Gladman Developments Ltd.

Land West of Cross Road, Deal

Flood Risk Assessment & Outline Surface Water Drainage Strategy

680074-R1(01)-FRA

OCTOBER 2021

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RSK GENERAL NOTES

Project No.: 680074-R1(01)-FRA
Site: Land at Cross Road, Deal
Title: Flood Risk Assessment & Outline Surface Water Drainage Strategy
Client: Gladman Developments Ltd.
Date: July 2021
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EXECUTIVE SUMMARY

RSK has been commissioned to undertake a Flood Risk Assessment and Outline Drainage Strategy in support of the Outline Planning Application for a proposed residential development at Cross Road, Deal, in Kent. This will be contained within a site totalling 8.71 hectares, accessed from Cross Road which forms the eastern site boundary. The site is currently considered as undeveloped from a hydraulic perspective and consists of arable agricultural land.

The developable area of the site is wholly located within Flood Zone 1 and therefore the proposed development passes the Sequential Test and does not require the Exception Test to be undertaken. Generally, the developable areas of the site are at low risk from all sources of flooding and will not increase the risk of flooding elsewhere as a result of the development of the site.

The SuDS strategy for the site includes the use of a SuDS treatment train, shown to have three main components within the indicative surface water drainage strategy. Runoff from impermeable areas will be directed to conveyance swales located within the site which will carry surface water runoff towards a pond for attenuation. Once the pond has exceeded its attenuation capacity then surface water runoff will discharge to an infiltration basin.

The drainage strategy should be confirmed by the Lead Local Flood Authority, in this case Kent County Council and the Environment Agency prior to development due to the sensitive nature of the receiving aquifer and the infiltration basin being located within Groundwater Source protection Zone 2, close to Zone 1.

It is recommended that finished floor levels should be set at or above the existing ground levels as not to increase the risk of flooding to the properties.

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APPENDICES

1 INTRODUCTION

1.1 Context

RSK Land and Development Engineering Ltd (RSK) was commissioned to carry out a Flood Risk Assessment (FRA) for Gladman Developments Ltd. (the 'client'). The assessment is in support of the outline planning submission for the land west of Cross Road, Deal, Kent (the 'site').

The assessment has been prepared in accordance with the National Planning Policy Framework (NPPF)[1] and its accompanying Planning Practice Guidance[2], the Interim Code of Practice for Sustainable Drainage[3], BS 8533-2017 Assessing and Managing Flood Risk in Development Code of Practice[4] and the Non-statutory technical standards for sustainable drainage systems[5], with site-specific advice from the Environment Agency (EA), the Lead Local Flood Authority (LLFA), the Local Planning Authority (LPA), the architect and the client.

The NPPF sets out the criteria for development and flood risk by stating that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.

The key definitions within the PPG are:

- "Flood risk" is a combination of the probability and the potential consequences of flooding from all sources – including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.
- "Areas at risk of flooding" means areas at risk from all sources of flooding. For fluvial (river) and sea flooding, this is principally land within Flood Zones 2 and 3. It can also include an area within Flood Zone 1 which the Environment Agency has notified the local planning authority as having critical drainage problems.

For this site, the key aspects that require the assessment are:

- The Environment Agency's indicative flood zone map shows that the site is located within Flood Zone 1; and
- The site area is approximately 8.71Ha, therefore surface water drainage must be considered, and sustainable drainage systems (SuDS), where possible.

[1] Communities and Local Government, 'National Planning Policy Framework', 2021

[2] Communities and Local Government, 'Planning Practice Guidance - Flood Risk and Coastal Change, ID 7', March 2014 http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/

[3] DEFRA, 'Interim Code of Practice for Sustainable Drainage Systems' National SUDS Working Group, July 2004

[4] BSI, 'BS 8533-2017 Assessing and managing flood risk in development Code of practice', 2017

[5] DEFRA, 'Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems', March 2015

1.2 Scope of Work

A key element of project development is to prepare a Flood Risk Assessment to establish the flood risk associated with the proposed development and to propose suitable mitigation, if required, to reduce the risk to a more acceptable level.

The scope of work relating to a Flood Risk Assessment is based on the guidance provided in Section 14 of the NPPF and its accompanying Planning Practice Guidance.

A site-specific Flood Risk Assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. The scope of this assessment therefore comprises the following elements:

- To review development framework plans, planning information and other studies to determine existing site conditions;
- To obtain information on the hydrology and hydrological regime in and around the site;
- To obtain the views of the Lead Local Flood Authority in terms of flood risk and drainage;
- To obtain the views of the Environment Agency including scope, location and impacts;
- To assess the impact on the site from climate change effects and anticipated increases in rainfall over a 100 year period for residential uses;
- To review site surface water drainage based on the proposed layout and, if necessary, to determine the extent of infrastructure required, and;
- To prepare a report including calculations and summaries of the source information and elements reviewed.

Reliance has been placed on factual and anecdotal data obtained from the sources identified. RSK cannot be held responsible for the scope of work, or any omissions, misrepresentation, errors or inaccuracies with the supplied information. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

The comments given in this report and opinions expressed are subject to RSK Group Service Constraints provided in **Appendix A**.

2 SITE DESCRIPTION

2.1 Location

Site Name: Land West of Cross Road, Deal

Site Address: Lane West of Cross Road,

Walmer,

Deal,

Kent,

CT14 9LA.

Site National Grid Reference: 636044 E, 150564 N

The site is located towards the south-west of Deal, approximately 300m west of Walmer train station, and is accessible from Cross Road. The site is a total of 8.71ha and is predominately used for arable farming.

Tables 2.1, below, provides a description of the immediate surroundings of the site on all sides.

Table 2.1: Site settings

Direction	Characteristic
North	Residential development located off Cross Road backs onto the northern boundary of the site. The urban extents of Deal are north of the site.
West	A mechanic's yard and agricultural working facilities are located to the immediate west of the site. Agricultural fields lie west of the site.
South	The southern boundary is defined by Ellens Road, land south of Ellens Road is predominately arable land.
East	Cross Road defines the eastern boundary of the site. Eastwards from the sites leads to the urban extents of Walmer.

Figure 2.1 shows a Site Location Map.

Figure 2.1: Site location plan

2.2 Land use and topography

A topographic survey has been provided for the site by Gladman Developments Limited (**Appendix B**). Generally the site falls to the south-west. The highest on-site elevation is located on the northern boundary at approximately 30.60mAOD. The lowest elevation is located to the at the most southern point at 17.1mAOD, with a continuous gradient across the site.

The approximate land use of the site are as follows:

Table 2.2: Existing site land uses

Land use	Area (Ha)	Percentage (%)
Impermeable	0.00	0
Permeable	8.71	100
Total	8.71	100

The site is shown to be entirely permeable, therefore site can be considered as Greenfield.

2.3 Hydrology

2.3.1 Fluvial and Tidal

There are no mapped watercourses on-site. The nearest watercourse to the proposed site is located approximately 1.3km to the north-west of the site. The North Sea coastline is approximately 1.9km to the east of the site.

It was noted in following a site walkover there were no drainage, irrigation or field boundary ditches located within the site boundary.

2.3.2 Sewer

Southern Water public sewer records (**Appendix C**) show that within the eastern boundary of the site there is a section of 1200mm diameter oversized pipe which appears to be online storage for the public foul sewer network. The foul sewer flows southwards along Cross Road, and turns eastwards onto Station Road.

A surface water sewer is shown to discharge into a field south of the site, it is not clear from the available information if the discharge is to a drainage ditch.

2.4 Geology

2.4.1 Desk Study

Based on published geological records for the area (British Geological Survey online mapping, the site exhibits the following geology:

- Superficial Geology: None recorded,
- Split Bedrock:
  - Seaford Chalk Formation (predominant site geology): Firm white chalk with conspicuous semicontinuous nodular and tabular flint seams. Hardgrounds and thin marls are known from the lowest beds. Some flint nodules are large to very large. Estimated depth of 50-80m,
  - Margate Chalk Formation (north-eastern corner of the site): Marl-free smooth white chalk with little flint, weakly developed indurated iron-stained sponge beds. There are no formal subdivisions, but informally the member includes a number of laterally persistent flint and marl beds named in Robinson (1986), which can be traced outside Kent in the Southern and "Transitional" provinces where they are correlated with the named beds of Mortimore (1986) within the Newhaven Chalk Formation. Estimated depth of up to 24m.

2.4.2 Site Investigation

Infiltration testing was undertaken at the site and the arisings from trial pits were recorded as part of the investigation, the report and conclusions are included in **Appendix D**. The general succession of strata encountered is described in **Table 2.3** below.

Table 2.3: General succession of strata encountered

Stratum	Exploratory holes encountered	Depth to top of stratum m bgl	Proven thickness (m)
Topsoil	All	Ground Level	0.60 to 0.80
Seaford Chalk Formation	All	0.60 to 0.80	Full depth not proven

The slowest infiltration rates achieved during the tests at each pit are summarised in **Table 2.4** and presented in full within the infiltration testing report[6]. The report concludes the potential for infiltration is greatest at the greater depth of 1.80mbgl. The infiltration rates at 1.20mbgl (TP03) and 1.50mbgl (TP02) are also considered appropriate for infiltration based drainage.

Table 2.4: Summary of infiltration rates

Test pit	Depth mbgl	Infiltration rate m/s
TP01	1.8	$5.34x10^{-5}$
TP02	1.5	$1.34x10^{-5}$
TP03	1.2	$1.59x10^{-6}$

2.5 Hydrogeology

Hydrogeological information was obtained from DEFRA's online 'Magic' mapping service. These maps indicate that the site lies above a Principal Bedrock Aquifer (These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage.

The site is located within a Groundwater Source Protection Zone (SPZ). The majority of the site is shown to be located within an Inner Zone 1. This zone is defined by a travel time of 50-days or less from any point within the zone at, or below, the water table. Additionally, the zone has as a minimum a 50-metre radius. It is based principally on biological decay criteria and is designed to protect against the transmission of toxic chemicals and water-borne disease. The remainder of the site, along the southern site boundary is designated an Outer Zone 2. This zone is defined by the 400-day travel time from a point below the water table. Additionally this zone has a minimum radius of 250 or 500 metres, depending on the size of the abstraction. The travel time is derived from consideration of the minimum time required to provide delay, dilution and attenuation of slowly degrading pollutants.

The site is within a Drinking Water Safeguard Zone (Groundwater). Drinking Water Groundwater Safeguard Zones (SgZs) are established around public water supplies where additional pollution control measures are needed.

[6] 315022 R01 (01), Old Road, Writhlington, Infiltration Testing Report, RSK Geosciences, September 2021

RSK's Preliminary Risk Assessment[7] (PRA) states that Groundwater beneath the site may be affected by saline intrusion and groundwater levels at the site may be affected by tidal variations due to the proximity to the coast to the east. It is also possible that localised perched water may be present in made ground at the site (if present).

As part of a previous site investigation undertaken for the PRA, trial pits were dug to a maximum depth of 2.70mbgl at the lowest area of the site (TP1). The trial pit log indicates that no Groundwater was recorded at this maximum depth. An extract of these results is included in **Appendix E**.

[7] RSK Preliminary Risk Assessment 28926-R01(01); Land off Cross Road, Deal, 2017

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3 DEVELOPMENT PROPOSALS

The proposed development is for a residential end use. The proposed Development Framework Plan shows that the site totals 8.71Ha with a developable area of 4.17Ha. As a result of the residential end use it is assumed that the site will contain a variety of dwellings, driveways, gardens, access highways off Cross Road, areas of public open space and associated soft landscaping. Of the proposed developable area it has been assumed that typically an impermeable area of 50% can be expected. Therefore the approximate land uses of the site are summarised in **Table 3.1** below.

Table 3.1: Proposed land uses for developable area (4.17Ha)

Land use	Area (Ha)	Percentage
Impermeable	2.085	50%
Permeable	2.085	50%
Total	4.17	100%

The remaining 4.54Ha within the site boundary will be classified as Green infrastructure which includes retained woodland, woodland planting, public open space, community allotments and sustainable drainage features. As a result, it is not necessary to include positive drainage for the Green Infrastructure areas as these will naturally drain as per the existing drainage regime of the site.

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4 LEGISLATION, POLICY AND GUIDANCE

4.1 National policy

Table 4.1: National legislation and policy context

Legislation	Key provisions
National Planning Policy Framework (2021)	The aims of planning policy on development and flood risk are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall.
Planning Practice Guidance (2014)	The NPPF is supported by an online Planning Practice Guidance, which provide additional guidance on flood risk.
Flood and Water Management Act 2010	The Flood and Water Management Act (FWMA) aims to implement the findings of the 2007 Pitt Review and co-ordinate control of drainage and flood issues. There are a number of increased responsibilities within the Act that affect adoption of SuDS features and the role of the EA to expand on the mapping data they provide. The implementation of SuDS features has many beneficial impacts on the treatment of surface water during remediation works.
Water Resources Act 1991	Section 24 – The Environment Agency is empowered under this Act to maintain and improve the quality of 'controlled' waters Section 85 – It is an offence to cause or knowingly permit pollution of controlled waters Section 88 – Discharge consents are required for discharges to controlled waters
Water Framework Directive (2000)	The Water Framework Directive (WFD) requires all inland and coastal waters to reach 'good' chemical and biological status by 2015. Flood risk management is unlikely to have a significant impact on chemical water quality except where maintenance works disturb sediment (such as de-silting) or where pollutants are mobilised from contaminated land by floodwaters. The main impact of the WFD on flood risk management, both now and in the future, relates to the ecological quality of water bodies. Channel works, such as straightening and deepening, or flood risk management schemes that modify geomorphological processes can change river morphology. The WFD aims to protect conservation sites identified by the EC Habitats Directive and Birds Directive that have water-related features, by designating them as 'protected sites'.

4.2 Local policy

Local policies ensures that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding and making development safe without increasing flood risk elsewhere and where possible, reducing flood risk.

Table 4.2: Local policy context

LDF document	Key provisions and policies
Dover District Council Local development Framework Core Strategy March 2010	There are no specific Flood Risk Assessment Policies within the Core Strategy. However, each policy discussing development within the area states that it should be undertaken in line with National Flood Risk Policy (NRM4, PPS25 (superseded by NPPF)).

4.3 Area guidance

Table 4.3: Area Guidance

Study	Key provisions and policies
Dover District Council Site-specific Guidance for Managing Flood Risk March 2019	"For all planning applications classified as major development, a detailed Surface Water Management Strategy report will need to be submitted alongside the planning application, which should evidence how SuDS can be incorporated within the proposed development. The SWMS must demonstrate compliance with the Non-Statutory Technical Standards for SuDS as well as all local planning policies related to drainage. Guidance on the completion of a detailed SWMS is set out within KCC's Drainage and Planning Policy Statement."
Kent County Council Drainage and Planning Policy December 2019	"SuDs Policy 1: Follow the Drainage hierarchy Surface runoff not collected for use must be discharged according to the following discharge hierarchy: • to ground, • to a surface water body, • a surface water sewer, highway drain, or another drainage system, or • to a combined sewer where there are absolutely no other options, and only where agreed in advance with the relevant sewage undertaker. The selection of a discharge point should be clearly demonstrated and evidenced." "Discharge to Ground The drainage strategy may be constrained if the drainage discharges to the ground via infiltration in a source protection zone (specifically SPZ 1), area of low permeability or area with high groundwater. Consultation with the Environment

Study	Key provisions and policies
	Agency early in the planning process is recommended to identify any constraints or specific requirements in these areas, specifically in relation to groundwater contamination. We recommend reference to the EA's latest policy guidance on groundwater protection." "SuDS 2: Deliver Effective Drainage Any proposed new drainage scheme must manage all sources of surface water and should be designed to match greenfield discharge rates, and volumes as far as possible. Development in previously developed land should also seek to reduce discharge rates and volumes off-site and utilise existing connections where feasible. Drainage schemes should provide for exceedance flows and surface flows from offsite, ensure emergency ingress and egress and protect any existing drainage connectivity, so that flood risk is not increased on-site or off site." "Suds Policy 3: Maintain Existing Drainage Flow Paths & Watercourses Drainage schemes should be designed to follow existing drainage flow paths and catchments and retain where possible existing watercourses and features" "SuDS Policy 4: Seek to Reduce and Avoid Existing Flood Risk New development should be designed to take full account of any existing flood risk, irrespective of the source of flooding. Where a site or its immediate surroundings have been identified to be at flood risk, all opportunities to reduce the identified risk should be investigated at the masterplanning stage of design and subsequently incorporated at the detailed design stage. Remedial works and surface water infrastructure improvements may be identified in the immediate vicinity of the development to facilitate surface water discharge from the proposed development site." "SuDS Policy 5: Drainage Sustainability and Resilience The design of the drainage system must account for the likely impacts of climate change and changes in impermeable area over the design life of the development. Appropriate allowances should be applied in each case. A sustainable drainage approach which considers control of surface runoff at the surface and at source is preferred and should be considered prior to other design solutions." "Climate Change In 2016, the Environment Agency published new guidance on how to use climate change allowances in flood risk assessments. The guidance can be found at: www.gov.uk/guidance/ flood-risk-assessments-climate-change-allowances KCC require that the drainage design accommodates the 1 in 100 year storm with a 20% allowance for climate change, with an additional analysis undertaken to understand the flooding implication for a greater climate change allowance of 40%." "Urban Creep To take account of possible future conversion of permeable surfaces to impermeable over time (e.g. surfacing of front gardens to provide additional parking spaces, extensions to existing

