



LAND AT LAKE LANE, BARNHAM, WEST SUSSEX

Proposed Residential Development

Surface Water Drainage Strategy

**Prepared on behalf of
Seaward Properties Ltd**

**D1042/DS/1.3
November 2016**

RGP Design Limited

Registered in England No. 09674169 :: Registered office:

Metro House, Northgate, Chichester, West Sussex, PO19 1BE



DOCUMENT CONTROL

Project: Land at Lake Lane, Barnham, West Sussex
Proposed Residential Development

Document: Surface Water Drainage Strategy

Client: Seaward Properties Ltd

Reference: D1042/DS/1.3

Document Checking:

Author:

MJA

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LDF

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6.			
7.			

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CONTENTS

1	INTRODUCTION.....	1
1.1	Background.....	1
1.2	Development Location and Description	1
2	PROBABILITY OF FLOODING.....	3
2.1	Strategic Flood Risk Assessment.....	3
2.2	Environment Agency Flood Data	3
2.3	Local Authority Information.....	4
3	EXISTING DRAINAGE AND GROUND CONDITIONS.....	5
3.1	Surface Water.....	5
3.2	Foul Water	5
3.3	Ground Conditions	5
4	PROPOSED DRAINAGE STRATEGY	6
4.1	Surface Water Run Off	6
4.2	Climate Change.....	6
4.3	Exceedance	7
4.4	Foul Water	7
4.5	Maintenance	7
5	SUMMARY	9

PLANS and DRAWINGS

2015/D1042/SK100 – Site Location Plan
2015/D1042/SK101 – Existing Topography & Contours
2015/D1042/SK200 – Impermeable Area Comparison
2015/D1042/SK300 – Proposed Drainage Strategy

GEOTECHNICAL INVESTIGATION

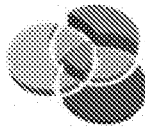
Extracts from Robert Clark Associates Ltd Report 1329-R7 April 2011

LOCAL AUTHORITY ENQUIRY DATA

Arun DC Response dated 15-09-18
WSCC Response dated 15-09-17

MICRODRAINAGE CALCULATIONS

Greenfield Run-off rate (Qbar)
Greenfield Run-off volume



1 INTRODUCTION

1.1 Background

- 1.1.1 RGP Design Ltd is instructed by Seaward Properties Ltd to prepare a Surface Water Drainage Strategy to support a planning application for the development of a site at Lake Lane, near Barnham in West Sussex.
- 1.1.2 This strategy considers Arun District Councils planning guidance document "Supplementary Requirements for Surface Water Drainage Proposals".
- 1.1.3 The proposed development comprises the construction of 5 dwellings, garages and the formation of parking areas.
- 1.1.4 In preparing this strategy, RGP Design Ltd has made reference to the Environment Agency's Flood Risk Maps for Planning, the Local Authorities Strategic Flood Risk Assessment (SFRA), Public Sewer Records and information provided by Local Authority.
- 1.1.5 Reference has also been made to a Topographic Survey undertaken by Stuart Bailey Land Surveys, and historic infiltration testing undertaken by Robert Clark Associates Ltd for the adjacent site, commissioned by the Client.
- 1.1.6 This strategy has been prepared to demonstrate that the proposed development will not increase flood risk and maximises the use of sustainable drainage techniques.
- 1.1.7 This report has been prepared for the benefit of the parties listed in the Terms of Appointment.

1.2 Development Location and Description

- 1.2.1 The proposed development is located directly opposite 'Flamsteed' to the south of Lake Lane near Barnham, West Sussex. PO22 0AD.
- 1.2.2 The site is currently greenfield.
- 1.2.3 The site is bounded to the north and west by ordinary watercourses and the Barnham Rife (Main River) lies approximately 160m to the west of the site. Records show that an existing culvert crosses the site.
- 1.2.4 The site is approximately 0.38Ha in size and it lies between 7.8m and 8.8m AOD, sloping in a north-easterly direction. The site is marginally elevated above the surrounding existing roadways.



- 1.2.5 The pre-development impermeable area is 0.013Ha. This is shown on drawing **2015/D1042/SK200**, included in this report.
- 1.2.6 The proposed development comprises 5 dwellings (1x 3 bed bungalow, 2x 3 bed houses & 2x 4 bed houses). New hardstanding areas will be formed to provide parking for the dwellings together with a short length of shared access road.
- 1.2.7 The post-development impermeable area is 0.101Ha. This is shown on drawing **2015/D1042/SK200**, included in this report.
- 1.2.8 Vehicular access to the proposed dwellings will be available from Lake Lane (Public Highway) using an existing crossover. The existing crossover currently provides access to the site and rear access to a number of existing dwellings adjacent the south east boundary. The crossover and access will be realigned and widened to serve the new dwellings and maintain 3rd party accessibility.
- 1.2.9 There is an un-metalled footpath (public right of way No.324) which runs through the south portion of the site which will be retained.



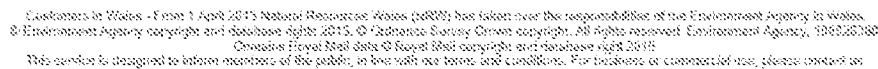
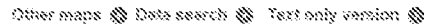
2 PROBABILITY OF FLOODING

2.1 Strategic Flood Risk Assessment

- 2.1.1 Whilst a formal flood risk assessment is not required due to the site area and its proximity to Environment Agency designated flood zones, a brief assessment of flood risk, generally in accordance with National Planning Policy Guidance: Flood Risk and Coastal Change, follows:
- 2.1.2 The NPPF requires that all sources of flooding are considered being Tidal, Fluvial, Pluvial, Groundwater, Sewers and Man-made reservoirs/canals.
- 2.1.3 The SRFA confirms that some areas of Lake Lane are at risk of flooding but these areas are not close to the site.
- 2.1.4 The SRFA confirms local geology to be at 'moderate to high' risk of groundwater flooding. Arun DC have confirmed the highest groundwater levels recorded on 15/2/11 was 0.18 mbgl, however no significant flooding has been observed historically.
- 2.1.5 The SRFA does not identify that the site to be at risk of flooding pluvial and fluvial sources.

2.2 Environment Agency Flood Data

- 2.2.1 The Environment Agency Flood Risk Maps for Planning (extract below) show that the site is located in Zone 1 (land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%)).





3 EXISTING DRAINAGE AND GROUND CONDITIONS

3.1 Surface Water

- 3.1.1 The existing run-off rate (QBar) has been calculated using Microdrainage (ICOP SUDS) to be 1.4 l/s. The Greenfield run-off volume is calculated to be 37.177m³.
- 3.1.2 The public sewer records show that there are no public surface water sewers in the vicinity of the site.
- 3.1.3 The topographic survey identifies there are watercourses on the northern and western boundaries. The levels indicate that the run-off from the majority of the site is directed northwards to the watercourses parallel to Lake Lane which flows to the east ultimately discharging to the Barnham Rife.

