

CCG-C-22-13413-1

**FLOOD RISK ASSESSMENT REPORT
FOR LAND AT THE FORMER
PRESCOT POLICE STATION
DERBY STREET
PRESCOT
MERSEYSIDE
L34**

SEPTEMBER 2022

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1.0 INTRODUCTION

1.1 Purpose & Aims of the Assessment

CC GEOTECHNICAL LIMITED (CCG) was commissioned by **PRIMA GROUP** (the *Client*) to prepare a Flood Risk Assessment (*FRA*) in connection with the proposed redevelopment of land located immediately to the north of Derby Street, Prescott, L34 3LG.

It is understood that an existing Police Station fronting on to Derby Street is to be retained and modified / converted for residential use.

It is further proposed that the land to the rear of the Police Station is to be developed by the construction of 6nr x 2.5-storey town houses constructed of traditional brick elevations under pitched roofing materials together with associated newly created hard paved access / egress roadway, off-road car parking facilities and front and rear private gardens.

The existing and proposed site layouts are as annotated on **KWL ARCHITECTS** architectural drawings contained herein.

A Flood Risk Assessment (*FRA*) was required by the *Client* to submit in support of an existing planning application.

The site is situated within the administrative jurisdiction of **KNOWSLEY METROPOLITAN BOURGH COUNCIL (MBC)**.

This *FRA* was undertaken in accordance with the requirements of **KNOWSLEY MBC 'Local Flood Risk Management Strategy: 2017 (LFRMS)**, the *National Planning Policy Framework (NPPF): 2019*, **KNOWSLEY MBC 'Level 2 Strategic Flood Risk Assessment: 2012 (L2SFRA)**, **KNOWSLEY MBC 'Sustainable Drainage and Surface Water Management – Technical Guidance for Developers' (Version 06, August 2016 - 2020)**, and the *Planning Practice Guidance' (PPG: 2014)*.

The principal objectives of the *FRA* were:

- To assess the potential for flooding on and within the vicinity of the site, following the proposed redevelopment
- To calculate the effects of climate change on likely future run off rates at the site
- If appropriate, to propose conceptual flood amelioration measures which can be practicably incorporated in the development infrastructure, to accommodate the 1 in 100-yr (+ Climate Change (CC)) flood event.

2.0 SITE DATA

2.1 Site Location & Description

The site is located immediately to the north of Derby Street, Prescott, L34 3LG as shown on **CCG** Drawing No. CCG-C-22-13413-1 contained herein. The **ORDNANCE SURVEY** coordinates for the approximate site centre are 346312 392867. It stands at an approximate elevation of c.72ma Ordnance Datum.

It comprises an irregular shaped parcel of land which extends to the approximate dimensions of c. 68m x 48m (c. 2240m²), its long axis being on a north – south alignment.

It is bound to the south by public pavements extending along Derby Street (A57), and to the west by an un-named roadway. Its south-eastern boundary is adjoined by commercial premises (Bridal Storey), with its northern and eastern boundaries being adjoined by a series of private gardens associated with residential properties fronting on to Egerton Road and Stanley Crescent respectively.

Existing structures occupying the site comprise a well-maintained 2-storey property fronting on to Derby Street with associated single storey out-buildings to the rear, each constructed of traditional brick and dressed sandstone elevations under pitched roofing materials with a terrace of prefabricated flat roofed garages extending along its northern boundary.

The external topography across the site was seen to be sensibly flat with surface cover comprising generally full hard standing, with lesser areas of soft landscaping to the northeast.

Environmental data contained herein, confirms that the site and its immediate environs have been continually utilised for mixed commercial / residential land uses since the late-1800's through to the present day.

2.2 Access and Egress

Access to the site is currently proposed from the Derby Street frontage to the south, which lies entirely within Flood Zone I and therefore safe dry access above the 1 in 100-year flood level is available.

2.3 Existing and Proposed Development & PPG Classification

By virtue of the proposed land use as residential, the development is classified as '*More Vulnerable*', according to Table 3 of PPG (presented in Appendix C).

3.0 BACKGROUND AND APPLICATION OF PPS25

3.1 Introduction

The aim of PPG is to ensure that flood risk is taken into account at all stages in the planning process and, where relevant, that development is directed away from areas at highest risk of flooding. Where new development is planned in risk areas, then current policy aims are:

- To make the development safe from flooding
- To avoid increasing flood risk elsewhere as a consequence of the development
- To contribute to reducing flood risk overall

3.2 Sequential Test

The proposed development was subjected to the Sequential Test as set out in Table 3 of PPG. For assessment in accordance with the Test, the site was determined by reference to the **ENVIRONMENT AGENCY (EA)** Flood Map to be in Flood Zone I, as defined by PPG. Since the proposed development is residential in a brownfield regeneration area, a "*More Vulnerable*" classification was assigned to it.

Inputting these parameters into the Sequential Test matrix indicated that the development proposal is '*appropriate*' and as such the development satisfies the Sequential Test as required by Table 3 of PPG.

4.0 SITE HYDROLOGY AND HYDROGEOLOGY

4.1 Watercourses & Bodies of Standing Water

EA mapping data indicates the site is situated within a designated Zone I and hence it is concluded that there is a '*Very Low*' Risk of flooding associated with surface water features.

There are no records pertaining to the presence of Surface Water Features and/or Surface Water Bodies within, or within 1km of, the study site. Hence, the risk of flooding associated with these features impacting the site is considered to be '*Insignificant*'.

There are no records relating to the presence of Water Networks (OS MasterMap) within 220m of the study site, the nearest record relating to an inland river / stream being located c.229m northwest of the study site, hence the risk of flooding associated with such features is considered to be '*Insignificant*'.

The **EA** does not have any flood modelling flood data at this site, nor does the **EA** have records pertaining to historical flood events on, or within a 250m radius of, the study site.

There are no areas which are utilised for flood storage and/or flood defences within 250m of the study site.

There are no areas within 250m of the study site which benefit from the presence of flood defences for a 1: 100 plus Climate Change event.

The site is not located within 500m of an area which is identified as being at potential risk of a canal failure.

4.2 Geology, Hydrogeology and Groundwater Flooding

The geology of the site is summarised on **BRITISH GEOLOGICAL SURVEY (BGS)** Sheet No.097 Runcorn (2007): 1:50000 Scale: Solid and Drift Editions. These indicate the site is devoid of natural drift cover. However, given the presence of natural drift deposits comprising impermeable diamicton (boulder clay) of glacial origin (*Late-Quaternary Epoch - Devensian Age*), there is a potential for the presence of unrecorded drift deposits to be present.

The documented solid geology comprises the Pennine Lower Coal Measures Formation (*formerly the Lower Coal Measures*) of the Pennine Coal Measures Group comprising interbedded argillaceous mudstone, siltstones, fluvial sandstones and productive coal measure, of the Upper Carboniferous Period (*Silesian: Westphalian A: Langsettian Age*).

An intrusive ground investigation undertaken by CCG (prepared under Report Reference No. CCG-C-21-12518, dated September 2021) within the curtilage of the study site during August 2018, comprising the sinking of 6nr light dynamic boreholes confirmed the underlying ground conditions to comprise:

Bituminous paving and associated sub-base overlying made ground deposits generally comprising grey / brown clayey sands and gravel extending to depths varying between 0.15m - 0.7mbgl. The sequence thereafter continues in natural drift deposits comprising loose silty, locally gravelly, sands and soft becoming firm brown / grey clay deposits extending to depths varying between 1.5m – 2mbgl. Thereafter, the sequence continued in grey weathered mudstone locally interbedded with thin intact coal, recovered as firm becoming stiff clay and locally as dense sands and gravel.

Slight seepages were reported at some borehole positions during the intrusive investigation, with monitored standing water levels being in the order of 2.21m - 2.32mbgl.

There was no visual and/or olfactory evidence of contamination and/or biodegradable materials affecting the made ground mass at any sampling position.

The underlying made ground deposits classify as an Unproductive Aquifer

The underlying natural drift deposits (Diamicton) classify as a Secondary A Undifferentiated Aquifer

The underlying bed rock formation (Pennine Lower Coal Measures Formation) is classified as a Secondary A Aquifer

The site is not located within a Source Protection Zone

The highest risk of Surface Water Flooding within and/or within 50m of the study site is classified as being '*Negligible*'.

4.3 Surface Water (Pluvial) Flooding

The flood risk data discussed in the GroundSure Report (Report Reference No. CMAPS-AAG-980046-4165-280721, dated July 2021) presented in Appendix B shows a '*Negligible*' risk (*0.1m - 0.3m in a 1: 30 Return Period*) of pluvial flooding affecting the western section of the study site.

4.4 Groundwater Flooding

The flood risk data presented in Appendix B states that there is a '*Negligible Risk*' of groundwater flooding affecting the study site.

4.5 Coastal Flooding

The western site boundary is located c.11km northeast of the River Mersey Estuary, hence there is a '*Very Low Risk*' of flooding from the sea.

5.0 SURFACE WATER RUNOFF

5.1 Requirements for Surface Water Drainage at the Site

PPG requires that surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to development. Opportunities to reduce surface runoff, and the associated flood risk, should be identified and future effects of climate change should be considered. The relevant calculations are described in this section of the report.

5.2 Surface Water Runoff Rate at the Development Site

This section of the report quantifies the impermeable and permeable areas of the site prior to, and following, the development. As shown on the appended historical environmental data, given that the site has historically been developed as a police station complete with full hard standing, the surface water run-off calculations presented hereunder are based on pre- and post-construction site configurations.

It was calculated that the proportion of impermeable surface (PIMP (%)) cover will decrease following completion of the redevelopment of the site since the post development configuration will incorporate larger areas of newly created landscaping. Notwithstanding this reduction, PPG now requires that climate change be considered in predicting future run-off.

The changes to proportions of permeable/impermeable surfaces from the proposed development are summarised in Table 1 hereunder:

Table 1: Changes to Permeable/Impermeable Areas Post Development

	Prior to development site	Developed Site
Buildings/Roofs Hardstanding	2105m ²	1769m ²
Permeable areas	135m ²	471m ²
Total	2240m²	2240m²

Using the Wallingford Procedure Runoff Equation, and the values contained in Volume 3 of the Wallingford procedure, a percentage runoff can be calculated for the current, and proposed site configurations.

$$PR (\%) = 0.829 \times PIMP (\%) + 25 \times SOIL + 0.078 \times UCWI - 20.7$$

$$SOIL = 0.45$$

$$UCWI = 138$$

$$PIMP \text{ Current site} = 94\%$$

$$PIMP \text{ Proposed Development} = 79\%$$

$$PR (\%) \text{ Current Site} = 79\%$$

$$PR (\%) \text{ Proposed development} = 67\%$$

It can be seen that the post-development percentage run-off (PR (%)) rates will decrease by 12% since the post construction impermeable surface cover will decrease from c.2105m² to c.1769m².

Using the Modified Rational Method, the run-off rate was calculated for a range of return periods. A time of concentration of 7.5 minutes was used, comprising a time of entry of 4 minutes and a time of flow of 3.5 minutes. A rainfall estimation calculation was also undertaken for 1, 5, 20 and 100year return period events. The calculated rainfall intensities are 34.3mm/hr, 55.2mm/hr, 77.7mm/hr, and 109mm/hr, respectively. The runoff rates given by the Modified Rational method are as follows:

$$Q = 2.78 \times C_v \times C_r \times \text{rainfall intensity} \times PIMP \times A$$

Table 2: Flow rates given by Modified Rational Method

Return Period	Runoff Rate (Q) Pre-Development	Runoff Rate (Q) Post Development	KMBC SFRA Target Discharge Rate (= -50% Q)	-50% (Q) Pre-Construction Reduction for 1:2yr Critical Events	Greenfield Runoff Rates (Q)
1 in 1 Year	23.75l/s	19.96l/s	9.98l/s	-	0..47/s
1 in 2 Year	27.57l/s	23.17l/s	-	11.59l/s	-
1 in 5 Year	38.22l/s	32.15l/s	16.06l/s	-	-
1 in 20 Year	53.81l/s	45.22l/s	22.61l/s	-	-
1 in 30 Year	57.15l/s	48.03l/s	24.02l/s	-	0.91l/s
1 in 100 Year	75.12l/s	63.33l/s	31.66l/s	-	1.12l/s
1 in 100 Year + Climate Change (+40%)	105.16l/s	88.66l/s	44.33l/s	-	-

For the 1 in 100year plus climate change (set at 1:100yr + 40%), a post development surface water run-off rate of 88.66l/s was calculated.

This compares with the target value of 11.59l/s calculated for a 1:2-year critical rainfall event (-50%), to provide betterment over existing runoff in accordance with **KNOWSLEY MBC** “Sustainable Drainage and Surface Water Management – Technical Guidance for Developers” (Version 06, August 2016, 2020). However, it is understood that the Lead Local Flood Authority (LLFA) in advising **KNOWSLEY MBC** planning department will only consider the 50% betterment flow rate as an acceptable discharge rate if the entirety of the existing drainage network is utilised without modification.

Given the current and proposed site configurations, it is assumed that this will not be a feasible option, and hence the LLFA will require the

rate of Discharge to Sewer to be either the calculated Qbar value or the generally accepted rate of 5l/sec whichever is the greater (the rate of 5l/sec being the minimum flow to maintain efficient flow through an attenuation outlet valve). Since there is a potential for blockages in Vortex Flow Control systems arising from an intake of vegetation and other detritus, it is recommended that rates of discharge from attenuation systems are set at no less than 5l/s rather than adopting the calculated Qbar values for the 'Greenfield Run-off Rate' to maintain their integrity. It is advised that the drainage design engineers propose these parameters to **UNITED UTILITIES**. The developer must consider that these are their options unless they can prove that extraordinary circumstances apply. Taking account of these constraints, surface water SUD's measures and/or attenuation will be required.

