BELOW GROUND DRAINAGE SPECIFICATION

British Museum – Number 38 Russell Square

	24.8.18	Tender	AL	LK
Rev	**Date**	**Reason for Issue**	**By**	**Checked**

Our Ref: Job N°1756/702 **August 2018**
Alan Baxter Ltd

CONTENTS PAGE NUMBER

BELOW GROUND DRAINAGE SPECIFICATION

1.0 GENERAL

This specification is to be read in conjunction with the Preliminaries and General Conditions unless specifically stated otherwise.

For brickwork, concrete and excavation details refer to the relevant specifications.

Where this Specification conflicts with the relevant British Standard, the requirements of this Specification take priority.

1.1 DRAINAGE: install drainage in accordance with good Engineering Practice and comply with requirements of BS EN 752.

1.2 EXISTING DRAINAGE: where drainage is to be re-used or a connection made to the existing drainage, confirm the existing cover and invert levels prior to starting work. Report to the Contract Administrator (C.A.) any discrepancies in levels from those assumed on the drawings.

2.0 MATERIALS

2.1 STORAGE AND HANDLING: handle and store materials and components in such a manner as to avoid any damage or contamination, and in accordance with all applicable recommendations of the manufacturers.

2.2. VITRIFIED CLAY PIPES AND FITTINGS: to be in accordance with BS EN 295-1 and supplied complete with the manufacturer's flexible joint. Pipes to be Hepseal/Supersleve Vitrified Clay Drainage System as manufactured by Hepworth Clay Products.

2.3 CONCRETE PIPES AND FITTINGS: to be in accordance with BS 5911-1 and BS EN 1916. Joints to be spigot and socket type with circular sealing rings. Provide details of the proposed supplier with the tender.

2.4 CAST IRON PIPES AND FITTINGS: to be in accordance with BS 437. Coat pipes and fittings internally and externally with an approved bituminous composition, except where encased in concrete when the external bitumen shall not be applied.

2.5 PLASTIC PIPES AND FITTINGS: to be in accordance with BS EN 1401-1. Joints to be spigot and socket type with circular sealing rings. Supply details of the proposed manufacturer with the tender.

2.6 SEALS FOR JOINTS IN PIPEWORK AND PIPELINES: to be in accordance with BS7874, BS EN681-1, BS EN681-2 and BS6920-1. Obtain seals from the pipe manufacturer.

2.7 PIPE BEDDING AND FILL MATERIAL: material to be granular and consist of single size aggregates from natural or recycled sources in accordance with BS EN 13242. Test recycled material to confirm its suitability. Agree testing regime with the C.A. Material to be sized in accordance with the following table:-

Nominal Bore of pipe (mm)	Aggregate Size All bedding classes (Single-sized) (mm)
100-225	4/10
300-500	8/14
exceeding 500	10/20

The material to be used for bedding and surround for concrete pipes to have a soluble sulphate content which must not exceed 1.0 g/litre when tested to BS 1377: Part 3, Test 10 using a 2:1 water extract. Test if required by the C.A.

2.8 GULLIES, HOPPERS AND ACCESS FITTINGS:

a) Unless otherwise noted, gullies to be trapped and rodable. Use untrapped gullies in lieu only with the agreement of the C.A.

b) Use trapped gullies for connections to combined or foul drains and for areas used for parking.

c) Precast concrete gullies to comply with BS 5911- 6 and vitrified clay gullies or hoppers with BS EN 295.

d) Obtain each complete assembly of access fittings, including appropriate couplings, from the same manufacturer. All fittings and couplings to be compatible.

e) Iron gully gratings, kerb type gully covers and frames to comply with BS EN 124 with class and size as indicated on the drawing.

2.9 MANHOLES, INSPECTION CHAMBERS & SOAKAWAYS

2.9.1 PRECAST CONCRETE MANHOLES, INSPECTION CHAMBERS & SOAKWAYS:

a) Provide the following information with the tender:-

(i) Details of proposed make of manhole units including basic rises.