3.2 Foul Water

- 3.2.1 The public sewer records show that a 175mm diameter foul sewer within the carriageway of Lake Lane at a depth of approximately 2.5m flowing to the west.

3.3 Ground Conditions

- 3.3.1 Infiltration testing was undertaken historically by Robert Clark Associates Ltd in October 2006 for the adjacent site.
- 3.3.2 The investigation showed that the underlying ground conditions generally comprised a fine clayey sand overlain by a silty clay and topsoil.
- 3.3.3 Testing was undertaken generally in accordance with BRE365 and recorded infiltration rates of 2×10^{-6} m/s and very high ground water.
- 3.3.4 Given the known high ground water levels in the locality, it is unlikely that infiltration methods of drainage will operate successfully. It is recommended that no further infiltration testing or groundwater level monitoring is undertaken.



4 PROPOSED DRAINAGE STRATEGY

4.1 Surface Water Run Off

- 4.1.1 The SUDS manual and Building Regulations sets out a hierarchy of drainage methods to ensure that developments maximise the use of sustainable drainage techniques. In short, this hierarchy favours infiltration methods of disposal over other methods such as watercourses or sewers.
- 4.1.2 Whilst there is some opportunity to utilise infiltration techniques, the soakage rates are low and there is a high risk of groundwater being close to the surface which could saturate the storage zone even if upper level porous pavement techniques were to be utilised. A positive piped drainage system to the watercourse is considered to be the most sustainable and reliable solution.
- 4.1.3 The proposed development will result in an increase in hard surface and roof area on the site of around 880m².
- 4.1.4 The system will require an outfall that is restricted to mimic the Greenfield run-off rate with storage upstream. It is proposed that the flow control device restricts the discharge to a minimum of 5l/s, in accordance with the DEFRA recommendations (minimum practical, whilst maintaining reliability). The outfall will need to be agreed under a Land Drainage Consent application.
- 4.1.5 Surface water storage will be provided on the site using either tanks formed with cellular blocks or using the voids available in the sub base of a porous paving construction. Preliminary calculations show that for a 1 in 100 year +40% critical storm, restricted to 5l/s, a storage volume of the order of 39m³ is required.
- 4.1.6 The proposed surface water drainage system is shown on drawing **2015/D1042/SK300**, included in this report.
- 4.1.7 All existing watercourses within the confines of the site will be maintained as open ditch.
- 4.1.8 The existing culvert crossing the site will be diverted to the existing watercourse adjacent the west boundary. The watercourse profile will be nominally widened to compensate the through flow and storage volume.

4.2 Climate Change

- 4.2.1 NPPF Table sets out percentage increases to be applied to peak rainfall intensity to allow for the effects of climate change over the design life of a development.



- 4.2.2 In designing the proposed storage volume, an increase in peak rainfall intensity of 30% has been applied.

4.3 Exceedance

- 4.3.1 Whilst the proposed drainage system has been designed to accommodate a significant rainfall event, it is possible that the design parameters could be exceeded during an extreme event.
- 4.3.2 Should this occur, overland flows are likely but due to the nature of the development, they will remain unchanged from the current situation (ground levels on the site will generally remain unchanged).
- 4.3.3 The surface water drainage system has been designed to ensure that there is no increase in flow from the site on to adjacent land or to existing drainage networks.

4.4 Foul Water

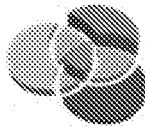
- 4.4.1 It is proposed to connect the foul drainage from the development to the existing public foul sewer within Lake Lane.
- 4.4.2 Based on the residential design guidance provided in Sewers for Adoption, the proposed foul flow will be in the region of 0.19l/s.
- 4.4.3 The proposed foul drainage layout is shown on drawing **2015/D1042/SK300** and follows the requirements of Sewers for Adoption 7th Edition.

4.5 Maintenance

- 4.5.1 Maintenance plays an important part in the long term performance of a surface water drainage system and will be required to ensure that it remains fully operational.
- 4.5.2 The traditional parts (inspection chambers, pipes, gullies etc) of the proposed surface water drainage system will need a minimal amount of maintenance similar to other traditional systems.
- 4.5.3 The SUDS devices will require slightly more maintenance focusing on reducing the amount of silt that is allowed to enter the system. For the cellular storage tanks this will involve ensuring that upstream catchpits and gully sumps are regularly emptied of silt.
- 4.5.4 It is important to ensure that the porous paved areas are properly maintained in accordance with the manufacturers recommendations which may include:



- Periodic surface sweeping to reduce silt and debris accumulation.
- Periodic silt removal from porous paved construction.
- Redressing the joints on the block paved surface as required.



