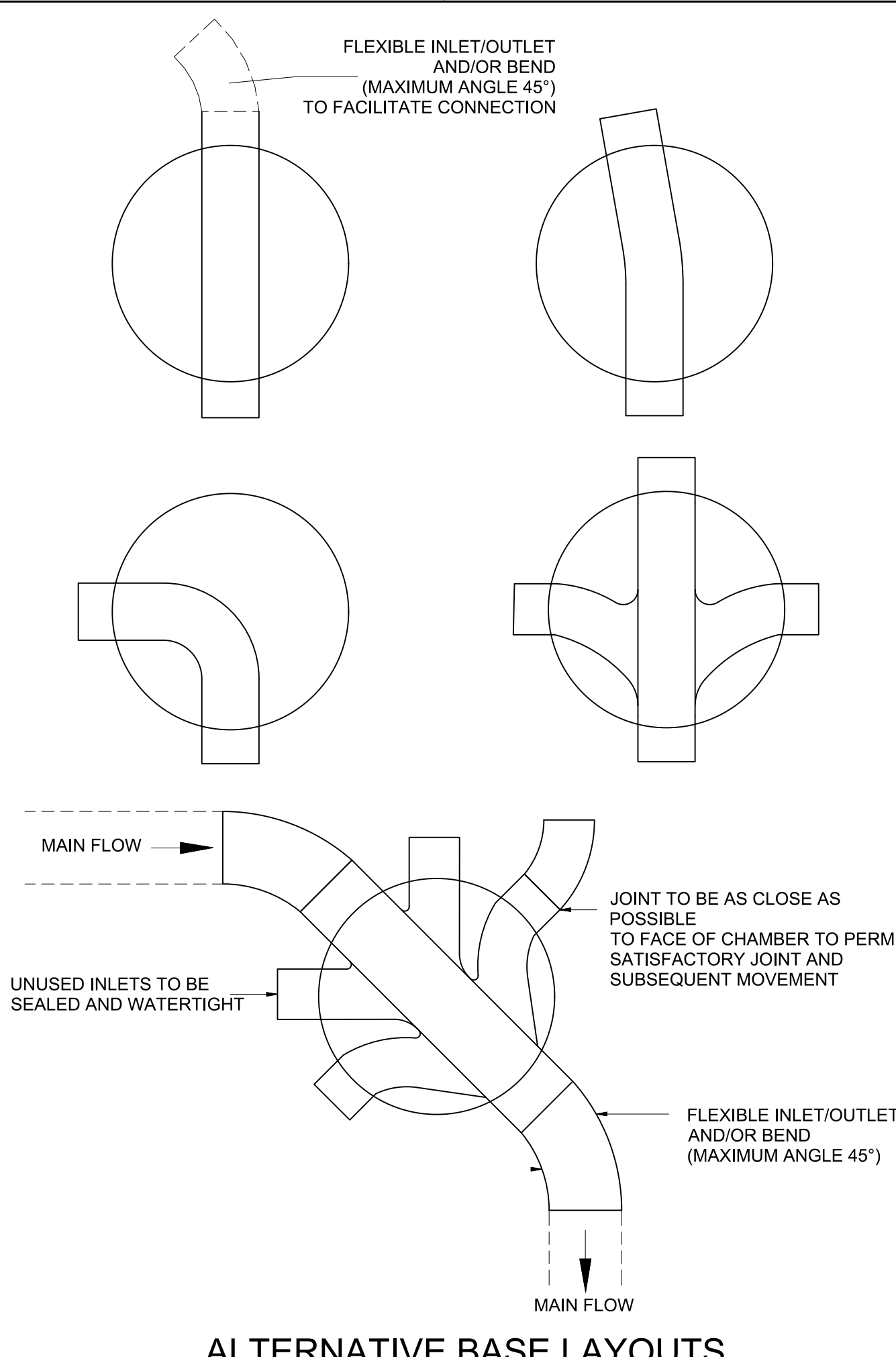
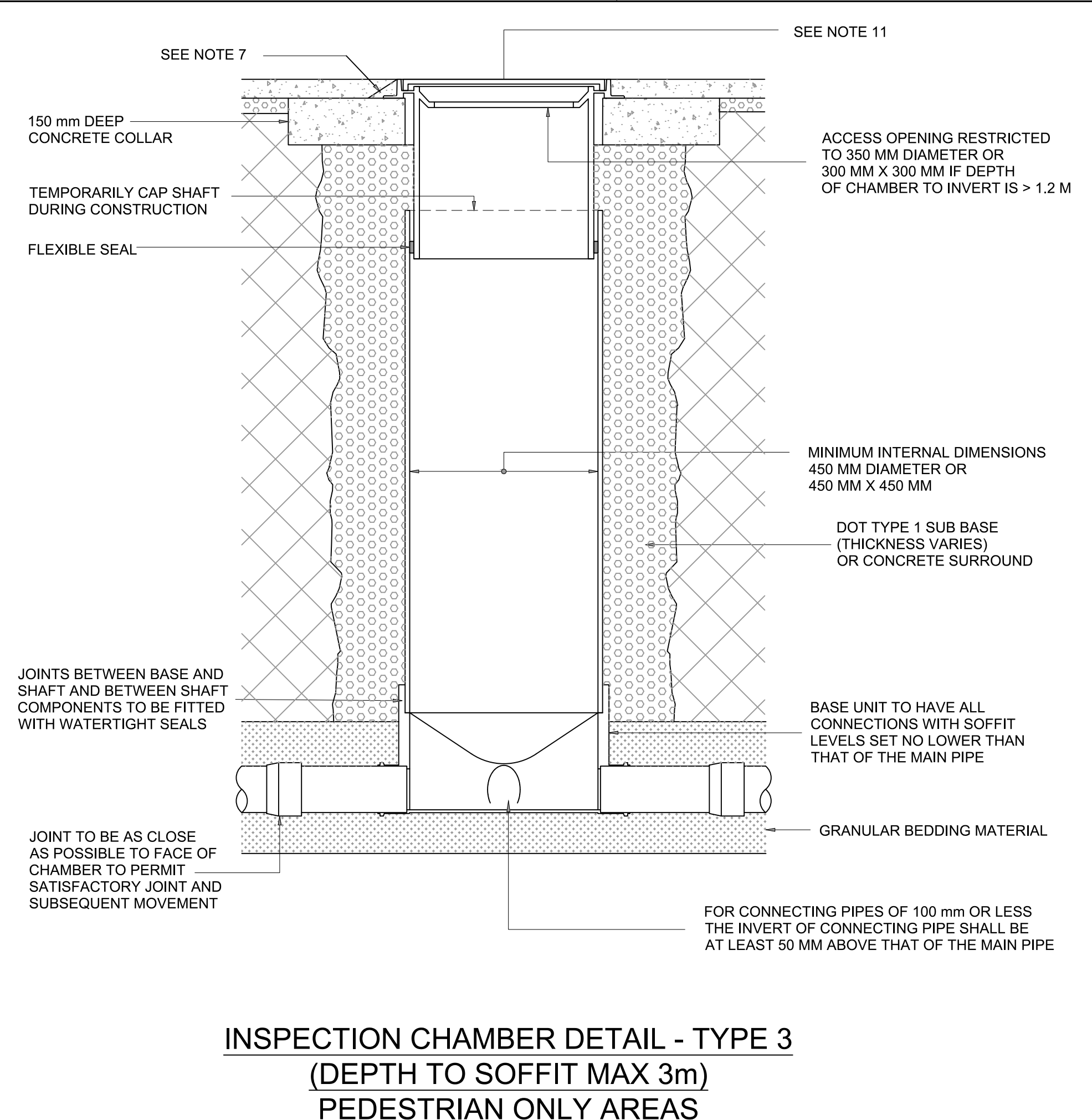
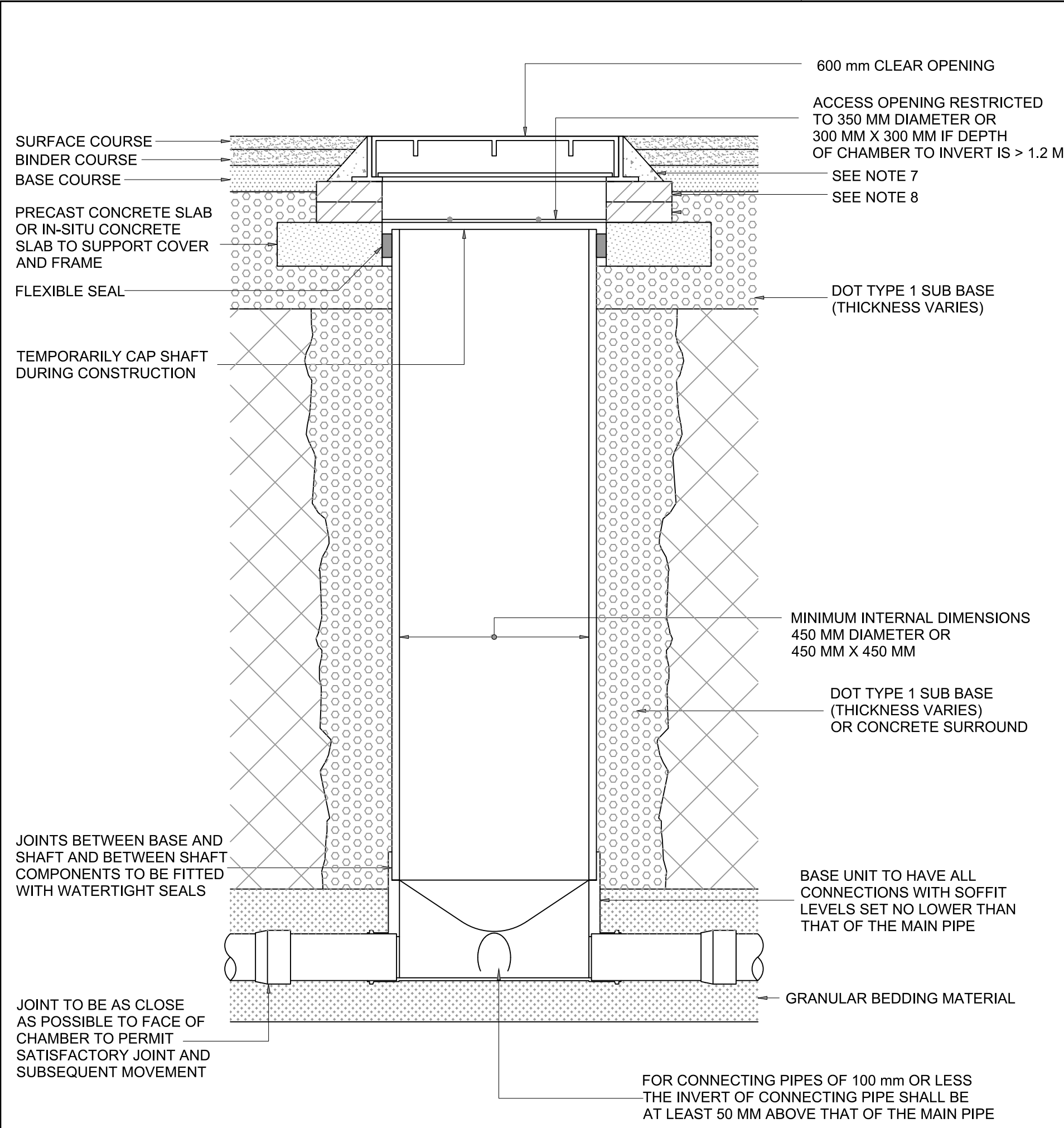


