

29-31 PARK GROVE, LEVENSHULME,
MANCHESTER

SUSTAINABLE DRAINAGE STRATEGY

Job Number: FRA 22 1003

Date: March 2022

Client: Studio Tashkeel Architecture



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LK Consult

Document Verification

Site Address	Land at 29-31 Park Grove, Levenshulme, Manchester, M19 2FH		
Report Title	Sustainable Drainage Strategy		
Job Number	FRA 22 1003	Document Ref.	FRA 22 1003 - R0
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Prepared By	Jenna Lowe – Graduate Flood Risk Assessor	Reviewed By	Anna Mierzejewska – Environmental Scientist

Revision Record

Revision No.	Date	Nature of Revision	Approved By

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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 at 29-31 Park Grove, Levenshulme, Manchester. The development comprises a block of apartments with associated landscaping and car parking. Access will be from Park Grove.

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

Consultations

Manchester City Council – Lead Local Flood Authority and United Utilities have been contacted during preparation of this report.

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.

Drainage Strategy

The ground conditions beneath the site are recorded as Till, Devensian superficial deposits that mainly consist of slightly sandy and silty Clay upon layers of Collyhurst Sandstone bedrock. Shallow ground water was recorded in the area at level of 1.5mbgl. The site is also constrained for the use of the soakaway due to its small size and proximity of the railway and adjacent properties. The levels on site indicate that it slopes down from the eastern boundary towards the remainder of the site.

Therefore, the outline drainage strategy considers the use of an infiltration-based SuDS not to be feasible. The most effective strategy, in line with the SuDS management train, would be to have a detention facility towards the north of the site with connection to the adjacent culverted water course (Nico Ditch) located in Park Grove. This is subject to the agreement with the Lead Local Flood Authority.

The proposed development will increase the proportion of the site covered by impermeable surfaces and will therefore generate more runoff. Therefore, attenuation will be required.

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

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 Studio Tashkeel Architects to carry out a Sustainable Drainage Strategy for land at 29-31 Park Grove, Levenshulme, Manchester. The report was undertaken in support of a future planning application to redevelop the site for residential use.

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 July 2021

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. Figures 1 indicates the site location and boundary. Figure 2 indicates the proposed development.

Site Details	
Location	Land at 29-31 Park Grove, Levenshulme, Manchester, M19 2FH. Centred at approximate National Grid Reference 387160E, 394645N.
Area	Approximately 0.073 Ha.
Topography	52 metres above ordnance datum (AOD) in the north and south, 53m AOD to the east and 52m AOD to the west. The site is approximately level but is gently sloping down from the eastern boundary towards the remainder of the site.
Current Land Use	<u>Site</u> The majority of the site is covered in dense vegetation and shrubbery. Small areas of the site contain grassland and established trees are present towards the southern site boundary. The site is bounded by Heras fencing to the north and east and wooden fencing to the south and west. <u>Surrounding Area/ Boundary Treatment</u> North: Access Road and Playing Fields. East: Railway. South: Car Parking and Residential properties. West: Railway.
Proposed Development	Residential apartments with associated soft landscaping and car parking. Access will be from Park Grove.

Table 1-1: Summary of site details.

2 Site Setting

2.1 Environmental Setting

LKC has undertaken a review of public domain information including British Geological Survey data, Environment Agency data, historical mapping, and aerial photography to provide a summary of the environmental setting of the site. This is summarised in Table 2-1 below.

Summary of the Environmental Setting			
Geology	Superficial		Till, Devensian (Diamicton).
	Bedrock		Collyhurst Sandstone Formation (Sandstone).
	BGS Boreholes		BH Ref: SJ89SE813, 200m E: Dirt ash cinder brick clayey fill to 1.40m, soft to firm grey slightly peaty Clay to 1.90m very fibrous slightly clayey peat to 2.40m, soft to firm grey slightly peaty Clay to 3.40m, and very stiff brown Clay with occasional gravel to 4.60m. BH Ref: SJ89SE839, 280m SW: Soil to 0.20m, brick rubble and stone fill to 0.90m, large stone driven possibly into soft Clay to 1.30m, soft Clay fill to 1.50m, soft grey silty clay to 2.15m, soft brown sandy clay to 2.50m and firm brown boulder Clay to 5.00m. Water struck at 1.5m, standing level at 1.3m. BH Ref: SJ89SE840, 300m SW: Soil to 0.20m, fairly compact Clay with brick rubble fill to 2.00m, firm brown and grey boulder Clay to 2.50m, and firm to stiff brown boulder Clay to 5.00m. BH Ref: SJ89SE13, 330m NE: Made ground to 0.30m, yellow clay to 1.27m, brown Clay to 3.79m, sandy brown clay to 3.89m, stiff brown Clay to 4.88m, stony Clay to 7.32m, red sandy Clay to 8.23m, sandy brown Clay to 12.04m and soft loamy Clay to 15.24m.
	Defra Soilscape Mapping		Type 17 – Slowly permeable seasonally wet acid loamy and clayey soils.
Hydrogeology	Aquifer Designation	Superficial	Secondary Undifferentiated Aquifer.
		Bedrock	Principal Aquifer.
	Source Protection Zone (SPZ)		Site not within an SPZ.
Flood Zone (EA)	The site is within Fluvial Flood Zone 1. Very Low risk, with annual probability of flooding from rivers and the sea of less than 0.1% (1 in 1000).		
Hydrology	All adjacent and internal surface water		A highway drain/culverted watercourse (Nico Ditch) is located to the north in Park Grove. The closest open watercourse is located approximately 980m to the north of the site.
Site History			According to historical mapping the site was formerly residential housing adjacent to Park Grove. The signal gantry to the east has been present since at least 1848. From 1923 historical mapping indicates that the site and surrounding area became significantly urbanised. From 1964 the area was residential but has since become derelict.

Table 2-1: Summary of the Environmental Setting.

2.2 Site Levels

The site falls away gently from the eastern boundary. The site elevation ranges from 52m AOD in the north, west and south and 53m AOD to the east.

3 Consultation

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

Relevant correspondence / information is provided in Appendix C.

Source	Details	
Manchester City Council (LLFA)	According to Manchester City Council the site is located within a Critical Drainage Area. These areas are particularly sensitive to an increase in the rate of surface water runoff and/or volume from new development. There are generally known local flooding problems associated with these areas. Specific drainage requirements are required in these areas to help reduce local flood risk. Manchester City Council's records indicate that the suspected highway drain located to the northeast of the site is an ordinary watercourse (Nico Ditch). They continue stating that all new surface water connections to ordinary watercourses should be restricted to greenfield run-off rates and require a land drainage consent. It is suggested that the ordinary watercourse culvert is surveyed to ensure that a gravity connection is feasible from the site and that the culvert is in a suitable condition.	
United Utilities (UU)	Sewer Map	There are no surface water sewers running parallel to the site boundaries. A 675mm diameter surface water highway drain/ culvert is located to the northwest of the site located in Park Grove. This is the historical culverted Nico Ditch that ran along the northern edge of Park Grove from east to west. Two inspection covers for the combined sewer system are located to the west of the site. A 225mm diameter public combined sewer is located to the southwest of the site in Central Avenue.
	Likely conditions for connecting into their sewerage system	UU would request conditions for a separate system with only foul draining to foul / combined sewers and surface water draining to soakaway/SuDS, watercourse, or surface water sewer. 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. UU stated that there are unlikely to be any issues discharging surface water into the 225mm diameter public combined sewer located within Central Avenue located southwest of the proposed site at a pass forward flow to be agreed by the LLFA. UU request that any agreed rate does not exceed 5l/s. UU also recommended to investigate the possibility of draining surface water to the 675mm highway drain on Park Grove where this ultimately discharges to a watercourse. UU suggest the relevant Highway Authority should be contacted to discuss ownership of the drain to decipher whether the drain is in fact a highway drain or a public sewer, which it is theorised to be due to its size. Foul flow from this site will be allowed to drain into the public combined sewer system. UU's preferred point of discharge would be to the 225mm diameter public combined sewer within Central Avenue at an unrestricted rate.

Table 3-1: Summary of Consultee Information.

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 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 H3³ 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 2010⁴.

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.

4.2 Sustainable Drainage Hierarchy

4.2.1 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 BGS superficial and bedrock aquifer descriptions and classifications is shown in Table 4-1 below:

Classification	Description	Aquifer Classification	Recorded Water Table Depth	Soakaway Potential
Glacial Till Deposits	Silty, sandy gravelly clay, peaty clay	Secondary Undifferentiated	1.5mbgl	Poor
Collyhurst Formation Bedrock	Sandstone	Principal	N/A	Good

Table 4-1: Geological and Hydrogeological Setting.

³ Building Regulations part H3 2010: Approved Document, Drainage and Waste Disposal.

⁴ Flood and Water Management Act 2010: UK Government.

Infiltration methods such as soakaways are unlikely to be feasible, but this may be investigated further at the detailed design stage, if required.

There is a slope over the site and surrounding area which indicates that groundwater in the vicinity of the site would likely drain away from the east towards the west.

4.2.2 Watercourses

There is a 675mm diameter highway drain/culvert mapped to the northwest of the site in Park Grove. This is the former Nico Ditch that flowed from east to west along the northern edge of Park Grove. If the culverted part of the watercourse is still accessible a connection to this should be considered.

Currently surface water from the site runs overland from the east towards the west.

4.2.3 Public Sewer

There is the forementioned highway drain located to the northwest of the site in Park Grove, which ownership is being confirmed by the LLFA.

Two inspection covers for a combined sewer system are located to the west of the site.

There is a 225mm diameter public combined sewer located to the southwest of the site in Central Avenue which connects to a 375mm combined sewer in Rushford Avenue.

4.2.4 Other Sewers

There is not a private connection to the public sewer from the study land.

4.3 Surface Water Drainage Strategy

Following the assessment of the site settings and existing constraints to the development. 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	Reasoning
a	Soakaway/Infiltration	3	Not likely to be feasible as the site is constrained by the proximity of the adjacent properties and roads. The impermeable ground conditions and groundwater level on the site also make the use of infiltration unlikely.
b	Connection to Watercourse	1	If feasible there is potential to connect to the culverted watercourse either adjacent to the site or to the west of the site in Park Grove where it connects to a surface water sewer flowing west. The ownership of the surface water asset, northwest of the site is being confirmed with the LLFA.
c	Discharge into a sewer	2	A connection into the 225mm diameter combined sewer in Central Avenue would be possible – subject to approval from LLFA and a connection consent 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)⁵ for the development:

SuDS Option	Appropriate to Development	Comments
Soakaways	X	Due to the nature of the ground conditions and size of the development, 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 drains	✓	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. In the process, a volume of water is kept out of the storm-water management system, thereby helping to reduce flooding risks.
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 – with granular and 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

⁵ CIRIA C697 - The SUDS Manual. London 2015

4.4 Surface Water Attenuation Requirements

In line with local guidance, the flow from this development should be limited to a 'greenfield scenario' 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 (ha)	0.0728
Existing Impermeable Area (ha)	0.0000
Green Infrastructure (ha)	0.0728
Developable Area (ha)	0.0545
Contributing Catchment	
Catchment Area (ha)	0.0545
Impermeable Area (ha)	0.0341
Permeable Area (ha)	0.0204

Table 4-4: Assumed plot areas.

Table 4-4 shows the assumed areas included within the calculations.

It can be seen that there is an increase in impermeable area from the existing usage to the proposed. This is likely to require attenuation to reduce the proposed flow off site to a level which is acceptable to the LLFA and to UU, including an allowance for climate change.

4.4.1 Attenuation Estimate

Surface water storage and greenfield runoff estimations based on the HR Wallingford procedure IH 124⁶ been undertaken for the development and the output report is presented in Appendix D.

For the contributing catchment an estimate has been produced assuming a developable area of 0.0545ha from the 0.0728ha plot. From the supplied plan the impermeable area will be 0.0341ha. This gives the following runoff rates and attenuation requirements for this section based on the Wallingford IH 124 method:

» Q_{bar} :	0.400 l/s
» 1 in 1-year greenfield runoff rate:	0.341 l/s
» 1 in 30-year greenfield runoff rate:	0.674 l/s
» 1 in 100-year greenfield runoff rate:	0.843 l/s

United Utilities has specified an allowable discharge rate of 5l/s to the culverted watercourse/surface water drain along Park Grove to the west.

The following attenuation has been estimated for the development using the restricted runoff rates and utilises the FSR methodology⁷ as:

- » Attenuation storage volume: **1.1 m³** (1 in 30-year event)
- » Retention on site volume: **2.9 m³** (1 in 100 year + 20% Climate Change)
- » Retention on site volume: **4.0 m³** (1 in 100 year + 40% Climate Change)

⁶ IH124 Flood Estimation of Small Catchments.

⁷ Flood Studies Report Wallingford NERC 1975.

Attenuation storage aims to limit the peak rate of runoff from the development to 5l/s before discharging to the 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 be negligible.

The attenuation required for a 1 in 30-year storm event, requires a storage volume of **1.1 m³** and for the 1 in 100-year event, a storage capacity of between **2.9 m³** and **4.0 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.

4.5 Site Specific SuDS

The use of attenuation SuDS are deemed to be the most feasible and practical option for the development. The attenuation tank or similar will provide the required storage volume to limit peak runoff arising from the development. Utilising of the flow control device at the end of the system will control the peak flow rates.

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.

4.6 Foul Drainage

The foul water could be discharged by gravity into the 225mm diameter combined sewer in Central Avenue as relative levels indicate that this will be feasible in terms of fall. The combined manhole has a recorded invert level of 48.81m AOD which appears to be low enough to provide a suitable connection point. There are several possible alternative manholes for the connection of foul drainage from the site.

