



FLOOD RISK ASSESSMENT

32 LANGSTONE ROAD, HAVANT, HAMPSHIRE PO9 1RF

CLIENT

Mrs. P. Hedley
32 Langstone Road
Havant
Hampshire
PO9 1RF

Ref: 4034/2.3F
Date: August 2011

CONSULTING ENGINEERS

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Report by: **John Pakenham BSc (Hons)**
Checked by: **John Roberts BSc (Hons)**

Issue	Date	Compiled	Checked
First Issue	08 August 2011	JP	JR

1.0 INTRODUCTION & REQUIREMENTS OF THE FLOOD RISK ASSESSMENT

- 1.1 This report has been prepared for Mrs. P. Hedley in conjunction with a Planning Application at 32 Langstone Road, Havant, and no responsibility is accepted to any third party for all or part of this study in connection with this or any other development.
- 1.2 This report will take the form of a formal Flood Risk Assessment in accordance with “Planning Policy Statement Note 25: Development and Flood Risk (PPS25)”.
- 1.3 PPS25 – Development and Flood Risk, Annexes E-G, sets out the requirements of a Flood Risk Assessment. The Environment Agency has also published Guidance Note No. 2 outlining minimum requirements for FRA documents.
- 1.4 This Guidance Note requires the FRA contain the following:
 - Location Plan
 - Development proposals
 - Existing information on extent and depth of flood events or on flood predictions from all sources
 - Flood mitigation measures to be taken into account
 - Survey plan
 - Sources of flooding
 - SUDS Measures

2.0 EXISTING SITE

- 2.1 This residential site lies approximately 150m north of Langstone Harbour, within the area administered by Havant Borough Council. Site location maps and an aerial view of the site are shown in Appendix A.
- 2.2 The site is within a predominantly residential village comprising large detached properties.
- 2.3 The existing dwelling comprises a detached 4 bedroom house with a separate garage.
- 2.4 The topographical survey in Appendix B shows there is an overall fall from north to south. Levels range between 3.34m AOD at the northwest corner to 2.97m AOD at the southeast corner. The ground floor threshold level is 3.32m AOD.
- 2.5 The site area is approximately 1068m², of which 106m² comprises the house and garage roofed areas, with the remaining area grassed/permeable.
- 2.6 British Geological Survey Maps show the bedrock geology as being Chalk, overlain by superficial river terrace deposits of sand, silt and clay. Chalk is renowned for its permeability but the drift deposits may be much less porous. Only a soakage test (to BRE Digest 365) will determine the soil's infiltration rate.
- 2.7 Existing Surface Water Drainage: run-off from the roof areas and hard surfaces is assumed to currently discharge to a soakaway.
- 2.8 Existing Foul Drainage: it is assumed that the foul drainage is discharged offsite to the foul sewerage network in the street. This run will be utilised as much as possible.

3.0 FLOOD CONDITIONS

- 3.1 According to the Environment Agency Flood Map in Appendix D, the majority of the site is in coastal Flood Zone 3, which is land designated as having a high probability of flooding from watercourses (greater than 1 in 200 or >0.5% annual chance of flooding).
- 3.2 During a discussion with Mr. Rob Waite at the EA it was understood that the critical flood level on this site is 4.4m AOD. The EA's data pack also includes modelled flood depths for various storm return periods and tide elevations. The data in Appendix D concurs with Mr. Waite's level of 4.4m AOD, if the site's level is taken as 3.0m AOD and the predicted flood depth is 1.4m.
- 3.3 Historical flooding incidents: neither the EA nor Havant Council hold records of flooding incidents near to this site.
- 3.4 Other sources: there is no indication from the PUSH Strategic Flood Risk Assessment (SFRA) of this site suffering from overland flow, sewer or groundwater flooding.

4.0 PROPOSED SITE AND FLOOD MITIGATION

- 4.1 The application is for a replacement two-storey detached 4 bedroom dwelling and garage – see the architect's floor plans in Appendix C.
- 4.2 The total proposed footprint area for the dwelling and garage is 299m² and although is a significant increase this has been designed as a 4 bedroom dwelling as per the existing unit.
- 4.3 All the external surfacing shall be of permeable paving, eg porous paviers.
- 4.4 Floor Levels: the normal recommendation from the EA is that ground floors of properties are set 300mm above the 0.5% with climate change flood level, this being 4.7m AOD. In this case further advice was sought from the EA as the existing FFL is approximately 1.4m below this. Mr. Waite recommended that the level is raised as high as possible and other mitigation is proposed to offset the remaining risk as far as possible. It is proposed that the FFL of the proposed property is raised to 3.42m AOD, ie significantly above existing ground levels surrounding the property and 100mm above the existing FFL.
- 4.5 Flood resilience measures: it is proposed to provide flood resilient construction up to the 4.7m AOD level. The document "Improving the Flood Performance of New Buildings - Flood Resilient Construction" published by DEFRA/Environment Agency should be consulted. Appendix E includes more detail on this, including how to download this publication.
- 4.6 Specific examples of flood resilient construction would include waterproof flooring and plaster as well as running all cabling and pipes (ie all services distribution) downwards from first floor level. All meters, distribution board and combi-boiler are to be positioned above this 4.7m level, too.

5.0 FLOOD WARNING AND EVACUATION

- 5.1 Safe means of access and escape: The closest land to the site which lies above the floodplain is directly to the north along Langstone Road.
- 5.2 Following a 1 in 200 year storm event, the entire site would become inundated. The danger to people crossing these floodwaters in an attempt to evacuate the site will be no different after the proposed dwelling is built than at present. It should also be noted that, as the flood pattern is tidal, there shall be a 12-hourly pattern, ie the flood waters should recede after a maximum of 12 hours.
- 5.3 As attempting to leave the site following an inundation shall probably be hazardous, occupants of the building should register with the free flood warning service provided by the Environment Agency (called 'Floodline') in order to facilitate evacuation of the premise prior to the site becoming inundated. In addition, TV news channels and local radio stations will augment the EA's warnings in their bulletins.
- 5.4 Occupants should therefore take refuge at first floor level, to which they can retreat. They can wait for emergency services in times of flooding if necessary but as the flooding is tidal the wait should be no longer than 12 hours or so. To convey this information, a durable plastic notice should be affixed adjacent to the electrical distribution board, which should state that occupants should sign up to the EA's 'Floodline' service and in the event of the site becoming inundated should seek refuge on the first floor.

6.0 SEQUENTIAL AND EXCEPTION TEST

6.1 Although not being an extension to an existing property, the view taken by this report is that the application could be considered under PPS25 as a 'Minor Development' as the proposed redevelopment is:

- of the same type as existing (ie a two-storey detached house)
- broadly the same scale and occupancy level as the existing, ie both are 4-bedroom dwellings
- occupies approximately the same position within the site as the existing dwelling
- involves an increase footprint of less than 250m²

6.2 Minor developments are exempt from sequential and exception tests.

7.0 PROPOSED DRAINAGE STRATEGY AND SUDS MEASURES

7.1 Surface Water: it is proposed to dispose of surface water runoff from the proposed site in the same manner as existing i.e. discharging to the soakaways. This is on the assumption that the soil's infiltration rate is found to be great enough, following a soakage test undertaken in accordance with BRE Digest 365.

7.2 Ideally any existing soakaways will be reused; however depending on their condition they may need to be replaced or supplemented with new soakaway(s). Any new soakaways should be designed in accordance with BRE 365 guidance. New soakaways should be sized up to a 1 in 100 year storm with a 30% climate change adjustment and should half-drain their volume of rainwater in less than 24 hours in readiness for a subsequent storm.

7.3 Soakaways should be located at least 5m from the building line. See the proposed layout drawing in Appendix C and the calculation in Appendix F that show a nominal soakaway design, assuming 10⁻⁴m/s soil infiltration rate. This must be re-worked once the actual rate has been determined.

7.4 In the event of soakaways being unfeasible due to the soakage rate being too low, it is proposed to discharge surface water offsite into the sewerage network in Langstone Road. This will be limited to 5.0l/s, subject to agreement with Southern Water, who owns the apparatus. This is the practical minimum discharge rate used in BREEAM's rating score system. The flow would be limited by a device such as an orifice plate and immediately adjacent to this would be an underground attenuation tank (strengthened by crates) sized to hold the critical 1 in 100 years plus 30% climate change event. See the calculation in Appendix F.

