Queensberry
DESIGN LIMITED
RESIDENTIAL AND COMMERCIAL DESIGN CONSULTANTS

Strata and Thirteen Group

Land at Main Avenue, Cowlersley, Huddersfield

FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

September 2024

Queensberry Design (Yorkshire) Ltd: Brookfield Court, Selby Road, Leeds, LS25 1NB

ISSUE SHEET

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APPENDICES

1. Introduction

1.1 Queensberry Design Ltd has been commissioned by Thirteen and Strata to undertake a Flood Risk Assessment (FRA) for a proposed residential development at Main Avenue, Cowlersley, Huddersfield.

1.2 This FRA has been produced to demonstrate how flood risk from all sources of flooding, and flood risk to others from the development will be managed, to satisfy the requirements, set out in *'National Planning Policy Framework, and Technical Guidance to the National Planning Policy Framework'*. A full assessment of the flood risk to the site and consideration of the surface water management as a result of the development is to be considered in this investigation.

1.3 Consultation has been undertaken with Yorkshire Water (YW), Environment Agency (EA) and Kirklees Lead Local Flood Authority (LLFA) including inspection of their Strategic Flood Risk Assessment (SFRA). Data has also been gathered from several other sources including aerial photographs, Ordnance Survey (OS), the British Geological Society (BGS), National Soil Resources Institute (NSRI), Sewerage Sector Guidance (SSG), SuDS Manual (C753) and anecdotal evidence from the internet.

2. Site Description

2.1 The application boundary is 2.12 ha with a developed area of 1.55 ha and is located 2km west of Huddersfield town centre, with the Cowlersley area.

2.2 The site is irregularly shaped and is predominantly greenfield, the site is accessed from Main Avenue and Windsor Road. Garage buildings and associated hard paved access are located at the northern end of the site, large parts of the site are heavily vegetated/overgrown.

2.3 Boundary features around the application site are residential dwellings to the east, west, and part of the northern boundary, the southern boundary is open undeveloped land, Woodside Green Primary School forms the majority of the northern boundary.

2.4 The location of the development is shown in Figure 1a, and Figure 1b.

Site Levels

2.5 A topographical survey was carried out during May 2024 and can be viewed in Appendix 1. Site levels generally fall from the north-west towards the south-east. The existing topography is steep with gradients up to 1 in 4.

2.6 Existing levels fall centrally forming a channel through the site, falling from west to east.

2.7 Appendix 2 provides a coloured plan showing how the existing topography falls.

Hydrogeology

2.8 Bedrock underlain the site is Millstone Grit (sandstone, mudstone and siltstone), a secondary A aquifer. The site is not located in a source protection zone.

Hydrology

2.9 The nearest main river is River Colne located 0.5km north of the site, the River Colne flows easterly through Huddersfield and is a tributary of the River Calder. Immediately north of River Colne is the Huddersfield Narrow Canal which follows a similar route as the River Colne to the River Calder.

2.10 The scheme is in the River Colne catchment and the site will not impact the main river network.

2.11 Information from Kirklees Council shows a culvert at the eastern edge of the site, the recorded culvert runs through the rear of the dwellings fronting Warneford Road. The culvert then discharged to a normal watercourse at the junction of Warneford Road and Manse Drive, an open channel then runs through the rear of dwellings fronting Avison Road.

2.12 Photographic information supplied by residents shows two large gully grates outside the site's eastern boundary, on the boundary of 66 Warneford Road, the area around these gully grates has collapsed allowing run-off to bypass the grates into the network below.

2.13 Drainage investigation has recorded a 225mm diameter pipe within the site boundary, this pipe has further connections which are all capped. This pipe connects to a chamber which is below the gully grates, some flow is recorded which is expected to be infiltrated surface water run-off and groundwater.

2.14 Based on the information available the culvert starts at the eastern edge of the development adjacent 66 Warneford Road.

2.15 The location of the culvert opening is directly on an existing overland flow route, discussed further in this assessment.

2.16 A stone culvert is located adjacent to a dry stone wall on the hillside to the south of the development site. During the site walkover, trickling water was observed within the culvert, although a ditch located further downslope was found to be dry at the time of inspection.

2.17 Consultation with the Lead Local Flood Authority (LLFA) and trial trenching have so far been unable to locate the outfall of the culvert. However, based on the local topography and site levels, it is anticipated that runoff from this feature is directed into the culvert to the rear of Warneford Road**.**

2.18 A saturated area was observed adjacent to the existing hardstanding. This area is densely vegetated with reed and wetland-type species, suggesting a persistently moist environment. Trial trenching in this location uncovered a subsurface void at a shallow depth, with continued ground saturation. It is therefore assumed this may represent a former culverted watercourse or a natural spring**.**

2.19 Consultation with the LLFA and a review of historic mapping have identified the likely presence of a well associated with the former Jubilee Properties. However, its exact location, dimensions, and depth remain unknown. If encountered during construction, the well should be decommissioned in accordance with the Environment Agency's guidance document:
"Good Practice for Decommissioning Redundant Boreholes and Wells" (EA, 2012).

2.20 Extensive intrusive investigations have been carried out across the site. Aside from the features noted above, no evidence of wet ground or additional drainage infrastructure has been identified. The results of the investigations are included in Appendix 8**.**

2.21 It has been agreed further investigation of the culvert within the rear gardens of Warneford Road is not required, as the proposed run-off will not enter the culvert.

Existing Drainage Infrastructure

2.22 Existing public sewerage infrastructure within the site's vicinity is described below. The existing sewer records provided by Yorkshire Water can be found in Appendix 4.

2.23 Sewer records show an existing 450mm diameter combined sewer crossing the site from Main Avenue flowing in an eastern direction leaving the site at the eastern boundary to the rear of the existing dwellings on Warneford Road.

2.24 Two combined sewers are recorded entering the site from the northern boundary from Windsor Road and Jubilee Lane, these sewers connect into the 450mm diameter sewer.

2.25 Records also show an existing 225mm diameter sewer passing along the school boundary connecting into the 450mm diameter sewer.

2.25 *Figure 1a – Site Location, Ordnance Survey*

2.26 *Figure 1b - Detailed Site Location*

3. Strategic Flood Risk Documentation

Calder Catchment Strategic Flood Risk Assessment Volume 1 (2016)

3.1 The Level 1 Strategic Flood Risk Assessment (SFRA) has been produced for Kirklees Council in April 2016 by JBA Consulting. The report considers the risk of flooding within the river Calder catchment as well as overview of risk from, groundwater and surface water runoff.

Calder Catchment Strategic Flood Risk Assessment Volume 2 (2016)

3.2 The Level 2 Strategic Flood Risk Assessment (SFRA) produced in July 2016 by JBA Consulting involves a more detailed (local) investigation. Volume 2 covers National Planning Policy and flood risk policy while assessing actual flood risk, flood risk within key communities and conclusions and recommended for further work.

3.3 The volume 2 assessment mapping highlights surface water flood risk crossing the site as shown in appendix 6.

3.4 Information available within the SFRA mapping confirms the site is outside of a critical drainage area and has a less the 25% chance of groundwater emergence.

4. Flood Risk Assessment

4.1 When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment.

4.2 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 future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

4.3 The Planning Practice Guidance was published in March 2014. The new Guidance is intended to reflect and support (but not replace) the National Planning Policy Framework (the NPPF) published in February 2019. On 25th August 2022, the Ministry of Housing, Communities & Local Government, released an updated version of the National Planning Policy Framework (NPPF).

4.4 In respect of flood risk, the NPPF was amended to clarify that all plans should apply a sequential, risk-based approach to the location of development, taking into account 'all sources of flood risk' and the current and future impacts of climate change.

4.5 If it is not possible for development to be located in zones with a lower risk of flooding, an application for the development should be considered having regard to the vulnerability of the site and development proposed. A new 'Floor Risk Vulnerability Classification' has been added to the NPPF that categorises those types of development particularly vulnerable to flood risk.

Sources of Flooding

4.6 In accordance with NPPF all forms of flood risk need to be considered in relation to any development. Flood risk has been assessed from the following sources: tidal and fluvial, surface water and flooding from the land, groundwater, sewer flooding and artificial sources (i.e., canals, reservoirs etc.)

Tidal and Fluvial Flooding

4.7 The Environment Agency 'Flood Map for Planning' map in figure 4.1, indicates the site is located entirely within Flood Zone 1 and so is considered to have the lowest probability of flooding from rivers and the sea, of 1 in 1000 in any one year (0.1%).

4.8 *Figure 4.1 – Environment Agency Flooding from Rivers and Sea Flood Map*

Surface Water Flooding

4.9 Flooding from overland flow can become a risk to any development if flooding occurs at a higher level than the development site.

4.10 The Environment Agency national Risk of Surface Water Flooding (RoFSW) data set map shows the majority of the site is at a very low risk.

4.11 Very low risk refers to land having less than a 1 in 1000 annual exceedance probability of flooding. Low risk refers to land having between a 1 in 1000 and 1 in 100 annual exceedance probability of flooding (0.1 % - 1% AEP). Medium risk refers to land having 1 in 100 and 1 in 30 annual probabilities (1% - 3.33% AEP). High risk refers to land having a greater than 1 in 30 annual exceedance probability of flooding (>3.33% AEP).

4.12 The RoFSW mapping shows a surface water flow route entering the development boundary where the Main Avenue carriageway ends, this flow route originates further west of the development, with Main Avenue collecting the run-off and channelling it into the development.

4.13 Once flows enter the development run-off is channelised by the existing site levels towards the existing properties on Warneford Road, ref appendix 2 for existing site falls diagram.

4.14 The risk probability and extent of flood risk then increase on the eastern boundary, it is anticipated this increase is due to the culverted watercourse discussed in section 2 not having the capacity to collect the run-off.

4.15 Mapping also shows a flow route entering the development's northern boundary from Windsor Road, as the flow from Main Avenue, Windsor Road is channelling exceedance run-off into the development, this run-off poses a lesser risk as it turns and follows lower-lying levels to the open space north-east of the site.

4.16 Although unrecorded the development will be subject to a significant amount of run-off from the land beyond the southern boundary, this run-off will also contribute to the surface water flooding entering the site from Main Avenue.

4.17 The development will provide a minor reduction in the cumulative run-off flowing towards the culverted watercourse, flooding at Warneford Road and adjacent open space, by collecting and attenuating run-off.

4.18 The design of the development must ensure the surface water flow routes entering the site are managed in a way that the site levels collect and divert the run-off to its existing location. Flow routing must pass through an adopted carriageway or managed shared drives to ensure run-off is managed for the development lifetime.

4.19 All new dwellings shall have 300mm freeboard from the flow route to ensure exceedance does not raise above a finished floor level – level design and exceedance routing can be viewed in appendix 9.

4.20 The proposed new dwellings backing onto the southern boundary will be intersecting surface water run-off from the land south of the site, and mitigation is required.

4.21 Due to the significant level changes across the site, a retaining wall will be required to form the southern boundary. To collect and divert the overland flow, the retaining wall is proposed to include a parapet. The parapet will stop the run-off from entering the gardens of the proposed dwellings and potentially flooding the dwellings.

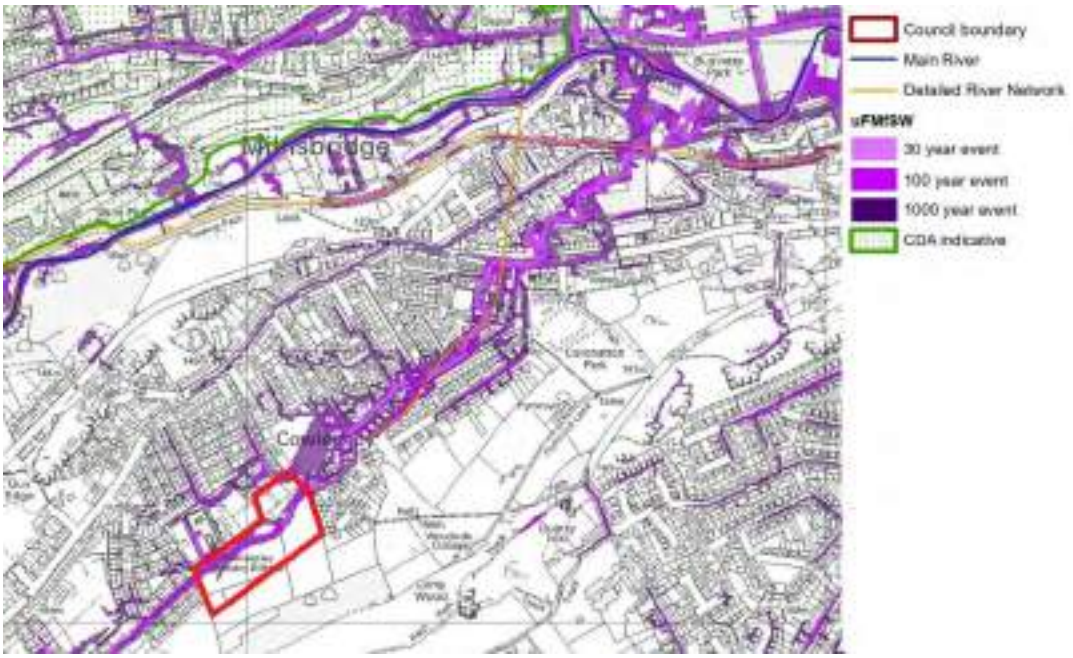
4.22 Levels and the retaining wall design must direct the existing run-off to the shared drive serving plots 49 - 52 to allow the run-off to escape down the drive to its current flow route as the surface water mapping.

4.23 Details within Appendix 9 provide the mitigation principle.

4.24 Based on the available information flood risk from this source is considered HIGH.

4.25 *Figure 4.2 – Environmental Agency Surface Water Flood Risk Map*

4.26 *Figure 4.3 – Environment Agency Surface Water – flood depth*



4.27 *Figure 4.4 – Strategic Flood Risk Assessment Surface Water Flood Risk Map*

Groundwater

4.28 Groundwater flooding is caused by water originating from beneath the ground surface from permeable strata through a natural process, usually after periods of higher-than-average rainfall.

4.29 The SRRA identifies the site as having a 25% risk of groundwater emergence.

4.30 Groundwater has been recorded during the site investigation, with the groundwater being shallower in low-lying areas.

4.31 Based on the information from the site investigation groundwater poses a low risk to the finished development.

4.32 Based on the available information significant flood risk from this source is considered LOW.

Sewer Flooding

4.33 No known sewer flood events are known, given that the scheme is to divert existing drainage to modern standards, and the new surface water network will be designed following this document and current best practice, possible future sewer flooding is limited.

4.34 Kirklees Council have witnessed flooding from the gullies at the end of Main Avenue and will be investigating this. If a flood event occurs from these gullies run-off will pass through the new road network.

4.35 Based on the available information flood risk from this source is considered LOW.

Land Drainage

4.36 If any land drainage discovered during excavations on site, it is recommended that the drain is repaired or diverted. Should this not be possible due to layout constraints, then it is recommended that the land drain is further investigated by the development engineer, to determine if the drain is still required post development.

4.37 Based on the available information flood risk from this source is considered LOW.

Artificial Sources

4.38 Environment Agency data and mapping indicates the site is not at risk of reservoir flooding.

4.39 Based on the available information flood risk from this source is considered LOW.

5. Summary of Existing Flood Risk

5.1 Table 5.1 below summarises the sources of possible flooding which have been investigated.

Table 5.1 – Summary of Flood Risk		
Flood Risk Source	**Current Risk Level**	**Mitigation Requirement**
Tidal & Fluvial Flooding	LOW	Not required
Groundwater	LOW	Not required
Sewer Flooding	LOW	Not required
Overland Flow	HIGH	Dwellings to be set 300mm higher than existing flow routes Existing flow routes are to be maintained along the southern boundary Recorded flow routes to the diverted through the site via the road network
Land Drainage	LOW	Not required
Artificial Sources	LOW	Not required

6. Existing Drainage Regime

6.1 The site is a mixture of permeable and impermeable surfaces, however, given the small amount of impermeable surfaces, the site is being assessed as a greenfield site.

6.2 Micro drainage rural run-off calculator (ICP SuDS for small catchments) has been used to calculate the existing greenfield run-off rates from the developed site, the results can be viewed in Table 6.1 and Appendix 7

Table 6.1 – Greenfield Run-off	
Return Period	**Discharge**
1 Year	7.2 l/sec
QBAR	8.3 l/sec
30 Year	14.6 l/sec
100 Year	17.7 l/sec

7. Proposed Development

7.1 Strata and Thirteen Group proposes to develop the site for residential use comprising 57 dwellings with associated landscaping, access and infrastructure works.

7.2 A copy of the proposed site layout can be viewed in Appendix 3.

Planning Context

7.3 The EA flood maps for the region show that the development sits within Flood Zone 1, which has a low probability of flooding 1 in 1000 in any one year (0.1%). This is illustrated in Table 7.1.

7.4 The proposed development will comprise residential dwellings. Therefore, in accordance with NPPF Table 7.2, the development is classified as 'more vulnerable'.

7.5 Thus, given that site is situated in Flood Zone 1 and the vulnerability classification in accordance with the NPPF compatibility matrix in Table 7.3, the scheme is classified as appropriate for development.

Table 7.1 Flood Risk Probability

Flood Zone	Probability	Explanation
Flood Zone 1	Low Probability	This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
Flood Zone 2	Medium Probability	This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.
Flood Zone 3a	High Probability	This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Flood Zone 3b	Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood

Table 7.2Flood Risk Vulnerability	
Category	**Explanation**
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. • Wind turbines and Solar farms.
Highly Vulnerable	• Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational 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, social services 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 educational 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 and cafes; hot food takeaways; offices; general industry; storage and distribution; non–residential institutions not included in 'more vulnerable'; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment plants. • Sewage treatment plants (if adequate pollution control measures are in place). • Car Parks
Water-compatible development	• Flood control infrastructure • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel workings. • Docks, marinas and wharves. • Navigation facilities. • MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and 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 and evacuation plan.

Table 7.3 Flood Risk Vulnerability Classification					
Flood Zone	**Essential Infrastructure**	**Highly Vulnerable**	**More Vulnerable**	**Less Vulnerable**	**Water Compatible**
Zone 1	Appropriate	Appropriate	Appropriate	Appropriate	Appropriate
Zone 2	Appropriate	Exception Test required	Appropriate	Appropriate	Appropriate
Zone 3a	Exception Test required	Not Permitted	Exception Test required	Appropriate	Appropriate
Zone 3b	Exception Test required	Not Permitted	Not Permitted	Not Permitted	Appropriate

8. Management of Surface Water

Possible Drainage Solutions

8.1 An assessment of possible drainage options has been undertaken in accordance with Building Regulations H3 Section 3 and NPPF. The disposal of surface water has been considered in the following order of priority.

-An adequate soakaway or some other infiltration system; or, where not reasonably practicable,

-A watercourse, or where not reasonably practicable,

-A sewer

Infiltration

8.2 In-situ testing carried out during the site investigation has determined that the use of infiltration will not be possible.

Discharge to a Watercourse

8.3 As this assessment, a culverted watercourse is located to the rear of the existing dwellings fronting Warneford Road, the watercourse is recorded on Local Authority records.

8.4 The culvert is fed by over land flow as shown on the surface water flood mapping. Investigation has shown that a 225 diameter pipe enters the development which feeds into the culverted watercourse, survey has shown this pipe to be 400mm deep, and is capped in all directions.

8.5 Given existing greenfield run-off from the development contributes to the culverts catchment, discharge to this watercourse is the preferred method of surface water disposal.

8.6 Discharge to this watercourse would follow the existing greenfield QBAR discharge rate of 8.3 litres/sec.

8.7 An assessment of surface water storage requirements, development layout, and outfall level has concluded a gravity connection to the 225 diameter pipe will not be possible, without pumping of flow.

8.8 A gravity connection to the culverted watercourse downstream may be possible (subject to further survey) however, this will require agreement from several third-party landowners.

Discharge to Public Sewers

8.9 Due to the issue with achieving a surface water outfall to the culverted watercourse, discharge to the existing public sewers will be necessary.

8.10 Yorkshire Water has been contacted through the pre-development enquiry process and has confirmed an allowable discharge of 3.5 litres/sec into the existing 450 diameter combined sewer.

8.11 This sewer is within the development boundary and is at a suitable depth for a gravity connection.

9. Preferred Drainage Solution

Storm Drainage

9.1 The preferred drainage solution will involve the discharge of site surface water flows to the combined sewerage within the site boundary. The proposed drainage strategy and calculations can be viewed in Appendix 9.

Storm Drainage

9.2 The allowable discharge rate from Yorkshire Water is 3.5 litres/second which is a 58% reduction of the existing QBAR discharge rate.

9.3 Surface water modelling has been undertaken to assess up to 45% climate with no inclusion of urban creep.

9.4 Attenuation will be provided by means of a pre-cast attenuation tank located within the green space on the development's eastern boundary and flows will be restricted using a vortex flow control device in accordance with Yorkshire Water adoption requirements. The minimum orifice diameter shall be 75mm.

9.5 The attenuation is to be placed allowing suitable standoff from the adoptable highway and neighbouring boundary.

9.6 Given that the outfall is an existing sewer owned by Yorkshire Water, no detailed considerations are required; the connection to the sewer must be made at soffit level or higher to mitigate possible surcharge from the existing sewer.

9.7 All new adoptable standard surface water drainage is to be designed in accordance with 'SSG' and to ensure that no flooding occurs during the critical 1 in 30-year storm event.

Foul Drainage

9.8 Foul drainage will connect into diverted sewers under Section 185 of the Water Industry Act or new foul drains under Section 104 of the Water Industry Act.

