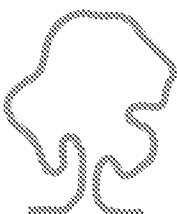


CARING HOMES

**WATERBURY HOUSE, FORD ROAD, ARUNDEL,
WEST SUSSEX BN18 0BH**

Flood Risk Assessment

August 2017

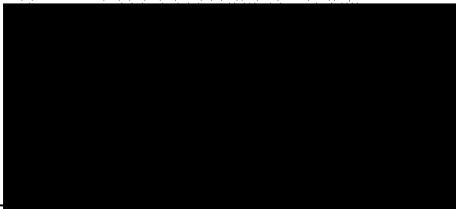
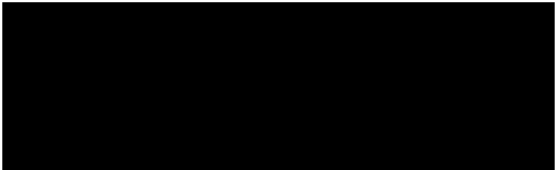


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REPORT DATA SHEET

Requirement	Data
Report Reference	CaringHomes/Waterbury/FRA/Aug2017
Date	August 2017
Client	Caring Homes
Report type	Flood Risk Assessment
Revisions	-
Prepared by	Lucy Monday BSc (Hons), MCIWEM, MIEEnvSc, AIEEM  Signed
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CARING HOMES

**WATERBURY HOUSE, FORD ROAD, ARUNDEL,
WEST SUSSEX BN18 0BH**

Flood Risk Assessment

August 2017

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CARING HOMES

**WATERBURY HOUSE, FORD ROAD, ARUNDEL,
WEST SUSSEX BN18 0BH**

Flood Risk Assessment

August 2017

NON-TECHNICAL SUMMARY

Environmental Assessment Services Ltd has been appointed to prepare a Flood Risk Assessment for submission to Adur District Council in relation to the proposed development of a residential annex at the existing Care Home in Ford, West Sussex.

It has been established that the site lies within Flood Zone 3a, at risk of tidal and potentially fluvial inundation from the River Arun. The site may also be at risk of groundwater flooding in the future.

The site is located within a generally rural area, approximately 200 m west of the River Adur and approximately 3.5 km north of the coastline. A concrete embankment presently maintained by the Environment Agency (EA) lies along the western bank of the River Adur. This defence is designed and maintained to provide a 1 in 200 (0.5 % AEP) standard of protection. We understand that it is policy to hold the line within the vicinity of the site for the next 50 years (from 2012), at which point maintenance is to be withdrawn.

It is proposed to develop a bungalow-style care facility comprising 5 No. one-bedroom units for adults with learning difficulties within the rear garden area of the existing Care Home. The building will comprise living accommodation across two floors, which will include bedrooms on the ground floor. The building is to be used as ancillary accommodation in connection with the main use of the site as a Care Home. It has been deemed that it is not feasible to locate the proposed development outside of the existing care home facility due to the vulnerability of the proposed occupants.

Flood modelling data indicates that the site would be affected by tidal flooding under the design flood event (0.5 % AEP plus climate change) however, the full extent of the site would not be affected. In this case, modelling forecasts that the site is at greater risk of flooding under the defended scenarios than the undefended scenarios. This is due to the potential for flood waters to become trapped and build up behind flood defences during a breach event.

The site falls from approximately + 5.0 m OD within the existing parking area to the west of the site, adjacent to Ford Road, down to approximately + 2.8 m OD at the eastern end of the garden. The building, which is to be located within the western end of the garden, lies within an area of lower flood risk than the eastern end of the site. Based on the defended design flood level (which is a worse case than the undefended level) and the known site levels (given in the topographic survey prepared for the site), it is predicted that the east end of the proposed building footprint would be

affected by approximately 0.03 m of flood waters. The western end of the building footprint lies above the defended design flood level.

In this case, recommendations to raise the floor level of the proposed building 600 mm above the predicted defended design flood level have been given. This would give a finished floor level of 4.69 m AOD. It has also been recommended that that paved access route, which leads to an area of lower flood risk, is raised above the predicted defended tidal flood level for 2110 (4.09 m), in order to allow for dry egress from the building during the (defended) design flood event.

Additional recommendations have been made regarding the preparation of an emergency evacuation and housing plan, which is to take into account the potential prolonged affects of groundwater flooding. Materials and detailing for the new building are to comply with good practice for flood resilient structures, as set out in '*Improving Flood Performance of New Buildings; Flood Resilient Construction*', CIRIA May 2007, in order to minimise the duration before the building may be re-occupied.

Sensitive land uses have been identified within the vicinity of the site, including static homes located adjacent to the eastern boundary of the site, at a lower ground level. In this case, surface water runoff must be dealt with on site. The existing development drains to soakaway, and this would be the preferred option for the new building. A drainage design is to be prepared for the new development based on onsite testing.

CARING HOMES

**WATERBURY HOUSE, FORD ROAD, ARUNDEL,
WEST SUSSEX BN18 0BH**

Flood Risk Assessment

August 2017

1. INTRODUCTION

- 1.1 Environmental Assessment Services Limited has been instructed to prepare a site-specific Flood Risk Assessment (FRA) in relation to the proposed development of a residential annex within the garden area of the existing residential care home (for people with learning difficulties) at Waterbury House.
- 1.2 The site is located on the eastern side of Ford Road, to the southwest of Arundel, in West Sussex. The site lies within an area at risk of flooding from the River Arun, which lies approximately 200 m southeast of the site. A flood risk assessment is required in support of the planning application.
- 1.3 This FRA is prepared generally in accordance with the Environment Agency's (EA's) standing advice for carrying out flood risk assessments (available online).
- 1.4 This report has been prepared for the purposes of addressing the Local Planning Authority's and the EA's concerns in relation to flood risks associated with the proposed development. It should be appreciated that the potential for flooding at a site depends on many factors, some natural, some man-made and some arising from accident, and also that these factors may change substantially over the life of the proposed development. The flood risk in this report is assessed on the basis of available information, which is generally catalogued in the report, but does not take into account any special risks or requirements of the development, unless we have been specifically informed of them.

2. EXISTING SITE & PROPOSED DEVELOPMENT

- 2.1 The site lies within the village of Ford, located a mile south of Arundel and two miles northwest of Littlehampton. The site lies immediately north of the railway line between Barnham (to the west) and Littlehampton (to the southeast). The Ordnance Survey Grid reference for the centre of the site is TQ 0029 0428. See Appendix A: Site Location Plan.

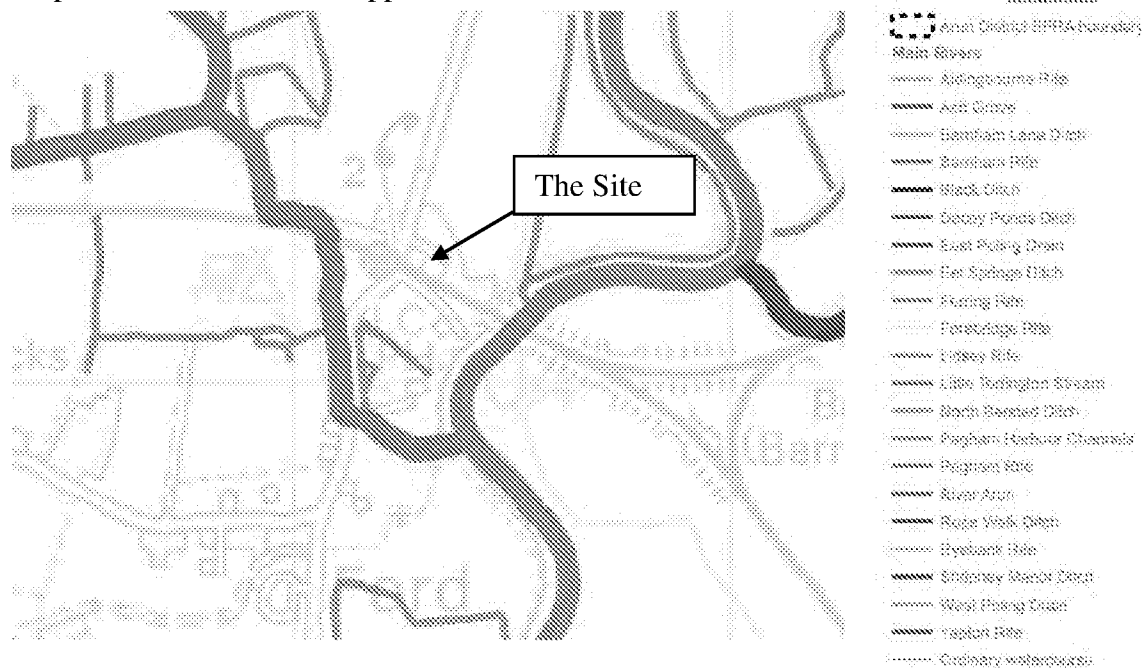
- 2.2 The site comprises a Victorian house (Waterbury House) with a single storey rear extension and an adjoining cottage (Railway Cottage) set in an acre of grounds. To the south of the property is a Klargester Waste Water Treatment Plant and an associated soakaway. The site elevation is approximately + 2.8 m OD at the eastern boundary of the site, rising to + 5.0 m OD within the existing parking area to the west, adjacent to Ford Road. See Appendix A: Topographical Survey.
- 2.3 It is proposed to construct a bungalow style care facility comprising 5 No. one-bedroom units for adults with learning difficulties within the rear garden area of the existing Care Home. The building, is to be used as ancillary accommodation in connection with the main use of the site as a Care Home. The two storey building will comprise three flats on the ground floor, and two flats on the first floor, plus an office/staff room on the first floor. See Appendix A: Figures for the Proposed Plans.

3. FLOOD RISK & HISTORY OF FLOODING AT THE SITE

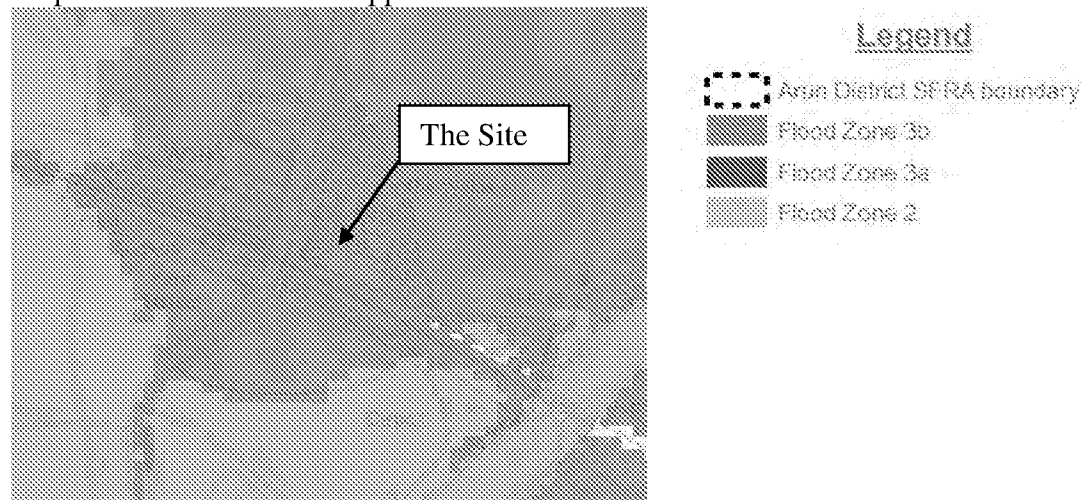
3.1 Undefended Flood Risk

- 3.1.1 The principal source of flood risk at the site is from tidal inundation via the River Adur, which lies some 200 m southeast of the site, and is tidal at this point. Land between the site and the River Adur comprises an irregular shaped plot used for static caravans and open fields divided by drainage channels (ordinary watercourses) to the north and a field, depot, camping and caravan parks to the south of the railway line, which lies along the southern boundary of the site.
- 3.1.2 Other watercourses within the vicinity of the site include the Little Tortington Stream, which lies some 215 m west of the site at its closest point before heading south and then east where it joins the River Adur approximately 400 m south of the site.
- 3.1.3 See below, map extracts centered on the site, which have been taken from the Strategic Flood Risk Assessment (SFRA) prepared by JBA Consulting (2016) for Arun District Council. These maps show the watercourses within the vicinity of the site, as discussed above, and the designated flood zones, which show the site to lie fully within Flood Zone 3a.

