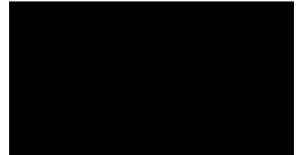




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Flood Risk Assessment

Proposed Residential Development at

**Land to the West of Thornlea Park,
Littlehampton, West Sussex**

On behalf of

Roman Oak Developments Ltd

November 2017

Document History and Status

Project Reference 22827

Date	Version	Prepared By	Reviewed By	Approved By
10/11/2017	1.0	B Sathan CEng MICE FIHE	S Magowan IEng MICE	B Sathan CEng MICE FIHE

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1 Non Technical Summary

- 1.1 This Flood Risk Assessment has been undertaken in accordance with the National Planning Policy Framework on behalf of Roman Oak Developments Ltd in support of an Outline Planning Application for the demolition of existing bungalow and outbuildings and erection of up to 25 dwellings with associated open space, on land to the west of Thornlea Park, Littlehampton, West Sussex, BN17 7PU.
- 1.2 This Assessment is to be read in conjunction with all planning, architectural and other reports that accompany the Outline Planning Application for the proposed development.
- 1.3 This Assessment confirms that the site is located within an area classified as Flood Zone 3a at risk of flooding from tidal or fluvial sources but benefiting from existing flood defences which protect the site up to the 1 in 200 year tidal flood event.
- 1.4 From the Environment Agency Product 4 flood level data the site is outside the area of functional flood plain (Flood Zone 3b).
- 1.5 The proposed development will incorporate a sustainable drainage system which will discharge surface water at the existing Greenfield runoff rate into the existing watercourse.
- 1.6 Surface water runoff from site can be collected and stored prior to discharge using a combination of conveyance and filtration systems including rain gardens and swales. The drainage system will be designed to cater for all storm return periods up to and including the 1 in 100 year rainfall event with an allowance for climate change.
- 1.7 Foul drainage will be discharged to the existing discharge point from the site along Old Mead Road.
- 1.8 This report concludes that the proposed development is suitable at this location and there are no significant flooding and drainage risks.

2 Planning Policy Context

2.1 National Planning Policy Framework

2.1.1 National Planning Policy Framework aims to reduce flood risk through development opportunities. The policy framework aims to ensure flood risks and the predicted effects of climate change have been taken into account and appropriate measures put in place to ensure that:

- The development is safe
- Where possible the flood risk overall is reduced
- Increased flood risk does not occur elsewhere
- Appropriate mitigation measures are employed to deal with these effects and risks.

2.1.2 The National Planning Policy Framework requires Planning Authorities to apply a sequential approach to planning and flood risk by placing development in areas of low flood risk before allocating sites in areas of higher risk sequentially and by exception following the processes of the Sequential and Exception Tests.

2.2 Arun District Council Emerging Local Plan 2011 – 2031

2.2.1 The Arun Local Plan 2011 – 2031 (Publication Version) is the most recent version of the emerging Local Plan.

2.2.2 The Arun District Local Plan 2011-2031 and supporting documents were submitted on 30th January 2015 for independent examination to the Secretary of State for Communities and Local Government via the Planning Inspectorate.

2.2.3 On 5 March 2015 the Inspector issued preliminary questions which were responded to by Arun District Council on 17 March 2015.

2.2.4 Until the Local Plan is adopted by the District Council the statutory development currently consists of:

- The saved policies within the Arun District Local Plan (2003)
- The Arun District Proposals Map
- The saved policies within the West Sussex Minerals Local Plan (2003)

2.3 Arun District Council Local Plan (2003)

2.3.1 The Arun District Council Local Plan 2003 saved policies will remain effective until replaced by the new Arun Local Plan.

