



Drainage Strategy Report

LITTLEHAMPTON, Land at Watersmead Business Park

14 May 2019

Prepared for:



**STRUCTURAL • CIVIL • DUE DILIGENCE • ENGINEERING MASTERPLANNING
FLOOD MANAGEMENT • INFRASTRUCTURE DESIGN
PRE-DEVELOPMENT ENGINEERING • BIM • TRANSPORTATION**

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APPROVALS

	Name	Position	Date
Prepared by	Andrew Quinn	Civil Engineer	14.05.19
Reviewed by	David Meigh	Director	14.05.19
Approved by	David Meigh	Director	14.05.19

VERSIONS

Number	By	Date	Context
1.0	Andrew Quinn	15.04.19	For Comment
2.0	Andrew Quinn	01.05.19	Updated from Comments
3.0	Jawsy Jabbar	14.05.19	Updated Following Infiltration Test Results

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1 INTRODUCTION

Pinnacle Consulting Engineers Ltd have been commissioned by Amazon to carry out a Drainage Strategy report for a proposed development of a site off Norway Lane, Watersmead Business Park, Toddington, BN17 6GY. A site location plan is enclosed in Appendix A.

1.1 Site description

The proposed development is located at National Grid Reference (NGR) 503839, 103654 off Norway Lane, Watersmead Business Park, Toddington, BN17 6GY.

The existing site consists of three large warehouse buildings, associated service yards, circulation routes and HGV parking areas. The site is located to the east of Wick, in the north of Toddington and just north of A259. The site is bound to the north by railway tracks between Angmering and Ford, to the south by parking and circulation roads associated with the Bodyshop HQ building and the “kids unlimited” pre-school, to the west by The Co-operative Childcare nursery and residential dwellings along Gratwicke Drive and to the east by a large feature lake running northwards towards Black Ditch. An approximately 0.5ha feature lake can be identified to the east of the site and appears to run into a complex of interconnecting tributaries and reservoirs roughly 140m north of the site.



Figure 2.1 – Aerial View of the existing development site (approximate site boundary edged red)

1.2 Topography

The development site is relatively flat with ground levels across the site varying between approximately 5m and 4m Above Ordnance Datum (AOD). The site falls generally in a south direction.

Topographical survey has been commissioned to confirm the levels across the site.

Details of existing development site levels are enclosed in Appendix B.

1.3 Geological ground conditions

Geological conditions at the site are detailed below and are based on a British Geological Survey (BGS) report and the Short Form Geotechnical Report carried out by Deltasimons in March 2019. The focus of this study on geology is on the potential movement of water through Made Ground, Drift Geology and Solid Geology.

Formation	Description
Artificial Ground (Made Ground)	Artificial deposits delineated in available Dynamic Sampler on site identify Made Ground prove to approximately 0.45m bgl.
Superficial Deposits (Drift Deposits)	River Terrace Deposits (undifferentiated) - Sand, Silt and Clay. These deposits are detrital, ranging from coarse- to fine-grained and form beds and lenses of deposits reflecting the channels, floodplains and levees of a river or estuary. These deposits have been proven to approximately 2.43m bgl.
Bedrock	New Pit Chalk Formation - Chalk. These sedimentary rocks are shallow-marine in origin. They are biogenic and detrital, generally comprising carbonate material (coccoliths), forming distinctive beds of chalk. Chalk deposits have been proven to 45.72m bgl.
Water Table	Available boreholes identify a water table at 5.18m deep that is not expected to significantly impact drainage design or associated earthworks activities.

Table 1.0 – Geological Ground Conditions

1.4 Proposed Development

The proposed development comprises installation of 5 no. 'vehicle-to-ground' lifts and a canopy cover over the associated service yard area for a temporary period of five years, minor alterations to the internal access road, including widening works, creation of a new spur, provision of a pedestrian footbridge, and associated lighting and drainage infrastructure provision.

The proposed development plans are enclosed in Appendix D.

2 EXISTING SURFACE WATER MANAGEMENT

2.1 Existing surface water management

A GPR survey was conducted by Malcom Hughes Chartered Land Surveyors in March of 2019 to define the location of existing infrastructure within the site. Current survey records identify that the site has two fully operational, primary, positive surface water networks, with separate discharge locations serving the existing site. Due to the lack of evidence to suggest otherwise, it is reasonable to assume the identified networks discharge into the large feature lake situated approximately 20m to the east of the site. Assumed outfall locations are positioned along the eastern perimeter of the site. One of sewers are assumed to outfall from the north east corner of the site via a Ø375mm and the other discharges immediately to the east of the central service yard via a Ø1050mm pipe. Following a critique of the existing networks, it is assumed that surface water runoff discharges into the pond at an unrestricted rate.

A series of gullies are depicted running along the inner kerb lines bordering the large warehouse to the north and are assumed to connect into the adjacent sewers, which roughly follow the centre line of the existing circulation routes. A series of surface water sewers are identified running parallel to the existing buildings along the centre of the site; they are shown to serve the central service yard, the large distribution centre to the north and both warehouse buildings to the south.

The existing drainage arrangement shown on the drainage survey is provided from the GPR Survey and enclosed in Appendix B.

The Environmental Agency's Flood map for planning indicates that the site is located mostly in Flood Zone 1 - little or no risk, with annual probability of flooding from rivers and the sea of less than 0.1% (1 in 1000 year rainfall event).

3 LOCAL POLICY

3.1 Arun District Council's Adopted Local Plan (July 2018)

The information provided below is an extract from Arun District Council's Adopted Local Plan (July 2018) found on the council website (<https://www.arun.gov.uk/adopted-local-plan>). The excerpt is part of Policy W DM3 found under section 18.4 titled "Sustainable Drainage Systems". The following policy is applicable to flood risk and management of drainage:

Sustainable Urban Drainage Systems

"To increase the levels of water capture and storage and improve water quality, all development must identify opportunities to incorporate a range of Sustainable Urban Drainage Systems (SUDS), appropriate to the size of development, at an early stage of the design process. Proposals for both major and minor development proposals must incorporate SUDS within the private areas of the development in order to provide source control features to the overall SUDS design. These features include:

- Green roofs*
- Permeable driveways and parking*
- Soakaways*
- Water harvesting and storage features including water butts.*

Proposals for major development must also integrate SUDS within public open spaces and roads, reflecting discussion with the appropriate bodies. SUDS must therefore be integrated into the overall design of a development and must:

- a) Contribute positively to the appearance of the area, integrating access to allow maintenance of existing watercourses and the system.*
- b) Effectively manage water (including its quality)*
- c) Accommodate and enhance biodiversity by making connections to existing Green Infrastructure assets and*
- d) Provide amenity for local residents (ensuring a safe environment)*
- e) Retain the existing drainage network of the site and the wider area,*
- f) Be maintained in perpetuity, supported through a Maintenance and Management Plan/Regime, including its financing, agreed with the Local Planning Authority.*

In order to ensure that SUDS discharge water from the development at the same or lesser rate, as prior to construction, developers must:

- g) Follow the hierarchy of preference for different types of surface water drainage disposal systems as set out in Approved Document H of the Building Regulations and the SUDS manual produced by CIRIA.*
- h) Undertake up to six months groundwater monitoring within the winter period.*
- i) Undertake winter percolation testing in accordance with BRE365.*
- j) The proposed drainage system must be designed to ensure that there is no flooding on a 1 in 30 year storm event.*
- k) The design must also take account of the 1 in 100 year storm event plus 30% allowance for climate change, on stored volumes, to ensure that there is no flooding of properties or the public highway or inundation of the foul sewerage system. Any excess flows must be contained within the site boundary, and within designated storage areas."*

4 PROPOSED DRAINAGE

4.1 Surface Water Discharge Location

Traditional approaches to urban drainage have comprised of underground tanks and pipe networks. More recently, the benefits and opportunities to use Sustainable Drainage Systems (SuDS) have been realised and encouragement to use such systems is promoted throughout Flood Risk Management policy at all levels. SuDS is a term which encompasses a variety of approaches to managing surface water in a way which is more sympathetic to the natural and human environment than conventional piped drainage systems. Management of surface water is an essential element for reducing flood risk and SuDS techniques are often designed to achieve this in a way that mimics the natural environment.

The Building Regulations (H3) states the priority for discharging surface water runoff from a development is as follows:

1. Infiltration into the ground;
2. Discharge into a watercourse;
3. Discharge into a sewer.

In conjunction with the aforementioned hierarchy, the preferred solution would be to replicate the natural drainage regime and to infiltrate surface water runoff into the ground. Following the results of a site-specific infiltration test to BRE Digest 365, conducted in May 2019 by Delta-Simons, it is confirmed that infiltration is a viable method of surface water management. Please refer to Appendix E for results of the infiltration test.

4.2 Proposed Development Surface Water Drainage Strategy

It can be seen from the enclosed drawings in Appendix C that the existing impermeable area for the site and therefore the existing positively drained area is 24,647m². The proposed impermeable area is 25,436m², resulting in an increase of 789m² of impermeable area.

As part of the proposed drainage strategy the majority of the infrastructure will remain un-altered. It is also important to note the existing warehouse buildings have fully operational, positive drainage systems that discharges into the aforementioned pond as described in section 2.1. Any alterations of the existing surface water management infrastructure should pertain to connecting the proposed rainwater down pipes serving the proposed canopy in between buildings 5 and 6.

The additional impermeable area of 789m² will be produced by extending the kerb line along the northern perimeter and by providing an additional road section for circulation. Runoff from the additional impermeable area created along the northern perimeter will be collected by the proposed drainage channel (Aco Multidrain M100D 0.0), before being conveyed via a proposed surface water sewer into a proposed 40.5m³ cellular soakaway unit. Runoff from the additional road section will be collected by a proposed sponge gulley and discharged into a proposed 8.5m³ cellular soakaway unit.

4.3 Surface Water Infiltration Rate and Soakaway design

As previously mentioned, the proposed impermeable area compared to the original design will increase by approximately 789m². As noted in the report, the infiltration tests were attempted at three locations across the site; two of the recorded infiltration rates were 2.4x10⁻⁵ m/s and 1.5 x10⁻⁵ m/s and the third could not be accurately recorded as the water drained too quickly to be measured. For the purposes of devising the required storage capacity for the proposed cellular soakaway units, an average of the two recorded infiltration rates (1.95x10⁻⁵m/s) was used in our calculations. The storage estimate calculations account for all storms up to a 1 in 100 year rainfall event plus a 30% allowance to accommodate climate

change (as is required by clause 'k' of Policy W DM3 in section 3.1 of this report) and an additional safety factor of 3.0.

In accordance with calculation results and standard dimensions of individual units, the prescribed soakaway storage volumes for the additional impermeable areas to the northern and central portions of the site are of 40.5m³ and 8.75m³ respectively. The sizes of these units have been devised using the "Quick Storage Estimate" programme on MicroDrainage. The results of the calculations are attached as part of Appendix F.

Winter ground water table monitoring will be carried out during the winter period and the infiltration system will be upgraded as required.

Surface water runoff will be collected from the proposed canopy into rainwater downpipes and discharged into the existing surface water networks. Runoff from the additional impervious areas to the north of the site will be collected by drainage channels located along the interface between the proposed and existing surfacing, filtered through a petrol interceptor then infiltrated via cellular soakaways. Runoff from the additional impervious areas at the central portions of the site will be collected and filtered through a sponge gulley then infiltrated via cellular soakaways. The proposed drainage layout is included as Appendix G.

Additional information has been provided in the Appendix I which comprises of a filled copy of Arun District Council's Drainage Checklist.

4.4 SuDS Features

The proposed Geolight (or equivalent) attenuation tank includes a perforated/ slotted distribution pipe surrounded by granular material providing filtration and treatment for surface water flows. This in conjunction with the proposed oil separator and a catchpit manhole (silt trap) is considered appropriate for the scale and nature of the development.

Refer to Appendix G for proposed the proposed drainage layout.

4.5 Maintenance Requirements

It is anticipated that a private management company will be employed to maintain the completed drainage network for the development incorporating the following activities and frequency for each SUDS component.

4.5.1 Gullies/Channels/Pipes/Manholes

All components are to be periodically cleaned of foreign particles and silt accumulation, on a quarterly basis. Components located in unadopted areas will be maintained by the landowner. Those located in adopted areas will be maintained by the adopting authority.

4.5.2 Proprietary Systems

Proprietary systems will require routine maintenance by the owner to ensure continuing operation to design performance standards. A typical maintenance schedule is detailed below in table 14.2 from the CIRIA SuDS manual.

TABLE 14.2 An example of operation and maintenance requirements for a proprietary treatment system

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	Six monthly
	Change the filter media	As recommended by manufacturer
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Six monthly
	Inspect filter media and establish appropriate replacement frequencies	Six monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every six months

5 CONCLUSION

The proposed development is centred at National Grid Reference (NGR) 503839, 103654 off Norway Lane, Watersmead Business Park, Toddington, BN17 6GY. The existing site consists of three large warehouse buildings, associated service yards, circulation routes and HGV parking areas.

The development site is relatively flat with ground levels falling in a southerly direction from approximately 5.20m to 4.28m Above Ordnance Datum (AOD).

The proposed development comprises installation of 5 no. 'vehicle-to-ground' lifts and a canopy cover over the associated service yard area for a temporary period of five years, minor alterations to the internal access road, including widening works, creation of a new spur, provision of a pedestrian footbridge, and associated lighting and drainage infrastructure provision.

The site has two fully operational, primary, positive surface water networks, with separate discharge locations. Both networks are assumed to discharge into the pond situated 20m to the east of the site. The proposed increase in impermeable area is 789m². Based on calculations for all storms up to a 1 in 100 year rainfall event with a 30% climate change allowance, a total of 49.75m³ of soakaway storage will be provided to facilitate infiltration.

Winter ground water table monitoring will be carried out during the winter period and the infiltration system will be upgraded as required.

