TECHNICAL DESIGN NOTE

Hydrock

Project name	Ocado, Bicester Plot B		
Design note title	Drainage Strategy Technical Note		
Document reference	Drainage Strategy Technical Note		
Author	John Hayden		
Revision	P04		
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Revision P04 dated 10.02.21 - updates in response to LLFA comments from meeting on 9.02.21

Hydrock Consultants have been commission to complete the detailed design of the foul and storm water drainage to accommodate the extension of the external yard and parking for Plot B at Symmetry Park, Bicester. The proposed works included additional parking area, out buildings, vehicle wash down, refuelling and storage zones. While this is a new detailed application for the yard extension, it will clearly function as part of the approved Unit B (Application Reference 18/00091/F), and the same approach to flood risk and drainage has therefore been taken, as previously agreed and approved.

In overall terms, the surface water and drainage strategy for Unit B and the associated yard extension will see a reduction in comparison to greenfield run off rates from 4.7l/s/ha to 3.7l/s/ha for a 1 in 100 year event.

This technical note is to be read in accordance with Hydrock drawings, these can be found in Appendix D:

C-13482-HYD-00-ZZ-DR-C-7000 and 7001 - Drainage Strategy Sheets 1 and 2 respectively

C-13482-HYD-00-ZZ-DR-C-7003- Catchment plan

C-13482-HYD-00-ZZ-DR-C-7100 - Flood Extents Plan

C-13482-HYD-00-ZZ-DR-C-7200 - Maintenance Plan

C-13482-HYD-XX-XX-SK-C-5100 - Drainage Details

C-13482-HYD-XX-XX-SK-C-5100 - Existing swale location

The drainage plans from the original Unit B can be found within Appendix E.

1. EXISTING STORM DRAINAGE

The existing storm water system for Plot B has been designed and installed to accommodate a 1in100yr+20% climate change storm event. The existing network has a pumped outfall with a pump rate of 5.5l/s for storms up to and including a 1in2yr event and 12.5l/s for all storms exceeding this event. The existing as built system when modelled for a 1 in 100yr +20%CC storm event has 29.8m3 of flooding in total (See Appendix A for MicroDrainage Results). When modelled for the 1 in 100yr +40%CC event as required to comply with current legislation the existing system floods to a volume of 360.4m3 (See Appendix B for MicroDrainage Results). Regardless of any planned extension or development this

flooding would be the case for such a storm event. This additional flooding can be accommodated safely within the yard docks and car park.

2. PROPOSED STORM WATER STRATEGY

Refer drawing C-13482-HYD-00-ZZ-DR-7003. This drawing illustrates the existing catchment (2.677Ha) and the additional catchment (0.67Ha) which is to be constructed following this planning application.

It is proposed to limit any impact on the existing as built drainage as a result of the proposed works. With the exception of minor diversion to avoid proposed out buildings, the existing network is to remain unchanged. This approach includes the existing pumping station and rising main that will remain as per the previously **approved discharge rates** (5.5l/s for a 2 year event and 12.5l/s for 1 in 100 year +40% climate change event) **and not increasing as a result of the increased impermeable area.**

Refer Appendix F - The online SUDS tool has been used to calculate green field run off rate. The table below demonstrates the GFR discharge rate for the site and the actual proposed discharge rate for the site. The impermeable catchment is 3.347 ha

Storm Event	GFR l/s/ha	GFR for site (3.347 ha impermeable) l/s	Proposed discharge rate l/s
QBAR	4.17	13.97	5.5
1 in 30	9.58	32.06	12.5
1 in 100	13.29	44.48	12.5

The above table shows that the site shall be draining at less than the QBAR rate for all storm events i.e. the strategy will see a reduction in run off in comparison to greenfield rates.

The proposed system primarily consists of a network of drainage channels with the surface levels graded to ensure car parking and yard areas fall towards the above-mentioned channels. Any rainwater pipes are connected via a traditional manhole and piped gravity system. The point of connection to the existing storm system is downstream of the existing petrol interceptor (to avoid overloading the existing interceptor) but upstream of the existing attenuation tank. The proposed system drains to the existing pump via the existing network with the existing pump acting as the flow control device for the complete site (existing and proposed); there is therefore no requirement for a flow control device on the proposed network.

With the existing discharge rate not increasing but additional impermeable area draining to the system there is a need for additional attenuation to control flooding. Attenuation is provided in the form of an offline tank located on the proposed system. The required attenuation volume is 665m3 to ensure the extent of flooding on the proposed system is controlled and that the flooding on the existing system does not increase.

The microdrainage modelling results for the proposed development can be found within Appendix C. These show no flooding at the 1 in 30 yr event. Flooding does occur during the 1 in 100 yr +40%. The water is all stored in safe locations within the service yard docks, service yard and car park. The volumes and depths in each location can be found on drawing C-13482-HYD-00-ZZ-DR-C-7100 located within Appendix D.

2.1 Exceedance and pump failure

The site is to drain via the existing pumping station. The pumpstation comprises a duty and standby pump with telemetry installed to alert the necessary people if failure occurs. This is unchanged from the approved Unit B strategy.

In the unlikely event of both pumps failing the surface water run off shall follow the exceedance routes. Drawing C-13482-HYD-00-ZZ-DR-C-7200 illustrates the maintenance management of the pump station with the tenant being responsible for the maintenance regime.

Arrows have been added to the drainage plans to illustrate the exceedance routes. The arrows show all flows to either be away from the building or into the docks.

2.2 Sensitivity testing of Cv coefficient of run off

Following comments from the LLFA, the model has also been run with a Cv value of 0.9. It is understood that this is not an OCC LLFA requirement and is a suggestion only. This increased Cv has therefore been run to understand its effects. As would be expected the flooding during the 1 in 100 +40% event does increase. It increases by 283m^3, approximately 180m^3 would be stored in the docks increasing the depth to 380mm. The remaining flood volume would follow exceedance routes, staying away from the building.

3. SUDS CONSIDERATIONS

As demonstrated by the catchment plan the site is an existing site for which the service yard is to be extended. The incorporation of SUDS features have been considered for the yard extension, those considered have been set out below.

Permeable Paving - Permeable paving to the parking bays within the yard extension have been considered. The yard extension is to offer flexibility to any future use. It is feasible that the parking bays may not always be used as such and may be trafficked by heavier vehicles. Permeable paving would not be suitable for heavy traffic. **To offer future proofing of the site, it is not feasible to provide permeable paving.**

Infiltration methods - infiltration such as soakaways / filter strips have been considered. Infiltration results provided within Listers Soakaway report 16.02.026a (Appendix G) tested for infiltration at depths from 0.8m to 2.5m. The report concluded that with results ranging from 8x10^{-7} to 9x10^{-8} m/s that infiltration is not feasible and therefore these methods have been discounted, as they were on previous phases of the site as this option was not feasible.

Swale - An existing swale serves the site (refer drawing C13482-HYD-00-ZZ-SK-C-8000 for its location). This was constructed for the original unit and shall continue to serve the unit and its increased yard area. This shall offer water quality enhancement before the run off enters the watercourse. A swale has also been considered for draining the yard extension. However, to fall the yard extension to the swale and to locate the swale at a depth would accept the water from the yard would entail digging further into the ground creating a significant surplus of material which can not be accommodated on the site. A compromise has therefore been proposed providing the swale at a higher level which will serve the neighbouring footway.

4. POLLUTION CONTROL

Due to the nature of the development (primarily external yard and parking) the proposed works are to drain via a suitably sized full retention petrol interceptor.

The refuelling area is to drain via a class 1 forecourt interceptor that is sufficient to discharge to the storm water network.

The wash down area is to drain via a washdown silt trap interceptor and to a below ground holding tank. The water is to be reused within the wash facility but once full the waste water within the holding tank is to be tankered from site.

Both the wash down and fuelling areas are to have canopies to prevent rainwater from filling or diluting the washdown and forecourt interceptors. All interceptor and washdown units are to be alarmed.

4.1 Water Quality Assessment

5.

A Water quality assessment has been carried out in accordance with section 26 of the CIRIA SuDS Manual.

Following the Simple index approach as specified by section 26.7.1:

Total SuDS mitigation index ≥ pollution hazard index

Pollution hazard index:

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]
Total hazard index		1.1	1.0	0.95

SuDs mitigation index:

	Mitigation indices[1]		
Type of SuDS component	**TSS**	**Metals**	**Hydrocarbons**
Swale	0.5	0.6	0.6
Proprietary treatment systems[5,6]	0.8	0.65	0.9
Total SuDS mitigation index	1.3	1.25	1.5

4.05 (SUDS mitigation index) > 3.05 (Total hazard index).

Suds mitigation index for each contaminant is also greater than the pollution hazard index.

Therefore, pollution mitigation is acceptable

6. FOUL DRAINAGE SYSTEM

Additional foul connections have been provided to proposed buildings that will require foul outlets. All connections can drain via gravity to the existing system.

At the time of writing this report the exact staff number is unknown. Subject to confirmation of this number the existing foul treatment facility may need to be upgraded.

Appendix A

Existing drainage network results modelled for a 1 in 100 yr +20% climate change

100 year Return Period Summary of Critical Results by Maximum Level (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	1
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	0.403
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	200.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	OFF		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	100	+20%	100/15 Summer	100/15 Winter		
1.001	2	15 Winter	100	+20%	100/15 Summer			
1.002	3	15 Winter	100	+20%	100/15 Summer			
1.003	4	960 Winter	100	+20%	100/15 Summer			
1.004	5	960 Winter	100	+20%	100/15 Summer			
1.005	6	960 Winter	100	+20%	100/15 Summer			
2.000	7	960 Winter	100	+20%	100/15 Summer	100/480 Winter		
3.000	8	960 Winter	100	+20%	100/360 Winter			
1.006	7	960 Winter	100	+20%	100/15 Summer			
1.007	8	960 Winter	100	+20%	100/15 Summer			
1.008	9	960 Winter	100	+20%	100/15 Summer			
1.009	10	960 Winter	100	+20%	100/15 Summer			
4.000	13	15 Winter	100	+20%	100/15 Summer			
4.001	14	15 Winter	100	+20%	100/15 Summer			
4.002	15	15 Winter	100	+20%	100/15 Summer			
4.003	16	15 Winter	100	+20%	100/15 Summer			
4.004	17	960 Winter	100	+20%	100/15 Summer			
4.005	18	960 Winter	100	+20%	100/15 Summer			
1.010	11	960 Winter	100	+20%	100/15 Summer			

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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	65.470	1.005	0.424	1.00		40.8	FLOOD	1
1.001	2	65.296	1.136	0.000	1.14		84.0	FLOOD RISK	
1.002	3	64.993	1.073	0.000	1.49		100.0	SURCHARGED	
1.003	4	64.911	1.081	0.000	0.12		9.2	SURCHARGED	
1.004	5	64.926	1.556	0.000	0.11		8.7	SURCHARGED	
1.005	6	64.925	1.670	0.000	0.08		15.9	SURCHARGED	
2.000	7	64.811	1.216	52.448	0.16		11.7	FLOOD	5
3.000	8	64.929	0.629	0.000	0.04		6.9	SURCHARGED	
1.006	7	64.925	1.820	0.000	0.16		30.5	SURCHARGED	
1.007	8	64.953	1.897	0.000	0.12		30.0	SURCHARGED	
1.008	9	64.963	2.207	0.000	0.12		29.8	SURCHARGED	
1.009	10	64.965	2.259	0.000	0.12		29.5	SURCHARGED	
4.000	13	65.636	0.706	0.000	0.39		119.1	SURCHARGED	
4.001	14	65.611	0.761	0.000	1.23		363.2	SURCHARGED	
4.002	15	65.489	0.719	0.000	2.19		601.1	SURCHARGED	
4.003	16	65.140	0.440	0.000	1.79		717.6	SURCHARGED	
4.004	17	64.953	0.413	0.000	0.05		50.7	SURCHARGED	
4.005	18	64.962	1.362	0.000	0.15		50.5	SURCHARGED	
1.010	11	64.965	2.915	0.000	0.84		12.8	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.000	21	15 Winter	100	+20%	100/15 Summer				64.937
5.001	22	960 Winter	100	+20%	100/15 Summer				64.853
5.002	23	960 Winter	100	+20%	100/15 Summer				64.878
1.011	13	1440 Winter	100	+20%	100/15 Summer				64.943
1.012	14	480 Summer	100	+20%	100/480 Summer				64.920

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.000	21	0.282	0.000	1.12		40.0	SURCHARGED	
5.001	22	0.598	0.000	0.07		3.9	SURCHARGED	
5.002	23	1.293	0.000	0.15		6.0	SURCHARGED	
1.011	13	3.063	0.000	2.30		12.5	SURCHARGED	
1.012	14	0.000	0.000	1.04		12.5	SURCHARGED	

Appendix B

Existing drainage network results modelled for a 1 in 100 yr +40% climate change

100 year Return Period Summary of Critical Results by Maximum Level (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	1
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	0.403
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	200.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
1.001	2	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
1.002	3	15 Winter	100	+40%	100/15 Summer			
1.003	4	15 Winter	100	+40%	100/15 Summer			
1.004	5	960 Winter	100	+40%	100/15 Summer			
1.005	6	960 Winter	100	+40%	100/15 Summer			
2.000	7	960 Winter	100	+40%	100/15 Summer	100/180 Winter		
3.000	8	960 Winter	100	+40%	100/15 Summer			
1.006	7	960 Winter	100	+40%	100/15 Summer			
1.007	8	960 Winter	100	+40%	100/15 Summer			
1.008	9	960 Winter	100	+40%	100/15 Summer			
1.009	10	960 Winter	100	+40%	100/15 Summer			
4.000	13	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
4.001	14	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
4.002	15	15 Winter	100	+40%	100/15 Summer	100/15 Winter		
4.003	16	15 Winter	100	+40%	100/15 Summer			
4.004	17	960 Winter	100	+40%	100/15 Summer			

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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	65.479	1.014	8.715	1.57		63.9	FLOOD	4
1.001	2	65.482	1.322	1.580	1.18		86.9	FLOOD	2
1.002	3	65.374	1.454	0.000	1.55		104.1	FLOOD RISK	
1.003	4	65.198	1.368	0.000	1.24		93.6	SURCHARGED	
1.004	5	65.139	1.744	0.000	0.13		9.9	SURCHARGED	
1.005	6	65.137	1.882	0.000	0.09		18.6	SURCHARGED	
2.000	7	65.128	1.533	327.917	0.15		11.7	FLOOD	18
3.000	8	65.138	0.838	0.000	0.05		8.1	SURCHARGED	
1.006	7	65.136	2.030	0.000	0.20		37.7	SURCHARGED	
1.007	8	65.135	2.079	0.000	0.15		37.5	SURCHARGED	
1.008	9	65.135	2.379	0.000	0.15		37.3	SURCHARGED	
1.009	10	65.135	2.429	0.000	0.15		37.1	SURCHARGED	
4.000	13	65.843	0.913	14.178	0.47		137.0	FLOOD	2
4.001	14	65.835	0.985	7.887	1.24		367.6	FLOOD	2
4.002	15	65.827	1.057	0.073	2.31		635.0	FLOOD	
4.003	16	65.453	0.753	0.000	1.89		759.0	SURCHARGED	
4.004	17	65.137	0.597	0.000	0.06		59.5	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
4.005	18	960 Winter	100	+40%	100/15 Summer				65.136
1.010	11	960 Winter	100	+40%	100/15 Summer				65.135
5.000	21	15 Winter	100	+40%	100/15 Summer				65.155
5.001	22	960 Winter	100	+40%	100/15 Summer				65.103
5.002	23	960 Winter	100	+40%	100/15 Summer				65.101
1.011	13	960 Winter	100	+40%	100/15 Summer				65.099
1.012	14	2880 Summer	100	+40%					65.020

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
4.005	18	1.536	0.000	0.18		58.9	SURCHARGED	
1.010	11	3.085	0.000	1.62		24.8	SURCHARGED	
5.000	21	0.460	0.000	1.10		45.8	SURCHARGED	
5.001	22	0.948	0.000	0.11		4.6	SURCHARGED	
5.002	23	1.266	0.000	0.12		4.6	SURCHARGED	
1.011	13	3.099	0.000	2.30		12.5	SURCHARGED	
1.012	14	0.000	0.000	1.04		12.5	OK	

Appendix C

Microdrainage results for 1 in 2, 30 and 100 +40%CC for drainage network incorporating additional impermeable area

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)	2	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.403	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	200	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.850	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

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	45.400	0.305	148.9	0.101	4.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	48.040	0.240	200.0	0.122	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	18.000	0.090	200.0	0.052	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	86.800	0.460	188.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	11.000	0.050	220.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	19.900	0.095	209.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.006	56.170	0.119	472.0	0.228	0.00	0.0	0.600	o	525	Pipe/Conduit	
2.000	49.800	1.194	41.7	0.265	4.00	0.0	0.600	o	300	Pipe/Conduit	
3.000	11.840	0.699	16.9	0.113	4.00	0.0	0.600	o	225	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	72.33	4.71	64.240	0.101	0.0	0.0	0.0	1.07	42.5	22.4
1.001	68.06	5.43	63.860	0.223	0.0	0.0	0.0	1.11	78.3	46.6
1.002	66.61	5.70	63.620	0.275	0.0	0.0	0.0	1.11	78.3	56.2
1.003	60.65	6.97	63.530	0.275	0.0	0.0	0.0	1.14	80.7	56.2
1.004	59.93	7.14	63.070	0.275	0.0	0.0	0.0	1.06	74.6	56.2
1.005	58.70	7.45	63.020	0.275	0.0	0.0	0.0	1.08	76.5	56.2
1.006	55.36	8.36	62.700	0.503	0.0	0.0	0.0	1.02	221.7	85.5
2.000	74.75	4.34	64.000	0.265	0.0	0.0	0.0	2.44	172.6	60.8
3.000	76.71	4.06	63.580	0.113	0.0	0.0	0.0	3.20	127.0	26.6

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
1.007	18.600	0.050	372.0	0.179	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.008	10.000	0.050	200.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.009	10.000	0.050	200.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
4.000	85.700	0.355	241.4	0.229	4.00	0.0	0.600	o	300	Pipe/Conduit	
5.000	57.300	0.355	161.4	0.373	4.00	0.0	0.600	o	300	Pipe/Conduit	
4.001	21.900	1.814	12.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
6.000	21.300	1.789	11.9	0.020	4.00	0.0	0.600	o	150	Pipe/Conduit	
7.000	10.000	0.020	500.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
4.002	12.100	0.030	403.3	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.010	10.000	0.050	200.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
8.000	28.180	0.080	352.3	0.237	4.00	0.0	0.600	o	600	Pipe/Conduit	
8.001	27.910	0.080	348.9	0.484	0.00	0.0	0.600	o	600	Pipe/Conduit	
8.002	28.300	0.070	404.3	0.484	0.00	0.0	0.600	o	600	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)
1.007	54.46	8.63	62.581	1.060	0.0	0.0	0.0	1.16	250.1	177.2
1.008	54.12	8.74	62.531	1.060	0.0	0.0	0.0	1.58	342.1	177.2
1.009	53.79	8.84	62.231	1.060	0.0	0.0	0.0	1.58	342.1	177.2
4.000	68.13	5.42	64.705	0.229	0.0	0.0	0.0	1.01	71.2	47.9
5.000	71.91	4.77	64.705	0.373	0.0	0.0	0.0	1.23	87.3	82.3
4.001	67.69	5.50	64.350	0.602	0.0	0.0	0.0	4.55	321.6	125.1
6.000	76.28	4.12	64.375	0.020	0.0	0.0	0.0	2.94	51.9	4.7
7.000	75.44	4.24	62.231	0.000	0.0	0.0	0.0	0.70	49.2	0.0
4.002	66.72	5.68	62.211	0.622	0.0	0.0	0.0	1.11	240.1	127.4
1.010	53.46	8.95	62.181	1.682	0.0	0.0	0.0	1.58	342.1	276.0
8.000	74.59	4.36	64.330	0.237	0.0	0.0	0.0	1.29	365.2	54.3
8.001	72.24	4.72	64.250	0.721	0.0	0.0	0.0	1.30	367.0	159.9
8.002	69.86	5.11	64.170	1.205	0.0	0.0	0.0	1.20	340.7	258.4

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
8.003	19.700	0.100	197.0	0.245	0.00	0.0	0.600	o	600	Pipe/Conduit	
8.004	12.600	0.060	210.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
8.005	19.430	0.890	21.8	0.063	0.00	0.0	0.600	o	600	Pipe/Conduit	
8.006	10.000	0.050	200.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.011	4.670	0.050	93.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
9.000	80.030	0.400	200.1	0.083	4.00	0.0	0.600	o	225	Pipe/Conduit	
9.001	47.300	0.650	72.8	0.033	0.00	0.0	0.600	o	225	Pipe/Conduit	
9.002	25.000	1.650	15.2	0.050	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.012	205.000	-3.040	-67.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.013	3.670	0.050	73.4	0.000	0.00	0.0	0.600	o	150	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)
8.003	68.77	5.30	64.100	1.450	0.0	0.0	0.0	1.73	489.6	306.1
8.004	68.07	5.43	64.000	1.450	0.0	0.0	0.0	1.68	474.1	306.1
8.005	67.73	5.49	63.940	1.513	0.0	0.0	0.0	5.23	1477.9	314.5
8.006	67.21	5.59	63.050	1.513	0.0	0.0	0.0	1.72	485.8	314.5
1.011	53.23	9.02	61.900	3.195	0.0	0.0	0.0	1.04	18.4«	522.0
9.000	67.96	5.45	64.430	0.083	0.0	0.0	0.0	0.92	36.6	17.3
9.001	65.27	5.96	64.030	0.116	0.0	0.0	0.0	1.53	61.0	23.2
9.002	64.66	6.09	63.380	0.166	0.0	0.0	0.0	3.38	134.3	32.9
1.012	26.00	30.00	61.730	3.361	0.0	0.0	0.0	0.09	1.6«	522.0
1.013	26.00	30.00	64.770	3.361	0.0	0.0	0.0	1.17	20.8«	522.0

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)
1.013		65.030	64.720	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.850	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
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

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.850
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.403		

Online Controls for Storm

Pump Manhole: 13, DS/PN: 1.012, Volume (m³): 6.0

Invert Level (m) 61.730

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	5.5000	1.370	5.5000	1.371	12.5000	3.560	12.5000

