

Drainage Strategy Report

LITTLEHAMPTON, Land at Watersmead Business Park

14 February 2020

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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Approved by	David Meigh	Director	21.05.19

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	J awsy J abbar	14.05.19	Updated Following Infiltration Test Results
4.0	J awsy J abbar	21.05.19	Updated from Comments
5.0	J awsy J abbar	14.02.20	Updated for Winter BRE 365 Soakaway Tests

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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 $\text{d}375\text{mm}$ and the other discharges immediately to the east of the central service yard via a $\text{d}1050\text{mm}$ 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 one of the two proposed surface water sewers into one of the two cellular soakaway unit with a combined capacity of 36.1m³. Runoff from the additional road section will be collected by a proposed sponge gulley and discharged into a proposed 7.125m³ 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 in the winter period; two of the recorded infiltration rates were 6.0x10⁻⁵ m/s (S101) and 1.7 x10⁻⁵ m/s (S102) and the third could not be accurately recorded as the water drained too quickly to be measured. For the purposes of devising adequate storage capacity for the proposed third cellular soakaway unit S103, the infiltration rate of 6.0x10⁻⁵ m/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 40% allowance to accommodate climate change and an additional safety factor of 4.0 (as required by the LLFA Engineer).

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 36.1m³ and 7.125m³ respectively. The sizes of these units have been modelled using the MicroDrainage software with the drainage network. The results of the calculations are attached as part of Appendix F.

Winter ground water table monitoring has been carried out during the winter period and the infiltration system has been revised based on the winter BRE 365 infiltration test results. Refer to Appendix E for Soakaway Infiltration Report prepared by Delta-S imons.

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 channel located along the interface between the proposed and existing surfacing, filtered through a full retention Class 1 separator 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 soakaway. 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 40% climate change allowance, a total of 43.225m³ of soakaway storage will be provided to facilitate infiltration.

Winter ground water table monitoring has been carried out during the winter period and the infiltration system has been revised as required.

Appendix A - Site Location Plan



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.

