Plot 5000
Hatfield Business Park

Flood Risk Assessment & Drainage Strategy

Project Ref: PT/12313
First Issue

March 2017

Client
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REPORT STATUS

Client	Goodman UK Ltd
Report Title	Plot 5000 Hatfield Business Park
Report Type	Flood Risk Assessment & Drainage Strategy
Report Number	FRA/12313
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	Name	Date	Signed for and on behalf of Baynham Meikle Partnership
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1 Introduction

This Flood Risk Assessment has been prepared on behalf of Goodman UK Ltd, in support of a planning application for a proposed new B1c, B2, or B8 development at Plot 5000, Hatfield Business Park, Hatfield.

Plot 5000 is located off Mosquito Way north west of the roundabout junction with Dragon Road and Tamblin Way and is largely an undeveloped parcel of green land.

The development site has an approximate area of 1.2 hectares in total and an O.S. grid reference of E521274, N209100. A site location plan is included within appendix A of this report.

Although Plot 5000 is undeveloped it can be said that the remaining business park is well developed and operational with a varying complexity of businesses currently residing at the park.

This assessment has been prepared following the guidance set out in National Planning Policy Framework (NPPF) formerly Planning Policy Statement Note no. 25.

Further guidance has been obtained from:

- EA / DEFRA R&D document W5-74/A/TR/1 "Preliminary rainfall runoff for new developments" Revision D, including figures 2.1 & 2.2.
- "Interim National Procedures" point 3, 10.2 & 10.3
- The Suds Manual (c753)
- "Interim Code of Practice for Sustainable Drainage Systems 2004" (ICOP SUDS).

2 Existing Site

2.1 Site Location and Receiving Watercourse / River

The existing site is 100% soft landscaped and currently has no formal positive drainage system on-site discharging to off-site watercourses.

The current Hatfield Business Park development has a park wide adopted infrastructure foul and surface water drainage system that was implemented as part of the redevelopment of the historic Hatfield Aerodrome site during the late 1990's and early 2000's.

This drainage system has been designed to cater for all future plot developments at the business park and has previously been signed-off and approved by the local authority and The Environment Agency.

The existing surface water system generally comprises a network of oversized sewers located beneath the main infrastructure spine roads to the business park.

The surface water sewer sizes range between 1350 – 2400mm in diameter and provide the necessary attenuation volume required to limit discharge rates from the park to Greenfield run-off rates.

Flows from the sewers are discharged to the Ellenbrook receiving watercourse and are controlled / limited by an existing storm water pumping station.

Further attenuation volume is also provided by a series of off-line balancing ponds that at located adjacent to the Ellenbrook Watercourse.

2.1.1 Topography

The existing levels of Plot 5000 vary from between 74.43m AOD to the eastern boundary to 75.54m AOD to the south east corner of the site. (Refer to the topographical survey plan within appendix A).

2.1.2 Description of Catchment

The Environment Agency flood plain map confirms the application site is <u>not</u> within a recognised floodplain and is categorised as Flood Zone 1.

2.2 Geology

A Desk Top Study Report has been carried out by RSK Environment Ltd over the extent of the site. This study includes:

- Groundsure Geo Insight geo-environmental information.
- Trial pits of varying depth upto 3.7m deep.
- Drainage Infiltration / soakaway testing.
- CBR % Testing

Their findings are as follows:

Published geological records for the site indicate that it is underlain by superficial drift deposits of the Lowestoft Formation comprising of clays, clayey sands and gravels, silts and fine to course flint.

Preliminary trial pit data has been issued and is included within Appendix D of this report, it can be summarised as follows:

Strata Thickness	Strata Description
0.0 – 0.3m	TOPSOIL comprising clay with occasional roots, gravelly clayey sand.
0.0 – 0.5m	MADE GROUND comprising grass over sandy clay with occasional roots, gravel also observed along with angular flint and brick fragments.
0.15 – 1.80m	CLAY, silty sandy slightly gravelly with course sand. Gravel is angular fine to course flint.
0.5 – 3.30m	SAND, fine to course, gravel in angular to sub-rounded fine to course flint.
2.20 – 3.30m	GRAVEL, orange grown slightly silty and clayey. Sand is coarse. Gravel is angular to sub-rounded fine to coarse flint.

Soil infiltration soakaway have been carried out at the site, and confirms permeability vary from 5.13×10^{-6} m/s to 2.92×10^{-5} m/s (refer to appendix D)

Groundwater was encountered only in TP05 with seepage occurring 3.10m bgl.

CBR % testing was carried out in six locations (refer to appendix D for results of tests).

3 Flood Risk Assessment (Pre Development)

3.1 Existing Information on Flood Risk

3.1.1 Tidal/Coastal

Tidal or coastal flooding is not considered a risk as the nearest coast is approx. 63 kilometres away from the site.

3.1.2 Groundwater

Groundwater flooding is not known to be an issue. The existing site has had no problem with any form of groundwater, only on trial pit (TP05) encountered groundwater at a depth of 3.10m bgl. (Refer to trial pits in appendix D).

3.1.3 Surface Water

There is no evidence to suggest that the site currently drains to the existing adopted surface water sewers in the vicinity. Discharge from the development into the public sewer in Mosquito Way is proposed and is to be approved by Thames Water and the Environment Agency in line with historic approvals already in place.

3.1.4 Rivers / Watercourses

The Environment Agency publishes floodplain maps on the internet (http://www.environment-agency.gov.uk). These maps show the possible extent of fluvial flooding for the 1 in 100-year flood (that which would have a 1% probability of being exceeded each year) or the possible extent of tidal flooding to a 1 in 200 year event. A plan showing the extent of the flooding along the nearest marked Environment Agency marked watercourse is presented in appendix A. This plan shows that the development under consideration is outside the area of any recognised floodplain.

4 Proposed Site

4.1 Description of development

The proposed planning application is for the development of a B1c, B2 or B8 building (subject to confirmation) of approximately 4,780 sq.m with a two-storey office facility of 1,550 sq.m.

The development site area is approximately 1.20 hectares.

The proposed building will have a two level access door to its main elevation with level entry doors to the warehouse and office main entrance. (Subject to detail design).

The external areas will comprise an access road, service yard, car parking including HGV manoeuvring space.

A soft Landscape scheme will also be integrated into the proposed development.

Development external levels strategy will seek to (where possible) follow the contours of the existing site so as to minimise the requirement for any retaining walls.

Proposed development levels will also be set such that should any flooding occur it is controlled and kept within the new development demise and not affect neighbouring properties or highway land.

5 Drainage Strategy

5.1 Existing Drainage

The existing site is currently an undeveloped "green" site that does not discharge surface water by means of any positive drainage system to off-site sewers or watercourses.

As previously indicated in section 2.1, the Hatfield Business Park site currently has a site wide adopted foul and surface water drainage system that has previously been put in place to cater for discharges from the various undeveloped plots including this development – Plot 5000.

The proposal is for foul and surface water to discharge from Plot 5000 to the existing positive drainage spurs that have already been constructed from the main sewers within Mosquito Way to serve the development.

5.2 Proposed Drainage

The findings of the preliminary site investigation data confirms the prevailing ground conditions are made ground, silty clay or fine sands and gravels encountered from ground level and beyond.

The site infiltration confirms permeabilities varies from 3.13×10^{-6} m/s to 2.92×10^{-5} m/s which confirms low level of infiltration is possible in specific areas, previous communications with The Environment Agency have concluded the drainage of the site via soakaway methods is not preferred – hence the current Business Park drainage strategy that is in place.

Concerns have previously been raised that allowing surface water infiltrate into the ground may promote the mobilisation of deep historic contaminants below ground and this may lead to possible contamination of the underlying aquifer.

The above constraints should however not prohibit the incorporation of SUDS drainage techniques into the proposed drainage strategy.

A proposed levels and drainage strategy plan is included within Appendix B of this report that illustrates the various techniques that are to be adopted.

The development plot has the use of a surface water drainage spur emanating from the storm water sewer in Mosquito Way. The spur not only serves the proposed development it will also serve a future development plot to the east.

It is envisaged that the proposed new main building is to have a syphonic roof water drainage system.

The service yard will have an oversized surface water drainage channel to collect run-off and provide additional underground attenuation volume. It will discharge to the on-site storm water drainage system and cellular storage tank via a suitably sized Class 1 full retention oil interceptor.

Further attenuation volume is to be provided to the car parking area in the form of free draining sub-base. This is to minimise any flooding during extreme rain fall events.

The new area of staff and visitors car parking area will be constructed as an area of permeable surfacing that will comprise permeable block paving underlain by a suitable free draining subbase material that will enable surface water run-off to be attenuated. This design will help attenuate peak design flows from the development by utilising the volume available within the permeable stone (type 1 material with no fines) within the structural layers of the construction. It is proposed that the permeable stone media is tanked by an impermeable membrane and flows are allowed to discharge into the drainage system via a series of perforated pipes placed within the stone media.

These methods of surface water interception / collection will also avoid the need to provide oil interceptor units within parking areas as the stone media under the permeable block paving will naturally capture hydrocarbon contaminants.

5.2.1 Proposed Foul Drainage

An existing drainage spur has previously been constructed off the public sewer in Mosquito Way to serve this site.

The proposed foul drainage strategy for the new development anticipates Thames Water will allow the use of the historically dedicated spur to discharge foul flows into the public sewer within Mosquito Way.

5.3 PROPOSED SUDS MEASURES - SUMMARY

5.3.1 Ground Permeability (Soakaways)

The findings of the ground investigation report would seem to suggest variable permeability across the site and that infiltration drainage techniques directly into the underlying strata would not be appropriate for use as part of the surface water drainage strategy.

5.3.2 Allowable Surface Flooding

Additional storage of peak storm water can be facilitated by allowing car-parking and Service yard areas to flood up to a maximum of 100mm, provided this does not put the buildings, or neighbouring properties at risk of flooding. The proposed site levels will be set such that this is achieved, and will need to be carefully considered to ensure that flooding is routed away for the proposed new office / populated areas.

5.3.3 Filtration / Cleaning

There will be a natural filtering/cleaning out of any hydrocarbon pollution form the effect of surface water passing through the stone media underneath the permeable car parking surfacing. The use of a petrol interceptor is not proposed in this instance, although full retention interceptors will still be incorporated into the service yard drainage scheme.

5.3.4 Underground Storage

Underground attenuation storage is to be provided to the surface water drainage system in the form a cellular tank, oversized drainage channels may also be provided to provide additional storage volumes at times of the higher 1 in 100 year plus climate change storm return periods.

5.3.5 Flow Controls

Peak surface water discharge rate to the public sewer is to be controlled by the introduction of a vortex control device installed within the on outfall manhole to limit the discharge to the pro rata value of 57 l/s, which is based on a 1 in 100 year plus 30% climate change storm event.

5.3.6 Maintenance

The complete drainage system will have a detailed maintenance regime in place prior to occupation. This regime will involve an inspection after 3 and 6 months, and any maintenance required will be carried out. A further inspection will be carried out after 12 months, after which the maintenance schedule will be reviewed and adjusted to suit the circumstances and maintenance requirements of the development. In any case following severe storm events, the system will be inspected to ensure that all elements are performing satisfactory.

5.4 Drainage Design Summary

Taking onboard the techniques previously discussed the following features are proposed for the scheme drainage strategy:

- Introduce oversizing of surface water drainage channels within the plot to provide underground storage volume.

- Introduce a surface water control to limit the discharge rate from the new development into the existing Infrastructure sewer via a vortex control device.

- Provide cellular storage tank. This provide a very high percentage of storage volume and surface area given the space required; whilst they are deemed not to provide any form of hydrocarbon capture they generally provide an effective means of attenuation storage volume.

- Provide permeable paving to the proposed new vehicular parking areas, where applicable.

- Allowing the external car parks, service yard areas to flood in the more extreme 1 in 100 year plus 30% climate change storm events. (Underground storage is to be designed such that no flooding occurs at the 1 in 30 year event).

- Incorporate a full retention interceptor serving to the service yard surface water drainage system.

The above systems are illustrated with the drainage strategy plan 12313 / 106 within appendix B of this report.

5.4.1 Discharge Rates

The Hatfield Business Park drainage system had been sized to allow various developed and undeveloped plots certain restricted surface water peak discharge rate into it.

This 1.20 Ha undeveloped plot of land under consideration has previously been allocated a 100 year plus climate change pro rata allowable peak surface water discharge rate of 57 l/s. It is therefore proposed that this rate is used to limit peak discharge rate values to the surface water design. (Refer to microdrainage calculations in appendix C).

5.4.2 Windes Design Analysis

Microdrainage simulation calculations indicate a volume of 115m³ simulation of underground surface water attenuation is required for the 1 in 100 year return period plus 30% climate change to prevent the onset of any excessive flooding.

The proposal is for attenuation to be provided in the form of cellular crates, oversized channels and free draining sub base to car parking to help to control flood waters for the 1 in 100 year plus climate change event to ensure all flood waters are contained on the site.

The proposed development levels will be set such that any flooding is confined to the main service yard area. In storm water exceedance events routing will be applied to ensure protection to proposed buildings and adjacent landowners.

Drainage Strategy drawing and levels 12313 / 106 within Appendix B of this report also illustrates the potential flood routing.

Refer to Microdrainage simulation calculating within Appendix C of this report.

6 Summary

Baynham Meikle Partnership has prepared this Flood Risk Assessment along the lines set out in National Planning Policy Framework (NPPF) formerly Planning Policy Statement Note no. 25 (PPS25), and SUD's manual c753 to support this Outline Planning Application.

