



Project Title

Drainage Strategy Report

At

Tiddlywinks Nursey Group

Croft Lane

Unsworth

Bury

BL9 8QA

For

Tiddlywinks Nursery Group

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Issue	Organisation	Quantity
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Executive Summary

Figure 1: Flood Risk and Drainage Strategy Summary

Item	Brief Description
Development Proposed	A proposed nursery development on land off Croft Lane, Unsworth, Bury, with car parking & landscaping. Existing site classed as Greenfield.
Flood Zone Classification	Flood Zone 1 – Low Risk
Geology	No formal Phase 2 site investigation has been completed at the site. According to a borehole carried out at the site in 1980, the site is underlain Made Ground to a depth of 6m+.
Infiltration Rate	Considering the made ground, the site is considered unsuitable for infiltration-based options.
Nearest Watercourses	River Roch, located some 100m to the west.
Nearest Adopted Sewers and Drainage Networks	300mm dia surface water sewer in Croft Lane and 1400mm dia combined water sewer in land to the west of the site. 150mm dia private surface water drain in land to the west, outfalling to River Roch.
Surface Water Drainage Outfall and SuDS Hierarchal Approach	Based on the unsuitable ground conditions, the principal strategy is to connect to the 150mm dia surface water drain within the adjoining land that outfalls to the River Roch.
Existing Discharge Rate	Greenfield: 1 yr – 1.3 l/s 30yr – 2.6 l/s 100yr – 3.1 l/s
Proposed Discharge Rate	5 l/s. Minimum rate to prevent blockage.
Allowance for Climate Change	40% - based on a residential/commercial > 50-year design life to 'the 2080's'.
Proposed Attenuation Method and Volume	Geocellular attenuation storage, 46m ³ for the 100yr + 40% CC.
SuDS features	Geocellular attenuation tank
Maintenance Responsibility	Owner / Management Company
Foul Drainage Outfall	Free discharge to public combined sewers in adjacent land via new connection.

1. Introduction

- 1.1 Paul Graveney Consulting Ltd (PGC) has been appointed by Tiddleywinks Nursery Group to prepare this Drainage & SuDS (Sustainable Drainage Systems) Strategy to support a full planning submission for a proposed nursery development on greenfield land off Croft Lane, Unsworth. The assessment has been undertaken in line with Section 10 of the 2019 'National Planning Policy Framework', plus the accompanying Technical Guidance on Flood Risk and any local policies.
- 1.2 This report has been commissioned by Tiddledywinks Nursery Group and is specific to their interests in the development proposals as described by the Architectural plan in Appendix A. This report may not be assigned.
- 1.3 The report has been commissioned to identify any drainage related issues associated with the proposed development and any likely constraints that could be imposed. The following issues have been addressed within this report;
- Determine the current surface water drainage regime and assess any potential increase in surface water runoff as a result of the proposed development.
 - Discuss Sustainable Drainage Systems (SUDS) as an option for reducing surface water flood risk and devise an outline Drainage layout.
 - Devise an appropriate outline surface water drainage strategy (including calculation where appropriate) to deal with any potential increase in surface water runoff and include for climate change.
 - Devise an appropriate outline foul water drainage strategy.

2. Development Description and Location

2.1 Site Location

The site is referenced in Figure 2, and a site location map is provided in Appendix A.

Item	Brief Description
Project name	Land off Croft Lane, Unsworth
Site address and location	Croft Lane, Unsworth, Bury, BL9 8QA
Council Area	Bury Council
Approximate Grid Reference	OS: 381332, 408661
General Locality	The site is located some 2km to the south of Bury Town Centre.

Figure 2: Site Referencing Information

2.2 Existing Site Description

- 2.2.1 The development site (Red Line Boundary) is irregular in plan shape and is situated within a mix of a residential and commercial area. The site currently encompasses a tarmac car park with surrounding unmade land. The site is bounded by Croft Lane to the east, a former public house and residential properties to the south, open fields to the West and a car park to a Health Centre to the north.
- 2.2.2 The existing site access is to be maintained and upgraded to serve to new proposed development. The site can be classed for drainage purposes as 'Greenfield'.
- 2.2.3 Figure 3 overleaf identifies the overall site location details. Further details of the existing layout can be seen on the Red Line Plans in Appendix A and the Topographical survey in Appendix B.



Figure 3: Site Location

2.3 Topography

- 2.3.1 A review of the topographical survey would indicate the main site to have a fall from the northeast at 81.00m AOD to the southwest at 77.00m AOD. The western boundary then falls steeper down to 72.00m AOD.

2.4 Hydrology

- 2.4.1 A review of local maps the closest identified watercourse is River Roch, situated some 100m to the west.

2.5 Development Proposals

- 2.5.1 As discussed in the earlier sections, the report is prepared to support a planning application for the construction of a new nursery development.
- 2.5.2 The outline Site Master Plan as indicated in Appendix A provides details of the proposed development intent. Access into the site would continue to be off Croft Lane.

3. Fluvial Flood Risk Review

- 3.1 Figure 4 below locates the site on the Environment Agency's indicative flood plain map. It is clear from this that the red line boundary sits outside of a fluvial generator of flood water from any identified water body or river. It is considered therefore that the site lays outside of the active 100-year and extreme event floodplains, thus lying within 'Flood Zone 1 Classification' in accordance with the 2019 National Planning Policy Framework (NPPF) Flood Risk Guidance Notes, i.e., probability of annual fluvial flooding significantly less than 1 in 1000 in any one year (<0.1%). The risk from fluvial flood water is diminished to acceptable levels, removing the requirement for further investigation and assessment of the fluvial flood regime.

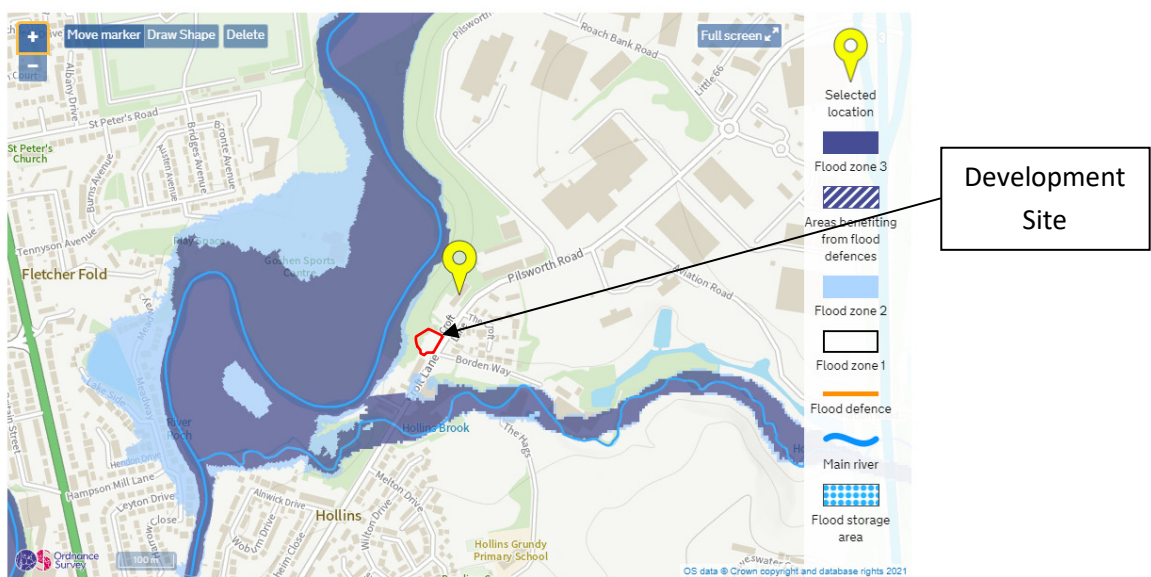


Figure 4: EA Indicative Flood Maps

- 3.2 In addition, the development application boundary is less than 1ha in plan area. In line with criteria set within the NPPF a Flood Risk Assessment is not required to support a planning application if the development is less than 1ha and in Flood Zone 1.

4. Outline Drainage Strategy

4.1 Existing Drainage

- 4.1.1 The United Utilities sewer records have been reviewed (Figure 5 below and Appendix E) and confirm there is a 300mm diameter surface water sewer in Croft Lane and a 1400mm diameter combined water sewer passing through the northwest corner, flowing in a southerly direction.

