Appendix A

LLFA COMMENTS & DESIGNER CHECKLIST

Public

Ground Floor
Northleigh
County Hall
Chichester
West Sussex
PO19 1RH

Lead Local Flood Authority

[redacted]
Planning and Building Control
Arun District Council
Arun Civic Centre
Maltravers Road
Littlehampton
West Sussex
BN17 5LF

Date 3rd April 2024

Dear [redacted]

RE: **AL/11/24/OUT – Land East of Westergate, Westergate (part of BEW allocated site)**

Thank you for your consultation on the above site, received on 27th March 2024. We have reviewed the application as submitted and wish to make the following comments.

This is a hybrid application where the outline application is for all matters reserved except access for up to 400 dwellings and associated works and the full planning application is for alterations to site access of Westergate Street and through Pine Close and east-west link road including a bridge over the Lidsey Rife.

We **object** to this planning application in the absence of an acceptable Flood Risk Assessment (FRA) & Drainage Strategy relating to:

- The application is not in accordance with NPPF paragraph 173 and 175, PPG Flood risk and coastal change or Policy W SP1 Water, W DM2 Flood Risk and W DM3 Sustainable Urban Drainage Systems.

Reason
To prevent flooding in accordance with National Planning Policy Framework paragraph 173, 175 and 180 by ensuring the satisfactory management of local flood risk, surface water flow paths, storage and disposal of surface water from the site in a range of rainfall events and ensuring the SuDS proposed operates as designed for the lifetime of the development.

We will consider reviewing this objection if the issues highlighted below are adequately addressed:

1. Outline drainage modelling calculations should be resubmitted using a CV value of 1 for both summer and winter events.

2. Outline drainage modelling calculations should be resubmitted and demonstrate how 10% urban creep has been included in the volume of SuDS storage required.

3. Use up to date FEH2022 rainfall parameters in any modelling scenarios.

4. For ordinary watercourses and SuDS features there should be a 3m easement on drawings. (8m for main rivers unless otherwise agreed with the EA who are responsible for main rivers)

5. The impact of ground raising on surface water flow paths should be considered, to ensure surface water flood risk is not increased elsewhere.

As the statutory consultee for development within Flood Zone 2/3 and development within 20 metres of a river, the Environment Agency must be consulted. Due to their responsibility for main rivers, we have not undertaken a full review of the modelling as this relates to fluvial water, not surface water.

Informatives:
Erection of flow control structures or any culverting of an ordinary watercourse requires consent from the appropriate authority, which in this instance is Arun District Council on behalf of West Sussex County Council. It is advised to discuss proposals for any works at an early stage of proposals.

Please note if the LPA decide to grant planning permission, we wish to be notified for our records should there be any subsequent surface water flooding that we may be required to investigate as a result of the new development.

Yours sincerely,

[redacted]
Flood Risk Management Team
[redacted]

Annex

The following documents have been reviewed, which have been submitted to support the application;

- Drainage Impact Assessment by WSP, September 2023, First Issue
- Hydraulic Modelling Report by WSP, September 2023, First Issue
- Flood Risk Assessment by WSP, September 2023, Revision 1
- Main Investigation Report by Soils Limited, September 2021, Document Status Final

[redacted]

From: Rhiannon Lloyd on behalf of Planning.Responses
Sent: 03 April 2024 14:22
To: Planning Scanning
Subject: FW: Response to AL/11/24/OUT at Land East of Westergate (BEW)
Attachments: AL 11 24 OUT letter.pdf

West Sussex response.
Thanks,

Rhiannon Lloyd (she/her)
Planner (Degree Apprentice), Planning

T: 01903 737637
E: rhiannon.lloyd@arun.gov.uk

Arun District Council, Civic Centre, Maltravers Rd
Littlehampton, West Sussex, BN17 5LF
www.arun.gov.uk

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From: [redacted]
Sent: Wednesday, April 3, 2024 12:06 PM
To: Planning.Responses <Planning.Responses@arun.gov.uk>
Subject: Response to AL/11/24/OUT at Land East of Westergate (BEW)

CAUTION: This email originated from outside of the organisation. You should take extra care when clicking links or opening attachments - if you are unsure the content is safe contact the IT Helpdesk before clicking or opening.

Please could the attached response be distributed to the relevant case officer.

Regards

Flood Risk Management

Please do not reply directly to this email.

Any formal reconsultation on the application should be directed to [redacted] but the responding officer can be contacted directly via email if there are any questions relating to this response.

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Outlook

Fw: AL/11/24/OUT - Land East of Westergate

From Hannah Kersley <Hannah.Kersley@arun.gov.uk>
Date Tue 03/03/2026 10:39
To Planning.Responses <Planning.Responses@arun.gov.uk>

Hi,

Please can this email be uploaded to AL/11/24/OUT as correspondence from WSCC LLFA.

Many thanks

Hannah Kersley (she/her)
Principal Planning Officer, Strategic Development

T: 01903 737856
E: hannah.kersley@arun.gov.uk

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Littlehampton, West Sussex, BN17 5LF
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From: Eleanor Rea [redacted]
Sent: Wednesday, February 25, 2026 16:47
To: Hannah Kersley <Hannah.Kersley@arun.gov.uk>
Subject: RE: AL/11/24/OUT - Land East of Westergate

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Hi Hannah,

I've had a look and think about the FRA and Drainage Strategy. Given the type of application, it would be sensible for the applicant to provide an addendum to the drainage strategy that meets the requirements in the outline Designer checklists | Arun District Council. This should also avoid issues later, when we will definitely require this site to follow the updated standards. The key one that is likely to mean they need extra storage (which is already a constraint) for this site, now that 10% urban creep is needed.

I have also noticed that the FRA is out of date now as it doesn't use the updated EA Risk of Flooding from Surface Water mapping (which has improved for this site as it is now picked up within the Rivers and Seas flood risk model instead). Safe access and egress now might be an issue as well (not looked at it in too much detail so far, as it isn't fully our remit as it is covered my Emergency Planner).

Kind regards,
Ellie

Eleanor Read
Senior Flood Risk Management Officer | Flood Risk Management Team
West Sussex County Council, Ground Floor, Northleigh, County Hall, Chichester PO19 1RH
Internal Phone [redacted]
Emai [redacted] Web: www.westsussex.gov.uk

OUTLINE APPLICATIONS ONLY
Surface Water Drainage Design

This checklist has been created to assist designers, by clearly defining our expectations and requirements for surface water drainage designs that are submitted to support **outline** planning applications – where the layout and scale of the proposed development is not being decided.

The checklist and critical items have been designed to align with the National Standards for SuDS and The SuDS Manual, offering clarity where there are deviations between them.

Critical items are highlighted in **bold**. A failure to address these will result in an **objection** to any outline application.

It is recommended that applicants and their designers take time, at the outset of the planning process, to familiarise themselves with our checklists and guidance. For details of our expectations for a fully detailed surface water drainage design, to support a full or reserved matters planning application, or an application to discharge a surface water drainage design condition, please refer to our Full Surface Water Drainage Design Checklist.

It is expected that surface water drainage information is submitted with all planning applications. Surface water drainage information may be requested for smaller proposals where drainage is expected to affect determination – for example, in the Lidsey Wastewater Treatment Catchment area.

Applicants who submit all the information requested by the checklist, as early as possible in the planning process, benefit from quicker review times and less delays caused by requests for further information. The omission of information may lead to objection to, or refusal of planning applications or applications to discharge conditions.

Applicants for major development sites must be aware that West Sussex County Council [WSCC] acting as Lead Local Flood Authority [LLFA] are a statutory consultee for flood risk and surface water drainage design. It is important to consult WSCC guidance in addition to our guidance and this checklist.

A major planning application is defined as:

- The creation of 10 or more residential units,
- Residential development of on a site of 0.5 hectares or more (where the number of residential units is not yet known i.e. for outline applications),
- Non-Residential development or change of use on a site of at least 1 hectare,
- Creation or change of use of 1000 square metres or more of gross floor space (not including housing).

Applicants have the option to apply for confidential pre-application advice relating to their surface water drainage design from either Arun District Council or WSCC. Bespoke advice is not offered outside of a fee-paying application.

ADC pre-application advice: https://www.arun.gov.uk/pre-application-advice

WSCC pre-application advice: https://www.westsussex.gov.uk/roads-and-travel/information-for-developers/flood-risk-management-pre-application-advice/

OUTLINE APPLICATIONS ONLY
Surface Water Drainage Design Checklist

Site Name/Address:	
Application Description:	
Any relevant planning application references:	

Policy and Guidance Information

Arun District Council Local Plan – Section 18, Water Adopted Local Plan.pdf (arun.gov.uk)

National planning Policy Framework - National Planning Policy Framework (publishing.service.gov.uk)

Arun District Council Surface Water Drainage Guidance (including design checklists) - https://www.arun.gov.uk/surfacewater

Land Drainage Consent – https://www.westsussex.gov.uk/fire-emergencies-and-crime/dealing-with-extreme-weather/flooding/flood-risk-management/ordinary-watercourse-land-drainage-consent/

Arun District Council Land Drainage Byelaws - https://www.arun.gov.uk/byelaws/

Arun District Council surface water pre-commencement conditions - https://www.arun.gov.uk/planning-pre-commencement-conditions

The National Standards for SuDS - https://www.gov.uk/government/publications/national-standards-for-sustainable-drainage-systems/national-standards-for-sustainable-drainage-systems-suds

The SuDS Manual [C753] by CIRIA

Ground Investigation Results

Ideally site-specific ground investigation results - to support a desk study - will be submitted with an outline planning application.

If infiltration is proposed at the outline planning application stage and there are no winter infiltration tests and winter groundwater monitoring available to prove that the strategy is viable, then alternative proposals for discharge must be provided. This will ensure that if subsequent site-specific winter ground investigations show that infiltration is not possible, then the site can still be sustainably and effectively drained.

If there are no alternative sustainable means of disposing of surface water, apart from using infiltration, then site-specific winter ground investigation results are essential prior to determination.

Groundwater monitoring

☐ Plan showing location of monitoring points provided[i].
☐ Depths of holes detailed[ii].
☐ Dates of observations and depth to groundwater recorded.
☐ Evidence of the strata within borehole or monitoring pits provided.
☐ Plan showing the peak groundwater levels at each monitoring point in mAOD (preferred).
☐ Peak groundwater levels recorded in metres below ground level and mAOD (preferred).

☐ If in an area of possible tidal influence, provide a comparison of readings against tide times/levels (preferred).

Infiltration testing

☐ Infiltration testing is completed strictly in accordance with BRE DG 365, CIRIA R156 or a similar approved method.
☐ Plan showing location of trial pits provided.
☐ Pit dimensions provided.
☐ Depths of testing provided[iii].
☐ Dates, times and readings of each test recorded.
☐ Calculations for the infiltration rate for each test provided.
☐ Incomplete testing results are not extrapolated to obtain design values for infiltration rates.
☐ Evidence of the strata within trial pits provided.
☐ Test locations, and depths correspond with the expected location and depths of proposed infiltration features.
☐ Depths of testing provided in m below ground level and mAOD (optional).

☐ Specialist advice is submitted to support designs where infiltration is proposed where there may be,

- risk of dissolution,
- risk of slope instability,
- infiltrating features closer than 5m to buildings or highways,
- contamination,
- made ground at the infiltration depth,
- ground raising proposed,
- deep bore soakaways proposed[iv].

Surface Water Drainage Statement

1. Runoff destination

Existing Site

☐ **The condition, performance (including capacity where appropriate) and ownership of any existing site surface water drainage infrastructure must be accurately reported.**

☐ It is clear what the natural drainage characteristics of the site and hydraulically linked areas are[v].
☐ Natural flow paths are identified on a plan (where applicable).
☐ Existing site drainage features are investigated – condition, performance, and ownership[vi].
☐ Environmentally sensitive receiving water bodies are identified – for example groundwater source protection zones.
☐ **Existing and future flood risk from any source is detailed**[vii].

Proposed Design

☐ **The proposed discharge method must accord with the SuDS hierarchy as given below.**

1. Rainwater reuse
2. Infiltration to ground
3. Hybrid infiltration and restricted discharge to an appropriate water body[viii] or surface water sewer is proposed
4. Restricted discharge to a water body
5. Restricted discharge to a surface water sewer or another piped surface water drainage system
6. Restricted discharge to a public combined sewer

☐ **Adequate evidence is supplied to justify the proposed discharge method[ix].**

☐ **Where infiltration has not been adequately investigated but is proposed, a second sustainable disposal method has been identified.**
☐ **No connection of surface water to the public foul sewer is proposed[x].**
☐ **It is demonstrated that the drainage proposals will integrate with and not compromise the function of the natural and existing drainage systems on the site.**
☐ **The design can be gravity based with no use of pumps[xi].**

☐ **1m unsaturated ground is provided between peak groundwater levels and the base of any infiltration feature.**
☐ If surface water must be discharged to a sewer network, then hydraulic capacity checks are provided.
☐ Relevant restrictions relating to discharging to an environmentally sensitive receiving water body – for example a groundwater source protection zone - are investigated, reported and adhered to.
☐ Details of any offsite works, plus any associated permissions or legal agreements from asset or landowners are identified and 'in principle' consents provided.

Preferred
☐ Ground raising is avoided where possible.
☐ Any previous relevant correspondence or pre-application advice from the Local Planning Authority [LPA] or the Lead Local Flood Authority [LLFA] regarding the surface water drainage design is included with the statement.

2. Interception drainage – N/A for OUTLINE applications

3. Extreme rainfall and flooding

Proposed Design
☐ Statement confirming the proposed design criteria including fixed design calculation inputs for the SuDS system. Examples include:
- Climate change allowances,
- Urban creep,
- CV values,
- Rainfall data,
- MADD factor or additional storage

☐ **The proposed discharge rate (per hectare) is explained and justified for attenuation designs.**
☐ **Any relaxation factors applied to discharge rates for previously developed sites[xii] are agreed prior to the scale and layout of the development being approved.**
☐ **It is shown how a surface water drainage design will not conflict with additional areas of flood storage or compensation.**
☐ **Surface water flow entering the site from elsewhere can be conveyed safely around or through the site without compromising the SuDS system.**

4. Water quality, amenity, biodiversity, construction and maintenance

☐ The design is committed to the use of multifunctional SuDS to meet community and environmental requirements.
☐ It is confirmed what the adoption arrangements for SuDS components will be.
☐ It is confirmed what elements of the SuDS will be private.

Surface Water Drainage Calculations/Modelling

General
☐ **FEH22 point descriptors for the site are submitted confidentially[xiii].**

☐ **The most recently applicable, or previously agreed FEH rainfall data is used.**

Infiltration

☐ **Half drain times do not exceed 24 hours for the critical 3.33% AEP + CCA event.**

Drainage Plans and Specifications

☐ **Appropriate easements and permissions relating to watercourses[xiv], infiltrating structures[xv], other services and third-party land[xvi] must be evidenced and shown on all plans where applicable.**

☐ Existing and proposed site sections and levels.

This checklist is designed to aid an applicant with their submission. The list is not exhaustive, and our engineers may request additional information to enable them to review a proposal to their satisfaction.

Where an outline planning application proposes to determine more than the principle of development and access, the applicant is encouraged to refer to our full detailed design checklist for more information on what may be required.

The checklist may also request information that an applicant does not feel is relevant to their submission. In this case the applicant can provide an explanation as to why they have omitted certain information in their drainage statement. However, the appraising engineer reserves the right to request this information if they believe it is necessary for their review.

[i] The monitoring locations must correspond with the location and depth of proposed infiltration features.
[ii] Groundwater monitoring holes must be deep enough to allow for 1m of unsaturated ground between the peak groundwater level and the base of any potential or proposed infiltration feature.
[iii] Testing depths and must account for groundwater levels and 1m of unsaturated ground between the base of the test pit and the peak groundwater level.
[iv] Deep bore soakaways are strongly resisted and any planning application that suggests the use of them without formal acceptance from the Environment Agency will be objected to.
[v] It is suggested that this is achieved with reference to the ground investigations and a topographical plan. Where there is more than one catchment these should be clearly identified.
[vi] Confirmation, plans and surveys of any existing drainage infrastructure on the site.
[vii] Flood maps (fluvial, tidal, pluvial, groundwater, sewer, and reservoir) are supplied (or Flood Risk Assessment referred to). Full details of any known flooding on the site is referred to.
[viii] A water body may be defined as a river, watercourse, ditch, culverted watercourse, reservoir, wetland or the sea.
[ix] Evidence includes ground investigations, locations, mapping, network types, flow direction, ownership/responsibility, depth, capacity, condition and cost. Higher priority destinations must be used to the maximum extent practicable.
[x] Engineers will object to any proposed connection of surface water to the foul sewer under all circumstances.
[xi] All surface water drainage designs must drain via gravity to corresponding points of discharge where possible. The use of pumps for surface water drainage will only be agreed to in exceptional circumstances.
[xii] See Arun District Council guidance note regarding surface water drainage of previously developed sites at www.arun.gov.uk/surfacewater.
[xiii] Please submit FEH22 point data files, in accordance with clause 5.1.7 of the FEH Web Service terms of use (https://fehweb.ceh.ac.uk/Home/Terms). These must be submitted directly to land.drainage@arun.gov.uk rather than to the planning portal (via the planning officer), this is to ensure that the data remains confidential in accordance with those terms.
[xiv] 3m from the top of the bank of all ordinary watercourses, and from the edge of all culverted watercourses. 8m from the top of the bank of all main rivers - unless an alternative easement has been stipulated by the Environment Agency.
[xv] 5m from all buildings and highways, unless an alternative easement is recommended by a geotechnical specialist. (Aside from permeable paving that does not take any extra impermeable catchment such as a roof).
[xvi] As stipulated by the utility owner or landowner.

Appendix B

DRAINAGE CALCULATION AMENDMENTS

Public

Autodesk, Inc. InfoDrainage 2024.4 ©2023 Autodesk, Inc. All rights reserved.

Name	Outgoing Item	Area (ha)	Preliminary Percentage Impervious (%)	Preliminary Volumetric Runoff Coefficie	Preliminary Time of Concentration (mins)	Volumetric Runoff Coefficient	Winter Volumetric Runoff Coefficie	Runoff Method	Used	Time of Concentration (mins)	Percentage Impervious (%)	Urban Creep (%)	Max. Inflow (L/s)	Total Inflow Volume (m³)
1 - DA Link	1	0.013	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	8.972	3.890
2 - DA	2	0.025	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	17.015	7.381
3 - DA	3	0.035	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	23.831	10.341
3 - DA (1)	3	0.015	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	10.279	4.463
4 - DA	4	0.033	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	22.514	9.771
5 - DA	5	0.036	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	24.729	10.731
6 - DA	6	0.075	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	51.335	22.277
7 - DA	7	0.101	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	68.549	29.741
8 - DA	8	0.070	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	47.892	20.780
8 - DA (1)	8	0.059	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	40.148	17.421
10 - DA	10	0.063	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	43.012	18.660
11 - DA	11	0.035	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	23.911	10.377
12 - DA	12	0.025	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	17.314	7.513
12 - DA (1)	12	0.068	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	46.075	19.995
15 - DA	15	0.022	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	14.989	6.502
Basin Area	Attenuation Basin	0.399	60	1.000	5	1.000	1.000	Time of Concentration		5	60	0	203.582	88.334
Resi Area 1	25 (1)	0.154	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	83.080	36.045
Resi Area 2 C	28	0.223	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	120.503	52.288
Resi Area 3 C	24 (1)	0.084	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	45.167	19.596
Resi Area 4 C	22	0.091	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	48.970	21.248
Road Area 1 C	21	0.058	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	39.369	17.086
Resi Area 5 C	36	0.265	60	1.000	5	1.000	1.000	Time of Concentration		5	60	0	135.103	58.619
Road Area 3 C	37	0.110	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	75.136	32.603
Road Area 2 C	31	0.074	80	1.000	5	1.000	1.000	Time of Concentration		5	80	0	50.117	21.749
Resi Area 6 C	38	0.298	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	161.189	69.938
Resi Area 7 C	30	0.458	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	247.812	107.528
Resi Area 8 C	33	0.366	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	197.874	85.857
Resi Area 9 C	25 (1)	0.078	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	42.453	18.420
Resi Area 10C	24 (1)	0.054	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	29.060	12.608
Resi Area 11 C	23	0.055	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	29.929	12.989
Resi Area 12 C	29	0.079	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	42.882	18.603
Resi Area 13 C	29	0.272	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	146.869	63.727
Resi Area 14 C	29	0.161	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	87.271	37.869
Resi Area 15 C	35	0.207	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	112.040	48.617
Resi Area 16 C	35	0.151	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	81.652	35.431
Resi Area 17 C	36	0.210	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	113.717	49.343
Resi Area 18 C	35	0.037	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	20.069	8.706
Resi Area 19 C	30	0.038	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	20.528	8.904
Resi Area 20 C	38	0.066	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	35.517	15.412
Resi Area 21 C	33	0.055	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	29.959	12.998
Resi Area 22 C	33	0.030	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	16.436	7.135
Resi Area 23 C	38	0.012	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	6.756	2.930
Resi Area 24 C	33	0.313	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	169.472	73.536
Resi Area 16(B)C	35	0.078	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	42.233	18.324
Resi Area 15 (B) C	35	0.108	60	1.000	5	1.000	0.840	Time of Concentration		5	60	6	58.510	25.387
Resi Area 1 (B) C	25 (1)	0.149	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	80.565	34.960
Resi Area 2 (B) C	26	0.373	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	201.806	87.566
Resi Area 4 (B) C	23	0.031	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	16.546	7.180
Resi Area 3 (B) C	24 (1)	0.061	60	1.000	5	1.000	1.000	Time of Concentration		5	60	6	33.122	14.368

Name	Junction Type	Easting (m)	Northing (m)	Cover Level (m)	Depth (m)	Invert Level (m)	Chamber Shape	Diameter (m)
1	Manhole	493895.881	104880.572	8.500	1.100	7.400	Circular	1.200
2	Manhole	493903.668	104882.226	8.600	1.345	7.255	Circular	1.200
3	Manhole	493927.340	104882.778	8.810	1.725	7.085	Circular	1.200
4	Manhole	493949.979	104875.852	9.000	2.699	6.301	Circular	1.200
5	Manhole	493990.796	104873.135	9.100	3.055	6.045	Circular	1.200
6	Manhole	494030.367	104864.756	8.950	3.233	5.717	Circular	1.200
7	Manhole	494084.568	104873.509	8.500	3.132	5.368	Circular	1.350
8	Manhole	494101.556	104872.061	8.250	3.131	5.119	Circular	1.500
9	Manhole	494121.632	104866.115	8.050	2.990	5.060	Circular	1.500
12	Manhole	494158.777	104852.266	7.780	2.831	4.949	Circular	1.500
10	Manhole	494190.984	104852.014	7.770	1.625	6.145	Circular	1.200
11	Manhole	494170.712	104849.916	7.690	1.673	6.017	Circular	1.200
13	Manhole	494158.209	104849.389	7.950	3.010	4.940	Circular	1.500
14	Manhole	494159.992	104843.877	7.900	2.977	4.923	Circular	1.500
15	Manhole	494185.599	104836.301	6.600	1.752	4.848	Circular	1.500
16	Simple Junction	494189.974	104829.705					
19	Manhole	494200.788	104705.555	4.400	0.800	3.600	Circular	1.200
20	Manhole	494102.485	104885.013	8.250	3.030	5.220	Circular	1.200
21	Manhole	494115.252	104916.526	8.235	2.750	5.485	Circular	1.200
22	Manhole	494130.159	104963.926	8.913	3.040	5.873	Circular	1.200
23	Manhole	494080.152	104966.109	9.359	2.911	6.448	Circular	1.200
24 (1)	Manhole	494059.843	104960.432	9.085	2.298	6.787	Circular	1.200
25 (1)	Manhole	493994.769	104961.087	9.091	1.800	7.291	Circular	1.200
26	Manhole	494029.363	104911.536	8.651	1.809	6.842	Circular	1.200
27	Manhole	494058.950	104911.835	8.650	2.236	6.414	Circular	1.200
28	Manhole	494097.951	104922.892	8.491	2.739	5.752	Circular	1.200

Junction	Inlet Name	Incoming Item(s)	Bypass Destination	Capacity Type
39	Inlet	3.020	(None)	No Restriction

Outlets

Junction	Outlet Name	Outgoing Connection	Outlet Type
1	Outlet	1.000	Free Discharge
2	Outlet	1.001	Free Discharge
3	Outlet	1.002	Free Discharge
4	Outlet	1.003	Free Discharge
5	Outlet	1.004	Free Discharge
6	Outlet	1.005	Free Discharge
7	Outlet	1.006	Free Discharge
8	Outlet	1.007	Free Discharge
9	Outlet	1.008	Free Discharge
12	Outlet	1.009	Free Discharge
10	Outlet	2.000	Free Discharge
11	Outlet	2.001	Free Discharge
13	Outlet	1.010	Free Discharge
14	Outlet	1.011	Free Discharge
15	Outlet	1.012	Free Discharge
16	Outlet	1.013	Free Discharge
20	Outlet	3.005	Free Discharge
21	Outlet	3.004	Free Discharge
22	Outlet	3.010	Free Discharge
23	Outlet	3.009	Free Discharge
24 (1)	Outlet	3.007	Free Discharge
25 (1)	Outlet	3.006	Free Discharge
26	Outlet	3.000	Free Discharge
27	Outlet	3.001	Free Discharge
28	Outlet	3.002	Free Discharge
29	Outlet	3.011	Free Discharge
30	Outlet	3.012	Free Discharge
31	Outlet	3.013	Free Discharge
32	Outlet	3.020	Free Discharge
33	Outlet	3.022	Free Discharge
35	Outlet	3.016	Free Discharge
36	Outlet	3.017	Free Discharge
37	Outlet	3.018	Free Discharge
38	Outlet	3.023	Free Discharge
39	Outlet	3.021	Free Discharge

29	Manhole	494012.874	104803.490	7.940	1.800	6.140	Circular	1.200
30	Manhole	494068.764	104801.472	7.281	1.956	5.325	Circular	1.200
31	Manhole	494092.371	104793.200	6.713	1.801	4.912	Circular	1.200
32	Manhole	494098.222	104807.525	6.783	2.080	4.703	Circular	1.200
33	Manhole	494164.402	104785.129	4.870	0.983	3.887	Circular	1.200
35	Manhole	494011.695	104763.353	7.070	1.726	5.344	Circular	1.200
36	Manhole	494063.587	104749.538	6.153	1.318	4.835	Circular	1.200
37	Manhole	494092.633	104743.340	5.865	1.386	4.479	Circular	1.200
38	Manhole	494158.694	104740.683	4.824	0.972	3.852	Circular	1.200
39	Manhole	494150.094	104789.683	5.427	1.465	3.962	Circular	1.200

Name	Access Required	Intersection Easting (m)	Intersection Northing (m)	Lock
1	☑	493895.881	104880.572	None
2	☑	493903.668	104882.226	None
3	☑	493927.340	104882.778	None
4	☑	493949.979	104875.852	None
5	☑	493990.796	104873.135	None
6	☑	494030.367	104864.756	None
7	☑	494084.568	104873.509	None
8	☑	494101.556	104872.061	None
9	☑	494121.632	104866.115	None
12	☑	494158.777	104852.266	None
10	☑	494190.984	104852.014	None
11	☑	494170.712	104849.916	None
13	☑	494158.209	104849.389	None
14	☑	494159.992	104843.877	None
15	☑	494185.599	104836.301	None

Attenuation Basin — Type : Pond

Dimensions

Exceedance Level (m)	4.700
Depth (m)	0.950
Base Level (m)	3.750
Freeboard (mm)	0
Initial Depth (m)	0.000
Porosity (%)	100
Average Slope (1:X)	7.327
Total Volume (m³)	2730.691

Depth (m)	Area (m²)	Volume (m³)
0.000	2485.00	0.000
0.100	2562.00	252.340
0.200	2640.00	512.430
0.300	2718.00	780.321
0.400	2797.00	1056.062
0.450	2836.00	1196.885
0.500	2876.00	1339.684
0.600	2956.00	1631.275
0.700	3036.00	1930.866
0.800	3117.00	2238.507
0.900	3199.00	2554.298
0.950	3867.24	2730.691

Inlets

Inlet

Inlet Type	Point Inflow
Incoming Item(s)	1.013 Basin Area
Bypass Destination	(None)
Capacity Type	No Restriction

Inlet (1)

Inlet Type	Point Inflow
Incoming Item(s)	3.022
Bypass Destination	(None)
Capacity Type	No Restriction

Inlet (2)

Inlet Type	Point Inflow
Incoming Item(s)	3.023
Bypass Destination	(None)
Capacity Type	No Restriction

16				
19	☑	494200.788	104705.555	None
20	☐			None
21	☐			None
22	☐			None
23	☐			None
24 (1)	☐			None
25 (1)	☐			None
26	☐			None
27	☐			None
28	☐			None
29	☐			None
30	☐			None
31	☐			None
32	☐			None
33	☐			None
35	☐			None
36	☐			None
37	☐			None
38	☐			None
39	☐			None

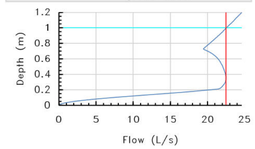
Inlets

Junction	Inlet Name	Incoming Item(s)	Bypass Destination	Capacity Type
1	Inlet	1 – DA Link	(None)	No Restriction
2	Inlet	1.000 2 – DA	(None)	No Restriction
3	Inlet	1.001 3 – DA 3 – DA (1)	(None)	No Restriction
4	Inlet	1.002 4 – DA	(None)	No Restriction
5	Inlet	1.003 5 – DA	(None)	No Restriction
6	Inlet	1.004 6 – DA	(None)	No Restriction
7	Inlet	1.005 7 – DA	(None)	No Restriction
8	Inlet	1.006 8 – DA 8 – DA (1) 3.005	(None)	No Restriction
9	Inlet	1.007	(None)	No Restriction
12	Inlet	1.008 2.001 12 – DA 12 – DA (1)	(None)	No Restriction
10	Inlet	10 – DA	(None)	No Restriction
11	Inlet	2.000 11 – DA	(None)	No Restriction
13	Inlet	1.009	(None)	No Restriction
14	Inlet	1.010	(None)	No Restriction

Outlets

Outlet

Outgoing Connection	Outlet
Outlet Type	Hydro-Brake®
Invert Level (m)	3.750
Design Depth (m)	1.000
Design Flow (L/s)	22.59
Objective	Minimise Upstream Storage Requirements
Application	Surface Water Only
Sump Available	☑
Unit Reference	SHE-0209-2259-1000-2259



Advanced

Perimeter	Circular
Length (m)	128.997
Friction Scheme	Manning's n
n	0.03

Name	Length (m)	Connection Type	Slope (1:X)	Manning's n	Colebrook-White Roughness (mm)	Diameter / Base Width (mm)	Upstream Cover Level (m)	Upstream Invert Level (m)
1.000	7.961	Pipe	54.904		0.6	150	8.500	7.400
1.001	23.678	Pipe	139.285		0.6	225	8.600	7.255
1.002	23.674	Pipe	30.197		0.6	225	8.810	7.085
1.003	40.908	Pipe	159.944		0.6	225	9.000	6.301
1.004	40.448	Pipe	160.058		0.6	225	9.100	6.045
1.005	54.903	Pipe	200.377		0.6	300	8.950	5.717
1.006	17.049	Pipe	172.211		0.6	375	8.500	5.368
1.007	20.938	Pipe	354.886		0.6	525	8.250	5.119
1.008	39.643	Pipe	357.144		0.6	525	8.050	5.060
2.000	20.381	Pipe	159.226		0.6	225	7.770	6.145
2.001	12.164	Pipe	15.839		0.6	225	7.690	6.017
1.009	2.933	Pipe	325.859		0.6	525	7.780	4.949
1.010	5.793	Pipe	340.751		0.6	525	7.950	4.940
1.011	26.704	Pipe	356.052		0.6	525	7.900	4.923
1.012	7.915	Pipe	164.900		0.6	525	6.600	4.848
1.013	9.800	Pipe	9.333		0.6	525	5.500	4.800
3.000	29.588	Pipe	69.132		0.6	375	8.651	6.842
3.001	40.538	Pipe	69.060		0.6	375	8.650	6.414
3.002	18.435	Pipe	69.043		0.6	450	8.491	5.752
3.004	34.001	Pipe	128.306		0.6	525	8.235	5.485
3.005	12.985	Pipe	128.561		0.6	525	8.250	5.220
3.006	65.078	Pipe	129.000		0.6	375	9.091	7.291
3.007	21.087	Pipe	80.021		0.6	375	9.085	6.787
3.009	50.055	Pipe	87.052		0.6	450	9.359	6.448
3.010	49.689	Pipe	128.063		0.6	525	8.913	5.873
3.011	55.926	Pipe	68.621		0.6	375	7.940	6.140
3.012	25.014	Pipe	74.007		0.6	375	7.281	5.325
3.013	15.474	Pipe	74.041		0.6	450	6.713	4.912
3.016	53.700	Pipe	105.501		0.6	375	7.070	5.344
3.017	29.700	Pipe	105.693		0.6	375	6.153	4.835
3.018	66.114	Pipe	105.446		0.6	450	5.865	4.479
3.020	54.854	Pipe	74.027		0.6	450	6.783	4.703
3.021	15.016	Pipe	73.971		0.6	525	5.427	4.090
3.022	10.203	Pipe	74.476		0.6	525	4.870	3.887
3.023	10.847	Pipe	106.348		0.6	450	4.824	3.852
Outlet	7.359	Pipe	49.063		0.6	375	4.700	3.750

Name	Downstream Cover Level (m)	Downstream Invert Level (m)	Part Family	Lock	Flow Restriction (L/s)
1.000	8.600	7.255		None	
1.001	8.810	7.085		None	
1.002	9.000	6.301		None	
1.003	9.100	6.045		All	
1.004	8.950	5.792		All	
1.005	8.500	5.443		All	
1.006	8.250	5.269		All	
1.007	8.050	5.060		All	
1.008	7.780	4.949		None	
2.000	7.690	6.017		None	
2.001	7.780	5.249		None	
1.009	7.950	4.940		All	
1.010	7.900	4.923		All	
1.011	6.600	4.848		All	
1.012	5.500	4.800		None	
1.013	4.700	3.750		None	
3.000	8.650	6.414		None	
3.001	8.491	5.827		All	
3.002	8.235	5.485		All	
3.004	8.250	5.220		All	
3.005	8.250	5.119		All	
3.006	9.085	6.787		None	
3.007	9.359	6.523		All	
3.009	8.913	5.873		All	
3.010	8.235	5.485		All	
3.011	7.281	5.325		None	
3.012	6.713	4.987		Levels	
3.013	6.783	4.703		Levels	
3.016	6.153	4.835		All	
3.017	5.865	4.554		Levels	
3.018	4.824	3.852		Levels	
3.020	5.427	3.962		Levels	
3.021	4.870	3.887		Levels	
3.022	4.700	3.750		None	
3.023	4.700	3.750		None	
Outlet	4.400	3.600		None	22.03

Flow Options

Peak Flow Calculation	Rational Method
Min. Time of Entry (mins)	5
Max. Travel Time (mins)	30

Pipe Options

Lock Slope Options	None
Design Options	Minimise Excavation
Design Level	Level Inverts
Min. Slope (1:X)	1000.00
Max. Slope (1:X)	40.00
Use Flow Restriction	☑
Reduce Channel Depths	☑

Pipe Size Library

Add. Increment (mm)	0
Max. Diameter (mm)	0

Diameter (mm)	Min. Slope (1:X)	Max. Slope (1:X)
150	0.00	0.00
225	0.00	0.00

Manhole Options

Apply Offset	☐

Manhole Size Library

Diameter / Width

Connection (mm)	Diameter / Length (m)	Width (m)
0	1.200	0.000
375	1.350	0.000
500	1.500	0.000
750	1.800	0.000

Depth

Depth (m)	Diameter / Length (m)	Width (m)
0.000	1.050	0.000
1.500	1.200	0.000

Benching Requirements

Landing Width (mm)	0
Benching Width (mm)	0

Outfalls

Outfall	Outfall Type	Fixed Surcharged Level (m)	Level Curve
19	Free Discharge		

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Use Catchment Values
Junction Flood Risk Margin (mm)	0
Perform No Discharge Analysis	☐

Rainfall

Sim Criteria FEH

Type: FEH

Site Location	GB 494145 104717 SU 94145 04717
Rainfall Version	2022
Summer	☑
Winter	☑

Return Period

Return Period (years)	Increase Rainfall (%)
100.0	45.000
100.0	0.000
30.0	40.000
30.0	0.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
240	480
360	720
480	960
960	1920
1440	2880

SUM Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
1 – DA Link	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.01	9.0	3.890
2 – DA	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.03	17.0	7.381
3 – DA	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.04	23.8	10.341
3 – DA (1)	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.02	10.3	4.463
4 – DA	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.03	22.5	9.771
5 – DA	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.04	24.7	10.731

6 – DA	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.08	51.3	22.277
7 – DA	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.10	68.5	29.741
8 – DA	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.07	47.9	20.780
8 – DA (1)	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.06	40.1	17.421
10 – DA	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.06	43.0	18.660
11 – DA	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.04	23.9	10.377
12 – DA	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.03	17.3	7.513

12 – DA (1)	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.07	46.1	19.995
15 – DA	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.02	15.0	6.502
Basin Area	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.40	203.6	88.334
Resi Area 1	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.15	83.1	36.045
Resi Area 2 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.22	120.5	52.288
Resi Area 3 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.08	45.2	19.596
Resi Area 4 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.09	49.0	21.248

Road Area 1 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.06	39.4	17.086
Resi Area 5 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.26	135.1	58.619
Road Area 3 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.11	75.1	32.603
Road Area 2 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.07	50.1	21.749
Resi Area 6 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.30	161.2	69.938
Resi Area 7 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.46	247.8	107.528
Resi Area 8 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.37	197.9	85.857

Resi Area 9 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.08	42.5	18.420	
Resi Area 10C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.05	29.1	12.608	
Resi Area 11 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.06	29.9	12.989	
Resi Area 12 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.08	42.9	18.603	
Resi Area 13 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.27	146.9	63.727	
Resi Area 14 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.16	87.3	37.869	
Resi Area 15 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.21	112.0	48.617	

Resi Area 16 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.15	81.7	35.431	
Resi Area 17 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.21	113.7	49.343	
Resi Area 18 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.04	20.1	8.706	
Resi Area 19 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.04	20.5	8.904	
Resi Area 20 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.07	35.5	15.412	
Resi Area 21 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.06	30.0	12.998	
Resi Area 22 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.03	16.4	7.135	

Resi Area 23 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.01	6.8	2.930	
Resi Area 24 C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.31	169.5	73.536	
Resi Area 16 (B)C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.08	42.2	18.324	
Resi Area 15 (B) C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.11	58.5	25.387	
Resi Area 1 (B) C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.15	80.6	34.960	
Resi Area 2 (B) C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.37	201.8	87.566	
Resi Area 4 (B) C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.03	16.5	7.180	

Resi Area 3 (B) C	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	0.06	33.1	14.368	

Critical Storm Per Item: Rank By: Max. Flooded Volume

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
1	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	8.500	7.400	8.506	1.106	16.0	7.025	5.781	11.7	9.040	Flood
2	Sim Criteria FEH: 100 years: +45 %: 30 mins: Summer	8.600	7.255	8.600	1.345	22.3	1.626	0.105	23.8	21.087	Flood
3	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	8.810	7.085	8.414	1.329	34.1	1.503	0.000	40.1	29.396	Surcharged
4	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	9.000	6.301	8.293	1.992	40.1	2.253	0.000	50.9	35.824	Surcharged
5	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	9.100	6.045	8.198	2.153	50.9	2.435	0.000	61.5	46.751	Surcharged
6	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	8.950	5.717	8.148	2.431	66.3	2.750	0.000	69.7	68.887	Surcharged
7	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	8.500	5.368	7.958	2.590	122.3	3.706	0.000	115.3	98.445	Surcharged
8	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	8.250	5.119	7.871	2.752	588.9	4.863	0.000	583.2	471.017	Surcharged
9	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	8.050	5.060	7.438	2.378	583.2	4.202	0.000	574.1	470.706	Surcharged

12	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	7.780	4.949	6.763	1.814	680.2	3.205	0.000	668.4	526.940	Surcharged
10	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	7.770	6.145	6.970	0.825	43.0	0.933	0.000	30.4	18.670	Surcharged
11	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	7.690	6.017	6.883	0.866	54.3	0.979	0.000	43.1	28.966	Surcharged
13	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	7.950	4.940	6.480	1.540	668.4	2.721	0.000	658.4	526.795	Surcharged
14	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	7.900	4.923	6.149	1.226	658.4	2.166	0.000	649.9	526.503	Surcharged
15	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	6.600	4.848	5.437	0.589	664.8	1.041	0.000	658.8	532.710	Surcharged
16	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer		4.800	5.034	0.234	658.8			657.2	532.685	OK
19	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	4.400	3.600	3.671	0.071	22.4	0.000	0.000	22.4	25.068	OK
20	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	8.250	5.220	8.005	2.785	465.2	3.150	0.000	466.5	334.565	Surcharged
21	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	8.235	5.485	8.261	2.776	575.1	29.461	26.351	465.2	334.692	Flood
22	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	8.913	5.873	8.438	2.565	297.7	2.902	0.000	298.5	177.828	Surcharged

23	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	9.359	6.448	8.745	2.297	240.7	2.598	0.000	248.7	155.827	Surcharged
24 (1)	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	9.085	6.787	8.992	2.206	182.9	2.495	0.000	194.2	135.363	Surcharged
25 (1)	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	9.091	7.291	9.098	1.807	206.1	8.603	6.567	147.7	89.034	Flood
26	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	8.651	6.842	8.653	1.811	201.8	4.153	2.107	129.9	87.410	Flood
27	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	8.650	6.414	8.512	2.098	129.9	2.373	0.000	130.1	86.549	Surcharged
28	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	8.491	5.752	8.374	2.622	237.5	2.965	0.000	237.2	140.415	Surcharged
29	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	7.940	6.140	7.943	1.803	277.0	4.813	2.777	212.2	120.184	Flood
30	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	7.281	5.325	7.287	1.962	480.5	7.827	5.615	394.1	236.543	Flood
31	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	6.713	4.912	6.271	1.359	415.8	1.537	0.000	414.2	258.268	Surcharged
32	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	6.783	4.703	5.864	1.161	414.2	1.313	0.000	417.6	258.487	Surcharged
33	Sim Criteria FEH: 100 years: +45 %: 960 mins: Winter	4.870	3.887	4.889	1.002	60.4	20.229	19.117	60.2	1380.265	Flood

35	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	7.070	5.344	7.073	1.729	314.5	4.430	2.478	250.3	137.165	Flood
36	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	6.153	4.835	6.198	1.363	499.1	46.407	44.917	317.2	243.692	Flood
37	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	5.865	4.479	5.596	1.117	334.1	1.263	0.000	336.0	276.346	Surcharged
38	Sim Criteria FEH: 100 years: +45 %: 960 mins: Winter	4.824	3.852	4.889	1.037	50.4	66.263	65.163	49.9	1138.772	Flood
39	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	5.427	3.962	4.837	0.875	417.6	0.990	0.000	423.0	255.014	Surcharged

Critical Storm Per Item: Rank By: Max. Flooded Volume

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Attenuation Basin	Sim Criteria FEH: 100 years: +45 %: 960 mins: Winter	4.889	4.889	1.139	1.139	196.9	3461.866	731.176	0.000	23.2	2196.877	-26.776	Flood

Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
1.000	Sim Criteria FEH: 100 years: +45 %: 60 mins: Summer	Pipe	1	2	8.500	8.502	0.150	6.755	1.1	0.8	19.3	Flood
1.001	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	Pipe	2	3	8.600	8.442	0.225	11.336	0.7	0.6	26.5	Surcharged
1.002	Sim Criteria FEH: 100 years: +45 %: 15 mins: Winter	Pipe	3	4	8.810	8.409	0.225	26.044	1.1	0.44	41.8	Surcharged
1.003	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	Pipe	4	5	9.000	8.293	0.225	35.824	1.3	1.24	50.9	Surcharged
1.004	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	Pipe	5	6	9.100	8.198	0.225	46.751	1.5	1.5	61.5	Surcharged
1.005	Sim Criteria FEH: 100 years: +45 %: 60 mins: Summer	Pipe	6	7	8.950	8.123	0.300	118.774	1.2	1.05	82.3	Surcharged

