



**SPECIFICATION FOR
UNDERGROUND DRAINAGE
SERVICES**

AT

**THE COTTAGE, SHRIPNEY ROAD
BOGNOR REGIS
WEST SUSSEX
PO22 9PA**

Issue Status:	DRAFT PLANNING SUBMISSION
Document Ref:	22761-SP-UDS-001
Date of Issue	23 DECEMBER 2019
Revision: (see next page for details)	00
Author:	CHRIS SPRINGETT
Checked By:	CHRIS JEFFERSON
Approved By:	KEITH HICKS

Copyright © HILSON MORAN – 2018 All rights reserved. This Technical Specification has been produced by Hilson Moran Partnership Ltd. No part of this document may be reproduced in any material form without the written permission of a Director of Hilson Moran Partnership Ltd. Enquiries about copyright should be made to the Technical Director at the Hilson Moran Partnership Ltd offices in London.

SPECIFICATION REVISION DETAILS

Rev.	Date	Status	Section	Clause	Comment
00	23.12.2019	Draft Planning	ALL	ALL	Draft Planning Issue

TABLE OF CONTENTS

D01	SCOPE OF WORK	1
D010100	DESCRIPTION.....	1
D010110	Overview	1
D010120	Foul Drainage Installation	1
D010130	Surface Water Drainage	2
D010140	Ground Conditions	2
D010400	DEFINITIONS.....	2
D010700	GENERAL	3
D011000	HEALTH AND SAFETY.....	3
D011300	DELETERIOUS MATERIALS.....	3
D011600	TENDERS.....	5
D011900	SAMPLES	5
D012200	PROTECTION AND STORAGE	5
D012500	UNDERGROUND DRAINAGE INSTALLER PREPARED DESIGN AND DRAWINGS.....	6
D013100	MANUFACTURERS.....	6
D013400	MATERIALS	6
D013700	NEGOTIATIONS AND INSPECTIONS.....	7
D014000	EXISTING SITE SERVICES	7
D014300	CONNECTION TO THE EXISTING SITE DRAINAGE NETWORKS AND PUBLIC SEWERS.....	8
D014600	CONNECTION TO WATERCOURSE OUTFALL	9
D014900	SEWER AND DRAINAGE DIVERSIONS	9
D015200	GROUND CONDITIONS	9
D015500	STANDARDS.....	10
D015800	ENVIRONMENTAL ASSESSMENT	10
D016100	RADIO INTERFERENCE AND ELECTROMAGNETIC COMPATIBILITY	11
D03	DESIGN CRITERIA	12
D030100	INTRODUCTION	12
D030400	FOUL DRAINAGE SYSTEM	12
D030700	SURFACE WATER DRAINAGE.....	12
D65	DRAINAGE PIPEWORK INSTALLATION	13
D650100	INTRODUCTION	13
D650400	EXCAVATION WORKS	13
D650401	Setting out.....	13
D650404	Excavation	14
D650407	Supports for Excavations.....	15
D650410	Trench Widths.....	15
D650700	PIPEWORK BED AND SURROUND	16
D651000	BACKFILLING.....	16
D651300	SURFACE REINSTATEMENT	17
D651600	PIPE LAYING.....	17
D651601	General.....	17
D651604	Levels.....	18
D651900	PIPEWORK	19
D651901	General.....	19

D651904	Vitrified Clay Pipework.....	19
D651919	PVCu Pipework.....	20
D651922	Thermoplastic Structured Wall Pipework (150 mm to 300 mm Diameter).....	20
D652200	MARKER TAPES	20
D67	MANHOLES	21
D670100	GENERAL	21
D670400	BRICK MANHOLES	22
D670700	PRE-CAST CONCRETE RING MANHOLES.....	22
D671200	PLASTIC INSPECTION CHAMBERS.....	23
D671300	MANHOLE COVERS AND FRAMES	23
D73	GULLIES	25
D730100	EXTERNAL GULLIES.....	25
D730200	EXTERNAL DRAINAGE CHANNELS	25
D77	ATTENUATION, COLLECTION AND TREATMENT SYSTEMS	26
D770100	GEOCELLULAR ATTENUATION STORAGE SYSTEMS.....	26
D770400	RUNOFF COLLECTION AND TREATMENT SYSTEMS.....	26
D770700	ATTENUATION CONTROL UNITS	26
D771000	GEOCELLULAR SOAKAWAYS.....	26
D82	CCTV SURVEYS	28
D820100	INTRODUCTION	28
D820400	CLEANING.....	28
D820700	PICTURE QUALITY.....	28
D821000	LINEAR MEASUREMENTS	28
D821300	REPORT.....	29
D90	TESTING AND INSPECTION.....	30
D900100	GENERAL	30
D900400	ATTENDANCE	30
D900700	TEST EQUIPMENT.....	31
D901000	TEST CERTIFICATES.....	31
D901300	FAILURE OF TEST	31
D901600	TESTING AND INSPECTION OF DRAINAGE WORKS	32
D901601	General.....	32
D901604	Pipework Air Test	32
D901607	Pipework Water Test, Gravity Systems.....	33
D901613	Testing of Manholes, Catchpits and Sumps	33
D902200	LOCAL AND STATUTORY AUTHORITIES	33
D91	TECHNICAL SUBMITTALS	34
D910100	TECHNICAL SUBMITTALS GENERAL.....	34
D92	DESIGN AND CONSTRUCTION DOCUMENTATION	36
D920100	TENDER DRAWINGS	36
D920400	CONTRACT DRAWINGS	36
D920700	DIGITAL DATA.....	36
D921300	MANUFACTURERS DRAWINGS.....	37
D921600	SAMPLES	37

D921900	UNDERGROUND DRAINAGE INSTALLER PREPARED DRAWINGS	37
D922500	BUILDERS WORK DRAWINGS	38
D922800	ISSUE OF DRAWINGS.....	38
D923100	DIMENSIONS	39
D923400	SITE COPIES	39
D95	RECORD DOCUMENTATION	41
D950100	ASSET REGISTER	41
D950400	BUILDING LOG BOOK	41
D950700	BUILDING USER GUIDE.....	41
D951000	MANUALS.....	41
D951300	RECORD DRAWINGS.....	43
D97	SCHEDULES	45
D970100	DRAINAGE DRAWING SCHEDULE.....	45
D970400	PIPEWORK, MATERIALS, JOINTS AND FITTINGS.....	46
D971600	ACCEPTABLE MANUFACTURERS	47

D01 SCOPE OF WORK

D010100 DESCRIPTION

D010110 Overview

- (a) The underground drainage works described below are to facilitate the construction of 20 new dwellings on the parcel of land known as The Cottage, Shripney Road, to the north of the public footpath.
- (b) The development comprises a mix of flats, semi-detached and detached dwellings.
- (c) There is a gentle gradient across the site falling from the north east to the south west corners of the site, towards Shripney Road.
- (d) The existing outbuildings and cottage on the site are to be demolished and all the associated utility services and drainage system are to be isolated and made safe.
- (e) It is not intended to retain any part of the existing drainage systems which currently serve the Cottage and outbuildings and these are to be grubbed up or, filled with a sand cement slurry where they will not impact the proposed works, to ensure they are stable and cannot become rat runs.

D010120 Foul Drainage Installation

- (a) A dedicated gravity foul drainage system shall be provided to receive the foul effluent discharge from all the dwellings on the development.
- (b) This drainage/sewer system shall be routed from east to west across the site, with the primary sewer run routed beneath the main estate access route.
- (c) The sewer shall be routed to ensure there is a clear utility service route to the north of the run and a clear zone to the south to accommodate the below ground surface water attenuation tanks located in this area.
- (d) Subject to the agreement of Southern Water, the intention is to connect the development's foul sewer network to the foul public sewer which flows from north to south along the west/far side of Shripney Road, at existing manhole No.7202.
- (e) At an early stage of the contract the Contractor shall locate manhole No.7202 and verify the cover and invert levels of this manhole against Ordnance Datum. (Southern Water sewer records indicate a cover level of +2.23m AOD, and an invert level of -0.37m BOD).
- (f) Prior to commencing any drainage works, the Contractor shall ensure he has Southern Water's written agreement to the connection and to the location at which the connection is to be made.
- (g) The Contractor shall record any defects found in the above manhole or with the associated sewer and also verify the size of that sewer. Any defects or differences in the levels stated above shall be immediately report to the Architect and Engineer.

D010130 Surface Water Drainage

- (a) In constructing this development the extent of the impervious area will significantly increase from that which currently exists.
- (b) There is currently no public surface water sewer network available to receive the rainwater run-off from this development and it will therefore be necessary to accommodate this increased load within the site.
- (c) To achieve this it is proposed to provide a number of interconnected below ground attenuation and infiltration tanks to capture and retain this additional surface water run-off and to then let it infiltrate into the subsoil via the infiltration units.
- (d) The combined actual storage volume of the attenuation and infiltration units, as required by Hilson Moran's Flood Risk Assessment Report No. 22761/S/FRA01/01 based on the 1 in 100 year return storm, is **204.7m³**.
- (e) Two overflow lines shall be provided from the attenuation system discharging to the ditches which run north to south along the western and eastern boundaries of the site. These overflows will only discharge once the attenuation system is full, so any discharge from these will be very infrequent.
- (f) The above overflows shall each be fitted with a flow control device to restrict the combined rate of discharge to **6.9 l/sec** the peak discharge flow from the current, pre-developed site. The Contractor is to liaise with the relevant Authorities with respect to the discharge of these overflows and obtain written consent from them.
- (g) With respect to the overflow lines which discharge to the western ditch on Shripney Road, these will discharge via a pond, to be detailed by the Landscape Architect. The flow control device will be installed on the outfall from the pond and prior to the connection to the ditch.

D010140 Ground Conditions

- (h) The Contractor shall ensure he is fully conversant with all available site and soil investigation reports, including the water table and infiltration report prepared by Robert Clark Associates Ltd dated 18 November 2019.
- (i) Water table levels recorded in the above report have been corrected to Ordnance Datum and have been plotted on the HM Surface Water Drainage GA, for ease of reference.
- (j) These water table levels have been used in determining the base level of the various attenuation and infiltration units as it is critical that the base of these units sits above the water table.

D010400 DEFINITIONS

- (a) The following terms are used within this specification and shall be construed accordingly:
 - i) **Contractor** - Contractor shall mean the person or persons appointed to carry out the Main Contract Works and shall have the same meaning as is defined in the Conditions of Contract

- ii) **Employer** - Employer shall mean the person or persons employing the Contractor to carry out the Contract Works and shall have the same meaning as is defined in the Conditions of Contract
- iii) **Contract Administrator** – Shall mean the person or persons appointed by the Employer to represent him for the purposes of administering the Contract
- iv) **Engineer** - Engineer shall mean the person or persons appointed by the Employer to represent him in connection with the monitoring of the works described in this Specification
- v) **Underground Drainage Installer** – Underground Drainage Installer shall mean the person or persons appointed by the Contractor to undertake the installation of the drainage systems described within this specification

D010700 GENERAL

- (a) This specification sets out the standards of materials and workmanship to be adopted for the Works. Materials shall be new, of high quality and shall conform to the latest edition of the relevant British Standards. Where a British Standard has been superseded by a European Standard adopted within the United Kingdom, then the replacement standard shall take precedence. Wherever possible, metric dimensioned equipment shall be employed.
- (b) Plant and equipment shall be fully protected during delivery, storage and installation. Protection shall be properly maintained subsequent to installation and to Practical Completion. The Contractor shall be responsible for any damage due to failure to protect the Works.
- (c) Where this specification refers to structural/civil elements such as chamber construction, reinforced details, concrete strength etc. the Underground Drainage Installer shall verify these with the Engineer during the tender period.