The Flood Risk Assessment may be summarised as follows:

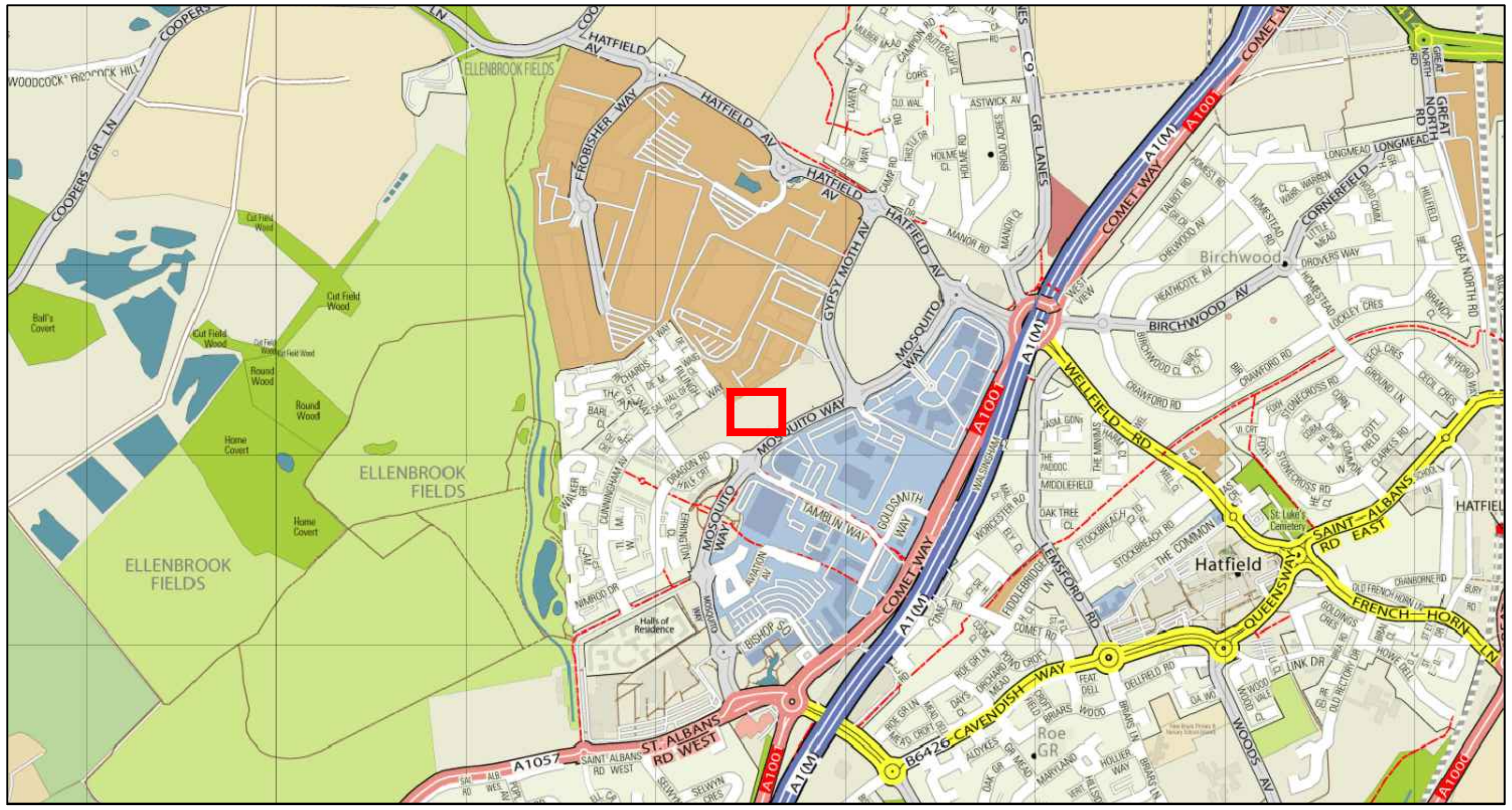
- The Flood Maps have shown that the site is not identified to be at risk from fluvial flooding and does not form part of the functional floodplain.
- The surface water discharge rate from the development will be limited to historic agreed pro rata value such that the volume of storage available to this plot within the Hatfield Business Park drainage system is realised.
- The surface water runoff from the development site will be controlled. This is to be achieved through flow attenuation and the use of SUDS techniques in the new design. The techniques proposed are sub-surface storage in the way of cellular tanks, oversized channel and permeable surfacing lined / tanked infiltration structures.
- External area of service yard is to be allowed to temporarily flood by circa 100mm in extreme storm events. Finished ground levels will be carefully considered and flood routing will be applied to ensure protection proposed buildings and where possible adjacent landowners, in the event of extreme conditions.
- The water quality will also be improved because of the use of SUDS drainage techniques such as permeable surfacing.
- The quality of water discharging from site will be assisted by the incorporation of a Class 1 full retention petrol interceptor serves the proposed service yard.

It can therefore be said that the proposed development drainage scheme will not increase the potential of any flooding. This is mainly due to the peak runoff flows from the site being controlled and the adoption of recommended SUDS design techniques in line with the EA guidance.

<u>APPENDIX A – EXISTING DRAWINGS</u>

- 12313 / 100 SITE LOCATION PLAN
- 12313 / 101 TOPOGRAPHICAL SURVEY PLAN
- 12313 / 102 ENVIRONMENTAL AGENCY FLOOD MAP
- 12313 / 103 CONSTRAINTS PLAN

NOTES | A3



WORKS BOUNDARY

EXISTING SITE PLAN
SCALE: N.T.S.

LOCATION PLAN
SCALE: N.T.S.

APPROXIMATE SITE LOCATION

POSTCODE: AL10 9AX.

GRID CO-ORDINATES:
E: 521311
N: 209118

FOR PLANNING

Rev	Date	Description	By	Chkd By

Revision Schedule

Drawn by	Checked by	Project Engineer
K.M.	P.T.	N.S.B.

Date	Scale
FEB 2017	N.T.S.

Project No	Drawing No	Rev
12313	100	-

Project Title
HATFIELD BUSINESS PARK
PLOT 5000

Drawing Title
SITE LOCATION PLAN

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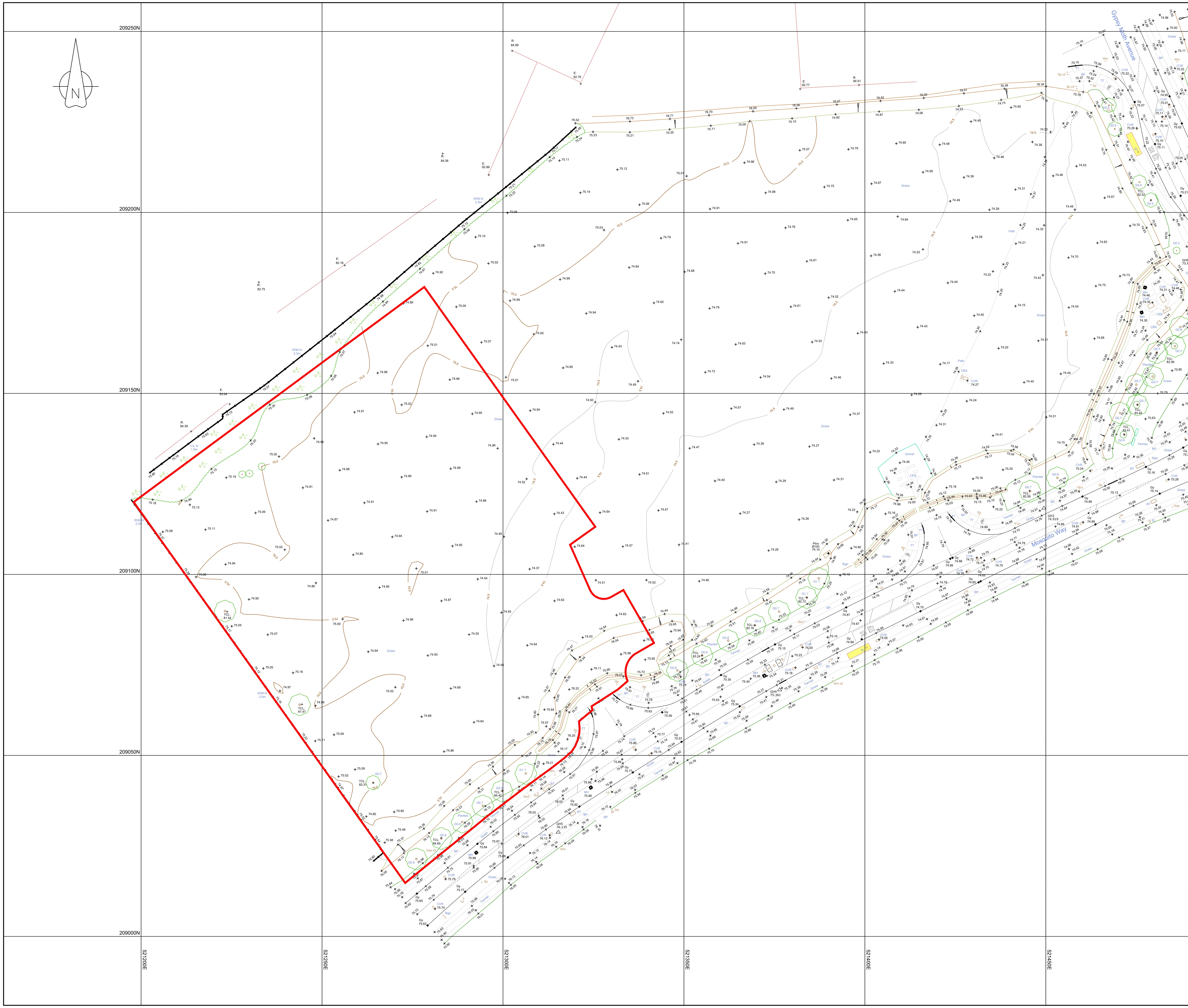

NOTES

A1

1. HISTORIC TOPOGRAPHICAL SURVEY PROVIDED BY A.J.A. ARCHITECTS, DRAWING No. 6050-019 SITE LAYOUT PLAN (DATED 10/02/2017).

KEY:

SITE BOUNDARY.

FOR PLANNING

Rev	Date	Description	By	Chkd By

Revision Schedule

Project Title
HATFIELD BUSINESS PARK
PLOT 5000

Drawing Title
TOPOGRAPHICAL SURVEY PLAN

Drawn by K.M.	Checked by P.T.	Project Engineer N.S.B.		
Date	Scale	Project No	Drawing No	Rev
FEB 2017	1:500	12313	101	-

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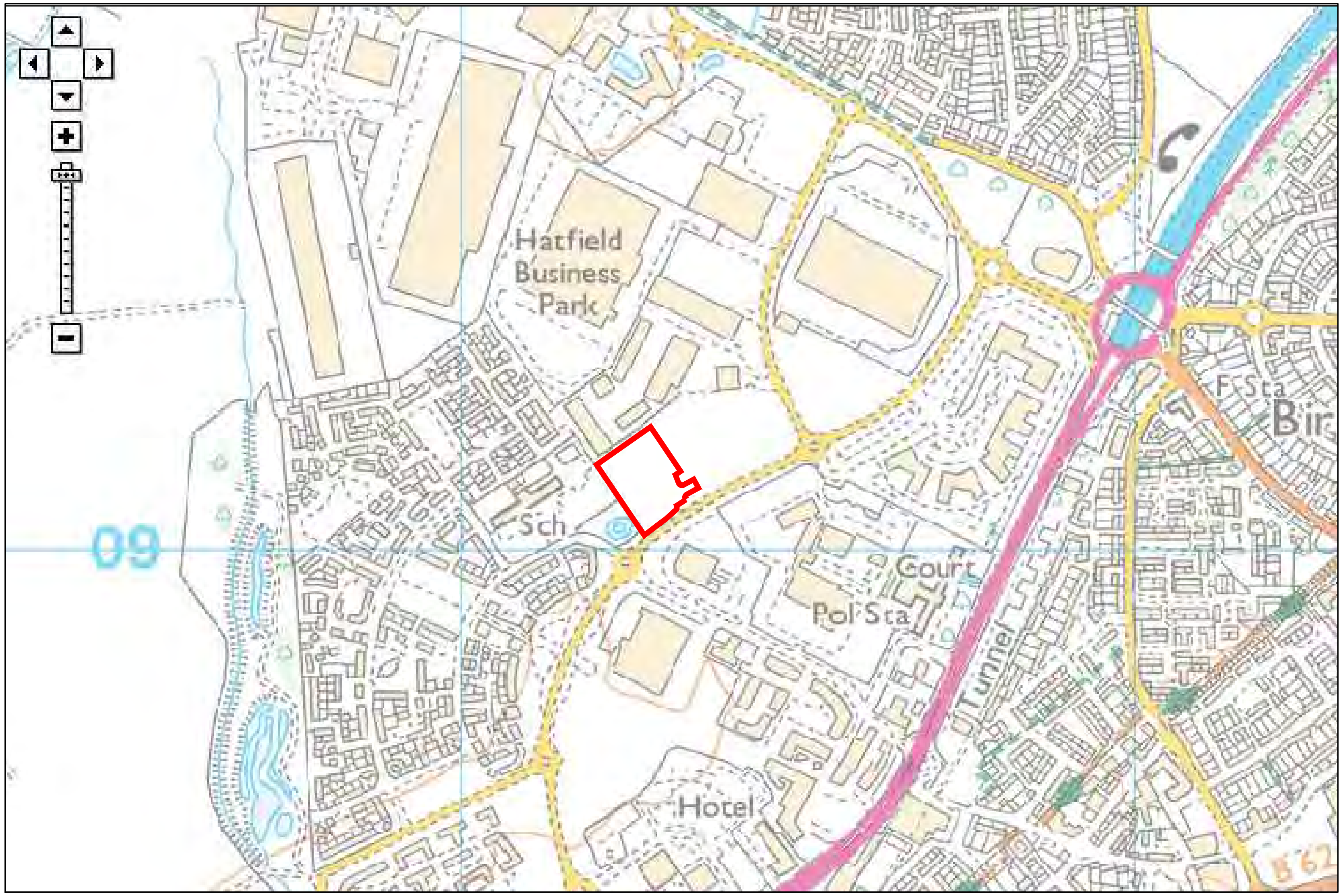
NOTES A3



KEY:

- Flood Zone 3
- Flood Zone 2
- Flood defences (Not all may be shown*)
- Areas benefiting from flood defences (Not all may be shown*)

WORKS BOUNDARY

E.A. FLOOD MAP
SCALE: N.T.S.

FOR PLANNING

Rev	Date	Description	By	Chkd By

Revision Schedule

Drawn by	Checked by	Project Engineer
K.M.	P.T.	N.S.B.

Date	Scale
FEB 2017	N.T.S.

