1.00 |
| V (75%-25%) | m3 | 1.43 | 1.43 | 1.43 |
| a (50%) | m2 | 6.95 | 6.95 | 6.95 |
| t (75%-25%) | mins | 0.50 | 0.50 | 0.50 |
| **SOIL INFILTRATION RATE** | m/s | **6.85E-03** | **6.85E-03** | **6.85E-03** |

| | |
|---|---|
| **DESIGN SOIL INFILTRATION RATE, f** | **6.85E-03** |



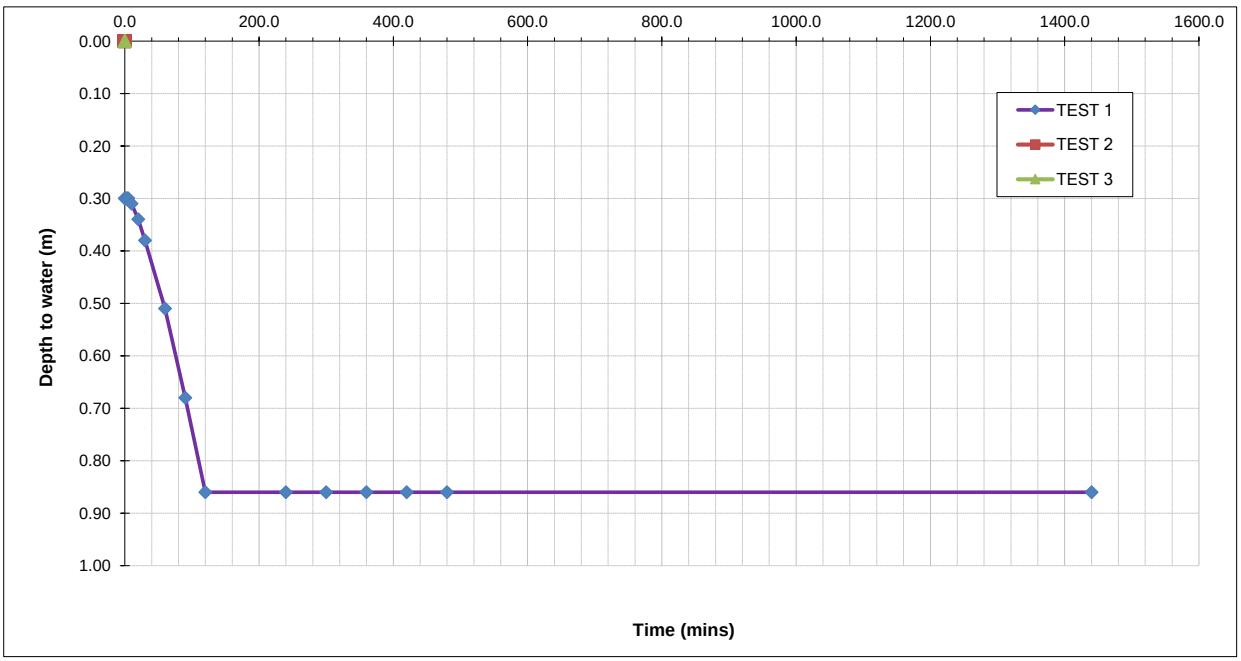
| | | | |
|---|---|---|---|
| e3p | **Site:** Ruthin Road, Wrexham<br>**Job Number:** 14-854<br>**Date of Test:** 30/07/2021 | **Trial Pit Number:** SA108<br>**Length:** 2.40 m<br>**Width:** 0.70 m<br>**Depth:** 2.50 m<br>**Groundwater Level:** N/A m | |

Water level did not fall below the 75% and 25% effective storage depths over the 24 hour period.

| TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|
| Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| 0 | 0.30 | | | | |
| 1 | 0.30 | | | | |
| 2 | 0.30 | | | | |
| 3 | 0.30 | | | | |
| 4 | 0.30 | | | | |
| 5 | 0.30 | | | | |
| 10 | 0.31 | | | | |
| 20 | 0.34 | | | | |
| 30 | 0.38 | | | | |
| 60 | 0.51 | | | | |
| 90 | 0.68 | | | | |
| 120 | 0.86 | | | | |
| 240 | 0.86 | | | | |
| 300 | 0.86 | | | | |
| 360 | 0.86 | | | | |
| 420 | 0.86 | | | | |
| 480 | 0.86 | | | | |
| 1440 | 0.86 | | | | |

| | | | | |
|---|---|---|---|---|
| Effective Storage Depth | m | 2.20 | | |
| 75% Effective Storage Depth | m | 1.65 | | |
| (i.e. depth below GL) | m | | | |
| 25% Effective Storage Depth | m | 0.55 | | |
| (i.e. depth below GL) | m | | | |
| Effective Storage Depth 75%-25% | m | 1.10 | | |
| Time to fall to 75% effective depth | mins | N/A | | |
| Time to fall to 25% effective depth | mins | N/A | | |
| V (75%-25%) | m3 | 1.85 | | |
| a (50%) | m2 | 8.50 | | |
| t (75%-25%) | mins | N/A | | |
| **SOIL INFILTRATION RATE** | m/s | **N/A** | | |

| | |
|---|---|
| **DESIGN SOIL INFILTRATION RATE, f** | **N/A** |



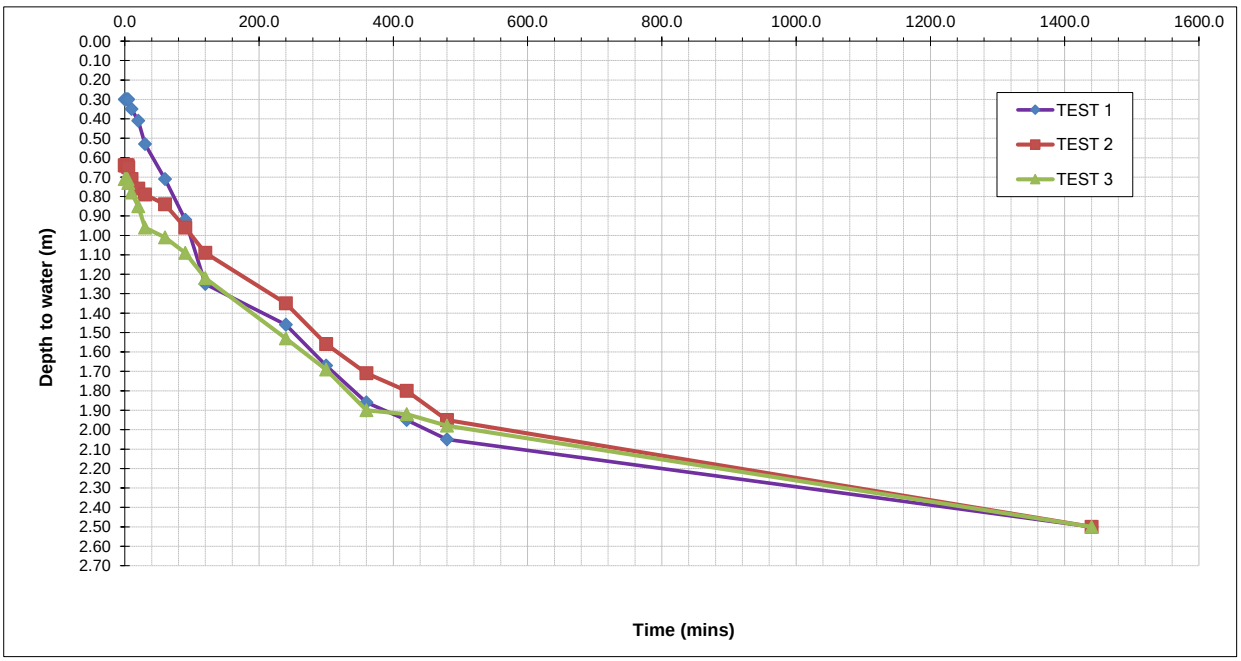
| | | | |
|---|---|---|---|
| | **Site:** | Ruthin Road, Wrexham | |
| | **Job Number:** | 14-854 | |
| | **Date of Test:** | 30/07/2021 | |

| | | |
|---|---|---|
| **Trial Pit Number:** | SA109 | |
| **Length:** | 2.40 | m |
| **Width:** | 0.70 | m |
| **Depth:** | 2.50 | m |
| **Groundwater Level:** | N/A | m |

| TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|
| Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| 0 | 0.30 | 0 | 0.64 | 0 | 0.71 |
| 1 | 0.30 | 1 | 0.64 | 1 | 0.71 |
| 2 | 0.30 | 2 | 0.64 | 2 | 0.71 |
| 3 | 0.30 | 3 | 0.64 | 3 | 0.71 |
| 4 | 0.30 | 4 | 0.64 | 4 | 0.71 |
| 5 | 0.30 | 5 | 0.65 | 5 | 0.73 |
| 10 | 0.35 | 10 | 0.71 | 10 | 0.78 |
| 20 | 0.41 | 20 | 0.76 | 20 | 0.85 |
| 30 | 0.53 | 30 | 0.79 | 30 | 0.96 |
| 60 | 0.71 | 60 | 0.84 | 60 | 1.01 |
| 90 | 0.92 | 90 | 0.96 | 90 | 1.09 |
| 120 | 1.25 | 120 | 1.09 | 120 | 1.22 |
| 240 | 1.46 | 240 | 1.35 | 240 | 1.53 |
| 300 | 1.67 | 300 | 1.56 | 300 | 1.69 |
| 360 | 1.86 | 360 | 1.71 | 360 | 1.90 |
| 420 | 1.95 | 420 | 1.80 | 420 | 1.92 |
| 480 | 2.05 | 480 | 1.95 | 480 | 1.98 |
| 1440 | 2.50 | 1440 | 2.50 | 1440 | 2.50 |

| | | | | |
|---|---|---|---|---|
| Effective Storage Depth | m | 2.20 | 1.86 | 1.79 |
| 75% Effective Storage Depth | m | 1.65 | 1.40 | 1.34 |
| (i.e. depth below GL) | m | 0.85 | 1.11 | 1.16 |
| 25% Effective Storage Depth | m | 0.55 | 0.47 | 0.45 |
| (i.e. depth below GL) | m | 1.95 | 2.04 | 2.05 |
| Effective Storage Depth 75%-25% | m | 1.10 | 0.93 | 0.90 |
| Time to fall to 75% effective depth | mins | 80.00 | 130.00 | 104.00 |
| Time to fall to 25% effective depth | mins | 430.00 | 680.00 | 640.00 |
| V (75%-25%) | m3 | 1.85 | 1.56 | 1.50 |
| a (50%) | m2 | 8.50 | 7.45 | 7.23 |
| t (75%-25%) | mins | 350.00 | 550.00 | 536.00 |
| **SOIL INFILTRATION RATE** | m/s | **1.04E-05** | **6.36E-06** | **6.47E-06** |

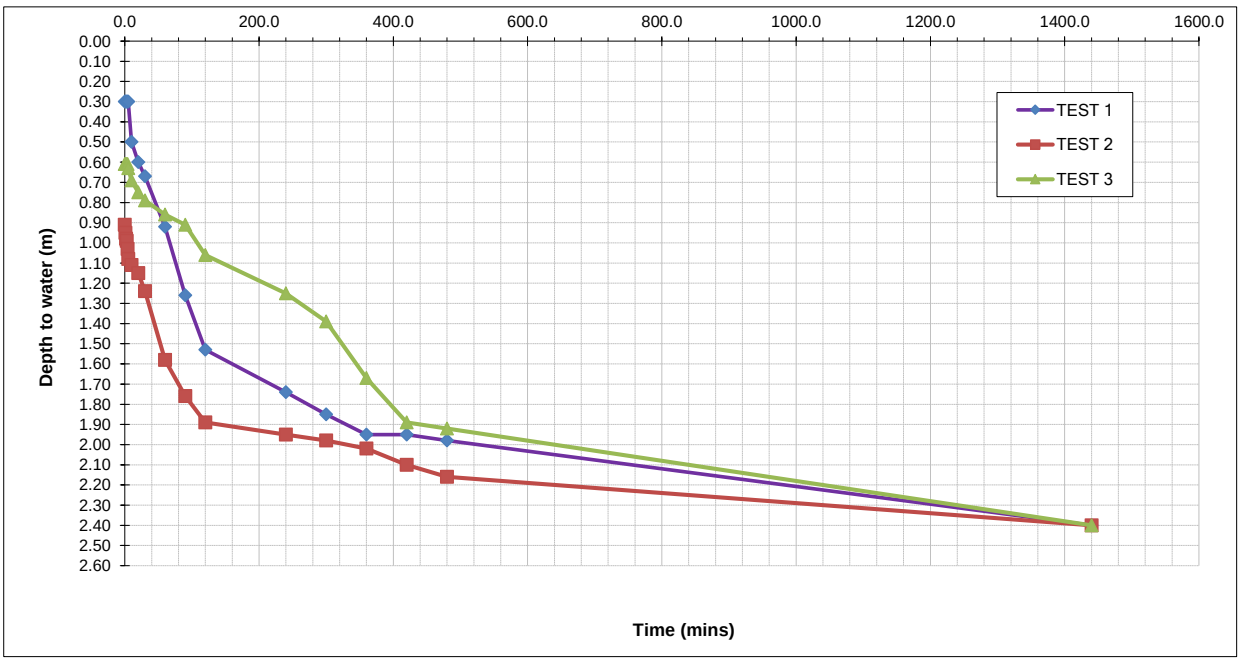
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| **DESIGN SOIL INFILTRATION RATE, f** | **6.36E-06** |



| | | | |
|---|---|---|---|
| e3p | **Site:** Ruthin Road, Wrexham<br>**Job Number:** 14-854<br>**Date of Test:** 30/07/2021 | **Trial Pit Number:** | SA110 |
| | | **Length:** | 2.00 m |
| | | **Width:** | 0.70 m |
| | | **Depth:** | 2.40 m |
| | | **Groundwater Level:** | N/A m |

| | TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|---|
| | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| | 0 | 0.30 | 0 | 0.91 | 0 | 0.61 |
| | 1 | 0.30 | 1 | 0.95 | 1 | 0.61 |
| | 2 | 0.30 | 2 | 0.98 | 2 | 0.61 |
| | 3 | 0.30 | 3 | 0.99 | 3 | 0.61 |
| | 4 | 0.30 | 4 | 1.03 | 4 | 0.61 |
| | 5 | 0.30 | 5 | 1.08 | 5 | 0.63 |
| | 10 | 0.50 | 10 | 1.11 | 10 | 0.69 |
| | 20 | 0.60 | 20 | 1.15 | 20 | 0.75 |
| | 30 | 0.67 | 30 | 1.24 | 30 | 0.79 |
| | 60 | 0.92 | 60 | 1.58 | 60 | 0.86 |
| | 90 | 1.26 | 90 | 1.76 | 90 | 0.91 |
| | 120 | 1.53 | 120 | 1.89 | 120 | 1.06 |
| | 240 | 1.74 | 240 | 1.95 | 240 | 1.25 |
| | 300 | 1.85 | 300 | 1.98 | 300 | 1.39 |
| | 360 | 1.95 | 360 | 2.02 | 360 | 1.67 |
| | 420 | 1.95 | 420 | 2.10 | 420 | 1.89 |
| | 480 | 1.98 | 480 | 2.16 | 480 | 1.92 |
| | 1440 | 2.40 | 1440 | 2.40 | 1440 | 2.40 |
| Effective Storage Depth | m | 2.10 | | 1.49 | | 1.79 |
| 75% Effective Storage Depth | m | 1.58 | | 1.12 | | 1.34 |
| (i.e. depth below GL) | m | 0.83 | | 1.28 | | 1.06 |
| 25% Effective Storage Depth | m | 0.53 | | 0.37 | | 0.45 |
| (i.e. depth below GL) | m | 1.88 | | 2.03 | | 1.95 |
| Effective Storage Depth 75%-25% | m | 1.05 | | 0.75 | | 0.90 |
| Time to fall to 75% effective depth | mins | 45.00 | | 38.00 | | 120.00 |
| Time to fall to 25% effective depth | mins | 320.00 | | 365.00 | | 580.00 |
| V (75%-25%) | m3 | 1.47 | | 1.04 | | 1.25 |
| a (50%) | m2 | 7.07 | | 5.42 | | 6.23 |
| t (75%-25%) | mins | 275.00 | | 327.00 | | 460.00 |
| **SOIL INFILTRATION RATE** | m/s | **1.26E-05** | | **9.80E-06** | | **7.28E-06** |

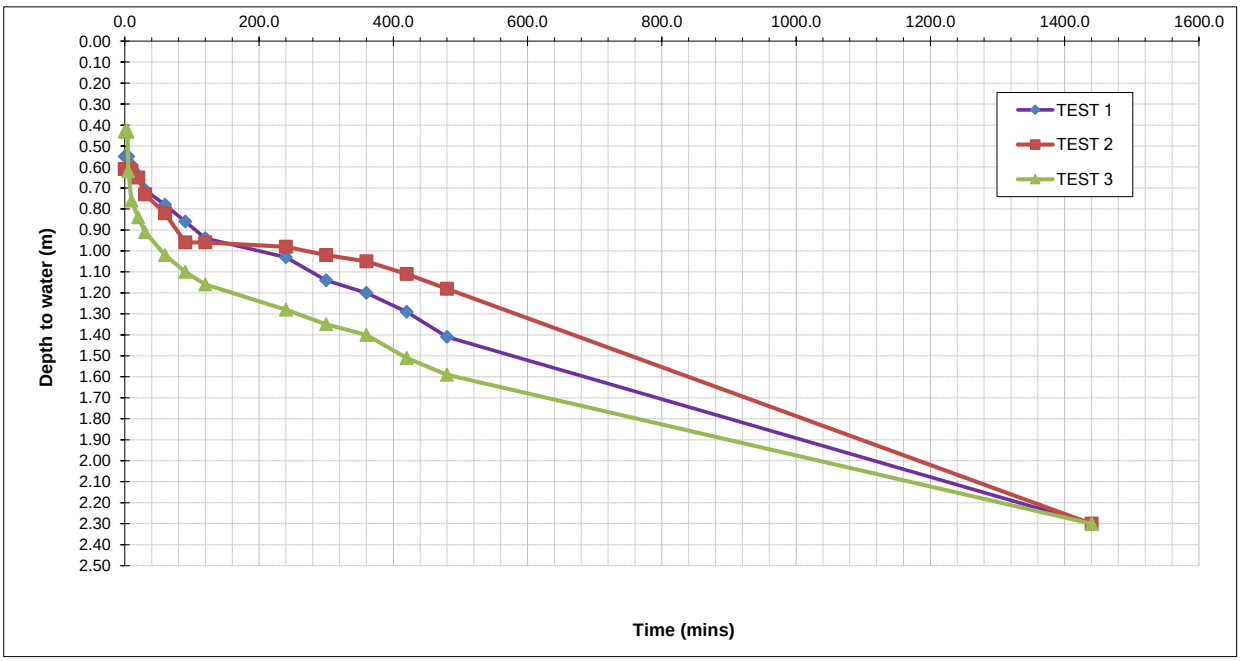
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| **DESIGN SOIL INFILTRATION RATE, f** | **7.28E-06** |



| | | | |
|---|---|---|---|
| e3p | **Site:** Ruthin Road, Wrexham<br>**Job Number:** 14-854<br>**Date of Test:** 30/07/2021 | **Trial Pit Number:** | SA111 |
| | | **Length:** | 2.10 m |
| | | **Width:** | 0.70 m |
| | | **Depth:** | 2.30 m |
| | | **Groundwater Level:** | N/A m |

| | TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|---|
| | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| | 0 | 0.55 | 0 | 0.61 | 0 | 0.43 |
| | 1 | 0.55 | 1 | 0.61 | 1 | 0.43 |
| | 2 | 0.55 | 2 | 0.61 | 2 | 0.43 |
| | 3 | 0.55 | 3 | 0.61 | 3 | 0.43 |
| | 4 | 0.55 | 4 | 0.61 | 4 | 0.43 |
| | 5 | 0.55 | 5 | 0.61 | 5 | 0.62 |
| | 10 | 0.59 | 10 | 0.62 | 10 | 0.76 |
| | 20 | 0.64 | 20 | 0.65 | 20 | 0.84 |
| | 30 | 0.71 | 30 | 0.73 | 30 | 0.91 |
| | 60 | 0.78 | 60 | 0.82 | 60 | 1.02 |
| | 90 | 0.86 | 90 | 0.96 | 90 | 1.10 |
| | 120 | 0.94 | 120 | 0.96 | 120 | 1.16 |
| | 240 | 1.03 | 240 | 0.98 | 240 | 1.28 |
| | 300 | 1.14 | 300 | 1.02 | 300 | 1.35 |
| | 360 | 1.20 | 360 | 1.05 | 360 | 1.40 |
| | 420 | 1.29 | 420 | 1.11 | 420 | 1.51 |
| | 480 | 1.41 | 480 | 1.18 | 480 | 1.59 |
| | 1440 | 2.30 | 1440 | 2.30 | 1440 | 2.30 |
| Effective Storage Depth | m | 1.75 | | 1.69 | | 1.87 |
| 75% Effective Storage Depth | m | 1.31 | | 1.27 | | 1.40 |
| (i.e. depth below GL) | m | 0.99 | | 1.03 | | 0.90 |
| 25% Effective Storage Depth | m | 0.44 | | 0.42 | | 0.47 |
| (i.e. depth below GL) | m | 1.86 | | 1.88 | | 1.83 |
| Effective Storage Depth 75%-25% | m | 0.88 | | 0.85 | | 0.94 |
| Time to fall to 75% effective depth | mins | 180.00 | | 305.00 | | 28.00 |
| Time to fall to 25% effective depth | mins | 960.00 | | 842.00 | | 800.00 |
| V (75%-25%) | m3 | 1.29 | | 1.24 | | 1.37 |
| a (50%) | m2 | 6.37 | | 6.20 | | 6.71 |
| t (75%-25%) | mins | 780.00 | | 537.00 | | 772.00 |
| **SOIL INFILTRATION RATE** | m/s | **4.31E-06** | | **6.22E-06** | | **4.42E-06** |

