

SPECIFICATION SERIES 0500 DRAINAGE AND SERVICE DUCTS

Rochdale Station Square

AUGUST 2025

DRAINAGE AND SERVICE DUCTS SPECIFICATION

Rochdale Station Square

Author	Hira Niamat
Checker	Brijesh Singh
Reviewer	Rohit Asthana
Approver	Rohit Asthana
Report No	30220231-ARC-HDG-ZZ-TS-HE-00001
Date	AUGUST 2025

Version Control

Issue	Revision No.	Date Issued	Page No.	Description	Reviewed By
FIRST	1	27/08/2025	All		Rohit Asthana

Contents

Appendix 5/1: Drainage Requirements.....	4
1 General Information.....	4
2 General Requirements for Drains	4
3 Permitted Pipe Alternatives	5
4 Values of Pipe Stiffness Class, Creep Ratio and Impact Resistance for Thermoplastic Pipes	6
5 Laying Method for Corrugated Coilable Perforated Pipes	6
6 Pipe and Bed Combinations	6
7 Additional Backfilling Requirements	8
8 Requirements for Geotextiles and Geomembrane.....	8
9 Existing Drainage	9
10 Existing Land Drains	11
11 Connection of Existing Drains to New Drains and Details of Special Connecting Pipes	11
12 Chambers	11
13 Gullies	13
14 Joints	13
15 Flow and Weir Control Devices	13
16 Requirement for Rapid Setting Bedding Materials.....	14
17 Requirements for Rodding Eye	14
18 Requirements for Retention Systems	14
19 Trenchless Pipe Installation	17
Appendix 5/2: Service Ducts Requirements	18
This Appendix is not used	18
Appendix 5/3: Surface Water Channels and Drainage Channel Blocks	19
This appendix is not used.....	19
Appendix 5/4: Fin Drains and Narrow Filter Drains	20
This appendix is not used.....	20
Appendix 5/5: Combined Kerb and Drainage System	21
This appendix is not used.....	21
Appendix 5/6: Linear Drainage Channel System.....	22
20 Linear Drainage Channel Systems	22
Appendix 5/7: Thermoplastics Structural Wall and Pipe Fittings.....	23
21 Thermoplastics Structural Wall and Pipe Fittings	23
Appendix 90/1: Specifications For Drainage CCTV Surveys	25
22 Testing	25
23 Drainage Handover	25

Tables

Table 5/1- 1 Pipes for Drainage	5
Table 5/1- 2 Permitted pipe and bedding combinations for carrier pipes	6
Table 5/1- 3 Permitted pipe and bedding combinations for filter drains	7
Table 5/1- 4 Geotextile Criteria	8
Table 5/1- 5 Geomembrane Criteria	9
Table 5/1- 6 A typical raingarden section make up	15
Table 5/7- 1 Unplasticised polyvinyl-chloride (PVC-U)	23
Table 5/7- 2 Polyethylene (PE)	23
Table 5/7- 3 Polypropylene (PP)	24

Appendix 5/1: Drainage Requirements

1 General Information

- 1.1** This specification shall be read in conjunction with Manual of Contract Documents for Highways Works (MCHW), Series 500 of the Specification for Highway Works (SHW). The system shall be designed and constructed in accordance with the relevant sections of the Design Manual for Roads and Bridges, Highway Construction Details (HCD), CIRIA 753 The SUDS Manual, CIRIA 698 Site Handbook for the Construction of SUDS.
- 1.2** Specification to be read in conjunction with:
- 30220231-ARC-HDG-ZZ-DR-HE-10001 to 10004 - Drainage and ducting Drawing Sheets 1 to 4
 - 30220231-ARC-HDG-ZZ-DR-HE-10006 to 10011 – Drainage and Ducting Details Sheets 1 to 6
 - 30220231-ARC-HDG-ZZ-SCH-HE-00001 – Pipe and Chamber Schedule
 - 30220231-ARC-HDG-ZZ-SCH-HE-00002 – Gully Schedule
- 1.3** The appendix should be read in conjunction with Highway and pavement specification documents 30220231-ARC-HPV-ZZ-TS-HE-00002 and 30220231-ARC-HKF-ZZ-TS-HE-00001.
- 1.4** The project standard details shall take precedence over the HCD.
- 1.5** All drainage systems shall be accessible for inspection and maintenance, with adequate facilities for rodding.
- 1.6** The Contractor shall take all measures necessary to prevent polluting matter entering the drainage system. All drainage outlets will be inspected following completion of the works and any debris found will be re-moved by the Contractor.

