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Flood Risk Assessment & Drainage Strategy

Proposed Residential Development, Queens Park, Millom

Thomas Armstrong Construction and Home Group

Ref: K41327.FRA/001B

Version	Date	Prepared By	Checked By	Approved By
Original	15th August 2024	C. Abram	T. Melhuish	T. Melhuish
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GLOSSARY OF TERMS

AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
BGL	Below Ground Level
BGS	British Geological Society
CC	Climate Change
DSM	Digital Surface Model
DTM	Digital Terrain Model
EA	Environment Agency
FEH	Flood Estimation Handbook
FFL	Finished Floor Level
FRA	Flood Risk Assessment
GIS	Geographical Information System
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
NPPF	National Planning Policy Framework
OS	Ordnance Survey
RGP	RG Parkins & Partners Ltd
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage System
TA	Thomas Armstrong Construction
UU	United Utilities

1. INTRODUCTION

1.1 BACKGROUND

This report has been prepared by R. G. Parkins & Partners Ltd (RGP) for Thomas Armstrong Construction and Home Group in support of their proposals to construct 47 new dwellings at a residential development located at Queens Park, Millom.

RGP has been appointed to undertake a Flood Risk Assessment and Foul and Surface Water Drainage Strategy to support a planning application that fulfils the requirements of the Local Planning Authority, Lead Local Flood Authority, Environment Agency and the Sewerage Undertaker.

The following report demonstrates the proposed development will not adversely affect flood risk elsewhere.

1.2 PLANNING POLICY

The NPPF [1] and its Planning Practice Guidance [2] states "a site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in the future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use."

1.3 THE DEVELOPMENT IN THE CONTEXT OF PLANNING POLICY

Owing to the size of the development in terms of number of properties (47no.), it is classed as major development (over 10 dwellings) in accordance with The Town and Country Planning Order 2015 [3].

The area covered by the application is 1.75 ha (hectares) and by reference to the Environment Agency Flood Map, the site lies entirely in Flood Zone 1.

Table 2 of the NPPF's Planning Practice Guidance [2] classifies each development into a vulnerability class, depending on the type of development, as outlined in Table 1.1.

The site is to be developed for a housing development; and is classified as 'More vulnerable'. 'More Vulnerable' development classes are deemed acceptable in terms of flood risk within Flood Zones 1, 2 and 3a but are not generally considered acceptable within Flood Zone 3b.

Table 1.1 Vulnerability Classification

Vulnerability Classification	Development
Essential Infrastructure	Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. Essential utility infrastructure, which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. Wind turbines.
Highly Vulnerable	Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operation during flooding. Emergency dispersal points. Basement dwellings. Caravans, mobile homes, and park homes intended for permanent residential use. Installations requiring hazardous substances consent.
More Vulnerable	Hospitals. Residential institutions such as residential care homes, children's homes, prisons and hostels. Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs, and hotels. Non-residential uses for health services, nurseries, and education establishments. Landfill and sites used for waste management facilities for hazardous waste. Sites used for holiday or short let caravans and camping, subject to a specific warning and evacuation plan
Less Vulnerable	Police, ambulance, and fire stations which are NOT required to be operational during flooding. Buildings used for shops; financial, professional, and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distributions; non-residential institutions not included in the 'more vulnerable' class; and assemble and leisure. Land and buildings used for agriculture and forestry. Waste treatment (except landfill & hazardous waste facilities). Minerals working & processing (except for sand & gravel working). Water treatment works which do not need to remain operational during times of flood. Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.
Water-Compatible Development	Flood control infrastructure. Water transmission infrastructure & pumping stations. Sewage transmission infrastructure & pumping stations. Sand & gravel working. Docks, marinas, and wharves. Navigation facilities. Ministry of Defence installations. Ship building, repairing & dismantling, dockside fish processing & refrigeration & compatible activities requiring a waterside location. Water based recreation (excluding sleeping accommodation). Lifeguard and coastguard stations. Amenity open space, nature conservation & biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. Essential ancillary sleeping or residential accommodation for staff required by uses in this category subject to a specific warning & evacuation plan.

2. SITE CHARACTERISATION

2.1 SITE LOCATION

The site is located at Queens Park, Millom, Cumbria approximately 500m to the west of the town centre. The National Grid Co-Ordinates to the centre of the site are 316570E 480195N. (Figure 2.1).

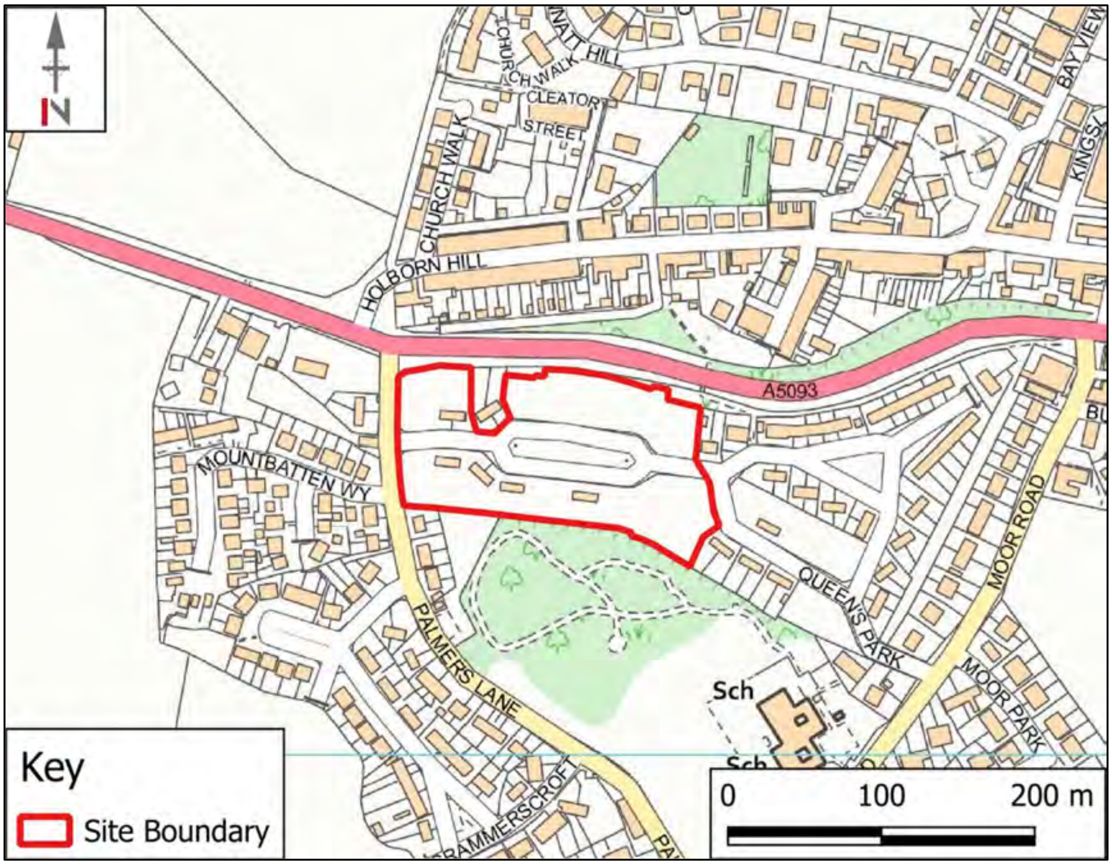

Figure 2.1 Site Location

2.2 SITE DESCRIPTION

The site covers an area of approximately 1.75 ha (17,494 m²). The proposed development site sits within the existing residential development of Queens Park and surrounds the adopted highway with development proposed in areas that were formerly the location of a number of now demolished residences. A few privately owned properties still remain in sporadic areas across the proposed development site. Despite being classified as a former brownfield site the majority of the site at present is unused greenspace.

The A5093 forms the northern boundary and Palmers Lane is located to the west, with the development site falling towards it. To the south is a dense woodland area. The Queens Park estate continues towards the east and falls towards Moor Road.

Topographically, the site typically falls from the north-east corner, from a high level of 18.50 mAOD, towards the south-west corner, to approx. 10.60 mAOD.

Primary access to the site would be via Palmers Lane from the west, although access can also be achieved from Moor Road to the east.

2.3 GEOLOGY & HYDROGEOLOGY

British Geological Survey (BGS) [4] and Land Information Systems (LandIS) [5] mapping indicates the site is underlain by the geological sequences outlined in Table 2.1. The Defra Magic Maps [6] indicates the nearest Source Protection Zone is located c. 8.50 km to the south (Zone III Total Catchment).

The site is not located within a drinking water protected area or drinking water safeguard zone for surface water or groundwater.

The development site overlies a secondary aquifer with 'Medium to High' groundwater vulnerability.

Table 2.1 Site Geological Summary

Geological Unit	Classification	Description	Aquifer Classification
Soil	Soilscape 21 & 22	Loamy and clayey soils with naturally high groundwater	N/A
Drift	Till, Devensian	Diamicton – clay, silt, sands and gravel	Summary: Secondary (undifferentiated)
Solid	Kirkley Bank Formation	Mudstone, calcareous sedimentary bedrock	Summary: Secondary B

2.4 HYDROLOGY

Reference to OS Mapping indicates the nearest open watercourse on plan lies approx. 500 m to the north is labelled as 'The Beck' which feeds into 'Salthouse Pool' which itself merges with the River Duddon Estuary.

This watercourse is classified as 'Main River' and is therefore regulated by the Environment Agency.

The development site is located approx. 1.5Km north from the sea at the nearest stretch of coastline along the mouth of the Duddon Estuary.

2.5 EXISTING SEWERS

Reference to the United Utilities sewer records indicates there are numerous public combined sewers located within or near to the vicinity of the site boundary. The sewers are routed in different directions depending on the site topography, but ultimately end up connecting to the same combined system that serves the wider geographical area.

A main 225mm diameter combined sewer is located within the existing adopted highway which is routed from the central highpoint of the site and traverses/falls towards the west where it is connected to a larger 600mm diameter combined sewer located under Palmers Lane. Numerous smaller diameter public sewers serving the existing and now demolished residences are shown to be connected to this sewer.

There is no separate surface water public sewer within the development site.

A copy of the sewer records is included in Appendix D for reference.

2.6 DRAINAGE SURVEY INVESTIGATIONS

RGP instructed Drain Doctor to carry out a drainage investigation and CCTV survey of all the existing sewers in the proposed development areas to verify the size, depth and condition of the existing drainage infrastructure both within the boundary and nearby vicinity.

The survey was undertaken in July 2024 and a copy of the findings is included within Drain Doctors report reference: 2024-06-30014.

The investigations found most of the sewer locations and depths to be reasonably consistent with the UU sewer records and was successful in verifying missing drainage runs from some of the remaining dwellings across the site to verify existing transferrable asset locations and routing of pipework that will need to be retained/incorporated as part of the new proposals. It also verified that the existing highways gullies are connected to the same combined system for disposal i.e. there are no separate highways drainage system.

This survey record obtained for the area will assist with future detailed drainage design and for any formal S185 sewer diversion and S116 abandonment agreements with UU that will be required.

2.7 PREVIOUS PLANNING APPLICATION

A previous iteration of the development scheme was submitted for Planning in July 2019 and received approval in July 2022 (ref: Copeland Borough Council no:4/19/2244/0F1).

A high-level design review has since been undertaken on the approved drainage scheme and it was determined that there were some major concerns regarding the buildability, cost and adoptability of the overall scheme which has ultimately led to the entire development being re-designed with a new layout and associated drainage strategy in support of a new Planning Application.

2.8 GROUND INVESTIGATION

A Phase 2 Ground Investigation report was commissioned and has been issued by 3E Consulting Engineers [17] in February 2019 to support the previous planning submission.

This included details of intrusive ground investigations and in particular the permeability testing undertaken at the site in November 2018.

The below generalised information regarding ground conditions are taken from this report.

Ground investigations comprised 15 No. mini percussive boreholes and 1 No. hand excavated trial pit with associated sampling and testing. A series of variable (falling) head permeability tests were also undertaken in 4 no. boreholes.

Made ground was encountered across sections of the site to depths of between c.0.40m and 0.60m bgl.

Typically, the majority of the site was underlain by firm and stiff slightly sandy gravely clay to depths between 3.0 to 5.45 m bgl. Soft silty clays were found to underly these deposits in certain locations up to 5.00m bgl.

In two of the boreholes a highly saturated slightly gravelly fine to coarse sand was identified between 2.1m and 3.0m bgl.

Probable bedrock was only encountered in the first borehole at a depth of 3.6m bgl. And was described as extremely weak grey laminated mudstone.

Groundwater was encountered in numerous boreholes at variable depths between 0.6m to 4.0m bgl, however the groundwater recorded appears to have a direct correlation to bands, lens and layers of granular deposits. Groundwater monitoring has taken place and based on the findings the groundwater beneath the site is considered to be perched/trapped rather than a continuous surface.

Permeability testing was undertaken in 4No. boreholes across different areas of the site to determine infiltration characteristics. All results returned low to very low permeability classifications and poor drainage characteristics, rendering the use of soakaways as an unsuitable drainage method at this site.

For further details refer to 3E Report No. P17-498/P2.

3. ASSESSMENT OF FLOOD RISK

3.1 BACKGROUND

The following risk assessment has been carried out in accordance with the National Planning Policy Framework [1] and its Planning Practice Guidance [2] on Flood Risk. The broad aim of the guidance is to reduce the number of people and properties within the natural and built environment at risk of flooding. To achieve this aim, planning authorities are required to ensure that flood risk is properly assessed during the initial planning stages.

Responsibility for this assessment lies with the developers and they must demonstrate:

- Whether the proposed development is likely to be affected by flooding.
- Whether the proposed development will increase flood risk in other parts of the hydrological catchment.
- That the measures proposed to deal with any flood risk are sustainable.

The developer must prove to the Local Planning Authority and the Environment Agency that the existing flood risk or the flood risk associated with the proposed development can be satisfactorily managed.

3.2 FLOOD RISK TERMINOLOGY

Flood risk considers both the probability and consequence of flooding.

Flood events are often described in terms of their probability of recurrence or probability of occurring in any one year. The threshold between a medium flood and a large flood is often regarded as the 1 in 100-year event. This is an event which statistical analysis suggests will occur on average once every hundred years. However, this does not mean that such an event will not occur more than once every hundred years. Table 9.1 shows the event return periods expressed in years and annual exceedance probabilities as a fraction and a percentage. For example, a 1 in 100-year event has a 1% probability of occurring in any one year, i.e. a 1 in 100 probability. A 1000-year event has a 0.1% probability of occurring in any one year, i.e. a 1 in 1000 probability.

Table 3.1 Flood Return Periods & Exceedance Probabilities

Return Period (years)	Annual Exceedance Probability (AEP)	
	Fraction	Percentage
2	0.5	50%
10	0.1	10%
25	0.04	4%
50	0.02	2%
100	0.01	1%
200	0.005	0.5%
500	0.002	0.2%
1000	0.001	0.1%

3.3 DATA COLLECTION

The following information was referred to for the Flood Risk Assessment:

- Environment Agency Flood Map for Planning covering the site and adjacent area.
- Environment Agency Surface Water Flood Risk Map
- Environment Agency Reservoir Flood Risk Map
- Environment Agency Historic Flood Map
- United Utilities sewer records
- British Geological Survey Groundwater Flooding Susceptibility Map
- Development layout plan
- Topographic survey

3.4 ENVIRONMENT AGENCY FLOOD MAP FOR PLANNING

Figure 3.1 is an extract from the EA's Flood Map for Planning[6].

This has been reviewed to assess the level of flood risk to the area. The flood map shows areas that may be at risk of fluvial flooding in a 1% (1 in 100 year, dark blue) or 0.1% (1 in 1000 year, light blue) Annual Exceedance Probability (AEP) event. Alternatively, if the flood risk is tidal the flood map will show areas predicted to be at risk of flooding from the sea in a 0.5% AEP event (1 in 200 year, dark blue) or a 0.1% AEP event (1 in 1000 year, light blue).

The Flood Map shows the current best information on the extent of the extreme flooding from rivers or the sea that would occur without the presence of flood defences. The potential impact of climate change is not considered by the mapping.

