

5.4 Permeable Pavements

Regular inspection and maintenance is important for the effective operation of pervious pavements. Before handing over the facility to the client, it should be inspected for clogging, litter, weeds and water ponding and all failures should be rectified. After handover, the facility should be inspected regularly, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding.

Pervious surface need to be regularly cleaned of silt and other sediments to preserve their infiltration capability. Experience in the UK is limited, but advice issued with permeable precast paving has suggested a minimum of three surface sweeping per year. Manufacturer’s recommendations should always be followed.

A brush and suction cleaner, which can be a lorry-mounted device or smaller precinct sweeper, should be used and the sweeping regime is as follows:

- End of winter (April) – to collect winter debris.
- Mid-summer (July/August) – to collect dust, flower and grass type deposits.
- After autumn leaf fall (November).

Care should be taken in adjusting vacuuming equipment to avoid removal of joining material. Any lost material should be replaced.

The likely design life (or period before pavement rehabilitation is required) has yet to be established for UK. However, it should be no different from standard paving assuming that an effective maintenance regime is in place to minimise the risk of infiltration clogging.

All silt trapped gullies and drainage channels, silt traps, manholes and catchpits to be regularly inspected every three months and cleared out on a regular frequency for the first nine months. After this period, the frequency can be reduced to every six months.

If reconstruction is necessary, the following procedure should be followed;

- Lift surface layer and laying course.
- Remove any geo-textile filter layer.
- Inspect sub-base and remove, wash and replace if required.
- Renew laying course, joining material and concrete block paving.

The reconstruction of failed areas of concrete block pavement should be less costly and disruptive than the rehabilitation of continuous concrete or asphalt porous surfaces due to the reduced area that is likely to be affected. Material removed from the voids or layers below the surface may contain heavy metals and hydrocarbons and may need to be disposed of as controlled waste. Sediment testing should be carried out before disposal to confirm its classification and appropriate disposal methods.

Maintenance plans and schedules should be prepared during the design phase. Specific maintenance needs of pervious pavement should be monitored and maintenance schedules adjusted to suit requirements.

5.5 Blue / Green Roofs

Ensure safe access can be gained to the roof and that relevant Health and Safety procedures are followed when working at roof level. It is advised that the contractor should always seek proof of current maintenance for any roof access, fall arrest / restraint systems prior to proceeding with the work on site.

The level of maintenance required is dependent on the final finish. Paved podium decks and extensive green roofs are relatively low maintenance where as intensive green roofs require maintenance like any garden.

Remove all dead vegetation and debris from the roof and ensuring all outlets, gutters and downpipes are clear. Where the species mix incorporates wild flowers and grasses it is recommended that all dead vegetation is mown / trimmed down and the waste is removed from the roof and disposed off.

Any vegetation which has encroached into drainage outlets, walkways and the vegetation barriers (pebbles) should be removed. Weeding an extensive green roof is necessary to maintain a healthy roof and all aggressive species of shrub sapling and undesirable plants should be removed. Some weeds however are helpful to the biodiversity of the roof and considered as a problem only of aesthetics. If considered excessive, they can be removed ensuring that care is taken to follow specific instructions as to the type and species of vegetation removed. All extensive green roof installations will at times include some moss and grass.

Areas of dead vegetation / bare patches can be easily repaired and this is best done during the main growing seasons of March/ April or from late August until the end of September. Take plug plants (new) or vegetation cuttings from surrounding areas of healthy mature plants and place on bare patches, pressing gently into the soil. A light sprinkling of sand mixed with compost should then be dressed over the affected area and watered to improve the uptake of the cuttings. If the vegetation is showing signs of distress, but has received regular rainfall, then the most likely problem is a lack of nutrient and a fertiliser should be applied.

Remove the lids of all Inspection chambers, ensure that all rainwater outlets and downpipes are free from blockages and that water can flow freely away, clean filters to outlets twice yearly and replace every three years. Ensure that any protective metal flashings and termination bars remain securely fixed in place.

Examine all mastic sealant and mortar pointing for signs of degradation. Check that all promenade tiles and paving slabs are securely fixed to the roof surface and in good condition.

Advise the client of the need to repair or renew any defects as necessary.