2 General Requirements for Drains

- 2.1** All pipes under carriageways with less than 900mm cover below the finished road level (measured to the soffit of the pipe) shall have Type Z concrete surround as shown on HCD Drawing No F1 and to SHW 503.3 (iii) having a minimum thickness 150mm, except for pipes intended to drain the pavement foundation.
- 2.2** All joints to surface water carrier drains shall be watertight when tested in accordance with SHW Clause 509.2
- 2.3** Rigid joints shall not be permitted.
- 2.4** In addition to the requirements of SHW Clause 504.5 where a concrete bed, cradle or surround is used with pipes with flexible joints a joint filler board shall be installed at each pipe joint to maintain flexibility.
- 2.5** Backfilling to drains in carriageways shall be Type 1 sub-base (SHW clause 803) or normal density concrete C16/20 (SHW clause 1043).

- 2.6** Saddle connections in accordance with SHW clause 508.9 shall only be permitted with the approval of the supervising engineer: -
- Where new surface water outlet connections are required to connect to existing drains or culverts, 375mm diameter or larger, by forming the hole in the pipe by coring; and
 - For new drainage on larger concrete pipes, greater than 525mm diameter and by forming the hole in the concrete pipe by coring.
- 2.7** The Contractor shall give due consideration to the protection of pipes from construction traffic loading during construction.
- 2.8** Air testing is required for all carrier drains as per SHW Clause 509.2, before and after backfilling have taken place.
- 2.9** Air testing is required on all sealed pipes.
- 2.10** All carrier and filter drains but excluding all fin and narrow filter drains shall have pre- construction and post construction surveys in accordance with SHW Clause 509.4 and 509.5.

3 Permitted Pipe Alternatives

- 3.1** Permitted pipe alternatives shall be in accordance with Table 5/1- 1:

Table 5/1- 1 Pipes for Drainage

Pipes for Drainage		
Usage	Material	Additional Information
Surface water carrier drains	• Vitrified Clay	
	• Concrete	
	• Thermoplastic structured wall	
	• Cast iron	
	• Thermoplastic solid wall PE or PP	
Filter Drains	• Concrete • Thermoplastic structured wall	Pipes shall be fully perforated or slotted.

4 Values of Pipe Stiffness Class, Creep Ratio and Impact Resistance for Thermoplastic Pipes

- 4.1 Thermoplastic pipes used in the Contract shall comply with the following requirements:
- 4.2 Minimum ring stiffness shall be 6kN/m² in accordance with BS EN ISO 9969.
- 4.3 Impact resistance shall be in accordance with BS EN 1411.
- 4.4 The creep ratio shall be a maximum of 4.0 in accordance with BS EN ISO 9969.
- 4.5 All structural wall pipes to comply with Table 5/9 of the specification for Highway Works – Drainage and Service Ducts and have HAPAS BBA certification.

5 Laying Method for Corrugated Coilable Perforated Pipes

- 5.1 Where used for sub-surface drainage, corrugated coilable perforated pipes shall be installed in accordance with the manufacturer's instructions.

6 Pipe and Bed Combinations

- 6.1 Surface water carrier drainage trench and bedding shall be in accordance with HCD Drawing No F1. Permitted pipe and bedding options for drains are detailed in Table 5/1- 2.

