Greater Norwich Call for Sites Submission Form

FOR OFFICIAL USE ONLY	
Response Number:	0372
Date Received:	

This form is to be filled out by any interested parties who want to promote a site for a specific use or development to be allocated in the Greater Norwich Local Plan.

Only one form should be submitted for each individual site i.e. it is not necessary for a separate form to be completed for each landowner on a single site in multiple ownerships. However, a separate form must be completed for each individual site submitted.

Your completed form should be returned to the Greater Norwich Local Plan team no later than **5pm** on **Friday 8 July 2016.**

By email: callforsites@gnlp.org.uk

Or, if it is not possible submit the form electronically,

By Post to:

Greater Norwich Local Plan Team
PO Box 3466
Norwich
NR7 7NX

The responses received as part of the Greater Norwich Local Plan Call for Sites will be published and made available for public viewing. By submitting this form you are consenting to the details about you and your individual site(s) being stored by Norfolk County Council and shared with Broadland District Council, Norwich City Council and South Norfolk District Council, and that the details of the site will be published for consultation purposes.

Further advice and guidance can be obtained by visiting the Greater Norwich Local Plan website or by contacting the Greater Norwich Local Plan team directly:

Website: www.greaternorwichlocalplan.org.uk
E-mail: callforsites@gnlp.org.uk
Telephone: 01603 306603

1a. Contact Details	
Title	Mr
First Name	Michael
Last Name	Braithwaite
Job Title (where relevant)	Chartered Town Planner
Organisation (where relevant)	Robert Doughty Consultancy Limited
Address	32 High Street Helpringham Sleaford Lincolnshire
Post Code	NG34 0RA
Telephone Number	01529 421646
Email Address	planning@rdc-landplan.co.uk

1b. I am…	
Owner of the site	Parish/Town Council
Developer	Community Group
Land Agent	Local Resident
Planning Consultant ✔	Registered Social Landlord
Other (please specify):	

1c. Client/Landowner Details (if different from question 1a)	
Title	
First Name	
Last Name	
Job Title (where relevant)	
Organisation (where relevant)	
Address	c/o Robert Doughty Consultancy Limited
Post Code	
Telephone Number	
Email Address	

2. Site Details	
Site location / address and post code (please include as an attachment to this response form a location plan of the site on an scaled OS base with the boundaries of the site clearly shown)	Land off High Bungay Road, Loddon.
Grid reference (if known)	
Site area (hectares)	8.54 ha

Site Ownership		
3a. I (or my client)….		
Is the sole owner of the site	Is a part owner of the site	Do have a legal interest in the site
○	○	◉
3b. Please provide the name, address and contact details of the site's landowner(s) and attach copies of all relevant title plans and deeds (if available).		
3c. If the site is in multiple landownerships do all landowners support your proposal for the site?	Yes ◉	No ○
3d. If you answered no to the above question please provide details of why not all of the sites owners support your proposals for the site.		

Current and Historic Land Uses		
4a. Current Land Use (Please describe the site's current land use e.g. agriculture, employment, unused/vacant etc.)		
Vacant agricultural land.		
4b. Has the site been previously developed?	Yes ○	No ◉

4c. Describe any previous uses of the site. (please provide details of any relevant historic planning applications, including application numbers if known)

Agriculture. The site was formally allocated for employment uses in the South Norfolk Local Plan. It was de-allocated in 2015 through the South Norfolk Allocations DPD process.

Proposed Future Uses

5a. Please provide a short description of the development or land use you proposed (if you are proposing a site to be designated as local green space please go directly to question 6)

The site is being promoted for residential uses. The land to the west of the site could be dedicated to the Parish Council for use as public open space.

The southern part of the site is being considered as a site for 60 starter homes across 3.3 ha. This development was subject to a public consultation drop in session on 15 March 2016.

5b. Which of the following use or uses are you proposing?

Market Housing	✔	Business & offices	☐	Recreation & Leisure	☐
Affordable Housing	✔	General industrial	☐	Community Use	✔
Residential Care Home	☐	Storage & distribution	☐	Public Open Space	✔
Gypsy & Traveller Pitches	☐	Tourism	☐	Other (Please Specify) Starter Homes	

5c. Please provide further details of your proposal, including details on number of houses and proposed floorspace of commercial buildings etc.

A development of approximately 130 dwellings across the whole site. (An initial phase of 60 starter homes could be promoted on the southern section of the site.) A Scout Hut and Public Open Space. As indicated on the attached masterplan which was used as the basis for the public consultation.

5d. Please describe any benefits to the Local Area that the development of the site could provide.

- Boost to the local economy as new residents will use local services and shops.
- Tidy up an area which is not used.
- Dedication of open space to eastern boundary of the site.
- Provision of a scout hut.
- Delivery of homes to meet the district's needs.

Local Green Space
If you are proposed a site to be designated as Local Green Space please complete the following questions. These questions do not need to be completed if you are not proposing a site as Local Green Space. Please consult the guidance notes for an explanation of Local Green Space Designations.
6a.Which community would the site serve and how would the designation of the site benefit that community.
6b. Please describe why you consider the site to be of particular local significance e.g. recreational value, tranquillity or richness in wildlife.

Site Features and Constraints
Are there any features of the site or limitations that may constrain development on this site (please give details)?
7a. Site Access: Is there a current means of access to the site from the public highway, does this access need to be improved before development can take place and are there any public rights of way that cross or adjoin the site?
A new site access is proposed. Discussions are underway with Norfolk County Council to agree appropriate access arrangements.
7b. Topography: Are there any slopes or significant changes of in levels that could affect the development of the site?
Eastern half of the site slopes, western half is undulating with 2 flat areas separated by a steep embankment. Topographic survey undertaken to support proposed starter homes scheme.
7c. Ground Conditions: Are ground conditions on the site stable? Are there potential ground contamination issues?
No contamination.
7d. Flood Risk: Is the site liable to river, ground water or surface water flooding and if so what is the nature, source and frequency of the flooding?
The site is Flood Zones 1 and 2, see the attached FRA.
7e. Legal Issues: Is there land in third party ownership, or access rights, which must be acquired to develop the site, do any restrictive covenants exist, are there any existing tenancies?
No

7f. Environmental Issues: Is the site located next to a watercourse or mature woodland, are there any significant trees or hedgerows crossing or bordering the site are there any known features of ecological or geological importance on or adjacent to the site?
A watercourse runs south/north along the western boundary of the site. There are a number of trees within the site area. An ecological report has been prepared and included as part of the submission.
7g. Heritage Issues: Are there any listed buildings, Conservation Areas, Historic Parklands or Schedules Monuments on the site or nearby? If so, how might the site's development affect them?
There is a WW2 Pillbox, which is not scheduled, but it is expected to be retained within the development The Conservation Area and Listed Buildings are some distance to the north.
7h. Neighbouring Uses: What are the neighbouring uses and will either the proposed use or neighbouring uses have any implications?
Residential/Industrial. There is an 'A' road to the south, with agricultural land beyond.
7i. Existing uses and Buildings: are there any existing buildings or uses that need to be relocated before the site can be developed.
No
7j. Other: (please specify):

Utilities			
8a. Which of the following are likely to be readily available to service the site and enable its development? Please provide details where possible.			
	Yes	No	Unsure
Mains water supply	◉	○	○
Mains sewerage	◉	○	○
Electricity supply	◉	○	○
Gas supply	◉	○	○
Public highway	◉	○	○
Broadband internet	◉	○	○

Other (please specify):	

8b. Please provide any further information on the utilities available on the site:

Availability	
9a. Please indicate when the site could be made available for the land use or development proposed.	
Immediately	○
1 to 5 years (by April 2021)	◉
5 - 10 years (between April 2021 and 2026)	○
10 – 15 years (between April 2026 and 2031)	○
15 - 20 years (between April 2031 and 2036)	○

9b. Please give reasons for the answer given above.

A housebuilder is promoting the site. Preliminary public consultation promoting a residential development has already been undertaken. An application could be ready in a matter of months.

Market Interest		
10. Please choose the most appropriate category below to indicate what level of market interest there is/has been in the site. Please include relevant dates in the comments section.		
	Yes	Comments
Site is owned by a developer/promoter	○	
Site is under option to a developer/promoter	◉	A public consultation promoting part of the site has already been undertaken.
Enquiries received	○	

Site is being marketed	○	
None	○	
Not known	○	

Delivery	
11a. Please indicate when you anticipate the proposed development could be begun.	
Up to 5 years (by April 2021)	◉
5 - 10 years (between April 2021 and 2026)	○
10 – 15 years (between April 2026 and 2031)	○
15 - 20 years (between April 2031 and 2036)	○
11b. Once started, how many years do you think it would take to complete the proposed development (if known)?	
Less than 5 years.	

Viability			
12a. You acknowledge that there are likely to be policy requirements and Community Infrastructure Levy (CIL) costs to be met which will be in addition to the other development costs of the site (depending on the type and scale of land use proposed). These requirements are likely to include but are not limited to: Affordable Housing; Sports Pitches & Children's Play Space and Community Infrastructure Levy			☑
	Yes	No	Unsure
12b. Do you know if there are there any abnormal costs that could affect the viability of the site e.g. infrastructure, demolition or ground conditions?	○	◉	○
12c. If there are abnormal costs associated with the site please provide details:			
12d. Do you consider that the site is currently viable for its proposed use taking into account any and all current planning policy and CIL considerations and other abnormal development costs associated with the site?	◉	○	○

12e. Please attach any viability assessment or development appraisal you have undertaken for the site, or any other evidence you consider helps demonstrate the viability of the site.

Other Relevant Information

13. Please use the space below to for additional information or further explanations on any of the topics covered in this form

We attach technical reports commissioned to support the proposed development of the site as follows:

- Flood Risk Assessment and Drainage Surveys
- Transport Assessment
- Ecological Survey
- Noise Report (supplementary noise report contains plan).

Check List			
Your Details		✔	
Site Details (including site location plan)		✔	
Site Ownership		✔	
Current and Historic Land Uses		✔	
Proposed Future Uses		✔	
Local Green Space (Only to be completed for proposed Local Green Space Designations)		✔	
Site Features and Constraints		✔	
Utilities		✔	
Availability		✔	
Market Interest		✔	
Delivery		✔	
Viability		✔	
Other Relevant Information		✔	
Declaration		✔	

14. Declaration

I understand that:

Data Protection and Freedom of Information
The Data Controller of this information under the Data Protection Act 1998 will be Norfolk County Council, which will hold the data on behalf of Broadland District Council, Norwich City Council and South Norfolk District Council. The purposes of collecting this data are:

- To assist in the preparation of the Greater Norwich Local Plan
- To contact you, if necessary, regarding the answers given in your form.
- To evaluate the development potential of the submitted site for the uses proposed within the form.

Disclaimer
The responses received as part of the Greater Norwich Local Plan "Call for Sites" will be published and made available for public viewing. By submitting this form you are consenting to the details about you and your individual sites being stored by Norfolk County Council, and the details being published for consultation purposes. Any information you consider to be confidential is clearly marked in the submitted response form and you have confirmed with the Council(s) in advance that such information can be kept confidential as instructed in the Greater Norwich Local Plan Call for Sites Response Form Guidance Notes.

I agree that the details within this form can be held by Norfolk County Council and that those details can be shared with Broadland District Council, Norwich City Council and South Norfolk District Council for the purposes specified in this declaration.

Name	Date
	7/7/16

THIS DRAWING IS FOR THE PURPOSE OF OBTAINING PLANNING PERMISSION ONLY

CDM NOTE:

The design has been undertaken as far as possible to avoid risks to health and safety or to reduce and control the effects of any unavoidable risks.

Any relevant information identifying risks which are not able to be eliminated will be included within the project Health and Safety file.

Rev.	By	Notes	Date

rdc
Robert Doughty Consultancy
32 High Street, Helpringham
© Sleaford, Lincolnshire NG34 ORA
Tel: 01529 421646
Fax: 01529 421358
Email: admin@rdc-landplan.co.uk
Web: www.rdc-landplan.co.uk

Client: Gin Property		
Project: Loddon		
Drawing title: Masterplan		
Drawing No. 606-11-MP101	Rev.	Drawn WW
Scale 1:1250 @ A3	Date 03/02/16	Checked MB

All measurements should be checked against on site conditions and any discrepancies should be brought to the attention of the Robert Doughty Consultancy.

Ecological Scoping Survey of Land Off High Bungay Road, Loddon, Norfolk.

Client: Larkfleet Homes

September 2015

Hillier Ecology Limited
127 Fletton Avenue, Peterborough, PE2 8BX
Office: 01733 894979 Mobile: 07730 758439
howardwhillier@btinternet.com

Contents

1.0 Summary

1.1 An ecological scoping survey has been carried out on land off High Bungay Road, Loddon, Norfolk; the survey covered the following species; birds *Aves*, Badger *Meles meles*, reptiles, bats *Chiroptera* sp. and flora.

1.2 Six common and widespread species of bird were recorded during the survey.

1.3 There is suitable nesting habitat in the trees and scrub on the site.

1.4 No evidence of badger setts or badgers using the site was recorded during the survey.

1.5 No further badger surveys will be required.

1.6 The habitat assessment did not highlight any areas within the site boundary that are capable of supporting reptiles.

1.7 No further reptile surveys will be required.

1.8 The habitat assessment for roosting bats identified a single tree with potential to support roosting bats.

1.9 If the tree is to be removed further surveys will be required to ascertain whether bats are using the tree to roost.

1.10 Thirty six common and widespread species of plant were recorded during the survey.

1.11 Overall the site is of low ecological value.

2.0 Introduction

2.1 Hillier Ecology Ltd was commissioned by Larkfleet Homes to carry out an ecological scoping survey on land off High Bungay Road, Loddon.

2.2 The survey was carried out to assess the impact the proposed residential development would have on the sites biodiversity.

3.0 Site Details

3.1 The site is located at NGR TM 3236497775 (Appendix 1).

3.2 The site and its surrounds comprise of the following habitats:

- Semi-improved grassland
- Shrubs
- Mature trees
- Dwellings
- Gardens

3.3 The diversity of habitats is sub-optimal for supporting protected species.

3.4 The survey area is shown in the photographs below and (Appendix 2).

Plate 1 Survey Area

Plate 2 Survey Area

Plate 3 Survey Area

Plate 4 Survey Area

4.0 Survey Methodologies

Birds

4.1 An assessment of the sites suitability to support breeding birds has been carried out.

4.2 All birds seen and heard were recorded.

Badgers

4.3 A walkover survey of the site has been carried out to search for the following signs (Harris et al 1989):

- Setts
- Latrines
- Dung
- Badger Hair
- Footprints
- Pathways

4.4 Evidence of badger activity if found was recorded.

Reptiles

4.5 A habitat assessment has been made to assess the sites potential for reptiles.

4.6 A walkover of the site has been carried out to assess if the habitat is suitable to sustain a population of reptiles. The following habitats were looked for:

- Bare Ground
- Variety of Sward Heights
- Natural Refugia
- Basking Areas

Bats Trees

4.7 The survey involved a thorough search of all the trees looking for potential roost sites, which are the following:

- Cracks
- Cavities
- Loose Bark
- Broken Limbs
- Ivy

4.8 A search was made for the following signs:

- Faeces
- Urine staining
- Fur rubbing
- Live bats

4.9 The trees were graded in line with the Bat Conservation Trust Bat Surveys Good Practice Guidelines.

- **Grade 3** – Trees with no potential to support bats.

- **Grade 2** – Trees with no obvious potential, although the tree is of a size and age that elevated surveys may result in cracks or crevices being found; or the tree supports some features which may have limited potential to support bats.

- **Grade 1** – Trees with definite bat potential, supporting fewer suitable features than grade 1* trees or with potential for use by single bats.

- **Grade 1*** - Trees with multiple, highly suitable features capable of supporting larger roosts.

- **Known or confirmed roost.**

Flora

4.10 A walkover the survey area to record plant species was carried out.

5.0 Survey Results

5.1 The surveys were carried out on the following date 20th September 2015.

5.2 The surveys were undertaken in the following weather conditions; sun, light breeze and a temperature of 20.9°c.

Birds

5.3 Six common and widespread species of bird were recorded during the survey.

5.4 A full species list is shown in (Appendix 3).

5.5 There is suitable nesting habitat in the trees and scrub on the site.

Badgers

5.6 The survey did not record any badger setts or evidence of badgers using the site.

Reptiles

5.7 The habitat assessment of the site did not meet the criteria as suitable reptile habitat; comprising in the main of semi-improved grassland.

Bats

5.8 The survey was conducted by Howard Hillier who holds Natural England Bat Survey License Number 2014-2995 CLS-CLS.

5.9 A Willow sp. *Salix sp.* tree located at NGR TM3646197865 was graded as 1; having cracks, broken limbs and loose bark.

Flora

5.10 Thirty six common and widespread plant species were recorded during the survey.

5.11 A full species list is shown in (Appendix 4).

6.0 Conclusions

Birds

6.1 Six species of bird were recorded during the survey; all were common and widespread.

6.2 The trees and shrubs offer suitable nesting habitat for birds.

6.3 Recommendations will be made to install a variety of nest boxes to mitigate the loss of nesting habitat.

Badgers

6.4 No badgers are present on or using the site.

6.5 No further badger surveys will be required.

Reptiles

6.6 The habitat assessment of the site did not meet the criteria as suitable reptile habitat; comprising in the main of semi-improved grassland and lacking in bare ground, natural refugia and basking areas.

6.7 No further reptile surveys will be required.

Bat (Trees)

6.8 The survey identified a grade 1 tree with multiple suitable roosting features.

6.9 If the tree is to be removed further surveys will be necessary to ascertain if bats are using the tree to roost.

Flora

6.10 All species recorded are considered common and widespread.

General

6.11 Overall the site is of low ecological value.

7.0 Recommendations

Birds

7.1 If any of the trees or scrub is to be removed this should be done outside of the bird breeding season (March to September inclusive), where this is not possible then an inspection should be carried out by a suitably qualified ecologist prior to work commencing.

7.2 To mitigate the potential loss of nesting habitat and enhance biodiversity a variety of nest boxes (Appendix 5) should be installed in the development.

Bats

7.3 If the tree identified as having potential to support roosting bats is to be removed, further surveys will be necessary to ascertain if bats are present.

8.0 Legal Protection

Birds

8.1 All bird's nests are protected under the Wildlife and Countryside Act 1981 (as amended), which makes it an offence to intentionally take, damage or destroy the nest of any wild bird while that nest is in use or being built.

Badgers

8.2 The badger receives legal protection under The Protection of Badgers Act 1992.

8.3 The following is a summary of the offences contained in the act. It is a criminal offence to commit any of the following:

- To interfere with a sett by damaging or destroying it.
- To obstruct access to, or any entrance of a badger sett.
- To disturb a badger when it is occupying a sett.

8.4 A badger sett is defined by the legislation as "any structure or place, which displays signs indicating current use by a badger" and this is taken by Natural England to include seasonally used setts.

Reptiles

8.5 The Wildlife and Countryside Act 1981 (as amended) and the Countryside and Rights of Way Act (2000) make it an offence to intentionally or recklessly kill or injure reptiles.

Bats

8.6 The Conservation (Natural Habitats &c.) Regulations 1994 (amended 2010) (the Habitats Regulations) transpose into UK law Council Directive 92/43/EEC of 992 (often referred to as the Habitats Directive). All bats are listed under Annex IV and some (horseshoe bats, Bechstein's and Barbastelle) are also listed under Annex II which relates to Special Areas of Conservation. These Regulations make it an offence to:

- Deliberately capture, injure or kill a bat.
- Deliberately disturb bats in a way as to be likely significantly to affect the ability of any significant groups of bats to survive, breed or rear or nurture their young, or to affect the local distribution of abundance of that species.
- Damage or destroy a breeding site or resting place of a bat.
- Keep, transport, sell or exchange, or offer for sale or exchange a live or dead bat or any part of a bat.