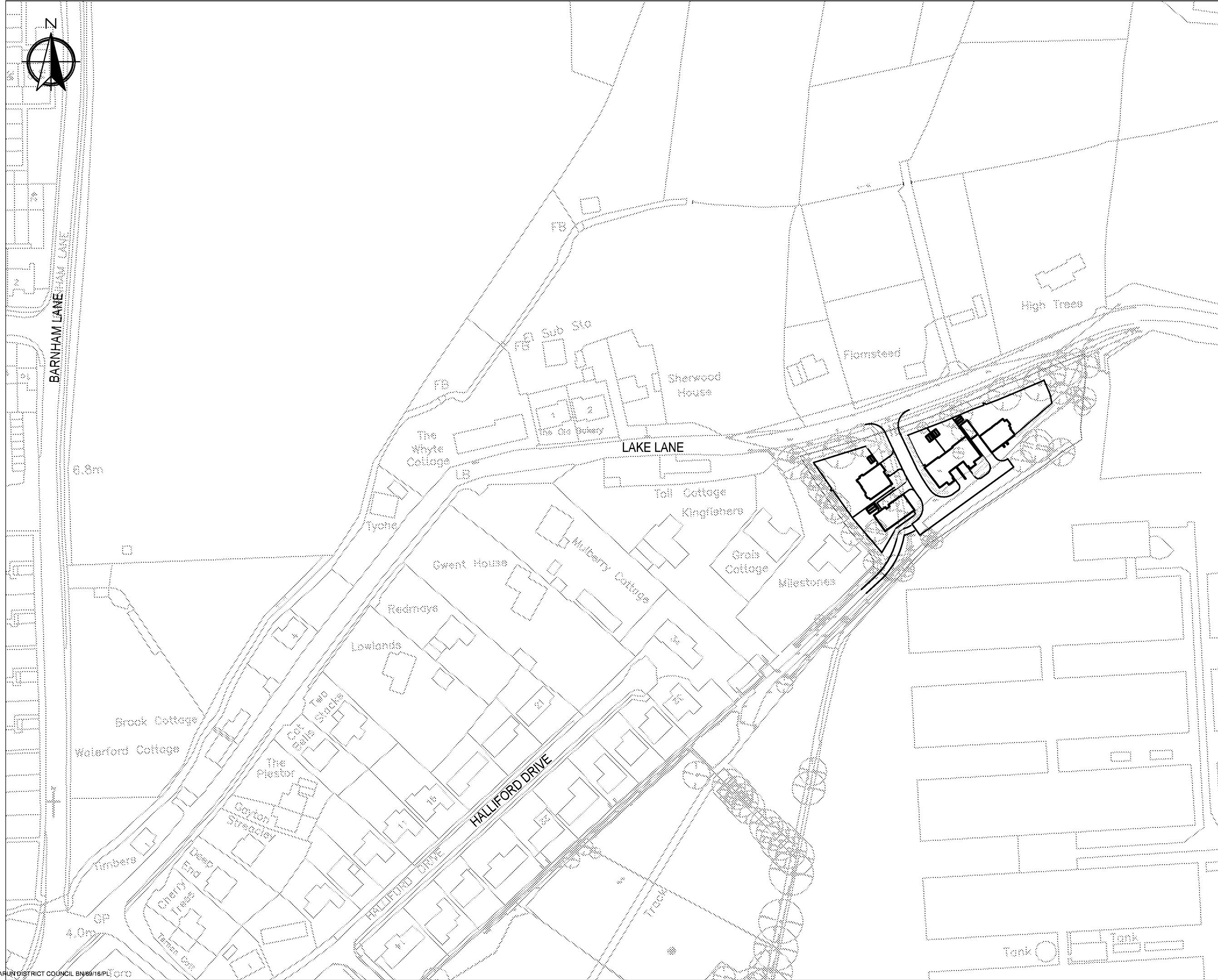
5 SUMMARY

- 5.1.1 This surface water drainage strategy considers the requirements of Arun District Councils planning guidance document “Supplementary Requirements for Surface Water Drainage Proposals”.
- 5.1.2 Reference has been made to the Local Authorities Strategic Flood Risk Assessment, Environment Agency's Flood Maps for Planning, Public Sewer Maps, local authority enquiry data, historic geotechnical testing and a Topographic Survey.
- 5.1.3 The site is currently greenfield.
- 5.1.4 The site is approximately 0.38Ha in size and it lies between 7.8m and 8.8m AOD. The pre-development impermeable area is 0.101Ha.
- 5.1.5 The site is located in Environment Agency Zone 1.
- 5.1.6 There is no formal drainage within the confines of the site and run-off believed to discharge to an existing watercourses adjacent the north and west boundaries. The culvert diversion and new outfall to the watercourse will require a Land Drainage Consent application.
- 5.1.7 Although a formal flood risk assessment is not required to support a planning application due to the size of the site and its proximity to Environment Agency flood zones, a brief assessment has been undertaken which concludes that flood risk is low.
- 5.1.8 The proposed development will result in a significant increase in impermeable area which is mitigated by utilising SUDS techniques where possible.
- 5.1.9 The proposed drainage system will be designed to cater for a 1 in 100 year critical storm event including a 40% increase in peak rainfall intensity, to cater for the effects of climate change.
- 5.1.10 The nature of the development will ensure that overflow land flows during exceedance event will remain unchanged.
- 5.1.11 This surface water drainage strategy shows that the development can be implemented without increasing flows on to adjacent land or to existing surface water drainage systems, ensuring that flood risk is not increased.



PLANS and DRAWINGS

2015/D1042/SK100 – Site Location Plan
2015/D1042/SK101 – Existing Topography & Contours
2015/D1042/SK200 – Impermeable Area Comparison
2015/D1042/SK300 – Proposed Drainage Strategy



NOTES

A3

1

This drawing is to be read in conjunction with all other RGP drawings, and with all relevant Architect's and Engineer's drawings and specification. Any discrepancies found are to be reported immediately to the Engineer.

2

RGP accepts no responsibility for inaccuracies in data provided by third parties such as topographic surveys or Ordnance Survey mapping.

3

Do not scale, work to figured dimensions only. All dimensions are in millimeters unless noted otherwise and all levels are in metres from the topographic survey datum.

4

Any information given regarding existing underground services is given in good faith after consultation with the relevant authority, however accuracy is not certain.

B
A

21.11.2016
06.10.2015

Layout GA updated
Layout GA updated

RAA
MJA

Rev.

Date

Amendments

Drawn

rgp

Design

Transport Planning and Infrastructure Design Consultants
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Tel: 01243 210418 Fax: 01483 861682 www.rgp.co.uk