D011000 HEALTH AND SAFETY

- (a) Work shall comply with the requirements of the Health and Safety Executive including Statutory Instructions and Recommendations issued by them.
- (b) The Construction (Design and Management) Regulations shall be complied with in the execution of the work. The instructions of the Principal Contractor and the requirements of the Health and Safety Plan shall be followed.
- (c) The installation shall incorporate every reasonable precaution and provision for the safety of all those concerned in the operation and maintenance of the Works and of associated works supplied by others.

D011300 DELETERIOUS MATERIALS

- (a) None of the following materials or products shall be incorporated into the Works:
 - i) Sea dredged aggregates, unless they have been tested in accordance with BS EN 1097; and conform in all respects to BS EN 1992
 - ii) Asbestos based products

- iii) Resin coated blocks
 - iv) Calcium silicate bricks or tiles
 - v) Slipbricks
 - vi) High alumina cement
 - vii) High alkali cement not conforming with British standards
 - viii) CFC's or any product using CFC's in its manufacture
 - ix) Chloride based mixtures
 - x) Glass fibre reinforced concrete
 - xi) Tricovite concrete
 - xii) Chipcrete
 - xiii) Woodcrete
 - xiv) Timber which is not obtained from a managed regulated sustainable source
 - xv) Lead, except where particularly specified for connection to existing cast iron drainage pipes
 - xvi) Asbestos substitutes or any naturally occurring or manmade mineral fibres (including rock-wool or slag wool) with a thickness of 3 microns or less and a length of 200 microns or less or which contain any fibres not sealed or otherwise stabilised to prevent migration of fibres
 - xvii) Vermiculite plaster
 - xviii) Extruded polystyrene other than low ozone depletion material
 - xix) Polyurethane Foam
 - xx) Urea-formaldehyde polyurethane, isocyanurates, polyisocyanurates in foams or materials which may release gases in quantities which may be hazardous, with reference to the limits set from time to time by the Health and Safety Executive
 - xxi) Woodwool slabs in permanent formwork or structural elements
 - xxii) Aggregates susceptible to alkali silica reaction
 - xxiii) Any products containing cadmium which are referred to in SI 2006/3311 Controls on dangerous substances and preparation regulations 2006 (including 2007 corrections) or any amendment or re-making thereof
 - xxiv) Any timber treated with pentachlorophenol
 - xxv) Polytetrafluorethylene (known as PTFE) except when used as non-stick sealing with valves or as an isolating tape
 - xxvi) Materials, which emit Radon gas
- (b) Other substances which, at the time of Tender, have been publicised by the Health and Safety Executive, Building Research Establishment, British Standards Institution

or other Specialist Authority as being deleterious to Health or Safety, shall not be incorporated into any part of the Works.

- (c) Substances, which have been similarly publicised as being deleterious to the durability of property, shall not be used, nor shall any substance, which has been publicised as being damaging to the environment unless the Engineer has agreed to such use in writing. The Engineer will only agree to the use of any such material where it can be shown that the use is essential in connection with the Works and that no suitable alternative exists.

D011600 TENDERS

- (a) Tenders shall be submitted in the format required by the tender documentation. The Tenderer shall complete the technical schedules (and appendices where included) attached to the rear of this Specification as part of the tender submission.
- (b) Tenders shall comply with the requirements of this Specification. Where the Tenderer wishes to submit an alternative for consideration it shall be submitted in an accompanying letter with a full description, including details of the variation from the Specification and the cost and programme effect of the proposal.
- (c) Tenders, which do not comply with the above requirements, will be rejected.

D011900 SAMPLES

- (a) Such samples of workmanship, finishes, materials or equipment as the Engineer may require shall be submitted for comment. Samples of items requested shall be forwarded in sufficient time to allow the Engineer to consult with the Contract Administrator and Employer before advising of any comments.
- (b) Where in the opinion of the Engineer the samples submitted are not of a high enough standard or are unsuitable for use in the proposed circumstances, alternative samples shall be obtained from such a source, as the Engineer shall decide.
- (c) Samples, after comment shall, as the Engineer decides, either remain in the possession of the Engineer until the expiry of the maintenance or guarantee period, whichever is the longer, be embodied in the installation, or be returned to the Manufacturer.

D012200 PROTECTION AND STORAGE

- (a) Where necessary, items of equipment shall be delivered in sections, suitable for installation in position within the Works.
- (b) Adequate and safe storage and protection of all materials, plant and equipment shall be provided. Equipment shall be stored in accordance with the relevant British Standard or Code of Practice. Where materials, plant and equipment cannot be stored in suitable buildings they shall be raised and supported clear of the ground. They shall be protected against frost or damage due to building work with waterproof covers or other appropriate protection.
- (c) Conduits, pipes and similar materials shall be adequately supported and stored on properly made racks to prevent bending and distortion. Ends shall be closed and

threads protected by means of purpose made end caps. Storage of pipes, conduits or other materials directly on earth will not be permitted.

- (d) Machined and bright surfaces shall be protected by paint, tallow or grease where this has not been carried out by others or has become removed in transit. On completion, surfaces so coated shall be cleaned and where appropriate, polished.
- (e) Plant and equipment shall be left in a condition ready for painting where painting is required. Parts liable to corrode shall be painted immediately after removal of the temporary protection.
- (f) Electrical cables shall be protected from any physical damage and their ends sealed using methods and materials recommended by the cable manufacturer

D012500 UNDERGROUND DRAINAGE INSTALLER PREPARED DESIGN AND DRAWINGS

- (a) The Underground Drainage Installer shall undertake to complete the design and production of all drawings required by this Specification. The design shall be based upon the information provided in this Specification and shown on the Tender Drawings.
- (a) The requirements for installation drawings prepared by the Underground Drainage Installer are set out in Clause V921900.
- (b) The design work shall be carried out under the direct control of suitably qualified and experienced personnel. The Underground Drainage Installer shall submit, as part of the Tender, the names of the personnel to be employed on the design work, together with their qualifications and a brief summary of their experience.
- (c) Copies of design calculations and installation drawings shall be submitted to the Engineer for comment prior to ordering of materials or commencing work.
- (d) The design shall comply with all current Regulations; Codes of Practice and Standards including those listed in the previous clauses.
- (e) The Contractor shall be responsible for submitting drawings to Local and Statutory Authorities and for obtaining all necessary approvals from them. Letters of approval from each Authority shall be provided to the Employer and Engineer in such time as to ensure no disruption to the contract.

D013100 MANUFACTURERS

- (a) Equipment shall only be selected from the manufacturers listed in this specification unless an alternative manufacturer has specifically been agreed with the Engineer in writing.

D013400 MATERIALS

- (a) A complete schedule of materials included shall be submitted with the Tender. The Schedule shall indicate manufacturer, material, description and identifying reference.
- (b) The same manufacturer throughout the Contract shall provide equipment of any one type. Components provided as part of any equipment shall be of the same type and manufacture throughout all items provided by one manufacturer.

- (c) Companies who provide a full after sales service shall supply materials. The supply of adequate general spares and components for a period of at least ten years from the date of Practical Completion shall be ensured so far as is reasonably practical.

D013700 NEGOTIATIONS AND INSPECTIONS

- (a) Costs involved in negotiations for Licences, Police Attendance, Notices etc involved in temporary road closures in connection with the installation of drainage within the public highway or in connection with plant and equipment deliveries shall be included by the Contractor. Arrangements shall comply with the requirements of the Health and Safety Executive.
- (b) The Underground Drainage Installer shall provide any inspection and testing of equipment required by the Employers Insurance Company, British Standard Specifications and by this Specification.

D014000 EXISTING SITE SERVICES

- (a) The Underground Drainage Installer shall fully acquaint himself with all existing site services and determine the exact location, depth, size and extent of existing watercourses, sewers, services and apparatus within or adjacent to the site boundaries. Such record copies of drawings or information as are available from the Contract Administrator or Engineer indicating Local and Statutory Authority networks and their approximate locations shall be obtained. Statutory and Local Authorities shall also be approached to obtain any further outstanding information. Should the information provided be inadequate, the Contractor shall notify the Contract Administrator and Engineer, with a view to obtaining an instruction to excavate additional trial holes or use other means of location in conjunction with the relevant authority. Where available, copies of record information indicating private services within the boundary of the site and their approximate locations shall be obtained, or their details similarly determined.
- (b) The Underground Drainage Installer shall determine the exact location, level and size of all sewers where a connection is to be made, or where the sewer is to be avoided. Levels for such connections shall be verified by adequate trial holes formed at the point of connection. Should the connection be obstructed The Contractor shall report the circumstances to the Engineer. All costs incurred in compliance with this clause including trial holes or the like shall be borne by the Contractor.
- (c) Where the site has not been previously developed or any buildings have been previously demolished the Contractor shall provide an electronic survey of the site to establish the presence, location and position of Local Authority, Statutory Authority, private services or any other underground obstruction.
- (d) Where excavation is taking place adjacent to or over an existing or suspected site service or retained structure the excavation shall be completed by hand, due care being taken to protect the existing service. Where an existing site service has been exposed care shall be taken to ensure that the excavation does not undermine its stability and to maintain the service bedding and surround or equivalent support at all times.
- (e) Where a redundant site service, which may be either dangerous to health or may lead to ground contamination is exposed, the Contract Administrator and Engineer shall

be notified. The Contract Administrator shall issue instructions regarding removal, grouting or sealing the ends of redundant services.

- (f) Where an existing sewer is to be retained but is liable to be affected by the site works, the Underground Drainage Installer shall carry out a CCTV condition survey of the sewer before commencing work. The full agreement of the responsible authority shall be obtained with respect to the manner and the timing of this survey and all their requirements shall be fully complied with. Three copies of the survey on DVD/USB Drive and two copies of the report shall be forwarded to the Contract Administrator and Engineer and a copy also retained as evidence for dilapidations.
- (g) Where an existing sewer is to be re-used, existing manhole covers, gullies, gratings and the like shall be replaced as indicated by this specification.
- (h) Where the Underground Drainage Installer or Contractor damages existing site services they shall be repaired or the service replaced to the satisfaction of the Engineer.
- (i) Damage to local or statutory authority services shall be brought to the attention of the appropriate body. Should this damage have been caused by the Contractor or Underground Drainage Installer they shall bear the full costs of rectification to the relevant Authority's complete satisfaction.

D014300 CONNECTION TO THE EXISTING SITE DRAINAGE NETWORKS AND PUBLIC SEWERS

- (a) The Underground Drainage Installer shall liaise with the local authority, water undertaker and the Environment Agency to obtain their agreement for the installation works associated with any outfalls and for the granting of any associated licence, including licences to discharge trade effluent, if required.
- (b) The Contractor shall liaise, at Tender stage, with the local authority or water undertaker to ensure that a sewer connection is agreed and provided within the programme, including any order or instruction required by the Authority or Undertaker. Copies of all information shall be submitted to the Engineer. The Contractor shall include all costs for the complete connection including road closures and inspections.
- (c) Where all or part of the sewer connection works on behalf of the local authority or water undertaker forms part of the Contract, the exact demarcation of the works shall be determined at Tender stage. The Contractor shall be responsible for obtaining all necessary licenses, including those required by the highways authority. All information and details required by the local authority or water undertaker relating to the sewer connection works shall be provided.
- (d) The Contractor, at time of tender, shall ascertain from the Local Authority whether the sewer connection works shall be completed from within an open excavation or using trenchless technology and shall make due allowance within the tender for such works. The method and materials required for the sewer connection shall be agreed with the Local Authority. Written consent shall be obtained prior to any orders being placed or work started.
- (e) Access shall be allowed to the site for local authority or water undertaker personnel involved in the sewer connection works. The relevant representatives shall be advised of all test and inspection dates as described within this specification.

- (f) Where an existing sewer connection is to be re-used a pressure test and CCTV survey of the connection shall be undertaken prior to progressing the installation of any new system pipework.
- (g) Unless Otherwise Stated the Underground Drainage Installer shall include for carrying out a second CCTV survey following completion of the sewer connection should the relevant Authority or the Engineer consider this necessary.
- (h) Surface reinstatement of all trenches and the like shall be to the original condition or to that described in the Specification.