Storage Structures for Storm

Cellular Storage Manhole: 16, DS/PN: 7.000

Invert Level (m) 62.231 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	350.0	0.0	2.001	0.0	0.0
2.000	350.0	0.0			

Cellular Storage Manhole: 11, DS/PN: 1.011

Invert Level (m) 61.900 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	758.0	0.0	2.010	0.0	0.0
2.000	758.0	0.0			

2 year Return Period Summary of Critical Results by Maximum Level (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	0.000
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 0.403
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	2	+0%	100/15 Summer	100/15 Summer		
1.001	2	15 Winter	2	+0%	30/15 Summer	100/15 Summer		
1.002	3	15 Winter	2	+0%	30/15 Summer			
1.003	4	15 Winter	2	+0%	30/15 Summer			
1.004	5	15 Winter	2	+0%	30/15 Summer			
1.005	5A	15 Winter	2	+0%	30/15 Summer			
1.006	6	15 Winter	2	+0%	30/15 Summer			
2.000	7	15 Winter	2	+0%	100/15 Summer	100/15 Winter		
3.000	9	15 Winter	2	+0%	100/15 Summer	100/480 Winter		
1.007	7	15 Winter	2	+0%	30/15 Summer			
1.008	8	15 Winter	2	+0%	30/15 Summer			
1.009	9	960 Winter	2	+0%	30/15 Summer			
4.000	N1	15 Winter	2	+0%	30/15 Summer	100/15 Summer		
5.000	N2	15 Winter	2	+0%	30/15 Summer	100/15 Summer		
4.001	N3	15 Winter	2	+0%	100/15 Summer			
6.000	N5	15 Winter	2	+0%	100/360 Winter			
7.000	16	960 Winter	2	+0%	2/240 Winter			

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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	64.350	-0.115	0.000	0.47		18.9	OK	4
1.001	2	64.013	-0.147	0.000	0.50		36.8	OK	4
1.002	3	63.798	-0.122	0.000	0.65		43.8	OK	
1.003	4	63.692	-0.138	0.000	0.53		41.5	OK	
1.004	5	63.255	-0.115	0.000	0.69		41.0	OK	
1.005	5A	63.191	-0.129	0.000	0.62		41.2	OK	
1.006	6	62.968	-0.257	0.000	0.33		65.7	OK	
2.000	7	64.115	-0.185	0.000	0.31		51.1	OK	1
3.000	9	63.648	-0.157	0.000	0.20		21.8	OK	7
1.007	7	62.922	-0.184	0.000	0.74		142.8	OK	
1.008	8	62.834	-0.222	0.000	0.63		143.1	OK	
1.009	9	62.645	-0.111	0.000	0.06		13.2	OK	
4.000	N1	64.880	-0.125	0.000	0.58		40.1	OK	2
5.000	N2	64.922	-0.083	0.000	0.83		69.1	OK	4
4.001	N3	64.480	-0.170	0.000	0.39		109.3	OK	
6.000	N5	64.403	-0.122	0.000	0.08		3.9	OK	
7.000	16	62.644	0.113	0.000	0.06		1.9	SURCHARGED	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
4.002	N6	960 Winter	2	+0%	30/15 Summer			
1.010	10	960 Winter	2	+0%	30/15 Summer			
8.000	11	15 Winter	2	+0%	30/15 Summer	100/15 Summer		
8.001	12	15 Winter	2	+0%	30/15 Summer	100/15 Summer		
8.002	13	15 Winter	2	+0%	30/15 Summer			
8.003	14	15 Winter	2	+0%	30/15 Summer			
8.004	14A	15 Winter	2	+0%	30/15 Summer			
8.005	15	15 Winter	2	+0%	100/15 Summer			
8.006	16	15 Winter	2	+0%	30/15 Summer			
1.011	11	720 Winter	2	+0%	2/15 Summer			
9.000	17	15 Winter	2	+0%	100/15 Summer			
9.001	22	15 Winter	2	+0%	100/15 Summer			
9.002	23	15 Winter	2	+0%	100/15 Summer			
1.012	13	720 Winter	2	+0%	2/15 Summer			
1.013	31	8640 Winter	2	+0%				

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
4.002	N6	62.644	-0.092	0.000	0.04		6.1	OK	
1.010	10	62.644	-0.062	0.000	0.08		18.2	OK	
8.000	11	64.602	-0.328	0.000	0.15		44.3	OK	
8.001	12	64.576	-0.274	0.000	0.38		113.4	OK	4
8.002	13	64.535	-0.235	0.000	0.66		180.5	OK	
8.003	14	64.445	-0.255	0.000	0.62		216.4	OK	
8.004	14A	64.362	-0.238	0.000	0.68		215.8	OK	
8.005	15	64.138	-0.402	0.000	0.24		223.1	OK	
8.006	16	63.435	-0.215	0.000	0.73		223.7	OK	
1.011	11	62.644	0.594	0.000	0.42		5.9	SURCHARGED	
9.000	17	64.536	-0.119	0.000	0.41		14.5	OK	
9.001	22	64.119	-0.136	0.000	0.33		19.1	OK	
9.002	23	63.451	-0.154	0.000	0.21		26.5	OK	
1.012	13	62.634	0.754	0.000	1.01		5.5	SURCHARGED	
1.013	31	64.835	-0.085	0.000	0.39		5.5	OK	

30 year Return Period Summary of Critical Results by Maximum Level (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	0.000
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	0.403
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	30	+0%	100/15 Summer	100/15 Summer		
1.001	2	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
1.002	3	15 Winter	30	+0%	30/15 Summer			
1.003	4	15 Winter	30	+0%	30/15 Summer			
1.004	5	15 Winter	30	+0%	30/15 Summer			
1.005	5A	15 Winter	30	+0%	30/15 Summer			
1.006	6	15 Winter	30	+0%	30/15 Summer			
2.000	7	15 Winter	30	+0%	100/15 Summer	100/15 Winter		
3.000	9	15 Winter	30	+0%	100/15 Summer	100/480 Winter		
1.007	7	15 Winter	30	+0%	30/15 Summer			
1.008	8	720 Winter	30	+0%	30/15 Summer			
1.009	9	720 Winter	30	+0%	30/15 Summer			
4.000	N1	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
5.000	N2	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
4.001	N3	15 Winter	30	+0%	100/15 Summer			
6.000	N5	15 Winter	30	+0%	100/360 Winter			
7.000	16	720 Winter	30	+0%	2/240 Winter			

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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	64.445	-0.020	0.000	0.88		35.6	OK	4
1.001	2	64.227	0.067	0.000	0.98		71.9	SURCHARGED	4
1.002	3	64.060	0.140	0.000	1.17		79.0	SURCHARGED	
1.003	4	63.941	0.111	0.000	0.95		73.9	SURCHARGED	
1.004	5	63.518	0.148	0.000	1.38		81.8	SURCHARGED	
1.005	5A	63.417	0.097	0.000	1.22		81.3	SURCHARGED	
1.006	6	63.352	0.127	0.000	0.58		116.8	SURCHARGED	
2.000	7	64.167	-0.133	0.000	0.60		97.0	OK	1
3.000	9	63.676	-0.129	0.000	0.38		41.5	OK	7
1.007	7	63.282	0.176	0.000	1.49		285.9	SURCHARGED	
1.008	8	63.182	0.126	0.000	0.13		29.0	SURCHARGED	
1.009	9	63.182	0.426	0.000	0.13		29.0	SURCHARGED	
4.000	N1	65.165	0.160	0.000	1.11		76.4	SURCHARGED	2
5.000	N2	65.598	0.593	0.000	1.57		130.2	SURCHARGED	4
4.001	N3	64.541	-0.109	0.000	0.73		206.7	OK	
6.000	N5	64.413	-0.112	0.000	0.15		7.3	OK	
7.000	16	63.181	0.650	0.000	0.13		3.8	SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
4.002	N6	720 Winter	30	+0%	30/15 Summer			
1.010	10	720 Winter	30	+0%	30/15 Summer			
8.000	11	15 Summer	30	+0%	30/15 Summer	100/15 Summer		
8.001	12	15 Summer	30	+0%	30/15 Summer	100/15 Summer		
8.002	13	15 Winter	30	+0%	30/15 Summer			
8.003	14	15 Winter	30	+0%	30/15 Summer			
8.004	14A	15 Winter	30	+0%	30/15 Summer			
8.005	15	15 Winter	30	+0%	100/15 Summer			
8.006	16	15 Winter	30	+0%	30/15 Summer			
1.011	11	720 Winter	30	+0%	2/15 Summer			
9.000	17	15 Winter	30	+0%	100/15 Summer			
9.001	22	15 Winter	30	+0%	100/15 Summer			
9.002	23	15 Winter	30	+0%	100/15 Summer			
1.012	13	720 Winter	30	+0%	2/15 Summer			
1.013	31	720 Winter	30	+0%				

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
4.002	N6	63.181	0.445	0.000	0.06		8.5	SURCHARGED	
1.010	10	63.181	0.475	0.000	0.12		26.9	SURCHARGED	
8.000	11	65.275	0.345	0.000	0.26		76.7	SURCHARGED	
8.001	12	65.225	0.375	0.000	0.79		231.9	SURCHARGED	4
8.002	13	65.157	0.387	0.000	1.45		398.3	SURCHARGED	
8.003	14	64.982	0.282	0.000	1.37		476.1	SURCHARGED	
8.004	14A	64.744	0.144	0.000	1.49		474.6	SURCHARGED	
8.005	15	64.249	-0.291	0.000	0.52		490.2	OK	
8.006	16	63.819	0.169	0.000	1.60		490.3	SURCHARGED	
1.011	11	63.180	1.130	0.000	0.89		12.5	SURCHARGED	
9.000	17	64.590	-0.065	0.000	0.77		27.5	OK	
9.001	22	64.165	-0.090	0.000	0.65		38.0	OK	
9.002	23	63.486	-0.119	0.000	0.44		54.0	OK	
1.012	13	63.144	1.264	0.000	2.30		12.5	SURCHARGED	
1.013	31	64.880	-0.040	0.000	0.89		12.5	OK	

100 year Return Period Summary of Critical Results by Maximum Level (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	0.000
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 0.403
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
1.001	2	15 Winter	100	+40%	30/15 Summer	100/15 Summer		
1.002	3	15 Winter	100	+40%	30/15 Summer			
1.003	4	15 Winter	100	+40%	30/15 Summer			
1.004	5	960 Winter	100	+40%	30/15 Summer			
1.005	5A	960 Winter	100	+40%	30/15 Summer			
1.006	6	960 Winter	100	+40%	30/15 Summer			
2.000	7	15 Winter	100	+40%	100/15 Summer	100/15 Winter		
3.000	9	1440 Winter	100	+40%	100/15 Summer	100/480 Winter		
1.007	7	960 Winter	100	+40%	30/15 Summer			
1.008	8	960 Winter	100	+40%	30/15 Summer			
1.009	9	960 Winter	100	+40%	30/15 Summer			
4.000	N1	15 Winter	100	+40%	30/15 Summer	100/15 Summer		
5.000	N2	15 Winter	100	+40%	30/15 Summer	100/15 Summer		
4.001	N3	960 Winter	100	+40%	100/15 Summer			
6.000	N5	960 Winter	100	+40%	100/360 Winter			
7.000	16	960 Winter	100	+40%	2/240 Winter			

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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	65.484	1.019	13.711	1.83		74.4	FLOOD	4
1.001	2	65.485	1.325	5.274	1.24		91.2	FLOOD	4
1.002	3	65.472	1.552	0.000	1.59		106.9	FLOOD RISK	
1.003	4	65.317	1.487	0.000	1.12		87.2	SURCHARGED	
1.004	5	65.303	1.933	0.000	0.18		10.8	SURCHARGED	
1.005	5A	65.302	1.982	0.000	0.16		10.7	FLOOD RISK	
1.006	6	65.300	2.075	0.000	0.10		19.5	FLOOD RISK	
2.000	7	65.500	1.200	0.005	1.00		162.3	FLOOD	1
3.000	9	65.290	1.485	209.590	0.11		11.9	FLOOD	7
1.007	7	65.299	2.193	0.000	0.21		40.6	FLOOD RISK	
1.008	8	65.300	2.244	0.000	0.18		40.4	SURCHARGED	
1.009	9	65.300	2.544	0.000	0.18		40.2	SURCHARGED	
4.000	N1	66.206	1.201	0.625	1.94		133.3	FLOOD	2
5.000	N2	66.218	1.213	12.966	2.08		172.0	FLOOD	4
4.001	N3	65.306	0.656	0.000	0.08		23.7	SURCHARGED	
6.000	N5	65.302	0.777	0.000	0.02		0.8	SURCHARGED	
7.000	16	65.302	2.771	0.000	0.37		10.9	SURCHARGED	

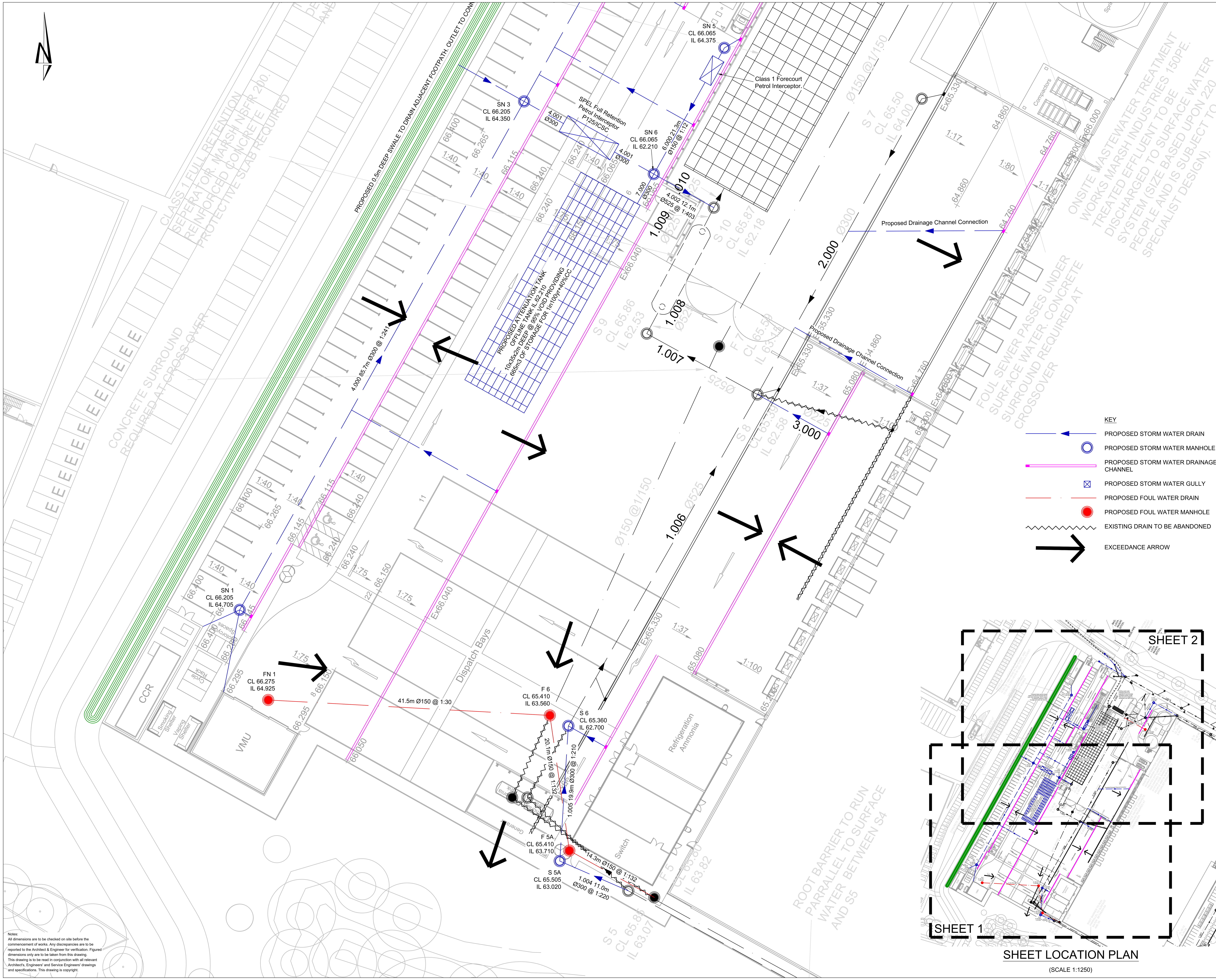
100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
4.002	N6	960 Winter	100	+40%	30/15 Summer			
1.010	10	960 Winter	100	+40%	30/15 Summer			
8.000	11	15 Winter	100	+40%	30/15 Summer	100/15 Summer		
8.001	12	15 Winter	100	+40%	30/15 Summer	100/15 Summer		
8.002	13	15 Winter	100	+40%	30/15 Summer			
8.003	14	15 Winter	100	+40%	30/15 Summer			
8.004	14A	960 Winter	100	+40%	30/15 Summer			
8.005	15	960 Winter	100	+40%	100/15 Summer			
8.006	16	960 Winter	100	+40%	30/15 Summer			
1.011	11	960 Winter	100	+40%	2/15 Summer			
9.000	17	960 Winter	100	+40%	100/15 Summer			
9.001	22	960 Winter	100	+40%	100/15 Summer			
9.002	23	960 Winter	100	+40%	100/15 Summer			
1.012	13	960 Winter	100	+40%	2/15 Summer			
1.013	31	2160 Winter	100	+40%				

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
4.002	N6	65.302	2.566	0.000	0.08		11.0	SURCHARGED	
1.010	10	65.301	2.595	0.000	0.12		27.6	SURCHARGED	
8.000	11	65.910	0.980	0.000	0.53		155.6	FLOOD RISK	
8.001	12	65.881	1.031	41.342	1.29		382.5	FLOOD	4
8.002	13	65.839	1.069	0.000	1.99		546.5	FLOOD RISK	
8.003	14	65.592	0.892	0.000	1.95		677.0	SURCHARGED	
8.004	14A	65.305	0.705	0.000	0.18		57.1	SURCHARGED	
8.005	15	65.303	0.763	0.000	0.06		59.5	SURCHARGED	
8.006	16	65.302	1.652	0.000	0.19		59.3	SURCHARGED	
1.011	11	65.300	3.250	0.000	1.04		14.5	SURCHARGED	
9.000	17	65.273	0.618	0.000	0.09		3.3	SURCHARGED	
9.001	22	65.271	1.016	0.000	0.08		4.6	SURCHARGED	
9.002	23	65.269	1.664	0.000	0.05		6.5	SURCHARGED	
1.012	13	65.267	3.387	0.000	2.30		12.5	SURCHARGED	
1.013	31	64.880	-0.040	0.000	0.89		12.5	OK	

Appendix D

Drawings for proposed development



KEY

- PROPOSED STORM WATER DRAIN
- PROPOSED STORM WATER MANHOLE
- PROPOSED STORM WATER DRAINAGE CHANNEL
- PROPOSED STORM WATER GULLY
- PROPOSED FOUL WATER DRAIN
- PROPOSED FOUL WATER MANHOLE
- EXISTING DRAIN TO BE ABANDONED
- EXCEEDANCE ARROW

Notes:
All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.
This drawing is to be read in conjunction with all relevant Architect's, Engineers' and Service Engineers' drawings and specifications. This drawing is copyright.

Keyplan:

Notes:

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2. All levels are shown in metres above Ordnance Datum (m AOD) unless otherwise shown.
3. Any ambiguities or discrepancies within this drawing and any other information given elsewhere must be reported to Hydrock for clarification.
4. All dimensions to be checked on site and any discrepancies reported to Hydrock before pricing / works commence.
5. It is recommended that all drains be laid starting from the downstream connection to the outlet and working upstream to the new development.
6. All private drainage to comply with current Building Regulations and relevant British Standards and Codes of Practices.
7. Connections to existing sewers in accordance with the Local Water Authority guidelines & approval.
8. Sewers and drains of different diameters should be laid soffit to soffit unless shown otherwise in the drawing.
9. All access chambers covers and frames to be installed to BS EN 124.
10. Private drainage pipe material and bedding to be agreed with Building control.
11. Foul drainage pipe connection to public sewer to be clay otherwise plastic twin-walled/ribbed pipe constructed to Water Industry Standard (WIS)-4-35-01.
12. Drainage Pipe work routes under building footprint will require installation prior to foundations.
13. The pipe diameters cover and invert levels of any existing manholes are to be verified on site prior to the commencement of the works.
14. All external drainage within trafficked areas with less than 1.2m cover to have type Z concrete bed and surround. All external drainage within landscaped areas with cover less than 0.6m to have type Z concrete bed and surround. All drainage with greater cover than the minimum required to have type S bed and surround.
15. All drainage to be installed in accordance with Sewers for Adoption 7th Edition.
16. All drainage to be installed in accordance with Civil Engineering Specification for the Water industry 7th Edition.