Appendix A – Site Location Plan



GENERAL NOTES

1. DO NOT SCALE THIS DRAWING. WORK ONLY TO FIGURED DIMENSIONS.
2. FOR ALL RELEVANT NOTES, REFER TO STRUCTURAL AND CIVIL ENGINEERING PERFORMANCE SPECIFICATION.
3. ANY DISCREPANCIES ARE TO BE REPORTED TO PINNACLE CONSULTING ENGINEERS IMMEDIATELY.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SUB-CONTRACTORS DRAWINGS AND DETAILS.

LEGEND

— SITE BOUNDARY



TI	FOR TENDER	RW	JJ	01.03.19
REV	DESCRIPTION	BY	CHK	DATE

CLIENT



PROJECT
LITTLEHAMPTON
DBN3 REFURBISHMENT

DRAWING TITLE
SITE LOCATION

PINNACLE
CONSULTING ENGINEERS

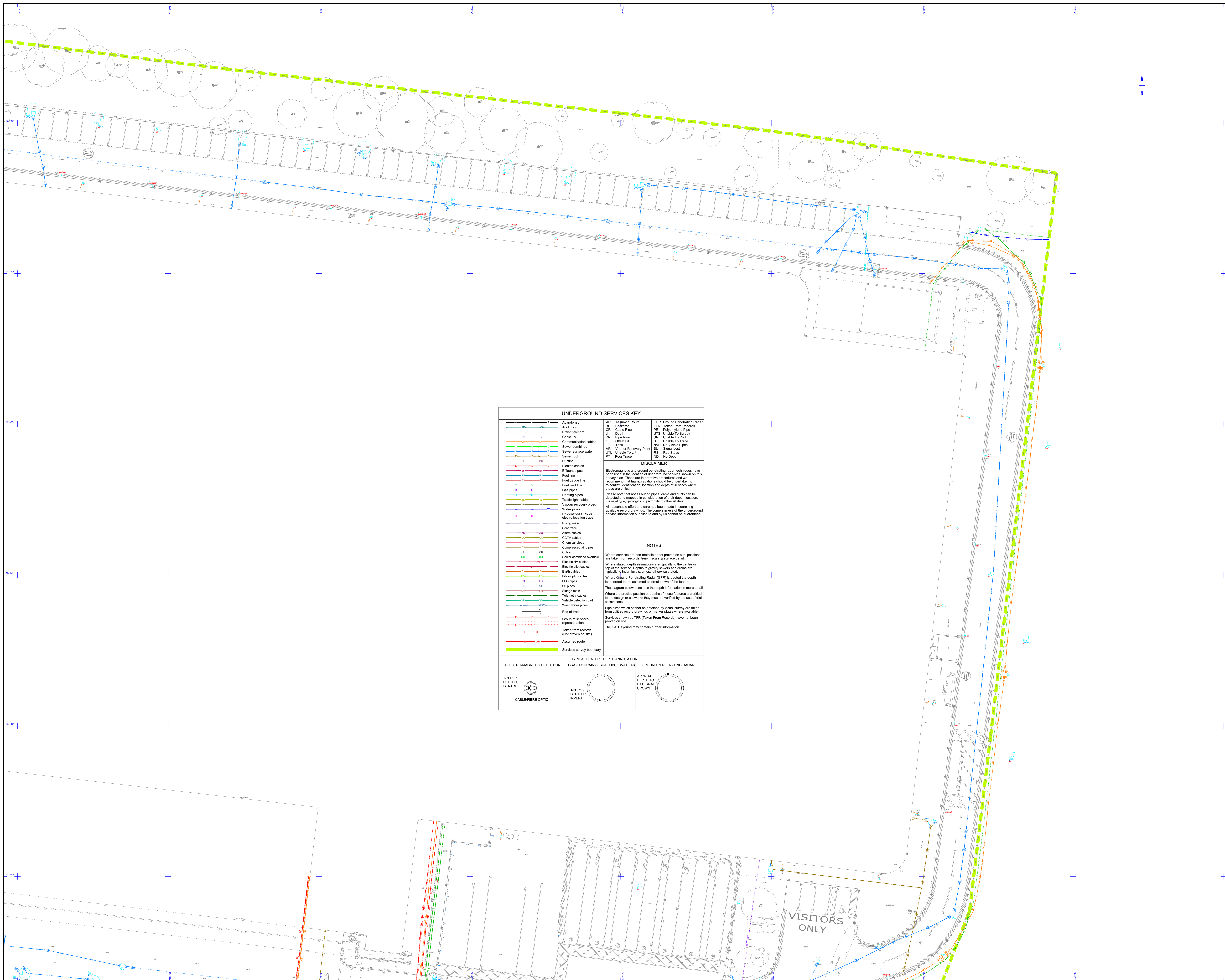
ALCHEMY,
BESSEMER ROAD,
WELWYN GARDEN CITY,
HERTS
AL7 1HE. TELEPHONE: 01707 527 630
NORWICH | LONDON | DUBLIN | THE HAGUE

DRAWING STATUS			
TENDER			
SCALE @ A1 1:2000	DATE FEB '19	DRAWN BY RW	CHECKED JJ
DRG NO. 190213-PIN-00-XX-DR-C-0200	REVISION TI		

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©GOOGLE MAPS 2019

Appendix B – GPR Survey



Survey Notes

Grid: Local Plane Metric related to National Grid at survey control SC2

Levels: Related to OS datum from GNSS positioning,
converted using the National Geoid Model OSGM15.

[illegible]

Sheet Index

1	2
3	4

[illegible]



**MALCOLM
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LAND SURVEYORS**

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Accreditations








Client

SMR ARCHITECTS
FLOOR 2, THE EXCHANGE, STATION PARADE
HARROGATE, HG1 1TS

Project

THE BODY SHOP
NORWAY LANE, WICK
LITTLEHAMPTON BN17 6LS

Drawing No		53168/2		Reason	
Drawn By AP		Survey Date FEBRUARY 2019			
Checked by DJ		Scale AS@ 1:200			

Sheet Index		
1	2	
3	4	

Rev.	Date	Description

Client SMR ARCHITECTS FLOOR 2, THE EXCHANGE, STATION PARADE HARROGATE, HG1 1TS
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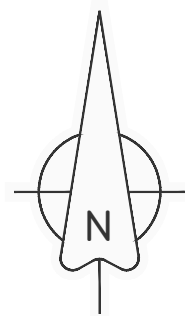
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Drawing Title UNDERGROUND SERVICES
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Drawn By: AP 05/03/19 Checked by: DJ 05/03/19	Survey Date: FEBRUARY 2019 Scale: A0@1:200
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Drawing No: 53168/4	Revision
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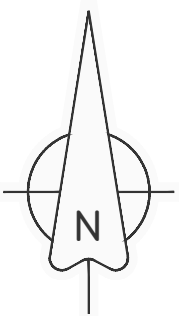
Appendix C – Existing & Proposed Impermeable Areas



EXISTING SITE

TOTAL IMPERMEABLE AREA = 24,647M²

TOTAL PERMEABLE AREA = 2,927M²



PROPOSED SITE

TOTAL IMPERMEABLE AREA = 25,436M²

TOTAL PERMEABLE AREA = 2,132M²

GENERAL NOTES

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LEGEND

- SITE BOUNDARY
- PERMEABLE AREA
- IMPERMEABLE AREA

0 50MM ON A1 DWG. 50

TI	FOR TENDER	AO	JJ	XX.04.19
REV	DESCRIPTION	BY	CHK	DATE

CLIENT

amazonlogistics

PROJECT
LITTLEHAMPTON
DBN3 REFURBISHMENT

DRAWING STATUS
EXISTING AND PROPOSED
IMPERMEABLE AREAS

PINNACLE
CONSULTING ENGINEERS

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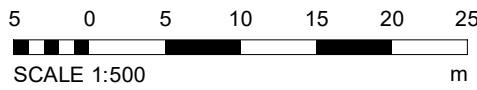
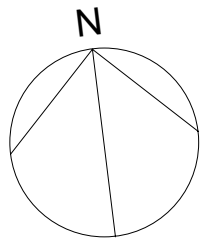
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TENDER			
SCALE @ A1 1:1000	DATE APR'19	DRAWN BY AO	CHECKED JJ
DRG NO. 190213-PIN-00-XX-DR-C-0205	REVISION TI		REF: 190213

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Appendix D – Proposed Development Plans

Do not scale this drawing.
Architects are to be notified of any discrepancies.
Contractors must check all dimensions on site.
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For other information refer to the latest revision of any cross referenced drawings.
To be read in conjunction with relevant design standards/protocols

This is a colour drawing. In order to ensure any subsequent reproduction is viewed correctly it should be printed in full colour.



TREE LIKELY TO REQUIRE ROOT PROTECTION - REFER TO ARBORICULTURIST REPORT / LANDSCAPE PLAN

TREE TO BE FELLED, SUBJECT TO ARBORICULTURIST / LANDSCAPE ARCHITECT CONFIRMATION

EXISTING TARMAC PARKING AREA RETAINED FOR VAN STAGING

EXISTING SOFT LANDSCAPING TO BE REPLACED WITH HGV GRADE TARMAC SURFACE - 750m2

EXISTING KERB LINE CUT BACK TO BE REPLACED WITH HGV GRADE TARMAC - 25m2

ROAD BUILDUP, KERBING, HAUNCH AND DRAINAGE DETAILS TO STRUCTURAL ENGINEER'S DESIGN

EXISTING REDUNDANT OIL TANK - TO BE RELOCATED BY LANDLORD

KERBLINE AMENDED TO ALLOW FOR HGV BYPASS AND ADDITIONAL VAN STAGING

KERB RADIUS MODIFIED TO ALLOW FOR LINE HAUL VEHICLE TO MANOEUVRE

PROPOSED HGV LAYBY

SMOKING SHELTER MOVED TO ALLOW FOR AMENDED KERB LINE

2m HIGH FENCE AND ARMCO TO BE INSTALLED TO SEGREGATE LOADING AREA - 12 LINEAR METRES

NEW PEDESTRIAN CROSSING, REFER TO SMR DRAWING 3007

CYCLE SHELTER TO BE REMOVED AND EXISTING HANDSTANDING TO BE REPAIRED AND MADE GOOD

NEW ARMCO TO PREVENT VEHICLE TRAFFIC ACCESSING DA YARD - 61 LINEAR METRES

EXISTING PLANT REMOVED AND EXISTING WALLS TO BE REPAIRED AND MADE GOOD

2no. ADDITIONAL LEVEL ACCESS DOORS TO BE INSTALLED

NOTE:
AREAS OF NEW WORKS TO RECEIVE NEW VEHICLE PEDESTRIAN BOLLARDS TO NEW DOORS & ARMCO TO ALL NEW WALLS & TEMPORARY STRUCTURES.
ADDITIONAL INFORMATION AVAILABLE ON REQUEST

P3	CONSTRUCTION ISSUE	30.04.19	MB	SR
P2	PEDESTRIAN BRIDGE REPLACED WITH CROSSING	28.03.19	MB	SR
P1	TENDER ISSUE	28.02.19	MB	SR
Rev	Description	Date	Dm	Ckd

Status
CONSTRUCTION

SMR

SMALLEY MARSEY RISPIN

ARCHITECTS

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01423 707 757 admin@smrarchitects.co.uk

Project

DBN3 - NEW COURTWICK LANE, LITTLEHAMPTON

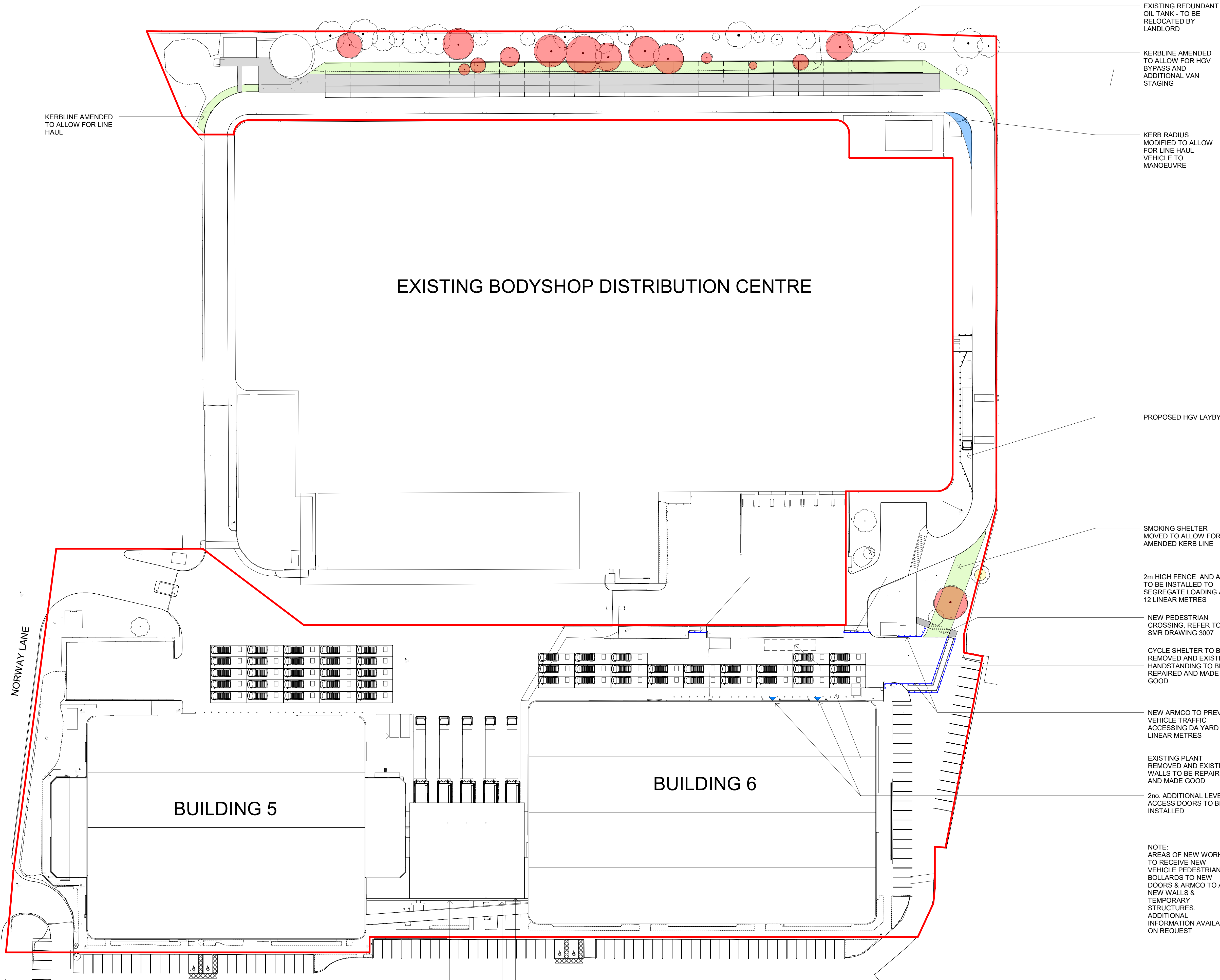
Client

amazonlogistics

Drawing Title

PROPOSED SITE GA

Proj Ref	Origin	Zone	Level	Type	Role	Num	Status	Rev
-- DBN3	- SMR	- 00	- ZZ	- DR	- A	- 3001	- S3	- P3
SMR Job Ref	Sheet	Scale	Drawn					
7260-00-3001	A1	NOTED	MB					