Subject to agreement with **UNITED UTILITIES**, surface water runoff may be discharged to the drainage network, if present, extending along Derby Street to the south. However, as stated above it is likely that **UNITED UTILITIES** will not accept any of the Return Period run-off rates calculated for the site and will require the rate to be limited to 5l/sec. In such circumstances, it will be necessary that the developer considers incorporation of supplementary SUDS measures to attenuate runoff in storm conditions.

Calculations for preliminary attenuation design based on 5l/sec discharge rate are presented hereunder:

Table 3: Post Development & Greenfield Run-off / Attenuation Calculations for 1:100^{yr} +CC Event

Unit	Post Development Run-off
Discharge to sewer rate l/sec	5l/s
Runoff rate 1;100yr + CC l/sec	88.66l/s
Accumulation rate l/sec	83.66l/s
Volume per 15m Storm Duration (m ³)	75.29
Length of Attenuation Storage facility based on 2m Ø chamber	24

Based on the generally accepted rate of 5l/s, to accommodate the 1:100yr + CC runoff rate for a 15 min' storm duration, a storage volume of 75.29m³ would be needed. This could be accommodated in a 2m diameter pipe of c.24m length (*where: $V = \pi r^2 h = \pi \cdot 1^2 \cdot 24 \approx 75.39m^3$*) incorporating a hydro-brake chamber or with discharge regulated by Vortex Flow Control or similar flow-controlled device.

As an alternative to the oversize pipe attenuation, consideration may be given to the construction of a c. 10m x 10m x 0.8m deep (total storage = 80m³) modular cell storage reservoir and associated works (*i.e., sediment catchpit etc.*), which slightly surpasses the calculated 75.29m³ as shown in Table 3 above. Thereafter, the attenuated surface water run-off should be designed to pass through a 'SPEL Stormceptor 300' Series Model 308 Class 1 oil/fuel separator as recommended in Gov.UK: 'Guidance: Discharges to surface water and groundwater: environmental permits' (2016, Revised April 2021) to provide an appropriate level of pollution treatment before being allowed to discharge into the nearby drainage network.

With regards the potential for soakaways, as discussed in Section 4.2 above, an intrusive ground investigation, undertaken by **CCG**, confirmed the prevailing ground conditions to comprise hard paved surfaces and associated sub-base overlying made ground deposits generally comprising grey / brown clayey sands and gravel extending to depths varying between 0.15m - 0.7mbgl. Thereafter the sequence continued in natural drift deposits comprising loose silty, locally gravelly, sands and soft becoming firm brown / grey clay deposits extending to depths varying between 1.5m – 2mbgl where the sequence continued in grey weathered mudstone locally interbedded with thin intact coal, proven to 3mbgl.

Notwithstanding the above, it is recommended that the *Client* commissions the undertaking of *in-situ* soil permeability test in accordance with 'BRE Digest 365 (2016)' at 2nr locations to determine if the underlying ground conditions are suitable for the adoption of natural soakaway drainage systems.

Should the underlying drift deposits be unsuitable for the adoption of soakaway systems, then subject to agreement with **UNITED UTILITIES**, surplus surface water runoff may be accommodated in the nearby drainage network extending along Derby Street to the south, discharging at the generally accepted rate of 5l/sec.

Other SUDS methods may be considered where they are appropriate, and an overview of the common SUDS options is presented below, with those most likely to be appropriate for this site identified in Section 6.13 hereunder.

6.0 SUDS OPTIONS

6.1 Approach to Selection of SUDS Techniques

The underlying ground conditions of a development site will often determine the type of SUDS approach used at development sites for the disposal of surface water runoff, the prevailing conditions being determined through ground investigations carried out on-site. However, in the absence of this information an initial assessment of the site suitability to the use of SUDS can be obtained from the review of the available soils/geological mapping.

The detailed design of any drainage system and SUDS approach, consideration should be given to site specific characteristics and where possible should be based on primary data from site investigations.

Further advice must also be sought in terms of water resources contaminated land, archaeology, ecology etc.

The initial appraisal of SUDS viability will help inform the developer/owner of the various options available for the development and may influence the final layout of the site.

6.2 Alternative SUDS Techniques Background

Traditionally, built developments have utilised piped drainage systems to manage storm water and convey surface water run-off away from developed areas as quickly as possible. Typically, these systems connect to the public sewer system for treatment and/or disposal to local watercourses. Whilst this approach rapidly transfers storm water from developed areas, the alteration of natural drainage processes can potentially impact on downstream areas by increasing flood risk and reducing water quality. Receiving watercourses are therefore much more sensitive to rainfall intensity, volume and catchment land uses after a catchment or areas of a catchment have been developed.

Due to the difficulties associated with upgrading sewer systems it is uncommon for sewer and drainage systems to keep pace with the rate of development/redevelopment and the increasingly stringent controls placed on discharges to watercourses. As development progresses and/or urban areas expand, these systems become inadequate for the volumes and rates of storm water they receive, resulting in increased flood risk and/or pollution of watercourses. Allied to this are the implications of climate change on rainfall intensities, overwhelming catchment responses and surcharging piped systems.

In addition, as flood risk has increased in importance within planning, a disparity has emerged between the design of conventional sewer systems (1 in 30yr) and the typical design event (1 in 100yr). This often results in drainage inadequacies for the flood return period developments need to consider, often resulting in potential flood risk from surface water sewers and combined sewer systems.

A sustainable solution to these issues is to reduce the volume and/or rate of water entering the sewer system and watercourses.

6.3 What are Sustainable Drainage Systems

Sustainable Drainage Systems (SUDS) are the preferred method (as set by the Environment Agency, Government and Building Regulations) for managing the surface water runoff generated by developed sites. SUDS seek to manage surface water runoff as close to the source as possible. Typically, this approach involves a move away from piped systems to softer engineering solutions inspired by natural drainage processes, where adoptable drainage criteria allow.

In addition, they should be designed to consider the surface water run-off quantity, rates and also water quality ensuring their effective operation up to and including the 1 in 100year design event.

Where possible a SUDS technique should seek to contribute to each of the three goals identified below with the favoured system contributing significantly to each objective:

- Reduce flood risk (to the site and to neighbouring areas)
- Reduce pollution
- Provide landscape and biodiversity benefit

In keeping with the guidance of Planning Policy Statement 25, Local Planning Authorities encourage the application of SUDS techniques.

Typically, the application of SUDS techniques is not limited to one technique per site. Often a successful SUDS solution will utilise several techniques in combination, providing flood risk, pollution, and biodiversity benefits. In addition, SUDS can be employed on a strategic scale, for example with several sites contributing to large scale jointly funded and managed SUDS.

6.4 SUDS Techniques

SUDS techniques can be used to reduce the rate and volume and improve the water quality of surface water discharges from sites to the receiving environment (*i.e.*, *natural watercourse or public sewer etc*). Various SUDS techniques are available; however, the techniques operate on two main principles:

- Infiltration
- Attenuation

All systems generally fall into one of these categories, or a combination of the two.

The design of SUDS measures should be undertaken as part of the drainage strategy and design for a development site. A ground investigation is normally required to assess the suitability of using infiltration measures, with this information being used to assess the required volume on site storage. Hydrological analysis is undertaken using industry approved methods.

The viability of alternative SUDS techniques needs to be robustly assessed on an individual site basis as part of this Flood Risk Assessment taking account of the following:

- Underlying geology and the results of on site Geo-Environmental Investigations
- Proximity of groundwater table
- Long term maintenance and management of the SUDS asset
- Sewerage undertakers' criteria relating to any public sewer systems that would rely upon the function of the SUDS asset
- Environment Agency criteria relating to the protection of underlying groundwater and water resources
- Contaminated land issues

During the detailed design process of the SUDS liaison should take place with the Local Planning Authority, the Environment Agency, and United Utilities in order to establish that the design methodology is satisfactory and to also agree a permitted rate of discharge from the site.

Building regulations advise that a SUDS hierarchy be followed to select the appropriate solution for a development site, with preference given to infiltration techniques over attenuation systems, provided that underlying conditions allow.

6.5 Infiltration SUDS

This type of Sustainable Drainage System relies on discharges to ground, where suitable ground conditions allow. Therefore, infiltration SUDS are reliant on the local ground conditions (*i.e.*, permeability of soils and geology, the groundwater table depth, and the importance of underlying aquifers as water resources etc) for their successful operation.

Various infiltration SUDS techniques are available from directing the surface water run-off to ground. However, development pressures and a desire to maximise development potential often result in typically small land areas available for infiltration systems. Small areas allied to the rapid rates of run-off generation often require some form of supplementary attenuation as part of the infiltration system. The storage may be provided in the sub-base of a permeable surface, within the chamber of a soakaway, as a pond/water feature, or within underground storage pipes

Infiltration measures include the use of permeable surfaces and other systems that are generally located below ground.

6.6 Permeable Surfaces

Permeable surfaces are designed to allow water to drain through to a sub-base at a rate greater than the rain that falls to the surface. Permeable surfaces act by directly intercepting the rain that falls and are therefore true source controls. In theory, this system would prevent

any surface water running off the site. However, it is impractical to design permeable surfaces to directly infiltrate intense rainfall events. The permeable sub-base can be used to temporarily store infiltrated run-off underground allowing it to percolate into the ground below. Alternatively, stored water within sub-base can be discharged from the site.

Maintenance programmes will need to ensure that the surface is kept clear of silt and voids are clear. The use of grit and salt during the winter months will adversely affect the drainage potential of paved surfaces, however this should not be required often as ice is less likely to form on these types of surfaces.

Grass/Landscaped Areas: Grassed or landscaped areas provide a permeable surface that allows for the infiltration of rain falling onto these areas, and potentially also run-off from adjacent impermeable areas. Grassed or landscaped areas are some relatively inexpensive SUDS measure however they are likely to be restricted to where vehicles are not present.

Reinforced Grass: Techniques are available that allow grass to be incorporated into a pavement type surface. These provide varying ratios of hard pavement to grass dependant on the site requirements. These range from concrete block arrangements to plastic meshes and can be utilised in those areas where the hard permanence of typical pavement might be undesirable, such as in conservation areas, roadside verges, emergency services access, canal towpaths, farm tracks, rural settings etc. In the past, these systems have been typically adopted for situations where a load bearing surface is required to fit into the surrounding environment, however these systems are often now installed for surface water management purposes. The grass: hard pavement ratio is one of the dominant factors that determine the rate of infiltration through to sub-surface.

Gravel: A bed of gravel with a high void space on a permeable sub-base offers a cost-effective solution for trafficked areas. Rain falling directly onto the area is able to infiltrate through to the subbase.

Solid paving with Void Spaces: Solid paving can be installed in such a way that voids are present that can be in-filled with a permeable material such as grass or gravel etc. If this is to be used as a SUDS measure, a permeable sub-base is required to allow infiltration into the underlying ground and/or temporary storage to attenuate discharges.

Permeable Pavements: Permeable pavements allow the rain falling directly onto the area to infiltrate through into a sub-base and where suitable, through into the underlying strata. Permeable pavements are constructed using porous concrete blocks. Small projects of less than 100m² (depending on sub-grade permeability can often be managed using 100% infiltration, whereas larger schemes will often require a combined system, with some form of attenuation as back up for periods of exceptional flows. The use of geo-membranes can trap pollutants and prevent them being carried into the environment. The use of geo-membranes can trap pollutants and prevent them being carried into the receiving environment. The use of an impermeable membrane beneath the subbase will work to contain any pollutants within the sub-base. One major advantage of tanked permeable paving systems is that any significant contamination, for example a diesel spillage, will be restricted to the immediate area and not transported into local sewers or watercourses. The performance of permeable pavements will dramatically decrease over a period of time with the clogging of voids, and this should be taken into consideration during the design process and maintenance.

6.7 Sub Surface Infiltration

Where permeable surfaces are not a practical option, more defined infiltration systems are available. In order to infiltrate run-off into the ground, a storage system is provided that allows the infiltration of the stored water into the surrounding ground through both the sides and bottom of the storage. These systems are constructed below ground and therefore may be advantageous with regards to the developable area of the site, however consideration needs to be given of construction methods and maintenance access to any development that takes place over an underground infiltration system. Consideration is also needed of the depth to the groundwater table. The provision of large volumes of infiltration /storage underground has potential cost implications and infiltration devices should not generally be built within 5m of a building, under a road or on soil that may dissolve or be washed away, in line with Building Regulations advice.

Geocellular Systems: Modular block systems can be used to provide an underground infiltration facility. The modular structures are usually made of plastic and can be stacked side by side or on top of each other to construct an infiltration/storage unit of the required size. The

modular blocks are usually sited upon a highly permeable sub-base through which the surface water run-off is discharged (usually through perforated pipes). The outlet from the pipes is restricted which causes the run-off to rise up through the sub-base into a geocellular storage system. The storage systems are usually tanked with a geomembrane. These types of systems are quick and easy to install, flexible in their configuration, and have minimal maintenance requirements (providing the inflow of silt is limited). While many manufacturers claim that their products are suitable for installation beneath roadways or car parks, their use in these areas should be taken with caution. Geocellular systems can also be utilised for providing storage without infiltration to attenuate discharge rates. In these situations, the system is tanked with a geomembrane or similar.

Filter Drain: A filter drain is a trench that contains a perforated or porous pipe that runs along its bottom. The trench is filled with a suitable filler material, granular material, or lightweight aggregate fill, all with high void space. The fill may be exposed at the ground surface or capped with turf, topsoil etc that allow the trench to flood (i.e., not an impermeable surface that could pressurise the trench). Surface water run-off generated by the site is directed through the perforated pipe which then flows into the trench and infiltrates into the surrounding ground. Filter drains have been used extensively for highways and car parking areas, where they generally been constructed in the verge and median strip.