(ii) Details of sealing compounds and bedding mortars

b) Precast concrete manhole and soakaway units to be in accordance with BS EN 1917 and relevant sections of BS 5911- 3.

c) Precast concrete inspection chambers to be in accordance with BS EN 1917 and BS 5911- 4.

d) Units which bed onto bases, or onto which cover slabs or reducing slabs sit, to

be manufactured so that imposed vertical loads are transmitted directly to the full wall thickness of the unit.

e) For joints between units and the underside of slabs, spigot-ended sections to only be used where the soffit of the slab is recessed to receive them.

f) Use mortar, plastomeric or elastomeric seals as the jointing material for manhole units.

2.9.2 BRICK-BUILT MANHOLES:

a) Bricks for the construction of manholes to be clay engineering bricks to comply with BS EN 771-1. Solid bricks must be used and laid in 1:$^{1}/_{4}$:3 cement:lime:sand mortar.

b) Cement to be CEM 1-SR 42.5N sulphate-resisting cement.

c) Sand to be to BS EN 933-8.

d) Construct manholes in English Bond, fully bonded and flush jointed.

2.10 COVER SLABS FOR MANHOLES: to be heavy duty type slabs complying with BS EN 1917 and BS 5911- 3 unless shown otherwise on the drawings.

2.11 COVERS AND FRAMES:

a) Covers and frames to comply with BS EN 124, class and size as shown on the drawing(s).

b) All covers to have closed keyways. Supply two sets of keys for each pattern of cover to the C.A. at completion of work.

c) All internal manhole covers to be double sealed and have locking screws.

2.12 BENCHING AND CHANNELS IN MANHOLES AND INSPECTION CHAMBERS

a) Form benching from 1:1:2 (sulphate-resisting cement/sharp sand/10mm-5mm granite chippings, free from dust), 50mm thick, neatly trowelled to a smooth hard finish to the falls shown on the drawings.

b) Install half circle vitrified clay channels where no connecting angle is more than 45°, and three-quarter circle where any connecting angle is between 45° and 90°. Bed the channels on FND2 concrete. Position vitrified clay slippers bedded on FND2 concrete so they feed branch pipes into the main channel.

2.13. FITTING AND FIXINGS FOR MANHOLES AND INSPECTION CHAMBERS

a) Step irons for manholes of less than 1.5 m depth to be malleable cast iron complying with BS EN 13101.

b) For brickwork manholes of less than 1.5 m depth, the tails are to be 230 mm long complying with BS EN 13101.

c) For manholes of greater than 1.5 m depth, provide Class A ladders to BS 4211 in lieu of step irons.

d) Safety chains for manholes to be 8 mm nominal size mild steel grade M(8), complying with BS EN 818 - 4.

e) Handholds and other fittings to comply with the Specification for Highways Works highway construction details.

f) Chamber cover bolts to comply with BS 4190, and rag and indented foundation bolts and nuts to comply with BS 4185 - 9.

g) All fittings to be hot-dip galvanized to BS EN ISO 1461.

2.14 CONCRETE MIXES: to be in accordance with Table 1 (see end of specification).

2.15 OIL SEPARATORS: install in accordance with manufacturer's recommendations. Submit details of proposed installation sequence to the C.A. for comment prior to commencement of work.

3.0 WORKMANSHIP

3.1 EXCAVATION: see Groundworks Specification.

3.2 BEDDING, LAYING AND SURROUNDING OF PIPES

a) Bed, lay and surround pipes immediately following the trench excavation, wherever practicable.

b) Lay pipes so that each is uniformly supported throughout the length of its barrel. In the case of socketed or sleeve-jointed pipes cut the bed away and remove at each socket or sleeve to give a clearance of at least 50 mm so that the socket or sleeve does not bear on the bed and to enable the joint to be made.

c) Raise the bed, haunch and surround equally on both sides of the pipe ensuring that it is in contact with the underside of the pipe barrel and carefully compact in layers not exceeding 150 mm thickness to ensure full compaction next to the trench walls.

d) Lay every pipeline to the correct line and level from joint to joint. Maintain pipes to line and level during the bedding, haunching and surrounding operations. Ensure the position of the internal face of any pipeline does not deviate from the line and level shown on the drawings by more than $\pm$ 20 mm. No pipe is to have a reverse gradient.