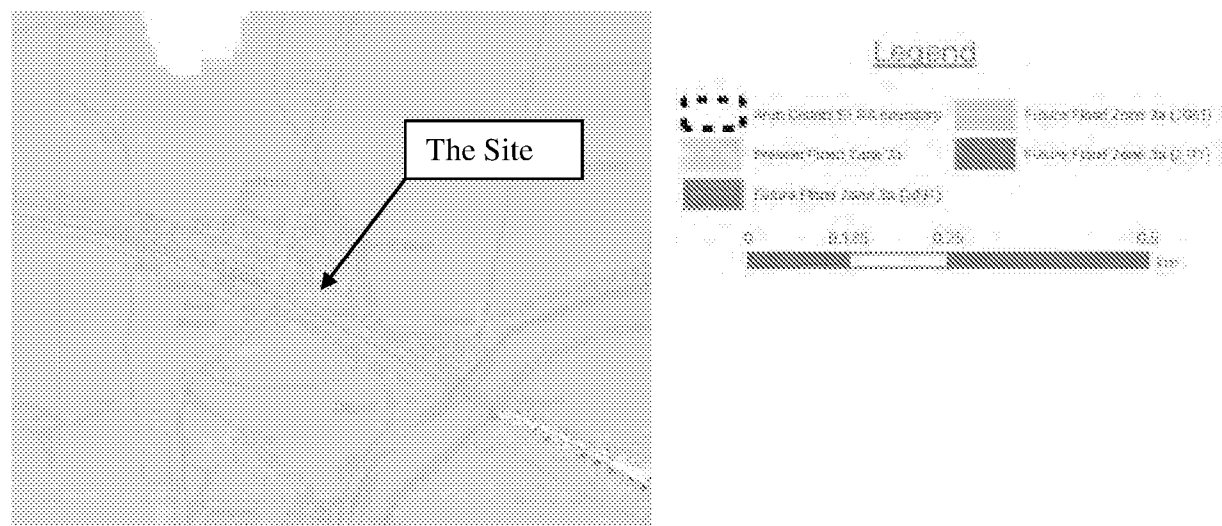
Map Extract from SFRA: Appendix B Watercourse



Map Extract from SFRA: Appendix C Flood Zones



Map Extract from Level 1 SFRA: Appendix D Climate Change Mapping



- 3.1.4 The EA Flood Map for Planning (see Appendix B) shows the site to lie wholly within Flood Zone 3. Flood Zone 3 is identified as an area that could be affected by flooding from the sea with a 1 in 200 or greater chance of happening each year (0.5 % Annual Exceedance Probability (AEP)). This probability does not take into account the presence of flood defences, which act to protect land behind the defences, but which may be breached and/or overtopped.
- 3.1.5 The EA have provided flood levels for various return periods at the site based on levels taken from The Lower Tidal River Arun Strategy model, completed in 2010 by Atkins.
- 3.1.6 We have been provided with modelled flood levels for nine data points within the rear garden of Waterbury House, which include the area of the proposed development footprint (see Appendix B: Site Boundary and Node Points map).
- 3.1.7 The data provided for the nine data points within the rear garden of Waterbury House may be used to assess the risk posed to the proposed property, and future site users, during any one of the given flood scenarios. No data has been provided for the area to the south or west of Waterbury House, or the adjacent road (Ford Road), which would be used to evacuate the site preceding or during a flood event.
- 3.1.8 The modelled **tidal undefended scenario** shows the lower areas of the site, which lie towards the eastern end of the site, to be affected by tidal flooding under each of the 5 %, 0.5 %, 0.5 % with climate change and the 0.1 % AEP scenarios. The predicted flood levels for each scenario have been compared with the site levels provided in the Topographic Survey (prepared for the site by ADG Architects and provided in Appendix A). The site is predicted to be affected as follows:
- **Under the 5 % AEP scenario** the northeast corner of the site (within the vicinity of Node Point 7) would be affected by flood waters up to a depth of 0.06 m (2.73 m AOD being the lowest level measured within the site). The proposed footprint of the building would remain unaffected under this scenario.
 - **Under the 0.5 % AEP scenario** a relatively small area adjacent to the eastern boundary of the site (within the vicinity of the Node Points 7, 8 and 9) would be affected by flood waters up to a depth of 0.29 m. The proposed footprint of the building would remain unaffected under this scenario.
 - **Under the 0.5 % (2110) AEP scenario** a greater area of the site would be affected by tidal flooding including part of the eastern footprint of the building. The lowest level measured within the footprint of the proposed building is 3.62 m AOD, giving a predicted flood depth of 0.03 m.
 - **Under the 0.1 % AEP scenario** a relatively small area adjacent to the eastern boundary of the site would be affected (again only within the vicinity of Node Points 7, 8 and 9), but a slightly greater area than that affected under the 0.5 % AEP scenario.

- 3.1.9 The modelled **fluvial undefended scenario** shows the site to be unaffected by fluvial flooding under the 5 %, 1 % and 0.1 % AEP scenarios. However, the lower areas of the garden, which lie at the eastern end of the site (see levels given in the Topographic Survey provided in Appendix A), may be affected by fluvial flood waters under the 1 % plus climate change scenario. The modelled flood level in meters (above ordnance survey datum) is given as 3.30 m. From comparison of this level with those provided on the Topographic Survey, it is evident that the eastern section of the site, which does not include the proposed location of the new building, would be flooded to a depth of up to 0.57 m above ground level (2.73 m AOD being the lowest level measured within the site).
- 3.1.10 The lowest level measured within the footprint of the proposed building is 3.62 m AOD (some 0.89 m higher than the northeast corner of the site). In this case, the building is not thought likely to be affected by fluvial flooding under any of the scenarios presented by the EA.

3.2 Climate Change

- 3.2.1 We understand the predicted flood levels provided for both the fluvial 1 % AEP plus climate change and the tidal 0.5 % AEP for 2110 scenarios discussed above are based on climate change predictions that have been revised/updated since the modelling was completed (2010).
- 3.2.2 Climate change predictions include increased rainfall intensity and peak river flows, rising sea levels, increased offshore wind speeds and increased extreme waves heights. We understand that the EA has updated their standard climate change allowances to take into account new understanding regarding these and other factors affecting flood risk.
- 3.2.3 It is considered possible that the flood risk at the site may be affected by rising sea levels and increased peak river flows. The site, located some 3.5 km north of the coastline and approximately 4 km northeast of the river mouth, is considered unlikely to be affected by increased extreme wave heights.
- 3.2.4 The EA has provided sea level allowances for the South East for each epoch in millimeters per year and a cumulative figure for sea level rise for each epoch, given in brackets (from the 1990 baseline). These are as follows:

TABLE 3.1: Sea Level Allowance

Year	1990-2025	2026-2055	2056-2085	2086-2115
Sea level allowance, mm	4 (140 mm)	8.5 (255 mm)	12 (360 mm)	15 (450 mm)

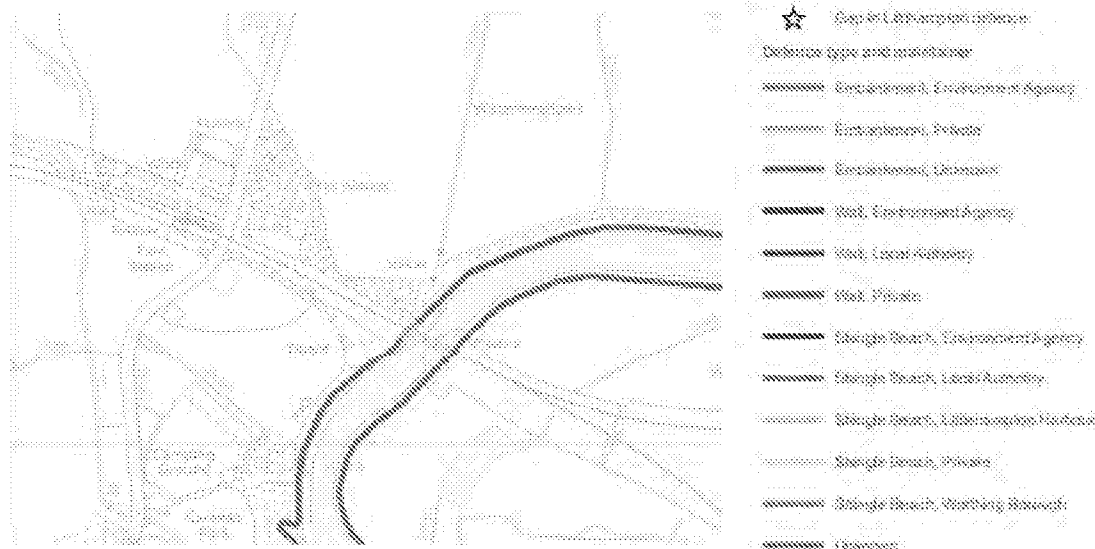
- 3.2.5 The allowances (given in the table above) can be added to the 1990 base sea level year to calculate the predicted sea level. We understand that these levels may differ from those used in The Lower Tidal River Arun Strategy model, completed by Atkins in 2010. The modelled undefended flood level for the 0.5 % AEP (2110) is 0.63 m greater than the 0.5 % AEP (presumably for 2010, when the modelling was completed). This level is greater than the cumulative 450 mm (0.45 m) suggested for 2115 (See Table 3.1 above).
- 3.2.6 According to the EA's current guidance (available online and accessed 9 August 2017), the standard climate change allowance, which should be added to peak river flows, has been increased from 20 % to 45 % for any site which lies within the South East, within an area identified to lie within Flood Zone 3a and where the proposed development is classified 'more vulnerable' (as in this case).
- 3.2.7 Modelling data from The Lower Tidal River Arun Strategy model used to provide the predicted fluvial flood level for the 1 % AEP plus climate change (given in Appendix B), identified that the eastern section of the site, which does not include the development footprint, may be affected by flood waters of up to 0.57 m above ground level (when compared with the levels provided in the Topographic Survey for the site). Taking into account the increased allowance for climate change (45 % increase in peak river flows), the depth of flooding within the eastern section of the site may be deeper (presenting a greater risk to site users) and the area affected by fluvial waters may be greater, possibly including the footprint of the proposed development area within the site, presenting at greater risk to both site users and the building.
- 3.2.8 It is therefore considered possible that the proposed building may be affected by both fluvial and tidal inundation, in isolation and in combination. It is considered that the site may be at greatest risk should defences fail during a peak high tide and rainfall event.
- 3.2.9 The 'high ++' allowance is not considered to apply in this case. The proposed development, comprising residential infill within an existing residential area, is not considered to be 'very sensitive' to flood risk and the lifetime of the development is not anticipated to extend beyond the end of the century (2099).