Millom is a coastal town and some low lying areas of the town in close proximity are susceptible to tidal flooding, however reference to Figure 3.1 indicates the site lies entirely within Flood Zone 1 "Low Probability", land assessed as having a less than 0.1% annual probability of flooding (i.e. rivers, lake or sea) in any year by reference to the NPPF and is therefore not considered to be at risk of tidal or fluvial flooding.

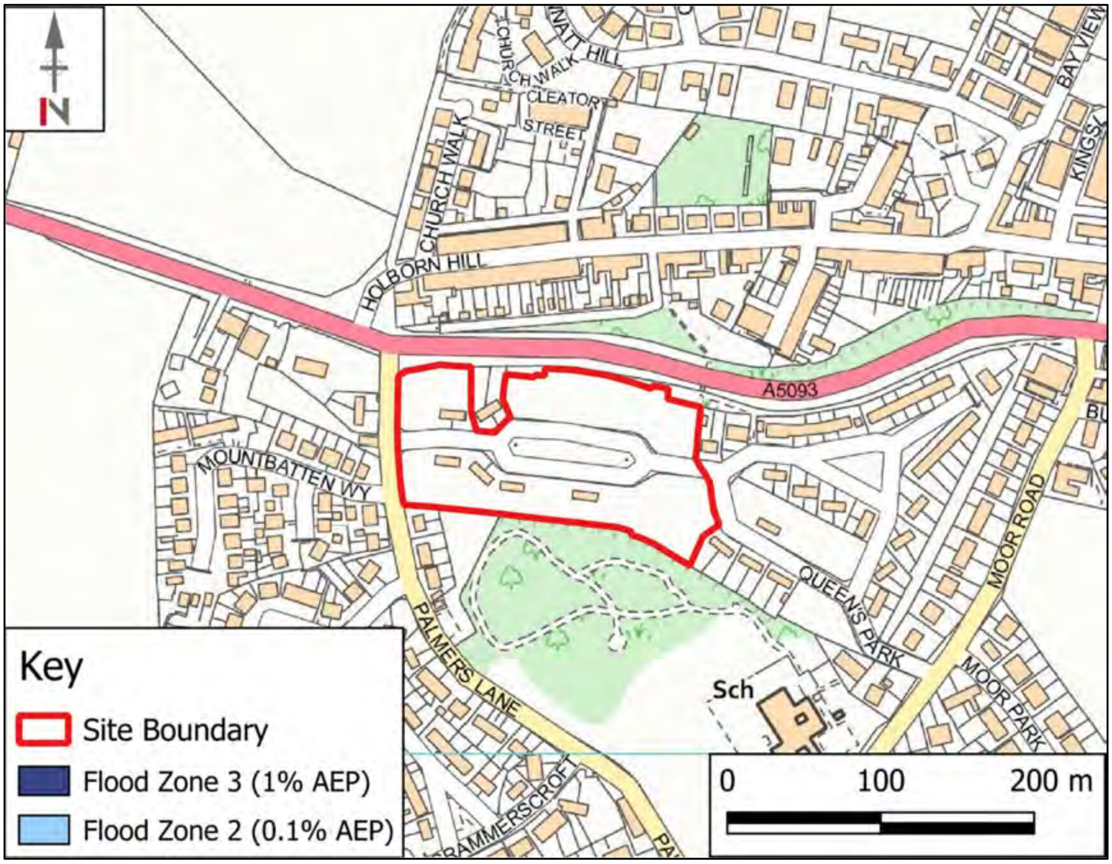

Figure 3.1 Environment Agency Flood Map for Planning

3.5 SURFACE WATER FLOOD RISK

Surface water flooding is that which results from extreme rainfall rather than overflowing rivers. This type of flooding typically occurs when extreme rainfall causes water to run down slopes and collect in depressions in the landscape or where runoff is focussed into an area where drainage is insufficient. It can also cause erosion resulting in the partial or complete blockage of drains or culverts.

Figure 3.2 shows an extract from the EA Surface Water Flood Risk Map[6]. This has four risk classifications from very low probability (<0.1% AEP) to high probability (>3.3% AEP).

The EA surface water flood map indicates that no area within the proposed development boundary is shown to be at risk of surface water flooding.

As any new development resulting in an increase in impermeable areas could cause additional run-off if not properly managed. It is therefore proposed to incorporate sufficient drainage features, SuDS measures and attenuation storage to mitigate this as part of the overall Drainage Strategy. This is discussed in further detail in Section 4.

Flooding via this mechanism is therefore not considered to be a risk for the proposed development.

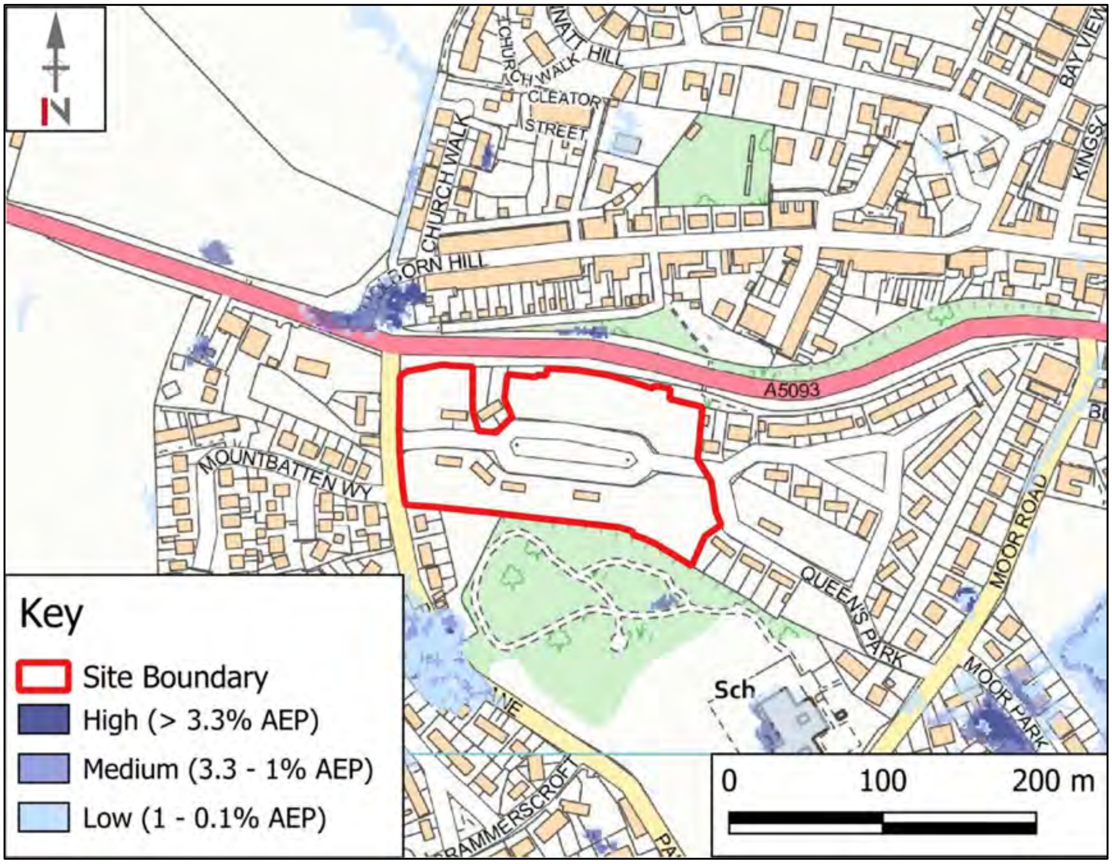

Figure 3.2 Environment Agency Surface Water Flood Map

3.6 GROUNDWATER FLOOD RISK

Groundwater flooding occurs when water levels in the ground rise above the ground surface. It is most likely to occur in low lying areas underlain by permeable drift and rocks.

As discussed in Section 2.7 the geotechnical testing and groundwater monitoring undertaken at the site location found that the variable levels of groundwater encountered in test locations can be considered as trapped/perched water rather than a continuous layer.

Nevertheless, no below ground development is proposed in any case therefore groundwater would not pose a risk of flooding to the site.

3.7 FLOODING FROM RESERVOIRS, CANALS OR OTHER ARTIFICIAL SOURCES

No reservoirs canals or artificial structures are recorded as being within the vicinity of the site and the site is not considered at risk of flooding by these methods.

Flooding from these methods is usually based on a worst-case scenario of catastrophic failure of a dam or reservoir structure and therefore the likelihood of reservoir flooding etc. is, however considered to be much lower than other forms of flooding. Current reservoir regulation, which has been further enhanced by the Flood and Water Management Act, aims to make sure that all reservoirs are properly maintained and monitored to detect and repair any problem.

The proposed development site is not however shown to be affected in any case.

3.8 FLOODING FROM SEWERS

United Utilities (UU) do not provide information on flood risk from their assets and there have been no reports of flooding from this method. It is therefore concluded the site is not at risk of flooding from these sources as they should be properly maintained by the sewerage undertaker.

4. SURFACE WATER DRAINAGE STRATEGY & DESIGN

4.1 INTRODUCTION

The principal aim of the following drainage strategy is to design the development to avoid, reduce and delay the discharge of rainfall to public sewers and watercourses in order to protect watercourses and reduce the risk of localised flooding, pollution and other environmental damage.

In order to satisfy these criteria this surface water runoff assessment and drainage design has been undertaken in accordance with the following reports and guidance documents:

- SuDS Manual, CIRIA Report C753, 2015 [7]
- Code of Practice for Surface Water Management, BS8582:2013, November 2013[8]
- Rainfall Runoff Management for Developments, Defra/EA, SC030219, October 2013[9]
- Designing for Exceedance in Urban Drainage – Good Practice, CIRIA Report C635, 2006[10]
- Flood Estimation Handbook (FEH)[11]
- Flood Studies Report (FSR), Volume 1, Hydrological Studies, 1993[12]
- Flood Studies Supplementary Report No 14 (FSSR14), Review of Regional Growth Curves, 1983[13]
- Flood Estimation for Small Catchments, Marshall & Bayliss, Institute of Hydrology, Report No. 124 (IoH 124), 1994[14]
- Department for Environment, Food and Rural Affairs, Non-Statutory Technical Standards for Sustainable Drainage Systems, March 2025[15]

The following drainage strategy is based on the latest site layout plan by Architects Plus (Drawing No. 25034-02F). Any alterations to the site plan resulting in changes to impermeable areas will require the drainage strategy to be revisited.

4.2 SURFACE WATER DISPOSAL

Surface water disposal has been considered in line with the hierarchy outlined in the SuDS Manual[7]. The approach considers infiltration drainage in preference to disposal to watercourse, in preference to discharge to sewer.

Cumberland Council as Lead Local Flood Authority prefer design in accordance with the Cumbria Design Guide which identifies the following hierarchy of techniques to be used:

- **Prevention**: Prevention of runoff by good site design and the reduction of impermeable areas.

- **Source Control**: Dealing with water where and when it falls (e.g. permeable paving).
- **Site Control**: Management of water in the local area (e.g. swales, detention basins).
- **Regional Control**: Management of runoff from sites (e.g. balancing ponds, wetlands).

4.2.1 COLLECTED FOR NON-POTABLE USE

The non-statutory technical standards for SuDS were updated in June 2025, placing “collected for non-potable use” (i.e. rainwater harvesting) as the highest priority, above “infiltrated to ground.” Rainwater harvesting (RWH) involves collecting and storing rainwater (typically from roof areas) for reuse in non-potable applications such as irrigation, toilet flushing, and laundry. While it can reduce reliance on mains water and lower water bills, RWH systems are generally expensive to install, often requiring large underground tanks and pumped distribution systems.

Most commercially available RWH systems provide minimal additional storage for attenuation, meaning they offer limited benefit in terms of SuDS performance. In Cumbria, tanks are also likely to be full at the onset of a storm, and without an automated drawdown mechanism to create pre-event capacity, they cannot function as effective attenuation features. For RWH to contribute meaningfully to SuDS, it must be paired with a consistent, frequent non-potable demand that keeps the tank sufficiently empty to accommodate new rainfall. Where water use is low or intermittent, the system cannot reliably provide attenuation.

Given the nature of the proposed affordable housing development, the budget constraints, and the limited attenuation benefit offered by RWH, it is concluded that RWH is not a suitable option for this site. Additionally, the Environment Agency does not classify Millom as a “seriously water-stressed” area, so the use of RWH is not considered necessary or appropriate in this context.

4.2.2 DISCHARGE TO GROUND

Permeability testing undertaken at the site by 3E Consulting Engineers has indicated that the ground is not suitable to facilitate soakaway drainage. For further information refer to Section 2.7.

In addition, as the existing hardstanding areas of the site and former residences were known to be positively drained and connected to the existing combined public sewers in the vicinity for conveyance/disposal, this also indicates that soakaways are not a viable drainage solution.

4.2.3 DISCHARGE TO WATERCOURSE, SURFACE WATER OR HIGHWAYS DRAIN

Disposal to the nearest watercourse (The Beck) has been discounted due to the fact it would require a long complex route through third party owned land and it is highly unlikely the topography allows for compatibility with the receiving beck levels to enable a gravity fed connection from the development. Significant lengths of new pipework would also need to be installed and agreements would have to be sought with potentially multiple third-party landowners to enable a route to be established.

No separate surface water sewers or separate Highways drains are in the vicinity of the site.

4.2.4 DISCHARGE TO COMBINED SEWERS

It is therefore considered most appropriate to replicate the original surface water drainage disposal arrangement utilising connections to the existing public combined sewer drainage network located within the site.

4.2.5 PRE-APPLICATION DISCUSSIONS

A pre-application meeting with RGP, TA, Cumberland Council LLFA and UU was held on 18th July 2024 to discuss the site proposals, the drainage parameters and disposal options available to dictate the drainage strategy.

It was agreed that despite the site having previously been developed it should be classified as 'Greenfield' based on the time period that has elapsed since occupation and because Millom has existing known issues elsewhere with surface water flooding.

A private attenuation-based scheme with controlled discharge to the existing public combined sewer network was determined to be the most suitable option based on the site constraints and to further mitigate against wider surface water flooding risk issues.

The drainage strategy as proposed has therefore been undertaken using these design principles.

4.3 ASSESSMENT OF SITE AREAS

To support the exploration of options for site drainage, the spatial extent of different types of proposed land cover on the site have been measured. Table 4.1 shows the measured proposed land cover areas.

Table 4.1 Land Cover Areas

Land Cover	Area		Percentage of total site area
	m^2	Ha	
Total housing roof area	2189.9	0.219	13%
Total drained parking and paved area	3784.2	0.378	22%
Potentially contributing garden & landscaped areas	1986.8	0.199	11%
Remaining garden & landscaped areas not contributing to the drainage network	6657.6	0.666	38%
Existing Road Area – not included	2874.5	0.287	16%

To develop the detailed drainage design, only certain surfaces and areas will be positively drained into the surface water network. Positively drained areas include roof areas, patio /paved areas, car parking, access road and footways. All other areas (principally gardens and landscaping) will either have a permeable surface or will have no positive drainage as will isolated parking spaces in communal areas that are disconnected from the residences.

Table 4.2 summarises this and shows that the total new catchment area which could contribute to the drained network as covering 46% of the overall site area with the existing impermeable road area covering 16% with undrained areas making up the remaining 38%.

A catchment plan is provided in Appendix A for reference.

Table 4.2 Summary of drained and undrained areas into surface water drainage system

Land Cover	Area		Percentage of total site area
	m²	Ha	
Total new positively drained impermeable	7960.9	0.796	46%
Existing impermeable road area	1986.8	0.199	16%
Remaining permeable/undrained area	7545.3	0.755	38%

Without attenuation-based SuDS, the proposed development would increase the Rate of Runoff from the developed areas of the site.

4.4 PRE-DEVELOPMENT RUNOFF ASSESSMENT

The pre-development Greenfield runoff assessment has been updated to reflect the latest Flood Estimation Handbook (FEH) Statistical Method which introduces significant changes to hydrological analysis in the UK, focusing on better representing current catchment conditions through updated datasets and recalibrated models. This update, effective for 2025 [15], impacts how greenfield runoff rates (the baseline flow from undeveloped land used in SuDS design) are calculated. The updated calculation has been undertaken using the Greenfield runoff rate estimation tool provided by HR Wallingford (www.uksuds.com). A copy of the results are presented in Appendix B and summarised below in Table 4.3. Note that this revised assessment uses the total drained area as stated in Table 2 (0.796 Ha) and not the full site area (1.75 Ha).