8.7 In addition the Wildlife & Countryside Act 1981 (as amended) makes it an offence to:

Intentionally or recklessly

- Disturb any bat whilst it is occupying a structure or place which it uses for shelter or protection.
- Obstruct access to any structure or place which any bat uses for shelter or protection.

.

8.8 Penalties are fines of up to £5000 per bat and up to 6 months custodial sentence.

9.0 References

Anon. (1998). Herpetofauna Groups of Britain and Ireland. Evaluating Local Mitigation/Translocation Programmes, Froglife, Halesworth, Unpubl.

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Gent T and Gibson S. (2003). Herpetofanua Workers Manual, JNCC, Peterborough.

Harris S, Cresswell P, and Jefferies D (1989). Surveying Badgers, The Mammal Society, London.

Harris S, Jefferies D, Cheeseman C and Booty C 1994. Problems with Badgers. RSPCA. West Sussex.

HMSO (1981). Wildlife and Countryside Act. HMSO, London.

HMSO (1994). Conservation (Natural Habitats, &c.) Regulations. HMSO, London.

HMSO (2000).Countryside and Rights of Way (CRoW) Act. HMSO, London.

Macdonald, D. W, Mace, G & Rushton, S 1998 Proposals for Future Monitoring of British Mammals, DETR, London.

Mitchell-Jones A.J (2004). Bat Mitigation Guidelines, English Nature, Peterborough.

Mitchell-Jones, A. J & McLeish, A. P (1999). The Bat Workers Manual, JNCC, Peterborough.

Preston C.D, Pearman D.A & Dines T.D (2002) New Atlas of the British & Irish Flora, OUP, Oxford.

Appendix 1 Site Location

Based on the Ordnance Survey Map with Permission of the Controller of Her Majesty's Stationary Office Crown Copyright Reserved. Licence No 10045706

Appendix 2 Survey Area

Appendix 3 Species List – Birds

Woodpigeon	Columba palumbus
Carrion Crow	*Corvus corone*
Great Tit	*Parus major*
Magpie	*Pica pica*
Collared Dove	*Streptopelia decaocto*
Blackbird	*Turdus merula*

Appendix 4 Species List – Flora

Achillea millefolium	Yarrow
Arrhenatherum elatius	False Oat-grass
Calystegia sepium	Hedge Bindweed
Cerastium fontanum	Common Mouse-ear
Cirsium arvense	Creeping Thistle
Cirsium vulgare	Spear Thistle
Crataegus monogyna	Hawthorn
Dactylis glomerata	Cock's-foot
Dipsacus fullonum	Wild Teasel
Epilobium hirsutum	Great Willowherb
Fraxinus excelsior	Ash
Galium aparine	Cleavers
Glechoma hederacea	Ground-ivy
Hedera helix	Ivy
Heracleum sphondylium	Hogweed
Hieracium murorum	Hawkweed
Hypericum maculatum	Imperforate St John's-wort
Juncus effusus	Soft-rush
Lamium album	White Dead-nettle
Malus pumila	Apple
Mentha arvensis	Corn Mint
Phragmites australis	Common Reed
Potentilla anserina	Silverweed
Prunus spinosa	Blackthorn
Pulicaria dysenterica	Common Fleabane
Quercus robur	Pedunculate Oak
Ranunculus repens	Creeping Buttercup
Rosa arvensis	Field-rose
Rubus fruticosus	Bramble
Rumex crispus	Curled Dock
Salix fragilis	Crack-willow
Sambucus nigra	Elder
Senecio jacobaea	Common Ragwort
Silene latifolia	White Campion
Sonchus arvensis	Perennial Sow-thistle
Urtica dioica	Common Nettle

Appendix 5 Bird Boxes

Suitable for robins doves

Suitable for starlings, thrushes,

Suitable for blue tit, great tit

Suitable for woodpecker, starling

Suitable for house/tree sparrow

Suitable for wrens

MA10188-FRA-R01

Proposed Residential Development
61 Units, High Bungay Road
Loddon, Norfolk

Flood Risk Assessment

March 2016

millward

- Civil & Structural Engineering
- Environmental & Geotechnical
- Flood Risk & Drainage
- Highways & Infrastructure
- Structural Inspections
- Transportation

INTEGRATED ENGINEERING CONSULTANTS

REVISION

Reference	Revision	Author	Date
MA10188-FRA-R01	Initial Issue for Planning	DMW	09 March 2016

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APPENDICIES

Appendix A – Drawings

- Site Location Plan: MA10188/100
- Architect's Masterplan: 606-11-MP02
- Proposed Drainage Strategy: MA10188/200
- Proposed Sections: MA10188/600-1 and 2

Appendix B – Consultations

- Anglian Water's Pre Development Enquiry Response

Appendix C – South Norfolk SFRA

- Loddon and Chedgrave Flood Probability Zones 1, 2, 3a and 3b, with and without, Climate Change.

Appendix D

- WinDES Network Details
- WinDES Simulation Summary at 30% Climate Change
- WinDES Simulation Summary at 40% Climate Change

1. INTRODUCTION

1.1 Millward have been appointed to undertake a Flood Risk Assessment (FRA) for a proposed, 61 unit, residential development immediately north-east of the junction of the A146 and High Bungay Road, Loddon.

1.2 This FRA is undertaken in accordance with the National Planning Policy Framework and associated Technical Guidance Document, dated March 2012 (NPPF).

1.3 This FRA will provide a qualitative and quantitative assessment of the proposed redevelopments current and future flood risk. The FRA will be undertaken with reference to the sequential and exception tests outlined in the NPPF.

2 THE SITE

2.1 The site is located to the north-east of the junction of the A146 and High Bungay Road, approximately 0.5 kilometres south of Loddon Town Centre. The site location is shown on drawing MA10188/100 provided in Appendix A.

2.2 The site consists of 3.30 hectares (33,000 m^2) of greenfield land stretching approximately 160 m north-south and 300 metres east-west.

2.3 The site is surrounded by a mixture of residential and agricultural land.

2.4 Vehicular access to the site will be via a simple priority junction off High Bungay Road.

2.5 The western half of the site is undulating but has two relatively flat areas separated by a steep embankment. The south-western corner has levels ranging from 11.0-12.25m AOD, whilst in the north western corner levels range from 7.0-8.5m AOD.

2.6 The eastern half of the site falls away steeply, with a gradient of up 1 in 7, towards adjacent flood zones at approximately 4.0m AOD.

2.7 A site visit was undertaken to confirm the site layout and the location and condition of any potential surface water outfalls or watercourses.

2.8 Existing drainage ditches flow approximately 120m from the eastern boundary of the site towards a watercourse.

2.9 Desktop investigations suggest that the site consists of sands and gravels overlaid with 2-3 metres of boulder clay and peat.

3 CONSULTATIONS

3.1 Environment Agency

3.1.1 The Environment Agency's (EA) national flood risk maps, available on their web site, were used to determine which flood zone applies for planning purposes.

3.1.2 The entire residential component of the development will be located within flood zone 1. To the east of the residential development is an area of flood zones 2 and 3. As part of the overall development a scout hall is proposed which will border Flood Zone 1 and 2.

3.1.3 Table 1 of the NPPF Technical Guidance Document defines Zone 1 as land having less than a 1 in 1000 chance (<0.1%) of flooding from rivers or the sea in any one year.

3.1.4 The South Norfolk Strategic Flood Risk Assessment was consulted to confirm and refine the flood zone information and therefore further EA consultation was not undertaken.

3.2 South Norfolk Strategic Flood Risk Assessment

3.2.1 The South Norfolk SFRA concurred with the flood zone information provided by the EA. The relevant map is available in Appendix C.

3.2.2 The boundaries of the flood zones run generally north-south forming concentric bands to the east of the development with the flood risk becoming greater heading east.

3.2.3 The approximate boundaries of the flood zones are also shown on drawing MA10188/200 allowing comparison with the proposed layout of the development. Flood Zone 2 approaches within 3-4 metres of the residential area of the development and overlaps the south-eastern corner of the scout hall. When climate change is considered the boundary of Flood Zone 2 rises to approximately 4.0m AOD meaning that it runs along the boundary of the residential area and fully envelops the scout hall.

3.2.4 Flood Zone 3a with and without climate change projections encroaches on the car park of the scout hall.

3.3 Anglian Water

3.3.1 Anglian Water was consulted, via a pre-development enquiry, considering both surface and foul water discharge options for this site.

3.3.2 Anglian Water's response to the pre-development enquiry, dated 18th September 2015, is provided in Appendix B.

3.3.3 Anglian Water confirms that they have no surface water sewers in the vicinity and are therefore unable to provide the site with a surface water solution.

3.3.4 Anglian Water confirms they have capacity for foul water into manhole 2901 in High Bungay Road (CL: 9.27 AOD, IL: 7.66m AOD). This is adjacent to the sites north-western corner.

3.3.5 The wastewater treatment facility serving this area is the Sisland Water Recycling Centre. Anglian Water confirms that at the time of assessment, this facility has capacity to handle the additional volume resulting from the proposed development.

3.3.6 Consequently, should this site obtain planning approval there will be a used water solution, into the Anglian Water network, without detriment to the existing infrastructure.

4 SEQUENTIAL AND EXCEPTION TESTS

4.1 Sequential Test

4.1.1 The site has been assessed in line with the NPPF technical guidance. The site is confirmed to be within Flood Zone 1 with the north-eastern corner, where the scout hall is to be situated, encroaching Flood Zone 2. This represents a low and moderate risk of flooding respectively, as defined in Table 1 (Flood Zones) of the technical guidance document for the NPPF.

4.1.2 Table 2, (Flood risk vulnerability classification) of the same document confirms that residential development (buildings used for dwelling houses) is classified as 'more vulnerable' development. The entire residential component of the development is to be located within flood zone 1.

4.1.3 Table 3, (Flood risk vulnerability and flood zone 'compatibility') confirms that development classified as 'more vulnerable' development in Flood Zone 1 is considered appropriate.

4.1.4 Table 2 of the NPPF Technical Guidance document classifies scout halls (assembly or leisure) as 'less vulnerable' development. The scout Hall is to be located at the edge of Flood Zone 1 slightly encroaching into Flood Zone 2.

4.1.5 Table 3, (Flood risk vulnerability and flood zone 'compatibility') confirms that development classified as 'less vulnerable' development is considered appropriate within Flood Zones 1, 2 and 3a.

4.1.6 Flood Zone 1 is the next lowest risk zone and therefore the sequential test is passed for the residential component of the development.

4.1.7 The scout hall has been situated in the lowest risk area available within the site, after sequential allocation of the lowest risk land to the 'more vulnerable' residential development. The sequential test is therefore passed for this component of the development, bearing in mind that the 'less vulnerable' development is considered appropriate within Flood Zone 2.

4.1.8 Table 3 of the NPPF Technical Guidance document states that the exception test is not required for the land use allocation outlined above.

5 PROPOSED DEVELOPMENT

5.1 Summary of proposals

5.1.1 The proposed development consists of a scout hall and 61 dwellings with associated garages, gardens, public open space and carriageways and provision of a scout hall. The proposed block plan is shown on drawing 606-11-MP02, contained within Appendix A.

5.1.2 The impermeable areas of the proposed development have been estimated from the site layout to be 1.26 Ha (12,600 m^2) which equates to 38% of the total site area. This is an increase in impermeable area from previous use. Mitigation measures will therefore be necessary to ensure that surface water outfall is maintained at greenfield rates.

5.1.3 Desktop investigations and the South Norfolk District SFRA suggests that the site is underlain by sands and gravels. The SFRA suggests south-eastern Loddon has average infiltration rates and therefore soakaways could be viable.

5.1.4 Discussions with a member of Norfolk County Council's Highways Department indicated that a previous development in south Loddon unsuccessfully implemented soakaways for surface water drainage. Consequently this drainage strategy will not utilise soakaways until their viability is confirmed by an appropriate site investigation. As soakaways would provide a cost effective surface water solution, it is recommended that further site investigation is undertaken before proceeding with the strategy outlined in drawing MA10188/200. Infiltration would potentially reduce the amount of attenuation required and treat the water at source.

5.1.5 The proposed development includes permeable paving for shared drives. Due to the aforementioned uncertainties, infiltration has not been considered and their function will be treatment and attenuation as part of a sealed system with positive outfall.

5.1.6 Foul drainage will connect into the existing foul sewer network at manhole 2901, as advised by Anglian Water in the pre-planning report available in Appendix B. This will be a pumped solution. The development will include an adoptable foul water pumping station in the north east corner of the site.

5.1.7 Finished floor levels of the development are to vary with topography. The eastern edge of the residential area will be elevated to a minimum of 4.60m AOD to provide 600mm freeboard above the Flood Zone 2 with projected climate change. The scout hall will be elevated to 4.0m AOD but will be constructed with flood resilient materials to 300mm above finished floor level. Preliminary levels are shown on drawings MA10188/200 and MA10188/600–1,2 contained within Appendix A.

5.1.8 Drawing MA10188/200 also shows the preliminary foul and surface water drainage strategy for the site discussed in Section 5.2.

5.2 Proposed Drainage Strategy

5.2.1 The preliminary drainage strategy for both foul and surface water is shown in drawing MA10188/200 available in Appendix A. The design is based upon the Masterplan provided by Allison Homes shown in drawing 606-11-MP02 and information obtained from Anglian Water.

5.2.2 The surface water network has been designed to accommodate a 100 year storm event plus a 20% allowance for climate change and further assessed with a 40% allowance for climate change in line with the latest NPPF requirements.

5.2.3 The only feasible surface water outfall is, via the land drains, into the small watercourse to the east of the site.

5.2.4 Discharge into the watercourse will be restricted to the average annual greenfield runoff rate (QBar). This was calculated using ICP SUDS in WinDES to be 9.4 l/s. The surface water drainage strategy, therefore, concentrates on attenuation to restrict the outfall to this rate and provide SUDS treatment trains where viable.

5.2.5 The topographical survey and findings of the site visit, suggest that the land drains have a minimum invert level of circa 2.10m AOD.

5.2.6 Discharge rates into the land drain and therefore the receiving watercourse will be restricted by a vortex flow control device. Temporary storage to facilitate this attenuation will be provided by 3 ponds, an underground tank and throughout the system in the form of 600mm diameter tank sewers. Two additional vortex flow control devices will be included in the system to ensure the attenuation capacity is fully utilised. Tank sewers will be laid with a long fall of 1:500 to achieve maximum functional storage capacity.

5.2.7 Although ponds are the preferred attenuation method for SUDS design, one tank was utilised in the drainage strategy. The tank is situated in an area of public open space with a cover level of 9.0m, AOD but connected to a network of tank sewers with a minimum cover level of 8.0m AOD. A pond would need to have an invert level of 6.80m AOD to utilise its full storage capacity before downstream flooding occurred. The earthworks needed to achieve this would include steep embankments which would significantly limit the functionality of the public open space.

5.2.8 To meet SUDS requirements, two treatment methods have been utilised in the proposed drainage strategy, an online pond and permeable pavements. All roof areas pass through, at a minimum, the one required treatment train. Where possible, carriageways and driveways pass through both treatment trains, but the constraints of meeting road adoption requirements means this is not always possible. If the adopting highway authority are minded to adopt permeable carriageways, the strategy would be able to accommodate this. We are advised that currently the adopting highway authority do not adopt permeable pavements.

5.2.9 It is envisaged that the entire surface water sewer system with the exception of the attenuation ponds and permeable carriageways will be adopted by Anglian Water through an S104 agreement, unless adopted permeable carriageways are allowed.

5.2.10 The attenuation ponds will be maintained by a private management company, to be funded by the residents of the proposed development. This funding will be secured in the property deeds making it legally binding, to ensure it continues through the lifetime of the development.

5.2.11 Preliminary WinDES calculations have been undertaken based upon the surface water drainage strategy shown on drawing MA10188/200 and the results provided in Appendix D.

5.2.12 The proposed foul water system will drain through gravity towards a foul water pumping station in the north east corner of the site. A rising main will connect the pumping station to the existing foul sewage network at manhole 2901 in High Bungay Road. A 5 metre length of gravity sewer will separate the rising main from the existing network.

5.2.13 It is envisaged that the proposed foul sewer network would be adopted in its entirety by Anglian Water through an S104 agreement.

6 FLOOD RISK

6.1 Flooding From Watercourses

6.1.1 The development area has been determined from the national flood risk maps provided by the Environment Agency. The residential component of the developments is to be within Flood Zone 1 (Less than a 1 in 1000 (0.1%) chance of flooding in any one year from fluvial or tidal sources – Low Probability in line with the NPPF) from watercourses.

6.1.2 The scout hall is to be located at the boundary Flood Zone 1, slightly encroaching on Flood Zone 2 (0.1%-1% chance of flooding in any one year). This will give it a moderate of flooding according to the NPPF.

6.1.3 Immediately adjacent to the eastern edge of the residential development is an area of flood zones 2, 3a and 3b. To accommodate the risk of flooding with climate change the ground levels and floor levels will be raised by a minimum of 600mm above the predicted extents of Flood Zone 2 with projected climate change as discussed in section 6.6. This will further minimise the risk of flooding from watercourses.

6.1.4 The risk of flooding to the residential development area from fluvial sources is considered to be **LOW** provided that ground levels are raised in line with this reports recommendation. The risk of flooding to the Scout hall is considered to be **MODERATE.** As discussed in section 4.1 this is an acceptable risk level for this land use when mitigation measures are applied.

6.2 Flooding From Adjacent Land / Developments

6.2.1 High Bungay Road runs along the western boundary of the site falling to the south towards the A146 and will direct any overland flows from the higher south-western Loddon away from the site.

6.2.2 The access road for the site will rise for its first 20 metres, further reducing the risk of water entering the site from High Bungay Road.

6.2.3 Overall the risk of flooding from adjacent land is considered to be **LOW**.

6.3 Flooding From Infrastructure Failure

6.3.1 The site is not located in an area deemed at risk of flooding from reservoirs, according to the mapping provided by the Environment Agency on their website.

6.3.2 As the site is outside the predicted flood extents from any reservoir failure, the risk of flooding from this source is considered **LOW**.

6.4 Flooding From Groundwater

6.4.1 Borehole samples available from the British Geological Survey suggest that groundwater levels are in the 3-4m AOD range. This means that at the eastern boundary of the site they are within 1-2 m of the surface.

6.4.2 The eastern boundary of the site will be elevated by a minimum of 0.6m to provide protection against flooding from the adjacent watercourse; this will also mitigate the risk of flooding from groundwater.

6.4.3 Should groundwater emerge onsite, the topography would ensure that it flowed east into the adjacent floodplain/watercourse before significant depths could accumulate.

6.4.4 Overall the risk of flooding from this source is considered to be **LOW** provided that the ground levels are raised in line with this reports recommendation.

6.5 Flooding From Sewers

6.5.1 The only sewer within the vicinity of the site is a foul water sewer in High Bungay Road, north of the junction with Gunton Road.

6.5.2 Should the sewer become blocked or surcharged the flow route would be either south towards the A146 or north towards Low Bungay Road (depending on which manhole is surcharged) and not into the site.

6.5.3 The risk of flooding from this source is considered to be **LOW**.

6.6 Flooding From Climate Change

6.6.1 The document entitled 'Flood Risk Assessments: Climate Change Allowances' published by the Environment Agency on the 19th of February 2016 was an addendum to the NPPF technical guidance document published in 2013. It provides updated advice on the effects of climate change in England and where applicable supersedes the NPPF Technical Guidance Document.

6.6.2 According to the 2016 addendum, peak rainfall intensity is estimated to increase by 40% due to climate change over the 100 year development lifetime. The 2016 advice is to assess both the central (20%) and upper end (40%) allowances to understand the range of impact.

6.6.3 In line with the 2016 addendum, the drainage strategy was modelled with both 30% and 40% increases in rainfall. The results for both simulations are available in appendix D.

