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Drainage Strategy

Proposed Development at the Former Pow Beck House Care Home, Mirehouse, Whitehaven

TVH Ltd

Ref: K38890.DS/001A

Version	Date	Prepared By	Checked By	Approved By
Original	16 January 2022	R. Heron	C. Abram	O. Sugden
A	2nd March 2022	R. Heron	O. Sugden	O. Sugden

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6. GLOSSARY OF TERMS

AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
BGL	Below Ground Level
BGS	British Geological Society
CC	Climate Change
CBC	Copeland Borough Council
EA	Environment Agency
FEH	Flood Estimation Handbook
LLFA	Lead Local Flood Authority
NPPF	National Planning Policy Framework
OS	Ordnance Survey
RGP	RG Parkins & Partners Ltd
SuDS	Sustainable Drainage System
UU	United Utilities

7. INTRODUCTION

7.1 BACKGROUND

This report has been prepared by R. G. Parkins & Partners Ltd (RGP) for TVH Ltd. in support of proposals for the redevelopment of the site of the former Pow Beck House care home, Mirehouse, Whitehaven.

RGP has been appointed to identify a Drainage Strategy in accordance with the National Planning Policy Framework (NPPF) to support a planning application that fulfils the requirements of the Local Planning Authority and the Sewerage Undertaker.

Due to the proposed floor space exceeding an area greater than 1,000 m², the development is classed as major development in accordance with The Town and Country Planning Order 2015[1]

7.2 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." As part of this assessment drainage details are required to prove the development can be drained in a sustainable manner without increasing flood risk to property downstream.

7.3 THE DEVELOPMENT IN THE CONTEXT OF PLANNING POLICY

The area covered by the application is 0.31 ha (hectares) and by reference to the Environment Agency Flood Map, the site lies 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 7.1. The site is to be developed for a residential care home; and is classified as 'more vulnerable'. 'More Vulnerable' development classes are deemed acceptable in terms of flood risk within Flood Zones 1 and 2 but require an exception test for development within Flood Zone 3a.

Figure 7.1 Vulnerability Clarification

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.

8. SITE CHARACTERISATION

8.1 SITE LOCATION

The proposed site is located on Meadow Road in Mirehouse which is on the south side of Whitehaven in West Cumbria at National Grid Co-Ordinates 298396E 515494N. The site's location is shown in Figure 8.1.

Figure 8.1 Site Location

8.2 SITE DESCRIPTION

The site consists of a former 38-bed care facility with off-street parking (14 spaces) which has been closed since 2019. There are some green areas in the centre and around the periphery of the buildings. The site was formerly owned and operated by the Copeland Borough Council. The site has a very gentle slope from north east to south west, with site levels ranging from 26.67m AOD on the north eastern boundary to 24.00m AOD upon the south western boundary of the site, as shown on the topographical survey.

8.3 DEVELOPMENT PROPOSALS

It is proposed to demolish an existing two-storey building, formerly known as Pow Beck care home and to erect a new care home comprising 36 one- and two-bedroom flats over three storeys.

8.4 GEOLOGY & HYDROGEOLOGY

British Geological Survey (BGS)[2] and Land Information Systems (LandIS)[3] mapping indicates the site is underlain by the geological sequences outlined in Table 8.1. The solid geology is classed as a Secondary A aquifer and the superficial geology is a Secondary (undifferentiated) aquifer[4]. The EA Groundwater Vulnerability Map[4] indicates that the underlying aquifers have a low to medium vulnerability.

Table 8.1 Site Geological Summary

Geological Unit	Classification	Description	Aquifer Classification
Soil	Soilscape 6	Freely draining slightly acid loamy soils	N/A
Drift	Till, Devensian – Diamicton Alluvium - Clay, Silt, Sand and Gravel	Typically, a clay-dominated material with frequent rounded stones. Clay, silt, sand and gravel	**Summary:** Secondary Undifferentiated
Solid	Pennine Lower Coal Measures Formation - Mudstone, Siltstone and Sandstone	Interbedded grey mudstone, siltstone and pale grey sandstone, commonly with mudstones containing marine fossils in the lower part, and more numerous and thicker coal seams in the upper part.	**Summary:** Secondary A

8.5 EXISTING DRAINAGE AND SEWERS

Reference to the UU sewer records and the drainage layout plan provided by Copeland Borough Council (CBC) shows 2 no. foul sewers and a surface water sewer crossing the eastern side of the site. The surface water sewer is a culverted watercourse, Pow Beck, which crosses beneath the eastern extent of the existing building. The records are provided in Appendix B for reference.

The surface water sewer has a diameter of 600mm as it crosses the site, increasing to a 1350mm dia. prior to the watercourse becoming an open channel at the rear of Seathwaite Avenue, c. 560m north west of the proposed development site.

Part of the existing surface water sewer passing through the site was investigated by SK Drainage Solutions Ltd in August 2021. The overall finding was that some sections of the 600mm culvert have defects which can be repaired without the need to excavate.

A more recent drainage survey was carried out by Drain Doctor on 18th January 2022. This investigation examined the surface water sewer (although not CCTV surveyed) and the two foul sewers that run under the site. The survey confirmed that the surface water sewer has a diameter of 600 mm and passes beneath part of the existing building.

The Drain Doctor survey also confirmed the presence of 2no. 225mm dia. foul sewers in the east of the site. These 2 pipes converge within a single manhole within the site boundary, flows then discharge into a single 225 dia. pipe downstream. Upon passing through the rear garden of No. 5 Link Road, the pipe is upsized to a 375mm dia. increasing to a 1200mm dia. foul sewer once within Link Road.

8.6 HYDROLOGY

The closest open channel surface water feature is Pow Beck which flows in a northerly direction, approximately 540m north west of the site. This watercourse flows northwards through Whitehaven and discharges into Whitehaven Harbour, its catchment is shown in Figure 8.2.

The watercourse is culverted beneath parts of Whitehaven, including parts of Mirehouse. At the point it passes through the proposed development site, the culvert is classed as an 'Ordinary Watercourse', and as such is maintained by the LLFA. It becomes a 'Main River' c. 200 m north west of the site. There are no surface water features within or adjacent to the site but there is an ephemeral pond approximately 40 m south of the site.

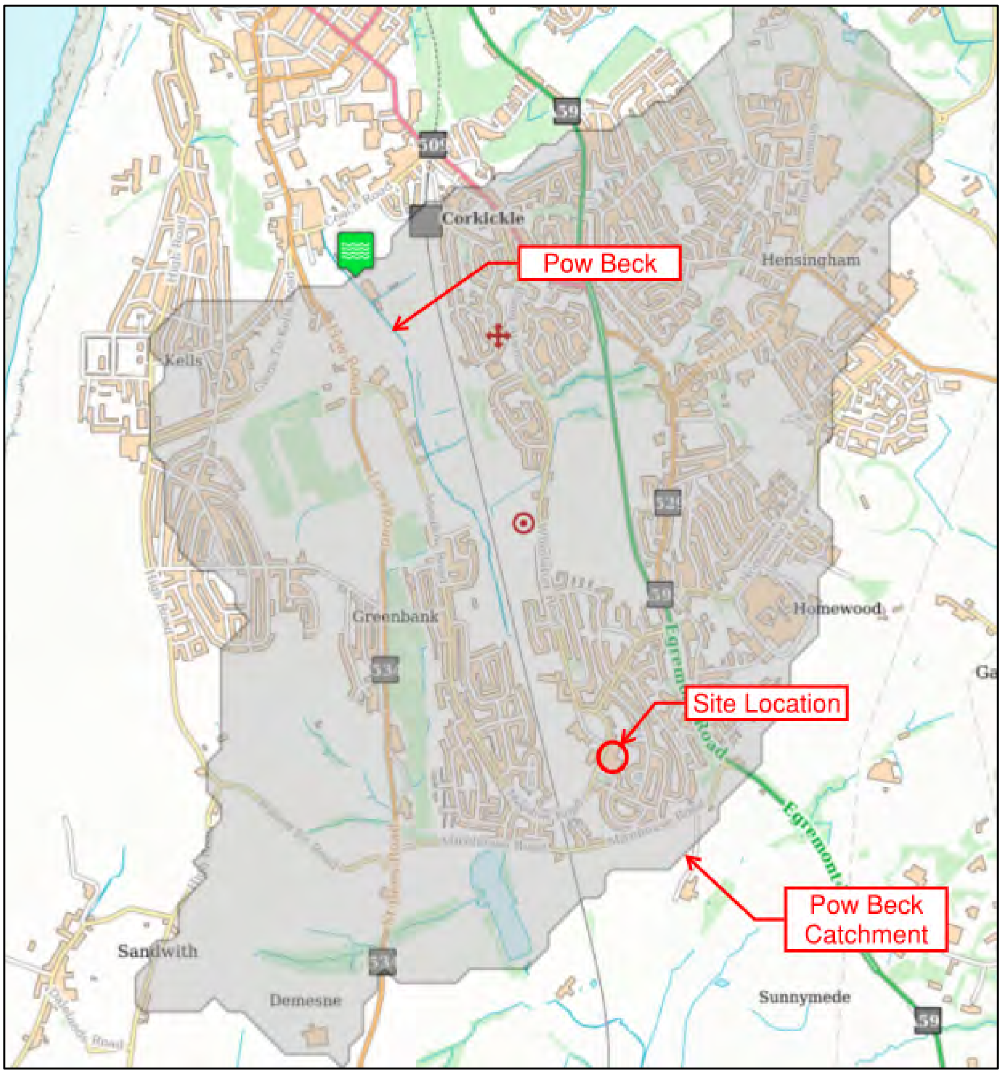

Figure 8.2 Pow Beck Surface Water Catchment

Figure 8.2 is based on FEH Catchment Descriptors, correspondence with Copeland BC's drainage engineer has identified this to be inaccurate, there are in fact numerous sub catchments within the overall catchment shown in Figure 8.2, as it is known the south west section drains to Pow Beck flowing towards St. Bees. Further anomalies within the catchment have also been identified but are not relevant for this planning application.

9. ASSESSMENT OF FLOOD RISK

9.1 BACKGROUND

The following risk assessment has been carried out in accordance with the National Planning Policy Framework[5] and its Planning Practice Guidance[6] 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.

9.2 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 9.1 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%

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9.3 STRATEGIC FLOOD RISK ASSESSMENT

Copeland Borough Council (CBC) has carried out a Strategic Flood Risk Assessment (SFRA) for their area[7]. The SFRA identifies Flood Zones 2, 3a and 3b. Figure 9.1 shows an extract from the CBC SFRA. This shows that the site is not in any of the identified flood zones. The nearest flood zone is on the opposite side of the nearby rail line, and this is Flood Zone 2. The map also identifies a localised drainage issue in Croasdale Avenue on the opposite side of the railway line from the site.

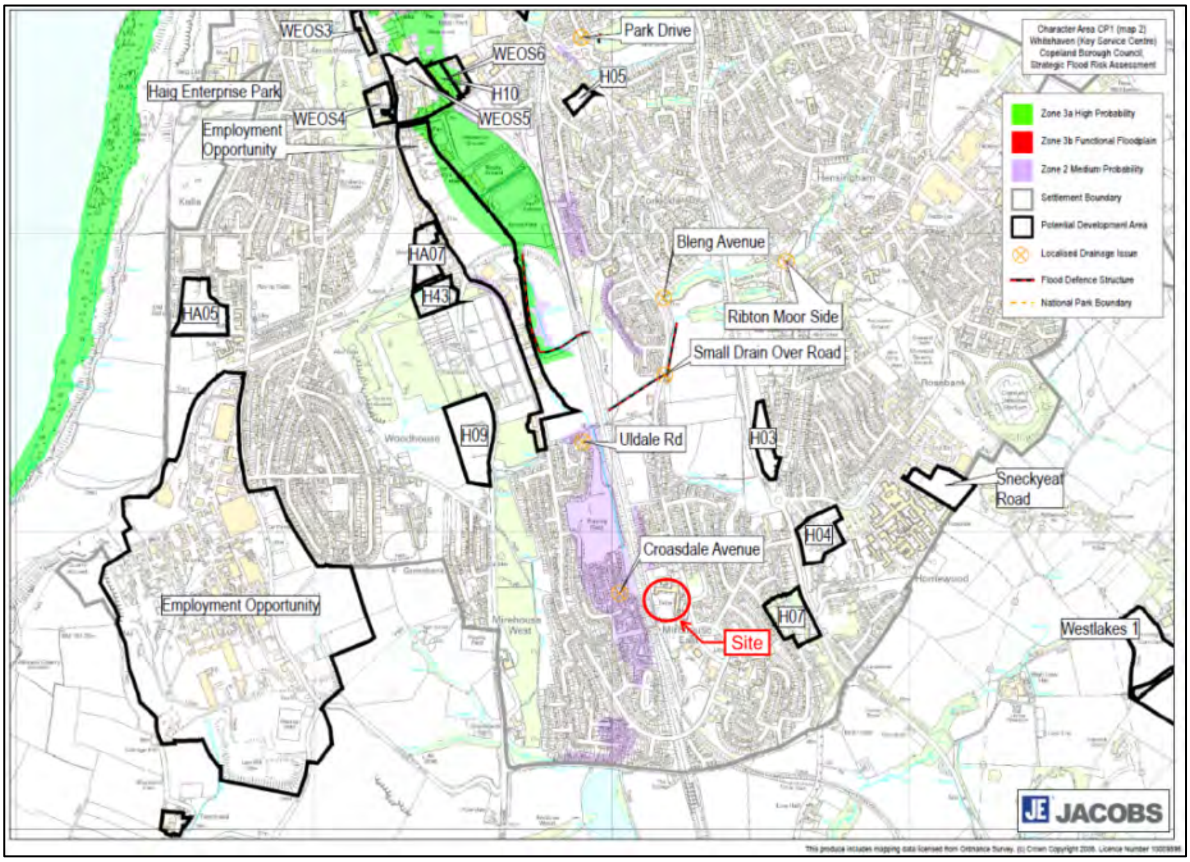


Figure 9.1 Copeland District Council Strategic Flood Risk Assessment Map

9.4 FLUVIAL FLOOD RISK

Figure 9.2 shows the flood zones identified by the Environment Agency's Flood Map for Planning[8]. This map identifies the extents of Flood Zones 2 and 3 but it does not subdivide Zone 3 into 3a and 3b. The map shows that the site is located within Flood Zone 1.

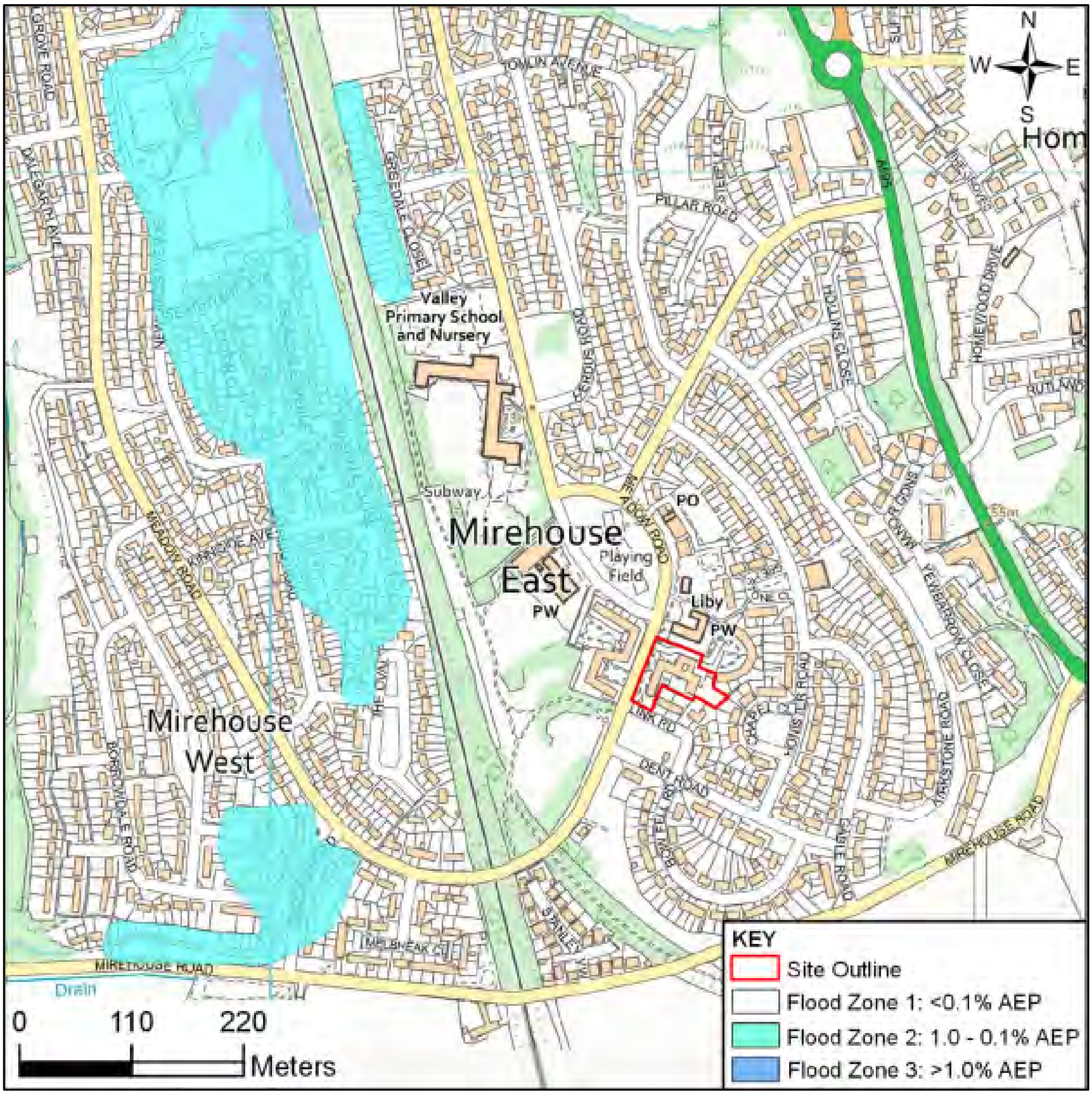


Figure 9.2 Environment Agency Flood Map for Planning

9.5 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 and deposition resulting in the partial or complete blockage of drains or culverts as well as damage to other infrastructure and property.

Figure 9.3 shows an extract from the EA surface water flood risk map[9]. This has four risk classifications from very low probability (<0.1% AEP) to high probability (>3.3% AEP). The EA's map shows that surface water flooding can occur around the site. Reference to the topographic survey in the area of the former care home entrance shows levels dip from the east and west, causing surface water to pond. It also appears there is a flow route from St. Andrews Church, adding to this area of ponding.

The surface water mapping product is a crude representation of possible pluvial flood risk due to omission of drainage systems and broad assumptions regarding conveyance.

As the existing building will be demolished, the new proposals will incorporate levelling/ regarding of the topography, the surface water map does therefore not provide an accurate model of the post development situation. Permeable paving is proposed which would convey surface water via the drainage system to the watercourse. A high level overflow will ensure this flow would not resurface from site drainage. Further detail is provided within the drainage strategy for the site.

Therefore, with appropriate consideration to the design of the surface water drainage system and site layout, it is considered that the risk to the site from this area of surface water flooding can be satisfactorily managed.

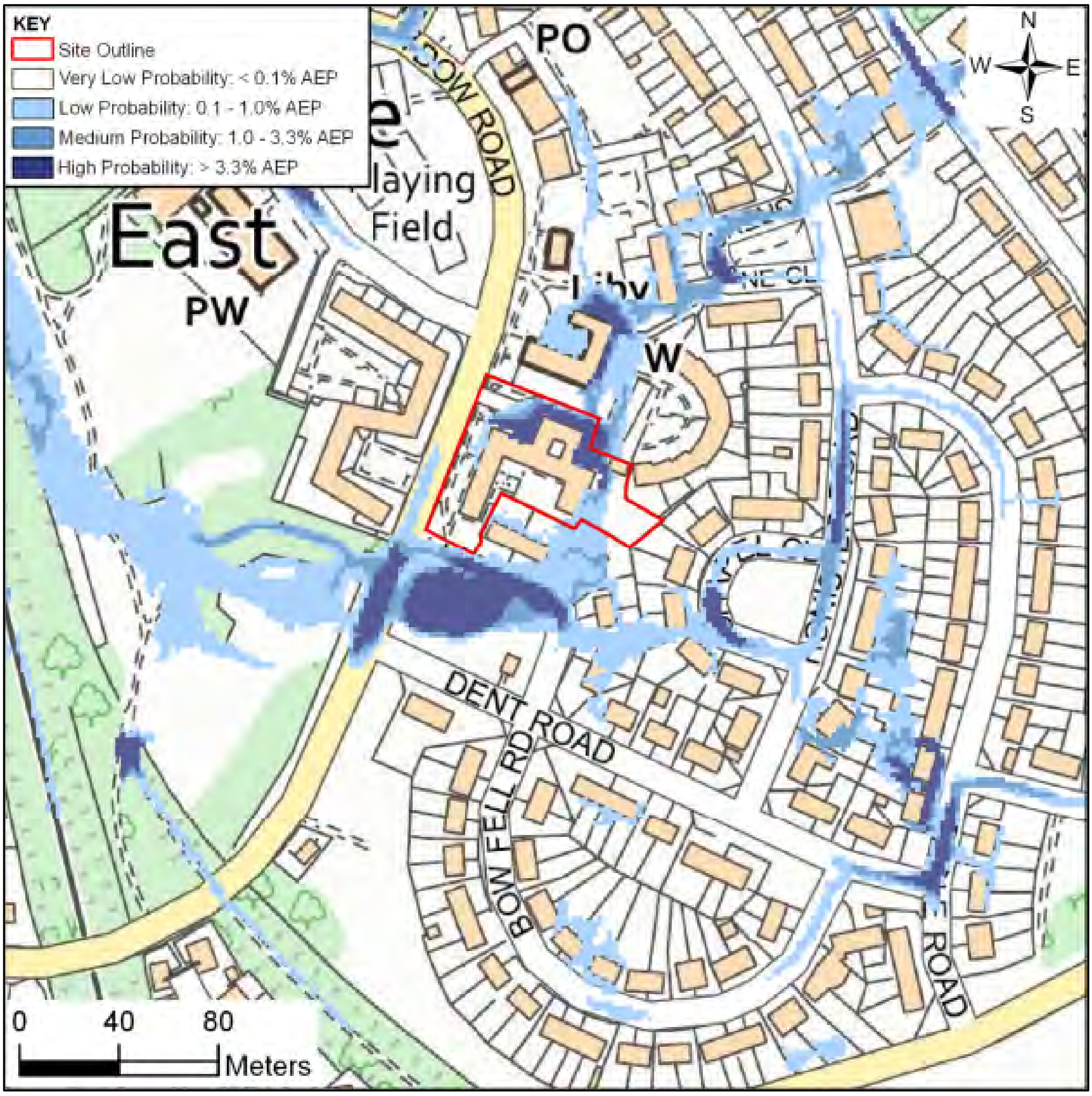


Figure 9.3 Environment Agency Surface Water Flood Map

9.6 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 the more permeable rock types such as chalk and limestone and superficial deposits such as sand and gravel.