Rev	Date	Description	By	Ckd
P05	11.02.2021	Pipe numbers updated	AB	JH
P04	19.01.21	Attenuation updated, exceedance arrows shown	JH	CB
P03	16.11.20	TITLE BLOCK UPDATED	JH	CB
P02	30.09.19	Wash down tank added	JW	CB
P01	20.09.19	PRELIMINARY ISSUE	JW	CB

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A TRITAX BIG BOX COMPANY

Project Title:
OCADO BICESTER

Drawing Title:
Proposed Drainage Strategy (Sheet 1 of 2)

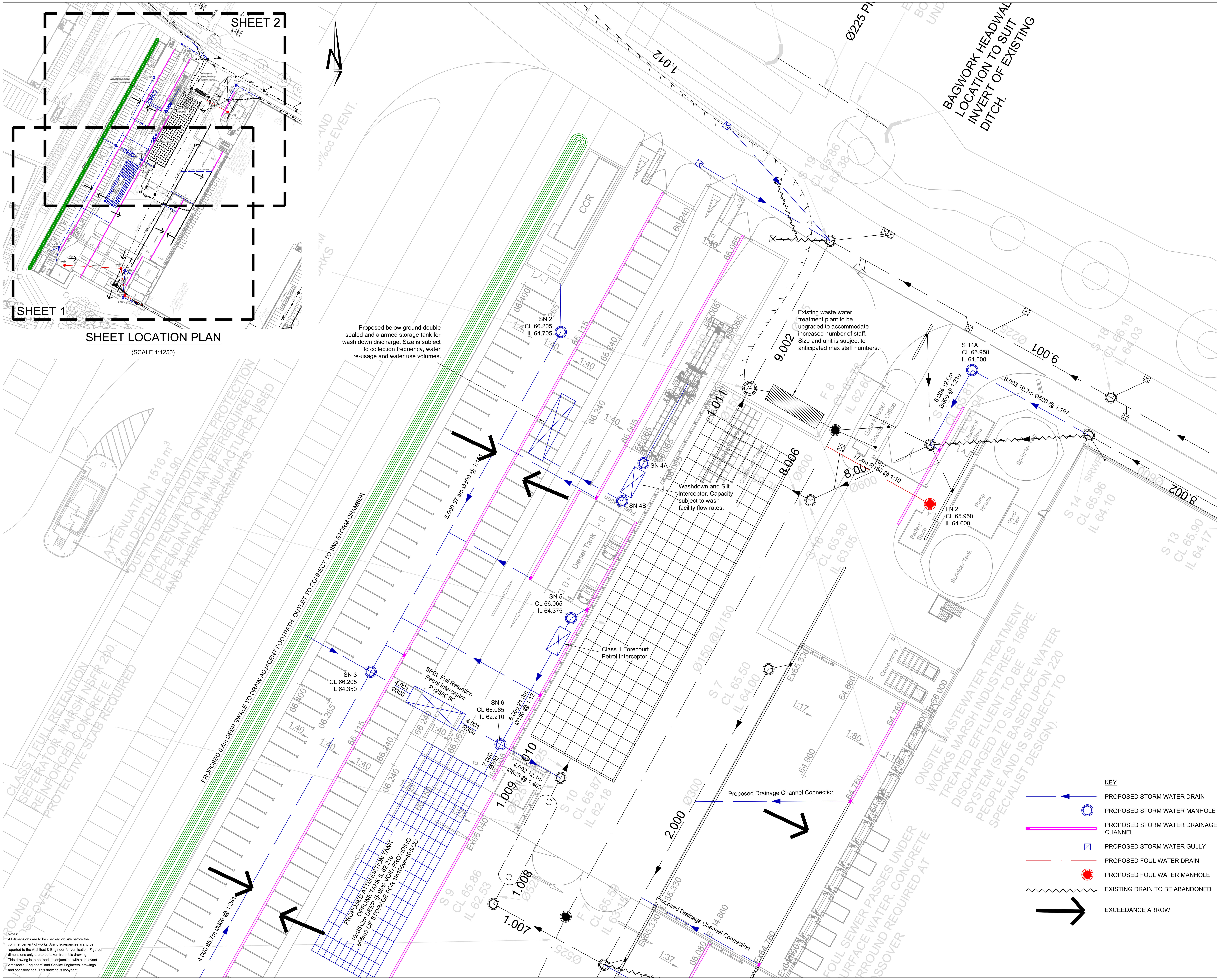
Status:	Purpose Of Issue:
S2	PRELIMINARY

Hydrock Project No: C-13482

Drawn	Checked	Scale @ A1	Date
JW	CB	1:250	11.02.2021

Drawing Number: (Project Code-Orginator-Zone-Level-Type-Role-Number) C-13482-HYD-00-ZZ-DR-C-7000

Revision: P05



SHEET 2
SHEET 1
SHEET LOCATION PLAN
(SCALE 1:1250)
Proposed below ground double sealed and alarmed storage tank for wash down discharge. Size is subject to collection frequency, water re-usage and water use volumes.
Existing waste water treatment plant to be upgraded to accommodate increased number of staff. Size and unit is subject to anticipated max staff numbers.
BAGWORK HEADWALL LOCATION TO SUIT INVERT OF EXISTING DITCH.
Washdown and Silt Interceptor. Capacity subject to wash facility flow rates.
Class 1 Forecourt Petrol Interceptor.
SPEL Full Retention Petrol Interceptor P125/ICSC
PROPOSED 0.5m DEEP SWALE TO DRAIN ADJACENT FOOTPATH. OUTLET TO CONNECT TO SN3 STORM CHAMBER
PROPOSED ATTENUATION TANK OFFLINE TANK IL 62.210 10x35x2m DEEP @ 95% VOID PROVIDING 665m3 OF STORAGE FOR 1in100yr+40%CC
Proposed Drainage Channel Connection
SN 2 CL 66.205 IL 64.705
SN 3 CL 66.205 IL 64.350
SN 4A
SN 4B
SN 5 CL 66.065 IL 64.375
SN 6 CL 66.065 IL 62.210
S 14A CL 65.950 IL 64.000
FN 2 CL 65.950 IL 64.600
CCR
Diesel Tank
Pump House
Sprinkler Tank
KEY
PROPOSED STORM WATER DRAIN
PROPOSED STORM WATER MANHOLE
PROPOSED STORM WATER DRAINAGE CHANNEL
PROPOSED STORM WATER GULLY
PROPOSED FOUL WATER DRAIN
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EXISTING DRAIN TO BE ABANDONED
EXCEEDANCE ARROW

Keyplan:

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Rev	Date	Description	By	Ckd
P05	11.02.21	Pipe numbers updated	AB	JH
P04	19.01.21	Attenuation updated, exceedance arrows shown	JH	CB
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P01	20.09.19	PRELIMINARY ISSUE	JW	CB

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Project Title:
OCADO BICESTER

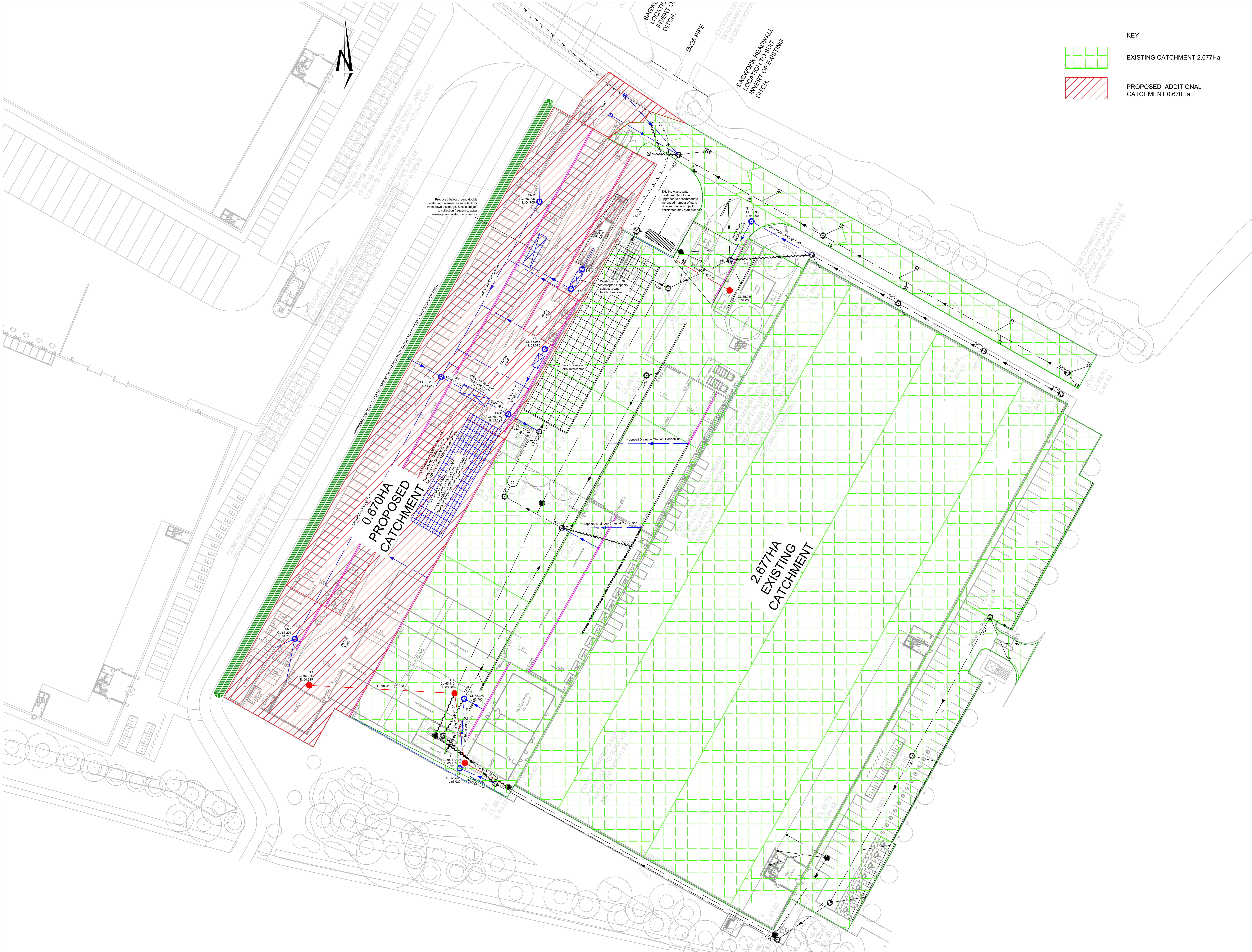
Drawing Title:
Proposed Drainage Strategy (Sheet 2 of 2)

Status:	Purpose Of Issue:
S2	PRELIMINARY

Hydrock Project No: C-13482

Drawn	Checked	Scale @ A1	Date
JW	CB	1:250	11.02.2021

Drawing Number: (Project Code-Orginator-Zone-Level-Type-Role-Number) C-13482-HYD-00-ZZ-DR-C-7001
Revision: P05



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Rev	Date	Description	By	Ckd
P01	19.01.21	PRELIMINARY ISSUE	JH	CB

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Client :

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Project Title:

OCADO BICESTER

Drawing Title:

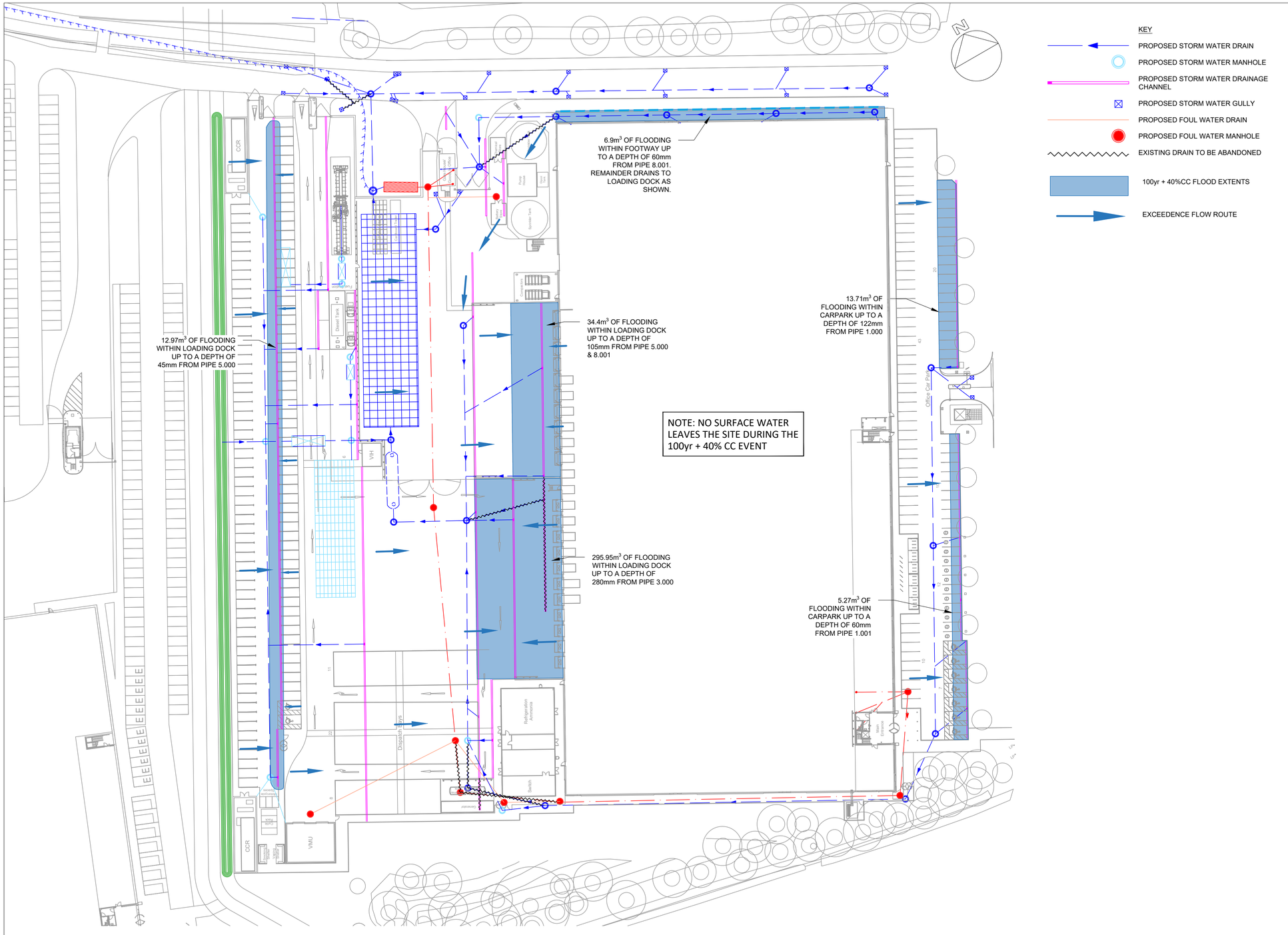
DRAINAGE CATCHMENTS

Status:	Purpose Of Issue:
S2	PRELIMINARY

Hydrock Project No:
C-13482

Drawn	Checked	Scale @ A1	Date
JH	CB	1:500	19/01/2021

Drawing Number: (Project Code-Originator-Zone-Level-Type-Role-Number)	Revision:
C-13482-HYD-00-ZZ-DR-C-7003	P01



KEY

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- PROPOSED STORM WATER MANHOLE
- PROPOSED STORM WATER DRAINAGE CHANNEL
- PROPOSED STORM WATER GULLY
- PROPOSED FOUL WATER DRAIN
- PROPOSED FOUL WATER MANHOLE
- EXISTING DRAIN TO BE ABANDONED
- 100yr + 40%CC FLOOD EXTENTS
- EXCEEDENCE FLOW ROUTE

NOTES:

1. THIS DRAWING IS NOT TO BE SCALED.
2. THIS DRAWING IS FOR INFORMATION PURPOSES ONLY, NOT FOR CONSTRUCTION. FOR DETAILED DRAINAGE INFORMATION FOR EACH PHASE OF THE SITE PLEASE REFER TO THE DRAINAGE PLANS AND STANDARD DETAILS.
3. THE DRAINAGE NETWORK SHOWN IS A WORK IN PROGRESS AND IS SUBJECT TO CHANGE PENDING FINAL COORDINATED CONSTRUCTION INFORMATION.

Rev	Date	Description	By	Ckd
P1	11.02.2021	FOR INFORMATION	AB	JH

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Client :

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Project Title:

OCADO, SYMMETRY PARK
BICESTER

Drawing Title:

FLOOD EXTENTS MAP

Drawing Status:

PRELIMINARY

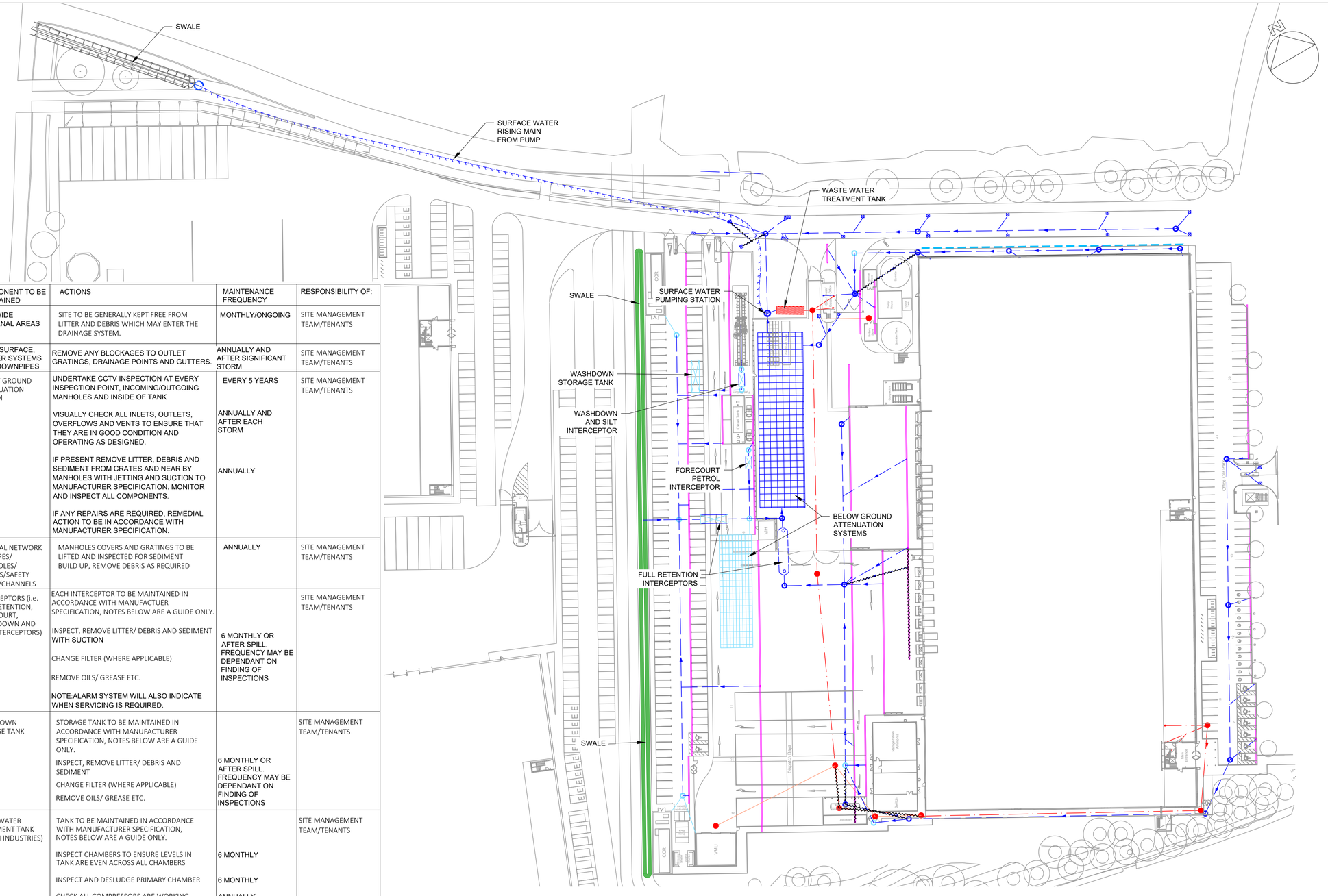
Hydrock Job No:

C-13482

Drawn	Checked	Scale @ A1	Date	Issue Date
AB	JH	1:500	11.02.21	11.02.21

Drawing Number: C-13482-HYD-00-ZZ-DR-C-7100

Revision: P1



COMPONENT TO BE MAINTAINED	ACTIONS	MAINTENANCE FREQUENCY	RESPONSIBILITY OF:
SITE WIDE EXTERNAL AREAS	SITE TO BE GENERALLY KEPT FREE FROM LITTER AND DEBRIS WHICH MAY ENTER THE DRAINAGE SYSTEM.	MONTHLY/ONGOING	SITE MANAGEMENT TEAM/TENANTS
ROOF SURFACE, GUTTER SYSTEMS AND DOWNPIPES	REMOVE ANY BLOCKAGES TO OUTLET GRATINGS, DRAINAGE POINTS AND GUTTERS.	ANNUALLY AND AFTER SIGNIFICANT STORM	SITE MANAGEMENT TEAM/TENANTS
BELOW GROUND ATTENUATION SYSTEM	UNDERTAKE CCTV INSPECTION AT EVERY INSPECTION POINT, INCOMING/OUTGOING MANHOLES AND INSIDE OF TANK VISUALLY CHECK ALL INLETS, OUTLETS, OVERFLOWS AND VENTS TO ENSURE THAT THEY ARE IN GOOD CONDITION AND OPERATING AS DESIGNED. IF PRESENT REMOVE LITTER, DEBRIS AND SEDIMENT FROM CRATES AND NEAR BY MANHOLES WITH JETTING AND SUCTION TO MANUFACTURER SPECIFICATION. MONITOR AND INSPECT ALL COMPONENTS. IF ANY REPAIRS ARE REQUIRED, REMEDIAL ACTION TO BE IN ACCORDANCE WITH MANUFACTURER SPECIFICATION.	EVERY 5 YEARS ANNUALLY AND AFTER EACH STORM ANNUALLY	SITE MANAGEMENT TEAM/TENANTS
GENERAL NETWORK INC. PIPES/ MANHOLES/ GULLIES/SAFETY GRILLS/CHANNELS	MANHOLES COVERS AND GRATINGS TO BE LIFTED AND INSPECTED FOR SEDIMENT BUILD UP, REMOVE DEBRIS AS REQUIRED	ANNUALLY	SITE MANAGEMENT TEAM/TENANTS
INTERCEPTORS (i.e. FULL RETENTION, FORECOURT, WASHDOWN AND SILT INTERCEPTORS)	EACH INTERCEPTOR TO BE MAINTAINED IN ACCORDANCE WITH MANUFACTUER SPECIFICATION, NOTES BELOW ARE A GUIDE ONLY. INSPECT, REMOVE LITTER/ DEBRIS AND SEDIMENT WITH SUCTION CHANGE FILTER (WHERE APPLICABLE) REMOVE OILS/ GREASE ETC. NOTE:ALARM SYSTEM WILL ALSO INDICATE WHEN SERVICING IS REQUIRED.	6 MONTHLY OR AFTER SPILL. FREQUENCY MAY BE DEPENDANT ON FINDING OF INSPECTIONS	SITE MANAGEMENT TEAM/TENANTS
WASHDOWN STORAGE TANK	STORAGE TANK TO BE MAINTAINED IN ACCORDANCE WITH MANUFACTURER SPECIFICATION, NOTES BELOW ARE A GUIDE ONLY. INSPECT, REMOVE LITTER/ DEBRIS AND SEDIMENT CHANGE FILTER (WHERE APPLICABLE) REMOVE OILS/ GREASE ETC.	6 MONTHLY OR AFTER SPILL. FREQUENCY MAY BE DEPENDANT ON FINDING OF INSPECTIONS	SITE MANAGEMENT TEAM/TENANTS
WASTEWATER TREATMENT TANK (MARSH INDUSTRIES)	TANK TO BE MAINTAINED IN ACCORDANCE WITH MANUFACTURER SPECIFICATION, NOTES BELOW ARE A GUIDE ONLY. INSPECT CHAMBERS TO ENSURE LEVELS IN TANK ARE EVEN ACROSS ALL CHAMBERS INSPECT AND DESLUDGE PRIMARY CHAMBER CHECK ALL COMPRESSORS ARE WORKING, CLEAN FILTER AND ENSURE VENTILATION IS ADEQUATE CHECK ALARM, BIO-MASS GROWTH, ENSURE BAFFLES ARE NOT DAMAGED AND CHECK ELECTRICAL SUPPLY AND WIRING	 6 MONTHLY 6 MONTHLY ANNUALLY ANNUALLY	SITE MANAGEMENT TEAM/TENANTS
PUMPING STATIONS	MANHOLE COVER TO BE LIFTED AND INSPECT, REMOVE LITTER/ DEBRIS AND SEDIMENT. MANHOLE BASE, SUMP, ANY DEBRIS SCREEN AND OPENINGS TO BE CLEANED AS REQUIRED. CHECK OPERATION AND MECHANICS OF PUMP(S) IN ACCORDANCE WITH MANUFACTURER SPECIFICATIONS	6 MONTHLY ANNUALLY	SITE MANAGEMENT TEAM/TENANTS
SWALES	CHECK AND MAINTAIN BATTERS AND BASE OF SWALES. ENSURE ALL SURFACES ARE STABLE, ANY GEO MEMBRANE AND LINING IS INTACT AND ADEQUATELY TURFED/PROTECTED TO ENSURE EROSION DOES NOT OCCUR. SURVEY AND INSPECT SWALES, REMOVE SEDIMENT AND ANY WEEDS AS REQUIRED	ANNUALLY ANNUALLY	SITE MANAGEMENT TEAM/TENANTS

