

MANLEY PARK PLAY CENTRE YORK AVENUE

SUSTAINABLE DRAINAGE STRATEGY

Job Number: FRA 20 1203

Date: August 2020

Client: Community on Solid Ground



INCREASING LAND VALUE

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LK Consult			
Document Verification			
Site Address	Manley Park Play Centre, York Avenue, Manchester, M16 0AS		
Report Title	Sustainable Drainage Strategy		
Job Number	FRA 20 1203	Document Ref.	FRA 20 1203 - R0
Date Issued	August 2020	Report Version	R0
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Reviewed By	Mark Jones - Associate	Signature	

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 Manley Park Play Centre, York Avenue in Manchester. The development comprises an activity hall extension to the existing office/activity room building.

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. A limited area in the south is shown to be at a shallow surface water risk for the 1 in 1000-year flooding event.

Mitigation

Design

The site is underlain by Sand and Gravel superficial deposits and Sandstone bedrock. The excavations on site confirmed that sand over clayey sand is present below the topsoil.

The proposed development covers the majority of the site within the existing play centre limits. This limits the available space for surface water drainage infrastructure within the boundary. As the site itself is considered too constrained for the use of an onsite soakaway given the size, proposed land use and close proximity of adjacent highways and foundations, if acceptable to the Park and Local Authority the required drainage infrastructure could be accommodated within the adjacent park land.

There is a connection of the existing building to the public combined sewer in York Avenue.

The proposed development will increase the proportion of the site covered by impermeable surfaces and will therefore generate more runoff. Attenuation will be required to allow for climate change.

In considering the potential drainage options for the site at present it is assumed that surface water runoff arising from the development could discharge into an infiltration facility adjacent to the site, subject to agreement with the local parks department and LPA.

If agreement to use an area of parkland for the soakaway is not reached the alternative would be to connect the public sewer system at a restricted rate. A pre-development enquiry has been sent to United Utilities to agree a condition for connecting of the proposed hall extension into their network via existing connection.

Therefore, as an alternative to the soakaway, the outline drainage strategy considers the use of attenuation-based SuDS to be feasible with a discharge to the adjacent combined sewer. If infiltration methods were unfeasible, the most effective strategy, in line with the SuDS management train, would be to have a below ground storage tank located within the site boundary. The required attenuation tank or similar has been estimated to be **4.6m³** for the 1 in 30-year considering practical minimum 5l/s flow restriction.

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 **10.0m³** and **12.9m³**.

The estimated volume can be stored within the site boundary.

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

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1 Introduction

1.1 Background

LK Consult Ltd (LKC) were commissioned by Community on Solid Ground to carry out a Sustainable Drainage Strategy for Manley Park Play Centre, York Avenue, Manchester. The report was undertaken in support of a planning application (reference number 127622/FO/2020) to redevelop the site for increasing the recreational facilities.

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	West of York Avenue, North of Clarendon Road, Whalley Range, Manchester, M16 0AS. Centred at approximate National Grid Reference 382220E, 394630N.
Area	Approximately 770m ² .
Topography	Approximately 28 metres above ordnance datum (AOD) across the site. Site is approximately level.
Current Land Use	<u>Site</u> Hardstood ground to the north of the site comprising existing building, tarmac play areas and paved surfacing. Grassed area within of the south of the site with play equipment and a storage compound. The site is fenced and secured separately from Manley Play Park. <u>Surrounding Area</u> North: Manley Play Park. East: Manley Play Park. South: Grassed verge of parkland and Clarendon Road beyond. West: Access from York Avenue, grassed verge of parkland to the southwest.
Proposed Development	Activity hall extension to the existing office / activity room building. Access off York Avenue to be retained.

Table 1-1: Summary of site details.

2 Site Setting

2.1 Vulnerability

As an initial phase in identifying which Sustainable Drainage System is appropriate for the site, LKC has consulted the Environment Agency's (EA) website Flood Zone Mapping.

The Flood Zone Mapping indicates the site as being within Flood Zone 1 in the PPG (paragraph 065, Table 1).

The proposed development is for an educational end use and this is classified within the 'More Vulnerable' category in the PPG (paragraph 066, Table 2).

2.2 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	Glaciofluvial Sheet Deposits (Sand and Gravel).
	Bedrock	Wilmslow Sandstone Formation (Sandstone).
	BGS Boreholes	No records available within 500m from the site. Nearest BH Ref: SJ89NW1697, 520m north: Fill - ash, soil and brick to 1.22m, compact sand and gravel to 3.66m, stiff sandy boulder clay to 4.57m.
Hydrogeology	Superficial	Secondary A Aquifer.
	Bedrock	Principal Aquifer. The site is not within a groundwater Source Protection Zone
Hydrology	All adjacent and internal surface water	No watercourses recorded within the vicinity of the site.
Site History		Annotated as Manley Park from 1933/1938 mapping. Annotated as Recreation ground from 1951/1955 mapping. Existing site layout from pre 2000 mapping. Former Canal Feeder approximately 190m S annotated from the earliest mapping until 1933. Likely culverted post 1933.

Table 2-1: Summary of the Environmental Setting.

2.3 Site Reconnaissance

A site reconnaissance was undertaken in August 2020 and photographs are provided in Appendix B.

Relevant features identified on site are summarised below:

- Gated access to the site from York Avenue.
- Site comprises of an office / activity room building in the centre north with a small extension to the north. Paved activity areas and playgrounds present to the north, east and south of the exiting building.

- »» A lawn area present in the south of the site, comprising of a storage compound and 2no. mature trees.
- »» Site is bounded by a metal fencing from the adjoining Manley Play Park and adjacent highways.
- »» Site is relatively flat.
- »» Positive drainage was observed in form of roof gutters, downpipes, and gully pots draining into shallow 0.72m manhole within the site and further into 1.30m deep manhole in the Manley Park footpath off York Avenue.
- »» Another manhole was observed north of the existing building likely associated with a parkland drainage.
- »» The existing building is connected to the combined sewer in York Avenue.
- »» Shallow ground investigation within the north of the site confirmed Sand to 0.8m over clayey Sand.
- »» No evidence of high ground water, standing water observed.
- »» No watercourse or other water features observed within vicinity of the site.

2.4 Site and Access Levels

The site is relatively flat at approximately 28.0m above ordnance datum (AOD) across the site. The final site levels and ground floor levels of the extension hall have not yet been determined. The access would join York Avenue at around 28.0m AOD.

3 Consultation

Information from consultees (Environment Agency (EA), Manchester City Council (Lead Local Flood Authority) and United Utilities (UU)) is summarised in Table 3-1 below.

Relevant correspondence / information is provided in Appendices C (EA) and D (others).

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). Shallow surface water risk to the south of the existing building for the 1 in 1000-year event.	
MCC (LLFA)	No flooding records, No record of ordinary watercourses in the area. Manchester City Council's SuDS Requirements for New Developments state that a flow from greenfield sites should be limited to greenfield runoff rates, and a flow from Brownfield sites should be reduced by a minimum of 50% compared to the existing runoff rates with an aim to reduce to greenfield runoff rates wherever practicable.	
United Utilities	Likely conditions for connecting into their sewerage system	No information received at time of writing. UU would normally 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.
	sewer map	No surface water sewers within the vicinity of the site. There is a 225mm diameter combined sewer in York Avenue joining a 450mm diameter combined sewer in Clarendon Road.

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 proposed 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.

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

⁴ Flood and Water Management Act 2010: UK Government.

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 supplemented by local records is shown in Table 4-1 below:

Classification	Description	Aquifer Classification	Recorded Water Table Depth	Soakaway Potential
Glaciofluvial Sheet Deposits	Sand over slightly gravelly clayey sand	Secondary A	2.29m BGL off site	Good
Wilmslow Formation Bedrock	Sandstone	Principal Aquifer	N/A	Good

Table 4-1: Geological and Hydrogeological Setting.

Infiltration methods such as soakaways are likely to be feasible, but this may be investigated further at the detailed design stage. This may be subject to a depth of groundwater levels below the site.

As the site itself is considered constrained, given the size, current land use and close proximity of adjacent highways, the existing and proposed foundations, a consideration could be given to utilise the adjacent parkland for the use of infiltration SuDS, subject to agreement with LPA.

4.2 Watercourses

There are no observable watercourses within or near the boundary of the site. Currently surface water from the site drains into the public sewer.

4.3 Public Sewer

There are no surface water sewers recorded within the vicinity of the site.

There is a 225mm diameter combined sewer running adjacent to the site in York Avenue and a 450mm diameter combined sewer in Clarendon Road south of the site.

4.4 Other Sewers

There is a private connection to the public sewer from the site.

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	1	Reasoning: good permeability potential from underlying soils. Constraints: Unknown groundwater level, space constraints.
b	Connection to Watercourse	N/A	There are no watercourses within the vicinity of the site where connection could be made.
c	Discharge into a sewer	2	The existing connection into a 225mm combined sewer could be utilised – subject to approval from the LPA/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	✓	Due to the nature of the ground conditions, the use of infiltration systems may be feasible.
Infiltration basin	✓	Depressions that store and dispose of water via infiltration. May be appropriate given the ground conditions.
Sand filter	✓	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	✓	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	*	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. 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 – 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.
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

4.6 Surface Water Attenuation Requirements

Given the current SuDS requirements set by LLFA, the flow from that site would likely need to 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)	0.077
Existing Permeable Area (ha)	0.026
Existing Impermeable Area (ha)	0.051
Proposed Areas	
Impermeable split (ha)	0.072
Permeable split (ha)	0.005

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 is an increase in impermeable area from the existing usage to the proposed. This is likely to require a limited attenuation to reduce the existing flow off site to a level which is acceptable to the LLFA and to UU.

4.6.1 Infiltration Storage Estimate

It is possible that this area maybe drained via infiltration-based SuDS following further testing.

Typical k Values from 'Environmental Geotechnics' (Sarsby)⁶ suggests that values between 1×10^{-4} m/s and 1×10^{-5} m/s are typical given that the area is underlain by sand and clayey sand.

As a result of these figures the volume of the required filter trench has been estimated using CIRIA Report 156⁷ and is shown in Appendix E. This assumes a safety factor of 2. For an infiltration rate of 10^{-4} m/s, for example a width of 2m, a length of 25m and a depth of 0.92m creates the required total storage volume of **20.6m³**. Whereas for an infiltration rate of 10^{-5} m/s a width of 3m, a length of 30m and a depth of 1.03m creates the required total volume of **41.7m³**, both of which can be half empty within 24 hours.

A consideration could be given to utilise the adjacent park land for the use of infiltration SuDS, subject to agreement with the Parks Authority and LPA.

4.6.2 Attenuation Estimate

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

For the contributing catchment, an estimate has been produced assuming a developable area of 0.033ha and existing development of 0.044ha from the 0.077ha plot. Assuming the development will comprise of 0.033ha of a new roof space and

⁶ Environmental Geotechnics 2nd Edition – Sarsby 2013.

⁷ Infiltration drainage, Manual of good practice (R156). 1996.