Client

Seaward Properties Limited

Project

Land East of Toll Cottage, Lake Lane,
Barnham, West Sussex, PO22 0AD

Drawing Title

Drainage Strategy
Site Location Plan

Scale

1:1250

Drawn By

MJA

Checked By

LDF

Approved By

LDF

Date

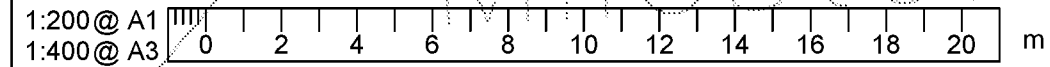
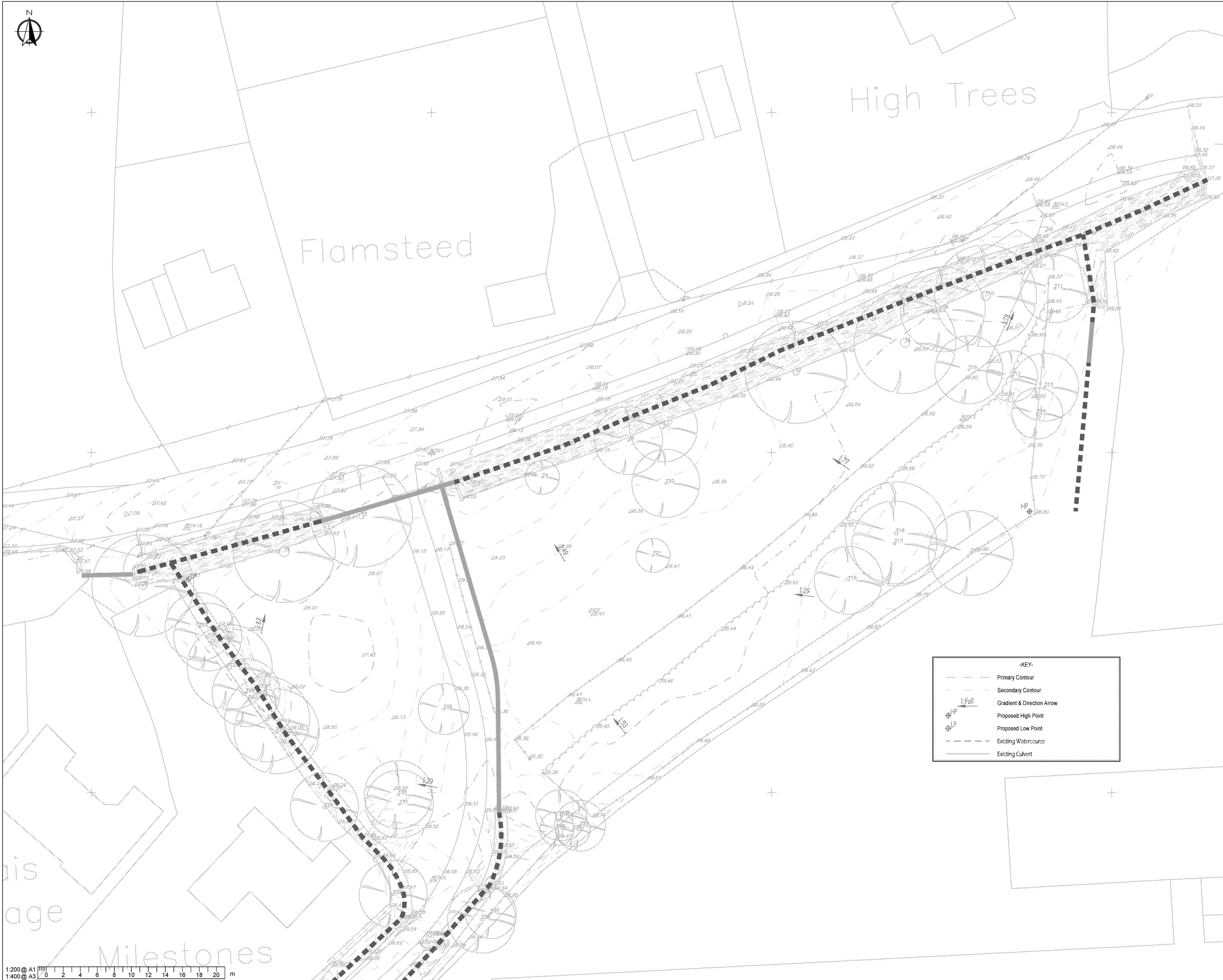
25/09/2015

Drawing No.

2015-D1042-SK100

Rev.

B



1. This drawing is to be read in conjunction with all other RGP drawings, and with all relevant Architect's and Engineer's drawings and specification. Any discrepancies found are to be reported immediately to the Engineer.
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B	21/11/2016	Titleblock updated	RAA	MJA
A	06/10/2015	Layout GA updated	MJA	LDF
Rev.	Date	Amendments	Drawn	Appr.

rgp Design

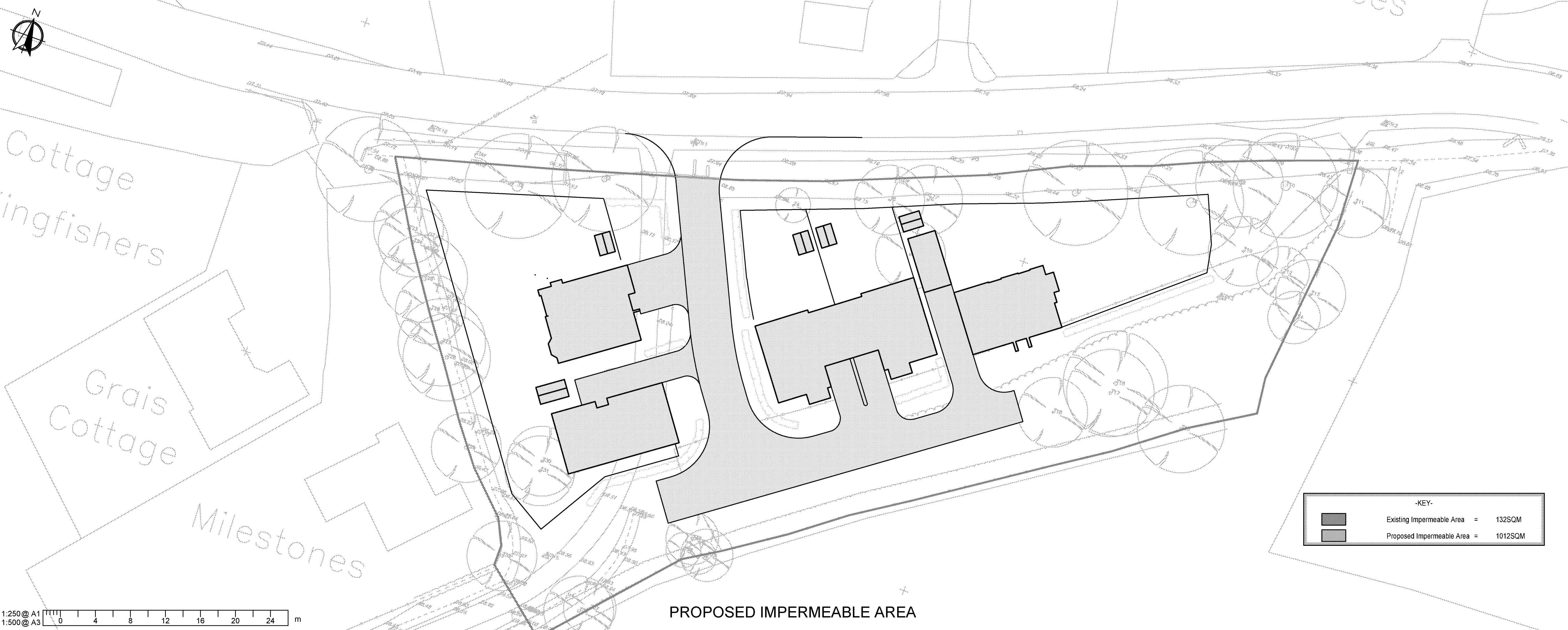
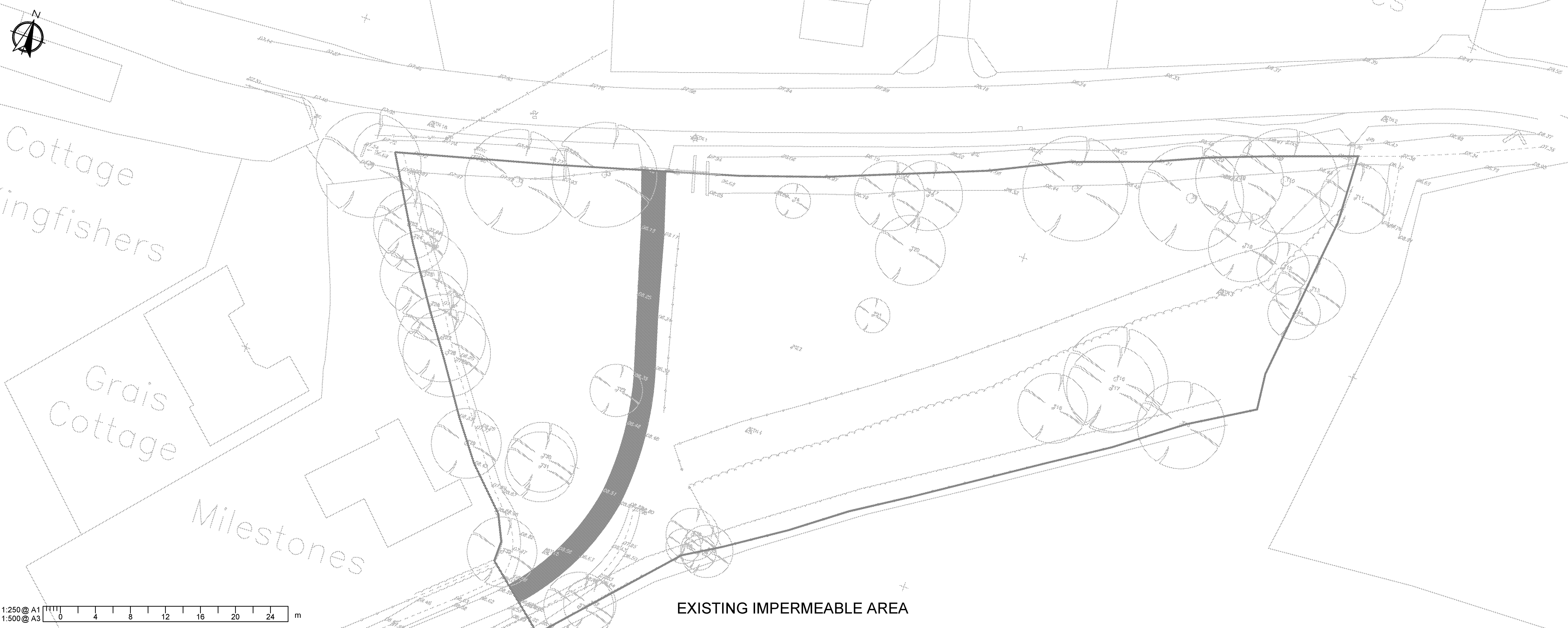
Transport Planning and Infrastructure Design Consultants
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Client
Seaward Properties Ltd