9.9 Flows will ultimately connect into the existing 450mm dia combined sewer at the east of the development.

9.10 All new adoptable foul sewerage is to be designed in accordance with 'SSG'.

Land Drainage and Surface Water Flooding

9.11 Due to the surface water constraints and flood risk identified on site, a number of mitigation interventions are required to manage existing overland flows and reduce flood risk to the proposed dwellings.

9.12 As discussed in Section 4, the development is at risk from surface water flooding, as shown in the Environment Agency flood mapping. This risk is primarily from overland flow originating on the hillside to the south of the site, conveyed via natural ground contours, existing culverts, and informal channels.

9.13 Floodwater and runoff from the southern hillside will be directed along the proposed road network, flowing west to east toward the existing outfall. Runoff will be intercepted by a parapet feature incorporated into the retaining wall, which will divert flows toward a proposed stepped access route, then down a private driveway, ultimately rejoining the natural discharge route.

9.14 To further reduce flood risk, a land drainage network is proposed. This system will manage runoff from both the hillside culvert and the suspected spring or former culvert identified in the western part of the site.

9.15 To manage flows from the hillside culvert:

- A headwall will be installed at the base of the ditch or culvert pipe (whichever is lower in elevation).
- A headwall is preferred over a direct connection to the existing culvert to ensure the wider upstream catchment (as shown on Drawing 2153-QD-XX-HD-DR-C-80-01 in Appendix 9) is captured effectively.
- This design also ensures future visibility and maintenance access, reducing the risk of blockage in vegetated areas.

9.16 From the headwall, a 225mm diameter pipe will be installed:

- Passing through the rear gardens of Plots 42 and 43,
- Entering the verge of the proposed carriageway,
- Connecting ultimately into the existing downstream culvert.

9.17 As Plot 43 lies downslope of the proposed drain therefore:

- A 225mm high coping is proposed along the retaining wall that runs parallel to the pipe and the plot.
- This feature is designed to contain exceedance flows in the event of surcharge or blockage and direct them safely toward the road fronting Plot 43, rather than toward vulnerable dwellings.

9.18 A spring or former culvert was observed adjacent to the existing car park in the western area of the site. Further trial pitting and trenching have not identified any active or continuous drainage feature in this location.

9.19 To manage any intermittent or unknown flows, a 225mm diameter land drain will be installed in the carriageway verge adjacent to this area.

9.20 Given the possibility of encountering additional culverts or springs, it is proposed that the land drain be extended along the full length of the carriageway verge, particularly around Plots 27–28 and the shared driveway serving Plots 29–32, where excavation works may reveal previously unrecorded drainage features.

9.21 An additional inspection chamber may be required at the location of SC7 within the carriageway. The final requirement will be confirmed following vegetation clearance and site level reduction.

10. Conclusion

Flood Risk

10.1 The flood risk assessment and drainage strategy has been prepared in accordance with the NPPF, Flood Risk and Coastal Change Planning Practice Guidance. The management of the surface water flows has also been considered in accordance with Building Regulations H3 Section 3.

10.2 The proposed development is classified as 'more vulnerable' and is located within Flood Zone 1 according to the SFRA and Flood Maps for Planning, therefore the development is suitable within this flood zone in accordance with NPPF.

10.3 The development is at risk of surface water flooding, employment of the mitigation measures stated in this report will ensure that the development will be safe and suitable in this location.

10.4 Flood risk from all sources have been considered and with mitigation where necessary, it has been established that these sources do not pose a residual risk to the development.

Storm Drainage

10.5 Surface water runoff will discharge to the existing combined sewerage to a rate of 3.5 litres/sec for all storm return periods.

10.6 Exceedance flows above the restricted rate of 3.5 litres/sec will be attenuated on-site via underground attenuation.

10.7 All new adoptable standard surface water drainage is to be designed in accordance with 'SSG' and to ensure that no flooding occurs during the critical 1 in 30-year storm event. A 45% increase in rainfall due to climate change has been considered.

Foul Drainage

10.8 It is proposed to discharge foul flows into either diverted or new sewers.

10.9 All new adoptable foul sewerage is to be designed in accordance with 'SSG'.

Appendix 1 - Topographical Survey

[illegible]

The Hollies, 43 Church Street, Royston, Barnsley, S71 4QU. T:01226 709630
E:info@land-surveying.co.uk W:land-surveying.co.uk

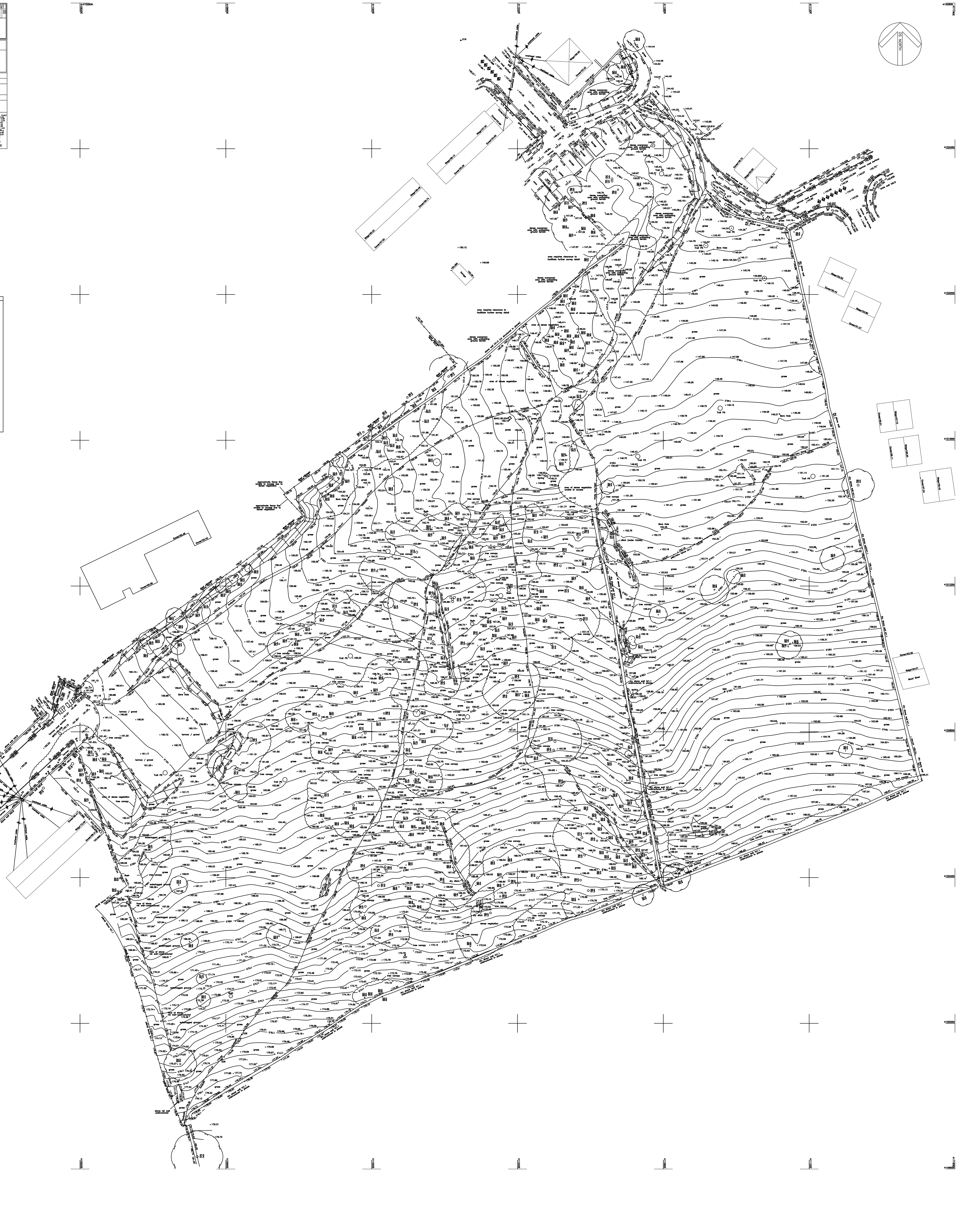
[illegible]

Sheet 1 of 1	Surveyed by PMS
Datum	Drawn by PMS
GRID- Related to Ordnance Survey using One Point Localisation on Station S4. Orientation at OS Grid North.	Date of Survey May 2024
	Scale 1/200
LEVEL- Related to Ordnance Survey by connection to the OS Active Network by G.P.S	Survey Job No. [illegible]

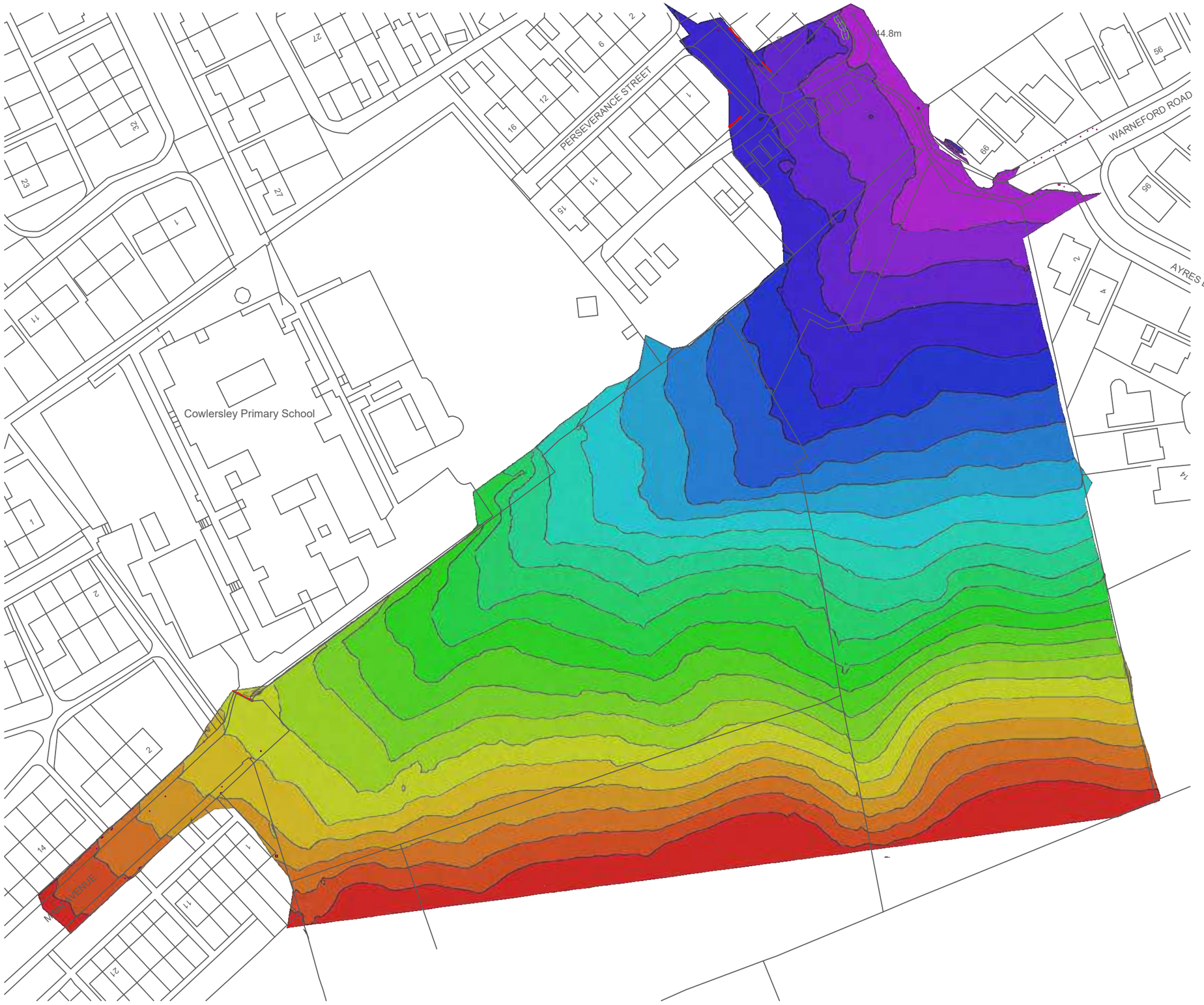
LEGEND

Manhole shown thus	MH	Floor Level	FL 10.907
Inspection Cover	IC	Height floor to ceiling	C 2.22
Lamp post	LP	Height floor to struct soffit	SS 2.67
Gully	G	Height floor to false ceiling	FC 2.22
Lampost	oLP	Height floor to sill	S0.67
Telegraph Pole	oTP	Height sill to window head	W1.23
Electricity Pole	oEP	Height of Door	D1.98
Road Traffic Signs	oRS	Height floor to underside	US 3.61
Traffic Lights	oTL	Ceiling Slopes Up	CSU
British Telecom	BT	Height floor to Arch	Ar2.99
Cable Television	CATV	Height floor to Arch Spring	Sp2.67
Fire Hydrant	FH	Vent	VP
Safety Valve	SV	Fall Pipe	FP
Stop tap Water	W	Sky Light	SL
Stopcock Gas	Gas	Water Closet	WC
Unknown Stoptap	ST	Sink	S
		Boxed Column	
		Survey Station	

Station	Easting	Northing	Level
S1	410836.485	415015.185	169.245
S2	410922.623	415087.179	161.236
S3	410903.922	415062.640	163.538
S4	410914.012	415071.608	162.654
S5	410909.115	415081.391	162.364
S6	410949.459	415083.817	160.137
S7	410965.586	415032.619	168.474
S8	411011.470	415105.944	157.055
S9	410986.147	415130.700	154.961
S10	411002.243	415149.924	153.385
S11	411042.333	415166.166	149.760
S12	411060.924	415176.795	148.150
S13	411038.881	415123.745	155.320
S14	411074.588	415207.022	145.850
S15	411097.078	415226.627	144.136
S16	411118.506	415220.553	144.129
S17	411079.186	415250.355	144.994
S18	411046.593	415243.400	147.155
S19	411024.465	415269.745	148.114
S20	411137.669	415229.193	143.324
S21	411135.916	415224.551	143.792
S22	411102.860	415200.147	146.490
S24	411112.997	415116.278	156.934
S25	411096.835	415091.076	162.080
S26	411070.970	415046.199	167.986
S27	411051.076	415037.732	170.298
S30	411033.561	415101.448	158.595
S31	411026.545	415085.909	160.056
S32	411011.428	415088.745	160.044
S33	411006.227	415085.508	163.877
S34	411000.195	415051.162	166.157
S35	410958.991	414990.119	177.034
S36	410964.391	414998.946	175.787
S37	411009.110	415018.694	172.785



Appendix 2 – Site Fall Diagram



Height Bands

- 166m - 167m
- 165m - 166m
- 164m - 165m
- 163m - 164m
- 162m - 163m
- 161m - 162m
- 160m - 161m
- 159m - 160m
- 158m - 159m
- 157m - 158m
- 156m - 157m
- 155m - 156m
- 154m - 155m
- 153m - 154m
- 152m - 153m
- 151m - 152m
- 150m - 151m
- 149m - 150m
- 148m - 149m
- 147m - 148m
- 146m - 147m
- 145m - 146m
- 144m - 145m
- 143m - 144m

Rev.	Date	Revision Details	Drawn	Checked

QUEENSBERRY DESIGN
CIVIL, STRUCTURAL, ARCHITECTURAL & GEOTECHNICAL CONSULTANTS

QUEENSBERRY DESIGN YORKSHIRE LTD
SUITE 12A, BROOKFIELD COURT, SELBY ROAD, LEEDS, LS25 1NB

www.queensberrydesign.co.uk

Client

STRATA AND THIRTEEN GROUP

Project

MAIN AVENUE
COWLERSLEY
HUDDERSFIELD

Title

SITE FALL DIAGRAM

Drawn	Checked	Date
ND		

Drawing Number

Drawing Status	Scale	Rev.
	1:1000 - A3	

Appendix 3 – Development Layout

DO NOT SCALE

All dimensions to be checked on site and Architect to be notified of any discrepancies prior to commencement

DESIGNERS RISK ASSESMENT

Construction (Design and Management) Regulations 2015

RESIDUAL RISKS

REF	DATE	DESCRIPTION
P1	03.10.24	Planning Issue GP
P2	11.10.24	Apartment footprints revised. GP
P3	22.10.24	Substation location revised. GP
P4	23.10.24	Private drive arrangement altered plots 16-18. GP Plot 1 changed to HT11 from HT9.
P5	26.11.24	Altered following client feedback. Coodinated with levels proposals. GP
P6	26.03.25	Raised table altered at the centre of the site. GP
P7	23.05.25	Layout altered to give easement to culvert. GP

Kirklees - Main Avenue

(GIA)

Thirteen Group/Strata

	ha	acres
GROSS SITE AREA	1.81	5.24
NET SITE AREA	1.55	4.47

HOUSE TYPE	BEDROOM	APPROVED DOCUMENT M COMPLIANCE	CONFIG	STOREYS	NO	MIX %	SQ FT	SQ M	TOTAL SQ FT	TOTAL SQ M
HT6	2B3P	CAT M4(2)	HOUSE	2	7	12	784.69	72.9	5493	510.30
HT7	2B4P	CAT M4(2)	HOUSE	2	8	14	877.26	81.5	7018	652.00
HT8	3B4P	CAT M4(1)	HOUSE	2	8	14	928.92	86.3	7431	690.40
HT9	3B5P	CAT M4(1)	HOUSE	2	3	5	1020.42	94.80	3061	284.40
HT10	3B5P	CAT M4(2)	HOUSE	2	1	2	1020.42	94.80	1020	94.80
HT11	3B5P	CAT M4(2)	HOUSE	2	7	12	1020.42	94.80	7143	663.60
HT12	3B5P	CAT M4(2)	HOUSE	2	8	14	1032.26	95.90	8258	767.20
HT14	4B6P	CAT M4(2)	HOUSE	2	1	2	1184.03	110.00	1184	110.00
HT24	4B6P	CAT M4(1)	HOUSE	2.5	6	11	1357.33	126.10	8144	756.60
APT (G)	2B3P	CAT M4(2)	APARTMENT	1	4	7	659.83	61.30	2639	245.20
APT (1)	2B3P	CAT M4(2)	APARTMENT	1	4	7	731.95	68.00	2928	272.00
			OVERALL TOTALS		57	100			54320	5047

OVERALL DENSITY	
UNITS / ha	36.77
UNITS / ACRE	12.75
SQ M / ha	3256
SQ FT / ACRE	12152

TOTALS	57

OVERALL MIX	TOTAL	%
2 BED	23	40
3 BED	27	47
4 BED	7	12
	57	100

OVERALL MIX APPROVED DOCUMENT M	TOTAL	%
CAT M4(1)	17	30
CAT M4(2)	40	70
CAT M4(3)	0	0
	57	100

NOTE: Nett area excludes all public open space and associated structural landscaping / buffer planting / half road

REV	DATE	INITIAL	DESCRIPTION

PROJECT / CLIENT	Kirklees Cluster Sites Main Avenue, Cowersley
PROJECT NO.	N81-3084
DRAWING STATUS	Planning
DRAWING TITLE	Proposed Site Layout
DRAWING NO.	102
PROJECT LEADER	GP
DRAWN BY	GP
CHECKED BY	IDP
SCALE	1 to 500 @ A1
DATE	22.10.2024
DRAWING REVISION	P8

idp Architecture Masterplanning Urban Design

Appendix 4 – Yorkshire Water

Mr N Dunwoodie
Queensbury Design Ltd
5 The Staithes
NE11 9SN
nick.dunwoodie@queensberrydesign.co.uk

Yorkshire Water Services
Developer Services
Pre-Development Team
PO BOX 52
Bradford
BD3 7AY

Tel: 0345 120 8482

Email:
technical.sewerage@yorkshirewater.co.uk

Your Ref:
Our Ref: A000354

For telephone enquiries ring:
Chris Roberts on 0345 120 8482

5th February 2024

Dear Mr Dunwoodie,

Main Aveune, Cowlersley, Huddesfield, HD4 5US - Pre-planning Enquiry V360332

Thank you for your recent enquiry and remittance. Our official VAT receipt has been sent to you under separate cover. Please find enclosed a complimentary extract from the Statutory Sewer Map which indicates the recorded position of the public sewers. Please note that as of October 2011 and the private to public sewer transfer, there are many uncharted Yorkshire Water assets currently not shown on our records.

The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of twelve months:

Existing Infrastructure

There is a 450 mm diameter public combined water sewer recorded crossing the site. No buildings, or other obstructions, are to be erected within 3.5 (three point five) metres is required at each side of the sewer centre-line, no trees planted within 5 (five) metres of this public sewer.

There is a 225 mm diameter public combined water sewer recorded crossing the site. No buildings, or other obstructions, are to be erected within 3 (three) metres is required at each side of the sewer centre-line, no trees planted within 5 (five) metres of this public sewer.

It may not be acceptable to raise or lower ground levels over the sewer, nor to restrict access to the manholes on the sewer. If you wish to have this sewer diverted under Section 185 of the Water Industry Act 1991 an application should be made in writing. To discuss this matter, please telephone 0345 120 84 82.

Foul Water

Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.

Foul water domestic waste can discharge to the 450 mm diameter public combined sewer recorded in the northern part of site.

Surface Water

The developer's attention is drawn to Requirement H3 of the Building Regulations 2010. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order.

Sustainable Drainage Systems (SuDS), for example the use of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SuDS in this instance from the appropriate authorities.

As a last resort and subject to providing satisfactory evidence as to why the other methods of surface water disposal have been discounted, curtilage surface water may discharge to the 450 mm diameter public combined sewer recorded in the northern part of site.

The surface water discharge from the site to be restricted to not greater than 3.5 (three pooint five) litres/second. This permission is not an acceptance in respect to any planning conditions imposed under the Grant of Planning Permission.