The geology at the site is mudstone, siltstone and sandstone overlain by glacial till and some alluvium. The topography of the site is relatively low-lying position within a shallow valley. The site is also close to the divide between the Woodhouse and Hensingham parts of Whitehaven. This combination of topography and sedimentary geology suggests a risk of groundwater flooding, but this is likely to be mitigated by the urban location and the likely well-developed urban drainage.

9.7 FLOODING FROM RESERVOIRS, CANALS OR OTHER ARTIFICIAL SOURCES

There is a small former reservoir approximately 550 m south-west of the site, now known as Mirehouse Ponds. The ponds appear to have been dammed at its northern end, with the dam wall appearing to be relatively low in height. If this was to fail or leak, the position of the wall relative to the topography suggests the water would flow to the south towards St Bees rather than to the north towards Whitehaven. It is known that two watercourses combine and form Seldom Seen Beck, which originally was the origin of Pow Beck to Whitehaven but was diverted into Mirehouse ponds.

The risk of flooding from this reservoir is not shown on the Environment Agency's flood risk map of reservoir flooding, probably because the reservoir volume is not high enough to qualify.

9.8 FLOODING FROM SEWERS

As illustrated by previous and recent drainage surveys, there is one surface water sewer and two foul sewers crossing the site. It is understood that sewer flooding has occurred off the site as a result of discharge from the foul sewers that run under the site. Examination of the foul sewers suggests that one of these sewers has previously been re-engineered to attenuate flow using a combination of large diameter inflow pipes, smaller diameter outflow pipes and large chambers to store flow. It is not known if this was successful or whether this sewer flooding still occurs.

10. SURFACE WATER DRAINAGE STRATEGY

10.1 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[10].
- Code of Practice for Surface Water Management, BS8582:2013, November 2013[11].
- Rainfall Runoff Management for Developments, Defra/EA, SC030219[12].
- Designing for Exceedance in Urban Drainage – Good Practice, CIRIA Report C635, 2006[13].
- Flood Estimation Handbook (FEH)[14].
- Flood Studies Report (FSR), Volume 1, Hydrological Studies, 1975. Institute of Hydrology[15].
- Flood Studies Supplementary Report No 14 (FSSR14), Review of Regional Growth Curves, 1983[16].
- Flood Estimation for Small Catchments, Marshall & Bayliss, Institute of Hydrology, Report No. 124 (IoH 124), 1994[17].
- Non-Statutory Technical Standards for Sustainable Drainage Systems, Defra, March 2015[18].

The following assessment and drainage strategy are based on the latest site layout plan by Stainforth Architects. Any alterations to the site plan resulting in changes in impermeable areas will require the drainage strategy to be revisited.

10.2 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 10.1 shows the measured proposed land cover areas. The highest percentage roof areas covering 41% of the total site area. Paved areas cover 30%, green and landscaped areas 19% and parking/driveway 9%.

Table 10.1 Land Cover Areas

Land Cover	Area		Percentage of total site area
	m²	Ha	
Total Roof Area	1287	0.129	41%
Total Paved Area	945	0.095	30%
Total Parking / Driveway	275	0.027	9%
Garden and Landscaped Areas	598	0.060	19%

The site can be subdivided into land cover that could be permeable and that which could be impermeable. Potential impermeable areas are regarded as roofs, parking, roads, driveways and walkways. All other areas (principally public open space) are regarded as having a permeable surface. Table 10.2 gives the areas of potentially permeable and impermeable land cover, and this shows that impermeable areas could cover 81% of the site and permeable areas 19%.

Table 10.2 Area of Potentially Impermeable & Permeable Land Cover

Land Cover	Area		Percentage of total site area
	m^2	Ha	
Total Impermeable Area	2506	0.251	81%
Remaining Permeable Area	598	0.060	19%

The existing site is the home of a former care home, which is now vacant and in a dilapidated state. The site is classed as brownfield, with the existing impermeable and permeable land cover directly comparable to determine the impact of the redevelopment. Table 10.3 shows that the proposed redevelopment of the site shows a like for like replacement.

Table 10.3 Area of Existing Impermeable & Permeable Land Cover

Land Cover	Area		Percentage of total site area
	m^2	Ha	
Total Impermeable Area	2492	0.249	80%
Remaining Permeable Area	612	0.061	20%

10.3 SURFACE WATER DRAINAGE DESIGN PARAMETERS

The surface water drainage system has been designed on the following basis using the modified rational method and FEH 2013 rainfall profiles.

10.3.1 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 the planned developments. Therefore, a factor for climate change is included in the calculations.

Current Environment Agency guidance on peak rainfall intensity climate change allowance provides two figures for climate change uplift, a Central and an Upper End estimation as outlined in Table 10.4.

Table 10.4 Peak Rainfall Intensity Allowance in Small and Urban Catchments

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End	10%	20%	40%
Central	5%	10%	20%

A climate change allowance of 40% has been selected for the purpose of drainage design based on the 100-year anticipated design life of the proposed development. This figure has been selected for conservative design.

10.3.2 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.

10.3.3 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 and are used for design.

10.3.4 RAINFALL MODEL

The calculations use the REFH2 unit hydrograph methodology in line with best practice as outlined in the SuDS Manual[10] . The calculations use the most up to date available catchment descriptors (2013) provided by the Centre for ecology and Hydrology Flood Estimation Handbook web service.

10.4 RATE OF RUNOFF ASSESSMENT

As the site area is less than 200 ha (0.3104ha), the Greenfield runoff calculations have been undertaken in accordance with the methodology described in IoH 124[17]. For catchments of less than 50 ha, the greenfield runoff rate is scaled according to the size of the catchment in relation to a 50-ha site.

Based on the anticipated design life of the proposed development (100 years), an increase in peak runoff at 40% has been used in the calculations for the post development rate of runoff to account for climate change. Peak runoff rates have been calculated for: (i) the site as 100% Greenfield (ii) the current site as 100% Brownfield, and (iii) the future site divided into c. 2505 m^2 of hardstanding and roof area, and approximately 600 m^2 of greenfield space.

Full details of the calculations and the methodology for deriving the Peak Rate of Runoff are in included in Appendix C. A summary of the results is included in Table 10.5.

Table 10.5 Calculated Greenfield Rate of Runoff from Proposed Impermeable Areas

Rate of Run-off (l/s)			
Event	**Greenfield**	**Brownfield**	**Post-Development**
Q1	1.8	19.4	19.5
QBAR	2.1	28.1	28.3
Q10	2.9	38.5	38.7
Q30	3.6	46.9	47.2
Q100	4.4	59.8	60.2
Q100 + 40% CC	6.1	83.8	84.3

10.5 SURFACE WATER DISPOSAL

Surface water disposal has been considered in line with the hierarchy outlined in the SuDS Manual[10]. The approach considers infiltration drainage in preference to disposal to watercourse, in preference to discharge to sewer.

Permeability testing has not been carried out because the site is low lying relative to surrounding land and is therefore likely to have shallow groundwater that would impede drainage. The level of the watercourse within the site will prevent the siting of soakaways 1m above the winter groundwater level. In additional the site is presently c. 80% impermeable, providing little opportunity for testing.

Space limitations also mean that soakaways are not viable at the site. It is not possible to achieve 5m from both the buildings proposed foundations and surrounding highways, in accordance with Building Regulations Document H.

In addition, the presence of a readily available culverted watercourse within the site offers a suitable route for surface water drainage at an attenuated rate.

10.6 SURFACE WATER DRAINAGE DESIGN

The proposed replacement care home and hardstanding areas will utilise the existing drainage network within the site, discharging to the 600mm dia. surface water culvert. Surface water runoff will be attenuated within 2 no. geocellular attenuation tanks, at the front and rear of the proposed property, before discharge to the culvert. Silt traps will be located upstream of each inlet, which will provide surface water treatment and access for maintenance. Silt traps isolate silt and other particles by encouraging settlement into removal silt buckets, preventing ingress into the tanks. The attenuation tanks will be founded at a suitable level, providing a minimum depth of cover of 600mm.

It is recommended that all hardstanding areas (access road, parking and paved areas) are constructed of Type B (partial infiltration) permeable block paving, incorporating a series of perforated pipes located at the base of the coarse graded aggregate, which will ultimately discharge into the geocellular attenuation tanks. The permeable block paving will act as a SuDS source control technique and provide treatment for small oil spills associated with parked vehicles.

It is proposed that all flat roofs on the care home will be constructed using Sedum roofing (green roof) product. Such roofs have reduced surface water runoff; however, all roof areas will be included within the drainage design for conservative design. The sedum roof will help support habitats for wildlife, while also helping to improve overall air quality, and boosting thermal performance of the building.

For further detail, refer to the Drainage Layout Plan (K38890-100), included in Appendix A.

10.7 FLOW CONTROL

Hydrobrake flow controls, or similar approved will restrict flows to a combined discharge of 2.1l/s to match the Greenfield Qbar. This rate will be split between the 2 no. attenuation tanks, 1.6 l/s for the tank in the north, and 0.5 l/s for the tank to the south. This combined rate will provide significant betterment on the existing Brownfield site.

10.8 STORAGE VOLUME

The drainage has been sized to attenuate runoff during a Q100 event, plus a 40% allowance for future climate change across the design life of the development (100 years). The storage estimate has been undertaken using Causeway Flow[19], with FEH point descriptors used to model the rainfall and determine the volume of attenuation required.

The combined storage volume between the 2 no. attenuation tanks is 171 m³. The attenuation crate at the top of the site, within the access road provides c. 80 m³, and the tank at the rear, 91 m³.

Additional storage will be provided within the permeable paving sub base, which has not been included as part of the overall design, equating to conservative design.

10.9 DESIGNING FOR LOCAL DRAINAGE SYSTEM FAILURE

In accordance with the general principles discussed in CIRIA Report C635 –Designing for Exceedance in Urban Drainage[13], the proposed surface water drainage, where practical, should be designed to ensure there is no increased risk of flooding to the buildings on the site or elsewhere as a result of extreme rainfall, lack of maintenance, blockages or other causes.

- Blockage & Exceedance

The site drainage will be designed to attenuate a 100-year design storm including a 40% allowance for climate change. The drainage system will also provide capacity for lower probability (greater design storm) events which are not of critical duration.

In the unlikely case of blockage in the geocellular tanks, associated silt traps, and/or flow control chambers, exceedance flows will remain within the paved areas/access road, with additional storage within the sub base. Perforated pipes will discharge exceedance flows back into the attenuation tanks, once the water level has subsided. The sub base storage has not been accounted for in the design, therefore the design is highly conservative.

Exceedance flows shall be retained on-site within the drainage system as far as practical.

- Additional Measures

The following general measures will be implemented as part of the detailed drainage design:

Surface Storage & External Levels – the access road and parking areas should be designed to offer additional storage volume and conveyance of flood water should the attenuation system fail, flood or exceed capacity.

Overland Flow Route – The overland flow routes in the highly unlikely event of exceedance of storage would be away from the site taking the site topography into consideration. A high level overflow on the Hydrobrake should prevent any spills from the chamber during exceedance events, however, were it to overtop, then the additional storage provided within the permeable paving sub base would be utilised.

Drainage Contingency – the proposed surface water system will be designed to provide adequate storage against flooding including a 40% allowance to account for climate change.

10.10 SURFACE WATER QUALITY

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 on-site use.

The SuDS Manual[10] outlines best practice with regards to the treatment of surface water by SuDS components prior to discharge to the environment. SuDS components can be effective in reducing the number 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.

The simple index approach as outlined in the SuDS manual has been used to assess the pollution hazard indices and proposed treatment components, the calculations are included in Appendix C. For the categories of runoff areas served by the drainage system, residential parking and access road, treatment is proposed by permeable surfacing. Tables 10.6 and 10.7 summarise the pollution hazard and mitigation indices for this type of runoff.

Table 10.6 Pollution Hazard & Mitigation Indices – Parking

Indices	Suspended Solids	Metals	Hydrocarbons
Pollution Hazard	0.5	0.4	0.4
Pollution Mitigation	0.7	0.6	0.7
Treatment Suitability	Adequate	Adequate	Adequate

Table 10.7 Pollution Hazard & Mitigation Indices – Access Road

Indices	Suspended Solids	Metals	Hydrocarbons
Pollution Hazard	0.5	0.4	0.4
Pollution Mitigation	0.7	0.6	0.7
Treatment Suitability	Adequate	Adequate	Adequate

10.11 MAINTENANCE

The drainage will remain private and will therefore be maintained by the site owners. A SuDS Operations & Maintenance Plan has been made available (K38890-02) to the site owners detailing the requirements for future maintenance of the drainage system.

11. EXISTING SEWERS AND WATERCOURSE

11.1 POW BECK

It is proposed that Pow Beck will remain on its original line under the building, as suggested by the LLFA. The survey of the culvert undertaken by SK Drainage Solutions Ltd in August 2021 noted there was cracking within the section that passes under the existing building. Whilst this section is likely to be repairable, the proposed layout places the new building over the current access manholes. As part of the works, this section of culvert will therefore be replaced, with the two existing manholes relocated upstream and downstream of the extent of the build over. The alignment of the watercourse will be retained. Over-pumping of the watercourse is likely to be the preferred option for management of flow and this work should be undertaken during low flow.

A build over agreement would be subject to approval from the LLFA and Building Control, prior to commencement on site, with the build over totalling 17.4 m. A watercourse consent application shall be submitted to the LLFA with method statements detailing the approach to construction.

11.2 EXISTING FOUL SEWERS

The CCTV survey undertaken by Drain Doctor in January 2022 confirmed that there are 2 no. 225mm diameter public foul sewers that pass under the proposed buildings outline, and these will require build over agreements (incorporating a sewer diversion for new manholes) with UU. As some of the existing manholes are located under the new building footprint, these foul runs will need to be extended and the manholes replaced and relocated outside of the building footprint for access. This will also require a formal sewer diversion agreement with UU.

To reduce the extent of build over agreement, it may be possible and more practical to combine the 2 no. foul runs into a single pipe upstream of the proposed building. This will result in only one public sewer passing below the building. This would require approval from UU and further investigations would be required to verify the relative invert levels of the existing sewers at this location. This will need to be progressed following planning approval.

12. FOUL WATER DRAINAGE STRATEGY

The existing site contains connections to the existing 225mm diameter public combined sewer that passes below the building. The CCTV drainage survey also confirmed the presence of an existing outfall from the south of the site with discharge to a 225 dia. foul sewer in Link Road. It is proposed that this existing connection is retained. Foul drainage shall reuse these connections.

Preliminary foul water discharge calculations have been undertaken in accordance with British Water Code of Practice Flow and Loads 4, see Table 12.1[20]. The estimated predicted peak foul water flow rate from the development is 0.297 l/s.

Table 12.1 Foul Runoff Results

Source of Waste				Flow (L/day)	
Description	No of Type	Occupancy /unit	P	Per Head	Total
Residential Care Home- British Water Flows and Loads					
Residential old people / nursing – 1bed	18	2	36	350	12,600
Residential old people / nursing – 2bed	9	4	36	350	12,600
Day Staff (including mid-day meal)	1	5	5	90	450
TOTAL					25,650

13. CONCLUSIONS AND RECOMMENDATIONS

In consideration of the Flood Risk and Drainage Strategy for the site, the following conclusions and recommendations are made:

- Reference to the EA'S Flood Map for Planning indicates the site is located within Flood Zone 1, and as such is considered to be at 'low' risk of flooding.
- The risk of flooding from groundwater, sewers, canals, and other artificial sources is considered to be low.
- The site is shown to be at risk of surface water flooding in the north of the site, however an effective surface water drainage system will satisfactorily manage the flood risk in this location.
- CCTV drainage surveys have confirmed the presence of the Pow Beck culvert (600mm dia.) running from north to south, in the east of the development site and below the footprint of the existing building.
- A CCTV drainage survey also confirmed the presence of 2 no. 225mm dia. foul sewers running parallel to each other, and parallel to the culvert under the footprint of the proposed building.
- The proposed development will extent the building footprint to the east, and its footprint will be sited over the culvert and both foul sewers. Build over agreements / sewer diversion will need to be agreed with the LLFA and UU prior to commencement on site.
- Attenuation shall be provided within 2 no. geocellular tanks, located at the front and rear of the proposed care home. Hydrobrake flow control units will restrict discharge from the tanks to a combined rate of 2.1 l/s (Greenfield Qbar), providing significant betterment on the existing Brownfield site. It is recommended that silt traps are provided upstream of all storage structures.
- The site layout and drainage systems will be designed to ensure that there is no increased risk of flooding on or off the site as a result of extreme rainfall, lack of maintenance, blockages or other causes. The measures that will be implemented comprise drainage by attenuation, reducing runoff from car parking areas using half-batter curbs and the careful design of building layouts and details.
- A SuDS Operations and Maintenance Plan has been provided which outlines required maintenance for the surface water system to ensure long term operation
- Foul drainage will discharge by gravity into the foul sewers via a number of connection points around the proposed care home.

14. REFERENCES

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

[2] British Geological Survey, 2020. Geoindex. http://mapapps2.bgs.ac.uk/geoindex/home.html

[3] Land Information System (LANDIS)- Soilscapes viewer, Accessed January 2022 http://www.landis.org.uk/soilscapes

[4] Defra Magic Maps, 2022. https://magic.defra.gov.uk/MagicMap.aspx.

[5] Ministry of Housing, Communities and Local Government, National Planning Policy Framework, July 2018.

[6] Ministry of Housing, Communities and Local Government, Planning Practice Guidance to the National Planning Policy Framework, October 2020.

[7] JE, Jacobs, Copeland Borough Council Strategic Flood Risk Assessment (SFRA), August 2007.

[8] Environment Agency Flood Map for Planning. https://flood-map-for-planning.service.gov.uk/

[9] Environment Agency Surface Water Flood Risk Map. https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

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

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

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

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

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

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

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

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

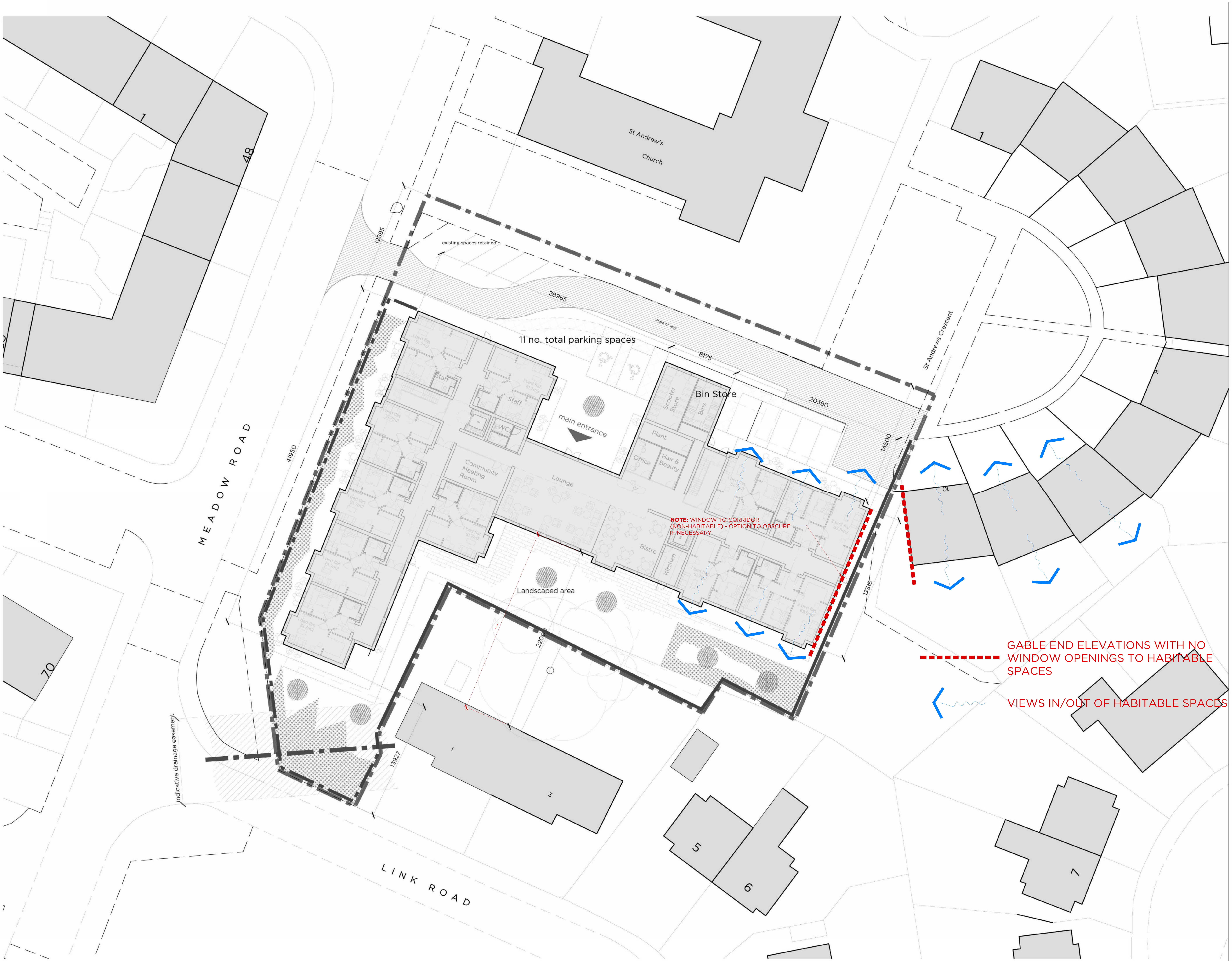
[18] Department for Environment, Food and Rural Affairs, Non-Statutory Technical Standards for Sustainable Drainage Systems, March 2015.

