

Appendix 12.2: Phosphate Assessment Technical Note



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TECHNICAL NOTE

Phosphate Assessment - Land North of Bryn Lane, Wrexham Industrial Estate, Wrexham LL13 9XW

Client:	Net World Sports	Version:	Final
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Re: Phosphate Assessment - Land North of Bryn Lane, Wrexham Industrial Estate, Wrexham LL13 9XW.

1 Introduction

1.1 Background

Tier Environmental were commissioned by Net World Sports to undertake a phosphate review assessment for the proposed development site at Land North of Bryn Lane, Wrexham Industrial Estate, Wrexham, LL13 9XW. Hereafter, referred to as the 'application site'.

The client owns the site and is looking to develop it for commercial purposes.

This technical note summarises desk-based research findings aimed at assessing potential phosphate loads and impacts from the proposed development to support the planning application and associated Environmental Impact Assessment.

Tier Environmental and Tier Consult have previously undertaken a Preliminary Risk Assessment (PRA), Flood Consequence Assessment (FCA) and Commentary on Nutrients – Technical Note for the site. The findings have been detailed in the following reports that should be read in conjunction with this technical note:

- Tier Environmental, 'Preliminary Risk Assessment Report, Bryn Lane, Wrexham', TE1624-TE-00-XX-RP-GE-001-V01, dated 10th January 2022.
- Tier Consult, 'Flood Consequence Assessment, Land North of Bryn Lane, Wrexham', Document No.: T/2486/FCA, dated 4th April 2022.
- Tier Environmental, 'Commentary on Nutrients – Bryn Lane, Wrexham' Technical Note, Reference: TE1624-TE-00-XX-TN-GE-001-V01, dated 31st October 2022.

Pertinent information from these reports is included within this technical note.



1.2 Scope of Works

The agreed scope of works for this assessment included:

- Undertake desk-based research to establish and summarise the site, topographic, geological, hydrogeological and hydrological site setting, including an assessment of potential nutrient (phosphate and nitrate) pollution linkages (sources-pathways-receptors).
- Liaisons with third parties (TEP) and Wrexham County Borough Council (WCBC) to agree a plan for undertaking calculations to derive phosphate loads from current and future land uses and staff wastewater discharges and establishing a total annual phosphate load.
- Produce a phosphate review assessment technical note summarising desk-based research and providing a plan detailing how phosphate loads will be derived.

2 Site Setting

2.1 Site Location and Description

The site is located approximately 2.7km from the eastern outskirts of Wrexham on land north of Bryn Lane, Wrexham Industrial Estate, Wrexham, LL13 9XW. The National Grid Reference for the site is E: 338540, N: 351120.

Irregular in plan, the application site is relatively flat, covered with arable land split into eight defunct and intact hedge bounded fields with intermittent trees and covers approximately 37.21 hectares. Several ponds measuring 9m to 44m, with associated trees, are located within the eastern, southern and western parts of the application site. A private residence (Honeysuckle Cottage) is located halfway along the northern boundary of the application site, off Francis' Lane. A cluster of buildings and associated hardstanding (Little Acorns) is located in the central southern part of the application site, adjacent to Bryn Lane. This includes a residential property and barn structures, which are currently in use. An access road linking these buildings with Bryn Lane is also present in the south of the application site. The fields immediately adjacent to Little Acorns are used as horse paddocks. The application site also includes the roundabout (junction of Industrial Estate Road, Bryn Lane, Ash Road North and Abenbury Way) at the southwest corner.

Hedgerows, trees and fencing generally delineate the site on all sides with Francis Lane and fields beyond the northern application site boundary. Houses with associated gardens are located (off-site) adjacent to the northwest corner of the site at the junction of Francis Lane and Highmore Lane. Open fields bound the application site to the east. Bryn Lane bounding the application site to the south, beyond which is the Wrexham Industrial Estate. Hugmore Lane/Industrial Estate Road and a roundabout bound the site to the west with a Unit occupied by JCB Transmission Ltd and Clays Golf Driving Range & Golf Course beyond.

The site is situated on relatively flat and low-lying ground on the western edge to the River Dee Catchment. Ground elevations slope gently across the site from approximately 40m Above Ordnance Datum (m AOD) in the west to between 27m AOD and 31m AOD in the east and northeast, following the general trend in the surrounding area.

Drawings showing the site location, current layout and topography (Drawings TE1624-TE-00-XX-DR-GE-001-V01 to TE1624-TE-00-XX-DR-GE-003-V01) are included in Appendix A.



2.2 Site History

Historical OS maps contained within the PRA indicate that the site has remained as undeveloped fields throughout its history, until the development of two residential properties within the site, with fields surrounding it to the north and east. To the south and west, the Wrexham Royal Ordnance Factory (ROF Wrexham) operated during the war years (1939 to 1945), which was developed into the existing Wrexham Industrial Estate from the 1970s onwards.

2.3 Proposed Development

The proposed development is commercial in nature and encompasses:

- Detailed Component:
 1. Demolition of existing buildings, site clearance and preparation works, including removal of vegetation and reprofiling of topsoil, where necessary;
 2. Construction of a new warehouse unit, providing 33,595 sqm Gross External Area (GEA) for B1c (light industry appropriate in a residential area), B2 (general industrial) and B8 (storage & distribution) uses (Unit 2);
 3. Construction of 8 new smaller units (Units 3-7; 14-16), providing a total of 29,659 sqm GEA for B1c (light industry appropriate in a residential area), B2 (general industrial) and B8 (storage & distribution) uses;
- Outline Component:
 1. Construction of up to 72,635 sqm GEA for employment uses (B1c (light industry appropriate in a residential area), B2 (general industrial) and B8 (storage & distribution) uses), ancillary retail/drive thru facilities and potential for a hotel and petrol filling station (A1, A3, C1 or sui generis). The overall quantum of A1, A3, C1 or sui generis use would not exceed 16,150 sqm GEA;
 2. The proposed buildings will be up to 28.5m in height above ground level;
- Site Wide:
 1. Access and parking provision, including new access junctions, internal roads, service yards and car and HGV parking. Two new junctions are proposed (in detail) providing vehicular access, as well as cycle and pedestrian access, from Bryn Lane/Industrial Estate Road with an additional access road for a substation. Car parking spaces, HGV trailer spaces and HGV lorry spaces are proposed across the application site;
 2. Retention and enhancement of some existing on-site green spaces and provision of landscaping around the application site; and
 3. Implementation of drainage/attenuation measures.

A drawing showing the indicative site layout (TE1624-TE-00-XX-DR-GE-004-V01) is included in Appendix A.



2.4 Geology

Geological information for the site has been obtained from the PRA and published British Geological Survey (BGS) maps Sheet 121, “Wrexham”, dated 1994 and Sheet 122, “Nantwich”, dated 1967. No artificial ground is shown to cover the site.

The site and immediate surrounding area are shown to be covered with superficial deposits comprising Devensian Till (Diamicton). Deposited during glacial retreat at the end of the last Ice Age, these deposits are generally described by the BGS geo-index website (www.mapapps2.bgs.ac.uk), as ‘unsorted and unstratified drift’, which ‘consists of a heterogenous mixture of clay, sand, gravel, and boulders varying widely in size and shape’.

Beneath the Till deposits, sandstone strata belonging to the Kinnerton Sandstone Formation underlies the northern and western parts of the site. Underlying the southeast half of the site are interbedded mudstone, sandstone and conglomerate strata belonging to the Salop Formation.

The Kinnerton Sandstone Formation is generally described as ‘sandstone, red-brown to yellow, generally pebble-free, fine- to medium-grained, cross-stratified’. The Salop Formation is generally described as ‘Red and red-brown mudstone, and red-brown (mostly sublitharenite) sandstone containing beds of pebbly sandstone and conglomerate’.

Historical BGS boreholes are located immediately north, northeast and south of the site. These boreholes recorded dark brown sandy topsoil, to around 1.00m depth, overlying firm and stiff brown and red brown sandy stoney clay soils to a maximum borehole depth at around 26m to 38m bgl. The clay soils are interpreted as Devensian Till (Diamicton). Groundwater was recorded on one borehole record at 16.00m and on a second as being artesian associated with the underlying bedrock.

A single northeast to southwest trending fault is shown traversing the middle of the site, separating the two bedrock strata and downthrown towards the northwest. The underlying strata are indicated to dip at a shallow angle towards the east.

2.5 Hydrogeology and Hydrology

Published topographic, historical and geological information indicate that groundwater is likely to occur at depth, i.e. 16.00m, towards the boundary between the Devensian Till deposits and the underlying bedrock. Groundwater will flow down hydraulic and stratigraphic gradient towards the east/northeast and the River Dee, with which it is likely to be in hydraulic continuity. Perched groundwater within confined granular pockets/horizons may occur within the Devensian Till deposits.