5 Conclusion

The site is currently disused, and the majority is covered in dense vegetation and shrubbery. Small areas contain grassland and established trees are present towards the southern boundary. The proposal is to develop residential apartments with associated car parking and amenity space.

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 site is considered to be too constrained due to the proximity of the adjacent properties and highways and due to likely impermeable ground conditions for the use of soakaway.
- » Discussions with the LLFA around the ownership of the surface water drain located in Park Grove are ongoing.
- » The suitability and depth of the potential connection into the adjacent sewer in Central Avenue should be confirmed on site.
- » There is no existing connection of the site to the adjacent public sewers. A pre-development advice received from United Utilities considered a flow rate of 5l/s would be acceptable if infiltration proved to be impractical.
- » The attenuation required for a 1 in 30-year storm event, requires a storage volume of **1.1 m³** and for the 1 in 100-year event, a storage capacity of between **2.9 m³** and **4.0 m³** will be required from on-site storage as well as SuDS systems.
- » All proposed outflow connections from the development should be agreed with the Lead Local Planning Authority and United Utilities.

APPENDIX A

FIGURES, PLANS AND DRAWINGS



Client: Studio Tashkeel Architecture				Title: Site Location & Boundary Plan				
Site: 29-31 Park Grove, Manchester				Scale (see scale bar): 1:25,000 & 1:1,000 @ A4			Figure: 1	Revision:
Job No.: FRA 22 1003	Drawn By: JL	Checked By: AM	Drawn: Feb 2022					



Level 0 Proposed Site Plan

1 : 200



Level 0 Proposed Boundary Treatment

1 : 200

Legend

- Existing Various Boundary Treatment
- 1.8 m High Timber Fencing Panels Between Concrete Posts
- 1.1 m High Brick Wall Including Metal Vertical Bar Railing
- Vehicle Metal Electric Gate and Pedestrians Gate



Precedent of Timber Fencing Panels



Precedent of Brick Boundary Wall



Precedent of Metal Electric Gate

GENERAL NOTES:

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Rev	Description	Date	Dr by	App by
original by Author		date created 03/20/20		approved by Approver



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client name
Noble Properties Ltd

project
Park Grove

drawing
Proposed Site Plan & Boundary Treatment

computer file
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project number
1908101

plot date
scale
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GRV_STA_PL_007

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APPENDIX B

SITE INFORMATION



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Floor Level	GIA
Ground Floor	170.5 m ²
First Floor	211 m ²
Second Floor	211 m ²
Total Area	592.5 m ²

Rev	Description	Date	Dr by	App by
original by Author	date created 02/03/20	approved by Approver		



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project
Park Grove

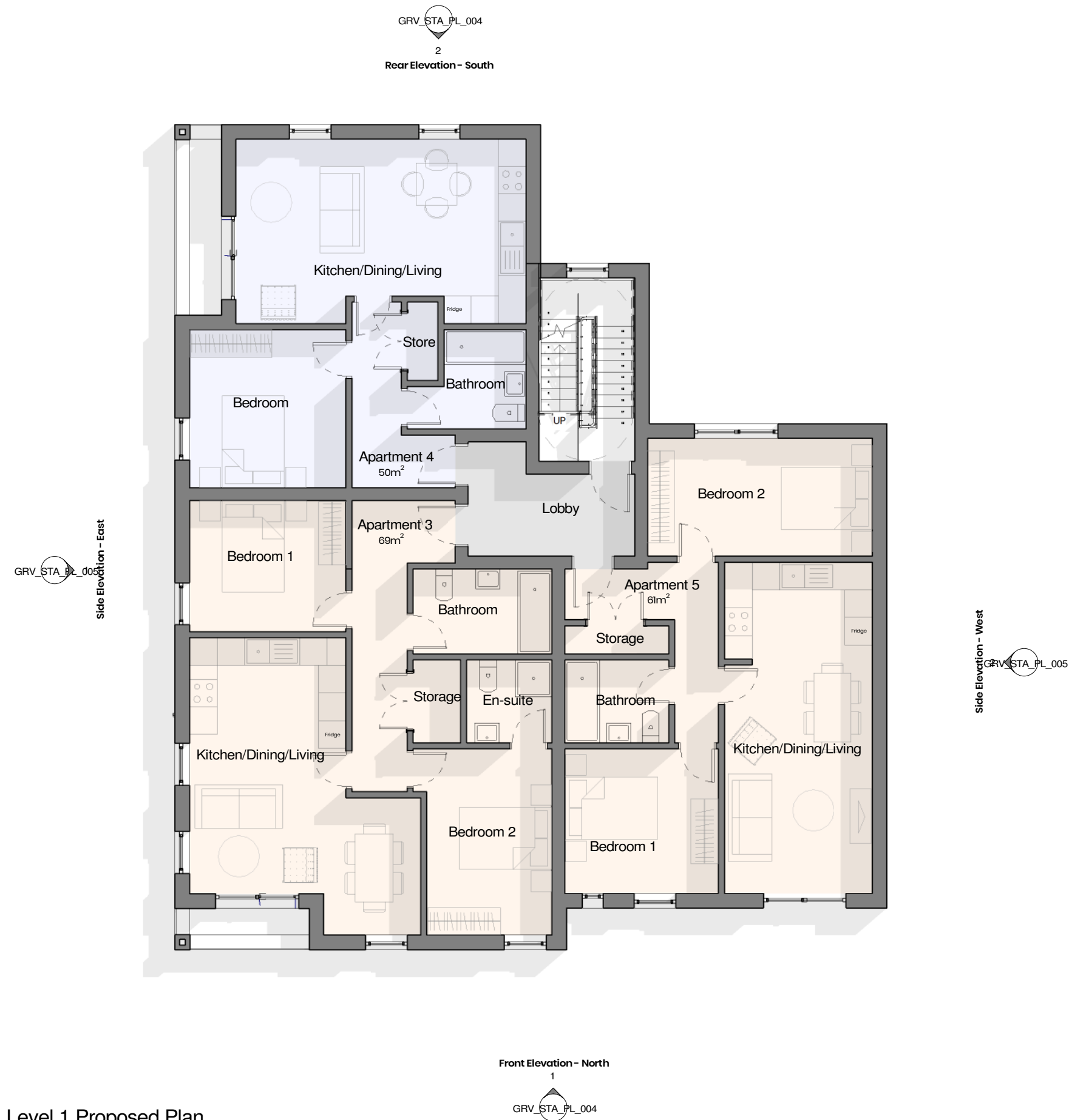
drawing
GA Proposed Ground Floor Plan

computer file
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plot date

project number 1908101	scale As indicated	@A3
drawing number GRV_STA_PL_001	rev	issue status PLANNING

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Level 1 Proposed Plan

1 : 100

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Floor Level	GIA
Ground Floor	170.5 m ²
First Floor	211 m ²
Second Floor	211 m ²
Total Area	592.5 m ²

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project
Park Grove

drawing
GA Proposed Fist Floor Plan

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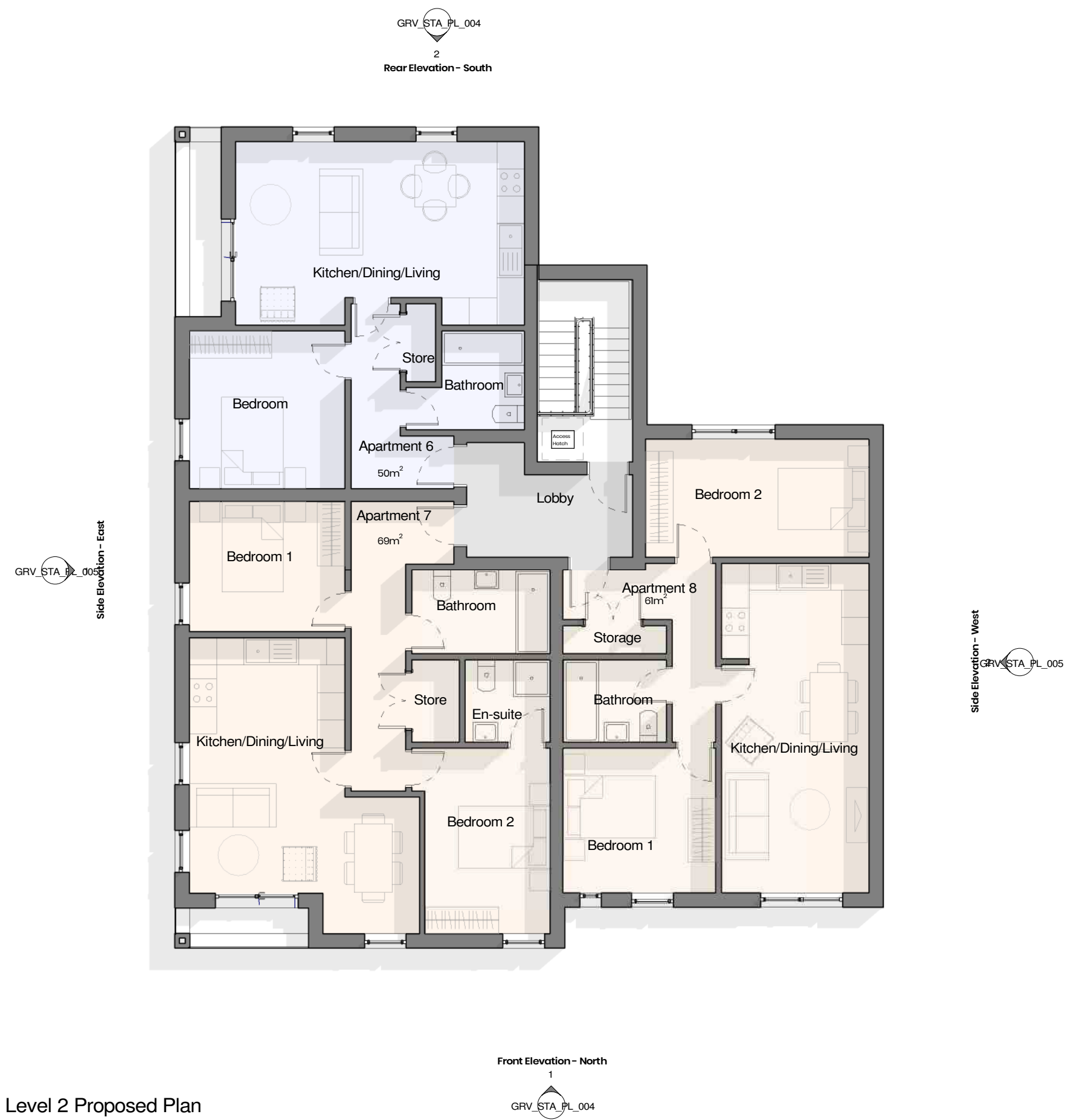
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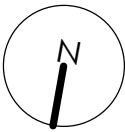
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Design intent drawing only. Construction to comply with latest building regulation requirements.

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Floor Level	GIA
Ground Floor	170.5 m ²
First Floor	211 m ²
Second Floor	211 m ²
Total Area	592.5 m ²

Rev	Description	Date	Dr by	App by
original by Author	date created 02/03/20	approved by Approver		



STUDIO TASHKEEL ARCHITECTURE
STUDIO TASHKEEL ARCHITECTURE LTD.
89 Princess Street, Manchester M1 4HT, UK
+44(0)161 694 6375
info@studiotashkeel.com | www.studiotashkeel.com

client name Noble Properties Ltd		
project Park Grove		
drawing GA Proposed Second Floor Plan		
computer file D:\AcD\STA\Projects\1908101 - Park Grove\11.00 - BIM\11.00 WIP Data\GRV_STA_XX_M3_AR_CENTRAL.rvt		plot date
project number 1908101	scale As indicated	@A3
drawing number GRV_STA_PL_003	rev	issue status PLANNING

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Front Elevation - North

1 : 100



Rear Elevation - South

1 : 100

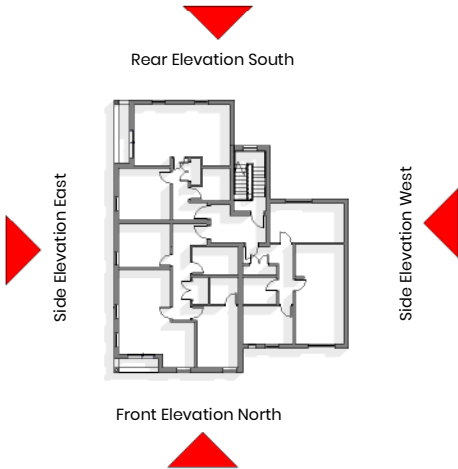
GENERAL NOTES:

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Key Plan

1 : 500

Rev	Description	Date	Dr by	App by
original by Author	date created 02/03/20	approved by Approver		