[19] Causeway, Flow, 2022

[20] 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 10, October 2019

APPENDIX A

DEVELOPMENT PROPOSALS



FOR PLANNING

0 5 10 20

Metres at scale 1:200

Revision	Date	Notes
A	14.06.21	Boundary treatments added
B	09.07.21	Boundary treatments adjusted

BOUNDARY TREATMENT PROPOSALS

Perimeter fencing - vertical slatted timber in metal framing system, height: 1800mm

Soft landscaped margin: low level 'box' hedging planting

STANIFORTH
ARCHITECTS

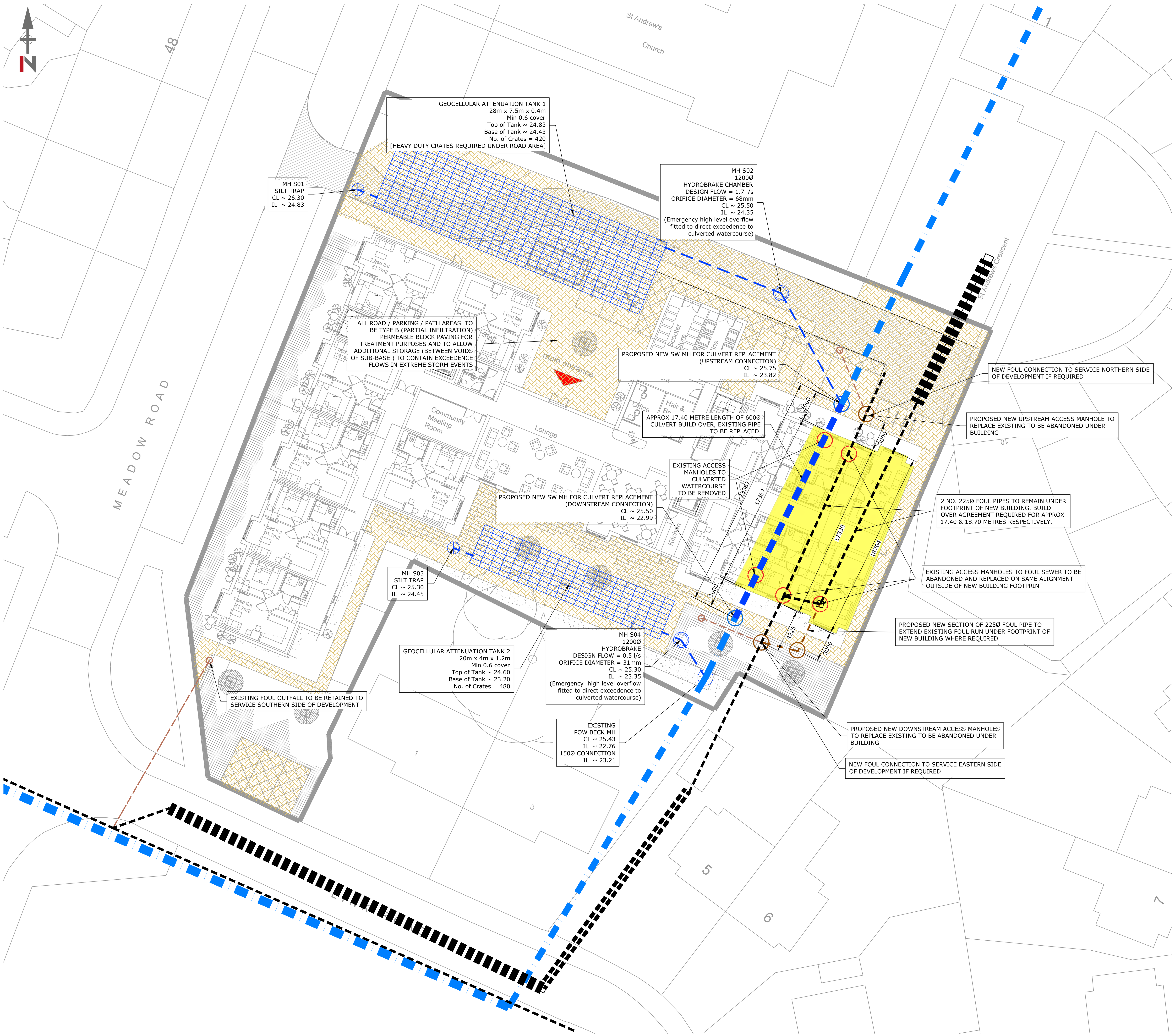
Proposed Site Plan

The Warehouse
1A Stamford Street
Leicester LE1 6NL

0116 2853775
www.staniforth.co.uk

Drawing Status:	For Comment
Cad Reference:	1610-P01
Drawn:	MB
Checked:	IP
Date:	03-03-2021
Scale:	1:200@A1

	Project No.	Drawing No.	Revision
Meadow Road Whitehaven	1610	SK03	



DRAINAGE KEY

- Existing Culverted Watercourse
- Proposed Surface Water Drainage
- Proposed Surface Water Manhole
- Type B Permeable Block Paving (Partial infiltration) Highway / Parking / Path Areas
- Existing Manholes to be removed
- Existing Public Foul Sewers
- Proposed Adopted Foul Sewers
- Proposed Foul Water Manhole
- Proposed Private Foul Drainage

Rev	Description	Date	Revised by	Checked by	Approved

Issue Purpose: DRAFT

Do not scale from this drawing

R G PARKINS

Kendal | 01539 729393 Lancaster | 01524 32548

Scale @ A1: 1/200	First Issue: 31/01/2022	Office of Origin: Kendal	
Drawn by: CA	Checked by: RH	Approved: OS	
Client: TVH LTD	Project No: K38890	Drawing No: 100	Rev:
Project: Meadow Road			
Drawing Title: Outline Drainage Layout	BIM No:		

APPENDIX B

UU SEWER RECORDS

Project

Project Name:	2021-12-16669 RG Parkin Powbeck House Whitehaven
Project Date:	28/01/2022
Inspection Standard:	MSCC5 Sewers & Drainage GB (SRM5 Scoring)

R. G. PARKINS & PARTNERS LTD

CONSULTING CIVIL & STRUCTURAL ENGINEERS

Table of Contents

Project Name	Project Number	Project Date
2021-12-16669 RG Parkin Powbeck House Whitehaven		28/01/2022

Project Information

Project Name	Project Number	Project Date
2021-12-16669 RG Parkin Powbeck House Whitehaven		28/01/2022

Client

Company: RG Parkin
Department: Meadowside
Street: Shap Road
Town or City: Kendal
Post Code: LA9 6NY

Site

Company: RG Parkin
Department: Pow Beck House
Street: Meadow Road
Town or City: Whitehaven

Contractor

Company: Drain Doctor

Drain Doctor

Section Inspection - 18/01/2022 - F1X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
1	1	18/01/22	12:22	Not Specified	Not Specified	No	F1X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Not Specified	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified

Town or Village:		**Inspection Direction:**	Downstream	**Upstream Node:**	F1
Road:		**Inspected Length:**	17.57 m	**Upstream Pipe Depth:**	
Location:		**Total Length:**	17.57 m	**Downstream Node:**	F2
Surface Type:		**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Foul	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	150 mm
Flow Control:		**Material:**	Polyvinyl chloride
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Routine inspection	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:152

Depth: m
F1

Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: F1	00:00:00		
17.57	MHF	Finish node, manhole, reference: F2	00:01:48		

F2
Depth: m

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

Drain Doctor

Section Inspection - 18/01/2022 - F2X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
2	1	18/01/22	12:25	Not Specified	Not Specified	No	F2X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Not Specified	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified

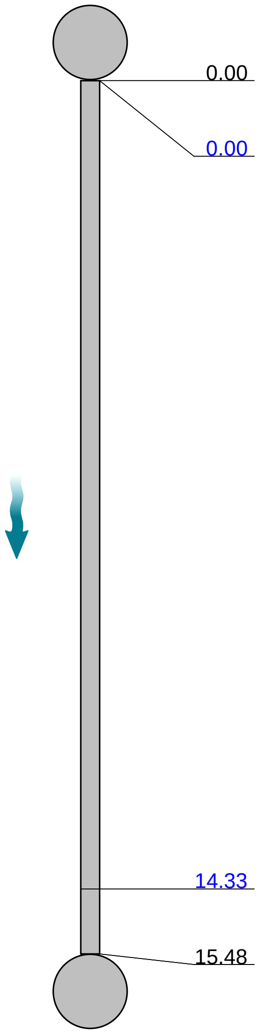
Town or Village:		**Inspection Direction:**	Downstream	**Upstream Node:**	F2
Road:		**Inspected Length:**	15.48 m	**Upstream Pipe Depth:**	
Location:		**Total Length:**	15.48 m	**Downstream Node:**	F3
Surface Type:		**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Foul	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	150 mm
Flow Control:		**Material:**	Polyvinyl chloride
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Routine inspection	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: **1:134**

Depth: m
F2



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: F2	00:00:00		
0.00	WL	Water level, 0% of the vertical dimension	00:00:15		
14.33	WL	Water level, 10% of the vertical dimension	00:01:06		
15.48	MHF	Finish node, manhole, reference: F3	00:01:13		

F3
Depth: m

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

DrainDoctor
Drainage & Plumbing Services

Section Inspection - 18/01/2022 - F3X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
3	1	18/01/22	12:28	Not Specified	Not Specified	No	F3X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Not Specified	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified

Town or Village:		**Inspection Direction:**	Downstream	**Upstream Node:**	F3
Road:		**Inspected Length:**	3.57 m	**Upstream Pipe Depth:**	
Location:		**Total Length:**	3.57 m	**Downstream Node:**	S3
Surface Type:		**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Foul	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	150 mm
Flow Control:		**Material:**	Polyvinyl chloride
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Routine inspection	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:50

Depth: m
F3

Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: F3	00:00:00		
0.00	WL	Water level, 0% of the vertical dimension	00:00:42		
0.87	JN	Junction at 09 o'clock, 150mm dia	00:00:16		
1.11	MCVC	Pipe material changes to vitrified clay at this point	00:00:21		
3.57	MHF	Finish node, manhole, reference: S3	00:00:32		

S3
Depth: m

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

DrainDoctor
Drainage & Plumbing Services

Section Inspection - 18/01/2022 - F4aX

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
4	2	18/01/22	13:01	Not Specified	Not Specified	No	F4AX

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Not Specified	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified

Town or Village:		**Inspection Direction:**	Downstream	**Upstream Node:**	F4A
Road:		**Inspected Length:**	16.04 m	**Upstream Pipe Depth:**	
Location:		**Total Length:**	16.04 m	**Downstream Node:**	F4
Surface Type:		**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Foul	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:		**Material:**	Vitrified clay
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Routine inspection	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:139

Depth: m
F4a

Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: F4a: Camera in reverse	00:00:00		
0.00	WL	Water level, 5% of the vertical dimension	00:00:26		
16.04	MHF	Finish node, manhole, reference: F4	00:00:00		

F4
Depth: m

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

DrainDoctor
Drainage & Plumbing Services

Section Inspection - 18/01/2022 - F4aX

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
4	1	18/01/22	12:59	Not Specified	Not Specified	No	F4AX

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Not Specified	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified

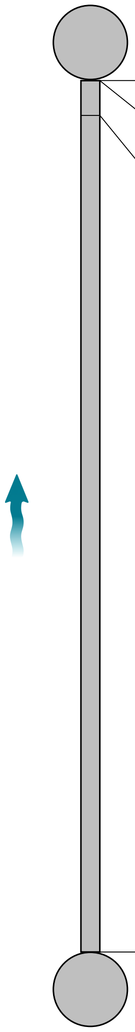
Town or Village:		**Inspection Direction:**	Upstream	**Upstream Node:**	F4A
Road:		**Inspected Length:**	16.04 m	**Upstream Pipe Depth:**	
Location:		**Total Length:**	16.04 m	**Downstream Node:**	F4
Surface Type:		**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Foul	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:		**Material:**	Vitrified clay
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Routine inspection	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:139

Depth: m
F4



F4a
Depth: m

Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: F4	00:00:00		
0.00	WL	Water level, 15% of the vertical dimension	00:00:02		
0.65	DEF	Attached deposits, fouling from 04 o'clock to 08 o'clock, 15% cross-sectional area loss	00:00:13	Upstream X_970b3284-fbcd-44	3
16.04	MHF	Finish node, manhole, reference: F4a: In garage	00:02:24		

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	1	2.0	0.1	2.0	3.0

Section Pictures - 18/01/2022 - F4aX

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
4	Upstream	F4AX		

UpstreamX_970b3284-fbcd-44e6-90d8-87792fdef5ee_20220128_081359_907.jpg, 00:00:13, 0.65 m
Attached deposits, fouling from 04 o'clock to 08 o'clock, 15% cross-sectional area loss

Section Inspection - 18/01/2022 - F4X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
5	1	18/01/22	13:18	Not Specified	Not Specified	No	F4X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Not Specified	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified

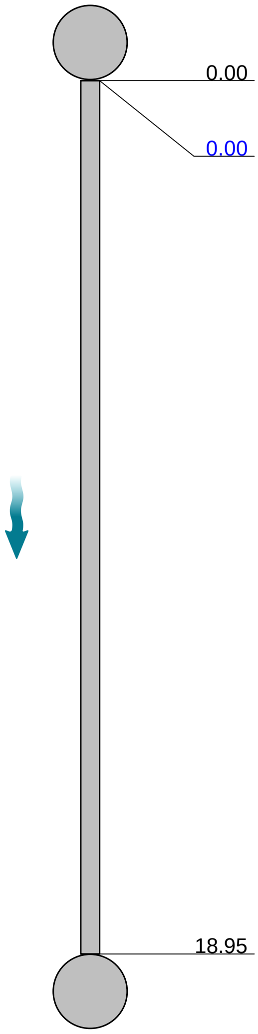
Town or Village:		**Inspection Direction:**	Downstream	**Upstream Node:**	F4
Road:		**Inspected Length:**	18.95 m	**Upstream Pipe Depth:**	
Location:		**Total Length:**	18.95 m	**Downstream Node:**	F5
Surface Type:		**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Foul	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:		**Material:**	Vitrified clay
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Routine inspection	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: **1:164**

Depth: m
F4



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: F4	00:00:00		
0.00	WL	Water level, 10% of the vertical dimension: flowing			
18.95	MHF	Finish node, manhole, reference: F5	00:01:33		

F5
Depth: m

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

Drain Doctor

Section Inspection - 18/01/2022 - F5X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
6	1	18/01/22	13:51	Not Specified	Not Specified	No	F5X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Not Specified	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified

Town or Village:		**Inspection Direction:**	Downstream	**Upstream Node:**	F5
Road:		**Inspected Length:**	22.83 m	**Upstream Pipe Depth:**	
Location:		**Total Length:**	22.83 m	**Downstream Node:**	F6
Surface Type:		**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Foul	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:		**Material:**	Vitrified clay
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Routine inspection	**Lining Material:**	No Lining

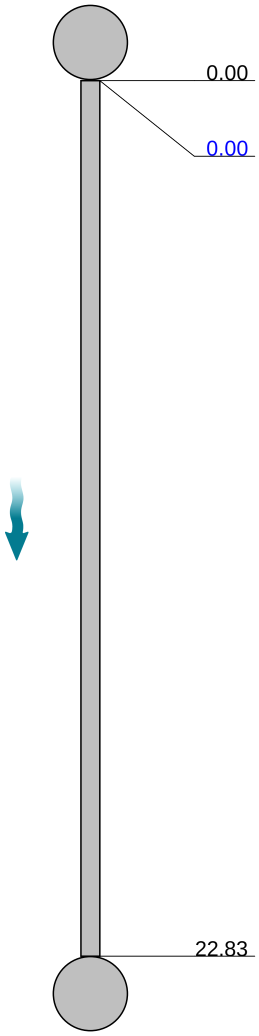
Comments:

Recommendations:

Scale: 1:197

Depth: m

F5



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: F5	00:00:00		
0.00	WL	Water level, 5% of the vertical dimension: flowing	00:00:12		
22.83	MHF	Finish node, manhole, reference: F6	00:02:02		

F6

Depth: m

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

Drain Doctor

Section Inspection - 18/01/2022 - F7X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
7	1	18/01/22	15:05	Not Specified	Not Specified	No	F7X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
Not Specified	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified

Town or Village:		**Inspection Direction:**	Downstream	**Upstream Node:**	F7
Road:		**Inspected Length:**	22.73 m	**Upstream Pipe Depth:**	
Location:		**Total Length:**	22.73 m	**Downstream Node:**	F4
Surface Type:		**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Foul	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	225 mm
Flow Control:		**Material:**	Vitrified clay
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Routine inspection	**Lining Material:**	No Lining

Comments:
Recommendations:

Scale: 1:196

Depth: m
F7

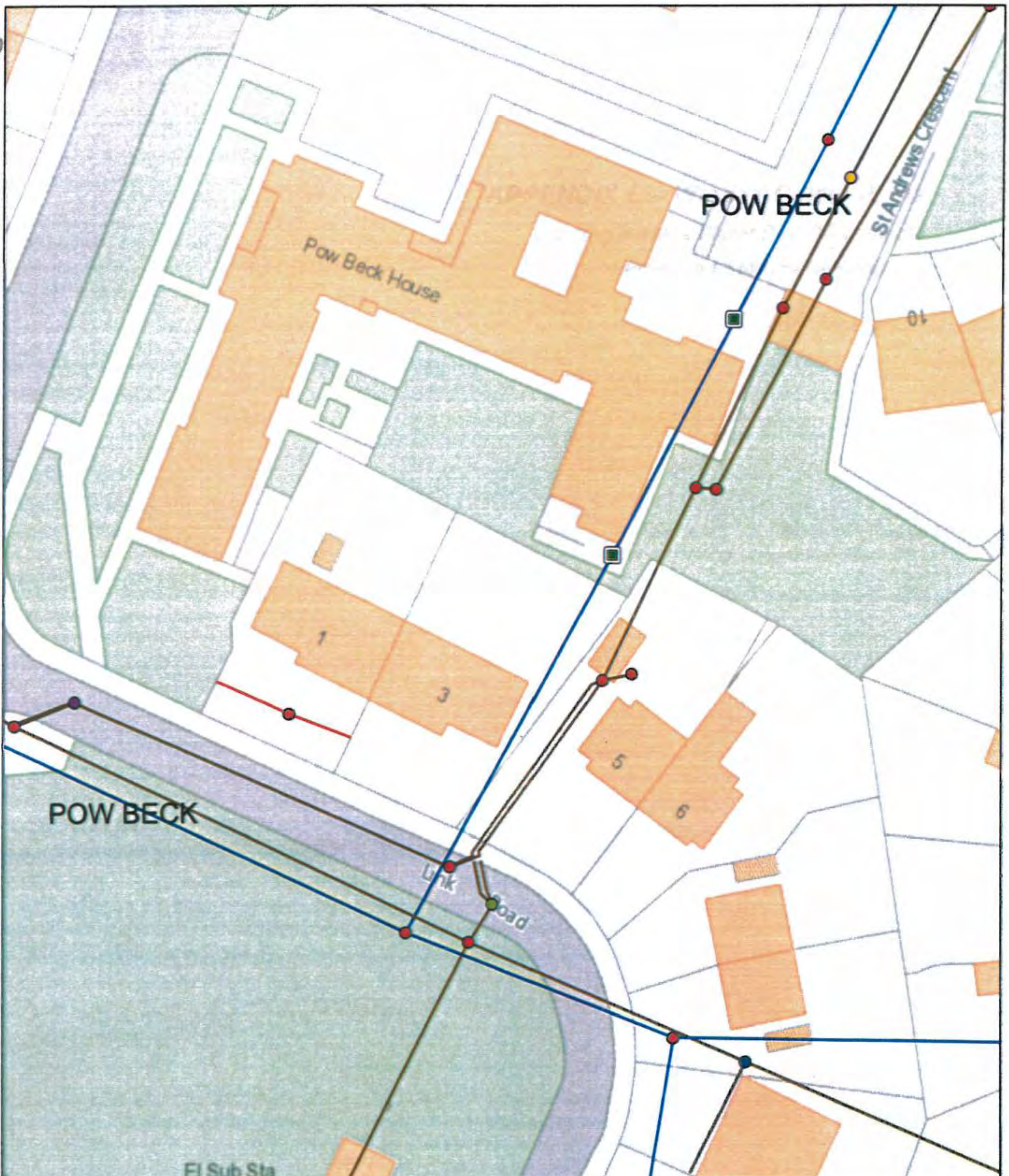
Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start node, manhole, reference: F7	00:00:00		
0.00	WL	Water level, 10% of the vertical dimension: flowing	00:00:19		
14.50	CUW	Loss of vision, camera under water	00:01:41		
22.73	MHF	Finish node, manhole, reference: F4	00:02:31		