2.3.2 The policies of the currently adopted Local Plan which are relevant to this development are as follows:

2.3.3 **POLICY GEN9** Foul and Surface Water Drainage states that *'planning permission for development which will materially increase foul and/or surface water discharges will be refused unless the Local Planning Authority is satisfied that either adequate drainage capacity exists or appropriate drainage capacity can be provided as part of the development. Consideration should also be given to the use of Sustainable Urban Drainage Systems (SUDS) as alternatives to conventional drainage where appropriate.'*

2.3.4 **POLICY GEN10** Tidal Flooding and Coastal Defence states that *'planning permission will be refused for development which would be at an unacceptable risk of tidal flooding and/or where proposals are detrimental to the integrity of tidal defences or the ability to maintain or improve them.'*

It continues *'within the built-up areas, planning permission will only be granted where the local planning authority is satisfied that appropriate flood and coastal defence and mitigation measures have been provided so that the development will not itself be at unacceptable risk and furthermore does not pose an unacceptable risk to existing development in the area.'*

2.3.5 **POLICY GEN11** Inland Flooding states that *'permission for development which would be at risk from flooding and/or materially decrease the capacity of a floodplain to store or pass flows of floodwater, will be refused unless the Local Planning Authority is satisfied that compensatory flood storage/waterway areas can be provided as part of the development and the function and effectiveness of existing watercourses, or their replacements, are not adversely affected.'*

2.3.6 **POLICY DEV17** Affordable Housing states *'Within allocated and unidentified housing developments of 25 or more dwellings or residential sites of 0.8 hectare or more, irrespective of the number of dwellings, the Local Planning Authority will seek to secure the provision of affordable housing.'*

2.3.7 **POLICY DEV18** Affordable Housing outside the Built-up Area states *'Proposals for affordable housing will be permitted on sites in the rural area, provided that:*

There are no other policy constraints upon development except the location of the site outside the built up area;

The Local Planning Authority is satisfied that a need exists in the locality for affordable housing;

The development meets the need of: the existing residents of a particular parish, requiring separate accommodation, or people who are not necessarily resident locally but who have long-standing links with the local community, or

people with the offer of a job in the locality who cannot take up the offer because of lack of affordable housing;

The site is well related to existing settlement;

The development does not contain any elements of private housing for sale or rent on the open market.

2.4 Strategic Flood Risk Assessment

2.4.1 JBA Consulting produced a Strategic Flood Risk Assessment (SFRA) on behalf of Arun District Council in August 2016.

2.4.2 The SFRA has been reviewed and is referenced within this Assessment.

2.5 Lead Local Flood Authority

2.5.1 West Sussex County Council became a Lead Local Flood Authority under the Flood and Water Management Act 2010 and was given a series of new responsibilities to coordinate the management of local flood risk.

2.5.2 As part of their role the County Council have produced a Preliminary Flood Risk Assessment which is referenced within this Assessment.

3 Existing Site

3.1 Site Location

- 3.1.1 The development site is located at Ordnance Survey reference TQ 021 042 on land west of Thornlea Park, Littlehampton, West Sussex, BN17 7PU.
- 3.1.2 The site is bounded on its northern side by the river Black Ditch with open farmland beyond that, on its east side by mobile homes on Arundel Drive, on its southern side by open farmland and on its western side by farmland and related outbuildings.
- 3.1.3 A copy of the site location plan is located in Appendix 1 at the rear of this Assessment.

3.2 Site Description

- 3.2.1 The development site is approximately 1.0 hectare in area and currently occupied by a detached bungalow and a number of outbuildings and hard standing areas.
- 3.2.2 Vehicular and pedestrian access to the site is available from Old Mead Road leading onto Lyminster Road to the east.
- 3.2.3 Levels across the site vary between 2.02mAOD at the southern end and 1.35mAOD to northeast of the site along the Black Ditch.
- 3.2.4 A copy of the existing site layout plan together with topographic information is located in Appendix 2 at the rear of this Assessment.

3.3 Geology and Groundwater

- 3.3.1 Information available from borehole records and maps hosted by the British Geological Survey have been used to inform this Assessment.
- 3.3.2 Site specific soil testing including borehole and groundwater monitoring has been commissioned and is being undertaken at the time of writing this Assessment. The information will be used to inform detailed design.
- 3.3.3 The superficial geology is shown to consist of Raised Marine Deposits consisting of a mixture of clay, silt and gravel. The underlying bedrock is shown to consist mainly of chalk.
- 3.3.4 A copy of the borehole records is located in Appendix 3 at the rear of this Assessment.

