



Drainage Strategy Report Okell Drive, Knowsley, Merseyside, L26 7AW

23/11/23

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Executive Summary

Client	Michael Gore Architecture Ltd
Location	Okell Drive, Knowsley, Merseyside
Description	Demolition of the existing building and erection of 9 no. dwellings, including associated parking and landscaping.
Report Objectives	The aim of this report is to undertake the following: • Undertake an assessment of the existing and anticipated surface water discharging from the proposed development. • Produce preliminary sustainable drainage proposals and provide guidance as to the viability of infiltration or attenuation to facilitate the drainage feasibility for the proposed development. • Should source control be identified as unviable, to assess the proximity of existing drainage points to which the proposed development may connect. • Produce preliminary drainage proposals for the collection and discharge of foul water and trade effluent into local public sewer networks.
Existing Runoff Rate	The existing runoff rate has been calculated using the modified rational method to be 40.5l/s QBar has been calculated as 1.2 l/s using the FEH methodology.
Concept Surface Water Sustainability Strategy	The site is a redevelopment of an existing public house with a large total impermeable area. Based on the limited information currently made available, the proposed strategy is to collect, convey and attenuate the surface water runoff before restricting the flow via a flow control and discharging into the United Utilities Surface Water Public Sewer. Based on the existing levels and invert levels of the surface water sewer, it may be unlikely to make a connection via gravity. Further investigations should be undertaken in detailed design to confirm the requirement for a pump. These strategies are subject to Knowsley MBC and Lead Local Flood Authority acceptance and approval, agreement from relevant authorities and detailed design.
Concept Foul Water Strategy	The foul water strategy identifies the collection and conveyance of foul water waste before discharge to the local United Utilities public sewer. Based on the existing levels and invert levels of the foul water / combined sewer, it may be unlikely to make a connection via gravity. Further investigations should be undertaken in detailed design to confirm the requirement for a pump.

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Introduction

1.1 Terms of Reference

- 1.1.1 Clancy Consulting Limited (CCL) have been commissioned by Michael Gore Architecture Ltd, to produce a Sustainable Drainage Strategy in support of the redevelopment at Okell Drive, Knowsley, Merseyside.
- 1.1.2 The proposed redevelopment will replace an area which was previously a public house.

1.2 General

- 1.2.1 The Local Planning Authority (LPA), Local Highway Authority (LHA) & Lead Local Flood Authority (LLFA) is Knowsley Metropolitan Borough Council.
- 1.2.2 The local incumbent potable water mains provider is United Utilities (UU).
- 1.2.3 The local sewerage undertaker is United Utilities (UU).
- 1.2.4 This report is prepared solely for the benefit of the Client. This report may not be assigned without prior written permission from Clancy Consulting Ltd.

1.3 Scope of this Report

- 1.3.1 The aim of this report is to identify the following to assist a sustained and viable drainage strategy for the proposed development:
 - Undertake an assessment of the existing and anticipated surface water discharging from the proposed development.
 - Produce preliminary sustainable drainage layout proposals and provide guidance as to the viability of any infiltration, attenuation, pumping, or existing drainage network improvements that may be required to facilitate the detailed drainage design for the proposed development.
 - Should source control be identified as unviable, assess the proximity of existing drainage points to which the proposed development may connect.
 - Produce preliminary drainage proposals for the collection and discharge of foul water into local public sewer networks.
- 1.3.2 This report has been compiled using the following sources of information:
 - Water Framework Directive
 - Water Act 2014
 - National Planning Policy Framework 2023 (NPPF)
 - Ciria SuDS Manual C753
 - Statutory Sewerage Guidance (SSG) – Design Construction Guidance (DCG).
 - Department for Environment, Food and Rural Affairs. (DEFRA) non-statutory technical standards for sustainable drainage
 - Building Research Establishment (BRE) Digest 365, 2016 edition
 - Environmental Agency (EA), Report – SC030219, Rainfall Runoff Management for developments

- The Knowsley MBC Plan 2022 - 2025
- Knowsley MBC Core Strategy Policy CS24
- Knowsley MBC New Residential Development SPD

2.0 Site Description

2.1 Location

- 2.1.1 Figure 1 below identifies an illustrative site boundary (red line) for the proposed development. This can be found in **Appendix A**.
- 2.1.2 The site extents cover circa 0.400 Ha and is located on brownfield land in Merseyside, as detailed below:

OS X (Eastings)	344065
OS Y (Northings)	386113
Nearest Post Code	LS26 7AW
Lat (WGS84)	N53:22:08 (53.368906)
Long (WGS84)	W2:50:32 (-2.8421081)
National Grid Ref	SJ440861

Table 1: Site Location Approximate Land Parcel Centre



Figure 1 – Site Location Plan

2.2 Site Observations

- 2.2.1 The existing public house site is located within the Borough of Merseyside.
- 2.2.2 The eastern boundary is defined by Okell Drive.
- 2.2.3 The southern and western boundaries are defined by a woodland, with the northern boundary defined by a grass area and woodland.
- 2.2.4 Opposite the existing public house to the east is an existing residential development, located on Harrier Drive.
- 2.2.5 The site is almost entirely impermeable, with hardstanding and paving around the building footprint and a small grass verge area behind the building.
- 2.2.6 A Topographical Survey was undertaken by Geospatial Engineering Services LTD in August 2020 and can be found in **Appendix B**.

2.3 Existing Public Sewerage Networks

- 2.3.1 Existing sewerage asset location plans have been obtained from United Utilities.
- 2.3.2 These existing sewer plans identify a surface water public sewerage network within the public footway on Okell Drive, located to the East of the site.
- 2.3.3 The plans also identify a foul water / combined public sewerage network within Harrier Drive, which is located further to the East of the site.
- 2.3.4 The asset maps identify that United Utilities Public Sewers are not within the site boundary.
- 2.3.5 Existing sewer asset maps obtained from United Utilities can be found in **Appendix C**.

2.4 Existing Geotechnical & Geo-environmental Report Information

- 2.4.1 At the time of writing this report, no ground investigations that assess the porosity of the sub strata have been made available.
- 2.4.2 Based on the British Geological Survey maps available online, it can be expected that the site is underlain by Diamicton Till in the superficial layer, with Wilmslow Sandstone as the bedrock layer.
- 2.4.3 According to Ciria document R113 Control of groundwater for temporary works 1986, Table 7, soil that consists of a mix of silt, sand, boulder and clay have very low degrees of permeability, typically ranging from 0.001 – 0.1 m/s x 10⁻⁶.

3.0 Development Proposals

3.1 Development Masterplan

- 3.1.1 Demolition of the existing building and erection of 9 no. dwellings, including associated parking and landscaping.

