CONSULTING STRUCTURAL ENGINEERS

DOA Consulting Structural Engineers
Ground Floor Offices
St. Stephens House
Dogflud Way
Farnham, Surrey GU9 7UD

Telephone: 01252 734898
Email: doa@doasteng.co.uk
www.doasteng.co.uk

Clayhill Lodge
Land off Court Lane
Epsom
KT19 8JF

Proposed Development of Five Houses

Flood Risk Assessment

and

Surface Water Drainage Strategy Report

February 2021

3734

Registered Office: Wey Court West, Union Road, Farnham, Surrey GU9 7PT Company Number 4971114

Contents:

Appendices

Version	Date	Circulation	Description of Amendments
1.0	15 February 2021	Planning	

Report Prepared by:

M J Harvey BSc. (Hons), C.Eng., M.I.C.E.

1. Introduction

1.1. DOA Consulting Structural Engineers have been retained by Mr and Mrs Arnold to undertake a site-specific Flood Risk Assessment (FRA) and drainage strategy in support of a planning application for a proposed development on land to the rear of Clayhill Lodge, West Hill, Epsom KT19 8JP with access off Court Lane Epsom.

1.2. This FRA is in accordance with the National Planning Policy Framework - 2012 (NPPF) and with the National Planning Practice Guidance - 2014.

1.3. From the National Planning Practice Guidance – 2014, Flood Zones and Flood Risk Tables, Table 2: Flood Risk Vulnerability Classification - educational establishments have a flood risk vulnerability classification of 'more vulnerable'.

1.4. This assessment has been undertaken by M J Harvey BSc. (Hons), C.Eng., M.I.C.E.

2. Development Description

2.1. The proposed development comprises the erection of 5 terraced dwellings together with associated car parking. Two apartment buildings Court Lodge (Phase 1) and Birchdene (Phase 2) on the adjoining former site of Court Lodge received planning consent and have been constructed. Access to the proposed development will be via the Birchdene (Phase 2) access road. For the purposes of this report the proposed development forms Phase 3 of the development as the drainage infrastructure of the earlier phases will be shared.

2.2. The site off Court Lane may be located by Ordnance Survey grid reference E520196m, N160988m. The following Figure 1 show the location of the site, Phase 3, edged in red with the Phase 1 and 2 area edged in blue and green respectively.

Figure 1 - Site Location

Figure 2 shows an aerial view with the phases 1 and 2 edged blue and green and the proposed phase 3 edged in red:

Figure 2 – Site Location Aerial View

3. Flood Risk Assessment

3.1. This flood risk assessment has considered the six possible sources of flooding: Tidal (Seas); Fluvial (Rivers); Surface Water; Groundwater; Sewers and Infrastructure Failure as follows:

3.1.1. **Tidal**

Tidal flooding occurs by the sea or estuary and can be due to breach or over topping of flood defences, wave action and fluvial flows due to tide locking.

The site is outside the influence of tidal flooding so there is a 'low probability' of flooding from this risk.

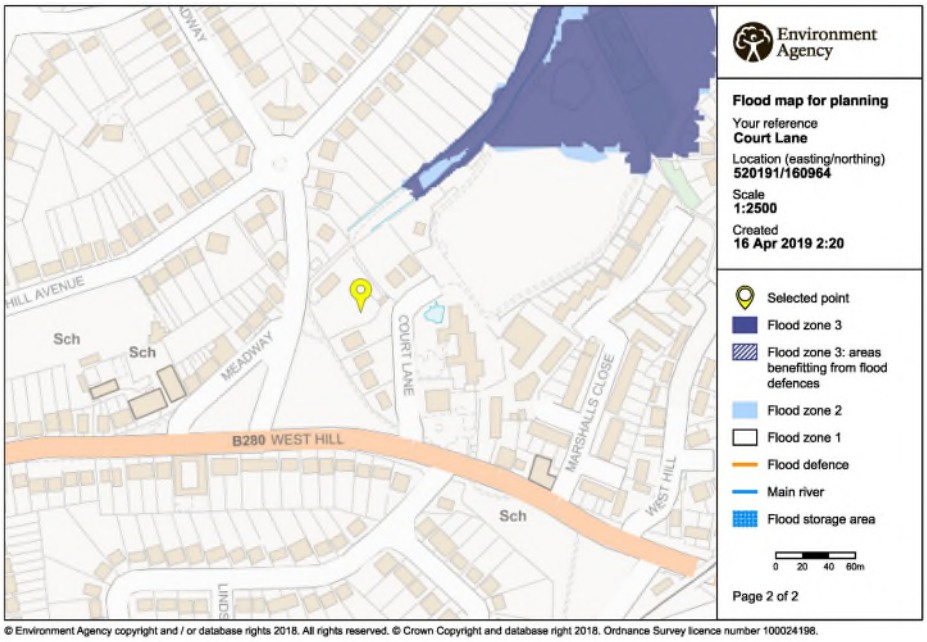
3.1.2. **Fluvial**

Fluvial flooding is due to out-of-bank flow, overtopping or breach of river defenses and blockages to culverts, flood channel or flood corridors.

All of the site is in Flood Zone 1 and therefore has a 'low probability' of flooding of less than at 0.1% (1 in 1000) in any year.

The following Figure 3 shows the Environment Agency flood map for planning with the site within the yellow marker.

Figure 3 – Fluvial Flood Map



Flood zones 2 and 3 are indicated to the north east of the site.

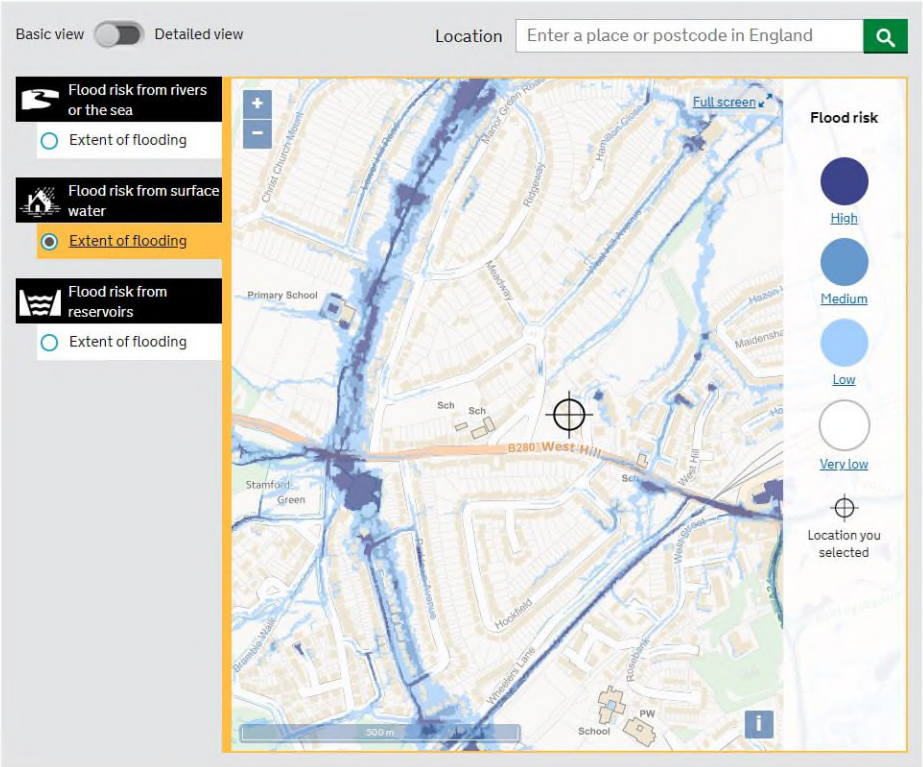
3.1.3. Surface Water

Sheet run-off from adjacent land (urban and rural) can result in local surface water flooding.

The British Geological Survey 'Geology of Britain' web viewer indicates that the site is underlain by bedrock deposits of London Clay.

Impermeable clay soils can cause sheet run-off (flash floods) to occur, However, the following Figure 4 of the Environment Agency surface water flooding map has the location of the site identified with a circular marker and it is shown to be at very low risk.

Figure 4 – Surface Water Flooding Map



3.1.4. Groundwater

The level of groundwater rises during wet winter months and falls again in the summer as water flows out into rivers. In very wet winters, rising water levels may emerge to the surface and lead to flooding of normally dry land. This is most likely to occur in low-lying areas underlain by permeable rock (aquifers).