Soakaway (Chamber): Surface water run-off is directed to a chamber set in the ground with holes in the sides and base. This allows the stored water to soak into the ground. The storage capacities of soakaway chambers are limited and therefore they are more suitable for dwellings than large, developed areas. The chambers are prone to silting up over time and therefore, need regular maintenance

Soakaway (Trench): Where the liner space is available, soakaways that use a trench rather than a chamber may be used to manage the runoff from larger areas.

Soakaway (Granular Soakaway): Similar to a filter drain, a soakaway (either chamber or trench) filled with a high percentage void, granular material can be used to store surface water runoff as it is infiltrated into the surrounding ground. The granular fill will offer structural strength to the soakaway although the storage volume will be substantially reduced.

6.8 Attenuation SUDS

Where site ground conditions are deemed unsuitable for the widespread implementation of infiltration techniques, the surface water runoff discharged from a site will need to be attenuated utilising on site attenuation storage. While this is a SUDS technique that will reduce the rate of discharge from the site, the overall volume will not be minimised using on site storage alone. An important factor that needs to be taken into consideration when assessing the suitability of on-site storage as part of a proposed development is the volume required and the associated impacts the storage will impose on development proposals and risks to neighbouring properties.

Should the use of infiltration to either partially or fully dispose of the water runoff from a developed site be found to be unfeasible, on-site storage will be required to attenuate the discharge from the site. An allowable rate of discharge will need to be agreed with the Environment Agency, United Utilities, and the Planning Authority. This can have significant implications to the proposed development with regard to the large volume of storage that may be required. On site storage can be constructed above ground or below ground, the above ground systems usually being cheaper on a cost per m3 of storage basis. It should be noted, however, that below ground systems may pose less constraints on the developable area of the site.

6.9 Basins

Basins are areas that have been re-profiled (or alternatively embanked) to allow for the temporary storage of runoff from a developed site. Basins are drained in such a way that ensures that they are free from water in dry weather. Therefore, between periods of rainfall they can be used for other purposes such as open public space, recreation etc. Basins treat run-off in a variety of ways i.e., settlement of solids in still water, absorption by aquatic vegetation by aquatic vegetation or biological activity etc. the construction of basins uses relatively simple techniques. Local varieties of vegetation should be used wherever possible and should be fully established before the basins are used. Access to the basin should be provided such that a maintenance programme can be implemented. This would include inspections, regular cutting of grass, annual clearance of aquatic vegetation and silt removal as required.

Detention Basins: A detention basin is designed and constructed to store surface water run-off temporarily in order to attenuate flows over a minimal period of time. Detention basins provide better flow attenuation than floodplains as they store water until the flood has passed. The stored water is then released at a controlled rate after the storm to avoid flooding downstream. If the runoff is held back for long enough, solids start to settle out of the water, which improves water quality.

Extended Detention Basin: If the period of detention increases to approximately 24hrs, the basin is referred to as an extended detention basin. This results in surface water runoff being stored beyond the time normally required for attenuation which provides extra time for natural processes to remove some of the pollutants in the water.

6.10 Ponds

Ponds are similar to basins except that the outflow is configured such that a volume of water is contained during dry weather, usually for amenity, recreational or agricultural purposes. Ponds are designed to hold the additional surface water runoff generated by the site during rainfall events. Like basins, ponds are designed to control discharge rates by storing the collected runoff and releasing it slowly once the risk of flooding has passed. Ponds can provide wildlife habitats, water features to enhance the urban landscape and where quality and flooding risks are acceptable, they can be used for recreation. It may be possible to integrate ponds and wetlands into public area to create new community ponds. Ponds and wetlands trap silt which may need to be removed periodically. Ideally, the contaminants should be removed at source to prevent silt from reaching the pond or wetland in the first place. In situations where this is not possible, consideration should be given to a small detention basin placed at the inlet to the pond in order to trap and subsequently remove the silt. Depending on the setting of a pond, health and safety issues may be important issues that need to be taken into consideration. The design of the pond can help minimise any health and safety issues (i.e., shallower margins to the pond to reduce the danger of falling in). A fence may also be required for keeping children and wildlife out.

Balancing/Attenuating Ponds: A balancing or attenuation pond is designed only to store surface water run-off and attenuate discharge until the flood/storm peak has passed. Therefore, storage periods may not be long enough to significantly improve water quality capacity compared with ponds with longer retention times. They contain some water at all times with the water level fluctuating as the runoff passes through the device.

Flood Storage Reservoirs: Flood storage reservoirs are very similar to balancing/attenuation ponds except that they are usually much larger. They are generally used to attenuate fluvial flood flows rather than the surface water run-off from developed areas and are therefore likely to be utilised as a SUDS measure. Should an existing flood storage reservoir in the vicinity of the proposed development be identified to offer spare capacity, then depending on ownership and agreement, it may be possible to utilise the spare capacity for storm water management of development areas.

Lagoons: Should the surface water run-off have high suspended solids content; a lagoon could be a suitable method for attenuating its discharge to the receiving environment. Lagoons are similar to balancing /attenuation ponds except that they are also designed for the settlement of suspended solids. Usually, they are long and narrow in shape to ensure the longest retention time and therefore an efficient removal of suspended solids. However, lagoons are usually free of vegetation and therefore do not provide any biological treatment.

Retention ponds: Retention ponds are designed to detain the surface water run-off for periods between several days and two weeks. This allows for a higher level of settlement, biological treatment, and limited attenuation of flows. Retention ponds provide a greater degree of treatment than extended detention basins.

Wetlands: A wetland is similar to a pond except that it has a high proportion of emergent vegetation in relation to open water. Wetlands use plants to make the treatment of surface water run-off more efficient and can allow detention times required to fully treat the run-off to be reduced to a couple of weeks. Constructed wetlands are ponds with irregular perimeters and undulating bottom contours into which the wetland vegetation is purposely placed to enhance pollutant removal from surface water runoff. Surface water run-off enters a constructed wetland through a forebay where larger solids and coarse organic material settle out. The run-off discharged from the forebay passes through emergent vegetation which acts to filter organic materials and soluble nutrients. The use of constructed wetlands can be looked at

from two perspectives. The first is that the wetland is primarily used to maximise pollutant removal from storm water flows. Alternatively, it may be used primarily to control storm water flows, with increased pollutant removal capabilities.

6.11 Alternative forms of Attenuation

In many situations the development of a site may involve proposals that would inhibit the use of basins or ponds as a means of managing surface water run-off discharged from the site. This may be due to land take, economic feasibility, or other issues such as health and safety etc. In these situations, it may be appropriate to use a storage option that is viewed as being more 'engineered' than an open basin or pond. Most of these methods involve the provision of storage beneath the ground surface, which may be advantageous with regards to the developable area of the site; however, consideration needs to be given to construction methods, maintenance access and to any development that takes place over an underground storage facility. The provision of large volumes of storage underground also has potential cost implications.

Deep Shafts: Deep shafts can be utilised in areas with low groundwater tables. Shafts have small footprints and are therefore useful on sites with low land availability. However, pumping from the shaft into the receiving drainage network may be required. Therefore, substantial mechanical and electrical works may be required as potentially would major civil engineering requirements. With a relatively small cross-sectional area, a shaft would be prone to siltation at a rapid rate depending on the quality of the run-off. Therefore, a maintenance programme would be required as would regular servicing of any pump works.

Oversized pipes: Over sizing the pipes that make up the on-site drainage network is a cost-effective method that is often used for providing attenuation storage within the network. The main drawback with using this method is that it can be very difficult to obtain the required level of storage as the pipe diameters are often restricted by depth of cover (vertical distance between top of pipe work and ground surface) available and the need to gravity drain into an existing network. A solution to this is to lay multiple pipes side by side; however, this increases the excavation areas and may also place restrictions on the development footprint. The use of oversized pipes is not an effective method of providing on site storage if the network is at a relatively steep gradient. This is because the storage at the upstream end of the pipe is unlikely to be utilised.

Rainwater Harvesting: Rainwater harvesting is the process of collecting rain that falls directly onto roofs (and in some cases hardstanding areas) such that it can be re used for non-potable uses around the home or business (typically flushing toilets, car washing and irrigation etc). The simplest form of rainwater harvesting involves the collection of run-offs from a roof via a water butt situated at the bottom of a down pipe. This water can then be used for irrigation. For systems where the collected run-off is to be used for toilet flushing, washing machines etc, it is likely that the water would be pumped from a storage tank installed on the grounds of the property. Packaged systems are available although the costs (including ongoing maintenance) may outweigh the payback in terms of reduced water supply charges. The use of rainwater harvesting fits well with the overall water cycle, as it may assist with a minor reduction in volumes of off-site run-off 'post development' together with reducing overall demand for potable water.

Tanks: The use of tanks for the provision of storage to attenuate surface water runoff is varied in the number of options available. While most storage tanks are installed beneath the ground surface, above ground storage tanks may be feasible as part of industrial or commercial type developments where amenity issues or space are not significant restrictions. Tanks are likely to be prefabricated but could also be constructed in-situ for below ground concrete tanks. Plastic and Glass Reinforced Plastic Tanks are also often utilised with sizes up to 25m² being available off the shelf (although larger tanks used above ground may have additional reinforcing requirements). Consideration must be given to below ground tanks with regards to cover depths, load bearings, and also invert depths should the tank be drained by gravity. The storage requirements need to be based on a sound hydrological assessment as under-sizing the tank would be costly to remediate.

Green Roofs: A roof area that is used for growing appropriate types of vegetation which provides a degree of retention and attenuation, it also promotes evapotranspiration. In addition, vegetation and substrate can absorb a range of pollutants. Green roofs are more suitable for public and institutional buildings that have good maintenance programmes and support. Green roofs are available in both prefabricated and in-situ construction; however, they are heavy systems and can have major structural implications for buildings and are usually impractical to retrofit.

6.12 Combined Infiltration/Attenuation Systems

In most situations, SUDS systems include both infiltration and storage, and most of the techniques identified above can be used in combination. Dedicated infiltration and attenuation systems may also include swales and filter strips.

Swales: A swale is a grass lined channel designed to control both the flow rate and quality of the surface water run-off that is generated by the adjacent site. Not only does the water run down the sides of the swale at reduced speed, but it can also be slowed further as it flows along the channel before being discharged from the site. This detention of the runoff also increases the infiltration from the swale.

Filter strips: A filter strip runs along the edge of a permeable area and is sloped to allow the sheet flow across the vegetated strip. Unlike a swale however, no storage is offered other than what is held back by the vegetation. The overland flow across the filter strip is likely to run into a water course at some point rather than being formally collected and discharged at a controlled rate from the site.

6.13 SUDS Options Appraisal

Taking account of the context setting of the site, it is strongly preferred that surface water runoff be wholly directed into the **UNITED UTILITIES (UU)** drainage system, and consultations should be made with UU to determine the feasibility of this. However, should supplementary SUDS be required by **UU**, or for conformity with design accreditations *e.g.*, **BREAM**, then the following comments are made:

- Natural rainwater infiltration *via* natural soak-a-ways should always be the prime objective wherever this may be feasible.

With regard to the adoption of soakaways, the above referenced intrusive ground investigation report confirms the prevailing ground conditions at this site to comprise hard paved surfaces and associated sub-base overlying made ground deposits generally comprising grey / brown clayey sands and gravel extending to depths varying between 0.15m - 0.7mbgl. Thereafter the sequence continued in natural drift deposits comprising loose silty, locally gravelly, sands and soft becoming firm brown / grey clay deposits extending to depths varying between 1.5m – 2mbgl, thereafter the sequence continued in grey weathered mudstone locally interbedded with thin intact coal, proven to 3mbgl.

Notwithstanding this, the *Client* is advised to undertake determinations of soil infiltration rates in accordance with 'BRE Digest 365' to confirm if the overlying deposits are suitable for the adoption of soak-a-way drainage.

- Should the underlying made ground deposits be unsuitable for the adoption of soakaway systems, then subject to agreement with **UU**, the surface water runoff rate may be accommodated in the drainage network extending along Derby Street to the south, although in keeping with current policy objectives, it is unlikely that **UNITED UTILITIES** will accept the calculated unregulated run-off rates, and taking account of the strategic discharge target set by **KNOWSLEY MBC**, it is highly likely that attenuation measures will be required.

In considering the foregoing recommendations, it should be borne in mind that the purpose of this FRA is to demonstrate that simple practical measures can be adopted to achieve the objectives of PPG. Detailed design of the adopted systems is outside the scope of this assessment.

7.0 CONCLUSIONS AND RECOMMENDATIONS

- It is concluded that the site is situated within an **EA** designated Flood Zone I as defined by PPG
- Since the proposed development is residential in a brownfield regeneration area, a "*More Vulnerable*" classification is assigned
- Inputting these parameters into the Sequential Test matrix indicated that the development proposals satisfy the Sequential Test
- It is concluded that the site is not located within an **EA** designated Source Protection Zone
- **OS** mapping illustrates that the western site boundary is located c.11km northeast of the River Mersey Estuary, hence there is a '*Very Low Risk*' of flooding from the sea.
- There are no records pertaining to the presence of Surface Water Features and/or Surface Water Bodies within, or within 1km of, the study site. Hence, the risk of flooding associated with these features impacting the site is considered to be

insignificant.