D014600 CONNECTION TO WATERCOURSE OUTFALL

- (a) The Contractor shall liaise with the local authority, water undertaker and the Environment Agency to obtain their agreement for the installation works associated with any outfalls and for the granting of any associated licence, including licences to discharge trade effluent, if required.
- (b) Access shall be allowed to the site for local authority, water undertaker and The Environment Agency personnel who wish to inspect the Works. The relevant representatives shall be advised of all test and inspection dates as described within this Specification.
- (c) The works shall be undertaken fully in accordance with the Environment Agency guidelines. Where the watercourse is tidal or where works are to be carried out through flood defences, the specified flood protection level shall be maintained at all times.

D014900 SEWER AND DRAINAGE DIVERSIONS

- (a) Sewer diversions shall be carried out as required by the Local Water Authority. The work shall comply with the requirements of the Water Authorities Association's document "Sewers for Adoption" unless the Local Authority determines otherwise.
- (b) Where any section of the works is being carried out with a view to the sewer being adopted by the Local Authority, either on completion or in the future, the works shall be carried out to the standards required by the Authority. The requirements of "Sewers for Adoption" shall be complied with unless the Authority requires an alternative standard.
- (c) All necessary temporary arrangements shall be allowed for and included within the tender to ensure, where necessary, a continuity of service as provided throughout the works i.e. temporary diversion, pumping over etc.

D015200 GROUND CONDITIONS

- (a) The Underground Drainage Installer shall take full cognisance of the information contained within the borehole or ground condition report where this is available. Full and adequate provision shall be made to accommodate any specific condition referred within the report. The Underground Drainage Installer shall confirm within the tender that provision has been made to deal with any reported ground condition.
- (b) Where the presence of ground water, chemicals, unstable ground, contaminants or other hazard is suspected from the reports, the Underground Drainage Installer shall

prepare method statements describing the action to be taken to ensure that the Works are installed and protected against the particular hazard. The method statements shall include all provisions necessary to comply with the risks to health and safety involved in the installation, operation and maintenance of the Works.

- (c) Where a borehole or ground condition report is not issued with the tender, the Contractor shall immediately advise the Engineer. Should the Contractor have, for any reason, reservations as to the accuracy or extent of the information contained within the report, he shall immediately advise the Contract Administrator and Engineer of his concerns.

D015500 STANDARDS

- (a) The works shall, unless otherwise stated elsewhere, conform to the requirements of the documents listed below. Design work carried out by the Underground Drainage Installer shall comply with the appropriate sections of these documents
- i) BS 6037 Code of Practice for the planning, design, installation and use of permanently installed access equipment. Suspended access equipment
 - ii) BS EN 12056 Parts 1 - 5 Gravity Drainage Systems
 - iii) BS 8000: Part 14 Workmanship on Building Sites. Code of Practice for below ground drainage
 - iv) BS 8000-0 Workmanship on Construction sites. Introduction and general principles
 - v) BS EN 752 Drains and Sewer Systems Outside Buildings
 - vi) Sewers for Adoption Current Edition
 - vii) Part H of the Building Regulations Current Edition
 - viii) Civil Engineering Specification for the Water Industry (CESWI By WRC) Current Edition
 - ix) Department of The Environment Road Note 35 Current Edition
 - x) BRE Digest DG365 Soakaway Design Current Edition

D015800 ENVIRONMENTAL ASSESSMENT

- (a) It is the responsibility of the Contractor to establish whether an environmental assessment (BREEAM, WELL, HQM, LEED or similar) is being carried out on the project and if so, to obtain a copy of the Assessors current report and comply with it. Complying with and achieving credits relating to construction activities shall deem to be included within the tender.
- (b) Where an environmental assessment is being undertaken, this technical specification may include a specific section relating to these requirements, which is to be read in conjunction with all other sections of the specification and complied with in all respects.
- (c) The Contractor shall at all times undertake his work to ensure targeted credits are achieved in the final Post Construction /Post Fit Out Assessment and shall provide the

appropriate evidence as required by the Assessment method being followed. Any “at risk” credits shall be discussed with the Assessor and Engineer at the earliest opportunity.

D016100 RADIO INTERFERENCE AND ELECTROMAGNETIC COMPATIBILITY

- (a) All equipment supplied to the site shall be either electromagnetically benign or carry the CE mark and be provided with copies of the relevant test certificates.
- (b) Prefabricated equipment shall conform to the Electromagnetic Compatibility Regulations by the provision of the Technical Justification File for the item.
- (c) The Underground Drainage Installer shall provide all relevant documentation as required by the Contractor to enable full production of a Technical Justification File for the project.

D03 DESIGN CRITERIA**D030100 INTRODUCTION**

- (a) The underground foul and surface water drainage systems shall be designed to carry the loads advised by the designer of the above ground soil, waste and rainwater collection systems when available.
- (b) Where a designer for the above ground soil, waste and rainwater systems has not been appointed, these loads shall be calculated based on the criteria below.

D030400 FOUL DRAINAGE SYSTEM

- (a) The gravity foul drainage system shall be designed to carry the load determined from the discharge units and flow rates scheduled in BSEN 12056 Part 2, Table 2, System III.
- (b) Foul gravity drainage systems shall be sized to flow no more than $\frac{3}{4}$ full under peak load and maintain a self-cleansing velocity of between 0.76 and 1.2m/sec, under average flow conditions.
- (c) Flow rates shall be calculated using a frequency factor determined from Table 3 of BS EN 12056 Part 2. Systems draining offices and dwellings will use a frequency factor of 0.5 intermittent use.

D030700 SURFACE WATER DRAINAGE

- (a) The surface water drainage system shall be designed to carry the load generated by the storm derived from the criteria below in compliance with Approved Document H of the Building Regulations:
 - i) Building life of 100 years.
 - ii) Storm duration of five minutes.
 - iii) Section H3 - Diagram 2.
- (b) This equates to a rainfall intensity of 0.014 l/sec/m².
- (c) Percentage increase applied over lifetime of building to meet climate change taken at 0.014 + 40% = 0.020 l/sec/m².

D65 DRAINAGE PIPEWORK INSTALLATION**D650100 INTRODUCTION**

- (a) This Section of the Specification describes the pipework, fittings, manholes, gullies, chambers and pumping stations together with all other related drainage elements and accessories required to provide a complete drainage installation. Drains, fittings, manholes etc. shall be set out in accordance with the Specification and Drawings. All items for the complete execution of the works shall be provided. Any works incorrectly constructed or constructed with incorrect materials shall be removed and replaced.
- (b) Work within or adjacent to any sewer shall be carried out in accordance with the provisions of "Safe Working in Sewers and at Sewage Works" obtainable from the Water Authorities Association and also with reference to the HSE Document "Working with Sewage".
- (c) The Contractor shall be responsible for co-ordinating the installation of the drainage works within this Contract with all other site works. Regular meetings shall be held for this purpose. The Contractor shall submit the requisite construction notices to all necessary Parties.
- (d) Materials shall be stored in accordance with the manufacturer's recommendations. Damaged protective coatings shall be rectified to the original condition of the component, or replaced, as required by the Engineer. Materials for drainage works shall be delivered and installed in accordance with the manufacturer's recommendations.
- (e) The Underground Drainage Installer shall at all times maintain a competent foreman on site with detailed knowledge of good drainage practice. Prior to commencement of the Works a Curriculum Vitae for the proposed foreman shall be submitted to the Engineer. Should the Engineer not be satisfied with the proposed foreman, details of alternative personnel shall be submitted. The Underground Drainage Installer shall employ tradesmen skilled in the installation of drainage works.

D650400 EXCAVATION WORKS**D650401 Setting out**

- (a) The Underground Drainage Installer shall be responsible for the correct setting out of the Works.
- (b) Finished ground levels, invert levels and sizes of existing drains, manholes and catch pits shall be checked before the commencement of any works. The Contract Administrator and Engineer shall be notified immediately if the declared levels, inverts or sizes are found to be incorrect. Prior to commencement of work, full details of the finished site ground levels shall be obtained. Exposed components of the system shall be installed relative to the finish levels as described elsewhere or to the manufacturers' recommendations.
- (c) The approximate position of drains and associated works shall be as shown on the drawings. Such positions shall be checked before proceeding with any works to avoid interference with existing structures and other existing site services. Trial holes shall

be made as necessary ahead of the work to ascertain the positions of existing services and obstructions. Excavation work adjacent to existing structures shall not undermine the stability of the structure. Any area of concern shall be clarified with the Engineer before work proceeds.

D650404 Excavation

- (a) Excavations shall be cut and trimmed to the lines, levels and depths shown on the drawings, or to such other lines, levels or depths as directed. Unless agreed otherwise excavations shall be formed with vertical sides. Dimensions of excavations shall not be larger than listed in this Specification, with allowance for timbering, shuttering or other temporary work where required.
- (b) Excavations exceeding the width or depth stated should be refilled with C7.5P grade concrete (lean mix) or equal fill to reduce the excavation to the listed dimensions. If any trench is cut to a greater width than specified the Engineer shall be informed to enable suitable alternative bedding to be agreed. Where a concrete or granular bed or surround is required the excavation shall be taken out to the overall dimensions of the bed or surround.
- (c) Excavated material, or other material to be used for backfilling purposes, shall be placed at a safe distance from the excavation. It shall not be placed closer than a distance equal to the depth of the excavation, unless suitable working and safety arrangements are made. Care shall be taken when placing excavation material to minimise the damage to the existing surface finish. Excavated material that may be suitable for use as backfill shall be adequately protected to maintain its suitability for re-use. Surplus excavated material shall be removed from the site unless directed otherwise.
- (d) Excavations shall be in open cut unless agreed in writing by the Engineer. Any soft spots within the trench bed shall be dug out to the satisfaction of the Engineer, refilled with a suitable imported material and compacted. Trial holes shall be made as necessary ahead of the work to ascertain the positions of existing services and obstructions.
- (e) Obstructions on the same alignment as the proposed new drainage works shall be reported to the Engineer before removal. The extent of the removal shall be agreed. Drainage works carried out prior to the completion of heavy earth moving operations or other abnormal loads shall be suitably protected to the requirements of the Engineer.
- (f) Excavation for any section of the drainage works shall not commence until a complete supply of pipes, fittings, bedding materials, bricks and concrete for manhole construction, are available on site for the entire section of the Works.
- (g) Excavations shall be cleared of water and shaped to prevent any accumulation of water either in or adjoining the excavation or the spoil there from. If necessary sumps shall be constructed and maintained clear of all excavations for permanent works, so that water is at all times kept below any permanent works in the course of construction. Ground water and water arising from construction operations shall not be permitted to enter the permanent drainage systems. The Underground Drainage Installer shall submit, with his tender, details of the number of pumps to be provided, construction of the well points and proposed discharge locations for the ground

water. He shall also provide any liaison with the Local Authority and the Environment Agency and comply with their requirements for discharge and/or treatment.

D650407 Supports for Excavations

- (a) The Contractor shall design, supply, fix, maintain and remove all planking, strutting and shoring required for the adequate temporary support of the excavation for the duration of the Works. Shoring shall be of sufficient strength to ensure the safety of personnel and to prevent damage to the works or to any foundations of adjoining buildings and structures. Should a trench slip or fall occur, it shall be made good to the satisfaction of the Engineer.
- (b) Supports of timbering with poling boards and runners, or steel trench sheeting shall be used according to the ground conditions. They shall be designed to prevent loss of ground during excavation and to ensure that backfilling can be carried out in accordance with the specified requirements, leaving no voids.
- (c) All trench supports shall be fully removed from the trench prior to backfilling.
- (d) Where it is anticipated that temporary trench supports cannot be progressively withdrawn as the trench is backfilled and compacted, the Engineer shall be informed prior to pipe laying so that a suitable pipe bedding can be adopted to cope with subsequent settlement of the trench fill when the support is finally withdrawn.

