4-6506-DS-001-D

Surface Water Drainage Strategy

Clegg Street

Liverpool

L5 3LD

28th February 2018

For Caro Developments

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Revision List

REVISION	REASON FOR ISSUE	DATE OF ISSUE
A	**Issued for Planning**	**27 September 2017**
B	**Description Update**	**7 November 2017**
C	**Drawing Updated**	**26 January 2018**
D	**Updated to Suit Revised Scheme Proposal**	**28 February 2018**

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1.0 INTRODUCTION

1.1 General

1.1.1 This report has been prepared on instructions received from Caro Developments and relates to the proposed redevelopment of Clegg Street, Liverpool L5 3LD.

1.1.2 It is proposed to redevelop the site to provide residential housing ranging in height between six to eight storeys containing a total of 95 units. At ground floor level, car parking is provided (including underneath the main footprint of the building).

1.1.3 This report is prepared solely for the benefit of the Client. This report may not be assigned without prior written permission from Clancy Consulting.

1.1.4 This report is for Planning Application purposes only. Detailed design of drainage, specialist engineers will be required prior to construction.

1.2 Background Information

1.2.1 Following recent consultation, planning guidance was issued which came into force on 6 April 2015 and concerns all “major” housing developments (developments of 10 dwellings or more). This guidance sets out the following main points;

LPAs will be required to consider SuDS in connection with planning applications, rather than a separate local government body.

Lead Local Flood Authorities (LLFAs) will become statutory consultees on surface water management regarding planning applications. LPAs must satisfy themselves that operational standards and maintenance are provided for the lifespan of the development using for example planning conditions or Section 106 agreements.

The operation and on-going maintenance of SuDS must also be economical.

A clear set of non-statutory technical standards for SuDS has been produced by the Government working closely with the Environment Agency, local authorities and developers to reduce the risk of surface water flooding, improve water quality and the environment and to ensure that SuDS are robust, safe and affordable.

They should be read in conjunction with a Planning Practice Guide which is now available online.

The Technical Guidance previously published has now been replaced with a Web based Practice Guide – Flood Risk and Coastal Change.

http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/reducing-the-causes-and-impacts-of-flooding/why-are-sustainable-drainage-systems-important/

2.0 LOCAL POLICY

LCC GREENFIELD / BROWNFIELD SITES SURFACE WATER MANAGEMENT GUIDANCE

If the site has previously been developed it should be demonstrated that the drainage system is still operational for it to be classed as brownfield. Information should be obtained on the system, e.g. pipe diameters, levels, gradients, lengths, hydraulic controls, etc. These details should be used, along with the contributing area characteristics of the site, to set up a drainage model (or to inform another assessment method) in order to evaluate the peak flow rates at the outfalls from the existing site for the design return period events. The maximum allowed flow from the site should then be derived using the 1:2yr critical rainfall event with a 30% reduction applied to offer improvement.

The limiting discharge figure for the proposed development should be used in the design of the drainage system for the minimum requirement that flows for up to the 1:30yr critical rainfall event are retained within the system and that for the 1:100yr+30% climate change allowance, critical rainfall event there will be no flooding to any buildings and any excess volumes of water will be retained on site.

Notwithstanding the above, the existing site drainage constraints will also be taken into account when agreeing any discharge limits and the proposed flow should not exceed existing pipe capacity. For example if the existing site outfall was a 150mm dia pipe, irrespective of the area being drained, it would have a maximum flow capacity which may be lower than any proposed flows calculated using the above criteria, assuming a free discharge. Therefore discharge to the existing drainage system from the development would be effectively increased from the existing situation which is contrary to Environment Agency and National Planning Policy Framework guidance for flood risk and surface water management.

Where records of the previously developed system are not available and system characteristics cannot otherwise be determined, or if the drainage system is broken or blocked (or no longer operational), then the run-off characteristics should be defined as greenfield.

If a site is classed as greenfield the flow rates from the development will be limited to the equivalent greenfield run off rates. For example the flow rate from the development for the 1:30yr critical rainfall event should not exceed the greenfield run off rate for the site for the 1:30 year rainfall event, likewise for the 1:2 & 1:100 year scenarios. A minimum flow of 5 l/s can be used when the greenfield run off rate falls below 5 l/s.

It should be noted that this discharge figure will satisfy planning requirements but the applicant should consult United Utilities to determine if they have any discharge restrictions, which could be more restrictive.