<table>
<tr><th>Study</th><th>Key provisions and policies</th></tr>
<tr><td></td><td>buildings, creation of large patio areas). Consideration of urban creep should be assessed for residential developments.
An allowance for the increase of impermeable area from urban creep must be included in the design of the drainage system. The allowances set out in Table 3 must be applied to the impermeable area within the property curtilage according to the proposed dwelling density.”
Table 3: impermeable area allowances for urban creep
<table><tr><th>Residential development density(Dwellings per hectare) (% of impermeable area)</th><th>Change allowance</th></tr><tr><td>≤ 25</td><td>10</td></tr><tr><td>30</td><td>8</td></tr><tr><td>35</td><td>6</td></tr><tr><td>45</td><td>4</td></tr><tr><td>≥ 50</td><td>2</td></tr><tr><td>Flats & Apartments</td><td>0</td></tr></table>
“SuDS Policy 7: Safeguard Water Quality
When designing a surface water management scheme, full consideration must be given to the system’s capacity to remove pollutants and to the cleanliness of the water being discharged from the site, irrespective of the receiving system.
Interception of small rainfall events should be incorporated into the design of the drainage system.”</td></tr>
<tr><td>Environment Agency
The Environment Agency’s approach to groundwater protection
February 2018
Version 1.2</td><td>This document contains position statements which provide information about the Environment Agency’s approach to managing and protecting groundwater. They detail how the Environment Agency delivers government policy for groundwater and adopts a risk-based approach where legislation allows. Many of the approaches set out in the position statements are not statutory but may be included in, or referenced by, statutory guidance and legislation.
Chapter G, Discharge of liquid effluents into the ground, applies to the sewage effluent, surface water run-off, industrial effluent and waste waters discharged to the ground. Relevant Position Statements include:
G9 - Use of deep infiltration systems for surface water or sewage effluent disposal
G10 - Developments posing an unacceptable risk of pollution
G11 - Discharges from areas subject to contamination
G12 - Discharge of clean roof water to ground
G13 - Sustainable drainage systems</td></tr>
</table>

Study	Key provisions and policies
	Position G13, relevant to the surface water drainage of the proposed development is described below: "The Government's expectation is that sustainable drainage systems (SuDS) will be provided in new developments wherever this is appropriate. The Environment Agency supports this expectation. Where infiltration SuDS are to be used for surface run-off from roads, car parking and public or amenity areas, they should: • be suitably designed • meet Governments non-statutory technical standards for sustainable drainage systems – these standards should be used in conjunction with the National Planning Policy Framework and Planning Practice Guidance • use a SuDS management treatment train – that is, use drainage components in series to achieve a robust surface water management system that does not pose an unacceptable risk of pollution to groundwater Where infiltration SuDS are proposed for anything other than clean roof drainage (see G12) in a SPZ1, a hydrogeological risk assessment should be undertaken, to ensure that the system does not pose an unacceptable risk to the source of supply. This position statement G13 needs to be read in conjunction with position statement G10. The design of infiltration SuDS schemes and of their treatment stages needs to be appropriate to the sensitivity of the location and subject to a relevant risk assessment, considering the types of pollutants likely to be discharged, design volumes and the dilution and attenuation properties of the aquifer. Unless the supporting risk assessments show that SuDS schemes in SPZ1 will not pose an unacceptable risk to the drinking water abstraction, the Environment Agency will object to the use of infiltration SuDS under position statement G10."

4.4 Sources of Information

Table 4.4: Sources of information

Consultee	Enquiry	Appendix
Kent County Council (LLFA)	Flood risk and drainage information was requested from the LLFA, they provided the following information: • Sustainable drainage systems should be designed to include a maximum climate change allowance of 40%; • No information on historic flooding is held for the site; • There is no information held for surface water discharges to the surrounding watercourses; • The LLFA are unaware of any groundwater flood risk issues on the site;	**Appendix F**

Consultee	Enquiry	Appendix
	• Geotechnical information should be provided if soakaways are to be utilised.	
Environment Agency (EA)	The EA responded to a pre-application data enquiry, the response included the following relevant information; • No record held of historic flooding of the site; • No known watercourses within 20m of the site; • The site is located within Flood Zone 1.	**Appendix G**
Southern Water	A pre-development enquiry was submitted to assess the available capacity of the foul and surface water in the local sewerage network. Sewer records are also included within the response.	**Appendix C**

5 SOURCES OF FLOOD RISK

5.1 Criteria

In accordance with the NPPF and advice from the Environment Agency, a prediction of the flood sources and levels is required along with the effects of climate change from the present for the design life of the development (in this case assumed to be 100 years). To consider the effects of climate change, Kent County Council has recommended that a climate change figure of 20% is used with and addition assessment of a up to a 40% increase in rainfall intensity over the lifetime of a More Vulnerable development in Flood Zone 1 (Higher Central category). The increase in river flows as a result of climate change is not required as part of this assessment as there are no watercourses which impact on the site.

The flood risk elements that need to be considered for any site are defined in BS 8533 as the "Forms of Flooding" and are listed as:

- Flooding from Rivers (fluvial flood risk);
- Flooding from the Sea (tidal flood risk);
- Flooding from the Land;
- Flooding from Groundwater;
- Flooding from Sewers (sewer and drain exceedance, pumping station failure etc), and;
- Flooding from Reservoirs, Canals and other Artificial Structures.

The following section reviews each of these in respect of the subject site.

5.2 Definitions of Risk

Table 5.1: Flood Map for Planning Risk Zoning

Flood Zone	Description
Flood Zone 1	Land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%)
Flood Zone 2	Flood Zone 2 - land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year
Flood Zone 3	Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Flood Zone 3b	Land having the potential to flood for storm events up to the 1 in 20 year return period (>5% annual probability of flooding occurring). It is classified as 'functional floodplain'

Table 5.2: Flood Risk from Rivers or the Sea and Flood Risk from Surface Water

Flood Zone	Description
High	High risk means that each year this area has a chance of flooding of greater than 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.
Medium	Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.
Low	Low risk means that each year this area has a chance of flooding of between 0.1% and 1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.
Very Low	Means that each year this area has a chance of flooding of less than 0.1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

Table 5.3: Flood Risk category matrix from Reservoirs, Groundwater, sewers and other artificial sources

Threat Probability	Low Impact	Medium Impact	High Impact
High	Medium	Medium	High
Medium	Low	Medium	Medium
Low	Low	Low	Low
Negligible	Very Low		

5.3 Flooding from rivers (fluvial flood risk)

5.3.1 Main River

The EA Flood Zone mapping study for England and Wales is available on their website at: https://flood-map-for-planning.service.gov.uk.

The latest Environment Agency published flood zone map (**Figure 5.1**), taking into account the presence of flood defences, shows the site to be located predominately in Flood Zone 1.

In December 2013, the EA released an additional form of mapping 'Risk of Flooding from Rivers and Sea', which is available at:

https://flood-warning-information.service.gov.uk/long-term-flood-risk

The latest 'Risk of Flooding from Rivers and Sea' flood map (**Figure 5.2**), which shows the Environment Agency's assessment of the likelihood of flooding from rivers and the sea at any location and is based on the presence and effect of all flood defences, predicted flood levels, and ground levels, indicates that the site is predominately designated as '**very low**' risk of flooding.

5.3.2 Ordinary Watercourse

The latest 'Risk of Flooding from Rivers and Sea' flood map (**Figure 5.2**) indicates that the site is considered to be at 'very low' risk of fluvial flooding. As the site is remote from the nearest watercourse, the risk of flooding from this source is considered to be **very low**.

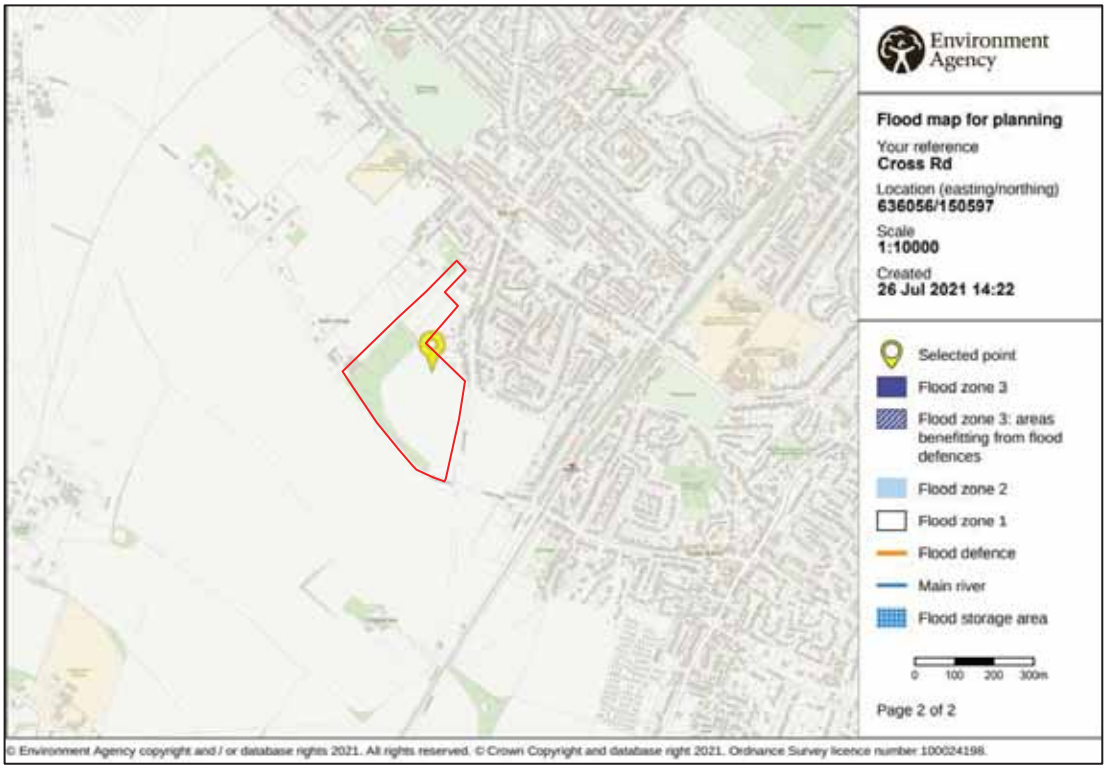

Figure 5.1: Environment Agency fluvial flood risk map

Figure 5.2: Environment Agency - Extent of flooding from Rivers and Sea (accessed 26.07.2021)

5.3.3 Climate change

Fluvial flooding is likely to increase as a result of climate change. A greater intensity and frequency of precipitation is likely to raise river levels and increase the likelihood of a river overtopping its banks. Climate change guidance for river modelling was updated by the EA in July 2021. No model re-runs have been undertaken as part of this site-specific FRA, and the supplied EA data therefore represents the best available and up-to-date data when considering the flood risk to the site. The impact upon the site should be negligible given its location within Flood Zone 1.

5.4 Flooding from the sea (tidal flood risk)

The site is not considered to be at risk from tidal flooding due to its elevated position above the coast line (approximately 18m above the approximate sea level).

5.5 Flooding from the land (overland pluvial flood risk)

If intense rain is unable to soak into the ground or be carried through manmade drainage systems, for a variety of reasons, it can run off over the surface causing localised floods before reaching a river or other watercourse.

Generally, where there is impermeable surfacing or where the ground infiltration capacity is exceeded, surface water runoff will occur. Excess surface water flows from the site are believed to drain naturally to the local water features, either by overland flow or through infiltration.

The Environment Agency's surface water flood map (**Figure 5.3**) shows the site is predominately considered at very low risk.

Figure 5.3: Environment Agency - Extent of Flooding from Surface Water (accessed 26.07.2021)

5.5.1 Climate change

Surface water flooding is likely to increase as a result of climate change in a similar ratio to fluvial flooding. Increased intensity and frequency of precipitation is likely to lead to reduced infiltration and increased overland flow. These increased flows have been incorporated into the indicative surface water drainage strategy.

5.6 Flooding from groundwater

Groundwater flooding tends to occur after much longer periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. Groundwater tends to flow from areas where the ground level is high, to areas where the ground level is low. In low-lying areas the water table is usually at shallower depths anyway, but during very wet periods, with all the additional groundwater flowing towards these areas, the water table can rise up to the surface causing groundwater flooding.

Environment Agency provided groundwater monitoring data from Ripple Nurseries located approximately 1.5km southwest of the proposed site, states that the highest recorded level that the Groundwater has reached was on 26th March 2014 at 13.26mAOD. This is the highest recorded level of Groundwater in the area and is 4.89m below the lowest point on the proposed site.

Ground investigation undertaken at the lowest area of the site shows that no Groundwater was struck within the trial pit which was excavated to a completion depth of 2.70mbgl (Trial Pit 1 within **Appendix E**).

In addition, during the operational phase, the absence of basement features within the proposals further minimises the potential hazards posed by groundwater flooding.

The resultant groundwater flood risk is considered to be **very low**. Site specific Groundwater depths may require confirmation prior to detailed design of drainage features.

5.6.1 Climate change

Climate change could increase the risk of groundwater flooding as a result of increased precipitation filtering into the groundwater body. If winter rainfall becomes more frequent and heavier, groundwater levels may increase. Higher winter recharge may however be balanced by lower recharge during the predicted hotter and drier summers. This is less likely to cause a significant change to flood risk than from other sources, since groundwater flow is not as confined. The change in flood risk is likely to be low.

5.7 Flooding from sewers

Flooding from artificial drainage systems occurs when flow entering a system, such as an urban storm water drainage system, exceeds its conveyance capacity, the system becomes blocked or it cannot discharge due to a high water level in the receiving watercourse. A sewer flood is often caused by surface water drains discharging into the combined sewer systems; sewer capacity is exceeded in large rainfall events causing the backing up of floodwaters within properties or discharging through manholes.

Most adopted surface water drainage networks are designed to the criteria set out in Sewers for Adoption[8]. One of the design parameters is that sewer systems be designed such that no flooding of any part of the site occurs in a 1 in 30 year rainfall event. By definition a 1 in 100 year event would exceed the capacity of the sewer network as well as any proposed drainage.

There is a public foul sewerage network within Cross Road with an oversized storage pipe located within the eastern boundary of the site. Surcharging of the sewer is unlikely to cause flooding to the proposed development due to the topography of the site. Overland exceedance flows are likely to flow southwards away from the proposed development.

In addition, the network is a foul system with only foul flows entering the network, this is considered to reduce the risk of surcharging as it would not be as affected by intense rainfall events.

As a result, the risk of flooding to the site from the existing sewer network is considered very low.

[8] WRC, ‘Sewers for Adoption’ 8th Edition, April 2020

5.7.1 Climate change

The impact of climate change is likely to be negative regarding flooding from sewers. Increased rainfall and more frequent flooding put existing sewer and drainage systems under additional pressure resulting in the potential for more frequent surcharging and potential flooding. This would increase the frequency of sewer flooding in general but is not significant in terms of the proposed development.

5.8 Other sources of flooding

5.8.1 Reservoirs

Flood events can occur from a sudden release of large volumes of water from reservoirs, canals and artificial structures.

The Environment Agency reservoir flood map (reproduced as **Figure 5.4**) shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. Since this is a prediction of a worst-case scenario, it is unlikely that any actual flood would be this large. According to the Environment Agency Reservoir flood maps the site is at risk of flooding from reservoirs. There has been no loss of life in the UK from reservoir flooding since 1925. Since then reservoir safety legislation has been introduced to ensure reservoirs are maintained.

The resultant flood risk is considered to be **very low**.

Reservoirs can be managed over time, controlling inflow/outflow of water and therefore there is the capacity to control the effects of climate change. Increased rainfall has the potential to increase base flow, but this should be minimal. It is unlikely that there will be a substantial change to the risk of flooding for this site.

Figure 7.4: Environment Agency reservoir flood risk map (accessed 26.07.2021)

5.8.2 Climate change

Reservoirs can be managed over time, controlling inflow/outflow of water and therefore there is the capacity to control the effects of climate change. Increased rainfall has the potential to increase base flow, but this should be minimal. It is unlikely that there will be a substantial change to the risk of flooding for this site.

5.8.3 Canals

There are no Canal & River Trust owned canals or assets within the study area.

5.8.4 Blockages of artificial drainage systems

There is a possibility that flooding may result due to culverts and/or sewers being blocked by debris or structural failure. This can cause water to backup and result in localised flooding, as well as placing areas with lower ground levels at risk.

As there are no drainage features such as those mentioned on-site, the risk of flooding from this source is considered to be **very low**.

Climate change is unlikely to affect the flooding risk to the site from such blockages.

5.9 Flood risk resulting from the development

In theory any development can increase flood risk downstream, if it is not designed properly. This potential is much increased where the site is on Greenfield land, as development tends to increase impermeable surfaces, resulting in increased runoff from the site.

The proposed development will use the latest best practice guidance to ensure that flood risk is not increased as a result of the development. This will require the provision of a suitable surface water management plan to ensure that the surface water generated from the site does not increase the risk off-site; this is investigated further in **Section 7** of this report.

6 PLANNING CONTEXT

6.1 Application of planning policy

Section 14 of the NPPF includes measures specifically dealing with development planning and flood risk using a sequential characterisation of risk based on planning zones and the Environment Agency Flood Map. The main study requirement is to identify the flood zones and vulnerability classification relevant to the proposed development, based on an assessment of current and future conditions.

6.2 Land use vulnerability

Planning Practice Guidance includes a list of appropriate land uses in each flood zone dependent on vulnerability to flooding. In applying the Sequential Test, reference is made to **Table 6.1** below, reproduced from **Table 3** of Planning Practice Guidance.

Table 6.1: Flood risk vulnerability and flood zone 'compatibility'

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	Appropriate	Appropriate	Appropriate	**Appropriate**	Appropriate
	Zone 2	Appropriate	Appropriate	Exception Test Required	Appropriate	Appropriate
	Zone 3a	Exception Test Required	Appropriate	Should not be permitted	Exception Test Required	Appropriate
	Zone 3b functional floodplain	Exception Test Required	Appropriate	Should not be permitted	Should not be permitted	Should not be permitted

With reference to Table 2 of the Planning Practice Guidance, the proposed development, based on its residential use, is classed as 'More Vulnerable'. This classification of development is appropriate for areas within Flood Zone 1 and therefore appropriate for the subject site.