NOTES:

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3. THE DRAINAGE NETWORK SHOWN IS A WORK IN PROGRESS AND IS SUBJECT TO CHANGE PENDING FINAL COORDINATED CONSTRUCTION INFORMATION.
4. SITE MANAGEMENT TEAM TO UNDERTAKE ALL INSPECTIONS AND KEEP RECORDS OF ALL INSPECTIONS FOR FUTURE REFERENCE AND MONITORING.
5. IF ANY REPAIR OR REMEDIATION WORKS ARE REQUIRED THESE ARE TO BE UNDERTAKEN BY APPROPRIATELY QUALIFIED CONTRACTORS/SPECIALISTS WITH WORKS UNDERTAKEN IN ACCORDANCE WITH MANUFACTURER SPECIFICATIONS TO RESTORE THE ELEMENT BACK TO WORKING CONDITION (AS NEW). WHERE REPAIR IS NOT POSSIBLE, ELEMENTS ARE TO BE REPLACED.
6. THIS MAINTENANCE PLAN SHOULD BE READ IN CONJUNCTION WITH PRODUCT SPECIFIC MAINTENANCE SPECIFICATIONS. I.E. WASTEWATER TREATMENT SYSTEMS TO BE MAINTAINED IN ACCORDANCE WITH MARSH INDUSTRIES SPECIFICATION ETC.
7. SITE WIDE DRAINAGE TO BE SURVEYED WITH CCTV EVERY 5 YEARS. WHERE REPAIR OR REMEDIATION WORKS ARE REQUIRED (AS IDENTIFIED BY THE CCTV SURVEY REPORT) THE WORKS ARE TO BE UNDERTAKEN BY A SPECIALIST IN ACCORDANCE WITH THE SEWER REHABILITATION MANUAL.

KEY

- PROPOSED STORM WATER DRAIN
- PROPOSED STORM WATER MANHOLE
- PROPOSED STORM WATER DRAINAGE CHANNEL
- PROPOSED STORM WATER GULLY
- PROPOSED FOUL WATER DRAIN
- PROPOSED FOUL WATER MANHOLE
- EXISTING DRAIN TO BE ABANDONED

Rev	Date	Description	By	Ckd
P1	10.02.2021	FOR INFORMATION	AB	JH

Architect :

pHp ARCHITECTS

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Client :

TRITAX SYMMETRY

Project Title:

OCADO, SYMMETRY PARK
BICESTER

Drawing Title:

MAINTENANCE PLAN

Drawing Status:

PRELIMINARY

Hydrock Job No:

C-13482

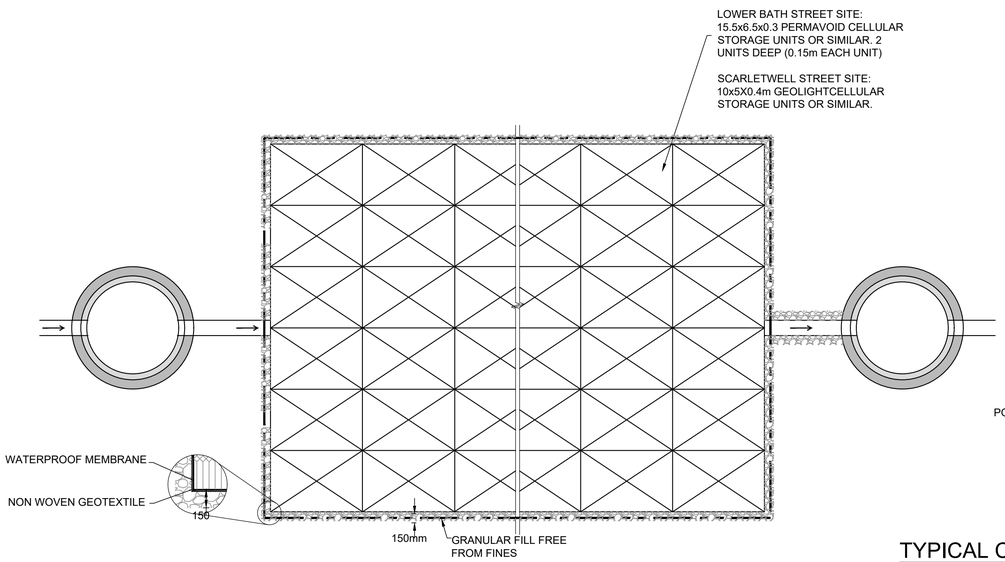
Drawn	Checked	Scale @ A1	Date	Issue Date
AB	JH	1:625	10.02.21	10.02.21

Drawing Number: C-13482-HYD-00-ZZ-DR-C-7200

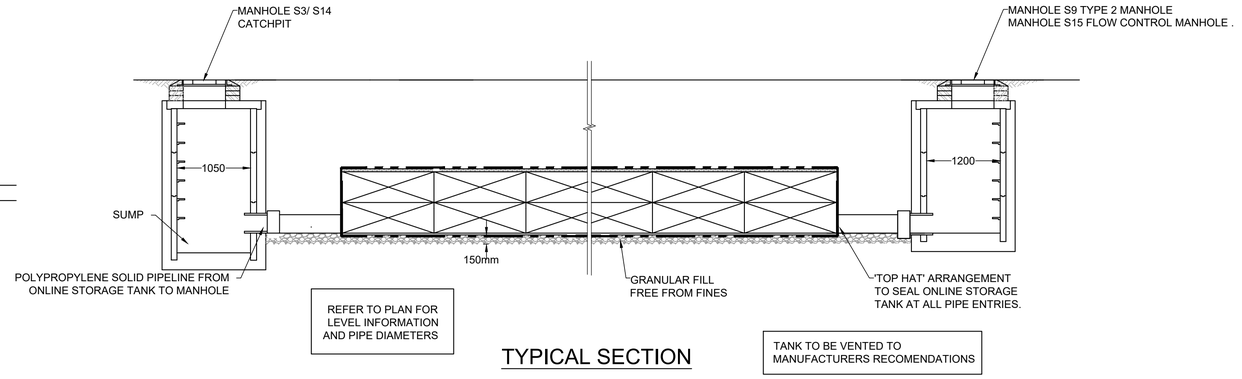
Revision: P1

NOTES:

1. THIS DRAWING IS NOT TO BE SCALED.
2. THIS DRAWING IS FOR INFORMATION PURPOSES ONLY, NOT FOR CONSTRUCTION. FOR DETAILED DRAINAGE INFORMATION FOR EACH PHASE OF THE SITE PLEASE REFER TO THE DRAINAGE PLANS AND STANDARD DETAILS.



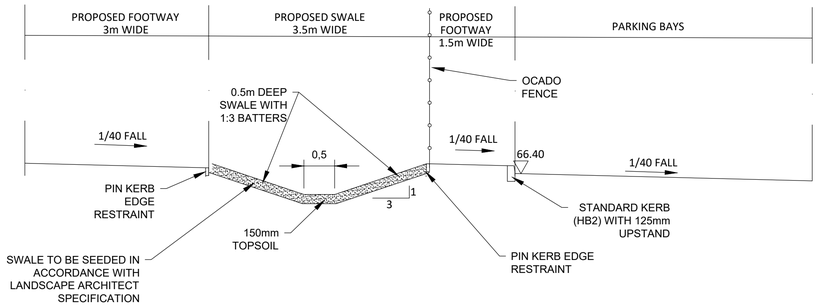
PLAN



TYPICAL SECTION

TYPICAL CELLULAR STORAGE TANK (SUBJECT TO CONTRACTORS CHOICE OF SUPPLIER)

NTS



UNLINED SWALE (TYPICAL)

1:50 (A1)

Rev	Date	Description	By	Ckd
P1	11.02.2021	FOR INFORMATION	AB	JH

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Client :

TRITAX SYMMETRY

Project Title:

OCADO, SYMMETRY PARK
BICESTER

Drawing Title:

TYPICAL DRAINAGE DETAILS

Drawing Status:

PRELIMINARY

Hydrock Job No:

C-13482

Drawn	Checked	Scale @ A1	Date	Issue Date
AB	JH	AS SHOWN	11.02.21	11.02.21

Drawing Number: C-13482-HYD-XX-XX-SK-C-5100

Revision: P1

SWALE CONSTRUCTION DURING WORKS FOR ORIGINAL UNIT

LOCALISED EARTHWORKS REQUIRED TO INCREASE GROUND LEVEL TO ACHIEVE 0.5m DEPTH TO SWALE

EXISTING DITCH TO BE MAINTAINED AND DUG OUT WHERE NECESSARY.

LOCALISED BANK WORKS TO EXISTING DITCH TO ALLOW SWALE CONNECTION. EXG IL 64.44

SWALE WITH 1 IN 3 SIDE SLOPES, 1 IN 200 GRADIENT. SWALE INCORPORATED WITHIN LANDSCAPED AREA FOR WATER QUALITY PURPOSES

+64.72

S 21
CL 65.38
IL 64.77

OUTFALL HEADWALL ALTHON H3C OR SIMILAR. IL 64.72

Ø150 PIPE

AREA AROUND MANHOLE SMH 21 TO BE LOCALLY GRADED TO ENSURE MINIMUM COVER OF 500mm TO PIPE

PUMPING STATION AND RISING MAN

RISING MAIN TO PASS A MINIMUM OF 600mm BELOW TREE ROOTS
IL APPROX 65.73
E 460104.774
N 220853.724

RISING MAIN TO PASS A MINIMUM OF 600mm BELOW TREE ROOTS
IL APPROX 65.73
E 460123.785
N 220835.411

IL APPROX 65.73
E460144.817
N220815.828

YARD EXTENSION AS APPLIED FOR IN THIS PLANNING APPLICATION

RISING MAIN TO BE INSTALLED IN COMPLIANCE WITH THE ARBORICULTURIST METHOD STATEMENT

RISING MAIN TO PASS A MINIMUM OF 600mm BELOW TREE ROOTS
IL APPROX 65.73
E 460169.431
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PROPOSED SURFACE WATER PUMP STATION WITH DUTY AND STANDBY PUMPS, CONTRACTOR DESIGNED. DESIGNED TO ACHIEVE DISCHARGE RATES OF
5.5l/s @ 1.04m HEAD IN 2yr EVENT,
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100mm OD HPPE RISING MAIN. PUMP DESIGNER TO CONFIRM DIAMETER. THRUST BLOCKS REQUIRED AT CHANGE IN DIRECTION.

ATTENUATION 1516 m³
2.0m DEPTH IL 61.90
DUE TO DEPTH ADDITIONAL PROTECTION TO ATTENUATION MAY BE REQUIRED DEPENDANT ON MANUFACTURER USED AND THEIR REQUIREMENTS.

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BAGWORK HEADWALL LOCATION TO SUIT INVERT OF EXISTING DITCH.

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EXISTING DITCH ALONG BOUNDARY TO BE PIPED UNDER FOOTWAY.

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S 20
CL 66.11
IL 61.73

S 19
CL 65.86
IL 63.38

S 9
CL 65.86
IL 62.53

S 10
CL 65.87
IL 62.18

S 8
CL 65.39
IL 62.58

F 7
CL 65.59
IL 63.15

S 7
CL 65.50
IL 64.00

S 16
CL 65.90
IL 63.05

F 8
CL 65.78
IL 62.60

S 15
CL 65.96
IL 63.94

Ø150 @1/150
Ø525
Ø300
Ø600
Ø225

LEGEND

- FOUL WATER CONNECTION
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- LIGHT LIQUID SEPERATOR
- ROAD GULLY — G
- SURFACE WATER DRAINAGE CHANNEL
- LAND DRAIN

SURFACE WATER MANHOLE SCHEDULE

MANHOLE REFERENCE	COVER LEVEL	INVERT LEVEL	TYPE	CHAMBER DIA (min)	COVER GRADE (min)	EASTING	NORTHING
S1	65.47	64.24	CP	1050	C250 (R)	460306.242	220615.397
S2	65.48	63.86	CP	1050	C250 (R)	460284.017	220575.844
S3	65.70	63.62	CP	1050	C250 (R)	460260.509	220533.945
S4	65.83	63.53	2	1200	C250 (R)	460245.539	220523.360
S5	65.85	63.10	2	1200	D400	460165.023	220567.913
S6	65.39	62.73	2	1200	D400	460150.183	220581.634
S7	65.50	64.00	CP	1050	D400	460208.202	220684.446
S8	65.39	62.58	2	1500	D400	460184.028	220640.945
S9	65.86	62.53	2	1500	D400	460167.736	220649.896
S10	65.87	62.18	CP	1500	D400	460177.608	220668.428
S11	65.97	64.33	2	1500	C250	460329.004	220677.659
S12	65.84	64.25	2	1500	C250	460304.402	220691.409
S13	65.90	64.17	2	1500	C250	460280.040	220705.026
S14	65.96	64.10	2	1500	C250	460255.332	220718.835
S15	65.96	63.94	2	1500	D400	460232.005	220717.438
S16	65.90	63.05	CP	1500	D400	460214.366	220709.288
S17	65.93	64.43	CP	1050	D400	460328.320	220685.150
S18	66.19	64.03	CP	1050	D400	460258.570	220724.394
S19	65.86	63.38	CP	1050	D400	460217.311	220747.447
S20	66.11	61.85	PUMPING STN		C250	460205.419	220725.751
S21	65.38	64.72	2	1200	B125	460087.964	220875.221

MANHOLES WITH SYPHONIC CONNECTION TO BE VENTED
R - DENOTES COVER TO BE RECESSED TO ACCOMMODATE PAVING SLABS/ BLOCK PAVING
CP - CATCHPIT

FOUL WATER MANHOLE SCHEDULE

MANHOLE REFERENCE	COVER LEVEL	INVERT LEVEL	TYPE	CHAMBER DIA (min)	COVER GRADE (min)	EASTING	NORTHING
F1	65.73	64.68	2	1200	C250	460259.784	220546.754
~~F2~~	~~65.56~~	~~64.21~~	~~2~~	~~1200~~	~~C250~~	~~460271.010~~	~~220542.245~~
~~F3~~	~~65.69~~	~~65.06~~	~~PPIC~~	~~450~~	~~B125 (R)~~	~~460254.614~~	~~220541.590~~
F4	65.80	64.40	2	1200	C250	460244.812	220524.844
F5	65.80	63.84	2	1200	D400	460168.837	220566.952
F6	65.39	63.65	2	1200	D400	460147.019	220579.643
F7	65.59	63.15	2	1200	D400	460178.382	220648.020
F8	65.78	62.60	2	1200	D400	460218.034	220719.601
~~F9~~	~~66.00~~	~~64.29~~	~~PPIC~~	~~450~~	~~B125~~	~~LOCATE ON SITE~~	

R - DENOTES COVER TO BE RECESSED TO ACCOMMODATE PAVING SLABS/ BLOCK PAVING

AS BUILT DRAWING:
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Rev	Date	Description	By	Ckd
AB	20.03.19	AS BUILT ISSUE	JH	JH
C3	18.10.18	SWALE AND RISING MAIN UPDATED	AB	JH
C2	31.08.18	REVISIONS AS CLOUDED	CM	JH
C1	19.07.18	CONSTRUCTION ISSUE	CM	JH
PC1	10.07.18	PRE-CONSTRUCTION ISSUE	AB	JH
T1	08.05.18	ADJUSTED FLOW RATES	AB	JH
T1	05.04.18	TENDER ISSUE	AB	JH

Architect :

pHp ARCHITECTS

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Client :

dbsymmetry

Project Title:

SYMMETRY PARK
A41, BICESTER PHASE 2

Drawing Title:

DRAINAGE LAYOUT
SHEET 3 OF 3

Drawing Status:

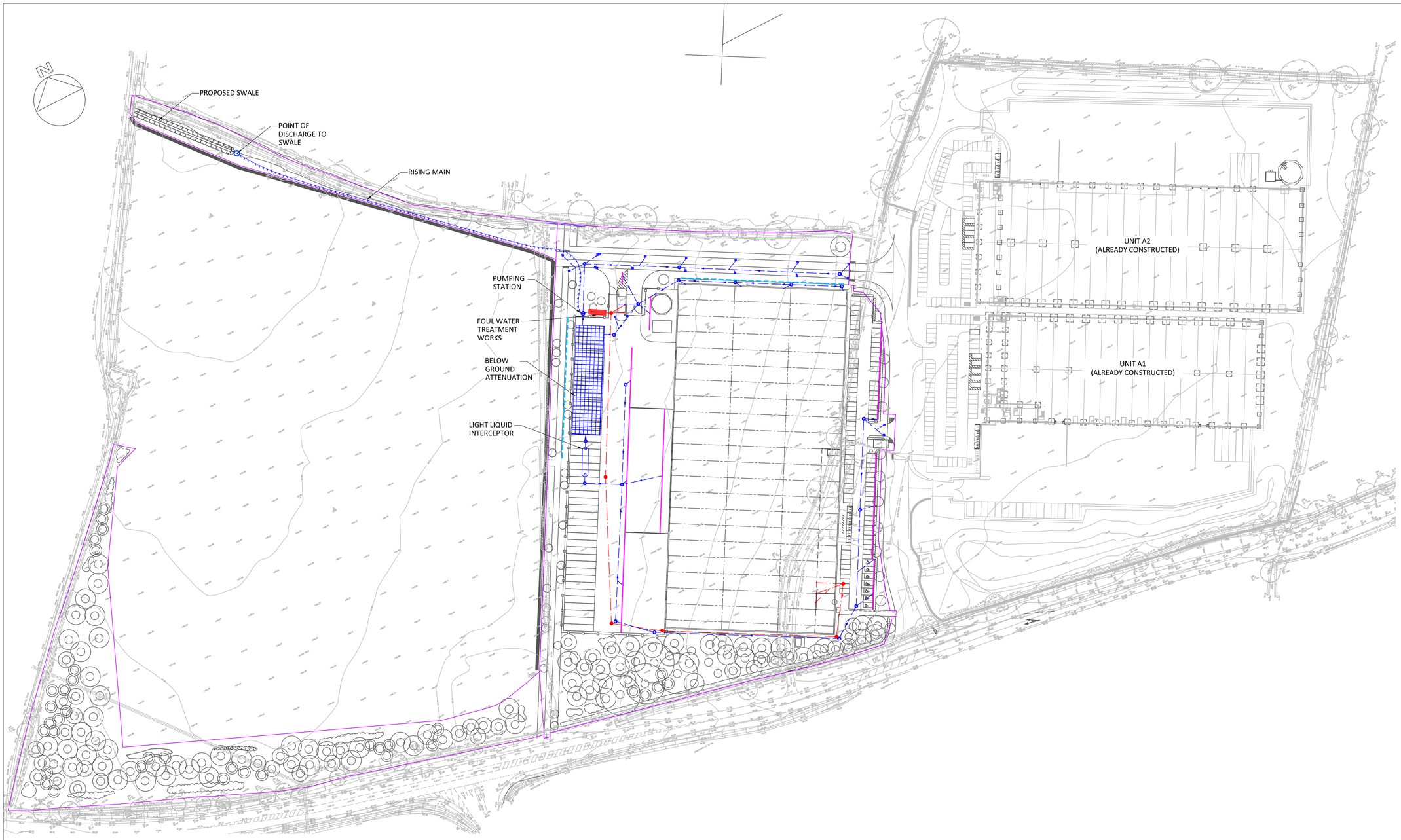
AS BUILT

OCADO BICESTER

C13482-HYD-00-ZZ-SK-C-8000

Appendix E

Drawings for existing approved Unit B drainage



LEGEND

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- FOUL WATER SEWER
- FOUL WATER MANHOLE
- FOUL WATER INSPECTION CHAMBER (PPIC)
- RAINWATER PIPE (SIPHONIC) — SRWP
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- LIGHT LIQUID SEPERATOR
- ROAD GULLY
- SURFACE WATER DRAINAGE CHANNEL
- LAND DRAIN

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NOTES:

1. THIS DRAWING IS NOT TO BE SCALED.
2. ALL DIMENSIONS AND LEVELS ARE TO BE CHECKED ON SITE BEFORE THE COMMENCEMENT OF WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ARCHITECT AND ENGINEER FOR VERIFICATION. FIGURED DIMENSIONS ONLY ARE TO BE TAKEN FROM THIS DRAWING.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS' AND SERVICE ENGINEERS' DRAWINGS AND SPECIFICATIONS.
4. DRAWING BASED ON PHP ARCHITECTS MASTERPLAN DRAWING 4036-B09-001 Masterplan-Unit B -200318.
5. THE CONTRACTOR SHALL ALLOW FOR THE PROTECTION, TEMPORARY AND PERMANENT SUPPORT AND DIVERSION WORKS AS NECESSARY, TO ALL EXISTING SERVICES TO THE SATISFACTION OF THE PUBLIC UTILITIES.
6. THE CONTRACTOR SHALL ALLOW FOR DEALING WITH SURFACE WATER RUN-OFF INTO EXCAVATION AND FROM GROUNDWATER BY MEANS OF SUMPS, PUMPING AND DE-WATERING AS APPROPRIATE, IN ORDER TO KEEP THE EXCAVATION AS REASONABLY DRY AS POSSIBLE DURING THE CONSTRUCTION OF THE WORKS,
7. ALL EXTERNAL DRAINAGE WORKS SHALL BE CONSTRUCTED IN ACCORDANCE WITH 'CIVIL ENGINEERING SPECIFICATION FOR THE WATER INDUSTRY' 7th EDITION FOR ADOPTABLE DRAINAGE, AND TO THE RELEVANT PROJECT SPECIFICATION AS DIRECTED BY THE ENGINEER FOR PRIVATE DRAINAGE.
7. PIPE MATERIAL SHALL BE AS FOLLOWS:

   WITHIN ACCESS ROAD:
   100Ø TO 225Ø - CLAYWARE TO BS EN 295
   300Ø AND ABOVE - CONCRETE TO BS EN 1916.

