



Drainage Strategy

Revision 3

Liverpool Waters
Plot CO2
East Waterloo Dock

26th October 2019

Ref: 4/6679

Prepared on Behalf of:

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DRAINAGE STRATEGY
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1.0 INTRODUCTION

1.1 General

- 1.1.1 This report has been prepared on instructions received from Romal Capital Group Ltd and relates to the proposed development works at West Waterloo Dock as part of Liverpool Waters Project. The development is currently referred to as Plot CO2.
- 1.1.2 The proposed works at the site include the construction of a new dock wall and infilling behind this wall to provide the platform to erect four new mixed-use blocks (A-D) of 10 storeys and provide a total of 538 apartments (one – three bedrooms), along with associated commercial space, car parking, landscaping, servicing and access.
- 1.1.1 This report outlines the initial drainage design philosophy in relation to the proposed development.
- 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 (CC).
- 1.1.4 This report is based upon existing and proposed plans for the development as well as data obtained from the Environment Agency, Liverpool City Council, United Utilities and site investigations undertaken by CC Geotechnical.

1.2 Report Structure

- 1.2.1 The report has been structured to follow the general principles set out in the Liverpool City Council's Greenfield/ Brownfield Site Surface Water Management Guidance (May 2016).
- 1.2.2 The methodology for this report has comprised of a desktop study including liaison with Liverpool City Council and United Utilities. Reference has also been made to all available and relevant plans, CCTV survey, Site / Ground Investigation and topographical survey information. Design calculations have been undertaken to establish existing discharge rates for the various storm events with attenuation sized accordingly.
- 1.2.3 The drainage strategy will provide justification of the discharge method considering the following (in order of preference);
1. Discharge by Infiltration
 2. Discharge to Watercourse
 3. Discharge to Surface Water Sewer
 4. Discharge to Combined Sewer
- 1.2.4 The drainage strategy will discuss proposed SUDs techniques and comply with the 'Non-Statutory Technical Standards for Sustainable Drainage Systems'.
- 1.2.5 Sources of information:
- Environment Agency (EA)
 - Clancy Consulting Ltd Flood Risk Assessment (FRA)
 - Liverpool City Council Greenfield/ Brownfield Site Surface Water Management Guidance (May 2016).
 - Flood Risk Resilience Strategy (Condition 21): Neighbourhood C by Curtins (May 2019) – referred to as Condition 21 Report within this document.
 - United Utilities Public Sewer Records

- Ground Investigation Report by CC Geotechnical (October 2018).
- Non-statutory technical standards for sustainable drainage systems.
- Merseyside Environmental Advisory Service Discretionary Advice
- Natural England Discretionary Advice
- Canal & River Trust

1.3 Background Information

- 1.3.1 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;
- 1.3.2 LPAs will be required to consider SuDS in connection with planning applications, rather than a separate local government body.
- 1.3.3 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.
- 1.3.4 The operation and on-going maintenance of SuDS must also be economical.
- 1.3.5 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.
- 1.3.6 They should be read in conjunction with a Planning Practice Guide which is now available online.
- 1.3.7 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 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 Existing Site Characteristics

3.1.1 The site is located as detailed as below in Table 1 & Figure 6.

Table 1 - Site Location References (streetmap.co.uk)

OS X (Eastings)	333455
OS Y (Northings)	391242
Nearest Post Code	L3 0BT
Lat (WGS84)	N53:24:50 (53.413770)
Long (WGS84)	W3:00:09 (- 3.002624)
LR	SJ334912
mX	-334250
mY	7025569

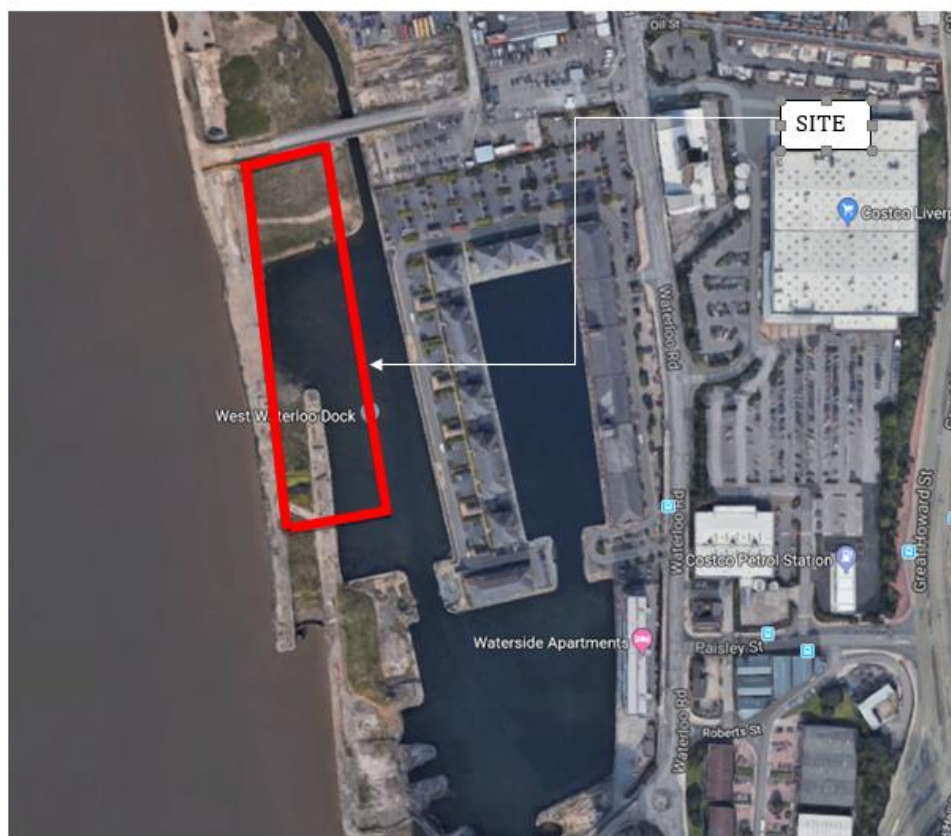


Figure 1 - Site Location Map (Google Maps)

- 3.1.2 The development is located North of Liverpool City Centre within West Waterloo Dock on the waterfront. The development is bordered by the Liverpool Canal Link to the West, Princes Half Tide Dock to the South, The River Mersey (and river wall) to the East and undeveloped land to the North.
- 3.1.3 The area proposed for development was historically West Waterloo Docks and warehouses. Over time, the warehouses have been demolished and the dock itself has been partially infilled along with Waterloo Lock system, whilst other areas remain as the dock.
- 3.1.4 The development falls within the wider Liverpool Waters masterplan – covering the re-development of up to 60 hectares of former dock land along Liverpool Waterfront providing mixed use developments and an extension from Liverpool City Centre northwards.
- 3.1.5 Outline planning was granted by Liverpool City Council in June 2013 (Application no. 10O/2424) for a mixed-use development across 60 hectares of derelict dockland.
- 3.1.6 The overall area proposed for development is approximately 1.12 hectares
- 3.1.7 Site ground levels along the dock sides are generally flat at a level of approximately 8.000m AOD. The canal level is generally kept at approximately 4.770m AOD.
- 3.1.8 The site is approximately 20m away from the River Mersey.

3.2 Existing Drainage

- 3.2.1 Asset drawings provided by United Utilities have shown no existing sewer infrastructure on or in the vicinity of the development.
- 3.2.2 It is likely that the vast majority – if not all - of the existing surface water drains freely into West Waterloo dock.
- 3.2.3 However, the future development of the area will see a new road constructed to service the Isle of Man Ferry Terminal and Plot C02.
- 3.2.4 The Flood Risk Assessment for the Northern Link Road indicates the storm sewerage for the site has been designed in accordance with DMRB Volume 4 (HD 33/16 and HA 102/00) for a 1 in 100 year storm event with checks against 1 a in 30 year storm event. The drainage system has also been assessed for the consequences of exceedance for return periods in excess of 1 in 100 years to ensure any surcharge levels do not exceed the levels of chamber covers.
- 3.2.5 The South to North link road which runs parallel to the West boundary of the development has a lowest proposed level of 6.849m AOD – lifting, on average, the existing ground level by approximately 300mm. and similar to this development.
- 3.2.6 The Flood Risk Assessment for the Northern Link Road states that the lowest level remains higher than the minimum ground level of 6.70m AOD as set out within Liverpool Waters Environmental Statement.
- 3.2.7 Review of the Northern Link Road levels against proposed site ground floor levels generally shows the development has been set to remain above the road level – further reducing the risk of flooding from the Northern Link Road.

- 3.2.8 The Flood Risk Assessment for the Northern Link Road indicates that stormwater run-off will be adequately managed by inclusion of road gullies and designated carrier networks, with discharge into the canal and locks – as existing drainage is believed to do.
- 3.2.9 No calculations or mitigations measures have been presented within the Flood Risk Assessment for review of the proposals and flood risk management.
- 3.2.10 Figures 5 and 6 show the proposed drainage below this road which borders the development. A surface water sewer is proposed ranging in diameter from 150mm up to 300mm but this appears to be solely for the road drainage as there are numerous gullies connected to it with no provisions for a connection for the development.
- 3.2.11 There is also a foul water sewer proposed below the road with a number of branches along the length coming onto the development for connection of the foul water system.
- 3.2.12 The impermeable areas on the existing site are the dockside wharf, with the rest either being dock (open, partial infill or full infill).

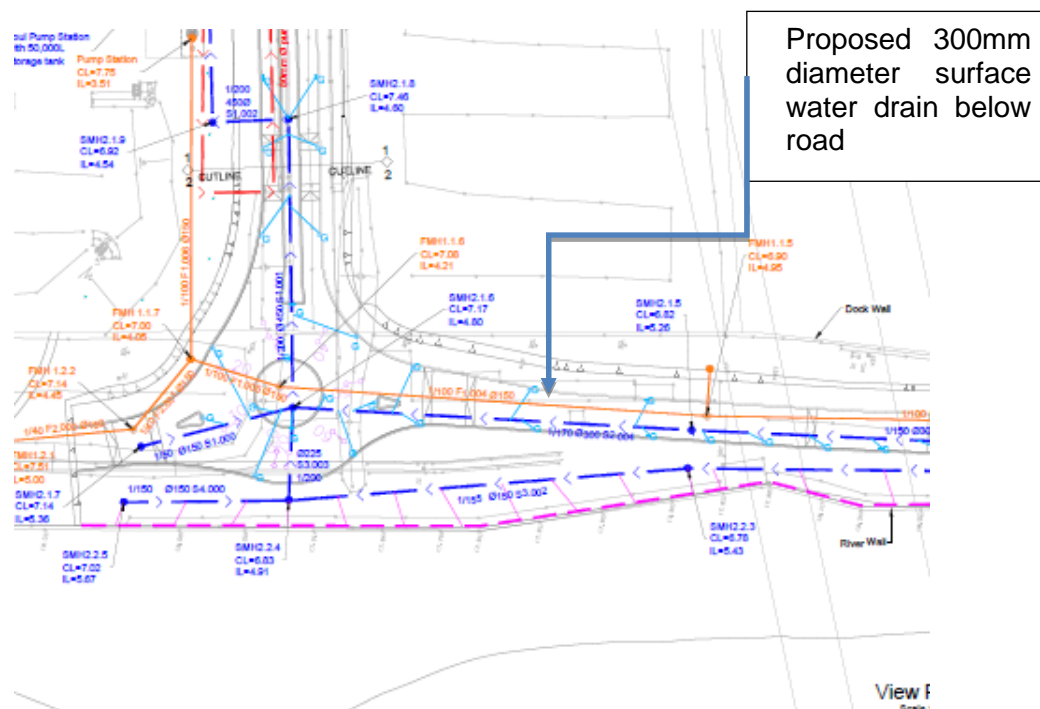


Figure 2 – Road Drainage Extract One (Amey Consulting Drawing CO00205341-H-D-NLR-500)



3.3 Development Proposals

- 3.3.1 The proposed works at the site include the construction of a new dock wall and infilling behind this wall to provide the platform to erect four new mixed-use blocks (A-D). These blocks range in height between 10 and 11 storeys and provide a total of 542 apartments (one – three bedrooms), along with associated commercial space, car parking, landscaping, servicing and access.
- 3.3.2 Blocks A and B are to be constructed facing along and projecting into the dock with Blocks C and D built facing the River Mersey. Across the blocks, the ground floors contain commercial units, reception areas, plant rooms and storage for bicycles with Blocks C and D only containing residential apartments.
- 3.3.3 A canal side walkway/ boardwalk will be provided at canal level (6.600m AOD) with the buildings projecting over into the canal to create a colonnade.
- 3.3.4 The proposed ground floor levels of the buildings range from 8.050m AOD at the North end of the development up to 8.400m AOD at the South end of the development. The lowest accessible level is set at 6.600m AOD (lower ground floor) to provide a transition and access point between the blocks and the canal side.

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

Table 2 – SUDS Hierachy

4.3 Disposal Strategy for Plot CO2

4.3.1 Infiltration

All soakaways must be situated at least 5m away from the building footprint as per building regulations which may limit the location of such soakaways.

In addition, although there are areas on this development subject to dock infill and this is likely to be by imported aggregates, the permeability at the base of the fill is likely to be minimal with its previous history as a water retaining dock.

4.3.2 Water Course

The nearest water course is the River Mersey located approximately 20m to the west of the site. While this would be a potential discharge point for the surface water, it is unlikely that this would be acceptable to Environment Agency and would also mean crossing third party land to do so.

A feasible option is to discharge directly into West Waterloo Dock. From initial discussions with both The Canal and Rivers Trust and Peel Land and Property Group Management Limited (Dock Operators), there have been no objections to this proposal. The only consideration Peel have advised is with regard to achieving a flow velocity into the dock of 0.5m/s. However, this is outside the limit advised for best practice construction and within Sewers for Adoption in order to achieve self-cleansing within the surface water drainage network.

To achieve this, the energy generated within the flow of water along the surface water network must be disrupted to dissipate the energy and subsequently its velocity. This can be achieved in a number of ways such as including orifice plates or flow controls with the effective volume of water behind this stored in storage in order to remain within the design requirements. This will require conversations with all relevant parties to achieve an amicable solution.

The outfall of the drainage into the dock should be located at a level above the maximum canal level to ensure surface water can discharge from the development but not too high to minimise any potential for turbulence in the water.

4.3.3 Surface Water Sewer

The nearest surface water drainage system will be below the new access road to the Isle of Man Ferry Terminal. The proposed drawings show no branches onto this development and it appears it may have been designed for the road drainage only. This drainage run does ultimately discharge into West Waterloo Dock.

The nearest surface water drainage system will be below the new access road to the Isle of Man Ferry Terminal. The proposed drawings show no branches onto this development and it appears it may have been designed for the road drainage only. This drainage run does ultimately discharge into West Waterloo Dock.

4.3.4 Combined Sewer

The nearest surface water drainage system will be below the new access road to the Isle of Man Ferry Terminal. The proposed drawings show no branches onto this development and it appears it may have been designed for the road drainage only. This drainage run does ultimately discharge into West Waterloo Dock.

4.4 SuDS Strategy for Plot CO2

4.4.1 Landscaped Areas

The most sustainable solution to control run-off at its source would be to utilise areas of landscaping (grass and planting). These areas will not be suitable for direct filtration but can 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 are no areas large enough on the development to accommodate ponds/ basins and/or swales.

4.4.3 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 would be to provide living or green roof areas. The current proposals do not allow for this an option.

4.4.4 Tanked System

A tanked system would provide additional attenuation storage to control rainfall up to 1 in 100 year change events with an allowance for climate change.

5.0 PROPOSED FOUL WATER DRAINAGE

5.1 Peak Flow Requirements

- 5.1.1 The foul drainage from each block will have separate foul drainage systems. These systems will combine on the development before entering a pumping station located in the North West corner of the development. See Appendix F.
- 5.1.2 This then rising main which runs below the North Link Road before turning East, across the canal bridge and into the gravity fed foul drainage system which ultimately connects into the existing United Utilities infrastructure.
- 5.1.3 The proposed foul water for the upper residential floors will be collected via soil vent pipes which will be hidden within the risers for the apartments along corridor lines.
- 5.1.4 Floor gullies from Plant rooms and cycle stores will be collected into the wider site foul drainage network.
- 5.1.5 The drainage for the ground floor commercial units will be routed via stub stacks and will be collected into the wide development foul drainage network. These will connect with the residential drainage runs before discharging off site.
- 5.1.6 The proposed floor layouts for Plot CO2 has been assessed and based on the discharge unit method. A total peak flow rate of approximately 43.6 l/s will be achieved from Plot CO2. This will be split further to avoid the discharge flowing through one pipe.

