

Technical Note

Project Name : The Grange Westergate
Job No. : C1967
Note Title : FW & SW Technical Note
Author : TZ
Approved : CS
Date : 16.03.2022

Revision	Date of Issue	Comments	Prepared By	Checked By
P	16.03.2022	Initial Issue	TZ	CS

1 Introduction

- 1.1.1 CGS Civils Ltd have been appointed by HP Developments to undertake a drainage strategy report for a proposed development at **The Grange, Westergate Street, Westergate**.
- 1.1.2 The purpose of this drainage strategy is to demonstrate how the development area can be satisfactorily drained without increasing flood risk onsite and elsewhere.
- 1.1.3 The existing site comprises two residential outbuildings on existing garden land to the eastern side of the residential property at The Grange, Westergate. The proposed development includes for the demolition of two outbuildings and subsequent erection of 2no. 1.5 storey detached chalet-style building, a detached 4-bay garage block and associated driveway, parking and landscape area.
- 1.1.4 The proposed development is located as OS Grid Reference **SU940043** and has the post code **PO20 3SQ**.
- 1.1.5 The total red line boundary is approximately **0.22 Ha** and the proposed development will result in a total of **0.083 Ha** of impermeable area, **0.0285 Ha** of which is roof areas and the other **0.0545 Ha** will be hard porous paved areas.
- 1.1.6 The proposed site will make use of an existing access driveway which leads off of the private lane from Westergate Street. The site is flanked to the north by undeveloped Greenfield, to the east and west by the existing residential scheme and to the south by access road and railway track.
- 1.1.7 The proposed site plan can be found in **Appendix A**.



Fig 1. Site Location

Snippet from MagicMaps – Outline of site <https://magic.defra.gov.uk/magicmap.aspx>

2 Site Geology

2.1 British Geological Survey information

2.1.1 The British Geological Survey confirms the bedrock geology to be made up London Clay Formation – Clay, Silt and Sand. The BGS website confirms the superficial deposits on site to be made up of River Terrace Deposits – Sand, Silt and Clay.

2.1.2 The British Geological survey also holds records of historical boreholes near the site which give some insight into the ground geology.

- Borehole SU90SW51 (Located approx. 700m North-East of the site) – Ground geology (Clay, clayey pebbly sand)
- Borehole SU90SW59 (Located approx. 900m South-West of the site) – Ground geology (Silty sandy clay, down fine silty Sand overlying blue silty Clay)
- Borehole SU90SW56 (Located approx. 800m South of the site) – Ground geology (sandy brown Clay, Clay with stones, bed of gravel overlying Blue clay with bands of hard stone)

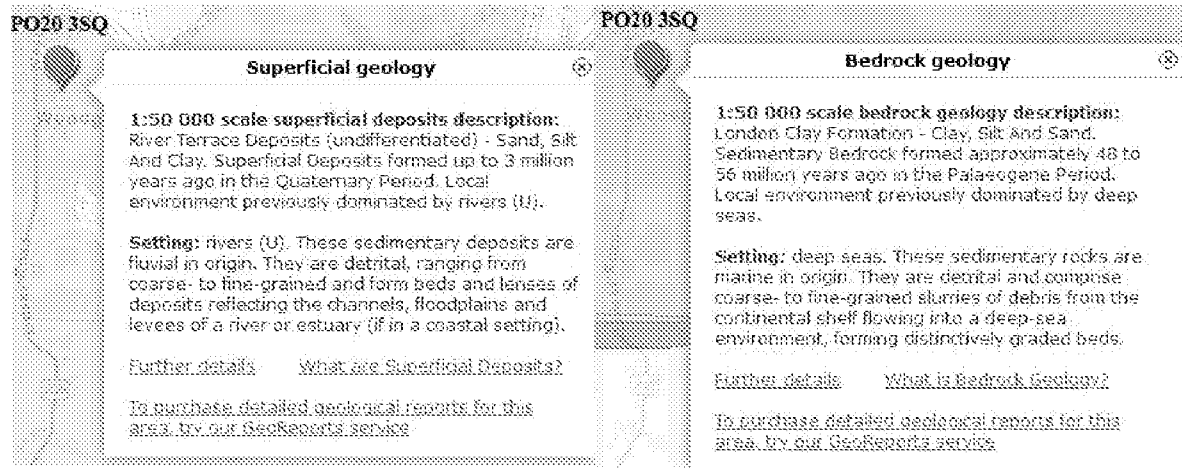


Fig 2. British Geological Survey

Snippet from BGS Website showing Bedrock geology/superficial deposits <http://mapapps.bgs.ac.uk/geologyofbritain/home.html?>



Fig 3. British Geological Survey (Historical Borehole Locations)

Snippet from BGS Website - <http://mapapps.bgs.ac.uk/geologyofbritain/home.html?>

2.1.3 The BGS Historical Borehole logs can be found in **Appendix B**.

2.2 Geological Assessment

- 2.2.1 Based on the available Planning Portal information, intrusive ground information and BRE365 test results it is confirmed that proposed development is underlain by Coarse Sand overlying sandy Silt/Clay.
- 2.2.2 The BRE365 Test results confirmed good infiltration within shallow (**0.6mBGL**) Made Ground Coarse Sand layer recorded as **1.05×10^{-5} m/s**.
- 2.2.3 The onsite intrusive Ground investigation report undertaken on site by Impact Geotechnical identified the groundwater at 1.9mBGL - 2.05mBGL.
- 2.2.4 Groundwater monitoring was undertaken during the 2020/2021 winter and identified groundwater at 0.8m – 2.25mbgl.
- 2.2.5 The Impact Geotechnical GI report and BRE365 Infiltration test results can be found in **Appendix C**.

2.3 Hydrogeology Setting

- 2.3.1 The Environment Agency (EA) mapping service, as provided by Magic Map, indicates the aquifer designation for the bedrock and superficial drift geology and the groundwater vulnerability in the area. The mapping, as included in **Appendix D**, provides the following information for the site:
- 2.3.2 The site will not pose a risk to the groundwater on site as there will be no discharge of any hazardous materials to ground.

Geology Map	Site Designation
Aquifer Designation (Bedrock)	Unproductive
Aquifer Designation (Superficial Drift)	Secondary A
Groundwater Vulnerability	Medium - Low
Groundwater Source Protection Zone	N/A

3 Existing Drainage

- 3.1.1 It is not currently known how existing site discharges surface water runoff, however it is presumed that surface water runoff is partially discharged into onsite combined foul sewer and partially into ground via infiltration.

4 Proposed Drainage Strategy

4.1 SuDS Hierarchy

- 4.1.1 All options for the destination of run-off generated on site have been assessed in line with the SuDS hierarchy as set out in Building Regulations Part H document and DEFRA's Draft National Standards for SuDS.

Discharge Destination	
Discharge to Ground	Available, a 1.05×10^{-5} m/s infiltration for permeable block paving calculations has been adopted.
Discharge to Watercourse	N/A
Discharge to Surface Water Sewer	N/A
Discharge to Other Sewer	N/A

4.2 Surface Water Drainage

- 4.2.1 Based upon the information gathered from the British Geological Survey website, intrusive ground investigation and BRE365 test infiltration it is proposed that surface water runoff from the whole development site is discharged into the ground via infiltration through a permeable subbase.
- 4.2.2 It is proposed that roof water is discharged into voided subbase via distribution tanks. The proposed voided subbase has been designed for a Critical 1 in 100 year +40% storm event.
- 4.2.3 It is proposed for permeable paving to be laid flat across the site so the full depth of voided subbase is utilised for attenuation and infiltration.
- 4.2.4 The proposed drainage plan and hydraulic calculations have been carried out which can be found at **Appendix E**.

4.3 Water Quality

- 4.3.1 A key requirement of any SuDS system is that it protects the receiving water body from the risk of pollution.
- 4.3.2 Frequent and short duration rainfall events are those that are most loaded with potential contaminants (silts, fines, heavy metals, and various organic and inorganic contaminants) Therefore the first 5-10mm of rainfall should be adequately treated with SuDS.
- 4.3.3 The new SuDS Manual (Ciria C753, November 2015) introduces slightly different approach compared to the previous version for the water quality management of surface water. The Manual describes risks posed by the surface water runoff to the receiving environment as a function of:
- The pollution hazard at a particular site (i.e., the pollution source)
 - The effectiveness of SuDS treatment components in reducing levels of pollutants to environmentally acceptable levels
 - The sensitivity of the receiving environment
- 4.3.4 The EA website indicates that the site does not lie within a Source Protection Zone.
- 4.3.5 The recommended approaches for water quality risk management are given in the SuDS Manual Table 26.1.

Fig 5. Approaches to Water Quality Risk Management

Table 26.1 Approaches to Water Quality Risk Management			
Design method	Hazard Characterisation	Risk Reduction	
		For Surface Water	For Groundwater
Simple Index Approach	Simple pollution hazard indices based on land use (Table 26.2)	Simple SuDS hazard mitigation indices (Table 26.3)	Simple SuDS hazard mitigation indices (Table 26.4)
Risk Screening	Factors characterising traffic density and extent of infiltration likely to occur (Table 26.5)	N/A	Factors characterising unsaturated soil depth and type, and predominant flow type through the soils (Table 26.5)
Detailed Risk Assessment	Site specific information used to define likely pollutants and their significance	More detailed, component specific performance information used to demonstrate that the proposed SuDS components reduce the hazard to acceptable levels	
Process-based treatment modelling	Time series rainfall used with generic pollution characteristics to determine statistical distributions of likely concentrations and loadings in the runoff	Models that represent the treatment processes in the proposed SuDS components give estimates of reductions in even mean discharge concentrations and total annual load reductions delivered by the system	

- 4.3.6 As per Table 26.1 Simple Index approach will be used as a design method for this site.

4.3.7 Table 26.2 will provide hazard classification of different land uses. The land uses for the surface water drainage for this site are.

- Residential Roofs
- Individual Property driveways and residential car parks

4.3.8 To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index for each contaminant type that equals or exceeds the pollution hazard index for each contaminant type. Therefore, the following must be achieved for the surface running off the site.

Total SuDS mitigation index $\geq$ pollution hazard index

4.3.9 Pollution Hazard Indices are given for different land uses in Table 26.2 of the SuDS manual;

Fig 6. Pollution Hazard Indices for Different Land Use Classifications

Land Use	Pollution Hazard Level	Total Suspended solids (TSS)	Metals	Hydro-Carbons
Residential roofs	Very Low	0.2	0.2	0.05
Other roofs (Typically commercial/industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (e.g., cul-de-sacs, homezones and general access roads) and non-residential car parking with infrequent change (e.g., schools, offices) i.e., < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g., hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g., haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways	High	0.8	0.8	0.9

4.3.10 From Table 26.2 the following information is tabulated in Table 1

Table 1: Pollution hazard index and destination of runoff for the proposed site

Land Use	Destination of Runoff	Pollution Hazard Level	Total Suspended Solids	Metals	Hydrocarbons
Residential Roof	Ground Water	Very Low	0.2	0.2	0.05
Individual driveways and residential car parks	Ground water	Low	0.5	0.4	0.4

4.3.11 The SuDS mitigation index will be obtained from Table 26.4 (for groundwater) of the SuDS manual.

Figure 7 Indicative SuDS Mitigation Indices for discharges to ground waters.

4.3.12 SuDS mitigation index are tabulated in Table 5 as followed.

Table 26.4 Indicative SuDS mitigation indices for discharges to groundwater			
Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates	TSS	Metals	Hydrocarbons
A layer of dense vegetation underlain by a soil with good containment attenuation potential of at least 300mm in depth	0.6	0.5	0.6
A soil with good contaminant attenuation potential of at least 300mm in depth	0.4	0.3	0.3
Infiltration trench (where a suitable depth of filtration material is included that provides treatment, i.e., graded gravel with sufficient smaller particles but not single size coarse aggregate such as 20mm gravel) underlain by a soil with good contaminant attenuation potential of at least 300mm in depth.	0.4	0.4	0.4
Constructed permeable pavement (where a suitable filtration later is included that provides treatment, and including a geotextile at the base separating the foundation from the subgrade) underlain by a soil with good contaminant attenuation potential of at least 300mm in depth	0.7	0.6	0.7
Bioretention underlain by a soil with good contaminant attenuation potential of at least 300mm in depth	0.8	0.8	0.8
Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area		

Table 26.4 Indicative SuDS mitigation indices for discharges to surface waters			
Type of SuDS Components	Mitigation Indices		
	TSS	Metals	Hydrocarbons
Filter Strip	0.4	0.4	0.5
Filter Drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention System	0.8	0.8	0.8
Permeable Pavement	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area		

Table 2: SuDS mitigation index

Mitigation Indices						
Runoff Source	Destination of Runoff	Mitigation Index Source	Type of SuDS Component	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential Roof Individual driveways and residential car parks	Ground water	Table 26.4 (for ground waters) Table 26.3 (for surface waters)	Permeable Pavement	0.7	0.6	0.7

4.3.13 The above analysis demonstrates that the SuDS devices within the design will mitigate any pollution present within the surface water system.

