BP CIVILS

10-12 NELSON ROAD, BOGNOR REGIS, WEST SUSSEX PO21 2RY

PROPOSED RESIDENTIAL DEVELOPMENT

Flood Risk Assessment & Drainage Strategy

Prepared on Behalf of

A, G & J Steventon

D2349/FRA1.2

February 2025

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1 INTRODUCTION

1.1 Background

1.1.1 BP Civils is instructed by A, G & J Steventon to prepare a flood risk assessment and drainage strategy to accompany a full planning for the proposed development at 10-12 Nelson Road, Bognor Regis.

1.1.2 This report has been undertaken in accordance with National Planning Policy Framework (NPPF) and The Planning Practice Guidance on the use of SuDS for achieving sustainable development.

1.1.3 The proposed development will involve the construction of 1 No. dwelling, 2 No. car ports and a rear extension to the existing property as demonstrated by the development proposals contained within **Appendix A**.

1.1.4 In preparing this report, BP Civils has referred to the following documents and information:

- Arun District Council Strategic Flood Risk Assessment
- British Geological Survey (BGS) Information and Records
- Environment Agency (EA) Flood Maps for Planning
- Flood Estimation Handbook (FEH) Catchment Data
- Long Term Flood Risk Maps for Rivers or the Sea, Surface Water and Reservoirs
- Southern Water Public Sewer Records

1.1.5 This report has been prepared to assess flood risk at the site, and to advise of any mitigation which may be required in order to ensure that the proposed development remains safe for its design life in accordance with current design standards.

1.1.6 This report has been prepared for the benefit of the named client only.

2 SITE LOCATION AND DESCRIPTION

2.1.1 A site location plan has been prepared and is included within this report.

2.1.2 The National Grid Reference is SZ 92501 99231.

2.1.3 The site is located in a built up residential area, with existing properties to the north, east and west. Nelson Road runs parallel to the southern boundary of the site.

2.1.4 The site measures 849m^2 (0.08Ha) and is occupied by the existing property; 10 Nelson Road.

2.1.5 A topographic survey has been undertaken at the site by HB Surveys Ltd, dated February 2025. The survey identifies levels in the range of 6.12m AOD and 6.66m AOD.

2.1.6 Drawing PL200 (Topographic Survey with Contours) has been prepared to illustrate the topography of the site.

2.1.7 The site topographic survey does not demonstrate any significant prevailing falls, with the site considered to be flat.

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3 GROUND CONDITIONS

3.1.1 Ground Management Ltd. has been instructed to undertake intrusive ground investigation at the site.

3.1.2 2 No. boreholes have been established on site (BH1 and BH2), both to 3.00m below ground level. The boreholes were installed on 17th February 2025.

3.1.3 Topsoil was encountered to depths of 200-250mm below ground level, underlain by silty clay to depths of 1.20m below ground level (BH1) and 1.90m below ground level (BH2). Variable sand was encountered beyond this to the final depths of both boreholes.

3.1.4 The BGS Geology of Britain Viewer indicates a 'London Clay Formation – Clay, silt and sand' bedrock geology.

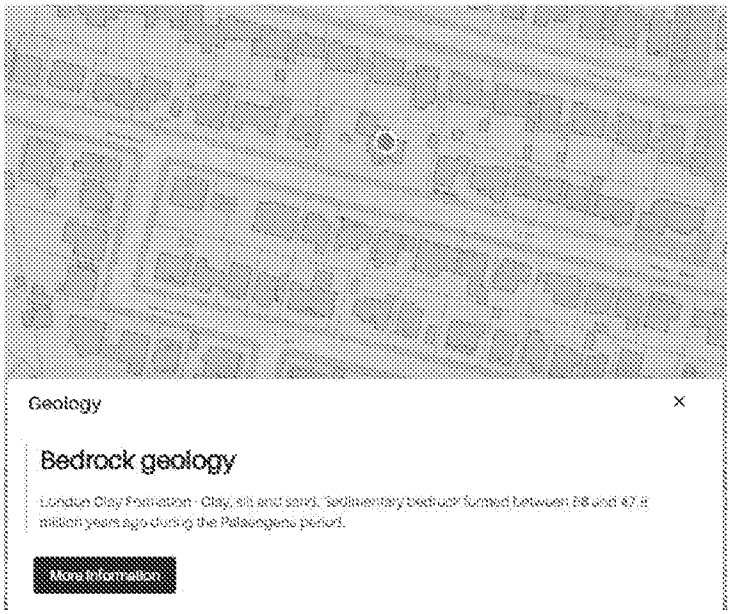

Figure 1. Geology of Britain Viewer – Bedrock Geology (BGS)

3.1.5 Superficial deposits are recorded as 'River Terrace Deposits – Sand, silt and clay.'

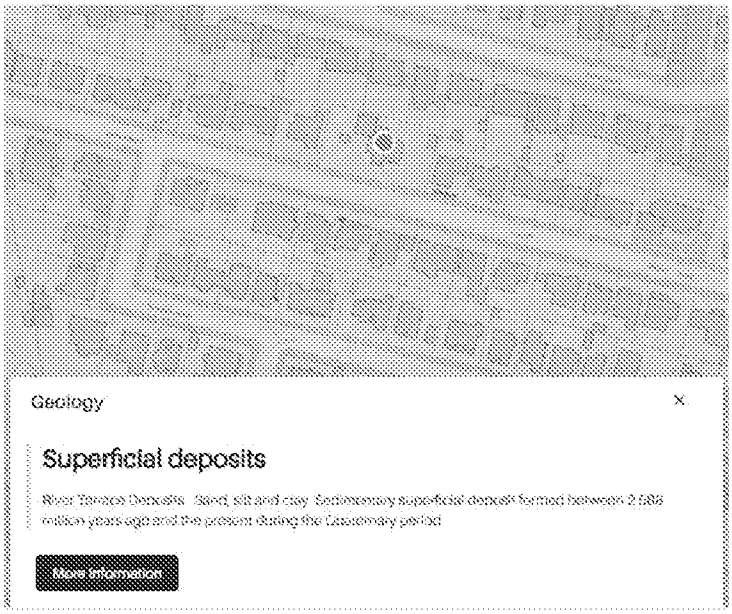

Figure 2. Geology of Britain Viewer – Superficial Deposits (BGS)

3.1.6 Historic borehole records are available on the BGS website (GeoIndex Onshore). A borehole has been identified c. 500m south-west of the site, identified as 'Hammonds Corner' (SZ99NW22; Easting: 492000, Northing: 99200).