Table 4.3 Pre-Development Greenfield Runoff Rates

Rate of Runoff (l/s)	
Event	**Greenfield**
Q1	3.7
QBAR	**4.2**
Q10	5.8
Q30	7.2
Q100	8.8
Q100 + 50% CC	13.2

Despite there being previous residences on the site that have only recently been demolished the entire site area has been classified as Greenfield for the purposes of deriving the runoff calculations. This approach is highly conservative as the peak runoff rate from the former residential estate would have been significantly higher than the greenfield runoff rate calculated.

The proposed discharge rate matching the equivalent Greenfield QBAR runoff of 4.2 l/s is also a considerable improvement on the rate of discharge that would previously have occurred when the site was occupied by housing which was positively drained at an unrestricted brownfield rate. By direct comparison if we assume the former (now demolished) housing development had comparable impermeable areas of only 46% of the overall site area, the equivalent brownfield

QBAR runoff rate can be calculated as 103 l/s demonstrating that a significant level of betterment is proposed. In addition, the 4.2 l/s QBAR rate derived using the FEH Statistical Method reduces the site discharge even further when compared to a previous iteration of this strategy which used the IoH124 methodology which calculated the QBAR rate to be 7.2 l/s.

4.5 SURFACE WATER DRAINAGE DESIGN PARAMETERS

The surface water drainage system has been designed on the following basis using the modified rational method and a generated rainfall profile:

4.5.1 CLIMATE CHANGE

Projections of future climate change indicate that more frequent short-duration, high intensity rainfall and more frequent periods of long-duration rainfall are likely to occur over the next few decades in the UK. These future changes will have implications for river flooding and for local flash flooding. These factors will lead to increased and new risks of flooding within the lifetime of planned developments.

The EA have provided a peak rainfall online map showing the anticipated changes in peak rainfall intensity across the UK. Climate change allowances are now provided on a catchment by catchment basis. The site falls within the South West Lakes catchment. Table 4.4 outlines the EA guidance for this catchment, for the anticipated design life of the proposed development.

In line with current guidance and for conservative design, a 50% allowance shall be used within this assessment.

Table 4.4 South West Lakes Management Catchment Peak Rainfall Allowances (1.0 AEP)

South West Lakes (1.0%AEP)	Central Allowance (%)	Upper End Allowance (%)
2050s	30	45
2070s	35	50

4.5.2 URBAN CREEP

BS 8582:2013[8] outlines best practice with regard to Urban Creep. Although not a statutory requirement, future increase in impermeable area due to extensions and introduction of impervious positively drained areas has been considered. An uplift of 10% on impermeable areas associated with plots only has been applied to the contributing area used for surface water drainage design.

4.5.3 PERCENTAGE IMPERMEABILITY (PIMP)

The percentage impermeability (PIMP) for all impermeable areas is modelled as 100%. The entirety of the impermeable areas is to be positively drained.

4.5.4 VOLUMETRIC RUNOFF COEFFICIENT (CV)

The volumetric runoff coefficient describes the volume of surface water which runs off an impermeable surface following losses due to infiltration, depression storage, initial wetting and evaporation. The coefficient is dimensionless. Default industry standard volumetric runoff coefficients are 0.75 for summer and 0.84 for winter.

A runoff coefficient of 1.0 has been used in the surface water drainage design. This is higher than the default industry standards and provides a further factor of safety within the hydraulic design.

4.5.5 RAINFALL MODEL

The calculations use the REFH2 unit hydrograph methodology in line with best practice as outlined in the SuDS Manual[7]. The calculations use the most up to date available catchment descriptors (2022) provided by the Centre for Ecology and Hydrology Flood Estimation Handbook web service.

4.5.6 SURFACE WATER DRAINED AREA CATCHMENT

Post-development, the runoff contribution from permeable gardens and landscaped areas that fall towards and could potentially contribute to a new drainage system must be assessed to ensure the drainage network is designed appropriately.

Runoff coefficients for pervious surfaces vary significantly with soil type, slope gradient, planting type, antecedent moisture, infiltration capacity, local depressions, and wider site conditions. There is no industry-wide consensus on values, with typical coefficients for gardens and landscaping ranging from 0.1 to 0.5. Applying a coefficient of 1.0 would be inappropriate, as it would disregard the attenuation and storage benefits that permeable areas provide during extreme rainfall events. To establish a more representative value, it is proposed that the Base Flow Index (BFI), derived from the UK Hydrology of Soil Types (HOST) classification within the FEH Web Service, is used as an inverse proxy for surface runoff intensity. A higher BFI indicates greater catchment storage and slower, lower-intensity runoff. Accordingly, the runoff coefficient decreases as BFI increases, and vice versa.

The site-specific BFI is 0.666, resulting in an estimated runoff coefficient of 0.333 for permeable areas. On this basis, 33.3% of the permeable area that falls towards potential intercepting drainage components is expected to contribute to the drainage network.

The catchment assessment is further complicated by the requirement to apply a 10% uplift to all roof areas to account for Urban Creep. Extensions, widened driveways, and enlarged patios typically encroach into garden areas, reducing the effective permeable area within each property’s curtilage. This reduction has been incorporated into the revised calculations, and the corresponding overall drained areas contributing to each attenuation tank have been included in Table 4.5 for reference.

4.6 SURFACE WATER DRAINAGE DESIGN

The proposed surface water drainage network serving the entire developable area of the site has been modelled using Causeway FLOW (a sample of results are included in Appendix B).

The drainage design has been sized to store a future 1% AEP event of critical duration without any flooding. Future climate change (50%) and urban creep (10% uplift to housing roof areas only) and is accounted for within the calculations.

Based on the site constraints a series of geocellular attenuation tanks are proposed to provide the surface water storage requirements of the various areas of the development.

Silt traps will be located upstream of each attenuation tank, which will provide surface water treatment and access for maintenance. Silt traps isolate silt and other particles by encouraging settlement into sumps, preventing ingress into the tank.

The attenuation tanks will be founded at a suitable level providing a minimum depth of suitable cover whilst allowing for connection to the existing or diverted public sewers. These tanks will be wrapped and sealed with an impermeable membrane to provide a water-tight structure.

Orifice flow control chambers will restrict discharge from each geocellular attenuation system. With a total off-site cumulative discharge rate of 4.2 l/s equalling the pre-development greenfield QBAR rate.

A summary of the number and size of geocellular attenuation tanks and associated flow control devices along with contributing catchment areas is provided below in Table 4.5.

Table 4.5 Attenuation System requirements

Tank No.	Plots	Drained Area ($m^{2)}$	Length (m)	Width (m)	Depth (m)	Plan Area (m^2)	Storage Volume required (m^3)	Discharge Rate (l/s)	Orifice Size (mm)
1	1 to 6	773	30	3.5	0.8	105	80	0.5	16
2	7 & 8	491	10	6	0.8	60	46	0.4	14
3	9 to 13	758	23	5	0.8	115	87	0.4	14
4	14 to 24	1730	30	8	0.8	240	182	1.1	24
5	25 to 28	557	20	4.5	0.8	90	68	0.3	12
6	29 to 33	630	25	4	0.8	100	76	0.3	12
7	34 to 42	1479	24	9.5	0.8	228	173	0.7	19
8	43 to 47	698	23	4	0.8	92	70	0.5	16
	TOTAL	**7116**					**783**	**4.2**	

Roof water, driveway, path and contributing green area runoff will connect directly into the surface water pipe network upstream of the attenuation systems, with inspection chambers utilised to route the new pipework and allow for future inspection and maintenance. Proposed external levels will fall consistently to enable gravity connections to the drainage system.

New shared access road and car parking areas will be constructed using conventional surfacing in the form of asphalt or block paving. The shared access roads will be drained via. a series of highway gullies and/or channel drains into the proposed surface water drainage network.

For parking areas that are located in isolated communal areas i.e. central public open space area that are disconnected from the plots, Type A (full infiltration) permeable surfacing is proposed with nominal surface falls away from the highway for redundancy.

Full details of the drainage proposals are shown on RGP drawings K41327-41, 42 & 43 included in Appendix A.

4.7 OTHER BENEFITS OF DEVELOPMENT

The development site in its current form is sparse vegetation, underlain by relatively impermeable soil, which provides little in the way of natural flood defence or attenuation to overland flows and stormwater runoff. The land in its current form also lacks any meaningful biodiversity or amenity value and provides limited benefits to the surrounding community.

The proposed development site will tie into the existing topography via careful design. Slopes, gardens and open space areas will be carefully landscaped using a variety of plants, shrubs and trees, providing a net gain in biodiversity and enhanced storage/protection against overland flows.

As such the existing hydraulic regime of the site will be modified whereby overland and subsurface flows will be intercepted, attenuated, and re-directed by below ground structures, positive drainage and service trenches.

Hydraulic gradients and velocities will be reduced, and the risk of downstream flooding would not be increased. As noted in Section 4.4, the new development will significantly reduce the rate of surface water runoff into the existing combined sewer network when compared to the original former housing development on the same site.

4.8 DESIGNING FOR LOCAL DRAINAGE SYSTEM FAILURE

In accordance with the general principles discussed in CIRIA Report C635 – Designing for Exceedance in Urban Drainage [10] the proposed surface water drainage, where practical, should be designed to ensure there is no increased risk of flooding to the proposed dwellings on the site or elsewhere as a result of extreme rainfall, lack of maintenance, blockages or other causes. These measures are discussed below.

4.8.1 BLOCKAGE & EXCEEDANCE

The sustainable drainage system has been designed to attenuate a 100-year design storm including a 50% allowance for climate change, with no flooding. The drainage system will also provide capacity for lower probability (greater design storm events) which are not critical duration.

Should flooding occur within any of the flow control devices, manholes or silt traps, exceedance flows would follow the road gradients, re-entering the network via capture from the proposed new road gullies.

In the highly unlikely event that exceedance flows were to bypass any of the proposed development, drainage flows would migrate towards the existing site highway where they would be contained and intercepted by existing road gullies.

A flood routing plan Drawing No. K41327-45 is included in Appendix A for reference.

4.8.2 SURFACE STORAGE & EXTERNAL LEVELS

The site levels have been designed to offer additional surface water storage volume and conveyance of flood water should the SuDS and drainage system fail, flood or exceed capacity. Where appropriate, the kerb lines have been raised to channel surface water runoff back into the drainage system or onto the existing highway.

4.8.3 BUILDING LAYOUT & DETAIL

The finished floor levels to the new dwellings have been designed and situated to ensure that they are not at risk of flooding from overland flow. Finished floor levels will typically be set 150mm above external paved areas (whilst providing level access where needed). External footpaths typically fall away from the thresholds, ensuring that any flood water runs away from, rather than towards the dwellings. Threshold drains could be incorporated at level access points for additional redundancy.

4.8.4 DRAINAGE CONTINGENCY

The proposed surface water system will be designed to provide adequate storage volume against flooding for the Q100 event, including a 50% allowance to account for climate change. The drainage system will also provide capacity for lower probability (greater design storm events) which are not critical duration.

4.9 SURFACE WATER TREATMENT

The treatment of surface water is not a statutory requirement. Water quality remains a material consideration but there are no prescriptive standards to be imposed in terms of treatment train management. In the absence of a design standard, the SuDS manual has been used which outlines best practice.

Pollutants such as suspended solids, heavy metals and organic pollutants may be present in surface water runoff, the quantity and composition of the runoff is highly dependent upon site use. For housing developments, the pollutant load is very low. The SuDS Manual[7] outlines best practice with regards to treatment of surface water by SuDS components prior to discharge to the environment. SuDS components can be effective in reducing the amount of pollutants within the surface water discharged and therefore environmental impact of the development. SuDS components may be installed in series to form a treatment train to treat the runoff.

At the pre-application meeting (Section 4.2.4) it was agreed with UU and CC LLFA that as the site surface water discharge will be to the combined public sewer that no additional proprietary treatment of surface water is required at this site as ultimately all combined flows will be treated by the receiving Wastewater Treatment Works.

Nevertheless, silt traps and flow control devices with built in sumps proposed across the site, will however isolate silt and other suspended solid particles by encouraging settlement, preventing ingress into the tank thus reducing migration into the wider combined sewer network.

4.10 OPERATIONS & MAINTENANCE RESPONSIBILITY

The drainage systems will be privately maintained by Home Group. A SuDS '*Operations & Maintenance Plan'* has been prepared by RGP detailing the requirements for future maintenance of the SuDS components.

5. FOUL WATER DRAINAGE STRATEGY

It is proposed that foul water from the new development shall be drained via gravity within the site for disposal via multiple connections to the existing public combined sewer network located within the existing site highways.

The new connections will be subject to formal application to UU under S106 agreements. Under Section 106 of The Water Industry Act 1991, '*the owner / occupier of any premises shall be entitled to have his drain or sewer communicate with the public sewer of any sewerage undertaker and thereby to discharge foul water and surface water from those premises or that private sewer*.' Unless '*the making of the communication would be prejudicial to the undertaker's sewerage system'*.

All private drainage will be constructed in accordance with The Building Regulations Approved Document Part H.

Foul water discharge calculations have been undertaken for the 47 no. dwellings in accordance with the Design and Construction Guidance for Foul and Surface Water Sewers [16], as shown in Table 5.1.

Table 5.1 Peak Foul Flow Rates

Sewerage Sector Design & Construction Guidance Clause B3.1	
Total Peak Load based on Number of Dwellings, 47 no. units @ 4000 l/day	188,000
Peak Flow Rate from Site (l/s)	2.18

The estimated cumulative total peak foul flow rate for the development is 2.18 litres/sec.

These flows will be split up across the site via multiple local connections to the existing combined sewer network to locally suit areas of the development.

For further details, refer to the Outline Drainage Layout Plan included in Appendix A (K41327-41).

6. CONCLUSIONS AND RECOMMENDATIONS

The proposed Flood Risk Assessment and Drainage Strategy can be summarised as follows:

- The site is located in Flood Zone 1 with a predicted annual probability of flooding from rivers or the sea of less than 0.1% AEP (1 in 1000).
- By reference to the National Planning Policy Framework [1] on Flood Risk, More Vulnerable development is acceptable within this flood zone.
- The site is not considered to be at significant risk of flooding from surface water, groundwater, reservoirs, canals, or any artificial structures.
- Rainwater harvesting is not considered appropriate for this development.
- Ground investigations have confirmed that the underlying strata is not suitable for infiltration-based SuDS components.
- The nearest watercourse located to the north of the site is not a suitable point of discharge due to topographical, third-party land ownership and routing complications. There are also no surface water sewers or separate highways drains in the vicinity of the site.
- It is proposed that surface water drainage shall be positively drainage and attenuated, using several geocellular tank systems, with individual orifice flow control devices restricting the cumulative site discharge to match the equivalent pre-development Greenfield QBAR rate of 4.2 l/s.
- This provides betterment when compared to the original housing development on the same site.
- Attenuated surface water disposal will be into the existing public combined water system located in the existing site roads that served the original housing estate.
- The communal car parking area will be constructed using permeable surfaces.
- Foul flows generated from the development shall discharge via gravity to the existing public combined sewers via several new connections.
- A SuDS Operations and Maintenance Plan has been prepared detailing future maintenance requirements of all sustainable drainage systems.

7. REFERENCES

[1] Ministry of Housing, Communities and Local Government, National Planning Policy Framework, December 2024.

[2] Ministry of Housing, Communities and Local Government, Planning Practice Guidance to the National Planning Policy Framework, February 2024

[3] Defra/Environment Agency, The Town and Country Planning Order 2015, 2015 No.595, April 2015

[4] British Geological Survey, Geoindex: http://mapapps2.bgs.ac.uk/geoindex/home.html

[5] Land Information System (LANDIS)- Soilscapes viewer, http://www.landis.org.uk/soilscapes

[6] Defra Magic Maps, https://magic.defra.gov.uk/MagicMap.aspx .

[7] CIRIA, The SuDS Manual, Report C753, 2015.

[8] BS8582:2013, Code of Practice for Surface Water Management, November 2013.

[9] DEFRA/EA, Rainfall Runoff Management for Developments, SC030219, October 2013.

[10] CIRIA, Designing for Exceedance in Urban Drainage – Good Practice, Report C635, London, 2006.