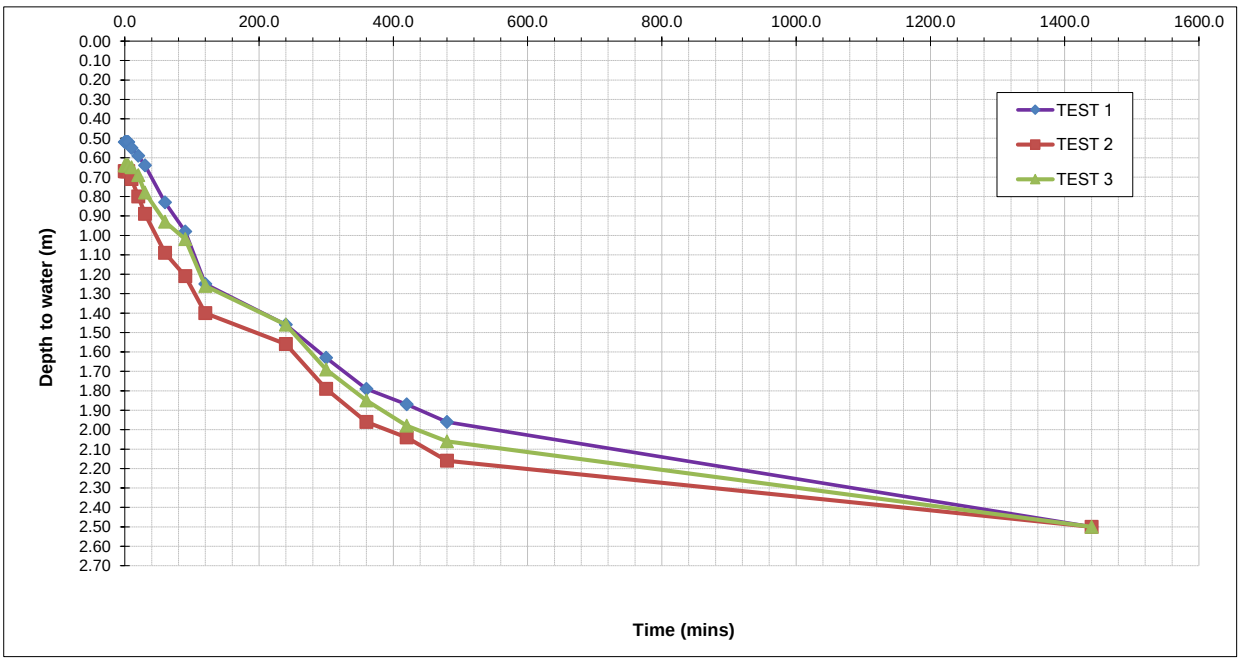
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| **DESIGN SOIL INFILTRATION RATE, f** | **4.31E-06** |



| | | | |
|---|---|---|---|
| e3p | **Site:** Ruthin Road, Wrexham<br>**Job Number:** 14-854<br>**Date of Test:** 30/07/2021 | **Trial Pit Number:** | SA112 |
| | | **Length:** | 2.30 m |
| | | **Width:** | 0.70 m |
| | | **Depth:** | 2.50 m |
| | | **Groundwater Level:** | N/A m |

| | TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|---|
| | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| | 0 | 0.52 | 0 | 0.67 | 0 | 0.64 |
| | 1 | 0.52 | 1 | 0.67 | 1 | 0.64 |
| | 2 | 0.52 | 2 | 0.67 | 2 | 0.64 |
| | 3 | 0.52 | 3 | 0.67 | 3 | 0.64 |
| | 4 | 0.52 | 4 | 0.67 | 4 | 0.64 |
| | 5 | 0.52 | 5 | 0.67 | 5 | 0.64 |
| | 10 | 0.55 | 10 | 0.71 | 10 | 0.65 |
| | 20 | 0.59 | 20 | 0.80 | 20 | 0.69 |
| | 30 | 0.64 | 30 | 0.89 | 30 | 0.78 |
| | 60 | 0.83 | 60 | 1.09 | 60 | 0.93 |
| | 90 | 0.98 | 90 | 1.21 | 90 | 1.02 |
| | 120 | 1.25 | 120 | 1.40 | 120 | 1.26 |
| | 240 | 1.46 | 240 | 1.56 | 240 | 1.46 |
| | 300 | 1.63 | 300 | 1.79 | 300 | 1.69 |
| | 360 | 1.79 | 360 | 1.96 | 360 | 1.85 |
| | 420 | 1.87 | 420 | 2.04 | 420 | 1.98 |
| | 480 | 1.96 | 480 | 2.16 | 480 | 2.06 |
| | 1440 | 2.50 | 1440 | 2.50 | 1440 | 2.50 |
| Effective Storage Depth | m | 1.98 | | 1.83 | | 1.86 |
| 75% Effective Storage Depth | m | 1.49 | | 1.37 | | 1.40 |
| (i.e. depth below GL) | m | 1.02 | | 1.13 | | 1.11 |
| 25% Effective Storage Depth | m | 0.50 | | 0.46 | | 0.47 |
| (i.e. depth below GL) | m | 2.01 | | 2.04 | | 2.04 |
| Effective Storage Depth 75%-25% | m | 0.99 | | 0.92 | | 0.93 |
| Time to fall to 75% effective depth | mins | 91.00 | | 76.00 | | 90.00 |
| Time to fall to 25% effective depth | mins | 600.00 | | 420.00 | | 472.00 |
| V (75%-25%) | m3 | 1.59 | | 1.47 | | 1.50 |
| a (50%) | m2 | 7.55 | | 7.10 | | 7.19 |
| t (75%-25%) | mins | 509.00 | | 344.00 | | 382.00 |
| **SOIL INFILTRATION RATE** | m/s | **6.91E-06** | | **1.01E-05** | | **9.09E-06** |

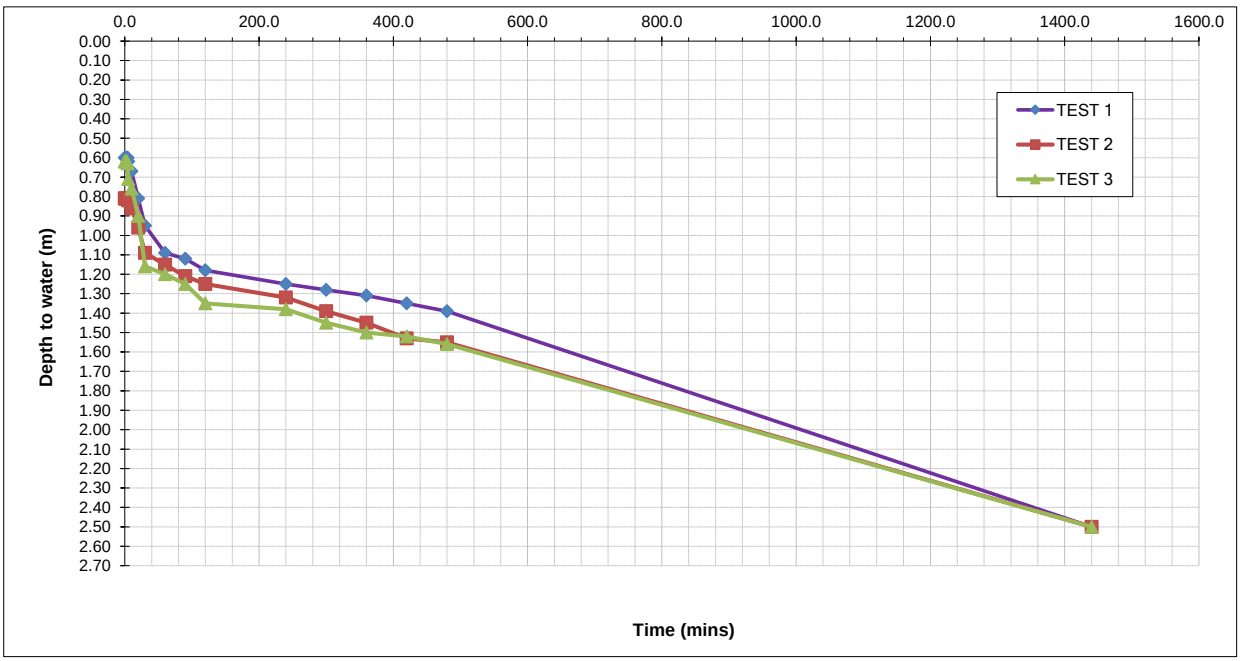
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| **DESIGN SOIL INFILTRATION RATE, f** | **6.91E-06** |



| | | | |
|---|---|---|---|
| e3p | **Site:** Ruthin Road, Wrexham<br>**Job Number:** 14-854<br>**Date of Test:** 30/07/2021 | **Trial Pit Number:** | SA113 |
| | | **Length:** | 2.10 m |
| | | **Width:** | 0.70 m |
| | | **Depth:** | 2.50 m |
| | | **Groundwater Level:** | N/A m |

| | TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|---|
| | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| | 0 | 0.60 | 0 | 0.81 | 0 | 0.62 |
| | 1 | 0.60 | 1 | 0.81 | 1 | 0.62 |
| | 2 | 0.60 | 2 | 0.81 | 2 | 0.62 |
| | 3 | 0.60 | 3 | 0.81 | 3 | 0.62 |
| | 4 | 0.60 | 4 | 0.81 | 4 | 0.63 |
| | 5 | 0.62 | 5 | 0.82 | 5 | 0.71 |
| | 10 | 0.67 | 10 | 0.86 | 10 | 0.76 |
| | 20 | 0.81 | 20 | 0.96 | 20 | 0.90 |
| | 30 | 0.95 | 30 | 1.09 | 30 | 1.16 |
| | 60 | 1.09 | 60 | 1.15 | 60 | 1.20 |
| | 90 | 1.12 | 90 | 1.21 | 90 | 1.25 |
| | 120 | 1.18 | 120 | 1.25 | 120 | 1.35 |
| | 240 | 1.25 | 240 | 1.32 | 240 | 1.38 |
| | 300 | 1.28 | 300 | 1.39 | 300 | 1.45 |
| | 360 | 1.31 | 360 | 1.45 | 360 | 1.50 |
| | 420 | 1.35 | 420 | 1.53 | 420 | 1.52 |
| | 480 | 1.39 | 480 | 1.55 | 480 | 1.56 |
| | 1440 | 2.50 | 1440 | 2.50 | 1440 | 2.50 |
| Effective Storage Depth | m | 1.90 | | 1.69 | | 1.88 |
| 75% Effective Storage Depth | m | 1.43 | | 1.27 | | 1.41 |
| (i.e. depth below GL) | m | 1.08 | | 1.23 | | 1.09 |
| 25% Effective Storage Depth | m | 0.48 | | 0.42 | | 0.47 |
| (i.e. depth below GL) | m | 2.03 | | 2.08 | | 2.03 |
| Effective Storage Depth 75%-25% | m | 0.95 | | 0.85 | | 0.94 |
| Time to fall to 75% effective depth | mins | 45.00 | | 105.00 | | 35.00 |
| Time to fall to 25% effective depth | mins | 1040.00 | | 1000.00 | | 960.00 |
| V (75%-25%) | m3 | 1.40 | | 1.24 | | 1.38 |
| a (50%) | m2 | 6.79 | | 6.20 | | 6.73 |
| t (75%-25%) | mins | 995.00 | | 895.00 | | 925.00 |
| **SOIL INFILTRATION RATE** | m/s | **3.45E-06** | | **3.73E-06** | | **3.70E-06** |

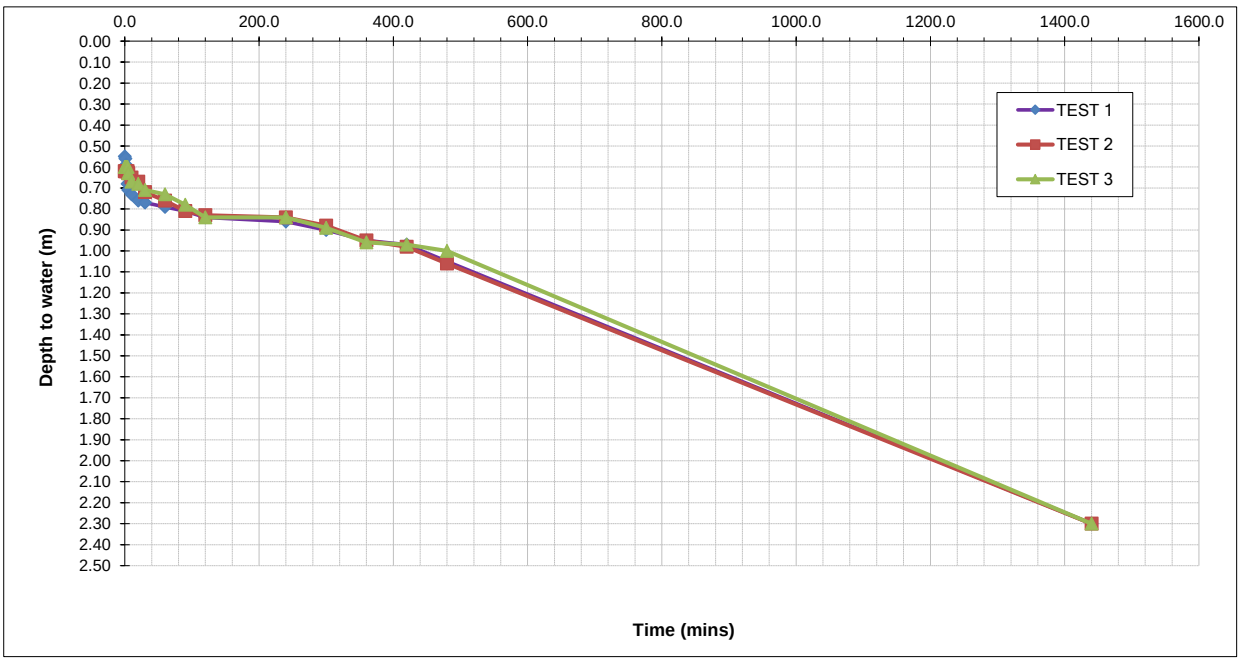
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| **DESIGN SOIL INFILTRATION RATE, f** | **3.45E-06** |



| | | | |
|---|---|---|---|
| e3p | **Site:** Ruthin Road, Wrexham<br>**Job Number:** 14-854<br>**Date of Test:** 30/07/2021 | **Trial Pit Number:** | SA114 |
| | | **Length:** | 2.10 m |
| | | **Width:** | 0.70 m |
| | | **Depth:** | 2.30 m |
| | | **Groundwater Level:** | N/A m |

| | TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|---|
| | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| | 0 | 0.55 | 0 | 0.62 | 0 | 0.60 |
| | 1 | 0.56 | 1 | 0.62 | 1 | 0.60 |
| | 2 | 0.59 | 2 | 0.62 | 2 | 0.60 |
| | 3 | 0.64 | 3 | 0.62 | 3 | 0.60 |
| | 4 | 0.68 | 4 | 0.62 | 4 | 0.60 |
| | 5 | 0.71 | 5 | 0.63 | 5 | 0.63 |
| | 10 | 0.73 | 10 | 0.65 | 10 | 0.67 |
| | 20 | 0.76 | 20 | 0.67 | 20 | 0.68 |
| | 30 | 0.77 | 30 | 0.72 | 30 | 0.71 |
| | 60 | 0.79 | 60 | 0.76 | 60 | 0.73 |
| | 90 | 0.81 | 90 | 0.81 | 90 | 0.78 |
| | 120 | 0.84 | 120 | 0.83 | 120 | 0.84 |
| | 240 | 0.86 | 240 | 0.84 | 240 | 0.84 |
| | 300 | 0.90 | 300 | 0.88 | 300 | 0.89 |
| | 360 | 0.95 | 360 | 0.95 | 360 | 0.96 |
| | 420 | 0.97 | 420 | 0.98 | 420 | 0.97 |
| | 480 | 1.05 | 480 | 1.06 | 480 | 1.00 |
| | 1440 | 2.30 | 1440 | 2.30 | 1440 | 2.30 |
| Effective Storage Depth | m | 1.75 | | 1.68 | | 1.70 |
| 75% Effective Storage Depth | m | 1.31 | | 1.26 | | 1.28 |
| (i.e. depth below GL) | m | 0.99 | | 1.04 | | 1.03 |
| 25% Effective Storage Depth | m | 0.44 | | 0.42 | | 0.43 |
| (i.e. depth below GL) | m | 1.86 | | 1.88 | | 1.88 |
| Effective Storage Depth 75%-25% | m | 0.88 | | 0.84 | | 0.85 |
| Time to fall to 75% effective depth | mins | 430.00 | | 470.00 | | 485.00 |
| Time to fall to 25% effective depth | mins | 1120.00 | | 1120.00 | | 1120.00 |
| V (75%-25%) | m3 | 1.29 | | 1.23 | | 1.25 |
| a (50%) | m2 | 6.37 | | 6.17 | | 6.23 |
| t (75%-25%) | mins | 690.00 | | 650.00 | | 635.00 |
| **SOIL INFILTRATION RATE** | m/s | **4.88E-06** | | **5.13E-06** | | **5.26E-06** |