The Environment Agency have designated the Devensian Till deposits as a Secondary (Undifferentiated) Aquifer. The underlying Kinnerton Sandstone Formation has been designated a Principal Aquifer and the Salop Formation a Secondary A Aquifer. The site is located within a groundwater Source Protection Zone 3 Total Catchment associated with the Kinnerton Sandstone Formation underlying the central, western and northern parts of the site.

Ground surfaces across the site are generally covered with grass/crops. Surface water drainage is anticipated to percolate directly through the topsoil to the underlying clay rich Till before occurring as through flow to local field drain networks and/or surface water storage areas.



Several ponds, between 9m to 44m in diameter, are located within the eastern, southern and western parts of the site, which are likely to store surface water. The nearest surface water courses are present roughly between 135m and 225m to the south and 235m to 245m to the southwest of the site and flow towards the northeast and the River Dee. It is anticipated that these surface water features sit on and flow over the Devensian Till deposits that underlie the site and immediate surrounding area. A culverted watercourse is also recorded approximately 110m west of the site and adjacent to the JCB Transmission Ltd building. The River Dee is located roughly 3km to the east of the site.

The PRA records 9 No. licensed discharge consents between 250m and 500m from the site and all generally associated with the Wrexham Industrial Estate. The nearest entries, located 278m to 287m to the southwest, are associated with JCB Transmissions Ltd for discharging unspecified effluent to an unnamed tributary of the River Dee; the consent is given as expired. A third discharge consent entry is located 320m west and associated with Bryn Villa for discharging final/treated sewage effluent to an unnamed watercourse; the status is given as New Consent (WRA 91, S88 & Sched 10 as amended Env), effective from 01/12/2006.

The site is located within a low flood risk area with respect to flooding from fluvial or surface water sources.

A plan showing the hydrological setting and flood risk for the site (Drawing TE1624-TE-00-XX-DR-GE-005-V01), is included in Appendix A.

The findings of the Tier Consult FCA report indicate that 'the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of TAN15'.

2.6 Proposed On-Site Foul Water Drainage

The proposed development includes extensive buildings and asphalt hardstanding, for access and parking, and also include some soft landscaping. It is proposed that foul wastewater from the newly constructed structures will feed into an existing Dwr Cymru Welsh Water (DCWW) sewerage network that runs roughly north to south and across the western end of the site. The network serves domestic properties and Holt Lodge Farm to the north, before crossing the site into the Wrexham Industrial Estate to the south. From the industrial estate, the network feeds south-westwards to the Five Fords WwTW where the wastewater is treated before being discharged via a sewer straight to the River Dee. The WwTW works is located approximately 3.1km southwest of the site. A drawing showing the Dwr Cymru Welsh Water Sewerage network is included in Appendix B.

Published geological plans indicate the existing DCWW foul sewer is predominantly laid within the Devensian Till deposits with the southern end crossing Alluvial and River Terrace Deposits at the Five Fords WwTW. A drawing (TE1624-TE-00-XX-DR-GE-005-V01) showing the approximate sewer route and underlying superficial deposits is included in Appendix A.

2.7 Comments on Nutrients Summary

Following the issue of the PRA, Tier Environmental produced a Commentary on Nutrients Technical Note.

Pertinent information from this technical note relating to nutrient pollution and the site is summarised below:

- The site is not located in or within 2,000m of either a Nitrate Sensitive Area (NSA) or Nitrate Vulnerable Zone (NVZ).



- The site is located within a phosphate sensitive Special Area of Conservation (SAC) freshwater catchment area associated with the River Dee.
- Mapped annual mean orthophosphate concentrations for the River Dee SAC within the vicinity of the site are low, which should be taken into account during drainage design.
- A review of the Wrexham County Borough Council (WCBC) website revealed:
 - Warmer, drier weather due to climate change would likely reduce river flows and increase phosphate concentrations, according to the Joint Nature Conservation Committee.
 - Natural Resources Wales (NRW) have published new targets to reduce river phosphate levels in SACs across Wales that may affect certain developments and planning applications.
 - The targets are based on new evidence relating to the damaging effects of phosphates on freshwater ecosystems and species.
 - Proposed new development designs within SAC river catchments must show that they would not contribute to increasing phosphate levels entering the catchment.
 - Wrexham CBC is predominantly located within the River Dee catchment, which is a designated SAC and currently failing NRW target criteria for phosphate concentrations.
 - Some planning application approvals within the River Dee SAC will depend on the WCBC receiving further guidance and an ability to measure and mitigate against increased phosphate levels.
 - WCBC are currently working on guidance to aid developers understand what is required with respect to phosphate levels and are developing a calculator to help them work out how much phosphate their proposed development may generate [due summer 2023].
 - Applications may go ahead if the development improves existing wastewater discharge quality by reducing phosphate concentrations, or by decreasing produced wastewater volumes.
 - In order for WCBC to approve an application, they recommend that as much information as possible regarding foul drainage proposals for the site are provided to them.
 - WCBC confirm that solutions are primarily nature based and that “the issue can be complex and a range of measures such as removal of phosphate at source, mitigation, and offsetting, need to be explored on a catchment and site-specific basis.”
- At its closest, the River Dee is located approximately 3km (1.8 miles) east of the site and the nearest water course is a culverted stream/river located approximately 110m to the west.
- Historical BGS borehole records indicate that the Diamicton Till underlying the site may reach depths of around 26m to 38m bgl. These deposits, being predominantly clay rich in nature, will provide some protection to underlying bedrock aquifers by inhibiting vertically migrating surface water and potential contaminants of concern.

3 Conceptual Site Model

3.1 Potential Phosphate Sources

Throughout its history, the site has remained as undeveloped fields for agricultural use with a farm property (now Little Acorns) located on the southern boundary. In agriculture and farming, phosphates can be found in fertilizers and animal manure that are applied and spread over the ground. Derived from phosphoric acid, many phosphate compounds are soluble in water and readily taken up by plants. Low permeability clay rich Till soils underlying the site would inhibit vertically migrating surface water and existing agricultural phosphates into the ground and to depth to impact deeper groundwater.



The proposed development will involve developing the site for commercial/light industrial buildings and hardstanding and demolishing the farm buildings at Little Acorns. Not only will this act to inhibit infiltration into the ground, it will also largely remove the source of agricultural phosphate from the site. The site won topsoil will be reused within the development within screening bunds and soft landscaping, but agricultural fertilisers and manure will no longer be used on the site.

The proposed development will include constructing several steel framed units for commercial, warehouse, petrol filling station, office use and a hotel. The main phosphate source associated with the proposed development will be from staff wastewater discharges containing human excreta and detergents. According to WCBC, there will be an increase in phosphate load from staff coming in from outside the River Dee catchment to work at the proposed development site and this additional load will impact on how and where the discharged wastewater is treated. There is also likely to be an additional load as a result of the potential hotel, which could be delivered within the outline component of the scheme.

3.2 Potential Receptors

The assessed land use category for the proposed development is commercial.

The potential receptors most likely to be impacted by existing and future on-site phosphate levels include:

- Groundwater within the Kinnerton Sandstone and Salop Formation bedrock.
- Existing surface water features, i.e. ponds on-site and nearby water courses draining towards the east and northeast.
- The River Dee and the wider Dee Catchment.

3.3 Potential Phosphate Pathways

Potential pathways for transporting phosphates from the site to potential receptors, include:

- Vertical migration through the ground and to groundwater.
- Horizontal migration in surface water / overground flow.
- Wastewater discharge from site to existing sewerage networks and the associated Five Fords Wastewater Treatment Works (WwTW).

4 Preliminary Phosphate Risk Assessment

4.1 Summary

The underlying Devensian Till deposits have been classed as a Secondary (Undifferentiated) Aquifer, the Kinnerton Sandstone Formation a Principal Aquifer and the Salop Formation a Secondary A Aquifer. The Till deposits are predominantly clay rich in nature and groundwater is expected to occur at depth towards the Till/bedrock boundary. Given this and the nature of the proposed development, it is considered vertical phosphate migration from percolating surface water will be largely inhibited and the potential risk to groundwater very low.

The nearest water course to the site is a culverted watercourse located 110m to the west and the nearest surface water courses are roughly 135m to 225m to the south. Several ponds, between 9m and 44m in diameter, are



also located within the eastern, southern and western parts of the site. The site is located within an area at low risk from flooding and currently on-site drainage is expected to be through flow to local field drainage networks and surface water storage areas. Therefore, given their distance and the absence of potential overground flow, it is considered that the potential risks posed to these water features from on-site phosphates is very low.