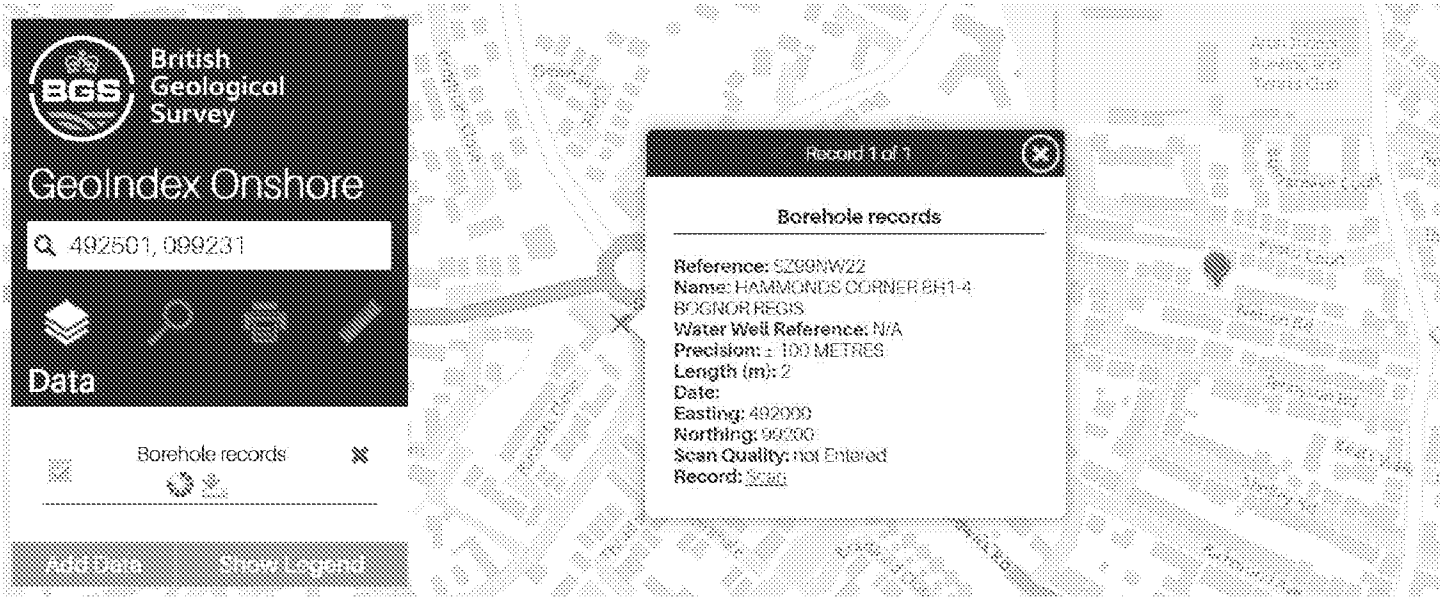

Figure 3. GeoIndex Onshore – Borehole Register (BGS)

3.1.7 Information for 4 No. boreholes is provided. The recorded geology is consistent with the BGS Geology of Britain Viewer, with silty clay and 'grit' encountered.

3.1.8 The BGS records reviewed can be found within **Appendix D**.

3.2 Groundwater

3.2.1 As part of Ground Management Ltd's instruction, groundwater investigation has been undertaken.

3.2.2 When the boreholes were installed on 17th February 2025, groundwater was recorded at 1.100m below

ground level (BH1) and 1.220m below ground level (BH2).

3.2.3 On 24th February 2025, groundwater was recorded at 540mm below ground level (BH1) and 550mm below ground level (BH2).

3.2.4 The BGS borehole records reviewed make no reference to groundwater.

3.2.5 Mapping managed by MAGIC (magic.defra.gov.uk) provides geographic information concerning the natural environment from across government. This mapping tool has been referred to in order to confirm whether the site is located within either any groundwater source protection zones or groundwater vulnerability zones.

3.2.6 The site is located within an 'Unproductive' bedrock aquifer and a 'Secondary A' superficial drift aquifer.

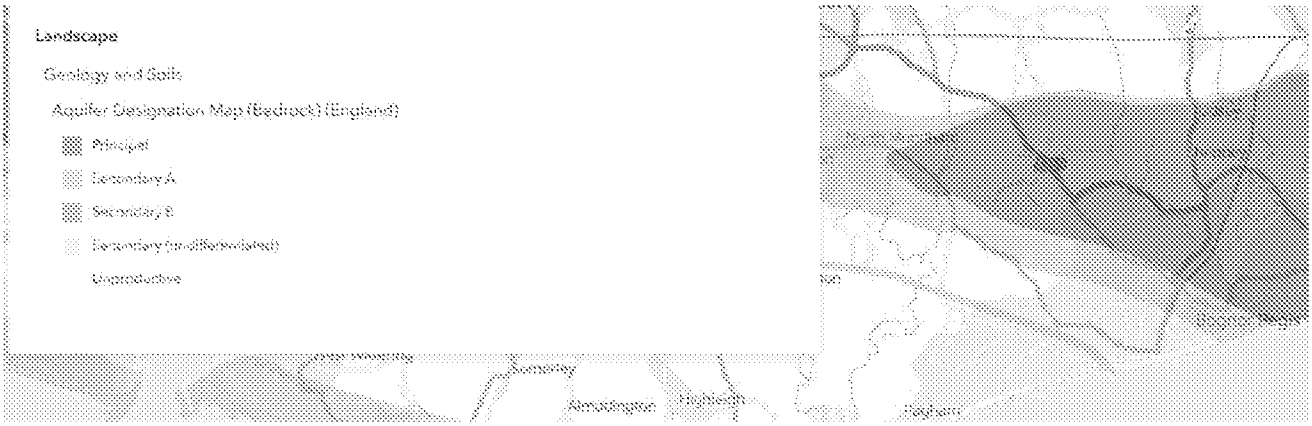

Figure 4. Aquifer Designation Map - Bedrock Aquifer (DEFRA)

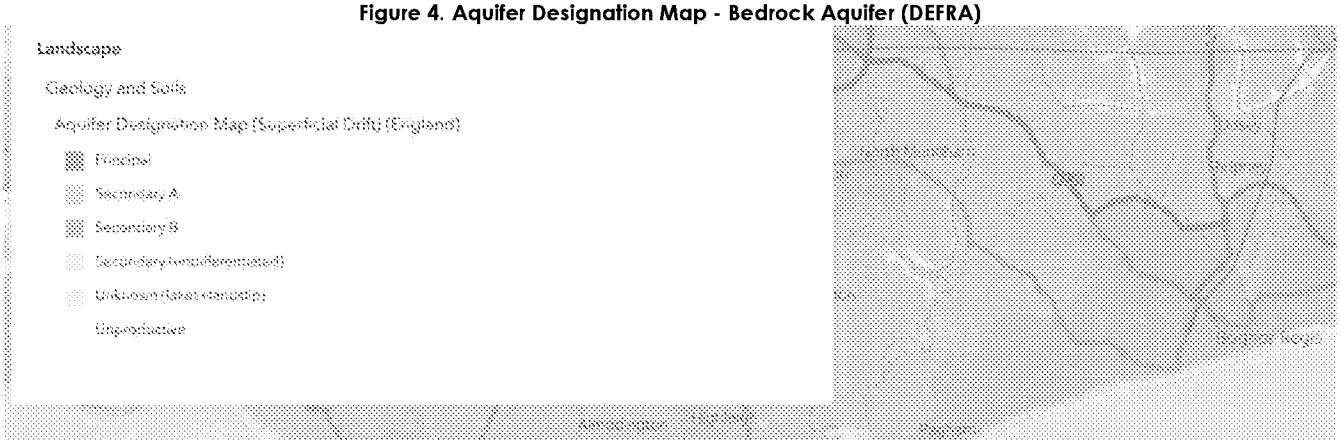

Figure 5. Aquifer Designation Map – Superficial Drift (DEFRA)

3.2.7 The site is located within a 'Medium - Low' groundwater vulnerability zone. also identified.

Figure 6. Groundwater Vulnerability Map (DEFRA)

3.2.8 The site does not fall within any drinking water protected areas (surface water), drinking water safeguard zones (surface water or groundwater) or source protection zones.

