BRIGHT PLAN CIVILS

EARNLEY MEADOWS, ALMODINGTON LANE, EARNLEY, CHICHESTER PO20 7JR

RESIDENTIAL DEVELOPMENT

Flood Risk Assessment & Drainage Strategy

Prepared on Behalf of

Oslac Ltd

D1879/FRA1.1

01 December 2020

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1 INTRODUCTION

1.1 Background

1.1.1 Bright Plan Civils is instructed by Oslac Ltd to prepare a site-specific Flood Risk Assessment & Drainage Strategy to support planning application for a proposed redevelopment of existing tourism farm and garden nursery into a new residential development consisting of 5 dwellings, with associated access, hardstanding and landscaping at Earnley Meadows, Almodington Lane, Earnley, Chichester PO20 7JR.

1.1.2 This FRA has been undertaken in accordance with Planning Practice Guidance: Flood Risk and Coasta Change and National Planning Policy Framework Section 14.

1.1.3 In preparing this report, Bright Plan Civils has referred to the following documents and information:

Environment Agency Flood Maps for Planning

Long Term Flood Risk Information; Flood Risk Maps

Local Authorities Strategic Flood Risk Assessment

Southern Water and Local Authority Drainage Records

British Geological Survey & Records

1.1.4 This document has been prepared to assess if the proposed development is suitable for the site anc confirms if mitigation is required to ensure that flood risk is not increased, and that the development remains safe during its design life.

1.1.5 This report has been prepared for the benefit of the named Client only.

1.2 Site Location and Description

1.2.1 The site location is located between Earnley and Almodington, in a sparsely populated residential area off of Almodington Lane, with a mixed residential and business site to the east, Almodington Lane and agricultural fields beyond to the south, residential properties to the west and open land to the nort

1.2.2 The site is located within a low lying area at approximately 4-5 metres above ordnance datum, with the tidally influenced Medmerry Nature Reserve to the southeast.

1.2.3 A Main River in the form of a relatively small ditch, which runs along the eastern boundary of the site flowing southwards before running under Almodington Lane towards the Grange Rife.

1.2.4 The existing site has a total area of approximately 1.55 Ha, consisting of housing, parking and a number of large nursery greenhouses.

1.3 Ground Conditions

1.3.1 In the absence of a site-specific geotechnical investigation, reference has been made to the British Geological Survey (BGS) website. The BGS geology viewer states that the bedrock geology is likely t consist of 'London Clay Formation - Clay, Silt and Sand', as seen in **Figure 1**.