Appendix D

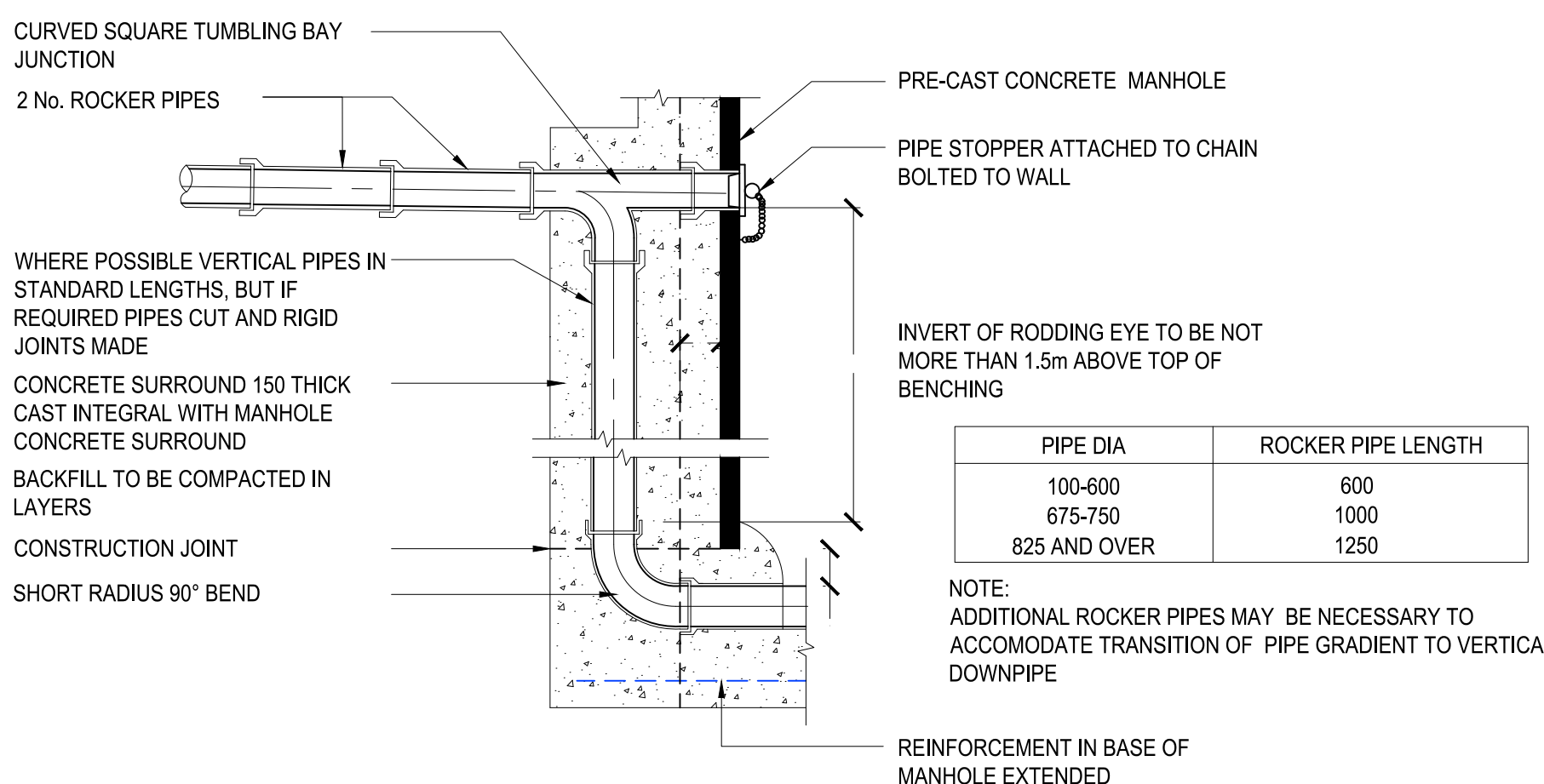
Drainage Details



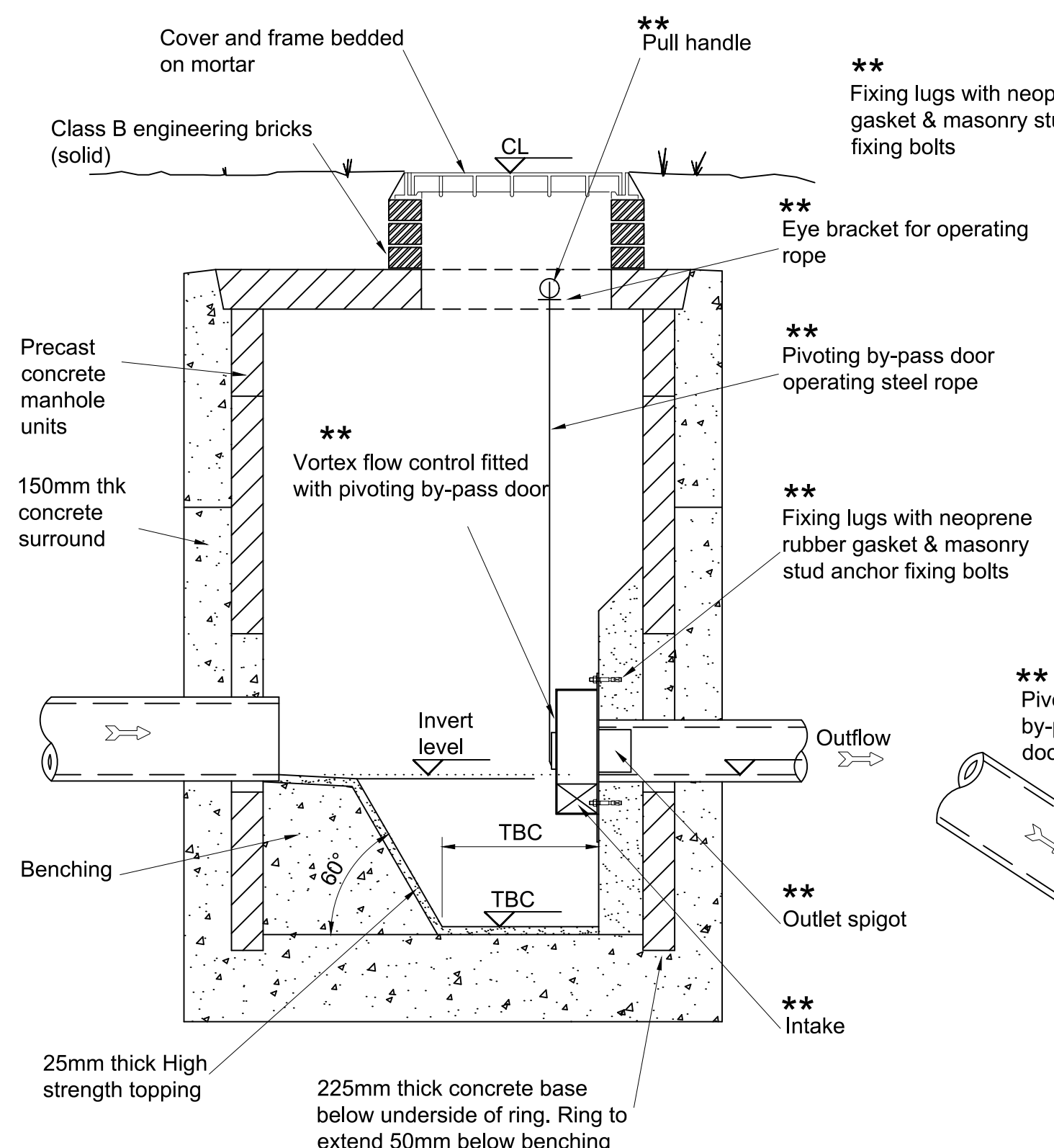
- NOTES**
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 - ALL LEVELS ARE IN METRES RELATIVE TO ORDANCE DATUM.
 - ALL WORKS TO BE IN ACCORDANCE SEWERS FOR ADOPTION 7TH EDITION.
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 - MANHOLE FRAMES SHALL BE SET LEVEL, BEDDED AND HAUNCHED TO CL E6.7
 - MANHOLE FRAME SHALL BE SEATED ON AT LEAST TWO COURSES OF CLASS B ENGINEERING BRICKS TO CL E6.7
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 - ALL PIPES NOT LESS THAN 150 mm DIA ENTERING THE BOTTOM OF THE MANHOLE TO HAVE SOFFITS LEVEL
 - PREFORMED SWEPT CHANNEL SHALL BE USED AT JUNCTIONS
 - NO BRANCH SHALL ENTER AT LESS THAN 90 DEGREES FROM THE OUTGOING SEWER

INSPECTION CHAMBER DETAIL - TYPE 3 |
(DEPTH TO SOFFIT MAX 3m)
VEHICULAR AREAS
SCALE - N.T.S.

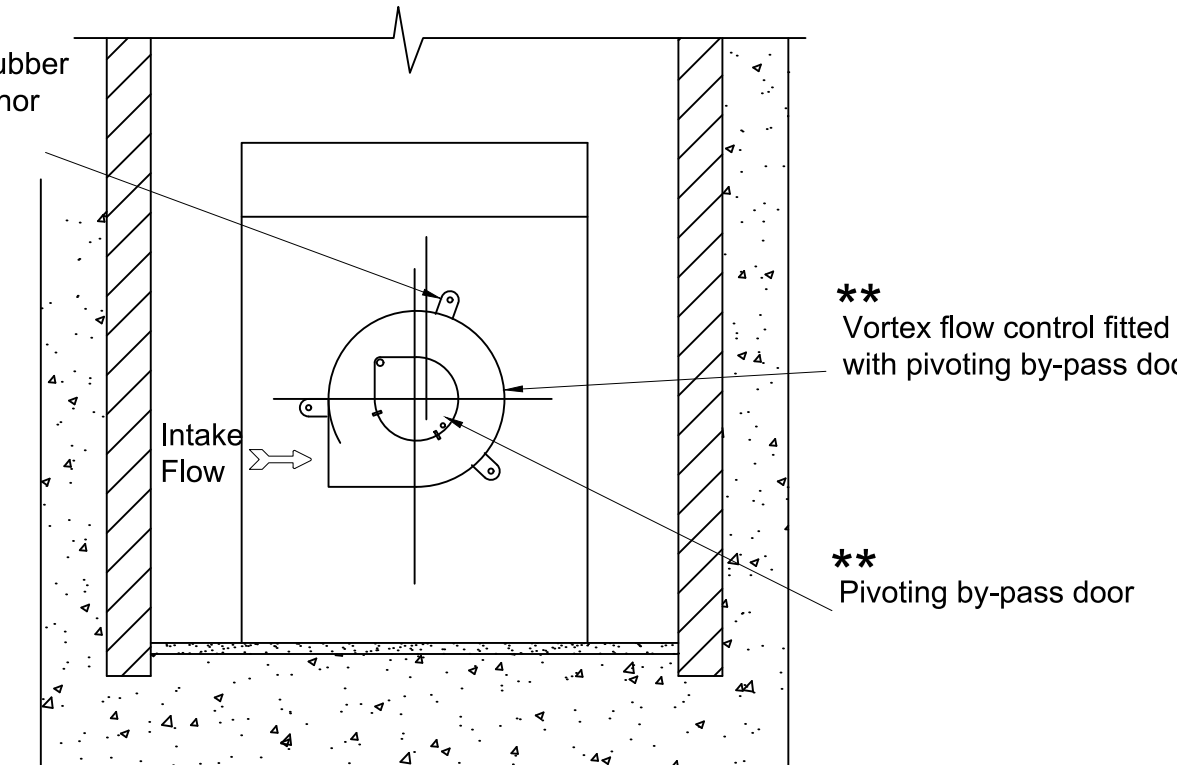
NOTE : IF ALTERNATIVE PRODUCTS / MANUFACTURERS ARE TO BE USED BY THE CONTRACTOR, THESE MUST BE TO AN EQUIVALENT STANDARD AND ARE TO BE INSTALLED WITH ANY REQUIRED ADAPTERS / COMPONENTS NECESSARY TO BE COMPATIBLE WITH BELOW GROUND DRAINAGE AND TO BE INSTALLED FULLY IN ACCORDANCE WITH THE MANUFACTURERS GUIDANCE AND RECOMMENDATIONS.