The site is not located over an aquifer or located in a low-lying area therefore, the risk of flooding from groundwater is low.

3.1.5. Sewers

Combined, foul or surface water sewers can surcharge due to insufficient capacity causing flooding of the surface depending upon the ground topography. Surface water sewers are now required to be designed not to flood for 1 in 30-year storm events, but the older sewer networks may not have this level of capacity. Foul sewers can flood in periods of intense rainfall due to connection of surface water to the system.

There is no knowledge of flooding at the site caused by any public or private sewers and therefore flooding by sewers has a low probability of occurrence.

3.1.6. **Infrastructure Failure**

Flooding due to infrastructure failure could be due to reservoirs, canals, industrial processes, burst water mains, blocked sewers or failed pumping stations.

No infrastructure has been identified that would cause flooding at the site due to failure.

3.2. The location of the site is within Flood Zone 1 and has also a 'low probability' of flooding from all other sources of flooding.

4. Sustainable Surface Water Drainage Strategy

4.1. As the proposed development is located on the site of an existing garden the new development can be considered as a greenfield development.

4.2. Thames Water sewer records are presented in Appendix A.

4.3. As the site is underlain by London Clay the use of structures such as soakaways and permeable paving infiltrating water directly to the ground is not viable.

4.4. An existing ditch is indicated to the north east of the site but is not within the ownership of the Phase 1, 2 or 3 sites to allow a discharge to this to be made.

4.5. The site area of Phases 1 and 2 was 0.324 hectares and for Phase 3 0.063 hectares giving a total site area for Phases 1-3 of 0.387 hectares.

4.6. Surface water run-off from the Phase 1 development is discharged into the system for the Phase 2 development which is then discharged at a reduced rate to a public surface water sewer located in Court Lane controlled by a vortex flow control. The attenuated surface water flow is retained on the Phase 2 site stored in an underground geo-cellular tank.

4.7. The impermeable area of Phases 1 and 2 was 0.218 hectares and for Phase 3 0.055 hectares giving a total impermeable area of 0.273 hectares. An additional allowance of 10% has now been added to the impermeable areas in the calculations to allow for urban creep.

4.8. Surface water run-off from the proposed Phase 3 development is to be discharged into the drainage system constructed for the Phase 1 and 2 development and the calculations in this report include for these sites although not part of this planning application as already approved. Four additional underground attenuation tanks are to be provided on the Phase 3 site to provide additional storage for the Phase 3 development and the urban creep allowance and these additional tanks will work in tandem with the existing attenuation tank.

4.9. The approved discharge to the public surface water sewer for Phases 1 and 2 was limited to a maximum rate of 4.4 l/s based upon the greenfield rate from the site area of 0.324 hectares as summarised in the table below:

Greenfield 0.324 Ha SAAR 687mm – Soil 0.45	
Return Period	Run-off
1-year	1.2 l/s
QBAR	1.4 l/s
30-year	3.2 l/s
100-year	4.4 l/s
100-year 6-hour duration volume	91.934 m^3

4.10. Although the site area has increased due to the addition of Phase 3 it is proposed that the maximum discharge off the site is still limited to 4.4 l/s.

4.11. The run-off values from the proposed development have been calculated using Causeway 'Flow' and the results are presented in Appendix B but are summarised below:

Proposed Development 0.273 Ha + 10%	
Return Period	Run-off To Public Sewer
1-year	4.3 l/s
2-year (QBAR)	4.4 l/s
30-year	4.4 l/s
100-year	4.4 l/s
100-year + 40% CC	4.4 l/s
100-year 6-hour duration volume + 40% CC	138.4 m^3

4.12. The completed Surrey County Council 'Surface Water Drainage Summary Pro-forma (2017)' is included in Appendix C.

4.13. The drainage system will be retained and maintained by a private management company. Maintenance requirements of the drainage scheme are provided in a schedule included in Appendix D.

4.14. The site slope down towards the Court Recreation Ground and any exceedance flooding event caused by an extreme rainfall, lack of maintenance, blockage or other cause of failure will flow towards this area and be dissipated. Exceedance flow paths are indicated on the Drainage Strategy Plan presented in Appendix E.

4.15. Drawings showing the proposed drainage strategy are presented in Appendix E.

4.16. During construction it is anticipated that the following will be employed to protect and maintain the SuDS system:

- Use of existing surface water drainage where possible until new systems available.
- Temporary soakaways.
- Control of erosion.
- Retain any silts on site by ensuring any discharges from pumping or other means of water control are filtered or settled before discharge.
- Control run off rates to existing.
- Prevent accidental spillages.
- Remove any pollutants in surface water from the development.

4.17. The design and adoption of measures to control the construction drainage will consider current industry good practice and guidance including:

- Environment Agency Pollution Prevention Guidance Notes.
- CIRIA reports C502 and C532 regarding Environmental Good Practice and Control of pollution from construction sites.
- CIRIA Handbook C650 Environmental Good Practice on Site.

5. Summary and Conclusions

5.1. DOA Consulting Structural Engineers has been retained by Mr and Mrs Arnold to undertake a flood risk assessment in support of a planning application for a proposed development located at Clayhill Lodge, Epsom.

5.2. Based upon the assessment in this FRA, EA data and topographical survey, the site lies entirely with Flood Zone 1.

5.3. Based upon the assessment in this FRA the site is not at flood risk from surface water, groundwater, sewer or infrastructure failure flooding.

5.4. As the site is underlain with London Clay the use of structures such as soakaways and permeable paving infiltrating water directly to the ground is not viable.

5.5. Surface water from the Phase 1 and Phase 2 parts of the development discharges to a Thames Water surface water sewer in Court Lane but restricted to a maximum rate of 4.4 l/s with attenuated surface water stored in an underground geo-cellular tank.

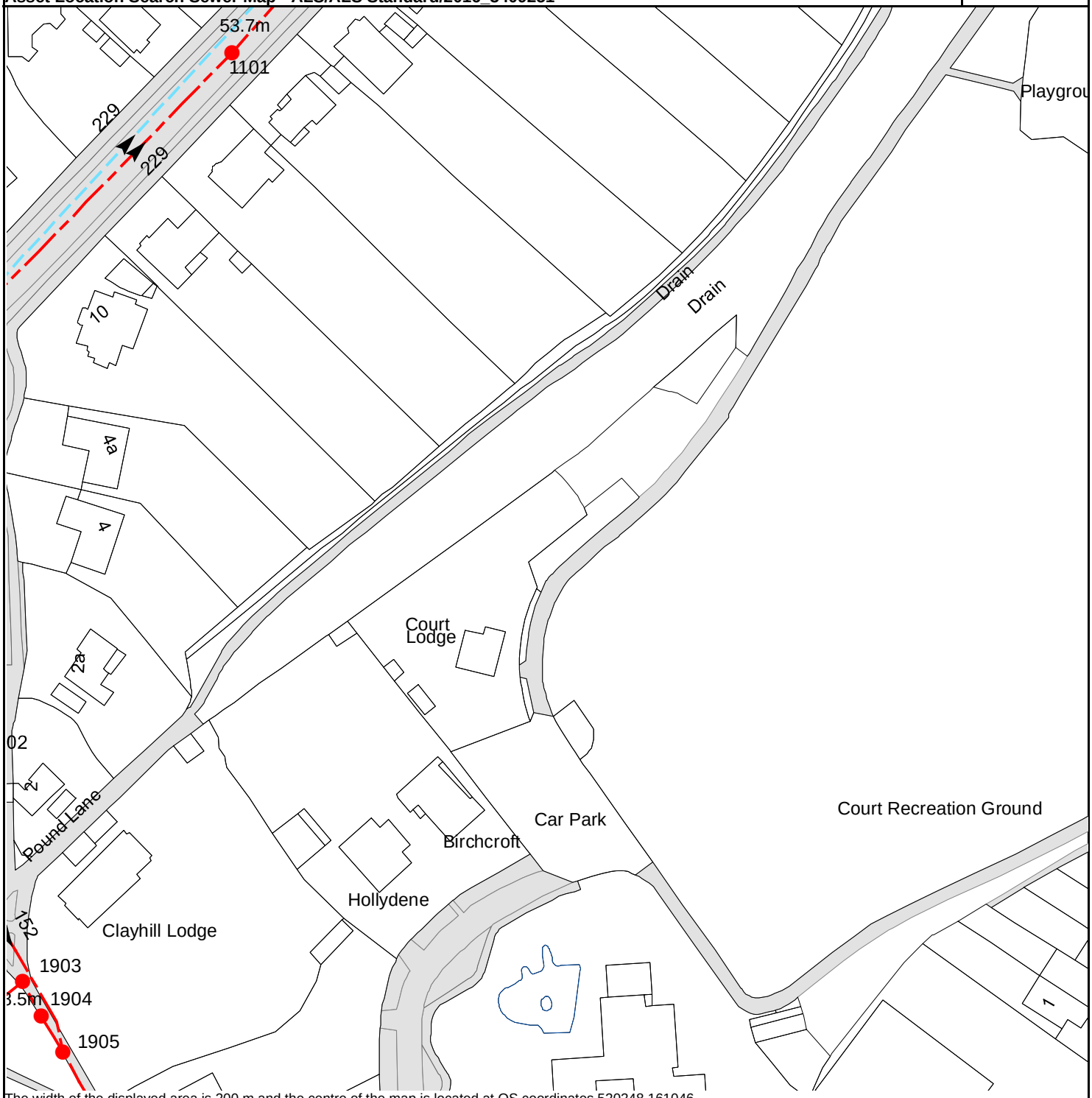
5.6. For this Phase 3 development four additional below ground geo-cellular attenuation tanks are to be provided to supplement the existing surface water storage on the site to allow for the additional urban creep allowance.