   WITHIN PLOTS:
   PVCu PIPES TO BE EN 1401-1:1998 MAY BE USED SUBJECT TO THE APPROVAL OF THE ENGINEER. PIPES OF LESS THAN 400MM DIAMETER TO HAVE A RESISTANCE OF 270 BAR.

8. ALL FOUL PIPES ARE TO BE 100Ø UNLESS STATED OTHERWISE OR TO SUIT ABOVE GROUND PIPEWORK. SURFACE WATER PIPE DIAMETERS ARE AS INDICATED
   PIPE GRADIENTS UNLESS SHOWN ARE:
   FOUL:
   MINIMUM GRADIENT WITHOUT W.C. TO BE 1:40,
   MINIMUM GRADIENT WITH W.C. TO BE 1:80,
9. CLAY AND CONCRETE PIPES SHALL BE BEDDED ON CLASS S BEDDING UNLESS COVER IS LESS THAN 1.2m IN TRAFFICKED AREAS, THEN CLASS Z BEDDING.
10. UPVC PIPES SHALL BE BEDDED ON CLASS P BEDDING UNLESS COVER IS LESS THAN 1.2m IN TRAFFICKED AREAS, THEN CLASS Q OR Z BEDDING.
11. BACKFILL TO TRENCHES MAY BE SUITABLE EXCAVATED MATERIAL IN LANDSCAPED AREAS. TYPE 1 GRANULAR MATERIAL TO BE USED UNDER HARDSTANDINGS AND ROADS.
12. ROAD GULLY CONNECTIONS SHALL BE 150mm DIAMETER AND WITH CLASS Z BEDDING.
13. ROAD GULLIES SHALL BE TRAPPED 450mm DIAMETER x 900mm DEEP WITH CLASS D400 FRAME AND GRATING TO BS EN 124.
14. DRAINAGE CHANNELS ARE TO BE ACO QMAX WITHIN YARDS OR SIMILAR APPROVED. CHANNELS SHALL HAVE PROPRIETRY OUTLETS/ SILT TRAPS. DETAILED DESIGN SHALL BE UNDERTAKEN BY THE CONTRACTOR'S PREFERRED CHANNEL MANUFACTURER/SUPPLIER. INSTALLATION TO MANUFACTURERS INSTRUCTIONS.
15. ALL MANHOLE AND DRAINAGE CHANNEL COVERS SHALL COMPLY WITH BS EN 124. FOR DETAILS OF COVER TYPE & LOCATION, PLEASE REFER TO THE MANHOLE SCHEDULE.MANHOLE COVERS WITHIN BLOCK PAVED AREAS & BUILDINGS SHALL BE RECESSED, DOUBLE SEALED WITHIN BUILDING.
16. ALL LIGHT LIQUID SEPARATORS SHALL BE VENTILATED BY VENTILATION PIPEWORK TO MANUFACTURER'S RECOMMENDATIONS AND FITTED WITH AN ALARM.
17. VENTILATION SHALL BE PROVIDED AT THE HEAD OF FOUL DRAINAGE RUNS.
    FOR SETTING OUT OF SOIL AND RAINWATER PIPES, SEE ARCHITECT'S LAYOUT.
18. ACCESS FOR RODDING/ JETTING SHALL BE PROVIDED TO ALL SOIL AND RAINWATER DOWNPIPES ABOVE FINISHED FLOOR LEVEL.
19. FOR DETAILS OF MANHOLE TYPES AND PIPE BEDDING ETC, SEE STANDARD DETAIL DRAWING(S).
20. COVER LEVELS SHOWN ARE APPROXIMATE.
    COVER LEVELS FOR MANHOLES WITHIN LANDSCAPED AREAS SHOULD BE CHECKED WITH THE LANDSCAPE ARCHITECTS. COVERS SHOULD BE ADJUSTED TO MATCH SURROUNDING FINISH LEVELS.
21. VENTILATION TO BE PROVIDED TO BELOW GROUND ATTENUATION AS REQUIRED BY MANUFACTURER.

Rev	Date	Description	By	Ckd
AB	20.03.19	AS BUILT ISSUE	JH	JH
C1	19.07.18	CONSTRUCTION ISSUE	CM	JH
PC1	10.07.18	PRE-CONSTRUCTION ISSUE	AB	JH
T1	5.04.18	TENDER ISSUE	AB	JH

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Client :

dbsymmetry

Project Title:

SYMMETRY PARK
A41, BICESTER PHASE 2

Drawing Title:

DRAINAGE LAYOUT
1 OF 3

Drawing Status:

AS BUILT

Hydrock Job No:

C-08601-C

Drawn	Checked	Scale @ A1	Date	Issue Date
AB	JH	1:1000	28.03.18	20.03.19

Drawing Number: SYM-HYD-XX-XX-DR-C-0103

Revision: AB

DRAINAGE LAYOUT
CONTINUED NEXT SHEET

IL APPROX 65.73
E460144.817
N220815.828

RISING MAIN TO BE INSTALLED IN COMPLIANCE WITH THE ARBORICULTURIST METHOD STATEMENT

RISING MAIN TO PASS A MINIMUM OF 600mm BELOW TREE ROOTS
IL APPROX 65.73
E 460169.431
N 220792.952

100mm OD HPPE RISING MAIN. PUMP DESIGNER TO CONFIRM DIAMETER. THRUST BLOCKS REQUIRED AT CHANGE IN DIRECTION.

PROPOSED SURFACE WATER PUMP STATION WITH DUTY AND STANDBY PUMPS, CONTRACTOR DESIGNED. DESIGNED TO ACHIEVE DISCHARGE RATES OF
5.5l/s @ 1.04m HEAD IN 2yr EVENT,
12.5l/s @ 1.66m HEAD IN 30yr EVENT, AND
12.5l/s @ 3.30m HEAD IN 100yr +20%cc EVENT.

NRV INSTALLED IN INCOMING PIPE FROM TREATMENT WORKS

ATTENUATION 1516 m³
2.0m DEPTH IL 61.90
DUE TO DEPTH ADDITIONAL PROTECTION TO ATTENUATION MAY BE REQUIRED DEPENDANT ON MANUFACTURER USED AND THEIR REQUIREMENTS.

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CONCRETE SURROUND REQUIRED AT CROSS OVER

BAGWORK HEADWALL LOCATION TO SUIT INVERT OF EXISTING DITCH.

Ø225 PIPE

EXISTING DITCH ALONG BOUNDARY TO BE PIPED UNDER FOOTWAY.

BAGWORK HEADWALL LOCATION TO SUIT INVERT OF EXISTING DITCH.

S 20
CL 66.11
IL 61.73

S 19
CL 65.86
IL 63.38

S 9
CL 65.86
IL 62.53

S 10
CL 65.87
IL 62.18

Ø525 Ø525 Ø525 Ø525

Ø150 Ø225 Ø600 Ø600

IL 63.00

F 8
CL 65.78
IL 62.60

F 6
CL 65.39
IL 63.65

Ø150 @1/150 Ø150 @1/150

F 7
CL 65.59
IL 63.15

S 7
CL 65.50
IL 64.00

S 6
CL 65.39
IL 62.73

Ø525 Ø300

S 8
CL 65.39
IL 62.58

S 16
CL 65.90
IL 63.05

S 15
CL 65.96
IL 63.94

Ø225 Ø225 IL 63.37

Ø600

S 18
CL 66.19
IL 64.03

S 5
CL 65.85
IL 63.07

F 5
CL 65.80
IL 63.82

Ø150 @ 1/150 Ø300

FOUL SEWER PASSES UNDER SURFACE WATER. CONCRETE SURROUND REQUIRED AT CROSSOVER

ONSITE WASTEWATER TREATMENT WORKS MARSH INDUSTRIES 150PE. TREATED EFFLUENT TO BE DISCHARGED TO SURFACE WATER SYSTEM (SIZE BASED UPON 220 PEOPLE AND IS SUBJECT TO SPECIALIST DESIGN).

S 14
CL 65.96
IL 64.10

SRWP

Ø600

S 13
CL 65.90
IL 64.17

ROOT BARRIER TO RUN PARRALLEL TO SURFACE WATER BETWEEN S4 AND S5

UNIT B
FFL 66.0

SRWP

Ø600 Ø225

S 12
CL 65.84
IL 64.25

SRWP

Ø600

STUB CONNECTIONS PROVIDED FROM PREVIOUS STAGE OF WORKS TO BE CAPPED OFF

S 11
CL 65.97
IL 64.33

SRWP

S 17
CL 65.93
IL 64.43

Ø300 Ø150 @ 1/150

S 4
CL 65.83
IL 63.53

F 4
CL 65.80
IL 64.40

F 1
CL 65.73
IL 64.68

Ø150 @ 1/100

Ø300

S 3
CL 65.70
IL 63.62

S 2
CL 65.48
IL 63.86

Ø300 Ø225

S 1
CL 65.47
IL 64.24

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Rev	Date	Description	By	Ckd
AB	20.03.19	AS BUILT ISSUE	JH	JH
C4	18.10.18	RISING MAIN DETAILS ADDED	JH	JH
C3	24.09.18	GULLIES LOCATED TO SUITE REVISED LEVELS	JH	JH
C2	31.08.18	REVISIONS AS CLOUDED	CM	JH
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dbsymmetry

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A41, BICESTER PHASE 2

Drawing Title:

DRAINAGE LAYOUT
SHEET 2 OF 3

Drawing Status:

AS BUILT

Hydrock Job No:

C-08601-C

Drawn	Checked	Scale @ A1	Date	Issue Date
AB	JH	1:500	28.03.18	19.07.18

Drawing Number:

SYM-HYD-XX-XX-DR-C-0104

Revision:

AB

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+64.72

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CL 65.38
IL 64.77

OUTFALL HEADWALL ALTHON H3C OR SIMILAR. IL 64.72

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CL 66.11
IL 61.73

S 19
CL 65.86
IL 63.38

S 9
CL 65.86
IL 62.53

S 10
CL 65.87
IL 62.18

S 8
CL 65.39
IL 62.58

F 7
CL 65.59
IL 63.15

S 7
CL 65.50
IL 64.00

S 16
CL 65.90
IL 63.05

F 8
CL 65.78
IL 62.60

S 15
CL 65.96
IL 63.94

Ø150 @1/150
Ø525
Ø300
Ø600
Ø225

LEGEND

- FOUL WATER CONNECTION
- FOUL WATER SEWER
- FOUL WATER MANHOLE
- FOUL WATER INSPECTION CHAMBER (PPIC)
- RAINWATER PIPE (SIPHONIC) — SRWP
- SURFACE WATER SEWER
- SURFACE WATER MANHOLE/ CATCHPIT
- SURFACE WATER INSPECTION CHAMBER
- SURFACE WATER ATTENUATION
- LIGHT LIQUID SEPERATOR
- ROAD GULLY — G
- SURFACE WATER DRAINAGE CHANNEL
- LAND DRAIN

SURFACE WATER MANHOLE SCHEDULE

MANHOLE REFERENCE	COVER LEVEL	INVERT LEVEL	TYPE	CHAMBER DIA (min)	COVER GRADE (min)	EASTING	NORTHING
S1	65.47	64.24	CP	1050	C250 (R)	460306.242	220615.397
S2	65.48	63.86	CP	1050	C250 (R)	460284.017	220575.844
S3	65.70	63.62	CP	1050	C250 (R)	460260.509	220533.945
S4	65.83	63.53	2	1200	C250 (R)	460245.539	220523.360
S5	65.85	63.10	2	1200	D400	460165.023	220567.913
S6	65.39	62.73	2	1200	D400	460150.183	220581.634
S7	65.50	64.00	CP	1050	D400	460208.202	220684.446
S8	65.39	62.58	2	1500	D400	460184.028	220640.945
S9	65.86	62.53	2	1500	D400	460167.736	220649.896
S10	65.87	62.18	CP	1500	D400	460177.608	220668.428
S11	65.97	64.33	2	1500	C250	460329.004	220677.659
S12	65.84	64.25	2	1500	C250	460304.402	220691.409
S13	65.90	64.17	2	1500	C250	460280.040	220705.026
S14	65.96	64.10	2	1500	C250	460255.332	220718.835
S15	65.96	63.94	2	1500	D400	460232.005	220717.438
S16	65.90	63.05	CP	1500	D400	460214.366	220709.288
S17	65.93	64.43	CP	1050	D400	460328.320	220685.150
S18	66.19	64.03	CP	1050	D400	460258.570	220724.394
S19	65.86	63.38	CP	1050	D400	460217.311	220747.447
S20	66.11	61.85	PUMPING STN		C250	460205.419	220725.751
S21	65.38	64.72	2	1200	B125	460087.964	220875.221

MANHOLES WITH SYPHONIC CONNECTION TO BE VENTED
R - DENOTES COVER TO BE RECESSED TO ACCOMMODATE PAVING SLABS/ BLOCK PAVING
CP - CATCHPIT

FOUL WATER MANHOLE SCHEDULE

MANHOLE REFERENCE	COVER LEVEL	INVERT LEVEL	TYPE	CHAMBER DIA (min)	COVER GRADE (min)	EASTING	NORTHING
F1	65.73	64.68	2	1200	C250	460259.784	220546.754
~~F2~~	~~65.56~~	~~64.21~~	~~2~~	~~1200~~	~~C250~~	~~460271.010~~	~~220542.245~~
~~F3~~	~~65.69~~	~~65.06~~	~~PPIC~~	~~450~~	~~B125 (R)~~	~~460254.614~~	~~220541.590~~
F4	65.80	64.40	2	1200	C250	460244.812	220524.844
F5	65.80	63.84	2	1200	D400	460168.837	220566.952
F6	65.39	63.65	2	1200	D400	460147.019	220579.643
F7	65.59	63.15	2	1200	D400	460178.382	220648.020
F8	65.78	62.60	2	1200	D400	460218.034	220719.601
~~F9~~	~~66.00~~	~~64.29~~	~~PPIC~~	~~450~~	~~B125~~	~~LOCATE ON SITE~~	

R - DENOTES COVER TO BE RECESSED TO ACCOMMODATE PAVING SLABS/ BLOCK PAVING

AS BUILT DRAWING:
THIS DRAWING IS THE FINAL CONSTRUCTION ISSUE AND DOES NOT PURPORT TO BE A SURVEY RECORD OF THE WORKS AS CONSTRUCTED.

Rev	Date	Description	By	Ckd
AB	20.03.19	AS BUILT ISSUE	JH	JH
C3	18.10.18	SWALE AND RISING MAIN UPDATED	AB	JH
C2	31.08.18	REVISIONS AS CLOUDED	CM	JH
C1	19.07.18	CONSTRUCTION ISSUE	CM	JH
PC1	10.07.18	PRE-CONSTRUCTION ISSUE	AB	JH
T1	08.05.18	ADJUSTED FLOW RATES	AB	JH
T1	05.04.18	TENDER ISSUE	AB	JH

Architect :

pHp ARCHITECTS

Hydrock

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Solihull
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T +44 (0)121 5069040
birmingham@hydrock.com
www.hydrock.com

Client :

dbsymmetry

Project Title:

SYMMETRY PARK
A41, BICESTER PHASE 2

Drawing Title:

DRAINAGE LAYOUT
SHEET 3 OF 3

Drawing Status:

AS BUILT

Hydrock Job No:

C-08601-C

Drawn	Checked	Scale @ A1	Date	Issue Date
AB	JH	1:500	28.03.18	18.10.18

Drawing Number:

SYM-HYD-XX-XX-DR-C-0105

Revision:

AB

Appendix F

Greenfield Run off calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by: John Hayden
Site name: Ocado
Site location: Bicester

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude: 51.88114° N
Longitude: 1.12641° W

Reference: 4251513287
Date: Feb 11 2021 16:31

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR
SPR estimation method: Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	617	617
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

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

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	4.17	4.17
1 in 1 year (l/s):	3.54	3.54
1 in 30 years (l/s):	9.58	9.58
1 in 100 year (l/s):	13.29	13.29
1 in 200 years (l/s):	15.58	15.58

Appendix G

Infiltration results

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DB Symmetry Limited

Soakaway Investigation

Akeman Park
Aylesbury Road
BICESTER
Oxfordshire
OX26 6HQ

Report No: 16.02.026a
December 2016

MAIN OFFICE & LABORATORIES
Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northamptonshire. NN12 8QD
Telephone: (01327) 860060 Fax: (01327) 860430 Email: info@listersgeotechnics.co.uk

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

DOCUMENT RECORD

Report Title	Soakaway Investigation Report
Project Title	New Commercial Development
Project Address	Akeman Park, Aylesbury Road, Bicester, Oxfordshire, OX26 6HQ
Project Number	16.02.026a
Client	DB Symmetry Limited

Prepared By:

Signed.....
Matt Johnston
Senior Geotechnical Engineer
BSc (Hons), FGS

Checked By:

Signed.....
Matthew Clarke
Principal Geotechnical Engineer
BSc (Hons), MSc (Dipl), FGS, CGeol

For and on behalf of ListersGeo, trading name of Listers Geotechnical Consultants Ltd

Issue No	Date	Status
1	19th December 2016	Draft
2	20th December 2016	Final
3	6th January 2017	Final Rev1

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EXECUTIVE SUMMARY

Project Reference	16.02.026a
Site Location	Akeman Park, Aylesbury Road, Bicester, Oxfordshire, OX26 6HQ
OS Grid Reference	460235, 220642
Development Proposals	Develop the site to accommodate between three and five warehouse type commercial units with associated offices, car parking, lorry parking and limited soft landscaped areas.
Existing Buildings	A shed of steel framed construction with cladding used for livestock.
Topography	Slopes gently down towards the east.
Vegetation	Mature hedgerows and mature trees along the field boundaries.
Published Geology	The site is underlain by the Peterborough Member with the Kellaways Sand Member and Kellaways Clay Member recorded to the east of the site.
Ground Conditions Encountered	Topsoil down to depths of between 0.30m and 0.35m overlying the Peterborough Member, overlying the Kellaways Sand Member which in turn overlies the Kellaways Clay Member.
Groundwater Encountered	Groundwater was not encountered in any of the exploratory holes during the fieldwork down to 2.5m depth below the existing ground level, however, monitoring carried out as part of the project has revealed standing groundwater levels within the natural deposits of between 0.57m and 1.26m below the existing ground level.
Soakaways	Infiltration results ranged between $8x10^{-8}$m/s and $9x10^{-7}$m/s, indicating soils with generally low infiltration potential. Given the low permeability of the soils encountered at this site it is recommended that an alternative Sustainable Drainage system (SUDs) is adopted at this site. This could include attenuation tanks which can temporarily store storm water for a period of time and then the water can be slowly released into the existing field ditches.

This executive summary should be read in conjunction with the main report.

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CONTENTS

APPENDICES

APPENDIX A - PLANS
- Site Location Plan
- Exploratory Hole Location Plan - Existing Site Layout

APPENDIX B – FIELDWORK AND TESTING
- Trial Pit Logs
- Soil Infiltration Test Results

APPENDIX C- LABORATORY TESTING RESULTS
- Geotechnical Laboratory Testing Results
- Plasticity Chart
- Moisture Content v Depth

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SOAKAWAY INVESTIGATION REPORT

INTRODUCTION

A soakaway investigation has been undertaken for a proposed commercial development at Akeman Park, Aylesbury Road, Bicester, Oxfordshire, OX26 6HQ. A Site Location Plan is provided in Appendix A.

The Ordnance Survey National Grid reference for the centre of the site is 460235, 220642.

Instructions to undertake the investigation were received by email from Savills on behalf of the client, on the 30th November 2016.

This report describes the exploratory work carried out by ListersGeo, the ground conditions encountered and discusses their implications with regard to the proposed use of soakaways.

This report supplements a previous Desk Study report prepared by Peter Brett Associates LLP (PBA), report number 32765/3501, dated November 2015 and a Phase II Ground Investigation report prepared by ListersGeo, report number 16.02.026, dated May 2016 and we have relied on information within these reports to aid our recommendations.

This report has been prepared for the sole use of the client and their professional advisors. This report shall not be relied upon by third parties without the express written authority of ListersGeo. If an unauthorised third party comes into possession of this report they must not rely on it and the authors owe them no duty of care and skill.

SCOPE OF THE INVESTIGATION

The scope of the investigation was to provide a preliminary assessment of the feasibility of adopting a soakaway drainage solution at the site as in order to discharge planning condition No. 20.

PROPOSALS

It is proposed to develop the site to accommodate between three and five warehouse-type commercial units with associated offices, car parking, lorry parking and limited soft landscaped areas.

SITE INFORMATION AND WALKOVER SURVEY

A walkover survey of the site and its immediate surrounds was undertaken on the 2nd December 2016.

The site lies in a predominantly rural area approximately 750m southeast of Bicester and essentially comprises three fields used for grazing purposes.

The site consists of a roughly 'L' shaped parcel of land, trending approximately northwest to southeast. Measuring approximately 610m by up to 290m the site extends to approximately 16.5ha in area.

The site slopes gently down towards the east with a change in ground level of approximately 3m across the length of the site.

The fields are separated by a combination of mature hedgerows and wire fencing with some mature trees sparsely located along the sites boundaries.