e) Whenever work is suspended adequately plug the open ends of all pipes and junctions to prevent the ingress of any soil or rubbish. Take care at all joints to prevent ingress of any material.

f) Where pipelines are to be tested before being covered, raise the bedding, haunching and surrounding material sufficiently to support the pipeline and clean the joints exposed until the test is completed and the pipeline accepted by the C.A.

g) Use suitable measures to anchor each pipe to prevent flotation or other movement before the works are completed.

h) Support pipes to be bedded on or cradled with concrete on precast concrete setting blocks, the top face of each block being covered with 2 layers of compressible packing.

i) Concrete required to provide protection to pipes and to be placed to the required depth in one operation.

Where pipes with flexible joints are used, provide joints in the concrete protection over its full cross-section, at intervals not exceeding 5 m, using 20 mm thick compressible filler, as shown on the drawing(s).

3.3. JOINTING OF PIPES: keep pipe jointing surfaces and components clean and free from extraneous matter where the joints have been made or assembled.

Form joints strictly in accordance with the manufacturer's recommendations.

3.4 MANHOLES/INSPECTION CHAMBERS

3.4.1 GENERAL

a) Construct manholes in accordance with the drawings and specifications and in the positions as detailed on the drawings or as directed by the C.A.

b) Test all manholes when complete to demonstrate their watertightness to the satisfaction of the C.A.

c) Form foundations/bases to manholes/chambers with concrete as specified in Table 1.

d) Provide a flexible joint, as shown on the drawings, within 150 mm of the outside face of every manhole into which the joint is built, compatible with the satisfactory completion and subsequent movement of the joint.

e) Provide rocker pipes adjacent to manholes as follows, unless shown otherwise on the drawings:

Nominal pipe diameter (mm)	length of rocker pipe (mm)
up to 600	600
601 – 750	1000
Over 750	1250

f) Set manhole frames to the required level and on at least two and not more than four courses of Class B Engineering brickwork. Set the frames to level and bed and haunch over the face and sides of the frame in mortar.

g) Fit manholes with outgoing pipes greater than 600mm diameter with safety chains.

h) Brush the base concrete for the 50 mm granolithic benching with a stiff brush just before it hardens, to remove all laitance and loose aggregate. Thoroughly clean the hardened base, wet it, remove surface water and then apply a grout of

cement and water brushed into the surface just before application of the benching.

3.4.2 PRECAST CONCRTE MANHOLES

a) Construct precast concrete manholes using precast concrete components set on in situ concrete bases.

b) Bed the lowest chamber ring with mortar.

c) Where precast concrete cover slabs are requested, bed them on mortar, plastomeric or elastomeric sealants, used in accordance with the manufacturer's recommendations.

d) Form joints so that the required jointing material completely fills the joint cavity. Trim off any surplus jointing material which is extruded inside the chamber or shaft. Point the joints on completion.

e) Fill lifting holes with mortar.

f) All precast concrete manholes to have minimum 150 mm in situ concrete surround as specified in Table 1, unless shown on the drawing (s).

3.4.3 BRICK-BUILT MANHOLES: form base slabs of concrete as noted in 3.4.1.c) unless shown on the drawing (s). Sidewalls to be brickwork as specified in section 2.9.2 a).

3.5 CONNECTING TO DRAINS/SEWERS

a) Before entering or breaking into an existing sewer or drain, issue a notice of intention to work to the responsible Authority for the pipeline to which the connection is to be made.

b) Adequately protect existing drains remaining live and maintain normal flows during construction.

c) Insert junction pipes for future connections as necessary during construction of the sewers. Close with purpose made stoppers, discs or jointers those pipes not needed for immediate use.

d) Form all connections to sewers with angle junctions set at the correct angle to minimise the use of bends. All angles are not to exceed 45° (in the plane of the two connecting pipes).