Figure 7. Drinking Water Protected Areas (Surface Water), Drinking Water Safeguard Zones (Surface Water and Groundwater and Source Protection Zone Map (DEFRA)

4 EXISTING DRAINAGE

4.1 Surface Water

4.1.1 The local sewerage authority is Southern Water. Public sewer records have been obtained from Southern Water, as contained within **Appendix E**.

4.1.2 Further drainage records have been obtained from West Sussex County Council, as contained within **Appendix F**.

4.1.3 Southern Water's public sewer records identify public surface water sewers at the western and eastern extents of Nelson Road, both measuring 225mm dia.

4.1.4 It is understood that the Southern Water public surface water sewer at the western end of Nelson Road discharges to a culverted ordinary watercourse which runs north-west to south-east between 31 & 37 Nelson Road, through rear gardens before discharging to a Southern Water public surface water sewer at the junction of Westingway, Richmond Avenue West and Richmond Avenue.

4.1.5 It is understood that the Southern Water public surface water sewer at the eastern end of Nelson Road run south between 7 & 7a Nelson Road, before diverting west between 15 & 19 Tennyson Road. From this point, the sewer runs west before discharging to the culverted ordinary watercourse referenced in 4.1.4.

4.1.6 The existing building(s) on site are served by a combination of open-ended rainwater pipes which discharge freely to the adjacent ground, in addition to rainwater pipes which discharge below ground. It is assumed that the rainwater pipes that discharge below ground may discharge to the on-site foul drainage network, which discharges to Southern Water's public foul water sewer beneath Nelson Road.

4.1.7 There is a gully positioned in the existing driveway, although it has not been confirmed where this drains to.

4.1.8 The remaining areas of the site are understood to drain naturally.

4.1.9 Arun District Council and West Sussex County Council records suggest a watercourse exists in the rear gardens of 10/14 to 26A Nelson Road. No evidence of this has been identified on site at 10 Nelson Road.

4.1.10 Greenfield run-off rates have been established in relation to the site area (849m^2) using HR Wallingford's 'Greenfield run-off rate estimation' tool. Rates have been calculated on a pro-rata basis (HR Wallingford's tool requires a minimum site area of 0.1Ha).

4.1.11 Greenfield run-off rates have been calculated as follows;

- Q^{BAR} – 0.25 l/s
- 1 in 1 Year – 0.21 l/s
- 1 in 30 Year – 0.56 l/s
- 1 in 100 Year – 0.78 l/s

- 1 in 200 Year – 0.92 l/s

4.2 Foul Water

4.2.1 Southern Water's public sewer records identify a 225mm dia. public foul water sewer beneath Nelson Road. This sewer is shown to flow in an easterly direction, communicating with a 375mm dia. public foul water sewer beneath Nyewood Lane.

4.2.2 The site is currently served by an existing connection to the 225mm dia. public foul water sewer beneath Nelson Road.

4.3 Highway Drainage

4.3.1 Nelson Road is served by traditional road gullies, as identified by West Sussex County Council's records.

4.3.2 It is not confirmed where these gullies discharge to, although it is assumed these discharge to Southern Water's public surface water sewers, where present, and/or to Southern Water's public foul water sewer where surface water sewers are not present.

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5 PROBABILITY

5.1 Sources of Information

5.1.1 The National Planning Policy Framework (NPPF) requires that all sources of flooding are considered being tidal, fluvial, pluvial, groundwater, sewers and man-made canals/reservoirs.

5.1.2 The likelihood of the site flooding has been established by reviewing the following information:

- Arun District Council's Strategic Flood Risk Assessment
- Environment Agency Flood Maps for Planning
- Long-Term Flood Risk Map for Rivers or the Sea
- Long-Term Flood Risk Map for Surface Water
- Long-Term Flood Risk Map for Reservoirs

5.2 Flood Map Analysis

5.2.1 Flood Maps for Planning confirms that the site is located fully within Flood Zone 1.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 0.1% annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b).
Zone 2 Medium Probability	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding. (Land shown in light blue on the Flood Map).
Zone 3a High Probability	Land having a 1% or greater annual probability of river flooding; or land having a 0.5% or greater annual probability of sea. (Land shown in dark blue on the Flood Map).
Zone 3b The Functional Floodplain	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of function floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise: • Land having a 3.3% or greater annual probability of flooding, with any existing flood management infrastructure operating effectively; or

	• Land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability flooding). Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map).

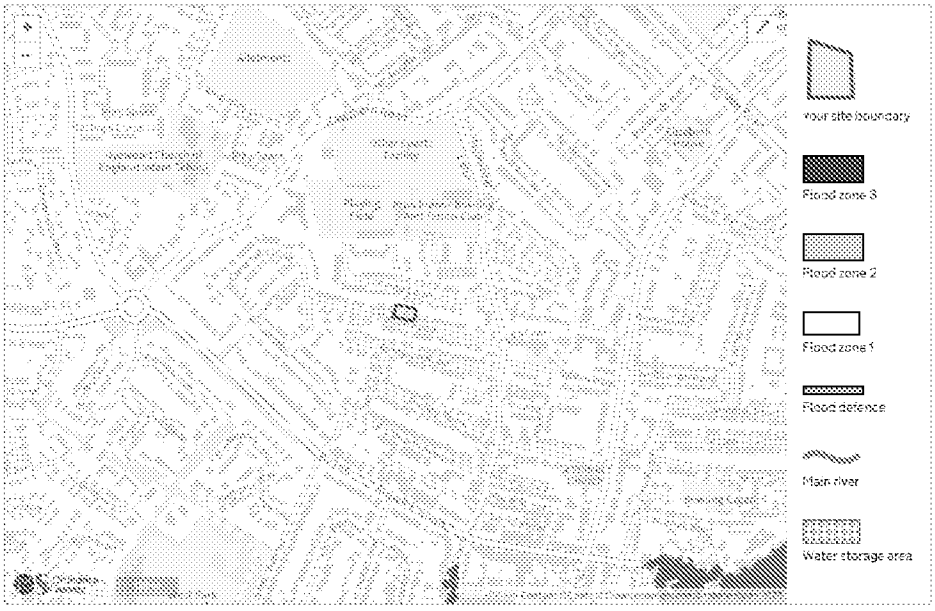


Figure 8. Flood Maps for Planning (Gov.uk)

5.2.2 The Long-term Flood Risk Map for Rivers and the Sea does not identify the site as being at risk of flooding from such sources.