D650410 Trench Widths

- (a) The maximum and minimum permitted trench widths are set out in the table below and shall be strictly followed unless otherwise agreed in writing by the Engineer. Widths are soil face to soil face and include the thickness of timbering or sheeting.
- (b) From the bottom of the trench to a level 300 mm above the crown of the pipe, trench widths shall not be less than the minimum nor greater than the maximum figures shown in the table, subject to the foregoing.

Pipe Nominal Diameter (mm)	Minimum Trench Width (mm)	Maximum Trench Width (mm)
100	450	525
150	490	600
225	580	700
300	680	750
375	950	1050
450	1030	1150
525	1120	1200
600	1240	1350
675	1330	1450
750	1400	1500
825	1490	1600
900	1900	2100
1050	2050	2250
1200	2250	2500
Above	Outside diameter of	Outside diameter of
1200	pipe plus 800 mm	pipe plus 1000 mm

D650700 PIPEWORK BED AND SURROUND

- (a) Pipework bed and surround shall be of the material type, grade and thickness indicated. Where granular beds and surrounds are to be installed care shall be taken not to contaminate the material with solids of larger nominal size or with fines.
- (b) Should the site be found to have a high and mobile water table, any areas of granular bed and surround shall be encased with a Geotextile permeable membrane of agreed pattern, to prevent contamination of the material by fines from the surrounding subsoil. A clay puddle surround 300 mm wide shall be placed around the pipe at 15 metre intervals to restrict the migration of ground water through the granular surround.
- (c) Pipework laid with less than 600 mm cover adjacent to a building structure, beneath a site access route or which may be adversely affected by traffic, including site traffic shall be encased in a minimum of 150 mm concrete surround, or greater as necessary to correspond to the trench depth and width required.
- (d) Where a concrete bed and surround is provided, a vertical joint of 25 mm minimum thickness shall be formed with compressible polystyrene or fibreboard sheet at each pipe joint to retain the flexibility of the pipeline. The material used to fill the gap shall be shaped around the pipe joint to the manufacturer's recommendations, and shall extend through the full cross sectional area of the surrounding concrete. Pipe joints shall in addition be wrapped with two coats of mastic bandage tape before concreting.
- (e) Where, due to anticipated future ground settlement, it is necessary to suspend the drainage system from the building slab or raft this shall take the form of a combined concrete surround and backfill cast as part of that slab with reinforcing bar "top hat" steels passing under the pipe and spliced back into the slab reinforcement mat. In this situation the sides of the trench excavation shall be battered back at 10° from the vertical to reduce the risk of the surrounding soil adhering to the concrete surround/backfill. The spacing of reinforcement splice lengths and concrete mix to be used shall all be as specified by the structural engineer.

D651000 BACKFILLING

- (a) On completion of the works, including testing and inspection as described in the Testing and Inspection Section of this Specification, the excavation shall be refilled. The Underground Drainage Installer shall be responsible for the protection of all drains in an open trench.
- (b) Refilling of the trench shall be carried out as described in BS EN 752, or as otherwise specified. Where applicable, existing surface levels shall be reinstated to the satisfaction of the Engineer. Backfilling shall, wherever practicable, be undertaken immediately the preceding operation, including testing, has been completed. Except where special backfill material is specified, trenches shall be refilled with suitable excavated material in accordance with BS EN 752. Unless stated to the contrary, any thickness of material described means the thickness after full compaction.
- (c) The initial layer of backfill material shall be free from stones and organic material. Backfill shall be carefully placed onto the pipe surround and compacted in 300 mm maximum layers using hand tools, up to at least the first 300 mm above the top of the pipe or special surround. Filling above the initial layer shall be deposited in layers not

exceeding 300 mm loose depth, and compacted to a dry density not less than that of the adjoining soil.

- (d) Trench supports shall be withdrawn ahead of the layer to be filled, care being taken to keep the sides of the trenches solid and to fill all the spaces left by the withdrawn supports. Mechanical appliances may only be used for compaction when there is a minimum of 600 mm of material above the crown of the pipe. The appliance shall be suitable for the conditions and not damage or displace the pipes. Backfilling over concrete surrounds shall not commence until at least 24 hours after placing concrete. Imposed loads shall be restricted until after 72 hours.
- (e) Land drains shall unless detailed otherwise be backfilled with large stones of nominal size as described elsewhere in this Specification. Care shall be taken when placing the initial layer of stones to prevent damage to the pipework.

D651300 SURFACE REINSTATEMENT

- (a) As work proceeds surface soil, kerb stones, paving or other materials shall be replaced and maintained to restore all disturbed surfaces to their original condition, including provision of any new materials where necessary.
- (b) Filling of trenches shall not be left proud of the surrounding finish level. Restored finishes shall be properly compacted to the satisfaction of the Engineer. Where new hard landscaping works are to be installed over the line of the trench the fill shall be finished at the appropriate level with selected backfill. Where existing hard landscaping is to be re-instated it shall be undertaken to the Engineers requirements.
- (c) Where excavations are undertaken in Private or Local Authority land the Contractor shall obtain from the owner or relevant Local Authority Department written verification that the surface re-instatement has been completed to their satisfaction. A copy shall be submitted to the Contract Administrator and Engineer.

D651600 PIPE LAYING**D651601 General**

- (a) Drains shall be accurately laid and true in line and gradient in an upstream direction from manhole to manhole or point to point. Changes of direction shall take place at a manhole using cast iron fittings connecting cast iron bolted access chambers, or purpose made vitrified clay slipper bends and channels, or as indicated. Short radius bends are not to be used. Changes in the internal diameter of main drain runs shall be made with taper pipes at the inlet to the manhole maintaining a level soffit. All branch entry levels shall discharge over the centre line of the main run.
- (b) Pipes shall be laid with the barrel of the pipe evenly and solidly supported by the bedding material with shaped holes to receive the sockets/couplings. After making the joint bedding material shall be carefully packed to fill the void left for jointing. Bricks, timber and other hard packing shall not be used as temporary pipe supports, nor shall pipe spigots be permitted to bear on socket inverts in such a manner as to produce uneven pressure on the joints or stops in the invert.
- (c) Sockets shall face up the gradient. Spigots shall be well driven home into the socket of the pipe previously laid and the joint completed as described elsewhere within this

Specification. The bore of the pipe shall be cleared of any obstructions before the next pipe is laid. Care shall be taken that there is no irregularity in the invert at the joint. Where it is necessary to shorten a pipe, it shall be cut off square and be free from any irregularities.

- (d) During the progress of the works, all open ends shall be temporarily sealed with proprietary plugs or manufacturers caps. On completion, open ends shall remain properly sealed off until such time as the final pipe connections are made.
- (e) Drains shall be kept free from mud, debris, superfluous cement or other obstruction. Obstructions found at any stage of the Contract shall be removed immediately. On completion, drains shall be thoroughly cleaned with each length individually rodded. At Practical Completion drains and manholes shall be thoroughly pressure jetted with water to remove any debris from the system. Any damage or inconvenience caused by flooding due to blockages in the drainage services shall be the responsibility of the Contractor. The Contractor shall make all necessary arrangements for the disposal of waste and removal of any debris arising from these jetting operations.
- (f) Where pipes pass through watertight structures they shall be fitted with suitable puddle flanges or provided with a specialised waterproofing system. Puddle flanges shall be installed centrally within the depth of structure. Puddle flanges shall be of the split collar pattern, laid on two layers of mastic bandage tightly wrapped around the pipework.
- (g) Adequate provision shall be made for the movement of all pipelines, concrete surrounds and other materials used in the execution of the works, due to ground settlement or imposed loads. Where pipework passes through vertical structures, two flexible couplings shall be provided, generally at 150 mm and 750 mm centres from the structure face. For pipework larger than 450 mm diameter flexible couplings shall be provided to suit the manufacturer's recommendations. Flexible couplings and their installation shall also comply with this Specification.
- (h) Where drainage pipework terminates within a ground or basement floor slab the correct transitional fitting for connection to the above ground systems shall be provided. The transitional fitting shall terminate 100mm above the structural slab level, with a pocket left in the screed for future connection, unless detailed otherwise.
- (i) Pipework installed within the building structure shall be adequately supported and restrained from movement in all directions to prevent displacement when structural concrete is poured.
- (j) Double or split collars shall not be used without the written permission of the Engineer.

D651604 Levels

- (a) Temporary benchmarks shall be set up and maintained as necessary to permit accurate levelling of the works.
- (b) Sight rails shall be set to the falls of the pipe. The rails shall be painted to indicate the intended centre. Boning rods shall be used to grade the pipe, each pipe being levelled individually. Rod lengths shall be such that when sighted in with the rails the foot is at the invert of the pipe. Pegs shall be set in the trench bottom on the centre line of the pipe to the invert, not more than 2.5 metres apart. The material below the top of the

pegs shall be excavated by hand, prior to removal of the pegs. Bedding materials under pipes shall be placed prior to pipe laying.

- (c) Sight rails shall be set up for all drains with at least three rails in position at one time on each line of pipes to any one gradient. The allowable tolerance on given invert levels shall be +5 mm provided that the gradient of the pipe runs between successive invert levels shall not vary by more than 10% from that shown on the drawings and provided that the relative level differences between pipes in an individual installation are maintained.
- (d) Laser equipment shall be used with a calibrated rod, braced vertically within the manhole such that it is free to rotate about its vertical axis on a baseplate at the manhole invert. The laser equipment shall be secured to the calibrated rod near the base of the manhole, not on or touching adjoining pipes. Before switching on the laser beam, the instrument shall be secured at the desired grade as dialled on the grade indicator.
- (e) To ensure correct alignment of the laser equipment, the beam shall be synchronised with the line of sight of an optical telescope mounted as low as possible on the calibrated rod and directed to the forward manhole marker.
- (f) Targets to suit the pipe size shall be placed into the socket of each pipe as it is laid. When the laser beam strikes the target, the pipe shall be secured against movement at the chosen line and grade. Refraction of the laser beam within the pipe shall be avoided by preventing the accumulation of fumes and smoke and minimising temperature variations.
- (g) Alternative schemes for providing line and level control may be proposed but will be subject to submission of full details prior to implementation.

D651900 PIPEWORK

D651901 General

- (a) Underground drainage pipework shall be installed in the materials listed within the technical schedules in this document.
- (b) Pipework and fittings shall be of high quality, new and stored on site in accordance with the manufacturer's recommendations. Any materials installed in an incorrect manner or not complying with the Specification shall be removed from the site and replaced with correct materials.
- (c) Where transitions are made between differing pipework materials only purpose made fittings shall be used.

D651904 Vitrified Clay Pipework

- (a) Vitrified clay pipes and fittings shall comply with the requirements of BS EN 295.
- (b) Pipework of nominal diameter between 100 mm and 300 mm shall be of the "super strength" standard having plain spigot ends jointed with polypropylene couplings complying with BS EN 295. Pipework of nominal diameter greater than 300 mm shall be of the "extra strength" standard with flexible spigot and socket joints and styrene

butadiene rubber sealing rings to BS 7874 and BS EN 681. Jointing of vitrified clay pipes shall comply fully with the manufacturer's recommendations.

- (c) For cement mortar jointed pipes tarred rope yarn shall be inserted and well caulked with a purpose made caulking tool. The operation shall commence at the bottom of the socket and the depth of yarn when fully caulked shall occupy two thirds of the depth of socket. The socket shall then be completely filled with 1:3 ratio cement mortar and a 45° fillet shall be worked around the joint with a smooth trowelled finish.
- (d) Flexible jointing where required within vitrified clayware pipe systems shall be provided by the standard range of polypropylene or spigot and socket joints.