⁸ IH124 Flood Estimation of Small Catchments.

giving the remaining hard standing and a roof space from the current use is 0.039ha, the resulting impermeable area would be 0.072ha. This gives the following runoff rates and attenuation requirements for this section based on the Wallingford IH 124 method:

» Q_{bar} :	0.18 l/s
» 1 in 1-year greenfield runoff rate:	0.15 l/s
» 1 in 30-year greenfield runoff rate:	0.30 l/s
» 1 in 100-year greenfield runoff rate:	0.37 l/s

As the greenfield Q_{bar} is less than 5l/s for this site, the practical minimum of 5l/s has been utilised to estimate the storage requirement using the FSR methodology⁹ as:

The following attenuation has been estimated for the development using greenfield runoff rates and utilises the FSR methodology¹⁰ as:

- » Attenuation storage volume: **4.6 m³** (1 in 30-year event)
- » Retention on site volume: **10.0 m³** (1 in 100 year + 20% Climate Change)
- » Retention on site volume: **12.9 m³** (1 in 100 year + 40% Climate Change)

Attenuation storage aims to limit the peak rate of runoff from the development before discharge to the combined sewer. As the flow from the development would be restricted to 5l/s there should be little change in the flows that enter the unnamed watercourse 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 **4.6 m³** and for the 1 in 100-year event, a storage capacity of between **10.0 m³** and **12.9 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.

4.7 Site Specific SuDS

A filter trench may be feasible giving likely permeable ground across the site and adjacent area. The trench will provide a significant volume of storage and contribute to surface water treatment via filtering through the soils and will also contribute to groundwater recharge and baseflow augmentation (subsurface storage). Alternatively, storage could be created by using crates or a tank to reduce the area affected by the soakaway.

Giving the existing constraints on-site, an alternative location off-site could be considered for the use of infiltration SuDS. If that was acceptable by the LPA, the infiltration trench could be located within the parkland area adjacent to the site.

Alternatively, if the use of soakaways is impractical and use of the connection to the sewer is necessary the use of attenuation tank or similar has deemed to be practical option for the development. The attenuation tank will provide required storage volume to limit peak runoff arising from the development.

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

⁹ Flood Studies Report Wallingford NERC 1975.

¹⁰ Flood Studies Report Wallingford NERC 1975.

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.

4.8 Foul Drainage

The foul water would continue to be discharged by gravity into the 225mm diameter combined sewer in York Avenue via an existing connection from the site. This is subject to agreement with United Utilities.

5 Conclusion

The site is currently occupied by a local community group, utilising the various play areas across the park. The lawn area in the south is proposed for the activity hall extension.

The excavations on site confirmed that Sand over clayey Sand was encountered below the topsoil. This indicates that shallow infiltration may be feasible. Given the existing site constraints, an alternative location outside of the boundary but within the park could be considered for the soakaway location if agreeable to the park authorities. which would allow infiltration into the ground by utilising an off-site filter drain or similar.

There is a connection of the site and existing building to the public combined sewer in York Avenue. A pre-development enquiry has been sent to United Utilities to agree a condition for connecting the flow from the new development into their network.

If the soakaway location cannot be agreed and a connection to the sewer system is required , the required volumes could be stored within the site boundary in a below ground storage tank with a flow attenuated to 5l/s or a runoff rate agreed by LPA and UU.

Consideration should be given to the route of the drainage infrastructure connections within the detailed design.

All proposed outflow connections from the development should be agreed with the Local Planning Authority and/or United Utilities.

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APPENDIX A

FIGURES, PLANS AND DRAWINGS

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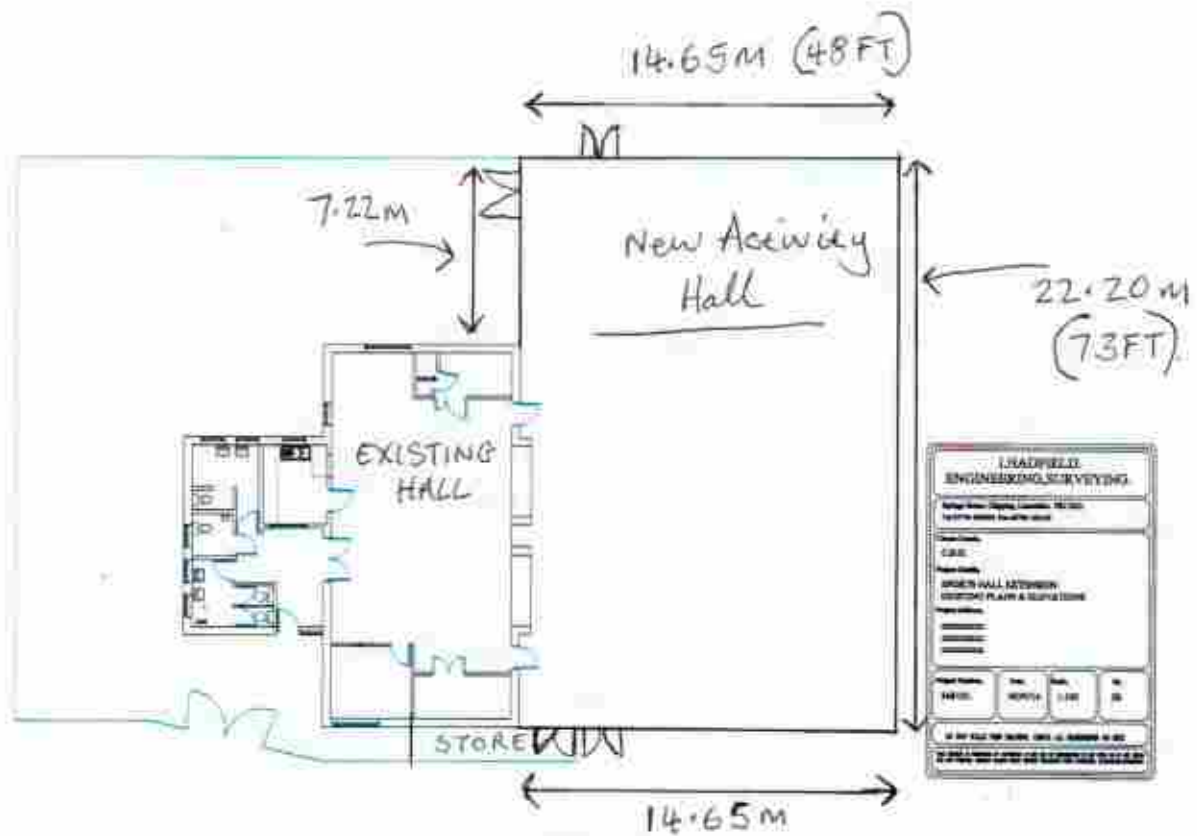
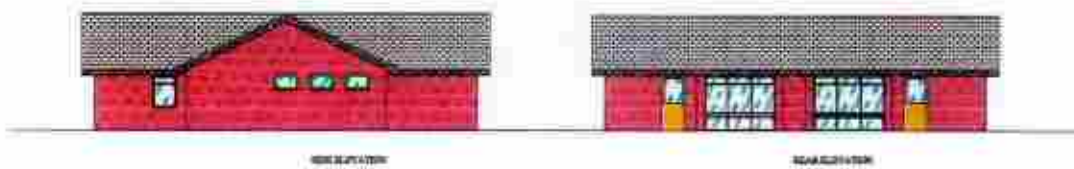
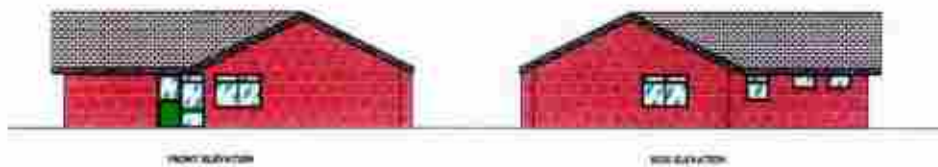
Client: Community On Solid Ground				Title: Site Location & Boundary Plan		LKCONSULT LIMITED	
Site: Manley Park Play Centre, York Avenue				Scale (see scale bar): 1:25,000 & 1:1,500 @ A4			
Job No.: FRA 20 1203	Drawn By: AM	Checked By: MJ	Drawn: August 2020	Figure: 1	Revision:		

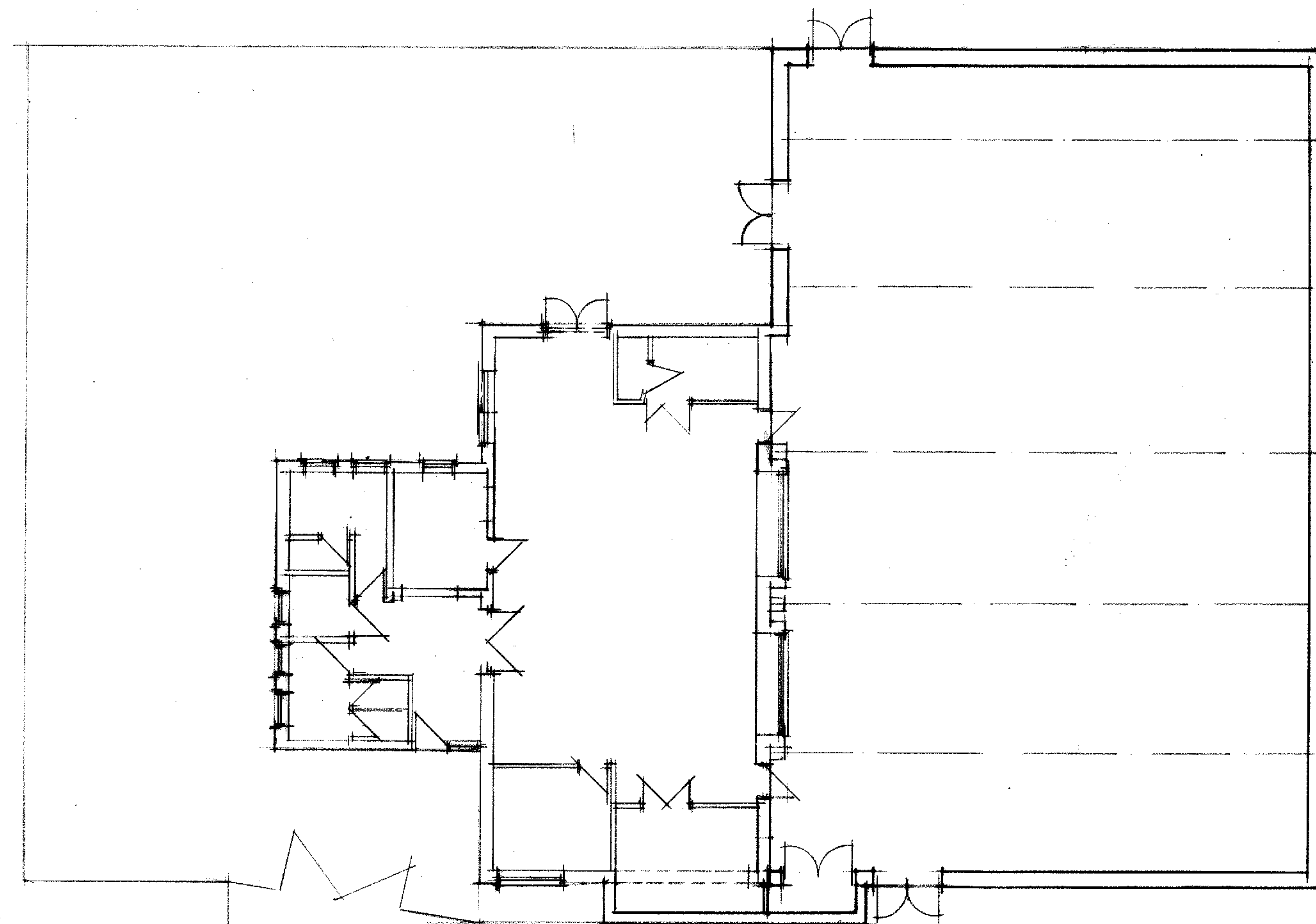
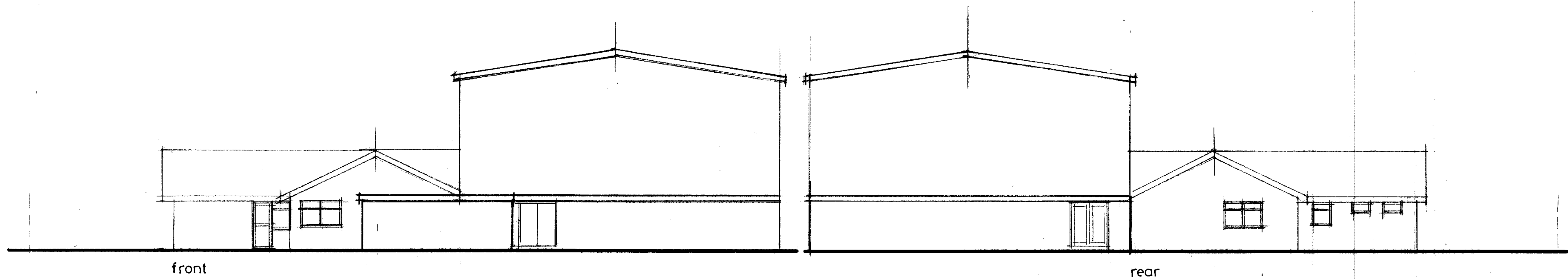
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APPENDIX B