The proposed development will involve discharging wastewater from the proposed development to the existing DCWW sewerage network that feeds to the Five Fords WwTW located roughly 3.1km to the southwest. In order to cope with the increased annual phosphate load, from staff and visitors coming in from outside the authority area, the WwTW will require sufficient headroom space. Without sufficient headroom space, there is a danger that untreated wastewater (and phosphate) will discharge directly into the River Dee.

4.2 Proposed Development Phosphate Load Calculations

In order to deal with potentially elevated phosphate concentrations in the Dee catchment, Wrexham CBC has produced a Dee Catchment Phosphorous Reduction Strategy and established a Dee Catchment Nutrient Management Board (DCNMB).

Their solution is closely linked to ongoing work by DCWW and Natural Resources Wales (NRW), which aims to establish whether, a given water treatment works has sufficient headroom space for growth, and under what conditions, and if there isn't headroom whether actions will be delivered to address this and when. If DCWW do not have plans to produce headroom, this will indicate where alternative mitigation solutions are required.

In order to determine the increased total annual phosphate load from the proposed development, WCBC are in the process of producing a Nutrient Budget Calculator that provides a step by step approach to calculating phosphate budgets for proposed new developments, to achieve nutrient neutrality. Whilst the calculator currently relates to new housing developments, it may be adapted for overnight uses, such as the proposed hotel, but it is not intended to cover employment uses. The WCBC Nutrient Budget Calculator will not be available until the summer of 2023, however, Carmarthenshire County Council (CCC) have produced such a calculator upon which the WCBC version will be loosely based.

Assuming there are no specific employment processes that could generate significantly increased phosphate loadings, the steps to calculating the potential phosphate load, as outlined by WCBC, from the proposed development are as follows:

1. Confirm phosphate pathways (i.e. wastewater from staff, land use, specific processes associated with employment use).
2. Calculate the phosphate load from the current land use.
3. Calculate phosphate loads from future land use (open spaces and hard surfaces).
4. Calculate the phosphate load from staff wastewater discharges (based on modelled staff numbers generated by the proposal, the number of staff from outside the Dee catchment, their likely water usage, and the additional phosphate to the Dee after treatment).
5. Combine the phosphate loads from step 3 with step 4 and deduct the phosphate load from step 2, to give a net phosphate figure that can be used to calculate mitigation requirements.

There is currently no formal guidance as to how these steps should be carried out, but proposals would need to be robustly evidenced for compliance with Habitat Regulations. Phosphate loads for current land use are set out in the CCC NB Calculator, which requires adapting to allow for local, site specific, soil, rainfall, landcover



data. The results will help inform a mitigation strategy should there be insufficient headroom at the target WwTW. Alternatively, this will demonstrate that the increased total annual phosphate load, from the proposed development, will be within the existing WwTW headroom space capacity.

Consultation is being undertaken with the DCWW to establish what the headroom space for the Five Fords WwTW is and whether calculated phosphate loads from the proposed development will be below or exceed this value and as such confirm the requirement for mitigation.

5 Nutrient Budget Calculations

The following nutrient budget calculations follow the steps outline by WCBC to derive the likely total annual phosphate loads generated by the proposed development. The calculations for each step are presented in Appendix C.

5.1 Step 1 – Phosphate Pathways

Phosphate pathways have been covered within the Conceptual Site Model (Section 3.0) above.

5.2 Step 2 - Phosphate Loads from the Current Land Use.

This step relates to the existing landcover type based on the drainage associated with the predominant soil type on-site and the average annual rainfall volume for the site. Instructions for establishing these parameters are broadly set out in the CCC nutrient budget calculator.

Relevant soil drainage information can be found at the Cranfield Soil and Agrifood Institute, Soilsclapes website (www.landis.org.uk/soilsclapes). For the proposed Bryn Lane development, the soil drainage type is identified as 'Impeded Drainage', defined as 'slowly permeable seasonably wet slightly acid but base-rich loamy and clayey soils'. A drawing (TE1624-TE-00-XX-DR-GE-007-V01), showing the Soilscape data for the site is included in Appendix A.

Average annual rainfall data can be obtained through the National River Flow Archive (NRFA) and UK Centre for Ecology & Hydrology website (www.nrfa.ceh.ac.uk/data/station/spatial/67025). The nearest NRW rainfall data station to the site on the River Clywedog at Bowling Bank (Station Number: 067025), located approximately 2.7km south of the application site. According to the website, the average annual rainfall in the standard period (SAAR), is 860mm (SAAR 1941-1970) and 851mm (SAAR 1961-1990), see Drawing TE1624-TE-00-XX-DR-GE-008-V01, presented in Appendix A. These results, according to the CCC nutrient budget calculator, correspond to an annual average rainfall between 900.1mm to 950mm.

Current site uses are understood to include residential (Honeysuckle Cottage and Little Acorns), horse paddocks (Little Acorns), a roundabout and fields for growing silage/grazing. In accordance with the nutrient budget calculator, this corresponds with several existing land cover types, including residential, open land – built environment, lowland grazing and mixed, which can be used to calculate the Annual Phosphorus nutrient export – Phosphate Load (kg TP/year) for the current land use.

The existing land cover types, their definitions, approximate areas (in hectares) and estimated annual phosphate load (in kg of Total Phosphate per year (kg TP/year)), from the CCC Nutrient Budget Calculator, are summarised in Table 5.1, below.



Table 5.1: Summary of Annual Phosphate Loads from Current Site Land Uses

Land Cover Type	Definition (From on the CCC Nutrient Budget Calculator)	Approximate Area (Hectares)	Annual Phosphate Loads (kg TP/year)
Residential - Little Acorns and Honeysuckle Cottage	Areas of Houses and associated infrastructure. This is inclusive of residential roads, driveways, grass verges, gardens and blue-green SuDs.	0.57	1.02
Open land - Built Environment - Roundabout	Area of land in urban areas used for various purposes, eg main roads, built facilities such as schools, sports centres, areas used for leisure and recreation - this may include open land, eg caravan sites, camping sites, sports fields, play grounds and public squares.	0.71	0.70
Lowland Grazing - Little Acorns Horse Paddocks	Agricultural areas on which cattle sheep and other grazing livestock are farmed. A holding is classified as lowland if less than 50% of its total area is classed as a lowland grazing area.	1.29	1.58
Mixed - Potential silage fields across the site	Agricultural areas where cereals, arable crops, horticultural crops, pigs, poultry and cows are not farmed or where it is too difficult to select a single category to describe the farm.	34.64	44.74
Total Annual Phosphate Load for the Current Site Use (kg TP/year)			48.04

Based on the land use types currently being used at the site, including residential, open land – built environment, lowland grazing and mixed, the estimated annual phosphate load is 48.04 kg TP/year.

5.3 Step 3 –Phosphate Loads from Future (non-employee) Land Uses.

Based on the CCC Nutrient Budget Calculator definitions, future land cover uses for the proposed development will include Commercial/Industrial (Units 1 to 16) and open land (for external landscaped areas and roads), with potential for open land (drive thru, petrol station, HGV pod, external landscaped areas, roads etc) and Residential (the proposed Hotel) to be delivered within the outline component.

The estimated annual phosphate load that is anticipated to be generated from the proposed development (in kg of Total Phosphate per year (kg TP/year)) has been calculated using the CCC Nutrient Budget Calculator based on a conservative basis using the land uses that would result in the highest phosphate loads on-site. The future land cover types, their definitions, approximate areas (in hectares) and estimated annual phosphate load used to inform the assessment are presented in Table 5.2, below.



Table 5.2 Summary of Annual Phosphate Loads from Future Site Land Uses

Land Cover Type	Definition (From on the CCC Nutrient Budget Calculator)	Approximate Area (Hectares)	Annual Phosphate Loads (kg TP/year)
Commercial/Industrial - Units 1 to 16.	Areas that are used for Industry. These are businesses that typically manufacture, process or otherwise generate products. Included in the definition of industrial land use are factories and storage facilities.	10.80	14.63
Open Land - Built Environment (Drive Thru, petrol station, HGV Pod, external landscaped areas, roads etc	Area of land in urban areas used for various purposes, eg main roads, built facilities such as schools, sports centres, areas used for leisure and recreation - this may include open land, eg caravan sites, camping sites, sports fields, play grounds and public squares.	26.11	25.94
Residential - Hotel	Areas of Houses and associated infrastructure. This is inclusive of residential roads, driveways, grass verges, gardens and blue-green SuDs.	0.29	0.54
Total Annual Phosphate Load for the Future Site Use (kg TP/year)			41.11

Based on the future land use types at the application site, including commercial/industrial, open land – built environment and residential, the estimated annual phosphate load is 41.11 kg TP/year.