8.0 SUMMARY AND CONCLUSIONS

- 8.1 The application is for a replacement 4 bedroom dwelling as per the existing.
- 8.2 The dwelling is in coastal Flood Zone 3 north of Langstone Harbour.
- 8.3 The proposed ground floor's FFL is to be set at 3.42m AOD, whilst the predicted critical flood level is 4.4m AOD. The usual EA requirement is to set new units 0.3m above this level, ie at 4.7m AOD.
- 8.4 To mitigate against this risk of flooding it is proposed to construct up to the 4.7m AOD level with resilient materials and techniques. Examples of such construction include waterproof flooring and plaster and running all cabling and pipes (ie all services distribution) downwards from first floor level, as per the publication, "Improving the Flood Performance of New Buildings - Flood Resilient Construction" published by DEFRA/Environment Agency. See Appendix E for more details.
- 8.5 Flood Warning & Evacuation: A durable plastic notice should be affixed adjacent to the electrical distribution board stating that this property is at risk of flooding from the coast and that occupants should sign up to the EA's 'Floodline' warning service in order to initiate evacuation prior to the site becoming inundated. The occupants should take refuge at high level in the case of the ground floor becoming flooded.
- 8.6 SUDS: depending on a site soakage test to BRE Digest 365 surface water is to be discharged to soakaways, sized for a 1 in 100 year + 30% storm event. If the soil's infiltration rate is found to be too low for soakaways to be feasible the roofs' surface water shall be discharged offsite as described in section 7.4.

It is therefore considered that this development is PPS25 compliant.