- There are no records relating to the presence of Water Networks (OS MasterMap) within 220m of the study site, the nearest record relating to an inland river / stream being located c.229m northwest of the study site, hence the risk of flooding associated with such features is considered to be '*Insignificant*'.
- The **EA** does not have any flood modelling flood data at this site, nor does the **EA** have records pertaining to historical flood events on, or within a 250m radius of, the study site.
- There are no areas which are utilised for flood storage and/or flood defences within 250m of the study site
- There are no areas within 250m of the study site which benefit from the presence of flood defences for a 1: 100 plus Climate Change event.
- The site is not located within 500m of an area which is identified as being at potential risk of a canal failure
- The flood risk data discussed in the GroundSure Report presented in Appendix B shows a '*Negligible*' risk (*0.1m - 0.3m in a 1: 30 Return Period*) of pluvial flooding affecting the study site
- The flood risk data presented in Appendix B states that there is a '*Negligible Risk*' of groundwater flooding affecting the study site.
- It is calculated that post-construction impermeable surface cover will decrease from c.2105m² to c.1769m²
- For the 1 in 100year plus climate change (set at 1:100yr + 40%), a post development surface water run-off rate of 88.66l/s was calculated
- The appended calculations (presented in Appendix D) confirm greenfield runoff rates for the overall site to be 0.47l/s for a 1:1yr event, 0.91l/s for a 1:30yr event and 1.12l/s for a 1:100yr event respectively, with Qbar (l/s) (mean annual greenfield peak flow) being in the order of 0.54l/s.
- Natural rainwater infiltration *via* soakaways should be a prime objective wherever this may be feasible. With regard to the adoption of soakaways on this site, since the natural drift geology comprises, clayey sand overlying impermeable boulder clay underlain with grey weathered mudstone it is likely that the site is not suitable for the adoption of soakaways. Notwithstanding this, it is recommended that the *Client* commissions the undertaking of *in-situ* soil permeability test in accordance with 'BRE Digest 365 (2016)' at 2nr locations to determine if the underlying ground conditions are suitable for the adoption of natural soakaway drainage systems.
- Since the underlying ground conditions may not be suitable for the adoption of soakaway systems, then subject to agreement with **UU**, the surface water runoff rate may be accommodated in the existing drainage network extending along Derby Street to the south, although in keeping with current policy objectives, it is unlikely that **UU** will accept the calculated unregulated run-off rates, and taking account of the strategic discharge target set by **KNOWSLEY MBC**, it is highly likely that attenuation measures will be required. – see Section 6.13 above

7.1 Surface Water Run-off Attenuation

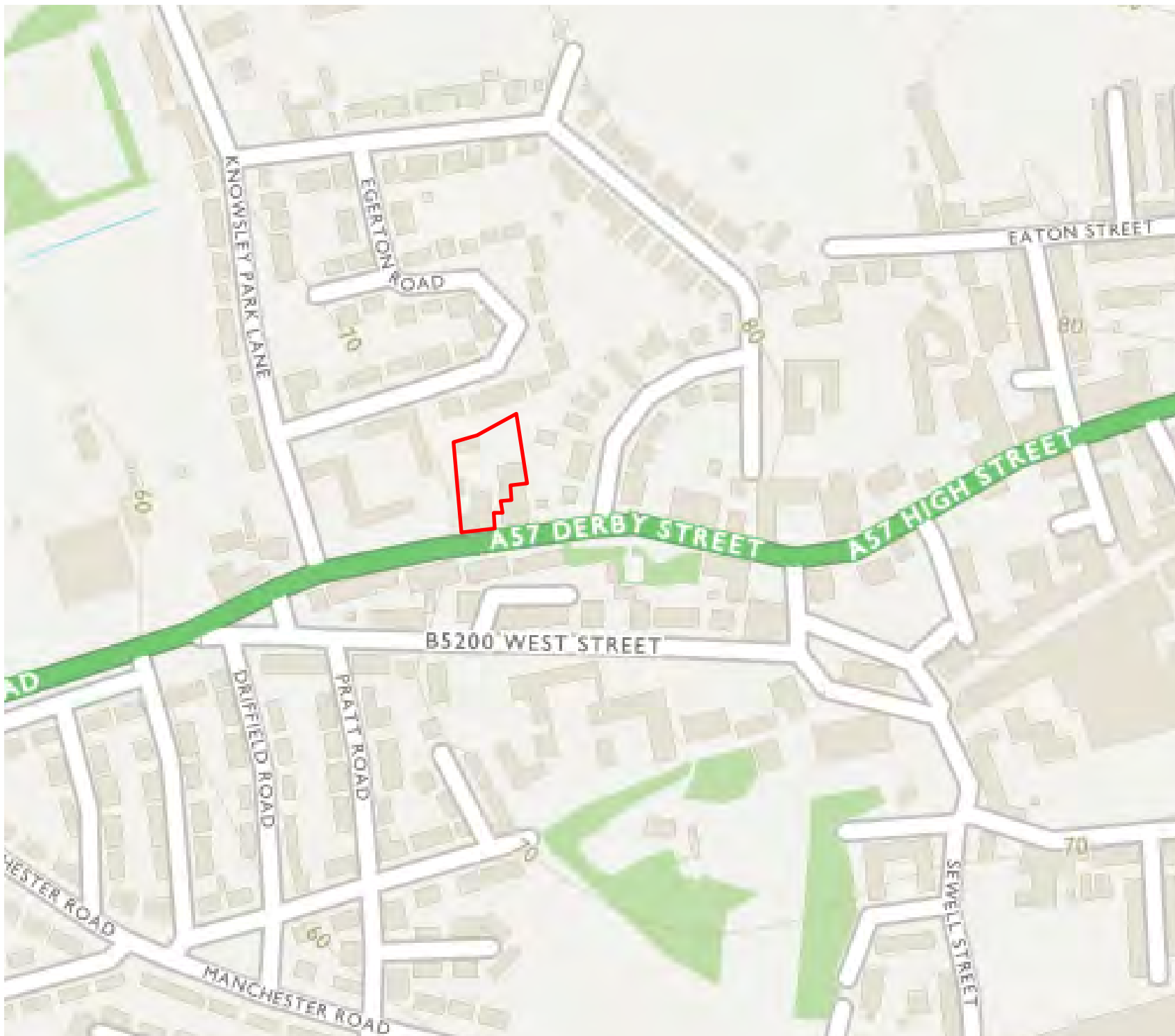
- Based on the calculated post construction impermeable surface covering the proposed development will induce calculated run-off rate of c.88.66l/s for a 1-100yr event + Climate Change
- This compares with the target value of 11.59l/s calculated for a 1:2-year critical rainfall event (-50%), to provide betterment over existing runoff in accordance with **KNOWSLEY MBC** '*Sustainable Drainage and Surface Water Management – Technical Guidance for Developers*' (Version 06, August 2016, 2020). However, it is understood that the Lead Local Flood Authority (LLFA) in advising **KNOWSLEY MBC** planning department will only consider the 50% betterment flow rate as an acceptable discharge rate if the entirety of the existing drainage network is utilised without modification.
- Based on the generally accepted rate of 5l/s, to accommodate the 1:100yr + CC runoff rate for a 15 min' storm duration, a storage volume of 75.29m³ would be needed. This could be accommodated in a 2m diameter pipe of c.24m length (where: $V = \pi r^2 h = \pi \cdot 1^2 \cdot 24 \approx 75.39m^3$) incorporating a hydro-brake chamber or with discharge regulated by Vortex Flow

Control or similar flow-controlled device.

- As an alternative to the oversize pipe attenuation, consideration may be given to the construction of a c. 10m x 10m x 0.8m deep (total storage = 80m³) modular cell storage reservoir and associated works (*i.e.*, *sediment catchpit etc.*), which slightly surpasses the calculated 75.29m³ as shown in Table 3 above. Thereafter, the attenuated surface water run-off should be designed to pass through a 'SPEL Stormceptor 300' Series Model 308 Class 1 oil/fuel separator as recommended in Gov.UK: 'Guidance: Discharges to surface water and groundwater: environmental permits' (2016, Revised April 2021) to provide an appropriate level of pollution treatment before being allowed to discharge into the nearby drainage network.
- Notwithstanding the above calculations and the fact the site and its immediate environs have been historically developed for commercial uses since late 1800's, for drainage purposes, the site classifies as 'Greenfield' in a 'Brownfield' setting and therefore operation of the attenuation system should take account of the LLFA and KNOWSLEY MBC 'Sustainable Drainage and Surface Water Management' (2016) requirement that the 'Greenfield' discharge rate of 5l/s be adopted as the basis of discussion with UNITED UTILITIES

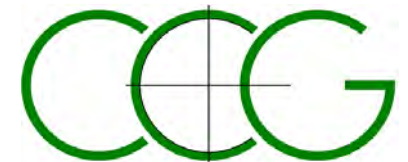
DRAWINGS:

22-13413-1 – SITE LOCATION PLAN
22-13413-2 – AERIAL PHOTOGRAPH



DO NOT SCALE

Notes: Study Site



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Client:
Prima Group

Project:
Former Prescott Police Station, Derby Road

Title:
Aerial Photograph

Scale: NTS	Issue: 01
Drawn by: DG	Date: September 2022
Project No. CCG-C-22-13413	Drawing No. 01

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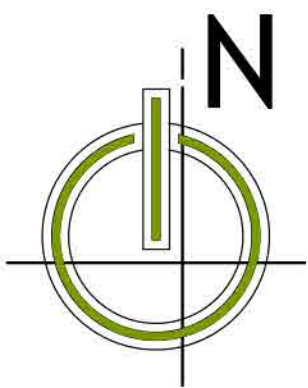
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Notes: Study Site



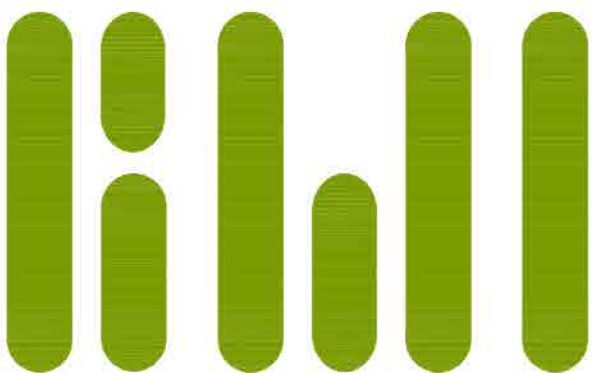
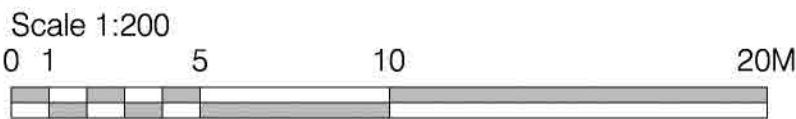
CC GEOTECHNICAL LIMITED
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Client: Prima Group	
Project: Former Prescott Police Station, Derby Road	
Title: Aerial Photograph	
Scale: NTS	Issue: 01
Drawn by: DG	Date: September 2021
Project No. CCG-C-22-13413	Drawing No. 02



NEW LANDSCAPE MATERIAL SCHEDULE

- Planting Areas to enhance bio diversity net gain
- Landscape grass
- Paved patios
- Courtyard permeable pavior sets - conservation type suitable for vehicle parking
- Paved Paths - conservation type
- Permeable paviour setts to incorporate flush demarcation
- conservation edging to finish of courtyard materials
- Conversion of Former Police Station - 7 Apartments
- Conversion of Outbuildings into dwellings - Plots 1
- Extension - Plots 1
- Conversion of Outbuildings into dwellings - Plots 6
- New 3 Bedroom Houses - Plots 2 - 5
- Indicates Vehicle Dual Electric Charging Points
- Communal Cycle Charging Points
- Low level fencing to new houses frontage with matching gates - ornate style metal painted black
- New brickwork wall enclosures
- Protected No build zone
- Existing Boundary Trees



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Revision	Date	Description	Drawn
Rev			

Client	PRIMA					 KWL Architects
Project	FORMER PRESCOT POLICE STATION, DERBY STREET, PRESCOT					
Drawing	PROPOSED SITE PLAN					
Scale	Date	Drawn	Checked			
1:200 @ A1	14.02.2023	JT	RJS			
Job No.	Dwg No.	Revision	Status	PLANNING		
5388	PL10					
					Poplar House Hazell Drive Newport S.Wales NP108FY T. +44 (0)1633 81 71 71 www.kwlarchitects.co.uk	

APPENDIX A: NOTES ON LIMITATIONS

Notes on Limitations For Geoenvironmental and Geotechnical Consultancy Services

General

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The findings and opinions provided in this document are made in good faith and are subject to the limitations imposed by employing site assessment methods and techniques, appropriate to the time of investigation and within the limitations and constraints defined in this document.

The findings and opinions are relevant to the dates when the assessment was undertaken, but should not necessarily be relied upon to represent conditions at a substantially later date. In particular, seasonal groundwater levels, with the effects of precipitation, may affect the conditions found during the investigation. The report should be read in conjunction with the further Notes on Limitations included in Appendix A.

Where opinions expressed in this report are based on current available guidance and legislation, no liability can be accepted by CC GEOTECHNICAL LTD for the effects of any future changes to such guidelines and legislation. Additional information, improved practices, new guidance, changes in legislation, or amendments to design proposals, may necessitate this report having to be reviewed in whole or in part after that date. Opinions and interpretations are not accredited by UKAS.

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2. the consequences of use of this document by any party with whom an agreement has not been executed.

Phase I Environmental Audits / Desk Studies

The work undertaken to provide the basis of a Phase 1 Desk Study report comprises a study of available documented information from a variety of sources (including the client), together with (where appropriate) a brief walk over inspection of the site and meetings and discussions with relevant authorities and other interested parties. The opinions given in a Desk Study report have been dictated by finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in the report, CC GEOTECHNICAL LTD reserves the right to review such information and to modify the opinions accordingly.