D651919 PVCu Pipework

- (a) PVCu pipework for pipes between 110 mm and 160 mm diameter shall comply with BS 4660, larger sizes shall comply with BS EN 1401. Pipework shall be provided in rigid lengths with flexible lip seal joints incorporating rubber push fit seals complying with BS EN 681. The lip seal joints shall be provided by the same manufacturer as the pipework. Plain pipe ends shall be chamfered prior to insertion into a joint or as otherwise recommended by the manufacturer.
- (b) Cleaning and lubrication fluid shall be used within the jointing process as advised and supplied by the manufacturer.
- (c) PVCu pipework shall NOT be installed where the trench is to be backfilled with concrete, or within a steel re-enforced concrete raft.

D651922 Thermoplastic Structured Wall Pipework (150 mm to 300 mm Diameter)

- (a) Thermoplastic structured wall pipes, joints and couplers with smooth bore for gravity sewers in PVC-U for diameters 150 mm, 225 mm and 300 mm shall be certified to British Standard KM55698, WIS 4-35-01 and BBA Certificate No. 02/3923. Suitable for use for the convenience of foul and surface water effluent outside buildings at depths of cover from 1.2 m to 10 m.
- (b) Fittings shall be double socketed and either injection moulded PVC-U or polypropylene, or thermoformed from extruded PVC-U pipe. Joints to be made with injection moulded EPDM rubber conforming to type WC as referred to in BS EN 681-1:1996.
- (c) Nominal short term stiffness to be not less than 8 kN/m².
- (d) For use in sewerage systems design in accordance with BS EN 752-1 to 4.

D652200 MARKER TAPES

- (a) Below ground drainage pipework between manholes shall be identified by a durable marker tape suitably worded to identify the pipeline service. The marker tape shall be worded 'Foul Drain Below', 'Surface Water Drain Below' or as suitable for the specific installation, in block letters with wording at least 50 mm high.
- (b) The marker tape shall be installed at a depth no greater than 300 mm below finished ground level. Tapes shall incorporate a traceable element suitable for monitoring by electronic survey equipment.

D67 MANHOLES**D670100 GENERAL**

- (a) No concrete works shall be undertaken during freezing weather conditions without the written consent of the Engineer. Any concrete damaged by frost shall be broken out and made good. Where there is a danger of concrete being attacked by aggressive ground conditions sulphate resistant cement shall be used throughout the manhole construction to the Structural Engineers recommendations.
- (b) The backfill space between the face of the excavation and the manhole shall be filled on completion with well compacted selected backfill, well compacted or lean mix concrete grade C20P. Manholes located adjacent to a structural base, which has any part of its construction below the underside level of the base, shall be backfilled to the Structural Engineers requirements.
- (c) Channels 450 mm or greater in depth shall have one or more toe-holes built in to give safe access to the channel and shall have a suitable handrail or post within easy reach. Manholes with outgoing pipes of 600 mm diameter or greater shall be fitted with galvanised steel safety chains of 8 mm nominal size complying with BS EN 818.
- (d) Manhole benching shall be finished with a cement and sand (1:2 mix) rendered mixed and hand smoothed with a trowel. The minimum thickness of render finish shall be 50 mm. The gradient of benching to channel shall be 1:12. Manhole benching is to be completed at the time of construction of the manhole.
- (e) Square junctions into the manhole channel shall not be allowed. Branches shall have large radius sweep bends, or slipper bends radiused in the direction of flow, to discharge over the centre line of the channel. The main run entering a manhole shall retain a level soffit with the outlet. The manhole channel size shall relate to the outgoing pipework size. Pipework passing through manhole walls shall be solidly built into the walls and be thoroughly watertight.
- (f) Manhole backdrops shall unless otherwise indicated be external to the manhole construction and supported off the manhole base slab. Rodding access at the top of a backdrop or ramp shall be continued through the manhole wall and fitted with a purpose made cap, chain and steeple.
- (g) Step irons or ladder rungs shall be installed immediately beneath the access opening with the first rung no more than 450 mm below the cover.
- (h) Manholes shallower than 4 metres from cover level to invert shall be fitted with 'D' rungs or step irons which comply with the requirements of BS EN 13101 (2.15 Kg general purpose pattern for brick manholes and 1.19 Kg for precast concrete circular manholes.). The 'D' rungs or step irons shall be galvanised after manufacture to BS EN ISO 1461. The step irons shall be built in at general vertical intervals of 300 mm and staggered 150 mm from the manhole centre line.
- (i) Manholes greater in depth than 4 metres shall be fitted with plastic encapsulated steel rung irons complying with Water Industry Standard 4-33-01. Rung irons shall be built into all manhole sections and shall be spaced at intervals not greater than 250 mm vertically. Safety cage hoops or 900 mm diameter access shaft shall be

provided and installed where necessary under the requirements of BS EN ISO 14122 or where required by the Building Control Officer.

- (j) During the construction period temporary manhole covers shall be fitted over manhole shafts. Temporary covers shall be steel plates of sufficient gauge to withstand any forces incurred from general site traffic shall be securely fixed in position and shall be clearly and brightly marked. The site Safety Officer shall inspect all temporary covers on a daily basis.
- (k) On completion of the works all manholes shall be tested in accordance with the requirements of this Specification.

D670400 BRICK MANHOLES

- (a) Brick manholes shall be constructed from class 'B' engineering bricks to the requirements of BS EN 772. A sample brick shall be submitted to the Engineer before an order is placed. Brickwork shall be built in English bond with each frog laid upwards. Joints shall be filled solidly with 1:3 cement mortar as the bricks are laid. They shall be neatly flush pointed internally as the work proceeds, external wall faces shall be weather pointed. No bats or broken bricks shall be used except as closers for the purpose of breaking bond. Joints shall not exceed 7 mm in thickness.
- (b) The chamber base slab shall be constructed from Grade C20P concrete with channels and benching as indicated on the Drawings. The base slab shall have a minimum thickness of 150 mm and shall be designed and reinforced to the Structural Engineers requirements. The chamber cover slab shall be constructed from Grade C30P concrete of the minimum thickness indicated on the Drawings. The cover slab shall be reinforced to the Structural Engineer's requirements.
- (c) The manhole cover shall be bedded onto between one and a maximum of three courses of Class B Engineering brick necking and haunched in cement mortar (1:3 mix).
- (d) A single brick arch shall be provided to all pipe entries of 300 mm to 450 mm diameter and for larger diameters a two brick arch shall be provided.

D670700 PRE-CAST CONCRETE RING MANHOLES

- (a) Concrete ring manholes shall only be provided where the depth of the manhole to the crown of pipe exceeds 1 metre. Manhole sections and cover slabs shall conform to the requirements of BS 5911: Part 3 and BS EN 1917. They shall be provided with tongue and grooved joints.
- (b) Joints between manhole sections and to base or cover slabs shall be made using a strip mastic bed, which shall be applied to the manufacturer's instructions. Joints between manhole sections shall be faced with cement mortar (1:3 mix) and flush pointed.
- (c) Concrete manhole ring sections shall be surrounded with C20P grade concrete to a thickness of 150 mm. A 225 mm surround shall be provided where a high water table is present. Care shall be taken when placing the manhole concrete ring sections to ensure they are installed true and in the correct orientation.
- (d) Openings through concrete ring sections of 400 mm diameter or larger shall be pre-formed at the manufacturer's works. Ring sections with preformed openings shall be

delivered to site with temporary polystyrene knock out panels. The cutting of openings through concrete ring sections of less than 400 mm diameter shall be undertaken with great care on site. Overall opening sizes shall be kept to the minimum necessary dimension and shall not be made within 100 mm from the edge of a ring section.

- (e) The chamber base slab shall be constructed from grade C20P concrete with channels and benching as indicated on the Drawings. The base slab shall have a minimum depth of 150 mm and shall be reinforced to the Structural Engineers requirements.
- (f) The manhole cover slab shall be constructed from C30P concrete of the minimum thickness indicated on the drawings. The cover slab shall be reinforced to the structural Engineers requirements. Where the appropriate pre-cast cover slab is available from the manufacturer of the manhole rings being installed these may be used providing the correct opening size, as listed in the manhole schedule, can be provided.
- (g) The manhole cover shall be bedded onto between one and a maximum of three courses of Class B Engineering brick necking and haunched in cement mortar (1:3 mix).

D671200 PLASTIC INSPECTION CHAMBERS

- (a) Plastic chambers and rings shall comply with BSEN 13598-1 and BSEN 13598-2.
- (b) The chamber shall be surrounded with C20P grade concrete to a thickness of 150mm.
- (c) The chamber base shall be constructed with C20P grade concrete to a thickness of 150mm.
- (d) The manhole cover shall be bedded onto between one and a maximum of three courses of Class B Engineering bricks necked and haunched in cement mortar (1:3 mix).
- (e) Where inspection chambers are to be constructed as catchpits a sump of at least 300mm in depth shall be provided below the outlet pipe level to collect solids the system discharges.

D671300 MANHOLE COVERS AND FRAMES

- (a) Manhole covers and frames shall be suitable for the location and design loading. They shall be of the type, size and rating listed within the schedules in Section D97 of this document and rating described in the materials schedules and identified in the manhole schedules. Care shall be taken with installation to ensure that the orientation of the manhole cover is perpendicular to wall, floor finishes or hard landscaping or as otherwise directed by the Engineer. Frames shall be securely bedded on cement mortar (1:3 mix). Any frames bedded in place out of true or which allow the cover to rock under normal use shall be replaced. Covers and frames shall be located immediately above the cover slab opening and step irons.
- (b) Manhole covers and frames shall be manufactured to the requirements of BS EN 124. They shall be coated with hot bitumen as described in the above standard. Steel covers and frames shall be hot dip galvanised to BS EN ISO 1461 after manufacture.
- (c) Infill type manhole covers shall be infilled in accordance with the cover manufacturer's recommendations to achieve the necessary design strength and finish

to suit adjacent finished areas to the Engineers or Architects specification. Frame depths provided should be suitable to receive the type of infill selected.

D73 GULLIES

D730100 EXTERNAL GULLIES

- (a) Gully type, size, outlet diameter, grating type and loading shall be as detailed in the technical schedules in this document. Details and samples of gullies and channel gratings shall be submitted to the Engineer for comment.
- (b) External gullies shall be laid approximately 5 mm below finished paving, road or ground level.
- (c) Gully gratings shall not be fitted until the final stages of the works. Prior to Practical Completion all gratings shall be cleaned and returned to their original condition. All gully traps shall be emptied out and any debris or build-up contained within the trap shall be removed to the satisfaction of the Engineer.
- (d) A waterproof joint shall be installed between the gully grating and surrounding finishes to the Engineers or Architects specification.
- (e) Gullies shall comply with the following manufacturing standards:
 - i) Precast concrete gullies shall comply with the requirements of BS 5911: Part 4
 - ii) Vitrified clay gullies shall comply with the requirements of BS EN 295
 - iii) PVCu gullies shall comply with the requirements of BS 4660, BS EN 1401 and BS EN 13598
 - iv) Cast iron gullies shall comply with the requirements of BS 437
- (f) To permit easy cleaning the base of a gully trap shall not be more than 600 mm below the gully grating finish level. Internal rodding eyes shall be incorporated where available.
- (g) Where identified on the drawings, gullies shall incorporate a galvanised steel sediment bucket

D730200 EXTERNAL DRAINAGE CHANNELS

- (a) External drainage channels shall be polymer concrete.
- (b) Channels shall be installed with a C20P grade concrete bed and surround to a minimum thickness of 150mm and shall have a loading rating of D400.
- (c) Where combined with a below ground attenuation or infiltration system the channel, connection system and attenuation units shall all be supplied by the same manufacturers as an integrated system.

D77 ATTENUATION, COLLECTION AND TREATMENT SYSTEMS**D770100 GEOCELLULAR ATTENUATION STORAGE SYSTEMS**

- (a) Geocellular attenuation storage systems shall comprise interlocking cellular high strength units complying with BS 7533-13: 2009.
- (b) Units shall be manufactured from polypropylene having a minimum short term compressive strength of 715 kN/m² vertically and 156 kN/m² laterally, with a volumetric void ratio of 95%.
- (c) The unit shall be wrapped in either a permafilter geotextile or heavy duty impermeable geomembrane, subject to application, as defined on the drainage drawings.
- (d) In all cases where an impermeable wrap is required, this shall extend only to the sides and base of the unit with the top of the unit covered with a geotextile fleece, to permit the unit to “breathe”.