3.1.2 The proposed site plan is shown below in figure 2 and attached within **Appendix D**.

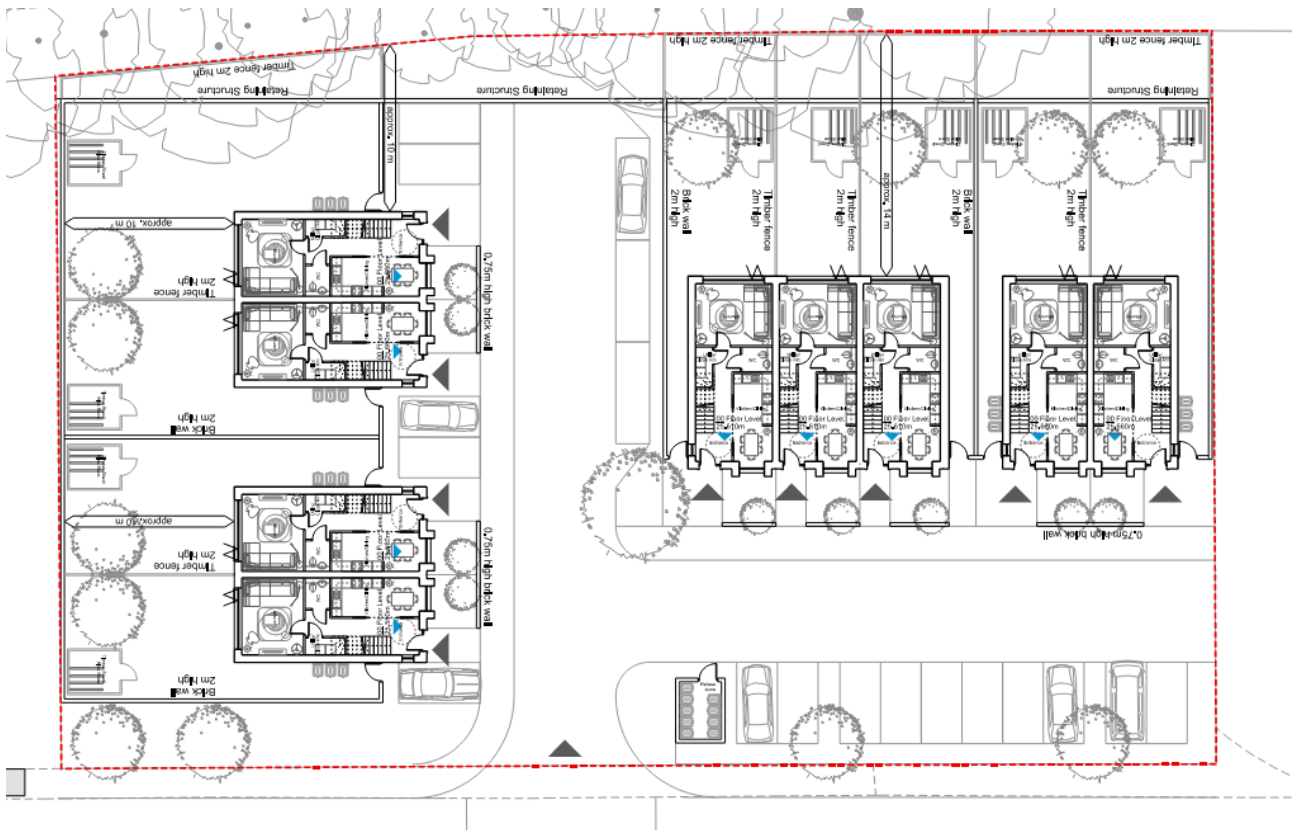


Figure 2 - Proposed Site Plan

4.0 Surface Water Drainage

4.1 Existing Surface Sewerage and Drainage Desktop Review

- 4.1.1 Existing drainage has been identified within the site extents from the topographical survey. It is unclear whether these drainage networks serve foul water, surface water or a combination of the two.
- 4.1.2 It is recommended that a CCTV survey and drainage connectivity survey are undertaken, to fully understand the routing and levels of the existing drainage network, as well as understanding the structural integrity of the network to assess suitability of re-use.
- 4.1.3 A United Utilities Surface Water Public Sewer has been identified running adjacent to the site to the east, within the public footway.
- 4.1.4 The sewer is recorded to be 225mm diameter and vitrified clay.
- 4.1.5 Existing public sewer asset maps obtained from United Utilities can be found in **Appendix C**.

4.2 Lead Local Flood Authority Pre-Application Consultation.

- 4.2.1 A pre-application consultation has not been undertaken at the time of writing this report.
- 4.2.2 Reference has been made to the following guidance published and highlighted by Knowsley Council:
 - Knowsley Council Local Plan 2022-2025
 - Knowsley Council Residential Development SPD 2018
 - Knowsley Local Flood Risk Management Strategy
 - Knowsley Council Local Plan Core Strategy CS24 – Managing Flood Risk
- 4.2.3 The requirements of the Lead Local Flood Authority are discussed within the following sections.

4.3 United Utilities Pre-Development Enquiry

- 4.3.1 A pre-development sewerage enquiry with United Utilities has been submitted to assess capacity of the existing combined public sewer and suitability to connect with the proposed surface water drainage from the development.
- 4.3.2 United Utilities have responded to state “*United Utilities will consider a connection to the 225mm diameter public surface water sewer within Okell Drive located East of the proposed site at a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 5l/s*”.
- 4.3.3 United Utilities have also stated “*In accordance with the hierarchy of drainage options within the National Planning Practice Guidance, both discharge to ground via infiltration and discharge to a waterbody should be discounted prior to consideration of discharging surface water to the public sewer system. Evidence should be provided to demonstrate how these have been discounted.*”
- 4.3.4 The rate of discharge is subject to review and confirmation by United Utilities & Knowsley MBC LLFA. It is expected that 1.2l/s would be deemed appropriate and a reduction from the current existing connection.

4.4 Existing Surface Water Assessment

Modified Rationale Method

- 4.4.1 The existing site land parcel is approximate 0.291 Ha in plan.
- 4.4.2 Based on the Modified Rational Method, the existing site runoff rate can be calculated as follows:
$$Q = 2.78 \times A \times i \times C_v \times C_r$$

Where:
$$Q = \text{Flow Rate (l/s)}$$

$$A = \text{Impermeable Area (Ha)} = 0.291 \text{ Ha estimated}$$

$$i = \text{Design Rainfall Intensity (mm/hr)} = 50 \text{ mm/hr}$$

$$C_v \text{ \& } C_r = \text{Run-off and Routing coefficient} \sim 1.0$$

Therefore $Q = \text{circa } 40.5 \text{ l/s}$

Greenfield Runoff - QBar

- 4.4.3 The existing 1 in 100-year runoff rate and the greenfield run off rate, QBar, has been calculated using Flow+ source control software. The 1 in 100-year surface water runoff equates to approximately 1.2 litres per second (l/s).
- 4.4.4 QBar has been calculated as 1.2 l/s using the FEH methodology.
- 4.4.5 The Flow+ calculations for QBar can be found in **Appendix E**.
- 4.4.6 It is considered that the flow is restricted down to QBar, as 1.2l/s to hold and store the runoff onsite, before slowly discharging into the existing United Utilities Combined Public Sewer. This will help to alleviate flooding on the proposed development and also further downstream.
- 4.4.7 Restricting the flow down to 1.2l/s will see the maximum runoff decreased by approximately 97.5%.

4.5 Climate Change Allowance

- 4.5.1 With respect to future development, it is recommended that the surface water drainage design parameters should be assessed for sensitivity to climate change and to cater for an allowance of 45% increase in peak rainfall intensity within the surface water runoff.
- 4.5.2 The Environment Agency published Flood Risk Assessment climate change allowances in February 2016. The latest update to this guidance was issued on the 27th May 2022.
- 4.5.3 The site is located within the Lower Mersey Management Catchment peak rainfall allowances.

The updated guidance states an assessment should be made for a 2070s epoch for development with a lifetime between 2061 and 2125. As this is a proposed residential development, it is suggested that the 2070s epoch upper end allowance is used within the return period events, meaning that 45% climate change is to be applied.

Lower Mersey Management Catchment peak rainfall allowances ✕

3.3% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	35%
2070s	30%	40%

1% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	25%	40%
2070s	30%	45%

*Use '2050s' for development with a lifetime up to 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125.

Figure 3 - Catchment Peak Rainfall Allowance

- 4.5.4 It is considered that it will be necessary to design the proposed below ground surface water drainage infrastructure to cater for the 100-year return period event + Climate Change allowance, and to contain this within the perimeter of the site in below ground infrastructure. This is to ensure that there is no increase in the rate of runoff discharged from the site due to topography and local site constraints.
- 4.5.5 Where onsite flooding for the upper end allowance presents a significant flood hazard (for example, where depths and velocities of surface water runoff cause a significant danger to people), it will be necessary to take measures to protect people and property. This could include, for example, raising floor levels. As a minimum, there should be no significant flood hazard to people from onsite flooding for the upper end allowance.
- 4.5.6 In this instance the buildings in the vicinity of the carriageway are constructed so the proposed below ground drainage should not increase flood risk to these buildings.

4.6 Overland Flow Routes

- 4.6.1 A topographic survey has been undertaken in August 2020 by Geospatial Engineering Services LTD and has identified levels to the West of the development as circa 25.60m, with levels to the East as circa 25.00m, creating a fall of circa 1 in 50 over circa 30m.
- 4.6.2 The Northern and Southern boundaries of the development both have levels of circa 25.40m, with the levels raising towards the centre of the site.
- 4.6.3 The Western boundary appears to be the high point of the site, consistently along the edge.
- 4.6.4 The topographic survey drawing ref Site Survey 2008 can be found in **Appendix B**.

4.7 Return Period Design

- 4.7.1 It is required that no part of the site should flood in a 30-year rainfall event, as such the proposed drainage systems should be designed to accommodate this event within any drainage or below ground storage system as a minimum.
- 4.7.2 In addition to the above, it is a requirement that no part of a building, utility plant or neighbouring site should flood in a 100-year event plus a suitable allowance for climate change impacts on rainfall intensities.
- 4.7.3 The proposed surface water drainage system should be designed to cater for the 100-year return period storm with a 45% sensitivity allowance for climate change impact.
- 4.7.4 Surface water associated with the proposed development is to be managed within the site perimeter and is not permitted to be passed through the drainage systems in an uncontrolled manner. As such, a restriction on discharge rate will need to be incorporated.

4.8 Allowances for 'Urban Creep'

- 4.8.1 In addition to the allowances to be made for climate change and a 100-year return period rainfall event, it is required to make allowance for 'Urban Creep', the process where impermeable areas can be added to residential development due to extension of properties, construction of conservatories or Sun Lounges and patio areas.
- 4.8.2 As this will be a residential development consisting of 9 dwellings, it is deemed appropriate to apply 10% urban creep to the design.

4.9 SuDs Hierarchy

- 4.9.1 The Water Framework Act and NPPF requires that for major developments, the management of runoff is required to be put in place, unless demonstrated to be inappropriate. Major developments described as; 10 or more plots; or equivalent non-residential or mixed developments (as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010) sustainable drainage systems.
- 4.9.2 If it is not possible to discharge via source control, then surface water should be controlled with the use of Sustainable Drainage Systems (SuDS) and considered using the following SuDS Hierarchy (Figure 4).