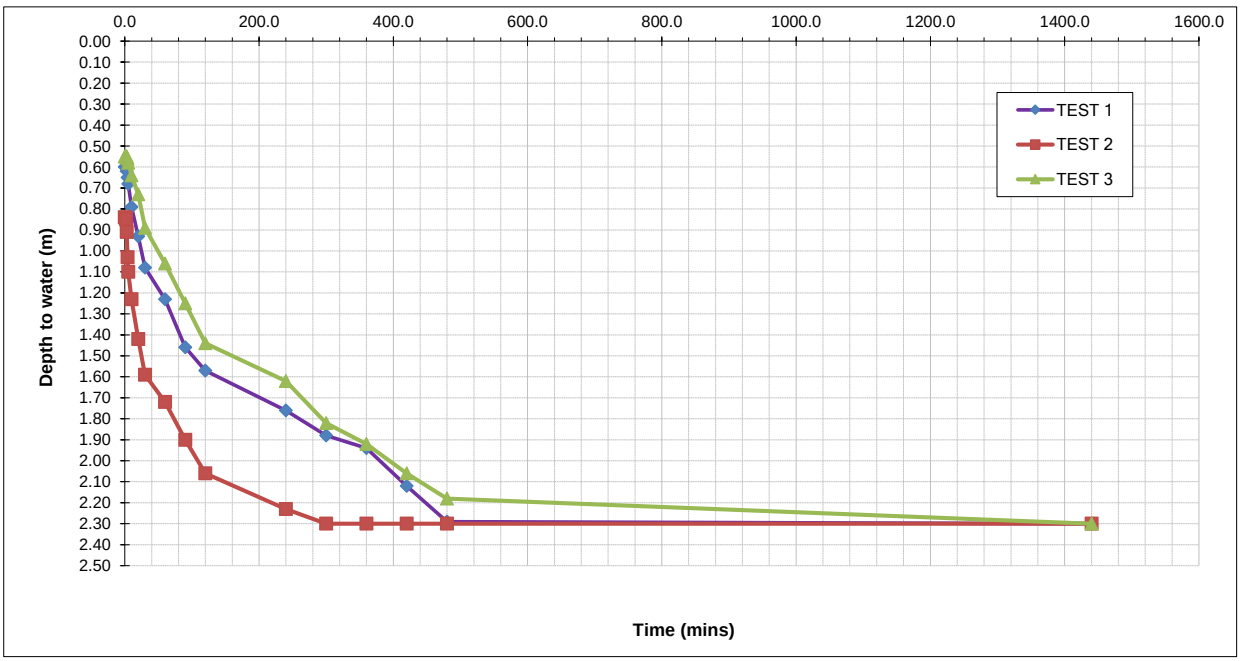
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|---|---|
| **DESIGN SOIL INFILTRATION RATE, f** | **4.88E-06** |



| | | | |
|---|---|---|---|
| e3p | **Site:** Ruthin Road, Wrexham<br>**Job Number:** 14-854<br>**Date of Test:** 30/07/2021 | **Trial Pit Number:** | SA115 |
| | | **Length:** | 2.30 m |
| | | **Width:** | 0.70 m |
| | | **Depth:** | 2.30 m |
| | | **Groundwater Level:** | N/A m |

| | TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|---|
| | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| | 0 | 0.60 | 0 | 0.84 | 0 | 0.55 |
| | 1 | 0.60 | 1 | 0.84 | 1 | 0.55 |
| | 2 | 0.60 | 2 | 0.85 | 2 | 0.55 |
| | 3 | 0.62 | 3 | 0.91 | 3 | 0.55 |
| | 4 | 0.65 | 4 | 1.03 | 4 | 0.56 |
| | 5 | 0.68 | 5 | 1.10 | 5 | 0.58 |
| | 10 | 0.79 | 10 | 1.23 | 10 | 0.64 |
| | 20 | 0.93 | 20 | 1.42 | 20 | 0.73 |
| | 30 | 1.08 | 30 | 1.59 | 30 | 0.89 |
| | 60 | 1.23 | 60 | 1.72 | 60 | 1.06 |
| | 90 | 1.46 | 90 | 1.90 | 90 | 1.25 |
| | 120 | 1.57 | 120 | 2.06 | 120 | 1.44 |
| | 240 | 1.76 | 240 | 2.23 | 240 | 1.62 |
| | 300 | 1.88 | 300 | 2.30 | 300 | 1.82 |
| | 360 | 1.94 | 360 | 2.30 | 360 | 1.92 |
| | 420 | 2.12 | 420 | 2.30 | 420 | 2.06 |
| | 480 | 2.29 | 480 | 2.30 | 480 | 2.18 |
| | 1440 | 2.30 | 1440 | 2.30 | 1440 | 2.30 |
| Effective Storage Depth | m | 1.70 | | 1.46 | | 1.75 |
| 75% Effective Storage Depth | m | 1.28 | | 1.10 | | 1.31 |
| (i.e. depth below GL) | m | 1.03 | | 1.21 | | 0.99 |
| 25% Effective Storage Depth | m | 0.43 | | 0.37 | | 0.44 |
| (i.e. depth below GL) | m | 1.88 | | 1.94 | | 1.86 |
| Effective Storage Depth 75%-25% | m | 0.85 | | 0.73 | | 0.88 |
| Time to fall to 75% effective depth | mins | 26.00 | | 9.00 | | 53.00 |
| Time to fall to 25% effective depth | mins | 300.00 | | 98.00 | | 310.00 |
| V (75%-25%) | m3 | 1.37 | | 1.18 | | 1.41 |
| a (50%) | m2 | 6.71 | | 5.99 | | 6.86 |
| t (75%-25%) | mins | 274.00 | | 89.00 | | 257.00 |
| **SOIL INFILTRATION RATE** | m/s | **1.24E-05** | | **3.67E-05** | | **1.33E-05** |

| | |
|---|---|
| **DESIGN SOIL INFILTRATION RATE, f** | **1.24E-05** |



| | | | |
|---|---|---|---|
| e3p | **Site:** Ruthin Road, Wrexham<br>**Job Number:** 14-854<br>**Date of Test:** 30/07/2021 | **Trial Pit Number:** | SA116 |
| | | **Length:** | 1.80 m |
| | | **Width:** | 0.70 m |
| | | **Depth:** | 2.30 m |
| | | **Groundwater Level:** | N/A m |

| | TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|---|
| | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| | 0 | 0.55 | 0 | 0.61 | 0 | 0.60 |
| | 1 | 0.55 | 1 | 0.61 | 1 | 0.60 |
| | 2 | 0.56 | 2 | 0.62 | 2 | 0.60 |
| | 3 | 0.57 | 3 | 0.64 | 3 | 0.63 |
| | 4 | 0.59 | 4 | 0.65 | 4 | 0.68 |
| | 5 | 0.62 | 5 | 0.67 | 5 | 0.72 |
| | 10 | 0.67 | 10 | 0.76 | 10 | 0.74 |
| | 20 | 0.74 | 20 | 0.86 | 20 | 0.79 |
| | 30 | 0.84 | 30 | 0.91 | 30 | 0.83 |
| | 60 | 1.04 | 60 | 1.07 | 60 | 1.00 |
| | 90 | 1.14 | 90 | 1.21 | 90 | 1.10 |
| | 120 | 1.29 | 120 | 1.35 | 120 | 1.26 |
| | 240 | 1.54 | 240 | 1.61 | 240 | 1.53 |
| | 300 | 1.79 | 300 | 1.86 | 300 | 1.70 |
| | 360 | 1.98 | 360 | 2.04 | 360 | 1.90 |
| | 420 | 2.30 | 420 | 2.20 | 420 | 2.10 |
| | 480 | 2.30 | 480 | 2.30 | 480 | 2.30 |
| | 1440 | 2.30 | 1440 | 2.30 | 1440 | 2.30 |
| Effective Storage Depth | m | 1.75 | | 1.69 | | 1.70 |
| 75% Effective Storage Depth | m | 1.31 | | 1.27 | | 1.28 |
| (i.e. depth below GL) | m | 0.99 | | 1.03 | | 1.03 |
| 25% Effective Storage Depth | m | 0.44 | | 0.42 | | 0.43 |
| (i.e. depth below GL) | m | 1.86 | | 1.88 | | 1.88 |
| Effective Storage Depth 75%-25% | m | 0.88 | | 0.85 | | 0.85 |
| Time to fall to 75% effective depth | mins | 52.00 | | 55.00 | | 65.00 |
| Time to fall to 25% effective depth | mins | 330.00 | | 310.00 | | 350.00 |
| V (75%-25%) | m3 | 1.10 | | 1.06 | | 1.07 |
| a (50%) | m2 | 5.64 | | 5.49 | | 5.51 |
| t (75%-25%) | mins | 278.00 | | 255.00 | | 285.00 |
| **SOIL INFILTRATION RATE** | m/s | **1.17E-05** | | **1.27E-05** | | **1.14E-05** |

| | |
|---|---|
| **DESIGN SOIL INFILTRATION RATE, f** | **1.14E-05** |



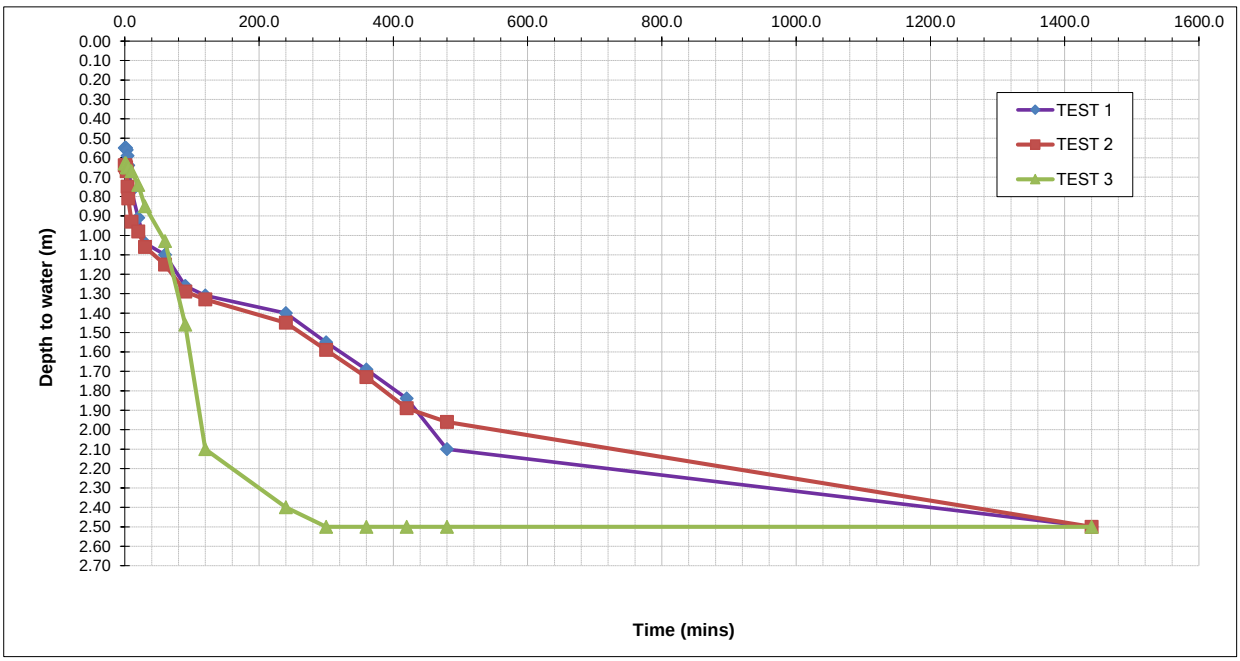
| | | | |
|---|---|---|---|
| | **Site:** | Ruthin Road, Wrexham | |
| | **Job Number:** | 14-854 | |
| | **Date of Test:** | 30/07/2021 | |

| | | |
|---|---|---|
| **Trial Pit Number:** | SA117 | |
| **Length:** | 2.00 | m |
| **Width:** | 0.70 | m |
| **Depth:** | 2.50 | m |
| **Groundwater Level:** | N/A | m |

| TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|
| Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| 0 | 0.55 | 0 | 0.64 | 0 | 0.63 |
| 1 | 0.55 | 1 | 0.64 | 1 | 0.63 |
| 2 | 0.55 | 2 | 0.65 | 2 | 0.63 |
| 3 | 0.56 | 3 | 0.67 | 3 | 0.65 |
| 4 | 0.59 | 4 | 0.75 | 4 | 0.65 |
| 5 | 0.64 | 5 | 0.81 | 5 | 0.65 |
| 10 | 0.77 | 10 | 0.93 | 10 | 0.67 |
| 20 | 0.91 | 20 | 0.98 | 20 | 0.74 |
| 30 | 1.04 | 30 | 1.06 | 30 | 0.85 |
| 60 | 1.10 | 60 | 1.15 | 60 | 1.03 |
| 90 | 1.26 | 90 | 1.29 | 90 | 1.46 |
| 120 | 1.31 | 120 | 1.33 | 120 | 2.10 |
| 240 | 1.40 | 240 | 1.45 | 240 | 2.40 |
| 300 | 1.55 | 300 | 1.59 | 300 | 2.50 |
| 360 | 1.69 | 360 | 1.73 | 360 | 2.50 |
| 420 | 1.84 | 420 | 1.89 | 420 | 2.50 |
| 480 | 2.10 | 480 | 1.96 | 480 | 2.50 |
| 1440 | 2.50 | 1440 | 2.50 | 1440 | 2.50 |

| | | | | |
|---|---|---|---|---|
| Effective Storage Depth | m | 1.95 | 1.86 | 1.87 |
| 75% Effective Storage Depth | m | 1.46 | 1.40 | 1.40 |
| (i.e. depth below GL) | m | 1.04 | 1.11 | 1.10 |
| 25% Effective Storage Depth | m | 0.49 | 0.47 | 0.47 |
| (i.e. depth below GL) | m | 2.01 | 2.04 | 2.03 |
| Effective Storage Depth 75%-25% | m | 0.98 | 0.93 | 0.94 |
| Time to fall to 75% effective depth | mins | 30.00 | 50.00 | 65.00 |
| Time to fall to 25% effective depth | mins | 460.00 | 640.00 | 120.00 |
| V (75%-25%) | m3 | 1.37 | 1.30 | 1.31 |
| a (50%) | m2 | 6.67 | 6.42 | 6.45 |
| t (75%-25%) | mins | 430.00 | 590.00 | 55.00 |
| **SOIL INFILTRATION RATE** | m/s | **7.94E-06** | **5.73E-06** | **6.15E-05** |

| | |
|---|---|
| **DESIGN SOIL INFILTRATION RATE, f** | **5.73E-06** |



| | | | |
|---|---|---|---|
| e3p | **Site:** Ruthin Road, Wrexham<br>**Job Number:** 14-854<br>**Date of Test:** 30/07/2021 | **Trial Pit Number:** | SA118 |
| | | **Length:** | 2.20 m |
| | | **Width:** | 0.70 m |
| | | **Depth:** | 2.50 m |
| | | **Groundwater Level:** | N/A m |

| | TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|---|
| | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| | 0 | 0.60 | 0 | 0.61 | 0 | 0.60 |
| | 1 | 0.60 | 1 | 0.61 | 1 | 0.61 |
| | 2 | 0.62 | 2 | 0.61 | 2 | 0.63 |
| | 3 | 0.65 | 3 | 0.63 | 3 | 0.65 |
| | 4 | 0.71 | 4 | 0.67 | 4 | 0.68 |
| | 5 | 0.75 | 5 | 0.73 | 5 | 0.71 |
| | 10 | 0.89 | 10 | 0.90 | 10 | 0.85 |
| | 20 | 1.03 | 20 | 1.06 | 20 | 1.00 |
| | 30 | 1.29 | 30 | 1.23 | 30 | 1.19 |
| | 60 | 1.50 | 60 | 1.46 | 60 | 1.40 |
| | 90 | 1.65 | 90 | 1.61 | 90 | 1.60 |
| | 120 | 1.80 | 120 | 1.75 | 120 | 1.80 |
| | 240 | 2.10 | 240 | 2.06 | 240 | 2.00 |
| | 300 | 2.30 | 300 | 2.29 | 300 | 2.30 |
| | 360 | 2.50 | 360 | 2.46 | 360 | 2.48 |
| | 420 | 2.50 | 420 | 2.50 | 420 | 2.50 |
| | 480 | 2.50 | 480 | 2.50 | 480 | 2.50 |
| | 1440 | 2.50 | 1440 | 2.50 | 1440 | 2.50 |
| Effective Storage Depth | m | 1.90 | | 1.89 | | 1.90 |
| 75% Effective Storage Depth | m | 1.43 | | 1.42 | | 1.43 |
| (i.e. depth below GL) | m | 1.08 | | 1.08 | | 1.08 |
| 25% Effective Storage Depth | m | 0.48 | | 0.47 | | 0.48 |
| (i.e. depth below GL) | m | 2.03 | | 2.03 | | 2.03 |
| Effective Storage Depth 75%-25% | m | 0.95 | | 0.95 | | 0.95 |
| Time to fall to 75% effective depth | mins | 25.00 | | 22.00 | | 25.00 |
| Time to fall to 25% effective depth | mins | 210.00 | | 220.00 | | 242.00 |
| V (75%-25%) | m3 | 1.46 | | 1.46 | | 1.46 |
| a (50%) | m2 | 7.05 | | 7.02 | | 7.05 |
| t (75%-25%) | mins | 185.00 | | 198.00 | | 217.00 |
| **SOIL INFILTRATION RATE** | m/s | **1.87E-05** | | **1.74E-05** | | **1.59E-05** |

| | |
|---|---|
| **DESIGN SOIL INFILTRATION RATE, f** | **1.59E-05** |



| | | | |
|---|---|---|---|
| | **Site:** | Ruthin Road, Wrexham | |
| | **Job Number:** | 14-854 | |
| | **Date of Test:** | 30/07/2021 | |

| | | |
|---|---|---|
| **Trial Pit Number:** | SA119 | |
| **Length:** | 2.00 | m |
| **Width:** | 0.80 | m |
| **Depth:** | 2.50 | m |
| **Groundwater Level:** | N/A | m |

| | TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|---|
| | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| | 0 | 0.60 | 0 | 0.41 | 0 | 0.71 |
| | 1 | 0.61 | 1 | 0.46 | 1 | 0.71 |
| | 2 | 0.65 | 2 | 0.55 | 2 | 0.75 |
| | 3 | 0.69 | 3 | 0.61 | 3 | 0.82 |
| | 4 | 0.73 | 4 | 0.68 | 4 | 0.88 |
| | 5 | 0.78 | 5 | 0.70 | 5 | 0.94 |
| | 10 | 0.84 | 10 | 0.79 | 10 | 1.01 |
| | 20 | 0.89 | 20 | 0.85 | 20 | 1.04 |
| | 30 | 0.95 | 30 | 0.96 | 30 | 1.06 |
| | 60 | 1.20 | 60 | 1.16 | 60 | 1.25 |
| | 90 | 1.45 | 90 | 1.35 | 90 | 1.49 |
| | 120 | 1.70 | 120 | 1.51 | 120 | 1.80 |
| | 240 | 1.94 | 240 | 2.04 | 240 | 2.28 |
| | 300 | 2.20 | 300 | 2.16 | 300 | 2.39 |
| | 360 | 2.40 | 360 | 2.30 | 360 | 2.50 |
| | 420 | 2.50 | 420 | 2.50 | 420 | 2.50 |
| | 480 | 2.50 | 480 | 2.50 | 480 | 2.50 |
| | 1440 | 2.50 | 1440 | 2.50 | 1440 | 2.50 |
| Effective Storage Depth | m | 1.90 | | 2.09 | | 1.79 |
| 75% Effective Storage Depth | m | 1.43 | | 1.57 | | 1.34 |
| (i.e. depth below GL) | m | 1.08 | | 0.93 | | 1.16 |
| 25% Effective Storage Depth | m | 0.48 | | 0.52 | | 0.45 |
| (i.e. depth below GL) | m | 2.03 | | 1.98 | | 2.05 |
| Effective Storage Depth 75%-25% | m | 0.95 | | 1.05 | | 0.90 |
| Time to fall to 75% effective depth | mins | 45.00 | | 25.00 | | 40.00 |
| Time to fall to 25% effective depth | mins | 260.00 | | 235.00 | | 280.00 |
| V (75%-25%) | m3 | 1.52 | | 1.67 | | 1.43 |
| a (50%) | m2 | 6.92 | | 7.45 | | 6.61 |
| t (75%-25%) | mins | 215.00 | | 210.00 | | 240.00 |
| **SOIL INFILTRATION RATE** | m/s | **1.70E-05** | | **1.78E-05** | | **1.50E-05** |