Table 5/1- 2 Permitted pipe and bedding combinations for carrier pipes

Pipe size	Cover to pipe m	Vitrified Clay Class 160	Precast concrete Class 120	Thermoplastic	
				PVC-u	PP/PE
150ø	< 0.9	Z	Z	Z	Z
	0.9 – 4.0	ASB	ASB	S	S

- 6.2 Filter drainage trench and bedding shall be in accordance with HCD Drawing No F2. Permitted pipe and bedding options are detailed in Table 5/1- 3

Table 5/1- 3 Permitted pipe and bedding combinations for filter drains

Drain Type (Lower Trench) HCD F2	Drain Type (Upper Trench) HCD B15 ¹	Pipe Dia mm	Cover to pipe m	Vitrified Clay Class 160	Precast concrete Class 120	Thermoplastic	
						PVC-u	PP/PE
Toe of batter drains/ filter drainage along edge of carriageway							
H/K	<1m from kerb – Type V or >1m from kerb - Filter material taken to the surface	150	0.6 – 4.0	✓	✓	✓	✓

✓ permitted pipe type

- 6.3** Type A and B filter materials to SHW clause 505 shall comply with the grading requirements given in Table 5/5 of clause 505 of the SHW.
- 6.4** Type A filter material shall have a minimum permeability of 2.0×10^{-4} m/s. Type B filter material shall have a minimum permeability of 6.0×10^{-3} m/s. Filter materials to SHW clause 505 shall be tested in accordance with the Constant Head Permeability Test, BS 5930: 2015 Table 37. Where in situ field testing is possible BS 5930:2015 (Sect 48) shall be used, otherwise laboratory testing shall be undertaken to BS 1377:1990 – Part 5.
- 6.5** Type C filter material can be proposed, based on local sources and supply, in which case it shall be designed based upon BS EN 13285 and TRRL Report LR346.
- 6.6** Filter drains to edge of carriageways shall be constructed using fully perforated or slotted pipes. Joints in filter drains shall be as per SHW 504.6.
- 6.7** Filter drains shall be lined with geotextile as detailed in Table 5/1- 4, except for lined filter drains, which shall use a geomembrane as detailed in Table 5/1- 5
- 6.8** Prior to installation, certification in accordance with the Table 5/1- 4 below shall be arranged by the Contractor. The results shall be submitted to the Designer's Site Representative, together with the batch or consignment numbers to which they relate. Materials not conforming shall be rejected and replaced with material that has passed conformance testing.
- 6.9** Where filter drains are providing sub-surface drainage of the pavement foundation, the pavement foundation shall be continuous with the filter drain trench.

7 Additional Backfilling Requirements

- 7.1 Where excavation occurs near existing buried equipment or to structures the Contractor shall ensure that the excavation support systems used is adequate to prevent displacement of the adjacent equipment or structures.
- 7.2 If the maximum allowable trench width is exceeded, or if the Contractor requests the adoption of wide trench conditions and is granted a concession to do so by the Designer Site Representative, then the Designer Site Representative shall determine the pipe strengths and associated class of bedding to the new conditions before work continues. No backfilling shall take place in trenches containing water or waterlogged material. If the Contractor allows the condition of the material to deteriorate such that it becomes unsuitable for re-use in the works, then the Contractor will be required to remove it from site and import any required filling material.
- 7.3 After the pipe and bedding has been laid, additional granular material shall be placed to a horizontal level 250mm above the crown of the pipe. The granular material shall be equally deposited each side of the pipe and compacted in layers of 100mm. Compaction will be achieved by hand and care shall be taken as to ensure no voids are present. Above 250mm over the crown of the pipe the backfill shall be selected as dug material or imported Type 2 granular material with a maximum aggregate size of 40mm and compacted in layers not exceeding 250mm. Where the excavation has been supported, the supports are to be removed progressively as backfilling proceeds, in such a manner to minimise the degree of collapse and avoid voids and properly compacted to form a stable backfill. The backfilling shall be carried out at or as near as possible to optimum water content and compaction shall be continued until the maximum density for the material is achieved. The
- 7.4 Contractor shall compact the material in a manner so as not to damage or displace the works and shall not drop large volumes of backfilling material directly on to the pipe or trench.