1.006	Sim Criteria FEH: 100 years: +45 %: 30 mins: Summer	Pipe	7	8	8.500	7.927	0.375	132.421	1.1	0.83	126.3	Surcharged
1.007	Sim Criteria FEH: 100 years: +45 %: 15 mins: Winter	Pipe	8	9	8.250	7.832	0.525	471.118	2.7	2.28	584.9	Surcharged
1.008	Sim Criteria FEH: 100 years: +45 %: 15 mins: Winter	Pipe	9	12	8.050	7.391	0.525	470.809	2.7	2.25	574.4	Surcharged
2.000	Sim Criteria FEH: 30 years: +40 %: 15 mins: Summer	Pipe	10	11	7.770	6.304	0.175	14.348	1.0	0.78	32.1	OK
2.001	Sim Criteria FEH: 100 years: +45 %: 30 mins: Summer	Pipe	11	12	7.690	6.857	0.225	38.974	1.7	0.34	44.9	Surcharged
1.009	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	Pipe	12	13	7.780	6.763	0.525	526.940	3.1	2.5	668.4	Surcharged
1.010	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	Pipe	13	14	7.950	6.480	0.525	526.795	3.0	2.52	658.4	Surcharged

1.011	Sim Criteria FEH: 100 years: +45 %: 30 mins: Summer	Pipe	14	15	7.900	6.146	0.525	708.884	3.0	2.57	656.8	Surcharged
1.012	Sim Criteria FEH: 100 years: +45 %: 30 mins: Summer	Pipe	15	16	6.600	5.440	0.414	717.640	3.6	1.77	666.8	Surcharged
1.013	Sim Criteria FEH: 100 years: +45 %: 30 mins: Summer	Pipe	16	Attenuation Basin	5.500	5.036	0.398	717.485	5.6	0.42	666.8	OK
3.000	Sim Criteria FEH: 100 years: +0 %: 15 mins: Winter	Pipe	26	27	8.651	7.047	0.359	60.320	1.5	0.58	139.9	OK
3.001	Sim Criteria FEH: 100 years: +45 %: 30 mins: Summer	Pipe	27	28	8.650	8.521	0.375	116.918	1.5	0.54	131.1	Surcharged
3.002	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	Pipe	28	21	8.491	8.374	0.450	140.279	1.5	0.61	237.2	Surcharged
3.004	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	Pipe	21	20	8.235	8.261	0.525	334.690	2.1	1.09	465.2	Flood

3.005	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	Pipe	20	8	8.250	8.005	0.525	334.565	2.2	1.09	466.5	Surcharged
3.006	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	Pipe	25 (1)	24 (1)	9.091	9.098	0.375	88.958	1.3	0.84	147.7	Flood
3.007	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	Pipe	24 (1)	23	9.085	8.992	0.375	135.287	1.8	0.87	194.2	Surcharged
3.009	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	Pipe	23	22	9.359	8.745	0.450	155.822	1.6	0.72	248.7	Surcharged
3.010	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	Pipe	22	21	8.913	8.438	0.525	177.821	1.4	0.7	298.5	Surcharged
3.011	Sim Criteria FEH: 100 years: +45 %: 15 mins: Winter	Pipe	29	30	7.940	7.942	0.375	120.126	1.9	0.88	212.3	Flood
3.012	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	Pipe	30	31	7.281	7.287	0.375	236.543	3.6	1.69	394.1	Flood

3.013	Sim Criteria FEH: 100 years: +45 %: 15 mins: Winter	Pipe	31	32	6.713	6.247	0.450	258.098	2.6	1.1	415.1	Surcharged
3.016	Sim Criteria FEH: 100 years: +45 %: 15 mins: Winter	Pipe	35	36	7.070	7.071	0.375	133.084	2.3	1.29	250.6	Flood
3.017	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	Pipe	36	37	6.153	6.198	0.375	243.692	2.9	1.63	317.2	Flood
3.018	Sim Criteria FEH: 100 years: +0 %: 15 mins: Winter	Pipe	37	38	5.865	5.323	0.450	188.268	2.2	1.12	352.8	Surcharged
3.020	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	Pipe	32	39	6.783	5.864	0.450	258.487	2.6	1.11	417.6	Surcharged
3.021	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	Pipe	39	33	5.427	4.837	0.525	254.683	2.0	0.75	423.0	Surcharged
3.022	Sim Criteria FEH: 100 years: +45 %: 15 mins: Summer	Pipe	33	Attenuation Basin	4.870	4.650	0.513	431.504	3.8	1.46	819.7	Surcharged

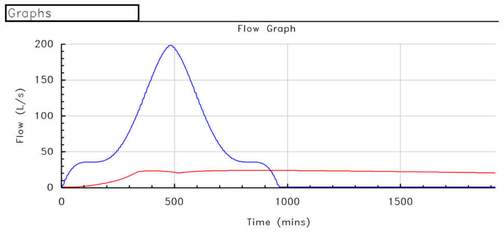
3.023	Sim Criteria FEH: 30 years: +40 %: 15 mins: Summer	Pipe	38	Attenuation Basin	4.824	4.489	0.450	276.439	3.2	1.61	505.8	Surcharged
Outlet	Sim Criteria FEH: 100 years: +45 %: 960 mins: Winter	Pipe	Attenuation Basin	19	4.700	4.889	0.075	2195.888	1.5	0.08	23.2	Flood

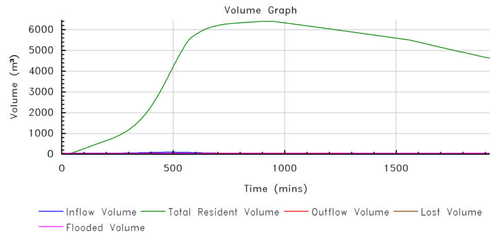
Storm
Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 960 mins: Winter

Tables

Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
19			23.2	2195.888
TOTAL	198.2	4514.726	23.2	2195.888

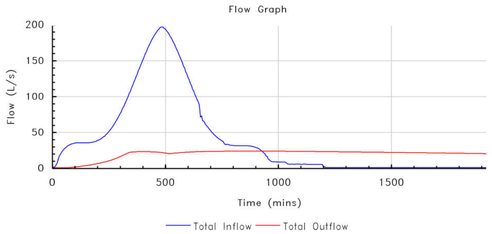
Graphs

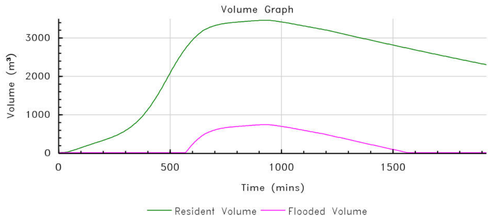


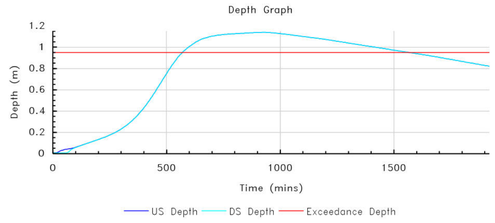


Attenuation Basin — Type : Pond
Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 960 mins: Winter

Graphs







Tables

Time (mins)	Total Inflow (L/s)	US Depth (m)	DS Depth (m)	Resident Volume (m³)	Flooded Volume (m³)	Total Outflow (L/s)
0	0.0	0.000	0.000	0.000	0.000	0.0
5	0.5	0.000	0.000	0.049	0.000	0.0
10	1.0	0.001	0.000	0.272	0.000	0.0
15	3.3	0.002	0.000	0.863	0.000	0.0
20	6.1	0.004	0.000	2.223	0.000	0.0
25	11.2	0.009	0.000	4.697	0.000	0.0
30	15.8	0.016	0.000	8.875	0.000	0.0
35	18.9	0.021	0.000	14.038	0.000	0.0
40	21.4	0.025	0.000	20.098	0.000	0.0
45	23.6	0.028	0.000	26.805	0.000	0.0
50	25.6	0.030	0.000	34.198	0.000	0.0
55	27.5	0.033	0.000	42.102	0.000	0.0
60	28.8	0.035	0.001	50.522	0.000	0.0
65	30.0	0.037	0.003	59.344	0.000	0.0
70	31.1	0.038	0.010	68.507	0.000	0.1
75	32.0	0.040	0.021	77.953	0.000	0.2
80	32.8	0.041	0.030	87.595	0.000	0.3
85	33.4	0.043	0.036	97.396	0.000	0.5
90	33.9	0.046	0.041	107.299	0.000	0.7
95	34.2	0.049	0.046	117.296	0.000	0.8
100	34.5	0.052	0.050	127.342	0.000	1.0
105	34.7	0.056	0.054	137.416	0.000	1.1
110	34.8	0.060	0.058	147.486	0.000	1.3
115	34.9	0.064	0.062	157.526	0.000	1.5
120	34.9	0.067	0.066	167.521	0.000	1.7
125	34.9	0.071	0.070	177.464	0.000	1.9
130	34.9	0.075	0.074	187.358	0.000	2.0
135	34.9	0.079	0.078	197.190	0.000	2.3
140	34.9	0.083	0.082	206.947	0.000	2.5
145	34.9	0.086	0.086	216.621	0.000	2.7
150	34.9	0.090	0.090	226.227	0.000	3.0
155	34.9	0.094	0.093	235.765	0.000	3.2
160	35.0	0.097	0.097	245.242	0.000	3.5
165	35.1	0.101	0.101	254.674	0.000	3.7
170	35.3	0.105	0.105	264.072	0.000	4.0
175	35.6	0.108	0.108	273.457	0.000	4.3
180	35.9	0.112	0.112	282.847	0.000	4.5
185	36.3	0.116	0.115	292.260	0.000	4.8
190	36.7	0.119	0.119	301.720	0.000	5.1
195	37.4	0.123	0.123	311.243	0.000	5.4
200	37.9	0.127	0.127	320.867	0.000	5.7
205	38.8	0.131	0.130	330.599	0.000	6.1
210	39.6	0.134	0.134	340.501	0.000	6.4
215	40.7	0.138	0.138	350.550	0.000	6.7
220	41.6	0.142	0.142	360.835	0.000	7.1
225	43.0	0.146	0.146	371.323	0.000	7.5
230	44.1	0.150	0.150	382.083	0.000	7.9
235	45.6	0.155	0.154	393.086	0.000	8.3

Time (mins)	Total Inflow (L/s)	US Depth (m)	DS Depth (m)	Resident Volume (m³)	Flooded Volume (m³)	Total Outflow (L/s)
240	47.0	0.159	0.159	404.493	0.000	8.7
245	49.1	0.163	0.163	416.188	0.000	9.1
250	50.8	0.168	0.168	428.375	0.000	9.6
255	52.7	0.173	0.173	440.899	0.000	10.1
260	54.8	0.178	0.178	453.975	0.000	10.6
265	57.1	0.183	0.183	467.448	0.000	11.1
270	59.3	0.188	0.188	481.529	0.000	11.7
275	62.1	0.194	0.194	496.069	0.000	12.3
280	64.6	0.200	0.200	511.263	0.000	12.9
285	66.8	0.206	0.205	527.002	0.000	13.5
290	70.1	0.212	0.212	543.445	0.000	14.1
295	73.0	0.218	0.218	560.511	0.000	14.8
300	76.4	0.225	0.225	578.295	0.000	15.5
305	79.0	0.232	0.232	596.784	0.000	16.2
310	82.7	0.239	0.239	616.019	0.000	17.0
315	85.9	0.247	0.246	636.045	0.000	17.7
320	89.3	0.254	0.254	656.827	0.000	18.5
325	92.4	0.262	0.262	678.470	0.000	19.2
330	96.6	0.271	0.271	700.901	0.000	20.0
335	99.7	0.279	0.279	724.289	0.000	20.8
340	104.2	0.288	0.288	748.455	0.000	21.5
345	107.2	0.298	0.298	773.754	0.000	21.7
350	112.0	0.307	0.307	800.003	0.000	21.8
355	114.9	0.317	0.317	827.560	0.000	22.0
360	120.0	0.328	0.328	856.075	0.000	22.1
365	123.0	0.339	0.339	886.006	0.000	22.2
370	128.0	0.350	0.350	916.874	0.000	22.2
375	131.2	0.362	0.362	949.179	0.000	22.3
380	136.0	0.374	0.374	982.448	0.000	22.4
385	139.4	0.386	0.386	1017.121	0.000	22.4
390	143.4	0.399	0.399	1052.715	0.000	22.5
395	146.8	0.412	0.412	1089.556	0.000	22.5
400	151.2	0.426	0.425	1127.443	0.000	22.5
405	154.7	0.439	0.439	1166.638	0.000	22.5
410	158.7	0.454	0.454	1206.867	0.000	22.5
415	162.3	0.468	0.468	1248.305	0.000	22.4
420	166.0	0.483	0.483	1290.799	0.000	22.4
425	169.5	0.498	0.498	1334.471	0.000	22.4
430	172.8	0.514	0.514	1379.058	0.000	22.3
435	176.3	0.530	0.529	1424.730	0.000	22.3
440	179.2	0.546	0.546	1471.407	0.000	22.2
445	182.5	0.562	0.562	1518.990	0.000	22.1
450	184.9	0.578	0.578	1567.501	0.000	22.0
455	187.9	0.595	0.595	1616.776	0.000	22.0
460	189.8	0.612	0.612	1666.891	0.000	21.9
465	192.3	0.629	0.629	1717.628	0.000	21.8
470	193.8	0.646	0.646	1769.082	0.000	21.6
475	195.8	0.664	0.664	1821.032	0.000	21.5
480	196.8	0.681	0.681	1873.534	0.000	21.4
485	196.9	0.699	0.699	1926.217	0.000	21.2
490	196.8	0.716	0.716	1978.962	0.000	21.0
495	195.2	0.733	0.733	2031.542	0.000	20.8

Time (mins)	Total Inflow (L/s)	US Depth (m)	DS Depth (m)	Resident Volume (m³)	Flooded Volume (m³)	Total Outflow (L/s)
500	194.1	0.750	0.750	2083.711	0.000	20.5
505	191.8	0.767	0.767	2135.539	0.000	20.2
510	190.1	0.783	0.783	2186.804	0.000	19.8
515	187.4	0.800	0.800	2237.603	0.000	19.4
520	184.7	0.816	0.816	2287.528	0.000	19.6
525	181.7	0.831	0.831	2336.602	0.000	19.8
530	179.1	0.847	0.847	2384.729	0.000	20.0
535	175.9	0.862	0.862	2431.977	0.000	20.2
540	172.7	0.876	0.876	2478.189	0.000	20.3
545	169.1	0.890	0.890	2523.371	0.000	20.5
550	165.6	0.904	0.904	2567.427	0.000	20.7
555	162.2	0.917	0.917	2610.375	0.000	20.8
560	158.0	0.929	0.929	2652.181	0.000	20.9
565	154.8	0.940	0.940	2692.806	0.000	21.1
570	150.3	0.950	0.950	2732.302	1.611	21.2
575	147.2	0.960	0.960	2770.525	39.835	21.3
580	142.3	0.970	0.970	2807.639	76.949	21.4
585	139.4	0.979	0.979	2843.425	112.734	21.5
590	134.2	0.988	0.988	2878.127	147.437	21.6
595	131.5	0.997	0.997	2911.301	180.610	21.7
600	126.1	1.005	1.005	2943.513	212.825	21.8
605	123.4	1.013	1.013	2974.282	243.592	21.9
610	117.9	1.021	1.021	3003.968	273.277	22.0
615	115.0	1.028	1.028	3032.207	301.517	22.0
620	110.1	1.035	1.035	3059.440	328.750	22.1
625	107.2	1.042	1.042	3085.314	354.624	22.2
630	102.6	1.048	1.048	3110.177	379.487	22.3
635	99.5	1.054	1.054	3133.755	403.065	22.3
640	95.3	1.060	1.060	3156.316	425.625	22.4
645	92.1	1.066	1.066	3177.680	446.989	22.4
650	88.4	1.071	1.071	3198.036	467.346	22.5
655	70.9	1.076	1.076	3216.251	485.560	22.5
660	72.7	1.079	1.079	3230.079	499.389	22.6
665	65.5	1.083	1.083	3244.003	513.312	22.6
670	65.1	1.086	1.086	3257.019	526.329	22.7
675	62.2	1.089	1.089	3269.188	538.498	22.7
680	59.9	1.092	1.092	3280.727	550.037	22.7
685	57.6	1.095	1.095	3291.561	560.870	22.7
690	55.8	1.098	1.098	3301.698	571.007	22.8
695	53.4	1.100	1.100	3311.278	580.587	22.8
700	51.9	1.102	1.102	3320.176	589.485	22.8
705	49.5	1.105	1.105	3328.584	597.893	22.8
710	48.4	1.107	1.107	3336.365	605.674	22.9
715	46.2	1.109	1.109	3343.738	613.047	22.9
720	45.2	1.110	1.110	3350.526	619.836	22.9
725	43.2	1.112	1.112	3356.973	626.282	22.9
730	42.3	1.113	1.113	3362.878	632.188	22.9
735	40.7	1.115	1.115	3368.500	637.809	22.9
740	39.9	1.116	1.116	3373.665	642.975	23.0
745	38.6	1.118	1.118	3378.576	647.886	23.0
750	37.9	1.119	1.119	3383.127	652.436	23.0
755	36.8	1.120	1.120	3387.444	656.754	23.0

Time (mins)	Total Inflow (L/s)	US Depth (m)	DS Depth (m)	Resident Volume (m³)	Flooded Volume (m³)	Total Outflow (L/s)
760	34.2	1.121	1.121	3390.745	660.055	23.0
765	32.3	1.122	1.122	3394.039	663.349	23.0
770	32.8	1.122	1.122	3397.097	666.406	23.0
775	32.7	1.123	1.123	3399.949	669.259	23.0
780	32.1	1.124	1.124	3402.691	672.001	23.0
785	31.6	1.124	1.124	3405.343	674.652	23.0
790	31.4	1.125	1.125	3407.901	677.211	23.0
795	31.2	1.126	1.126	3410.388	679.697	23.1
800	31.1	1.126	1.126	3412.812	682.121	23.1
805	31.0	1.127	1.127	3415.197	684.506	23.1
810	30.9	1.128	1.128	3417.547	686.856	23.1
815	30.8	1.128	1.128	3419.873	689.182	23.1
820	30.8	1.129	1.129	3422.187	691.497	23.1
825	30.8	1.129	1.129	3424.495	693.804	23.1
830	30.8	1.130	1.130	3426.803	696.113	23.1
835	30.8	1.131	1.131	3429.117	698.427	23.1
840	30.8	1.131	1.131	3431.431	700.741	23.1
845	30.8	1.132	1.132	3433.748	703.057	23.1
850	30.8	1.132	1.132	3436.065	705.375	23.1
855	30.8	1.133	1.133	3438.380	707.690	23.1
860	30.8	1.134	1.134	3440.686	709.996	23.1
865	30.7	1.134	1.134	3442.976	712.286	23.1
870	30.6	1.135	1.135	3445.237	714.546	23.1
875	30.4	1.135	1.135	3447.444	716.754	23.2
880	30.1	1.136	1.136	3449.589	718.899	23.2
885	29.9	1.136	1.136	3451.644	720.953	23.2
890	29.5	1.137	1.137	3453.606	722.915	23.2
895	29.0	1.137	1.137	3455.432	724.741	23.2
900	28.4	1.138	1.138	3457.102	726.411	23.2
905	27.7	1.138	1.138	3458.575	727.885	23.2
910	27.0	1.139	1.139	3459.827	729.137	23.2
915	25.9	1.139	1.139	3460.825	730.135	23.2
920	25.1	1.139	1.139	3461.506	730.816	23.2
925	23.5	1.139	1.139	3461.866	731.176	23.2
930	22.6	1.139	1.139	3461.802	731.111	23.2
935	20.5	1.139	1.139	3461.351	730.661	23.2
940	19.4	1.139	1.139	3460.348	729.657	23.2
945	16.7	1.138	1.138	3458.861	728.171	23.2
950	15.5	1.138	1.138	3456.667	725.976	23.2
955	12.0	1.137	1.137	3453.947	723.256	23.2
960	11.1	1.136	1.136	3450.390	719.699	23.2
965	9.3	1.135	1.135	3446.481	715.791	23.2
970	8.7	1.134	1.134	3442.207	711.516	23.1
975	8.3	1.133	1.133	3437.828	707.137	23.1
980	8.3	1.132	1.132	3433.391	702.700	23.1
985	8.2	1.131	1.131	3428.911	698.221	23.1
990	8.1	1.129	1.129	3424.423	693.732	23.1
995	8.1	1.128	1.128	3419.925	689.234	23.1
1000	8.0	1.127	1.127	3415.423	684.732	23.1
1005	8.0	1.126	1.126	3410.915	680.224	23.1
1010	8.0	1.125	1.125	3406.400	675.710	23.0
1015	8.0	1.124	1.124	3401.884	671.194	23.0

Time (mins)	Total Inflow (L/s)	US Depth (m)	DS Depth (m)	Resident Volume (m³)	Flooded Volume (m³)	Total Outflow (L/s)
1020	8.0	1.122	1.122	3397.368	666.678	23.0
1025	8.0	1.121	1.121	3392.854	662.163	23.0
1030	8.0	1.120	1.120	3388.340	657.650	23.0
1035	6.7	1.119	1.119	3383.126	652.436	23.0
1040	5.3	1.117	1.117	3377.824	647.133	23.0
1045	4.9	1.116	1.116	3372.460	641.770	23.0
1050	5.1	1.115	1.115	3367.018	636.327	22.9
1055	4.7	1.113	1.113	3361.600	630.909	22.9
1060	4.8	1.112	1.112	3356.192	625.501	22.9
1065	4.8	1.110	1.110	3350.769	620.079	22.9
1070	4.8	1.109	1.109	3345.363	614.672	22.9
1075	4.9	1.108	1.108	3339.957	609.267	22.9
1080	4.9	1.106	1.106	3334.553	603.863	22.9
1085	4.9	1.105	1.105	3329.154	598.464	22.8
1090	4.9	1.103	1.103	3323.756	593.065	22.8
1095	4.8	1.102	1.102	3318.361	587.670	22.8
1100	4.8	1.101	1.101	3312.968	582.277	22.8
1105	4.8	1.099	1.099	3307.576	576.885	22.8
1110	4.8	1.098	1.098	3302.187	571.496	22.8
1115	4.8	1.096	1.096	3296.801	566.110	22.8
1120	4.8	1.095	1.095	3291.417	560.727	22.7
1125	4.8	1.094	1.094	3286.037	555.346	22.7
1130	4.8	1.092	1.092	3280.660	549.969	22.7
1135	4.8	1.091	1.091	3275.285	544.595	22.7
1140	4.8	1.089	1.089	3269.914	539.223	22.7
1145	4.8	1.088	1.088	3264.542	533.852	22.7
1150	4.8	1.087	1.087	3259.173	528.482	22.7
1155	4.8	1.085	1.085	3253.806	523.115	22.6
1160	4.8	1.084	1.084	3248.442	517.752	22.6
1165	4.8	1.082	1.082	3243.082	512.391	22.6
1170	4.8	1.081	1.081	3237.724	507.034	22.6
1175	4.7	1.080	1.080	3232.370	501.680	22.6
1180	4.7	1.078	1.078	3227.020	496.329	22.6
1185	4.7	1.077	1.077	3221.672	490.981	22.6
1190	4.7	1.076	1.076	3216.328	485.637	22.5
1195	4.7	1.074	1.074	3210.988	480.297	22.5
1200	0.2	1.073	1.073	3204.594	473.903	22.5
1205	1.2	1.071	1.071	3198.071	467.380	22.5
1210	0.0	1.069	1.069	3191.593	460.902	22.5
1215	0.1	1.067	1.067	3184.921	454.231	22.5
1220	0.2	1.066	1.066	3178.237	447.546	22.4
1225	0.3	1.064	1.064	3171.557	440.866	22.4
1230	0.3	1.062	1.062	3164.882	434.191	22.4
1235	0.3	1.061	1.061	3158.213	427.522	22.4
1240	0.2	1.059	1.059	3151.551	420.860	22.4
1245	0.1	1.057	1.057	3144.896	414.206	22.3
1250	0.1	1.055	1.055	3138.248	407.557	22.3
1255	0.1	1.054	1.054	3131.604	400.913	22.3
1260	0.2	1.052	1.052	3124.965	394.275	22.3
1265	0.2	1.050	1.050	3118.331	387.640	22.3
1270	0.2	1.049	1.049	3111.700	381.010	22.3
1275	0.2	1.047	1.047	3105.076	374.385	22.2

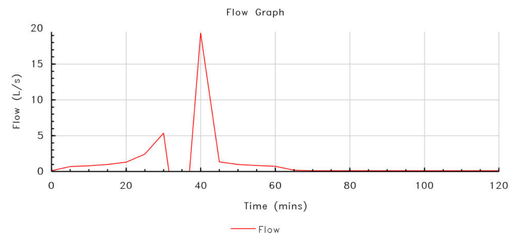
Time (mins)	Total Inflow (L/s)	US Depth (m)	DS Depth (m)	Resident Volume (m³)	Flooded Volume (m³)	Total Outflow (L/s)
1280	0.2	1.045	1.045	3098.457	367.766	22.2
1285	0.2	1.043	1.043	3091.844	361.153	22.2
1290	0.2	1.042	1.042	3085.236	354.546	22.2
1295	0.2	1.040	1.040	3078.634	347.943	22.2
1300	0.2	1.038	1.038	3072.037	341.346	22.1
1305	0.2	1.037	1.037	3065.445	334.755	22.1
1310	0.2	1.035	1.035	3058.858	328.168	22.1
1315	0.2	1.033	1.033	3052.277	321.586	22.1
1320	0.2	1.031	1.031	3045.700	315.010	22.1
1325	0.2	1.030	1.030	3039.129	308.439	22.1
1330	0.2	1.028	1.028	3032.563	301.872	22.0
1335	0.2	1.026	1.026	3026.001	295.310	22.0
1340	0.2	1.025	1.025	3019.444	288.754	22.0
1345	0.2	1.023	1.023	3012.894	282.204	22.0
1350	0.2	1.021	1.021	3006.350	275.660	22.0
1355	0.2	1.020	1.020	2999.812	269.122	22.0
1360	0.2	1.018	1.018	2993.280	262.589	21.9
1365	0.2	1.016	1.016	2986.753	256.062	21.9
1370	0.2	1.015	1.015	2980.232	249.541	21.9
1375	0.2	1.013	1.013	2973.717	243.026	21.9
1380	0.2	1.011	1.011	2967.207	236.517	21.9
1385	0.2	1.009	1.009	2960.703	230.013	21.8
1390	0.2	1.008	1.008	2954.205	223.515	21.8
1395	0.2	1.006	1.006	2947.712	217.022	21.8
1400	0.2	1.004	1.004	2941.226	210.535	21.8
1405	0.2	1.003	1.003	2934.744	204.054	21.8
1410	0.2	1.001	1.001	2928.269	197.579	21.8
1415	0.2	0.999	0.999	2921.800	191.110	21.7
1420	0.2	0.998	0.998	2915.337	184.647	21.7
1425	0.2	0.996	0.996	2908.880	178.190	21.7
1430	0.2	0.994	0.994	2902.429	171.739	21.7
1435	0.2	0.993	0.993	2895.984	165.293	21.7
1440	0.2	0.991	0.991	2889.543	158.853	21.6
1445	0.2	0.989	0.989	2883.109	152.418	21.6
1450	0.2	0.988	0.988	2876.679	145.989	21.6
1455	0.2	0.986	0.986	2870.255	139.565	21.6
1460	0.2	0.984	0.984	2863.837	133.146	21.6
1465	0.2	0.983	0.983	2857.424	126.733	21.5
1470	0.2	0.981	0.981	2851.017	120.326	21.5
1475	0.2	0.979	0.979	2844.616	113.925	21.5
1480	0.2	0.978	0.978	2838.220	107.530	21.5
1485	0.2	0.976	0.976	2831.831	101.140	21.5
1490	0.2	0.974	0.974	2825.447	94.756	21.4
1495	0.2	0.973	0.973	2819.068	88.377	21.4
1500	0.2	0.971	0.971	2812.695	82.004	21.4
1505	0.2	0.970	0.970	2806.327	75.636	21.4
1510	0.2	0.968	0.968	2799.964	69.273	21.4
1515	0.2	0.966	0.966	2793.606	62.916	21.4
1520	0.2	0.965	0.965	2787.253	56.563	21.3
1525	0.2	0.963	0.963	2780.906	50.216	21.3
1530	0.2	0.961	0.961	2774.564	43.874	21.3
1535	0.2	0.960	0.960	2768.228	37.537	21.3

Time (mins)	Total Inflow (L/s)	US Depth (m)	DS Depth (m)	Resident Volume (m³)	Flooded Volume (m³)	Total Outflow (L/s)
1540	0.2	0.958	0.958	2761.896	31.205	21.3
1545	0.1	0.956	0.956	2755.565	24.874	21.2
1550	0.1	0.955	0.955	2749.237	18.546	21.2
1555	0.1	0.953	0.953	2742.913	12.223	21.2
1560	0.1	0.952	0.952	2736.594	5.904	21.2
1565	0.1	0.950	0.950	2730.280	0.000	21.2
1570	0.1	0.948	0.948	2723.972	0.000	21.2
1575	0.1	0.947	0.947	2717.668	0.000	21.1
1580	0.1	0.945	0.945	2711.370	0.000	21.1
1585	0.1	0.943	0.943	2705.078	0.000	21.1
1590	0.1	0.942	0.942	2698.791	0.000	21.1
1595	0.1	0.940	0.940	2692.511	0.000	21.1
1600	0.1	0.938	0.938	2686.237	0.000	21.0
1605	0.1	0.937	0.937	2679.969	0.000	21.0
1610	0.1	0.935	0.935	2673.707	0.000	21.0
1615	0.1	0.933	0.933	2667.451	0.000	21.0
1620	0.1	0.931	0.931	2661.201	0.000	21.0
1625	0.1	0.930	0.930	2654.958	0.000	20.9
1630	0.1	0.928	0.928	2648.719	0.000	20.9
1635	0.1	0.926	0.926	2642.487	0.000	20.9
1640	0.1	0.924	0.924	2636.261	0.000	20.9
1645	0.1	0.923	0.923	2630.041	0.000	20.9
1650	0.1	0.921	0.921	2623.826	0.000	20.9
1655	0.1	0.919	0.919	2617.619	0.000	20.8
1660	0.2	0.917	0.917	2611.418	0.000	20.8
1665	0.2	0.915	0.915	2605.224	0.000	20.8
1670	0.2	0.914	0.914	2599.036	0.000	20.8
1675	0.2	0.912	0.912	2592.855	0.000	20.7
1680	0.2	0.910	0.910	2586.681	0.000	20.7
1685	0.2	0.908	0.908	2580.514	0.000	20.7
1690	0.2	0.906	0.906	2574.354	0.000	20.7
1695	0.2	0.904	0.904	2568.200	0.000	20.7
1700	0.2	0.902	0.902	2562.053	0.000	20.6
1705	0.2	0.900	0.900	2555.914	0.000	20.6
1710	0.2	0.899	0.899	2549.781	0.000	20.6
1715	0.2	0.897	0.897	2543.656	0.000	20.6
1720	0.2	0.895	0.895	2537.537	0.000	20.5
1725	0.2	0.893	0.893	2531.424	0.000	20.5
1730	0.2	0.891	0.891	2525.319	0.000	20.5
1735	0.2	0.889	0.889	2519.220	0.000	20.5
1740	0.2	0.887	0.887	2513.127	0.000	20.5
1745	0.2	0.885	0.885	2507.042	0.000	20.4
1750	0.2	0.883	0.883	2500.963	0.000	20.4
1755	0.2	0.881	0.881	2494.891	0.000	20.4
1760	0.2	0.879	0.879	2488.825	0.000	20.4
1765	0.2	0.878	0.878	2482.767	0.000	20.3
1770	0.2	0.876	0.876	2476.715	0.000	20.3
1775	0.2	0.874	0.874	2470.669	0.000	20.3
1780	0.2	0.872	0.872	2464.630	0.000	20.3
1785	0.2	0.870	0.870	2458.598	0.000	20.3
1790	0.2	0.868	0.868	2452.573	0.000	20.2
1795	0.2	0.866	0.866	2446.553	0.000	20.2

Time (mins)	Total Inflow (L/s)	US Depth (m)	DS Depth (m)	Resident Volume (m³)	Flooded Volume (m³)	Total Outflow (L/s)
1800	0.2	0.864	0.864	2440.541	0.000	20.2
1805	0.2	0.862	0.862	2434.535	0.000	20.2
1810	0.2	0.860	0.860	2428.536	0.000	20.1
1815	0.2	0.859	0.859	2422.544	0.000	20.1
1820	0.2	0.857	0.857	2416.559	0.000	20.1
1825	0.2	0.855	0.855	2410.582	0.000	20.1
1830	0.2	0.853	0.853	2404.612	0.000	20.1
1835	0.2	0.851	0.851	2398.650	0.000	20.0
1840	0.2	0.849	0.849	2392.695	0.000	20.0
1845	0.2	0.847	0.847	2386.748	0.000	20.0
1850	0.2	0.845	0.845	2380.808	0.000	20.0
1855	0.2	0.843	0.843	2374.876	0.000	19.9
1860	0.2	0.842	0.842	2368.951	0.000	19.9
1865	0.2	0.840	0.840	2363.034	0.000	19.9
1870	0.2	0.838	0.838	2357.124	0.000	19.9
1875	0.2	0.836	0.836	2351.221	0.000	19.8
1880	0.2	0.834	0.834	2345.324	0.000	19.8
1885	0.2	0.832	0.832	2339.435	0.000	19.8
1890	0.2	0.830	0.830	2333.552	0.000	19.8
1895	0.2	0.828	0.828	2327.676	0.000	19.8
1900	0.2	0.827	0.827	2321.807	0.000	19.7
1905	0.2	0.825	0.825	2315.944	0.000	19.7
1910	0.2	0.823	0.823	2310.088	0.000	19.7
1915	0.2	0.821	0.821	2304.239	0.000	19.7
1920	0.2	0.819	0.819	2298.368	0.000	19.7

1.000 Type : Pipe
Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 60 mins: Summer

Graphs

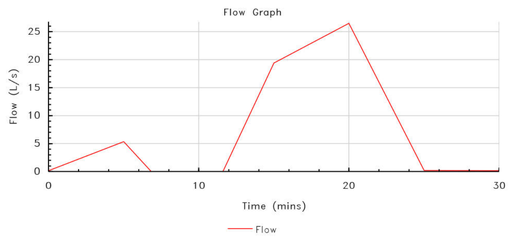


Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.023	0.6
10	0.026	0.7
15	0.028	0.9
20	0.033	1.2
25	0.046	2.3
30	0.070	5.3
35	0.150	-13.2
40	0.150	19.3
45	0.035	1.3
50	0.029	0.9
55	0.026	0.7
60	0.024	0.6
65	0.010	0.1
70	0.003	0.0
75	0.002	0.0
80	0.001	0.0
85	0.001	0.0
90	0.001	0.0
95	0.001	0.0
100	0.001	0.0
105	0.001	0.0
110	0.001	0.0
115	0.001	0.0
120	0.001	0.0

1.001 Type : Pipe
Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Graphs

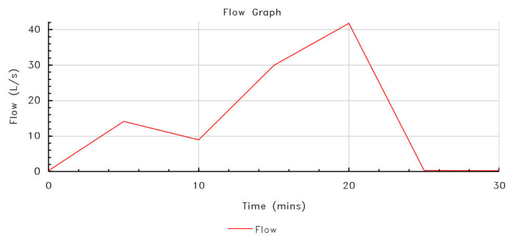


Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.054	5.3
10	0.225	-9.4
15	0.225	19.3
20	0.218	26.5
25	0.006	0.1
30	0.002	0.0

1.002 Type : Pipe
Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Winter

Graphs

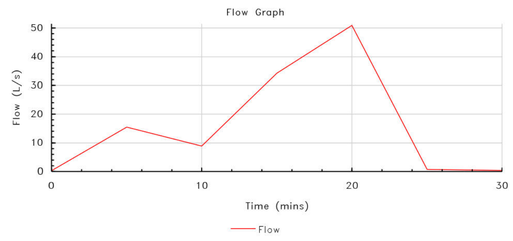


Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.083	14.0
10	0.225	8.8
15	0.225	29.9
20	0.225	41.8
25	0.011	0.1
30	0.005	0.0

1.003 Type : Pipe
Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Graphs

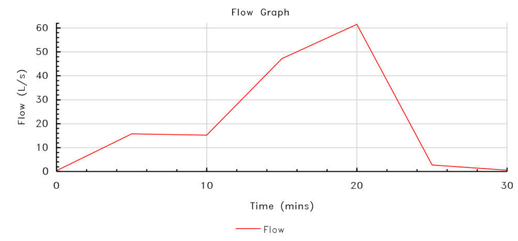


Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.101	15.3
10	0.225	8.7
15	0.225	34.2
20	0.225	50.9
25	0.027	0.5
30	0.011	0.1

1.004 Type : Pipe
Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Graphs



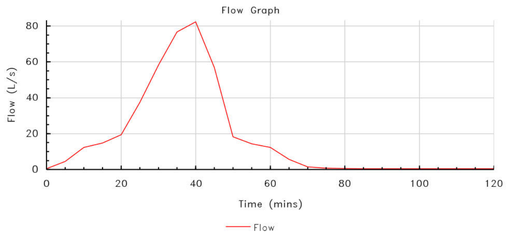
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.098	15.5
10	0.225	14.9
15	0.225	47.1
20	0.225	61.5
25	0.037	2.4
30	0.014	0.3

1.005 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 60 mins: Summer

Graphs



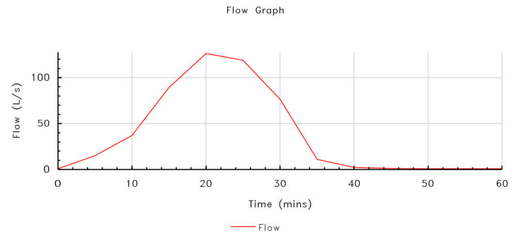
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.047	4.1
10	0.080	12.0
15	0.088	14.4
20	0.102	19.1
25	0.161	37.2
30	0.300	58.2
35	0.300	76.7
40	0.300	82.3
45	0.300	56.8
50	0.098	17.9
55	0.086	13.9
60	0.079	11.9
65	0.052	5.3
70	0.024	1.0
75	0.013	0.3
80	0.008	0.1
85	0.005	0.1
90	0.004	0.0
95	0.003	0.0
100	0.002	0.0
105	0.002	0.0
110	0.001	0.0
115	0.001	0.0
120	0.001	0.0

1.006 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 30 mins: Summer

Graphs



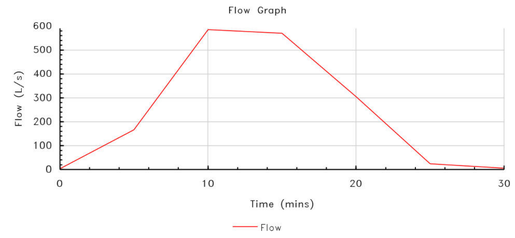
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.080	14.4
10	0.180	36.4
15	0.375	89.1
20	0.375	126.3
25	0.375	118.9
30	0.375	76.3
35	0.066	10.3
40	0.027	1.6
45	0.015	0.4
50	0.008	0.2
55	0.005	0.1
60	0.004	0.1

1.007 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Winter

Graphs



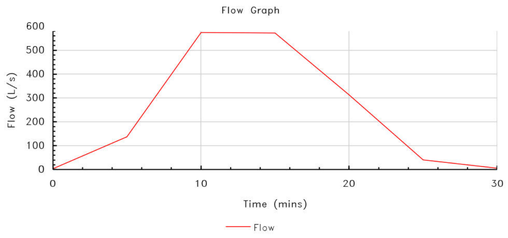
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.324	163.9
10	0.525	584.9
15	0.525	569.8
20	0.525	304.1
25	0.122	21.2
30	0.037	2.1

1.008 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Winter

Graphs



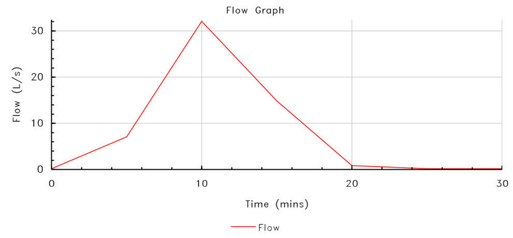
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.321	134.8
10	0.525	574.4
15	0.525	572.8
20	0.525	312.4
25	0.165	38.1
30	0.046	3.1

2.000 Type : Pipe

Critical Storm: Sim Criteria FEH: 30 years: Increase Rainfall (%): +40: 15 mins: Summer

Graphs



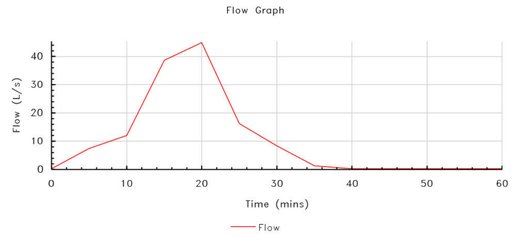
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.055	6.9
10	0.175	32.1
15	0.131	14.8
20	0.018	0.7
25	0.003	0.0
30	0.001	0.0

2.001 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 30 mins: Summer

Graphs



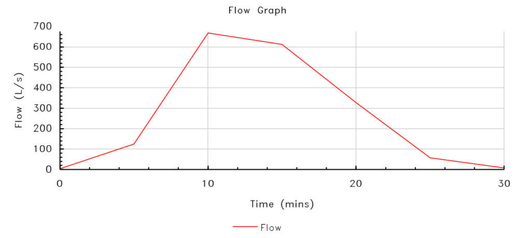
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.036	7.2
10	0.069	11.9
15	0.225	38.7
20	0.225	44.9
25	0.225	16.1
30	0.184	8.2
35	0.014	1.0
40	0.003	0.0
45	0.001	0.0
50	0.000	0.0
55	0.000	0.0
60	0.000	0.0

1.009 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Graphs



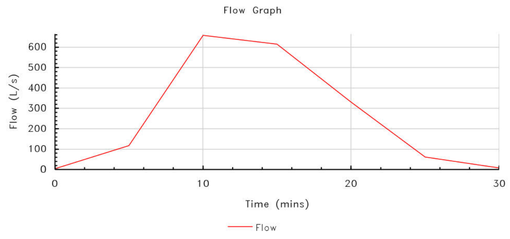
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.288	121.1
10	0.525	668.4
15	0.525	611.5
20	0.525	325.2
25	0.195	54.3
30	0.053	4.4

1.010 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Graphs



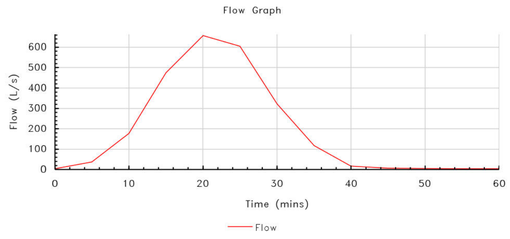
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.257	114.4
10	0.525	658.4
15	0.525	613.9
20	0.525	329.7
25	0.182	58.1
30	0.054	4.8

1.011 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 30 mins: Summer

Graphs



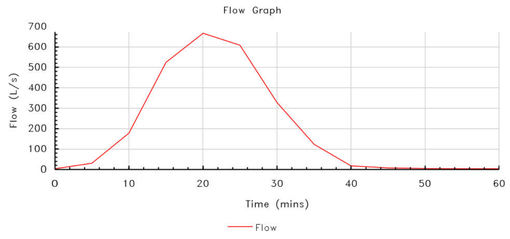
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.119	33.7
10	0.283	175.0
15	0.525	473.8
20	0.525	656.8
25	0.525	603.9
30	0.446	320.6
35	0.220	113.7
40	0.076	13.4
45	0.040	3.3
50	0.026	1.3
55	0.019	0.6
60	0.015	0.4

1.012 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 30 mins: Summer

Graphs



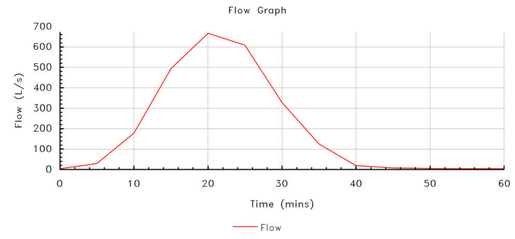
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.074	27.6
10	0.184	175.0
15	0.347	523.5
20	0.414	666.8
25	0.379	607.6
30	0.269	325.8
35	0.147	120.9
40	0.052	14.9
45	0.027	3.7
50	0.018	1.4
55	0.013	0.7
60	0.010	0.4