5.7. The drainage system will be retained and maintained by a private management company.

Appendix A

Thames Water Sewer Records

Asset Location Search Sewer Map - ALS/ALS Standard/2016_3409251



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 520248,161046

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

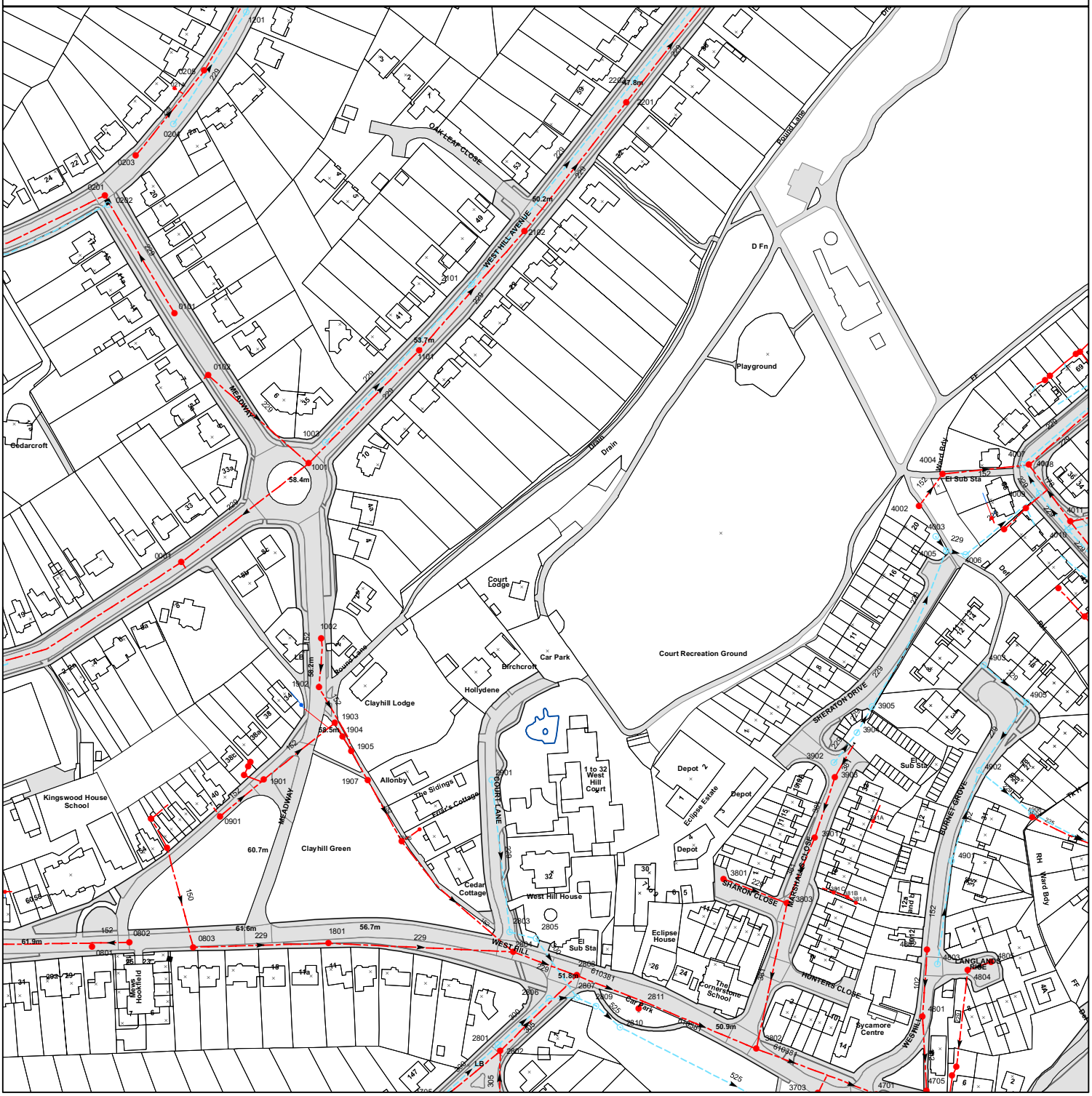
NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
1101	54.26	51.86
1905	57.22	55.14
1904	57.53	55.7
1903	57.88	56.12

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2016_3409251



The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1790
Width:	500m
Printed By:	Vkumar1
Print Date:	13/09/2016
Map Centre:	520248,161046
Grid Reference:	TQ2061SW

Comments:

ALS/ALS Standard/2016_3409251

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
41MM		
4011	45.72	43.99
2201	48.11	45.35
3902	48.41	47.69
3904	48.08	47.19
4002	46.81	45.72
4004	46.25	45.37
4006	47.08	45.91
4903	47.12	46.25
40MG		
40MF		
4008	45.69	
41ND		
40LM		
1101	54.26	51.86
2101	52.26	50.81
0202	57.23	55.3
0203	56.98	54.76
021A		
1201	56.06	54.76
2901	53.44	50.33
19YZ		
19ZQ		
1904	57.53	55.7
191A		
1002	58.13	56.65
1001	58.28	55.51
0102	58.96	56.56
4906	49.09	
4705	50.67	47.69
481A		
2810	51.75	47.91
2811	51.19	
2807	52.4	48.09
4803	49.15	48.57
3803	49.62	47.16
381B		
3801	49.7	47.5
3901	49.02	47.24
2802	54.49	50.09
2806	52.78	51.21
2804	52.83	50.53
0801	62.44	59.94
0802	62.49	59.94
2803	52.9	49.79
0908		
19YT		
0901	61	59.97

REFERENCE	COVER LEVEL	INVERT LEVEL
41NM		
40LL		
2202	47.79	46.42
3903	48.53	
3905	47.67	46.41
4003	46.9	46.02
4005	46.79	45.93
4902	47.23	45.82
401A		
4007	45.66	43.91
4905	46.93	46.15
4009	45.78	44.12
41NL		
4010	45.72	44.32
0101	58.94	57.34
2102	50.84	48.22
0201	57.22	54.74
0204	56.81	55.48
0205	56.49	54.04
1907		
1901	59.88	58.62
19ZP		
1905	57.22	55.14
1903	57.88	56.12
1902	58.27	55.31
0001	60.18	58.25
1003	57.68	56.05
4805	48.06	47.17
4904	47.08	45.04
481B		
3802	50.8	46.94
4801	49.72	48.19
2809	51.89	48.04
4804	48.55	47.13
4802	49.16	48.5
381A		
381C		
4901	48.18	46.83
391A		
2801	54.49	52.94
2808	51.86	48.69
0803	62.8	61.3
1801	59.07	57.51
2805	52.36	49.2
981A		
1906	56.87	54.63
0907		

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plans are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole level indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Appendix B

Causeway 'Flow' Attenuation Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	x
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.273	52.400	1200	100.000	100.000	1.550

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	10	0
2	0	10	0
30	0	10	0
100	0	10	0
100	40	10	0