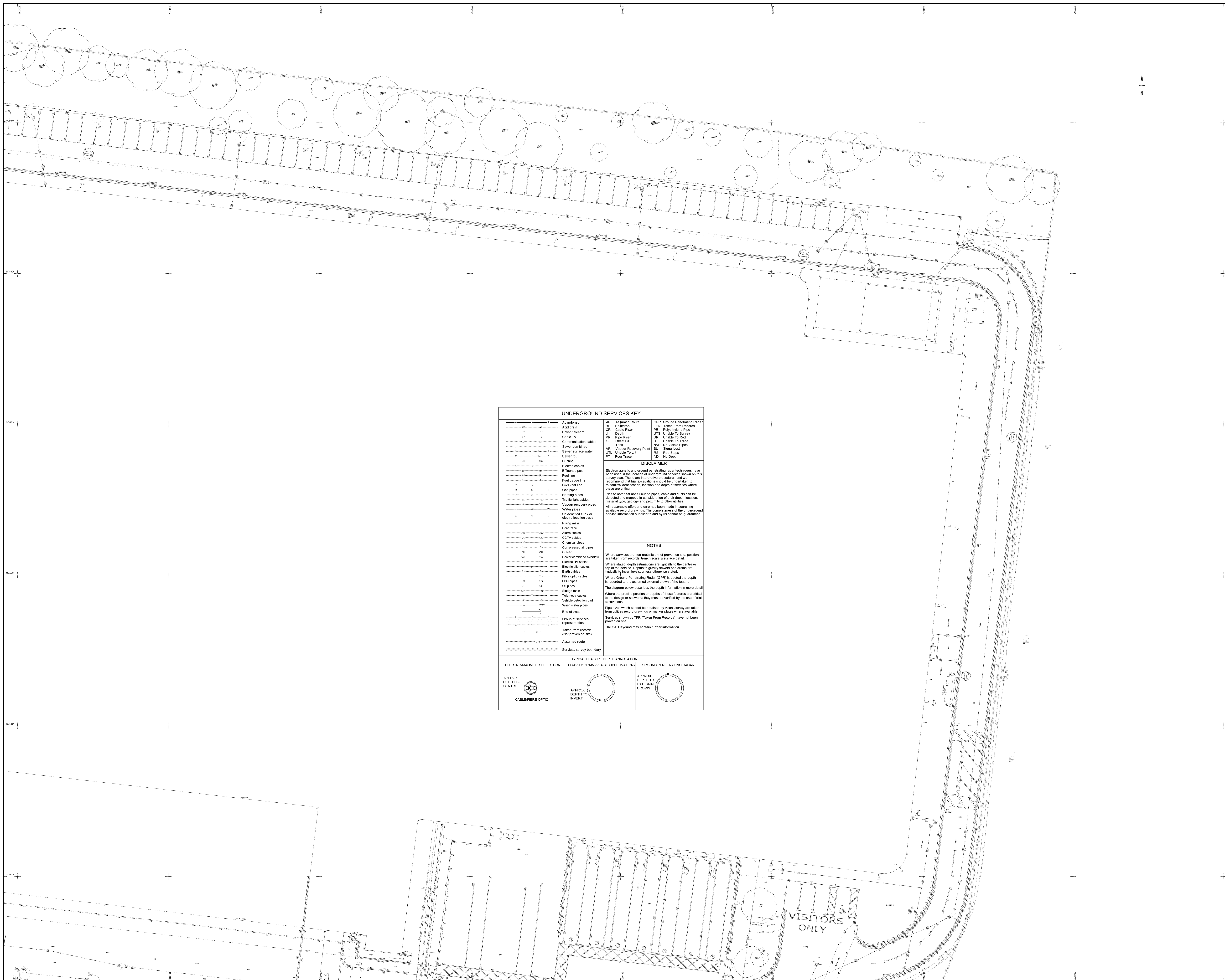
 SITE BOUNDARY

PROJECT
LITTLEHAMPTON
DBN3 REFURBISHMENT

PINNACLE
CONSULTING ENGINEERS

DRAWING STATUS			
TENDER			
SCALE @ AI	DATE	DRAWN BY	CHECKED
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I90213-PIN-00-XX-DR-C-0200			TI

Appendix B – GPR Survey



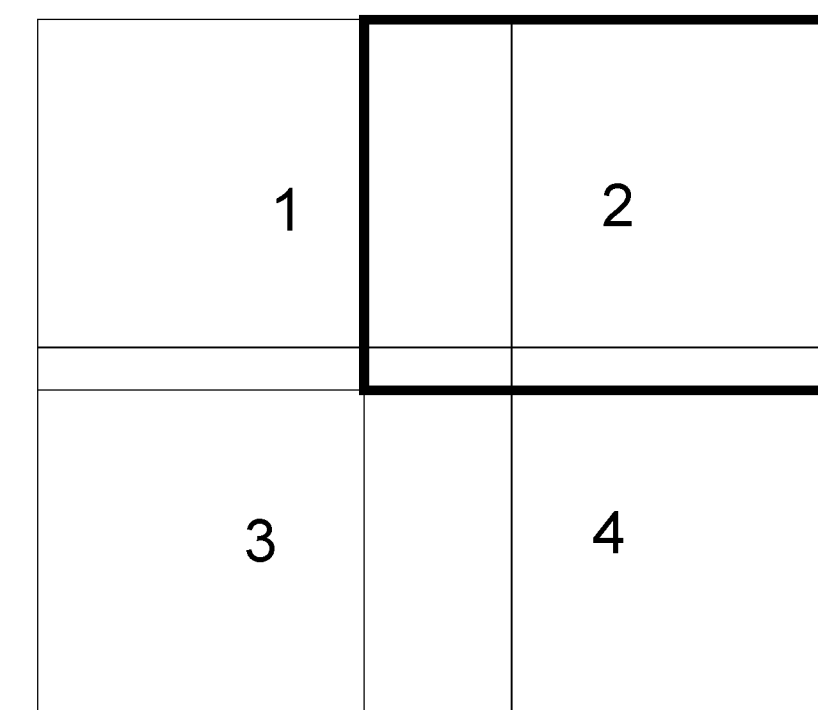
Survey Notes	
Grid:	Local Plane Metric related to National Grid at survey control SC2
Levels:	Related to OS datum from GNSS positioning, converted using the National Geoid Model OSGM15.

Notes

Topographical Survey Legend

[illegible]

Sheet Index

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**MALCOLM
HUGHES**

**CHARTERED
LAND SURVEYORS**

65 Cross Street, Sale, Manchester
M33 7HF, Tel: 0161 905 1205
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survey@mh.co.uk