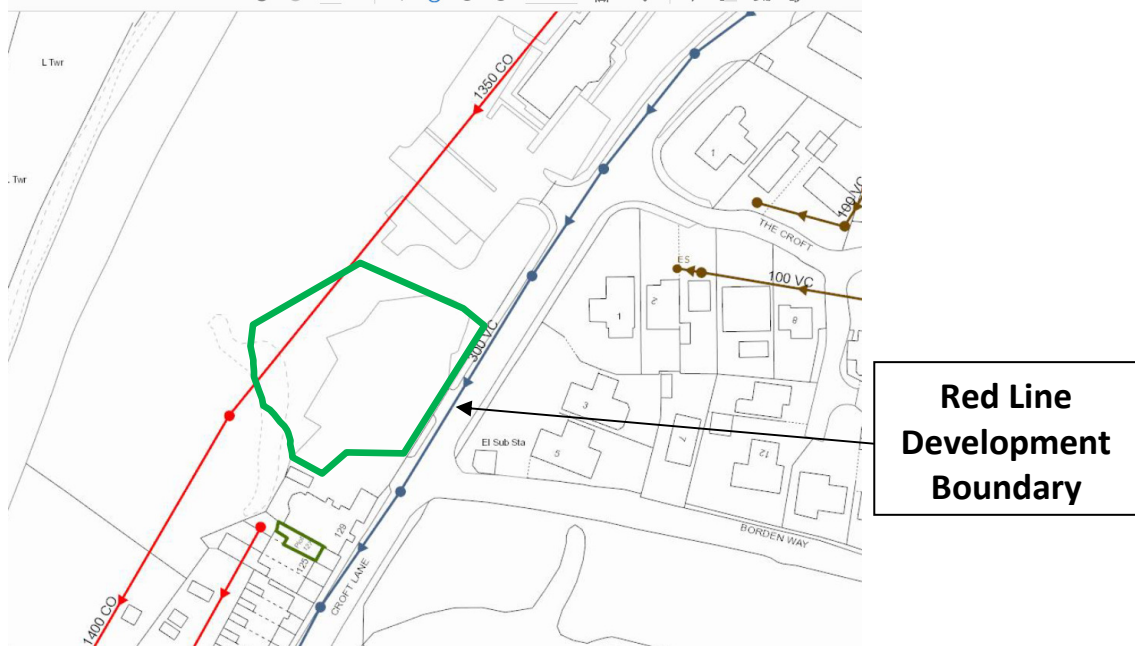


Figure 5: United Utilities Sewer Records

- 4.1.2 In addition to the public sewers, a 150mm diameter surface water drain has been located at the western edge of the site flowing from the adjacent health centre and outfalling into the River Roch.

4.2 Existing Runoff

- 4.2.1 The existing site is predominantly unmade. The existing predevelopment greenfield discharge rates are summarised in Figure 6 below:

Return Period (yr)	Existing Greenfield Runoff Rates (l/s)
1	1.3
30	2.6
100	3.1

Figure 6: Existing Greenfield Discharge Rates

4.3 Geology

- 4.3.1 No site-specific intrusive Phase 2 Site Investigation has been carried out at the site. A borehole taken from the British Geological Society (BGS) within the existing car park in 1980 identified made ground to 6m+ as shown in Figure 7 below. Considering this, infiltration options have been discounted.

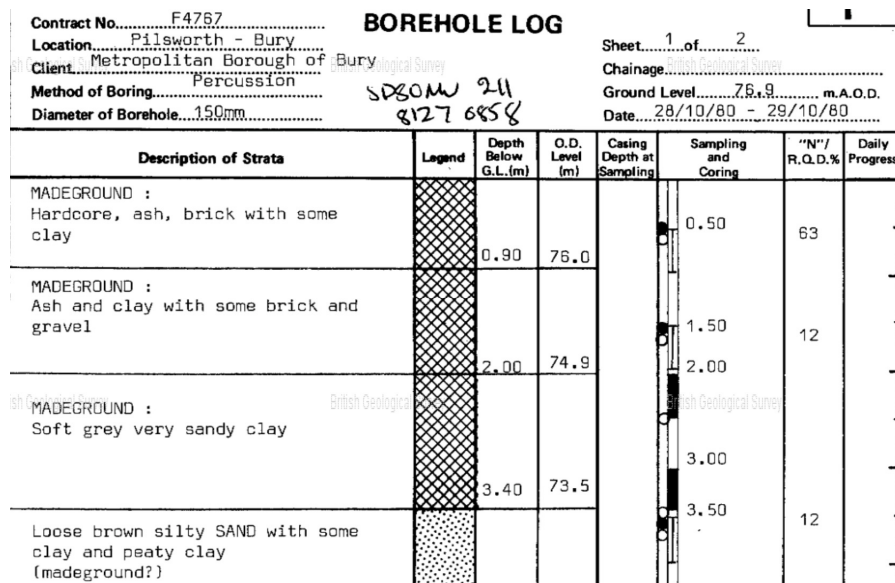


Figure 7: Borehole Log

4.4 Hydrological Assessment

- 4.4.1 As discussed in previous sections, a review of the topographical survey, OS Maps and Environment Agency maps would indicate the closest surface water feature to be the River Roch, located some 100m to the west.

4.5 Sustainable Drainage Systems (SuDS) Assessment

4.5.1 SuDS Objectives

- 4.5.1.1 Sustainable drainage developed in line with the ideals of sustainable development is collectively referred to as Sustainable Drainage Systems (SuDS). At a particular site, these systems are designed both to manage the environmental risks resulting from the urban runoff and to contribute wherever possible to environmental enhancement. SuDS objectives are therefore to minimise the impacts from the development on the quantity and quality of the runoff and maximise amenity and biodiversity opportunities (CIRIA C753, 2015).

4.5.2 SuDS Design Themes

- 4.5.2.1 The 'Management Train Approach' should be central to the surface water drainage strategy of the proposed site. The main objective is treatment and control of runoff as near to the source as possible protecting downstream habitats and further enhancing the amenity value of the site. This concept uses a hierarchy of drainage techniques to incrementally reduce pollution, flow rates and volumes of storm water discharge from the site, and is as follows:

- Prevention** – The use of good site design and housekeeping measures to prevent runoff and pollution and includes the use of rainwater reuse / harvesting.

- ii. **Source Controls** – Control of runoff at source or as close to source as possible (e.g. soakaways, green roofs, pervious pavements).
- iii. **Site Control** – Management of water in a local area and can include below ground storage / attenuation, detention basins, large infiltration devices.
- iv. **Regional Control** – Management of water from a site or various sites and can include wetlands and balancing ponds.

4.5.3 SuDS Site Constraints

4.5.3.1 SuDS techniques are suitable for all sites; therefore an assessment of the existing site is required so that SuDS limitations can be determined.

- *Land Use Characteristics:* The size and type of development enables the potential range of site control SuDS devices to be considered below ground only.
- *Site Characteristics:* A site investigation has not been carried out at the site. However, investigations are that infiltration techniques would not be suitable.
- *Catchment Characteristics:* The site is currently classed for drainage purposes as 'Greenfield' and so for surface water runoff purposes off site, the runoff rates would be no greater than the respective greenfield runoff rates or in this case a minimum of 5l/s.
- *Environmental and Amenity Performance:* The inclusion of SuDS within the overall development is a key driver in providing both amenity and habitat creation. All types of SUDs will be considered and blended into the landscaping zone, if possible. Safety to all future users is paramount and so best practice guidance will be incorporated so that these devices blend into the surrounding without the need for significant safety precautions. Maintenance plans will be prepared for all SuDS devices that are included.

4.5.4 SuDS Methods

4.5.4.1 Figure 8 and 9 on the following pages provide an assessment of various above and below ground SuDS methods that can provide water quality treatment and management of flows to reduce runoff rates and volumes and whether they can be suitably incorporated at this development site. The purpose of this assessment is to set out options to be considered at the planning stage with consideration to time constraints, viability and lifetime maintenance of the nursery development.