3.4 Site Drainage

- 3.4.1 The site currently has no positive surface water drainage infrastructure to drain the land within the site boundary. Rainfall on the site currently discharges by overland flow to the watercourse at the northern boundary of the site.
- 3.4.2 Greenfield runoff from the site has been determined at 5.15l/s per hectare.
- 3.4.3 The site is connected to the public foul sewer network serving the area.
- 3.4.4 A copy of the Greenfield runoff calculation is located in Appendix 4 at the rear of this Assessment.
- 3.4.5 A copy of the foul infrastructure information from Southern Water is attached in Appendix 5 at the rear of this Assessment

4 Flood Zone and Flood History

4.1 Flood Zone and Flood Defences

- 4.1.1 The Environment Agency's flood maps show the site is located in Flood Zone 3 and as having a high probability of flooding.
- 4.1.2 However the site is within an area benefiting from flood defences with the Environment Agency maps showing a raised bund along the Black Ditch. The Environment Agency further note that there is a concrete embankment to the west of the site providing flood protection up to the 1 in 200 year event.
- 4.1.3 The Environment Agency have provided flood level details as part of their Product 4 information.
- 4.1.4 Table 2 of the flood level data when compared to the topographical survey indicates that the site is outside the functional flood plain.
- 4.1.5 The site is shown to be only affected along the northern bank with the Black Ditch for the 1 in 100 year fluvial event.
- 4.1.6 Table 4 of the flood level data when compared to the topographical survey indicates the site is outside the current day 1 in 200 year tidal flood event.
- 4.1.7 The Strategic Flood Risk Assessment prepared by JBA Consulting on behalf of Arun District Council in 2016 also identifies the site to be within an area shown as Flood Zone 3a defended flood plain.
- 4.1.8 Copies of the Environment Agency Flood Maps together with the flood level data are located in Appendix 6 at the rear of this Assessment.

4.2 Flood History

4.2.1 Environment Agency

- 4.2.1.1 The Environment Agency has confirmed that they hold no data related to flooding of the site.

4.2.2 West Sussex County Council

- 4.2.2.1 The Preliminary Flood Risk Assessment prepared by West Sussex County Council in May 2011 does not identify any specific flood incidents at the proposed development site.
- 4.2.2.2 West Sussex County Council has confirmed one historic record for the area which is not dated stating that *'Southdown Nursey and gardens (6) flooded due to insufficient fall from land to the Black Ditch, the north end of Eel Springs Ditch is culverted (see IDD file) and possibly the IL should have been 300mm lower - pumping station could remedy the situation'*.

4.2.3 Arun District Council

4.2.3.1 The Strategic Flood Risk Assessment includes a map of historic flood incidents in the District.

4.2.3.2 The SFRA identifies no incident related to surface water flooding to the south of the site.

4.2.3.3 Arun District Council have confirmed that they hold no historical records of flooding affecting this site.

4.2.4 Copies of the correspondence received from the Environment Agency, West Sussex County Council and Arun District Council are located in Appendix 7 at the rear of this Assessment.

5 Flooding Potential

5.1 Tidal and Fluvial Flooding

- 5.1.1 The flood level information provided by the Environment Agency has been reviewed against the topographic information for the site.
- 5.1.2 The flood levels information from the Lower Tidal River Arun Strategy Study undertaken by Atkins in 2010 indicates that the 1 in 100 year fluvial flood depths are estimated to be 0.03m near to the north bank of the Black Ditch.
- 5.1.3 With Climate Change the fluvial flood depth is anticipated to vary between 0.07m at the southern boundary and 0.18m at the northern boundary of the site.
- 5.1.4 As mentioned previously the site is currently protected against tidal flooding up to the 1 in 200 year event.
- 5.1.5 The future Climate Change 2110 1 in 200 year defended flood event is shown to flood the site to an estimated depth of 1.57m.
- 5.1.6 Arun District Council has undertaken a breach modelling of the existing flood defence which indicates that the site is not at risk of flooding should the defences be breached.
- 5.1.7 There is a very low residual risk of flooding from either fluvial or tidal flood events affecting the site.