3.6 DIS-USED DRAINS/SEWERS

a) If existing drains are no longer required, confirm that the drains are not owned by a utility company or other third party and undertake either of the following works, as directed by the C.A.:-

(i) cap off former connection to live sewer, then break out the drain and fill the trench with compacted hardcore which shall be good clean hard brick (free from old plaster and timber), crushed cement concrete, hard tiles, stone or ballast broken before placing to pass a 75mm ring, suitably graded so as to be capable of thorough compaction and free from all rubbish, contamination, etc. The soluble sulphate content (SO_3) of materials for filling within 1m of permanent works must not exceed 1.0 g/litre when tested to BS 1377 - 3, Test 10 using a 2:1 water extract.

or

(ii) block off where shown on the drawings and fill with a mixture of pfa and cement under pressure so as to entirely fill the old sewer. Take great care to ensure there is no seepage or spillage into working sewers, ducts, etc. and to prevent spillage onto finished work or surrounding property.

4.0 CLEANSING AND TESTING

4.1 CLEANING OF SEWERS AND MANHOLES: On completion of construction, thoroughly clean internal surfaces or sewers and manholes to remove all deleterious matter, without such matter being passed forward into existing public sewers or watercourses.

4.2 PRECAUTIONS PRIOR TO TESTING PIPELINES: Before testing any pipeline, ensure that it is anchored adequately and that thrusts from bends, branch outlets or from the pipeline ends are transmitted to solid ground or to a suitable temporary anchorage. Stop up open ends with plugs, caps or blank flanges properly jointed.

4.3 EXISTING PIPES: Before commencement of work, arrange for a CCTV inspection of all existing pipelines that are to be re-used and issue a report to the C.A. Undertake remedial works, cleansing and testing as agreed with the C.A. Do not proceed with the new drainage until the scope of any remedial works has been agreed.

4.4 NEW PIPES: visually inspect all new drain runs to and between new manholes prior to backfilling and air test in accordance with Clause 4.4.1, before and after backfilling. If the air test "fails", undertake a water test, in accordance with Clause 4.4.2. If any section of pipework fails to pass a water test, locate the fault or faults and make good. Test the work again until the section is accepted by the C.A. Bear costs of all remedial work and re-testing needed.

4.4.1 *Air test for Gravity Sewers.*

Gravity sewers to be air tested shall have air pumped in by suitable means until a pressure of 100 mm head of water is indicated in a U-tube connected to the system. The pipeline shall be accepted if the air pressure remains above 75 mm head of water after a period of five minutes without further pumping following a period for requisite stabilisation. Failure to pass the test shall not preclude acceptance of the pipeline if a successful water test can subsequently be carried out as described below.

4.4.2 *Water Test for Gravity Sewers*

The test pressure for gravity sewers shall be not less than 1.5 m head of water

above the pipe soffit at the highest point and not greater than 4 m head at the lowest point of the section. Test steeply graded sewers in stages in cases where the maximum head, as stated above, would be exceeded if the whole section were tested in one length.

Fill the pipeline, including manholes, with water and allow a minimum period of two hours for absorption. Top up and the add water from a measuring vessel at intervals of 10 minutes and note the quantity required to maintain the original water level. Unless otherwise specified, the length of pipeline shall be accepted if the quantity of water added over a 30 minute period is less than 0.5 litre per linear metre per metre of nominal bore.

Notwithstanding the satisfactory completion of the above test, replace the pipe or manhole and/or remake the joints, as appropriate, if there is any discernible leakage of water from any pipe. Repeat the test until leakage is stopped.

TABLE 1 TYPES OF MIXES

Ref Use/Location	Designation	Nominal max Aggregate Size mm	Identity Testing	RCA Permitted up to 20%
DESIGNATED MIXES				
D Blinding	GEN 1	20	No	Yes
F Manhole bases; benching, haunching and protection to pipes; surrounds to precast manholes	FND 2	20	Yes	Yes

NOTES:

1. Determine the consistence class appropriate for each part of the works to suit construction requirements.
2. Determine any restrictions on cements or combinations to be used to suit construction requirements.
3. Chloride classes: for reinforced concrete: cl 0.40
   for prestressed or post-tensioned concrete: cl 0.10

* RCA = Recycled Concrete Aggregate (less than 1% non-concrete material)