- End of Report -

APPENDIX A

Site Location Maps & Aerial Photo

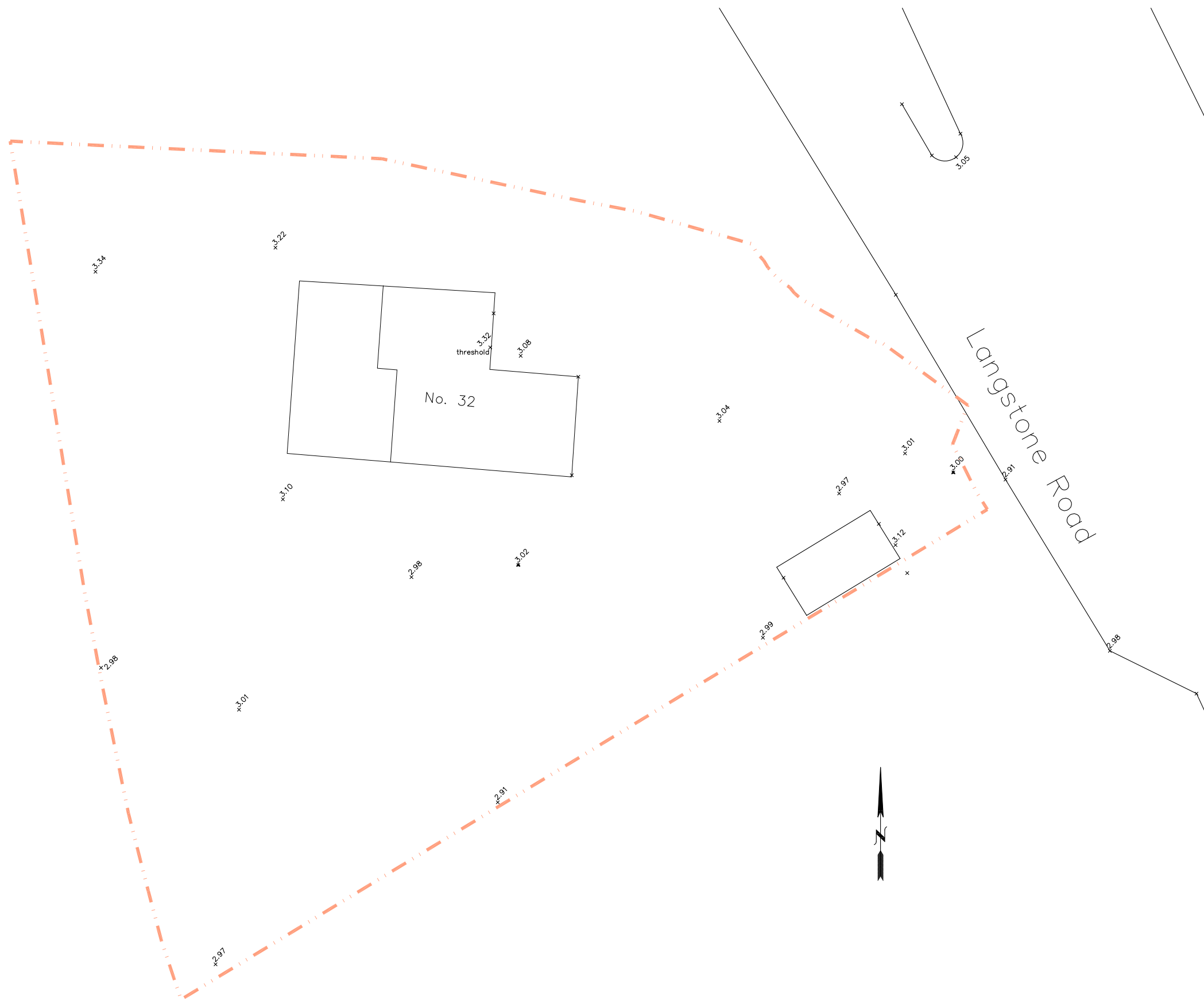






APPENDIX B

Topographical Survey

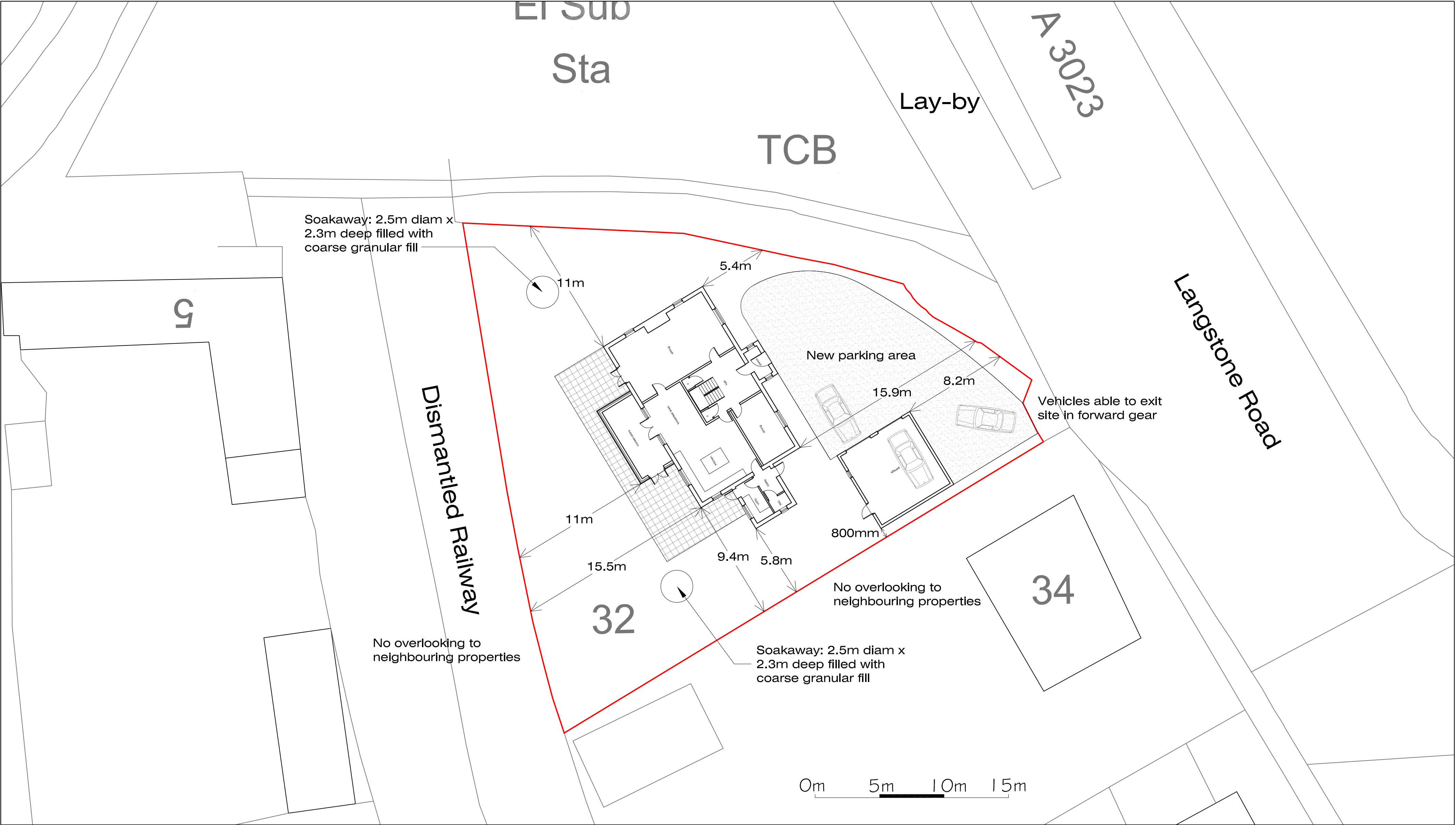


GTA Civils Ltd. Topographical Survey 32 Langstone Road, Havant

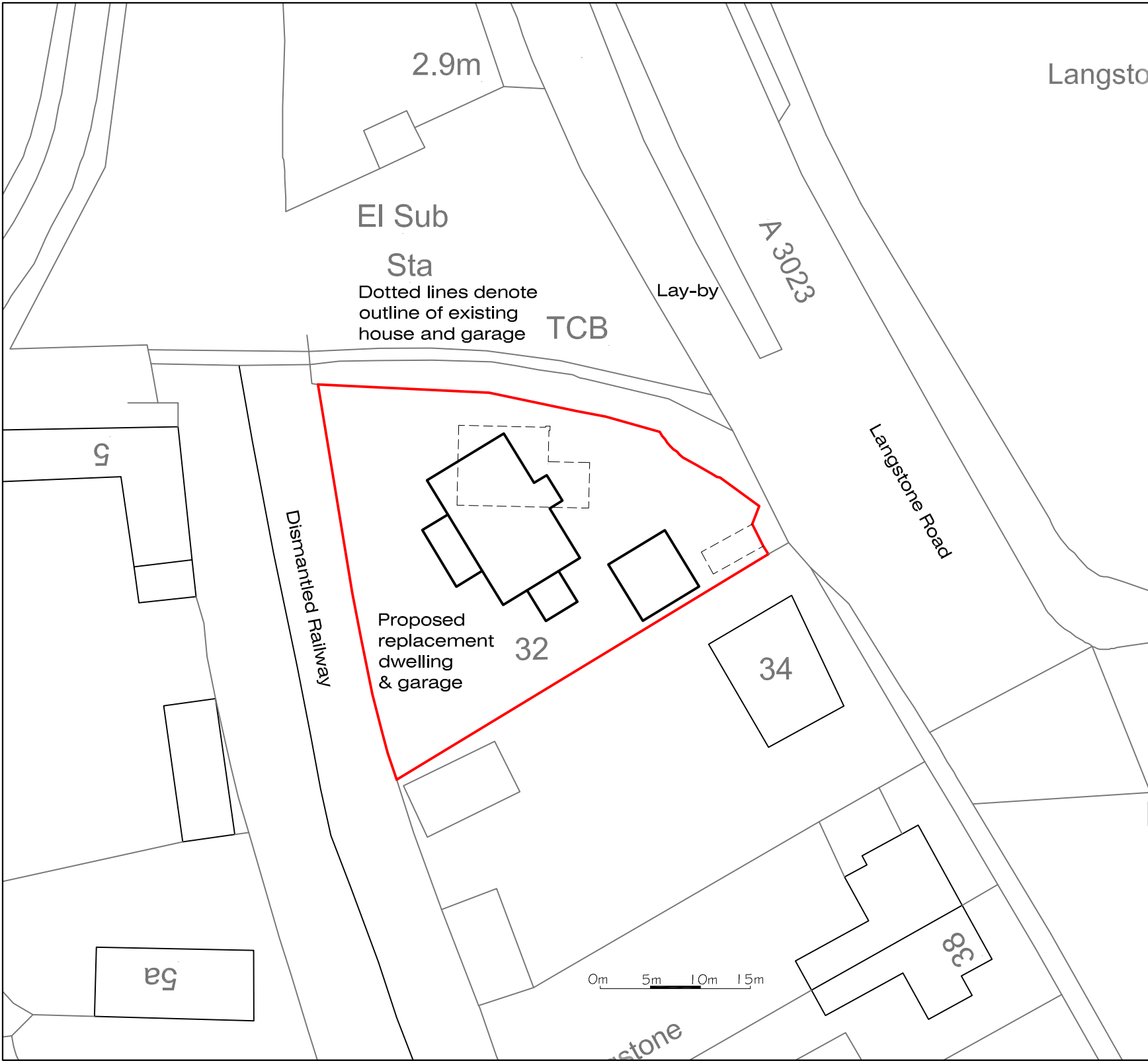
Scale 1:200

APPENDIX C

Architectural Drawings



Site Layout - As Proposed - 1:200



Block Plan - As Proposed - 1:500

A	Issued for Planning Application	NJ	08-08-11
-	Issued for Pre-Application	NJ	16-05-11
Rev.		By	Date

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Title			
Site & Block Plan - As Proposed			
Date	Apr 11	Drawn By	NJ
Job No.	Drawing No.	Scale	Revision
11-009	102	1:200 /500@A1	A