Most Sustainable ↑ ↓ Least 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 paviers	✓	✓	
	Tanked systems - over-sized pipes/tanks - storms cells	✓		

Figure 4 - Table of SuDS Hierarchy

4.10 Surface Water Disposal Hierarchy

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

1. Source control, infiltration into source, evapotranspiration,
2. Discharge to a water course or the sea
3. Discharge to a surface water sewer
4. Discharge to a combined sewer.

4.10.2 As mentioned previously in section 2.4, no ground investigation that assesses the porosity of the sub strata has been made available. Based on the limited desktop information available, it is assumed that the degree of permeability of the soils will range from 0.001 – 0.1 m/s x 10⁻⁶.

4.10.3 As such, disposal of the surface water though infiltration techniques and into the ground via source control may be deemed unviable for the site.

4.10.4 There are no records of a watercourse in the immediate vicinity of the site.

4.10.5 EA main river maps show an ordinary watercourse situated within Halewood Triangle County park, located to the west and south of the proposed site approximately 110m away.

4.10.6 It is currently unconfirmed whether a connection to the existing watercourse for surface water discharge is viable.

4.10.7 There is an existing United Utilities Surface Water Public Sewer in the vicinity of the site, which runs adjacent to the site in Okell Drive.

4.10.8 Based on the above, priority 3 is deemed the most suitable approach for this residential development. Surface water will be collected, conveyed and attenuated onsite before discharge to the United Utilities Public Surface Water Sewer.

4.10.9 This strategy is subject to review of the limited information available and is subject to acceptance by LLFA & relevant authorities at planning stage.

4.11 Sustainable Drainage Provisions (SuDS)

4.11.1 In accordance with Knowsley MBC Core Strategy CS24 and Knowsley MBC Planning Guidance (2018), developers should utilise SuDS on developments to manage surface water, in accordance with Building Regulations Part H and national legislation.

4.11.2 The use of SuDS has been considered early in the design stage, to ensure that a suitable drainage system is developed. SuDS options may be updated or amended once detailed design is underway and further ground conditions and design information is available.

4.11.3 Below is a summary of the typical SuDS measures, which may be suitable for installation within the car park development;

- Permeable / Porous Paving
- Filter Strip or Drain
- Cellular attenuation Crates
- Oversized Pipes
- Rain Gardens
- Green Roofs & Green Walls
-

4.11.4 These techniques are subject to the topography of the site as the storage provided by these techniques is practical when used in steep gradients. The depth of the existing drainage will also dictate the availability to utilise these techniques.

4.11.5 The techniques listed above will be subject to confirmation on site prior to design / construction.

Table 2: SuDS assessment overview

Method	Comment	Suitability for the Development
Green Roof & Green Wall	Can be used on suitable low-rise buildings to provide retention, attenuation and treatment of rainwater. Promotes evaporation and local biodiversity.	Feasible Further investigations should be undertaken to assess the suitability of using green roofs / green walls on the development.
Water Butts & Rainwater Harvesting	Tanks placed at the base of rainwater down pipes to collect rainwater runoff from the roof areas.	Feasible Subject to confirmation of positions of the rainwater pipes. Would require overflow runoff collection when tanks are full. No guarantee residents wouldn't remove them. Further investigations should be undertaken to assess the viability of installing rainwater harvesting techniques.

Infiltration	Reduces total run off volume from the development.	<u>Not Suitable</u> Based on information provided, it is deemed that infiltration may be unviable.
Permeable Surfacing (Infiltration)	Reduces total run off volume from the development. Can be used to enhance water quality.	<u>Not Suitable</u> Based on information provided, it is deemed that infiltration may be unviable.
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 within a granular fill subbases designed to depths to meet requirements.	<u>Suitable</u> Pavement design needs to accommodate both the subbase and the vehicle overrun to minimise long term settlement concerns.
Landscaping, Tree Pits	Can be used to enhance quality of runoff water. Provides 'source' storage and reduces the volume of storage downstream. Natural source of 'Water Extraction' from tree roots.	<u>Suitable</u> Sufficient space to locate. Able to be tailored in size to suit storage requirements. Not ideal as sole means of storage.
Swales, basins and ponds	Provides areas for above ground storage. Swales also improve water quality through filtration.	<u>Not Suitable</u> Not part of architectural proposals. Safety concerns (of young children) of the development and risk of drowning. Liabilities and Insurances involved for the client would make this prohibitive. Limited space to implement
Geocellular Storage/ Crates/	Suitable for sites with insufficient space for basins, etc. Suitable for sited where topography prevents use of open basins, etc. Suitable for areas where excessive vehicle overrun is likely.	<u>Suitable</u> Sufficient space to locate. Able to be tailored in size to suit storage requirements. Can accommodate vehicle overrun. Suitable in car parks.
Large Diameter Pipes & Chambers, Tanks	Suitable for sites with insufficient space for basins, etc. High Void Ratio for effective storage provisions – assists future maintenance regimes.	<u>Suitable</u> Sufficient space to locate. Able to be tailored in size to suit storage requirements.

Pollution

- 4.11.6 The development does not contain 50 spaces or an area for parking greater than 800m² therefore a petrol separator is not required.

4.12 Proposed Sustainable Drainage Option – Proposed Attenuation and Discharge to Sewer.

- 4.12.1 Based on the limited information currently made available, the proposed strategy is to collect, convey and attenuate the surface water runoff before discharging into the United Utilities Surface Water Public Sewer.
- 4.12.2 The proposed redevelopment will create an area of reduced impermeable area. The hardstanding is to be installed with a crossfall towards the proposed carriageway, where the water can be collected by gullies and fed into the system.
- 4.12.3 The proposed parking bays have an opportunity to be tanked or infiltration (Type A, B or C) permeable paving to allow collection of the runoff into the system, whilst cleansing and providing a low amount of storage.
- 4.12.4 There is an opportunity to collect and store the runoff in cellular attenuation / infiltration crates, which will cleanse the water and provide additional storage to the permeable paving. The two systems can be utilised together as the crates can be installed underneath the permeable paving.
- 4.12.5 There is an opportunity to utilise oversized pipes in the scheme to attenuation flows, before discharging to the existing public sewer downstream.
- 4.12.6 On plot drainage sustainable techniques such as rain water harvesting, rain gardens and tree pits can all be considered viable within these areas.
- 4.12.7 Rainwater harvesting can be a way to help reduce the surface water runoff developed by residential impermeable areas, providing a means of storing, treating (if recommended) and from this a supply of water to help reduce the water demand for the properties.
- 4.12.8 Green Roofs and Green Walls can reduce the surface water runoff and also provide visual benefits, ecological value and enhanced building performances. Further investigations should be undertaken to appraise the viability of utilising green roofs on this scheme.
- 4.12.9 The rates of discharge and point(s) of connection are subject to acceptance and confirmation by Knowsley MBC and United Utilities.
- 4.12.10 Runoff rates and volumes will be further restricted by flow controls that are incorporated to control runoff prior to discharge to the existing United Utilities Public Sewer to prevent flooding occurring.
- 4.12.11 Based on the existing levels and invert levels of the surface water sewer, it may be unlikely to make a connection via gravity. Further investigations should be undertaken in detailed design to confirm the requirement for a pump.
- 4.12.12 A concept surface water drainage arrangement has been developed. This is subject to Knowsley MBC and Lead Local Flood Authority acceptance and approval by relevant authorities at planning submission and detailed design stages. This strategy drawing can be found in **Appendix F**.

4.13 Proposed Surface Water Discharge Rates

- 4.13.1 It is proposed that surface water from the site will be limited to 1.2/s, before discharge into the existing United Utilities Public Sewer, subject to agreement from United Utilities and Knowsley MBC.
- 4.13.2 Given that the existing surface water runoff rate based on the Modified Rational method is significantly higher (see section 4.4) it is proposed that 1.2 l/s is approved

for the redevelopment of the site as this will provide significant betterment and reduced risk of flooding on and offsite.

5.0 Foul Water Drainage

5.1 Existing Combined Sewerage and Drainage

- 5.1.1 Existing drainage has been identified within the site extents from the topographical survey. It is unclear whether these drainage networks serve foul water, surface water or a combination of the two.
- 5.1.2 It is recommended that a CCTV survey and drainage connectivity survey are undertaken, to fully understand the routing and levels of the existing drainage network, as well as understanding the structural integrity of the network to assess suitability of re-use.
- 5.1.3 A United Utilities Foul Water / Combined Public Sewer has been identified in Harrier Drive.
- 5.1.4 The sewer is recorded as 150mm diameter and vitrified clay.
- 5.1.5 Existing sewer asset maps obtained from United Utilities can be found in **Appendix C**.

5.2 United Utilities Pre-development Enquiry

- 5.2.1 A pre-development sewerage enquiry with United Utilities has been submitted to assess capacity of the existing combined public sewer and suitability to connect with the proposed foul water drainage from the development.
- 5.2.2 A response from United Utilities has been received, stating *"Foul flow from this site will be allowed to drain into the public foul water/combined sewer system. Our preferred point of discharge would be to the 150mm diameter public foul water sewer within Harrier Drive located to the East of your proposed development at an unrestricted rate"*.