[11] Centre for Ecology and Hydrology, Flood Estimation Handbook, Vols. 1 – 5 & FEH CD-ROM 3, 2009.

[12] Institute of Hydrology, Flood Studies Report, Volume 1, Hydrological Studies, 1993.

[13] Institute of Hydrology, Flood Studies Supplementary Report No 14 – Review of Regional Growth Curves, August 1983.

[14] Marshall & Bayliss, 1994. Flood Estimation for Small Catchments, Report No. 124 (IoH 124), Institute of Hydrology.

[15] Department for Environment, Food and Rural Affairs, Non-Statutory Technical Standards for Sustainable Drainage Systems, July 2025

[16] Water UK, Design and Construction Guidance for Foul & Surface Water Sewers Offered for Adoption Under the Code for Adoption Agreements for Water and Sewage Companies Operating Wholly or Mainly in England, Approved Version 2.3 Nov 2023

[17] 3E Consulting Engineers. February 2019. Phase II: Geo Environmental Assessment Report Report no. P17-498.

APPENDIX A

DRAWINGS

Drainage Key

- Existing Highways Drainage
- Existing Combined Water Public Sewer
- Combined Sewer Diversion S185
- Combined Sewer Closure S116
- Proposed Foul Water Private Drainage
- Proposed Surface Water Private Drainage
- Proposed Channel Drains

Tank No.	Plots	Drained Area (m2)	Length (m)	Width (m)	Depth (m)	Plan Area (m2)	Storage Volume required (m3)	Discharge Rate (l/s)	Orifice Size (mm)
1	1 to 6	773	30	3.5	0.8	105	80	0.5	16
2	7 & 8	491	10	6	0.8	60	46	0.4	14
3	9 to 13	758	23	5	0.8	115	87	0.4	14
4	14 to 24	1730	30	8	0.8	240	182	1.1	24
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6	29 to 33	630	25	4	0.8	100	76	0.3	12
7	34 to 42	1479	24	9.5	0.8	228	173	0.7	19
8	43 to 47	698	23	4	0.8	92	70	0.5	16
Total		7116					783	4.2	

Note:
All attenuation tanks to include silt traps at all upstream connection locations with discharge controlled via. a downstream orifice flow control chamber with built in removable overflow weir wall.
Assume 1m cover over tanks to facilitate service crossings.
Allow for ventilation and provision for maintenance access on all tanks (to suit preferred manufacturers specification).
Tank sizes shown are based on standard Polystorm geocellular crate dimensions.

Note:
Drawing is provided to indicate the extent of drainage attenuation requirements and associated discharge rates to match the cumulative equivalent Greenfield QBar rate (4.2 l/s) and is subject to change pending any future alterations to the layout and or levels.

Note:
Drainage runs are shown indicatively.
Refer to Architects drawings for plot specific drainage items.
Assume 100Ø/150Ø pipework for all plot drainage and allow for threshold drains at each doorway.
Assume linear channel drains on all private driveways and gullies for shared road/court areas.

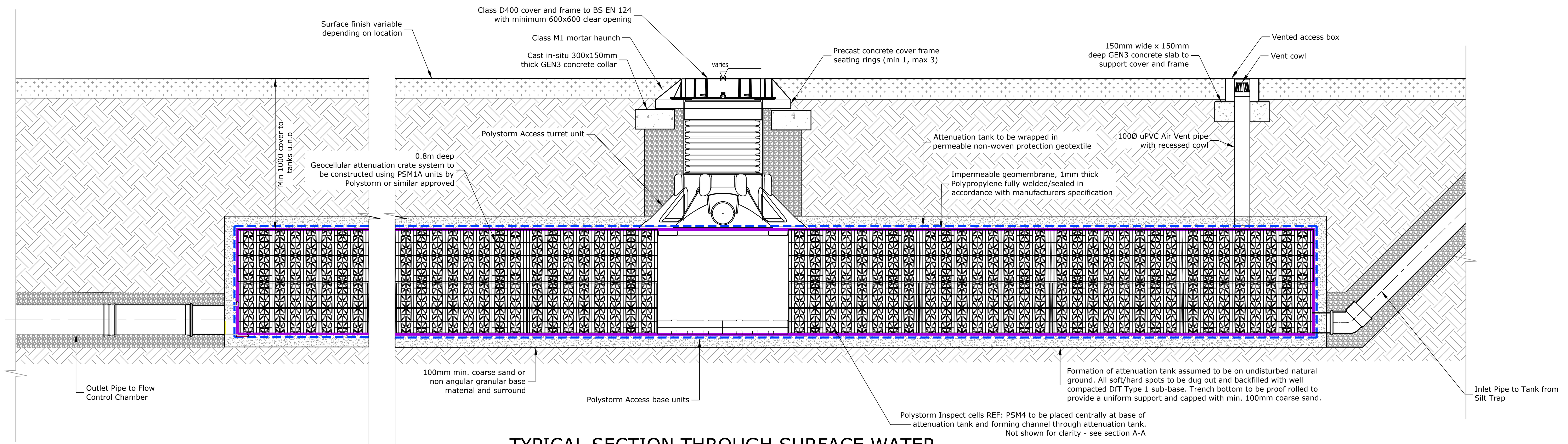
Rev	Description	Date	Revised by	Checked by	Approved
A	Updated for revised site layout	21/05/26	TM	TM	TM

Issue Purpose: PLANNING

Do not scale from this drawing

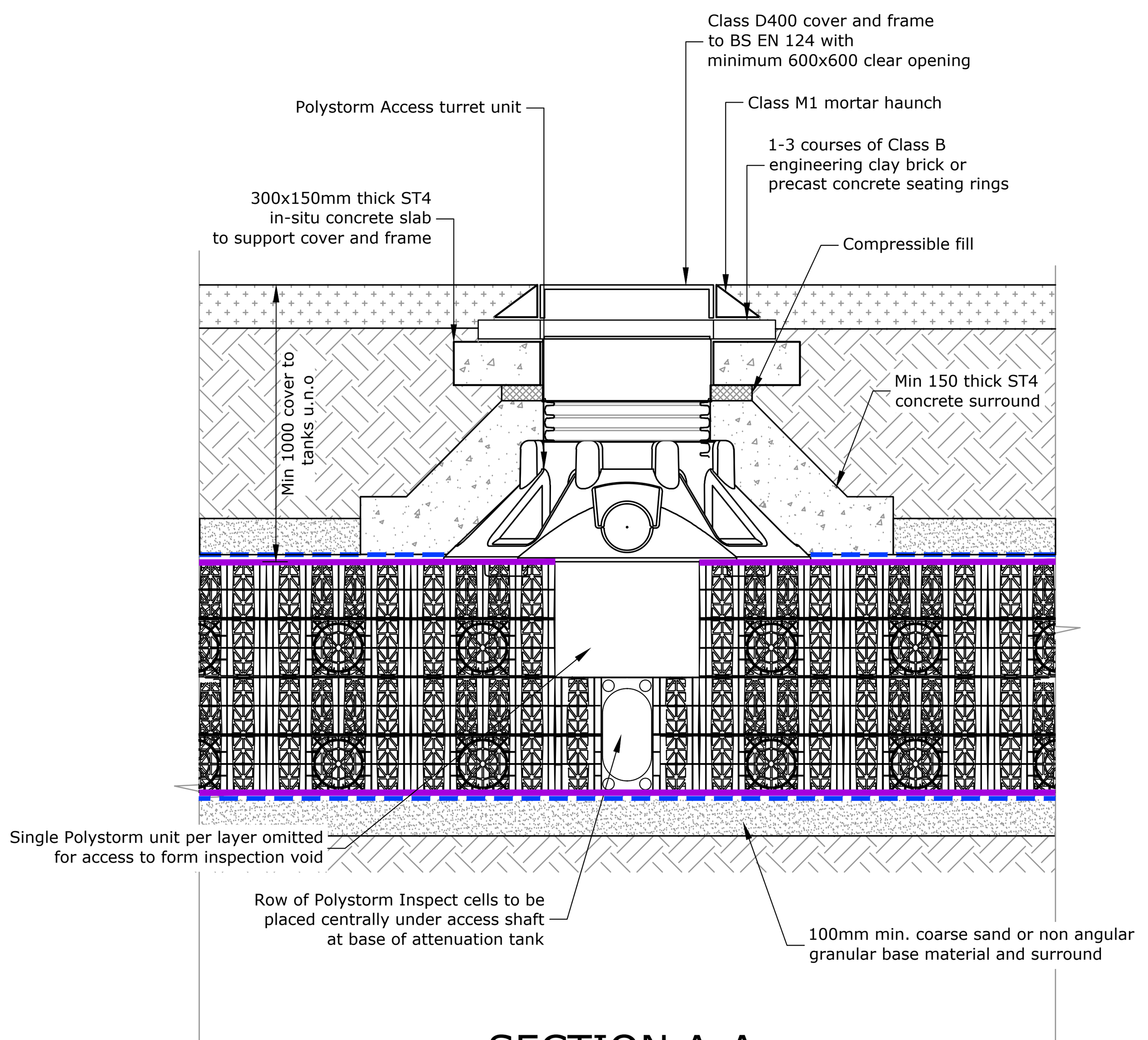
R G PARKINS
Kendal | 01539 729393 Lancaster | 01524 32548

Client: Thomas Armstrong	Scale @ A1: 1:250	First Issue: 14/04/26	Office of Origin: Kendal
Project: Queens Park, Millom	Drawn by: CA	Checked by: TM	Approved: TM
Drawing Title: Outline Drainage Layout	Project No: K41327	Drawing No: 41	Rev: A
	BIM No:		



