

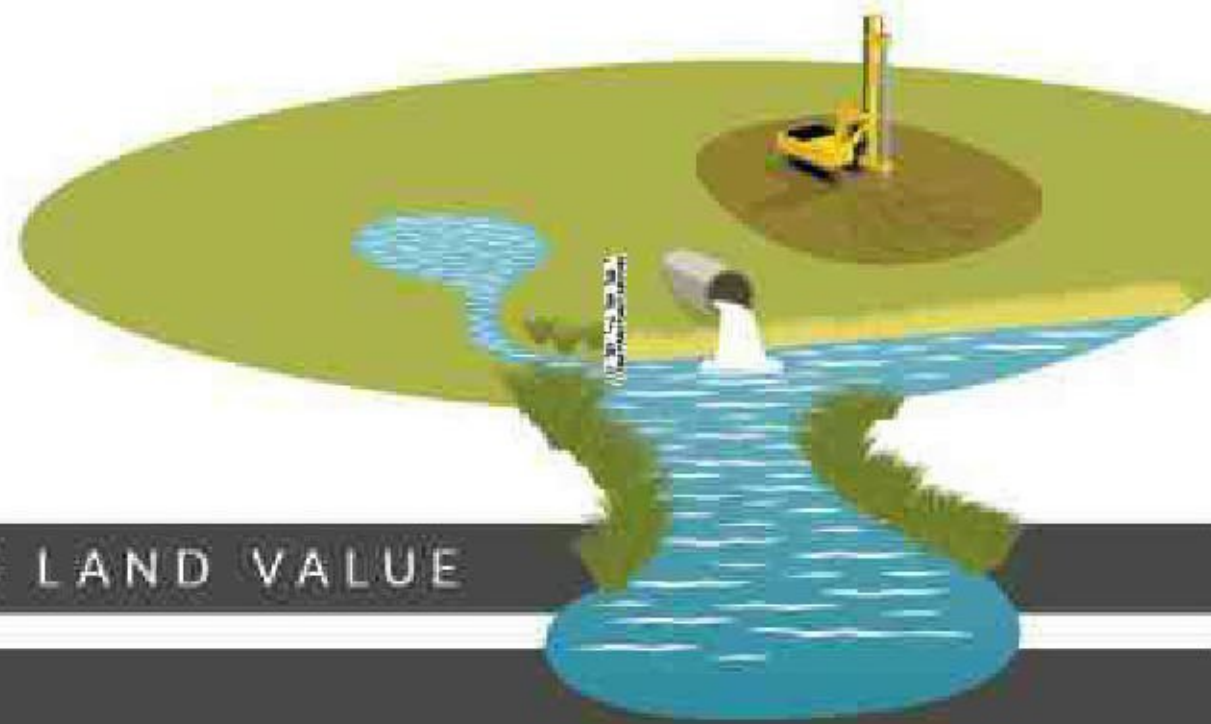
157A BLACKPOOL ROAD,
POULTON-LE-FLYDE

SUSTAINABLE DRAINAGE STRATEGY

Job Number: FRA 21 1018

Date: March 2021

Client: Mr Paul Kelly



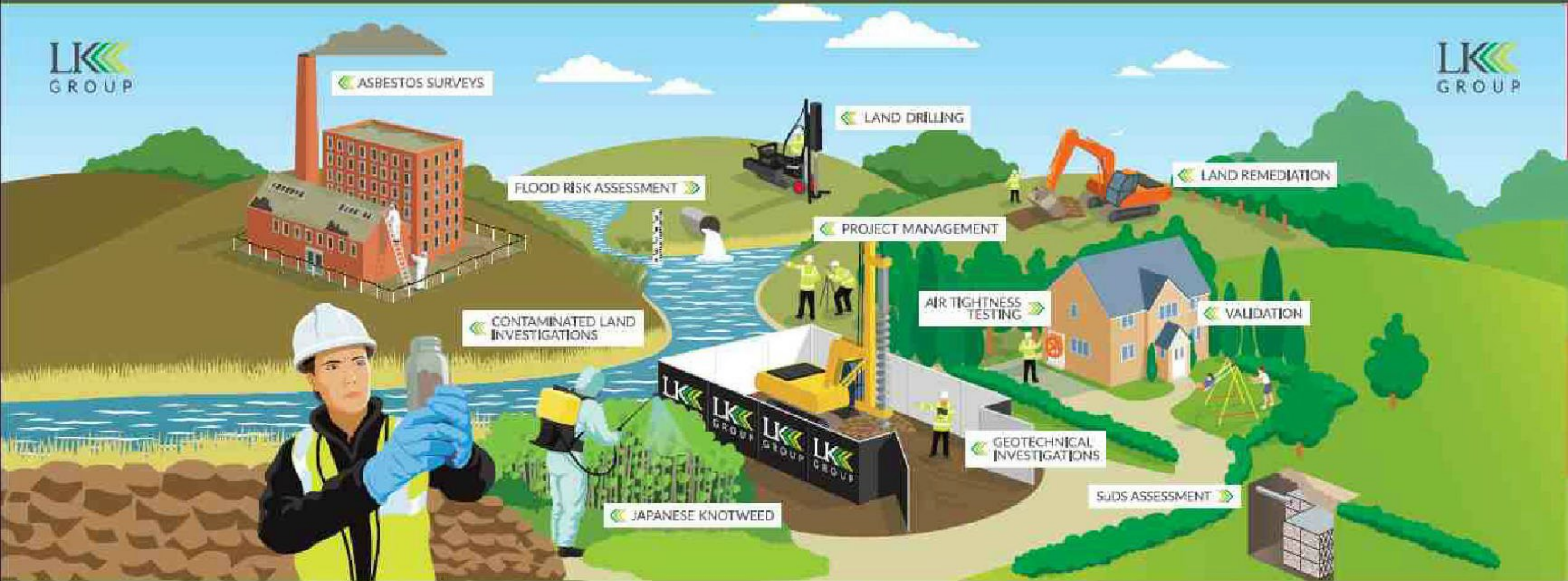
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| LK Consult | | | |
|------------------------------|---|-----------------------|------------------|
| Document Verification | | | |
| Site Address | 157A Blackpool Rd, Poulton-le-Fylde, FY6 7QH | | |
| Report Title | Sustainable Drainage Strategy | | |
| Job Number | FRA 21 1018 | Document Ref. | FRA 21 1018 - R0 |
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| Prepared By | Anna Mierzejewska – Environmental Scientist | Signature | |
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| | | | |

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EXECUTIVE SUMMARY

Scope and Background

This Sustainable Drainage (SuDS) Strategy has been undertaken by LK Consult Ltd (LKC) to support a planning application for the development of land to the rear of 157A Blackpool Road, Poulton-le-Fylde. The development comprises a new log-cabin supported on concrete pads.

LKC has prepared this SuDS Strategy in line with the NPPF and Technical Guidance where appropriate.

Consultations

The Environment Agency (EA) website has been utilised to assess if there are any limitations that may affect the form of SuDS that may be appropriate to this site. The records show that the site is within Flood Zone 1.

Lancashire County Council – Lead Local Flood Authority (LLFA) and United Utilities (UU) have also been contacted during preparation of this report.

Mitigation

Design

The ground conditions beneath the site are recorded as Till, Devensian superficial deposits that likely consist of sandy Clay with occasional stones (Boulder clay) as recorded for the area. Made ground of silty sand over concrete was recorded at shallow depth across the site. The surrounding area appears very waterlogged, which may indicate presence of shallow water levels or impermeable ground conditions.

The site is relatively flat with an access track sloping away towards Blackpool Road.

In considering the potential drainage options for the site at present it is assumed that surface water runoff arising from the development will discharge into the existing adjacent combined sewer.

The flows from the site should be restricted to an acceptable level to the Lead Local Flood Authority and the United Utilities.

The proposed development will likely decrease the proportion of the site covered by impermeable surfaces, subject to confirmation of the garden layout. At the moment the site is assumed to have a similar percentage of impermeable surfaces and will therefore generate similar runoff. Attenuation will therefore be required.

The outline drainage strategy considers the use of attenuation-based SuDS to be feasible with a discharge to the adjacent sewer via existing connection from the site. For the 5l/s discharge rate the required storage has been estimated to be **4.4m³** for the 1 in 30-year event.

Similarly, the estimated volume to be retained on site for the 1 in 100-year storm event including the allowance for climate change is between **11.4m³** and **15.6m³**.

The estimated volume can be stored within the site boundary.

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1 Introduction

1.1 Background

LK Consult Ltd (LKC) were commissioned by Mr Paul Kelly to carry out a Sustainable Drainage Strategy for land at 157A Blackpool Road, Poulton-le-Fylde. The report was undertaken in support of a future planning application to redevelop part of the site to include a log cabin.

The report will consider the impact of the development on surface water runoff accounting for climate change. The sustainable drainage assessment in Section 4 will provide an overview of the SuDS techniques which could be considered on the site.

This preliminary SuDS assessment complies with the principles presented in the Draft National Standards for Sustainable Drainage Systems (Defra, 2015)¹ and the Planning Practice Guidance (PPG) March 2014². The sustainable drainage assessment is presented with reference to the hydrological and hydrogeological context of the development.

The report findings are based upon professional judgement and are summarised below. The report includes baseline data from the Environment Agency (EA), rainfall data from the Wallingford Studies and Hydrogeological information from the British Geological Survey (BGS). The assessment will summarise and refer to these datasets in the text.

Drainage on the site has been assessed by considering the following key constraints:

- » Topography of the site.
- » Local water features and hydrological context.
- » Underlying geology, soil types and permeability.
- » Layout and geometry of the proposed development.

¹ Non-statutory Technical Standards for Sustainable Drainage Systems – DEFRA March 2015

² Planning Practice Guidance – Department for Communities and Local Government April 2014

1.2 Site Details

A summary of the general site details is presented in Table 1-1. Plans, Drawings and Figures are provided in Appendix A. Figure 1 indicates the site location and boundary. Figure 2 indicates the proposed development.

| Site Details | |
|-----------------------------|---|
| Location | Located at 157A Blackpool Road, the site is located to the rear of a semi-detached house. Centred at approximate National Grid Reference 333305E, 439645N. |
| Area | 803m ² . |
| Topography | 13 metres Above Ordnance Datum (AOD). Site is approximately level with the existing driveway falling to the east. |
| Current Land Use | <u>Site</u> Site is currently used as part of a gravel yard/storage area as well as a space for a mobile home, which is currently occupied by the client. A small, paved area is present adjacent to the mobile home. <u>Surrounding Area</u> North: Nursery. East: No 157 Property and associated outbuildings. South: Public footpath and residential properties. West: Overgrown vegetation/Trees. |
| Proposed Development | A log-cabin supported on concrete pads. Access will be via the existing access from Blackpool Road. |

Table 1-1: Summary of site details.

2 Site Setting

2.1 Environmental Setting

LKC have previously undertaken a Preliminary Risk Assessment for the site³ and pertinent environmental information for the site is summarised in Table 2-1 below.

| Summary of the Environmental Setting | | | |
|--------------------------------------|---|-------------|---|
| Geology | Superficial | | Till, Devensian (Diamicton). |
| | Bedrock | | Kirkham Mudstone Member (Mudstone). |
| | BGS Boreholes | | BH Ref: SD33NW61, 340m northwest: Topsoil to 0.1m, sandy Clay with occasional stones (Boulder clay) to 8.45m. Water level at 2mbgl. |
| | Defra Soilscape Mapping | | The slowly permeable, seasonally wet, slightly acid but base-rich, loamy and clayey soils recorded. |
| Hydrogeology | Aquifer | Superficial | Secondary Undifferentiated Aquifer. |
| | Designation | Bedrock | Secondary B Aquifer. |
| | Source Protection Zone (SPZ) | | Site not within an SPZ. |
| Hydrology | All adjacent and internal surface water | | 27m northwest, seasonal pond. |
| Site History | | | Undeveloped land from the earliest mapping until 1913. Used as a rear garden between 1930 and 2015. Storage of vehicles/machinery since. A number of ponds recorded within the close proximity to the site. |

Table 2-1: Summary of the Environmental Setting.

2.2 Site Reconnaissance

A site reconnaissance was undertaken in January 2021 and relevant photographs are provided in Plate 2-1.

Relevant features identified on site are summarised below:

- The site access is via a gate off Blackpool Road, to the rear of No. 157A accessed via a track to the south of the existing detached property.
- The majority of the site surface comprises compacted sand and gravel, with several trees and shrubs towards the rear of the site.
- The site is used as a commercial yard for the storage of logs, several pieces of machinery, as well as a mobile home which is occupied by the client. Adjacent to the mobile home, there is also a paved area with a shed.
- The access comprises sand and gravel, with a few potholes noted.
- The site is relatively flat with a track gently falling towards the road.
- Wooden fencing is present along all site boundaries, noted to be in poor repair in places.
- A concrete channel drain was noted where the track starts off Blackpool Road.
- A manhole cover was noted along the track, running from the mobile home and presumably connecting to the main sewers and drains located on Blackpool Road.
- A manhole cover was noted in a public pathway immediately to the south.

The surrounding area comprises residential rear garden areas, adjacent house 157A Blackpool Road, domestic garage for the house, residential properties and the pathway.

³ Phase 1 Preliminary Risk Assessment: LK Consult Ltd, Ref: CL-602-LKC 20 1381-01, February 2021.



Photograph 1: View of site from NW.



Photograph 2: View of track from N.



Photograph 3: Existing mobile home and drain on site.



Photograph 4: View of manhole cover along the track.



Photograph 5: Machinery present on site – possible wood chipper.



Photograph 6: Shed and area of hardstanding in the east of the site.

Plate 2-1: Site photographs.

Hand dug pits were carried out in 2no. locations across the western area and are summarised in Plate 4-2.

| HD101 | HD102 |
|--|---|
| GL-0.1m Made Ground (silty gravelly sand with occasional brick, plastics). 0.3m Textile membrane underlain by concrete. | GL-0.1m Made Ground (silty gravelly sand with occasional brick, plastic fragments). 0.3m Concrete. |

Table 2-2: Hand Dug Pit Logs.

2.3 Site Levels

A topographic survey of the site has been undertaken to OS GPS datum, and information is included on the drawings in Appendix B. The site is approximately flat at around 13m AOD. The access track falls gently towards Blackpool Road.

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3 Consultation

Information from consultees is summarised in Table 3-1 below.

Relevant correspondence / information is provided in Appendix C.

| Source | Details | |
|--|---|--|
| Environment Agency | Flood Zone 1: Very Low risk, with annual probability of flooding from rivers and the sea of less than 0.1% (1 in 1000). | |
| Lancashire County Council (Lead Local Flood Authority) | LLFA would require that the Non-Statutory Standards for SuDS were followed. Runoff from a brownfield site should be as close as reasonably practical to the greenfield runoff rates. LLFA have no records of culverted watercourses in the vicinity of the site. The site is not within a Critical Drainage Area. | |
| United Utilities | Sewer Map | No surface water sewers running close to the development. There is a 225mm diameter combined sewer running in a pathway immediately to the south and a 375mm combined sewer in Blackpool Road to the east. |
| | Likely conditions for connecting into their sewerage system | All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80 of the National Planning Practice Guidance. Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible. If not feasible, UU will consider a connection to the adjacent combined sewers at a pass forward flow to be agreed by the Lead Local Flood Authority. UU request that any agreed rate does not exceed 5l/s. Foul flow from this site will be allowed to drain into the public combined sewer system at an unrestricted rate. UU have no objection for connection to either combined sewers adjacent to the site. UU have no current record of sewer flooding on their DG5 register within the vicinity of the proposed development. |

Table 3-1: Summary Consultee Information.

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4 Sustainable Drainage Strategy

4.1 Introduction

The NPPF recognises that flood risk and other environmental damage can be managed by minimising changes in the volume and rate of surface run-off from development sites through the use of Sustainable Drainage Systems (SuDS), this being complementary to the control of development within the floodplain.

SuDS will not alleviate flooding in an area prone to flooding; however, properly designed SuDS have the potential to prevent the surface water runoff from new development worsening the flood risk. The effective disposal of surface water from the development is a material planning consideration in determining proposals for the development and use of land.

The accepted principles are that surface water arising from a developed area should, as far as practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

The Building Regulations Requirement H3⁴ stipulates that rainwater from roofs and paved areas is carried away from the surface to discharge to one of the following, listed in order of priority:

- » an adequate soakaway or other adequate infiltration system,
- » a watercourse or, where that is not practicable,
- » a sewer.

The concept of a sustainable drainage system has been incorporated into the outline drainage strategy for the study area in order to comply with the Flood and Water Management Act 2010⁵.

Suitability of different SuDS will be governed by prevailing site conditions, such as the type and scale of development, topography, ground conditions (soil permeability, ground stability, depth to water table), local hydrogeology and risk of groundwater contamination (presence of sensitive aquifers and source protection zones) etc.

4.1 Infiltration

The Groundwater Source Protection Zone mapping from the EA website shows that the site is not within any identified protection zones.

A summary of the British Geological Survey superficial and bedrock aquifer descriptions and classifications is shown in Table 4-1 below:

| Classification | Description | Aquifer Classification | Recorded Water Table Depth | Soakaway Potential |
|---------------------------------|--|----------------------------|----------------------------|--------------------|
| Till Deposits | Sandy Clay with occasional stones (Boulder clay) | Secondary Undifferentiated | Approx. 2mbgl | Poor |
| Kirkham Mudstone Member Bedrock | Mudstone | Secondary B | N/A | Poor |

Table 4-1: Geological and Hydrogeological Setting.