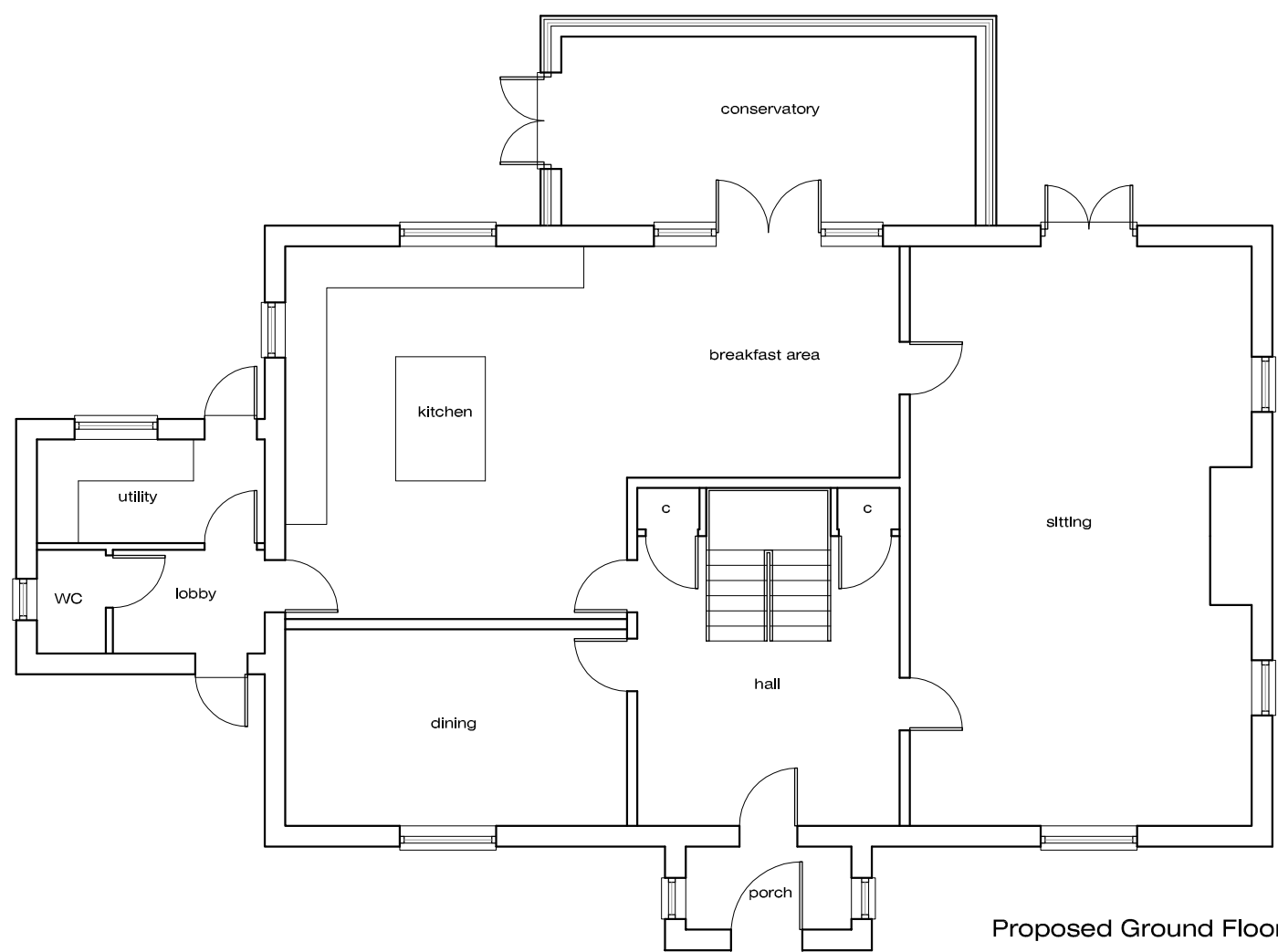


Front (East) Elevation - As Proposed

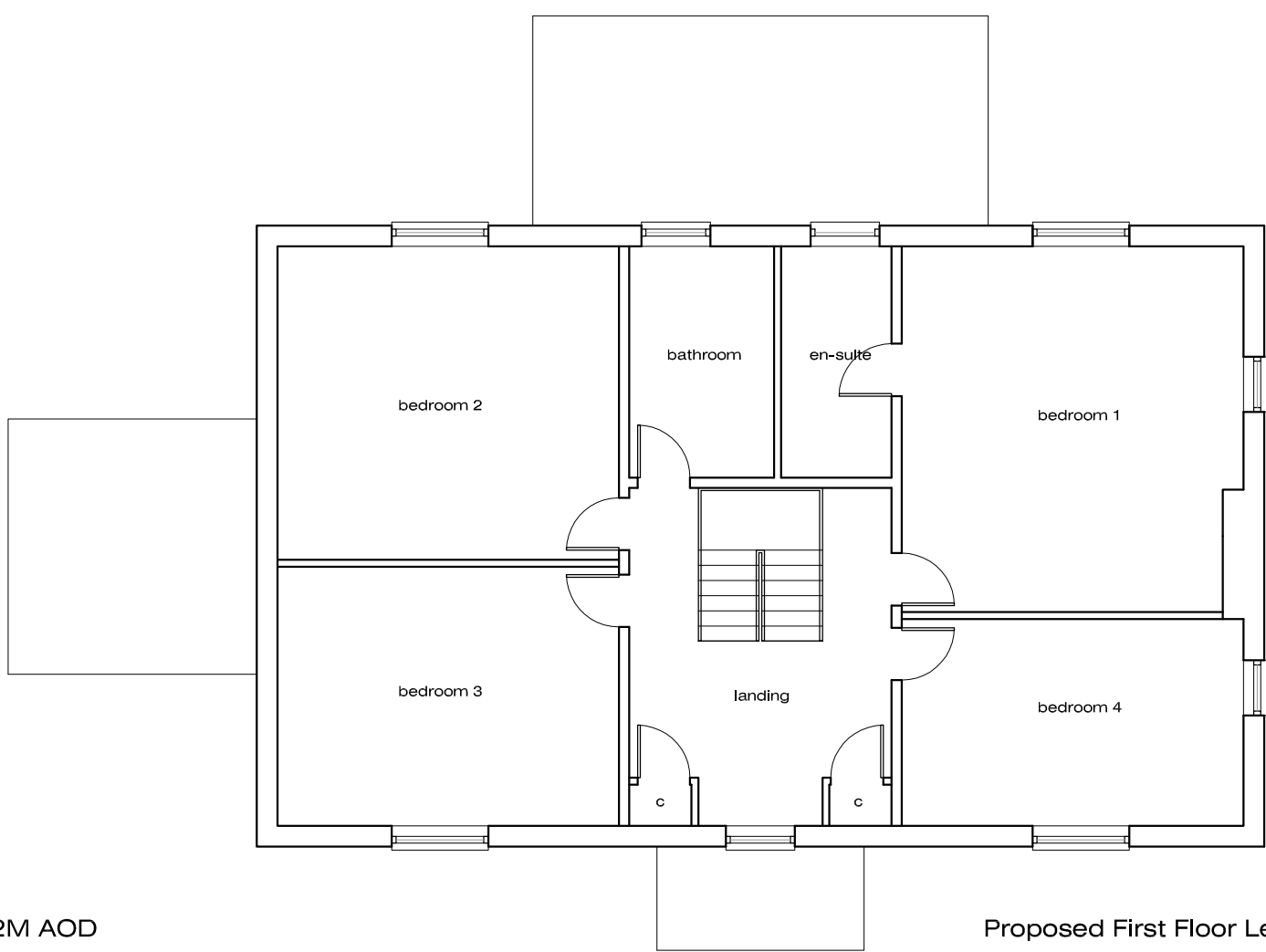
Side (North) Elevation - As Proposed

Side (South) Elevation - As Proposed

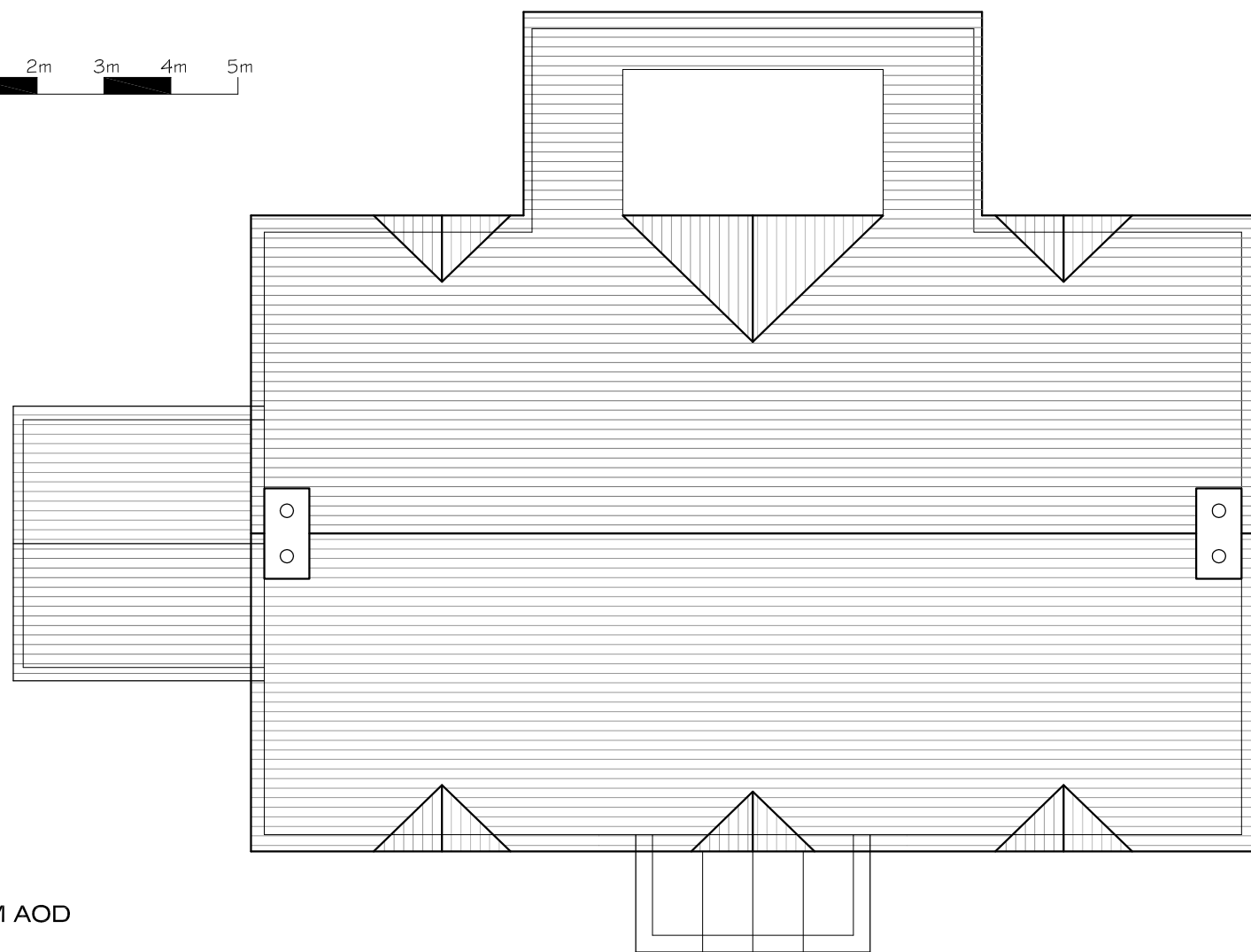
Rear (West) Elevation - As Proposed



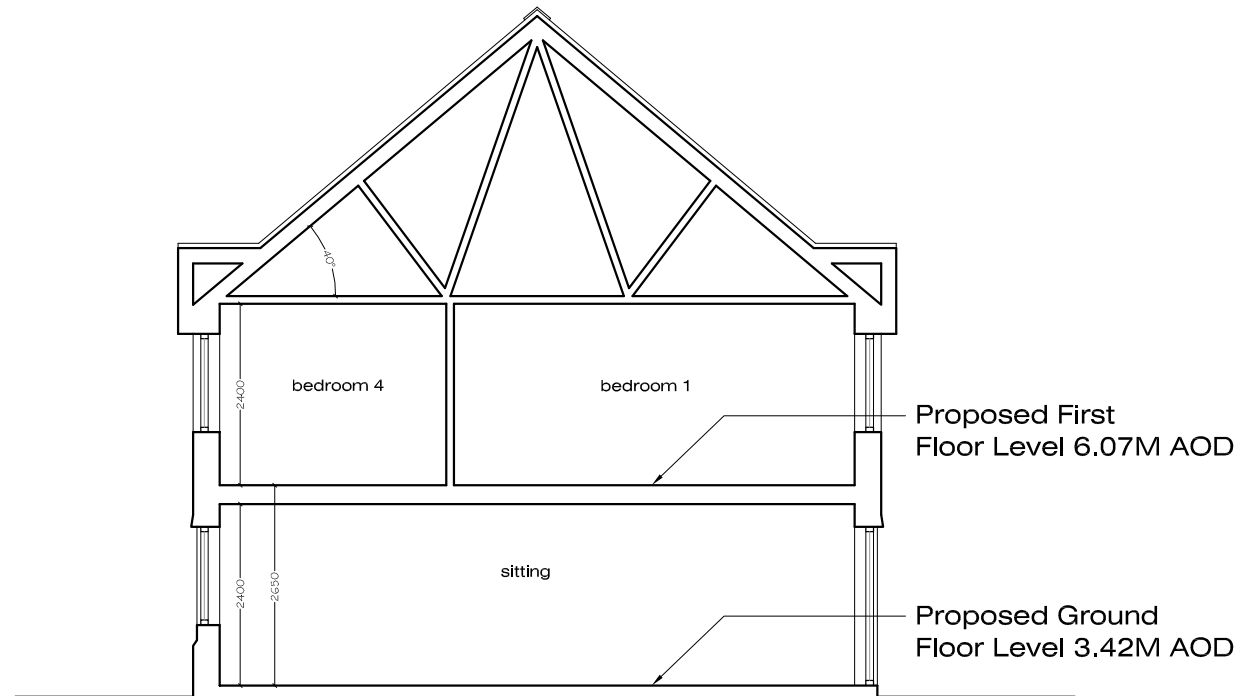
Ground Floor Plan - As Proposed



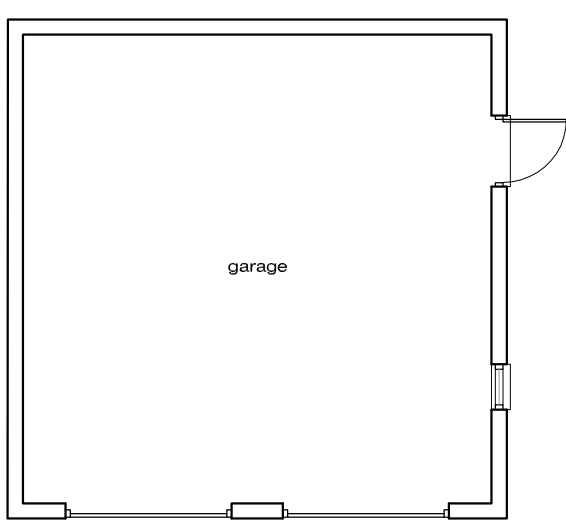
First Floor Plan - As Proposed



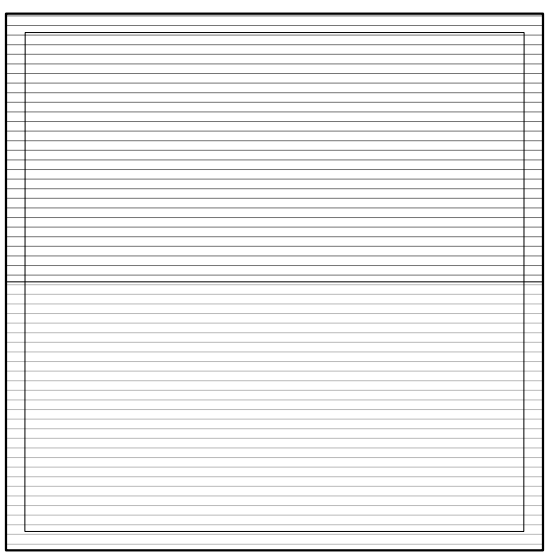
Roof Plan - As Proposed



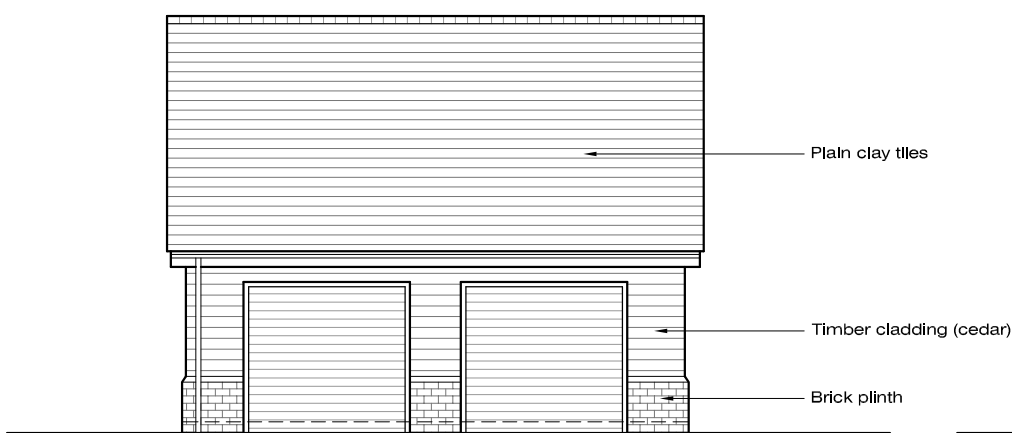