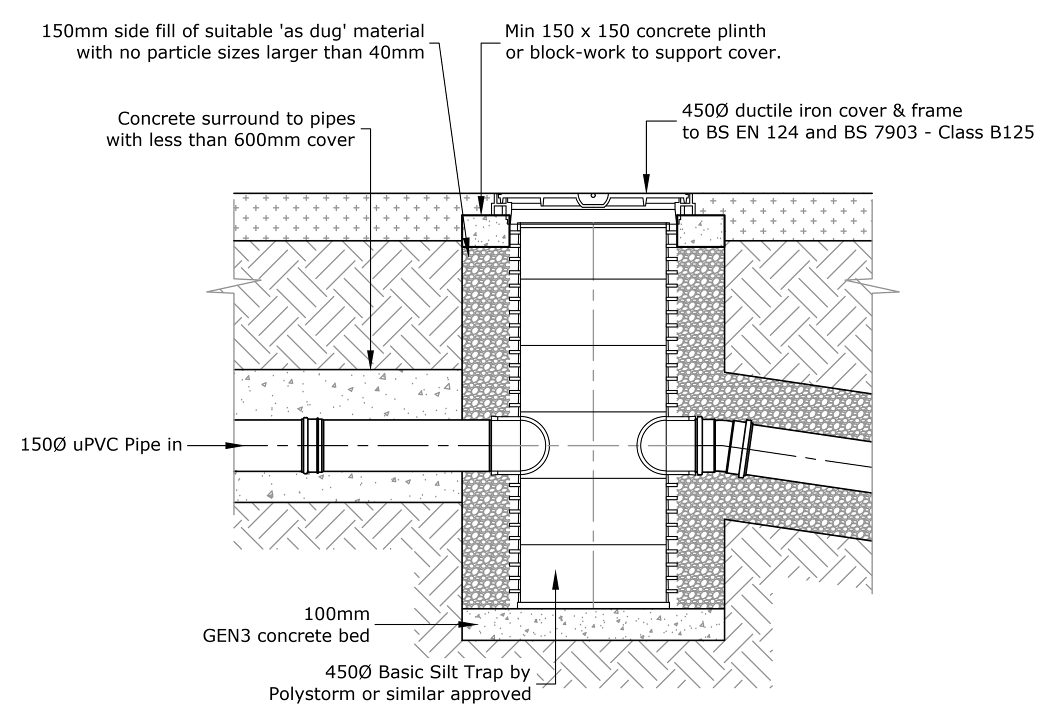
TYPICAL SECTION THROUGH SURFACE WATER DRAINAGE ATTENUATION TANK

Scale 1:20



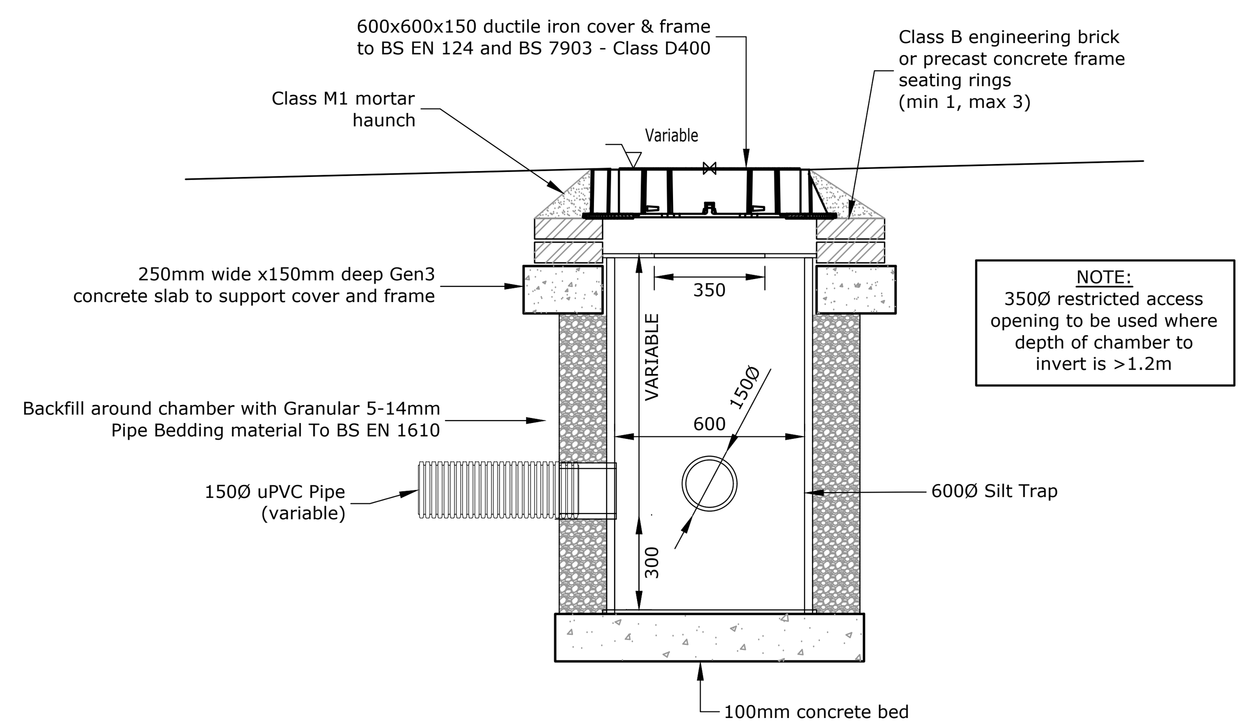
SECTION A-A THROUGH ACCESS TURRET

Scale 1:20



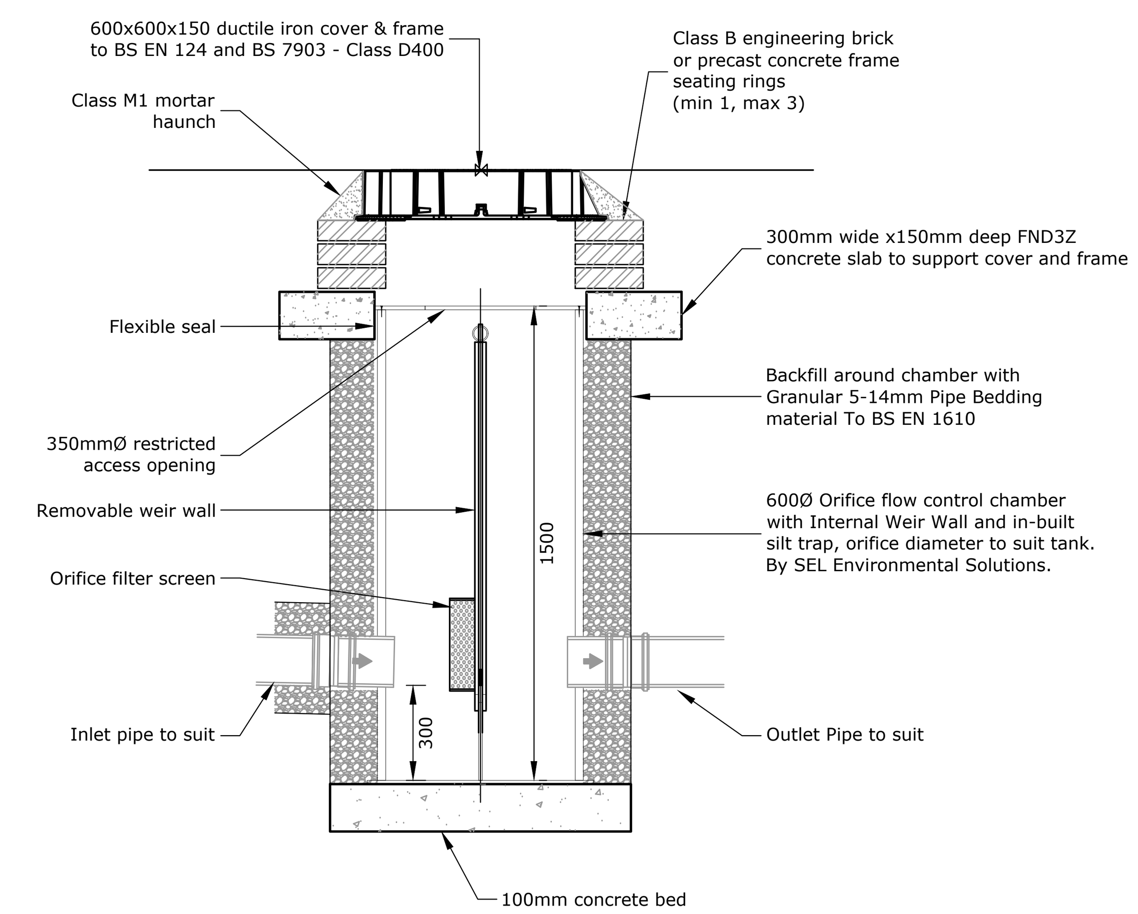
TYPICAL 450Ø SILT TRAP

Scale 1:20



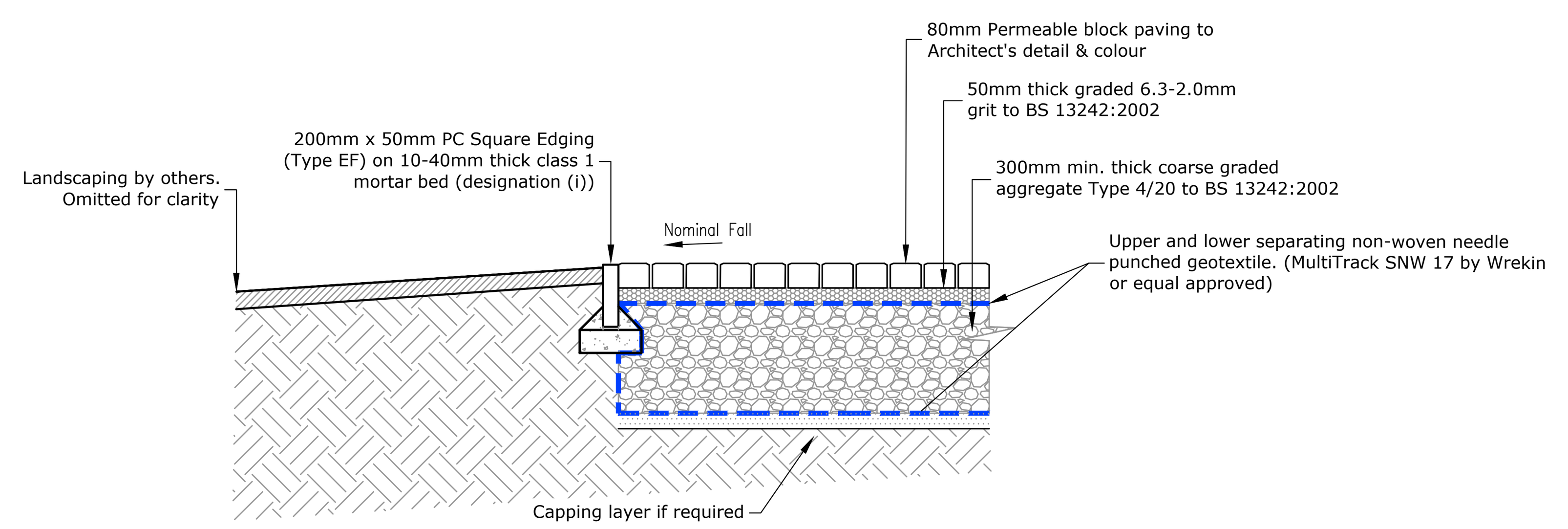
TYPICAL 600Ø SILT TRAP

Scale 1:20



TYPICAL 600Ø ORIFICE FLOW CONTROL

Scale 1:20



CONSTRUCTION ASSUMES IN-SITU CBR VALUES OF >5%.
CONTRACTOR TO UNDERTAKE ADDITIONAL CBR TESTS AT FORMATION TO VERIFY DESIGN.

TYPICAL PERMEABLE PAVING DETAIL [PARKING BAYS]

Scale 1:20

General Notes

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2. All dimensions are in millimetres and all levels in mAOD unless stated otherwise.
3. This drawing is to be read in conjunction with all relevant Architects drawings as well as all other drawings by RG Parkins.
4. The Contractor is responsible for verifying all dimensions on site prior to commencing works.
5. Any specified proprietary products are to be installed in strict accordance with manufacturers guidelines. No specified product should be substituted without gaining approval from RG Parkins.
6. All private plot drainage should be installed in accordance with The Building Regulations 2010 Approved Document Part H: Drainage and Waste Disposal.
7. All proposed drainage cover levels are based on indicative level information as provided by the Architect. RGP to be notified if finalised levels differ from those shown resulting in shallower drainage components.
8. All drainage construction offered for adoption is to be in accordance with all relevant clauses from the Civil Engineering Specification for the Water Industry (CESWI) and Design and Construction Guidance (DCG) for foul and surface water sewers under the code for adoption agreements for water and sewerage companies operating wholly or mainly in England.

Rev	Description	Date	Revised by	Checked by	Approved

Issue Purpose: PLANNING

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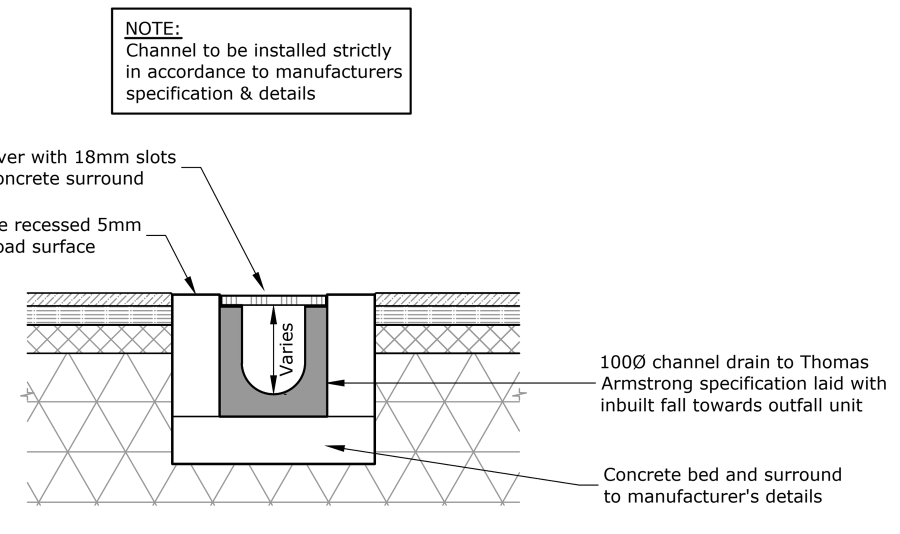
Kendal | 01539 729393 Lancaster | 01524 32548

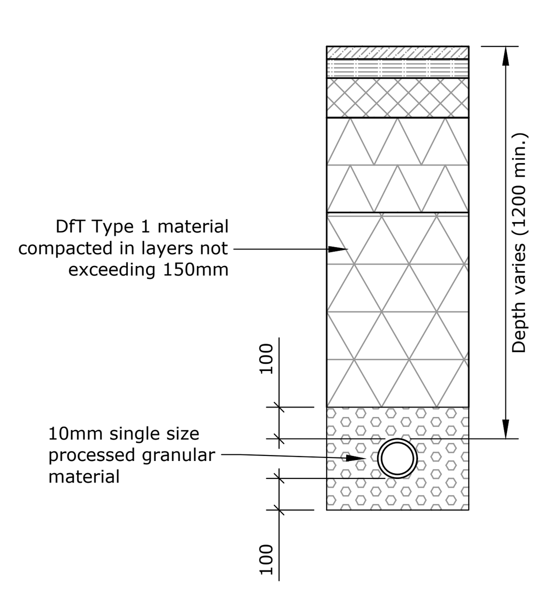
Scale @ A1: 1:20	First Issue: 14/04/26	Office of Origin: Kendal
Drawn by: CA	Checked by: TM	Approved: TM
Project No: K41327	Drawing No: 42	Rev:
BIM No:		

Client: Thomas Armstrong
Project: Queens Park, Millom
Drawing Title: Typical Drainage Construction Details Sheet 1 of 2



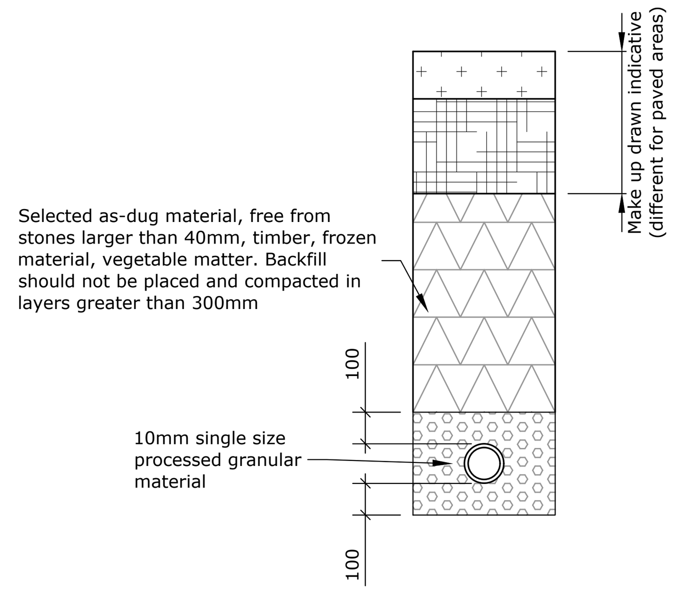
TYPICAL CHANNEL DRAIN DETAIL

Scale 1:20



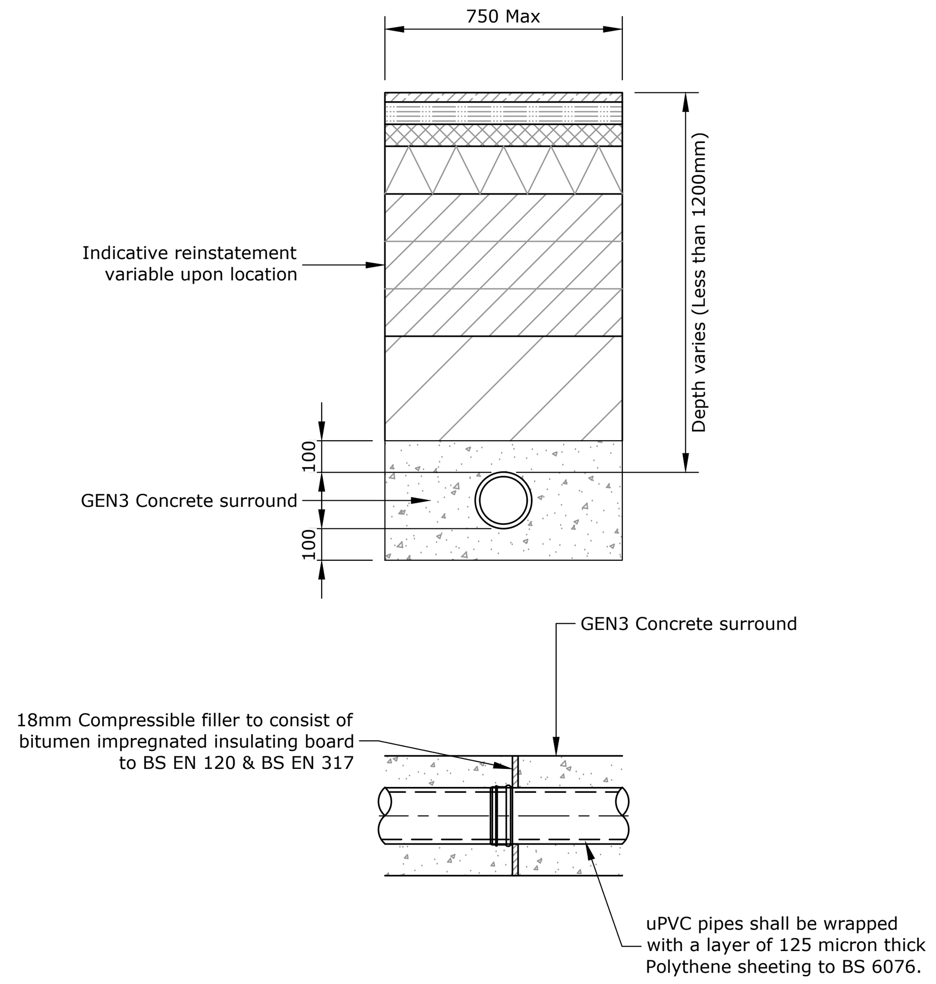
PIPE BEDDING FOR 100Ø/150Ø PIPES IN HARD LANDSCAPED AREAS

Scale 1:20



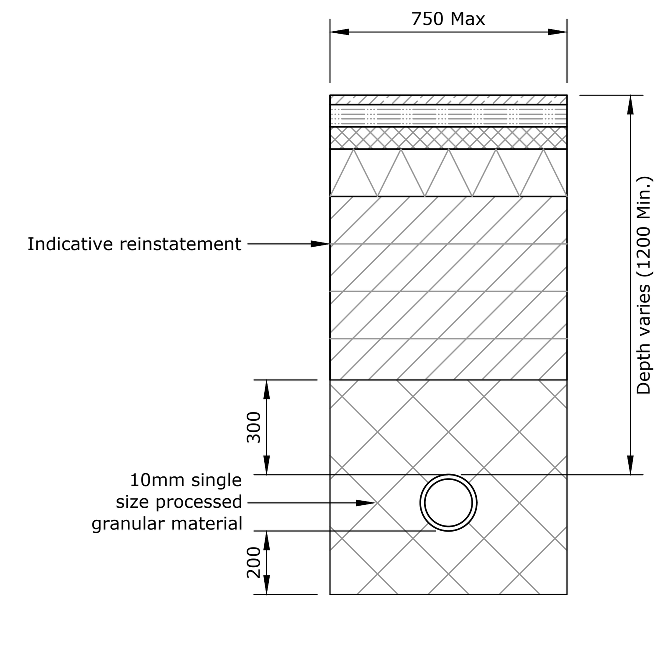
PIPE BEDDING FOR 100Ø/150Ø PIPES IN SOFT LANDSCAPED AREAS

Scale 1:20



CONCRETE SURROUND FOR 150Ø UPVC PIPE [If required]

Scale 1:50



Type 7 Embedment Class S for 150Ø Pipe

Scale 1:20

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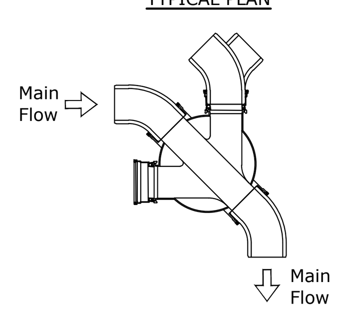
TYPICAL PLAN