6.3 Sequential Test

The Sequential Test is required to assess flood risk and the Planning Practice Guidance recommends that the test be applied at all stages of the planning process to direct new development to areas with the lowest probability of flooding (Flood Zone 1). Therefore the proposed development passes the Sequential Test and does not require the Exception Test to be satisfied.

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7 SURFACE WATER DRAINAGE ASSESSMENT

7.1 Scope

As development will be located in Flood Zone 1 but it is greater than 1ha in size, the development should focus on the management of surface water run-off. This section discusses the potential quantitative effects of the development on both the risk of surface water flooding on-site and elsewhere within the catchment, as well as the type of potential SuDS features that could be incorporated as part of the development framework plan.

The NPPF states that SuDS should be considered wherever practical. The use of SuDS is also encouraged by regional and local policy (see Section 4.3). In accordance with local and national guidance, the surface water drainage strategy should seek to implement a SuDS hierarchy that aspires to achieve reductions in surface water runoff rates to Greenfield rates (Preferred Standard).

In addition, Building Regulations Part H[9] requires that the first choice of surface water disposal should be to discharge to an adequate soakaway or infiltration system, where practicable. If this is not reasonably practicable then discharge should be to a watercourse, the least favourable option being to a sewer (surface water before combined). Infiltration techniques should therefore be applied wherever they are appropriate.

7.2 Pre-development situation

The existing site area is 8.71Ha and is considered as 100% Greenfield as the existing does not contain significant impermeable area.

The IoH 124 method[10] has been used to estimate the Greenfield surface water runoff for the developable area of the site, outlined in **Table 3.1** (4.17Ha). Calculations are contained in **Appendix H** and have been summarised within **Table 7.1**.

Table 7.1: IoH 124 surface water runoff (Greenfield) estimation

Return period	Peak flow (l/s)
QBar	1.9
1 in 1 year	1.6
1 in 30 year	4.2
1 in 100 year	6.0

[9] HM Government (2010 with 2013 amendments), 'The Building Regulations 2010: Approved Document H - Drainage and Waste Disposal (2002 Edition incorporating 2010 amendments)'

[10] Institute of Hydrology (IoH), 'Flood Estimation for small catchments - Report 124', 1994

7.3 Post-development situation

With the available information, a drainage strategy has been assessed against the surface water drainage hierarchy in line with development proposals to find the most suitable that surface water run-off solution which can be managed as close to its source as possible.

7.3.1 Off site discharge options

7.3.1.1 Infiltration

Infiltration should be considered as the primary option to discharge surface water from the developed site. The effectiveness of infiltration is completely dependent on the physical conditions at the site. Potential obstacles include:

- Local variations in permeability preventing infiltration – It is understood from on-site observation and infiltration testing that the local geology will receive surface water at a rate of 5.34 x 10^{-5} m/s at a depth of 1.8mbgl, and at a rate of 1.59 x 10^{-5} m/s at a depth of 1.2mbgl. (**Appendix D**). Infiltration testing has been undertaken within the area considered best placed for an infiltration basin and at a range of depths to assess suitability;
- Shallow groundwater table - For infiltration drainage devices, Building Regulation approved document H states that these *"should not be built in ground where the water table reaches the bottom of the device at any time of the year"*. During the site investigations, trial pits were excavated on-site to depths of up to 2.7m below ground level and no Groundwater was present in any of the excavations. As stated within the CIRIA guidance[11] there should be a 'minimum depth of 1m of unsaturated aquifer material between the base of any infiltration system and the maximum likely Groundwater level'. Therefore where SuDS meet this requirement then Groundwater depth should not limit the use of shallow infiltration based SuDS, and;
- Source Protection Zones - As discussed above, the site is located within a Groundwater Source Protection Zone 1 and Zone 2. This means that any water discharged into the bedrock aquifer at this location will require multiple levels of treatment prior to discharge. Treatment will be required for the development in order to not increase the risk of pollutants entering the aquifer below which is discussed within Section 7.3.4. In addition to this, guidance provided by the Environment Agency outlined with the Position Statements[12] not limited to but including G10 -G13 should be adhered to, outlined in Section 4.3.

From the information available regarding the study area's underlying Chalk bedrock geology and recorded infiltration rates, infiltration is considered a viable option as part of the drainage strategy, provided that treatment can be provided within the site boundary, prior to discharge.

[11] CIRIA SuDS Manual 2015

[12] Environment Agency (February 2018) Groundwater protection: Principles and practice. Version 1.2. Section G13 – Sustainable drainage systems

7.3.1.2 Discharge to watercourse

Discharging surface water directly to a local watercourse is not considered feasible as there are no known watercourses on, or within the vicinity of the study area.

7.3.1.3 Discharge to surface water sewer

Discharging surface water directly to a public surface water sewer is not deemed feasible at this location as the surface water sewer is located to the south of the site and discharges onto the adjacent field, south of the proposed site. In order to not increase flooding to others, this discharge option is not considered feasible. Southern Water have confirmed there is no capacity within this sewer to discharge to and the closest surface water sewer is located north of the site though would require surface water pumping to achieve a connection (**Appendix C**).

7.3.2 Storage estimates

Based on the current Development Framework Plan the proposed residential developable area for the site is 4.17Ha. An estimate of the required infiltration basin has been produced based on a 50% impermeability figure for the developable area, equal to an impermeable area of 2.085Ha.

An additional 10% impermeable area has been included to account for urban creep in line with the LLFA requirements equivalent to a total impermeable area of 2.294Ha.

For the purposes of storage sizing, no outfalls have been assumed with the only surface water discharge being to ground. Infiltration SuDS features are to be limited to the southern end of the site where the rate of infiltration achieved is 5.34 x 10^{-5}m/s at a depth of 1.8mbgl (equivalent to 0.19224m/hr), and a rate of 1.59 x 10^{-4}m/s at a depth of 1.2mbgl (equivalent to 0.05724m/hr). The rate achieved at 1.8mbgl is to be used on the base of the infiltration basin, the rate achieved at 1.2mbgl is to be used on the side slopes of the basin.

To determine the volume of attenuation storage that would be required on the site, the WinDes ' 4-Stage Design Guide' tool has been used. The WinDes '4-Stage Design Guide' tool allows for an attenuation figure to be calculated based upon basin dimensions, rainfall values and permitted infiltration rates with a 1:4 slope to the base in line with CIRIA guidance. These volumes can be later revised at detail design.

It has been calculated that an infiltration basin with a depth of 1.8m and a surface area of 1100m^2, providing a minimum volume of 1368m^3 would be sufficient to provide attenuation and drainage during a 1 in 100 year event inclusive of 40% climate change. These calculations above have been provided within **Appendix I**.

It is proposed that this infiltration basin could be incorporated within the public open space located to the south of the site.

These volumes are provided to demonstrate the feasibility of a proposed drainage strategy for the development; however, the final attenuation volume will be determined during subsequent detailed design work and should be agreed by the Lead Local Flood Authority.

7.3.3 Proposed drainage strategy

Based on the current development framework plan, and falls across the site, conveyance of surface water will be to the lowest point on site. The indicative surface water drainage strategy has been designed to incorporate a SuDS treatment train which is outlined in greater detail in Section 7.3.4. The indicative surface water drainage strategy drawing is shown in **Appendix J**. In principle, the strategy contains the following features and criteria:

- A preliminary site investigation in 2017 found that infiltration rates were more suitable for surface water drainage at the south of the site. Further testing at targeted depths and locations of the proposed basin provided the appropriate infiltration rates for drainage calculations;
- Runoff from impermeable areas such as highways, driveways and rooftops will be conveyed to below ground drainage. Catchpit manholes and trapped gullies could be incorporated into all traditional drainage runs in order to remove suspended sediment where possible;
- Surface water runoff will be conveyed to conveyance swales as the first component of the SuDS treatment train. Swales are shown where possible within public open space and around the perimeter of the developable area. At detailed design swales may be incorporated alongside highways within the developable area to increase the maximum length of conveyance swales. The design of the swales should be assessed at detailed design to determine if the underlying soil is sufficient to avoid unwanted infiltration to the chalk bedrock, or whether swales would be required to be underlined with an impermeable membrane to prevent unwanted infiltration. Swales may also be planted with vegetation to increase the potential for pollution mitigation;
- Surface water flows from conveyance swales enter below ground pipes to avoid the area of LEAP shown on the development framework plan, this design may be changed at detailed design to increase the maximum length of the swales;
- Where surface water runoff cannot achieve flow through a swale due to the constraints of the layout, then a hydrocarbon interceptor is proposed to provide treatment of the surface water runoff, the interceptor is shown on the strategy drawing;
- Surface water runoff is discharged to a pond with an approximate minimum surface area of 200m^2. The pond forms a second stage component of the SuDS treatment train. The pond is defined by having a permanent water level, this can be achieved by lining the area of the pond with an impermeable membrane to prevent unwanted infiltration. The pond can provide amenity, biodiversity and water quality benefits;
- The surface water will be attenuated within the pond, once the pond has reached its maximum capacity then surface water will spill over into the infiltration basin via an outlet to be designed at detailed design to minimise disturbance to settled sediment and reduce erosion;
- The infiltration basin should be designed in line with best guidance to provide the best maximum possible pollution mitigation, this includes using a base layer of soil with a minimum of 300mm and good contamination potential;
- The infiltration basin is located within Groundwater Source Protection Zone 2, bordering Zone 1;
- Though not shown within the indicative drainage strategy, permeable paving could be incorporated within all minor roads, parking areas and driveways. This can provide additional attenuation and pollution mitigation as part of the SuDS treatment train. Main roads would not be constructed using permeable paving

due to ownership and future maintenance issues, where responsibility will most likely lie with the highway authority;

- If deemed necessary, then additional pollution mitigation can be provided by the inclusion of proprietary systems, such as an oil separator. This has not been included in the indicative surface water drainage strategy;
- The indicative surface water drainage strategy (**Appendix J**) is shown to provide sufficient attenuation for the 1 in 100 year storm event plus 40% climate change, with the inclusion of 10% urban creep, as identified in Section 7.3.2.
- The SuDS treatment train shown in the indicative surface water drainage strategy should adequately mitigate medium level pollution as identified in Section 7.3.4;
- It is assumed for this report that the hydrocarbon interceptor will provide pollution mitigation indices equivalent to those of a swale, however this will need to considered further at detailed design;

The dimensions, volumes and location of the SuDS features will need to be revised as the development framework plan develops and during the detailed planning stage. Detailed design of individual features is not part of the scope of this report. Preliminary design criteria have been based upon guidance given in CIRIA: The SuDS Manual[13].

7.3.4 Water Quality

As the site is largely located within an area of Groundwater Source Protection Zone 1 with a small area of Zone 2 along the southern boundary of the site, it is required that surface water resulting from the development is treated prior to discharge into the infiltration basin.

The proposed indicative outline surface water drainage strategy (**Appendix J**) identifies the feasibility of including a number of components into a SuDS treatment train. The main components included in the strategy are swales, a pond and an infiltration basin. Permeable paving and proprietary treatment systems including trapped gullies and catchpit manholes and oil separators haven't been included in this report.

In accordance with Table 4.3 of the SuDS Manual, the proposed development for the site can be summarised with the following pollution hazard levels and management requirements for discharge to the receiving Groundwater:

- Residential roofs – **Very Low** Pollution Hazard;
- Individual property driveways, roofs, residential car parks, low traffic roads, non-residential car parking with infrequent change (schools, offices) – **Low** Pollution Hazard
- All roads except low traffic roads – **Medium** Pollution Hazard

It is therefore considered appropriate to use the Simple Index Approach for the purpose of this assessment.

Table 26.1 of the SuDS Manual indicates that for the Simple Index Approach:

- Simple pollution hazard indices should be based on land use (e.g., Table 26.2), and;

[13] CIRIA, 'The SUDS Manual – C753', 2015

- Risk reduction for Surface Water should be done using hazard mitigation indices (e.g., Table 26.3).
- Risk reduction for Groundwater should be done using hazard mitigation indices (e.g., Table 26.4).

Extracts of Tables 26.2 and 26.4 are replicated as Table 7.2, 7.3 and 7.4, highlighting the relevant features applicable to the indicative surface water drainage strategy shown in **Appendix I**.

Table 7.2: Extract of SuDS Manual Table 26.2: Pollution hazard indices for different land use classifications

Land use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential roofs	**Very Low**	0.2	0.2	0.05
Individual property driveways, roofs, residential car parks, low traffic roads, non-residential car parking with infrequent change (schools, offices)	**Low**	0.5	0.4	0.4
All roads except low traffic roads	**Medium**	0.7	0.6	0.7

Table 7.3: Extract of Table 26.3: Indicative SuDS mitigation indices for discharges to Surface Water

Land use	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Swale	0.5	0.6	0.6
Pond	0.7	0.7	0.5

Table 7.4: Extract of Table 26.4: Indicative SuDS mitigation indices for discharges to Groundwater

Land use	Total Suspended Solids (TSS)	Metals	Hydrocarbons
A soil with good attenuation potential of at least 300mm	0.4	0.3	0.3

The SuDS Manual States to deliver adequate treatment the selected SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type):

Total SuDS mitigation index ≥ pollution hazard index

(for each contaminant type) (for each contaminant type)

Where the mitigation of an individual component is insufficient, two components or more in series will be required where:

Total SuDS mitigation index = mitigation index$_1$, + 0.5 (mitigation index$_2$)

Where:

Mitigation index$_n$ = mitigation index for component n

A factor of 0.5 is used to account for the reduction performance of secondary or tertiary components associated with already reduced inflow concentrations.

Where the infiltration component does not provide sufficient pollution mitigation, the design should include upstream SuDS components that are lined to prevent infiltration from occurring. The mitigation indices set out in CIRIA Table 26.3 should be used for upstream treatment.

A summary of the pollution scoring is included in Table 7.5, below. The table indicates that the SuDS components used for the indicative surface water drainage strategy provide adequate pollution mitigation, with the mitigation score exceeding the pollution hazard level. As the basin is located within Groundwater Source Protection Zone 2 then additional pollution mitigation may be required at detailed design, this could be provided as permeable paving or other features.

Table 7.5: Indicative surface water Simple Index Approach summary table

Characteristic	Indices,n	TSS	Metals	Hydro-carbons
Medium Risk	Hazard Level	0.7	0.6	0.7
Swale	Mitigation,1	0.5	0.6	0.6
Pond	Mitigation,2	0.7	0.7	0.5
Infiltration basin*	Mitigation,3	0.4	0.3	0.3
	Total mitigation	1.05	1.1	1.0
Outcome		Mitigated	Mitigated	Mitigated
Notes: * Underlain by a soil with good contaminant attenuation potential of at least 300mm in depth				

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8 FLOOD MITIGATION MEASURES

8.1 Overview

The site is currently proposed to be a residential end use development. As a result, is considered to be More Vulnerable. However, as the site is at low risk from all sources of flooding, it is not proposed that additional mitigation measures should be incorporated into the design. There are elements of best practice which should be considered at an early stage as outlined below.

8.2 Overland flood flow

Conveyance measures and flow controls should be provided in order to transport the surface water resulting from the proposed development into the infiltration basins located at the topographic low to the south of the site. Surface flows may be generated due to drainage capacity exceedance, which can also be conveyed into the SuDS features via surface flows along the new roads.

8.3 Finished floor levels

As this site will not be affected by fluvial flooding there is no need to incorporate any freeboard levels into the finished floor levels of the design. Low lying areas that could lead to ponding of surface flows will be avoided by careful design of finished levels.

As a result it is recommended that the proposed site levels should be set at or above the existing ground levels.

8.4 Safe access/egress

As the site lies outside of the 1 in 1000 year climate change flood extent, safe access and egress will be available up to this storm event.

8.5 Surface water treatment

The site is located within a Groundwater Source Protection Zone 1 and 2 and therefore sufficient treatment must be provided in order to allow the safe and unpolluted disposal of surface water into the ground via infiltration based drainage design. This has been assessed within Section 7.3.4 and as a result, multiple levels of treatment have been provided within the proposed drainage strategy, to minimise the pollutants discharging to ground.

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9 CONCLUSIONS AND RECOMMENDATIONS

This FRA complies with the NPPF and Planning Practice Guidance and demonstrates that flood risk from all sources has been considered in the proposed development. It is also consistent with the Local Planning Authority requirements with regard to flood risk.

The whole development lies in an area designated by the EA as Flood Zone 1, outlined to have a chance of flooding of less than 1 in 1,000 (<0.1%) in any year.

NPPF sets out a Sequential Test, which states that preference should be given to development located within Flood Zone 1. This flood risk assessment demonstrates that the requirements of the Sequential Test have been met, with the developable area of the site located within Flood Zone 1 and 'More Vulnerable' classification of the development.

This flood risk assessment has considered multiple sources of flooding and concluded the following:

Table 9.1: Flood risk summary

Source	Level of risk	Mitigation
Fluvial	Very Low	Developable area and SuDS are shown to be wholly within Flood Zone 1.
Tidal	Very Low	The site is inland and elevated.
Surface water	Very Low	There is some minor surface flooding on site though not considered a risk.
Groundwater	Very Low	Though Groundwater levels are unknown, trial pit information did not indicate a risk from Groundwater. It is recommended this is investigated further.
Sewers	Very Low	Sewer records indicated there is a foul sewer east of the site. The sewer is not considered a flood risk to the site.
Reservoir	Very Low	The site is not within an area of reservoir flooding.
Canal	Very Low	The site is not within an area of canal flooding.
Artificial sources	Very Low	The site is not within an area of flooding from this source.