For all developments over 1ha a FRA (Flood Risk Assessment) will be required which should be based on the requirements as detailed in Environment Agency (Greater Manchester, Merseyside & Cheshire) Local Planning Standing Advice and NPPF guidance. The detail and technical complexity of a FRA will reflect the scale, nature and location of the development. Where available, reference should be made to the Strategic Flood Risk Assessment (SFRA) for locally specific guidance and information.

The following list sets out key information that should be submitted within a FRA for developments

- A location plan that includes geographical features, street names and identifies the catchment, watercourses or other bodies of water in the vicinity.
- A plan of the site showing existing site; development proposals; and identification of any structures (e.g. embankments), which may influence local flood flow overland or in any watercourses (e.g. culverts) present on the site.
- Site levels of both existing and proposed. Reference to Ordnance Datum, may be required where details of context of the site to its surroundings is needed.
- Details of the existing surface water drainage arrangements on site (if any) and the receptor e.g. soakaway, sewer, canal, watercourse etc.
- Proposals for surface water management that aims to not increase, and where practicable reduce the rate of runoff from the site as a result of the development
- Information about the surface water disposal measures already in place and estimates of the rates of run-off generated by the surfaces drained.
- An assessment of the volume of surface water run-off likely to be generated from the proposed development and confirmation of how any excess volumes would be retained within the development.
- Information regarding how the proposed drainage design will perform under the increased frequency and intensity of rainfall that is predicted as a result of climate change (30% for residential development & 20% for non- residential).
- Information about other potential sources of flooding, if any, that may affect the site e.g. streams, surface water run-off, sewers, groundwater, reservoirs, canals and other artificial sources or any combination of these; including details on how these sources of flooding will be managed safely within the development proposal.

It should be noted that the above list is not exhaustive but provides a framework for the FRA to be prepared.

For developments less than 1 ha a FRA will not be required but a drainage design statement should be provided proportional to the scale of the development and follow the same design principles with regards to the calculating the maximum design flow rates for the site.

In line with NPPF (National Planning Policy Framework) the development of a site should look towards the use of SUDS techniques as a method of reducing the run off from the site, as a result of the development. Government policy strongly encourages a hierarchical approach to the use of sustainable drainage systems in new developments and infiltration methods for private drainage should be used where possible.

For residential developments greater than 0.5 ha and where the floor space of any building is greater than 1000m² Ground Investigations should be carried out to BRE 365 to determine if infiltration drainage methods are practicable and suitable for the sites. A soils report including ground percolation test results and recommendations will need to be submitted within the drainage design statement or FRA, for approval, although any detailed soakaway design information is not required at this stage. If this proves that infiltration drainage is not a viable option, then a positive piped system of surface water run off disposal will need to be provided.

Any soakaway design and the sub ground strata of the sloping site areas shall be considered so as not to cause flooding to any adjoining third party land.

For developments containing prospectively adoptable surface water sewers the following document published by United Utilities should be referred to for guidance related to SUDS

http://www.unitedutilities.com/documents/7010b_S104_Guide_adoption_sewers_2016_WEB_ACC.pdf

3.0 SITE CHARACTERISTICS

3.1 Location

3.1.1 The site is located as detailed as below.

OS X (Eastings)	335143
OS Y (Northings)	391979
Nearest Post Code	L5 3LD
Lat (WGS84)	N53:25:14 (53.420604)
Long (WGS84)	W2:58:39 (-2.977384)
LR	SJ351919 / SJ35149391979
mX	-331440
mY	7026843

3.2 Site Description

3.2.1 The site is located at the top of Clegg Street, parallel to Great Homer Street and covers an area of approximately 0.23 hectares.