PROPOSED SITE PLAN
1 : 500

600 M2 TEMPORARY BUILDING TO BE INSTALLED BY SPECIALIST TO OFFER ENCLOSED CENTRAL INDUCT. ALLOW 3 HGV LOADING DOORS.

ACCESS TO LANDLORD TO BE PROVIDED

PEDESTRIAN ACCESS TO FACILITATE SERVICE ACCESS TO SOLAR MAINTENANCE.

Appendix E – Infiltration Test Results

Soakaway Infiltration Report

Amazon Littlehampton DBN2

Presented to Pinnacle c/o Amazon

Issued: May 2019

Delta-Simons Project Number: 19-0138.07

Issue No.	Status	Issue Date	Comments	Author	Technical Review	Authorised
1	Final	10 th May 2019	-			
				Gemma Tatton Consultant	Tom Horner Associate	Paul Bennett Unit Director

1.0 Authorisation and Purpose

Delta-Simons Environmental Consultants Limited (Delta-Simons) has been requested by Pinnacle on behalf of Amazon (the "Client") to undertake three BRE365 soakaway tests (SA101 to SA103) to provide information for the suitability and design for soakaways as a drainage solution at Amazon Littlehampton DBN2 (hereafter referred to as the "Site").

2.0 Limitations

No limitations were encountered during the works.

3.0 Context

Delta-Simons has previously completed the following report pertaining to the Site:

- ▲ Short Form Geotechnical Report, Amazon DBN2 Refurbishment, Littlehampton, (Ref. 19-0138.04), dated March 2019.

A review of the Site's published geology and hydrogeology is provided below.

4.0 Desktop Information

From BGS mapping, the Site is indicated to be underlain by superficial River Terrace Deposits, followed by bedrock of the New Pit Chalk Formation. Ground conditions encountered during Delta-Simons previous investigation comprised a thin layer of Made Ground, overlying generally cohesive deposits to a maximum (proven) depth of 2.8 m bgl, followed by Chalk bedrock (encountered as clay in the south of the Site). Groundwater was not encountered during the works.

5.0 Fieldworks and Results

Soakage testing was undertaken in general accordance with BRE Digest 365: Soakaway Design ^[Ref. 1] on 8th and 9th May 2019.

The soakage testing comprised the excavation of three trial pits (SA101 to SA103) to depths of between 1.3 and 1.7 m bgl. The geology of the trial pit locations was logged. A gravel pack and monitoring pipes were then installed in the trial pits and the remaining voids were backfilled with arisings. The remaining spoil was graded back to original ground level.

The gravel pack in the test locations was then filled with water from a water container and the depth to water from ground level recorded at regular intervals.

The soakage test data was recorded and used to calculate the soil infiltration rate for the locations.

5.1 Identified Ground and Groundwater Conditions

Ground conditions encountered in each location comprised the following:

SA101

- ▲ Grass over topsoil comprising of dark brown slightly clayey fine to medium sand with frequent rootlets to a depth of 0.4 m bgl;
- ▲ River Terrace Deposits comprising of soft dark brown slightly sandy clay to a depth of 0.8 m bgl; and
- ▲ River Terrace Deposits comprising of light brown slightly gravelly clayey fine to medium sand, with gravel content comprising of flint, to a depth of 1.6 m bgl.

SA102

- ▲ Topsoil comprising of dark brown slightly gravelly slightly clayey fine to medium sand with rootlets. Gravel content comprised of flint, to a depth of 0.14 m bgl;
- ▲ River Terrace Deposits comprising of soft dark brown slightly sandy clay to a depth of 0.4 m bgl;
- ▲ River Terrace Deposits comprising of soft dark brownish mottled blue clay to a depth of 1.5 m bgl; and
- ▲ River Terrace Deposits comprising of light brown slightly gravelly clayey medium to coarse sand, with gravel content comprising of flint, to a depth of 1.7 m bgl.

SA103

- ▲ Grass over topsoil comprising of dark brown slightly clayey fine to medium sand to a depth of 0.6 m bgl; and
- ▲ New Pit Chalk Formation comprising of white slightly sandy chalk gravel to a depth of 1.3 m bgl.

6.0 Soakage Tests

Test results are provided in Appendix I and summarised in Table 1 below. The approximate locations of the soakage tests/trial pits are shown on Figure 1.

Table 1: Summary of Testing in General Accordance with BRE 365

Soakaway Test Reference Number	Test Depth Range (m bgl)	Infiltration Rate	Geology
SA101	0.6 – 1.6	2.4×10^{-05}	Sand
SA102	0.8 – 1.7	1.5×10^{-05}	Clay and Sand

It was not possible to obtain an infiltration rate in SA103 due to the high rates at which water drained during the test, therefore, this can be interpreted as a very high permeability classification.

7.0 Conclusions

The infiltration testing has been undertaken to a maximum depth of between 1.3 and 1.7 m bgl in sand (SA101), clay and sand (SA102) and chalk (SA103), which is considered to represent the mapped superficial deposits / bedrock geology. Given the nature of the soils encountered, the infiltration tests reached the 25% effective depth over a period of approximately 52 minutes and 1 hour, in SA101 and SA102, respectively. It was not possible to obtain an infiltration rate for SA103 due to the high rates at which the water drained.

As a result, traditional soakaways are considered to be a suitable method of drainage at the Site, provided they are placed within the granular River Terrace Deposits or within the New Pit Chalk Formation.

8.0 References

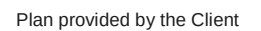
Ref 1: BRE Digest 365: Soakaway Design, BRE 1991.

Enclosed:

Figure 1 Approximate Intrusive Location Plan
Appendix A Soakaway Test Results

Figure 1 – Approximate Intrusive Location Plan

 SA101 BRE365 Soakaway



TITLE: Approximate Intrusive Location Plan
Amazon Littlehampton DBN2

DRAWN BY: GT	SCALE: NTS	PROJECT NO: 19-0138.07
CHECKED BY: TH	REVISION: -	FIGURE NO: 1
DATE: 9 th May 2019		

Appendix A – Soakaway Test Results

	units	Infill 1	Infill 2	Infill 3
Length	m	1.80		
Width	m	0.55		
Depth	m	1.60		
Gravel type		20mm single size		
Voids ratio		0.40		
Resting groundwater level at time of testing	m	0.00		
Depth of first reading	m	0.61	0.66	0.61
Depth of final reading	m	1.60	1.60	1.60
Did soakage test reach 25% of maximum fill depth?		Yes	Yes	Yes
Did soakage test reach near empty?		Yes	Yes	Yes
Depth at 75% full/effective depth	m	0.86	0.90	0.86
Depth at 25% full/effective depth	m	1.35	1.37	1.35
Time at 75% full/effective depth	mins	5.44	9.50	10.58
Time at 25% full/effective depth	mins	23.30	40.92	52.16
Vp75 - 25 (volume outflowing between 75% and 25% full/effective depth)	m ³	0.20	0.19	0.20
Mean surface area for outflow (50% full/effective depth)	m ²	3.32	3.20	3.32
tp75 (time for the water level to fall from 75% to 25% full/effective depth)	mins	17.87	31.42	41.58
Soil infiltration rate, f =	m/s	0.00005514	0.00003087	0.00002369
or	m/s	5.5E-05	3.1E-05	2.4E-05

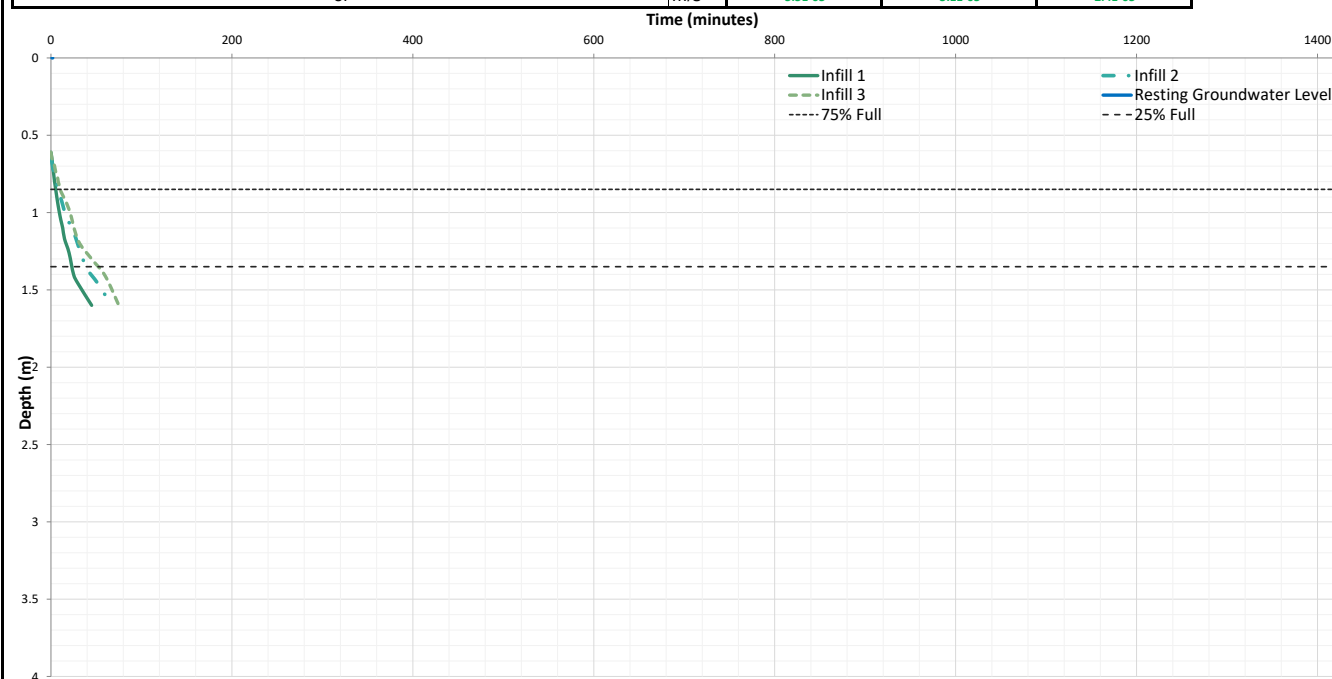
Recommended soil infiltration rate

2.4E-05

m/s

Note:

Where water level reaches nearly empty (5% full), soil infiltration based on 'Full' depth. Where water level did not reach nearly empty (5% full), soil infiltration rate is based on 'Effective' drainage achieved only. Where water level did not fall below 25% of the maximum fill level, this is considered to be a 'Failed' test.