Project No	Drawing No	Rev
12313	102	-

Project Title
HATFIELD BUSINESS PARK
PLOT 5000

Drawing Title
E.A. FLOOD MAP

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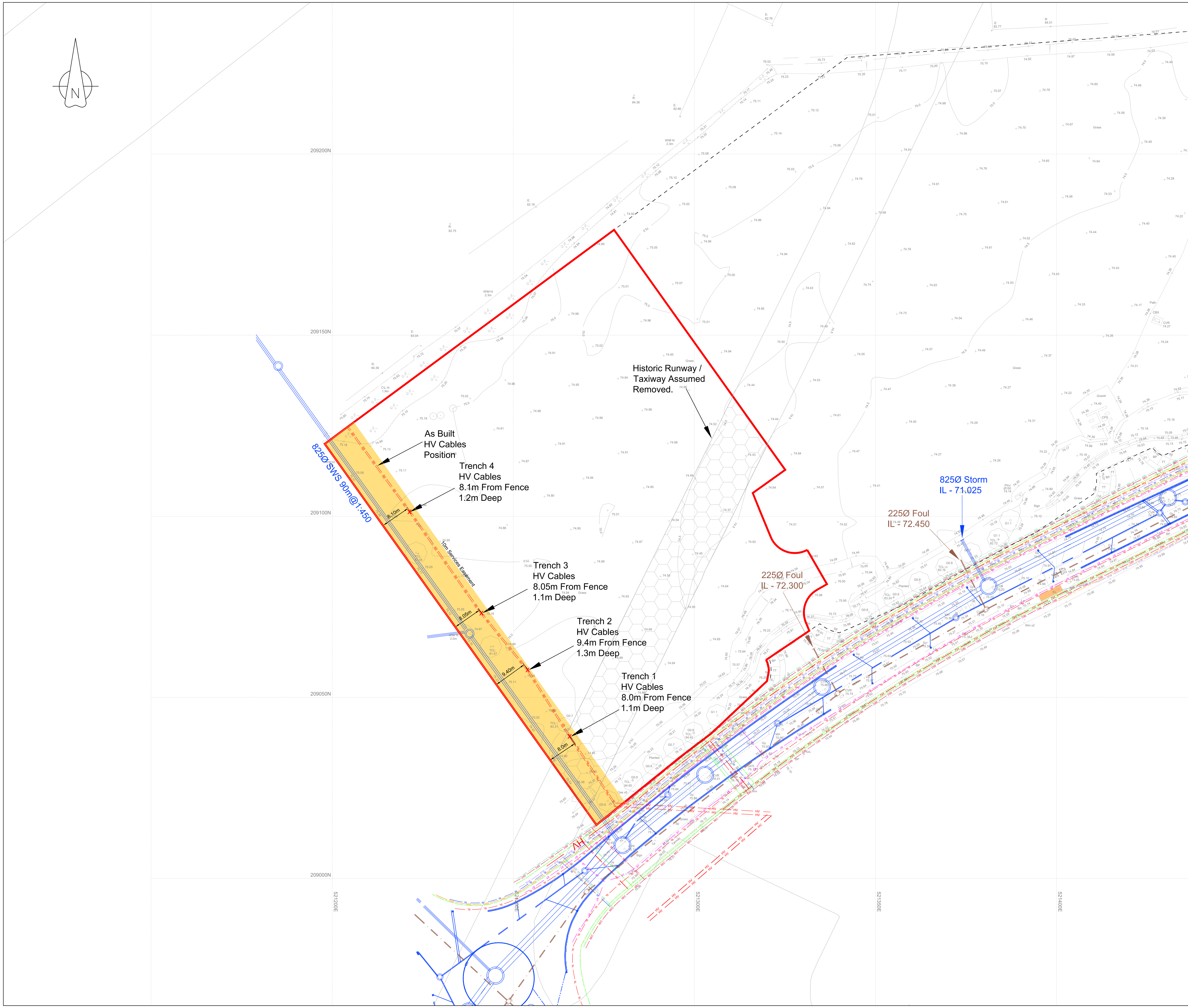

NOTES | A1

1. PROPOSED SITE LAYOUT TAKEN FROM A.J.A. ARCHITECTS, DRAWING No. 6050-019 SITE LAYOUT PLAN (DATED 10/02/2017).
2. ALL EXISTING UTILITIES SHOWN ON THIS DRAWING HAVE BEEN TAKEN FROM RECORD DRAWINGS, AND THEIR ACCURACY CANNOT BE GUARANTEED BY BMP.
3. EXACT POSITION OF THE SERVICES AS WELL AS NEW POINTS OF CONNECTIONS TO BE CONFIRMED ONCE SERVICES QUOTATIONS HAVE BEEN RECEIVED.

KEY:

- SITE BOUNDARY
- W — W — EXISTING WATER MAINS.
- GAS — GAS — EXISTING GAS MAINS.
- HV — HV — EXISTING H.V. ELECTRICITY.
- BT — BT — EXISTING B.T. DUCTS.
- SPARE — SPARE — EXISTING SPARE DUCTS.
- SEC — SEC — EXISTING SECURITY.
- IRR — IRR — EXISTING IRRIGATION.
- LV — LV — EXISTING L.V. ELECTRICITY.
- BUS — BUS — EXISTING BUS DUCTS.
- SL — SL — EXISTING STREET LIGHTING.
- EXISTING FOUL WATER DRAINAGE.
- EXISTING SURFACE WATER DRAINAGE.
- 10M SERVICES EASEMENT.
- HISTORIC RUNWAY / TAXIWAY

FOR COMMENT

Rev	Date	Description	By	Chkd By
A	17.03.17	HV Cables location in easement confirmed. Topographical survey updated.	GH	NSB

Revision Schedule

Project Title
HATFIELD BUSINESS PARK
PLOT 5000

Drawing Title
EXISTING SITE CONSTRAINTS PLAN

Drawn by K.M. | Checked by P.T. | Project Engineer N.S.B.

Date	Scale	Project No	Drawing No	Rev
FEB 2017	1:500	12313	103	A

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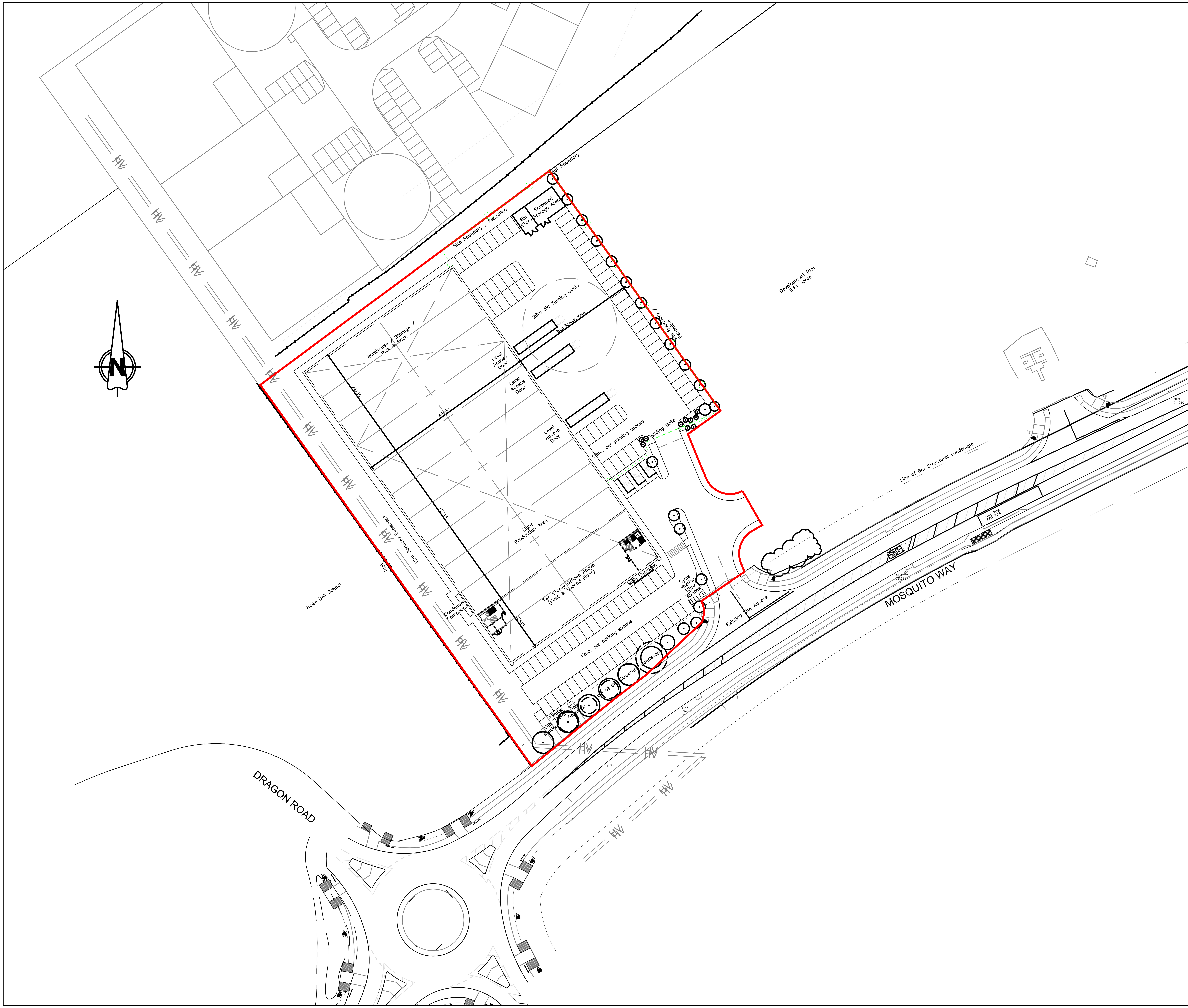
APPENDIX B – PROPOSED DRAWINGS

- 12313 / 104 PROPOSED SITE LAYOUT PLAN
- 12313 / 106 PROPOSED DRAINAGE STRATEGY PLAN
- 12313 / 110 PROPOSED IMPERMEABLE AREAS PLAN



NOTES | A1

1. PROPOSED SITE LAYOUT TAKEN FROM A.J.A. ARCHITECTS, DRAWING No. 6050-048 SITE LAYOUT PLAN (DATED 15/03/2017).

KEY:

SITE BOUNDARY.

FOR PLANNING

Rev	Date	Description	By	Chkd By

Revision Schedule

Project Title
HATFIELD BUSINESS PARK
PLOT 5000

Drawing Title
PROPOSED SITE LAYOUT PLAN

Drawn by K.M.	Checked by P.T.	Project Engineer N.S.B.		
Date	Scale	Project No	Drawing No	Rev
FEB 2017	1:500	12313	104	-

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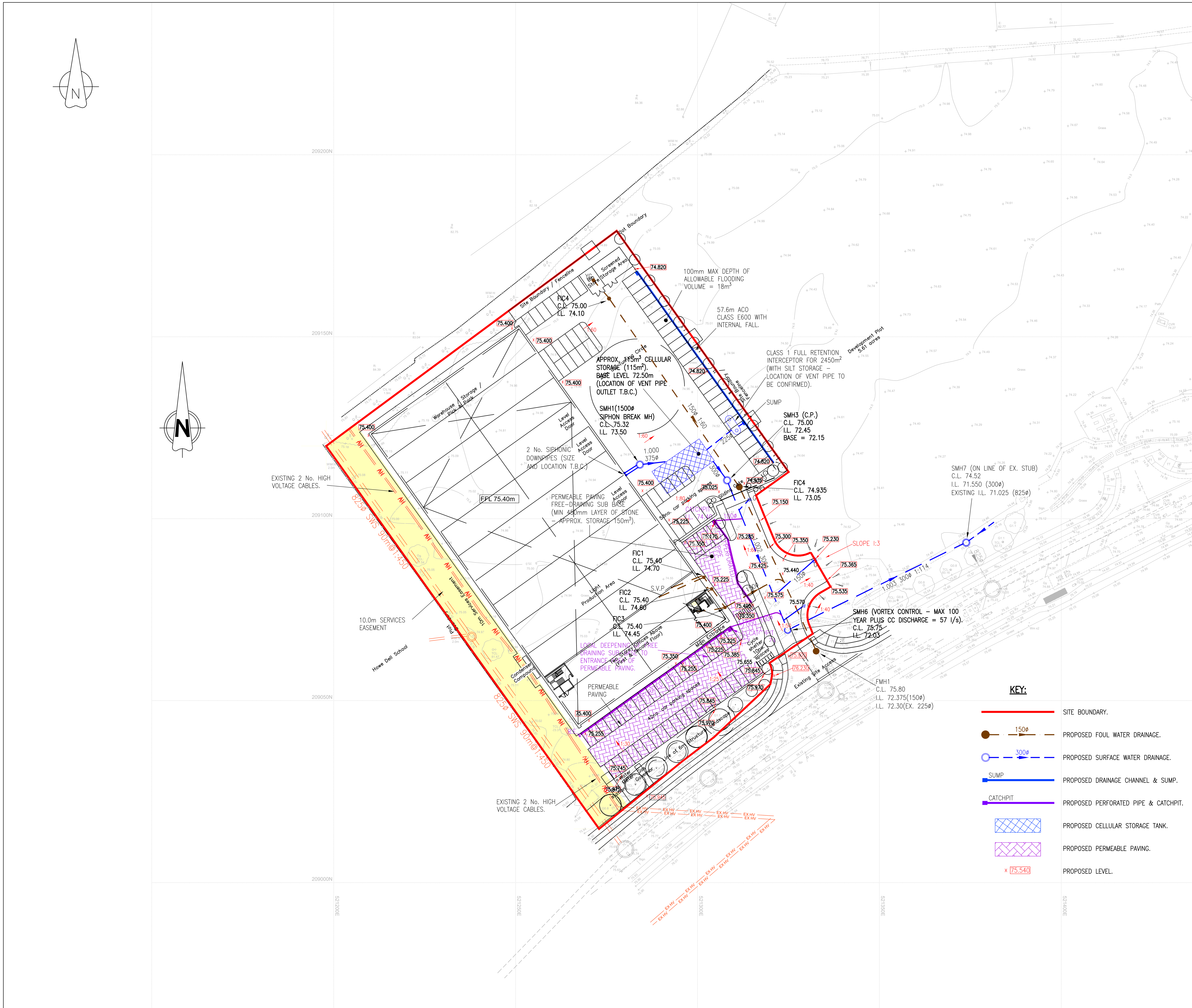


KEY:

	SITE BOUNDARY.
150ø	PROPOSED FOUL WATER DRAINAGE.
300ø	PROPOSED SURFACE WATER DRAINAGE.
SUMP	PROPOSED DRAINAGE CHANNEL & SUMP.
CATCHPIT	PROPOSED PERFORATED PIPE & CATCHPIT.
	PROPOSED CELLULAR STORAGE TANK.
	PROPOSED PERMEABLE PAVING.
× 75.540	PROPOSED LEVEL.