Other Observations

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may apply on line or obtain an application form from our website - https://www.yorkshirewater.com/developers/sewerage/sewerage-connections/

Prospectively adoptable sewers and pumping stations must be designed and constructed in accordance with the Code for Adoption 2023/24, pursuant to an agreement under Section 104 of the Water Industry Act 1991. We are happy to offer pre-development technical advice on any prospective sites that you would like to put forward for adoption, prior to submission of your adoption application.

An application to enter into a Section 104 agreement must be made in writing prior to any works commencing on site. Please contact our Sewer Adoption, Diversion and Requisition (telephone 0345 120 84 82) or email technical.sewerage@yorkshirewater.co.uk or visit - https://www.yorkshirewater.com/developers/sewerage/sewer-adoptions/ for further information.

All the above comments are based upon the information and records available at the present time and is subject to formal planning approval agreement. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith.

Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours sincerely

Chris Roberts
Development Services Technician

Play Area

167.0m

144.8m

171.0m

Cowersley Court Residential Care Home

Woodside Green Primary School

Community Centre

Play Area

COWERSLEY LANE

STORTH AVENUE

WINGET AVENUE

LUTON STREET

WINDSOR ROAD

PERSEVERANCE STREET

WOODSIDE VIEW

WARNCLIFFE ROAD

AYRES DRIVE

SOUTH AVENUE

ROSE AVENUE

MAIN AVENUE

Path (um)

410894 : 415090	Map Name : SE1014NE	Title	Partial Key Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS
Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : YorMap Advisor C ROBERTS Contact Tel : 87 2582		Notes	This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connections are shown.
		(Ody) COPYRIGHT STATEMENTS: Reproduced by permission of Ordnance Survey on behalf of HMSO © Crown copyright and database 2014. All rights reserved Ordnance Survey Licence number 100022432	Date Req : 05/02/2024, 15:08:41 Source : Sewer Network Enquiry
			Date Gen : 05/02/2024, 15:15:28

UPN: Undefined Originator: C ROBERTS, YorMap, 87 2582

Appendix 5 – Environment Agency

Flood map for planning

Your reference	Location (easting/northing)	Created
<Unspecified>	**411031/415144**	**11 Sep 2024 9:10**

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Environment Agency

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
411031/415144

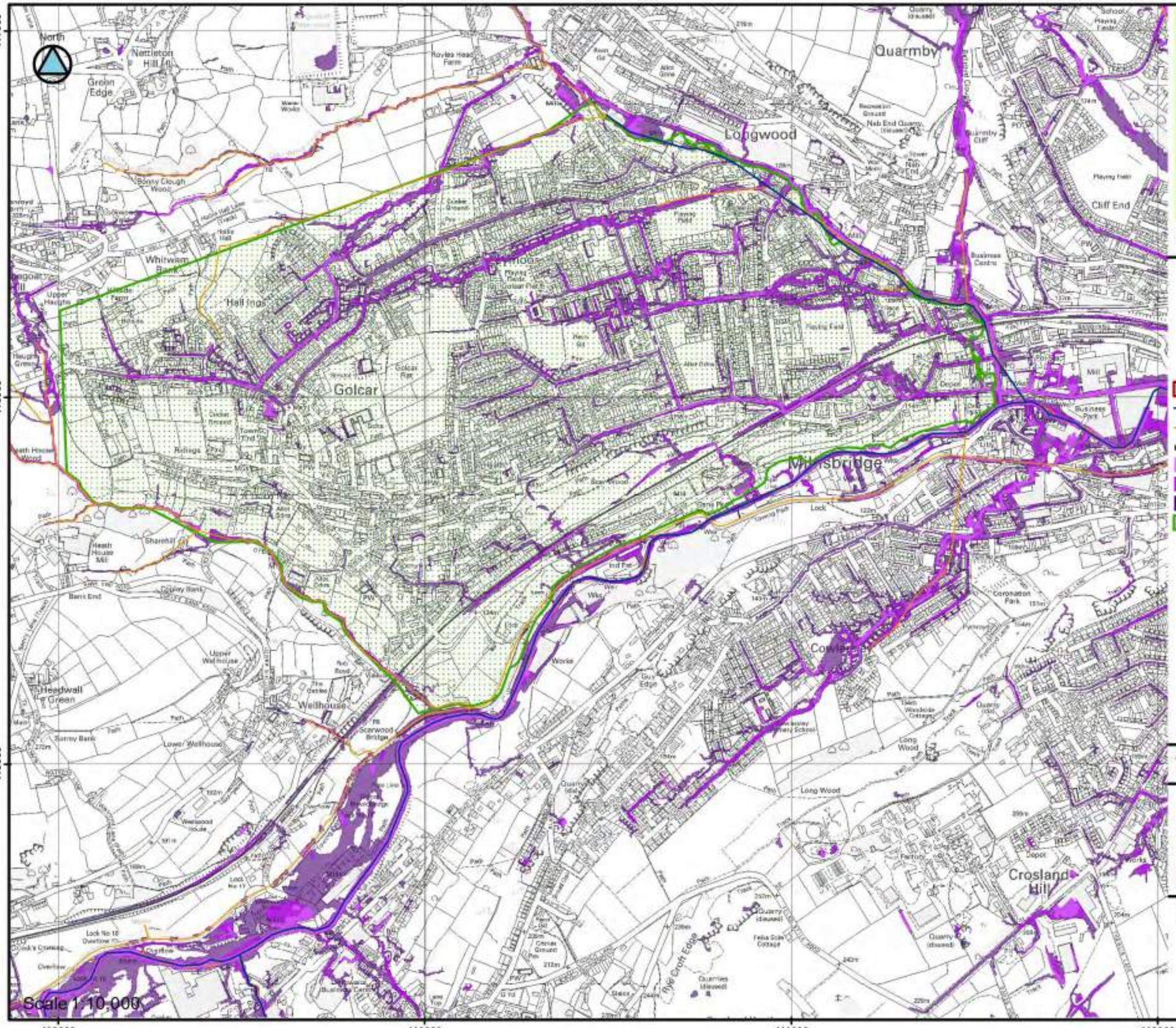
Scale
1:2500

Created
11 Sep 2024 9:10

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m

Appendix 6 – Lead Local Flood Authority



LEGEND

Choose Option: Updated Flood Map for Surface Water

- Council boundary
- Main River
- Detailed River Network

uFMfSW

- 30 year event
- 100 year event
- 1000 year event
- CDA indicative

JBA consulting

Kirklees COUNCIL

STRATEGIC FLOOD RISK ASSESSMENT

For

KIRKLEES COUNCIL

MAP_D

Consultation Response from KC, **Lead Local Flood Authority**
2024/93605 Land at, Main Avenue, Cowlersley, Huddersfield, HD4 5US
Erection of 57 dwellings with access from new through road connecting Main Avenue and Windsor Road, and associated works, including engineering and landscaping
Date Responded:7th February 2025 **Responding Officer: Paul Farndale** **Responding Ref:**

Kirklees Flood Management & Drainage acting as LLFA, requires FURTHER INFORMATION before making an initial decision on the application.

We accept that infiltration techniques for the removal of surface water are not suitable for this development. We would object to a pumped solution to watercourse as identified would be required due to attenuation requirements and the shallow depth of the receiving system. We therefore hold no objection to discharging surface water to the public combined sewer at a restricted rate of 3.5l/s as stipulated by Yorkshire Water.

The WYCA guide to SUDS is now out of date and Kirklees climate change requirements default to NPPF and associated guidance. For this a 45% uptake is required. As the 1 in 100 year + climate change critical event is being stored, there is no requirement for urban creep. This should be analysed to provide indicative drawings, at the very least, that show that space has been made for water in the proposed layout.

We note that a survey of the watercourse running from site at the eastern boundary has been attempted indicating some capped off land drainage but with the main run obstructed. As land drainage from the site will need to connect in at this point, a full downstream survey of the culverted section of the watercourse is required to show that it is fit for purpose (this will form part of the flood risk assessment). For a site of this size, the survey should extend to the first open section located at 67 Warneford Road (see attached).

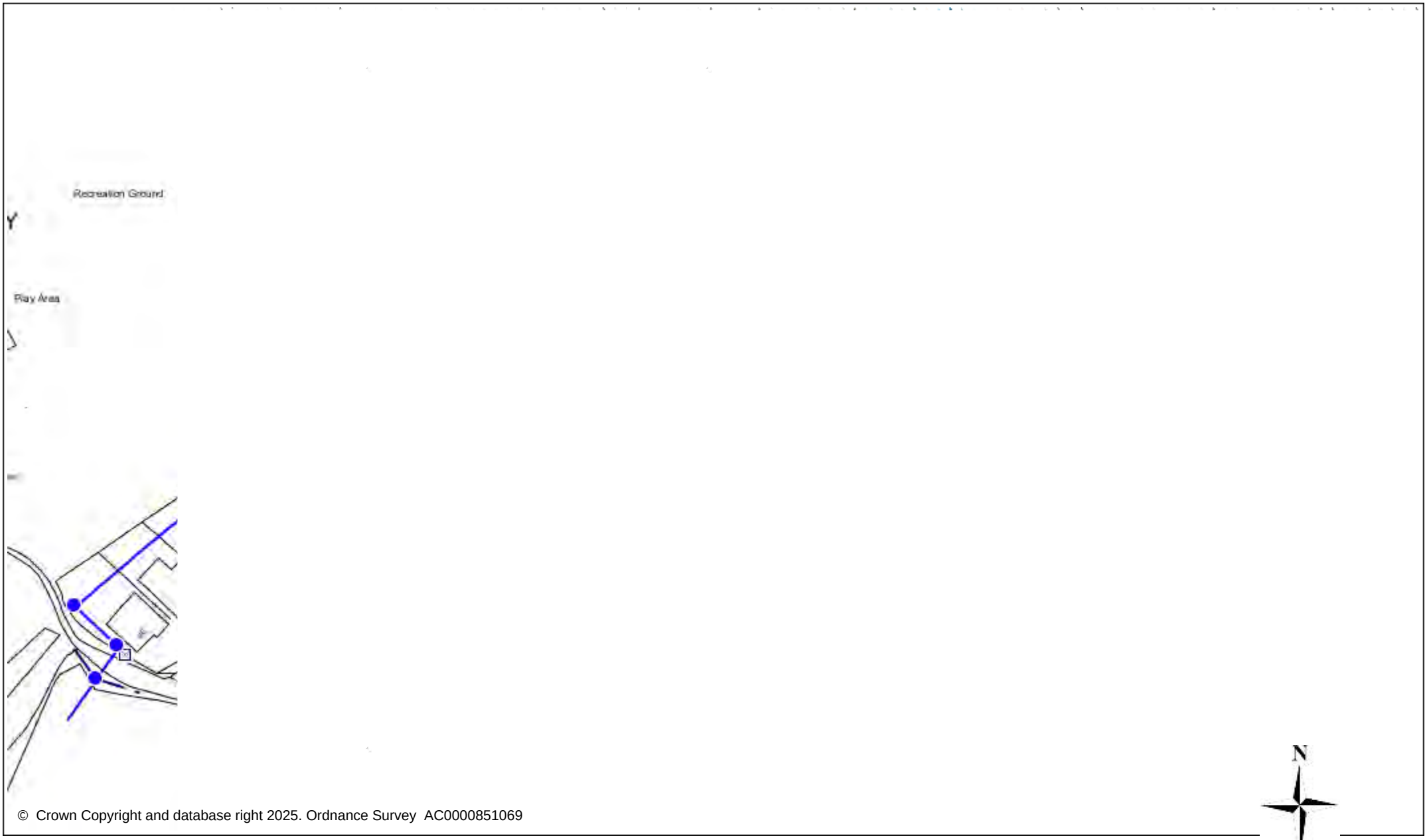
An examination of historical OS Maps shows a cluster of buildings toward the eastern boundary named ‘Jubilee’. A well is clearly shown and in line with the downstream watercourse. The 1933 map is included as an example. Kirklees would like the applicant to determine the depth of the system as it leaves site and perform the excavation of slip trenches at the well location and upstream at several intervals including the western boundary with Main Avenue. Kirklees Council has previously noted overland flows (flows escaping?) along this low valley within the site in addition to water running south to north. The presence of existing systems must be fully investigated.

Kirklees Council has also witnessed flooding from gullies at the end of Main Avenue and will investigate this ourselves to ascertain what system they are connected to. There is anecdotal evidence of a culvert in a verge in Main Avenue and an abandoned manhole independent of the combined public sewer is still present within the road itself.

The LLFA is concerned about levels to the south of the development with a clear valley running toward retaining walls. This low spot does not coincide with the step identified as flow route. A layout review is required as should be the potential to include positive land drainage from the perimeter of the site.

Some plots on the northern side of the access road may need lifting slightly to ensure all driveways fall back toward to the road, in the interests of safe flood routing.

warneford road



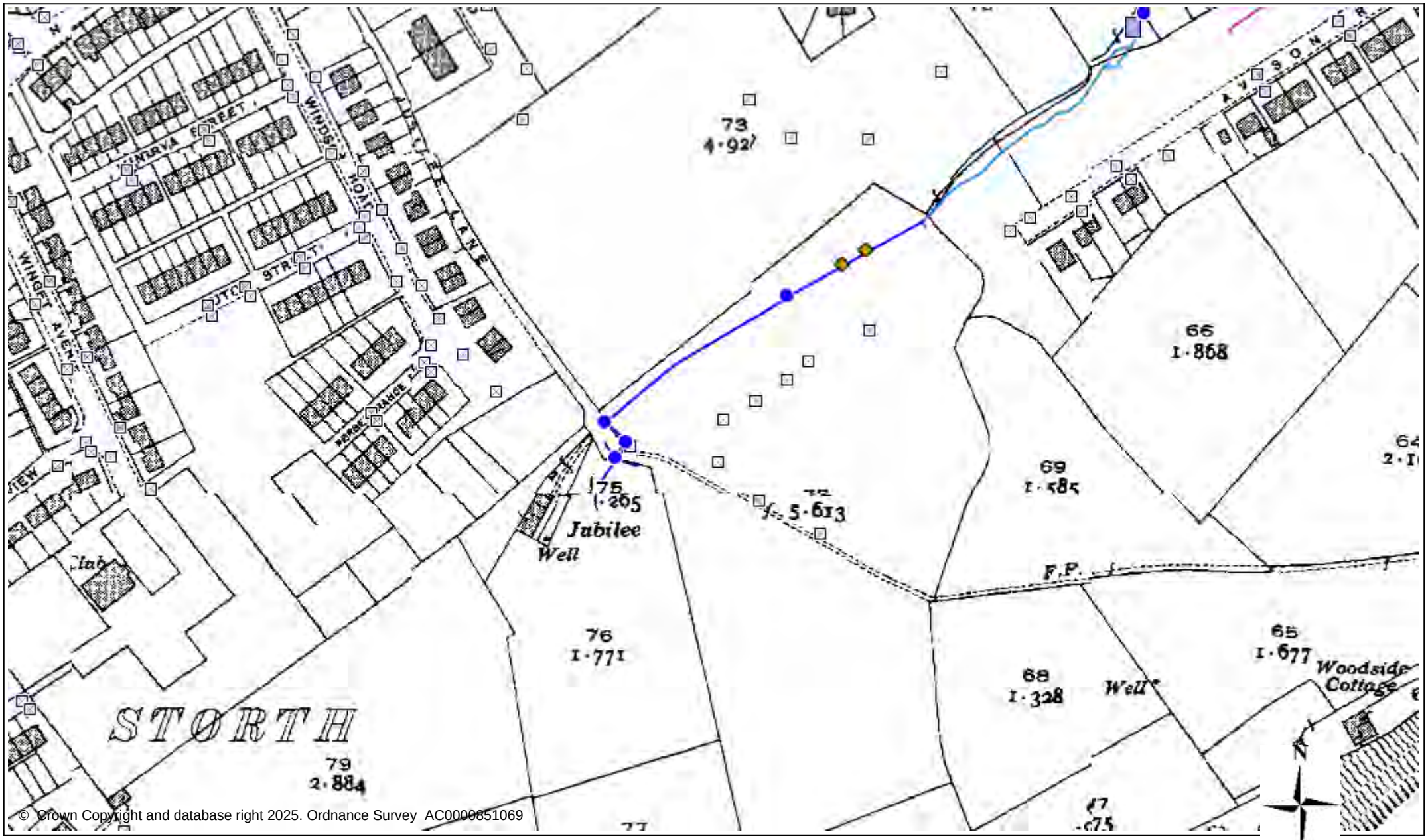
N

Scale = 1:952.560

Print Date : 10-Feb-2025

Kirklees COUNCIL

1933 Map - -Well



Scale = 1:1905.120

Print Date : 10-Feb-2025

Kirklees COUNCIL

Appendix 7 – Greenfield Run-off Calculation

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	1.550	Urban	0.000
SAAR (mm)	831	Region Number	Region 3

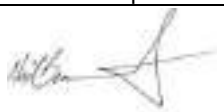
Results l/s

QBAR Rural	8.3
QBAR Urban	8.3
Q1 year	7.2
Q1 year	7.2
Q30 years	14.6
Q100 years	17.3

Appendix 8 – Drainage Investigation

CCTV Drainage Inspection Report.

WRc MSCC Fifth Edition

Control			
	Prepared By	Reviewed By	Authorised By
	Curtis Hobson-Clarke Centara Ltd Principle CCTV Surveyor	Tom Peart Centara Ltd Survey Manager	Neil Beaumont Centara Ltd Director of Operations
Signed			
Client	**Strata Homes**		
Location	**Cowersley, Kirklees**		
Requirements	**To carry out a CCTV Drainage Condition survey showing connectivity**		

Distribution List	
Issued to Strata	03/07/24

Revision Control	
00 – Issued – 03/07/24 - CHC	

Table of Contents.

Executive Summary.

Further to our recent commission to carry out an investigative survey and provide a condition report of the underground drainage system at: **138 Main Ave, Cowersley, Kirklees.**

This report should be viewed in conjunction with the individual MP4 Files included in the report.

Each Folder contains the MP4 files for the individual pipes associated with the Coded Manhole. E.g., MH01, MH101 etc.

Issues Encountered on Site:

We were unable to complete a full survey for the reasons listed below:

MH105 Pipe B was unable to be surveyed as it would require man access to place the camera unit in the pipe

MH105A Was unable to be raised (UTR)

General Considerations

The drainage system consists of mostly (PVC) Polyvinylchloride, (CO) Concrete. The drains surveyed are in good condition.

Recommendations

Centara are not able to make recommendations for remedial works or indeed whether this is feasible. However, in its current state the drainage is flowing, reparative measures will most likely be needed in the short term.

Survey Drawing

Each manhole is referenced in the report using a unique code e.g., MH01 etc. This report should be read in conjunction with the AutoCAD drawing provided as an appendix to this report.

CCTV Drainage Survey Code List.