5.4 Step 4 - Phosphate Load from Staff Wastewater Discharges.

This step requires combining the volume of water from development in m³/day with the phosphate concentration at the receiving treatment works in mg/litre. The volume of water from development relates to the number of people using the new development and their likely water usage.

The total number of employees likely to be using Unit 1 to 16 of the new development have been calculated by CBRE based on the type of usage, floorspace (m²) and employment density to derive a Full-Time Equivalent (FTE) number. The FTE number of staff likely to be using the new development have been calculated as a minimum 1,190 and maximum 4,236. These figures have been used by an appointed wastewater treatment specialist for this project to calculate the total foul water discharge from the new development to the receiving Wastewater Treatment Works (WwTW). The calculated discharge for the minimum number of staff (1,190) is 59.5m³/day and for the maximum number of staff (4,236) is 211.8m³/day.

However, as agreed with WCBC, the additional phosphate load impacting on the WwTW will come from those commuting in from outside the authority to work. For those employees already residing within the county the wastewater will be treated at Five Fords, or a similar, treatment works. Therefore, WCBC have recommended that a precautionary figure, for those staff commuting in from outside the authority, of 40% is used within the nutrient budget calculations. Therefore, the wastewater discharge from Units 1 to 16 for the 40% of staff commuting in from outside the county will be between (minimum) 23.8m³/day and (maximum) 84.7m³/day.



For the hotel, it has been assumed that there will be a maximum 130 rooms with an average occupancy rate of 1.5 and a water usage rate of 120 litres per person per day (as per the CCC Nutrient Budget Calculator). The total wastewater discharge from the hotel has been estimated to be 23.4m³/day.

Therefore, the total wastewater discharge coming from the proposed development (Units 1 to 16 and the hotel) is likely to be between (minimum) 47m³/day and (maximum) 108m³/day.

According to WCBC, discharges from Open Land - Built Environment land cover uses can be ignored as these areas will be in use temporarily and likely phosphate loads will be minimal.

The receiving WwTW for the proposed development is Five Fords which currently has a phosphate permit of 1mg/l. It is understood that this will potentially be tightened to 0.7 mg/l.

The phosphate load from staff wastewater discharges, in kg TP/year, can be calculated from:

$$P_c / 10^6 \times W_v \times 1000 \times 365$$

Where P_c is the phosphate permit concentration at the receiving treatment works (mg/litre) and W_v is the wastewater discharge from the proposed development in (m³/day).

The calculated phosphate loads for minimum and maximum wastewater discharges, from the proposed development, entering the Five Fords WwTW, depending on a phosphate permit value (1mg/l or 0.7mg/l) are summarised in Table 5.3 below.

Table 5.3: Summary of Calculated Phosphate Loads from Staff Wastewater Discharges, depending on the Phosphate Permit Value

Phosphate Permit Value (mg/l)	Estimated Phosphate Loads for the Proposed Development for a Phosphate Permit of 1mg/l & 0.7mg/l (kg TP/year)	
	Minimum	Maximum
1	17	39
0.7	12	28

5.5 Step 5 – Total Annual Phosphate Load

Combining the calculated phosphate load from the future land use (Step 3) with the wastewater discharges from the proposed development (Step 4) and deducting the phosphate load from the current site land use (Step 2), gives a phosphate load budget for the proposed development. For mitigation purposes WCBC have added a 20% buffer to the phosphate load budget to give a total annual phosphate load. The total annual phosphate load represents what either needs to be taken up within the headroom space of the Five Fords WwWT works or mitigated against to ensure nutrient neutrality in line with the Habitats Regulations.

The likely calculated phosphate load budget for the proposed development depending on minimum and maximum discharges for the existing phosphate permit (1mg/l) and a tightened phosphate permit (0.7mg/l) are summarised in Table 5.4 below.



Table 5.4: Calculated Phosphate Budgets for a phosphate permit of 1mg/l and 0.7mg/l.

Phosphate Permit Value (mg/l)	Calculated Phosphate Load Budgets (kg TP/year)	
	Minimum Discharge	Maximum Discharge
1	10.30	32.53
0.7	5.13	20.69

The total (rounded) annual phosphate load entering the Five Fords WwTW for treatment with the added 20% buffer for a 1mg/l and 0.7mg/l phosphate permit are summarised in Table 5.5 below.

Table 5.5: Summary of Total Annual Phosphate Loads for a 1mg/l and 0.7mg/l phosphate permit.

Phosphate Permit Value (mg/l)	Total Annual Phosphate Load (kg TP/year)	
	Minimum Discharge	Maximum Discharge
1	12	39
0.7	6	25

The likely annual phosphate loads entering the Five Fords WwTW from the proposed development, for which headspace room is required for treatment ranges from 12 to 39kg TP/year (1mg/l permit) and from 6 to 25kg TP/year (0.7mg/l permit). Should the Five Fords WwTW not have the headspace to deal with this annual phosphate load, prior to the wastewater being discharged into the River Dee, then the proposed development will include measures to reduce the phosphate load to the required levels prior to it reaching the SAC.

6 Phosphate Mitigation Options Appraisal

Initial consultation with Dwr Cymru Welsh Water (DCWW) has confirmed that there is unlikely to be sufficient headroom at the Five Fords WwTW to treat the wastewater & phosphate load that would be generated by the proposed development. Therefore, foul water will require mitigation before being discharged off-site. All mitigation measures undertaken as part of site development shall aim to remove or reduce the annual phosphate load entering the Five Fords WwTW.

As such, an option for an on-site wastewater treatment system has been designed to ensure that there would be no phosphate impacts to the River Dee SAC, should it be required following confirmation from DCWW. The wastewater treatment system comprises a series of 5 modular tank systems which would be located across the application site and would treat waste coming from the individual units before feeding into the proposed foul water drainage system. The foul water drainage system would flow across the centre of application site to a pumping station in the east, which would discharge into the existing ditch, which runs in a north-south orientation.

The modular tanks proposed would comprise a two-stage treatment process, including biological treatment followed by Hydro's Electrocoagulation (EC) system. The tanks would be installed below ground. The exact scale of on-site treatment required would be determined during the detailed design stages & following completion of consultation with Natural Resource Wales, Wrexham CBC and DCWW.



Preliminary appraisals undertaken by the wastewater treatment specialist appointed for the project have confirmed that these measures are viable and can be easily accommodated on-site. Implementation of such measures, if required, will be secured via an appropriately worded planning condition to ensure that no significant effects would occur to the SAC as a result of phosphate discharges from the proposed development.

7 Conclusions

The site comprises several relatively flat agricultural fields, residential properties, horse paddocks and an existing roundabout covering approximately 37.21 hectares, and has been largely undeveloped throughout its history.

It is proposed to develop the site for employment uses (Use Classes B1c/B2/B8) with potential for a hotel, a drive-thru and petrol filling station uses with associated access roads, parking and soft landscaping.

The underlying ground conditions likely comprise a topsoil layer underlain by clay rich Devensian Till (Diamicton) to around 26m to 38m depth, in turn underlain by sandstone and mudstone strata belonging to the Kinnerton Sandstone and Salop Formations.

Groundwater is likely to occur at depth towards the Till/bedrock boundary and flow towards the east/northeast in hydraulic continuity with the River Dee.

The Devensian Till deposits have been designated as a Secondary (Undifferentiated) Aquifer and the underlying Kinnerton Sandstone Formation as a Principal Aquifer and the Salop Formation a Secondary A Aquifer. The site is located within a groundwater Source Protection Zone 3 Total Catchment associated with the Kinnerton Sandstone Formation.

Several ponds are located within the eastern, southern and western parts of the site and the nearest surface water courses are present roughly 110m to the west (culverted), between 135m and 225m to the south and 235m to 245m to the southwest. The River Dee is located roughly 3km to the east and the site is not located within an area at risk from flooding.

The proposed development includes extensive buildings and hardstanding and it is proposed to feed on-site drainage into an existing Dwr Cymru Welsh Water (DCWW) sewerage network that feeds to the Five Fords WwTW located roughly 3.1km southwest of the site. From the WwTW, treated water is discharged into the River Dee via a sewer.

The most significant way for phosphate to enter the Dee Catchment from the proposed development will be from wastewater discharge to and from the Five Fords WwTW.

The increased phosphate load being discharged to the Five Fords WwTW has been assessed as coming from the 40% of staff and visitors commuting in from outside the authority.