Surface water drainage assessment within this report has concluded that:

- The proposed development will increase the impermeable surfacing on-site which will result in an increase of surface water runoff, therefore a sustainable drainage strategy is required;

- Infiltration based SuDS are considered feasible based upon the tested infiltration rate within the southern area of the site;
- As the site is within Groundwater Source Protection Zone 1 and 2 then emphasis should be placed on mitigation of pollution hazards associated with the surface water runoff from urban environments;
- The indicative surface water drainage strategy has shown that multiple components of a SuDS treatment train can be provided to adequately mitigate against pollution hazard associated with infiltration of surface water runoff. These components include swales, a pond and an infiltration basin with appropriate underlining soil;
- The basin has been calculated to provide sufficient attenuation for 1 in 100 year event inclusive of 40% climate change factor from the impermeable area inclusive of 10% urban creep.

Overall, taking into account the above points, the development of the site should not be precluded on flood risk grounds.

APPENDIX A
SERVICE CONSTRAINTS

RSK Group service constraints

1. This report and the Drainage design carried out in connection with the report (together the "Services") were compiled and carried out by RSK LDE Ltd (RSK) for Gladman Developments Limited (the "client") in accordance with the terms of a contract between RSK and the "client". The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable Civil Engineer at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.

2. Other than that expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.

3. Unless otherwise agreed the Services were performed by RSK exclusively for the purposes of the client. RSK is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.

4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date hereof, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.

5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.

6. The observations and conclusions described in this report are based solely upon the Services, which were provided pursuant to the agreement between the client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the

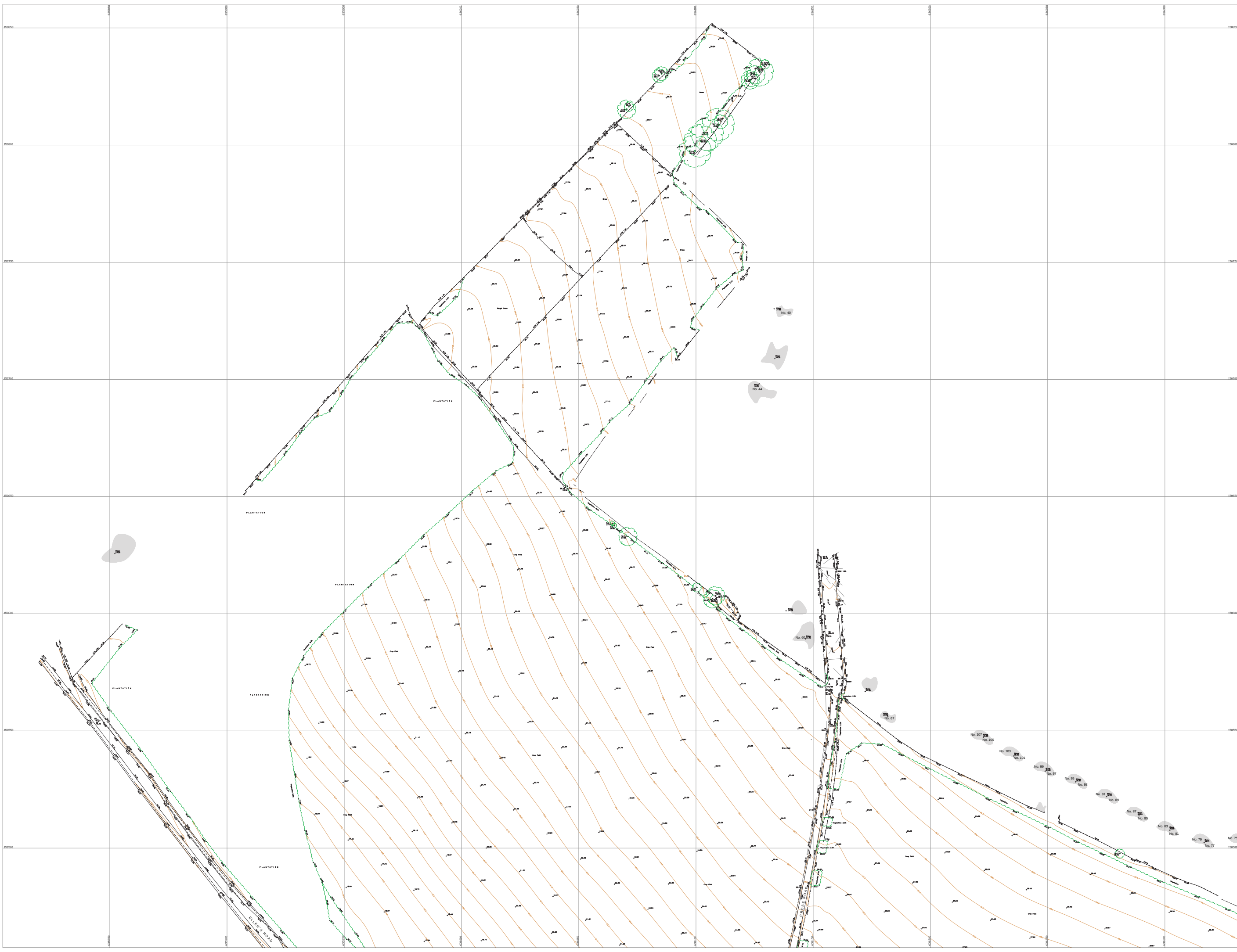
Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials.

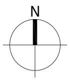
7. The Services are based upon RSK's observations of existing physical conditions at the site gained from a walk-over survey of the site together with RSK's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The Services are also based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely. The Services clearly are limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the walk-over survey. Further RSK was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the client and RSK.

8. The phase II or intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined borehole and soil vapour locations based on the operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and RSK] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.

9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (boreholes, trial pits etc) annotated on site plans are not drawn to scale but are centred over the appropriate location. Such features should not be used for setting out and should be considered indicative only.

APPENDIX B
TOPOGRAPHIC SURVEY





NOTES

THIS SURVEY IS ORIENTATED TO ORDNANCE SURVEY GRID NORTH. THE SURVEY IS TO A PLANE GRID. HORIZONTAL MEASUREMENTS TAKEN FROM THIS SURVEY WILL BE GROUND DISTANCES.

ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM GENERATED BY ACTIVE GPS NETWORK.

LEGEND

- 30.29 SPOT LEVEL
- SURVEY STATION
- SAPLING
- BUSHES/SHRUB
- TREE (INDICATIVE ONLY)
- HEDGE/AREA OF UNDERGROWTH
- CONTOUR
- GATE
- OVERHEAD CABLE
- FENCE

ABBREVIATIONS

ArL	ARCH LEVEL	LB	LETTER BOX
AV	AIR VALVE	LP	LAMPOST
B	BOLLARD	MH	MANHOLE
BB	BELISHA BEACON	MKR	MARKER
BH	BOREHOLE	OHC	OVERHEAD CABLE
BL	BED LEVEL	OpL	OPENING LEVEL
BS	BUS STOP	OSBM	OS BENCHMARK
BT	BT COVER	P	POST
C/B	CLOSED BOARD FENCE	P/R	POST AND RAIL FENCE
C/L	CHAIN LINK FENCE	P/W	POST AND WIRE FENCE
CATV	CABLE TELEVISION COVER	PEC	PEDESTRIAN CROSSING
CC	CONTROL CABIN	PM	PARKING METER
COL	COLUMN	RE	RODDING EYE
Conc/p	CONCRETE PANEL FENCE	RWL	RETAINING WALL
CPY	CANOPY	SAP	SAPLING
CrL	CROWN LEVEL	SEC	SECURITY CAMERA
Csty	CABLE STAY	SGY	STRIP GULLY
CTV	CABLE TELEVISION POINT	SoL	SOFFIT LEVEL
CYR	CYCLE RACK	SP	SIGNPOST
DK	DROPPED KERB	SpL	SPRINGING LEVEL
DP	DOWNPIPE	SV	STOP VALVE
EIP	ELECTRIC INLET POINT	T/Pit	TRIAL PIT
EL	ELECTRIC INSPECTION COVER	TCB	TELEPHONE BOX
EP	ELECTRICITY SUPPLY POLE	TE/?	TREE + NUMBER
ER	EARTH ROD	THL	THRESHOLD LEVEL
FH	FIRE HYDRANT	TL	TRAFFIC LIGHT
G	GULLY	ToF	TOP OF FENCE
G/DP	GULLY AND DOWNPIPE	ToW	TOP OF WALL
GP	GATE POST	TP	TELEPHONE POLE
Gpi	GAS PIPE	W/M	WIRE MESH FENCE
GV	GAS VALVE	W/P	WOODEN PANEL FENCE
IC	INSPECTION CHAMBER	WLV	WATER LEVEL
IL	INVERT LEVEL	WM	WATER METER
I/R	IRON RAILING FENCE	WO	WASH OUT
KO	KERB OUTLET	Tact	TACTILE PAVING

STATION CO-ORDINATES

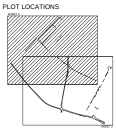
STATION	EASTING	NORTHING	LEVEL	DESCRIPTION
STN/54	636194.67	150285.84	19.01	Survey Nail
STN/57	636300.74	150265.83	20.97	Survey Nail
STN/58	636331.20	150316.37	23.97	Survey Nail
STN/62	636405.32	150557.20	31.53	Survey Nail
STN/63	636156.86	150570.03	28.64	Survey Nail

TREE SCHEDULE

No.	DIAM.	SPREAD Ø	HEIGHT
TE/1	0.20	5	5
TE/2	0.30	7	13
TE/3	0.60	10	10
TE/4	0.60	14	14
TE/5	0.20	4	6
TE/6	0.40	3	4
TE/7	0.50	7	7
TE/8	0.60	8	8
TE/9	0.40	4	4
TE/10	0.60	6	6
TE/11	0.40	6	6
TE/12	0.70	14	14
TE/13	0.70	14	14
TE/14	0.70	14	14
TE/15	0.70	14	9
TE/16	0.20	6	9
TE/17	0.20	6	6
TE/18	0.60	8	8
TE/19	0.60	8	8
TE/20	0.60	12	10
TE/21	0.15	4	4
TE/22	0.30	8	8
TE/23	0.40	4	4
TE/24	0.40	8	8
TE/25	0.40	8	8
TE/26	0.20	4	4
TE/27	0.40	4	4

TREE DIAMETER MEASURED APPROXIMATELY 1.5M ABOVE GROUND LEVEL. TREE SPREADS ARE SYMBOLIC ONLY AND ARE REPRESENTATIVE OF THE GENERALISED CANOPY SIZE. TREE BOLE MAY NOT SIT CENTRALLY TO THE CANOPY. TREE HEIGHT ESTIMATED FROM GROUND LEVEL.

PLOT LOCATIONS



Rev	Date	Revision notes	By
*	*	*	*

DO NOT SCALE

Status: INFORMATION

Project: Cross Road, Deal

Title: TOPOGRAPHICAL SURVEY AS OF 12.01.17 SHEET 1 OF 2

Drawn By	Publish Date	Scale(s)	Sheet Size
JH/JW	23.01.17	1:500	A0

Project no.	Drawing no.	Revision
2016-127	Topo_01_2D	0

N

NOTES

THIS SURVEY IS ORIENTATED TO ORDNANCE SURVEY GRID NORTH. THE SURVEY IS TO A PLANE GRID. HORIZONTAL MEASUREMENTS TAKEN FROM THIS SURVEY WILL BE GROUND DISTANCES.

ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM GENERATED BY ACTIVE GPS NETWORK.

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- SURVEY STATION
- SAPLING
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Csty	CABLE STAY	SGY	STRIP GULLY
CTV	CABLE TELEVISION POINT	SoL	SOFFIT LEVEL
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DK	DROPPED KERB	SpL	SPRINGING LEVEL
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TE/13	0.70	14	14
TE/14	0.70	14	14
TE/15	0.70	14	9
TE/16	0.20	6	9
TE/17	0.20	6	6
TE/18	0.60	8	8
TE/19	0.60	8	8
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TE/21	0.15	4	4
TE/22	0.30	8	8
TE/23	0.40	4	4
TE/24	0.40	8	8
TE/25	0.40	8	8
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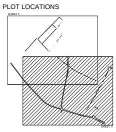


Rev	Date	Revision notes	By
*	*	*	*

DO NOT SCALE

Status

INFORMATION

Project

Cross Road,
Deal

Title

TOPOGRAPHICAL SURVEY
AS OF 12.01.17
SHEET 2 OF 2

Drawn By	Publish Date	Scale(s)	Sheet Size
JH/JW	23.01.17	1:500	A0

Project no.	Drawing no.	Revision
2016-127	Topo_02_2D	0

APPENDIX C
SOUTHERN WATER CORRESPONDENCE AND SEWER RECORDS

Ryan Whitfield

From: Developer Services <Developer.Services@southernwater.co.uk>
Sent: 14 July 2021 16:08
To: Ryan Whitfield
Subject: SWS-KENT-CC-005632 - DS_CC_PPE-155551 - Land West of Cross Road, Walmer, Deal, Kent, CT14 9LA
Attachments: Response Letter.pdf; Response GIS - Site.pdf; Growth Build Info Request Letter BAU.docx

Dear Mr Whitfield,

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

Yours sincerely,

Growth Planning Team
Business Channels

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

T. 0330 303 0119
southernwater.co.uk

Ryan Whitfield
RSK LDE
14 Beecham Court
Wigan
Lancashire
Greater Manchester
WN3 6PR

Your ref

Our ref
DS_CC_PPE-155551

Date
14 July 2021

Contact
Tel 0330 303 0119

Dear Mr Whitfield,

Level 1 Capacity Check Enquiry: Land West of Cross Road, Walmer, Deal, Kent, CT14 9LA.

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

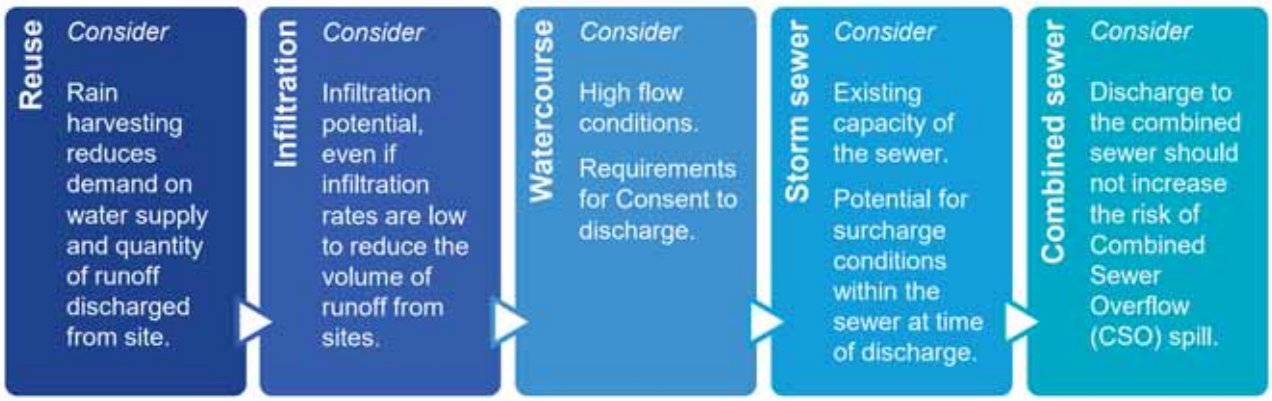
Foul Water

There is currently adequate capacity in the local sewerage network to accommodate a foul flow of **1.26 l/s** for the above development at manhole reference TR3650**1307**. Please note that no surface water flows (existing or proposed) can be accommodated within the existing foul sewerage system unless agreed by the Lead Local Flood Authority in consultation with Southern Water, after the hierarchy Part H3 of Building Regulations has been complied with.

Surface Water

There is currently inadequate capacity within the local surface water network to accommodate a flow of **1.6 l/s** at manhole reference TR3650**1350**.

In situations where surface water is being considered for discharge to our network, we require the below hierarchy for surface water to be followed which is reflected in part H3 of the Building Regulations. Whilst reuse does not strictly form part of this hierarchy, Southern Water would encourage the consideration of reuse for new developments.



Guidance on Building Regulations is here: gov.uk/government/publications/drainage-and-waste-disposal-approved-document-h

We would like to engage with you on the design for disposal of surface water, with a particular focus on the potential for incorporating Sustainable Drainage Systems (SuDS), for this development at the earliest opportunity and we recommend that civil engineers and landscape architects work together and with Southern Water. In many cases this may negate or reduce the need for network reinforcement and allow earlier completion of the development.

Where a surface water connection to the foul or combined sewer is being considered, this should be agreed by the Lead Local Flood Authority, in consultation with Southern Water.

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 manhole reference **TR36502951** which is located approximately **350m** North of the proposed development site.

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: Developer Services Portal (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.