4.4 Foul water drainage

- 4.4.1 The foul water will discharge into the local foul water sewer located to the south of the proposed site.
- 4.4.2 The new connection is subject to Section 106 sewer application.

4.5 Construction Phase Drainage

- 4.5.1 It is an offence to cause or knowingly permit the entry of any polluting, poisonous or noxious material in the water environment. If the pollution is serious enough to lower the ecological status of the water body as set out in terms by the Water Framework Directive (2000/60/EC) then prosecution may occur.
- 4.5.2 Remediation of any damage caused will not require the polluter to be prosecuted first. If the water pollution is serious enough to be classed as environmental damage, the damage will require to be remediated such that the area is returned to the condition it would have been in if the damage had not occurred.
- 4.5.3 If any pollution has not been reported or the polluter has not taken actions to prevent any further damage; they would then be causing an offence. Third parties (e.g., Private water supply users, landowners, recreation users and the public) who may be affected by possible damage may also report the risk of any environmental damage to the enforcing authority.
- 4.5.4 The principles of SuDS (Sustainable Drainage Systems) shall be applied to all components of design and construction regarding surface water management. Any design or site works that may impact on the site drainage or the water quality shall:
- Soakaway where soils allow
 - Consider and manage erosion
 - Remove pollutants in surface water
 - Retain any silts on site and prevent silts from discharging to watercourses or drains
 - Keep runoff rates at existing greenfield runoff
 - Prevent accidental spillages reaching watercourse
- 4.5.5 As infiltration on site is viable, the temporary drainage for the development will be in the form of land drains which will discharge into the ground.
- 4.5.6 Pollution will be controlled via the use of catchpit manholes and geotextiles.
- 4.5.7 Any potential hazardous substances will be within a controlled compound with a separate drainage system that will contain a penstock valve / containment kit in the event of a spillage.

5 Maintenance

5.1 Introduction

- 5.1.1 During construction, the Contractor will be responsible for maintaining the drainage and SuDS (Sustainable Drainage Systems). Upon handover, the developer will appoint a maintenance firm that will take on the responsibility of these duties as laid out in this report.
- 5.1.2 The maintenance schedule for the proposed development will be split down into two separate categories; SuDS features and regular private drainage.

5.2 SuDS at The Grange, Westergate Street, Westergate

Richard Cobden House, Lion Street, Chichester, West Sussex, PO19 1LW

5.2.1 As listed above, in section 5.1.2, the SuDS features used on site will be **permeable block paving**.

5.2.2 The SuDS features have been designed for easy maintenance and comprise:

- Regular Day-to-Day care – litter collection, regular gardening to control vegetation growth and checking inlets where water enters the SuDS features
- Occasional tasks – checking the SuDS features and removing any silt that builds up in the SuDS feature
- Remedial work – repairing damage where necessary

5.3 SuDS Drainage Maintenance Specification

5.3.1 Permeable Paving

In order to maintain the functioning of the permeable paving, the following maintenance requirements should be adhered to:

Table 21.3 Operation and maintenance requirements for permeable paving		
Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required take remedial action	Three-monthly, 48h after large storms in first six months
	Inspect silt accumulation rate and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

6 Summary and Conclusions

- 6.1.1 CGS Civils has been instructed by HP Developments to produce a Drainage statement under National Planning Policy Framework (NPPF) to support the Planning Application for erection of 2 No 1.5 storey dwellings, detached garage block and associated access road, parking areas and soft landscaping.
- 6.1.2 The Surface Water will discharge to ground via infiltration.
- 6.1.3 The Foul water will discharge into existing public foul sewer via new gravity connection.
- 6.1.4 The report has demonstrated that the proposed drainage measures ensure that suitable means of surface water and foul drainage can be achieved for the proposed development.

7 Appendices

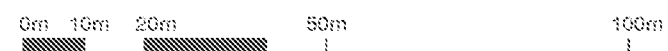
7.1 Appendix A – Site Plan

Richard Cobden House, Lion Street, Chichester, West Sussex, PO19 1LW

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LOCATION PLAN
SCALE 1:1250 @ a3

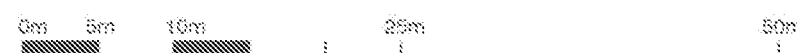




FOR EXISTING TREES -
SEE TREE CONSTRAINTS
PLAN BY UZARD REF.
LLD2168-ARB-DWG-001-00

A. BINS AND BIKES WITHIN
GARAGES - MIN. 5x8m INTERNALLY
B. TURNING FOR FIRE APPLIANCE
C. BIN COLLECTION POINT

ROOF/SITE PLAN
SCALE 1:500 @ a3



7.2 **Appendix B – BGS Historical Borehole Logs**

SU 90 SW 51

9454 8470

Eastergate

Block G

Surface level +9.3 m
Water struck at +7.8 m
September 1981

Overburden 1.8 m
Mineral 1.4 m
Bedrock 2.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Brickearth	Clay, silty, mottled brown, with sand and pebbles near base	1.0	1.5
Raised Beach Deposits (younger)	'Clayey' pebbly sand Gravel: coarse and fine; flint (some white and porous) with some chalk, sandstone and ironstone Sand: fine with some medium and coarse Fines: silt	1.4	2.9
London Clay	Clay, brown at top, grey below	2.1+	5.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				-#	+# -#	+# -#	+1 -4	+4 -16	+16 -64	+64 mm
11	75	14	1.5-2.5	13	69	2	2	7	7	0
			2.5-2.9	8	65	7	5	7	8	0
			Mean	11	68	4	3	7	7	0

DETAILS OF STRATA

317/453

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA (and any additional remarks)	THICKNESS	DEPTH
		METRES	METRES
	Topsoil	0.50	0.50
	Sandy brown clay	0.50	1.00
DRIFT	C lay with stones	1.00	2.00
	Bed of gravel	1.00	3.00
	Sandy blue clay	9.00	12.00
LONDON CLAY	Blue clay with bands of hard stone	67.00	79.00
	Bed of blue coloured clay	5.00	84.00
	Very hard black stone with pyrites	0.50	84.50
	Blue clay with bands of stone	17.50	102.00
	Sandy/green/brown clay	2.00	105.00
REDONDS BEDS	Red mottled clay	9.00	114.00
	Dark blue mottled clay	2.00	116.00
	Red mottled clay	2.00	118.00
	Red clay with bands of blue/green shale	2.00	120.00
	Red/blue mottled clay	14.00	134.00
	Red clay mottled green and yellow	2.00	136.00
Upper chalk	Chalk and flints	20.00	156.00
GRIST 9/78			(512 ft)



SURFCE OF 945-045

Sn B 3/4.

Date 14/5/75.

BORE HOLE LOG

Log Ref. 0442

HOLE NO. 1

Land at Woodham Farm

SURFCE

Eastgate Eastgate.

COMMERCIAL

Ordinance Plot No.

IN CONFIDENCE

Water Struck at 2-0 metres. Rest Water Level metres after hours

CONFIDENTIAL TO ERST Log

Description of Material	From	To	Depth of Seam metres	Total Depth metres
	metres	metres		
Top Soil	0-0	0-3	0-3	
Brown Silty Sandy Clay	0-3	1-5	1-2	
Brown Fine Silty Sand.	1-5	4-7	3-2	
Blue Silty Clay	4-7	6-0	1-3	6-0

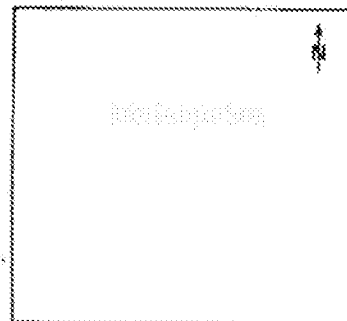
REMARKS

Sketch Plan

Samples taken at

(1) 3-5 metres (2) metres (3) metres (4) metres

(5) metres (6) metres (7) metres (8) metres



7.3 **Appendix C – Impact Geotechnical and BRE365 Infiltration test report extract.**



Percussion Drilling Log

Project Name: The Grange		Client: Smith Simmons & Partners		Date: 13/11/2020	
Location: Westergate, West Sussex		Contractor: Impact Geotechnical Ltd			
Project No. : P20.213		Crew Name: RM/SG		Drilling Equipment: Archway Dart WLS Rig	
Borehole Number WS1	Hole Type WLS	Level	Logged By SG	Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20			0.20			(MADE GROUND) Grass over brown/ dark brown gravelly sandy Silt/Clay. Gravel is fine to coarse, angular to sub-rounded flint and brick. Sand is fine to coarse. (TOPSOIL)	
		0.40			0.40			(MADE GROUND) Brown very gravelly medium to coarse Sand. Gravel is fine to coarse, angular to sub-rounded flint brick and concrete. Occasional cobbles of brick.	
		0.80			0.80			Soft dark grey sandy SILT/CLAY. Sand is fine to medium. Slight organic odour. (ORGANIC DEPOSIT)	
		1.00	SPT	N=6 (0,1/1,1,2,2)	1.00			Soft brown mottled orangish brown slightly gravelly sandy silty CLAY. Sand is fine to medium. Gravel is fine to coarse, sub-angular to sub-rounded flint. (RIVER TERRACE DEPOSITS)	1
		1.70			1.70			Medium dense becoming loose brown/ orangish brown silty fine to medium SAND. (RIVER TERRACE DEPOSITS)	2
		2.00	SPT	N=23 (2,4/5,6,6,6)	2.00				
		3.00	SPT	N=3 (1,0/1,0,1,1)	3.00				3
		4.00			4.00				4
								End of Borehole at 4.000m	5

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks Hand excavated pit to 1.00mbgl. SPT's completed at 1.00m centres. Groundwater at 2.05mbgl. Pipe installed at 4.00mbgl (35mm diameter - 1.0m, plain, 3.0m slotted)										
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Percussion Drilling Log

Project Name: The Grange		Client: Smith Simmons & Partners		Date: 13/11/2020	
Location: Westergate, West Sussex		Contractor: Impact Geotechnical Ltd			
Project No. : P20.213		Crew Name: RM/SG		Drilling Equipment: Archway Dart WLS Rig	
Borehole Number WS2	Hole Type WLS	Level	Logged By SG	Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20			0.20			(MADE GROUND) Grass over brown/ dark brown gravelly sandy Silt/Clay. Gravel is fine to coarse, angular to sub-rounded flint and brick. Sand is fine to coarse. (TOPSOIL)	
		0.60			0.60			(MADE GROUND) Brown very gravelly medium to coarse Sand. Gravel is fine to coarse, angular to sub-rounded flint brick and concrete. Occasional cobbles of brick.	
		1.00	SPT	N=9 (1,2/2,2,3,2)	1.00			Soft brown mottled orangish brown slightly gravelly sandy silty CLAY. Sand is fine to medium. Gravel is fine to coarse, sub-angular to sub-rounded flint. (RIVER TERRACE DEPOSITS)	1
		1.70			1.70			...below 1.00mbgl becoming firm Medium dense becoming loose brown/ orangish brown silty fine to medium SAND. (RIVER TERRACE DEPOSITS)	2
		2.00	SPT	N=19 (1,2/3,5,5,6)	2.00				
		3.00	SPT	N=8 (1,2/2,1,2,3)	3.00				3
		4.00			4.00			End of Borehole at 4.000m	4
									5

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks Hand excavated pit to 1.00mbgl. SPT's completed at 1.00m centres. Groundwater at 2.25mbgl. Pipe installed at 3.90mbgl (35mm diameter - 1.0m, plain, 3m slotted)										
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Percussion Drilling Log

Project Name: The Grange		Client: Smith Simmons & Partners		Date: 13/11/2020	
Location: Westergate, West Sussex		Contractor: Impact Geotechnical Ltd			
Project No. : P20.213		Crew Name: RM/SG		Drilling Equipment: Archway Dart WLS Rig	
Borehole Number WS3	Hole Type WLS	Level	Logged By SG	Scale 1:25	Page Number Sheet 1 of 1