F4
Depth: m

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

Provided by David Bertelli

Pow Beck



5/27/2021, 9:06:03 AM

1:500

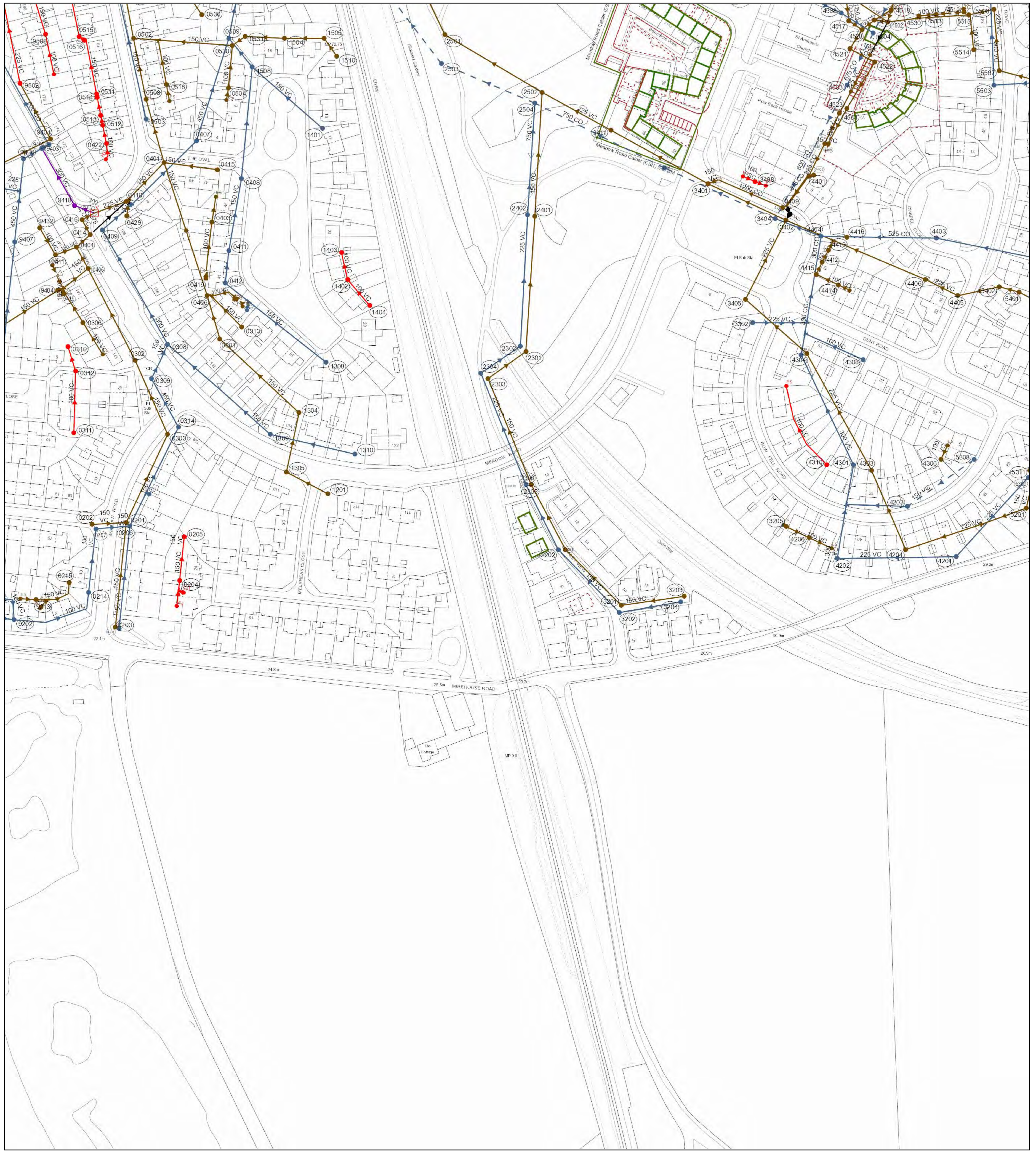
0 0 0.01 0.02 mi

0 0.01 0.01 0.02 km

United Utilities - Points
- Manhole
- Fitting
- AbandNode
- Structure
- CleanOut

United Utilities - Lines
- Combined
- Foul
- Surface Water

Flood and Coastal Management Officer



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
2301		FO	0	150			VC	75.16648	
0422		CO		100			VC	10.4373	
0422		CO		100			VC	10.4373	
0401	18.13	FO	15.54	150			VC	36.40055	
0401	18.13	FO	15.54	150			VC	36.40055	
0536	15.54	FO	13.96	150			VC	25.23886	1 in 41
0536	15.54	FO	13.96	150			VC	25.23886	1 in 41
4530		FO		100			VC	1.376528	
4530		FO		100			VC	1.376528	
4530		FO		100			VC	1.376528	
4530		FO		100			VC	1.376528	
5311		FO		150			VC	3.162278	1 in
5311		FO		150			VC	3.162278	1 in
3404	23.91	SW	21.41	750			CO	67.7195	1 in 68
3404	23.91	SW	21.41	750			CO	67.7195	1 in 68
4302	27.16	SW	25.59	300			CO	66.91039	1 in 25
0530	16.2	FO	14.93	150			VC	55.14526	1 in 82
0530	16.2	FO	14.93	150			VC	55.14526	1 in 82
3408		CO		100			PSC	6.29429	
3408		CO		100			PSC	6.29429	
4414		FO		100			VC	13.61621	
4502	27.76	FO		300			VC	7.468843	
4502	27.76	FO		300			VC	7.468843	
0309	20.16	SW	17.77	450			VC	11.18034	
1504	16.83	FO	15.64	150			VC	22.02271	1 in 200
1504	16.83	FO	15.64	150			VC	22.02271	1 in 200
0211	22.43	SW	19.89	150			VC	57.31492	
4201	29.17	SW	27.42	225			VC	66.00758	1 in 106
4201	29.17	SW	27.42	225			VC	66.00758	1 in 106
4503	26.11	SW	24.36	675			CO	41.92244	1 in 29
4503	26.11	SW	24.36	675			CO	41.92244	1 in 29
0516		CO		150			VC	3.653792	
0516		CO		150			VC	3.653792	
4501	25.95	FO	23.72	225			CO	20.14352	
4501	25.95	FO	23.72	225			CO	20.14352	
0202	20.64	FO	19.12	150			VC	19.0263	1 in 106
1309	22.63	SW	21.4	150			VC	37.53665	1 in 21
4404	24.5	SW	22.2	525			CO	27.25498	1 in 34
4404	24.5	SW	22.2	525			CO	27.25498	1 in 34
1305	23.69	FO	22.01	150			VC	33.73426	1 in 45
9406	17.18	SW	15.15	600			CO	11.67726	
9406	17.18	SW	15.15	600			CO	11.67726	
5401	29.01	FO	27.31	225			VC	11.40175	1 in 190
5401	29.01	FO	27.31	225			VC	11.40175	1 in 190
4406	28.17	FO	26.77	225			VC	84.18546	1 in 19
4406	28.17	FO	26.77	225			VC	84.18546	1 in 19
4518	27.72	FO	26.46	300			CO	11.04943	1 in 53
4518	27.72	FO	26.46	300			CO	11.04943	1 in 53
0512		CO		100			VC	5.600421	
0512		CO		100			VC	5.600421	
2504		SW		750			CO	56.46238	
2504		SW		750			CO	56.46238	
9419	17.85	FO	16.74	150			VC	2	
4405	28.95	FO	26.99	225			VC	20.12461	1 in 91
4405	28.95	FO	26.99	225			VC	20.12461	1 in 91
0415		FO		150			VC	29.91423	
0415		FO		150			VC	29.91423	
5308	29.74	SW	28.64	150			VC	45.22168	1 in 1.64802027
5308	29.74	SW	28.64	150			VC	45.22168	1 in 1.64802027
4202	28.49	SW	26.8	300			VC	52.77449	1 in 182
0204		CO		150			VC	24.44627	
1505	17.09	FO	16.1	150			VC	22	1 in 48
1505	17.09	FO	16.1	150			VC	22	1 in 48
0515		CO		150			VC	43.05281	
0515		CO		150			VC	43.05281	
9405	17.03	SW	15.03	600			CO	52.83938	1 in 91
9405	17.03	SW	15.03	600			CO	52.83938	1 in 91
0514		CO		100			VC	1.986563	
0514		CO		100			VC	1.986563	
0302	19.33	FO	17.48	150			VC	57.41194	1 in 62
4303	28.15	FO	26.2	225			VC	74.30343	1 in 275
4513		FO		100			VC	9.620073	
4513		FO		100			VC	9.620073	
4513		FO		100			VC	9.620073	
4513		FO		100			VC	9.620073	
0411		SW	0	150			VC	40.60788	
0409	17.96	SW	16.21	450			VC	21.29191	
0409	17.96	SW	16.21	450			VC	21.29191	
9407	17.47	SW	15.89	450			VC	46.27103	1 in 63
9407	17.47	SW	15.89	450			VC	46.27103	1 in 63
4206		FO		100			VC	14.01998	
4516	26.91	FO	24.47	1350			CO	12.11725	1 in 121
4521	26.58	FO	24.1	1350			CO	15.6783	1 in 261
4521	26.58	FO	24.1	1350			CO	15.6783	1 in 261
3402	23.76	FO	22.44	225			VC	47.76448	1 in 44
3402	23.76	FO	22.44	225			VC	47.76448	1 in 44
0203	22.43	FO	19.83	150			VC	58.30952	1 in 66
3401	24.06	FO	21.36	225			VC	61.68341	1 in 43
3401	24.06	FO	21.36	225			VC	61.68341	1 in 43
4401	24.9	FO	23.39	375			CO	23.26349	1 in 23
4401	24.9	FO	23.39	375			CO	23.26349	1 in 23
0303	20.76	FO	18.19	150			VC	44.77723	1 in 63
4519	27.17	FO	26.22	300			CO	8.652072	1 in 4
4519	27.17	FO	26.22	300			CO	8.652072	1 in 4
1402		CO		100			VC	15.47645	
0406	19.28	FO	17.88	150			VC	77.7946	1 in 33
2303		FO	0	150			VC	25.80698	
3205		FO		100			VC	14.07017	
4508		SW		100			VC	20.99432	
4508		SW		100			VC	20.99432	
4204	29.01	FO	27.21	225			VC	47.92703	1 in 47
4204	29.01	FO	27.21	225			VC	47.92703	1 in 47
4502	27.76	FO	26.36	225			VC	36.6166	1 in 16
4502	27.76	FO	26.36	225			VC	36.6166	1 in 16
0414		FO	0	375			VC	9.405542	
0414		FO	0	375			VC	9.405542	
4520	26.91	FO	24.19	1350			CO	12.58149	1 in 180
4520	26.91	FO	24.19	1350			CO	12.58149	1 in 180
4413		FO		150			VC	6.102794	
3203		FO	0	150			VC	35.35534	
1510	17.69	FO	16.44	150			VC	12.20656	1 in 36
1510	17.69	FO	16.44	150			VC	12.20656	1 in 36
0408	18.51	SW	15.99	150			VC	62.28965	
0408	18.51	SW	15.99	150			VC	62.28965	
0518		FO		100			VC	25.16109	
0518		FO		100			VC	25.16109	
9404		FO	0	150			VC	3.162278	
4504	27.47	SW	25.42	675			CO	32.32324	1 in 30
4504	27.47	SW	25.42	675			CO	32.32324	1 in 30
4509		FO		100			VC	51.46301	
5514		FO		100			VC	19.99409	
5514		FO		100			VC	19.99409	
5514		FO		100			VC	19.99409	
5514		FO		100			VC	19.99409	
0502	16.76	FO	14.26	150			VC	48.83646	1 in 43
0502	16.76	FO	14.26	150			VC	48.83646	1 in 43
2503	17.42	SW	15.82	750			CO	52.80151	
2503	17.42	SW	15.82	750			CO	52.80151	
0314	20.76	SW	18.09	450			VC	30.88689	1 in 97
5307	29.25	FO	27.55	225			VC	25.94224	1 in 108
4415		FO		150			VC	7.647893	
4501	25.95	FO	24.1	225			CO	18.71612	1 in 51
4501	25.95	FO	24.1	225			CO	18.71612	1 in 51
5309	29.53	SW	28.56	225			VC	59.46428	1 in 52
5309	29.53	SW	28.56	225			VC	59.46428	1 in 52
4308		SW		100			VC	35.48844	
9411		FO	0	150			VC	12.4498	
3201		FO	0	150			VC	43.84062	
4601	29.39	FO	27.68	225			VC	43.38344	1 in 37
4601	29.39	FO	27.68	225			VC	43.38344	1 in 37
1404		CO		100			VC	19.03796	
4401	24.9	FO	23.39	375			CO	23.26993	1 in 23
4401	24.9	FO	23.39	375			CO	23.26993	1 in 23
4203	29.29	SW	28.09	150			VC	34.0147	
4203	29.29	SW	28.09	150			VC	34.0147	
9401	16.8	FO	15.55	225			VC	35.35534	1 in 43
9401	16.8	FO	15.55	225			VC	35.35534	1 in 43
4523	25.95	FO	23.82	225			VC	22.18646	1 in 740
4523	25.95	FO	23.82	225			VC	22.18646	1 in 740
0503	17.84	SW	16.45	150			VC	88.07383	
0503	17.84	SW	16.45	150			VC	88.07383	
3204		SW	0	150			VC	34.52535	
0201	20.54	FO	18.94	150			VC	54.12947	1 in 72
4412		FO		150			VC	7.347721	
0504		FO		100			VC	23.73143	
0504		FO		100			VC	23.73143	
0301	20.59	FO	19.37	150			VC	25	1 in 17
0513		CO		100			VC	10.20893	
0513		CO		100			VC	10.20893	
1304	22.81	FO	21.26	150			VC	60.1415	1 in 32
1310	24.23	SW	22.65	150			VC	48.27007	1 in 39
9403		SW	0	600			CO	4.447292	
9403		SW	0	600			CO	4.447292	
4402		FO		150			VC	2.861308	
4402		FO		150			VC	2.861308	
4403	27.81	SW	26.11	525			CO	64.00781	1 in 20
4403	27.81	SW	26.11	525			CO	64.00781	1 in 20
4403	27.81	SW	26.11	525			CO	64.00781	1 in 20
4403	27.81	SW	26.11	525			CO	64.00781	1 in 20
2201		FO	0	150			VC	40.70626	
4601	29.39	FO	26.5	225			VC	5.948884	1 in 42
4601	29.39	FO	26.5	225			VC	5.948884	1 in 42
3403	23.96	SW	20.41	750			CO	80.49844	
3403	23.96	SW	20.41	750			CO	80.49844	
5508	29.11	FO	27.01	225			VC	14.31782	
5508	29.11	FO	27.01	225			VC	14.31782	
5508	29.11	FO	27.01	225			VC	14.31782	
5508	29.11	FO	27.01	225			VC	14.31782	
0404	18.1	FO	16.12	150			VC	10.34995	
0404	18.1	FO	16.12	150			VC	10.34995	
1201	24.65	FO	22.9	150			VC	25.94224	1 in 29
4409	25.49	FO	23.8	150			VC	1.953424	1 in 28
4409	25.49	FO	23.8	150			VC	1.953424	1 in 28
2306		FO	0	150			VC	63.69458	
4505	27.91	SW	26.14	675			CO	28.06448	1 in 39
0531	16.53	FO	15.53	150			VC	8.602325	1 in 14
0531	16.53	FO	15.53	150			VC	8.602325	1 in 14
0405	18.38	FO	16.55	150			VC	13.49806	1 in 31
0508		FO	0	150			VC	34.71311	
0508		FO	0	150			VC	34.71311	
5402	28.98	FO	27.25	225			VC	23.5372	1 in 91
5402	28.98	FO	27.25	225			VC	23.5372	1 in 91
4301	28.19	SW	26.51	300			VC	67.54258	1 in 73
4517	26.72	FO	24.31	300			CO	8.737325	1 in 97
4517	26.72	FO	24.31	300			CO	8.737325	1 in 97
4507		SW		100			VC	18.34195	
0418		OV	0	300			VC	36.56709	
0418		OV	0	300			VC	36.56709	
5201	29.45	FO	27.83	225			VC	26.57066	
5201	29.45	FO	27.83	225			VC	26.57066	
0511		CO		150			VC	30.77025	

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
4522	27.44	FO	24.04	1350			CO	30.0378	1 in 137
4522	27.44	FO	24.04	1350			CO	30.0378	1 in 137
0412	19.55	SW	18.69	150			VC	18.11077	
5507	28.95	FO	27.17	225			VC	34.1321	1 in 213
5507	28.95	FO	27.17	225			VC	34.1321	1 in 213
5507	28.95	FO	27.17	225			VC	34.1321	1 in 213
5507	28.95	FO	27.17	225			VC	34.1321	1 in 213
9502	16.1	CO	14.72	225			VC	60.20797	1 in 109
9502	16.1	CO	14.72	225			VC	60.20797	1 in 109
2304	22.41	SW	21.16	225			VC	26.62705	1 in 62
0311		CO		100			VC	34.27452	
1401	18.75	SW	17.63	150			VC	51.73973	
1401	18.75	SW	17.63	150			VC	51.73973	
2302	21.93	SW	20.73	225			VC	73.1095	1 in 65
0509		SW	0	450			VC	31.57531	
0509		SW	0	450			VC	31.57531	
3302	27.44	SW	26.19	225			VC	16	
4310		CO		100			VC	50.44906	
1308	22.37	SW	21.99	150			VC	71.21797	1 in 22
1508		SW	0	150			VC	20.61553	
1508		SW	0	150			VC	20.61553	
2202	26.25	SW	23.65	225			VC	40.24922	1 in 29
3405	26.83	FO	25.39	225			VC	49.34852	
2402	20.65	SW	19.58	225			VC	31.06445	1 in 3
2402	20.65	SW	19.58	225			VC	31.06445	1 in 3
0416		FO		375			CO	7.768578	
0416		FO		375			CO	7.768578	
2401		FO	0	150			VC	69.11584	
2401		FO	0	150			VC	69.11584	
2502	20.48	FO	18.89	225			VC	62.76942	1 in 20
2502	20.48	FO	18.89	225			VC	62.76942	1 in 20
5503	28.97	SW	27.65	300			VC	54.03703	1 in 35
5503	28.97	SW	27.65	300			VC	54.03703	1 in 35
5503	28.97	SW	27.65	300			VC	54.03703	1 in 35
5503	28.97	SW	27.65	300			VC	54.03703	1 in 35
0410		FO	0	150			VC	30.1067	
0410		FO	0	150			VC	30.1067	
0214		SW		100			VC	35.41158	
5404	28.99	SW	27.44	525			CO	56.08921	1 in 42
9508		CO		150			VC	47.16734	
9508		CO		150			VC	47.16734	
0207	20.64	SW	18.91	150			VC	18.95066	
2305	24.95	SW	22.28	225			VC	66.85058	1 in 60
3409	23.6	FO	21.78	1200			CO	38.92234	1 in 97
3409	23.6	FO	21.78	1200			CO	38.92234	1 in 97
0206		SW	0	150			VC	61.26989	
0312		CO		100			VC	14.18338	
0308	19.46	SW	17.8	300			VC	36.71512	1 in 46
0429		FO		150			VC	9.579852	
0429		FO		150			VC	9.579852	
0313		FO		150			VC	26.57819	
3202		SW	0	150			VC	48.79549	
0407	17.5	SW	15.47	450			VC	59.77458	
0407	17.5	SW	15.47	450			VC	59.77458	
0403		FO		100			VC	14.30602	
0403		FO		100			VC	14.30602	
5511	29.1	FO	0	225			VC	23.76973	
5511	29.1	FO	0	225			VC	23.76973	
9213		FO		150			VC	24.89945	
9202		SW		100			VC	50.87231	
2501	17.29	FO	15.74	225			VC	55.4617	1 in 55
2501	17.29	FO	15.74	225			VC	55.4617	1 in 55
4304	26.8	FO	25.93	225			VC	45.34314	1 in 84

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
- HS Head of System
- ES Extent of Survey
- RE Rodding Eye
- IN Inlet
- DP Discharge Point
- HY Vortex
- PE Penstock
- WO Washout Chamber
- VA Valve
- AV Air Valve
- NRV Non Return Valve
- SO Soakaway
- GU Gully
- CA Cascade
- FM Flow Meter
- HA Hatch Box
- OI Oil Interceptor
- SM Summit
- DS Drop Shaft
- OP Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- IC Inspection Chamber
- Bifurcation Chamber
- LH Lamp Hole
- T Junction / Saddle
- Catchpit
- Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- Network Storage Tank
- Sewer Overflow
- WwTW Ww Treatment Works
- Ww Pumping Station
- Septic Tank
- Control Kiosk
- 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:

3 LINK ROAD,
WHITEHAVEN,
CA28 8HJ

OS sheet Number: NX9815SW
Scale: 1:1250 **Date:** 14/01/2022
Nodes: 264
Sheet: 1 of 4