3.3 Defended Flood Risk

- 3.3.1 The River Arun lies some 200 m southeast of the site. The river at this point is tidal and land adjacent to the banks is at risk of both tidal and fluvial flooding. Flood defences have been installed along the banks of the River Adur. The Flood Defence Locations map (provided by the EA and included in Appendix B), shows embankments along both the eastern and western banks of the River Adur within the vicinity of the site.
- 3.3.2 We understand (from the EA) that the embankments are concrete, and are designed to give an estimated standard of protection of 1 in 200 (0.5 %). At this time, the defences are considered to provide sufficient protection from flooding, but may not provide sufficient protection in the future, subject to the impacts of climate change.

- 3.3.3 The modelled **tidal defended scenario** shows the site to be unaffected by tidal flooding under the 5 %, 0.5 % and the 0.1 % AEP scenarios, with the exception of a small area immediately adjacent to the eastern boundary of the site, which may be affected by up to 0.13 m of tidal flooding under the 0.1 % AEP scenario. However, the 0.5 % AEP tidal defended scenario for 2110 predicts significant flooding at the site, to a depth greater than that of the undefended scenario.
- 3.3.4 Under the **defended 0.5 % (2110) AEP scenario** the rear garden (including the proposed footprint of the new building) would be inundated by tidal flooding. The lowest area of the garden, within the northeast corner of the site could be affected by flood waters up to a depth of 1.38 m. The lowest measured point within the footprint of the proposed building would be inundated with tidal flood waters up to a depth of 0.47 m above ground level.
- 3.3.5 When questioned as part of this assessment, the EA confirmed that the tidal defended scenario includes the effects of wave overtopping on the flood levels and depths. *When modelling the effects of wave overtopping, the defences can trap water behind them, causing water to build up behind the defences. In some areas this will result in higher levels of water in comparison to the undefended scenario.* However, the site lies some 3.5 km from the coastline, and the River Adur meanders its way to an area of coastline approximately 4 km southeast of the site. Wave overtopping is considered unlikely to be a significant factor in this case.
- 3.3.6 The site is considered more likely to be at risk of a breach. This may occur where the flood defences are damaged or not maintained. We understand, from consultation with the EA, that the EA have permissive powers to undertake maintenance works on the embankment in accordance with the Lower Tidal River Arun Strategy and subject to funding. *The EA are currently planning some fairly major works to repair the linear defence between Ford and Arundel within the next six months. The defences within the area closest to the site are understood to be outside of the scope of this planned work, but the defences will continue to be regularly monitored and formally inspected twice yearly. Any defects noted will duly be recorded against the prescribed condition assessment for this asset (embankment / defence), if lower than that stated this will form the first process to action work. Currently the grading requirement for this defence is 3 (Fair); the EAs works being currently planned will repair the defence to this criteria.*
- 3.3.7 The Level 1 SFRA Defences map shows the embankments within the vicinity of the site to be managed by the Environment Agency, with the exception of a small section beneath the railway line along the western embankment, which is thought to be maintained by the local railway company (see map extract below).

Map Extract from Level 1 SFRA: Appendix I Defences



- 3.3.8 The EA's Lower Tidal River Arun Final Strategy Report (December 2012), sets out the EA's plans for flood management between Pallingham Weir (north of Pulborough) down to the Ford railway bridge on the west bank and the A259 road bridge on the east bank, upstream of the river mouth at Littlehampton, for the next 100 years (from 2012). The site lies within the Arundel to Littlehampton area (referred to as SU6). The strategy for this area is to maintain the defences for the next 50 years, followed by the withdrawal of maintenance. See Table Extract below, taken from the EA's Lower Tidal River Arun Final Strategy Report (December 2012).

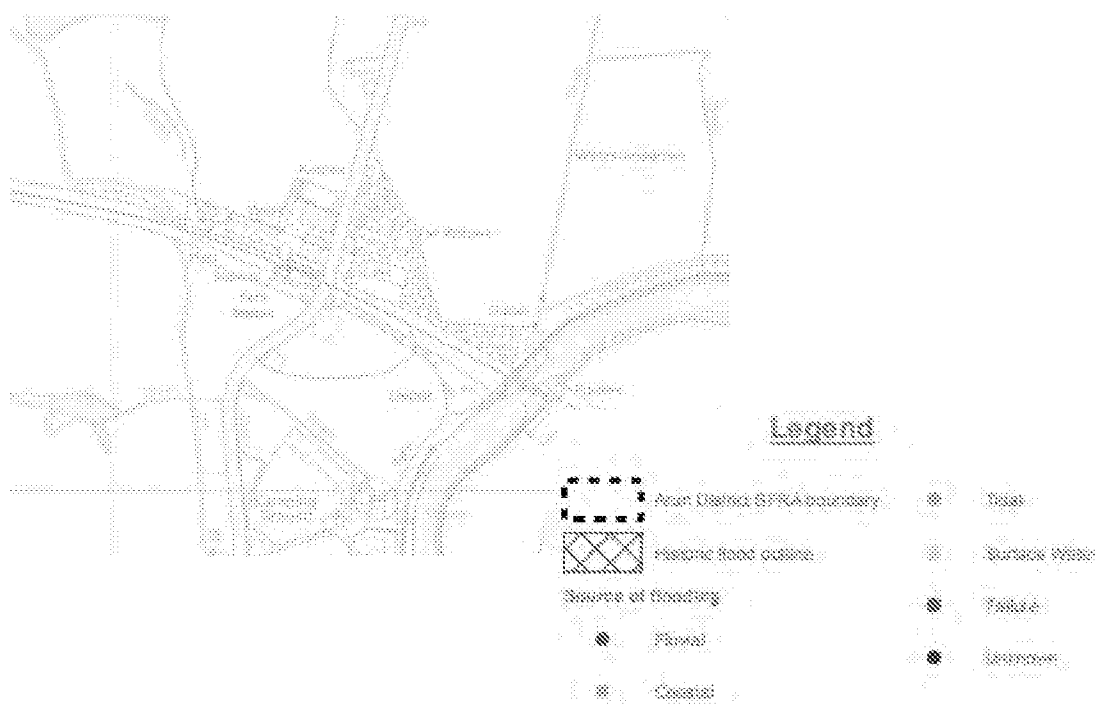
Strategy Unit	Environmentally Preferred Option	Strategy Preferred Option	Rationale for Option Selection
SU6	Sustain	Maintain for 50 years, followed by Withdrawal of Maintenance	This option has been selected because maintaining the defences in SU6 for 50 years provides a cost effective approach to protecting properties and assets in SU5 and SU7. There are no significant environmental benefits in SU6 that would justify the additional costs of the Sustain option. After year 50 the investment required to Maintain the defences in SU6, is more than the cost of providing flanking defences for SU5 and SU7. At this point any secondary benefits are lost and the option for SU6 will then change to Withdrawal of Maintenance.

- 3.3.9 It can be assumed that the concrete defences will remain in position from 2062, but will no longer be maintained by the EA. The landowners may choose to continue to maintain the defences to protect their land, however, the situation is uncertain and therefore the risk to the site cannot be confirmed beyond this time.

3.4 History of Flooding

- 3.4.1 The EA hold no record of previous flooding events affecting the site. It was, however, recommended that further checks be made with additional data holders. A review of Arun District Council's Strategic Flood Risk Assessment (2016) was made, together with consultation with West Sussex County Council and the local water and sewerage company (Southern Water).
- 3.4.2 The updated Level 1 SFRA includes records of historic flooding and flood source information where available. There are no records of historic flooding from any source recorded within the village of Ford. See SFRA Map Extract below.

Map Extract Level 1 SFRA: Appendix H Historic Flooding Records



- 3.4.3 The Lead Local Flood Authority did not provide any additional information.

3.5 Alternative Sources of Flooding

An assessment of alternative sources of flooding has also been made from review of the Strategic Flood Risk Assessment (SFRA), Environment Agency (EA) online mapping and consultation with the Lead Local Flood Authority (West Sussex County Council).

3.5.1 Surface Water Flooding

According to the government's online Surface Water Flood Risk Map and the Level 1 SFRA, the site does not lie within an area identified to be at risk of surface water flooding (see SFRA Map Extract below).

Map Extract from Level 1 SFRA: Appendix E Surface Water Flood Risk



West Sussex County Council confirmed that they could provide no additional information.

3.5.2 Sewer Water Flooding

The SFRA (2016) identifies 20 recorded flooding incidents within the BN18 0 post code area from information provided by the local sewerage company, Southern Water.

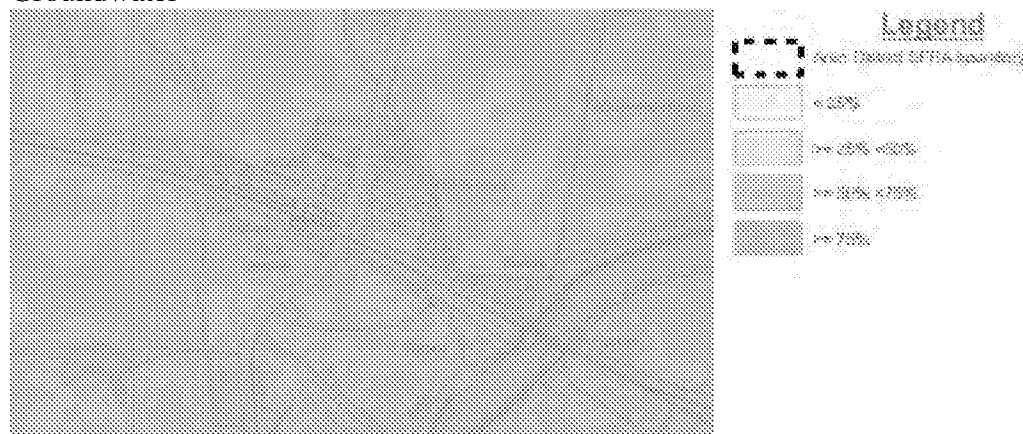
Southern Water was contacted as part of the current assessment regarding their records of sewers and sewer related flooding within the vicinity of the site (Waterbury House). We were informed by Southern Water on the 10 August 2017, that they have no apparatus in the area and would therefore hold no records of sewer flooding for the site.

3.5.3 Groundwater Flooding

According to the Geological Survey (available online) the site lies on an area of Brickearth over Chalk to the east of Alluvium laid down by the River Arun. According to the EA's Groundwater mapping (available online) the site lies on a Major Aquifer of High leaching potential.