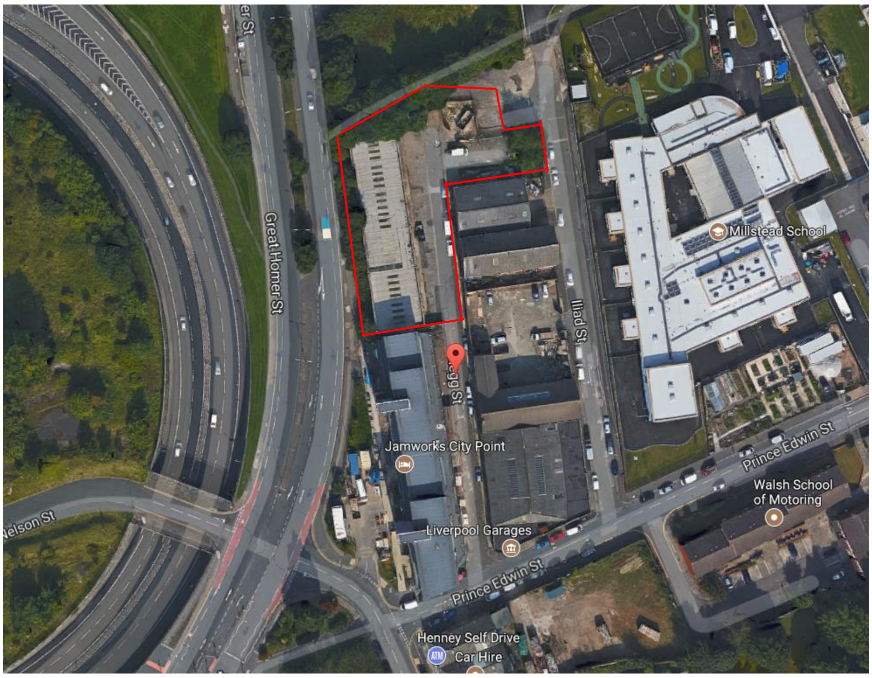


Figure 1 – Site Plan view. Source; Google

3.2.2 The site currently comprises primarily of single storey, masonry constructed garage units with an area of derelict impermeable ground located at the North end of the site. Clegg Street passes through the centre of the site, running North to South.

3.2.3 The River Mersey is located to the East of the development approximately 1.8km away. There are no other known water courses in the vicinity of the site.

3.3 Existing Drainage

3.3.1 Public Sewer records for the site have been obtained from United Utilities. These indicate that there is a network of large combined foul and surface water drains along the North elevation (UU Ref 1703) and within the site boundary directly below Clegg Street (UU Ref 1614).

3.3.2 United Utilities indicate that the depth of the sewer to the North of the site is 3.6m deep and the drainage run below Clegg Street within the site boundary is 2.77m deep.

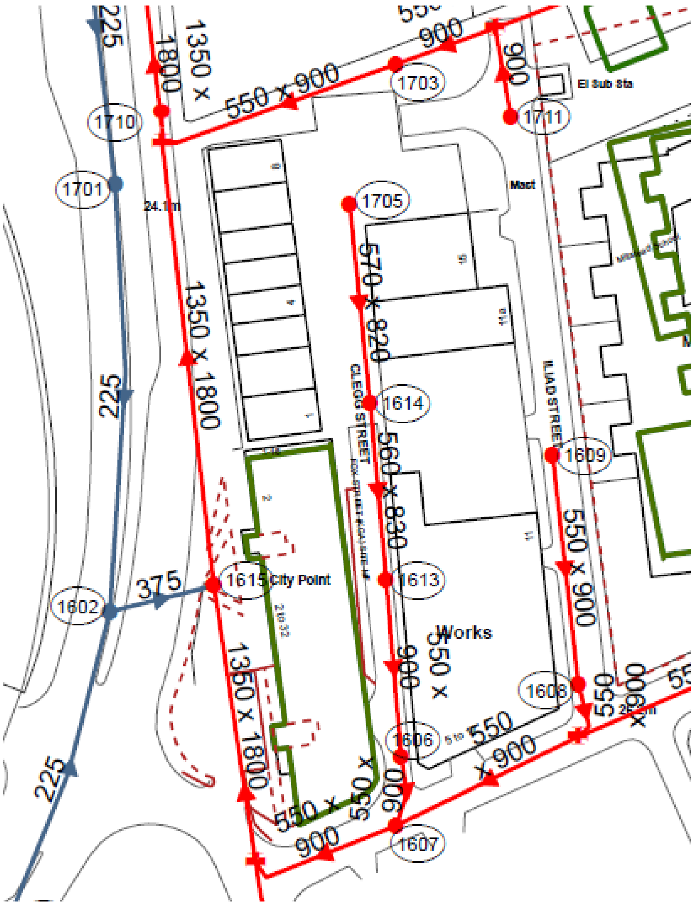


Figure 2 – Public Sewer Network. Source: United Utilties.

Figure 3 – Historic Mapping (1894) Source: National Library of Scotland

3.3.3 The historic street plan in Figure 3 shows that the current United Utilities public drainage system would have been entirely within the streets prior to redevelopment of this area.

3.4 Ground Conditions and Geology

3.4.1 Geological maps indicate that the site is not underlain by superficial deposits with the solid strata comprising sandstone of the Helsby Sandstone Formation. Made Ground (upto 3m in depth) is indicated within the local area from historical borehole logs. They also record a mixture of sand and clay varying from soft to stiff and loose to very dense between 1.10m to 4.60m below ground level. Weathered Sandstone was recorded between 2.10m and 4.70m below ground level.