1.013 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 30 mins: Summer

Graphs



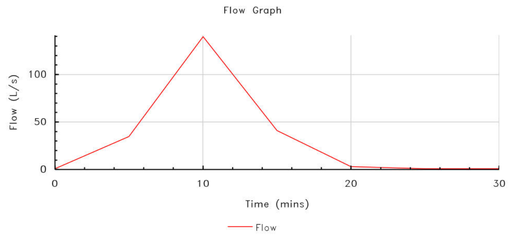
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.044	26.4
10	0.119	174.6
15	0.224	492.8
20	0.313	666.8
25	0.389	607.8
30	0.398	326.3
35	0.382	122.1
40	0.355	15.1
45	0.346	3.8
50	0.343	1.5
55	0.340	0.7
60	0.338	0.4

3.000 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +0: 15 mins: Winter

Graphs



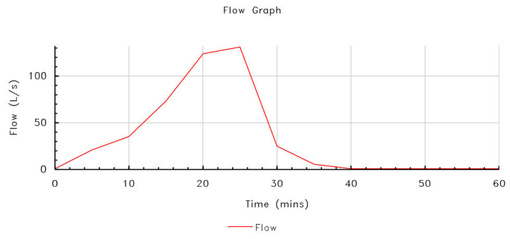
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.096	34.1
10	0.359	139.9
15	0.255	40.3
20	0.033	2.2
25	0.005	0.0
30	0.003	0.0

3.001 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 30 mins: Summer

Graphs



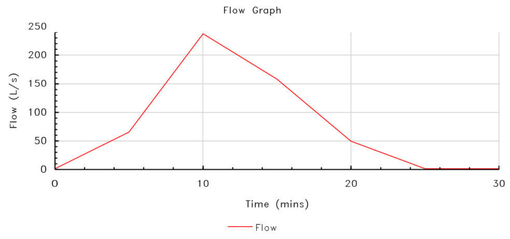
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.074	20.1
10	0.098	34.8
15	0.375	73.0
20	0.375	123.8
25	0.375	131.1
30	0.120	24.4
35	0.036	4.7
40	0.007	0.2
45	0.003	0.0
50	0.001	0.0
55	0.000	0.0
60	0.000	0.0

3.002 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Graphs



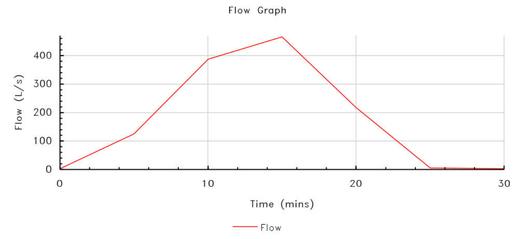
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.177	64.6
10	0.450	237.2
15	0.450	157.6
20	0.450	48.6
25	0.021	0.3
30	0.009	0.1

3.004 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Graphs

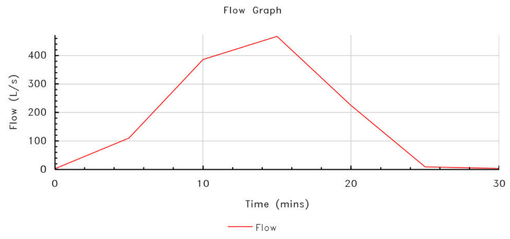


Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.228	123.1
10	0.525	387.1
15	0.525	465.2
20	0.525	216.5
25	0.038	3.4
30	0.016	0.6

3.005 Type : Pipe
Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Graphs

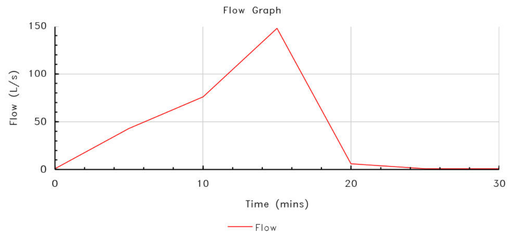


Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.275	108.1
10	0.525	385.5
15	0.525	466.5
20	0.525	223.9
25	0.079	6.6
30	0.025	0.8

3.006 Type : Pipe
Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Graphs

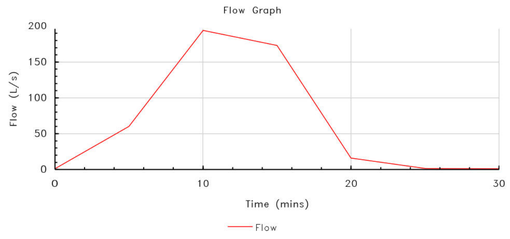


Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.136	42.5
10	0.375	75.5
15	0.375	147.7
20	0.054	5.2
25	0.010	0.1
30	0.005	0.0

3.007 Type : Pipe
Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Graphs

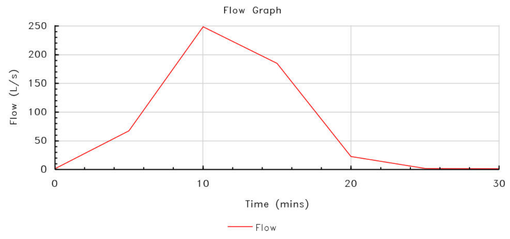


Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.138	59.5
10	0.375	194.2
15	0.375	173.1
20	0.065	14.9
25	0.012	0.4
30	0.005	0.1

3.009 Type : Pipe
Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Graphs

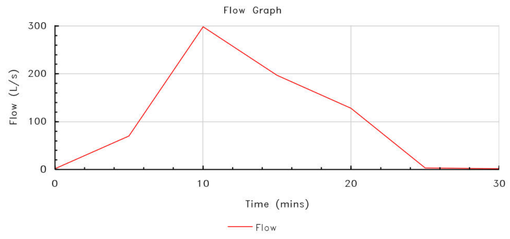


Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.141	66.3
10	0.450	248.7
15	0.450	184.7
20	0.158	21.7
25	0.019	0.7
30	0.009	0.1

3.010 Type : Pipe
Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Graphs

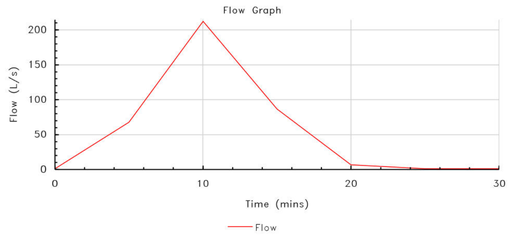


Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.180	69.0
10	0.525	298.5
15	0.525	196.3
20	0.417	127.4
25	0.028	1.5
30	0.013	0.3

3.011 Type : Pipe
Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Winter

Graphs

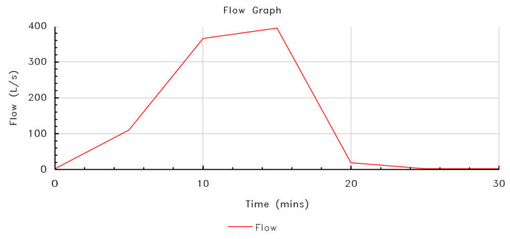


Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.176	67.0
10	0.375	212.3
15	0.276	86.2
20	0.054	5.6
25	0.007	0.1
30	0.003	0.0

3.012 Type : Pipe
Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Graphs

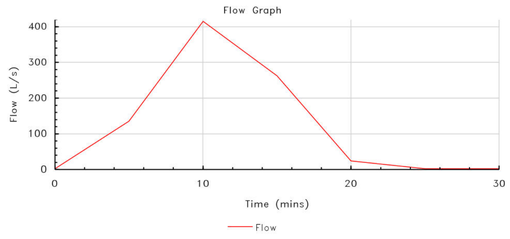


Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.189	108.3
10	0.375	365.7
15	0.375	394.1
20	0.068	17.1
25	0.010	0.3
30	0.004	0.1

3.013 Type : Pipe
Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Winter

Graphs



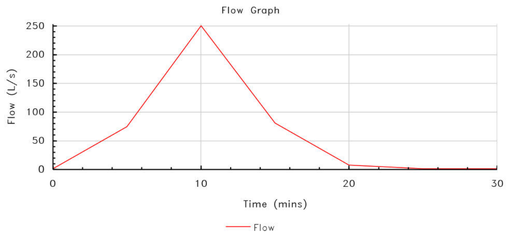
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.196	134.1
10	0.450	415.1
15	0.349	261.9
20	0.078	21.9
25	0.013	0.4
30	0.006	0.1

3.016 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Winter

Graphs



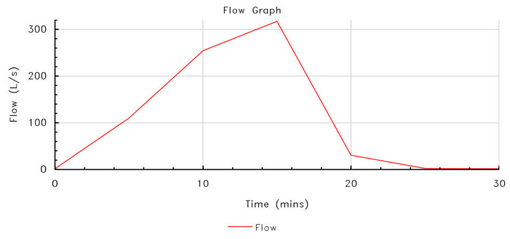
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.202	73.8
10	0.375	250.6
15	0.375	80.2
20	0.066	6.6
25	0.010	0.1
30	0.005	0.0

3.017 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Graphs



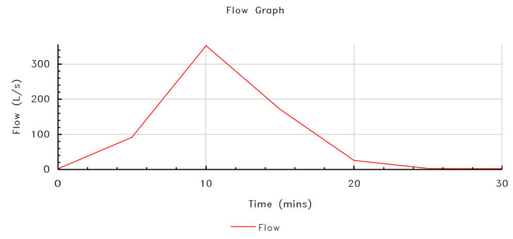
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.211	108.9
10	0.375	253.9
15	0.375	317.2
20	0.095	29.1
25	0.014	0.5
30	0.005	0.1

3.018 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +0: 15 mins: Winter

Graphs



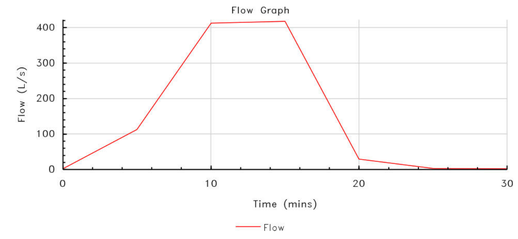
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.185	90.3
10	0.450	352.8
15	0.285	170.5
20	0.163	23.8
25	0.140	1.0
30	0.134	0.2

3.020 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Graphs



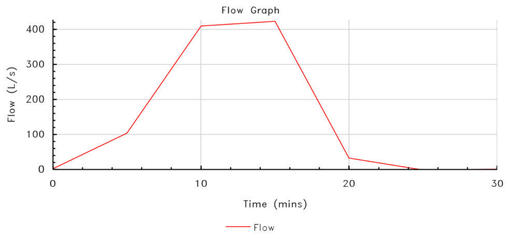
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.239	111.1
10	0.450	412.3
15	0.450	417.6
20	0.178	27.6
25	0.158	0.9
30	0.155	0.2

3.021 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Graphs



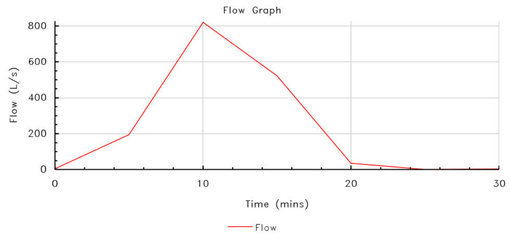
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.206	102.5
10	0.525	409.5
15	0.502	423.0
20	0.251	30.9
25	0.275	−3.3
30	0.277	−1.0

3.022 Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Graphs



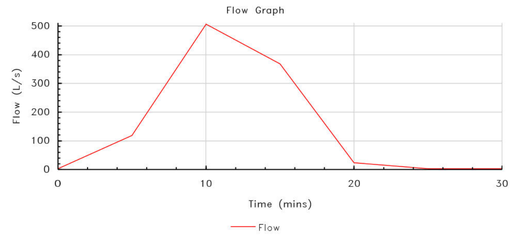
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.155	190.3
10	0.513	819.7
15	0.446	521.1
20	0.422	30.7
25	0.446	−4.3
30	0.448	−1.3

3.023 Type : Pipe

Critical Storm: Sim Criteria FEH: 30 years: Increase Rainfall (%): +40: 15 mins: Summer

Graphs



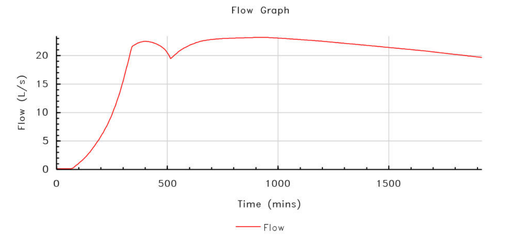
Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.130	116.2
10	0.435	505.8
15	0.450	367.4
20	0.340	21.2
25	0.352	0.0
30	0.351	0.0

Outlet Type : Pipe

Critical Storm: Sim Criteria FEH: 100 years: Increase Rainfall (%): +45: 960 mins: Winter

Graphs



Tables

Time (mins)	Depth (m)	Flow (L/s)
0	0.000	0.0
5	0.000	0.0
10	0.000	0.0
15	0.000	0.0
20	0.000	0.0
25	0.000	0.0
30	0.000	0.0
35	0.000	0.0
40	0.000	0.0
45	0.000	0.0
50	0.000	0.0
55	0.000	0.0
60	0.000	0.0
65	0.002	0.0
70	0.004	0.1
75	0.007	0.2
80	0.010	0.3
85	0.012	0.5
90	0.013	0.7
95	0.015	0.8
100	0.016	1.0
105	0.017	1.1
110	0.018	1.3

E-W LINK STRATEGY:
Climate Change Allowance
Results

Date: 22/09/2023
Designed by: UKJXB042
Checked by:
Approved By:

Report Details:
Type: Connection Results
Storm Phase: Storm

Company Address:

DRN

Time (mins)	Depth (m)	Flow (L/s)
115	0.020	1.5
120	0.021	1.7
125	0.022	1.9
130	0.023	2.0
135	0.024	2.3
140	0.025	2.5
145	0.026	2.7
150	0.027	3.0
155	0.028	3.2
160	0.029	3.5
165	0.030	3.7
170	0.031	4.0
175	0.032	4.3
180	0.033	4.5
185	0.034	4.8
190	0.035	5.1
195	0.036	5.4
200	0.037	5.7
205	0.038	6.1
210	0.039	6.4
215	0.040	6.7
220	0.041	7.1
225	0.043	7.5
230	0.044	7.9
235	0.045	8.3
240	0.046	8.7
245	0.047	9.1
250	0.048	9.6
255	0.049	10.1
260	0.051	10.6
265	0.052	11.1
270	0.053	11.7
275	0.054	12.3
280	0.056	12.9
285	0.057	13.5
290	0.058	14.1
295	0.060	14.8
300	0.061	15.5
305	0.063	16.2
310	0.064	17.0
315	0.066	17.7
320	0.067	18.5
325	0.068	19.2
330	0.070	20.0
335	0.071	20.8
340	0.073	21.5
345	0.073	21.7
350	0.073	21.8
355	0.073	22.0
360	0.073	22.1
365	0.074	22.2
370	0.074	22.2
375	0.074	22.3
380	0.074	22.4

E-W LINK STRATEGY:
Climate Change Allowance
Results

Date: 22/09/2023
Designed by: UKJXB042
Checked by:
Approved By:

Report Details:
Type: Connection Results
Storm Phase: Storm

Company Address:

DRN

Time (mins)	Depth (m)	Flow (L/s)
385	0.074	22.4
390	0.074	22.5
395	0.074	22.5
400	0.074	22.5
405	0.074	22.5
410	0.074	22.5
415	0.074	22.4
420	0.074	22.4
425	0.074	22.4
430	0.074	22.3
435	0.074	22.3
440	0.074	22.2
445	0.074	22.1
450	0.073	22.0
455	0.073	22.0
460	0.073	21.9
465	0.073	21.8
470	0.073	21.6
475	0.072	21.5
480	0.072	21.4
485	0.072	21.2
490	0.072	21.0
495	0.071	20.8
500	0.071	20.5
505	0.070	20.2
510	0.069	19.8
515	0.069	19.4
520	0.069	19.6
525	0.069	19.8
530	0.070	20.0
535	0.070	20.2
540	0.070	20.3
545	0.071	20.5
550	0.071	20.7
555	0.071	20.8
560	0.071	20.9
565	0.072	21.1
570	0.072	21.2
575	0.072	21.3
580	0.072	21.4
585	0.072	21.5
590	0.073	21.6
595	0.073	21.7
600	0.073	21.8
605	0.073	21.9
610	0.073	22.0
615	0.073	22.0
620	0.074	22.1
625	0.074	22.2
630	0.074	22.3
635	0.074	22.3
640	0.074	22.4
645	0.074	22.4
650	0.074	22.5

E-W LINK STRATEGY:
Climate Change Allowance
Results

Date: 22/09/2023
Designed by: UKJXB042
Checked by:
Approved By:

Report Details:
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Storm Phase: Storm

Company Address:

DRN

Time (mins)	Depth (m)	Flow (L/s)
655	0.074	22.5
660	0.074	22.6
665	0.074	22.6
670	0.074	22.7
675	0.074	22.7
680	0.075	22.7
685	0.075	22.7
690	0.075	22.8
695	0.075	22.8
700	0.075	22.8
705	0.075	22.8
710	0.075	22.9
715	0.075	22.9
720	0.075	22.9
725	0.075	22.9
730	0.075	22.9
735	0.075	22.9
740	0.075	23.0
745	0.075	23.0
750	0.075	23.0
755	0.075	23.0
760	0.075	23.0
765	0.075	23.0
770	0.075	23.0
775	0.075	23.0
780	0.075	23.0
785	0.075	23.0
790	0.075	23.0
795	0.075	23.1
800	0.075	23.1
805	0.075	23.1
810	0.075	23.1
815	0.075	23.1
820	0.075	23.1
825	0.075	23.1
830	0.075	23.1
835	0.075	23.1
840	0.075	23.1
845	0.075	23.1
850	0.075	23.1
855	0.075	23.1
860	0.075	23.1
865	0.075	23.1
870	0.075	23.1
875	0.075	23.2
880	0.075	23.2
885	0.075	23.2
890	0.075	23.2
895	0.075	23.2
900	0.075	23.2
905	0.075	23.2
910	0.075	23.2
915	0.075	23.2
920	0.075	23.2

E-W LINK STRATEGY:
Climate Change Allowance
Results

Date: 22/09/2023
Designed by: UKJXB042
Checked by:
Approved By:

Report Details:
Type: Connection Results
Storm Phase: Storm

Company Address:

DRN

Time (mins)	Depth (m)	Flow (L/s)
925	0.075	23.2
930	0.075	23.2
935	0.075	23.2
940	0.075	23.2
945	0.075	23.2
950	0.075	23.2
955	0.075	23.2
960	0.075	23.2
965	0.075	23.2
970	0.075	23.1
975	0.075	23.1
980	0.075	23.1
985	0.075	23.1
990	0.075	23.1
995	0.075	23.1
1000	0.075	23.1
1005	0.075	23.1
1010	0.075	23.0
1015	0.075	23.0
1020	0.075	23.0
1025	0.075	23.0
1030	0.075	23.0
1035	0.075	23.0
1040	0.075	23.0
1045	0.075	23.0
1050	0.075	22.9
1055	0.075	22.9
1060	0.075	22.9
1065	0.075	22.9
1070	0.075	22.9
1075	0.075	22.9
1080	0.075	22.9
1085	0.075	22.8
1090	0.075	22.8
1095	0.075	22.8
1100	0.075	22.8
1105	0.075	22.8
1110	0.075	22.8
1115	0.075	22.8
1120	0.075	22.7
1125	0.075	22.7
1130	0.075	22.7
1135	0.075	22.7
1140	0.075	22.7
1145	0.074	22.7
1150	0.074	22.7
1155	0.074	22.6
1160	0.074	22.6
1165	0.074	22.6
1170	0.074	22.6
1175	0.074	22.6
1180	0.074	22.6
1185	0.074	22.6
1190	0.074	22.5

E-W LINK STRATEGY:
Climate Change Allowance
Results

Date: 22/09/2023
Designed by: UKJXB042
Checked by:
Approved By:

Report Details:
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Storm Phase: Storm

Company Address:

DRN

Time (mins)	Depth (m)	Flow (L/s)
1195	0.074	22.5
1200	0.074	22.5
1205	0.074	22.5
1210	0.074	22.5
1215	0.074	22.5
1220	0.074	22.4
1225	0.074	22.4
1230	0.074	22.4
1235	0.074	22.4
1240	0.074	22.4
1245	0.074	22.3
1250	0.074	22.3
1255	0.074	22.3
1260	0.074	22.3
1265	0.074	22.3
1270	0.074	22.3
1275	0.074	22.2
1280	0.074	22.2
1285	0.074	22.2
1290	0.074	22.2
1295	0.074	22.2
1300	0.074	22.1
1305	0.074	22.1
1310	0.074	22.1
1315	0.073	22.1
1320	0.073	22.1
1325	0.073	22.1
1330	0.073	22.0
1335	0.073	22.0
1340	0.073	22.0
1345	0.073	22.0
1350	0.073	22.0
1355	0.073	22.0
1360	0.073	21.9
1365	0.073	21.9
1370	0.073	21.9
1375	0.073	21.9
1380	0.073	21.9
1385	0.073	21.8
1390	0.073	21.8
1395	0.073	21.8
1400	0.073	21.8
1405	0.073	21.8
1410	0.073	21.8
1415	0.073	21.7
1420	0.073	21.7
1425	0.073	21.7
1430	0.073	21.7
1435	0.073	21.7
1440	0.073	21.6
1445	0.073	21.6
1450	0.073	21.6
1455	0.073	21.6
1460	0.073	21.6

E-W LINK STRATEGY:
Climate Change Allowance
Results

Date: 22/09/2023
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Checked by:
Approved By:

Report Details:
Type: Connection Results
Storm Phase: Storm

Company Address:

DRN

Time (mins)	Depth (m)	Flow (L/s)
1465	0.073	21.5
1470	0.072	21.5
1475	0.072	21.5
1480	0.072	21.5
1485	0.072	21.5
1490	0.072	21.4
1495	0.072	21.4
1500	0.072	21.4
1505	0.072	21.4
1510	0.072	21.4
1515	0.072	21.4
1520	0.072	21.3
1525	0.072	21.3
1530	0.072	21.3
1535	0.072	21.3
1540	0.072	21.3
1545	0.072	21.2
1550	0.072	21.2
1555	0.072	21.2
1560	0.072	21.2
1565	0.072	21.2
1570	0.072	21.2
1575	0.072	21.1
1580	0.072	21.1
1585	0.072	21.1
1590	0.072	21.1
1595	0.072	21.1
1600	0.072	21.0
1605	0.072	21.0
1610	0.072	21.0
1615	0.072	21.0
1620	0.072	21.0
1625	0.071	20.9
1630	0.071	20.9
1635	0.071	20.9
1640	0.071	20.9
1645	0.071	20.9
1650	0.071	20.9
1655	0.071	20.8
1660	0.071	20.8
1665	0.071	20.8
1670	0.071	20.8
1675	0.071	20.7
1680	0.071	20.7
1685	0.071	20.7
1690	0.071	20.7
1695	0.071	20.7
1700	0.071	20.6
1705	0.071	20.6
1710	0.071	20.6
1715	0.071	20.6
1720	0.071	20.5
1725	0.071	20.5
1730	0.071	20.5

E-W LINK STRATEGY:
Climate Change Allowance
Results

Date: 22/09/2023
Designed by: UKJXB042
Checked by:
Approved By:

Report Details:
Type: Connection Results
Storm Phase: Storm

Company Address:

DRN

Time (mins)	Depth (m)	Flow (L/s)
1735	0.071	20.5
1740	0.071	20.5
1745	0.071	20.4
1750	0.071	20.4
1755	0.071	20.4
1760	0.070	20.4
1765	0.070	20.3
1770	0.070	20.3
1775	0.070	20.3
1780	0.070	20.3
1785	0.070	20.3
1790	0.070	20.2
1795	0.070	20.2
1800	0.070	20.2
1805	0.070	20.2
1810	0.070	20.1
1815	0.070	20.1
1820	0.070	20.1
1825	0.070	20.1
1830	0.070	20.1
1835	0.070	20.0
1840	0.070	20.0
1845	0.070	20.0
1850	0.070	20.0
1855	0.070	19.9
1860	0.070	19.9
1865	0.070	19.9
1870	0.070	19.9
1875	0.070	19.8
1880	0.070	19.8
1885	0.069	19.8
1890	0.069	19.8
1895	0.069	19.8
1900	0.069	19.7
1905	0.069	19.7
1910	0.069	19.7
1915	0.069	19.7
1920	0.069	19.7

TITLE: **Land at Westergate Drainage - Basin Volume Assessment**

QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks				
Date	07.07.2023	15.09.2023	07.06.2024	
Prepared by	J Blavignac	J Blavignac	J Blavignac	
Checked by		L.Beeching	L.Beeching	
Authorised by		Bruno Venturini	L.Beeching	
Project number	70013258	70013258	70013258	
Report number				
File reference	LAW-WSP-XX-XX-C-CA-00001	LAW-WSP-XX-XX-C-CA-00001	LAW-WSP-XX-XX-C-CA-00001	

NOTES:
The calculations include Greenfield runoff calc, Quick Storage Estimate (FEH2022) and Pond Sizing and are based on Thrive Architects layout CALA230719-ASKL-01 REV .P3 (31.07.23)

Westergate -Qbar & QSE Assessment

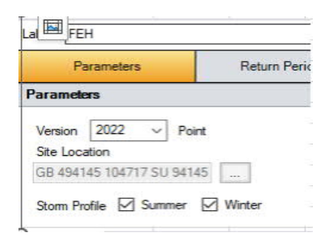
Catchment	Top North Parcel	Central Residential	Central Main Road	Southern Parcel (HA)	Site
Extended Catchment Area (ha) - (B)	1.912	5.03	0.915	5.691	13.548
%Imp assumed for current Strategy (D)	60%	60%	80%	60%	
Max Discharge to Qbar (l/s) (BxQ)	7.27	22.59		21.63	51.48
Area without Basin (F) #	1.576	4.61		5.17	
Residential Land Parcel Occupancy (G) ##	0.41	0.41		0.41	
Residential Land Parcel Area (FXG)	0.65	1.89		2.12	
Urban Creep from Resi Area (6%) (FxGx6%)###	0.04	0.11		0.13	
Imp Area assumed for QSE (ha) - (BxD)+(FxGx6%)	1.19	3.131	0.732	3.54	8.59
QSE30yr+40%	746 to 968m3	2446 to 3164m3		2219 to 2878m3	
QSE100yr+45%	1020 to 1304m3	3338 to 4257m3		3035 to 3880m3	
Volume Required (Averaged QSE)	Vol Required at Freeboard:(746+968)/2=857m3 (1) Vol Required at Crest: (1020+1304)/2=1162m3 (2)	Volume Required at Freeboard:(2446+3164)/2=2805m3 (1) Volume Required at Crest: (3338+4257)/2=3,797m3 (2)		Vol Required at Freeboard:(2219+2878)/2=2548m3 (1) Vol Required at Crest: (3035+3880)/2=3457m3 (2)	
Basin Volumes (Base extended or Gabion Wall on 1 side included)	(Base Extension) 732m3 at freeboard (5), 1186m3 at crest(6)	(Extended Base) 1781m3 at freeboard, (5) 2715m3 at crest (6)		(Gabion Walls) 2522m3 at freeboard (5), 3399m3 at Crest (6)	
Shortage	Shortage of +/-149m3 (1)-(5), No Shortage at crest (2)-(6)	Shortage of +/-1024m3, (1)-(5) Shortage of 1082m3 at crest (2)-(6)		Shortage of +/- 26m3 (1)-(5) Shortage of +/- 58m3 (2)-(6)	
Minimum Additional Storage to be provided (Tank Perv Pav, Raingarden & Tree pit corridor)	150m3 of effective storage.Area to be made available for Tanked Perv Paving, Raingardens & Tree Pits Corridors	1082m3 of effective storage. Area to be made available for Tanked Perv Paving, Raingardens & Tree Pits Corridors		58m3 of effective storage. Area to be made available for Tanked Perv Paving, Raingardens & Tree Pits Corridors	

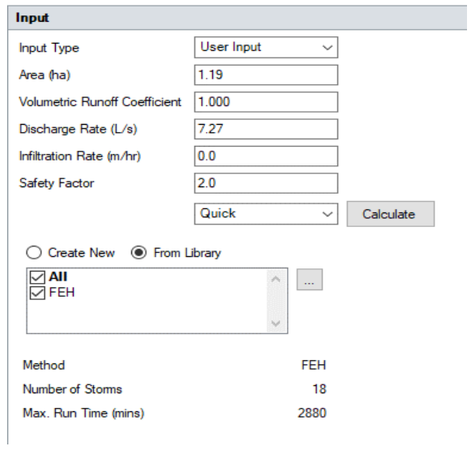
ICPSUDS (IH124)	l/s/ha
Qbar (Q)	3.8
Q1	3.2
Q2	3.3
Q30	8.6
Q100	12.1

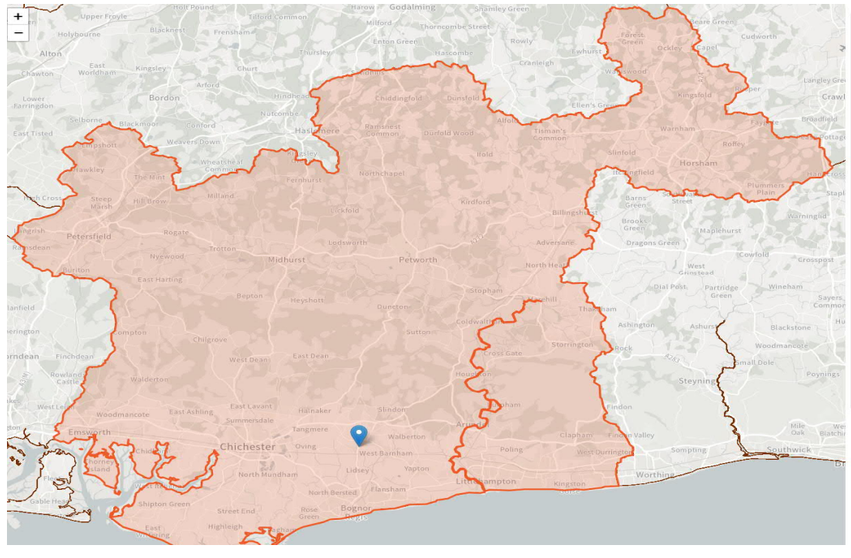
Note: # Area taken from drawing LAW-WSP-ZZ-ZZ-C-DR-05000.

##Based on assesment made on LAW-WSP-XX-XX-C-SK-004

Urban Creep factor of 6% obtained from Lasoo Report for Dwelling density of 35 dwelling per ha







Arun and Western Streams Management Catchment peak rainfall allowances

3.3% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	35%
2070s	25%	40%

1% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	45%
2070s	25%	45%

*Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125.

This map contains information generated by Met Office Hadley Centre (2019): UKCP Local Projections on a 5km grid over the UK for 1980-2080. Centre for Environmental Data Analysis, 2022

ICP SUDS Mean Annual Flood

Input

Return Period (years)	2	Soil	0.400
Area (ha)	1.000	Urban	0.000
SAAR (mm)	766	Region Number	Region 7

Results l/s

QBAR Rural	3.8
QBAR Urban	3.8
Q2 years	3.3
Q1 year	3.2
Q30 years	8.6
Q100 years	12.1

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Basin 1 Volume Calc

13/09/2023

J.Blavignac

Basin Levels from 6.6 to 5.70m AOD	Contours (m AOD)	Area (m2)	Volume Per Slice of elevation (m3)	Cumulative Volume from base (m3)
	5.70	1031	0.0	0.0
	5.80	1092	106.2	106.2
	5.90	1155	112.4	218.5
	6.00	1219	118.7	337.2
	6.10	1283	125.1	462.3
	6.20	1349	131.6	593.9
	6.30	1415	138.2	732.1
	6.40	1481	144.8	876.9
	6.50	1549	151.5	1028.4
	6.60	1618	158.3	1186.8
		Vol Total (m3) (Sum)	1186.8	

Note: Freeboard at 6.3m Vol=	732.1

Basin 2 Volume Calc

13/09/2023

J.Blavignac

Basin Levels from 4.7 to 3.75m AOD	Contours (m AOD)	Area (m2)	Volume Per Slice of elevation (m3)	Cumulative Volume from base (m3)
	3.75	2485	0.0	0.0
	3.85	2562	252.4	252.4
	3.95	2640	260.1	512.5
	4.05	2718	267.9	780.4
	4.15	2797	275.8	1056.1
	4.2	2836	140.8	1196.9
	4.25	2876	142.8	1339.7
	4.35	2956	291.6	1631.3
	4.45	3036	299.6	1930.9
	4.55	3117	307.6	2238.6
	4.65	3199	315.8	2554.4
	4.7	3259	161.4	2715.8
		Vol Total (m3) (Sum)	2715.8	

Note: Freeboard at 4.4m. Vol (m3)=	1781.1

Basin 3a Volume Calc

13/09/2023

J.Blavignac

Basin Levels from 5.50 to 4.15m AOD	Contours (m AOD)	Area (m2)	Volume Per Slice of elevation (m3)	Cumulative Volume from base (m3)
	4.15	558	0	0
	4.20	577	28.375	28.375
	4.30	614	59.55	87.925
	4.40	652	63.3	151.225
	4.50	690	67.1	218.325
	4.60	729	70.95	289.275
	4.70	769	74.9	364.175
	4.80	809	78.9	443.075
	4.90	851	83	526.075
	5.00	893	87.2	613.275
	5.10	938	91.55	704.825
	5.20	984	96.1	800.925
	5.30	1027	100.55	901.475
	5.40	1070	104.85	1006.325
	5.50	1113	109.15	1115.475
		Vol Total (m3) (Sum)	1115.5	

Note: Freeboard at 5.2m Vol=	800.9

Basin 3b Volume Calc

13/09/2023

J.Blavignac

Basin Levels from 5.20 to 3.75m AOD	Contours (m AOD)	Area (m2)	Volume Per Slice of elevation (m3)	Cumulative Volume from base (m3)
	3.75	1213	0	0
	3.8	1237	61.25	61.25
	3.9	1286	126.15	187.4
	4	1334	131	318.4
	4.1	1383	135.85	454.25
	4.2	1433	140.8	595.05
	4.3	1483	145.8	740.85
	4.4	1533	150.8	891.65
	4.5	1584	155.85	1047.5
	4.6	1635	160.95	1208.45
	4.7	1687	166.1	1374.55
	4.8	1740	171.35	1545.9
	4.9	1793	176.65	1722.55
	5	1845	181.9	1904.45
	5.1	1898	187.15	2091.6
	5.2	1952	192.5	2284.1
		Vol Total (m3) (Sum)	2284.1	

Note: Freeboard at 4.9m Vol=	1722.6

Central Catchment - SuDS Volume Assessment
(other than basin)

06.06.24

J.Blavignac

This schedule is to be read in conjunction with drawing LAW-WSP-XX-XX-C-DR-05000.

	Porosity	Height (m)	Area (m2)	Volume (m3)	Ratio use due to gradient (Vol Availability)	Effective Vol. (m3)
Porous Paving Volume Assessment	0.3	0.65	100	19.5	0.8	15.6

	Porous Paving available	Tree Pit corridors	Rain Gardens	Total (m3)
Area (sqm)	6702	400	380	
Volume Available(H:0.65) (m3)	1046	-	65	1111
Volume Available(H:1.0) (m3)	-	96	-	96
				1207

Notes: - Pervous Paving to be located in driveways, shared car park and low traffic road.

-Tree pit corridors to be located within landscape corridor abutting southern boundary of East West link corridor road.This assessment assumes that the whole length can be used as SuDS.

-Rain Gardens to be located between footpath/cycleway and carriageway on the southern side of the East West link corridor road. This assessment assumes that the whole length can be used as SuDS.

Appendix C

URBAN CREEP ASSESSMENT

Public

A3

Ivy Lane

St Richards Road

Westergate Street

Orchard Gardens

Adjacent scheme shown for context
area classifications are the same

- Site boundary
- Low density 20-30 DPH*
- Mid density 31-45 DPH*
- Mid to high density 46-50 DPH*
- Open spaces within development parcel*
- Open space*
- East-West link road
- Site access

*Precise areas to be determined at detailed design application stage

0 100m
1:2500

N

Romsey T: 01794 367703
Portishead T: 01275 407000
London T: 01794 367703

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Rev	Description	Date	Au	Ch
A	Planning Issue	20.09.23	AB/NN	AB/--

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ARUN DISTRICT COUNCIL AL/11/24/OUT

Project	Land East Of Westergate, Aldingbourne
Drawing	Development Parcels & Density Parameter Plan - 01
	-
Client	Cala Homes South Home Counties
Job no.	CALA230719
Dwg no.	DPDPP-01
Date	31.07.23
Rev.	A
Author	PM/AA
Checked	HM/-
Scale	1:2500@A3
Status	PLANNING
Office	Romsey
Client ref.	-

thrive. architects



LASOO
Local Authority SuDS Officer Organisation

NON-STATUTORY TECHNICAL STANDARDS FOR SUSTAINABLE DRAINAGE

Practice Guidance

HBF
HOME BUILDERS FEDERATION

HBA
House Builders Association

"Greenfield runoff rate" The rate of runoff that would occur from the site in its undeveloped and therefore undisturbed state.

"Impermeable area" all paved or roof areas that are not specifically designed to be permeable.

"Maintenance" means the on-going maintenance of all elements of the sustainable drainage system (including mechanical components) and will include elements such as; on-going inspections relating to performance and asset condition assessments, operation costs, regular maintenance, remedial works and irregular maintenance caused by less sustainable limited life assets.

"Operation" Activities which are required to ensure that control components function as per the approved design

"Peak rate of runoff" is the highest rate of flow from a defined catchment area assuming that rainfall is uniformly distributed over the drainage area, considering the entire drainage area as a single unit and estimation of flow at the most downstream destination(s) only

"Previously developed land" refer to definition in Annex 2 NPPF. This may be referred to as brownfield development.

"Single property drainage system" This is the constituent parts of a drainage system within the curtilage of a single property and that only receive flows from that property.

"Structural integrity" Ensures that a system fulfils its design function

"Unacceptable deformation" Changes, failure or damage that prevents the design function of the component or drainage system such that safety and/or flood risk is adversely impacted.

"Urban Creep" This is the conversion of permeable surfaces to impermeable over time e.g. impermeable surfacing of front gardens to provide additional parking spaces, extensions to existing buildings, creation of large patio areas. The consideration of urban creep (is best) assessed on a site by site basis but is limited to residential development only.

It is important that the appropriate allowance for urban creep is included in the design of the drainage system over the lifetime of the proposed development. The allowances set out below are applied to the impermeable area within the property curtilage:

Residential development density Dwellings per hectar	Change allowance % of impermeable area
≤ 25	10
30	8
35	6
45	4
≥ 50	2
Flats & apartments	0

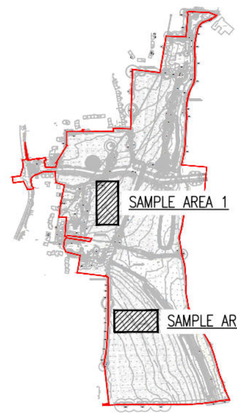
Note where the inclusion of the appropriate allowance would increase the total impermeable area to greater than 100%, 100% should be used as the maximum.

"Viability" as used in the explanatory notes reflects economic viability as defined within the Town and Country Planning Act and utilised by Local Planning Authorities.

"Water body" A manageable unit of surface water, being the whole (or part) of a stream, river or canal, lake or reservoir, transitional water (estuary) or stretch of coastal water. A 'body of groundwater' is a distinct volume of groundwater within an aquifer or aquifers.

'Developers have a vital role to play in delivering the outcomes of risk management strategy. Planning authorities should take necessary regard of not just the statutory planning framework and the National FCERM Strategy, but also the Local Flood Risk Management Strategy. The Local Strategy should be considered as supplementary planning guidance (SPG) and therefore form a material consideration in the planning process. In so doing, future developments will take proper regard of the local flood risk management strategy including the risk of flooding from surface water, groundwater and ordinary watercourses. Information on principally coastal and fluvial flooding may be found in the Strategic Flood Risk Assessment, although some also seek to address surface water flood risk'.