LOG	DEPTH (m)	BACKFILL	DEPTH (m)
Dark brown slightly clayey sand with frequent fine rootlets	0.0	Arisings	0.0
Dark brown slightly sandy CLAY	0.4		
		Gravel	0.6
Light brown slightly gravelly clayey SAND	0.8		
	1.6		1.6



TITLE: Soakaway Test Results
Amazon Littlehampton DBN2
Amazon

In accordance with BRE Digest 365 (2016)

DRAWN BY: CB
CHECKED BY: SS
DATE: 09/05/2019
SCALE: Not to Scale
REVISION: 1

PROJECT NUMBER:
19-0138.07
SOAKAWAY NUMBER:
SA101

	units	Infill 1	Infill 2	Infill 3
Length	m	1.04		
Width	m	0.50		
Depth	m	1.70		
Gravel type		20mm single size		
Voids ratio		0.40		
Resting groundwater level at time of testing	m	0.00		
Depth of first reading	m	0.84	0.81	0.81
Depth of final reading	m	1.65	1.65	1.65
Did soakage test reach 25% of maximum fill depth?		Yes	Yes	Yes
Did soakage test reach near empty?		No	No	No
Depth at 75% full/effective depth	m	1.04	1.02	1.02
Depth at 25% full/effective depth	m	1.45	1.44	1.44
Time at 75% full/effective depth	mins	8.63	10.80	17.78
Time at 25% full/effective depth	mins	34.38	64.67	27.92
Vp75 - 25 (volume outflowing between 75% and 25% full/effective depth)	m ³	0.08	0.09	0.09
Mean surface area for outflow (50% full/effective depth)	m ²	1.77	1.81	1.81
tp75 (time for the water level to fall from 75% to 25% full/effective depth)	mins	25.75	53.87	10.15
Soil infiltration rate, f =	m/s	0.00003085	0.00001490	0.00007913
or	m/s	3.1E-05	1.5E-05	7.9E-05

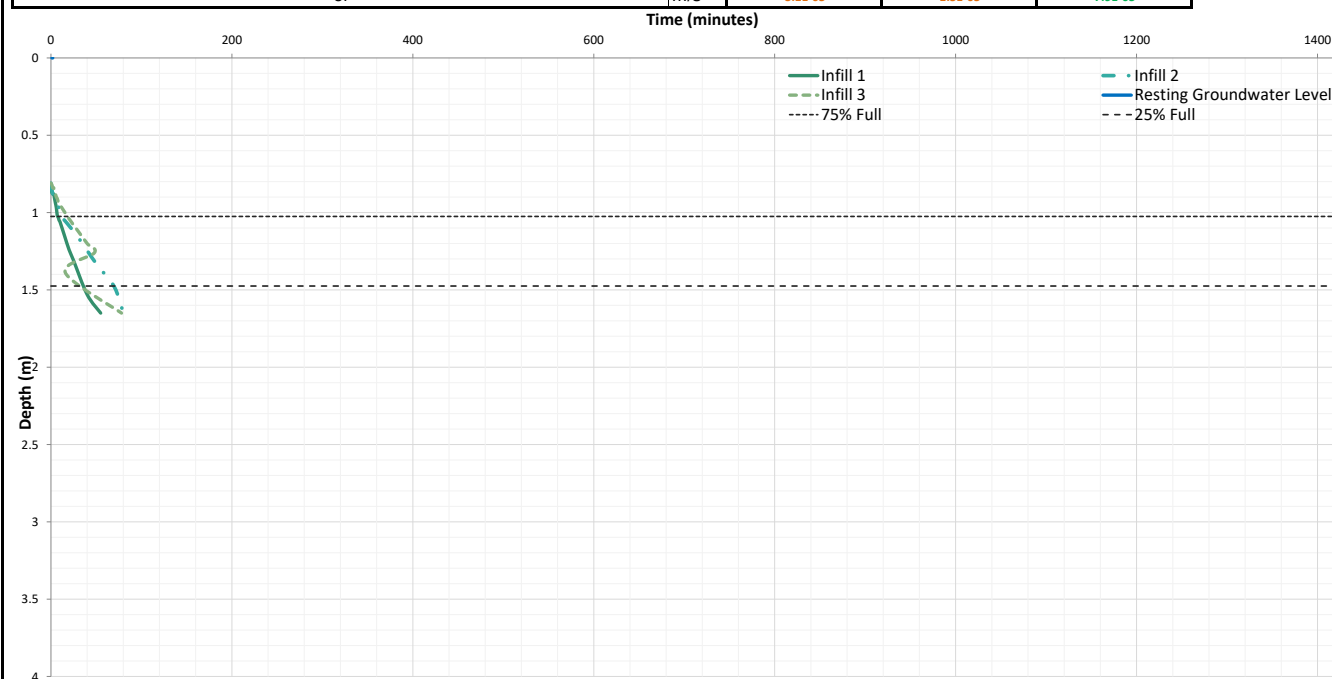
Recommended soil infiltration rate

1.5E-05

m/s

Note:

Where water level reaches nearly empty (5% full), soil infiltration based on 'Full' depth. Where water level did not reach nearly empty (5% full), soil infiltration rate is based on 'Effective' drainage achieved only. Where water level did not fall below 25% of the maximum fill level, this is considered to be a 'Failed' test.



LOG	DEPTH (m)	BACKFILL	DEPTH (m)
Dark brown slightly gravelly slightly clayey sand	0.0	Arisings	0.0
Dark brown slightly sandy CLAY	0.2		
Dark brownish mottled blue CLAY	0.4		
		Gravel	0.8
Light brown slightly gravelly clayey SAND	1.5		
	1.7		1.7



TITLE: Soakaway Test Results
Amazon Littlehampton DBN2
Amazon

In accordance with BRE Digest 365 (2016)

DRAWN BY: CB
CHECKED BY: SS
DATE: 09/05/2019
SCALE: Not to Scale
REVISION: 1

PROJECT NUMBER: 19-0138.07
SOAKAWAY NUMBER: SA102

Appendix F – Drainage Calculations

North Soakaway Storage Calculations

Quick Storage Estimate

Micro Drainage

Variables

FSR Rainfall

Return Period (years)

Region

Map

Ratio R

Cv (Summer)

Cv (Winter)

Impermeable Area (ha)

Maximum Allowable Discharge (l/s)

Infiltration Coefficient (m/hr)

Safety Factor

Climate Change (%)

Analyse OK Cancel Help

Enter Infiltration Coefficient between 0.00000 and 100000.00000

Quick Storage Estimate

Micro Drainage

Results

Global Variables require approximate storage of between 92 m³ and 92 m³.

With Infiltration storage is reduced to between 17 m³ and 48 m³.

These values are estimates only and should not be used for design purposes.

Analyse OK Cancel Help

Enter Infiltration Coefficient between 0.00000 and 100000.00000

Central Soakaway Storage Calculations

Quick Storage Estimate

Micro Drainage

Variables

FSR Rainfall

Return Period (years)

Region

Map

Ratio R

Cv (Summer)

Cv (Winter)

Impervious Area (ha)

Maximum Allowable Discharge (l/s)

Infiltration Coefficient (m/hr)

Safety Factor

Climate Change (%)

Analyse OK Cancel Help

Enter Climate Change between -100 and 600

Quick Storage Estimate

Micro Drainage

Results

Global Variables require approximate storage of between 20 m³ and 20 m³.

With Infiltration storage is reduced to between 3.8 m³ and 10 m³.

These values are estimates only and should not be used for design purposes.

Analyse OK Cancel Help

Enter Climate Change between -100 and 600

Half Drain Time for 1 in 10year Event Plus Climate Change

North Soakaway Storage Unit



Results

Results are presented in paired rows. These represent maximum and minimum storage requirements for each size of structure.

Depth (m)	Net Vol (m³)	Surface Area (m²)	Ex/Fill Vol (m³)	Half Drain (mins)
0.2	19.9	104.9	21.0	314
	17.2	90.5	18.1	313
0.3	20.7	72.6	21.8	415
	19.1	67.2	20.1	414
0.4	21.7	57.2	22.9	515
	20.3	53.5	21.4	514
0.6	23.6	41.4	24.8	702
	22.6	39.6	23.8	700
1.0	25.9	27.3	27.3	1011
	25.0	26.3	26.3	1007
1.5	27.7	19.5	29.2	1288
	26.3	18.5	27.7	1277
2.0	28.8	15.2	30.3	1469
	27.2	14.3	28.6	1451

Variables

Results

2D Graphs

3D Graphs

Structures

Pollution

Analyse

OK

Cancel

Help



Variables

Rainfall and Runoff

FEH Rainfall v

Return Period (years) 10

Version 1999 v ...

Site GB 504150 103950 TQ 04150 03950

C (1km) -0.026

D3 (1km) 0.404

D1 (1km) 0.387

E (1km) 0.313

D2 (1km) 0.278

F (1km) 2.347

Cv (Summer) 0.750

Cv (Winter) 0.840

Impermeable Area (ha) 0.064

Climate Change (%) 30

Infiltration Structure

Cellular Storage v

Infiltration Coefficient Base (m/hr) 0.07020

Infiltration Coefficient Side (m/hr) 0.07020

Safety Factor 3.0

Porosity 0.95

☒ With Outflow
 Maximum Discharge (l/s) 0.0

Variables

Results

2D Graphs

3D Graphs

Structures

Pollution

Cerntal Soakaway Storage Unit



Results

Results are presented in paired rows. These represent maximum and minimum storage requirements for each size of structure.

Depth (m)	Net Vol (m³)	Surface Area (m²)	Ex/Fill Vol (m³)	Half Drain (mins)
0.2	4.3	22.7	4.5	302
	3.7	19.6	3.9	301
0.3	4.4	15.6	4.7	391
	4.1	14.3	4.3	389
0.4	4.7	12.3	4.9	475
	4.3	11.4	4.6	472
0.6	5.1	8.9	5.3	617
	4.7	8.3	5.0	612
1.0	5.5	5.8	5.8	812
	5.1	5.4	5.4	801
1.5	5.9	4.1	6.2	937
	5.4	3.8	5.7	918
2.0	6.0	3.2	6.3	985
	5.4	2.9	5.7	956

Variables

Results

2D Graphs

3D Graphs

Structures

Pollution

Analyse OK Cancel Help

Enter Area between 0.000 and 999.999

Source Control, A.P.T. | 2017.1.2



Variables

Rainfall and Runoff

FEH Rainfall v

Return Period (years)

Version 1999 v ...

Site

C (1km) D3 (1km)

D1 (1km) E (1km)

D2 (1km) F (1km)

Cv (Summer)

Cv (Winter)

Impermeable Area (ha)

Climate Change (%)

Infiltration Structure

Cellular Storage v

Infiltration Coefficient Base (m/hr)

Infiltration Coefficient Side (m/hr)

Safety Factor

Porosity

☒ With Outflow
 Maximum Discharge (l/s)

Variables

Results

2D Graphs

3D Graphs

Structures

Pollution

Half Drain Time for 1 in 100year Event Plus Climate Change

North Soakaway Storage Unit



Results

Results are presented in paired rows. These represent maximum and minimum storage requirements for each size of structure.

Depth (m)	Net Vol (m³)	Surface Area (m²)	Ex/Fill Vol (m³)	Half Drain (mins)
0.2	36.5	192.1	38.4	317
	32.6	171.5	34.3	316
0.3	37.7	132.4	39.7	421
	35.3	123.9	37.2	420
0.4	39.4	103.6	41.4	525
	37.6	99.0	39.6	525
0.6	42.8	75.1	45.0	724
	41.5	72.7	43.6	723
1.0	47.0	49.5	49.5	1069
	45.7	48.1	48.1	1067
1.5	49.6	34.8	52.2	1400
	48.0	33.7	50.5	1394
2.0	51.3	27.0	54.0	1639
	49.4	26.0	51.9	1628

Variables

Results

2D Graphs

3D Graphs

Structures

Pollution



Variables

Rainfall and Runoff

FEH Rainfall

Return Period (years)

Version

Site

C (1km) D3 (1km)

D1 (1km) E (1km)

D2 (1km) F (1km)

Cv (Summer)

Cv (Winter)

Impermeable Area (ha)

Climate Change (%)

Infiltration Structure

Cellular Storage

Infiltration Coefficient Base (m/hr)

Infiltration Coefficient Side (m/hr)

Safety Factor

Porosity

☒ With Outflow

Maximum Discharge (l/s)

Variables

Results

2D Graphs

3D Graphs

Structures

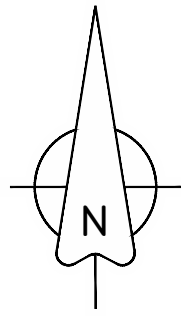
Pollution

Cerntal Soakaway Storage Unit

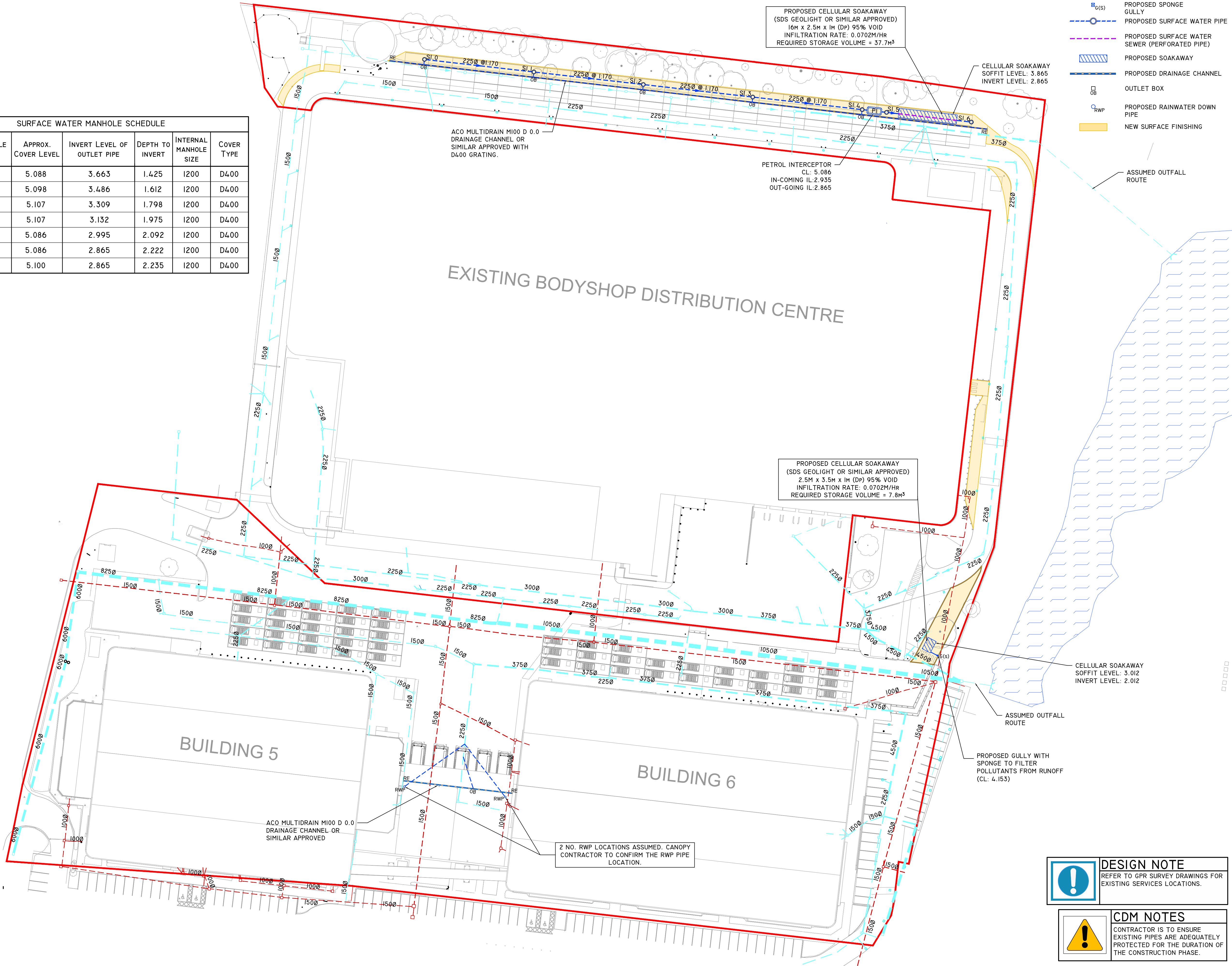
	Results				
	Results are presented in paired rows. These represent maximum and minimum storage requirements for each size of structure.				
	Depth (m)	Net Vol (m³)	Surface Area (m²)	Ex/Fill Vol (m³)	Half Drain (mins)
	0.2	8.0	42.0	8.4	308
		7.2	37.9	7.6	307
	0.3	8.3	29.0	8.7	403
		7.7	26.9	8.1	401
	0.4	8.5	22.5	9.0	493
		8.2	21.5	8.6	492
	0.6	9.2	16.1	9.6	655
		8.8	15.4	9.2	652
	1.0	10.0	10.5	10.5	896
		9.5	10.0	10.0	888
	1.5	10.6	7.4	11.1	1076
		9.9	7.0	10.5	1061
	2.0	10.9	5.7	11.5	1169
		10.1	5.3	10.6	1145
Variables					
Results					
2D Graphs					
3D Graphs					
Structures					
Pollution					