Section - As Proposed



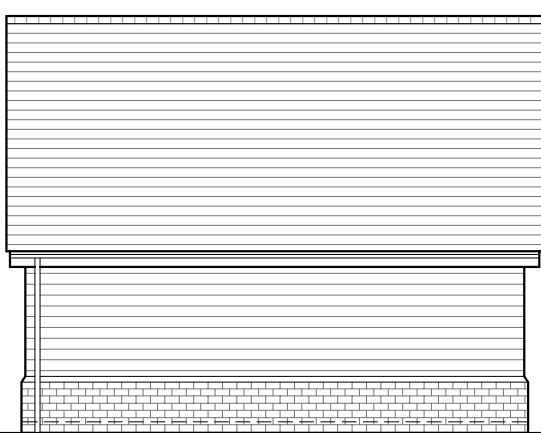
Garage Floor Plan - As Proposed



Roof Plan - As Proposed



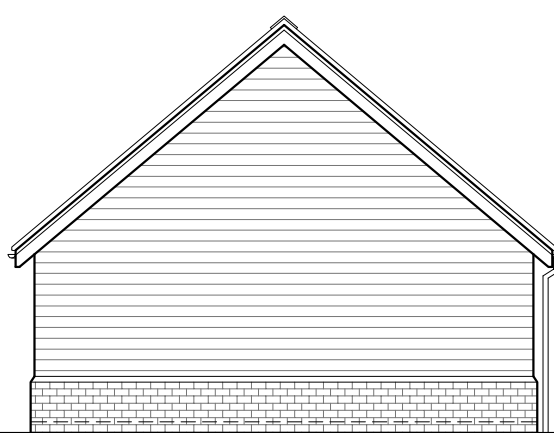
Front (North) Elevation - As Proposed



Rear (South) Elevation - As Proposed



Side (West) Elevation - As Proposed



Side (East) Elevation - As Proposed

A	Issued for Planning Application	NJ	08-08-11
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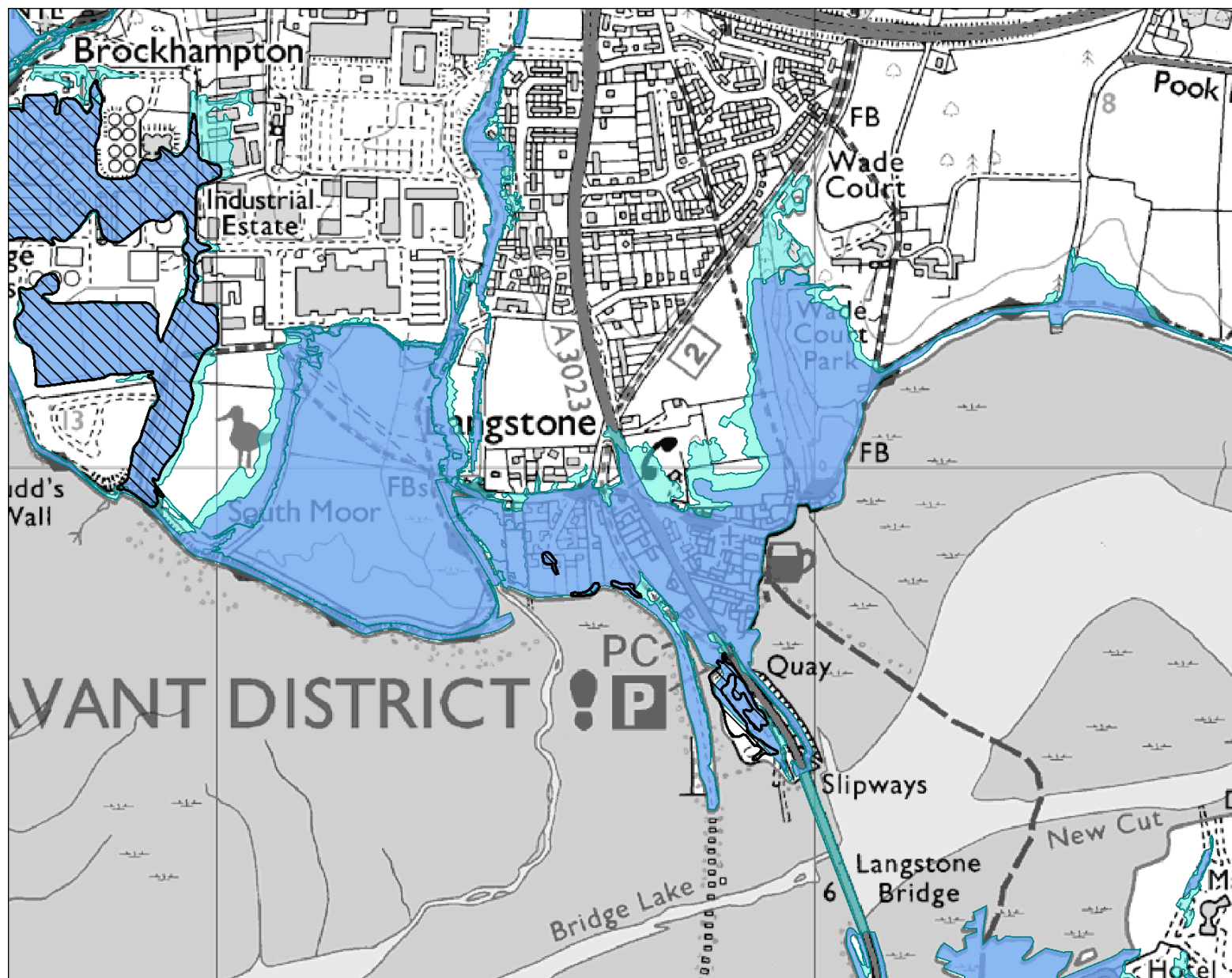
Client
Mrs P Hedley

Title Plans & Elevations - As Proposed			