Printed by: Property Searches

SEWER RECORDS

United Utilities
Water for the North West

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
0401	18.13	FO	15.54	150			VC	36.40055	
0401	18.13	FO	15.54	150			VC	36.40055	
0536	15.54	FO	13.96	150			VC	25.23886	1 in 41
0536	15.54	FO	13.96	150			VC	25.23886	1 in 41
3404	23.91	SW	21.41	750			CO	67.7195	1 in 68
3404	23.91	SW	21.41	750			CO	67.7195	1 in 68
4302	27.16	SW	25.59	300			CO	66.91039	1 in 25
4708	35.75	SW	33.49	225			CO	31.01612	1 in 20
4502	27.76	FO		300			VC	7.468843	
4502	27.76	FO		300			VC	7.468843	
5903	50.87	FO	49.67	225			VC	52	1 in 12
5903	50.87	FO	49.67	225			VC	52	1 in 12
0516		CO		150			VC	3.653792	
0516		CO		150			VC	3.653792	
4501	25.95	FO	23.72	225			CO	20.14352	
4501	25.95	FO	23.72	225			CO	20.14352	
4404	24.5	SW	22.2	525			CO	27.25498	1 in 34
4404	24.5	SW	22.2	525			CO	27.25498	1 in 34
9406	17.18	SW	15.15	600			CO	11.67726	
9406	17.18	SW	15.15	600			CO	11.67726	
4406	28.17	FO	26.77	225			VC	84.18546	1 in 19
4406	28.17	FO	26.77	225			VC	84.18546	1 in 19
0803	11.46	CO	10.37	225			VC	94.92102	1 in 88
4518	27.72	FO	26.46	300			CO	11.04943	1 in 53
4518	27.72	FO	26.46	300			CO	11.04943	1 in 53
1703		FO		225			VC	3.534177	
9801	10.58	CO	9.29	225			VC	31.01095	1 in 129
1906		FO	0	150			VC	11.31371	
3805		FO		100			VC	3.336896	
4901		FO	0	150			VC	39.81206	
9405	17.03	SW	15.03	600			CO	52.83938	1 in 91
9405	17.03	SW	15.03	600			CO	52.83938	1 in 91
0517		CO		150			VC	16.77545	
0608	13.7	SW	11.39	1200			CO	77.49194	1 in 95
0409	17.96	SW	16.21	450			VC	21.29191	
0409	17.96	SW	16.21	450			VC	21.29191	
3806	33.1	SW	31.67	150			VC	12	
9407	17.47	SW	15.89	450			VC	46.27103	1 in 63
9407	17.47	SW	15.89	450			VC	46.27103	1 in 63
4521	26.58	FO	24.1	1350			CO	15.6783	1 in 261
4521	26.58	FO	24.1	1350			CO	15.6783	1 in 261
3401	24.06	FO	21.36	225			VC	61.68341	1 in 43
3401	24.06	FO	21.36	225			VC	61.68341	1 in 43
4401	24.9	FO	23.39	375			CO	23.26349	1 in 23
4401	24.9	FO	23.39	375			CO	23.26349	1 in 23
4506	28.45	SW	27.1	225			VC	21.68619	1 in 23
4506	28.45	SW	27.1	225			VC	21.68619	1 in 23
5704		FO	0	150			VC	32.44996	
5704		FO	0	150			VC	32.44996	
1002		CO	0	150			VC	53.85165	
3906		SW		600			CO	60.0408	
4809		CO		100			VC	18.66908	
4519	27.17	FO	26.22	300			CO	8.652072	1 in 4
4519	27.17	FO	26.22	300			CO	8.652072	1 in 4
0006		FO		100			VC	8.347057	
9601	13.3	CO	12.29	150			VC	14.56022	1 in 27
3804		FO		100			VC	10.45402	
4508		SW		100			VC	20.99432	
4508		SW		100			VC	20.99432	
5702	46.78	SW	45.43	150			VC	61.66036	1 in 13
2901		FO	0	150			VC	47.51842	
0414		FO	0	375			VC	9.405542	
0414		FO	0	375			VC	9.405542	
9512		CO		150			VC	3.213516	
4520	26.91	FO	24.19	1350			CO	12.58149	1 in 180
4520	26.91	FO	24.19	1350			CO	12.58149	1 in 180
4413		FO		150			VC	6.102794	
4911	47.33	FO	45.48	225			VC	26.68333	1 in 40
4911	47.33	FO	45.48	225			VC	26.68333	1 in 40
1510	17.69	FO	16.44	150			VC	12.20656	1 in 36
1510	17.69	FO	16.44	150			VC	12.20656	1 in 36
0518		FO		100			VC	25.16109	
0518		FO		100			VC	25.16109	
0707	12.45	SW	10.57	1200			CO	11.40175	
0703	12.46	FO	11.39	225			VC	23.63253	
0801	11.19	FO	9.4	300			VC	72.17962	1 in 278
5514		FO		100			VC	19.99409	
5514		FO		100			VC	19.99409	
5514		FO		100			VC	19.99409	
5514		FO		100			VC	19.99409	
0705	12.6	FO	11.42	300			VC	17.44135	1 in 17
4615		FO		150			VC	28.84502	
3001		FO	0	150			VC	55.03635	
0614		SW	11.61	600			CO	3.362518	
4401	24.9	FO	23.39	375			CO	23.26993	1 in 23
4401	24.9	FO	23.39	375			CO	23.26993	1 in 23
9401	16.8	FO	15.55	225			VC	35.35534	1 in 43
9401	16.8	FO	15.55	225			VC	35.35534	1 in 43
4706	34.33	SW	32.93	225			CO	30.67572	1 in 30
4523	25.95	FO	23.82	225			VC	22.18646	1 in 740
4523	25.95	FO	23.82	225			VC	22.18646	1 in 740
0503	17.84	SW	16.45	150			VC	88.07383	
0503	17.84	SW	16.45	150			VC	88.07383	
4905	48.62	FO	46.15	225			VC	22.80351	1 in 34
4905	48.62	FO	46.15	225			VC	22.80351	1 in 34
0700	12.32	FO	10.35	300			VC	21.97663	1 in 122
0504		FO		100			VC	23.73143	
0504		FO		100			VC	23.73143	
4707	33.82	SW	31.92	300			CO	40.31129	1 in 58
4402		FO		150			VC	2.861308	
4402		FO		150			VC	2.861308	
4601	29.39	FO	26.5	225			VC	5.948884	1 in 42
4601	29.39	FO	26.5	225			VC	5.948884	1 in 42
5508	29.11	FO	27.01	225			VC	14.31782	
5508	29.11	FO	27.01	225			VC	14.31782	
5508	29.11	FO	27.01	225			VC	14.31782	
5508	29.11	FO	27.01	225			VC	14.31782	
2908		SW		600			CO	47.07441	
0501	14.25	FO	13.13	150			VC	33.10758	1 in 97
0610		SW		100			VC	15.36097	
4505	27.91	SW	26.14	675			CO	28.06448	1 in 39
0506	15.4	SW	13.39	825			CO	104.5033	1 in 52
0531	16.53	FO	15.53	150			VC	8.602325	1 in 14
0531	16.53	FO	15.53	150			VC	8.602325	1 in 14
0405	18.38	FO	16.55	150			VC	13.49806	1 in 31
0508		FO	0	150			VC	34.71311	
0508		FO	0	150			VC	34.71311	
0615		SW	12.19	150			CO	9.621812	1 in 17
2702	21.52	SW	19.92	225			VC	25.70992	1 in 7
4517	26.72	FO	24.31	300			CO	8.737325	1 in 97
4517	26.72	FO	24.31	300			CO	8.737325	1 in 97
0418		OV	0	300			VC	36.56709	
0418		OV	0	300			VC	36.56709	
4906	46.26	FO	44.81	225			VC	40.24922	1 in 39
4906	46.26	FO	44.81	225			VC	40.24922	1 in 39
0505	14.84	FO	13.34	150			VC	44.94441	1 in 166
3905		FO	0	150			VC	28	
4522	27.44	FO	24.04	1350			CO	30.0378	1 in 137
4522	27.44	FO	24.04	1350			CO	30.0378	1 in 137
5507	28.95	FO	27.17	225			VC	34.1321	1 in 213
5507	28.95	FO	27.17	225			VC	34.1321	1 in 213
5507	28.95	FO	27.17	225			VC	34.1321	1 in 213
5507	28.95	FO	27.17	225			VC	34.1321	1 in 213
5509	34.68	SW	33.29	450				38.91015	1 in 9
2301		FO	0	150			VC	75.16648	
0422		CO		100			VC	10.4373	
0422		CO		100			VC	10.4373	
2601	26.07	SW	24.27	225			VC	62.8172	1 in 59
4808		CO		100			VC	9.075637	
4530		FO		100			VC	1.376528	
4530		FO		100			VC	1.376528	
4530		FO		100			VC	1.376528	
4530		FO		100			VC	1.376528	
0902	11.41	SW	9.28	1350			CO	27.16885	
4705	32.33	SW	31.23	300			CO	19.41649	1 in 33
2903		FO	0	150			VC	31.32092	
0530	16.2	FO	14.93	150			VC	55.14526	1 in 82
0530	16.2	FO	14.93	150			VC	55.14526	1 in 82
9613		CO		150			VC	9.10295	
4603	30.82	FO	28.97	225			VC	11.75652	1 in 41
3408		CO		100			PSC	6.29429	
3408		CO		100			PSC	6.29429	
2703	27.19	FO	25.99	150			VC	79.51101	1 in 8
1504	16.83	FO	15.64	150			VC	22.02271	1 in 200
1504	16.83	FO	15.64	150			VC	22.02271	1 in 200
4503	26.11	SW	24.36	675			CO	41.92244	1 in 29
4503	26.11	SW	24.36	675			CO	41.92244	1 in 29
4004		FO	0	150			VC	22.67157	
4703	36.5	FO	34.17	225			VC	55.9017	1 in 26
9606	14.36	CO	13.52	150			VC	27.40759	1 in 38
0512		CO		100			VC	5.600421	
0512		CO		100			VC	5.600421	
2504		SW		750			CO	56.46238	
2504		SW		750			CO	56.46238	
0415		FO		150			VC	29.91423	
0415		FO		150			VC	29.91423	
2801	18.61	SW	16.48	225			VC	43.17406	1 in 50
5619		FO		150			VC	20.55012	
5619		FO		150			VC	20.55012	
9706	12.61	SW	10.96	300			VC	60.08327	1 in 194
4907		SW		600			CO	21.93171	
1505	17.09	FO	16.1	150			VC	22	1 in 48
1505	17.09	FO	16.1	150			VC	22	1 in 48
0515		CO		150			VC	43.05281	
0515		CO		150			VC	43.05281	
0514		CO		100			VC	1.986563	
0514		CO		100			VC	1.986563	
4513		FO		100			VC	9.620073	
4513		FO		100			VC	9.620073	
4513		FO		100			VC	9.620073	
4513		FO		100			VC	9.620073	
0717	12.28	CO	11.16	225			VC	24.59675	1 in 79
4603	30.82	FO	28.67	225			VC	41.42784	
0411		SW	0	150			VC	40.60788	
4516	26.91	FO	24.47	1350			CO	12.11725	1 in 121
3402	23.76	FO	22.44	225			VC	47.76448	1 in 44
3402	23.76	FO	22.44	225			VC	47.76448	1 in 44
0708		FO		100			VC	20.1825	
0601	13.43	CO	12.05	225			VC	50.61401	1 in 66
4702	33.88	FO	31.98	225			VC	45.96738	1 in 33
4709	42.93	SW	40.78	225			VC	56.60389	1 in 8
4709	42.93	SW	40.78	225			VC	56.60389	1 in 8
2907		FO	0	150			VC	38.60052	
3803		FO	0	150			VC	37.64306	
1611		FO		150			VC	11.00741	
0704	12.51	FO	11.7	225			VC	36.49657	1 in 118
3904		FO	0	150			VC	17.46425	
2701	24.7	SW	23.2	225			VC	37.36308	1 in 11
0406	19.28	FO	17.88	150			VC	77.7946	1 in 33
9704	11.65	SW	10.22	225			VC	87.0919	1 in 229
3903		FO	0	150			VC	18.11077	

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
5902	54.85	FO	53.77	225			VC	47.43417	1 in 12
0706	12.81	SW	10.65	1350			CO	20.02498	
4704	40.29	FO	39.16	225			VC	52.15362	1 in 8
4704	40.29	FO	39.16	225			VC	52.15362	1 in 8
0408	18.51	SW	15.99	150			VC	62.28965	
0408	18.51	SW	15.99	150			VC	62.28965	
5504	31.59	SW	29.19	600			CO	52.28185	1 in 17
5504	31.59	SW	29.19	600			CO	52.28185	1 in 17
4504	27.47	SW	25.42	675			CO	32.32324	1 in 30
4504	27.47	SW	25.42	675			CO	32.32324	1 in 30
1907		SW		600			CO	94.26028	
3004		FO	0	150			VC	31.57531	
4509		FO		100			VC	51.46301	
0502	16.76	FO	14.26	150			VC	48.83646	1 in 43
0502	16.76	FO	14.26	150			VC	48.83646	1 in 43
2503	17.42	SW	15.82	750			CO	52.80151	
2503	17.42	SW	15.82	750			CO	52.80151	
0606	13.93	FO	13.07	150			VC	16.12452	1 in 124
4804	36.38	FO	34.33	225			VC	34	1 in 213
9411		FO	0	150			VC	12.4498	
0613		SW		100			VC	26.74208	
0805	12.1	SW	10.22	1350			CO	43.41659	1 in 94
0709	12.2	SW	10.85	225			VC	63.78872	1 in 95
3902		FO	0	150			VC	50.24938	
4902		CO		100			VC	14.94349	
0711		FO		100			VC	4.152076	
4801	40.81	FO	39.21	225			VC	40.22437	1 in 10
4801	40.81	FO	39.21	225			VC	40.22437	1 in 10
3901		FO	0	150			VC	35.44009	
0513		CO		100			VC	10.20893	
0513		CO		100			VC	10.20893	
4805	39.53	SW	38.43	150			CO	68	1 in 12
4605	30.36	SW	28.25	300			VC	74.53845	1 in 35
1507	15.95	SW		750			CO	29	
0607	13.78	SW	12.21	225			VC	34.71311	
9403		SW	0	600			CO	4.447292	
9403		SW	0	600			CO	4.447292	
0710	12.15	FO	10.15	300			VC	91.53317	1 in 125
4403	27.81	SW	26.11	525			CO	64.00781	1 in 20
4403	27.81	SW	26.11	525			CO	64.00781	1 in 20
4403	27.81	SW	26.11	525			CO	64.00781	1 in 20
4403	27.81	SW	26.11	525			CO	64.00781	1 in 20
4528		FO		225			VC	2.701522	
4528		FO		225			VC	2.701522	
0702	12.18	FO	11.14	225			VC	9.848858	1 in 34
5618		FO		150			VC	17.28155	
5618		FO		150			VC	17.28155	
3703	31.59	SW	30.74	150			VC	29.52965	1 in 109
3403	23.96	SW	20.41	750			CO	80.49844	
3403	23.96	SW	20.41	750			CO	80.49844	
1506	15.75	SW	14.02	825			CO	21.2132	1 in 34
0404	18.1	FO	16.12	150			VC	10.34995	
0404	18.1	FO	16.12	150			VC	10.34995	
5703	46.34	FO	44.61	150			VC	27.20294	
4409	25.49	FO	23.8	150			VC	1.953424	1 in 28
4409	25.49	FO	23.8	150			VC	1.953424	1 in 28
2902		FO	0	150			VC	62.00806	
3808	31.04	SW	29.64	150			VC	97.52948	
0906	10.69	FO	9.12	300			VC	11.49545	1 in 192
0626	13.26	CO	11.75	225			VC	22.12057	
4908		SW		600			CO	13.34166	
4507		SW		100			VC	18.34195	
0804	11.69	SW	9.76	1350			CO	61.52235	1 in 128
0511		CO		150			VC	30.77025	
0511		CO		150			VC	30.77025	
2909		SW		600			CO	38.01316	
4909		SW		600			CO	33.54102	
3801		FO	0	150			VC	100.6876	
3601	31.54	SW	29.96	375			CO	30.41381	1 in 36
4803	46.65	SW	44.67	225			VC	31.89044	1 in 17
4803	46.65	SW	44.67	225			VC	31.89044	1 in 17
1702	14.69	FO	0	225			VC	92.64988	
2807		CO		100			VC	7.273033	
1508		SW	0	150			VC	20.61553	
1508		SW	0	150			VC	20.61553	
4910	44.07	SW	42.5	225			VC	11.6619	
0416		FO		375			CO	7.768578	
0416		FO		375			CO	7.768578	
3701	31.83	FO	30.61	150			VC	40.56448	
2502	20.48	FO	18.89	225			VC	62.76942	1 in 20
2502	20.48	FO	18.89	225			VC	62.76942	1 in 20
2001	16.31	CO	15.11	225			VC	43	1 in 16
4612	28.73	FO	25.04	750			CO	52.49455	1 in 99
0521		FO		100			VC	9.232088	
9508		CO		150			VC	47.16734	
9508		CO		150			VC	47.16734	
1904	12.57	FO	0	225			VC	10.04988	
0904	10.6	CO	8.69	225			VC	28.74003	
3008		FO		100			VC	4.476743	
2802	16.68	SW	14.69	300			VC	19.69772	1 in 20
0407	17.5	SW	15.47	450			VC	59.77458	
0407	17.5	SW	15.47	450			VC	59.77458	
5605	33.53	SW	32.13	225			VC	65.79514	1 in 13
0701	11.92	CO	10.85	225			VC	9.219544	1 in 51
2803	14.98	SW	13.62	375			CO	38.32754	
0522		FO		100			VC	5.411832	
1905	13.05	FO	11.75	225			VC	15.04664	
1603	13.75	SW	12.46	225			VC	67.68308	
1911		FO		100			VC	11.96887	
0913	10.7	CO	9.05	225			VC	29.68368	1 in 65
9502	16.1	CO	14.72	225			VC	60.20797	1 in 109
9502	16.1	CO	14.72	225			VC	60.20797	1 in 109
3807	33.79	SW	32.07	225			VC	86.13245	
2906		FO	0	150			VC	4	
0003	11.74	FO	9.94	225			VC	47.29694	
0605	13.65	FO	12.94	150			VC	24.83954	1 in 131
4806	39.15	SW	37.77	225			VC	53.48832	1 in 12
2401		FO	0	150			VC	69.11584	
2401		FO	0	150			VC	69.11584	
2808		CO		100			VC	9.366224	
5404	28.99	SW	27.44	525			CO	56.08921	1 in 42
1009		SW	0	150			VC	41.04875	
9001	10.46	CO	8.25	300			VC	64.38168	1 in 248
1802		FO		100			VC	16.7648	
9514		CO		150			VC	12.03963	
1608	14.23	FO	12.98	225			VC	41.23106	1 in 243
3409	23.6	FO	21.78	1200			CO	38.92234	1 in 97
3409	23.6	FO	21.78	1200			CO	38.92234	1 in 97
1003		CO		100			VC	10.02404	
9903	10.74	SW	9.4	375			CO	1.414214	1 in 14
4613		FO		100			VC	4.672034	
4611	30.6	FO	27.7	300			CO	32.75766	1 in 26
3002		FO		100			VC	12.73439	
0602	13.74	CO	12.48	225			VC	31.90611	1 in 74
1901	12.65	FO	10.35	225			VC	64.03124	1 in 156
2302	21.93	SW	20.73	225			VC	73.1095	1 in 65
0509		SW	0	450			VC	31.57531	
0509		SW	0	450			VC	31.57531	
2905	19.74	CO		225			VC	53.93445	
1909	12.79	SW	11.42	225			VC	8.979747	
1801	14.93	FO	13.23	225			VC	91.63798	
1609	16.08	FO	14.68	225			VC	90.47099	1 in 53
0523		FO		100			VC	4.963074	
2402	20.65	SW	19.58	225			VC	31.06445	1 in 3
2402	20.65	SW	19.58	225			VC	31.06445	1 in 3
2905	19.74	CO	18.54	225			VC	35.13294	
5503	28.97	SW	27.65	300			VC	54.03703	1 in 35
5503	28.97	SW	27.65	300			VC	54.03703	1 in 35
5503	28.97	SW	27.65	300			VC	54.03703	1 in 35
5503	28.97	SW	27.65	300			VC	54.03703	1 in 35
0410		FO	0	150			VC	30.1067	
0410		FO	0	150			VC	30.1067	
4701	32.14	FO	30.59	225			VC	32.38827	1 in 29
1902		FO	9.84	225			VC	39.86621	
5624		FO		100			VC	18.20085	
5624		FO		100			VC	18.20085	
0429		FO		150			VC	9.579852	
0429		FO		150			VC	9.579852	
1804		FO		100			VC	12.86319	
1916		FO		100			VC	21.91234	
4610		FO		100			VC	12.45347	
5901	50.18	SW	49.28	150			VC	65.76473	1 in 15
5901	50.18	SW	49.28	150			VC	65.76473	1 in 15
4807		FO	0	225			VC	46.17358	
4807		FO	0	225			VC	46.17358	
3604		FO		225			VC	40.56556	
0716	11.65	CO	10.56	225			VC	30.80584	1 in 162
0612	14.14	SW	11.73	600			CO	14.3135	1 in 119
1401	18.75	SW	17.63	150			VC	51.73973	
1401	18.75	SW	17.63	150			VC	51.73973	
1903	12.69	FO	10.89	225			VC	11.27755	1 in 12
1005	13.58	CO	12.41	225			VC	32.24903	
4617		FO		150			VC	9.226533	
4617		FO		150			VC	9.226533	
3405	26.83	FO	25.39	225			VC	49.34852	
0609	14.37	SW	0	150			VC	3.674557	
3005		FO	0	150			VC	13.91416	
4614		FO		100			VC	27.16132	
2808		CO		100			VC	8.843112	
4802	45.42	FO	43.77	225			VC	8.544003	
4802	45.42	FO	43.77	225			VC	8.544003	
2704	18.19	FO	15.54	150			VC	53.00943	1 in 21
0507	13.36	SW	0	150			VC	44.55334	
1617		FO		100			VC	11.04954	
1908		SW	0	225			VC	23.34524	
4604	31.31	FO	29.42	225			VC	26.52557	1 in 59
5602	33.95	FO	32.09	225			VC	2	
5602	33.95	FO	32.09	225			VC	2	
0901	10.66	SW	9.34	450			VC	38.64283	1 in 644
1915		SW	11.42	225			VC	33.47022	
4607		FO		100			VC	6.065398	
0603		CO	12.79	150			VC	11.82697	1 in 27
0005	11.85	SW	10.59	225			VC	36.05551	
0403		FO		100			VC	14.30602	
0403		FO		100			VC	14.30602	
4616		FO		225			VC	18.83547	
4616		FO		225			VC	18.83547	
5511	29.1	FO	0	225			VC	23.76973	
5511	29.1	FO	0	225			VC	23.76973	
0806	11.38	SW	10.18	225			VC	83.36066	1 in 110
2501	17.29	FO	15.74	225			VC	55.4617	1 in 55
2501	17.29	FO	15.74	225			VC	55.4617	1 in 55
4609		SW		100			VC	48.74485	
1914		FO	11.51	300			VC	11.38568	1 in 37

