



Drainage Strategy Report

LITTLE HAMPTON, Land at Watersmead Business Park

16 April 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
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Reviewed by	David Meigh	Director	15.04.19
Approved by	David Meigh	Director	15.04.19

VERSIONS

Number	By	Date	Context
1	Andrew Quinn	15.04.19	For Comment

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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.

These strata are outlined in Table 2.2.

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 PROPOSED DRAINAGE

3.1 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.

Therefore, the preferred solution would be to replicate the natural drainage regime and to infiltrate surface water runoff into the ground. It is imperative that a site-specific infiltration test to BRE Digest 365 is commissioned at a number of locations around the site, to ascertain whether infiltration would be a suitable method of surface water management.

3.2 Proposed Development Runoff Rate

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.

Despite the greenfield runoff rate calculations (Appendix E) yielding a discharge rate of 0.3l/s QBar, such a restriction is not deemed to be practicable and therefore 5l/s is proposed as this is to ensure that there will be no adverse effect on the existing drainage infrastructure.

3.3 Proposed Development Surface Water Drainage Strategy

As part of the proposed drainage strategy it is assumed that the majority of the infrastructure will remain un-altered. It is also important to note the existing warehouse buildings have a fully operational, positive drainage system that discharges into the aforementioned pond as described in section 2.1.

As part of the proposal, an additional impermeable area of 789m² will be produced by extending the kerb line along the northern perimeter. The proposed drainage channel along this area will collect surface water runoff to be attenuated, before being conveyed into the existing network at a restricted rate of 5l/s via a hydrobrake.

3.4 Surface Water Discharge Rate and Attenuation

As mentioned in section 3.2, the proposed impermeable area compared to the original design will increase by approximately 789m². Based on calculations for all storms up to a 1 in 30 year rainfall event, it is deduced that additional attenuation storage is needed. An additional required attenuation storage volume of 14m³ has been estimated quick storage estimate through MicroDrainage, the results of which are included in Appendix E.

The proposed network will collect the surface water from the site via rainwater downpipes and drainage channels, passing through petrol interceptor where necessary. Flows from the additional impervious

areas to the north of the site will be attenuated by the proposed tank and discharge via a Ø150mm pipe into the existing private sewer network. The proposed drainage layout is included as Appendix F.

3.5 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, deep trapped gullies and a catchpit manhole (silt trap) is considered appropriate for the scale and nature of the development.

Refer to Appendix F for proposed the proposed drainage layout.

3.6 Attenuation Tank

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 catchpit manhole (silt trap) is considered appropriate for the scale and nature of the development.

3.7 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.

3.7.1 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.

3.7.2 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

4 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 rate of discharge from the additional drainage infrastructure will be restricted to 5l/s. Discharge of the existing networks will remain unrestricted.