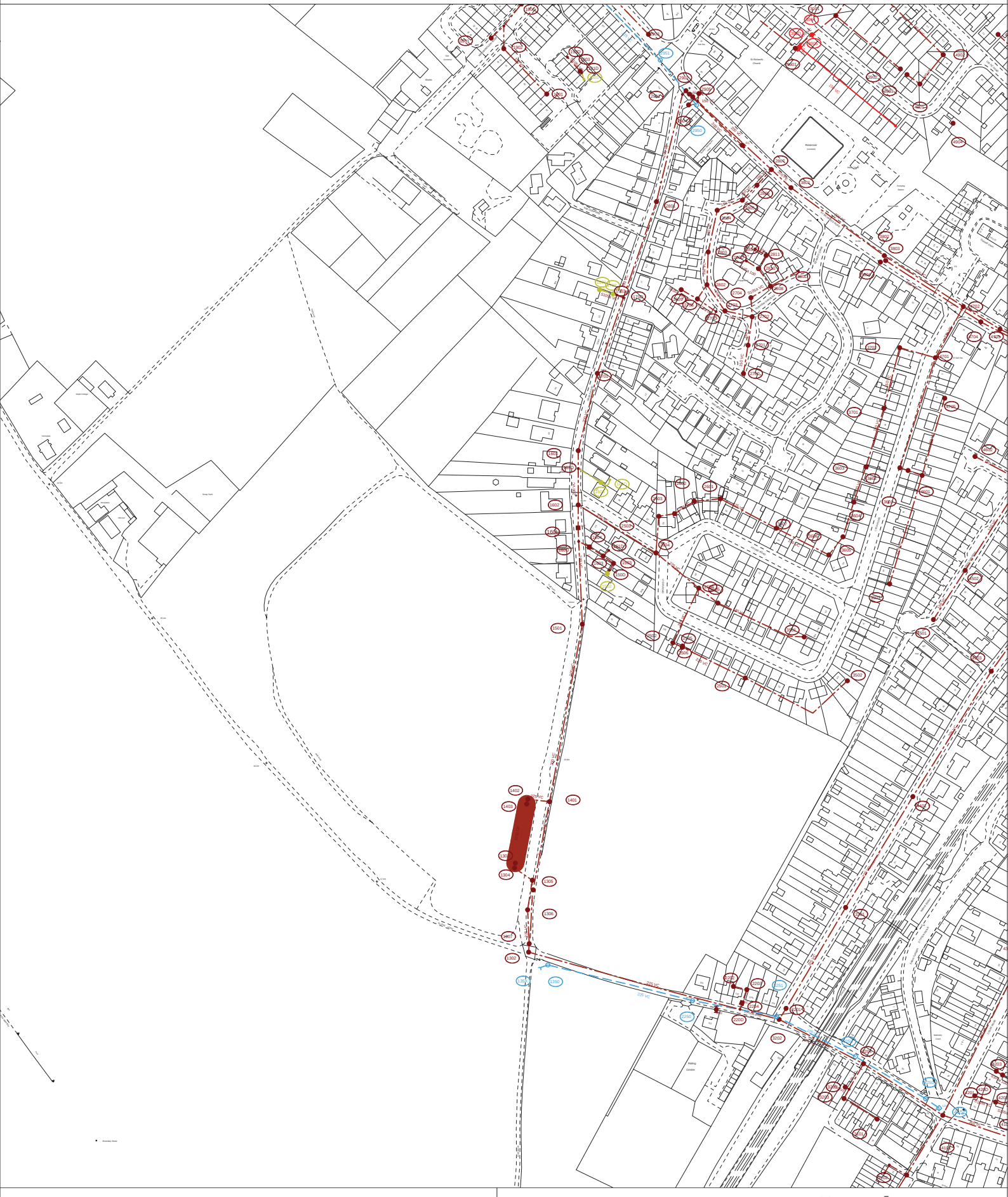
Should it be necessary to contact us please quote our above reference number relating to this application by email at southernwaterplanning@southernwater.co.uk

Yours sincerely,

Growth Planning Team
Business Channels

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

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.

Southern Water

O.S. REF: TR3650NW

Scale: 1:2500

N

Printed By: Mercy

Date: 21-6-2021

Sewer Plot

Site Plan

WARNING: BAC pipes are constructed of Bonded Asbestos Cement

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

Requested By:

APPENDIX D
SITE INVESTIGATION LOGS AND INFILTRATION TESTING RESULTS (2021)

Anerley Court
Half Moon Lane
Hildenborough
Tonbridge
Kent
TN11 9HU
UK

Telephone: +44 (0)1732 833111
Fax: +44 (0)1732 838549
www.rsk.co.uk

Ref: 52285-L01 (00)

30th September 2021

Steve Barker
Gladman Developments Ltd
Gladman House
Alexandria Way
Congleton
Cheshire
CW12 1LB

Dear Steve,

RE: LAND WEST OF CROSS ROAD, DEAL: INFILTRATION TESTING

1. INTRODUCTION

RSK have been commissioned by Gladman Developments to undertake investigation works at the land west of Cross Road, Deal, to investigate the infiltration characteristics of the shallow soils at 3No. specified locations on site.

The works have been conducted as set out in RSK's email proposal, dated 19th April 2021.

This letter report is subject to the RSK service constraints given in **Appendix A.**

2. BACKGROUND

The site is situated to the south west of Deal and can be located at a National Grid Reference 63656 E, 150375 N as shown in **Figure 1**. The site boundary and current site layout are shown in **Figure 2**.

The site covers an area of c. 8.2 hectares, divided approximately into two parcels; the larger of the parcels located on the central portion of the site is currently occupied by agricultural (arable) land. The smaller parcel is located on the northern portion of the site and is currently fallow land.

It is understood that the site will be developed for residential end-use. Plans for the development have not yet been provided to RSK.

RSK completed a Preliminary Risk Assessment desk-based study in April 2017. The findings from the PRA are contained within RSK report reference 28926-R01 (01), dated April 2017.

Published records (BGS GeoIndex, 2021) for the area and available historical borehole logs indicate the site is directly underlain by the natural bedrock geology of the Seaford Chalk Formation. This formation predominately constitutes firm white chalk with conspicuous semi-continuous nodular and tabular flint seams. There is no indication from historical mapping that significant made ground will be present on site.

3. SITE INVESTIGATION

RSK attended site on 22nd and 23rd September 2021 to conduct soakaway testing at three soakaway test locations specified by RSK and agreed with the client. The location references are TP1, TP2 and TP3, as presented on **Figure 2**.

3.1 Ground conditions

The exploratory holes were logged by an engineer in general accordance with the recommendations of BS 5930:2015. Detailed exploratory hole records are presented within **Appendix B** and a photographic log in **Appendix C**. The strata encountered during fieldworks are summarised within **Table 1** below.

Table 1: Summary of strata encountered during site investigation.

Stratum	Exploratory holes encountered	Depth to top of stratum m below ground level (bgl)	Proven thickness (m)
Topsoil	All	Ground Level	0.60 to 0.80
Seaford Chalk Formation	All	0.60 to 0.80	Full depth not proven

3.2 Soil descriptions

Topsoil was encountered at all locations. It was generally described as soft dark brown silty sandy gravelly clay with occasional rootlets. Underlying the topsoil, the initially weathered Seaford Chalk Formation was encountered at all three locations. It was generally described as unstructured light brown chalk with fine to cobble sized angular to rounded flints.

3.3 Groundwater

No groundwater was encountered during the investigation.

3.4 Infiltration testing

Infiltration tests were carried out in all three trial pit locations to establish the infiltration rate of the Seaford Chalk Formation. The trial pit tests were carried out generally in accordance with the method described in BRE Digest 365 (BRE, 2016).

The results of the infiltration testing are summarised in **Table 2**.

Table 2: Summary of infiltration testing

Location	Depth (m bgl)	Test number	Infiltration rate (m/s)
TP1	1.80	1	$1.24x10^{-4}$
TP1	1.80	2	$8.49x10^{-5}$
TP1	1.80	3	$5.34x10^{-5}$
TP2	1.50	1	$1.40x10^{-5}$
TP2	1.50	2	$1.34x10^{-5}$

Location	Depth (m bgl)	Test number	Infiltration rate (m/s)
TP3	1.20	1	$2.49x10^{-5}$
TP3	1.20	2	$1.59x10^{-5}$

Copies of the testing records are presented within **Appendix D**.

Note that three (3no.) repeat infiltration tests were not permissible within exploratory positions TP2 and TP3, owing to the comparatively low infiltration rates and the permissible time allocated for this round of exploratory works.

We hope that the information provided within this letter is sufficient for your current requirements, however, if you have any questions, then please contact the undersigned.

Yours faithfully

For RSK Environment Ltd

Author:

Josh Curnow
Graduate Geo-environmental Consultant

Reviewed by:

Chris Ball
Principal Geo-environmental Consultant

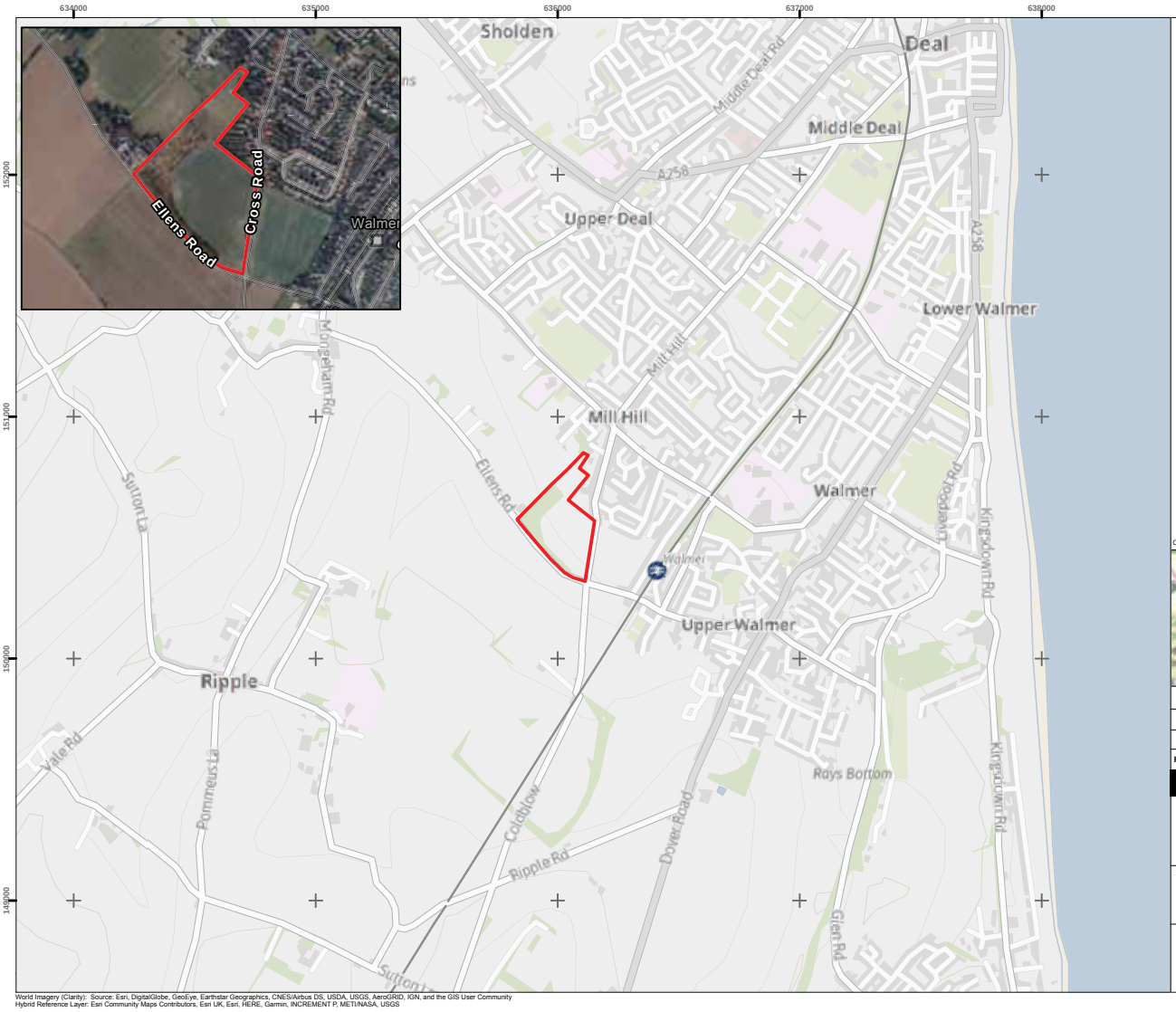
Enclosed:
Figures

Figure 1 Site Location Plan
Figure 2 Exploratory Location Plan

Appendices

Appendix A Service constraints
Appendix B Exploratory logs
Appendix C Photographic log
Appendix D Infiltration test data

52285-L01(00) - FIGURES



Legend:

Site Boundary

Coordinate System:

Rev	Date	Description	Drn	Chk	App
00	29/09/2021	First Draft	DR	JC	JC

Gladman Developments Ltd
Land West of Cross Road, Deal

RSK GEOSCIENCES

TITLE:

Figure 1:
Site Location Plan

0 200 400
Metres

SCALE: 1:20,000 @ A4

N
W E
S

REV 00

World Imagery (Clarity): Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Hybrid Reference Layer: Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS

Document Path: P:\Geosciences\52200 - 52300\52285 - Deal, Kent\01 - GIS\11 - ArcPro\Figure 1 - Site Location Plan - A4.aprx

Legend:

Site Boundary

D Trial Pit Locations

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description	Drn	Chk	App
00	29/09/2021	First Draft	DR	JC	JC

Gladman Developments Ltd
Land West of Cross Road, Deal

RSK GEOSCIENCES

TITLE:
Figure 2:
Exploratory Hole Location Plan

0 50 100
Metres
SCALE: 1:4,000 @ A4

REV 00

Document Path: P:\Geosciences\52200 - 52300\52285 - Deal, Kent\01 - GIS\Figure 2 - Exploratory Hole Location Plan - A4.mxd

52285-L01(00) APPENDIX A
SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for Gladman Developments Ltd (the "Client") in accordance with the terms of a contract [RSK Environment Standard Terms and Conditions] between RSK and the Client. The Services were performed by RSK with the reasonable skill and care ordinarily exercised by an environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the Client.
2. Other than that, expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.
3. Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the Client. RSK is not aware of any interest of or reliance by any party other than the Client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. **Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.**
4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.
5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the Client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.
6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the Client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, invasive plants, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials, unless specifically identified in the Services.
7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a visual inspection of the site together with RSK's interpretation of information, including documentation, obtained from third parties and from the Client on the history and usage of the site, unless specifically identified in the Services or accreditation system (such as UKAS ISO 17020:2012 clause 7.1.6):
    a. The Services were based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely.

b. The Services were limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the visual inspection.

c. The Services did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services.

RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the Client and RSK.

8. The intrusive environmental site investigation aspects of the Services are a limited sampling of the site at pre-determined locations based on the known historic / operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the properties of the materials adjacent and local conditions, together with the position of any current structures and underground utilities and facilities, and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters (as stipulated in the scope between the client and RSK, based on an understanding of the available operational and historical information) and it should not be inferred that other chemical species are not present.

9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.

10. The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows, may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.

11. Asbestos is often observed to be present in soils in discrete areas. Whilst asbestos-containing materials may have been locally encountered during the fieldworks or supporting laboratory analysis, the history of brownfield and demolition sites indicates that asbestos fibres may be present more widely in soils and aggregates, which could be encountered during more extensive ground works.

12. Unless stated otherwise, only preliminary geotechnical recommendations are presented in this report and these should be verified in a Geotechnical Design Report, once proposed construction and structural design proposals are confirmed.

52285-L01(00)APPENDIX B
EXPLORATORY LOGS

RSK GEOSCIENCES

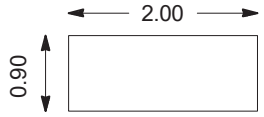
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Land West of Cross Road, Deal	**Gladman Developments Ltd**	**TP1**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
52285	**22.09.21** End: **22.09.21**	**---**	**E:636086.0 N:150342.0**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						Soft dark brown silty sandy gravelly CLAY with occasional fine rootlets. Sand is fine. Gravel is fine to coarse angular to rounded chalk and flint.	(0.60)	
							0.60	
						Unstructured light brown CHALK with fine to cobble sized angular to rounded flints. (SEAFORD CHALK FORMATION)	(1.20)	
							1.80	
						Trial pit terminated at 1.80m depth.		

Plan (Not to Scale)



General Remarks

1. Trial pit terminated at 1.80m depth.
2. Trial pit remained dry and stable.
3. Trial pit backfilled with arisings.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Mini tracked excavator**	**JCurnow**	

AGS

RSK GEOSCIENCES

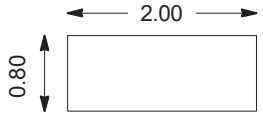
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Land West of Cross Road, Deal	**Gladman Developments Ltd**	**TP2**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
52285	**22.09.21** End: **22.09.21**	**---**	**E:626056.0 N:150375.0**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						Soft dark brown silty sandy gravelly CLAY with occasional fine rootlets. Sand is fine. Gravel is fine to coarse angular to rounded chalk and flint.	(0.80) 0.80	
						Unstructured light brown CHALK with fine to cobble sized angular to rounded flints. (SEAFORD CHALK FORMATION)	(0.70) 1.50	
						Trial pit terminated at 1.50m depth.		

Plan (Not to Scale)



General Remarks

1. Trial pit terminated at 1.50m depth.
2. Trial pit remained dry and stable.
3. Trial pit backfilled with arisings.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Mini tracked excavator**	**JCurnow**	

AGS

RSK GEOSCIENCES

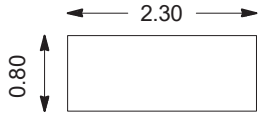
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Land West of Cross Road, Deal	**Gladman Developments Ltd**	**TP3**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
52285	**22.09.21** End: **22.09.21**	**---**	**E:636020.0 N:150413.0**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						Soft dark brown silty sandy gravelly CLAY with occasional fine rootlets. Sand is fine. Gravel is fine to coarse angular to rounded chalk and flint.	(0.80)	
							0.80	
						Unstructured light brown CHALK with fine to cobble sized angular to rounded flints. (SEAFORD CHALK FORMATION)	(0.40)	
							1.20	
						Trial pit terminated at 1.20m depth.		

Plan (Not to Scale)



General Remarks

1. Trial pit terminated at 1.20m depth.
2. Trial pit remained dry and stable.
3. Trial pit backfilled with arisings.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**Mini tracked excavator**	**JCurnow**	

AGS

52285-L01(00) APPENDIX C
PHOTOGRAPHIC LOG

PHOTOGRAPHIC LOG

Client Name: Gladman Developments Ltd	Site Location: Land West of Cross Road, Deal	52285

Photo No.	Date:
1	22.09.21

Direction Photo Taken:

n/a

Description:

TP1 fenced off overnight to allow for repeated testing the following day.