6.6.4 The drainage strategy was designed to be completely free from flooding with a 30% (and therefore 20% by default) increase in peak rainfall intensity. When modelled with a 40% increase in peak rainfall intensity, 40.17m^3 of flooding from the surface water sewer network is predicted by the simulation.

6.6.5 The flooding that is predicted to occur will be along a flat section of carriageway, this will allow it to be contained as shallow flooding of the carriageway within through design of the road surface topography. The area of roadway that will be flooded, will total approximately 740m^2 (as shown on drawing MA10188/200) this represents an average flood depth of 54 mm. Such flooding represents no risk to lives and property and is therefore considered acceptable.

6.6.6 The South Norfolk SFRA provides maps of the predicted flood zones with projected climate change. Whilst the South Norfolk SFRA was published in 2008 and does not utilise the climate change projections outlined in the 2016 addendum it is still the most accurate flood modelling of the proposed development available.

6.6.7 According to the Norfolk SFRA the residential component of the proposed development is still located entirely within Flood Zone 1 when climate change is considered.

6.6.8 The Norfolk SFRA still places the scout hall within Flood Zone 2 when climate change is considered. As discussed within section 4.1, this is sequentially appropriate.

6.6.9 Along the eastern boundary of the site, levels will be raised to 4.60m AOD or 600mm above the extent of Flood Zone 2 with climate change as predicted by the Norfolk SFRA. This will provide a safety margin against flooding, should the effect of climate change exceed the allowance in the SFRA.

6.6.10 Overall the risk of flooding does not increase when climate change is considered and therefore the risk to the development from this source is considered **LOW,** provided that levels are raised in line with this reports recommendation.

6.7 Off-Site Flood Risks

6.7.1 The proposed development of the site will include a comprehensive network of highway gullies, permeable driveways and roof drainage (which will discharge into private permeable areas where possible) to divert surface water into the site drainage infrastructure.

6.7.2 The proposed surface water system for the site has been designed to ensure that surface water discharge is limited to greenfield rates, ensuring that load on downstream drainage, receiving ditches and watercourses is not increased. This has been achieved through attenuation, which has been designed to accommodate a 100 year event plus a 40% allowance for climate change. In the event of an upper end (40%) increase in peak rainfall intensity, surface water flooding will be maintained within the site.

6.7.3 The risk of offsite flooding, resulting from the proposed redevelopment is considered to be **LOW** as the drainage network will be designed to accommodate extreme events without discharging in excess of the existing greenfield rate.

7 MITIGATION MEASURES

7.1 Essential Mitigation Measures

7.1.1 The assessment of flood risk in Section 6, confirms a **LOW** risk of flooding to all residential buildings from all perceived sources.

7.1.2 The scout hall will have a **MODERATE** risk of flooding from fluvial sources when climate change is considered. As discussed in section 4.1 this is an acceptable risk for the building use, as the sequential test has been passed in accordance with NPPF requirements.

7.1.3 The scout hall will have a minimum finished floor level of 4.0m AOD. This will place it at the maximum predicted level of flooding, with climate change up to a 1 in 1000 year event placing it at the lowest end of the **MODERATE** risk band. 300 mm of flood resilient construction should be incorporated above the finished floor level. This should include concrete ground floors with damp resilient flooring such as tiles. Electrical wiring should be at roof level to elevate it above any flooding.

7.1.4 To reduce the risk of flooding from adjacent land, the site access road should be designed rise at a gradient of 1 in 40 for the first 20 metres as it enters the site, preventing any surface water on High Bungay Road entering the site. Furthermore the site roads should be graded to ensure that any surface water that enters the site is directed along the carriageways east towards the watercourse as per pre-development and not across plots.

7.1.5 To ensure that risk levels remain low the drainage strategy and minimum level for dwellings of 4.60m AOD as outlined above and in drawing MA10188/200 and MA10188/600-1-2 should be adopted.

7.2 Recommended Mitigation Measures

7.2.1 All dwellings should be constructed with concrete ground floors, with damp proof membranes (DPM) connected to a damp proof brick course as this is considered the most flood resilient floor type. This would also protect against rising groundwater should this risk increase. The DPM should be laid between the surface screed and the concrete slab to allow the concrete floor to dry quickly.

7.2.2 Where practically possible, finished floor levels of the proposed dwellings should be above the adjacent road level, to minimise the risk of surface water inundation should the onsite sewers flood. Whenever not possible, linear cut off drainage should be situated at entrances to prevent surface runoff entering dwellings.

7.2.3 Permeable paving as outlined in the proposed drainage strategy should be utilised in non-adopted areas, as it provides attenuation and a SUDS treatment train in line with CIRIA C753.

7.2.4 Where external gradients are flat or fall towards the dwelling entrances, linear cut-off drainage should be provided to prevent surface water entering through any doorways.

7.2.5 All foul sewer pipes should be fitted with one way valves at the entrance to dwellings to prevent backing up, should the system become blocked or surcharged.

8 CONCLUSIONS

8.1 This Flood Risk Assessment serves to review, assess and quantify (where applicable) the sources, pathways and recipients of any potential flooding within the vicinity of the proposed redevelopment.

8.2 This assessment determines the risk of flooding to the residential development to be **LOW** from all perceived sources.

8.3 This assessment determines that the risk of flooding to the scout hall is **MODERATE** but that this is an acceptable risk and sequentially acceptable for the land use in line with the NPPF.

8.4 Implementation of the essential mitigation measures outlined in this report will ensure that the risk of flooding remains **LOW** for the 'more vulnerable' residential development and acceptable for the 'less vulnerable' scout hall.

8.5 The recommended mitigation measures will provide further protection and reduce residual risk as far as practicable. It is recommended that planning approval be conditional upon compliance with the recommendations of this FRA.

8.6 Development of the site is not anticipated to increase the risk of flooding to other sites within the locality, provided that the drainage strategy and proposed mitigation measures are properly implemented.

8.7 This assessment concludes that the proposed development does not have an unacceptable risk of flooding, from any source, and is therefore suitable for development.

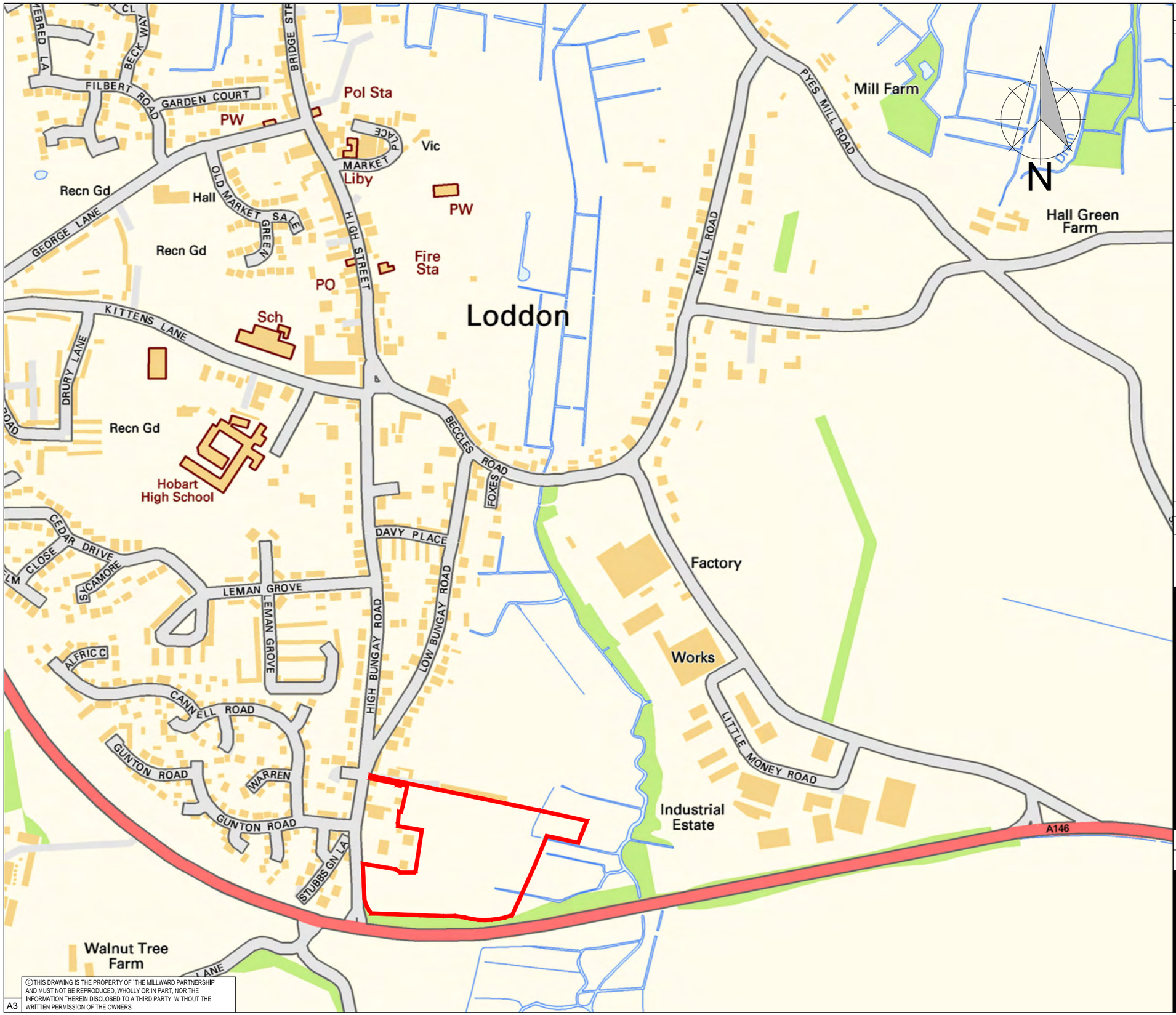
Appendix A – Drawings

Site Location Plan: MA10188/100

Architect's Masterplan: 606-11-MP02

Proposed Drainage Strategy: MA10188/200

Proposed Sections: MA10188/600-1 and 2



A3

ASSOCIATED DRAWINGS

No.	TITLE

NOTES

KEY

Site Boundary

REV	DATE	BY	DETAILS	CHK'D

AMENDMENTS

CLIENT

LarkfleetHomes

PROJECT

High Bungay Road Loddon

TITLE

SITE LOCATION PLAN

DRAWING No:	DRAWING STATUS
MA10188/100	PRELIMINARY

SCALE	DRAWN	ENGINEER
N.T.S.	D M Wilson	D M Wilson
DATE	CHECKED	APPROVED BY
18.12.2015	JMcK	JMcK

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THIS DRAWING IS FOR THE PURPOSE OF OBTAINING PLANNING PERMISSION ONLY

CDM NOTE:

The design has been undertaken as far as possible to avoid risks to health and safety or to reduce and control the effects of any unavoidable risks.

Any relevant information identifying risks which are not able to be eliminated will be included within the project Health and Safety file.

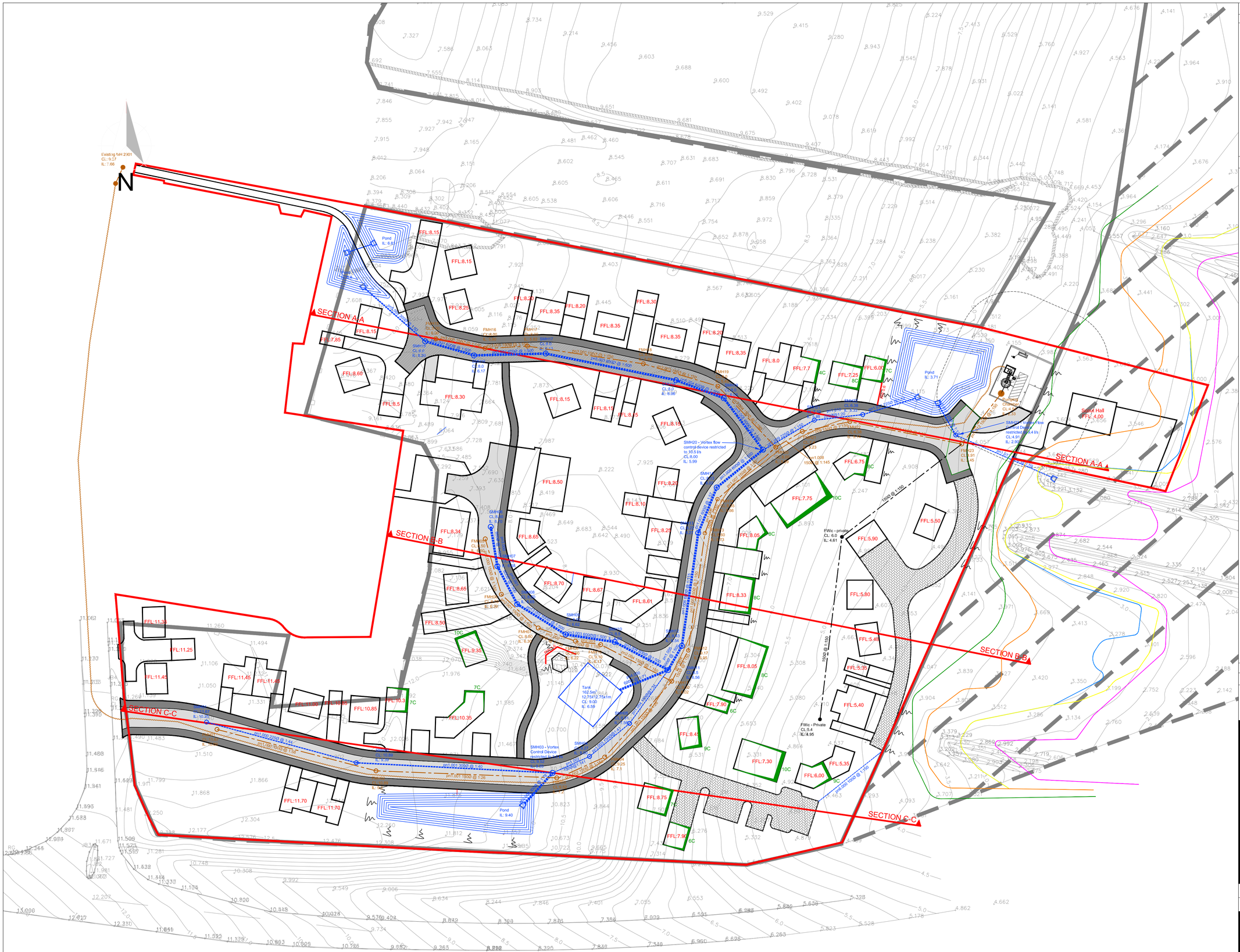
0 10 20 30 40 50m

Rev.	By	Notes	Date

rdc Robert Doughty Consultancy
32 High Street, Helpringham
Sleaford, Lincolnshire NG34 ORA
Tel: 01529 421646
Fax: 01529 421358
Email: admin@rdc-landplan.co.uk
Web: www.rdc-landplan.co.uk

Client: Gin Property		
Project: Loddon		
Drawing title: Masterplan		
Drawing No. 606-11-MP02	Rev.	Drawn WW
Scale 1:1250 @ A3	Date 03/02/16	Checked MB

All measurements should be checked against on site conditions and any discrepancies should be brought to the attention of the Robert Doughty Consultancy.



ASSOCIATED DRAWINGS

No.	TITLE

NOTES

KEY

- Carriageway flooded to 54mm with 40% increase in rainfall due to climate change. Area = 740 m²
- Development Boundary
- Boundary of Flood Zone 2 with climate change
- Boundary of Flood Zone 2 without climate change
- Boundary of Flood Zone 3a with climate change
- Boundary of Flood Zone 3a without climate change
- Boundary of Flood Zone 3b with and without climate change (limited change)

REV	DATE	BY	DETAILS	CHK'D

AMENDMENTS

CLIENT

ALLISON Homes

PROJECT

High Bungay Road
Loddon

TITLE

PRELIMINARY DRAINAGE STRATEGY

DRAWING No:	DRAWING STATUS
MA10188 / 200	PRELIMINARY

SCALE	DRAWN	ENGINEER
1:500 @ A1	D M Wilson	D M Wilson
DATE	CHECKED	APPROVED BY
March 2016	JMcK	JMcK

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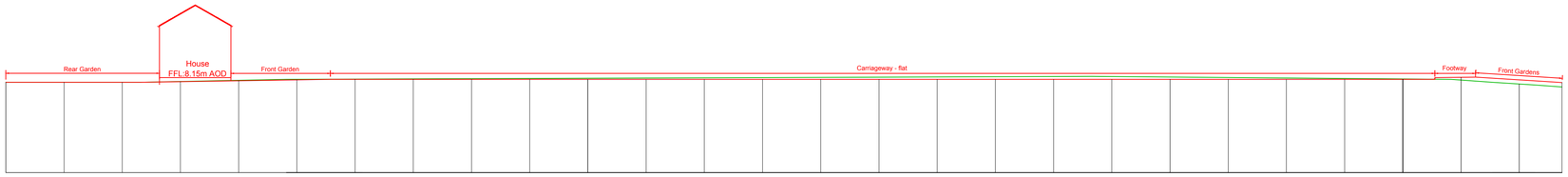
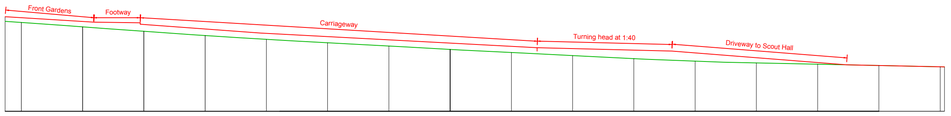
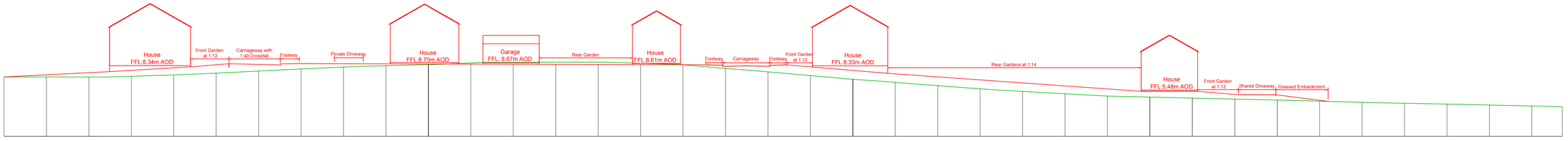
A1



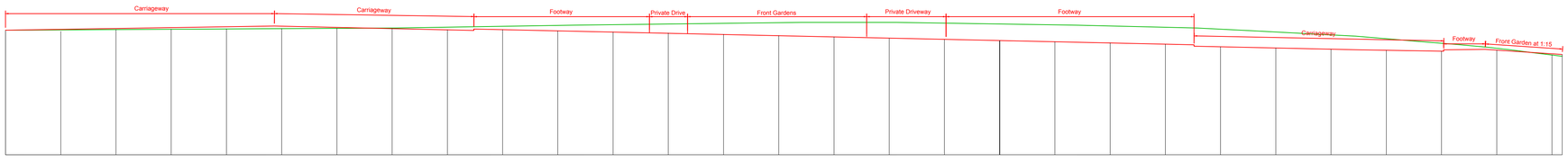
Section A-A



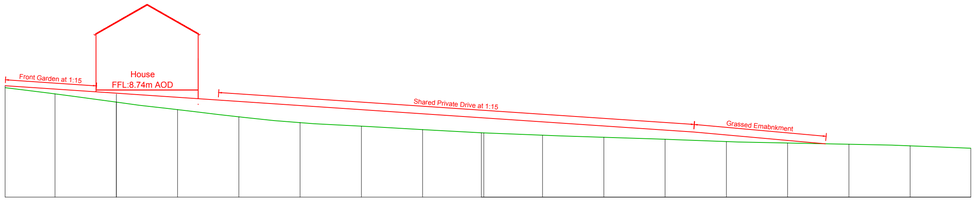
Section A-A Continued



Section B-B



Section C-C



Section C-C Continued

REV	DATE	BY	DETAILS	CHK'D
A1			AMENDMENTS	

NOTES

TITLE: PRELIMINARY SECTIONS SHEET 1 OF 2

PROJECT: High Bungay Road Loddon

CLIENT: ALLISON Homes

DATE	CHECKED	APPROVED BY	SCALE	DRAWN	ENGINEER	DRAWING No:	DRAWING STATUS
March 2016	JMcK	JMcK	1:250 @ A1	D M Wilson	D M Wilson	MA10188 / 600-1	PRELIMINARY

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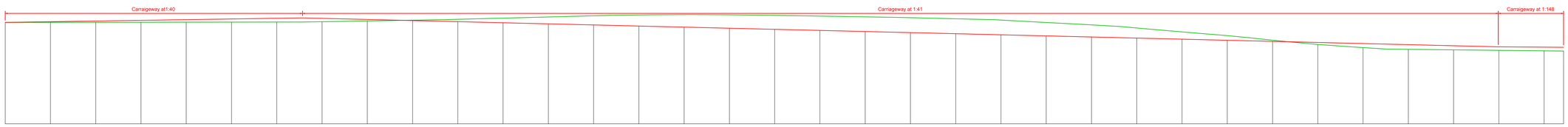
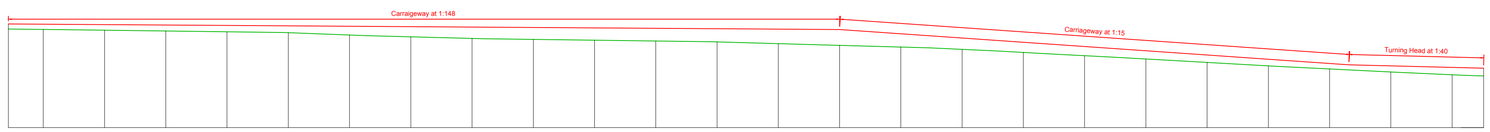


Main Road Centreline Section



Main Road Centreline Section Continued

REV	DATE	BY	DETAILS	CHK'D
A1			AMENDMENTS	

NOTES

TITLE: PRELIMINARY SECTIONS SHEET 2 OF 2

PROJECT: High Bungay Road Loddon

CLIENT: ALLISON Homes

DATE	CHECKED	APPROVED BY	SCALE	DRAWN	ENGINEER	DRAWING No:	DRAWING STATUS
March 2016	JMcK	JMcK	1:250 @ A1	D M Wilson	D M Wilson	MA10188 / 600-2	PRELIMINARY

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Appendix B – Consultations

Anglian Water's Pre Development Enquiry Response

Pre-Planning Assessment Report

High Bingham Road (A146), Loddon

Section 1: Proposed Development

Thank you for submitting a pre-planning enquiry. This has been produced for Millward. Your reference number is **00008498**. If you have any questions upon receipt of this report, please contact Lauren McMahon on 01733 414690 or email planningliaison@anglianwater.co.uk.