Node 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	50.750	Product Number	CTL-SHE-0100-4400-0950-4400
Design Depth (m)	0.950	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	4.4	Min Node Diameter (mm)	1200

Node 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	50.850
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	139.5	0.0	0.800	139.5	0.0	0.801	0.0	0.0

Node 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	50.900
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	60.0	0.0	0.800	60.0	0.0	0.801	0.0	0.0

Results for 1 year +10% A Critical Storm Duration. Lowest mass balance: 98.56%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	1	51	50.962	0.112	22.0	19.0118	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
60 minute winter	1	Hydro-Brake®	4.3	32.3

Results for 2 year +10% A Critical Storm Duration. Lowest mass balance: 98.56%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	1	58	51.002	0.152	27.9	26.8643	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
60 minute winter	1	Hydro-Brake®	4.4	40.8

Results for 30 year +10% A Critical Storm Duration. Lowest mass balance: 98.56%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	1	118	51.200	0.350	32.5	65.3028	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
120 minute winter	1	Hydro-Brake®	4.4	90.3

Results for 100 year +10% A Critical Storm Duration. Lowest mass balance: 98.56%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	1	120	51.354	0.504	42.7	95.3434	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
120 minute winter	1	Hydro-Brake®	4.4	87.5

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 98.56%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	1	180	51.621	0.771	43.9	147.1447	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
180 minute winter	1	Hydro-Brake®	4.4	98.3

Appendix C

Surrey County Council 'Model Surface Water Drainage Pro-forma (2017)'

Surface Water Drainage Summary Pro-forma (2017)

Introduction (with links)

Surrey County Council recommends that this pro-forma should be completed in full and accompany the submitted drainage statement and sufficient additional evidence to confirm the information supplied. This information should be submitted with any planning application which seeks permission for 'major' development. This information contained in this form will be used by Surrey County Council in its role as Lead Local Flood Authority and 'statutory consultee' on SuDs for all 'major' planning applications. The pro-forma follows the national non-statutory technical SuDS standards (Defra 2015) is supported by the Defra/EA Guidance on Rainfall Runoff Management and can be completed using freely available tools including SuDS Tools. The pro-forma should be considered alongside other supporting SuDS Guidance (particularly the LASOO Guidance available online), but focuses on NPPF paragraphs 103 and 109: ensuring flood risk is not increased on or off-site and using SuDS as the primary drainage option. The SuDS solution must operate effectively for as long as the development exists and consideration of maintenance and management must be clearly demonstrated throughout its lifetime.

A summary of the evidential information to be provided at each stage of planning is provided in Appendix A

Pre-application advice (fees may apply) and existing flood risk information is available from Surrey County Council – SuDS@surreycc.gov.uk

1. Site Details

Site/development name	Clayhill Lodge
Address & post code	Land off Court Lane, Epsom, KT19 8JF
Grid reference	E520196m, N160988m
LPA reference	TBC
Type of application (e.g. full, outline etc)	Full
Is the existing site developed or greenfield?	Greenfield
Total site area	0.063 (0.387 with Phase 1 and 2 already developed)
Site area served by proposed drainage system (excluding open space) (Ha)*	0.055 (0.273 with Phase 1 and 2 already developed)
REFERENCES of topographical survey plan showing existing site layout, drainage system and site levels	3734-101-P1, 102-P1, Refer also to accompanying FRA and Surface Water Drainage Strategy Report 3734

***** The Greenfield runoff off rate from the development should either be calculated for the entire area or the part that forms the drainage network for the site; whatever the size of site and type of drainage technique. See section 3. Greenfield runoff rate is to be used to assess the requirements for limiting discharge flow rates and attenuation storage for the same area as chosen for greenfield rates. Please refer to the EA Rainfall Runoff Management document or CIRIA manual for further details.

2. Impermeable Area and Existing Drainage

	Existing (E)	Proposed (P)	Difference (P-E)	NOTES AND REQUIRED EVIDENCE
Impermeable area (Ha) (plan of areas and values) A 10% addition for urban creep to be included within proposed area	0.000	0.055 + (0.218 Ph 1 & 2) + 10%	0.055	If the proposed amount of impermeable surface is greater than existing, then runoff rates and volumes will increase and will need to be attenuated. The national standards require that runoff for previously developed sites should be as close to greenfield rates/volumes as possible. **Evidence: Plan showing impermeable areas, total area calculations +10% urban creep**
Existing Drainage Method (infiltration/watercourse/sewer)	Sewer			**Evidence: Existing drainage plan showing location of drainage elements**

3. Proposed Surface Water Discharge Method according to SuDS Hierarchy (see Appendix B)

SUDS HIERARCHY (see Appendix B)	Proposed (tick all that apply)	Reference of evidence that this is possible or not practicable	NOTES AND REQUIRED EVIDENCE Evidence must be provided to demonstrate that the proposed Sustainable Drainage proposal has had regard to the SuDS hierarchy
Reduced at source	X		**Evidence: Details of amount of runoff reduced and storage provided**
Infiltration to ground		London Clay	**Evidence: The results of infiltration tests in soakaway locations. If infiltration is deemed not viable clear site specific evidence must be provided** see Section 6 (infiltration)
Attenuated volume and discharge to watercourse			**Evidence: Details of any watercourse to which the site drains including cross-sections of any adjacent water courses for appropriate distance upstream and downstream of the discharge point (as agreed with the LLFA and/or EA)** see Section 7 (attenuated discharge)
Attenuated volume and discharge to surface water sewer	X		**Evidence: Confirmation from sewer provider of agreed discharge rate and that sufficient capacity exists for this connection** see Section 7 (attenuated discharge)
Attenuated volume and discharge to combined/foul water sewer			**Evidence: Confirmation from sewer provider of agreed discharge rate and that sufficient capacity exists for this connection** see Section 7 (attenuated discharge)
	Drawings provided		**NOTES AND REQUIRED EVIDENCE**
Drawings and Details (e.g. Existing and proposed drainage, Topography, Impermeable areas, cross sections of SuDS elements)	3734-101-P1, 102-P1		**Evidence:** Please provide plan reference numbers showing the details of the site layout showing where the sustainable drainage infrastructure will be located on the site. If the development is to be constructed in phases this should be shown on a separate plan and confirmation should be provided that the sustainable drainage proposal for each phase can be constructed and can operate independently and is not reliant on any later phase of development.

4. Calculate Peak Discharge Rates – Technical Standards S2 and S3

This is the maximum flow rate at which surface water runoff leaves the site during the critical storm event.

	Greenfield Rates (l/s)	**Brownfield rates (l/s)** (as appropriate)	**Proposed Rates (l/s)**	**Difference (**Proposed-Existing**) (l/s)**	**NOTES AND REQUIRED EVIDENCE**
Qbar	1.4	0	4.4	3.0	Mean annual Greenfield peak flow - QBAR is approx. 1 in 2 storm events. **Qbar**$_{rural}$ should be used for this value. If the site is currently developed, the appropriate figures should be used to calculate Qbar (and associated rates) in proportion to the amount of existing hardstanding present on the site. Use Qbar$_{rural}$ and Qbar$_{urban}$ as appropriate and prorata'd to effectively model the site.
1 in 1	1.2	0	4.3	3.1	Proposed discharge rates (with mitigation) should be as close to greenfield as possible and should be no greater than existing rates for all corresponding storm events. To mitigate for climate change the proposed 1 in 100 +CC must be no greater than the existing 1 in 100 runoff rate. If not, flood risk increases under climate change. See appendix 2 for climate change allowances. **Evidence: Micro-drainage (or equivalent) calculations of existing and proposed run-off rates and volumes in accordance with a recognised methodology**
1 in 30	3.2	0	4.4	1.2	
1in 100	4.4	0	4.4	0.0	
1 in 100 plus 20% climate change *	N/A	N/A	4.4		

5. Calculate discharge volumes - Technical Standards S4 to S8

The total volume of water leaving the development site for a particular rainfall event. Introducing new impermeable surfaces increases surface water runoff and may increase flood risk outside the development.