The Level 1 SFRA identifies the site to lie within a 1 km grid square where more than 75% of the area may be susceptible to groundwater flooding (see Map Extract below). However, we are not aware of any records of groundwater flooding at the site, which was developed prior to 1900; first as a public house and later for residential use.

Map Extract from Level 1 SFRA: Appendix F Areas Susceptible to Groundwater



West Sussex County Council confirmed that they could provide no additional information.

3.5.4 Other Potential Sources of Flooding

We are not aware of any artificial waterbodies within the wider area (such as reservoirs) that may pose a potential threat of flooding to the site.

4. PLANNING STATUS WITH RESPECT TO FLOODING

- 4.1 The extent to which information relating to flood risk at a proposed development site is required is presently based on the level of 'Flood Risk' at the proposed development site (i.e. how likely an area is to flood), and the 'vulnerability' of the proposed development/future site users to flooding.
- 4.2 In this case, it is proposed to develop a new building comprising five residential units, to be located within Flood Zone 3a (as evidenced above) and within an area at potential risk of groundwater flooding in the future. Residential development is classified as 'More Vulnerable' under current EA guidance.
- 4.3 According to current guidance 'More Vulnerable' development is appropriate within Flood Zone 3a where the Sequential and Exception Tests are passed.
- 4.4 The proposed development (to provide additional accommodation associated with the existing development on the site) has been subject to, and passed the Sequential Test, as part of a previous planning application (F/4/10), which has lapsed. The current proposal is a repeat application. It is our understanding that it is not reasonably feasible to locate the proposed building anywhere but within the boundaries of the existing site. It is intrinsic that the proposed accommodation should be located on the site, and it is not practical to locate the accommodation elsewhere in view of the vulnerability of the proposed occupants concerned. We therefore suggest that there are no other "reasonably available" alternative sites at lower flood risk, which could be used for this purpose.

- 4.5 Information relating to the application of the second part of the Exception Test is given in the following sections of this report.

5. RISKS TO PROPERTY

- 5.1 As established, the whole site has been identified to lie within Flood Zone 3a (high probability of flooding). In this case, it would not be possible to move the proposed development to an area of lower flood risk within the site, however, modelling data shows that the western end of the garden is at lower flood risk than the eastern end of the garden (as set out in 3.1.8 above). It is proposed to locate the building within the lower risk area, towards the western end of the garden.
- 5.2 The predicted flood level for undefended tidal flooding at the site is greater than that of fluvial flooding, however, the model predicts that the greatest flood risk is posed by tidal flooding with the presence of defences. The predicted flood levels within the footprint of the proposed building for both the tidal undefended and tidal defended scenarios are as follows:
- Undefended - 3.65 m AOD giving a depth of 0.03 m at the lowest point within the footprint of the proposed development.
 - Defended - 4.09 m AOD giving a depth of 0.47 m at the lowest point within the footprint of the proposed development.
- 5.3 The site has also been identified to lie within an area susceptible to groundwater flooding. Whilst there are no known records of groundwater flooding at the site or within the local area, it is acknowledge that groundwater flooding may potentially be an issue within the area in the future. At present, information regarding future groundwater flood risks is limited and the potential depths of groundwater flooding is unknown. However, it is known that groundwater flooding typically lasts for longer durations than fluvial and surface water flooding.
- 5.4 In this case, measures to protect the property from flooding are recommended. These may include raising of the ground floor level within the property above the predicted flood level plus climate change, together with measures to protect the structure of the property, and to make the property more quickly uninhabitable following a flood event (i.e. reduce the time period that the property is uninhabitable).
- 5.5 The highest elevation within the footprint of the proposed development presently lies at 4.00 m AOD within the northwest corner of the proposed footprint. This is 0.01 m above the predicted defended design flood level. However, current EA guidance recommends that floor levels are raised 600 mm (0.6 m) above the predicted design flood level. In this case, it is recommended that the ground floor of the building is raised 600 mm above the defended 0.5 % AEP flood level, which is greater than that of the undefended level. This would give a finished floor level of 4.69 m AOD.

- 5.6 It is recommended that a combination of flood resistant and flood resilient measures are incorporated into the design of the new building. Resilient measures aim at avoiding structural damage by:
- Using materials with low permeability to at least 0.3 m (300 mm).
 - Making it easy for water to drain away after flooding.
 - Making sure there is access to all spaces to enable drying and cleaning.
- 5.7 Materials and detailing for the new building should comply with good practice for flood resilient structures, as set out in '*Improving Flood Performance of New Buildings; Flood Resilient Construction*', CIRIA May 2007.
- 5.8 An emergency housing plan should be put into place, ready for implementation should a flooding event occur. Groundwater flooding can last days or weeks before receding. Sufficient time should be allowed for flood waters to recede, an assessment of damage to be made, and for clearing, cleaning and repairs to be made.

6. RISKS TO OCCUPIERS

- 6.1 As established, the western end of the site lies above the predicted defended 0.5 % AEP flood level. However, given the sensitivity of the proposed site users it is recommended that the site is evacuated prior to any predicted local flood event. The SFRA Flood Warning Map (shown below) shows the existing and proposed buildings to lie outside of the flood warning area, however, it may be possible to arrange for flood warnings to be given, as the eastern end of the garden appears to lie within the flood warning zone.

Map Extract from Level 1 SFRA: Appendix G Flood Warning Areas



- 6.2 It is recommended that the paved access / egress route from the proposed building is set at a level above 4.09 m (the defended design flood level). This will allow for dry egress from the building during the predicted defended 0.5 % AEP flood event onto Ford Road, from which areas of lower flood risk may be reached to the north and south of the site.

7. LIKELY IMPACT ON FLOOD RISK ELSEWHERE

- 7.1 The proposed development is to include a pitched roof building with two patio areas adjacent to the building, and paved access from the new building to the existing patio to the rear of Waterbury House.
- 7.2 The proposed development will result in an increase in hard standing within the site. Vulnerable land uses, including mobile homes to the east of the site, have been identified. The mobile homes lie on adjacent land at a lower level than the site, and may receive surface water runoff from the site. In this case, surface water runoff generated from the proposed development should be dealt with onsite in order to reduce the flood risk elsewhere.
- 7.3 Southern Water have confirmed that there are no public surface water sewers within the vicinity of the site. It is understood that the existing buildings and hardcover within the site drain to soakaway.
- 7.4 Arun District Council was contacted regarding their understanding/knowledge of soakaways within the local area. We understand that discharge into the ground (infiltration) is the preferred option for dealing with surface water runoff from new developments. Infiltration structures include soakaways, basins, swales and permeable paving.
- 7.5 The preferred option in this case would be drainage to soakaway. Soakage/percolation testing and some groundwater monitoring may be required in order to design a soakaway system for the site. It is recommended that the scope of any such monitoring is agreed with the Council's drainage engineers. See Appendix C for further guidance.
- 7.6 It is recommended that all new hard surfacing (i.e. the proposed patio areas and access), is laid as permeable paving. This will help to reduce surface water runoff generated from the development.
- 7.7 The proposal will allow for sustainable drainage options to be incorporated within the redevelopment of site. Rainwater harvesting options, such as the use of water butts (to collect roof water to irrigate the garden) may also be incorporated into the development of the site.

8. SUMMARY & RECOMMENDATIONS

- 8.1 It is proposed to develop a bungalow-style care facility with 5 No. one-bedroom units for adults with learning difficulties within the rear garden of Waterbury House, located to the east of Ford Road, Arundel, and some 200 m to the west of the River Arun.
- 8.2 The full extent of the site has been identified to lie within Flood Zone 3a, at risk of tidal flooding via the River Arun, which is tidal at this point. A small area of the site has also been identified to be at risk of fluvial flooding under the 1 % AEP plus climate change scenario, however, this flood risk is not

considered likely to affect the proposed location of the new building, which is to lie within the western end of the rear garden.

- 8.3 The development will form an annex to the existing residential care home. It has been deemed that it is not feasible to locate the proposed development outside of the existing care home facility due to the vulnerability of the proposed occupants. However, the building is to be located within the western end of the rear garden, which lies at a higher elevation than the eastern end of the garden, and is at lower risk of flood.
- 8.4 The predicted undefended design flood level plus climate change within the vicinity of the site is 3.30 m AOD for fluvial flooding and 3.65 m AOD for tidal flooding. Defended levels for fluvial flooding have not been given, however, the presence of defences along the banks of the River Adur are considered likely to increase the tidal flood risk at the site. The predicted defended tidal flood level at the proposed location of the site is 4.09 m (i.e. 0.44 m higher than the undefended level).
- 8.5 The area is protected by a concrete embankment along the western bank of the River Adur within the vicinity of the site. Flooding at the site may be caused by a breach or overtopping of the flood defences. It is understood that the predicted flood level under the defended scenario is greater than that of the undefended scenario as the presence of defences may result in flood waters becoming trapped and accumulating behind the defences.
- 8.6 It is understood that, whilst the embankment lies on private land, the EA undertake maintenance in order to maintain a 1 in 200 (0.5 %) standard of protection. The EA have set out their policy relating to the maintenance of flood defences along the River Arun in the Lower Tidal River Arun Final Strategy Report (December 2012). This document states that it is policy to maintain the defences within the vicinity of the site for the next 50 years, at which point maintenance will be withdrawn. The impact of flooding on the site in the future (beyond 50 years) is therefore uncertain.
- 8.7 There are no records of flooding at or within the immediate vicinity of the site. The site is not thought to be at risk of surface water flooding, sewer flooding or flooding from artificial sources, however, the site has been identified to lie within an area which may be at risk from groundwater flooding. We understand that the EA are in the process of updating their groundwater flooding information, however, this information will not be available until later in the year.
- 8.8 In this case, measures to protect the property and future site users from tidal and groundwater flooding are recommended. A combination of flood resistant and flood resilient measures should be incorporated into the design of the new building.

8.9 It is recommended that:

- i. The ground floor of the building is raised 600 mm above the defended design flood level (0.5 % AEP) plus climate change, which is greater than that of the undefended level. This would give a finished floor level of 4.69 m AOD.
- ii. The paved access / egress route to and from the building is set above the predicted defended tidal flood level for 2110 (4.09 m), in order to allow for dry egress from the building during the (defended) design flood event.
- iii. An emergency evacuation and housing plan should be put into place, ready for implementation should a flooding event occur. Groundwater flooding can last days or weeks before receding. Sufficient time should be allowed for flood waters to recede, an assessment of damage to be made, and for clearing, cleaning and repairs to be made.
- iv. Materials and detailing for the new building should comply with good practice for flood resilient structures, as set out in '*Improving Flood Performance of New Buildings; Flood Resilient Construction*', CIRIA May 2007.

8.10 Resilient measures aim at avoiding structural damage by:

- Using materials with low permeability to at least 0.3 m (300 mm).
- Making it easy for water to drain away after flooding.
- Making sure there is access to all spaces to enable drying and cleaning.