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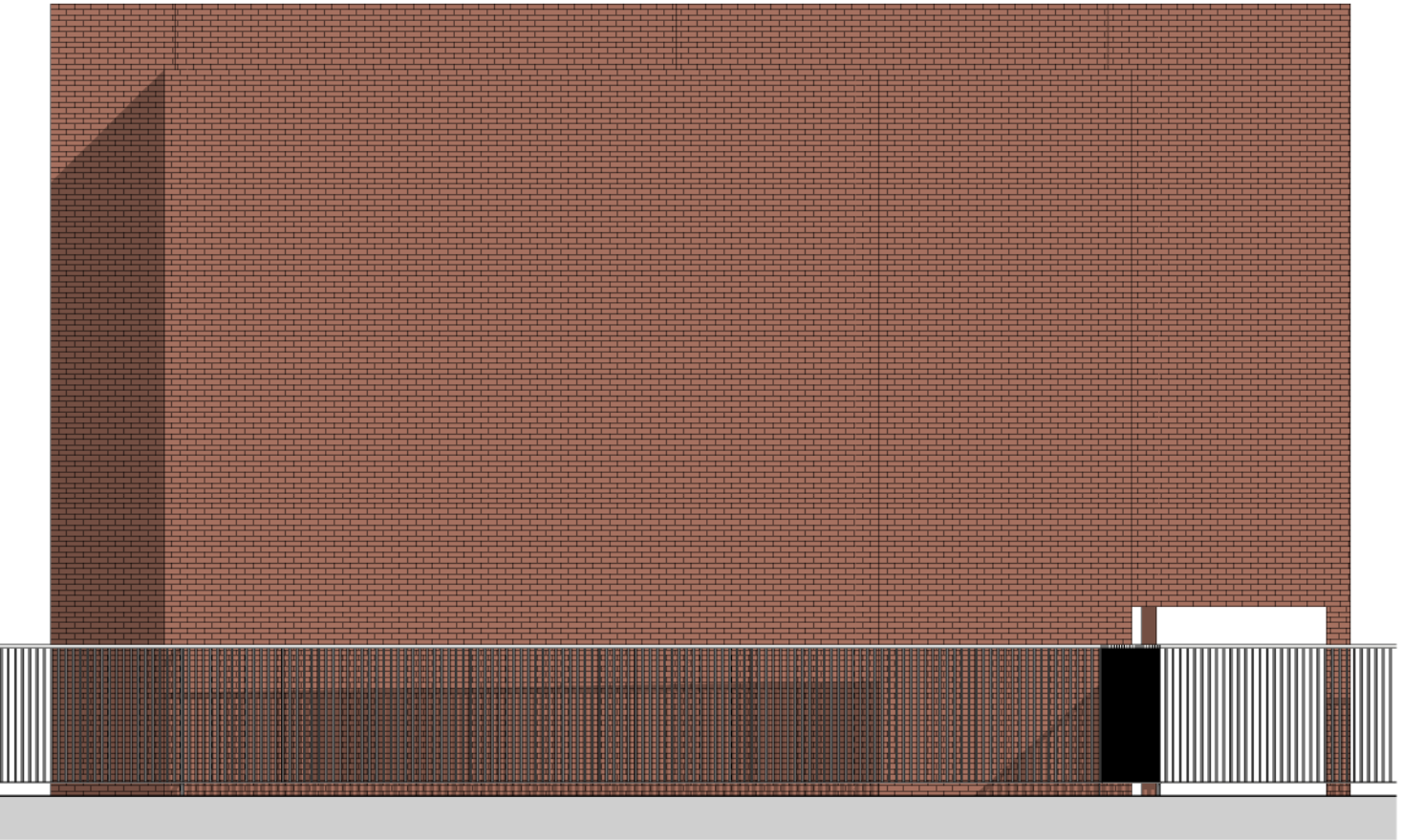
client name Noble Properties Ltd		
project Park Grove		
drawing GA Proposed Front & Rear Elevations		
computer file I:\TASERVER\Projects\1908101 - Park Grove\11.00 - BIM\11.00 WIP Data\GRV_STA_XX_M3_AR_CENTRAL.rvt		plot date
project number 1908101	scale As indicated	@A3
drawing number GRV_STA_PL_004	rev	issue status PLANNING

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Side Elevation - East

1 : 100



Side Elevation - West

1 : 100

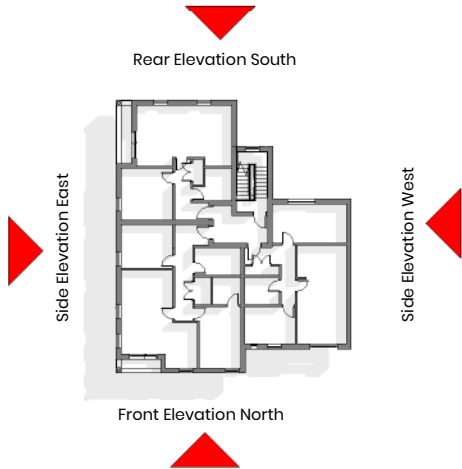
GENERAL NOTES:

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Key Plan

1 : 500

Rev	Description	Date	Dr by	App by
original by Author	date created 02/03/20	approved by Approver		



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client name Noble Properties Ltd		
project Park Grove		
drawing GA Proposed Side Elevations		
computer file I:\TASERVER\Projects\1908101 - Park Grove\11.00 - BIM\11.00 WIP Data\GRV_STA_XX_M3_AR_CENTRAL.rvt		plot date
project number 1908101	scale As indicated	@A3
drawing number GRV_STA_PL_005	rev	issue status PLANNING

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British
Geological
Survey

Version 2.0.6.4

BGS ID: 865691 : BGS Reference: SJ89SE13
British National Grid (27700) : 387258,394883

[Report an issue with this borehole](#)

<<

< Prev

Page 1 of 3

Next >

>>

(H11867) Wk. 17868-S154-5,000 12/26 Gp. 180. O.A.

SECTION OF *Boreholes* **SJ89SE13** *Levenshulme* *12 on standard*

Maps: One-inch *85* Six-inch *111 N.E.* County *Lancs*

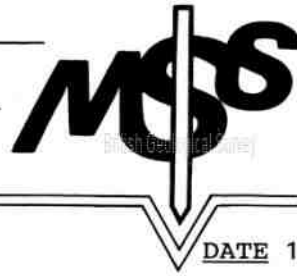
Height above O.D. Latitude Longitude

Communicated by *Manchester Corporation* Date of Sinking

Made by Dip of Strata

		Thickness.		Depth from Surface.	
No. <i>12</i>	<i>12 on pit map</i>				
No. 102.	<i>172.61 ft. O.D. In Stockport Road 100 yds. S. of corner with Chapel St.</i>				<i>LEVENSHULME.</i>
<i>No 20</i>	<i>made ground</i>	<i>1 -</i>	<i>0.30</i>	<i>1 -</i>	<i>0.30</i>
<i>12</i>	<i>Yellow clay</i>	<i>3 2</i>	<i>1.27</i>	<i>4 2</i>	
<i>111 N.E.</i>	<i>Brown clay</i>	<i>8 3</i>	<i>3.79</i>	<i>12 5</i>	
	<i>Sandy brown clay</i>	<i>- 4</i>	<i>3.89</i>	<i>12 9</i>	
	<i>Stiff brown clay</i>	<i>3 3</i>	<i>4.88</i>	<i>16 -</i>	
	<i>Stony clay.</i>	<i>8 -</i>	<i>7.32</i>	<i>24 -</i>	
	<i>Red sandy clay.</i>	<i>3 -</i>	<i>8.23</i>	<i>27 -</i>	
	<i>Sandy brown clay</i>	<i>12 6</i>	<i>12.04</i>	<i>39 6</i>	
	<i>loamy clay.</i>	<i>3 6</i>	<i>13.11</i>	<i>43 -</i>	
	<i>Soft loamy clay.</i>	<i>7 -</i>	<i>15.24</i>	<i>50 -</i>	
No. <i>14</i>	<i>157.75 ft. O.D. Corner of Victoria Road & Albert Road.</i>				<i>LEVENSHULME.</i>
<i>No 14</i>	<i>Soil & cinders.</i>	<i>2 -</i>	<i>0.61</i>	<i>2 -</i>	
<i>111 N.E.</i>	<i>Yellow stony clay.</i>	<i>3 -</i>	<i>1.52</i>	<i>5 -</i>	
	<i>Yellow clay.</i>	<i>9 -</i>	<i>4.27</i>	<i>14 -</i>	
No. <i>13</i>	<i>117.67 ft. O.D. In Stockport Road. 50 yds S. of corner with Shade Hall Road.</i>				<i>LEVENSHULME.</i>
<i>No 13</i>	<i>Filled up stuff.</i>	<i>3 -</i>	<i>0.91</i>	<i>3 -</i>	
<i>111 N.E.</i>	<i>Brown clay.</i>	<i>14 6</i>	<i>5.33</i>	<i>17 6</i>	

MINI • SOIL • SURVEYS


JOB NUMBER CAS0058
DATE 13/11/89
SITE 18/20 Matthews Lane L/hulme
BOREHOLE No. 3 of 8 CREW A
GROUND LVL (if recorded)

Description	Depth	Leg	Sample/Test
TARMAC Dirt ash cinder brick clayey FILL Very wet from .400	0.05		
Soft to firm grey slightly peaty CLAY	1.40		
Very fibrous slightly clayey PEAT	1.90		1.7m SV 49 Kn/m ²
Soft to firm grey slightly peaty CLAY	2.40		
			2.9m SV 52 Kn/m ²
Very stiff brown CLAY with occ., gravel	3.40		
			3.5m SV 140+ Kn/m ²
End of hole.	4.60		
			4.7m SV 140+ Kn/m ²

Comments: Fill wet. Stif clay dry.
No standing water

BOREHOLE LOG

GROUNDSHIRE
GROUNDSHIRE
GROUNDSHIRE
GROUNDSHIRE

LOCATION **50-60 WINDSOR RD - LEVENSHULME**CLIENT **MOSS CAKE HOUSING LTD**BOREHOLE No. **1**DIAMETER **150mm**

GROUND LEVEL:

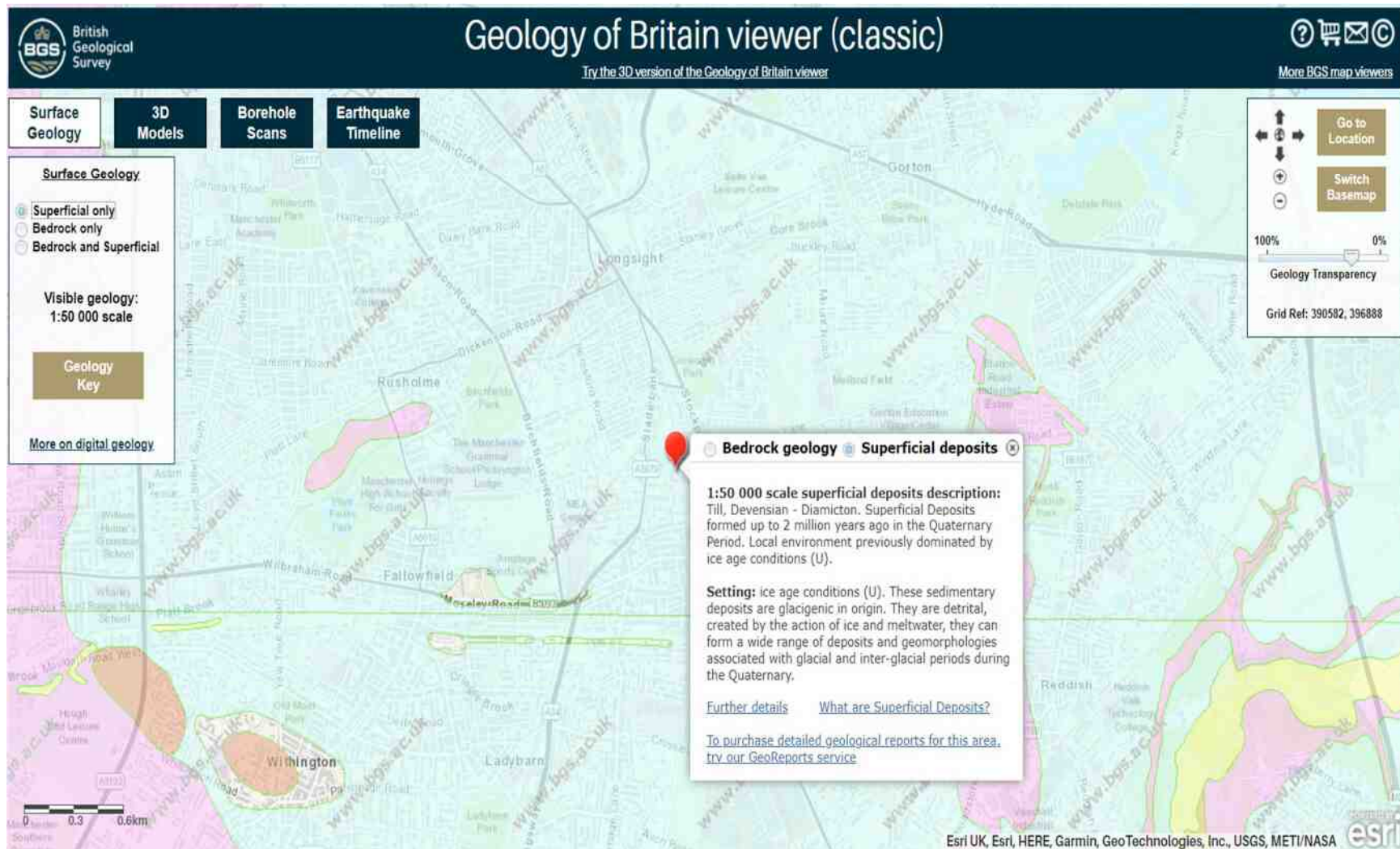
DATE: **NOVEMBER 1988**Telephone:
(091) 4161108/4179794