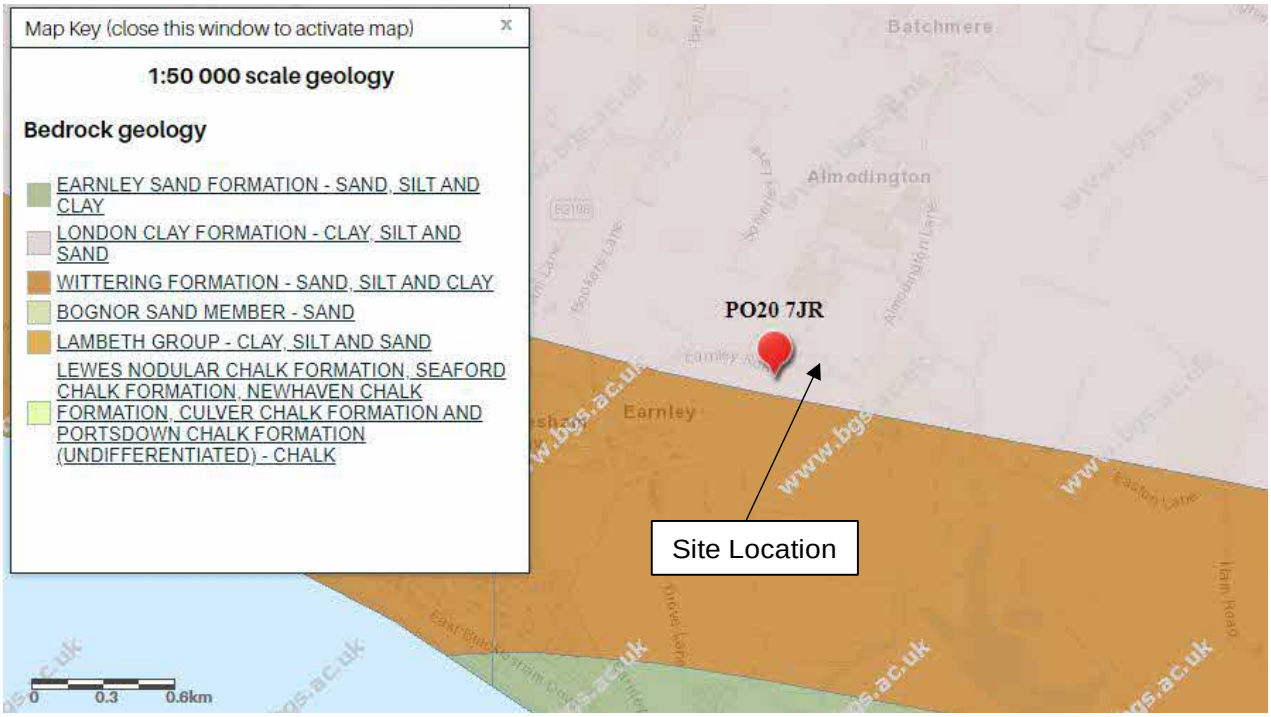

Figure 1. BGS website Bedrock geology

1.3.2 Superficial Deposits may consist of 'River Terrace Deposits (undifferentiated) - Sand, Silt and Clay', as seen in **Figure 2** to the west and north of the site.

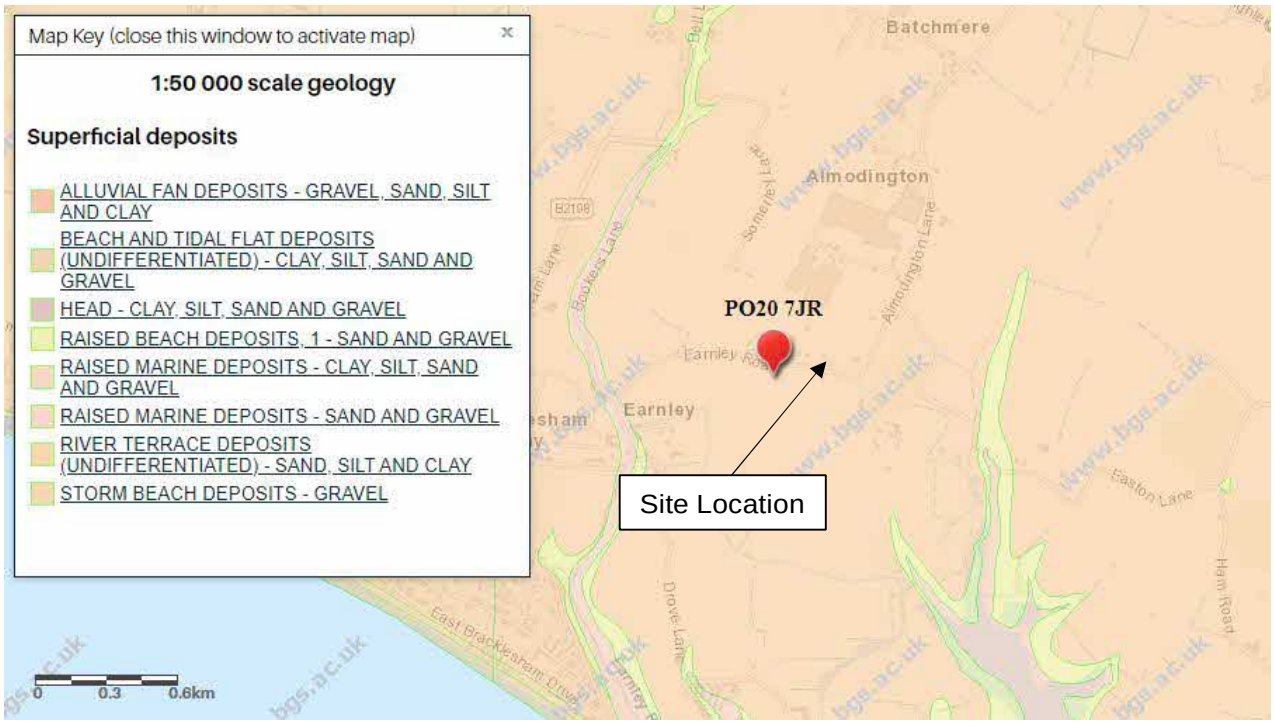

Figure 2. BGS website superficial deposits

1.3.3 Historic borehole records from the Single Onshore Boreholes Index (SOBI) on the BGS website have also been reviewed in the absence of a site-specific geotechnical investigation, as depicted in **Figure 3**.