B	BROKEN PIPE AT..... (OR FROM... TO...) O'CLOCK
BR	BRANCH MAJOR
CC	CRACK CIRCUMFERENTIAL FROM ... TO ... O'CLOCK
CL	CRACK LONGITUDINAL AT ... O'CLOCK
CM	CRACK'S MULITIPLE FROM ... TO ... O'CLOCK
CN	CONNECTIONS AT ... O'CLOCK, DIAMETER ... MM
CNI	CONNECTION AT ... O'CLOCK, DIAMETER ...MM, INTRUSION ... MM
CU	CAMERA UNDER WATER
CX	CONNECTION DEFECTIVE AT ... O'CLOCK, DIAMETER ... MM
CXI	CONNECTION DEFECTIVE AT ... O'CLOCK, DIAMETER ... MM, INTRUSION
D	DEFORMED SEWER ... %
DB	DISPLACED BRICKS AT ... (OR FROM ... TO ...) O'CLOCK
DC	DIMENSION OF SEWER CHANGES, NEW DIMENSION ... MM
DE	DEBRIS ...% CROSS-SECTIONAL AREA LOSS
DEG	DEBRIS GREASE ...% CROSS-SECTIONAL AREA LOSS
DES	DEBRIS SILT ...% CROSS-SECTIONAL AREA LOSS
DI	DROPPED INVERT, GAP ...MM
EH	ENCRUSTATION HEAVY FROM ... TO ... O'CLOCK ...% CROSS-SECTIONAL AREA LOSS
EHJ	ENCRUSTATION HEAVY FROM ... TO ... O'CLOCK ...% CROSS-SECTIONAL AREA LOSS AT JOINT
EN	ENCRUSTATION LIGHT FROM ... TO ... O'CLOCK
ELJ	ENCRUSTATION LIGHT FROM ... TO ... O'CLOCK AT JOINT
EM	ENCRUSTATION MEDIUM FROM ... TO ... O'CLOCK ...% CROSS-SECTIONAL AREA LOSS
EMJ	ENCRUSTATION MEDIUM FROM ... TO ... O'CLOCK ...% CROSS-SECTIONAL AREA LOSS
ESH	SCALE HEAVY FROM ... TO ... O'CLOCK ...%
ESL	SCALE LIGHT ...% CROSS-SECTIONAL AREA LOSS FROM ... TO ... O'CLOCK
ESM	SCALE MEDIUM ...% CROSS-SECTIONAL AREA LOSS FROM ... TO ... O'CLOCK
FC	FRACTURE CIRCUMFERENTIAL FROM ... TO ... O'CLOCK
FH	FINISH SURVEY
FL	FRACTURE LONGITUDINAL AT ... O'CLOCK
FM	FRACTURES MULTIPLE FROM ... TO ... O'CLOCK
GO	GENERAL OBSERVATION AT THIS POINT
GP	GENERAL PHOTOGRAPH NUMBER ... TAKEN AT THIS POINT
H	HOLE IN SEWER AT ... (OR FROM ... TO ...) O'CLOCK
ID	INFILTRATION DRIPPER AT ... (OR FROM ... TO ...) O'CLOCK
IDJ	INFILTRATION DRIPPER AT ... (OR FROM ... TO ...) O'CLOCK AT JOINT
IG	INFILTRATION GUSHER AT ... (OR FROM ... TO ...) O'CLOCK
IGJ	INFILTRATION GUSHER AT ... (OR FROM ... TO ...) O'CLOCK AT JOINT
IR	INFILTRATION RUNNER AT ... (OR FROM ... TO ...) O'CLOCK

IRJ	INFILTRATION RUNNER AT ... (OR FROM ... TO ...) O'CLOCK AT JOINT
IS	INFILTRATION SEEPER AT ... (OR FROM ... TO ...) O'CLOCK
ISJ	INFILTRATION SEEPER AT ... (OR FROM ... TO ...) O'CLOCK AT JOINT
JDL	JOINT DISPLACED LARGE
JDM	JOINT DISPLACED MEDIUM
JN	JUNCTION AT ... O'CLOCK, DIAMETER ...MM
JX	JUNCTION DEFECTIVE AT ... O'CLOCK, DIAMETER ...MM
LC	LINING OF SEWER CHANGES/START/FINISHES AT THIS POINT
LD	LINE OF SEWER DEVIATES DOWN
LL	LINE OF SEWER DEVIATES LEFT
LN	LINING DEFECT AT ... (OR FROM ... TO ...) O'CLOCK
LR	LINE OF SEWER DEVIATES RIGHT
LU	LINE OF SEWER DEVIATES UP
MB	MISSING BRICKS AT ... (OR FROM ... TO ...) O'CLOCK
MC	MATERIAL OF SEWER CHANGES AT THIS POINT
MH	MANHOLE/NODE
MM	MORTAR MISSING MEDIUM AT ... (OR FROM ... TO ...) O'CLOCK
MS	MORTAR MISSING SURFACE AT ... (OR FROM ... TO ...) O'CLOCK
MT	MORTAR MISSING TOTAL AT ... (OR FROM ... TO ...) O'CLOCK
OB	OBSTRUCTION ...% HEIGHT/DIAMETER LOSS
OJL	OPEN JOINT LARGE
OJM	OPEN JOINT MEDIUM
PC	LENGTH OF PIPE FORMING SEWER CHANGES AT THIS POINT, NEW LENGTH ...MM
RF	ROOTS FINE
RFJ	ROOTS MASS ...% CROSS-SECTIONAL AREA LOSS
RMJ	ROOTS MASS ...% CROSS-SECTIONAL AREA LOSS AT JOINT
RT	ROOTS TAP
RTJ	ROOTS TAP AT JOINT
SA	SURVEY ABANDONED
SC	SHAPE OF SEWER CHANGES AT THIS POINT
SSL	SURFACE DAMAGE, SPALLING LARGE AT ... (OR FROM ... TO ...) O'CLOCK
SSM	SURFACE DAMAGE, SPALLING MEDIUM AT ... (OR FROM ... TO ...) O'CLOCK
SSS	SURFACE DAMAGE, SPALLING SLIGHT AT ... (OR FROM ... TO ...) O'CLOCK
ST	START OF SURVEY
SWL	SURFACE DAMAGE, WEAR LARGE AT ... (OR FROM ... TO ...) O'CLOCK
SWM	SURFACE DAMAGE, WEAR MEDIUM AT ... (OR FROM ... TO ...) O'CLOCK
SWS	SURFACE DAMAGE, WEAR SLIGHT AT ... (OR FROM ... TO ...) O'CLOCK
V	VERMIN (RATS AND MICE)
WL	WATER LEVEL ...% HEIGHT/DIAMETER
X	SEWER COLLAPSED ...% CROSS-SECTIONAL AREA LOSS

MANHOLE NODE: Combined Water	MH 101	PHOTOGRAPHIC PLAN

EXTERNAL PHOTOGRAPH:

INTERNAL PHOTOGRAPH:

MANHOLE NODE: Combined Water	MH 102	PHOTOGRAPHIC PLAN

EXTERNAL PHOTOGRAPH:

INTERNAL PHOTOGRAPH:

MANHOLE NODE: Combined Water	MH 103	PHOTOGRAPHIC PLAN

EXTERNAL PHOTOGRAPH:

INTERNAL PHOTOGRAPH:

MANHOLE NODE: Combined Water	MH 104	PHOTOGRAPHIC PLAN

EXTERNAL PHOTOGRAPH:

INTERNAL PHOTOGRAPH:

MANHOLE NODE: Combined Water	MH 105	PHOTOGRAPHIC PLAN

EXTERNAL PHOTOGRAPH:

INTERNAL PHOTOGRAPH:

MANHOLE NODE: Combined Water	MH 105A	PHOTOGRAPHIC PLAN

EXTERNAL PHOTOGRAPH:

INTERNAL PHOTOGRAPH:

MANHOLE NODE: Surface Water	MH 01	PHOTOGRAPHIC PLAN

EXTERNAL PHOTOGRAPH:

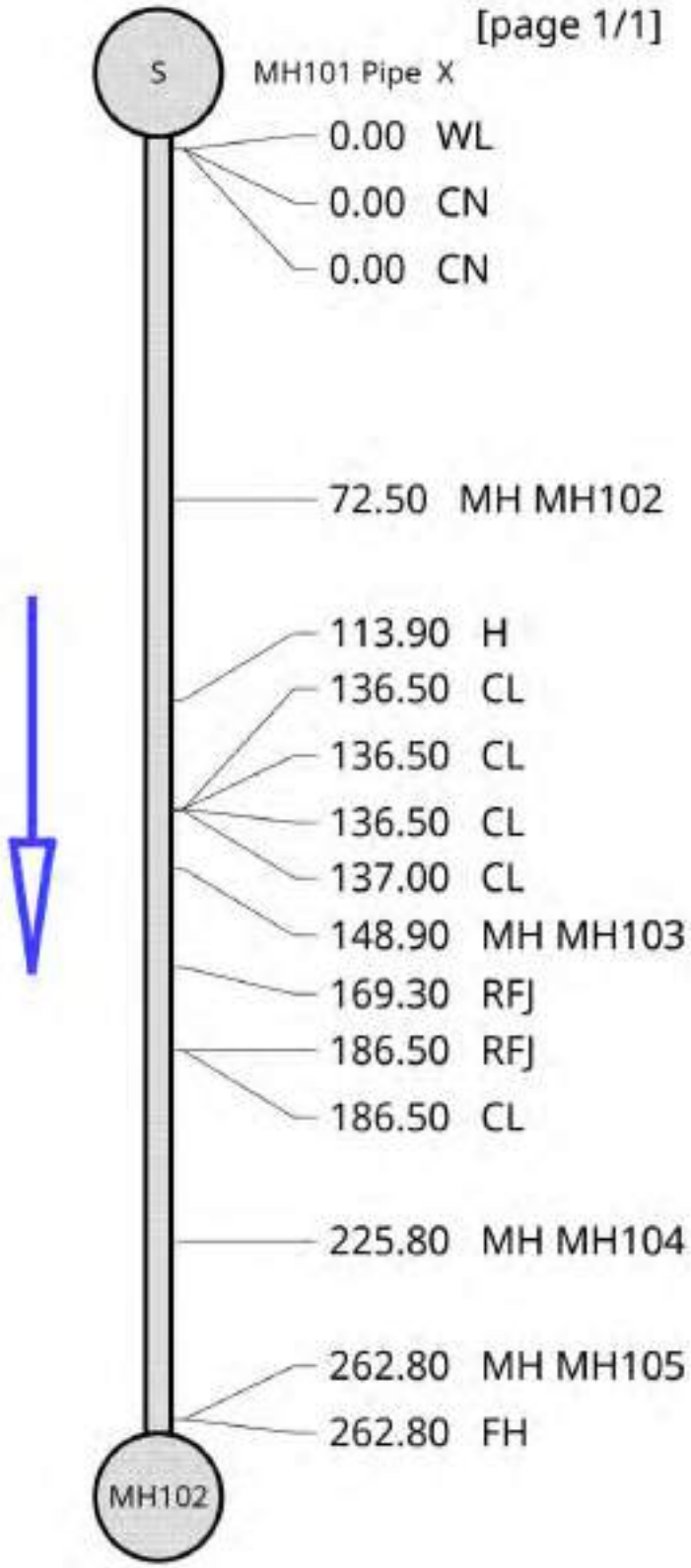
INTERNAL PHOTOGRAPH:

1 MH101 Pipe X Drain / Sewer Survey

1.1 Survey Header

1.1.1	**Surveyed by (Operator)**	Hobson-Clarke
1.1.2	**Contract no.**	N/A
1.1.3	**Job no.**	109726
1.1.4	**Catchment (Drainage area)**	N/A
1.1.5	**Division**	N/A
1.1.6	**District**	N/A
1.1.7	**Pipeline length ref**	N/AA
1.1.8	**Date**	200624
1.1.9	**Time**	09:41
1.1.10	**Location**	Cowersley
1.1.11	**Start manhole no.**	MH101 Pipe X
1.1.12	**Start depth**	1.96m
1.1.13	**Start cover level**	N/A
1.1.14	**Start invert level**	N/A
1.1.15	**Finish manhole no.**	MH102
1.1.16	**Finish depth**	N/Am
1.1.17	**Finish cover level**	N/A
1.1.18	**Finish invert level**	N/A
1.1.19	**Use of Drain**	(C) Combined
1.1.20	**Direction**	(D) Survey downstream (camera pointing with flow)
1.1.21	**Size 1 (diameter/height)**	500mm
1.1.22	**Size 2 (width)**	500mm
1.1.23	**Shape**	(C) Circular
1.1.24	**Material**	(CO) Concrete
1.1.25	**Lining**	
1.1.26	**Pipe length**	N/Am
1.1.27	**Total length**	N/Am
1.1.28	**Year laid**	N/A
1.1.29	**Video cassette number**	N/A
1.1.30	**Comments: General**	
1.1.31	**Purpose**	(F) Sample survey to determine asset condition
1.1.32	**Sewer category**	(Z) Not Known
1.1.33	**Pre-cleaning**	(N) No
1.1.34	**Weather**	(1) Dry
1.1.35	**Location code**	(C) Light road (rural roads with light traffic, town and city back streets, estate roads and parking areas)
1.1.36	**Further location details**	

1.2 Diagram


[page 1/1]
S
MH101 Pipe X
0.00 WL
0.00 CN
0.00 CN
72.50 MH MH102
113.90 H
136.50 CL
136.50 CL
136.50 CL
137.00 CL
148.90 MH MH103
169.30 RFJ
186.50 RFJ
186.50 CL
225.80 MH MH104
262.80 MH MH105
262.80 FH
MH102

1.3 Observations

Distance Cont. Defect Clock (At – To) Junta	Condition code and attributes Remarks	Photo Ref Video Ref
0.0	(WL) Water level ...% height/diameter Percentage: 10%	./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-09_45_18_839.jpg 
		0:00:00
0.0 01	(CN) Connection at ... o'clock, diameter ...mm Clock At/From: 01 Diameter/Dimension: 150	./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-09_45_24_162.jpg 
		0:00:02
0.0 12	(CN) Connection at ... o'clock, diameter ...mm Clock At/From: 12 Diameter/Dimension: 225	./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-09_45_57_062.jpg 
		0:00:18
72.5	(MH) Manhole/node	./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-09_50_32_074.jpg 
	MH102	0:04:01
113.9 11 - 01	(H) Hole in sewer at ... (OR from ... to ...) o'clock Clock At/From: 11 Clock To: 01 Diameter/Dimension: 100	./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-09_53_23_273.jpg 
		0:06:23
136.5 12	(CL) Crack longitudinal at ... o'clock Clock At/From: 12	./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-09_55_39_319.jpg 
		0:08:29

Distance Cont. Defect Clock (At – To)	Condition code and attributes	Photo Ref
Junta	Remarks	Video Ref
136.5 03	(CL) Crack longitudinal at ... o'clock Clock At/From: 03	./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-09_55_48_056.jpg 
		0:08:30
136.5 07	(CL) Crack longitudinal at ... o'clock Clock At/From: 07	./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-09_55_56_667.jpg 
		0:08:30
137.0 06	(CL) Crack longitudinal at ... o'clock Clock At/From: 06	./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-09_56_37_525.jpg 
		0:08:56
148.9	(MH) Manhole/node	./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-09_57_27_563.jpg 
	MH103	0:09:43
169.3	(RFJ) Roots fine at joint	./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-09_58_42_603.jpg 
		0:10:50
186.5	(RFJ) Roots fine at joint	./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-09_59_56_593.jpg 
		0:11:53

Distance Cont. Defect Clock (At – To) Junta	Condition code and attributes Remarks	Photo Ref Video Ref
186.5 06	(CL) Crack longitudinal at ... o'clock Clock At/From: 06	./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-10_00_02_209.jpg  0:11:53
225.8 	(MH) Manhole/node MH104	./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-10_02_19_714.jpg  0:14:05
262.8 	(MH) Manhole/node MH105	./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-10_16_22_651.jpg  0:18:45
262.8 	(FH) Finish survey	./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-10_16_41_854.jpg  0:18:50

1.4 Photographs

(WL) Water level ...% height/diameter ./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-

(CN) Connection at ... o'clock, diameter ...mm ./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-

(CN) Connection at ... o'clock, diameter ...mm ./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-

(MH) Manhole/node ./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-

(H) Hole in sewer at ... (OR from ... to ...) ./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-

(CL) Crack longitudinal at ... o'clock ./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-

(CL) Crack longitudinal at ... o'clock ./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-

(CL) Crack longitudinal at ... o'clock ./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-

(CL) Crack longitudinal at ... o'clock ./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-

(MH) Manhole/node ./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-

(RFJ) Roots fine at joint ./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-

(RFJ) Roots fine at joint ./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-

(CL) Crack longitudinal at ... o'clock ./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-

(MH) Manhole/node ./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-

(MH) Manhole/node ./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-

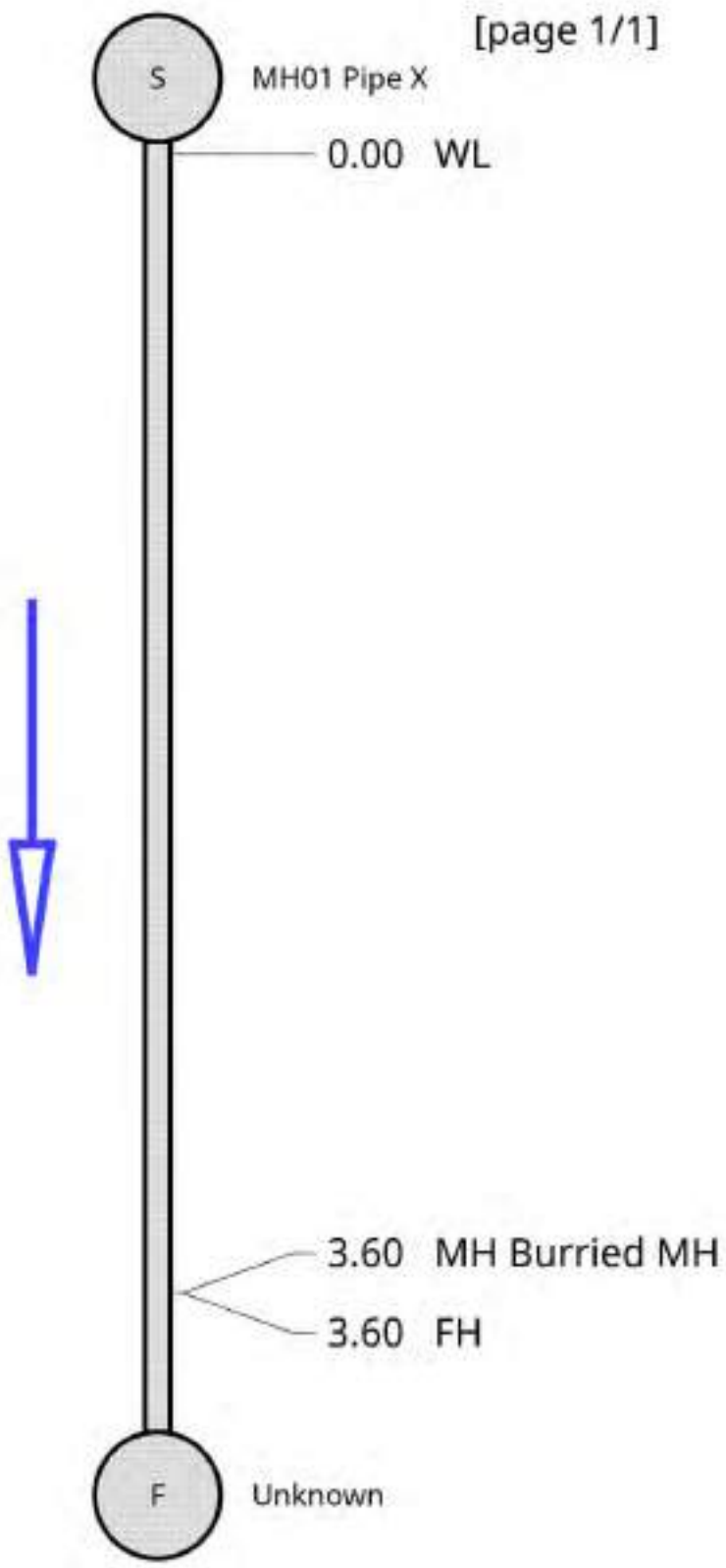
(FH) Finish survey ./MH101-Pipe---X/MH101-Pipe---X_2024_06_20-

2 MH01 Pipe X Drain / Sewer Survey

2.1 Survey Header

2.1.1	**Surveyed by (Operator)**	Hobson-Clarke
2.1.2	**Contract no.**	N/A
2.1.3	**Job no.**	109726
2.1.4	**Catchment (Drainage area)**	N/A
2.1.5	**Division**	N/A
2.1.6	**District**	N/A
2.1.7	**Pipeline length ref**	N/AA
2.1.8	**Date**	200624
2.1.9	**Time**	11:46
2.1.10	**Location**	Cowersley
2.1.11	**Start manhole no.**	MH01 Pipe X
2.1.12	**Start depth**	0.82m
2.1.13	**Start cover level**	N/A
2.1.14	**Start invert level**	N/A
2.1.15	**Finish manhole no.**	Unknown
2.1.16	**Finish depth**	N/Am
2.1.17	**Finish cover level**	N/A
2.1.18	**Finish invert level**	N/A
2.1.19	**Use of Drain**	(S) Surface Water
2.1.20	**Direction**	(D) Survey downstream (camera pointing with flow)
2.1.21	**Size 1 (diameter/height)**	225mm
2.1.22	**Size 2 (width)**	225mm
2.1.23	**Shape**	(C) Circular
2.1.24	**Material**	(CO) Concrete
2.1.25	**Lining**	
2.1.26	**Pipe length**	N/Am
2.1.27	**Total length**	N/Am
2.1.28	**Year laid**	N/A
2.1.29	**Video cassette number**	N/A
2.1.30	**Comments: General**	
2.1.31	**Purpose**	(F) Sample survey to determine asset condition
2.1.32	**Sewer category**	(Z) Not Known
2.1.33	**Pre-cleaning**	(N) No
2.1.34	**Weather**	(1) Dry
2.1.35	**Location code**	(C) Light road (rural roads with light traffic, town and city back streets, estate roads and parking areas)
2.1.36	**Further location details**	

2.2 Diagram



2.3 Observations

Distance Cont. Defect Clock (At – To)	Condition code and attributes	Photo Ref
Junta	Remarks	Video Ref
0.0	(WL) Water level ...% height/diameter Percentage: 5%	./MH01-Pipe-----X/MH01-Pipe-----X_2024_06_20-11_49_03_667.jpg 
		0:00:00
3.6	(MH) Manhole/node	./MH01-Pipe-----X/MH01-Pipe-----X_2024_06_20-11_52_01_920.jpg 
	Burried MH	0:02:38
3.6	(FH) Finish survey	./MH01-Pipe-----X/MH01-Pipe-----X_2024_06_20-11_52_10_717.jpg 
		0:02:38

2.4 Photographs

(WL) Water level ...% height/diameter ./MH01-Pipe-----X/MH01-Pipe-----X_2024_06_20-