SUMMARY	Discharge Unit	Totals	Total DU
Shower	0.6	1405	843
Washbasin	0.6	1415	849
WCs (4l - 9l cistern)	2.5	1415	3537.5
Kitchen Sink	1.3	656	852.8
Dishwasher	0.8	542	516.8
Floor drains (50mm - 100mm)	2	15	30
Washing Machine (House)	1.5	542	969
			7598.1
Peak Flow Discharge	43.6	l/s	

Table 3 – Preliminary Foul Discharge Flow Rate (Total)

- 5.1.7 It is currently understood that Section 106 agreements will not be required for the connections onto the new sewer in the link road. This will be covered by the Section 104 agreement that will be undertaken by others for the sewer under the link road. However, this should be confirmed at detailed design stage.

6.0 PROPOSED SURFACE WATER DRAINAGE

6.1 Peak Flow and Attenuation Requirements

- 6.1.1 The site currently has an impermeable area of 800m². Based upon a 15 minute storm event, the 1 in 2 year storm event has a peak flow of 8l/s. It is likely that this currently drains straight into West Waterloo Dock.
- 6.1.2 In accordance with the SUDS hierarchy, the FRA has established that filtration via a soakaway is not practical on site but connection to West Waterloo Dock is practical and feasible.
- 6.1.3 Following discussions with Liverpool City Council, no betterment on the current flow is required and an unrestricted flow into the dock is permissible along with ensuring the requirements for the peak storms is achieved.
- 6.1.4 Following discussions with The Canal and River Trust, they have not imposed any further restrictions on the discharge into West Waterloo Dock.
- 6.1.5 Following discussions with Peel Land and Property Group Management Limited, the only restriction imposed is that discharge from the site into West Waterloo Dock should be at 0.5 m/s. This is outside the limit advised for best practice construction and within Sewers for Adoption in order to achieve self cleansing within the surface water drainage network.
- 6.1.6 To achieve this, the energy generated within the flow of water along the surface water network must be disrupted to dissipate the energy and subsequently its velocity. This can be achieved in a number of ways such as including orifice plates or flow controls with the effective volume of water behind this stored in storage in order to remain within the design requirements. Conversations are currently ongoing.
- 6.1.7 The FRA has established that the attenuation requirements for the 30 year and 100 year (including 30% climate change) rainfall events can be accommodated by allowing the water level in the dock to raise temporarily.
- 6.1.8 This is subject to agreement from the Canal and Rivers Trust and the dock operators and is detailed below.
- 6.1.9 Any new development's drainage must be designed in accordance with current best practice to provide adequate capacity not to flood for the critical 1 in 30 year storm event and flood water generated for the 1 in 100 year plus climate change storm event shall be controlled with the area of the development so as not to cause damage to buildings, essential services or adjoining developments and services.
- 6.1.10 The FRA has confirmed the 1 in 2 year storm event will also be analysed to ensure no access chambers/ manholes surcharge during this event.
- 6.1.11 A surface water drainage model has been designed using MicroDrainage design software by WinDes for the following storm events;
 - 1. The 1 in 2 year storm event with a free outfall.
 - 2. The 1 in 30 year storm event with a surcharged outfall set to 6.000m AOD.

3. The 1 in 100 year storm event, including an allowance of 30% for climate change, with a surcharged outfall set at 6.000m AOD.
 4. The 1 in 100 year storm event, including an allowance of 40% for climate change with a surcharged outfall set at 7.150m AOD.
- 6.1.12 The surcharged outfall level of 6.000m AOD corresponds to the estimated flood level for the 1 in 100 year storm event as noted within the FRA.
- 6.1.13 The surcharged outfall level of 7.15m AOD corresponds to the estimated flood level for the 1 in 200 year River Mersey Level for the year 2115. This is the level on which floor levels have been set against.
- 6.1.14 The results from the initial drainage models are as follows;

Event	Maximum Discharge Rate (l/s)	Design Requirement	Result
1: 2 Year	124	No Surcharge	Pass
1 in 30 Year Event (Surcharged Outfall 6.00m AOD)	64.4	No Flooding	Pass
1 in 100 Year Event + 30% Climate Change (Surcharged Outfall 6.00m AOD)	111.6	Flooding Contained on Site	Pass – Total Flood Volume 300m ³ – to be contained and kept away from buildings with level management during detailed design.
1 in 100 Year Event + 40% Climate Change (Surcharged Outfall 7.150m AOD)	92.2	Flooding Contained on Site	Pass – Total Flood Volume 369m ³ – to be contained and kept away from buildings with level management during detailed design.

Table 4 – Surface Water Model Summary

- 6.1.15 The finished habitable floor levels of the buildings are set at a minimum of 8.050m AOD, as specified in the FRA – giving in excess of the 600mm freeboard above the 1 in 200 year River Mersey level up to the year 2115.
- 6.1.16 Correspondence with all relevant parties with vested interest is ongoing.
- 6.1.17 In accordance with the FRA, West Waterloo dock will provide the attenuation storage for the 30 year storm event, by allowing the water level to temporarily rise in storm events and will be controlled outside of the scope of this development.
- 6.1.18 A brief estimation has been undertaken to assess the additional volume of water entering the dock, assuming a 30% betterment has been applied to the 1 in 2 year storm event on the current site ($8\text{l/s} \times 0.7 = 5.6\text{l/s}$).
- 6.1.19 Using a figure of 5600m² as the revised area of West Waterloo Dock (post CO2 development), the volume entering the dock and estimated rise in water level is as follows;
1. The 1 in 30 year storm event: 490m³ giving a 88mm raise in water level.
 2. The 1 in 100 year storm event, including 30% climate change allowance: 820m³ giving a 146mm raise in water level.

- 6.1.20 These estimates give no consideration to any other developments discharging into West Waterloo Dock, no consideration to the larger area of the docks as in reality the docks are not seldom closed along the Leeds-Liverpool Canal route, no consideration to evaporation.
- 6.1.21 These level changes would not cause a significant issue; even when applied to the 1 in 200 Mersey level for 2115 (7.15m AOD), this would not cause flooding to the surrounding area.
- 6.1.22 The proposed drainage strategy drawing 001 is enclosed in Appendix B along with areas susceptible to flooding under the initial drainage arrangement (Drawing 002).
- 6.1.23 A minimum of one stage of water quality treatment is provided for all areas within the site and a two-stage treatment has been proposed for all areas subject to vehicles.
- 6.1.24 The measures to implement this, include for vehicular areas subject to surface water runoff are to pass through a Class 1, Full Retention Petrol Interceptor prior to connecting to the drainage picked up from roofs.
- 6.1.25 Further measures to be assessed during detailed design include silt traps located within the drainage system to prevent silt passing to the dock waters, green roofs, permeable paving and tree pits to reduce the volume of water leaving the development.
- 6.1.26 The surface water drainage system will remain separate from the foul water drainage system whilst on the development.
- 6.1.27 All proposed flow rates and connection points will be subject to agreement and approval from relevant and interested parties.
- 6.1.28 The surface water drainage strategy is summarised as follows:
- Building rooftops – to be drained under gravity before entering the onsite public surface water system discharging directly into West Waterloo Dock.
 - Areas of external hardstanding– to be drained via gravity using falls within the external works and collected in gullies and linear drainage before entering the onsite public surface water system and discharging directly into West Waterloo Dock.
 - Areas of external car parking – to be drained via gravity using falls within the external works and collected in gullies and linear drainage before entering the onsite public surface water system via a petrol interceptor and discharged directly into West Waterloo Dock.
 - No surcharging of access chambers/ manholes during the 1 in 2 year storm event.
 - No surface flooding will occur for all storm events up to and including the 1 in 30 year storm event.
 - Under the 1 in 100 year storm event plus 30% climate change allowance, on site flooding is acceptable. Site levels will be designed to ensure flood water remains on site whilst also not effecting the residents.
 - The FRA has established that the attenuation requirements for the 30 year and 100 year (including 30% climate change) rainfall events can be accommodated by allowing the water level in the dock to raise temporarily.

- The volume range for the 30 year and 100 year storm events entering West Waterloo Dock ranges between 490m³ and 820m³. This gives a theoretical water level increase in West Waterloo Dock from this development of 88mm and 146mm respectively.
- Consideration of the 1 in 100 year storm event plus 40% climate change allowance.
- Detailed design will look at using green roofs, permeable paving and tree pits to reduce the volume entering West Waterloo Dock where possible.
- Approval of flows entering the drainage system by relevant and interest parties will be required to proceed with detailed design.

6.2 Flood Risk within the Development

- 6.2.1 Reference should be made to the Flood Risk Assessment report which supports the application.
- 6.2.2 The drainage system must be designed so that, surcharging of access chambers/manholes does not occur on any part of the site for a 1 in 2 year rainfall event.
- 6.2.3 The drainage system must be designed so that, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.
- 6.2.4 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 (with 30% climate change allowance) 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.
- 6.2.5 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.
- 6.2.6 Consideration must be given to the implications of flooding on site during the 1 in 100 year rainfall event plus 40% climate change.
- 6.2.7 Levels will be designed such that in the event of a more extreme rainfall event water will discharge away from buildings.

7.0 MAINTENANCE & CONSTRUCTION

7.1 Maintenance Considerations

- 7.1.1 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.
- 7.1.2 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.
- 7.1.3 The surface water network has been designed to accommodate the 1 in 100 year storm rainfall event plus an allowance for climate change particular to the requirements of the development.
- 7.1.4 It may be that the exceedance flows above the 1 in 30 year storm rainfall event are stored within the site partially above ground, on non-habitable external landscaping, parking or other space.
- 7.1.5 As the flows are generally being attenuated on site and within SuDS features there will be a period after storm events where the network is still partially or fully surcharged and is draining down.
- 7.1.6 Where this surcharging is still present after 48hrs appropriate action should be taken.
- 7.1.7 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.
- 7.1.8 It is assumed that the maintenance of the drainage network will be the responsibility of an on-site facilities management team.
- 7.1.9 A copy of the final construction drainage layout should be provided in the final Operations and Maintenance Manual.
- 7.1.10 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.
- 7.1.11 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.
- 7.1.12 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.
- 7.1.13 During the winter months, drainage features such as gullies and channels should be cleared of ice, snow, debris or litter
- 7.1.14 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.

- 7.1.15 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.

7.2 Construction

- 7.2.1 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.
- 7.2.2 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.
- 7.2.3 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.
- 7.2.4 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.
- 7.2.5 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.

8.0 CONCLUSIONS AND RECOMMENDATIONS

- 8.1.1 This report outlines the design philosophy for the drainage system proposed for Plot CO2 development at Liverpool Waters in accordance with Lead Local Authority (Liverpool City Council) requirements for surface water management on and in accordance with the findings from the FRA.
- 8.1.2 The site is part of the historic dock network on Liverpool's waterfront and had remained derelict and unused for some time. As such, surface water runoff is believed to drain directly into West Waterloo Dock, as there are no existing public sewers to connect to.
- 8.1.3 The proposed development will collect rainfall from roofs, hardstanding and car parking and discharge this volume directly into West Waterloo Dock. Following discussions with the LLFA, no betterment is required and the FRA has established that the volume of surface water from the peak storms can be accommodated within the dock itself.
- 8.1.4 The development will be designed to avoid surcharging access chambers/ manholes during the 1 in 2 year storm event, avoid flooding on the development during the 1 in 30 year storm event and ensure flooding within the 1 in 100 year storm event (plus climate change) is managed on site away from people and property.
- 8.1.5 As the flow will discharge directly into West Waterloo Dock, consideration has been given in the event flood water levels as noted in the FRA are above the outfall and prevent flow from the development.
- 8.1.6 Although not used for filtration, other SUDs options may be viable to store peak flow volume on site. These include green roofs, permeable paving and tree pits.
- 8.1.7 Foul water will be collected from the buildings in a separate foul drainage network before discharging into the main Liverpool Waters drainage network to be constructed as part of the Link Road.
- 8.1.8 Approval of flows entering the drainage system by relevant and interest parties will be required to proceed with detailed design.

APPENDIX A

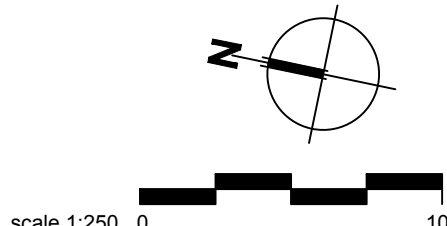
PROPOSED SITE PLAN

Ollier Smurthwaite Architects A476_P_101



- cores/ reception/ circulation
- one bed - 38sqm
- two bed - 57sqm
- three bed - 97sqm
- penthouse - varies
- duplex - 79sqm
- ancillary

C02 SITE GROUND FLOOR PLAN



NOTES

1. This drawing is copyright of Ollier Smurthwaite Architects Ltd

2. This drawing is for the proposed development only

rev	date	dm	aud
drawing status			

DRAFT

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www.olliersmurthwaite.com

Client

ROMAL CAPITAL

Job title

PLOTS C02 CENTRAL DOCKS, LIVERPOOL

Drawing title

PROPOSED GROUND FLOOR PLAN

Scale	Drawn	Checked	Date	Issue
1:500@A3	VM	VM	20.09.19	1
job number	A476			
Drawing number	A476_P_101			

APPENDIX B

DRAINAGE STRATEGY DRAWING 001 & FLOOD AREA DRAWING 002

GENERAL NOTES

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT CLANCY CONSULTING, ARCHITECTURAL AND OTHER ENGINEERS DRAWINGS AND SPECIFICATIONS.

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EXISTING DRAINAGE AND LEVELS SHOWN ON THIS DRAWING TO BE CONFIRMED BY THE CONTRACTOR ON SITE PRIOR TO COMMENCEMENT OF THE DRAINAGE WORKS. THE ENGINEER IS TO BE NOTIFIED OF ANY DISCREPANCIES.

ALL NEW PIPES UP TO BE V.C. TO BSEN 295-1.1991 EXTRA STRENGTH GRADE

ALL PIPES TO BE 150 DIA. MIN FALL 1 : 150 (UNO)

MANHOLES, RODDING EYES ETC. TO BE ENCASED IN S.R.C.

ALL INTERNAL CONNECTIONS TO CONSIST OF STANDARD REST BEND WITH APPROPRIATE ADAPTOR TO CONNECT TO ABOVE GROUND DRAINAGE.