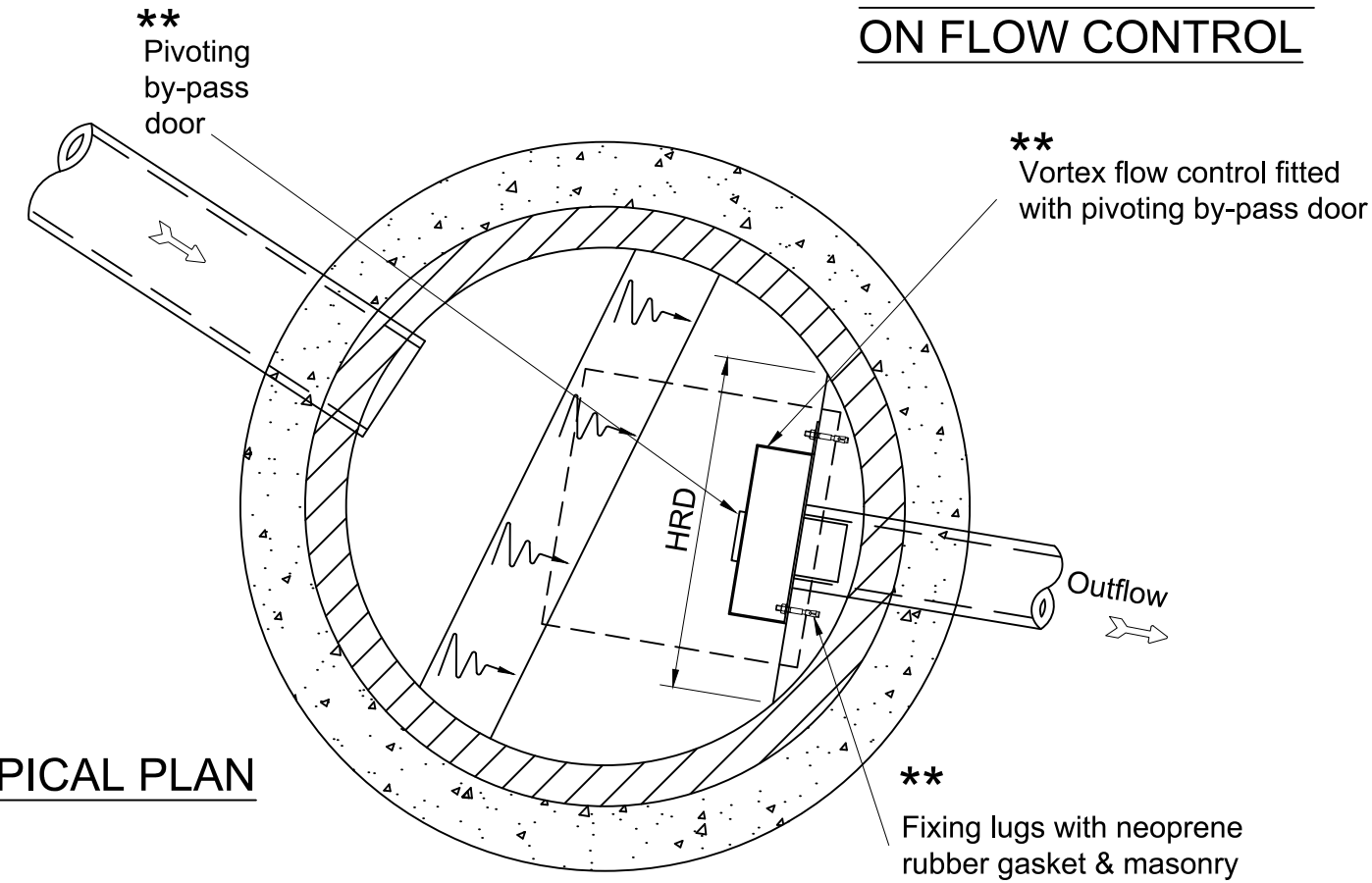
VERTICAL BACKDROP CONNECTION TO MANHOLE (> 1.25m)
SCALE 1:25



TYPICAL SECTION THROUGH CONTROL MANHOLE
** By Vortex Flow Control supplier



TYPICAL ELEVATION ON FLOW CONTROL



TYPICAL VORTEX FLOW CONTROL MANHOLE
NOT TO SCALE

C01 CONSTRUCTION ISSUE	EW	LJ	06/03/20
(P02) STAGE 4/CP ISSUE	LJ	DN	09/12/19
(P01) DRAFT CP ISSUE	ARJ	DN	24/10/19

FIRST ISSUE

REVISION	DESCRIPTION	DRAWN	CHECKED	DATE
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REV PLAN

CLAY

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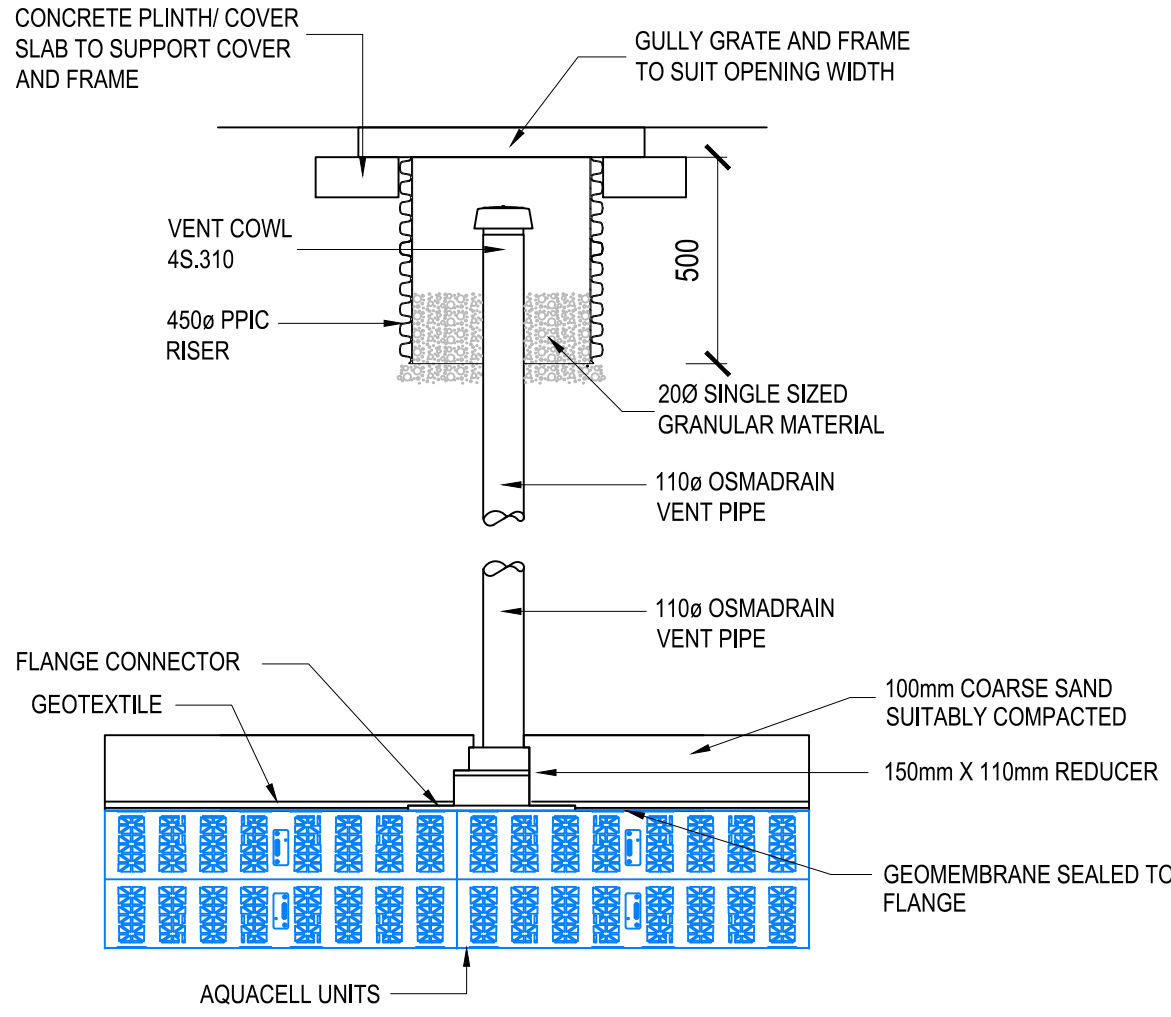
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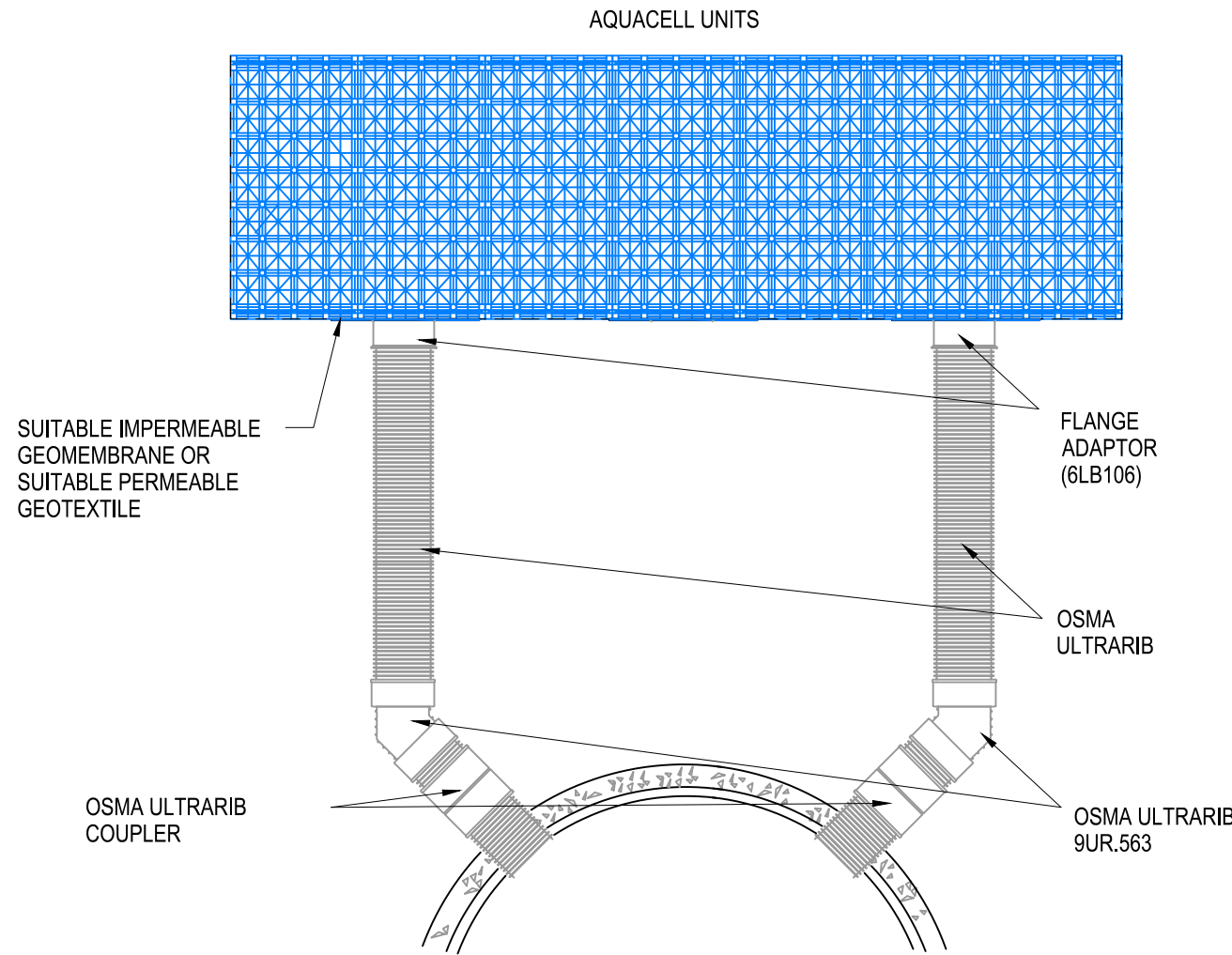
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United Kingdom
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PROJECT TITLE	CHORLTON HIGH SCHOOL SOUTH
DRAWING TITLE	TYPICAL DRAINAGE DETAILS SHEET 2
PROJECT NUMBER	P2008475
DRAWING NO.	FS0765-BDP-XX-XX-DR-C-60002
SCALE	@ A1 VARIES
DATE	OCT '19
REVISION	C01



TYPICAL VENT DETAIL

NOTE: IT IS RECOMMENDED THAT ONE VENT PIPE, 110MM IN DIAMETER, IS PROVIDED PER ATTENUATION TANK. VENT POSITION TO BE AGREED ON SITE



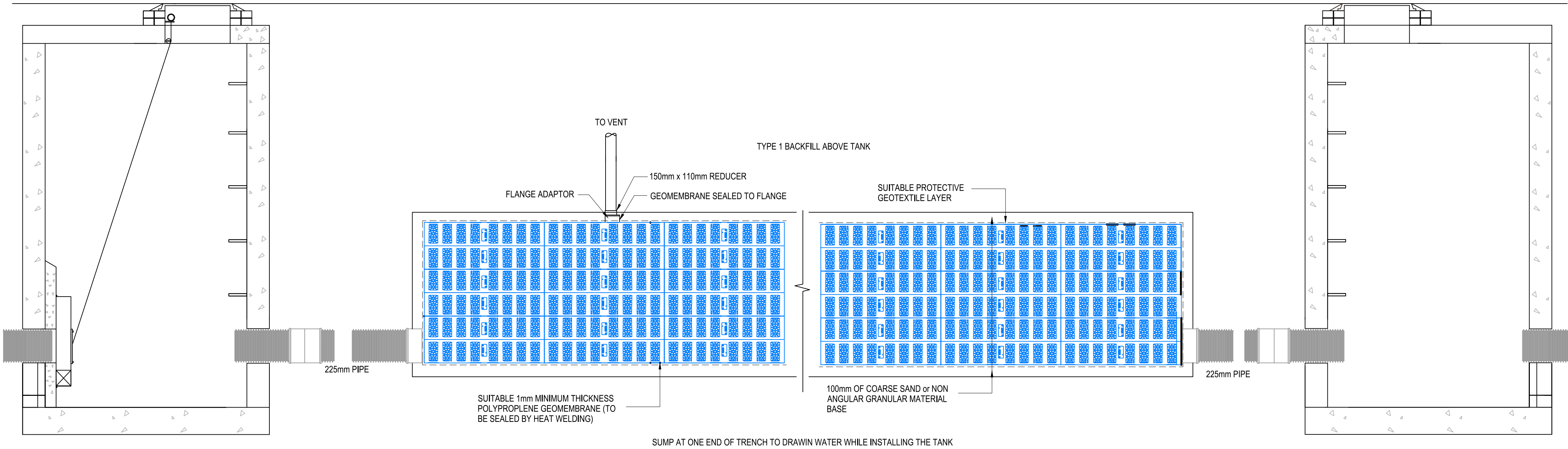
TYPICAL MANIFOLD CONFIGURATION

CONNECTION FOR STORAGE APPLICATION USING FLANGE ADAPTOR AT POINTS OTHER THAN PRE-FORMED SOCKET, (FOR AQUACELL ONLY).
INSTALLATION PROCEDURE:
1. FIX FLANGE ADAPTOR TO THE AQUACELL UNIT WITH SELF TAPPING SCREWS.
2. DRILL OR CUT THROUGH THE GEOMEMBRANE AND AQUACELL UNIT USING EITHER A CROWN DRILL BIT CUTTER OR SIMILAR.
3. INSERT PIPEWORK INTO FLANGE ADAPTOR.

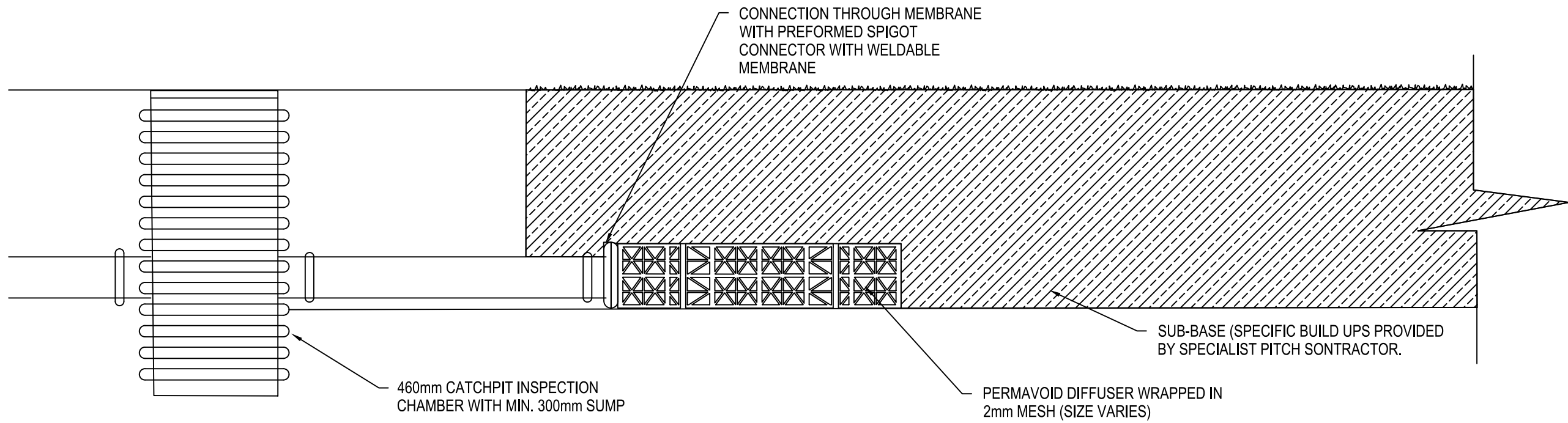
Notice: These details are provided subject to the following:

The details shown illustrate a drainage system using Wavin's products. These details are indicative only and should not be used any other purpose other than to illustrate the typical arrangement of the geocellular attenuation tank. In particular, they should not be used as a plan for construction without further consultation with Wavin and the provision of a site specific design.

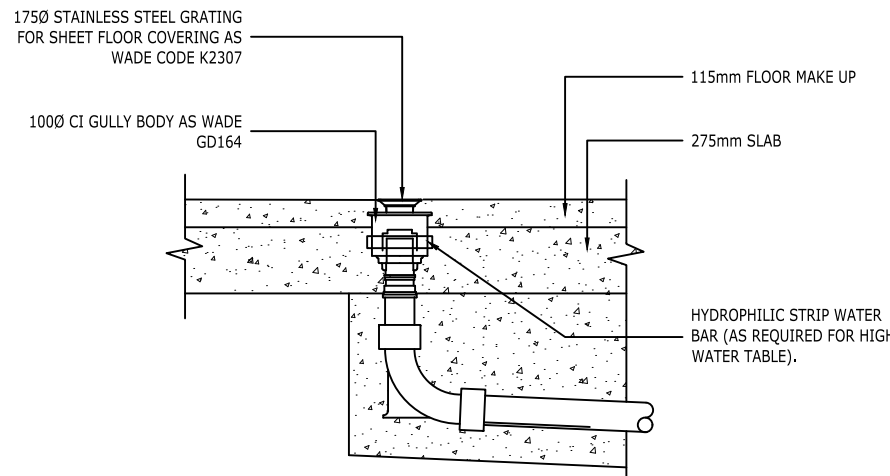
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WAVIN GEO CELLULAR ATTENUATION SYSTEM



RAINWATER DIFFUSER UNIT BELOW FOOTBALL PITCH



TYPICAL FINISHED FLOOR, TOILET & CHANGING AREA FLOOR GULLY

NOTE : IF ALTERNATIVE PRODUCTS / MANUFACTURERS ARE TO BE USED BY THE CONTRACTOR, THESE MUST BE TO AN EQUIVALENT STANDARD AND ARE TO BE INSTALLED WITH ANY REQUIRED ADAPTERS / COMPONENTS NECESSARY TO BE COMPATIBLE WITH BELOW GROUND DRAINAGE AND TO BE INSTALLED FULLY IN ACCORDANCE WITH THE MANUFACTURERS GUIDANCE AND RECOMMENDATIONS.