D770400 RUNOFF COLLECTION AND TREATMENT SYSTEMS

- (a) Runoff collection and treatment units shall comprise an inline polymer concrete unit with integral weir and baffle to still the runoff and encourage silt deposition, to separate oils and prevent the effluent and silt entering the primary drainage system.
- (b) Units shall comply with the requirements of BS 7533-13: 2009.
- (c) Units shall have a minimum short term compressive strength of 715 kN/m² vertically and 156 kN/m² laterally.
- (d) The unit shall be wrapped in either a permafilter geotextile or heavy duty impermeable geomembrane, subject to application, as defined on the drainage drawings.
- (e) In all cases where an impermeable wrap is required, this shall extend only to the sides and base of the unit with the top of the unit covered with a geotextile fleece, to permit the unit to “breathe”.

D770700 ATTENUATION CONTROL UNITS

- (a) Attenuation control units shall be manufactured from BS 316 stainless steel, designed to create a vortex discharge flow to limit and maintain the specified discharge rate through the unit under varying hydraulic head conditions.
- (b) Units shall incorporate either an emergency bypass weir or a bypass hatch which can be operated remotely via a steel cable and handle, eliminating the need to access the attenuation chamber if surcharged.

D771000 GEOCELLULAR SOAKAWAYS

- (a) Geocellular soakaway systems shall comprise interlocking cellular high strength units complying with BS 7533-13.

- (b) Units shall be manufactured from polypropylene having a minimum short term compressive strength of 715kN/m² vertically and 156kN/m² laterally, with a volumetric void ratio of 95%.
- (c) The unit shall be wrapped in a permafilter geotextile as defined on the drainage drawings.

D82 CCTV SURVEYS**D820100 INTRODUCTION**

- (a) Closed circuit television (CCTV) surveys of the existing foul and surface water drainage systems shall be carried out to internally inspect pipework and associated manholes. The extent of the survey shall be as described in the Scope of Works section of this Specification. The survey shall be carried out to determine the structural condition and serviceability of the drains and to provide a record of the drains condition. It shall also be used to locate all branch connections to a drainage run. Branches shall be surveyed whether particularly described elsewhere in this Specification or not.
- (b) The survey shall be carried out using a colour CCTV monitoring and digital recording system as described in the Scope of Works. The system shall also produce colour photographs, of all significant faults in the drainage system. Items of particular interest shall also be photographically recorded.
- (c) Sufficient water shall be maintained in the drains to show wherever possible the correct orientation of the camera to the invert, and to highlight any low points.
- (d) The survey shall be carried out in accordance with “the Manual of Sewer Condition Classification” as published by the Water Research Council (WRC). All existing services, including cables, drains and other underground services, shall be protected and maintained in operation during the Works. The Local Authority shall be contacted if necessary.

D820400 CLEANING

- (a) All manholes and drains shall be cleaned prior to survey. The minimum acceptable standard of cleanliness shall be when no more than 10% of the internal walls remain obscured by silt, debris, fat or scaling. High pressure jet cleaning techniques shall be used for the pre-cleaning work, unless otherwise agreed.

D820700 PICTURE QUALITY

- (a) The electronic systems, CCTV camera and monitor shall be high performance solid state equipment with automatic tracing for white balance. The system shall be capable of providing a picture not less than 300 lines definition. Horizontal and vertical linearity shall be better than 10% positional error over the whole TV monitor screen (central circle only).
- (b) Adjustment of focus shall give a focus range from near objects to the limit of illumination. The combination of illumination of the object and light sensitivity of the camera shall be adequate to obtain an effective picture of the structure of the drains to be surveyed.

D821000 LINEAR MEASUREMENTS

- (a) The monitor display shall incorporate an automatically updated linear record of the camera position along the drain accurate to within 2% of the travel.

- (b) A suitable device, which enables the cable length to be accurately measured, shall be provided. Compliance with the above tolerance shall be demonstrated by using the cable calibration device in conjunction with tape measurements of the surface distance between manholes.

D821300 REPORT

- (a) A full written report describing the survey findings shall be provided. The format of how the report is to be issued shall be as described in the Scope of Works section of this Specification.
- (b) Photographs shall be taken of point defects and to indicate the average condition of the pipework. The photographs shall be included within the report.
- (c) Where stated within the Scope of Works section of this Specification DVD/USB Drives of the full investigation video shall be provided with the report. The survey shall be in a format suitable for viewing on a computer or hand held tablet. The information shall include headings to allow the viewer to understand which part of the system is under inspection and giving on-screen information about the drain identification, pipe diameter, pipe diameter, travel distance and date.
- (d) The report shall be accompanied by a drawing or drawings of the drainage system clearly identifying each drain, indexed to the references used in the report and on the accompanying video. The drawings shall also identify the locations of the photographs described above.

D90 TESTING AND INSPECTION**D900100 GENERAL**

- (a) The entire Works shall be inspected, tested and commissioned in accordance with all relevant British Standard Specifications and Codes of Practice together with the details given in this Specification to the entire satisfaction of the Engineer.
- (b) Installations shall be inspected and tested in sections as the work proceeds and test certificates issued accordingly. The Engineer or an Insurance Company may require to inspect or test any equipment during manufacture at the Manufacturer's works. The costs for this and all necessary arrangements shall be included within the Tender.
- (c) No section of the Works shall be in any way concealed prior to testing and inspection. Subsequent concealment, where applicable, shall only take place following authority from the Engineer. Tests shall be carried out and witnessed before any concealment or backfilling is carried out.
- (d) On completion of the Drainage works but prior to Practical Completion, a CCTV survey shall be carried out of the entire system. The survey and report shall comply with the CCTV survey section of this Specification.
- (e) A further CCTV survey of the entire drainage system shall be carried out approximately one month before the end of the defects liability period to verify that the system is still functioning correctly. The survey report shall comply with the CCTV survey section of the Specification.
- (f) Commissioning of Mechanical and Electrical Equipment shall be undertaken by an experienced specialist commissioning engineer who shall commission all systems. The specialist shall produce a comprehensive report on the systems.

D900400 ATTENDANCE

- (a) Tests shall be arranged by the Contractor. The Engineer shall be given five working days notice in writing of the time, location and nature of the test to be performed. No test shall be considered valid unless the Engineer or an appointed representative is present.
- (b) All necessary skilled and unskilled labour shall be provided for attendance duties during the test (including pre- and post-test activities). Test media shall be provided and subsequently disposed of except where specifically stated otherwise.
- (c) Representatives present during inspection and testing shall be fully conversant with the system concerned and the method of system and instrument operation. Manufacturers or specialist contractor's representatives shall attend where specifically indicated elsewhere in the Specification or where necessary to ensure that the Works are tested and commissioned in accordance with the requirements of the Specification.
- (d) Items with electrical supplies including, where appropriate, BMS systems, shall be certified ready for use.
- (e) It is the Contractors responsibility to ensure that the District surveyor signs off the installation.

D900700 TEST EQUIPMENT

- (a) All necessary facilities, measuring and recording instruments including test pumps and gauges for inspection or testing purposes shall be provided and shall be checked or calibrated by the Underground Drainage Installer as necessary before use. Current calibration certificates shall be produced for each instrument. The Engineer reserves the right to call for a demonstration of the accuracy of any instruments provided. Tests carried out using uncalibrated instruments shall be declared null and void.
- (b) Test points which are necessary to carry out the specified test and commissioning requirements shall be provided including facilities for pressure, pressure drop, volume flow, velocity or other relevant conditions to be measured. Such points shall be fitted with removable plugs, flanges or other similar devices appropriate to the service concerned. Permanent test or reading points shall be provided only where specified elsewhere.

D901000 TEST CERTIFICATES

- (a) Duplicate signed test certificates shall be provided after each test, which will be countersigned by the Engineer, or person appointed to witness the test. The test certificate shall give the following particulars:
 - i) The Underground Drainage Installer's Name and Address
 - ii) Project name and date of test
 - iii) Apparatus or section under test
 - iv) Makers number (if any)
 - v) Nature, duration and conditions of test
 - vi) Result of test
- (b) No test shall be valid until the test certificate is provided.

D901300 FAILURE OF TEST

- (a) Defects occurring at any time during the test duration shall be made good and a complete re-test shall be carried out.
- (b) Remedial works to the building fabric, to any services not provided as part of this Contract, or subsequent builders work in connection with the above required due to failure during a test shall be the Contractor's responsibility. Failure to be ready for a test or inspection or failure of the test result in abortive or repeated visits by the Engineer or person appointed to witness the test may result in the Contractor being contra-charged for the time and expenses involved in the abortive visit.
- (c) Leakages shall be repaired by properly remaking or replacing the defective joint or section. Caulking will not be permitted.

D901600 TESTING AND INSPECTION OF DRAINAGE WORKS

D901601 General

- (a) Prior to testing all parts of the installation shall be thoroughly flushed through and inspected to ensure that they are clean and clear. The entire system shall be thoroughly water jetted to the Engineers satisfaction, should it be deemed to be necessary.
- (b) The Contractor shall give written notice at the following stages, to the Contract Administrator and Engineer, for the purpose of inspection and measurement:
 - i) When excavations are completed
 - ii) Concrete bases and beds are laid
 - iii) Drains are laid and jointed
 - iv) Plant and equipment is to be commissioned or tested
- (c) All works shall be inspected, tested and examined as specified before backfilling of excavations is commenced.
- (d) A test shall be applied to all drains after installation but before backfilling. After backfilling a further test shall be applied. A final test shall be undertaken just prior to Practical Completion to the satisfaction of the Engineer. Tests on gravity discharge pipework shall be an air test or water test as agreed with the Engineer and with the Local Authority.
- (e) The drains shall be tested for straightness of run by the insertion of a lamp at one end of the drain and a mirror placed at a 45° to the invert at the other end. A full circle of light shall be observed. Where this is not possible for any reason a drain rod and appropriate sized disk or profile shall be passed through the pipe to prove there are no obstructions or misalignment of joints. Where this is not satisfactory or does not provide a satisfactory result the Engineer may direct that a CCTV survey of that section be carried out.

D901604 Pipework Air Test

- (a) Gravity drainage systems shall be subjected to an air test. Expanding plugs shall be moistened and applied to both ends of the pipe and to all lateral connections. Air shall then be pumped by bellows into the pipe at the lower end until a pressure equal to 100 mm water gauge is recorded on an U-tube at the upper end. Five minutes shall be allowed for stabilisation of air temperature.
- (b) The test air pressure shall be adjusted to achieve 100 mm water gauge. Without further pumping, the water gauge shall not fall by more than 25 mm in a period of 5 minutes.
- (c) After the testing period has elapsed the pressure shall be released from the lower end. This shall be indicated by a fall of pressure in the manometer, proving continuity throughout the pipe.

D901607 Pipework Water Test, Gravity Systems

- (a) Gravity drainage systems shall be subject to a water test. All outlets shall be securely plugged. A plug shall be inserted into the pipe at the highest point with a stand pipe connected to the plug to enable a minimum pressure of 1.5 metres head of water to be exerted on the crown of the pipe at the highest point and no more than 4.0 metres at the lowest point.
- (b) After the pipework has been filled with water with no pockets of entrapped air, the standpipe shall be filled to the requisite level. It shall be left for a minimum period of 2 hours to enable the pipe to become saturated, topping up as necessary. The water level shall then be maintained for 30 minutes, with the standpipe being topped up at regular intervals of 5 minutes. The rate of loss of water from each metre of pipe run shall not be greater than 1 litre per hour per metre diameter.
- (c) Whilst intermediate tests may be an air test, the final test shall be a full water flood test unless otherwise directed by the Engineer.