The response within this report has been based on the following information which was submitted as part of your application:

List of Planned Developments	
Type of Development	No. Of Units
C3 Dwellings	61

The anticipated residential build rate is:

Year	2015	2016
Build Rate	50	11

- The grid reference for the site is TM3650397809.
- The site currently does not have planning permission and is located on a greenfield site.

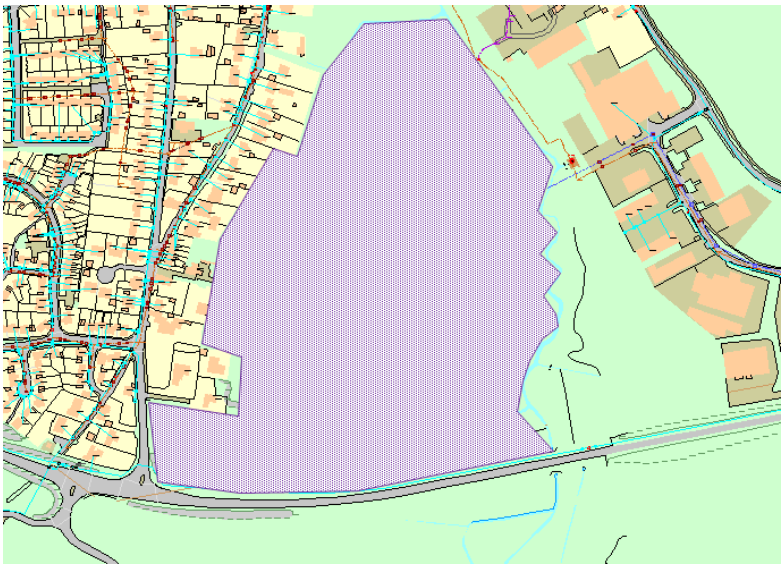

Figure 1: Location of proposed development.

The comments contained within this report relate to the public water mains and sewers indicated on our records. Your attention is drawn to the disclaimer in the useful information section of this report.

Section 2: Assets Affected

Our records indicate that we have the following types of assets within or overlapping the boundary of your development site as listed in the table below.

Additionally, it is highly recommended that you carry out a thorough investigation of your proposed working area to establish whether any unmapped public or private sewers and lateral drains are in existence. We are unable to permit development either over or within the easement strip without our prior consent. The extent of the easement is provided in the table below. Please be aware that the existing water mains/public sewers should be located in highway or open space and not in private gardens. This is to ensure available access for any future maintenance and repair and this should be taken into consideration when planning your site layout.

Water and Used Water Easement Information		
Asset Type	Pipe Size (mm)	Total Easement Required (m)
Public Foul Sewer	100	3.0 m either side of the centre line
Surface Water Sewer	225	3.0 m either side of the centre line
Water Mains	207	3.0 m either side of the centre line

If it is not possible to avoid our assets then the water main/sewer may need to be diverted in accordance with Section 185 of the Water Industry Act (1991). We have a duty to divert our sewerage infrastructure if requested to do so although this would be at your expense. You will need to make a formal application if you would like a diversion to be considered. A copy of the section 185 diversion application form can be found at www.anglianwater.co.uk/developers

Due to the private sewer transfer in October 2011 many newly adopted public used water assets and their history are not indicated on our records. You also need to be aware that your development site may contain private water mains, drains or other assets not shown on our records. These are private assets and not the responsibility of Anglian Water but that of the landowner.

The development site is within the recommended 15 metre cordon sanitaire of a pumping station. This is a significant asset both in itself and in terms of the sewerage infrastructure leading to it. For practical reasons therefore it cannot be easily relocated.

Section 3: Water Recycling Services

In examining the used water system we assess the ability for your site to connect to the public sewerage network without causing a detriment to the operation of the system. We also assess the receiving water recycling centre and determine whether the water recycling centre can cope with the increased flow and influent quality arising from your development.

Water Recycling Centre

The foul drainage from the proposed development is in the catchment of Sisland Water Recycling Centre, which currently has capacity to treat the flows from your development site. Anglian Water cannot reserve capacity and the available capacity at the water recycling centre can be reduced at any time due to growth and due to environmental and regulation driven changes.

Used Water Network

Anglian Water has assessed the impact of gravity flows from the planned developments listed below to the public foul sewerage network. We can confirm that this is acceptable as the foul sewerage system, at present, has available capacity for your site.

The connection point will be to manhole 2901 in High Bungay Road at NGR TM3650397809.

Surface Water Disposal

There are no public surface water sewers within the vicinity of the proposed development. Therefore Anglian Water will be unable to provide the site with a feasible solution of surface water disposal within the current assets. Alternative methods of surface water disposal will need to be investigated such as infiltration techniques or a discharge to a watercourse in accordance with the surface water management hierarchy as outlined in Building Regulations Part H.

The alternative is that a new surface water sewer is constructed which is used to convey your surface water to a watercourse or as part of a SuDs scheme, where appropriate. Subject to the sewer being designed in accordance with the current version of Sewers For Adoption, the sewer can be put forward for adoption by Anglian Water under Section 104 of the Water Industry Act 1991. If the outfall is to a watercourse, the applicant will be required to obtain consent to discharge via the appropriate body.

If your site has no means of drainage due to third party land then you may be able to requisition Anglian Water, under Section 98, to provide a connection to the public sewer

for domestic drainage purposes. As part of this option, you may wish to enter into a works agreement in accordance with Section 30 of the Anglian Water Authority Act 1977. This will allow you to design and construct the public sewer using Anglian Waters' statutory powers in accordance with Section 159/168 of the Water Industry Act 1991.

As you may be aware, Anglian Water will consider the adoption of SuDs provided that they meet the criteria outline in our SuDs adoption manual. This can be found on our website at http://www.anglianwater.co.uk/developers/suds.aspx. We will adopt features located in public open space that are designed and constructed, in conjunction with the Local Authority and Lead Local Flood Authority (LLFA), to the criteria within our SuDs adoption manual. Specifically, developers must be able to demonstrate:

1. Effective upstream source control,
2. Effective exceedance design, and
3. Effective maintenance schedule demonstrating than the assets can be maintained both now and in the future with adequate access.

If you wish to look at the adoption of any SuDs then an expression of interest form can be found on our website at: http://www.anglianwater.co.uk/developers/suds.aspx

Trade Effluent

We note that you do not have any trade effluent requirements. Should this be required in the future you will need our written formal consent. This is in accordance with Section 118 of the Water Industry Act (1991).

Used Water Budget Costs

It has been assumed that the onsite used water network will be provided under a section 104 Water Industry Act application. It is recommended that you also budget for both infrastructure charges and connection costs. The 2015/16 charges are:

Infrastructure Charge	£351.00 per connection

Please note that we offer alternative types of connections depending on your needs and these costs are available in our annual charges booklet, which can be downloaded from www.anglianwater.co.uk/developers/charges.

Section 4: Map of Proposed Connection Points

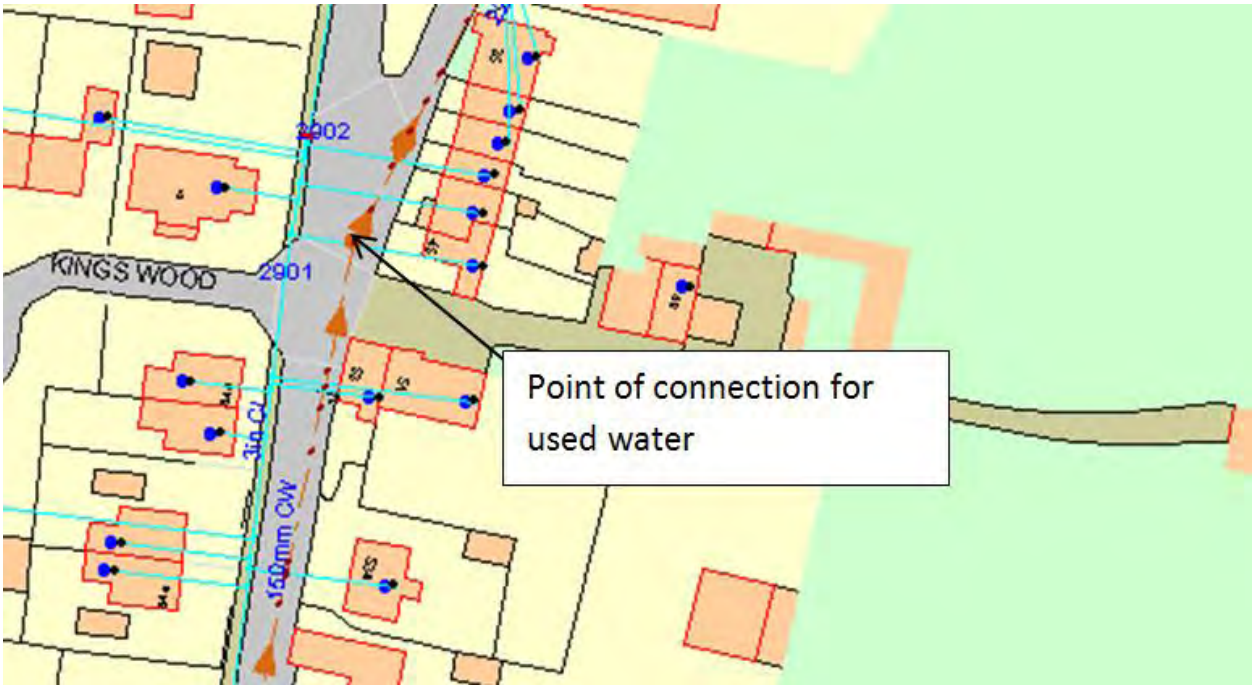

Figure 2: Showing your used water point of connection at manhole 2901 with a Cover Level of 9.27m and an Invert Level of 7.66m.

Water

Water Industry Act – Key Water Sections:

- Section 41: This provides you with the right to requisition a new water main for domestic purposes to connect your site to the public water network.
- Section 45: This provides you with the right to have a connection for domestic purposes from a building or part of a building to the public water main.
- Section 51A: This provides you with the right to provide the water main or service connection yourself and for us to vest them into our company.
- Section 55: This applies where you request a supply of water for non domestic premises.
- Section 185: This provides you with the right to make a reasonable request to have a public water main, sewer or public lateral drain removed or altered, at your expense. Details on how to make an application and the s185 form is available on our website at http://www.anglianwater.co.uk20/developers or via our Developer Services team on 08457 60 66 087.

Details on how you can make a formal application for a new water main, new connection or diversion are available on from our Developer Services team on 08457 60 66 087 or via our website at www.anglianwater.co.uk/developers

If you have any other queries on the rights to requisition or connect your housing to the public water and sewerage infrastructure then please contact our developer services team at: Developer Services, Anglian Water, PO Box 495, Huntingdon, PE29 6YY or Telephone: 0845 60 66 087 or Email: developerservices@anglianwater.co.uk

Water pressure and flow rate: The water pressure and consistency that we must meet for your site is laid out in the Water Industry Act (1991). This states that we must supply a flow rate of 9 litres per minute at a pressure of 10 metres of head to the external stop tap. If your water pressure requirements exceed this then you will need to provide and maintain any booster requirements to the development site.

Self Lay of Water Mains: A list of accredited Self Lay Organisations can be found at www.lloydsregister.co.uk/schemes/WIRS/providers-list.aspx.

Used Water

Water Industry Act – Key Used Water Sections:

- Section 98: This provides you with the right to requisition a new public sewer. The new public sewer can be constructed by Anglian Water on your behalf. Alternatively, you can construct the sewer yourself under section 30 of the Anglian Water Authority Act 1977.

- Section 102: This provides you with the right to have an existing sewerage asset vested by us. It is your responsibility to bring the infrastructure to an adoptable condition ahead of the asset being vested.
- Section 104: This provides you with the right to have a design technically vetted and an agreement reached that will see us adopt your assets following their satisfactory construction and connection to the public sewer.
- Section 106: This provides you with the right to have your constructed sewer connected to the public sewer.
- Section 185: This provides you with the right to have a public sewerage asset diverted.

Details on how to make a formal application for a new sewer, new connection or diversion are available on our website at www.anglianwater.co.uk/developers or via our Developer Services team on 08457 60 66 087.

Sustainable Drainage Systems:
Many existing urban drainage systems can cause problems of flooding, pollution or damage to the environment and are not resilient to climate change in the long term. Therefore our preferred method of surface water disposal is through the use of Sustainable Drainage Systems (SuDS). SuDS are a range of techniques that aim to mimic the way surface water drains in natural systems within urban areas. For more information on SuDS, please visit our website at http://www.anglianwater.co.uk/developers/suds.aspx . We also recommend that you contact the Local Authority and Lead Local Flood Authority (LLFA) for the area to discuss your application.

Private Sewer Transfers: Sewers and lateral drains connected to the public sewer on the 1 July 2011 transferred into Water Company ownership on the 1 October 2011. This follows the implementation of the Floods and Water Management Act (FWMA). This included sewers and lateral drains that were subject to an existing Section 104 Adoption Agreement and those that were not. There were exemptions and the main non-transferable assets were as follows:

- Surface water sewers and lateral drains that did not discharge to the public sewer, e.g. those that discharged to a watercourse.
- Foul sewers and lateral drains that discharged to a privately owned sewage treatment/collection facility.
- Pumping stations and rising mains will transfer between 1 October 2011 and 1 October 2016.

The implementation of Section 42 of the FWMA will ensure that future private sewers will not be created. It is anticipated that all new sewer applications will need to have an approved section 104 application ahead of a section 106 connection.

Encroachment: Anglian Water operates a risk based approach to development encroaching close to our used water infrastructure. We assess the issue of encroachment if you are

planning to build within 400 metres of a water recycling centre or, within 15 metres to 100 metres of a pumping station. We have more information available on our website at http://anglianwater.co.uk/developers/encroachment.aspx

Locating our assets: Maps detailing the location of our water and used water infrastructure including both underground assets and above ground assets such as pumping stations and recycling centres are available from www.digdat.co.uk. All requests from members of the public or non-statutory bodies for maps showing the location of our assets will be subject to an appropriate administrative charge. We have more information on our website at: www.anglianwater.co.uk/developers/our-assets/

Summary of charges: A summary of this year's water and used water connection and infrastructure charges can be found at
http://www.anglianwater.co.uk/developers/charges/

Disclaimer: The information provided within this report is based on the best data currently recorded, recorded within the last 12 months or provided by a third party. The position must be regarded as approximate. If there is further development in the area or for other reasons the position may change.

The accuracy of this report is therefore not guaranteed and does not obviate the need to make additional appropriate searches, inspections and enquiries. You are advised therefore to renew your enquiry should there be a delay in submitting your application for water supply/sewer connection to re-confirm the situation.

Any cost calculations provided within the report are estimated only and may be subject to change.

The responses made in this report are based on the presumption that your proposed development obtains planning permission. Whilst this report has been prepared to help assess the viability of your proposal, it must not be considered in isolation. Anglian Water supports the plan led approach to sustainable development that is set out in the National Planning Policy Framework (NPPF). As a spatial planning statutory consultee, we assist planning authorities in the preparation of a sustainable local plan on the basis of capacity within our water and water recycling (formerly referred to as wastewater) infrastructure. Consequently, any infrastructure needs identified in this report must only be considered in the context of up to date, adopted or emerging local plans. Where local plans are absent, silent or out of date these needs should be considered against the definition of sustainability set out in the NPPF as a whole.

No liability whatsoever including liability for negligence is accepted by Anglian Water Services Limited for any error or inaccuracy or omission including the failure to accurately record or record at all, the location of any water main, discharge pipe, sewer, or drain or disposal main or any item of apparatus.

Appendix C – South Norfolk SFRA

Loddon and Chedgrave Flood Probability Zones 1, 2, 3a and 3b, with and without, Climate Change.

SOUTH NORFOLK COUNCIL

LEGEND

- ZONE 3b INCLUDING CLIMATE CHANGE
- ZONE 3b
- ZONE 3a INCLUDING CLIMATE CHANGE
- ZONE 3a
- ZONE 2 INCLUDING CLIMATE CHANGE
- ZONE 2

NOTE
THESE FLOOD PROBABILITY MAPS ARE INTENDED FOR STRATEGIC PLANNING PURPOSES ONLY AS SET OUT IN PPS25 AND SHOULD BE INTERPRETED WITHIN THE CONTEXT OF PPS25. THE MAPS TAKE ACCOUNT OF EXISTING DEFENCES. ACCURACY IS LIMITED BY THE AVAILABLE BASE DATA AND UNCERTAINTIES INHERENT IN FLOOD ESTIMATION METHODS. ONLY SIGNIFICANT WATERCOURSES ARE MODELLED AND FLOOD RISK MAY EXIST OUTSIDE THE OUTLINES INDICATED FROM SMALL TRIBUTARIES OR FROM DRAINAGE SYSTEMS. CLIMATE CHANGE ALLOWANCES ARE APPROPRIATE TO THE YEAR 2115 IN ACCORDANCE WITH PPS25 ANNEX B. PLANNING APPLICATIONS FOR INDIVIDUAL DEVELOPMENT PROPOSALS SHOULD BE BE ACCOMPANIED BY A SITE SPECIFIC FLOOD RISK ASSESSMENT AS REQUIRED BY PPS25 ANNEX E. THESE FLOOD PROBABILITY MAPS ARE NOT INTENDED TO BE USED FOR INSURANCE PURPOSES.