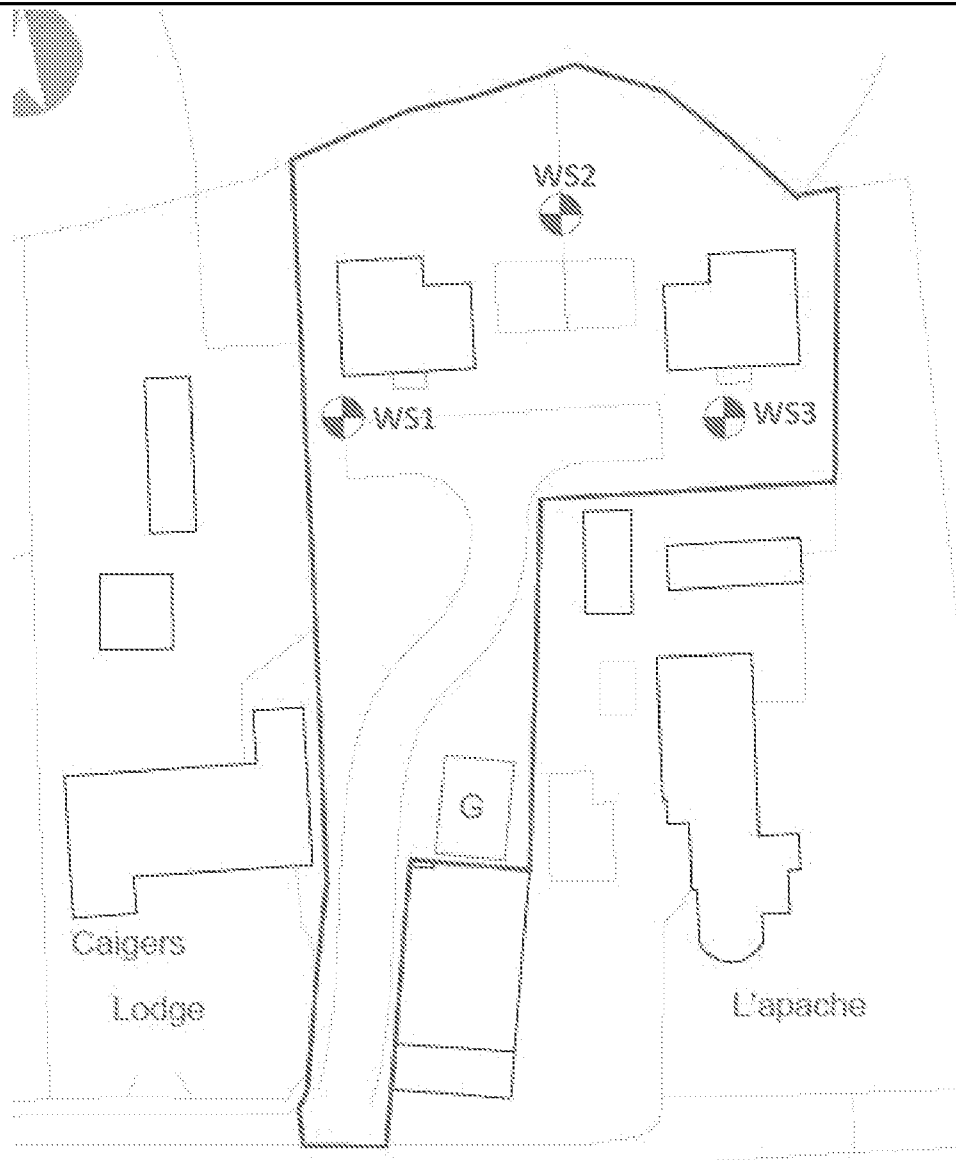
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.25			0.25			(MADE GROUND) Grass over brown/ dark brown gravelly sandy Silt/Clay. Gravel is fine to coarse, angular to sub-rounded flint and brick. Sand is fine to coarse. (TOPSOIL)	
		1.00	SPT	N=7 (1,0/1,2,2,2)				Soft brown mottled orangish brown slightly gravelly sandy silty CLAY. Sand is fine to medium. Gravel is fine to coarse, sub-angular to sub-rounded flint. (RIVER TERRACE DEPOSITS)	1
		2.00	SPT	N=13 (1,3/3,3,4,3)	1.60			Medium dense becoming loose brown/ orangish brown silty fine to medium SAND. (RIVER TERRACE DEPOSITS)	2
		3.00	SPT	N=2 (1,0/0,0,1,1)	4.00			End of Borehole at 4.000m	3
									4
									5

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Hand excavated pit to 1.00mbgl. SPT's completed at 1.00m centres. Groundwater at 1.90mbgl. Pipe installed at 3.90mbgl (35mm diameter - 1.0m, plain, 3m slotted)





Notes:

1. Do not scale from this drawing.
2. All dimensions must be checked on site prior to commencement of work.
3. Where applicable this drawing is to be read in conjunction with other consultants drawings.
4. This drawing is the copyright of Impact Geotechnical Ltd.

Drawing Title:

Hole Location Plan

Site Name:

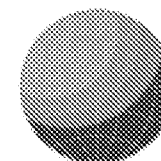
The Grange, Westergate

Project Reference:

P20.213

Revision: 0

Drawn by: SG
Scale: Not to Scale



IMPACT
GEOTECHNICAL

Ref: CS/C1592

Perry Duffy
HD Developments23rd March 2021**Re: The Grange, Westergate Street, Woodgate – Soakaway Testing – Infiltration Test Result Summary**

Dear Perry

The following investigation was carried out at the above location.

1. Site Works

The purpose of the investigation was to supply soakaway test data in general accordance with BRE document 365 (Soakaway Design) at one location which would be the approximate intended location for a possible infiltration device to serve a new small residential site.

The appended drawing illustrates the position of the test pit. The BRE365 pit was excavated to a depth of 0.6m in line with the approximate depth of the proposed infiltration feature which would be porous paving due to high recorded groundwater by others.

The testing commenced at 09:00 on 14th March 2021 with three tests being undertaken in accordance with BRE 365.

2. BRE 365 Soakaway Test Findings

Testing of the sub soils which was noted as silty clay with gravels with gravels produced a BRE 365 design infiltration rate of **1.05x10⁻⁵m/s** at a depth of 0.6m. This rate was the slowest taken from all three tests. This is considered a poor rate but suitable for infiltration devices with a large surface area.

3. BRE 365 Soakaway Test Results

Test Pit No	Infiltration Rate (1-3 Tests)			Depth of Test	Soil Type
SAT1	1.24x10 ⁻⁵ m/s	1.13x10 ⁻⁵ m/s	1.05x10⁻⁵m/s	0.6m	Silty clay with gravels

Appendix A – Soakaway Test Location Plan



Richard Cobden House, Lion Street, Chichester, West Sussex, PO19 1LW

Appendix B – Site Photographs



Appendix C – Soakaway Test Results



Job: The Grange, Woodgate - Test 1

Infiltration Calculator

$$f = \frac{V_{p75-25}}{ap_{50} \times tp_{75-25}}$$

V_{p75-25} = Effective storage volume between 75% and 25% effective depth

ap_{50} = Internal surface area of the trial pit up to 50% effective depth and including the base area

tp_{75-25} = The time for the water level to fall from 75% to 25% effective depth

f = Infiltration rate

Trial pit width	=	0.3
Trial pit depth	=	0.6
Trial pit length	=	1

ap_{50} =

0.93

 m/squared

tp_{75-25} =

7800

 seconds

V_{p75-25} =

0.09

 m/cubed

F =

1.24E-05



Job: The Grange, Woodgate - Test 2

Infiltration Calculator

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25} = Effective storage volume between 75% and 25% effective depth

a_{p50} = Internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} = The time for the water level to fall from 75% to 25% effective depth

f = Infiltration rate

Trial pit width	=	0.3
Trial pit depth	=	0.6
Trial pit length	=	1

a_{p50} =

0.93

 m/squared

t_{p75-25} =

8600

 seconds

V_{p75-25} =

0.09

 m/cubed

F =

1.13E-05



Job: The Grange, Woodgate - Test 3

Infiltration Calculator

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25} = Effective storage volume between 75% and 25% effective depth

a_{p50} = Internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} = The time for the water level to fall from 75% to 25% effective depth

f = Infiltration rate

Trial pit width	=	0.3
Trial pit depth	=	0.6
Trial pit length	=	1

a_{p50} =

0.93

 m/squared

t_{p75-25} =

9200

 seconds

V_{p75-25} =

0.09

 m/cubed

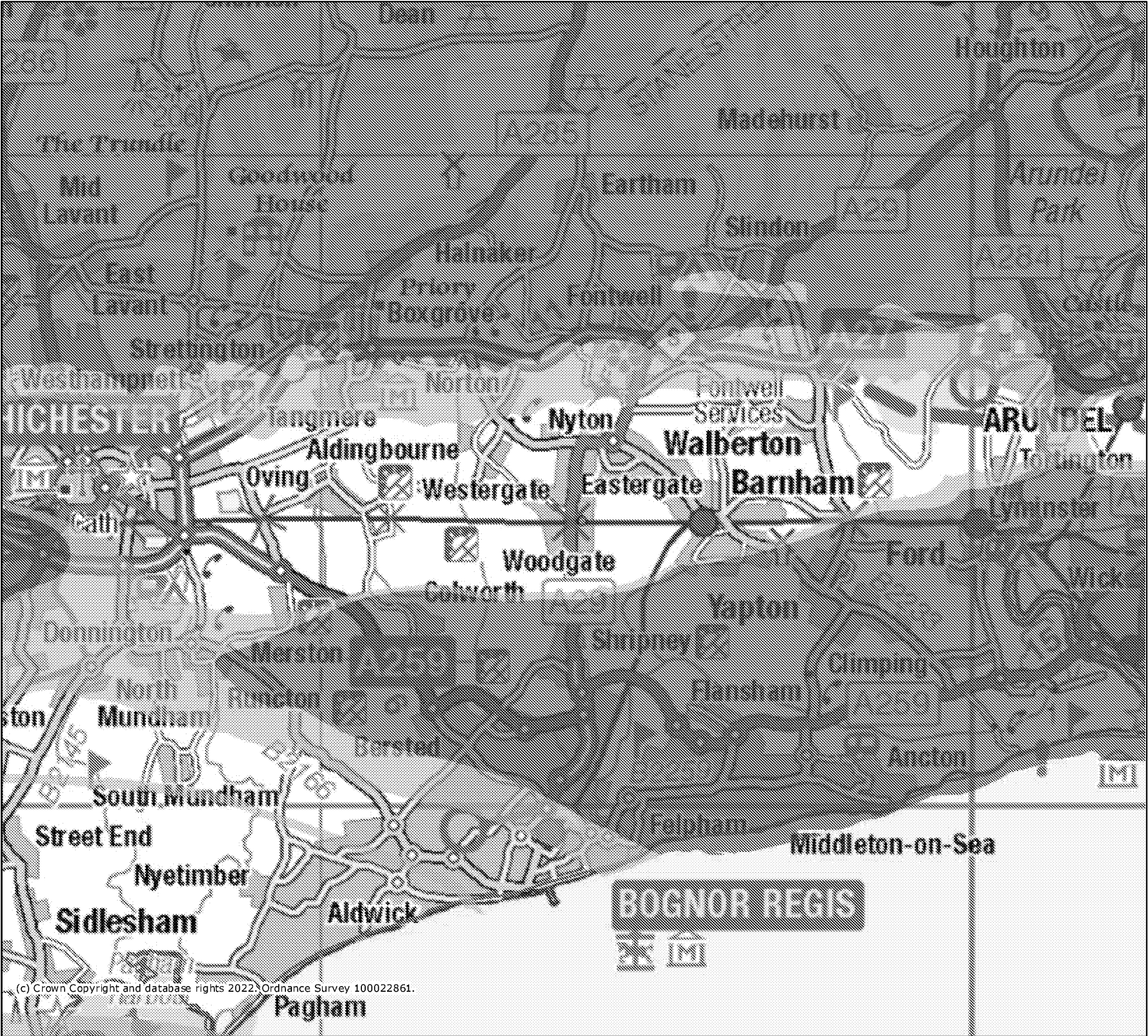
F =

1.05E-05

Measurement equates to depth below ground level at location of monitoring well.

NCIL AL/55/22/DOC

7.4 **Appendix D – Magic Map from Environment Agency**



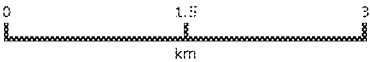
Legend

Aquifer Designation Map (Bedrock)
(England)

- Principal
- Secondary A
- Secondary B
- Secondary (undifferentiated)
- Unproductive

Projection = OSGB36
xmin = 477900
ymin = 96700
xmax = 509900
ymax = 112100

Map produced by MAGIC on 16 March, 2022.
Copyright resides with the data suppliers and the map must not be reproduced without their permission. Some information in MAGIC is a snapshot of the information that is being maintained or continually updated by the originating organisation. Please refer to the metadata for details as information may be illustrative or representative rather than definitive at this stage.