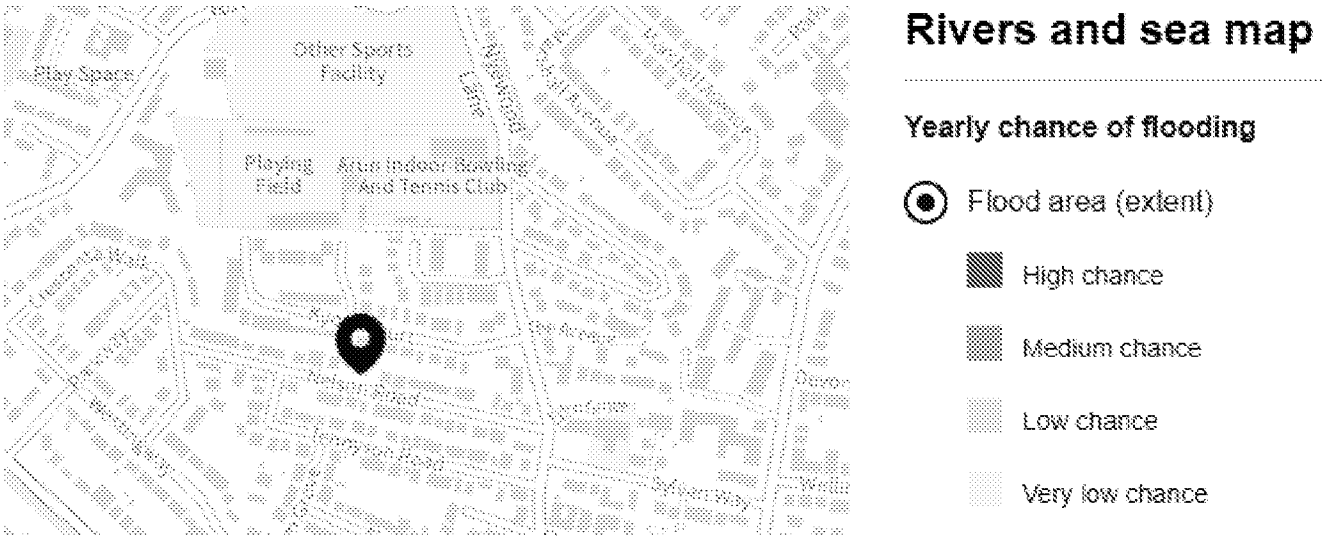


Figure 9. Long-term Flood Risk Map for Rivers and the Sea (Gov.uk)

5.2.3 The 'Yearly chance of flooding between 2036 and 2069' rivers and sea flood risk map also does not

identify the site as being at risk of flooding from such sources.

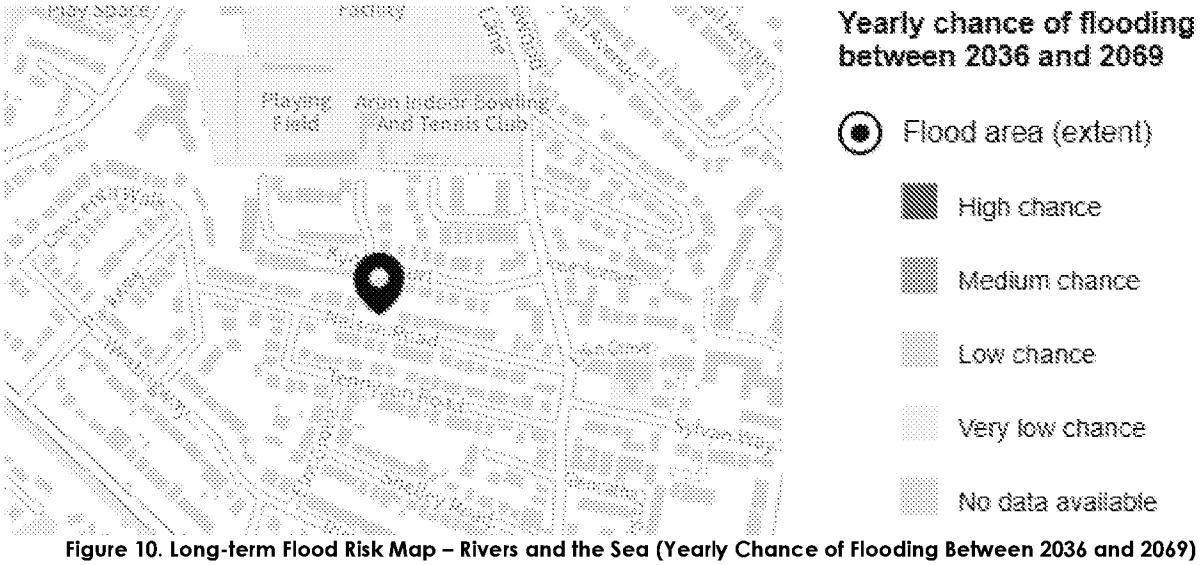


Figure 10. Long-term Flood Risk Map – Rivers and the Sea (Yearly Chance of Flooding Between 2036 and 2069)

5.2.4 The Long-term Flood Risk Map for Surface Water does not identify the site as being at risk of surface water flooding.

5.2.5 Areas of Nelson Road to the east of the site are identified as having a 'High' to 'Low' risk of surface water flooding.

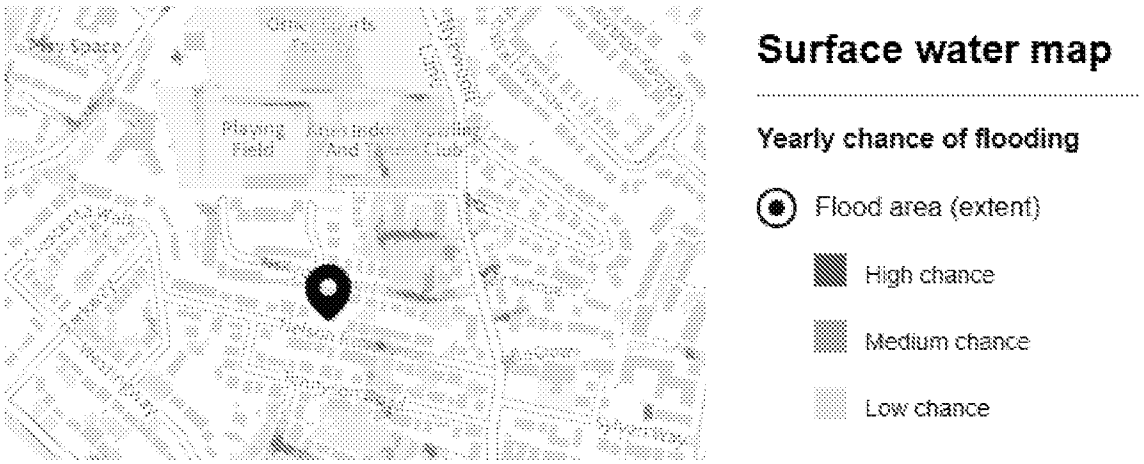


Figure 11. Long-term Flood Risk Map – Surface Water (Gov.uk)

5.2.6 The 'Yearly chance of flooding between 2040 and 2060' surface water flood risk map also does not identify the site as being at risk of surface water flooding. The areas to the east of the site identified as being at risk of surface water flooding demonstrate increased extents for this period.