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- NO BRANCH SHALL ENTER AT LESS THAN 90 DEGREES FROM THE OUTGOING SEWER

C01 CONSTRUCTION ISSUE EW LJ 06/03/20
(P02) STAGE 4/CP ISSUE EW DN 09/12/19
(P01) DRAFT CP ISSUE ARJ DN 24/10/19

FIRST ISSUE

REVISION DESCRIPTION DRAWN CHECKED DATE

REV PLAN

CLIENT

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CHORLTON HIGH SCHOOL SOUTH

DRAWING TITLE
TYPICAL DRAINAGE DETAILS
SHEET 3

SCALE
@ A1
VARIES
DATE
OCT '19
PROJECT NUMBER
P2008475
DRAWING NO.
FS0765-BDP-XX-XX-DR-C-60003
REVISION
C01

SURFACE WATER

Manhole Number	Cover Level	Connections	Pipe	Manhole Size	Types	
	Depth To Invert		Inverts		Manhole	Cover
S2	29.430		28.780	600	3	600x600 C250 RECESSED
	0.650					
S3	29.800		28.570	600	3	600x600 C250 RA
	1.230					
S4	29.400		28.750	600	3	600x600 C250 RECESSED
	0.650					
S5	29.450		28.320	1350	2	1200x675 C250
	1.130					
S7	29.800		28.700	1200	2	750x750 C250
	1.100					

SURFACE WATER

Manhole Number	Cover Level	Connections	Pipe	Manhole Size	Types	
	Depth To Invert		Inverts		Manhole	Cover
S18	29.630		28.230	1350	2	1200x675 D400
	1.400					
S19	29.730		27.950	1500	2	1200x675 D400
	1.780					
S21	29.700		27.600	1500	2	600x600 C250
	2.100					
S22	29.520		28.320	600	3	600x600 C250
	1.200					
S25	29.500		28.300	600	3	600x600 C250
	1.200					

SURFACE WATER

Manhole Number	Cover Level	Connections	Pipe	Manhole Size	Types	
	Depth To Invert		Inverts		Manhole	Cover
S10	29.900		28.190	1200	2	750x750 C250
	1.710					
S11	29.860		28.140	1350	2	1200x675 C250
	1.720					
S13	29.600		28.170	1200	2	750x750 C250
	1.430					
S15	29.800		27.730	1500	2	600x600 C250
	2.070					
S16	29.700		27.640	1350	2	600x600 C250
	2.060					
S17	29.850		28.700	1200	2	750x750 C250
	1.150					

SURFACE WATER

Manhole Number	Cover Level	Connections	Pipe	Manhole Size	Types	
	Depth To Invert		Inverts		Manhole	Cover
S26	30.350		29.150	600	3	600x600 C250
	1.200					
S27	30.000		28.800	600	3	600x600 C250
	1.200					
S28	30.200		27.200	1800	FLOW CONTROL	600x600 (OR AS REQ. BY SPECIALIST) D400
	3.000					
S29	30.250		27.170	1200	D'STREAM DEFENDER	600x600 (OR AS REQ. BY SPECIALIST) D400
	3.080					
S30	30.700		27.010	1200	1	600x600 D400
	3.690					
S32	29.700		27.450	1800	2	600x600 D400
	2.250					

REDUCED ACCESS (RA)
TO BE FITTED TO PPIC
MANHOLES WITH A
DEPTH TO INVERT OF
GREATER THAN 1.2m

MANHOLE NUMBERS
NOT LISTED HAVE BEEN
OMITTED

PIPES TO HAVE LEVEL
SOFFIT CONNECTIONS
UNLESS NOTED
OTHERWISE

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1. MANHOLE COVER LEVELS TO BE ADJUSTED TO TIE IN WITH NEW SITE LEVELS.

C01 CONSTRUCTION ISSUELJDN09/03/20

P01 DRAFT CP ISSUEARJDN24/10/19

FIRST ISSUE

REVISION / DESCRIPTIONDRAWNCHECKEDDATE

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PROJECT TITLE

CHORLTON HIGH SCHOOL SOUTH

DRAWING TITLE

MANHOLE SCHEDULE
SHEET 1

SCALE

@ A1
NTS

DATE

OCT '19

PROJECT NUMBER

P2008524

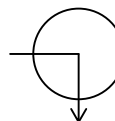
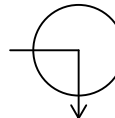
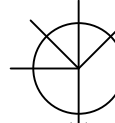
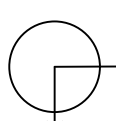
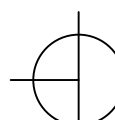
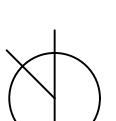
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FS0765-BDP-XX-XX-DR-C-60005

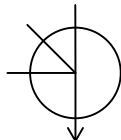
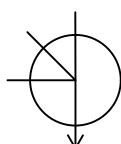
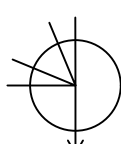
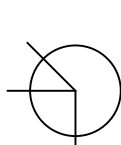
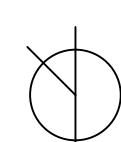
REVISION

C01

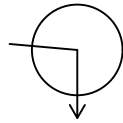
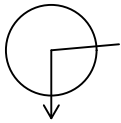
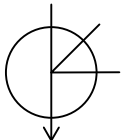
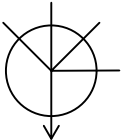
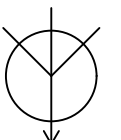
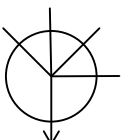
FOUL WATER

Manhole Number	Cover Level	Connections	Pipe	Manhole Size	Types	
			Inverts		Manhole	Cover
F2			28.320	450	3	600x600 C250
	29.800					
F3			28.120	1050	2	750x750 C250
	29.550					
F4			29.000	450	3	600x600 C250
	29.800					
F5			27.850	1200	2	600x600 C250
	29.860					
F7			27.650	450	3	600x600 C250 RA
	29.800					
F8			27.490	450	3	600x600 C250 RA
	29.850					

FOUL WATER

Manhole Number	Cover Level	Connections	Pipe	Manhole Size	Types	
			Inverts		Manhole	Cover
F10	29.850		27.420	450	3	600x600 C250 RA
	2.430					
F11	29.800		27.260	1200	2	600x600 C250
	2.540					
F12	29.800		27.200	1200	2	600x600 C250
	2.600					
F13	29.650		27.130	1200	2	600x600 C250
	2.520					
F14	29.700		28.900	450	3	600x600 C250
	0.800					
F15	29.700		28.950	450	3	600x600 C250
	0.750					

FOUL WATER

Manhole Number	Cover Level	Connections	Pipe	Manhole Size	Types	
			Inverts		Manhole	Cover
F16	29.830		28.470	1050	2	750x750 C250
	1.360					
F17	29.500		28.210	1200	2	750x750 C250
	1.290					
F19	29.650		28.110	450	3	600x600 C250 RA
	1.540					
F20	29.750		28.950	450	3	450Ø B125
	0.800					
F21	29.750		28.950	450	3	450Ø B125
	0.800					
F22	29.800		29.000	450	3	600x600 C250 RECESSED
	0.800					

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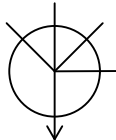
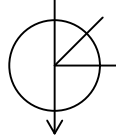
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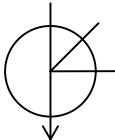
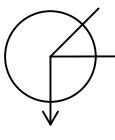
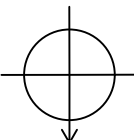
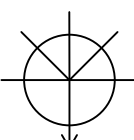
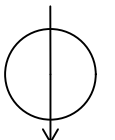
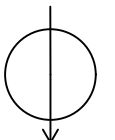
NOTES

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FOUL WATER

Manhole Number	Cover Level	Connections	Pipe	Manhole Size	Types	
			Inverts		Manhole	Cover
F23	29.750		28.950	450	3	600x600 C250 RECESSED
	0.800					
F25	29.750		27.700	1200	2	600x600 C250
	2.050					

FOUL WATER

Manhole Number	Cover Level	Connections	Pipe	Manhole Size	Types	
	Depth To Invert		Inverts		Manhole	Cover
F27	29.750		27.630	1200	2	600x600 C250
	2.120					
F28	29.750		27.270	1200	2	600x600 D400
	2.480					
F29	29.700		26.960	1200	2	600x600 D400
	2.740					
F30	29.850		29.050	450	3	600x600 C250
	0.800					
F31	29.550		28.750	450	3	600x600 C250
	0.800					
F33	29.900		29.100	450	3	600x600 C250
	0.800					

REDUCED ACCESS (RA)
TO BE FITTED TO PPIC
MANHOLES WITH A
DEPTH TO INVERT OF
GREATER THAN 1.2m

MANHOLE NUMBERS
NOT LISTED HAVE BEEN
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PIPES TO HAVE LEVEL
SOFFIT CONNECTIONS
UNLESS NOTED
OTHERWISE

01 CONSTRUCTION ISSUE	LJ	DN	09/03/20
P01) DRAFT CP ISSUE	ARJ	DN	24/10/19

FIRST ISSUE

VISION / DESCRIPTION	DRAWN	CHECKED	DATE
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P.O. Box 85, Piccadilly Basin
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BDP.

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MANHOLE SCHEDULE SHEET 2

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Appendix E

Manufacturer Specific Information

ECO BLOC

DE Anleitung für den Betrieb und die Wartung des GRAF EcoBloc Inspect 420, 230 und flex

>> Seite 1-7

EN instructions for maintenance of GRAF EcoBloc Inspect flex, Ecobloc Inspect 230 & EcoBloc Inspect 420

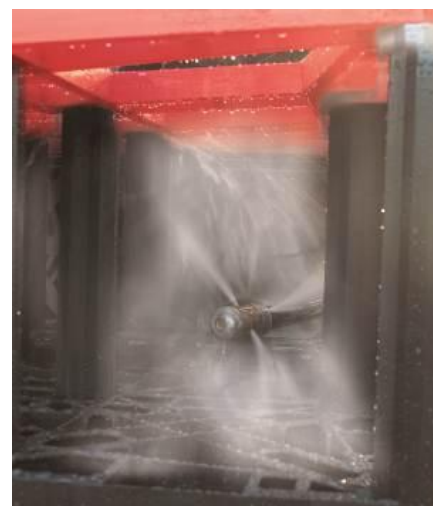
>> Page 8-14

FR Notice d'exploitation et d'entretien des EcoBloc Inspect GRAF

>> Page 15-21

ES Manual para el uso y el mantenimiento de GRAF EcoBloc Inspect 420, 230 y flex

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Instructions for maintenance of GRAF EcoBloc Inspect flex, Ecobloc Inspect 230 & EcoBloc Inspect 420

GRAF EcoBloc Inspect



The points described in these instructions must be observed under all circumstances. All warranty rights are invalidated in the event of non-observance. Separate installation instructions are enclosed in the transportation packaging for all additional articles purchased from GRAF.

The Graf EcoBloc Inspect must be checked for any damage prior to installation under all circumstances.

Missing instructions can be downloaded on www.graf.info or can be requested from GRAF.

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1. General information

1.1 General

Infiltration/attenuation systems are usually subject to official approval processes. This should be investigated in the planning phase and approval sought if required. The statutory specifications and the requirements in the relevant literature, such as German and European standards and work sheets / data sheets of the DWA, always apply.

Only authorised and qualified personnel should install and inspect the infiltration/attenuation system. The following safety and installation instructions should also be noted.

The infiltration/attenuation system is usually sized in accordance with national standards. You can request free sizing from Graf. The permeability of the surrounding soil is of great significance and may result in problems with and damage to the Graf infiltration & attenuation system if calculated incorrectly.

Please ensure correct storage. This means away from negative influences such as fuel, lubricants, chemicals and acids.

1.2 Safety

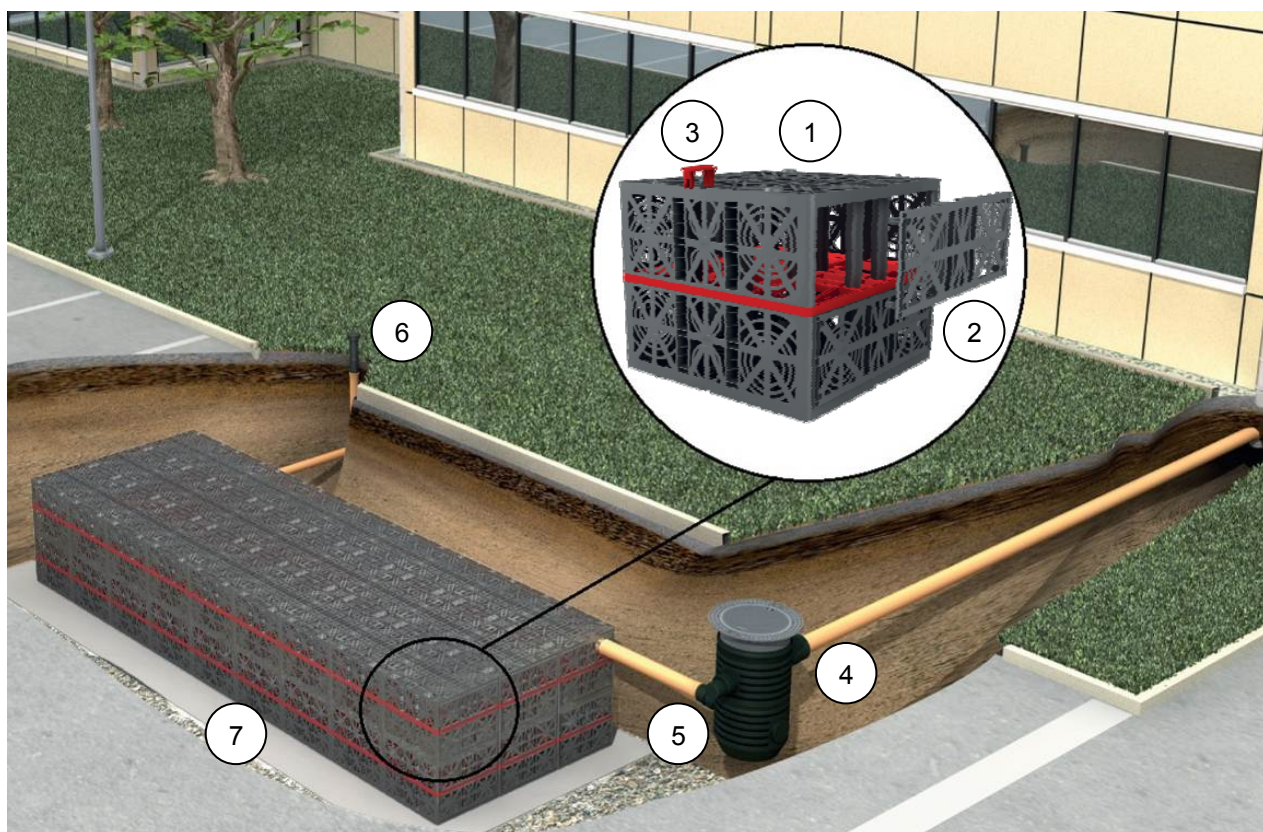
All work should be undertaken in compliance with the relevant accident prevention regulations according to BGV C22. There is an increased risk of slipping on Graf Ecobloc Inspect flex, 230 or 420 in frosty and wet conditions.