5.3 Proposed Foul Water Strategy

- 5.3.1 The proposed strategy is to have one foul network for the proposed drainage onsite.
- 5.3.2 The foul water drainage network is proposed below ground, which will collect all foul flows from the proposed swellings. These flows will then continue downstream and connect to the existing drainage infrastructure that connects and discharges to the existing United Utilities combined public sewer.
- 5.3.3 Based on the existing levels and invert levels of the foul water / combined sewer, it may be unlikely to make a connection via gravity. Further investigations should be undertaken in detailed design to confirm the requirement for a pump.
- 5.3.4 The above strategy will be subject to agreement and approval from Knowsley MBC and United Utilities and will be subject to Section 106 agreement for permission to connect and communicate flows with the public sewerage network or S104 agreement to give adoption to UU.
- 5.3.5 A concept foul water drainage arrangement has been developed. This is subject to Knowsley MBC acceptance and approval at planning submission, agreement from relevant authorities and detailed design stages. This strategy drawing can be found in **Appendix F**.

6.0 Maintenance & Construction

6.1 Maintenance Considerations

- 6.1.1 This section is intended to give an overview of the operation and maintenance for the drainage features included with the drainage strategy and in relation to typical details.
- 6.1.2 Where proprietary products are specified, the manufacturer's instructions and recommendations should be followed in priority to this document unless specifically noted otherwise due to project constraints.
- 6.1.3 The surface water network has been designed to accommodate the 1 in 100-year storm rainfall event plus an allowance for 45% climate change particular to the requirements of the development.
- 6.1.4 As the flows are generally being attenuated on site, there will be a period after storm events where the network is still partially or fully surcharged and is draining down.
- 6.1.5 Where this surcharging is still present after 48hrs appropriate action should be taken.
- 6.1.6 A suitable maintenance strategy should be adopted to ensure the drainage network is cleaned regularly and the routine maintenance and cleansing regime should be documented.
- 6.1.7 It is advisable that above ground signage is installed detailing size and depth of any below ground structures to make any future works manageable.
- 6.1.8 It is assumed that the maintenance of the drainage network will be the responsibility of a third party facilities management team, appointed by the developer, or by the adopting authority United Utilities, subject to agreement.
- 6.1.9 A copy of the final construction drainage layout should be provided in the final Operations and Maintenance Manual.
- 6.1.10 It is recommended that the drainage system is inspected as a minimum twice a year, with the system also being inspected after any major storm event.
- 6.1.11 Significant sediment deposition is likely in areas used for storage, so a post clean-up operation may be required including the removal of litter, vegetation, sewerage debris and larger objects.
- 6.1.12 Long-term management practices include monthly sweeping of external paved areas. The sweeping program will remove sand and contaminants directly from paved surfaces before they become mobilised during storm events and transported to the drainage system.
- 6.1.13 During the winter months, drainage features such as gullies and channels should be cleared of ice, snow, debris or litter.
- 6.1.14 Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols; especially where run-off is taken from potentially contaminated areas such as the filter drains and the upstream/downstream chambers.
- 6.1.15 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.
- 6.1.16 An outline regular and remedial maintenance strategy table is shown below;

Regular Maintenance Schedule	
Weekly	Visual inspection to check gullies are free flowing and not blocked. Removal of litter and other materials left on development that could find a pathway into the drainage network. Silt removed as necessary and branches of drainage flushed.
Monthly	As Weekly plus landscaped areas to be cut and maintained with clippings collected and removed. Lifting of manhole covers to check they are free flowing and not blocked. Silt removed as necessary and system flushed as necessary.
Quarterly	Full inspection of systems to identify and remove silt and debris including inlet and outlet pipes. Remove sediment/ flush as necessary.
Annually	Full inspection of systems to identify and remove silt and debris including inlet and outlet pipes. Remove sediment/ flush as necessary. Issue report to file for record keeping.
Other	If surcharge remains after 48 hours of a storm event, undertake inspection of components to ensure water can drain freely and make good if required. CCTV and high pressure flushing to remove sediment build up – every 5 years or as required.
Remedial Maintenance Schedule	
Tasks in advance of a significant storm	Inspections may be required to ensure the system is clear of blockages and continues to operate effectively. Sandbags at door thresholds.
Inspection following a significant storm	Inspect system in full, remove/ repair blockages, sediment etc. Flush system
Likely tasks following a significant storm	Removal of debris/ sediment.

Table 3: Outline Maintenance Overview

7.0 Conclusions & Recommendations

- 7.1.1 This report details the sustainable foul and surface drainage strategy for the proposed development along Okell Drive at the former Dales Country Club.
- 7.1.2 The site is considered brownfield.
- 7.1.3 It is recommended that the rate of runoff for the site is restricted to QBar, which has been calculated as 1.2 l/s using the FEH method. This is subject to agreement with Knowsley MBC LLFA.
- 7.1.4 Following review of topographical survey, geo-environmental desktop and limited information which is available, it is considered that the potential for source control via infiltration or discharging to an existing watercourse may be unviable, so using the surface water disposal hierarchy, it is deemed that discharge to an existing surface water sewer network is the next priority.
- 7.1.5 The sustainable drainage solution will make provision for 30 year and 100-year return period events, incorporating climate change allowance for increases in rainfall intensity at factor of 45%.
- 7.1.6 'Urban Creep' allowance is to be incorporated into the proposed design with an allowance of 10%.
- 7.1.7 Existing United Utilities public sewerage networks are to be modelled to identify if the existing sewerage network needs to be extended and/or improved to facilitate the proposed development. This is subject to discussions with United Utilities to further understand their requirements and the viability of a new connection onto the existing public sewer network.
- 7.1.8 Proposed foul water drainage networks are envisaged to consist of gravity and pumped sewerage infrastructure.
- 7.1.9 Masterplanning for the development, to aid viability appraisal, has confirmed that the spatial arrangements for the proposed sustainable drainage infrastructure can be accommodated.
- 7.1.10 The strategies identified within this report are concept and are intended to inform and assist with the future detailed design of the development of the land parcel.
- 7.1.11 It is concluded that the proposed development can provide sustainable drainage infrastructure in accordance with the best practise guidance.
- 7.1.12 The above is subject to further investigations, acceptance from Knowsley MBC LLFA, acceptance by relevant authorities at planning and detailed design.

Appendix A – Site Location Plan

Notes

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KEY PLAN



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P01	09.04.23	RB	RB	First Issue
Rev:	Date:	By:	Chk By:	Rev Note:

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Project Title
Okell Drive, Knowsley
Client
MID Developments
Drawing Title
Location Plan

Drawing No. P23036-FCH-XX-XX-DR-A-0100			Rev P01
Status S2	Issue suitable for: Information	Date 09.04.23	Drawn By RB
Job No. P23-036	Drawing Stage Planning	Scale 1:1250 @ A3	Checked By RB

Appendix B – Topographical Survey



SYMBOLS

TREE

FENCELINE -

GATE

HEDGE

LIMIT OF TREE CANOPY / BUSHES / SHRUBS

BENCHMARK

STATION (WITH LEVEL)

C-B CLOSE-BOARD CHAINLINK

CF CONC. FRAME

IR RAILINGS OR PALISADE

PC POST & CHAIN

PR POST & RAIL

PW POST & WIRE

PAL PALISADE

ABBREVIATIONS

ACD 'ACID' DRAINAGE CHANNEL

AV AIR-VALVE COVER

BPAV BLOCK PAVING

BL BUILDING LEVEL

BN BOREHOLE (WITH GROUND-LEVEL)

BN BOLLARD

BT BTELECOM IC

C.PAV CONCRETE PAVING (FLAGG)

CH CAMERA CAMERA-HOLE

CH CHANNEL / GUT-DRAIN

CH CEILING HEIGHT

CH COVER-LEVEL

CH STONE COBBLES

CH CONCRETE

CH CROWN LEVEL

CH CABLE TV POINT/IC

EIC ELECTRIC IC

EL EAVES LEVEL

EL ELECTRIC-POLE

ER EARTH-ROD

FB FIBREBRIDGE

FB FIRE-RESISTANT COVER

FL FLOORLIGHT

FL FLOOR LEVEL

FL FLAGPOLE

G GUTTER

GL GROUND-LEVEL

GL GRILLE-COVER

H HEIGHT (IN METRES)

HD HEAD

HR HANDRAIL / SAFETY-RAIL

IL INVERT LEVEL

IL INSPECTION CHAMBER

IP INLET PIPE

IS INFORMATION SIGN

KD KERB-OUTLET

L HANDRAIL / SAFETY-RAIL

LP LAMP POST

MH MANHOLE

NP NAME-PLATE

NTL NTL COMMS. IC

DGP OVER-GROUND PIPE/CONDUIT

DHE OVERHEAD ELECTRIC CABLES

DHB OVERHEAD GUTTER/PIPE-BRIDGE

DHT OVERHEAD TELECOM CABLES

DHT OUTLET OF OUTFALL PIPE

DGM DRAINAGE SURVEY BENCH-MARK

P POST

PV PIPE (VERTICAL)