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	Side Entry Manhole
HS Head of System	Outfall
ES Extent of Survey	Screen Chamber
RE Rodding Eye	IC Inspection Chamber
IN Inlet	Bifurcation Chamber
DP Discharge Point	LH Lamp Hole
HY Vortex	T Junction / Saddle
PE Penstock	CA Catchpit
WO Washout Chamber	VC Valve Chamber
VA Valve	Vent Column
AV Air Valve	Vortex Chamber
NRV Non Return Valve	Penstock Chamber
SO Soakaway	Network Storage Tank
GU Gully	Sewer Overflow
CA Cascade	WwTW Ww Treatment Works
FM Flow Meter	Ww Pumping Station
HA Hatch Box	ST Septic Tank
OI Oil Interceptor	CK Control Kiosk
SM Summit	
DS Drop Shaft	Change of Characteristic
OP Orifice Plate	

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:

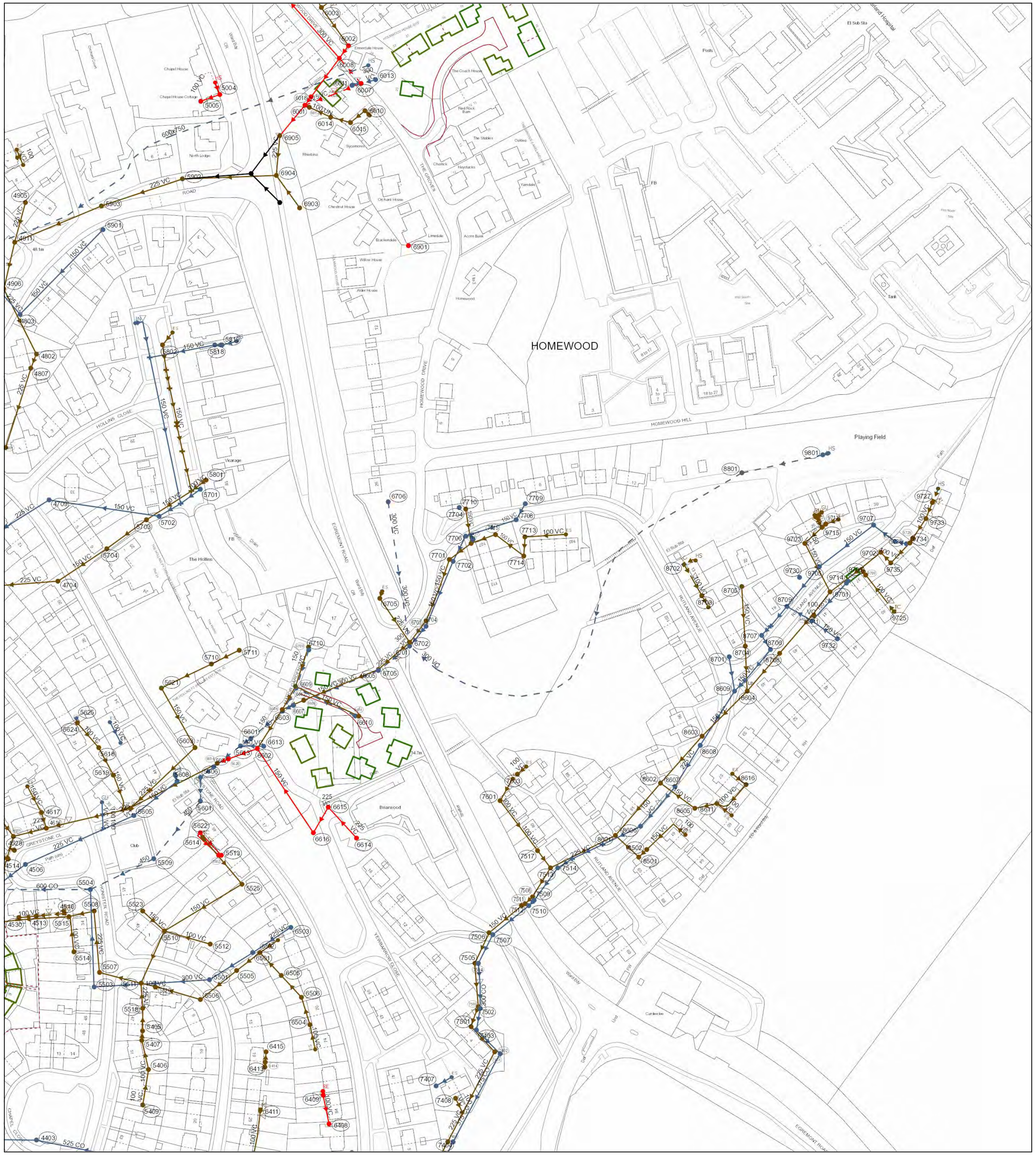
3 LINK ROAD,
WHITEHAVEN,
CA28 8HJ

OS sheet Number: NX9815NW
Scale: 1:1250　**Date:** 14/01/2022
Nodes: 395
Sheet: 2 of 4

Printed by: Property Searches

SEWER RECORDS

United Utilities
Water for the North West



Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
6701	55.04	SW	50.78	300			VC	22.02983	1 in 137.686449
6603	46.88	SW	45.35	300			VC	23.4031	1 in 9.00119430
5903	50.87	FO	49.67	225			VC	52	1 in 12
5903	50.87	FO	49.67	225			VC	52	1 in 12
5409		FO		100			VC	20.01115	
5409		FO		100			VC	20.01115	
8501	63.78	FO	62.12	150			VC	17.69181	1 in 61
6616		CO		150			VC	56.06404	
6615		CO		225			VC	16.37895	
8708	76.28	FO	74.15	150			VC	27.65863	1 in 14
8605	67.67	FO	66.37	150			VC	23.60085	1 in 41
6611	49.47	SW	47.9	150			VC	36.1031	1 in 24.2302685
6007	63	CO	60.77	300			VC	16.15549	1 in 0.27377553
7512	55.2	FO	54.3	150			VC	2.236068	
7708	65	SW	63.95	150			VC	29.41109	1 in 7
9715		FO		100			VC	12.94631	
8604	73.98	FO	72.15	150			VC	35.35534	1 in 12
4506	28.45	SW	27.1	225			VC	21.68619	1 in 23
4506	28.45	SW	27.1	225			VC	21.68619	1 in 23
6008	62.8	CO	60.67	300			VC	78.64477	1 in 67
5704		FO	0	150			VC	32.44996	
5704		FO	0	150			VC	32.44996	
5702	46.78	SW	45.43	150			VC	61.66036	1 in 13
4911	47.33	FO	45.48	225			VC	26.68333	1 in 40
4911	47.33	FO	45.48	225			VC	26.68333	1 in 40
9708	82.26	SW	80.91	150			VC	15	1 in 22
5818		SW	0	150			VC	36.67424	
5514		FO		100			VC	19.99409	
5514		FO		100			VC	19.99409	
5514		FO		100			VC	19.99409	
5514		FO		100			VC	19.99409	
7713		FO		100			VC	10.53182	
6604	46.9	FO	44.63	150			VC	25.75065	1 in 14
8709	77.5	SW	75.63	150			VC	14.21267	
7601		FO		100			VC	34.57288	
6706		SW	0	300			VC	80.895	
4905	48.62	FO	46.15	225			VC	22.80351	1 in 34
4905	48.62	FO	46.15	225			VC	22.80351	1 in 34
7709	66.18	SW	64.83	150			VC	10.29563	1 in 12
6602		CO		150			VC	17.04596	
6007	63	CO	60.77	300			VC	18.43909	1 in 0.31444558
9705	79.58	SW	77.42	150			VC	28.42534	1 in 16
5607	41.45	SW	39.93	300			VC	9.433059	1 in 11.9405804
6504		FO		100			VC	15.91971	
6504		FO		100			VC	15.91971	
9710	78.38	SW	76.68	150			VC	16.12452	1 in 15
5508	29.11	FO	27.01	225			VC	14.31782	
5508	29.11	FO	27.01	225			VC	14.31782	
5508	29.11	FO	27.01	225			VC	14.31782	
5508	29.11	FO	27.01	225			VC	14.31782	
6601	44.52	SW	42.75	300			VC	6.945468	
5802	50.54	FO	49.67	150			VC	14.14214	
6506		FO		100			VC	16.48307	
6506		FO		100			VC	16.48307	
4906	46.26	FO	44.81	225			VC	40.24922	1 in 39
4906	46.26	FO	44.81	225			VC	40.24922	1 in 39
5819		SW	0	150			VC	4	
9701	79.47	FO	77.45	150			VC	44.05985	1 in 13
9706		FO		100			VC	2.239773	
5507	28.95	FO	27.17	225			VC	34.1321	1 in 213
5507	28.95	FO	27.17	225			VC	34.1321	1 in 213
5507	28.95	FO	27.17	225			VC	34.1321	1 in 213
5507	28.95	FO	27.17	225			VC	34.1321	1 in 213
5509	34.68	SW	33.29	450				38.91015	1 in 9
6602		CO		150			VC	6.536495	
4530		FO		100			VC	1.376528	
4530		FO		100			VC	1.376528	
4530		FO		100			VC	1.376528	
4530		FO		100			VC	1.376528	
6011	63.21	SW	60.91	600				3.162278	1 in 5.39177776
7506	53.73	FO	50.38	150			VC	18.78829	1 in 10
7506	53.73	FO	50.38	150			VC	18.78829	1 in 10
7502	46.78	FO	45.75	150			VC	5.385165	1 in 5
7502	46.78	FO	45.75	150			VC	5.385165	1 in 5
5604	41.89	FO		150			VC	53.55499	
6605	52.57	SW	50.62	300			VC	50.94532	
8616		FO		100			VC	21.69431	
8601	63.88	FO	61.83	150			VC	40.24922	1 in 11
6710	49.72	SW	48.15	150			VC	22.29396	1 in 13
5407		FO		100			VC	5.308584	
5407		FO		100			VC	5.308584	
8701	73.51	SW	71.73	150			VC	19.23538	1 in 51
9707	81.69	SW	80.24	150			VC	37.80212	1 in 13
5619		FO		150			VC	20.55012	
5619		FO		150			VC	20.55012	
8607	67.66	SW	65.86	225			VC	14.21267	1 in 13
6709	49.39	FO	47.59	150			VC	22.97539	1 in 16.4109902
4513		FO		100			VC	9.620073	
4513		FO		100			VC	9.620073	
4513		FO		100			VC	9.620073	
4513		FO		100			VC	9.620073	
8603	70.18	FO	69.13	150			VC	34.71311	1 in 10
8609	72.45	SW	71.35	225			VC	35.51056	1 in 11
7513	60.48	FO	58.08	150			VC	18.86796	1 in 5
9706		FO		100			VC	2.239773	
7508	56.55	FO	54.6	150			VC	5.656854	1 in 19
6612	47.98	SW	46.41	150			VC	14.77557	1 in 9
5613		SW		300			VC	18.76549	
8705	76.67	FO	74.99	150			VC	33.06055	1 in 13
4709	42.93	SW	40.78	225			VC	56.60389	1 in 8
4709	42.93	SW	40.78	225			VC	56.60389	1 in 8
6614		CO		225			VC	23.23131	
6013	64.09	SW	61.94	300			VC	8.246211	1 in 0.13810435
7517		FO		100			VC	11.92194	
5902	54.85	FO	53.77	225			VC	47.43417	1 in 12
8502		FO		150			VC	5.895051	
6606		FO	0	150			VC	12.9908	
6613	45.45	SW	43.88	150			VC	12.86137	1 in 5.76742921
8707	75.96	SW	73.63	150			VC	9.433981	1 in 13
7715		FO		100			VC	14.36438	
4704	40.29	FO	39.16	225			VC	52.15362	1 in 8
4704	40.29	FO	39.16	225			VC	52.15362	1 in 8
8608	70	SW	68.24	225			VC	26.92582	1 in 11
5504	31.59	SW	29.19	600			CO	52.28185	1 in 17
5504	31.59	SW	29.19	600			CO	52.28185	1 in 17
6003	63.8	FO	61.87	225			VC	25.80698	1 in 70
8706	74.84	SW	72.89	150			VC	22.02271	
8602	67.44	FO	65.79	150			VC	38.28838	1 in 10
5601	39.48	SW	37.86	450				41.23106	1 in 9
9703	79.45	FO	77.95	150			VC	30.41381	1 in 61
6409		CO		100			VC	16.23578	
6409		CO		100			VC	16.23578	
5501	30.02	SW	28.22	300			VC	30.06659	
5501	30.02	SW	28.22	300			VC	30.06659	
4601	29.39	FO	27.68	225			VC	43.38344	1 in 37
4601	29.39	FO	27.68	225			VC	43.38344	1 in 37
5406		FO		100			VC	16.51454	
5406		FO		100			VC	16.51454	
7511		FO	0	150			VC	23.43075	
7511		FO	0	150			VC	23.43075	
6501	34.04	SW	32.84	225			VC	28.30194	1 in 6
6501	34.04	SW	32.84	225			VC	28.30194	1 in 6
7706	61.6	SW	0	150			VC	15.65248	
6607		SW		300			VC	6.738397	
7504	49.68	FO	48.48	150			VC	24.08319	1 in 9
7504	49.68	FO	48.48	150			VC	24.08319	1 in 9
7704	62.76	FO	60.66	150			VC	19.23538	1 in 18
5701	48.95	SW	47.47	150			VC	13.60147	
4801	40.81	FO	39.21	225			VC	40.22437	1 in 10
4801	40.81	FO	39.21	225			VC	40.22437	1 in 10
8704	74.41	FO	72.51	150			VC	25.01999	1 in 69
5525		FO	0	150			VC	50.24938	
4403	27.81	SW	26.11	525			CO	64.00781	1 in 20
4403	27.81	SW	26.11	525			CO	64.00781	1 in 20
4403	27.81	SW	26.11	525			CO	64.00781	1 in 20
4403	27.81	SW	26.11	525			CO	64.00781	1 in 20
4528		FO		225			VC	2.701522	
4528		FO		225			VC	2.701522	
5801	48.99	FO	48.02	100			VC	5	1 in 0
5618		FO		150			VC	17.28155	
5618		FO		150			VC	17.28155	
9702	81.85	FO	80.25	150			VC	35.61361	1 in 13
6705	52.57	FO	50.62	225			VC	21.8653	1 in 0.84097320
8611		FO		100			VC	12.5538	
5703	46.34	FO	44.61	150			VC	27.20294	
5606	40.41	SW	39.14	300			VC	2.305402	1 in 3.60219034
7714		FO		100			VC	19.66671	
6002	63.41	CO	61.5	225			VC	8.602325	1 in 10
5622		CO		150			VC	18.26448	
6008	62.8	CO	60.67	225			VC	26.5821	
5622		CO		100			VC	17.09685	
6609	48.09	FO	46.19	150			VC	14.80399	1 in 15.9182671
4803	46.65	SW	44.67	225			VC	31.89044	1 in 17
4803	46.65	SW	44.67	225			VC	31.89044	1 in 17
8801	76.36	SW	71.86	0			UN	236.4736	
9732		SW	0	150			VC	17.20465	
6414		FO		100			VC	2.759144	
6414		FO		100			VC	2.759144	
7402	44.28	FO	42.93	225			VC	56.35601	1 in 19
7402	44.28	FO	42.93	225			VC	56.35601	1 in 19
9727		FO		100			VC	9.488516	
6903	60.03	FO	57.45	225			VC	22.2036	
7510	55.17	SW	0	225			VC	25.6125	
7510	55.17	SW	0	225			VC	25.6125	
7717	66.33	SW	64.78	100			VC	3.162278	
9729		FO		100			VC	3.222691	
5608	38.32	SW	36.87	150			VC	30.61046	1 in 7
7404	41.83	SW	40.2	375			CO	15.65248	1 in 21
7404	41.83	SW	40.2	375			CO	15.65248	1 in 21
9733		FO		100			VC	13.01498	
9801	78.17	SW	74.87	0			UN	46.09772	1 in 15
5621	41.57	FO	40.96	150			VC	37.95677	1 in 42
7403	43.85	SW	43.11	375			CO	18.38478	
7403	43.85	SW	43.11	375			CO	18.38478	
7408		FO		100			VC	9.018431	
7408		FO		100			VC	9.018431	
6413		FO		100			VC	5.739352	
6413		FO		100			VC	5.739352	
5503	28.97	SW	27.65	300			VC	54.03703	1 in 35
5503	28.97	SW	27.65	300			VC	54.03703	1 in 35
5503	28.97	SW	27.65	300			VC	54.03703	1 in 35
5503	28.97	SW	27.65	300			VC	54.03703	1 in 35
6001	59.71	CO	58.16	225			VC	22.02271	1 in 17
7509	56.55	SW	54.6	225			VC	4.24264	
7701	60.1	FO	58.4	150			VC	18.02776	1 in 9
5624		FO		100			VC	18.20085	
5624		FO		100			VC	18.20085	
7514	60.65	SW	58.01	225			VC	22.2036	1 in 7
6010	1.4	FO		100			UN	10.38323	
6702	55.04	FO	50.76	300			VC	10.80979	1 in 154
5605	33.53	SW	32.13	225			VC	65.79514	1 in 13

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
5603	40.75	FO	39.36	225			VC	34.41863	
5506	29.66	FO	27.86	225			VC	34.21954	1 in 71
5506	29.66	FO	27.86	225			VC	34.21954	1 in 71
7401	45.32	SW	43.2	375			CO	55.47071	1 in 19
7401	45.32	SW	43.2	375			CO	55.47071	1 in 19
5518		FO	0	225			VC	14.03567	
5518		FO	0	225			VC	14.03567	
5710	45.51	FO	44.4	150			VC	30.67964	1 in 9
6015	1	FO		100			UN	11.39401	
5512		FO		100			VC	26.41201	
5512		FO		100			VC	26.41201	
6703	56.32	FO	54.54	225			VC	15	1 in 15
5901	50.18	SW	49.28	150			VC	65.76473	1 in 15
5901	50.18	SW	49.28	150			VC	65.76473	1 in 15
9735		FO		100			VC	8.171545	
4807		FO	0	225			VC	46.17358	
4807		FO	0	225			VC	46.17358	
5405		FO		100			VC	12.36931	
5405		FO		100			VC	12.36931	
7505	49.67	SW	48.36	225			VC	12.04159	1 in 9
7505	49.67	SW	48.36	225			VC	12.04159	1 in 9
9711	78.53	FO	76.79	100			VC	1	
5711	46.51	FO	45.12	150			VC	17.2714	1 in 25
6505		FO		100			VC	17.31768	
6505		FO		100			VC	17.31768	
4617		FO		150			VC	9.226533	
4617		FO		150			VC	9.226533	
5523		FO	0	150			VC	16.27882	
5523		FO	0	150			VC	16.27882	
8606	64.94	SW	62.64	225			VC	23.25941	
7703	61.92	FO	59.58	150			VC	15	1 in 14
6014	1	FO		100			UN	12.96326	
9728		SW		150			VC	6.316731	
7405	41.74	FO	39.85	225			VC	25.94224	1 in 15
7405	41.74	FO	39.85	225			VC	25.94224	1 in 15
6704	56.31	SW	54.47	225			VC	6.403124	1 in 3
5004		CO		100			VC	11.181	
5404	28.99	SW	27.44	525			CO	56.08921	1 in 42
7503	46.78	SW	45.71	375			CO	12.16553	1 in 5
7503	46.78	SW	45.71	375			CO	12.16553	1 in 5
6502	35.16	FO	34.06	225			VC	16.40122	1 in 4
6502	35.16	FO	34.06	225			VC	16.40122	1 in 4
7702	60.06	SW	58.6	150			VC	39	1 in 10
5505	31.31	FO	30.28	225			VC	25.6125	1 in 11
5505	31.31	FO	30.28	225			VC	25.6125	1 in 11
4802	45.42	FO	43.77	225			VC	8.544003	
4802	45.42	FO	43.77	225			VC	8.544003	
6904		FO	0	225			VC	52.03845	
6012	1.2	FO		100			UN	2.707188	
6610	49.51	FO	47.62	150			VC	39.25717	1 in 27.4525660
7507	53.73	SW	50.38	225			VC	17.88854	1 in 9
7507	53.73	SW	50.38	225			VC	17.88854	1 in 9
6503	40.08	SW	38.7	225			VC	25.23886	1 in 4
6503	40.08	SW	38.7	225			VC	25.23886	1 in 4
5602	33.95	FO	32.09	225			VC	2	
5602	33.95	FO	32.09	225			VC	2	
6905	58.7	FO	58.7	225			VC	22.09072	
9714	80.37	SW	0	150			VC	28.3196	
5520	28.75	FO	27.94	100			VC	1	
5520	28.75	FO	27.94	100			VC	1	
9734		FO		100			VC	15.17437	
7501	43.85	FO	43.31	225			VC	19.10421	1 in 50
7501	43.85	FO	43.31	225			VC	19.10421	1 in 50
8703		FO		100			VC	7.357398	
5510		FO	0	150			VC	31.7805	
5510		FO	0	150			VC	31.7805	
4616		FO		225			VC	18.83547	
4616		FO		225			VC	18.83547	
5511	29.1	FO	0	225			VC	23.76973	
5511	29.1	FO	0	225			VC	23.76973	