PROJECT TITLE
STRATEGIC FLOOD RISK ASSESSMENT STAGE 2

Broadland District Council ... leading the way | NORTH NORFOLK | SOUTH NORFOLK | NORWICH City Council | Broads Authority – The Broads – a member of the National Park family

DRAWING TITLE
LODDON AND CHEDGRAVE FLOOD PROBABILITY ZONES 2, 3a AND 3b WITH/WITHOUT CLIMATE CHANGE

DRAWN BY	CHECKED BY	SCALE
RAB	CH	1:6000
DRAWING NUMBER	REV	DATE
72930/21/541		NOV 2007

Millard Consulting

ORIGINAL SHEET SIZE A3H

Appendix D

WinDES Network Details

WinDES Simulation Summary at 30% Climate Change

WinDES Simulation Summary at 40% Climate Change

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)
1.000	34.213	0.780	43.9	0.109	5.00	0.600	o	225
1.001	55.094	1.390	39.6	0.100	0.00	0.600	o	300
2.000	15.633	0.200	78.2	0.000	5.00	0.600	o	300
1.002	11.342	0.080	141.8	0.018	0.00	0.600	o	150
1.003	14.572	0.360	40.5	0.025	0.00	0.600	o	150
1.004	18.510	0.550	33.7	0.019	0.00	0.600	o	150
3.000	12.704	0.025	508.2	0.076	5.00	0.600	o	600
3.001	12.217	0.024	509.0	0.041	0.00	0.600	o	600
3.002	14.035	0.028	501.3	0.041	0.00	0.600	o	600
3.003	13.932	0.028	497.6	0.018	0.00	0.600	o	600
3.004	16.956	0.035	484.5	0.024	0.00	0.600	o	600
4.000	17.073	0.034	502.1	0.000	5.00	0.600	o	600
1.005	7.775	0.016	485.9	0.007	0.00	0.600	o	600
1.006	32.055	0.278	115.3	0.066	0.00	0.600	o	600
1.007	13.788	0.242	57.0	0.067	0.00	0.600	o	600

PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
1.000	01	11.670	10.245	1.200	10.890	9.465	1.200		1050
1.001	02	10.890	9.390	1.200	9.500	8.000	1.200		1050
2.000	Pond	9.400	8.200	0.900	9.500	8.000	1.200		1050
1.002	03	9.500	8.000	1.350	9.270	7.920	1.200	Hydro-Brake®	1050
1.003	04	9.270	7.920	1.200	8.910	7.560	1.200		1050
1.004	05	8.910	7.560	1.200	8.500	7.010	1.340		1050
3.000	06	8.500	6.700	1.200	8.500	6.675	1.225		1500
3.001	07	8.500	6.675	1.225	8.500	6.651	1.249		1500
3.002	08	8.500	6.651	1.249	8.500	6.623	1.277		1500
3.003	09	8.500	6.623	1.277	8.500	6.595	1.305		1500
3.004	10	8.500	6.595	1.305	8.500	6.560	1.340		1500
4.000	TANK	9.000	6.594	1.806	8.500	6.560	1.340		1500
1.005	11	8.500	6.560	1.340	8.430	6.544	1.286		1500
1.006	12	8.430	6.544	1.286	8.220	6.266	1.354		1500
1.007	13	8.220	6.266	1.354	8.130	6.024	1.506		1500

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)
1.008	16.763	0.034	500.0	0.042	0.00	0.600	o	600
5.000	27.606	0.310	89.1	0.000	5.00	0.600	o	300
5.001	14.735	0.029	508.1	0.080	0.00	0.600	o	600
5.002	19.982	0.040	499.6	0.034	0.00	0.600	o	600
5.003	37.386	0.075	498.5	0.045	0.00	0.600	o	600
5.004	14.424	0.029	497.4	0.057	0.00	0.600	o	600
5.005	18.223	0.037	492.5	0.052	0.00	0.600	o	600
1.009	16.511	0.110	150.0	0.000	0.00	0.600	o	225
1.010	13.825	0.550	25.1	0.026	0.00	0.600	o	225
1.011	21.454	1.620	13.2	0.065	0.00	0.600	o	225
1.012	9.744	0.225	43.3	0.000	0.00	0.600	o	225
6.000	22.960	0.153	150.1	0.084	5.00	0.600	o	100
6.001	12.933	0.875	14.8	0.098	0.00	0.600	o	100
1.013	29.376	1.385	21.2	0.072	0.00	0.600	o	150

PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
1.008	14	8.130	6.024	1.506	8.000	5.990	1.410		1500
5.000	Pond	8.010	6.810	0.900	8.000	6.500	1.200		1050
5.001	15	8.000	6.200	1.200	8.000	6.171	1.229		1500
5.002	16	8.000	6.171	1.229	8.000	6.131	1.269		1500
5.003	17	8.000	6.131	1.269	8.000	6.056	1.344		1500
5.004	18	8.000	6.056	1.344	8.000	6.027	1.373		1500
5.005	19	8.000	6.027	1.373	8.000	5.990	1.410		1500
1.009	20	8.000	5.990	1.785	7.100	5.880	0.995	Depth/Flow Relationship	1500
1.010	21	7.100	5.880	0.995	6.380	5.330	0.825		1050
1.011	22	6.380	5.330	0.825	4.910	3.710	0.975		1050
1.012	POND	4.910	3.710	0.975	4.910	3.485	1.200		1050
6.000	P1	5.063	4.563	0.400	4.910	4.410	0.400		1050
6.001	P2	4.910	4.410	0.400	4.910	3.535	1.275		1050
1.013	23	4.910	3.485	1.275	4.000	2.100	1.750	Depth/Flow Relationship	1050

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
01	11.670	1.425	1050	1.000	10.245	225				
02	10.890	1.500	1050	1.001	9.390	300	1.000	9.465	225	
Pond	9.400	1.200	1050	2.000	8.200	300				
03	9.500	1.500	1050	1.002	8.000	150	1.001	8.000	300	
							2.000	8.000	300	
04	9.270	1.350	1050	1.003	7.920	150	1.002	7.920	150	
05	8.910	1.350	1050	1.004	7.560	150	1.003	7.560	150	
06	8.500	1.800	1500	3.000	6.700	600				
07	8.500	1.825	1500	3.001	6.675	600	3.000	6.675	600	
08	8.500	1.849	1500	3.002	6.651	600	3.001	6.651	600	
09	8.500	1.877	1500	3.003	6.623	600	3.002	6.623	600	
10	8.500	1.905	1500	3.004	6.595	600	3.003	6.595	600	
TANK	9.000	2.406	1500	4.000	6.594	600				
11	8.500	1.940	1500	1.005	6.560	600	1.004	7.010	150	
							3.004	6.560	600	
							4.000	6.560	600	
12	8.430	1.886	1500	1.006	6.544	600	1.005	6.544	600	
13	8.220	1.954	1500	1.007	6.266	600	1.006	6.266	600	
14	8.130	2.106	1500	1.008	6.024	600	1.007	6.024	600	
Pond	8.010	1.200	1050	5.000	6.810	300				
15	8.000	1.800	1500	5.001	6.200	600	5.000	6.500	300	
16	8.000	1.829	1500	5.002	6.171	600	5.001	6.171	600	
17	8.000	1.869	1500	5.003	6.131	600	5.002	6.131	600	
18	8.000	1.944	1500	5.004	6.056	600	5.003	6.056	600	
19	8.000	1.973	1500	5.005	6.027	600	5.004	6.027	600	
20	8.000	2.010	1500	1.009	5.990	225	1.008	5.990	600	
							5.005	5.990	600	
21	7.100	1.220	1050	1.010	5.880	225	1.009	5.880	225	
22	6.380	1.050	1050	1.011	5.330	225	1.010	5.330	225	
POND	4.910	1.200	1050	1.012	3.710	225	1.011	3.710	225	
P1	5.063	0.500	1050	6.000	4.563	100				
P2	4.910	0.500	1050	6.001	4.410	100	6.000	4.410	100	
23	4.910	1.425	1050	1.013	3.485	150	1.012	3.485	225	
							6.001	3.535	100	
	4.000	1.900	0		OUTFALL		1.013	2.100	150	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
1.000	o	225	01	11.670	10.245	1.200	1050
1.001	o	300	02	10.890	9.390	1.200	1050
2.000	o	300	Pond	9.400	8.200	0.900	1050
1.002	o	150	03	9.500	8.000	1.350	1050
1.003	o	150	04	9.270	7.920	1.200	1050
1.004	o	150	05	8.910	7.560	1.200	1050
3.000	o	600	06	8.500	6.700	1.200	1500
3.001	o	600	07	8.500	6.675	1.225	1500
3.002	o	600	08	8.500	6.651	1.249	1500
3.003	o	600	09	8.500	6.623	1.277	1500
3.004	o	600	10	8.500	6.595	1.305	1500
4.000	o	600	TANK	9.000	6.594	1.806	1500
1.005	o	600	11	8.500	6.560	1.340	1500
1.006	o	600	12	8.430	6.544	1.286	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
1.000	34.213	43.9	02	10.890	9.465	1.200	1050
1.001	55.094	39.6	03	9.500	8.000	1.200	1050
2.000	15.633	78.2	03	9.500	8.000	1.200	1050
1.002	11.342	141.8	04	9.270	7.920	1.200	1050
1.003	14.572	40.5	05	8.910	7.560	1.200	1050
1.004	18.510	33.7	11	8.500	7.010	1.340	1500
3.000	12.704	508.2	07	8.500	6.675	1.225	1500
3.001	12.217	509.0	08	8.500	6.651	1.249	1500
3.002	14.035	501.3	09	8.500	6.623	1.277	1500
3.003	13.932	497.6	10	8.500	6.595	1.305	1500
3.004	16.956	484.5	11	8.500	6.560	1.340	1500
4.000	17.073	502.1	11	8.500	6.560	1.340	1500
1.005	7.775	485.9	12	8.430	6.544	1.286	1500
1.006	32.055	115.3	13	8.220	6.266	1.354	1500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
1.007	o	600	13	8.220	6.266	1.354	1500
1.008	o	600	14	8.130	6.024	1.506	1500
5.000	o	300	Pond	8.010	6.810	0.900	1050
5.001	o	600	15	8.000	6.200	1.200	1500
5.002	o	600	16	8.000	6.171	1.229	1500
5.003	o	600	17	8.000	6.131	1.269	1500
5.004	o	600	18	8.000	6.056	1.344	1500
5.005	o	600	19	8.000	6.027	1.373	1500
1.009	o	225	20	8.000	5.990	1.785	1500
1.010	o	225	21	7.100	5.880	0.995	1050
1.011	o	225	22	6.380	5.330	0.825	1050
1.012	o	225	POND	4.910	3.710	0.975	1050
6.000	o	100	P1	5.063	4.563	0.400	1050
6.001	o	100	P2	4.910	4.410	0.400	1050
1.013	o	150	23	4.910	3.485	1.275	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
1.007	13.788	57.0	14	8.130	6.024	1.506	1500
1.008	16.763	500.0	20	8.000	5.990	1.410	1500
5.000	27.606	89.1	15	8.000	6.500	1.200	1500
5.001	14.735	508.1	16	8.000	6.171	1.229	1500
5.002	19.982	499.6	17	8.000	6.131	1.269	1500
5.003	37.386	498.5	18	8.000	6.056	1.344	1500
5.004	14.424	497.4	19	8.000	6.027	1.373	1500
5.005	18.223	492.5	20	8.000	5.990	1.410	1500
1.009	16.511	150.0	21	7.100	5.880	0.995	1050
1.010	13.825	25.1	22	6.380	5.330	0.825	1050
1.011	21.454	13.2	POND	4.910	3.710	0.975	1050
1.012	9.744	43.3	23	4.910	3.485	1.200	1050
6.000	22.960	150.1	P2	4.910	4.410	0.400	1050
6.001	12.933	14.8	23	4.910	3.535	1.275	1050
1.013	29.376	21.2		4.000	2.100	1.750	0

Setting Out Information - Site Coordinates (Storm)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Layout (North)
1.000	01	1050		636268.541	297776.999	
1.001	02	1050		636301.539	297767.962	
2.000	Pond	1050		636346.076	297753.350	
1.002	03	1050		636356.551	297764.955	
1.003	04	1050		636366.912	297769.569	
1.004	05	1050		636378.148	297778.848	
3.000	06	1500		636339.110	297834.009	
3.001	07	1500		636341.304	297821.496	
3.002	08	1500		636348.254	297811.448	
3.003	09	1500		636360.248	297804.159	
3.004	10	1500		636373.963	297801.711	
4.000	TANK	1500		636372.713	297788.694	
1.005	11	1500		636388.988	297793.852	
1.006	12	1500		636392.828	297800.613	
1.007	13	1500		636397.423	297832.337	

Setting Out Information - Site Coordinates (Storm)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Layout (North)
1.008	14	1500		636402.627	297845.105	
5.000	Pond	1050		636309.699	297910.724	
5.001	15	1500		636320.152	297885.173	
5.002	16	1500		636334.586	297882.208	
5.003	17	1500		636354.561	297882.719	
5.004	18	1500		636391.318	297875.891	
5.005	19	1500		636404.570	297870.196	
1.009	20	1500		636415.615	297855.702	
1.010	21	1050		636429.894	297863.991	
1.011	22	1050		636443.628	297865.575	
1.012	POND	1050		636464.909	297868.294	
6.000	P1	1050		636448.895	297836.099	
6.001	P2	1050		636469.151	297846.910	
1.013	23	1050		636469.736	297859.830	

Setting Out Information - Site Coordinates (Storm)

PN	DSMH Name	Dia/Len (mm)	Width (mm)	DS Easting (m)	DS Northing (m)	Layout (North)
1.013		0		636496.605	297847.955	

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.013		4.000	2.100	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	30.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	3	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.400		

Online Controls for Storm

Hydro-Brake® Manhole: 03, DS/PN: 1.002, Volume (m³): 6.1

Design Head (m) 1.000 Diameter (mm) 80
Design Flow (l/s) 3.6 Invert Level (m) 8.000
Hydro-Brake® Type Md6 SW Only

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	1.200	4.0	3.000	6.3	7.000	9.7
0.200	2.7	1.400	4.3	3.500	6.8	7.500	10.0
0.300	2.5	1.600	4.6	4.000	7.3	8.000	10.3
0.400	2.5	1.800	4.9	4.500	7.7	8.500	10.6
0.500	2.7	2.000	5.2	5.000	8.2	9.000	11.0
0.600	2.9	2.200	5.4	5.500	8.6	9.500	11.3
0.800	3.3	2.400	5.7	6.000	8.9		
1.000	3.7	2.600	5.9	6.500	9.3		

Depth/Flow Relationship Manhole: 20, DS/PN: 1.009, Volume (m³): 12.6

Invert Level (m) 5.990

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.8320	0.900	10.0050	1.700	9.7160	2.500	0.0000
0.200	8.6920	1.000	9.6520	1.800	9.9810	2.600	0.0000
0.300	9.6630	1.100	9.1020	1.900	10.2390	2.700	0.0000
0.400	10.1610	1.200	8.2890	2.000	10.4900	2.800	0.0000
0.500	10.3790	1.300	8.5660	2.100	10.7340	2.900	0.0000
0.600	10.4270	1.400	8.8690	2.200	10.9730	3.000	0.0000
0.700	10.3680	1.500	9.1610	2.300	11.2060		
0.800	10.2300	1.600	9.4430	2.400	11.4340		

Depth/Flow Relationship Manhole: 23, DS/PN: 1.013, Volume (m³): 1.7

Invert Level (m) 3.485

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.8050	0.900	7.3920	1.700	0.0000	2.500	0.0000
0.200	8.3020	1.000	7.7650	1.800	0.0000	2.600	0.0000
0.300	8.8880	1.100	8.1190	1.900	0.0000	2.700	0.0000
0.400	9.0390	1.200	8.4560	2.000	0.0000	2.800	0.0000
0.500	8.9810	1.300	8.7800	2.100	0.0000	2.900	0.0000
0.600	8.8140	1.400	9.0910	2.200	0.0000	3.000	0.0000
0.700	8.5180	1.500	9.3900	2.300	0.0000		
0.800	7.9610	1.600	9.6800	2.400	0.0000		

Storage Structures for Storm

Tank or Pond Manhole: Pond, DS/PN: 2.000

Invert Level (m) 8.200

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	88.2	0.400	187.1	0.800	297.3	1.200	418.7
0.200	136.2	0.600	240.8	1.000	356.7		

Tank or Pond Manhole: TANK, DS/PN: 4.000

Invert Level (m) 6.594

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	160.0	0.400	160.0	0.800	160.0	1.001	0.0
0.200	160.0	0.600	160.0	1.000	160.0		

Tank or Pond Manhole: Pond, DS/PN: 5.000

Invert Level (m) 6.810

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	40.3	0.400	103.5	0.800	198.3	1.200	325.3
0.200	68.0	0.600	146.8	1.000	258.4		

Tank or Pond Manhole: POND, DS/PN: 1.012

Invert Level (m) 3.710

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	225.0	0.400	304.1	0.800	393.2	1.200	492.9
0.200	263.6	0.600	347.3	1.000	441.8		

Porous Car Park Manhole: P1, DS/PN: 6.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	12.4
Membrane Percolation (mm/hr)	1000	Length (m)	38.9
Max Percolation (l/s)	134.0	Slope (1:X)	150.0
Safety Factor	1.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	4.563	Cap Volume Depth (m)	0.400

Porous Car Park Manhole: P2, DS/PN: 6.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.5
Membrane Percolation (mm/hr)	1000	Length (m)	83.0
Max Percolation (l/s)	149.9	Slope (1:X)	500.0
Safety Factor	1.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	4.410	Cap Volume Depth (m)	0.400

Manhole Headloss for Storm

PN	US/MH Name	US/MH Headloss
1.000	01	0.500
1.001	02	0.500
2.000	Pond	0.500
1.002	03	0.500
1.003	04	0.500
1.004	05	0.500
3.000	06	0.500
3.001	07	0.500
3.002	08	0.500
3.003	09	0.500
3.004	10	0.500
4.000	TANK	0.500
1.005	11	0.500
1.006	12	0.500
1.007	13	0.500
1.008	14	0.500
5.000	Pond	0.500
5.001	15	0.500
5.002	16	0.500
5.003	17	0.500
5.004	18	0.500
5.005	19	0.500
1.009	20	0.500
1.010	21	0.500
1.011	22	0.500
1.012	POND	0.500
6.000	P1	0.500
6.001	P2	0.500
1.013	23	0.500

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

Margin for Flood Risk Warning (mm)	450.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	1	0%	100/15 Summer				
1.001	15 Winter	1	0%	100/15 Summer				
2.000	60 Winter	1	0%	30/15 Winter				
1.002	15 Winter	1	0%					
1.003	15 Winter	1	0%	100/15 Summer				
1.004	15 Winter	1	0%	100/15 Summer				
3.000	15 Winter	1	0%	100/15 Summer				
3.001	15 Winter	1	0%	30/180 Winter				
3.002	15 Winter	1	0%	30/120 Winter				
3.003	15 Winter	1	0%	30/120 Winter				
3.004	60 Winter	1	0%	30/120 Winter				
4.000	120 Winter	1	0%	30/120 Winter				
1.005	60 Winter	1	0%	30/15 Winter				
1.006	60 Winter	1	0%	30/15 Winter				
1.007	60 Winter	1	0%	30/15 Summer				
1.008	60 Winter	1	0%	1/15 Winter				
5.000	360 Winter	1	0%	30/60 Winter				
5.001	60 Winter	1	0%	30/15 Summer				
5.002	60 Winter	1	0%	1/60 Winter				
5.003	60 Winter	1	0%	1/30 Winter				
5.004	60 Winter	1	0%	1/30 Summer				
5.005	60 Winter	1	0%	1/15 Winter				
1.009	60 Winter	1	0%					
1.010	15 Winter	1	0%					
1.011	15 Winter	1	0%					
1.012	480 Winter	1	0%	1/120 Summer				
6.000	30 Winter	1	0%	30/15 Summer				
6.001	30 Winter	1	0%	30/15 Summer				
1.013	480 Winter	1	0%					