It should be noted that any risks identified in this report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

Factual Ground Investigations

The investigation of the site has been carried out in accordance with the scope and specification instructed by the Client. No interpretations of the data generated by the investigation have been provided or implied. The exploratory holes undertaken in this commission, investigate only a small volume of the ground in relation to the size of the site, and can only provide a general indication of site conditions. Conditions may exist on the site which have not been detected by the works undertaken. Furthermore, the number of sampling points and the methods of sampling and testing do not preclude the existence of localised "hotspots" or more widespread contamination where concentrations may be significantly higher than those actually encountered.

Interpretative Phase II Environmental Audits

The investigation of the site has been carried out with the intention of providing sufficient information concerning the type and degree of contamination, and ground and groundwater conditions to allow a reasonable risk assessment to be made. The objectives of the investigation have been limited to establishing the risks associated to potential human targets, building materials, the environment (including adjacent land), and surface and groundwater.

The amount of exploratory work and chemical testing undertaken may have been restricted by factors including inter alia the Clients budget, the available timescale, access to all parts of the site, the existence of buried services etc., and where this is the case, a more comprehensive investigation may be required if the site is to be redeveloped, since a number of important engineering and environmental issues may need further assessment.

For those reasons, if costs have been included in relation to site remediation these must be considered as tentative only and must, in any event, be confirmed by a qualified quantity surveyor.

It must be borne in mind, that the exploratory holes undertaken, investigate only a small volume of the ground in relation to the size of the site, and can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions apparent at the site of each of the exploratory holes. There may be ground conditions present on the site which have not been disclosed by this investigation, and which have therefore not been taken into account in this report. The number of sampling points and the methods of sampling and testing do not preclude the existence of localised "hotspots" or more widespread contamination where concentrations may be significantly higher than those actually encountered. The findings of the investigation are valid for the time of investigation and the passage of time may result in changes to the contamination status of the site, and a reassessment of the site may be required where significant time has elapsed.

Geoenvironmental Ground Investigations

The investigation of the site has been carried out within the constraints of Client budget, available timeframe, access to all parts of the site, the existence of buried services and a more comprehensive investigation may be required to provide sufficient information regarding the type and degree of contamination, geotechnical characteristics, and ground and groundwater conditions, to formulate a reasonable assessment of the environmental risks together with engineering and development implications.

If costs have been included in relation to the site remediation, these must be confirmed by a qualified quantity surveyor.

The exploratory holes undertaken, investigate only a small volume of the ground in relation to the size of the site, and can only provide a general indication of the site conditions. The opinions provided and recommendations given in this report are based on the ground conditions apparent at the site of each of the exploratory holes. There may be ground conditions present on the site which have not been disclosed by this investigation, and which have therefore not been taken into account in this report. The findings of the investigation are valid for the time of investigation and the passage of time may result in changes to the contamination status of the site, and a reassessment of the site may be required where significant time has elapsed.

The comments made on groundwater conditions are based on observations made at the time that site work was carried out. It should be noted that groundwater levels will vary owing to seasonal, tidal, weather, or other effects.

The risk assessment and opinions provided, inter alia, take into consideration currently available guidance relating to acceptable contamination concentrations and no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

APPENDIX B: COMMERCIAL FLOOD INSIGHT REPORT

Prescot Police Station, L34 3LG

Order Details

Date: 28/07/2021
Your ref: 4165
Our Ref: CMAPS-AAG-980046-4165-280721EDRGEO
Client: CENTREMAPS

Site Details

Location: 346312 392867
Area: 0.23 ha
Authority: [Knowsley Metropolitan Borough Council](#)



Summary of findings

p. 2

Aerial image

p. 8

OS MasterMap site plan

p.12

groundsure.com/insightuserguide

Contact us with any questions at:

info@groundsure.com

08444 159 000

Recent aerial photograph



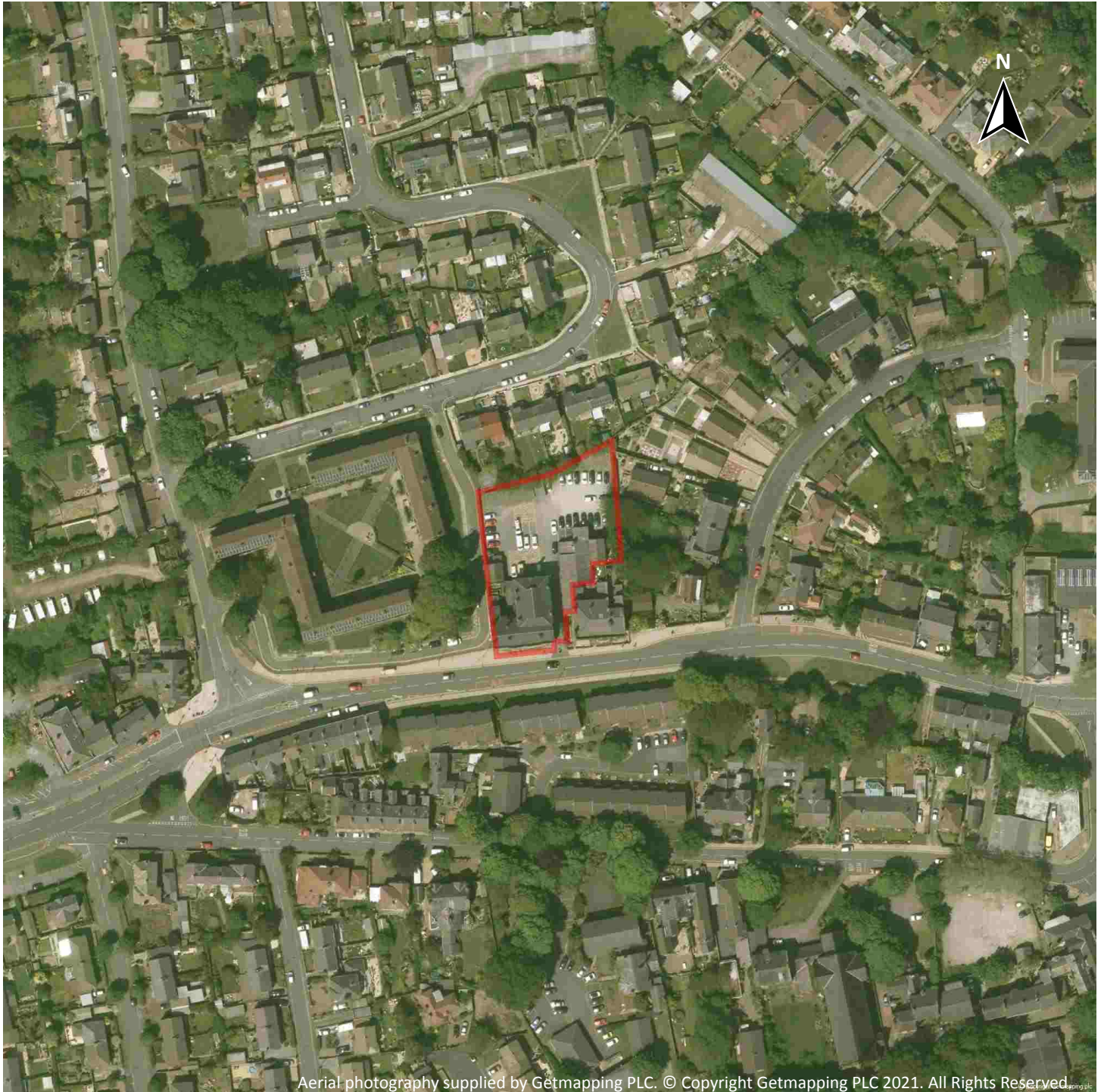
Aerial photography supplied by Getmapping PLC. © Copyright Getmapping PLC 2021. All Rights Reserved.

Capture Date: 22/04/2019

Site Area: 0.23ha



Recent site history - 2015 aerial photograph



Aerial photography supplied by Getmapping PLC. © Copyright Getmapping PLC 2021. All Rights Reserved.

Capture Date: 11/06/2015

Site Area: 0.23ha



Recent site history - 2005 aerial photograph



Aerial photography supplied by Getmapping PLC. © Copyright Getmapping PLC 2021. All Rights Reserved.

Capture Date: 02/09/2005

Site Area: 0.23ha



Recent site history - 2000 aerial photograph



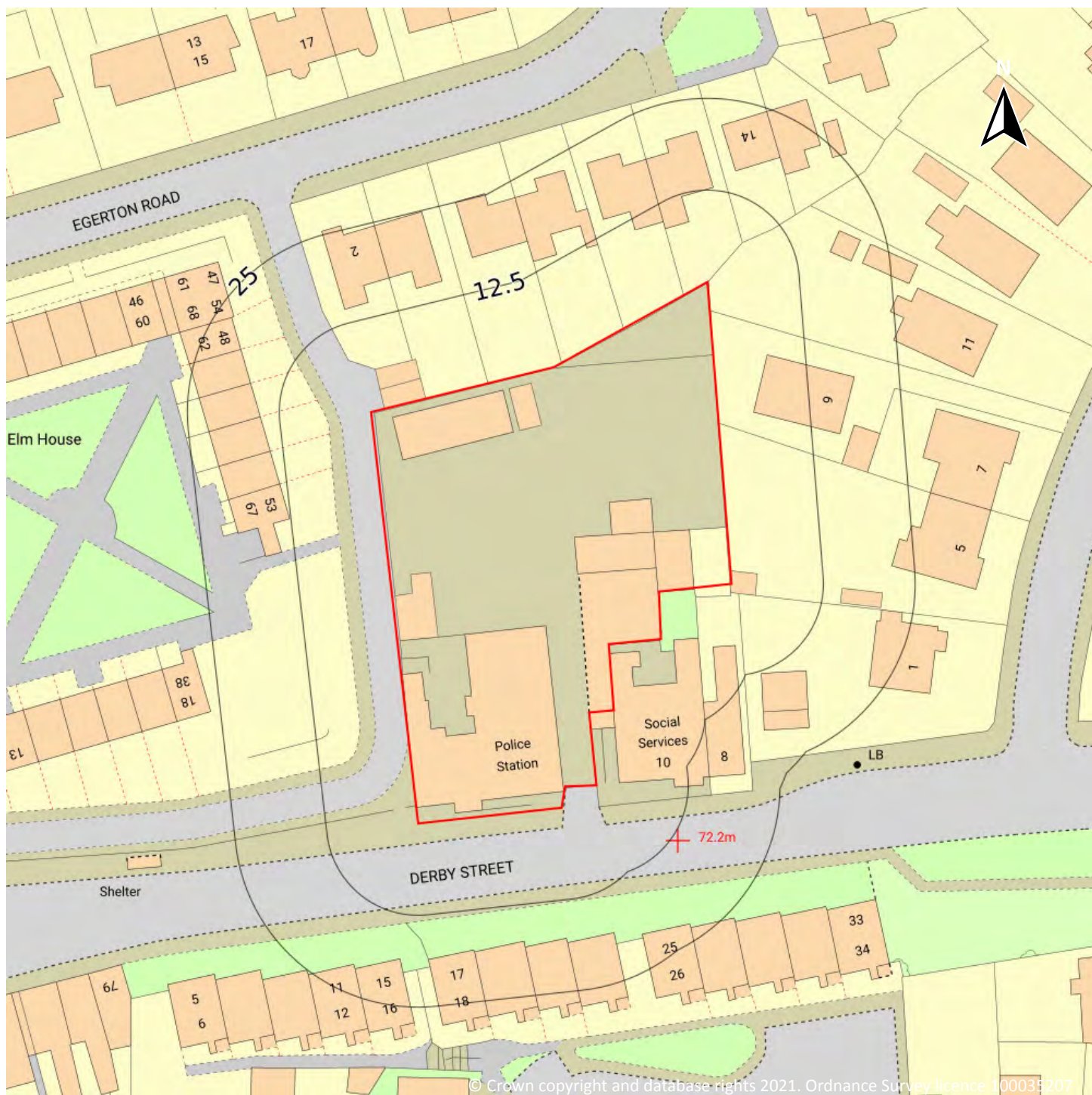
Aerial photography supplied by Getmapping PLC. © Copyright Getmapping PLC 2021. All Rights Reserved.

Capture Date: 21/07/2000

Site Area: 0.23ha



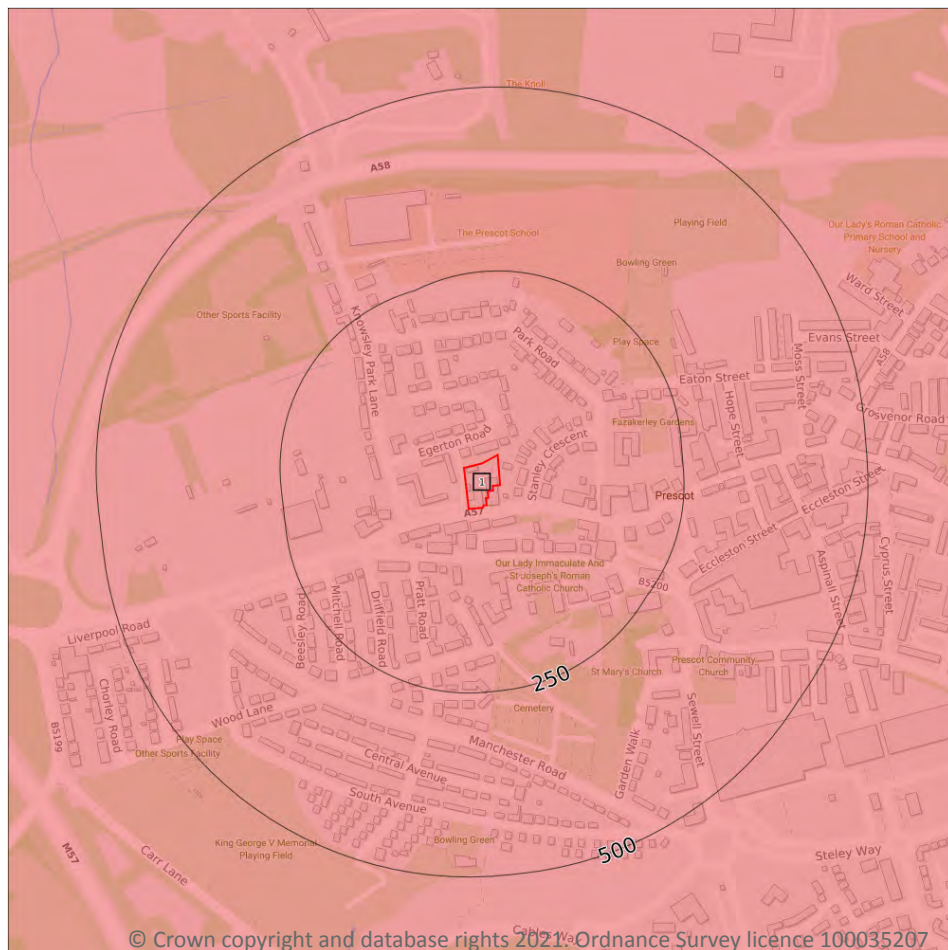
OS MasterMap site plan



Site Area: 0.23ha



Bedrock aquifer



- Site Outline
- Search buffers in metres (m)
- Principal
 - Secondary A
 - Secondary B
 - Secondary Undifferentiated
 - Unproductive

5.2 Bedrock aquifer

Records within 500m

1

Aquifer status of groundwater held within bedrock geology.