COVER LEVELS TO BE CHECKED AGAINST ARCHITECTS PROPOSED EXTERNAL WORKS LEVEL / DETAIL DRAWINGS

EXISTING MANHOLES, LEVELS & PIPE SIZES TO BE CHECKED ON SITE

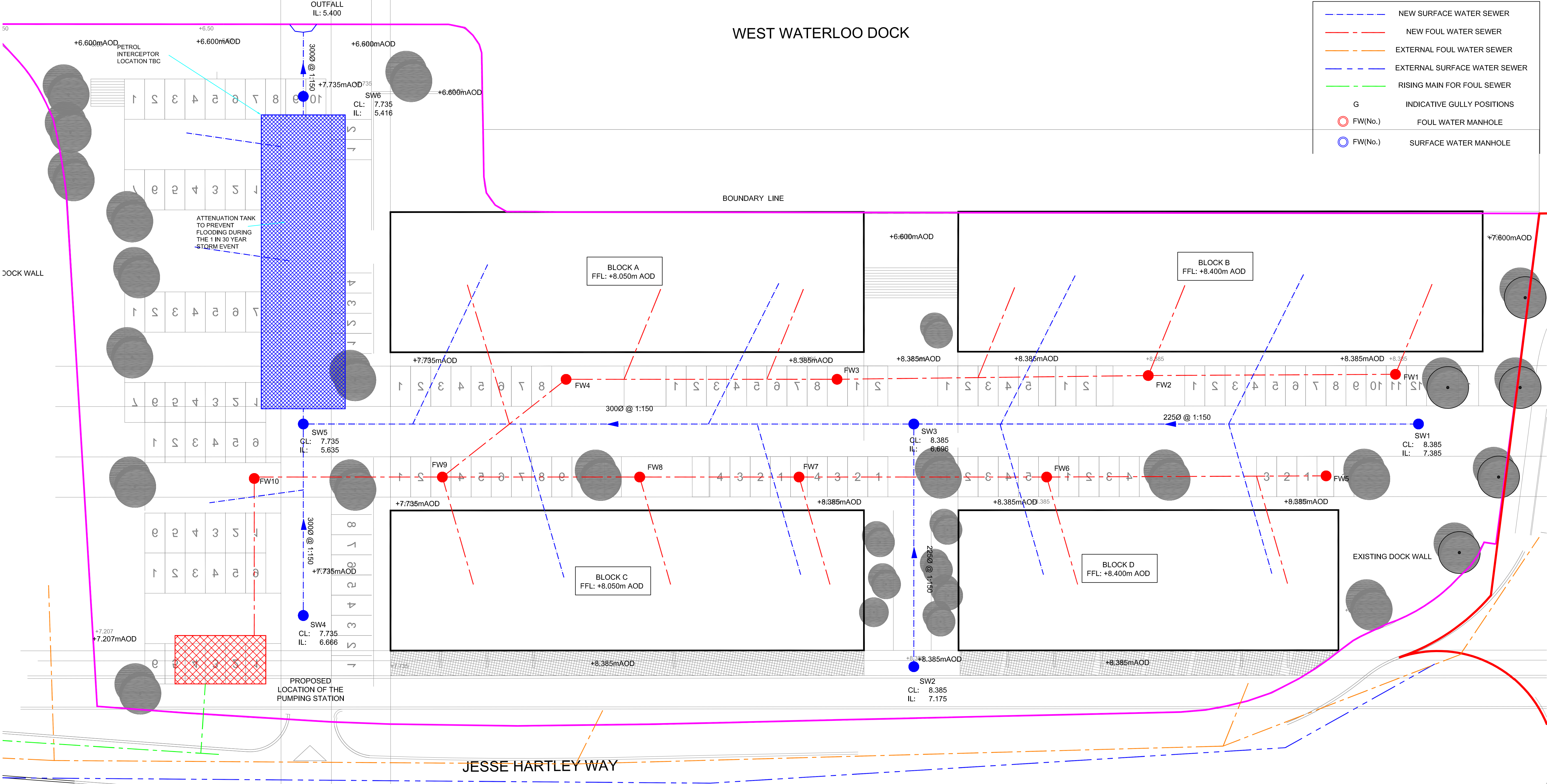
RWP POSITIONS ARE TO BE CONFIRMED BY ARCHITECT

ALL CONNECTIONS INTO EXISTING SEWERS ARE VIA MANHOLES, ANY SADDLE CONNECTION IS SUBJECT TO CONFIRMATION FROM LOCAL WATER AUTHORITY.

ALL OUTGOING AND INCOMING PIPES AT MANHOLE JUNCTIONS TO BE CONNECTED SOFFIT TO SOFFIT UNLESS SPECIFIED OTHERWISE.

---	NEW SURFACE WATER SEWER
---	NEW FOUL WATER SEWER
---	EXTERNAL FOUL WATER SEWER
---	EXTERNAL SURFACE WATER SEWER
---	RIISING MAIN FOR FOUL SEWER
G	INDICATIVE GULLY POSITIONS
FW(No.)	FOUL WATER MANHOLE
FW(No.)	SURFACE WATER MANHOLE

WEST WATERLOO DOCK



02	25/10/19	ISSUED FOR INFORMATION	MD	JG	BRH
01	30/11/18	ISSUED FOR INFORMATION	MD	JG	BRH
Rev	Date	Description	By	Check	App.

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Client	ROMAL CAPITAL GROUP LTD
Project	PLOT CO2 LIVERPOOL WATERS
Office	LIVERPOOL
Discipline	CIVIL
Title	PROPOSED DRAINAGE

Scale @ A1	1:250	Status	INFORMATION
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Job Number	Originator	Building/Zone	Level
4/6679	CCL	CO2	EXT
Type	Discipline	Drawing No.	Revision
DRN	C	001	02

SURFACE WATER STRATEGY:

THIS DEVELOPMENT IS NOT SUBJECT TO ANY BETTERMENT ON THE EXISTING FLOW AS THE CURRENT SURFACE WATER IS UNDERSTOOD TO DISCHARGE DIRECTLY INTO THE ADJACENT WATERLOO DOCK.

THE FOLLOWING CRITERIA HAVE BEEN ASSESSED;

1 IN 2 YEAR STORM EVENT WITH NO SURCHARGE

1 IN 30 YEAR STORM EVENT WITH NO FLOODING WITH OUTFALL SURCHARGED TO 6.000mAOD.

1 IN 100 YEAR STORM EVENT (+ 30% CLIMATE CHANGE) WITH FLOODING CONTAINED ON SITE WITH OUTFALL SURCHARGED TO 6.000mAOD.

1 IN 100 YEAR STORM EVENT (+ 30% CLIMATE CHANGE) WITH FLOODING CONTAINED ON SITE WITH OUTFALL SURCHARGED TO 7.150mAOD.

FOUL WATER STRATEGY:

THIS WILL BE COLLECTED ON SITE THROUGH A SEPARATE FOUL DRAINAGE SYSTEM WHICH IS COLLECTED AND PUMPED FROM THE PUMPING STATION INTO THE RISING MAIN AND UP INTO THE GRAVITY SYSTEM THE ESTIMATED PEAK FOUL FLOW IS SUBJECT TO CONFIRMATION OF NUMBERS AND LAYOUTS OF ROOMS.

THIS DRAWING IS FOR INFORMATION ONLY AND IS SUBJECT TO FURTHER DISCUSSIONS WITH THE RELEVANT AUTHORITIES, DOCK OPERATORS, RIVER AND CANAL TRUST AND SUBSEQUENT FURTHER DETAILED DESIGN - DO NOT CONSTRUCT FROM THIS DRAWING.

THE STRATEGY SHOWN IS SUBJECT TO CONFIRMATION OF RWP, GULLY & SVP NUMBERS AND POSITIONS, PROPOSED LEVELS, POSITION OF TREE AND PLANTING AND CONFIRMATION OF AGREED OUTFALL LEVEL.

THE STRATEGY ASSUMES A GRAVITY FED DRAINAGE SYSTEM IS TO BE USED ON THE DEVELOPMENT WITH NO PUMPING.

- NOTES:
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER ENGINEERS AND ARCHITECTS DRAWINGS, DETAILS AND SPECIFICATIONS.
 - 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 OUTFALL LEVEL.
 - AS CONFIRMED BY THE LEAD LOCAL FLOOD AUTHORITY, NO BETTERMENT IS PROPOSED FOR THE EXISTING BROWNFIELD SITE AS CURRENT SURFACE WATER DRAIN FREELY INTO THE EXISTING DOCK SYSTEM.
 - 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.
 - ALL PROPOSED RESTRICTED FLOW RATES AND CONNECTION POINTS WILL BE SUBJECT TO RELEVANT THIRD PARTY AGREEMENTS AND APPROVALS
 - FOUL WATER FLOW RATES ARE ESTIMATED IN ACCORDANCE WITH BS EN 752:2008 AND DESIGNED FOR PEAK FLOW RATES.
 - IF FOUL WATER CONNECTION IS MADE TO A PUBLIC SEWER, UNITED UTILITIES CONFIRMATION OF APPROVAL FOR THE FLOW RATE ENTERING THE PUBLIC SEWER WILL BE REQUIRED TO PROCEED WITH THE DETAILED DESIGN.

GENERAL NOTES

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT CLANCY CONSULTING, ARCHITECTURAL AND OTHER ENGINEERS DRAWINGS AND SPECIFICATIONS.

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ALL NEW PIPES UP TO BE V.C. TO BSEN 295-1:1991 EXTRA STRENGTH GRADE

ALL PIPES TO BE 150 DIA. MIN FALL 1 : 150 (UNO)

MANHOLES, RODDING EYES ETC. TO BE ENCASED IN S.R.C.

ALL INTERNAL CONNECTIONS TO CONSIST OF STANDARD REST BEND WITH APPROPRIATE ADAPTOR TO CONNECT TO ABOVE GROUND DRAINAGE.

COVER LEVELS TO BE CHECKED AGAINST ARCHITECTS PROPOSED EXTERNAL WORKS LEVEL / DETAIL DRAWINGS

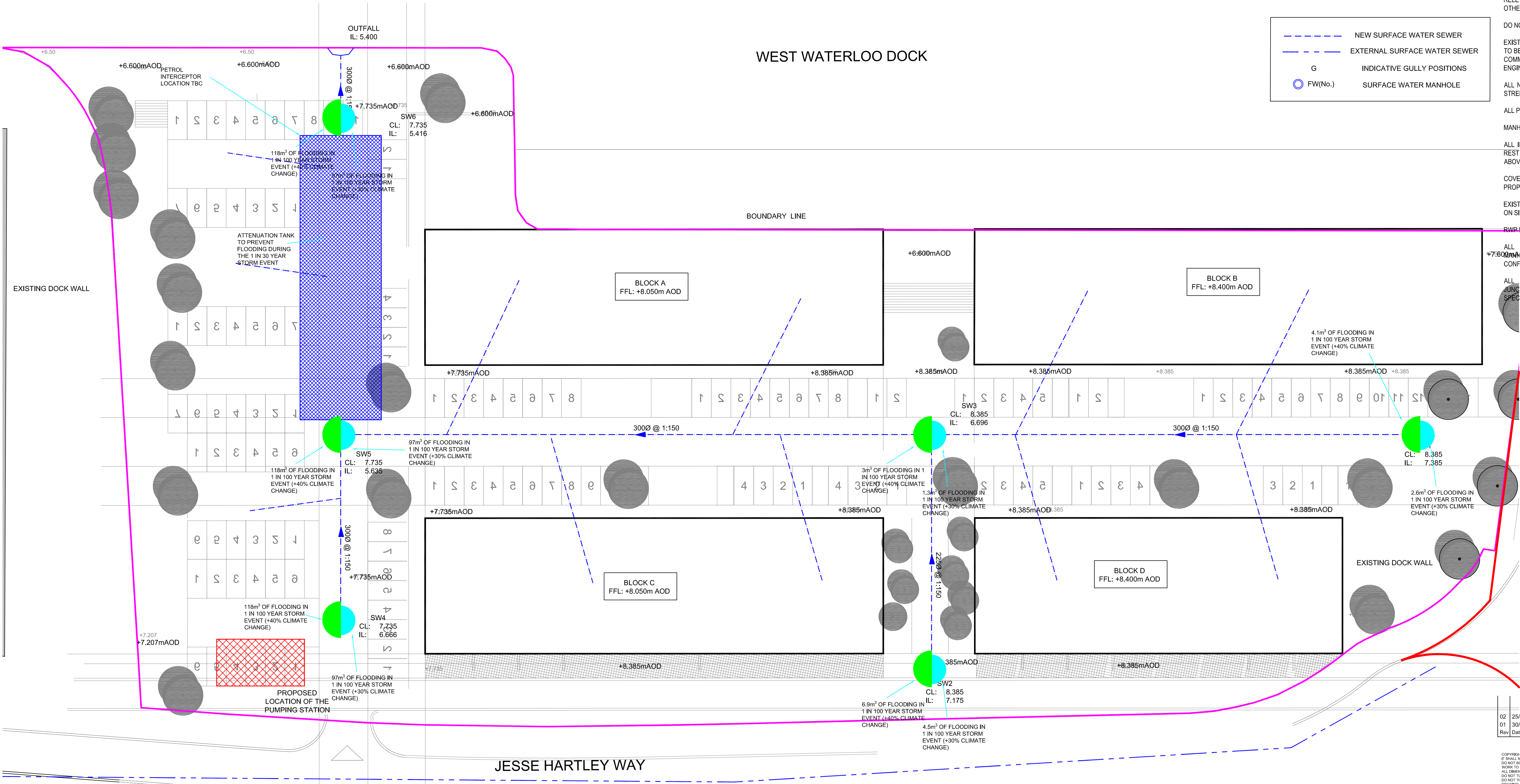
EXISTING MANHOLES, LEVELS & PIPE SIZES TO BE CHECKED ON SITE

RWP POSITIONS ARE TO BE CONFIRMED BY ARCHITECT

ALL CONNECTIONS INTO EXISTING SEWERS ARE VIA MANHOLES, ANY SADDLE CONNECTION IS SUBJECT TO CONFIRMATION FROM LOCAL WATER AUTHORITY.

ALL OUTGOING AND INCOMING PIPES AT MANHOLE JUNCTIONS TO BE CONNECTED SOFFIT TO SOFFIT UNLESS SPECIFIED OTHERWISE.

---	NEW SURFACE WATER SEWER
---	EXTERNAL SURFACE WATER SEWER
G	INDICATIVE GULLY POSITIONS
○ FW(No.)	SURFACE WATER MANHOLE



SURFACE WATER STRATEGY:

THIS DEVELOPMENT IS NOT SUBJECT TO ANY BETTERMENT ON THE EXISTING FLOW AS THE CURRENT SURFACE WATER IS UNDERSTOOD TO DISCHARGE DIRECTLY INTO THE ADJACENT WATERLOO DOCK.

THE FOLLOWING CRITERIA HAVE BEEN ASSESSED;

1 IN 2 YEAR STORM EVENT WITH NO SURCHARGE

1 IN 30 YEAR STORM EVENT WITH NO FLOODING WITH OUTFALL SURCHARGED TO 6.000mAOD.

1 IN 100 YEAR STORM EVENT (+ 30% CLIMATE CHANGE) WITH FLOODING CONTAINED ON SITE WITH OUTFALL SURCHARGED TO 6.000mAOD.

1 IN 100 YEAR STORM EVENT (+ 30% CLIMATE CHANGE) WITH FLOODING CONTAINED ON SITE WITH OUTFALL SURCHARGED TO 7.150mAOD.

THIS DRAWING IS FOR INFORMATION ONLY AND IS SUBJECT TO FURTHER DISCUSSIONS WITH THE RELEVANT AUTHORITIES, DOCK OPERATORS, RIVER AND CANAL TRUST AND SUBSEQUENT FURTHER DETAILED DESIGN - DO NOT CONSTRUCT FROM THIS DRAWING.

THE FLOOD VOLUMES SHOWN IS IS BASED ON THE DRAINAGE STRATEGY WHICH IS SUBJECT TO CONFIRMATION OF RWP, GULLY & SVP NUMBERS AND POSITIONS, PROPOSED LEVELS, POSITION OF TREE AND PLANTING AND CONFIRMATION OF AGREED OUTFALL LEVEL.

THE STRATEGY ASSUMES A GRAVITY FED DRAINAGE SYSTEM IS TO BE USED ON THE DEVELOPMENT WITH NO PUMPING.

02	25/10/19	ISSUED FOR INFORMATION	MD	JG	BRH
01	30/11/18	ISSUED FOR INFORMATION	MD	JG	BRH
Rev	Date	Description	By	Check	App.