3.5 Development Proposals

3.5.1 It is proposed to redevelop the site to provide residential housing ranging in height between six to eight storeys containing a total of 95 units. At ground floor level, car parking is provided (including underneath the main footprint of the building).

4.0 SURFACE WATER DRAINAGE STRATEGY

4.1 Surface Water Disposal Hierarchy

The disposal of surface water should be considered in the following order of priority;

1. Infiltration into the subsoil via soakaways or permeable paving.

2. Discharge to a water course or the sea.

3. Discharge to a surface water sewer.

4. Discharge to a combined sewer.

If it is not possible to discharge to a soakaway, then surface water should be controlled with the use of Sustainable Drainage Systems (SuDS) and considered using the SuDS Hierarchy.

4.2 SuDS Hierarchy

Most Sustainable	*SUDS technique*	*Flood Reduction*	*Pollution Reduction*	*Landscape & Wildlife Benefit*
↑	**Living roofs**	✓	✓	✓
	Basins and ponds - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✓	✓	✓
	Filter strips and swales	✓	✓	✓
	Infiltration devices - soakaways - infiltration trenches and basins	✓	✓	✓
↓	**Permeable surfaces and filter drains** - gravelled areas - solid paving blocks - porous paviors	✓	✓	
Least Sustainable	**Tanked systems** - over-sized pipes/tanks - storms cells	✓		

4.3 Disposal Strategy for Clegg Street

4.3.1 Infiltration

Infiltration for this development is unlikely to be possible due to the space constraints, the sloping site and the nature of the subsoils.

It is necessary to position soakaways at least 5m from building structures to prevent potential damage to the structure by weakening sub-soils close to foundations. There is no space on this site to locate a soakaway at least 5m from the building.

There are external areas of paving so the provision of permeable paving is possible for this site.

4.3.2 Water Couse / Surface water Sewer

There are no watercourses or surface water sewers within practical distance of the site and this would entail crossing third party land.

4.3.3 Combined Sewer

This is the only practical solution for the discharge of all drainage from the site.

4.4 SuDS Strategy for Erskine

4.4.1 Living Roof

A significant area of the site receiving surface water is roof area.

The most sustainable solution to control run-off at its source is to provide a living or green roof areas. These roof areas retain part of the rainwater, slow down the speed of run-off and also reduce water pollution.

4.4.2 Ponds/ Basins and Swales.

There is no suitable space on site to provide these systems.

4.4.3 Tanked System

A tanked system will provide additional attenuation storage to control rainfall up to 1 in 100 year events with an allowance for climate change. An overall reduction in flow rate from the site will be proposed in accordance with Liverpool Council development standards.

5.0 SuDS TECHNICAL STANDARD REQUIREMENTS

5.1 Peak Flow

5.1.1 For sites which were previously developed (brownfield), the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 2 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

The standards stipulated by Liverpool City Council require at least a 30 % reduction of the 1 in 2 year critical event.

5.1.2 Refer to calculations in Appendix B.

The Existing impermeable area is 2285 m2.

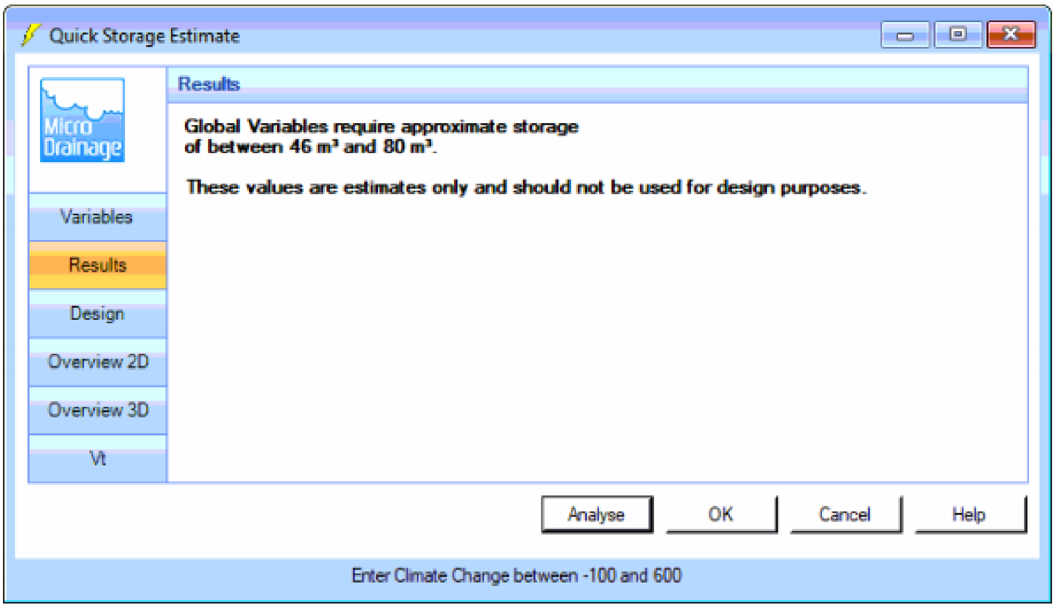
The Existing 1 in 2-year (15 minute) run-off for the site is 24 l/s