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

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	01	10.324	-0.146	0.000	0.26	0.0	19.5	OK
1.001	02	9.483	-0.207	0.000	0.21	0.0	34.8	OK
2.000	Pond	8.386	-0.114	0.000	0.02	0.0	2.4	OK
1.002	03	8.533	0.383	0.000	0.20	0.0	2.7	SURCHARGED
1.003	04	7.971	-0.099	0.000	0.25	0.0	6.5	OK
1.004	05	7.619	-0.091	0.000	0.33	0.0	9.4	OK
3.000	06	6.857	-0.443	0.000	0.08	0.0	13.2	OK
3.001	07	6.845	-0.430	0.000	0.12	0.0	18.8	OK
3.002	08	6.827	-0.424	0.000	0.15	0.0	24.0	OK
3.003	09	6.799	-0.424	0.000	0.16	0.0	26.3	OK
3.004	10	6.776	-0.419	0.000	0.10	0.0	18.1	OK
4.000	TANK	6.726	-0.468	0.000	0.02	0.0	4.3	OK
1.005	11	6.774	-0.386	0.000	0.12	0.0	20.9	OK
1.006	12	6.779	-0.365	0.000	0.05	0.0	25.8	OK
1.007	13	6.779	-0.087	0.000	0.05	0.0	23.8	OK
1.008	14	6.779	0.155	0.000	0.13	0.0	22.9	SURCHARGED
5.000	Pond	6.810	-0.300	0.000	0.00	0.0	0.0	OK
5.001	15	6.786	-0.014	0.000	0.04	0.0	5.9	OK
5.002	16	6.784	0.013	0.000	0.02	0.0	4.4	SURCHARGED
5.003	17	6.783	0.052	0.000	0.02	0.0	5.0	SURCHARGED
5.004	18	6.782	0.126	0.000	0.04	0.0	6.7	SURCHARGED
5.005	19	6.781	0.154	0.000	0.04	0.0	8.4	SURCHARGED
1.009	20	6.779	0.564	0.000	0.28	0.0	10.4	SURCHARGED
1.010	21	5.939	-0.166	0.000	0.15	0.0	13.9	OK
1.011	22	5.395	-0.160	0.000	0.18	0.0	23.7	OK
1.012	POND	4.108	0.173	0.000	0.14	0.0	9.0	SURCHARGED
6.000	P1	4.657	-0.006	0.000	1.00	0.0	4.8	FLOOD RISK
6.001	P2	4.482	-0.028	0.000	0.79	0.0	11.8	FLOOD RISK
1.013	23	4.097	0.462	0.000	0.24	0.0	9.0	SURCHARGED

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

Margin for Flood Risk Warning (mm)	450.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	30	0%	100/15 Summer				
1.001	15 Winter	30	0%	100/15 Summer				
2.000	180 Winter	30	0%	30/15 Winter				
1.002	180 Winter	30	0%					
1.003	15 Winter	30	0%	100/15 Summer				
1.004	15 Summer	30	0%	100/15 Summer				
3.000	30 Winter	30	0%	100/15 Summer				
3.001	180 Winter	30	0%	30/180 Winter				
3.002	180 Winter	30	0%	30/120 Winter				
3.003	240 Winter	30	0%	30/120 Winter				
3.004	240 Winter	30	0%	30/120 Winter				
4.000	240 Winter	30	0%	30/120 Winter				
1.005	240 Winter	30	0%	30/15 Winter				
1.006	180 Winter	30	0%	30/15 Winter				
1.007	180 Winter	30	0%	30/15 Summer				
1.008	180 Winter	30	0%	1/15 Winter				
5.000	240 Winter	30	0%	30/60 Winter				
5.001	180 Winter	30	0%	30/15 Summer				
5.002	180 Winter	30	0%	1/60 Winter				
5.003	180 Winter	30	0%	1/30 Winter				
5.004	180 Winter	30	0%	1/30 Summer				
5.005	180 Winter	30	0%	1/15 Winter				
1.009	180 Winter	30	0%					
1.010	15 Summer	30	0%					
1.011	15 Winter	30	0%					
1.012	1440 Winter	30	0%	1/120 Summer				
6.000	60 Winter	30	0%	30/15 Summer				
6.001	1440 Winter	30	0%	30/15 Summer				
1.013	1440 Winter	30	0%					

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

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	01	10.379	-0.091	0.000	0.65	0.0	48.0	OK
1.001	02	9.553	-0.137	0.000	0.56	0.0	93.6	OK
2.000	Pond	8.675	0.175	0.000	0.03	0.0	2.9	SURCHARGED
1.002	03	8.676	0.526	0.000	0.22	0.0	3.0	SURCHARGED
1.003	04	8.002	-0.068	0.000	0.58	0.0	14.8	OK
1.004	05	7.665	-0.045	0.000	0.83	0.0	23.9	OK
3.000	06	7.300	0.000	0.000	0.15	0.0	23.1	OK
3.001	07	7.292	0.017	0.000	0.07	0.0	10.3	SURCHARGED
3.002	08	7.291	0.040	0.000	0.08	0.0	13.1	SURCHARGED
3.003	09	7.293	0.070	0.000	0.07	0.0	11.1	SURCHARGED
3.004	10	7.296	0.101	0.000	0.06	0.0	11.9	SURCHARGED
4.000	TANK	7.286	0.092	0.000	0.03	0.0	5.9	SURCHARGED
1.005	11	7.298	0.138	0.000	0.07	0.0	12.7	SURCHARGED
1.006	12	7.301	0.157	0.000	0.03	0.0	17.9	SURCHARGED
1.007	13	7.315	0.449	0.000	0.03	0.0	15.9	SURCHARGED
1.008	14	7.320	0.696	0.000	0.09	0.0	15.9	SURCHARGED
5.000	Pond	7.272	0.162	0.000	0.03	0.0	3.5	SURCHARGED
5.001	15	7.313	0.513	0.000	0.02	0.0	3.9	SURCHARGED
5.002	16	7.317	0.546	0.000	0.03	0.0	5.5	SURCHARGED
5.003	17	7.319	0.588	0.000	0.03	0.0	8.9	SURCHARGED
5.004	18	7.319	0.663	0.000	0.08	0.0	13.8	SURCHARGED
5.005	19	7.319	0.692	0.000	0.09	0.0	18.4	SURCHARGED
1.009	20	7.319	1.104	0.000	0.28	0.0	10.4	SURCHARGED
1.010	21	5.956	-0.149	0.000	0.25	0.0	22.7	OK
1.011	22	5.430	-0.125	0.000	0.41	0.0	53.6	OK
1.012	POND	4.621	0.686	0.000	0.14	0.0	8.9	FLOOD RISK
6.000	P1	4.779	0.116	0.000	1.14	0.0	5.4	FLOOD RISK
6.001	P2	4.608	0.098	0.000	0.25	0.0	3.8	FLOOD RISK
1.013	23	4.610	0.975	0.000	0.24	0.0	9.0	FLOOD RISK

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

Margin for Flood Risk Warning (mm)	450.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	100	+30%	100/15 Summer				
1.001	15 Winter	100	+30%	100/15 Summer				
2.000	240 Winter	100	+30%	30/15 Winter				
1.002	240 Winter	100	+30%					
1.003	15 Winter	100	+30%	100/15 Summer				
1.004	15 Winter	100	+30%	100/15 Summer				
3.000	240 Winter	100	+30%	100/15 Summer				
3.001	240 Winter	100	+30%	30/180 Winter				
3.002	240 Winter	100	+30%	30/120 Winter				
3.003	240 Winter	100	+30%	30/120 Winter				
3.004	240 Winter	100	+30%	30/120 Winter				
4.000	240 Winter	100	+30%	30/120 Winter				
1.005	240 Winter	100	+30%	30/15 Winter				
1.006	240 Winter	100	+30%	30/15 Winter				
1.007	360 Winter	100	+30%	30/15 Summer				
1.008	360 Winter	100	+30%	1/15 Winter				
5.000	360 Winter	100	+30%	30/60 Winter				
5.001	360 Winter	100	+30%	30/15 Summer				
5.002	360 Winter	100	+30%	1/60 Winter				
5.003	360 Winter	100	+30%	1/30 Winter				
5.004	360 Winter	100	+30%	1/30 Summer				
5.005	360 Winter	100	+30%	1/15 Winter				
1.009	360 Winter	100	+30%					
1.010	15 Winter	100	+30%					
1.011	15 Summer	100	+30%					
1.012	2880 Winter	100	+30%	1/120 Summer				
6.000	60 Winter	100	+30%	30/15 Summer				
6.001	2880 Winter	100	+30%	30/15 Summer				
1.013	2880 Winter	100	+30%					

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

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	01	10.788	0.318	0.000	1.02	0.0	75.9	SURCHARGED
1.001	02	9.955	0.265	0.000	0.86	0.0	144.4	SURCHARGED
2.000	Pond	8.952	0.452	0.000	0.03	0.0	3.5	FLOOD RISK
1.002	03	8.953	0.803	0.000	0.26	0.0	3.6	SURCHARGED
1.003	04	8.247	0.177	0.000	0.79	0.0	20.4	SURCHARGED
1.004	05	8.024	0.314	0.000	1.16	0.0	33.4	SURCHARGED
3.000	06	8.000	0.700	0.000	0.07	0.0	10.7	SURCHARGED
3.001	07	8.000	0.725	0.000	0.11	0.0	16.4	SURCHARGED
3.002	08	7.999	0.748	0.000	0.13	0.0	21.8	SURCHARGED
3.003	09	7.999	0.776	0.000	0.14	0.0	23.5	SURCHARGED
3.004	10	7.998	0.803	0.000	0.14	0.0	25.7	SURCHARGED
4.000	TANK	7.997	0.803	0.000	0.00	0.0	0.2	SURCHARGED
1.005	11	7.997	0.837	0.000	0.13	0.0	23.3	SURCHARGED
1.006	12	7.996	0.852	0.000	0.05	0.0	28.8	FLOOD RISK
1.007	13	7.994	1.128	0.000	0.06	0.0	27.4	FLOOD RISK
1.008	14	7.993	1.369	0.000	0.17	0.0	30.2	FLOOD RISK
5.000	Pond	7.984	0.874	0.000	0.06	0.0	6.1	FLOOD RISK
5.001	15	7.989	1.189	0.000	0.04	0.0	6.1	FLOOD RISK
5.002	16	7.990	1.219	0.000	0.03	0.0	6.2	FLOOD RISK
5.003	17	7.991	1.260	0.000	0.03	0.0	7.5	FLOOD RISK
5.004	18	7.991	1.335	0.000	0.07	0.0	10.9	FLOOD RISK
5.005	19	7.991	1.364	0.000	0.07	0.0	14.4	FLOOD RISK
1.009	20	7.991	1.776	0.000	0.28	0.0	10.5	FLOOD RISK
1.010	21	5.969	-0.136	0.000	0.33	0.0	30.0	OK
1.011	22	5.460	-0.095	0.000	0.63	0.0	82.2	OK
1.012	POND	4.869	0.934	0.000	0.14	0.0	9.1	FLOOD RISK
6.000	P1	4.896	0.233	0.000	1.14	0.0	5.4	FLOOD RISK
6.001	P2	4.855	0.345	0.000	0.24	0.0	3.6	FLOOD RISK
1.013	23	4.857	1.223	0.000	0.24	0.0	9.0	FLOOD RISK

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

Margin for Flood Risk Warning (mm)	450.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	1	0%	100/15 Summer				
1.001	15 Winter	1	0%	100/15 Summer				
2.000	60 Winter	1	0%	30/15 Winter				
1.002	15 Winter	1	0%					
1.003	15 Winter	1	0%	100/15 Summer				
1.004	15 Winter	1	0%	100/15 Summer				
3.000	15 Winter	1	0%	100/15 Summer				
3.001	15 Winter	1	0%	30/180 Winter				
3.002	15 Winter	1	0%	30/120 Winter				
3.003	15 Winter	1	0%	30/120 Winter				
3.004	60 Winter	1	0%	30/120 Winter				
4.000	120 Winter	1	0%	30/120 Winter				
1.005	60 Winter	1	0%	30/15 Winter				
1.006	60 Winter	1	0%	30/15 Winter				
1.007	60 Winter	1	0%	30/15 Summer				
1.008	60 Winter	1	0%	1/15 Winter				
5.000	360 Winter	1	0%	30/60 Winter				
5.001	60 Winter	1	0%	30/15 Summer	100/180 Winter			6
5.002	60 Winter	1	0%	1/60 Winter	100/180 Winter			6
5.003	60 Winter	1	0%	1/30 Winter	100/180 Winter			6
5.004	60 Winter	1	0%	1/30 Summer	100/180 Winter			6
5.005	60 Winter	1	0%	1/15 Winter	100/120 Winter			7
1.009	60 Winter	1	0%		100/120 Winter			7
1.010	15 Winter	1	0%					
1.011	15 Winter	1	0%					
1.012	480 Winter	1	0%	1/120 Summer	100/4320 Winter			1
6.000	30 Winter	1	0%	30/15 Summer				
6.001	30 Winter	1	0%	30/15 Summer				
1.013	480 Winter	1	0%					

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

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	01	10.324	-0.146	0.000	0.26	0.0	19.5	OK
1.001	02	9.483	-0.207	0.000	0.21	0.0	34.8	OK
2.000	Pond	8.386	-0.114	0.000	0.02	0.0	2.4	OK
1.002	03	8.533	0.383	0.000	0.20	0.0	2.7	SURCHARGED
1.003	04	7.971	-0.099	0.000	0.25	0.0	6.5	OK
1.004	05	7.619	-0.091	0.000	0.33	0.0	9.4	OK
3.000	06	6.857	-0.443	0.000	0.08	0.0	13.2	OK
3.001	07	6.845	-0.430	0.000	0.12	0.0	18.8	OK
3.002	08	6.827	-0.424	0.000	0.15	0.0	24.0	OK
3.003	09	6.799	-0.424	0.000	0.16	0.0	26.3	OK
3.004	10	6.776	-0.419	0.000	0.10	0.0	18.1	OK
4.000	TANK	6.726	-0.468	0.000	0.02	0.0	4.3	OK
1.005	11	6.774	-0.386	0.000	0.12	0.0	20.9	OK
1.006	12	6.779	-0.365	0.000	0.05	0.0	25.8	OK
1.007	13	6.779	-0.087	0.000	0.05	0.0	23.8	OK
1.008	14	6.779	0.155	0.000	0.13	0.0	22.9	SURCHARGED
5.000	Pond	6.810	-0.300	0.000	0.00	0.0	0.0	OK
5.001	15	6.786	-0.014	0.000	0.04	0.0	5.9	OK
5.002	16	6.784	0.013	0.000	0.02	0.0	4.4	SURCHARGED
5.003	17	6.783	0.052	0.000	0.02	0.0	5.0	SURCHARGED
5.004	18	6.782	0.126	0.000	0.04	0.0	6.7	SURCHARGED
5.005	19	6.781	0.154	0.000	0.04	0.0	8.4	SURCHARGED
1.009	20	6.779	0.564	0.000	0.28	0.0	10.4	SURCHARGED
1.010	21	5.939	-0.166	0.000	0.15	0.0	13.9	OK
1.011	22	5.395	-0.160	0.000	0.18	0.0	23.7	OK
1.012	POND	4.108	0.173	0.000	0.14	0.0	9.0	SURCHARGED
6.000	P1	4.657	-0.006	0.000	1.00	0.0	4.8	FLOOD RISK
6.001	P2	4.482	-0.028	0.000	0.79	0.0	11.8	FLOOD RISK
1.013	23	4.097	0.462	0.000	0.24	0.0	9.0	SURCHARGED

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

Margin for Flood Risk Warning (mm)	450.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	30	0%	100/15 Summer				
1.001	15 Winter	30	0%	100/15 Summer				
2.000	180 Winter	30	0%	30/15 Winter				
1.002	180 Winter	30	0%					
1.003	15 Winter	30	0%	100/15 Summer				
1.004	15 Summer	30	0%	100/15 Summer				
3.000	30 Winter	30	0%	100/15 Summer				
3.001	180 Winter	30	0%	30/180 Winter				
3.002	180 Winter	30	0%	30/120 Winter				
3.003	240 Winter	30	0%	30/120 Winter				
3.004	240 Winter	30	0%	30/120 Winter				
4.000	240 Winter	30	0%	30/120 Winter				
1.005	240 Winter	30	0%	30/15 Winter				
1.006	180 Winter	30	0%	30/15 Winter				
1.007	180 Winter	30	0%	30/15 Summer				
1.008	180 Winter	30	0%	1/15 Winter				
5.000	240 Winter	30	0%	30/60 Winter				
5.001	180 Winter	30	0%	30/15 Summer	100/180 Winter			6
5.002	180 Winter	30	0%	1/60 Winter	100/180 Winter			6
5.003	180 Winter	30	0%	1/30 Winter	100/180 Winter			6
5.004	180 Winter	30	0%	1/30 Summer	100/180 Winter			6
5.005	180 Winter	30	0%	1/15 Winter	100/120 Winter			7
1.009	180 Winter	30	0%		100/120 Winter			7
1.010	15 Summer	30	0%					
1.011	15 Winter	30	0%					
1.012	1440 Winter	30	0%	1/120 Summer	100/4320 Winter			1
6.000	60 Winter	30	0%	30/15 Summer				
6.001	1440 Winter	30	0%	30/15 Summer				
1.013	1440 Winter	30	0%					

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

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	01	10.379	-0.091	0.000	0.65	0.0	48.0	OK
1.001	02	9.553	-0.137	0.000	0.56	0.0	93.6	OK
2.000	Pond	8.675	0.175	0.000	0.03	0.0	2.9	SURCHARGED
1.002	03	8.676	0.526	0.000	0.22	0.0	3.0	SURCHARGED
1.003	04	8.002	-0.068	0.000	0.58	0.0	14.8	OK
1.004	05	7.665	-0.045	0.000	0.83	0.0	23.9	OK
3.000	06	7.300	0.000	0.000	0.15	0.0	23.1	OK
3.001	07	7.292	0.017	0.000	0.07	0.0	10.3	SURCHARGED
3.002	08	7.291	0.040	0.000	0.08	0.0	13.1	SURCHARGED
3.003	09	7.293	0.070	0.000	0.07	0.0	11.1	SURCHARGED
3.004	10	7.296	0.101	0.000	0.06	0.0	11.9	SURCHARGED
4.000	TANK	7.286	0.092	0.000	0.03	0.0	5.9	SURCHARGED
1.005	11	7.298	0.138	0.000	0.07	0.0	12.7	SURCHARGED
1.006	12	7.301	0.157	0.000	0.03	0.0	17.9	SURCHARGED
1.007	13	7.315	0.449	0.000	0.03	0.0	15.9	SURCHARGED
1.008	14	7.320	0.696	0.000	0.09	0.0	15.9	SURCHARGED
5.000	Pond	7.272	0.162	0.000	0.03	0.0	3.5	SURCHARGED
5.001	15	7.313	0.513	0.000	0.02	0.0	3.9	SURCHARGED
5.002	16	7.317	0.546	0.000	0.03	0.0	5.5	SURCHARGED
5.003	17	7.319	0.588	0.000	0.03	0.0	8.9	SURCHARGED
5.004	18	7.319	0.663	0.000	0.08	0.0	13.8	SURCHARGED
5.005	19	7.319	0.692	0.000	0.09	0.0	18.4	SURCHARGED
1.009	20	7.319	1.104	0.000	0.28	0.0	10.4	SURCHARGED
1.010	21	5.956	-0.149	0.000	0.25	0.0	22.7	OK
1.011	22	5.430	-0.125	0.000	0.41	0.0	53.6	OK
1.012	POND	4.621	0.686	0.000	0.14	0.0	8.9	FLOOD RISK
6.000	P1	4.779	0.116	0.000	1.14	0.0	5.4	FLOOD RISK
6.001	P2	4.608	0.098	0.000	0.25	0.0	3.8	FLOOD RISK
1.013	23	4.610	0.975	0.000	0.24	0.0	9.0	FLOOD RISK