SCALE FOR PLANNING PURPOSES ONLY

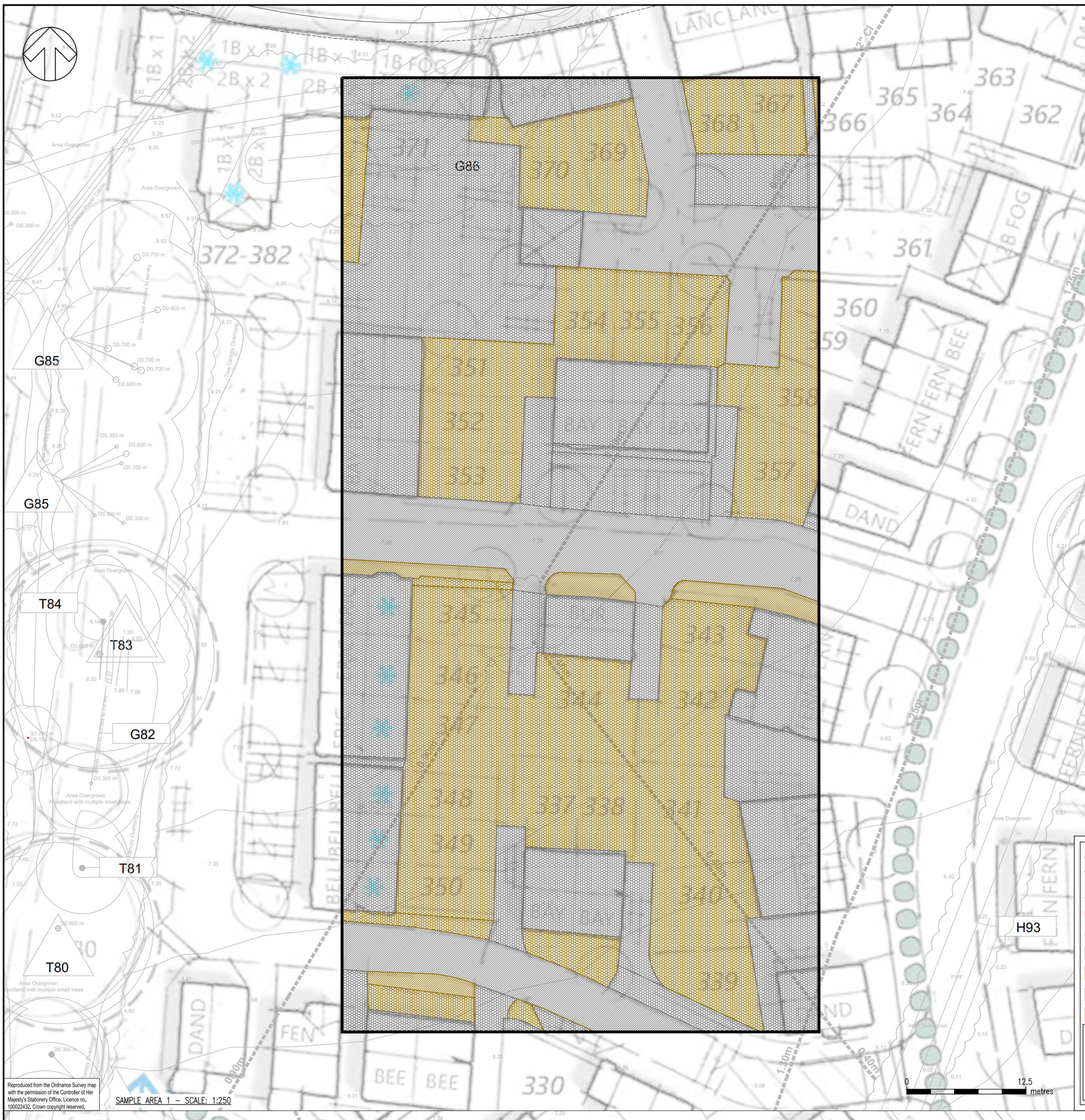


SITE LOCATION PLAN
SCALE 1:10000

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SAMPLE AREA 1 – SCALE: 1:250

0 12.5 metres

PROPOSED HARD STANDING & GREENFIELD AREAS – MID TO HIGH DENSITY 46-50DPH*

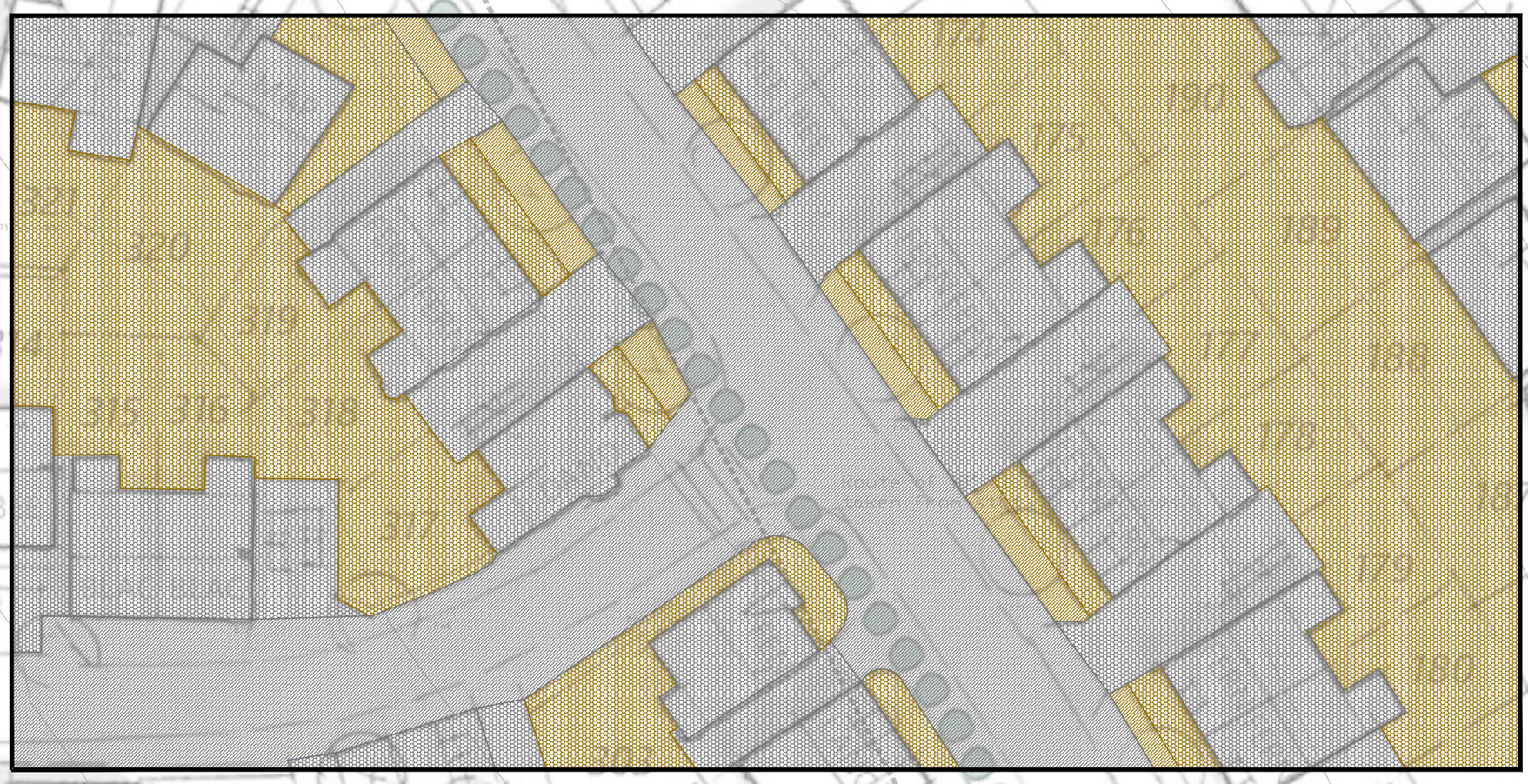
*PRECISE AREAS TO BE DETERMINED AT DETAILED DESIGN STAGE

KEY:

- SITE BOUNDARY
- SAMPLE AREA (0.5ha)
- PROPOSED HARD STANDING AREA – HIGHWAY
- PROPOSED GREENFIELD AREA – HIGHWAY
- PROPOSED HARD STANDING AREA – PRIVATE
- PROPOSED GREENFIELD AREA – PRIVATE

SAMPLE AREA 1=5,000m²=0.5ha

- PROPOSED HARD STANDING – HIGHWAY=823m² (16.4%)
- PROPOSED GREENFIELD – HIGHWAY=100m² (2.0%)
- PROPOSED HARD STANDING – PRIVATE=2,068m² (41.4%)
- PROPOSED GREENFIELD – PRIVATE=2,009m² (40.2%)



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SAMPLE AREA 2 – SCALE: 1:250

0 12.5 metres

PROPOSED HARD STANDING & GREENFIELD AREAS – MID DENSITY 31-45DPH*

*PRECISE AREAS TO BE DETERMINED AT DETAILED DESIGN STAGE

KEY:

- SITE BOUNDARY
- SAMPLE AREA (0.5ha)
- PROPOSED HARD STANDING AREA – HIGHWAY
- PROPOSED GREENFIELD AREA – HIGHWAY
- PROPOSED HARD STANDING AREA – PRIVATE
- PROPOSED GREENFIELD AREA – PRIVATE

SAMPLE AREA 2=5,000m²=0.5ha

- PROPOSED HARD STANDING – HIGHWAY=1,144m² (22.9%)
- PROPOSED GREENFIELD – HIGHWAY=121m² (2.4%)
- PROPOSED HARD STANDING – PRIVATE=1,922m² (38.4%)
- PROPOSED GREENFIELD – PRIVATE=1,813m² (36.3%)

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	11/06/2024	GLG	FIRST ISSUE	JB	LRB

DRAWING STATUS: B3 - FOR PLANNING

Grosvenor House
2 Grosvenor Square
Southampton
SO15 2BE, UK

T+ 44 (0) 2380 101 700
wsp.com

CLIENT: CALA HOMES

ARCHITECT: -

PROJECT: LAND AT WESTERGATE

TITLE: PROPOSED DEVELOPMENT HARD STANDING ASSESSMENT

SCALE @ A1:	CHECKED:		APPROVED:
AS SHOWN	JB		LRB
PROJECT No:	DESIGNED:	DRAWN:	DATE:
70013258	GLG	GLG	June 24

DRAWING No: LAW-WSP-ZZ-ZZ-C-SK-004 REV: P01

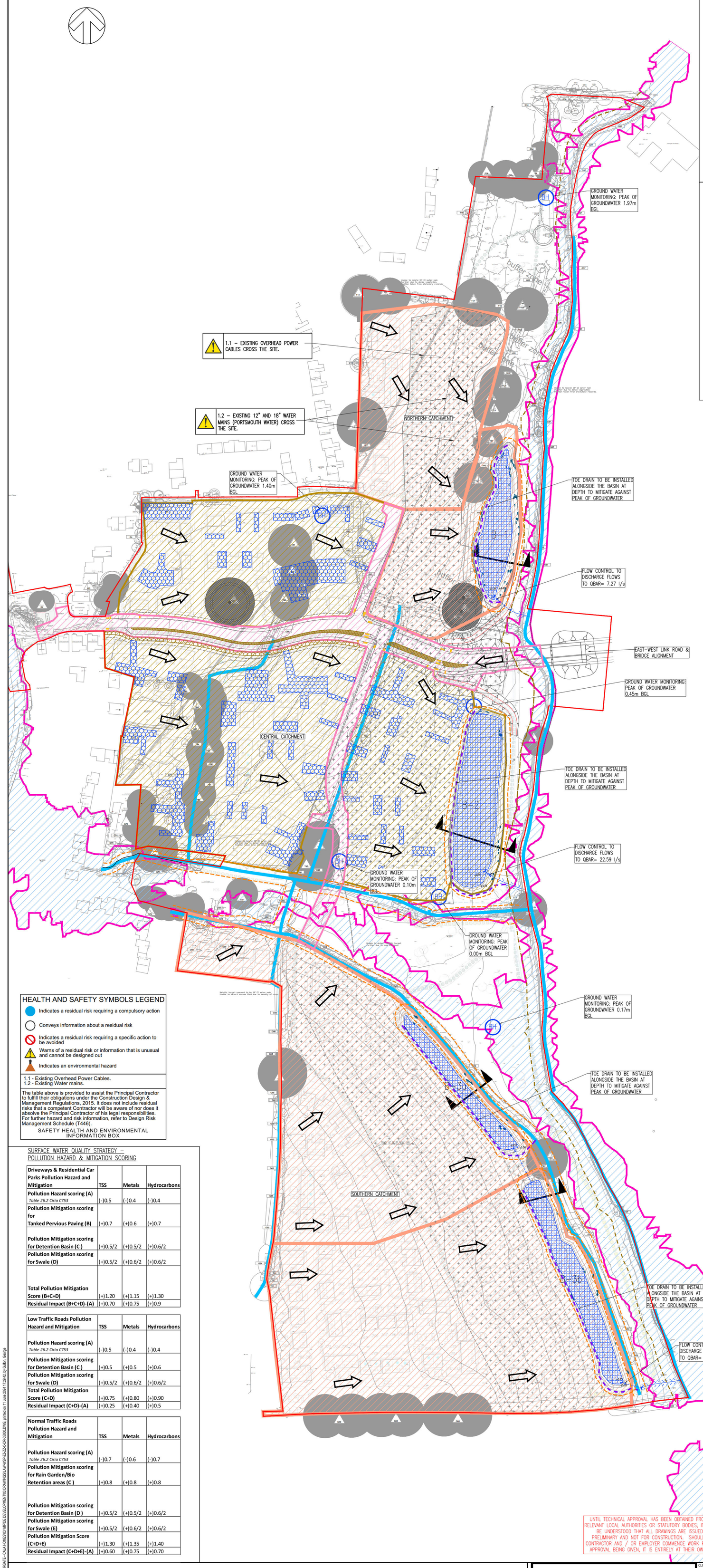
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File name: W:\70013XXX\70013258 - LAND AT WESTERGATE - CALA HOMES\03 WIP\DE DEVELOPMENT\10 SKETCHES\LAW-WSP-ZZ-ZZ-C-SK-004.DWG, printed on 11 June 2024 10:08:41, by Gulton, George

Appendix D

DRAINAGE STRATEGY LAYOUT UPDATE

Public



SCALE FOR PLANNING PURPOSES ONLY

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SURFACE WATER ATTENUATION STRATEGY – SUMMARY

	FLOW RESTRICTION TO LIDSEY RIFE RIVER (BASED ON QBAR – 3.8l/s/ha)	ESTIMATED ATTENUATION VOLUME REQUIRED (#) (##)	VOLUME AVAILABLE IN BASIN(S)	VOLUME AVAILABLE OTHER SUDS (###)
NORTHERN RESI. AREA: 1.912HA ESTIMATED IMP. AREA(60%): 1.15HA RESIDENTIAL LAND PARCEL: 0.65HA URBAN CREEP (6%):0.04HA IMP. AREA+URBAN CREEP:1.19HA	QBAR1=7.27l/s	QUICK STORAGE ESTIMATE (QSE): QSE30YR+40%=(746 TO 968m3) =857m3 QSE100YR+45%=(1020 TO 1304m3) =1162m3	VOLUME AVAILABLE IN BASIN 1 (B1) WITHIN 300mm FREEBOARD=732m3; AT MIN CREST LEVEL=1186m3	AVAILABLE (NOT ASSESSED) – TANKED PERVIOUS PAVING TO BE USED WHEN NEEDED INTO CAR PARK AREAS & DRIVEWAYS
CENTRAL RESI. AREA: 5.03HA ESTIMATED IMP. AREA(60%): 3.02HA RESIDENTIAL LAND PARCEL:1.89HA URBAN CREEP (6%):0.11HA IMP. AREA+URBAN CREEP:3.13HA CENTRAL HIGHWAY AREA: 0.915HA ESTIMATED IMP. AREA(80%): 0.73HA	QBAR2=22.59l/s	QUICK STORAGE ESTIMATE(QSE): QSE30YR+40%=(2,446 TO 3,164m3) =2805m3 QSE100YR+45%= (3,338 TO 4,257m3) =3797m3	VOLUME AVAILABLE IN BASIN 2 (B2) WITHIN 300mm FREEBOARD=1,781m3; AT MIN CREST LEVEL=2,715m3	TANKED PERVIOUS PAVING (DIRVEWAYS & CAR PARK AREAS): 1046m3 RAIN GARDENS (EAST WEST LINK CORRIDOR): 41m3 TREE PIT CORRIDORS (ALONG EAST WEST LINK CORRIDOR): 96m3
SOUTHERN RESI. AREA: 5.69HA ESTIMATED IMP. AREA (60%): 3.41HA RESIDENTIAL LAND PARCEL: 2.12HA URBAN CREEP (6%):0.13HA IMP. AREA+URBAN CREEP: 3.54HA	QBAR3=21.63l/s	QUICK STORAGE ESTIMATE(QSE): QSE30YR+40%=(2,219 TO 2,878m3) =2548m3 QSE100YR+45%=(3,035 TO 3,880m3) =3457m3	VOLUME AVAILABLE IN BASIN 3a&b (B3a+B3b) WITHIN 300mm FREEBOARD (800+1722)=2,522m3; AT MIN CREST LEVEL (1,115+2,284)=3,399m3	AVAILABLE (NOT ASSESSED) – TANKED PERVIOUS PAVING TO BE USED WHEN NEEDED INTO CAR PARK AREAS & DRIVEWAYS

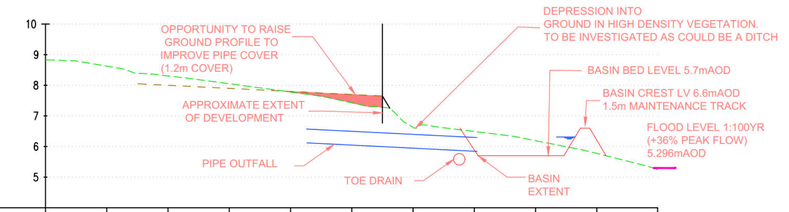
NOTES:
(#) QSE RESULTS BASED ON FEH 2022 RAINFALL DATA & CV VALUE OF '1.00' APPLIED TO CALCULATIONS.
(##) QSE RESULTS INCLUDE AN ALLOWANCE 6% FOR URBAN CREEP (IN LINE WITH LASOO NON STATUTORY TECHNICAL STANDARDS FOR SUSTAINABLE DRAINAGE PRACTICE GUIDANCE FOR URBAN CREEP FACTOR FOR HOUSING DENSITY OF 35 DWELLING/HA).
(###) VOLUMES FOR OTHER SUDS ASSUME DEPTH 0.65m OF EFFECTIVE STORAGE FOR TANKED PERV PAVING, 0.45m FOR RAIN GARDENS, 1.00m IN TREE PIT CORRIDORS, 0.3 POROSITY & 80% VOL AVAILABILITY.

SURFACE WATER STRATEGY –SUDS MANAGEMENT TRAIN

	Residential Property SuDS management train.
Source Control	Rainwater collected on roof to drain to rainwater pipe
	Rainwater pipe to connect to garden water butt. Opportunity for attenuating planter or water butt where appropriate.
	Runoff from driveway, car park area and rainwater pipes to be filtered and stored into tanked pervious paving to be located under driveway and car park.
	Attenuated flows to be slowly released via orifice flow control to carrier pipe drainage system.
Site Control	Carrier pipe drainage system to convey flows toward attenuation basin where flows are slowly released via a Vortex flow control to a section of swale/ditch connecting to the river.
	Residential Low Traffic Road SuDS management train.
	Rainwater collected from footpath, verge and carriageway to be collected via road gully or channel drain to Carrier pipe drainage system
Site Control	Carrier pipe drainage System to convey flows toward attenuation basin where flows are slowly released via a Vortex flow control to a section of swale/ditch connecting to the river.
	Main Road - East West Link Road SuDS management train
Site Control	Rainwater from footpath, cycleway, verge and carriageway to discharge into rain gardens (Bio retention area).
Site Control	Filtered flows and overflows from raingardens to be collected to carrier pipe drainage System
	Carrier pipe drainage System to convey flows toward attenuation basin where flows are slowly released via a Vortex flow control to a section of swale/ditch connecting to the river.

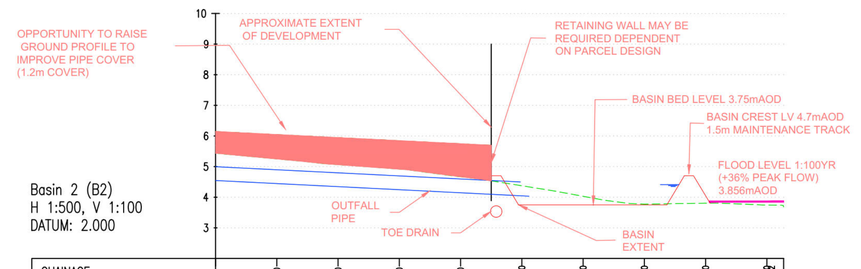
BASINS CROSS SECTIONS

Basin 1 (B1)
H 1:500, V 1:100
DATUM: 4.000



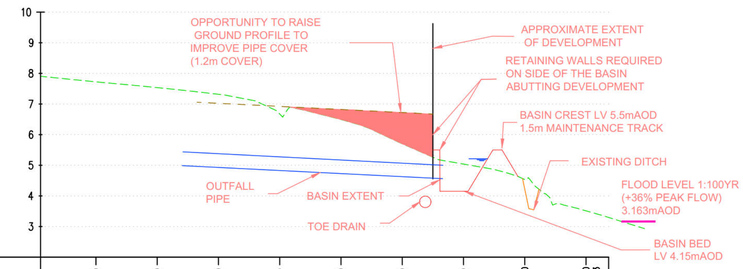
CHAINAGE	10	20	30	40	50	60	70	80	90	99
EXISTING LEVELS	8.625	8.304	8.051	7.779	7.427	6.625	6.491	6.191	5.776	5.247
PROPOSED LEVELS							5.700	5.700	6.187	
LEVEL DIFFERENCE							0.791	0.491	-0.411	

Basin 2 (B2)
H 1:500, V 1:100
DATUM: 2.000



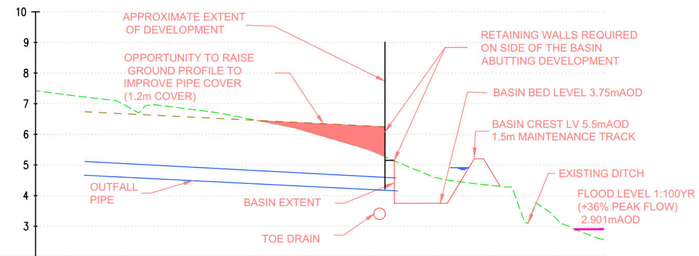
CHAINAGE	60	70	80	90	100	110	120	130	142
EXISTING LEVELS	5.251	5.064	4.918	4.667	4.374	4.030	3.774	3.804	3.844 3.857
PROPOSED LEVELS					3.750	3.750	3.750	4.047	
LEVEL DIFFERENCE					0.624	0.280	0.024	-0.243	

Basin 3a (B3a)
H 1:500, V 1:100
DATUM: 2.000



CHAINAGE	30	40	50	60	70	80	90	100	110 115
EXISTING LEVELS	7.724	7.536	7.319	6.674	6.494	5.702	5.039	4.534	3.512 3.302
PROPOSED LEVELS							4.150		
LEVEL DIFFERENCE							0.889		

Basin 3b (3B)
H 1:500, V 1:100
DATUM: 2.000



CHAINAGE	40	50	60	70	80	90	100	110	120	127
EXISTING LEVELS	7.298	6.923	6.830	6.506	6.060	5.462	4.618	4.324	3.285	2.564
PROPOSED LEVELS							3.750	4.653		
LEVEL DIFFERENCE							0.868	-0.329		

HEALTH AND SAFETY SYMBOLS LEGEND

- Indicates a residual risk requiring a compulsory action
- Conveys information about a residual risk
- Indicates a residual risk requiring a specific action to be avoided
- Warns of a residual risk or information that is unusual and cannot be designed out
- Indicates an environmental hazard

1.1 - Existing Overhead Power Cables.
1.2 - Existing Water mains.

The table above is provided to assist the Principal Contractor to fulfill their obligations under the Construction Design & Management Regulations, 2015. It does not include residual risks that a competent Contractor will be aware of nor does it absolve the Principal Contractor of his legal responsibilities. For further hazard and risk information, refer to Design Risk Management Schedule (T446).

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION BOX

SURFACE WATER QUALITY STRATEGY – POLLUTION HAZARD & MITIGATION SCORING

Driveways & Residential Car Parks Pollution Hazard and Mitigation	TSS	Metals	Hydrocarbons
Pollution Hazard scoring (A) *Table 26.2 Ciria C753*	(-)0.5	(-)0.4	(-)0.4
Pollution Mitigation scoring for Tanked Pervious Paving (B)	(+)0.7	(+)0.6	(+)0.7
Pollution Mitigation scoring for Detention Basin (C)	(+)0.5/2	(+)0.5/2	(+)0.6/2
Pollution Mitigation scoring for Swale (D)	(+)0.5/2	(+)0.6/2	(+)0.6/2
Total Pollution Mitigation Score (B+C+D)	(+)1.20	(+)1.15	(+)1.30
Residual Impact (B+C+D)-(A)	(+)0.70	(+)0.75	(+)0.9

Low Traffic Roads Pollution Hazard and Mitigation	TSS	Metals	Hydrocarbons
Pollution Hazard scoring (A) *Table 26.2 Ciria C753*	(-)0.5	(-)0.4	(-)0.4
Pollution Mitigation scoring for Detention Basin (C)	(+)0.5	(+)0.5	(+)0.6
Pollution Mitigation scoring for Swale (D)	(+)0.5/2	(+)0.6/2	(+)0.6/2
Total Pollution Mitigation Score (C+D)	(+)0.75	(+)0.80	(+)0.90
Residual Impact (C+D)-(A)	(+)0.25	(+)0.40	(+)0.5

Normal Traffic Roads Pollution Hazard and Mitigation	TSS	Metals	Hydrocarbons
Pollution Hazard scoring (A) *Table 26.2 Ciria C753*	(-)0.7	(-)0.6	(-)0.7
Pollution Mitigation scoring for Rain Garden/Bio Retention areas (C)	(+)0.8	(+)0.8	(+)0.8
Pollution Mitigation scoring for Detention Basin (D)	(+)0.5/2	(+)0.5/2	(+)0.6/2
Pollution Mitigation scoring for Swale (E)	(+)0.5/2	(+)0.6/2	(+)0.6/2
Pollution Mitigation Score (C+D+E)	(+)1.30	(+)1.35	(+)1.40
Residual Impact (C+D+E)-(A)	(+)0.60	(+)0.75	(+)0.70

UNTIL TECHNICAL APPROVAL HAS BEEN OBTAINED FROM THE RELEVANT LOCAL AUTHORITIES OR STATUTORY BODIES, IT SHOULD BE UNDERSTOOD THAT ALL DRAWINGS ARE ISSUED AS PRELIMINARY AND NOT FOR CONSTRUCTION. SHOULD THE CONTRACTOR AND / OR EMPLOYER COMMENCE WORK PRIOR TO APPROVAL BEING GIVEN, IT IS ENTIRELY AT THEIR OWN RISK

REV	DATE	BY	DESCRIPTION	CHK	APP
P03	11/06/2024	GG	STRATEGY UPDATED TO ADDRESS COMMENTS	JS	LRS
P02	21/09/2023	GG	STRATEGY UPDATED TO FIXED LAYOUT	JS	LRS
P01	14/07/2023	PN	FIRST ISSUE	JS	LRS

DRAWING STATUS: B3 - FOR PLANNING

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wsp.com

CLIENT: CALA HOMES SOUTH HOMES COUNTIES

ARCHITECT:

PROJECT: LAND AT WESTERGATE

TITLE: OUTLINE SURFACE WATER DRAINAGE STRATEGY

SCALE @ A0:	CHECKED:	APPROVED:
LAYOUT 1:1000	JB	LRB
PROJECT No: 70013258	DESIGNED: PN	DRAWN: PN
DATE: June 24		

DRAWING No: LAW-WSP-ZZ-ZZ-C-DR-05000 REV: P03

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File name: W:\70013XX\70013258 - LAND AT WESTERGATE - CALA HOMES\03 WIP\DE DEVELOPMENT\03 DRAWINGS\LAW-WSP-ZZ-ZZ-C-DR-05000.DWG, printed on 11 June 2024 17:29:42, by Collins, George

Appendix E

GROUNDWATER INVESTIGATIONS & MONITORING

Public

Newton House
Cross Road
Tadworth
Surrey KT20 5SR

[redacted]

Soilslimited.co.uk

BHA Consulting Ltd

Via email only: [redacted]

F.A.O.: Gillian Hoy

Our Ref: 15808/FR

19th October 2016

Dear Gillian,

RE: Land at Westergate, Chichester, West Sussex PO20 3RD

Soils Limited were commissioned by the BHA Consulting Ltd to undertake two days of machine excavated trial pitting, infiltration testing and the relevant geotechnical laboratory testing, and provide factual reporting for the site outlined above to provide ground conditions information, as specified by the client. The scope of the investigation was outlined in the Soils Limited quotation reference Q17753/rev1.02, dated 9th September 2016.

Ground Conditions

On the 26th and 27th September 2016, 14No trial holes (SA01-S03A, TP01-TP12, except TP10) were machine excavated to enable infiltration testing to be undertaken, with the associated sampling for geotechnical laboratory testing, at locations given by the client. The trial holes were excavated to depths of between 1.20m below existing ground level (bgl) (TP4) and 4.00m bgl (SA02 & TP06). Infiltration testing were undertaken in SA01, SA02, SA03A and TP04. TP10 could not be excavated due to the presence of services. In SA03, groundwater was encountered, and therefore a shallow trial pit SA03A was excavated adjacent to it, to enable useful infiltration testing to be undertaken. On completion the trial holes were backfilled with arisings. The trial hole location plan is given in Figure 1.

The ground conditions encountered were Topsoil (TS) (dark orange brown slightly gravelly sandy CLAY with roots and rootlets) to depths of between 0.30m and 0.80m bgl, overlying Head (HD) (dark orange brown, dark brown and orangish brown slightly gravelly sandy CLAY, sandy clayey GRAVEL and fine to coarse SAND) to depths of between 1.00m and 3.50m bgl, which in turn overlay the London Clay Formation (LC) (stiff heavily bluish brown and dark brownish blue silty CLAY with frequent rootlets and selenite crystals), to the full depth of the trial holes. The summary of the ground conditions are given in Table 1. Full engineering logs are in Appendix A.

Table 1 Ground Conditions

Strata	Age	Depth Encountered (m bgl)		Typical Thickness (m)	Typical Description
		Top	Bottom		
TS	Recent	G.L.	0.30 – 0.80	0.50	Dark orange brown slightly gravelly sandy CLAY with roots and rootlets.
HD	Pleistocene	0.30-0.80	1.20-3.50[1,2]	Not proven in places	Dark orange brown, dark brown and orangish brown slightly gravelly sandy CLAY, sandy clayey GRAVEL and fine to coarse SAND.
LC	Eocene	0.80-2.60	3.00-4.00[1,2]	Not Proven	Stiff heavily bluish brown and dark brownish blue silty CLAY with frequent rootlets and selenite crystals.

Note: [1] Final depth of trial hole. [2] Base of strata not encountered. TS (Topsoil), HD (Head), LC (London Clay Formation)

Roots

Roots were encountered in each of the trial holes at depths ranging between 0.40 and 4.00m bgl. The depths of root penetration have been included in **Error! Reference source not found.**

Table 2 Depth of Root Penetration

Trial Hole	Depth (m bgl)	Trial Hole	Depth (m bgl)
SA01	1.00	TP05	1.00
SA02	4.00[1]	TP06	4.00[1]
SA03/3A	0.50	TP07	3.20[1]
TP01	1.00	TP08	2.60
TP02	1.00	TP09	0.40
TP03	1.00	TP11	2.10
TP04	0.40	TP12	0.40

Note: [1] Final depth of trial hole.

Groundwater

Groundwater was encountered within seven out of the fifteen holes at depth of between 2.00m and 2.80m bgl, and the details are given in Table 3.

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in September (2016), when groundwater levels should typically be at their annual minimum (lowest) elevation, which typically occurs around September.

Table 3 Groundwater Records

Trial Hole	Depth to Water (m bgl)
	26-27/09/16
SA01	2.00
SA03A	2.00
TP01	2.30
TP03	2.40
TP05	2.40
TP08	Slow seepage at 2.60
TP09	2.80

Note: Trial holes were groundwater was encountered.

Infiltration Tests (BRE Digest: 365)

Infiltration tests were performed at three locations (SA01, SA02, SA03A and TP04). The summary of the test results are given in Table 4, whilst the tests details are given in Appendix B. The tests were conducted in accordance with the principles of BRE Digest 365 Soakaway Design: 2016.

Table 4 Infiltration Rates

Trial Hole	Test No.	Infiltration Rate (m/sec)
SA01	3	Insufficient head loss
SA02	1	Insufficient head loss
SA03A	1	Insufficient head loss
TP04	2	Insufficient head loss

Notes:

Geotechnical Laboratory Results

Geotechnical laboratory analyses were undertaken on selected samples recovered from the trial holes as given below. The details of the results are given in Appendix C.

Atterberg Limit Tests

Moisture Content Determination and Atterberg Limit Tests were undertaken on 2No samples of the Head and 3No samples of the London Clay Formation.

The results showed the Head to have **low to medium** volume change potential in accordance with the BRE Digest 240 and NHBC Standards Chapter 4.2, whilst the London Clay Formation had **medium to high** volume change potential.

Particle Size Distribution Tests

Particle Size Distribution (PSD) tests were performed on 5No samples of the Head.

The results showed the PSD classified the granular beds of the Head as having a volume change potential in accordance with the BRE Digest 240 and the NHBC Standards Chapter 4.2.

Sulphate and pH Tests

Sulphate and pH Tests were undertaken on 3No samples of the Head and 1No sample of the London Clay Formation, for water soluble sulphate (2:1) and pH testing in accordance with Building Research Establishment Special Digest 1, 2005, 'Concrete in Aggressive Ground'.

The tests recorded water soluble sulphate between <10mg/l and 26mg/l with pH values of 7.3 to 7.9.

I trust I have interpreted your instructions correctly, though should you have any queries please do not hesitate to contact the undersigned.

Yours Sincerely

[redacted]

R Biney BSc (Hons) MSc FGS MIEnvSc MIET
Principal Geotechnical Engineer
[redacted]

Figure 1 – Trial Hole Location Plan

Appendix A – Trial Hole Logs
Appendix B – Infiltration Test Results
Appendix B – Geotechnical Laboratory Results



Figure number
1

Title
Trial Hole Location Plan

Project
Land at Westergate, Chichester, West Sussex PO20 3RD

Date
October 2016

Client
BHA Consulting Ltd

Job Number
15808

Appendix A – Trial Hole Logs

soils LIMITED Geotechnical & Environmental Consultants

Soils Limited
Newton House [redacted] Tadworth KT20 5SR

Trial Pit Log

Trial Pit No. **SA01** Sheet 1 of 1

Project Name: Land at Westergate,	Project No.: 15808	Method:	Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:	
		Support:	Scale 1:25
Client: BHA Consulting Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 26/09/2016	Level:	Co-ords:	Logged By CF

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	D					Turf over stiff dark orangish brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint. TOPSOIL
	0.60	D					
				0.70			Stiff dark orangish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint. HEAD
	0.90	D		0.90			Dark brown sandy clayey fine to coarse, sub angular to sub rounded flint GRAVEL. Sand is fine to coarse. HEAD
	1.50	D					
				1.80			Orangish brown fine to coarse SAND. HEAD
▼	2.00	D		2.00			End of Pit at 2.00m

1 2 3 4 5

General Remarks:
Roots encountered to 1.0m bgl.

Groundwater Remarks: Running sand at 2.0m bgl

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

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Newton House [redacted] Tadworth KT20 5SR

Trial Pit Log

Trial Pit No. **SA02** Sheet 1 of 1

Project Name: Land at Westergate,	Project No.: 15808	Method:	Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:	
		Support:	Scale 1:25
Client: BHA Consulting Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 26/09/2016	Level:	Co-ords:	Logged By CF

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	D					Turf over stiff dark orange brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint, with frequent rootlets. TOPSOIL
	0.60	D					
				0.80			
	0.90	D					Stiff dark brown silty CLAY, with occasional orange fine to coarse sand pockets and occasional selenite crystals. LONDON CLAY FORMATION
	1.50	D					
	2.00	D					
				2.10			
	2.50	D					Stiff heavily fissured bluish brown silty CLAY with frequent rootlets and selenite crystals. LONDON CLAY FORMATION
	3.00	D					
	3.50	D					
	4.00	D		4.00			End of Pit at 4.00m

1 2 3 4 5

General Remarks:
Roots encountered to 4.0m bgl.

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

soils LIMITED Geotechnical & Environmental Consultants

Soils Limited
Newton House [redacted] Tadworth KT20 5SR

Trial Pit Log

Trial Pit No. **SA03**
Sheet 1 of 1

Project Name: Land at Westergate,	Project No.: 15808	Method:	Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:	
		Support:	Scale 1:25
Client: BHA Consulting Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 26/09/2016	Level:	Co-ords:	Logged By CF

Water Strike	Samples & In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	D		0.40			Dark orangish brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded made up of flint, with occasional rootlets. TOPSOIL
	0.60	D					Orangish brown sandy CLAY. Sand is fine to coarse. HEAD
	0.90	D		0.80			Dark orangish brown sandy clayey GRAVEL. Sand is fine to coarse. Gravel is fine to coarse sub angular to sub rounded made up of flint. HEAD
	1.50	D		1.20			Orangish brown fine to coarse SAND. HEAD
▼	2.00	D		2.00			End of Pit at 2.00m

1 2 3 4 5

General Remarks:
Roots encountered to 0.5m bgl.

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

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Soils Limited
Newton House [redacted] Tadworth KT20 5SR

Trial Pit Log

Trial Pit No. **SA03A** Sheet 1 of 1

Project Name: Land at Westergate,	Project No.: 15808	Method:	Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:	
		Support:	Scale 1:25
Client: BHA Consulting Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 26/09/2016	Level:	Co-ords:	Logged By CF

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	D		0.40			Dark orangish brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded made up of flint, with occasional rootlets. TOPSOIL
	0.60	D		0.80			Orangish brown sandy CLAY. Sand is fine to coarse. HEAD
	0.90	D		1.20			Dark orangish brown sandy clayey GRAVEL. Sand is fine to coarse. Gravel is fine to coarse sub angular to sub rounded made up of flint. HEAD
				1.35			Orangish brown fine to coarse SAND. HEAD
							End of Pit at 1.35m

1 2 3 4 5

General Remarks:
Roots encountered to 0.5m bgl.

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

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Soils Limited
Newton House [redacted] Tadworth KT20 5SR

Trial Pit Log

Trial Pit No. **TP01** Sheet 1 of 1

Project Name: Land at Westergate,	Project No.: 15808	Method:	Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:	
		Support:	Scale 1:25
Client: BHA Consulting Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 27/09/2016	Level:	Co-ords:	Logged By CF

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	D		0.70			Turf over stiff dark orange brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint. TOPSOIL
	0.60	D					
	0.90	D					Stiff dark orangish brown slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded flint. HEAD
	1.50	D		1.60			Dark brown sandy clayey fine to coarse, sub angular to sub rounded flint GRAVEL. Sand is fine to coarse. HEAD
▼	2.00	D					
	2.50	D		2.40			Orangish brown fine to coarse SAND. HEAD
	3.00	D		3.20			End of Pit at 3.20m

1 2 3 4 5

General Remarks:
Pit collapsing at 3.2m bgl, backfilled. Roots encountered to 1.0m bgl.

Groundwater Remarks: Groundwater encountered at 2.30m bgl.

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

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Soils Limited
Newton House [redacted] Tadworth KT20 5SR

Trial Pit Log

Trial Pit No. **TP02** Sheet 1 of 1

Project Name: Land at Westergate,	Project No.: 15808	Method:	Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:	
		Support:	Scale 1:25
Client: BHA Consulting Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 27/09/2016	Level:	Co-ords:	Logged By CF

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	D					Turf over stiff dark orange brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint. TOPSOIL
	0.60	D					
				0.70			
	0.90	D					Dark brown sandy clayey fine to coarse, sub angular to sub rounded flint GRAVEL. Sand is fine to coarse.
	1.50	D					
				1.60			Orangish brown fine to coarse SAND.
	2.00	D					
	2.50	D					
	3.00	D					
				3.50			End of Pit at 3.50m

1 2 3 4 5

General Remarks:
Pit collapsing at 3.50m bgl, backfilled. Roots encountered to 1.0m bgl.

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

soils LIMITED Geotechnical & Environmental Consultants

Soils Limited
Newton House [redacted] Tadworth KT20 5SR

Trial Pit Log

Trial Pit No. **TP03** Sheet 1 of 1

Project Name: Land at Westergate,	Project No.: 15808	Method:	Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:	
		Support:	Scale 1:25
Client: BHA Consulting Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 26/09/2016	Level:	Co-ords:	Logged By CF

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	D					Turf over stiff dark orange brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint. TOPSOIL
	0.60	D					
				0.70			
	0.90	D					Stiff dark orangish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint. HEAD
				1.00			
							Dark brown sandy clayey fine to coarse, sub angular to sub rounded flint GRAVEL. Sand is fine to coarse. HEAD
	1.50	D					
				1.70			
	2.00	D					Orangish brown fine to coarse SAND. HEAD
▼	2.50	D					
	3.00	D		3.00			End of Pit at 3.00m

1 2 3 4 5

General Remarks:
Pit collasped. Roots encountered to 1.0m bgl.

Groundwater Remarks: Running sand at 2.4m bgl.

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

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Soils Limited
Newton House [redacted] Tadworth KT20 5SR

Trial Pit Log

Trial Pit No. **TP04** Sheet 1 of 1

Project Name: Land at Westergate,	Project No.: 15808	Method:	Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:	
		Support:	Scale 1:25
Client: BHA Consulting Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 26/09/2016	Level:	Co-ords:	Logged By CF

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	D		0.40			Turf over stiff dark orangish brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint. TOPSOIL`
	0.60	D		1.00			Stiff dark orangish brown gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint. HEAD
	1.10	D		1.20			Orangish brown fine to coarse SAND. HEAD End of Pit at 1.20m

1 2 3 4 5

General Remarks:
Roots encountered to 0.40m bgl. Infiltration testing undertaken.

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

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Trial Pit Log

Trial Pit No. **TP05** Sheet 1 of 1

Project Name: Land at Westergate,	Project No.: 15808	Method:	Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:	
		Support:	Scale 1:25
Client: BHA Consulting Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 27/09/2016	Level:	Co-ords:	Logged By CF

Water Strike	Samples & In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	D		0.40			Turf over stiff dark orange brown slightly gravelly sandy silty CLAY. Sand is fine to coarse, gravel is fine to medium, sub angular to sub rounded, made up of flint. TOPSOIL
	0.60	D					Light orangish brown slightly clayey gravelly SAND. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint. HEAD
	0.90	D		0.90			Orangish brown gravelly slightly clayey fine to coarse SAND. Gravel is fine to coarse, sub angular to sub rounded made up of flint. HEAD
▼	1.50	D		1.60			Firm dark brownish blue slightly fissured silty CLAY with occasional selenite crystals. LONDON CLAY FORMATION
	2.00	D					
	2.50	D					
	3.00	D					
	3.50	D		3.50			End of Pit at 3.50m

1 2 3 4 5

General Remarks:
Roots encountered to 1.0m bgl.

Groundwater Remarks: Running sand at 2.40m bgl.

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

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Trial Pit Log

Trial Pit No. **TP06** Sheet 1 of 1

Project Name: Land at Westergate,	Project No.: 15808	Method:	Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:	
		Support:	Scale 1:25
Client: BHA Consulting Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 26/09/2016	Level:	Co-ords:	Logged By CF

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	D		0.35			Turf over stiff dark brown slightly gravelly sandy silty CLAY. Sand is fine to coarse, gravel is fine to medium, sub angular to sub rounded, made up of flint, with frequent rootlets. TOPSOIL
	0.60	D					Dark orangish brown sandy clayey GRAVEL. Sand is fine to medium and gravel is fine to coarse sub angular to sub rounded flint. HEAD
	0.90	D		1.00			Stiff dark brown silty CLAY occasional rootlets. LONDON CLAY FORMATION
	1.50	D					
	2.00	D		2.10			Stiff fissured bluish brown silty CLAY, with frequent rootlets and frequent selenite crystals. LONDON CLAY FORMATION
	2.50	D					
	3.00	D					
	3.50	D					
	4.00	D		4.00			End of Pit at 4.00m

1 2 3 4 5

General Remarks:
Roots encountered to 4.0m bgl.

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

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Trial Pit Log

Trial Pit No. **TP07** Sheet 1 of 1

Project Name: Land at Westergate,	Project No.: 15808	Method:	Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:	
		Support:	Scale 1:25
Client: BHA Consulting Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 26/09/2016	Level:	Co-ords:	Logged By CF

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	D		0.30			Dark brown sandy silty CLAY. Sand is fine to coarse. TOPSOIL
	0.60	D					Stiff dark orangish brown slightly gravelly sandy silty CLAY. Sand is fine to coarse, gravel is fine to coarse, sub angular to sub rounded, made up of flint. HEAD
	0.90	D					
	1.50	D					
	2.00	D		2.10			Stiff heavily fissured bluish brown silty CLAY, with frequent rootlets and frequent selenite crystals. LONDON CLAY FORMATION
	2.50	D					
	3.00	D		3.20			End of Pit at 3.20m

1 2 3 4 5

General Remarks:
Roots encountered to 3.2m bgl.

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

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Trial Pit Log

Trial Pit No. **TP08** Sheet 1 of 1

Project Name: Land at Westergate,	Project No.: 15808	Method:	Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:	
		Support:	Scale 1:25
Client: BHA Consulting Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 29/09/2016	Level:	Co-ords:	Logged By CF

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	D		0.50			Turf over stiff dark brown slightly gravelly sandy silty CLAY. Sand is fine to coarse, gravel is fine to medium, sub angular to sub rounded, made up of flint, with frequent rootlets. TOPSOIL
	0.60	D					Stiff dark orangish brown slightly gravelly silty sandy CLAY / very clayey SAND. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded made up of flint, with occasional rootlets. HEAD
	0.90	D					
	1.50	D					
	2.00	D					
	2.50	D		2.60			Dark orangish brown sandy CLAY / clayey SAND, with occasional weakly cemented mudstone bands between 2.6-3.0m. Sand is fine to medium. LONDON CLAY FORMATION
	3.00	D		3.10			End of Pit at 3.10m

1 2 3 4 5

General Remarks:
Roots encountered to 2.6m bgl.

Groundwater Remarks: 2.60m bgl slow seepage.

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

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Trial Pit Log

Trial Pit No. **TP09** Sheet 1 of 1

Project Name: Land at Westergate,	Project No.: 15808	Method:	Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:	
		Support:	Scale 1:25
Client: BHA Consulting Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 26/09/2016	Level:	Co-ords:	Logged By CF

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	D		0.40			Dark orangish brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded made up of flint, with occasional rootlets. TOPSOIL
	0.60	D					Stiff orangish brown sandy CLAY. Sand is fine to coarse. HEAD
	0.90	D					*... becoming soft from 0.8m*
				1.20			Orangish brown fine to coarse SAND. HEAD
	1.50	D					
	2.00	D					
	2.50	D					
	3.00	D		3.10			End of Pit at 3.10m

1 2 3 4 5

General Remarks:
Pit collapsed back to 1.2m, backfilled.

Groundwater Remarks: Running sand approximately at 2.8m bgl.

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

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Trial Pit Log

Trial Pit No.
TP10
Sheet 1 of 1

Project Name: Land at Westergate,	Project No.: 15808	Method:	Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:	
		Support:	Scale 1:25
Client: BHA Consulting Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates:	Level:	Co-ords:	Logged By CF

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Not undertaken, due to uncertaintly of underground service location.

1
2
3
4
5

General Remarks:

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

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Trial Pit Log

Trial Pit No. **TP11** Sheet 1 of 1

Project Name: Land at Westergate,	Project No.: 15808	Method:	Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:	
		Support:	Scale 1:25
Client: BHA Consulting Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 26/09/2016	Level:	Co-ords:	Logged By CF

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	D		0.35			Turf over stiff dark brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular to sub rounded, made up of flint, with frequent rootlets. TOPSOIL
	0.60	D		0.70			Dark orangish brown sandy clayey GRAVEL. Sand is fine to coarse and gravel is fine to coarse, sub angular to sub rounded flint. HEAD
	0.90	D					Stiff dark orangish brown sandy silty slightly gravelly CLAY / slightly gravelly very clayey SAND. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded made up of flint, with occasional rootlets. HEAD
	1.50	D					
	2.00	D		2.10			Dark orangish brown sandy CLAY / clayey SAND, with occasional weakly cemented mudstone bands between 2.6-3.0m. LONDON CLAY FORMATION
	2.50	D					
	3.00	D		3.00			End of Pit at 3.00m

1 2 3 4 5

General Remarks:
Roots encountered to 2.1m bgl.