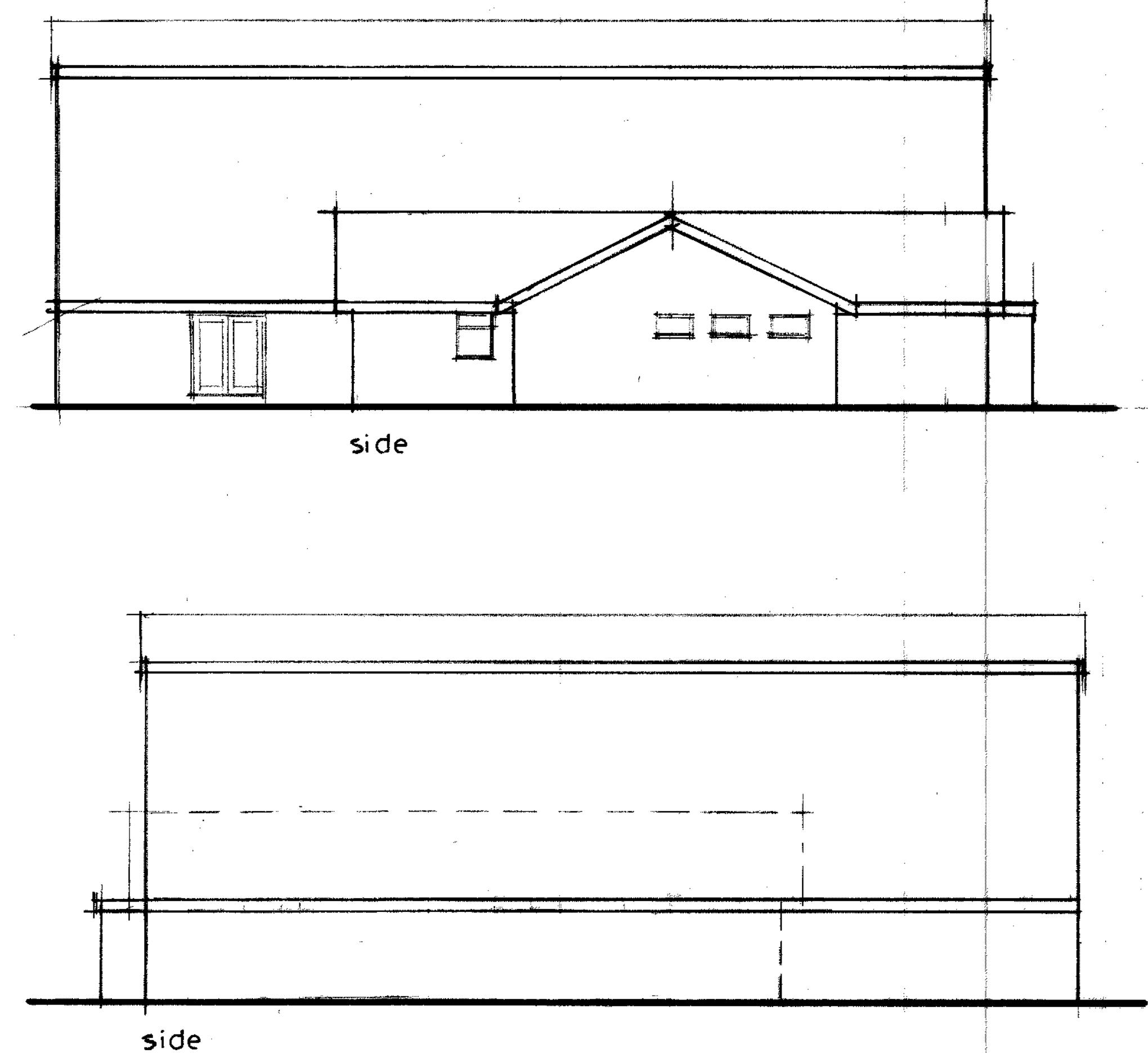
SITE INFORMATION

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GROUND FLOOR PLAN



CLIENT
COMMUNITY ON SOLID GROUND
MANLEY PARK PLAY CENTRE
YORK AVENUE M16 0AS

JOB TITLE
PROPOSED ACTIVITY HALL
EXTENSION

ORG. TITLE
PLAN AND ELEVATIONS
AS PROPOSED

**HOLBOROW +
ORMESHER +**
Limited

**architectural &
interior design**

Station House
Adams Hill
Knutsford
Cheshire WA16 6DN
telephone : 01565 652275
fax : 01565 750501

ISSUE	ORIGINAL	1	2	3	4	5	6	7
REVISION								
DATE								
DRAWN								
CHECKED								
APPROVED								
SCALE	1:100 at A1							

DRAWING
NUMBER 2071 / 20/02



Surface
Geology

3D
Models

Borehole
Scans

Earthquake
Timeline

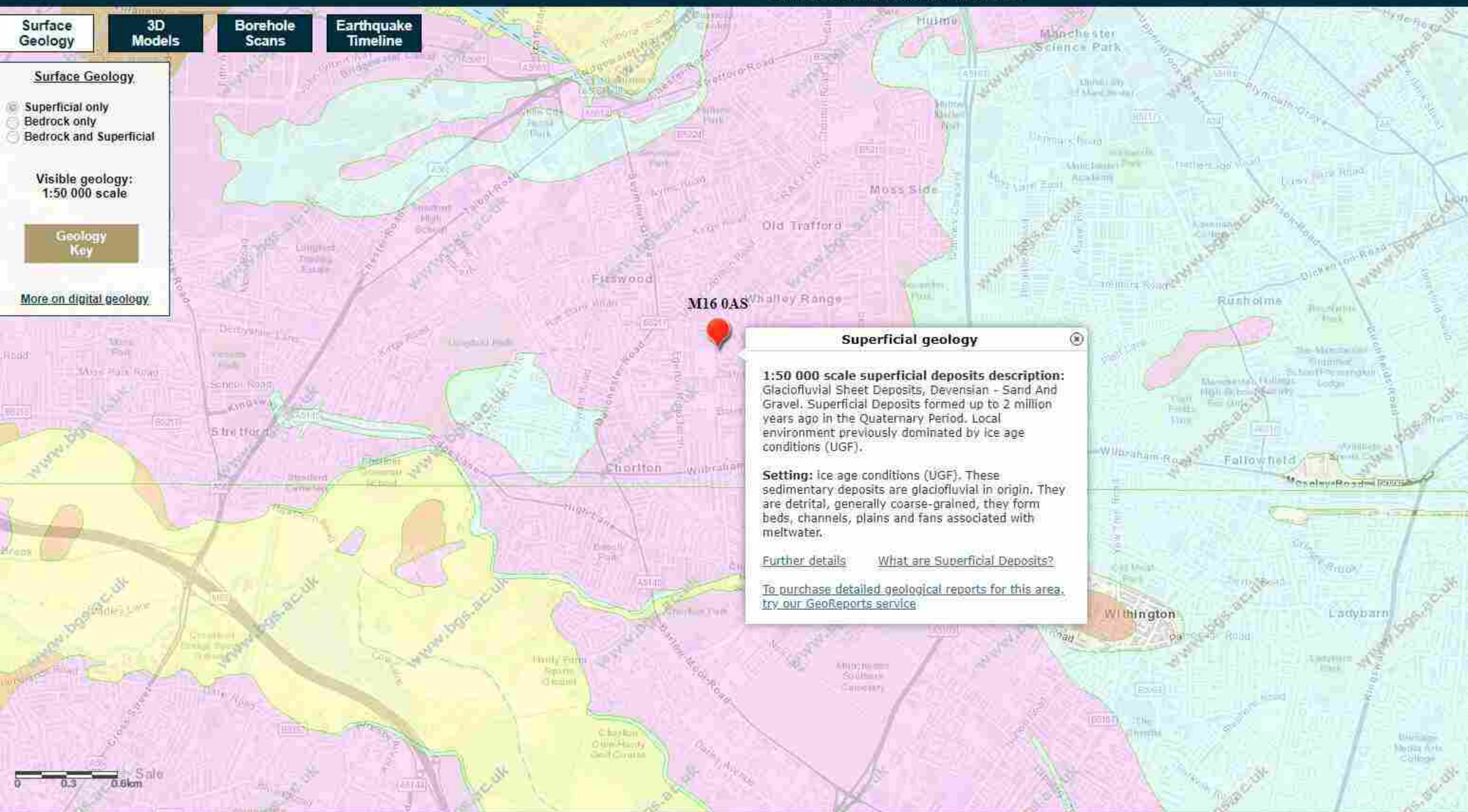
Surface Geology

- ☒ Superficial only
- ☐ Bedrock only
- ☐ Bedrock and Superficial

Visible geology:
1:50 000 scale

Geology
Key

[More on digital geology](#)



Superficial Geology, BGS



Surface
Geology

3D
Models

Borehole
Scans

Earthquake
Timeline

Surface Geology

- ☒ Superficial only
- ☐ Bedrock only
- ☐ Bedrock and Superficial

Visible geology:
1:50 000 scale

Geology
Key

[More on digital geology](#)

MI6 0AS

Bedrock geology

1:50 000 scale bedrock geology description:

Wilmslow Sandstone Formation - Sandstone.
Sedimentary Bedrock formed approximately 247 to 252 million years ago in the Triassic Period. Local environment previously dominated by hot deserts.

Setting: hot deserts. These sedimentary rocks are fluvial, lacustrine and marine in origin. They are detrital, deposited in lagoons or shallow seas; where a hot, arid climate also leads to the precipitation of beds of evaporites.

[Further details](#)

[What is Bedrock Geology?](#)

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BOREHOLE LOG

SJ89NW1697
8229 9517

Site UPPER CHORLTON ROAD-MANCHESTER. Job No. S.I. 453
 Client Messrs Broadhurst & Goodwin. Date Jan. 1973.
 Borehole No. 2. Diameter 6"
 Ground Level Existing. 29.90m = 98.30' Scale 1/4" = 1.0'

Description	Depth	Legend	Sample	'N' Value	Shear Strength	Water Levels
Fill - ash, soil & brick.	4'-0"			3' 10		
Compact sand & gravel.	12'-0"			6' 18		7'-6" water entry.
Stiff sandy boulder clay.	15'-0" 4.5m					F.W.L. 7'-6"

NORTHERN FOUNDATIONS LIMITED



Photograph 1
(facing E):
View of the
development site
from York Avenue.