A gravel surfaced access track runs northwards from the A41 to a shed of steel framed construction with cladding used for livestock. Some general rubble including brick and concrete was noted to the immediate southwest of this shed and a large pile of manure was noted to the immediate east of this shed.

Each of the soakaway trial pits were excavated within approximately 100m of the above noted shed.

GEOLOGY

Published Geology

Reference to the British Geological Survey 1:50,000 scale map and other published geological information on the area indicates that the site is underlain by the Peterborough Member of Jurassic age.

The Peterborough Member is a subdivision of the Oxford Clay Formation occurring up to 26m in thickness in this area and is generally represented by mainly brownish-grey, fissile, organic-rich (bituminous) mudstones with shelly fauna dominated by crushed aragonitic ammonites and bivalves. Subordinate beds of pale-medium grey, blocky mudstone are common with several bands of cementstone nodules and concretions.

Although the Peterborough Member is recorded to occur up to 26m in thickness in this area it is noted that the Kellaways Sand Member is recorded approximately 100m to the southeast of the site and therefore it is considered likely that the Peterborough Member may be significantly thinner toward the south of the site.

The Kellaways Sand Member is generally represented by siltstone, fine grained sand and sandstone and sandy mudstone occurring up to 5m in thickness.

This Kellaways Sand Member is itself underlain by the Kellaways Clay Member which is represented by dark grey mudstone occurring to 4m in thickness which is then underlain by the grey brown limestone of the Cornbrash Formation at depth.

PREVIOUS WORK

A desk study report was previously undertaken by Peter Brett Associates LLP (PBA) report number 32765/3501 dated November 2015 and a Phase II Ground Investigation report was prepared by ListersGeo, report number 16.02.026, dated May 2016. The salient points relevant to this report are included here, but the full report should be referred to for more detail.

Desk Study Report - PBA report number 32765/3501

The desk study report prepared by PBA established that the site had essentially remained as agricultural fields since 1876 with the exception of probable farm buildings constructed in the southeastern corner of the western field fronting on to the A41.

The Peterborough Member is recorded as Unproductive stratum whilst the underlying Kellaway Sand Member is recorded as a Secondary A Aquifer.

A drain or ditch, which runs towards the south, was recorded along the western site boundary and a tributary of the River Ray lies 20m to the south of the site.

Phase II Ground Investigation Report – ListersGeo report number 16.02.026

A total of forty-three exploratory holes were formed at the site during the previous investigation, inclusive of twenty-three machine excavated trial pits, eleven continuous tube sample boreholes, seven dynamic probe holes and two hand auger boreholes, between the 4th and 6th April 2016.

The previous investigation revealed the underlying soils comprised Topsoil down to depths of between 0.10m and 0.60m, locally overlying Made Ground to a maximum depth of 2.4m in the area of the infilled pond, overlying the Peterborough Member to depths of between 1.0m and 6.0 overlying the Kellaways Sand Member in the east, which in turn locally overlies the Kellaways Clay Member at depth around the boundary between the central and eastern fields.

A comment on the soakaway potential of the soils was not within the scope of works required during the previous investigation.

EXPLORATION AND TESTING

GENERAL

A total of four machine excavated trial pits were excavated at the site on the 2nd December 2016. The logs are provided in Appendix B.

SAMPLING STRATEGY

The investigation was undertaken in accordance with the scope of works agreed with our client.

The position of the exploratory holes were selected by ListersGeo the area of the site which had recorded sand associated with the Kellaways Sand Member which was considered more likely to be amenable to soakaways in comparison to the clay soils of the Peterborough Member.

The position of all exploratory holes undertaken at the site as part of this investigation can be seen on the Exploratory Hole Location Plans in Appendix A.

The results of the laboratory testing are provided in Appendix C.

METHODOLOGY

The trial pits, TP101 to TP104, were excavated with a JCB-3CX backhoe excavator to a maximum depth of 2.50m below ground level. Small-disturbed samples were taken at regular intervals down to the base of the holes for subsequent laboratory testing and inspection.

Infiltration testing was undertaken in these trial pits in accord with BRE Digest 365 'Soakaway Design' for a 250 minute time-period.

On completion, each trial pit was carefully backfilled with arisings in thin layers, ensuring that excavated material was replaced in the same order as it had been removed.

Engineering conclusions given in this report are based on data obtained from these sources but it should be noted that variations, which affect these conclusions, may inevitably occur between and beyond the test locations. Also water levels may vary with time.

GROUND CONDITIONS

The site and laboratory test work revealed that the general succession of strata in this area of the site can be represented by Topsoil overlying the Kellaways Sand Member which in turn overlies the Kellaways Clay Member. Our Ground Model for the site may be summarised as follows:

Topsoil - encountered at each test location from ground level down to depths of between 0.30m and 0.35m. Represented by dark brown silty sandy organic clay with abundant fine roots.

Peterborough Member - encountered in TP101, TP102 and TP103 from beneath the Topsoil at depth of between 0.30m and 0.35m down to depths of between 0.70m and 1.40m. Represented by firm orange brown sandy clay.

Atterberg limits classify the Peterborough Member as a shrinkable soil of low volume change potential. Moisture contents ranged from 17% to 23%.

Restricted sieve analyses on corresponding samples revealed a coarse soil fraction of less than 5%.

Kellaways Sand Member - encountered in each trial pit from beneath the Topsoil or Peterborough Member at depths of between 0.35m and 1.40m down to the base of trial pits TP101, TP102 and TP103 at a maximum depth of 2.50m and to a depth of 1.80m in TP104. Represented, in general, by orange and grey very clayey fine sand.

Full laboratory sieve analyses on the coarser horizons revealed fines (silty/clay) contents of between 34% and 40%.

Kellaways Clay Member - encountered in TP104 at a depth of 1.80m down to a depth of 2.40m. Represented by stiff dark grey silty clay.

Atterberg limits classify the Peterborough Member as a shrinkable soil of medium volume change potential. A moisture content of 30% was recorded.

Restricted sieve analyses on a corresponding sample revealed a coarse soil fraction of 0%.

GROUNDWATER

Groundwater was not encountered in any of the exploratory holes during the fieldwork down to 2.5m depth below the existing ground level.

Groundwater monitoring carried out as part of the previous investigation has revealed standing groundwater levels within the natural deposits of between 0.57m and 1.26m below the existing ground level.

INFILTRATION TESTING

Infiltration testing was carried out at a depth of between 0.8m and 2.5m in trial pits TP101, TP102, TP103 and TP104 in accord with BRE Digest 365 'Soakaway Design'. The infiltration results ranged between $8x10^{-8}$m/s and $9x10^{-7}$m/s.

The results of the soakaway test are included in Appendix C.

GEOTECHNICAL ENGINEERING CONCLUSIONS

GENERAL

We understand that it is proposed to develop the site to accommodate between three and five warehouse type commercial units with associated offices, car parking, lorry parking and limited soft landscaped areas.

The exploratory work from this soakaway investigation has generally confirmed the findings of the previous investigation comprising around 0.30m of Topsoil overlying the Peterborough Member beneath much of the site to around 1.1m; and the Kellaways Sand Member. In TP104, where the Peterborough Member was absent and the Kellaways Sand was seen above the Kellaways Clay Member.

Groundwater was not encountered in any of the exploratory holes during the fieldwork down to 2.5m depth below the existing ground level. However, monitoring carried out as part of the project has revealed standing groundwater levels within the natural deposits of between 0.57m and 1.26m below the existing ground level.

SITE EXCAVATION

Conventional hydraulic plant should be satisfactory for excavating a soakaway.

In line with HSE guidelines, all excavations requiring personnel access should be adequately supported to avoid the risk of collapse. Open vertical excavations within the Kellaways Sand Member should be considered unlikely to remain stable even in the short term and will require some side support.

Shallow excavations are likely to remain dry in the short term.

It should be appreciated, however, that seasonal variations may exist and hence percolating ground waters may occur, particularly during wetter months or after periods of inclement weather.

Consideration should be given to the effects of trees and shrubs on service runs that cross the site. Soil movements brought on by the influence of vegetation can severely disrupt the drain runs and mains services, and measures should be incorporated into the excavations to allow for future ground movements.

INFILTRATION MEASURES

Appropriately designed sustainable drainage systems (SuDS) are more sustainable than using piped drainage to local sewer systems. However, infiltration measures close to buildings may result in undermining of foundations and softening of soils leading to instability. Attenuation measures should be located at suitable distances from foundations and infrastructure.

Infiltration testing was carried out at depths of between 0.8m and 2.5m and the results ranged between $8x10^{-8}$m/s and $9x10^{-7}$m/s. These results are indicative of soils with poor soakage potential which are typical of the clayey sands encountered.

Given the low permeability of the soils encountered at this site it is recommended that an alternative Sustainable Drainage system (SUDs) is adopted at this site. This could include attenuation tanks which can temporarily store storm water for a period of time and then the water can be slowly released into the existing field ditches.

REFERENCES

1. Site Investigations, Code of Practice, BS5930:2015.
2. Soils for Civil Engineering Purposes, BS1377, 1990.
3. CIRIA Report 113, 'Control of groundwater for temporary WORKS', 1986
4. BRE Digest 365, Soakaway design, 2016.

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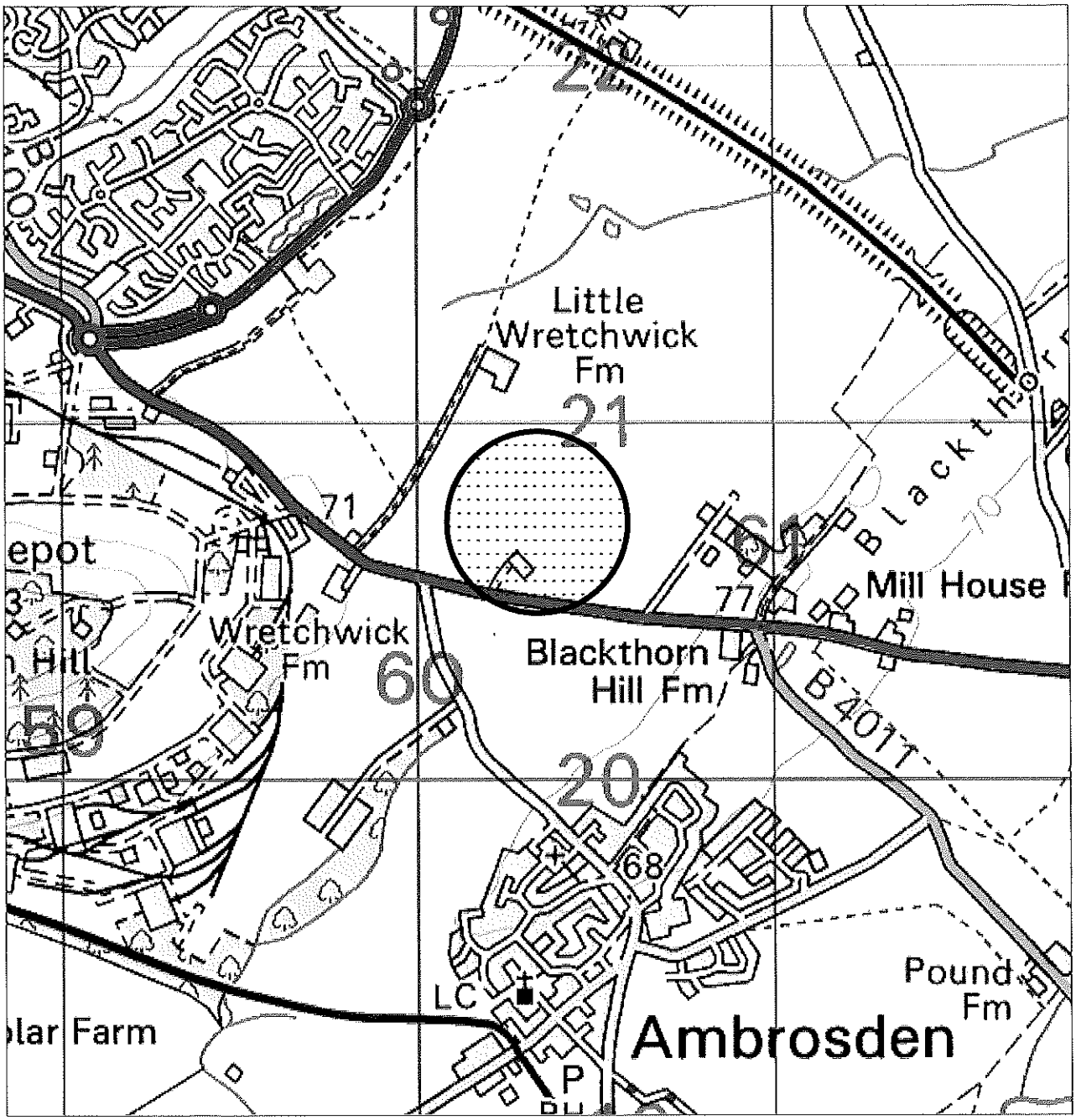
APPENDIX A
PLANS

Extract of 1:50,000 Ordnance Survey Explorer Map



Key: Approximate Site Location

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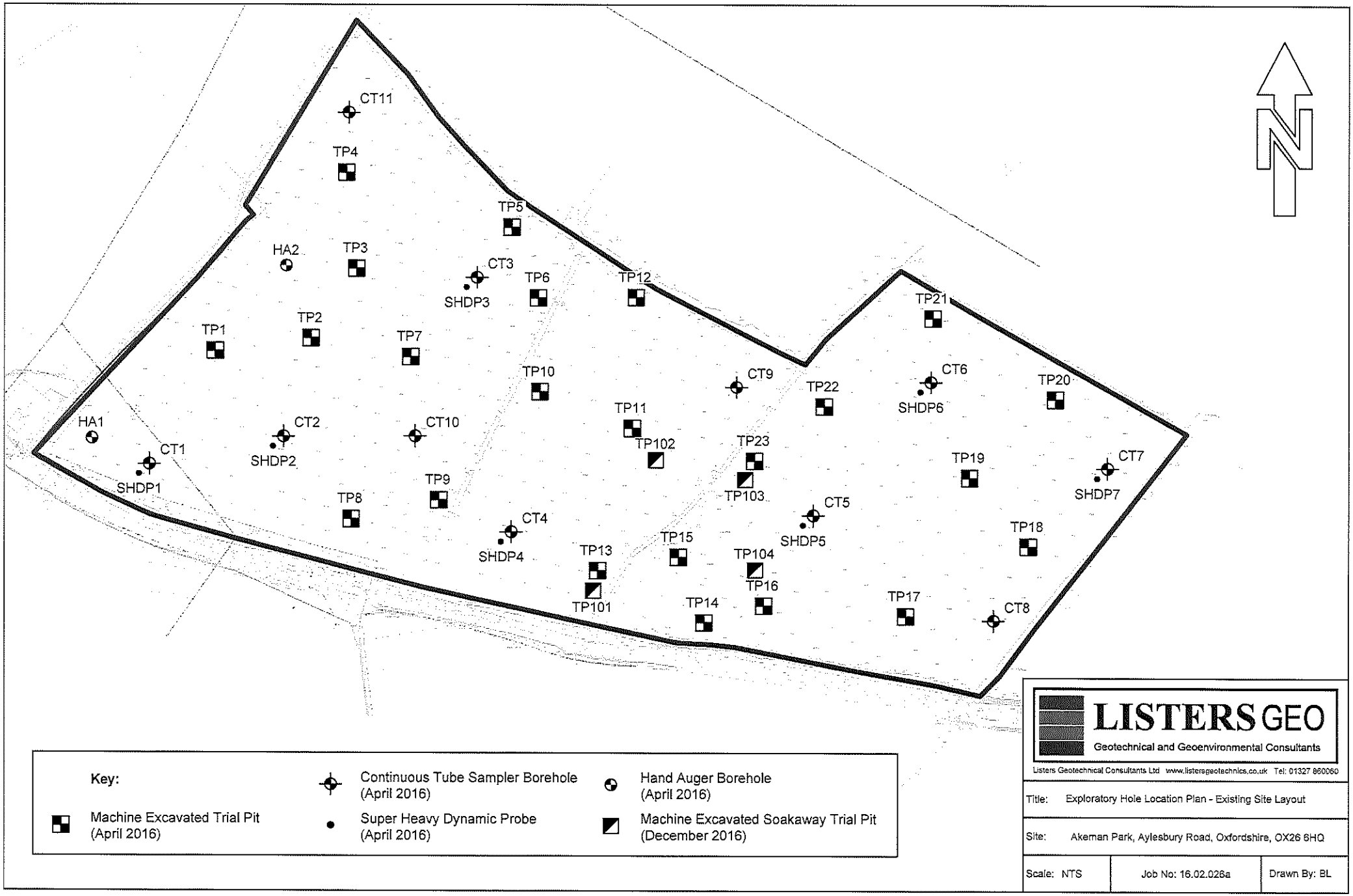
Listers Geotechnical Consultants Ltd www.listersgeotechnics.co.uk Tel: 01327 860060

Title:	Site Location Plan	
Site:	Akeman Park, Aylesbury Road, Oxfordshire, OX26 6HQ	
Scale: NTS	Job No: 16.02.026a	Drawn By: BL

N


CT11
TP4
TP5
HA2
TP3
CT3
SHDP3
TP6
TP12
TP21
TP1
TP2
TP7
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SHDP6
TP22
TP20
HA1
CT2
CT10
TP11
TP102
TP23
TP19
CT7
CT1
SHDP2
SHDP1
TP9
TP103
SHDP7
TP8
CT5
CT4
SHDP5
TP18
SHDP4
TP13
TP15
TP104
TP16
TP101
TP14
TP17
CT8
N
Key:
Machine Excavated Trial Pit (April 2016)
Continuous Tube Sampler Borehole (April 2016)
Super Heavy Dynamic Probe (April 2016)
Hand Auger Borehole (April 2016)
Machine Excavated Soakaway Trial Pit (December 2016)
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Geotechnical and Geoenvironmental Consultants
Listers Geotechnical Consultants Ltd www.listersgeotechnics.co.uk Tel: 01327 860060
Title: Exploratory Hole Location Plan - Existing Site Layout
Site: Akeman Park, Aylesbury Road, Oxfordshire, OX26 6HQ
Scale: NTS
Job No: 16.02.026a
Drawn By: BL

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APPENDIX B
FIELDWORK AND TESTING

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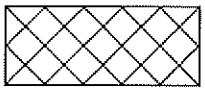
LEGEND - Soils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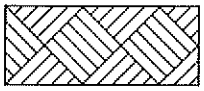
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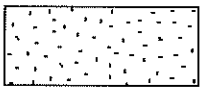
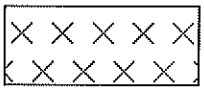
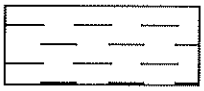
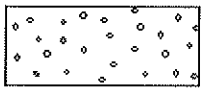

Sand


Silt

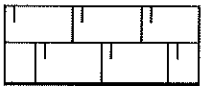

Boulders and Cobbles


Clay

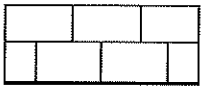

Gravel


Peat

LEGEND - Rocks (Sedimentary)


Chalk


Siltstone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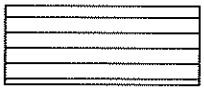
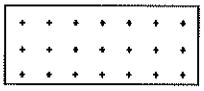
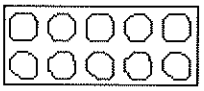
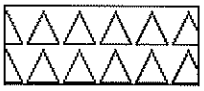

Mudstone


Sandstone


Coal


Conglomerate


Breccia

LOG ABREVIATIONS

W	Water Sample	▽	Water Strike
B	Bulk Sample	▼	Water (Standing Level)
D	Disturbed Sample	PP	Pocket Penetrometer
J	Jar Sample	HV	Hand Vane
U	Undisturbed Sample	SPT	Standard Penetration Test
(No. of blows shown in brackets for U100 samples)		CPT	Cone Penetration Test
WAC	Waste Acceptance criteria Sample	CBR	California Bearing Ratio
		*	Extrapolated Value

Pocket penetrometer testing provides values of unconfined compressive strength. The results have been converted to an approximate equivalent shear strength which should be used with due circumspection. As the pocket penetrometer tends to overestimate shear strength, we have used an appropriate reduction factor.