The Existing 1 in 100-year run-off for the site is 79 l/s

It is proposed to control the surface water run-off to the existing 1 in 2 year rate with a reduction of 30%. 24l/s – 30% = 16.8 litres per second.

Storage will be provided for all storm events up to and including the 1 in 100-year event plus climate change allowance, based on a maximum flow rate off site of 16.8 litres per second.

The volume of surface water storage required for this site for the 1 in 100-year event plus climate change allowance, based on a maximum flow rate off site of 16.8 litres per second is between 46 - 80m^3.



This quantity of storage can be accommodated within the site and an outline strategy has been shown on SK01 – Drainage Strategy.

5.2 Volume Control

Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

There will be some minor reductions in the volume of discharge with the introduction of soft landscaping.

5.3 Flood Risk within the Development

The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.

The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.

The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.

Levels will be designed such that in the event of a more extreme rainfall event water will discharge away from buildings.

5.4 Structural Integrity

Components must be designed to ensure structural integrity of the drainage system and any adjacent structures or infrastructure under anticipated loading conditions over the design life of the development taking into account the requirement for reasonable levels of maintenance.

The materials, including products, components, fittings or naturally occurring materials, which are specified by the designer, must be of a suitable nature and quality for their intended use.

The detailed design of the system and product selection for the storage and pipe solution will be made at the detailed design stage when all the site constraints can be considered. There are numerous products available for storage of water below ground and care will be needed to ensure that the right product is chosen for the final loading conditions.

5.5 Designing for Maintenance considerations

Pumping should only be used to facilitate drainage for those parts of the site where it is not reasonably practicable to drain water by gravity.

5.6 Construction

The mode of construction of any connection with an existing sewer or drainage system must be such that the making of the connection would not be prejudicial to the structural integrity and functionality of the sewerage or drainage system.

Damage to the drainage system resulting from associated construction activities must be minimised and must be rectified before the drainage system is considered to be completed.

A Section 106 application will be required for the connection to the public sewer. United Utilities will provide details of how the connection be allowed to be made to their assets.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1. This report gives details of the Drainage Strategy, which has been carried out in relation to the proposed development of Clegg Street, Liverpool.

6.2 The existing site is currently 100% impermeable and discharges surface water run-off into a private below ground drainage system where it is collected and discharged to the public combined sewer system.