	Greenfield Volume (m^3)	**Brownfield Volume (m^3)** (as appropriate)	**Proposed Volume (m^3)**	**Difference (m^3) (Proposed-Existing)**	**NOTES AND REQUIRED EVIDENCE**
1 in 1					Proposed discharge volumes (without mitigation) should be no greater than existing volumes for all corresponding storm events. Any increase in volume increases flood risk elsewhere. Where volumes are increased attenuation must be provided to reduce volume outflow during the event. To mitigate for climate change the volume discharge from site must be no greater than the existing 1 in 100 storm event. **Evidence: Micro-drainage (or equivalent) calculations of existing and proposed run-off rates and volumes in accordance with a recognised methodology**
1 in 30					
1in 100	91.9	0	138.4	46.5	
1 in 100 plus 20% climate change *	N/A	N/A			

* Climate Change Allowance for Rainfall Intensity Increases

Designs should include 20% provision for increases in surface water runoff due to climate change during the development's lifetime – please see Appendix C

6. Infiltration

If infiltration is proposed – sufficient evidence must be provided to show that this is viable and does not increase flood risk

	SITE INFORMATION	Details	NOTES AND REQUIRED EVIDENCE
Is infiltration feasible?	**Yes/No?**	No – Site Investigation	**Evidence: If deemed NOT FEASIBLE clear site specific evidence (site investigation, site photos, infiltration testing) must be provided to demonstrate why**
Infiltration information	**Site Geology** (bedrock and superficial)	London Clay	Avoid infiltrating in made ground. **Evidence: suitable mapping/SI**
	Is ground water table less than 3m below ground?		If yes, please provide details of the site's hydrology. **Evidence : Site Investigation**
	Is the site within a known Source Protection Zones (SPZ) or above a Major Aquifer?		Refer to Environment Agency website to identify and source protection zones (SPZ). **Evidence: Adequate water treatment stages must be provided**
	Infiltration rate used in calculations		Infiltration rates should be no lower than $1x10^{-6}$ m/s. **Evidence: infiltration testing according to BRE 365 or equivalent**
	Were infiltration rates obtained by desk study or on site infiltration testing?		**Evidence: Infiltration rates solely estimated from desk studies are only suitable at outline planning applications unless clear site specific evidence can be provided and a back-up attenuation scheme is provided**
	Is the site contaminated? If yes, consider advice from EA on whether infiltration is acceptable.		Water should not be infiltrated through land that is contaminated. The Environment Agency may provide bespoke advice in planning consultations for contaminated sites that should be considered
Design details	**Infiltration type** (soakaway, deep bore, blanket etc)		**Evidence: Suitable designs must be provided**
	Storage volume provided within infiltration feature (m^3)		Infiltration must be designed to ensure that at a minimum no flooding occurs onsite in a 1 in 30 year event except in designed areas and no flooding occurs offsite in a 1 in 100 year (+CC allowance) event **Evidence:. Calculations showing available volume of proposed infiltration device and storage. Plan and Cross sectional drawings of proposed infiltration.**
	State the vertical distance between any proposed infiltration device base and the normal ground water (GW) level		1m (min) is required between the base of the infiltration device & the water table to protect groundwater quality & ensure groundwater doesn't enter infiltration devices.
	Half drain times of infiltration features (hr)		**Evidence: Suitable calculations**
	Factor of safety used in infiltration calculations		**Evidence: Suitable calculations**
	Minimum distance of infiltration from buildings		**Evidence: Minimum distance should be >5m unless designed specifically to reduce impact on adjacent buildings.**

7. Attenuated storage

In order to minimise the negative impact on flood risk resulting from any increase in runoff rate or volume from the proposed development, attenuation storage must be provided. Installed flow restriction and stored the attenuation volumes should ensure final discharge from the site at the rates and volumes set out in sections 4 and 5. If some of the stored volume of water can be infiltrated back into the ground, the remainder can be discharged at a rate at or below greenfield rates. A combined storage calculation using the partial infiltration rate and the attenuation rate used to slow the runoff from site.

ATTENUATION DETAILS	Details	NOTES AND REQUIRED EVIDENCE
How are flow rates being restricted?	Vortex Flow Control	Hydrobrakes can be used where rates are >2l/s. Orifice plates with an opening <75mm in open systems may require pre-screening.
Storage volume provided (m^3) (excluding non-void spaces)	151.62	Volume provided to attenuate on site to discharging at existing rates. See section 5. **Evidence: Attenuation must be designed to ensure that at no flooding occurs onsite in a 1 in 30 year event except in designed areas and no flooding occurs offsite in a 1 in 100 year (+CC allowance) event. A 10% additional allowance should be included for underground attenuation systems which cannot be fully accessed/cleansed as well as the provision of u/s siltation protection and access/jetting points. Calculations showing available volume of proposed attenuation storage. Plan and Cross sectional drawings of proposed storage**
How will the storage be provided on site?	Porous sub-base to permeable roads and parking areas plus 5 underground attenuation tanks	
Half drain times of attenuation feature (hr)		**Evidence: suitable calculations to show feature**

8. Construction and Exceedance Planning - Technical Standards S9 and S14

CONSIDERATION	Details	NOTES AND REQUIRED EVIDENCE
How will exceedance/infrastructure failure events be catered on site without significantly increasing flood risks (both on site and outside the development)? Technical Standard S9	Drawing 3734-101-P1 indicates flood routing paths to the Court Recreation Ground.	**Evidence: Topographic plan showing flow routes for events above those designed – routing of water away from existing properties and critical infrastructure**. Retained water should not cause property flooding or posing a hazard to site users i.e. no deeper than 300mm on roads/footpaths and not preventing safe access/egress
Drainage during construction period: temporary drainage, pollution prevention and protection of existing/part built drainage systems. Technical Standard S14	Contractor will not be appointed until planning consent is granted so the construction phasing plan, CEMP are not available at this time. No diversions are required and no discharges to any watercourses.	Provide details of how drainage will be managed during the construction period including any necessary connections, impacts, diversions and erosion control. How pollution prevention for any local watercourses will be considered – especially siltation from runoff **Evidence: Construction phasing plan, construction environmental management plan (CEMP) or other statements**

9. Management and Maintenance of SuDs - Technical Standards S10 to S12

Details are required to be provided of the management and maintenance plan for the SuDS, including for the individual plots, in perpetuity.

How is the entire drainage system to be maintained in perpetuity?	By Management Company Maintenance schedule presented in Appendix D of report.	Clear details of the maintenance proposals of all elements of the proposed drainage system must be provided to show that all parts of SuDs are effective and robust. It should consider how the SuDs will perform and develop over time anticipating any additional maintenance tasks to ensure the system continues to perform as designed. Responsibility for the management and maintenance of each element of the SUDS scheme will also need to be detailed within the Management Plan. Where open water is involved please provide a health and safety plan within the management plan. **Evidence: A maintenance schedule describes what work is to be done and when it is to be done using frequency and performance requirements as appropriate.**
Please confirm the owners/adopters of the entire drainage system throughout the development. Please list all the owners.	Developer until properties are sold	If these are multiple owners then a drawing illustrating exactly what features will be within each owner's remit should be submitted **Evidence: statement of ownership or plan on complex sites**
Please demonstrate that any third party agreements required for adoption or using land outside the application site have been secured.	None	**Evidence: proof of agreements (at least in principle at planning approval stage) with adopters or external landowners**

10. Additional Considerations to comply with the Technical Standards and other legislation

Water Quality – Appropriate level and stages of water treatment must be used to prevent pollution of the environment (SuDS manual CIRIA C753)

S10 Components must be designed to ensure structural integrity of the drainage system and any adjacent structures or infrastructure under anticipated loading conditions over the design life of the development taking into account the requirement for reasonable levels of maintenance.

S11 The materials, including products, components, fittings or naturally occurring materials, which are specified by the designer must be of a suitable nature and quality for their intended use. (e.g. BS or kitemarked)

S12 Pumping should only be used to facilitate drainage for those parts of the site where it is not reasonably practicable to drain water by gravity.

S13 The mode of construction of any communication with an existing sewer or drainage system must be such that the making of the communication would not be prejudicial to the structural integrity and functionality of the sewerage or drainage system.

The above form should be completed using evidence from information which should be appended to this form/within the planning submission. The information being submitted should be proportionate to the site conditions, flood risks and magnitude of development. It should serve as a summary of the drainage proposals and should clearly show that the proposed discharge rate and volume as a result of development will not be increasing. Where there is an increase in discharge rate or volume due to development, then the relevant section of this form must be completed with clear evidence demonstrating how the greenfield rates (or as close to them as possible if a brownfield site) will be met.

This form is completed using factual information and can be used as a summary of the surface water drainage strategy on this site.