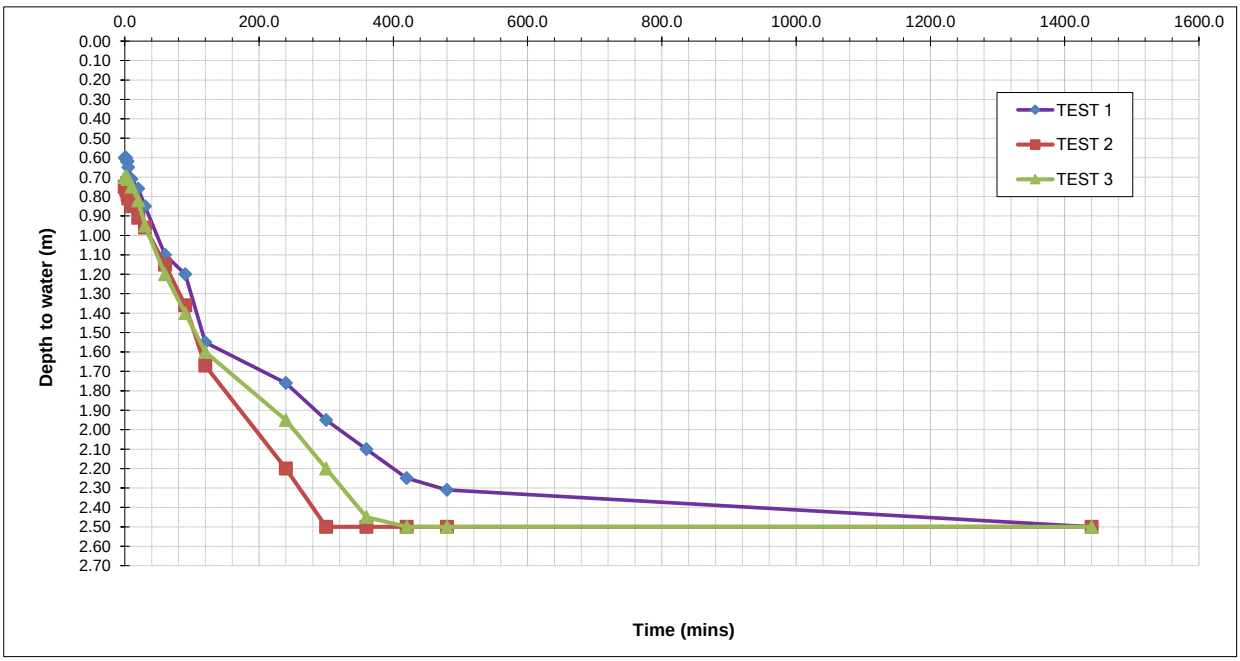
| | |
|---|---|
| **DESIGN SOIL INFILTRATION RATE, f** | **1.50E-05** |



| | | | |
|---|---|---|---|
| **Site:** | Ruthin Road, Wrexham | **Trial Pit Number:** | SA220 |
| **Job Number:** | 14-854 | **Length:** | 2.10 m |
| **Date of Test:** | 30/07/2021 | **Width:** | 0.70 m |
| | | **Depth:** | 2.50 m |
| | | **Groundwater Level:** | N/A m |

| | TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|---|
| | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| | 0 | 0.60 | 0 | 0.75 | 0 | 0.70 |
| | 1 | 0.60 | 1 | 0.75 | 1 | 0.70 |
| | 2 | 0.60 | 2 | 0.76 | 2 | 0.70 |
| | 3 | 0.62 | 3 | 0.77 | 3 | 0.70 |
| | 4 | 0.62 | 4 | 0.79 | 4 | 0.71 |
| | 5 | 0.65 | 5 | 0.81 | 5 | 0.71 |
| | 10 | 0.71 | 10 | 0.85 | 10 | 0.75 |
| | 20 | 0.76 | 20 | 0.91 | 20 | 0.82 |
| | 30 | 0.85 | 30 | 0.96 | 30 | 0.95 |
| | 60 | 1.10 | 60 | 1.15 | 60 | 1.20 |
| | 90 | 1.20 | 90 | 1.36 | 90 | 1.40 |
| | 120 | 1.55 | 120 | 1.67 | 120 | 1.60 |
| | 240 | 1.76 | 240 | 2.20 | 240 | 1.95 |
| | 300 | 1.95 | 300 | 2.50 | 300 | 2.20 |
| | 360 | 2.10 | 360 | 2.50 | 360 | 2.45 |
| | 420 | 2.25 | 420 | 2.50 | 420 | 2.50 |
| | 480 | 2.31 | 480 | 2.50 | 480 | 2.50 |
| | 1440 | 2.50 | 1440 | 2.50 | 1440 | 2.50 |
| Effective Storage Depth | m | 1.90 | | 1.75 | | 1.80 |
| 75% Effective Storage Depth | m | 1.43 | | 1.31 | | 1.35 |
| (i.e. depth below GL) | m | 1.08 | | 1.19 | | 1.15 |
| 25% Effective Storage Depth | m | 0.48 | | 0.44 | | 0.45 |
| (i.e. depth below GL) | m | 2.03 | | 2.06 | | 2.05 |
| Effective Storage Depth 75%-25% | m | 0.95 | | 0.88 | | 0.90 |
| Time to fall to 75% effective depth | mins | 50.00 | | 70.00 | | 55.00 |
| Time to fall to 25% effective depth | mins | 330.00 | | 210.00 | | 260.00 |
| V (75%-25%) | m3 | 1.40 | | 1.29 | | 1.32 |
| a (50%) | m2 | 6.79 | | 6.37 | | 6.51 |
| t (75%-25%) | mins | 280.00 | | 140.00 | | 205.00 |
| **SOIL INFILTRATION RATE** | m/s | **1.22E-05** | | **2.40E-05** | | **1.65E-05** |

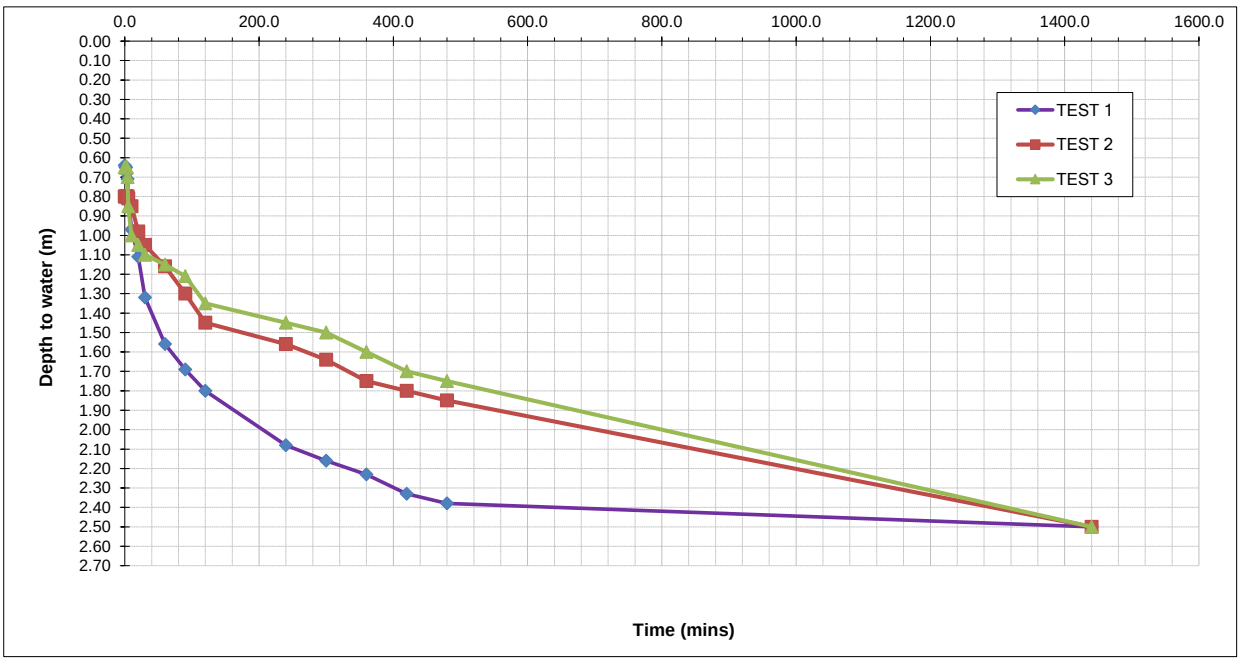
| | |
|---|---|
| **DESIGN SOIL INFILTRATION RATE, f** | **1.22E-05** |



| | | | |
|---|---|---|---|
| e3p | **Site:** Ruthin Road, Wrexham<br>**Job Number:** 14-854<br>**Date of Test:** 30/07/2021 | **Trial Pit Number:** | SA121 |
| | | **Length:** | 2.10 m |
| | | **Width:** | 0.70 m |
| | | **Depth:** | 2.50 m |
| | | **Groundwater Level:** | N/A m |

| | TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|---|
| | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| | 0 | 0.64 | 0 | 0.80 | 0 | 0.65 |
| | 1 | 0.65 | 1 | 0.80 | 1 | 0.65 |
| | 2 | 0.65 | 2 | 0.80 | 2 | 0.65 |
| | 3 | 0.68 | 3 | 0.80 | 3 | 0.65 |
| | 4 | 0.71 | 4 | 0.80 | 4 | 0.70 |
| | 5 | 0.79 | 5 | 0.81 | 5 | 0.85 |
| | 10 | 0.97 | 10 | 0.85 | 10 | 1.00 |
| | 20 | 1.11 | 20 | 0.98 | 20 | 1.05 |
| | 30 | 1.32 | 30 | 1.05 | 30 | 1.10 |
| | 60 | 1.56 | 60 | 1.16 | 60 | 1.15 |
| | 90 | 1.69 | 90 | 1.30 | 90 | 1.21 |
| | 120 | 1.80 | 120 | 1.45 | 120 | 1.35 |
| | 240 | 2.08 | 240 | 1.56 | 240 | 1.45 |
| | 300 | 2.16 | 300 | 1.64 | 300 | 1.50 |
| | 360 | 2.23 | 360 | 1.75 | 360 | 1.60 |
| | 420 | 2.33 | 420 | 1.80 | 420 | 1.70 |
| | 480 | 2.38 | 480 | 1.85 | 480 | 1.75 |
| | 1440 | 2.50 | 1440 | 2.50 | 1440 | 2.50 |
| Effective Storage Depth | m | 1.86 | | 1.70 | | 1.85 |
| 75% Effective Storage Depth | m | 1.40 | | 1.28 | | 1.39 |
| (i.e. depth below GL) | m | 1.11 | | 1.23 | | 1.11 |
| 25% Effective Storage Depth | m | 0.47 | | 0.43 | | 0.46 |
| (i.e. depth below GL) | m | 2.04 | | 2.08 | | 2.04 |
| Effective Storage Depth 75%-25% | m | 0.93 | | 0.85 | | 0.93 |
| Time to fall to 75% effective depth | mins | 20.00 | | 35.00 | | 32.00 |
| Time to fall to 25% effective depth | mins | 235.00 | | 800.00 | | 880.00 |
| V (75%-25%) | m3 | 1.37 | | 1.25 | | 1.36 |
| a (50%) | m2 | 6.68 | | 6.23 | | 6.65 |
| t (75%-25%) | mins | 215.00 | | 765.00 | | 848.00 |
| **SOIL INFILTRATION RATE** | m/s | **1.59E-05** | | **4.37E-06** | | **4.02E-06** |

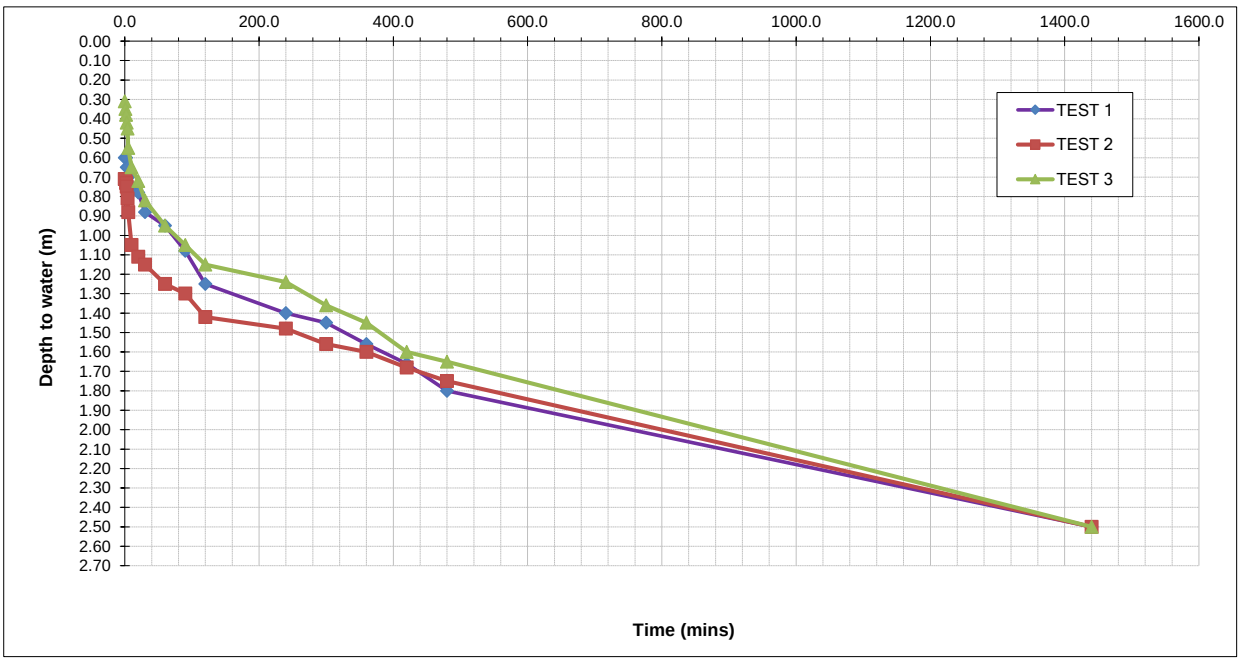
| | |
|---|---|
| **DESIGN SOIL INFILTRATION RATE, f** | **4.02E-06** |



| | | | |
|---|---|---|---|
| e3p | **Site:** Ruthin Road, Wrexham<br>**Job Number:** 14-854<br>**Date of Test:** 30/07/2021 | **Trial Pit Number:** | SA122 |
| | | **Length:** | 2.50 m |
| | | **Width:** | 0.70 m |
| | | **Depth:** | 2.50 m |
| | | **Groundwater Level:** | N/A m |

| | TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|---|
| | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| | 0 | 0.60 | 0 | 0.71 | 0 | 0.31 |
| | 1 | 0.60 | 1 | 0.71 | 1 | 0.35 |
| | 2 | 0.60 | 2 | 0.73 | 2 | 0.38 |
| | 3 | 0.65 | 3 | 0.75 | 3 | 0.42 |
| | 4 | 0.65 | 4 | 0.81 | 4 | 0.45 |
| | 5 | 0.70 | 5 | 0.88 | 5 | 0.55 |
| | 10 | 0.75 | 10 | 1.05 | 10 | 0.65 |
| | 20 | 0.78 | 20 | 1.11 | 20 | 0.72 |
| | 30 | 0.88 | 30 | 1.15 | 30 | 0.82 |
| | 60 | 0.95 | 60 | 1.25 | 60 | 0.95 |
| | 90 | 1.08 | 90 | 1.30 | 90 | 1.05 |
| | 120 | 1.25 | 120 | 1.42 | 120 | 1.15 |
| | 240 | 1.40 | 240 | 1.48 | 240 | 1.24 |
| | 300 | 1.45 | 300 | 1.56 | 300 | 1.36 |
| | 360 | 1.56 | 360 | 1.60 | 360 | 1.45 |
| | 420 | 1.66 | 420 | 1.68 | 420 | 1.60 |
| | 480 | 1.80 | 480 | 1.75 | 480 | 1.65 |
| | 1440 | 2.50 | 1440 | 2.50 | 1440 | 2.50 |
| Effective Storage Depth | m | 1.90 | | 1.79 | | 2.19 |
| 75% Effective Storage Depth | m | 1.43 | | 1.34 | | 1.64 |
| (i.e. depth below GL) | m | 1.08 | | 1.16 | | 0.86 |
| 25% Effective Storage Depth | m | 0.48 | | 0.45 | | 0.55 |
| (i.e. depth below GL) | m | 2.03 | | 2.05 | | 1.95 |
| Effective Storage Depth 75%-25% | m | 0.95 | | 0.90 | | 1.10 |
| Time to fall to 75% effective depth | mins | 90.00 | | 35.00 | | 38.00 |
| Time to fall to 25% effective depth | mins | 800.00 | | 840.00 | | 820.00 |
| V (75%-25%) | m3 | 1.66 | | 1.57 | | 1.92 |
| a (50%) | m2 | 7.83 | | 7.48 | | 8.76 |
| t (75%-25%) | mins | 710.00 | | 805.00 | | 782.00 |
| **SOIL INFILTRATION RATE** | m/s | **4.98E-06** | | **4.34E-06** | | **4.66E-06** |

| | |
|---|---|
| **DESIGN SOIL INFILTRATION RATE, f** | **4.34E-06** |



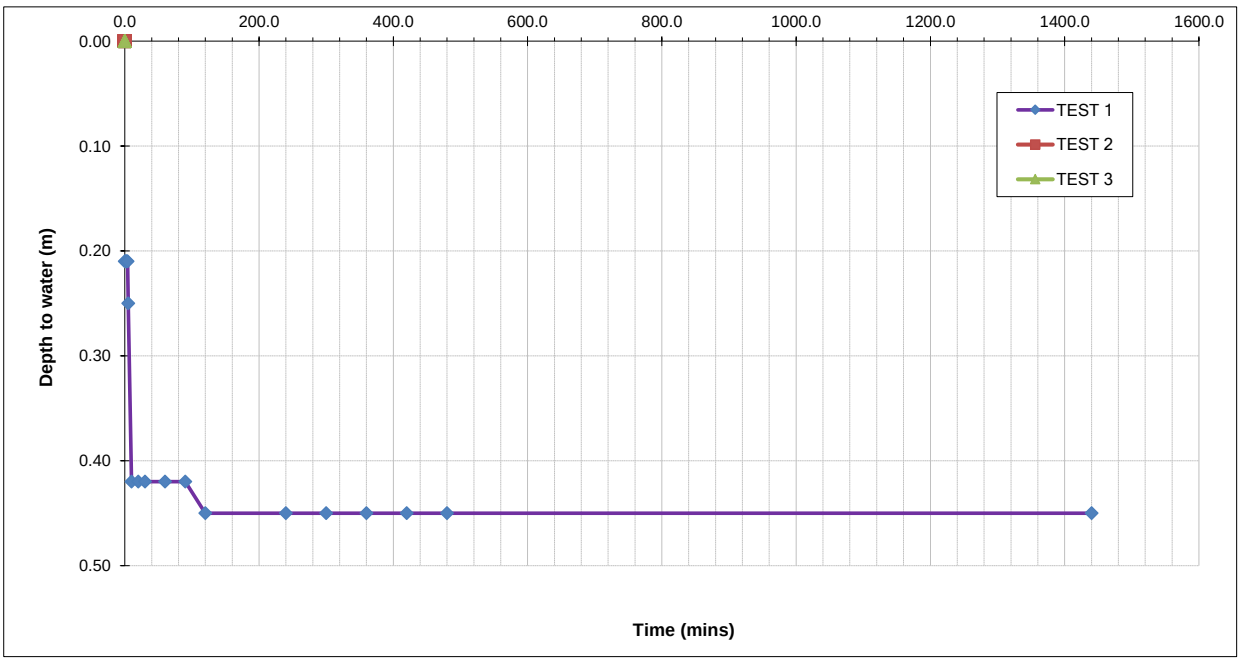
| | | | |
|---|---|---|---|
| e3p | **Site:** Ruthin Road, Wrexham<br>**Job Number:** 14-854<br>**Date of Test:** 30/07/2021 | **Trial Pit Number:** SA123<br>**Length:** 2.50 m<br>**Width:** 0.70 m<br>**Depth:** 2.50 m<br>**Groundwater Level:** N/A m | |