Figure 12. Long-term Flood Risk Map – Surface Water (Yearly Chance of Flooding Between 2040 and 2060)

5.2.7 The site is not identified as being at risk of flooding from reservoirs.

5.3 Historic Flooding

5.3.1 No instances of historic flooding have been identified at the site, upon review of the information available at the time of undertaking this flood risk assessment.

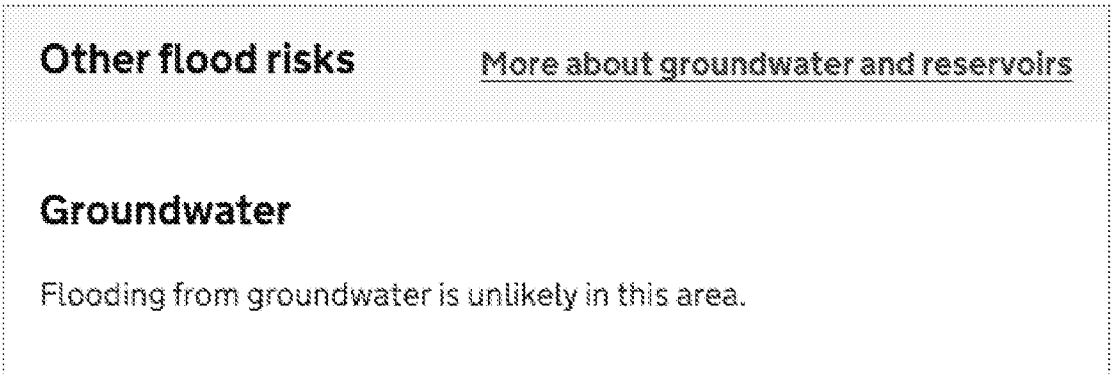
5.4 Strategic Flood Risk Assessment

5.4.1 Arun District Council has a Strategic Flood Risk Assessment, dated November 2016.

5.4.2 The site, and/or Nelson Road, is not specifically referenced within the Strategic Flood Risk Assessment.

5.4.3 Mapping contained within the Strategic Flood Risk Assessment has been reviewed, with the following observations made:

- The Strategic Flood Risk Assessment Appendix B - 'Watercourses' does not identify any significant watercourses within the vicinity of the site
- The Strategic Flood Risk Assessment Appendix C - 'Flood Zones' confirms that the site is located in Flood Zone 1
- The Strategic Flood Risk Assessment Appendix D - 'Climate Change Mapping' does not identify the site as being at risk of future flooding in respect of climate change considerations
- The Strategic Flood Risk Assessment Appendix E - 'Surface Water Flood Risk' mapping is consistent with the earlier discussed Long-term Flood Risk Maps for Surface Water. The site is not identified as being at risk of surface water flooding
- The Strategic Flood Risk Assessment Appendix F - 'Areas Susceptible to Groundwater' identifies the site as being in an area of 'High' groundwater flood risk (>=75%). This contrasts with the Long-term Flood Risk Service on Gov.uk which states that 'flooding from groundwater in unlikely in this area'



- **Figure 13. Long-term Flood Risk Service (Gov.uk)**

- The Strategic Flood Risk Assessment Appendix G - 'Flood Warning Areas' does not identify the site as falling with any flood warning area(s)

- The Strategic Flood Risk Assessment Appendix H - 'Historic Flooding Records' does not identify any historic flood events recorded at the site, or the immediate surrounding areas.

5.5 Summary of Flood Risk

5.5.1 The potential sources of flooding are:

Source of Flooding	Level of Risk
Rivers and Coastal	**Very Low** The site is located fully within Flood Zone 1 and is not identified as being at risk of flooding from such sources either in the current day or in view of climate change considerations.
Surface Water	**Very Low** The Long-Term Flood Risk Map indicates that the site is at 'Very Low' risk of surface water flooding.
Groundwater	**Low** Ground Management Ltd. has encountered groundwater at shallow depths on site (540mm below ground level at BH1). The Long-term Flood Risk Service on Gov.uk states that 'Flooding from groundwater is unlikely in this area.' No records or knowledge of groundwater emergence at the site has been identified in the undertaking of this flood risk assessment.
Sewers	**Very Low** No historic instances of historic sewer flooding have been recorded at the site, or in the surrounding areas. Southern Water is responsible for ensuring that capacity exists within their network to support both existing and new development.
Artificial Sources	**None** The site is not identified as being at risk of flooding from such sources.

5.5.2 The site has been assessed as being at 'Very Low' or 'Low' risk of flooding from all of the potential sources of flooding as identified in the above table.

5.5.3 The drainage design for the proposed development should ensure that capacity up to the design event is provided whilst potential exceedance routes should also be considered, so as to not increase the risk of surface water flooding on or off the site.

6 PROPOSED DEVELOPMENT

6.1 Description of Development

6.1.1 The proposed development will involve the construction of 1 No. dwelling, 2 No. car ports and a rear extension to the existing property as demonstrated by the development proposals contained within **Appendix A**.

6.1.2 The type of development proposed falls within the "More Vulnerable" flood risk vulnerability classification (Annex 3: Flood risk vulnerability classification, NPPF) and is appropriate in Flood Zone 1 (Flood Risk and Coastal Change Table 2).

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	**Highly Vulnerable**	**More Vulnerable**	**Less Vulnerable**	**Water Compatible**
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	Exception Test Required	✓	✓	✓
Flood Zone 3a†	Exception Test Required †	✗	Exception Test Required	✓	✓
Flood Zone 3b*	Exceptions Test Required *	✗	✗	✗	✓*
✓ = Development is appropriate ✗ = Development should not be permitted					

6.1.3 The proposed development will see the introduction of new impermeable surfaces at the site, which can lead to an increase in the rate of run-off generated. SuDS measures will be used where possible in order to mitigate this.

6.1.4 The post-development impermeable/hardstanding area has been determined to be 429m^2 (0.04Ha).

6.1.5 Of the above figure of 429m^2, 173m^3 is existing impermeable area associated with the existing dwelling which is to be retained. This area will continue to drain as existing.

6.1.6 The catchment associated with the proposed development which is to be positively drained is 229m^2.

6.1.7 The use of SuDS methods and techniques, where site conditions and constraints allow, will be utilised to assist in the management of surface water run-off generated by the proposed development, whilst adhering to the SuDS hierarchy as stated within Building Regulations (Part H) and The SuDS Manual (C753).