Method	Comment	Suitability for Development
Green Roofs	Can be used on suitable low-rise buildings to provide retention, attenuation and treatment of rainwater, and promotes evaporation and local biodiversity.	<u>Not suitable:</u> Not suitable due to the limited area of available roof.
Water Butts	Plastic tanks placed at the base of rainwater down pipes to collect rainwater runoff from the roof areas.	<u>Suitable:</u> To be included to the rear downpipes where possible for reuse by the maintenance team and users.
Rainwater Harvesting	Rainwater harvesting reduces the total runoff volume from the developed site and reduces treated water consumption.	<u>Not Suitable:</u> - Additional costs of installation would have severe effect on viability of the development. - Running and maintenance costs would not be acceptable to our client and future occupiers. - The ability to restrict peak flow rates and short-term peak volumes is non-existent where a critical storm event occurs.
Infiltration Options	Reduces total run off volume from the development.	<u>Not Suitable:</u> Intrusive investigations have indicated that the underlying ground is not suitable for infiltration.
Permeable Surfacing (Infiltration)	- Reduces total run off volume from the development. - Can be used to enhance water quality.	<u>Not Suitable:</u> Intrusive investigations have indicated that the underlying ground is not suitable for infiltration.
Permeable Surfacing (Standard)	- Can be used to enhance quality of runoff water. - Sub-base provides 'source' storage and reduces the volume of storage downstream. - The storage can be created with selection of the stone fill or plastic box stems. - Impermeable membrane at base of construction to prevent impact on pavement stability.	<u>Not Suitable:</u> Intrusive investigations have indicated that the underlying ground is not suitable for infiltration.

Swales, basins and ponds	• Provide areas for above ground surface runoff storage. • Swales also allow filtering of particulate matter, improving water quality	<u>Not suitable:</u> • No space available in the site for any of these features to be incorporated.
Bio-Retention	• Collect and retain run-off to help improve water quality, prior to discharge in piped system on infiltration.	<u>Not suitable:</u> • Space constraints on site do not permit large above ground areas for flood storage. • No scope to reduce development area due to site viability.

Figure 8: Surface SuDS Methods

Method	Comment	Suitability for Development
Geocellular Storage	• Suitable for sites with insufficient space for basins etc. • Suitable for sites where topography prevents the use of open basins etc.	<u>Suitable:</u> • Subject to detailed design and drainage layout.
Large Diameter Pipes, Culverts or Tanks	• Suitable for sites with insufficient space for basins etc. • Provide a volume of below ground storage with a high void ratio and good man entry provision to allow for future maintenance and cleaning. • Generally be suitable for adoption by the statutory water company (e.g. Severn Trent Water).	<u>Not suitable:</u> • More suited to larger residential schemes with adopted sewers.

Figure 9: Sub-Surface SuDS Methods

4.5.5 SuDS Hierarchal Approach

4.5.5.1 Based on the SuDS assessment in Figure 8 and 9, plus an assessment of the local site conditions, the SuDS hierarchal approach for discharge of surface water at the development site is considered in greater detail below:

Method	Suitability	Suitability for Development
Infiltration to Ground	No	Intrusive site investigation has indicated that the underlying ground is not suitable for infiltration-based options.
Connection to Watercourse	Yes	Use an existing private drain at the boundary of the site to pass forward the surface water from the new development to the River Roch.
Connection to Surface Water Sewer	No	Higher options possible.
Connection to a Combined Sewer	No	Higher options possible.

Figure 10: SuDS Hierarchal Approach

4.5.6 SuDS Design Philosophy

4.5.6.1 SuDS assessment and hierarchal approach discussed in Figure 8, 9 and 10 above has defined the overall SuDS strategy. Thus, the SuDS philosophy for the development site is the promotion of Prevention and Site Control techniques with connection to the River Roch at greenfield rates.

4.5.6.2 The following design philosophy is proposed:

- Surface water treatment using the 'Management Train' approach to remove and isolate contamination at all SuDS facilities prior to conveyance to the existing drainage infrastructure.
- Water Butts to rear rainwater pipes.
- Geocellular attenuation tank to serve the roof areas and car park.
- Aim to limit where possible the impermeable fraction of development.

4.6 Outline Surface Water Drainage Strategy

- 4.6.1 The general principal of the surface water drainage strategy is to collect the runoff from the roof of the new nursery building and external parking, and direct it to a new below ground surface water drainage network. This will then outfall to the existing surface water drain to the west of the site at a peak flow of 5l/s. Due to this restriction a geocellular attenuation tank located beneath the car park will retain the peak flow.
- 4.6.2 The proposed private drainage layout for the new development building will be designed in accordance with BS EN 752: 2017 and Building Regulations Part H guidance. This is to indicate no surcharge for the 2-year storm event and no flooding for up to the 30-year storm event.
- 4.6.3 The surface water drainage strategy plan is indicated on the drawing in Appendix C which should be read in conjunction with the outline hydraulic calculations in Appendix D.

4.7 Maintenance

- 4.7.1 The long-term maintenance of the new drainage and SuDS infrastructure will be with the owner or a management company in line with best practice guidance.

Typically the maintenance regime will be in line with Figure 11 below.

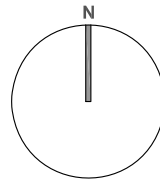
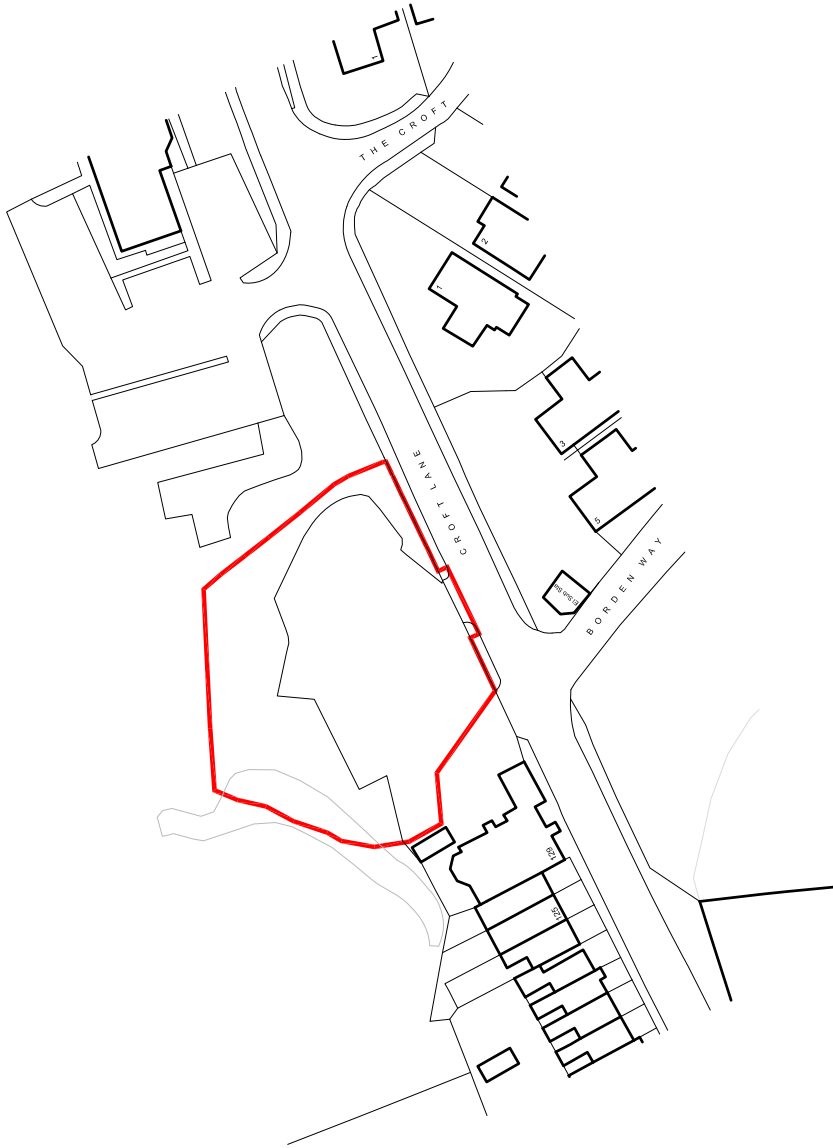
Future Maintenance of the Drainage System			
Responsibility	Feature	Maintenance	Frequency
Owner / Management Company	Rainwater gutters, downpipes and above ground drainage.	Regular maintenance and inspections.	Ad-hoc sweeping and emptying of silt and debris required. Annual visual inspections to check for damage/leaks.
	Flow control chambers.	Regular maintenance / removal of blockages and debris.	Annual inspection and following significant rainfall events.
	Geocellular Attenuation / Attenuation Tanks	Regular maintenance / removal of blockages and debris.	Annual inspection and following significant rainfall events.
	Pipes, sewers, manholes	Regular maintenance / removal of blockages and debris.	Annual inspection and removal of silts if required.