5.2 Groundwater Flooding

- 5.2.1 Site specific soil investigation including borehole sampling and groundwater monitoring is currently being undertaken for the site.
- 5.2.2 Arun District Council SFRA indicates that the site is within an area noted to have 75% risk of groundwater flooding.
- 5.2.3 There are however no historical record of groundwater affecting the site.
- 5.2.4 There is a low residual risk of groundwater flooding affecting the site.

5.3 Overland Flow

- 5.3.1 From the topographic survey it is noted that the general slope of the land is from Old Mead Road towards the Black Ditch.
- 5.3.2 The site naturally drains towards the Black Ditch.

5.4 Flooding from Sewers and Drains

- 5.4.1 There are no records of flooding incidents from drains or sewers.

5.4.2 There is a very low residual risk of flooding from drains or sewers affecting the site.

5.5 Flood Routing

5.5.1 The natural route for flood waters to dissipate should any ever occur on the site is towards the Black Ditch along the northern site boundary.

5.5.2 Copies of the SFRA flood maps together with the natural flow paths layout are attached in Appendix 8 at the rear of this Assessment.

6 Development Proposals

6.1 Description

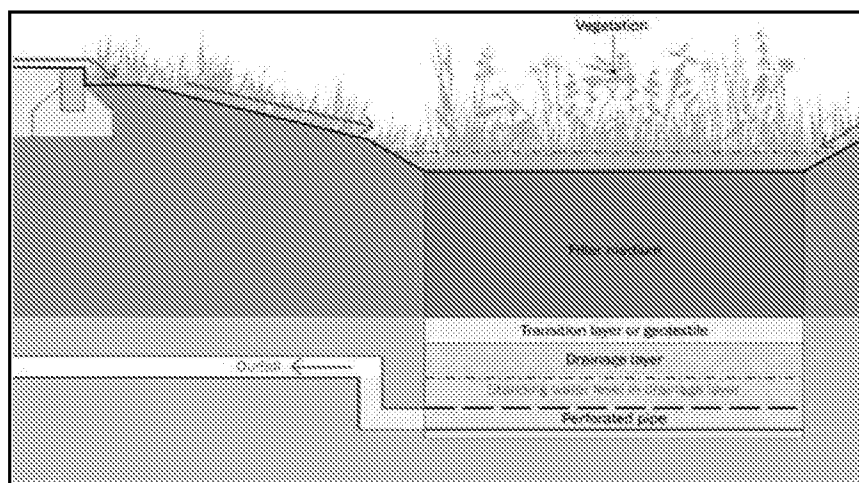
- 6.1.1 The development proposal is for the demolition of existing bungalow and outbuildings and erection of up to 25 dwellings with associated open space.
- 6.1.2 The total impermeable area of the proposed development site is approximately 3,995m².
- 6.1.3 A copy of the proposed site layout plan is located in Appendix 9 at the rear of this Assessment.

6.2 Drainage Strategy

- 6.2.1 Based upon the geology of the area and borehole information it is anticipated that infiltration based solutions will not be appropriate for the site.
- 6.2.2 The surface water drainage system will be designed to comply with National Planning Policy Framework and its supporting guidance documents including the Non-Statutory Technical Standards for SuDS.
- 6.2.3 In accordance with the discharge destination hierarchy under National Planning Policy Framework and its accompanying guidance document where an infiltration system is proven not to be feasible for the site the next available discharge point is to a watercourse.
- 6.2.4 The proposed drainage strategy includes a Climate Change allowance of 40% in accordance with the latest guidance published by the Environment Agency.
- 6.2.5 In accordance with the guidance document supporting the Non-Statutory Technical Standards for SuDS an allowance for Urban Creep of 10% for increase to impermeable area has also been included in the preliminary design for the drainage system.
- 6.2.6 With the 10% allowance for Urban Creep, the estimated impermeable area is approximately 4,400m².
- 6.2.7 The Greenfield runoff rate for the undeveloped site has been calculated at 5.15 l/s for the whole site which equates to 2.3 l/s for the developable area of the site.
- 6.2.8 Based upon the proposed indicative layout, estimated impermeable area and discharge rate approximately 380m³ of surface water storage is required prior to discharge into the Black Ditch.
- 6.2.9 As mentioned above the storage will accommodate the 100 year return period rainfall event plus a 40% allowance for future Climate Change in line with current SuDS guidance.