GRAF provides an extensive range of accessories, which are all coordinated and can be combined to form complete systems. Using other manufacturers accessories or components may result in the system's reduced performance or failure and liability for damage or costs will not be accepted.

2. General product information

The GRAF infiltration/attenuation range includes the following products:

Produkttyp		Beschreibung	Art.Nr.
Infiltration ditch elements			
	1	GRAF EcoBloc Inspect 420	402000
	2	GRAF EcoBloc Inspect end plates	402002
	3	GRAF EcoBloc connecting elements, e.g. 10-piece set	402015
		GRAF EcoBloc Inspect flex	402005
		GRAF EcoBloc Inspect baseplate	402006
Shafts			
	4	GRAF VS inlet module DN 400	330339
		GRAF VS connecting piece DN 400	330341
	5	GRAF VS distributor module DN 400	330340
		GRAF VS inlet module DN 600	330360
		GRAF VS connecting piece DN 600	371003
		GRAF VS distributor module DN 600	330361
Accessories			
	6	DN 100 venting end	369017
		DN 200 Inspection end	340527
	7	GRAF-tex geo textile, roll width 5metre	231002



3. General legal information

European and German guidelines for infiltration/attenuation system operators

The person operating an infiltration/attenuation system, usually the owner, is bound by obligations which are laid down in European and German guidelines. Any discharge, by infiltration/attenuation system through layers of soil, of dangerous substances into the water cycle, especially the groundwater, is prohibited by the European Directives 76/464/EEC and 80/68/EEC. Operators of infiltration/attenuation systems are also bound to the German Federal Water Act (WHG) and in terms of the soil layers, the Federal Soil Protection Act and Federal Soil Protection Ordinance.

Together with local guidelines, the operator is subject to the following obligations:

- Dangerous substances such as bleach, chemical stone, cleaning fluids etc. must not enter the water cycle
- If there is a risk of dangerous substances entering the water cycle, appropriate countermeasures (treatment with filter or swale) should be taken
- Should ensure that the infiltration/attenuation system is operated correctly at all times.

An information brochure detailing the methods required (oil separators, filters, silt traps, swale etc.) for pre-treatment is usually available from the local authority or water board responsible. This will also contain information about infiltration/attenuation not requiring a licence and the licence issued under water law for infiltration/attenuation which may have to be obtained.

4. Technical data

Volumen (gross/net)	420 Liter/405 Liter (111/107 US-gal.)	205 Liter/195 Liter (54.2/51.5 US-gal.)
Dimensions (LxWxH)	800 x 800 x 660 mm (31.44" x 31.44" x 25.98")	800 x 800 x 320 mm (31.44" x 31.44" x 12.6")
Connections	8x DN 200/DN 150/DN 100 + 8 x DN 100 (8x 8'6'4' + 8 4')	4 x DN 200/DN 150/DN 100 + 4 x DN 100 (4x 8'6'4' + 4x 4')
Weight	17 kg (37.5 lbs)	8 kg (17.6 lbs)

Material 100 % polypropylene (PP), recycled material

Load capacity

Short term max. 100 kN/m² (14.5 psi)
Long term max. 59 kN/m² (8.55 psi)

5. Treating Surface & rainwater

5.1 Treating surface & rainwater

To ensure perfect operation of the infiltration/attenuation system, filters of sufficient sizes should usually be fitted. These filters are required to be installed upstream of the infiltration/attenuation system.

In special cases, multi-stage filter systems with coarse and fine filters are used to treat the rainwater. The exposure and size of the collection surfaces can be used to determine whether a multi-stage system is needed and the size of filter required. We would be happy to help you select an appropriate filter/filter shaft. GRAF provides an extensive range of such products.

Work sheet DWA A-138 and data sheet DWA M-153 also contain sizing examples and information about filter stages upstream of infiltration/attenuation systems.

5.2 Filter units

The DWA data sheet M-153 provides various recommendations for working with rainwater. An overview is provided in Table 1.

Table 1

Groundwater intake	Retention soil filters	Sedimentation systems	Filters
Swales	Sand filters	Silt traps	Coarse filters
Surface infiltration	Ponds	Purification basins for rainwater	Fine filters
			Substrate filters

In areas with high concentrations of pollutants, several filter systems can also be combined to form one overall filter. This firstly filters out coarse particles and then retains dissolved substances.

The layers of soil which the rainwater penetrates during the infiltration process before it reaches the groundwater also have a filtering effect. A distance of one metre between the bed of the infiltration system and average groundwater level should therefore be maintained during the planning phase and/or when setting up the system in accordance with DWA A-138.

6. Maintaining the infiltration/attenuation system

6.1 Collection surfaces

Maintenance begins at the start of the rain cycle. A very dirty collection surface may produce an increased amount of dirt for the system which then requires a lot of effort to filter out later on. To extend the service life of the filters, we would therefore recommend maintaining the collection surfaces to remove large pieces of dirt (leaves, grit etc.).

6.2 Filter unit

All kinds of filter units, see chapter 5, require maintenance to ensure the infiltration/attenuation system operates perfectly. Perfect operation is essential for avoiding damage to the infiltration/attenuation system and maintaining performance.

The pollutant levels depend on seasonal factors. During these periods, we would therefore recommend checking the filter units for overflows or full sludge and dirt buckets. Increased dirt levels will arise in the event of

- snow melt
- build-up of grit
- high pollen levels
- heavy rainfall during storms
- autumn leaf drop

The details provided by the manufacturer on maintaining and servicing the filter units used should also be followed.

6.3 Inspection & performance of system

Regularly checking the infiltration/attenuation system will ensure high performance and guarantee the rapid distribution of surface & rainwater in the event of heavy rainfall of a high intensity.



Jet washing the system



Inspection with camera

7. Maintaining the infiltration/attenuation system

As described above, dirt may reduce the performance of the infiltration/attenuation system. Drops in performance can be checked using e.g. tests with a defined volume.

The volume and duration for a test can be estimated and compared using the sizing documents according to DWA A-138.

If the infiltration performance deviates by $\geq 25\%$, we would recommend using inspection equipment to check the system. Coarse particles or dirty geo textile impairing the infiltration performance can be removed with appropriate high-pressure purging probes. The general condition, for example, correct installation or changes to the system over time, can also be checked with Inspection equipment.

Local drain Inspection companies can inspect and rinse the systems.

8. Other applications

This documentation only relates to use of the GRAF EcoBloc infiltration/attenuation systems for retaining, storing or infiltrating surface & rainwater. Any other use of the infiltration/attenuation system must be agreed with Otto GRAF GmbH from a technical, material and/or structural viewpoint.

Should special requirements apply, we would also recommend contacting architects or planners with knowledge of hydrology and geology.



Hydro Water Management Solutions Maintenance Requirements

Regular inspection and maintenance is required to ensure the effective long term operation of below ground modular storage systems. The following table details the recommended maintenance requirements for modular systems.

Maintenance schedule	Required action	Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required take remedial action.	Monthly for 3 months then annually
	Debris removal from catchment surface (where may cause risk to performance)	Monthly or as required
	Remove sediment from pre-treatment structures and/or manifold connections	Monthly or as required
Remedial actions	Repair/rehabilitation of inlets/outlets, overflows and vents	Annual inspection or as required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build up and remove if necessary	Annually and after large storms

The maintenance plan and schedule should be developed during the design phase. Specific maintenance requirements should be identified based on upstream drainage sedimentation controls and the schedule developed to suit these needs.

Maintenance details should be detailed in the project Health & safety file and a risk assessment should be undertaken and recorded.

Note,

It is generally recommended that the cells be flushed through with large volumes of water under low pressure.

Certain modular units will allow higher pressure jetting to remove larger objects or heavier deposits of sediment. These modules can be accessed via integral access chambers (where applicable) and surveyed/flushed in a linear fashion or alternately water can be flushed/jetted through via the inlet/outlet pipe connections.

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TECHNICAL INFORMATION

OPERATIONS & MAINTENANCE RECYFIX® SYSTEMS



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GENERAL INFORMATION

All drainage installations should be kept free from debris to ensure their satisfactory operation.

HAURATON recommends that the channel drainage system is inspected and maintained at least one time in a calendar year and that this activity is included within a planned maintenance schedule.

The frequency of inspection and maintenance is dependent on local site conditions, the local environment and also the preference of the client.

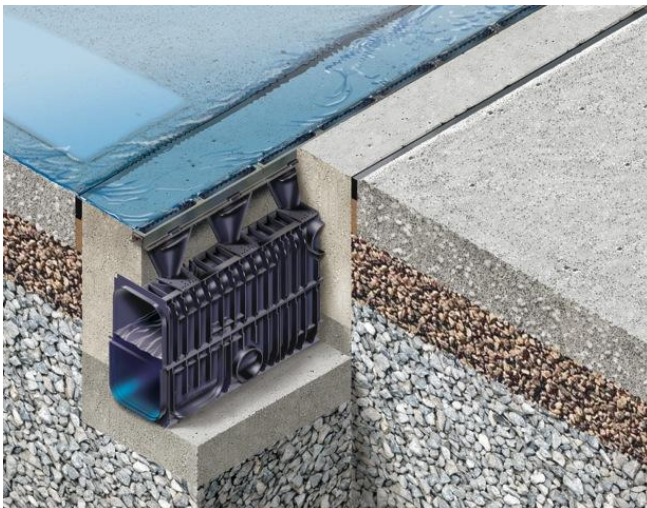
If the area where the channel drainage system is installed is subject to a higher level of surface dirt and debris; or if there are special circumstances (example: cold climate environment, wind bourn dust and sand etc), then it might be practical to carry out inspection and maintenance more frequently.

Modular channel drainage systems will not require any additional maintenance in comparison to the usual planned maintenance activities undertaken for other methods of surface drainage, such as point drain systems (with individual gulley outlets).

In many ways, maintenance of linear drainage systems will be quicker and easier, as there is total access into the system along the full length of the channel run. Total access is not possible with point drainage systems, as these may have complex underground pipe networks.

Inspection and maintenance is required in order to check the system is working efficiently and also to ensure a safe environment for users.

The design of channel runs and the location of access points and outlet boxes (especially relating to slot drain systems) should be undertaken with consideration of the maintenance activities and equipment used by the client.



INSPECTION

RECYFIX® channel drainage systems should be inspected at regular intervals to ensure that the system is performing effectively and is free from damage and blockage.

System gratings should be visually inspected on the top surface along the full length of the channel run to check for impact damage and also clogging of openings.

Visual inspection should also be carried out within the body of the channel system.

For grated channel systems visual inspection can be achieved by looking through gratings (with wider openings) or by removal of selected gratings along the channel run, when grating designs may have smaller openings; which could make simple inspection from the top surface a more difficult task.

For slot drain and monolithic systems, visual inspection within the system can be achieved by entry through access and outlet points. This will require removal of gratings/ covers that are bolted to the access or outlet box. If top surface gratings have narrow slots; and if slot drain runs are long, the team undertaking inspection and maintenance may choose to use an Inspection Mirror, Industrial Endoscope, Borescopes and/or other Inspection Camera/ Probe.

The surrounding surfaces and structures should also be regularly inspected.

If the channel concrete surround (encasement) is installed to the top edge of the channel unit, the surface of the concrete should be checked for 'spalling' (concrete surface breaking up).

All areas where a flexible sealant has been applied (if any) should be checked to ensure that the integrity of the seal is maintained (example: sealant applied at system joints, over expansion joints, along the channel unit top edge etc).

If sealant applied to joints has been compromised, the sealant should be removed and reapplied. The maintenance team should reapply the same sealant specification as previously applied during installation of the channel system (sealant as specified by the project consultant).

OXIDATION – DUCTILE IRON GRATINGS & COVERS

RECYFIX® surface drainage systems can be fitted with a variety of gratings and covers in high grade spheroidal ductile iron (EN GJS 500-7; according to EN 1563).

On some projects and in some markets it is quite common for cast ductile iron gratings or access covers to have oxidation occur on the surface of the grating/ cover very soon after installation. The grating/ cover may adopt a brown 'rusty' appearance.

This sometimes occurs during the period between installation of the channel system and handover of the site to the client.

The oxidation process is common with all cast ductile iron products. As soon as gratings/ covers are trafficked, the 'rust' layer will be rubbed from the surface of the grating/ cover, which will then adopt a polished appearance.

The oxidation (discolouration) process can be accelerated when cast ductile iron products are transported (shipped) inside containers to long-distance markets, especially when subject to temperature differentials, high humidity and formation of condensation within the container. If goods are shrink-wrapped, this can also accelerate the oxidation process.

The oxidation (rust) layer has no detrimental effect regarding the strength and performance of ductile iron gratings/ covers; in fact it adds a protective layer (passivation layer) to the grating/ cover.

The black paint applied to gratings/ covers is purely cosmetic and applied for transit, and will quickly wear off soon after installation, when the site has been commissioned and the system is being trafficked.

The client may draw attention to localised oxidation during the period immediately following installation and before the contractor has commissioned and handed over the site for use by the client.

At this point it may be necessary for the contractor to simply re-paint the top surface of the grating/ cover prior to client handover. This can be done with a black bituminous paint (or water-based paint where local regulations require this).

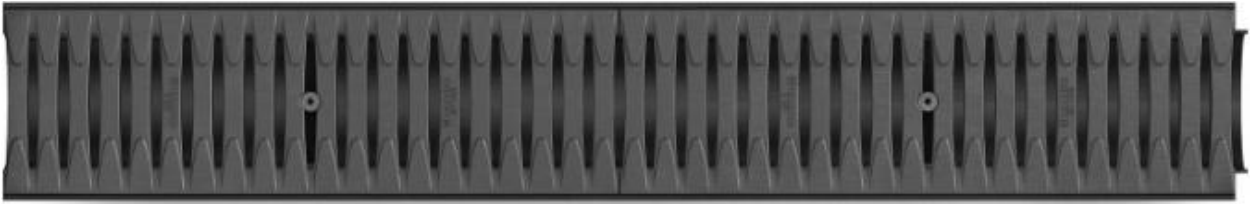
Re-painting the top surface of the grating could be included in an annual maintenance schedule if considered a necessity by the client.

In regions where climates and local environments are more extreme, the oxidation process of cast ductile iron grates/ covers is well known and accepted by construction industry professionals.