(MH) Manhole/node ./MH01-Pipe-----X/MH01-Pipe-----X_2024_06_20-

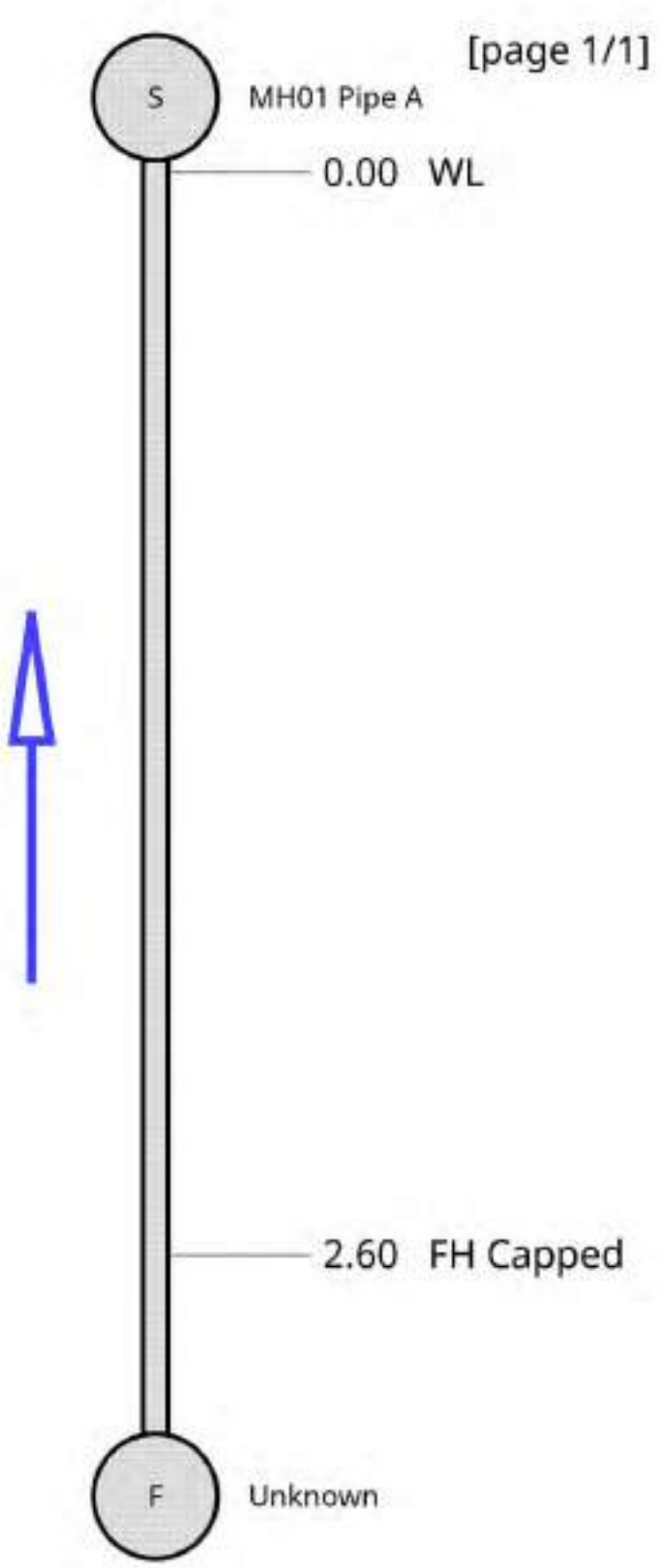
(FH) Finish survey ./MH01-Pipe-----X/MH01-Pipe-----X_2024_06_20-

3 MH01 Pipe A Drain / Sewer Survey

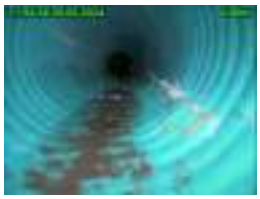
3.1 Survey Header

3.1.1	**Surveyed by (Operator)**	Hobson-Clarke
3.1.2	**Contract no.**	N/A
3.1.3	**Job no.**	109726
3.1.4	**Catchment (Drainage area)**	N/A
3.1.5	**Division**	N/A
3.1.6	**District**	N/A
3.1.7	**Pipeline length ref**	N/AA
3.1.8	**Date**	200624
3.1.9	**Time**	11:54
3.1.10	**Location**	Cowersley
3.1.11	**Start manhole no.**	MH01 Pipe A
3.1.12	**Start depth**	0.32m
3.1.13	**Start cover level**	N/A
3.1.14	**Start invert level**	N/A
3.1.15	**Finish manhole no.**	Unknown
3.1.16	**Finish depth**	N/Am
3.1.17	**Finish cover level**	N/A
3.1.18	**Finish invert level**	N/A
3.1.19	**Use of Drain**	(S) Surface Water
3.1.20	**Direction**	(U) Survey upstream (camera pointing against flow)
3.1.21	**Size 1 (diameter/height)**	150mm
3.1.22	**Size 2 (width)**	150mm
3.1.23	**Shape**	(C) Circular
3.1.24	**Material**	(PVC) Polyvinyl chloride
3.1.25	**Lining**	
3.1.26	**Pipe length**	N/Am
3.1.27	**Total length**	N/Am
3.1.28	**Year laid**	N/A
3.1.29	**Video cassette number**	N/A
3.1.30	**Comments: General**	
3.1.31	**Purpose**	(F) Sample survey to determine asset condition
3.1.32	**Sewer category**	(Z) Not Known
3.1.33	**Pre-cleaning**	(N) No
3.1.34	**Weather**	(1) Dry
3.1.35	**Location code**	(C) Light road (rural roads with light traffic, town and city back streets, estate roads and parking areas)
3.1.36	**Further location details**	

3.2 Diagram

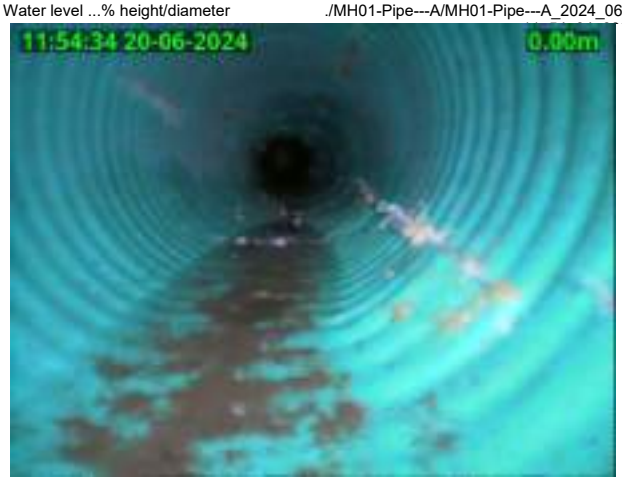


3.3 Observations

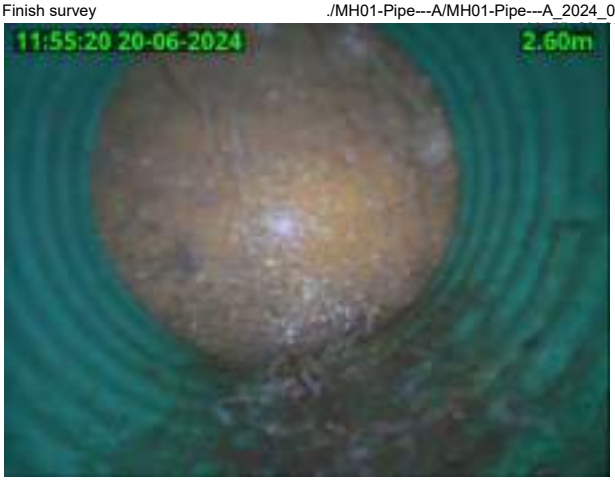
Distance Cont. Defect Clock (At – To)	Condition code and attributes	Photo Ref
Junta	Remarks	Video Ref
0.0	(WL) Water level ...% height/diameter Percentage: 5%	./MH01-Pipe---A/MH01-Pipe---A_2024_06_20-11_54_34_686.jpg 
		0:02:39
2.6	(FH) Finish survey	./MH01-Pipe---A/MH01-Pipe---A_2024_06_20-11_55_20_368.jpg 
	Capped	0:00:42

3.4 Photographs

(WL) Water level ...% height/diameter ./MH01-Pipe---A/MH01-Pipe---A_2024_06_20-



(FH) Finish survey ./MH01-Pipe---A/MH01-Pipe---A_2024_06_20-

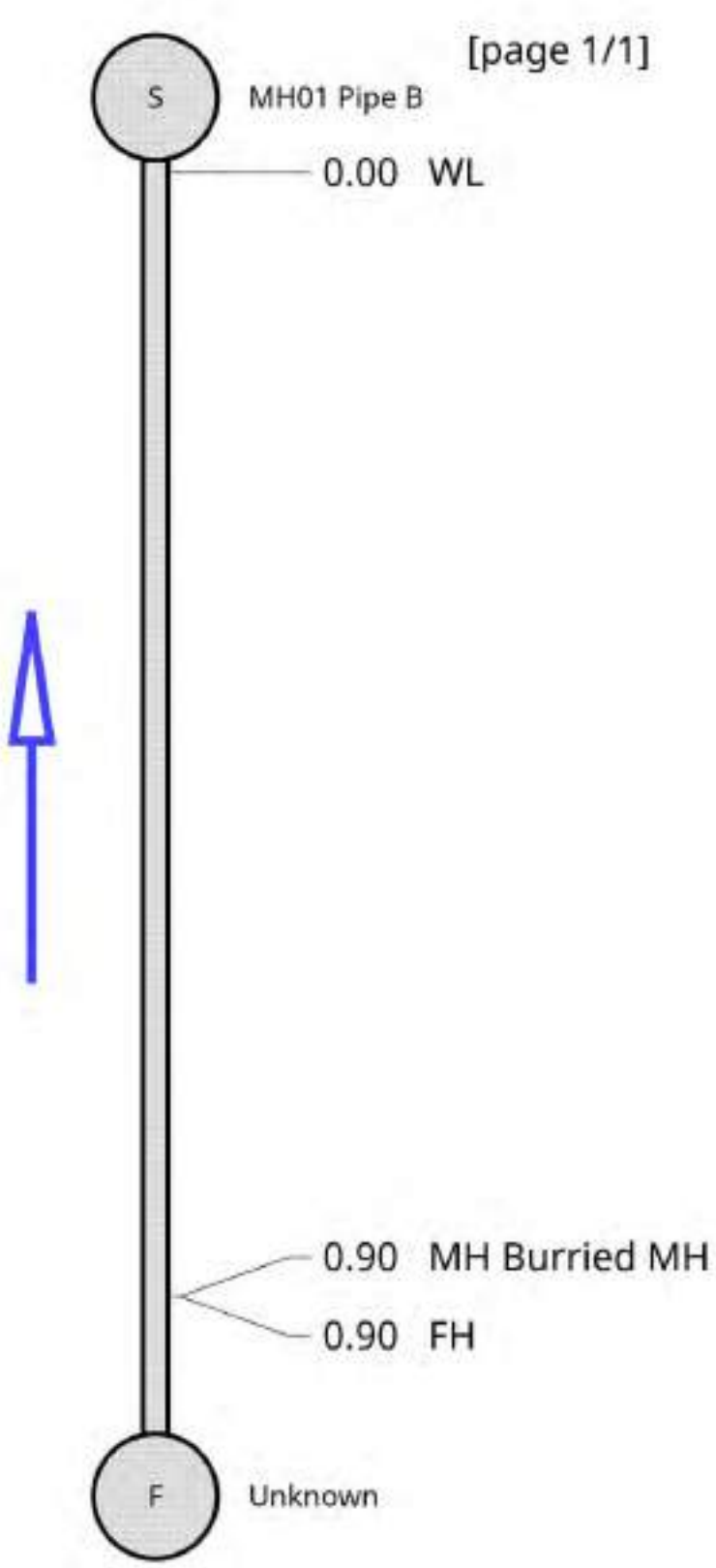


4 MH01 Pipe B Drain / Sewer Survey

4.1 Survey Header

4.1.1	**Surveyed by (Operator)**	Hobson-Clarke
4.1.2	**Contract no.**	N/A
4.1.3	**Job no.**	109726
4.1.4	**Catchment (Drainage area)**	N/A
4.1.5	**Division**	N/A
4.1.6	**District**	N/A
4.1.7	**Pipeline length ref**	N/AA
4.1.8	**Date**	200624
4.1.9	**Time**	11:57
4.1.10	**Location**	Cowersley
4.1.11	**Start manhole no.**	MH01 Pipe B
4.1.12	**Start depth**	0.80m
4.1.13	**Start cover level**	N/A
4.1.14	**Start invert level**	N/A
4.1.15	**Finish manhole no.**	Unknown
4.1.16	**Finish depth**	N/Am
4.1.17	**Finish cover level**	N/A
4.1.18	**Finish invert level**	N/A
4.1.19	**Use of Drain**	(S) Surface Water
4.1.20	**Direction**	(U) Survey upstream (camera pointing against flow)
4.1.21	**Size 1 (diameter/height)**	225mm
4.1.22	**Size 2 (width)**	225mm
4.1.23	**Shape**	(C) Circular
4.1.24	**Material**	(PVC) Polyvinyl chloride
4.1.25	**Lining**	
4.1.26	**Pipe length**	N/Am
4.1.27	**Total length**	N/Am
4.1.28	**Year laid**	N/A
4.1.29	**Video cassette number**	N/A
4.1.30	**Comments: General**	
4.1.31	**Purpose**	(F) Sample survey to determine asset condition
4.1.32	**Sewer category**	(Z) Not Known
4.1.33	**Pre-cleaning**	(N) No
4.1.34	**Weather**	(1) Dry
4.1.35	**Location code**	(C) Light road (rural roads with light traffic,town and city back streets,estate roads and parking areas)
4.1.36	**Further location details**	

4.2 Diagram



4.3 Observations

Distance Cont. Defect Clock (At – To) Junta	Condition code and attributes Remarks	Photo Ref Video Ref
0.0	(WL) Water level ...% height/diameter Percentage: 5%	./MH01-Pipe---B/MH01-Pipe---B_2024_06_20-11_57_36_478.jpg 
		0:00:02
0.9	(MH) Manhole/node	./MH01-Pipe---B/MH01-Pipe---B_2024_06_20-11_59_12_213.jpg 
	Burried MH	0:00:53
0.9	(FH) Finish survey	./MH01-Pipe---B/MH01-Pipe---B_2024_06_20-11_59_20_206.jpg 
		0:00:54

4.4 Photographs

(WL) Water level ...% height/diameter ./MH01-Pipe---B/MH01-Pipe---B_2024_06_20-

(MH) Manhole/node ./MH01-Pipe---B/MH01-Pipe---B_2024_06_20-

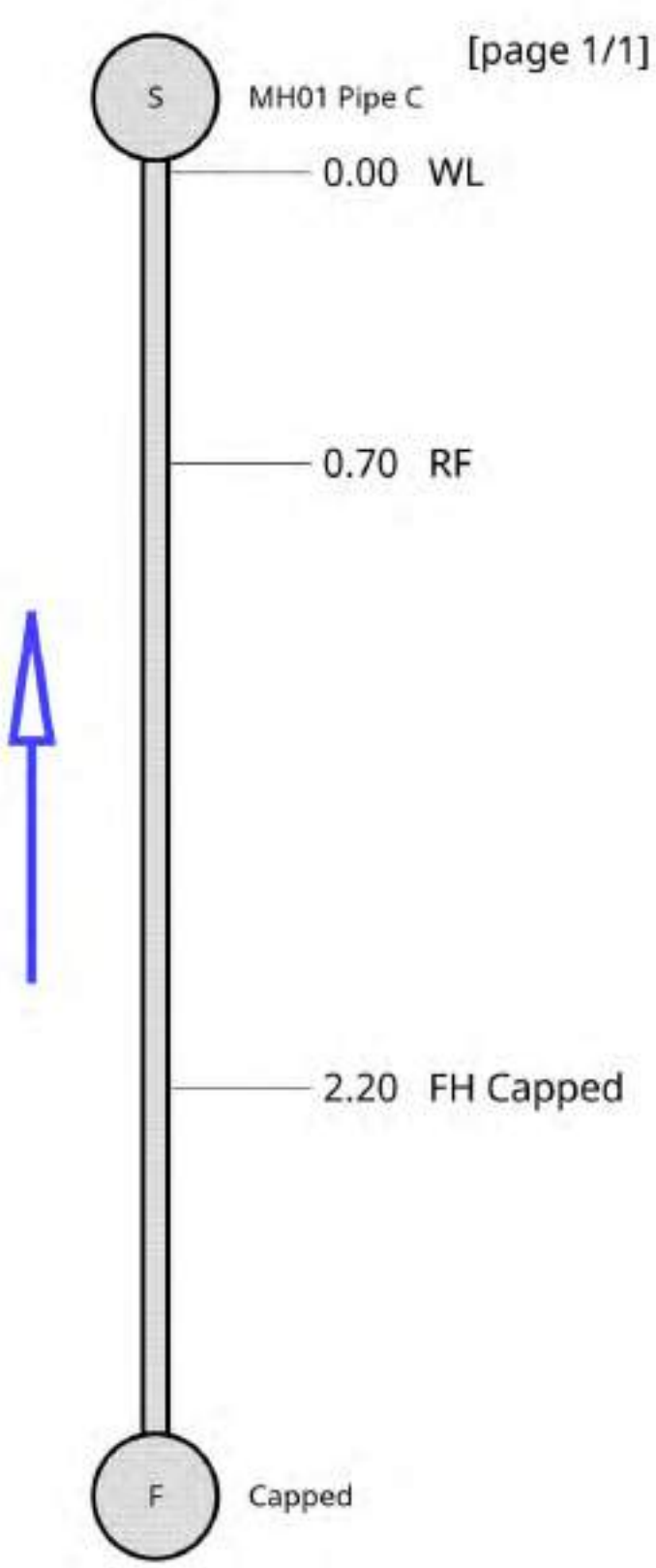
(FH) Finish survey ./MH01-Pipe---B/MH01-Pipe---B_2024_06_20-

5 MH01 Pipe C Drain / Sewer Survey

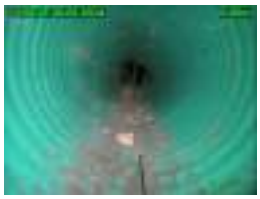
5.1 Survey Header

5.1.1	**Surveyed by (Operator)**	Hobson-Clarke
5.1.2	**Contract no.**	N/A
5.1.3	**Job no.**	109726
5.1.4	**Catchment (Drainage area)**	N/A
5.1.5	**Division**	N/A
5.1.6	**District**	N/A
5.1.7	**Pipeline length ref**	N/AA
5.1.8	**Date**	200624
5.1.9	**Time**	11:59
5.1.10	**Location**	Cowersley
5.1.11	**Start manhole no.**	MH01 Pipe C
5.1.12	**Start depth**	0.33m
5.1.13	**Start cover level**	N/A
5.1.14	**Start invert level**	N/A
5.1.15	**Finish manhole no.**	Capped
5.1.16	**Finish depth**	N/Am
5.1.17	**Finish cover level**	N/A
5.1.18	**Finish invert level**	N/A
5.1.19	**Use of Drain**	(S) Surface Water
5.1.20	**Direction**	(U) Survey upstream (camera pointing against flow)
5.1.21	**Size 1 (diameter/height)**	150mm
5.1.22	**Size 2 (width)**	150mm
5.1.23	**Shape**	(C) Circular
5.1.24	**Material**	(PVC) Polyvinyl chloride
5.1.25	**Lining**	
5.1.26	**Pipe length**	N/Am
5.1.27	**Total length**	N/Am
5.1.28	**Year laid**	N/A
5.1.29	**Video cassette number**	N/A
5.1.30	**Comments: General**	
5.1.31	**Purpose**	(F) Sample survey to determine asset condition
5.1.32	**Sewer category**	(Z) Not Known
5.1.33	**Pre-cleaning**	(N) No
5.1.34	**Weather**	(1) Dry
5.1.35	**Location code**	(C) Light road (rural roads with light traffic,town and city back streets,estate roads and parking areas)
5.1.36	**Further location details**	

5.2 Diagram

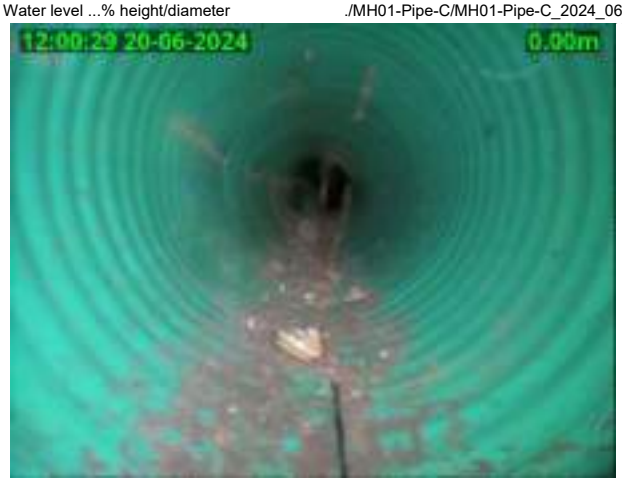


5.3 Observations

Distance Cont. Defect Clock (At – To)	Condition code and attributes	Photo Ref
Junta	Remarks	Video Ref
0.0	(WL) Water level ...% height/diameter Percentage: 5%	./MH01-Pipe-C/MH01-Pipe-C_2024_06_20-12_00_29_935.jpg 
		0:00:55
0.7	(RF) Roots fine	./MH01-Pipe-C/MH01-Pipe-C_2024_06_20-12_00_47_766.jpg 
		0:00:15
2.2	(FH) Finish survey	./MH01-Pipe-C/MH01-Pipe-C_2024_06_20-12_01_20_276.jpg 
	Capped	0:00:43