⁴ Building Regulations part H3 2010: Approved Document, Drainage and Waste Disposal.

⁵ Flood and Water Management Act 2010: UK Government.

Infiltration methods such as soakaways are unlikely to be feasible given the local impermeable ground conditions and potential for seasonal ponding in the area, likely due to the soils and shallow groundwater table, but this may be investigated further at the detailed design stage, if required.

4.2 Watercourses

There are no observable watercourses within or near the boundary of the site. Currently surface water from the site runs overland to the public sewers.

4.3 Public Sewer

There are no surface water sewers within the vicinity of the site. The nearest public sewers are combined drains in Blackpool Road and in a pathway to the south of the plot.

4.4 Other Sewers

There is a connection to the private sewer from the study land. The nearest manhole is located within the access track and it connects into a public sewer in Blackpool Road.

4.5 Surface Water Drainage Strategy

The drainage options relating to the final discharge of surface water for this section of the site are listed in Table 4-2 in order of priority within the NPPF:

| Option No: | Drainage Solution | Most feasible solution | Comments |
|-------------------|---------------------------|-------------------------------|---|
| a | Soakaway/Infiltration | 2 | Reasoning: low permeability / high water table, local ponding. |
| b | Connection to Watercourse | N/A | No watercourses available where a connection could be made. |
| c | Discharge into a sewer | 1 | A connection into the combined sewer in Blackpool Road via existing connection from the site would be possible – subject to approval from LLFA and a formal connection agreement from UU. |

Table 4-2: Drainage options.

Table 4-3 provides a summary of the SuDS options appraisal with consideration of CIRIA C697 (The SUDS Manual)⁶ for the development:

| SuDS Option | Appropriate to Development | Comments |
|--|----------------------------|---|
| Soakaways | X | Due to the nature of the ground conditions, the use of infiltration systems may not be feasible. |
| Infiltration basin | X | Depressions that store and dispose of water via infiltration. May not be appropriate given the ground conditions. |
| Sand filter | X | Treatment devices using sand beds as filter media. |
| Filter strip | X | Engineered filters that use vegetation to remove and treat runoff. The filter strip is sloped to allow sheet flow across the vegetated strip. A filter strip offers no storage and is used solely to remove pollutants from surface water. |
| Filter drains | X | Linear trenches filled with a permeable granular material, often with a perforated pipe in the base of the trench. |
| Detention basin | X | Dry depressions designed to hold water for a specific retention time. |
| Swales | X | Swales are shallow grass-lined channels that provide capacity for conveying flows at a controlled rate into ponds and watercourses. |
| Rainwater harvesting | ✓ | Rainwater harvesting collects the rain which falls onto roofs, then stores it in a tank until required for a non-potable use. When required, the water is pumped to the point of use, thus displacing what would otherwise be a demand for mains-water. In the process, a volume of water is kept out of the storm-water management system, thereby helping to reduce flooding risks. Rainwater harvesting systems are currently not included in the development proposals. |
| Green roofs | * | Green roof installations can help to reduce surface water runoff from roof areas depending on the system specified. Green roofs are not currently included in the development proposals. |
| Geo-cellular storage systems | ✓ | Modular block systems can be used to provide an underground storage facility. Any geo-cellular storage systems should be lined with a geo-membrane to provide attenuation storage. |
| Permeable Pavements – geo-cellular storage systems | ✓ | Permeable pavements allow inflow of rainwater into underlying construction. Any geo-cellular storage systems would have to be lined with an impermeable membrane to provide storage rather than infiltration for runoff from highways. |
| Ponds | X | Attenuation ponds can be used to offset the increase in surface water flows attributable to increased area of hard standing, in order to minimise the risk of flooding to and from the proposed development. Ponds will attenuate the surface water flow prior to discharging to the public surface water sewers. The storage volume afforded by these features should not include any permanent water in the pond. |
| Oversized Pipes | ✓ | Oversizing the pipes that make up the on-site drainage network is a cost-effective method for providing attenuation storage within the network. Such systems could be considered on the parts of the development where gradients are relatively flat. |
| Tanks | ✓ | Prefabricated underground tanks could be considered at the detailed design stage in order to provide storage to attenuate surface water runoff. |
| Flow control devices | ✓ | The peak flow rates will be controlled by flow control devices e.g. hydrobrake style flow control systems, and restricted orifices. Flow control devices enable the discharge to be restricted to a constant rate from the development. |

Table 4-3: Summary of the SuDS options appraisal.

Notes

- ✓ Suitable for use given the nature and scale of the development
- * Possibly suitable for use – not included in the client and architect design proposal at present
- X Not suitable

⁶ CIRIA C697 - The SUDS Manual. London 2015

4.6 Surface Water Attenuation Requirements

According with the LLFA requirements the flow from that brownfield site should be limited to as close as reasonably practical to greenfield runoff rates for estimating the attenuation volumes required.

It is estimated from the supplied plan (see Appendix A) that the site will have the following designated areas (Table 4-4).

| Designated Areas | Plot Area |
|---|-----------|
| Total area (m ²) | 803 |
| Existing Impermeable Area (m ²) | 803 |
| Green Infrastructure (m ²) | 0 |
| Contributing Catchment | |
| Catchment Area (ha) | 803 |
| Impermeable split (ha) | 803 |
| Green Infrastructure (ha) | 0 |

Table 4-4: Assumed plot areas.

Table 4-4 shows the assumed split in area included within the calculations.

It can be seen that there will be similar percentage of impermeable area from the existing usage to the proposed. The proposed garden layout has not yet been determined. This is likely to require attenuation to reduce the existing flow off site to a level which is acceptable to the LLFA and to UU.

4.6.1 Attenuation Estimate

Surface water storage and runoff estimations based on the HR Wallingford procedure IH 124⁷ (including IH 124⁸) have been undertaken for the development and the output report is presented in Appendix D.

For the contributing catchment, an estimate has been produced assuming the site will be fully drained into the existing onsite drainage, therefore the assumed impermeable area would be 803m² at the moment. This gives the following runoff rates and attenuation requirements for this section based on the Wallingford IH 124 method:

| | |
|---------------------------------------|----------|
| Q _{bar} : | 0.47 l/s |
| 1 in 1-year greenfield runoff rate: | 0.40 l/s |
| 1 in 30-year greenfield runoff rate: | 0.79 l/s |
| 1 in 100-year greenfield runoff rate: | 0.99 l/s |

The site is currently draining into the public sewers via a private connection. The following existing brownfield rates have been calculated:

| | |
|---------------------------------|----------|
| Q _{bar} : | 8.0 l/s |
| 1 in 1-year peak runoff rate: | 5.9 l/s |
| 1 in 30-year peak runoff rate: | 13.8 l/s |
| 1 in 100-year peak runoff rate: | 17.3 l/s |

United Utilities has specified an allowable discharge rate of 5l/s to their adjacent combined drain. This is also a practical minimum to prevent from blockages and to provide the proper maintenance of drainage network.

⁷ IH124 Flood Estimation of Small Catchments.

⁸ IH124 Flood Estimation of Small Catchments.

The following attenuation has been estimated for the development using 5l/s runoff rates and utilises the FSR methodology⁹ as:

- Attenuation storage volume: **4.4 m³** (1 in 30-year event)
- Retention on site volume: **11.4 m³** (1 in 100 year + 20% Climate Change)
- Retention on site volume: **15.6 m³** (1 in 100 year + 40% Climate Change)

Attenuation storage aims to limit the peak rate of runoff from the development to the 5l/s before discharge to public sewer. As the flow from the development would be reduced there should be little change in the flows that enter the public sewer and thus the risk of flooding as a result from the development should not increase the risk of flooding off-site.

The attenuation required for a 1 in 30-year storm event, requires a storage volume of **4.4 m³** and for the 1 in 100-year event, a storage capacity of between **11.4 m³** and **15.6 m³** will be required from on-site storage as well as SuDS systems. All volumes can be stored within the site boundary and discharges will be limited by flow control devices to the adjacent sewer.

The use of permeable paving may be viable dependant on the detailed design of the proposed development. If this drainage technique is considered to be feasible then it will reduce the requirement for attenuation as it will reduce the contributing impermeable area. The permeable paving will also provide some level of water treatment reducing effects of pollution in runoff on the environment.

Assuming that the outline drainage strategy is acceptable to the Local Authority, a more detailed design can be presented and agreed with the appropriate regulatory bodies during the detailed design phase.

4.7 Maintenance and Management Plan

The SuDS maintenance and inspections responsibility rests with the owners or could be arranged through appointment of a site management company.

A suitable form of attenuation tank constructed to adoptable standards along with the new sewer connection can be offered for S104 adoption with United Utilities.

4.8 Foul Drainage

The foul water could be discharged by gravity into the 375mm diameter combined sewer in Blackpool Road via the existing connection from the site, as relative levels indicate that this will be feasible in terms of fall.

⁹ Flood Studies Report Wallingford NERC 1975.

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5 Conclusion

The site is currently used as part of a storage area and contains a mobile home. The proposal is to set a new log cabin supported on concrete pads, with a small, paved area and a shed to remain the same.

An assessment of the site settings and existing constraints in conjunction with the development proposals have resulted in the following recommendations for the safe development of the site:

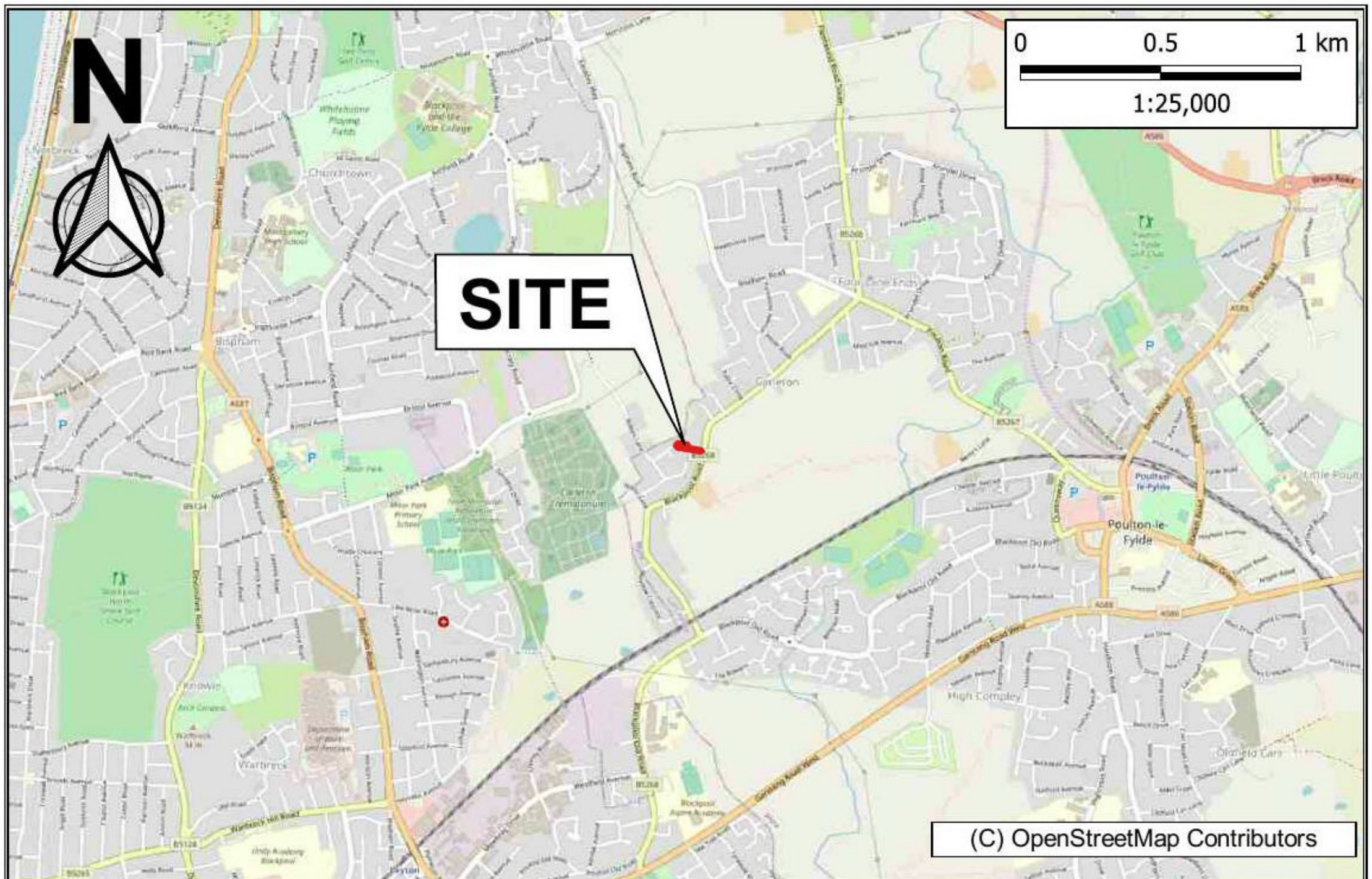
- » The recorded geology on site and local hydrological settings would indicate that infiltration may not be practical. This may be investigated at the detailed design stage by means of undertaking permeability testing if required.
- » A suitability and a depth of the onsite private connection to the public sewer should be confirmed on site.
- » The storage design may make the connection to the on-site drainage impractical and a separate connection to the sewer may be required.
- » A pre-development advice received from United Utilities considered a flow rate of 5l/s would be acceptable if infiltration proved to be impractical.
- » All proposed outflow connections from the development should be agreed with the Lead Local Planning Authority and United Utilities.


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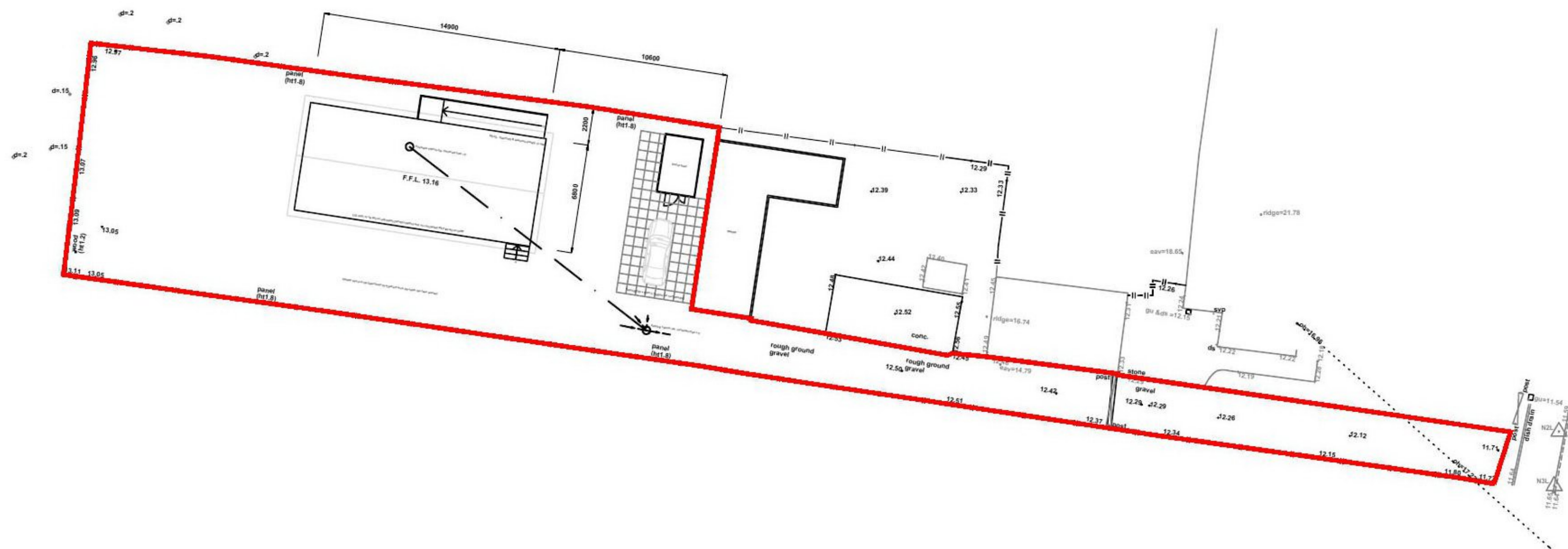
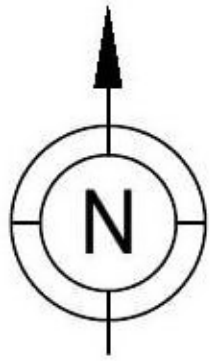
APPENDIX A

FIGURES, PLANS AND DRAWINGS

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| | | | | | | | |
|--|--|-----------------|-------------------|--|--|---|--------------|
| Client: Mr Paul Kelly | | | | Title: Site Location & Boundary Plan | |  | |
| Site: 157A Blackpool Road, Poulton-le-Fylde | | | | | | | |
| Job No.: FRA 21 1018 | | Drawn By: AM | Checked By: MJ | Drawn: March 2021 | Scale (see scale bar): 1:25,000 & 1:2,000 @ A4 | | Figure: 1 |



KEY

 Site Boundary

Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.