Form completed by: M J Harvey

Contact details: Tel: 01420 561209 Email: martin.harvey@doasteng.co.uk

Qualification of person responsible for signing off this pro-forma: C.Eng., B.Sc (Hons) in Civil Engineering, MICE

Company: DOA Consulting Structural Engineers

On behalf of (Client's details): Mr & Mrs Arnold

Date: 15 February 2021

Appendix A

Evidence to be submitted at each stage of planning

Pre-app	Outline	Full	Reserved	Discharge	Document submitted
✓	✓	✓			Flood Risk Assessment/Statement
✓	✓	✓			Drainage Strategy/Statement & sketch layout plan
	✓				Preliminary layout drawings
	✓				Preliminary "Outline" hydraulic calculations
	✓				Preliminary landscape proposals
	✓				Ground investigation report (for infiltration)
	✓	✓			Evidence of third party agreement for discharge to their system (in principle/ consent to discharge)
		✓		✓	Maintenance program and on-going maintenance responsibilities
		✓	✓		Detailed development layout
		✓	✓	✓	Detailed flood & drainage design drawings
		✓	✓	✓	Full Structural, hydraulic & ground investigations
		✓	✓	✓	Geotechnical factual and interpretive reports, including infiltration results
		✓	✓	✓	Detailed landscaping details
		✓	✓	✓	Discharge agreements (temporary and permanent)
		✓	✓	✓	Development Management & Construction Phasing Plan

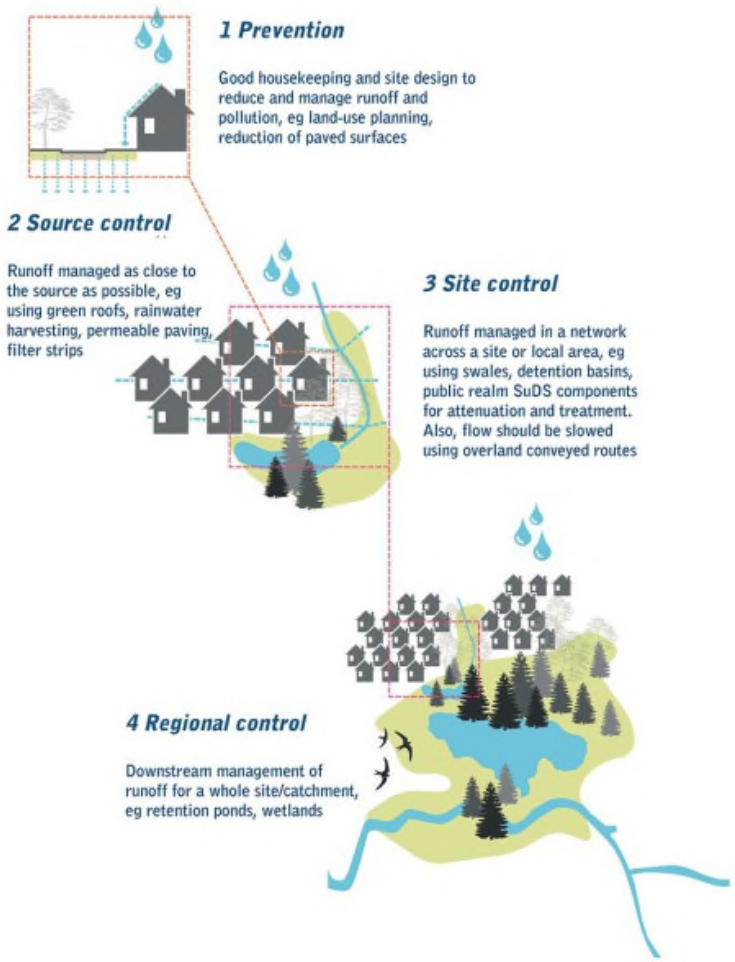
This chart details the minimum evidence required to be submitted regarding surface water drainage provision at each stage of planning:

At Outline Planning stage enough evidence must be provided to prove that a viable method of draining the site has been provided which does not increase local flood risk

At Full Application, Discharge of Conditions or Reserved Matters stage suitable evidence must be provided to show that all the requirements of the national standards have been met

Appendix B

SuDS Treatment Train



Dickie, S, McKay, G, Ions, L, Shaffer, P (2010) Planning for SuDS – making it happen, C687, CIRIA, London (ISBN: 978-0-86017-687-9).

Discharge Hierarchy

Sustainability Hierarchy

DISCHARGE CHOICE		SUSTAINABILITY CHOICE				
Discharge Hierarchy	**SuDS Type**	**Sustainability Level**	**SuDS Technique**	Flood Reduction	Pollution Reduction	Wildlife & Landscape Benefit
MUST BE CONSIDERED FIRST	**Source Control**	MOST SUSTAINABLE (PREFERRED)	**Green/Living Roofs & Walls**	✓	✓	✓
	OPTION 1 Infiltration To Ground		**Infiltration:** • Infiltration trenches & basins • Soakaways: (standard or crate system)	✓	✓	✓
	OPTION 2 Attenuation and Discharge: **To Pond, Ordinary Watercourse or Main River**		**Filter strips and Swales**	✓	✓	✓
			Basins and ponds: • Wetlands • Balancing Ponds • Detention Basins • Retention Basins • Conveyance swales	✓	✓	✓
	OPTION 3 Attenuation and Discharge **a) To Surface Water Sewer** **b) To Combined Sewer**		**Permeable Surfaces & filter drains:** • Gravelled areas • Porous paving	✓	✓	
ONLY IF ALL OTHER OPTIONS ARE UNVIABLE	**OPTION 4 Attenuation and Discharge** **To Foul or Highways sewer (only in exceptional circumstances)**	LEAST SUSTAINABLE	**Tanks & Piped Systems:** • Crated Attenuation • Tanks • Oversize pipes	✓		

Appendix C

Climate change allowances

In February 2016 there was a change to the EA climate change advice to modify the allowance levels for rainfall when designing surface water drainage: to 20% CC allowance for 1 in 100 year events but with a 40% sensitivity test. (please note the advice for river flow levels also changed – please contact the Environment Agency for more details)

Applicants should design the discharge rates and attenuation on site to accommodate the 1:100 year +20% CC event and understand the flooding implications for the +40% CC event.

If the implications are significant i.e. the site contains "highly vulnerable" or "critical infrastructure" receptors, could flood another development or put people at risk then a view should be taken to provide more attenuation to meet the 40% CC event. This will tie into designing for exceedance principles.

An example: Attenuation basin designed to accommodate the 1:100 year + 20% climate change event, during the modelling of the 40% cc event the water level of the basin rises by 340mm, which equates to 40mm over the 300mm already freeboard provided. Therefore a suitable mitigation would be to provide freeboard of 350mm instead of 300mm, in order to ensure the development doesn't flood third parties downstream for the extreme 40% cc scenario.

Extract taken from Environment Agency publication; *Adapting to Climate Change: Advice for Flood and Coastal Risk Management Authorities:*

What are the climate change allowances?

To assess the potential impacts that climate change may have on extreme rainfall, river flood flows, sea level rise and storm surges, climate change allowances are provided in Annex 1. The climate change allowances quantify the potential change (as either mm or percentage increase, depending on the variable) to the baseline. The climate change allowances are based on the best available, credible, peer-reviewed scientific evidence from UKCP09, but given the complexity of the science around climatic projections, there are significant uncertainties attributed to the climate change allowances. This is why the climate change allowances are presented as a range of possibilities (Lower, Central, Higher Central and Upper), to reflect the potential variation in climate change impacts over three epochs from the present day to 2115. It is recommended that the performance of flood risk management options are assessed against all of the change allowances covering the whole of the decision lifetime.

Change to extreme rainfall intensity compared to a 1961-90 baseline Applies across all of England			
Climate Change scenario	**Total potential change anticipated for '2020s' (2015-39)**	**Total potential change anticipated for '2050s' (2040-2069)**	**Total potential change anticipated for '2080s' (2070-2115)**
Upper estimate	10%	20%	40%
Central estimate	5%	10%	20%

Appendix D

Management and Maintenance Schedule

Sustainable Drainage Scheme
Management and Maintenance Schedule
Timetable for implementation

The planning consent requires that surface water shall be disposed of by means of sustainable urban drainage systems (SuDS).

All SuDS will be installed prior to the occupation of the first house.

The SuDS on the site have been designed to cater for a 1 in 100-year storm event with a 40% allowance for climate change.

All SuDS features will be maintained by a private management company.