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

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Soils Limited
Newton House [redacted] Tadworth KT20 5SR

Trial Pit Log

Trial Pit No. **TP12** Sheet 1 of 1

Project Name: Land at Westergate,	Project No.: 15808	Method:	Hole Type TP
Location: Near Saint Richards Road, Westergate, Chichester PO20 3RD		Plant:	
		Support:	Scale 1:25
Client: BHA Consulting Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 26/09/2016	Level:	Co-ords:	Logged By CF

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	D		0.40			Dark orangish brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub angular to sub rounded made up of flint, with occasional rootlets. TOPSOIL
	0.60	D					Stiff orangish brown sandy CLAY. Sand is fine to coarse. HEAD
	0.90	D					*... becoming soft from 0.8m*
				1.20			Orangish brown fine to coarse SAND. HEAD
	1.50	D					
	2.00	D					
	2.50	D					
	3.00	D					
				3.20			End of Pit at 3.20m

1 2 3 4 5

General Remarks:
Pit collasped back to 1.2m, backfilled.

Groundwater Remarks: No seepage, but sand very wet.

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

Appendix B – Infiltration Test Results

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Infilation Testing Data

Job No: 15808
Job Name: Westergate

Trial Hole	**TP04**
Width Top (m)	0.50
Width Bottom (m)	0.50
Length Top (m)	2.10
Length Bottom (m	1.20
Depth (m)	1.10

Test 1	
Time (Min)	**Depth (m)**
0	0.420
1	0.460
2	0.540
3	0.620
5	0.700
10	0.790
15	0.840
End of test hole collapsed	

Test 2	
Time (Min)	**Depth (m)**
0	0.250
1	0.350
3	0.400
4	0.460
5	0.500
6	0.540
7	0.563
8	0.595
9	0.608
10	0.620
11	0.641
12	0.656
13	0.678
18	0.730
23	0.774
28	0.788
33	0.806
38	0.813
43	0.830
End of test	

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Trial Hole	SA01
Width Top (m)	0.50
Width Bottom (m)	0.50
Length Top (m)	2.40
Length Bottom (m	2.20
Depth (m)	1.80

Test 1

Time (Min)	Depth (m)
0	1.500
4	1.580
6	1.600
End of test hole collasped	

Test 2

Time (Min)	Depth (m)
Trial hole cleared out to 1.60m bgl.	
0	1.420
1	1.460
2	1.500
3	1.510
4	1.520
5	1.530
7	1.540
10	1.540
16	1.550
26	1.560
35	1.570
50	1.580
End of test	

Test 3

Time (Mir	Depth (m
0	1.400
1	1.420
2	1.440
4	1.450
8	1.470
10	1.470
22	1.480
32	1.490
50	1.510
End of test	

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Trial Hole	**SA02**
Width Top (m)	0.50
Width Bottom (m)	0.50
Length Top (m)	2.40
Length Bottom (m	2.20
Depth (m)	4.00

Test 1

Time (Mir	Depth (m)
0	2.720
1	2.720
2	2.730
5	2.730
20	2.730
48	2.730
End of test	

Trial Hole	**SA03A**
Width Top (m)	0.50
Width Bottom (m)	0.50
Length Top (m)	2.40
Length Bottom (m	2.20
Depth (m)	1.35

Test 1

Time (Mir	Depth (m)
0	0.468
1	0.470
2	0.478
3	0.479
4	0.482
5	0.483
6	0.485
7	0.488
8	0.491
9	0.493
10	0.494
15	0.500
20	0.509
25	0.516
30	0.525
35	0.529
45	0.542
75	0.570
105	0.593
135	0.605
205	0.621
235	0.635
265	0.645
End of test	

Appendix C – Geotechnical Laboratory Results

Laboratory Report

UKAS TESTING
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GEO Site & Testing Services Ltd

Contract Number: 32654

Client's Reference: **15808**

Report Date: **17-10-2016**

Client **Soils Limited**
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR

Contract Title: **Westergate**

For the attention of: **Luke Wilkinson**

Date Received: **05-10-2016**
Date Commenced: **05-10-2016**
Date Completed: **17-10-2016**

Test Description	Qty
4 Point Liquid & Plastic Limit (LL/PL) 1377 : 1990 Part 2 : 4.3 & 5.3 - * UKAS	5
Moisture Content 1377 : 1990 Part 2 : 3.2 - * UKAS	5
PSD Wet Sieve method 1377 : 1990 Part 2 : 9.2 - * UKAS	5
Disposal of Samples on Project	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
- denotes test carried out by approved contractor
@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved Signatories:
Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - Emma Sharp (Office Manager)
Paul Evans (Quality/Technical Manager) - Vaughan Edwards (Managing Director)

GEO Site & Testing Services Ltd
Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
[redacted] gstl.co.uk

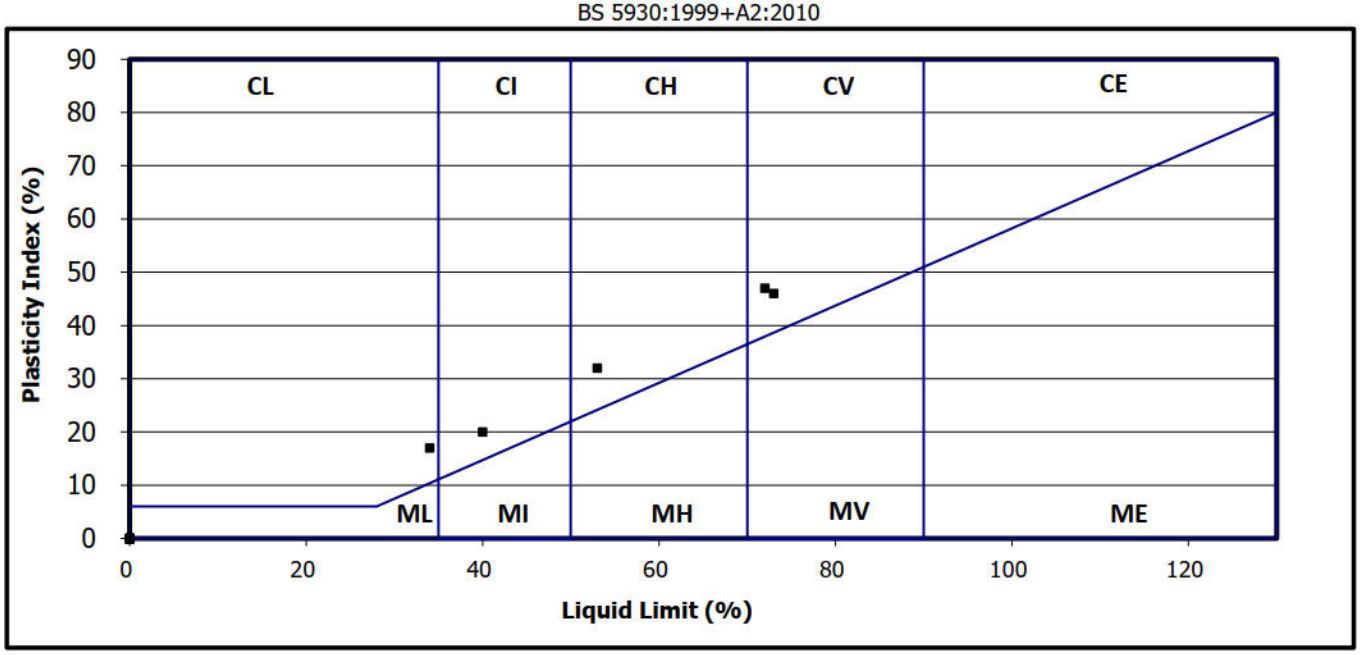
Test Report: **Method of the Determination of the plastic limit and plasticity index**
BS 1377 : Part 2 : 1990 Method 5

Client ref: **15808**
Location: **Westergate**
Contract Number: **32654**

Hole/ Sample Number	Sample Type	Depth m	Moisture Content % Cl. 3.2	Liquid Limit % Cl. 4.3/4.4	Plastic Limit % Cl. 5.	Plasticity Index % Cl. 6.	% Passing .425mm	Remarks
TP1	S/B	0.90	18	34	17	17	95	CL Low Plasticity
TP5	S/B	2.00	35	72	25	47	100	CV Very High Plasticity
TP6	S/B	3.00	32	73	27	46	100	CV Very High Plasticity
TP8	S/B	1.50	23	53	21	32	100	CH High Plasticity
TP11	S/B	2.50	21	40	20	20	100	CI Intermediate Plasticity

Symbols: **NP : Non Plastic** **# : Liquid Limit and Plastic Limit Wet Sieved**

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.
BS 5930:1999+A2:2010



For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Emma Sharp (Office Manager)
Date: 17.10.16

[redacted]

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Client ref: ###

Location: Westergate

Contract Number: 32654

Hole Number	Sample Number	Type	Depth (m)	Description of Sample*
TP1		S/B	0.90	Brown silty sandy CLAY
TP5		S/B	2.00	Brown silty sandy CLAY
TP6		S/B	3.00	Greyish brown silty sandy CLAY
TP8		S/B	1.50	Brown silty sandy CLAY
TP11		S/B	2.50	Brown silty sandy CLAY

Note: Results on this table are in summary format and may not meet the requirements of the relevant standards, additional information is held by the laboratory

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For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Emma Sharp (Office Manager)
Date: 17.10.16

[redacted]

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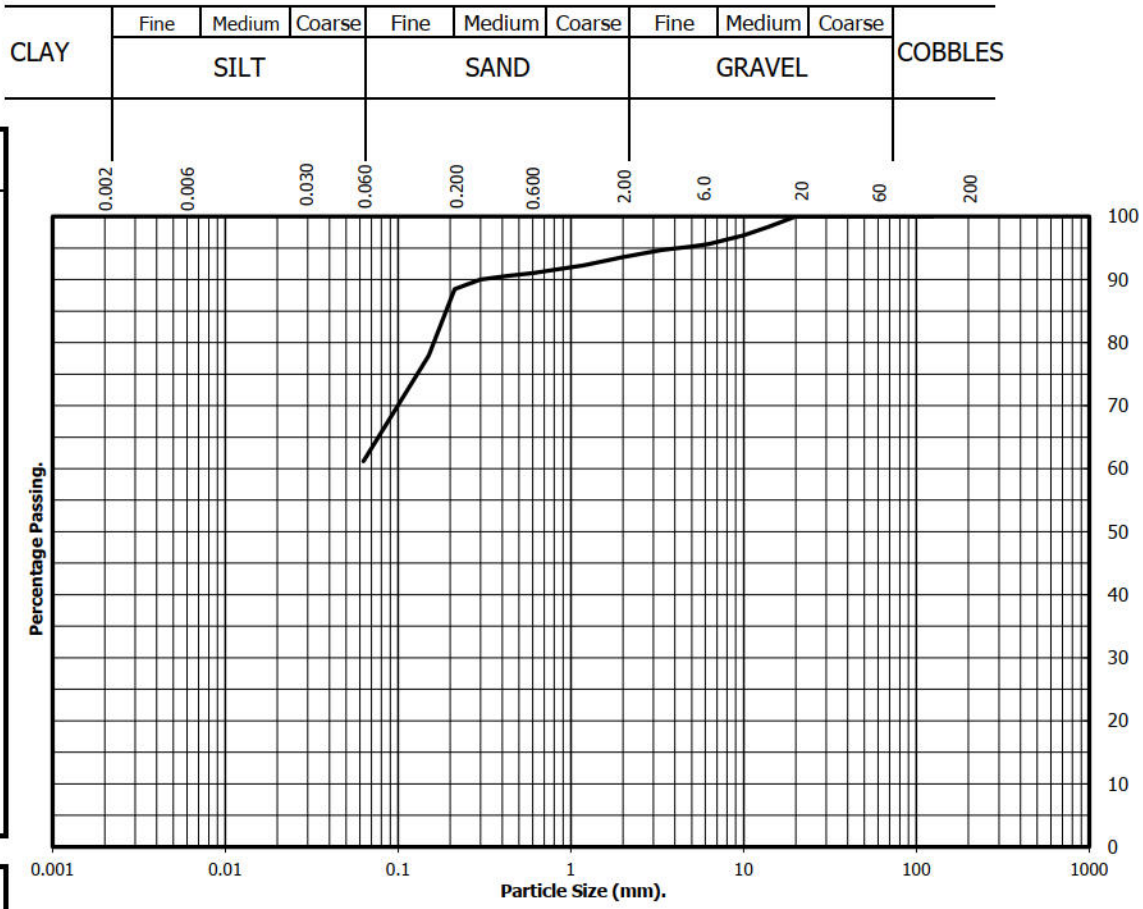
Test Report:

Particle Size Distribution Test
BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Client ref:	**15808**	**Sample Number:**	
Contract Number:	**23654**	**Depth from (m):**	**1.50**
Hole Number:	**TP2**	**Depth to (m):**	**0.00**
		Sample Type:	**S/B**
Location:	**Westergate**		
Description:	**Brown slightly gravelly sandy SILT**		

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	98
10	97
6.3	96
5.0	95
3.35	95
2.00	94
1.18	92
0.60	91
0.425	91
0.300	90
0.212	88
0.150	78
0.063	61



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	61	33	6	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Ben Sharp (Contracts Manager)

[redacted]

Date: 17.10.16

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Test Report:

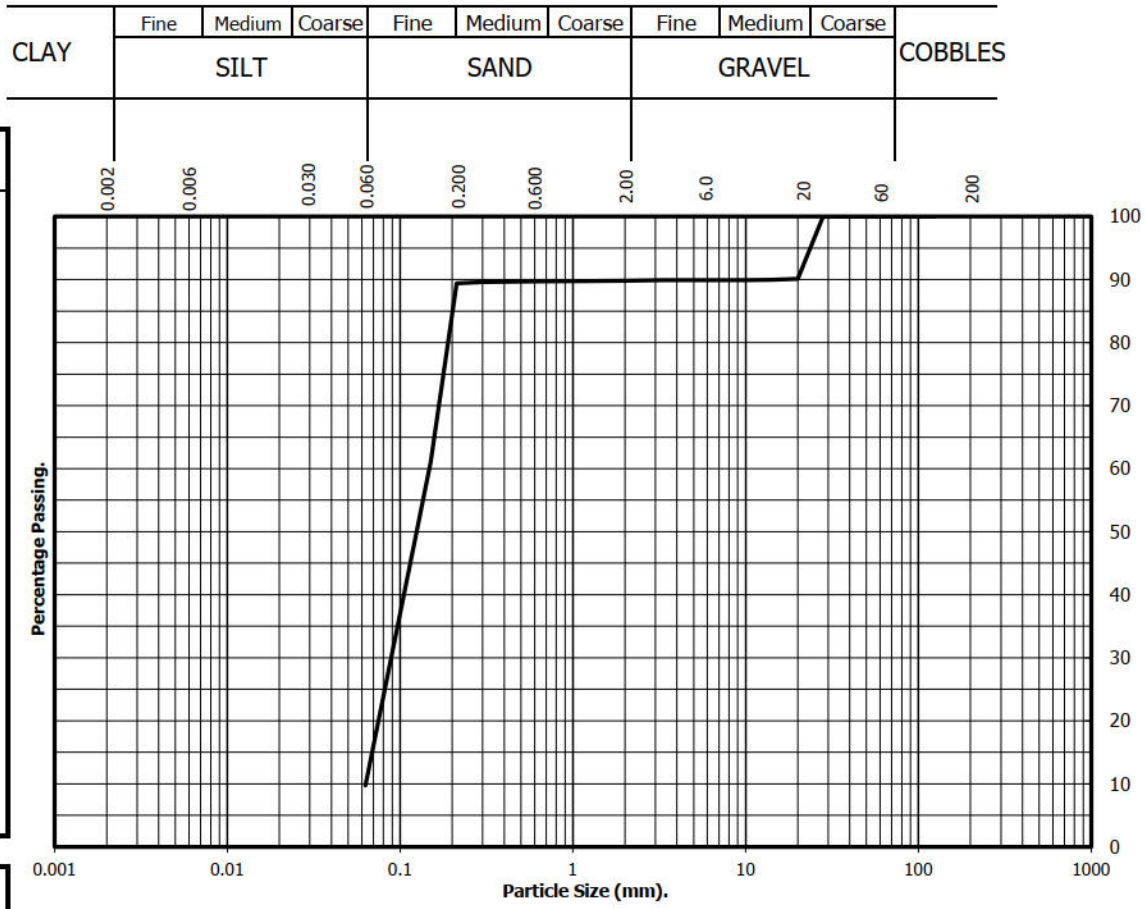
Particle Size Distribution Test
BS 1377 Part 2:1990.
Wet Sieve, Clause 9.2

Client ref: 15808
Contract Number: 23654
Hole Number: TP3

Sample Number:
Depth from (m): 2.00
Depth to (m): 0.00
Sample Type: S/B

Location: Westergate
Description: Brown slightly gravelly slightly silty SAND

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	90
14	90
10	90
6.3	90
5.0	90
3.35	90
2.00	90
1.18	90
0.60	90
0.425	90
0.300	90
0.212	89
0.150	61
0.063	10



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	10	80	10	0	Total Percentage

Remarks:
#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Ben Sharp (Contracts Manager) [redacted]

Date: 17.10.16

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Test Report:

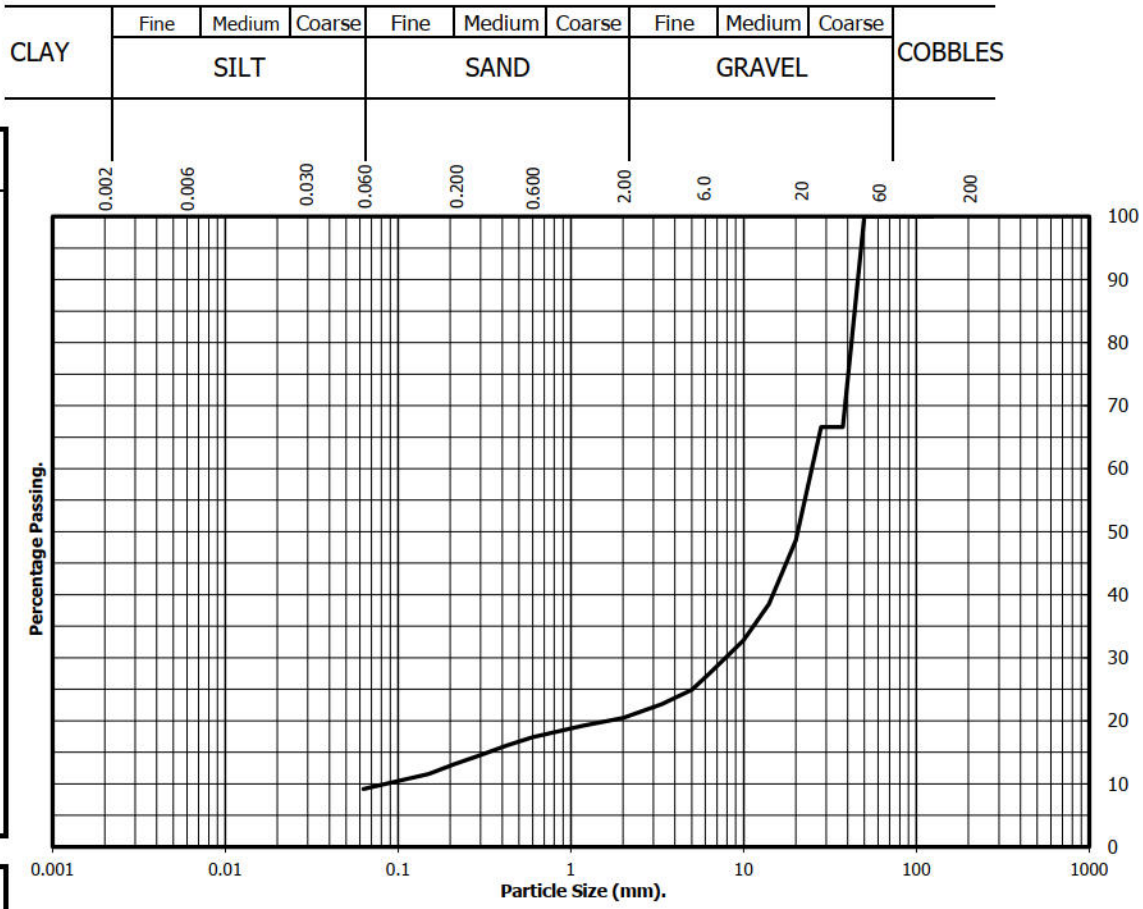
Particle Size Distribution Test
BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Client ref:	**15808**	**Sample Number:**	
Contract Number:	**23654**	**Depth from (m):**	**0.90**
Hole Number:	**TP6**	**Depth to (m):**	**0.00**
		Sample Type:	**S/B**
Location:	**Westergate**		
Description:	**Brown slightly silty slightly sandy GRAVEL**		

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	67
28	67
20	49
14	38
10	33
6.3	27
5.0	25
3.35	23
2.00	20
1.18	19
0.60	17
0.425	16
0.300	15
0.212	13
0.150	12
0.063	9

Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#



	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	9	11	80	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Ben Sharp (Contracts Manager)

[redacted]

Date: 17.10.16

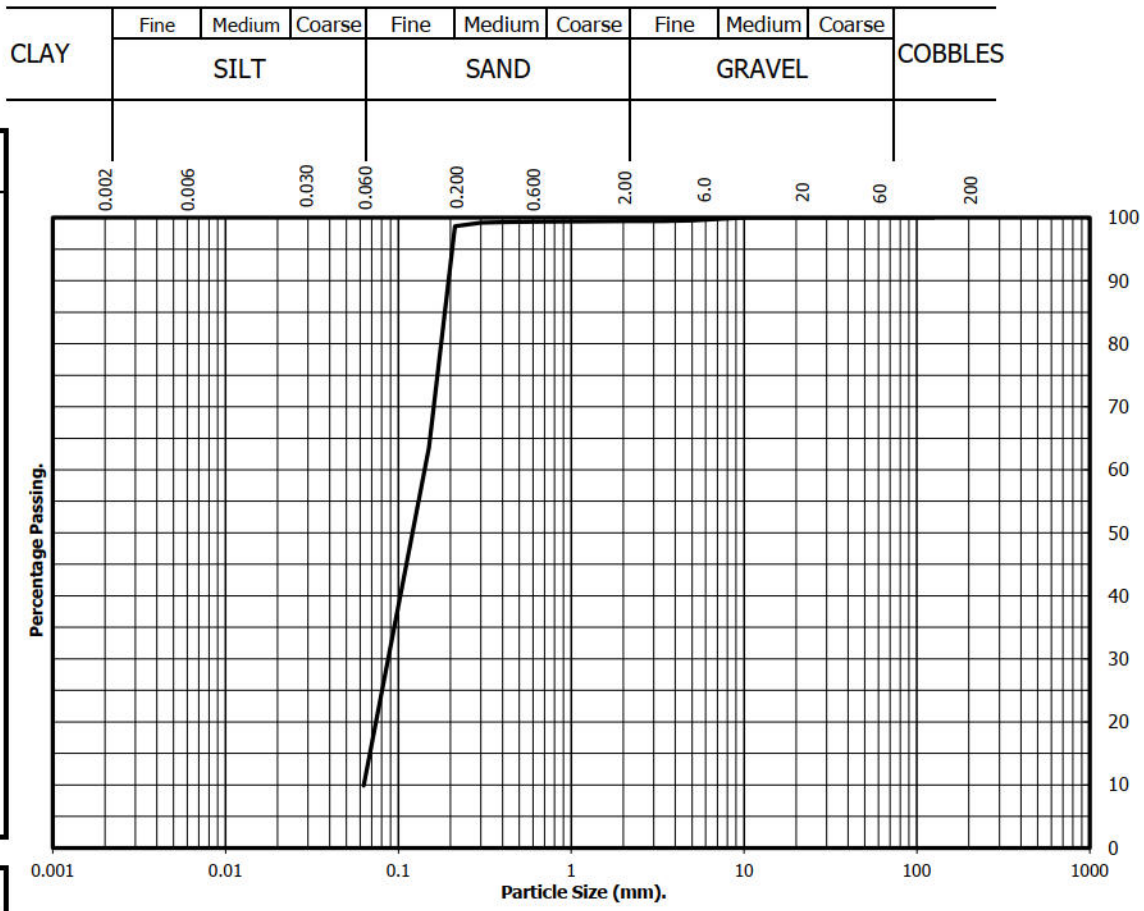
GSTL
GEO SITE & TESTING SERVICES LTD

UKAS TESTING
2788

Test Report:

Particle Size Distribution Test
BS 1377 Part 2:1990.
Wet Sieve, Clause 9.2

Client ref:	**15808**	**Sample Number:**	
Contract Number:	**23654**	**Depth from (m):**	**2.50**
Hole Number:	**TP9**	**Depth to (m):**	**0.00**
		Sample Type:	**S/B**
Location:	**Westergate**		
Description:	**Brown silty SAND**		



BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5.0	100
3.35	99
2.00	99
1.18	99
0.60	99
0.425	99
0.300	99
0.212	99
0.150	64
0.063	10

Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	10	89	1	0	Total Percentage

Remarks:
#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Ben Sharp (Contracts Manager) [redacted]

Date: 17.10.16

GSTL
GEO SITE & TESTING SERVICES LTD

UKAS TESTING
2788

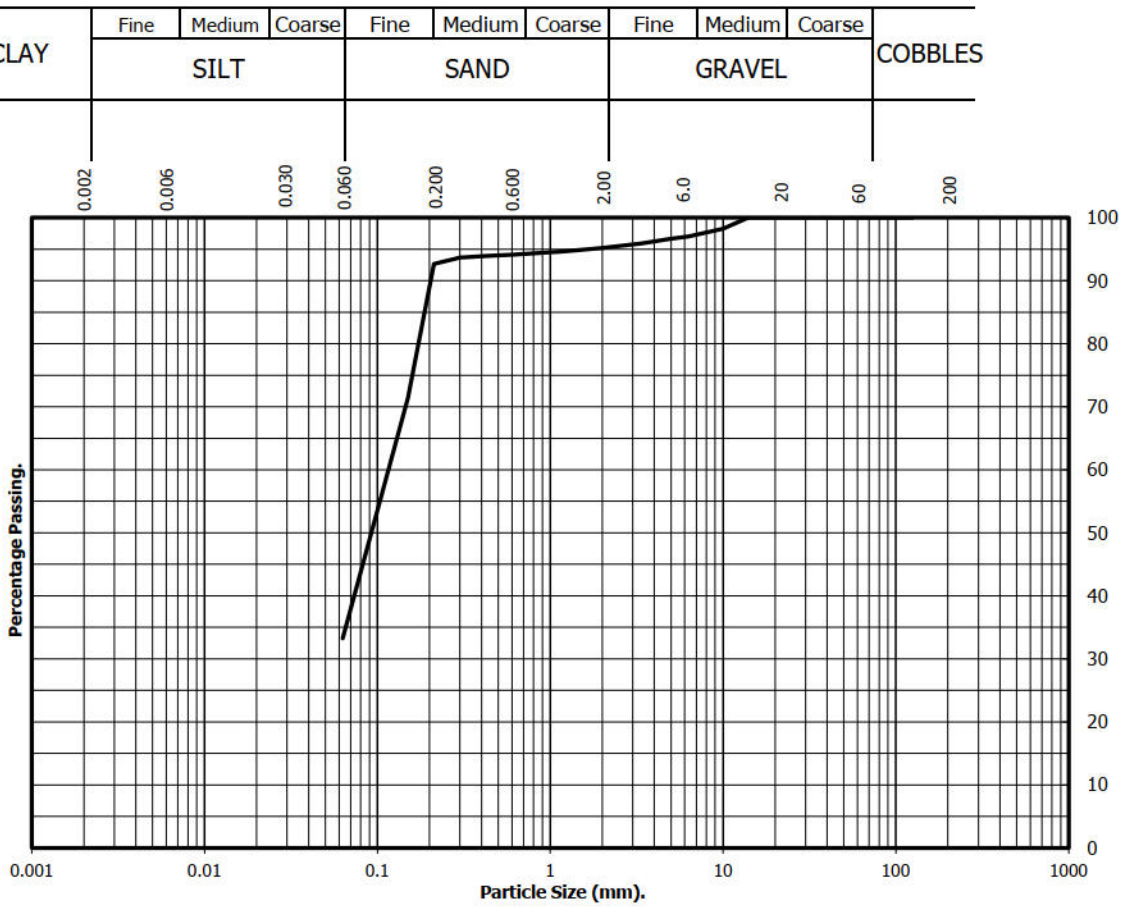
Test Report:

Particle Size Distribution Test
BS 1377 Part 2:1990.
Wet Sieve, Clause 9.2

Client ref:	**15808**	**Sample Number:**	
Contract Number:	**23654**	**Depth from (m):**	**1.50**
Hole Number:	**TP12**	**Depth to (m):**	**0.00**
		Sample Type:	**S/B**
Location:	**Westergate**		
Description:	**Brown slightly gravelly silty SAND**		

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	98
6.3	97
5.0	97
3.35	96
2.00	95
1.18	95
0.60	94
0.425	94
0.300	94
0.212	93
0.150	71
0.063	33

Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#



	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	33	62	5	0	Total Percentage

Remarks:
#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Ben Sharp (Contracts Manager [redacted]

Date: 17.10.16

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QTS Environmental Report No: 16-49918

Site Reference:	Westergate
Project / Job Ref:	15808
Order No:	None Supplied
Sample Receipt Date:	04/10/2016
Sample Scheduled Date:	04/10/2016
Report Issue Number:	1
Reporting Date:	10/10/2016

Authorised by:

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Kevin Old
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Associate Director of Client Services

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Lenham Heath
Maidstone
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4480

Soil Analysis Certificate							
QTS Environmental Report No: 16-49918	Date Sampled	27/09/16	27/09/16	27/09/16	27/09/16		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied		
Site Reference: Westergate	TP / BH No	TP1	TP4	TP7	TP12		
Project / Job Ref: 15808	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	1.50	1.10	2.50	2.00		
Reporting Date: 10/10/2016	QTSE Sample No	230573	230574	230575	230576		

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	7.3	7.9	7.6	7.4	
Total Sulphate as SO_4	mg/kg	< 200	NONE	331	< 200	< 200	< 200	
Total Sulphate as SO_4	%	< 0.02	NONE	0.03	< 0.02	< 0.02	< 0.02	
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	26	< 10	16	< 10	
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	0.03	< 0.01	0.02	< 0.01	
Total Sulphur	%	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	
Ammonium as NH_4	mg/kg	< 0.5	NONE	5.6	7	8.8	6.3	
Ammonium as NH_4	mg/l	< 0.05	NONE	0.56	0.70	0.88	0.63	
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	46	12	29	7	
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	22.9	5.9	14.7	3.7	
Water Soluble Nitrate (2:1) as NO_3	mg/kg	< 3	MCERTS	< 3	5	5	8	
Water Soluble Nitrate (2:1) as NO_3	mg/l	< 1.5	MCERTS	< 1.5	2.4	2.6	4.1	
W/S Magnesium	mg/l	< 0.1	NONE	1.2	0.2	2.1	0.2	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content
Subcontracted analysis $^{(S)}$

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Maidstone
Kent ME17 2JN
[redacted]

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

UKAS TESTING 4480

Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 16-49918	
Soils Ltd	
Site Reference: Westergate	
Project / Job Ref: 15808	
Order No: None Supplied	
Reporting Date: 10/10/2016	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
230573	TP1	None Supplied	1.50	14.1	Light brown clay with stones
230574	TP4	None Supplied	1.10	17.9	Brown clay
230575	TP7	None Supplied	2.50	19.7	Brown clay
230576	TP12	None Supplied	2.00	19.3	Brown clay

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample I/S

Unsuitable Sample U/S

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4480

Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 16-49918
Soils Ltd
Site Reference: Westergate
Project / Job Ref: 15808
Order No: None Supplied
Reporting Date: 10/10/2016

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

BINGHAM : HALL ASSOCIATES

Civil and Environmental Engineering Consultants

Groundwater Monitoring Report

Land East of Westergate

CALA Homes (South Home Counties) Limited

June 2017 – Version 3

Document Control Sheet

Project Name:	Proposed Residential Development, Land East of Westergate, West Sussex, PO20 3QR
Project Reference:	3030
Report Title:	Groundwater Monitoring Report
Document Reference:	Version 2 – Minor changes Version 3 – Groundwater monitoring and precipitation data included July 2016 to February 2017.

	Name	Position	Signature	Date
Prepared By:	Gillian Hoy	Geotechnical Engineer	Removed for issue to LPA	23 June 2017
Approved By:	Andrew Bingham	Managing Director	Removed for issue to LPA	23 June 2017
For and on behalf of Bingham Hall Associates				

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Appendix C: Borehole Logs
Appendix D: Groundwater Monitoring Data
Appendix E: Geological Cross Sections
Appendix F: Precipitation Data

Executive Summary

This Report is provided in accordance with requirements set out by Arun District Council policy to assess groundwater conditions for new developments. Groundwater monitoring is required over a six month winter season to assess the risk of groundwater flooding to the development, and to inform the surface water drainage strategy. To facilitate long term groundwater monitoring at the Site five (BH1-5) groundwater monitoring wells were installed. Groundwater monitoring was undertaken between March 2016 and February 2017.

Geological Cross Sections have been prepared and illustrate that groundwater lies within the Superficial Deposits sitting above the impermeable London Clay cap. Cross sections of the wider Barnham – Eastergate – Westergate area show that the site is some distance from the possible groundwater emergence zones located to the north and south of the Site, i.e north of Eastergate and further to the south towards Bognor Regis, that coincide with the Chalk outcrop. Therefore, the groundwater regime within the Site is not connected to the deeper Chalk Aquifer.

The groundwater monitoring results indicate groundwater levels are consistent and within an expected range considering the underlying geology and the proximity of the monitoring wells to nearby watercourses.

All development will be undertaken within Flood Zone 1.

The monitoring undertaken indicates groundwater levels within BH1, BH2 and BH5, located within Flood Zone 1, were between 0.60m and 2.40mbgl. Groundwater levels within BH1 remained relatively constant throughout the monitoring period indicating a low responsiveness to intense rainfall events. Groundwater levels within BH2 and BH5 showed a steady decrease during the summer months but were influenced by intense rainfall events.

Groundwater levels within BH3 and BH4 reflect their proximity, and hydraulic continuity, with the Lidsey Rife and Westergate Stream, and position within Flood Zone 2.

There is no indication that high rainfall events result in groundwater flooding.

No flooding above existing ground level was noted during this monitoring period.

Groundwater levels within the Superficial Deposits are separated from the underlying Chalk Aquifer by a significant thickness of London Clay which acts as an aquiclude.

Groundwater levels will be a factor in the design of surface water drainage systems which must provide a 1m unsaturated zone beneath the base of any infiltration structure and the maximum recorded groundwater level.

This report demonstrates that the risk from groundwater flooding impacting upon the Site is negligible.

1 Introduction

General

1.1 Bingham Hall Associates has been commissioned by CALA Homes (South Home Counties) Limited to assess the groundwater regime in support of a hybrid planning application for a development of 350 dwellings on land east of Westergate, referred to hereafter as 'the Site'.

1.2 Groundwater monitoring is required to assess annual fluctuations in groundwater levels to assess the risk of groundwater flooding, and to inform drainage design.

1.3 The Site is currently greenfield land located to the east of the developed area of Westergate.

1.4 The scope of works comprised:

- Installation of 5 long term groundwater monitoring wells
- 12 months groundwater monitoring*
- Interpretative report assessing the impact of groundwater on the development

* Installation was carried out in February 2016 and monitoring commenced at the beginning of March 2016. The initial monitoring did not encompass the full six months winter monitoring season therefore monitoring continued until February 2017 to cover the required period.

Limitations

1.5 This document has been prepared for the titled project and should not be relied upon or used for any other project. Bingham Hall Associates accepts no responsibility or liability for the consequences of this document being used for a purpose other than that for which it was commissioned. The assessments and judgments contained herein should not be relied upon as legal opinion.

1.6 The findings and opinions are relevant to the dates of the site visits and it should be noted that groundwater conditions will change over time due to natural variations and may be affected by human activities. The opinions included herein are based on the information obtained from the assessments undertaken at the site and from our experience. If additional information becomes available which may alter our conclusions, we request the opportunity to review the information, reassess the potential concerns and modify our opinion, if warranted.

2 Background

2.1 Arun District Council Emerging Local Plan notes that parts of eastern area of Barnham are prone to foul and surface water sewer flooding with this potentially due to high groundwater levels.

2.2 The British Geological Survey defines groundwater flooding as "the emergence of groundwater at the ground surface away from perennial river channels or the rising of groundwater into man made ground (e.g. property situated below ground level), under conditions where the 'normal' ranges of groundwater level and groundwater flow are exceeded". Given the nature of groundwater flooding this is sometimes difficult to fully establish without the use of long term groundwater monitoring data. The geology and inherent hydrogeology has a significant influence on flood risk as it has direct bearing on rates of infiltration, runoff which directly influences groundwater flooding, and groundwater emergence zones.

2.3 The West Sussex SFRA, Map G 'Areas More Prone to Groundwater Flooding' shows the site to be in an area that is at medium risk of groundwater flooding. There are no recorded areas of groundwater flooding or groundwater flood events within close proximity of the site.

2.4 The Lidsey Surface Water Management Plan (SWMP) has identified groundwater infiltration to piped drainage in the 6 villages as the primary cause of sewer flooding in the urban area. High groundwater levels in the 6 villages is attributed to rainfall on the South Downs, particularly in winter, causing groundwater levels to rise in the Chalk aquifer. Sub-standard drainage (private and public) in the 6 villages allows water ingress to pipework hence overloading sewers. This subsequently overloads the downstream Wastewater Treatment Works with significant 'clean' water flows through the works taking up a substantial part of the consented outfall from the Works.

Planning Policy Context

2.5 Arun District Council Emerging Local Plan Policies relevant to Flood Risk are described below:

- Policy DM2: identifies the potential for flooding (coastal, fluvial, surface water and groundwater) as being a matter for further assessment in a planning application.
- Policy DM3: encourages the use of Sustainable Urban Drainage Systems (SUDS) to minimise the impact of urban development on the water environment, reduce flood risk, and provide habitats for wildlife. In particular, to ensure that SUDS discharge water from the development at the same or lesser rate, the policy requires developers to undertake six months groundwater monitoring within the winter months (October – March).

- Policy DM41: further specifies the use of SUDS and the requirement to undertake 6 months monitoring within the winter period.

Lidsey Surface Water Management Plan

2.6 Lidsey SWMP (Section 4.6.6) details appropriate SuDS drainage for areas prone to groundwater flooding. It states that only two methods (green roofs and rainwater harvesting) are considered appropriate in areas where groundwater flooding or high groundwater levels occur as other methods all seek to utilise capacity in the ground to remove surface water. There may be potential to use other methods such as ponds & wetlands; swales, detention basins; bio-retention basins; car parking areas; permeable paving; and soakaways. Prior to considering these monitoring needs to be undertaken to establish groundwater conditions during periods of prolonged wet weather (the winter period).

Stakeholder Consultation

2.7 Appropriate consultees in respect of this report are:

- Arun District Council
- West Sussex County Council – Lead local Flood Authority

2.8 The groundwater monitoring undertaken for this report has been carried out in accordance the scope of work agreed with Arun District Council. Correspondence with Arun District Council is provided in **Appendix A**.

3 Site Appraisal

Site Setting

3.1 The site is currently undeveloped arable land covering approximately 18.4ha as shown in Figures 3.1 and 3.2:

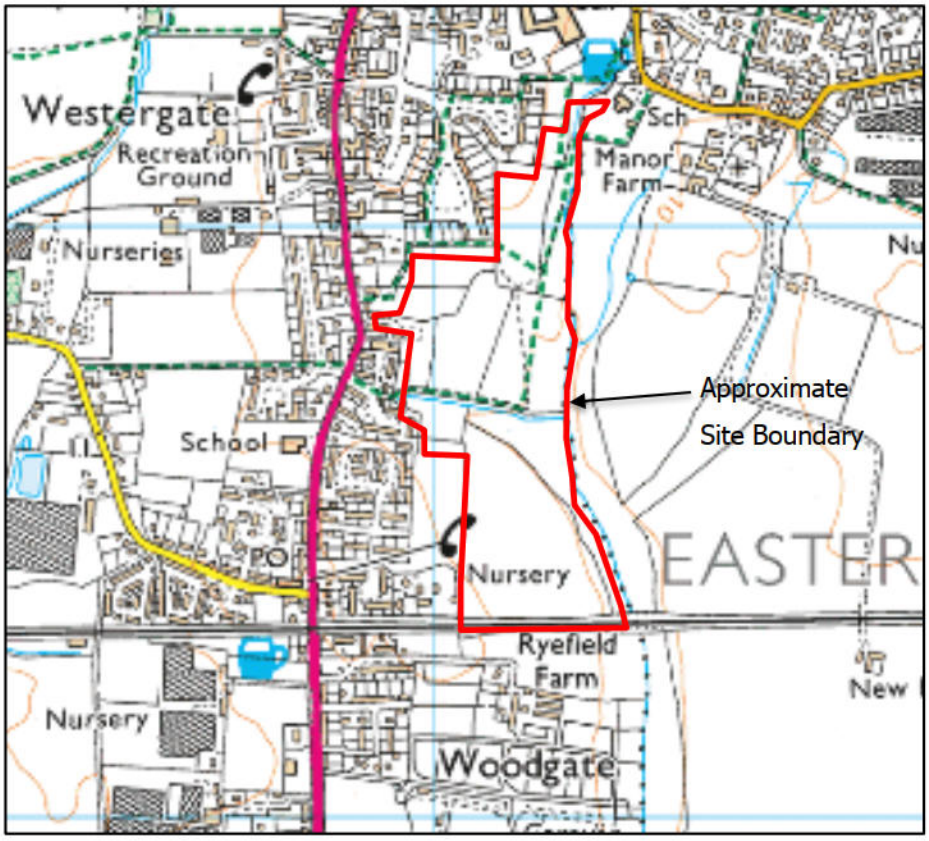


Figure 3.1: Site Location Plan



Figure 3.2: Site Location Plan: Aerial View

Topography

3.2 A detailed topographic survey has been carried out and is provided in **Appendix B**. The land falls from west to east and towards Lidsey Rife forming the eastern boundary. The west part of the site is relatively level at an elevation of around 8m–10m AOD and falling to between 5m–3.5m AOD along the lower edge adjacent to Lidsey Rife.

Geology

3.3 The British Geological Survey (BGS) 1:50,000 map for Chichester/Bognor (sheet 317/332) indicates the site lies on bedrock of the London Clay Formation. This is largely masked by superficial deposits of Head (Gravel, Sand Silt & Clay) in the northern part of the site and River Terrace Deposits (Sand, Silt & Clay) in the southern part of the site, with the river valley comprising Alluvium (Clay, Silt, Sand & Gravel) and Raised Beach Deposits (Sand and Gravel).

3.4 The London Clay Formation and Lambeth Group strata (clay, silt & sand) is known to be in excess of 100m thick beneath the Site, and lies upon the Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation and Culver Chalk Formation (Chalk – undifferentiated).

Hydrology

3.5 The Site is located in an area of agricultural land that is bounded to the east by Lidsey Rife which flows from the north to the south and is culverted underneath the railway line. An unnamed tributary from the west joins the Lidsey Rife through the Site from Westergate, to assist in identification this watercourse is termed Westergate Stream in this Report.

Hydrogeology

Aquifer Characteristics

3.6 The superficial deposits are designated as Secondary A Aquifers (i.e. permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers). Groundwater within these deposits will be perched upon the Unproductive London Clay Formation (i.e. low permeability layers with negligible significance for water supply or river base flow) which is known to be in excess of 100m thick beneath the site.

3.7 Considering the topography and underlying impermeable geology it is likely that groundwater within the superficial deposits is in hydraulic continuity with the Lidsey Rife and Westergate Stream located along the eastern boundary and through the centre of the site, respectively.

3.8 Groundwater movement in the Superficial Deposits will generally be down the slope and towards Lidsey Rife hence resulting in a slow decline in groundwater levels between rainfall periods.

Groundwater Vulnerability

3.9 The vulnerability of groundwater at a location is based on the hydrological, geological, hydrogeological and soil properties within a one kilometer square grid and is expressed at high, medium or low vulnerability, as defined by the Environment Agency. Typically this information is used to assess the exposure of groundwater to pollution hazards, however it can also be a useful tool in judging the likely permeability, flow and storage characteristics of the underlying strata.

3.10 The Secondary A aquifers beneath the Site are designated as high vulnerability and therefore, likely to have good permeability, flow and storage properties.

Source Protection Zones

3.11 Groundwater provides a third of the drinking water in England and Wales. The Environment Agency has defined Source Protection Zones around protected groundwater sources such as wells, boreholes and springs used for public drinking water supply. The zones are defined by the groundwater travel time from a point below the water table to the source. Zone 1 is defined by a travel time of 50 days, Zone 2 by a travel time of 400 days and Zone 3 by the total catchment area within which all groundwater recharge is presumed to be discharged at the source.

3.12 The Site is not within a Source Protection Zone, therefore the groundwater beneath the site is not used for public drinking water supply.