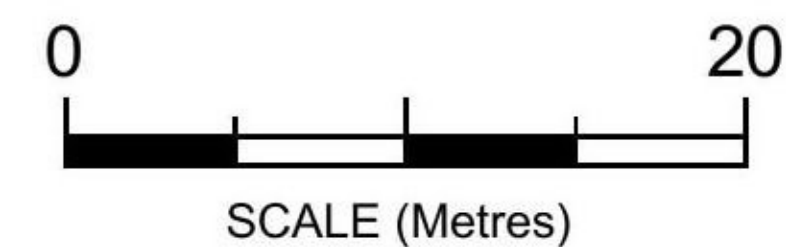
Client: **Mr Paul Kelly**

Site: **157A Blackpool Road, Poulton-le-Fylde**

Title: **Proposed Development Plan**

| | | | |
|--------------------------------|---|---------------------------|-----------|
| Job No.: FRA 21 1018 | Scale (See Scale Bar): 1:500 @ A3 | Figure: 2 | Revision: |
| Drawn By: AC | Checked By: AM | Drawn: Mar 2021 | |

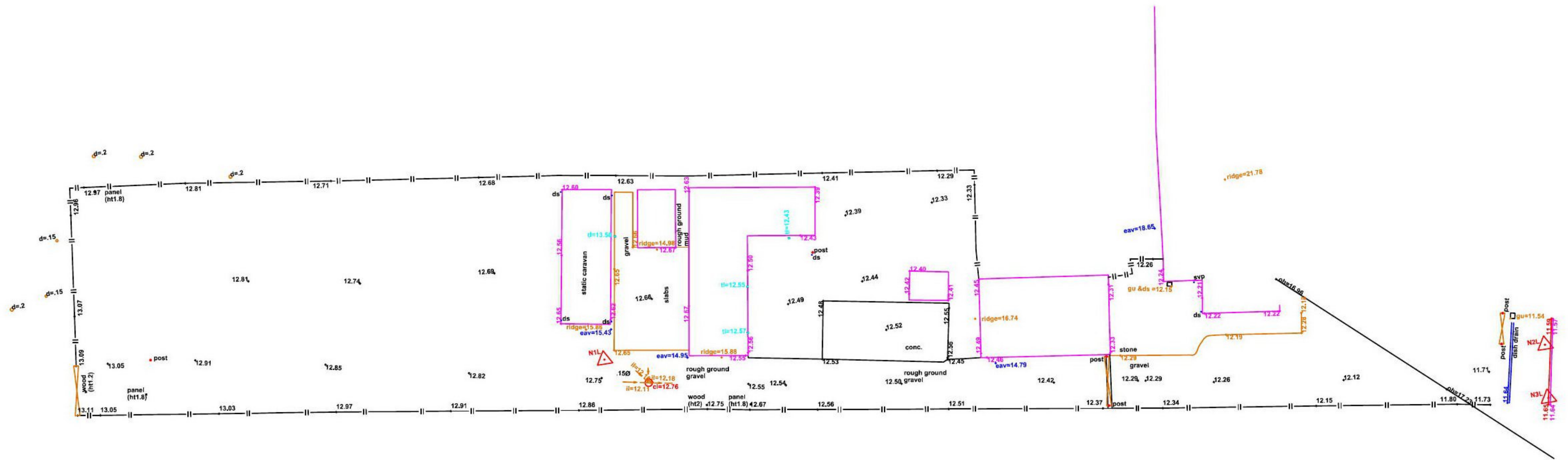
Extract from: JPL Design & Construct Ltd
Drawing Ref: Proposed Site Plan, No.SP01 (24/03/2021)



APPENDIX B

SITE INFORMATION

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BOREHOLE LOG

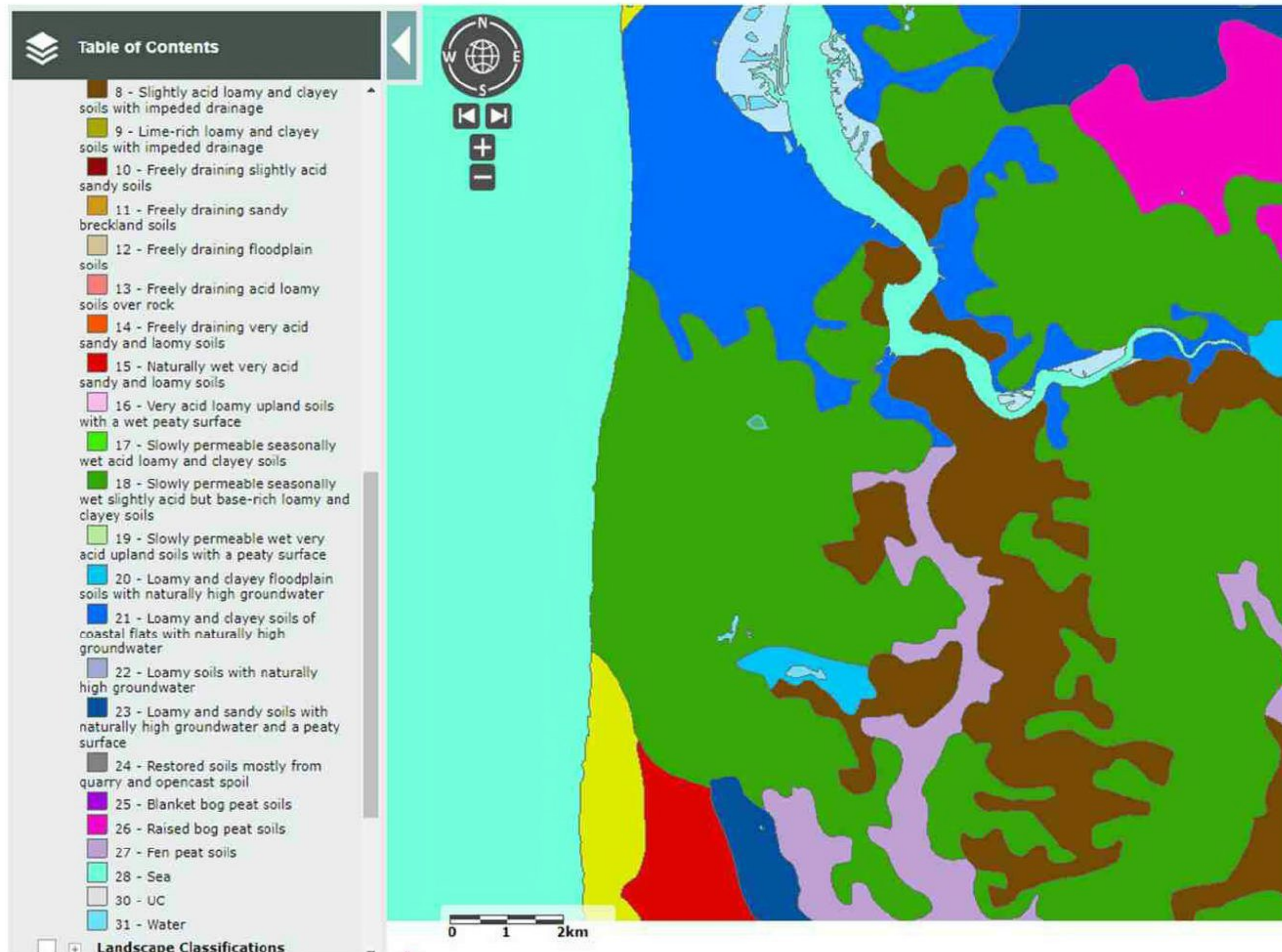
BOREHOLE NO. VG. 7
DIAM. 150mm

WATER STRUCK AT 2.0m

S.P.T. ☒
U. 100 Sample ☒
U. 100 No. Sample ☐


Bulk sample ☐
Lab sample ☐

| DATE | DEPTH OF BORING | DEPTH OF CASING | DEPTH TO WATER | STRATA DESCRIPTION | DEPTH (m) | S.P.T. BLows | DEPTH | SAMPLE TYPE |
|------------------|-----------------|-----------------|----------------|--|-----------|----------------|--------------|-------------|
| 3.4.74 | | | | SD 33 NW / 61 3316 391 | 0.10 | 13.25 13.15 | | |
| | 1.50 | None | | SANDY CLAY with occasional STONES. Soft turning firm below 4m. Red-brown. Some grey mottling at top of stratum. (Boulder clay). | | | 0.50 | O |
| | 2.00 | 2.00 | 2.00 | | | | 1.50 to 1.95 | I |
| 3.4.74 4.4.74 | 2.60 | 2.50 | Dry | | | | 2.60 to 3.05 | I |
| | 3.50 | | Wet | | | | 3.50 | O |
| | 4.00 | 4.00 | Dry | | | | 4.00 to 4.45 | I |
| | 6.00 | 6.00 | | | | | 6.00 to 6.45 | I |
| | 8.00 | 7.00 | | | | | 8.00 to 8.45 | I |
| 4.4.74 | 8.45 | 7.00 | Dry | END OF BOREHOLE. | 8.45 | 4.80 | 8.45 | I |



Geology 1:50,000 Maps Legends





Artificial Ground and Landslip

| Map Colour | Lex Code | Rock Name | Rock Type | Min and Max Age |
|---|----------|-------------------------|--------------------|-------------------------|
|  | MGR | Made Ground (Undivided) | Artificial Deposit | Not Supplied - Holocene |

Superficial Geology

| Map Colour | Lex Code | Rock Name | Rock Type | Min and Max Age |
|---|----------|-----------------------------------|-----------------------------|---------------------------|
|  | ALV | Alluvium | Clay, Silt, Sand and Gravel | Not Supplied - Holocene |
|  | TFD | Tidal Flat Deposits | Clay and Silt | Not Supplied - Holocene |
|  | TILLD | Till, Devensian | Diamicton | Not Supplied - Devensian |
|  | GFDUD | Glaciofluvial Deposits, Devensian | Sand and Gravel | Not Supplied - Devensian |
|  | PEAT | Peat | Peat | Not Supplied - Quaternary |
|  | TFD1 | Tidal Flat Deposits, 1 | Clay and Silt | Not Supplied - Quaternary |
|  | ALF | Alluvial Fan Deposits | Clay And Gravel | Not Supplied - Quaternary |

Bedrock and Faults

| Map Colour | Lex Code | Rock Name | Rock Type | Min and Max Age |
|---|----------|---------------------------|---------------------------|-------------------------------|
|  | KRM | Kirkham Mudstone Member | Mudstone | Not Supplied - Anisian |
|  | MSA | Mythop Halite Member | Mudstone and Halite-stone | Not Supplied - Anisian |
|  | SNM | Singleton Mudstone Member | Mudstone | Not Supplied - Early Triassic |
|  | | Faults | | |



Geology 1:50,000 Maps

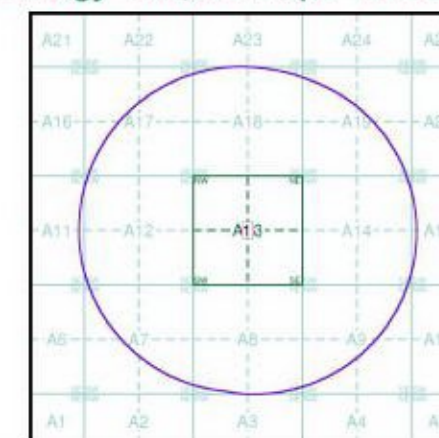
This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:50,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around the site. This mapping may be more up to date than previously published paper maps.

The various geological layers - artificial and landslip deposits, superficial geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page. Not all layers have complete nationwide coverage, so availability of data for relevant map sheets is indicated below.

Geology 1:50,000 Maps Coverage

| | |
|----------------------|---------------|
| Map ID: | 1 |
| Map Sheet No: | 066 |
| Map Name: | Blackpool |
| Map Date: | 1975 |
| Bedrock Geology: | Available |
| Superficial Geology: | Available |
| Artificial Geology: | Available |
| Faults: | Not Supplied |
| Landslip: | Not Available |
| Rock Segments: | Not Supplied |

Geology 1:50,000 Maps - Slice A



Order Details:

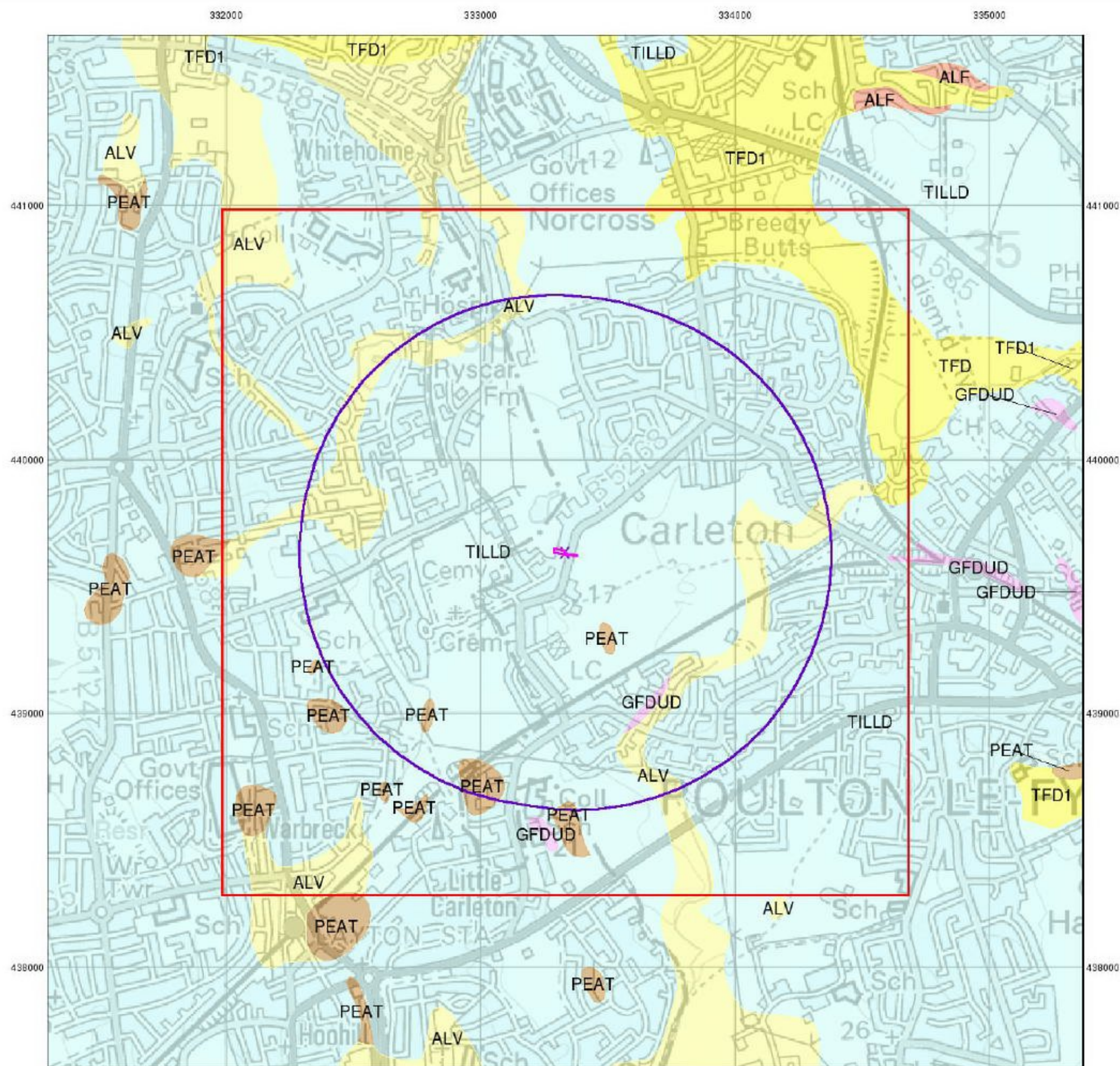
| | |
|--------------------------|----------------|
| Order Number: | 272247102_1_1 |
| Customer Reference: | LKC 20 1381 |
| National Grid Reference: | 333330, 439630 |
| Slice: | A |
| Site Area (Ha): | 0.08 |
| Search Buffer (m): | 1000 |

Site Details:

157a Blackpool Road, Poulton-le-Fylde, FY6 7QH



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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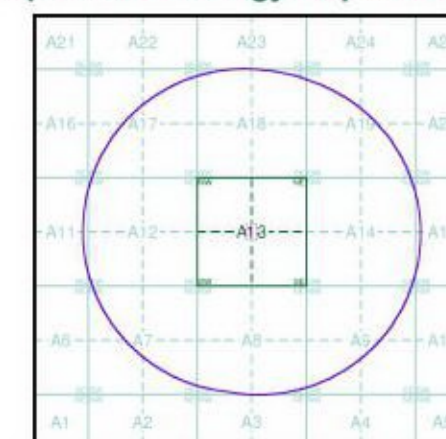
Superficial Geology

Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 1.8 million years from the present.

They rest on older deposits or rocks referred to as Bedrock. This dataset contains Superficial deposits that are of natural origin and 'in place'. Other superficial strata may be held in the Mass Movement dataset where they have been moved, or in the Artificial Ground dataset where they are of man-made origin.

Most of these Superficial deposits are unconsolidated sediments such as gravel, sand, silt and clay, and onshore they form relatively thin, often discontinuous patches or larger spreads.