D901613 Testing of Manholes, Catchpits and Sumps

- (a) Manholes, catchpits and sumps shall be cleaned internally. They shall then be completely filled with water and, after time has been allowed for absorption to take place, refilled to the cover slab. For two hours no more water shall be added to the manhole and the water level shall not drop in level by more than 25 mm. Should the drop in level be more than the amount stated the leakages shall be located and the manhole re-tested.
- (b) Manholes, catchpits or sumps constructed below the ground water table shall have all outlet pipes closed by means of expanding stoppers. After a period of 2 hours if water has entered the manhole to a depth of 25 mm or more the leakages shall be located and the manhole re-tested.

D902200 LOCAL AND STATUTORY AUTHORITIES

- (a) The Contractor shall be responsible for fully liaising with all local authority departments and water undertakers to obtain all acceptances required for the installation. Full access to the site shall be provided at all times for inspection and witnessing of testing required by the organisations.
- (b) Written agreements from all relevant parties shall be obtained for the entire works. The Contractor shall present to the Client, Contract Administrator and Engineer, a full set of acceptance documents prior to the Practical Completion Certificate being granted.

D91 TECHNICAL SUBMITTALS

D910100 TECHNICAL SUBMITTALS GENERAL

- (a) Technical submittals which do not comply with the following requirements will be rejected.
- (b) Technical submittals must be specific for the project. Standard literature and extracts from manufacturers catalogues will not be acceptable.
- (c) Technical submittals shall be submitted for each item of equipment and system components proposed prior to placement of orders. Submittals shall be issued to the Engineer allowing a minimum of 10 working days for comment by the Engineer (unless otherwise agreed), and giving adequate time for comments to be incorporated before equipment orders need to be placed. The issue dates and commenting periods for all technical submittals shall be scheduled by the Contractor and agreed with the Engineer at the commencement of the contract. Once agreed, this schedule shall be updated by the Contractor to reflect any changes in programme. Technical submittals issued not in accordance with the agreed date schedule may take longer to return.
- (d) The first page of each technical submittal must contain a specific compliance statement confirming that equipment is fully in compliance with the specification, or if not, stating which clauses are not being complied with and in what specific regard. Any variations from the specified requirements must be clearly and specifically stated on this first page submittal. General comments regarding compliance will not be acceptable.
- (e) Technical submittals shall include an assessment of the impact on the design resulting from the equipment proposed, including the impact of any non-compliance to the required specification.
- (f) The Technical Submittals for each item of equipment shall include the following information as a minimum:
 - i) Confirmation of all data contained within the technical schedules which form part of this specification
 - ii) All data identified in the technical schedules as 'to be confirmed by the manufacturer' specified design conditions, the actual conditions achieved by the proposed equipment and the performance of the equipment at the specified design conditions
 - iii) Manufacturer's specifications and data sheets for the equipment proposed
 - iv) Performance curves and noise data
 - v) Type test certification where requested elsewhere within this specification
 - vi) WRAS/KIWA UK Certificates for all pipes, fittings and equipment in contact with the domestic water system
- (g) Technical Submittals will be reviewed using the following notation:
 - i) A - No comments. Fabrication, manufacture, procurement or installation can proceed

- ii) B - Fabrication, manufacture, procurement or installation can proceed provided any comments are incorporated into the works. If the Mechanical Services Installer cannot incorporate all comments, the submission is to be amended and re-submitted
 - iii) C - The submission is rejected for the reasons noted and is to be re-submitted
- (h) Technical Submissions will be reviewed for compliance with the design intent and any comments made do not relieve the Underground Drainage Installer of his obligations under the Contract to coordinate the works and comply with the Contract Documents in all respects unless specifically agreed otherwise.
- (i) Technical submittals are expected to achieve A Status within two submittals. Multiple submittals for the same item as a result of not achieving the requisite standard, or failing to address previous Engineers comments may attract a charge levied to the submitting party for the additional time spent reviewing non-compliant submissions.

D92 DESIGN AND CONSTRUCTION DOCUMENTATION**D920100 TENDER DRAWINGS**

- (a) The Tender Drawings are prepared to show the general arrangement of equipment and services, which form the intended Contract. The drawings, in conjunction with the Specification, are sufficiently detailed to allow competitive Tenders to be submitted.
- (b) The Underground Drainage Installer shall interpret the drawings, making due allowance for offsets to avoid the building structure or other services, whether indicated or not. The Underground Drainage Installer shall take all necessary steps to ensure that they are fully acquainted with the nature and extent of the works by visiting the site and inspecting the Engineers, structural and other service drawings. No claim for loss or expense due to the above factors will be considered.

D920400 CONTRACT DRAWINGS

- (a) The Contract drawings are issued when the Contract is placed. They will comprise the Tender drawings as described, modified to include any variation to the Contract since the issue of the Tender Drawings.
- (b) Variations to the Contract, requiring further drawing information will be issued by the Engineer by issuing updated copies of the Contract Drawings, or sketch drawings until such times as the installation drawings are available for marking up, or by such other method as the Engineer may decide.

D920700 DIGITAL DATA

- (a) A digital copy of the Engineers drawings (in 2D or 3D Format) may be made available to the Underground Drainage Installer to assist in the preparation of the Installers installation drawings should a request for the information be made to the Engineer in writing. Drawings will be issued in the current version of AutoCAD or in DXF format as required.
- (b) The Underground Drainage Installer shall be solely responsible for the modification of the digital information to provide the installation drawings as required by this specification. The modified drawings shall accurately reflect the equipment and installation proposed by the Underground Drainage Installer as if the drawings had been drawn without the benefit of the digital data. They shall also take account of the most recent Architectural and Structural information. The Underground Drainage Installer's particular attention is drawn to the following conditions which apply to the use of any digital information provided by the Engineer:
 - i) Any 3D Digital models made available to the Underground Drainage Installer are provided for information only unless explicitly stated otherwise
 - ii) It is an express condition of the contract under which data is supplied that the Underground Drainage Installer is responsible for satisfying himself regarding its accuracy, correctness and completeness. The drawings and data have not specifically been prepared for use by the Underground Drainage Installer and may not fully reflect his needs

- iii) The Engineer accepts no liability or responsibility whatsoever for any loss or damage suffered by the recipient arising out of or in connection with the use or misuse of this digital data
- iv) While all reasonable steps have been taken to ensure that the digital data is free from computer viruses, the Engineer cannot be held responsible for any damage or loss that might subsequently occur from their presence
- v) The copyright of the digital data belongs to the Engineer. Measurements taken from information which is not dimensioned are at the Underground Drainage Installers own risk

D921300 MANUFACTURERS DRAWINGS

- (a) The Underground Drainage Installer shall obtain copies of Manufacturer's drawings and details of all plant and equipment forming part of the Contract. The drawings and details shall be certified by the Manufacturer as being applicable to the particular items being supplied.
- (b) The drawings shall include general layouts and assembly drawings, details of materials and construction, methods of support and fixing and electrical wiring diagrams. The information shall be in sufficient detail to allow comment on the equipment. Where particular requirements for drawings are listed in the appropriate clauses for equipment or systems then these shall also be provided.
- (c) Four copies of all such drawings shall be issued to the Engineer.

D921600 SAMPLES

- (a) Where the Engineer wishes to comment on the standard of construction or finish of any item of equipment, the Contractor shall arrange for samples of the items concerned to be forwarded in sufficient time to allow consultation between the Engineer and Employer before advising of any comments.

D921900 UNDERGROUND DRAINAGE INSTALLER PREPARED DRAWINGS

- (a) The Underground Drainage Installer shall be responsible for the production of fully detailed and dimensioned installation drawings of the complete installation, including all-purpose made plant and equipment. The location of all plant, equipment and services shall be fully dimensioned from each other, from other work and from the building structure.
- (b) The Underground Drainage Installer shall ensure that all services, including those of other Contractors, are fully co-ordinated with each other and with the building structure and finishes and shall include in the tender for obtaining the necessary information from other Contractors and for the indication of the service routes for all trades on composite drawings.
- (c) The Underground Drainage Installer shall allow for any plant, equipment, pipework or manholes to be moved during the preparation of installation drawings up to one metre from the position inferred by the Tender Drawings.
- (d) Installation drawings shall include fully dimensioned details and positions of all supports and fixings. They shall clearly define the detail and arrangement of all

installed equipment and systems including access allowances for service and maintenance.

- (e) Installation drawings shall be produced in accordance with a programme, which is to be agreed to suit the overall programme. Reasonable allowance shall be made for incorporating any comments made by the Engineer and Professional Team.
- (f) The Underground Drainage Installer 's drawings must include the following fully co-ordinated drawings, in addition to any separate trades' drawings, which the Underground Drainage Installer may require:

	Area	Minimum Scale
i)	General Arrangement Drawings	1:100
ii)	Under Building Layouts	1:50
iii)	External Site Layouts	1:50
iv)	Plant Area Layouts and Sections	1:20
v)	General Installation details	1:20

- (g) The drawings shall be produced to a scale suitable for the application, but at least to the scale listed above. Only recognised metric scales shall be used. Drawings shall be presented on A1 or A0 sized sheets as appropriate. A3 or A4 drawings shall be used for specific component details only, such as typical brackets. Drawings shall be clear and legible.

D922500 BUILDERS WORK DRAWINGS

- (a) The Underground Drainage Installer shall be required to produce drawings indicating the Builders work requirements in connection with the works. These drawings shall include details of penetrations through the structure and Builders work supports and bases.
- (b) These drawings shall only be prepared after the installation drawings have been finally agreed with the Engineer and shall be based on the detail of these installation drawings. The drawing production programme shall take this fully into account.

D922800 ISSUE OF DRAWINGS

- (a) Copies of installation drawings, wiring diagrams and builders work drawings shall be submitted to the Engineer for comment. Where an electronic document control system is employed for the project this shall be used for the transfer of all drawings and other documentation utilising the protocols agreed for the project. Where an electronic document control system is not being employed, electronic and/or printed copies of all drawings shall be distributed by the Underground Drainage Installer as directed by the Engineer. A period of fifteen working days shall then be allowed for comment on the drawings by the Professional Team.
- (b) Where drawings are submitted for comment they will be reviewed by the Engineer and any comments returned, either by marking directly on the drawing, or by

correspondence. Drawings will be marked with A, B or C status with the definition of each category being as follows:

- i) A – No comments. The drawing is to be re-issued for Construction and installation works can proceed
- ii) B – Comments provided by the Engineer. The drawing is to be amended to incorporate all of the Engineers comments and marked for Construction. Installation work can proceed but must incorporate all comments made by the professional team
- iii) C – The drawing is inadequate and is to be redrawn and resubmitted for comment. No installation work can proceed until a Status A or B is achieved

The giving of an 'A' status does not relieve the Underground Drainage Installer from ensuring that the drawings meet the requirements of the contract documentation

- (c) The status of installation drawings does not relieve the Underground Drainage Installer from his obligations to progress and complete the works in line with the agreed programme. Should the Underground Drainage Installer elect, in order to meet the programme, to proceed with installation work before 'A' status installation drawing is achieved, this shall be at his own risk. Should unacceptable work be installed, it will be the responsibility of the Underground Drainage Installer to ensure it is removed and replaced in a manner acceptable to the Engineer. No claims for delay or payment will be entertained in this respect.
- (d) When the drawings have been amended to incorporate these comments, the Contractor shall issue the construction issue to the Contract Administrator and Engineer.
- (e) The same preliminary and construction issue distribution of drawings shall apply to any subsequent revisions of installation drawings. Any further copies required for site construction purposes shall be provided by the Underground Drainage Installer.

D923100 DIMENSIONS

- (a) The Underground Drainage Installer will be required to take site dimensions and shall be responsible for their accuracy. Setting out of the works on site shall be carried out by the Underground Drainage Installer who shall be responsible for any errors arising from inaccuracies in the setting out.
- (b) The Underground Drainage Installer shall be solely responsible for the accuracy of drawings and for any equipment shown being suitable for the purpose for which it is intended and in accordance with the Specification.