Depth	Thick- ness	Legend	Description of Strata	Type of Sample	C kN/m ²	M %	Ø	Density Kg/m ³	N
0.20	0.20		SOIL						
0.90	0.70		BRICK RUBBLE & STONE FILL	P 0.75					SS
1.30	0.40		LARGE STONE DRIVEN POSSIBLY INTO SOFT CLAY						
1.50	0.20		SOFT CLAY FILL	P 1.50					4
2.15	0.65		SOFT GREY SILTY CLAY						
2.50	0.35		SOFT BROWN SANDY CLAY						
				U 3.00	216.0	13.0	-	2220	
	2.50		FIRM BROWN BOUNDED CLAY						
				U 4.50	254.0	12.0	-	2300	
5.00									
CHISELING BETWEEN 0.90 & 1.30m 1 1/4 hrs									
Water Struck at <u>1.50m</u> Standing Water Level <u>1.30m</u>									

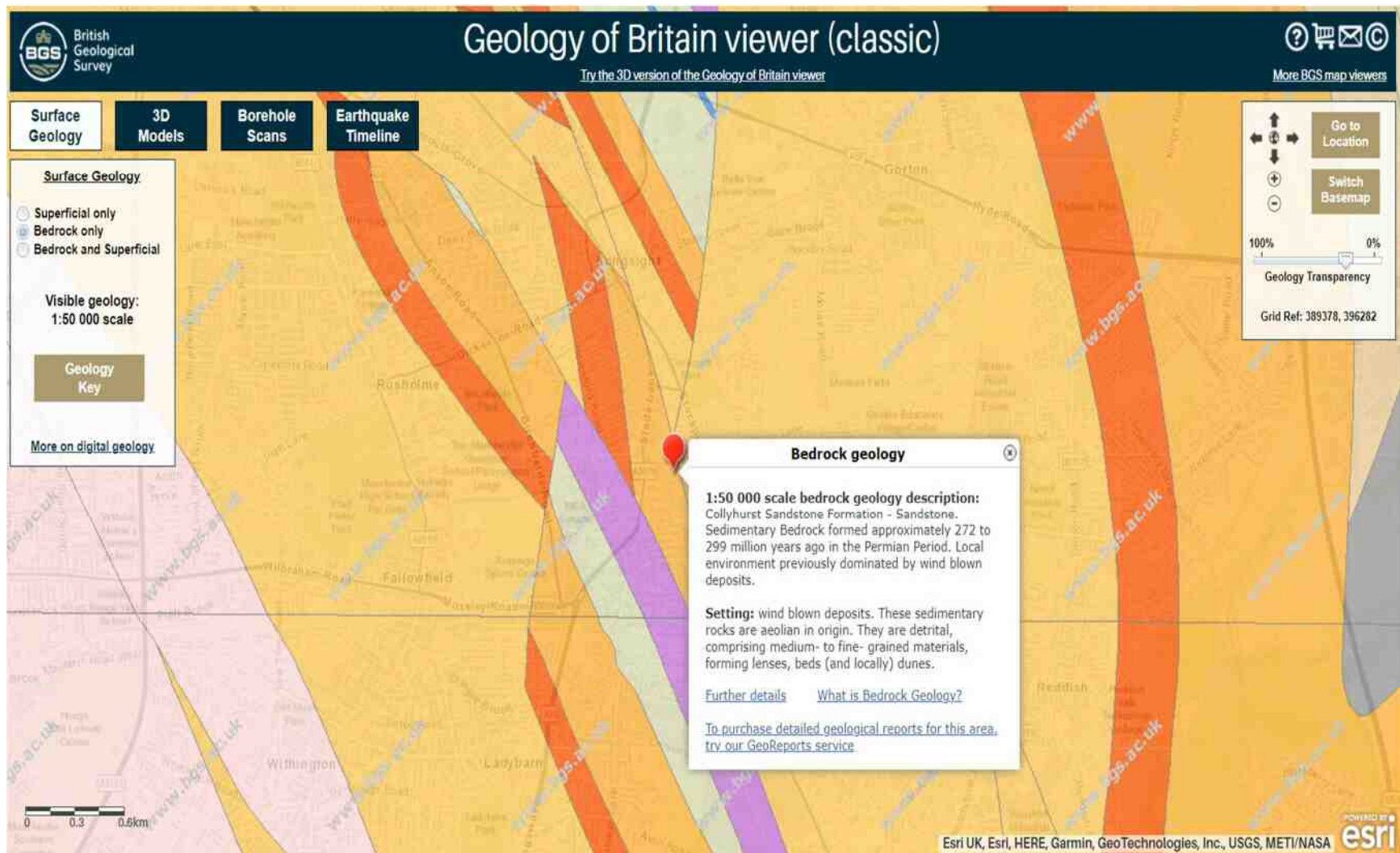
GROUNDSH RE
GROUNDSHIRE
GROUNDSHIRE
GROUNDSHIRE

Telephone:
(091) 4161108/4179794

scans.bgs.ac.uk/sobi_scans/boreholes/17972890/images/17972970.html



BGS Superficial Geology - Contains British Geological Survey Materials © UKRI 2020



BGS Bedrock Geology – Contains British Geological Survey Materials © UKRI 2020



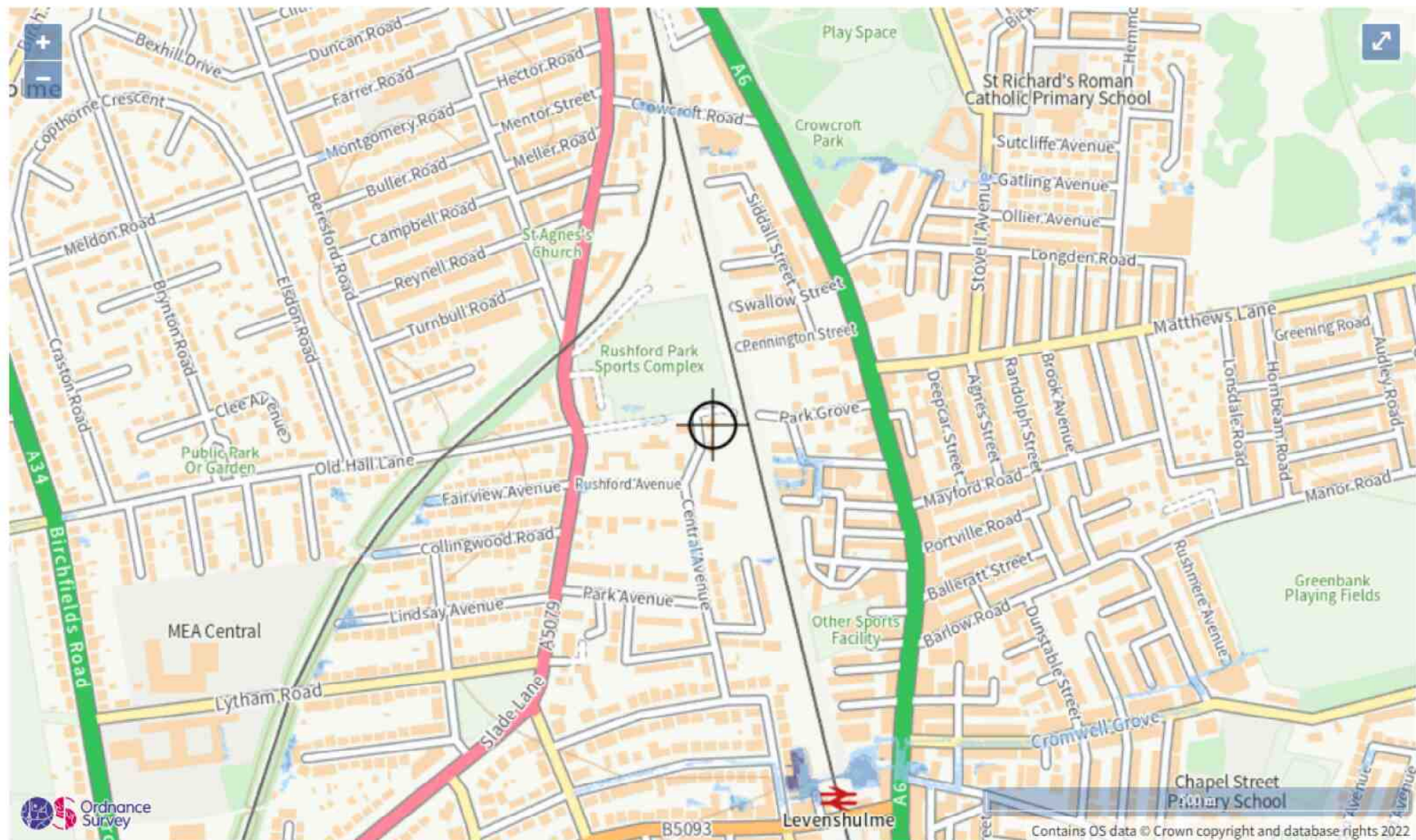
Defra Soilscape Mapping - (c) Crown Copyright and database rights 2021. Ordnance Survey 100022861

APPENDIX C

CONSULTEE CORRESPONDENCE

High risk: depth

M19 2FH



Surface water flood risk: water depth in a high risk scenario

Flood depth (millimetres)

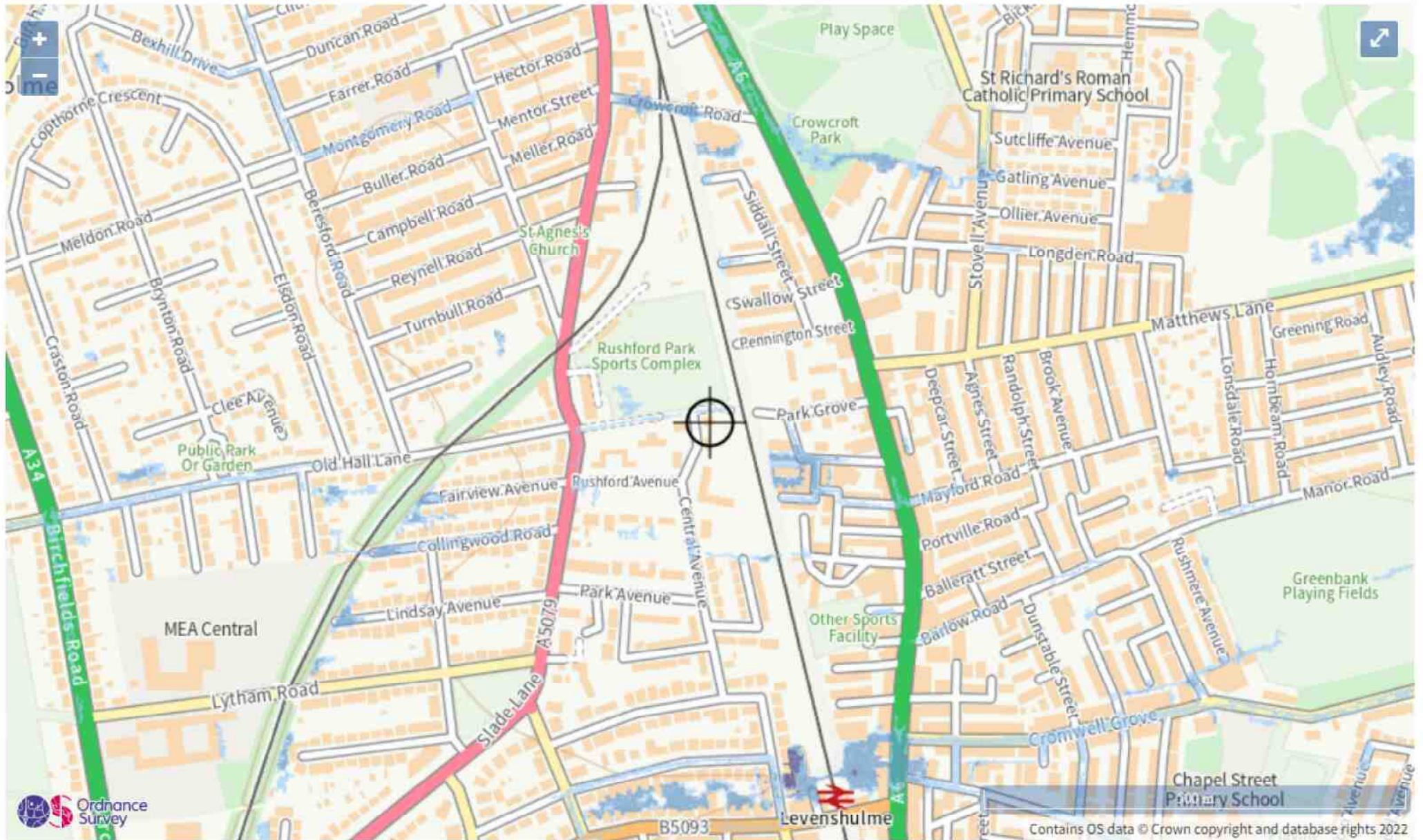
Over 900mm 300 to 900mm Below 300mm Location you selected

Flood risk

Location

Medium risk: depth

M19 2FH



Surface water flood risk: water depth in a medium risk scenario

Flood depth (millimetres)