Date	Apr 11	Drawn By	NJ
Job No.	Drawing No.	Scale	Revision
11-009	101	1:100 /500@A1	A

APPENDIX D

Environment Agency Flood Data

Flood Map Centered on Langstone Road - Created 20 July 2011 (Ref: SSD/461/KJB)



Scale 1:10,001



- Flood Map - Defences
- Areas Benefiting from Flood Defences
- Flood Map - Flood Storage Areas
- Flood Map - Flood Zone 3
- Flood Map - Flood Zone 2

Flood Map Areas (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:

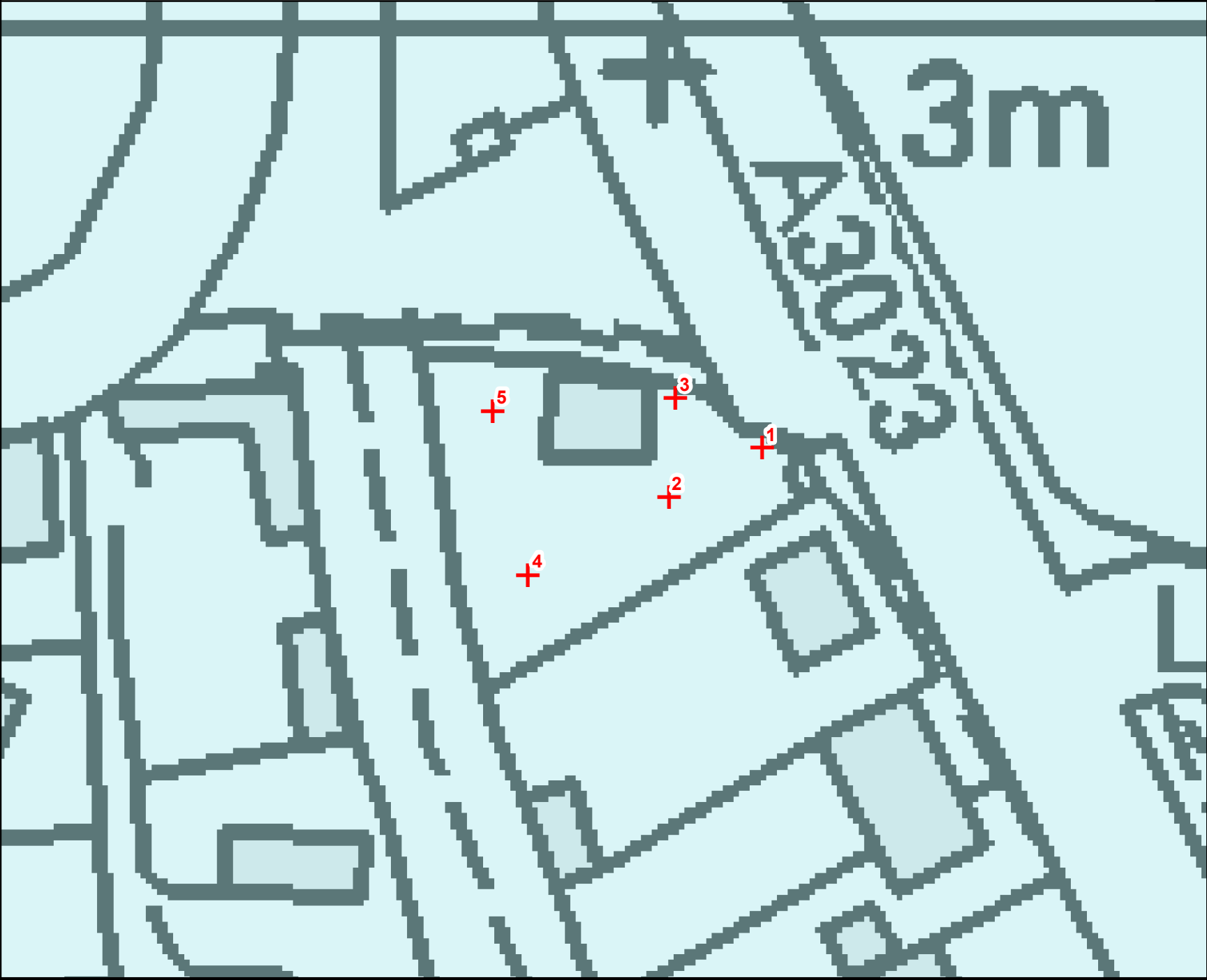
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