Below Ground pipework

Maintenance Activity: Lift Inspection chamber covers and check for signs of blockages and silt / debris build up.

Remedial Action: Jet clean and remove debris as required to ensure correct operation of the system.

Frequency: Typically, annually or as required.

All maintenance operations are to be carried out in accordance with the manufacturer's recommendations.

System inlets

Maintenance Activity: Check gullies, drainage channels, etc. for build-up of silt or other detrimental materials.

Remedial Action: Ensure all items are clear and operating correctly.

Frequency: Typically, every 6 months or as required.

All maintenance operations are to be carried out in accordance with the manufacturer's recommendations.

Pre-treatment structures (silt traps)

Maintenance Activity: Inspect for build-up of sediment.

Remedial Action: Remove debris as required to ensure correct operation of system.

Frequency: 3-4 times during the first year, then annually or as required thereafter.

All maintenance operations are to be carried out in accordance with the manufacturer's recommendations.

Underground Surface Water Attenuation Tank and Flow Control

Maintenance Activity: Inspect upstream drainage channel, gullies and silt traps to check for correct operation of the inlet pipework.

Inspect the vortex flow control manhole to ensure the flow control is not blocked and operating correctly.

Attenuation tank should not require regular maintenance providing all gullies, drainage channels and silt traps are kept clear of silt and debris so this cannot enter the tank

Remedial Action: Take remedial action as required to ensure correct operation of the system.

Frequency: 3-4 times during the first year, then annually or as required thereafter.

All maintenance operations are to be carried out in accordance with the manufacturer's recommendations

Block Paved Permeable Roads and Parking Areas

The roads and parking areas have been designed as tanked porous pavements to attenuate surface water and improve water quality before discharge to the main underground attenuation system.

The ongoing maintenance activities for the permeable block paving, is tabulated below:

Maintenance Activity	**Remedial Action**	**Inspection Frequency**
Check the surface and ensure it is free from debris, dirt and the like	Clean surfacing as required and remove detrimental materials	Typically, monthly or as required
Ensure the surface is clear of sediments	Sweep surface clean of silt and deleterious materials, top up joints with sealing grit as required	Typically, monthly or as required
Inspect joints and carry out weed control	Remove weeds and top up joints with sealing grit as required	Typically, 3-4 times per year or as required
Ensure paving dewaters after rain and between storms	Check joints for sedimentation, mechanically clean or jet wash and sweep surface free from silt, etc. Refill joints with sealing grit as required	Typically, annually or as required
Inspect blocks for spalling or deterioration and joints for loss of grit	Replace blocks and top up joints as required	Typically, annually or as required
Check pre-treatment structures (Catchpits) for sediment	Remove sediment from pre-treatment structures	Monthly in the first year and then annually

Appendix E

Surface Water Drainage Strategy Drawings

NOTES

1. All drainage shall be 100mm dia. except where otherwise shown as 150mm dia. or 225mm dia. and pipework shall be vitrified clayware to BS EN 295 or uPVC pipework to BS 4660.
2. Flexible joints to be provided both sides where drainage passes through foundations/walls.
3. Backfill to trenches under footpaths or areas with proposed vehicular access or within 1.0m of such areas shall be with Type 1 granular material.
4. Clay pipes (rigid) to be laid to Class S or Z bedding details and PVC–U pipe (flexible) to have Class T or Z bedding details as appropriate to depth, location and proximity to foundations as required by Building Regulations.
5. Where RWPs are connected direct to a drain, rodding access plates are to be provided.
6. Covers located in paving to have recessed covers to receive paving finish.

LEGEND - SW DRAINAGE

- SW DRAIN
- SIL96.80 — SW INVERT LEVEL
- SW MANHOLE
- SW INSPECTION CHAMBER
- SW ACCESS CHAMBER (MAX. 0.6m DEEP)
- ST — PCC SILT TRAP
- ST — PLASTIC SILT TRAP
- DC / TD — DRAINAGE CHANNEL / THRESHOLD DRAIN
- SW RODDING EYE
- G — SW GULLY
- CELLULAR ATTENUATION TANK
- EXIISTING SW DRAINAGE TO PREVIOUS PHASES
- FLOOD FLOW ROUTES

SW ATTENUATION TANK CONSTRUCTED FROM WAVIN AQUACELL CORE (DARK BLUE) CELLULAR UNITS OR EQUAL. IMPERMEABLE AREA OF 2180 m2 COMPRISING PHASES 1 & 2. ATTENUATION DESIGNED FOR 1 IN 100 YEAR STORM EVENT + 40% CLIMATE CHANGE. 9.0 x 15.50 x 0.8m (2 UNIT DEPTH) BASE 50.85 DEPTH APPROX. 1.70m

SW ATTENUATION TANKS CONSTRUCTED FROM GEO-CELLULAR UNITS. 4 NO. 3.0 x 5.0m x 0.8m DEEP TANKS IN CONJUNCTION WITH PHASE 1 / 2 ATTENUATION TANK TO STORE RUNOFF FROM TOTAL IMPERMEABLE AREA OF 2730 m2 + 10% FOR URBAN CREEP. ATTENUATION DESIGNED FOR 1 IN 100 YEAR STORM EVENT + 40% CLIMATE CHANGE. BASE OF ATTENUATION TANKS 50.90

EXISTING CONTROL MH WITH FLOW CONTROL LIMITING RUNOFF TO PUBLIC SW SEWER TO GREENFIELD RUNOFF, AS FAR AS PRACTICAL, MAX. 4.4 l/s @ 0.95m HEAD FOR 1 IN 100 YEAR CRITICAL EVENT + 40% FOR CLIMATE CHANGE.