Superficial Geology Map - Slice A



Order Details:

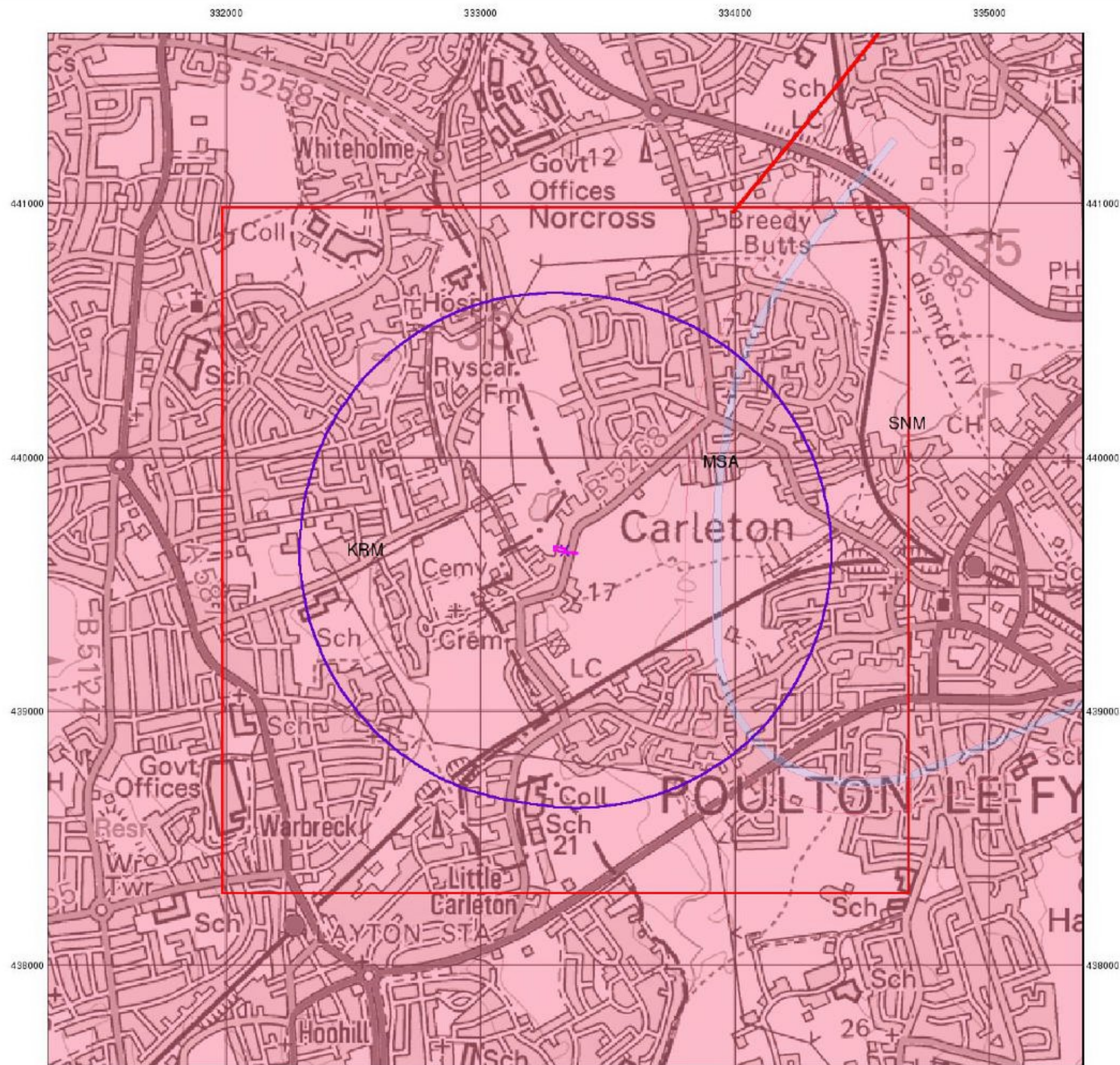
Order Number: 272247102_1_1
 Customer Reference: LKC 20 1381
 National Grid Reference: 333330, 439630
 Slice: A
 Site Area (Ha): 0.08
 Search Buffer (m): 1000

Site Details:

157a Blackpool Road, Poulton-le-Fylde, FY6 7QH



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 Fax: 0844 844 9951
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Bedrock and Faults

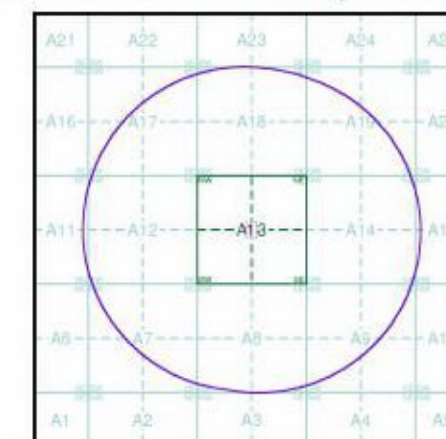
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

The bedrock has formed over vast lengths of geological time ranging from ancient and highly altered rocks of the Proterozoic, some 2500 million years ago, or older, up to the relatively young Pliocene, 1.8 million years ago.

The bedrock geology includes many lithologies, often classified into three types based on origin: igneous, metamorphic and sedimentary.

The BGS Faults and Rock Segments dataset includes geological faults (e.g. normal, thrust), and thin beds mapped as lines (e.g. coal seam, gypsum bed). Some of these are linked to other particular 1:50,000 Geology datasets, for example, coal seams are part of the bedrock sequence, most faults and mineral veins primarily affect the bedrock but cut across the strata and post date its deposition.

Bedrock and Faults Map - Slice A



Order Details:

Order Number: 272247102_1_1
Customer Reference: LKC 20 1381
National Grid Reference: 333330, 439630
Slice: A
Site Area (Ha): 0.08
Search Buffer (m): 1000

Site Details:

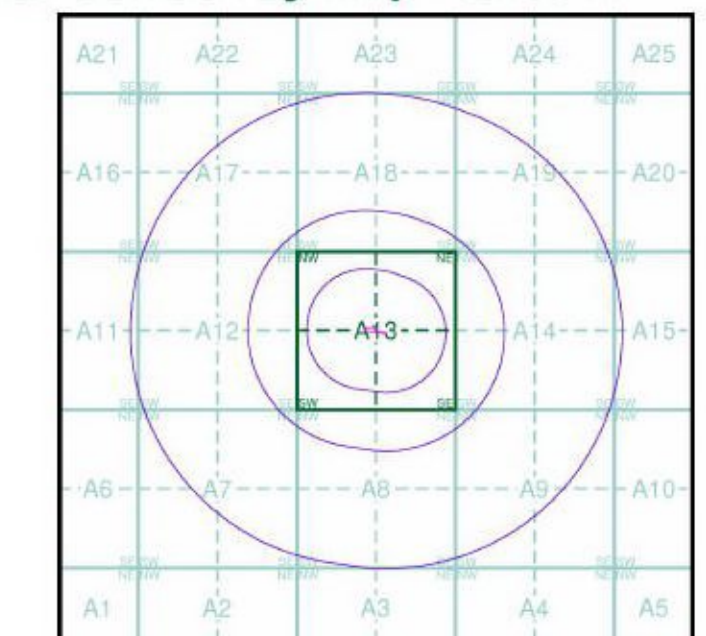
157a Blackpool Road, Poulton-le-Fylde, FY6 7QH



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

- General**
- Specified Site
 - Specified Buffer(s)
 - Bearing Reference Point
 - Map ID
 - Several of Type at Location
- Agency and Hydrological**
- Contaminated Land Register Entry or Notice (Location)
 - Discharge Consent
 - Enforcement or Prohibition Notice
 - Integrated Pollution Control
 - Integrated Pollution Prevention and Control
 - Local Authority Integrated Pollution Prevention and Control
 - Local Authority Pollution Prevention and Control
 - Local Authority Pollution Prevention and Control Enforcement
 - Pollution Incident to Controlled Waters
 - Prosecution Relating to Authorised Processes
 - Prosecution Relating to Controlled Waters
 - Registered Radioactive Substance
 - River Network or Water Feature
 - River Quality Sampling Point
 - Substantiated Pollution Incident Register
 - Water Abstraction
 - Water Industry Act Referral
- Hazardous Substances**
- COMAH Site
 - Explosive Site
 - NIHHS Site
 - Planning Hazardous Substance Consent
 - Planning Hazardous Substance Enforcement
 - BGS Recorded Mineral Site
- Waste**
- BGS Recorded Landfill Site (Location)
 - EA Historic Landfill (Buffered Point)
 - EA Historic Landfill (Polygon)
 - Integrated Pollution Control Registered Waste Site
 - Licensed Waste Management Facility (Landfill Boundary)
 - Licensed Waste Management Facility (Location)
 - Local Authority Recorded Landfill Site (Location)
 - Local Authority Recorded Landfill Site
 - Potentially Infilled Land (Non-water)
 - Potentially Infilled Land (Non-water)
 - Potentially Infilled Land (Water)
 - Potentially Infilled Land (Water)
 - Potentially Infilled Land (Water)
 - Registered Landfill Site (Location)
 - Registered Landfill Site (Point Buffered to 100m)
 - Registered Landfill Site (Point Buffered to 250m)
 - Registered Waste Transfer Site (Location)
 - Registered Waste Transfer Site
 - Registered Waste Treatment or Disposal Site (Location)
 - Registered Waste Treatment or Disposal Site

Site Sensitivity Map - Slice A

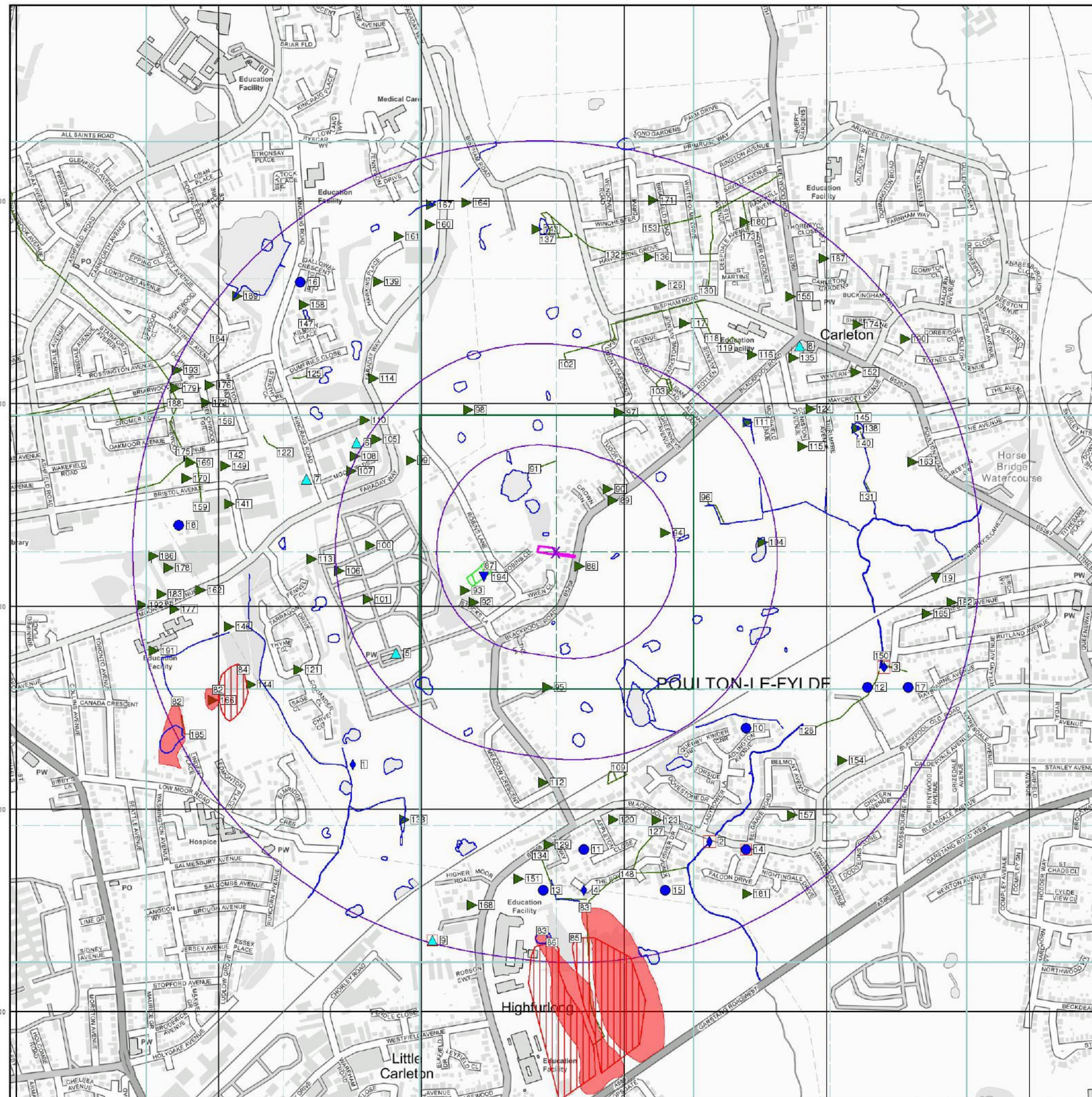


Order Details

Order Number: 272247102_1_1
 Customer Ref: LKC 20 1381
 National Grid Reference: 333330, 439630
 Slice: A
 Site Area (Ha): 0.08
 Search Buffer (m): 1000

Site Details

157a Blackpool Road, Poulton-le-Fylde, FY6 7QH



APPENDIX C

CONSULTEE CORRESPONDENCE

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Flood map for planning

Your reference
FRA 21 1018

Location (easting/northing)
333331/439632

Created
26 Jan 2021 14:04

Your selected location is in flood zone 1, an area with a low probability of flooding.

This means:

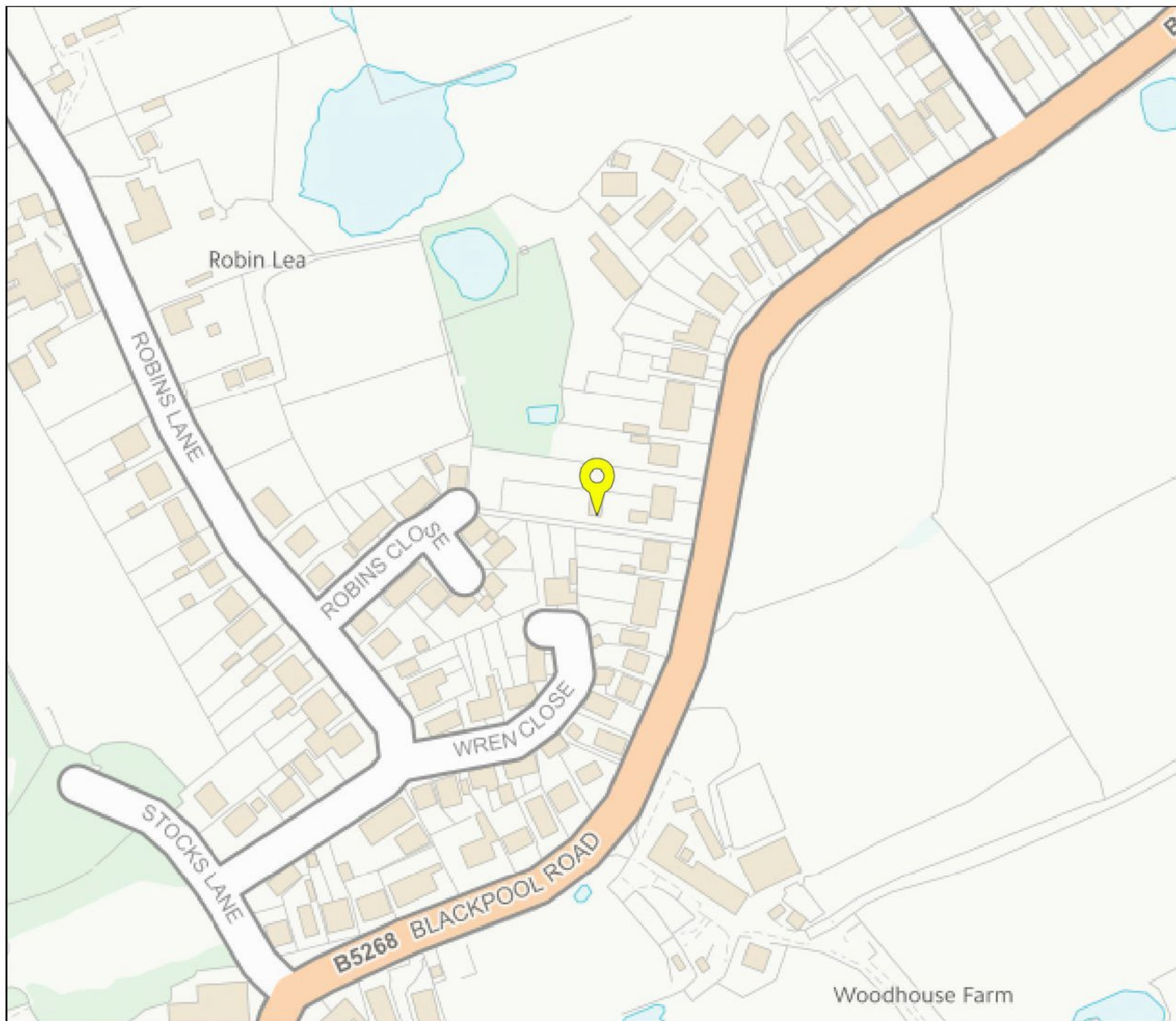
- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

The Open Government Licence sets out the terms and conditions for using government data.
<https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>



Flood map for planning

Your reference

FRA 21 1018

Location (easting/northing)

333331/439632

Scale

1:2500

Created

26 Jan 2021 14:04

-  Selected point
-  Flood zone 3
-  Flood zone 3: areas benefitting from flood defences
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Flood storage area

0 20 40 60m

Anna Mierzejewska

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 09 February 2021 10:58
To: Anna Mierzejewska
Cc: Wastewater Developer Services
Subject: 4200036823 157A Blackpool Road, Poulton-le-Fylde, FY6 7QH
Attachments: Preferred drainage outfall route.pdf

Good Morning Anna,

We would not object to a connection to the 225mm combined sewer. To confirm, in the case of surface water this is providing infiltration is properly discounted in the first instance, as below.