Test completed in predominantly cohesive materials did not fall below 75% or 25% effective storage.

| TEST 1 | | TEST 2 | | TEST 3 | |
|---|---|---|---|---|---|
| Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) | Time(min) | Depth to Water (m) |
| 0 | 0.21 | | | | |
| 1 | 0.21 | | | | |
| 2 | 0.21 | | | | |
| 3 | 0.21 | | | | |
| 4 | 0.21 | | | | |
| 5 | 0.25 | | | | |
| 10 | 0.42 | | | | |
| 20 | 0.42 | | | | |
| 30 | 0.42 | | | | |
| 60 | 0.42 | | | | |
| 90 | 0.42 | | | | |
| 120 | 0.45 | | | | |
| 240 | 0.45 | | | | |
| 300 | 0.45 | | | | |
| 360 | 0.45 | | | | |
| 420 | 0.45 | | | | |
| 480 | 0.45 | | | | |
| 1440 | 0.45 | | | | |

| | | | | |
|---|---|---|---|---|
| Effective Storage Depth | m | 2.29 | | |
| 75% Effective Storage Depth | m | 1.72 | | |
| (i.e. depth below GL) | m | 0.78 | | |
| 25% Effective Storage Depth | m | 0.57 | | |
| (i.e. depth below GL) | m | 1.93 | | |
| Effective Storage Depth 75%-25% | m | 1.15 | | |
| Time to fall to 75% effective depth | mins | N/A | | |
| Time to fall to 25% effective depth | mins | N/A | | |
| V (75%-25%) | m3 | 2.00 | | |
| a (50%) | m2 | 9.08 | | |
| t (75%-25%) | mins | N/A | | |
| **SOIL INFILTRATION RATE** | m/s | **N/A** | | |

| | |
|---|---|
| **DESIGN SOIL INFILTRATION RATE, f** | **N/A** |



# Trial Pit Log

TrialPit No: TP101
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331328.00 - 350192.00<br>Level: | Date 27/08/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 x 0.80<br>Depth 2.50 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.20 | | | Light brown slightly clayey SAND. Sand is fine to coarse. Frequent rootlets. (TOPSOIL) |
| | | | | 0.40 | | | Light reddish brown clayey SAND. Sand is coarse. Occasional rootlets. |
| | | | | 1.50 | | | Light reddish brown clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. |
| | | | | 2.50 | | | Light reddish brown slightly clayey SAND. Sand is coarse. Coal at circa 2.4 m bgl. |
| | | | | | | | End of Pit at 2.50m |

## Trial Pit Photographs



Trial Pit 101



Trial Pit 101 Spoil

Remarks: 1. Complete 2. Very friable CLAY unable to complete HSV test.

Stability: Stable

# Trial Pit Log

TrialPit No: TP102
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331378.00 - 350054.00<br>Level: | Date 27/08/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 × 0.80<br>Depth 2.40 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.20 | | | Light brown slightly clayey fine to SAND. Sand is coarse. Frequent rootlets. (TOPSOIL) |
| | | | | 0.50 | | | Soft light reddish brown sandy CLAY. |
| | 2.00 | | | 2.40 | | | Stiff light brown slighty gravelly CLAY. Gravel is fine to coarse subrounded of mudstone with occasional coal. |
| | | | | | | | End of Pit at 2.40m |

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## Trial Pit Photographs



Trial Pit 102



Trial Pit 102 Spoil

Remarks: 1. Complete

Stability: Stable

# Trial Pit Log

TrialPit No: TP103
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331677.00 - 350019.00<br>Level: | Date 27/08/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 x 0.80<br>Depth 2.40 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Light brown slightly clayey fine to SAND. Sand is coarse. Frequent rootlets. (TOPSOIL) |
| | | | | 2.40 | | | Light reddish brown slightly clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subrounded of mudstone. Pockets of light brown clay.<br>End of Pit at 2.40m |

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## Trial Pit Photographs



Trial Pit 103



Trial Pit 103 Spoil

Remarks: 1. Complete 2. Very friable CLAY unable to complete HSV test.

Stability: Stable

# Trial Pit Log

TrialPit No: TP104
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331601.00 - 350067.00<br>Level: | Date 27/08/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 × 0.80<br>Depth 2.50 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

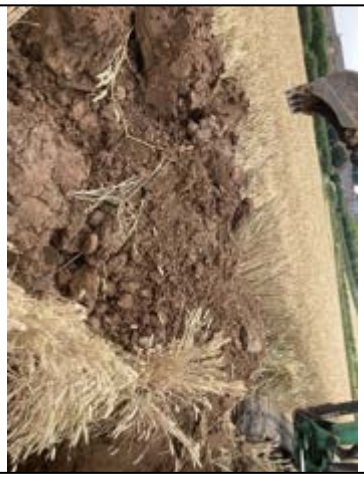
| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Light brown slightly clayey SAND. Sand is fine to coarse. Frequent rootlets. (TOPSOIL) |
| | | | | 0.90 | | | Light brown very gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subrounded of mudstone with occasional coal. |
| | 2.00 | | | 1.90 | | | Stiff light brown slighty gravelly CLAY. Gravel is fine to coarse rounded to subrounded of mudstone with occasional rounded cobbles (< 130 mm). |
| | | | | 2.50 | | | Firm light orangish brown gravelly CLAY. Gravel is fine to coarse rounded to subrounded of mudstone. Pockets of grey clay. |
| | | | | | | | End of Pit at 2.50m |

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## Trial Pit Photographs



Trial Pit 104



Trial Pit 104 Spoil

Remarks: 1. Complete

Stability: Stable

# Trial Pit Log

TrialPit No: TP105
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331771.00 - 350058.00<br>Level: | Date 27/08/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 x 0.80<br>Depth 2.60 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Light brown slightly clayey SAND. Sand is fine to coarse. Frequent rootlets. (TOPSOIL) |
| | | | | 1.70 | | | Light brown slightly clayey slightly gravelly SAND. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone with occasional boulders (< 300 mm). |
| | | | | 2.60 | | | Brown slightly clayey slightly sandy GRAVEL. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone with frequent boulders (< 250 mm) and coal. |
| | | | | | | | End of Pit at 2.60m |

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## Trial Pit Photographs



Trial Pit 105



Trial Pit 105 Spoil

Remarks: 1. Complete 2. Very friable CLAY unable to complete HSV test.

Stability: Unstable at 2.3 m bgl

# Trial Pit Log

TrialPit No: TP106
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331786.00 - 349954.00 | Date 27/08/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 x 0.80 | Scale 1:30 |
| Client: Redrow Homes | | Depth 2.40 | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Light brown slightly clayey SAND. Sand is fine to coarse. Frequent rootlets. (TOPSOIL) |
| | | | | 1.20 | | | Light brown slightly clayey gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. |
| | | | | 2.40 | | | Brown sandy slightly clayey GRAVEL. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone with frequent boulders (< 250 mm) and coal. |
| | | | | | | | End of Pit at 2.40m |

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## Trial Pit Photographs



Trial Pit 106



Trial Pit 106 Spoil

Remarks: 1. Complete 2. Very friable CLAY unable to complete HSV test.

Stability: Unstable at 1.2 m bgl

# Trial Pit Log

TrialPit No: TP107
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331822.00 - 349853.00<br>Level: | Date 27/08/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 × 0.80<br>Depth 2.30 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Light brown slightly clayey SAND. Sand is fine to coarse. Frequent rootlets. (TOPSOIL) |
| | | | | 0.50 | | | Brown slightly clayey slightly gravelly SAND. Sand if fine to coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone. |
| | 1.00 | | | | | | Firm greyish brown CLAY. |
| ▼ 2.20 | | | | 2.10 | | | Dark grey slightly sandy GRAVEL. Gravel is fine to coarse rounded subrounded of mudstone and sandstone with frequent boulders (< 250 mm). |
| | | | | 2.30 | | | End of Pit at 2.30m |

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## Trial Pit Photographs



Trial Pit 107



Trial Pit 107 Spoil

Remarks: 1. Complete. 2. Water strike encountered at 2.2m bgl.

Stability: Unstable at 2.1 m bgl

# Trial Pit Log

TrialPit No: TP108
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331642.00 - 349868.00<br>Level: | Date 27/08/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 × 0.80<br>Depth 2.50 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Light brown slightly clayey SAND. Sand is fine to coarse. Frequent rootlets. (TOPSOIL) |
| | 1.00 | | | 1.20 | | | Soft light brown sandy slightly gravelly CLAY. Gravel is fine to medium subrounded of mudstone and sandstone. Pockets of ligh orangeish brown clay. Occasional rootlets. |
| | | | | 2.50 | | | Soft light brown slightly gravelly slightly sandy CLAY. Gravel is fine to medium rounded to subrounded of mudstone and sandstone with occasional coal. |
| | | | | | | | End of Pit at 2.50m |

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## Trial Pit Photographs



Trial Pit 108



Trial Pit 108 Spoil

Remarks: 1. Complete

Stability: Stable

# Trial Pit Log

TrialPit No: TP109
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331483.00 - 349797.00<br>Level: | Date 27/08/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 × 0.80<br>Depth 2.30 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Light brown slightly clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to medium rounded to subrounded of mudstone and sandstone. Frequent rootlets. (TOPSOIL) |
| | | | | 1.20 | | | Light brown very gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subrounded of mudstone and sandstone with frequent cobbles (< 200 mm) and coal at 0.5 m bgl. |
| | | | | 2.30 | | | Brown slightly clayey sandy GRAVEL. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone with coal. |
| | | | | | | | End of Pit at 2.30m |

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## Trial Pit Photographs



Trial Pit 109



Trial Pit 109

Remarks: 1. Complete 2. Very friable CLAY unable to complete HSV test.

Stability: Unstable at 1.0 m bgl

# Trial Pit Log

TrialPit No: TP110
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331433.00 - 350151.00<br>Level: | Date 27/08/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 x 0.80<br>Depth 2.40 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Light brown slightly clayey SAND. Sand is fine to coarse. Frequent rootlets. (TOPSOIL) |
| | | | | 0.50 | | | Light orangeish brown sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone.<br>Soft light reddish brown sandy CLAY. |
| | | | | 1.90 | | | Soft light reddish brown sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded of mudstone with occasional cobbles (< 200 mm). |
| | | | | 2.40 | | | End of Pit at 2.40m |

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## Trial Pit Photographs



Trial Pit 110



Trial Pit 110 Spoil

Remarks: 1. Complete 2. Very friable CLAY unable to complete HSV test.

Stability: Stable

# Trial Pit Log

TrialPit No: TP111
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331301.00 - 349783.00<br>Level: | Date 27/08/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 x 0.80<br>Depth 2.30 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Light brown slightly clayey SAND. Sand is fine to coarse. Frequent rootlets. (TOPSOIL) |
| | | | | 1.30 | | | Brown slightly clayey gravelly SAND. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone with frequent cobbles (< 200 mm) and coal at 0.7 m bgl. |
| | | | | 2.30 | | | Dark brown slightly clayey sandy GRAVEL. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone with frequent cobbles (< 200 mm) and coal. |
| | | | | | | | End of Pit at 2.30m |

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## Trial Pit Photographs



Trial Pit 111



Trial Pit 111 Spoil

Remarks: 1. Complete 2. Very friable CLAY unable to complete HSV test.

Stability: Unstable at 1.2 m bgl

# Trial Pit Log

TrialPit No: TP112
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331450.00 - 349873.00<br>Level: | Date 27/08/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 × 0.80<br>Depth 2.50 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Light brown slightly clayey SAND. Sand is fine to coarse. Frequent rootlets. (TOPSOIL) |
| | | | | 0.80 | | | Soft light reddish brown sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded of mudstone with occasional cobbles (< 150 mm) and coal. |
| | | | | 1.50 | | | Brown slightly clayey gravelly SAND. Sand is coarse. Gravel is fine to medium subrounded of mudstone with occasional cobbles (< 100 mm). |
| | | | | 2.30 | | | Brown clayey slightly sandy GRAVEL. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone with boulders (< 300 mm). |
| | | | | 2.50 | | | Firm light brown gravelly CLAY. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone. |
| | | | | | | | End of Pit at 2.50m |

1 2 3 4

## Trial Pit Photographs



Trial Pit 112



Trial Pit 112 Spoil

Remarks: 1. Complete 2. Very friable CLAY unable to complete HSV test.

Stability: Stable

# Trial Pit Log

TrialPit No: TP113
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331288.00 - 349981.00<br>Level: | Date 27/08/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 x 0.80<br>Depth 2.50 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Light brown slightly clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to medium rounded to subrounded of mudstone and sandstone. Frequent rootlets. (TOPSOIL) |
| | | | | 0.40 | | | Light brown slightly clayey gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. |
| | | | | | | | Soft light reddish brown sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone with coal. |
| | | | | 2.50 | | | End of Pit at 2.50m |

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## Trial Pit Photographs



Trial Pit 113



Trial Pit 113 Spoil

Remarks: 1. Complete 2. Very friable CLAY unable to complete HSV test.

Stability: Stable

# Trial Pit Log

TrialPit No: TP114
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331128.00 - 349844.00<br>Level: | Date 27/08/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 × 0.80<br>Depth 2.30 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Light brown slightly clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to medium rounded to subrounded of mudstone and sandstone. Frequent rootlets. (TOPSOIL) |
| | | | | 1.10 | | | Brown gravelly SAND. Sand is coarse. Gravel is fine to medium subangular to subrounded of mudstone and sandstone with occasional cobbles (< 200 mm) and coal at 0.5 m bgl. |
| | | | | 2.30 | | | Brown slightly clayey sandy GRAVEL. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone with frequent boulders (< 250 mm) and coal. |
| | | | | | | | End of Pit at 2.30m |

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## Trial Pit Photographs



Trial Pit 114



Trial Pit 114 Spoil

Remarks: 1. Complete 2. Very friable CLAY unable to complete HSV test.

Stability: Unstable at 0.9 m bgl

# Trial Pit Log

TrialPit No: TP115
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331013.00 - 349582.00<br>Level: | Date 28/07/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 x 0.80<br>Depth 2.30 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Light brown slightly clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular of mudstone and sandstone. Frequent rootlets. (TOPSOIL) |
| | | | | 0.60 | | | MADE GROUND: Brown slightly clayey very gravelly SAND. Sand is coarse. Gravel is fine to coarse subangular of mudstone with occasional coal. |
| | 1.00 | | | | | | MADE GROUND: Firm dark greyish brown gravelly CLAY. Gravel is fine to coarse angular to subangular of mudstone and sandstone with frequent boulders (< 300 mm). (Reworked clay) |
| | 2.00 | | | | | | |
| | | | | 2.30 | | | End of Pit at 2.30m |

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## Trial Pit Photographs



Trial Pit 115



Trial Pit 115 Spoil

Remarks: 1. Complete

Stability: Stable

# Trial Pit Log

TrialPit No: TP116
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331005.00 - 349385.00<br>Level: | Date 28/07/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 x 0.80<br>Depth 2.30 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Light brown slightly clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular of mudstone and sandstone. Frequent rootlets. (TOPSOIL) |
| | | | | 0.60 | | | MADE GROUND: Light brown slightly clayey very gravelly SAND. Sand is coarse. Gravel is fine to coarse subangular of mudstone and sandstone with frequent boulders (< 250 mm) and coal. |
| | | | | 1.40 | | | MADE GROUND: Dark greyish brown very gravelly SAND. Sand is coarse. Gravel is fine to coarse subangular of mudstone and sandstone with frequent boulders (< 300 mm). |
| | | | | 2.30 | | | MADE GROUND: Light grey slightly clayey very gravelly SAND. Sand is coarse. Gravel is fine to coarse angular to subangular of mudstone and sandstone with frequent cobbles (< 200 mm). Pockets of grey clay. |
| | | | | | | | End of Pit at 2.30m |

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## Trial Pit Photographs



Trial Pit 116



Trial Pit 116 Spoil

Remarks: 1. Complete 2. Very friable CLAY unable to complete HSV test.

Stability: Stable

# Trial Pit Log

TrialPit No: TP117
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331108.00 - 349638.00<br>Level: | Date 28/07/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 x 0.80<br>Depth 2.50 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Brown slightly clayey SAND. Sand is fine to coarse. Frequent rootlets. (TOPSOIL) |
| | 1.00 | | | | | | Stiff light orangish brown slightly sandy CLAY. |
| | 2.00 | | | 1.90 | | | Stiff light brown clayey gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone with boulders (< 250 mm). |
| | | | | 2.20 | | | Grey very gravelly SAND. Sand is coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone. |
| | | | | 2.50 | | | End of Pit at 2.50m |

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## Trial Pit Photographs



Trial Pit 117



Trial Pit 117 Spoil

Remarks: 1. Complete

Stability: Stable

# Trial Pit Log

TrialPit No: TP118
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331141.00 - 349338.00<br>Level: | Date 28/07/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 × 0.80<br>Depth 2.50 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Brown slightly clayey SAND. Sand is fine to coarse. Frequent rootlets. (TOPSOIL) |
| | | | | 0.90 | | | Soft light orangish brown sandy slightly gravelly CLAY. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone. |
| | | | | 1.60 | | | Soft light orangeish brown slightly sandy gravelly CLAY. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone. |
| | | | | 2.50 | | | Light orangeish brown clayey very gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone. |
| | | | | | | | End of Pit at 2.50m |

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## Trial Pit Photographs



Trial Pit 118



Trial Pit 118 Spoil

Remarks: 1. Complete 2. Very friable CLAY unable to complete HSV test.