MAGiC

Aquifer Designation Map (Superficial Drift)



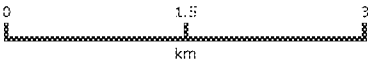
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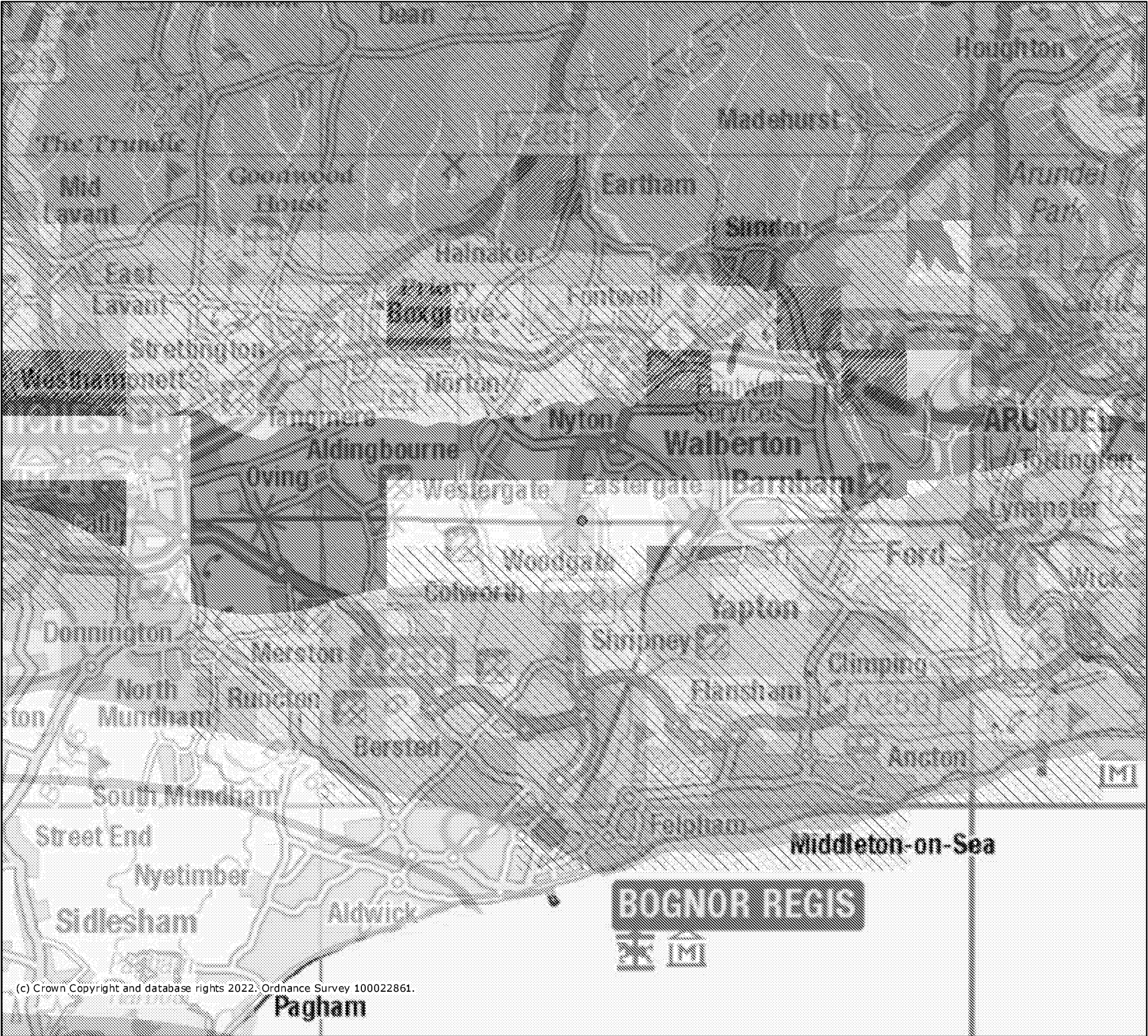
Aquifer Designation Map (Superficial Drift) (England)

- Principal
- Secondary A
- Secondary B
- Secondary (undifferentiated)
- Unknown (lakes+landslip)
- Unproductive

Projection = OSGB36
xmin = 477900
ymin = 96700
xmax = 509900
ymax = 112100

Map produced by MAGIC on 16 March, 2022.
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Legend

Groundwater Vulnerability Map (England)

- Local Information
- Soluble Rock Risk
- High
- Medium - High
- Medium
- Medium - Low
- Low
- Unproductive

Projection = OSGB36
xmin = 477900
ymin = 96700
xmax = 509900
ymax = 112100

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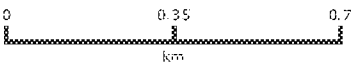
Legend

Source Protection Zones merged (England)

- Zone I - Inner Protection Zone
- Zone I - Subsurface Activity
- Zone II - Outer Protection Zone
- Zone II - Subsurface Activity
- Zone III - Total Catchment
- Zone III - Subsurface Activity
- Zone of Special Interest

Projection = OSGB36
xmin = 489900
ymin = 103400
xmax = 497800
ymax = 107200

Map produced by MAGIC on 16 March, 2022.
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7.5 **Appendix E – Proposed Drainage Plan and Hydraulic Calculations**

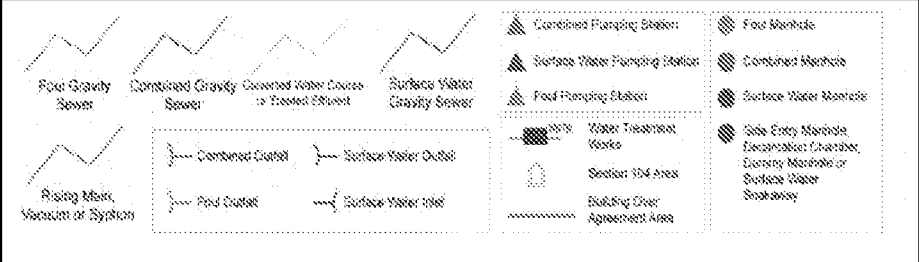


(c) Crown copyright and database rights 2022 Ordnance Survey 100031673 Date: 10/01/22 Scale: 1:1000 Map Centre: 493982,104365 Data updated: 22/12/21 Our Ref: 751562 - 1 Wastewater Plan A3

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2022 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

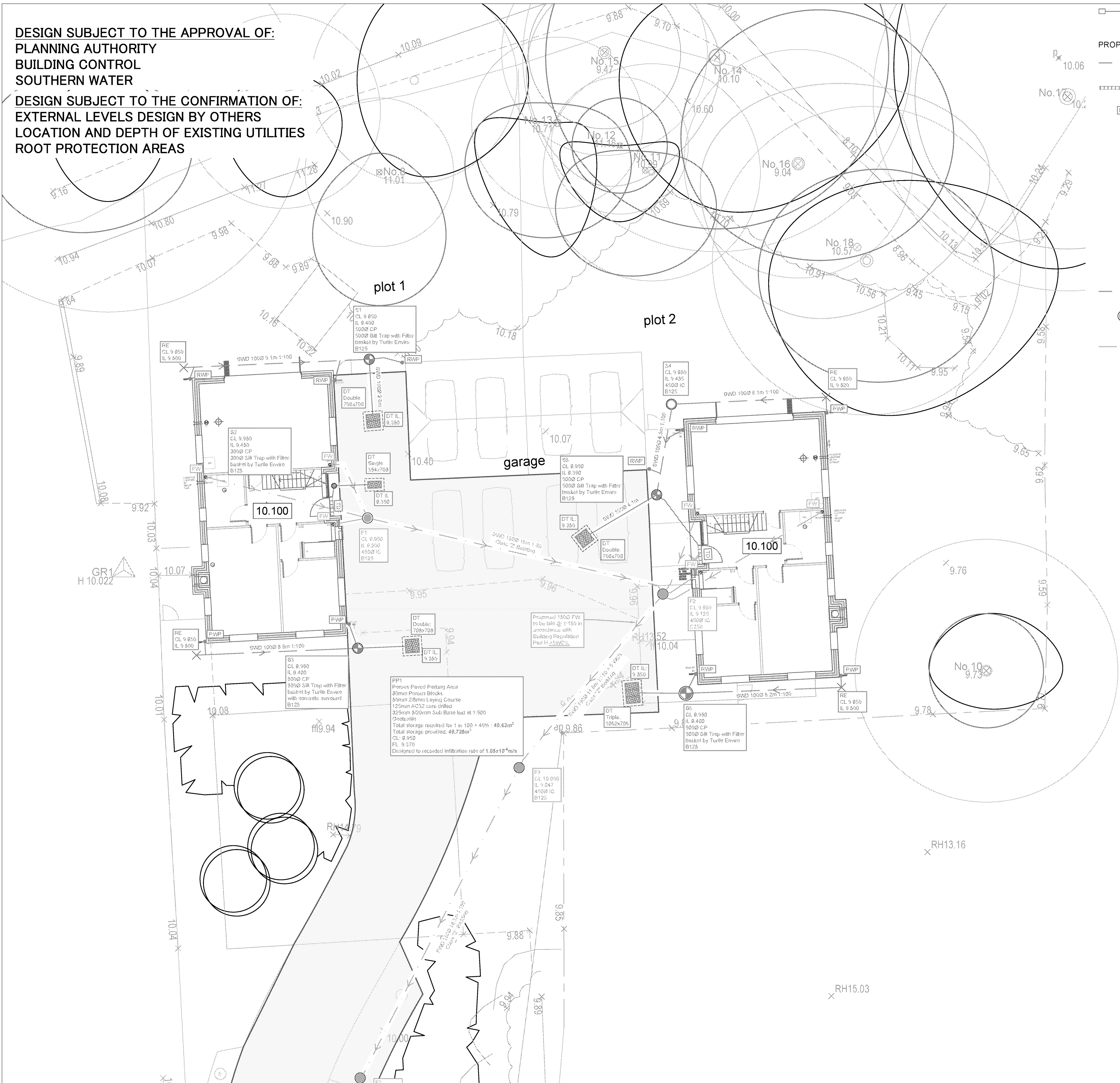


ben@bisdesign.co.uk
The Grange



DESIGN SUBJECT TO THE APPROVAL OF:
PLANNING AUTHORITY
BUILDING CONTROL
SOUTHERN WATER

DESIGN SUBJECT TO THE CONFIRMATION OF:
EXTERNAL LEVELS DESIGN BY OTHERS
LOCATION AND DEPTH OF EXISTING UTILITIES
ROOT PROTECTION AREAS



PROPOSED FEATURES

Existing foul water sewer/drain and manhole as taken from Southern Water Asset Plan

Storm water sewer/drain

Threshold/Channel drain (for channel drain details see plan)

Proposed distribution tank by Formpave or equivalent (for size see drainage plan). Dashed lines denotes localised sub base thickening.

Rainwater pipe

Storm water inspection chamber (4500)

Storm water catchpit chamber (for size see plan)

Storm water rodding eye

Porous paved parking and access road area to Client specification

Pipe drainage 'Z' Bedding or Concrete Slab Protection

Proposed inspection chambers with concrete surround

Foul water sewer/drain

Soil stack (as taken from Smith Simmons&Partners drg. 1251/BR201 and 1251/BR202)

Foul water inspection chamber (4500)

Finished floor level (as taken from Architects drawing)

Pipe info - diameter, length, gradient, bedding type

ABBREVIATIONS

MH - MANHOLE
IC - INSPECTION CHAMBER
AC - ACCESS CHAMBER
CP - CATCHPIT
BC - BRAKE CHAMBER
RE - RODDING EYE
IL - INVERT LEVEL
SL - SUMP LEVEL
CL - COVER LEVEL

- Site Specific Notes**
- Proposed permeable paving designed to measured rate of 1.05×10^{-4} m/s and factor of safety 5.0.
 - Existing access road to be replaced with permeable block paving or similar permeable surface finish to Client's specification.
 - Private FW Drainage to be 1500 sewer laid on 1:150 gradient as shown on drainage plan in accordance with Building Regulation Part H > SWCs.
 - Existing public foul sewer location as taken from Southern Water Asset plan. Exact location and depth to be confirmed on site prior works commencing.