5.4 Photographs

(WL) Water level ...% height/diameter ./MH01-Pipe-C/MH01-Pipe-C_2024_06_20-



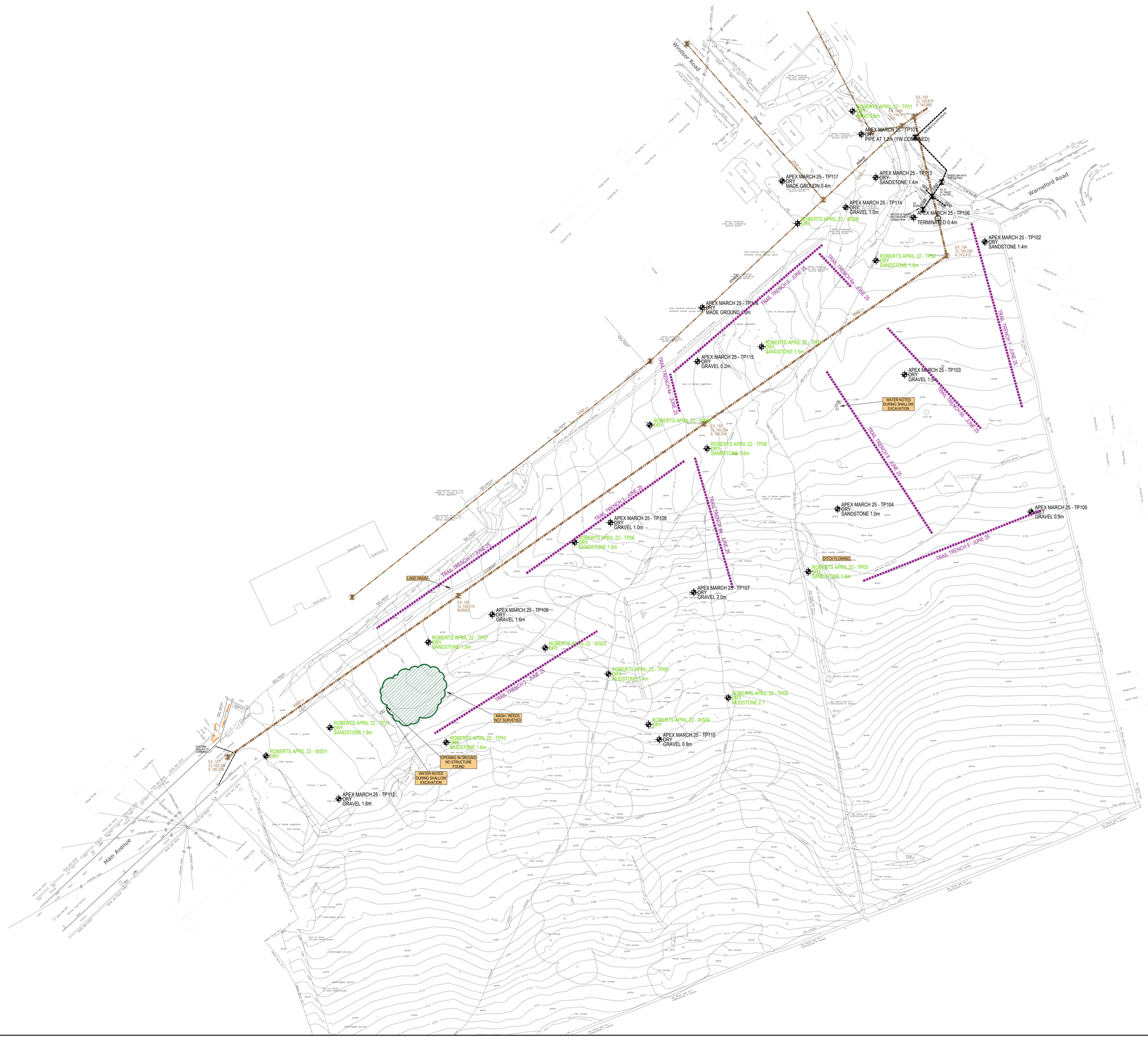
(RF) Roots fine ./MH01-Pipe-C/MH01-Pipe-C_2024_06_20-

(FH) Finish survey ./MH01-Pipe-C/MH01-Pipe-C_2024_06_20-


PERSEVERANCE STREET
Warneford Road
WARNEFORD
Stone Culvert located here
Dye tested Green, waited 35 minutes but no dye appeared in manhole located on culvert downstream.
Area in field very wet and boggy at this location


Warneford Road
SPRING NOTED ON TOPO BUT NOT LOCATED ON DATE OF WALKOVER
WATER FEATURE LOCATED APPROX. WHERE * IS. VISIBLE TRICKLING WATER. GROUND DRY IMMEDIATELY DOWNSTREAM
DITCH DRY ON DATE OF WALKOVER
WATER FEATURE WITH STONE CAP LOCATED. VISIBLE TRICKLING WATER. GROUND DRY IMMEDIATELY DOWNSTREAM
BOGGY GROUND NOTED ON TOPO - DRY ON DATE OF WALKOVER

Possible spring or former culvert



Only PDF/ DWF Issues of this drawing are controlled. All other formats (eg. DWG AutoCAD FILES) are UN-controlled and are used at your own risk.

CONSTRAINTS PLAN

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH :
   ALL EXISTING UTILITIES RECORDS.
   TOPOGRAPHICAL SURVEY.
   TRIAL HOLE INVESTIGATIONS IF AVAILABLE.
2. SERVICES INDICATED ON THIS DRAWING ARE INTERPOLATED FROM EXISTING RECORDS. ADDITIONAL SERVICES MAY BE PRESENT THAT ARE NOT IDENTIFIED ON RECORDS.
3. EXISTING SERVICES ARE TO BE LOCATED BY HAND PRIOR COMMENCEMENT OF ADJACENT EXCAVATION WORKS.
4. SUPPLIES TO EXISTING BUILDINGS ARE TO BE TERMINATED BACK TO MAIN BY RELEVANT UTILITY COMPANY PRIOR TO DEMOLITION WORKS.
5. ANY DISCREPANCIES ARE TO BE REPORTED TO ENGINEER, IF IN DOUBT ASK.

EXISTING COMBINED SEWER

EXISTING COMBINED SEWER TO BE SURVEYED

EXISTING SURFACE WATER

SURFACE WATER FLOODING

SURFACE WATER FLOW ROUTES

Rev.	Date	Revision Details	Drawn	Checked

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Client: STRATA / THIRTEEN

Project: MAIN AVEUNE
COWERSLEY

Title: INVESTIGATION RESULTS

Drawn	Checked	Date
ND		24.07.2025

Drawing Number: -

Drawing Status	Scale	Rev.
INFORMATION	1:500 - A1	

Appendix 9 – Drainage Strategy

Only PDF/ DWF Issues of this drawing are controlled. All other formats (eg. DWG AutoCAD FILES) are UN-controlled and are used at your own risk.

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7. THE CONTRACTOR MUST MONITOR THE "AS BUILT" PROGRESS OF EACH CONSTRUCTION STAGE (ROADS/SEWERS/PLOT WORKS ETC), TO ENABLE THE NEXT STAGES OF CONSTRUCTION TO BE CHECKED BEFORE INSTALLATION.

HIGHWAYS

1. ALL HIGHWAY WORKS TO BE CARRIED OUT IN ACCORDANCE WITH THE CURRENT LOCAL AUTHORITY DESIGN GUIDE AND SPECIFICATION
2. ALL EXCAVATIONS BELOW PROPOSED AND EXISTING HIGHWAYS TO BE BACK FILLED WITH GRANULAR TYPE 1 SUB BASE AND WELL COMPACTED IN LAYERS NOT EXCEEDING 150MM, UNLESS OTHERWISE AGREED.
3. HIGHWAY AUTHORITY TO BE NOTIFIED BY THE CONTRACTOR PRIOR TO THE COMMENCEMENT OF WORKS.

ADOPTABLE DRAINAGE

1. ALL ADOPTABLE SEWER WORKS AND MATERIAL TO BE IN ACCORDANCE WITH “CODE FOR ADOPTION”. THE RELEVANT BRITISH/EUROPEAN AND YORKSHIRE WATER'S STANDARDS/REQUIREMENTS/ADDENDUM TO THE MECHANICAL AND ELECTRICAL SPECIFICATION AND KITEMARKED
2. MANHOLE COVERS SHALL/MUST HAVE A CLEAR OPENING OF 600MM AND SHALL BE CLASS D400 TO BS EN 124 WITH 150MM DEEP FRAMES IN HIGHWAYS
3. FILLED GROUND MUST BE FILLED AND CONSOLIDATED UNDER THE SUPERVISION AND TO THE SATISFACTION OF YORKSHIRE WATER BEFORE ANY SEWER WORKS ARE CARRIED OUT
4. YORKSHIRE WATER IS NOT OBLIGED TO ACCEPT FILTER DRAIN/LAND DRAINAGE RUN-OFF INTO THE PUBLIC SEWER NETWORK OR ADOPTABLE DRAINAGE SYSTEM (DIRECTLY OR IN-DIRECTLY). AN ALTERNATIVE METHOD OF DISPOSAL OF THE LAND DRAINAGE RUN-OFF WILL THEREFORE BE REQUIRED AND YOU WILL HAVE TO LIAISE WITH THE LOCAL AUTHORITY, LAND DRAINAGE SECTION REGARDING THE DISPOSAL OF THE FILTER DRAIN/LAND DRAINAGE RUN-OFF
5. THE ADOPTABLE SEWERS SHOULD BE A MINIMUM OF 1M AND MANHOLES 0.5M FROM KERB FACES AND SERVICE MARGINS
6. SEWERS MUST HAVE 5 METRES CLEARANCE FROM TREES AND HEDGES OR THE WIDTH OF THE CANOPY AT MATURE HEIGHT.
7. SEWERS TO BE LAID IN CLASS “S” BEDDING (150MM GRANULAR BED AND SURROUND). WHERE DEPTH OF COVER TO TOP OF THE SEWER IS LESS THAN 1.2M IN HIGHWAYS AND VERGES (OR LESS THAN 900MM IN NONVEHICULAR ACCESS AREAS) THEN A CONCRETE SLAB SHOULD BE PROVIDED ABOVE GRANULAR BED AND SURROUND
8. BEDDING AND BACKFILL MATERIAL TO CONFORM TO THE REQUIREMENT OF WATER INDUSTRY SPECIFICATION 4-08-02 (TABLE A2).
9. YORKSHIRE WATER POLICY IS THAT TYPE “C” BRICK MANHOLES AND 1050MM DIAMETER MANHOLE RINGS ARE NOT PREFERRED. INSTEAD, IT IS PREFERRED THAT YOU USE A TYPE “B” MANHOLE WITH 1200MM DIAMETER OR 1500MM DIAMETER RINGS, WITH THE OPENING SITED OVER THE CHANNEL WHERE DEPTH OF COVER TO PIPE SOFFIT IS 1 - 1.5M
10. ADOPTABLE PLASTIC SEWER PIPES TO BE BSI KITEMARKED (CERTIFIED TO WIS 4-35-01 AND BS/EN13476). ADOPTABLE PLASTIC SEWER PIPES TO BE LAID IN MAXIMUM 3 METRE LENGTHS UNLESS THERE IS A SPECIFIC OPERATIONAL NEED TO LAY LONGER LENGTHS. PLASTIC CHANNEL SECTIONS IN MANHOLES ARE NOT ACCEPTABLE AND YORKSHIRE WATER WOULD REQUIRE CLAY WARE CHANNEL IN MANHOLES
11. THE MINIMUM CRUSHING STRENGTH FOR CLAY PIPES SHOULD BE AS FOLLOWS: 100MM DIA. 40KN/M, 150MM DIA. 40KN/M, 225MM DIA. 45KN/M AND 300MM DIA. 72KN/M. THE MINIMUM CRUSHING STRENGTH FOR CONCRETE PIPES SHOULD BE - (CLASS120 TO EN 1916/BS5911-1 2002). PLASTIC PIPES SHOULD CONFORM TO WIS 4-35-01 AND BS EN13476
12. WHERE A B125 COVER AND FRAME HAS BEEN APPROVED, THIS MUST NOT BE COATED IN PLASTIC AND MUST HAVE LIFTING EYES SUITABLY SIZED TO ACCOMMODATE STANDARD LIFTING KEYS. SCREW DOWN COVERS ARE NOT ACCEPTABLE
13. THERE MUST BE ENOUGH CLEARANCE AT CROSSOVERS TO ACCOMMODATE BEDDING TO BOTH PIPES, APPROX. 300MM : IF CROSSOVER IS NEAR THE ROCKER THEN THE CLEARANCE NEEDED MAY NEED TO BE INCREASED".

DRAINAGE WITHIN HIGHWAY REQUIREMENTS

14. ALL ADOPTABLE SEWER WORKS AND MATERIALS TO BE IN ACCORDANCE WITH CODE FOR ADOPTION AND NATIONAL SPECIFICATION DESIGN MANUAL FOR ROADS AND BRIDGES
15. ALL PCC UNITS IN OVERSIZE MANHOLES MUST HAVE A DESIGN WORKING LIFE OF 100 YEARS (MIN) IN ACCORDANCE WITH BS 8500-1:2015+A2:2019-TABLE A5.
16. PRECAST CONCRETE MANHOLE UNITS INCLUDING THEIR PCC COVER SLABS SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 1917 AND BS 5911-3 AND SHALL BE MANUFACTURED FROM CONCRETE WITH A DESIGN CHEMICAL CLASS DC-4 UNLESS SATISFACTORY EVIDENCE THROUGH SOIL ANALYSIS CAN BE PROVIDED THAT A LOWER CLASS WILL RESIST ATTACK FROM SOILS AND GROUND WATER.
17. PRECAST CONCRETE CORBEL SLABS SHALL COMPLY WITH BS 5911-3 TABLE 3 AND FIGURE 8.
18. COVER SLABS SHALL BE INSTALLED WITH A MINIMUM OF 300mm COVER TO FINISHED GROUND LEVEL.
19. SUBMISSION OF A CONSTRUCTION COMPLIANCE CERTIFICATE SHALL BE PROVIDED UPON COMPLETION OF DRAINAGE WORKS

EXISTING SERVICES

PRIOR TO THE COMMENCEMENT OF ANY WORKS UNDER GROUND MAPPING SURVEYS AND CONSTRAINTS PLAN IS TO BE REFERRED TO ANY DISCREPANCIES ARE TO BE REPORTED TO ENGINEER.

ANY EXISTING SERVICES WHICH MAY BE AFFECTED BY THE PROPOSED WORKS SHOULD BE LOCATED BY MEANS OF A HAND DIG IN CLOSE LIAISON WITH THE STATUTORY SERVICE AUTHORITIES. THE CONTRACTOR SHALL INFORM THE DEVELOPER OF ANY SERVICES THAT MAY AFFECT THE PROPOSED DESIGN. CONTRACTOR TO NOTIFY STATUTORY SERVICE AUTHORITIES PRIOR TO COMMENCEMENT OF WORK. AS CONSTRUCTED INFORMATION IT IS THE CONTRACTORS RESPONSIBILITY TO PROVIDE THE FOLLOWING AS CONSTRUCTED DRAWINGS TO THE DEVELOPER UPON THE COMPLETION OF THE WORKS COVERED BY THE CONTRACT :-

14. POSITION/CO-ORDINATES OF ALL ADOPTABLE MANHOLES.
15. INVERT AND COVER LEVELS OF ALL ADOPTABLE MANHOLES.
16. NEW GULLY POSITIONS AND CONNECTIONS.
17. POSITION AND DEPTH OF SERVICE DUCTS FOR WATER, GAS, ELECTRIC, BT, CABLE AND STREET LIGHTING, STATING SIZE AND NUMBER OF DUCTS.

LEGEND

ADOPTABLE DRAINAGE

- PROPOSED ADOPTABLE COMBINED MANHOLE (F1)
- PROPOSED ADOPTABLE STORM MANHOLE (S1)
- PROPOSED ADOPTABLE FOUL MANHOLE (F1)
- PROPOSED CULVERT (SC1)
- PROPOSED EASEMENT
- EXISTING ADOPTED STORM MANHOLE (ex.mh)
- EXISTING ADOPTED COMBINED MANHOLE (ex.mh)

HEALTH & SAFETY RISKS

IN ADDITION TO THE STANDARD HAZARDS AND RISKS NORMALLY ASSOCIATED WITH THE TYPE OF WORK DETAILED ON THIS DRAWING. PLEASE NOTE THE FOLLOWING RESIDUAL HEALTH AND SAFETY RISKS THESE RISKS ARE APPLICABLE TO THE SET OF DRAWINGS FORMING THE DESIGN

CONSTRUCTION RISKS

C1	BURIED SERVICES - OBTAIN ACCURATE LOCATIONS OF UNDERGROUND SERVICES PRIOR TO EXCAVATION.
C2	CONFINED SPACE WORKS - ENSURE STAFF ARE SUITABLY TRAINED.
C3	CONSTRUCTION ADJACENT LIVE TRAFFIC - ENSURE SAFE METHOD OF WORKING
C4	DEEP EXCAVATIONS - RISK OF LAND SLIPS AND LARGE FALLS CONNECTION TO EXISTING LIVE SEWERS - RISK OF DROWNING
C5	CONSTRUCTION ADJACENT LIVE TRAFFIC - ENSURE SAFE METHOD OF WORKING
C6	CONTAMINATED GROUND - SITE ASSESSMENT MUST BE CARRIED OUT TO DETERMINE RISK IF CONTAMINATED GROUND IS UNCOVERED.
C7	UNFORESEEN GROUND CONDITIONS - CONTRACTOR SHOULD CARRY OUT APPROPRIATE SURVEYS TO MINIMISE RISK OF ENCOUNTERING UNKNOWN STRUCTURES
C8	STEEP SIDED STRUCTURES/RETAINING WALLS - COULD RESULT IN FALLS FROM HEIGHT ENSURE FALL PROTECTION PRIOR TO PERMANENT FENCING BEING ERECTED.
C9	SHALLOW GROUND WATER WILL BE ENCOUNTERED <1m BGL

OPERATION & MAINTENANCE RISKS

OM 1	UNTREATED/POLLUTED WATER CAN CAUSE ILL HEALTH FOR OPERATIVES
OM 2	WORKING ON OR NEAR SEWERS STEEP SIDED STRUCTURES/RETAINING WALLS COULD RESULT IN FALLS FROM HEIGHT.
OM 3	ENSURE BARRIERS ARE PLACED AROUND TOPS OF RETAINING WALLS AND EXCAVATIONS PRIOR TO PERMANENT FENCING BEING ERECTED. CONFINED SPACE WORKS - ENSURE STAFF ARE SUITABLY TRAINED.

ALL WORKS MUST BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING IN ACCORDANCE WITH THE REQUIREMENTS DEFINED IN THE CDM REGULATIONS AND BS 8000

THE RISK LISTED ARE NOT EXHAUSTIVE REFER TO DESIGNERS RISK ASSESSMENT FOR FULL DETAILS

Rev.	Date	Revision Details	Drawn	Checked
P03	21.07.25	UPDATED TO SUIT STRATA COMMENTS	JR	ND
P02	17.07.25	UPDATED TO SUIT STRATA COMMENTS, CULVERT ADDED FOLLOWING DRAINAGE SURVEY	JR	ND
P01	28.02.25	FIRST ISSUE	JR	ND

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SUITE 12A, BROOKFIELD COURT, SELBY ROAD, LEEDS, LS25 1NB
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www.queensberrydesign.co.uk

Client: STRATA/ THIRTEEN

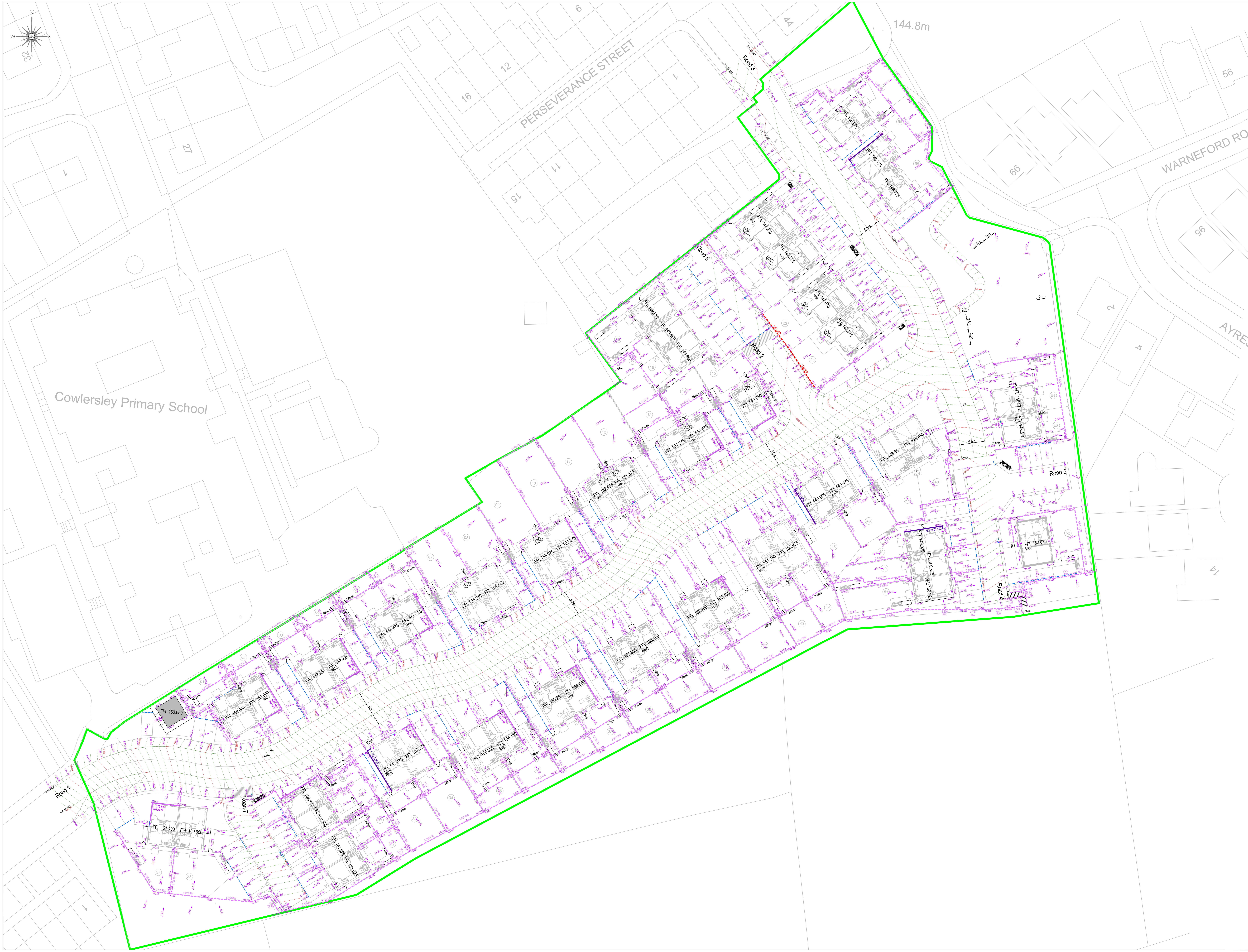
Project: MAIN AVENUE COWERSLEY

Title: ENGINEERING LAYOUT

Drawn	Checked	Date
JR	ND	28.02.2025

Drawing Number: 2153-QD-XX-HD-DR-C-03-01

Drawing Status	Scale	Rev.
TENDER	1:250 - A0	P03



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LEGEND

RETAINING WALL (RETAINED HEIGHT SHOWN) (EDGE PROTECTION REQUIRED OVER 600MM HT)	Rwall
BRICKWORK TO BE SHOWN BELOW DPC	??? bwk below ffl
DOUBLE DAMP PROOF COURSE	??? DDPC
PAVING FLAG STEPS - 300MM GOING 150MM RISE HANDRAIL TO BE PROVIDED FOR 3 OR MORE STEPS	
BATTER - THESE SHOULD NOT EXCEED 1:3 ENGINEERED DESIGN AS REQUIRED	
FINISHED GROUND LEVEL	93.579
DRAINAGE CHANNEL (B125 COVER)	
YARD GULLY (B125 COVER)	G