Stability: Stable

# Trial Pit Log

TrialPit No: TP119
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331976.00 - 349710.00<br>Level: | Date 28/07/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 × 0.80<br>Depth 2.50 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Dark brown slightly clayey slightly gravelly SAND. Sand is coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone. Frequent rootlets. (TOPOSIL) |
| | 2.00 | | | 2.30 | | | Brown slightly clayey slightly gravelly SAND. Sand if fine to coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone with frequent cobbles (< 150 mm). |
| | | | | 2.50 | | | Stiff light reddish brown CLAY.<br>End of Pit at 2.50m |

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## Trial Pit Photographs



Trial Pit 119



Trial Pit 119 Spoil

Remarks: 1. Complete

Stability: Unstable at 0.6 m bgl

# Trial Pit Log

TrialPit No: TP120
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331758.00 - 349712.00 | Date 28/07/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 x 0.80, Depth 2.50 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Dark brown slightly clayey slightly gravelly SAND. Sand is coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone. Frequent rootlets. (TOPOSIL) |
| | | | | 0.50 | | | Light orangeish brown slightly clayey slightly gravelly SAND. Sand is coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone with occasional cobbles (< 200 mm). |
| | | | | | | | Light brown clayey gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone. |
| | | | | 2.50 | | | End of Pit at 2.50m |

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## Trial Pit Photographs



Trial Pit 120



Trial Pit 120 Spoil

Remarks: 1. Complete 2. Very friable CLAY unable to complete HSV test.

Stability: Unstable at 1.6 m bgl

# Trial Pit Log

TrialPit No: TP121
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331836.00 - 349587.00 | Date 28/07/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 x 0.80 Depth 2.50 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Dark brown slightly clayey slightly gravelly SAND. Sand is coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone. Frequent rootlets. (TOPOSIL) |
| | | | | | | | Light orangish brown slightly clayey gravelly SAND. Sand is coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone with coal. |
| | | | | 2.50 | | | End of Pit at 2.50m |

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## Trial Pit Photographs



Trial Pit 121



Trial Pit 121 Spoil

Remarks: 1. Complete 2. Very friable CLAY unable to complete HSV test.

Stability: Unstable at 1.5 m bgl

# Trial Pit Log

TrialPit No: TP122
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331493.00 - 349630.00<br>Level: | Date 28/07/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 x 0.80<br>Depth 2.50 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Dark brown slightly clayey slightly gravelly SAND. Sand is coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone. Frequent rootlets. (TOPOSIL) |
| | | | | 0.50 | | | Light brown slightly clayey slightly gravelly SAND. Sand is coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone. |
| | | | | | | | Brown slightly clayey gravelly SAND. Sand is coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone with coal. |
| | | | | 2.50 | | | End of Pit at 2.50m |

1
2
3
4

## Trial Pit Photographs



Trial Pit 122



Trial Pit 122 Spoil

Remarks: 1. Complete 2. Very friable CLAY unable to complete HSV test.

Stability: Unstable at 1.2 m bgl

# Trial Pit Log

TrialPit No: TP123
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331444.00 - 349468.00<br>Level: | Date 28/07/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 x 0.80<br>Depth 2.50 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Brown slightly clayey slightly gravelly SAND. Sand is coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone. Frequent rootlets. (TOPOSIL) |
| | | | | 0.90 | | | Soft light brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded of mudstone and sandstone. |
| | 1.00 | | | | | | Stiff brown sandy slightly gravelly CLAY. Gravel is fine to medium subrounded of mudstone and sandstone. |
| | | | | 2.50 | | | End of Pit at 2.50m |

1
2
3
4

## Trial Pit Photographs



Trial Pit 123



Trial Pit 123 Spoil

Remarks: 1. Complete 2. Very friable CLAY unable to complete HSV test.

Stability: Stable

# Trial Pit Log

TrialPit No: TP124
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331672.00 - 349470.00<br>Level: | Date 28/07/2021 |
| Location: Wrexham | | Dimensions (m): 3.00 × 0.80<br>Depth 2.50 | Scale 1:30 |
| Client: Redrow Homes | | | Logged A. Rae |

| Water Strike | Samples & In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.30 | | | Dark brown slightly clayey slightly gravelly SAND. Sand is coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone. Frequent rootlets. (TOPOSIL) |
| | | | | 0.90 | | | Light orangish brown slightly clayey gravelly SAND. Sand is coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone with cobbles (< 200 mm). |
| | | | | 2.30 | | | Brown clayey GRAVEL. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone with occasional boulders (< 300 mm). |
| | | | | 2.50 | | | Brown slightly clayey GRAVEL. Gravel is fine to coarse subrounded of mudstone and sandstone with boulders (<300 mm). |
| | | | | | | | End of Pit at 2.50m |

1
2
3
4

## Trial Pit Photographs



Trial Pit 124



Trial Pit 124 Spoil

Remarks: 1. Complete 2. Very friable CLAY unable to complete HSV test.

Stability: Unstable at 1.2 m bgl

# Borehole Log

Borehole No. **WS101**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331418E - 350087N | Hole Type WS |
| Location: Wrexham | | Level: | Scale 1:50 |
| Client: Redrow Homes | | Dates: 27/07/2021 | Logged By A. Rae |

| Well | Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | 0.20 | ES | | 0.20 | | | Brown slightly clayey SAND. Sand is fine to coarse. Frequent rootlets. (TOPSOIL) |
| | | 0.50 - 1.00 | U | | 0.50 | | | Stiff medium strength light orangeish brown CLAY. Occasional rootlets. |
| | | 1.00<br>1.00 | D<br>SPT | N=12 (2,2/3,3,3,3) | | | | Stiff medium strength light reddish brown mottled grey CLAY with occasional coal. |
| | | 1.80 | ES | | | | | |
| | | 2.00<br>2.00 | D<br>SPT | N=7 (2,2/1,2,2,2) | | | | |
| | | | | | 2.50 | | | Firm low strength light reddish brown sandy CLAY. |
| | | 3.00<br>3.00 | D<br>SPT | N=12 (2,2/3,3,3,3) | | | | |
| | ▼ 3.30 | | | | 3.30 | | | Stiff medium strength brown slightly sandy CLAY with coal band at circa 3.80 m bgl. |
| | | 4.00<br>4.00 | D<br>SPT | N=11 (2,3/2,3,3,3) | | | | |
| | | 5.00<br>5.00 | D<br>SPT | N=18 (3,4/4,5,4,5) | | | | |
| | | | | | 5.45 | | | End of Borehole at 5.45m |

Remarks

1. Complete. 2. Final depth 5.45m bgl. 3. Water strike encountered at 3.3m bgl.

# Borehole Log

Borehole No. **WS102**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331438E - 350043N | Hole Type WS |
| Location: Wrexham | | Level: | Scale 1:50 |
| Client: Redrow Homes | | Dates: 27/07/2021 | Logged By A. Rae |

| Well | Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | 0.20 | ES | | 0.20 | | | Brown slightly clayey SAND. Sand is fine to coarse. Frequent rootlets. (TOPSOIL) |
| | | 0.50 | ES+L | | | | | Stiff medium strength light reddish brown sandy CLAY. |
| | | 1.00 | D | | 0.90 | | | Stiff medium strength brown CLAY with occasional coal. Pocket of sand at 2.00 m bgl. |
| | | 1.00 | SPT | N=8 (2,1/2,2,2,2) | | | | |
| | | 1.50 - 2.00 | U | | | | | |
| | | 2.00 | D | | 2.10 | | | Stiff medium strength reddish brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium rounded to subrounded of mudstone. |
| | | 2.00 | SPT | N=11 (2,2/3,3,2,3) | | | | |
| | ▼ 3.00 | 3.00 | D | | 3.10 | | | Very stiff very high strength dark brown slightly sandy slightly gravelly CLAY. Gravel is fine subrounded of mudstone. |
| | | 3.00 | SPT | N=16 (3,3/4,4,4,4) | | | | |
| | | 4.00 | SPT | 50 (3,7/50 for 260mm) | | | | |
| | | | | | 4.45 | | | End of Borehole at 4.45m |

Remarks

1. Complete. 2. Final depth 4.45m bgl. 3. Water strike encountered at 3m bgl. 4. Refused on gravel at 4.45 m bgl.

# Borehole Log

Borehole No. **WS103**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331582E - 349984N | Hole Type WS |
| Location: Wrexham | | Level: | Scale 1:50 |
| Client: Redrow Homes | | Dates: 27/07/2021 | Logged By A. Rae |

| Well | Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | 0.20 | ES | | 0.20 | | | Brown slightly clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse rounded to subrounded of mudstone. Frequent rootlets. (TOPSOIL) |
| | | 1.00 | SPT | N=14 (5,6/5,3,3,3) | | | | Medium dense brown slightly clayey gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of mudstone with occasional cobbles (< 90 mm). Coal at circa 1.3 m bgl. |
| | | 1.50 | ES+L | | 1.60 | | | |
| | | 2.00 | SPT | N=8 (3,3/2,2,2,2) | 2.10 | | | Loose brown slightly clayey gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of mudstone with occasional cobbles (< 90 mm) with frequent coal. |
| | | 2.50 - 3.00 | U | | | | | Stiff medium strength brown sandy gravelly CLAY. Gravel is fine to coarse subrounded of mudstone. |
| | | 3.00 | D | | | | | |
| | | 3.00 | SPT | N=13 (3,3/4,3,3,3) | 3.30 | | | Medium dense dark brown grey sandy GRAVEL. Gravel is fine to medium subrounded of mudstone. |
| | ▼ 4.00 | 4.00 | SPT | N=17 (3,4/4,5,4,4) | | | | |
| | | 5.00 | SPT | N=19 (5,4/4,5,5,5) | 5.45 | | | End of Borehole at 5.45m |

Remarks

1. Complete. 2. Final depth 5.45m bgl. 3. Water strike encountered at 4m bgl.

# Borehole Log

Borehole No. **WS104**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331688E - 350084N | Hole Type WS |
| Location: Wrexham | | Level: | Scale 1:50 |
| Client: Redrow Homes | | Dates: 27/07/2021 | Logged By A. Rae |

| Well | Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | 0.20 | ES | | 0.20 | | | Brown slightly clayey SAND. Sand is fine to coarse. Frequent rootlets. (TOPSOIL) |
| | | 0.50 - 1.00 | U | | | | | Stiff medium strength light brown sandy slightly gravelly CLAY. Gravel is fine to coarse subrounded of mudstone. |
| | | 1.00 | D | | | | | |
| | | 1.00 | SPT | N=8 (2,3/2,2,2,2) | | | | |
| | | | | | 1.70 | | | Very loose brown clayey slightly gravelly SAND. Sand is coarse. Gravel is fine to coarse subrounded of mudstone. |
| | | 2.00 | D | | | | | |
| | | 2.00 | SPT | N=8 (2,2/2,2,2,2) | | | | |
| | | 2.50 | ES | | | | | |
| | | 3.00 | SPT | N=4 (1,1/1,1,1,1) | | | | |
| | | | | | 3.80 | | | Loose reddish brown clayey slightly gravelly SAND. Sand is coarse. Gravel is fine rounded to subrounded. |
| | 4.00 | 4.00 | SPT | N=7 (1,2/1,2,2,2) | | | | |
| | | 5.00 | SPT | N=7 (2,2/2,1,2,2) | | | | |
| | | | | | 5.45 | | | End of Borehole at 5.45m |

Remarks

1. Complete. 2. Final depth 5.45m bgl. 3. Water strike encountered at 4m bgl.

# Borehole Log

Borehole No. **WS105**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331604E - 350123N | Hole Type WS |
| Location: Wrexham | | Level: | Scale 1:50 |
| Client: Redrow Homes | | Dates: 27/07/2021 | Logged By A. Rae |

| Well | Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | 0.20 | ES | | 0.20 | | | Brown slightly clayey SAND. Sand is fine to coarse. Frequent rootlets. (TOPSOIL) |
| | | 1.00 | D | | | | | Firm low strength light brown slightly sandy CLAY. Coal at circa 1.2 m bgl. |
| | | 1.00 | ES | | | | | |
| | | 1.00 | SPT | N=7 (2,2/1,2,2,2) | | | | |
| | | 1.50 - 2.00 | U | | | | | |
| | | 2.00 | D | | | | | |
| | | 2.00 | SPT | N=8 (2,2/1,2,3,2) | | | | |
| | ▼ 3.10 | 3.00 | SPT | N=5 (1,1/1,1,1,2) | 3.10 | | | Loose brown slightly clayey SAND. Sand is fine to coarse. |
| | | | | | 3.40 | | | Firm low strength light brown sandy CLAY. |
| | | | | | 3.60 | | | Dense brown slightly sandy GRAVEL. Gravel is fine to coarse subangular to subrounded of mudstone with occasional cobbles (< 90 mm). |
| | | 4.00 | SPT | 50 (10,13/50 for 280mm) | | | | |
| | | | | | 4.45 | | | End of Borehole at 4.45m |

Remarks

1. Complete. 2. Final depth 4.45m bgl. 3. Water strike encountered at 3.1m bgl. 4. Refused on gravel at 4.45 m bgl.

# Borehole Log

Borehole No. **WS106**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331742E - 349982N | Hole Type WS |
| Location: Wrexham | | Level: | Scale 1:50 |
| Client: Redrow Homes | | Dates: 28/07/2021 | Logged By A. Rae |

| Well | Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | 0.20 | ES | | 0.20 | | | Dark brown gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of mudstone. Frequent rootlets. (TOPSOIL) |
| | | | | | 0.60 | | | Very loose brown gravelly slightly clayey SAND. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. |
| | | 1.00 | SPT | N=3 (1,1/0,1,1,1) | | | | Very loose brown very gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. Frequent coal. |
| | | 1.30 | ES | | 1.20 | | | |
| | | 1.50 - 2.00 | U | | | | | Firm low strength light brown very sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. |
| | | 2.00 | SPT | N=8 (1,2/2,1,2,3) | 1.90 | | | Medium dense greyish brown sandy GRAVEL. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. Pockets of light brown coarse sand. |
| | | 3.00 | SPT | N=19 (4,6/5,5,6,3) | | | | |
| | | 4.00 | SPT | 50 (8,8/50 for 230mm) | | | | |
| | | | | | 4.45 | | | End of Borehole at 4.45m |

1 2 3 4 5 6 7 8 9 10

Remarks

1. Complete. 2. Final depth 4.45m bgl. 3. Refused on gravel at 4.45 m bgl.

# Borehole Log

Borehole No. **WS107**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331746E - 349876N | Hole Type WS |
| Location: Wrexham | | Level: | Scale 1:50 |
| Client: Redrow Homes | | Dates: 28/07/2021 | Logged By A. Rae |

| Well | Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | 0.20 | ES | | 0.20 | | | Dark brown gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of mudstone. Frequent rootlets. (TOPSOIL) |
| | | 0.50<br>0.50 - 1.00 | ES<br>U | | 0.80 | | | Medium dense brown gravelly slightly clayey SAND. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. |
| | | 1.00 | SPT | N=15 (4,5/6,4,2,3) | | | | Medium dense greyish brown very gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone with frequent coal. |
| | | 2.00 | SPT | N=7 (2,1/1,2,2,2) | 1.80<br>2.00 | | | Loose brown very gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. Frequent coal. |
| | | 3.00<br>3.00 | D<br>SPT | N=4 (1,1/1,1,1,1) | 2.50 | | | Loose greyish brown very gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone with frequent coal.<br>Very loose light brown slightly clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone. |
| | | 4.00 | SPT | N=31 (4,5/8,7,8,8) | 3.90 | | | Very loose light greyish brown slightly gravely clayey SAND. Sand is fine to coarse. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone. |
| | | 5.00 | SPT | 50 (25 for 45mm/50 for 5mm) | 4.80 | | | Very stiff high strength greyish brown gravelly sandy CLAY. Gravel is fine to medium rounded to subrounded of mudstone and sandstone. |
| | | | | | 5.45 | | | End of Borehole at 5.45m |

Remarks

1. Complete. 2. Final depth 5.45m bgl.

# Borehole Log

Borehole No. **WS108**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331864E - 349926N | Hole Type WS |
| Location: Wrexham | | Level: | Scale 1:50 |
| Client: Redrow Homes | | Dates: 28/07/2021 | Logged By A. Rae |

| Well | Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | 0.20 | ES | | 0.20 | | | Dark brown gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of mudstone. Frequent rootlets. (TOPSOIL) |
| | | 1.00 | SPT | N=12 (3,4/4,3,2,3) | 1.10 | | | Medium dense brown gravelly slightly clayey SAND. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. |
| | | 1.50 - 2.00 | U | | 1.60 | | | Medium dense grey sandy GRAVEL. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. |
| | | 2.00<br>2.10 | SPT<br>ES | N=11 (2,3/2,3,3,3) | | | | Medium dense brown slightly gravelly slightly clayey SAND. Sand is fine to coarse. Gravel is fine to coarse subrounded of mudstone and sandstone. |
| | | 3.00<br>3.00 | D<br>SPT | N=7 (2,2/1,1,2,3) | 2.80<br>3.10 | | | Firm low strength brown very sandy slightly gravelly CLAY. Gravel is fine to coarse subrounded of mudstone and sandstone. |
| | | 4.00 | SPT | N=10 (2,3/3,2,3,2) | | | | Stiff medium strength light brown CLAY. Pockets of orangish grey coarse sand. |
| | | 5.00 | SPT | N=39 (10,13/15,8,9,7) | 4.80 | | | Very stiff very high strength dark brown gravelly CLAY. Gravel is fine to coarse subangular to subrounded of mudstone. |
| | | | | | 5.45 | | | End of Borehole at 5.45m |

Remarks

1. Complete. 2. Final depth 5.45m bgl.

# Borehole Log

Borehole No. **WS109**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331666E - 349793N | Hole Type WS |
| Location: Wrexham | | Level: | Scale 1:50 |
| Client: Redrow Homes | | Dates: 28/07/2021 | Logged By A. Rae |

| Well | Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | 0.20 | ES | | 0.20 | | | Dark brown gravelly slightly clayey SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. Frequent rootlets. (Topsoil) |
| | | 0.50 - 1.00 | U | | | | | Firm low strength brown slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. |
| | | 1.00 | SPT | N=5 (1,2/2,1,1,1) | | | | |
| | | 1.50 | ES | | | | | |
| | | 2.00 | D | | 2.00 | | | Loose brown sandy slightly clayey GRAVEL. Gravel is fine to coarse rounded to subrounded of mudstone and sandstone. |
| | | 2.00 | SPT | N=8 (2,2/1,2,2,3) | | | | |
| | | | | | 2.50 | | | Stiff medium strength brown slightly sandy CLAY. |
| | | 3.00 | SPT | N=10 (3,2/3,3,2,2) | | | | |
| | | | | | 3.30 | | | Firm low strength light brown sandy slightly gravelly CLAY. Gravel is fine to medium subrounded of mudstone and sandstone. |
| | | 4.00 | SPT | N=8 (2,2/2,2,2,2) | | | | |
| | | 5.00 | SPT | N=24 (5,6/7,6,5,6) | | | | |
| | | | | | 5.45 | | | End of Borehole at 5.45m |