NOTES

A1

1. DO NOT SCALE THIS DRAWING. ALL DIMENSIONS MUST BE VERIFIED ON SITE. IF IN DOUBT ASK.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL LEVELS IN METRES UNLESS NOTED OTHERWISE.
4. ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
5. THE BASE SPECIFICATION FOR DRAINAGE WORKS SHALL BE THE WATER AUTHORITY ASSOCIATION "SEWERS FOR ADOPTION" (LATEST EDITION).
6. FOR DETAILS OF GROUND CONDITIONS REFER TO THE GROUND INVESTIGATION REPORT.
7. THE FOLLOWING PIPE STRENGTHS SHALL BE ADOPTED UNLESS NOTED OTHERWISE:–
   PIPES UP TO AND INCLUDING 150mm ø TO BE PVC–U TO BS EN 1329, OR CLAYWARE TO BS EN 295 CLASS 160.
   PIPES 150mm ø UP TO AND INCLUDING 225mm ø TO BE CLAYWARE TO BS EN 295 CLASS 160
   300mm ø TO BE CLAYWARE TO BS EN 295 CLASS 160 OR CONCRETE TO BS 5911 CLASS M.
   PIPES OVER 300mm ø TO BE CONCRETE TO BS 5911 CLASS M.
9. ALL PIPE RUNS TO BE LAID WITH FLEXIBLE JOINTS.
10. ALL PIPES ENTERING AND EXITING MANHOLES ARE TO BE CONNECTED WITH PIPE SOFFITS LEVEL UNLESS NOTED OTHERWISE.
11. BEDDING AND SURROUND TO BE AS FOLLOWS :–

LOCATION	COVER TO SOFFIT	BEDDING
ROADS	>1.2m	CLASS "S" GRANULAR BED & SURROUND
	<1.2m	CLASS "Z" CONCRETE SURROUND
HARD AND SOFT LANDSCAPING	>0.6m	CLASS "S" GRANULAR BED & SURROUND
	<0.6m	CLASS "Z" CONCRETE SURROUND

12. THE FOLLOWING CONCRETE MIXES ARE TO BE USED (ALL IN ACCORDANCE WITH BS 8500) :–

LOCATION	MIX REFERENCE	(WHERE APPLICABLE)
CONCRETE SURROUND TO PIPES	GEN 3	
CONCRETE BASE & SURROUND TO MANHOLES	GEN 3	

13. ALL PRECAST CONCRETE PRODUCTS (IE PIPES, MANHOLES RINGS ETC.) SHALL BE OF SUITABLE CONCRETE MIX TO CATER FOR CLASS 2 SULPHATES.
14. PRE–FORMED CHANNELS ARE TO BE USED IN MANHOLES WHERE APPLICABLE.
15. GRANOLITHIC CONCRETE BENCHING TO BE STEEL TROWELLED TO A DENSE SMOOTH FACE NEATLY SHAPED AND FINISHED TO ALL BRANCH CONNECTIONS AND LAID IN ACCORDANCE WITH THE SPECIFICATION.
16. ALL CONNECTIONS TO BE TURNED IN DIRECTION OF FLOW USING PIPE BENDS.
17. MANHOLE COVERS AND FRAMES TO BE DUCTILE IRON MEDIUM DUTY GRADE B125 CIRCULAR OR RECTANGULAR TO BS EN124 POSITIONS OUTSIDE VEHICULAR TRAFFICKED AREAS.
18. MANHOLE COVERS AND FRAMES TO BE DUCTILE IRON MEDIUM DUTY GRADE A15 COVERS IN SOFT LANDSCAPING, E600 IN SERVICE YARD.
19. FIRST FLEXIBLE JOINT IN PIPES ADJACENT TO A MANHOLE SHALL BE A MAXIMUM OF 600mm FROM INSIDE FACE OF MANHOLE, CONNECTING TO ROCKER PIPE.

   THE LENGTH OF ROCKER PIPE IS AS FOLLOWS:–

PIPE DIAMETER	LENGTH OF ROCKER PIPE
150mm – 600mm	600mm
675mm – 750mm	1000mm
825mm & OVER	1250mm

20. MANHOLES WITH OUTGOING PIPES GREATER THAN 600mm ø SHALL BE FITTED WITH GUARD BARS, SAFETY CHAINS OR OTHER SAFETY DEVICES.
21. THE PRINCIPLE CONTRACTOR SHALL BE RESPONSIBLE FOR CHECKING THE EXISTING LINE AND INVERT LEVELS OF ANY CONNECTION POINTS FOR BOTH THE FOUL AND SURFACE WATER SYSTEMS, PRIOR TO UNDERTAKING INSTALLATION OF ANY NEW DRAINAGE WORKS. ANY DEVIATION TO THE LEVELS AND POSITIONS INDICATED ON THE DRAWING SHOULD BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE PROJECT ENGINEER.
22. ALL INVERTS SPECIFIED ARE OUTGOING (EXCEPT BACKDROP). ALL PIPE ARE TO BE LAID SOFFITS LEVELS UNLESS NOTED OTHERWISE.
23. ALL FOUL CONNECTIONS TO BE 100mm ø LAID AT A MINIMUM GRADIENT OF 1/40 UNLESS NOTED OTHERWISE. ALL SURFACE WATER PIPE TO BE 150mm ø UNLESS NOTED OTHERWISE.
24. ALL CONNECTIONS TO BE MADE BY PURPOSE–MADE JUNCTIONS AS FAR AS PRACTICABLE.
25. LOCATION OF CELLULAR SOAKAWAYS VENT PIPES TO BE CONFIRMED AT DETAIL DESIGN BY MANUFACTURER.
26. PROPOSED SITE LAYOUT TAKEN FROM A.J.A. ARCHITECTS DRAWING No. 605–033 SITE LAYOUT PLAN (DATED 28/02/2017).
27. SIPHONIC ROOF WATER DRAINAGE SYSTEM DISCHARGE PIPES/FLOWS/OVER FLOWS TO BE CONFIRMED.
28. THIS DRAWING IS SUBJECT TO DETAIL DESIGN AND IS FOR PLANNING SUBMISSION ONLY.

FOR PLANNING

Rev	Date	Description	By	Chkd By
B	21/03/17	ARCHITECT'S LAYOUT UPDATED. LEVELS REVISED.	GH	N.S.B.
A	01/03/17	ARCHITECT'S LAYOUT UPDATED. DRAINAGE UPDATED.	P.T.	N.S.B.

Revision Schedule

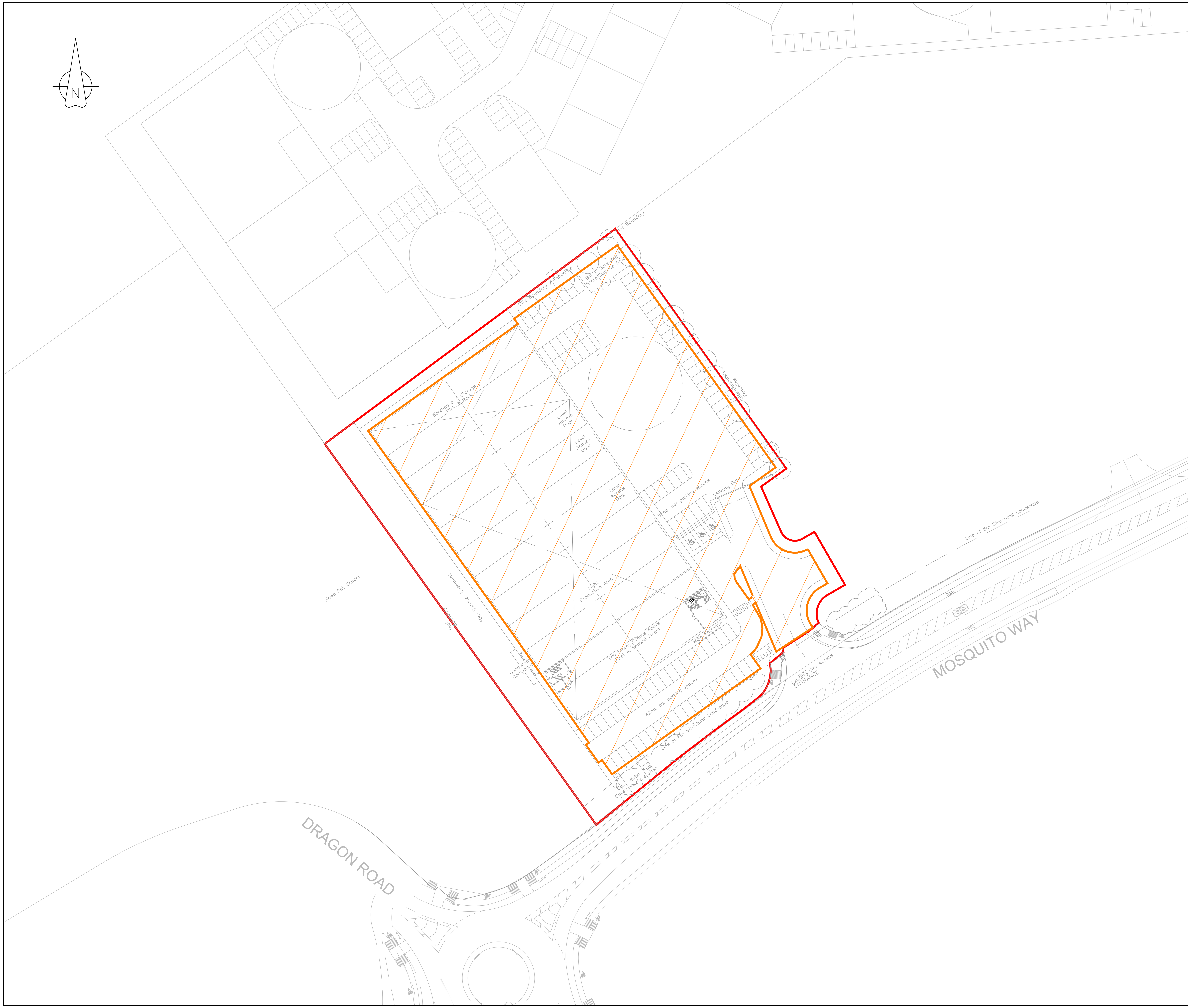
Project Title
HATFIELD BUSINESS PARK
PLOT 5000

Drawing Title
PROPOSED LEVELS AND DRAINAGE STRATEGY PLAN

Drawn by	Checked by	Project Engineer
K.M.	P.T.	N.S.B.

Date	Scale	Project No	Drawing No	Rev
FEB 2017	1:500	12313	106	B

BAYNHAM MEIKLE
Consulting Structural & Civil Engineers
8 Meadow Road, Edgbaston, Birmingham B17 8BU
Tel: 0121 434 4100 Fax: 0121 434 4073 Email: admin@bm-p.co.uk



NOTES

A1

1. PROPOSED SITE LAYOUT TAKEN FROM A.J.A. ARCHITECTS, DRAWING No. 6050-033 SITE LAYOUT PLAN (DATED 28/02/2017).

KEY:

PROPOSED IMPERMEABLE AREA = **0.95 Ha.**

SITE BOUNDARY.

FOR PLANNING

Rev	Date	Description	By	Chkd By

Revision Schedule

Project Title
HATFIELD BUSINESS PARK
PLOT 5000

Drawing Title
PROPOSED IMPERMEABLE AREAS PLAN

Drawn by K.M.	Checked by P.T.	Project Engineer N.S.B.		
Date	Scale	Project No	Drawing No	Rev
FEB 2017	1:500	12313	110	-

BAYNHAM MEIKLE
Consulting Structural & Civil Engineers
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APPENDIX C – MICRODRAINAGE CALCULATIONS

- 12313 – PLOT 5000 SIMULATION CALCULATIONS FOR PLANNING

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	Add Flow / Climate Change (%)	0
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio R	0.400	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	0	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	3.600	0.375	9.6	0.510	2.00	0.0	0.600	o	375	Pipe/Conduit	
1.001	6.500	0.050	130.0	0.260	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	44.400	0.420	105.7	0.056	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	12.300	1.770	6.9	0.125	12.00	0.0	0.600	o	100	Pipe/Conduit	
1.003	54.600	0.475	114.9	0.002	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	14.300	0.048	297.9	0.000	0.00	0.0	0.600	o	825	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	0.00	2.01	73.500	0.510	0.0	0.0	0.0	5.88	649.1	0.0
1.001	0.00	2.09	72.500	0.770	0.0	0.0	0.0	1.38	97.4	0.0
1.002	0.00	2.57	72.450	0.826	0.0	0.0	0.0	1.53	108.1	0.0
2.000	0.00	12.07	74.000	0.125	0.0	0.0	0.0	2.95	23.2	0.0
1.003	0.00	12.69	72.030	0.953	0.0	0.0	0.0	1.47	103.6	0.0
1.004	0.00	12.83	71.025	0.953	0.0	0.0	0.0	1.71	916.7	0.0

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	375	1	75.320	73.500	1.445	Open Manhole	1350
1.001	o	300	2	75.050	72.500	2.250	Open Manhole	1350
1.002	o	300	3	75.050	72.450	2.300	Open Manhole	1200
2.000	o	100	4	75.320	74.000	1.220	Open Manhole	1200
1.003	o	300	4	75.750	72.030	3.420	Open Manhole	1200
1.004	o	825	5	74.520	71.025	2.670	Open Manhole	1800

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	3.600	9.6	2	75.050	73.125	1.550	Open Manhole	1350
1.001	6.500	130.0	3	75.050	72.450	2.300	Open Manhole	1200
1.002	44.400	105.7	4	75.750	72.030	3.420	Open Manhole	1200
2.000	12.300	6.9	4	75.750	72.230	3.420	Open Manhole	1200
1.003	54.600	114.9	5	74.520	71.555	2.665	Open Manhole	1800
1.004	14.300	297.9		74.400	70.977	2.598	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.004		74.400	70.977	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.400		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 4, DS/PN: 1.003, Volume (m^3): 7.3

Unit Reference	MD-SHE-0273-5700-3720-5700
Design Head (m)	3.720
Design Flow (l/s)	57.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	273
Invert Level (m)	72.030
Minimum Outlet Pipe Diameter (mm)	Site Specific Design (Contact Hydro International)
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	3.720	56.9
Flush-Flo™	1.073	56.9
Kick-Flo®	2.228	44.5
Mean Flow over Head Range	-	49.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.6	1.200	56.8	3.000	51.3	7.000	77.3
0.200	28.1	1.400	56.1	3.500	55.3	7.500	80.0
0.300	44.5	1.600	54.9	4.000	59.0	8.000	82.5
0.400	48.7	1.800	53.0	4.500	62.4	8.500	85.0
0.500	51.6	2.000	50.0	5.000	65.7	9.000	87.4
0.600	53.7	2.200	45.4	5.500	68.8	9.500	89.7
0.800	56.1	2.400	46.1	6.000	71.8		
1.000	56.9	2.600	47.9	6.500	74.6		

Storage Structures for Storm

Cellular Storage Manhole: 2, DS/PN: 1.001

Invert Level (m) 72.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	**Area (m²)**	**Inf. Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
0.000	115.0	115.0	1.000	115.0	157.9

Porous Car Park Manhole: 4, DS/PN: 2.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	68.8
Membrane Percolation (mm/hr)	1000	Length (m)	15.6
Max Percolation (l/s)	298.1	Slope (1:X)	30.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	74.500	Membrane Depth (mm)	0

Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	150.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