Ensure that any new items of plant/equipment on the roof are mounted on suitable isolated slabs and that any fixings used to secure the plant/equipment in place do not penetrate the waterproofing. Report signs of damage or degradation to the waterproofing to manufacturer immediately, in order that arrangements can be made for remedial work to be carried out if necessary. It is recommended that a record is kept of the findings of the inspection to avoid confusion and provide an on-going record of roof performance. Plants suitable for an extensive green roof which will colonise in partial and full shade will generally be greener in colour and grow “taller” in these locations. There will be a significant variance in the growth and colour between the plants growing in full or partial shade and those exposed to full sunlight and this should be recognised as a feature of the biodiversity of each individual roof.

5.6 Outlets from blue roof

Inspection chambers containing orifice plates to be inspected regularly in accordance with the manufacturer recommendations (minimum twice annually):

- Remove litter and blockages as required
- Records of inspections and maintenance undertaken should be kept by the client.
- Check orifice plate for any sign of blockages

Maintenance Schedule	Required action	Frequency
Regular maintenance	Brushing and vacuuming.	Three times/year at end of winter, mid-summer, after autumn leaf fall, or as required based on site specific observations of clogging or manufacturers’ recommendations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas.	As required.
	Removal of weeds.	As required.
Remedial actions	Remediate any landscaping which , through the vegetation maintenance or soil slip, has been raised to within 50mm of the level of paving.	As required.
	Remedial works to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users.	As required.
	Rehabilitation of surface and upper sub-structure.	As required (if infiltration performance is reduced as a result of significant clogging).
	Initial inspection.	Monthly for 3 months after installation.
Monitoring	Inspect for evidence of poor operation and/or weed growth. If required take remedial action.	3 monthly and 48h after large storms.
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.
	Monitor inspection chamber.	Annually.

Table 1 Pervious pavements maintenance schedule

6 Drainage design standards

- The following guides and current British Standards will be used for the design of the drainage elements on this project:
- BS EN 752:2017 Drain and Sewer Systems Outside Buildings. Sewer System Management
 - BS EN 12056 Gravity Drainage Systems Inside Buildings: Part 2
 - Building Regulations 2010 Part H1 – Foul Water Drainage (2015 Edition)
 - Building Regulations 2010 Part H2 – Wastewater Treatment Systems and Cesspools (2015 Edition)
 - Building Regulations 2010 Part H3 – Rainwater Drainage (2015 Edition)
 - Building Regulations 2010 Part H4 – Building Over Sewers (2015 Edition)
 - Building Regulations 2010 Part H5 – Separate Systems of Drainage (2015 Edition)
 - Building Regulations 2010 Part H6 – Solid Waste Storage (2015 Edition)
 - Environment Agency “Control of Runoff from New Developments Interim Regional Guidance”
 - National Planning Policy Framework
 - Planning Practice Guidance

7 Materials

	Item	Material	British standard
a)	Drainage pipe work	Vitrified clayware	BS EN 295-1
		Cast iron	BS EN 877
		Concrete	BS 5911-1 and BS EN 1916
		uPVC	BS EN 1401-1
b)	Precast inspection chambers	Precast concrete	BS 5911 Part 200
c)	Drainage gullies and gratings	Vitrified clayware	BS EN 295-1
		Ductile iron	BS EN 124 D 400
d)	Drainage channels and gratings	Polymer concrete	
		Ductile iron	BS EN 124 D 400
e)	Access covers	Grey iron	BS EN 124
		Galvanised steel	Facta Class A, B & D
f)	Cellular units	Polypropylene	
g)	Geotextiles		