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

Margin for Flood Risk Warning (mm)	450.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	100	+40%	100/15 Summer				
1.001	15 Winter	100	+40%	100/15 Summer				
2.000	240 Winter	100	+40%	30/15 Winter				
1.002	240 Winter	100	+40%					
1.003	15 Winter	100	+40%	100/15 Summer				
1.004	120 Winter	100	+40%	100/15 Summer				
3.000	120 Winter	100	+40%	100/15 Summer				
3.001	120 Winter	100	+40%	30/180 Winter				
3.002	120 Winter	100	+40%	30/120 Winter				
3.003	120 Winter	100	+40%	30/120 Winter				
3.004	120 Winter	100	+40%	30/120 Winter				
4.000	120 Winter	100	+40%	30/120 Winter				
1.005	120 Winter	100	+40%	30/15 Winter				
1.006	120 Winter	100	+40%	30/15 Winter				
1.007	120 Winter	100	+40%	30/15 Summer				
1.008	180 Winter	100	+40%	1/15 Winter				
5.000	360 Winter	100	+40%	30/60 Winter				
5.001	360 Winter	100	+40%	30/15 Summer	100/180 Winter			6
5.002	360 Winter	100	+40%	1/60 Winter	100/180 Winter			6
5.003	360 Winter	100	+40%	1/30 Winter	100/180 Winter			6
5.004	360 Winter	100	+40%	1/30 Summer	100/180 Winter			6
5.005	240 Winter	100	+40%	1/15 Winter	100/120 Winter			7
1.009	240 Winter	100	+40%		100/120 Winter			7
1.010	15 Summer	100	+40%					
1.011	15 Summer	100	+40%					
1.012	4320 Winter	100	+40%	1/120 Summer	100/4320 Winter			1
6.000	60 Winter	100	+40%	30/15 Summer				
6.001	4320 Winter	100	+40%	30/15 Summer				
1.013	4320 Winter	100	+40%					

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

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	01	11.049	0.579	0.000	1.08	0.0	80.2	SURCHARGED
1.001	02	10.120	0.430	0.000	0.90	0.0	150.9	SURCHARGED
2.000	Pond	8.999	0.499	0.000	0.03	0.0	3.5	FLOOD RISK
1.002	03	9.001	0.851	0.000	0.27	0.0	3.6	SURCHARGED
1.003	04	8.376	0.306	0.000	0.83	0.0	21.4	SURCHARGED
1.004	05	8.225	0.515	0.000	0.51	0.0	14.6	SURCHARGED
3.000	06	8.195	0.895	0.000	0.12	0.0	19.1	FLOOD RISK
3.001	07	8.193	0.918	0.000	0.19	0.0	29.2	FLOOD RISK
3.002	08	8.191	0.940	0.000	0.24	0.0	39.1	FLOOD RISK
3.003	09	8.187	0.964	0.000	0.26	0.0	42.7	FLOOD RISK
3.004	10	8.184	0.989	0.000	0.25	0.0	47.9	FLOOD RISK
4.000	TANK	8.179	0.985	0.000	0.01	0.0	1.3	SURCHARGED
1.005	11	8.179	1.019	0.000	0.18	0.0	32.2	FLOOD RISK
1.006	12	8.175	1.031	0.000	0.08	0.0	39.7	FLOOD RISK
1.007	13	8.164	1.298	0.000	0.10	0.0	48.1	FLOOD RISK
1.008	14	8.011	1.387	0.000	0.26	0.0	47.4	FLOOD RISK
5.000	Pond	8.006	0.896	0.000	0.06	0.0	6.2	FLOOD RISK
5.001	15	8.006	1.206	6.289	0.04	0.0	6.3	FLOOD
5.002	16	8.006	1.235	6.300	0.03	0.0	6.5	FLOOD
5.003	17	8.006	1.275	6.431	0.03	0.0	7.3	FLOOD
5.004	18	8.006	1.350	6.472	0.07	0.0	11.0	FLOOD
5.005	19	8.007	1.380	6.882	0.10	0.0	19.1	FLOOD
1.009	20	8.008	1.793	7.796	0.28	0.0	10.5	FLOOD
1.010	21	5.972	-0.133	0.000	0.35	0.0	31.6	OK
1.011	22	5.465	-0.089	0.000	0.67	0.0	87.8	OK
1.012	POND	4.910	0.975	0.167	0.14	0.0	8.9	FLOOD
6.000	P1	4.919	0.256	0.000	1.14	0.0	5.4	FLOOD RISK
6.001	P2	4.900	0.390	0.000	0.19	0.0	2.8	FLOOD RISK
1.013	23	4.899	1.264	0.000	0.25	0.0	9.1	FLOOD RISK

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ASSESSMENT OF IMPACT OF ROAD TRAFFIC ON A PROPOSED RESIDENTIAL DEVELOPMENT

SITE AT HIGH BUNGAY RD LODDON

Brief: To advise on the layout and design of a proposed residential development at the above site, which is exposed to road traffic noise, to ensure that satisfactory noise levels can be achieved within the proposed dwellings.

Site: Site at High Bungay Rd Loddon.

Dates: Noise measurements 20/21 October 2015

This report 28 November 2015

Author Gordon Brown MCIEH, FIOA

CONTENTS

1. OBJECTIVES

1.1. The site proposed for residential development is bounded on its southern side by the A146 single carriageway, which carries a relatively high volume of road traffic and noise from traffic is therefore likely to affect the site. Larkfleet Ltd has requested an investigation into the effect of this factor on the development with a view to informing the design of the development and incorporating mitigation measures where necessary.

1.2. This report describes the investigation of the noise levels and advises if it is necessary to include any mitigation or design features to give protection from noise for the future occupiers.

2. NOISE LEVEL MEASUREMENT & ASSESSMENT

2.1. The A146 single carriageway that passes the southern boundary of the site is the only noise source likely to have a significant effect on the development, but the site is partially shielded from the road by an embankment that places much of the A146 up to 4m below the site level. Measurements have been made to determine the effect of these factors on noise propagation and road traffic noise has been calculated and modelled using a software tool in accordance with the methodologies described in Department of Transport, Technical Memorandum, Calculation of Road Traffic Noise (CRTN), 1988 and ISO9613-2 1996 Acoustics - Attenuation of sound during propagation outdoors.

2.2. The National Planning Policy Framework (NPPF) sets out the Government's economic, environmental and social planning policies for England and these policies articulate the Government's vision of sustainable development. In respect of noise, Paragraph 123 of the document states the following:

Planning policies and decisions should aim to:

avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;

mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;

recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restriction put on them because of changes in nearby land uses since they were established;

identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

2.3. The NPPF refers to the DEFRA publication, Noise Policy Statement for England" (NPSE, March 2010), which gives three policy aims, these being as follows.

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life*
- *mitigate and minimise adverse impacts on health and quality of life*
- *where possible, contribute to the improvement of health and quality of life."*

2.4. The first two objectives require that no significant adverse impact should occur and that, where a noise does have an adverse effect, then *"all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur."*

2.5. Additional guidance to the NPPF is set out in the National Planning Practice Guidance (NPPG), which sets out how planning can manage potential noise impacts in new development. It advises that planning authorities' should take account of the acoustic environment and in doing so consider:

- *whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved.*

2.6. The NPPG states that these potential effects should be evaluated by comparison with the significant observed adverse effect level and the lowest observed adverse effect level for the given situation. To illustrate these thresholds and help identify where noise could be a concern, the NPPG provides an example table of noise exposure hierarchy shown below.

Table 1 - Noise exposure hierarchy.

Perception	Example of Outcomes	Increasing Effect level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect Level (NOAEL)	No specific measures required
Lowest Observed Adverse Effect Level (LOAEL)			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level (SOAEL)			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

2.7. There are a number of guidance documents that contain recommended fixed guideline noise values, in particular the World Health Organisation Guidelines for Community Noise 1999 and BS8233:2014 Sound Insulation and Noise Reduction for Buildings. Both of these documents are generally suitable to assist in the assessment and design of new residential developments.

2.8. BS 8233:2014 advises the following noise criteria for internal residential areas:

- Living rooms during the daytime – 35 dB LA $LA_{eq,16hr}$.
- Dining rooms during the daytime – 40 dB LA $LA_{eq,16hr}$.

- Bedrooms - 35 dB LA $LA_{eq,16hr}$ during the day (for rest) and 30 dB $LA_{eq,8hr}$ at night (for sleep).

2.9. In respect of external spaces, BS8233:2014 states;

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB LAeq,T, with an upper guideline value of 55 dB LAeq,T which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

2.10. The previous version of the Standard (1999) suggested that a window, when partially open, will provide approximately 10 to 15 dB Rw of sound attenuation; this reference is now removed from the latest iteration of the Standard but the worked example (G.1) at Annex G of the current Standard suggests that a partially open window would provide sound attenuation of approximately 15 dB Rw. The current version of the Standard also suggests that "standard insulating glass units have an insulation value of approximately 33 dB Rw" when closed.

2.11. Although PPG24, Planning & Noise, has now been discontinued as official guidance it does provide guidance on the typical noise reduction of dwelling facades with windows, which gives an indication of the noise levels likely to be generated by each of transport based noise sources under consideration. This advice is still valid and is shown in Table 2 below.

Table 2 - Typical noise reduction of a dwelling facade with windows set in a brick/block wall.

Difference between dB(A) levels outside and inside

Noise Source	Single glazing	Thermal double glazing	Secondary glazing
Road Traffic	28	33	34
Civil Aircraft	27	32	35
Military Aircraft	29	35	39
Diesel Train	28	32	35
Electric Train	30	36	41

Note: The values in the table above are the difference between dB(A) levels measured outside and inside typical dwellings; they have not been corrected for reverberation time or window area, and so cannot be compared with values obtained under other conditions. The Table is intended to give an idea of the insulation likely to be achieved in practice - not under ideal conditions. Secondary glazing systems in particular will perform better in installations where sound insulation is not limited by poor sealing or by flanking sound paths such as through doors or acoustically weak parts of window bays. The values for single glazing are representative of well-sealed windows.

2.12. Mr Adrian Nicholas, Environmental Health Officer at South Norfolk District Council (SNDC), has indicated that the council does not have its own adopted policy in respect of noise affecting new residential developments. He has also advised that he considers the standards given in BS8233:2014, Guidance on sound insulation and noise reduction for buildings, to be suitable for the assessment of this proposed development, and that he regards the external spaces value of 55 dB $LA_{eq,16hours}$ to be satisfactory.

2.13. Mr Nicholas has also indicated that the internal noise level targets should be determined with windows closed and suitable ventilation provided, and where the assessment identifies that mitigation measures may be necessary to provide a commensurate level of protection against noise, then the guidance presented in BS

8233:2014 and the World Health Organisation Guidelines for Community Noise should be referenced and used to derive appropriate criteria.

2.14. Mr Nicholas has advised that he regards the use of CRTN to determine road traffic noise levels as an appropriate methodology, where suitable traffic flow data is available, and that where measurements are carried out, the Shortened Measurement Procedure in CRTN is an acceptable methodology for the measurement of daytime levels. In this instance traffic flow data is available and has been derived from data published by Norfolk County Council, representing the data for 2014 at a count point on the A146 approximately 1.5km north of the site.

2.15. The shortened measurement protocol described in CRTN provides a methodology that is suitable for determining road traffic noise levels affecting sites. Noise is measured over three consecutive hours between 10:00 and 17:00, and using $LA_{10,3hour}$ as the arithmetic mean of the three consecutive values of hourly LA_{10} the current value of $LA_{10,18\text{-}hour}$ can be calculated from the relationship: $LA_{10,18\text{-}hour} = LA_{10\ ,3hour}$ -1 dB. This value can be converted to $LA_{eq,16hour}$ by subtracting 2dB (Annex 1, PPG24 refers).

2.16. The purpose of carrying out measurements in this instance is primarily to validate the calculated values, the noise likely to prevail on the site as developed has been modelled using Soundplan Essential. This is a software tool that uses the methodologies of CRTN and ISO9613 to calculate noise levels, taking into account topography and the potential built environment.

2.17. Noise levels were measured at three locations on 20 and 21 October 2015, as shown on the plan in Appendix 1, their distances from the nearside carriageway edge being as follows; positions 1 at 19m, position 2 at 31m, and position 3 at 20m. During the measurement exercise the weather was cool, winds were light and south westerly in direction, and no precipitation was recorded during the daytime survey. The night time survey was affected by light rain from 05:00, which may have elevated the recorded levels.

2.18. The noise environment at the monitoring positions entirely comprised road traffic on the A146. The daytime measurements were carried out from approximately 10:00 to 13:00 and the table below shows the average noise levels recorded at each position (all levels in dB, rounded to the nearest whole number).

Table 3 – Measurement results

Position	$LA_{10,1hour}$	$LA_{10,3hour}$	$LA_{eq,16hour}$
1 – 19m from A146	70	70	67
	70		
	70		
2 – 31m from A146	61	61	58
	61		
	61		
3 – 20m from A146	67	67	64
	67		
	67		

2.19. In addition to measuring levels on the site, calculations have been made based on the following data;

Average hourly flow for the hours from 07:00 to 23:00, and 23:00 to 07:00

Percentage of heavy vehicles in each of the flows.

Average speed

Gradient of road

Type of road surface

Angle of view of road and any reflective surfaces opposite

Local topography (the site is largely shielded from the road by a steep and high embankment)

The proposed built environment

Percentage of absorbent ground between road and receiver

2.20. The actual road traffic data used in the Soundplan model is as below;

Hourly vehicle flow from 07:00 to 23:00 962 vehicles

Hourly vehicle flow from 23:00 to 07:00	134 vehicles
Percentage of heavy vehicles in the flow.	4.4% daytime, 20% night
Average speed	88kph (CRTN value)
Gradient of road	Varies, model takes this into account
Road surface	Impervious, speed > 75kph
Angle of view of road	Varies with position
Angle of view reflective surfaces opposite	Nil
Percentage of absorbent ground	Above 89%

2.21. The results of the Soundplan modelling are shown in Appendix 2, both with and without mitigation and at ground and first floor heights. The red line on the plots represents the 55dB $LA_{eq,16hour}$ contour, which is the limit value for daytime noise in garden spaces, and the green line represents the 45dB $LA_{eq,8hour}$ nighttime limit value where there is no requirement for windows to be closed to achieve a satisfactory internal noise environment. It is clear from the results that some mitigation will be required in order to ensure that the acoustic environment of the proposed dwellings meets a reasonable standard.

2.22. In view of this the second and third models in Appendix 2 include a 2.8m high acoustic fence on part of the boundary of the site. This fence rises to 3.0m high in the south eastern corner. The effect of this barrier is to reduce daytime noise levels in garden spaces to below 55dB, with the exception of small proportions of the gardens in those dwellings on the southern boundary, and nighttime levels largely meet the 45dB criterion, with the exception of a small number of facades. In addition, noise levels in garden amenity spaces that are located further to the north of the boundary with the A146 will be protected by the bulk of the built environment, further reducing external noise levels.

2.23. In the case of three proposed bungalows on the southern boundary the night time noise level at those facades directly facing the A146 will be marginally in excess of

45dB $LA_{eq,8hours}$ at ground floor height. In addition, a further 10 houses have first floor facades that will be exposed to noise levels exceeding the 45dB criterion.

2.24. Table 2 above indicates that with windows closed the typical noise reduction of a dwelling facade with thermal double glazed windows set in a brick/block wall is 33dB in respect of road traffic noise. The highest predicted first floor noise level at night is 53dB, which equates to a level of 20dB internally, assuming a 33dB noise reduction by the façade. All of the other predicted external noise levels are lower than this value therefore all internal noise levels with windows closed are within the recommended values given in BS8223:2014. However, it should be noted that achieving these internal levels requires windows to be closed and suitable acoustically protected ventilation to be provided.

2.25. The extent to which road noise affects the proposed dwellings may be minimised by ensuring that as few habitable rooms as possible are located on the noise exposed facades. Kitchens, hallways, cloakrooms, bathrooms, utility rooms and other similar spaces should be located on the noise exposed side of the building. Living rooms and main bedrooms should be located on the non-noise exposed facades, so far as is practicable.

2.26. Daytime noise levels in external spaces also need to be considered and these may be controlled by a site boundary acoustic barrier as shown in the Soundplan models. The presence of the built environment and site boundary barrier will reduce levels to bring the noise level in garden spaces below the threshold value of 55dB $LA_{eq,16hour}$.

2.27. Dwellings located further from the A146 will experience lower noise levels as the road traffic noise attenuates over distance and the built environment will provide additional barrier attenuation.

3. CONCLUSIONS & RECOMMENDATIONS

3.1. The noise exposure of the site has been assessed and if appropriate mitigation in the form of a combination of barriers, building envelope specification, and internal design is provided then the noise environment for potential future occupiers will be satisfactory. Points that require particular attention are as follows.

3.2. A barrier must be provided on the site boundary covering the length shown in the plans in Appendix 2, at least 2.8m high to ensure that external and internal noise levels meet the design advice in BS8223:2014.

3.3. The internal layout of the proposed dwellings should aim to place as few habitable rooms as possible on the road noise exposed side of the buildings. Kitchens, hallways, cloakrooms, bathrooms, utility rooms and other similar spaces should be located on the noise exposed side of the building where practicable. As many habitable rooms as possible, such as bedrooms and living rooms, should be located on the non-noise exposed facades.