Kind regards,

Tom



Thomas Bethell
Assistant Engineer
Developer Services & Metering
Customer Services
M: 07880 339 195
unitedutilities.com

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From: Anna Mierzejewska <[REDACTED]>
Sent: 09 February 2021 08:56
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Cc: Mark Jones <[REDACTED]>
Subject: RE: PDE Received 29-01-2021 Blackpool Road, Poulton-le-Fylde

Morning Tom,

Thank you for your assessment below.

Would you advise on whether a connection of either foul and surface water flow would alternatively be allowed to drain into the 225mm dia combined sewer as shown on the attached drawing, please.

Many thanks
Anna

From: Anna Mierzejewska <[REDACTED]>
Sent: 29 January 2021 14:15
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>

Anna Mierzejewska

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 08 February 2021 17:53
To: Anna Mierzejewska
Cc: Wastewater Developer Services
Subject: Pre Development Enquiry - 157A Blackpool Road, Poulton-le-Fylde, FY6 7QH - UU ref 4200036823
Attachments: PDE Received 29-01-2021

Good Afternoon Anna,

Pre Development Enquiry - 157A Blackpool Road, Poulton-le-Fylde, FY6 7QH - UU ref 4200036823

We have carried out an assessment of your application which is based on the information provided. This pre-development advice on your drainage strategy will be valid for 12 months. Your drainage strategy will need to be reviewed by other competent authorities as part of the planning process, and we advise that you carry out the necessary site investigations to confirm the viability of your proposals.

If your investigations require access to our public sewer network, we ask that you contact our network engineers with a request for an access certificate via our main contact telephone number 0345 3723223 or refer to the link below:

<https://www.unitedutilities.com/builders-developers/working-near-our-assets/>

Records of historic flooding

I can confirm that we have no current record of sewer flooding on our DG5 register within the vicinity of the proposed development. The DG5 register is a register of properties that have flooded as a result of hydraulic inadequacy of the public sewer network.

Please note that United Utilities Water Limited (Uuw) can only record and check flooding events which are reported to us and we have to comply with our Regulators instructions on the qualification of flooding events to place on the register.

Our response does not include:

- any sewer flooding events caused by blockages or collapses which are the result of third party actions, natural events or other actions over which Uuw has no control and not a facet of sewer capacity; or
- any historical sewer flooding events that have been removed from the register as a result of investment in our infrastructure.

Foul Water

Foul flow from this site will be allowed to drain into the public foul water/combined sewer system at an unrestricted rate and at any convenient point. Our preferred point of connection would be to the 375mm combined sewer in Blackpool Road.

Surface Water

All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80, (Reference ID: 7-080-20150323), of the National Planning Practice Guidance. We also recommend you

prioritise the use of multi-functional sustainable drainage systems for the management of surface water in accordance with national planning policy.

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.

This is outlined as follows, in order of priority:

- 1. into the ground (infiltration);**
- 2. to a surface waterbody;**
- 3. to a surface water sewer or highway drain;**
- 4. to a combined sewer.**

For guidance, The [North West SuDS Pro-Forma](#) provides information on the appropriate evidence required at each stage of the hierarchy, to demonstrate how each level has been discounted.

The Lead Local Flood Authority has responsibility for all surface water drainage concerns and their input to your proposal is critical. You should also consider whether it is necessary to discuss your proposal with the Environment Agency, or Internal Drainage Board (if operating in your area).

The Local Planning Authority are the determining authority for any application for planning permission and the appropriate authority for determining cost viability of a proposed drainage scheme, such assessments are outside of the jurisdiction of United Utilities.

Infiltration

Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible. It is noted from your email that BGS and topography indicate infiltration is likely to be unfeasible, however we would expect on-site investigations to be done before fully discounting this option. For information:

A detailed evidence based feasibility assessment must be carried out in line with Chapter 25 of the CIRIA SuDS Manual 2015 to determine whether infiltration is a suitable method of surface water disposal.

Particular attention must be paid to Ground Water Source Protection Zones to ensure that the risk of pollution to these valuable resources is not compromised. Details can be obtained from the government website:

<https://www.gov.uk/guidance/groundwater-source-protection-zones-spzs#find-groundwater-spzs>

If your site is in a Groundwater Source Protection Zone, you should have regard to the Environment Agency's approach to Groundwater Protection. Information on this is available via the link below:

<https://www.gov.uk/government/publications/groundwater-protection-position-statements>

Please note that such a location could have implications for the principle of your development and the need for additional mitigating measures to protect the groundwater environment and public water supply in the detailed design of your site.

Public Sewer

In accordance with the hierarchy of drainage options within the National Planning Practice Guidance, discharge to ground via infiltration should be discounted prior to consideration of discharging surface water to the public sewer system.

Once evidence is provided as outlined above, United Utilities will consider a connection to the combined sewer network at any convenient point, at a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 5 l/s. Our preferred point of connection would be to the 375mm public combined sewer in Blackpool Road.

As a Water Company, we have no obligation to accept highway drainage into our public sewer network. However, should your proposals include runoff from highways, we would request that consideration is given to SuDS components that deliver source control are incorporated within the design of the scheme to reduce the volume and frequency of discharges of these flows to the public sewer.

Levels

For low-lying sites, (where the ground level of the site or the level of a basement is below the ground level at the point where the drainage connects to the public sewer), care should be taken to ensure that the property is not at increased risk of flooding. If these circumstances exist, we recommend that you contact us to discuss further. It could affect the detailed design of your site and result in the need to incorporate appropriate mitigating measures in your drainage scheme.

Land drainage / Overland flows / track drainage

United Utilities have no obligation, and furthermore we do not accept land drainage, overland flows or track drainage into the public sewerage network under any circumstances

Existing Water Assets Crossing the Site

It is the developer responsibility to identify utilities on-site. Where clean water assets are shown on our records, we recommend that you contact our Water Pre-Development Team, via the following email address:

DeveloperServicesWater@uuplc.co.uk. Further information for this service can be found on our website via the link below:

<https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/water-pre-dev/>

Connection Application

Although we may discuss and agree discharge points and rates in principle, please be aware that you will have to apply for a formal sewer connection. This is so that we can assess the method of construction, Health & Safety requirements and to ultimately inspect the connection when it is made. Details of the application process and the form itself can be obtained from our website by following the link below:

<https://www.unitedutilities.com/builders-developers/larger-developments/wastewater/sewer-connections/>

We recommend that the detailed design should confirm the locations of all utilities in the area and ensure that any proposed drainage solution considers routing and clash checks where required.

If we can be of any further assistance please don't hesitate to contact us further.

Many thanks and kind regards,

Tom



Thomas Bethell
Assistant Engineer
Developer Services & Metering
Customer Services
M: 07880 339 195
[unitedutilities.com](https://www.unitedutilities.com)

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Cc: Mark Jones [REDACTED]

Subject: PDE Received 29-01-2021

Dear All,

LK Consult Ltd. has been commissioned to undertake a SuDS Statement for the 157A Blackpool Road, Poulton-le-Fylde, FY6 7QH, centered at approximate National Grid Reference 333305E, 439645N. The site is 803m² in total and is proposed for residential dwelling. The site runoff currently appears to drain into underground system – there are gullies and a channel drain at the entrance from Blackpool Road.

The area of interest appears to be within Flood Zone 1.

BGS data indicates that the site is underlain by Till, Devensian superficial deposits over Kirkham Mudstone Member - Mudstone bedrock. The site appears to be located on a raised platform and therefore is likely underlain by made ground. Nearest BGS borehole record northwest of the site shows sandy Clay with occasional stones (boulder clay) to over 8mbgl and water level at 2mbgl. There is a number of ponds and waterlogged areas locally which indicates low potential for infiltration in the ground.

There are no indications of any surface watercourses within the close vicinity of the site. There is a 225mm public combined sewer immediately to the south of the site running to the east (attached).

To complete the SuDS Strategy, we would be grateful if you could supply us with the following, if available, for the vicinity of the site:

- Records of any historic flood events and potential sources of flooding from foul and surface water sewers on site and in the area.
- Any restrictions to discharge into the sewers

The site location plan, nearest borehole record, runoff calculations, a preferred drainage outfall route and a Pre-development Enquiry Form are also attached to this email.

We will be in contact with all other relevant authorities to get a more complete understanding of the issues in the area.

Regards,
Anna



Anna Mierzejewska MSc
Environmental Scientist – Flood Risk



I N C R E A S I N G L A N D V A L U E



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Anna Mierzejewska

From: Freedom of Information <CSSGFreedom@lancashire.gov.uk>
Sent: 08 March 2021 17:50
To: Anna Mierzejewska
Subject: FOI Request 995.147 (AG3) - 157A Blackpool Road, Poulton-le-Fylde, FY6 7QH
Attachments: Red boundary plan.pdf

Dear Ms Mierzejewska,

Request for information under the Freedom of Information Act 2000

Further to your request for information, made under the provisions of the above Act, please see below our response.

Request:

LK Consult Ltd. has been commissioned to undertake a SuDS Statement for the 157A Blackpool Road, Poulton-le-Fylde, FY6 7QH, centered at approximate National Grid Reference 333305E, 439645N. The site is 803m² in total and is proposed for residential dwelling.

The site location plan is attached to this email.

To complete our assessment, we would be grateful if you could supply us with the following, in line with FOI Act, for the vicinity of the site:

- Records of any historic flood events and potential sources of flooding from rivers, land drainage, groundwater on site and in the area.*
- Any records of culverted watercourses in the vicinity of the site.*
- Highway drainage restrictions and records.*
- Indications if the site is within the Critical Drainage Area.*
- Policies that may relate to Sustainable Drainage Systems (SuDS).*

Response:

Please note we have used the last 5 years as any more than this will result in being more than 18 hours of work which would be exempt under Section 12 (1) of the Freedom Of Information Act.

- There have been no reports of flooding at this property and the address has not appeared on a Section 19 produced by Lancashire County Council (as Lead Local Flood Authority). We can confirm that 2 drainage issues were reported around the vicinity of the property shown in the red boundary plan. One of the issues was reporting a blocked gully which was cleared and works were carried out by Lancashire County Council Highways. The other issue reported was investigated by Lancashire County Council Highways and the issue was found to be related to a water hydrant valve box so the issue was referred to United Utilities.*

Usually when it is 1 property that is being checked we would advise of the service which the Environment Agency offers where history of a property can be obtained. This can be found via following link for the service <https://www.gov.uk/check-flood-risk>.

- *We are not aware of any records of culverted watercourses in the vicinity of the site and no assets are showing on our current mapping system.*
- *The site shown within the red boundary plan is not within a Critical Drainage Area.*
- *Any policies that may relate to Sustainable Drainage Systems (SuDS) is publicly available on the Wyre Council website.*

If you have any queries regarding any of the above, or you require any additional information, please do not hesitate to contact the team quoting reference number **995.147 (AG3)**.

We trust that our response is to your satisfaction, and your request will now be closed as of this date.

Yours sincerely
Information Governance Team
Lancashire County Council
Web: www.lancashire.gov.uk

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APPENDIX D

CALCULATIONS

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MasterDrain
HY 10.07

| | | | | | | |
|---|--|--|--|---------------|---------|----------|
| <div><div>The LK Group</div><div>www.thelkgroup.com</div></div> | | Eton Business Park, Eton Hill Road, Radcliffe M26 2ZS Tel: 0161 763 7200 email: m.jones@thelkgroup.com | | Job No. | | |
| | | | | Sheet no. 1 | | |
| | | | | Date 29/01/21 | | |
| Project Greenfield runoff | | | | By | Checked | Reviewed |
| Title IoH 124 Runoff calcs for Blackpool Rd, Poulton | | | | | | |

Hydrological Data:-

FSR Hydrology:-

| | | | |
|-------------------|-------------------------|-------------------|-------------------|
| Location | = Blackpool Rd, Poulton | Grid reference | = SD8875 |
| M5-60 (mm) | = 18.2 | r | = 0.2 |
| Soil runoff | = 0.45 | SAAR (mm/yr) | = 900 |
| WRAP | = 4 | Area | = England & Wales |
| Hydrological area | = 10 | Hydrological zone | = 3 |

Soil classification for WRAP type 4

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Design data:-

Area = 0.0008 Km² - 0.08 Ha - 803 m²

Calculation method:-

Runoff is calculated from:-

$$Q_{\text{BAR(rural)}} = 0.00108 \text{ AREA}^{0.89} \cdot \text{SAAR}^{1.17} \cdot \text{SOIL}^{2.17}$$

where

AREA = Site area in Km²
 SAAR = Standard Average Annual Rainfall (mm/yr)
 SOIL = Soil value derived from Winter Rainfall Acceptance Potential
 Q_{BAR(rural)} = Runoff (cumecs)

Q_{BAR(rural)} is then multiplied by a growth factor - GC(T) - for different storm return periods derived from EA publication W5-074/A.

Calculated data:-

For areas less than 50Ha, a modified calculation which multiplies the 50Ha runoff value by the ratio of the site area to 50Ha is used
Reducing factor used for these calculations is 0.002

Mean Annual Peak Flow $Q_{\text{BAR(rural)}} = 0.47 \text{ l/s}$



MasterDrain
HY 10.07

The LK Group

www.thelkgroup.com

Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

| | | |
|----------------------|---------|----------|
| Job No. | | |
| Sheet no. 2 | | |
| Date 29/01/21 | | |
| By | Checked | Reviewed |

| | |
|---------|---|
| Project | Greenfield runoff |
| Title | IoH 124 Runoff calcs for Blackpool Rd, Poulton |

Values for $Q_{BAR(rural)}$

| Ret. per. | m ³ /hr | l/s | l/s/ha | Ret. per. | m ³ /hr | l/s | l/s/ha |
|-----------|--------------------|-------|--------|-------------|--------------------|-------|--------|
| 1yr | 1.443 | 0.401 | 5.011 | 100yr+20% | 4.278 | 1.188 | 14.855 |
| 2yr | 1.579 | 0.439 | 5.482 | 100yr+30% | 4.635 | 1.287 | 16.093 |
| 5yr | 2.054 | 0.571 | 7.133 | 100yr+40% | 4.991 | 1.386 | 17.331 |
| 10yr | 2.343 | 0.651 | 8.135 | 200yr | 4.075 | 1.132 | 14.148 |
| 30yr | 2.852 | 0.792 | 9.903 | 200yr + 30% | 5.297 | 1.471 | 18.392 |
| 50yr | 3.141 | 0.872 | 10.905 | 500yr | 4.635 | 1.287 | 16.093 |
| 100yr | 3.565 | 0.990 | 12.379 | 1000yr | 5.161 | 1.434 | 17.920 |

Growth factors -

| 1yr | 2yr | 5yr | 10yr | 30yr | 50yr | 100yr | 200yr | 500yr | 1000yr |
|------|------|------|------|------|------|-------|-------|-------|--------|
| 0.85 | 0.93 | 1.21 | 1.38 | 1.68 | 1.85 | 2.10 | 2.40 | 2.73 | 3.04 |

The above is based on the Institute of Hydrology Report 124
to which you are referred for further details (see Sect 7).
Note that the 200 and above year growth curves were taken from W5-074.