Project
Land East of Toll Cottage, Lake Lane,
Barnham, West Sussex, PO22 0AD

Drawing Title
Drainage Strategy
Topographical Survey and Contours

Scale	1:200	Drawn By	MJA	Checked By	LDF	Approved By	LDF
Date	25/09/2015	Drawing No.	2015-D1042-SK101	Rev.	B		



NOTES

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B

21/11/2016

Titleblock updated

RAA

MJA

A

06/10/2015

Layout GA updated

MJA

LDF

Rev

Date

Amendments

Drawn

Appr

rgp

Design

Transport Planning and Infrastructure Design Consultants

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Tel: 01243 410418 Fax: 01483 861682 www.rgp.co.uk

Client

Seaward Properties Ltd

Project

Land East of Toll Cottage, Lake Lane, Barnham, West Sussex, PO22 0AD

Drawing Title

Drainage Strategy
Impermeable Area Comparison

Scale

1:250

Drawn By

MJA

Checked By

LDF

Approved By

LDF

Date

25/09/2015

Drawing No.

2015-D1042-SK101

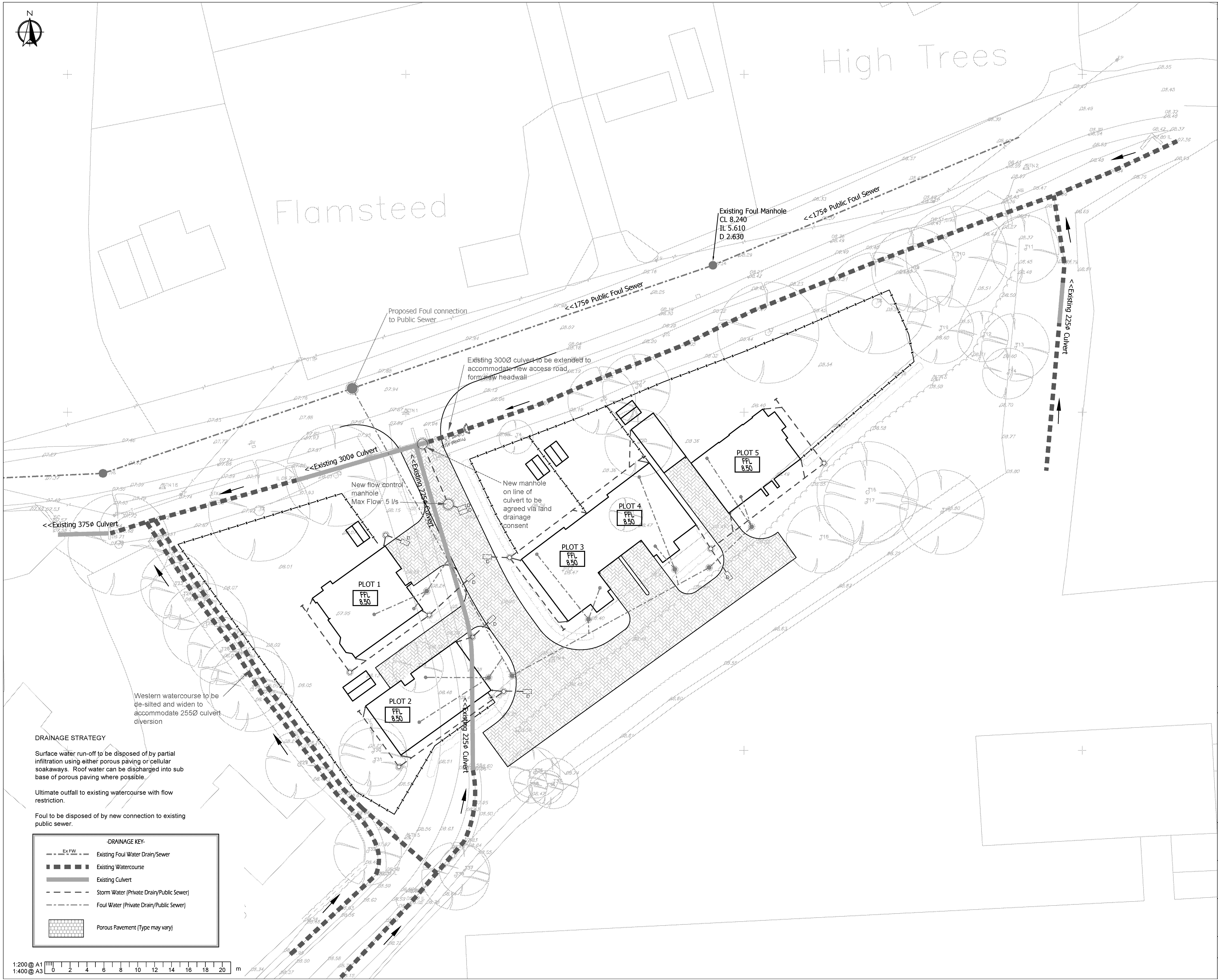
Rev.