- STANDARD DRAINAGE NOTES
- DO NOT SCALE FROM THIS DRAWING. REFER TO FIGURED DIMENSIONS ONLY. THE CONTRACTOR SHOULD CHECK ALL DIMENSIONS ON SITE.
 - ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS ARE IN METERS UNLESS NOTED OTHERWISE.
 - THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECT AND ENGINEERING DETAILS, DRAWINGS AND SPECIFICATIONS.
 - ANY DISCREPANCIES SHOULD BE REPORTED TO THE ARCHITECT AND/OR ENGINEER IMMEDIATELY, SO THAT CLARIFICATION CAN BE SOUGHT PRIOR TO THE COMMENCEMENT OF WORK.
 - BEFORE COMMENCING CONSTRUCTION THE CONTRACTOR MUST CHECK THE INVERT LEVELS OF EXISTING SEWERS TO WHICH CONNECTIONS ARE MADE. IN ADDITION THE CONTRACTOR MUST LOCATE AND DETERMINE INVERT LEVELS OF THE EXISTING SPURS TO WHICH CONNECTIONS ARE PROPOSED. ANY DISCREPANCIES ARE TO BE NOTIFIED TO THE ENGINEER IMMEDIATELY, PRIOR TO CONSTRUCTION.
 - ALL DRAINAGE WORKS SHOULD COMMENCE AT THE PROPOSED DOWNSTREAM CONNECTION POINT. THE WORKS CONTINUING UPSTREAM FOLLOWING CONFIRMATION OF THE TIE-IN INVERT LEVELS TO THE ENGINEER. CONNECTIONS TO MANHOLES OR LARGER SIZED PIPES ETC. SHOULD BE SOFFIT TO SOFFIT UNLESS OTHERWISE INSTRUCTED BY THE ENGINEER. IF THIS IS NOT POSSIBLE INFORM THE ENGINEER IMMEDIATELY.
 - COVER LEVELS SHOWN ARE APPROXIMATE. COVERS AND FRAMES SHALL BE SET TO FINISHED GROUND LEVELS AND FALLS.
 - ALL UN-REFERENCED PIPES ARE ASSUMED TO BE 100mm DIA
 - ALL PIPES TO BE ADOPTED, OR CONNECTING TO ADOPTED SEWERS, TO BE VITRIFIED CLAY TO BS EN 295 AND BS885 (SWS ONLY), OR CONCRETE PIPES TO BE EN 1916 AND BS5911 PART 1.
 - ROAD GULLY OUTLET PIPES ARE TO BE 150mm DIA. WITH CONCRETE SURROUND AND FLEXIBLE JOINTS. ALL GULLIES SHALL BE FITTED WITH GRADE D400 GRATINGS AND FRAMES TO BS EN124. UNLESS OTHERWISE STATED.
 - ALL ADOPTABLE SEWERS SHALL BE CONSTRUCTED TO THE STANDARDS AND SPECIFICATION LAID DOWN IN SEWERS FOR ADOPTION 8th EDITION, WITH A VIEW TO ADOPTION UPON COMPLETION OF WORKS.
 - ALL PRIVATE DRAINAGE TO BE IN ACCORDANCE WITH THE BUILDING REGULATIONS APPROVED DOCUMENT PART-H, AND TO THE SATISFACTION OF THE BUILDING CONTROL INSPECTOR.
 - THE CONTRACTOR IS TO KEEP A RECORD OF ANY VARIATIONS MADE ON SITE, INCLUDING THE RELOCATION OF SEWERS OR DRAINS, SO THAT AN AS CONSTRUCTED DRAWING CAN BE PREPARED UPON COMPLETION OF THE PROJECT.
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 - IF ANY SUB SOIL DRAINAGE SYSTEMS ARE UNCOVERED DURING THE WORKS CONTACT THE ENGINEER FOR INSTRUCTIONS. SUB SOIL DRAINS ARE TO BE DIVERTED AROUND NEW WORKS AND CONNECTED INTO THE SURFACE WATER.
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 - MANHOLE AND CHAMBER COVER GRADES:
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 - 'B125' IN ALL DRIVEWAYS
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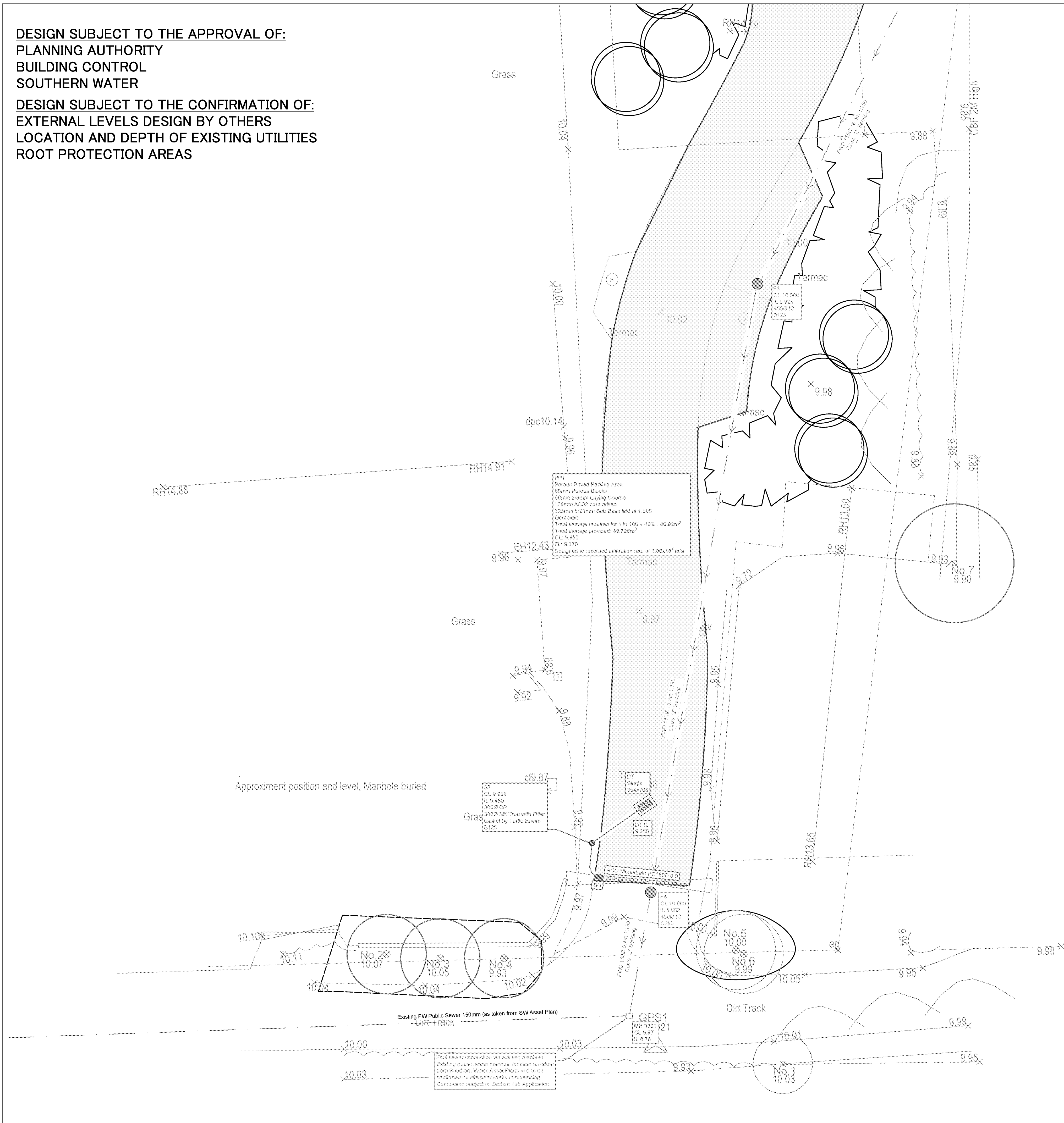


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P-	09.03.22	PRELIMINARY ISSUE	TZ	CS	CS
REV	DATE	DESCRIPTION	BY	CHK	APP
 Consulting Civil Engineers					
CLIENT HP DEVELOPMENTS					
ARCHITECT SMITH SIMMONS & PARTNERS					
JOB TITLE THE GRANGE, WESTERGATE STREET WESTERGATE PO20 3SQ					
DRAWING TITLE PROPOSED DRAINAGE LAYOUT SHEET 1 OF 2					
DRAWN	TZ	ENGINEER	TZ	CHECKED	CS
DATE	MARCH 2022	SCALE @ A1	1:100	APPROVED	CS
JOB No.	C1967	STATUS	P	DRAWING No.	100
REV					P-

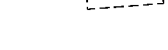
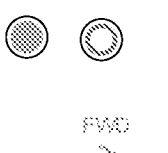
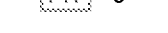
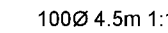
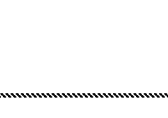
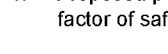
PRELIMINARY

DESIGN SUBJECT TO THE CONFIRMATION OF:
EXTERNAL LEVELS DESIGN BY OTHERS
LOCATION AND DEPTH OF EXISTING UTILITIES
ROOT PROTECTION AREAS






PROPOSED FEATURES

	Storm water sewer/drain
	Threshold/Channel drain (for channel drain details see plan)
	Proposed distribution tank by Formpave or equivalent (for size see drainage plan). Dashed lines denotes localised sub base thickening.
	Rainwater pipe
	Storm water inspection chamber (450Ø)
	Storm water catchpit chamber (for size see plan)
	Storm water rodding eye
	Porous paved parking and access road area to Client specification
	Pipe drainage 'Z' Bedding or Concrete Slab Protection
	Proposed inspection chambers with concrete surround
	Foul water sewer/drain
	Soil stack (as taken from Smith Simmons&Partners dgs 1251/BR201 and 1251/BR202)
	Foul water inspection chamber (450Ø)
	Finished floor level (as taken from Architects drawing)
	Pipe info - diameter, length, gradient, bedding type

ABBREVIATIONS

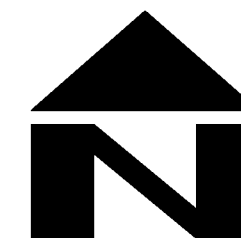
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CL - COVER LEVEL

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11. ALL ADAPTABLE SEWERS SHALL BE CONSTRUCTED TO THE STANDARD AND SPECIFICATION Laid DOWN IN 'SEWERS FOR ADOPTION' 6TH EDITION. WITH A VIEW TO ADOPTION UPON COMPLETION OF WORKS.
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REV	DATE	DESCRIPTION	BY	CHK	APP