The minimum and maximum Full-Time Equivalent (FTE) number of staff likely to be using the new development have been calculated to be between 1,190 (minimum) and 4,326 (maximum).

The estimated wastewater discharge from 40% of staff using the new development has been calculated at between 23.8m³/day (minimum) and 84.7m³/day (maximum).



The total annual phosphate load from the 40% of staff using the new development will depend on the minimum and maximum discharge rate (m^3/day), the initial land use (general cropping, lowland grazing, dairy and mixed) and the phosphate permit value (1mg/l or 0.7mg/l) for the Five Fords WwTW.

For a 1mg/l phosphate permit, the total annual phosphate loads likely range between 7 and 33kg TP/year and for a 0.7mg/l phosphate permit, the total annual phosphate loads likely range between 0.5 and 19kg TP/year.

To ensure nutrient neutrality, in accordance with the Habitats Regulations Assessment, the generated total annual phosphate load will need to be taken up within the headroom space of the Five Fords WwTW and/or reduced using appropriate on-site treatment prior to discharge from site.

The mitigation measures for dealing with total annual phosphate loads from the new development will be included within the detailed drainage design.

Based on discussions with WCBC and DCWW and depending on the mitigation measures required it is anticipated that the calculated total annual phosphate loads should not preclude the new development from going ahead.



References

- British Geological Survey map Sheet 121, “Wrexham”, Solid and Drift edition (1:50,000), dated 1994 and Sheet 122, “Nantwich”, Solid and Drift edition (1:50,000), dated 1967.
- Tier Environmental, ‘Preliminary Risk Assessment Report, Bryn Lane, Wrexham’, TE1624-TE-00-XX-RP-GE-001-V01, dated 10th January 2022.
- Tier Consult, ‘Flood Consequence Assessment, Land North of Bryn Lane, Wrexham’, Document No.: T/2486/FCA, dated 4th April 2022.
- Tier Environmental, ‘Commentary on Nutrients – Bryn Lane, Wrexham’ Technical Note, Reference: TE1624-TE-00-XX-TN-GE-001-V01, dated 31st October 2022.



APPENDIX A – DRAWINGS

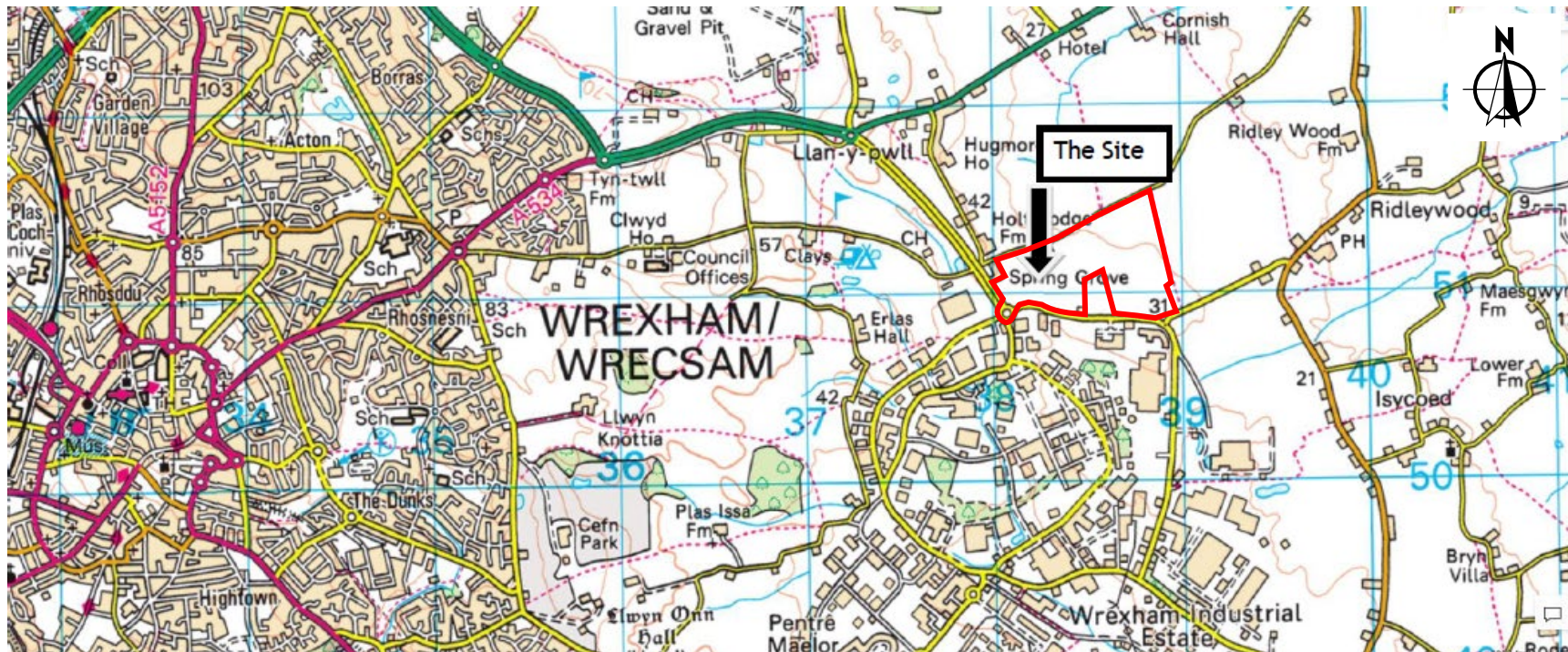


Site Location Plan

Contract Number: TE1624

Contract: Land North of Bryn Lane, Wrexham Industrial Estate, Wrexham LL13 9XW.

Client: Net World Sports



KEY:

 Site Boundary

0 km 2
Approximate Scale

Scale

Drawn by AH

Approved AH

Drawing TE1624-TE-00-XX-
Number DR-GE-001-V01



Existing Site Layout Plan

Contract Number: TE1624

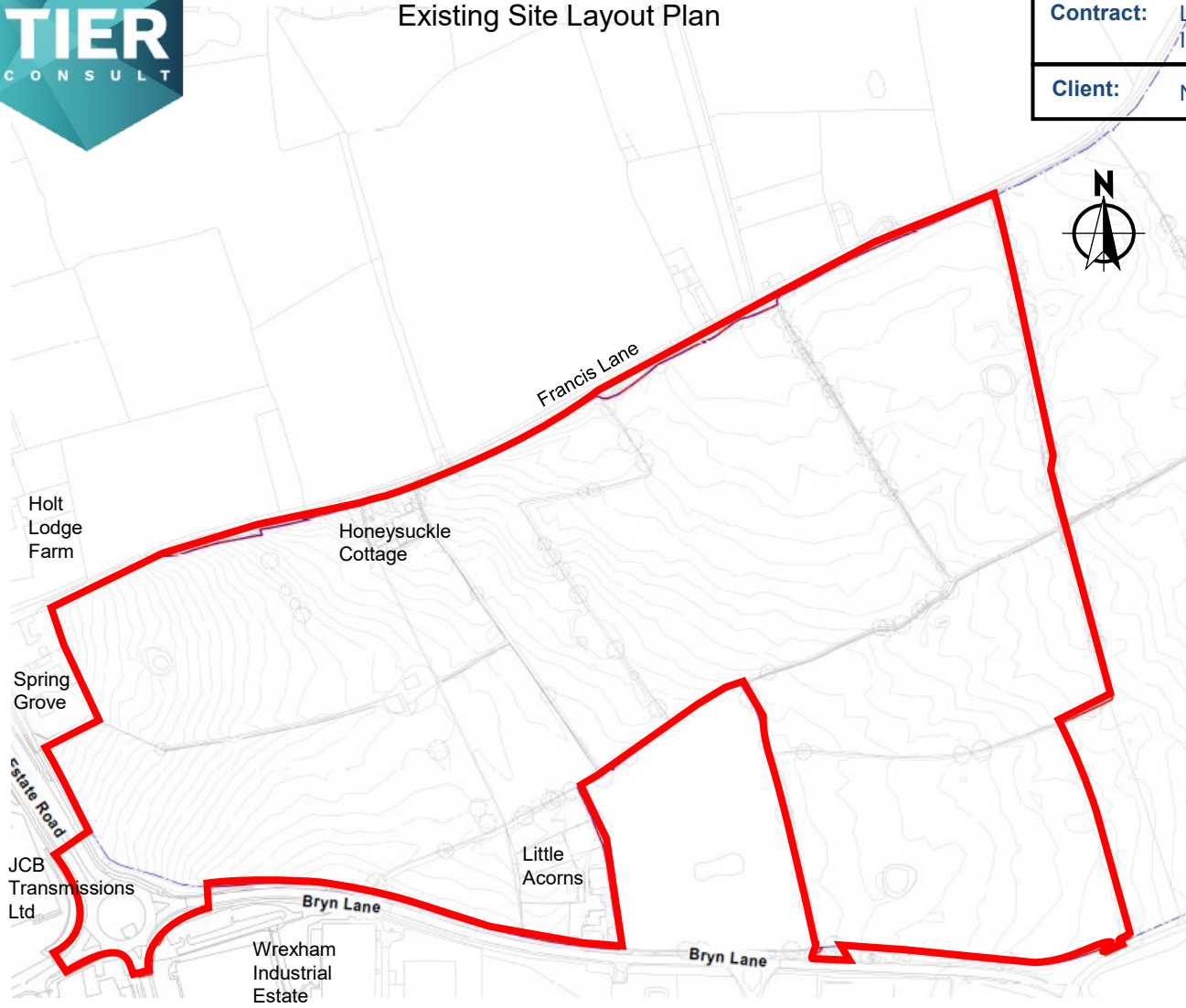
Contract: Land North of Bryn Lane, Wrexham Industrial Estate, Wrexham LL13 9XW.