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Modelled Flood Depths Centered on Langstone Road -
Created 20 July 2011 (Ref: SSD/461/KJB)



Legend

+ Location Point

Water Depth

Value



High : 3.40282e+038

Low : 1.17549e-038

1:617

N



Flood Depths in metres

Location Point	Tide of 3.3mAOD - 2s Wave Period	Tide of 3.7mAOD - 2s Wave Period	Tide of 3.9mAOD - 2s Wave Period	Tide of 4.0mAOD - 2s Wave Period	Tide of 4.5mAOD - 2s Wave Period
1	0.24	0.67	0.87	0.97	1.47
2	0.30	0.73	0.93	1.03	1.53
3	0.20	0.63	0.83	0.93	1.42
4	0.25	0.69	0.88	0.98	1.48
5	0.06	0.48	0.68	0.78	1.28

APPENDIX E

Extract from “Improving the Flood Performance of New Buildings – Flood Resilient Construction”

Services

General advice for resilient design

Where possible, all service entries should be sealed (e.g. with expanding foam or similar closed cell material).

Pipework: Closed cell insulation should be used for pipes which are below the predicted flood level.

Drainage services: Non-return valves are recommended in the drainage system to prevent back-flow of diluted sewage in situations where there is an identified risk of the foul sewer surcharging. Maintenance of these valves is important to ensure their continued effectiveness.

Water, electricity and gas meters: should be located above predicted flood level.

Electrical services: electrical sockets should be installed above flood level for ground floors to minimise damage to electrical services and allow speedy re-occupation (see Figure 6.13. Note a dado rail which provides a limit for replacement of any wall covering). Electric ring mains should be installed at first floor level with drops to ground floor sockets and switches.

Heating systems: boiler units and ancillary devices should be installed above predicted flood level and preferably on the first floor of two-storey properties. Underfloor heating should be avoided on ground floors and controls such as thermostats should be placed above flood level. Conventional heating systems, e.g. hot water pipes are unlikely to be significantly affected by flood water unless it contains a large amount of salts. The less common, hot air duct heating would remain effective provided it is installed above the design flood level.

Communications wiring: wiring for telephone, TV, Internet and other services should be protected by suitable insulation in the distribution ducts to prevent damage. Any proposed design solution for flood insulation on all potentially vulnerable wiring should be discussed with the relevant service providers.

Aim of the Guidance

This document aims to provide guidance to developers and designers on how to improve the resilience of new properties in low or residual flood risk areas by the use of suitable materials and construction details. These approaches are appropriate for areas where the probability of flooding is low (e.g. flood zone 1 as defined by PPS 25) or areas where flood risk management or mitigation measures have been put in place. The guidance will also be useful to planners, building control officers and loss adjusters.

Specifically this guidance document provides:

- o practical and easy-to-use guidance on the design and specification of new buildings (primarily housing) in low or residual flood risk areas in order to reduce the impacts of flooding
- o recommendations for the construction of flood resistant and resilient buildings.

The full document can be downloaded from:

http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf

APPENDIX F

Micro Drainage Calculations

GTA Consulting		Page 1
Unity House 2 Albert Drive Burgess Hill RH15 9TN	32 Langstone Road Havant	
Date 05-08-11 File 32 langstone rd So...	Designed By JP Checked By	
Micro Drainage	Source Control W.11.4	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 37 minutes

Storm Duration (mins)	Maximum Filtration (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
15 Summer	2.2	2.2	27.5717	1.5717	5.9	0 K
30 Summer	2.5	2.5	27.8592	1.8592	7.0	0 K
60 Summer	2.6	2.6	27.9977	1.9977	7.5	0 K
120 Summer	2.5	2.5	27.9187	1.9187	7.2	0 K
180 Summer	2.4	2.4	27.7522	1.7522	6.6	0 K
240 Summer	2.2	2.2	27.6042	1.6042	6.0	0 K
360 Summer	2.0	2.0	27.3617	1.3617	5.1	0 K
480 Summer	1.8	1.8	27.1703	1.1703	4.4	0 K
600 Summer	1.6	1.6	27.0168	1.0168	3.8	0 K
720 Summer	1.5	1.5	26.8888	0.8888	3.3	0 K
960 Summer	1.3	1.3	26.6903	0.6903	2.6	0 K
1440 Summer	1.1	1.1	26.4278	0.4277	1.6	0 K
2160 Summer	0.8	0.8	26.2008	0.2007	0.8	0 K
2880 Summer	0.7	0.7	26.0788	0.0788	0.3	0 K
4320 Summer	0.5	0.5	26.0393	0.0392	0.1	0 K
5760 Summer	0.4	0.4	26.0313	0.0312	0.1	0 K
7200 Summer	0.4	0.4	26.0263	0.0262	0.1	0 K
8640 Summer	0.3	0.3	26.0228	0.0227	0.1	0 K
10080 Summer	0.3	0.3	26.0203	0.0202	0.1	0 K
15 Winter	2.4	2.4	27.7802	1.7802	6.7	0 K
30 Winter	2.7	2.7	28.1127	2.1127	7.9	FLOOD RISK
60 Winter	2.9	2.9	28.2467	2.2467	8.4	FLOOD RISK
120 Winter	2.7	2.7	28.0847	2.0847	7.8	0 K
180 Winter	2.5	2.5	27.8372	1.8372	6.9	0 K
240 Winter	2.2	2.2	27.6222	1.6222	6.1	0 K
360 Winter	1.9	1.9	27.2948	1.2947	4.9	0 K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	129.16	16
30 Summer	86.66	26
60 Summer	55.35	44
120 Summer	34.00	78
180 Summer	25.12	112
240 Summer	20.22	144
360 Summer	14.87	208
480 Summer	11.94	270
600 Summer	10.06	332
720 Summer	8.74	392
960 Summer	6.99	514
1440 Summer	5.10	754
2160 Summer	3.71	1120
2880 Summer	2.96	1468
4320 Summer	2.14	2200
5760 Summer	1.71	2928
7200 Summer	1.43	3552
8640 Summer	1.24	4272
10080 Summer	1.10	5056
15 Winter	129.16	16
30 Winter	86.66	28
60 Winter	55.35	46
120 Winter	34.00	82
180 Winter	25.12	118
240 Winter	20.22	152
360 Winter	14.87	218

GTA Consulting		Page 2
Unity House 2 Albert Drive Burgess Hill RH15 9TN	32 Langstone Road Havant	
Date 05-08-11 File 32 langstone rd So...	Designed By JP Checked By	
Micro Drainage	Source Control W.11.4	

Summary of Results for 100 year Return Period (+30%)

Storm Duration (mins)	Maximum Filtration (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
480 Winter	1.7	1.7	27.0518	1.0518	3.9	0 K
600 Winter	1.5	1.5	26.8653	0.8653	3.2	0 K
720 Winter	1.3	1.3	26.7178	0.7178	2.7	0 K
960 Winter	1.1	1.1	26.4997	0.4997	1.9	0 K
1440 Winter	0.9	0.9	26.2333	0.2332	0.9	0 K
2160 Winter	0.7	0.7	26.0488	0.0487	0.2	0 K
2880 Winter	0.5	0.5	26.0388	0.0387	0.1	0 K
4320 Winter	0.4	0.4	26.0283	0.0282	0.1	0 K
5760 Winter	0.3	0.3	26.0228	0.0227	0.1	0 K
7200 Winter	0.3	0.3	26.0188	0.0188	0.1	0 K
8640 Winter	0.2	0.2	26.0163	0.0163	0.1	0 K
10080 Winter	0.2	0.2	26.0148	0.0148	0.1	0 K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
480 Winter	11.94	282
600 Winter	10.06	344
720 Winter	8.74	406
960 Winter	6.99	530
1440 Winter	5.10	766
2160 Winter	3.71	1088
2880 Winter	2.96	1468
4320 Winter	2.14	2140
5760 Winter	1.71	2896
7200 Winter	1.43	3544
8640 Winter	1.24	4248
10080 Winter	1.10	5088