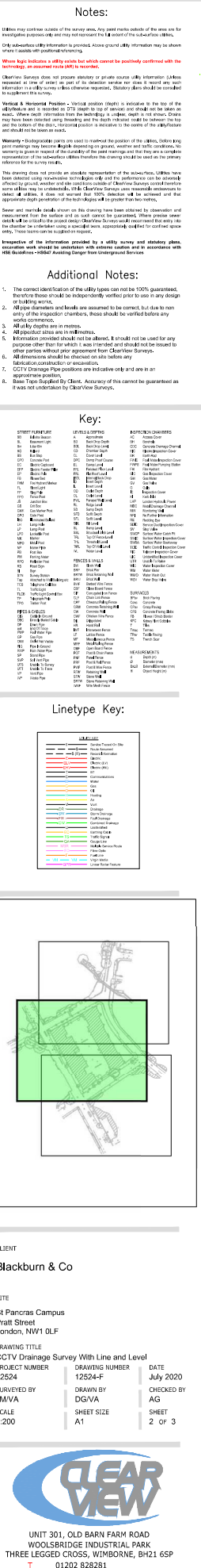
8 Risks and unknowns

- The main risk items relating to the drainage which have been identified during the scheme design stage are as follows. These areas will be addressed during the ongoing stages of the design with the goal of minimising or removing them.
- 1. Remedial Works to Sewer Connections**
Cost allowance should be made for remedial works required to the existing sewer connections proposed to be reused as per the CCTV drainage survey reports dated 22/07/2020 (12317 Survey Report) and 22/07/2019 (11828 Survey Report).
 - 2. Water authority discharge agreement**
If it is deemed the discharge from the light industrial units at the basement and ground floor level are of trade / industrial process in nature, Thames Water would need to approve the discharge via a Trade Effluent Agreement.
 - 3. MEP layout and flows**
Frozen MEP drainage layout and flows will be required to allow for the below ground drainage to be progressed.
 - 4. Architect’s layout**
Frozen architectural layouts will be required to allow for the below ground drainage to be progressed.
- Whilst this is not exhaustive it covers the main areas that affect the cost of the drainage.

Appendix 1

CCTV Drainage Survey





Appendix 2

Thames Water Asset Map



Asset Location Search Sewer Map - ALS/ALS Standard/2018 3808174



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 529368, 183955

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.



ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

	Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.
	Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.
	Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.
	Trunk Surface Water
	Trunk Foul
	Storm Relief
	Trunk Combined
	Vent Pipe
	Bio-solids (Sludge)
	Proposed Thames Surface Water Sewer
	Proposed Thames Water Foul Sewer
	Gallery
	Foul Rising Main
	Surface Water Rising Main
	Combined Rising Main
	Sludge Rising Main
	Proposed Thames Water Rising Main
	Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

	Air Valve
	Dam Chase
	Fitting
	Meter
	Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

	Control Valve
	Drop Pipe
	Ancillary
	Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

	Outfall
	Undefined End
	Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

	Public/Private Pumping Station
	Change of characteristic indicator (C.O.C.I.)
	Invert Level
	Summit

Areas

Lines denoting areas of underground surveys, etc.

	Agreement
	Operational Site
	Chamber
	Tunnel
	Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

	Foul Sewer		Surface Water Sewer
	Combined Sewer		Gully
	Culverted Watercourse		Proposed
			Abandoned Sewer

Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.
- 6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
61AD	n/a	n/a
42DH	n/a	n/a
41BE	n/a	n/a
41BJ	n/a	n/a
41BI	n/a	n/a
51AC	n/a	n/a
3019	26.44	n/a
40GA	n/a	n/a
4101B	26.49	22.99
4010	26.7	20.12
40GB	n/a	n/a
4001A	26.29	13.44
4102A	27.1	n/a
40FG	n/a	n/a
40FI	n/a	n/a
40FH	n/a	n/a
40FJ	n/a	n/a
40GC	n/a	n/a
4011	27.8	23.74
40GD	n/a	n/a
4002A	27.8	21.85
40FD	n/a	n/a
40DJ	n/a	n/a
40FE	n/a	n/a
40EC	n/a	n/a
40BF	n/a	n/a
40EJ	n/a	n/a
40BG	n/a	n/a
40AE	n/a	n/a
4012	28.3	24.2
4003B	28.3	21.97
40DA	n/a	n/a
40DF	n/a	n/a
40BI	n/a	n/a
40BJ	n/a	n/a
41CB	n/a	n/a
5001A	28.5	24.75
50CB	n/a	n/a
5002A	28.5	22.2
50EF	n/a	n/a
50EA	n/a	n/a
5101	28.91	24.96
50DH	n/a	n/a
50DF	n/a	n/a
50CA	n/a	n/a
50AI	n/a	n/a
50AH	n/a	n/a
5003B	28.8	22.52
50BJ	n/a	n/a
50AG	n/a	n/a
51AI	n/a	n/a
5004	28.8	24.25
5005	28.8	22.6
59BB	n/a	n/a
59EC	n/a	n/a
49DG	n/a	n/a
59AB	n/a	n/a
59FI	n/a	n/a
59BC	n/a	n/a
49AJ	n/a	n/a
59FJ	n/a	n/a
59FG	n/a	n/a
49CD	n/a	n/a
59FH	n/a	n/a
49CC	n/a	n/a
49CB	n/a	n/a
59FD	n/a	n/a
49DI	n/a	n/a
49DF	n/a	n/a
50EC	n/a	n/a
50EH	n/a	n/a
40EB	n/a	n/a
50EB	n/a	n/a
40DC	n/a	n/a
50DJ	n/a	n/a
50ED	n/a	n/a
40FC	n/a	n/a
40FA	n/a	n/a
50EG	n/a	n/a
40DB	n/a	n/a
4902A	n/a	n/a
491A	n/a	n/a
4901B	21.24	19.17
4802	21.26	17.29
59AH	n/a	n/a
59DJ	n/a	n/a
59EB	n/a	n/a
59AG	n/a	n/a
59DH	n/a	n/a
59DI	n/a	n/a
59AF	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
59AE	n/a	n/a
59DG	n/a	n/a
59AJ	n/a	n/a
59AD	n/a	n/a
59BA	n/a	n/a
59AC	n/a	n/a
5701	21.24	14.4
59EF	n/a	n/a
59EH	n/a	n/a
59EG	n/a	n/a
59FC	n/a	n/a
50BI	n/a	n/a
5702	n/a	n/a
4721	23.86	n/a
5718	20.05	17.31
471A	n/a	n/a
5704	19.71	16.96
3814	23.94	n/a
5801	n/a	n/a
5803	21.36	16.99
3701	24.89	21.41
3702	24.74	19.9
1104	n/a	n/a
2108	27.88	n/a
2107	n/a	n/a
21CG	n/a	n/a
211C	n/a	n/a
221F	n/a	n/a
211D	n/a	n/a
3105	n/a	n/a
2901	n/a	n/a
2930	24.89	18.08
2903	n/a	n/a
2929	25.02	22.03
2928	25.09	20.58
3901	25.29	18.49
2902	n/a	n/a
3001	25.29	12.67
201A	n/a	n/a
201B	n/a	n/a
2002	26.34	22.4
201C	n/a	n/a
10DJ	n/a	n/a
201D	n/a	n/a
10DI	n/a	n/a
2003	n/a	n/a
11DG	n/a	n/a
11DB	n/a	n/a
11DA	n/a	n/a
11CJ	n/a	n/a
2101	n/a	n/a
2124	n/a	n/a
2102	n/a	n/a
11CI	n/a	n/a
11CH	n/a	n/a
2103	27.58	23.31
211B	n/a	n/a
2125	n/a	n/a
211A	n/a	n/a
2703	25.97	22.3
2701	25.41	9.46
37JE	n/a	n/a
371A	n/a	n/a
37JH	n/a	n/a
1704	27.73	23.22
1703	27.45	22.73
3703	n/a	n/a
37AH	n/a	n/a
38CI	n/a	n/a
1802	26.8	21.57
38CA	n/a	n/a
38EI	n/a	n/a
181B	n/a	n/a
38DF	n/a	n/a
181A	n/a	n/a
38FD	n/a	n/a
38FE	n/a	n/a
38DI	n/a	n/a
1805	26.63	n/a
181C	n/a	n/a
3802	n/a	n/a
38GA	n/a	n/a
2803	n/a	n/a
1808	26.21	22.82
1810	26.13	n/a
1811	26.09	21.32
1901	25.96	10.77
1902	n/a	n/a
19GE	n/a	n/a
1024	26.67	18.53
19II	n/a	n/a
19GF	n/a	n/a
19FC	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
19IH	n/a	n/a
19FE	n/a	n/a
19EH	n/a	n/a
19EI	n/a	n/a
10CH	n/a	n/a
19FA	n/a	n/a
19ED	n/a	n/a
19BG	n/a	n/a
19BC	n/a	n/a
18CJ	n/a	n/a
1804	27.28	22.18
171B	n/a	n/a
1102	24.61	21.79
1101	27.58	22.24
1103	27.7	n/a
11DE	n/a	n/a
11DD	n/a	n/a
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.		

Appendix 3

Pre-Planning Enquiry with Thames Water