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
- 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:

3 LINK ROAD,
WHITEHAVEN,
CA28 8HJ

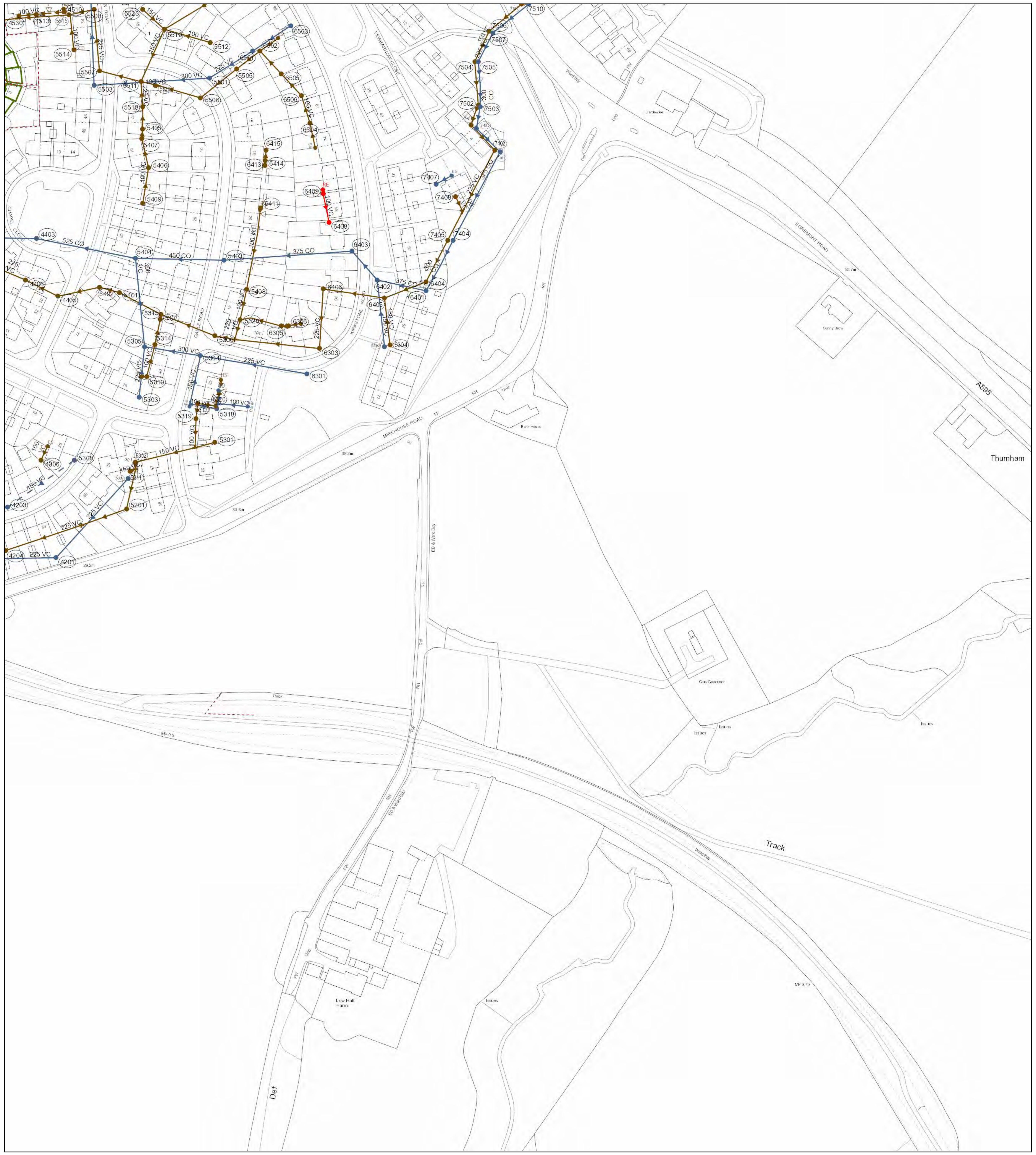
OS sheet Number: NX9815NE
Scale: 1:1250 **Date:** 14/01/2022
Nodes: 271
Sheet: 3 of 4

Printed by: Property Searches

SEWER RECORDS

United Utilities
Water for the North West

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
6305		FO		100			VC	23.40878	
4530		FO		100			VC	1.376528	
4530		FO		100			VC	1.376528	
4530		FO		100			VC	1.376528	
4530		FO		100			VC	1.376528	
5311		FO		150			VC	3.162278	1 in
5311		FO		150			VC	3.162278	1 in
7506	53.73	FO	50.38	150			VC	18.78829	1 in 10
7506	53.73	FO	50.38	150			VC	18.78829	1 in 10
7502	46.78	FO	45.75	150			VC	5.385165	1 in 5
7502	46.78	FO	45.75	150			VC	5.385165	1 in 5
5409		FO		100			VC	20.01115	
5409		FO		100			VC	20.01115	
6302	38.51	SW	37.54	150			VC	37.21559	1 in 64
4201	29.17	SW	27.42	225			VC	66.00758	1 in 106
4201	29.17	SW	27.42	225			VC	66.00758	1 in 106
5407		FO		100			VC	5.308584	
5407		FO		100			VC	5.308584	
5401	29.01	FO	27.31	225			VC	11.40175	1 in 190
5401	29.01	FO	27.31	225			VC	11.40175	1 in 190
4406	28.17	FO	26.77	225			VC	84.18546	1 in 19
4406	28.17	FO	26.77	225			VC	84.18546	1 in 19
5328		FO		225			VC	11.40175	1 in
5304	29.85	SW	28.05	300			VC	31.40064	1 in 157
5306	30.29	FO	28.57	225			VC	32.31099	1 in 32
6401	39.85	SW	38.71	375			CO	27.65863	1 in 16
4405	28.95	FO	26.99	225			VC	20.12461	1 in 91
4405	28.95	FO	26.99	225			VC	20.12461	1 in 91
5308	29.74	SW	28.64	150			VC	45.22168	1 in 1.64802027
5308	29.74	SW	28.64	150			VC	45.22168	1 in 1.64802027
5310		FO		100			VC	18.27649	
4513		FO		100			VC	9.620073	
4513		FO		100			VC	9.620073	
4513		FO		100			VC	9.620073	
4513		FO		100			VC	9.620073	
7512	55.2	FO	54.3	150			VC	2.236068	
6406	37	FO	34.87	225			VC	33.06055	1 in 107
4204	29.01	FO	27.21	225			VC	47.92703	1 in 47
4204	29.01	FO	27.21	225			VC	47.92703	1 in 47
6306		FO		100			VC	4.183614	
6303	36.1	FO	34.56	225			VC	47.26521	
5514		FO		100			VC	19.99409	
5514		FO		100			VC	19.99409	
5514		FO		100			VC	19.99409	
5514		FO		100			VC	19.99409	
5307	29.25	FO	27.55	225			VC	25.94224	1 in 108
5309	29.53	SW	28.56	225			VC	59.46428	1 in 52
5309	29.53	SW	28.56	225			VC	59.46428	1 in 52
6409		CO		100			VC	16.23578	
6409		CO		100			VC	16.23578	
5501	30.02	SW	28.22	300			VC	30.06659	
5501	30.02	SW	28.22	300			VC	30.06659	
5315		FO		100			VC	2.951841	
5406		FO		100			VC	16.51454	
5406		FO		100			VC	16.51454	
7511		FO	0	150			VC	23.43075	
7511		FO	0	150			VC	23.43075	
6501	34.04	SW	32.84	225			VC	28.30194	1 in 6
6501	34.04	SW	32.84	225			VC	28.30194	1 in 6
7504	49.68	FO	48.48	150			VC	24.08319	1 in 9
7504	49.68	FO	48.48	150			VC	24.08319	1 in 9
4203	29.29	SW	28.09	150			VC	34.0147	
4203	29.29	SW	28.09	150			VC	34.0147	
5408		FO		100			VC	17.21699	
5525		FO	0	150			VC	50.24938	
6504		FO		100			VC	15.91971	
6504		FO		100			VC	15.91971	
5314		FO		100			VC	14.23171	
4403	27.81	SW	26.11	525			CO	64.00781	1 in 20
4403	27.81	SW	26.11	525			CO	64.00781	1 in 20
4403	27.81	SW	26.11	525			CO	64.00781	1 in 20
4403	27.81	SW	26.11	525			CO	64.00781	1 in 20
5508	29.11	FO	27.01	225			VC	14.31782	
5508	29.11	FO	27.01	225			VC	14.31782	
5508	29.11	FO	27.01	225			VC	14.31782	
5508	29.11	FO	27.01	225			VC	14.31782	
6301	35.13	SW	33.66	225			VC	59.84146	1 in 11
5402	28.98	FO	27.25	225			VC	23.5372	1 in 91
5402	28.98	FO	27.25	225			VC	23.5372	1 in 91
6506		FO		100			VC	16.48307	
6506		FO		100			VC	16.48307	
5201	29.45	FO	27.83	225			VC	26.57066	
5201	29.45	FO	27.83	225			VC	26.57066	
5507	28.95	FO	27.17	225			VC	34.1321	1 in 213
5507	28.95	FO	27.17	225			VC	34.1321	1 in 213
5507	28.95	FO	27.17	225			VC	34.1321	1 in 213
5507	28.95	FO	27.17	225			VC	34.1321	1 in 213
5302	29.44	FO	0	150			VC	4	
7505	49.67	SW	48.36	225			VC	12.04159	1 in 9
7505	49.67	SW	48.36	225			VC	12.04159	1 in 9
6414		FO		100			VC	2.759144	
6414		FO		100			VC	2.759144	
7402	44.28	FO	42.93	225			VC	56.35601	1 in 19
7402	44.28	FO	42.93	225			VC	56.35601	1 in 19
5301	29.85	FO	28.45	150			VC	45.35761	1 in 151
6505		FO		100			VC	17.31768	
6505		FO		100			VC	17.31768	
5523		FO	0	150			VC	16.27882	
5523		FO	0	150			VC	16.27882	
7510	55.17	SW	0	225			VC	25.6125	
7510	55.17	SW	0	225			VC	25.6125	
5403	30.8	SW	29.16	450			CO	49.0102	1 in 28
7404	41.83	SW	40.2	375			CO	15.65248	1 in 21
7404	41.83	SW	40.2	375			CO	15.65248	1 in 21
5305	29.37	SW	27.85	300			VC	49.25444	1 in 120
6403	37.61	SW	35.72	375			CO	71.17584	1 in 11
7405	41.74	FO	39.85	225			VC	25.94224	1 in 15
7405	41.74	FO	39.85	225			VC	25.94224	1 in 15
7403	43.85	SW	43.11	375			CO	18.38478	
7403	43.85	SW	43.11	375			CO	18.38478	
7408		FO		100			VC	9.018431	
7408		FO		100			VC	9.018431	
6413		FO		100			VC	5.739352	
6413		FO		100			VC	5.739352	
5503	28.97	SW	27.65	300			VC	54.03703	1 in 35
5503	28.97	SW	27.65	300			VC	54.03703	1 in 35
5503	28.97	SW	27.65	300			VC	54.03703	1 in 35
5503	28.97	SW	27.65	300			VC	54.03703	1 in 35
5404	28.99	SW	27.44	525			CO	56.08921	1 in 42
7503	46.78	SW	45.71	375			CO	12.16553	1 in 5
7503	46.78	SW	45.71	375			CO	12.16553	1 in 5
6502	35.16	FO	34.06	225			VC	16.40122	1 in 4
6502	35.16	FO	34.06	225			VC	16.40122	1 in 4
6404	39.84	FO	38.08	225			VC	24.69818	1 in 20
5319		FO		100			VC	16.19121	
5505	31.31	FO	30.28	225			VC	25.6125	1 in 11
5505	31.31	FO	30.28	225			VC	25.6125	1 in 11
5320		FO		100			VC	10.17068	
7509	56.55	SW	54.6	225			VC	4.24264	
7507	53.73	SW	50.38	225			VC	17.88854	1 in 9
7507	53.73	SW	50.38	225			VC	17.88854	1 in 9
6503	40.08	SW	38.7	225			VC	25.23886	1 in 4
6503	40.08	SW	38.7	225			VC	25.23886	1 in 4
5318		SW		100			VC	15.08822	
5303	29.33	SW	28.33	225			VC	28.16026	1 in 59
5506	29.66	FO	27.86	225			VC	34.21954	1 in 71
5506	29.66	FO	27.86	225			VC	34.21954	1 in 71
5520	28.75	FO	27.94	100			VC	1	
5520	28.75	FO	27.94	100			VC	1	
7401	45.32	SW	43.2	375			CO	55.47071	1 in 19
7401	45.32	SW	43.2	375			CO	55.47071	1 in 19
5518		FO	0	225			VC	14.03567	
5518		FO	0	225			VC	14.03567	
7501	43.85	FO	43.31	225			VC	19.10421	1 in 50
7501	43.85	FO	43.31	225			VC	19.10421	1 in 50
5510		FO	0	150			VC	31.7805	
5510		FO	0	150			VC	31.7805	
5511	29.1	FO	0	225			VC	23.76973	
5511	29.1	FO	0	225			VC	23.76973	
5512		FO		100			VC	26.41201	
5512		FO		100			VC	26.41201	
6405	38.51	FO	36.74	225			VC	34.36568	1 in 18
6304	38.53	FO	37.56	150			VC	26.1725	1 in 40
6402	38.3	SW	36.96	375			CO	21.26029	1 in 19
5405		FO		100			VC	12.36931	
5405		FO		100			VC	12.36931	
5317		FO		100			VC	8.427039	

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad

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

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- 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
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- Lamp Hole
- T Junction / Saddle
- Catchpit
- Valve Chamber
- Vent Column
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- Control Kiosk
- Change of Characteristic

MANHOLE FUNCTION

FO Foul
SW Surface Water
CO Combined
OV Overflow

SEWER SHAPE

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

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:

3 LINK ROAD,
WHITEHAVEN,
CA28 8HJ

OS sheet Number: NX9815SE
Scale: 1:1250 **Date:** 14/01/2022
Nodes: 157
Sheet: 4 of 4

Printed by: Property Searches

SEWER RECORDS

United Utilities
Water for the North West

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R G PARKINS

APPENDIX C

DRAINAGE CALCULATIONS

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	40	Minimum Backdrop Height (m)	0.200
CV	0.840	Preferred Cover Depth (m)	0.900
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)
POW BECK 1			26.030	1500	298426.967	515510.054	2.210
POW BECK 2			25.430	1500	298413.665	515483.316	2.670
POW BECK 3			23.910	1500	298394.473	515451.196	2.500
MHS01	0.139	5.00	26.300	1200	298379.686	515530.991	1.600
MHS02			25.500	1200	298421.060	515520.878	1.148
TI1			26.100		298381.542	515530.246	1.664
TO1		5.00	25.600		298409.758	515525.335	1.167
MHS03	0.112	5.00	25.300	1200	298389.028	515495.995	0.850
MHS04			25.300	1200	298411.288	515487.008	1.950
TO2		5.00	25.300		298409.436	515487.761	1.900
TI2			25.300		298390.884	515495.251	1.898

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	POW BECK 1	POW BECK 2	29.864	0.600	23.820	22.760	1.060	28.2	600	5.61	50.0
1.001	POW BECK 2	POW BECK 3	37.417	0.600	22.760	21.410	1.350	27.7	600	5.74	50.0
2.000	MHS01	TI1	2.000	0.600	24.700	24.658	0.042	47.6	150	5.02	50.0
2.001	TO1	MHS02	12.149	0.600	24.433	24.352	0.081	150.0	150	5.25	50.0
2.002	MHS02	POW BECK 1	12.331	0.600	24.352	24.270	0.082	150.4	150	5.50	50.0
3.000	MHS03	TI2	2.000	0.600	24.450	24.425	0.025	80.0	150	5.03	50.0
3.001	TO2	MHS04	1.999	0.600	23.400	23.350	0.050	40.0	150	5.02	50.0
3.002	MHS04	POW BECK 2	4.391	0.600	23.350	23.210	0.140	31.4	150	5.06	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)
1.000	4.599	1300.3	0.0	1.610	2.070	0.000	0.0
1.001	4.637	1311.0	0.0	2.070	1.900	0.000	0.0
2.000	1.461	25.8	29.5	1.450	1.292	0.139	0.0
2.001	0.818	14.5	0.0	1.017	0.998	0.000	0.0
2.002	0.817	14.4	0.0	0.998	1.610	0.000	0.0
3.000	1.125	19.9	23.8	0.700	0.725	0.112	0.0
3.001	1.596	28.2	0.0	1.750	1.800	0.000	0.0
3.002	1.804	31.9	0.0	1.800	2.070	0.000	0.0

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	29.864	28.2	600	Circular	26.030	23.820	1.610	25.430	22.760	2.070
1.001	37.417	27.7	600	Circular	25.430	22.760	2.070	23.910	21.410	1.900
2.000	2.000	47.6	150	Circular	26.300	24.700	1.450	26.100	24.658	1.292
2.001	12.149	150.0	150	Circular	25.600	24.433	1.017	25.500	24.352	0.998
2.002	12.331	150.4	150	Circular	25.500	24.352	0.998	26.030	24.270	1.610
3.000	2.000	80.0	150	Circular	25.300	24.450	0.700	25.300	24.425	0.725
3.001	1.999	40.0	150	Circular	25.300	23.400	1.750	25.300	23.350	1.800
3.002	4.391	31.4	150	Circular	25.300	23.350	1.800	25.430	23.210	2.070

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	POW BECK 1	1500	Manhole	Adoptable	POW BECK 2	1500	Manhole	Adoptable
1.001	POW BECK 2	1500	Manhole	Adoptable	POW BECK 3	1500	Manhole	Adoptable
2.000	MHS01	1200	Manhole	Adoptable	TI1		Junction	
2.001	TO1		Junction		MHS02	1200	Manhole	Adoptable
2.002	MHS02	1200	Manhole	Adoptable	POW BECK 1	1500	Manhole	Adoptable
3.000	MHS03	1200	Manhole	Adoptable	TI2		Junction	
3.001	TO2		Junction		MHS04	1200	Manhole	Adoptable
3.002	MHS04	1200	Manhole	Adoptable	POW BECK 2	1500	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
POW BECK 1	298426.967	515510.054	26.030	2.210	1500	1	2.002	24.270	150
						0	1.000	23.820	600
POW BECK 2	298413.665	515483.316	25.430	2.670	1500	1	3.002	23.210	150
						2	1.000	22.760	600
						0	1.001	22.760	600
POW BECK 3	298394.473	515451.196	23.910	2.500	1500	1	1.001	21.410	600
MHS01	298379.686	515530.991	26.300	1.600	1200	0	2.000	24.700	150
MHS02	298421.060	515520.878	25.500	1.148	1200	1	2.001	24.352	150
						0	2.002	24.352	150
TI1	298381.542	515530.246	26.100	1.664		1	2.000	24.658	150
TO1	298409.758	515525.335	25.600	1.167		0	2.001	24.433	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
MHS03	298389.028	515495.995	25.300	0.850	1200	0	3.000	24.450	150
MHS04	298411.288	515487.008	25.300	1.950	1200	1	3.001	23.350	150
						0	3.002	23.350	150
TO2	298409.436	515487.761	25.300	1.900		0	3.001	23.400	150
TI2	298390.884	515495.251	25.300	1.898		1	3.000	24.425	150

Simulation Settings

Rainfall Methodology	FEH-13	Skip Steady State	x	Check Discharge Volume	✓
Summer CV	0.750	Drain Down Time (mins)	240	100 year 360 minute (m^3)	
Winter CV	0.840	Additional Storage (m^3/ha)	20.0		
Analysis Speed	Normal	Check Discharge Rate(s)	✓		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
30	0	0	0
30	40	0	0
100	0	0	0
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m^3)	

Node MHS02 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	24.352	Product Number	CTL-SHE-0068-1600-0400-1600
Design Depth (m)	0.400	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	1.6	Min Node Diameter (mm)	1200

Node MHS04 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	23.350	Product Number	CTL-SHE-0031-5000-1200-5000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.5	Min Node Diameter (mm)	1200

Node TO1 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Main Channel Length (m)	28.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	24.433	Main Channel Slope (1:X)	10000.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.020

Inlets

TI1

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	210.0	0.0	0.400	210.0	0.0	0.401	0.0	0.0

Node TO2 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Main Channel Length (m)	20.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	23.400	Main Channel Slope (1:X)	10000.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.020