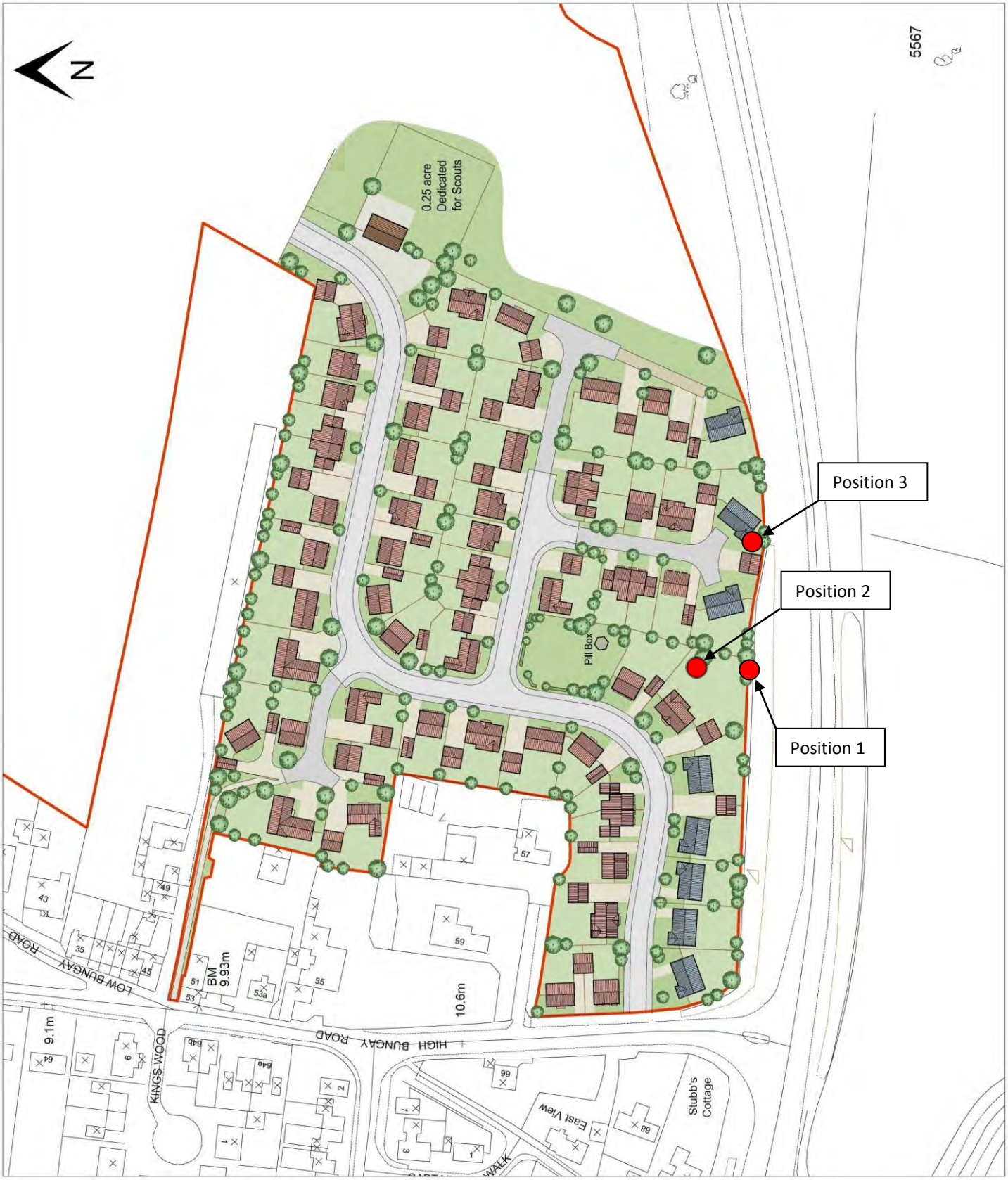
3.4. The building envelope construction must be specified so as to ensure the target internal noise levels are achieved. This will require particular attention to ventilation specification. Habitable rooms on the noise exposed facades must be provided with a suitable ventilation system that is protected against noise.

4. NOISE MEASUREMENT EQUIPMENT

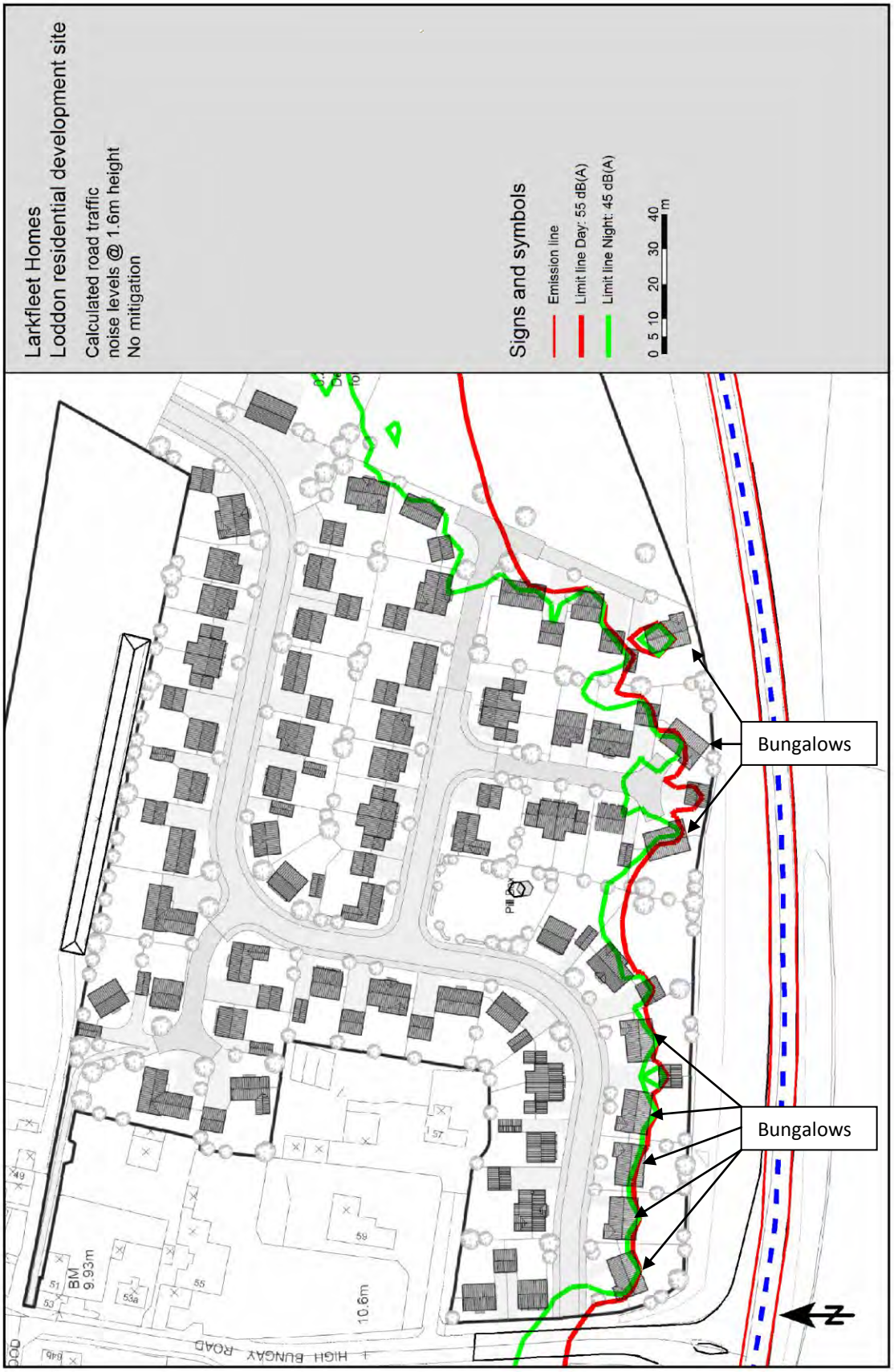
4.1. Sound Level Meters: Svan 959, Svan 945A, and Svan 971 type 1 instruments, complete with all accessories. The meters incorporate full integrating facilities to determine true average sound levels ($L_{eq,T}$), and the capability to measure time profiles using different time constants and frequency weightings. The meters are able to measure levels in 1/1 octaves, 1/3 octaves and the Svan 959 has full real time FFT capabilities. A matching acoustic calibrator Grade 1 instrument was used for checking the accuracy of the sound level meters, before and after making noise measurements.

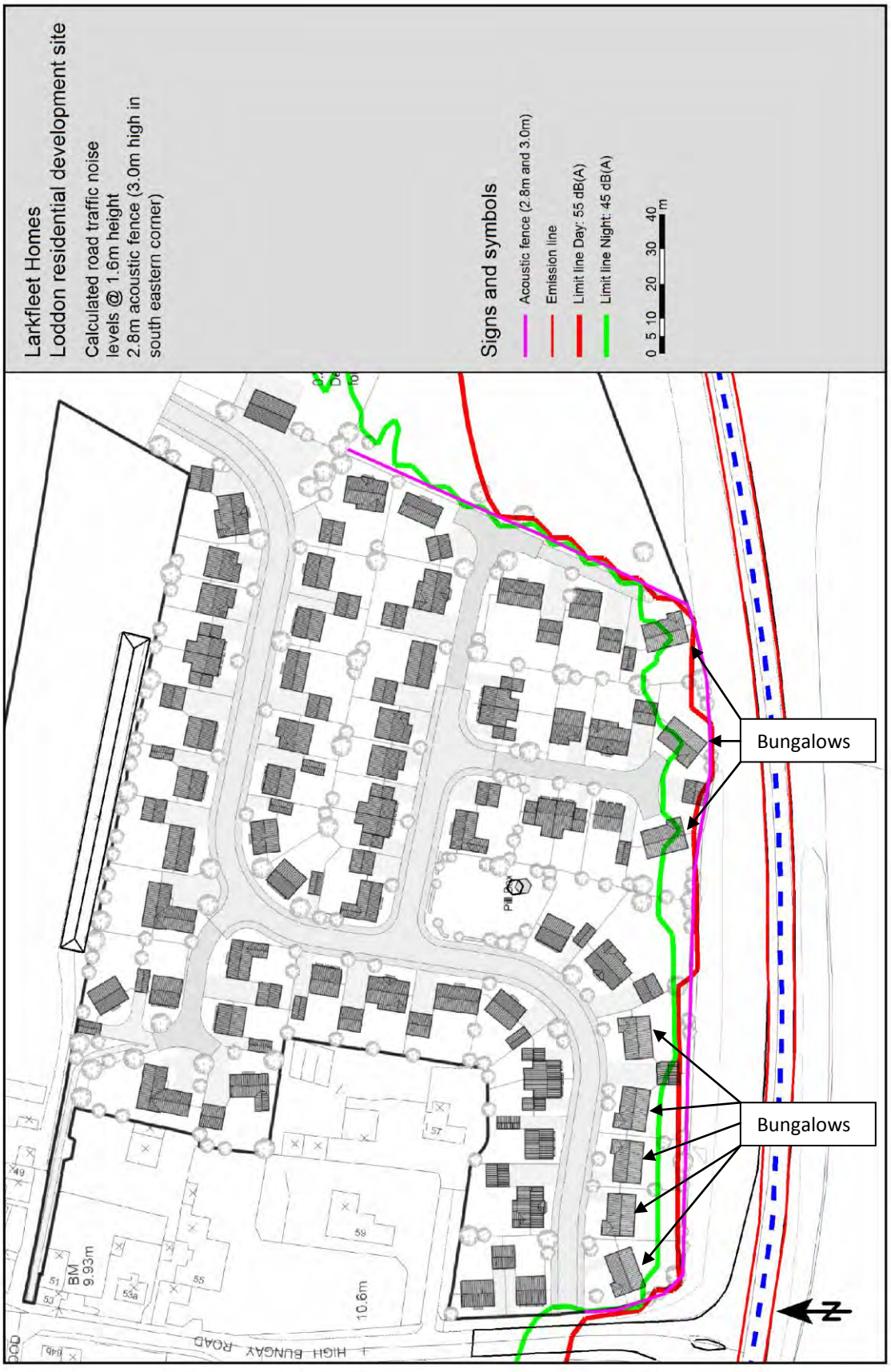
4.2. All equipment is calibrated to UKAS standards and accompanied by current calibration certificates.

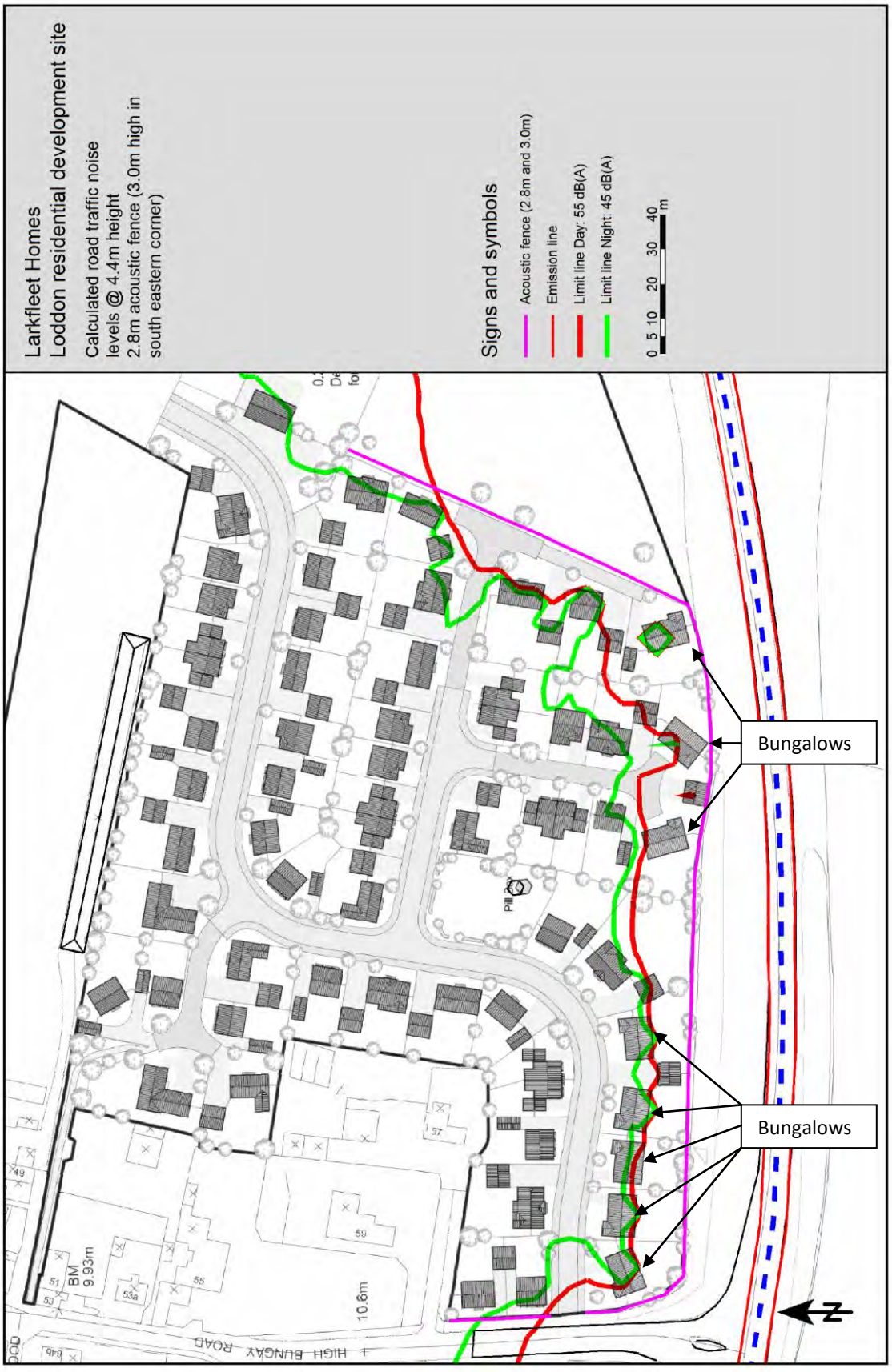
APPENDIX 1 – MEASUREMENT LOCATION PLAN

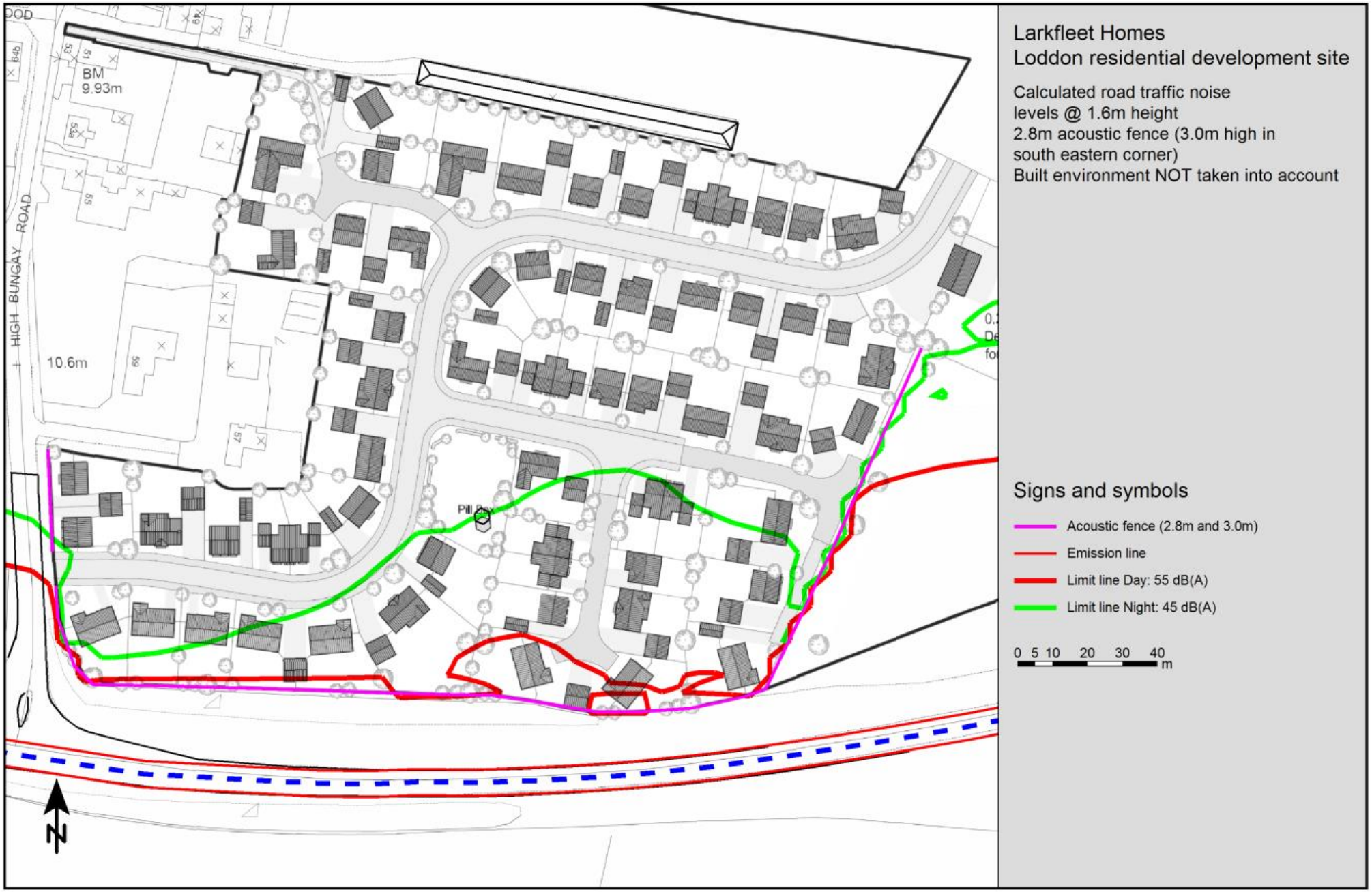


APPENDIX 2 – SOUNDPLAN MODELLING RESULTS




Larkfleet Homes
Loddon residential development site
Calculated road traffic noise levels @ 1.6m height
2.8m acoustic fence (3.0m high in south eastern corner)
Signs and symbols
Acoustic fence (2.8m and 3.0m)
Emission line
Limit line Day: 55 dB(A)
Limit line Night: 45 dB(A)
0 5 10 20 30 40 m
Bungalows
Bungalows
HIGH BUNGAY ROAD
BM 9.93m
10.6m
N


Larkfleet Homes
Loddon residential development site
Calculated road traffic noise levels @ 4.4m height
2.8m acoustic fence (3.0m high in south eastern corner)
Signs and symbols
Acoustic fence (2.8m and 3.0m)
Emission line
Limit line Day: 55 dB(A)
Limit line Night: 45 dB(A)
0 5 10 20 30 40 m
Bungalows
Bungalows
HIGH BUNGAY ROAD
BM 9.93m
10.6m
N



Larkfleet Homes
Loddon residential development site

Calculated road traffic noise
levels @ 1.6m height
2.8m acoustic fence (3.0m high in
south eastern corner)
Built environment NOT taken into account

Signs and symbols

- Acoustic fence (2.8m and 3.0m)
- Emission line
- Limit line Day: 55 dB(A)
- Limit line Night: 45 dB(A)

0 5 10 20 30 40 m

Larkfleet Homes
Loddon residential development site

Calculated road traffic
noise levels @ 1.6m height
No mitigation
Built environment NOT taken into account

Signs and symbols

- Emission line
- Limit line Day: 55 dB(A)
- Limit line Night: 45 dB(A)

0 5 10 20 30 40 m