Over 900mm
 300 to 900mm
 Below 300mm

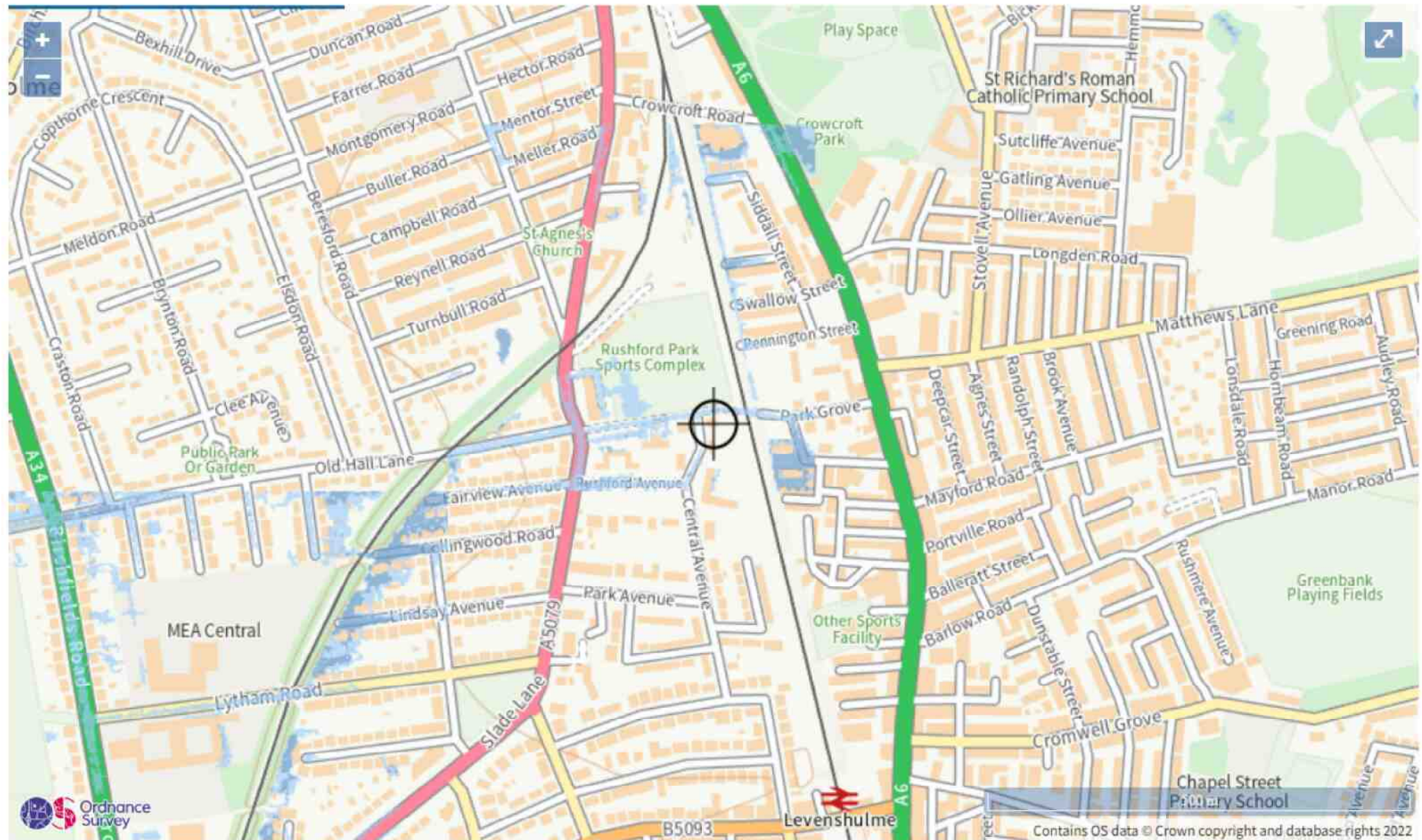
+
 Location you selected

Flood risk

Location

Low risk: depth

M19 2FH



Surface water flood risk: water depth in a low risk scenario

Flood depth (millimetres)

Over 900mm 300 to 900mm Below 300mm Location you selected

LKGroup**Unit 29 Eton Business Park
Eton Hill Road, Radcliffe
Radcliffe, Greater
M26 2ZS****FAO:****How to contact us:****United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP****Telephone: 0370 7510101****E-mail: propertysearches@uuplc.co.uk****Your Ref: FRA 22 1003 - Park Grove
Our Ref: UUPS-ORD-360027
Date: 21/01/2022****Dear Sirs****Location: FRA 22 1003 - Park Grove**

I acknowledge with thanks your request dated 20/01/2022 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,



Karen McCormack
Property Searches Manager

TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
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- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.



Refo	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
2714	CO	0	150	150	150	VC	6.03053	1	154
2604	CO	0	150	150	150	VC	16.5387	1	154
1701	CO	0	225	225	225	VC	23.5372	1	154
1400	CO	0	375	375	375	VC	170.423	1	154
9601	51.79	CO	48.48	225	225	VC	45.5162	1	154
3601	50.92	CO	48.48	225	225	VC	45.5162	1	154
3601	54.85	CO	48.48	225	225	VC	45.5162	1	154
3605	54.5	CO	48.48	225	225	VC	45.5162	1	154
3610	53.78	CO	48.48	225	225	VC	45.5162	1	154
6008	SW	0	675	675	675	VC	84.10255	1	154
1511	CO	0	150	150	150	VC	17.32868	1	154
3818	54.45	CO	48.48	375	375	VC	142.7709	1	154
1900	52.78	CO	48.48	375	375	VC	35.22783	1	154
3400	53.81	CO	50.06	450	450	VC	55.0943	1	154
2804	54.28	CO	47.97	750	750	VC	101.1336	1	158
3603	CO	0	0	0	0	VC	3.565345	1	158
2412	CO	0	225	225	225	VC	7.525369	1	158
2302	52.69	CO	50.11	300	300	VC	60.03833	1	158
2404	52.52	CO	51.25	300	300	VC	56.32051	1	158
4806	53.07	CO	50.7	300	300	VC	14.14214	1	158
2802	52.67	CO	0	750	750	VC	33.42155	1	158
1402	51.81	CO	48.6	375	375	VC	4	1	140
2900	53.23	CO	51.43	300	300	VC	61.78833	1	157
3601	53.72	CO	0	225	225	VC	23.25941	1	157
4701	55.58	CO	54.2	225	225	VC	33.03319	1	157
2508	SW	0	300	300	300	VC	3.13067	1	157
2631	CO	0	150	150	150	VC	14.72869	1	157
2503	52.98	CO	51.03	300	300	VC	38.1184	1	157
1702	54.79	CO	52.82	300	300	VC	91.25226	1	157
4700	55.52	CO	54.32	225	225	VC	30.06659	1	157
3411	53.81	CO	51.14	300	300	VC	41.74876	1	157
3607	54.04	CO	50.3	450	450	VC	37.02499	1	157
9401	50.5	CO	47.63	300	300	VC	112.8718	1	157
0809	CO	0	100	100	100	VC	10.3616	1	157
3804	54.15	CO	51.1	300	300	VC	22.84732	1	157
2710	CO	0	150	150	150	VC	2.505805	1	157
4303	54.07	CO	52.45	225	225	VC	2	1	157
3600	54.96	SW	53.78	900	900	VC	11.18034	1	157
1301	51.84	CO	48.48	300	300	VC	18.10777	1	157
3301	53.48	CO	48.91	450	450	VC	67.36485	1	157
3517	53.17	CO	50.98	225	225	VC	31.04912	1	157
2411	CO	0	225	225	225	VC	8.081676	1	157
1300	CO	0	300	300	300	VC	34.71311	1	157
3518	53.38	CO	50.86	300	300	VC	78.10253	1	157
3505	53.5	SW	51.98	225	225	VC	8.488833	1	157
4704	55.87	CO	54.52	225	225	VC	35.87912	1	157
4505	53.91	CO	50.83	300	300	VC	38.40947	1	157
4303	53.94	CO	50.83	300	300	VC	8.235434	1	157
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3408	53	CO	51.81	150	150	VC	20.8961	1	157
2405	54.04	CO	50.3	450	450	VC	7.707168	1	157
4501	54.44	CO	52.35	225	225	VC	4.059137	1	157
2300	CO	0	150	150	150	VC	7.071688	1	157
2708	SW	0	225	225	225	VC	21.40392	1	157
3622	CO	0	0	0	0	VC	1.020399	1	157
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3703	54.8	SW	53.81	225	225	VC	13.26975	1	157
3402	CO	0	150	150	150	VC	7.071688	1	157
1416	CO	0	150	150	150	VC	14.4466	1	157
3611	53.88	CO	50.89	300	300	VC	25.34455	1	157
1907	CO	0	100	100	100	VC	52.31153	1	157
3403	53.83	CO	50.07	450	450	VC	82.31312	1	157
3806	54.42	CO	48.24	750	750	VC	45.69464	1	157
3528	CO	0	150	150	150	VC	2.058005	1	157
9317	CO	0	150	150	150	VC	30.01877	1	157
3607	54.06	CO	50.89	450	450	VC	28.23119	1	157
4406	54.08	CO	50.83	300	300	VC	99.42739	1	157
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2406	53.84	CO	51.89	300	300	VC	72.87279	1	157
3501	53.74	CO	50.56	450	450	VC	11.45209	1	157
9901	50.9	CO	48.43	225	225	VC	30.13073	1	157
1314	CO	0	150	150	150	VC	48.27007	1	157
1406	CO	0	150	150	150	VC	66.4358	1	157
1801	CO	0	225	225	225	VC	63.7584	1	157
9501	49.19	CO	46.58	375	375	VC	36.08128	1	157
4902	49.73	CO	46.61	375	375	VC	5.703979	1	157
4909	CO	0	225	225	225	VC	13.92839	1	157
3608	52.59	CO	51.3	225	225	VC	4.472136	1	157
4408	53.93	CO	52.42	225	225	VC	6.820762	1	157
4407	54	CO	51.05	225	225	VC	41.23106	1	157
0911	CO	0	100	100	100	VC	25.11028	1	157
1401	52.32	CO	50.22	300	300	VC	67.78904	1	157
3506	54.48	CO	51.28	225	225	VC	20.02498	1	157
1302	51.88	CO	48.28	300	300	VC	7.615773	1	157
4403	53.93	CO	51	225	225	VC	3.455309	1	157
4514	53.99	CO	51	225	225	VC	15.0333	1	157
3721	CO	0	150	150	150	VC	7.097106	1	157
3701	55.21	CO	51.74	150	150	VC	40.31129	1	157
3727	CO	0	225	225	225	VC	2.230968	1	157
9500	50.42	CO	47.78	225	225	VC	157.0371	1	157
3502	53.68	CO	50.8	300	300	VC	24.02082	1	157
8800	51.3	CO	49.18	225	225	VC	70.14246	1	157
9600	51.23	CO	49.31	225	225	VC	23.19483	1	157
4804	53.85	CO	50.81	300	300	VC	64.27729	1	157
1502	51.38	CO	48.81	375	375	VC	70.17834	1	157
9702	51.47	CO	49.39	225	225	VC	21.93171	1	157
9801	51.47	CO	48.99	225	225	VC	49.65884	1	157
3503	53.24	SW	51.09	225	225	VC	19.10497	1	157
3600	54.64	SW	53.72	225	225	VC	51.85251	1	157
2803	54.5	SW	51.2	300	300	VC	40.3196	1	157
9900	50.9	CO	47.27	300	300	VC	63.09091	1	157
3811	54.75	CO	53.2	225	225	VC	43.17406	1	157
9700	51.73	CO	48.38	225	225	VC	46.09772	1	157
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3401	53.78	CO	50.41	375	375	VC	151.0828	1	157
0800	52.13	CO	48.91	300	300	VC	32.27299	1	157
3607	54.37	CO	50.85	300	300	VC	32.01662	1	157
9603	50.36	SW	48.84	825	825	VC	25.1421	1	157
3602	53.65	CO	50.39	300	300	VC	105.7213	1	157
1700	54.35	SW	52.96	225	225	VC	42.16044	1	157
3609	53.84	SW	50.51	300	300	VC	46.46648	1	157
2801	53.15	CO	51.28	225	225	VC	32.14032	1	157
9802	51.85	CO	49.22	225	225	VC	48.46648	1	157
4805	54.89	SW	54.25	225	225	VC	26.84881	1	157
9602	50.73	SW	49	750	750	VC	17.46425	1	157
3603	54.13	CO	50.75	300	300	VC	25.07887	1	157
2805	55.22	CO	54.1	225	225	VC	14.48484	1	157
4816	53.72	CO	50.86	300	300	VC	54.30658	1	157
4405	54.02	CO	50.88	225	225	VC	21.05002	1	157
2403	52.52	CO	51.38	225	225	VC	28.19204	1	157
9400	50.67	CO	47.28	600	600	VC	28.19204	1	157
4404	54.04	CO	50.74	300	300	VC	28.19204	1	157
4808	54.25	CO	51.12	300	300	VC	28.19204	1	157
4513	54.13	CO	51	300	300	VC	28.19204	1	157
2704	50.6	CO	51.35	300	300	VC	28.19204	1	157
9701	51.59	CO	48.15	225	225	VC	28.19204	1	157
3812	54.83	CO	51.55	300	300	VC	28.19204	1	157
2402	53.15	CO	51.48	225	225	VC	28.19204	1	157
1801	54.03	CO	48.73	375	375	VC	28.19204	1	157
3803	53.71	SW	52.55	450	450	VC	28.19204	1	157
2901	52.35	CO	50.03	375	375	VC	28.19204	1	157
9802	51.81	CO	47.74	525	525	VC	28.19204	1	157
3606	54.53	CO	51.29	375	375	VC	28.19204	1	157
3609	54.43	CO	52.37	225	225	VC	28.19204	1	157
2900	53.28	CO	48.85	375	375	VC	28.19204	1	157
2708	CO	0	0	0	0	VC	28.19204	1	157
2702	54.97	SW	52.08	300	300	VC	28.19204	1	157

Jenna Lowe

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 23 February 2022 13:30
To: LK SuDS & Floods
Cc: Wastewater Developer Services; Mark Jones; Jenna Lowe; Lisa Aspinall
Subject: PDE for: Park Grove Manchester M19 2FE UU Reference Number : 4200047360

Good afternoon Jenna,

Pre Development Enquiry for: Park Grove Manchester M19 2FE UU Reference Number : 4200047360

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/>

Foul Water

Foul flow from this site will be allowed to drain into the public foul water/combined sewer system.