Figure 11: Outline Management and Maintenance Strategy

4.8 Foul Water Drainage

- 4.8.1 Foul drainage generated from the new development will discharge to the existing combined water public sewer passing through the western part of the site via a new saddle connection.
- 4.8.2 The proposed private drainage layout for the new development site will be designed in accordance with BS EN 752: 2017 and Building Regulations Part H guidance.
- 4.8.3 An indicative foul water drainage layout can be found on the drawing in Append C.

Appendix A – Architects Drawings



Scale

01020304050m

1:1250 @ A4

Notes

Figured dimensions are to be used in all case.

Dimensions should not be scaled from drawing unless for planning application purposes.

All existing dimensions should be checked on site before commencement of the works.

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No deviation from this drawing will be permitted without the prior written consent of the Architect.

This drawing is to be read in conjunction with all the relevant Mechanical and Electrical drawings.

This drawing is to be read in conjunction with the relevant Structural Engineer's drawings, structural calculations and recommendations.

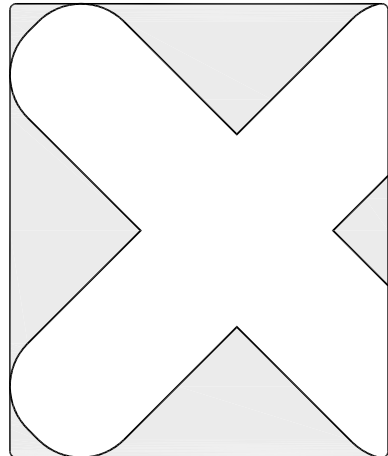
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Revision Notes

Rev.	Date	Revision Description	Drawn	Checked
P1	22.11.21	Initial Issue	RH	AT



Project Name

Unsworth
Croft Lane

Drawing Title

Location Plan

Drawing Number

UCL-KMA-XX-XX-DR-A-7000

Project Number

T1033

Status

A3
Planning

Revision

P1

Drawn by

RH

Authorised by

AT

Date

22.11.21

Studio KMA

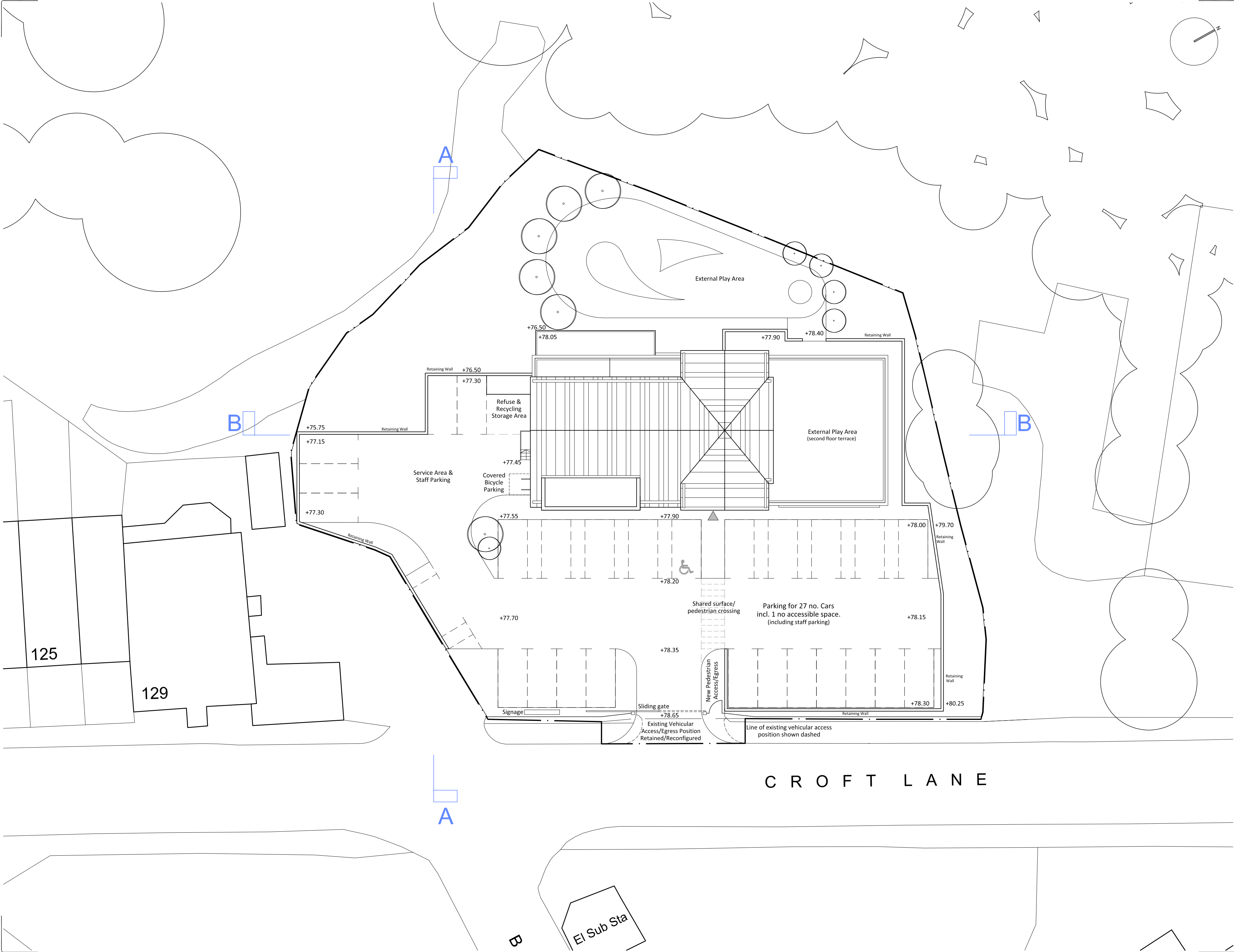
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STUDIO



Scale

02468m

1:200 @ A2

Notes

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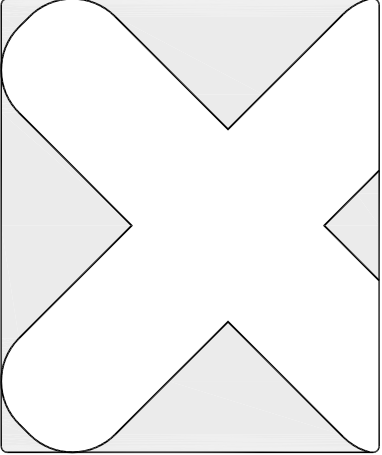
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Revision Notes			
Rev.	Date	Revision Description	Drawn Checked
P1	22.11.21	Initial Issue	RH AT