CIENT	HP DEVELOPMENTS
ARCHITECT	SMITH SIMMONS & PARTNERS
JOB TITLE	THE GRANGE, WESTERGATE STREET WESTERGATE PO20 3SQ

DRAWING TITLE

PROPOSED DRAINAGE LAYOUT
SHEET 2 OF 2

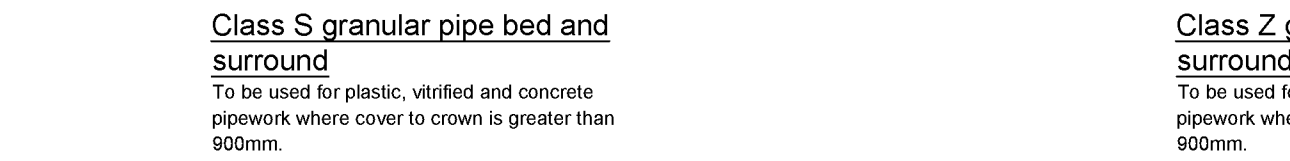
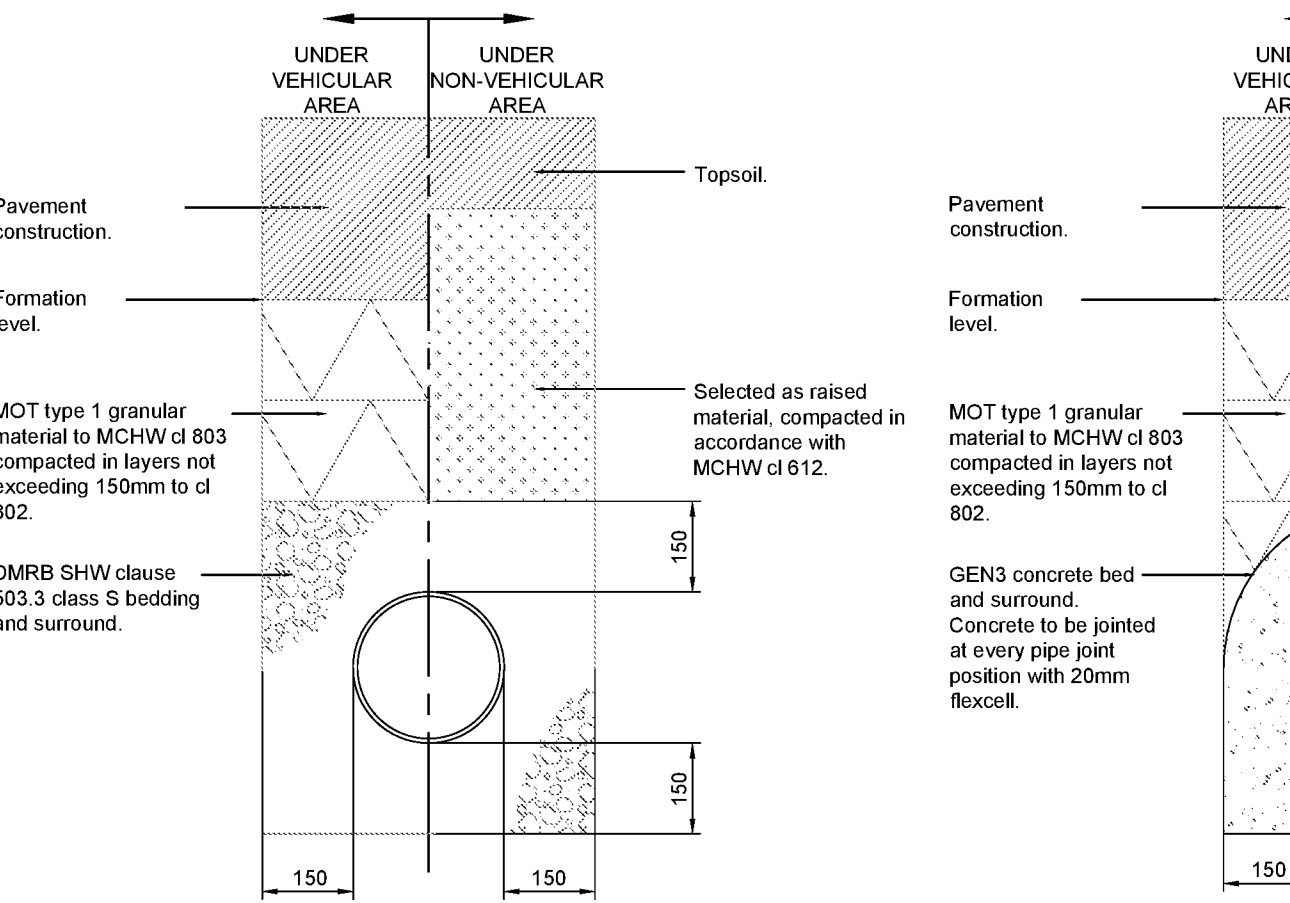
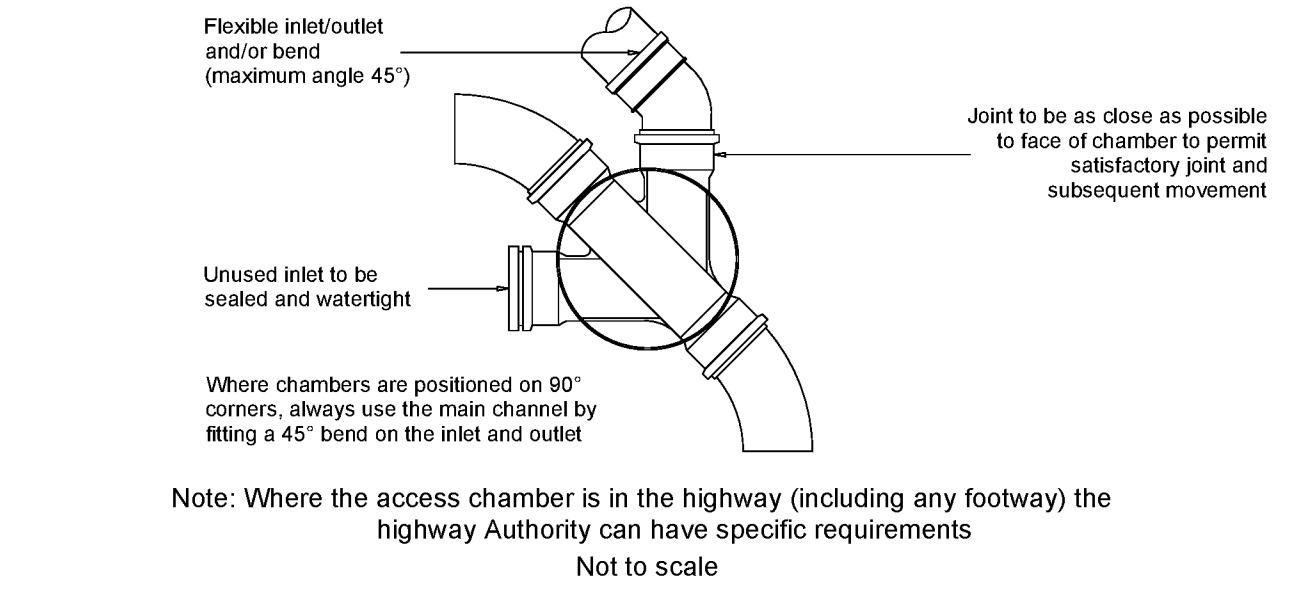
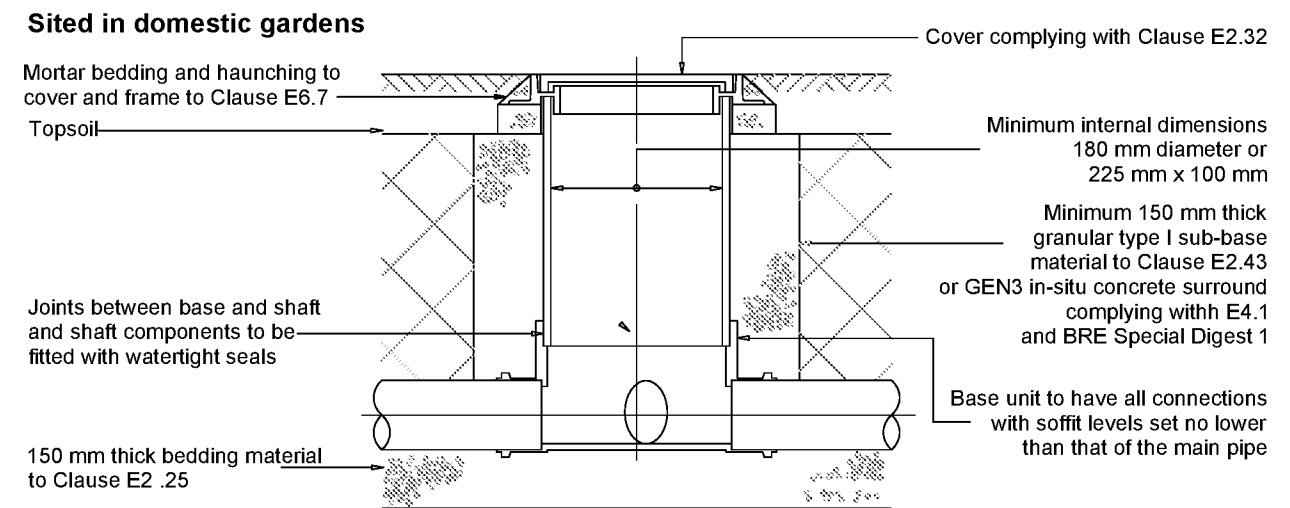
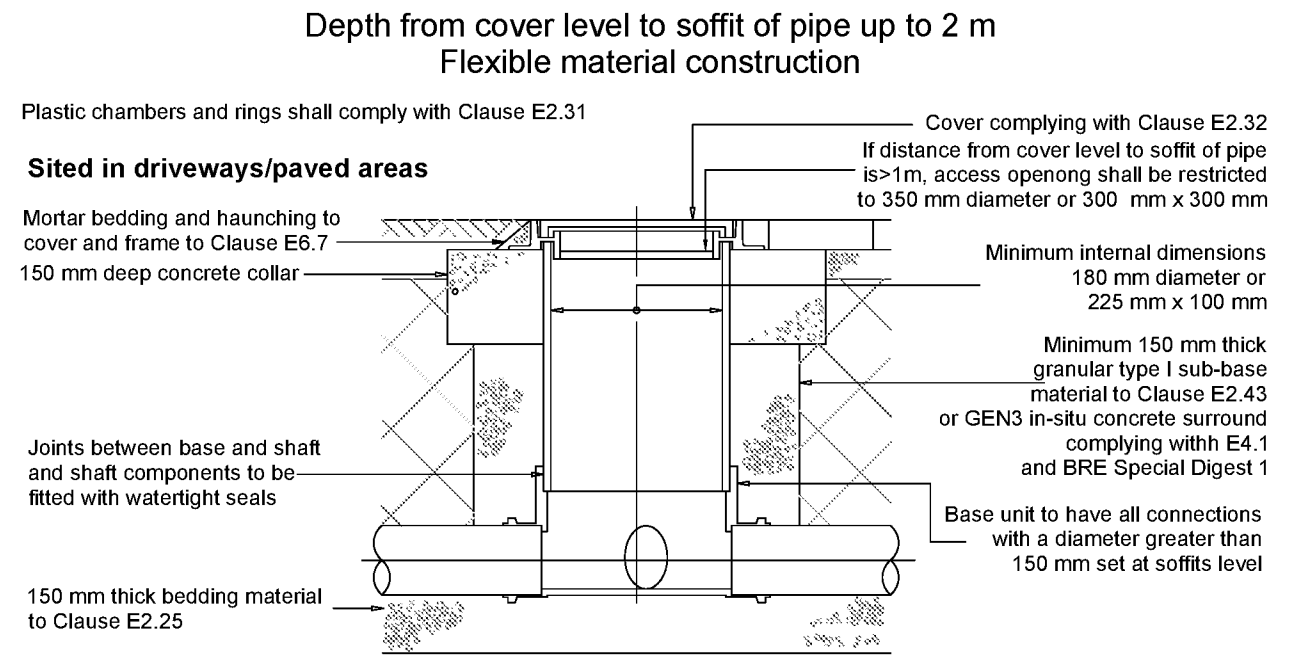
DRAWN TZ	ENGINEER TZ	CHECKED CS	APPROVED CS
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DATE	SCALE  A1
MARCH 2022	1:100

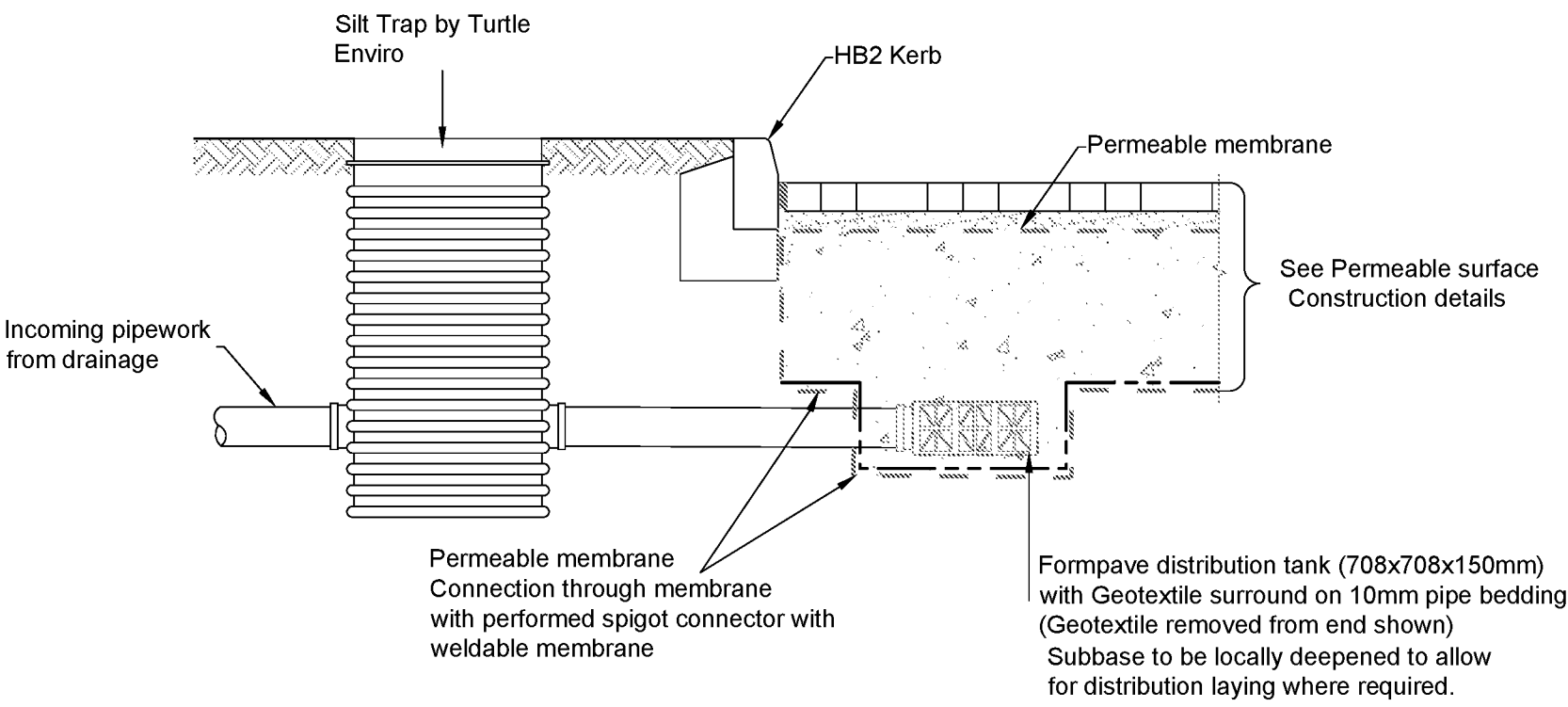
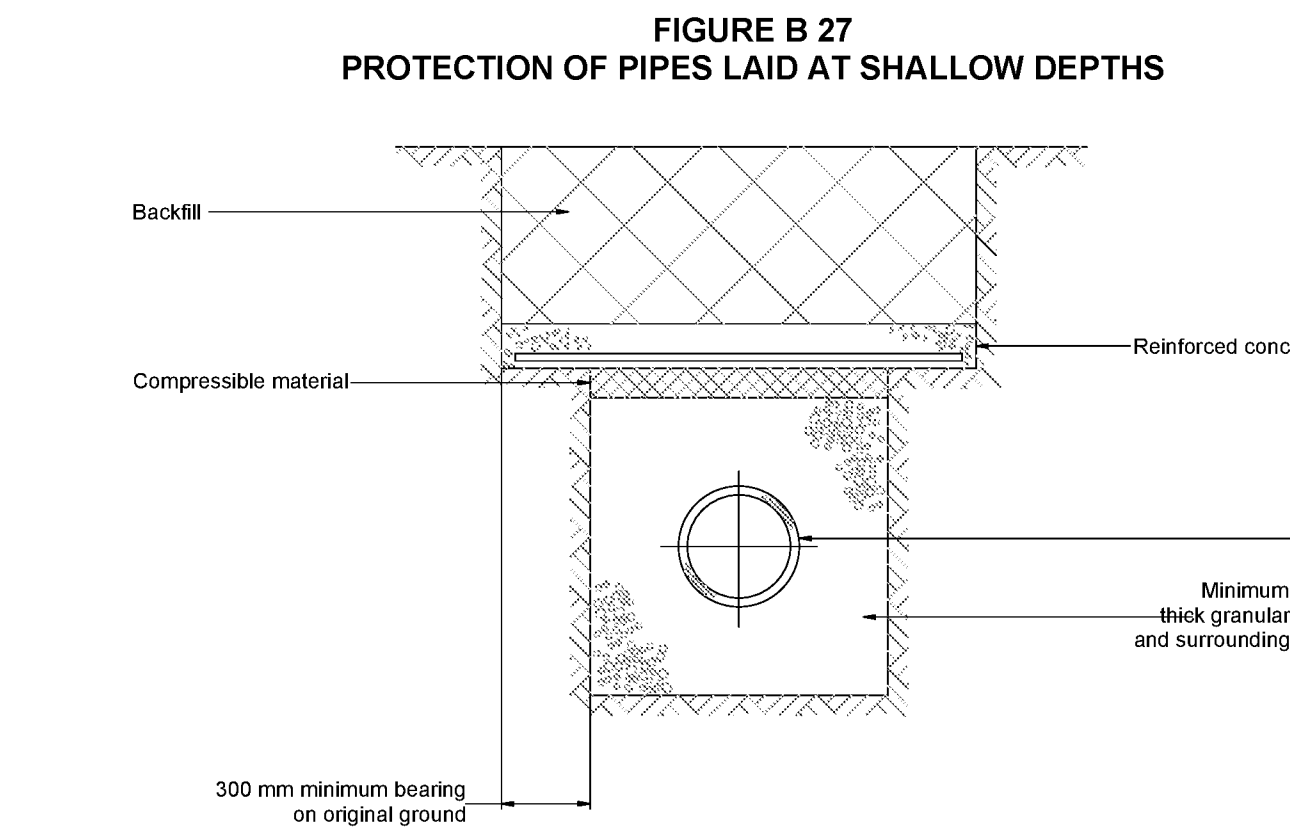
JOB No.	STATUS	DRAWING No.	REV.
C1967	P	101	P-