	Variables	
	Rainfall and Runoff	
	FEH Rainfall	
	Return Period (years)	100
	Version	1999
	Site	GB 504150 103950 TQ 04150 03950
	C (1km)	-0.026
	D3 (1km)	0.404
	D1 (1km)	0.387
	E (1km)	0.313
	D2 (1km)	0.278
	F (1km)	2.347
	Cv (Summer)	0.750
	Cv (Winter)	0.840
	Impemeable Area (ha)	0.014
	Climate Change (%)	30
	Infiltration Structure	
	Cellular Storage	
	Infiltration Coefficient Base (m/hr)	0.07020
	Infiltration Coefficient Side (m/hr)	0.07020
	Safety Factor	3.0
	Porosity	0.95
	☒ With Outflow	
	Maximum Discharge (l/s)	0.0
Variables		
Results		
2D Graphs		
3D Graphs		
Structures		
Pollution		

Appendix G – Proposed Drainage Strategy



SURFACE WATER MANHOLE SCHEDULE						
MANHOLE REF	MANHOLE TYPE	APPROX. COVER LEVEL	INVERT LEVEL OF OUTLET PIPE	DEPTH TO INVERT	INTERNAL MANHOLE SIZE	COVER TYPE
SI.0	PCC	5.088	3.663	1.425	I200	D400
SI.1	PCC	5.098	3.486	1.612	I200	D400
SI.2	PCC	5.107	3.309	1.798	I200	D400
SI.3	PCC	5.107	3.132	1.975	I200	D400
SI.4	PCC	5.086	2.995	2.092	I200	D400
SI.5	PCC	5.086	2.865	2.222	I200	D400
SI.6	PCC	5.100	2.865	2.235	I200	D400



LEGEND

- SITE BOUNDARY
- EXISTING PRIVATE FOUL WATER SEWER
- EXISTING PRIVATE SURFACE WATER SEWER
- PROPOSED SPONGE GULLY
- PROPOSED SURFACE WATER PIPE
- PROPOSED SURFACE WATER SEWER (PERFORATED PIPE)
- PROPOSED SOAKAWAY
- PROPOSED DRAINAGE CHANNEL
- OUTLET BOX
- PROPOSED RAINWATER DOWN PIPE
- NEW SURFACE FINISHING

GENERAL NOTES

- DO NOT SCALE THIS DRAWING. WORK ONLY TO FIGURED DIMENSIONS.
- FOR ALL RELEVANT NOTES, REFER TO STRUCTURAL AND CIVIL ENGINEERING PERFORMANCE SPECIFICATION.
- ANY DISCREPANCIES ARE TO BE REPORTED TO PINNACLE CONSULTING ENGINEERS IMMEDIATELY.
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SUB-CONTRACTORS DRAWINGS AND DETAILS.

DRAINAGE NOTES

- CONTRACTOR TO CONFIRM THE APPROVAL FOR THE TYPE OF PIPE AND BEDDING BEING USED WITH THE PERMITTING AUTHORITY PRIOR TO ANY CONSTRUCTION COMMENCING.
- ANY TRAFFIC MANAGEMENT REQUIRED TO UNDERTAKE WORKS IN THE PUBLIC HIGHWAY MUST BE APPROVED BY THE LOCAL AUTHORITY PRIOR TO THESE WORKS COMMENCING.
- ALL WORKS IN THE PUBLIC HIGHWAY MUST BE CARRIED OUT WITH THE PRIOR APPROVAL AND TO THE SATISFACTION OF THE LOCAL AUTHORITY.
- THE CONTRACTOR IS TO LIAISE WITH THE WATER AUTHORITY ENGINEER, AFFORDING THEM REASONABLE NOTICE TO INSPECT THE WORKS DURING CONSTRUCTION.
- THE CONTRACTOR IS TO ALLOW FOR JET WASHING ALL LENGTHS OF EXISTING SEWERS WHICH ARE TO BE RETAINED.
- ALL PRIVATE DRAINAGE WORKS TO BE IN ACCORDANCE WITH BS EN 752.
- THE CONTRACTOR MUST CHECK THE LEVELS AND CONDITION OF ALL EXISTING MANHOLES AND DRAINAGE OUTFALLS PRIOR TO CONSTRUCTION OF ANY DRAINAGE, UNLESS OTHERWISE AGREED, TO ENSURE THE PROPOSED DESIGN MAY BE ACHIEVED. ANY DISCREPANCIES MUST BE REPORTED TO PINNACLE IMMEDIATELY.
- ALL RWP POSITIONS ARE TO BE CONFIRMED BY THE ARCHITECT.
- WHERE RWPS ARE CONNECTED DIRECT TO THE DRAIN, RODDING ACCESS PLATES ARE TO BE PROVIDED.
- CONTRACTOR IS TO ALLOW FOR ALL ABANDONED DRAINAGE RUNS AND MANHOLES / SOAKAWAYS TO BE FULLY GROUTED UP OR REMOVED AS NECESSARY.
- ALL BURIED MANHOLES TO BE REINSTATED AND INVERT LEVELS SUPPLIED TO PINNACLE. MANHOLE COVERS ARE TO BE BROUGHT UP TO THE REQUIRED LEVELS.
- ALL GULLIES TO BE SET 5MM LOWER THAN THE PROPOSED FINISHED LEVELS.
- ALL SURFACE WATER AND RAIN WATER PIPEWORK TO BE Ø150MM, LAID TO A MINIMUM FALL OF 1 IN 100 U.N.O.

0 50MM ON A1 DWG. 50

C2	FOR CONSTRUCTION	AO	JJ	16.05.19
C1	FOR CONSTRUCTION	AO	JJ	02.05.19
P03	FOR INFORMATION	AO	AQ	01.05.19
P02	FOR INFORMATION	AO	JJ	16.04.19
P01	FOR INFORMATION	AO	JJ	15.04.19
T1	FOR TENDER	RW	JJ	01.03.19
REV	DESCRIPTION	BY	CHK	DATE

CLIENT



PROJECT
LITTLEHAMPTON
DBN3 REFURBISHMENT

DRAWING TITLE
PROPOSED DRAINAGE
STRATEGY

PINNACLE
CONSULTING ENGINEERS

ALCHEMY,
BESSEMER ROAD,
WELWYN GARDEN CITY,
HERTS.
AL7 1HE. TELEPHONE: 01707 527 630
NORWICH | LONDON | DUBLIN | THE HAGUE

DRAWING STATUS			
CONSTRUCTION			
SCALE @ A1	DATE	DRAWN BY	CHECKED
1:500	FEB '19	RW	JJ
DRG NO.	REVISION		
190213-PIN-00-XX-DR-C-0220	C2		

COPYRIGHT PINNACLE



DESIGN NOTE
REFER TO GPR SURVEY DRAWINGS FOR EXISTING SERVICES LOCATIONS.



CDM NOTES
CONTRACTOR IS TO ENSURE EXISTING PIPES ARE ADEQUATELY PROTECTED FOR THE DURATION OF THE CONSTRUCTION PHASE.

Appendix H –Drainage Construction Details

1. DO NOT SCALE THIS DRAWING. WORK ONLY TO FIGURED DIMENSIONS.
2. FOR ALL RELEVANT NOTES, REFER TO STRUCTURAL AND CIVIL ENGINEERING PERFORMANCE SPECIFICATION.
3. ANY DISCREPANCIES ARE TO BE REPORTED TO PINNACLE CONSULTING ENGINEERS IMMEDIATELY.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SUB-CONTRACTORS DRAWINGS AND DETAILS.

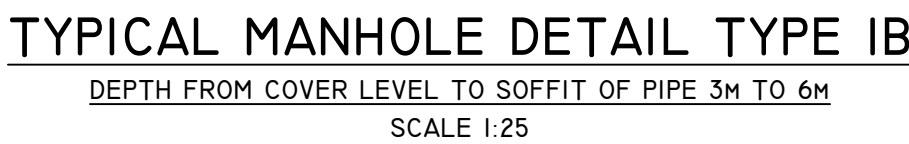
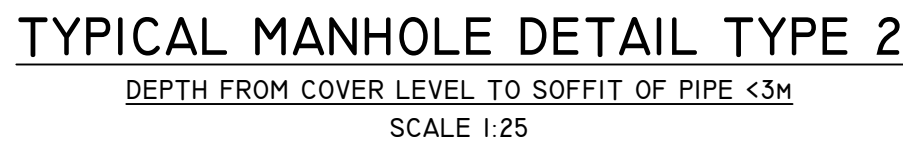


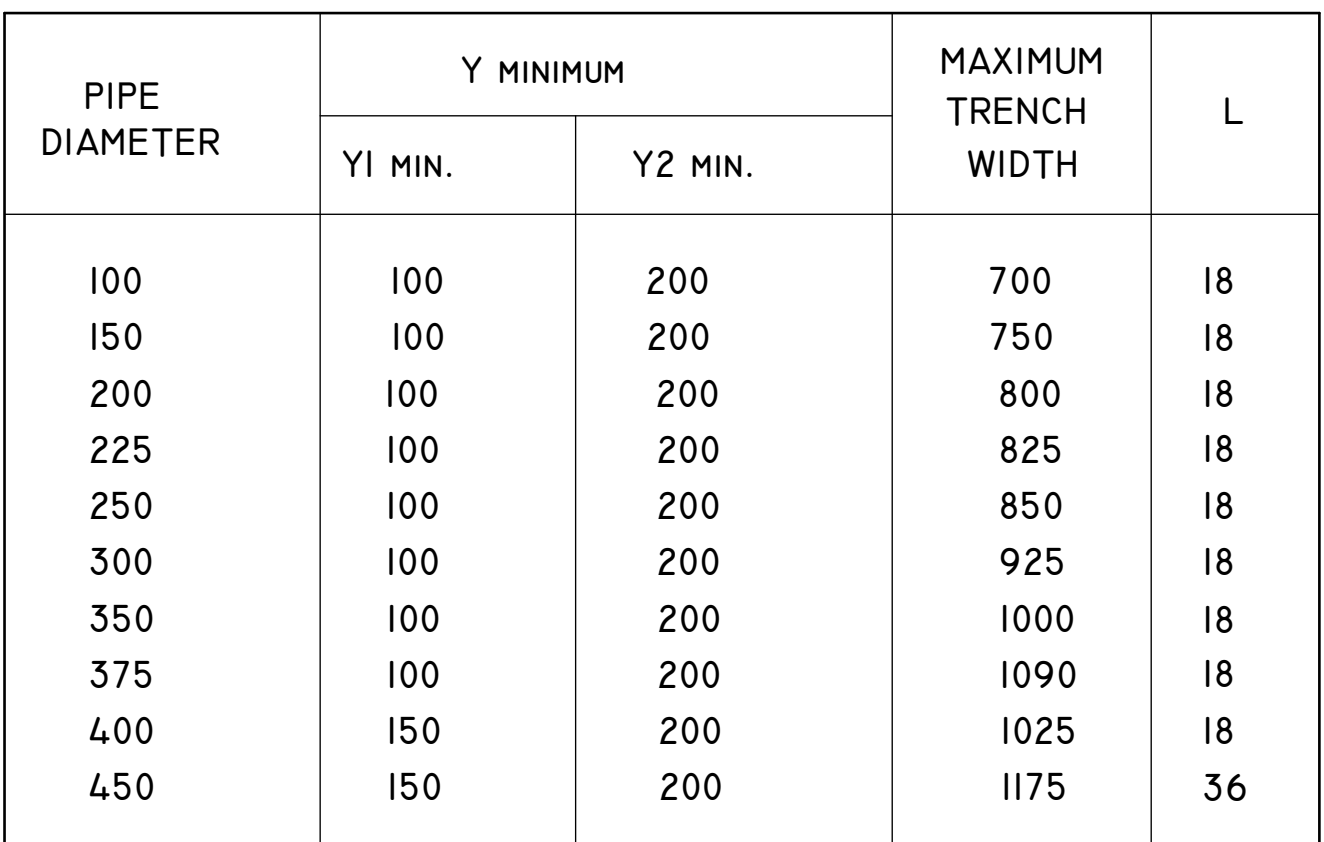
Diagram illustrating the internal structure of a 4-way manhole. The diagram shows a circular manhole with four preformed swept channels leading to four rigid pipes. The pipes are labeled: "ROCKER PIPE REQUIRED FOR RIGID PIPES." and "MINIMUM WIDTH OF BENCHING TO BE 225MM." The junction is labeled: "NO JUNCTION LESS THAN 90° FROM OUTGOING SEWER." The manhole is labeled: "PREFORMED SWEEP CHANNELS." and "INTERNAL INTERNAL MANHOLE (MM)".