Our preferred point of discharge would be to the 225mm diameter public combined sewer within Central Avenue located to the south west of your proposed development at an unrestricted rate.

If you are able to identify an alternative, more suitable point of discharge, we request that you contact us at your earliest convenience so that we can assess suitability.

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.

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.

Highway Drainage

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you investigate the possibility of draining surface water to the 675mm highway drain on Park Grove where this ultimately discharges to a watercourse, by contacting the relevant Highway Authority. It may be worth discussing ownership with them because I suspect that it may actually be a public sewer and not a highway drain due to its size

Public Sewer

In accordance with the hierarchy of drainage options within the National Planning Practice Guidance, both discharge to ground via infiltration and discharge to a waterbody should be discounted prior to consideration of discharging surface water to the public sewer system. Evidence should be provided to demonstrate how these have been discounted, as outlined in the North West SuDS pro-forma.

Once evidence is provided as outlined above, United Utilities will consider a connection to the 225mm diameter public combined sewer within Central Avenue located south west of the proposed site 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.

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 Wastewater Assets Crossing the Site

We have reviewed our records and can confirm that there does not appear to be any charted public sewers located within the boundary of proposed development. However, due to the accuracy of the records and the public sewer transfer legislation in 2011, not all public sewers are shown on our records so we would ask that you proceed with caution and carry out your own site investigation works. If any uncharted sewers are identified while carrying out your works we would ask that you contact United Utilities at the earliest opportunity so that we can offer guidance and update our records.

Please refer to the link below to obtain full details of the processes involved with sewer diversions:

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

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.

Kind regards,



United Utilities
Water for the North West

Mohammed Aljafarawi
Developer Engineer
Developer Services & Metering
Customer Services
Email: Mohammed.Aljafarawi@uuplc.co.uk
unitedutilities.com

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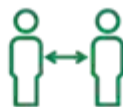
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Wash your
hands



Disinfect
common surfaces



Practise social
distancing



FEVER +
COUGH

Stay home if you
have symptoms

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Jenna Lowe

From: Anna Mierzejewska
Sent: 10 March 2022 13:21
To: LK SuDS & Floods
Subject: Fwd: FRA QUERY - FRA 22 1003 - Park Grove, Manchester

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From: Flood Risk Management <floodriskmanagement@manchester.gov.uk>
Sent: Thursday, March 10, 2022 12:09:03 PM
To: Anna Mierzejewska <a.mierzejewska@thelkgroup.com>
Subject: RE: FRA QUERY - FRA 22 1003 - Park Grove, Manchester

Hi Anna,

Our records actually show this highway drain to be an ordinary watercourse culvert (the Nico Ditch), therefore we as the lead local flood authority are the RMA for this asset.

Based on the drainage hierarchy as set out within Building Regulations Document H consideration should firstly be given to discharge surface water via infiltration and then to the ordinary watercourse, once evidence has been presented to highlight that these methods of outfall are not feasible only then can a connection to the UU network be considered appropriate.

I would also highlight that all new SW connections to ordinary watercourses should be restricted to greenfield run-off rates and require a land drainage consent. I would also recommend that the ordinary watercourse culvert is surveyed to ensure that a gravity connection is feasible from your site and that the culvert is in a suitable condition.

Kind Regards,

Oliver

Oliver Timmins
Engineer (Flood Risk Management)

Lead Local Flood Authority
Highways
Growth & Development and Neighbourhoods Directorate
Manchester City Council
PO Box 532 Town Hall
Manchester
M60 2LA

Web: <http://www.manchester.gov.uk>

From: Anna Mierzejewska <a.mierzejewska@thelkgroup.com>
Sent: 01 March 2022 16:57
To: Flood Risk Management <floodriskmanagement@manchester.gov.uk>

Cc: LK SuDS & Floods <flooding@thelkgroup.com>; Jenna Lowe <j.lowe@thelkgroup.com>; Mark Jones <M.Jones@thelkgroup.com>

Subject: Re: FRA QUERY - FRA 22 1003 - Park Grove, Manchester

Importance: High

Dear Flood Team,

Following from our recent email (attached), could you also advise on the below, that was received from United Utilities in relation to the above site. The sewer plan is also attached.

Highway Drainage

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you investigate the possibility of draining surface water to the 675mm highway drain on Park Grove where this ultimately discharges to a watercourse, by contacting the relevant Highway Authority. It may be worth discussing ownership with them because I suspect that it may actually be a public sewer and not a highway drain due to its size

Kind regards,
Anna



Anna Mierzejewska MSc
Environmental Scientist – Flood Risk
LK Group | 0161 763 7200 | 07515 051 602
Manchester | London | Liverpool | Glasgow
www.thelkgroup.com

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



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This footnote also confirms that this email message has been swept for the presence of computer viruses.

Jenna Lowe

From: LK SuDS & Floods
Sent: 20 January 2022 15:43
To: floodriskmanagement@manchester.gov.uk
Cc: Jenna Lowe; Mark Jones; Lisa Aspinall
Subject: FRA QUERY - FRA 22 1003 - Park Grove, Manchester
Attachments: Location Plan.pdf

Dear Sir/Madam,

LK Consult Ltd. has been commissioned to undertake a Flood Risk Assessment (FRA), for a site located at 29-31 Park Grove, Levenshulme, Manchester, M19 2FE. Centred at approximate National Grid Reference 387159E , 394645N.

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

BGS data indicates that the site is within an area underlain by Till, Devensian - Diamicton superficial deposits and Collyhurst Sandstone Formation - Sandstone bedrock.

The site location is attached to this email.

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

- Details of any flood defences in the immediate area, including their extent, crest levels (and datum), assumed level of standard, construction and maintenance regime, as well as any other structures which may influence the local hydraulics.
- Records of any historic flood events and potential sources of flooding from rivers, land drainage, groundwater, foul and surface water sewers on site and in the area.
- Any restrictions applied to ordinary watercourses and sewers in the area.
- Highway drainage restrictions and records.
- Indications if the site is within the Critical Drainage Area.
- Policies that may relate to Sustainable Drainage Systems (SuDS).

If you have any queries, please do not hesitate to get in touch.

We are, of course, happy to pay your reasonable charge for this service. Please let me know by return what information is available, what the charge will be, and we will pay the relevant fees by debit card as soon as possible.

Any advice or recommendations you may have regarding the potential discharges from the development of this site would also be appreciated.

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

Regards,
Jenna Lowe

APPENDIX D

CALCULATIONS



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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. 1		
				Date 07/03/22		
Project	Park Grove Greenfield Runoff			By	Checked	Reviewed
Title	Park Grove Greenfield Runoff					

Hydrological Data:-

FSR Hydrology:-

Location	=	Park Grove	Grid reference	=	SJ8794
M5-60 (mm)	=	19	r	=	0.36
Soil runoff	=	0.45	SAAR (mm/yr)	=	850
WRAP	=	4	Area	=	England & Wales
Hydrological area	=	10	Hydrological zone	=	8

Soil classification for WRAP type 4

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

Design data:-

Area = 0.000728 Km² - 0.073 Ha - 728 m²

Calculation method:-

Runoff is calculated from:-

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

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 0.001

Mean Annual Peak Flow Q_{BAR(rural)} = 0.40 l/s



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The LK Group

www.thelkgroup.com

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Radcliffe M26 2ZS
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email: m.jones@thelkgroup.com

Job No.		
Sheet no. 2		
Date 07/03/22		
By	Checked	Reviewed

Project	Park Grove Greenfield Runoff
Title	Park Grove Greenfield Runoff

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	1.228	0.341	4.686	100yr+20%	3.641	1.011	13.894
2yr	1.344	0.373	5.128	100yr+30%	3.945	1.096	15.052
5yr	1.748	0.486	6.671	100yr+40%	4.248	1.180	16.210
10yr	1.994	0.554	7.609	200yr	3.468	0.963	13.232
30yr	2.428	0.674	9.263	200yr + 30%	4.508	1.252	17.202
50yr	2.673	0.743	10.200	500yr	3.945	1.096	15.052
100yr	3.034	0.843	11.578	1000yr	4.393	1.220	16.761

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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email: m.jones@thelkgroup.com

Job No.		
Sheet no. 1		
Date 07/03/22		
By	Checked	Reviewed

Project	Park Grove 30 Year Storage Event
Title	Park Grove 30 Year Storage Event

Data:-

FSR Hydrology:-

Location = Park Grove
M5-60 (mm) = 19
Soil index = 0.45
Return period = 30
UCWI = 91.2

Grid reference = SJ8794
r = 0.36
SAAR (mm/yr) = 850
WRAP = 4
Climate change = 0

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

Runoff factor (RF) = 50.0, 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 = 341 m²
Total area (TA) = 545 m²
Mean disch. rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 204 m²
Equiv area = 272 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 0

Calculated data:-

Time to max = 6.0 mins
Rainfall at max = 107.71 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 1.1 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 8.00 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	137.1	1125	1.1	400 x 600	6.0	500 x 500	4.3
150	60.9	1200	1.0	600 x 900	2.6	500 x 750	2.9
225	27.1	1275	0.8	800 x 1200	1.5	500 x 1000	2.2
300	15.2	1350	0.8			750 x 1000	1.4
375	9.7	1425	0.7			750 x 1200	1.2
450	6.8	1500	0.6			750 x 1500	1.0
525	5.0	1575	0.6			1000 x 1000	1.1
600	3.8	1650	0.5			1000 x 1200	0.9
675	3.0	1725	0.5			1000 x 1500	0.7
750	2.4	1800	0.4			1000 x 1800	0.6
825	2.0	1875	0.4			1000 x 2000	0.5
900	1.7	1950	0.4			1500 x 1500	0.5
975	1.4	2025	0.3			1500 x 1800	0.4
1050	1.2	2100	0.3			1500 x 2000	0.4



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Data:-

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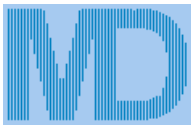
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email: m.jones@thelkgroup.com

Job No.		
Sheet no. 2		
Date 07/03/22		
By	Checked	Reviewed

Project	Park Grove 30 Year Storage Event	
Title	Park Grove 30 Year Storage Event	

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	86.0	3.823	3.000	0.823
20	59.0	5.249	6.000	0.000
30	46.0	6.149	9.000	0.000
40	38.0	6.819	12.000	0.000
50	33.0	7.356	15.000	0.000
60	29.0	7.808	18.000	0.000
70	26.0	8.198	21.000	0.000
80	24.0	8.543	24.000	0.000
90	22.0	8.852	27.000	0.000
100	21.0	9.133	30.000	0.000
110	19.0	9.390	33.000	0.000
120	18.0	9.627	36.000	0.000
130	17.0	9.848	39.000	0.000
140	16.0	10.054	42.000	0.000
150	15.0	10.247	45.000	0.000
160	15.0	10.429	48.000	0.000
170	14.0	10.601	51.000	0.000
180	13.0	10.764	54.000	0.000
190	13.0	10.919	57.000	0.000
200	12.0	11.066	60.000	0.000
210	12.0	11.207	63.000	0.000
220	12.0	11.342	66.000	0.000
230	11.0	11.471	69.000	0.000
240	11.0	11.595	72.000	0.000
250	11.0	11.714	75.000	0.000
260	10.0	11.829	78.000	0.000
270	10.0	11.939	81.000	0.000
280	10.0	12.046	84.000	0.000
290	9.0	12.153	87.000	0.000
300	9.0	12.258	90.000	0.000
310	9.0	12.361	93.000	0.000
320	9.0	12.460	96.000	0.000
330	9.0	12.558	99.000	0.000
340	8.0	12.652	102.000	0.000
350	8.0	12.745	105.000	0.000
360	8.0	12.836	108.000	0.000
370	8.0	12.925	111.000	0.000
380	8.0	13.011	114.000	0.000
390	8.0	13.096	117.000	0.000
400	7.0	13.179	120.000	0.000
410	7.0	13.261	123.000	0.000
420	7.0	13.341	126.000	0.000
430	7.0	13.420	129.000	0.000
440	7.0	13.497	132.000	0.000
450	7.0	13.572	135.000	0.000
460	7.0	13.647	138.000	0.000
470	7.0	13.720	141.000	0.000
480	6.0	13.792	144.000	0.000
490	6.0	13.862	147.000	0.000
500	6.0	13.932	150.000	0.000
510	6.0	14.000	153.000	0.000
520	6.0	14.067	156.000	0.000
530	6.0	14.134	159.000	0.000
540	6.0	14.199	162.000	0.000
550	6.0	14.263	165.000	0.000
560	6.0	14.327	168.000	0.000
570	6.0	14.389	171.000	0.000
580	6.0	14.451	174.000	0.000
590	6.0	14.512	177.000	0.000
600	5.0	14.572	180.000	0.000