Client: Net World Sports



KEY:

 Site Boundary



0 400m

Approximate Scale

Scale -	
Drawn by AH	Approved AH
Drawing Number TE1624-TE-00-XX-DR-GE-002-V01	



Topographic Plan

Contract Number: TE1624

Contract: Land North of Bryn Lane, Wrexham Industrial Estate, Wrexham LL13 9XW.

Client: Net World Sports



KEY:

 Site Boundary

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0 400m

Approximate Scale

Scale -	
Drawn by AH	Approved AH
Drawing Number TE1624-TE-00-XX-DR-GE-003-V01	



Illustrative Mastepplan

Contract Number: TE1624

Contract: Land North of Bryn Lane, Wrexham Industrial Estate, Wrexham LL13 9XW.

Client: Net World Sports



KEY:

 Site Boundary

Scale

-

Drawn by AH

Approved AH

Drawing Number TE1624-TE-00-XX-DR-GE-004-V01

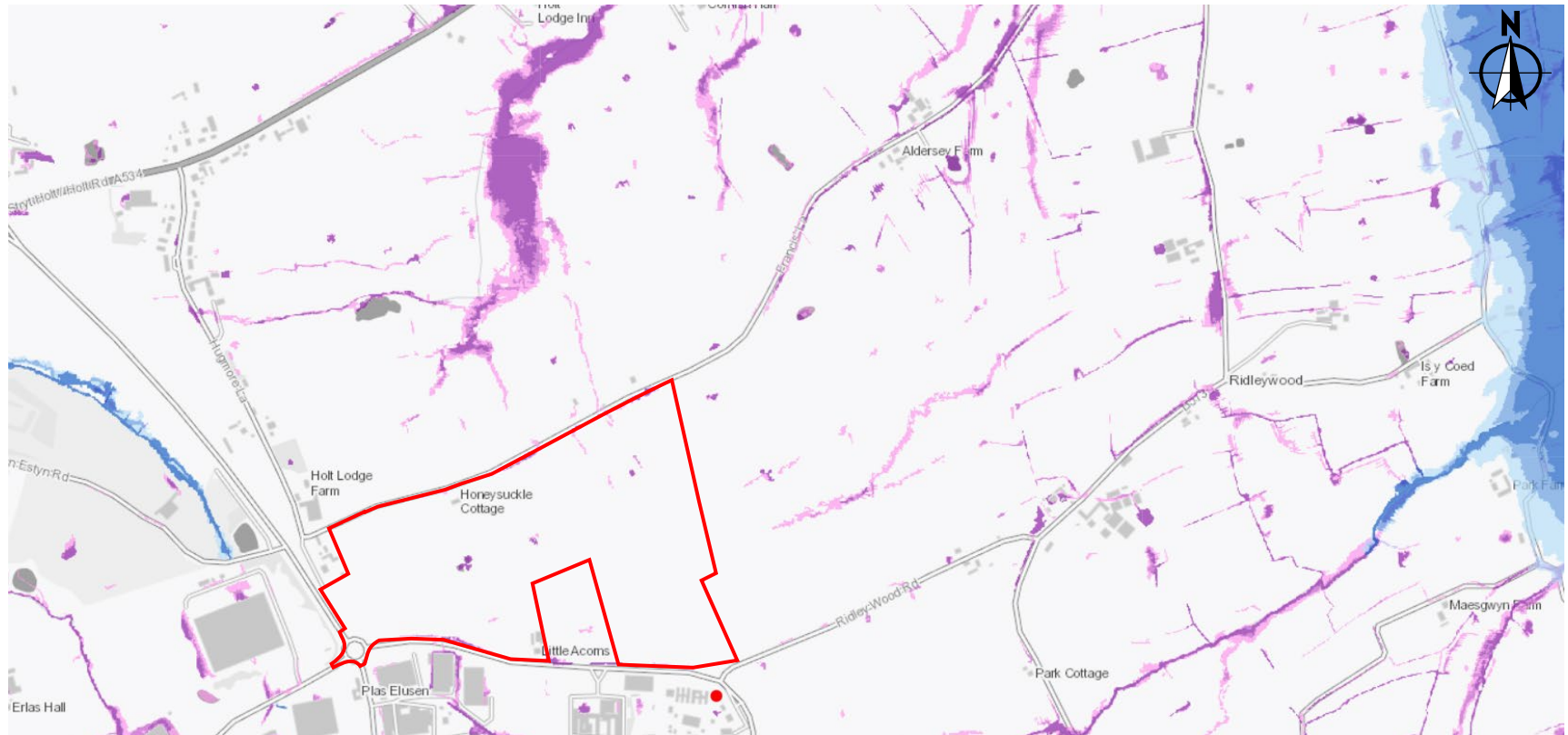


Hydrological and Flood Risk Map

Contract Number: TE1624

Contract: Land North of Bryn Lane, Wrexham Industrial Estate, Wrexham LL13 9XW.

Client: Net World Sports



KEY:

 Site Boundary

Flood Risk From Rivers

- Extent

 High

 Medium

 Low

Flood Risk From Surface Water & Small Water Courses

 High

 Medium

 Low

0 400m

Approximate Scale

Extract taken from Natural Resources Wales Flooding website (www.maps.cyfoethnaturiolcymru.gov.uk), dated 2020.