SW DRAINAGE CONNECTED TO PUBLIC SW SEWER MH 2901 TO THAMES WATER S106 CONSENT

TW MH 2901
CL 53.44
I/ 50.33

2294 PUBLIC SW SEWER

SW DRAINAGE FROM PHASE 1 CONNECTED TO PHASE 2 DRAINAGE

NEW SW DRAIN CONNECTED INTO EXISTING ST MH

EXISTING SW ATTENUATION TANK SERVING PHASES 1 & 2

CONTROL MH SIL50.75

BACKDROP SIL51.42

RETAINING WALL TO THIS BOUNDARY TO ENSURE GROUND LEVELS AT LEAST 52.20

COURT RECREATION GROUND

COURT LANE

EXISTING SITE ACCESS

POUND LANE

CLAYHILL

CLAY HILL GREEN

Clayhill Green

The Sidings

Court Lane

COUR LODGE

BIRCHDENE

ALLONBY

SHARED SPACE

CRANE BASE

TANKED PERMEABLE PAVED PARKING SPACES

REV	DRN	CHK	DATE	DETAILS
P1	MJH	..	11.02.21	ISSUED FOR COMMENTS

ARCHITECT
Lytle Associates Architects

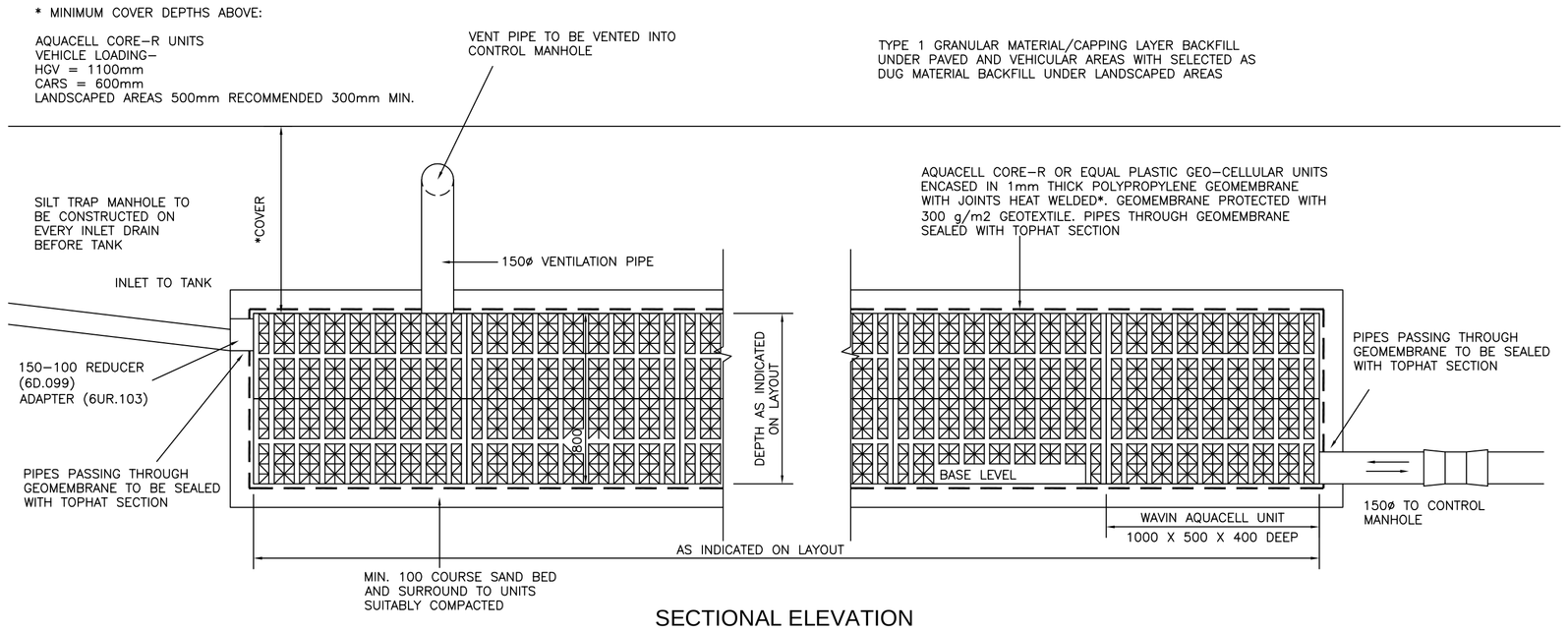
JOB
Land at Clayhill Lodge
Off of Court Lane
Epsom KT19 8JF

DRG
SW DRAINAGE STRATEGY LAYOUT

SCALE 1:200 @ A1
DATE February 2021
DRN MJH
CHK CHK

CONSULTING STRUCTURAL ENGINEERS
Ground Floor Offices
St. Stephens House
Dogflud Way
Farnham
Surrey GU9 7UD
T: 01252 734898
E: doo@doasteng.co.uk
www.doasteng.co.uk

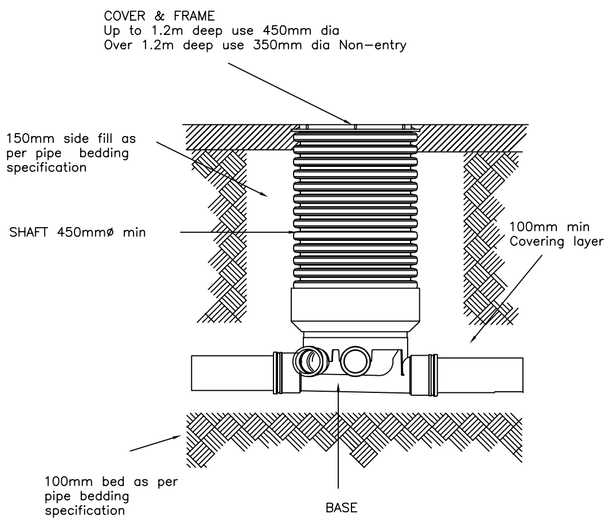
DRG. NUMBER P1
3734-101



SECTIONAL ELEVATION

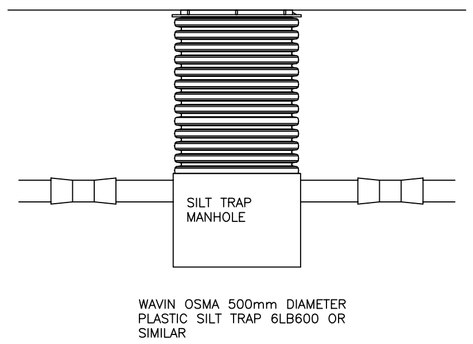
TYPICAL WAVIN AQUACELL CELLULAR SURFACE WATER ATTENUATION TANK DETAIL

SCALE 1:20



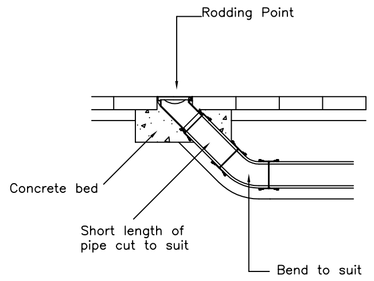
INSPECTION CHAMBER - UP TO 3.0m DEEP

NTS

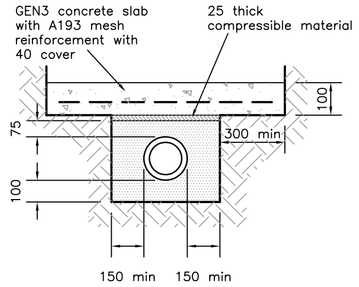


TYPICAL PLASTIC SILT TRAP DETAIL

SCALE 1:20

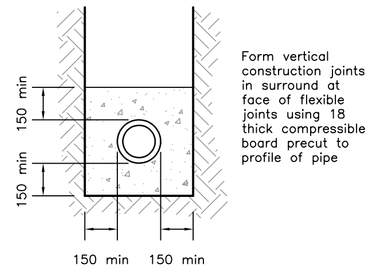


RODDING EYE



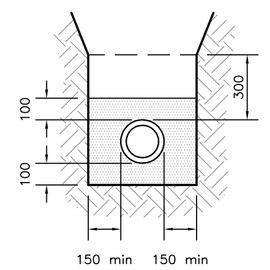
CLASS Q (PVC-U PIPES)

Cover less than 0.6m pedestrian areas
Cover less than 0.9m vehicular areas
Class Q is an alternative to Class Z when not near buildings



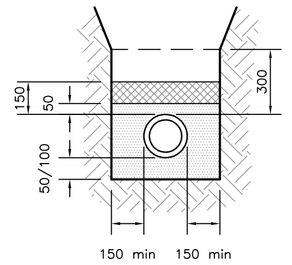
CLASS Z

Cover less than 0.6m pedestrian areas
Cover less than 0.9m vehicular areas
Pipe runs near buildings



CLASS T (PVC-U PIPES)

Cover 0.6m - 6.0m pedestrian areas
Cover 0.9m - 6.0m vehicular areas



CLASS S (RIGID PIPES)

Cover 0.6m - 6.0m pedestrian and vehicular areas

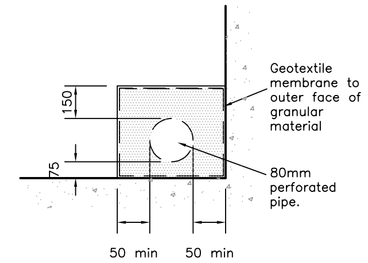
LEGEND

GRANULAR MATERIAL TO BS 882

SELECTED FILL

CONCRETE MIX GEN3 C16/20

SELECTED FILL:
Fill free from vegetable matter, rubbish, frozen soil and material retained on a 40 mm sieve. Compacted by hand in 100 mm layers.



CLASS X

RETAINING WALL LAND DRAIN

PIPE BEDDING DETAILS

NOTES

1. All manholes/inspection chambers shall have two short pipes either side of the manhole. The first short pipe shall have a flexible joint provided as close as feasible to the outside face of the structure into which it is built. The second pipe (rocker pipe) shall be of a length as follows:

NOMINAL PIPE DIAMETER mm	ROCKER PIPE LENGTH mm
150-600	600
675-750	1000
825 AND OVER	1250

2. All grating and manhole cover types to be approved by Architect.
3. All works in vicinity of tree root protection areas to be in compliance with tree specialists recommendations.
4. Manhole covers in paving to be recessed type to receive paving finish.

REV	DRN	CHK	DATE	DETAILS
P1	MJH	--	11.02.21	ISSUED FOR COMMENTS

ARCHITECT
Lytle Associates Architects

JOB
Land at Clayhill Lodge
Off of Court Lane
Epsom KT19 8JF

DRG
SW DRAINAGE STRATEGY
CONSTRUCTION DETAILS

SCALE As shown, NTS @ A1
DATE February 2021
DRN MJH
CHK CHK

CONSULTING STRUCTURAL ENGINEERS
Ground Floor Offices
St. Stephens House
Dogflud Way
Farnham
Surrey GU9 7UD
T: 01252 734898
E: doa@doasteng.co.uk
www.doasteng.co.uk

DRG. NUMBER P1
3734-102