Accreditations








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

Project

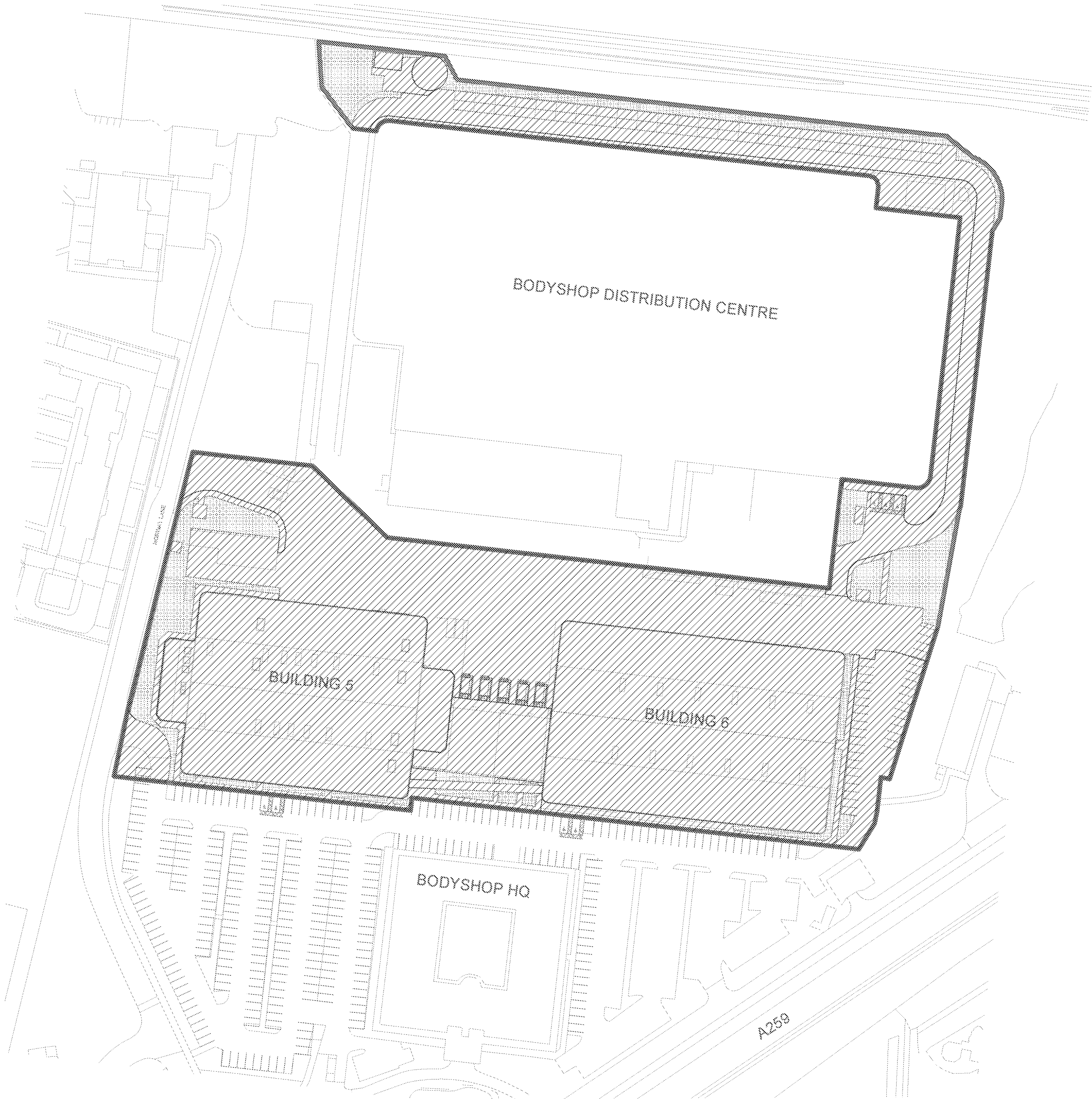
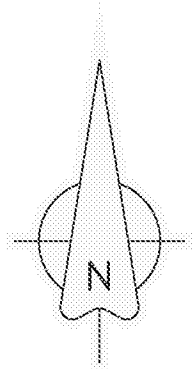
THE BODY SHOP
NORWAY LANE, WICK
LITTLEHAMPTON BN17 6LS

Drawing Title

UNDERGROUND SERVICES

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Checked by DJ	05/03/19	Scale A0@1:200
Drawing No 53168/2		Revision