DPC LEVELS MUST NOT BE ALTERED WITHOUT INFORMING THE DESIGNER

REFER TO ARCHITECTS LAYOUT FOR DETAILS OF PROPOSED FENCING AND WALLS

Rev.	Date	Revision Details	Drawn	Checked
P03	21.07.25	UPDATED TO SUIT ARHCITECT'S COMMENTS	JR	ND
P02	16.07.25	UPDATED TO SUIT STRATA COMMENTS	JR	ND
P01	28.02.25	FIRST ISSUE	JR	ND

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Client: STRATA/ THIRTEEN

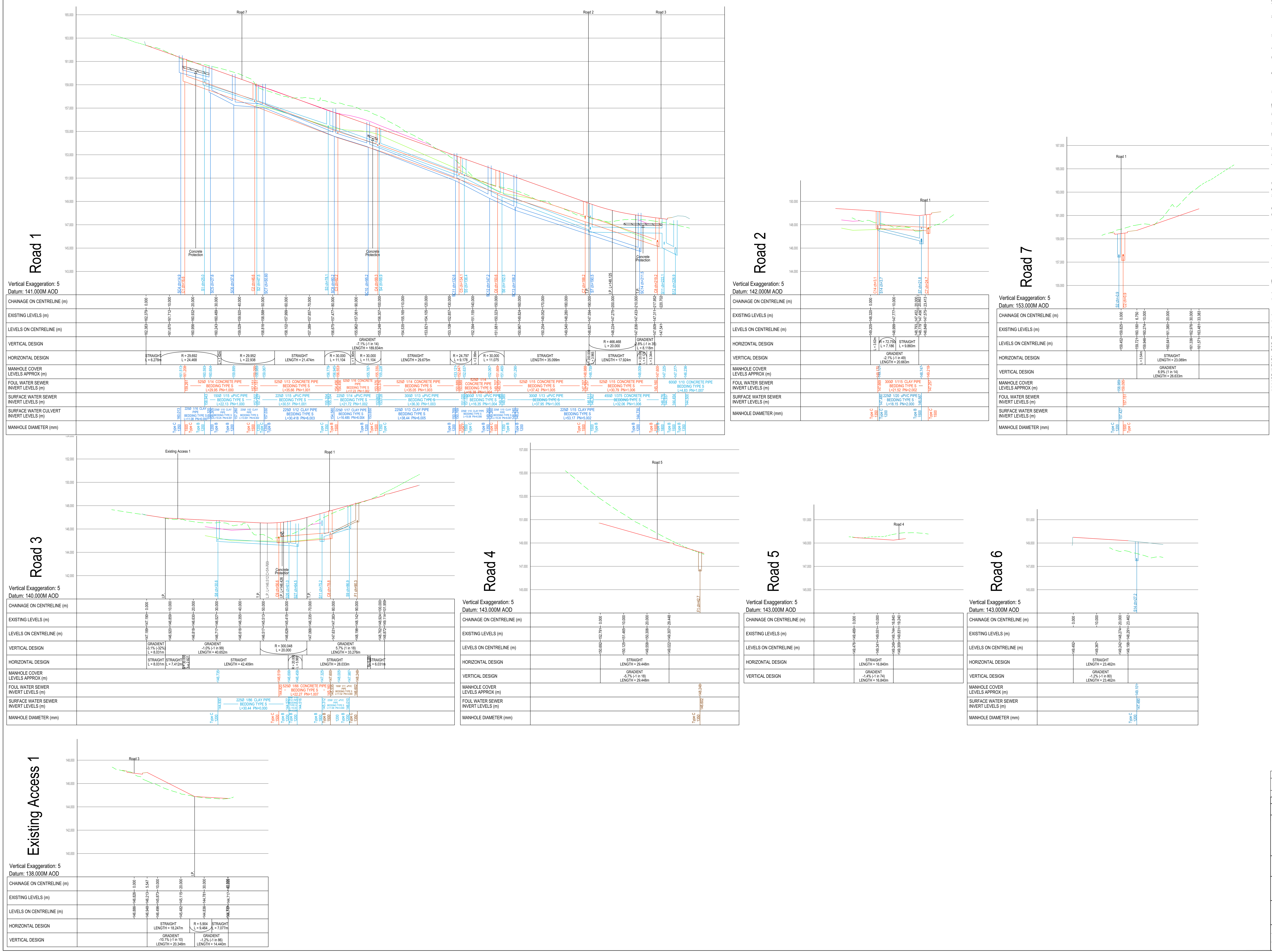
Project: MAIN AVENUE COWERSLEY

Title: EXTERNAL WORKS

Drawn	Checked	Date
JR	ND	28.02.2025

Drawing Number: 2153-QD-XX-HD-DR-C-04-01

Drawing Status	Scale	Rev.
TENDER	1:250 - A0	P03



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3. FILLED GROUND MUST BE FILLED AND CONSOLIDATED UNDER THE SUPERVISION AND TO THE SATISFACTION OF YORKSHIRE WATER BEFORE ANY SEWER WORKS ARE CARRIED OUT
4. YORKSHIRE WATER IS NOT OBLIGED TO ACCEPT FILTER DRAIN/LAND DRAINAGE RUN-OFF INTO THE PUBLIC SEWER NETWORK OR ADOPTABLE DRAINAGE SYSTEM (DIRECTLY OR IN-DIRECTLY). AN ALTERNATIVE METHOD OF DISPOSAL OF THE LAND DRAINAGE RUN-OFF WILL THEREFORE BE REQUIRED AND YOU WILL HAVE TO LIAISE WITH THE LOCAL AUTHORITY, LAND DRAINAGE SECTION REGARDING THE DISPOSAL OF THE FILTER DRAIN/LAND DRAINAGE RUN-OFF
5. THE ADOPTABLE SEWERS SHOULD BE A MINIMUM OF 1M AND MANHOLES 0.5M FROM KERB FACES AND SERVICE MARGINS
6. SEWERS MUST HAVE 5 METRES CLEARANCE FROM TREES AND HEDGES OR THE WIDTH OF THE CANOPY AT MATURE HEIGHT.
7. SEWERS TO BE LAID IN CLASS "S" BEDDING (150MM GRANULAR BED AND SURROUND). WHERE DEPTH OF COVER TO TOP OF THE SEWER IS LESS THAN 1.2M IN HIGHWAYS AND VERGES (OR LESS THAN 900MM IN NONVEHICULAR ACCESS AREAS) THEN A CONCRETE SLAB SHOULD BE PROVIDED ABOVE GRANULAR BED AND SURROUND
8. BEDDING AND BACKFILL MATERIAL TO CONFORM TO THE REQUIREMENT OF WATER INDUSTRY SPECIFICATION 4-08-02 (TABLE A2).
9. YORKSHIRE WATER POLICY IS THAT TYPE "C" BRICK MANHOLES AND 1050MM DIAMETER MANHOLE RINGS ARE NOT PREFERRED. INSTEAD, IT IS PREFERRED THAT YOU USE A TYPE "B" MANHOLE WITH 1200MM DIAMETER OR 1500MM DIAMETER RINGS, WITH THE OPENING SITED OVER THE CHANNEL WHERE DEPTH OF COVER TO PIPE SOFFIT IS 1 - 1.5M
10. ADOPTABLE PLASTIC SEWER PIPES TO BE BSI KITEMARKED (CERTIFIED TO WIS 4-35-01 AND BS/EN13476). ADOPTABLE PLASTIC SEWER PIPES TO BE LAID IN MAXIMUM 3 METRE LENGTHS UNLESS THERE IS A SPECIFIC OPERATIONAL NEED TO LAY LONGER LENGTHS. PLASTIC CHANNEL SECTIONS IN MANHOLES ARE NOT ACCEPTABLE AND YORKSHIRE WATER WOULD REQUIRE CLAY WARE CHANNEL IN MANHOLES
11. THE MINIMUM CRUSHING STRENGTH FOR CLAY PIPES SHOULD BE AS FOLLOWS: 100MM DIA. 40KN/M, 150MM DIA. 40KN/M, 225MM DIA. 45KN/M AND 300MM DIA. 72KN/M. THE MINIMUM CRUSHING STRENGTH FOR CONCRETE PIPES SHOULD BE - (CLASS120 TO EN 1916/BS5911-1 2002). PLASTIC PIPES SHOULD CONFORM TO WIS 4-35-01 AND BS EN13476
12. WHERE A B125 COVER AND FRAME HAS BEEN APPROVED, THIS MUST NOT BE COATED IN PLASTIC AND MUST HAVE LIFTING EYES SUITABLY SIZED TO ACCOMMODATE STANDARD LIFTING KEYS. SCREW DOWN COVERS ARE NOT ACCEPTABLE
13. THERE MUST BE ENOUGH CLEARANCE AT CROSSOVERS TO ACCOMMODATE BEDDING TO BOTH PIPES, APPROX. 300MM : IF CROSSOVER IS NEAR THE ROCKER THEN THE CLEARANCE NEEDED MAY NEED TO BE INCREASED".

DRAINAGE WITHIN HIGHWAY REQUIREMENTS

14. ALL ADOPTABLE SEWER WORKS AND MATERIALS TO BE IN ACCORDANCE WITH CODE FOR ADOPTION AND NATIONAL SPECIFICATION DESIGN MANUAL FOR ROADS AND BRIDGES
15. ALL PCC UNITS IN OVERSIZE MANHOLES MUST HAVE A DESIGN WORKING LIFE OF 100 YEARS (MIN) IN ACCORDANCE WITH BS 8500-1:2015+A2:2019-TABLE A5.
16. PRECAST CONCRETE MANHOLE UNITS INCLUDING THEIR PCC COVER SLABS SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 1917 AND BS 5911-3 AND SHALL BE MANUFACTURED FROM CONCRETE WITH A DESIGN CHEMICAL CLASS DC-4 UNLESS SATISFACTORY EVIDENCE THROUGH SOIL ANALYSIS CAN BE PROVIDED THAT A LOWER CLASS WILL RESIST ATTACK FROM SOILS AND GROUND WATER.
17. PRECAST CONCRETE CORBEL SLABS SHALL COMPLY WITH BS 5911-3 TABLE 3 AND FIGURE 8.
18. COVER SLABS SHALL BE INSTALLED WITH A MINIMUM OF 300mm COVER TO FINISHED GROUND LEVEL.
19. SUBMISSION OF A CONSTRUCTION COMPLIANCE CERTIFICATE SHALL BE PROVIDED UPON COMPLETION OF DRAINAGE WORKS

EXISTING SERVICES

PRIOR TO THE COMMENCEMENT OF ANY WORKS UNDER GROUND MAPPING SURVEYS AND CONSTRAINTS PLAN IS TO BE REFERRED TO ANY DISCREPANCIES ARE TO BE REPORTED TO ENGINEER.

ANY EXISTING SERVICES WHICH MAY BE AFFECTED BY THE PROPOSED WORKS SHOULD BE LOCATED BY MEANS OF A HAND DIG IN CLOSE LIAISON WITH THE STATUTORY SERVICE AUTHORITIES. THE CONTRACTOR SHALL INFORM THE DEVELOPER OF ANY SERVICES THAT MAY AFFECT THE PROPOSED DESIGN. CONTRACTOR TO NOTIFY STATUTORY SERVICE AUTHORITIES PRIOR TO COMMENCEMENT OF WORK. AS CONSTRUCTED INFORMATION IT IS THE CONTRACTORS RESPONSIBILITY TO PROVIDE THE FOLLOWING AS CONSTRUCTED DRAWINGS TO THE DEVELOPER UPON THE COMPLETION OF THE WORKS COVERED BY THE CONTRACT :-

14. POSITION/CO-ORDINATES OF ALL ADOPTABLE MANHOLES.
15. INVERT AND COVER LEVELS OF ALL ADOPTABLE MANHOLES.
16. NEW GULLY POSITIONS AND CONNECTIONS.
17. POSITION AND DEPTH OF SERVICE DUCTS FOR WATER, GAS, ELECTRIC, BT, CABLE AND STREET LIGHTING, STATING SIZE AND NUMBER OF DUCTS.

HEALTH & SAFETY RISKS

IN ADDITION TO THE STANDARD HAZARDS AND RISKS NORMALLY ASSOCIATED WITH THE TYPE OF WORK DETAILED ON THIS DRAWING. PLEASE NOTE THE FOLLOWING RESIDUAL HEALTH AND SAFETY RISKS THESE RISKS ARE APPLICABLE TO THE SET OF DRAWINGS FORMING THE DESIGN

CONSTRUCTION RISKS

C1	BURIED SERVICES - OBTAIN ACCURATE LOCATIONS OF UNDERGROUND SERVICES PRIOR TO EXCAVATION.
C2	CONFINED SPACE WORKS - ENSURE STAFF ARE SUITABLY TRAINED.
C3	CONSTRUCTION ADJACENT LIVE TRAFFIC - ENSURE SAFE METHOD OF WORKING
C4	DEEP EXCAVATIONS - RISK OF LAND SLIPS AND LARGE FALLS CONNECTION TO EXISTING LIVE SEWERS - RISK OF DROWNING
C5	CONSTRUCTION ADJACENT LIVE TRAFFIC - ENSURE SAFE METHOD OF WORKING
C6	CONTAMINATED GROUND - SITE ASSESSMENT MUST BE CARRIED OUT TO DETERMINE RISK IF CONTAMINATED GROUND IS UNCOVERED.
C7	UNFORESEEN GROUND CONDITIONS - CONTRACTOR SHOULD CARRY OUT APPROPRIATE SURVEYS TO MINIMISE RISK OF ENCOUNTERING UNKNOWN STRUCTURES
C8	STEEP SIDED STRUCTURES/RETAINING WALLS - COULD RESULT IN FALLS FROM HEIGHT ENSURE FALL PROTECTION PRIOR TO PERMANENT FENCING BEING ERECTED.
C9	SHALLOW GROUND WATER WILL BE ENCOUNTERED <1m BGL

OPERATION & MAINTENANCE RISKS

OM 1	UNTREATED/POLLUTED WATER CAN CAUSE ILL HEALTH FOR OPERATIVES
OM 2	WORKING ON OR NEAR SEWERS STEEP SIDED STRUCTURES/RETAINING WALLS COULD RESULT IN FALLS FROM HEIGHT.
OM 3	ENSURE BARRIERS ARE PLACED AROUND TOPS OF RETAINING WALLS AND EXCAVATIONS PRIOR TO PERMANENT FENCING BEING ERECTED. CONFINED SPACE WORKS - ENSURE STAFF ARE SUITABLY TRAINED.

ALL WORKS MUST BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING IN ACCORDANCE WITH THE REQUIREMENTS DEFINED IN THE CDM REGULATIONS AND BS 8000
THE RISK LISTED ARE NOT EXHAUSTIVE REFER TO DESIGNERS RISK ASSESSMENT FOR FULL DETAILS

KEY

- PROPOSED GROUND
- EXISTING GROUND
- S185 SEWER DIVERSION
- PROPOSED S104 SW SEWER
- PROPOSED S104 FW SEWER
- PROPOSED CULVERT
- SAND LEVEL
- ROCK LEVEL

Rev.	Date	Revision Details	Drawn	Checked
P03	21.07.25	UPDATED TO SUIT STRATA COMMENTS	JR	ND
P02	17.07.25	UPDATED TO SUIT STRATA COMMENTS, CULVERT ADDED FOLLOWING DRAINAGE SURVEY	JR	ND
P01	28.02.25	FIRST ISSUE	JR	ND

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Client: STRATA/ THIRTEEN

Project: MAIN AVENUE COWERSLEY

Title: PROPOSED LONGSECTIONS

Drawn	Checked	Date
JR	ND	28.02.2025

Drawing Number: 2153-QD-XX-HD-DR-C-05-01

Drawing Status	Scale	Rev.
TENDER	1:500/100 - A0	P02

Only PDF/ DWF Issues of this drawing are controlled. All other formats (eg. DWG AutoCAD FILES) are UN-controlled and are used at your own risk.

GENERAL NOTES:-

1. DO NOT USE THIS DRAWING IN ISOLATION. THIS DRAWING HAS BEEN PREPARED AS PART OF A SET, AND MUST THEREFORE BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER PRIOR TO COMMENCING WORKS.
2. THIRD PARTY INFORMATION IS USED TO PREPARE THE ENGINEERING DESIGN (INCLUDING, ARCHITECTURAL LAYOUT, GROUND INVESTIGATION, EXISTING UTILITIES RECORDS, AND SPECIALIST DESIGN ITEMS). THE ENGINEERING DESIGN MUST THEREFORE BE READ IN CONJUNCTION WITH ALL THIRD PARTY INFORMATION PRIOR TO COMMENCING WORK. QUEENSBERRY DESIGN LTD ARE NOT RESPONSIBLE FOR ANY THIRD PARTY INFORMATION OR DETAILS.
3. DRAWING STATUS WILL REMAIN PRELIMINARY UNTIL FULL TECHNICAL APPROVAL IS RECEIVED FROM LOCAL AUTHORITY AND SEWERAGE UNDERTAKER. WORKS COMMENCED PRIOR TO TECHNICAL APPROVAL ARE DONE SO AT RISK AND MAY BE SUBJECT TO CHANGE.
4. THE CONTRACTOR IS EXPECTED TO PREPARE APPROPRIATE CONSTRUCTION METHOD STATEMENTS FOR ALL ASPECTS OF APPOINTED WORK. THIS SHOULD INCLUDE ANY TEMPORARY PROTECTION / WORKS.
5. LAND DRAINAGE IS NOT PERMITTED TO DISCHARGE INTO THE PUBLIC SEWER NETWORK. ANY NEED FOR LAND DRAINAGE SHOULD BE ASSESSED BY THE GROUND WORKER AND LANDSCAPER DURING CONSTRUCTION AND PLACEMENT OF GARDENS ON AN INDIVIDUAL PLOT BASIS. IF LAND DRAINAGE DESIGNS ARE REQUIRED, THEY SHOULD BE APPOINTED PRIOR TO PLOT COMPLETION.
6. THE CONTRACTOR IS EXPECTED TO CROSS CHECK ALL DRAINAGE INVERTS PRIOR TO COMMENCING WORK, THIS MAY INVOLVE COMPLETION OF TRIAL HOLES IF INVERT LEVELS HAVE BEEN INTERPOLATED. THE POSITION, LINE AND DIAMETER OF ALL EXISTING DRAINAGE APPARATUS SHOULD BE CONFIRMED ON SITE PRIOR TO THE COMMENCEMENT OF THE WORKS. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER IMMEDIATELY.
7. THE CONTRACTOR MUST MONITOR THE "AS BUILT" PROGRESS OF EACH CONSTRUCTION STAGE (ROADS/SEWERS/PLOT WORKS ETC), TO ENABLE THE NEXT STAGES OF CONSTRUCTION TO BE CHECKED BEFORE INSTALLATION.

HIGHWAYS

1. ALL HIGHWAY WORKS TO BE CARRIED OUT IN ACCORDANCE WITH THE CURRENT LOCAL AUTHORITY DESIGN GUIDE AND SPECIFICATION
2. ALL EXCAVATIONS BELOW PROPOSED AND EXISTING HIGHWAYS TO BE BACK FILLED WITH GRANULAR TYPE 1 SUB BASE AND WELL COMPACTED IN LAYERS NOT EXCEEDING 150MM, UNLESS OTHERWISE AGREED.
3. HIGHWAY AUTHORITY TO BE NOTIFIED BY THE CONTRACTOR PRIOR TO THE COMMENCEMENT OF WORKS.

EXISTING SERVICES

PRIOR TO THE COMMENCEMENT OF ANY WORKS UNDER GROUND MAPPING SURVEYS AND CONSTRAINTS PLAN IS TO BE REFERRED TO ANY DISCREPANCIES ARE TO BE REPORTED TO ENGINEER.