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| By | Checked | Reviewed |

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|---------|---|
| Project | 1year |
| Title | Peak runoff calculations for Blackpool Rd, Poulton |

Area data:-

FSR data

M5-60 = 18.2
Soil index = 0.45
WRAP value = 4

r = 0.20
SAAR = 900
Nat grid = SD8875

Site data:-

Ret. period (yrs) = 1
Time of entry = 10.00
Impervious area drained = 803 m²
Site slope = Mild <2% (1:50)
Length of overland flow = 0.00

ToC = 10.0 mins
Overland flow time = 0.0 mins
Pervious area drained = 0 m²
Soil type = Clay
Climate change factor = 0.0 %

Calculated data:-

Calculated runoff factor = 81.0%
Rainfall rate = 32.7 mm/Hr

UCWI = 93.9
Runoff rate (gross) = 5.9 l/s

Methods

Runoff factor (RF) = 81.0, calculated from:-

$$\text{Runoff factor} = (0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$$

where

PIMP = Impervious Area * 100 / (Impervious Area + Pervious Area)

UCWI = Calculated value for Wetness Index

Calculations produced by MasterDrain Surface Water design program



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| Project | Qbar |
| Title | Peak runoff calculations for Blackpool Rd, Poulton |

Area data:-

FSR data

M5-60 = 18.2
Soil index = 0.45
WRAP value = 4

r = 0.20
SAAR = 900
Nat grid = SD8875

Site data:-

Ret. period (yrs) = 2.33
Time of entry = 7.00
Impervious area drained = 803 m²
Site slope = Mild <2% (1:50)
Length of overland flow = 0.00

ToC = 7.0 mins
Overland flow time = 0.0 mins
Pervious area drained = 0 m²
Soil type = Clay
Climate change factor = 0.0 %

Calculated data:-

Calculated runoff factor = 81.0%
Rainfall rate = 44.5 mm/Hr

UCWI = 93.9
Runoff rate (gross) = 8.0 l/s

Methods

Runoff factor (RF) = 81.0, calculated from:-

$$\text{Runoff factor} = (0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$$

where

PIMP = Impervious Area * 100 / (Impervious Area + Pervious Area)

UCWI = Calculated value for Wetness Index

Calculations produced by MasterDrain Surface Water design program



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| Job No. | | |
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|---------|---|
| Project | 30year |
| Title | Peak runoff calculations for Blackpool Rd, Poulton |

Area data:-

FSR data

M5-60 = 18.2

Soil index = 0.45

WRAP value = 4

r = 0.20

SAAR = 900

Nat grid = SD8875

Site data:-

Ret. period (yrs) = 30

Time of entry = 6.00

Impervious area drained = 803 m²

Site slope = Mild <2% (1:50)

Length of overland flow = 0.00

ToC = 6.0 mins

Overland flow time = 0.0 mins

Pervious area drained = 0 m²

Soil type = Clay

Climate change factor = 0.0 %

Calculated data:-

Calculated runoff factor = 81.0%

Rainfall rate = 76.2 mm/Hr

UCWI = 93.9

Runoff rate (gross) = 13.8 l/s

Methods

Runoff factor (RF) = 81.0, calculated from:-

Runoff factor = $(0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$

where

PIMP = $\text{Impervious Area} \times 100 / (\text{Impervious Area} + \text{Pervious Area})$

UCWI = Calculated value for Wetness Index

Calculations produced by MasterDrain Surface Water design program



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|---------|---|
| Project | 100year |
| Title | Peak runoff calculations for Blackpool Rd, Poulton |

Area data:-

FSR data

M5-60 = 18.2

Soil index = 0.45

WRAP value = 4

r = 0.20

SAAR = 900

Nat grid = SD8875

Site data:-

Ret. period (yrs) = 100

Time of entry = 6.00

Impervious area drained = 803 m²

Site slope = Mild <2% (1:50)

Length of overland flow = 0.00

ToC = 6.0 mins

Overland flow time = 0.0 mins

Pervious area drained = 0 m²

Soil type = Clay

Climate change factor = 0.0 %

Calculated data:-

Calculated runoff factor = 81.0%

Rainfall rate = 95.5 mm/Hr

UCWI = 93.9

Runoff rate (gross) = 17.3 l/s

Methods

Runoff factor (RF) = 81.0, calculated from:-

Runoff factor = $(0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$

where

PIMP = $\text{Impervious Area} \times 100 / (\text{Impervious Area} + \text{Pervious Area})$

UCWI = Calculated value for Wetness Index

Calculations produced by MasterDrain Surface Water design program

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| Date 26/03/21 | | |
| By | Checked | Reviewed |

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| Project 30yr | |
| Title Peak flow storage calcs for Blackpool Rd, Poulton | |

Data:-

FSR Hydrology:-

Location = Blackpool Rd, Poulton
M5-60 (mm) = 18.2
Soil index = 0.45
Return period = 30
UCWI = 96.2

Grid reference = SD8875
r = 0.20
SAAR (mm/yr) = 900
WRAP = 4
Climate change = 0

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Runoff factor (RF) = 81.0, calculated from:-

$$\text{Runoff factor} = (0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$$

where

PIMP = Impervious Area * 100 / (Impervious Area + Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 803 m²
Total area (TA) = 803 m²
Allowed discharge rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 0 m²
Equiv area = 650 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 0

Calculated data:-

Time to max = 18.0 mins
Rainfall at max = 50.30 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 4.4 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 10.00 mm/hr

Calculated storage volume = 0.0 m³
Allowed discharge rate = 5.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

| Diam | Len | Diam | Len | Ovoid | Len | Box culvert | Len |
|------|-------|------|-----|------------|------|-------------|------|
| 100 | 562.2 | 1125 | 4.4 | 400 x 600 | 24.5 | 500 x 500 | 17.7 |
| 150 | 249.9 | 1200 | 3.9 | 600 x 900 | 10.7 | 500 x 750 | 11.8 |
| 225 | 111.0 | 1275 | 3.5 | 800 x 1200 | 6.0 | 500 x 1000 | 8.8 |
| 300 | 62.5 | 1350 | 3.1 | | | 750 x 1000 | 5.9 |
| 375 | 40.0 | 1425 | 2.8 | | | 750 x 1200 | 4.9 |
| 450 | 27.8 | 1500 | 2.5 | | | 750 x 1500 | 3.9 |
| 525 | 20.4 | 1575 | 2.3 | | | 1000 x 1000 | 4.4 |
| 600 | 15.6 | 1650 | 2.1 | | | 1000 x 1200 | 3.7 |
| 675 | 12.3 | 1725 | 1.9 | | | 1000 x 1500 | 2.9 |
| 750 | 10.0 | 1800 | 1.7 | | | 1000 x 1800 | 2.5 |
| 825 | 8.3 | 1875 | 1.6 | | | 1000 x 2000 | 2.2 |
| 900 | 6.9 | 1950 | 1.5 | | | 1500 x 1500 | 2.0 |
| 975 | 5.9 | 2025 | 1.4 | | | 1500 x 1800 | 1.6 |
| 1050 | 5.1 | 2100 | 1.3 | | | 1500 x 2000 | 1.5 |



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| Project 30yr | |
| Title Peak flow storage calcs for Blackpool Rd, Poulton | |

| Time (mins) | Rain mm/hr | Inflow (m3) | Outflow (m3) | Balance (m3) |
|----------------|---------------|----------------|-----------------|-----------------|
| 10 | 64.0 | 6.907 | 3.000 | 3.907 |
| 20 | 48.0 | 10.404 | 6.000 | 4.404 |
| 30 | 40.0 | 12.913 | 9.000 | 3.913 |
| 40 | 34.0 | 14.944 | 12.000 | 2.944 |
| 50 | 31.0 | 16.674 | 15.000 | 1.674 |
| 60 | 28.0 | 18.193 | 18.000 | 0.193 |
| 70 | 26.0 | 19.553 | 21.000 | 0.000 |
| 80 | 24.0 | 20.786 | 24.000 | 0.000 |
| 90 | 22.0 | 21.916 | 27.000 | 0.000 |
| 100 | 21.0 | 22.959 | 30.000 | 0.000 |
| 110 | 20.0 | 23.928 | 33.000 | 0.000 |
| 120 | 19.0 | 24.832 | 36.000 | 0.000 |
| 130 | 18.0 | 25.679 | 39.000 | 0.000 |
| 140 | 17.0 | 26.476 | 42.000 | 0.000 |
| 150 | 17.0 | 27.227 | 45.000 | 0.000 |
| 160 | 16.0 | 27.936 | 48.000 | 0.000 |
| 170 | 16.0 | 28.607 | 51.000 | 0.000 |
| 180 | 15.0 | 29.244 | 54.000 | 0.000 |
| 190 | 15.0 | 29.874 | 57.000 | 0.000 |
| 200 | 14.0 | 30.488 | 60.000 | 0.000 |
| 210 | 14.0 | 31.082 | 63.000 | 0.000 |
| 220 | 13.0 | 31.658 | 66.000 | 0.000 |
| 230 | 13.0 | 32.217 | 69.000 | 0.000 |
| 240 | 13.0 | 32.760 | 72.000 | 0.000 |
| 250 | 12.0 | 33.288 | 75.000 | 0.000 |
| 260 | 12.0 | 33.802 | 78.000 | 0.000 |
| 270 | 12.0 | 34.303 | 81.000 | 0.000 |
| 280 | 11.0 | 34.792 | 84.000 | 0.000 |
| 290 | 11.0 | 35.269 | 87.000 | 0.000 |
| 300 | 11.0 | 35.735 | 90.000 | 0.000 |
| 310 | 11.0 | 36.191 | 93.000 | 0.000 |
| 320 | 11.0 | 36.638 | 96.000 | 0.000 |
| 330 | 10.0 | 37.075 | 99.000 | 0.000 |
| 340 | 10.0 | 37.503 | 102.000 | 0.000 |
| 350 | 10.0 | 37.923 | 105.000 | 0.000 |
| 360 | 10.0 | 38.335 | 108.000 | 0.000 |
| 370 | 10.0 | 38.740 | 111.000 | 0.000 |
| 380 | 10.0 | 39.137 | 114.000 | 0.000 |
| 390 | 9.0 | 39.527 | 117.000 | 0.000 |
| 400 | 9.0 | 39.910 | 120.000 | 0.000 |
| 410 | 9.0 | 40.287 | 123.000 | 0.000 |
| 420 | 9.0 | 40.658 | 126.000 | 0.000 |
| 430 | 9.0 | 41.023 | 129.000 | 0.000 |
| 440 | 9.0 | 41.382 | 132.000 | 0.000 |
| 450 | 9.0 | 41.736 | 135.000 | 0.000 |
| 460 | 8.0 | 42.085 | 138.000 | 0.000 |
| 470 | 8.0 | 42.428 | 141.000 | 0.000 |
| 480 | 8.0 | 42.766 | 144.000 | 0.000 |
| 490 | 8.0 | 43.100 | 147.000 | 0.000 |
| 500 | 8.0 | 43.429 | 150.000 | 0.000 |
| 510 | 8.0 | 43.754 | 153.000 | 0.000 |
| 520 | 8.0 | 44.075 | 156.000 | 0.000 |
| 530 | 8.0 | 44.391 | 159.000 | 0.000 |
| 540 | 8.0 | 44.703 | 162.000 | 0.000 |
| 550 | 8.0 | 45.012 | 165.000 | 0.000 |
| 560 | 7.0 | 45.316 | 168.000 | 0.000 |
| 570 | 7.0 | 45.617 | 171.000 | 0.000 |
| 580 | 7.0 | 45.914 | 174.000 | 0.000 |
| 590 | 7.0 | 46.208 | 177.000 | 0.000 |
| 600 | 7.0 | 46.499 | 180.000 | 0.000 |

Storage volume (m³) = 4.4 m³



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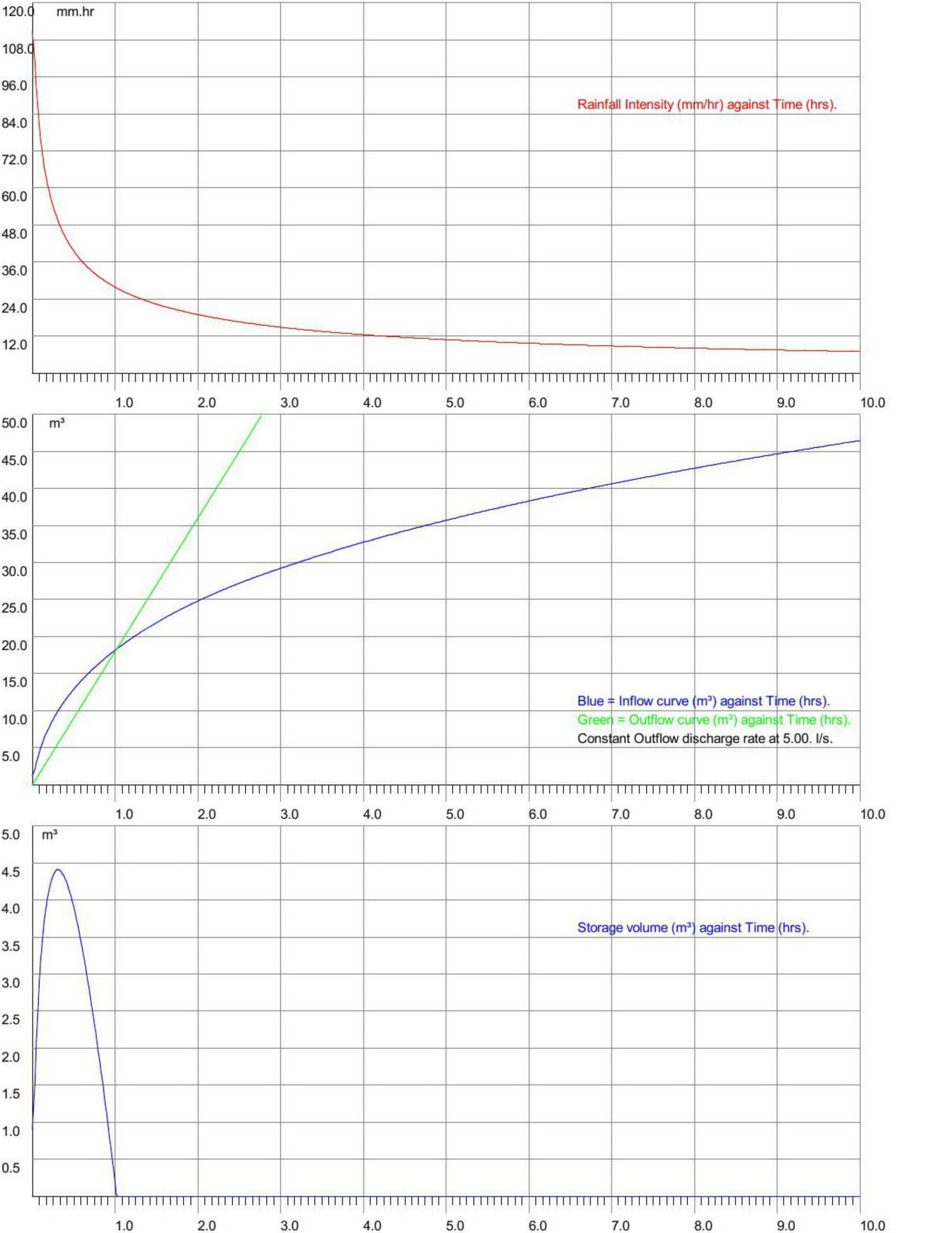
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| Project 30yr | Title Peak flow storage calcs for Blackpool Rd, Poulton |
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Explanatory notes for Peak Flow Storage

- 1) This system uses the rainfall intensity/ duration curve calculated using either the Wallingford or FEH method as selected.
- 2) The balance is calculated from the inflow minus the outflow.
- 3) The storage volume is the maximum value of the balance curve.
- 4) This method was described by Davis (1963) - see Butler & Davies, 2nd edition, p294
- 5) References to 'storm duration' relate only to the hydrograph method (qv).
- 6) There are always 600 steps in the calculation process, thus a 'run' time of 10 hours will be sampled every minute,

Explanatory notes for Hydrograph Storage

- 1) The user has the choice of Summer or Winter curves
- 2) The mean intensity varies with the duration of the storm curve
- 3) There are always 120 steps in the calculation process, irrespective of storm duration.
- 4) The balance is calculated from the inflow minus the outflow.
- 5) The storage volume is the sum of the balance values for each step.
- 6) Varying durations should be tried to find the maximum storage value - this can be narrowed down very closely.

*Modelling using the flow characteristics of the restrictor is available using Vortex Control modelling function. Please be aware that this function needs the full design data file to function.

Why do the two methods give different results?

The rainfall characteristics for each method are very different.

The Peak flow (using the Intensity/Duration/Frequency curve) does not model the actual rainfall. This curve is joined points which represent the mean intensity of a storm at a given duration i.e. a value of 19.5 mm/hr for a 60 minute storm indicates that over the sixty minute period, the mean intensity was 19.5 mm/hr. The calculation method samples the IDF curve for a given location and frequency (Return Period) and calculates the storage for that rate and duration less the outflow volume. The maximum value is displayed as the 'worst case' storage.

The hydrograph method uses a standard curve for either Winter or Summer storms. Traditionally these are symmetrical about the central peak. UK rainfall does not fit into this convenient curve, so the calculations are dealing with a stylised set of data. The mean intensity for the storm is calculated from the IDF curve and applied to the curve data, calculating the storage for that step less the outflow volume. The final storage volume is the sum of the storage for all the steps.

It can be seen that these two methods are very different, and the user may have the choice of which result to use. This is not an exact science, though is often treated as such by those that do not understand the principles of the calculations.