4 Fieldwork

4.1 Ground investigation works were carried out on 22 February 2016 to install five 50mm diameter monitoring standpipes to depths of 5mbgl (below ground level) using window sampling apparatus.

4.2 The exploratory borehole locations were chosen to provide a spread across the site, as shown in Figures 4.1. Borehole locations are dictated to some extent by presence of below ground utility apparatus; land use (presence of crops); field boundaries; and accessibility.

4.3 The exploratory holes (BH1-5 (WS1-5)) were logged on site, by an engineer, to BS5930:1999+A2:2010 'Code of Practice for Site Investigations' and are provided in **Appendix C**.

4.4 Return monitoring visits, to record groundwater levels, were carried out at regular intervals from March 2016 to February 2017.

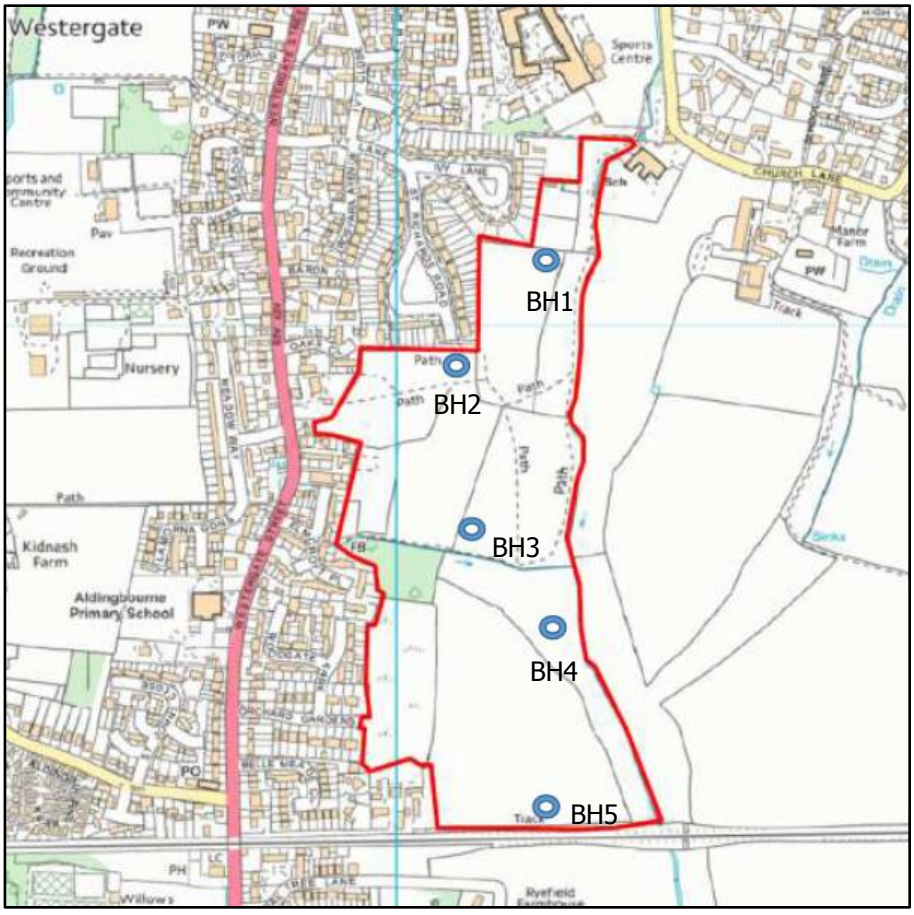


Figure 4.1: Groundwater Monitoring Well Locations

5 Groundwater Monitoring

General

5.1 Groundwater levels were recorded using either a manual dip tape or via water level dataloggers, installed within the monitoring standpipes. Dataloggers are regarded as the most reliable way of recording long term continuous water levels, however, the standpipes were vandalised in April and October which compromised their data and therefore manual readings were deemed more reliable.

5.2 Where datalogger readings were available, the groundwater levels have been interpreted using average values, ignoring any significant short term spikes that are attributed to localised vibration or disturbance. Groundwater monitoring data is provided in **Appendix D**.

Groundwater Assessment

5.3 The groundwater monitoring results indicate groundwater levels are consistent and within an expected range considering the underlying geology and the proximity of the monitoring wells to nearby watercourses.

5.4 Geological Cross Sections have been prepared and illustrate that groundwater lies within the Superficial Deposits sitting above the impermeable London Clay cap. Cross sections of the wider Barnham – Eastergate – Westergate area show that the site is some distance from the possible groundwater emergence zones located to the north and south of the Site, north of Eastergate and further to the south towards Bognor Regis, that coincide with the Chalk outcrop. Therefore, the groundwater regime within the Site is not connected to the deeper Chalk Aquifer.

5.5 Geological Cross Sections are provided in **Appendix E**.

Precipitation Data

5.6 Weekly precipitation data for the same period has been obtained from RP5.co.uk. The records are taken from the Meteorological Office weather Station at Thorney Island. This weather station is located to the west of Chichester and hence rainfall rates are not necessarily directly comparable with weather conditions at the Site. However, this data does give an indication of weather patterns in the area. The data is presented graphically in **Appendix F.**

5.7 The records show significant rainfall in weeks commencing 24 March 2016, 16 June 2016, 23 June 2016, 28 July 2016, 17 November 2016, 12 January 2017, 2 February 2017 and 23 February 2017.

5.8 These records have been correlated with the groundwater monitoring data:

BH1: Groundwater levels have remained relatively constant throughout the monitoring period indicating a low responsiveness to rainfall. BH1 is located within Flood Zone 1 and the well is installed within the River Terrace Deposits.

BH2: Groundwater levels show a steady decline during the summer months, with a marked increase noted around late June 2016. Levels were at their highest during January and February 2017. BH2 is located within Flood Zone 1 and the well is installed within the River Terrace Deposits.

BH3: Groundwater levels show a steady decrease during the summer months, with marked increases noted around late June 2016, late July 2016, January and February 2017, in response to rainfall events. BH3 is located within Flood Zone 2 and the well is installed within Alluvium.

BH4: BH4 indicates a similar trend to BH3. BH3 is also located within Flood Zone 2 and the well is installed within Alluvium.

BH5: BH5 follows a similar trend to BH2. BH5 is located within Flood Zone 1 and the well is installed within the River Terrace Deposits.

6 Conclusions

6.1 All development will be undertaken within Flood Zone 1. The monitoring undertaken indicates groundwater levels within BH1, BH2 and BH5, located within Flood Zone 1, were between 0.60m and 2.40mbgl. Groundwater levels within BH1 remained relatively constant throughout the monitoring period indicating a low responsiveness to intense rainfall events. Groundwater levels within BH2 and BH5 showed a steady decrease during the summer months, however were influenced by intense rainfall events.

6.2 Groundwater levels within BH3 and BH4 were between 0.10m and 1.43mbgl. These levels reflect their proximity, and hydraulic continuity, with the Lidsey Rife and Westergate Stream, and position within Flood Zone 2. Development will not be undertaken within Flood Zone 2.

6.3 There is no indication that high rainfall events result in groundwater flooding. No flooding above existing ground level was noted during this monitoring period.

6.4 Groundwater levels within the Superficial Deposits are separated from the underlying Chalk Aquifer by a significant thickness of London Clay which acts as an aquiclude, preventing any hydraulic continuity between the two, as demonstrated by the Geological Cross Sections.

6.5 Groundwater levels will be a factor in the design of surface water drainage systems which must provide a 1m unsaturated zone beneath the base of any infiltration structure and the maximum recorded groundwater level. However, this report demonstrates that the risk from groundwater flooding impacting upon the Site is negligible.

Appendix A: Correspondence with Arun District Council

Andrew Bingham

From: Thomas Callaway <Thomas.Callaway@arun.gov.uk>
Sent: 18 February 2016 14:07
To: Andrew Bingham
Cc: Paul Cann
Subject: RE: Land east of Westergate: groundwater monitoring

Andrew

The strategy is acceptable. Groundwater monitoring can be done now but will need to be supplemented by monitoring throughout next winter, from October through to March.

This is required to inform the drainage design before any building work can start.

Regards

Tom Callaway

Thomas Callaway | Drainage & Coastal Engineer, Engineering Services, Arun District Council | Location: Second Floor, Arun Civic Centre, Maltravers Road, Littlehampton, BN17 5LF
Internal: 37818 | External: +44 (0) 1903 737818 | Fax: +44 (0) 1903 716019 | E-mail: Thomas.Callaway@arun.gov.uk
Arun is Working in Partnership with Chichester District Council
Visit our web site at www.arun.gov.uk and www.chichester.gov.uk
Save the environment - think before you print.

From: Paul Cann
Sent: 18 February 2016 10:21
To: Thomas Callaway
Subject: FW: Land east of Westergate: groundwater monitoring

Paul Cann
Senior Engineer (Drainage & Coastal)

Paul Cann | Senior Engineer (Drainage & Coastal), Engineering Services, Arun District Council | Location: Second Floor, Arun Civic Centre, Maltravers Road, Littlehampton, BN17 5LF
Internal: 37819 | External: +44 (0) 1903 737819 | Fax: +44 (0) 1903 716019 | E-mail: Paul.Cann@arun.gov.uk
Arun is Working in Partnership with Chichester District Council
Visit Arun's web site at http://www.arun.gov.uk/ and www.chichester.gov.uk
Save the environment - think before you print.

From: Andrew Bingham [redacted]
Sent: 18 February 2016 08:59

To: Paul Cann
Subject: Land east of Westergate: groundwater monitoring

Paul

I refer to our conversation yesterday.

The proposed land is as shown attached for approximately 320 dwellings to be developed in advance of the wider development with initially a hybrid planning application.

In accordance with policy W DM3 we need to undertake 6 months groundwater monitoring within the winter period – I appreciate we are at the latter end of the period but hope we can obtain a reasonable amount of viable data to inform the planning application, with if required further monitoring next winter.

As discussed as propose to install 4 wells and consider that this will provide a reasonable distribution across the site, approximate locations shown on the attached plan. The geology in this area is shown to be a clay cap in excess of 100m thick overlying the water bearing chalk. It is clear that groundwater flooding will not arise from the deep aquifer but may occur due to perched water tables in the upper strata. Consequently borehole monitoring will target these shallow water tables with well monitoring depth of 5m. Water levels will be monitored continuously using data loggers with data retrieved weekly. At the end of the 6 month monitoring period a report will be produced, if required interim results can be provided.

Can you let me know if you are in agreement with this strategy, and subject to the proviso that additional monitoring may be required post planning.

regards

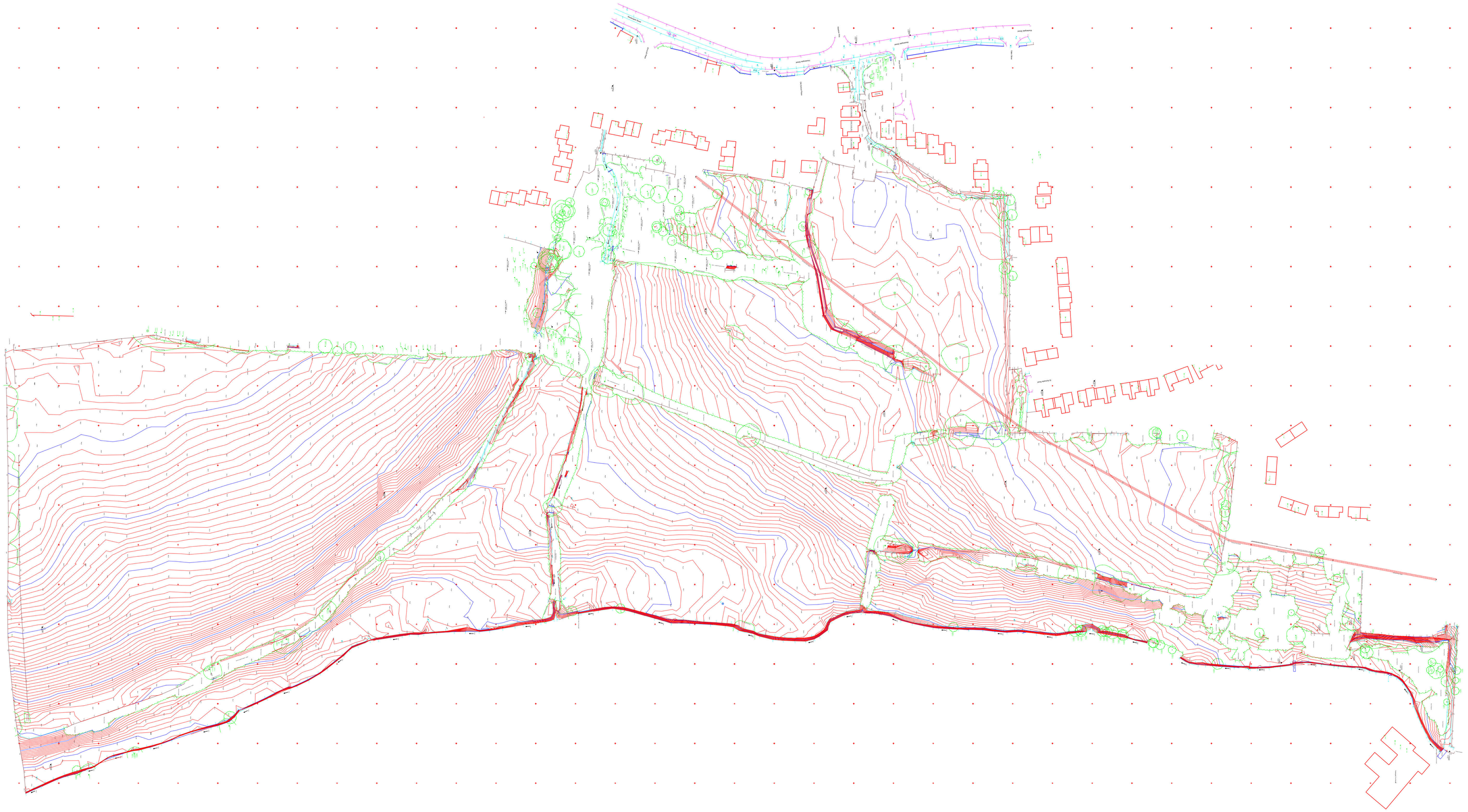
Andrew Bingham C. Eng.
Managing Director
BHA Consulting Ltd
Oakleigh Connaught Rd
Attleborough
Norfolk NR17 2BW
[redacted]
see our website at www.binghamhall.com

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****

Appendix B: Topographic Survey



Notes

1. This survey has been computed and drawn about the national grid.
2. All levels are in metres and relate to Ordnance Datum. With levels tied via GPS link to Leica Smartnet Network. Station 01 has an accepted value of 7.42m.
3. This survey was surveyed for a scale of 1:200, any subsequent enlargements should be verified on site.
4. Whilst every care has been taken, no responsibility can be accepted for errors or omissions caused by detail obscured or not accessible at the time of this survey.
5. Tree Canopy lines are indicative.
6. Trees under 100mm trunk dia not surveyed.
7. All dimensions to be checked on site prior to any work taking place.
8. Any surrounding buildings are indicated using data collected and as viewed from the site. This may not represent the actual footprint at ground level and must be checked using an OS overlay if critical to the scheme.
9. Building site at Pine Close was under construction at the time of the survey.
10. Many Areas heavily overgrown thus obscuring any detail within.
11. Surrounding buildings positioned using OS data from Promap. License No. 10022432
12. Positions of features and contours within overgrown areas have been assumed due to no access being possible. Trees within these areas have been remotely collected and may not exactly represent the true position.

Legend

BOL	Bollard
BT	BT Inspection Chamber
CBF	Close Boarded Fence
CLF	Chain Link Fence
CATV	Cable Television Point
CCTV	Closed Circuit Television Camera
CL	Cover Level
CPS	Concrete Paving Slabs
DK	Drop Kerb
DPC	Damp Proof Course
EL	Eaves Level
FB	Flower Bed
FH	Fire Hydrant
FL	Floor Level
FW	Foul Water Sewer
GL	Rain Water Gully/Drain
GAS	Gas Inspection Cover
Ht	Height
IR	Iron Railing Fence
IC	Inspection Cover
Inv	Chamber Lowest Invert Level
LB	Letter Box
LP	Lamp Post
MH	Man Hole/Inspection Chamber
OSBM	Ordnance Survey Bench Mark
BWF	Barbed Wire Fence
PARA	Parapet Wall Height
PCF	Post and Chain Fence
PF	Panel Fence
PRF	Post and Rail Fence
PWF	Post and Wire Fence
PB	Post Box
PP	Electrical Power Pole
RE	Rodding Eye
RL	Ridge Level
RWP	Rain Water Pipe
SIGN	Road Sign
STN	Survey Control Station
SV	Stop Valve
SVP	Soil & Vent Pipe
TL	Threshold Level
TP	Telegraph Pole
VP	Vent Pipe
WM	Water Meter
WS	Water Supply Cover

TELEPHONE CABLE
ELECTRICITY CABLE
BANK TOP
BUILDING LINES
DRAIN RUNS
FENCES
FOOTPATH
KERB LINES
WALLS

HEDGES
Spread
Dia of trunk
Species

RE
TREE CANOPY
(INDICATIVE ONLY)

GATE

Rev.	Description	By	Date	Chk'd	Auth
A	Building Footprints Amended	SC	Dec 15		
B	3D Contours added	SC	Jun 16		

10m
5m
0m
Scale Bar - Measurements in Metres.

Scale Bar - Measurements in Metres.

N

Indicative Only

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COLE & COLE
Measured Land & Building Surveys

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Client

CALA Homes

Project

Land at:
Westergate Street,
Westergate, West Sussex.

Title

Topographical Survey

Original Scale	Surveyed	Drawn	
1:1000@A0	CG/SMC/TY	SMC	
	Date Jan 16	Date Jan 16	

Drawing Number

16 – 0102a

Rev

B

Appendix C: Borehole Logs

soils LIMITED Geotechnical & Environmental Consultants

Soils Limited
Newton House [redacted] Tadworth KT20 5SR

Borehole Log

Borehole No. **WS1**
Sheet 1 of 1

Project Name: Land at Westergate	Project No.: 15474	Co-ords:	Hole Type WS
Location: Land at Wester Gate, St Richards Rd, Westergate, Chichester, West Sussex PO20 3RD		Level:	Scale 1:50
Client: BHA Consulting Ltd		Dates: 07/03/2016	Logged By OK

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	D		0.20			Grass over very soft grey slightly sandy silty CLAY.Sand is fine.Occasional fine to medium sub-angular flint gravels. Abundant of fine roots and rootlets. TOPSOIL
		0.50	D					Soft light brown slightly sandy silty CLAY becoming firm yellowish grey with depth. Sand is fine.Very rare fine to medium sub-angular flint gravels becoming frequent at with depth.Frequent fine roots and rootlets becoming occasional fine to medium with depth. ALLUVIUM
		0.90	D					
		1.20	D		1.30			Yellowish brown slightly clayey fine SAND. A occasional pockets of slightly clayey gravelly fine to coarse SAND .Gravel is fine to medium sub-angular flint. RIVER TERRACE GRAVELS
		1.80	D					
		2.20	D					
		2.80	D					
		3.20	D					
		3.80	D					
		4.30	D					
		4.95	D		5.00			End of Borehole at 5.00m

1 2 3 4 5 6 7 8 9 10

General Remarks:
Fine to medium roots and rootlets to 1.30

Groundwater Remarks:

Borehole Type
CP: Cable Percussive
WS: Windowless Sampler
RC: Rotary Cored

Sample Types
D: Disturbed
B: Bulk
J: Jar
W: Water
U: Undisturbed

In-Situ Testing
SPT: Split spoon - Standard Penetration Test
CPT: Cone - Standard Penetration Test

soils LIMITED
Geotechnical & Environmental Consultants

Soils Limited
Newton House [redacted] Tadworth KT20 5SR

Borehole Log

Borehole No.
WS2
Sheet 1 of 1

Project Name: Land at Westergate	Project No.: 15474	Co-ords:	Hole Type WS
Location: Land at Wester Gate, St Richards Rd, Westergate, Chichester, West Sussex PO20 3RD		Level:	Scale 1:50
Client: BHA Consulting Ltd		Dates: 07/03/2016	Logged By OK

Well	Water Strikes	Sample and In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.10	D					Grass over soft light brown slightly sandy silty CLAY. Sand is fine. Occasional fine to coarse sub-angular flint gravels. Abundant of fine roots and rootlets to 0.10. Occasional fine roots and rootlets. ALLUVIUM
		0.40	D					
		0.80	D		0.90			
		1.20	D					Light brown slightly sandy clayey fine to coarse angular flint GRAVEL. Sand is fine to coarse. Rare fine roots and rootlets. RIVER TERRACE GRAVELS
		1.50	D		1.30			
					1.60			Light brownish white clayey gravelly fine to coarse SAND. Gravel is fine to coarse angular flint. Frequent fine to coarse sand sized chalk particles. RIVER TERRACE GRAVELS
		2.20	D					Light brown slightly clayey fine SAND. Occasional pockets of fine to medium sub-angular flint gravels. Rare occasional pockets of firm grey CLAY at depth. RIVER TERRACE GRAVELS
		2.80	D					
		3.30	D					
		3.80	D					
		4.50	D					
					5.00			End of Borehole at 5.00m

1 2 3 4 5 6 7 8 9 10

General Remarks:
Fine roots and rootlets to 1.30

Groundwater Remarks:

Borehole Type
CP: Cable Percussive
WS: Windowless Sampler
RC: Rotary Cored

Sample Types
D: Disturbed
B: Bulk
J: Jar
W: Water
U: Undisturbed

In-Situ Testing
SPT: Split spoon - Standard Penetration Test
CPT: Cone - Standard Penetration Test

soils LIMITED
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Newton House [redacted] Tadworth KT20 5SR

Borehole Log

Borehole No.
WS3
Sheet 1 of 1

Project Name: Land at Westergate	Project No.: 15474	Co-ords:	Hole Type WS
Location: Land at Wester Gate, St Richards Rd, Westergate, Chichester, West Sussex PO20 3RD		Level:	Scale 1:50
Client: BHA Consulting Ltd		Dates: 07/03/2016	Logged By OK

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	D		0.20			Grass over slightly sandy clayey SILT. Sand is fine. Very rare fine to medium sub-angular flint gravels. Abundant of fine roots and rootlets. TOPSOIL
		0.50	D					Firm light brown slightly silty CLAY.Frequent fine to coarse angular flint gravels at depth. Occasional pockets of fine to medium gravel sized calcareous nodules.Occasional fine roots and rootlets. ALLUVIUM
		0.80	D		1.00			Stiff light brown mottled orange and grey slightly silty CLAY becoming very stiff with depth. Occcasional pockets of fine to medium gravel.Rare pockets of fine sand at depth. Rare pockets of fine to medium sand sized selenite crystal particles at depth. Rare fine roots present till 2.0m bgl. LONDON CLAY FORMATION.
		1.30	D					
		1.80	D					
		2.30	D					
		2.80	D					
		3.30	D					
		3.80	D					
		4.30	D					
		4.80	D		5.00			End of Borehole at 5.00m

1 2 3 4 5 6 7 8 9 10

General Remarks:
Fine roots and rootlets to 2

Groundwater Remarks:

Borehole Type
CP: Cable Percussive
WS: Windowless Sampler
RC: Rotary Cored

Sample Types
D: Disturbed
B: Bulk
J: Jar
W: Water
U: Undisturbed

In-Situ Testing
SPT: Split spoon - Standard Penetration Test
CPT: Cone - Standard Penetration Test

soils LIMITED
Geotechnical & Environmental Consultants

Soils Limited
Newton House [redacted] Tadworth KT20 5SR

Borehole Log

Borehole No.
WS4
Sheet 1 of 1

Project Name: Land at Westergate	Project No.: 15474	Co-ords:	Hole Type WS
Location: Land at Wester Gate, St Richards Rd, Westergate, Chichester, West Sussex PO20 3RD		Level:	Scale 1:50
Client: BHA Consulting Ltd		Dates: 07/03/2016	Logged By OK

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.20	D		0.30			Grass over grey slightly sandy clayey SILT. Sand is fine. Rare fine to medium sub-angular flint gravels. Frequent fine roots and rootlets. TOPSOIL
		0.50	D					Firm grey sandy silty CLAY. Sand is fine. Occasional fine to coarse angular to sub-angular flint gravels. Occasional fine roots and rootlets. ALLUVIUM
		0.90	D		1.00			No sample received
		2.30	D		2.00			Stiff grey mottled orange CLAY with occasional lenses of silty fine sand. Rare fine roots and rootlets. LONDON CLAY FORMATION
		2.80	D		3.00			Stiff grey CLAY with occasional silty lenses. A single thin band of fine to coarse sand sized shell fragments observed at 3.50m bgl. LONDON CLAY FORMATION
		3.30	D					
		3.80	D					
		4.30	D					
		4.80	D		5.00			End of Borehole at 5.00m

General Remarks:
Fine roots and rootlets to 3.0

Groundwater Remarks:

Borehole Type
CP: Cable Percussive
WS: Windowless Sampler
RC: Rotary Cored

Sample Types
D: Disturbed
B: Bulk
J: Jar
W: Water
U: Undisturbed

In-Situ Testing
SPT: Split spoon - Standard Penetration Test
CPT: Cone - Standard Penetration Test

soils LIMITED
Geotechnical & Environmental Consultants

Soils Limited
Newton House [redacted] Tadworth KT20 5SR

Borehole Log

Borehole No. **WS5**
Sheet 1 of 1

Project Name: Land at Westergate	Project No.: 15474	Co-ords:	Hole Type WS
Location: Land at Wester Gate, St Richards Rd, Westergate, Chichester, West Sussex PO20 3RD		Level:	Scale 1:50
Client: BHA Consulting Ltd		Dates: 07/03/2016	Logged By OK

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.20	D		0.40			Grass over grey slightly sandy clayey SILT. Sand is fine. Rare fine to medium sub-angular flint gravels. Frequent fine roots and rootlets. TOPSOIL
		0.50	D					Soft light brown slightly sandy silty CLAY. Sand is fine. Rare fine to medium angular to sub-angular flint gravels with depth. Occasional decomposed material. Occasional fine roots and rootlets. RIVER TERRACE GRAVELS
		0.80	D		1.00			
		1.30	D					Stiff light brown slightly sandy slightly silty CLAY. Sand is fine. Occasional pockets of fine to coarse sand sized calcareous nodules. Rare fine to medium sub-angular calcareous gravels. Rare fine rootlets. RIVER TERRACE GRAVELS
		1.80	D		2.00			
		2.30	D					Stiff light brown mottled grey CLAY with occasional lenses of silty fine sand. Rare decomposed material. LONDON CLAY FORMATION
		2.80	D		3.00			
		3.30	D					Stiff grey CLAY with occasional lenses of silty fine sand becoming frequent at with depth. Occasional pockets of fine to medium sand observed at depth. LONDON CLAY FORMATION
		3.80	D					
		4.30	D					
		4.80	D		5.00			End of Borehole at 5.00m

General Remarks:
Fine roots and rootlets to 2.0

Groundwater Remarks:

Borehole Type
CP: Cable Percussive
WS: Windowless Sampler
RC: Rotary Cored

Sample Types
D: Disturbed
B: Bulk
J: Jar
W: Water
U: Undisturbed

In-Situ Testing
SPT: Split spoon - Standard Penetration Test
CPT: Cone - Standard Penetration Test

Appendix D: Groundwater Monitoring Data

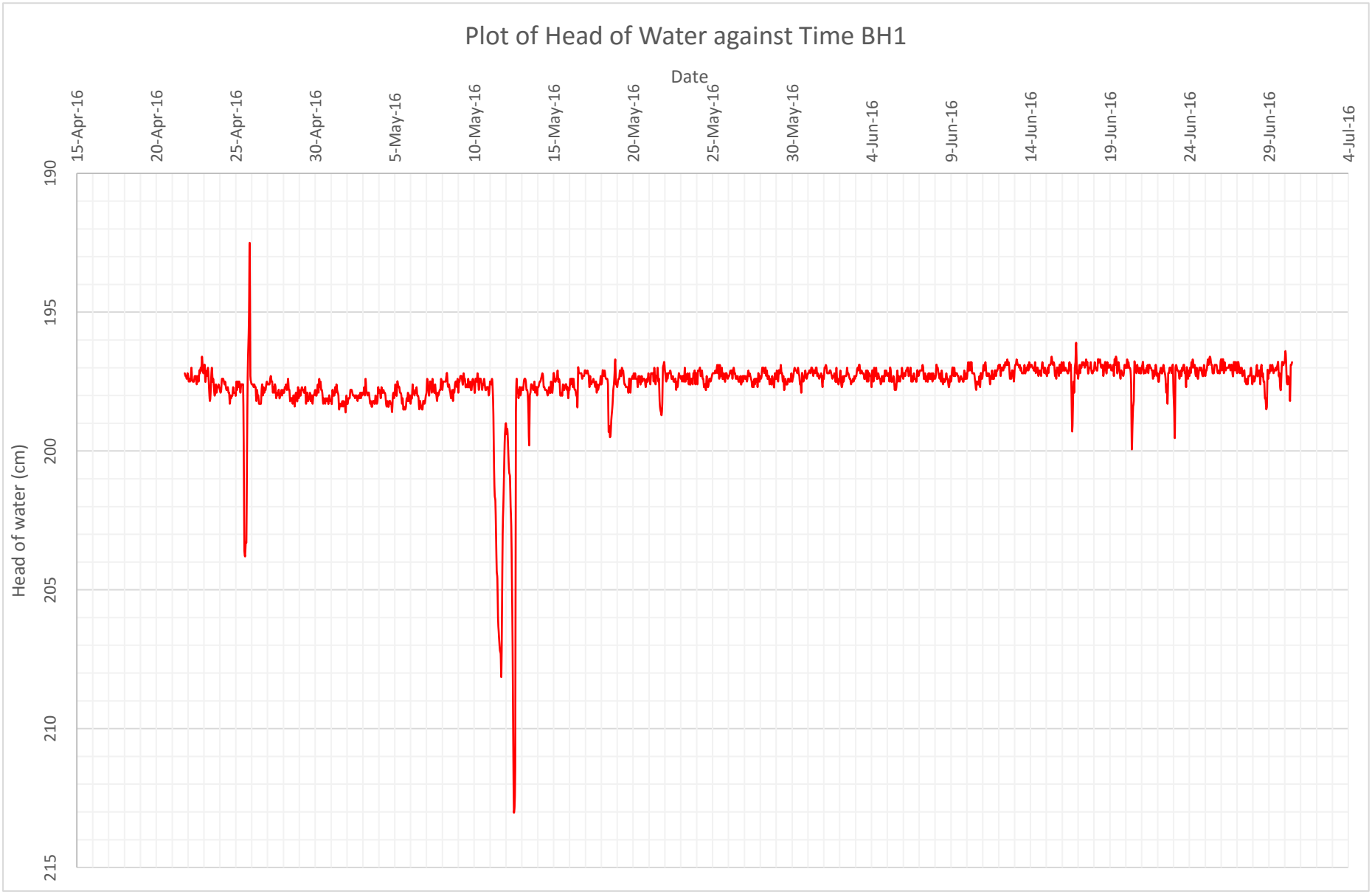
3030 Land East of Westergate - Annual Groundwater Monitoring Data

Monitoring Well Number				BH1	BH2	BH3	BH4	BH5
Depth of well (mbgl) - 22/2/16				5	5	5	5	5
Depth of well (mbgl) - 21/4/16 (reinstated)				2.3	2.18	4.48	4.7	4.54
Groundwater Level (mbgl*)	Reading No.	Method	Date					
	1	Manual	08/03/2016	2.40	1.40	0.50	0.75	0.60
	2	Manual	17/03/2016	2.34	1.58	0.45	0.90	0.98
	Monitoring wells vandalised early April. Covers reinstated & data loggers installed 21/04/16							
	3	Data Logger	25/04/2016	1.98	1.65	0.76	0.57	0.96
	4	Data Logger	02/05/2016	1.98	1.69	0.86	0.52	1.09
	5	Data Logger	09/05/2016	1.97	1.70	0.94	0.52	1.13
	6	Data Logger	16/05/2016	1.98	1.69	0.93	0.52	1.17
	7	Data Logger	23/05/2016	1.97	1.72	0.81	0.52	1.18
	8	Data Logger	30/05/2016	1.97	1.73	0.88	0.54	1.27
	9	Data Logger	06/06/2016	1.97	1.74	0.97	0.58	1.40
	10	Data Logger	13/06/2016	1.97	1.75	1.03	0.71	1.53
	11	Data Logger	20/06/2016	2.00	1.73	0.98	0.68	1.56
	12	Data Logger	27/06/2016	1.97	1.58	0.62	0.40	1.27
	Monthly manual readings instructed over summer monitoring period.							
	13	Manual	19/07/2016	2.30	1.78	1.19	0.80	1.85
	14	Manual	25/08/2016	2.30	1.73	1.41	0.60	1.80
	15	Manual	12/09/2016	2.30	1.72	1.40	0.70	1.75
	16	Manual	07/10/2016	2.30	1.73	1.43	0.72	1.80
	Data loggers installed 31/10/16. Monitoring visit on 29/11/16 found wells had been vandalised and one data logger stolen. No recoverable readings on other data loggers. Weekly manual readings instructed.							
	17	Manual	05/12/2016	2.30	1.70	0.74	0.46	1.21
	18	Manual	14/12/2016	2.30	1.71	0.67	0.54	1.26
	19	Manual	19/12/2016	2.30	1.72	0.64	0.53	1.23
	20	Manual	05/01/2017	2.30	2.00	0.85	0.35	0.95
	21	Manual	12/01/2017	2.30	1.67	0.56	0.30	0.78
	22	Manual	17/01/2017	2.30	1.53	0.40	0.20	0.74
	23	Manual	26/01/2017	2.30	1.62	0.48	0.31	0.85
	24	Manual	02/02/2017	2.30	1.52	0.40	0.22	0.74
	25	Manual	09/02/2017	2.30	1.53	0.10	0.18	0.71
	26	Manual	14/02/2017	2.30	1.55	0.32	0.22	0.75
	27	Manual	22/02/2017	2.29	1.60		0.17	0.88

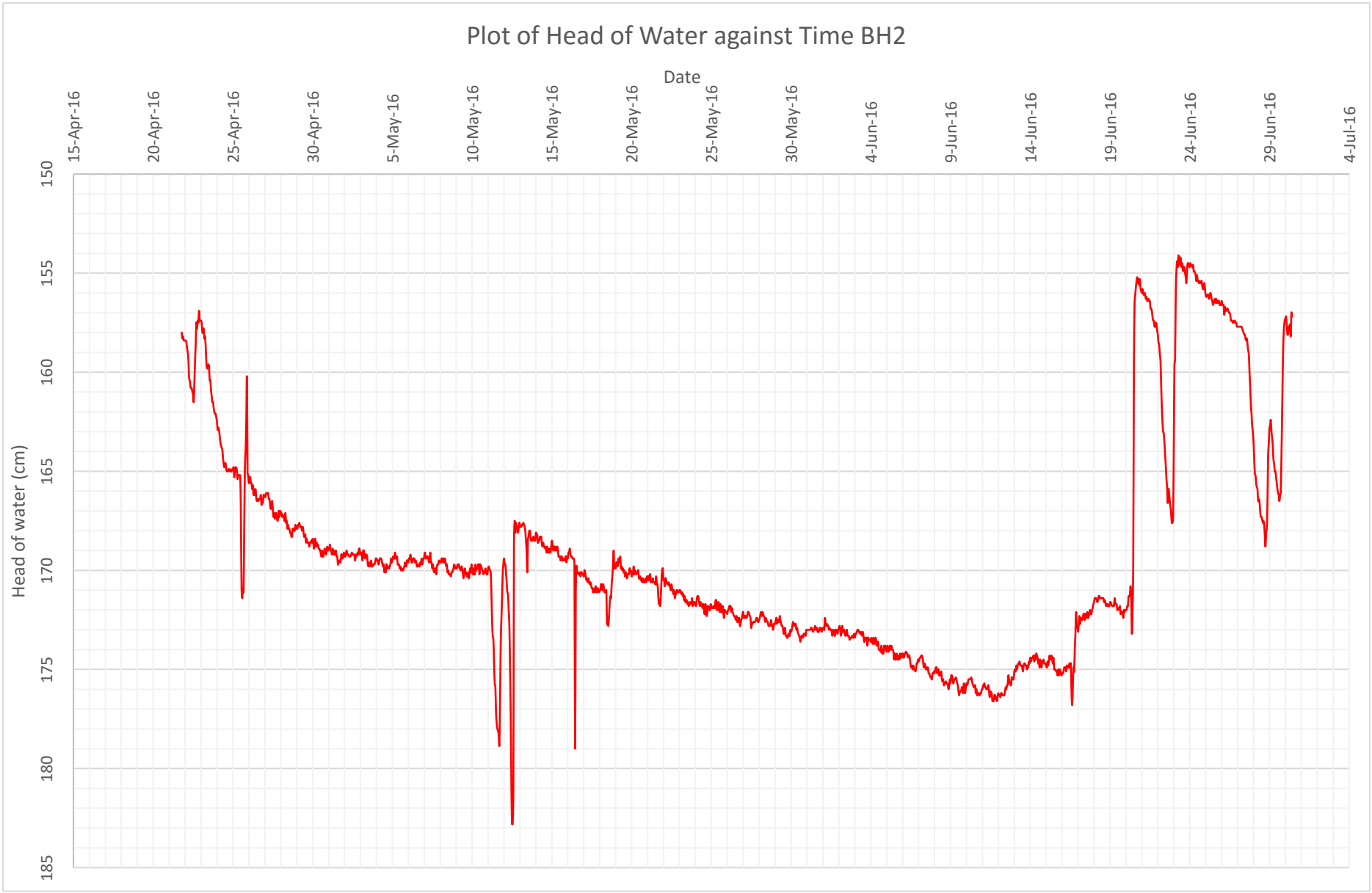
mbgl* = meters below existing ground level

CALA HOMES			**Bingham : Hall Associates** Oakleigh Connaught Rd Attleborough Norfolk NR17 2BW
Prepared By:	Chcked By:	Apprvd By:	Groundwater Monitoring Data
GH	AB	AB	