Storage volume (m³) = 1.1 m³



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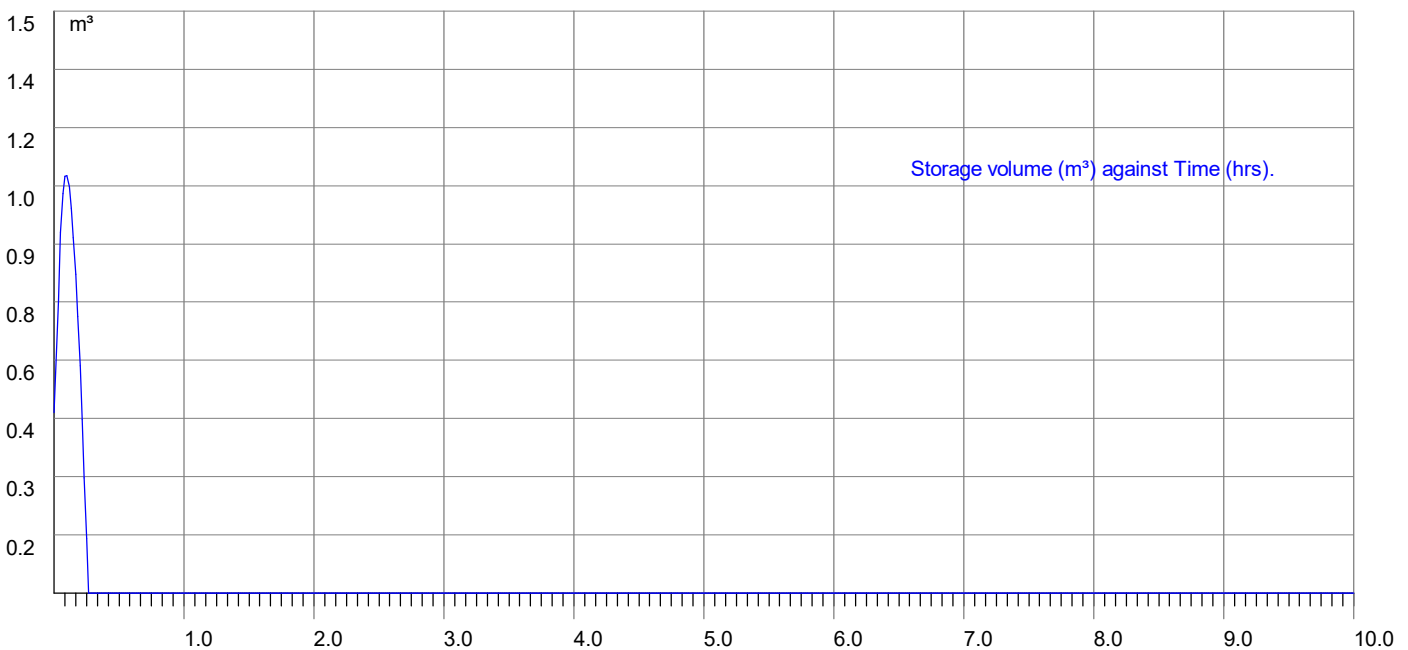
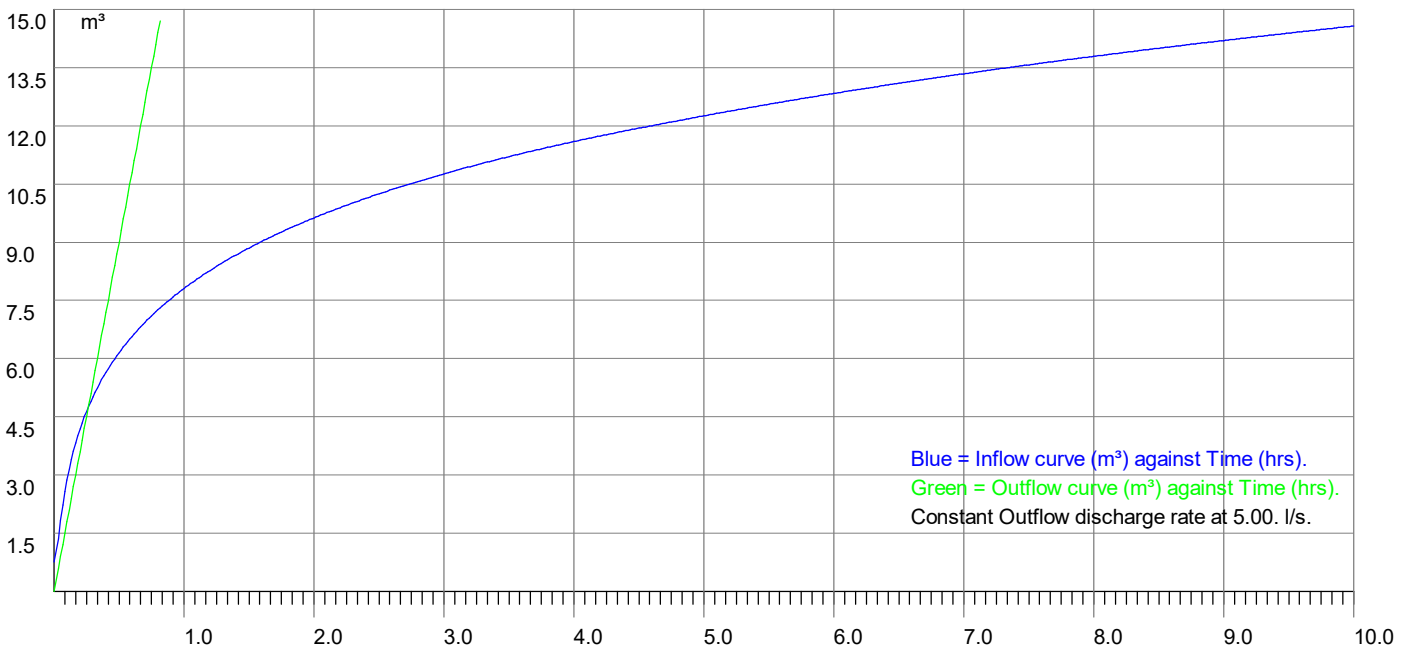
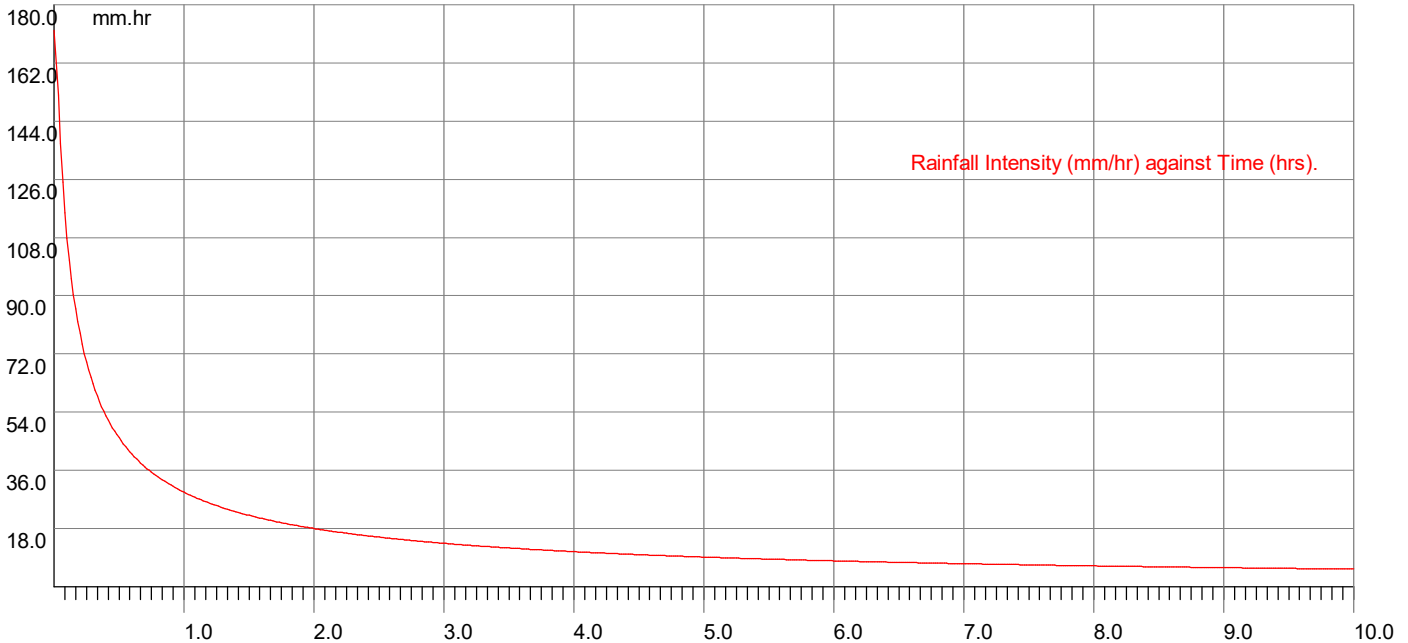
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Job No.		
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Date 07/03/22		
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Project **Park Grove 30 Year Storage Event**
Title **Park Grove 30 Year Storage Event**





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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 outflow volume is constant throughout the process at the specified discharge rate.

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. The outflow volume varies with the hydraulic head on the control device using flow equations provided by the control manufacturer. This is a far more accurate method than the peak flow method and often results in bigger storage volumes.

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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Job No.		
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Project	Park Grove 100 Year Event + 20% CC
Title	Park Grove 100 Year Event + 20% CC

Data:-

FSR Hydrology:-

Location = Park Grove
M5-60 (mm) = 19
Soil index = 0.45
Return period = 100
UCWI = 91.2

Grid reference = SJ8794
r = 0.36
SAAR (mm/yr) = 850
WRAP = 4
Climate change = 20

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

Runoff factor (RF) = 50.0, 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 = 341 m²
Total area (TA) = 545 m²
Mean disch. rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 204 m²
Equiv area = 272 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 20

Calculated data:-

Time to max = 11.0 mins
Rainfall at max = 126.59 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 2.9 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 12.00 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	369.0	1125	2.9	400 x 600	16.1	500 x 500	11.6
150	164.0	1200	2.6	600 x 900	7.0	500 x 750	7.7
225	72.9	1275	2.3	800 x 1200	3.9	500 x 1000	5.8
300	41.0	1350	2.0			750 x 1000	3.9
375	26.2	1425	1.8			750 x 1200	3.2
450	18.2	1500	1.6			750 x 1500	2.6
525	13.4	1575	1.5			1000 x 1000	2.9
600	10.3	1650	1.4			1000 x 1200	2.4
675	8.1	1725	1.2			1000 x 1500	1.9
750	6.6	1800	1.1			1000 x 1800	1.6
825	5.4	1875	1.0			1000 x 2000	1.4
900	4.6	1950	1.0			1500 x 1500	1.3
975	3.9	2025	0.9			1500 x 1800	1.1
1050	3.3	2100	0.8			1500 x 2000	1.0



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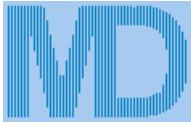
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Project	Park Grove 100 Year Event + 20% CC	
Title	Park Grove 100 Year Event + 20% CC	

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	132.0	5.889	3.000	2.889
20	92.0	8.184	6.000	2.184
30	72.0	9.638	9.000	0.638
40	60.0	10.719	12.000	0.000
50	52.0	11.585	15.000	0.000
60	46.0	12.310	18.000	0.000
70	42.0	12.934	21.000	0.000
80	38.0	13.483	24.000	0.000
90	35.0	13.973	27.000	0.000
100	32.0	14.416	30.000	0.000
110	30.0	14.819	33.000	0.000
120	28.0	15.190	36.000	0.000
130	27.0	15.532	39.000	0.000
140	25.0	15.850	42.000	0.000
150	24.0	16.147	45.000	0.000
160	23.0	16.425	48.000	0.000
170	22.0	16.687	51.000	0.000
180	21.0	16.933	54.000	0.000
190	20.0	17.166	57.000	0.000
200	20.0	17.387	60.000	0.000
210	19.0	17.596	63.000	0.000
220	18.0	17.796	66.000	0.000
230	18.0	17.985	69.000	0.000
240	17.0	18.167	72.000	0.000
250	16.0	18.340	75.000	0.000
260	16.0	18.506	78.000	0.000
270	16.0	18.664	81.000	0.000
280	15.0	18.817	84.000	0.000
290	15.0	18.973	87.000	0.000
300	14.0	19.128	90.000	0.000
310	14.0	19.279	93.000	0.000
320	14.0	19.425	96.000	0.000
330	13.0	19.568	99.000	0.000
340	13.0	19.707	102.000	0.000
350	13.0	19.843	105.000	0.000
360	12.0	19.976	108.000	0.000
370	12.0	20.106	111.000	0.000
380	12.0	20.232	114.000	0.000
390	12.0	20.356	117.000	0.000
400	12.0	20.478	120.000	0.000
410	11.0	20.597	123.000	0.000
420	11.0	20.713	126.000	0.000
430	11.0	20.828	129.000	0.000
440	11.0	20.940	132.000	0.000
450	11.0	21.050	135.000	0.000
460	10.0	21.158	138.000	0.000
470	10.0	21.264	141.000	0.000
480	10.0	21.368	144.000	0.000
490	10.0	21.470	147.000	0.000
500	10.0	21.571	150.000	0.000
510	10.0	21.670	153.000	0.000
520	9.0	21.767	156.000	0.000
530	9.0	21.863	159.000	0.000
540	9.0	21.958	162.000	0.000
550	9.0	22.051	165.000	0.000
560	9.0	22.142	168.000	0.000
570	9.0	22.232	171.000	0.000
580	9.0	22.321	174.000	0.000
590	9.0	22.409	177.000	0.000
600	8.0	22.495	180.000	0.000