Project Name:
**Unsworth
Croft Lane**

Drawing Title
**Proposed
Site Plan / Roof Plan**

Drawing Number
UCL-KMA-XX-XX-DR-A-7002

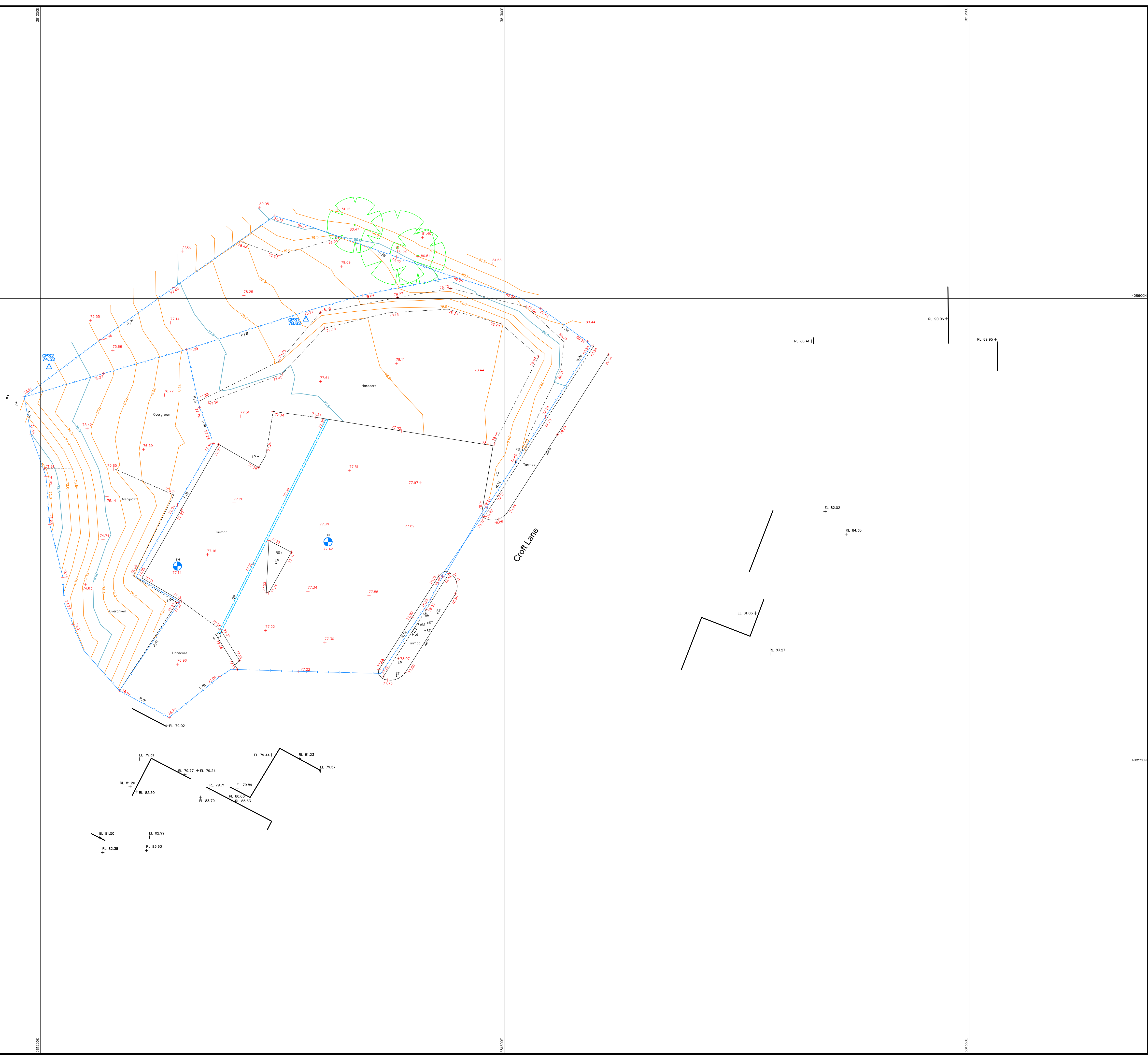
Project Number T1033	Status A3 Planning	Revision P1
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Drawn by RH	Authorized by AT	Date 22.11.21
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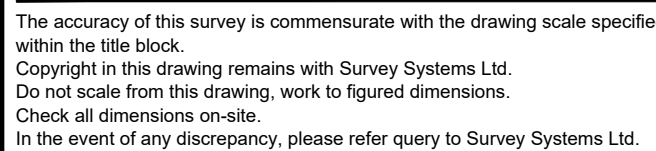


Appendix B – Topographical Survey

[illegible]

Stn	Easting	Northing	Level
GPS1	381278.58	408597.85	78.624
GPS2	381250.928	408592.714	74.521

Head and Registered Office
Survey Systems Ltd
Willow Bank House
Old Road
Handforth • Wilmslow
Cheshire SK9 3AZ
Tel. 01625 533444
Fax 01625 526815
mail@survsys.co.uk
www.survsys.co.uk

Coordinates are related to **National Grid (GPS)**

Surveyed	RL RA	Drawn	BP
Date	May 2021	Checked	NAD
File name	20674	Revision No.	Sheet size A1
Drawing No. SSL:20674:200:1;1			



Appendix C – PGC Drawings

SURFACE WATER DRAINAGE

CONSIDERATION HAS BEEN GIVEN TO THE HIERARCHY OF DRAINAGE OPTIONS FOR THE SITE AS FOLLOWS:

DISCHARGE INTO GROUND - UNDERLYING MADE GROUND IS DEEMED UNSUITABLE FOR ALL INFILTRATION BASED OPTIONS.

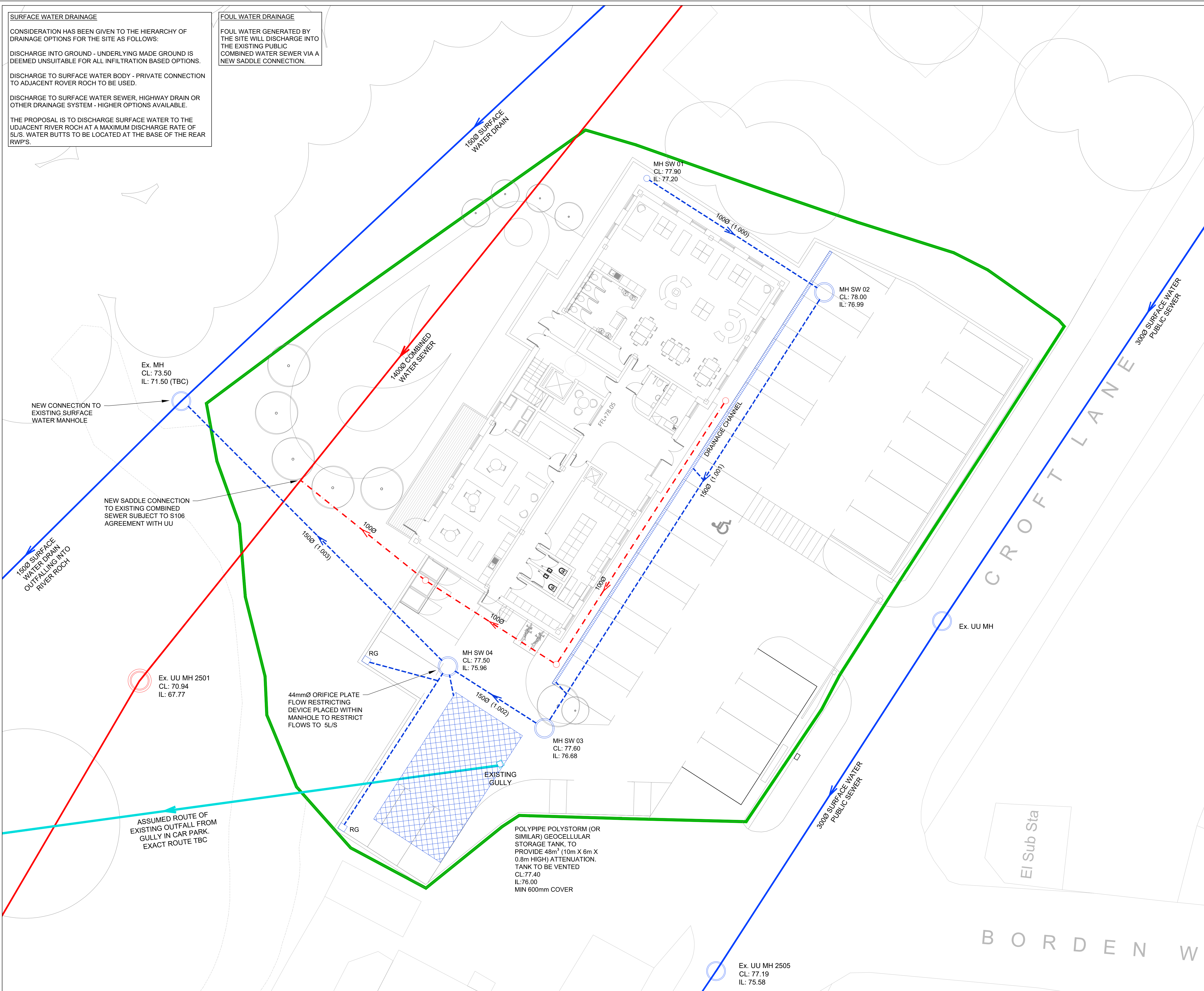
DISCHARGE TO SURFACE WATER BODY - PRIVATE CONNECTION TO ADJACENT ROVER ROCH TO BE USED.

DISCHARGE TO SURFACE WATER SEWER, HIGHWAY DRAIN OR OTHER DRAINAGE SYSTEM - HIGHER OPTIONS AVAILABLE.

THE PROPOSAL IS TO DISCHARGE SURFACE WATER TO THE UDJACENT RIVER ROCH AT A MAXIMUM DISCHARGE RATE OF 5L/S. WATER BUTTS TO BE LOCATED AT THE BASE OF THE REAR RWP'S.

FOUL WATER DRAINAGE

FOUL WATER GENERATED BY THE SITE WILL DISCHARGE INTO THE EXISTING PUBLIC COMBINED WATER SEWER VIA A NEW SADDLE CONNECTION.