INTERNAL INTERNAL MANHOLE (MM)
00
50
00
00
00
ATER + 900

VE A
HE
E LENGTH

RIGID PIPES BUILT INTO MANHOLE SHOULD HAVE A FLEXIBLE JOINT AS CLOSE AS FEASIBLE TO THE EXTERNAL FACE OF THE STRUCTURE AND THE LENGTH OF THE NEXT ROCKER PIPE SHOULD BE AS SHOWN,

ALL PIPES ENTERING THE BOTTOM OF
THE MANHOLE TO HAVE SOFFITS LEVEL



0 50MM ON AI DWG. 50

amazon logistics

DRAWING TITLE

DRAINAGE CONSTRUCTION
DETAILS SHEET I

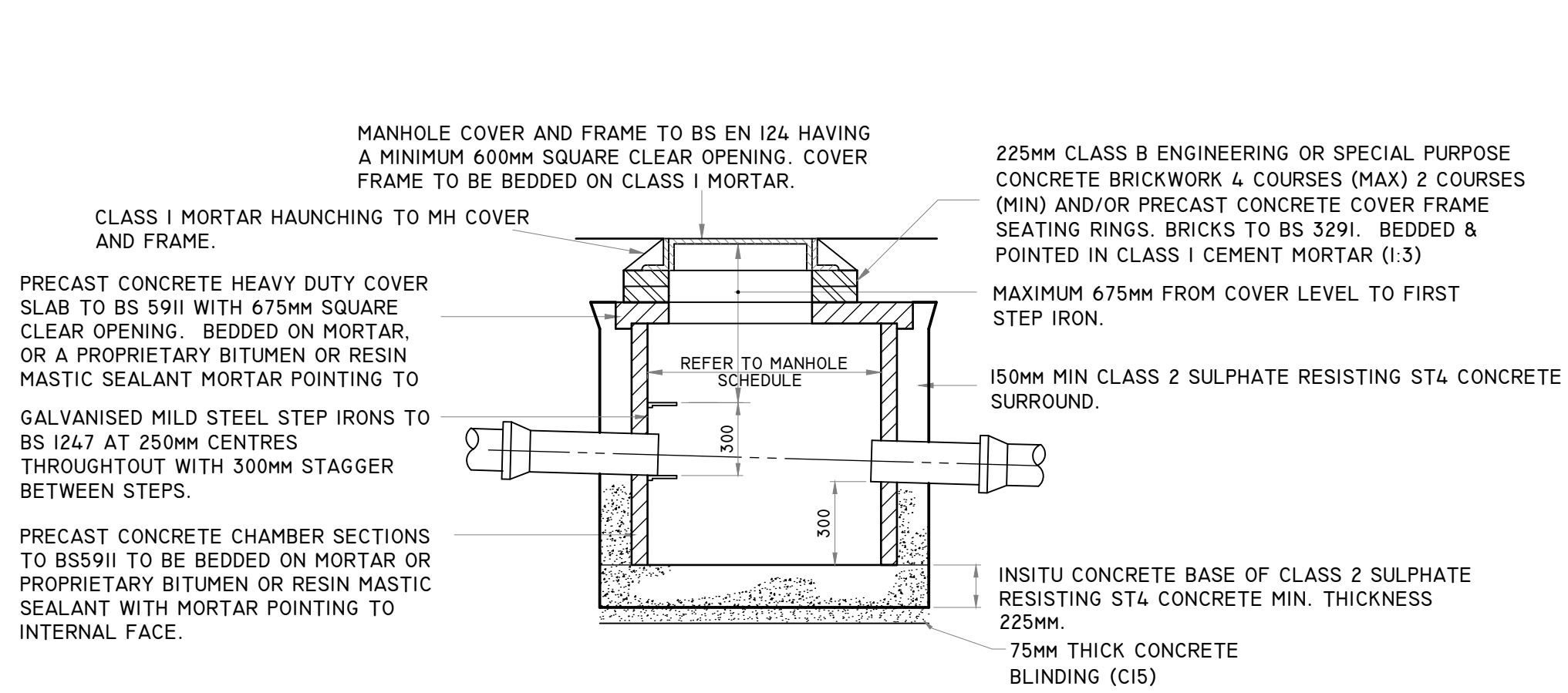
ALCHEMY,
ESSEMER ROAD,
WELWYN GARDEN CITY,
ERTS,
L7 1HE. TELEPHONE: 01707 527 630

OPYRIGHT PINNACLE



NOT TO SCALE

GRANULAR BEDDING & SIDEFILL MATERIALS FOR RIGID + FLEXIBLE PIPES



CEMENT MORTAR JOINT

DOWNPIPE UP TO A MAX OF 110MM O.D.

ACCESS GULLY WITH INTEGRAL VERTICAL BACK INLET, CODE SUPERSLEVE 191A

410

20

175

315

WHERE RWP LESS THAN 100MM DIAMETER PIPEWORK FROM ACCESS GULLY TO BE 100MM DIAMETER.
IF RWP 100MM DIAMETER OR GREATER, PIPEWORK FROM ACCESS GULLY TO BE INCREASED TO 150MM DIA. USING A TAPER PIPE

SUPERSLEVE COUPLING (POLYPROPYLENE)

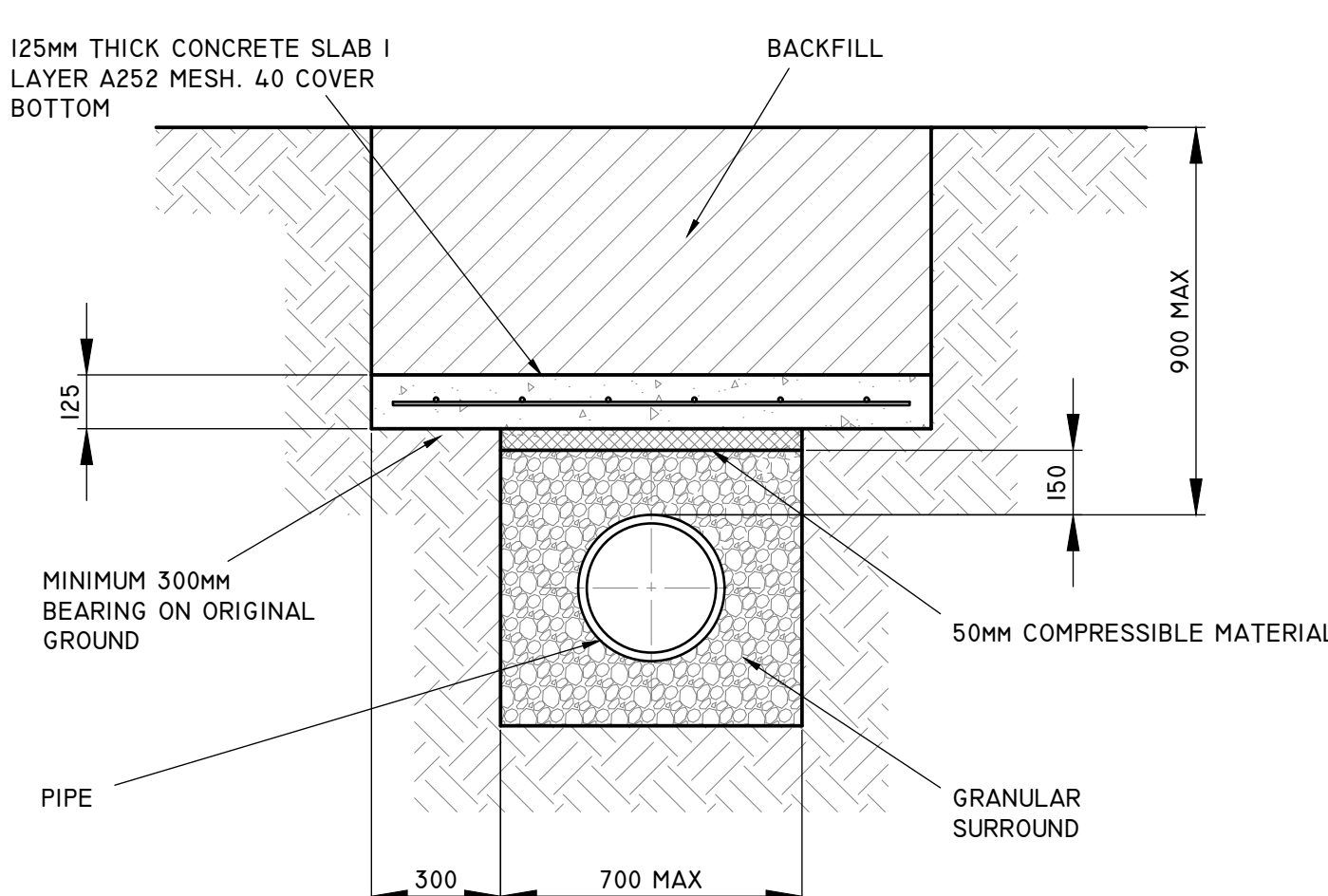
PLASTIC STOPPER

BED AND SURROUND TO SPECIFICATION AND STANDARD DETAILS

GENERAL NOTES

1. DO NOT SCALE THIS DRAWING. WORK ONLY TO FIGURED DIMENSIONS.
2. FOR ALL RELEVANT NOTES, REFER TO STRUCTURAL AND CIVIL ENGINEERING PERFORMANCE SPECIFICATION.
3. ANY DISCREPANCIES ARE TO BE REPORTED TO PINNACLE CONSULTING ENGINEERS IMMEDIATELY.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SUB-CONTRACTORS DRAWINGS AND DETAILS. LI

SCALE 1:25



GROUND LEVEL

SUITABLE COMPACTED SUB-BASE FILL TO SPEC.

GEOCOMPOSITE VENT 20X150MM

WATERPROOF MEMBRANE AND GEOTEXTILE CARRIED OVER GRANULAR FILL.

TOP OF TANK ∇ VARIES

GEOTEXTILE BETWEEN GEOLIGHTTM AND GRANULAR FILL

GRANULAR 15/25 GRADED FILL FREE FINES

NON WOVEN GEOTEXTILE, CODE SDS20.

TANK I.L. VARIES ∇

BACKFILL USING SUITABLE ON SITE MATERIAL

GRANULAR BEDDING OR SELECTED BACKFILL MATERIAL.

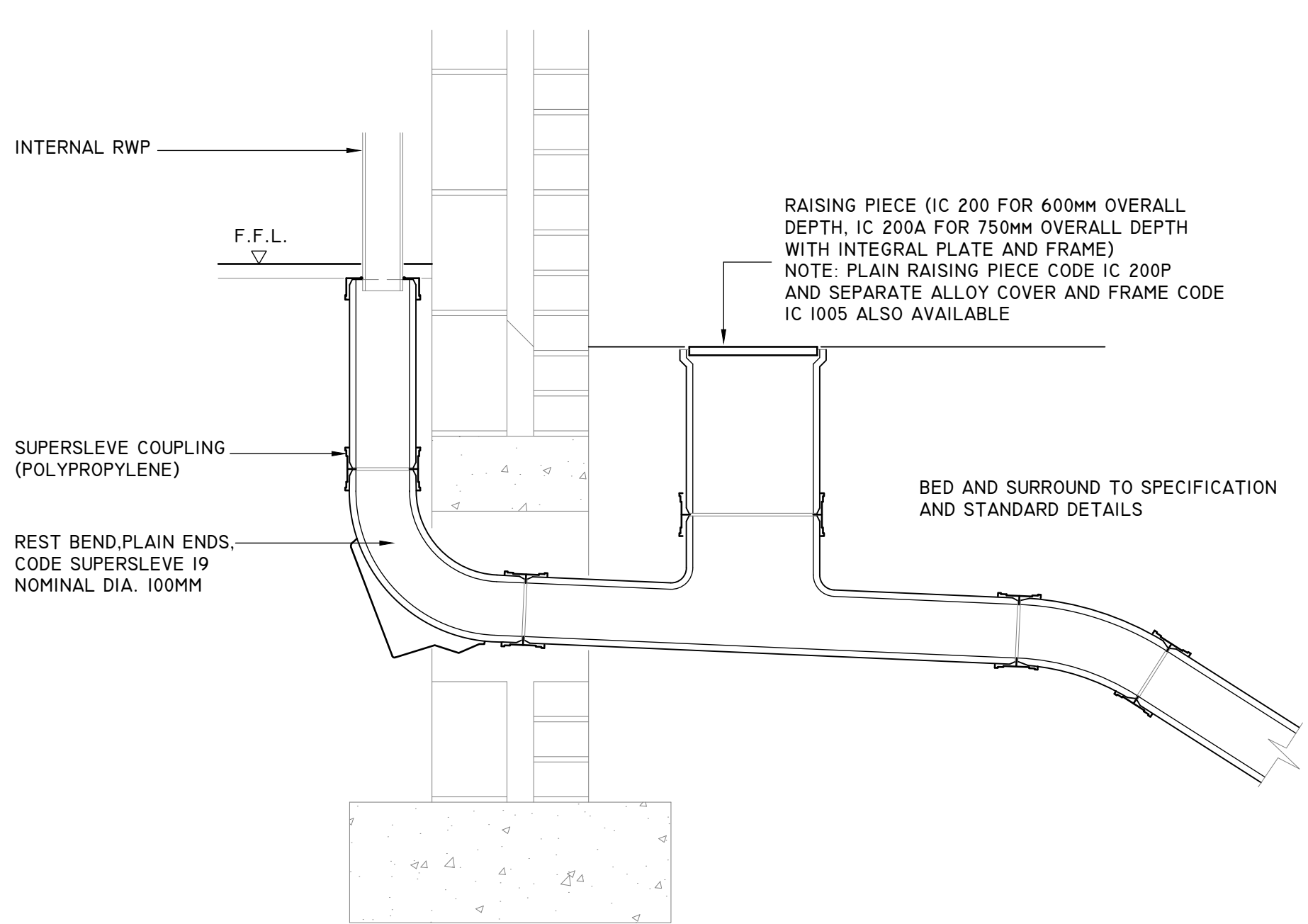
DISTRIBUTION PIPE (APPROX 4% OF SURFACE AREA SLOTTED) WRAPPED IN SDS SPECIFICATION GEOTEXTILE.