8 Requirements for Geotextiles and Geomembrane

- 8.1 Geotextiles used as a filter fabric shall satisfy the criteria listed in Table 5/1-4 and Table 5/1-5:
- 8.2 Joining of geotextiles shall be by overlapping only and all overlaps shall be a minimum of 500mm or in accordance with the manufacturer's recommendations.
- 8.3 Any punctures or damage to geotextiles shall be made good by overlapping with geotextile having an overlap of at least 500mm from the edge of the damaged area or in accordance with the manufacturer's recommendations.

Table 5/1- 4 Geotextile Criteria

Geotextile Material		
Criterion	Testing Standard	Value
Opening Size, O ₉₀ (microns)	BS EN ISO 12956	100 microns min 300 microns max
Tensile Strength	BS EN ISO 10319	5 kN/m

CBR Puncture Resistance	BS EN ISO 12236	1500 N
Thickness at 2kPa	BS EN ISO 9863-1	0.8 mm
Permeability - (Breakthrough head 5mm)	BS EN ISO 11058	50-100 l/m ² /s
Weight		>125g/m ²

Table 5/1- 5 Geomembrane Criteria

Geomembrane Material		
Criterion	Testing Standard	Value
Tensile Strength	EN 12311	22 N/mm ²
Tensile elongation	EN 12311	799 %
Watertightness @ 60 kPa	EN 1928	Pass
Impact Resistance	EN 12691	600 mm
Thickness	EN 1849-2	1 mm
Weight	EN 1849-2	974 g/m ²

9 Existing Drainage

Existing drainage to be abandoned

- 9.1** The Contractor shall maintain all existing drainage within the Site and adjacent areas until the new permanent drainage is installed and functioning satisfactorily or alternatively provide temporary drainage systems as required so that the drainage of the carriageway is not impaired.
- 9.2** Existing drainage including chambers, gullies and the like within areas of proposed site clearance are to be abandoned unless noted otherwise on the Drainage Design Drawings. Refer to Series 200 for further details.
- 9.3** In accordance with Clause 201 all abandoned existing pipework:
- ✓ within 1 metre of the carriageway formation level shall be removed.
 - ✓ over 1m below formation level shall be grouted in accordance with Clause 506
- 9.4** Existing gully connections shall be sealed in accordance with Clause 506 at formation level.
- 9.5** Existing filter drains to be abandoned shall be excavated and removed from the site and backfilled with acceptable Class 6 material.

- 9.6** In accordance with Clause 201 all abandoned chambers and gullies shall be either removed or broken down to formation level and treated in accordance with Clause 201.3.
- 9.7** Unless described elsewhere trenches shall be backfilled to Clause 505.