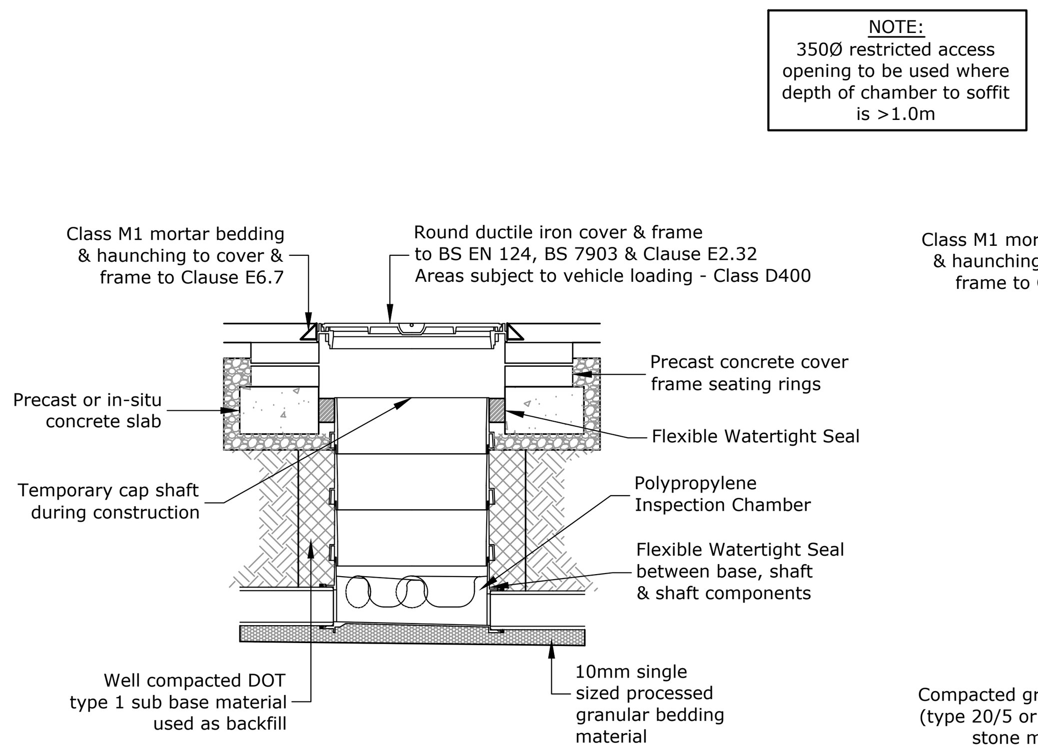


Where chambers are positioned on 90° corners always use the main channels by fitting a 45° bend on inlet & outlet

Bends of up to max 45° can be used on any inlet or the outlet

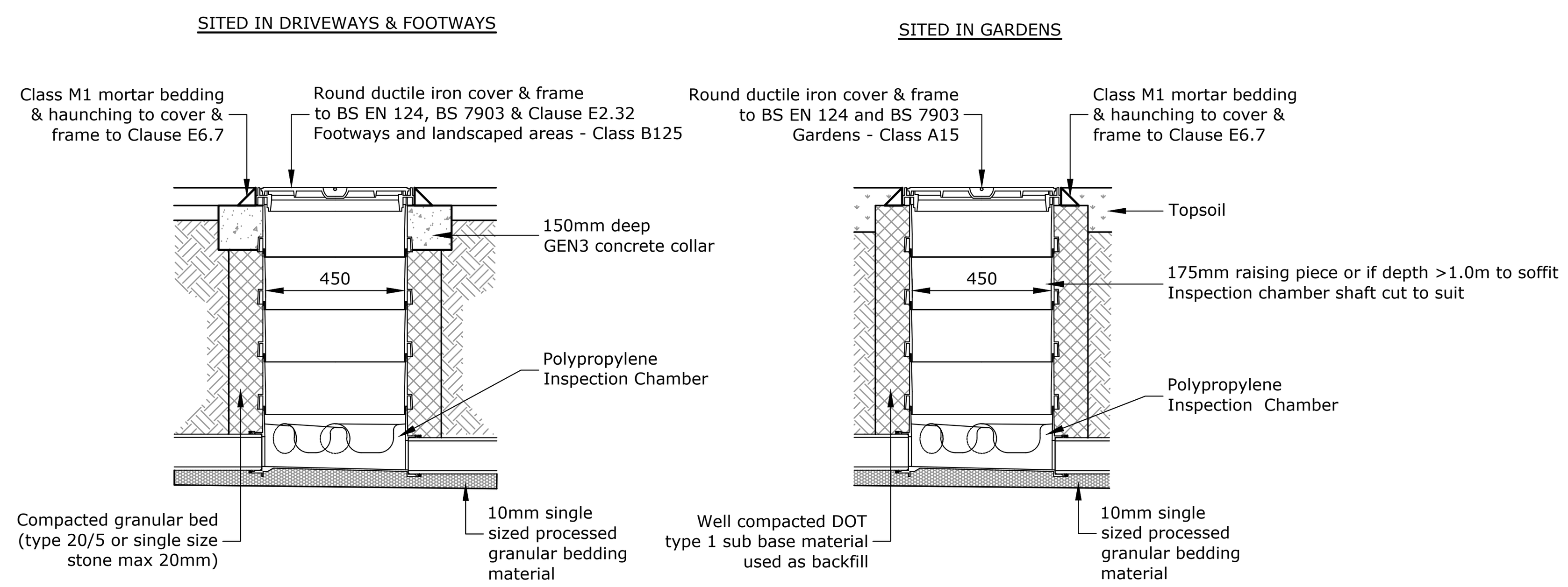
Short steep branch connections to be connected via a 45° inlet using a bend where necessary

Inlet stoppers to remain where connection not required



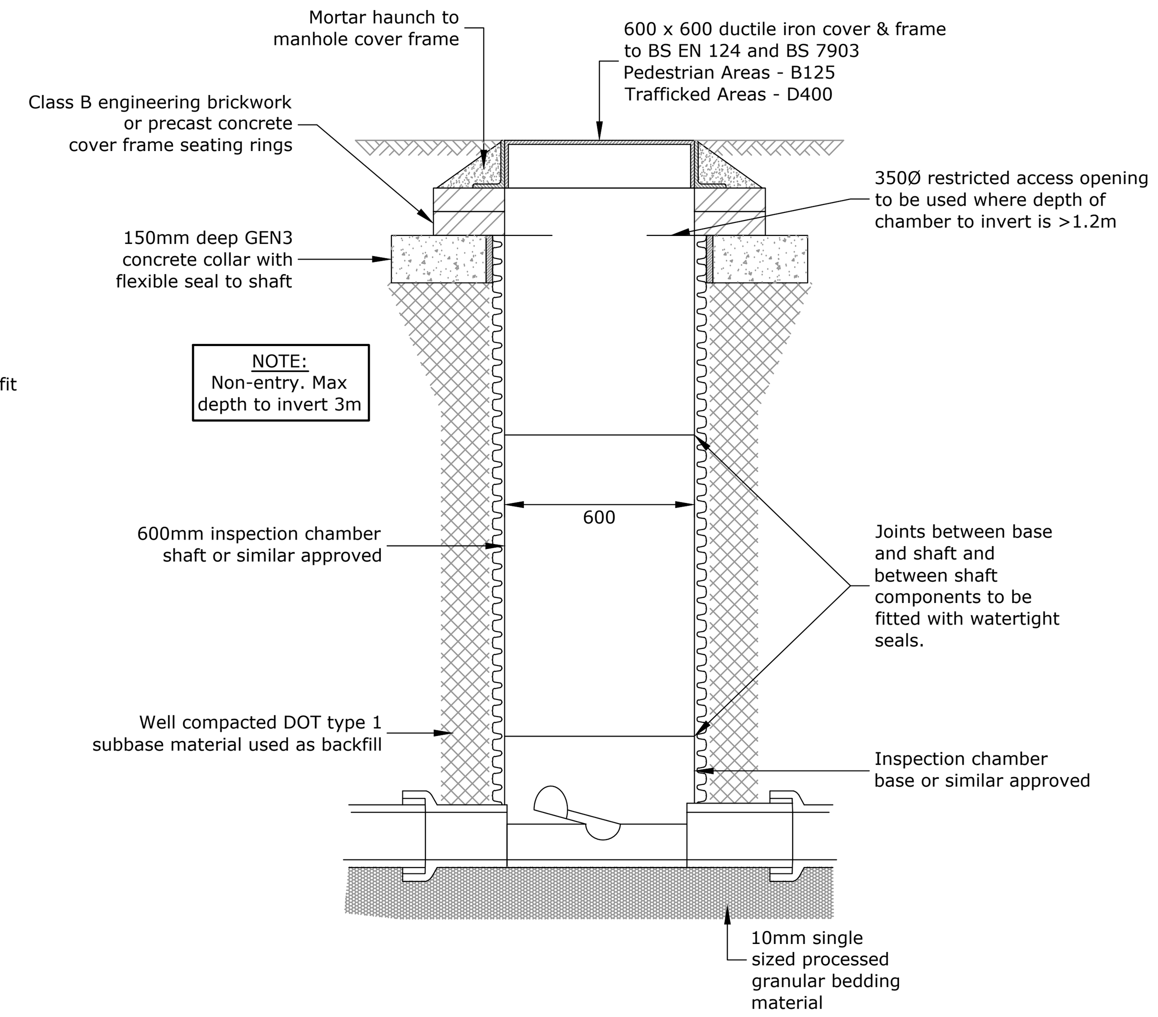
TYPICAL INSPECTION CHAMBER DETAIL (VEHICLE LOADING)

Scale 1:20



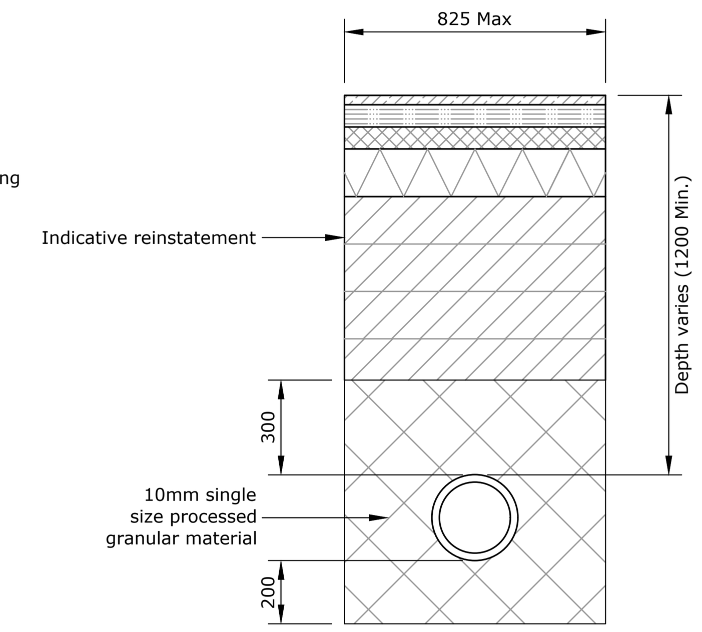
TYPICAL INSPECTION CHAMBER DETAIL (LIGHT LOADING)

Scale 1:20



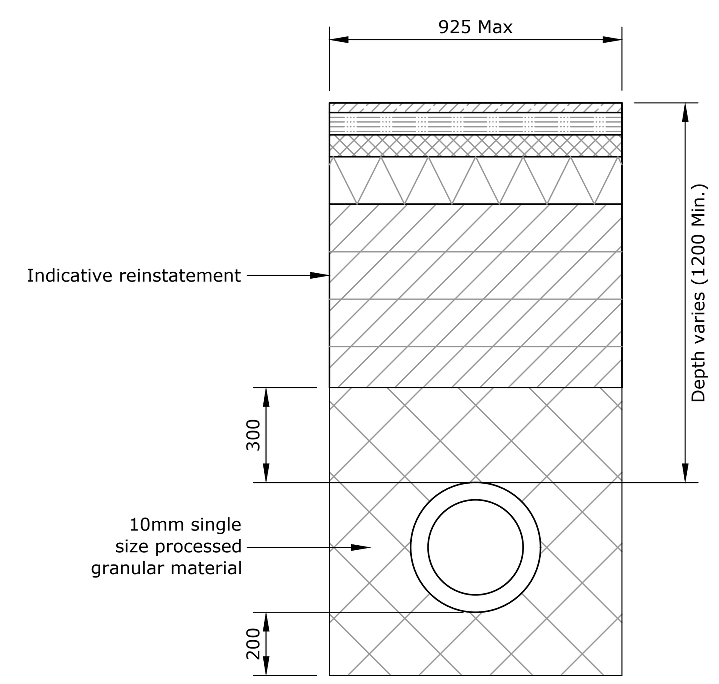
LARGE ACCESS CHAMBER DETAIL

Scale 1:20



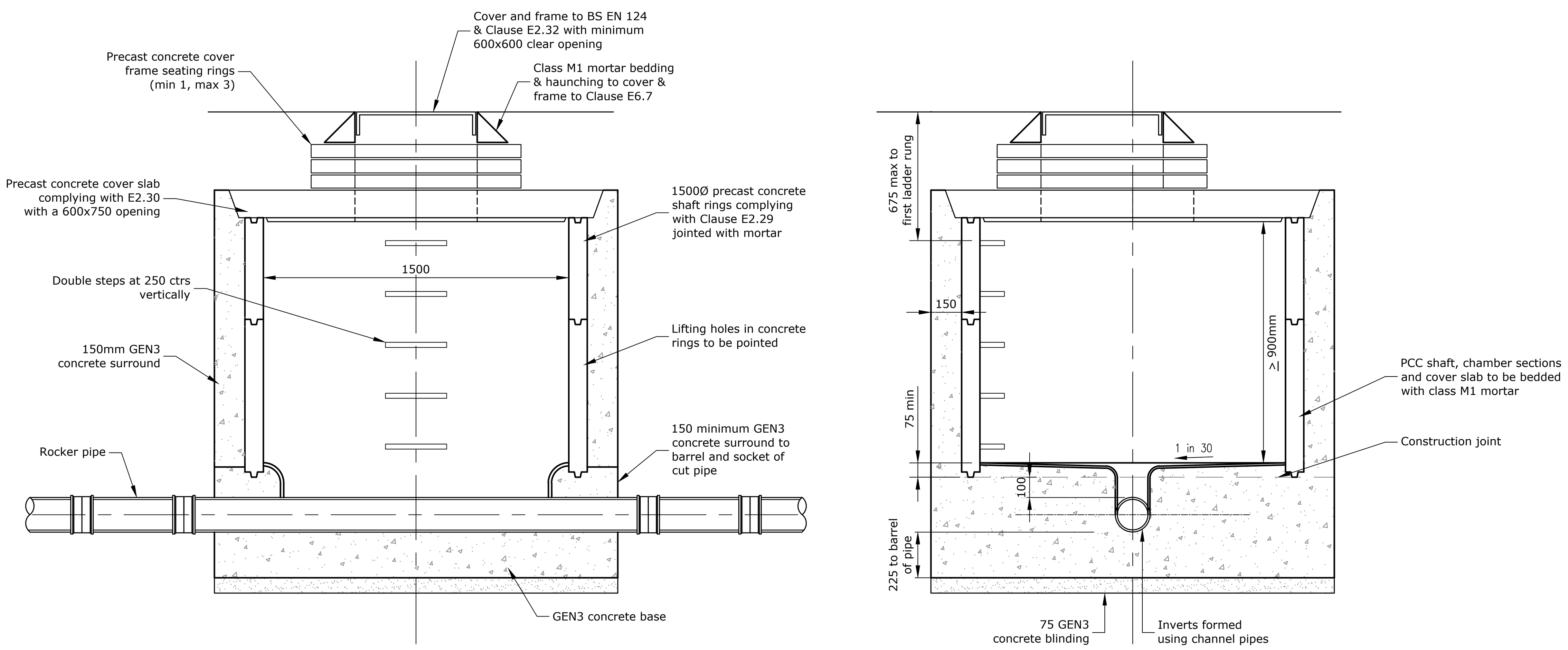
Type 7 Embedment Class S for 225Ø Pipe

Scale 1:20



Type 7 Embedment Class S for 300Ø Pipe

Scale 1:20



TYPICAL MANHOLE DETAIL - TYPE B DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE 1.5m to 3m (1500Ø)