PZ FREEDOMETER (WITH GROUND-LEVEL)

RE RODDING-EYE

RL RIDGE LEVEL

RS ROAD-SEAL

RWP RAINWATER PIPE

S.PAV STONE PAVING

S.S. SARFING

SB SIGN-BOARD

SCCH SUSPENDED-CEILING HEIGHT

SCCH STONE SETTING

ST STOP-TAP

ST STOP-STOP

SV STOP-VALVE

TAC TACTILE PAVING

TAR TARMAC

TBC TO BE CONFIRMED (ON-SITE)

TM TEMPORARY BENCH-MARK

TBR TELEPHONE CALL-BOX

TEL TELECOM BOX

THL THRESHOLD LEVEL

TL TRAFFIC LIGHT

TP TELECOM POLE

UL UPLIGHTER

UL UNABLE TO LIFT

UTS UNABLE TO SURVEY (ACCESS ISSUE)

US UNDERSIDE (SCOFFIT)

VP VENT-PIPE

WL WATER LEVEL

WM WATER METER COVER

WD WASHOUT VALVE COVER

WV WATER VALVE COVER

NOTES

1. This survey has been presented at the survey scale indicated below with its accuracy commensurate with that scale.

2. All heights and levels in metres (u.o.n.)

3. All levels are at ground u.o.n.

CONTROL STATIONS				
REF	EASTING	NORTHING	LEVEL	TYPE
G1	344083.212	386130.157	24.919	NAIL
G2	344105.104	386082.645	25.118	NAIL

SURVEY GRID

ORDNANCE SURVEY DATUM OSGB36 NATIONAL GRID AT STATION G1

GPS OBSERVATIONS ON ETRS89 TRANSFORMED USING OSTN02

SURVEY THEN TRANSFORMED TO A SCALE FACTOR OF 1.000000 FROM STATION G1

LEVEL DATUM

ORDNANCE SURVEY DATUM NEWLYN (OSDN) BY GPS OBSERVATIONS AT STATION G1

TRANSFORMED FROM ETRS89 USING OSGM02 GEIOD

REV	DESCRIPTION	BY	CHK	DATE
01	TREES ALONG WESTERN FENCELINE ADDED & LEVELS CORRECTED TO OSDN	MPW	LW	25/08/23
0	ORIGINAL ISSUE	MPW	LW	30/08/20

DRAWN MPW CHECKED LW DATE 25 AUG. 2023

TITLE

TOPOGRAPHICAL SURVEY AT
OKELL DRIVE, HALEWOOD
LIVERPOOL L26 7YH

ARCHITECT

MICHAEL GORE ARCHITECTURE LTD

SURVEYED BY

GEOSPATIAL
ENGINEERING
SERVICES LTD

**27 PROSPECT VALE
LIVERPOOL
L6 8PE**

TEL 0151-280-2021
EMAIL mail@GESUK.net

CAD FILE	SCALE	1 : 250	SHT	A0
DRAWING No	00956		01	

Appendix C – United Utilities Sewer Asset Maps



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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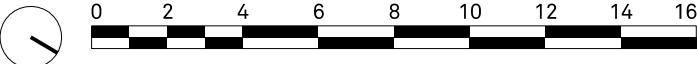
Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
8809	33.84	FO	SW	20.61	100	100	PVC	4.55594	1 m 189
2809		SW	22.63	100	100	VC	17.23809	1 m 189	2802
2905	24.37	SW	SW	22.65	225	225	VC	52.47857	1 m 71
8003	31.89	FO	SW	20.53	150	150	VC	68.7968	1 m 81
0308		FO	SW	19.85	150	150	VC	63.22598	1 m 43
0204	22.95	FO	SW	19.85	150	150	VC	9.522593	1 m 86
2107	20.35	FO	SW	0	150	150	VC	39.32444	1 m 86
0307	20.89	SW	SW	19.11	150	150	VC	41.91155	1 m 104
7843		SW	SW	150	150	150	VC	13.31282	1 m 84
1407	20.91	SW	SW	18.05	450	450	CO	46.84015	1 m 106
2717		FO	SW	225	225	225	VC	51.3784	1 m 84
3102	19.68	SW	SW	18.2	150	150	VC	49.01955	1 m 53
7842		SW	SW	100	100	100	VC	4.070144	1 m 174
2305	19.05	FO	SW	17.3	225	225	VC	24.39901	1 m 174
1316		FO	SW	16.83	375	375	VC	14.62777	1 m 174
9307		SW	SW	0	150	150	VC	54.56189	1 m 338
3409		FO	SW	150	150	150	VC	4.518914	1 m 104
0325		FO	SW	150	150	150	VC	11.41484	1 m 104
7202	28.39	FO	SW	26.53	225	225	VC	64.34114	1 m 204
2304	19.16	FO	SW	17.22	150	150	VC	26.40705	1 m 181
1304	20.26	SW	SW	18.81	225	225	VC	34	1 m 97
2005	22.42	SW	SW	20.82	225	225	VC	54.52923	1 m 47
7835		FO	SW	150	150	150	VC	2.370725	1 m 149
2318	18.97	SW	SW	17.68	225	225	VC	22.41054	1 m 149
2209	20.93	FO	SW	19.39	225	225	VC	28.71883	1 m 181
7304	29.07	SW	SW	24.93	825	825	VC	78.39005	1 m 490
1105	23.19	FO	SW	16.83	375	375	VC	10.85412	1 m 338
2413	16.79	SW	SW	16.83	375	375	VC	16.82283	1 m 338
3906	22.63	SW	SW	21.12	300	300	CO	22.62326	1 m 73
3231		SW	SW	21.12	300	300	CO	39.30734	1 m 131
2213		FO	SW	100	100	100	VC	4.830564	1 m 127
7905	22.8	SW	SW	21.25	300	300	CO	15.21155	1 m 127
1319		SW	SW	100	100	100	VC	5.413867	1 m 127
3409		FO	SW	100	100	100	VC	5.442207	1 m 127
0101	24.93	SW	SW	22.96	300	300	CO	43.56604	1 m 207
0302	22.89	SW	SW	20.79	375	375	CO	75.90753	1 m 50
7906	33.76	SW	SW	31.4	525	525	CO	99.74467	1 m 169
1202	23.08	SW	SW	20.25	300	300	VC	17.56862	1 m 117
1402	21.42	SW	SW	17.86	450	450	VC	18.8019	1 m 157
0210		FO	SW	19.12	100	100	VC	4.068384	1 m 155
1008		CO	SW	0	0	0	PVC	23.77505	1 m 155
8804	32.86	CO	SW	30.91	300	300	PVC	8.493012	1 m 49
3908	22.35	SW	SW	20.81	300	300	VC	13.45555	1 m 49
1203	22.89	FO	SW	20.14	150	150	VC	46.84781	1 m 75
1403	21.42	SW	SW	17.86	450	450	VC	24.51008	1 m 126
1308	20.76	FO	SW	16.24	150	150	VC	78.39238	1 m 201
1301	21	SW	SW	18.25	150	150	VC	16.83122	1 m 84
2416		FO	SW	0	225	225	PVC	13.24003	1 m 84
9308		FO	SW	0	225	225	VC	23.32428	1 m 84
8903	32.19	FO	SW	30.03	300	300	VC	34.9265	1 m 81
2003	22.48	FO	SW	20.98	150	150	VC	32.51316	1 m 81
3313	18.78	SW	SW	17.84	225	225	VC	55.14819	1 m 47
2002	23.15	FO	SW	21.34	150	150	VC	29.02864	1 m 94
1301	19.22	SW	SW	16.48	750	750	VC	38.99923	1 m 85
0304		FO	SW	16.48	450	450	CO	12.47673	1 m 623
2212	20.91	SW	SW	18.58	450	450	VC	25.29886	1 m 86
1318		FO	SW	26.47	225	225	VC	31.70216	1 m 86
8102	28.39	FO	SW	26.47	225	225	VC	8.44005	1 m 86
1117		FO	SW	20.5	150	150	VC	89.92698	1 m 146
1205	21.88	FO	SW	20.5	150	150	VC	6.817377	1 m 146
3806	23.81	FO	SW	20.5	150	150	VC	49.82638	1 m 146
1001	25.36	SW	SW	23.65	225	225	VC	72.81389	1 m 41
2911		SW	SW	23.65	225	225	VC	39.07591	1 m 126
8805	33.9	SW	SW	32.03	225	225	VC	34.64405	1 m 126
7905	33.8	FO	SW	30.82	225	225	VC	67	1 m 60
8101		FO	SW	30.82	225	225	VC	102.8968	1 m 129
3411		FO	SW	30.82	225	225	VC	2.278072	1 m 129
8020		FO	SW	26.9	150	150	VC	11.45449	1 m 129
8802	32.55	SW	SW	30.52	300	300	VC	10.8266	1 m 129
8814		FO	SW	225	225	225	VC	63	1 m 54
0206	23.7	SW	SW	22.16	150	150	PVC	11.88787	1 m 24
2432		SW	SW	17.49	150	150	VC	21.89932	1 m 24
3212	19.23	FO	SW	17.49	150	150	VC	12.15644	1 m 24
1317		FO	SW	100	100	100	VC	7.718992	1 m 56
2108	21.26	SW	SW	19.5	300	300	VC	46.70234	1 m 56
2001	23.45	SW	SW	21.93	225	225	VC	31.257	1 m 56
1306	20.73	FO	SW	17.00	150	150	VC	67.72001	1 m 56
2408	18.79	FO	SW	17.14	225	225	VC	19.13097	1 m 120
2801	23.87	FO	SW	21.53	225	225	VC	45.25416	1 m 69
8201		FO	SW	0	375	375	VC	88.14617	1 m 143
8001	30.88	SW	SW	27.52	450	450	VC	87.46428	1 m 143
7821		FO	SW	27.52	450	450	PVC	13.83602	1 m 143
8906	30.85	SW	SW	28.67	375	375	VC	35.90285	1 m 92
0203		FO	SW	150	150	150	VC	5.385165	1 m 92
0104	23.55	FO	SW	21.75	150	150	VC	34.87036	1 m 54
1110	23.34	FO	SW	21.47	150	150	VC	21.51536	1 m 81
2109	20.35	SW	SW	18.66	300	300	VC	40.57288	1 m 507
0310	22.37	FO	SW	20.5	150	150	VC	21.99152	1 m 43
2317	19.28	SW	SW	18.02	150	150	VC	53.03823	1 m 143
8802		FO	SW	150	150	150	VC	26.01104	1 m 81
9309		FO	SW	0	225	225	VC	44.54594	1 m 81
3246		FO	SW	0	225	225	VC	34.20526	1 m 81
2303	18.97	FO	SW	17.43	150	150	VC	19.37807	1 m 172
2215		FO	SW	100	100	100	VC	20.29234	1 m 107
0316		FO	SW	100	100	100	VC	4.546453	1 m 107
1208	21.69	SW	SW	19.59	100	100	VC	3.831021	1 m 107
9902		CO	SW	150	150	150	VC	4.755555	1 m 107
1301		FO	SW	100	100	100	VC	38.95596	1 m 205
0215		FO	SW	150	150	150	VC	7.455418	1 m 107
2804	24.23	FO	SW	21.88	375	375	VC	19.37807	1 m 172
1004	24.76	FO	SW	22.98	150	150	VC	20.29234	1 m 107
3202	18.93	FO	SW	17.1	150	150	VC	3.831021	1 m 107
3809	23.83	FO	SW	22.03	225	225	VC	4.755555	1 m 107
0216		FO	SW	100	100	100	VC	27.07331	1 m 30
1111	23.59	SW	SW	22.1	225	225	VC	55.9874	1 m 180
1201	23.06	FO	SW	19.93	150	150	VC	29.88164	1 m 114
1108	23.19	SW	SW	21.74	225	225	VC	27.07331	1 m 30
2205	20.74	FO	SW	19.04	225	225	VC	4.740059	1 m 118
2416		PVC	SW	0	100	100	VC	17.54416	1 m 125
2902	23.04	FO	SW	21.16	225	225	VC	8.16203	1 m 85
0205	22.88	SW	SW	20.08	300	300	VC	53.74012	1 m 85
7003	32.59	SW	SW	30.84	225	225	VC	40.60717	1 m 92
2313	19.54	SW	SW	16.53	750	750	VC	24.16009	1 m 804
8907	31.68	FO	SW	28.66	225	225	VC	78	1 m 104
0201		SW	SW	0	300	300	VC	21.09502	1 m 104
7840		SW	SW	0	300	300	VC	30.84511	1 m 258
1303	20.76	SW	SW	18.56	225	225	VC	23.19483	1 m 258
1309	20.37	FO	SW	19.27	150	150	VC	20.89126	1 m 108
0323		FO	SW	100	100	100	VC	4.266666	1 m 108
8201		SW	SW	0	375	375	VC	9.87624	1 m 108
8907		FO	SW	150	150	150	VC	39.44617	1 m 54
3814	23.38	SW	SW	21.08	375	375	CO	78.59534	1 m 54
1310	21.32	SW	SW	19.14	150	150	VC	23.81035	1 m 40
2104	22.66	SW	SW	21.14	150	150	VC	22.1211	1 m 116
3306		SW	SW	18.61	225	225	VC	25.56568	1 m 116
1112	28.36	FO	SW	21.97	150	150	VC	26.6852	1 m 118
2414	18.83	SW	SW	16.77	375	375	VC	26.1426	1 m 200
1204	22.86	FO	SW	20.15	300	300	VC	23.72477	1 m 153
2201	20.55	FO	SW	18.67	225	225	VC	40.87543	1 m 181
8903	24.42	SW	SW	21.74	750	750	VC	29.01724	1 m 181
3303	16.34	FO	SW	16.38	150	150	VC	27.8126	1 m 155
2202		FO	SW	150	150	150	VC	20.29234	1 m 107
2001	23.17	SW	SW	21.43	225	225	VC	36.79674	1 m 155
8904	26.57	FO							