Photo No.	Date:
2	22.09.21

Direction Photo Taken:

n/a

Description:

TP2 fenced off overnight to allow for repeated testing the following day.

PHOTOGRAPHIC LOG

Client Name: Gladman Developments Ltd	Site Location: Land West of Cross Road, Deal	52285

Photo No.	Date:
3	22.09.21

Direction Photo Taken:

n/a

Description:

TP3 fenced off overnight to allow for repeated testing the following day.

Photo No.	Date:
4	23.09.21

Direction Photo Taken:

n/a

Description:

TP1 reinstated.

PHOTOGRAPHIC LOG

Client Name: Gladman Developments Ltd	Site Location: Land West of Cross Road, Deal	52285

Photo No.	Date:
5	23.09.21

Direction Photo Taken:

n/a

Description:

TP2 reinstated.

Photo No.	Date:
6	23.09.21

Direction Photo Taken:

n/a

Description:

TP3 reinstated.

52285-L01(00) APPENDIX D
INFILTRATION TEST DATA

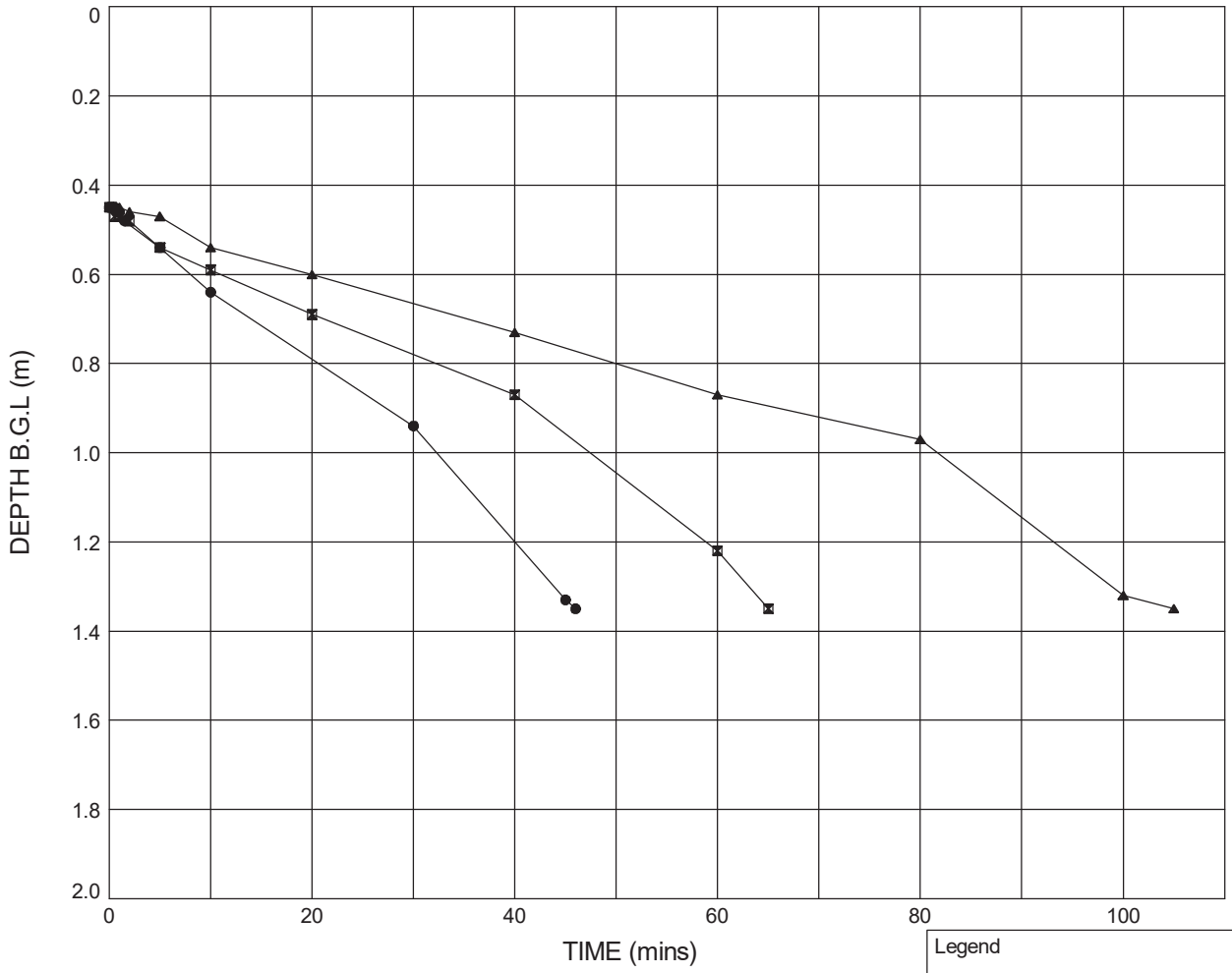
FULL SCALE SOAKAWAY TEST

In accordance with BRE Digest 365

Soakaway Test - Position ID : **TP1**

Ground Level (m AOD): **---** National Grid Co-ordinates: **E:636086.0 N:150342.0**

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME

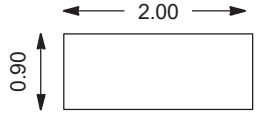


		Test 1	Test 2	Test 3	
Pit start depth:	=	*1.80*	*1.80*	*1.80*	m
Pit final depth:	=	*1.80*	*1.80*	*1.80*	m
Effective depth, De	=	*0.90*	*0.90*	*0.90*	m
Effective storage volume, V_{p75-25}	=	*0.8100*	*0.8100*	*0.8100*	m^3
Surface area, a_{p50}	=	*4.4100*	*4.4100*	*4.4100*	m^2
Time, t_{p75-25}	=	*1487*	*2164*	*3439*	secs
Infiltration rate, *f*	=	$1.24x10^{-4}$	$8.49x10^{-5}$	$5.34x10^{-5}$	m/s

Legend

●	Test 1	(22.09.21)
⊠	Test 2	(22.09.21)
▲	Test 3	(22.09.21)

Plan (Not to scale)



No Bearing Taken

Compiled By	Date	Checked By	Date
	29/09/21		

Contract	Contract Ref:
Land West of Cross Road, Deal	**52285**

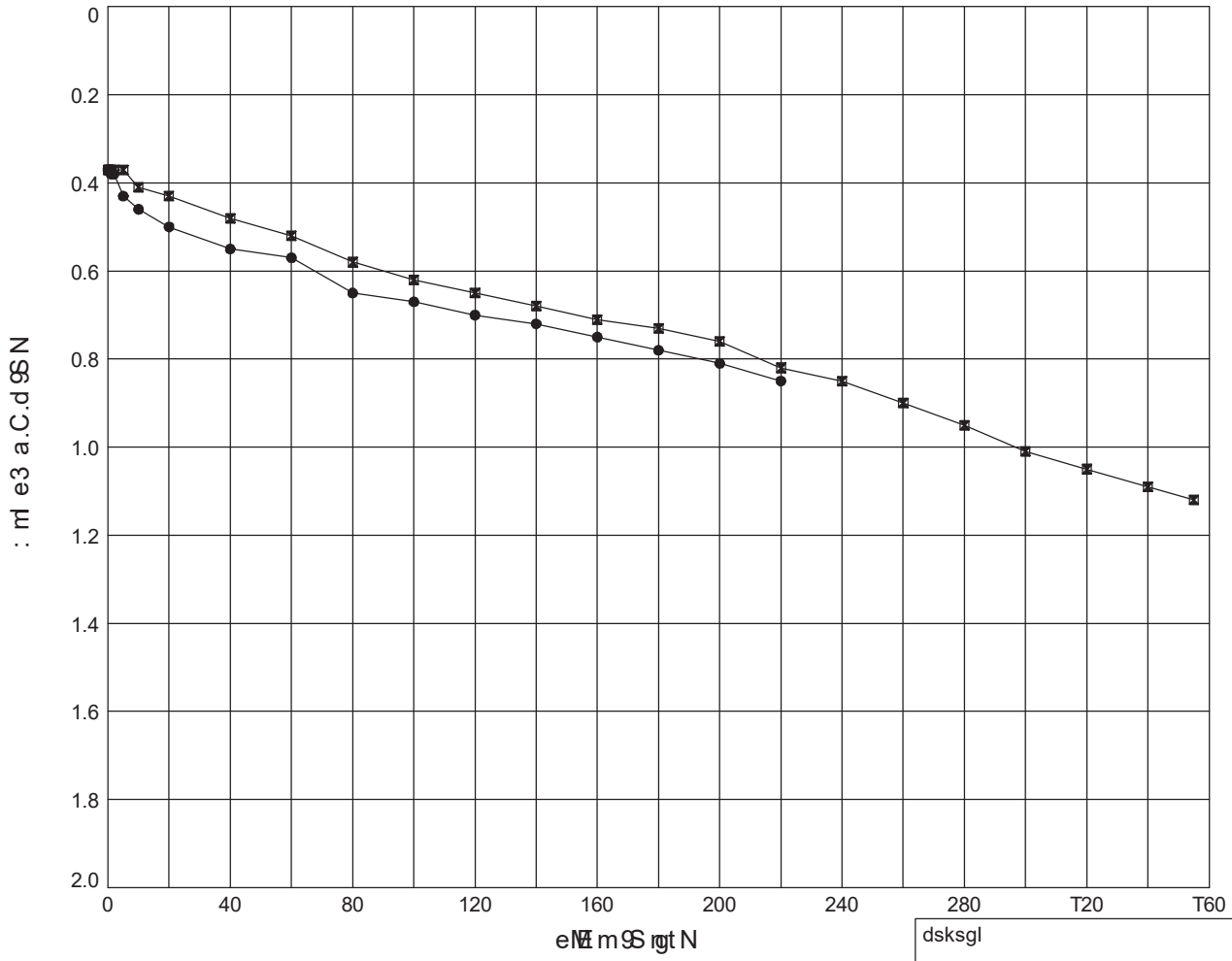
FULL SCALE SOAKAWAY TEST

In accordance with BRE Digest 365

wBr Pr y r - est (Dl Bt r(mBg M GTP2

CiBvgl dsAsc9S OH: NG--- or (mBgr cCim uBDBil mgr (st GE:626056.0 N:150375.0

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



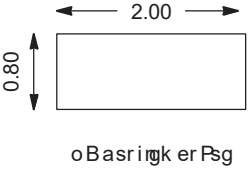
dsksgl

● est (1 922.0) .21N

⊠ est (2 92T.0) .21N

		est (1	est (2	
I r(t (r i(I sp(hG	=	*1.50*	*1.50*	S
I r(frgr cl sp(hG	=	*1.50*	*1.50*	S
mffsL(mAs I sp(h, : s	=	*0.76*	*0.76*	S
mffsL(mAs t (Bir ks ABcvSs, V_{p75D25}	=	*0.6080*	*0.6080*	S^T
wvifr Ls r isr , a_{p50}	=	*3.7280*	*3.7280*	S^2
enSs, t_{p75D25}	=	*11685*	*12160*	tsLt
Mgfm(ir (mBg ir (s, f	=	*1.40x10^{-5}*	*1.34x10^{-5}*	S /t

I cg 9oB((Bt Lr csN



oBasr ingk er Psg

uBSpmsI a-	: r(s	uhsLPsI a-	: r(s
	29/09/21		
uBg(ir L(		uBg(ir L(RsfG	
Land West of Cross Road, Deal		**52285**	

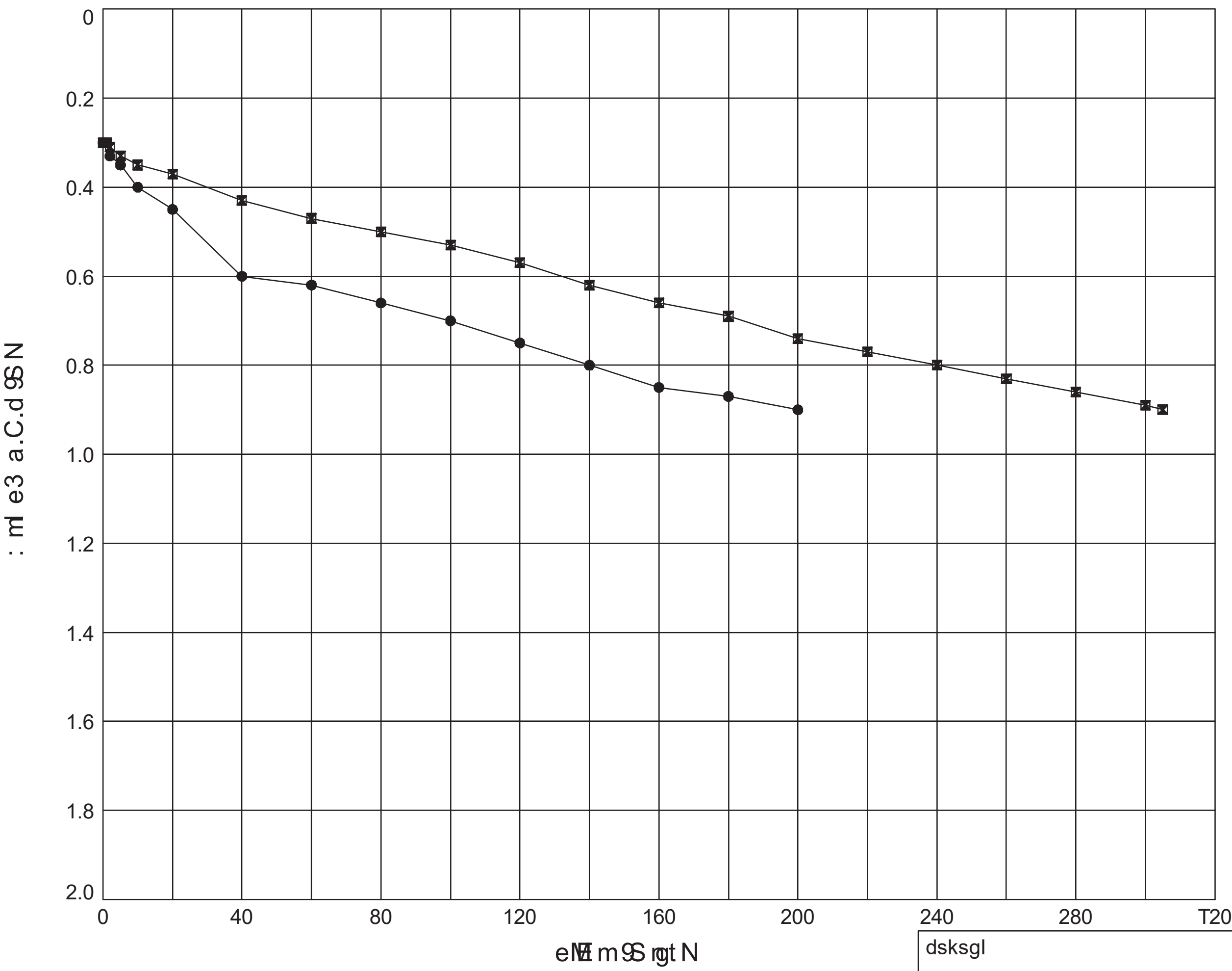
2FUU LSCUE LACOCK CWTELT

V naacorn-ad e wit RHE Ywdgi 165

wBr Pr y r - est (DI Bt nmBg M GTP1

CiBvgl dsAsc9S OH: NGMMM   or (nBgr cCinl u BDBil mgr (st G**E:6163038 . :N534N183**