Inlets

TI2

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	80.0	0.0	1.200	80.0	0.0	1.201	0.0	0.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	POW BECK 1	12	23.836	0.016	1.6	0.0288	0.0000	OK
1440 minute winter	POW BECK 2	1200	22.778	0.018	2.0	0.0316	0.0000	OK
1440 minute winter	POW BECK 3	1200	21.427	0.017	2.0	0.0000	0.0000	OK
15 minute winter	MHS01	10	24.975	0.275	40.6	0.7889	0.0000	SURCHARGED
240 minute winter	MHS02	228	24.614	0.262	3.5	0.2962	0.0000	SURCHARGED
240 minute winter	TI1	228	24.615	0.179	9.2	0.0000	0.0000	OK
240 minute winter	TO1	228	24.615	0.182	5.6	0.0000	0.0000	SURCHARGED
15 minute winter	MHS03	10	24.680	0.230	32.7	0.8672	0.0000	SURCHARGED
1440 minute winter	MHS04	1320	23.986	0.636	1.0	0.7198	0.0000	SURCHARGED
1440 minute winter	TO2	1320	23.986	0.586	1.8	0.0000	0.0000	SURCHARGED
1440 minute winter	TI2	1320	23.986	0.584	2.1	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	POW BECK 1	1.000	POW BECK 2	1.6	0.798	0.001	0.0632	
1440 minute winter	POW BECK 2	1.001	POW BECK 3	2.0	0.870	0.002	0.0849	119.9
15 minute winter	MHS01	2.000	TI1	39.5	2.245	1.530	0.0349	
30 minute summer	MHS02	Hydro-Brake®	POW BECK 1	1.6				
15 minute summer	TI1	Flow through pond	TO1	30.5	0.116	0.071	15.2988	
15 minute summer	TO1	2.001	MHS02	4.5	0.530	0.314	0.1632	
15 minute winter	MHS03	3.000	TI2	31.8	1.805	1.599	0.0349	
1440 minute winter	MHS04	Hydro-Brake®	POW BECK 2	0.4				
30 minute summer	TO2	3.001	MHS04	4.9	0.566	0.174	0.0352	
15 minute summer	TI2	Flow through pond	TO2	16.2	0.109	0.013	12.5484	

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 98.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	POW BECK 1	11	23.836	0.016	1.6	0.0287	0.0000	OK
1440 minute winter	POW BECK 2	1590	22.778	0.018	2.0	0.0320	0.0000	OK
1440 minute winter	POW BECK 3	1590	21.428	0.018	2.0	0.0000	0.0000	OK
15 minute winter	MHS01	11	25.134	0.434	56.7	1.2445	0.0000	SURCHARGED
360 minute winter	MHS02	336	24.715	0.363	3.7	0.4102	0.0000	SURCHARGED
360 minute winter	TI1	336	24.716	0.280	9.8	0.0000	0.0000	OK
360 minute winter	TO1	336	24.716	0.283	5.7	0.0000	0.0000	SURCHARGED
15 minute winter	MHS03	11	24.784	0.334	45.7	1.2571	0.0000	SURCHARGED
1440 minute winter	MHS04	1380	24.284	0.934	1.4	1.0565	0.0000	SURCHARGED
1440 minute winter	TO2	1380	24.284	0.884	1.8	0.0000	0.0000	SURCHARGED
1440 minute winter	TI2	1380	24.284	0.882	2.9	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	POW BECK 1	1.000	POW BECK 2	1.6	0.799	0.001	0.0628	
1440 minute winter	POW BECK 2	1.001	POW BECK 3	2.0	0.878	0.002	0.0866	155.4
15 minute winter	MHS01	2.000	TI1	54.7	3.108	2.118	0.0349	
15 minute summer	MHS02	Hydro-Brake®	POW BECK 1	1.6				
15 minute winter	TI1	Flow through pond	TO1	36.5	0.125	0.085	24.4632	
15 minute summer	TO1	2.001	MHS02	4.8	0.543	0.334	0.1919	
15 minute winter	MHS03	3.000	TI2	44.1	2.505	2.218	0.0349	
1440 minute winter	MHS04	Hydro-Brake®	POW BECK 2	0.4				
15 minute winter	TO2	3.001	MHS04	4.9	0.744	0.175	0.0352	
15 minute winter	TI2	Flow through pond	TO2	22.4	0.118	0.018	19.9104	

Results for 100 year Critical Storm Duration. Lowest mass balance: 98.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	POW BECK 1	11	23.836	0.016	1.6	0.0288	0.0000	OK
1440 minute winter	POW BECK 2	1440	22.778	0.018	2.0	0.0318	0.0000	OK
1440 minute winter	POW BECK 3	1440	21.428	0.018	2.0	0.0000	0.0000	OK
15 minute winter	MHS01	10	25.094	0.394	53.2	1.1299	0.0000	SURCHARGED
240 minute winter	MHS02	232	24.687	0.335	2.7	0.3794	0.0000	SURCHARGED
240 minute winter	TI1	232	24.688	0.252	12.0	0.0000	0.0000	OK
240 minute winter	TO1	232	24.688	0.255	6.8	0.0000	0.0000	SURCHARGED
15 minute winter	MHS03	10	24.757	0.307	42.8	1.1550	0.0000	SURCHARGED
960 minute winter	MHS04	930	24.166	0.816	3.2	0.9226	0.0000	SURCHARGED
960 minute winter	TO2	930	24.166	0.766	2.3	0.0000	0.0000	SURCHARGED
960 minute winter	TI2	930	24.166	0.764	3.5	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	POW BECK 1	1.000	POW BECK 2	1.6	0.786	0.001	0.0629	
1440 minute winter	POW BECK 2	1.001	POW BECK 3	2.0	0.876	0.002	0.0861	143.3
15 minute winter	MHS01	2.000	TI1	51.2	2.910	1.983	0.0349	
30 minute summer	MHS02	Hydro-Brake®	POW BECK 1	1.6				
15 minute summer	TI1	Flow through pond	TO1	35.8	0.129	0.083	20.2377	
15 minute summer	TO1	2.001	MHS02	5.1	0.540	0.354	0.1854	
15 minute winter	MHS03	3.000	TI2	41.2	2.342	2.074	0.0349	
960 minute winter	MHS04	Hydro-Brake®	POW BECK 2	0.4				
15 minute summer	TO2	3.001	MHS04	5.6	0.637	0.200	0.0352	
15 minute winter	TI2	Flow through pond	TO2	21.7	0.116	0.017	18.5801	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	POW BECK 1	344	23.837	0.017	1.7	0.0296	0.0000	OK
360 minute winter	POW BECK 2	344	22.779	0.019	2.2	0.0331	0.0000	OK
360 minute winter	POW BECK 3	344	21.428	0.018	2.2	0.0000	0.0000	OK
15 minute winter	MHS01	11	25.369	0.669	74.2	1.9189	0.0000	SURCHARGED
360 minute winter	MHS02	344	24.829	0.477	4.0	0.5391	0.0000	SURCHARGED
360 minute winter	TI1	344	24.830	0.394	13.4	0.0000	0.0000	OK
360 minute winter	TO1	344	24.830	0.397	12.5	0.0000	0.0000	SURCHARGED
15 minute winter	MHS03	11	24.936	0.486	59.9	1.8298	0.0000	SURCHARGED
1440 minute winter	MHS04	1380	24.536	1.186	3.4	1.3415	0.0000	SURCHARGED
1440 minute winter	TO2	1380	24.536	1.136	2.0	0.0000	0.0000	SURCHARGED
1440 minute winter	TI2	1380	24.536	1.134	3.6	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	POW BECK 1	1.000	POW BECK 2	1.7	0.754	0.001	0.0684	
360 minute winter	POW BECK 2	1.001	POW BECK 3	2.2	0.899	0.002	0.0914	66.4
15 minute winter	MHS01	2.000	TI1	71.4	4.056	2.764	0.0349	
360 minute winter	MHS02	Hydro-Brake®	POW BECK 1	1.7				
15 minute summer	TI1	Flow through pond	TO1	42.9	0.128	0.099	28.7797	
15 minute summer	TO1	2.001	MHS02	5.6	0.549	0.389	0.2132	
15 minute winter	MHS03	3.000	TI2	57.5	3.266	2.892	0.0349	
1440 minute winter	MHS04	Hydro-Brake®	POW BECK 2	0.5				
30 minute winter	TO2	3.001	MHS04	4.5	0.669	0.160	0.0352	
15 minute winter	TI2	Flow through pond	TO2	30.3	0.130	0.024	26.1245	

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Meadowside	Job	Meadow Road	Drg no.	N/A	Date	16/02/2022
Shap Road		Whitehaven	Revision	Orig	Initial	RH
KENDAL LA9 6NY	Title	Rate of Run-Off			Checked	CA

DESIGN BASIS MEMORANDUM - PEAK RATE OF RUN-OFF CALCULATION

Design Brief

The following peak rate of run-off calculations have been undertaken to determine changes in peak flow resulting from the development of a greenfield or brownfield site. These calculations are for the **Peak Rate of Run-Off** requirements only.

Background Information & References

The site area **is less than** 200ha and the Greenfield (pre-development) calculation has been undertaken in accordance with methodology described by Marshall & Bayliss, Institute of Hydrology, Report No. 124, Flood Estimation for Small Catchments, 1994 (IoH 124).

In addition, the following references have been used in the preparation of these calculations:

- Interim Code of Practice for Sustainable Drainage Systems (SUDS), CIRIA, 2004
- CIRIA, The SUDS Manual, Report C753, 2015
- Designing for Exceedance in Urban Drainage - good practice, CIRIA Report C635, 2006
- Flood Estimation Handbook (FEH)
- Flood Studies Report (FSR), Volume 1, Hydrological Studies, 1993
- Flood Studies Supplementary Report No 2 (FSSR2), The Estimation of Low Return Period Floods
- Flood Studies Supplementary Report No 14 (FSSR14), Review of Regional Growth Curves, 1983
- Planning Practice guidance of the National Planning Policy Framework, Recommended national precautionary sensitivity ranges for peak rainfall intensities, peak river flows, offshore wind speeds and wave heights.

Proposed Land Use Changes

Changes to the existing site are as follows:

Brownfield Site to Brownfield Site (Reduced Impermeable Area)

Results Summary

Rate of Run-Off (l/s)			
Event	Greenfield	Brownfield	Post-Development
Q1	1.8	19.4	19.5
QBAR	2.1	28.1	28.3
Q10	2.9	38.5	38.7
Q30	3.6	46.9	47.2
Q100	4.4	59.8	60.2
Q100 + 40% CC	6.1	83.8	84.3

SITE AREAS (LAND COVER AREAS)

Existing Impermeable & Permeable Land Cover

Total Site Area: **0.3104** **ha** **3104** **m²**

Existing Impermeable & Permeable Land Cover

Land Cover	Area		Percentage of total site area
	m²	ha	
Total impermeable area	2492	0.249	80%
Remaining permeable area	612	0.061	20%

Proposed Land Cover Areas

Land Cover	Area		Percentage of total site area
	m²	ha	
Total housing roof area	1287	0.129	41%
Total parking and paved area	945	0.095	30%
Total road area	275	0.027	9%
Garden & landscaped areas	598	0.060	19%
	3104		100%

Proposed Impermeable & Permeable Land Cover

Land Cover	Area		Percentage of total site area
	m²	ha	
Total impermeable area	2506	0.251	81%
Remaining permeable area	598	0.060	19%

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Meadowside	Job	Meadow Road	Drg no.	N/A	Date	16/02/2022
Shap Road		Whitehaven	Revision	Orig	Initial	RH
KENDAL LA9 6NY	Title	Rate of Run-Off			Checked	CA

ESTIMATION OF QBAR (RURAL) (GREENFIELD RUNOFF RATE)

IoH 124 based on research on small catchments < 25 km2

Method is based on regression analysis of response times
using catchments from 0.9 to 22.9 km^2

$QBAR_{rural}$ is mean annual flood on rural catchment
$QBAR_{rural}$ depends on SOIL, SAAR and AREA most significantly

$QBAR_{rural}$ = $\boxed{0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}}$

For SOIL refer to FSR Vol 1, Section 4.2.3 and 4.2.6 and IoH 124

Contributing watershed area

Area, A	=	500000	m^2	insert 50 ha for EA
	=	0.500	km^2	small catchment method
	=	50.000	ha	
SAAR	=	**1120**	mm	From UKSuds website (point data)

Soil index based on soil type, SOIL $= \dfrac{(0.1S1+0.3S2+0.37S3+0.47S4+0.53S5)}{(S1+S2+S3+S4+S5)}$

Where: S1	=		%	
S2	=		%	
S3	=		%	
S4	=	**100**	%	Value from UK SuDS seems reasonable
S5	=		%	
		100	%	
So, SOIL	=	**0.47**		

Note: for very small catchments it is far better to rely on local site investigation information.

$QBAR_{rural}$	=	0.418	m^3/s
	=	418.4	l/s

Small rural catchments less than 50 ha
The Environment Agency recommends that this method should be used for development sizes from 0 to 50 ha and should linearly interpolate the formula to 50 ha.

So, catchment size	=	**2506**	m^2	Excluding significant open space which would remain disconnected from the positive drainage system during flood events.
	=	0.003	km^2	
	=	0.251	ha	
$QBAR_{rural\ site}$	=	0.00210	m^3/s	
	=	**2.10**	l/s	

GREENFIELD RETURN PERIOD ORDINATES

QBAR can be factored by the UK FSR regional growth curves for return periods <2 years and for all other return periods to obtain peak flow estimates for required return periods.

These regional growth curves are constant throughout a region, whatever the catchment type and size.

See Table 2.39 for region curve ordinates
Use FSSR2 Growth Curves to estimate Qbar

Reference- Pg 173-FSR V.1, ch 2.6.2

Region = **10**

Use Figure A1.1 to determine region

GREENFIELD RETURN PERIOD FLOW RATES

Return Period	Ordinate	Q (l/s)
1	0.87	1.82
2	0.93	1.95
5	1.19	2.50
10	1.38	2.89
25	1.64	3.44
30	1.7	3.57
50	1.85	3.88
100	2.08	4.36
200	2.32	4.87
500	2.73	5.73
1000	3.04	6.38

Ordinate from FSSR2

Interpolation taken from Figure 24.2 (pg 515) SuDS Manual

ESTIMATE OF BROWNFIELD RUNOFF

Total site impermeable area, A = **2492** m²

M5-60 rainfall depth **16** mm *[Flood Studies Report (NERC, 1975)]*

Ratio M5-60/M5-2Day, r **0.27** *[The Wallingford Proceedure - V4 Modified Rational Method, Fig A.2 (Hydraulics Research, 1983)]*

Storm Duration 15 mins — Anticipated critical duration for the site - usually 15 minutes

Duration factor, Z1 0.58 *[The Wallingford Proceedure - V4 Modified Rational Method, Fig A.3b (Hydraulics Research, 1983)]*

M5-15 rainfall depth = 9.3 mm

Return period ratio, Z2

M1-15	0.61
M10-15	1.21
M30-15	1.48
M100-15	1.89

[The Wallingford Proceedure - V4 Modified Rational Method, Table A1 (Hydraulics Research, 1983)]

Rainfall

	Depth (mm)	Intensity, i (mm/hr)
M1-15	5.7	23
M10-15	11.3	45
M30-15	13.7	55
M100-15	17.5	70

Peak discharge, Qp = Cv Cr i A

Where:

Cv = Volumetric Runoff Coefficient
Cr = Routing Coefficient
i = Rainfall intensity (mm/hour)

Cv = 0.95
Cr = 1.3

Peak Runoff

	l/s
Q1	19.4
Q10	38.5
Q30	46.9
Q100	59.8

ESTIMATION OF QBAR (BROWNFIELD RUNOFF RATE)

See Table 2.39 for region curve ordinates

Use FSSR2 Growth Curves to estimate Qbar

Reference- Pg 173-FSR V.1, ch 2.6.2

Region = **10**

Use Figure A1.1 to determine region

Return Period	Ordinate
1	0.87
2	0.93
5	1.19
10	1.38
25	1.64
30	1.70
50	1.85
100	2.08
200	2.32
500	2.73
1000	3.04

Ordinate from FSSR2

Interpolation taken from Figure 24.2 (pg 515) SuDS Manual

Qbar

Ordinate used	l/s
10 year	27.9
30 year	27.6
100 year	28.8

Proposed Brownfield Runoff, Qbar = 28.09 l/s

Using the average Qbar derived from three ordinates.

ESTIMATE OF BROWNFIELD RUNOFF

Total site impermeable area, A = **2506** m^2

M5-60 rainfall depth **16** mm *[Flood Studies Report (NERC, 1975)]*

Ratio M5-60/M5-2Day, r **0.27** *[The Wallingford Proceedure - V4 Modified Rational Method, Fig A.2 (Hydraulics Research, 1983)]*

Storm Duration 15 mins — Anticipated critical duration for the site - usually 15 minutes

Duration factor, Z1 0.58 — *[The Wallingford Proceedure - V4 Modified Rational Method, Fig A.3b (Hydraulics Research, 1983)]*

M5-15 rainfall depth = 9.3 mm

Return period ratio, Z2

M1-15	0.61
M10-15	1.21
M30-15	1.48
M100-15	1.89

[The Wallingford Proceedure - V4 Modified Rational Method, Table A1 (Hydraulics Research, 1983)]

Rainfall

	Depth (mm)	**Intensity, i (mm/hr)**
M1-15	5.7	23
M10-15	11.3	45
M30-15	13.7	55
M100-15	17.5	70

Peak discharge, Qp = Cv Cr i A

Where:

Cv = Volumetric Runoff Coefficient
Cr = Routing Coefficient
i = Rainfall intensity (mm/hour)

Cv = 0.95
Cr = 1.3

Peak Runoff

	l/s
Q1	19.5
Q10	38.7
Q30	47.2
Q100	60.2

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Meadowside	Job	Meadow Road	Drg no.	N/A	Date	16/02/2022
Shap Road		Whitehaven	Revision	Orig	Initial	RH
KENDAL LA9 6NY	Title	Rate of Run-Off			Checked	CA

ESTIMATION OF QBAR (BROWNFIELD RUNOFF RATE)

See Table 2.39 for region curve ordinates

Use FSSR2 Growth Curves to estimate Qbar

Reference- Pg 173-FSR V.1, ch 2.6.2

Region = **10**

Use Figure A1.1 to determine region

Return Period	Ordinate
1	0.87
2	0.93
5	1.19
10	1.38
25	1.64
30	1.70
50	1.85
100	2.08
200	2.32
500	2.73
1000	3.04

Ordinate from FSSR2

Interpolation taken from Figure 24.2 (pg 515) SuDS Manual

Ordinate used	Qbar l/s
10 year	28.1
30 year	27.7
100 year	28.9

Proposed Brownfield Runoff, Qbar = 28.25 l/s

Using the average Qbar derived from three ordinates.

DESIGN BASIS MEMORANDUM - SUSTAINABLE DRAINAGE TREATMENT OF SURFACE WATER

Design Brief

The following calculations outline the recommended treatment requirements for a sustaionable drainage system as outlined in the SuDS Manual 2015. The method used is the simple index approach outlined in section 26.
The requirement for oil interceptors has been assessed in line with the now withdrawn Pollution Prevention Guidance document PPG3, produced by the Environment Agency. An oil interceptor is not required for the proposed development.

Treatment within SuDS components is affected by the flow rate and volume of water which passes through the component. It is not reasonable or practical to treat the entirety of the runoff for infrequent greater intensity design storms. In any case the majority of the pollutants are removed from surfaces by the more frequent rainfall events and in the first flush resulting from the initial runoff from the larger events.
and to a certain capacity.

The following references have been used in the preparation of these calculations:

- SUDS Manual, CIRIA Report C753, 2015
- Pollution Mitigation Indicies provided by Hydro International

Results Summary

Residential Parking:

Treatment component 1 Pervious pavement underlain by 300 mm minimum depth of soils with good contamination attenuation potential

Treatment component 2 None

Indices	Suspended Solids	Metals	Hydrocarbon
Pollution Hazard	0.5	0.4	0.4
Pollution Mitigation	0.7	0.6	0.7
Treatment Suitability	Adequate	Adequate	Adequate

Residential Roads

Treatment component 1 Pervious pavement (where the pavement is not designed as an infiltration component)

Treatment component 2 None

Indices	Suspended Solids	Metals	Hydrocarbon
Pollution Hazard	0.5	0.4	0.4
Pollution Mitigation	0.7	0.6	0.7
Treatment Suitability	Adequate	Adequate	Adequate

POLLUTION HAZARD INDEX

Source of Runoff	Pollution Hazard	Pollution Hazard Indices: Suspended Solids	Metals	Hydro-carbons
Residential parking	Low	0.5	0.4	0.4

POLLUTION MITIGATION INDEX

The receiving water body shall be: Surface Water

SuDS Component		Pollution Mitigation Indices: Suspended Solids	Metals	Hydro-carbons
1	Pervious pavement underlain by 300 mm minimum depth of soils with good contamination attenuation potential	0.7	0.6	0.7
2	None	0	0	0
3	None	0	0	0
4	None	0	0	0
	Total Pollution Mitigation Index	**0.7**	**0.6**	**0.7**

ASSESSMENT OF TREATMENT PROPOSAL

Indices	Suspended Solids	Metals	Hydro-carbons
Pollution Hazard	0.5	0.4	0.4
Pollution Mitigation	0.7	0.6	0.7
	Adequate	**Adequate**	**Adequate**

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POLLUTION HAZARD INDEX

Source of Runoff	Pollution Hazard	Pollution Hazard Indices: Suspended Solids	Metals	Hydro-carbons
Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)	Low	0.5	0.4	0.4

POLLUTION MITIGATION INDEX

The receiving water body shall be: Surface Water

SuDS Component		Pollution Mitigation Indices: Suspended Solids	Metals	Hydro-carbons
1	Pervious pavement (where the pavement is not designed as an infiltration component)	0.7	0.6	0.7
2	None	0	0	0
3	None	0	0	0
4	None	0	0	0
	Total Pollution Mitigation Index	**0.7**	**0.6**	**0.7**

ASSESSMENT OF TREATMENT PROPOSAL

Indices	Suspended Solids	Metals	Hydro-carbons
Pollution Hazard	0.5	0.4	0.4
Pollution Mitigation	0.7	0.6	0.7
	Adequate	**Adequate**	**Adequate**