GENERAL NOTES

- DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL RELEVANT SPECIFICATIONS, ENGINEERS, ARCHITECTS & SERVICES DRAWINGS, INCLUDING APPROVED BUILDERS WORK DRAWINGS. CONTRACTOR TO NOTIFY ENGINEER OF DISCREPANCIES BETWEEN STRUCTURAL DRAWINGS AND SPECIFICATIONS OR OTHER DRAWINGS.
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
- DETAILS OF EXISTING SEWERS SHALL BE CONFIRMED BY THE CONTRACTOR ON SITE PRIOR TO THE COMMENCEMENT OF WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY. THE CONTRACTOR SHOULD CHECK THE LEVELS OF ALL NEW OUT FALLS IN RELATION TO EXISTING SEWERS PRIOR TO ANY CONSTRUCTION TO ENSURE THE PROPOSED DESIGN CAN BE ACHIEVED.
- DO NOT SCALE FROM THIS DRAWN, WORK TO DIMENSIONS OR COORDINATES PROVIDED. ALL LEVELS ARE IN MILLIMETRES, UNLESS OTHERWISE NOTED. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER IMMEDIATELY.
- INFORMATION CONTAINED ON THIS DRAWING IS SCHEME DESIGN ONLY AND REQUIRED FURTHER DETAILED DESIGN AND CO-ORDINATION WITH THE CONTRACTOR, DESIGN TEAM AND APPROPRIATE SUB CONTRACTORS.

KEY

- EXISTING COMBINED WATER PUBLIC SEWER
- EXISTING SURFACE WATER PUBLIC SEWER / PRIVATE DRAIN
- PROPOSED FOUL WATER DRAINAGE
- PROPOSED SURFACE WATER DRAINAGE
- SITE BOUNDARY

P2	30.11.21	PG	PG	SITE PLAN UPDATED
P1	18.10.21	PG	PG	PRELIMINARY ISSUE
REV	DATE	DRAWN	REV'D	NOTES
CLIENT				
TIDDLYWINKS NURSERY GROUP				
PROJECT				
PROPOSED NURSERY, CROFT LANE, UNSWORTH				
DRAWING TITLE				
DRAINAGE STRATEGY PLAN				
DRAWING STATUS				
INFORMATION				
SCALE	1:125	DRAWN BY	PG	ENGINEER
			PG	SHEET
				A1
DRAWING No				REVISION
PGC315-C-100				P2
PGConsulting				
Civil & Infrastructure Engineers				
108 Ack Lane West, Cheshire, SK8 7ES				
Tel: 07710 758971				
Email: paul@pgc.co.uk				

Appendix D – Hydraulic Calculations

		Page 1
	Croft Lane, Unsworth Greenfield Runoff Rates	
Date 18/10/2021 File	Designed by paulg Checked by	
Innovyze	Source Control 2017.1.2	
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 1 Soil 0.450 Area (ha) 0.210 Urban 0.000 SAAR (mm) 1068 Region Number Region 10 Results 1/s QBAR Rural 1.5 QBAR Urban 1.5 Q1 year 1.3 Q1 year 1.3 Q30 years 2.6 Q100 years 3.1		
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	Croft Lane, Unsworth SW Network	
Date 18/10/2021 File Croft Lane - SW Network...	Designed by paulg Checked by	
Innovyze	Network 2017.1.2	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.308	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	4.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.106	4-8	0.024

Total Area Contributing (ha) = 0.130

Total Pipe Volume (m³) = 1.469

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	16.000	0.160	100.0	0.020	4.00	0.0	0.600	o	100	Pipe/Conduit	
1.001	37.000	0.308	120.0	0.070	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	8.000	0.067	120.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	4.000	0.040	100.0	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	27.000	3.800	7.1	0.040	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	4.35	77.200	0.020	0.0	0.0	0.0	0.77	6.0	2.7
1.001	50.00	5.02	76.990	0.090	0.0	0.0	0.0	0.92	16.2	12.2
1.002	50.00	5.17	76.682	0.090	0.0	0.0	0.0	0.92	16.2	12.2
2.000	50.00	4.07	76.000	0.000	0.0	0.0	0.0	1.00	17.8	0.0
1.003	50.00	5.28	75.960	0.130	0.0	0.0	0.0	3.80	67.2	17.6