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

0 50MM ON A1 DWG. 50

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

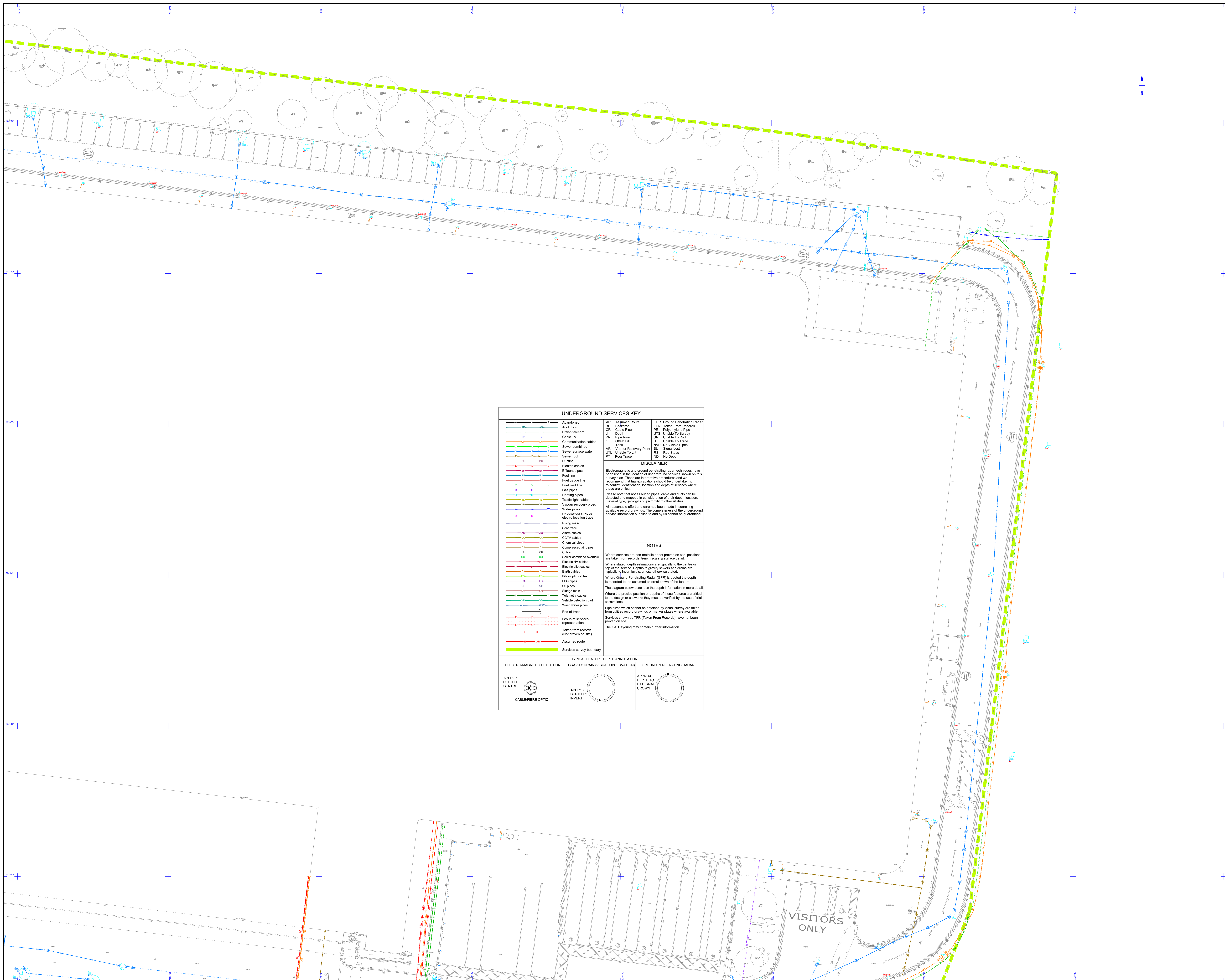
ALCHEMY,
BESSEMER ROAD,
WELWYN GARDEN CITY,
HERTS
AL7 1HE. TELEPHONE: 01707 527 630
NORWICH | LONDON | DUBLIN | THE HAGUE

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.

No

[illegible]

Sheet Index

1	2
3	4

[illegible]



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HUGHES**

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www.malcolmhughes.co.uk
survey@mhsl.co.uk

Accreditations








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THE BODY SHOP
NORWAY LANE, WICK
LITTLEHAMPTON BN17 6LS

Drawing Title

UNDERGROUND SERVICES

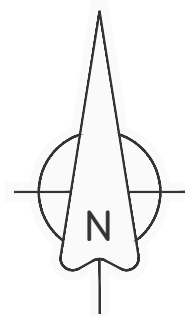
Drawn By AP	05/03/19	Survey Date FEBRUARY 2019
Checked by DJ	05/03/19	Scale A0@1:200
Drawing No 53168/2		Revision

Sheet Index

The diagram shows a 2x2 grid of sheets. The sheets are labeled 1, 2, 3, and 4. Sheet 4 is highlighted with a thick black border.

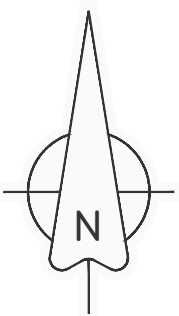
[illegible]

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

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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

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PROJECT
LITTLEHAMPTON
DBN3 REFURBISHMENT

DRAWING STATUS
EXISTING AND PROPOSED
IMPERMEABLE AREAS

PINNACLE
CONSULTING ENGINEERS

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WELWYN GARDEN CITY,
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AL7 1HE. TELEPHONE: 01707 527 630
NORWICH LONDON DUBLIN THE HAGUE

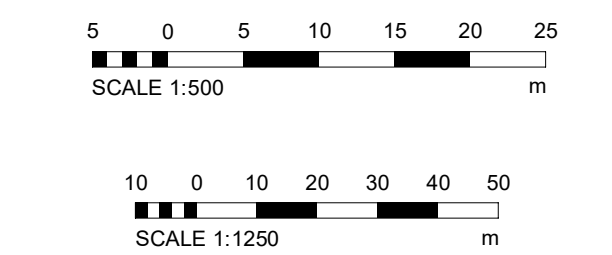
DRAWING STATUS			
TENDER			
SCALE @ A1 1:1000	DATE APR'19	DRAWN BY AO	CHECKED JJ
DRG NO. 190213-PIN-00-XX-DR-C-0205	REVISION TI		REF: 190213

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Appendix D – Proposed Development Plans

Architects are to be notified of any discrepancies.
Contractors must check all dimensions on site.
This drawing is subject to copyright law and is to be used only for the project only.
The drawing is to be used only for the information as stated only.
For other information refer to the latest revision of any other 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.