Photograph 2
(facing N):
View of the
development site
and existing
building from
Clarendon Road.



Photograph 3
(facing S):
Entrance to
Community Centre
off York Avenue.



Photograph 4
(facing N):
Manley Park
outside the
development area.



Photograph 5
(facing W):
View of the
development area.



Photograph 6
(facing NW):
View of the
development area
and the existing
building.



Photograph 7
(facing W):
Various play areas
(surfaced).



Photograph 8
(facing N):
Various play areas
(surfaced) and
grassed area east
of the building.



Photograph 9
(facing W):
Surfaced play area
in the north.



Photograph 10
(facing SE):

Existing drainage serving the building and paved areas discharging into 0.72m deep onsite manhole.



Photograph 11
(facing S):

Existing drainage serving the building and paved areas.



Photograph 12
(facing NW):

Roof gutters.



Photograph 13
A 0.72m deep manhole by the building entrance.



Photograph 14
A 1.3m manhole further towards York Avenue, with a site drainage outfall.



Photograph 15
(facing N):
Public sewer in York Avenue.



Photograph 16:
Gullies observed in adjacent highways.



Photograph 17:
Public sewer in Clarendon Road.



Photograph 18
(facing N):
Manley Park adjacent to the east of site.



Photograph 19
(facing SE):
Shallow excavation undertaken within north of the site.
Topsoil to 0.25m
Sand to 0.8m,
Clayey slightly
gravelly sand to 1.1m.



Photograph 20
Sand encountered
on site as above.

APPENDIX C

ENVIRONMENT AGENCY DATA

Flood map for planning

Your reference
FRA 20 1203

Location (easting/northing)
382221/394625

Created
24 Aug 2020 12:58

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

This means:

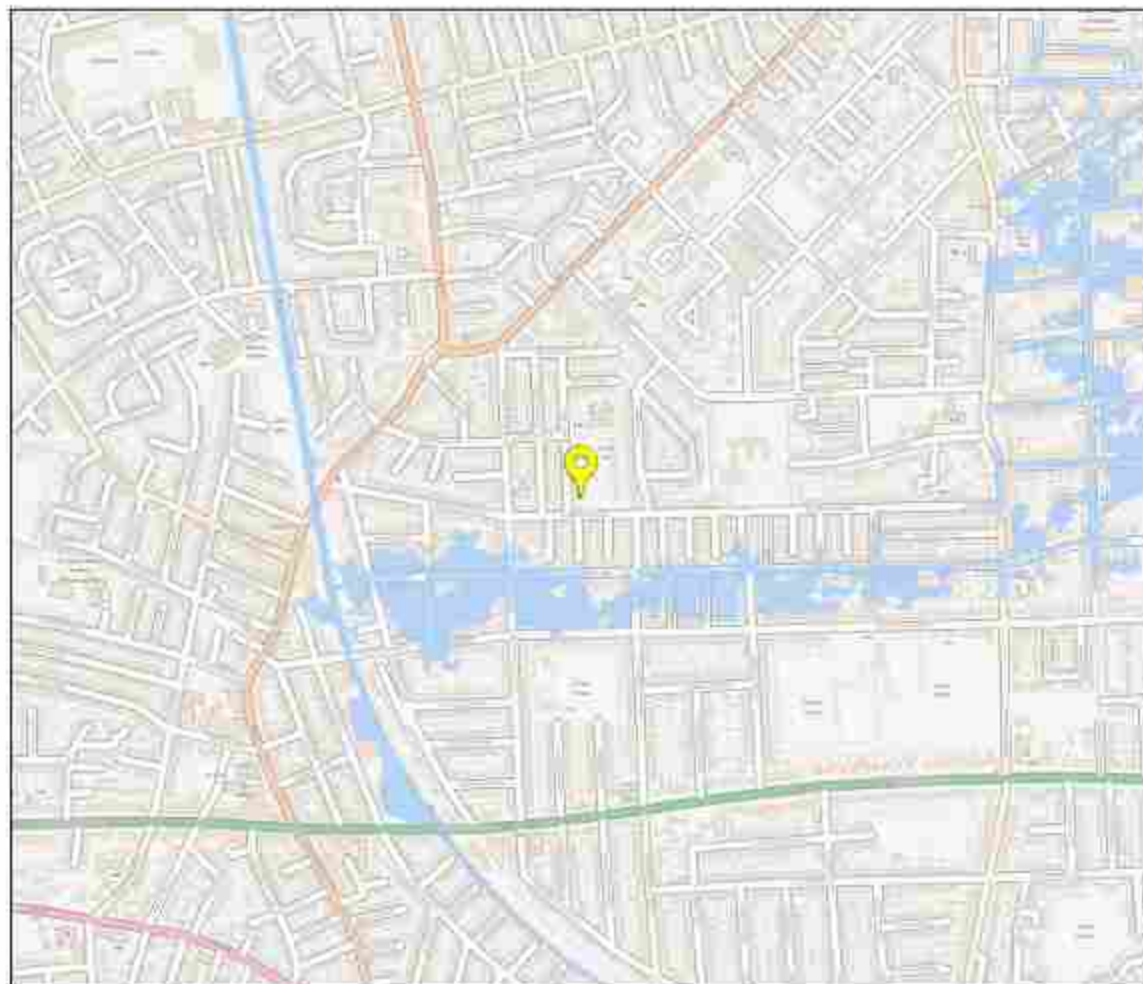
- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage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



Environment
Agency

Flood map for planning

Your reference:

FRA 20 1203

Location (easting/northing):

382221/394625

Scale:

1:10000

Created:

24 Aug 2020 12:58



Selected point



Flood zone 3



Flood zone 3; areas
benefiting from flood
defences



Flood zone 2



Flood zone 1



Flood defence



Main river



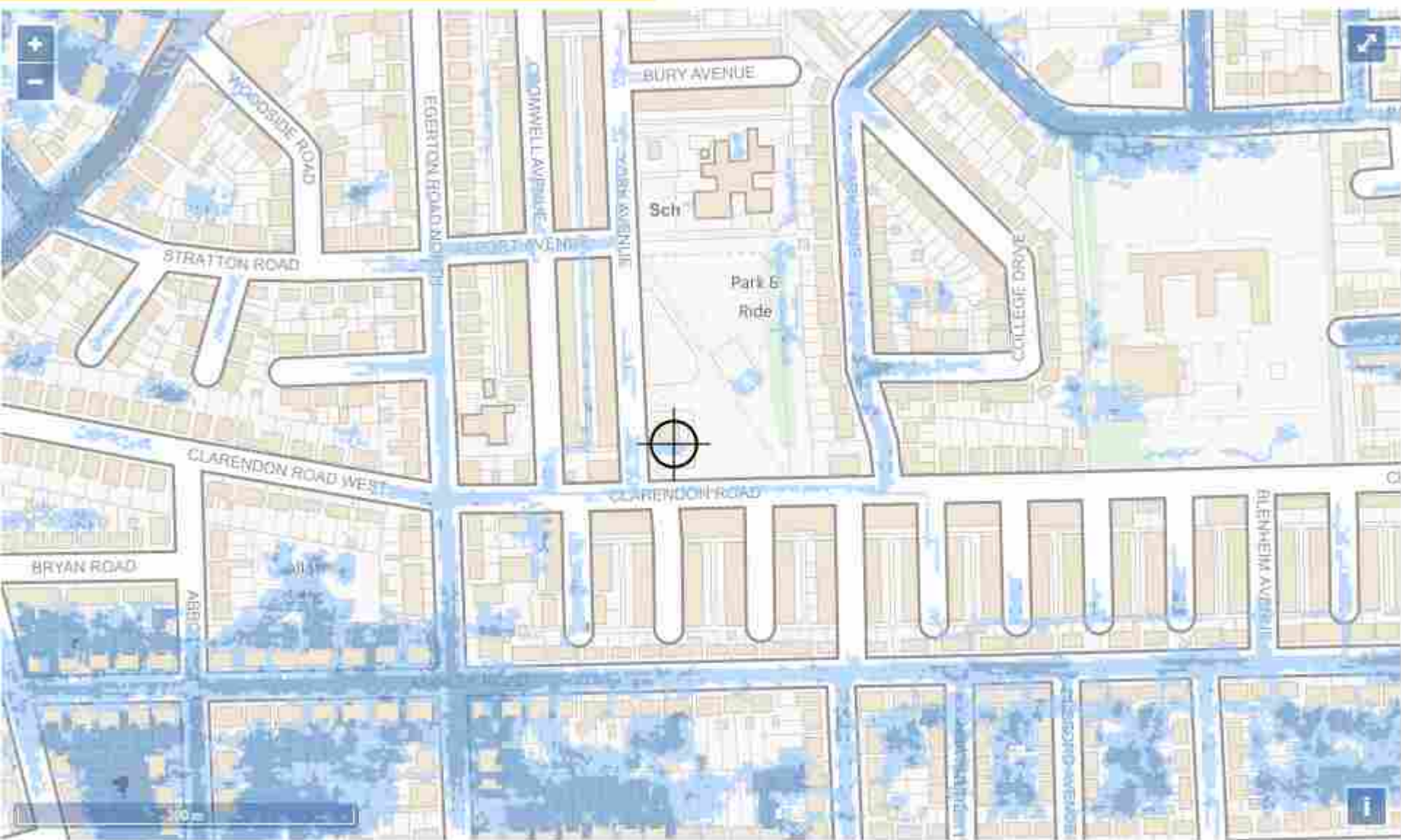
Flood storage area



Page 2 of 2:

Low risk: depth

Enter a place or postcode



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

Flood depth (millimetres)

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

APPENDIX D

CONSULTEE CORRESPONDENCE

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Mark Jones

From: Anna Mierzejewska
Sent: 28 August 2020 10:03
To: Mark Jones
Subject: Fwd: SuDS Enquiry -Manley Play Park, York Avenue M16 0AS 127622/FO/2020
Attachments: Manchester City Council - SuDS Requirement for Developers 2019.pdf

Sending it just in case they didn't forward that to you.

Get [Outlook for iOS](#)

From: z.todorovic@manchester.gov.uk <z.todorovic@manchester.gov.uk> on behalf of floodriskmanagement@manchester.gov.uk <floodriskmanagement@manchester.gov.uk>
Sent: Friday, August 28, 2020 9:21:21 AM
To: Anna Mierzejewska <a.mierzejewska@thelkgroup.com>
Cc: floodriskmanagement@manchester.gov.uk <floodriskmanagement@manchester.gov.uk>
Subject: Re: SuDS Enquiry -Manley Play Park, York Avenue M16 0AS 127622/FO/2020

Good morning

We are attaching the MCC guidance for developers where you could find information about the restrictions related to discharges and the policy on SuDS.

With regards to your other queries, our comments are in italic below:

- 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.
We do not have record of any flooding at the proposed site or in an immediate vicinity of the site.
- Any restrictions applied to ordinary watercourses and sewers in the area.
Please see the attached guidance.
- Any records of culverted watercourses in the area. Indications of whether the site is located within a critical drainage area.
The site is located in the CDA. We do not have record of any watercourse in the immediate vicinity of the site.
- Highway drainage restrictions and records.
We do not accept any flows into the existing highway drains as they are designed to accept highways flows only. We do not have record of highway drains in this area.
- Policies that may relate to Sustainable Drainage Systems (SuDS)
Please find the attached guidance.

If you need further clarifications please let us know.