Existing drainage incorporated into the Works

- 9.8** Details of existing drainage including chambers, gullies and the like to be retained are shown on the Proposed Drainage Drawings.
- 9.9** Existing drainage incorporated within the Works shall require pre-construction surveys and reporting in accordance with Appendix 90/1.
- 9.10** Where the existing pipe material is unknown, or the pipe condition is of structural condition grade 3 or poorer, the jetting pressure shall not exceed 80 bar in accordance with Table 5/12 of Clause 521.
- 9.11** Where new drainage connects to existing pipe work the Contractor shall, before drainage works begin, undertake the pre-construction surveys as outlined in Appendix 90/1 to confirm that the line and invert levels of the existing pipe are as detailed on the drainage schedules. Any discrepancies shall be notified to the Designer's Site Representative so that appropriate adjustment to the drainage design can be made before construction commences.
- 9.12** Defects identified during the pre-construction CCTV defect survey shall be reported in accordance with Appendix 90/1.
- 9.13** Category 4 & 5 defects within pipes to be incorporated into the works are to be repaired or replaced.
- 9.14** Where Category 4 & 5 defects are identified within existing pipework downstream of the proposed works to the outfall are identified. These are to be raised to the attention of the relevant maintenance authority and repair / replacement works agreed.
- 9.15** Where existing drainage is directly affected by the construction works, the Contractor shall take suitable permanent measures in order to maintain the connection with existing ditches or carriers outside the Works or taken into the Works in accordance with Clause 506.
- 9.16** Pipes shall be cut by a method which provides a clean square profile, without splitting or fracturing the pipe wall, and which causes minimal damage to any protective coating.
- 9.17** Connections to existing chambers shall be undertaken by breaking through the wall of the chamber providing an opening of the minimum size to effectively make the connection. The pipe shall be installed such that its soffit level is level with the soffit of existing pipes within the chamber, unless otherwise stated on the contract drawings. The flexible pipe joints shall be provided at the connection to the chamber in accordance with SHW Clause 507.17
- 9.18** The Contractor shall undertake investigative works at the locations detailed in the Drainage Drawings.
- 9.19** Where the new drainage utilises part of an existing system, the existing drain is to be cleaned to the next downstream chamber or outfall into ditch or watercourse.
- 9.20** Pipe connections shall be made in accordance with SHW Clause 506 and as shown on the project standard details. Joints shall be fully flexible and rocker pipes shall be used to mitigate the effects of settlement.

- 9.21** All covers and frames to existing chambers incorporated into the permanent works shall be replaced and set to the finished levels in compliance with the section on chambers in this Appendix.
- 9.22** For details of raising or lowering of existing chamber covers to suit the new finished ground level refer to SHW Clause 507.
- 9.23** New drains connected to existing manholes that are above the existing benching shall protrude beyond the chamber wall for a length of 100mm maximum. For new drains entering below top of benching, the benching shall be re-shaped to suit and re-benched with 20mm thick granolithic concrete.

10 Existing Land Drains

- 10.1** Where land drains are encountered or severed in the construction of the works they shall be reconnected to a separate outfall within the owner's land. Where this is not feasible, the existing land drainage will connect to the highway drainage system.
- 10.2** The position of each existing land drain when intercepted shall be recorded, and this information added to the construction records.

11 Connection of Existing Drains to New Drains and Details of Special Connecting Pipes

- 11.1** The layout of existing pipe work shown on the drawings and the levels shown in the chamber schedule are provided for information only. All relevant dimensions are to be verified prior to the commencement of construction and any significant discrepancies reported to the Overseeing Organisation.
- 11.2** The Contractor shall carry out all adjustments to existing chamber cover levels, which may be necessary as a consequence of the works. Detailed proposals shall be agreed with the Overseeing Organisation prior to commencing the works.
- 11.3** The existing CCTV condition survey along the scheme has identified defects along sections of existing drainage. Where existing pipes are to be repaired or replaced, these have been identified in the scheme drainage drawings and detailed. Techniques for in-situ (trenchless) pipe repairs and pipe replacement (using open trench) shall be confirmed by the Contractor and agreed with the Overseeing Organisation.

12 Chambers

- 12.1** Chambers shall be constructed in accordance with the HCD and project standard details for drainage; the project standard details for drainage shall take precedence should there be any conflict of detail.
- 12.2** All standard chambers for drainage will be WASP WW or Contraflow 500 Prefabricated Orifice flow control chambers (HDPE) or similar approved as detailed in the schedules and the standard detail drawing 30220231-ARC-HDG-ZZ-DR-HE-10007.