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Client		ROMAL CAPITAL GROUP LTD			
Project		PLOT CO2 LIVERPOOL WATERS			
Office		LIVERPOOL			
Discipline		CIVIL			
Title		INDICATIVE FLOOD VOLUMES & LOCATIONS OF FLOODING IN 1 IN 100 YEAR STORM EVENTS			
Scale @ A1		1:250	Status		INFORMATION




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Job Number	Originator	Building/Zone	Level
4/6679	CCL	CO2	EXT
Type	Discipline	Drawing No.	Revision
DRN	C	002	02

APPENDIX C

INITIAL DRAINAGE CALCULATIONS


Clancy Consulting		Page 1
Old Hall Chambers 31 Old Hall Street Liverpool L3 9SY		
Date 26/10/2019 13:44 File C02 1 IN 2 FREE OUTFALL...	Designed by WinDes Checked by	
Micro Drainage Network 2018.1.1		

Existing Network Details for Storm

* - Indicates pipe has been modified outside of System 1


PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	Section Type
* 1.000	58.400	0.389	150.1	0.038	5.00	0.600	o	225	Pipe/Conduit
* 2.000	26.900	0.179	150.3	0.064	5.00	0.600	o	225	Pipe/Conduit
* 1.001	71.500	0.477	149.9	0.300	0.00	0.600	o	300	Pipe/Conduit
* 3.000	22.000	0.147	149.7	0.074	5.00	0.600	o	225	Pipe/Conduit
* 1.002	33.000	0.220	150.0	0.362	0.00	0.600	o	450	Pipe/Conduit
* 1.003	15.400	0.077	200.0	0.108	0.00	0.600	o	450	Pipe/Conduit

PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
* 1.000	mhs 1	8.385	7.385	0.775	8.385	6.996	1.164		1200
* 2.000	mhs 2	8.385	7.175	0.985	8.385	6.996	1.164		1200
* 1.001	mhs 3	8.385	6.996	1.089	7.735	6.519	0.916		1200
* 3.000	mhs 4	7.735	6.666	0.844	7.735	6.519	0.991		1200
* 1.002	mhs 5	7.735	6.519	0.766	7.735	6.299	0.986		1500
* 1.003	mhs 6	7.735	5.477	1.808	6.600	5.400	0.750		1500

Clancy Consulting		Page 2
Old Hall Chambers 31 Old Hall Street Liverpool L3 9SY		
Date 26/10/2019 13:44	Designed by WinDes	
File C02 1 IN 2 FREE OUTFALL...	Checked by	
Micro Drainage		Network 2018.1.1

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
mhs 1	8.385	1.000	Open Manhole	1200	1.000	7.385	225				
mhs 2	8.385	1.210	Open Manhole	1200	2.000	7.175	225				
mhs 3	8.385	1.389	Open Manhole	1200	1.001	6.996	300	1.000	6.996	225	
								2.000	6.996	225	
mhs 4	7.735	1.069	Open Manhole	1200	3.000	6.666	225				
mhs 5	7.735	1.216	Open Manhole	1500	1.002	6.519	450	1.001	6.519	300	
								3.000	6.519	225	
mhs 6	7.735	2.258	Open Manhole	1500	1.003	5.477	450	1.002	6.299	450	822
	6.600	1.200	Open Manhole	0		OUTFALL		1.003	5.400	450	

Clancy Consulting	Page 3
Old Hall Chambers 31 Old Hall Street Liverpool L3 9SY	
Date 26/10/2019 13:44 File C02 1 IN 2 FREE OUTFALL...	
Micro Drainage	

Designed by WinDes
Checked by
Network 2018.1.1

PIPELINE SCHEDULES for Storm

Upstream Manhole

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	225	mhs 1	8.385	7.385	0.775	Open Manhole	1200
2.000	o	225	mhs 2	8.385	7.175	0.985	Open Manhole	1200
1.001	o	300	mhs 3	8.385	6.996	1.089	Open Manhole	1200
3.000	o	225	mhs 4	7.735	6.666	0.844	Open Manhole	1200
1.002	o	450	mhs 5	7.735	6.519	0.766	Open Manhole	1500
1.003	o	450	mhs 6	7.735	5.477	1.808	Open Manhole	1500

Downstream Manhole

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	58.400	150.1	mhs 3	8.385	6.996	1.164	Open Manhole	1200
2.000	26.900	150.3	mhs 3	8.385	6.996	1.164	Open Manhole	1200
1.001	71.500	149.9	mhs 5	7.735	6.519	0.916	Open Manhole	1500
3.000	22.000	149.7	mhs 5	7.735	6.519	0.991	Open Manhole	1500
1.002	33.000	150.0	mhs 6	7.735	6.299	0.986	Open Manhole	1500
1.003	15.400	200.0		6.600	5.400	0.750	Open Manhole	0

Free Flowing Outfall Details for Storm


Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
------------------------	-----------------	-----------------	-----------------	------------------------	-------------	-----------

1.003		6.600	5.400	0.000	0	0
-------	--	-------	-------	-------	---	---

Volume Summary (Static)

Length Calculations based on Centre-Centre


Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	mhs 1	1.131	2.322	0.000	3.453
2.000	mhs 2	1.368	1.070	0.000	2.438
1.001	mhs 3	1.571	5.054	0.000	6.625
3.000	mhs 4	1.209	0.875	0.000	2.084
1.002	mhs 5	2.149	5.248	0.000	7.397
1.003	mhs 6	3.990	2.449	0.000	6.439
Total		11.418	17.018	0.000	28.437

Clancy Consulting		Page 4
Old Hall Chambers 31 Old Hall Street Liverpool L3 9SY		
Date 26/10/2019 13:44 File C02 1 IN 2 FREE OUTFALL...	Designed by WinDes Checked by	
Micro Drainage	Network 2018.1.1	

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	mhs 1	1.131	2.274	0.000	3.405
2.000	mhs 2	1.368	1.022	0.000	2.390
1.001	mhs 3	1.571	4.959	0.000	6.530
3.000	mhs 4	1.209	0.821	0.000	2.030
1.002	mhs 5	2.149	5.010	0.000	7.159
1.003	mhs 6	3.990	2.330	0.000	6.320
Total		11.418	16.416	0.000	27.834

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2 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 Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details


Rainfall Model FSR M5-60 (mm) 19.100 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.400 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960,
 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
 Return Period(s) (years) 2
 Climate Change (%) 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	mhs 1	15 Winter	2	+0%					7.445	-0.165	0.000
2.000	mhs 2	15 Winter	2	+0%					7.256	-0.144	0.000
1.001	mhs 3	15 Winter	2	+0%					7.180	-0.116	0.000
3.000	mhs 4	15 Winter	2	+0%					6.776	-0.115	0.000
1.002	mhs 5	15 Winter	2	+0%					6.751	-0.218	0.000
1.003	mhs 6	15 Winter	2	+0%					5.782	-0.145	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Level Status Exceeded
1.000	mhs 1	0.15		6.3	OK
2.000	mhs 2	0.27		10.8	OK
1.001	mhs 3	0.67		58.1	OK
3.000	mhs 4	0.31		12.0	OK
1.002	mhs 5	0.52		118.9	OK
1.003	mhs 6	0.79		133.5	OK


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Existing Network Details for Storm

* - Indicates pipe has been modified outside of System 1


PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	Section Type
* 1.000	58.400	0.389	150.1	0.038	5.00	0.600	o	225	Pipe/Conduit
* 2.000	26.900	0.179	150.3	0.064	5.00	0.600	o	225	Pipe/Conduit
* 1.001	71.500	0.477	149.9	0.300	0.00	0.600	o	300	Pipe/Conduit
* 3.000	22.000	0.147	149.7	0.074	5.00	0.600	o	300	Pipe/Conduit
* 1.002	33.000	0.220	150.0	0.362	0.00	0.600	o	225	Pipe/Conduit
* 1.003	15.400	0.015	1026.7	0.108	0.00	0.600	o	225	Pipe/Conduit

PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
* 1.000	mhs 1	8.385	7.385	0.775	8.385	6.996	1.164		1200
* 2.000	mhs 2	8.385	7.175	0.985	8.385	6.996	1.164		1200
* 1.001	mhs 3	8.385	6.996	1.089	7.735	6.519	0.916		1200
* 3.000	mhs 4	7.735	6.666	0.769	7.735	6.519	0.916		1200
* 1.002	mhs 5	7.735	5.635	1.875	7.735	5.415	2.095		300
* 1.003	mhs 6	7.735	5.415	2.095	6.600	5.400	0.975		1500

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
mhs 1	8.385	1.000	Open Manhole	1200	1.000	7.385	225				
mhs 2	8.385	1.210	Open Manhole	1200	2.000	7.175	225				
mhs 3	8.385	1.389	Open Manhole	1200	1.001	6.996	300	1.000	6.996	225	
								2.000	6.996	225	
mhs 4	7.735	1.069	Open Manhole	1200	3.000	6.666	300				
mhs 5	7.735	2.100	Open Manhole	300	1.002	5.635	225	1.001	6.519	300	959
								3.000	6.519	300	959
mhs 6	7.735	2.320	Open Manhole	1500	1.003	5.415	225	1.002	5.415	225	
	6.600	1.200	Open Manhole	0		OUTFALL		1.003	5.400	225	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

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	225	mhs 1	8.385	7.385	0.775	Open Manhole	1200
2.000	o	225	mhs 2	8.385	7.175	0.985	Open Manhole	1200
1.001	o	300	mhs 3	8.385	6.996	1.089	Open Manhole	1200
3.000	o	300	mhs 4	7.735	6.666	0.769	Open Manhole	1200
1.002	o	225	mhs 5	7.735	5.635	1.875	Open Manhole	300
1.003	o	225	mhs 6	7.735	5.415	2.095	Open Manhole	1500

Downstream Manhole

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	58.400	150.1	mhs 3	8.385	6.996	1.164	Open Manhole	1200
2.000	26.900	150.3	mhs 3	8.385	6.996	1.164	Open Manhole	1200
1.001	71.500	149.9	mhs 5	7.735	6.519	0.916	Open Manhole	300
3.000	22.000	149.7	mhs 5	7.735	6.519	0.916	Open Manhole	300
1.002	33.000	150.0	mhs 6	7.735	5.415	2.095	Open Manhole	1500
1.003	15.400	1026.7		6.600	5.400	0.975	Open Manhole	0


Surcharged Outfall Details for Storm


Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
------------------------	-----------------	-----------------	-----------------	------------------------	-------------	-----------

1.003 6.600 5.400 0.000 0 0

Datum (m) 6.000 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1	6.000	16	6.000	31	6.000	46	6.000	61	6.000	76	6.000	91	6.000	106	6.000
2	6.000	17	6.000	32	6.000	47	6.000	62	6.000	77	6.000	92	6.000	107	6.000
3	6.000	18	6.000	33	6.000	48	6.000	63	6.000	78	6.000	93	6.000	108	6.000
4	6.000	19	6.000	34	6.000	49	6.000	64	6.000	79	6.000	94	6.000	109	6.000
5	6.000	20	6.000	35	6.000	50	6.000	65	6.000	80	6.000	95	6.000	110	6.000
6	6.000	21	6.000	36	6.000	51	6.000	66	6.000	81	6.000	96	6.000	111	6.000
7	6.000	22	6.000	37	6.000	52	6.000	67	6.000	82	6.000	97	6.000	112	6.000
8	6.000	23	6.000	38	6.000	53	6.000	68	6.000	83	6.000	98	6.000	113	6.000
9	6.000	24	6.000	39	6.000	54	6.000	69	6.000	84	6.000	99	6.000	114	6.000
10	6.000	25	6.000	40	6.000	55	6.000	70	6.000	85	6.000	100	6.000	115	6.000
11	6.000	26	6.000	41	6.000	56	6.000	71	6.000	86	6.000	101	6.000	116	6.000
12	6.000	27	6.000	42	6.000	57	6.000	72	6.000	87	6.000	102	6.000	117	6.000
13	6.000	28	6.000	43	6.000	58	6.000	73	6.000	88	6.000	103	6.000	118	6.000
14	6.000	29	6.000	44	6.000	59	6.000	74	6.000	89	6.000	104	6.000	119	6.000
15	6.000	30	6.000	45	6.000	60	6.000	75	6.000	90	6.000	105	6.000	120	6.000

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Surcharged Outfall Details for Storm													
Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
121	6.000	183	6.000	245	6.000	307	6.000	369	6.000	431	6.000	493	6.000
122	6.000	184	6.000	246	6.000	308	6.000	370	6.000	432	6.000	494	6.000
123	6.000	185	6.000	247	6.000	309	6.000	371	6.000	433	6.000	495	6.000
124	6.000	186	6.000	248	6.000	310	6.000	372	6.000	434	6.000	496	6.000
125	6.000	187	6.000	249	6.000	311	6.000	373	6.000	435	6.000	497	6.000
126	6.000	188	6.000	250	6.000	312	6.000	374	6.000	436	6.000	498	6.000
127	6.000	189	6.000	251	6.000	313	6.000	375	6.000	437	6.000	499	6.000
128	6.000	190	6.000	252	6.000	314	6.000	376	6.000	438	6.000	500	6.000
129	6.000	191	6.000	253	6.000	315	6.000	377	6.000	439	6.000	501	6.000
130	6.000	192	6.000	254	6.000	316	6.000	378	6.000	440	6.000	502	6.000
131	6.000	193	6.000	255	6.000	317	6.000	379	6.000	441	6.000	503	6.000
132	6.000	194	6.000	256	6.000	318	6.000	380	6.000	442	6.000	504	6.000
133	6.000	195	6.000	257	6.000	319	6.000	381	6.000	443	6.000	505	6.000
134	6.000	196	6.000	258	6.000	320	6.000	382	6.000	444	6.000	506	6.000
135	6.000	197	6.000	259	6.000	321	6.000	383	6.000	445	6.000	507	6.000
136	6.000	198	6.000	260	6.000	322	6.000	384	6.000	446	6.000	508	6.000
137	6.000	199	6.000	261	6.000	323	6.000	385	6.000	447	6.000	509	6.000
138	6.000	200	6.000	262	6.000	324	6.000	386	6.000	448	6.000	510	6.000
139	6.000	201	6.000	263	6.000	325	6.000	387	6.000	449	6.000	511	6.000
140	6.000	202	6.000	264	6.000	326	6.000	388	6.000	450	6.000	512	6.000
141	6.000	203	6.000	265	6.000	327	6.000	389	6.000	451	6.000	513	6.000
142	6.000	204	6.000	266	6.000	328	6.000	390	6.000	452	6.000	514	6.000
143	6.000	205	6.000	267	6.000	329	6.000	391	6.000	453	6.000	515	6.000
144	6.000	206	6.000	268	6.000	330	6.000	392	6.000	454	6.000	516	6.000
145	6.000	207	6.000	269	6.000	331	6.000	393	6.000	455	6.000	517	6.000
146	6.000	208	6.000	270	6.000	332	6.000	394	6.000	456	6.000	518	6.000
147	6.000	209	6.000	271	6.000	333	6.000	395	6.000	457	6.000	519	6.000
148	6.000	210	6.000	272	6.000	334	6.000	396	6.000	458	6.000	520	6.000
149	6.000	211	6.000	273	6.000	335	6.000	397	6.000	459	6.000	521	6.000
150	6.000	212	6.000	274	6.000	336	6.000	398	6.000	460	6.000	522	6.000
151	6.000	213	6.000	275	6.000	337	6.000	399	6.000	461	6.000	523	6.000
152	6.000	214	6.000	276	6.000	338	6.000	400	6.000	462	6.000	524	6.000
153	6.000	215	6.000	277	6.000	339	6.000	401	6.000	463	6.000	525	6.000
154	6.000	216	6.000	278	6.000	340	6.000	402	6.000	464	6.000	526	6.000
155	6.000	217	6.000	279	6.000	341	6.000	403	6.000	465	6.000	527	6.000
156	6.000	218	6.000	280	6.000	342	6.000	404	6.000	466	6.000	528	6.000
157	6.000	219	6.000	281	6.000	343	6.000	405	6.000	467	6.000	529	6.000
158	6.000	220	6.000	282	6.000	344	6.000	406	6.000	468	6.000	530	6.000
159	6.000	221	6.000	283	6.000	345	6.000	407	6.000	469	6.000	531	6.000
160	6.000	222	6.000	284	6.000	346	6.000	408	6.000	470	6.000	532	6.000
161	6.000	223	6.000	285	6.000	347	6.000	409	6.000	471	6.000	533	6.000
162	6.000	224	6.000	286	6.000	348	6.000	410	6.000	472	6.000	534	6.000
163	6.000	225	6.000	287	6.000	349	6.000	411	6.000	473	6.000	535	6.000
164	6.000	226	6.000	288	6.000	350	6.000	412	6.000	474	6.000	536	6.000
165	6.000	227	6.000	289	6.000	351	6.000	413	6.000	475	6.000	537	6.000
166	6.000	228	6.000	290	6.000	352	6.000	414	6.000	476	6.000	538	6.000
167	6.000	229	6.000	291	6.000	353	6.000	415	6.000	477	6.000	539	6.000
168	6.000	230	6.000	292	6.000	354	6.000	416	6.000	478	6.000	540	6.000
169	6.000	231	6.000	293	6.000	355	6.000	417	6.000	479	6.000	541	6.000
170	6.000	232	6.000	294	6.000	356	6.000	418	6.000	480	6.000	542	6.000
171	6.000	233	6.000	295	6.000	357	6.000	419	6.000	481	6.000	543	6.000
172	6.000	234	6.000	296	6.000	358	6.000	420	6.000	482	6.000	544	6.000
173	6.000	235	6.000	297	6.000	359	6.000	421	6.000	483	6.000	545	6.000
174	6.000	236	6.000	298	6.000	360	6.000	422	6.000	484	6.000	546	6.000
175	6.000	237	6.000	299	6.000	361	6.000	423	6.000	485	6.000	547	6.000
176	6.000	238	6.000	300	6.000	362	6.000	424	6.000	486	6.000	548	6.000
177	6.000	239	6.000	301	6.000	363	6.000	425	6.000	487	6.000	549	6.000
178	6.000	240	6.000	302	6.000	364	6.000	426	6.000	488	6.000	550	6.000
179	6.000	241	6.000	303	6.000	365	6.000	427	6.000	489	6.000	551	6.000
180	6.000	242	6.000	304	6.000	366	6.000	428	6.000	490	6.000	552	6.000
181	6.000	243	6.000	305	6.000	367	6.000	429	6.000	491	6.000	553	6.000
182	6.000	244	6.000	306	6.000	368	6.000	430	6.000	492	6.000	554	6.000
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Surcharged Outfall Details for Storm


Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1113	6.000	1154	6.000	1195	6.000	1236	6.000	1277	6.000	1318	6.000	1359	6.000
1114	6.000	1155	6.000	1196	6.000	1237	6.000	1278	6.000	1319	6.000	1360	6.000
1115	6.000	1156	6.000	1197	6.000	1238	6.000	1279	6.000	1320	6.000	1361	6.000
1116	6.000	1157	6.000	1198	6.000	1239	6.000	1280	6.000	1321	6.000	1362	6.000
1117	6.000	1158	6.000	1199	6.000	1240	6.000	1281	6.000	1322	6.000	1363	6.000
1118	6.000	1159	6.000	1200	6.000	1241	6.000	1282	6.000	1323	6.000	1364	6.000
1119	6.000	1160	6.000	1201	6.000	1242	6.000	1283	6.000	1324	6.000	1365	6.000
1120	6.000	1161	6.000	1202	6.000	1243	6.000	1284	6.000	1325	6.000	1366	6.000
1121	6.000	1162	6.000	1203	6.000	1244	6.000	1285	6.000	1326	6.000	1367	6.000
1122	6.000	1163	6.000	1204	6.000	1245	6.000	1286	6.000	1327	6.000	1368	6.000
1123	6.000	1164	6.000	1205	6.000	1246	6.000	1287	6.000	1328	6.000	1369	6.000
1124	6.000	1165	6.000	1206	6.000	1247	6.000	1288	6.000	1329	6.000	1370	6.000
1125	6.000	1166	6.000	1207	6.000	1248	6.000	1289	6.000	1330	6.000	1371	6.000
1126	6.000	1167	6.000	1208	6.000	1249	6.000	1290	6.000	1331	6.000	1372	6.000
1127	6.000	1168	6.000	1209	6.000	1250	6.000	1291	6.000	1332	6.000	1373	6.000
1128	6.000	1169	6.000	1210	6.000	1251	6.000	1292	6.000	1333	6.000	1374	6.000
1129	6.000	1170	6.000	1211	6.000	1252	6.000	1293	6.000	1334	6.000	1375	6.000
1130	6.000	1171	6.000	1212	6.000	1253	6.000	1294	6.000	1335	6.000	1376	6.000
1131	6.000	1172	6.000	1213	6.000	1254	6.000	1295	6.000	1336	6.000	1377	6.000
1132	6.000	1173	6.000	1214	6.000	1255	6.000	1296	6.000	1337	6.000	1378	6.000
1133	6.000	1174	6.000	1215	6.000	1256	6.000	1297	6.000	1338	6.000	1379	6.000
1134	6.000	1175	6.000	1216	6.000	1257	6.000	1298	6.000	1339	6.000	1380	6.000
1135	6.000	1176	6.000	1217	6.000	1258	6.000	1299	6.000	1340	6.000	1381	6.000
1136	6.000	1177	6.000	1218	6.000	1259	6.000	1300	6.000	1341	6.000	1382	6.000
1137	6.000	1178	6.000	1219	6.000	1260	6.000	1301	6.000	1342	6.000	1383	6.000
1138	6.000	1179	6.000	1220	6.000	1261	6.000	1302	6.000	1343	6.000	1384	6.000
1139	6.000	1180	6.000	1221	6.000	1262	6.000	1303	6.000	1344	6.000	1385	6.000
1140	6.000	1181	6.000	1222	6.000	1263	6.000	1304	6.000	1345	6.000	1386	6.000
1141	6.000	1182	6.000	1223	6.000	1264	6.000	1305	6.000	1346	6.000	1387	6.000
1142	6.000	1183	6.000	1224	6.000	1265	6.000	1306	6.000	1347	6.000	1388	6.000
1143	6.000	1184	6.000	1225	6.000	1266	6.000	1307	6.000	1348	6.000	1389	6.000
1144	6.000	1185	6.000	1226	6.000	1267	6.000	1308	6.000	1349	6.000	1390	6.000
1145	6.000	1186	6.000	1227	6.000	1268	6.000	1309	6.000	1350	6.000	1391	6.000
1146	6.000	1187	6.000	1228	6.000	1269	6.000	1310	6.000	1351	6.000	1392	6.000
1147	6.000	1188	6.000	1229	6.000	1270	6.000	1311	6.000	1352	6.000	1393	6.000
1148	6.000	1189	6.000	1230	6.000	1271	6.000	1312	6.000	1353	6.000	1394	6.000
1149	6.000	1190	6.000	1231	6.000	1272	6.000	1313	6.000	1354	6.000	1395	6.000
1150	6.000	1191	6.000	1232	6.000	1273	6.000	1314	6.000	1355	6.000	1396	6.000
1151	6.000	1192	6.000	1233	6.000	1274	6.000	1315	6.000	1356	6.000	1397	6.000
1152	6.000	1193	6.000	1234	6.000	1275	6.000	1316	6.000	1357	6.000	1398	6.000
1153	6.000	1194	6.000	1235	6.000	1276	6.000	1317	6.000	1358	6.000	1399	6.000


Simulation Criteria for Storm

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.400
Return Period (years)	30	Profile Type	Summer
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

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<p style="text-align: center;"><u>Synthetic Rainfall Details</u></p> <p style="text-align: center;">Storm Duration (mins) 30</p>		
<p style="text-align: center;">©1982-2018 Innovyze</p>		

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Storage Structures for Storm

Cellular Storage Manhole: mhs 5, DS/PN: 1.002

Invert Level (m) 5.635 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	350.0	350.0	1.499	350.0	485.0	1.500	0.0	485.0

Volume Summary (Static)


Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	mhs 1	1.131	2.322	0.000	3.453
2.000	mhs 2	1.368	1.070	0.000	2.438
1.001	mhs 3	1.571	5.054	0.000	6.625
3.000	mhs 4	1.209	1.555	0.000	2.764
1.002	mhs 5	0.148	1.312	498.528	499.989
1.003	mhs 6	4.100	0.612	0.000	4.712
Total		9.528	11.925	498.528	519.981

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	mhs 1	1.131	2.274	0.000	3.405
2.000	mhs 2	1.368	1.022	0.000	2.390
1.001	mhs 3	1.571	5.001	0.000	6.572
3.000	mhs 4	1.209	1.502	0.000	2.711
1.002	mhs 5	0.148	1.276	498.528	499.953
1.003	mhs 6	4.100	0.582	0.000	4.682
Total		9.528	11.658	498.528	519.714

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

Synthetic Rainfall Details


Rainfall Model FSR M5-60 (mm) 19.100 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.400 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS 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) 30, 100
 Climate Change (%) 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	mhs 1	15 Winter	30	+0%	30/15 Summer	100/15 Summer			7.658	0.048
2.000	mhs 2	15 Winter	30	+0%	30/15 Summer	100/15 Summer			7.666	0.266
1.001	mhs 3	15 Winter	30	+0%	30/15 Summer	100/15 Summer			7.622	0.326
3.000	mhs 4	1440 Winter	30	+0%	30/1440 Winter	100/240 Winter			7.073	0.107
1.002	mhs 5	1440 Winter	30	+0%	30/15 Summer	100/240 Winter			7.073	1.213
1.003	mhs 6	1440 Winter	30	+0%	30/15 Summer	30/960 Winter			7.315	1.675

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	mhs 1	0.000	0.29		12.0	SURCHARGED	3
2.000	mhs 2	0.000	0.51		19.9	SURCHARGED	3
1.001	mhs 3	0.000	1.30		112.7	SURCHARGED	3
3.000	mhs 4	0.000	0.01		1.1	SURCHARGED	13
1.002	mhs 5	0.000	1.61		64.2	SURCHARGED	13
1.003	mhs 6	0.000	6.01		64.4	SURCHARGED	13


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Existing Network Details for Storm

* - Indicates pipe has been modified outside of System 1


PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	Section Type
* 1.000	58.400	0.389	150.1	0.038	5.00	0.600	o	225	Pipe/Conduit
* 2.000	26.900	0.179	150.3	0.064	5.00	0.600	o	225	Pipe/Conduit
* 1.001	71.500	0.477	149.9	0.300	0.00	0.600	o	300	Pipe/Conduit
* 3.000	22.000	0.147	149.7	0.074	5.00	0.600	o	300	Pipe/Conduit
* 1.002	33.000	0.220	150.0	0.362	0.00	0.600	o	225	Pipe/Conduit
* 1.003	15.400	0.015	1026.7	0.108	0.00	0.600	o	225	Pipe/Conduit

PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
* 1.000	mhs 1	8.385	7.385	0.775	8.385	6.996	1.164		1200
* 2.000	mhs 2	8.385	7.175	0.985	8.385	6.996	1.164		1200
* 1.001	mhs 3	8.385	6.996	1.089	7.735	6.519	0.916		1200
* 3.000	mhs 4	7.735	6.666	0.769	7.735	6.519	0.916		1200
* 1.002	mhs 5	7.735	5.635	1.875	7.735	5.415	2.095		300
* 1.003	mhs 6	7.735	5.415	2.095	6.600	5.400	0.975		1500

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
mhs 1	8.385	1.000	Open Manhole	1200	1.000	7.385	225				
mhs 2	8.385	1.210	Open Manhole	1200	2.000	7.175	225				
mhs 3	8.385	1.389	Open Manhole	1200	1.001	6.996	300	1.000	6.996	225	
								2.000	6.996	225	
mhs 4	7.735	1.069	Open Manhole	1200	3.000	6.666	300				
mhs 5	7.735	2.100	Open Manhole	300	1.002	5.635	225	1.001	6.519	300	959
								3.000	6.519	300	959
mhs 6	7.735	2.320	Open Manhole	1500	1.003	5.415	225	1.002	5.415	225	
	6.600	1.200	Open Manhole	0		OUTFALL		1.003	5.400	225	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

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	225	mhs 1	8.385	7.385	0.775	Open Manhole	1200
2.000	o	225	mhs 2	8.385	7.175	0.985	Open Manhole	1200
1.001	o	300	mhs 3	8.385	6.996	1.089	Open Manhole	1200
3.000	o	300	mhs 4	7.735	6.666	0.769	Open Manhole	1200
1.002	o	225	mhs 5	7.735	5.635	1.875	Open Manhole	300
1.003	o	225	mhs 6	7.735	5.415	2.095	Open Manhole	1500

Downstream Manhole

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	58.400	150.1	mhs 3	8.385	6.996	1.164	Open Manhole	1200
2.000	26.900	150.3	mhs 3	8.385	6.996	1.164	Open Manhole	1200
1.001	71.500	149.9	mhs 5	7.735	6.519	0.916	Open Manhole	300
3.000	22.000	149.7	mhs 5	7.735	6.519	0.916	Open Manhole	300
1.002	33.000	150.0	mhs 6	7.735	5.415	2.095	Open Manhole	1500
1.003	15.400	1026.7		6.600	5.400	0.975	Open Manhole	0


Surcharged Outfall Details for Storm


Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
------------------------	-----------------	-----------------	-----------------	------------------------	-------------	-----------


1.003 6.600 5.400 0.000 0 0


Datum (m) 7.150 Offset (mins) 0


Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1	7.150	16	7.150	31	7.150	46	7.150	61	7.150	76	7.150	91	7.150
2	7.150	17	7.150	32	7.150	47	7.150	62	7.150	77	7.150	92	7.150
3	7.150	18	7.150	33	7.150	48	7.150	63	7.150	78	7.150	93	7.150
4	7.150	19	7.150	34	7.150	49	7.150	64	7.150	79	7.150	94	7.150
5	7.150	20	7.150	35	7.150	50	7.150	65	7.150	80	7.150	95	7.150
6	7.150	21	7.150	36	7.150	51	7.150	66	7.150	81	7.150	96	7.150
7	7.150	22	7.150	37	7.150	52	7.150	67	7.150	82	7.150	97	7.150
8	7.150	23	7.150	38	7.150	53	7.150	68	7.150	83	7.150	98	7.150
9	7.150	24	7.150	39	7.150	54	7.150	69	7.150	84	7.150	99	7.150
10	7.150	25	7.150	40	7.150	55	7.150	70	7.150	85	7.150	100	7.150
11	7.150	26	7.150	41	7.150	56	7.150	71	7.150	86	7.150	101	7.150
12	7.150	27	7.150	42	7.150	57	7.150	72	7.150	87	7.150	102	7.150
13	7.150	28	7.150	43	7.150	58	7.150	73	7.150	88	7.150	103	7.150
14	7.150	29	7.150	44	7.150	59	7.150	74	7.150	89	7.150	104	7.150
15	7.150	30	7.150	45	7.150	60	7.150	75	7.150	90	7.150	105	7.150