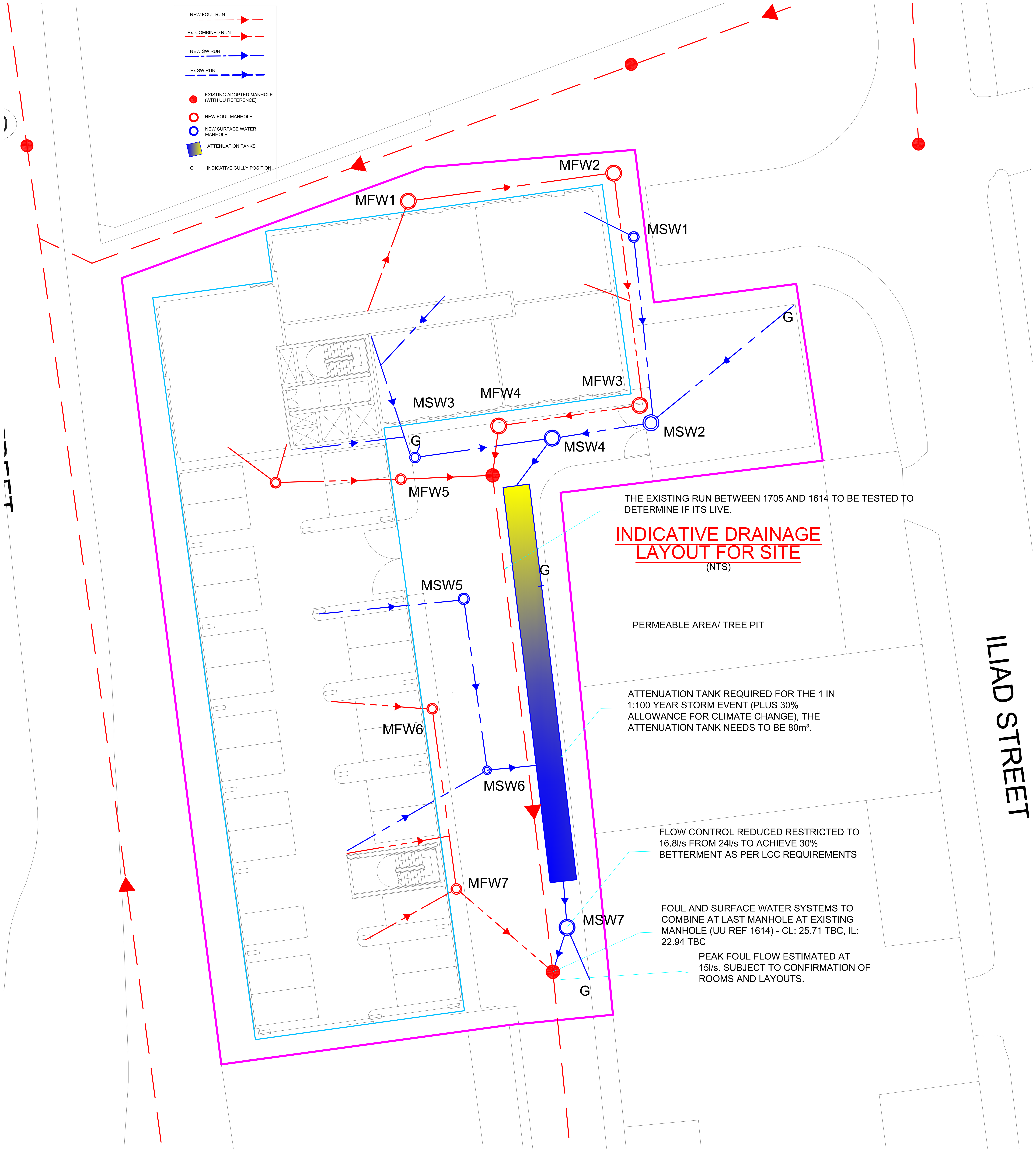
6.3 The proposed development provides an opportunity to reduce local area flood risk by controlling surface water on site. Following the SuDS and water disposal hierarchy it has been determined that surface water will be controlled using flow controls and storage tanks before being discharged to the public combined sewer system.