- 12.3** HDPE chambers shall have natural resistance to most chemicals associated with stormwater drainage systems.
- 12.4** Chamber covers and frames shall be Class D400 for trafficked area and C250 for non trafficked areas manufactured in ductile iron to BS EN 124. Covers shall be solid, non-rock and double triangular shaped with a frame depth of 150mm.
- 12.5** The cover classes and minimum clear opening for each chamber are stated in the drainage schedules.
- 12.6** When chamber covers are situated in the carriageway or other paved surface, the cover shall be of a suitable material, design and construction to achieve an in-service skid/slip resistance potential no less than the equivalent Polished Skid Resistance Value of the adjacent surfacing and not less than 60. A test certificate shall be supplied for both dry and wet conditions from an approved UKAS tester.
- 12.7** All chambers are deemed to be confined spaces and the Contractor shall fully comply with all relevant legislation regarding entry into the same and to give all notices applicable to this type of activity.
- 12.8** Prior to commencing a drainage run which connects to an existing manhole or ties into an existing system, the Contractor shall verify and record the route and invert levels of the existing pipe/chambers and identify any side connections along its length. Any discrepancies shall be immediately reported to the Designer.
- 12.9** Flexible couplings are used for forming joints between WASP chamber spigots and inlet/outlet drainage pipes. A range of diameters and adapters are available to suit most combinations. Where the difference in diameter exceeds 12mm a bush should be used.
- 12.10** The stainless steel and rubber construction allows for greater flexibility and the ability to withstand an internal water pressure of 2.5 bar. Couplings comply with the requirements of Water Industry Specification WIS 4-41-01 "Specification for flexible couplings for gravity sewerage and drainage pipes".
- 12.11** The WASP WW Chamber and Contraflow 500 range offers the flexibility to include a fixed height weir overflow. The overflow weir is installed within the bulkhead on which the orifice device is mounted. The weir can be set to a specific height relative to the outlet pipe invert level.
- 12.12** In places where a high-water table is encountered, the buoyancy forces acting on chambers shall be determined prior to the commencement of construction and any significant discrepancies reported to the Designer.
- 12.13** The locations of flow control devices are detailed in the drainage schedules.
- 12.14** Chambers for all surface water drains shall be watertight.
- 12.15** Risks relating to the accumulation of ground gas across the Scheme is considered to be present during the construction and maintenance phases of the works where temporary confined / enclosed spaces are likely to be present. During construction, access to confined spaces and excavations should be restricted. Where work in confined spaces is unavoidable, a site specific and task specific risk assessment should be undertaken prior to the commencement of the works. Monitoring of confined spaces for potential ground gas accumulation should be carried out and the works should be undertaken by suitably trained personnel with the use of specialist personal protective equipment where necessary.

13 Gullies

- 13.1** All gully grating and frames in trafficked areas shall be Class D400 manufactured in ductile iron to BS EN 124. Nominal clear opening of gully gratings shall be 450mm x 450mm, minimum area of waterway shall be 1200mm², with a frame depth of at least 100mm. Gully grates and frames shall be kerb hinged, fitted with captive hinge that provides fast access and security against theft.
- 13.2** Gully gratings are to be orientated so as not to pose a hazard to cyclists riding over them in the direction of travel.
- 13.3** All gullies are to be trapped and be in accordance with drainage standard details.
- 13.4** Gully and combined kerb drain, and linear channel silt trap connections shall be a minimum of 150mm diameter.
- 13.5** Connections to the new drainage system shall be made using proprietary junction fittings.
- 13.6** Gully connections to drains shall be along the shortest line between the gully or silt trap and the drain.
- 13.7** The backfilling and surround to gully connections should be in accordance with drainage standard details.

14 Joints

- 14.1** Joints in surface water drains shall be flexible and watertight complying with Sub-Clause 3 of Clause 504 of the Specification for Highway Works.
- 14.2** Filter drains shall have joints in accordance with Sub-Clause 6 of Clause 504 of the Specification for Highway Works.
- 14.3** Filler board for use at pipe joints to preserve the flexibility of concrete protected pipelines shall comply with BS EN 322 / BS EN 323 and clause 1015 of the Specification for Highway Works.
- 14.4** All branch connections to pipelines shall be made using formed junctions ("Y" or "T" connections) or uni-junctions. Saddles shall only be permitted for achieving connection to an existing drainage system and only with the Designer's approval. Where pipe to pipe connections is required due to repair / remediation works, band seal connections are acceptable.