PRELIMINARY

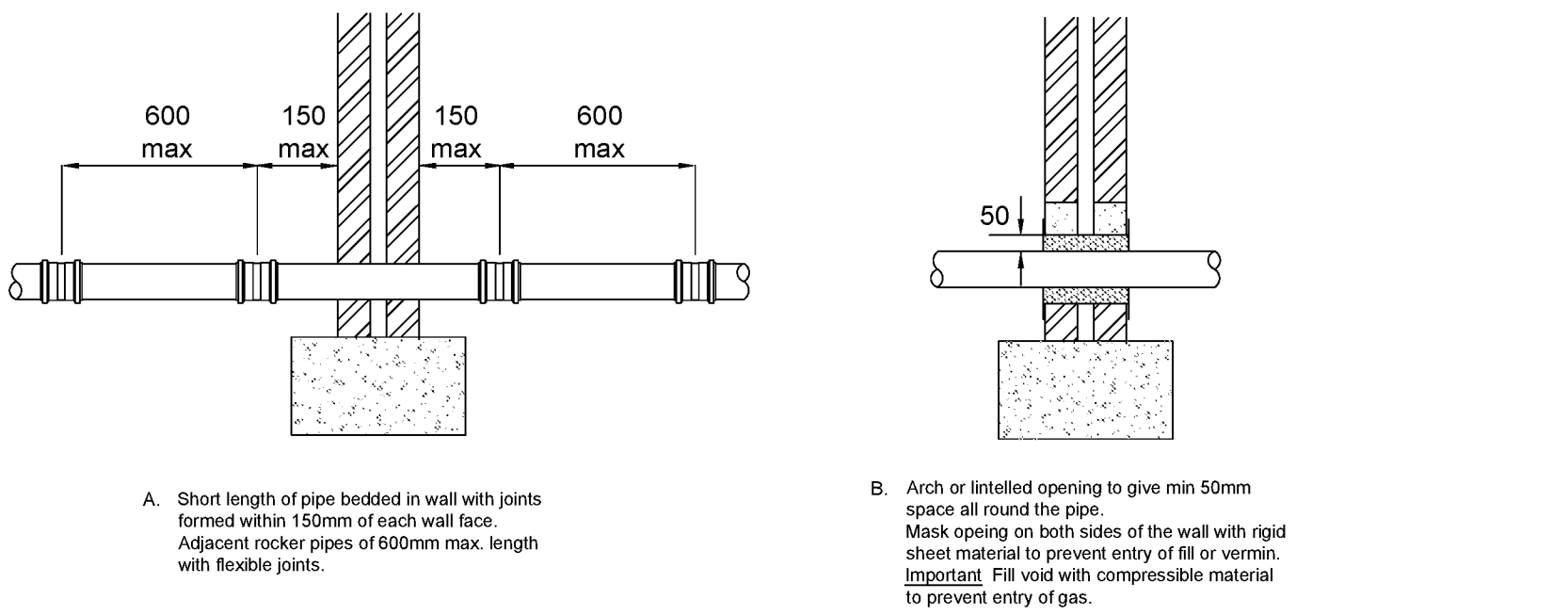
FIGURE B 23
TYPICAL INSPECTION CHAMBER DETAIL - TYPE E



Pipe Bedding Details

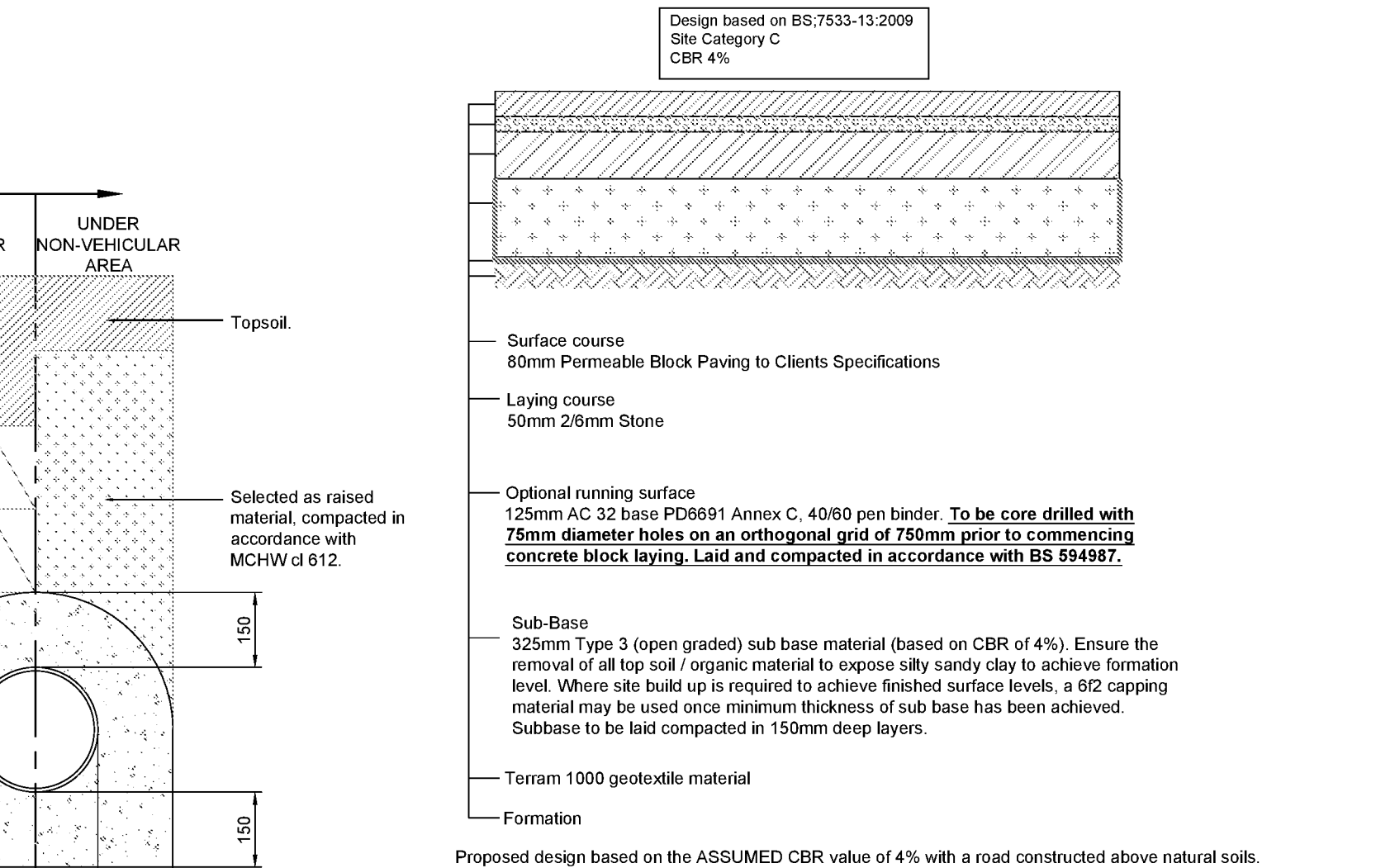


Typical Distribution Tank
Outflow Detail

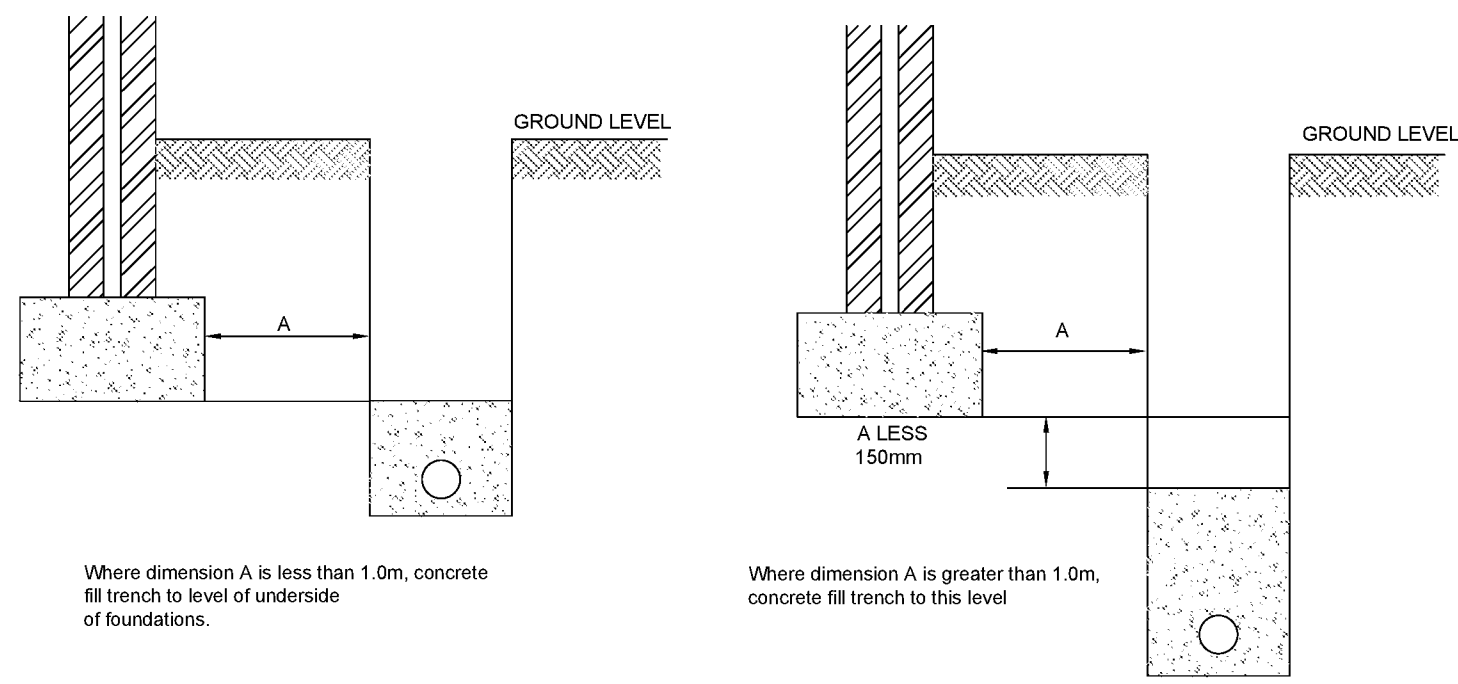


Pipes through wall detail

Pipes through wall with lintel detail



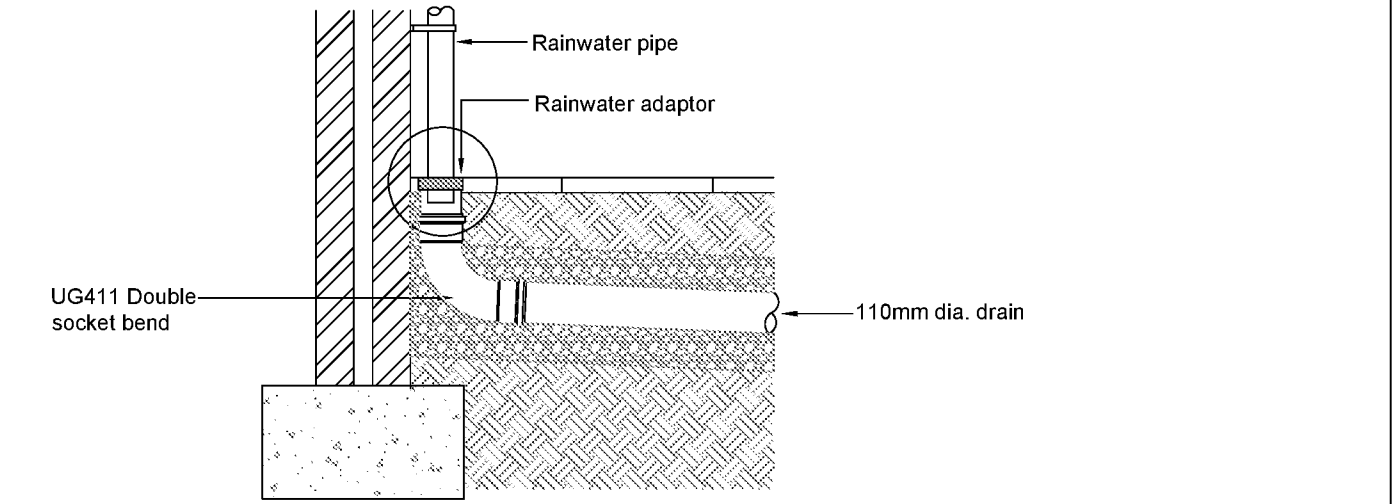
Proposed permeable block paving
typical construction