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Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
121	7.150	183	7.150	245	7.150	307	7.150	369	7.150	431	7.150	493	7.150
122	7.150	184	7.150	246	7.150	308	7.150	370	7.150	432	7.150	494	7.150
123	7.150	185	7.150	247	7.150	309	7.150	371	7.150	433	7.150	495	7.150
124	7.150	186	7.150	248	7.150	310	7.150	372	7.150	434	7.150	496	7.150
125	7.150	187	7.150	249	7.150	311	7.150	373	7.150	435	7.150	497	7.150
126	7.150	188	7.150	250	7.150	312	7.150	374	7.150	436	7.150	498	7.150
127	7.150	189	7.150	251	7.150	313	7.150	375	7.150	437	7.150	499	7.150
128	7.150	190	7.150	252	7.150	314	7.150	376	7.150	438	7.150	500	7.150
129	7.150	191	7.150	253	7.150	315	7.150	377	7.150	439	7.150	501	7.150
130	7.150	192	7.150	254	7.150	316	7.150	378	7.150	440	7.150	502	7.150
131	7.150	193	7.150	255	7.150	317	7.150	379	7.150	441	7.150	503	7.150
132	7.150	194	7.150	256	7.150	318	7.150	380	7.150	442	7.150	504	7.150
133	7.150	195	7.150	257	7.150	319	7.150	381	7.150	443	7.150	505	7.150
134	7.150	196	7.150	258	7.150	320	7.150	382	7.150	444	7.150	506	7.150
135	7.150	197	7.150	259	7.150	321	7.150	383	7.150	445	7.150	507	7.150
136	7.150	198	7.150	260	7.150	322	7.150	384	7.150	446	7.150	508	7.150
137	7.150	199	7.150	261	7.150	323	7.150	385	7.150	447	7.150	509	7.150
138	7.150	200	7.150	262	7.150	324	7.150	386	7.150	448	7.150	510	7.150
139	7.150	201	7.150	263	7.150	325	7.150	387	7.150	449	7.150	511	7.150
140	7.150	202	7.150	264	7.150	326	7.150	388	7.150	450	7.150	512	7.150
141	7.150	203	7.150	265	7.150	327	7.150	389	7.150	451	7.150	513	7.150
142	7.150	204	7.150	266	7.150	328	7.150	390	7.150	452	7.150	514	7.150
143	7.150	205	7.150	267	7.150	329	7.150	391	7.150	453	7.150	515	7.150
144	7.150	206	7.150	268	7.150	330	7.150	392	7.150	454	7.150	516	7.150
145	7.150	207	7.150	269	7.150	331	7.150	393	7.150	455	7.150	517	7.150
146	7.150	208	7.150	270	7.150	332	7.150	394	7.150	456	7.150	518	7.150
147	7.150	209	7.150	271	7.150	333	7.150	395	7.150	457	7.150	519	7.150
148	7.150	210	7.150	272	7.150	334	7.150	396	7.150	458	7.150	520	7.150
149	7.150	211	7.150	273	7.150	335	7.150	397	7.150	459	7.150	521	7.150
150	7.150	212	7.150	274	7.150	336	7.150	398	7.150	460	7.150	522	7.150
151	7.150	213	7.150	275	7.150	337	7.150	399	7.150	461	7.150	523	7.150
152	7.150	214	7.150	276	7.150	338	7.150	400	7.150	462	7.150	524	7.150
153	7.150	215	7.150	277	7.150	339	7.150	401	7.150	463	7.150	525	7.150
154	7.150	216	7.150	278	7.150	340	7.150	402	7.150	464	7.150	526	7.150
155	7.150	217	7.150	279	7.150	341	7.150	403	7.150	465	7.150	527	7.150
156	7.150	218	7.150	280	7.150	342	7.150	404	7.150	466	7.150	528	7.150
157	7.150	219	7.150	281	7.150	343	7.150	405	7.150	467	7.150	529	7.150
158	7.150	220	7.150	282	7.150	344	7.150	406	7.150	468	7.150	530	7.150
159	7.150	221	7.150	283	7.150	345	7.150	407	7.150	469	7.150	531	7.150
160	7.150	222	7.150	284	7.150	346	7.150	408	7.150	470	7.150	532	7.150
161	7.150	223	7.150	285	7.150	347	7.150	409	7.150	471	7.150	533	7.150
162	7.150	224	7.150	286	7.150	348	7.150	410	7.150	472	7.150	534	7.150
163	7.150	225	7.150	287	7.150	349	7.150	411	7.150	473	7.150	535	7.150
164	7.150	226	7.150	288	7.150	350	7.150	412	7.150	474	7.150	536	7.150
165	7.150	227	7.150	289	7.150	351	7.150	413	7.150	475	7.150	537	7.150
166	7.150	228	7.150	290	7.150	352	7.150	414	7.150	476	7.150	538	7.150
167	7.150	229	7.150	291	7.150	353	7.150	415	7.150	477	7.150	539	7.150
168	7.150	230	7.150	292	7.150	354	7.150	416	7.150	478	7.150	540	7.150
169	7.150	231	7.150	293	7.150	355	7.150	417	7.150	479	7.150	541	7.150
170	7.150	232	7.150	294	7.150	356	7.150	418	7.150	480	7.150	542	7.150
171	7.150	233	7.150	295	7.150	357	7.150	419	7.150	481	7.150	543	7.150
172	7.150	234	7.150	296	7.150	358	7.150	420	7.150	482	7.150	544	7.150
173	7.150	235	7.150	297	7.150	359	7.150	421	7.150	483	7.150	545	7.150
174	7.150	236	7.150	298	7.150	360	7.150	422	7.150	484	7.150	546	7.150
175	7.150	237	7.150	299	7.150	361	7.150	423	7.150	485	7.150	547	7.150
176	7.150	238	7.150	300	7.150	362	7.150	424	7.150	486	7.150	548	7.150
177	7.150	239	7.150	301	7.150	363	7.150	425	7.150	487	7.150	549	7.150
178	7.150	240	7.150	302	7.150	364	7.150	426	7.150	488	7.150	550	7.150
179	7.150	241	7.150	303	7.150	365	7.150	427	7.150	489	7.150	551	7.150
180	7.150	242	7.150	304	7.150	366	7.150	428	7.150	490	7.150	552	7.150
181	7.150	243	7.150	305	7.150	367	7.150	429	7.150	491	7.150	553	7.150
182	7.150	244	7.150	306	7.150	368	7.150	430	7.150	492	7.150	554	7.150
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Micro Drainage												Network 2018.1.1	
Surcharged Outfall Details for Storm													
Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
617	7.150	679	7.150	741	7.150	803	7.150	865	7.150	927	7.150	989	7.150
618	7.150	680	7.150	742	7.150	804	7.150	866	7.150	928	7.150	990	7.150
619	7.150	681	7.150	743	7.150	805	7.150	867	7.150	929	7.150	991	7.150
620	7.150	682	7.150	744	7.150	806	7.150	868	7.150	930	7.150	992	7.150
621	7.150	683	7.150	745	7.150	807	7.150	869	7.150	931	7.150	993	7.150
622	7.150	684	7.150	746	7.150	808	7.150	870	7.150	932	7.150	994	7.150
623	7.150	685	7.150	747	7.150	809	7.150	871	7.150	933	7.150	995	7.150
624	7.150	686	7.150	748	7.150	810	7.150	872	7.150	934	7.150	996	7.150
625	7.150	687	7.150	749	7.150	811	7.150	873	7.150	935	7.150	997	7.150
626	7.150	688	7.150	750	7.150	812	7.150	874	7.150	936	7.150	998	7.150
627	7.150	689	7.150	751	7.150	813	7.150	875	7.150	937	7.150	999	7.150
628	7.150	690	7.150	752	7.150	814	7.150	876	7.150	938	7.150	1000	7.150
629	7.150	691	7.150	753	7.150	815	7.150	877	7.150	939	7.150	1001	7.150
630	7.150	692	7.150	754	7.150	816	7.150	878	7.150	940	7.150	1002	7.150
631	7.150	693	7.150	755	7.150	817	7.150	879	7.150	941	7.150	1003	7.150
632	7.150	694	7.150	756	7.150	818	7.150	880	7.150	942	7.150	1004	7.150
633	7.150	695	7.150	757	7.150	819	7.150	881	7.150	943	7.150	1005	7.150
634	7.150	696	7.150	758	7.150	820	7.150	882	7.150	944	7.150	1006	7.150
635	7.150	697	7.150	759	7.150	821	7.150	883	7.150	945	7.150	1007	7.150
636	7.150	698	7.150	760	7.150	822	7.150	884	7.150	946	7.150	1008	7.150
637	7.150	699	7.150	761	7.150	823	7.150	885	7.150	947	7.150	1009	7.150
638	7.150	700	7.150	762	7.150	824	7.150	886	7.150	948	7.150	1010	7.150
639	7.150	701	7.150	763	7.150	825	7.150	887	7.150	949	7.150	1011	7.150
640	7.150	702	7.150	764	7.150	826	7.150	888	7.150	950	7.150	1012	7.150
641	7.150	703	7.150	765	7.150	827	7.150	889	7.150	951	7.150	1013	7.150
642	7.150	704	7.150	766	7.150	828	7.150	890	7.150	952	7.150	1014	7.150
643	7.150	705	7.150	767	7.150	829	7.150	891	7.150	953	7.150	1015	7.150
644	7.150	706	7.150	768	7.150	830	7.150	892	7.150	954	7.150	1016	7.150
645	7.150	707	7.150	769	7.150	831	7.150	893	7.150	955	7.150	1017	7.150
646	7.150	708	7.150	770	7.150	832	7.150	894	7.150	956	7.150	1018	7.150
647	7.150	709	7.150	771	7.150	833	7.150	895	7.150	957	7.150	1019	7.150
648	7.150	710	7.150	772	7.150	834	7.150	896	7.150	958	7.150	1020	7.150
649	7.150	711	7.150	773	7.150	835	7.150	897	7.150	959	7.150	1021	7.150
650	7.150	712	7.150	774	7.150	836	7.150	898	7.150	960	7.150	1022	7.150
651	7.150	713	7.150	775	7.150	837	7.150	899	7.150	961	7.150	1023	7.150
652	7.150	714	7.150	776	7.150	838	7.150	900	7.150	962	7.150	1024	7.150
653	7.150	715	7.150	777	7.150	839	7.150	901	7.150	963	7.150	1025	7.150
654	7.150	716	7.150	778	7.150	840	7.150	902	7.150	964	7.150	1026	7.150
655	7.150	717	7.150	779	7.150	841	7.150	903	7.150	965	7.150	1027	7.150
656	7.150	718	7.150	780	7.150	842	7.150	904	7.150	966	7.150	1028	7.150
657	7.150	719	7.150	781	7.150	843	7.150	905	7.150	967	7.150	1029	7.150
658	7.150	720	7.150	782	7.150	844	7.150	906	7.150	968	7.150	1030	7.150
659	7.150	721	7.150	783	7.150	845	7.150	907	7.150	969	7.150	1031	7.150
660	7.150	722	7.150	784	7.150	846	7.150	908	7.150	970	7.150	1032	7.150
661	7.150	723	7.150	785	7.150	847	7.150	909	7.150	971	7.150	1033	7.150
662	7.150	724	7.150	786	7.150	848	7.150	910	7.150	972	7.150	1034	7.150
663	7.150	725	7.150	787	7.150	849	7.150	911	7.150	973	7.150	1035	7.150
664	7.150	726	7.150	788	7.150	850	7.150	912	7.150	974	7.150	1036	7.150
665	7.150	727	7.150	789	7.150	851	7.150	913	7.150	975	7.150	1037	7.150
666	7.150	728	7.150	790	7.150	852	7.150	914	7.150	976	7.150	1038	7.150
667	7.150	729	7.150	791	7.150	853	7.150	915	7.150	977	7.150	1039	7.150
668	7.150	730	7.150	792	7.150	854	7.150	916	7.150	978	7.150	1040	7.150
669	7.150	731	7.150	793	7.150	855	7.150	917	7.150	979	7.150	1041	7.150
670	7.150	732	7.150	794	7.150	856	7.150	918	7.150	980	7.150	1042	7.150
671	7.150	733	7.150	795	7.150	857	7.150	919	7.150	981	7.150	1043	7.150
672	7.150	734	7.150	796	7.150	858	7.150	920	7.150	982	7.150	1044	7.150
673	7.150	735	7.150	797	7.150	859	7.150	921	7.150	983	7.150	1045	7.150
674	7.150	736	7.150	798	7.150	860	7.150	922	7.150	984	7.150	1046	7.150
675	7.150	737	7.150	799	7.150	861	7.150	923	7.150	985	7.150	1047	7.150
676	7.150	738	7.150	800	7.150	862	7.150	924	7.150	986	7.150	1048	7.150
677	7.150	739	7.150	801	7.150	863	7.150	925	7.150	987	7.150	1049	7.150
678	7.150	740	7.150	802	7.150	864	7.150	926	7.150	988	7.150	1050	7.150
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Old Hall Chambers 31 Old Hall Street Liverpool L3 9SY													
Date 26/10/2019 13:48 File C02 1 IN 100 7.15M SURC...													
Designed by WinDes Checked by													
Micro Drainage				Network 2018.1.1									
<u>Surcharged Outfall Details for Storm</u>													
Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1113	7.150	1154	7.150	1195	7.150	1236	7.150	1277	7.150	1318	7.150	1359	7.150
1114	7.150	1155	7.150	1196	7.150	1237	7.150	1278	7.150	1319	7.150	1360	7.150
1115	7.150	1156	7.150	1197	7.150	1238	7.150	1279	7.150	1320	7.150	1361	7.150
1116	7.150	1157	7.150	1198	7.150	1239	7.150	1280	7.150	1321	7.150	1362	7.150
1117	7.150	1158	7.150	1199	7.150	1240	7.150	1281	7.150	1322	7.150	1363	7.150
1118	7.150	1159	7.150	1200	7.150	1241	7.150	1282	7.150	1323	7.150	1364	7.150
1119	7.150	1160	7.150	1201	7.150	1242	7.150	1283	7.150	1324	7.150	1365	7.150
1120	7.150	1161	7.150	1202	7.150	1243	7.150	1284	7.150	1325	7.150	1366	7.150
1121	7.150	1162	7.150	1203	7.150	1244	7.150	1285	7.150	1326	7.150	1367	7.150
1122	7.150	1163	7.150	1204	7.150	1245	7.150	1286	7.150	1327	7.150	1368	7.150
1123	7.150	1164	7.150	1205	7.150	1246	7.150	1287	7.150	1328	7.150	1369	7.150
1124	7.150	1165	7.150	1206	7.150	1247	7.150	1288	7.150	1329	7.150	1370	7.150
1125	7.150	1166	7.150	1207	7.150	1248	7.150	1289	7.150	1330	7.150	1371	7.150
1126	7.150	1167	7.150	1208	7.150	1249	7.150	1290	7.150	1331	7.150	1372	7.150
1127	7.150	1168	7.150	1209	7.150	1250	7.150	1291	7.150	1332	7.150	1373	7.150
1128	7.150	1169	7.150	1210	7.150	1251	7.150	1292	7.150	1333	7.150	1374	7.150
1129	7.150	1170	7.150	1211	7.150	1252	7.150	1293	7.150	1334	7.150	1375	7.150
1130	7.150	1171	7.150	1212	7.150	1253	7.150	1294	7.150	1335	7.150	1376	7.150
1131	7.150	1172	7.150	1213	7.150	1254	7.150	1295	7.150	1336	7.150	1377	7.150
1132	7.150	1173	7.150	1214	7.150	1255	7.150	1296	7.150	1337	7.150	1378	7.150
1133	7.150	1174	7.150	1215	7.150	1256	7.150	1297	7.150	1338	7.150	1379	7.150
1134	7.150	1175	7.150	1216	7.150	1257	7.150	1298	7.150	1339	7.150	1380	7.150
1135	7.150	1176	7.150	1217	7.150	1258	7.150	1299	7.150	1340	7.150	1381	7.150
1136	7.150	1177	7.150	1218	7.150	1259	7.150	1300	7.150	1341	7.150	1382	7.150
1137	7.150	1178	7.150	1219	7.150	1260	7.150	1301	7.150	1342	7.150	1383	7.150
1138	7.150	1179	7.150	1220	7.150	1261	7.150	1302	7.150	1343	7.150	1384	7.150
1139	7.150	1180	7.150	1221	7.150	1262	7.150	1303	7.150	1344	7.150	1385	7.150
1140	7.150	1181	7.150	1222	7.150	1263	7.150	1304	7.150	1345	7.150	1386	7.150
1141	7.150	1182	7.150	1223	7.150	1264	7.150	1305	7.150	1346	7.150	1387	7.150
1142	7.150	1183	7.150	1224	7.150	1265	7.150	1306	7.150	1347	7.150	1388	7.150
1143	7.150	1184	7.150	1225	7.150	1266	7.150	1307	7.150	1348	7.150	1389	7.150
1144	7.150	1185	7.150	1226	7.150	1267	7.150	1308	7.150	1349	7.150	1390	7.150
1145	7.150	1186	7.150	1227	7.150	1268	7.150	1309	7.150	1350	7.150	1391	7.150
1146	7.150	1187	7.150	1228	7.150	1269	7.150	1310	7.150	1351	7.150	1392	7.150
1147	7.150	1188	7.150	1229	7.150	1270	7.150	1311	7.150	1352	7.150	1393	7.150
1148	7.150	1189	7.150	1230	7.150	1271	7.150	1312	7.150	1353	7.150	1394	7.150
1149	7.150	1190	7.150	1231	7.150	1272	7.150	1313	7.150	1354	7.150	1395	7.150
1150	7.150	1191	7.150	1232	7.150	1273	7.150	1314	7.150	1355	7.150	1396	7.150
1151	7.150	1192	7.150	1233	7.150	1274	7.150	1315	7.150	1356	7.150	1397	7.150
1152	7.150	1193	7.150	1234	7.150	1275	7.150	1316	7.150	1357	7.150	1398	7.150
1153	7.150	1194	7.150	1235	7.150	1276	7.150	1317	7.150	1358	7.150	1399	7.150
<u>Simulation Criteria for Storm</u>													
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 Offline Controls 0									
Number of Online Controls 0				Number of Storage Structures 1									
				Number of Time/Area Diagrams 0									
				Number of Real Time Controls 0									
<u>Synthetic Rainfall Details</u>													
Rainfall Model				FSR				Ratio R 0.400					
Return Period (years)				30				Profile Type Summer					
Region England and Wales				Cv (Summer) 0.750									
M5-60 (mm)				19.100				Cv (Winter) 0.840					
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Old Hall Chambers 31 Old Hall Street Liverpool L3 9SY		
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Micro Drainage Network 2018.1.1		
<p style="text-align: center;"><u>Synthetic Rainfall Details</u></p> <p style="text-align: center;">Storm Duration (mins) 30</p>		
<p style="text-align: center;">©1982-2018 Innovyze</p>		

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Micro Drainage	Network 2018.1.1	

Storage Structures for Storm

Cellular Storage Manhole: mhs 5, DS/PN: 1.002

Invert Level (m) 5.635 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	350.0	350.0	1.499	350.0	485.0	1.500	0.0	485.0

Volume Summary (Static)


Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Manhole Volume (m ³)	Pipe Volume (m ³)	Storage Structure Volume (m ³)	Total Volume (m ³)
1.000	mhs 1	1.131	2.322	0.000	3.453
2.000	mhs 2	1.368	1.070	0.000	2.438
1.001	mhs 3	1.571	5.054	0.000	6.625
3.000	mhs 4	1.209	1.555	0.000	2.764
1.002	mhs 5	0.148	1.312	498.528	499.989
1.003	mhs 6	4.100	0.612	0.000	4.712
Total		9.528	11.925	498.528	519.981