6.2.10 The proposed surface water drainage strategy will incorporate the combined use of bioretention units e.g. swales and shallow landscaped depressions, dry swales, detention basins in combination with filter strips and French drains.

6.2.11 A bioretention unit or rain garden is a shallow depression with absorbent yet free draining soil planted with vegetation that can withstand occasional temporary flooding.



CIRIA SuDS Manual Extract: Anaerobic bioretention system

6.2.12 Rain gardens are designed to mimic the natural water retention of undeveloped land by water entering the soil being taken up by the plants and lost back to the air by evapotranspiration.

6.2.13 Rain gardens usually absorb all the rainwater that flows into them but when they do fill up following particularly heavy rainfall events excess water is allowed to flow overland from the rain garden across the natural downstream catchment.

6.2.14 A rain garden occupying approximately 450m² base area is proposed at the north corner of the site. The rain garden is proposed to be underlain by a 500mm deep voided subbase providing approximately 67m³ of storage below ground. With 700mm raised banks the additional above ground storage that can be provided is 315m³. The combined storage within the rain garden is 382m³.

6.2.15 The surface water drainage can be adequately accommodated within the site without any increased flood risk elsewhere. Subject to further site investigations and testing the final drainage solution will be confirmed at detailed design stage.

6.2.16 The full extent of the drainage infrastructure will be confirmed during detailed design and may also include other suitable SuDS drainage techniques that are defined in CIRIA document C753 The SuDS Manual.

6.3 Foul Water

- 6.3.1 In accordance with Sewers for Adoption 7th Edition the peak foul flow from 25 residential units is 1.2l/s discharge.
- 6.3.2 It is proposed to connect the foul drainage system into the existing public sewer subject to approval from Southern Water.
- 6.3.3 It is proposed to provide a demarcation chamber at the southern boundary of the site with Old Mead Road where a gravity lateral connection can be made to the public foul sewer system.
- 6.3.4 A preliminary drainage strategy plan together with preliminary storage volume calculations are located in Appendix 10 at the rear of this Assessment.
- 6.3.5 An outline drainage maintenance schedule is included in Appendix 11 at the rear of this Assessment.

7 Water Quality

7.1.1 The proposed development is for residential use only. In accordance with CIRIA SuDS Manual 2015 (Report C753), the pollution hazard level for this type of development is considered low. Where surface water runoff is to be discharged into watercourses, the SuDS components are only required to control potential contaminants for the frequent low intensity rainfall events as the natural high volume of flows within the receiving water body during a high intensity rainfall event is likely to dilute any contaminants within the water body.

7.1.2 The surface water scheme will include mitigation to ensure water quality before the discharge point will be treated and pollution will be significantly reduced before its discharge to the existing watercourse.

7.1.3 Table 26.2 in Chapter 26 of CIRIA report C753 The SuDS Manual provides Pollution Hazard Indices for varying land types and uses and defines runoff from residential roofs to be a very low risk potential for pollution. Runoff from individual property driveways, residential car park and associated low traffic roads are considered to be a low risk potential for pollution. The table below summarises the anticipated pollution index from the proposed development.

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential Roofs	Very Low	0.20	0.20	0.05
Individual property driveways, residential car park, low traffic roads	Low	0.50	0.40	0.4
Total:		0.70	0.60	0.45

7.1.4 Where multiple drainage components are used in series the individual mitigation index of secondary and tertiary components are lowered due to reduced performance associated with primary treatment. The total mitigation indices with the proposed combined surface water drainage system are shown in the table on the following page.