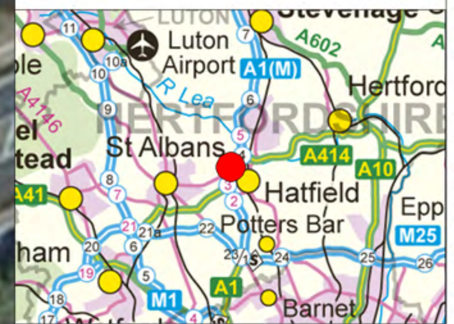
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Summer	100	+30%	100/15 Summer			
1.001	2	30 Summer	100	+30%	30/15 Summer			
1.002	3	15 Summer	100	+30%	30/15 Summer	100/120 Winter		
2.000	4	15 Winter	30	+0%	30/15 Summer			
1.003	4	15 Winter	100	+30%	1/15 Summer			
1.004	5	30 Summer	100	+30%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	74.489	0.614	0.000	1.58		378.6	SURCHARGED	
1.001	2	74.170	1.370	0.000	1.54		94.3	SURCHARGED	
1.002	3	74.040	1.290	0.000	0.80		81.1	SURCHARGED	
2.000	4	74.553	0.453	0.000	0.97		21.3	SURCHARGED	
1.003	4	74.491	2.161	0.000	0.58		56.8	SURCHARGED	
1.004	5	71.201	-0.649	0.000	0.10		56.8	OK	

APPENDIX D – SITE INVESTIGATION

- RSK TRIAL PITS EXPLORATORY LOCATION PLAN
- TRIAL PIT LOGS
- SOAKAWAY TESTS
- CBR % TESTS

Site boundary
Borehole (BH)
Trial Pit (TP)



00	23.02.17	313555	SP	RG	MS
Rev	Date	Description	Drn	Chk	App

Hatfield Plot 5000

RSK

Figure 3

Exploratory Location Plan

0 25
metres
Scale = 1:750 @ A3

N W E S

REV 00

File Name : \\cv-nas1\AsbestosGeoscience Data\Cov Ground and Environment\Jobs\313000 ONWARDS\313500 - 313599\313555 - Hatfield Plot 5000\10 Drawings\GIS

TRIAL PIT LOG

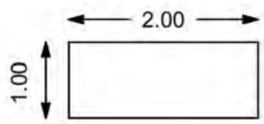
RSK

Contract:	Client:	Trial Pit:
Plot 5000, Hatfield Business Park	Goodmans	TP01

Contract Ref:	Start:	End:	Ground Level:	Co-ordinates:	Sheet:
313555	06.03.17	06.03.17	---	---	1 of 1

Depth	No	Type	Results	Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
0.20 0.20	1	ES PID	 0.0ppm			Grass over brown slightly gravelly clayey SAND with frequent roots and rootlets. Sand is coarse. Gravel is sub-angular to rounded fine to coarse quartzite and flint. (TOPSOIL)	0.25	
0.40 0.40 0.50 1.00 1.00 1.00	2 3 4 5	ES PID B D D V	 0.0ppm c_u=82/89/92/90			Firm to stiff brown slightly gravelly silty sandy friable CLAY. Sand is coarse. Gravel is angular to sub-angular fine to coarse flint. (LOWESTOFT FORMATION) . . . becoming more gravelly and sandy from 1.20m bgl.	(1.55) 1.80	
1.80 2.00 3.00	6 7 8	D D D				Light orangish brown gravelly very clayey SAND with frequent pockets of clay. Sand is fine to coarse. Gravel is angular to sub-rounded fine to coarse flint. (LOWESTOFT FORMATION) . . . sand is damp from 2.50m bgl.	(1.30) 3.10	
3.20 3.20 3.70	9 10	D V D	 c_u=55/52/50			Firm occasionally stiff light brown mottled orange and grey silty slightly gravelly CLAY. Gravel is angular to sub-rounded fine to coarse flint. (LOWESTOFT FORMATION)	(0.70) 3.80	
						Trial pit terminated at 3.80m bgl.		

Plan (Not to Scale)



General Remarks

1. Location scanned with GPR and a CAT and signal generator prior to breaking ground. No services detected.
2. Trial pit remained stable during excavation.
3. Groundwater not encountered.
4. Trial pit backfilled with arisings upon completion.
5. UXO specialist present onsite observing the excavation of the trial pit for UXO mitigation purposes.

All dimensions in metres | Scale: 1:28

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	JCB-3CX	MSouthworth	

AGS

RSK

TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Plot 5000, Hatfield Business Park	**Goodmans**	**TP02**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
313555	**06.03.17** / End: **06.03.17**	**---**	**---**	**1** of **1**

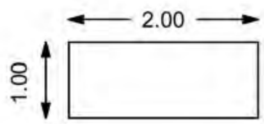
Samples and In-situ Tests

Depth	No	Type	Results
0.10	1	ES	
0.10		PID	0.0ppm
0.40	2	B	
0.50	3	ES	
0.50		PID	0.0ppm
0.60	4	D	
0.60		V	c_u=30/55/60
1.00	5	D	
1.00		V	c_u=55/57/60
1.30	6	D	
1.50	7	B	
2.00	8	D	
3.00	9	D	

Description of Strata

Description of Strata	Depth (Thickness)
Grass oer light brown slightly gravelly clayey SAND with frequent roots and rootlets. Sand is fine to coarse. Gravel is angular to sub-roundec fine to coarse quartzite and flint. (TOPSOIL)	(0.30) 0.30
Firm light orangish brown to brown slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is angular to sub-rounded fine to coarse flint. (LOWESTOFT FORMATION)	(1.10) 1.40
Orange brown slightly silty clayey very gravelly SAND. Sand is coarse. Gravel is sub-angular to sub-rounded fine to coarse flint. (LOWESTOFT FORMATION) . . . Cobbles of flint from 2.00m bgl.	(0.80) 2.20
Orange brown slightly silty clayey very sandy GRAVEL. Sand is coarse. Gravel is sub-angular to sub-rounded fine to coarse flint. (LOWESTOFT FORMATION)	(0.90) 3.10
Trial pit terminated at 3.10m bgl.	

Plan (Not to Scale)



General Remarks

1. Location scanned with GPR and a CAT and signal generator prior to breaking ground. No services detected.
2. Trial pit sidewalls were unstable from 2.00m bgl, thus trial pit was terminated at 3.10m bgl.
3. Groundwater not encountered.
4. Trial pit backfilled with arisings upon completion.
5. UXO specialist present onsite observing the excavation of the trial pit for UXO mitigation purposes.

All dimensions in metres | Scale: **1:28**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**MSouthworth**	

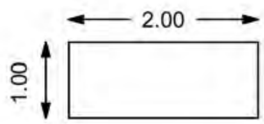
AGS

TRIAL PIT LOG

Contract: Plot 5000, Hatfield Business Park		Client: Goodmans	Trial Pit: TP03/SA03
Contract Ref: 313555	Start: 06.03.17 End: 06.03.17	Ground Level: ---	Co-ordinates: ---	Sheet: 1 of 1

Depth	No	Type	Results	Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
0.20	1	ES				Firm brown slightly gravelly sandy CLAY with occasional roots and rootlets. Sand is coarse. Gravel is angular to sub-rounded fine to coarse quartzite, flint, brick, concrete, wire, flagstones and cloth. (MADE GROUND)	(0.50)	
0.20		PID	0.0ppm					
0.30	2	B						
0.30	3	D					0.50	
0.60	4	ES				Stiff to very stiff light orangish brown occasionally light brown slightly gravelly, silty CLAY. Gravel is angular to sub-rounded fine to coarse flint. (LOWESTOFT FORMATION)	(0.60)	
0.60		PID	0.0ppm					
0.80	5	B						
0.90	6	D						
1.00	7	D					1.10	
						Trial pit terminated for soakaway testing at 1.10m bgl.		

Plan (Not to Scale)



General Remarks

1. Location scanned with GPR and a CAT and signal generator prior to breaking ground. No services detected.
2. Trial pit remained stable during excavation.
3. Groundwater not encountered.
4. Trial pit backfilled with arisings upon completion.
5. UXO specialist present onsite observing the excavation of the trial pit for UXO mitigation purposes.

All dimensions in metres | Scale: 1:28

Method Used: Machine dug	Plant Used: JCB-3CX	Logged By: MSouthworth	Checked By:

AGS

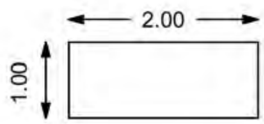
TRIAL PIT LOG

Contract: Plot 5000, Hatfield Business Park	Client: Goodmans	Trial Pit: TP04

Contract Ref: 313555	Start: 06.03.17 / End: 06.03.17	Ground Level: ---	Co-ordinates: ---	Sheet: 1 of 1

Depth	No	Type	Results	Water	Backfill	Description of Strata	Depth (Thickness)
0.10 0.10 0.10	1 2 	ES D PID	 0.0ppm			Grass over dark brown slightly clayey, slightly gravelly SAND. Sand is fine to coarse. Gravel is sub-angular to subrounded fine to coarse quartzite and flint with rare brick fragment. (POSSIBLE MADE GROUND)	0.20
0.40 0.40 0.50 1.00 1.00	3 4 5 	ES PID D B V	 0.0ppm c_u=50/59/47			Firm light orangish brown slightly gravelly slightly sandy CLAY. Sand is coarse. Gravel is angular to sub-rounded fine to coarse flint. (LOWESTOFT FORMATION)	(1.45) 1.65
1.60 2.00 3.00	6 7 8	D D D				Orange brown slightly silty clayey very gravelly SAND. Sand is fine to coarse. Gravel is angular to sub-rounded fine to coarse flint. (LOWESTOFT FORMATION) . . . Becoming more yellowish brown from 1.80 to 2.50m bgl. . . . Sand becomes damp from 3.00m bgl.	(1.45) 3.10
						Trial pit terminated at 3.10m bgl due to sidewalls collapsing from 2.50m bgl.	

Plan (Not to Scale)



General Remarks

1. Location scanned with GPR and a CAT and signal generator prior to breaking ground. No services detected.
2. Trial pit sidewalls were unstable from 2.50m bgl, thus trial pit was terminated at 3.10m bgl.
3. Groundwater not encountered.
4. Trial pit backfilled with arisings upon completion.
5. UXO specialist present onsite observing the excavation of the trial pit for UXO mitigation purposes.

All dimensions in metres | Scale: 1:28

Method Used: Machine dug	Plant Used: JCB-3CX	Logged By: MSouthworth	Checked By:

TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Plot 5000, Hatfield Business Park	Goodmans	TP05

Contract Ref:	Start: 06.03.17 / End: 06.03.17	Ground Level:	Co-ordinates:	Sheet:
313555	Start: 06.03.17 End: 06.03.17	---	---	1 of 1

Samples and In-situ Tests: Depth	No	Type	Results	Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
0.20 0.20	1	ES PID	 0.0ppm			Grass over brown slightly gravelly clayey SAND with frequent roots and rootlets. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse quartzite and flint. (TOPSOIL)	(0.30) 0.30	
0.40 0.40 0.50 1.00 1.00	2 3 4 5	ES PID B D D	 0.0ppm			Firm dark orangish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to sub-rounded fine to coarse flint. (LOWESTOFT FORMATION)	(0.90) 1.20	
1.50 2.00 2.50 3.00	6 7 8 9	B D D D				Light orangish brown clayey very sandy GRAVEL. Sand is fine to coarse. Gravel is angular to sub-rounded fine to caorse flint with occasional pockets of clay. (LOWESTOFT FORMATION)	(2.10) 3.30	
						Trial pit terminated at 3.30m bgl.		

Plan (Not to Scale)

2.00 × 1.00

General Remarks

1. Location scanned with GPR and a CAT and signal generator prior to breaking ground. No services detected.
2. Trial pit remained stable during excavation.
3. Groundwater seepage encountered from 3.10m bgl.
4. Trial pit backfilled with arisings upon completion.
5. UXO specialist present onsite observing the excavation of the trial pit for UXO mitigation purposes.

All dimensions in metres | Scale: 1:28

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	JCB-3CX	MSouthworth	

TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Plot 5000, Hatfield Business Park	**Goodmans**	**TP06/SA06**

Contract Ref:	Start:	End:	Ground Level:	Co-ordinates:	Sheet:
313555	**06.03.17**	**06.03.17**	**---**	**---**	**1** of **1**

Depth	No	Type	Results	Water	Backfill	Description of Strata	Depth (Thickness)
						Grass over dark brown slightly gravelly sandy CLAY with occasional roots and rootlets. Sand is fine to caorse. Gravel is angular to sub-roundec fine to coarse quartzite. (TOPSOIL)	0.15
0.30	1	ES				Light orangish brown clayey sandy GRAVEL. Sand is fine to coarse. Gravel is angular to sub-rounded fine to coarse flint. (LOWESTOFT FORMATION)	(0.65) 0.80
0.30		PID	0.0ppm				
0.40	2	B					
0.50	3	D					
1.00	4	D				Very stiff light orangish brown occasional mottled light brown slightly gravelly silty CLAY. Gravel is angular to sub-rounded fine to coarse flint. (LOWESTOFT FORMATION)	(0.40) 1.20
1.00		V	c_u=90/120/120				
1.10	5	D					
						Trial pit terminated at 1.20m bgl due to soakaway testing.	

Plan (Not to Scale)

2.00 × 1.00

General Remarks

1. Location scanned with GPR and a CAT and signal generator prior to breaking ground. No services detected.
2. Trial pit remained stable during excavation.
3. Groundwater not encountered.
4. Trial pit backfilled with arisings upon completion.
5. UXO specialist present onsite observing the excavation of the trial pit for UXO mitigation purposes.

All dimensions in metres | Scale: **1:28**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**MSouthworth**	

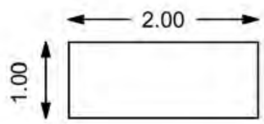
RSK

TRIAL PIT LOG

Contract: Plot 5000, Hatfield Business Park	Client: Goodmans	Trial Pit: TP07
Contract Ref: 313555	Start: 06.03.17 End: 06.03.17	Ground Level: ---
Co-ordinates: ---	Sheet: 1 of 1	

Depth	No	Type	Results	Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
0.20 0.20 0.20 0.40	1 2 3	ES D PID B	 0.0ppm			Dark brown slightyl gravelly slightly sandy CLAY with frequent roots and rootlets. Sand is fine to coarse. Gravel is sub-angular fine to coarse quartzite with a rare piece of plastic meshing. (POSSIBLE MADE GROUND).	(0.30) 0.30	
						Light orangish brown clayey gravelly SAND. Sand is fine to coarse. Gravel is angular to sub-rounded flint. (LOWESTOFT FORMATION)	0.50	
0.90 1.00	4 5	D D				Firm light orangish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to sub-rounded fine to coarse flint. (LOWESTOFT FORMATION)	(1.00) 1.50	
1.60 2.00	6 7	B D				Light orangish brown slightly clayey gravelly SAND. Sand is coarse. Gravel is angular to sub-rounded fine to coarse flint. (LOWESTOFT FORMATION)	(1.10) 2.60	
2.80 3.20	8 9	D D				Orange brown sligthly silty clayey very sandy GRAVEL. Sand is coarse. Gravel is sub-angular to sub-rounded fine to coarse flint. (LOWESTOFT FORMATION) . . . becoming damp from 2.60m bgl.	(0.70) 3.30	
						Trial pit terminated at 3.30m bgl.		