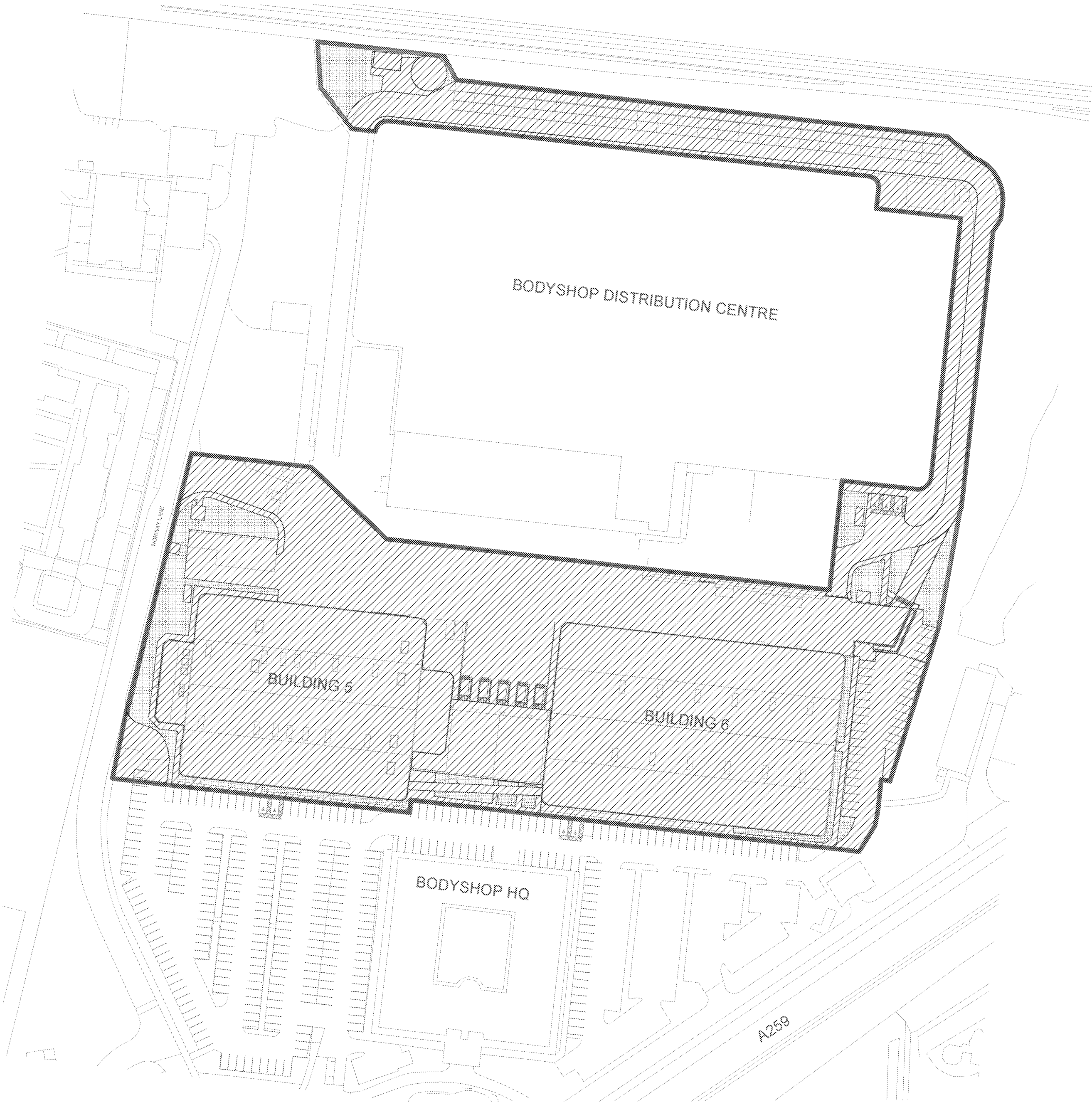
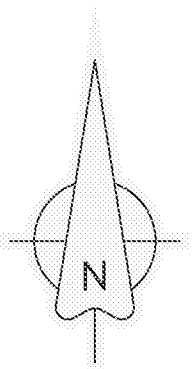
Appendix C - Existing & Proposed Impermeable Areas



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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4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SUB-CONTRACTORS DRAWINGS AND DETAILS.

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 TITLE
EXISTING AND PROPOSED
IMPERMEABLE AREAS

PINNACLE
CONSULTING ENGINEERS

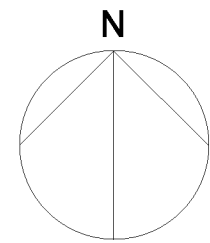
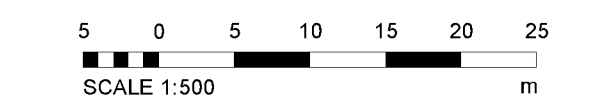
ALCHEMY,
BESSEMER ROAD,
WELWYN GARDEN CITY,
HERTS
AL7 1HE. TELEPHONE: 01707 527 830
NORWICH | LONDON | DUBLIN | THE HAGUE