SuDS Type	Mitigation Indices		
	Total suspended solids (TSS)	Metals	Hydro-carbons
French Drain / Filter Strip	0.4	0.4	0.5
Bioretention system	0.8 x 0.5	0.8 x 0.5	0.8 x 0.5
Swale / Filter Strip (using the lower value)	0.4 x 0.5	0.4 x 0.5	0.5 x 0.5
Total:	1.00	1.00	1.15

7.1.5 The proposed combined use of French drain, bioretention system, swales or filter strip including catchpit manholes will exceed the target treatment level required for runoff with low risk of pollution potential thus demonstrating that the surface water drainage system for the site adequately mitigates against the risk of pollution.

7.1.6 The proposed drainage strategy will incorporate measures exceeding the water quality target requirements and therefore complies with the Water Framework Directives for discharge of runoff into controlled waters.

8 The Sequential and Exception Tests

8.1 Sequential Test

- 8.1.1 The proposed development is classified as More Vulnerable in accordance to Table 2 Flood Risk Vulnerability Classification under Paragraph 66 of National Planning Practice Guidance (NPPG) and considered suitable subject to the Exception Test in accordance with Table 3 Flood Risk Vulnerability and Flood Zone Compatibility under Paragraph 67 of the NPPG, a copy of which is reproduced below.

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test Required	✓	✓	✓
Zone 3a	Exception Test Required	x	Exception Test Required	✓	✓
Zone 3b	Exception Test Required	x	x	x	✓

- 8.1.2 The site benefits from existing flood defences and is protected against tidal flooding for current day 1 in 200 year flood event.
- 8.1.3 Pre Application Advice was provided by Arun District Council which indicated the requirement for the Sequential Test.
- 8.1.4 The site has been positively assessed within the Arun Housing and Economic Land Availability Assessment (HELAA). It is deemed that the Council has undertaken a spatial Sequential Test for site allocation when considering the site's suitability under HELAA.
- 8.1.5 On a site specific basis, the layout has been designed to allow open space and drainage within the lowest part of the site and positioning residential development away from the Black Ditch.
- 8.1.6 The site is considered to have passed the Sequential Test and subject to the Exception Test is considered suitable for development.

8.2 Exception Test

- 8.2.1 The Exception Test aims to demonstrate that the proposed development has taken account of the residual flood risk and does not impact on flood risk downstream from the development site.
- 8.2.2 The Planning Statement accompanying the Outline Planning Application provides details about the sustainability elements of the proposed development and its close proximity to existing amenities and facilities.
- 8.2.3 The Planning Statement notes that the proposed development achieves the sustainability requirements in accordance with National Planning Policy Framework.
- 8.2.4 The development aims to provide much needed housing facilities including affordable housing for the locality.
- 8.2.5 Flood defence information provided by Environment Agency indicates the site is protected by high grounds along the northern boundary.
- 8.2.6 The adjoining mobile home park benefits from a raised wall acting as flood defence.
- 8.2.7 As part of the new development it is proposed to extend the existing wall around the developable area.
- 8.2.8 The 1 in 100 year fluvial flood level is noted to be at 1.72mAOD including an allowance for Climate Change. The site is currently not at risk from tidal flooding.
- 8.2.9 It is proposed to set the finished floor level of the new buildings 600mm above the 1 in 100 year plus Climate Change fluvial flood level.
- 8.2.10 It is also proposed to provide under floor voids to allow free passage of water should a flood occur.
- 8.2.11 The future 2110 tidal flood level is noted to be at 3.13mAOD.
- 8.2.12 It is proposed to incorporate a flood resistant and resilient method of construction within the new buildings up to 1m above the proposed finished floor level, thus providing protection against the future predicted tidal flood level.
- 8.2.13 The site is within an area where the Environment Agency issues Flood Warning. Future property owners/occupiers will be registered to the Flood Warning Service.
- 8.2.14 The proposed development meets the sustainability requirements. It will not impact on the current situation and the proposed drainage system will ensure

there is no increase in runoff downstream. The residual risks can be mitigated by appropriate resistant and resilience measures incorporated within the new builds.