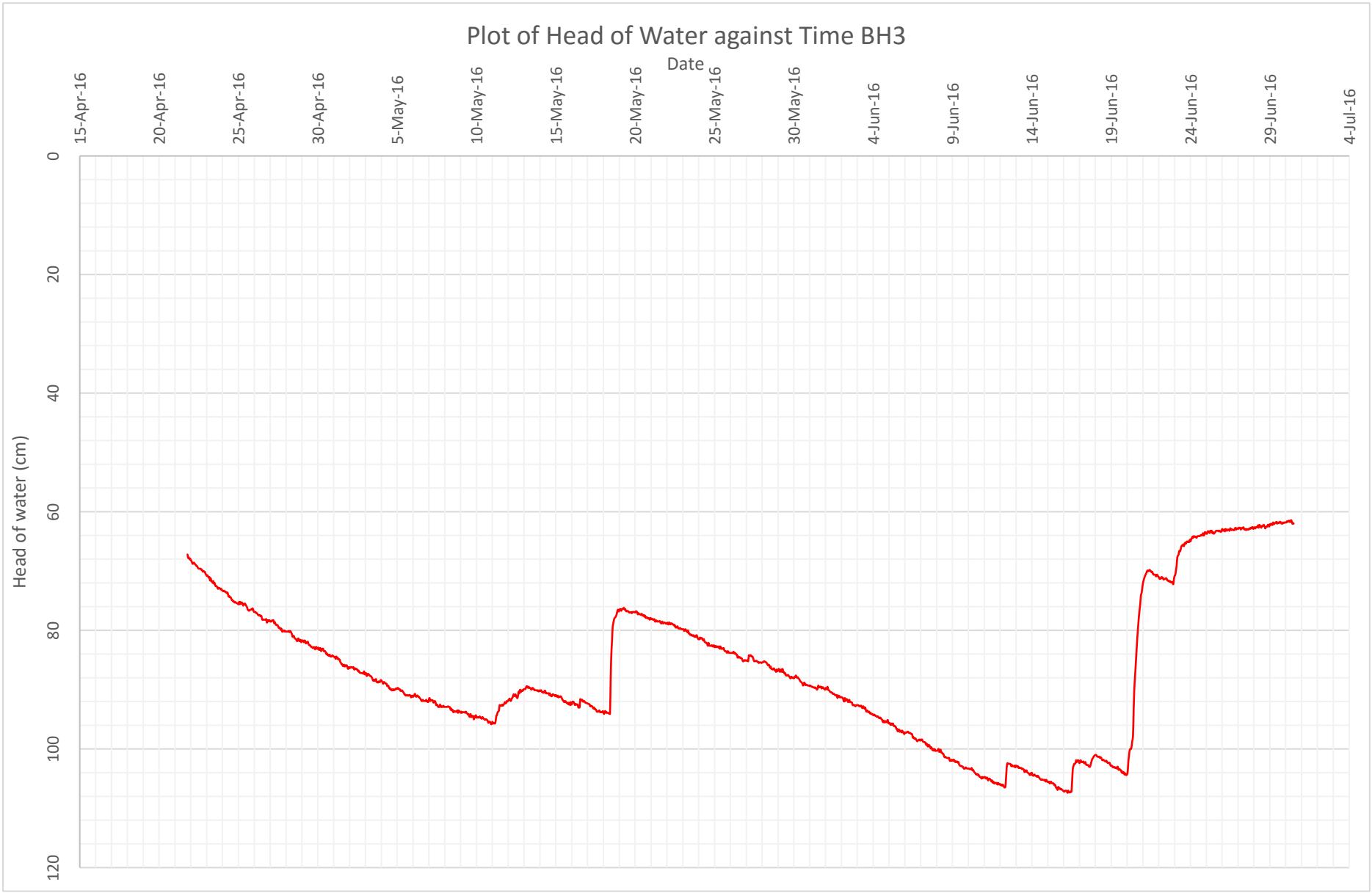
BH1 Readings for Head of Groundwater



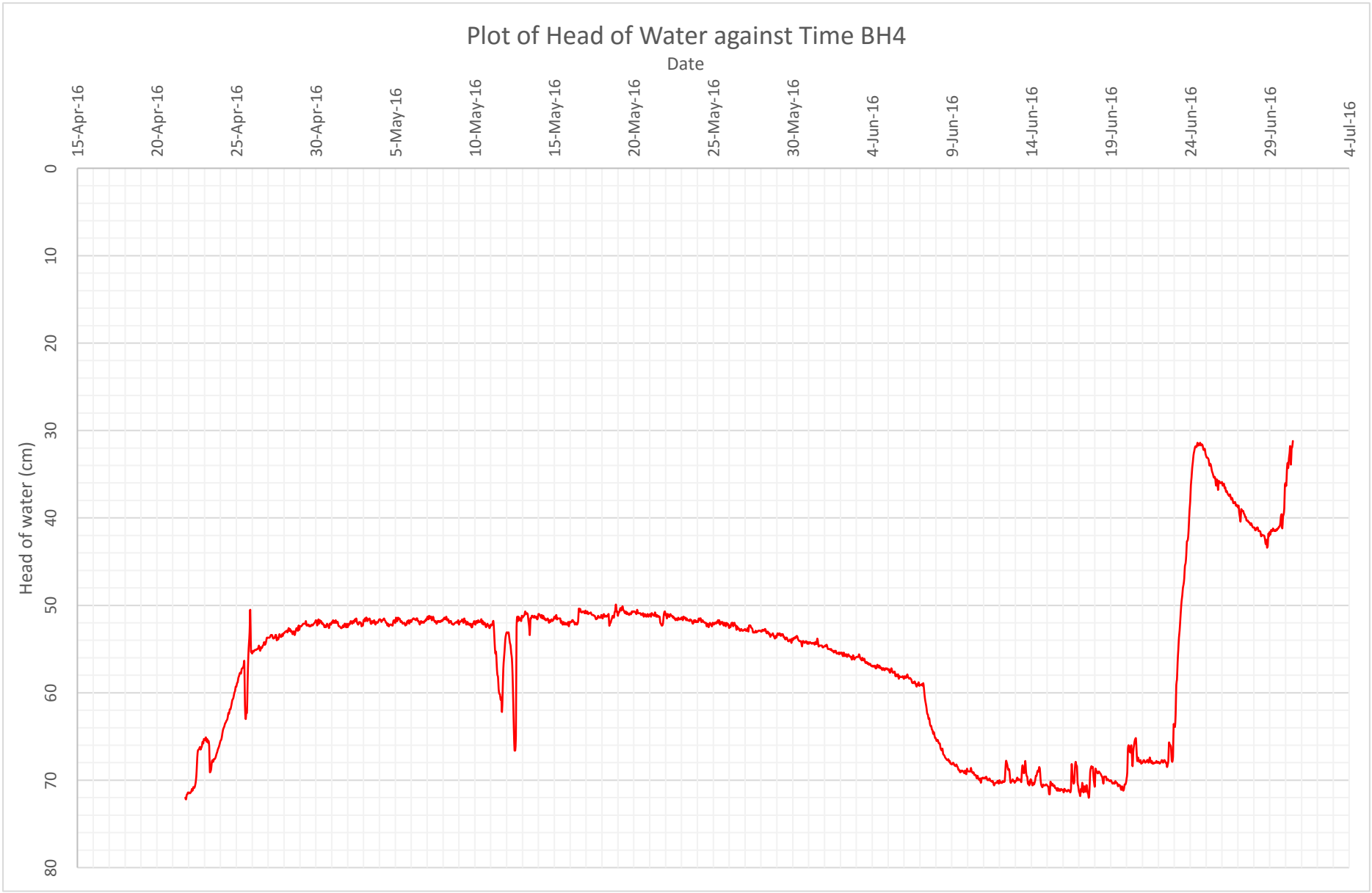
BH2 Readings for Head of Groundwater



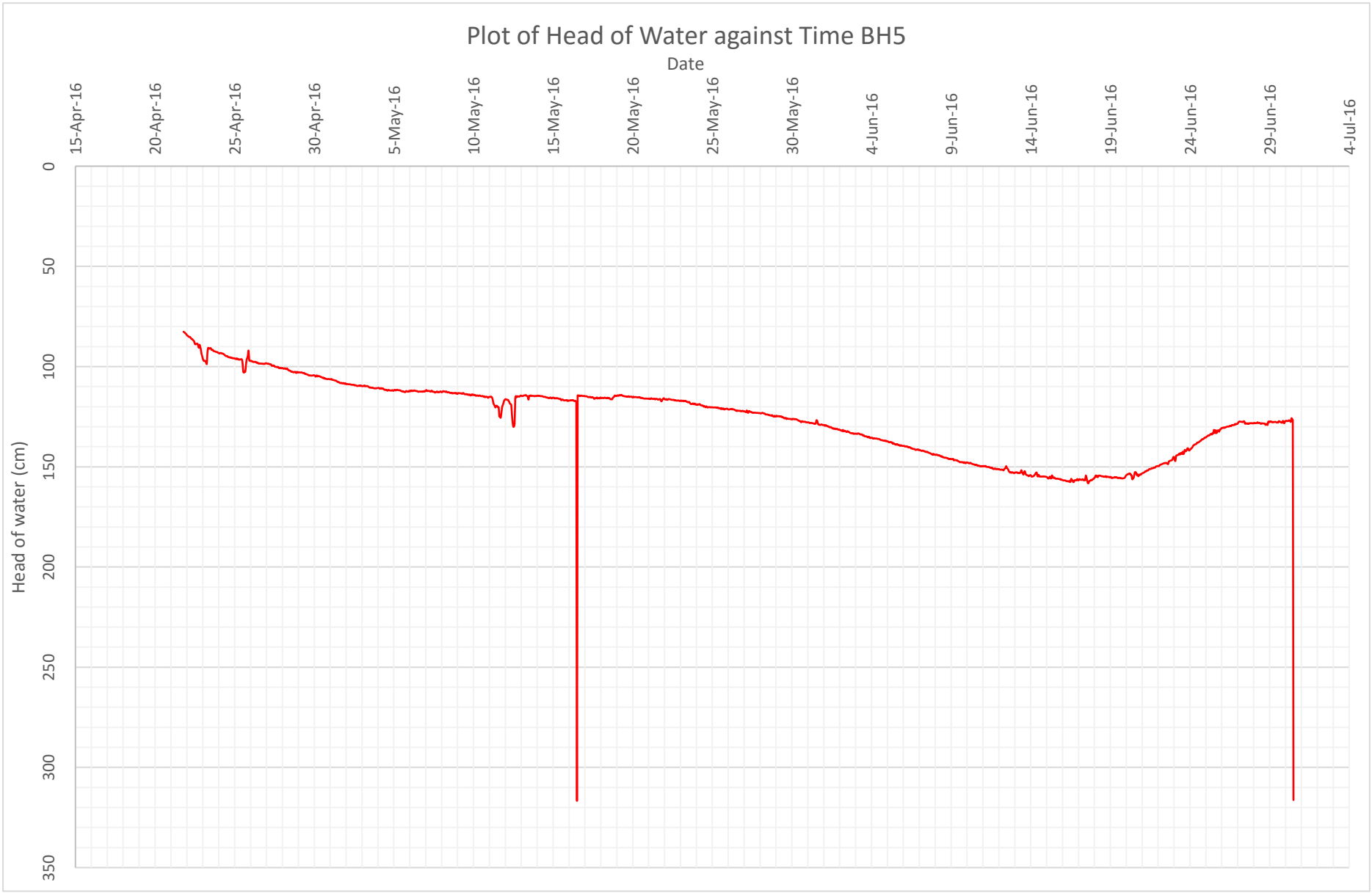
BH3 Readings for Head of Groundwater



BH4 Readings for Head of Groundwater

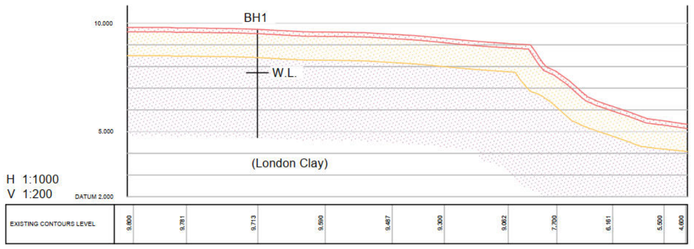


BH5 Readings for Head of Groundwater



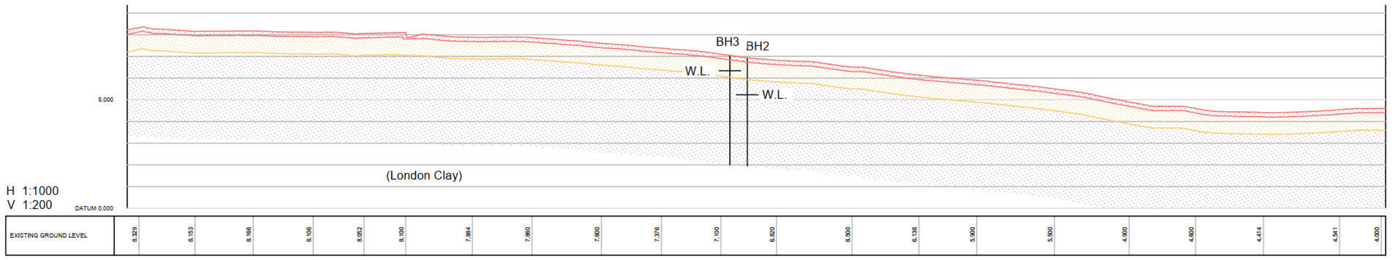
Appendix E: Geological Cross Sections

LAND EAST OF WESTERGATE

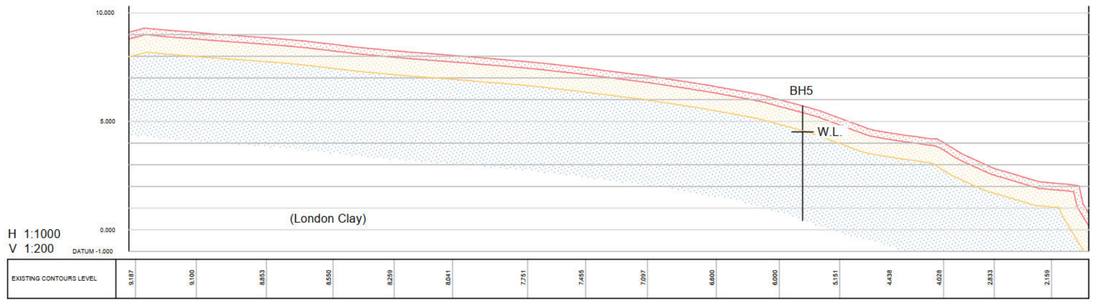


Water Levels (Approx.)	
BH1	2.000 mbgl
BH2	1.700 mbgl
BH3	0.700 mbgl
BH4	0.500 mbgl
BH5	1.200 mbgl

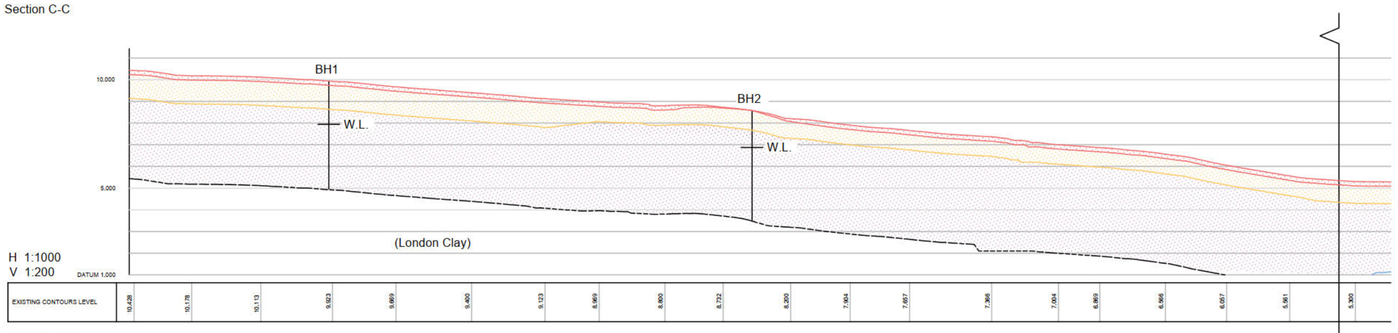
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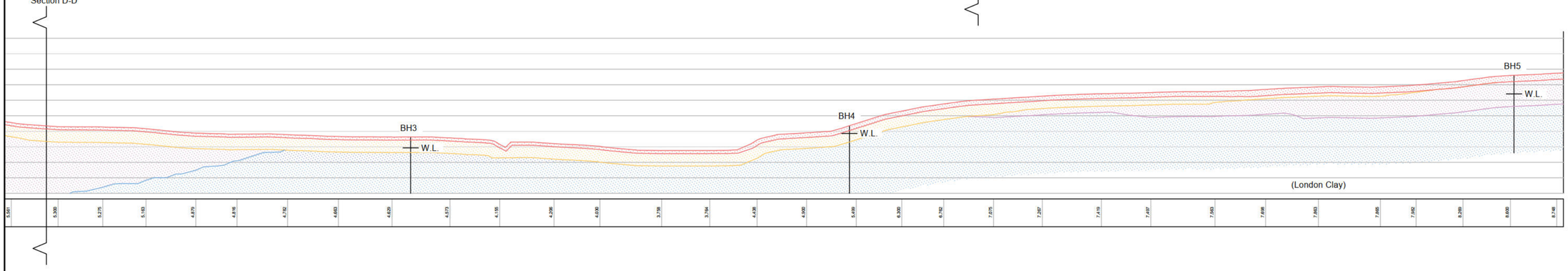
Section B-B

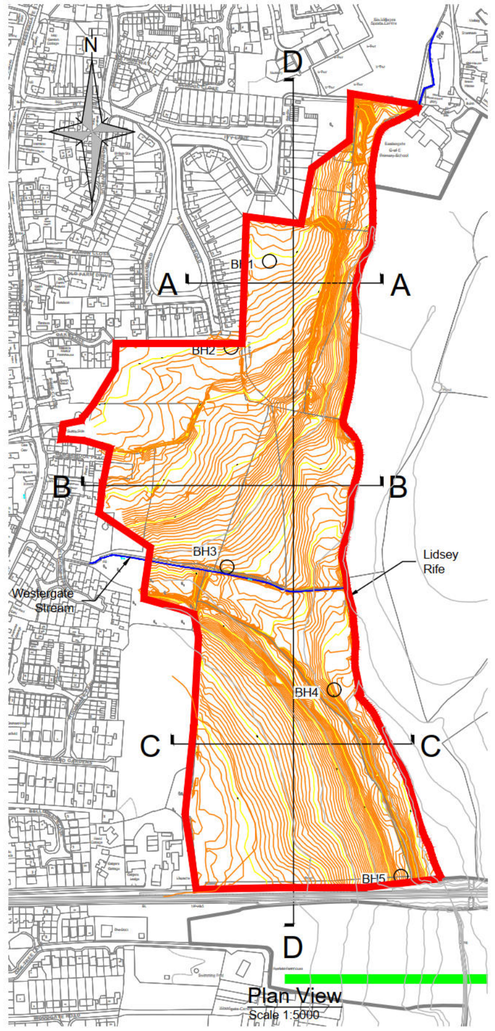


Section C-C



Section D-D





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Key:

- Major Contour
- Minor Contour
- BH1 Borehole Location
- Topsoil
- Alluvium
- River Terrace Gravels
- London Clay Formation

Rev	Description	Date	By	App
P1	First Issue	18.08.16	RB	AB

P - Planning
C - For Construction

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Client: CALA HOMES

Project Title: Land East of Westergate

Drawing Title: Sections Showing Geology

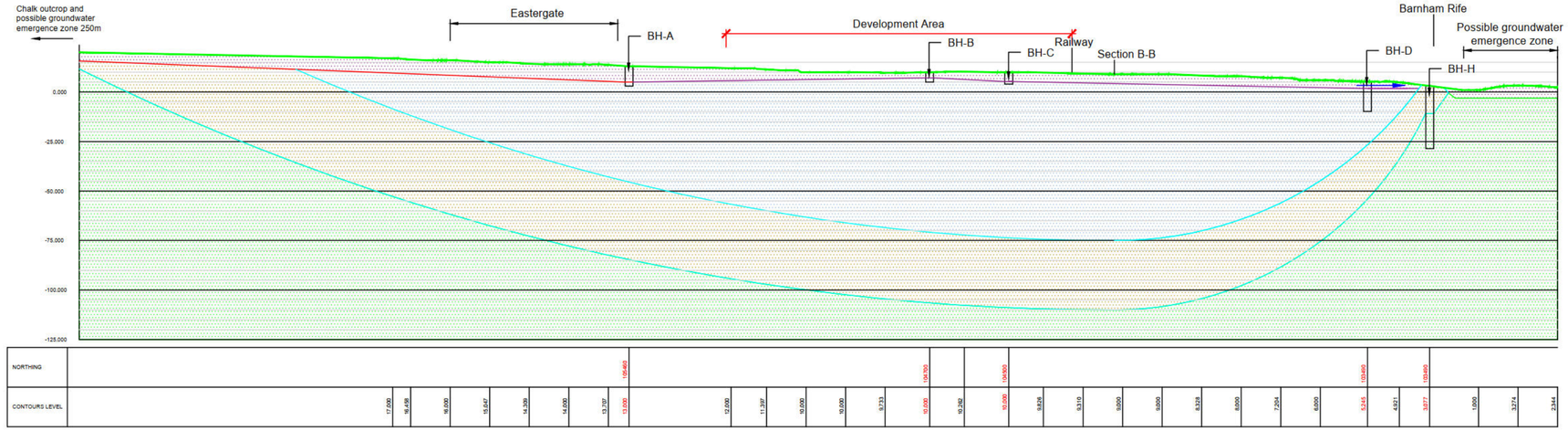
Drawn by	Checked by	Approved By
RB	GH	KE

Size	Scale	Date
A2	As Shown	Aug 2016

Drawing No. 3030.100 Rev P1

SECTIONS SHOWING GEOLOGY

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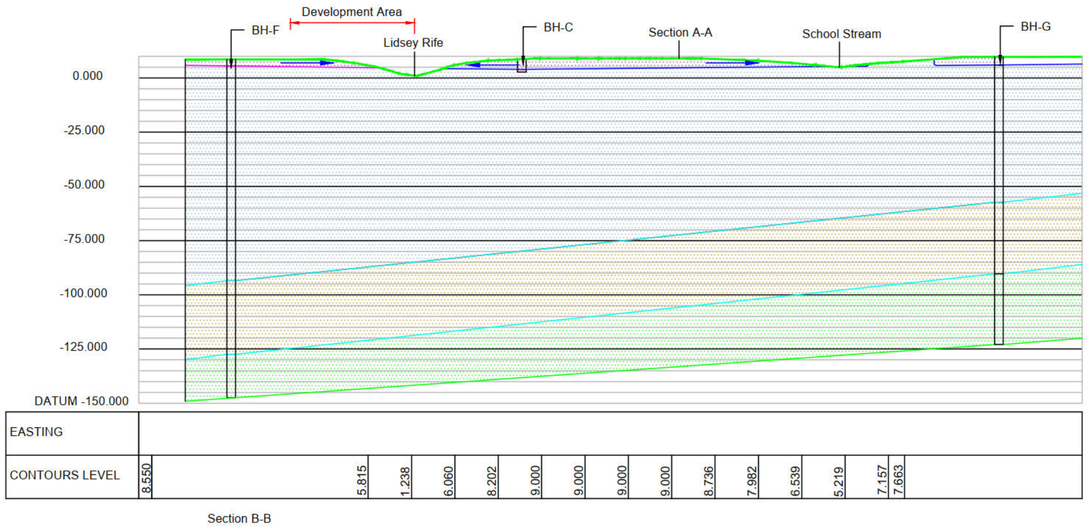


Section A-A

Section A-A
1:10

North-South Section					
Section Borehole Name	A	B	C	D	H
BGS Borehole name	SU90NW76 EASTERGATE	SU90SW51 EASTERGATE	SU90SW59 WOODHAM FARM, EASTERGATE 1	SU90SW52 LIDSEY	SU90SW22 SW RAILWAY STATION BARNHAM SUSSEX
Date	Sept. 1981	Sept. 1981		Sept. 1981	1899
Easting	**494800**	**494540**	**484500**	**494570**	**494930**
Northing	**105460**	**104700**	**104500**	**103490**	**103490**
Depth (m)	**10.00**	**5.00**	**6**	**15.00**	**31.69**
GL (mAOD)	13.5	9.3		8.00	16.00
Depth to base of:					
Drift (undifferentiated)	8.00	2.90	4.70	3.40	NONE
London Clay	10.00 End of BH	5.0 End of BH	6.0 - End of BH	15.0 - End of BH	NONE
Lambeth - Reading Beds					14.02
Chalk					31.69 End of BH
Groundwater	4.00	1.50	2.00	2.00	2.20

East-West Section			
Section Borehole Name	F	C	G
BGS Borehole name	SU90SW56 WOODGATE NEAR CHICHESTER SUSSEX	SU90SW59 WOODHAM FARM, EASTERGATE 1	SU90SE12 RAILWAY STATION BARNHAM EASTERGATE
Date	01.08.1978		24.09.1898
Easting	**493830**	**484500**	**495600**
Northing	**104000**	**104500**	**104320**
Depth (m)	**156.00**	**6.00**	**132.58**
GL (mAOD)	30.00		
Depth to base of:			
Drift (undifferentiated)	3.00	4.70	
London Clay	102.00	6.00 - End of BH	
Lambeth - Reading Beds	136.00		
Chalk	156 - End of BH		132.82 End of BH
Groundwater	Drilled by rotary mud flush, therefore groundwater depth not apparent.	2.00	5.49



Section B-B

Section B-B
1:10



Plan
1:20

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Key

- Drift (undifferentiated)
- London Clay
- Lambeth - Reading Beds
- Chalk
- Ground Level
- G — Borehole Location
- Lateral Flow To Rife

Rev	Description	Date	By	App
P1	First Issue	18:08:16	JTT	AB

P - Planning
C - For Construction

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Project Title: Land East of Westergate

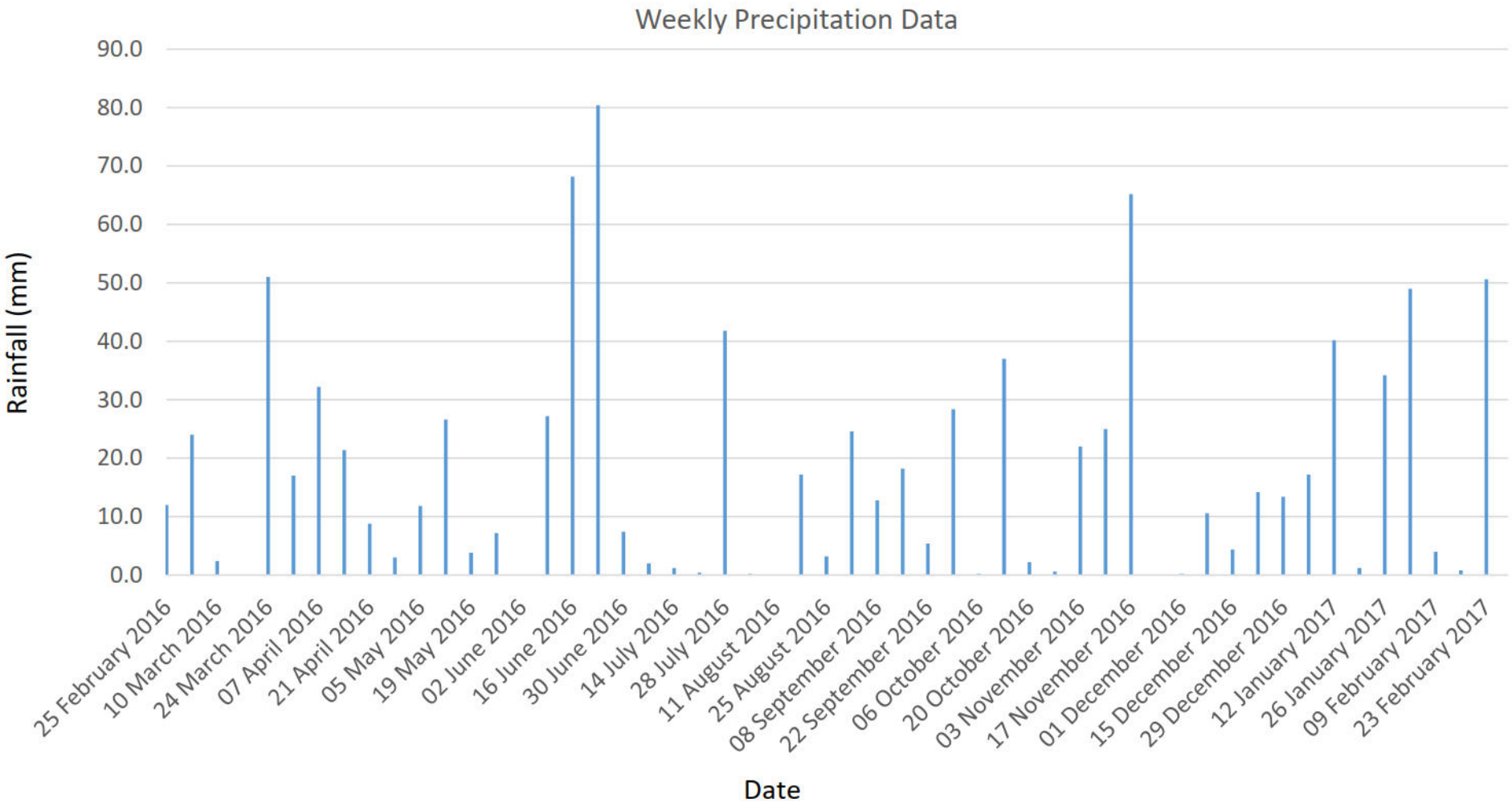
Drawing Title: Geological Sections Through Barnham - Eastergate - Westergate

Drawn by	Checked by	Approved By
JTT	GH	AB
Size	**Scale**	**Date**
A2	As Shown	Aug 2016

Drawing No. 3030.101 — Rev P1

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Appendix F: Precipitation Data



Source: http://rp5.co.uk/Weather_archive_on_Thorney_Island
Location: Thorney Island

CALA HOMES			**Bingham : Hall Associates** Oakleigh Connaught Rd Attleborough Norfolk NR17 2BW
Drwan By:	Chcked By:	Apprvd By:	Rainfall Profile
RB	AB	AB	

Appendix F

SUPPLEMENTARY DOCUMENTS

Public

Cala Homes South Homes Counties

LAND AT WESTERGATE, WEST SUSSEX

Drainage Impact Assessment



LAW-WSP-XX-XX-C-RP-00003
SEPTEMBER 2023

PUBLIC

Cala Homes South Homes Counties

LAND AT WESTERGATE, WEST SUSSEX

Drainage Impact Assessment

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70013258

OUR REF. NO. LAW-WSP-XX-XX-C-RP-00003

DATE: SEPTEMBER 2023

WSP

Grosvenor House
2 Grosvenor Square
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SO15 2BE

[redacted]

WSP.com

QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	P01			
Date	21 September 23			
Prepared by	George Gullon /Julien Blavignac			
Signature				
Checked by	Luke Beeching			
Signature				
Authorised by	Luke Beeching			
Signature				
Project number	70013258			
Report number	LAW-WSP-XX-XX-C-RP-00003			
File reference	\\uk.wspgroup.com\central data\Projects\70013xxx\70013258 - Land at Westergate - Cala Homes\03 WIP\DE Development\05 Reports			

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APPENDIX B - TOPOGRAPHICAL SURVEY
APPENDIX C - SOUTHERN WATER RECORDS & CONSULTATION
APPENDIX D - DEVELOPMENT LAYOUT
APPENDIX E - DRAINAGE STRATEGY

1 INTRODUCTION

1.1 APPOINTMENT AND BRIEF

1.1.1. This report was commissioned by Cala Homes (South Home Counties) as part of the supporting documentation for an Hybrid Application 1) Full Planning Application for western section of East/West Link Road with new access, road bridge & associated works; 2) Outline Planning Application with all matters reserved for up to 400 No. dwellings with access & associated works at land to the east of Westergate, West Sussex and prepare a Foul Drainage Strategy and Drainage Impact Assessment.

1.2 BACKGROUND

1.2.1. Historically questions have been raised regarding the capacity of the existing Southern Water foul sewerage system and the Lidsey Waste Water Treatment Works (WTW) as a result of sewerage flooding of roads and property that has taken place in the Lidsey WTW catchment, including areas of Barnham and Westergate.

1.2.2. Arun District Council (ADC)'s Local Plan 2011-2031 states that this flood risk is assumed to be caused by groundwater infiltration and surface water inundation of the sewerage system.

1.2.3. West Sussex County Council, in partnership with Southern Water, Arun District Council, the Environment Agency and Local Groups, has undertaken a Surface Water Management Plan (SWMP) [1] for the Lidsey WWTW catchment area, in order to identify the key reasons for these events and to identify measures to help reduce or resolve them. The SWMP was published in October 2014.

1.2.4. Arun District Council (ADC)'s Local Plan 2011-2031 policy W DM1 (3) requires that any Major Development in the Lidsey WTW catchment must be accompanied by a Drainage Impact Assessment, which takes account of surface water and foul water disposal.

1.2.5. The Application Site is located within the drainage catchment of Lidsey WTW (Refer to map in Appendix C).

[1] Lidsey SWMP (2014), *Lidsey Surface Water Management Plan, West Sussex County Council,* Atkins

2 EXISTING SITE

2.1 SITE LOCATION

2.1.1. The Application Site is situated to the east of Westergate Street in West Sussex. The Ordnance Survey Grid Reference for the site is 494017, 104879 and the nearest post code is PO20 3QR.

2.1.2. The Site is bordered to the east by the Lidsey Rife, a water course that runs along the boundary and open land. To the west and north the site is bordered by a residential area and along the southern boundary of the site runs a railway line, beyond which there is open land. Refer to the Site Location Plans in Appendix A.

2.2 SITE DESCRIPTION

2.2.1. The Application Site has previously been used for arable agriculture. The site is surrounded by trees and hedgerows. There are also several hedgerows that cross the site.

2.2.2. Table 1 describes the Application Site's general characteristics.

Table 1 – Application Site's general characteristics

Characteristic	Description	
Area	Approximately 19.23 ha	
General Topography	Cole & Cole Ltd completed a topographical survey of the Site in June 2016. The topographical survey indicates that levels range from approximately 9.8m Above Ordnance Datum (AOD) to approximately 1.9mAOD. The Topographical Survey indicates that the north part of the Application Site slopes from north west to the south east providing a level difference of approximately 6.5m across the north part of the Site. The south part of the Application Site slopes from south west to the north east providing a level difference of approximately 6m across the south part of the Site. Refer to Appendix B for the Cole & Cole Ltd Topographical Survey - Drawing number: 16-0102a-Rev C (unspecified date). Ground levels on the survey undertaken by Cole & Cole Ltd have not been independently verified by WSP.	
Existing Surfacing	Greenfield	
Current Use	Vacant open space	
Boundaries	North	Residential Development
	South	Railway Track / Green Open Space
	East	Watercourse / Green Open Space
	West	Residential Development
Access	Access to the Application Site is via Westergate Street	

2.3 EXISTING DRAINAGE

SURFACE WATER

2.3.1. The Application Site drains to the Lidsey Rife on the eastern boundary via a series of on-site ditches, some of which also carry flow from existing development to the west. For more detail refer to WSP's Flood Risk Assessment (FRA), 2023.

2.3.2. Record plans received from Southern Water (Appendix C) indicate that a 675mm diameter surface water sewer crosses the north-eastern corner of the site prior to discharging to the Lidsey Rife and associated manholes exist within the vicinity and within the Application Site boundary.

FOUL DRAINAGE

2.3.3. There are no existing buildings on the Application Site and no existing foul discharge generated.

2.3.4. Record plans received from Southern Water (Appendix C) indicate that two foul sewers cross the Application Site from west to east and one foul sewer is located within the eastern boundary draining from north to south. All the foul sewers that cross the Application Site connect before leaving the Site in the south eastern corner, crossing the Lidsey Rife and the railway line to the south. This sewer continues south to connect to the Lidsey WTW.

2.3.5. A number of the existing foul manholes are also identified on the Topographical Survey (Appendix B).

2.3.6. The foul sewer that crosses the northern part of the Application Site from west to east is identified as a 150mm diameter vitrified clay sewer and connects to a 300mm diameter vitrified clay sewer that runs within the eastern boundary towards the south.

2.3.7. The second foul sewer that crosses the Application Site from the west is identified as a 300mm diameter vitrified clay pipe and also connects with the sewer that runs within the eastern boundary. After this connection point the main north-south sewer changes to a 375mm diameter pre-cast concrete pipe.

3 DEVELOPMENT PROPOSALS

3.1 PROPOSED DEVELOPMENT

3.1.1. The Application Site covers approximately 19.35 hectares (ha) and would provide up to 400 new residential dwellings (see Appendix D for an illustrative layout of the proposed development). A single vehicular access onto Westergate Street via Pine Close is proposed. The Site forms part of Strategic Site SD5 allocated under policy H SP1 of the ADC Local Plan, and proposals include a highway link to the wider allocated site via a new bridge over the Lidsey Rife.

3.1.2. The proposed development will include mixed size dwellings with gardens and associated new vehicular and pedestrian accesses, estate roads, parking, footpaths/cycleways, public open space and landscaping.

3.1.3. The proposed development site is located in the catchment of the Lidsey Waste Water Treatment Works (WWTW) and Southern Water are the statutory sewerage undertaker.

4 POLICY

4.1 CONSULTATION

4.1.1. Consultation has been undertaken with Southern Water (the statutory sewerage undertaker) during the preparation of this assessment. Refer to Appendix C for correspondence.

4.1.2. Southern Water has advised (July 2023) that 50 dwellings can be accommodated within the existing network without the need for network reinforcement, with a Point of Connection to manhole SU94042401, in the south-east of the site.

4.1.3. Southern Water has also confirmed that there is capacity at the Lidsey WTW for the development. The WTW is the nearest point of connection where capacity for the whole development is currently available and Southern Water has advised that network reinforcement works would be required to cater for the proposed development. The WTW is located approximately 1km southeast of the site.

4.1.4. Southern Water has also advised that a solution for the whole site would be provided via a detailed assessment once planning permission has been granted.

4.2 POLICY AND GUIDANCE

This report has been informed by and makes reference, where appropriate, to the following documents and policies:

- The NPPF; Department for Levelling Up, Housing & Communities (2023);
- The NPPF Flood Risk and Coastal Change PPG; Department for Levelling Up, Housing & Communities (2022);
- Flood Risk Assessments: Climate Change Allowances; Environment Agency (2022);
- Non-Statutory Technical Standards for Sustainable Drainage Systems; DEFRA (2015);
- Building Regulations Approved Document H; Ministry of Housing, Communities & Local
- Government (2015);
- The SuDS Manual (CIRIA C753); CIRIA (2015);
- Design and Construction Guidance; Water UK (2021);
- West Sussex Strategic Flood Risk Assessment (January, 2010);
- West Sussex Preliminary Flood Risk Assessment (May, 2011);
- West Sussex local flood risk management strategy (October, 2014);
- Arun and Western Streams Catchment Flood Management Plan (December, 2009);
- Lidsey Surface Water Management Plan (October 2014);
- Arun Strategic Surface Water Management Study (October 2016);
- Arun District Strategic Flood Risk Assessment (November, 2016);
- Adopted Arun Local Plan 2011-2031 Publication (July 2018);
- Arun District Council Infrastructure Capacity Study and Delivery Plan draft report (2016);
- Arun District Council Local Plan – Memorandum of Understanding: Sewerage capacity (and treatment) (September 2017);
- Aldingbourne Neighbourhood Development Plan (2019-2031) (June 2021);
- The Flood Risk Implications of Strategic Development at Barnham / Eastergate / Westergate - Richard Allitt Associates Ltd (April 2014);
- Southern Water Drainage & Wastewater Management Plan (May 2023).

4.3 LIDSEY SURFACE WATER MANAGEMENT PLAN (OCTOBER 2014)

4.3.1. The Lidsey Surface Water Management Plan (SWMP) was led by West Sussex County Council as part of its role as the Lead Local Flood Authority and was jointly funded by Southern Water.

4.3.2. The purpose of the SWMP is to evaluate flood risk from various sources of flooding and develop an agreed "Action Plan" to reduce or mitigate current and future flood risk, by bringing together primary stakeholders to share data and expertise. An evidence base of historical flooding is provided within the SWMP. The plan was created to cover the Lidsey Sewage Treatment Works catchment and also the areas of Middleton, Elmer and Slindon as well as Westergate.

4.3.3. Amongst other proposals, to reduce flood risk, the Lidsey SWMP identifies the need for measures to reduce ingress of surface water and ground water into the existing foul sewer network. These measures were anticipated to principally involve lining of existing sewers. Southern Water previously confirmed that identified works to reduce infiltration had been completed.

4.3.4. The proposed Barnham Eastergate Westergate allocation site (now allocated site SD5) has been identified within the SWMP study.

4.3.5. Lidsey WTW is located south of Westergate and receives flows from three different sources in total. A 450mm diameter gravity sewer from Westergate connects with a 600mm inlet sewer, which flows to the terminal pumping station within the WTW compound.

4.3.6. The SWMP reports that groundwater flooding has been reported in several locations including Westergate.

4.3.7. Groundwater as well as surface water was found to be entering a number of manhole chambers around the areas of Eastergate, Westergate and Barnham. The closest manhole to the Application Site that was recommended in the SWMP to be repaired is manhole SU93049703 on Elm Croft Place, Westergate.

4.3.8. According to the SWMP Westergate is characterised as an area with "Low Risk" of Fluvial and Groundwater flooding, "Medium Risk" of Pluvial (surface water) flooding and "High Risk" of Public Sewer flooding. Hydraulic overload of sewers was reported in Oak Tree Lane on 02/01/2013 and on Westergate Street on 29/01/2013 and 09/11/2010.

4.3.9. The SWMP follows the NPPF policy and states that if Greenfield sites are going to be developed it has to be ensured that the discharge rates are limited to current Greenfield runoff rates and discharge is to watercourse and/or ground, where infiltration is viable.

4.4 SOUTHERN WATER DRAINAGE AND WASTEWATER MANAGEMENT PLAN (DWMP) (MAY 2023)

4.4.1. Southern Water published its first Drainage and Wastewater Management Plan (DWMP) for submission to Ofwat in May 2023.

4.4.2. Under Section 94A of the Water Industry Act (1991), added by Section 79 of the Environment Act (2021), water companies are required to produce one regional DWMP for their operating area based on the plans for each River Basin Catchment and the drainage and wastewater systems within these. Lidsey WWTW is located within the Arun and Western Streams catchment.

4.4.3. For each River Basin Catchment the DWMP is developed through a series of stages:

1. Risk based catchment screening
2. Baseline Risk and Vulnerability Assessment (BRAVA)
3. Problem Characterisation
4. Options development and appraisal
5. Programme Appraisal
6. Consultation

4.4.4. The results of each stage of work for each river catchment are published on-line on Southern Water's website https://www.southernwater.co.uk/dwmp/arun-and-western-streams-catchment

4.4.5. Lidsey is one of fifty-three WTW catchments that were identified as having a potential risk / vulnerability and were progressed to the BRAVA stage.

BASELINE RISK AND VULNERABILITY ASSESSMENT (BRAVA)

4.4.6. Southern Water summarise:

"The output of the BRAVA shows:

- the current risks and issues in each sewer catchment within the Arun and Western Streams catchment – providing a baseline to assess future risks against
- how those risks may change in future, and when they may change
- the primary drivers behind the future changes in risk including:
  - a deterioration in the performance of our sewerage systems.
  - climate change – including the increasing frequency and severity of droughts and storms.
  - customer behaviour – including issues such as sewer blockages or use of environmentally degrading materials such as chemicals, pesticides, and plastics.
  - growth and urban creep.
  - a combination of any or all of these that are relevant in the catchment being assessed".

4.4.7. The BRAVA considers 14 different planning objectives, the drivers for particular risks within the catchment, and whether the risk to each planning objective is either:

- Not applicable
- Not Significant
- Moderately Significant
- Very Significant

This is assessed for 2020 and where relevant, the risk is also assessed for 2050 taking account of predicted growth within the catchment.

4.4.8. For the Lidsey WwTW catchment:

- Population is expected to increase by 58% from 21,708 (2020) to 34,299 (2050).
- 8 out of 14 planning objectives are identified as having either a Moderately Significant or Very Significant risk. These are generally identified as driven by hydraulic or water quality requirements.
- The BRAVA proposes an "improve" investment strategy for the catchment, with a "Medium" level of concern. This is therefore included within the catchments taken forward to the Problem Characterisation Stage.
- Planning Objective 8 "Dry Weather Flow Compliance" is identified as a Moderately Significant risk for 2020 with it predicted to increase to Very Significant in 2050, meaning that spare capacity is currently between 0-20% and is at risk of being exceeded in 2050 without works to increase

capacity (as set out in Southern Water's DWMP Summary of the methodology for the Baseline Risk and Vulnerability Assessment (BRAVA) on Wastewater Treatment Works Dry Weather Flow Compliance).

PROBLEM CHARACTERISATION

4.4.9. This stage of the DWMP "uses the results from the Baseline Risk and Vulnerability Assessment (BRAVA) to explore the causes of risks and the primary drivers".

4.4.10. The impact of rainfall / surface water runoff on the performance and capacity of the existing sewerage network is identified for a number of planning objectives. Groundwater infiltration is also identified as contributing to flows within the existing sewer network.

4.4.11. For Planning Objective 8 - Dry Weather Flow Compliance, the Problem Characterisation results include a figure showing that predicted Dry Weather Flow (DWF) is expected to increase significantly from 2020 with a risk that without intervention the existing permit limit of 5833m3/day could be exceeded around 2025.

OPTIONS DEVELOPMENT AND APPRAISAL

4.4.12. In this stage of the DWMP generic options were first screened (August 2021) to identify the types of options that are most appropriate to improve system performance within a catchment.

4.4.13. Identified investment needs for the Lidsey WTW catchment are set out in the DWMP Investment Needs document (May 2023). This identifies nineteen preferred options to improve the performance of the Lidsey WTW catchment with indicative costs and timescales identified for each option. Seven of the preferred options identify works to be carried out in the AMP8 period (2025 – 2030). These include:

LIDS.WINEP01.1 – Works to reduce the impact from storm spills from Lidsey SSO.

LIDS.PW01.3 – Enhanced sewer maintenance in Barnham and Westergate to reduce the number of blockages.

LIDS.OT01.5 – Works to improve the hydraulic model to improve confidence and accuracy.

LIDS.WINEP.P02.2 – Action to reduce nutrient discharge .

LIDS.WINEP.P02.2 – Optimisation of existing assets to achieve 14mg/l BOD.

4.4.14. Further work to increase capacity to allow for planned new developments and a wider growth scheme for the Lidsey catchment are identified as necessary in the AMP9 (2030 to 2035) and AMP10 (2035 to 2040) periods respectively.

5 PROPOSED DRAINAGE STRATEGY

5.1 ANTICIPATED FOUL FLOWS

5.1.1. Based on the guidance in Design and Construction Guidance[2], a peak design flow of 4000 l/dwelling/day for the proposed development would be expected to produce approximately 18.5l/s of wastewater at peak flow.

5.1.2. However, as the number of homes increases the probability of all discharging peak flow at the same time reduces. Recent experience with Southern Water has highlighted that a reduced peaking factor is considered more realistic for new developments of this size. This method is based on a consumption of 125l/h/d with an occupancy rate of 2.4 person/dwelling using 10% infiltration and a DWF of 2.5. Using this approach gives the values for peak flows of:

- 3.61 l/s for all 400 homes

5.1.3. The existing on-site 375mm diameter Southern Water sewer has a minimum gradient of 1:229 between manhole 2401 and 3301. Based on hydraulic pipe tables this is estimated to have an un-surcharged capacity of 117l/s.

5.2 FOUL DRAINAGE STRATEGY

5.2.1. As there is an existing foul sewer on site of suitable size for a Point of Connection the starting point for a proposed drainage strategy is to connect by gravity to the existing sewers. If downstream reinforcement is required to increase capacity the developer contributes to this financially via the per plot Infrastructure Charge, in line with Annex A2 of Ofwat's Charging Rules for New Connections, effective April 2023.

5.2.2. Southern Water has advised (July 2023, Appendix C) that:

- 50 dwellings can be accommodated within the existing network without the need for network reinforcement, based on a Point of Connection to manhole SU94042401 in the south of the site;
- a solution for the whole site would be provided via a detailed assessment once planning permission has been granted;
- the nearest point of connection where capacity for the whole development is currently available is Lidsey WTW, which is located approximately 1km southeast of the site.

5.2.3. The proposed development is expected to require the diversion of two of the on-site foul sewers that cross the site from west to east. This offers an opportunity to improve maintenance access and construct these in modern materials such as structured wall plastic pipes replacing the existing vitrified clay and reducing the risk of groundwater infiltration for these lengths.

[2] Design and Construction Guidance (2021), *A design and construction guide for developers for Foul and Surface Water Sewers offered for Adoption under "The Code" for developers*, Ofwat.

5.2.4. Three possible options for foul drainage strategy have been identified:

OPTION 1:

5.2.5. Connect by gravity to the existing (and diverted) on-site foul sewers.

- Drawing LAW-WSP-ZZ-ZZ-C-DR-05001 (Appendix E) shows this option and demonstrates that the proposed development could drain by gravity to the existing foul sewer network.
- Each development parcel would drain by gravity and connect locally to the on-site foul sewers.
- Reinforcement works to the sewerage network would be identified and carried out by Southern Water to mitigate against any shortfall in existing capacity. These works could potentially be upstream or downstream of the Application Site dependent on Southern Water's detailed assessment.
- This is the preferred strategy for the proposed development.

OPTION 2:

5.2.6. Connect to the Lidsey WTW via a new foul gravity sewer.

- In this option a separate foul drainage network would serve the proposed development and connect to the existing network immediately upstream of the Lidsey WTW via a new off-site foul sewer.
- This option is illustrated on Drawing LAW-WSP-ZZ-ZZ-C-DR-05002 (Appendix E).
- This would result in deeper sewers and the need for Southern Water to construct a new gravity foul sewer between the Application Site and the Lidsey WTW along the Lidsey Rife corridor.

OPTION 3

5.2.7. Connect to the Lidsey WTW via a new on- or off-site foul pumping station and rising main.

- This option would be similar to Option 2 in providing a separate foul drainage network for the proposed development but would drain to a new foul pumping station that would then discharge to another point on the existing foul sewer network via a new rising main.
- This option would again be subject to Southern Water's detailed assessment.
- If an on-site foul pumping station were required, an area of development would need to be provided to locate it (typically 8m x 12m, with appropriate access and 15m offset from habitable buildings).
- If this option was taken Southern Water might want to consider an off-site location as part of a wider strategy for the area.

5.3 SURFACE WATER DRAINAGE STRATEGY

5.3.1. The surface water drainage strategy for the proposed development is to manage and attenuate surface water via the use of Sustainable drainage Systems (SuDS), including tanked pervious paving and attenuation basins, prior to discharge at Qbar to the Lidsey Rife.

5.3.2. This strategy will manage surface water sustainably and avoid an increase in flood risk off site. Refer to WSP's FRA (2023) report for more information.