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		

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REF: 190213

Appendix D - Proposed Development Plans



REFER TO
ARBORICULTURAL
REPORT FOR LOCATIONS
OF TREES AND
VEGETATION

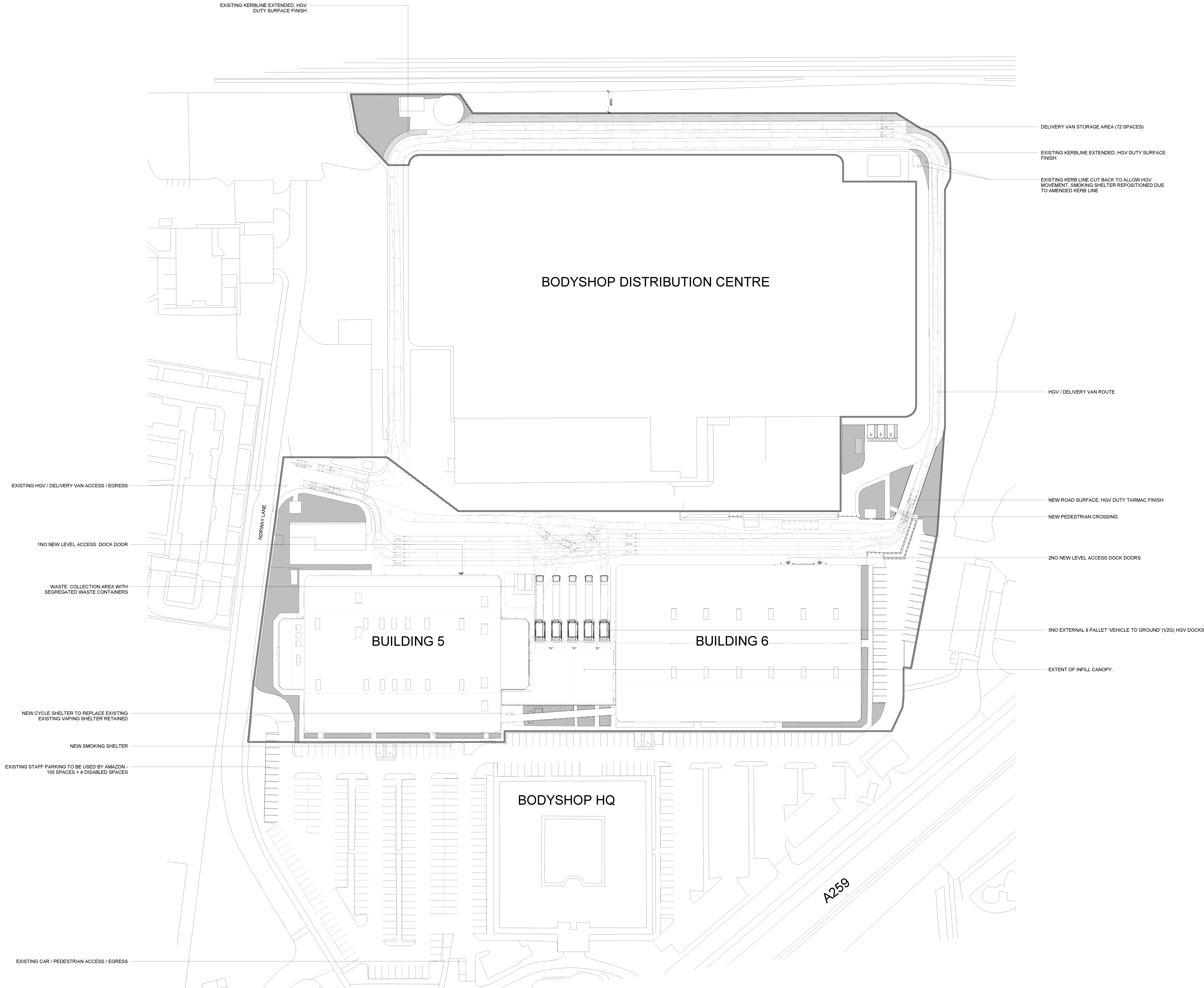
NO NEW BOUNDARY
TREATMENTS

NO PUBLIC RIGHTS OF
WAY ACROSS SITE

EXISTING LANDSCAPED AREA
TO BE RETAINED: 2128 m²

LANDSCAPED AREA TO BE
REPLACED WITH VEHICLE
HARDSTANDING: 582 m²

KERBED AREA TO BE
REPLACED WITH VEHICLE
HARDSTANDING: 25 m²



PROPOSED SITE PLAN
1 : 500

P10	SMOKING & CYCLE SHELTER ADDED	24.07.19	TO	MB
P9	CANOPY ADJUSTED	05.04.19	JN	MB
P8	PEDESTRIAN BRIDGE REPLACED WITH CROSSING	25.03.19	MB	SR
P7	UPDATED TRACKING	12.03.19	BC	MB
P6	UPDATED VOGS	06.03.19	MB	SR
P5	REVISION AMENDED	20.2.19	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	25.01.19	MB	SR
P1	FIRST ISSUE	24.1.19	MB	SR
Rev.	Description	Date	Drawn	Okd