Regards

Zorica Todorovic
Flood Risk Management
Highways Service, Growth and Neighbourhoods Directorate
Manchester City Council
Tel: 0161 219 6295
Email: floodriskmanagement@manchester.gov.uk
Web: <http://www.manchester.gov.uk/>

POSTAL ADDRESS: Manchester City Council, Public Realm, The Neighbourhood Service, PO Box 532, Town Hall, Manchester M60 2LA

From: Anna Mierzejewska <a.mierzejewska@thelkgroup.com>
To: "floodriskmanagement@manchester.gov.uk" <floodriskmanagement@manchester.gov.uk>,
Cc: "planning@manchester.gov.uk" <planning@manchester.gov.uk>
Date: 17/08/2020 13:36
Subject: SuDS Enquiry -Manley Play Park, York Avenue M16 0AS 127622/FO/2020

Dear Sir/Madam,

Re planning application Ref: 127622/FO/2020

LK Consult Ltd. has been commissioned to undertake a SuDS Strategy, for a site located at Manley Park Childrens Nursery, York Avenue, M16 0AS, centred at approximate National Grid Reference 382238, 394642. The proposed development would comprise of an extension to the existing office/activity room building within a currently grassed play field. The site is bounded by fencing and is surrounded by Manley Play Park and public open space along the adjacent highways.

The area of interest appears to be within Flood Zone 1 with no risk of surface water flooding.

BGS data indicates that the site is within an area underlain by Sand and gravel superficial deposits and Sandstone bedrock. The nearest BGS borehole record to the north shows sand and gravel from 1.2-3.6m over sandy boulder clay. Water level at approx. 2.25m. The development site is considered too constrained for the use of soakaway due to the space restrictions and close proximity of the adjacent highways, and existing / proposed foundations.

There are no known watercourses in the vicinity of the development site.

A connection of the existing building into the public sewer has been confirmed during the site visit. A shallow 0.72m site drainage discharges into 1.3m manhole of the public combined sewer adjacent to York Avenue.

The site location plan, the proposed development plan, and the nearest borehole records are attached to this email.

To complete the SuDS Assessment, 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 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.
- Any records of culverted watercourses in the area. Indications of whether the site is located within a critical drainage area.
- Highway drainage restrictions and records.
- 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,
Anna

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 20 1203
Our Ref: UUPS-ORD-185181
Date: 21/08/2020**

Dear Sirs

Location: MANLEY PARK COMMUNITY CENTRE YORK AVENUE, MANCHESTER, M16 0AS

I acknowledge with thanks your request dated 12/08/2020 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

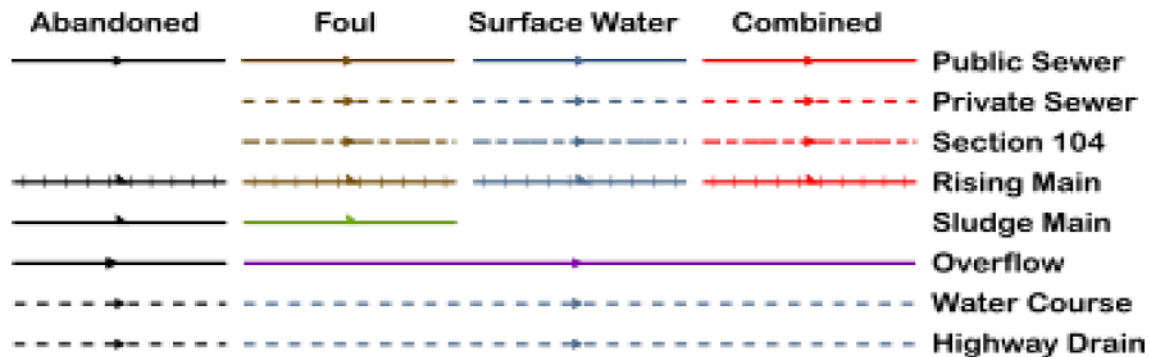
TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

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:

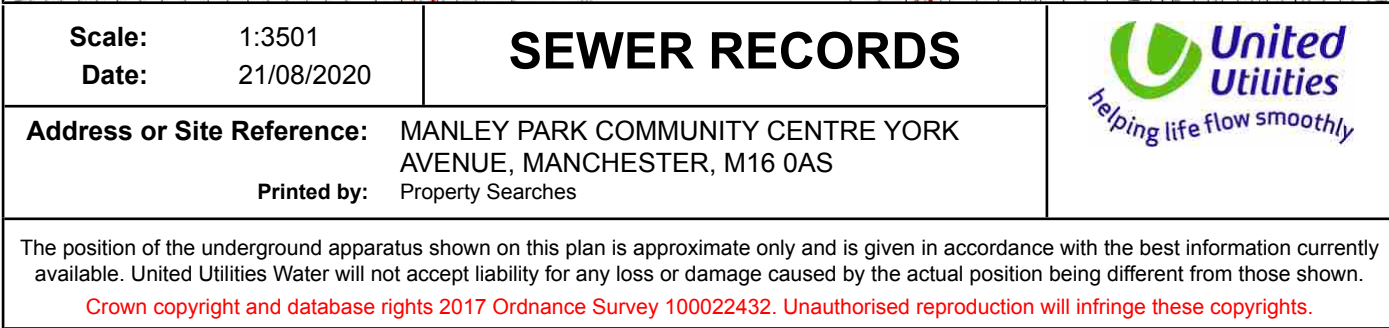
- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- 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.

Wastewater Symbolology



All point assets follow the standard colour convention: **red** – combined **brown** - foul
blue – surface water **purple** - overflow

Manhole	Side Entry Manhole
Head of System	Outfall
Extent of Survey	Screen Chamber
Rodding Eye	Inspection Chamber
Inlet	Bifurcation Chamber
Discharge Point	Lamp Hole
Vortex	T Junction / Saddle
Penstock	Catchpit
Washout Chamber	Valve Chamber
Valve	Vent Column
Air Valve	Vortex Chamber
Non Return Valve	Penstock Chamber
Soakaway	Network Storage Tank
Gully	Sewer Overflow
Cascade	Ww Treatment Works
Flow Meter	Ww Pumping Station
Hatch Box	Septic Tank
Oil Interceptor	Control Kiosk
Summit	
Drop Shaft	Change of Characteristic
Orifice Plate	



APPENDIX E

CALCULATIONS

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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. 1			
				Date 27/08/20			
Project	Greenfield runoff				By	Checked	Reviewed
Title	IoH 124 Runoff calcs for Manley Play Park, York Ave						

Hydrological Data:-

FSR Hydrology:-

Location = Manley Play Park, York Ave
 M5-60 (mm) = 18
 Soil runoff = 0.30
 WRAP = 2
 Hydrological area = 10

Grid reference = SJ8295
 r = 0.37
 SAAR (mm/yr) = 860
 Area = England & Wales
 Hydrological zone = 3

Soil classification for WRAP type 2

- i) Very permeable soils with shallow ground water;
- ii) Permeable soils over rock or fragipan, commonly on slopes in western Britain associated with smaller areas of less permeable wet soils; (fragipan - a natural subsurface horizon having a higher bulk density than the solum above. Seemingly cemented when dry but showing moderate to weak brittleness when moist. The layer is low in organic matter, mottled and slowly or very slowly permeable to water. It is found in profiles of either cultivated or virgin soils but not in calcareous material).
- iii) Moderately permeable soils, some with slowly permeable subsoils.

Design data:-

Area = 0.00077 Km² - 0.077 Ha - 770 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 $Q_{\text{BAR(rural)}} = 0.18 \text{ l/s}$



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Job No.		
Sheet no. 2		
Date 27/08/20		
By	Checked	Reviewed

Project	Greenfield runoff
Title	IoH 124 Runoff calcs for Manley Play Park, York Ave

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	0.546	0.152	1.971	100yr+20%	1.620	0.450	5.843
2yr	0.598	0.166	2.156	100yr+30%	1.755	0.487	6.330
5yr	0.778	0.216	2.806	100yr+40%	1.890	0.525	6.817
10yr	0.887	0.246	3.200	200yr	1.543	0.429	5.565
30yr	1.080	0.300	3.895	200yr + 30%	2.005	0.557	7.234
50yr	1.189	0.330	4.290	500yr	1.755	0.487	6.330
100yr	1.350	0.375	4.869	1000yr	1.954	0.543	7.049

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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Job No.		
Sheet no. 1		
Date 27/08/20		
By	Checked	Reviewed

Project k= 1x10⁻⁴		
Title Trench soakaway calculations for Manley Play Park, York Ave		

Data:-

Location hydrological data (FSR):-

Location	= Manley Play Park, York Ave	Grid reference	= SJ8295
M5-60 (mm)	= 18.0	r	= 0.37
Soil index	= 0.30	SAAR (mm/yr)	= 860
WRAP	= 2	Area	= England and Wales

Soil classification for WRAP type 2

- i) Very permeable soils with shallow ground water;
- ii) Permeable soils over rock or fragipan, commonly on slopes in western Britain associated with smaller areas of less permeable wet soils;
- iii) Moderately permeable soils, some with slowly permeable subsoils.

Design data:-

Safety factor = 2.0 - Minor inconvenience (SF=2)
Fill porosity = 0.45 - Clean stone (porosity = 0.4 - 0.5)

Equivalent porosity (n1) = 0.45

Area drained = 720 m²

Infiltration coefficient = 0.360 m/hr
Effective inf.coeff (q) = 0.180

Return period = 100 yrs

Climate change factor = 30%

Calculations :-

Perimeter of pit = (2 x Excavation Width)+(2 x Excavation Length)
Area of base = Excavation Width x Excavation Length
Infiltration area = (Area of base)+(Perimeter of pit x Hmax)
Temporary constant 'a'
= (Area of base / perimeter)-((AreaDrained x Rainfall depth /1000)/(Perimeter/Inf. coeff))
Temporary constant 'b' = (Perimeter/Inf. coeff) / (Area of base x porosity)
Hmax = a*((EXP(-1 x b x Duration of storm))-1)

Note: The Hmax calculation is iterated to a maximum value of Hmax.

Note: Duration of storm in hours, Rainfall depth in mm/hr x Climate Change factor.

Results :-

Emptying time to 50% volume = 0:40 (hr:min)

hMax (Depth) = 0.92 metres

Time to maximum = 0:01 hr:min

Rainfall at maximum = 55.55mm/hr

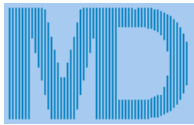
Width (m) = 2.0

Length (m) = 25.0

Total Infiltration area = 99.4m² (base area + sidewall area).

Total available volume = 20.60m³

N.B. The rainfall rates are calculated using the location specific values above in accordance with the Wallingford procedure.
Formulae and methods from CIRIA 156.