15 Flow and Weir Control Devices

- 15.1** Orifice plate and flow control details are provided on the drawings and schedules as appropriate and shall be constructed in accordance with the project standard details.

16 Requirement for Rapid Setting Bedding Materials

- 16.1** Gully tops shall be set in rapid setting bedding materials complying with the requirements of CD 534 – Chamber Tops and Gully Tops for Road Drainage and Services as follows:
- 1) Material is non-shrink
 - 2) Material to have a minimum workable life of 15 mins
 - 3) Minimum compressive strength of 30 N/mm² in 3 hours
 - 4) Minimum tensile strength of 5 N/mm² in 3 hours
- 16.2** Rapid bedding is not required for chambers as these are out with the live carriageway.

17 Requirements for Rodding Eye

- 17.1** 45 DEGREE RODDING POINT:
- Type – Circular or Oval rodding point
 - Manufacturer and reference – PS622S as manufactured by Polypipe or approved equivalent.
 - Size – 150 mm Diameter
 - Assembly material – Aluminium
 - Surrounded with selected dug material in accordance with BS EN 1610:2015 Clause 5.3.2
 - Refer to standard detail drawing 30220231-ARC-HDG–ZZ-DR-HE-10007

18 Requirements for Retention Systems

- 18.1** Rain Gardens and RootSpace or similar approved modular structure attenuation areas are required at the locations shown on the drainage layout drawings and make-up as per the associated detail drawings 30220231-ARC-HDG–ZZ-DR-HE-10008 to 10011
- 18.2** Base and sides of Rain Garden and RootSpace or similar approved unit to be wrapped in an impermeable geomembrane.
- 18.3** Any shrubs that are proposed to be planted in rain gardens shall comply with requirements stated in the Landscape specification document 30220231-ARC-ELS-XX-TS-LA-00001.

Table 5/1- 6 A typical raingarden section make up

Rain Garden	
Freeboard	75mm
Bark Mulch	50mm
Depth of topsoil	300mm
Depth of subsoil	120mm
Topsoil total porosity	47%
Subsoil total porosity	37%
Diameter of under-drainpipe	150 (fully perforated)
Drainage layer	Minimum 300mm

- 18.4** The RootSpace units or similar approved modular structure attenuation areas shall comply with the following pavement buildup requirements:

Pavement Layer	Pavement Option F1	
	Material Ref:	Thickness (mm)
Surface Course	PV01, PV02, PV07	80
Laying Course	LC1	30
Base course	B1	80
Subbase	SB1	240
Total Thickness		430

Pavement Layer	Pavement Option F4 ¹	
	Material Ref:	Thickness (mm)
Surface Course	PV05	80
Laying Course	LC2	50
Base course	B2	70
Subbase	SB2	200
Total Thickness		400

Pavement Layer	Pavement Option F5 ¹	
	Material Ref:	Thickness (mm)
Surface Course	PV06	80
Laying Course	-	-
Laying Course	LC1	30
Subbase	SB1	290
Total Thickness		400

Note: Refer to Road Appendix 11- Kerbs, footways and paved areas Specification – 30220231-ARC-HKF-ZZ-TS-HE-00001 for further details.