LOG KEY

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Trial Pit Log

Trial Pit No. TP 101

Project Location: Akeman Park, Aylesbury Road, Bicester, Oxfordshire OX26 6HQ

Co-ords:

Level:

Dates: 02/12/2016

Project Number: 16.02.026a

Logged By: Matthew Johnston to BS 5930:2015

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth (m)	Type	(kPa)				
							TOPSOIL Dark brown silty clay TOPSOIL with fine roots
				0.30			
	0.50	D					PETERBOROUGH MEMBER Firm orange brown slightly sandy CLAY
	1.00	D					
				1.20			KELLAWAYS SAND MEMBER Orange and grey very clayey fine SAND
	2.00	D					
				2.50			End of Trial Pit at 2.50m

1 2 3 4

Method of excavation: JCB 3CX

Stability: Sides Stable

Groundwater: None encountered

Trial Pit Dimensions: 0.60 x 1.80 x 2.50m

Remarks: Maximum depth of visible roots: 0.40m

QMS ISO 9001 REGISTERED FIRM

AGS Association of Geotechnical & Geoenvironmental Specialists

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Trial Pit Log

Trial Pit No. TP 102

Project Location: Akeman Park, Aylesbury Road, Bicester, Oxfordshire OX26 6HQ

Co-ords:

Level:

Dates: 02/12/2016

Project Number: 16.02.026a

Logged By: Matthew Johnston to BS 5930:2015

Water Strikes	Sample and In Situ Testing Depth (m)	Type	(kPa)	Depth (m)	Level (m)	Legend	Stratum Description
							TOPSOIL Dark brown silty sandy clay TOPSOIL with abundant fine roots
				0.30			PETERBOROUGH MEMBER Firm brown sandy silty CLAY
	0.50	D					
				0.70			KELLAWAYS SAND MEMBER Grey yellow and orange clayey SAND
	1.00	D					
	2.00	D					
				2.50			End of Trial Pit at 2.50m

1 2 3 4

Method of excavation: JCB 3CX

Stability: Sides Stable

Groundwater: None encountered

Trial Pit Dimensions: 0.60 x 1.80 x 2.50m

Remarks: Maximum depth of visible roots: 0.50m

QMS ISO 9001 REGISTERED FIRM

AGS Association of Geotechnical & Geoenvironmental Specialists

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Trial Pit Log

Trial Pit No. TP 103

Project Location: Akeman Park, Aylesbury Road, Bicester, Oxfordshire OX26 6HQ

Co-ords:

Level:

Dates: 02/12/2016

Project Number: 16.02.026a

Logged By: Matthew Johnston to BS 5930:2015

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth (m)	Type	(kPa)				
							TOPSOIL Dark brown sandy silty slightly gravelly TOPSOIL with abundant fine roots
				0.35			
	0.50	D					PETERBOROUGH MEMBER Firm orange brown very sandy CLAY
	1.00	D					
				1.40			KELLAWAYS SAND MEMBER Grey and orange very clayey SAND
	2.00	D					
				2.50			End of Trial Pit at 2.50m

Method of excavation: JCB 3CX

Stability: Sides Stable

Groundwater: None encountered

Trial Pit Dimensions: 0.60 x 1.90 x 2.50m

Remarks: Maximum depth of visible roots: 0.40m

QMS ISO 9001 REGISTERED FIRM

AGS Association of Geotechnical & Geoenvironmental Specialists

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

Trial Pit Log

Trial Pit No. TP 104

Project Location: Akeman Park, Aylesbury Road, Bicester, Oxfordshire OX26 6HQ

Co-ords:

Level:

Dates: 02/12/2016

Project Number: 16.02.026a

Logged By: Matthew Johnston to BS 5930:2015

Water Strikes	Sample and In Situ Testing Depth (m)	Type	(kPa)	Depth (m)	Level (m)	Legend	Stratum Description
							TOPSOIL Dark brown silty sandy clay TOPSOIL with abundant fine roots
				0.35			
	0.50	D					KELLAWAYS SAND MEMBER Orange and grey very clayey SAND
	1.00	D					
				1.80			KELLAWAYS CLAY MEMBER Stiff dark grey silty CLAY
	2.00	D					
				2.40			End of Trial Pit at 2.40m

1
2
3
4

Method of excavation: JCB 3CX

Stability: Sides Stable

Groundwater: None encountered

Trial Pit Dimensions: 0.60 x 1.80 x 2.40m

Remarks: Maximum depth of visible roots: 0.40m

QMS ISO 9001 REGISTERED FIRM

AGS Association of Geotechnical & Geoenvironmental Specialists

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

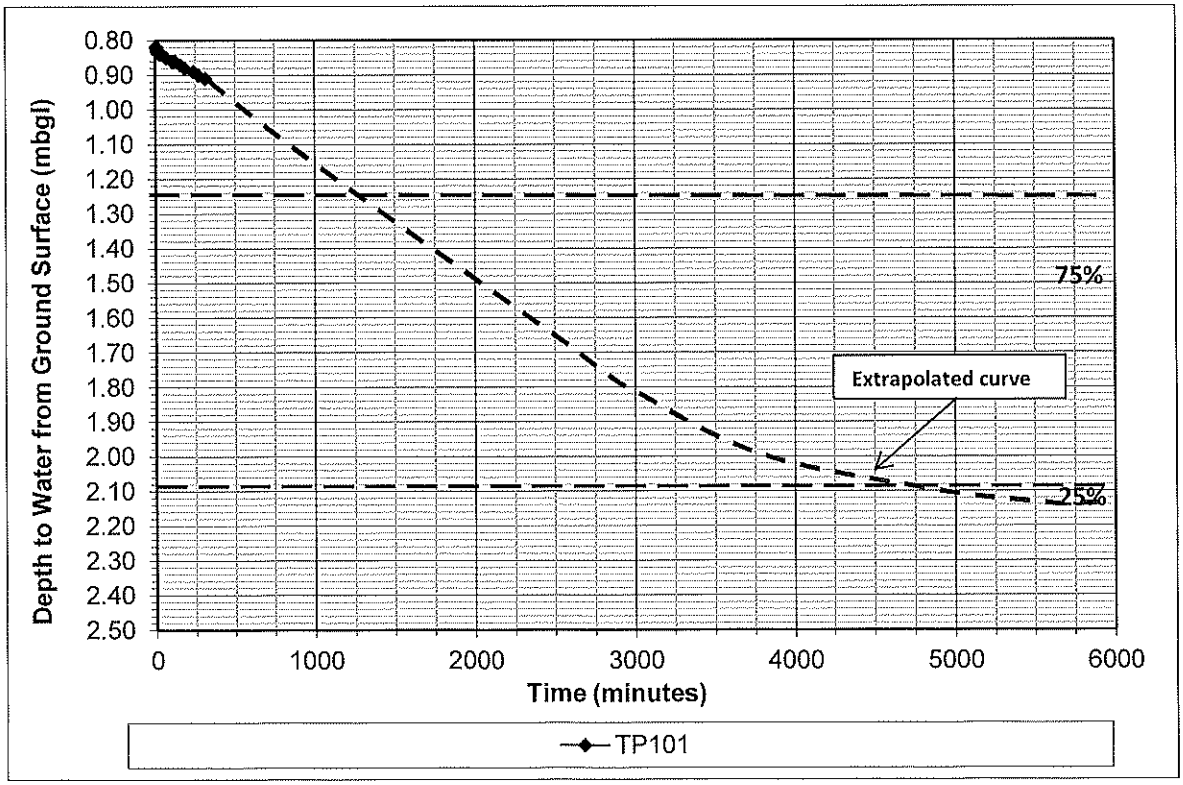
Client:	Savills	**Report No:**	16.02.026a
Site:	Akeman Park, Bicester	**Date Tested:**	02/12/2016
Dimensions:	0.6m x 1.8m x 2.5m width x length x depth	**Test Location:**	TP101

Soil Description - test response zone:

0.30-1.20m : Firm orange borwn slightly sandy CLAY.
1.95-2.40m : Medium dense orange and grey very clayey silty fine SAND

Time	Depth BGL	Time	Depth BGL	Time	Depth BGL
0	0.82	10	0.83	184	0.88
1	0.82	24	0.84	237	0.89
2	0.82	39	0.84	270	0.90
3	0.82	65	0.85	312	0.91
4	0.82	102	0.86		
5	0.83	120	0.86		
7	0.83	155	0.87		

Calculated Average Soil Infiltration Rate = 9.10E-07 m/s



TRIAL PIT INFILTRATION TESTING to BRE Digest 365

Report: 16.02.026a

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

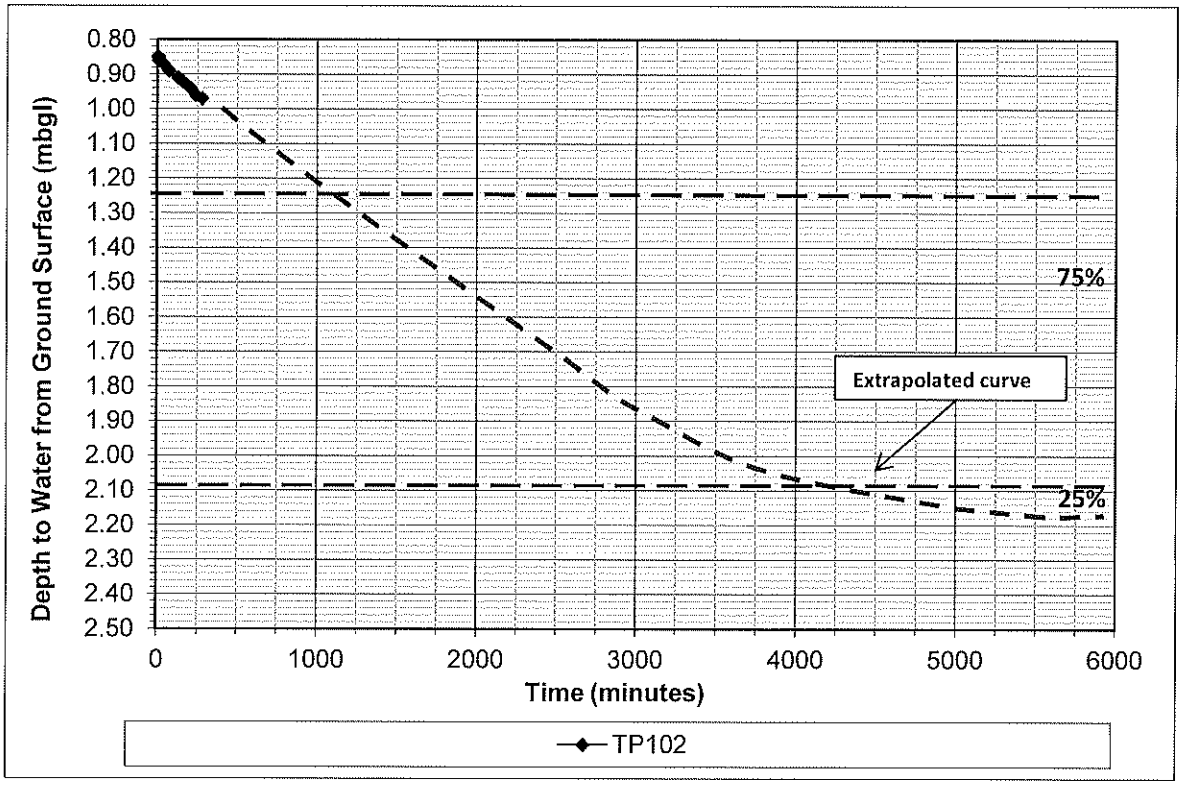
Client:	Savills	**Report No:**	16.02.026a
Site:	Akeman Park, Bicester	**Date Tested:**	02/12/2016
Dimensions:	0.6m x 1.8m x 2.5m width x length x depth	**Test Location:**	TP102

Soil Description - test response zone:

0.70-2.50m : Medium dense orange, grey and yellow very clayey silty fine SAND

Time	Depth BGL	Time	Depth BGL	Time	Depth BGL
0	0.85	10	0.86	277	0.97
1	0.85	34	0.87	0	0.00
2	0.85	69	0.89	0	0.00
3	0.85	125	0.91	0	0.00
4	0.85	153	0.92		
5	0.86	203	0.94		
7	0.86	235	0.96		

Calculated Average Soil Infiltration Rate = 9.35E-07 m/s



TRIAL PIT INFILTRATION TESTING to BRE Digest 365	Report: 16.02.026a

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

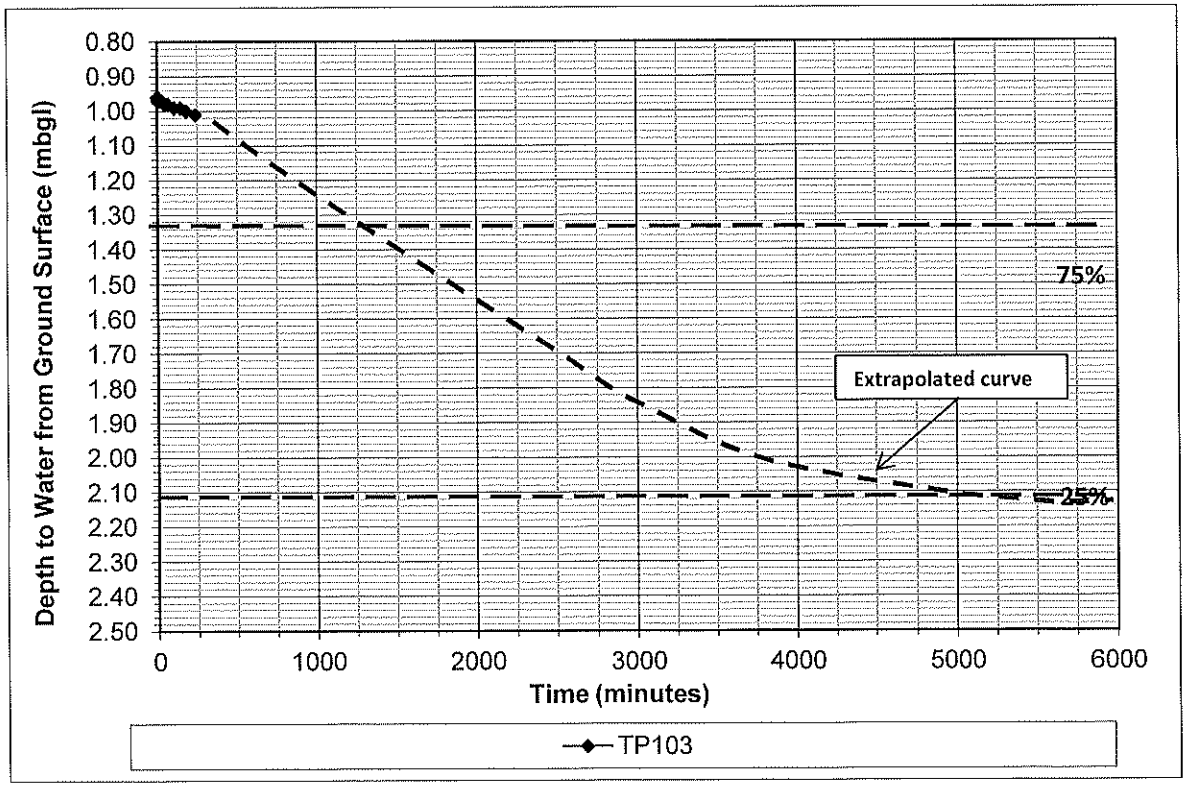
Client:	Savills	**Report No:**	16.02.026a
Site:	Akeman Park, Bicester	**Date Tested:**	02/12/2016
Dimensions:	0.6m x 1.9m x 2.5m width x length x depth	**Test Location:**	TP103

Soil Description - test response zone:

0.35-1.4m : Firm orange brown sandy CLAY
1.4-2.5m : Medium dense grey and orange very clayey silty SAND

Time	Depth BGL	Time	Depth BGL	Time	Depth BGL
0	0.96	20	0.97		
1	0.96	45	0.98		
2	0.97	64	0.98		
3	0.97	103	0.99		
4	0.97	143	0.99		
5	0.97	180	1.00		
10	0.97	237	1.01		

Calculated Average Soil Infiltration Rate = 7.33E-07 m/s



TRIAL PIT INFILTRATION TESTING to BRE Digest 365	Report: 16.02.026a

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

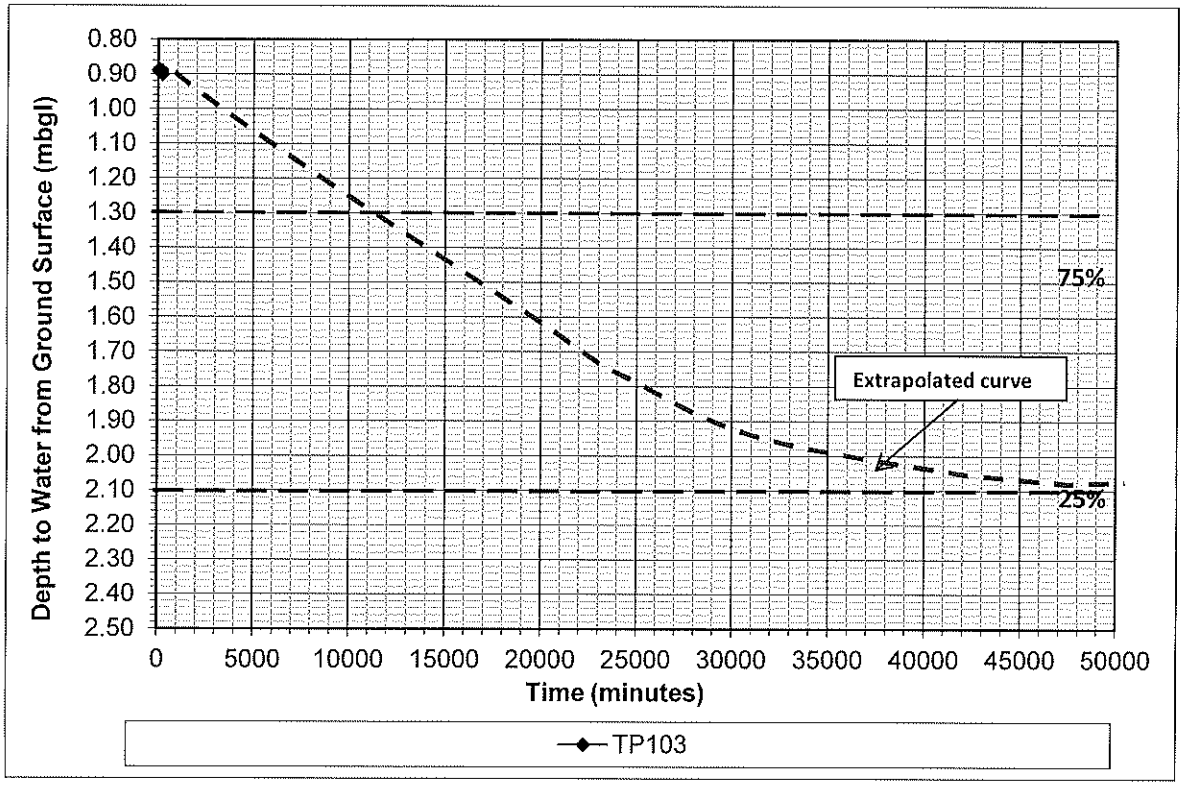
Client:	Savills	**Report No:**	16.02.026a
Site:	Akeman Park, Bicester	**Date Tested:**	02/12/2016
Dimensions:	0.6m x 1.9m x 2.5m width x length x depth	**Test Location:**	TP104

Soil Description - test response zone:

0.35-1.8m :Medium dense orange grey very silty very clayey SAND
1.8- 2.4m : Stiff dark grey silty CLAY

Time	Depth BGL	Time	Depth BGL	Time	Depth BGL
0	0.89	20	0.89		
1	0.89	40	0.89		
2	0.89	60	0.89		
3	0.89	120	0.89		
4	0.89	160	0.89		
5	0.89	210	0.90		
10	0.89				

Calculated Average Soil Infiltration Rate = 7.79E-08 m/s



TRIAL PIT INFILTRATION TESTING to BRE Digest 365	Report: 16.02.026a

LISTERS GEO
Geotechnical and Geoenvironmental Consultants

APPENDIX C
LABORATORY TESTING RESULTS AND TABLES

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone:- 01327 860947/860060 Fax:- 01327 860430 Email: groundtech@listersgeotechnics.co.uk

PROJECT INFORMATION	
Site Location:-	Akeman Park A41 Bicester Oxon OX26 6HQ
Client Reference:-	-
Date Samples Received:-	6th December 2016
Date Testing Completed:-	14th December 2016

The results relate only to the samples tested

SAMPLE INFORMATION

Laboratory Tests Undertaken:-

TEST TYPE	TEST METHOD	TESTED
Natural Moisture Contents (MC%)	(BS 1377:Part 2:1990 Clause 3.2)	✓
Liquid Limits (%)	(BS 1377:Part 2:1990 Clause 4.3)	✓
Plastic Limits (%)	(BS 1377:Part 2:1990 Clause 5.3)	✓
Plasticity Index (%)	(BS 1377:Part 2:1990 Clause 5.4)	✓
Linear Shrinkage (%)	(BS 1377:Part 2:1990 Clause 6.5)	
PSD - Wet Sieving	(BS 1377:Part 2:1990 Clause 9.2)	✓
Engineering Sample Descriptions	(BS 5930 : Section 6)	
Passing 425/63 (μm)	-	✓
Hydrometer	(BS 1377:Part 2:1990 Clause 9.5)	
Loss on Ignition (%)	-	
Soil Suctions (kPa)	BRE Digest IP 4/93, 1993	
Bulk Density (Mg/m^3)	(BS 1377:Part 2:1990 Clause 7.2)	
Strength Tests	(BS 1377:Part 7:1990 Clause 8 & 9)	
Soluble Sulphate Content (SO_4g/l)	(BS 1377:Part 3:1990 Clause 5.3)	
pH value	(BS 1377:Part 3:1990 Clause 9.4)	
California Bearing Ratios (CBR)	(BS 1377:Part 4:1990 Clause 7)	
Compaction Tests	(BS 1377:Part 4:1990 Clauses 3.0-3.6)	

Laboratory testing in accord with BS EN ISO/IEC 17025-2000 and Quality Management in accord with ISO 9001

Signed on behalf of GroundTech Laboratories:- _____ **Technical Signatory**

Quality Assured to ISO 9001

GEOTECHNICAL LABORATORY TEST RESULTS

Report No: 16.02.026a

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD
Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured to ISO 9001

SAMPLES				CLASSIFICATION TESTS							CLASSIFICATION TESTS							STRENGTH TESTS					CHEMICAL TESTS	
Test Location	Sample Type	Sample Depth -m	Test Type	MC %	LL %	PL %	PI %	Passing 425 µm %	Modified PI %	Class	Passing 63 µm %	MC/ LL	PL+ 2%	Liquidity Index	Loss on Ignition %	Soil Suction kPa	Bulk Density Mg/m3	Test Type	Cell Pressure kN/m2	Deviator Stress kN/m2	Apparent Cohesion kN/m2	ϕ	pH Value	Soluble Sulphate Content SO4 g/l
TP 101	D	0.50	PI/63	20	30	17	13	98	13	CL	65	0.67	19	0.23										
	D	1.00	PI/63	19	31	17	14	100	14	CL	37	0.61	19	0.14										
	D	2.00	PSD	20																				
TP 102	D	0.50		23																				
	D	1.00	PI/63	17	37	17	20	100	20	CI	66	0.46	19	0.00										
	D	2.00	PSD	22	23	18	5			ML		0.96	20	0.80										
TP 103	D	0.50		20																				
	D	1.00	PI/63	17	32	15	17	99	17	CL	48	0.53	17	0.12										
	D	2.00	PSD	21																				
TP 104	D	0.50	PSD	14	28	21	7			ML		0.50	23	-1.00										
	D	1.00	PSD	18	27	22	5			ML		0.67	24	-0.80										
	D	2.00	PI/63	30	52	22	30	100	30	CH	97	0.58	24	0.27										

Symbols:

U	Undisturbed Sample	R	Remoulded	PI	Plasticity Index	T	Triaxial Undrained	L	100mm specimen
D	Disturbed Sample	63	Passing 63µm	F	Filter Paper Suction Tests	M	Multistage Triaxial	S	38mm specimen
B	Bulk Sample	H	Hydrometer	CC	Continuous Core	HP	Hand Penetrometer		
W	Water Sample	PSD	Wet Sieving			V	Vane Test		

LABORATORY TEST RESULTS

Project Reference
16.02.026a

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD
Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

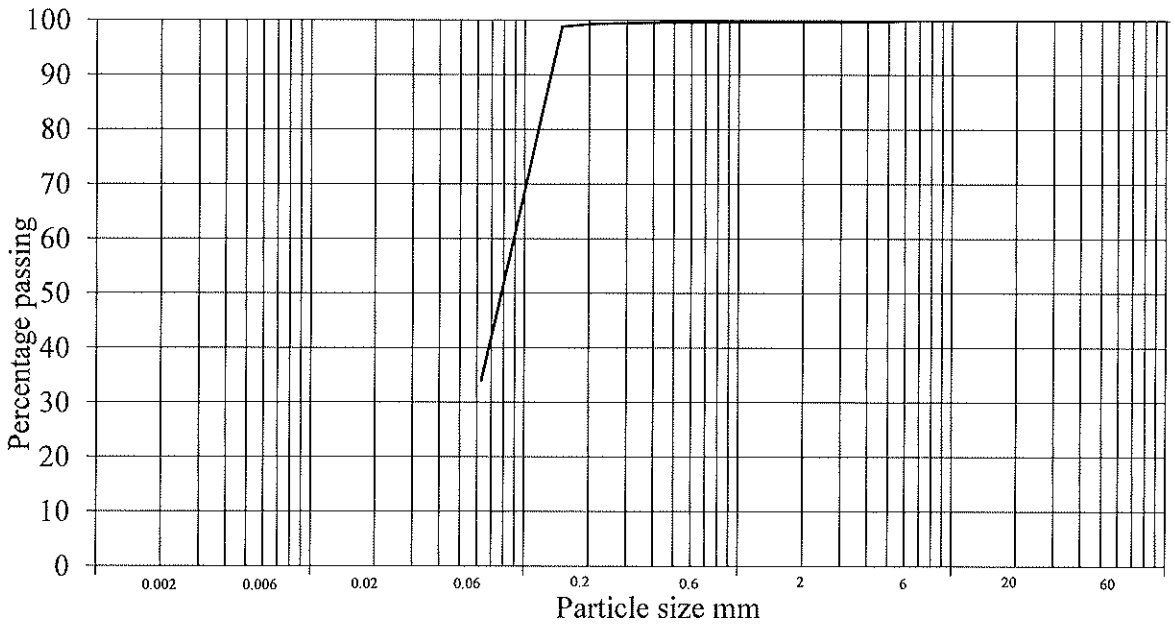
Site: Akeman Park A41, Bicester, Oxon, OX26 6HQ.