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Manhole Volume (m ³)	Pipe Volume (m ³)	Storage Structure Volume (m ³)	Total Volume (m ³)
1.000	mhs 1	1.131	2.274	0.000	3.405
2.000	mhs 2	1.368	1.022	0.000	2.390
1.001	mhs 3	1.571	5.001	0.000	6.572
3.000	mhs 4	1.209	1.502	0.000	2.711
1.002	mhs 5	0.148	1.276	498.528	499.953
1.003	mhs 6	4.100	0.582	0.000	4.682
Total		9.528	11.658	498.528	519.714

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Micro Drainage						Network 2018.1.1		

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

Synthetic Rainfall Details

Rainfall Model	FSR M5-60 (mm)	19.100 Cv (Summer)	0.750
Region	England and Wales	Ratio R	0.400 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm)	150.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS 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)	100
Climate Change (%)	40

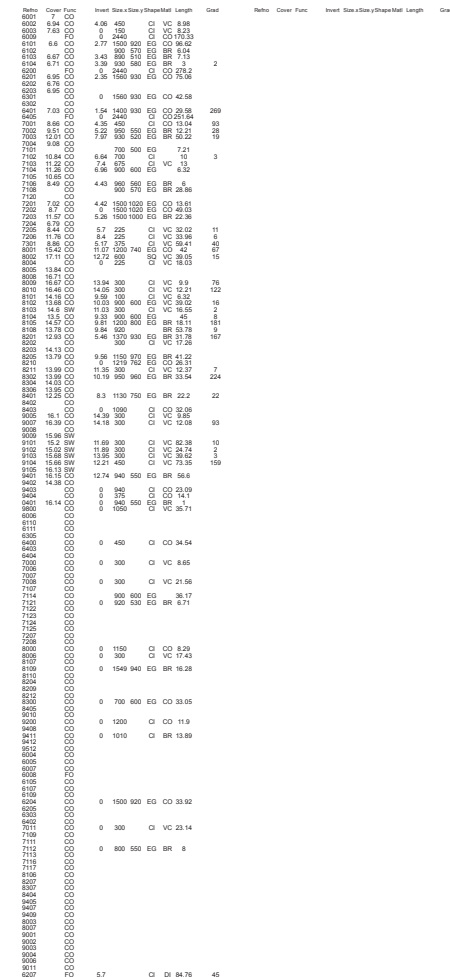
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	mhs 1	15 Winter	100	+40%	100/15 Summer	100/15 Summer			8.389	0.779
2.000	mhs 2	15 Winter	100	+40%	100/15 Summer	100/15 Summer			8.392	0.992
1.001	mhs 3	15 Winter	100	+40%	100/15 Summer	100/15 Summer			8.388	1.092
3.000	mhs 4	1440 Winter	100	+40%	100/120 Summer	100/180 Winter			7.853	0.887
1.002	mhs 5	1440 Winter	100	+40%	100/15 Summer	100/180 Winter			7.854	1.994
1.003	mhs 6	1440 Winter	100	+40%	100/15 Summer	100/180 Winter			7.853	2.213

PN	US/MH Name	Volume (m³)	Flooded Flow / Cap.	Pipe Overflow (l/s)	Pipe Flow (l/s)	Status	Level
							Exceeded
1.000	mhs 1	4.130	0.88		36.0	FLOOD	4
2.000	mhs 2	6.901	1.47		57.7	FLOOD	4
1.001	mhs 3	3.018	1.82		158.2	FLOOD	3
3.000	mhs 4	118.144	0.33		26.6	FLOOD	15
1.002	mhs 5	118.767	1.46		58.1	FLOOD	15
1.003	mhs 6	118.075	8.61		92.2	FLOOD	15

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APPENDIX D

UNITED UTILITIES ASSET DRAWINGS




The position of underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available.

The actual positions may be different from those shown on the plan and private pipes, sewers or drains may not be recorded.

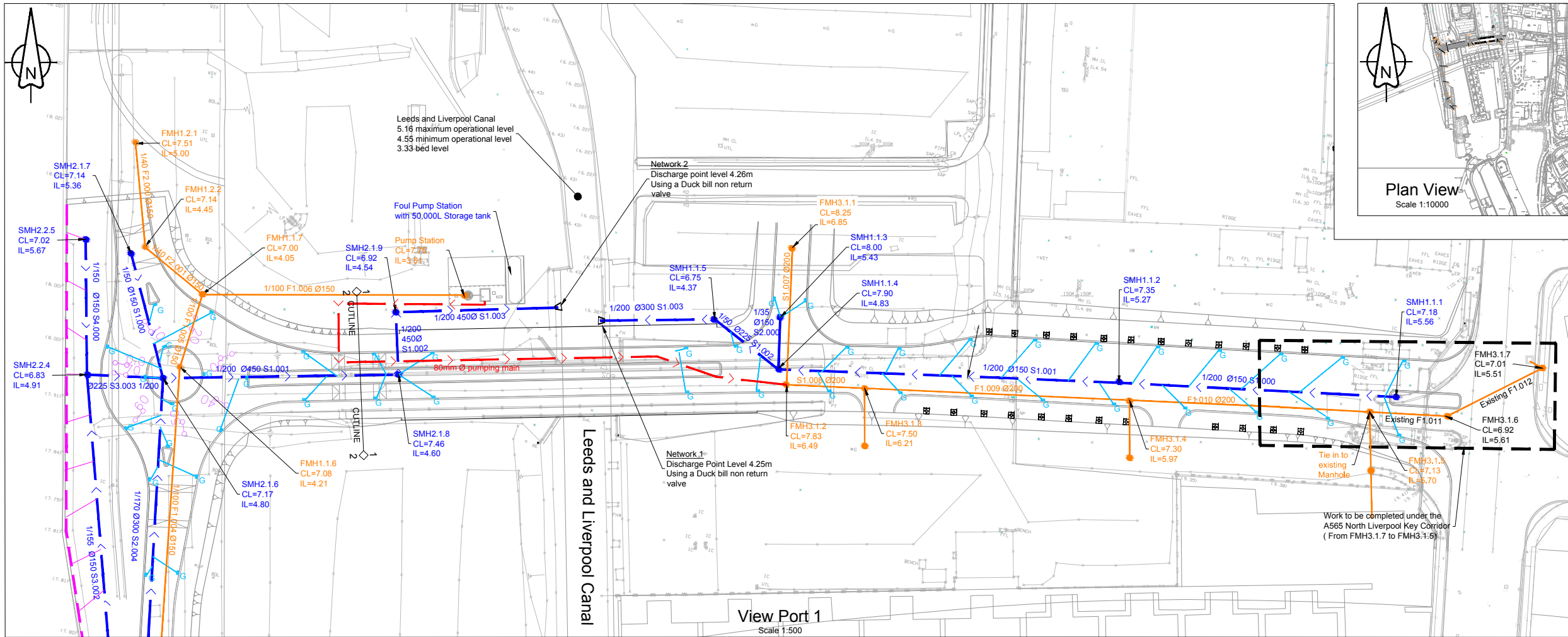
United Utilities will not accept any liability for any damage caused by the actual positions being different from those shown.

United Utilities Water Limited 2014. The plan is based upon the Ordnance Survey Map with the sanction of the Controller of H.M. Stationery Office. Crown and United Utilities copyrights are reserved. Unauthorised reproduction will infringe these copyrights.

	<p>OS Sheet No: SJ3391SE</p> <p>Scale: 1: 1250 Date: 20/07/2016</p> <p>145 Nodes</p> <p>Sheet 1 of 1</p>	
	 <p>SEWER RECORDS</p>	

APPENDIX E

**NORTHERN LINK ROAD GENERAL
ARRANGEMENTDRAWING CO00205341-H-D-NLR-500
BY AMEY CONSULTING.**



RESIDUAL DESIGN HAZARDS
(The following information has been collected from Preconstruction Information and the Amey CDM Hazard Management Process.)

- Asbestos
- Working Near Water
- Unexpected void shafts in existing ground
- Working on unstable ground
- Working at heights

- NOTES**
- All levels are in metres above Ordnance Datum.
 - All Dimensions are in metres unless stated otherwise.
 - The Specification clauses referred to in this drawing, unless stated otherwise are from the Manual of Contract Documents for Highway Works (MCHW) - Volume 1 Specification for Highway Works.
 - Any discrepancies to be brought to the attention of Amey.
 - This drawing is to be read in conjunction with;
 - CO00205341-H-D-NLR-501-503 Proposed Drainage Long-Sections
 - CO00205341-H-D-NLR -700-701 Proposed Construction Details
 - FMH 3.15, 3.16 and 3.17 constructed under A565 Liverpool (NLKC). Refer to drawing CO0020216-PH3-DR-506 included in site information.
 - For gully and manhole detail please refer to LCC standard drainage detail SD-D-05 Type G1 gully and SD-D-16 Type 1 Manhole respectively.
 - Outfall pipes should be turned in the direction of flow
 - Precast concrete headwall to be constructed for road drainage outfalls shall be to spec. cl. 1710 and to comply with BS EN206-1:2000.
 - Adequate protection measures should be constructed at each outfall to prevent bank erosion or scouring of the channel bed.
 - Carrier drain to be solid wall pipe with Type S bedding.

KEY

Pumping Main

Foul Drainage

Storm Drainage

Gully & Connection

Slot Drainage Channel

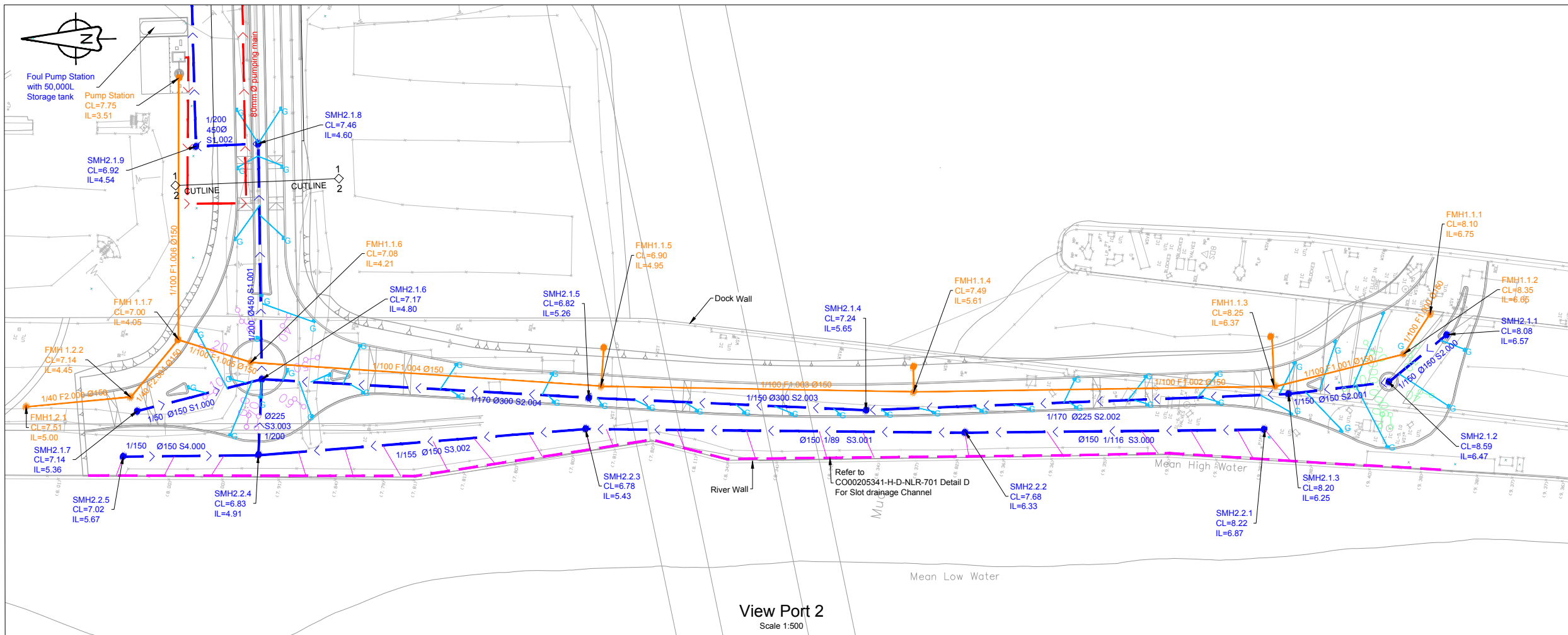
Channel Drainage Connection

SMH = Storm Manhole

FMH = Foul Drainage Manhole

Network no. Pipe Branch no. Trunk no.

Network no. Pipe Branch no. Trunk no.



TENDER

Rev	Revision details	Drwn	Chkd	Appd	Date
Designed:	CM				Date: June 18
Drawn:	CB				Date: June 18
Checked:	GML				Date: June 18
Approved:	GML				Date: June 18

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Client

Liverpool City Council

Project Name

Liverpool City Centre Connectivity Phase 2

Drawing Title

Northern Link Proposed Storm and Foul Drainage

Original Drawing Size : A1 Scale : As Shown

Dimensions : m

Drawing Status

PUBLISHED

Suitability D2

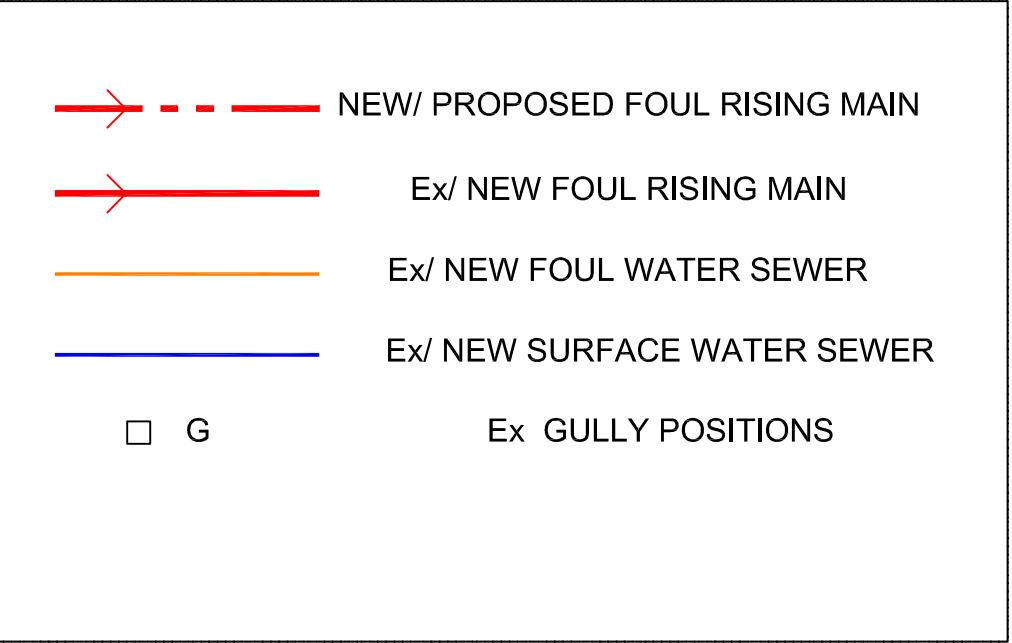
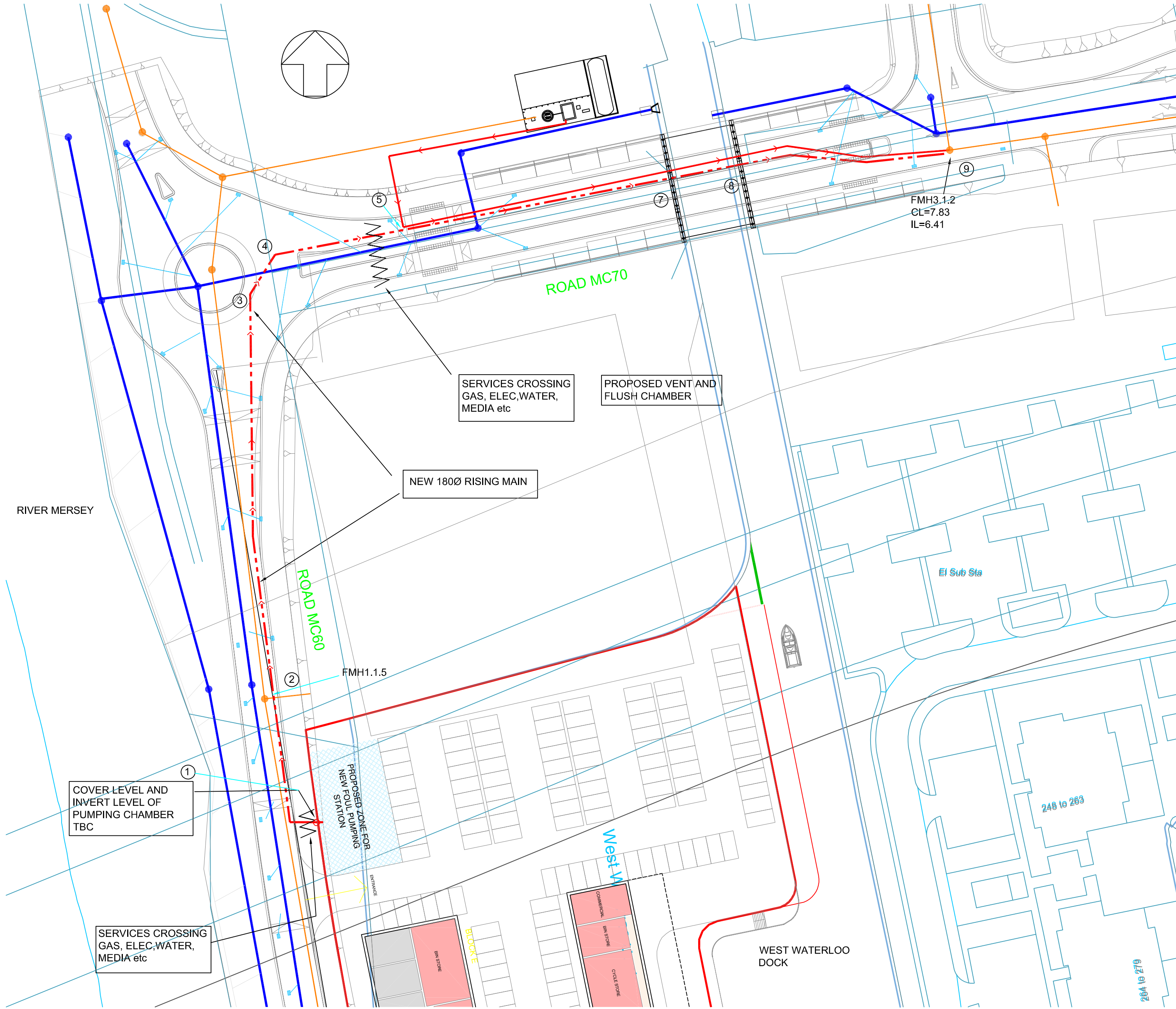
Drawing No