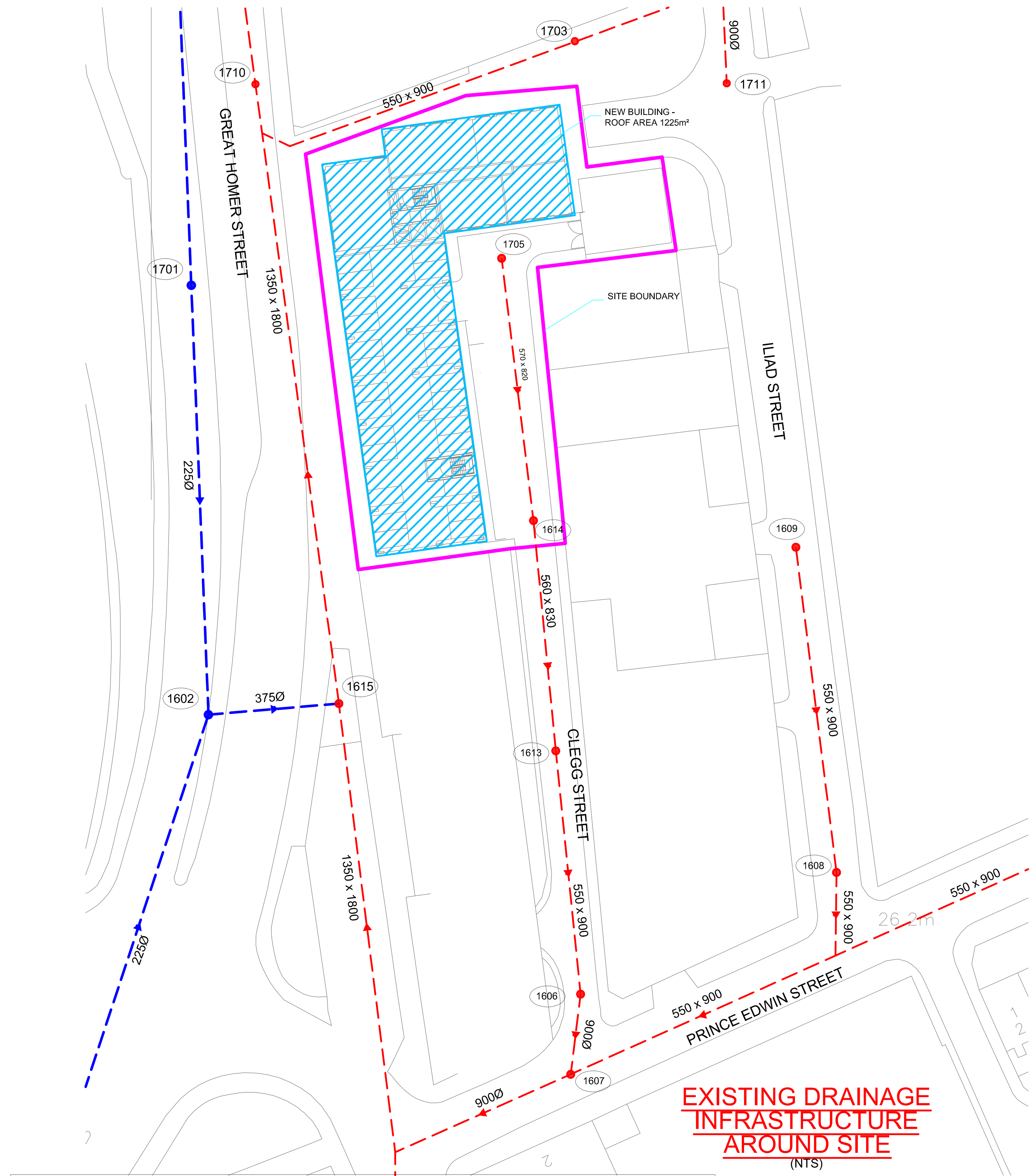
6.4 The proposed system will be designed to control surface water run-off for all storms up to and including the 100 year plus climate change event. Water will be stored on site below ground before being discharged at a flow rate reduced from existing run-off rates by 30% in accordance with Liverpool City Council's requirements. Final run-off rates will be dependent on approval by United Utilities.

6.5 The proposed system will be designed to meet the Sustainable Drainage Systems Non-statutory technical standards for sustainable drainage systems, March 2015.

APPENDIX A

Drainage Strategy Drawing





NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER ENGINEER'S AND ARCHITECT'S DRAWINGS, DETAILS AND SPECIFICATIONS.
2. OWNERSHIP OF PIPE NETWORKS ARE TO BE CONFIRMED PRIOR TO ANY DIVERSION WORKS.
3. THIS DRAWING INDICATES DRAINAGE PRINCIPLES AND STRATEGY ONLY AND FURTHER DETAIL DESIGN IS REQUIRED FOLLOWING CONFIRMATION OF BUILDING SET OUT, PROPOSED LEVELS, PROPOSED INTERNAL POP UPS AND FURTHER DISCUSSIONS WITH ALL RELEVANT PARTIES REGARDING ALLOWABLE DISCHARGE.
4. A 30% BETTERMENT IS PROPOSED FOR THE EXISTING BROWNFIELD SITE IN ACCORDANCE WITH LIVERPOOL CITY COUNCIL GUIDANCE.
5. EXISTING DISCHARGE BASED UPON A 15 MIN PEAK PERIOD FOR A 1 IN 2 YEAR STORM EVENT.
6. DURING THE DETAILED DESIGN PHASE, ALL STORM EVENT DURATIONS UP TO AND INCLUDING 6 HOURS WILL BE MODELLED TO DETERMINE THE FINAL STORAGE REQUIREMENT FOR THE DEVELOPMENT.
7. ALL PROPOSED RESTRICTED FLOW RATES AND CONNECTION POINTS WILL BE SUBJECT TO UNITED UTILITIES AGREEMENT AND APPROVAL.
8. FOUL WATER FLOW RATES ARE ESTIMATED IN ACCORDANCE WITH BS EN 752:2008 AND DESIGNED FOR PEAK FLOW RATES.
9. UNITED UTILITIES CONFIRMATION OF APPROVAL FOR THE FLOW RATE ENTERING THE PUBLIC SEWER WILL BE REQUIRED TO PROCEED WITH THE DETAILED DESIGN.
10. ALL EXISTING ON-SITE DRAINAGE (ABANDONED OR LIVE) TO BE IDENTIFIED AND TERMINATED AT SITE BOUNDARY UNO.