B

ARUN DISTRICT COUNCIL TNSP/15P/



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DRAINAGE STRATEGY

Surface water run-off to be disposed of by partial infiltration using either porous paving or cellular soakaways. Roof water can be discharged into sub base of porous paving where possible.

Ultimate outfall to existing watercourse with flow restriction.

Foul to be disposed of by new connection to existing public sewer.

-DRAINAGE KEY-

- Ex FW Existing Foul Water Drain/Sewer
- Existing Watercourse
- Existing Culvert
- Storm Water (Private Drain/Public Sewer)
- Foul Water (Private Drain/Public Sewer)

Porous Pavement (Type may vary)

1:200 @ A1
1:400 @ A3
0 2 4 6 8 10 12 14 16 18 20 m

B	21/11/2016	Layout GA updated	RAA	MJA
A	06/10/2015	Layout GA updated	MJA	LDF
Rev.	Date	Amendments	Drawn	Appr.



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Client
Seaward Properties Ltd

Project
Land East of Toll Cottage, Lake Lane,
Barnham, West Sussex, PO22 0AD

Drawing Title
Drainage Strategy
Foul and Surface Water Proposals

Scale	1:250	Drawn By	MJA	Checked By	LDF	Approved By	LDF
Date	25/09/2015	Drawing No.	2015-D1042-SK300	Rev.	B		



GEOTECHINICAL INVESTIGATION

Extracts from Robert Clark Associates Ltd Report 1329-R7 Apr 2011

6. Flooding History

- 6.1 There are no recorded instances of flooding at the site, although Barnham itself has a long history of both foul and surface water flooding. Predominantly sandy ground conditions, as described below, combined with high groundwater levels, results in extensive 'running sand' throughout Barnham and surrounding villages. This can cause sewers and drains to become disturbed, joints to open and infiltration to occur.
- 6.2 Much work has been carried out by the Environment Agency and Southern Water in recent years to improve both the land drainage and sewerage systems and work is ongoing to improve the situation further.

7. Ground Conditions

- 7.1 The geology at the site is complex, being situated on two varieties of superficial deposits: Raised Beach Deposits composed of sand and gravel and River Terrace Deposits composed of sand, silt and clay. Both are classified as secondary aquifers. The superficial deposits overlie London Clay that is classified as unproductive strata. However, the clay overlies the Lambeth Group that is classified as a secondary aquifer and Undifferentiated Chalk that is classified as a principal aquifer. The Lambeth Group and the chalk, both outcrop some 500 metres to the south.
- 7.2 In October 2006, four trial pits were excavated on site and percolation testing to BRE 365 carried out. Ground conditions were found to comprise fine clayey sand overlain by 0.6 – 0.8m of silty clay with up to 0.3m of topsoil. Only one test in each open pit was possible due to sudden collapse of the sides of the excavations within the sand layer. However, 100mm diameter perforated standpipes were installed in each pit with a shingle surround and a second test carried out after backfilling. The average soil infiltration rate was very low at 2.0×10^{-6} metres/second. The full test results are provided at Appendix 4.
- 7.3 We inspected the site at the end of February 2010 after a prolonged period of wet weather and found groundwater at all the monitoring points to be between 100 and 150mm below the surface. Shallow percolation tests for permeable pavement design were thus determined to be of little assistance.

8. Surface Water Drainage Strategy

- 8.1 There are no public surface water sewers in the immediate area and flows from existing developments drain to the Barnham Rife via private surface water sewers.

- 8.2 From the soil testing and groundwater monitoring described above, it will not be possible to design any form of surface water drainage system for the new development that relies on soakage alone. As the water table can be very close to the surface, open ponds, swales and the like are unlikely to be feasible, since they will be full of water and have no available capacity in the winter months. A positive piped drainage system is currently considered to be the only suitable system, although detailed design may show that some SuDS features can usefully be incorporated into the scheme. See Drawing No. 1329/F3.1C in Appendix 7 for the Drainage Layout Plan
- 8.3 The system will require a storage/ soakage structure with an outfall that is restricted to mimic the present greenfield run-off rate, which has been calculated using ICP SuDS at 32.1 litres/ second for the main site and 2.2 litres/ second for the northern area on a 1 in 100 year storm with no addition for climate change.
- 8.4 There are two options for the storage/ soakage structures:
- (1) They could be provided as geocellular soakaways with low level controlled outlets and would thereby have dual functions:
 - They would serve as storage/ control structures for rainfall
 - They would act as land drainage features and assist in managing groundwater levels

Due to the high groundwater levels, the outlet from the tanks will need to be at low level to ensure that the tanks are empty at the start of a rainfall event. Under dry conditions, it is not expected that the outfalls will show much groundwater flow, as the soil is not very permeable – see paragraph 7.2 and Appendix 4. Over time, however, there would be a local reduction in groundwater levels which would improve surface conditions to the benefit of the site.
 - (2) The alternative use of sealed tanks would be possible but they would not provide the land drainage benefits discussed above and hydrostatic forces would need to be given due consideration to prevent instability and collapse. The option is perfectly feasible, however, and The Environment Agency is known to prefer this – see Appendix 8 for their letter dated 30 June 2010.
- 8.5 The tanks shown are illustrative as to how such a surface water drainage system could be provided. Detailed design may show that several smaller units, possibly combined with some oversized pipework through the network, could provide a more effective solution.
- 8.6 The existing outfalls from the site are at too high a level to allow connections to be made from the new on-site system. Re-laying the outfalls would be impractical since they pass through private lands and whilst the site has a right of drainage, ownership of the pipes is