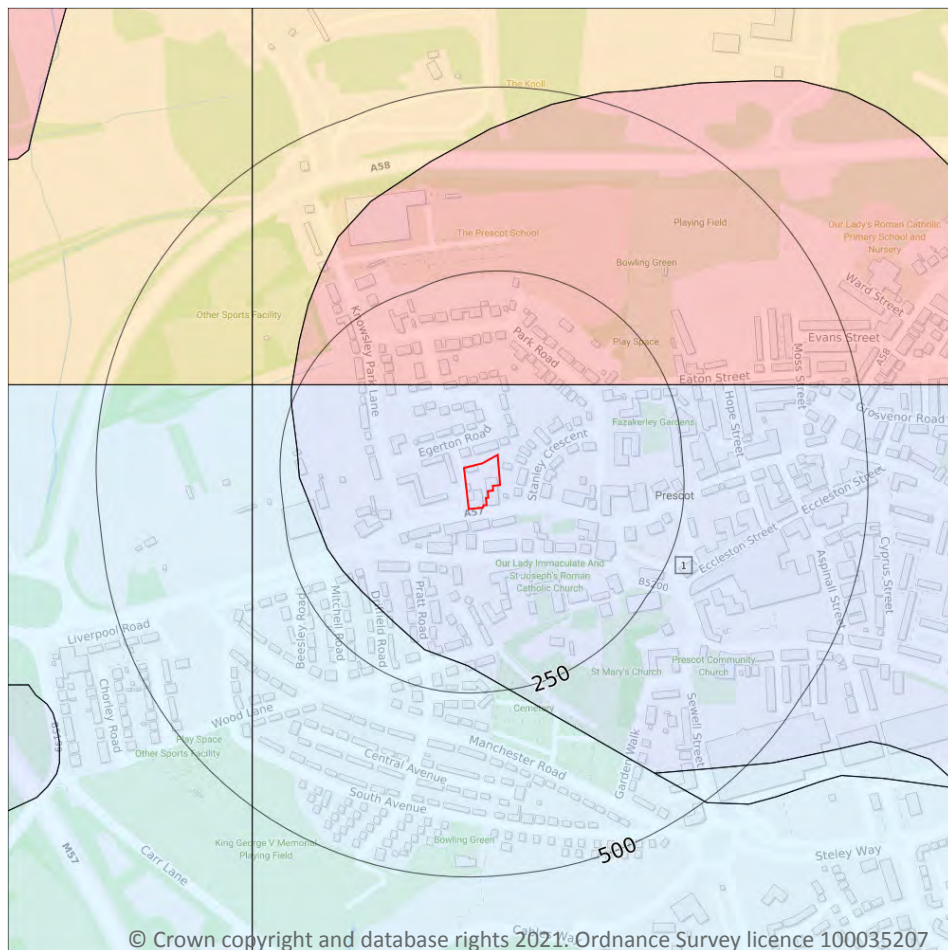
Features are displayed on the Bedrock aquifer map on **page 46**

ID	Location	Designation	Description
1	On site	Secondary A	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

This data is sourced from the British Geological Survey, the Environment Agency and Natural Resources Wales.



Groundwater vulnerability



— Site Outline

Search buffers in metres (m)

Superficial vulnerability

- Principal superficial aquifer, high vulnerability
- Secondary superficial aquifer, high vulnerability
- Principal superficial aquifer, medium vulnerability
- Secondary superficial aquifer, medium vulnerability
- Principal superficial aquifer, low vulnerability
- Secondary superficial aquifer, low vulnerability

Bedrock vulnerability

- Principal bedrock aquifer, high vulnerability
- Secondary bedrock aquifer, high vulnerability
- Principal bedrock aquifer, medium vulnerability
- Secondary bedrock aquifer, medium vulnerability
- Principal bedrock aquifer, low vulnerability
- Secondary bedrock aquifer, low vulnerability

Other information

- Unproductive aquifer
- Soluble rock risk
- Local information

5.3 Groundwater vulnerability

Records within 50m

1

An assessment of the vulnerability of groundwater to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties within a one kilometre square grid. Groundwater vulnerability is described as High, Medium or Low as follows:

- High - Areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits.
- Medium - Intermediate between high and low vulnerability.
- Low - Areas that provide the greatest protection from pollution. They are likely to be characterised by low leaching soils and/or the presence of superficial deposits characterised by a low permeability.

Features are displayed on the Groundwater vulnerability map on **page 47**



ID	Location	Summary	Soil / surface	Superficial geology	Bedrock geology
1	On site	Summary Classification: Secondary bedrock aquifer - Low Vulnerability Combined classification: Productive Bedrock Aquifer, No Superficial Aquifer	Leaching class: Low Infiltration value: <40% Dilution value: 300- 550mm/year	Vulnerability: - Aquifer type: - Thickness: 3-10m Patchiness value: <90% Recharge potential: Low	Vulnerability: Low Aquifer type: Secondary Flow mechanism: Well connected fractures

This data is sourced from the British Geological Survey, the Environment Agency and Natural Resources Wales.

5.4 Groundwater vulnerability- soluble rock risk

Records on site	0
------------------------	----------

This dataset identifies areas where solution features that enable rapid movement of a pollutant may be present within a 1km grid square.

This data is sourced from the British Geological Survey and the Environment Agency.

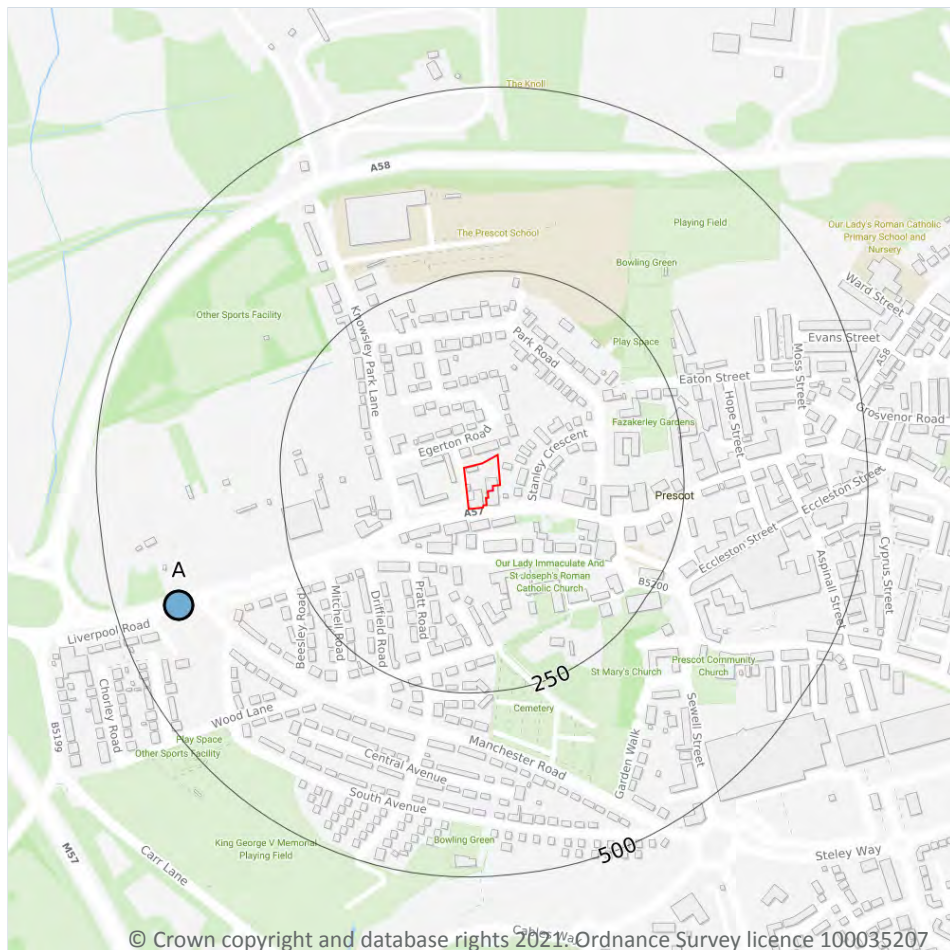
5.5 Groundwater vulnerability- local information

Records on site	0
------------------------	----------

This dataset identifies areas where additional local information affecting vulnerability is held by the Environment Agency. Further information can be obtained by contacting the Environment Agency local Area groundwater team through the Environment Agency National Customer Call Centre on 03798 506 506 or by email on enquiries@environment-agency.gov.uk.

This data is sourced from the British Geological Survey and the Environment Agency.

Abstractions and Source Protection Zones



- Site Outline
- Search buffers in metres (m)
- Source Protection Zone 1
Inner catchment
- Source Protection Zone 2
Outer catchment
- Source Protection Zone 3
Total catchment
- Source Protection Zone 4
Zone of Special Interest
- Source Protection Zone 1c
Inner catchment - confined aquifer
- Source Protection Zone 2c
Outer catchment - confined aquifer
- Source Protection Zone 3c
Total catchment - confined aquifer
- Drinking water abstraction licences
Polygon features
- Drinking water abstraction licences
Linear features
- Groundwater abstraction licence (point)
- Groundwater abstraction licence (area)
- Groundwater abstraction licence (linear)
- Surface Water Abstractions (point)
- Surface Water Abstractions (area)
- Surface Water Abstractions (linear)

5.6 Groundwater abstractions

Records within 2000m

5

Licensed groundwater abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, between two points (line data) or a larger area.

Features are displayed on the Abstractions and Source Protection Zones map on **page 49**

ID	Location	Details	
-	1830m SE	Status: Historical Licence No: 2569025072 Details: "Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services" Direct Source: Ground Water - North West Region Point: "TWO BOREHOLES AT WHISTON HOSPITAL, PRESCOT, MERSEYSIDE" Data Type: Point Name: ST HELENS AND KNOWSLEY HOSPITALS Easting: 348000 Northing: 392100	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 13/08/1992 Expiry Date: - Issue No: 100 Version Start Date: 13/08/1992 Version End Date: -
-	1830m SE	Status: Historical Licence No: 2569025072 Details: General use relating to Secondary Category (Medium Loss) Direct Source: Ground Water - North West Region Point: "TWO BOREHOLES AT WHISTON HOSPITAL, PRESCOT, MERSEYSIDE" Data Type: Point Name: ST HELENS AND KNOWSLEY HOSPITALS Easting: 348000 Northing: 392100	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 13/08/1992 Expiry Date: - Issue No: 100 Version Start Date: 13/08/1992 Version End Date: -
-	1830m SE	Status: Historical Licence No: 2569025072 Details: General use relating to Secondary Category (Medium Loss) Direct Source: Ground Water - North West Region Point: TWO BOREHOLES AT WHISTON HOSPITAL, PRESCOT, MERSEYSIDE Data Type: Point Name: ST HELENS AND KNOWSLEY HOSPITALS Easting: 348000 Northing: 392100	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 13/08/1992 Expiry Date: - Issue No: 100 Version Start Date: 13/08/1992 Version End Date: -
-	1830m SE	Status: Historical Licence No: 2569025072 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Ground Water - North West Region Point: TWO BOREHOLES AT WHISTON HOSPITAL, PRESCOT, MERSEYSIDE Data Type: Point Name: ST HELENS AND KNOWSLEY HOSPITALS Easting: 348000 Northing: 392100	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 13/08/1992 Expiry Date: - Issue No: 100 Version Start Date: 13/08/1992 Version End Date: -



ID	Location	Details	
-	1963m E	Status: Historical Licence No: 2569025020 Details: Potable Water Supply - Direct Direct Source: Ground Water - North West Region Point: BOREHOLE AT ECCLESTON PARK RAILWAY STATION Data Type: Point Name: UNITED UTILITIES WATER PLC Easting: 348300 Northing: 392900	Annual Volume (m ³): 295490 Max Daily Volume (m ³): 986.482 Original Application No: - Original Start Date: 31/05/1966 Expiry Date: - Issue No: 100 Version Start Date: 10/07/1975 Version End Date: -

This data is sourced from the Environment Agency and Natural Resources Wales.

5.7 Surface water abstractions

Records within 2000m

2

Licensed surface water abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, a stretch of watercourse or a larger area.