6 CONCLUSION

6.1.1. There are existing public foul drainage networks within the immediate vicinity of the proposed Westergate development including on-site public sewers.

6.1.2. Southern Water has confirmed that there is capacity for 50 new dwellings to discharge to the existing sewer network at a location in the south of the site.

6.1.3. Southern Water has advised that the nearest point of connection with existing capacity for 400 dwellings is the Lidsey WTW.

6.1.4. Following any planning permission granted for the Application Site, Southern Water would carry out a detailed assessment and provide a solution for the whole development.

6.1.5. Under Section 94 of the Water Industry Act 1991 Southern Water is the drainage authority responsible for effectually draining the Lidsey WwTW catchment.

6.1.6. Southern Water was a consultee on the Adopted Arun District Council Local Plan which includes the Application Site as part of site SD5.

6.1.7. Southern Water has assessed growth and the effect of predicted growth on planning objectives and via the DWMP process has identified investment needs so that works can be planned to address these risks at the appropriate time.

6.1.8. The above demonstrates that Southern Water as Sewerage undertaker has a planned strategy aligned with the broader planning objectives to allow for local developments.

6.1.9. The design of the on-site foul sewer network will incorporate measures to reduce the risk of infiltration into the foul sewer network, subject to agreement with the adopting authority.

6.1.10. The surface water drainage strategy (refer to WSP's Flood Risk Assessment, 2023) will manage surface water runoff from the proposed development sustainably to avoid an increase in the risk of surface water entering the foul drainage network.

6.1.11. The outline foul drainage strategies demonstrate that the proposed development could be drained by gravity to either the existing on-site Southern Water foul sewers or a new off-site foul gravity sewer or a new on- or off-site foul pumping station.

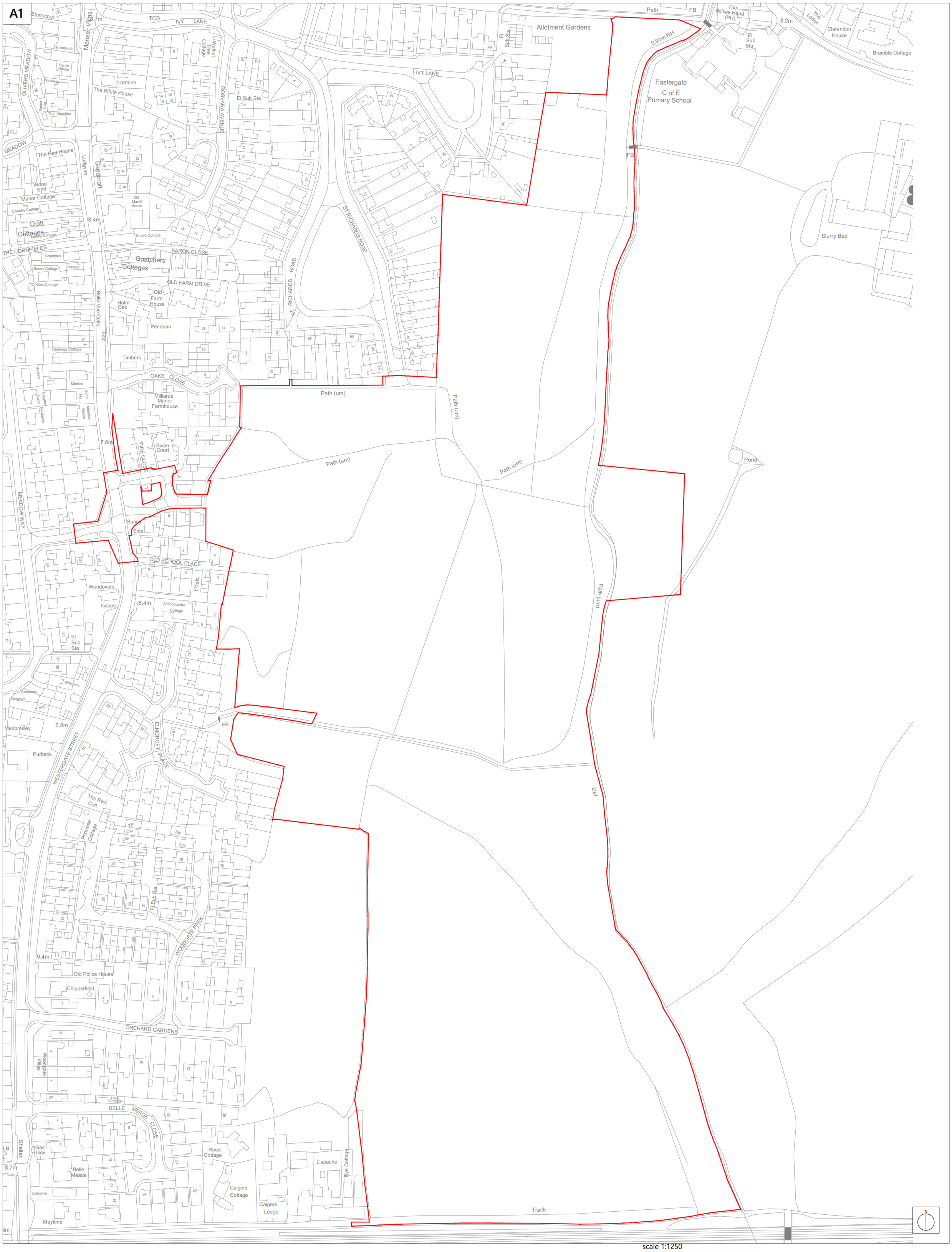
6.1.12. There is therefore a process by which the impact of the development on the existing sewer network will be assessed and details developed alongside Southern Water as part of any reserved matters planning applications for residential development on the Application Site. This process, alongside Southern Water's DWMP, would ensure that risks from development foul drainage would be appropriately managed to mitigate against any negative impact on the existing foul sewer network.

Appendix A

SITE INFORMATION

Public

A1



scale 1:1250

0 25m 50m 75m

Rev	Description	Date	Au	Ch
P1	First Issue	06.09.23	MK	

Romsey
T:01794 367703
F:01794 367276

Portishead
T:01275 407000
F:01794 367276

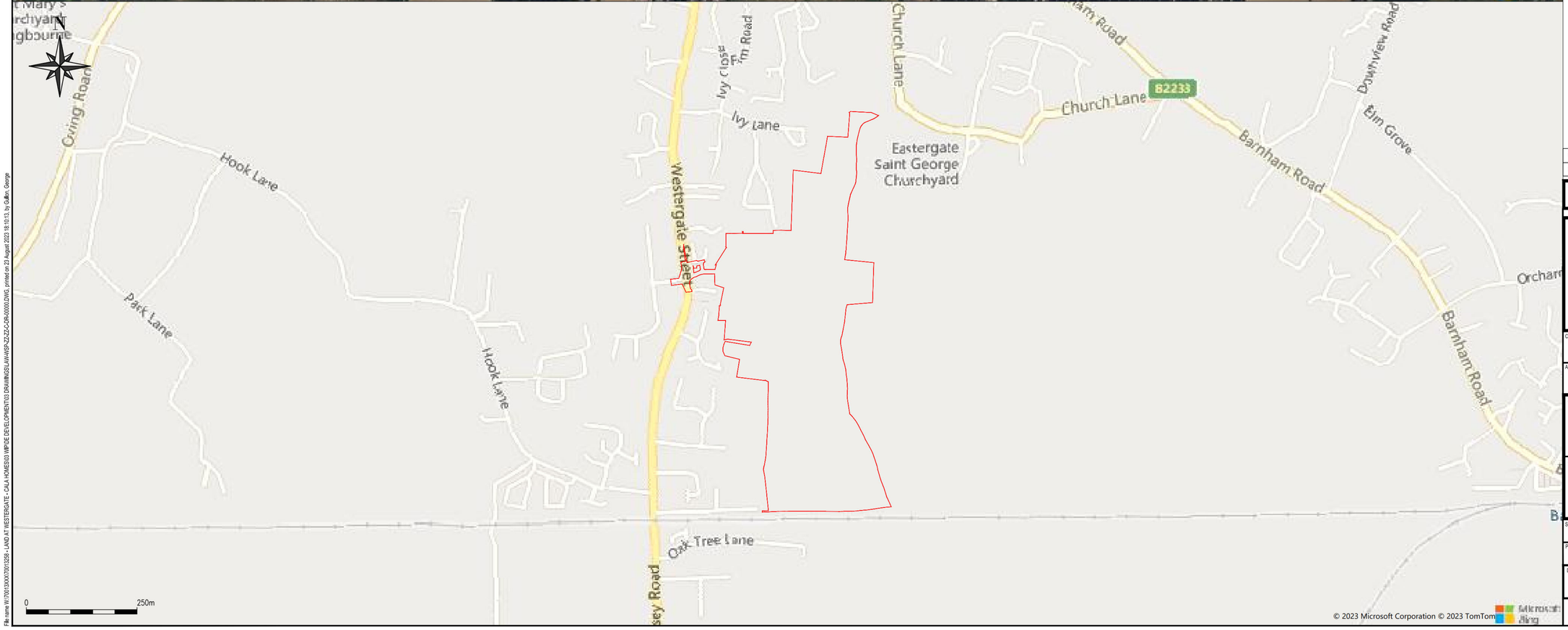
www.thrivearchitects.co.uk

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Project	**Land East of Westergate, Aldingbourne**
Drawing	**Location Plan**
Client	**Cala Homes South Home Counties**
Job no.	**CALA230719**
Dwg no.	**LP01**
Date	**06.09.23**
Revision	**P1**
Author	**MK**
Checker	
Scale	**1:1250 at A1**
Status	
Office	**Romsey**
Client ref.	

thrive. architects





NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
2. LAND OWNERSHIP BOUNDARIES ARE BASED ON OS MAPPING & INFORMATION PROVIDED BY THE CLIENT TEAM FOR REFERENCE AT A LARGE SCALE. THIS INFORMATION SHOULD NOT BE RELIED ON FOR DETAILED DEFINITION OF LAND BOUNDARIES.
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KEY:

SITE LOCATION

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REV	DATE	BY	DESCRIPTION	CHK	APP
P01	23/08/2023	GLG	FIRST ISSUE	JP	LRB

DRAWING STATUS: S2 - FOR INFORMATION

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Grosvenor House, 2 Grosvenor Square, Southampton, SO15 2BE, UK
T+ 44 (0) 2380 101 700
wsp.com

CLIENT: CALA HOMES

ARCHITECT: -

SITE/PROJECT: LAND AT WESTERGATE

TITLE: SITE LOCATION PLAN

SCALE @ A1:	CHECKED:		APPROVED:
1:5000	JB		LRB
PROJECT NO: 70013258	DESIGNED: GLG	DRAWN: GLG	DATE: August 2023

DRAWING No: LAW-WSP-ZZ-ZZ-C-DR-00000 REV: P01

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File name:W:\70013XXX\70013258 - LAND AT WESTERGATE - CALA HOMES\03 WIP\DE DEVELOPMENT\03 DRAWINGS\LAW-WSP-ZZ-ZZ-C-DR-00000.DWG, printed on 23 August 2023 18:10:13, by Gillian George

Appendix B

TOPOGRAPHICAL SURVEY

Public



Notes

1. This survey has been computed and drawn about the national grid.
2. All levels are in metres and relate to Ordnance Datum. With levels tied via GPS link to Leica Smartnet Network. Station 01 has an accepted value of 7.42m.
3. This survey was surveyed for a scale of 1:200, any subsequent enlargements should be verified on site.
4. Whilst every care has been taken, no responsibility can be accepted for errors or omissions caused by detail obscured or not accessible at the time of this survey.
5. Tree Canopy lines are indicative.
6. Trees under 100mm trunk dia not surveyed.
7. All dimensions to be checked on site prior to any work taking place.
8. Any surrounding buildings are indicated using data collected and as viewed from the site. This may not represent the actual footprint at ground level and must be checked using an OS overlay if critical to the scheme.
9. Building site st Pine Close was under construction at the time of the survey.
10. Many Areas heavily overgrown thus obscuring any detail within.
11. Surrounding buildings positioned using OS data from Promap. License No. 10022432
12. Positions of features and contours within overgrown areas have been assumed due to no access being possible. Trees within these areas have been remotely collected and may not exactly represent the true position.

Legend

BOL	Bollard
BT	BT Inspection Chamber
CBF	Close Boarded Fence
CLF	Chain Link Fence
CATV	Cable Television Point
CCTV	Closed Circuit Television Camera
CL	Cover Level
CPS	Concrete Paving Slabs
DK	Drop Kerb
DPC	Damp Proof Course
EL	Eaves Level
FB	Flower Bed
FH	Fire Hydrant
FL	Floor Level
FW	Foul Water Sewer
GL	Rain Water Gully/Drain
GAS	Gas Inspection Cover
HI	Height
IR	Iron Railing Fence
IC	Inspection Cover
Inv	Chamber Lowest Invert Level
LB	Letter Box
LP	Lamp Post
MH	Man Hole/Inspection Chamber
OSBM	Ordnance Survey Bench Mark
BWF	Barbed Wire Fence
PARA	Parapet Wall Height
PCF	Post and Chain Fence
PF	Panel Fence
PRF	Post and Rail Fence
PWF	Post and Wire Fence
PB	Post Box
PP	Electrical Power Pole
RE	Rodding Eye
RL	Ridge Level
RWP	Rain Water Pipe
SIGN	Road Sign
STN	Survey Control Station
SV	Stop Valve
SVP	Soil & Vent Pipe
TL	Threshold Level
TP	Telegraph Pole
VP	Vent Pipe
WM	Water Meter
WS	Water Supply Cover

TELEPHONE CABLE
ELECTRICITY CABLE
BANK TOP
BUILDING LINES
DRAIN RUNS
FENCES
FOOTPATH
KERB LINES
WALLS

HEDGES
Spread of Trunk
Species

HS
00.000 m
Trunk
Spread

TREE CANOPY
(INDICATIVE ONLY)

GATE

Rev.	Description	By	Date	Chk'd	Auth
A	Building Footprints Amended	SC	Dec 15		
B	30 Contours added	SC	Jun 16		
C	Road Construction added	SC			

10m
5m
0m
Scale Bar - Measurements in Metres.

10m 5m 0m
Scale Bar - Measurements in Metres.

N
Indicative Only

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COLE & COLE
Measured Land & Building Surveys
9, Fosim View,
Bryanston,
Blandford Forum,
Dorset,
DT11 0PW
T: 01258 488749
M: 07795 816345
www.colesandcole.co.uk

Client
CALA Homes

Project
Land at:
Westergate Street,
Westergate, West Sussex.

Title
Topographical Survey

Original Scale	Surveyed	Drawn	
1:1000@A0	CG/SMC/TY	SMC	
	Date Jan 16	Date Jan 16	

Drawing Number
16 – 0102a

Rev
C

Appendix C

SOUTHERN WATER RECORDS & CONSULTATION

Public

(c) Crown copyright and database rights 2023 Ordnance Survey 100031673
Data updated: 21/03/23

Scale: 1:1250
Map Centre: 494092,104778

Date: 28/04/23
Our Ref: 1156872 - 16

Wastewater Plan A0
Powered by digdat

Foul Gravity Sewer
Combined Gravity Sewer
Converted Water Course or Trusted Effluent
Surface Water Gravity Sewer
Rising Main, Vacuum or Syphon
Combined Outfall
Foul Outfall
Surface Water Outfall
Surface Water Inlet
Combined Pumping Station
Surface Water Pumping Station
Foul Pumping Station
Water Treatment Works
Section 104 Area
Building Over Agreement Area
Foul Manhole
Combined Manhole
Surface Water Manhole
Side Entry Manhole, Catchpit, Inspection Chamber, Manhole or Surface Water Soakaway

payments.utilitysolutions@atkinsglobal.com

203277

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2023 Ordnance Survey 100031673 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

0m 100m 200m 300m

from Southern Water

George Gullon
WSP UK
Matrix House
Basing View
Basingstoke
Hampshire
RG21 4DZ

Your ref

Our ref
DSA000023113

Date
29 June 2023

[redacted]

Dear Mr Gullon,

Level 1 Capacity Check Enquiry: Land at Westergate, Chichester, West Sussex, PO20 3QR.

Thank you for your capacity check application relating to the above development.

Your application will be progressed by our modelling team and we will send you our response within 21 calendar days.

Expected Response Date: 18 July 2023

Application Submitted	Acknowledgement 5 days	Assessment	Full Response Within 21 days

Should it be necessary to contact us please quote our above reference number in all communications relating to this application by email at southernwaterplanning@southernwater.co.uk

Yours sincerely,

Future Growth Planning Team
Developer Services

southernwater.co.uk/developing-building/planning-your-development

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
0001	F	9.46	7.72	
0002	F	10.12	7.66	
0003	F	10.21	8.97	
0101	F	9.97	8.87	
0102	F	8.99	5.36	
0102	F	10.23	8.47	
0103	F	10.39	8.42	
0104	F	10.16	8.34	
0105	F	10.50	8.35	
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0107	F	10.29	8.80	
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7703	F	8.20	6.33	
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8301	F	9.61	8.05	
8301	F	9.45	7.81	
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8403	F	9.91	7.43	
8501	F	0.00	0.00	
8601	F	6.64	5.44	
8602	F	6.59	4.72	
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8802	F	7.37	5.97	
8803	F	7.45	7.44	
8804	F	7.24	5.32	
8805	F	6.95	4.83	
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8807	F	7.20	6.35	
8808	F	7.27	6.14	
8809	F	7.45	5.42	
8902	F	7.80	0.00	
8903	F	8.08	0.00	
8904	F	8.03	5.64	
8906	F	8.80	0.00	
8912	F	0.00	0.00	
9001	F	9.64	9.63	
9002	F	9.64	8.64	
9003	F	9.66	8.47	
9004	F	9.60	8.42	
9005	F	9.38	8.08	
9101	F	7.89	6.48	
9101	F	0.00	0.00	
9102	F	8.98	5.72	
9102	F	0.00	0.00	
9103	F	9.16	5.52	
9103	F	0.00	0.00	
9105	F	0.00	0.00	
9106	F	0.00	0.00	
9107	F	0.00	0.00	
9108	F	0.00	0.00	
9109	F	0.00	0.00	
9110	F	0.00	0.00	
9111	F	0.00	0.00	
9112	F	0.00	0.00	
9202	F	10.61	0.00	
9202	F	9.48	8.35	
9203	F	9.99	0.00	
9204	F	0.00	0.00	
9205	F	0.00	0.00	
9206	F	0.00	0.00	
9207	F	0.00	0.00	
9301	F	0.00	0.00	
9301	F	9.97	8.76	
9302	F	10.01	8.45	
9303	F	0.00	0.00	
9304	F	0.00	0.00	
9401	F	10.20	8.49	
9404	F	0.00	0.00	
9405	F	0.00	0.00	
9601	F	6.86	5.46	
9602	F	6.70	4.91	
9701	F	7.32	5.73	
9702	F	6.52	4.32	
9703	F	6.77	3.97	
9704	F	6.50	3.90	
9901	F	9.10	0.00	
9902	F	9.25	0.00	
0252	S	11.02	0.00	
0253	S	10.61	6.24	
0254	S	10.75	6.23	
0255	S	10.56	6.21	
0256	S	10.80	6.16	
0350	S	11.48	9.08	
0351	S	11.39	8.79	
0352	S	11.20	8.65	
0353	S	11.42	9.68	
0354	S	11.30	8.23	
0451	S	11.93	9.55	
0452	S	11.67	9.41	
0453	S	0.00	0.00	
1250	S	0.00	0.00	
1450	S	0.00	0.00	
2250	S	9.36	5.90	
2251	S	7.12	5.82	
6358	S	8.89	8.21	
6450	S	9.88	8.94	
6451	S	9.82	8.79	
6452	S	10.77	9.79	
6453	S	10.00	0.00	
6550	S	10.00	9.15	
6551	S	9.96	9.10	
6552	S	9.82	0.00	
6553	S	9.82	0.00	
7150	S	9.67	9.05	
7151	S	9.02	8.14	
7152	S	8.82	7.87	
7250	S	9.47	8.70	
7251	S	9.39	8.57	
7252	S	9.20	8.32	
7350	S	9.83	9.07	
7351	S	9.85	8.85	
7352	S	9.76	8.83	
7353	S	9.81	8.67	
7354	S	9.76	8.76	
7355	S	9.88	9.10	
7451	S	9.83	9.20	
7452	S	10.10	9.03	
7453	S	10.02	8.78	
7454	S	10.12	9.18	
7455	S	10.12	8.95	
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7457	S	0.00	0.00	
7459	S	10.40	9.31	
7650	S	9.13	8.17	
7651	S	8.17	7.11	
7750	S	8.93	7.48	
7751	S	8.28	6.69	
7752	S	7.73	6.18	
7950	S	7.82	7.20	
7951	S	8.04	6.87	
8050	S	8.43	7.26	
8051	S	8.41	0.00	
8150	S	0.00	0.00	
8151	S	0.00	0.00	
8153	S	9.44	7.95	
8154	S	8.78	7.84	
8155	S	8.81	7.85	
8156	S	8.50	7.31	
8250	S	9.03	6.51	
8251	S	8.91	6.54	
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8352	S	9.47	0.00	
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8354	S	9.37	7.94	
8355	S	9.33	7.70	
8356	S	9.27	0.00	
8357	S	9.23	8.31	
8358	S	9.37	8.33	
8650	S	6.69	5.79	
8651	S	6.64	5.49	
8750	S	7.28	5.59	
8752	S	6.95	5.05	
8753	S	6.45	5.05	
8754	S	6.40	4.80	
8757	S	6.51	0.00	
8759	S	6.54	5.43	
8850	S	7.24	5.75	
8853	S	6.58	5.62	
8854	S	6.49	0.00	
8950	S	8.10	6.44	
8951	S	7.92	6.65	
8952	S	7.73	6.36	
8953	S	8.27	6.69	
9150	S	0.00	0.00	
9150	S	0.00	0.00	
9151	S	0.00	0.00	
9152	S	0.00	0.00	
9153	S	0.00	0.00	
9250	S	0.00	0.00	
9251	S	9.59	6.51	
9650	S	6.88	6.09	
9651	S	6.68	5.69	
9750	S	6.66	5.56	
9751	S	6.56	4.80	
9752	S	6.63	5.44	
9753	S	6.54	0.00	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

from Southern Water

George Gullon
WSP UK
Matrix House
Basing View
Basingstoke
Hampshire
RG21 4DZ

Your ref

Our ref
DSA000023113

Date
14 July 2023

[redacted]

Dear Mr Gullon,

Level 1 Capacity Check Enquiry: Land at Westergate, Chichester, West Sussex, PO20 3QR.

We have completed the capacity check for the above development site and the results are as follows:

Foul Water

There is currently inadequate capacity within the foul sewerage network to accommodate a foul flow of **3.61 l/s** for the above development at manhole reference SU9404**2401**. The proposed development would increase flows to the public sewerage system which may increase the risk of flooding to existing properties and land. Additional off-site sewers or improvements to existing sewers will be required to provide sufficient capacity to service the development. Southern Water has a duty to provide Network capacity from the point of practical connection (point of equivalent or larger diameter pipe) funded by the New Infrastructure Charge.

Southern Water aim to provide this within 24 months following the date that planning has been granted for developments not identified as strategic sites in our current business plan. Strategic sites are larger developments and will often take longer than 24 months for a full solution to be provided.

The nearest point where capacity is currently available is at **Lidsey WTW** which is located approximately **1 km** towards Southeast of the proposed development site. Rights are not issued for a direct connection to Wastewater Treatment Works (WTW). Please note that connection to the WTW will have to be agreed by Southern Water Services before being carried out.

New Infrastructure Charging

Please note as of 1st April 2018 we have moved to the "New Connections Services Charging Arrangements". We understand that this may cause uncertainty for customers, particularly where they may have already committed to a development based on previous charging arrangements. We have worked with our stakeholders and Water UK to agree a set of principles by which we will base our charges. Please read through our new charging arrangement documents available at the following link: southernwater.co.uk/developing-building/connection-charging-arrangements

Alternatively, New Appointees and Variations (NAVs), also known as 'inset' companies, can provide new connection services or take ownership of the new water and wastewater connection infrastructure provided for a new development. NAVs are appointed by Ofwat and replace the regional water company. It is for the developer to choose whether to use a NAV or the regional water company to supply services for new sites, according to certain legal criteria.

Connecting to our network

It should be noted that this information is only a hydraulic assessment of the existing sewerage network and does not grant approval for a connection to the public sewerage system. A formal Sewer Connection (S106) application is required to be completed and approved by Southern Water Services. To make an application visit: developerservices.southernwater.co.uk

Please note the information provided above does not grant approval for any designs/drawings submitted for the capacity analysis. The results quoted above are only valid for 12 months from the date of issue of this letter.

Should it be necessary to contact us please quote our above reference number relating to this application by email at [redacted]

Yours sincerely,

Future Growth Planning Team
Developer Services

southernwater.co.uk/developing-building/planning-your-development

SOUTHERN WATER



Southern Water

SOUTHERN WATER



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site.

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Southern Water

O.S. REF: SU9403SW	Scale: 1:2500	Printed By: LamaniS	Date: 13-7-2023
Sewer Plot		Nearest Point of Capacity	
WARNING: BAC pipes are constructed of Bonded Asbestos Cement		Requested By:	
WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement			

Blavignac, Julien

From: Southern Water Planning [redacted]
Sent: 31 July 2023 09:54
To: Gullon, George
Subject: RE: DSA000023113-CC- 230505 Land at Westergate, Chichester, West Sussex, PO20 3QR

Good Morning George,

Our technical team have re-run the modelling and confirmed that we are able to accommodate 50 units at manhole **SU94042401** without network reinforcement. In order to accommodate the entire site it will be necessary for a more detailed assessment to be undertaken, however, as you will appreciate we have a number of developments to design infrastructure for and we do not commence this process until planning permission has been granted. This is to avoid expending resources unnecessarily as many developments do not gain planning permission and to expend resource in such circumstances is not a justifiable use of customer money. Furthermore, I would advise that we are unable to reserve capacity in our network for developments that do not have planning consent, therefore upon consultation, via the planning authority we will look to further review the development and it's connection.

We aim to provide infrastructure within 24 months of planning being granted or provide an alternative method of drainage should any required infrastructure not be in place by then. The developer will be asked to contribute to the costs of reinforcement via the New Infrastructure charging system details of which are available at https://www.southernwater.co.uk/developing-building/connection-charging-arrangements.

As previously advised, I am awaiting for confirmation on the growth information for Lidsey and I will get back to you on your enquiry relating to planned works separately.

Kind Regards

Rachael Powys-Keck
Future Growth Planner, South East Region
[redacted]

southernwater.co.uk

From: Gullon, George [redacted]
Sent: 20 July 2023 11:06
To: Developer Services [redacted]
Cc: Beeching, Luke [redacted]
Subject: RE: DSA000023113-CC- 230505 Land at Westergate, Chichester, West Sussex, PO20 3QR

Good Morning Developer Services,

Many thanks for your feedback – it has been very useful!

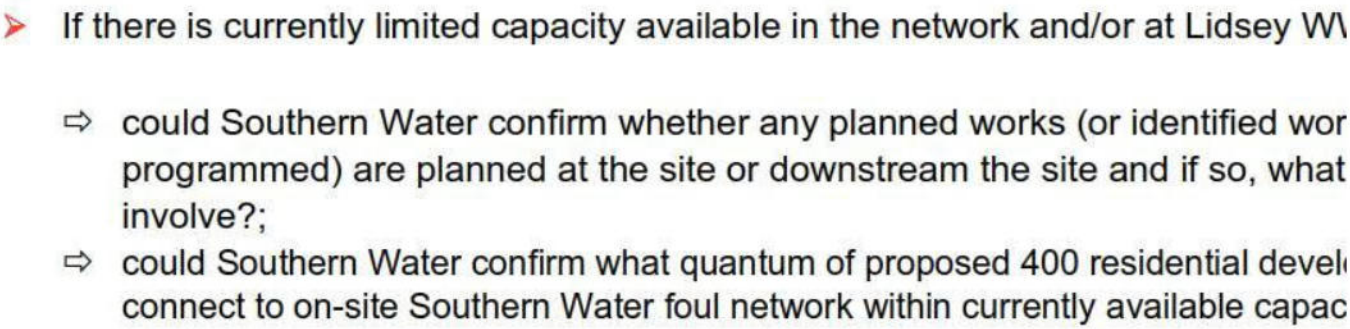
DSA000023113 - Land at Westergate, Chichester, West Sussex, PO20 3QR
Pre-Development Enquiry – Southern Water

As part of our initial pre-development enquiry, we also issued a supplementary letter (Document: 230505 FW Drainage Enquiry) breaking down various items we require information for. I have attached a copy of our initial Pre-Development enquiry to this email, as well as a pdf of the supplementary letter for your ease of reference.

After an initial review of all of the information we have received to date, cross-referencing with the issued supplementary letter, I was wondering whether you could help with a few further queries below?

Query 1

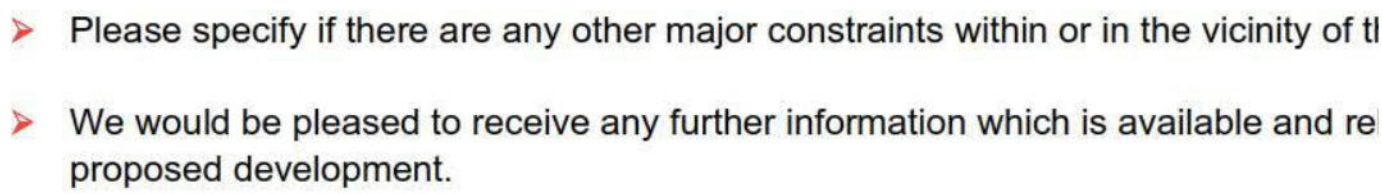
1. Regarding the supplementary letter, we believe we have sufficient information for Items 1, and 2. However, we do not appear to have any response to Item 3.
2. Please could you advise on these additional queries? (please see snip from supplementary letter below).



If any of these queries are out of your position to advise on, please could you guide us on the best point of contact for these?

Query 2

1. Should you feel Items 4 and 5 are relevant for our project, please could you advise further? (again, please see snip from supplementary letter below).



Hopefully this all makes sense, but should you have any queries or wish to discuss anything further, please do not hesitate to contact me.

Thank you for your time – it is greatly appreciated.

Thanks again.

Kind Regards,

George Gullon
Assistant Engineer – Development Infrastructure

[redacted]

WSP in the UK
Matrix House, Basing View
Basingstoke
RG21 4FF

wsp.com

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From: Developer Services [redacted]
Sent: Friday, July 14, 2023 2:43 PM
To: Gullon, George [redacted]
Subject: DSA000023113-CC- 230505 Land at Westergate, Chichester, West Sussex, PO20 3QR

Dear Mr Gullon,

Please find the Southern Water's response to your recent enquiry.

Yours sincerely,

Future Growth Planning Team
Developer Services

southernwater.co.uk/developing-building/planning-your-development

[redacted]
southernwater.co.uk

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-LAEmHhHzdJzBlTWfa4Hgs7pbKl

Appendix D

DEVELOPMENT LAYOUT

Public

A0



PRIVATE

House Type	No of Bedrooms	SqFt (GIA)	No	Total SqFt
1B FOG	1	538	1	538
1B Maisonette Ground Floor	1	538	4	2152
1B2P Flat	1	550	8	4400
1B Maisonette First Floor	1	659	4	2636
2B4P FOG	2	770	1	770
2B4P Flat	2	800	**27**	21600
Bayberry M4(2)	2	864	35	30240
Beech + study	2	876	59	51684
Blackthorne + GR M4(2)	2	1047	14	14658
Burdock	3	1046	12	12552
Dandelion M4(2)	3	1155	42	48510
Fennel M4(2)	3	1179	11	12969
Fern	3	1250	47	58750
Lancewood	3	1296	20	25920
Keriberry	4	1273	9	11457
Orpine M4(2)	4	1404	12	16848
Maple	4	1415	15	21225
Magnolia	4	1442	10	14420
Rockrose	4	1553	9	13977
TOTALS			340	365306

Private housing plot areas (sqft)	365306
Net developable area (acres)	22.289
Coverage sqft/acre	16390

AFFORDABLE

House Type	No of Bedrooms / Persons	SqFt (GIA)	No	Total SqFt
1B FOG	1	538	2	1076
1B Flat	1	538	7	3766
1B Flat M4(3)	1	753	14	10542
2B3P Flat	2	657	2	1314
2B4P Flat	2	753	17	12801
2B FOG	2	753	1	753
Bellflower M4(2)	2	864	4	3456
Erica M4(2)	3	1114	9	10026
Heather M4(2)	4	1267	4	5068
TOTALS			60	48802

Affordable housing plot areas (sqft)	48802
Net developable area (acres)	2.335
Coverage sqft/acre	20900

SITE TOTALS	400	414108

Total Housing plot areas (sqft)	414108
Total Net developable area (acres) based on sketch	24.624
Total Coverage sqft/acre	16817

- Site Boundary
- 26 Plot Number
- DAND House Type
- Affordable Housing
- Cycle Route
- Public Right of Way (PROW)
- Footpath

Romsey
T: 01794 367703
F: 01794 367276

Portishead
T: 01275 407000
F: 01794 367276

Camberley
T: 01276 749050
F: 01794 367276

www.thrivearchitects.co.uk

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Rev	Description	Date	Au	Ch
P1	Preliminary Issue	31.07.23	PM/MG	--/--
P2	Revised Layout	08.08.23	PM/MG	--/--
P3	Revised Layout	18.08.23	PM/hm	

Project	Land east of Westergate, Aldingbourne				
Drawing	Overall Sketch Layout - 01				
	-				
Client	Cala Homes South Home Counties				
Job no.	CALA230719			Date	31,07,23
Dwg no.	OSKL-01			Rev.	P3
Author	PM/MG	Checked	-/-	Scale	1:1000@A0
Status	PRELIMINARY			Office	Romsey
Client ref.	-				

thrive. architects

Appendix E

DRAINAGE STRATEGY

Public

SCALE FOR PLANNING PURPOSES ONLY

NOTES:

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5. UTILITY SURVEYED BY PULSE MAPPING AND SHOWN ON SURVEY DRG REF P160622-WESTERGATE (P01), 27/06/2016 REUSE COLE SURVEY TOPOGRAPHICAL SURVEY INFORMATION (REF.16-0102A REV C, (UNSPECIFIED DATE) PREPARED FOR THE SITE
6. INFORMATION AND DESIGN ON THIS DRAWING ARE BASED ON THRIVE ARCHITECTS PRELIMINARY LAYOUT OSKL-01 REV.P3 DATED 31.07.23.
7. COVER LEVELS FROM THE PROPOSED FOUL DRAINAGE ARE BASED ON EXISTING GROUND LEVELS.

DISCLAIMER NOTE:
INFORMATION ON THE LOCATION AND SIZE FOR EACH SERVICE HAS BEEN BASED ON RECORD INFORMATION PROVIDED BY THE RELEVANT SERVICE COMPANIES. NOT ALL SERVICES ARE SHOWN. THE POSITIONS SHOWN ARE INDICATIVE ONLY AND MAY NOT BE COMPLETE. THE PRESENCE OF SERVICES ON SITE SHOULD BE VERIFIED PRIOR TO ANY CONSTRUCTION WORK OR INTRUSIVE INVESTIGATIONS. CURRENT ORIGINAL PLANT RECORDS SHOULD BE USED AND NOT THIS INDICATIVE COMBINED SERVICES PLAN.

KEY:

- PROPOSED FOUL DRAINAGE & MANHOLE
- EXISTING SOUTHERN WATER FW DRAINAGE
- EXISTING SOUTHERN WATER SW SEWER
- PROPOSED FOUL DRAINAGE DIVERSION
- EXISTING FOUL DRAINAGE TO BE ABANDONED
- EXISTING PORTSMOUTH WATER MAIN
- BS CATEGORY A (TREES OF HIGH QUALITY)
- BS CATEGORY B (TREES OF MODERATE QUALITY)
- BS category C (TREES OF LOW QUALITY)
- BS category U (TREES UNSUITABLE FOR RETENTION)
- ESTIMATED TREE POSITIONS NOT INCLUDED ON ORIGINAL LAND SURVEY AND/OR ADJUSTED CROWN SPREADS
- 100YR(+36% PEAK FLOW) FLOOD PLAIN EXTENT
- EXTENT OF LAND WHERE GROUND LEVELS ARE LIKELY TO BE RAISED TO ALLOW DEVELOPMENT

1.1 – EXISTING OVERHEAD POWER CABLES CROSS SITE.

1.2 – EXISTING 12" AND 18" WATER MAINS (PORTSMOUTH WATER) CROSS THE SITE.

PROPOSED CONNECTION TO EXISTING SEWER

PROPOSED CONNECTION TO EXISTING SEWER

CONNECTION TO EXISTING SOUTHERN WATER SEWER

HEALTH AND SAFETY SYMBOLS LEGEND

- Indicates a residual risk requiring a compulsory action
- Conveys information about a residual risk
- Indicates a residual risk requiring a specific action to be avoided
- Warns of a residual risk or information that is unusual and cannot be designed out
- Indicates an environmental hazard

1.1 - Existing Overhead Power Cables.
1.2 - Existing Water mains.

The table above is provided to assist the Principal Contractor to fulfill their obligations under the Construction Design & Management Regulations, 2015. It does not include residual risks that a competent Contractor will be aware of nor does it absolve the Principal Contractor of his legal responsibilities. For further hazard and risk information, refer to Design Risk Management Schedule (T446).

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION BOX

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REV	DATE	BY	DESCRIPTION	CHK	APP
P01	21/09/2023	PN	FIRST ISSUE	JP	LRB

DRAWING STATUS: B3 - FOR PLANNING

Grosvenor House
2 Grosvenor Square
Southampton
SO15 2BE, UK

T+ 44 (0) 2380 101 700
wsp.com

CLIENT: CALA HOMES SOUTH HOMES COUNTIES

ARCHITECT: -

PROJECT: LAND AT WESTERGATE

TITLE: FOUL DRAINAGE STRATEGY OPTION 1 (ON SITE CONNECTION TO EXISTING FW NETWORK)

SCALE @ A1:	CHECKED:	APPROVED:
1:1250	LRB	LRB

PROJECT No:	DESIGNED:	DRAWN:	DATE:
70013258	GR	PN	September 23

DRAWING No: LAW-WSP-ZZ-ZZ-C-DR-05001. REV: P01

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File name \\UK.WSPGROUP.COM\CENTRAL DATA\PROJECTS\70013XXX\70013258 - LAND AT WESTERGATE - CALA HOMES\00 WIP\DE DEVELOPMENT\03 DRAWINGS\LAW-WSP-ZZ-ZZ-C-DR-05001..DWG, printed on 21 September 2023 16:14:32, by Blavignac, Julien

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4. CONFLICTING INFORMATION SHOWN ON THE ENGINEER'S DRAWINGS OR DISCREPANCIES BETWEEN THE INFORMATION GIVEN BY THE ENGINEER AND THAT PROVIDED BY OTHERS MUST BE REFERRED TO THE ENGINEER BEFORE THE WORKS COMMENCE.
5. UTILITY SURVEYED BY PULSE MAPPING AND SHOWN ON SURVEY DRG REF P160622-WESTERGATE (P01), 27/06/2016 REUSE COLE SURVEY TOPOGRAPHICAL SURVEY INFORMATION (REF.16-0102A REV C, (UNSPECIFIED DATE) PREPARED FOR THE SITE.
6. INFORMATION AND DESIGN ON THIS DRAWING ARE BASED ON THRIVE ARCHITECTS PRELIMINARY LAYOUT OSKL-01 REV.P3 DATED 31.07.23.
7. COVER LEVELS FROM THE PROPOSED FOUL DRAINAGE ARE BASED ON EXISTING GROUND LEVELS.

DISCLAIMER NOTE:
INFORMATION ON THE LOCATION AND SIZE FOR EACH SERVICE HAS BEEN BASED ON RECORD INFORMATION PROVIDED BY THE RELEVANT SERVICE COMPANIES. NOT ALL SERVICES ARE SHOWN. THE POSITIONS SHOWN ARE INDICATIVE ONLY AND MAY NOT BE COMPLETE. THE PRESENCE OF SERVICES ON SITE SHOULD BE VERIFIED PRIOR TO ANY CONSTRUCTION WORK OR INTRUSIVE INVESTIGATIONS. CURRENT ORIGINAL PLANT RECORDS SHOULD BE USED AND NOT THIS INDICATIVE COMBINED SERVICES PLAN.

KEY:

- PROPOSED FOUL DRAINAGE & MANHOLE
- EXISTING SOUTHERN WATER FW DRAINAGE
- EXISTING SOUTHERN WATER SW SEWER
- EXISTING FOUL DRAINAGE CROSSING APPICATION SITE TO BE RETAINED
- PROPOSED FOUL DRAINAGE DIVERSION
- EXISTING FOUL DRAINAGE TO BE ABANDONED
- EXISTING PORTSMOUTH WATER MAIN
- BS CATEGORY A (TREES OF HIGH QUALITY)
- BS CATEGORY B (TREES OF MODERATE QUALITY)
- BS category C (TREES OF LOW QUALITY)
- BS category U (TREES UNSUITABLE FOR RETENTION)
- ESTIMATED TREE POSITIONS NOT INCLUDED ON ORIGINAL LAND SURVEY AND/OR ADJUSTED CROWN SPREADS
- 100YR(+36% PEAK FLOW) FLOOD PLAIN EXTENT
- EXTENT OF LAND WHERE GROUND LEVELS ARE LIKELY TO BE RAISED TO ALLOW DEVELOPMENT

HEALTH AND SAFETY SYMBOLS LEGEND

- Indicates a residual risk requiring a compulsory action
- Conveys information about a residual risk
- Indicates a residual risk requiring a specific action to be avoided
- Warns of a residual risk or information that is unusual and cannot be designed out
- Indicates an environmental hazard

1.1 - Existing Overhead Power Cables.
1.2 - Existing Water mains.
1.3 - Deep Sewers in proximity of existing watercourse

The table above is provided to assist the Principal Contractor to fulfill their obligations under the Construction Design & Management Regulations, 2015. It does not include residual risks that a competent Contractor will be aware of nor does it absolve the Principal Contractor of his legal responsibilities. For further hazard and risk information, refer to Design Risk Management Schedule (T446).

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION BOX

1.1 – EXISTING OVERHEAD POWER CABLES CROSS SITE.

1.2 – EXISTING 12" AND 18" WATER MAINS (PORTSMOUTH WATER) CROSS THE SITE.

PROPOSED 150ø PIPE DIVERSION
SOFFIT LEVEL:4.78
INVERT LEVEL:4.63
PROPOSED 150ø PIPE
SOFFIT LEVEL:4.28
INVERT LEVEL:4.13

PROPOSED 300ø PIPE DIVERSION
SOFFIT LEVEL:3.23
INVERT LEVEL:2.83
PROPOSED 150ø PIPE
SOFFIT LEVEL:2.48
INVERT LEVEL:2.33

1.3 – DEEP SEWERS IN PROXIMITY TO EXISTING WATERCOURSE.

SUBJECT TO SOUTHERN WATER REINFORCEMENT STRATEGY REQUIREMENTS, A PUMPING STATION (ON OR OFF SITE) MAY BE REQUIRED.

EXISTING 375ø PIPE
SOFFIT LEVEL:0.61
INVERT LEVEL:0.23
PROPOSED 225ø PIPE
SOFFIT LEVEL:-0.27
INVERT LEVEL:-0.50

UNTIL TECHNICAL APPROVAL HAS BEEN OBTAINED FROM THE RELEVANT LOCAL AUTHORITIES OR STATUTORY BODIES, IT SHOULD BE UNDERSTOOD THAT ALL DRAWINGS ARE ISSUED AS PRELIMINARY AND NOT FOR CONSTRUCTION. SHOULD THE CONTRACTOR AND / OR EMPLOYER COMMENCE WORK PRIOR TO APPROVAL BEING GIVEN, IT IS ENTIRELY AT THEIR OWN RISK

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REV	DATE	BY	DESCRIPTION	CHK	APP
P01	21/09/2023	GLG	FIRST ISSUE	JB	LRB

DRAWING STATUS: B3 - FOR PLANNING

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CLIENT: CALA HOMES SOUTH HOMES COUNTIES

ARCHITECT: -

PROJECT: LAND AT WESTERGATE

TITLE: FOUL DRAINAGE STRATEGY OPTION 2 & 3 (NEW FW CONNECTION TO LIDSEY WWTW)

SCALE @ A1:	CHECKED:		APPROVED:
1:1250	JB		LRB
PROJECT No:	DESIGNED:	DRAWN:	DATE:
70013258	GLG	GLG	September 23

DRAWING No: LAW-WSP-ZZ-ZZ-C-DR-05002 REV: P01

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