Robert Clark Associates Ltd

Percolation testing at Land off Barn Rise, Barnham

Results from insitu testing carried out 28 - 31 October 2006

Results are in metres/second

Test No.	TP 1	TP 2	TP 3	TP 4	Average
1	1.24×10^{-6}	4.51×10^{-6}	1.75×10^{-6}	-	2.50×10^{-6}
2	6.08×10^{-7}	2.17×10^{-6}	-	-	1.39×10^{-6}
Av.	9.24×10^{-7}	3.34×10^{-6}	1.75×10^{-6}	-	2.00×10^{-6}

Notes

Test 1 was carried out in open trench and complied strictly with BRE 365

Test 2 was carried out within the standpipe after backfilling of the test pits

The water level in Test Pit 3 rose during Test 2

Groundwater levels in Test Pit 4 were too high to enable tests to be carried out



LOCAL AUTHORITY ENQUIRY DATA

Arun DC Response dated 15-09-18

WSCC Response dated 15-09-17

Mark Akmenkalns

From: Kevin Macknay [REDACTED]
Sent: 17 September 2015 10:28
To: Mark Akmenkalns
Subject: RE: D1042 - Lake Lane, Barnham - Pre App - Drainage Enquiry
Attachments: Barnham, Lake Lane_uFMfSW 1in30 and 1in100 event.pdf; Barnham, Lake Lane.docx

Mark,

Please find attached our comments re the above development.

Regards,

Kevin

Kevin Macknay
Flood Risk Management - Team Lead
Residents' Services - Highways and Transport
West Sussex County Council

 CALL  IM  EMAIL

Location: Western Area Office, Drayton Depot, Drayton Lane, Nr Chichester, West Sussex, PO20 2AJ
Contact: Internal: 26429 | External: +44 (0)330 222 6429 | Mobile: +44 (0)7540 641819 | E-mail: kevin.macknay@westsussex.gov.uk

 Did you know you can follow West Sussex Highways on Twitter? [REDACTED]

We've launched our new website www.westsussex.gov.uk

From: Mark Akmenkalns [REDACTED]
Sent: 16 September 2015 09:21
To: Paul Cann; Kevin Macknay
Subject: FW: D1042 - Lake Lane, Barnham - Pre App - Drainage Enquiry

Paul/Kevin,

Have you had the opportunity to review this site data as yet?

Regards,

Mark Akmenkalns
RGP Design Ltd - Transport Planning and Infrastructure Design Consultants



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**WEST SUSSEX COUNTY COUNCIL
FLOOD RISK MANAGEMENT CONSULTATION**

DATE: 17 September 2015

FROM: Kevin Macknay

**TO: RGP Design Ltd
FAO: Mark Akmenkalns**

SUBJECT: Lake Lane, Barnham.

West Sussex County Council (WSCC), in its capacity as the Lead Local Flood Authority (LLFA), has been consulted on the above proposed development in respect of surface water drainage.

The following is the detailed comments of the LLFA relating to surface water drainage and flood risk for the proposed development and any associated observations, advice and conditions.

Current surface water flood risk based on uFMfSW for 30year and 100year events:	Low risk.
Comments: Current uFMfSW mapping shows the site to be at 'Low' risk from surface water flooding. Some areas of the site are shown to be at risk from surface water flooding due to local topography across the site. Any existing surface water flow paths across the site must be maintained. Reason: NPPF paragraph 103 states – 'When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere..' Therefore, a wholesale site level rise via the spreading of excavated material should be avoided. Any excavated material kept on site should be located in areas designed and designated for that purpose.	

Current ground water flood risk based on ESI Ground Water mapping:	Moderate to High risk / High susceptibility.
Comments: The proposed development is shown to be at 'Moderate to High risk' from ground water flooding based on the current ESI maps. Based on the same mapping the current geology is shown to have 'High susceptibility' to ground water flooding. This means the general geology in the area may be suitable for infiltration / soakaways. However, it should be noted that this suitability to infiltration may also make the area susceptible to ground water flooding. Where the intention is to dispose of surface water via infiltration / soakaway, these should be shown to work through an appropriate assessment carried out under BRE Digest 365. Ground water contamination and Source Protection Zones. The potential for ground water contamination within a source protection zone has not been considered by the LLFA. The LPA should consult with the EA if this is considered as risk.	

Is the proposed development is within or close to an existing Flood Zone, as defined by the National Planning Policy Framework (NPPF):	Yes.
Comments: The proposed development is with 100m of Flood Zone 2, as defined by the National Planning Policy Framework (NPPF).	

Records of any ordinary watercourses or culverted watercourses within or in close vicinity to the site:	No.
Comments: Current Ordnance Survey mapping does not show an ordinary watercourse running within or in close vicinity to the proposed development. Local or field boundary ditches, not shown on Ordnance Survey mapping, may exists around and across the site. If present these should be maintained and highlighted on future development plans. No development should take place within 5m of any watercourse. Future maintenance and access of local field boundary ditches must be considered during the design and planning process.	

Records of any historic ordinary watercourses shown to have once crossed or been in close vicinity to the site:	Yes.
Comments: Historic ordnance survey mapping does show that an ordinary watercourse once ran across the front of the site. It is believed that this watercourse has been piped and now forms the adjacent highway drain along the front of the site.	

Records of any historic flooding within the confines of the proposed site:	None.
Comments: We do not have any records of historic flooding within the confines of the proposed site. This should not be taken that this site has never suffered from flooding, only that it has never been reported to the LLFA.	

Records of any historic flooding in close vicinity to the site and/or on the adjacent public highway:	Yes.
Comments: Areas both to the north and west of the proposed development are known to have flooded in the past. Flooding has historically followed the existing watercourse to the north, but has affected the roads to the east i.e. Lake Lane / Barnham Lane is the past too.	

Existing highway drainage in the vicinity to the site:	Yes.
Comments: The adjacent road, Lake Lane, has a positive highway drainage system.	

Future development - Sustainable Drainage Systems (SuDs)

SuDs seek to mimic natural drainage systems and retain water on or near to the site, when rain falls, in contrast to traditional drainage approaches, which tend to pipe water off site as quickly as possible.

SuDs offer significant advantages over conventional piped drainage systems in reducing flood risk by reducing the quantity of surface water run-off from a site and the speed at which it reaches water courses, promoting groundwater recharge, and improving water quality and amenity. The range of SuDs techniques available means that a SuDs approach in some form will be applicable to almost any development.

Government policy set out in paragraph 103 of the NPPF expects LPAs to give priority to the use of SuDs in determining planning applications. Further support for SuDs is set out in chapter 5 of the flood risk Practice Guide.

Approved Document Part H of the Building Regulations 2000 establishes a hierarchy for surface water disposal, which encourages a SuDs approach beginning with infiltration where possible e.g. soakaways or infiltration trenches.