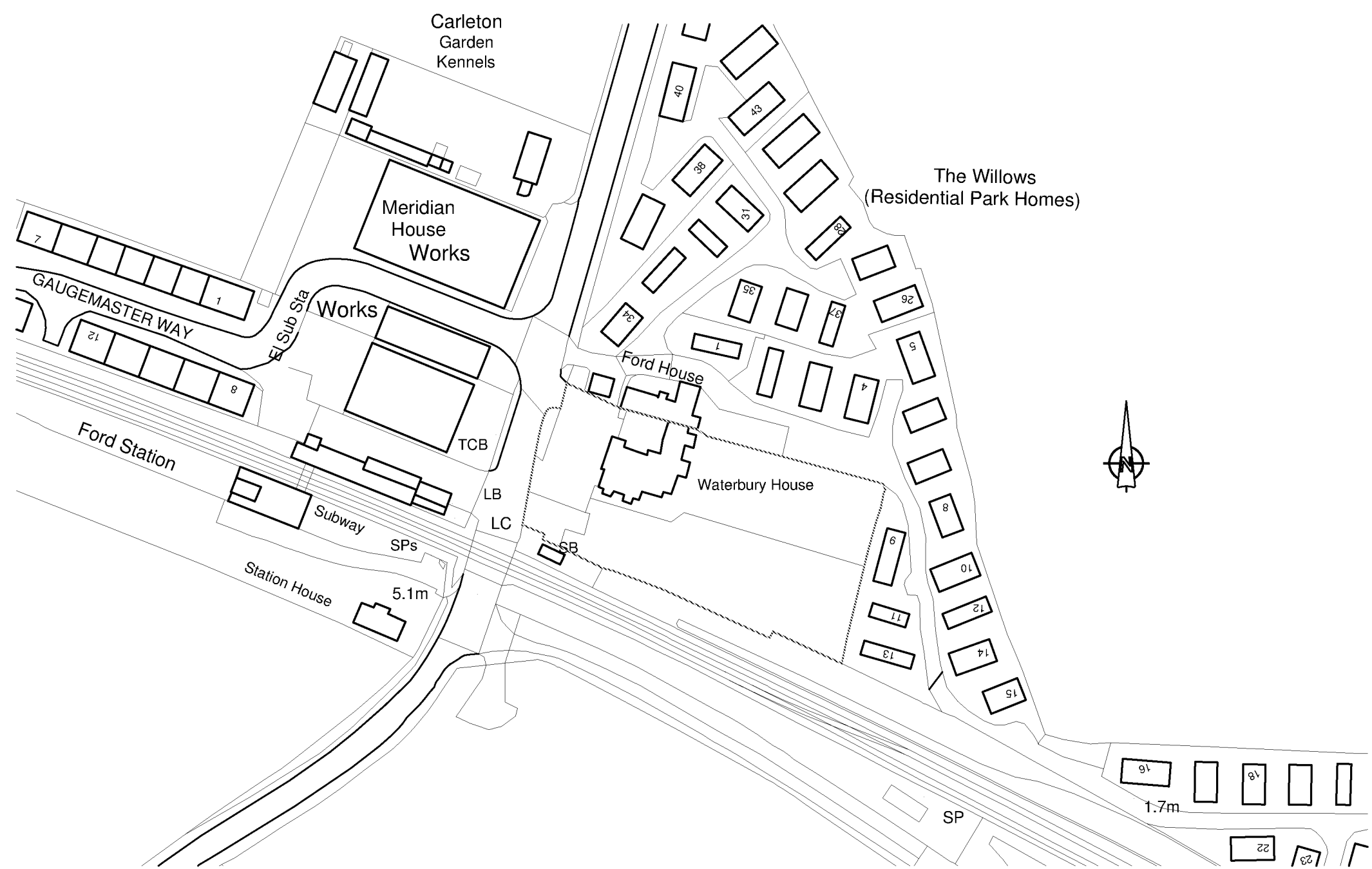
8.11 The proposed development will result in an increase in hard standing within the site and vulnerable site users have been identified on adjacent land. Surface water runoff generated from the proposed development should be dealt with onsite in order to reduce flood risk within the area from this source. The site presently drains to soakaway and this is the preferred option for the proposed development. An appropriate drainage design will need to be prepared to ensure that sufficient capacity can be provided for the development within the site.

8.12 It is recommended that all new hard surfacing (i.e. the proposed patio areas and access), is laid as permeable paving. This will help to reduce surface water runoff generated from the development together with any additional measures such as rainwater harvesting that may be included within the design.

☆☆☆☆☆☆

APPENDIX A: FIGURES

Site Location Plan
Topographic Survey
Proposed Plans



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-		07/07/17	Original Drawing	JB	JB
Rev	Date	Revision Description			Drawn By / Approved By
 ADG ARCHITECTS 8 Pioneer Court, Eastcham, Kent, ME17 1JL t: 01323 464 111 e: studio@adgenibuild.co.uk w: www.adgenibuild.co.uk					
Client					
Consensus					
Caring Homes Group					
Project Information					
Proposed Bungalow, Waterbury House, 8 Ford Road, Arundel					
Drawing Title					
Existing Site Location Plan					
A1: Block			As Seen		
			1:1250		
Web Number		Drawing Number		Revision	
H.17.37		(9-) 1		-	
Drawing Issue					
PLANNING					

ARUN DISTRICT COUNCIL REF: 25117/PL



C	05/09/17	Layouts have been revised to accommodate the clients comments	JB	JB
B	11/08/17	Layouts have been revised to accommodate the clients comments	JB	JB
A	19/07/17	Flat notes have been adjusted	JB	JB
-	07/07/17	Original Drawing	JB	JB

Rev	Date	Revision Description	Drawn By	Approved By
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8 Pioneer Court, Darlington, DL1 4WD
t: 01325 464 111
e: studio@adgarchitects.co.uk
w: www.adgarchitects.co.uk

Client:
Consensus
Caring Homes Group

Project Information:
Proposed Bungalow, Waterbury House, 8 Ford Road, Arundel

Drawing Title:
Proposed Site Plan inc. Topographical Survey

A1 Scale: 1:200
A3 Scale:

Job Number: H.17.37
Drawing Number: (9-) 3
Revision: C

Drawing Issue:
PLANNING



Proposed Ground Floor Plan
3 No. Apartments



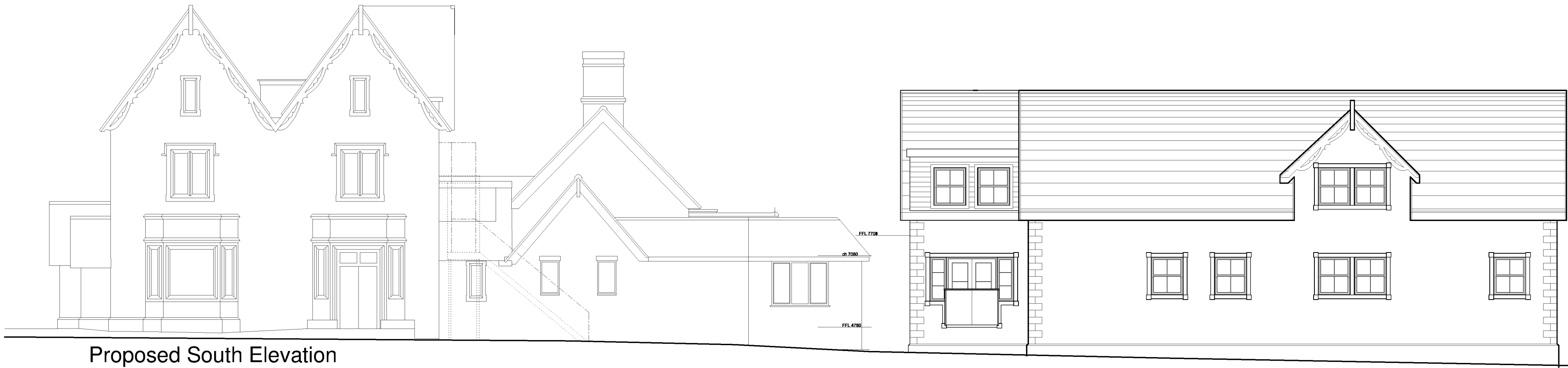
Proposed First Floor Plan
2 No. Apartments

D	05/09/17	Layouts have been revised to accommodate the clients comments	JB	JB
C	24/08/17	Layouts have been revised to accommodate the clients comments	JB	JB
B	11/08/17	Layouts have been revised to accommodate the clients comments	JB	JB
A	19/07/17	Flat notes have been adjusted	JB	JB
-	15/02/17	Original Drawing	JB	JB

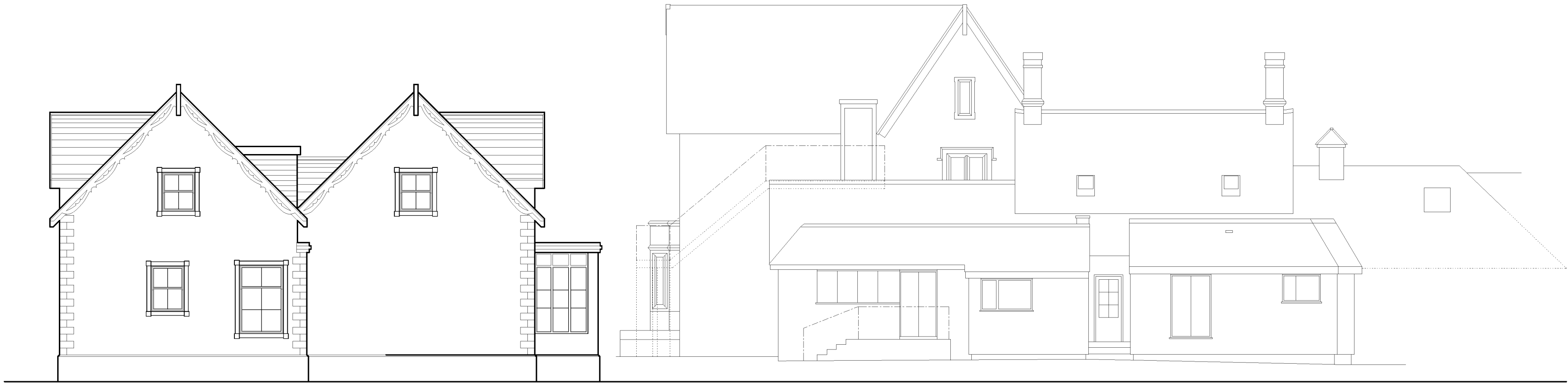
Rev	Date	Revision Description	Drawn By	Approved By
ARCHITECTS 8 Pioneer Court, Darlington, DL1 4WD t: 01325 464 111 e: studio@adgarchitects.co.uk w: www.adgarchitects.co.uk Client Consensus Caring Homes Group Project Information Proposed Bungalow, Waterbury House, 8 Ford Road, Arundel Drawing Title Proposed Floor Plans A1 Scale 1:50 A3 Scale 1:100 Job Number H.17.37 Drawing Number (00) 1 Revision D Drawing Issue PLANNING				



Proposed West Elevation



Proposed South Elevation



Proposed East Elevation



Proposed North Elevation

C	05/09/17	Elevations have been updated to suit the floor plans.	JB	JB
B	27/08/17	Elevations have been updated to suit the floor plans.	JB	JB
A	12/08/17	Elevations have been revised to accommodate an additional apartment	JB	JB
-	15/02/17	Original Drawing	JB	JB

Rev	Date	Revision Description	Drawn By	Approved By
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ARCHITECTS

8 Pioneer Court, Darlington, DL1 4WD

t: 01325 464 111

e: studio@adgarchitects.co.uk

w: www.adgarchitects.co.uk

Client
Consensus
Caring Homes Group

Project Information
Proposed Bungalow, Waterbury House, 8 Ford Road, Arundel

Drawing Title
Proposed Elevations

A1 Scale 1:100	A3 Scale 1:200
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Job Number H.17.37	Drawing Number (21) 1	Revision C
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Drawing Issue
PLANNING

APPENDIX B: EA FLOOD MAP AND DATA

Covering Letter
Flood Defence Locations
Flood Map for Planning
Levels Request
Modelled Flood Outlines:
 Defended Fluvial
 Defended Tidal
 Undefended Fluvial
 Undefended Tidal
Site Boundary and Node Points
FRA Advisory Text

Lucy Monday
EAS Ltd
London Road
Hickstead
Haywards Heath
RH17 5LZ

Our ref: SSD55361

Date: 04/08/2017

Dear Lucy Monday,

Provision of Product 4 for address: Buttercups, Waterbury House, Arundel, West Sussex, BN18 0BH.