6.1.8 The specific Surface Water and Foul Water drainage proposals are detailed in **Section 8** of this report.

7 SEQUENTIAL AND EXCEPTION TESTS

7.1 Sequential Test

7.1.1 The Sequential Test ensures that a sequential, risk-based approach is followed to steer new development to areas with the lowest risk of flooding, taking all sources of flood risk and climate change into account.

7.1.2 Where it is not possible to locate development in low-risk areas, the Sequential Test should look to compare reasonably available sites within medium risk areas, and then only where there are no reasonably available sites in low and medium risk areas, within high-risk areas.

7.1.3 The site is located fully within Flood Zone 1, and has been assessed as being at 'Very Low' or 'Low' risk of flooding from all of the potential sources of flood risk considered.

7.1.4 In view of the above factors, the Sequential Test is passed.

7.2 Exception Test

7.2.1 The Exception Test requires two additional elements to be satisfied (as set out in paragraph 164 of the National Planning Policy Framework) before development can be permitted in situations where suitable sites at lower risk of flooding are not available following application of the Sequential Test.

7.2.2 The Exception Test requires the applicant to demonstrate that;

i. development that has to be in a flood risk area will provide wider sustainability benefits to the community that outweigh flood risk, and;

ii. the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

7.2.3 Flood Risk and Coastal Change, Table 2 (see 6.1.2) confirms that "More Vulnerable" development is acceptable in Flood Zone 1, and therefore application of the Exception Test is not required.

8 PROPOSED DRAINAGE STRATEGY

8.1 Surface Water

8.1.1 The SUDS Manual (CIRIA C753) and Building Regulations, Approved Document H (Drainage and Waste Disposal) set out a hierarchy of drainage methods to ensure that developments maximise the use of sustainable drainage techniques. The hierarchy favours infiltration methods of disposal over other methods such as watercourse and sewers, as detailed below;

i. Utilise infiltration techniques

ii. Attenuate rainwater in ponds or open water features for gradual release

iii. Attenuate rainwater by storing in tanks or sealed water features for gradual release

iv. Discharge rainwater direct to a watercourse

v. Discharge rainwater to a surface water sewer/drain

vi. Discharge rainwater to a combined sewer

SUDS Technique	Suitable	Comments
Living Roof	No	Not appropriate in view of development proposals.
Basins and Ponds (such as Wetlands, Balancing Ponds, Detention Basins, Retention Ponds)	No	Not appropriate in view of the size and scale of the proposed development, or in view of site spatial constraints.
Filter strips and swales	No	Not appropriate in view of the size and scale of the proposed development.
Infiltration Devices - Soakaways - Infiltration trenches and basins	No	Spatial constraints dictate that soakaways cannot be accommodated on site.
Permeable surfaces and filter drains (such as gravelled areas and porous block paving)	Yes	No initial constraints identified. Infiltration is not viable owing to shallow groundwater depths, however such features may be tanked to provide storage.
Tanked systems (such as oversized pipes or cellular tanks)	Yes	No initial constraints.

8.1.2 Ground Management Ltd. has undertaken intrusive ground investigation at the site, which has confirmed shallow groundwater depths (540mm below ground level at BH1, and 550mm below ground level at BH2).

8.1.3 Spatial constraints dictate that soakaways cannot be accommodated on site – at least 5.00m away from buildings – therefore such features cannot be provided. This is in addition to the constraint of shallow groundwater depths restricting the ability for permeable surfaces to infiltrate (i.e. permeable paving).

8.1.4 It is proposed that run-off from the proposed roof of the new dwelling and car ports will drain to below ground pipework. A connection will be provided to Southern Water's public surface water sewer to the east of the site, beneath Nelson Road.

8.1.5 The proposed driveways will be of permeable construction, which will provide an additional storage volume.

8.1.6 The proposed driveways have a combined area of 83m^2. A 300mm sub-base is proposed, providing a volume of 7.47m^3 (30% voids).

8.1.7 Flows discharging off-site will be restricted to a maximum of 2.00 l/s.

8.1.8 Investigation will be undertaken to establish whether there is a continuation of Southern Water's public surface water sewer(s) along Nelson Road, which may not currently be mapped (refer to Southern Water's public sewer records, contained within Appendix E). This may allow for a shorter length of off-site works, and provide a closer point of connection to reduce disruption within the Public Highway.

8.1.9 It is proposed that all captured run-off from the proposed hardstanding areas is captured up to the 100-year event including 45% climate change without exceedance.

8.2 Treatment

8.2.1 In accordance with the CIRIA SuDS Manual C753 regarding methods for managing pollution risks, the risk posed by surface water run-off to the receiving environment depends on the pollution hazard at the site (the source), SuDS treatment techniques (the pathway), and the sensitivity of the environment (the receptor).

8.2.2 The simple index approach considers whether SuDS techniques are appropriate for the site. The states that for SuDS components to deliver adequate treatment, the total pollution mitigation index for each contaminant type should equal or exceed the pollution hazard index.

8.2.3 The SuDS Manual outlines three categories of pollution hazard identification, which vary depending on proposed land use, which are as follows:

- Total Suspended Solids (TSS).
- Metals (M).
- Hydrocarbons (H).

8.2.4 In accordance with C753 Table 26.2, the proposed land uses at the site are categorised as follows:

- Residential Roofs – Very low/TSS=0.2/M=0.2/H=0.05

- Individual property driveways – Low/TSS=0.5/M=0.5/H=0.4

8.2.5 In accordance with C753 Table 26.3, the values of SuDS Mitigation indices are provided for permeable paving:

- Permeable Pavement – TSS=0.7/M=0.6/H=0.7

8.2.6 As the pollution hazard index does not exceed any pollution mitigation index for any contaminant type, the proposed SuDS methods will provide sufficient treatment for the proposed development.

8.3 Foul Water Drainage

8.3.1 It is proposed that the new dwelling with drain to Southern Water's public foul water sewer beneath Nelson Road, via a new connection.

8.3.2 The existing dwelling on site will continue to drain to Southern Water's public foul water sewer network via the existing connection.

8.3.3 Post development, there will be an estimated increase in peak foul water flows to 0.046 l/s (based on Water UK Sewer sector Guidance, Design and Construction Guidance).

8.3.4 The infrastructure and connection charges (OFWAT Charging Rules) place the onus on the sewerage undertaker to reinforce their network should there no longer be sufficient capacity to serve the new development. Funding for this is provided by revised charging arrangements for infrastructure and connection charges for each dwelling constructed comprising a Network Reinforcement Charge and Site-Specific Charges. The revised charging arrangement (funded by the developer) covers alterations to the Existing Sewer Network and the sewerage undertaker remains responsible for the cost of reinforcing their Strategic Assets. The developer is responsible for connecting the development to the public sewer network.

8.4 Climate Change

8.4.1 Gov.uk provides guidance for local planning authorities preparing strategic flood risk assessments and developers and their agents preparing flood risk assessments for planning applications, and development consent orders for nationally significant infrastructure projects.

8.4.2 Climate change allowances are predictions of anticipated change for peak river flow, peak rainfall intensity, sea level rise and offshore wind speed and extreme wave height.