Features are displayed on the Abstractions and Source Protection Zones map on **page 49**

ID	Location	Details	
A	415m W	Status: Historical Licence No: 2569028003 Details: Spray Irrigation - Direct Direct Source: "Surface, Non-Tidal - North West Region" Point: "LOGWOOD MILL BROOK AT LH'S PREMISES, PRESCOT, MERSEYSIDE" Data Type: Point Name: JAMES WHITAKER & SONS NURSERYMEN LTD Easting: 345900 Northing: 392700	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 04/02/1966 Expiry Date: - Issue No: 100 Version Start Date: 01/03/1999 Version End Date: -
A	415m W	Status: Historical Licence No: 2569028003 Details: Spray Irrigation - Direct Direct Source: Surface, Non-Tidal - North West Region Point: LOGWOOD MILL BROOK AT LH'S PREMISES, PRESCOT, MERSEYSIDE Data Type: Point Name: JAMES WHITAKER & SONS NURSERYMEN LTD Easting: 345900 Northing: 392700	Annual Volume (m ³): 772.82 Max Daily Volume (m ³): 77.282 Original Application No: - Original Start Date: 04/02/1966 Expiry Date: - Issue No: 100 Version Start Date: 01/03/1999 Version End Date: -

This data is sourced from the Environment Agency and Natural Resources Wales.



5.8 Potable abstractions

Records within 2000m

3

Licensed potable water abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, a stretch of watercourse or a larger area.

Features are displayed on the Abstractions and Source Protection Zones map on **page 49**

ID	Location	Details	
-	1830m SE	Status: Historical Licence No: 2569025072 Details: "Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services" Direct Source: Ground Water - North West Region Point: "TWO BOREHOLES AT WHISTON HOSPITAL, PRESCOT, MERSEYSIDE" Data Type: Point Name: ST HELENS AND KNOWSLEY HOSPITALS Easting: 348000 Northing: 392100	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 13/08/1992 Expiry Date: - Issue No: 100 Version Start Date: 13/08/1992 Version End Date: -
-	1830m SE	Status: Historical Licence No: 2569025072 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Ground Water - North West Region Point: TWO BOREHOLES AT WHISTON HOSPITAL, PRESCOT, MERSEYSIDE Data Type: Point Name: ST HELENS AND KNOWSLEY HOSPITALS Easting: 348000 Northing: 392100	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: 13/08/1992 Expiry Date: - Issue No: 100 Version Start Date: 13/08/1992 Version End Date: -
-	1963m E	Status: Historical Licence No: 2569025020 Details: Potable Water Supply - Direct Direct Source: Ground Water - North West Region Point: BOREHOLE AT ECCLESTON PARK RAILWAY STATION Data Type: Point Name: UNITED UTILITIES WATER PLC Easting: 348300 Northing: 392900	Annual Volume (m ³): 295490 Max Daily Volume (m ³): 986.482 Original Application No: - Original Start Date: 31/05/1966 Expiry Date: - Issue No: 100 Version Start Date: 10/07/1975 Version End Date: -

This data is sourced from the Environment Agency and Natural Resources Wales.



5.9 Source Protection Zones

Records within 500m

0

Source Protection Zones define the sensitivity of an area around a potable abstraction site to contamination.

This data is sourced from the Environment Agency and Natural Resources Wales.

5.10 Source Protection Zones (confined aquifer)

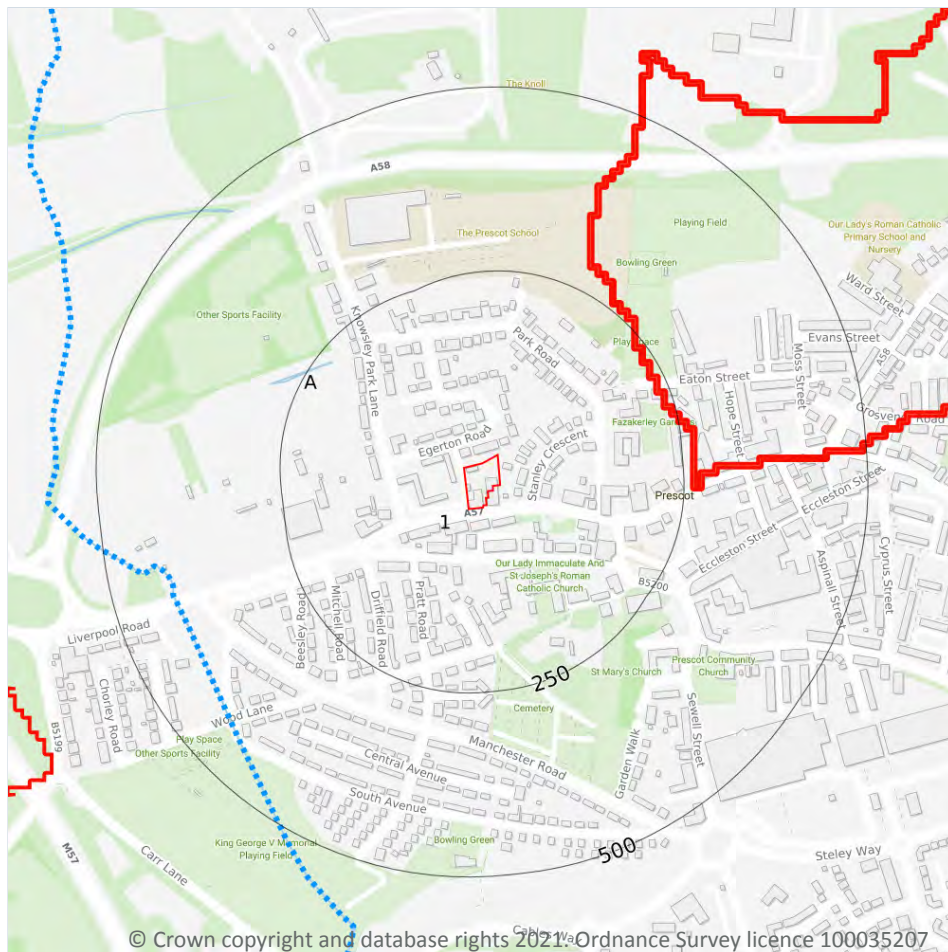
Records within 500m

0

Source Protection Zones in the confined aquifer define the sensitivity around a deep groundwater abstraction to contamination. A confined aquifer would normally be protected from contamination by overlying geology and is only considered a sensitive resource if deep excavation/drilling is taking place.

This data is sourced from the Environment Agency and Natural Resources Wales.

6 Hydrology



- Site Outline
- Search buffers in metres (m)
- Water Network (OS MasterMap)
- Surface water features (wider than 5m)
- Surface water features (narrower than 5m)
- ⋯ WFD River, canal and surface water transfer water bodies
- WFD Lake water bodies
- WFD Transitional and coastal water bodies
- WFD Surface water body catchments boundaries
- WFD Groundwater body boundaries

6.1 Water Network (OS MasterMap)

Records within 250m

1

Detailed water network of Great Britain showing the flow and precise central course of every river, stream, lake and canal.

Features are displayed on the Hydrology map on **page 54**

ID	Location	Type of water feature	Ground level	Permanence	Name
A	229m NW	Inland river not influenced by normal tidal action.	On ground surface	Watercourse contains water year round (in normal circumstances)	-

This data is sourced from the Ordnance Survey.



6.2 Surface water features

Records within 250m

1

Covering rivers, streams and lakes (some overlap with OS MasterMap Water Network data in previous section) but additionally covers smaller features such as ponds. Rivers and streams narrower than 5m are represented as a single line. Lakes, ponds and rivers or streams wider than 5m are represented as polygons.

Features are displayed on the Hydrology map on **page 54**

This data is sourced from the Ordnance Survey.

6.3 WFD Surface water body catchments

Records on site

1

The Water Framework Directive is an EU-led framework for the protection of inland surface waters, estuaries, coastal waters and groundwater through river basin-level management planning. In terms of surface water, these basins are broken down into smaller units known as management, operational and water body catchments.

Features are displayed on the Hydrology map on **page 54**

ID	Location	Type	Water body catchment	Water body ID	Operational catchment	Management catchment
1	On site	River WB catchment	Prescot Brook (Logwood Mill Brook)	GB112069060710	Ditton	Lower Mersey

This data is sourced from the Environment Agency and Natural Resources Wales.

6.4 WFD Surface water bodies

Records identified

1

Surface water bodies under the Directive may be rivers, lakes, estuary or coastal. To achieve the purpose of the Directive, environmental objectives have been set and are reported on for each water body. The progress towards delivery of the objectives is then reported on by the relevant competent authorities at the end of each six-year cycle. The river water body directly associated with the catchment listed in the previous section is detailed below, along with any lake, canal, coastal or artificial water body within 250m of the site. Click on the water body ID in the table to visit the EA Catchment Explorer to find out more about each water body listed.

Features are displayed on the Hydrology map on **page 54**

ID	Location	Type	Name	Water body ID	Overall rating	Chemical rating	Ecological rating	Year
3	413m SW	River	Prescot Brook (Logwood Mill Brook)	GB112069060710	Poor	Good	Poor	2016

This data is sourced from the Environment Agency and Natural Resources Wales.

6.5 WFD Groundwater bodies

Records on site

0

Groundwater bodies are also covered by the Directive and the same regime of objectives and reporting detailed in the previous section is in place. Click on the water body ID in the table to visit the EA Catchment Explorer to find out more about each groundwater body listed.

This data is sourced from the Environment Agency and Natural Resources Wales.



7 River and coastal flooding

7.1 Risk of Flooding from Rivers and Sea (RoFRaS)

Records within 50m

0

The chance of flooding from rivers and/or the sea in any given year, based on cells of 50m. Each cell is allocated one of four flood risk categories, taking into account flood defences and their condition; Very low (less than 1 in 1000 chance in any given year), Low (less than 1 in 100 but greater than or equal to 1 in 1000 chance), Medium (less than 1 in 30 but greater than or equal to 1 in 100 chance) or High (greater than or equal to 1 in 30 chance).

This data is sourced from the Environment Agency and Natural Resources Wales.

7.2 Historical Flood Events

Records within 250m

0

Records of historic flooding from rivers, the sea, groundwater and surface water. Records began in 1946 when predecessor bodies started collecting detailed information about flooding incidents, although limited details may be included on flooding incidents prior to this date. Takes into account the presence of defences, structures, and other infrastructure where they existed at the time of flooding, and includes flood extents that may have been affected by overtopping, breaches or blockages.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.3 Flood Defences

Records within 250m

0

Records of flood defences owned, managed or inspected by the Environment Agency and Natural Resources Wales. Flood defences can be structures, buildings or parts of buildings. Typically these are earth banks, stone and concrete walls, or sheet-piling that is used to prevent or control the extent of flooding.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.4 Areas Benefiting from Flood Defences

Records within 250m

0

Areas that would benefit from the presence of flood defences in a 1 in 100 (1%) chance of flooding each year from rivers or 1 in 200 (0.5%) chance of flooding each year from the sea.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.5 Flood Storage Areas

Records within 250m

0

Areas that act as a balancing reservoir, storage basin or balancing pond to attenuate an incoming flood peak to a flow level that can be accepted by the downstream channel or to delay the timing of a flood peak so that its volume is discharged over a longer period.

This data is sourced from the Environment Agency and Natural Resources Wales.



River and coastal flooding - Flood Zones

7.6 Flood Zone 2

Records within 50m

0

Areas of land at risk of flooding, when the presence of flood defences are ignored. Covering land between Flood Zone 3 (see next section) and the extent of the flooding from rivers or the sea with a 1 in 1000 (0.1%) chance of flooding each year.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.7 Flood Zone 3

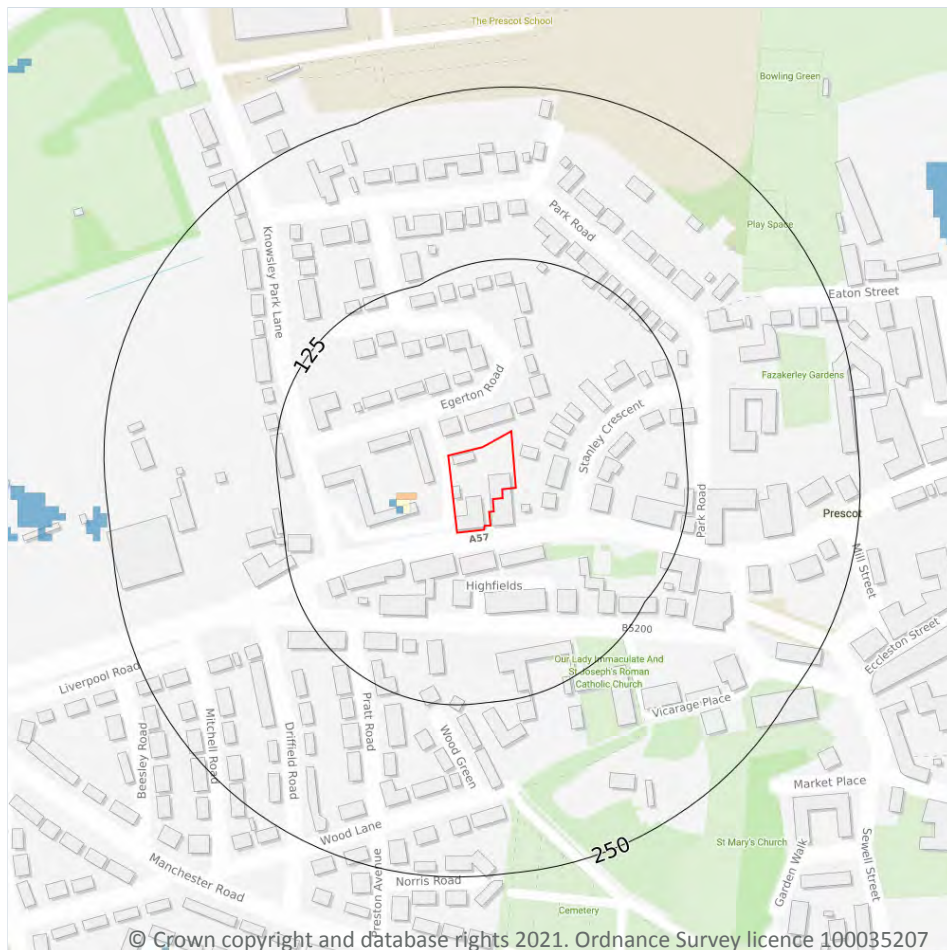
Records within 50m

0

Areas of land at risk of flooding, when the presence of flood defences are ignored. Covering land with a 1 in 100 (1%) or greater chance of flooding each year from rivers or a 1 in 200 (0.5%) or greater chance of flooding each year from the sea.