PUAT A2 YEPTD A2 K CTEH REUAK BHAF. Y UEGEU CBCV LT TV E

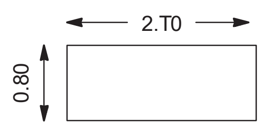


		est (1	est (2	
I n(t (ri (I sp(hG	=	*1.20*	*1.20*	S
I n(fmgr cl sp(hG	=	*0.60*	*0.60*	S
mffsL(nAs I sp(h, : s	=	*0.60*	*0.60*	S
mffsL(nAs t (Birks ABcvS s, V_{p75D25}	=	*0.5520*	*0.5520*	S^T
wvifr Ls risr, a_{p50}	=	*3.7000*	*3.7000*	S^2
enS s, t_{p75D25}	=	*6000*	*9400*	t sLt
Mgfmqir (nBg ir (s, f	=	*$2.49x10^{-5}$*	*$1.59x10^{-5}$*	S /t

dsksgl

●	est (1	922.0) .21N
⧗	est (2	92T.0) .21N

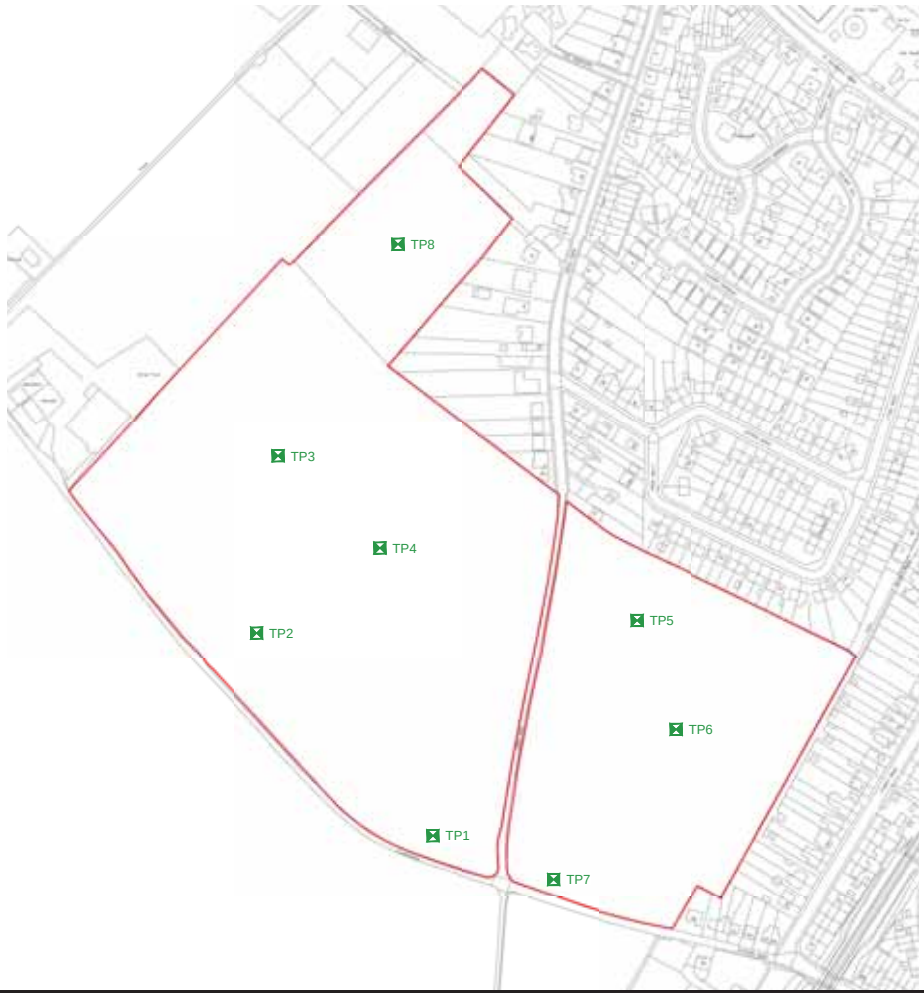
I crg 9oB((Bt Lr csN



oBasrimgk er Psg

	uBS prnsl a-	: r(s	uhsLPsl a-	: r(s
	[signature]	0s9s9N		
	uBg(ir L(Un- r K dgi cf Socgg Hcnr , Ydnl		uBg(ir L(RsfG **500/ 5**	

APPENDIX E
SITE INVESTIGATION LOGS AND INFILTRATION TESTING RESULTS (2017)



N

LEGEND

Site Boundary

Trial Pit Location

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

RSK

18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT
United Kingdom

Tel: +44 (0) 1442 437500
Fax: +44 (0) 1442 437550
Email: info@rsk.co.uk
Web: www.rsk.co.uk

Client

GLADMAN DEVELOPMENTS

Project Title

CROSS ROAD,
DEAL

Drawing Title

EXISITING
SITE LAYOUT
PLAN

Drawn	Date	Checked	Date	Approved	Date
ASC	17.02.17	SF	17.02.17	SF	17.02.17

Scale	Orig Size	Dimensions
1:1000	A3	m

Project No.	Drawing File
28926 - L01	28926 (L01) Fig 1.dwg

Drawing No.	Rev.
FIGURE 1	P1

Scale

0 10 20 30 40 50m

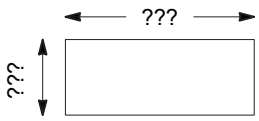
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Cross Road	**RSK**	**TP1**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
28926	End: **???**	**---**	**---**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						TOPSOIL: Dark brown very clayey gravelly SAND. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of brick and flint.	(0.40) 0.40	
						Firm to stiff slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of flint. (CLAY WITH FLINTS)	(0.30) 0.70	
						Cream mottled light brown clayey sandy GRAVEL. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of weak low density white chalk and flint.	(0.50) 1.20	
						Weak medium density white CHALK. Fractures are closely spaced infilled with white comminuted chalk occasionally medium to coarse subangular flint of gravel. Grade B3.	(1.50) 2.70	
						Trial pit terminated at 2.70m depth.		

Plan (Not to Scale)



General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Hand and machine dug	**Unknown**	**???**	

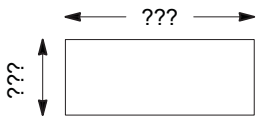
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Cross Road	**RSK**	**TP2**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
28926	End: **???**	**---**	**---**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						TOPSOIL: Dark brown silty clayey gravelly SAND. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of brick and flint.	(0.40) 0.40	
						Firm to stiff slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of flint. (CLAY WITH FLINTS)	(0.60) 1.00	
						STRUCTURELESS CHALK composed of sandy silty subangular to rounded GRAVEL and COBBLES. Clasts are very weak low density white. Matrix is light brown. Rinded flint, gravel and cobbles throughout.	(2.10) 3.10	
						Trial pit terminated at 3.10m depth.		

Plan (Not to Scale)



General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Hand and machine dug	**Unknown**	**???**	

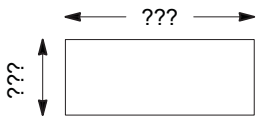
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Cross Road	**RSK**	**TP3**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
28926	End: **???**	**---**	**---**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						TOPSOIL: Dark brown very clayey gravelly SAND. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of flint and brick.	(0.50) 0.50	
						Firm to stiff slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of flint. (CLAY WITH FLINTS)	(0.60) 1.10	
						Very weak medium density white CHALK. Fractures are closely spaced infilled with white comminuted chalk occasionally medium to coarse subangular flint gravel. Grade B3.	(1.60) 2.70	
						Trial pit terminated at 2.70m depth.		

Plan (Not to Scale)



General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Hand and machine dug	**Unknown**	**???**	

APPENDIX F
KENT COUNTY COUNCIL CORRESPONDENCE

Robert Brenton

From: SUDS@kent.gov.uk
Sent: 30 November 2016 11:38
To: Robert Brenton
Cc: Colin Whittingham
Subject: RE: Cross Road, Deal Information Request

Good morning Robert.

Thank you for your enquiry. Please accept our apologies for the delayed response.

I will address your questions as presented:

- Information on the recently published climate change guidance for this area,
  The revised tidal/fluvial guidance would have no implications for this site owing to its elevation and absence of any main rivers in the vicinity. However, any sustainable drainage scheme should be designed to take the recently revised guidance into account. This will mean that the system should be designed to accommodate the critical 1 in 100 year storm with a 20% allowance for climate change, with an additional analysis undertaken to understand the flooding implication for a greater climate change allowance of 40%.
- Information on surface water flood risk including flow pathways and depths,
  In the absence of any site-specific surface water modelling for the area, we would refer you to the updated Flood Map for Surface Water, produced and maintained by the Environment Agency. This can be found at https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?easting=636174&northing=150613&address=100060889577&map=SurfaceWater
- Information on historic flooding from all sources,
  We do not hold any information for this specific site. We would suggest that the Local Authority and Environment Agency are also consulted on this issue as they may hold information we are unaware of. For a general overview of the area, our Surface Water Management Plan should be referred to: http://www.kent.gov.uk/about-the-council/strategies-and-policies/environment-waste-and-planning-policies/flooding-and-drainage-policies/surface-water-management-plans/deal-surface-water-management-plan
- Any data on existing surface water discharges to the surrounding watercourse or sewers,
  We are unaware of any existing discharges to watercourses in this area. However, we would expect this information to be provided within any detailed surface water management strategy for the site.
- Any data on groundwater flooding,
  We are unaware of any groundwater flooding issues in this area. However, if soakaways are to be utilised, we would expect to see geotechnical information that identifies the depth to the water table across the site to ensure that a sufficient unsaturated zone is provided.
- Any information on reservoir flooding; and,
  We would refer you to the Environment Agency for this information: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?easting=636174&northing=150613&address=100060889577&map=SurfaceWater
- Any information on culverted watercourses or privates sewers which you know of which do not show up on the public sewer records.
  We do not hold this information.
- Finally, please could you provide any recommendation on how the surface water is to be managed; for example, restrictions in discharge rates the requirements for SuDS, possible discharge locations and attenuation requirements?
  Without any site specific information we are unable to provide any detailed guidance. However, when considering options for development of this site, we would recommend that our masterplanning for SuDS guidance is referred to as early in the design process as possible. We would further recommend that full

regard is given to our Drainage and Planning Policy Statement; this outlines how we approach our role as statutory consultee, and provides detail on our 10 Sustainable Drainage policies.

Please let me know if I can be of any further assistance?

Kind regards,

Joe Williamson

Joseph Williamson | Flood Risk Project Officer | **Kent County Council**
Environment Planning and Enforcement, Invicta House, County Hall, Maidstone, Kent, ME14 1XX
t: 03000 413481 | **e:** joseph.williamson@kent.gov.uk | www.kent.gov.uk

From: RBrenton@rsk.co.uk [mailto:RBrenton@rsk.co.uk]
Sent: 08 November 2016 15:31
To: Flood - GT
Cc: CWhittingham@rsk.co.uk
Subject: Cross Road, Deal Information Request

Dear Sir/Madam,

Please could I order information on flooding and drainage for the following site in order to inform a Flood Risk Assessment:

Cross Road,
Walmer,
Deal,
East Sussex,
CT14 9LA.

Grid reference – 636020 E, 150570 N

I would like all the flooding information and advice you have including the following, if available:

- Information on the recently published climate change guidance for this area,
- Information on surface water flood risk including flow pathways and depths,
- Information on historic flooding from all sources,
- Any data on existing surface water discharges to the surrounding watercourse or sewers,
- Any data on groundwater flooding,
- Any information on reservoir flooding; and,
- Any information on culverted watercourses or privates sewers which you know of which do not show up on the public sewer records.

Finally, please could you provide any recommendation on how the surface water is to be managed; for example, restrictions in discharge rates the requirements for SuDS, possible discharge locations and attenuation requirements?

We have a relatively quick turn around on this project and would therefore appreciate a quick response.

If you have any queries please don't hesitate to contact me.

APPENDIX G
ENVIRONMENT AGENCY CORRESPONDENCE

Robert Brenton

From: KSL Enquiries [KSLE@environment-agency.gov.uk]
Sent: 06 December 2016 11:11
To: Robert Brenton
Subject: KSL 29204 SD and KSL 29208 SD - Cross Road, Deal and Dover Road, Deal
Attachments: 2016-127 101 Location Plan.pdf; RIPPLE NURSERY.XLSX; VICTORIA PARK LOGGER DATA.XLSX; VICTORIA PARK.XLSX; KSL climate change guidance.doc.Sept.2016.pdf

Dear Robert,

KSL 29204 SD and KSL 29208 SD - Cross Road, Deal and Dover Road, Deal

Thank you for your request for information that was received on 08 November 2016.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

This site is located in an area of Flood Zone 1 where we do not have modelled flood levels.

We can confirm that we have no record of flooding (from rivers and/or the sea) for the two locations specified. You may wish to check with the Lead Local Flood Authority for this area, Kent County Council, who hold detailed records for surface water flooding.

Please be aware that you can access our flood map(s) for free here.

Please see our responses to your enquiries below in dark blue. These responses are relevant for both Dover Road, and Cross Road in Deal.

- Information on the recently published climate change guidance for this area
  -Please find Climate Change Document attached in PDF format.

- Information on surface water flood risk including flow pathways and depths
  -Please refer to the Lead Local Flood Authority for this area- Kent County Council- who hold information on surface water and surface water flooding.

- Information on historic flooding from all sources
  -We hold no record of historic flooding at either site from rivers and/or sea. Both sites are located in Flood Zone 1. Please refer to the Lead Local Flood Authority- Kent County Council- for historic flooding data from surface and groundwater.

- Any data on existing surface water discharges to the surrounding watercourse or sewers
  -We do not hold this data.

- Any data on groundwater flooding
  -Please find attached requested groundwater data in Excel spreadsheets.
  The most appropriate data for both requests are from the following sites:

  1) Ripple Nurseries- Groundwater manual dip data only, entire available record.
  2) Victoria Park- Groundwater manual dip data and logged data, entire available record for both.

  Limitations of the data:

Ripple Nurseries – This is an active borehole within the grounds of a plant nursery. It has, on occasion, been measured whilst the borehole pump was running. The regularity of abstraction has reduced over the years as the nursery has become less and less active, but it does not detract from the fact that the pumping will have had an effect on the results collected i.e. potentially have drawn the water level down during pumping.

Victoria Park – It will be very clear from the logger data that this site is tidally effected, the tidal cycle can be clearly seen within the data. Please ensure the dip data is used in conjunction with the logger data.

- Any information on reservoir flooding;
  -Dover Road, Deal: Reservoir flood maps are freely available as open data from: https://flood-warning-information.service.gov.uk/long-term-flood-risk.
  To use the system: enter the post code and choose the correct address, then select 'View map of river and sea flood risk'. This will then take you to the reservoir flood maps.

  -Cross Road, Deal: We hold no records of any reservoirs within 20 metres of this site, therefore we do not hold any information on reservoir flooding.

- Any information on culverted watercourses or privates sewers which you know of which do not show up on the public sewer records
  -We hold no records of main rivers or ordinary watercourses within 20 metres of both sites. We do not hold information on private sewers – please refer to the relevant Water Company/ Local Authority who may hold this information.

Finally, please could you provide any recommendation on how the surface water is to be managed; for example, restrictions in discharge rates the requirements for SuDS, possible discharge locations and attenuation requirements?
-Please refer to the Lead Local Flood Authority- Kent County Council- who deal with SuDS enquiries.

I trust this information is of use. If you have any further questions or require any additional information, please do not hesitate to contact me and I will be happy to help.

Please refer to the Open Government Licence which explains the permitted use of this information.

If you have any further queries or if you'd like us to review the information we have provided under the Freedom of Information Act 2000 and Environmental Information Regulations 2004 please contact us within two months and we will happily do this for you.

We would be really grateful if you could spare five minutes to help us improve our service. Please click on the link below and fill in our survey – we use every piece of feedback we receive:
http://www.smartsurvey.co.uk/s/EnvironmentAgencyCustomerSurvey/?a=KSL

Kind Regards,

Sasha

Sasha David
Customers & Engagement Officer
Kent South London and East Sussex

Environment Agency | 02084746848 | Orchard House | Endeavour Park | London Road | West Malling | Kent | ME19 5SH
www.gov.uk/floodsdestroy

From: RBrenton@rsk.co.uk [mailto:RBrenton@rsk.co.uk]
Sent: 08 November 2016 15:32
To: DDC DevelopmentControl
Cc: CWhittingham@rsk.co.uk
Subject: Cross Road, Deal Information Request

Dear Sir/Madam,

Please could I order information on flooding and drainage for the following site in order to inform a Flood Risk Assessment:

Cross Road,
Walmer,
Deal,
East Sussex,
CT14 9LA.

Grid reference – 636020 E, 150570 N

I would like all the flooding information and advice you have including the following, if available:

- Information on the recently published climate change guidance for this area
- Information on surface water flood risk including flow pathways and depths
- Information on historic flooding from all sources
- Any data on existing surface water discharges to the surrounding watercourse or sewers
- Any data on groundwater flooding
- Any information on reservoir flooding;
- Any information on culverted watercourses or privates sewers which you know of which do not show up on the public sewer records.

Finally, please could you provide any recommendation on how the surface water is to be managed; for example, restrictions in discharge rates the requirements for SuDS, possible discharge locations and attenuation requirements?

We have a relatively quick turn around on this project and would therefore appreciate a quick response.

If you have any queries please don't hesitate to contact me.

Kind regards,

Robert Brenton
Assistant Hydrologist BSc (Hons) FdSc

RSK
Land & Development Engineering
14, Beecham Court, Pemberton Business Park, Wigan, UK, WN3 6PR

Switchboard: +44 (0) 1942 493255
Fax: +44 (0) 1942 493171

Flood risk assessments: Climate change allowances

Its essential landuse planning decisions are based on the latest evidence and quality site specific Flood Risk Assessments. A key part of this is using the latest climate change allowances and using local evidence and data.

We encourage early pre applications discussions and you should complete this form and email back to kslplanning@environment-agency.gov.uk for sites in high risk flood zones. You should also discuss proposed developments with the local planning authority and refer to their local plan flood risk policies and Strategic Flood Risk Assessment. Guidance on producing a Flood Risk Assessment.

To obtain the latest flood map and data please email our customers and engagement team kslenquiries@environment-agency.gov.uk

1) The climate change allowances

The National Planning Practice Guidance refers planners, developers and advisors to the Environment Agency guidance on considering climate change in Flood Risk Assessments (FRAs). This guidance was updated in February 2016 and is available on Gov.uk and should be read in conjunction with this document. The guidance can be used for planning applications, local plans, neighbourhood plans and other projects. It provides climate change allowances for peak river flow, peak rainfall, sea level rise, wind speed and wave height. The guidance provides a range of allowances to assess fluvial flooding, rather than a single national allowance. It advises on what allowances to use for assessment based on vulnerability classification, flood zone and development lifetime. For proposed development in the tidal Thames flood zone you should continue to use the Thames Estuary 2100 (TE2100) plan and latest flood models.

2) Assessment of climate change impacts on fluvial flooding

Table A below indicates the level of technical assessment of climate change impacts on fluvial flooding appropriate for new developments depending on their scale and location. This should be used as **a guide only**. Ultimately, the agreed approach should be based on expert local knowledge of flood risk conditions, local sensitivities and other influences. **For these reasons we recommend that applicants and / or their consultants should contact the Environment Agency at the pre-planning application stage to confirm the assessment approach, on a case by case basis**. **Table A** defines three possible approaches to account for flood risk impacts due to climate change, in new development proposals:

- **Basic:** Developer can add an allowance to the 'design flood' (i.e. 1% annual probability) peak levels to account for potential climate change impacts.
- **Intermediate:** Developer can use existing modelled flood and flow data to construct a stage-discharge rating curve, which can be used to interpolate a flood level based on the required peak flow allowance to apply to the ‘design flood’ flow. See Appendix 1.
- **Detailed:** Perform detailed hydraulic modelling, through either re-running Environment Agency hydraulic models (if available) or construction of a new model by the developer.