WATERPROOF MEMBRANE MIN 435 G/M², CODE GM400 INSIDE AND NON-WOVEN GEOTEXTILE, CODE SDS20 OUTSIDE

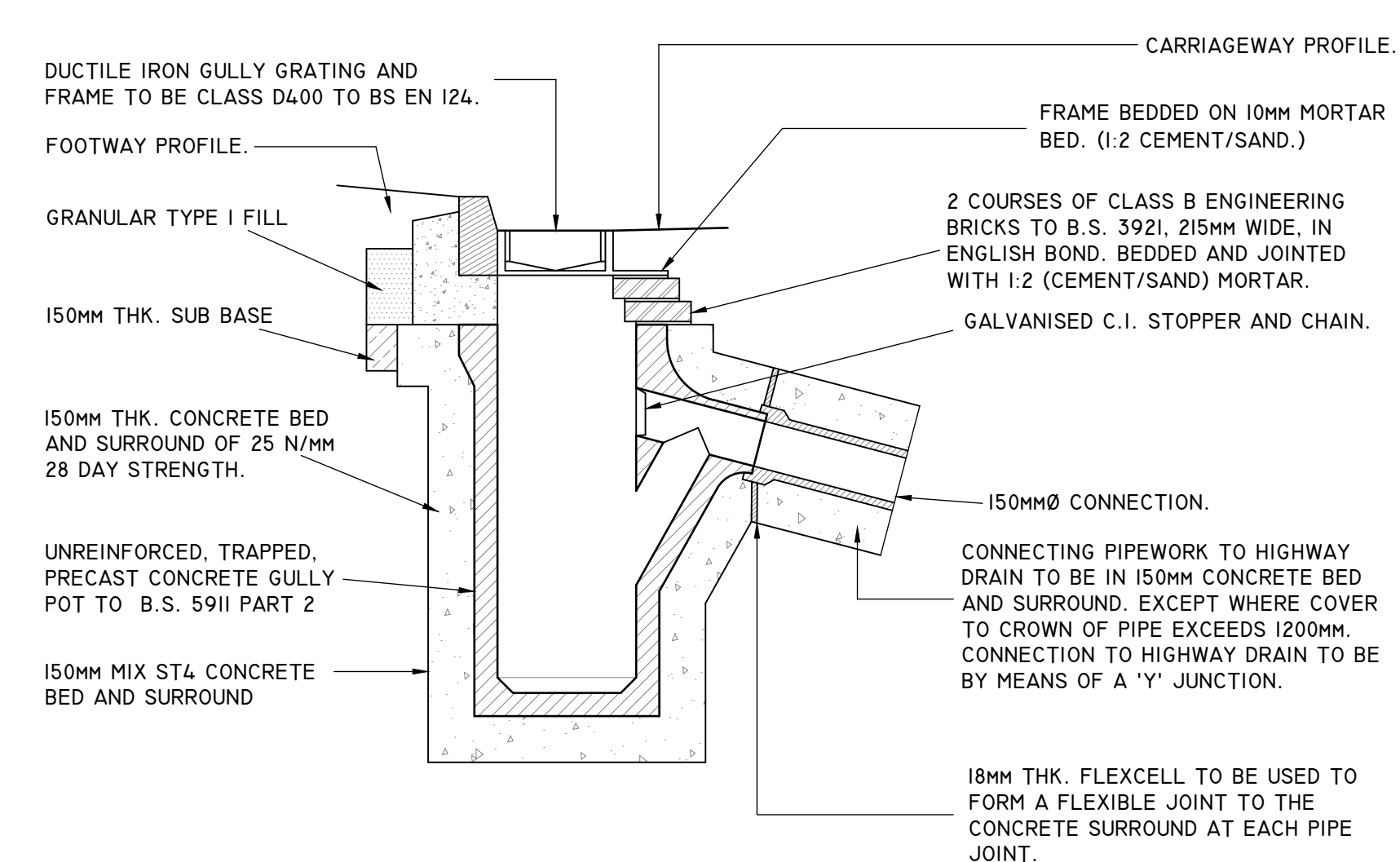
SCALE: NTS

0 50MM ON AI DWG. 50

NOT TO SCALE



NOT TO SCALE



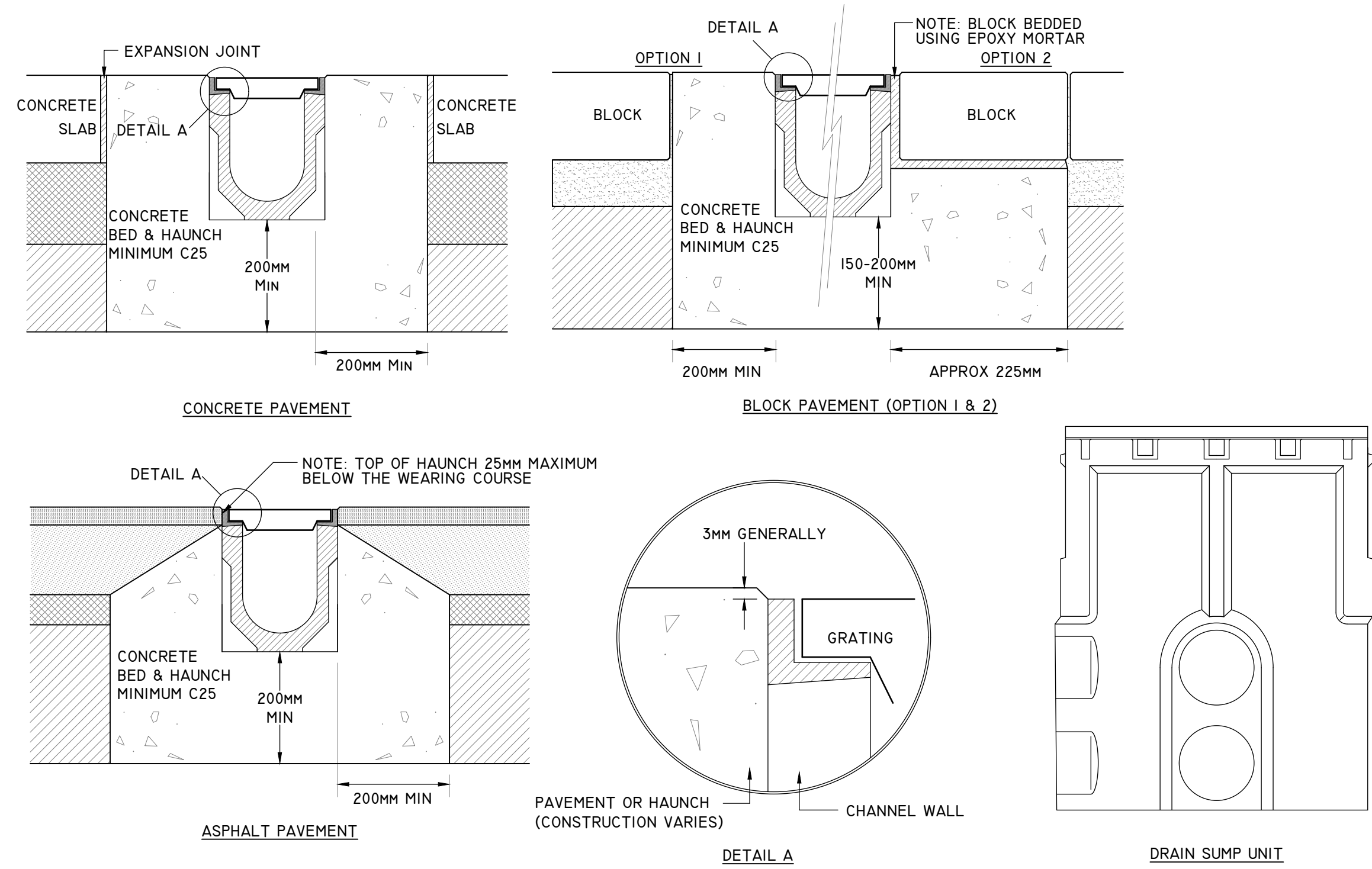
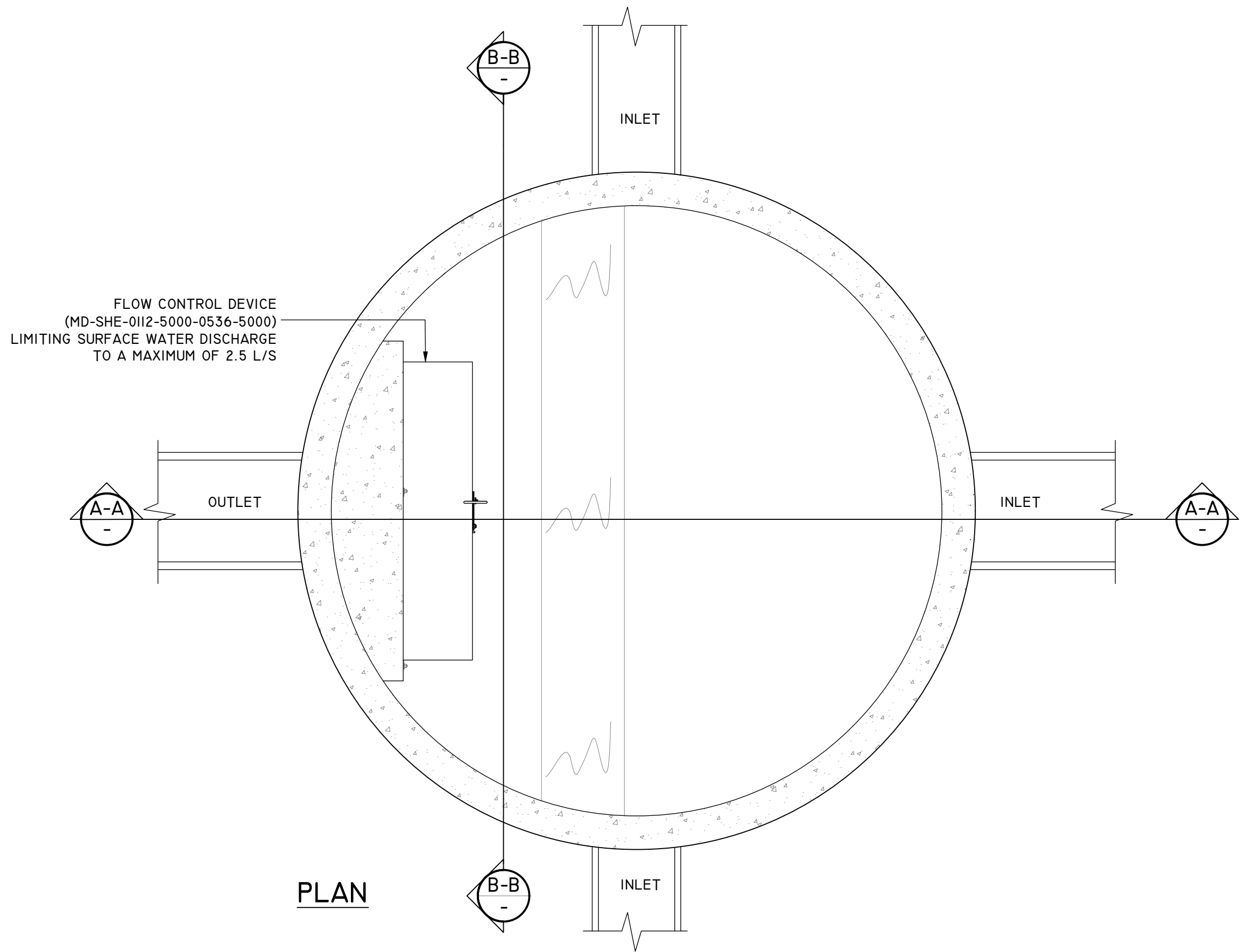
(450MM x 900MM FOR ROAD GULLY, 375MM x 750MM FOR CAR PARK GULLY)
NOT TO SCALE