RECYFIX® surface drainage systems are available with a wide range of ductile iron gratings. Some of these can be supplied with a KTL 'cathodic dip' coating on request, which will help avoid surface oxidation for a certain period of time.

Other grating designs (FIBRETEC® and GUGI® Mesh) are also available in high-grade composite Glass-Fibre Polyamide (PA-GF) composite. The high-quality aesthetic appearance of these gratings will be unaffected by extreme or corrosive environments.

Gratings in high-quality stainless steel are also available. These provide a high-level of corrosion resistance. However, certain environments (eg shoreline location with hot, humid climates) may require higher grades of stainless steel material to be used (eg 316, 316L).



FIBRETEC® Composite Grating, 9mm Wide Slots

MAINTENANCE

System Entry

Gratings and covers should be lifted to gain access into the channel drainage system.

To remove and replace gratings/ covers, the following tools can be used:

Gratings and covers fixed with hexagon head screw

Channel systems 100mm wide – Off-set ring spanner metric size 13

Channel systems 150mm wide and wider – Off-set ring spanner metric size 16

Gratings and covers fixed with hexagon socket screw

Channel systems 100mm wide – Hexagon key size 5mm

Channel systems 150mm wide and wider – Hexagon key size 6mm

Lifting Heavy Items

The maintenance team may need to use special lifting equipment to break the gas and air-tight seal of heavy-duty engineered access covers, should these have been used with the system. Please refer to guidelines provided by third-party manufacturers.

The lifting of heavy items should be in compliance with local 'Health & Safety' regulations. For example, in some countries manual handling equipment should be used to lift single items that are heavier than 25kg.

Channel Drainage Systems

The frequency, methods and equipment used for the cleaning and maintenance of channel drainage systems are generally determined by the client.

HAURATON recommends that channel units can be most easily cleaned by using a high-pressure washer (power washer/ high pressure mechanical sprayer/ high-pressure jet washer) with a water jet pressure between 90 - 120 bar.

The nozzle and line of the high-pressure cleaning system can be installed within the channel drainage system through gratings that have been removed at intervals along the channel run.
*Note: There is no need to remove all gratings for cleaning and maintenance purposes.

For slot channel systems, the high-pressure cleaner can be fed into the slot channel run via access and outlet points.

Cleaning water at high-pressure should be directed through the full length of the channel run, ensuring that any sediment or debris within the system is loosened and washed down to the nearest access or outlet point. Sediment and debris can be washed into the sump area of access and outlet boxes, from where it can be removed safely and easily (by cleaning machines or by hand).

Finer particles and debris within the channel run are likely to be flushed towards an access or outlet point during periods of heavy rainfall.

Access & Outlet Points

Care should be taken to prevent gratings, covers and components falling into chamber openings.

RECYFIX® modular access and outlet boxes can be supplied with removable sediment buckets, which make removal of finer particles, sediments and debris a simple task. Sediment buckets should be removed and cleaned thoroughly with a high-pressure washer. Access units and trash boxes (gully boxes) should be cleaned thoroughly whilst the sediment bucket is removed.

Sediment buckets should be replaced after being cleaned.

Gratings, covers and angle-frame seatings should be carefully cleaned during routine annual maintenance periods and whenever gratings/covers are removed. All dirt and debris should be removed from contact points to enable gratings/covers to sit properly within their respective frames. This will ensure that the gratings/covers are non-rocking, to safely transmit imposed loads and to avoid trip hazards.

Heavy-duty engineered access covers may require graphite grease to be re-applied between angle-frame seating's and the cover, in order to achieve a gas and air-tight seal. The maintenance team should refer to third-party manufacturer's guidelines regarding removal, operation and maintenance of engineered access covers and gratings.

Gratings and covers should be locked into position to prevent these being removed, stolen or dislodged when trafficked.

Bolting Torque

When re-fitting gratings and covers, the maximum bolting torque should not be exceeded:

RECYFIX®PRO, PLUS and STANDARD channel systems - Bolting torque should be no greater than 5Nm

RECYFIX®NC - Bolting torque should be no greater than 15Nm

Gratings & Covers

General Comments

Normal safety practices, such as the erection of safety barriers and warning signs, should be followed when grating and cover components are removed from their frames.

There are a variety of grating designs available with RECYFIX® channel drainage systems. These include slotted, perforated, mesh, longitudinal and decorative designs.

System gratings can be supplied in a variety of materials that provide a high degree of corrosion resistance to extreme environments:

- Composite materials (Glass-Fibre Polyamide; PA-GF)
- Spheroidal ductile iron grade EN GJS 500-7 (EN 1563)
- Stainless steel (various grades)
- High quality galvanised steel

All grating types can be supplied in a variety of opening sizes, from very narrow 'HeelSafe' openings to wider openings. As a result, if there is concern that a smaller opening within a grating may become clogged, there are alternative gratings to choose with wider openings.

Gratings with smaller openings can be beneficial when used in areas where there may be surface debris. Smaller openings will help reduce the ingress of surface debris within the body of the channel system. This will help keep the channel system (and the underground pipe network) clear of debris, so reducing maintenance costs.

Gratings with large openings may allow larger items of debris to enter the surface drainage system. Point drainage systems typically have much wider grating openings and this often causes a maintenance issue through the blockage of individual gullies.

Cleaning & Maintenance – Gratings

Surface debris that may be resting on top of the gratings can be easily brushed clear.

Grating inlets and the slotted openings/ throat section of slot channel systems should be cleaned thoroughly with a high-pressure washer to ensure uninterrupted flow of surface water through openings and slots.

Smaller openings may be prone to clogging by solid matter (eg cigarette butts, paper, small stones, asphalt etc), so care should be taken to ensure these items are removed; so that gratings/ slots perform effectively.

If debris is fixed within smaller openings (narrow slots), this can be removed easily by jet-washing the gratings with a high-pressure cleaner during periods of planned maintenance.

Small stones can be simply and quickly removed by using a screw driver or other pointed implement.

Reasonable care should be taken not to damage the top surface of gratings and covers with heavy impact or sharp instruments. Grating/ cover components should be handled carefully to prevent damage to gratings, covers and frame edges.

Gratings and covers should be locked into position to prevent these being removed, stolen or dislodged by traffic.

Any worn or broken components should be replaced.



Locking Mechanisms

Different grating and cover designs will have different locking mechanisms. All locking mechanisms (bolts and locking bars) are designed to withstand and operate within extreme environments.

Locking bolts/ bars can be provided in high quality galvanised steel, stainless steel (various grades) and composite materials.

As the standard locking mechanisms are designed to be durable and corrosion resistant, they can be removed and replaced easily when access for maintenance is required.

Mechanical fixings/ locking bolts and threaded inserts within the angle-frame housing should be cleaned thoroughly and then grease re-applied before bolts are replaced, to achieve a smooth operation when re-fitting, and also to maintain the fixing/bolt/ thread to ensure ease of removal at some point in the future.

Mechanical fixings/ locking bolts should be replaced and tightened sufficiently, ensuring that fixings and bolt heads do not stand above the top surface of the grating or cover.

If gratings/covers are allowed to move within their angle-frame housing, this may cause damage to the angle-frame housing or seating face.

Tools

To remove and replace gratings/ covers, the following tools can be used:

Gratings and covers fixed with hexagon head screw

Channel systems 100mm wide – Off-set ring spanner metric size 13

Channel systems 150mm wide and wider – Off-set ring spanner metric size 16

Gratings and covers fixed with hexagon socket screw

Channel systems 100mm wide – Hexagon key size 5mm

Channel systems 150mm wide and wider – Hexagon key size 6mm

Bolting Torque

When re-fitting gratings and covers, the maximum bolting torque should not be exceeded:

RECYFIX®PRO, PLUS and STANDARD channel systems - Bolting torque should be no greater than 5Nm

RECYFIX®NC - Bolting torque should be no greater than 15Nm

SEASONAL CONSIDERATIONS – DRY CLIMATES

In regions of the world subjected to dry climates (Eg. Middle East), during some months of the year there may be limited rainfall.

During periods of limited rainfall the RECYFIX® channel drainage system may not be fully charged with storm-water (which helps to keep the system clean).

In such environments it may be recommended to inspect channel systems more regularly throughout the year in order to assess the levels of sediment accumulation.

Channel drainage systems may require flushing through with clean water more regularly in such environments.

This procedure will be required for all types of surface drainage system when used in environments with dry climates.

RECYFIX® channel drainage systems can be fitted with gratings with narrow openings, which will help to reduce the level of sand and sediment ingress within the body of channel system.

SEASONAL CONSIDERATIONS – COLD CLIMATES

RECYFIX® channel system standard components and accessories have been designed to withstand the most adverse weather conditions, and do this on a daily basis within extreme environments.

Preventative Maintenance: De-Icing

In cold climate regions facilities may experience temperatures well below freezing point.

In regions with colder climates, the use of road salts and de-icing solutions may be required; sometimes for 3-4 months of the year or longer.

In hard surface areas where pedestrians or vehicles pass more frequently (safety critical locations), de-icing salts and solutions should be used more widely in order to ensure safe passage. These are areas where linear surface drainage systems are typically installed. The use of de-icing salts and solutions in these locations will help to keep channel drainage systems clear of snow and ice.

De-icing solutions can also be applied within the system if required. The pipe connection from the outlet box (chamber) to main sewer should ideally be short and should have a slope of at least 1% to help avoid ice formation within the pipe.

RECYFIX® PP composite material is resistant to a wide range of salts and de-icing solutions, including:

De-Icing Solutions:

Isopropanol (Isopropyl Alcohol /IPA) – Used in the de-icing solutions

Glycol (Ethylene Glycol) – Used in anti-freeze chemicals

Glycerol (Glycerine) – Used in anti-freeze chemicals

Other Salts:

Sodium Chloride (Saturated) – Used in de-icing of roadways

Various Saturated Chlorides

Calcium Chloride – Used to prevent ice formation on roads

Sodium Acetate – Used in chemicals for sealing concrete against water ingress.

Sulfuric (Sulphuric) Acid (Concentration of 60% at 20°C) – Used in the production of anti-freeze Sea Water

Brine

Salts and ground sulphates may also be present within the environment in coastal locations.

Maintenance teams should be guided by the manufacturers of de-icing salts/solutions regarding their use.

RECYFIX® PP composite is unaffected by road salts and de-icing fluids (eg glycols).

RECYFIX® PP composite is non-polar and does not absorb water, so de-icing salts and solutions will not be absorbed within the material.

During winter months, any de-icing salts that may have accumulated within the body of the channel drainage system will help to prevent the formation of snow and ice within the system.

During spring and summer months, de-icing salts and sediments will generally be flushed from the channel drainage system by melt-water, seasonal rainfall and maintenance (cleaning).

Salts will not remain within the channel system in concentrated form (only diluted form).

RECYFIX® channel drainage systems are available in sizes up to 300mm wide clear opening (some systems larger; 400mm and 680mm). Using a larger channel drainage system in locations where there may be greater use of de-icing salts and sand will help ensure that the system has adequate capacity and continues to provide efficient surface drainage, even if subject to sediment debris within the base of the channel units. This can be cleaned from the channel drainage system during periods of planned maintenance.

Any sand or de-icing salts that may have accumulated within the channel run can be cleaned by flushing the system clear with water. Sediments can be directed towards access and outlet points and removed from these locations.

System gratings can be supplied in a variety of materials that provide a high degree of corrosion resistance to extreme environments where de-icing salts and solutions are commonly used:

- Composite materials (polyamide)
- Spheroidal ductile iron grade EN GJS 500-7 (EN 1563)
- Stainless steel (various grades)



RECYFIX®PRO with FIBRETEC® Grating – Composite system that is fully corrosion resistant

Locking bolts/ bars can be provided in high quality galvanised steel, stainless steel (various grades) and composite materials. As the standard locking systems are designed to be durable and corrosion resistant, they can be removed and replaced easily when access for maintenance is required.

Snow Ploughs

RECYFIX® channel drainage systems are available for load applications up to F900kN (USA: 202,320 lbs). Systems and gratings have been load tested in accordance with EN 1433: 2002 and have been designed to withstand heavy-duty wheel loads, static loads, dynamic and impact forces.

RECYFIX® channel drainage systems are typically installed with the top of the unit resting 3mm – 5mm below the finished surface level.



As a result, when in operation snow plough blades will not come into contact with the channel drainage system whatsoever. These will pass over the top of the system without causing damage.

In open pavement areas, snow ploughs will usually move snow over the top of linear drainage systems and well beyond channel drainage runs.

Practical Maintenance – Cold Climates

After periods of cold weather and/or heavy snow fall, visual inspection along the full length of the channel drainage system should be carried out frequently to ensure that grating openings and the channel system is not clogged with snow and ice.

Should snow accumulate within the body of a grated channel system, if required gratings can be removed easily in order to help clear snow from the system. There is clear access into the system along the full length of the channel run.

If localised clogging occurs, this can be cleared using appropriate tools and equipment.

Snow and ice may accumulate over and within all types of surface drainage system, no matter what the design.

If snow or ice forms within a linear drainage system, this will melt at some stage due to warmer temperatures or through the use of de-icing salts and solutions.

Metal gratings may speed up this melting process as they will warm up more quickly under direct sunlight.

As water is often held within snow and ice on the surface during periods when temperatures are below freezing, it could be argued that all methods of surface drainage could be considered as being redundant during these periods.

Specifiers may consider including heat cables within pavement designs for facilities located in regions that experience severe cold climate conditions. RECYFIX® channel drainage systems will perform effectively without the use of heat cables.

Cold Climates – Intake Capacity

RECYFIX® channel drainage systems are supplied with a variety of grating designs, which include the following:

Slotted
Mesh
Longitudinal
Perforated
HeelSafe
Decorative
Composite
Other

Gratings are available in a variety of mesh opening sizes and slot widths. HeelSafe gratings are also available with narrow slot and small diameter perforated openings. The grating design selected will determine the intake capacity and practical performance of the grating within a specific environment. The grating design should meet the needs of the project.

De-icing salts and solutions will help keep the channel drainage system and gratings clear of snow and ice.

The choice of whether to use a grating/ slot design with a large or narrow opening should be that of the project engineer, taking into consideration the location where the channel system will be installed and the requirements of the project.

RECYFIX® channel drainage systems used on de-icing platforms in airports should ideally be high capacity and should have a high intake capacity through the slot opening/ grating.

If gratings with narrow openings/ slots are fitted, less snow will be pushed into the body of the channel system due to the smaller surface area of the opening/slot. Grating openings can be periodically cleared of snow and ice with a stiff brush or screwdriver.

The total intake surface area of a linear drainage system is likely to be much greater compared with an individual gulley grate. This helps ensure that surface drainage is effective.