Scale 1:20

Rev	Description	Date	Revised by	Checked by	Approved

Issue Purpose: PLANNING

Do not scale from this drawing

R G PARKINS

Kendal | 01539 729393 Lancaster | 01524 32548

Client:	Thomas Armstrong
Project:	Queens Park, Millom
Drawing Title:	Typical Drainage Construction Details Sheet 2 of 2

Scale @ A1: 1:20	First Issue: 14/04/26	Office of Origin: Kendal
Drawn by: CA	Checked by: TM	Approved: TM
Project No: K41327	Drawing No: 43	Rev:
BIM No:		

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KEY

Dwelling Roof Areas	= 0.219 Ha
Footpath/Patio Areas	= 0.244 Ha
Car Parking/ Driveway Areas	= 0.135 Ha
Landscaped/Gardens/ POS Areas	= 0.198 Ha
TOTAL AREA	= 0.796 Ha

Rev	Description	Date	Revised by	Checked by	Approved
A	Updated for revised site layout	21/05/26	TM	TM	TM

Issue Purpose: PLANNING

Do not scale from this drawing

R G PARKINS

Kendal | 01539 729393 Lancaster | 01524 32548

Client: Thomas Armstrong

Project: Queens Park, Millom

Drawing Title: Catchment Plan for Greenfield Calculation

Scale @ A1: 1:250	First Issue: 14/04/26	Office of Origin: Kendal
Drawn by: MG	Checked by: CA	Approved: TM
Project No: K41327	Drawing No: 44	Rev: A
BIM No:		

Drainage Key

- Existing Highways Drainage
- Existing Combined Water Public Sewer
- Combined Sewer Diversion S185
- Combined Sewer Closure S116
- Proposed Foul Water Private Drainage
- Proposed Surface Water Private Drainage
- Proposed Channel Drains
- Exceedence Flows

Rev	Description	Date	Revised by	Checked by	Approved
A	Updated for revised site layout	21/05/26	TM	TM	TM

Issue Purpose: PLANNING

Do not scale from this drawing

R G PARKINS

Kendal | 01539 729393 Lancaster | 01524 32548

Client: Thomas Armstrong	Scale @ A1: 1:250	First Issue: 14/04/26	Office of Origin: Kendal
Project: Queens Park, Millom	Drawn by: MG	Checked by: CA	Approved: TM
Drawing Title: Flood Routing Plan	Project No: K41327	Drawing No: 45	Rev: A
	BIM No:		

APPENDIX B

CALCULATIONS

Greenfield runoff rate estimation tool

hr wallingford

www.uksuds.com | Greenfield runoff rate estimation tool (https://www.uksuds.com/)

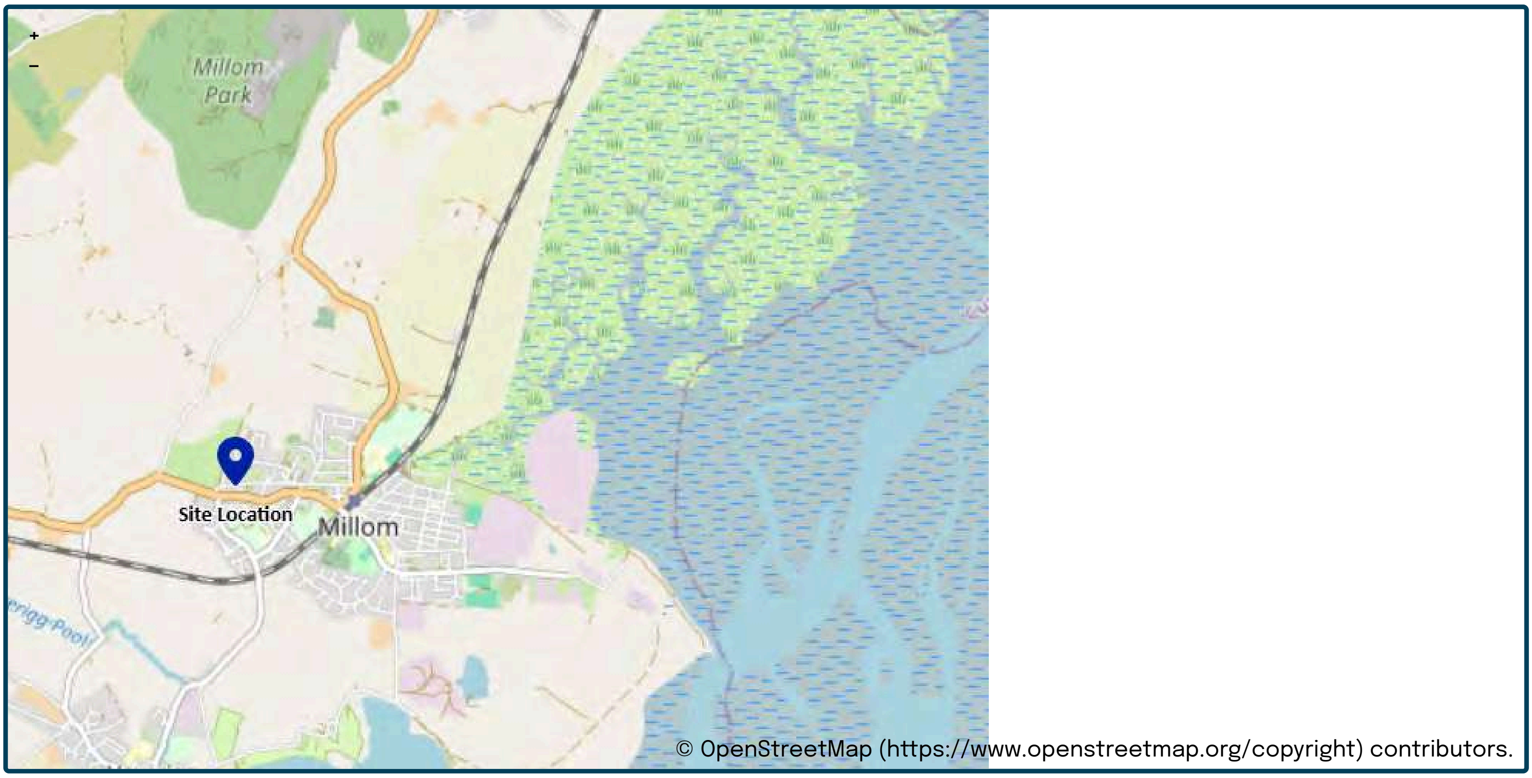
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	17/03/2026
Calculated by	MG
Reference	K41327
Model version	2.2.3

Location

Site name	Queens Park
Site location	Millom



Site easting (British National Grid)	316550
Site northing (British National Grid)	480198

Site details

Total site area (ha)	0.796 ha

Greenfield runoff

Method

Method	FEH statistical (2025)

FEH statistical (2025)

	My value	Map value
SAAR9120 (mm)	1432 mm	
BFIHOST19scaled	0.666	
QMed-QBar conversion	1.075	1.075
QMed (l/s)	3.9 l/s	
QBar (FEH statistical 2025) (l/s)	4.2 l/s	

Growth curve factors

	My value	Map value
Hydrological region	10	10
1 year growth factor	0.87	
2 year growth factor	0.93	
10 year growth factor	1.38	
30 year growth factor	1.7	
100 year growth factor	2.08	
200 year growth factor	2.37	

Results

Method	FEH statistical (2025)
Flow rate 1 year (l/s)	3.7 l/s
Flow rate 2 year (l/s)	3.9 l/s
Flow rate 10 years (l/s)	5.8 l/s
Flow rate 30 years (l/s)	7.2 l/s
Flow rate 100 years (l/s)	8.8 l/s
Flow rate 200 years (l/s)	10.0 l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent 'zero' figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
Catchment	0.077	5.00	10.000	600	0.000	0.000	1.650
Tank Inlet			10.000		0.000	3.000	1.735
Tank Outlet		5.00	10.000		0.000	29.000	1.800
Flow Control			10.000	600	0.000	32.000	1.810
Outfall			10.000		0.000	37.000	1.900

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	Catchment	Tank Inlet	3.000	0.600	8.350	8.300	0.050	60.0	150	5.04	50.0
1.002	Tank Outlet	Flow Control	3.000	0.600	8.200	8.190	0.010	300.0	150	5.09	50.0
1.003	Flow Control	Outfall	5.000	0.600	8.190	8.100	0.090	55.6	150	5.15	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.301	23.0	13.9	1.500	1.550	0.077	0.0	84	1.360
1.002	0.575	10.2	0.0	1.650	1.660	0.000	0.0	0	0.000
1.003	1.352	23.9	0.0	1.660	1.750	0.000	0.0	0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	3.000	60.0	150	Circular	10.000	8.350	1.500	10.000	8.300	1.550
1.002	3.000	300.0	150	Circular	10.000	8.200	1.650	10.000	8.190	1.660
1.003	5.000	55.6	150	Circular	10.000	8.190	1.660	10.000	8.100	1.750

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	Catchment	600	Manhole	Adoptable	Tank Inlet		Junction	
1.002	Tank Outlet		Junction		Flow Control	600	Manhole	Adoptable
1.003	Flow Control	600	Manhole	Adoptable	Outfall		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Catchment	0.000	0.000	10.000	1.650	600	0	1.000	8.350	150
Tank Inlet	0.000	3.000	10.000	1.735		1	1.000	8.300	150
Tank Outlet	0.000	29.000	10.000	1.800		0	1.002	8.200	150
Flow Control	0.000	32.000	10.000	1.810	600	1	1.002	8.190	150
						0	1.003	8.190	150
Outfall	0.000	37.000	10.000	1.900		1	1.003	8.100	150

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Detailed	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	1.000	Additional Storage (m³/ha)	20.0		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	50	0	0

Node Flow Control Online Orifice Control

Flap Valve	x	Design Depth (m)	0.800	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Flow (l/s)	0.5		
Invert Level (m)	8.190	Diameter (m)	0.016		

Node Tank Outlet Tank Storage Structure

Invert Level (m)	8.200	Analyse flow through structure	✓	Main Channel Slope (1:X)	400.0
Time to half empty (mins)		Main Channel Length (m)	26.000	Main Channel n	0.200

Inlets

Tank Inlet

Depth (m)	Area (m^2)	Depth (m)	Area (m^2)	Depth (m)	Area (m^2)
0.000	105.0	0.800	105.0	0.801	0.0

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.37%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
2880 minute summer	Catchment	2040	8.977	0.627	3.0	0.7624	0.0000	SURCHARGED
2880 minute summer	Tank Inlet	2040	8.977	0.712	2.7	0.0000	0.0000	OK
2880 minute summer	Tank Outlet	2040	8.977	0.777	1.8	78.1611	0.0000	SURCHARGED
2880 minute summer	Flow Control	2040	8.977	0.787	0.5	0.2227	0.0000	SURCHARGED
2880 minute summer	Outfall	2040	8.115	0.015	0.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
2880 minute summer	Catchment	1.000	Tank Inlet	2.7	0.490	0.116	0.0528	
2880 minute summer	Tank Inlet	Tank	Tank Outlet	1.8	0.009	0.003		
2880 minute summer	Tank Outlet	1.002	Flow Control	0.5	0.100	0.046	0.0528	
2880 minute summer	Flow Control	1.003	Outfall	0.5	0.530	0.020	0.0044	60.1

Design Settings

Rainfall Methodology	FEH-22
Return Period (years)	100
Additional Flow (%)	0
CV	1.000
Time of Entry (mins)	5.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	50.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Soffits
Minimum Backdrop Height (m)	0.200
Preferred Cover Depth (m)	1.200
Include Intermediate Ground	✓
Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
Catchment	0.173	5.00	10.000	600	0.000	0.000	1.650
Tank Inlet			10.000		0.000	3.000	1.700
Tank Outlet		5.00	10.000		0.000	43.000	1.800
Flow Control			10.000	600	0.000	45.000	1.810
Outfall			10.000		0.000	50.000	1.900

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	Catchment	Tank Inlet	3.000	0.600	8.350	8.300	0.050	60.0	225	5.03	50.0
1.002	Tank Outlet	Flow Control	2.000	0.600	8.200	8.190	0.010	200.0	225	5.04	50.0
1.003	Flow Control	Outfall	5.000	0.600	8.190	8.100	0.090	55.6	150	5.10	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.691	67.2	31.3	1.425	1.475	0.173	0.0	108	1.660
1.002	0.921	36.6	0.0	1.575	1.585	0.000	0.0	0	0.000
1.003	1.352	23.9	0.0	1.660	1.750	0.000	0.0	0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	3.000	60.0	225	Circular	10.000	8.350	1.425	10.000	8.300	1.475
1.002	2.000	200.0	225	Circular	10.000	8.200	1.575	10.000	8.190	1.585
1.003	5.000	55.6	150	Circular	10.000	8.190	1.660	10.000	8.100	1.750

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	Catchment	600	Manhole	Adoptable	Tank Inlet		Junction	
1.002	Tank Outlet		Junction		Flow Control	600	Manhole	Adoptable
1.003	Flow Control	600	Manhole	Adoptable	Outfall		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Catchment	0.000	0.000	10.000	1.650	600	0	1.000	8.350	225
Tank Inlet	0.000	3.000	10.000	1.700		1	1.000	8.300	225
Tank Outlet	0.000	43.000	10.000	1.800		0	1.002	8.200	225
Flow Control	0.000	45.000	10.000	1.810	600	1	1.002	8.190	225
						0	1.003	8.190	150
Outfall	0.000	50.000	10.000	1.900		1	1.003	8.100	150

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Detailed	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	1.000	Additional Storage (m³/ha)	20.0		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	50	0	0

Node Flow Control Online Orifice Control

Flap Valve	x	Design Depth (m)	0.800	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Flow (l/s)	1.1		
Invert Level (m)	8.190	Diameter (m)	0.024		

Node Tank Outlet Tank Storage Structure

Invert Level (m)	8.200	Analyse flow through structure	✓	Main Channel Slope (1:X)	400.0
Time to half empty (mins)		Main Channel Length (m)	40.000	Main Channel n	0.200

Inlets

Tank Inlet

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	240.0	0.800	240.0	0.801	0.0

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.69%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
2880 minute summer	Catchment	2040	8.975	0.625	7.2	1.4864	0.0000	SURCHARGED
2880 minute summer	Tank Inlet	2040	8.975	0.675	6.0	0.0000	0.0000	OK
2880 minute summer	Tank Outlet	2040	8.975	0.775	3.5	173.8954	0.0000	SURCHARGED
2880 minute summer	Flow Control	2040	8.975	0.785	1.1	0.2220	0.0000	SURCHARGED
2880 minute summer	Outfall	2100	8.121	0.021	1.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
2880 minute summer	Catchment	1.000	Tank Inlet	6.0	0.750	0.090	0.1193	
2880 minute summer	Tank Inlet	Tank	Tank Outlet	3.5	0.010	0.004		
2880 minute summer	Tank Outlet	1.002	Flow Control	1.1	0.107	0.029	0.0795	
2880 minute summer	Flow Control	1.003	Outfall	1.1	0.673	0.044	0.0078	134.6

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
Catchment	0.148	5.00	10.000	600	0.000	0.000	1.650
Tank Inlet			10.000		0.000	3.000	1.740
Tank Outlet		5.00	10.000		0.000	27.000	1.800
Flow Control			10.000	600	0.000	29.000	1.810
Outfall			10.000		0.000	34.000	1.900

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	Catchment	Tank Inlet	3.000	0.600	8.350	8.300	0.050	60.0	225	5.03	50.0
1.002	Tank Outlet	Flow Control	2.000	0.600	8.200	8.190	0.010	200.0	225	5.04	50.0
1.003	Flow Control	Outfall	5.000	0.600	8.190	8.100	0.090	55.6	150	5.10	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.691	67.2	26.7	1.425	1.475	0.148	0.0	99	1.600
1.002	0.921	36.6	0.0	1.575	1.585	0.000	0.0	0	0.000
1.003	1.352	23.9	0.0	1.660	1.750	0.000	0.0	0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	3.000	60.0	225	Circular	10.000	8.350	1.425	10.000	8.300	1.475
1.002	2.000	200.0	225	Circular	10.000	8.200	1.575	10.000	8.190	1.585
1.003	5.000	55.6	150	Circular	10.000	8.190	1.660	10.000	8.100	1.750