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The LK Group

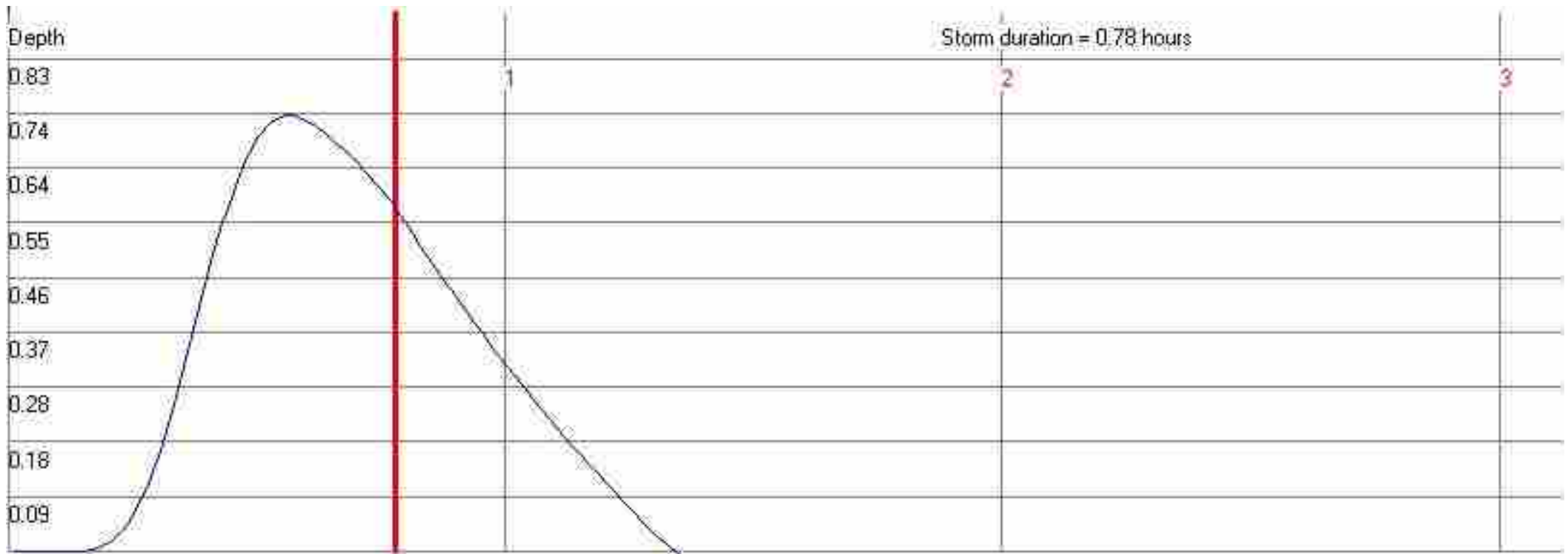
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email: m.jones@thelkgroup.com

Job No.		
Sheet no. 2		
Date 27/08/20		
By	Checked	Reviewed

Project **k= 1x10⁻⁴**

Title **Worst case soakaway times to empty.**





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Job No.		
Sheet no. 1		
Date 27/08/20		
By	Checked	Reviewed

Project k=1x10-5		
Title Trench soakaway calculations for Manley Play Park, York Ave		

Data:-

Location hydrological data (FSR):-

Location	= Manley Play Park, York Ave	Grid reference	= SJ8295
M5-60 (mm)	= 18.0	r	= 0.37
Soil index	= 0.30	SAAR (mm/yr)	= 860
WRAP	= 2	Area	= England and Wales

Soil classification for WRAP type 2

- i) Very permeable soils with shallow ground water;
- ii) Permeable soils over rock or fragipan, commonly on slopes in western Britain associated with smaller areas of less permeable wet soils;
- iii) Moderately permeable soils, some with slowly permeable subsoils.

Design data:-

Safety factor = 2.0 - Minor inconvenience (SF=2)
Fill porosity = 0.45 - Clean stone (porosity = 0.4 - 0.5)

Equivalent porosity (n1) = 0.45

Area drained = 720 m²

Infiltration coefficient = 0.036 m/hr
Effective inf.coeff (q) = 0.018

Return period = 100 yrs

Climate change factor = 30%

Calculations :-

Perimeter of pit = (2 x Excavation Width)+(2 x Excavation Length)
Area of base = Excavation Width x Excavation Length
Infiltration area = (Area of base)+(Perimeter of pit x Hmax)
Temporary constant 'a'
= (Area of base / perimeter)-((AreaDrained x Rainfall depth /1000)/(Perimeter/Inf. coeff))
Temporary constant 'b' = (Perimeter/Inf. coeff) / (Area of base x porosity)
Hmax = a*((EXP(-1 x b x Duration of storm))-1)

Note: The Hmax calculation is iterated to a maximum value of Hmax.

Note: Duration of storm in hours, Rainfall depth in mm/hr x Climate Change factor.

Results :-

Emptying time to 50% volume = 8:15 (hr:min)

hMax (Depth) = 1.03 metres

Time to maximum = 5:00 hr:min

Rainfall at maximum = 14.05mm/hr

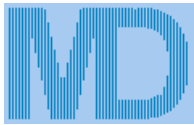
Width (m) = 3.0

Length (m) = 30.0

Total Infiltration area = 158.0m² (base area + sidewall area).

Total available volume = 41.70m³

N.B. The rainfall rates are calculated using the location specific values above in accordance with the Wallingford procedure.
Formulae and methods from CIRIA 156.



MasterDrain
SW 16.07

The LK Group

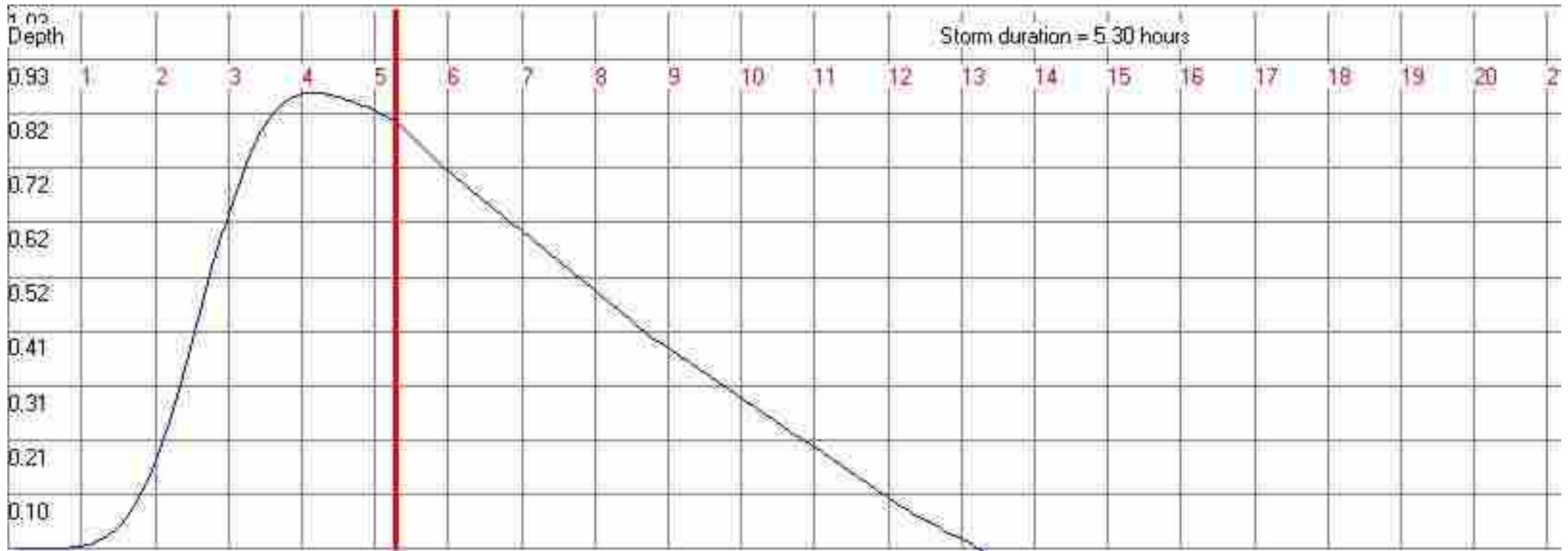
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Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 2		
Date 27/08/20		
By	Checked	Reviewed

Project **k=1x10-5**

Title **Worst case soakaway times to empty.**





MasterDrain
SW

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Job No.		
Sheet no. 1		
Date 27/08/20		
By	Checked	Reviewed

Project **30-year**

Title **Peak flow storage calcs for Manley Play Park, York Ave**

Data:-

FSR Hydrology:-

Location = Manley Play Park, York Ave
M5-60 (mm) = 18
Soil index = 0.30
Return period = 30
UCWI = 92.2

Grid reference = SJ8295
r = 0.37
SAAR (mm/yr) = 860
WRAP = 2
Climate change = 0

- i) Very permeable soils with shallow ground water;
- ii) Permeable soils over rock or fragipan, commonly on slopes in western Britain associated with smaller areas of less permeable wet soils; The layer is low in organic matter, mottled and (fragipan - a natural subsurface horizon having a higher bulk density than the solum above. Seemingly cemented when dry but showing moderate to weak brittleness when moist. Slowly or very slowly permeable to water. It is found in profiles of either cultivated or virgin soils but not in calcareous material).
- iii) Moderately permeable soils, some with slowly permeable subsoils.

Runoff factor (RF) = 72.0, 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 = 720 m²
Total area (TA) = 770 m²
Allowed discharge rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 50 m²
Equiv area = 554 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 0

Calculated data:-

Time to max = 13.0 mins
Rainfall at max = 71.66 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 4.6 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 7.00 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	584.2	1125	4.6	400 x 600	25.5	500 x 500	18.4
150	259.7	1200	4.1	600 x 900	11.1	500 x 750	12.2
225	115.4	1275	3.6	800 x 1200	6.2	500 x 1000	9.2
300	64.9	1350	3.2			750 x 1000	6.1
375	41.5	1425	2.9			750 x 1200	5.1
450	28.9	1500	2.6			750 x 1500	4.1
525	21.2	1575	2.4			1000 x 1000	4.6
600	16.2	1650	2.1			1000 x 1200	3.8
675	12.8	1725	2.0			1000 x 1500	3.1
750	10.4	1800	1.8			1000 x 1800	2.5
825	8.6	1875	1.7			1000 x 2000	2.3
900	7.2	1950	1.5			1500 x 1500	2.0
975	6.1	2025	1.4			1500 x 1800	1.7
1050	5.3	2100	1.3			1500 x 2000	1.5



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Data:-

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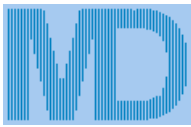
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Project **30-year**

Title **Peak flow storage calcs for Manley Play Park, York Ave**

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	82.0	7.466	3.000	4.466
20	56.0	10.223	6.000	4.223
30	44.0	11.950	9.000	2.950
40	36.0	13.230	12.000	1.230
50	31.0	14.256	15.000	0.000
60	28.0	15.118	18.000	0.000
70	25.0	15.864	21.000	0.000
80	23.0	16.522	24.000	0.000
90	21.0	17.113	27.000	0.000
100	19.0	17.650	30.000	0.000
110	18.0	18.142	33.000	0.000
120	17.0	18.596	36.000	0.000
130	16.0	19.019	39.000	0.000
140	15.0	19.414	42.000	0.000
150	14.0	19.785	45.000	0.000
160	14.0	20.135	48.000	0.000
170	13.0	20.467	51.000	0.000
180	13.0	20.781	54.000	0.000
190	12.0	21.080	57.000	0.000
200	12.0	21.365	60.000	0.000
210	11.0	21.638	63.000	0.000
220	11.0	21.899	66.000	0.000
230	11.0	22.150	69.000	0.000
240	10.0	22.391	72.000	0.000
250	10.0	22.623	75.000	0.000
260	10.0	22.846	78.000	0.000
270	9.0	23.062	81.000	0.000
280	9.0	23.270	84.000	0.000
290	9.0	23.472	87.000	0.000
300	9.0	23.667	90.000	0.000
310	8.0	23.856	93.000	0.000
320	8.0	24.039	96.000	0.000
330	8.0	24.217	99.000	0.000
340	8.0	24.390	102.000	0.000
350	8.0	24.558	105.000	0.000
360	8.0	24.722	108.000	0.000
370	7.0	24.889	111.000	0.000
380	7.0	25.053	114.000	0.000
390	7.0	25.213	117.000	0.000
400	7.0	25.370	120.000	0.000
410	7.0	25.524	123.000	0.000
420	7.0	25.675	126.000	0.000
430	7.0	25.823	129.000	0.000
440	6.0	25.968	132.000	0.000
450	6.0	26.110	135.000	0.000
460	6.0	26.251	138.000	0.000
470	6.0	26.388	141.000	0.000
480	6.0	26.523	144.000	0.000
490	6.0	26.657	147.000	0.000
500	6.0	26.787	150.000	0.000
510	6.0	26.916	153.000	0.000
520	6.0	27.043	156.000	0.000
530	6.0	27.168	159.000	0.000
540	6.0	27.291	162.000	0.000
550	5.0	27.412	165.000	0.000
560	5.0	27.532	168.000	0.000
570	5.0	27.649	171.000	0.000
580	5.0	27.766	174.000	0.000
590	5.0	27.880	177.000	0.000
600	5.0	27.993	180.000	0.000