This data is sourced from the Environment Agency and Natural Resources Wales.

8 Surface water flooding



— Site Outline

Search buffers in metres (m)

1 in 1000 return period

- Depth between 0.1m - 0.3m
- Depth between 0.3m - 1.0m
- Depth greater than 1.0m

1 in 250 return period

- Depth between 0.1m - 0.3m
- Depth between 0.3m - 1.0m
- Depth greater than 1.0m

1 in 100 return period

- Depth between 0.1m - 0.3m
- Depth between 0.3m - 1.0m
- Depth greater than 1.0m

1 in 30 return period

- Depth between 0.1m - 0.3m
- Depth between 0.3m - 1.0m
- Depth greater than 1.0m

8.1 Surface water flooding

Highest risk on site

Negligible

Highest risk within 50m

1 in 30 year, 0.1m - 0.3m

Ambiental Risk Analytics surface water (pluvial) FloodMap identifies areas likely to flood as a result of extreme rainfall events, i.e. land naturally vulnerable to surface water ponding or flooding. This data set was produced by simulating 1 in 30 year, 1 in 100 year, 1 in 250 year and 1 in 1,000 year rainfall events. Modern urban drainage systems are typically built to cope with rainfall events between 1 in 20 and 1 in 30 years, though some older ones may flood in a 1 in 5 year rainfall event.

Features are displayed on the Surface water flooding map on **page 60**

The data shown on the map and in the table above shows the highest likelihood of flood events happening at the site. Lower likelihood events may have greater flood depths and hence a greater potential impact on a site.

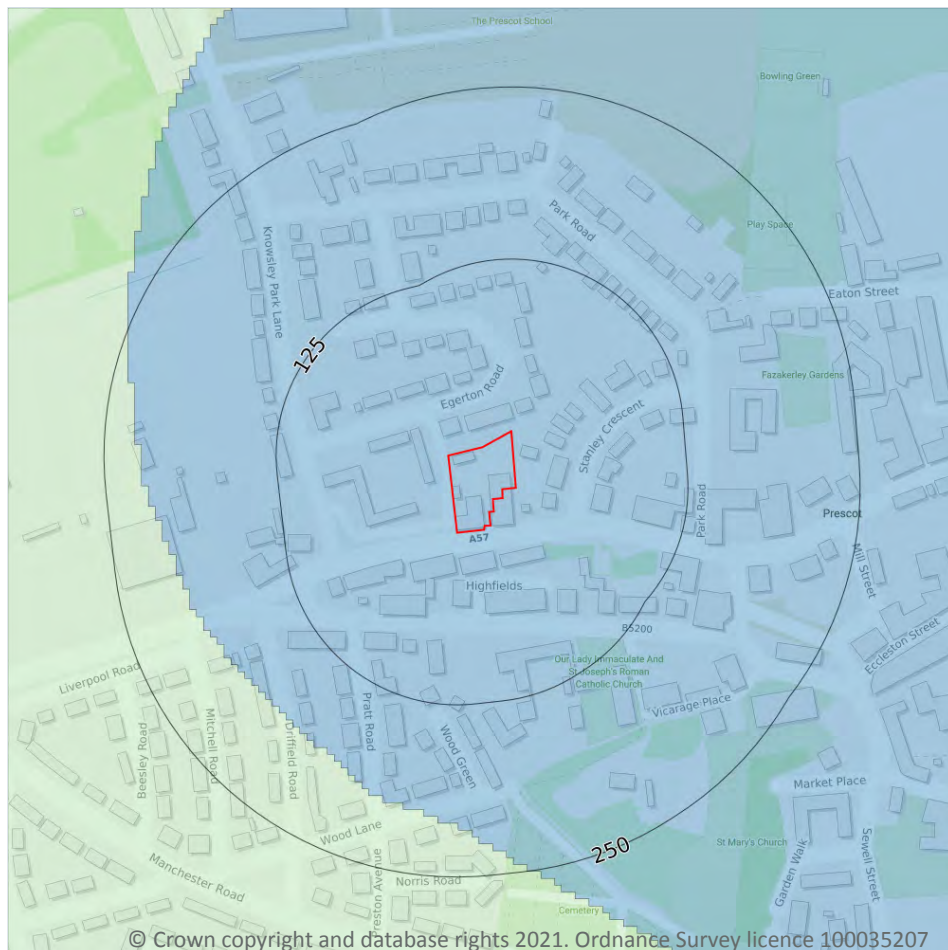
The table below shows the maximum flood depths for a range of return periods for the site.

Return period	Maximum modelled depth
1 in 1000 year	Negligible
1 in 250 year	Negligible
1 in 100 year	Negligible
1 in 30 year	Negligible

This data is sourced from Ambiantal Risk Analytics.



9 Groundwater flooding



— Site Outline
Search buffers in metres (m)

- High
- Moderate - High
- Moderate
- Low
- Negligible

9.1 Groundwater flooding

Highest risk on site

Negligible

Highest risk within 50m

Negligible

Groundwater flooding is caused by unusually high groundwater levels. It occurs when the water table rises above the ground surface or within underground structures such as basements or cellars. Groundwater flooding tends to exhibit a longer duration than surface water flooding, possibly lasting for weeks or months, and as a result it can cause significant damage to property. This risk assessment is based on a 1 in 100 year return period and a 5m Digital Terrain Model (DTM).

Features are displayed on the Groundwater flooding map on **page 62**

This data is sourced from Ambient Risk Analytics.

APPENDIX C: NATIONAL PLANNING POLICY FRAMEWORK TABLE 1 – 3

Note: These flood zones refer to the probability of river and sea flooding, ignoring the presence of defences

TABLE 1: FLOOD ZONES

Zone 1 - low probability

Definition

This zone comprises land assessed as having a less than 1:1 000 annual probability of river or sea flooding (<0.1%).

Appropriate uses

All uses of land are appropriate in this zone.

Flood risk assessment requirements

For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a flood risk assessment. This need only be brief unless the factors above or other local considerations require particular attention.

Policy aims

In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems².

Zone 2 - medium probability

Definition

This zone comprises land assessed as having between a 1:100 and 1:1,000 annual probability of river flooding (1% – 0.1%), or between a 1:200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.

Appropriate uses

Essential infrastructure and the water-compatible, less vulnerable, and more vulnerable uses, as set out in table 2, are appropriate in this zone. The highly vulnerable uses are only appropriate in this zone if the Exception Test is passed.

Flood risk assessment requirements

All development proposals in this zone should be accompanied by a flood risk assessment.

Policy aims

In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage systems.

Zone 3a - high probability

Definition

This zone comprises land assessed as having a 1:100 or greater annual probability of river flooding (>1%), or a 1:200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Appropriate uses

The water-compatible and less vulnerable uses of land (table 2) are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone.

The more vulnerable uses and essential infrastructure should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.

Flood risk assessment requirements

All development proposals in this zone should be accompanied by a flood risk assessment.

Policy aims

In this zone, developers and local authorities should seek opportunities to:

- Reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
- Relocate existing development to land in zones with a lower probability of flooding; and
- Create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

Zone 3b - the functional floodplain

Definition

This zone comprises land where water has to flow or be stored in times of flood.

Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1:20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

Appropriate uses

Only the water-compatible uses and the essential infrastructure listed in table 2 that has to be there should be permitted in this zone. It should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows; and
- not increase flood risk elsewhere.

Essential infrastructure in this zone should pass the Exception Test.

Flood risk assessment requirements

All development proposals in this zone should be accompanied by a flood risk assessment.

Policy aims

In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
- relocate existing development to land with a lower probability of flooding.

TABLE 2: FLOOD RISK VULNERABILITY CLASSIFICATION

Essential infrastructure

- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.
- Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.
- Wind turbines.

Highly vulnerable

- Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding.
- Emergency dispersal points.
- Basement dwellings.
- Caravans, mobile homes, and park homes intended for permanent residential use³.
- Installations requiring hazardous substances consent⁴. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as “essential infrastructure”)⁵

More vulnerable

- Hospitals.
- Residential institutions such as residential care homes, children’s homes, social services homes, prisons, and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs, and hotels.
- Non-residential uses for health services, nurseries, and educational establishments.
- Landfill and sites used for waste management facilities for hazardous waste⁶.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan⁷

³ For any proposal involving a change of use of land to a caravan, camping or chalet site, or to a mobile home site or park home site, the Sequential and Exception Tests should be applied.

⁴ See Circular 04/00: Planning controls for hazardous substances (paragraph 18) at:

www.communities.gov.uk/publications/planningandbuilding/circularplanningcontrols

⁵ In considering any development proposal for such an installation, local planning authorities should have regard to planning policy on pollution in the National Planning Policy Framework.

⁶ For definition, see Planning for Sustainable Waste Management: Companion Guide to Planning Policy Statement 10 at www.communities.gov.uk/publications/planningandbuilding/planningsustainable

⁷ See footnote 3.

Less vulnerable

- Police, ambulance, and fire stations which are not required to be operational during flooding.
- Buildings used for shops, financial, professional, and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage, and distribution, non-residential institutions not included in “more vulnerable”, and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).

Water-compatible development

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas, and wharves.
- Navigation facilities.
- Ministry of Defence defence installations.
- Ship building, repairing, and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Notes to table 2:

1. This classification is based partly on Department for Environment, Food and Rural Affairs and Environment Agency research on Flood Risks to People (FD2321/TR2)8 and on the need of some uses to keep functioning during flooding.
2. Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.
3. The impact of a flood on the uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a vulnerability classification.

⁸ See website for further details. www.defra.gov.uk/science/Project_Data/DocumentLibrary/FD2320_3364_TRP.pdf

TABLE 3: FLOOD RISK VULNERABILITY AND FLOOD ZONE COMPATIBILITY						
VULNERABILITY CLASSIFICATION (TABLE 2)		ESSENTIAL INFRASTRUCTURE	WATER COMPATIBLE	HIGHLY VULNERABLE	MORE VULNERABLE	LESS VULNERABLE
FLOOD ZONE (TABLE 1)	Zone 1	√	√	√	√	√
	Zone 2	√	√	Exception Test Required	√	√
	Zone 3a	Exception Test Required	√	*	Exception Test Required	√
	Zone 3b Functional Floodplain	Exception Test Required	√	*	*	*

Key:

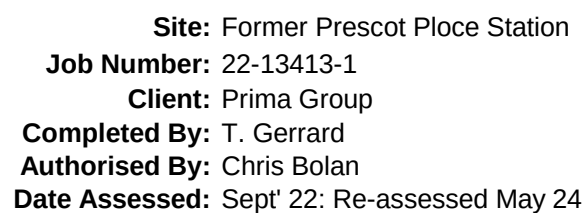
√ Development is appropriate

* Development should not be permitted

Notes on Table 3;

- The application of the Sequential Test which guides development to Flood Zone 1 first, then Zone 2, and then Zone 3;
- Flood risk assessment requirements; or
- The policy aims for each flood zone.

APPENDIX D: GREENFIELD CALCULATIONS



Total Site Area	2240	m ²													
Previous Impermeable Area	2105	m ²	PIMP	94	%										
Post Developmet Imp Area	1769	m ²	PIMP	79	%										
Soil Value	4		%age Runoff Before	79	%										
Average Rainfall	850		%age Runoff After	67	%										
M5-60	19														
UCWI	138														
Return Period	100	30	20	5	2	1		100	30	20	5	2	1		
r	0.4	0.4	0.4	0.4	0.4	0.4	Cv	0.85	0.84	0.85	0.85	0.85	0.85		
Z1	0.47	0.47	0.47	0.47	0.47	0.47	Cr	1.40	1.40	1.40	1.40	1.40	1.40		
M5-10	8.93	8.93	8.93	8.93	8.46	8.93	Area	0.22	0.22	0.22	0.22	0.22	0.22		
Z2	2.03	1.55	1.45	1.03	0.78	0.64	Q	63.33	48.03	45.22	32.12	23.17	19.96		
Rainfall Intensity	108.7674	83.05	77.69	55.19	39.59	34.29									
Q100year+ Climate Change (40%)									88.66 l/s						

Calculated by: Tony Gerrard

Site name: Former Police Station

Site location: Derby Street, Prescott, L34

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

Site Details

Latitude: 53.42989° N

Longitude: 2.8095° W

Reference: 132171877

Date: Sep 28 2022 14:46

Runoff estimation approach: IH124

Site characteristics

Total site area (ha): 0.224

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	885	885
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

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

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

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

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

(3) Is $SPR/SPRHOST \leq 0.3$?

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

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	0.54	0.54
1 in 1 year (l/s):	0.47	0.47
1 in 30 years (l/s):	0.91	0.91
1 in 100 year (l/s):	1.12	1.12
1 in 200 years (l/s):	1.27	1.27

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