HEALTH & SAFETY – RISK ASSESSMENT INFORMATION

This information has been prepared to provide the client with risk assessment information for use during the construction phase of projects and for inclusion in 'Health & Safety' documents regarding maintenance and cleaning work.

This information relates to the following product range:

HAURATON RECYFIX® linear surface drainage system.

RECYFIX® Product & Material Datasheets

For specific information regarding the RECYFIX® channel drainage system installed, please refer to the 'Product' and 'Material' datasheet's available from HAURATON.

RECYFIX® System

RECYFIX® channel units incorporate the following components and materials:

Channel Body

Most RECYFIX® channel units are manufactured from recycled polypropylene (PP) composite material.

A small number of system components are manufactured from virgin polypropylene (PP) or polyamide (PA-GF), when specific performance characteristics are required.

The recycled polypropylene (PP) composite used is high quality recycled material from high-grade industrial plastics.

This material consists of the following:

The mixture of PP/PE is made up of approximately 95% plastics and the remaining material is that which is often found in recycled composites. The PE content is <10%

Ash <5% (DIN EN ISO 3451-1)

Carbon Black content >2% (DIN 19580/ EN 1433: 2002) for UV stability

MFR (230°C/2,16kg) = 12 g/10min (DIN EN ISO 1133)

Material density is 0.92 g/cm³ (DIN EN ISO 1183-1)

RECYFIX®MONOTEC 100/200 channel units are manufactured from high-quality Reinforced Polypropylene (PP) TV 30.

RECYFIX®MONOTEC 200 top grating section is formed from Reinforced Polypropylene (PP) GF 30.

System Edge Rails

Integral edge-frame in Polypropylene (PP) composite
Galvanised Steel DX 51D+Z275-MA-C
Austenitic Stainless Steel AISI Grade 304; EN CNS 1.4301

Gratings

Gratings are available in the following materials

Galvanised Steel DX 51D+Z275-MA-C
Austenitic Stainless Steel AISI Grade 304; EN CNS 1.4301
Spheroid Ductile Iron EN-GJS-500-7 (EN 1563)
Polyamide Glass Fibre Composite (PA-GF)

Grating Fixings

BZP Steel
Galvanised Steel
Stainless Steel
Composite

Modular Trash-Boxes (Outlet Boxes)

Body: Polypropylene (PP)
Frame: Galvanised Steel
Gratings: Variety
Sediment Bucket: Galvanised Steel
Fixings: BZP Steel or Stainless Steel

**Note: Modular access and outlet boxes may not be supplied on the project*

Materials

There are no direct hazards associated with the materials or substances used in the manufacture of the above products.

Installation

RECYFIX® channel units should be installed in accordance with the manufacturer's recommendations.

The system should be installed approximately 3mm-5mm below the surrounding pavement surface to avoid any trip or snagging hazards for passing pedestrians, site operatives, machinery, vehicles, forklifts and aircraft.

Component Handling (During Installation)

The assembled or component parts of RECYFIX® products/ systems may exceed the maximum weight for single-person-lift recommended under current 'Health & Safety' Legislation.

Channels, castings and steel products of various shapes, sizes and weights may be difficult to move by manual handling. It is strongly recommended to use suitable lifting equipment such as cranes and hoists, with tested and certified lifting strop, slings or chains.

Care should be exercised when lifting/moving assembled or component parts using:

- Recommended manual lifting practices, employing adequate number of site operatives
or
- Certified mechanical lifting devices, ensuring that adequate packing is employed to protect the product when using strops, slings, chains, etc.
- Where lifting strops or chains are used, under no circumstances should these be looped around a slot drain top grating or throat section. HAURATON would advise that any such lifting strops or chains are positioned around the complete unit at the central point along the length. Care should be taken to ensure the unit is retained in a level position and prevented from any possible sliding action.

Modular outlet boxes used with some RECYFIX® channel drainage systems have lifting points incorporated into the galvanised steel angle frame housing to facilitate easy lifting by suitable mechanical handling equipment.

Component Handling (After Installation)

Refer to previous sections. This is not applicable regarding RECYFIX®HICAP® Slot Channel systems as grating units are permanently fixed within the ground.

HEALTH & SAFETY – MATERIAL SPECIFICATION

This information has been prepared to provide the client with material specification information for inclusion in 'Health & Safety' documents regarding maintenance and cleaning work.

This information relates to the following product range:

HAURATON RECYFIX® linear surface drainage system.

RECYFIX® Product & Material Datasheets

For specific information regarding the RECYFIX® channel drainage system installed, please refer to the 'Product' and 'Material' datasheet's available from HAURATON.

Material Specifications

RECYFIX® channel drainage units incorporate the following components and materials:

RECYFIX® Polypropylene (PP) Composite Material

Most RECYFIX® channel units are manufactured from recycled polypropylene (PP) composite material.

A small number of system components are manufactured from virgin polypropylene (PP) or polyamide (PA-GF), when specific performance characteristics are required.

The recycled polypropylene (PP) composite used is high quality recycled material from high-grade industrial plastics.

This material consists of the following:

The mixture of PP/PE is made up of approximately 95% plastics and the remaining material is that which is often found in recycled composites. The PE content is <10%

Ash <5% (DIN EN ISO 3451-1)

Carbon Black content >2% (DIN 19580/ EN 1433: 2002) for UV stability

MFR (230°C/2,16kg) = 12 g/10min (DIN EN ISO 1133)

Material density is 0.92 g/cm³ (DIN EN ISO 1183-1)

RECYFIX® Polyamide Glass-Fibre Material

Refer to Material Datasheet when relevant.

System Edge Rails

Integral edge-frame in Polypropylene (PP) composite

Galvanised Steel DX 51D+Z275-MA-C

Austenitic Stainless Steel AISI Grade 304; EN CNS 1.4301

Gratings

Gratings are available in the following materials

Galvanised Steel DX 51D+Z275-MA-C

Austenitic Stainless Steel AISI Grade 304; EN CNS 1.4301

Spheroid Ductile Iron EN-GJS-500-7 (EN 1563)

Polyamide Glass Fibre Composite (PA-GF)

Metal Products

Metal castings and steel contain added alloying elements, which can include carbon, manganese, silicon, aluminium, niobium, vanadium, chromium, nickel, titanium, boron and copper. Residual elements also occur in steel and could include sulphur, molybdenum, tin, phosphorus and cobalt.

Hazards

There is a risk of skin laceration from burrs and sharp edges when handling metal and composite products.

There is a risk that bundles may break open if improperly handled or if bundle-strapping has been damaged. Personal injury, including skin laceration and damage to eyes, may occur when breaking open the strapping, due to quick release of strap tension.

During fabrication, rolled structural steel sections may be flame cut, machined, and/or drilled. Since these contain residual stresses induced during rolling and cold straightening, precautions are necessary to prevent sudden release of such stresses, which can cause significant movement and/or fracture, particularly regarding beams and columns.

Noxious fumes may be produced when metal/ steel/ composite products are subjected to high temperatures during welding, flame cutting, disc cutting or heat treatment.

Fumes may also be produced when metals; applied with oil, paint, grease or wax, is subject to high temperatures as above.

Fumes may be produced when Galvanised or Zinc Coated Steel is subject to high temperatures as above.

Fumes may occur if products that have been oiled, painted, greased or waxed, to prevent oxidation, are chemically removed.

Fumes may contain iron oxide, zinc oxide and other residual elements. The principal method of entry into the body is by inhalation. Potential effects on health include metal fume fever and irritation within the eyes and upper respiratory tracts.

When cutting or abrading iron, steel or composite materials, hazardous dust can be given off. The principal method of entry to the body is by inhalation.

When cutting or drilling there may be a risk of laceration to the skin or eye injury due to metal swarf.

Noxious fumes may be produced when PP/ PA/ PA-GF products are subjected to high temperatures caused by direct flame.

Safety equipment such as Gloves, Goggles and Respirators/ Masks should be worn at all times when working materials.

RECYFIX® channel drainage systems are installed within the ground and generally in external locations, so for most projects there are no fire regulations required to be considered. In most

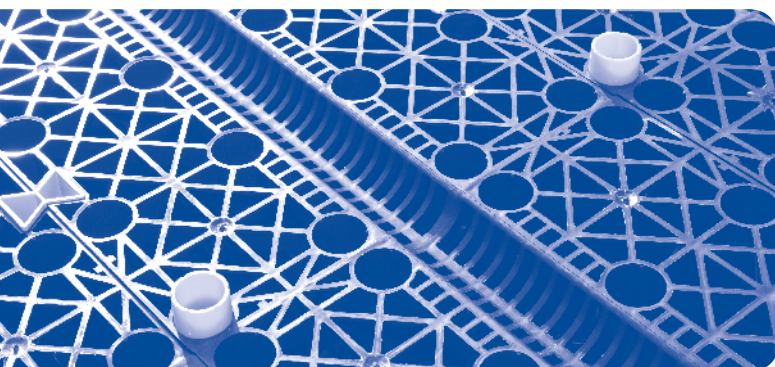
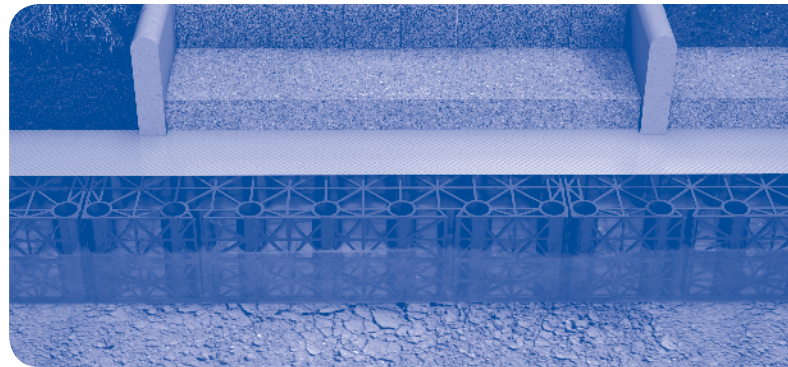
cases fire protection requirements are at a much lower level regarding construction of facilities in external locations.

PP (PA/ PA-GF) composite material does not conduct electricity nor has it the potential to create a spark if impacted; so there is less risk of fire ignition with composite materials. This risk may be greater with drainage systems fully manufactured from metals such as galvanised steel.

HAURATON RECYFIX® Polypropylene (PP) composite products have been designed and manufactured with 'Health & Safety' and safe handling in mind. RECYFIX® channel bodies have moulded features (edge frames, structural ribbing, concrete anchors, male-female joint profiles, other) with rounded edges to avoid injury or damage.

PRODUCT & MATERIAL DATASHEETS

Permavoid System Technical Manual



Planning, design, specification and installation guide

Delivery and storage

Permavoid

- Permavoid is delivered to site on pallets. Palletised load measurements are approx. 1.2m x 1.1m x 2.3m high and each pallet will contain 72 Permavoid units
- Pallet weight is circa 220kg
- Deliveries shall be unloaded using mechanical handling equipment

Permachannel

- Permachannel is delivered to site on pallets. Palletised load measurements are approx. 1.0m x 0.8m x 1.0m high and each pallet will contain 20 Permachannel units
- Pallet weight is circa 850kg
- Permachannel is delivered with gratings in position
- Deflection plates are supplied within the channel and need to be positioned during installation
- Deliveries shall be unloaded using mechanical handling equipment

Storage

- Position pallets on stable, level ground
- Stacking of pallets is not recommended
- Store away from direct sources of heat or ignition
- Transit banding should not be removed until installation

Geotextile and Geomembrane

- Deliveries shall be unloaded using mechanical handling equipment

Geosynthetic	Permafilter	Permatex 300	Wicking Geotextile	Geomembrane
Material	Polyester blend	Modified polyester	Polyester blend	Polypropylene
Roll size	2.4m x 100m	5.25m x 65m	2m x 25m	Variable
Weight	300g/m ²	300g/m ²	500g/m ²	900g/m ²
Delivery	Single rolls	Single rolls	Single rolls	Single rolls



Installation

Excavation and preparation

Excavation

- Ensure that the ground-bearing capacity at formation level is adequate for the design loads.
- The excavation is dug to the required plan, dimensions and level, ensuring that the excavation will allow installation of connecting pipework. Slopes must be cut to a safe angle or adequately supported and safe access must be provided to allow personnel to enter the excavation. Excavation should be carried out in accordance with BS 6031:2009, with particular attention paid to safety procedures.
- It is recommended that the excavation provides a minimum of 500mm clear zone on all sides of the plan dimensions of the tank to allow working space for the installation. If required, suitable protection and earthwork support must be provided beyond the clear zone to all excavated faces.

Base

To be trimmed smooth and free from sharp objects and projections to provide an even formation that shall be free from undulations. Any present must be excavated and replaced with compacted granular fill material.

Tolerance

The formation shall be graded to achieve a maximum deviation of 5mm in 3m in any direction to prevent formation of voids below installation which will cause Permavoid units to ‘rock’. A blinding layer may be used to achieve required tolerances.

Blinding

A 50mm thick blinding layer of 20/6 clean crushed stone or sand to BS EN13242:2002 shall be used to achieve a suitable bedding surface.

Laying

Ensure membrane is clean and free from debris before laying Permavoid. Check installation plan/details to confirm Permavoid orientation. Commence laying in corner of installation area and work forwards in a diagonal line to the opposite corner until layer is complete. Repeat for further layers.



Permatie

Adjacent Permavoid units are connected using Permatie interlocking pins, which have integral creep resistance. Permaties must be inserted into all available slots where units butt together up to a maximum of 5 Permaties per Permavoid unit. The Permatie provides rigidity and minimises deflections.

Shear Connectors

Multi-layered Permavoid tank configurations shall be fixed with proprietary Shear Connectors between each layer interface to maintain rigidity and minimise lateral displacement. A minimum of four Shear Connectors per square meter at layer interface is recommended.

Drainage connections

Proprietary drainage connections are available where a drainage connection is required to the Permavoid installation. There are several different options available subject to type of tank encapsulation and whether the connection is at invert or centrally located.



Installation

Attenuation applications

Where required, all penetrations through an impermeable encapsulation shall be sealed. Create an impermeable seal using a preformed spigot connector with a weldable membrane.

The adaptors comprise a rigid body and spigot with a flexible outer membrane manufactured from compatible material to the geomembrane encapsulating the tank. Adaptors are available as invert or standard type and come in a range of diameters. The adaptors are fully welded to the main tank encapsulation.

All joints should be sealed, using proprietary techniques recommended by the manufacturer. Advice on seam testing procedures is given in CIRIA Report SP124.

Protection

Permatex protection geotextile should be installed to the outside face of the base, top and sides of the installation as protection layer to geomembrane.