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| Project | 100yr plus 20% climate change |
| Title | Peak flow storage calcs for Blackpool Rd, Poulton |

Data:-

FSR Hydrology:-

Location = Blackpool Rd, Poulton
M5-60 (mm) = 18.2
Soil index = 0.45
Return period = 100
UCWI = 96.2

Grid reference = SD8875
r = 0.20
SAAR (mm/yr) = 900
WRAP = 4
Climate change = 20

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Runoff factor (RF) = 81.0, calculated from:-

$$\text{Runoff factor} = (0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$$

where

PIMP = Impervious Area * 100 / (Impervious Area + Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 803 m²
Total area (TA) = 803 m²
Allowed discharge rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 0 m²
Equiv area = 650 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 20

Calculated data:-

Time to max = 40.0 mins
Rainfall at max = 54.01 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 11.4 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 15.00 mm/hr

Calculated storage volume = 0.0 m³
Allowed discharge rate = 5.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

| Diam | Len | Diam | Len | Ovoid | Len | Box culvert | Len |
|------|--------|------|------|------------|------|-------------|------|
| 100 | 1454.4 | 1125 | 11.5 | 400 x 600 | 63.4 | 500 x 500 | 45.7 |
| 150 | 646.4 | 1200 | 10.1 | 600 x 900 | 27.6 | 500 x 750 | 30.5 |
| 225 | 287.3 | 1275 | 8.9 | 800 x 1200 | 15.5 | 500 x 1000 | 22.8 |
| 300 | 161.6 | 1350 | 8.0 | | | 750 x 1000 | 15.2 |
| 375 | 103.4 | 1425 | 7.2 | | | 750 x 1200 | 12.7 |
| 450 | 71.8 | 1500 | 6.5 | | | 750 x 1500 | 10.2 |
| 525 | 52.8 | 1575 | 5.9 | | | 1000 x 1000 | 11.4 |
| 600 | 40.4 | 1650 | 5.3 | | | 1000 x 1200 | 9.5 |
| 675 | 31.9 | 1725 | 4.9 | | | 1000 x 1500 | 7.6 |
| 750 | 25.9 | 1800 | 4.5 | | | 1000 x 1800 | 6.3 |
| 825 | 21.4 | 1875 | 4.1 | | | 1000 x 2000 | 5.7 |
| 900 | 18.0 | 1950 | 3.8 | | | 1500 x 1500 | 5.1 |
| 975 | 15.3 | 2025 | 3.5 | | | 1500 x 1800 | 4.2 |
| 1050 | 13.2 | 2100 | 3.3 | | | 1500 x 2000 | 3.8 |



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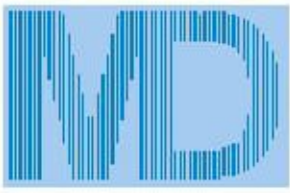
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| Project | 100yr plus 20% climate change |
| Title | Peak flow storage calcs for Blackpool Rd, Poulton |

| Time (mins) | Rain mm/hr | Inflow (m3) | Outflow (m3) | Balance (m3) |
|----------------|---------------|----------------|-----------------|-----------------|
| 10 | 97.0 | 10.499 | 3.000 | 7.499 |
| 20 | 74.0 | 16.104 | 6.000 | 10.104 |
| 30 | 62.0 | 20.141 | 9.000 | 11.141 |
| 40 | 54.0 | 23.421 | 12.000 | 11.421 |
| 50 | 48.0 | 26.214 | 15.000 | 11.214 |
| 60 | 44.0 | 28.660 | 18.000 | 10.660 |
| 70 | 41.0 | 30.839 | 21.000 | 9.839 |
| 80 | 38.0 | 32.805 | 24.000 | 8.805 |
| 90 | 35.0 | 34.593 | 27.000 | 7.593 |
| 100 | 33.0 | 36.232 | 30.000 | 6.232 |
| 110 | 32.0 | 37.741 | 33.000 | 4.741 |
| 120 | 30.0 | 39.135 | 36.000 | 3.135 |
| 130 | 29.0 | 40.429 | 39.000 | 1.429 |
| 140 | 27.0 | 41.633 | 42.000 | 0.000 |
| 150 | 26.0 | 42.754 | 45.000 | 0.000 |
| 160 | 25.0 | 43.801 | 48.000 | 0.000 |
| 170 | 24.0 | 44.779 | 51.000 | 0.000 |
| 180 | 23.0 | 45.695 | 54.000 | 0.000 |
| 190 | 23.0 | 46.614 | 57.000 | 0.000 |
| 200 | 22.0 | 47.517 | 60.000 | 0.000 |
| 210 | 21.0 | 48.389 | 63.000 | 0.000 |
| 220 | 21.0 | 49.231 | 66.000 | 0.000 |
| 230 | 20.0 | 50.047 | 69.000 | 0.000 |
| 240 | 20.0 | 50.837 | 72.000 | 0.000 |
| 250 | 19.0 | 51.604 | 75.000 | 0.000 |
| 260 | 19.0 | 52.350 | 78.000 | 0.000 |
| 270 | 18.0 | 53.075 | 81.000 | 0.000 |
| 280 | 18.0 | 53.781 | 84.000 | 0.000 |
| 290 | 17.0 | 54.469 | 87.000 | 0.000 |
| 300 | 17.0 | 55.140 | 90.000 | 0.000 |
| 310 | 17.0 | 55.795 | 93.000 | 0.000 |
| 320 | 16.0 | 56.435 | 96.000 | 0.000 |
| 330 | 16.0 | 57.061 | 99.000 | 0.000 |
| 340 | 16.0 | 57.672 | 102.000 | 0.000 |
| 350 | 15.0 | 58.271 | 105.000 | 0.000 |
| 360 | 15.0 | 58.858 | 108.000 | 0.000 |
| 370 | 15.0 | 59.433 | 111.000 | 0.000 |
| 380 | 15.0 | 59.996 | 114.000 | 0.000 |
| 390 | 14.0 | 60.549 | 117.000 | 0.000 |
| 400 | 14.0 | 61.091 | 120.000 | 0.000 |
| 410 | 14.0 | 61.624 | 123.000 | 0.000 |
| 420 | 14.0 | 62.147 | 126.000 | 0.000 |
| 430 | 13.0 | 62.661 | 129.000 | 0.000 |
| 440 | 13.0 | 63.166 | 132.000 | 0.000 |
| 450 | 13.0 | 63.663 | 135.000 | 0.000 |
| 460 | 13.0 | 64.151 | 138.000 | 0.000 |
| 470 | 13.0 | 64.632 | 141.000 | 0.000 |
| 480 | 13.0 | 65.106 | 144.000 | 0.000 |
| 490 | 12.0 | 65.572 | 147.000 | 0.000 |
| 500 | 12.0 | 66.031 | 150.000 | 0.000 |
| 510 | 12.0 | 66.483 | 153.000 | 0.000 |
| 520 | 12.0 | 66.929 | 156.000 | 0.000 |
| 530 | 12.0 | 67.368 | 159.000 | 0.000 |
| 540 | 12.0 | 67.801 | 162.000 | 0.000 |
| 550 | 11.0 | 68.229 | 165.000 | 0.000 |
| 560 | 11.0 | 68.650 | 168.000 | 0.000 |
| 570 | 11.0 | 69.066 | 171.000 | 0.000 |
| 580 | 11.0 | 69.477 | 174.000 | 0.000 |
| 590 | 11.0 | 69.882 | 177.000 | 0.000 |
| 600 | 11.0 | 70.282 | 180.000 | 0.000 |

Storage volume (m³) = 11.4 m³



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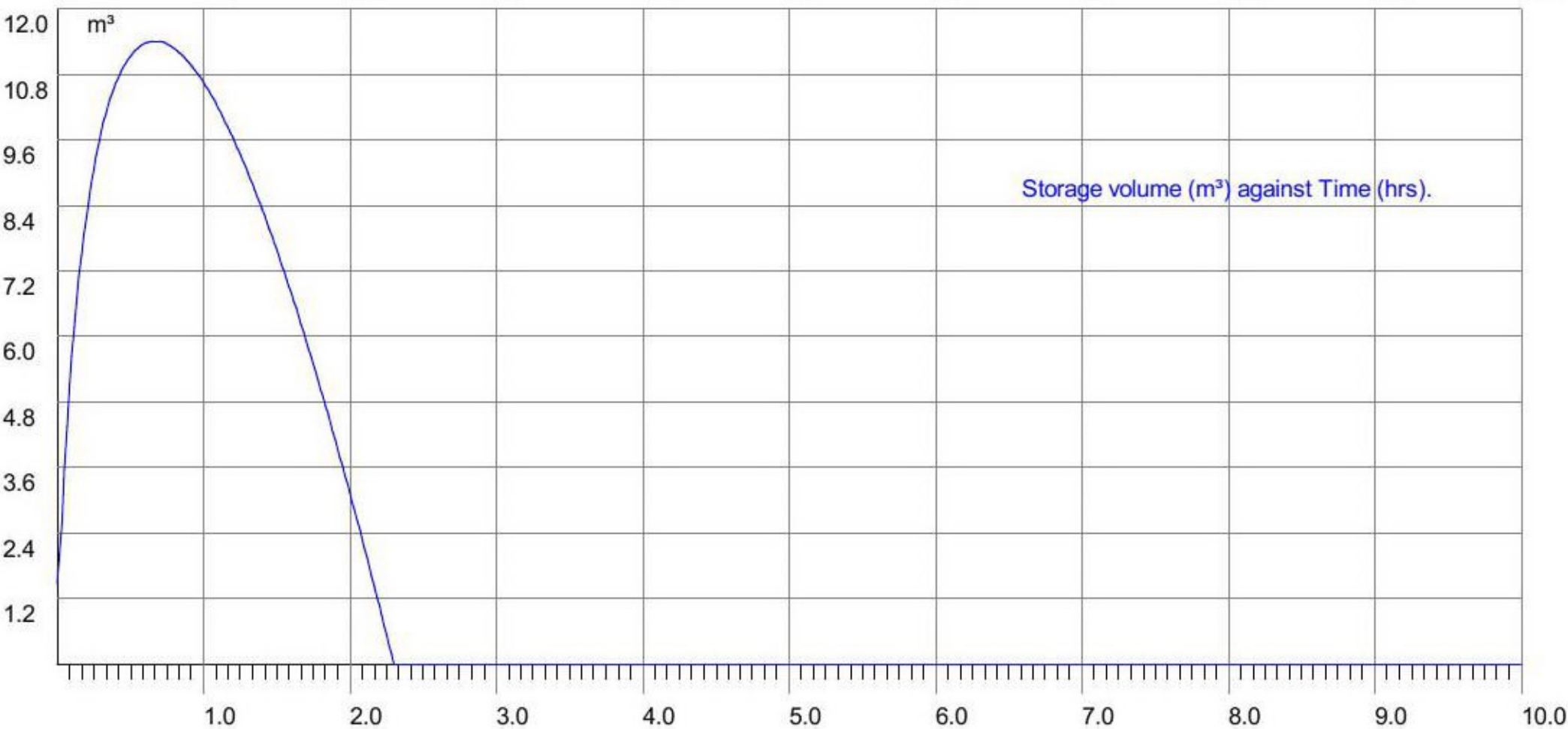
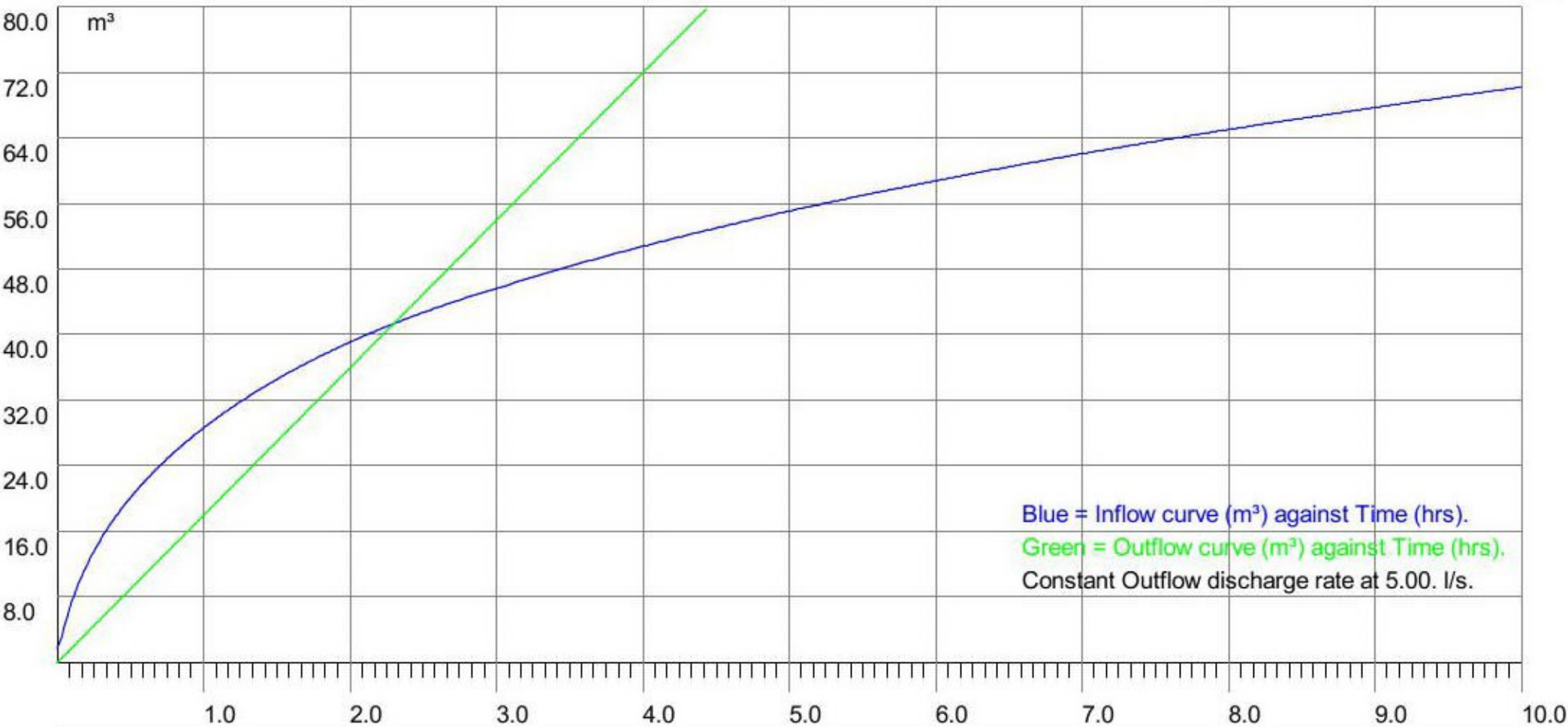
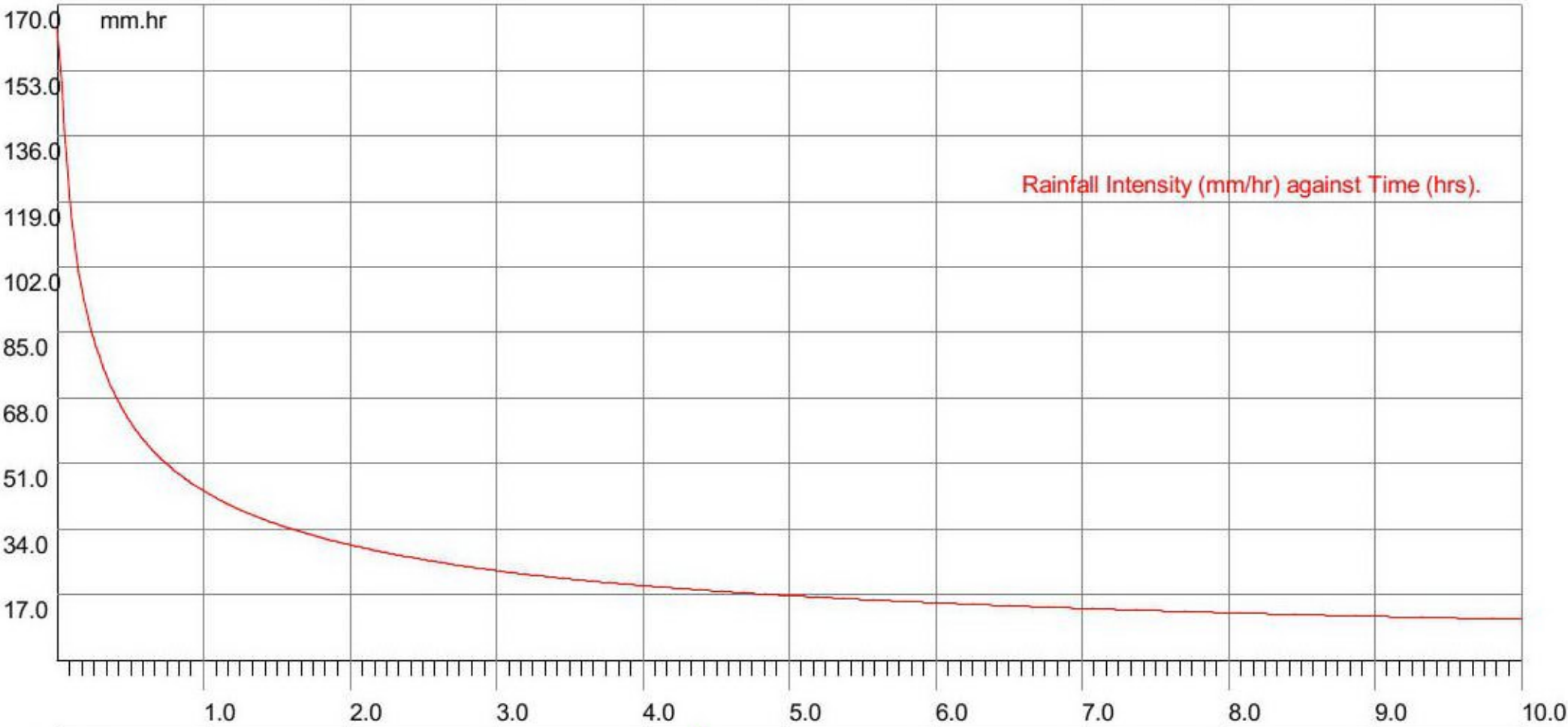
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| | | |
|----------------------|---------|----------|
| Job No. | | |
| Sheet no. 3 | | |
| Date 26/03/21 | | |
| By | Checked | Reviewed |

| | |
|---------|--|
| Project | 100yr plus 20% climate change |
| Title | Peak flow storage calcs for Blackpool Rd, Poulton |





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| Job No. | | |
| Sheet no. 1 | | |
| Date 26/03/21 | | |
| By | Checked | Reviewed |

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|---------|--|
| Project | 100yr plus 40% climate change |
| Title | Peak flow storage calcs for Blackpool Rd, Poulton |

Data:-

FSR Hydrology:-

Location = Blackpool Rd, Poulton
M5-60 (mm) = 18.2
Soil index = 0.45
Return period = 100
UCWI = 96.2