Appendix D – Development Masterplan



Notes

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KEY PLAN



P02	20.10.2023	RB	RB	Floor level added
P01	28.08.2023	RB	RB	First Issue
Rev: Date:		By: Chk By:		Rev Note:

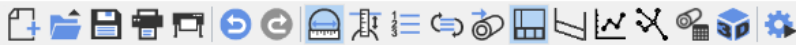
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FCH

Project Title				Rev
Okell Drive, Knowsley				P02
Client				Drawn By
MID Developments				RB
Drawing Title				Checked By
Proposed Site Plan				RB
Drawing No.				
P23036-FCH-XX-XX-DR-A-1210				
Status	Issue suitable for:	Date		
S2	Information	09.04.23		
Job No.	Drawing Stage	Scale		
P23-036	Planning	1:200 @ A2		

Appendix E – Greenfield QBar Runoff & Outline Calculations



- Sketch
- Simulation Settings
- Storm Network
- Design Settings
- Nodes
- Links
- Manhole Schedule
- Hydrographs
- Flow Controls
- Storage
- Other
- Results
- Approval Settings
- Approval Results
- Libraries
- Manhole Types
- Link Types
- Networks
- Preferences

Pre-development discharge

Site Makeup	Brownfield	OK
Brownfield Method	Greenfield	Cancel
Greenfield Method	FEH	
Positively Drained Area (ha)	0.291	
SAAR (mm)	803	Load
Host	18	
BFIHost	0.520	
Region	10	
QBar/QMed conversion factor	1.075	
Betterment (%)	0	
	Calc	
QMed (l/s)	1.1	
QBar (l/s)	1.2	

Return Period (years)	Growth Factor	Q (l/s)
2	0.93	1.1
30	1.70	2.1
100	2.08	2.5

Clancy Consulting		Page 1
Old Hall Chambers 31 Old Hall Street Liverpool L3 9SY	30yr Capacity Okell Drive, Knowsley Merseyside	
Date 23/10/2023 File 30yr FSR Oversize Pipe.SRCX	Designed by CAM Checked by MLC	
Micro Drainage	Source Control 2020.1	

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	22.955	0.755	1.5	21.9	O K
30 min Summer	23.108	0.908	1.5	27.7	O K
60 min Summer	23.239	1.039	1.6	32.6	O K
120 min Summer	23.315	1.115	1.7	35.3	O K
180 min Summer	23.307	1.107	1.7	35.0	O K
240 min Summer	23.283	1.083	1.7	34.2	O K
360 min Summer	23.236	1.036	1.6	32.5	O K
480 min Summer	23.195	0.995	1.6	31.0	O K
600 min Summer	23.157	0.957	1.6	29.6	O K
720 min Summer	23.119	0.919	1.6	28.2	O K
960 min Summer	23.048	0.848	1.5	25.4	O K
1440 min Summer	22.917	0.717	1.5	20.4	O K
2160 min Summer	22.715	0.515	1.5	12.8	O K
2880 min Summer	22.529	0.329	1.5	6.6	O K
4320 min Summer	22.349	0.149	1.4	1.8	O K
5760 min Summer	22.284	0.084	1.2	0.6	O K
7200 min Summer	22.268	0.068	1.0	0.4	O K
8640 min Summer	22.259	0.059	0.9	0.3	O K
10080 min Summer	22.253	0.053	0.8	0.2	O K
15 min Winter	23.028	0.828	1.5	24.7	O K
30 min Winter	23.206	1.006	1.6	31.4	O K
60 min Winter	23.371	1.171	1.7	37.2	O K
120 min Winter	23.489	1.289	1.8	40.8	O K
180 min Winter	23.498	1.298	1.8	41.1	O K
240 min Winter	23.464	1.264	1.8	40.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	76.035	0.0	23.5	22
30 min Summer	49.499	0.0	30.6	36
60 min Summer	30.811	0.0	38.1	64
120 min Summer	18.615	0.0	46.1	122
180 min Summer	13.715	0.0	50.9	170
240 min Summer	10.995	0.0	54.4	200
360 min Summer	8.034	0.0	59.7	264
480 min Summer	6.428	0.0	63.6	332
600 min Summer	5.404	0.0	66.9	402
720 min Summer	4.687	0.0	69.6	470
960 min Summer	3.743	0.0	74.1	608
1440 min Summer	2.723	0.0	80.9	880
2160 min Summer	1.979	0.0	88.2	1264
2880 min Summer	1.577	0.0	93.6	1564
4320 min Summer	1.143	0.0	101.9	2212
5760 min Summer	0.910	0.0	108.1	2936
7200 min Summer	0.762	0.0	113.1	3640
8640 min Summer	0.659	0.0	117.4	4336
10080 min Summer	0.583	0.0	121.1	5120
15 min Winter	76.035	0.0	26.3	22
30 min Winter	49.499	0.0	34.3	36
60 min Winter	30.811	0.0	42.7	64
120 min Winter	18.615	0.0	51.6	120
180 min Winter	13.715	0.0	57.0	174
240 min Winter	10.995	0.0	61.0	224