Table A – Indicative guide to assessment approach

vulnerability classification	flood zone	development type		
		minor	small-major	large-major
essential infrastructure	Zone 2	Detailed		
	Zone 3a	Detailed		
	Zone 3b	Detailed		
highly vulnerable	Zone 2	Intermediate/ Basic	Intermediate/ Basic	Detailed
	Zone 3a	Not appropriate development		
	Zone 3b	Not appropriate development		
more vulnerable	Zone 2	Basic	Basic	Intermediate/ Basic
	Zone 3a	Basic	Detailed	Detailed
	Zone 3b	Not appropriate development		
less vulnerable	Zone 2	Basic	Basic	Intermediate/ Basic
	Zone 3a	Basic	Basic	Detailed
	Zone 3b	Not appropriate development		
water compatible	Zone 2	None		
	Zone 3a	Intermediate/ Basic		
	Zone 3b	Detailed		

Notes:

- Minor: 1-9 dwellings/ less than 0.5 ha | Office / light industrial under 1ha | General industrial under 1 ha | Retail under 1 ha | Gypsy/traveller site between 0 and 9 pitches
- Small-Major: 10 to 30 dwellings | Office / light industrial 1ha to 5ha | General industrial 1ha to 5ha | Retail over 1ha to 5ha | Gypsy/traveller site over 10 to 30 pitches
- Large-Major: 30+ dwellings | Office / light industrial 5ha+ | General industrial 5ha+ | Retail 5ha+ | Gypsy/traveller site over 30+ pitches | any other development that creates a non residential building or development over 1000 sq m.

The assessment approach should be agreed with the Environment Agency as part of pre-planning application discussions to avoid any wasted work.

3) Specific local considerations in Kent and South London

Where the Environment Agency and the applicant and / or their consultant has agreed that a '**basic**´ level of assessment is appropriate the figures in Table B below can be used as a precautionary allowance for potential climate change impacts on peak 'design' (i.e. 1% annual probability) fluvial flood level rather than undertaking detailed modelling.

Table B – Local precautionary allowances for potential climate change impacts

River basin	Central	Higher Central	Upper
Thames	500mm	700mm	1000mm
South East	700mm	850mm	1400mm

For proposed developments in the tidal Thames flood zone you should continue to use the Thames Estuary 2100 (TE2100) plan and latest flood models.

4) Fluvial food risk mitigation

Read the guidance on Gov.uk to find out which allowances to use to **assess** the impact of climate change on flood risk.

For planning consultations where we are a statutory consultee and our Flood risk standing advice **does not** apply we use the following benchmarks to inform flood risk **mitigation** for different vulnerability classifications. **These are a guide only**.

We recommend you contact us at the pre-planning application stage to confirm this on a case by case basis. We can provide you with a free basic opinion and more detailed advice is subject to cost recovery.

For planning consultations where we are not a statutory consultee or our Flood risk Standing advice applies we recommend local planning authorities and developers use these benchmarks but we do not expect to be consulted.

- For development classed as '**Essential Infrastructure**' our benchmark for flood risk mitigation is for it to be designed to the '**upper end**' climate change allowance for the epoch that most closely represents the lifetime of the development, including decommissioning.

- For **highly vulnerable** in flood zone 2, the '**higher central'** climate change allowance is our minimum benchmark for flood risk mitigation. In sensitive locations it may be necessary to use the **upper end** allowance.

- For **more vulnerable developments** in flood zone 2, the '**central**' climate change allowance is our minimum benchmark for flood risk mitigation, and in flood zone 3 the '**higher central**' climate change allowance is our minimum benchmark for flood risk mitigation. In sensitive locations it may be necessary to use the **higher central** (in flood zone 2) and the **upper end** allowance (in flood zone 3).

- For **water compatible** or **less vulnerable** development (e.g. commercial), the '**central**' climate change allowance for the epoch that most closely represents the lifetime of the development is our minimum benchmark for flood risk mitigation. In sensitive locations it may be necessary to use the **higher central** (particularly in flood zone 3) to inform built in resilience.

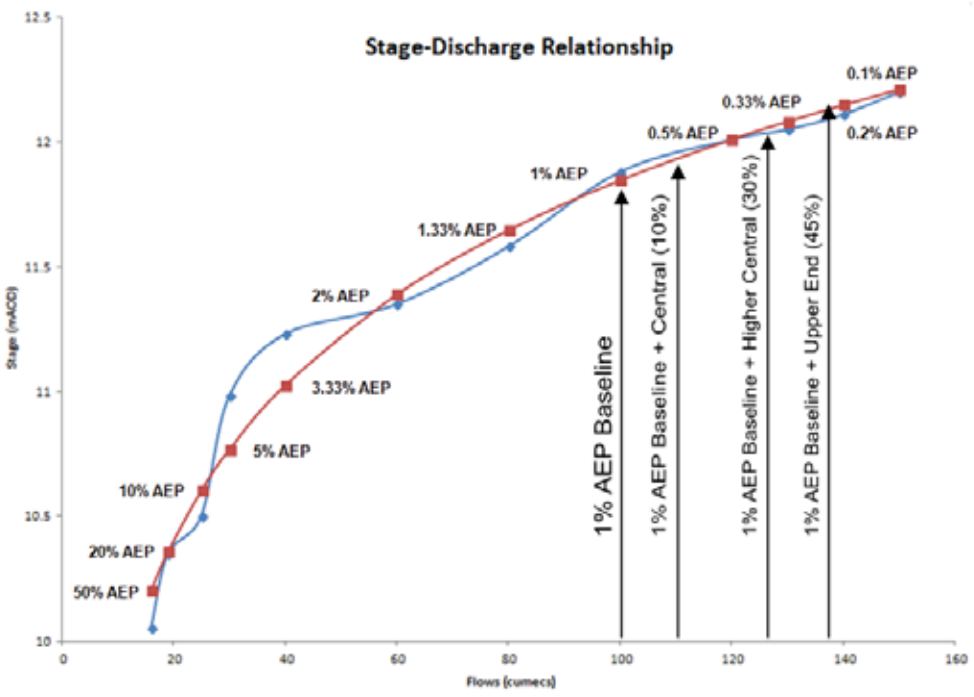
There may be circumstances where local evidence supports the use of other data or allowances. Where you think this is the case we may want to check this data and how you propose to use it.

Appendix 1 – Further information on the Intermediate approach

1) The methodology the chart is based on does not produce an accurate stage-discharge rating and is a simplified methodology for producing flood levels that can be applied in low risk small-scale development situations;

2) The method should not be applied where there is existing detailed modelled climate change outputs that use the new allowances. In such circumstances, the 'with climate change' modelled scenarios should be applied.

An example stage-discharge relationship is shown below:



APPENDIX H
PRE-DEVELOPMENT GREENFIELD RUNOFF CALCULATIONS

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.150
Area (ha)	4.170	Urban	0.000
SAAR (mm)	764	Region Number	Region 7

Results	**l/s**
QBAR Rural	1.9
QBAR Urban	1.9
Q100 years	6.0
Q1 year	1.6
Q30 years	4.2
Q100 years	6.0

APPENDIX I
DRAINAGE CALCULATIONS

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 428 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	16.724	1.024	22.3	628.5	O K
30 min Summer	16.943	1.243	24.8	813.7	O K
60 min Summer	17.130	1.430	26.9	986.7	O K
120 min Summer	17.268	1.568	28.4	1123.3	Flood Risk
180 min Summer	17.313	1.613	28.9	1168.5	Flood Risk
240 min Summer	17.326	1.626	29.1	1182.6	Flood Risk
360 min Summer	17.317	1.617	29.0	1173.1	Flood Risk
480 min Summer	17.299	1.599	28.8	1154.2	Flood Risk
600 min Summer	17.276	1.576	28.5	1131.2	Flood Risk
720 min Summer	17.251	1.551	28.2	1106.0	Flood Risk
960 min Summer	17.197	1.497	27.6	1051.9	O K
1440 min Summer	17.093	1.393	26.5	952.0	O K
2160 min Summer	16.959	1.259	25.0	827.8	O K
2880 min Summer	16.839	1.139	23.6	723.1	O K
4320 min Summer	16.632	0.932	21.3	555.6	O K
5760 min Summer	16.462	0.762	19.5	429.9	O K
7200 min Summer	16.320	0.620	17.9	333.1	O K
8640 min Summer	16.201	0.501	16.6	257.6	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	151.809	26
30 min Summer	99.447	40
60 min Summer	61.893	68
120 min Summer	37.087	126
180 min Summer	27.062	184
240 min Summer	21.596	242
360 min Summer	15.698	320
480 min Summer	12.500	382
600 min Summer	10.467	444
720 min Summer	9.050	512
960 min Summer	7.188	650
1440 min Summer	5.187	926
2160 min Summer	3.737	1328
2880 min Summer	2.958	1728
4320 min Summer	2.125	2472
5760 min Summer	1.679	3232
7200 min Summer	1.398	3960
8640 min Summer	1.203	4672

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
10080 min Summer	16.099	0.399	15.5	197.9	O K
15 min Winter	16.818	1.118	23.4	706.0	O K
30 min Winter	17.054	1.354	26.0	915.3	O K
60 min Winter	17.258	1.558	28.3	1113.0	Flood Risk
120 min Winter	17.413	1.713	30.1	1273.9	Flood Risk
180 min Winter	17.467	1.767	30.7	1332.2	Flood Risk
240 min Winter	17.489	1.789	30.9	1355.5	Flood Risk
360 min Winter	17.488	1.788	30.9	1355.1	Flood Risk
480 min Winter	17.462	1.762	30.6	1327.0	Flood Risk
600 min Winter	17.439	1.739	30.4	1301.3	Flood Risk
720 min Winter	17.410	1.710	30.0	1270.4	Flood Risk
960 min Winter	17.344	1.644	29.3	1200.5	Flood Risk
1440 min Winter	17.201	1.501	27.7	1056.3	Flood Risk
2160 min Winter	17.012	1.312	25.5	876.5	O K
2880 min Winter	16.846	1.146	23.7	729.0	O K
4320 min Winter	16.565	0.865	20.6	504.7	O K
5760 min Winter	16.342	0.642	18.1	347.3	O K
7200 min Winter	16.162	0.462	16.2	234.3	O K
8640 min Winter	16.017	0.317	14.6	151.9	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Summer	1.061	5352
15 min Winter	151.809	26
30 min Winter	99.447	40
60 min Winter	61.893	68
120 min Winter	37.087	124
180 min Winter	27.062	180
240 min Winter	21.596	238
360 min Winter	15.698	346
480 min Winter	12.500	400
600 min Winter	10.467	470
720 min Winter	9.050	548
960 min Winter	7.188	702
1440 min Winter	5.187	998
2160 min Winter	3.737	1428
2880 min Winter	2.958	1824
4320 min Winter	2.125	2600
5760 min Winter	1.679	3352
7200 min Winter	1.398	4048
8640 min Winter	1.203	4760

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	15.899	0.199	13.3	91.2	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Winter	1.061	5448

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	21.800	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time / Area Diagram

Total Area (ha) 2.294

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.765	4-8	0.765	8-12	0.765

Model Details

Storage is Online Cover Level (m) 17.500

Infiltration Basin Structure

Invert Level (m) 15.700 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.19224 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.05724

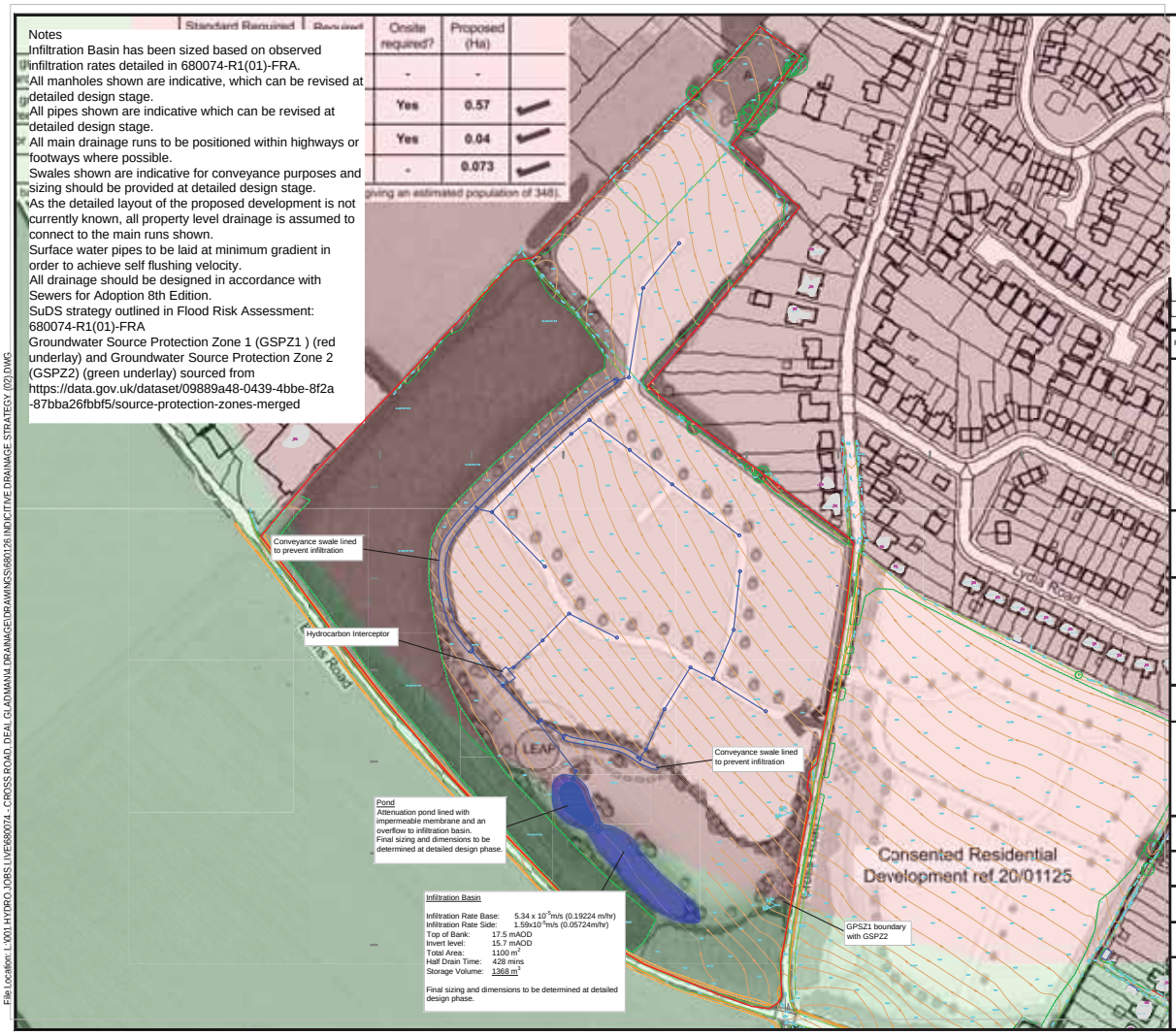
Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	420.0	1.800	1100.0

APPENDIX J
OUTLINE SURFACE WATER DRAINAGE STRATEGY

Notes
Infiltration Basin has been sized based on observed infiltration rates detailed in 680074-R1(01)-FRA.
All manholes shown are indicative, which can be revised at detailed design stage.
All pipes shown are indicative which can be revised at detailed design stage.
All main drainage runs to be positioned within highways or footways where possible.
Swales shown are indicative for conveyance purposes and sizing should be provided at detailed design stage.
As the detailed layout of the proposed development is not currently known, all property level drainage is assumed to connect to the main runs shown.
Surface water pipes to be laid at minimum gradient in order to achieve self flushing velocity.
All drainage should be designed in accordance with Sewers for Adoption 8th Edition.
SuDS strategy outlined in Flood Risk Assessment: 680074-R1(01)-FRA
Groundwater Source Protection Zone 1 (GSPZ1) (red underlay) and Groundwater Source Protection Zone 2 (GSPZ2) (green underlay) sourced from https://data.gov.uk/dataset/09889a48-0439-4bbe-8f2a-87bba26fbbf5/source-protection-zones-merged

	Onsite required?	Proposed (Ha)	
	-	-	
	Yes	0.57	✓
	Yes	0.04	✓
	-	0.073	✓

giving an estimated population of 348).



Notes
Do not scale from this drawing
Layout provided by FPCR
Drawing is subject to change
Drawing is indicative and subject to change following layout revisions

Key
- Red Line Boundary
- Proposed Surface Water Network
- Proposed Swale
- Proposed Infiltration Basin
- Proposed Pond

Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P2	07.10.21	Update infiltration rates + sizes	RW	CW	CW
P1	02.08.21	Issued for Discussion	RW	KJ	CW

RSK
LAND & DEVELOPMENT ENGINEERING LTD
Spring Lodge
172 Chester Road
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United Kingdom
Tel: +44 (0) 1928 726006
Fax: +44 (0) 1928 725633
Email: ldc@rsk.co.uk
Web: www.rsk.co.uk

Client: Gladman Developments Ltd

Project Title: Cross Road Deal

Status: Draft

Drawing Title: Indicative Surface Water Drainage Strategy DRAFT

Drawn	Date	Checked	Date	Approved	Date
RW	Oct 21	CW	Oct 21	CW	Oct 21

Scale	Orig Size	Dimensions
-	A3	m

Project No.	Drawing File
680074	

Drawing No.	Rev.
10-01	P2

File Location: L:\001.HYDRO.JOBS.LIVE\680074 - CROSS ROAD, DEAL GLADMAN\4.DRAINAGE\DRAWINGS\680126 INDICITVE DRAINAGE STRATEGY (02).DWG