Storage volume (m³) = 2.9 m³



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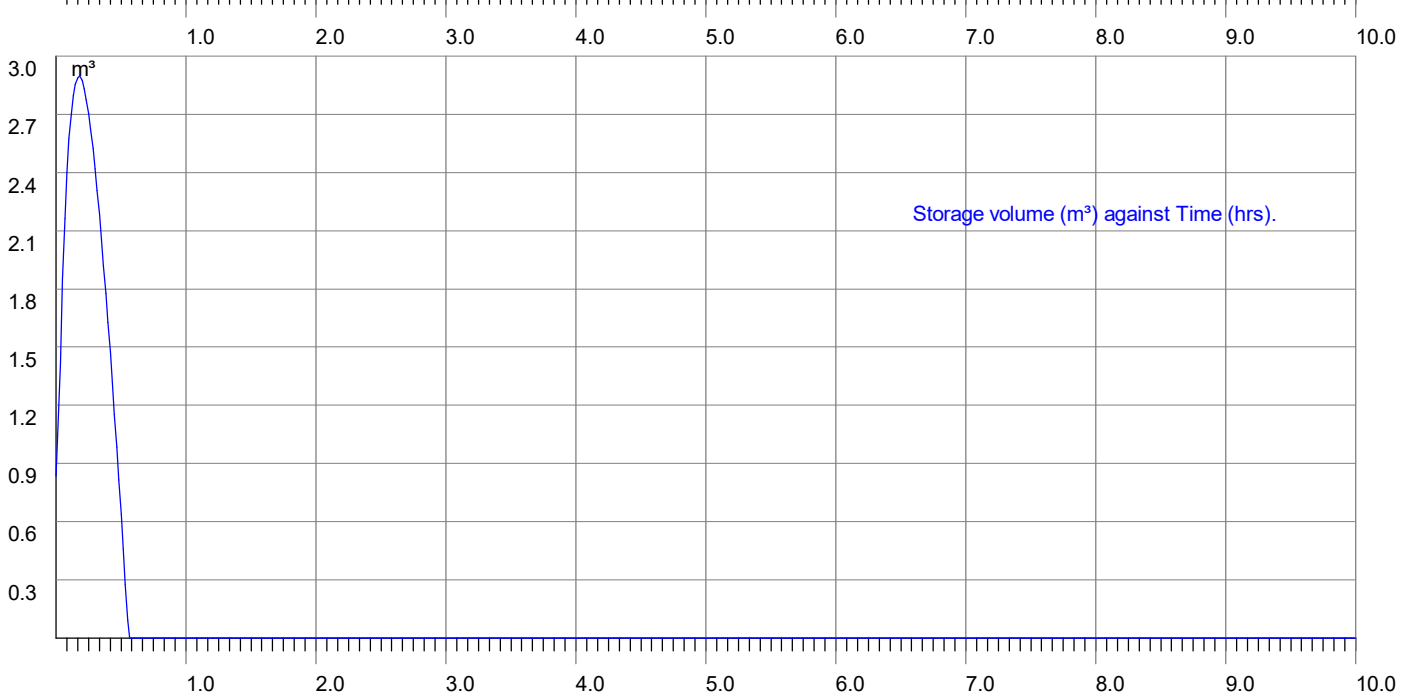
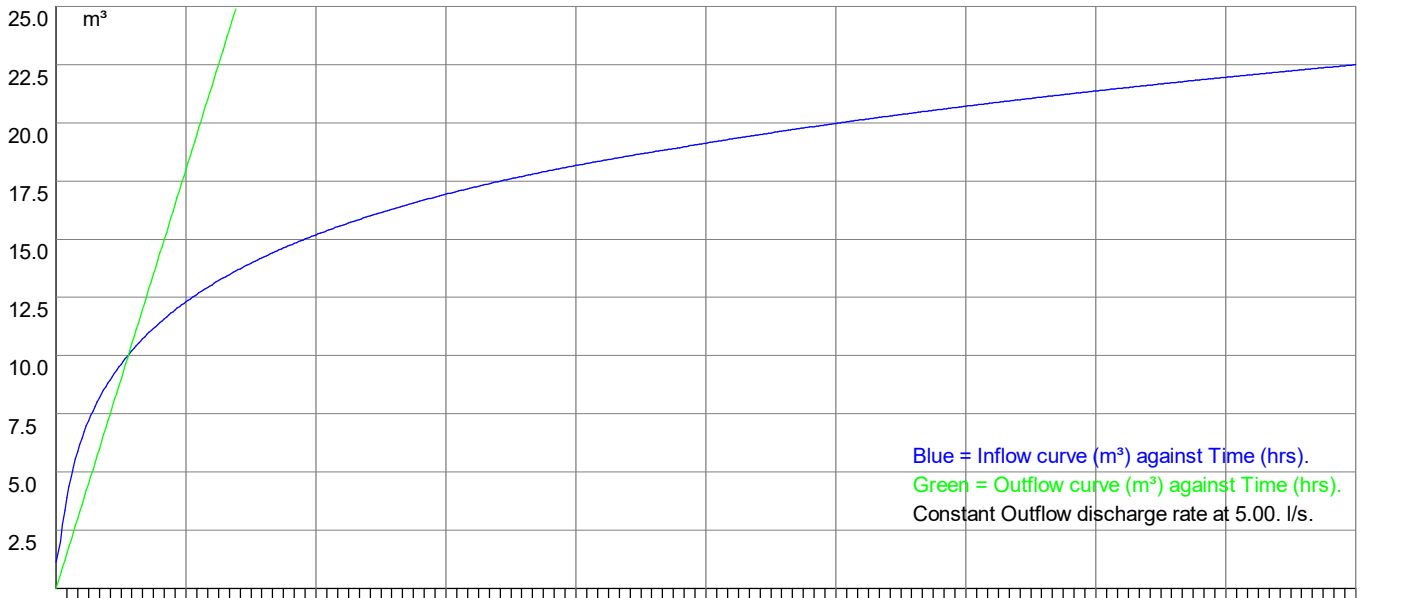
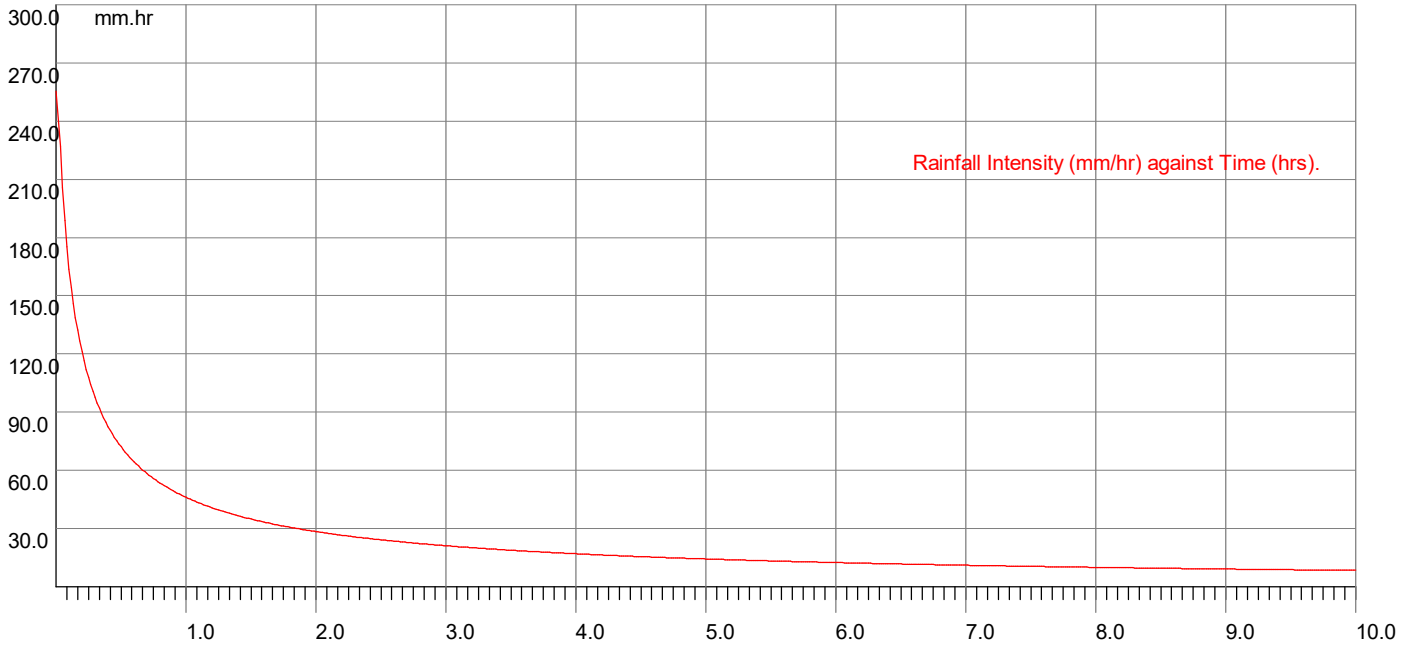
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Project **Park Grove 100 Year Event + 20% CC**

Title **Park Grove 100 Year Event + 20% CC**





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Title Park Grove 100 Year Event + 20% CC						

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 outflow volume is constant throughout the process at the specified discharge rate.

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. The outflow volume varies with the hydraulic head on the control device using flow equations provided by the control manufacturer. This is a far more accurate method than the peak flow method and often results in bigger storage volumes.

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	Park Grove 100 Year Event + 40% CC
Title	Park Grove 100 Year Event + 40% CC

Data:-

FSR Hydrology:-

Location = Park Grove
M5-60 (mm) = 19
Soil index = 0.45
Return period = 100
UCWI = 91.2

Grid reference = SJ8794
r = 0.36
SAAR (mm/yr) = 850
WRAP = 4
Climate change = 40

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

Runoff factor (RF) = 50.0, 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 = 341 m²
Total area (TA) = 545 m²
Mean disch. rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 204 m²
Equiv area = 272 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 40

Calculated data:-

Time to max = 13.0 mins
Rainfall at max = 135.74 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 4.0 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 14.00 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	503.5	1125	4.0	400 x 600	22.0	500 x 500	15.8
150	223.8	1200	3.5	600 x 900	9.6	500 x 750	10.5
225	99.5	1275	3.1	800 x 1200	5.4	500 x 1000	7.9
300	55.9	1350	2.8			750 x 1000	5.3
375	35.8	1425	2.5			750 x 1200	4.4
450	24.9	1500	2.2			750 x 1500	3.5
525	18.3	1575	2.0			1000 x 1000	4.0
600	14.0	1650	1.8			1000 x 1200	3.3
675	11.1	1725	1.7			1000 x 1500	2.6
750	9.0	1800	1.6			1000 x 1800	2.2
825	7.4	1875	1.4			1000 x 2000	2.0
900	6.2	1950	1.3			1500 x 1500	1.8
975	5.3	2025	1.2			1500 x 1800	1.5
1050	4.6	2100	1.1			1500 x 2000	1.3



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Data:-

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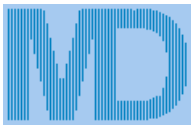
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Project	Park Grove 100 Year Event + 40% CC	
Title	Park Grove 100 Year Event + 40% CC	

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	154.0	6.871	3.000	3.871
20	107.0	9.548	6.000	3.548
30	84.0	11.245	9.000	2.245
40	70.0	12.506	12.000	0.506
50	61.0	13.516	15.000	0.000
60	54.0	14.362	18.000	0.000
70	48.0	15.090	21.000	0.000
80	44.0	15.730	24.000	0.000
90	41.0	16.302	27.000	0.000
100	38.0	16.818	30.000	0.000
110	35.0	17.289	33.000	0.000
120	33.0	17.721	36.000	0.000
130	31.0	18.121	39.000	0.000
140	30.0	18.492	42.000	0.000
150	28.0	18.838	45.000	0.000
160	27.0	19.163	48.000	0.000
170	26.0	19.468	51.000	0.000
180	25.0	19.755	54.000	0.000
190	24.0	20.027	57.000	0.000
200	23.0	20.284	60.000	0.000
210	22.0	20.529	63.000	0.000
220	21.0	20.761	66.000	0.000
230	20.0	20.983	69.000	0.000
240	20.0	21.194	72.000	0.000
250	19.0	21.397	75.000	0.000
260	19.0	21.590	78.000	0.000
270	18.0	21.775	81.000	0.000
280	18.0	21.953	84.000	0.000
290	17.0	22.135	87.000	0.000
300	17.0	22.316	90.000	0.000
310	16.0	22.492	93.000	0.000
320	16.0	22.663	96.000	0.000
330	16.0	22.829	99.000	0.000
340	15.0	22.992	102.000	0.000
350	15.0	23.150	105.000	0.000
360	15.0	23.305	108.000	0.000
370	14.0	23.457	111.000	0.000
380	14.0	23.604	114.000	0.000
390	14.0	23.749	117.000	0.000
400	13.0	23.891	120.000	0.000
410	13.0	24.030	123.000	0.000
420	13.0	24.166	126.000	0.000
430	13.0	24.299	129.000	0.000
440	12.0	24.430	132.000	0.000
450	12.0	24.558	135.000	0.000
460	12.0	24.684	138.000	0.000
470	12.0	24.808	141.000	0.000
480	12.0	24.929	144.000	0.000
490	11.0	25.049	147.000	0.000
500	11.0	25.166	150.000	0.000
510	11.0	25.282	153.000	0.000
520	11.0	25.395	156.000	0.000
530	11.0	25.507	159.000	0.000
540	11.0	25.617	162.000	0.000
550	11.0	25.726	165.000	0.000
560	10.0	25.833	168.000	0.000
570	10.0	25.938	171.000	0.000
580	10.0	26.041	174.000	0.000
590	10.0	26.144	177.000	0.000
600	10.0	26.245	180.000	0.000

Storage volume (m³) = 4.0 m³



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Project **Park Grove 100 Year Event + 40% CC**

Title **Park Grove 100 Year Event + 40% CC**