Installation

Adjacent sheets to be lap jointed with a minimum lap of 300mm or heat sealed. Corners to be formed in folded welts and heat sealed if required. Ensure geotextile is clean and free from debris. Trafficking over placed material to be avoided.



Geotextile for infiltration

Permafilter Geotextile should be used for infiltrations applications. The geotextile should be laid with minimum of 300mm overlap or to lap marker and to be applied to all external surfaces of Permavoid units.

Installation

Corners to be formed into folded welts and heat sealed if required. Ensure geotextile is clean and free from debris before installing Permavoid. Trafficking over laid material to be kept to a minimum.

It is recommended that site vehicle traffic is prevented from trafficking the Permavoid tanks until the installation is complete.

Backfilling

The Permavoid tanks shall be backfilled with an initial layer minimum 50mm thick of 20/6 clean crushed stone or sand to BS EN 13242:2002. The preferred method of aggregate placement is for the plant to be situated on top of a minimum of 300mm thick aggregate layer. Recommended plant to be used for placement of the aggregate to be a tracked machine with a maximum operating bearing pressure of 200kN/m². Wheeled machines to have low bearing pressure tyres (maximum permitted pressure 30psi), maximum tread/cleat projection 15mm. **Under no circumstances should plant operate in direct contact with Permavoid units.**

Permachannel excavation and bedding preparation

Base

To be trimmed smooth and free from sharp objects and projections. For optimum capacity the Permachannel should be installed with zero gradient but it can be installed to shallow gradients should the drainage design require. The Permachannel should be laid on a 200mm deep concrete bed with a minimum 150mm thick haunch to both sides. A 30N/mm² concrete mix is recommended.

Tolerance

Local subgrade below concrete bed tolerance of $\pm 5\text{mm}$ within any 3m direction. The commensurate level for the Permachannel installation should allow for the height of the Permachannel and the depth of the concrete bedding, plus a further 3-5mm below the finished level to protect the Permachannel and prevent ponding. Ensure the membrane encapsulation from the Permavoid tanks (if required) spans below the Permachannel installation with sufficient length to return up the rear of the Permachannel run.

Manual handling

It is recommended to remove the gratings and stainless steel diverter plate prior to installation to reduce the handling weight from 42kg to 29kg. Consult your employer for specific manual handling advice.

Installation of Permachannel

Check installation plan/details to confirm Permachannel orientation in relation to Permavoid tank(s). Align using a builder's line or suitable laser alignment equipment. When positioning the Permachannel, insertion of the stainless diverter plate will assist alignment. The diverter plate should be positioned so that it spans from the ends of adjacent Permachannel units to divert rainwater run-off into the central Permachannel unit. Install the Permachannel connection units along the length of the Permachannel run, 1 connection unit required per linear metre of Permachannel, installed where adjacent Permachannel units butt against each other to form a 40mm diameter outlet. Install the connection unit by firstly removing the fresh concrete bed (before hardening) in immediate area and inserting 'o' ring (supplied with connection unit) into the rebate of the 40mm diameter outlet from the Permachannel and then insert 40mm diameter spigot into the Permachannel aperture.



Ensure connection unit is seated in a vertical position if installing Permachannel ahead of the Permavoid tank, or is butted against the Permavoid tank if installing the Permachannel after the Permavoid tanks. Redundant Permachannel outlet, if not used must be blanked prior to placing concrete haunch. 40mm blanking plugs are available. Place the concrete haunch to the front and rear of the Permachannel. The channel elements must be kept clean during installation. Trafficking over laid material is to be kept to a minimum.

Surface finish options

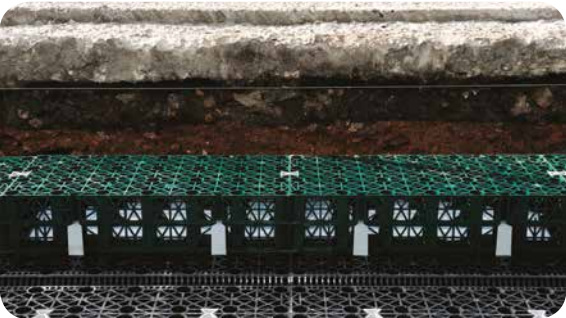
It is recommended the grating is installed within the Permachannel prior to construction of the pavement.

Concrete

Between the minimum 150mm concrete surround and the concrete slab, an expansion joint must be inserted, as structural engineer's specification.

Bituminous bound

To avoid damaging the channels during compaction of the surfacing, the concrete surround must be haunched as high as possible (45° back to the Permachannel). The bituminous bound surfacing can be installed against the side of the channel. The finished level following compacting has to be 3-5mm above the height of the grating.



Maintenance

Like any conventional drainage system, sustainable drainage systems (SuDS) should be inspected regularly and correctly maintained to ensure optimum performance.

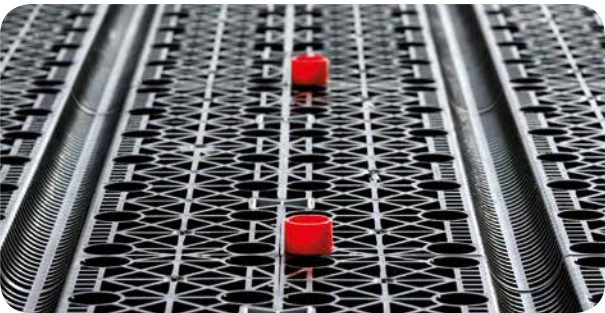
Maintenance plan

This should be initiated by the drafting of routine maintenance plans to suit the site installation. A pre-handover inspection should be carried out and the Permavoid system cleaned prior to final handover.

Routine inspection and maintenance should include:

- Inspection of systems
- Removal of silts
- Decanting of oils and hydrocarbons
- Channel jetting
- Water sampling and testing at point of discharge (if required)

Excess silt/debris held within Permachannel and gullies should be cleared manually or with a vacuum tank. We do not recommend pressure led cleaning.



Routine maintenance

Permachannel

For Permachannel the following routine maintenance procedures are required:

- 3 monthly inspections of channels for signs of blockage and oil spillage
- Remove litter and blockages as required
- Every 12 months inspect all chambers for silt and oil build up
- Every 12 months sweep external surfaces
- Remove silt as required but at least every year
- Records of inspections and maintenance undertaken should be kept by the client

Permaceptor

For Permaceptors the following routine maintenance procedures are required:

- 3 monthly inspections of road/yard gullies for signs of blockage and oil spillage
- Remove litter and blockages as required
- Every 6 months inspect all Permaceptors for silt and oil build up
- Every 12 months sweep external surfaces
- Records of inspections and maintenance undertaken should be kept by the client

Accidental spillages

If accidental spillages occur of oil or other substances that can cause water pollution, they must be dealt with immediately. An example of this is if a car sump fails and there is large spillage of oil on the car park or road surfaces. A spillage kit appropriate to the size of the car park should be kept by the site caretaker. This should include absorbent pads, socks and rain seals.

As soon as a spillage is identified, the drain inlets in that area should be covered to prevent pollution entering the system. The pollution should then be cleared from the road or car park surface. The local channel system and/or Permaceptor receiving the spillage should be emptied of all pollution that has entered.

The Permachannels and Permaceptors should prevent any significant pollution entering the rest of the drainage system. The Environment Agency should be informed of the spillage and the appropriate actions should be taken.

General design details

The Permavoid range of products can be used individually or linked together to provide unique and flexible water management solutions.

The following typical design details highlight a range of solutions available. These drawings are available on the Polypipe website at www.polypipe.com/toolbox. Individual projects may require tailored solutions that are not detailed. For more information please contact our Technical Team on +44 (0) 1509 615100.

Typical permeable pavements

Figure 8.1.1: Sub-base infiltration detail (drawing no. PV_SD_IN_PP_001)

(For illustration purposes, we have shown a permeable block paving system. For Permeable asphalt a 40mm surface course and 80mm binder course are recommended)

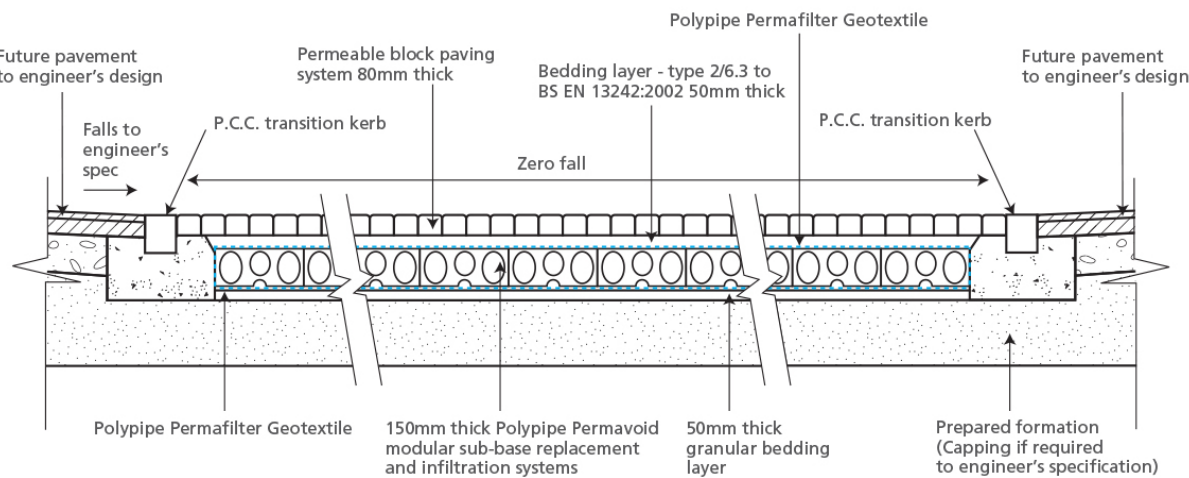
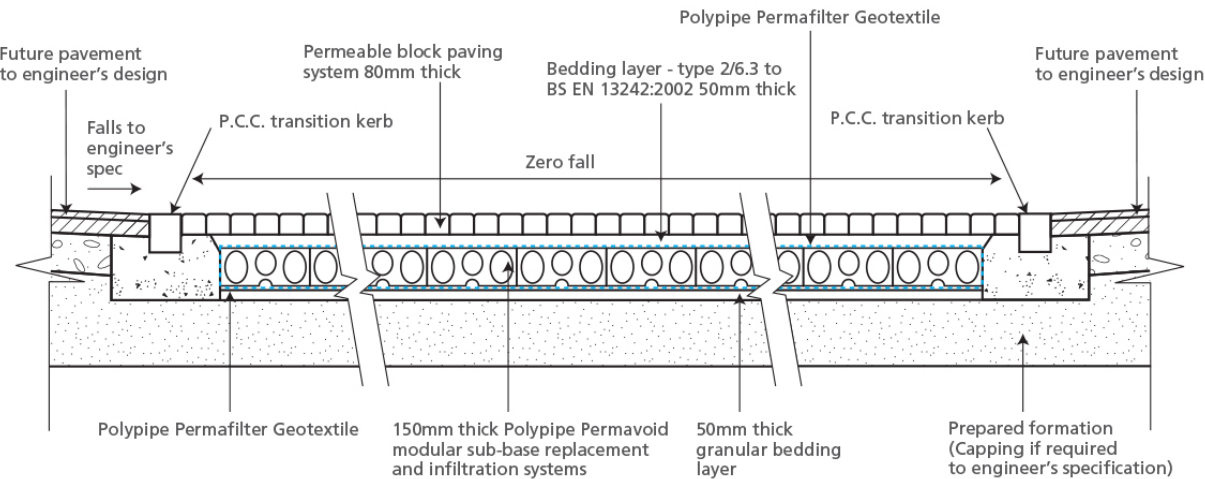
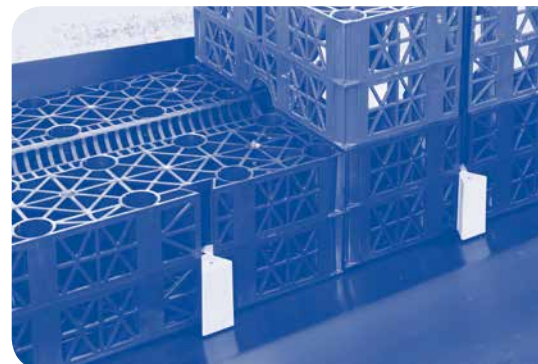


Figure 8.1.2: Permavoid permeable pavement sub-base attenuation detail (drawing no. PV_SD_AT_PP_001)

(For illustration purposes, we have shown a permeable block paving system. For Permeable asphalt a 40mm surface course and 80mm binder course are recommended)



Permavoid System Technical Manual



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Inspection and Maintenance. Easy. Convenient.

When it rains, oils, sediment and other contaminants are captured and contained by over 40,000 X-ceptor units operating worldwide. While X-Cepto's patented scour prevention technology ensures captured pollutants remain in the unit during all rainfall events, the accumulated pollutants must eventually be removed as part of a regular maintenance program.

If neglected, oil and sediment gradually build up and diminish any BMP's efficiency, harming the environment and leaving owners and operators vulnerable to fines, surcharges and bad publicity.

Maintenance is a must

Ease, frequency and cost of maintenance are often overlooked by specifiers when considering the merits of a stormwater treatment system. In reality, maintenance is fundamental to the long-term performance of any stormwater quality treatment device.

While regular maintenance is crucial, it shouldn't be complicated. An ongoing maintenance program with X-ceptor is convenient and practically effortless. With virtually no disruptions, you can concentrate on your core business.

Quick inspections

Inspections are easily carried out above ground from any standard surface access cover through a visual inspection of the orifice and drop tee components. A sludge judge and oil dip-stick are all that are needed for sediment and oil depth measurements.

Easy unit access

Maintenance is typically conducted from the same surface access cover, eliminating the need for confined space entry into the unit. Your site remains undisturbed, saving you time and money.



No muss, no fuss and fast

Maintenance is performed quickly and inexpensively with a standard vacuum truck. Servicing usually takes less than two hours, with no disruption to your site.

A complete stormwater management plan for X-ceptor extends beyond installation and performance to regular maintenance. It's the smart, cost-effective way to ensure your unit continues to remove more pollutants than any other separator for decades to come.



X-ceptor maintenance recommendations

- Units should be inspected post-construction, prior to being put into service.
- Inspect every six months for the first year of operation to determine the oil and sediment accumulation rate.
- In subsequent years, inspections can be based on first-year observations or local requirements.
- Cleaning is recommended once the sediment depth reaches 15% of storage capacity, (generally taking one year or longer). Local regulations for maintenance frequency may vary.
- Inspect the unit immediately after an oil, fuel or chemical spill.
- A licensed waste management company should remove captured petroleum waste products from any oil, chemical or fuel spills and dispose responsibly.

With over 40,000 units operating worldwide, X-ceptor performs and protects every day, in every storm.



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