Remarks

1. Complete. 2. Final depth 5.45m bgl.

# Borehole Log

Borehole No. **WS110**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Ruthin Road | Project No. 14854 | Co-ords: 331579E - 349891N | Hole Type WS |
| Location: Wrexham | | Level: | Scale 1:50 |
| Client: Redrow Homes | | Dates: 28/07/2021 | Logged By A. Rae |

| Well | Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | 0.20 | ES | | 0.20 | | | Dark brown gravelly slightly clayey SAND. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. Frequent rootlets. (Topsoil) |
| | | 0.80 | ES+L | | | | | Medium strength dark brown very sandy slightly gravelly CLAY. Gravel isfine to coarse rounded to subrounded of mudstone and sandstone. |
| | | 1.00 | SPT | N=8 (1,2/2,2,2,2) | 1.10 | | | Loose brown sandy slightly clayey GRAVEL. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. |
| | | | | | 1.30 | | | Firm low strength dark brown very sandy gravelly CLAY. Gravel is fine to coarse subrounded of mudstone and sandstone. |
| | ▼ 2.00 | 2.00 | D | | | | | |
| | | 2.00 | SPT | N=7 (1,1/2,2,1,2) | | | | |
| | | 2.50 - 3.00 | U | | | | | |
| | | 3.00 | SPT | N=15 (3,3/4,3,4,4) | | | | |
| | | 4.00 | SPT | 50 (6,11/50 for 250mm) | | | | |
| | | | | | 4.45 | | | End of Borehole at 4.45m |

Remarks

1. Complete. 2. Final depth 4.45m bgl. 3. Water strike encountered at 2m bgl. 4. Refused on gravel at 4.45 m bgl.

# Appendix D DCWW Sewer Records

Dŵr Cymru
Welsh Water

SEWER PLAN PPA0005680

N
W E
S

**LEGEND(Representative of most common features)**

Waste network:

| | | | |
|---|---|---|---|
| | Foul chamber | | Outfall |
| | Surface water chamber | LH | Lamphole |
| | Combined chamber | | Storm Overflow |
| CO | Combined sewer overflow | | Rising main |
| SPC | Special purpose chamber | | Gravity sewer |
| | Treatment works | | Private sewer |
| | Pumping station | S 104 | Private sewer subject to Sect. 104 adoption agreement |
| | | | Private Sewer Transfer |
| | | | Lateral Drain |
| | | | Inspection Chamber |

NB: Sewer symbol colour indicates the type.
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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| Map Ref: | 331444,349746 |
| Map scale: | 1:5000 |
| Printed by: | Natalie Walmsley |
| Printed on: | 19 May 2021 |

# Appendix E Illustrative Masterplan




| | |
|---|---|
| 1 | Residential development up to 1,450 dwellings |
| 2 | Two site access points onto the A525 Ruthin Road |
| 3 | Two site access points onto Bersham Road |
| 4 | Main access roads suitable for buses with active travel walking and cycling routes, tree avenue planting and landscape verges with swales for drainage |
| 5 | Site for a primary school up to 2FE located close to the existing high school |
| 6 | Local centre reflecting historic courtyard layout with Lower Berse Farmhouse and associated buildings of heritage value retained and enhanced |
| 7 | Development blocks to front onto existing and proposed roads and open space to create active frontages |
| 8 | Development overlooking Ruthin Road and set back to create a green frontage to the road |
| 9 | Development to sensitively integrate with Bersham Conservation Area and create a rural character along Bersham Road and Berse Lane |
| 10 | Variations in density and building heights to be used to create different character areas with lower density development to the south and west to respect the Conservation Area and rural character |
| 11 | Development set back from the existing dwelling Bryn-moel at the site centre |
| 12 | East-west green corridor and active travel route along the PRoW Bridleway with buffers to development and central open space |
| 13 | Northeast southwest green link and active travel route along PRoW connecting Bersham to Wrexham and providing a wildlife corridor |
| 14 | Retention of the existing watercourse as a wildlife corridor and feature providing a green link through the northern part of the site |
| 15 | Retention of existing landscape features to create a strong landscape framework, including important hedgerows, veteran trees, and ancient woodland |
| 16 | Drainage attenuation basins integrated at low parts of the site and along primary roads as swales |
| 17 | Land to the south of the site retained as a strategic green space and Green Wedge to Bersham |
| 18 | Series of distinctive and attractive green spaces through the development to create a sense of place and legibility with play provision focused along the PRoW Bridleway at the centre of the site |
| 19 | Ancient Woodland adjacent Berse Lane protected and sensitively integrated with development with public access restricted |
| 20 | Access to the western development parcel from Berse Lane or if feasible from development on the east side of Berse Lane. Consider potential access/interconnectivity between development if Berse Lane closed and becomes a Greenway; or provide emergency access and ped cycle connection |
| 21 | Potential to close Berse Lane and Holmestead Lane to vehicles and create Greenways as active travel walking and cycling routes |

## Key

### Existing

- Application Boundary (72.85ha)
- Trees/Woodland
- Hedgerow
- Watercourse
- Public Right of Way (PRoW) Footpath
- Public Right of Way (PRoW) Bridleway
- Public Right of Way (PRoW) BOAT

### Proposed

- Residential Development in the region of 1,450 dwellings (38.10ha)
- 2FE Primary School Site (1.62ha)
- Local Centre with possible nursery, shops, cafe, public house and community facilities subject to viability(1.46ha)
- Land Reserved for Potential Future Highways Scheme (2.54ha excluding spine road)
- Telecom Mast Exclusion Zone
- Spine Road with Tree Avenue, Landscape Verge and Swale
- Secondary Road/Shared Drive
- Emergency Access
- Footpath
- Footpath Cycleway
- Footpath Cycleway Off Road
- Public Open Space (15.39ha)
- Strategic Open Space (7.89ha)
- Drainage Attenuation (1.96ha)
- Tree Planting
- Hedgerow Planting
- Neighbourhood Equipped Area for Play (NEAP)
- Multi Use Games Area (MUGA)
- Locally Equipped Area for Play (LEAP)
- Local Area for Play (LAP)

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| Rev | Description | Drawn | Approved | Date |
|---|---|---|---|---|
| G | Updates in relation to land for future highways scheme and removal of WWTW | SO | NKH | 12/06/24 |
| F | Title amended to Option 1 | SO | NKH | 07/08/23 |
| E | Spine Road and NDA amended | NKH | NKH | 23/03/23 |
| D | Removal of WG highway scheme | NKH | NKH | 17/03/23 |
| C | Parcel L update | AJG | NKH | 01/02/23 |
| B | Update to primary school site | EL | NKH | 09/12/22 |
| A | Updates following DTM 06/12/22 | EL | NKH | 08/12/22 |

THE ENVIRONMENT PARTNERSHIP
Genesis Centre, Birchwood Science Park, Warrington WA3 7BH
Tel 01925 844004 e-mail tep@tep.uk.com www.tep.uk.com

Project
Lower Berse Farm, Ruthin Road, Wrexham

Title
Masterplan Framework

Drawing Number
PS9730.001G

Scale
1:2500 @ A1

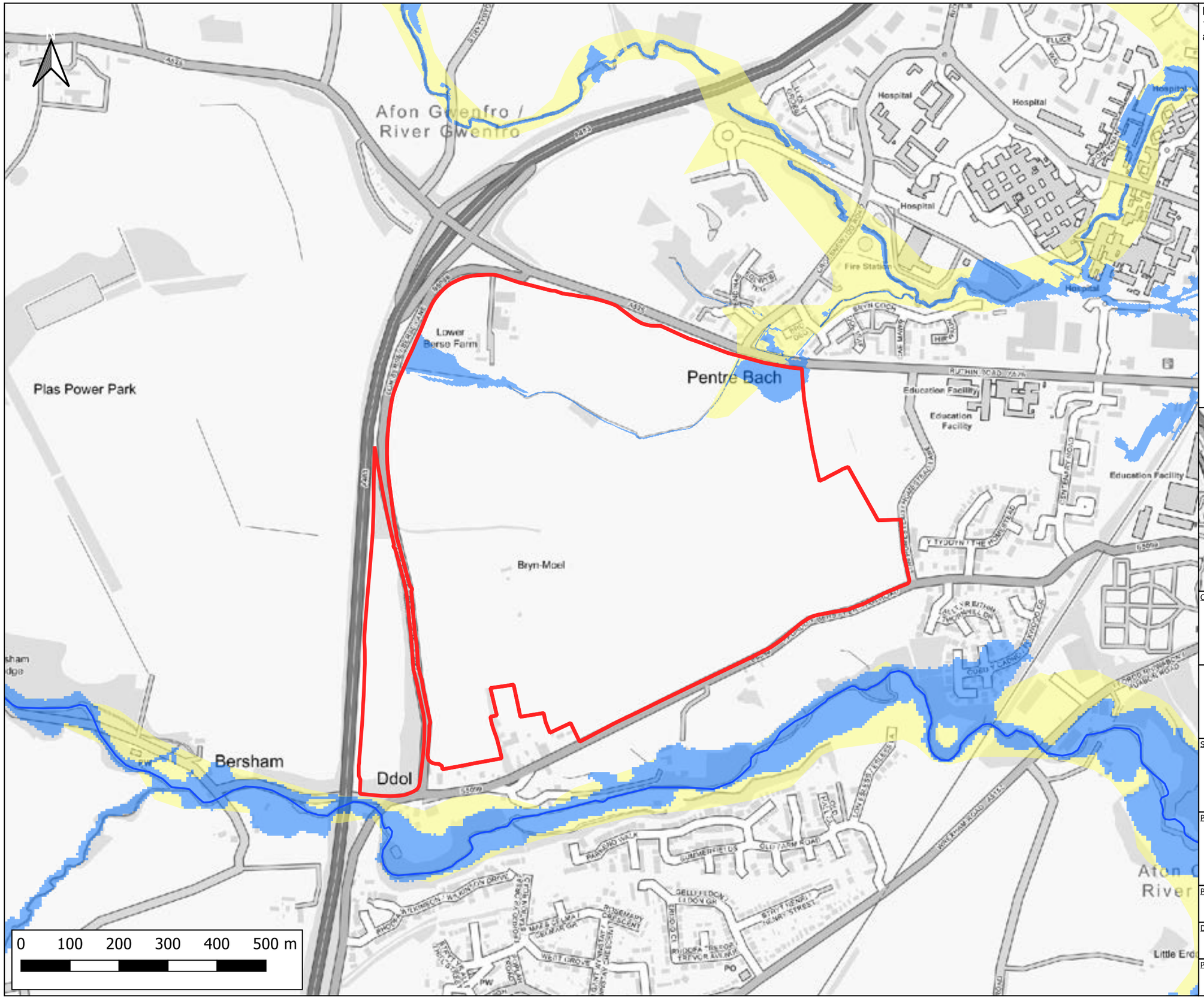
Date
24/11/2022

Drawn
EL

Checked
NKH

Approved
NKH

# Appendix F NRW Maps and Correspondence




Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

**LEGEND**

- Site Boundary
- Main Rivers

Development Advice Map (TAN15)

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




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SCHEME: Ruthin Road, Wrexham

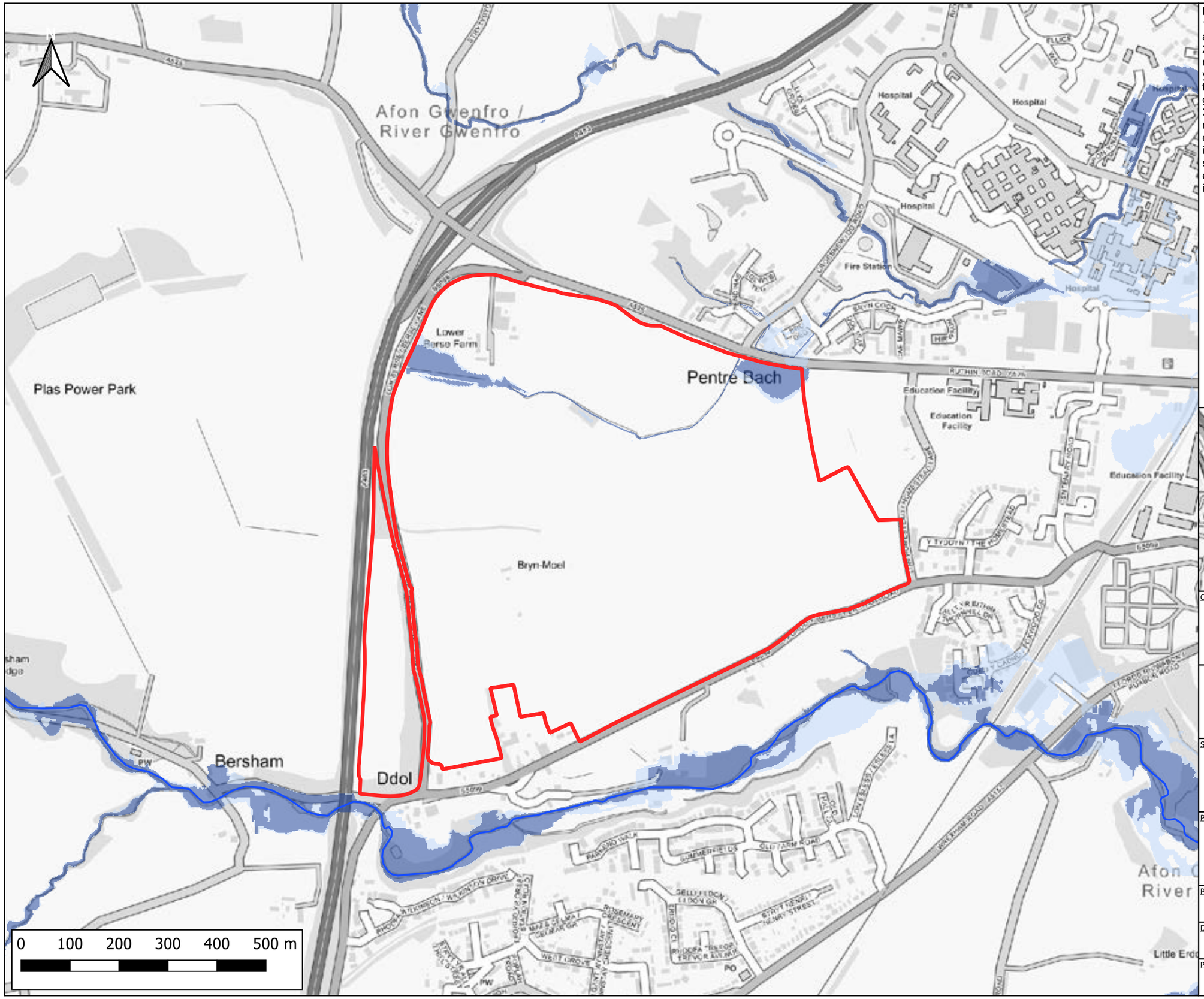
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Data accessed October 2023

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| PLOT NAME: | REVISION: |
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Notes:
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2) Flood Zone 3 displays the extent of flooding from rivers with a 1% AEP or greater of flooding in a given year including and allowance for climate change and the sea with a 0.5% AEP or greater of flooding in a given year including and allowance for climate change
3) Flood Zone 2 displays the extent of flooding from rivers with a less than 1% AEP but greater than or equal to 0.1% AEP of flooding in a given year including and allowance for climate change and the sea with a less than 0.5% AEP but greater than or equal to 0.1% AEP of flooding in a given year including and allowance for climate change

**LEGEND**

- Site Boundary
- Main Rivers

NRW Flood Map for Planning

- Flood Zone 2
- Flood Zone 3




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SCHEME: Ruthin Road, Wrexham

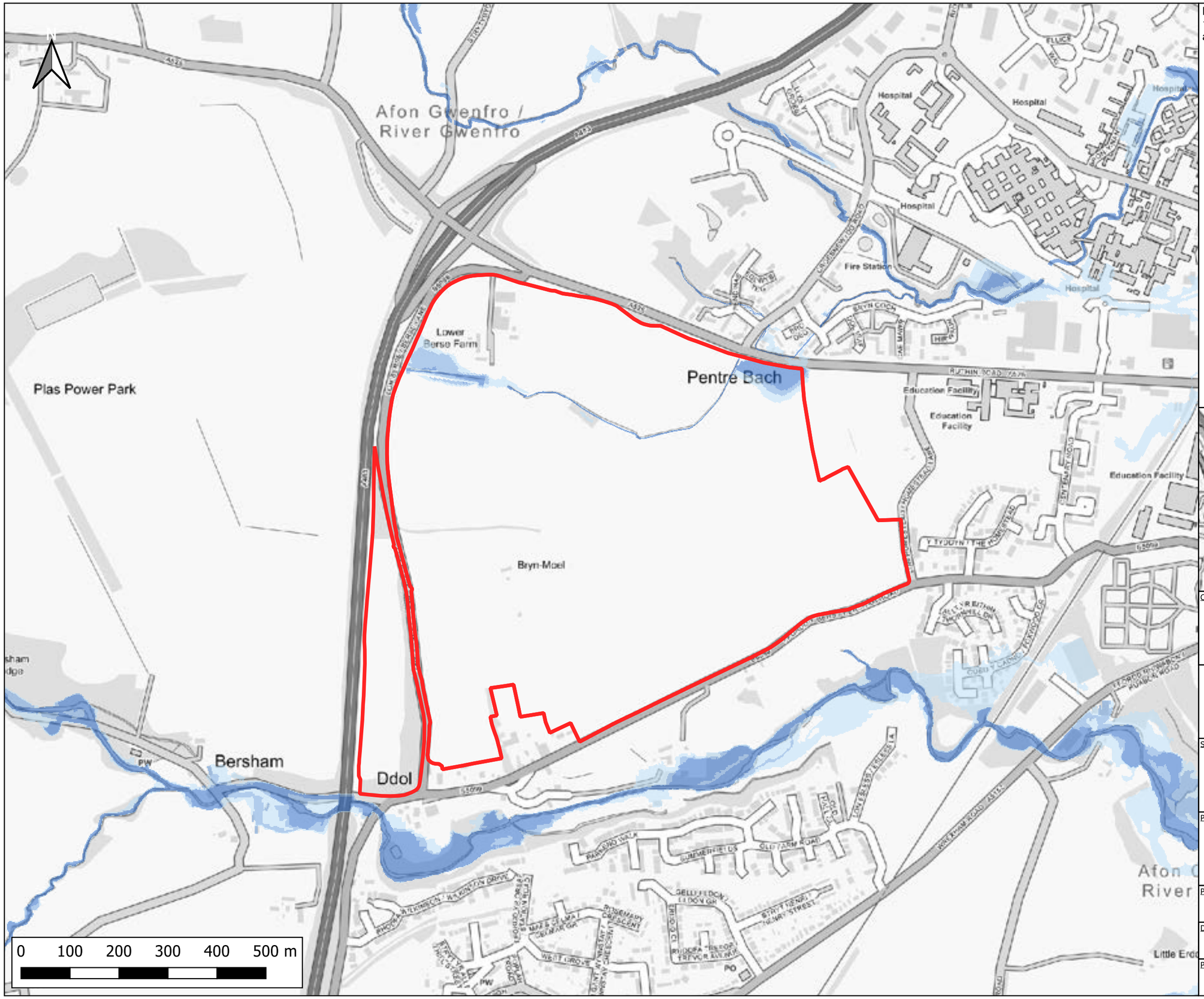
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**LEGEND**