Test Location: TP 101
Sample Depth: 2.00m
Sample Description:

Hydrometer No.:
SG Gs:
Water Visc. (N):
Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	100.00		
14mm	100.00		
10mm	100.00		
6.3mm	100.00		
5mm	99.80		
3.5mm	99.80		
2mm	99.70		
1.18mm	99.70		
600µm	99.60		
425µm	99.60		
300µm	99.50		
212µm	99.40		
150µm	98.80		
63µm	34.00		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE DISTRIBUTION

Project Reference
16.02.026a

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD
Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

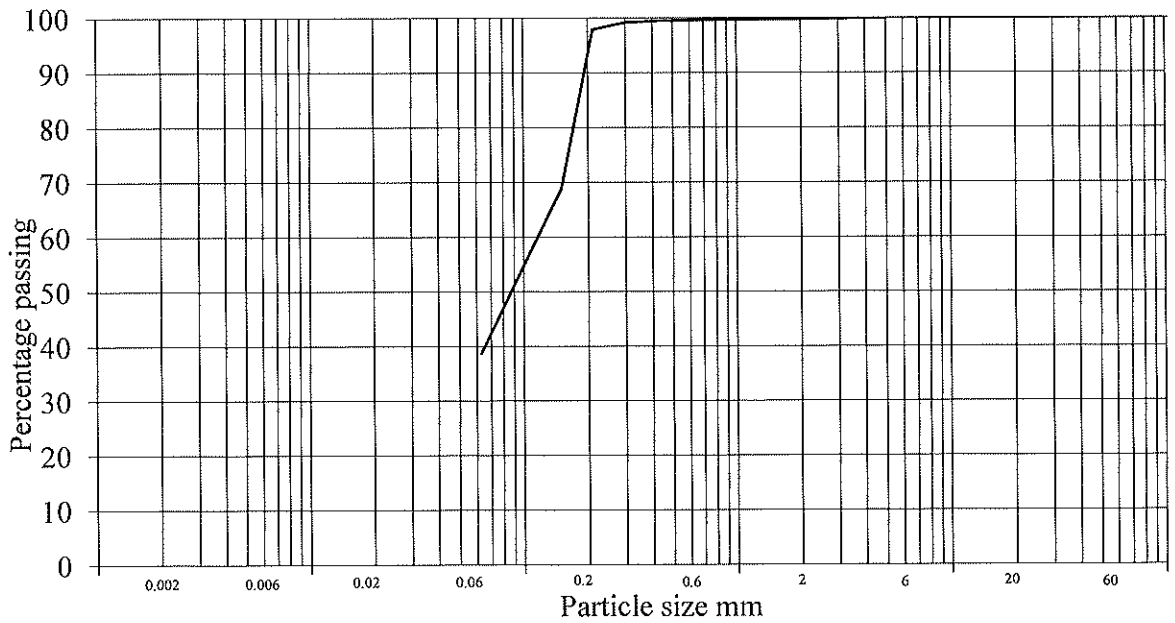
Site: Akeman Park A41, Bicester, Oxon, OX26 6HQ.

Test Location: TP 102
Sample Depth: 2.00m
Sample Description:

Hydrometer No.:
SG Gs:
Water Visc. (N):
Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	100.00		
14mm	100.00		
10mm	100.00		
6.3mm	100.00		
5mm	100.00		
3.5mm	99.90		
2mm	99.80		
1.18mm	99.70		
600µm	99.60		
425µm	99.50		
300µm	99.20		
212µm	97.90		
150µm	68.80		
63µm	38.70		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE DISTRIBUTION

Project Reference
16.02.026a

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD
Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

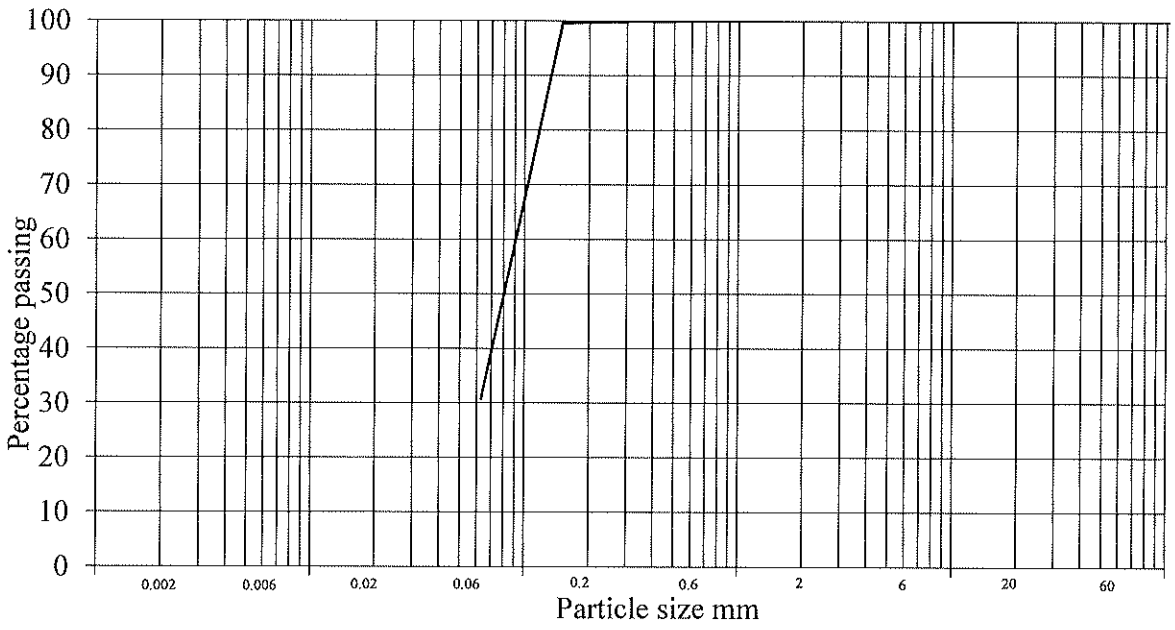
Site: Akeman Park A41, Bicester, Oxon, OX26 6HQ.

Test Location: TP 103
Sample Depth: 2.00m
Sample Description:

Hydrometer No.:
SG Gs:
Water Visc. (N):
Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	100.00		
14mm	100.00		
10mm	100.00		
6.3mm	100.00		
5mm	100.00		
3.5mm	100.00		
2mm	100.00		
1.18mm	100.00		
600µm	100.00		
425µm	99.90		
300µm	99.90		
212µm	99.80		
150µm	99.60		
63µm	30.80		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE DISTRIBUTION

Project Reference
16.02.026a

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD

Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

Site: Akeman Park A41, Bicester, Oxon, OX26 6HQ.

Test Location: TP 104

Sample Depth: 0.50m

Sample Description:

Hydrometer No.:

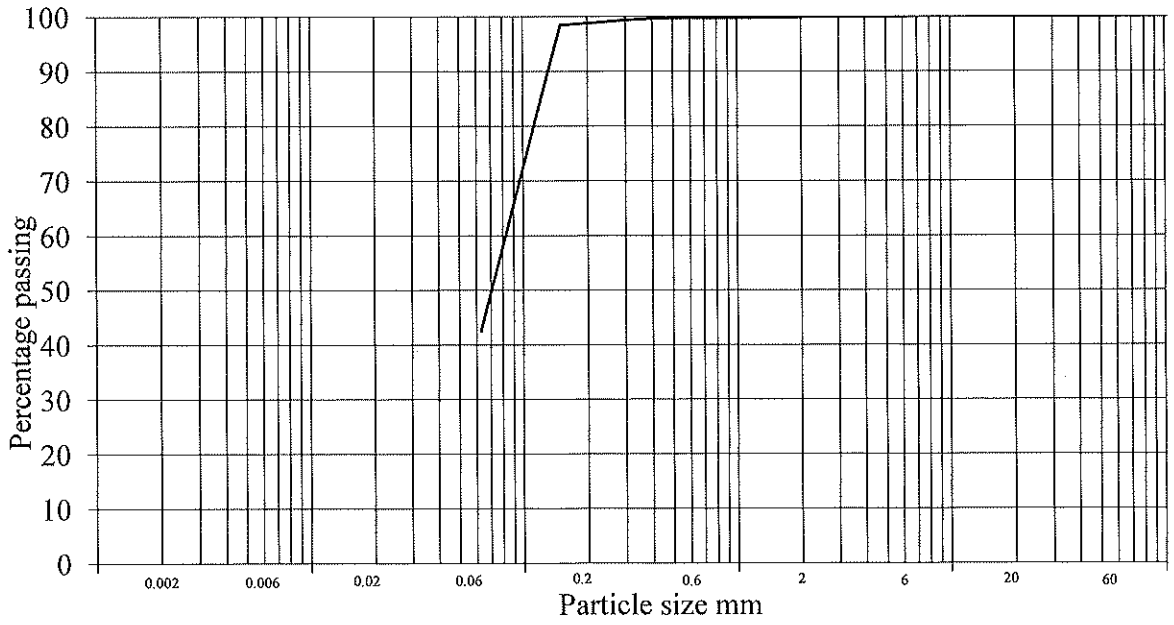
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	100.00		
14mm	100.00		
10mm	100.00		
6.3mm	100.00		
5mm	99.90		
3.5mm	99.90		
2mm	99.90		
1.18mm	99.80		
600µm	99.70		
425µm	99.70		
300µm	99.40		
212µm	98.90		
150µm	98.50		
63µm	42.50		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE DISTRIBUTION

Project Reference
16.02.026a

GroundTech Laboratories

Geotechnical Testing Facility

Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD
Telephone: 01327 860947/860060 Fax: 01327 860430 Email: groundtech@listersgeotechnics.co.uk

Quality Assured ISO 9001

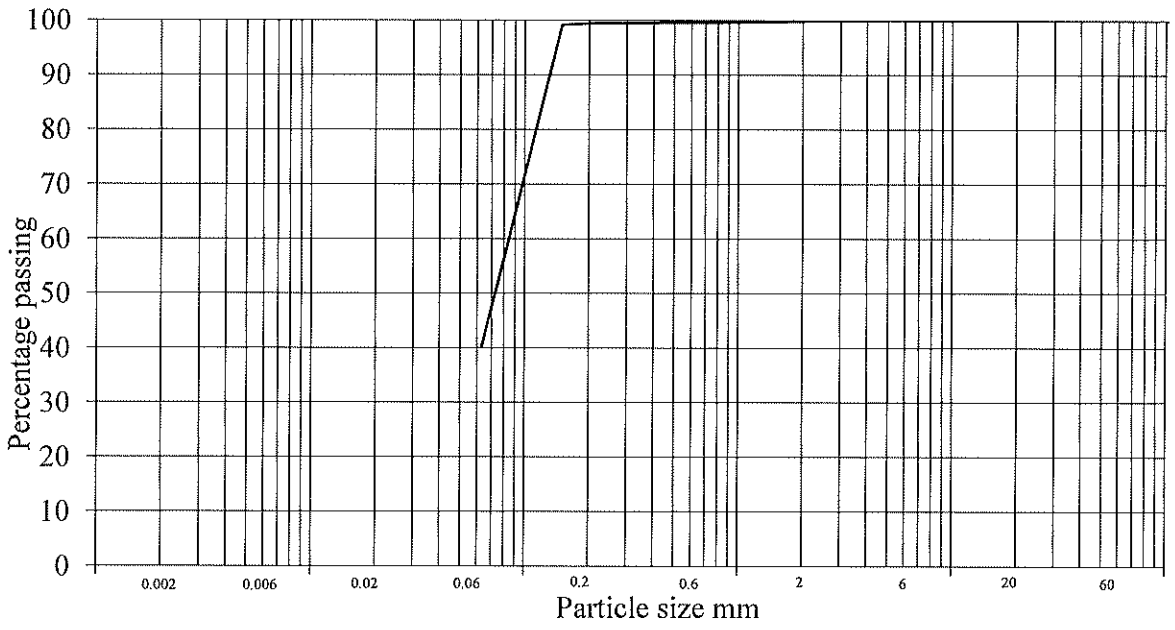
Site: Akeman Park A41, Bicester, Oxon, OX26 6HQ.

Test Location: TP 104
Sample Depth: 1.00m
Sample Description:

Hydrometer No.:
SG Gs:
Water Visc. (N):
Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 ; 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	100.00		
14mm	100.00		
10mm	100.00		
6.3mm	100.00		
5mm	100.00		
3.5mm	100.00		
2mm	99.90		
1.18mm	99.70		
600µm	99.60		
425µm	99.60		
300µm	99.50		
212µm	99.50		
150µm	99.20		
63µm	40.10		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE DISTRIBUTION

Project Reference
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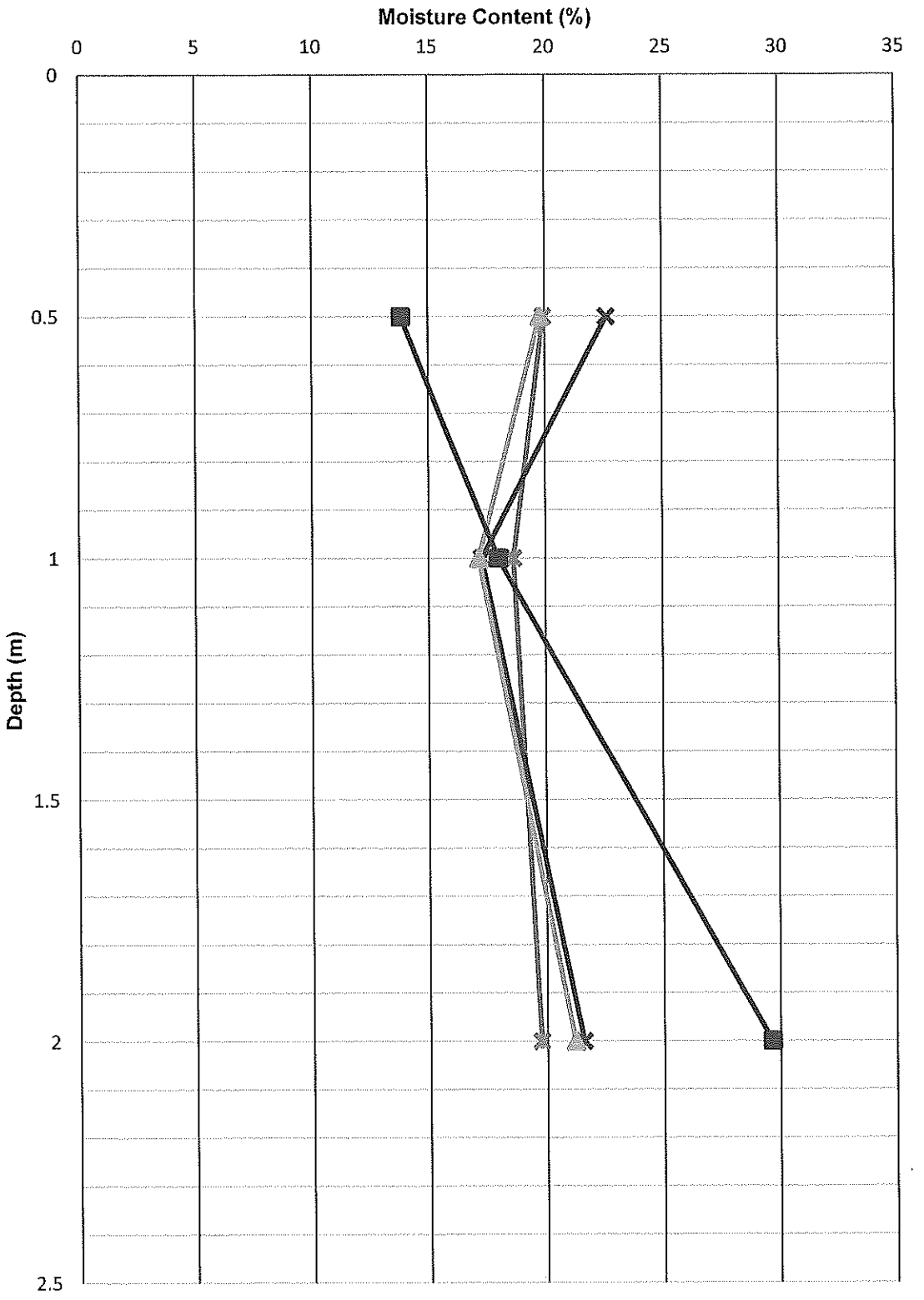
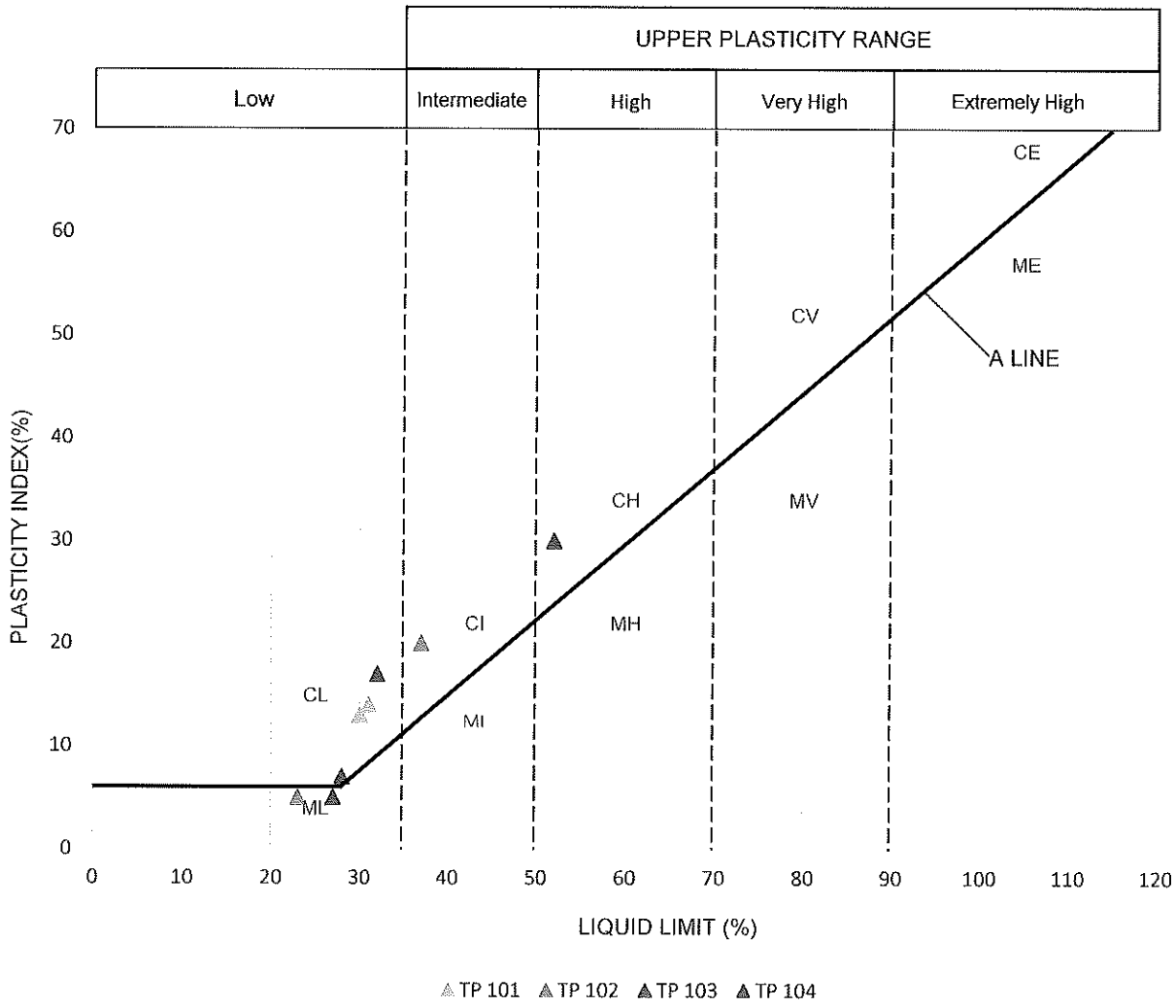


MOISTURE CONTENT v DEPTH

Report:
16.02.026a



PLASTICITY CHART

Report:
16.02.026a