19 Trenchless Pipe Installation

19.1 Locations of trenchless pipes. Refer to Appendix 1/10 and Appendix 80/1 if applicable.

Appendix 5/2: Service Ducts Requirements

This Appendix is not used

Appendix 5/3: Surface Water Channels and Drainage Channel Blocks

This appendix is not used

Appendix 5/4: Fin Drains and Narrow Filter Drains

This appendix is not used

Appendix 5/5: Combined Kerb and Drainage System

This appendix is not used

Appendix 5/6: Linear Drainage Channel System

20 Linear Drainage Channel Systems

- 20.1** Linear drainage channel units are indicated in the drainage layout drawing and standard details:
- 20.2** The design is based on BIRCO 100 with a 0/0 channel unit system with 10mm weep holes to be drilled at a span of 50mm along the concrete channel. If alternative manufacturers are to be used, their products will require a further Designer's Site Representative assessment prior to approval.
- 20.3** Linear Drainage units shall be load class D400, in accordance with BS EN 1433.
- 20.4** For bedding details in relation to Linear Drainage Channel system, refer to manufacturer's installation details.
- 20.5** Survey requirements shall be in accordance with Appendix 90/1.

Appendix 5/7: Thermoplastics Structural Wall and Pipe Fittings

21 Thermoplastics Structural Wall and Pipe Fittings

- 21.1** The Contractor shall provide the following information, in accordance with sub- Clause 518.2, for the range of pipes and fittings (to be verified by the Certification body – see sub-Clause 518.15:
- 21.2** Technical drawings showing dimensions and tolerances including sealing rings and weight per metre, together with properties, as specified in sub- Clauses 518.3 and 518.5.
- 21.3** Material specification, as required in sub-Clause 518.2.

Table 5/7- 1 Unplasticised polyvinyl-chloride (PVC-U)

Unplasticised polyvinyl-chloride (PVC-U)		
Property	Test Method Reference	Specification
Tensile properties	BS EN ISO 6259, BS EN ISO 527-1	
Vicat	BS EN 727	
Longitudinal reversion	BS EN 743	
K-value	BS EN 922	
PVC Content	EN 1905	
Density	BS EN ISO 1183-3, ISO 4451	
Heat Reversion	ISO 12091	
Effects of heating (injection moulded of fittings only)	BS EN 763	

Table 5/7- 2 Polyethylene (PE)

Polyethylene (PE)		
Property	Test Method Reference	Specification
Tensile properties	BS EN ISO 6259, BS EN ISO 527-1	
Oxygen induction time	BS EN 728	
Melt Flow Rate	BS EN ISO 1133	

Density	BS EN ISO 1183-3, ISO 4451	
Melt Flow Rate	ISO 4440	
Heat Reversion	ISO 12091	
Effects of heating (injection moulded of fittings only)	BS EN 763	

Table 5/7- 3 Polypropylene (PP)

Polypropylene (PP)		
Property	Test Method Reference	Specification
Tensile properties	BS EN ISO 6259, BS EN ISO 527-1	
Oxygen induction time	BS EN 728	
Melt Flow Rate	BS EN ISO 1133	
Density	BS EN ISO 1183-3, ISO 4451	
Melt Flow Rate	ISO 4440	
Heat Reversion	ISO 12091	
Effects of heating (injection moulded of fittings only)	BS EN 763	

Appendix 90/1: Specifications For Drainage CCTV Surveys

22 Testing

- 22.1** On completion of the whole of the works the Contractor shall flush and survey all drainage elements. All drainage elements are to be left free from obstruction.
- 22.2** All existing carrier pipe runs to be incorporated into the proposed works shall be cleaned using high pressure jetting apparatus in such a manner to remove any deposited solids from within the pipes upon completion of all new/replacement pipe work and remedial treatments. The jetting equipment for the operation shall be capable of operating at a pressure of 2000 PSI (140.6 kg/cm²) and have a flow rate of 55 gallons per minute (4.2 litres/second). The pipes, when jetted and cleaned, shall be checked by drawing through a mandrel as Clause 509.4 with the exception that the mandrel shall be 20mm less than the diameter of the pipe.
- 22.3** A CCTV survey of the pipe networks shall be undertaken by the contractor on completion of the works to confirm there are no defects left.

23 Drainage Handover

- 23.1** Transport for London requires a walk-through inspection to enable a snagging list to be produced and closed out for all the surface drainage assets.