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SURFACE WATER FLOODING

SURFACE WATER FLOW ROUTES →

Rev.	Date	Revision Details	Drawn	Checked
P04	24.07.25	UPDATED FOLLOWING LLFA CONSULTATION AND SITE INVESTIGATION	ND	ND
P03	11.12.24	LAYOUT REVISION P6 ADDED	ND	ND
P02	15.10.24	APARTMENTS AMENDED AS LAYOUT REVISION P02	ND	ND
P01	29.09.24	FIRST ISSUE	JR	ND

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Client: STRATA/ THIRTEEN

Project: MAIN AVENUE COWERSLEY

Title: EXCEEDANCE ROUTING

Drawn	Checked	Date
JR	ND	28.02.2025

Drawing Number: 2153-QD-XX-HD-DR-C-00-10

Drawing Status	Scale	Rev.
TENDER	1:250 - A0	P04

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.330	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1	0.041	5.00	160.593	1200	410932.657	415088.862	1.650
S2	0.102	5.00	158.989	1200	410954.724	415090.494	1.562
S3	0.053	5.00	156.779	1350	410979.156	415108.764	1.425
S4	0.086	5.00	155.228	1350	410999.080	415117.416	1.444
S5	0.099	5.00	152.628	1500	411028.141	415139.166	1.608
S6	0.046	5.00	151.458	1350	411037.773	415152.382	2.073
S14	0.046	5.00	149.101	1200	411057.116	415189.737	1.621
S7	0.150	5.00	148.747	1500	411068.056	415175.249	2.385
S8	0.108	5.00	146.735	1200	411064.067	415227.901	1.425
S9	0.120	5.00	147.987	1200	411098.720	415184.037	1.977
S11	0.042	5.00	147.325	1800	411093.637	415194.565	2.859
S12			147.377	1500	411097.912	415196.822	2.923
TANK			147.403	1200	411099.317	415197.507	4.209
1		5.00	145.800	2100	411101.868	415215.539	2.650
S13FC			145.300	2400	411101.233	415218.138	2.175

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	S1	S2	22.127	0.600	158.943	157.502	1.441	15.4	150	5.14	46.7
1.001	S2	S3	30.508	0.600	157.427	155.354	2.073	14.7	225	5.29	46.1
1.002	S3	S4	21.722	0.600	155.354	153.803	1.551	14.0	225	5.39	45.8
1.003	S4	S5	36.299	0.600	153.784	151.020	2.764	13.1	300	5.53	45.3
1.004	S5	S6	16.354	0.600	151.020	149.385	1.635	10.0	300	5.59	45.1
1.005	S6	S7	37.946	0.600	149.385	146.512	2.873	13.2	300	5.73	44.6
2.000	S14	S7	18.154	0.600	147.480	146.587	0.893	20.3	225	5.10	46.8
1.006	S7	S11	32.056	0.600	146.362	144.616	1.746	18.4	450	5.85	44.2

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	2.583	45.7	5.2	1.500	1.337	0.041	0.0	34	1.728
1.001	3.428	136.3	17.9	1.337	1.200	0.143	0.0	55	2.396
1.002	3.514	139.7	24.3	1.200	1.200	0.196	0.0	63	2.646
1.003	4.360	308.2	34.6	1.144	1.308	0.282	0.0	67	2.911
1.004	4.998	353.3	46.6	1.308	1.773	0.381	0.0	73	3.498
1.005	4.348	307.3	51.6	1.773	1.935	0.427	0.0	83	3.264
2.000	2.915	115.9	5.8	1.396	1.935	0.046	0.0	34	1.530
1.006	4.761	757.3	74.7	1.935	2.259	0.623	0.0	94	3.082

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)
3.000	S8	S11	44.573	0.600	145.310	145.049	0.261	170.8	225	5.74	44.6
4.000	S9	S11	11.691	0.600	146.010	144.841	1.169	10.0	225	5.05	47.1
1.007	S11	S12	4.833	0.600	144.466	144.454	0.012	402.8	600	5.91	44.0
1.008	S12	TANK	2.015	0.600	144.454	144.450	0.004	503.8	600	5.94	43.9
1.009	1	S13FC	2.909	0.600	143.150	143.125	0.025	116.4	600	5.02	47.1

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
3.000	0.997	39.7	13.0	1.200	2.051	0.108	0.0	88	0.894
4.000	4.161	165.5	15.3	1.752	2.259	0.120	0.0	46	2.632
1.007	1.207	341.3	106.5	2.259	2.323	0.893	0.0	229	1.072
1.008	1.078	304.8	106.3	2.323	2.353	0.893	0.0	244	0.986
1.009	2.256	638.0	0.0	2.050	1.575	0.000	0.0	0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	22.127	15.4	150	Circular	160.593	158.943	1.500	158.989	157.502	1.337
1.001	30.508	14.7	225	Circular	158.989	157.427	1.337	156.779	155.354	1.200
1.002	21.722	14.0	225	Circular	156.779	155.354	1.200	155.228	153.803	1.200
1.003	36.299	13.1	300	Circular	155.228	153.784	1.144	152.628	151.020	1.308
1.004	16.354	10.0	300	Circular	152.628	151.020	1.308	151.458	149.385	1.773
1.005	37.946	13.2	300	Circular	151.458	149.385	1.773	148.747	146.512	1.935
2.000	18.154	20.3	225	Circular	149.101	147.480	1.396	148.747	146.587	1.935
1.006	32.056	18.4	450	Circular	148.747	146.362	1.935	147.325	144.616	2.259
3.000	44.573	170.8	225	Circular	146.735	145.310	1.200	147.325	145.049	2.051
4.000	11.691	10.0	225	Circular	147.987	146.010	1.752	147.325	144.841	2.259
1.007	4.833	402.8	600	Circular	147.325	144.466	2.259	147.377	144.454	2.323
1.008	2.015	503.8	600	Circular	147.377	144.454	2.323	147.403	144.450	2.353
1.009	2.909	116.4	600	Circular	145.800	143.150	2.050	145.300	143.125	1.575

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	1200	Manhole	Adoptable	S2	1200	Manhole	Adoptable
1.001	S2	1200	Manhole	Adoptable	S3	1350	Manhole	Adoptable
1.002	S3	1350	Manhole	Adoptable	S4	1350	Manhole	Adoptable
1.003	S4	1350	Manhole	Adoptable	S5	1500	Manhole	Adoptable
1.004	S5	1500	Manhole	Adoptable	S6	1350	Manhole	Adoptable
1.005	S6	1350	Manhole	Adoptable	S7	1500	Manhole	Adoptable
2.000	S14	1200	Manhole	Adoptable	S7	1500	Manhole	Adoptable
1.006	S7	1500	Manhole	Adoptable	S11	1800	Manhole	Adoptable
3.000	S8	1200	Manhole	Adoptable	S11	1800	Manhole	Adoptable
4.000	S9	1200	Manhole	Adoptable	S11	1800	Manhole	Adoptable
1.007	S11	1800	Manhole	Adoptable	S12	1500	Manhole	Adoptable
1.008	S12	1500	Manhole	Adoptable	TANK	1200	Manhole	Adoptable
1.009	1	2100	Manhole	Adoptable	S13FC	2400	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	19.000	Drain Down Time (mins)	60
Ratio-R	0.330	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

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 %)
1	0	0	0
2	0	0	0
30	0	0	0
100	45	0	0

Node S13FC Online StormBrake™ Control

Flap Valve	x	Design Flow (l/s)	3.5
Replaces Downstream Link	✓	Product Code	FPM-SB1-02300-00350-1100
Invert Level (m)	143.125	Min Outlet Diameter (m)	0.100
Design Depth (m)	2.300	Min Node Diameter (mm)	1200

Node 1 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	22.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	143.150	Main Channel Slope (1:X)	500.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.600

Inlets

TANK

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	300.0	0.0	2.000	300.0	0.0	2.001	0.0	0.0

Other (defaults)

Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	x
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	97.427	27.568	1 year 180 minute summer	23.288	5.993
1 year 15 minute winter	68.370	27.568	1 year 180 minute winter	15.138	5.993
1 year 30 minute summer	65.213	18.453	1 year 240 minute summer	18.832	4.977
1 year 30 minute winter	45.763	18.453	1 year 240 minute winter	12.511	4.977
1 year 60 minute summer	45.726	12.084	1 year 360 minute summer	14.747	3.795
1 year 60 minute winter	30.379	12.084	1 year 360 minute winter	9.586	3.795
1 year 120 minute summer	29.443	7.781	1 year 480 minute summer	11.830	3.126
1 year 120 minute winter	19.561	7.781	1 year 480 minute winter	7.860	3.126

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 600 minute summer	9.836	2.690
1 year 600 minute winter	6.720	2.690
1 year 720 minute summer	8.880	2.380
1 year 720 minute winter	5.968	2.380
1 year 960 minute summer	7.450	1.962
1 year 960 minute winter	4.935	1.962
1 year 1440 minute summer	5.581	1.496
1 year 1440 minute winter	3.750	1.496
2 year 15 minute summer	126.058	35.670
2 year 15 minute winter	88.462	35.670
2 year 30 minute summer	84.152	23.812
2 year 30 minute winter	59.054	23.812
2 year 60 minute summer	58.092	15.352
2 year 60 minute winter	38.595	15.352
2 year 120 minute summer	36.747	9.711
2 year 120 minute winter	24.414	9.711
2 year 180 minute summer	28.735	7.394
2 year 180 minute winter	18.678	7.394
2 year 240 minute summer	23.035	6.088
2 year 240 minute winter	15.304	6.088
2 year 360 minute summer	17.901	4.607
2 year 360 minute winter	11.636	4.607
2 year 480 minute summer	14.289	3.776
2 year 480 minute winter	9.493	3.776
2 year 600 minute summer	11.831	3.236
2 year 600 minute winter	8.084	3.236
2 year 720 minute summer	10.643	2.852
2 year 720 minute winter	7.153	2.852
2 year 960 minute summer	8.877	2.338
2 year 960 minute winter	5.880	2.338
2 year 1440 minute summer	6.590	1.766
2 year 1440 minute winter	4.429	1.766
30 year 15 minute summer	238.477	67.481
30 year 15 minute winter	167.352	67.481
30 year 30 minute summer	160.302	45.360
30 year 30 minute winter	112.492	45.360
30 year 60 minute summer	110.635	29.238
30 year 60 minute winter	73.503	29.238
30 year 120 minute summer	69.224	18.294
30 year 120 minute winter	45.991	18.294
30 year 180 minute summer	53.400	13.742
30 year 180 minute winter	34.711	13.742
30 year 240 minute summer	42.212	11.155
30 year 240 minute winter	28.045	11.155
30 year 360 minute summer	32.279	8.307
30 year 360 minute winter	20.982	8.307
30 year 480 minute summer	25.473	6.732
30 year 480 minute winter	16.923	6.732
30 year 600 minute summer	20.893	5.715
30 year 600 minute winter	14.275	5.715
30 year 720 minute summer	18.644	4.997
30 year 720 minute winter	12.530	4.997
30 year 960 minute summer	15.343	4.040
30 year 960 minute winter	10.163	4.040
30 year 1440 minute summer	11.157	2.990
30 year 1440 minute winter	7.498	2.990
100 year +45% CC 15 minute summer	446.880	126.452
100 year +45% CC 15 minute winter	313.600	126.452
100 year +45% CC 30 minute summer	303.454	85.867
100 year +45% CC 30 minute winter	212.950	85.867
100 year +45% CC 60 minute summer	210.766	55.699
100 year +45% CC 60 minute winter	140.028	55.699
100 year +45% CC 120 minute summer	131.943	34.869
100 year +45% CC 120 minute winter	87.660	34.869
100 year +45% CC 180 minute summer	101.403	26.094
100 year +45% CC 180 minute winter	65.915	26.094
100 year +45% CC 240 minute summer	79.749	21.075
100 year +45% CC 240 minute winter	52.983	21.075
100 year +45% CC 360 minute summer	60.567	15.586
100 year +45% CC 360 minute winter	39.370	15.586
100 year +45% CC 480 minute summer	47.557	12.568
100 year +45% CC 480 minute winter	31.596	12.568
100 year +45% CC 600 minute summer	38.848	10.626
100 year +45% CC 600 minute winter	26.543	10.626
100 year +45% CC 720 minute summer	34.545	9.258
100 year +45% CC 720 minute winter	23.217	9.258
100 year +45% CC 960 minute summer	28.262	7.442
100 year +45% CC 960 minute winter	18.722	7.442
100 year +45% CC 1440 minute summer	20.369	5.459
100 year +45% CC 1440 minute winter	13.689	5.459

Results for 1 year Critical Storm Duration. Lowest mass balance: 80.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	158.977	0.034	5.1	0.0388	0.0000	OK
15 minute winter	S2	10	157.482	0.055	17.8	0.0618	0.0000	OK
15 minute winter	S3	10	155.419	0.065	24.3	0.0933	0.0000	OK
15 minute winter	S4	10	153.852	0.068	34.8	0.0967	0.0000	OK
15 minute winter	S5	10	151.095	0.075	47.0	0.1326	0.0000	OK
15 minute winter	S6	10	149.470	0.085	52.5	0.1221	0.0000	OK
15 minute winter	S14	10	147.515	0.035	5.8	0.0392	0.0000	OK
15 minute winter	S7	10	146.457	0.095	76.3	0.1677	0.0000	OK
15 minute winter	S8	11	145.400	0.090	13.5	0.1020	0.0000	OK
15 minute winter	S9	10	146.058	0.048	15.1	0.0540	0.0000	OK
15 minute winter	S11	11	144.737	0.271	109.0	0.6895	0.0000	OK
15 minute winter	S12	11	144.702	0.247	108.6	0.4373	0.0000	OK
600 minute winter	TANK	480	143.590	0.396	14.0	0.4474	0.0000	OK
600 minute winter	1	480	143.590	0.440	8.5	1.5228	0.0000	OK
600 minute winter	S13FC	480	143.590	0.465	6.2	2.1019	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S2	5.0	1.685	0.110	0.0661	
15 minute winter	S2	1.001	S3	17.7	2.094	0.130	0.2586	
15 minute winter	S3	1.002	S4	24.0	2.584	0.172	0.2018	
15 minute winter	S4	1.003	S5	34.6	2.704	0.112	0.4648	
15 minute winter	S5	1.004	S6	46.7	3.090	0.132	0.2472	
15 minute winter	S6	1.005	S7	51.9	3.220	0.169	0.6119	
15 minute winter	S14	2.000	S7	5.7	1.505	0.049	0.0690	
15 minute winter	S7	1.006	S11	75.9	2.770	0.100	0.9363	
15 minute winter	S8	3.000	S11	13.1	0.895	0.330	0.6523	
15 minute winter	S9	4.000	S11	15.0	2.528	0.091	0.0695	
15 minute winter	S11	1.007	S12	108.6	0.932	0.318	0.5632	
15 minute winter	S12	1.008	TANK	108.9	1.101	0.357	0.1995	
600 minute winter	TANK	Flow through pond	1	8.5	0.007	0.005	125.2958	
600 minute winter	1	1.009	S13FC	6.2	0.290	0.010	0.6625	
600 minute winter	S13FC	StormBrake™		2.8				83.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 80.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	158.982	0.039	6.7	0.0446	0.0000	OK
15 minute winter	S2	10	157.489	0.062	23.2	0.0706	0.0000	OK
15 minute winter	S3	10	155.429	0.075	31.7	0.1077	0.0000	OK
15 minute winter	S4	10	153.861	0.077	45.3	0.1106	0.0000	OK
15 minute winter	S5	10	151.106	0.086	61.1	0.1527	0.0000	OK
15 minute winter	S6	10	149.483	0.098	68.2	0.1405	0.0000	OK
15 minute winter	S14	10	147.519	0.039	7.5	0.0446	0.0000	OK
15 minute winter	S7	10	146.470	0.108	99.0	0.1911	0.0000	OK
15 minute winter	S8	11	145.414	0.104	17.5	0.1180	0.0000	OK
15 minute winter	S9	10	146.065	0.055	19.5	0.0618	0.0000	OK
15 minute winter	S11	11	144.778	0.312	141.3	0.7951	0.0000	OK
15 minute winter	S12	11	144.738	0.284	140.4	0.5013	0.0000	OK
600 minute winter	TANK	570	143.723	0.529	16.9	0.5986	0.0000	OK
600 minute winter	1	570	143.723	0.573	10.1	1.9857	0.0000	OK
600 minute winter	S13FC	585	143.723	0.598	5.6	2.7049	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S2	6.6	1.820	0.145	0.0805	
15 minute winter	S2	1.001	S3	23.1	2.247	0.169	0.3140	
15 minute winter	S3	1.002	S4	31.3	2.773	0.224	0.2451	
15 minute winter	S4	1.003	S5	45.0	2.896	0.146	0.5648	
15 minute winter	S5	1.004	S6	60.7	3.301	0.172	0.3009	
15 minute winter	S6	1.005	S7	67.3	3.453	0.219	0.7412	
15 minute winter	S14	2.000	S7	7.4	1.619	0.064	0.0830	
15 minute winter	S7	1.006	S11	98.5	2.797	0.130	1.2911	
15 minute winter	S8	3.000	S11	17.0	0.957	0.428	0.7898	
15 minute winter	S9	4.000	S11	19.4	2.709	0.117	0.0837	
15 minute winter	S11	1.007	S12	140.4	1.005	0.411	0.6752	
15 minute winter	S12	1.008	TANK	140.8	1.190	0.462	0.2387	
600 minute winter	TANK	Flow through pond	1	10.1	0.008	0.006	165.3873	
600 minute winter	1	1.009	S13FC	5.6	0.273	0.009	0.8126	
600 minute winter	S13FC	StormBrake™		2.8				80.4

Results for 30 year Critical Storm Duration. Lowest mass balance: 80.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	158.998	0.055	12.6	0.0624	0.0000	OK
15 minute winter	S2	10	157.514	0.087	43.8	0.0984	0.0000	OK
15 minute winter	S3	10	155.463	0.109	59.8	0.1553	0.0000	OK
15 minute winter	S4	10	153.892	0.108	85.6	0.1548	0.0000	OK
15 minute winter	S5	10	151.144	0.124	115.6	0.2193	0.0000	OK
15 minute winter	S6	10	149.526	0.141	129.0	0.2020	0.0000	OK
15 minute winter	S14	10	147.535	0.054	14.1	0.0616	0.0000	OK
15 minute winter	S7	10	146.512	0.150	187.7	0.2652	0.0000	OK
15 minute winter	S8	10	145.468	0.158	33.2	0.1790	0.0000	OK
15 minute winter	S9	10	146.086	0.076	36.8	0.0861	0.0000	OK
15 minute winter	S11	10	144.920	0.453	268.4	1.1541	0.0000	OK
15 minute winter	S12	11	144.857	0.403	266.8	0.7122	0.0000	OK
960 minute winter	TANK	930	144.332	1.138	21.2	1.2868	0.0000	OK
960 minute winter	1	930	144.332	1.182	11.9	4.0931	0.0000	SURCHARGED
960 minute winter	S13FC	930	144.331	1.206	6.2	5.4549	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S2	12.5	2.163	0.273	0.1275	
15 minute winter	S2	1.001	S3	43.6	2.634	0.320	0.5049	
15 minute winter	S3	1.002	S4	59.2	3.257	0.424	0.3948	
15 minute winter	S4	1.003	S5	85.2	3.385	0.276	0.9143	
15 minute winter	S5	1.004	S6	114.9	3.827	0.325	0.4912	
15 minute winter	S6	1.005	S7	127.7	4.065	0.415	1.1931	
15 minute winter	S14	2.000	S7	14.0	1.938	0.121	0.1309	
15 minute winter	S7	1.006	S11	187.0	2.832	0.247	2.5641	
15 minute winter	S8	3.000	S11	32.1	1.108	0.811	1.2928	
15 minute winter	S9	4.000	S11	36.8	3.140	0.223	0.1410	
15 minute winter	S11	1.007	S12	266.8	1.240	0.782	1.0385	
15 minute winter	S12	1.008	TANK	266.4	1.463	0.874	0.3665	
960 minute winter	TANK	Flow through pond	1	11.9	0.008	0.007	347.9232	
960 minute winter	1	1.009	S13FC	6.2	0.287	0.010	0.8194	
960 minute winter	S13FC	StormBrake™		2.8				137.5

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 80.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	159.023	0.080	23.6	0.0900	0.0000	OK
15 minute winter	S2	10	157.552	0.125	82.1	0.1412	0.0000	OK
15 minute winter	S3	10	155.522	0.168	112.2	0.2406	0.0000	OK
15 minute winter	S4	10	153.939	0.155	160.4	0.2222	0.0000	OK
15 minute winter	S5	10	151.206	0.186	216.8	0.3291	0.0000	OK
15 minute winter	S6	10	149.601	0.216	242.0	0.3096	0.0000	OK
15 minute winter	S14	10	147.556	0.076	26.5	0.0863	0.0000	OK
15 minute winter	S7	10	146.574	0.212	352.1	0.3739	0.0000	OK
15 minute winter	S8	11	145.845	0.535	62.1	0.6050	0.0000	SURCHARGED
15 minute winter	S9	10	146.111	0.101	69.0	0.1138	0.0000	OK
15 minute winter	S11	10	145.151	0.685	501.4	1.7441	0.0000	SURCHARGED
1440 minute summer	S12	1020	145.472	1.018	202.5	1.7988	0.0000	SURCHARGED
720 minute winter	TANK	525	145.090	1.896	361.0	2.1448	0.0000	OK
720 minute winter	1	525	145.095	1.945	99.7	6.7361	0.0000	SURCHARGED
720 minute winter	S13FC	510	145.096	1.971	15.8	8.9162	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S2	23.4	2.534	0.512	0.2042	
15 minute winter	S2	1.001	S3	81.7	2.988	0.600	0.8303	
15 minute winter	S3	1.002	S4	110.9	3.694	0.794	0.6515	
15 minute winter	S4	1.003	S5	159.8	3.860	0.518	1.5016	
15 minute winter	S5	1.004	S6	215.5	4.289	0.610	0.8206	
15 minute winter	S6	1.005	S7	239.5	4.640	0.779	1.9615	
15 minute winter	S14	2.000	S7	26.3	2.297	0.227	0.2079	
15 minute winter	S7	1.006	S11	351.1	2.724	0.464	3.7131	
15 minute winter	S8	3.000	S11	59.5	1.497	1.499	1.7163	
15 minute winter	S9	4.000	S11	68.9	3.232	0.416	0.3329	
15 minute winter	S11	1.007	S12	497.7	1.767	1.458	1.3595	
1440 minute summer	S12	1.008	TANK	97.2	0.824	0.319	0.5673	
720 minute winter	TANK	Flow through pond	1	99.7	0.011	0.058	576.0635	
720 minute winter	1	1.009	S13FC	15.8	0.305	0.025	0.8194	
720 minute winter	S13FC	StormBrake™		3.3				124.9