8.4.3 Allowance for climate change shall be provided in the undertaking of site-specific flood risk assessments where new development is proposed to minimise vulnerability and provide resilience to flooding and coastal change.

8.4.4 The 'Peak Rainfall Allowances Map' shows anticipated changes in peak rainfall intensity.

8.4.5 Based on the latest allowances, for the 3.3% annual exceedance rainfall event, an increase of 40% should be applied to peak rainfall in relation to the proposed development.

8.4.6 For the 1% annual exceedance rainfall event, an increase of 45% should be applied to peak rainfall in relation to the proposed development.

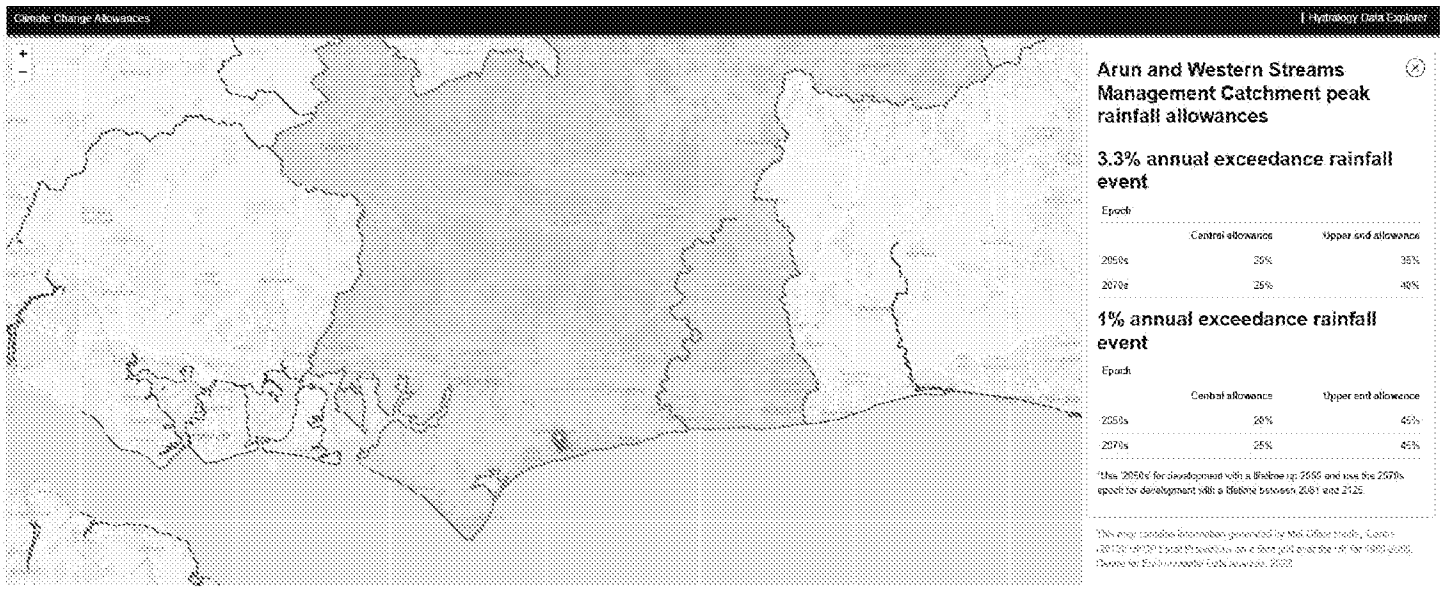


Figure 14. Climate Change Allowances – Peak Rainfall Allowances (Gov.uk)

8.5 Urban Creep

8.5.1 An allowance of 10% has been made within the surface water drainage calculations for the potential impacts of urban creep across the lifetime of the development, in accordance with West Sussex County Council's policies for the management of surface water.

9 RESIDUAL RISK AND MITIGATION

9.1 Residual Risk

9.1.1 The following residual risks have been identified in relation to the proposed development:

i. Extreme rainfall events that exceed the design criteria used for the drainage system causing surface water flooding

ii. Blockage/failure of the proposed drainage system causing flooding to the site

iii. Groundwater flooding to the site caused by groundwater levels exceeding the ground surface level

iv. Surface water flooding of proposed buildings

9.2 Mitigation

9.2.1 Consideration has been taken to the residual risks stated in Section 9.1, and the following mitigation measures are proposed:

i. The surface water drainage design has considered the current design standards and is able to accommodate a 1 in 100-year storm event, inclusive of an allowance of 45% for the potential impacts of climate change. In addition to this, a further allowance has been made for urban creep, providing additional capacity within the system. Should a more extreme storm event occur, the system will be exceeded. In exceedance events, run-off will follow the topography of the site. The site is considered to be flat, with little in terms of demonstratable falls across the site. As such, exceedance would either be retained on site, or fall to the public highway drainage system.

ii. Maintenance plays a vital role in managing and reducing flood risk. The proposed drainage system will require little maintenance, however, nonetheless maintenance activities will still be required to ensure that the system is able to operate as intended. Should blockage or failure of the system occur, it is possible that flooding may occur. Maintenance that is required in order for the system to operate as intended through its design is detailed within Section 11.

iii. Groundwater has been identified on site at depths as shallow as 540mm below ground level. The Long-term Flood Risk Service on Gov.uk suggests that groundwater flooding is 'unlikely' in this location, although the Arun District Council Strategic Flood Risk Assessment considers groundwater flood risk to be 'High'. The proposed finished floor level is to be elevated above the existing ground level, which will provide mitigation should groundwater emergence occur on site. Groundwater that may emerge, would behave in the same way as surface water flooding, and would follow the topography of the site and surrounding areas.

iv. The site has been assessed as being at 'Very Low' risk of surface water flooding. The introduction of new, impermeable surfaces on site has the potential to increase the risk of surface water flooding, if not properly managed. The proposed drainage system will cater for surface water run-off generated by the proposed development. Should surface water flooding occur, as a result of exceedance/blockage or other reason, this would follow the topography of the site and surrounding areas. Where present, third party infrastructure may intercept this, such as highway drainage assets. The finished floor level of the proposed dwelling will also be raised above existing ground level providing resilience.

10 FLOOD RISK MANAGEMENT

10.1 Safe Access and Egress

10.1.1 The development proposes the minor relocation of the existing vehicular access, in addition to the provision of a second vehicular access, immediately to the east of the existing access.

10.1.2 The site, as well as both points of access, is located in Flood Zone 1, and has been assessed as being at 'Very Low' or 'Low' risk of flooding from all of the potential sources of flood risk considered in the undertaking of this flood risk assessment.

10.1.3 Areas east of the site are identified as being at increased risk of surface water flooding, however, access to the site is available from the west via Crescenta Walk, which is not identified as being at risk of surface water flooding.

10.1.4 In view of the above considerations, it is demonstrated that safe access and egress is available from a flood risk perspective.