Storage volume (m³) = 4.6 m³



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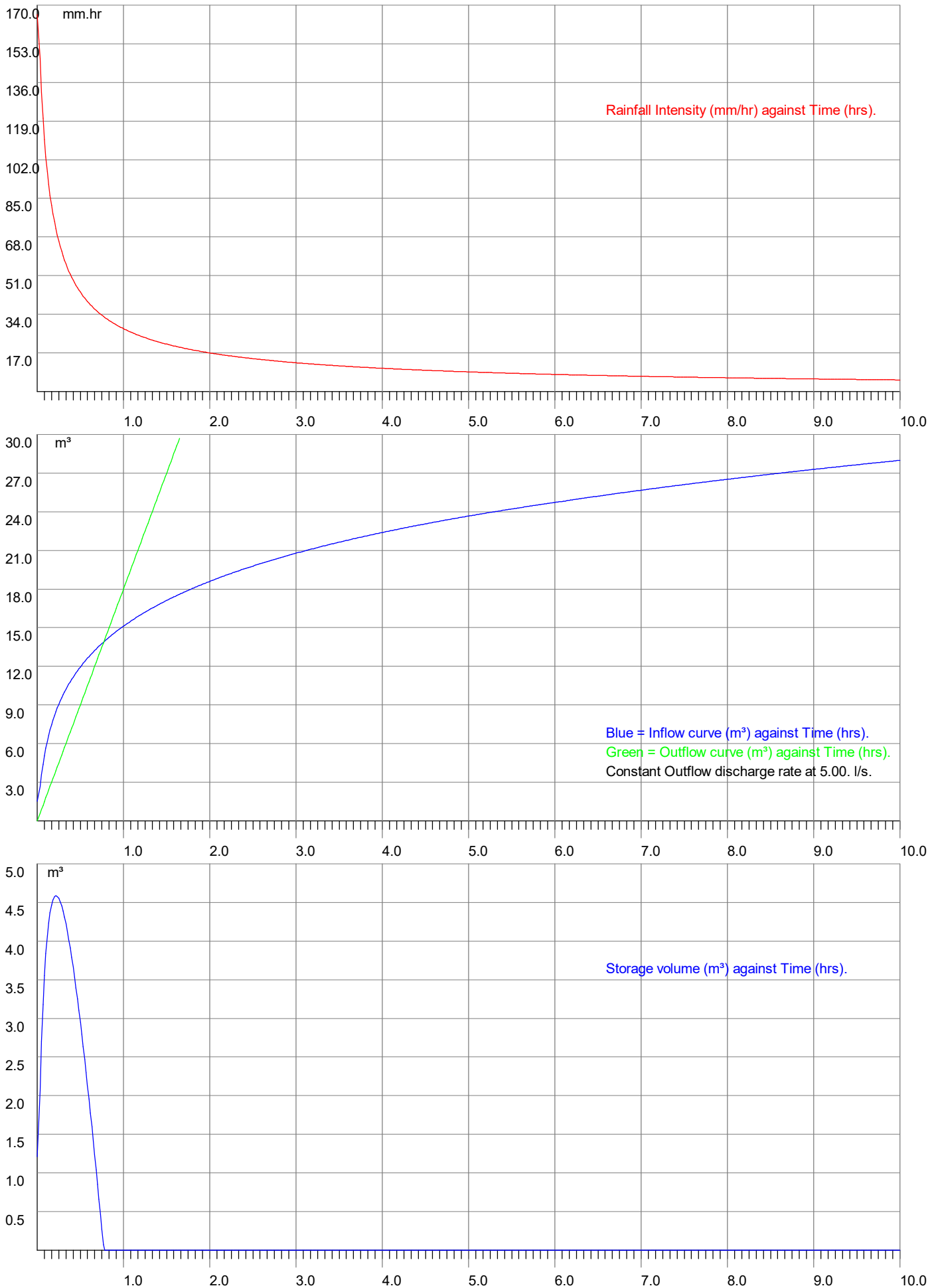
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Project **30-year**

Title **Peak flow storage calcs for Manley Play Park, York Ave**





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Project 30-year				By	Checked	Reviewed
Title Peak flow storage calcs for Manley Play Park, York Ave						

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	100-year plus 20% cc
Title	Peak flow storage calcs for Manley Play Park, York Ave

Data:-

FSR Hydrology:-

Location = Manley Play Park, York Ave
M5-60 (mm) = 18
Soil index = 0.30
Return period = 100
UCWI = 92.2

Grid reference = SJ8295
r = 0.37
SAAR (mm/yr) = 860
WRAP = 2
Climate change = 20

- i) Very permeable soils with shallow ground water;
- ii) Permeable soils over rock or fragipan, commonly on slopes in western Britain associated with smaller areas of less permeable wet soils; The layer is low in organic matter, mottled and (fragipan - a natural subsurface horizon having a higher bulk density than the solum above. Seemingly cemented when dry but showing moderate to weak brittleness when moist. Slowly or very slowly permeable to water. It is found in profiles of either cultivated or virgin soils but not in calcareous material).
- iii) Moderately permeable soils, some with slowly permeable subsoils.

Runoff factor (RF) = 72.0, 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 = 720 m²
Total area (TA) = 770 m²
Allowed discharge rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 50 m²
Equiv area = 554 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 20

Calculated data:-

Time to max = 23.0 mins
Rainfall at max = 80.43 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 10.0 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 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	1267.9	1125	10.0	400 x 600	55.3	500 x 500	39.8
150	563.5	1200	8.8	600 x 900	24.1	500 x 750	26.5
225	250.4	1275	7.8	800 x 1200	13.5	500 x 1000	19.9
300	140.9	1350	7.0			750 x 1000	13.3
375	90.2	1425	6.2			750 x 1200	11.1
450	62.6	1500	5.6			750 x 1500	8.8
525	46.0	1575	5.1			1000 x 1000	10.0
600	35.2	1650	4.7			1000 x 1200	8.3
675	27.8	1725	4.3			1000 x 1500	6.6
750	22.5	1800	3.9			1000 x 1800	5.5
825	18.6	1875	3.6			1000 x 2000	5.0
900	15.7	1950	3.3			1500 x 1500	4.4
975	13.3	2025	3.1			1500 x 1800	3.7
1050	11.5	2100	2.9			1500 x 2000	3.3



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Data:-

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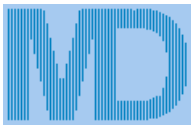
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Project	100-year plus 20% cc
Title	Peak flow storage calcs for Manley Play Park, York Ave

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	126.0	11.475	3.000	8.475
20	87.0	15.913	6.000	9.913
30	68.0	18.699	9.000	9.699
40	57.0	20.767	12.000	8.767
50	49.0	22.423	15.000	7.423
60	44.0	23.810	18.000	5.810
70	39.0	25.007	21.000	4.007
80	36.0	26.061	24.000	2.061
90	33.0	27.004	27.000	0.004
100	31.0	27.857	30.000	0.000
110	29.0	28.636	33.000	0.000
120	27.0	29.353	36.000	0.000
130	25.0	30.017	39.000	0.000
140	24.0	30.636	42.000	0.000
150	23.0	31.215	45.000	0.000
160	22.0	31.758	48.000	0.000
170	21.0	32.270	51.000	0.000
180	20.0	32.754	54.000	0.000
190	19.0	33.213	57.000	0.000
200	18.0	33.649	60.000	0.000
210	18.0	34.064	63.000	0.000
220	17.0	34.459	66.000	0.000
230	17.0	34.837	69.000	0.000
240	16.0	35.199	72.000	0.000
250	16.0	35.546	75.000	0.000
260	15.0	35.879	78.000	0.000
270	15.0	36.199	81.000	0.000
280	14.0	36.506	84.000	0.000
290	14.0	36.802	87.000	0.000
300	14.0	37.088	90.000	0.000
310	13.0	37.363	93.000	0.000
320	13.0	37.629	96.000	0.000
330	13.0	37.886	99.000	0.000
340	12.0	38.135	102.000	0.000
350	12.0	38.376	105.000	0.000
360	12.0	38.609	108.000	0.000
370	12.0	38.856	111.000	0.000
380	11.0	39.097	114.000	0.000
390	11.0	39.333	117.000	0.000
400	11.0	39.564	120.000	0.000
410	11.0	39.790	123.000	0.000
420	10.0	40.011	126.000	0.000
430	10.0	40.228	129.000	0.000
440	10.0	40.441	132.000	0.000
450	10.0	40.650	135.000	0.000
460	10.0	40.855	138.000	0.000
470	10.0	41.056	141.000	0.000
480	9.0	41.254	144.000	0.000
490	9.0	41.449	147.000	0.000
500	9.0	41.640	150.000	0.000
510	9.0	41.828	153.000	0.000
520	9.0	42.013	156.000	0.000
530	9.0	42.195	159.000	0.000
540	9.0	42.374	162.000	0.000
550	8.0	42.551	165.000	0.000
560	8.0	42.725	168.000	0.000
570	8.0	42.896	171.000	0.000
580	8.0	43.065	174.000	0.000
590	8.0	43.231	177.000	0.000
600	8.0	43.395	180.000	0.000