Thank you for your request of 28/07/2017 to use Environment Agency data, Product 4. The information is attached.

The information on Flood Zones in the area relating to this address is as follows:

The property is in an area located within Flood Zone 3 shown on our Flood Map for Planning (Rivers and Sea).

Note - This information relates to the area that the above named property is in and is not specific to the property itself.

Please find attached a copy of the Flood Map for Planning (Rivers and Sea) for the area relating to your address.

Further details about the Environment Agency information supplied can be found on the GOV.UK website:

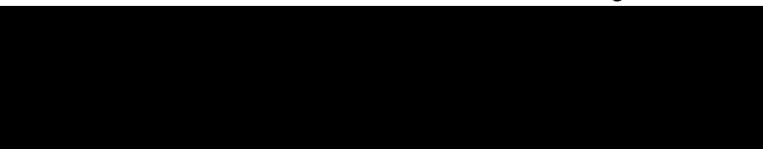
<https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather>

If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency Information for Flood Risk Assessments

<https://www.gov.uk/planning-applications-assessing-flood-risk>

<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Guildbourne House, Chatsworth Road, Worthing, West Sussex, BN11 1LD



Following a recent research programme into climate change and the consequent future effects on flood risk, the Environment Agency has updated it's guidance on climate change allowances. The standard climate change allowance of adding 20% to peak river flows (as per previous guidance in the National Planning Policy Framework), has now changed to 45% for a development proposal of this size. It is possible that our current modelling has under estimated flood risk when taking climate change into consideration. Our advice on potential development on this site will take this issue into consideration.

For further guidance on how climate change could affect flood risk to new development please visit: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Supporting Information

Flood Defences

There are concrete embankments along the Arun, these are designed to give an estimated standard of protection of 1 in 200 (0.5%).

Model Information

All flood outlines, levels and depths have been taken from the Lower Tidal River Arun Strategy Study, completed in 2010 by Atkins.

Flood History

We hold no record of previous flooding events affecting this property. I recommend contacting Arun District Council for a more comprehensive flood history check.

Please note our records are not comprehensive and may not include all events, you can contact your Local Authority to check if they hold any relevant information regarding your application.

You are encouraged to use and re-use this information freely and flexibly, with only a few conditions. Details of which can be found here:

<http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

We respond to requests for recorded information that we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

If you are not satisfied with our response to your request for information you can contact us within 2 calendar months to ask for our decision to be reviewed.

If you have any queries or would like to discuss the content of this letter further please call us on 03708 506506.

Yours faithfully,

Jake Spence

FCRM Officer – PSO West Sussex

Enc. Flood Map for Planning (Rivers and Sea) / Node point locations / Flood levels/depths / Modelled flood outlines / Flood Defence Locations

Flood Defence Locations. Centred BN18 0BH. Created 04/08/2017.