Status

PLANNING

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Project

NEW COURTTWICK, LITTLEHAMPTON

Client

Drawing Title

PROPOSED SITE BLOCK PLAN

Proj Ref	Origin	Zone	Level	Type	Rev	Notes	Rev
7260 - SMR	- 00 - Z2 - DR - A - 2001	- S3 - P10					
SMR Job Ref	Sheet	Drawn	Scale	Notes	Drawn	Rev	
7260-00-2001	A0			NOTED	MAB		

Appendix E – Infiltration Test Results

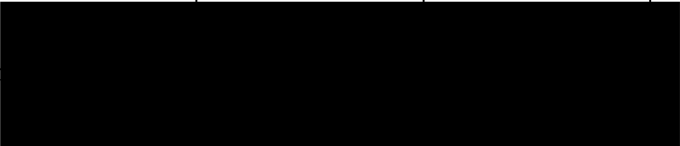
Soakaway Infiltration Report

Amazon Littlehampton DBN2

Presented to Gleave Partnership c/o Amazon

Issued: February 2020

Delta-Simons Project Number: 19-0138.08

Issue No.	Status	Issue Date	Comments	Author	Technical Review	Authorised
2	Final	10 th February 2020	Amended to include details of regulatory liaison			
				Alex Hunter Graduate	Tom Horner Associate	Paul Bennett Unit Director

1.0 Authorisation and Purpose

Delta-Simons Environmental Consultants Limited (Delta-Simons) has been requested by Gleave Partnership on behalf of Amazon (the "Client") to undertake continuous groundwater level monitoring within three newly installed boreholes (BH101 to BH103) to identify the variation of winter groundwater levels at the Site. Further works included 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 reports pertaining to the Site:

- ▲ Short Form Geotechnical Report, Amazon DBN2 Refurbishment, Littlehampton, (Ref. 19-0138.04), dated March 2019; and
- ▲ Soakaway Infiltration Report, Amazon DBN2, Littlehampton, (Ref. 19-0138.07), dated May 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).

5.0 Regulatory Liaison

Arun District Council were contacted prior to any works commencing to confirm their satisfaction with the scope of works proposed. Email correspondence is included as Appendix A.

Prior to completion of the soakage testing, Delta-Simons contacted Sarah Burrow of Arun District Council to discuss the timing of the testing, following the completion of the groundwater level monitoring. An agreement was reached to undertake the soakage testing on the basis that groundwater levels had been shown to decrease over the monitoring period (see Section 6.0 below), however, it was agreed to extend the groundwater level monitoring following completion of the soakage testing, to ensure groundwater levels do not increase significantly following completion of the testing.

6.0 Fieldworks and Results

6.1 Groundwater Level Monitoring

Delta-Simons undertook a five-week period of continuous groundwater level monitoring within three newly installed boreholes (BH101 to BH103). The installed boreholes logged groundwater levels at 15-minute intervals to assess the diurnal variance of groundwater levels at the Site.

Table 1: Summary of Continuous Groundwater Level Data

Borehole Location	Highest Recorded Depth to Groundwater (cm bgl)	Date and Time	Lowest Recorded Depth to Groundwater (cm bgl)	Date and Time
BH101	247.885	21/12/2019 21:15	343.836	13/01/2020 03:00
BH102	281.989	21/12/2019 20:45	351.347	13/01/2020 03:15
BH103	208.946	21/12/2019 20:15	238.028	13/01/2020 03:15

The continuous groundwater level data identified an increase in depth to groundwater over the five-week monitoring period. This information was used to determine the design of soakaway infiltration tests at the Site.

The results of groundwater level monitoring can be provided upon request (each dataset is circa 120 pages long).

6.2 Soakaway Infiltration Testing

Soakage testing was undertaken in general accordance with BRE Digest 365: Soakaway Design [Ref. 1] on 27th and 28th January 2020.

The soakage testing comprised the excavation of three trial pits (SA101 to SA103) to depths of between 1.1 and 2.0 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.

6.2.1 Identified Ground Conditions

Ground conditions encountered in each location comprised the following:

SA101

- ▲ Grass over topsoil comprising of dark brown slightly clayey fine to medium sand to a depth of 0.4 m bgl;
- ▲ River Terrace Deposits comprising of dark brown sandy clay to a depth of 0.75 m bgl; and
- ▲ River Terrace Deposits comprising of light brown clayey fine to medium sand, to a depth of 1.62 m bgl.

SA102

- ▲ Topsoil comprising of dark brown slightly gravelly slightly clayey fine to medium sand. Gravel content comprised of flint, to a depth of 0.2 m bgl;
- ▲ River Terrace Deposits comprising of dark brown slightly sandy clay to a depth of 0.4 m bgl;
- ▲ River Terrace Deposits comprising of bluish brown clay to a depth of 1.5 m bgl; and
- ▲ River Terrace Deposits comprising of light brown clayey medium to coarse sand, to a depth of 2.0 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 1.1 m bgl.