Clancy Consulting		Page 2
Old Hall Chambers 31 Old Hall Street Liverpool L3 9SY	30yr Capacity Okell Drive, Knowsley Merseyside	
Date 23/10/2023 File 30yr FSR Oversize Pipe.SRCX	Designed by CAM Checked by MLC	
Micro Drainage Source Control 2020.1		

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	23.394	1.194	1.7	37.9	O K
480 min Winter	23.331	1.131	1.7	35.8	O K
600 min Winter	23.270	1.070	1.7	33.7	O K
720 min Winter	23.212	1.012	1.6	31.6	O K
960 min Winter	23.102	0.902	1.5	27.5	O K
1440 min Winter	22.903	0.703	1.5	19.9	O K
2160 min Winter	22.558	0.358	1.5	7.5	O K
2880 min Winter	22.366	0.166	1.5	2.1	O K
4320 min Winter	22.275	0.075	1.1	0.5	O K
5760 min Winter	22.259	0.059	0.9	0.3	O K
7200 min Winter	22.250	0.050	0.7	0.2	O K
8640 min Winter	22.245	0.045	0.6	0.2	O K
10080 min Winter	22.242	0.042	0.6	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	8.034	0.0	66.8	280
480 min Winter	6.428	0.0	71.3	358
600 min Winter	5.404	0.0	74.9	434
720 min Winter	4.687	0.0	78.0	510
960 min Winter	3.743	0.0	83.0	658
1440 min Winter	2.723	0.0	90.6	942
2160 min Winter	1.979	0.0	98.7	1276
2880 min Winter	1.577	0.0	104.9	1536
4320 min Winter	1.143	0.0	114.1	2152
5760 min Winter	0.910	0.0	121.1	2888
7200 min Winter	0.762	0.0	126.7	3632
8640 min Winter	0.659	0.0	131.5	4336
10080 min Winter	0.583	0.0	135.6	5128

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Old Hall Chambers 31 Old Hall Street Liverpool L3 9SY	30yr Capacity Okell Drive, Knowsley Merseyside	
Date 23/10/2023 File 30yr FSR Oversize Pipe.SRCX	Designed by CAM Checked by MLC	
Micro Drainage		Source Control 2020.1

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.165

Time (mins)		Area	Time (mins)		Area
From:	To:	(ha)	From:	To:	(ha)
0	4	0.083	4	8	0.082

Clancy Consulting		Page 4
Old Hall Chambers 31 Old Hall Street Liverpool L3 9SY	30yr Capacity Okell Drive, Knowsley Merseyside	
Date 23/10/2023	Designed by CAM	
File 30yr FSR Oversize Pipe.SRCX	Checked by MLC	
Micro Drainage		Source Control 2020.1

Model Details

Storage is Online Cover Level (m) 25.300

Pipe Structure

Diameter (m) 1.500 Slope (1:X) 400.000 Length (m) 25.000 Invert Level (m) 22.200

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0060-2000-1600-2000
Design Head (m) 1.600
Design Flow (l/s) 2.0
Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 60
Invert Level (m) 22.200
Minimum Outlet Pipe Diameter (mm) 75
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	2.0	Kick-Flo®	0.536	1.2
Flush-Flo™	0.263	1.5	Mean Flow over Head Range	-	1.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.3	0.800	1.5	2.000	2.2	4.000	3.0	7.000	4.0
0.200	1.5	1.000	1.6	2.200	2.3	4.500	3.2	7.500	4.1
0.300	1.5	1.200	1.8	2.400	2.4	5.000	3.4	8.000	4.2
0.400	1.5	1.400	1.9	2.600	2.5	5.500	3.5	8.500	4.3
0.500	1.3	1.600	2.0	3.000	2.7	6.000	3.7	9.000	4.4
0.600	1.3	1.800	2.1	3.500	2.9	6.500	3.8	9.500	4.6

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Old Hall Chambers 31 Old Hall Street Liverpool L3 9SY	100yr+45%CC Capacity Okell Drive, Knowsley Merseyside	
Date 23/10/2023	Designed by CAM	
File 100yr + 45%CC FSR Oversize	Checked by MLC	
Micro Drainage	Source Control 2020.1	

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	22.936	0.736	1.5	42.5	O K
30 min Summer	23.087	0.887	1.5	55.1	O K
60 min Summer	23.232	1.032	1.6	67.0	O K
120 min Summer	23.356	1.156	1.7	76.5	O K
180 min Summer	23.402	1.202	1.8	79.9	O K
240 min Summer	23.412	1.212	1.8	80.6	O K
360 min Summer	23.390	1.190	1.7	79.0	O K
480 min Summer	23.356	1.156	1.7	76.6	O K
600 min Summer	23.325	1.125	1.7	74.2	O K
720 min Summer	23.298	1.098	1.7	72.2	O K
960 min Summer	23.251	1.051	1.6	68.5	O K
1440 min Summer	23.169	0.969	1.6	61.8	O K
2160 min Summer	23.059	0.859	1.5	52.7	O K
2880 min Summer	22.959	0.759	1.5	44.5	O K
4320 min Summer	22.776	0.576	1.5	29.5	O K
5760 min Summer	22.571	0.371	1.5	14.4	O K
7200 min Summer	22.445	0.245	1.5	6.8	O K
8640 min Summer	22.367	0.167	1.5	3.0	O K
10080 min Summer	22.320	0.120	1.4	1.4	O K
15 min Winter	23.000	0.800	1.5	47.8	O K
30 min Winter	23.172	0.972	1.6	62.1	O K
60 min Winter	23.344	1.144	1.7	75.7	O K
120 min Winter	23.509	1.309	1.8	87.2	O K
180 min Winter	23.584	1.384	1.9	91.6	O K
240 min Winter	23.612	1.412	1.9	93.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	143.087	0.0	44.3	22
30 min Summer	93.944	0.0	58.1	37
60 min Summer	58.739	0.0	72.7	66
120 min Summer	35.469	0.0	87.8	124
180 min Summer	26.047	0.0	96.7	184
240 min Summer	20.795	0.0	102.9	242
360 min Summer	15.106	0.0	112.2	352
480 min Summer	12.038	0.0	119.2	406
600 min Summer	10.086	0.0	124.8	470
720 min Summer	8.725	0.0	129.6	532
960 min Summer	6.936	0.0	137.3	668
1440 min Summer	5.012	0.0	148.8	942
2160 min Summer	3.615	0.0	161.1	1360
2880 min Summer	2.864	0.0	170.1	1760
4320 min Summer	2.060	0.0	183.6	2552
5760 min Summer	1.629	0.0	193.6	3168
7200 min Summer	1.357	0.0	201.6	3816
8640 min Summer	1.169	0.0	208.3	4416
10080 min Summer	1.030	0.0	214.1	5144
15 min Winter	143.087	0.0	49.6	22
30 min Winter	93.944	0.0	65.1	36
60 min Winter	58.739	0.0	81.4	66
120 min Winter	35.469	0.0	98.3	122
180 min Winter	26.047	0.0	108.3	180
240 min Winter	20.795	0.0	115.3	236

Clancy Consulting		Page 2
Old Hall Chambers 31 Old Hall Street Liverpool L3 9SY	100yr+45%CC Capacity Okell Drive, Knowsley Merseyside	
Date 23/10/2023 File 100yr + 45%CC FSR Oversize	Designed by CAM Checked by MLC	
Micro Drainage Source Control 2020.1		

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	23.604	1.404	1.9	92.7	O K
480 min Winter	23.560	1.360	1.9	90.3	O K
600 min Winter	23.511	1.311	1.8	87.3	O K
720 min Winter	23.470	1.270	1.8	84.7	O K
960 min Winter	23.397	1.197	1.7	79.6	O K
1440 min Winter	23.271	1.071	1.7	70.0	O K
2160 min Winter	23.104	0.904	1.5	56.5	O K
2880 min Winter	22.957	0.757	1.5	44.3	O K
4320 min Winter	22.623	0.423	1.5	18.0	O K
5760 min Winter	22.395	0.195	1.5	4.3	O K
7200 min Winter	22.304	0.104	1.3	1.0	O K
8640 min Winter	22.277	0.077	1.1	0.5	O K
10080 min Winter	22.267	0.067	1.0	0.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	15.106	0.0	125.6	348
480 min Winter	12.038	0.0	133.5	452
600 min Winter	10.086	0.0	139.8	488
720 min Winter	8.725	0.0	145.1	562
960 min Winter	6.936	0.0	153.8	718
1440 min Winter	5.012	0.0	166.7	1024
2160 min Winter	3.615	0.0	180.4	1468
2880 min Winter	2.864	0.0	190.6	1900
4320 min Winter	2.060	0.0	205.6	2600
5760 min Winter	1.629	0.0	216.8	3112
7200 min Winter	1.357	0.0	225.8	3672
8640 min Winter	1.169	0.0	233.3	4336
10080 min Winter	1.030	0.0	239.8	5064