8.2.15 The Exception Test is passed in accordance with the guidance set under National Planning Policy Framework.

8.3 Risk to Others

8.3.1 The proposed surface water drainage system will be designed to current standards incorporating SuDS elements providing treatment, attenuation and storage which will minimise runoff leaving the site during times of heavy rain.

8.3.2 Allowance has been made for a 40% increase in rainfall intensities which is in accordance with the latest figures published by the Environment Agency and in accordance with the requirements under the National Planning Policy Framework.

8.3.3 Allowance has been made for Urban Creep accounting for future property owners extending their houses or adding to the impermeable areas.

8.3.4 The proposed drainage system will incorporate treatment prior to final discharge destination thus mitigating the risk of pollution from the site.

8.3.5 Foul flows from the residential development will be discharged to the public sewer beneath Old Mead Road subject to approval from Southern Water.

8.3.6 The risk of flooding to others due to the development proposals is negligible.

9 Conclusions

- 9.1 The site is shown to be in defended Flood Zone 3 and passed both the Sequential Test and Exception Test.
- 9.2 The Environment Agency and Arun District Council have confirmed they hold no records of flooding having affected the site.
- 9.3 West Sussex County Council have reported one incident of flooding to Southdown Nursery attributed to poor drainage.
- 9.4 The site benefits from flood defences offering protection up to the 1 in 200 year tidal flood event and is not affected by potential flooding resulting from a breach of the flood defences.
- 9.5 The finished floor level of the building will be set 600mm above the forecasted 1 in 100 year fluvial flood level including Climate Change allowance.
- 9.6 The proposed development will include flood resistant and resilient methods of construction further reducing and alleviating the risks of future flooding.
- 9.7 It is anticipated that surface water runoff generated by the proposed development can be attenuated onsite for all rainfall events up to the 1 in 100 year event including an allowance for Climate Change and an additional allowance for future increase in impermeable areas.
- 9.8 Preference will be given to the use of different attenuation, filtration and storage techniques prior to discharge at Greenfield runoff rates into the adjoining watercourse in accordance with National Planning Policy Framework and its supporting guidance documents.
- 9.9 The detailed design will be developed with input from landscape and ecology specialists to provide an integrated drainage solution.
- 9.10 Foul drainage will be discharged to the existing public sewer system
- 9.11 In terms of flood risk planning the proposed development is safe and suitable at this location and is considered acceptable.

10 List of Appendices

Appendix 1	Site Location Plan
Appendix 2	Existing Site Layout and Topographical Information
Appendix 3	Extract of British Geological Survey Data
Appendix 4	Greenfield Runoff Calculation
Appendix 5	Southern Water Infrastructure Map
Appendix 6	Environment Agency Flood Maps
Appendix 7	Correspondence with Environment Agency, Arun District Council and West Sussex County Council
Appendix 8	Extracts from SFRA and Flow Paths
Appendix 9	Proposed Site Layout
Appendix 10	Preliminary Drainage Strategy Layout and Calculations
Appendix 11	Outline Maintenance Schedule

Appendix 1

Site Location Plan



SITE LOCATION

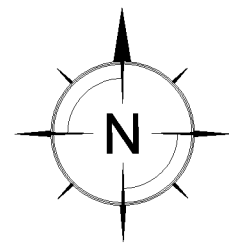
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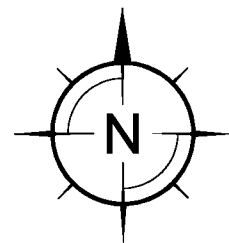
TITLE
Site Location
Grid Reference: TQ 021 042
Nearest postcode: BN17 7PU
SCALE
1:10000 @ A3
DRG. No.
1