7.0 Soakage Tests

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

Table 2: Summary of Testing in General Accordance with BRE 365

Soakaway Test Reference Number	Test Depth Range (m bgl)	Infiltration Rate	Geology
SA101	0.95 – 1.62	6.1×10^{-05}	Sand (River Terrace Deposits)
SA102	1.20 – 2.00	1.7×10^{-05}	Sand (River Terrace Deposits)

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.

8.0 Conclusions

The infiltration testing has been undertaken to a maximum depth of between 1.62 and 2.0 m bgl within sand of River Terrace Deposits at SA101 and SA102, and chalk at 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 15 to 55 minutes, 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.

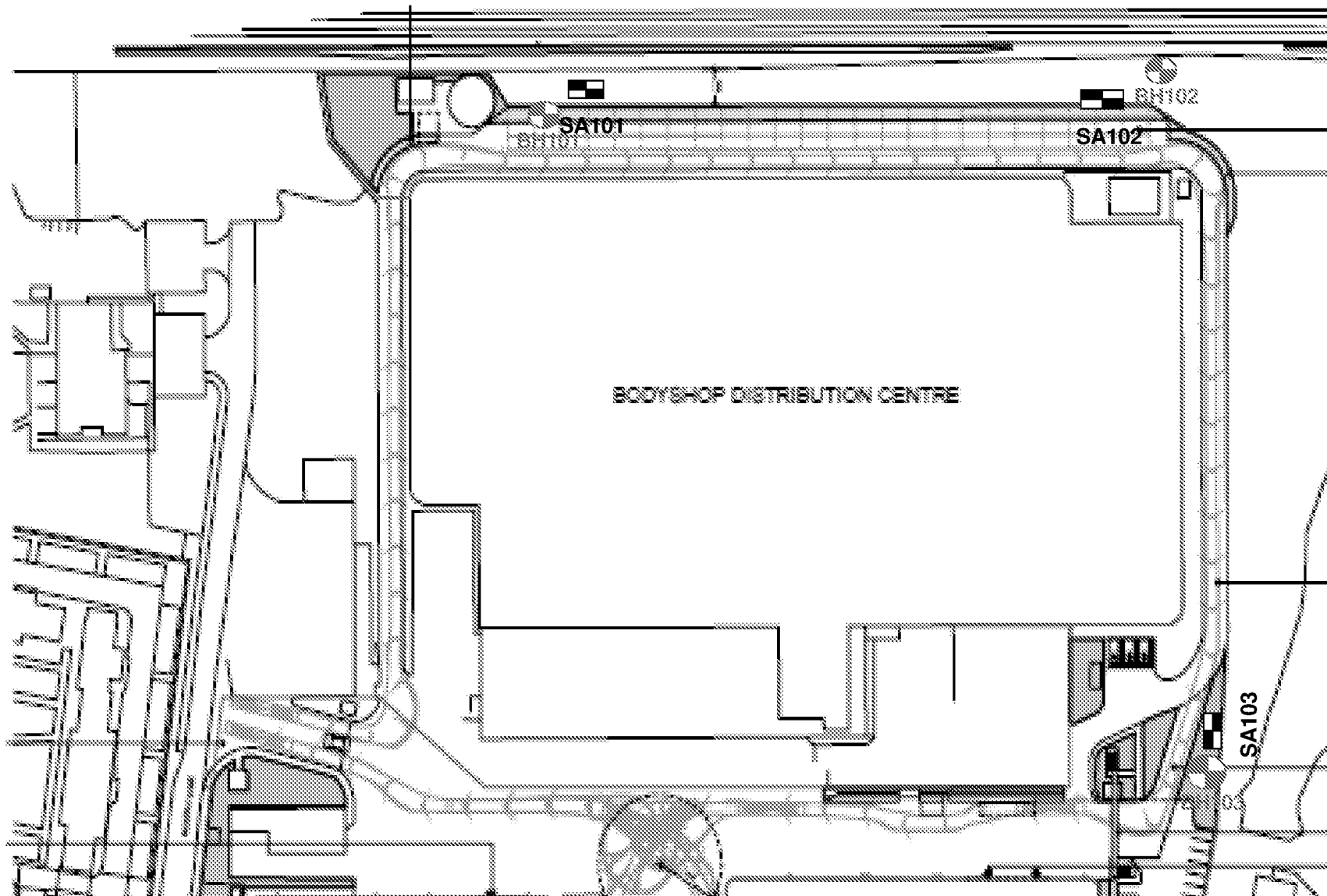
9.0 References

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

Enclosed:

- Figure 1 Approximate Intrusive Location Plan
- Appendix A Council Correspondence
- Appendix B Soakaway Test Results