Plan (Not to Scale)



General Remarks

1. Location scanned with GPR and a CAT and signal generator prior to breaking ground. No services detected.
2. Trial pit remained stable during excavation.
3. Groundwater not encountered.
4. Trial pit backfilled with arisings upon completion.
5. UXO specialist present onsite observing the excavation of the trial pit for UXO mitigation purposes.

All dimensions in metres | Scale: 1:28

Method Used: Machine dug	Plant Used: JCB-3CX	Logged By: MSouthworth	Checked By:

AGS

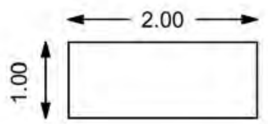
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Plot 5000, Hatfield Business Park	**Goodmans**	**TP08/SA08**

Contract Ref:	Start / End	Ground Level:	Co-ordinates:	Sheet:
313555	Start: **06.03.17** End: **06.03.17**	**---**	**---**	**1** of **1**

Depth	No	Type	Results	Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
0.10	1	ES				Grass over brown slightyl gravelly clayey SAND with frequent roots and rootlets. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse quartzite and occasional flint. (TOPSOIL)	0.15	
0.10		PID	0.0ppm					
0.30	2	ES				Firm to stiff brown slightly gravelly silty sandy friable CLAY. Sand is coarse. Gravel is angular to sub-abgular fine to coarse flint. (LOWESTOFT FORMATION)	(1.05)	
0.30		PID	0.0ppm					
0.50	3	D						
1.00	4	B						
1.00		V	c_u=88/90/92					
1.10	5	D					1.20	
						. . . becoming more gravelly and sandy from 1.20m bgl. Trial pit terminated at 1.20m bgl for soakaway testing.		

Plan (Not to Scale)



General Remarks

1. Location scanned with GPR and a CAT and signal generator prior to breaking ground. No services detected.
2. Trial pit remained stable during excavation.
3. Groundwater not encountered.
4. Trial pit backfilled with arisings upon completion.
5. UXO specialist present onsite observing the excavation of the trial pit for UXO mitigation purposes.

All dimensions in metres | Scale: **1:28**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**JCB-3CX**	**MSouthworth**	

STRUCTURAL SOILS LTD

INSITU TESTING REPORT

1774

Report No. 747205R.01(00)

Date	14-March-2017	Contract	Plot 5000, Hatfield

Client RSK Environment Ltd
Address Spring Lodge
172 Chester Road
Helsby
Cheshire
WA6 0AR
For the Attention of Melissa Southwood

Order received	28-February-2017	Client Reference	None
Testing Started	10-March-2017	Client Order No.	PO266043
Testing Completed	10-March-2017	Instruction Type	Written

Tests marked 'Not UKAS Accredited' in this report are not included in the UKAS Accreditation Schedule for our Laboratory.

UKAS Accredited Tests

Not UKAS Accredited Tests

3no. Insitu soakaway tests carried out at locations specified by client.

The results represent the ground conditions at the specified locations and depths at the time of testing.

Please Note: Remaining samples will be retained for a period of one month from today and will then be disposed of.
Test were undertaken on samples 'as received' unless otherwise stated.
Opinions and interpretations expressed in this report are outside the scope of accreditation for this laboratory.

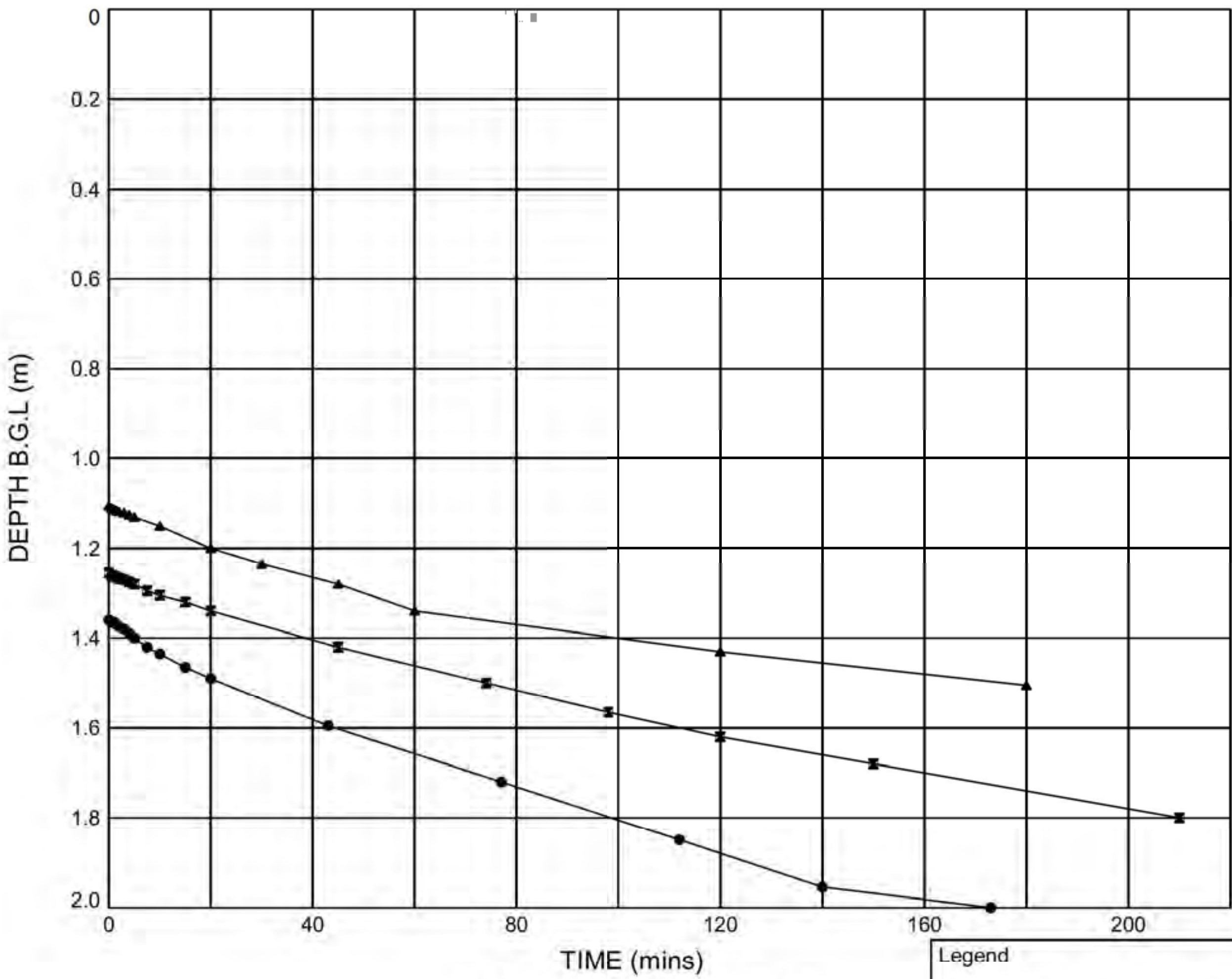
Structural Soils Ltd 1a Princess Street Bedminster Bristol BS3 4AG Tel.0117 9471000. e-mail dimitris.xirouchakis@soils.co.uk

FULL SCALE SOAKAWAY TEST

In accordance with BRE Digest 365

Soakaway Test - Position ID : **SA01 TP08**

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



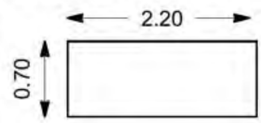
Legend

●	Test 1	(10.03.17)
⧗	Test 2	(10.03.17)
▲	Test 3	(10.03.17)

		Test 1	Test 2	Test 3	
Pit start depth:	=	*2.00*	*2.00*	**1.95**	m
Pit final depth:	=	*2.00*	*1.95*	**1.90**	m
Effective depth, De	=	*0.64*	*0.70*	**0.80**	m
Effective storage volume, V_{p75-25}	=	*0.4928*	*0.5352*	**0.6122**	m^3
Surface area, a_{p50}	=	*3.3960*	*3.5555*	**3.8455**	m^2
Time, t_{p75-25}	=	*4964*	*8998*	**19080**	secs
Infiltration rate, f	=	$2.92x10^{-5}$	$1.67x10^{-5}$	$\mathbf{8.34x10^{-6}}$	m/s

Please note test data was extrapolated to obtain tp75-tp25.

Plan (Not to scale)



No Bearing Taken

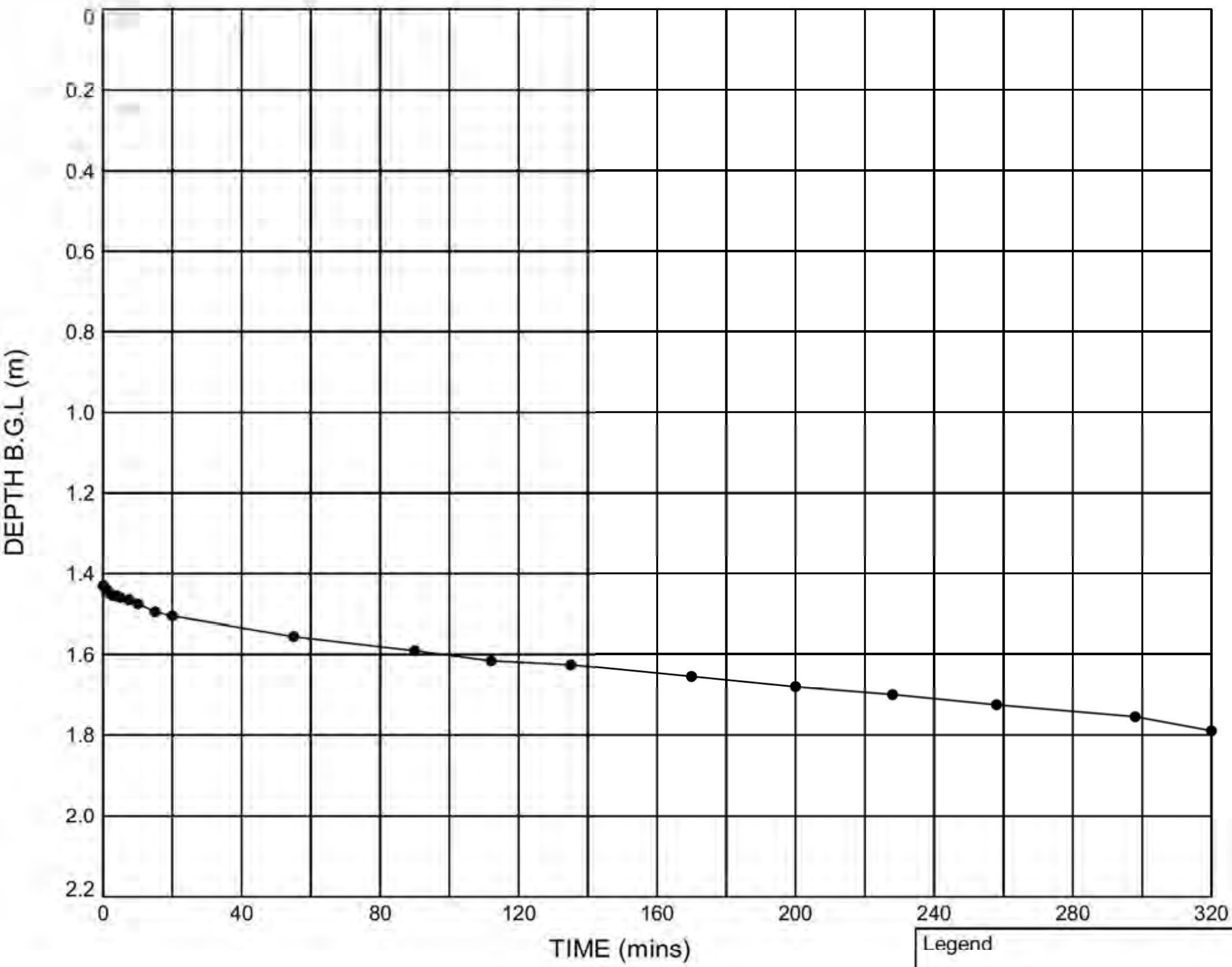
STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By	Date	Checked By	Date
	Claire Morley	13/03/17	S. Phil	14/03/17
	Contract: **Plot 5000, Hatfield**		Contract Ref: **747205**	

FULL SCALE SOAKAWAY TEST

Non-standard test

Soakaway Test - Position ID : **SA02 TP06**

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



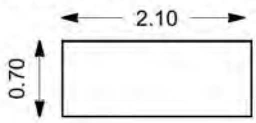
Test 1

Pit start depth:	=	**2.10**	m
Pit final depth:	=	**1.85**	m
Effective depth, De	=	**0.42**	m
Effective storage volume, V_{p75-25}	=	**0.3087**	m^3
Surface area, a_{p50}	=	**2.6460**	m^2
Time, t_{p75-25}	=	**14620**	secs
Infiltration rate, f	=	**7.98×10^{-6}**	m/s

Legend

● Test 1 (10.03.17)

Plan (Not to scale)