CO00205341-H-D-NLR-500

Rev -

APPENDIX F

**PROPOSED RISING MAIN GENERAL ARRANGEMENT
DRAWING 4/6679-CCL-CO2-DRN-GA-C-100-01
BY CLANCY CONSULTING.**



GENERAL NOTES

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT CLANCY CONSULTING, ARCHITECTURAL, AMEY CONSULTING AND OTHER ENGINEERS' DRAWINGS AND SPECIFICATIONS.

DO NOT SCALE THIS DRAWING.

EXISTING DRAINAGE AND LEVELS SHOWN ON THIS DRAWING TO BE CONFIRMED BY THE CONTRACTOR ON SITE PRIOR TO COMMENCEMENT OF THE DRAINAGE WORKS. THE ENGINEER IS TO BE NOTIFIED OF ANY DISCREPANCIES.

COVER LEVELS TO BE CHECKED AGAINST ARCHITECTS PROPOSED EXTERNAL WORKS LEVEL / DETAIL DRAWINGS

EXISTING MANHOLES, LEVELS & PIPE SIZES TO BE CHECKED ON SITE

ALL OUTGOING AND INCOMING PIPES AT MANHOLE JUNCTIONS TO BE CONNECTED SOFFIT TO SOFFIT UNLESS SPECIFIED OTHERWISE.

PRELIMINARY COVER LEVEL AND INVERT LEVEL INTO THE PUMPING STATION ON CO2 SITE IS SUBJECT TO CONFIRMATION BY THE LANDSCAPE ARCHITECT

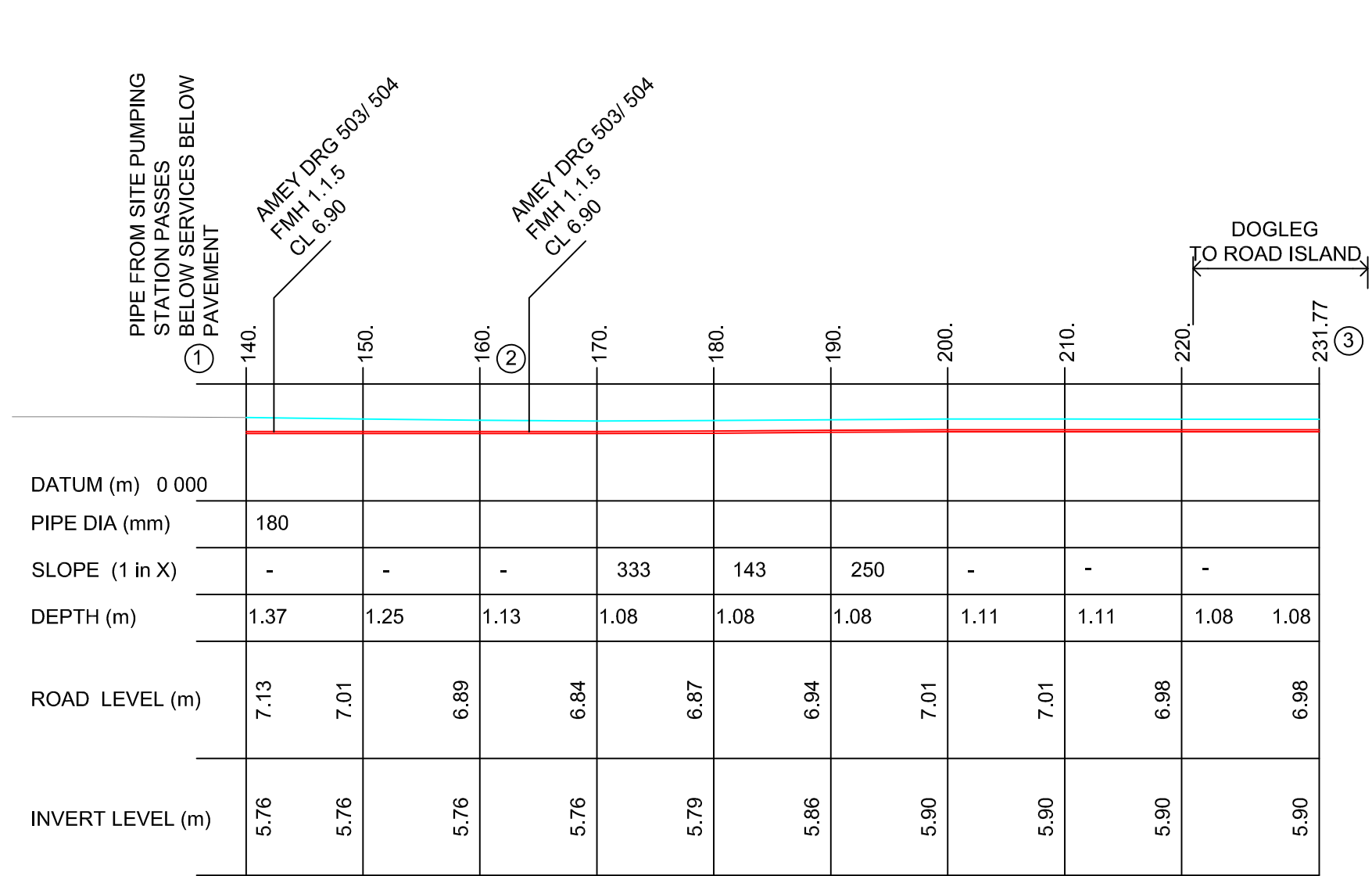
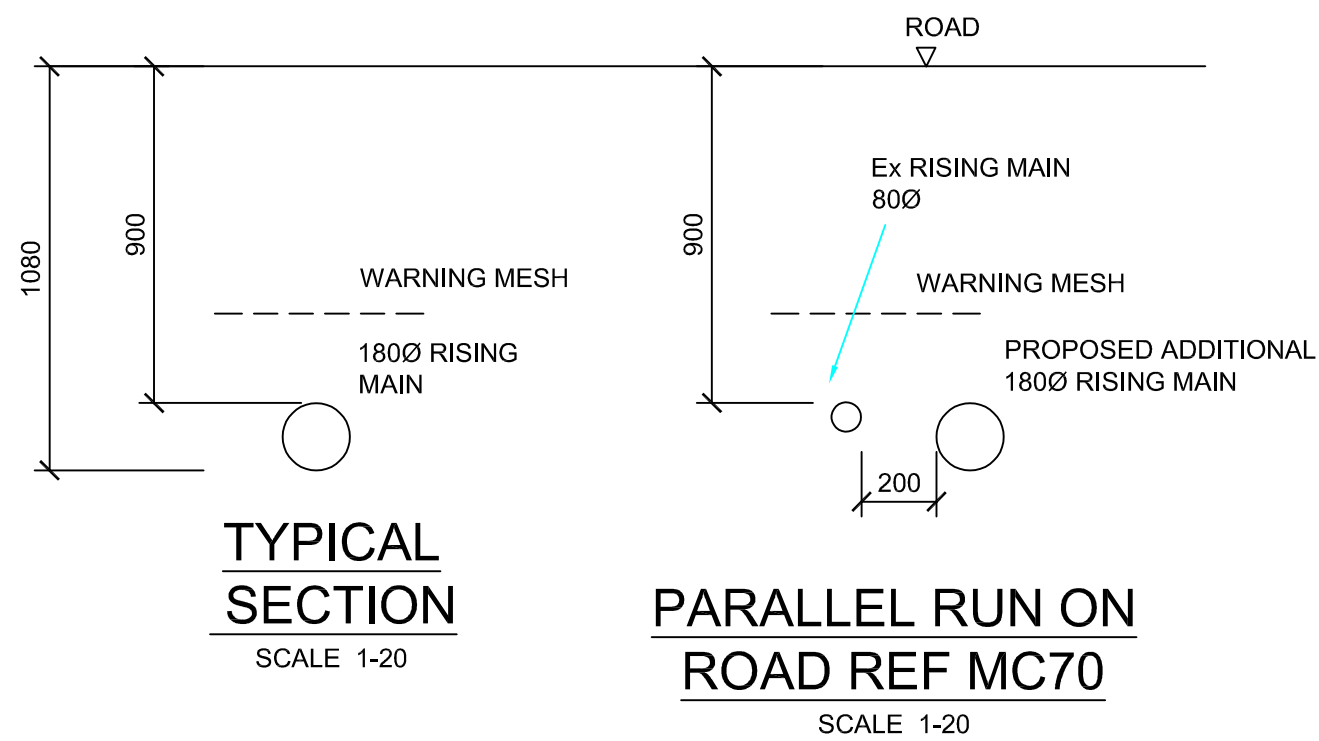
PROPOSED NEW RISING MAIN - LOCATED ADJACENT TO EX/ NEW 800 RISING MAIN PIPE TO HAVE A min 200mm GAP TO PREVENT UNDERMINING PIPE.

180mm RISING MAIN FROM CO2 SITE SET 900mm BELOW ROAD LEVEL AND 2m OFF THE KERB LINE AS PER AMEY CONSULTING EMAIL DATED 23 AUG 2019.

THE NEW 180mm RISING MAIN FROM CO2 SITE IS TO FOLLOW THE LINE OF THE OTHER 80mm RISING MAIN AT THE POINT IT RUNS PARALLEL ACROSS THE BRIDGE AND CONNECTION INTO THE EXISTING COMBINED SEWER. DATED 23 AUG 2019.

POSITION, DEPTH, QUANTITY OF WASH OUT CHAMBERS AND AIR VALVES SUBJECT TO CONFIRMATION BY PUMP PROVIDERS

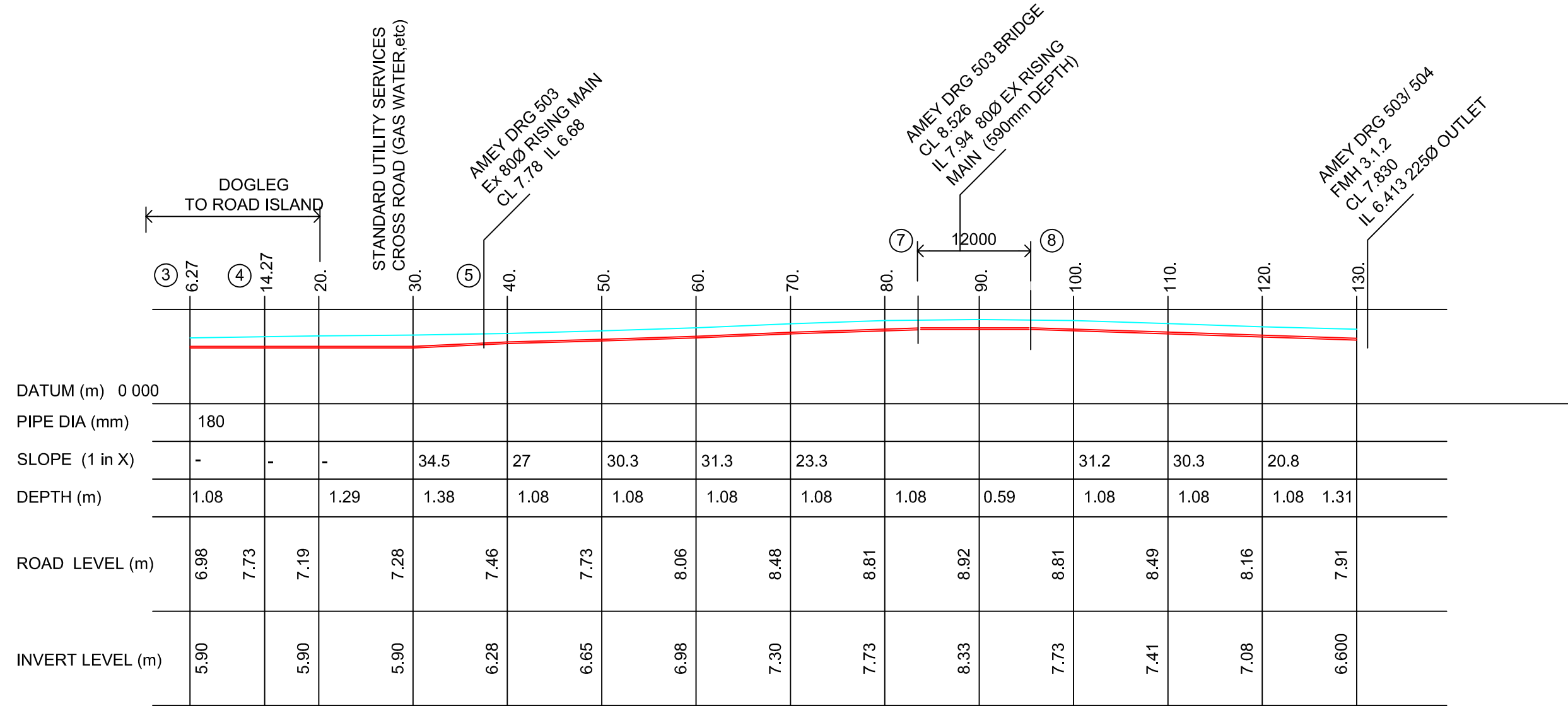
THE DRAWING IS CONCEPT AND SUBJECT TO CHANGE FOLLOWING COMMENTS. DO NOT CONSTRUCT FROM THIS DRAWING.



LONGITUDINAL ROAD SECTION

(USING AMEY CONSULTING DRG C000205341-H-D-NLR-714 CO3 MC60 LONG SECTION AS REFERENCE)

SCALE 1:500



LONGITUDINAL ROAD SECTION

(USING AMEY CONSULTING DRG C000205341-H-D-NLR-715 CO2 MC70 LONG SECTION AS REFERENCE)

SCALE 1:500

Rev	Date	Description	RJM	MD	BRH
01	03/09/19	ISSUED FOR INFORMATION	By	Check	App.

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Client

ROMAL CAPITAL GROUP LTD

Project

PLOT CO2 LIVERPOOL WATERS

Office

LIVERPOOL

Discipline

CIVIL

Title

PROPOSED RISING MAIN

Scale @ A1

1:500

Status

INFORMATION



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Job Number	Originator	Building/Zone	Level
4/6679	CCL	CO2	DRN
Type	Discipline	Drawing No.	Revision
GA	C	100	01