Grid reference = SD8875
r = 0.20
SAAR (mm/yr) = 900
WRAP = 4
Climate change = 40

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Runoff factor (RF) = 81.0, calculated from:-

$$\text{Runoff factor} = (0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$$

where

PIMP = Impervious Area * 100 / (Impervious Area + Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 803 m²
Total area (TA) = 803 m²
Allowed discharge rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 0 m²
Equiv area = 650 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 40

Calculated data:-

Time to max = 51.0 mins
Rainfall at max = 55.86 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 15.6 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 17.00 mm/hr

Calculated storage volume = 0.0 m³
Allowed discharge rate = 5.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

| Diam | Len | Diam | Len | Ovoid | Len | Box culvert | Len |
|------|--------|------|------|------------|------|-------------|------|
| 100 | 1984.7 | 1125 | 15.7 | 400 x 600 | 86.6 | 500 x 500 | 62.3 |
| 150 | 882.1 | 1200 | 13.8 | 600 x 900 | 37.7 | 500 x 750 | 41.6 |
| 225 | 392.0 | 1275 | 12.2 | 800 x 1200 | 21.2 | 500 x 1000 | 31.2 |
| 300 | 220.5 | 1350 | 10.9 | | | 750 x 1000 | 20.8 |
| 375 | 141.1 | 1425 | 9.8 | | | 750 x 1200 | 17.3 |
| 450 | 98.0 | 1500 | 8.8 | | | 750 x 1500 | 13.9 |
| 525 | 72.0 | 1575 | 8.0 | | | 1000 x 1000 | 15.6 |
| 600 | 55.1 | 1650 | 7.3 | | | 1000 x 1200 | 13.0 |
| 675 | 43.6 | 1725 | 6.7 | | | 1000 x 1500 | 10.4 |
| 750 | 35.3 | 1800 | 6.1 | | | 1000 x 1800 | 8.7 |
| 825 | 29.2 | 1875 | 5.6 | | | 1000 x 2000 | 7.8 |
| 900 | 24.5 | 1950 | 5.2 | | | 1500 x 1500 | 6.9 |
| 975 | 20.9 | 2025 | 4.8 | | | 1500 x 1800 | 5.8 |
| 1050 | 18.0 | 2100 | 4.5 | | | 1500 x 2000 | 5.2 |



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Data:-

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| Sheet no. 2 | | |
| Date 26/03/21 | | |
| By | Checked | Reviewed |

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|---------|--|
| Project | 100yr plus 40% climate change |
| Title | Peak flow storage calcs for Blackpool Rd, Poulton |

| Time (mins) | Rain mm/hr | Inflow (m3) | Outflow (m3) | Balance (m3) |
|----------------|---------------|----------------|-----------------|-----------------|
| 10 | 113.0 | 12.249 | 3.000 | 9.249 |
| 20 | 87.0 | 18.788 | 6.000 | 12.788 |
| 30 | 72.0 | 23.498 | 9.000 | 14.498 |
| 40 | 63.0 | 27.324 | 12.000 | 15.324 |
| 50 | 56.0 | 30.584 | 15.000 | 15.584 |
| 60 | 51.0 | 33.437 | 18.000 | 15.437 |
| 70 | 47.0 | 35.979 | 21.000 | 14.979 |
| 80 | 44.0 | 38.272 | 24.000 | 14.272 |
| 90 | 41.0 | 40.359 | 27.000 | 13.359 |
| 100 | 39.0 | 42.271 | 30.000 | 12.271 |
| 110 | 37.0 | 44.031 | 33.000 | 11.031 |
| 120 | 35.0 | 45.658 | 36.000 | 9.658 |
| 130 | 33.0 | 47.168 | 39.000 | 8.168 |
| 140 | 32.0 | 48.571 | 42.000 | 6.571 |
| 150 | 31.0 | 49.880 | 45.000 | 4.880 |
| 160 | 29.0 | 51.101 | 48.000 | 3.101 |
| 170 | 28.0 | 52.242 | 51.000 | 1.242 |
| 180 | 27.0 | 53.310 | 54.000 | 0.000 |
| 190 | 26.0 | 54.383 | 57.000 | 0.000 |
| 200 | 26.0 | 55.437 | 60.000 | 0.000 |
| 210 | 25.0 | 56.454 | 63.000 | 0.000 |
| 220 | 24.0 | 57.437 | 66.000 | 0.000 |
| 230 | 23.0 | 58.388 | 69.000 | 0.000 |
| 240 | 23.0 | 59.310 | 72.000 | 0.000 |
| 250 | 22.0 | 60.205 | 75.000 | 0.000 |
| 260 | 22.0 | 61.075 | 78.000 | 0.000 |
| 270 | 21.0 | 61.921 | 81.000 | 0.000 |
| 280 | 21.0 | 62.745 | 84.000 | 0.000 |
| 290 | 20.0 | 63.547 | 87.000 | 0.000 |
| 300 | 20.0 | 64.330 | 90.000 | 0.000 |
| 310 | 19.0 | 65.094 | 93.000 | 0.000 |
| 320 | 19.0 | 65.841 | 96.000 | 0.000 |
| 330 | 19.0 | 66.571 | 99.000 | 0.000 |
| 340 | 18.0 | 67.284 | 102.000 | 0.000 |
| 350 | 18.0 | 67.983 | 105.000 | 0.000 |
| 360 | 18.0 | 68.667 | 108.000 | 0.000 |
| 370 | 17.0 | 69.338 | 111.000 | 0.000 |
| 380 | 17.0 | 69.995 | 114.000 | 0.000 |
| 390 | 17.0 | 70.640 | 117.000 | 0.000 |
| 400 | 16.0 | 71.273 | 120.000 | 0.000 |
| 410 | 16.0 | 71.894 | 123.000 | 0.000 |
| 420 | 16.0 | 72.504 | 126.000 | 0.000 |
| 430 | 16.0 | 73.104 | 129.000 | 0.000 |
| 440 | 15.0 | 73.693 | 132.000 | 0.000 |
| 450 | 15.0 | 74.273 | 135.000 | 0.000 |
| 460 | 15.0 | 74.843 | 138.000 | 0.000 |
| 470 | 15.0 | 75.404 | 141.000 | 0.000 |
| 480 | 15.0 | 75.956 | 144.000 | 0.000 |
| 490 | 14.0 | 76.500 | 147.000 | 0.000 |
| 500 | 14.0 | 77.036 | 150.000 | 0.000 |
| 510 | 14.0 | 77.563 | 153.000 | 0.000 |
| 520 | 14.0 | 78.084 | 156.000 | 0.000 |
| 530 | 14.0 | 78.596 | 159.000 | 0.000 |
| 540 | 14.0 | 79.102 | 162.000 | 0.000 |
| 550 | 13.0 | 79.600 | 165.000 | 0.000 |
| 560 | 13.0 | 80.092 | 168.000 | 0.000 |
| 570 | 13.0 | 80.577 | 171.000 | 0.000 |
| 580 | 13.0 | 81.056 | 174.000 | 0.000 |
| 590 | 13.0 | 81.529 | 177.000 | 0.000 |
| 600 | 13.0 | 81.996 | 180.000 | 0.000 |

Storage volume (m³) = 15.6 m³



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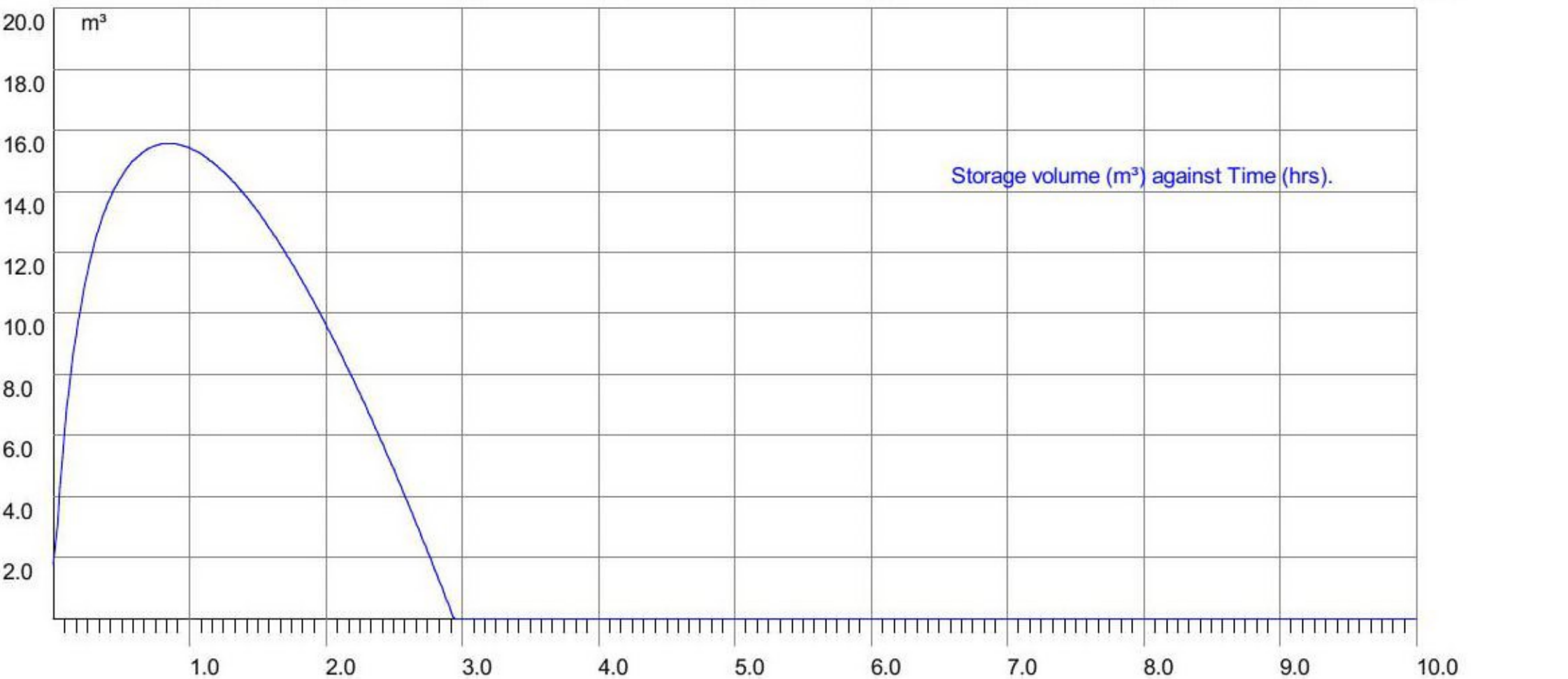
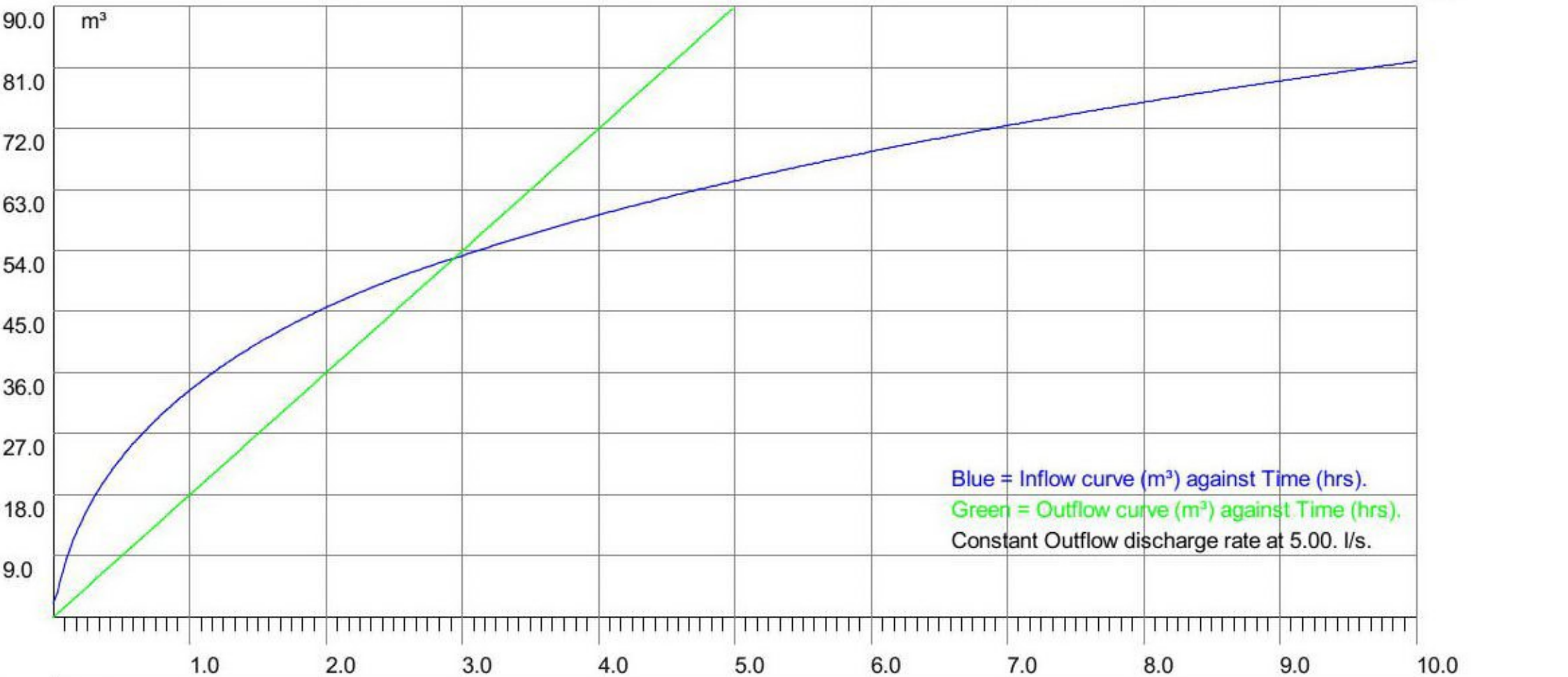
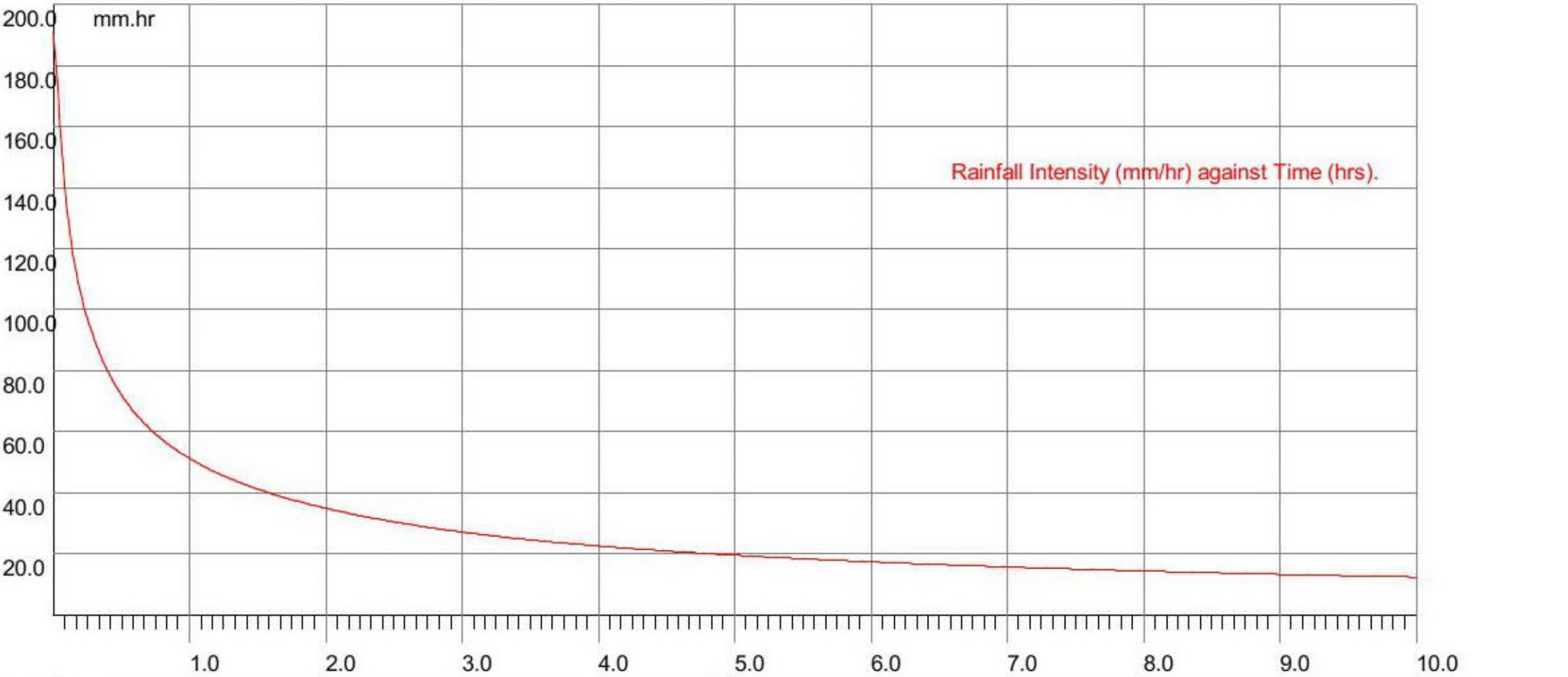
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| Project | 100yr plus 40% climate change |
| Title | Peak flow storage calcs for Blackpool Rd, Poulton |



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