No Bearing Taken

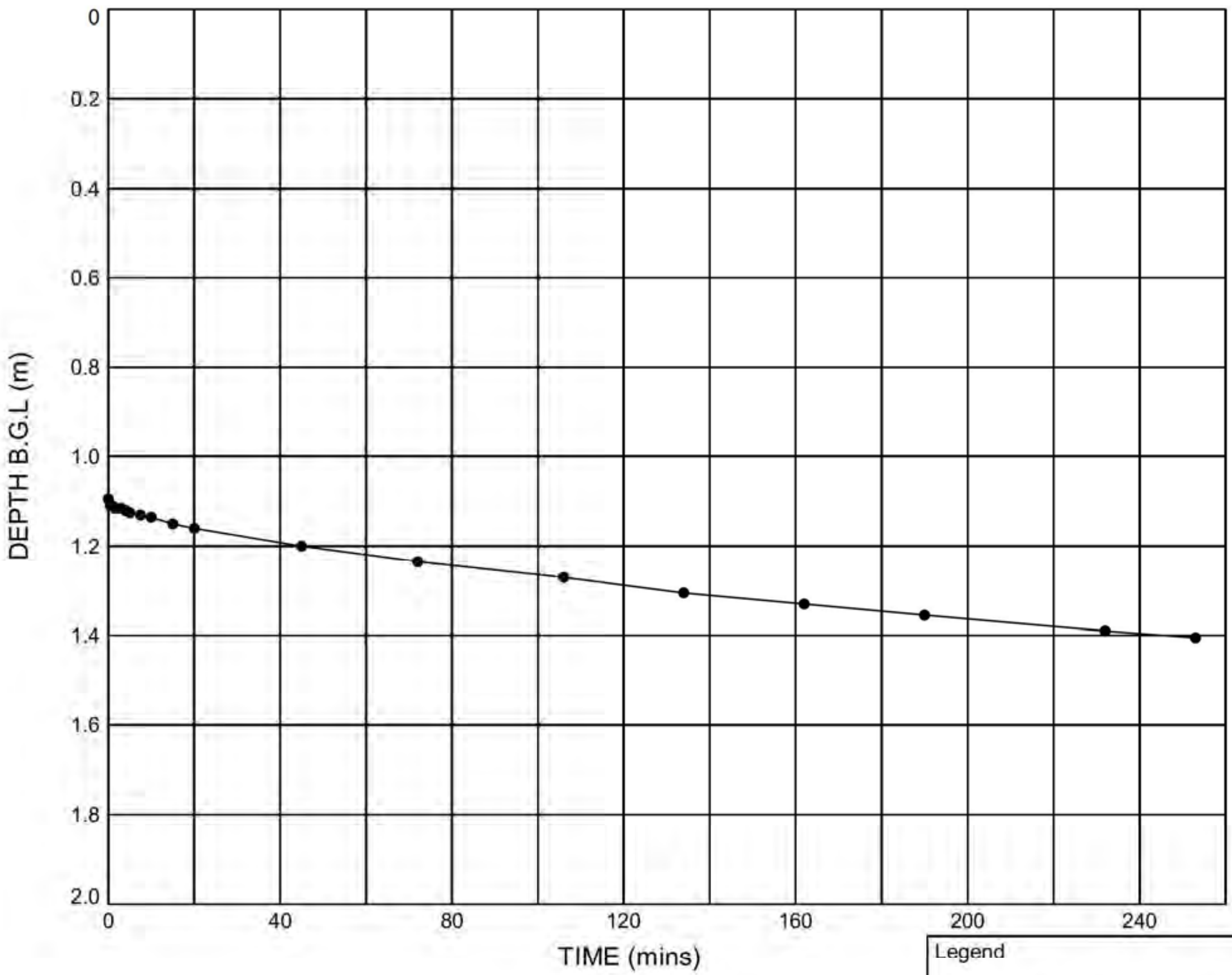
STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By	Date	Checked By	Date
	Claire Morley	13/03/17	S. Phil	14/03/17
	Contract: **Plot 5000, Hatfield**		Contract Ref: **747205**	

FULL SCALE SOAKAWAY TEST

Non-standard test

Soakaway Test - Position ID : **SA03 TP03**

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



Legend

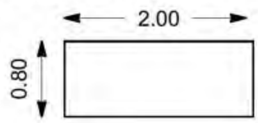
● Test 1 (10.03.17)

Test 1

Pit start depth:	=	**2.00**	m
Pit final depth:	=	**1.85**	m
Effective depth, De	=	**0.76**	m
Effective storage volume, V_{p75-25}	=	**0.6040**	m^3
Surface area, a_{p50}	=	**3.7140**	m^2
Time, t_{p75-25}	=	**31710**	secs
Infiltration rate, f	=	**5.13×10^{-6}**	m/s

Please note test data was extrapolated to obtain tp75-tp25.

Plan (Not to scale)



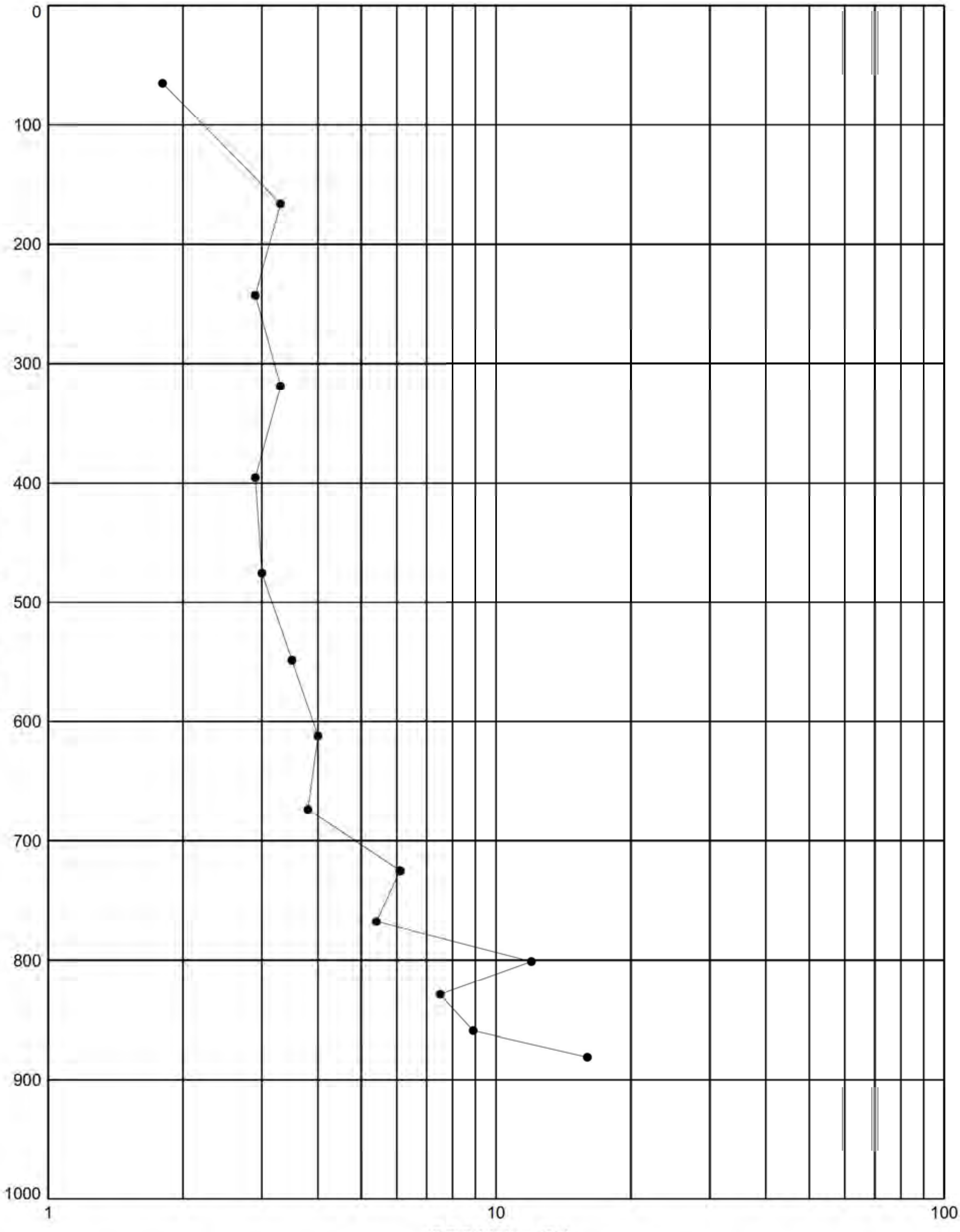
No Bearing Taken

STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By	Date	Checked By	Date
	Claire Morley	13/03/17	S. Phil	14/03/17
	Contract: **Plot 5000, Hatfield**		Contract Ref: **747205**	

DCP TEST RESULTS - DEPTH vs CBR VALUE

Position Ref : **DCP01** Test Date : **10.03.17**

Ground Level: --- Co-ordinates: ---



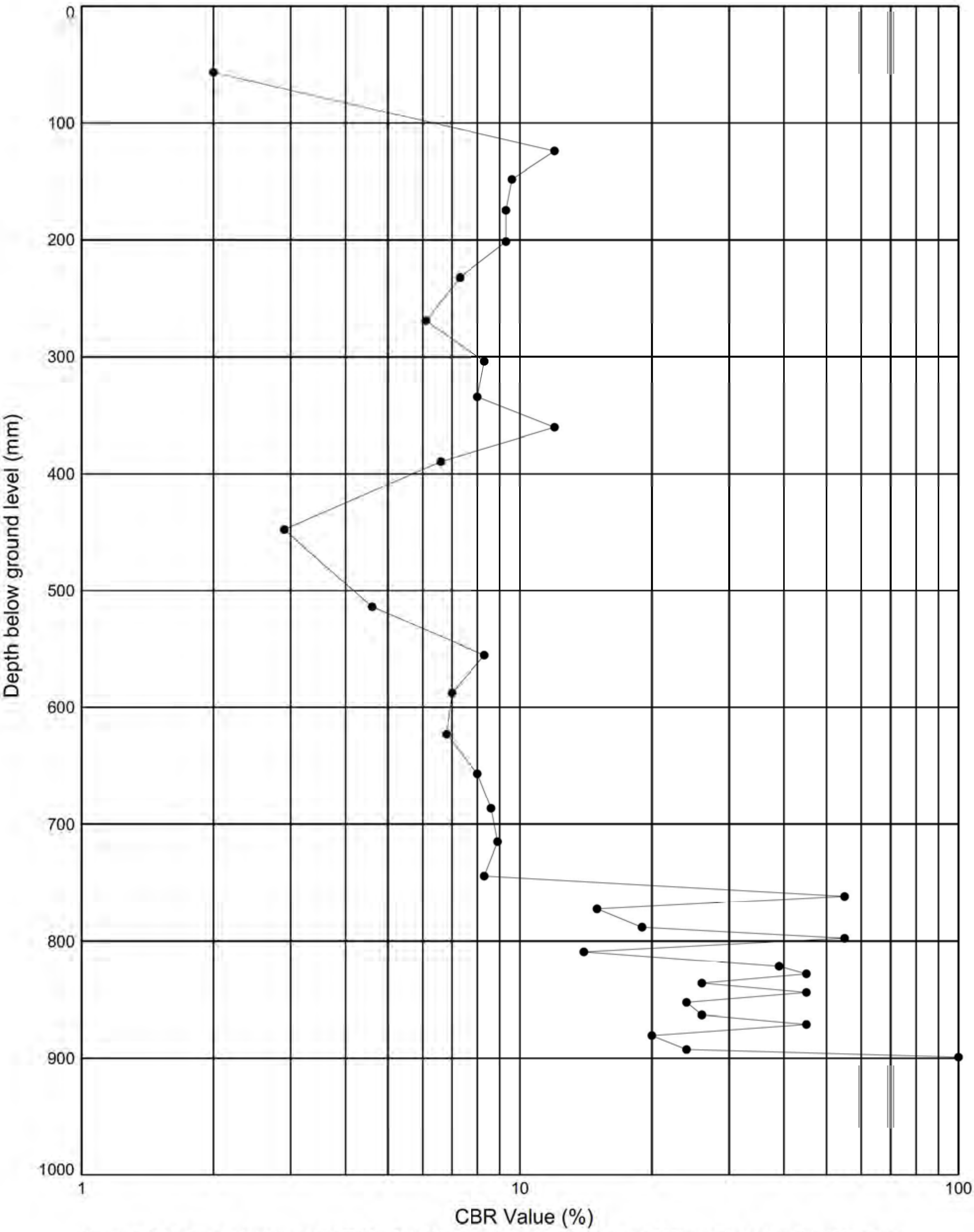
Notes: **CBR values calculated after TRRL Road Note 8 method. Values over 100% are plotted on the 100% line.**

RSK Environment Ltd Abbey Park Humber Road Coventry CV3 4AQ	Compiled By	Date	Checked By	Date
	D J Martin	**14/03/17**		
	Contract: **Plot 5000, Hatfield Business Park**		Contract Ref: **313555**	

DCP TEST RESULTS - DEPTH vs CBR VALUE

Position Ref : **DCP02** Test Date : **10.03.17**

Ground Level: **---** Co-ordinates: **---**



Notes: **CBR values calculated after TRRL Road Note 8 method. Values over 100% are plotted on the 100% line.**

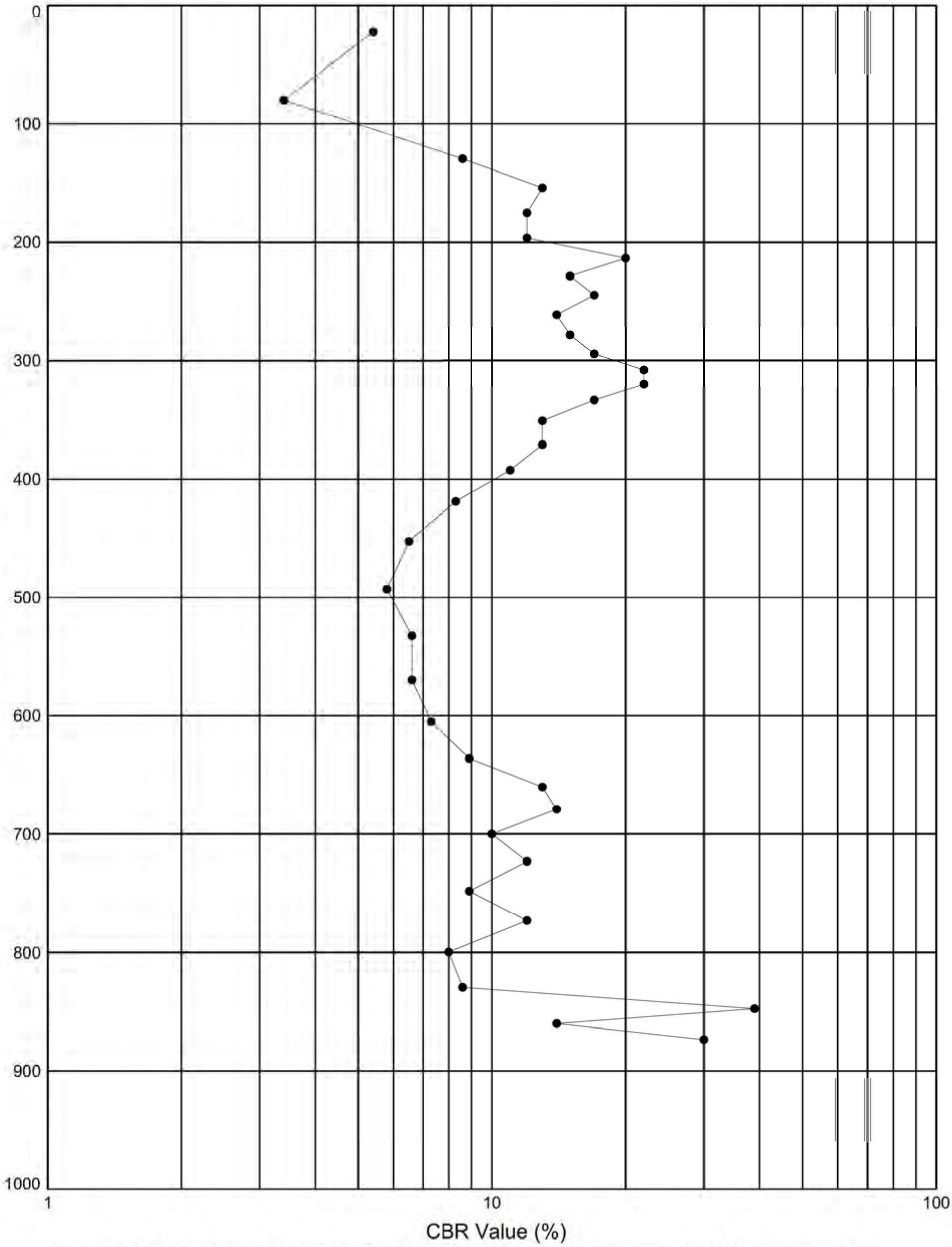
RSK Environment Ltd Abbey Park Humber Road Coventry CV3 4AQ	Compiled By	Date	Checked By	Date
	D J Martin	**14/03/17**		
	Contract **Plot 5000, Hatfield Business Park**		Contract Ref: **313555**	