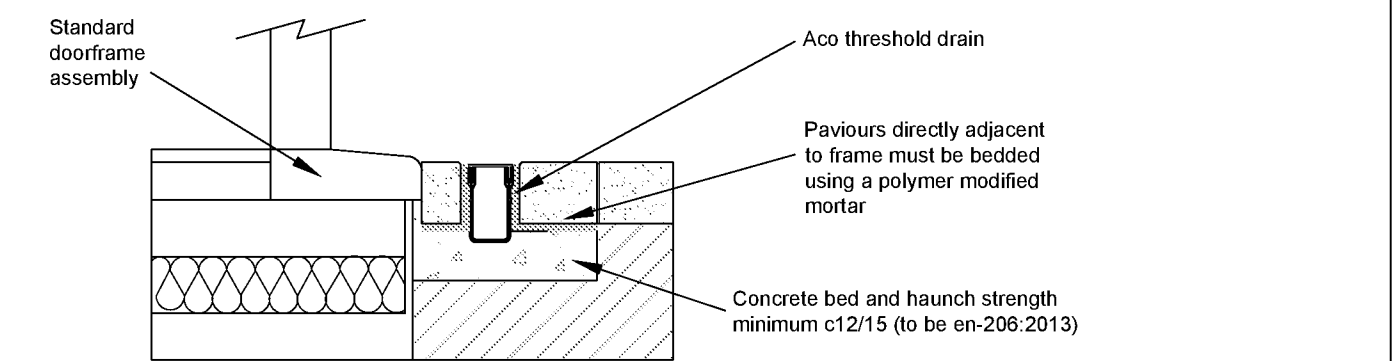
Pipes near buildings

Pipes near buildings

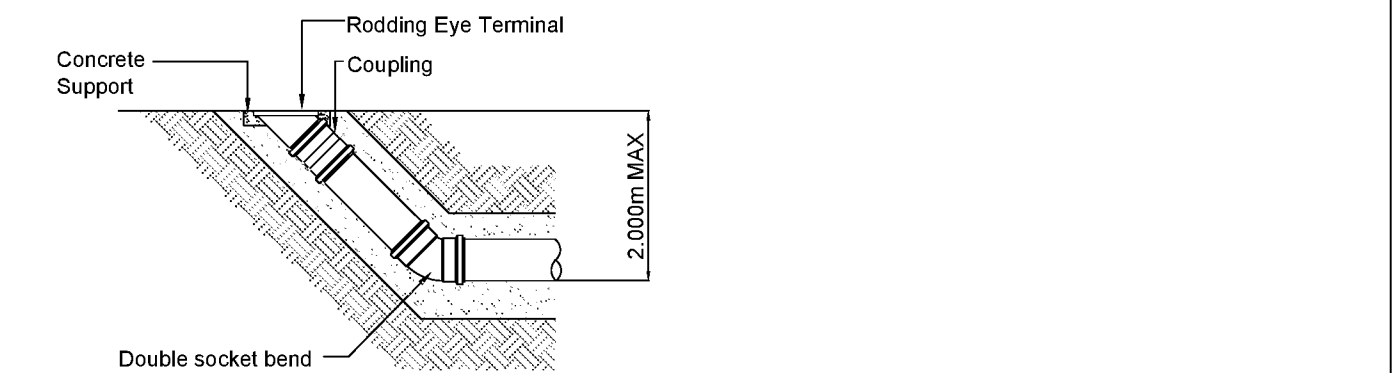
TABLE 11 MIN. DIMENSIONS FOR ACCESS FITTINGS AND INSPECTION CHAMBERS						
TYPE	DEPTH TO INVERT FROM COVER LEVEL (m)	INTERNAL SIZES		COVER SIZES		
		RECTANGULAR LENGTH AND WIDTH	CIRCULAR DIAMETER	RECTANGULAR LENGTH AND WIDTH	CIRCULAR DIAMETER	
Rodding Eye		As drain but min 100			Same size as pipework (1)	
Access Fittings						
small	150 dia 150x100	0.6 or less, except where situated in a chamber	150x100	150	150x100 (1)	Same size as access fitting
large	225x100		225x100	225	225x100 (1)	
Inspection Chamber						
Shallow	0.6 or less	225x100	190 (2)	-	190 (1)	
	1.2 or less	450x450	450	Min 430x430	430	
Deep	>1.2 but <3.0	450x450	450	max 300x300 (3)	Access restricted to max 350 (3)	
Notes: (1) The clear opening may be reduced by 20mm in order to provide proper support for the cover and frame. (2) Drains upto 150mm. (3) A larger clear opening may be used in conjunction with a restricted access. The size is restricted for health and safety reasons to deter entry.						



Rainwater pipe connection



Aco Threshold Drain
(1:10)



Rodding eye detail

Prefixed to drawing numbers shall signify the following:-			
PL = PLANNING	Shall not be used for contract or construction purposes		
P = PRELIMINARY	Shall not be used for contract or construction purposes		
T = TENDER	Shall not be used for construction purposes		
C = CONSTRUCTION	These are the only drawings that shall be used for construction purposes		
R = RECORD	Record of actual completed work		

P-	04.03.22	PRELIMINARY ISSUE	TZ	CS	CS
REV	DATE	DESCRIPTION	BY	CHK	APP

cgs civils Consulting Civil Engineers							
CLIENT: HD DEVELOPMENTS							
ARCHITECT: SMITH SIMMONS & PARTNERS							
JOB TITLE: THE GRANGE, WESTERGATE STREET WESTERGATE PO20 3SQ							
DRAWING TITLE: PROPOSED CONSTRUCTION DETAILS							
DRAWN	ENGINEER	TZ	CHECKED	APPROVED			
TZ		CS	CS				
DATE	MARCH 2022		SCALE @ A1	1:20			
JOB No.	C1967	STATUS	P	DRAWING No.	500	REV.	-P

PRELIMINARY

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
PP1	0.081	4.00	9.950	450	494017.482	104410.248	0.570

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15 30 60 120 180 240 360 480 600 720 960 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
10	0	0	0
30	0	0	0
100	40	0	0

Node PP1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.03780	Invert Level (m)	9.380	Slope (1:X)	800.0
Side Inf Coefficient (m/hr)	0.03780	Time to half empty (mins)	314	Depth (m)	0.325
Safety Factor	5.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.30	Length (m)	52.000		

Approval Settings

Node Size	x	Coordinates	x	Full Bore Velocity	x	Time to Half Empty	✓
Node Losses	x	Crossings	x	Proportional Velocity	x	Return Period (years)	30
Link Size	x	Cover Depth	x	Surcharged Depth	x	Discharge Rates	x
Link Length	x	Backdrops	x	Flooding	x	Discharge Volume	x

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	109.521	30.991	30 year 15 minute summer	268.706	76.035
1 year 15 minute winter	76.857	30.991	30 year 15 minute winter	188.566	76.035
1 year 30 minute summer	71.439	20.215	30 year 30 minute summer	174.929	49.499
1 year 30 minute winter	50.133	20.215	30 year 30 minute winter	122.757	49.499
1 year 60 minute summer	48.435	12.800	30 year 60 minute summer	116.589	30.811
1 year 60 minute winter	32.179	12.800	30 year 60 minute winter	77.459	30.811
1 year 120 minute summer	30.053	7.942	30 year 120 minute summer	70.438	18.615
1 year 120 minute winter	19.966	7.942	30 year 120 minute winter	46.797	18.615
1 year 180 minute summer	23.233	5.979	30 year 180 minute summer	53.298	13.715
1 year 180 minute winter	15.102	5.979	30 year 180 minute winter	34.645	13.715
1 year 240 minute summer	18.475	4.882	30 year 240 minute summer	41.604	10.995
1 year 240 minute winter	12.274	4.882	30 year 240 minute winter	27.641	10.995
1 year 360 minute summer	14.169	3.646	30 year 360 minute summer	31.221	8.034
1 year 360 minute winter	9.210	3.646	30 year 360 minute winter	20.295	8.034
1 year 480 minute summer	11.185	2.956	30 year 480 minute summer	24.324	6.428
1 year 480 minute winter	7.431	2.956	30 year 480 minute winter	16.160	6.428
1 year 600 minute summer	9.182	2.511	30 year 600 minute summer	19.756	5.404
1 year 600 minute winter	6.274	2.511	30 year 600 minute winter	13.498	5.404
1 year 720 minute summer	8.203	2.199	30 year 720 minute summer	17.490	4.687
1 year 720 minute winter	5.513	2.199	30 year 720 minute winter	11.754	4.687
1 year 960 minute summer	6.768	1.782	30 year 960 minute summer	14.215	3.743
1 year 960 minute winter	4.483	1.782	30 year 960 minute winter	9.416	3.743
1 year 1440 minute summer	4.949	1.326	30 year 1440 minute summer	10.161	2.723
1 year 1440 minute winter	3.326	1.326	30 year 1440 minute winter	6.829	2.723
10 year 15 minute summer	211.819	59.937	100 year +40% CC 15 minute summer	488.233	138.153
10 year 15 minute winter	148.645	59.937	100 year +40% CC 15 minute winter	342.620	138.153
10 year 30 minute summer	136.831	38.718	100 year +40% CC 30 minute summer	320.551	90.705
10 year 30 minute winter	96.022	38.718	100 year +40% CC 30 minute winter	224.948	90.705
10 year 60 minute summer	90.826	24.003	100 year +40% CC 60 minute summer	214.603	56.713
10 year 60 minute winter	60.342	24.003	100 year +40% CC 60 minute winter	142.577	56.713
10 year 120 minute summer	54.899	14.508	100 year +40% CC 120 minute summer	129.587	34.246
10 year 120 minute winter	36.474	14.508	100 year +40% CC 120 minute winter	86.094	34.246
10 year 180 minute summer	41.666	10.722	100 year +40% CC 180 minute summer	97.729	25.149
10 year 180 minute winter	27.084	10.722	100 year +40% CC 180 minute winter	63.526	25.149
10 year 240 minute summer	32.645	8.627	100 year +40% CC 240 minute summer	75.977	20.078
10 year 240 minute winter	21.689	8.627	100 year +40% CC 240 minute winter	50.477	20.078
10 year 360 minute summer	24.632	6.339	100 year +40% CC 360 minute summer	56.677	14.585
10 year 360 minute winter	16.012	6.339	100 year +40% CC 360 minute winter	36.841	14.585
10 year 480 minute summer	19.260	5.090	100 year +40% CC 480 minute summer	43.979	11.622
10 year 480 minute winter	12.796	5.090	100 year +40% CC 480 minute winter	29.219	11.622
10 year 600 minute summer	15.690	4.291	100 year +40% CC 600 minute summer	35.604	9.738
10 year 600 minute winter	10.720	4.291	100 year +40% CC 600 minute winter	24.327	9.738
10 year 720 minute summer	13.925	3.732	100 year +40% CC 720 minute summer	31.433	8.424
10 year 720 minute winter	9.358	3.732	100 year +40% CC 720 minute winter	21.125	8.424
10 year 960 minute summer	11.365	2.993	100 year +40% CC 960 minute summer	25.432	6.697
10 year 960 minute winter	7.528	2.993	100 year +40% CC 960 minute winter	16.847	6.697
10 year 1440 minute summer	8.174	2.191	100 year +40% CC 1440 minute summer	18.055	4.839
10 year 1440 minute winter	5.493	2.191	100 year +40% CC 1440 minute winter	12.134	4.839

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	PP1	90	9.451	0.071	3.8	6.2417	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
120 minute winter	PP1	Infiltration	1.1

Results for 10 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	PP1	114	9.499	0.119	6.9	13.7943	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
120 minute winter	PP1	Infiltration	1.1

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	PP1	116	9.531	0.151	8.8	19.0004	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
120 minute winter	PP1	Infiltration	1.1

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	PP1	176	9.669	0.289	12.0	40.8297	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
180 minute winter	PP1	Infiltration	1.2