Legend

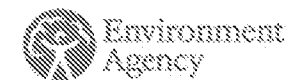
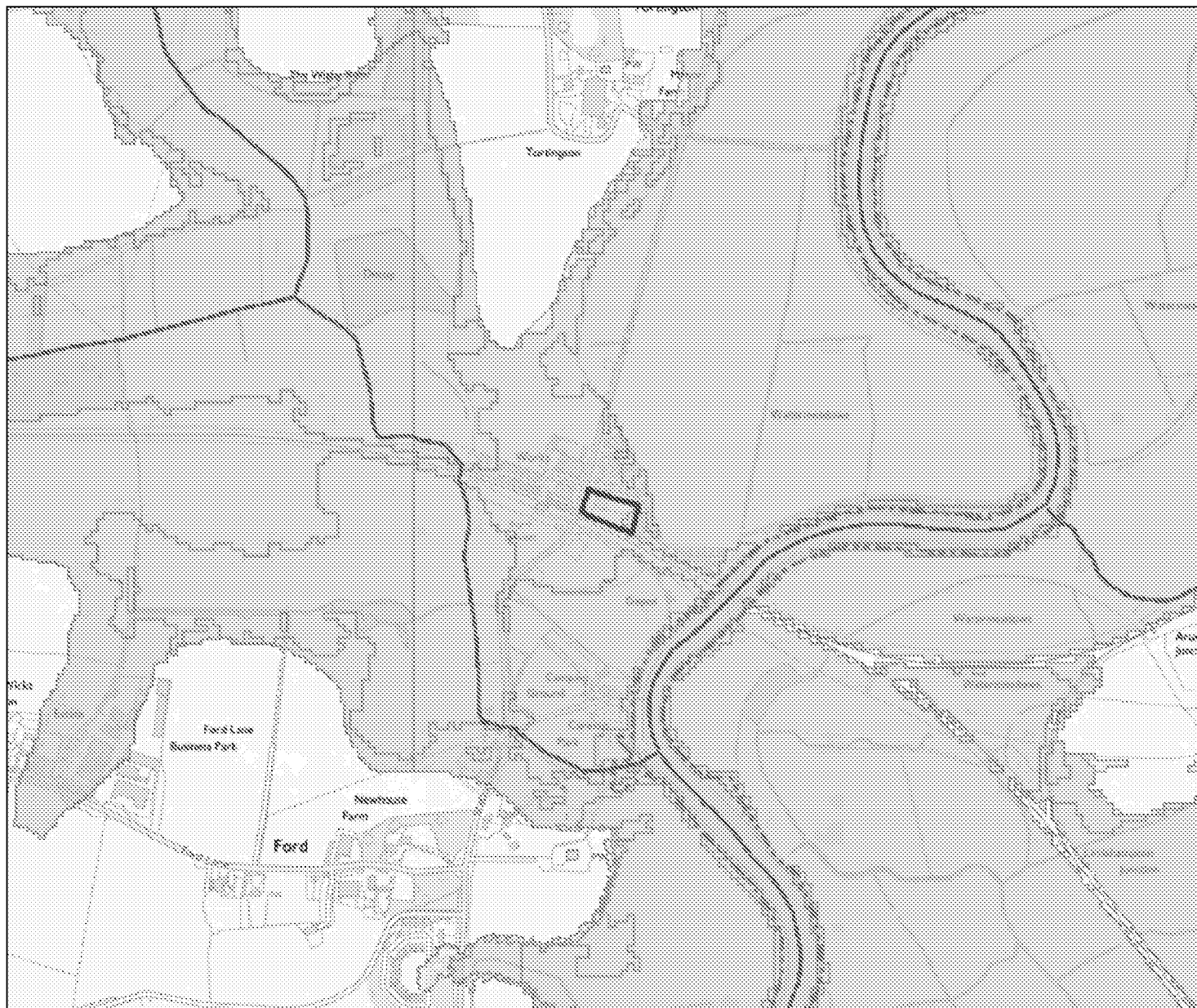
- ~~~~~ Statutory Main Rivers
- Defences**
 - ===== Embankment
 - Wall
 - ===== Flood Gate
 - ===== Demountable Defence
 - ===== Bridge Abutment
 - High Ground
 - Beach
 - ===== Barrier Beach
 - ===== Promenade
 - ===== Quay
 - ===== Cliff
 - ===== Dunes
 - Culvert



0 100 200 300
Metres



Flood Map for Planning (Rivers and Sea). Centred BN18 0BH. Created 04/08/2017.



Scale 1: 10,000



Flood Map for Planning (Rivers & Sea)

- Sealed Main Rivers
- Defences
- Flood Storage Areas
- Areas benefiting from flood defences
- Flood Zone 3
- 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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Product 4 Flood Risk Data Requested by: Lucy Monday

Site: Buttercups, Waterbury House, Ford Road, Arundel, West Sussex, BN18 0BH.

Table 1: Water Levels: Fluvial Undefended

Node Reference	NGR		Modelled Flood Levels in Metres			
	Easting	Northing	Undefended Annual Exceedance Probability			
			5%	1%	1% Plus Climate Change	0.1%
1	500324	104286	-	-	-	-
2	500320	104270	-	-	-	-
3	500314	104251	-	-	-	-
4	500345	104281	-	-	-	-
5	500339	104265	-	-	-	-
6	500334	104242	-	-	-	-
7	500362	104277	-	-	3.30	-
8	500357	104258	-	-	3.30	-
9	500351	104235	-	-	-	-

Table 2: Water Levels: Tidal Undefended

Node Reference	NGR		Modelled Flood Levels in Metres			
	Easting	Northing	Undefended Annual Exceedance Probability			
			5%	0.5%	0.5% (2110)	0.1%
1	500324	104286	-	-	-	-
2	500320	104270	-	-	-	-
3	500314	104251	-	-	-	-
4	500345	104281	-	-	3.65	-
5	500339	104265	-	-	3.65	-
6	500334	104242	-	-	-	-
7	500362	104277	2.79	3.02	3.65	3.10
8	500357	104258	-	-	3.65	-
9	500351	104235	-	-	-	-

Table 3: Water Levels: Tidal Defended

Node Reference	NGR		Modelled Flood Levels in Metres			
	Eastings	Northings	Defended Annual Exceedance Probability			
			5%	0.5%	0.5% (2110)	0.1%
1	500324	104286	-	-	4.09	-
2	500320	104270	-	-	4.09	-
3	500314	104251	-	-	4.09	-
4	500345	104281	-	-	4.09	-
5	500339	104265	-	-	4.09	-
6	500334	104242	-	-	-	-
7	500362	104277	-	-	4.09	2.86
8	500357	104258	-	-	4.08	-
9	500351	104235	-	-	4.11	-

Table 4: Water Depth: Fluvial Undefended

Node Reference	NGR		Modelled Flood Depth in Metres			
	Eastings	Northings	Undefended Annual Exceedance Probability			
			5%	1%	1% Plus Climate Change	0.1%
1	500324	104286	-	-	-	-
2	500320	104270	-	-	-	-
3	500314	104251	-	-	-	-
4	500345	104281	-	-	-	-
5	500339	104265	-	-	-	-
6	500334	104242	-	-	-	-
7	500362	104277	-	-	0.68	-
8	500357	104258	-	-	0.12	-
9	500351	104235	-	-	-	-

Table 5: Water Depth: Tidal Undefended

Node Reference	NGR		Modelled Flood Depth in Metres			
	Eastings	Northings	Undefended Annual Exceedance Probability			
			5%	0.5%	0.5% (2110)	0.1%
1	500324	104286	-	-	-	-
2	500320	104270	-	-	-	-
3	500314	104251	-	-	-	-
4	500345	104281	-	-	0.25	-
5	500339	104265	-	-	0.25	-
6	500334	104242	-	-	-	-
7	500362	104277	0.17	0.40	1.02	0.47
8	500357	104258	-	-	0.46	-
9	500351	104235	-	-	-	-

Office Address: Guildbourne House, Chatsworth Road, Worthing BN11 1LD.
Customer services line: 03708 506 506. Email: enquiries@environment-agency.gov.uk
www.gov.uk/government/organisations/environment-agency

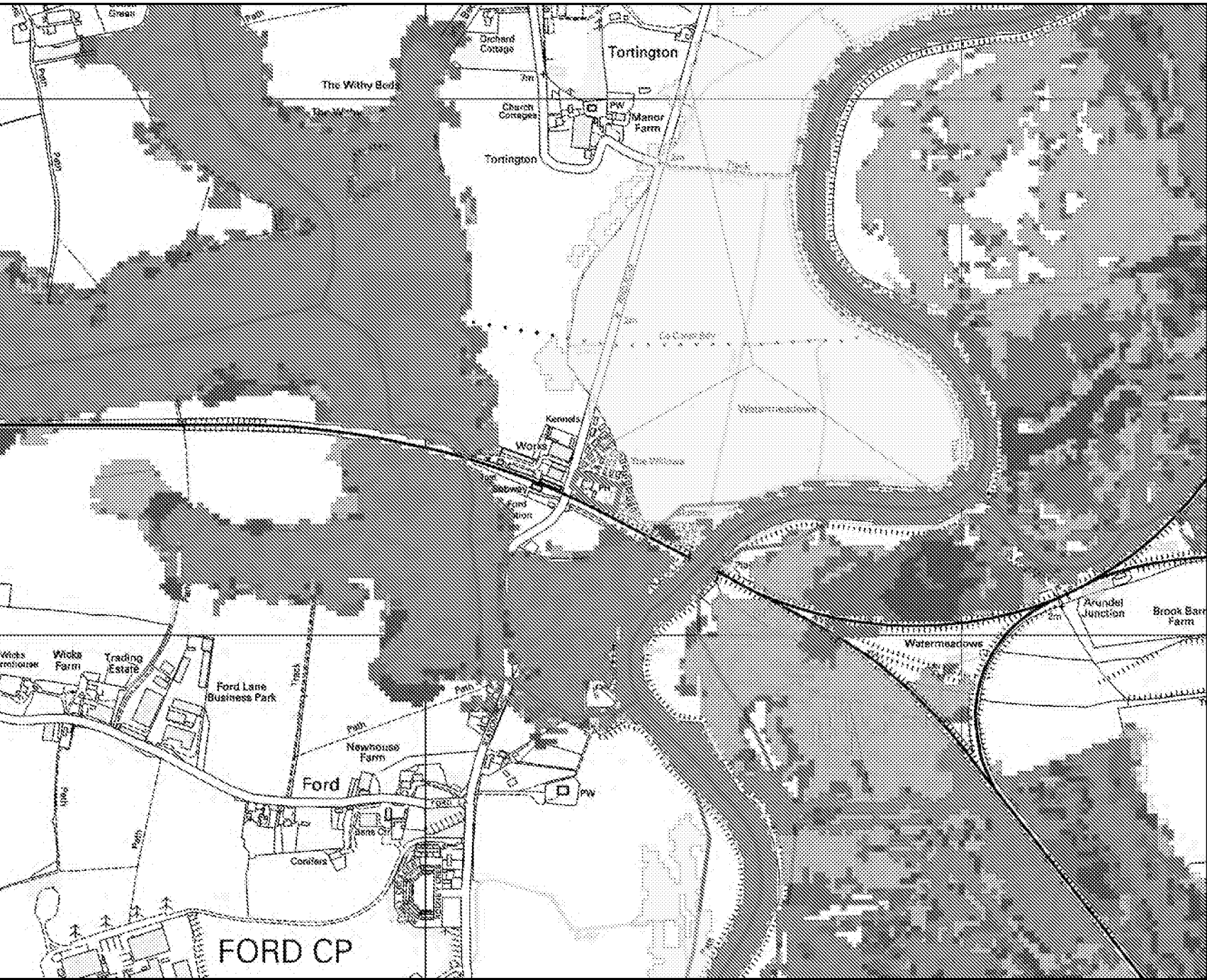
Table 6: Water Depth: Tidal Defended

Node Reference	NGR		Modelled Flood Depth in Metres			
	Eastings	Northings	Defended Annual Exceedance Probability			
			5%	0.5%	0.5% (2110)	0.1%
1	500324	104286	-	-	0.17	-
2	500320	104270	-	-	0.22	-
3	500314	104251	-	-	0.02	-
4	500345	104281	-	-	0.69	-
5	500339	104265	-	-	0.69	-
6	500334	104242	-	-	-	-
7	500362	104277	-	-	1.46	0.23
8	500357	104258	-	-	0.90	-
9	500351	104235	-	-	0.19	-

All levels taken from: The Lower Tidal River Arun Strategy model, completed in 2010 by Atkins.

There is no additional information or health warnings for these levels/depths or the model from which they have been produced.

Produced on 04/08/2017.





Environment
Agency

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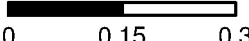


Legend

- Site Boundary
- Main River
- 20% AEP (Defended Fluvial)
- 5% AEP (Defended Fluvial)
- 1.3% AEP (Defended Fluvial)
- 1% AEP (Defended Fluvial)
- 1% AEP Plus Climate Change (Defended Fluvial)
- 0.1% AEP (Defended Fluvial)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:10,000



0 0.15 0.3
Kilometers





Environment
Agency



N

Legend

- Site Boundary
- Main River
- 20% AEP (Defended Tidal)
- 5% AEP (Defended Tidal)
- 1.3% AEP (Defended Tidal)
- 0.5% AEP (Defended Tidal)
- 0.5% AEP (2110) (Defended Tidal)
- 0.1% AEP (Defended Tidal)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

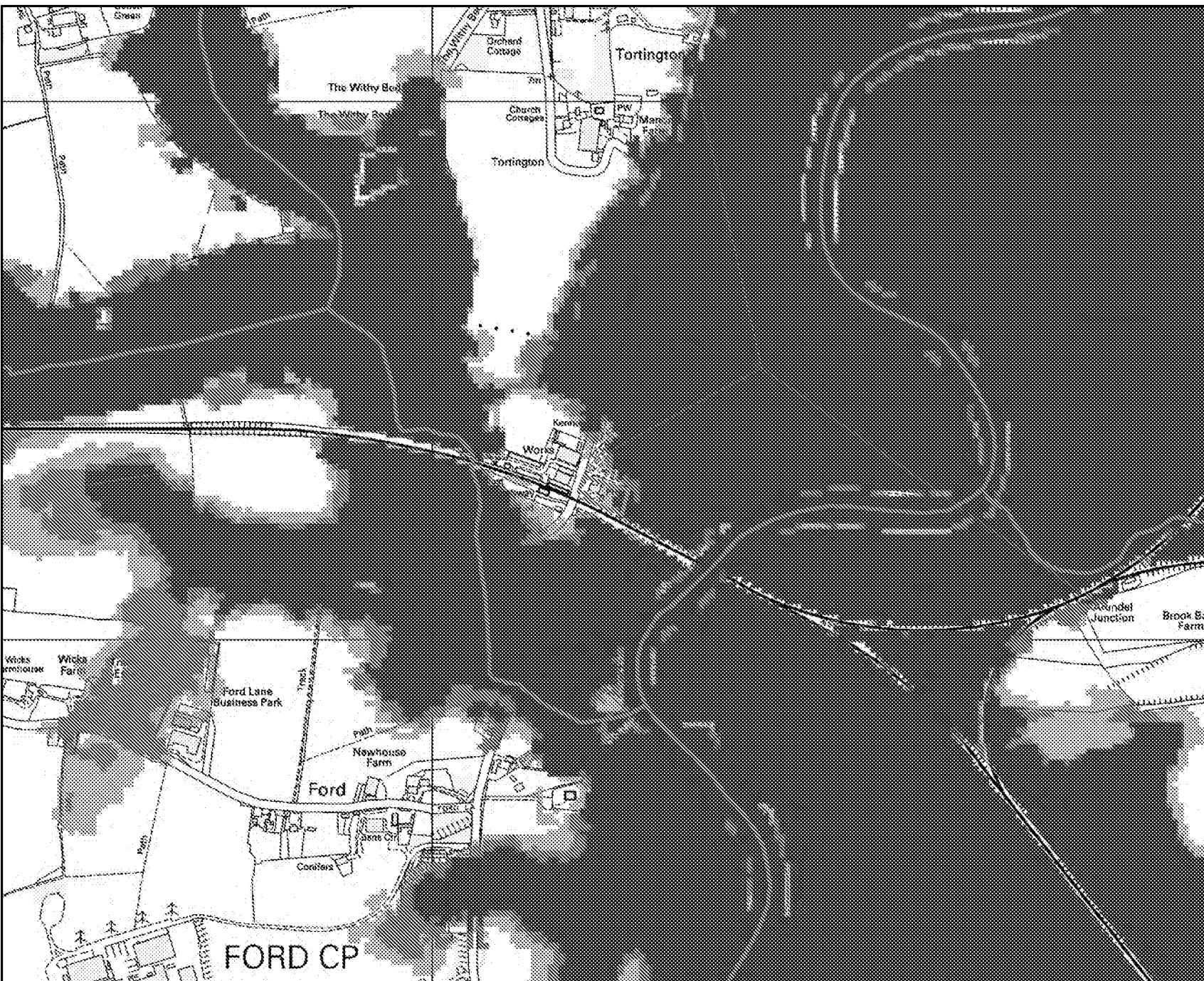
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0.15

0.3

Kilometers



Environment
Agency

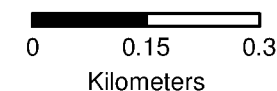


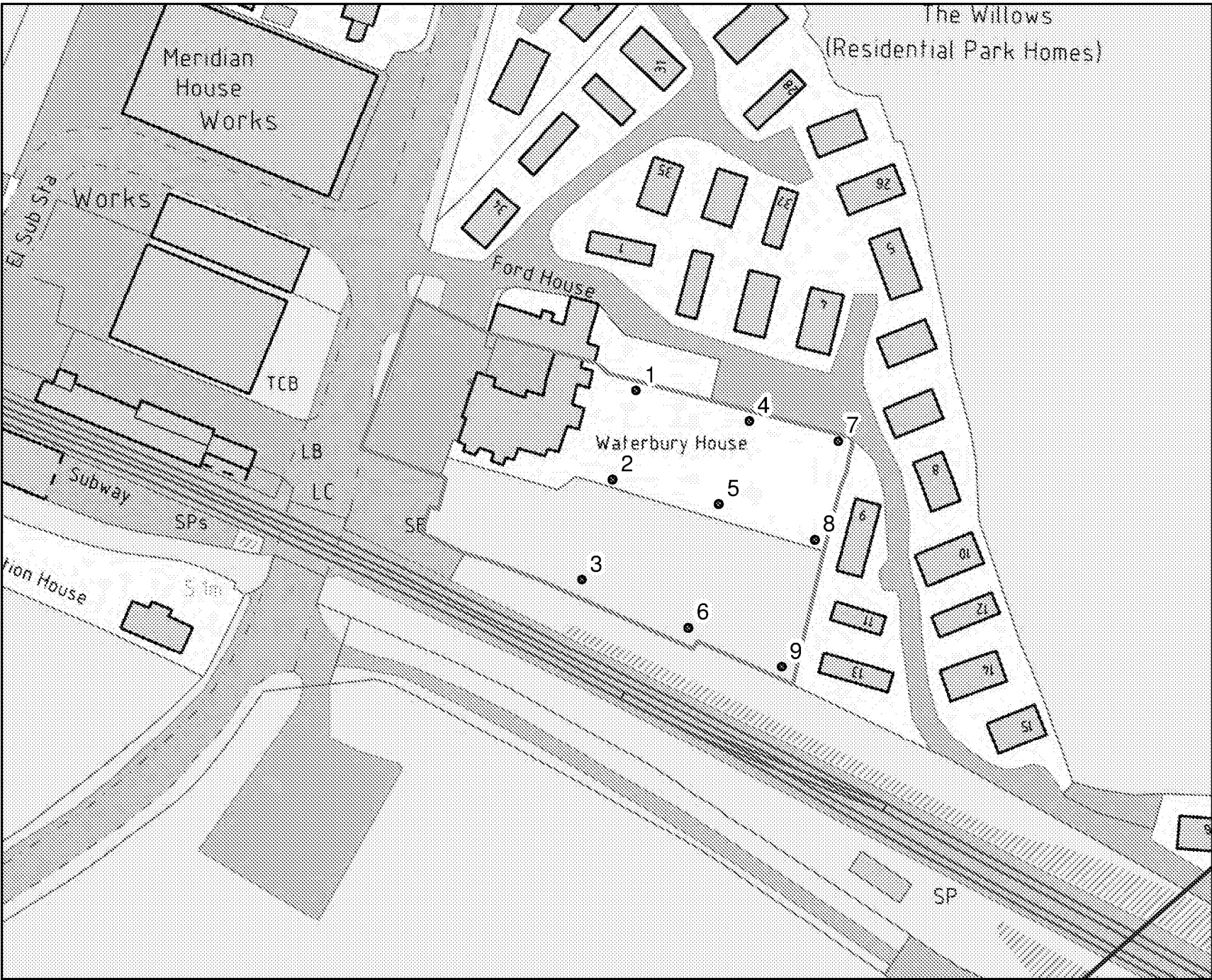
Legend

-  Site Boundary
 Main River
 5% AEP (Undefended Tidal)
 0.5% AEP (Undefended Tidal)
 0.5% AEP (2110) (Undefended Tidal)
 0.1% AEP (Undefended Tidal)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:10,000







Environment
Agency

N
▲

Legend

- Site Nodes
- Site Boundary
- Main River

Scale: 1:1,000

00.0250.05

Kilometers

APPENDIX C: ARUN DISTRICT COUNCIL

Email Correspondence
Drainage – Supplementary Guidance Notes

Lucy Monday

From: Paul Cann [REDACTED]
Sent: Wednesday, August 2, 2017 2:45 PM
To: [REDACTED]
Subject: RE: Buttercups, Ford Road - Soakaway Plans
Attachments: Drainage - Supplementary Guidance Notes.pdf

Hi Lucy

Building Control have passed us your email. If we, as engineers are consulted on the new planning application, then our requirements are set out in the enclosed document.

Essentially, infiltration must be investigated for surface water disposal.

Infiltration rates for soakage structures are to be based on percolation tests undertaken in the winter period and at the location and depth of the proposed structures. The percolation tests must be carried out in accordance with BRE 365, CIRIA R156 or a similar approved method and cater for the 1 in 10 year storm between the invert of the entry pipe to the soakaway, and the base of the structure. It must also have provision to ensure that there is capacity in the system to contain below ground level the 1 in 100 year event plus 30% on stored volumes, as an allowance for climate change. Adequate freeboard must be provided between the base of the soakaway structure and the highest recorded annual groundwater level identified in that location.

Any SuDS or soakaway design must include adequate groundwater monitoring data to determine the highest winter groundwater table in support of the design. The applicant is advised to discuss the extent of groundwater monitoring with the Council's Engineers.

Regards

Paul Cann
Senior Engineer (Drainage & Coastal)

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

Internal: 37819 | External: +44 (0) 1903 737819 | Fax: +44 (0) 1903 716019 | E-mail: Paul.Cann@arun.gov.uk

Arun is Working in Partnership with Chichester District Council

Visit Arun's web site at <http://www.arun.gov.uk/> and www.chichester.gov.uk



Save the environment - think before you print.

From: Lucy Monday [REDACTED]
Sent: 31 July 2017 12:21
To: Bldg Con
Subject: Buttercups, Ford Road - Soakaway Plans

Dear Building Control