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	Catchment	600	Manhole	Adoptable	Tank Inlet		Junction	
1.002	Tank Outlet		Junction		Flow Control	600	Manhole	Adoptable
1.003	Flow Control	600	Manhole	Adoptable	Outfall		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Catchment	0.000	0.000	10.000	1.650	600	0	1.000	8.350	225
Tank Inlet	0.000	3.000	10.000	1.740		1	1.000	8.300	225
Tank Outlet	0.000	27.000	10.000	1.800		0	1.002	8.200	225
Flow Control	0.000	29.000	10.000	1.810	600	1	1.002	8.190	225
						0	1.003	8.190	150
Outfall	0.000	34.000	10.000	1.900		1	1.003	8.100	150

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Detailed	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	1.000	Additional Storage (m³/ha)	20.0		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	50	0	0

Node Flow Control Online Orifice Control

Flap Valve	x	Design Depth (m)	0.800	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Flow (l/s)	0.7		
Invert Level (m)	8.190	Diameter (m)	0.019		

Node Tank Outlet Tank Storage Structure

Invert Level (m)	8.200	Analyse flow through structure	✓	Main Channel Slope (1:X)	400.0
Time to half empty (mins)		Main Channel Length (m)	24.000	Main Channel n	0.200

Inlets

Tank Inlet

Depth (m)	Area (m^2)	Depth (m)	Area (m^2)	Depth (m)	Area (m^2)
0.000	228.0	0.800	228.0	0.801	0.0

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.71%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
5760 minute summer	Catchment	3900	8.986	0.636	3.4	1.3207	0.0000	SURCHARGED
5760 minute summer	Tank Inlet	3900	8.986	0.726	8.9	0.0000	0.0000	OK
5760 minute summer	Tank Outlet	3900	8.986	0.786	3.2	172.3324	0.0000	SURCHARGED
5760 minute summer	Flow Control	3900	8.986	0.796	0.7	0.2252	0.0000	SURCHARGED
5760 minute summer	Outfall	3900	8.117	0.017	0.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
5760 minute summer	Catchment	1.000	Tank Inlet	6.5	0.520	0.096	0.1193	
5760 minute summer	Tank Inlet	Tank	Tank Outlet	-5.2	0.007	-0.004		
5760 minute summer	Tank Outlet	1.002	Flow Control	0.7	0.108	0.018	0.0795	
5760 minute summer	Flow Control	1.003	Outfall	0.7	0.588	0.028	0.0057	160.8

APPENDIX C

UU SEWER RECORDS

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

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
9806		SW	0	300			VC	16.69202	
5201	13.81	CO	11.84	150			VC	9.423683	1 in 18
6203	23.31	CO	21.58	225			VC	30.18931	
5212		CO		100			VC	10.76864	
7000	9.27	CO	6.23	750			CO	41.1227	1 in 457
4306	11.1	CO	10.25	225			VC	48.02764	1 in 102
6205	18.97	SW	17.18	150			VC	24.86326	1 in 64
5216		CO		100			VC	16.55076	
3101	12.37	FO	9.6	225			VC	33.75628	1 in 113
5406	15.79	CO	13.9	225			VC	25.71679	1 in 71
8401		CO	0	225			VC	30.41391	
5217		CO		100			VC	10.61362	
8305		CO		150			VC	21.15826	
8014		CO		100			VC	7.284697	
3105	11.81	SW	10.58	225			VC	34.72551	1 in 183
4401	10.18	CO	9.18	375			CO	9.095455	1 in 36
6104		CO		100			VC	8.516265	
5900	10.33	CO	7.8	375			VC	39.12561	1 in 217
6204	18.51	SW	16.79	150			VC	74.24935	1 in 23
4403	10.79	CO	10.19	300			VC	41.6938	1 in 232
6900	11.18	CO	6.65	750			CO	95.53389	1 in 637
5207		CO		100			VC	4.119734	
6300	17.48	CO	15.29	225			VC	71.99956	1 in 42
7201	20.8	SW	19.7	150			VC	85.0675	1 in 72
6302	23.77	CO	21.62	300			VC	20.53685	
8205	20.15	SW	18.64	150			VC	45.22306	1 in 29
4003	9.65	CO	8.67	225			VC	32.94329	1 in 165
8207	20.15	SW	18.52	150			VC	63.14556	1 in 44
4402	10.18	SW	9.28	150			VC	63.63301	
5402	11.87	CO	10.28	375			VC	16.77108	1 in 280
5100	13.3	CO	11.29	225			VC	20.12763	1 in 43
5919		CO		150			VC	22.46937	
4010		CO		100			VC	2.750209	
8303	24.69	CO	22.58	225			VC	30.38283	1 in 12
5917		CO		100			VC	7.974282	
4202	12.34	CO	8.37	600			CO	13.08448	
5903	10.26	SW	9.49	150			VC	4.377762	
5203	15.2	SW	13.59	150			VC	100.1333	1 in 34
6111		CO		150			VC	15.44753	
7301	29.17	CO	27.84	225			VC	46.01501	
6109		CO		150			VC	10.11645	
4002	9.58	CO	8.45	225			VC	47.05581	1 in 392
4102	10.87	CO	8.24	300			VC	0.87	
4303	12.46	CO	9.74	375			VC	4.229764	1 in 0.61035549
6401	19.82	CO	16.82	150			VC	26.88542	1 in 12
7801	10.25	CO	8.7	225			VC	18.82961	1 in 94
7802	10.27	CO	8.5	225			VC	44.45475	1 in 111
4203	11.63	CO	8.86	375			VC	1.456915	1 in 146
8008		CO		150			VC	22.51522	
4901	9.56	CO	8.31	225			VC	31.18451	1 in 130
3000	9.78	CO	8.84	225			VC	44.98999	1 in 122
6403	23.63	CO	22.12	225			VC	40.79468	1 in 28
7905	10.93	CO	7.75	300			VC	10.87894	1 in 19
7003	10.85	CO	9.18	225			VC	46.74343	1 in 28
6207	15.23	CO	13.25	150			VC	76.59431	1 in 56
5400	10.89	CO	9.77	375			CO	18.25855	1 in 32
4001	9.19	CO	8.22	375			VC	61.03218	1 in 138.709490
5805		CO	0	225			VC	31.42863	
8000	7.82	CO	6.67	300			VC	66.55406	1 in 196
3100	12.52	FO	9.28	225			VC	35.68499	1 in 149
6304		CO		300			VC	36.60342	
6102	18.24	CO	16.63	225			VC	46.24189	1 in 15
4108	9.66	CO	8.31	225			VC	14.09646	1 in 235
8306		CO		150			VC	5.551791	
8004	9.29	CO	7.33	300			VC	1.386831	1 in 3
4203	11.63	CO	9.43	375			VC	87.65411	1 in 83
6105		CO		100			VC	24.94458	
4008		CO		100			VC	4.206883	
7301	29.17	CO		225			VC	111.4506	
4902		CO		100			VC	5.246844	
8203	17.97	SW	16.9	225			VC	24.79886	1 in 413
8801		FO		150			VC	67.59318	
3102	11.79	FO	10.53	225			VC	38.37213	1 in 240
4001	9.19	CO	8.01	300			VC	5.453091	1 in 9
7904	10.29	CO	8.5	225			VC	18.36216	1 in 46
5900	10.33	CO	7.82	300			VC	14.47598	1 in 23
4300	12.21	CO	8.46	600			CO	38.21942	1 in 546
9001		CO		100			VC	13.34795	
5901	10.17	CO	8.02	300			VC	39.23575	1 in 151
5801		CO	0	225			VC	14.07979	
5902	9.87	CO	8.05	300			VC	32.20314	1 in 3220
9803		FO	0	225			VC	15.12736	
7002	9.39	SW	7.99	150			VC	6.209042	1 in 5
6308		CO		100			VC	1.629629	
5202	15	SW	13.57	150			VC	97.75214	1 in 37
8202	17.79	SW	16.84	225			VC	22.36832	1 in 68
5305		CO		150			VC	5.693903	
8005	9.44	CO	5.99	825			CO	48.78106	1 in 407
8009		CO		150			VC	10.59724	
4400	9.97	CO	8.92	450			CO	121.2783	1 in 276
3104	12.43	SW	9.25	300			CO	35.42841	1 in 169
8802		FO		150			VC	20.12313	
6901	11.42	CO	6.81	750			CO	65.64176	1 in 469
6106		CO		100			VC	20.98753	
5000	11.44	CO	6.94	750			CO	44.91577	1 in 449
4304	12.24	CO	9.79	300			VC	23.35247	1 in 778
6202	21.16	CO	19	225			VC	42.90044	
8300	21.11	CO	19.77	225			VC	39.41982	1 in 25
5002	10.04	CO	7.76	300			VC	11.35935	1 in 24
4406		CO		100			VC	6.911385	
4005	9.69	CO	8.65	225			VC	37.6428	1 in 80
8901	10.13	CO	8.74	150			VC	17.11856	1 in 71
4303	12.46	CO	0	300			VC	26.34525	
8404		CO	0	225			VC	4.06341	
8006	9.2	CO	6.12	825			CO	39.99018	1 in 333
5404	15.37	CO	12.55	225			VC	43.04656	1 in 48
5002	10.04	CO	0	375			VC	40.00095	
4305	11.66	CO	9.99	300			VC	37.62954	1 in 209
4205	12.25	CO	9.47	300			VC	8.586617	1 in 12
8310		CO		150			VC	1.69122	
5922		CO		100			VC	11.34277	
8004	9.29	CO	7.05	375			VC	15.02027	1 in 4
5300	15.79	CO	13.56	225			VC	75.0406	1 in 25
5401	12.63	CO	10.21	375			VC	18.21955	1 in 101
9200	17.31	CO	16.08	225			VC	28.84904	
9405		CO	0	225			VC	65.57568	
6903	10.86	CO	7.6	375			VC	58.49647	
8101	10.1	CO	8.08	225			VC	83.94785	1 in 122
4011		CO		100			VC	12.40333	
6201	20.08	CO	17.76	225			VC	21.11406	
7103		CO		100			VC	18.05532	
5213		CO		100			VC	8.63277	
7310		CO		150			VC	3.691199	
4109	10.21	SW	8.46	375			CO	6.806247	1 in 170
8204	18.56	SW	17.06	225			VC	34.86625	1 in 218
4014		CO		100			VC	26.31781	
6101	15.5	CO	13.51	225			VC	21.04595	1 in 35
4205	12.25	CO	9.73	375			VC	6.160203	1 in 34
4107	9.88	CO	7.82	600			CO	17.89419	
6905		CO		375			VC	19.46389	
4103	11.04	CO	8.68	300			CO	5.434344	1 in 32
4101	9.88	CO	8.35	375			VC	17.17222	1 in 57
7001	9.24	CO	6.76	225			VC	5.261065	1 in 33
6200	16.51	CO	14.89	225			VC	150.1564	
4000	9.16	CO	7.41	675			CO	59.3003	1 in 258
4100	9.6	CO	8.01	675			CO	54.35199	1 in 94
8302	22.11	CO	20.09	225			VC	24.98525	1 in 139
3103	12.5	SW	9.02	300			CO	34.65992	1 in 347
8002	8.32	CO	6.71	450			VC	31.45131	
4013		CO		100			VC	12.13081	
4104	11.11	FO	8.84	300			VC	1.466049	
8001	8.08	CO	6.7	450			VC	13.40037	
5314		CO		150			VC	18.53517	
5804	10.88	CO	8.94	150			VC	17.79716	
6902	11.58	CO	7.35	225			VC	21.14498	1 in 50
6400	17.16	CO	14.53	225			VC	23.1753	1 in 23
4106	11.37	SW	8.9	300			CO	13.35493	1 in 134
8304		CO		150			VC	4.870408	
5905		CO	0	225			VC	41.29831	
6110		CO		150			VC	6.010375	
8100	10.06	CO	5.86	825			CO	97.11871	1 in 335
5910		CO		100			VC	2.496269	
7404		CO		100			PVC	16.62984	
8013		CO		100			VC	1.769251	
5215		CO		100			VC	10.78209	
8101	10.1	CO	6.31	300			VC	5.500518	1 in 92
7001	9.24	CO	6.96	450			VC	40.33036	1 in 52
4016		CO		100			VC	15.69186	
4301	12.34	CO	9.51	375			CO	29.1435	1 in 32
6301	18.44	CO	0	300			VC	21.05941	
4404		CO		150			VC	4.8519	
4105	11.41	FO	9.02	225			VC	12.41285	1 in 155
6206	20.73	SW	19.17	150			VC	72.31483	1 in 30
4206	12.03	SW	11	150			VC	34.674	
8206	18.45	SW	17.1	225			VC	22.34712	1 in 86
5200	13.11	CO	10.81	225			VC	60.73671	1 in 38
6100	14.74	CO	12.89	225			VC	76.49206	1 in 48
6103	16.17	CO	14.36	150			VC	77.02373	1 in 21
4200	11.59	CO	8.3	600			CO	85.77817	1 in 186
7903	10.5	CO	8.1	300			VC	41.56095	1 in 119
5001	11.18	CO	7.16	675			CO	42.32264	1 in 353
4201	12.12	CO	8.36	600			CO	49.01001	1 in 1225
5301	16.6	CO	15.54	225			VC	108.9125	1 in 24
4009		CO		100			VC	11.3943	
5802		CO	9.53	150			VC	29.36683	1 in 65
5918		CO		100			VC	9.304451	
5210		CO		100			VC	9.912787	
9907		CO		100			VC	9.346656	
4302	12.14	CO	9.76	375			VC	35.78403	1 in 133
4204	12.4	CO	9.27	300			CO	1.407302	1 in 3
6107		CO		100			VC	4.060508	
7900	10.79	CO	6.48	750			CO	62.79937	1 in 262
6402	22.26	CO	20.66	225			VC	84.64162	1 in 13
6305		CO		100			VC	5.30971	
4115		CO		100			VC	5.001736	
7100	12.46	CO	10.68	225			VC	35.0014	1 in 23
4405		CO		150			VC	10.19058	
7303	25.76	CO	23.36	225			VC	33.83039	1 in 20
8003	8.46	CO	6.62	450			VC	29.22699	1 in 292
8400	29.52	CO	27.29	225			VC	1.00005	
5803		CO	9.08	150			VC	6.119158	1 in 44
4007		CO		100			VC	6.319304	
4900	9.91	CO	8.16	225			VC	41.8805	1 in 419
5211		CO		100			VC	11.32843	
8301	24.59	CO	22.84	225			VC	49.86541	1 in 16
5906		CO	0	225			VC	31.14865	
6800	12.8	CO	10.14	225			VC	45.69844	1 in 31
5400	10.89	CO	10.13	225			VC	4.311473	
7311		CO		225			VC	71.32996	
5405	15.33	CO	13.53	225			VC	85.16805	1 in 24
4903		CO		100			VC	12.10999	

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
5418		CO		100			VC	3.264944	
6407		CO		150			VC	11.5637	
7102		CO		150			VC	12.28218	
7306		CO		225			VC	22.89572	

LEGEND

Abandoned | Foul | Surface Water | Combined

- Public Sewer
- Private Sewer
- Section 104
- Rising Main
- Sludge Main
- Overflow
- Water Course
- Highway Drain

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

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

MANHOLE FUNCTION

FO Foul
SW Surface Water
CO Combined
OV Overflow

SEWER SHAPE

CI Circular TR Trapezoidal
EG Egg AR Arch
OV Oval BA Barrel
FT Flat Top HO HorseShoe
RE Rectangular UN Unspecified
SQ Square

SEWER MATERIAL

AC Asbestos Cement
BR Brick
PE Polyethylene
RP Reinforced Plastic Matrix
CO Concrete
CSB Concrete Segment Bolted
CSU Concrete Segment Unbolted
CC Concrete Box Culverted
PSC Plastic / Steel Composite
GRC Glass Reinforced Plastic
DI Ductile Iron
PVC Polyvinyl Chloride
CI Cast Iron
SI Spun Iron
ST Steel
VC Vitrified Clay
PP Polypropylene
PF Pitch Fibre
MAC Masonry, Coursed
MAR Masonry, Random
U Unspecified

Address or Site Reference:

9 QUEENS PARK,
MILLOM,
LA18 5DY

Scale: 1:1250 **Date:** 22/05/2024

Sheet: 1 of 1

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SEWER RECORDS

United Utilities
Water for the North West