		Page 2																																																																																																																																																																							
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Innovyze		Network 2017.1.2																																																																																																																																																																							
PIPELINE SCHEDULES for Storm Upstream Manhole <table><thead><tr><th>PN</th><th>Hyd Sect</th><th>Diam (mm)</th><th>MH Name</th><th>C.Level (m)</th><th>I.Level (m)</th><th>D.Depth (m)</th><th>MH Connection</th><th>MH DIAM., L*W (mm)</th></tr></thead><tbody><tr><td>1.000</td><td>o</td><td>100</td><td>SW01</td><td>77.900</td><td>77.200</td><td>0.600</td><td>Open Manhole</td><td>450</td></tr><tr><td>1.001</td><td>o</td><td>150</td><td>SW02</td><td>78.000</td><td>76.990</td><td>0.860</td><td>Open Manhole</td><td>1200</td></tr><tr><td>1.002</td><td>o</td><td>150</td><td>SW03</td><td>77.600</td><td>76.682</td><td>0.768</td><td>Open Manhole</td><td>1200</td></tr><tr><td>2.000</td><td>o</td><td>150</td><td>TANK</td><td>77.500</td><td>76.000</td><td>1.350</td><td>Open Manhole</td><td>1200</td></tr><tr><td>1.003</td><td>o</td><td>150</td><td>SW04</td><td>77.500</td><td>75.960</td><td>1.390</td><td>Open Manhole</td><td>1200</td></tr></tbody></table> Downstream Manhole <table><thead><tr><th>PN</th><th>Length (m)</th><th>Slope (1:X)</th><th>MH Name</th><th>C.Level (m)</th><th>I.Level (m)</th><th>D.Depth (m)</th><th>MH Connection</th><th>MH DIAM., L*W (mm)</th></tr></thead><tbody><tr><td>1.000</td><td>16.000</td><td>100.0</td><td>SW02</td><td>78.000</td><td>77.040</td><td>0.860</td><td>Open Manhole</td><td>1200</td></tr><tr><td>1.001</td><td>37.000</td><td>120.0</td><td>SW03</td><td>77.600</td><td>76.682</td><td>0.768</td><td>Open Manhole</td><td>1200</td></tr><tr><td>1.002</td><td>8.000</td><td>120.0</td><td>SW04</td><td>77.500</td><td>76.615</td><td>0.735</td><td>Open Manhole</td><td>1200</td></tr><tr><td>2.000</td><td>4.000</td><td>100.0</td><td>SW04</td><td>77.500</td><td>75.960</td><td>1.390</td><td>Open Manhole</td><td>1200</td></tr><tr><td>1.003</td><td>27.000</td><td>7.1</td><td>SEWER</td><td>73.500</td><td>72.160</td><td>1.190</td><td>Open Manhole</td><td>0</td></tr></tbody></table> Free Flowing Outfall Details for Storm <table><thead><tr><th>Outfall Pipe Number</th><th>Outfall Name</th><th>C. Level (m)</th><th>I. Level (m)</th><th>Min I. Level (m)</th><th>D,L (mm)</th><th>W (mm)</th></tr></thead><tbody><tr><td>1.003</td><td>SEWER</td><td>73.500</td><td>72.160</td><td>71.500</td><td>0</td><td>0</td></tr></tbody></table> Simulation Criteria for Storm <table><tbody><tr><td>Volumetric Runoff Coeff</td><td>0.750</td><td>Additional Flow - % of Total Flow</td><td>0.000</td></tr><tr><td>Areal Reduction Factor</td><td>1.000</td><td>MADD Factor * 10m³/ha Storage</td><td>2.000</td></tr><tr><td>Hot Start (mins)</td><td>0</td><td>Inlet Coefficient</td><td>0.800</td></tr><tr><td>Hot Start Level (mm)</td><td>0</td><td>Flow per Person per Day (l/per/day)</td><td>0.000</td></tr><tr><td>Manhole Headloss Coeff (Global)</td><td>0.500</td><td>Run Time (mins)</td><td>60</td></tr><tr><td>Foul Sewage per hectare (l/s)</td><td>0.000</td><td>Output Interval (mins)</td><td>1</td></tr><tr><td>Number of Input Hydrographs</td><td>0</td><td>Number of Storage Structures</td><td>1</td></tr><tr><td>Number of Online Controls</td><td>1</td><td>Number of Time/Area Diagrams</td><td>0</td></tr><tr><td>Number of Offline Controls</td><td>0</td><td>Number of Real Time Controls</td><td>0</td></tr></tbody></table> Synthetic Rainfall Details <table><tbody><tr><td>Rainfall Model</td><td>FSR</td><td>Region</td><td>England and Wales</td></tr><tr><td>Return Period (years)</td><td>2</td><td>M5-60 (mm)</td><td>19.000</td></tr></tbody></table>				PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)	1.000	o	100	SW01	77.900	77.200	0.600	Open Manhole	450	1.001	o	150	SW02	78.000	76.990	0.860	Open Manhole	1200	1.002	o	150	SW03	77.600	76.682	0.768	Open Manhole	1200	2.000	o	150	TANK	77.500	76.000	1.350	Open Manhole	1200	1.003	o	150	SW04	77.500	75.960	1.390	Open Manhole	1200	PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)	1.000	16.000	100.0	SW02	78.000	77.040	0.860	Open Manhole	1200	1.001	37.000	120.0	SW03	77.600	76.682	0.768	Open Manhole	1200	1.002	8.000	120.0	SW04	77.500	76.615	0.735	Open Manhole	1200	2.000	4.000	100.0	SW04	77.500	75.960	1.390	Open Manhole	1200	1.003	27.000	7.1	SEWER	73.500	72.160	1.190	Open Manhole	0	Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)	1.003	SEWER	73.500	72.160	71.500	0	0	Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000	Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000	Hot Start (mins)	0	Inlet Coefficient	0.800	Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000	Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60	Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1	Number of Input Hydrographs	0	Number of Storage Structures	1	Number of Online Controls	1	Number of Time/Area Diagrams	0	Number of Offline Controls	0	Number of Real Time Controls	0	Rainfall Model	FSR	Region	England and Wales	Return Period (years)	2	M5-60 (mm)	19.000
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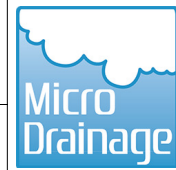
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	Croft Lane, Unsworth SW Network	
Date 18/10/2021 File Croft Lane - SW Network...	Designed by paulg Checked by	
Innovyze	Network 2017.1.2	
Synthetic Rainfall Details Ratio R 0.308Cv (Winter) 0.840 Profile Type Summer Storm Duration (mins) 30 Cv (Summer) 0.750		
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	Croft Lane, Unsworth SW Network	
Date 18/10/2021 File Croft Lane - SW Network...	Designed by paulg Checked by	
Innovyze	Network 2017.1.2	
<u>Online Controls for Storm</u> <u>Orifice Manhole: SW04, DS/PN: 1.003, Volume (m³): 1.9</u> Diameter (m) 0.044 Discharge Coefficient 0.600 Invert Level (m) 75.960		
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Innovyze	Network 2017.1.2																																																																																					
<u>Storage Structures for Storm</u> <u>Cellular Storage Manhole: TANK, DS/PN: 2.000</u> Invert Level (m) 76.000 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>60.0</td><td>60.0</td><td>5.200</td><td>0.0</td><td>84.8</td></tr><tr><td>0.400</td><td>60.0</td><td>72.4</td><td>5.600</td><td>0.0</td><td>84.8</td></tr><tr><td>0.800</td><td>60.0</td><td>84.8</td><td>6.000</td><td>0.0</td><td>84.8</td></tr><tr><td>0.801</td><td>0.0</td><td>84.8</td><td>6.400</td><td>0.0</td><td>84.8</td></tr><tr><td>1.600</td><td>0.0</td><td>84.8</td><td>6.800</td><td>0.0</td><td>84.8</td></tr><tr><td>2.000</td><td>0.0</td><td>84.8</td><td>7.200</td><td>0.0</td><td>84.8</td></tr><tr><td>2.400</td><td>0.0</td><td>84.8</td><td>7.600</td><td>0.0</td><td>84.8</td></tr><tr><td>2.800</td><td>0.0</td><td>84.8</td><td>8.000</td><td>0.0</td><td>84.8</td></tr><tr><td>3.200</td><td>0.0</td><td>84.8</td><td>8.400</td><td>0.0</td><td>84.8</td></tr><tr><td>3.600</td><td>0.0</td><td>84.8</td><td>8.800</td><td>0.0</td><td>84.8</td></tr><tr><td>4.000</td><td>0.0</td><td>84.8</td><td>9.200</td><td>0.0</td><td>84.8</td></tr><tr><td>4.400</td><td>0.0</td><td>84.8</td><td>9.600</td><td>0.0</td><td>84.8</td></tr><tr><td>4.800</td><td>0.0</td><td>84.8</td><td>10.000</td><td>0.0</td><td>84.8</td></tr></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	60.0	60.0	5.200	0.0	84.8	0.400	60.0	72.4	5.600	0.0	84.8	0.800	60.0	84.8	6.000	0.0	84.8	0.801	0.0	84.8	6.400	0.0	84.8	1.600	0.0	84.8	6.800	0.0	84.8	2.000	0.0	84.8	7.200	0.0	84.8	2.400	0.0	84.8	7.600	0.0	84.8	2.800	0.0	84.8	8.000	0.0	84.8	3.200	0.0	84.8	8.400	0.0	84.8	3.600	0.0	84.8	8.800	0.0	84.8	4.000	0.0	84.8	9.200	0.0	84.8	4.400	0.0	84.8	9.600	0.0	84.8	4.800	0.0	84.8	10.000	0.0	84.8
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Date 18/10/2021		Designed by paulg						
File Croft Lane - SW Network...		Checked by						
Innovyze		Network 2017.1.2						
1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm								
Simulation Criteria								
Areal Reduction Factor 1.000		Additional Flow - % of Total Flow 0.000						
Hot Start (mins) 0		MADD Factor * 10m³/ha Storage 2.000						
Hot Start Level (mm) 0		Inlet Coefficient 0.800						
Manhole Headloss Coeff (Global) 0.500		Flow per Person per Day (l/per/day) 0.000						
Foul Sewage per hectare (l/s) 0.000								
Number of Input Hydrographs 0		Number of Storage Structures 1						
Number of Online Controls 1		Number of Time/Area Diagrams 0						
Number of Offline Controls 0		Number of Real Time Controls 0						
Synthetic Rainfall Details								
Rainfall Model		FSR		Ratio R 0.308				
Region England and Wales Cv (Summer) 0.750								
M5-60 (mm)		19.000 Cv (Winter) 0.840						
Margin for Flood Risk Warning (mm)				300.0				
Analysis Timestep 2.5 Second Increment (Extended)								
DTS Status				OFF				
DVD Status				ON				
Inertia Status				ON				
Profile(s)				Summer and Winter				
Duration(s) (mins)		15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440						
Return Period(s) (years)				1, 30, 100				
Climate Change (%)				0, 0, 40				
US/MH Return Climate First (X) First (Y) First (Z) Overflow								
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.
1.000	SW01	15 Winter	1	+0%	30/15 Summer	100/15 Summer		
1.001	SW02	15 Winter	1	+0%	30/15 Summer	100/15 Summer		
1.002	SW03	15 Winter	1	+0%	30/15 Summer			
2.000	TANK	120 Winter	1	+0%	30/15 Summer	100/180 Winter		
1.003	SW04	15 Winter	1	+0%	1/15 Summer	100/180 Winter		
Water Surcharged Flooded						Pipe		
PN	US/MH	Level	Depth	Volume	Flow / Overflow	Flow	Status	Level
	Name	(m)	(m)	(m³)	Cap. (l/s)	(l/s)		Exceeded
1.000	SW01	77.247	-0.053	0.000	0.45	2.6	OK	6
1.001	SW02	77.076	-0.064	0.000	0.61	9.6	OK	3
1.002	SW03	76.773	-0.059	0.000	0.68	9.5	OK	
2.000	TANK	76.138	-0.012	0.000	0.11	1.4	OK	2
1.003	SW04	76.200	0.090	0.000	0.03	1.9 SURCHARGED		2
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Croft Lane, Unsworth
SW Network



Date	18/10/2021
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Designed by paulg

File Croft Lane - SW Network...