Scale

Drawn by AH

Approved AH

Drawing Number TE1624-TE-00-XX-DR-GE-005-V01

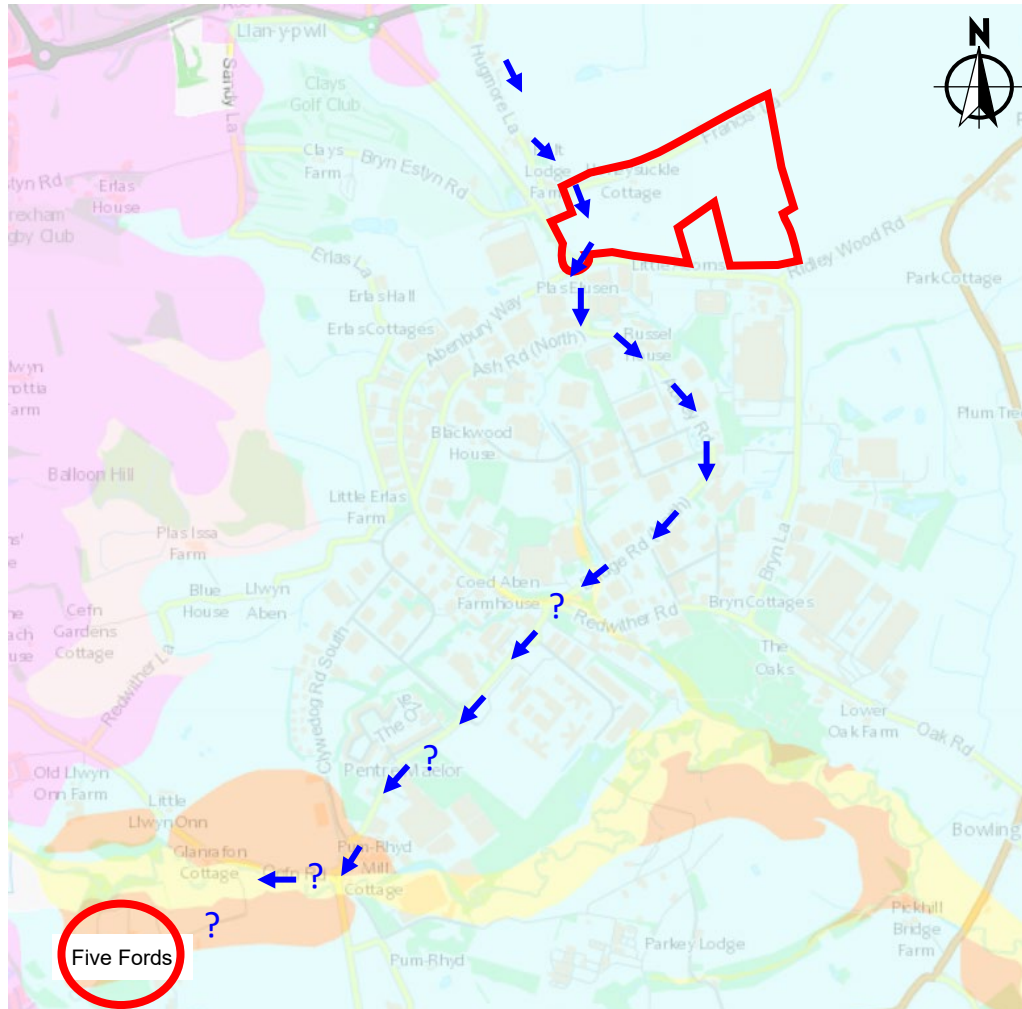


Sewer Route and Underlying Superficial Geology

Contract Number: TE1624

Contract: Land North of Bryn Lane, Wrexham Industrial Estate, Wrexham LL13 9XW.

Client: Net World Sports



KEY:

-  Approximate Site Boundary.
-  Five Fords Sewage Treatment Works.
-  Approximate DCWW Sewer Route.
-  Alluvial Deposits.
-  River Terrace Deposits.
-  Devensian Till (Diamicton).

0 1km
Approximate Scale

Scale -	
Drawn by AH	Approved AH
Drawing Number TE1624-TE-00-XX-DR-GE-006-V01	



Soilscape Map

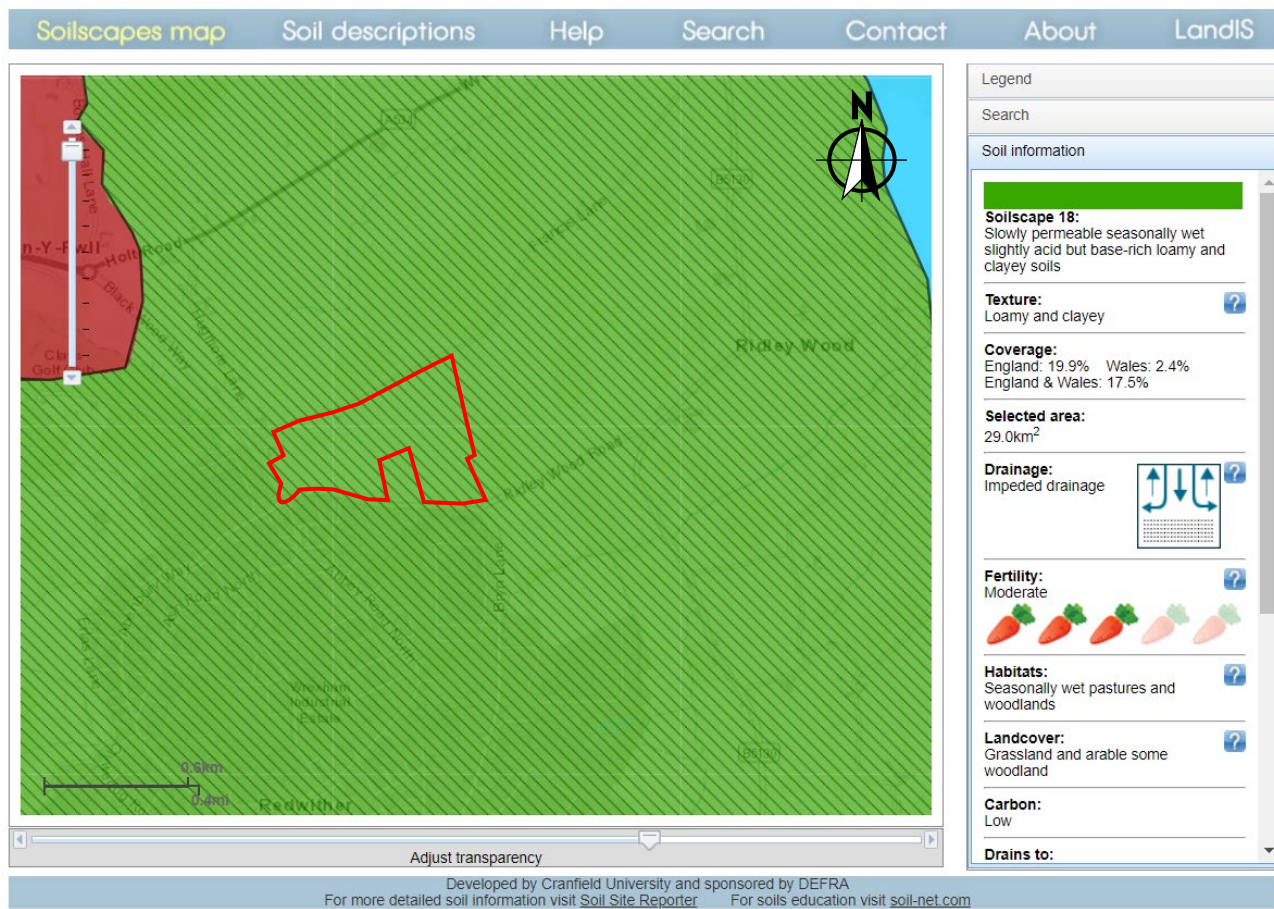
Contract Number: TE1624

Contract: Land North of Bryn Lane, Wrexham Industrial Estate, Wrexham LL13 9XW.

Client: Net World Sports

KEY:

 Approximate Site Boundary



0 800m

Approximate Scale

Scale -	
Drawn by AH	Approved AH
Drawing Number TE1624-TE-00-XX-DR-GE-007-V01	

Extract taken from the Cranfield Soil and Agrifood Institute – Soilscape website (www.landis.org.uk/soilscape/index.cfm), dated 2023.



Average Annual Rainfall Data

Contract Number: TE1624

Contract: Land North of Bryn Lane, Wrexham Industrial Estate, Wrexham LL13 9XW.

Client: Net World Sports

67025 - Clywedog at Bowling Bank

[Station info](#) [Daily flow data](#) [Catchment info](#) [Photo gallery](#) [Other flow datasets](#)

Catchment Description:

Mainly Carboniferous strata, mostly of moderate permeability, with superficial deposits, Boulder Clay, sands and gravels. Mixed farming (pasture predominates), substantially urbanised. Much mining in the catchment.

Select spatial data type to view: **Rainfall**

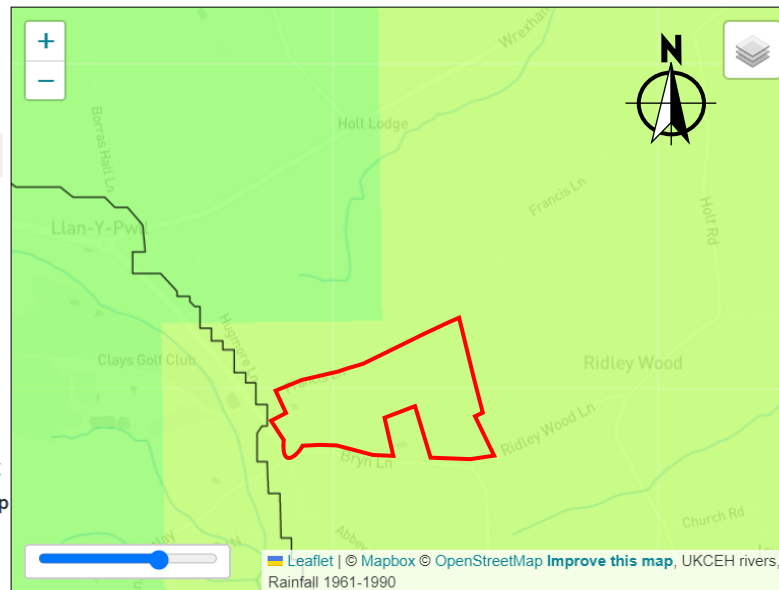
Catchment statistics [Legend](#)

SAAR 1941-1970: 860 mm

SAAR 1961-1990: 851 mm

Click on the labels above for more information on how these maps and statistics were derived

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KEY:

 Approximate Site Boundary

0 800m

Approximate Scale

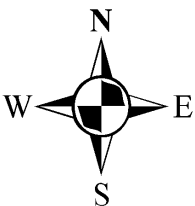
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Drawn by	AH	Approved AH
Drawing Number	TE1624-TE-00-XX-DR-GE-008-V01	

Extract taken from the National River Flow Archive and UK Centre for Ecology & Hydrology website (www.nrfa.ceh.ac.uk/data/station/spatial/67025), dated 2023.