REFER TO
ARBORICULTURAL
REPORT FOR LOCATIONS
OF TREES AND
VEGETATION

NO NEW BOUNDARY
TREATMENTS

NO PUBLIC RIGHTS OF
WAY ACROSS SITE

- EXISTING LANDSCAPED AREA
TO BE RETAINED: 2128 m²
- LANDSCAPED AREA TO BE
REPLACED WITH VEHICLE
HARDSTANDING: 592 m²
- KERBED AREA TO BE
REPLACED WITH VEHICLE
HARDSTANDING: 25 m²



PROPOSED SITE PLAN
1 : 500

P9	CANOPY ADJUSTED	04.04.19	JN	MB
P8	PEDESTRIAN BRIDGE REPLACED WITH CROSSING	29.03.19	MB	SR
P7	UPDATED TRACKING	12.03.19	BC	MB
P6	UPDATED VOLS	06.03.19	MB	SR
P5	ASPIRING AMENDED	20.12.18	MB	SR
P4	LANDSCAPE AREAS SHOWN	05.02.19	MB	SR
P3	REVISED AFTER PLANNING REVIEW	01.02.19	JN	MB
P2	REVISED FOLLOWING PLANNING CALL	29.01.19	KSK	SR
P1	FIRST ISSUE	24.1.19	MB	SR
Rev	Description	Date	By	Chk

Status

PLANNING

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Project
DBN3 - NEW COURTWICK LANE, LITTLEHAMPTON

Client
amazonlogistics

Drawing Title
PROPOSED SITE BLOCK PLAN

Proj Ref	Origin	Zone	Level	Type	Rate	Num	Status	Rev
7260 - SMR	- 00	- 22	- DR	- A	- 2001	- S3	- P9	

SMR Job Ref	Sheet	Scale	Drawn
7260-00-2001	A0	NOTED	MAB

Appendix E – Drainage Calculations

Calculated by:

Site name:

Site location:

Site coordinates

Latitude:

Longitude:

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Reference:

Date:

Methodology

IH124

Site characteristics

Total site area (ha)	0.1
----------------------	-----

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	3	3
HOST class	---	---
SPR/SPRHOST	0.37	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm)	722	722
Hydrological region	7	7
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.3	2.3
Growth curve factor: 100 year	3.19	3.19

Notes:

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consents are usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set in which case blockage work must be addressed by using appropriate drainage elements

(3) Is $SPR/SPRHOST \leq 0.3$?

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	0.3	0.3
1 in 1 year (l/s)	0.25	0.25
1 in 30 years (l/s)	0.69	0.69
1 in 100 years (l/s)	0.95	0.95

Variables

Results

Design

Overview 2D

Overview 3D

Vt

FSR Rainfall

Return Period (years)

Region

Map

M5-60 (mm)

Ratio R

30

England and Wales

19.200

0.350

Cv (Summer)

Cv (Winter)

Impervious Area (ha)

Maximum Allowable Discharge (l/s)

Infiltration Coefficient (m/hr)

Safety Factor

Climate Change (%)

0.750

0.840

0.080

5.0

0.00000

2.0

0

Analyse

OK

Cancel

Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0

Variables

Results

Design

Overview 2D

Overview 3D

Vt

Results

Global Variables require approximate storage of between 7.3 m³ and 14 m³.