Checked by

Innovyze

Network 2017.1.2

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.308
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

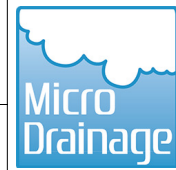
Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH		Return Period	Climate Change	First (X)		First (Y)		First (Z)		Overflow Act.
	Name	Storm			Surcharge		Flood		Overflow		
1.000	SW01	15 Winter	30	+0%	30/15	Summer	100/15	Summer			
1.001	SW02	15 Winter	30	+0%	30/15	Summer	100/15	Summer			
1.002	SW03	15 Winter	30	+0%	30/15	Summer					
2.000	TANK	180 Winter	30	+0%	30/15	Summer	100/180	Winter			
1.003	SW04	180 Winter	30	+0%	1/15	Summer	100/180	Winter			

PN	US/MH Name	Water	Surcharged	Flooded	Pipe			Level Exceeded	
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)		Status
1.000	SW01	77.644	0.344	0.000	0.84		4.9	FLOOD RISK	6
1.001	SW02	77.530	0.390	0.000	1.39		21.8	SURCHARGED	3
1.002	SW03	76.917	0.085	0.000	1.53		21.6	SURCHARGED	
2.000	TANK	76.439	0.289	0.000	0.20		2.5	SURCHARGED	2
1.003	SW04	76.441	0.331	0.000	0.04		2.7	SURCHARGED	2

Croft Lane, Unsworth
SW Network



Date	18/10/2021
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Designed by paulg

File Croft Lane - SW Network...

Checked by

Innovyze

Network 2017.1.2

100 year Return Period Summary of Critical Results by Maximum Level (Rank
1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.308
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH		Return Period	Climate Change	First (X)		First (Y)		First (Z)	Overflow Act.
	Name	Storm			Surcharge		Flood		Overflow	
1.000	SW01	15 Winter	100	+40%	30/15	Summer	100/15	Summer		
1.001	SW02	15 Winter	100	+40%	30/15	Summer	100/15	Summer		
1.002	SW03	180 Winter	100	+40%	30/15	Summer				
2.000	TANK	180 Winter	100	+40%	30/15	Summer	100/180	Winter		
1.003	SW04	180 Winter	100	+40%	1/15	Summer	100/180	Winter		

PN	US/MH Name	Water	Surcharged	Flooded	Pipe			Level Exceeded	
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)		Status
1.000	SW01	77.903	0.603	3.393	2.14		12.4	FLOOD	6
1.001	SW02	78.001	0.861	0.775	1.79		28.1	FLOOD	3
1.002	SW03	77.514	0.682	0.000	0.96		13.6	FLOOD RISK	
2.000	TANK	77.500	1.350	0.073	0.28		3.5	FLOOD	2
1.003	SW04	77.501	1.391	0.534	0.08		5.0	FLOOD	2

Appendix E – United Utilities Sewer Records

Paul Graveney Consulting Ltd

**108
ack lane west,
cheshire
SK8 7ES**

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: PGC 315
Our Ref: UUPS-ORD-334450
Date: 13/10/2021**

Dear Sirs

Location: Croft Lane Unsworth

I acknowledge with thanks your request dated 11/10/2021 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

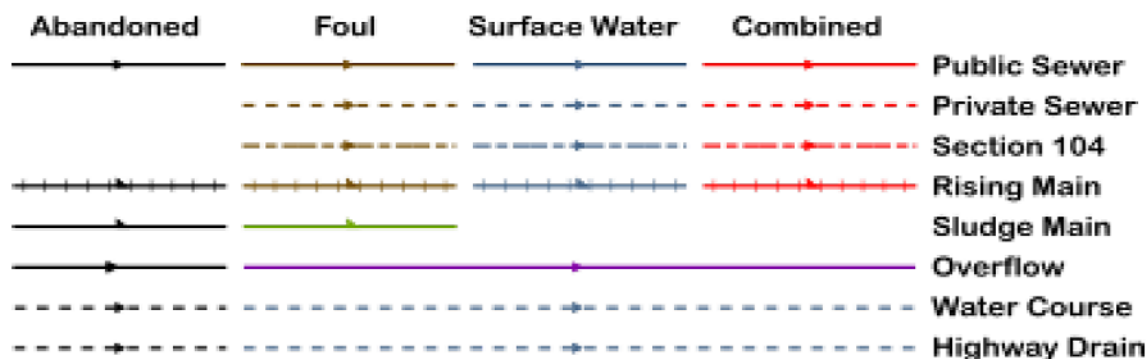
TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

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:

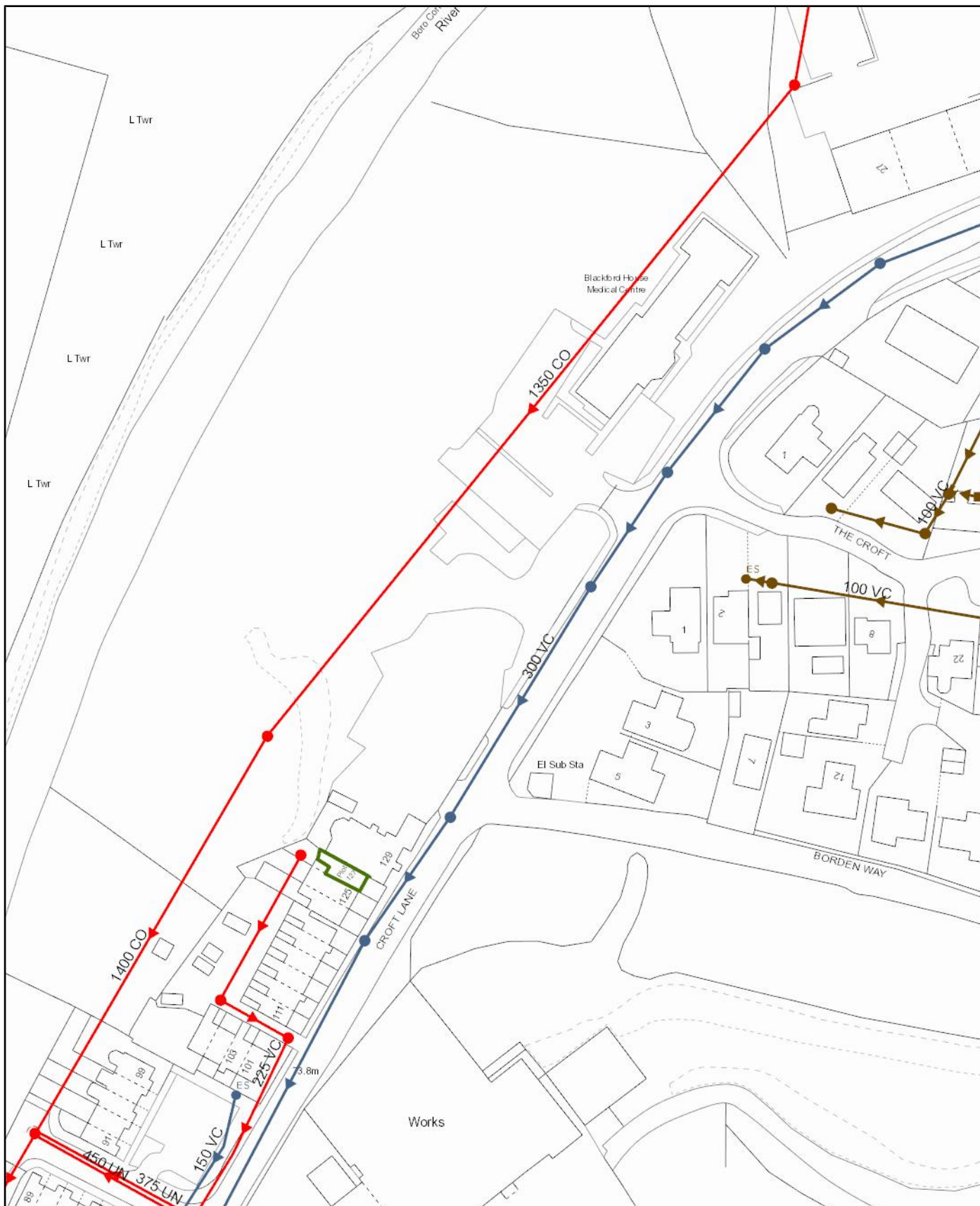
- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out 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	



Scale: 1:1250
Date: 13/10/2021

SEWER RECORDS



Address or Site Reference: Croft Lane Unsworth
Printed by: Property Searches

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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