Storage volume (m³) = 10.0 m³



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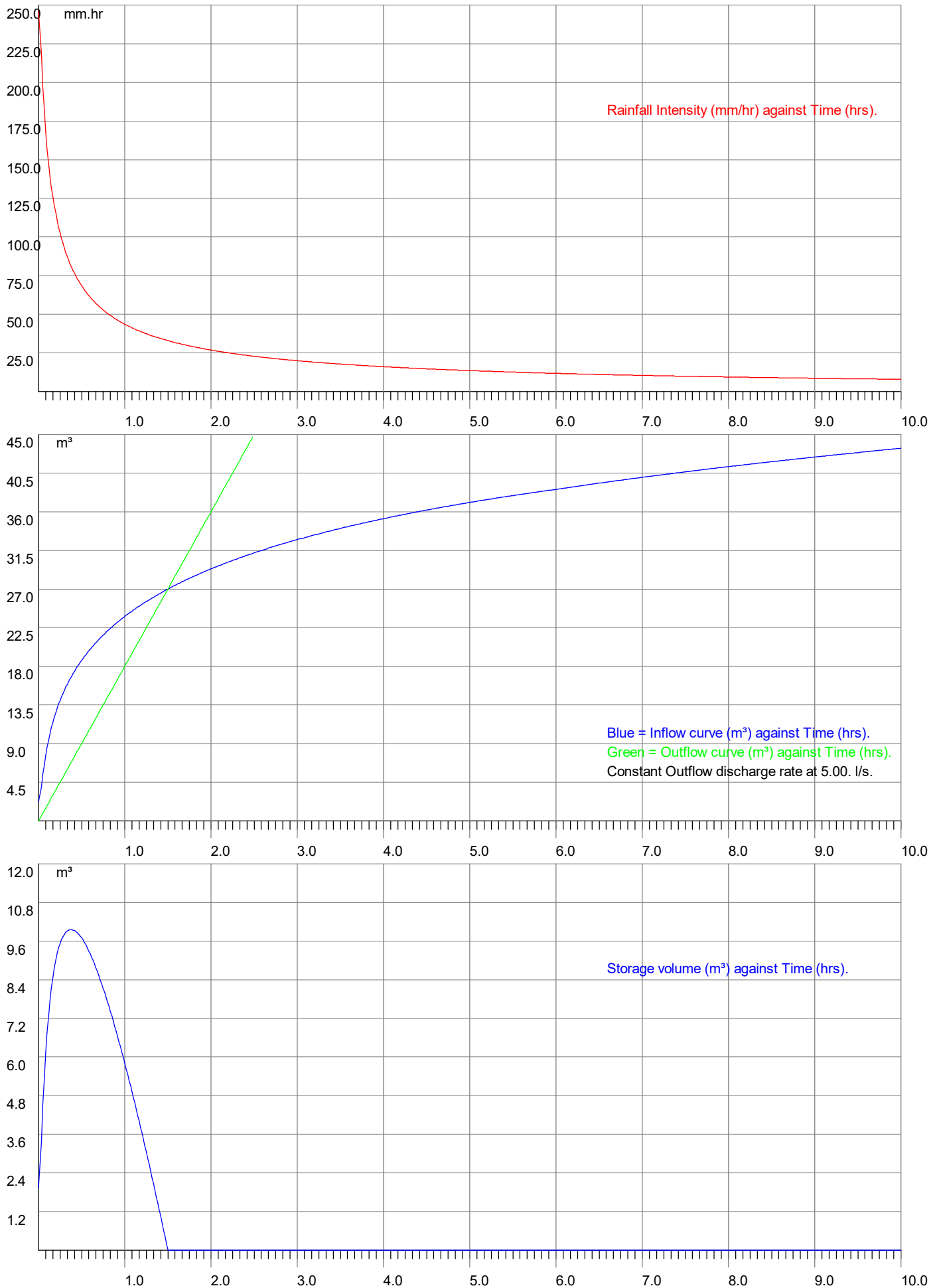
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Project **100-year plus 20% cc**
Title **Peak flow storage calcs for Manley Play Park, York Ave**





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Project	100-year plus 40% cc
Title	Peak flow storage calcs for Manley Play Park, York Ave

Data:-

FSR Hydrology:-

Location = Manley Play Park, York Ave
M5-60 (mm) = 18
Soil index = 0.30
Return period = 100
UCWI = 92.2

Grid reference = SJ8295
r = 0.37
SAAR (mm/yr) = 860
WRAP = 2
Climate change = 40

- i) Very permeable soils with shallow ground water;
- ii) Permeable soils over rock or fragipan, commonly on slopes in western Britain associated with smaller areas of less permeable wet soils; The layer is low in organic matter, mottled and (fragipan - a natural subsurface horizon having a higher bulk density than the solum above. Seemingly cemented when dry but showing moderate to weak brittleness when moist. Slowly or very slowly permeable to water. It is found in profiles of either cultivated or virgin soils but not in calcareous material).
- iii) Moderately permeable soils, some with slowly permeable subsoils.

Runoff factor (RF) = 72.0, 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 = 720 m²
Total area (TA) = 770 m²
Allowed discharge rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 50 m²
Equiv area = 554 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 40

Calculated data:-

Time to max = 27.0 mins
Rainfall at max = 85.17 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 12.9 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 13.00 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	1636.9	1125	12.9	400 x 600	71.4	500 x 500	51.4
150	727.5	1200	11.4	600 x 900	31.1	500 x 750	34.3
225	323.3	1275	10.1	800 x 1200	17.5	500 x 1000	25.7
300	181.9	1350	9.0			750 x 1000	17.1
375	116.4	1425	8.1			750 x 1200	14.3
450	80.8	1500	7.3			750 x 1500	11.4
525	59.4	1575	6.6			1000 x 1000	12.9
600	45.5	1650	6.0			1000 x 1200	10.7
675	35.9	1725	5.5			1000 x 1500	8.6
750	29.1	1800	5.1			1000 x 1800	7.1
825	24.1	1875	4.7			1000 x 2000	6.4
900	20.2	1950	4.3			1500 x 1500	5.7
975	17.2	2025	4.0			1500 x 1800	4.8
1050	14.8	2100	3.7			1500 x 2000	4.3



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Data:-

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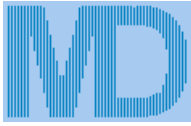
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Project	100-year plus 40% cc
Title	Peak flow storage calcs for Manley Play Park, York Ave

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	147.0	13.387	3.000	10.387
20	102.0	18.565	6.000	12.565
30	80.0	21.815	9.000	12.815
40	66.0	24.228	12.000	12.228
50	57.0	26.160	15.000	11.160
60	51.0	27.779	18.000	9.779
70	46.0	29.175	21.000	8.175
80	42.0	30.405	24.000	6.405
90	38.0	31.504	27.000	4.504
100	36.0	32.500	30.000	2.500
110	33.0	33.409	33.000	0.409
120	31.0	34.245	36.000	0.000
130	30.0	35.020	39.000	0.000
140	28.0	35.742	42.000	0.000
150	27.0	36.417	45.000	0.000
160	25.0	37.051	48.000	0.000
170	24.0	37.649	51.000	0.000
180	23.0	38.213	54.000	0.000
190	22.0	38.748	57.000	0.000
200	22.0	39.257	60.000	0.000
210	21.0	39.741	63.000	0.000
220	20.0	40.203	66.000	0.000
230	19.0	40.644	69.000	0.000
240	19.0	41.066	72.000	0.000
250	18.0	41.470	75.000	0.000
260	18.0	41.859	78.000	0.000
270	17.0	42.232	81.000	0.000
280	17.0	42.591	84.000	0.000
290	16.0	42.936	87.000	0.000
300	16.0	43.269	90.000	0.000
310	15.0	43.591	93.000	0.000
320	15.0	43.901	96.000	0.000
330	15.0	44.201	99.000	0.000
340	14.0	44.491	102.000	0.000
350	14.0	44.771	105.000	0.000
360	14.0	45.043	108.000	0.000
370	13.0	45.333	111.000	0.000
380	13.0	45.614	114.000	0.000
390	13.0	45.889	117.000	0.000
400	13.0	46.158	120.000	0.000
410	12.0	46.421	123.000	0.000
420	12.0	46.680	126.000	0.000
430	12.0	46.933	129.000	0.000
440	12.0	47.181	132.000	0.000
450	12.0	47.425	135.000	0.000
460	11.0	47.664	138.000	0.000
470	11.0	47.899	141.000	0.000
480	11.0	48.130	144.000	0.000
490	11.0	48.357	147.000	0.000
500	11.0	48.580	150.000	0.000
510	11.0	48.799	153.000	0.000
520	10.0	49.015	156.000	0.000
530	10.0	49.228	159.000	0.000
540	10.0	49.437	162.000	0.000
550	10.0	49.642	165.000	0.000
560	10.0	49.845	168.000	0.000
570	10.0	50.045	171.000	0.000
580	10.0	50.242	174.000	0.000
590	9.0	50.436	177.000	0.000
600	9.0	50.627	180.000	0.000

Storage volume (m³) = 12.9 m³



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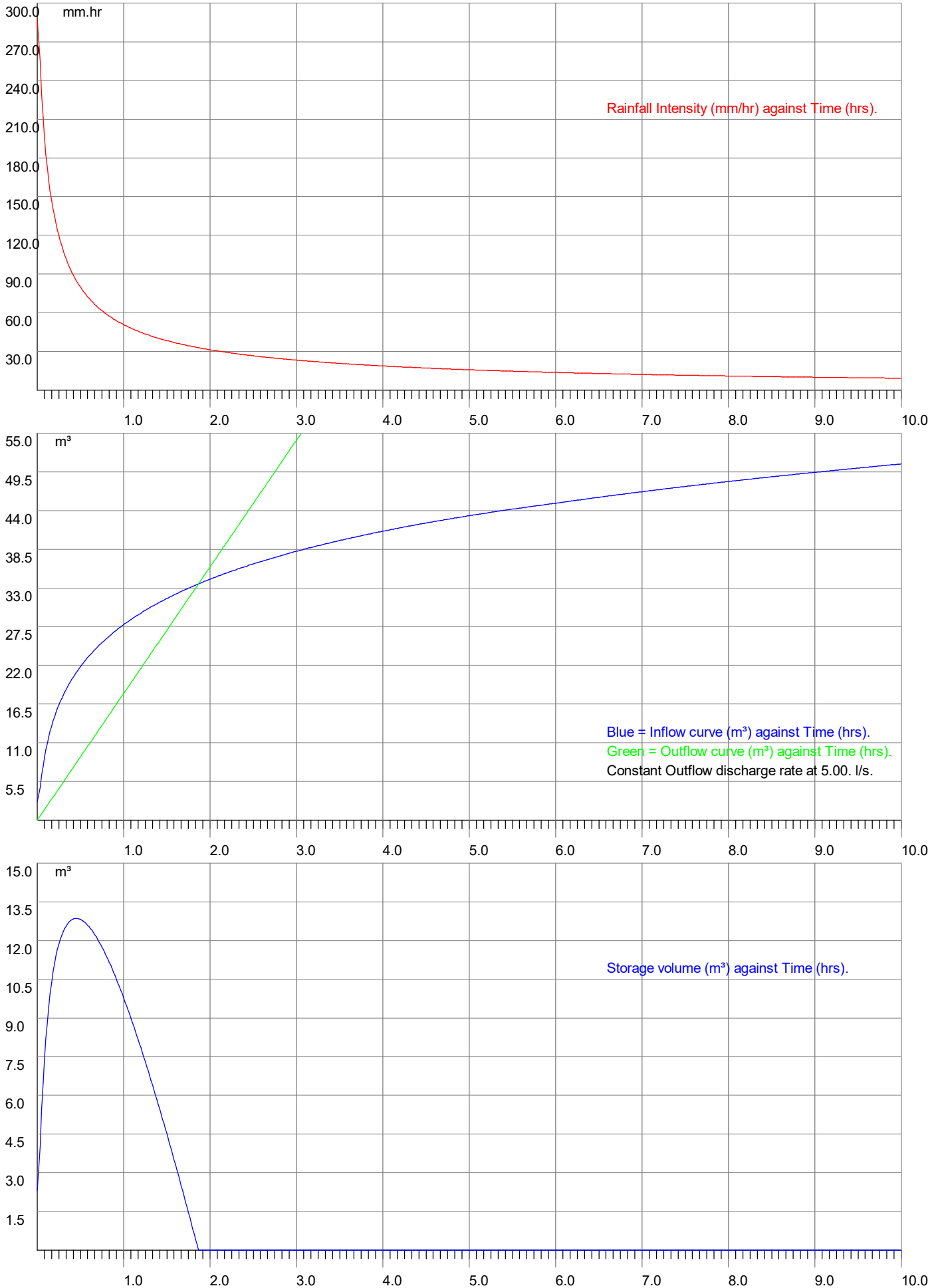
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Date 27/08/20		
By	Checked	Reviewed

Project **100-year plus 40% cc**

Title **Peak flow storage calcs for Manley Play Park, York Ave**



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