Where SuDs are used, it must be established that these options are feasible, can be adopted and properly maintained and would not lead to any other environmental problems. For example, using soakaways or other infiltration methods on contaminated land carries groundwater pollution risks and may not work in areas with a high water table. Where the intention is to dispose to soakaway, these should be shown to work through an appropriate assessment carried out under BRE Digest 365.

Provision for long-term maintenance should be provided as part of any SuDs scheme submitted to the LPA.

Kevin Macknay
Flood Risk Management Team

Mark Akmenkalns

From: Thomas Callaway [REDACTED]
Sent: 18 September 2015 11:03
To: Mark Akmenkalns
Cc: Paul Cann
Subject: RE: D1042 - Lake Lane, Barnham - Pre App - Drainage Enquiry
Attachments: LD extract.jpg

Mark

- No future drainage improvements that we are aware of, please see the Lidsey SWMP for more information
- No flooding on the site itself that we are aware of
- EA historic flood map shows previous flooding along much of the length of the Barnham Rife where it follows Lake Lane
- WSCC to confirm highway drainage system
- Highest recorded groundwater level on the site on 15/2/11 of 0.18 mbgl
- Area not defended, site generally higher than the highway
- UFMf5W records show possible flooding along the northern boundary for the 1 in 1000 year event, up to depth of 0.9m
- Site levels are unlikely to require engineering and must not increase the risk of flooding on the other side of Lake Lane, where the land naturally falls away

Additional points:

- The new development at Goodacres has a discharge point for a small catchment of the site to the ditch to the south west of your site. This ditch has been cleared for the length of their site boundary and further work is required for the ditch along your site.
- Please note the piped system across the site from this ditch, it may be beneficial to do further work on the ditch on the western boundary and incorporate this system into it, however we would have to be certain that the pipe does discharge to the Lake Lane ditch and not somewhere else.
- The ditches all require an easement for access and maintenance, especially where gardens butt up against them.
- The access crossing may require complete replacement, the condition should be checked and reported back on as there may be a mix of pipes and lack of headwalls etc.

Regards

Tom Callaway

Thomas Callaway | Drainage & Coastal Engineer, Engineering Services, Arun District Council | Location: Second Floor, Arun Civic Centre, Maltrovers Road, Littlehampton, BN17 5LF

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Save the environment - think before you print.

From: Paul Cann
Sent: 14 September 2015 14:44
To: Thomas Callaway
Subject: FW: D1042 - Lake Lane, Barnham - Pre App - Drainage Enquiry

Paul Cann
Senior Engineer (Drainage & Coastal)

Paul Cann | Senior Engineer (Drainage & Coastal), Engineering Services, Arun District Council | Location: Second Floor, Arun Civic Centre, Maitravers Road, Littlehampton, BN17 5LF

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Save the environment - think before you print

From: Mark Akmenkalns [REDACTED]
Sent: 02 September 2015 12:35
To: Paul Cann; [REDACTED]
Subject: D1042 - Lake Lane, Barnham - Pre App - Drainage Enquiry

Paul/Kevin,

We are preparing a drainage strategy for the above site and would be grateful if you could provide us with any relevant information you have as per our drainage checklist below:

- Please confirm if there are any future drainage improvements proposed for this area.
- Please confirm if any drainage studies and/or SWMP have/are being assess for this area.
- Please confirm if you are aware of any historic flooding within the confines of the site.
- Please confirm if you are aware of any historic flooding in close vicinity and/or on the public highway.
- Please confirm if there are any historic culverted watercourses within or in close vicinity to the site. Please provide map records where available.
- Please can you provide any map records denoting the highway drainage network. Is this a piped system or soakaways?
- Please advise if there is any groundwater records.
- Please confirm if any areas are defended or will be defended in the future.
- Please provide plans and depth data from your GIS UFMSW for 30yr, 100yr & 1000yr as applicable.
- Please confirm flood depths relative to OS Datum.
- Please confirm if, should site levels be engineered, would flood compensatory measures be necessary and/or acceptable to the EA/LPA?

Land Drainage Consent

The minor relocation of the vehicular access will dictate the need for an LDC. This appears to be a straight forward pipe extension rather than a full re-construction however we would welcome your thoughts prior to formalising the strategy.

We will be attending site over the next few weeks to complete our initial walkover. Please let me know if you would like to meet us on site.

Regards,

Mark Akmenkaite
RGP Design Ltd - Transport Planning and Infrastructure Design Consultants



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DX 57406 Littlehampton

Arun District Council Residents please remember to complete and return your Household Enquiry Form. Our Elections team can help with any questions. Contact help@arun.gov.uk or 01903 737616. For more information visit www.arun.gov.uk/registration

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MICRODRAINAGE CALCULATIONS

Greenfield Run-off rate (Qbar)

Greenfield Run-off volume

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Metro House Northgate Chichester PO19 1BE		
Date 25/09/2015 12:02 File	Designed by m.akmenkalns Checked by	
XP Solutions		Source Control 2015.1

ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 SAAR (mm) 751 Urban 0.000
Area (ha) 0.380 Soil 0.400 Region Number Region 7

Results 1/s

QBAR Rural 1.4
QBAR Urban 1.4

Q100 years 4.5

Q1 year 1.2
Q30 years 3.2
Q100 years 4.5

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Metro House Northgate Chichester PO19 1BE																												
Date 28/09/2015 15:57 File	Designed by m.akmenkalns Checked by																											
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<u>Greenfield Runoff Volume</u> FSR Data <table> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>Storm Duration (mins)</td> <td>360</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> </tr> <tr> <td>M5-60 (mm)</td> <td>20.000</td> </tr> <tr> <td>Ratio R</td> <td>0.400</td> </tr> <tr> <td>Areal Reduction Factor</td> <td>1.00</td> </tr> <tr> <td>Area (ha)</td> <td>0.160</td> </tr> <tr> <td>SAAR (mm)</td> <td>737</td> </tr> <tr> <td>CWI</td> <td>109.774</td> </tr> <tr> <td>Urban</td> <td>0.000</td> </tr> <tr> <td>SPR</td> <td>37.000</td> </tr> </table> Results <table> <tr> <td>Percentage Runoff (%)</td> <td>37.17</td> </tr> <tr> <td>Greenfield Runoff Volume (m³)</td> <td>37.177</td> </tr> </table>			Return Period (years)	100	Storm Duration (mins)	360	Region	England and Wales	M5-60 (mm)	20.000	Ratio R	0.400	Areal Reduction Factor	1.00	Area (ha)	0.160	SAAR (mm)	737	CWI	109.774	Urban	0.000	SPR	37.000	Percentage Runoff (%)	37.17	Greenfield Runoff Volume (m³)	37.177
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