GINT_LIBRARY_V8_06.GLB LibVersion: v8_06_015 PrjVersion: v8_06 - Core+Logs - 002 | Graph I - DCP - 2 - CBR VALUE VS DEPTH - A4P | 313555 - PLOT 5000, HATFIELD BUSINESS PARK.GPJ - v8_06. | 14/03/17 - 10:00 | DM1 |

DCP TEST RESULTS - DEPTH vs CBR VALUE

Position Ref : **DCP04** Test Date : **10.03.17**

Ground Level: **---** Co-ordinates: **---**



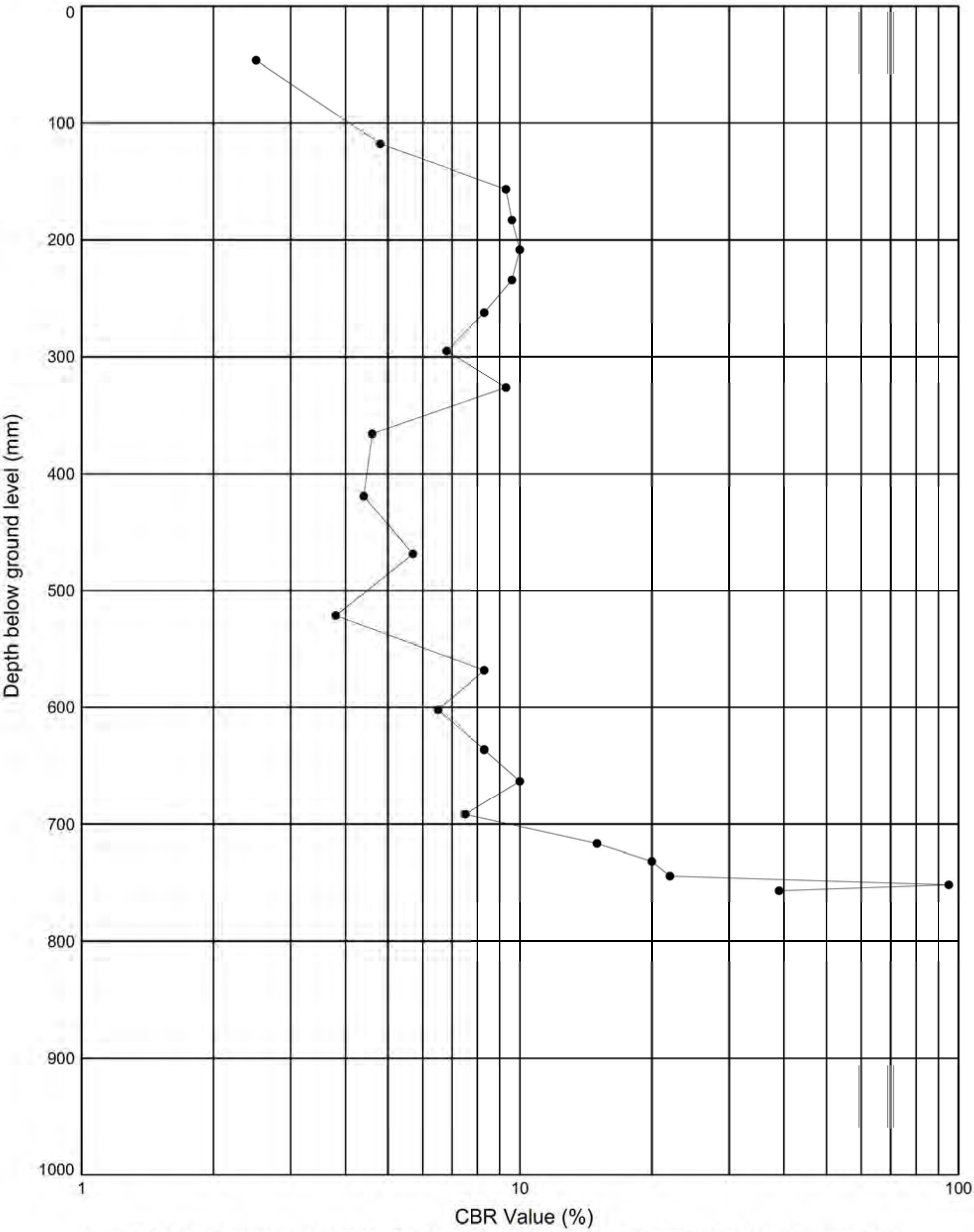
Notes: **CBR values calculated after TRRL Road Note 8 method. Values over 100% are plotted on the 100% line.**

RSK Environment Ltd Abbey Park Humber Road Coventry CV3 4AQ	Compiled By	Date	Checked By	Date
	D J Martin	**14/03/17**		
	Contract **Plot 5000, Hatfield Business Park**		Contract Ref: **313555**	

DCP TEST RESULTS - DEPTH vs CBR VALUE

Position Ref : **DCP05** Test Date : **10.03.17**

Ground Level: --- Co-ordinates: ---



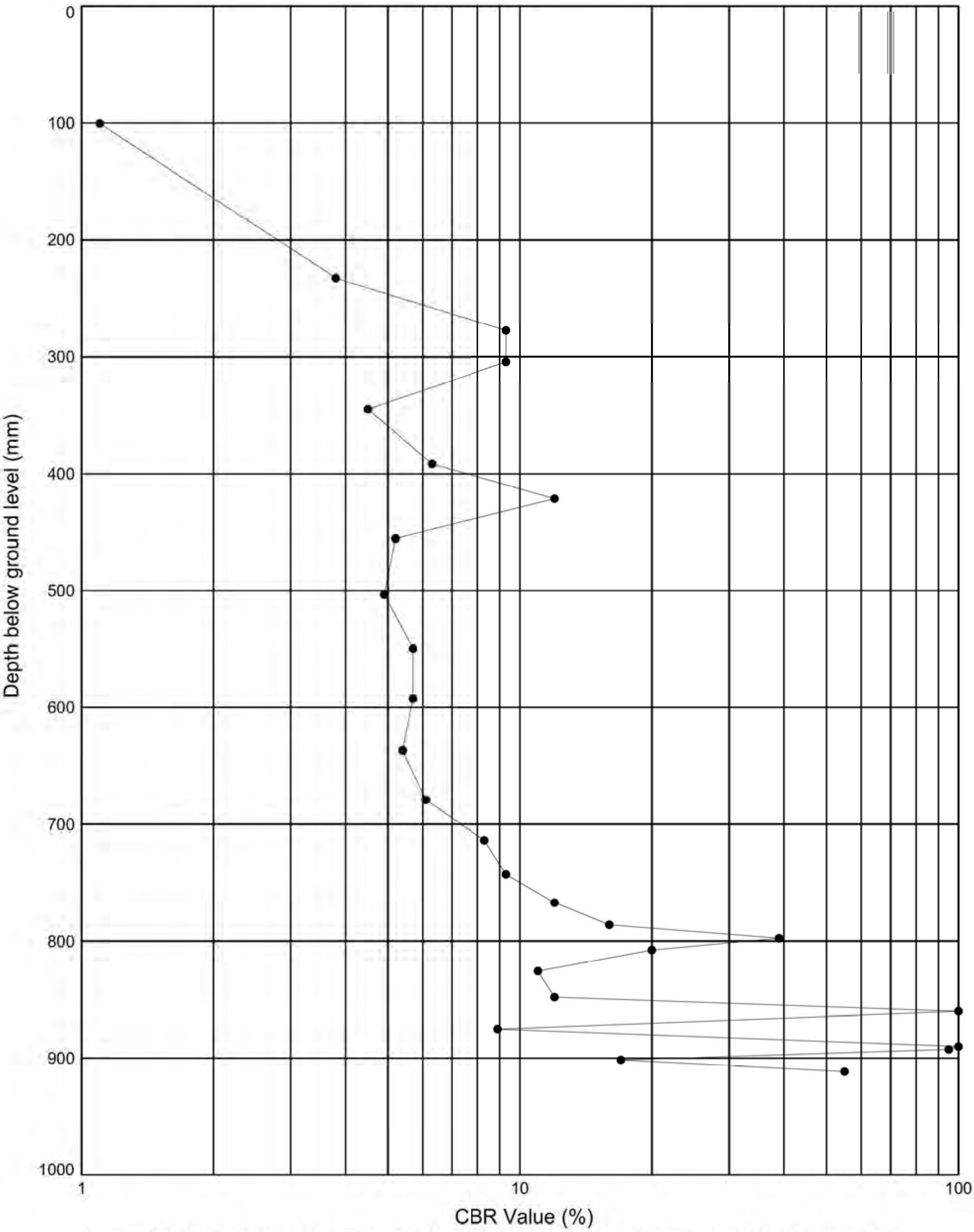
Notes: **CBR values calculated after TRRL Road Note 8 method. Values over 100% are plotted on the 100% line.**

RSK Environment Ltd Abbey Park Humber Road Coventry CV3 4AQ	Compiled By	Date	Checked By	Date
	D J Martin	**14/03/17**		
	Contract **Plot 5000, Hatfield Business Park**		Contract Ref: **313555**	

DCP TEST RESULTS - DEPTH vs CBR VALUE

Position Ref : **DCP07** Test Date : **10.03.17**

Ground Level: **---** Co-ordinates: **---**



Notes: **CBR values calculated after TRRL Road Note 8 method. Values over 100% are plotted on the 100% line.**

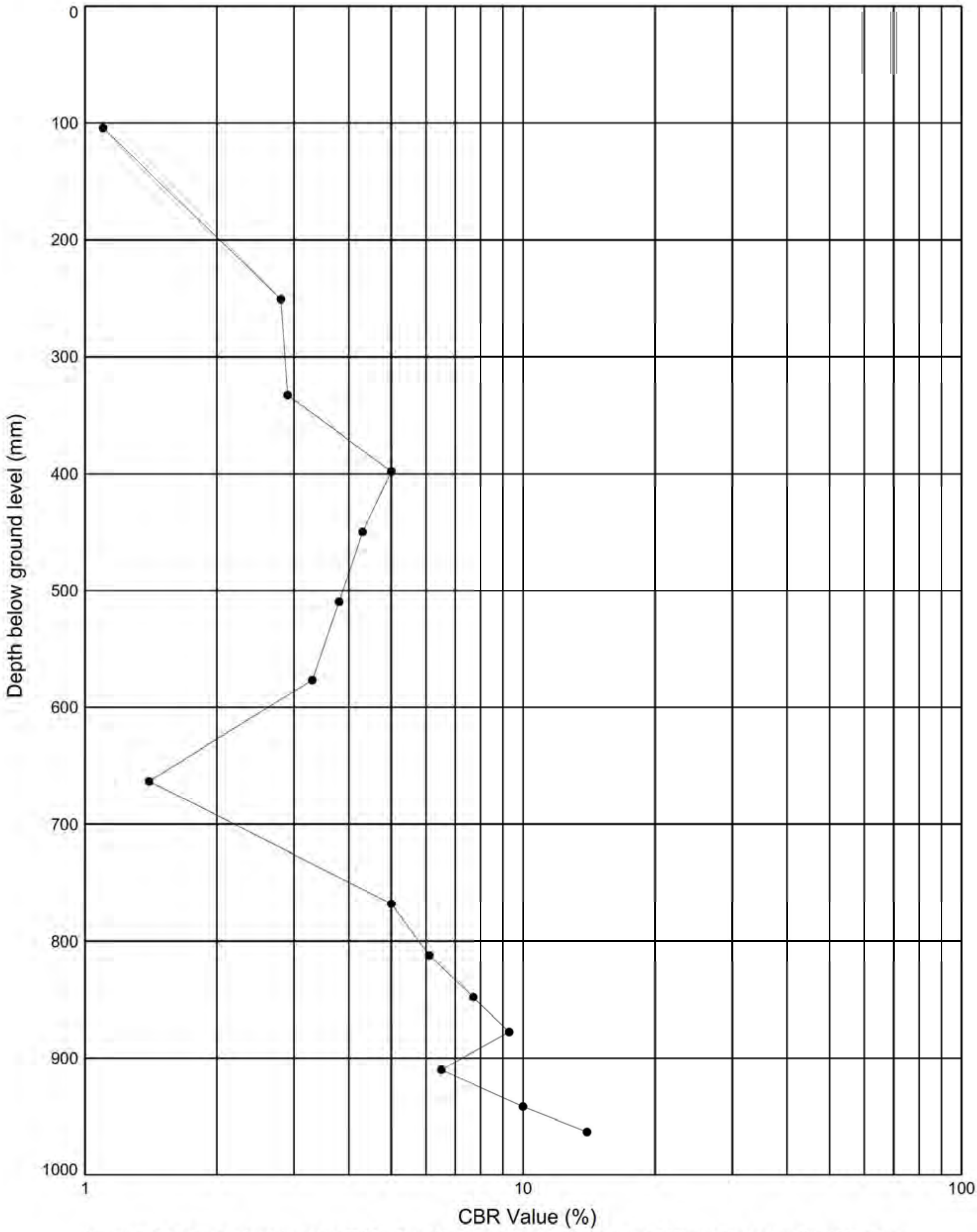
RSK Environment Ltd Abbey Park Humber Road Coventry CV3 4AQ	Compiled By	Date	Checked By	Date
	D J Martin	**14/03/17**		
	Contract **Plot 5000, Hatfield Business Park**		Contract Ref: **313555**	

GINT_LIBRARY_V8_06.GLB LibVersion: v8_06_015 PrjVersion: v8_06 - Core+Logs - 002 | Graph I - DCP - 2 - CBR VALUE VS DEPTH - A4P | 313555 - PLOT 5000, HATFIELD BUSINESS PARK.GPJ - v8_06. | 14/03/17 - 10:00 | DM1 |

DCP TEST RESULTS - DEPTH vs CBR VALUE

Position Ref : **DCP08** Test Date : **10.03.17**

Ground Level: **---** Co-ordinates: **---**



Notes: **CBR values calculated after TRRL Road Note 8 method. Values over 100% are plotted on the 100% line.**

RSK Environment Ltd Abbey Park Humber Road Coventry CV3 4AQ	Compiled By	Date	Checked By	Date
	D J Martin	**14/03/17**		
	Contract **Plot 5000, Hatfield Business Park**		Contract Ref: **313555**	