D923400 SITE COPIES

- (a) One set of prints of installation drawings, manufacturing drawings and installation drawings shall be retained on site as necessary to provide a complete record of the Works.
- (b) These drawings shall be kept in good condition and shall be marked up, at least once a week, to show the progress of work on site and incorporate all alterations, omissions, variations and amendments agreed during the progress of the works.

- (c) The drawings shall be available at all times for inspection.

D95 RECORD DOCUMENTATION**D950100 ASSET REGISTER**

- (a) The Underground Drainage Installer shall complete an asset register of all equipment supplied under the contract. A standard form may be provided by the Employer and shall be used for this purpose. Where no standard form is provided, the Underground Drainage Installer shall provide a template and obtain the Engineers agreement. All information shall be incorporated in the operation and maintenance manuals and supplied separately to the Employer in electronic format for inclusion in an overall asset document.

D950400 BUILDING LOG BOOK

- (a) The Underground Drainage Installer shall produce all required information for the Building Log book to meet the requirements of the Building Regulations Approved Document in accordance with CIBSE TM31: Building Log Books and Standard Templates.
- (b) The Underground Drainage Installer shall issue the required information to the Contractor in good time for onward transmission to the Log book Author to allow the completed log book to be issued one week prior to Practical Completion. Failure to issue the required information may prejudice the issue of the Practical Completion certificate.

D950700 BUILDING USER GUIDE

- (a) The Underground Drainage Installer will be required to contribute to a non-technical building user guide which describes the operation and environmental performance of the building.
- (b) The Underground Drainage Installers contribution shall include guidance on all engineering systems covered by this specification and shall be issued to the Building User Guide author promptly when requested.

D951000 MANUALS

- (a) All record documentation shall be available in a digital format. Where a Computer Aided Facilities Management (CAFM) system is used by the Employer or identified within the Contract, all record documentation shall be issued to accommodate the software platform in use by the Employer and adopt any protocol required by that system.
- (b) Where no specific requirements are specified, manuals should consist of one electronic copy and up to four sets of printed manuals. Both electronic and printed copies shall incorporate all test certificates and acceptances. Six weeks prior to Practical Completion draft copies of the manuals shall be submitted for comment. One week before Practical Completion final agreed manuals shall be handed over to the Employer.
- (c) The Engineer will review and comment upon the draft Operating and Maintenance Manuals and other relevant contributions to the Health and Safety File. This review

will not relieve the Underground Drainage Installer of this responsibility to ensure the information included is accurate and complete.

- (d) Failure to issue the manuals in time for incorporation into the Health and Safety File will result in failure to achieve Practical Completion.
- (e) The manual shall be arranged as follows:
 - i) **Section 1** Index
 - ii) **Section 2** Description of the Design Intent
 - iii) **Section 3** Description of the Operation Routine. The description shall include specific instruction for start-up, operation and shut down of each system, procedures for emergency shut down, making safe potentially dangerous plant, precautions necessary to overcome known hazards when operating each system, bringing into operation standby equipment, instructions on fault finding and emergency in case of plant malfunction or equipment failure and control sequences for all systems. Health and safety matters identified in the Health and Safety Plan and relevant to the operation, maintenance and replacement of the installation shall be described with precautions envisaged as necessary
 - iv) **Section 4** Planned Maintenance Instructions. These shall detail the procedures appropriate to the maintenance tasks. Instructions shall include dismantling and reassembly, replacements, adjustment, calibration and testing, reference to parts, identification lists, special tools, test equipment and auxiliary services, hazards which may arise and precautions to be taken, fault finding routines
 - v) **Section 5** Maintenance Schedules. These shall detail recommendations for the nature and frequency of inspections, examinations, tests and maintenance to keep the equipment in a safe and efficient working order. Guidance shall be given on the nature of deterioration and defects to be looked for. Activities shall be listed for daily, weekly, monthly, quarterly, bi-annual and annual routines
 - vi) **Section 6** Dismantling. Description of the methods and processes to be used in draining down and emptying of all systems including safe disposal of the contents. Description of the methods envisaged for dismantling of systems to comply with health and safety requirements, including schedules of hazardous substances and methods of disposal
 - vii) **Section 7** Equipment Schedules and Parts Lists. The schedules shall locate each item with details of the design and actual operating conditions, including replaceable assemblies. Sufficient information shall be provided to identify each item, with the source of supply, ratings, dimensions and appropriate standards. Equipment schedules shall include the name and address of the manufacturer, reference number, name and address of supplier, order number, date of purchase and duration of warranty. A separate parts list shall be provided for each item detailed in the equipment schedule. Schedules should be provided electronically in MS Word or MS Excel tabular form

- viii) **Section 8** A set of Record Drawings and Test Certificates. If necessary, due to the number of drawings which have to be included in the manual, each drawing shall be photographically reduced in size to suit the manual. There should also be a Master Record Index provided electronically in MS Word or MS Excel, listing drawing numbers, descriptions, category and all related drawings
 - ix) **Section 9** Emergency Measures. This shall include telephone numbers of Underground Drainage Installer emergency staff and name, address and telephone number of all manufacturers
 - x) **Section 10** Copies of all test certificates and commissioning data for each service and item of plant and equipment. They shall be final copies of the data produced as required by the Inspection, Testing and Commissioning Section of this Specification. Where such data is not available for inclusion in the draft copy of the manual required by paragraph b of this Clause, the draft shall be forwarded without them. Inability to include these items will not be accepted as a reason for non-production of the rest of the draft manual
- (f) Covers of printed manuals shall be substantial, of adequate size, distinctive and of sufficient strength to protect the contents for the life of the installation. The binding shall give a permanent anchorage along the left hand side whilst allowing the text to be flat without damage to the spine.
 - (g) The contents shall be prepared with an agreed typeface on top quality A4 paper suitable for direct insertion into the manuals.
 - (h) The front cover and where appropriate the spine shall have the name or logotype of the Employer, the name of the building and details of the services included in the manual clearly displayed in permanent lettering. Where the manual is contained in more than one volume, a volume number shall be added.
 - (i) The title page shall identify the building, describe the Services referred to in the manual and give the full name and address of the Employer. It shall also contain, date of completion and date of handover of the services to the Employer. The date of issue of the manual with the name and address of the manual author and the Author's reference number
 - (j) The preliminary pages shall contain the full name, address and telephone number of the Engineer, the Underground Drainage Installer and specialists. A description of how to use the manual with any limitations on its use shall be included. The preliminary pages shall include a contents list, list of supplementary documents and a record of amendments to the manual.
 - (k) Each section of the manual shall be divided by a stiff divider of the same size as the holder. The divider shall be labelled to identify the section of the manual which is following.
 - (l) All pages comprising the manual shall be sequentially numbered within each Section.

D951300 RECORD DRAWINGS

- (a) The Record Drawings, as described, shall be drawn using the current version of AutoCAD. Where record drawings are generated from a 3D Model, each drawing shall

be annotated in sufficient detail to fully describe the engineering installations without the need to refer to the 3D Model. Printed copies shall be reproduced on quality paper using international A series sizes. Lettering shall be not less than 5 mm in height.

- (b) The Engineer will review and comment upon the draft Record Drawings and other relevant contributions to the Health and Safety File. This review will not relieve the Underground Drainage Installer of this responsibility to ensure the information included is accurate and complete.
- (c) When agreement with the contents of the Drawings is received, digital and paper copies, in quantities to match the Manuals, shall be issued by the Underground Drainage Installer. The Drawings shall comply with the requirements of the Construction (Design and Management) Regulations for incorporation into the Health and Safety File for the Contract.
- (d) Record Drawings shall show the work as completed and shall record the following:
 - i) The location, including levels if buried, of public service connections provided within the Contract, whether installed as part of the Contract or the appropriate authority, together with the points of origin and termination, size and materials of pipes, line pressure, flow and other relevant information
 - ii) The layout, location and extent of all piped services showing pipe sizes, together with all valves for regulation, isolation and other purposes, drain cocks, test pockets, gauges, flow or pressure switches and other instruments
 - iii) Location, identification size and details of all apparatus and controls equipment served by, or associated with, each of the various services
- (e) Each Record Drawing shall show the name of the Contract and, where appropriate, the zone or floor designation. They shall include a description of the drawing, drawing number and scale. The name and address of the Underground Drainage Installer and the Engineer shall be included. Each Drawing shall include the words 'Record Drawing' in 18 mm upper case lettering in the bottom right hand corner adjacent to the title block.

D97 SCHEDULES

D970100 DRAINAGE DRAWING SCHEDULE

Drawing No.	Drawing Title
22761-HM-XX-XX-DR-PH-1201	Public Health Services - Proposed Foul Drainage Network
22761-HM-XX-XX-DR-PH-1202	Public Health Services - Proposed Surface Water Drainage Network
22761-HM-XX-XX-DR-PH-0301	Public Health Services - Drainage Details - Sheet 1
22761-HM-XX-XX-DR-PH-0302	Public Health Services - Drainage Details - Sheet 2
22761-HM-XX-XX-DR-PH-0303	Public Health Services - Drainage Details - Sheet 3
22761-HM-XX-XX-DR-PH-0304	Public Health Services - Drainage Details - Sheet 4
22761-HM-XX-XX-DR-PH-0305	Public Health Services - MH Schedule - Sheet 1
22761-HM-XX-XX-DR-PH-0306	Public Health Services - MH Schedule - Sheet 2
22761-HM-XX-XX-DR-PH-0307	Public Health Services - MH Schedule - Sheet 3
22761-HM-XX-XX-DR-PH-0308	Public Health Services - MH Schedule - Sheet 4

D970400 PIPEWORK, MATERIALS, JOINTS AND FITTINGS

Service	Location	Material and Code Compliance
Gravity Drainage Systems	Beneath Buildings – 100mm dia	Vitrified clay drainage system to BS EN 295-1 as Hepworth Building Products Supersleve system or similar.
Gravity Drainage Systems	External – 100mm dia	PVCu pipes, joints and couplers to BS 4660 and BSEN 1401 jointed with socket fittings and EPDM rubber jointing rings as Polypipe Ltd.
Gravity Drainage Systems	Below Ground Outside Building where more than 0.9m cover to crown of pipe 150mm, 225mm and 300mm diameter	PVC-U thermoplastic structured wall pipes, joints and couplers with smooth internal bore jointed with socketed fitting and EPDM rubber jointing rings as Polypipe Ltd Polysewer Gravity Sewer System.
Drainage Channels	All External Areas	As Polypipe Ltd “Permachannel” system including “Permachannel” connectors to “Permavoid” system.
Attenuation Tanks	External	Polypipe Ltd “Permavoid” Geocellular modular system with geotextile and geomembrane wrap.
Infiltration Tanks	External	Polypipe Ltd “Permavoid” Geocellular modular system with geotextile and “Permatex 300” permeable wrap.
Oil Separators	On each Gully Outlet Branch Drain	Polypipe Ltd “Permaceptor” with weir and baffle to trap silt and oil with geotextile and geomembrane wrap.
Flow Control Devices	External Chambers as noted	Polypipe Ltd “Orifice Plate Flow Control” with demountable filter.
Manhole Covers	Refer to Schedules	Jones of Oswestry, Elkington Gatic Type M gas-tight to BSEN124. Howe Green Ltd, 7500 series stainless steel recessed double seal bolt down covers.

D971600 ACCEPTABLE MANUFACTURERS

Ref.	Item	Acceptable Manufacturer
1	PVC-U Thermoplastic single and structured wall pipework and fittings	Polypipe Building Products Ltd
2	Attenuation and Infiltration Geocellular Tanks	Polypipe Ltd
3	Access Covers and Frames	Jones of Oswestry Ltd Howe Green Ltd Elkington Gatic Ltd
4	Drainage Channels	Polypipe Ltd
5	Vitrified Clay Pipework Fittings	Hepworth Building Products Ltd www.hepworth.co.uk