10.2 Flood Warning

10.2.1 The site is located fully within Flood Zone 1 as has been assessed as being at 'Very Low' or 'Low' risk of flooding from all of the sources of potential flood risk considered in the undertaking of this flood risk assessment. As such, there is no requirement for a Flood Warning System, Flood Plan or Flood Evacuation Plan to be provided in relation to the site and/or the proposed development, although the owner/occupier may still wish to consider preparing a Flood Plan.

11 MAINTENANCE

11.1 Proposed Maintenance Regime

11.1.1 Maintenance is required to ensure the long-term operational performance of the proposed surface water drainage system.

11.1.2 The drainage system has been designed to minimise maintenance requirements; however a number of key tasks will need to be undertaken so that the system remains in optimal condition. These operations are summarised in the table below, along with the required frequency of works.

Drainage System feature	Proposed maintenance / remedial works	Required frequency of works
Permeable Paving	Surface sweeping to reduce silt and debris accumulation.	Every 8 to 12 weeks
	Removal / management of weed growth	At least once a year
	Silt removal from permeable surfaces, possibly involving raking out of joints, redressing, removal and remedial works.	As required / to be specified by manufacturer
Catch pits, gully sumps and drains	Inspection and additional cleansing as required.	Annual
	Desilting	Year 1, Year 3, then every 5 years
Pipework	Jetting to clear blockages	As required

11.1.3 The surface water drainage system designed in relation to the proposed development at the site will remain private. The owner/occupier will be responsible for maintaining the system.

Permeable Paving / Diffuser Units

11.1.4 The proposed driveways will be of a permeable construction. Permeable paving is designed to allow surface water run-off through the surface course and into the sub-base below. The water is then collected and discharged into the positive drainage system.

11.1.5 The permeable driveways will require the following actions to be undertaken to ensure they are able to drain, as intended:

- Periodic surface sweeping to reduce silt and debris accumulation. The permeable surfaces should be swept at least every 8 to 12 weeks with additional sweeps in the autumn to clear fallen leaves

- Removal / management of weed growth, as required. Typically, once or twice a year for regularly used areas

- Periodic silt removal from permeable surfaces as described by the manufacturer. If any areas are showing signs of ponding, they shall be dealt with by raking out the joints and redressing. The entire surface shall be monitored and when there are signs of excessive siltation resulting in

poor drainage over the whole area, the blocks shall be taken up and a replacement of bedding layer and geotextile shall be undertaken

- Redressing of joints on the block paving as required

- Catchpits upstream of diffuser units, should be emptied and inspected on the same regime as all catchpits specified previously set out in this document

Flow Controls

11.1.6 A flow control (such as a HydroBrake or Crown Vortex) is self-activating, relying on upstream hydraulic head to generate an air-filled vortex within the centre of the casing. Once the vortex is initiated water drains down through a small opening in the back of the device at the designed restricted flow rate.

11.1.7 The flow control device has two measures in case of emergency (i.e. blockage). The first is a door situated in the front of the unit itself, this can be operated from the surface by a release cable situated just under the manhole cover which closes under its own weight and does not require any mechanism to operate. The second is a high-level overflow pipe situated within the flow control manhole. Both measures allow the system to drain down freely, until the blockage can be cleared.

11.1.8 The flow control chamber will require additional maintenance measures to ensure it operates as designed. The additional measures are as follows:

- The sump within the flow control chamber should be monitored for build-up of silts and should be emptied, as a minimum, on the same regime as specified for catchpits previously within this document

- The drain down door located on the centre of the unit will require inspection and opening annually, to ensure it is operating as intended.

12 OFFSITE IMPACTS

12.1.1 If viable, surface water will be managed fully within the confines of the site, subject to the findings of on-site investigation and testing.

12.1.2 If, for whatever reason is established, infiltration is not viable, surface water will discharge to Southern Water's public surface water sewer, to the east of the site, beneath Nelson Road.

12.1.3 Flows to the public surface water sewer network will be restricted to a rate of 2.00 l/s.

12.1.4 Foul flows generated by the proposed new dwelling will discharge to Southern Water's public foul water sewer beneath Nelson Road. A new connection to the public sewer will be provided.

12.1.5 Post development, there will be an estimated increase in peak foul water flows to 0.046 l/s (based on Water UK Sewer sector Guidance, Design and Construction Guidance).

12.1.6 Southern Water is responsible for ensuring that capacity exists within their network to support new development, funded in part by contributions made by Developers.

ARUN DISTRICT COUNCIL BR/47/25/PL

13 SUMMARY

13.1.1 The site measures 849m^2 (0.08Ha) and is occupied by the existing property; 10 Nelson Road. The proposed development will involve the construction of 1 No. dwelling, 2 No. car ports and a rear extension to the existing property.

13.1.2 The site topographic survey identifies levels in the range of 6.12m AOD and 6.66m AOD, with the site considered to be flat.

13.1.3 The existing building(s) on site are served by a combination of open-ended rainwater pipes which discharge freely to the adjacent ground, in addition to rainwater pipes which discharge below ground. It is assumed that the rainwater pipes that discharge below ground may discharge to the on-site foul drainage network, which discharges to Southern Water's public foul water sewer beneath Nelson Road. There is a gully positioned in the existing driveway, although it has not been confirmed where this drains to. The remaining areas of the site are understood to drain naturally.

13.1.4 The site is located in Flood Zone 1, and has been assessed as being at 'Very Low' to 'Low' risk of flooding from all of the potential sources of flood risk.

13.1.5 The post-development impermeable/hardstanding area has been determined to be 429m^2 (0.04Ha). Of the above figure of 429m^2, 173m^3 is existing impermeable area associated with the existing dwelling which is to be retained. This area will continue to drain as existing. The catchment associated with the proposed development which is to be positively drained is 229m^2.

13.1.6 Spatial constraints dictates that soakaways cannot be accommodated on site, in addition to shallow groundwater depths (540mm below ground level) restricting the use of infiltration methods and techniques.

13.1.7 It is proposed that run-off from the proposed roof of the new dwelling and car ports will drain to below ground pipework. A connection will be provided to Southern Water's public surface water sewer to the east of the site, beneath Nelson Road.

13.1.8 Post-development surface water run-off will be managed through sustainable drainage measures, with the installation of permeable paving with a combined area of 83m^2. A 300mm sub-base is proposed, providing a volume of 7.47m^3 (30% voids).

13.1.9 It is proposed that all captured run-off from the proposed hardstanding areas is captured up to the 100-year event including 45% climate change without exceedance. An allowance of 10% has also been provided in the surface water drainage calculations prepared for the potential impact of urban creep across the lifetime of the development. Surface water flows discharging off-site will be restricted to a maximum of 2.00 l/s.

13.1.10 Foul water generated by the existing property drains to Southern Water's public foul water sewer, beneath Nelson Road.

13.1.11 Foul water from the proposed new dwelling will drain to Southern Water's public foul water sewer beneath Nelson Road. A new connection to the public sewer will be established.

13.1.12 In conclusion, this development will not increase flood risk on or off the site and is suitable in respect of both flood risk and surface water drainage.