Figure 1 – Approximate Intrusive Location Plan



TITLE:
Approximate Intrusive Location Plan
Littlehampton, Amazon

SCALE:
NTS

DWN/CHKD:
AH

PROJECT NO.:
19-0138.08

DATE:
03-01-20

FIGURE NO.:
1

Appendix A – Council Correspondence

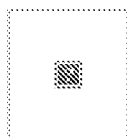
From: Aarti O'Leary
To: Tom Horner, Jaway Jabbar, Ryan Liley
Subject: Fwd: Application Ref: LU/59/19/PL - Condition 4
Date: 12 November 2019 19:02:47
Attachments: image001.jpg
image002.jpg

All

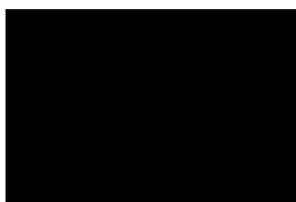
Please see email below.

Kind Regards

Aarti O'Leary
BSc (Hons), MA (Merit), MRTPI
Associate



Chartered Surveyors & Town
Planners
6 New Bridge Street
London
EC4V 6AE



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Begin forwarded message:

From: Sarah Burrow <[REDACTED]>
Date: 12 November 2019 at 18:05:31 GMT
To: Aarti O'Leary <[REDACTED]>
Cc: Stuart Corbey <[REDACTED]> Paul Cann <[REDACTED]>
Subject: RE: Application Ref: LU/59/19/PL - Condition 4

Dear Aarti,

First of all thank you for getting in touch, it is refreshing to be discussing proposed testing before it is completed. My initial impression is that you're going to be finishing too early. The most important period to cover is when we expect groundwater to peak – normally January-February. Similarly the BRE365 tests will need to be completed above the highest recorded groundwater so it is best that they are completed towards the end of your monitoring.

I would suggest losing a couple of December monitoring weeks and spreading the remainder to cover to the end of February, with fortnightly checking being sufficient.

Kind Regards

Sarah Burrow
Engineering Assistant

From: Aarti O'Leary <[REDACTED]>
Sent: 08 November 2019 16:55
To: Land Drainage <[REDACTED]>
Cc: Stuart Corbey <[REDACTED]>
Subject: Application Ref: LU/59/19/PL - Condition 4

Dear Sir/ Madam,

We write with regard to Condition 4 of consent ref: LU/59/19/PL, which states the following:

"Prior to the implementation of proposed surfacing works as shown on plan reference DBN3-SMR-00-ZZ-DR-A-2009-S3-P1, winter groundwater monitoring shall be undertaken to establish the highest annual ground water levels and winter Percolation testing to BRE 364. The monitoring results and any necessary amendment to the proposed drainage strategy to be submitted and agreed by the local planning authority. Until such time as the proposed surfacing works can commence a temporary van staging area comprising temporary roadway aluminium mats to be utilised."

With a view to preparing an application seeking to discharge the above condition, we wish to discuss the proposed monitoring works and timetable with you.

Firstly, we wish to confirm that the refence in the condition should be to BRE 365 tests, rather than BRE 364.

The attached plan shows the proposed locations of the BRE365 tests. The monitoring wells will be installed in these locations too.

The table below provides the proposed timetable for the monitoring works:

w/c 2/12/19	w/c 9/12	w/c 16/12	w/c 23/12	w/c 30/12	w/c 6/01/20	w/c 13/01
Undertake winter BRE365 testing.	First week of monitoring groundwater levels.	Second week of monitoring groundwater levels.	Third week of monitoring groundwater levels.	Fourth week of monitoring groundwater levels.	Fifth week of monitoring groundwater levels.	Provision of report detailing BRE365 soakaway testing results, and details of groundwater levels during monitoring period.
Install groundwater monitoring wells adjacent to BRE365 locations.	Continuous groundwater level data loggers to be installed within monitoring wells.				End of monitoring period	

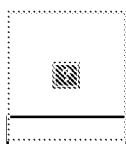
We would be grateful if could advise whether the proposed works and timetable would be acceptable in relation to discharging Condition 4 of consent ref: LU/59/19/PL.

Once we receive your feedback, we would look to apply to formally discharge the condition.

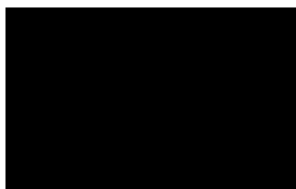
Should you wish to discuss the proposed monitoring works, please do contact me.

Kind Regards

Aarti O'Leary
BSc (Hons), MA (Merit), MRTPI
Associate



Chartered Surveyors & Town Planners
6 New Bridge Street
London
EC4V 6AB



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Appendix B – Soakaway Test Results