Appendix 2

Existing Site Layout and

Topographical Information





TITLE
Thornlea Park, Littlehampton
Existing Contours

SCALE
Not to Scale @ A3

DRG. No.
3

Appendix 3

Extract of British Geological Survey Data



British
Geological Survey

NATURAL ENVIRONMENT RESEARCH COUNCIL

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3D

Models



Bedrock
Geology



Earthquakes
Timeline



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Location

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Basemap

Surface Geology

- ☐ Superficial only
- ☐ Bedrock only
- ☐ Bedrock and Superficial

Visible geology:
1:50 000 scale

Geology
Key

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ARUN DISTRICT COUNCIL LU/376/17/OUT

BN177PU

Bedrock geology

X 00%

0%

Geology Transparency

Grid Ref 504998, 105604

1:50 000 scale bedrock geology description:

Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation And Portsdown Chalk Formation (undifferentiated) - Chalk. Sedimentary Bedrock formed approximately 72 to 94 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas.

Setting: warm chalk seas. These sedimentary rocks are shallow-marine in origin. They are biogenic and detrital, generally comprising carbonate material (coccoliths), forming distinctive beds of chalk.



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Surface
Geology

3D

Models



Borehole
Scans



Earthquake
Timeline

Surface Geology

- ☒ Superficial only
- ☐ Bedrock only
- ☐ Bedrock and Superficial

Visible geology:
1:50 000 scale

Geology
Key

[More on digital geology](#)



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0.6 km

BN177PU

Superficial geology

100%

0%

Geology Transparency

Grid Ref 505266, 105224

1:50 000 scale superficial deposits description:

Raised Marine Deposits - Clay, Silt, Sand And Gravel. Superficial Deposits formed up to 3 million years ago in the Quaternary Period. Local environment previously dominated by shallow seas (U).

Setting: shallow seas (U). These sedimentary deposits are shallow-marine in origin. They are detrital, generally coarse-grained forming beaches and bars in a coastal setting.

[Further details](#)

[What are Superficial Deposits?](#)

1:50 000



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Borehole
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Timeline

Borehole Scans

Click on a borehole to view
scan.

Borehole depth

- 0 - 10m
- 10 - 30m
- 30m+
- Unknown
- Confidential
or Restricted

[More on boreholes](#)

Go to
Location

Switch
Basemap

100% 0%

Geology Transparency

Grid Ref: 504286, 105062

ord



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B2187

For Institute use only) GEOLOGICAL CLASSIFICATION	NATURE OF STRATA If measurements start below ground surface, state how far.	THICKNESS			DEPTH		
		Feet	Inches	Metres	Feet	Inches	Metre
	<u>Geological classification</u> Made young, Drift (Alluvium, and Brighthelm)	5'	0"	(1.52m)	5'	0"	(1.52m)
	Middle Chalk	46'	6"	(14.18m)	51'	6"	(15.70m)
The record suggests that this is 317/358A ; the Drift consists of pebbly sand of the Brighton Raised Beach according to the 1:10 000 survey R. J. Wyatt 12.11.81							

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA If measurements start below ground surface, state how far ..	THICKNESS		DEPTH	
		Feet ..	Inches ..	Feet ..	Inches ..
Drift (Alluvium, Boulder, Gravel) 43'		43	(13.1m)	43	(13.1m)
Meddle Chalk 2'	(probably base of Upper Chalk)	7	(2.1m)	50	(15.2m)
The record suggests that this is 317/358B; the Drift consists of Estuarine Alluvium according to the 1:10000 survey.					

For Institute use only) GEOLOGICAL CLASSIFICATION	NATURE OF STRATA If measurements start below ground surface, state how far.	THICKNESS			DEPTH		
		Feet	Inches	Metres	Feet	Inches	Metre
MH 21/2/73	Geological classification: Drift (Alluvium, sand & gravel) Middle Chalk } The record suggests that this is 317/358A ; the Drift consists of pebbly sand of the Brighton Raised Beach according to the 1:10,000 survey. [Redacted]	5' 6"	0'	(1.52m)	5' 0"	0'	(1.52m)
		46'	6"	(14.18m)	51'	6"	(15.70m)

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