APPENDIX B - DWR CYMRU WELSH WATER SEWERAGE NETWORK

Bryn Lane Wrexham LL13 9XG



LEGEND(Representative of most common features)

Waste network:			
	Foul chamber		Outfall
	Surface water chamber		Lamphole
	Combined chamber		Storm Overflow
	Combined sewer overflow		Rising main
	Special purpose chamber		Gravity sewer
	Treatment works		Private sewer
	Pumping station		Private sewer subject to Sect. 104 adoption agreement
			Private Sewer Transfer
			Lateral Drain
			Inspection Chamber

NB: Sewer symbol colour indicates the type.
RED - Combined
GREEN - Surface Water
BROWN - Foul
Purple - Former S24 sewers (for indicative purposes only)

Notes:

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

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

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

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

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Map Ref: 338542,351108
Map scale: 1:4950
Printed by: Zara Howells
Printed on: 11 Jan 2023



APPENDIX C – NUTRIENT BUDGET CALCULATION

19/06/2023

Nutrient Budget Calculations

Land North of Bryn Lane, Wrexham Industrial Estate Wrexham LL13 9XW

Nutrient Budget Calculator - (Based on Carmarthenshire County Council Nutrient Budget Calculator (CCC NBC) and Discussions with Wrexham Council (WCBC))

1 Step 2 - The Phosphate Load from Existing Land Uses.

1.1	Soil Drainage Type (Based on data from http://www.landis.org.uk/soilscapes/#):	Impeded Drainage
1.2	Annual average rainfall (mm) (Based on data from	900.1 - 950
1.3	Total Site Area (ha):	37.2
	Existing Land Cover Type(s)*	Approximate Area (Hectares)
1.4	Residential - Little Acorns and Honeysuckle Cottage	0.57
	Open land - Built Environment - Roundabout	0.71
	Lowland Grazing - Little Acorns Horse Paddocks	1.29
	Mixed - Potential silage fields across the site	34.64
	Total	48.04

*Existing Land Use Type (Based on CCC NBC Stage 2 dropdown menu).

** Existing Land Use Phosphate Load calculated from CCC NBC Stage 2 Tab.

2 Step 3 - The Phosphate Load from Future Land Uses.

2.2	Total Site Area (ha):	37.2
	Future Land Cover Type(s)*	Approximate Area (Hectares)
	Commercial/Industrial - Units 1 to 16.	10.80
	Open Land - Built Environment (Drive Thru, petrol station, HVG Pod, external landscaped areas, roads etc	26.11
	Residential - Hotel	0.29
	Total	41.11

*Existing Land Use Type (Based on CCC NBC Stage 3 dropdown menu).

** Existing Land Use Phosphate Load calculated from CCC NBC Stage 3 Tab.

3 Step 4 - The Phosphate Load from Staff Wastewater Discharges:

3.1	New Development Occupancy (Based on CBRE Full-Time Equivalent (FTE) figures):	
	Minimum Estimate (Minimum Total Floorspace + Lowest Employment generating uses):	1190
	Maximum Estimate (Maximum Total Floorspace + Highest Employment generating uses):	4236

3.2 Total Foul Water Discharge (Based on Hydro-Industries Figures):

Total Discharge for a Total Number of Staff between 1,190 and 3,582 using Units 1 to 16:

Minimum Trade Effluent Design Flow Rate (based on FTE of 1190):	0.689	l/s
Maximum Trade Effluent Design Flow Rate (based on FTE of 4236):	2.451	
Minimum Trade Effluent Design Flow Rate (based on FTE of 1190):	59.5	m ³ /day
Maximum Trade Effluent Design Flow Rate (based on FTE of 4236):	211.8	

3.3 Total Discharge for 40% of staff commuting in from outside the county using Units 1 to 16:

Minimum foul water discharge (based on minimum FTE of 1190):	23.8	m ³ /day
Maximum foul water discharge (based on maximum FTE of 4236):	84.7	

3.4 Five Fords Wastewater Treatment Works - Phosphate Permit Concentration (DCWW):

Current Phosphate Permit Concentration:	1	mg/l
Tightened Phosphate Permit Concentration:	0.7	

3.5 Total Discharge for the hotel (assuming 130 rooms)

Average Occupancy rate (based on between 1 and 2 people using a room)	1.5	
Water Usage (l/person/day) (based on default CCC Nutrient Budget Calculator values)	120	litres/person/day
Development Proposal (No of Rooms)	130	
Total Discharge for the hotel	23400	litres/day
	23.4	m ³ /day

3.6 Total Discharge from Units 1 to 16 and the Hotel:

Minimum foul water discharge:	47	m ³ /day
Maximum foul water discharge:	108	

3.5 The Phosphate Load from Staff Wastewater Discharges

(Phosphate Discharge (Pc/10⁶ x (volume of water from development in m³/day) x 1000 x 365 days)

Additional Nutrient loading from wastewater (Pc = 1.0 mg/l):

(40% of staff from outside the catchment and Minimum foul water discharge):	17	kg TP/yr
(40% of staff from outside the catchment and Maximum foul water discharge):	39	

Additional Nutrient loading from wastewater (Pc = 0.7 mg/l):

(40% of staff from outside the catchment and Minimum foul water discharge):	12	kg TP/yr
(40% of staff from outside the catchment and Maximum foul water discharge):	28	

4 Step 5 – Total Annual Phosphate Load:

4.1	Additional Nutrient loading from wastewater (Pc = 1.0 mg/l), (40% staff from outside the county and Minimum foul water discharge):	Combined Phosphate Load from Step 3 and Step 4	PO4 Load from Step 1	PO4 Budget	Total Annual PO4 Load (kg TP/year)	Total Annual PO4 Load (Rounded) (kg TP/year)
		58.34	48.04	10.30	12.36	12

4.2	Additional Nutrient loading from wastewater (Pc = 1.0 mg/l), (40% staff from outside the county and Maximum foul water discharge):	Combined Phosphate Load from Step 3 and Step 4	PO4 Load from Step 1	PO4 Budget	Total Annual PO4 Load (kg TP/year)	Total Annual PO4 Load (Rounded) (kg TP/year)
		80.57	48.04	32.53	39.03	39

4.3	Additional Nutrient loading from wastewater (Pc = 0.7 mg/l), (40% staff from outside the county and Minimum foul water discharge):	Combined Phosphate Load from Step 3 and Step 4	PO4 Load from Step 1	PO4 Budget	Total Annual PO4 Load (kg TP/year)	Total Annual PO4 Load (Rounded) (kg TP/year)
		53.17	48.04	5.13	6.16	6

4.4	Additional Nutrient loading from wastewater (Pc = 0.7 mg/l), (40% staff from outside the county and Maximum foul water discharge):	Combined Phosphate Load from Step 3 and Step 4	PO4 Load from Step 1	PO4 Budget	Total Annual PO4 Load (kg TP/year)	Total Annual PO4 Load (Rounded) (kg TP/year)
		68.73	48.04	20.69	24.83	25

Landcover Type Definitions from the CCC Nutrient Balance Calculator:

Lowland grazing:	Agricultural areas on which cattle sheep and other grazing livestock are farmed. A holding is classified as lowland if less than 50% of its total area is classed as a lowland grazing area.
Mixed:	Agricultural areas where cereals, arable crops, horticultural crops, pigs, poultry and cows are not farmed or where it is too difficult to select a single category to describe the farm.
Commercial/Industrial Land:	Areas that are used for Industry. These are businesses that typically manufacture, process or otherwise generate products. Included in the definition of industrial land use are factories and storage facilities.
Open Land - Built Environment:	Area of land in urban areas used for various purposes, eg main roads, built facilities such as schools, sports centres, areas used for leisure and recreation - this may include open land, eg caravan sites, camping sites, sports fields, play grounds and public squares.
Residential land:	Areas of Houses and associated infrastructure. This is inclusive of residential roads, driveways, grass verges, gardens and blue-green SuDs.

	Data derived from third-parties and online sources.
	Data derived from CCC Nutrient Budget Calculator.
	Calculated Values.