PINNACLE
CONSULTING ENGINEERS

ALCHEMY,
BESSEMER ROAD,
WELWYN GARDEN CITY,
HERTS,
AL7 1HE. TELEPHONE: 01707 527 630

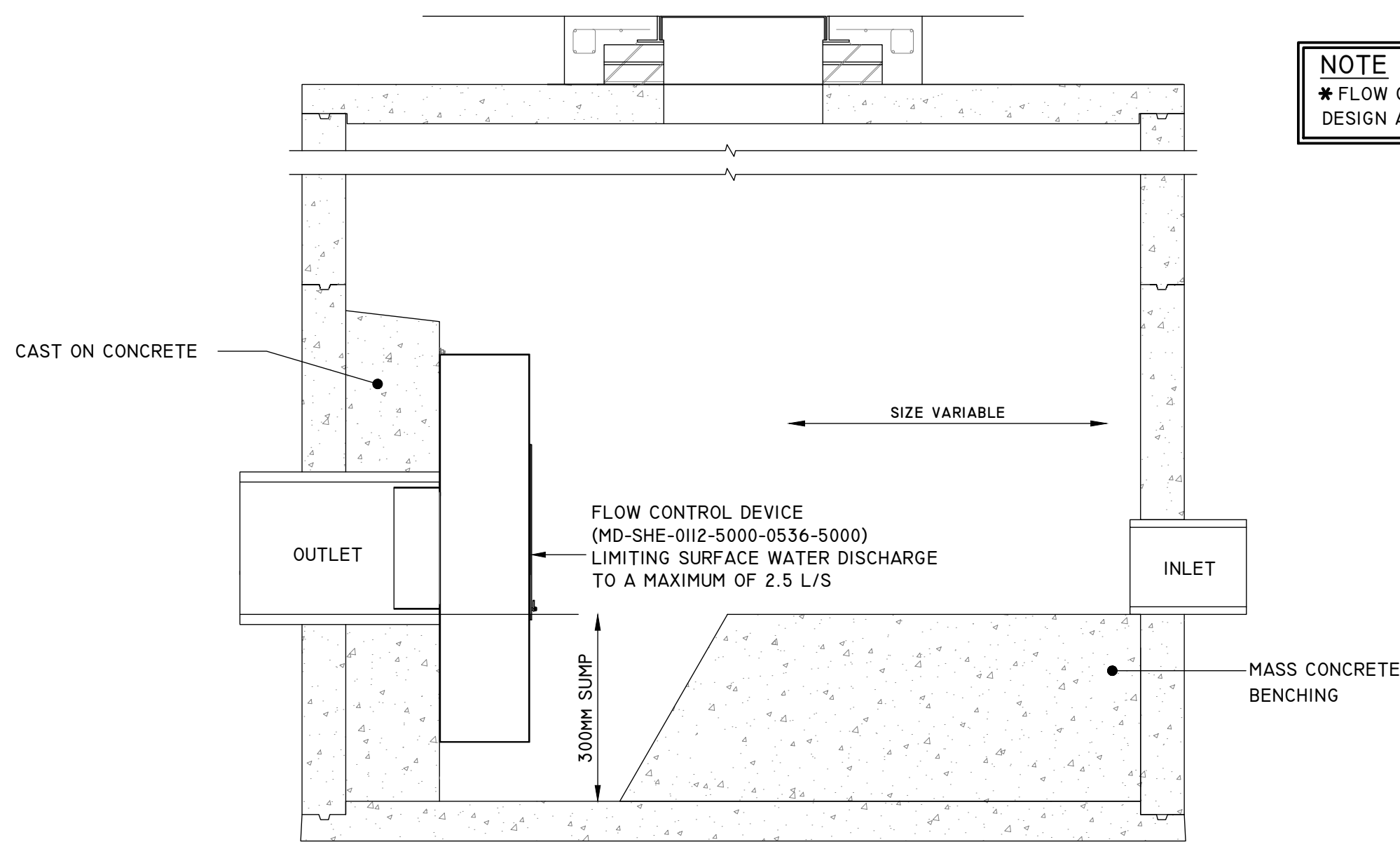
NORWICH LONDON DUBLIN THE HAGUE

DRAWING STATUS			
CONSTRUCTION			
SCALE @ AI	DATE	DRAWN BY	CHECKED
NTS	FEB '19	RC	JJ
DRG NO.			REVISION
190213-PIN-00-XX-DR-C-0226			CI



TYPICAL DRAINAGE CHANNEL DETAILS

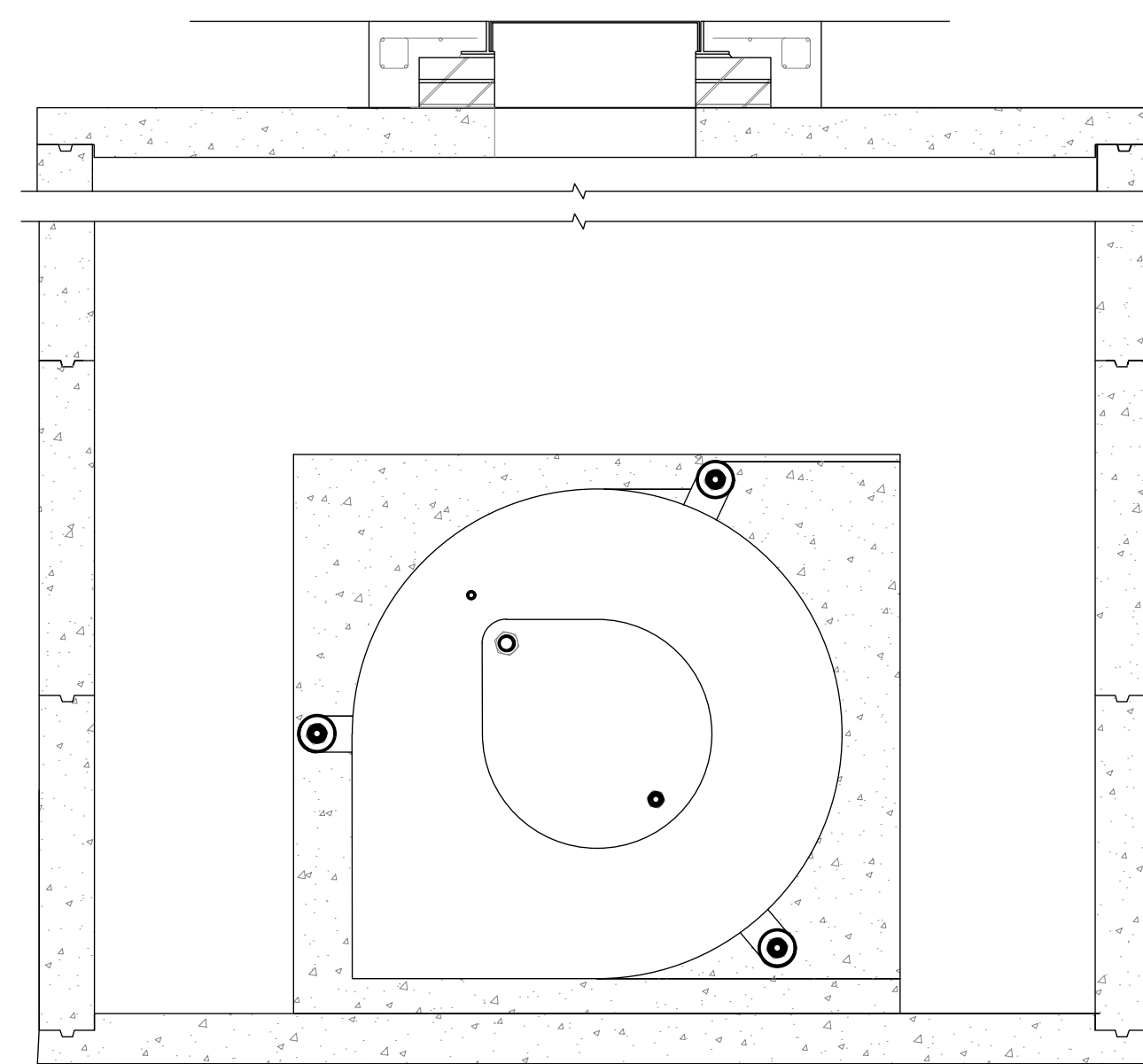
NOT TO SCALE



SECTION A-A

NOTE

* FLOW CONTROL DEVICE DETAILS TO MANUFACTURERS DESIGN AND SPECIFICATION



SECTION B-B

GENERAL NOTES

- DO NOT SCALE THIS DRAWING. WORK ONLY TO FIGURED DIMENSIONS.
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- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SUB-CONTRACTORS DRAWINGS AND DETAILS.

0 50MM ON A1 DWG. 50

REV	DESCRIPTION	BY	CHK	DATE
CI	FOR CONSTRUCTION	AO	JJ	02.05.19
POI	FOR INFORMATION	AO	AO	01.05.19
TI	FOR TENDER	RC	JJ	01.03.19

CLIENT

amazonlogistics

PROJECT

LITTLEHAMPTON

DBN3 REFURBISHMENT

DRAWING TITLE

DRAINAGE CONSTRUCTION

DETAILS SHEET 3

PINNACLE

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DRAWING STATUS			
CONSTRUCTION			
SCALE @ A1	DATE	DRAWN BY	CHECKED
NTS	FEB '19	RC	JJ
DRG NO.	REVISION		
190213-PIN-00-XX-DR-C-0227	CI		

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Appendix I – Arun District Council Drainage Checklist



[Home](#) | [Planning Applications](#) | Drainage Checklist

Drainage Checklist

Surface Water Drainage Proposal Checklist

Foreword

Before completing this checklist you are advised to read "[Arun/Chichester District Council Supplementary Requirements for Surface Water Drainage Proposals](#)".

The Surface Water Drainage Proposals Checklist is designed to clearly outline Arun/Chichester District Council's expectations and requirements for Surface Water Drainage Proposals and to expedite their review. This document should be used when completing Discharge of Conditions Applications or if the applicant wishes to avoid pre-commencement conditions relating to surface water drainage.

The Town and Country Planning Regulations now require pre-commencement conditions to have the prior agreement of the applicant regarding their wording and use. If an applicant wishes to avoid surface water drainage pre-commencement conditions they will need to submit detailed surface water drainage proposals in line with the Surface Water Drainage Proposal Checklist.

The below details are required to enable Arun/Chichester District Council to examine if proposals follow the hierarchy for sustainable drainage and if the design will adequately drain the site.

N.B. It will be difficult for Arun/Chichester District Council to undertake an appropriate and therefore timely assessment of your application if you answer "no" to any of the questions below, or if you fail to provide any of the information requested.

Checklist

Winter groundwater monitoring results included	Y/ N
Winter infiltration test results included	Y/ N
Period of winter groundwater monitoring	N/A
Maximum recorded groundwater level (AOD)	N/A
Date of infiltration testing	09.05.2019
Minimum infiltration rate recorded (at location of infiltrating structure)	1.5×10^{-5}
Plan showing the location of winter groundwater monitoring and infiltration testing included	Y /N
Method of surface water disposal proposed (Delete as appropriate)	Infiltration / Attenuation with discharge to watercourse Attenuation with discharge to surface water sewer/ Attenuation with discharge to foul sewer
If infiltration is <u>not</u> to be used: Justification supplied	Y/N
If infiltration is proposed: half drain time for 10 year event + climate change allowance (hours)	17-25 hours

If infiltration is proposed: half drain time for 100 year event + climate change allowance (hours) If infiltration is proposed: lowest base level of infiltrating structure	18.15 hours	
If attenuation is proposed: calculations of pre-development runoff rates included *	Y/☒N	Rate l/s
If attenuation is proposed: is proposed discharge rate less than or equal to pre-development rate?*	Y/☒N	Rate l/s
Calculations included demonstrating that the 1 in 100 year plus climate change event can be accommodated on site**	☒Y/N	
If proposing an impermeable lined attenuation feature/s, calculations included demonstrating that resistance to floatation (due to groundwater levels) is achieved and catered for in the design	Y/N/<u>Not applicable</u>	
If alterations or discharge to an ordinary watercourse is proposed: has Ordinary Watercourse Land Drainage Consent been sought?	Y/☒N	
Drainage layout plans included***	☒Y/N	
Construction detail plans included****	☒Y/N	
Exceedance flow route plans included (Not required for <5 properties)	Y/N/<u>Not applicable</u>	

*If developing brownfield sites, please provide fully detailed plans of the existing surface water drainage arrangements on site, including impermeable areas, gullies, outfalls, pipes & diameters, manholes, etc.

**If infiltration is proposed the following factor of safety should be applied to calculations (in accordance with CIRIA R156/ CIRIA C609)

Size of area to be drained	Consequences of failure					
	No damage or inconvenience		Minor inconvenience, e.g. surface water on car park		Damage to buildings or structures or roads	
	Cv=1.0	Cv=0.75	Cv=1.0	Cv=0.75	Cv=1.0	Cv=0.75
< 100 m sq	1.5	2	2	3	10	13
100m sq to 1000m sq	1.5	2	3	4	10	13
> 1000m sq	1.5	2	5	6.5	10	13

***Please note that drainage layout plans should include:

- All surface water drainage pipes labelled with; diameters, pipe materials, falls and invert levels.
- All infiltrating and attenuating structures (including permeable paving) labelled with; dimensions, invert and cover levels.
- All manholes labelled with; cover levels, invert levels, cover types detailed.
- All silt traps clearly labelled with sump depths.
- Control structures with outflow rates and invert levels.
- Proposed/existing levels of any areas subject to ground raising, together with suitable measures/detailed drawings for the associated managing of surface water runoff. Please note that ground raising should be avoided unless there are exceptional circumstances.

****If your proposed drainage scheme includes any of the following elements site specific construction detail plans should be supplied: pipe bed and surround; infiltrating structures; attenuating structures; manholes; catchpits/silt traps; control devices; permeable paving; headwalls.

Arun Civic Centre ([map](#))

Maltravers Road
Littlehampton
West Sussex
BN17 5LF
DX: 57406 Littlehampton
Monday - Thursday: 8:45am - 5:15pm
Friday: 8:45am - 4:45pm

Bognor Regis Town Hall ([map](#))

Clarence Road
Bognor Regis
West Sussex
PO21 1LD
Monday to Thursday: 8:45am - 5:15pm
Friday: 8:45am - 4:45pm

Benefits: 01903 737753
Rubbish & Recycling: 01903 737754
Council Tax & Business Rates: 01903 737752
Environmental Health: 01903 737755
Housing Repairs/Maintenance: 01903 737827
Planning & Building Control: 01903 737756
Elections: 01903 737616

[More telephone numbers & email addresses](#)

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