SURFACE WATER STRATEGY:

BASED ON EXISTING PEAK DISCHARGE FOR A 1:2 YEAR STORM EVENT AND APPLYING A BETTERMENT OF 30% TO THIS FIGURE, THE MAXIMUM PEAK DISCHARGE FROM THE NEW DEVELOPMENT WILL BE 16.8l/s (TOTAL) AND MAINTAINED USING A FLOW CONTROL CHAMBER. BASED ON AREAS SUPPORTED, A TOTAL OF 80m³ IS REQUIRED FOR THE 1:100 YEAR EVENT + 30% CLIMATE CHANGE ON SITE.

FOUL WATER STRATEGY:

BASED ON ARCHITECTURAL LAYOUTS AT THE TIME OF ISSUE, THE ESTIMATED PEAK FOUL FLOW IS 15 l/s. THIS IS SUBJECT TO CONFIRMATION OF NUMBERS AND LAYOUTS OF ROOMS.

Rev	Date	Description	By	Check	App.
03	28/02/2018	SITE PLAN UPDATED	RJM	MD	BRH
02	24/01/2018	FW RUN UPDATED	RJM	MD	BRH
01	27/09/2017	ISSUED FOR INFORMATION	RJM	MD	BRH

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Client: CARO DEVELOPMENTS

Project: CLEGG STREET

Office: LIVERPOOL 0151 227 5300

Discipline: CIVIL

Title: DRAINAGE STRATEGY

Scale @ A1: NTS | Status: INFORMATION

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Originator	Job Number	Discipline	Building/Zone
CCL	4-6506	S	SITE
Type	**Level**	**Drawing No.**	**Revision**
DRN	BGL	001	03

APPENDIX B

Initial Calculations

DESIGN RAINFALL (THE WALLINGFORD PROCEDURE) 1 IN 2 YEAR STORM EVENT

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.00

Design rainfall intensity

Location of catchment area; Liverpool

Storm duration; D = **15** min

Return period; Period = **2** yr

Ratio 60 min to 2 day rainfall of 5 yr return period; r = **0.400**

5-year return period rainfall of 60 minutes duration; M5_60min = **19.0** mm

Increase of rainfall intensity due to global warming; $p_{climate}$ = **0** %

Factor Z1 (Wallingford procedure); Z1 = **0.63**

Rainfall for 15min storm with 5 year return period; $M5\_15min_i = Z1 \times M5\_60min$ = **12.0** mm

Factor Z2 (Wallingford procedure); Z2 = **0.79**

Rainfall for 15min storm with 2 year return period; $M2\_15min = Z2 \times M5\_15min_i$ = **9.6** mm

Design rainfall intensity; $I_{max} = M2\_15min / D$ = **38.2** mm/hr

Maximum surface water runoff

Catchment area; A_{catch} = **2285** m^2

Percentage of area that is impermeable; p = **100** %

Maximum surface water runoff; $Q_{max} = A_{catch} \times p \times I_{max}$ = **24.3** l/s

DESIGN RAINFALL (THE WALLINGFORD PROCEDURE) 1 IN 100 YEAR STORM EVENT

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.00

Design rainfall intensity

Location of catchment area; Liverpool

Storm duration; D = **15** min

Return period; Period = **100** yr

Ratio 60 min to 2 day rainfall of 5 yr return period; r = **0.400**

5-year return period rainfall of 60 minutes duration; M5_60min = **19.0** mm

Increase of rainfall intensity due to global warming; $p_{climate}$ = **30** %

Factor Z1 (Wallingford procedure); Z1 = **0.63**

Rainfall for 15min storm with 5 year return period; $M5\_15min_i = Z1 \times M5\_60min \times (1 + p_{climate})$ = **15.6** mm

Factor Z2 (Wallingford procedure); Z2 = **2.00**

Rainfall for 15min storm with 100 year return period; $M100\_15min = Z2 \times M5\_15min_i$ = **31.2** mm

Design rainfall intensity; $I_{max} = M100\_15min / D$ = **124.8** mm/hr

Maximum surface water runoff

Catchment area; A_{catch} = **2285** m^2

Percentage of area that is impermeable; p = **100** %

Maximum surface water runoff; $Q_{max} = A_{catch} \times p \times I_{max}$ = **79.2** l/s