GTA Consulting		Page 3
Unity House 2 Albert Drive Burgess Hill RH15 9TN	32 Langstone Road Havant	
Date 05-08-11 File 32 langstone rd So...	Designed By JP Checked By	
Micro Drainage	Source Control W.11.4	

Rainfall Details

Region	ENG+WAL	Shortest Storm (mins)	15
Return Period (years)	100	Longest Storm (mins)	10080
M5-60 (mm)	21.000	Summer Storms	Yes
Ratio-R	0.350	Winter Storms	Yes
Cv (Summer)	0.750	Climate Change %	+30
Cv (Winter)	0.840		

Time / Area Diagram

Total Area (ha) = 0.030

Time from:	(mins) to:	Area (ha)
0	4	0.030

GTA Consulting		Page 4
Unity House 2 Albert Drive Burgess Hill RH15 9TN	32 Langstone Road Havant	
Date 05-08-11 File 32 langstone rd So...	Designed By JP Checked By	
Micro Drainage	Source Control W.11.4	

House Soakaway Details

Infil Coef - Base (m/hr)	0.360000	Number Required	2
Infil Coef - Sides (m/hr)	0.360000	Invert Level (m)	26.000
Safety Factor	2.0	Cover Level (m)	28.300
Porosity	0.30	Cap Volume (m)	28.250
Pit Width (m)	2.50	Cap Infiltration (m)	28.250

GTA Consulting		Page 1
Unity House 2 Albert Drive Burgess Hill RH15 9TN	32 Langstone Road Havant	
Date 04-08-11 File 32 langstone rd At...	Designed By JP Checked By	
Micro Drainage	Source Control W.11.4	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 11 minutes

Storm Duration (mins)	Maximum Control (l/s)	Maximum Filtration (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
15 Summer	4.5	0.0	4.5	27.6193	0.6193	4.4	0 K
30 Summer	4.7	0.0	4.7	27.6808	0.6808	4.9	0 K
60 Summer	4.6	0.0	4.6	27.6453	0.6453	4.6	0 K
120 Summer	4.2	0.0	4.2	27.5138	0.5137	3.7	0 K
180 Summer	3.8	0.0	3.8	27.3938	0.3937	2.8	0 K
240 Summer	3.4	0.0	3.4	27.3038	0.3037	2.2	0 K
360 Summer	2.9	0.0	2.9	27.1823	0.1822	1.3	0 K
480 Summer	2.5	0.0	2.5	27.1073	0.1073	0.8	0 K
600 Summer	2.2	0.0	2.2	27.0583	0.0583	0.4	0 K
720 Summer	2.0	0.0	2.0	27.0253	0.0252	0.2	0 K
960 Summer	1.7	0.0	1.7	27.0000	0.0000	0.0	0 K
1440 Summer	1.2	0.0	1.2	27.0000	0.0000	0.0	0 K
2160 Summer	0.9	0.0	0.9	27.0000	0.0000	0.0	0 K
2880 Summer	0.7	0.0	0.7	27.0000	0.0000	0.0	0 K
4320 Summer	0.5	0.0	0.5	27.0000	0.0000	0.0	0 K
5760 Summer	0.4	0.0	0.4	27.0000	0.0000	0.0	0 K
7200 Summer	0.4	0.0	0.4	27.0000	0.0000	0.0	0 K
8640 Summer	0.3	0.0	0.3	27.0000	0.0000	0.0	0 K
10080 Summer	0.3	0.0	0.3	27.0000	0.0000	0.0	0 K
15 Winter	4.8	0.0	4.8	27.7138	0.7138	5.1	0 K
30 Winter	4.9	0.0	4.9	27.7738	0.7738	5.5	0 K
60 Winter	4.7	0.0	4.7	27.6953	0.6953	5.0	0 K
120 Winter	4.1	0.0	4.1	27.4892	0.4892	3.5	0 K
180 Winter	3.5	0.0	3.5	27.3313	0.3312	2.4	0 K
240 Winter	3.1	0.0	3.1	27.2233	0.2232	1.6	0 K
360 Winter	2.5	0.0	2.5	27.0963	0.0963	0.7	0 K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	129.16	14
30 Summer	86.66	22
60 Summer	55.35	40
120 Summer	34.00	72
180 Summer	25.12	102
240 Summer	20.22	134
360 Summer	14.87	194
480 Summer	11.94	252
600 Summer	10.06	312
720 Summer	8.74	370
960 Summer	6.99	0
1440 Summer	5.10	0
2160 Summer	3.71	0
2880 Summer	2.96	0
4320 Summer	2.14	0
5760 Summer	1.71	0
7200 Summer	1.43	0
8640 Summer	1.24	0
10080 Summer	1.10	0
15 Winter	129.16	14
30 Winter	86.66	24
60 Winter	55.35	42
120 Winter	34.00	76
180 Winter	25.12	106
240 Winter	20.22	136
360 Winter	14.87	196

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Date 04-08-11 File 32 langstone rd At...	Designed By JP Checked By	
Micro Drainage	Source Control W.11.4	

Summary of Results for 100 year Return Period (+30%)

Storm Duration (mins)	Maximum Control (l/s)	Maximum Filtration (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m ³)	Status
480 Winter	2.0	0.0	2.0	27.0288	0.0287	0.2	0 K
600 Winter	1.8	0.0	1.8	27.0000	0.0000	0.0	0 K
720 Winter	1.5	0.0	1.5	27.0000	0.0000	0.0	0 K
960 Winter	1.2	0.0	1.2	27.0000	0.0000	0.0	0 K
1440 Winter	0.9	0.0	0.9	27.0000	0.0000	0.0	0 K
2160 Winter	0.7	0.0	0.7	27.0000	0.0000	0.0	0 K
2880 Winter	0.5	0.0	0.5	27.0000	0.0000	0.0	0 K
4320 Winter	0.4	0.0	0.4	27.0000	0.0000	0.0	0 K
5760 Winter	0.3	0.0	0.3	27.0000	0.0000	0.0	0 K
7200 Winter	0.3	0.0	0.3	27.0000	0.0000	0.0	0 K
8640 Winter	0.2	0.0	0.2	27.0000	0.0000	0.0	0 K
10080 Winter	0.2	0.0	0.2	27.0000	0.0000	0.0	0 K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
480 Winter	11.94	254
600 Winter	10.06	0
720 Winter	8.74	0
960 Winter	6.99	0
1440 Winter	5.10	0
2160 Winter	3.71	0
2880 Winter	2.96	0
4320 Winter	2.14	0
5760 Winter	1.71	0
7200 Winter	1.43	0
8640 Winter	1.24	0
10080 Winter	1.10	0

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Rainfall Details

Region	ENG+WAL	Shortest Storm (mins)	15
Return Period (years)	100	Longest Storm (mins)	10080
M5-60 (mm)	21.000	Summer Storms	Yes
Ratio-R	0.350	Winter Storms	Yes
Cv (Summer)	0.750	Climate Change %	+30
Cv (Winter)	0.840		

Time / Area Diagram

Total Area (ha) = 0.030

Time from:	(mins) to:	Area (ha)
0	4	0.030

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Cellular Storage Details

Infil Coef - Base (m/hr) 0.000000 Porosity 0.95
 Infil Coef - Sides (m/hr) 0.000000 Invert Level (m) 27.000
 Safety Factor 2.0 Ground Level (m) 28.300

Depth (m)	Area (m ²)	Infil. Area (m ²)	Depth (m)	Area (m ²)	Infil. Area (m ²)	Depth (m)	Area (m ²)	Infil. Area (m ²)	Depth (m)	Area (m ²)	Infil. Area (m ²)
0.00	7.5	7.5	0.70	7.5	15.2	1.40	0.0	16.3	2.10	0.0	16.3
0.10	7.5	8.6	0.80	7.5	16.3	1.50	0.0	16.3	2.20	0.0	16.3
0.20	7.5	9.7	0.90	0.0	16.3	1.60	0.0	16.3	2.30	0.0	16.3
0.30	7.5	10.8	1.00	0.0	16.3	1.70	0.0	16.3	2.40	0.0	16.3
0.40	7.5	11.9	1.10	0.0	16.3	1.80	0.0	16.3	2.50	0.0	16.3
0.50	7.5	13.0	1.20	0.0	16.3	1.90	0.0	16.3			
0.60	7.5	14.1	1.30	0.0	16.3	2.00	0.0	16.3			

Orifice Outflow Control

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 26.850