- Site Boundary

Flood Risk from Rivers

- High (greater than 3.3% AEP)
- Medium (between 1% and 3.3% AEP)
- Low (between 0.1% and 1% AEP)




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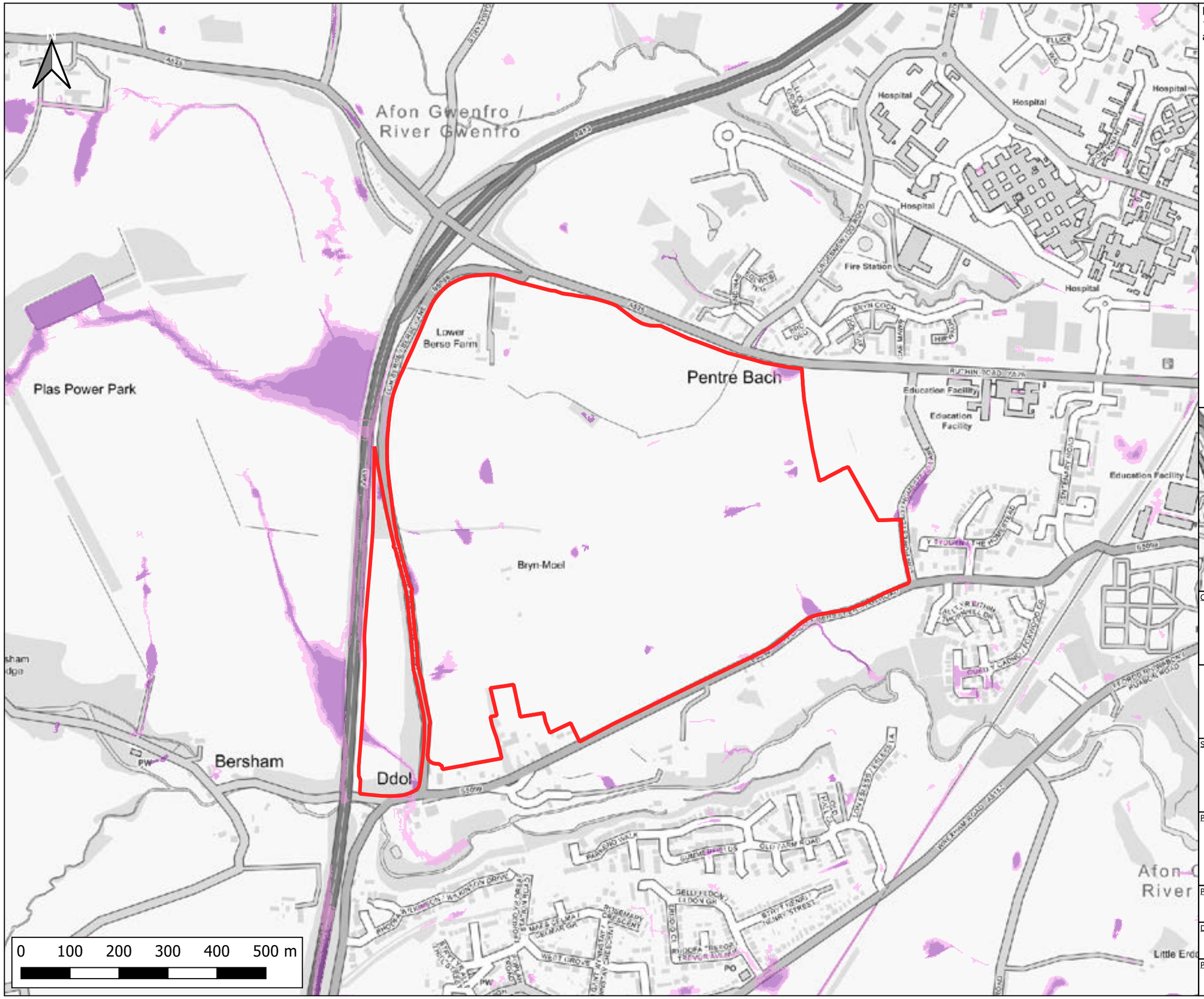
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Data accessed October 2023

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**LEGEND**

- Site Boundary

Flood Risk from Surface Water & Small Watercourses

- High (greater than 3.3% AEP)
- Medium (between 1% and 3.3% AEP)
- Low (between 0.1% and 1% AEP)




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SCHEME: Ruthin Road, Wrexham

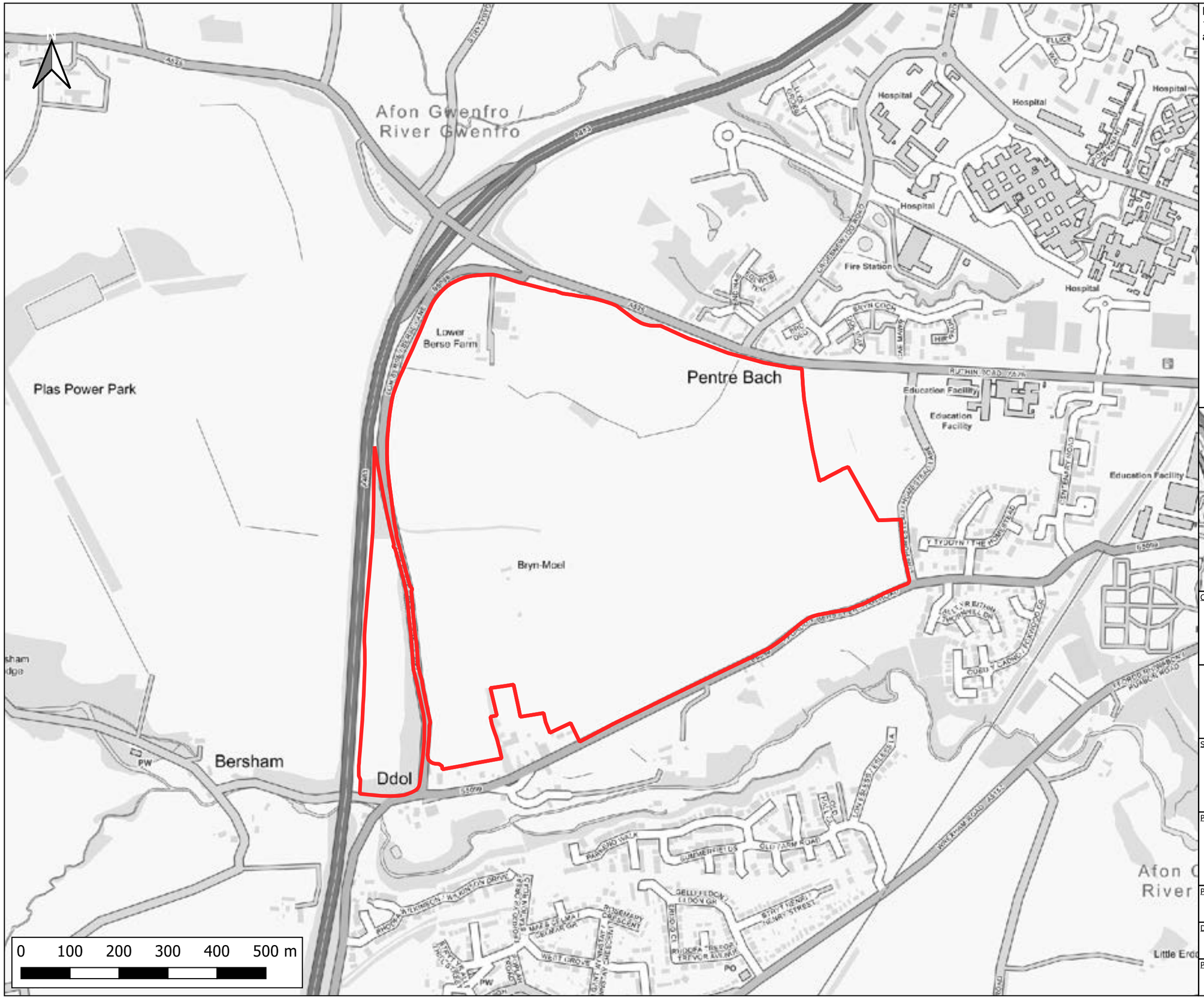
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Data accessed October 2023

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**LEGEND**

- Site Boundary

Flood Risk from the Sea

- High (greater than 3.3% AEP)
- Medium (between 0.5% and 3.3% AEP)
- Low (between 0.1% and 0.5% AEP)




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SCHEME: Ruthin Road, Wrexham

PLOT TITLE: NRW Flood Risk from the Sea
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**LEGEND**

- Site Boundary
- Flood Risk from Reservoirs Extent




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SCHEME:

Ruthin Road, Wrexham

PLOT TITLE:

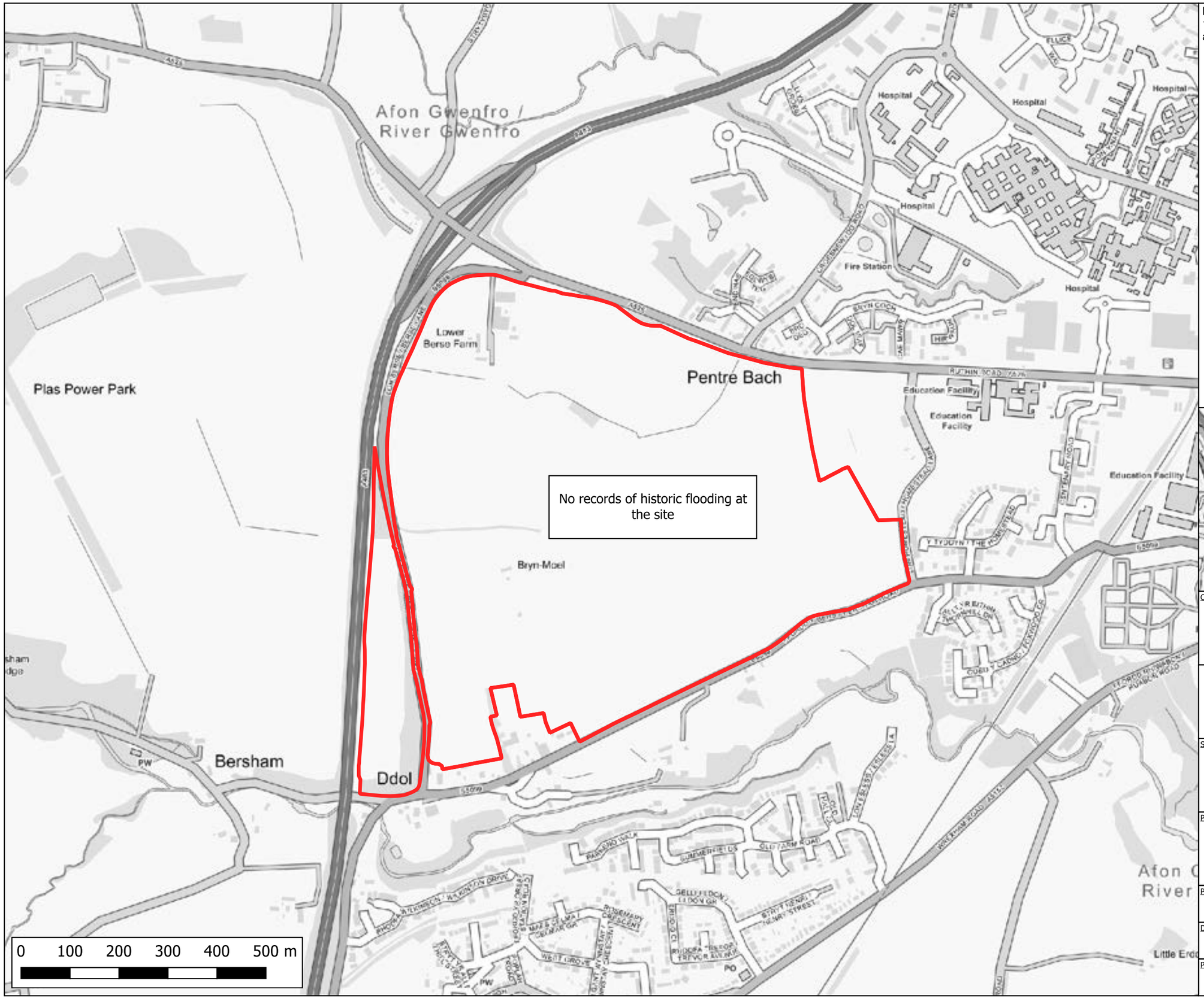
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**LEGEND**

- Site Boundary
- NRW Historic Flood Map




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Cyfoeth Naturiol Cymru
Natural Resources Wales

Ein cyf/Our ref: CAS-147202-M5T1
Eich cyf/Your ref: 13840

Maes Y Ffynnon,
Penrhosgarnedd,
Bangor,
Gwynedd
LL572DW

ebost/email:
northplanning@cyfoethnaturiolcymru.gov.uk

Waterco Ltd
Eden Court
Ruthin
LL15 1NJ

25/05/2021

Dear Sir/Madam

**PRELIMINARY PRE-APPLICATION ADVICE**

**PROPOSAL: THE SITE IS ALLOCATED FOR 1,500 DWELLINGS WITH 400 DWELLINGS EXPECTED TO BE DELIVERED DURING THE PLAN PERIOD WHICH RUNS UP TO 2028 AND THE REMAINING 1,100 EXPECTED AFTERWARD.**

**LOCATION: LAND OFF RUTHIN ROAD, WREXHAM**

Thank you for consulting Cyfoeth Naturiol Cymru / Natural Resources Wales about the above pre-application enquiry, which we received on 28th April 2021.

We have considered your enquiry in relation to our Development Planning Consultations Topics document (September 2018). We advise that the following matters are relevant to your site / proposed development and suggest you consider these further prior to the submission of any planning application:

**Flood Risk Management**

We understand the proposal is for highly vulnerable development housing and access roads. Our Flood Risk Map confirms the site to be partially within Zone C2 of the Development Advice Map (DAM) contained in TAN15.

We refer you to Section 6 of TAN15 and the Chief Planning Officer letter from Welsh Government, dated 9 January 2014, which affirms that highly vulnerable development and emergency services should not be permitted in Zone C2 (paragraph 6.2 of TAN15). The justification tests in paragraph 6.2 of TAN15 do not apply to highly vulnerable development or emergency services in Zone C2.

In consideration of the above, we will not provide any pre-application advice regarding flood risk, unless we receive written confirmation from the Planning Authority that there are overriding reasons for them to consider the proposals despite the site's location within Zone

C2. In such circumstances, we would then review any submitted FCA. If the FCA fails to demonstrate that the consequences of flooding can be acceptably managed over the lifetime of the development, then we would **object** to the application.

Finally, as you may be aware, under the Town & Country Planning (Notification) (Wales) Direction 2012 and more specifically Category I relating to Flood Risk Area Development, where the Planning Authority is minded to grant permission, there is a requirement to refer applications for emergency services or highly vulnerable development within Zone C2 to Welsh Government.

**Flood Risk Activity Permit**
The proposed development is near the Afon Clywedog, a designated main river. If development works in this area are within 8 metres of the river, you may need to apply for a Flood Risk Activity Permit. We refer you to our website for further advice.

**Watercourses**
An un-named ordinary watercourse runs through the site. An Ordinary Watercourse Consent may be required from the Lead Local Flood Authority for any works in, over, under or near an ordinary watercourse

**European Protected Species (EPS)**
Our records show there may be protected species on and in the vicinity of the site including Triturus cristatus (great crested newt) and several species of bats. We advise liaison with the LPA ecologist to discuss and agree the scope of any surveys required.

We refer you to our website for further advice.

**Foul Drainage**
We note the site is within the catchment of the River Dee Special Area of Conservation (SAC).

On the 21st January 2021, NRW published an evidence package outlining phosphate levels for all river SACs across Wales. As part of this package, we issued a Planning Position Statement, in which we advised that any proposed development that might increase the amount of phosphate within the catchment could lead to damaging effects to the SAC. Therefore, such proposals should be screened through a Habitats Regulations Assessment (HRA) by the Local Planning Authority (LPA) to determine whether they are likely to have a significant effect on the SAC.

The suitability of foul drainage arrangements for the proposed development is a matter for the LPA to determine. We therefore advise that as part of any future planning application submission, you provide the LPA with sufficient details of the proposed method of foul drainage to inform their HRA

For further information, please refer to the Planning Advice on our website. The Planning Advice is in the process of being updated. We advise that you check our website regularly and consider the updated Planning Advice (version 2) when available.

**Historic Landfill**
The proposal site is approximately 519m from a historic landfill site. The Environment Agency provided the Local Authority with Historic Landfill data in 2007. You may wish to consult the Local Authority's Environmental Health department with regard to this aspect.

**Protected Sites**
The site lies within 1.1km of Gatewen Marsh SSSI and 1.9km of the Johnstown Newt Sites SAC & Stryt Las a'r Hafod SSSI.

Special Area of Conservation (SAC)

The Local Planning Authority is a Competent Authority for the purposes of the *Conservation of Habitats and Species 2017 Regulations*. As such, they must not agree to any plan or project unless they are certain that it will not adversely affect the integrity of a Special Area of Conservation (SAC).

The Local Planning Authority should carry out a test of likely significant effects (TLSE) for the SAC, which is required under Regulation 63 of the *Conservation of Habitats and Species Regulations 2017*. This test applies to impacts on the SACs from the proposed works, either alone or in combination with other plans and projects.

If the test concludes there is likely to be a significant effect then an appropriate assessment of the impacts on the SAC from the proposed works, either alone or in combination with other plans and projects, will be required. We would be able to assist with that assessment in our role as the statutory nature conservation body under the above Regulations.

Site of Special Scientific Interest (SSSI)

The Wildlife and Countryside Act 1981 (as amended) places a duty on public authorities in exercising their functions, so far as this is likely to affect the flora, fauna, geological or physiographical features of a SSSI, to take reasonable steps consistent with the proper exercise of their functions to further the conservation and enhancement of those features.

By satisfying the requirements regarding the SACs, as indicated above, it is likely the requirements for the SSSIs will also be met.

We refer you to our website for further advice.

**Landscape**
The site is located approximately 3km the Clwydian Range and Dee Valley AONB. You are advised to consult with the Local Planning Authority and consider the need for Landscape Assessments in accordance with published best practice guidance.

We refer you to our website for further advice.

**Provision of Data**
In addition to the above, please note, we can also provide certain data free of charge, as set out in our Open Data Policy. Customers can access our data via our website.

**Other Matters**

Please note the view expressed in this letter is a response to a pre-planning enquiry only. We trust these comments will prove helpful but they should not set a precedent for any future Natural Resources Wales' response to any formal application for planning permission or other legal consent. Such applications shall be assessed on the information submitted and regulations of relevance at that time. The details contained in this letter are based on the information available to date.

As part of our discretionary advice service we can provide further advice relating to land contamination, groundwater and flood risk prior to your planning application being submitted. There is a charge for this service. Further details are available on our website.

If you have any queries on the above please do not hesitate to contact us.

Yn gywir / Yours faithfully

**Rachael Burke**
Cynghorydd - Cynllunio Datblygu / Advisor - Development Planning
Cyfoeth Naturiol Cymru / Natural Resources Wales