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

Analyse

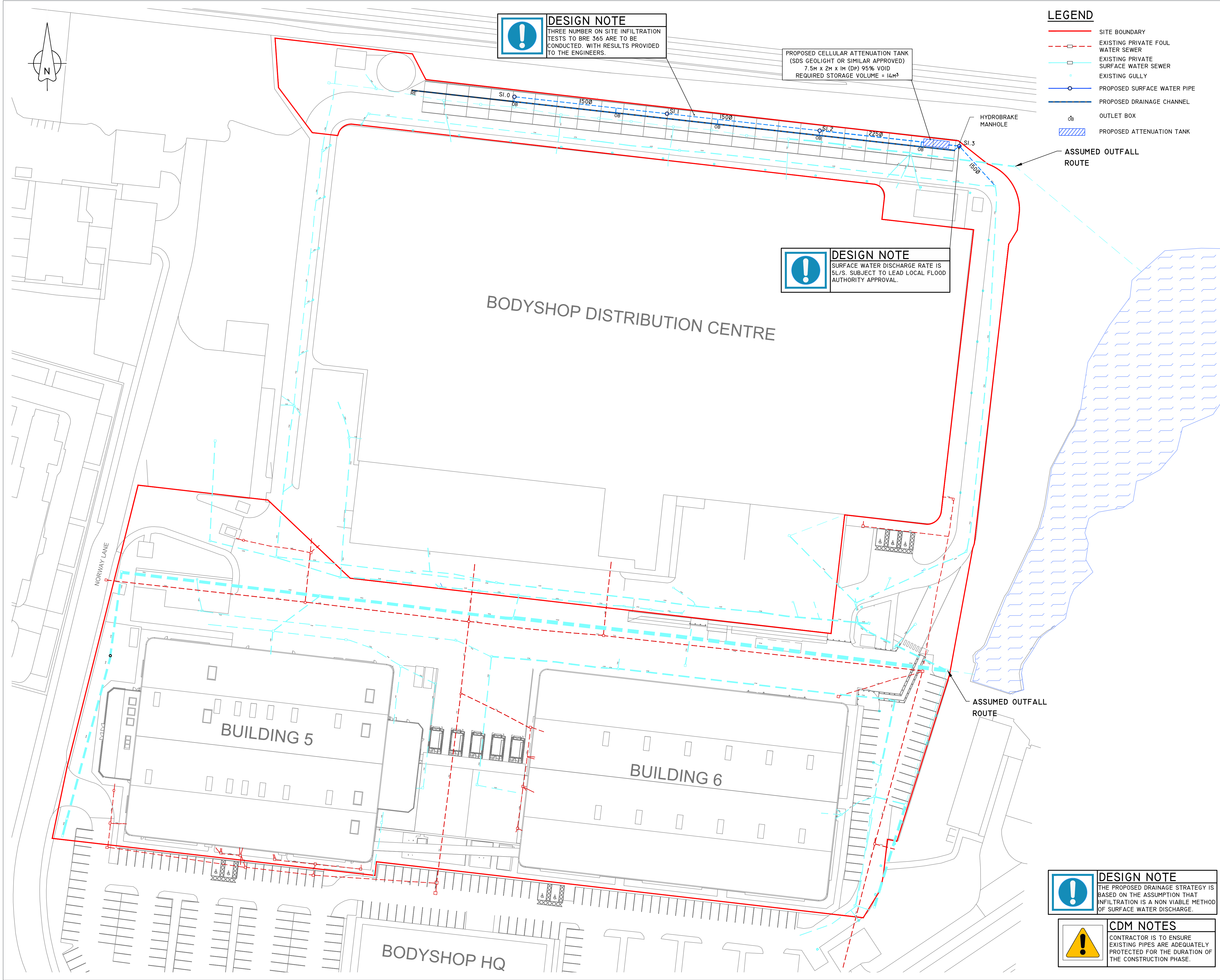
OK

Cancel

Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0

Appendix F – Proposed Drainage Strategy



DESIGN NOTE
THREE NUMBER ON SITE INFILTRATION TESTS TO BRE 365 ARE TO BE CONDUCTED. WITH RESULTS PROVIDED TO THE ENGINEERS.

PROPOSED CELLULAR ATTENUATION TANK
(SDS GEOLIGHT OR SIMILAR APPROVED)
7.5M X 2M X 1M (DP) 95% VOID
REQUIRED STORAGE VOLUME = 14M³

DESIGN NOTE
SURFACE WATER DISCHARGE RATE IS 5L/S. SUBJECT TO LEAD LOCAL FLOOD AUTHORITY APPROVAL.

- LEGEND**
- SITE BOUNDARY
 - EXISTING PRIVATE FOUL WATER SEWER
 - EXISTING PRIVATE SURFACE WATER SEWER
 - EXISTING GULLY
 - PROPOSED SURFACE WATER PIPE
 - PROPOSED DRAINAGE CHANNEL
 - OUTLET BOX
 - PROPOSED ATTENUATION TANK

- GENERAL NOTES**
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 - 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 / SOAKWAYS 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

P02	FOR INFORMATION	AO	JJ	16.04.19
P01	FOR INFORMATION	AO	JJ	15.04.19
TI	FOR TENDER	RW	JJ	01.03.19
REV	DESCRIPTION	BY	CHK	DATE

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PROJECT
**LITTLEHAMPTON
DBN3 REFURBISHMENT**

DRAWING TITLE
**PROPOSED DRAINAGE
STRATEGY**

PINNACLE
CONSULTING ENGINEERS

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DRAWING STATUS			
INFORMATION			
SCALE @ A1	DATE	DRAWN BY	CHECKED
1:500	FEB '19	RW	JJ
DRG NO.	REVISION		
190213-PIN-00-XX-DR-C-0220	P02		

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DESIGN NOTE
THE PROPOSED DRAINAGE STRATEGY IS BASED ON THE ASSUMPTION THAT INFILTRATION IS A NON VIABLE METHOD OF SURFACE WATER DISCHARGE.

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

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