RE: BUTTERCUPS, FORD ROAD, ARUNDEL, WEST SUSSEX BN18 0BH

We are updating a Flood Risk Assessment (FRA) for the above site which was granted planning permission (F/4/10) but which has now expired. The application for a residential annex (comprising 4 units) within the garden area of the existing residential care home is now being resubmitted.

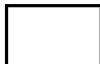
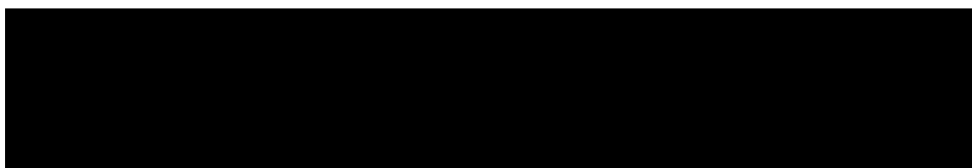
Please find attached a site location plan and proposed development plan for the site. The new building is to measure 13 m wide by 28.5 m long and have a pitched roof (height 7 m).

The design of a surface water drainage system was previously Conditioned (but not prepared, as the development did not proceed). There are no public surface water sewers to connect to in the area. The existing buildings on site drain to soakaway, and it is intended to use the same method of surface water drainage for the new, additional building.

Before we advised that the new building is also drained to soakaway, we would be grateful to know if you have any comment? Do you know if there have been any issues with soakaways in this area or know of any other issues we should be aware of?

Many thanks

Lucy Monday



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<http://www.arun.gov.uk>

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Supplementary Requirements for Surface Water Drainage Proposals

Any proposed surface water scheme must consider sustainable drainage principles.

SuDS Selection

The following destinations must be considered for surface runoff in order of preference:

1. Discharge into the ground (infiltration);
2. Controlled discharge to a surface water body;
3. Controlled discharge to a surface water sewer.

Surface water must not be discharged into the foul sewer system. Infiltration structures include soakaways, basins, swales and permeable paving. Discharge to surface water bodies and surface water sewers must be restricted to an agreed rate.

SuDS selection hierarchy based on:

CIRIA C753 - The SuDS Manual

BS8582:2013 – Code of Practice for Surface Water Management for Development Sites

Approved Document H of the Building Regulations

Infiltration Drainage Design

Infiltration rates for soakage structures are to be based on percolation tests undertaken in the winter period at the location and depth of the proposed structures. The percolation tests must be carried out in accordance with BRE 365, CIRIA R156 or a similar approved method, and cater for the 1 in 10 year storm event between the invert of the lowest entry pipe into the infiltration structure and the base. For the purpose of design, the percolation rate must be applied to the sides of the infiltration structure only and the rate for the base must be zero. This does not apply to infiltration basins or permeable pavements, whereby the percolation rate is applied to the base only. There must be provision to ensure that there is capacity in the system to contain the 1 in 100 year storm event plus 30% on stored volumes, as an allowance for climate change. The infiltration structure should also drain 50% of its total volume in 24 hours or less for both the 1 in 10 and 1 in 100 year (plus 30%) storm events, in order to provide spare capacity for subsequent storms.

Any infiltration drainage design must include adequate winter groundwater monitoring data to determine the highest winter groundwater table. Residential developments in excess of five properties will require ground water monitoring to be carried out between October and March inclusive. The extent of monitoring required for smaller developments will be subject to agreement with the Council's Engineers.

Adequate freeboard must be provided between the base of the soakaway structure and the highest recorded groundwater level identified in that location.

Restricted Discharge

Discharge to a watercourse or surface water sewer must be restricted to the estimated mean greenfield runoff rate (Q_{bar}) by means of a controlled outflow (or restricted to existing runoff rates for brownfield sites). This can be derived from IH124 or a similar approved method. Any storage design must be submitted with groundwater monitoring data where applicable to ensure there will be no detrimental effect on the structure or storage. Storage areas are preferred to be in an 'open' form such as ponds, rather than underground tanks.

Flow Exceedance Routes

The drainage design should show flow routes through the proposed development, demonstrating where surface water will be conveyed for three types of flow:

1. Low flow routes

Regular flow from source control features such as permeable pavements should travel in low flow channels through the development in a controlled way contributing to landscape quality.

2. Overflows

In the event of local blockages or surcharge a simple overflow arrangement should allow water to bypass the obstruction and return to the management train sequence until conditions return to normal.

3. Exceedance routes

When SuDS are overwhelmed by exceptional rainfall, then exceedance routes are required to protect people and property. These provide unobstructed overland flow routes from the development and should be considered for all drainage schemes. Exceedance routes should also be protected from future changes in land use.

Culverting a Watercourse

Culverting (piping) a watercourse is not advised unless there is no alternative. The resulting reduction in storage volume, flow capacity and habitat potential would be unacceptable. Culverted watercourses are also more difficult to maintain due to the limited accessibility.

Land Drainage Consent must be sought from the Lead Local Flood Authority (West Sussex County Council), or its agent (Arun District Council – land.drainage@arun.gov.uk), prior to starting any works (temporary or permanent) that affect the flow of water in the watercourse. Such works may include culverting, channel diversion and the installation of trash screens.

The development layout must take account of any existing watercourses (open or culverted) to ensure that future access for maintenance is not restricted.

See also:

Land Drainage Act 1991 (amended 1994)

Maintenance and Management

Ditches and watercourses (including culverts) should retain a three metre easement with access that allows for its future maintenance.

Details of the maintenance and management of the SuDS system are to be set out in writing in a site specific maintenance manual. This manual shall include details of the financial management and arrangements for the replacement of components at the end of the manufacturers recommended design life. This document is then to be submitted as part of the planning process.

References

The Building Regulations 2000
Drainage and waste disposal
Approved document H
ISBN: 1-859462-08-1

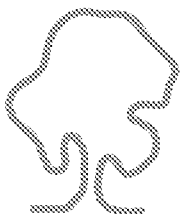
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Flood Estimation for Small Catchments - IH Report 124
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C697 The SUDs Manual
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ISBN: 978-0-86017-697-8, 2007

CIRIA
R156 Infiltration Drainage – Manual of Good Practice
Bettess, R.
ISBN: 0 86017 457 3

British Standards Institution
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