Clancy Consulting		Page 3
Old Hall Chambers 31 Old Hall Street Liverpool L3 9SY	100yr+45%CC Capacity Okell Drive, Knowsley Merseyside	
Date 23/10/2023	Designed by CAM	
File 100yr + 45%CC FSR Oversize	Checked by MLC	
Micro Drainage		Source Control 2020.1

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.165

Time (mins)		Area	Time (mins)		Area
From:	To:	(ha)	From:	To:	(ha)
0	4	0.083	4	8	0.082

Clancy Consulting		Page 4
Old Hall Chambers 31 Old Hall Street Liverpool L3 9SY	100yr+45%CC Capacity Okell Drive, Knowsley Merseyside	
Date 23/10/2023	Designed by CAM	
File 100yr + 45%CC FSR Oversize	Checked by MLC	
Micro Drainage		Source Control 2020.1

Model Details

Storage is Online Cover Level (m) 25.300

Pipe Structure

Diameter (m) 1.500 Slope (1:X) 400.000 Length (m) 55.000 Invert Level (m) 22.200

Hydro-Brake® Optimum Outflow Control

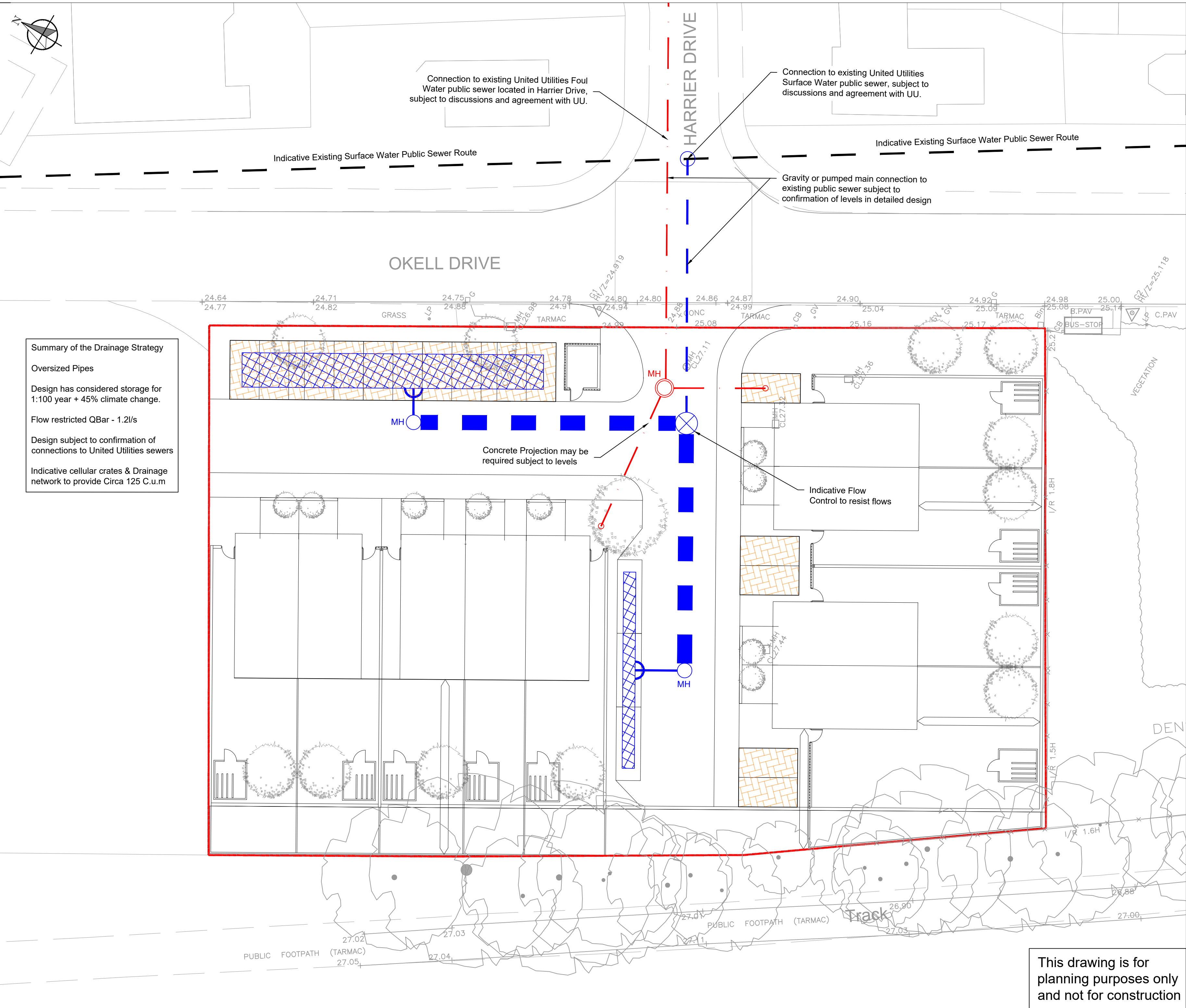
Unit Reference MD-SHE-0060-2000-1600-2000
Design Head (m) 1.600
Design Flow (l/s) 2.0
Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 60
Invert Level (m) 22.200
Minimum Outlet Pipe Diameter (mm) 75
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	2.0	Kick-Flo®	0.536	1.2
Flush-Flo™	0.263	1.5	Mean Flow over Head Range	-	1.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.3	0.800	1.5	2.000	2.2	4.000	3.0	7.000	4.0
0.200	1.5	1.000	1.6	2.200	2.3	4.500	3.2	7.500	4.1
0.300	1.5	1.200	1.8	2.400	2.4	5.000	3.4	8.000	4.2
0.400	1.5	1.400	1.9	2.600	2.5	5.500	3.5	8.500	4.3
0.500	1.3	1.600	2.0	3.000	2.7	6.000	3.7	9.000	4.4
0.600	1.3	1.800	2.1	3.500	2.9	6.500	3.8	9.500	4.6

Appendix F – Concept Drainage Strategy Plan



Summary of the Drainage Strategy

Oversized Pipes

Design has considered storage for 1:100 year + 45% climate change.

Flow restricted QBar - 1.2l/s

Design subject to confirmation of connections to United Utilities sewers

Indicative cellular crates & Drainage network to provide Circa 125 C.u.m

- GENERAL NOTES
- All Clancy Consulting drawings are to be read in conjunction with all other relevant drawings and specifications. Should there be any conflict between the details indicated on this drawing and those indicated on other drawings, Clancy Consulting should be informed prior to construction.
 - Do not scale from any Clancy drawing, in either paper or digital form. Use written dimensions only. All dimensions and levels are in metres unless otherwise stated.
 - Until technical approval has been obtained from the relevant authorities, it shall be understood that all drawings issued are preliminary and not for construction.
 - All levels TBC on site prior to construction, following full topographical survey, drainage level survey information and current existing services plans and maps.
 - Any discrepancies must be reported to Clancy Consulting prior to the commencement or continuance of any further works.

- DRAWING NOTES
- All information shown is feasibility only and not be used to construction.
 - Feasibility review is based on Falconer Chester Hall site plan ref P23036-FCH-XX-XX-DR-A-1210 dated 20-10-2023
 - All information shown is subject to acceptance and comments from consultees at outline planning stage, further investigations and detailed design.

Key:

	Existing Surface Water Sewer
	Indicative Proposed Surface Water Drainage
	Indicative Proposed Foul Water Drainage
	Indicative Type C Porous Paving
	Indicative Attenuation Crates
	Indicative Rodding Eye
	Indicative Flow Control Chamber
	Indicative Surface Water PPIC
	Indicative Foul Water PPIC
	Indicative Surface Water Manhole
	Indicative Foul Water Manhole
	Indicative Surface Water Catchpit

P1	26/10/23	Initial Issue	JP	CAM	MLC
Rev	Date	Description	By	Check	App.

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Client	Michael Gore Architecture Ltd				
Project	Okell Drive, Halewood, Liverpool, L26 7XB				
Office	Liverpool				
Discipline	Civil Engineering				
Title	Illustrative Foul & Surface Water Drainage Layout				
Scale @ A2	1:200	Status	Preliminary		

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Originator	Job Number	Discipline	Building/Zone
CCL	4/9301	CE	ALL
Type	Level	Drawing No.	Revision
DET	EXT	SK001	P1

This drawing is for planning purposes only and not for construction