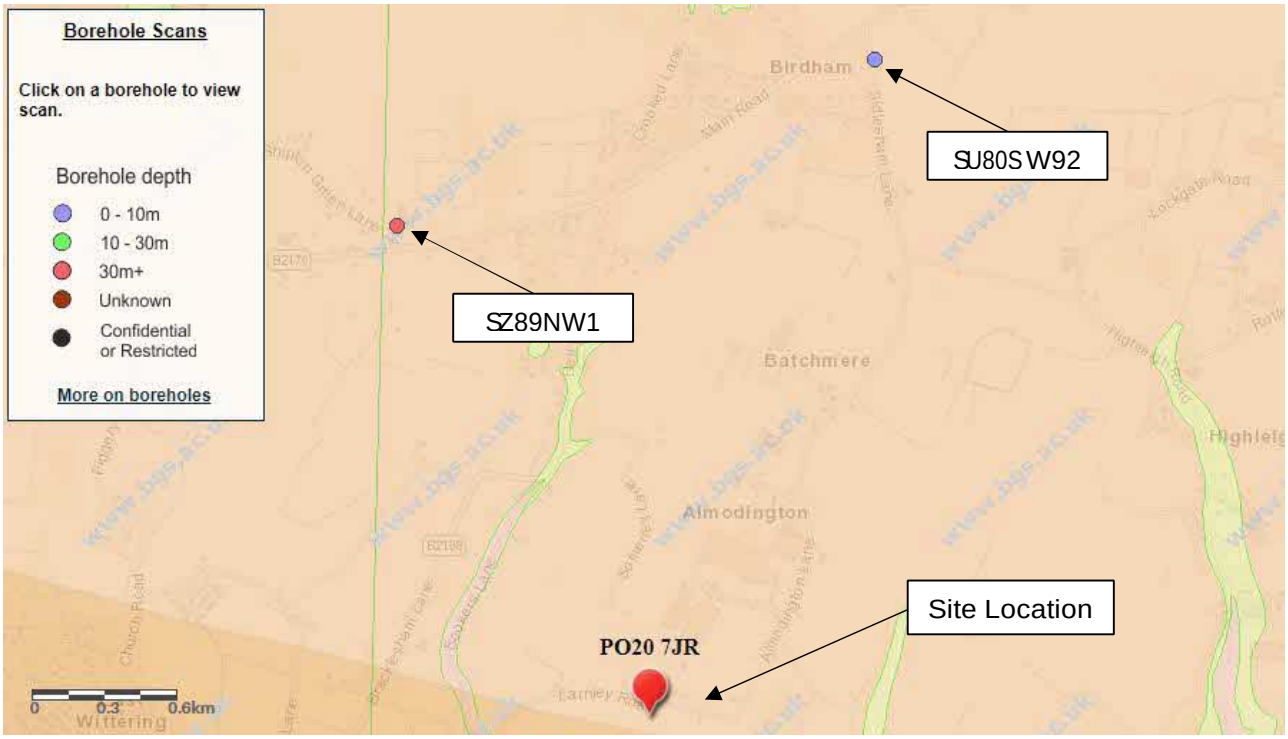

Figure 3. BGS website borehole locations

1.3.4 The nearest boreholes with comparable geological strata are over 2km away, as seen in **Figure 3**. The log SZ89NW1 found that the geological composition encountered consisted of 'Brickearth' to 4.6mbgl (metres below ground level), followed by 'London Clay' to the depth of the borehole (76.2mbgl). The log at SU80SW92 found 'Brickearth' to a depth of 1.6mbgl, followed by Raised Beach deposits 1.8mbgl, followed by London Clay.

1.3.5 A copy of the BGS records reviewed can be found within **Appendix B** of this report.

1.4 Groundwater

1.4.1 Groundwater monitoring at the site is ongoing over the winter period, however as of 30 November 2020 groundwater has been encountered at less than 1.0m below ground level.

1.4.2 The recorded BGS borehole at SZ89NW1 did not record groundwater. The recorded BGS borehole at SU80SW92 recorded water struck at 4.7mOAD, which was 1.8mbgl at the site location.

1.4.3 The Chichester SFRA indicates that groundwater risk is more pronounced within the areas of the Distr with Chalk deposits, however low-lying coastal areas such as the site location would be vulnerable high groundwater or even groundwater flooding due to prolonged extreme rainfall, failed or ceas pumping of flows, inundation of ditches due to high groundwater levels, leakage of fluvial flood v through river gravels and permeable geology, and rise of adjacent sea levels.

1.4.4 The SFRA notes that significant groundwater flooding has occurred in the District in the past downstrea of major aquifers in the surrounding floodplains. Soils on the Manhood Peninsula (the peninsula encapsulating Witterings, Earnley and Selsey) are noted as seasonally waterlogged and clay-rich, and that prolonged wet periods lead to high groundwater levels and saturated groun contributing to flooding in this area. Extracts can be found within **Appendix C**.

1.4.5 Consultation with West Sussex County Council indicated that the site area is at 'high risk' groundwater flooding, as seen in **Appendix C.** This would indicate that groundwater leve be very

close to ground level and may contribute to surface water inundation.

1.4.6 Mapping managed by MAGIC (magic.defra.gov.uk) provides geographic information concerning th natural environment from across government. This mapping tool has been referred to in order to confi whether the site is located within either any groundwater source protection zones or groundwate vulnerability zones. The site is situated within a 'Secondary A' Aquifer, as seen in **Figure 4**, for Superficial Drift Deposits. It is within an 'Unproductive' Aquifer for Bedrock however.

1.4.7 This refers to superficial deposits geology that exhibits variable permeability and may provide groundwater storage or supply at a local scale at a shallow depth above the bedrock.

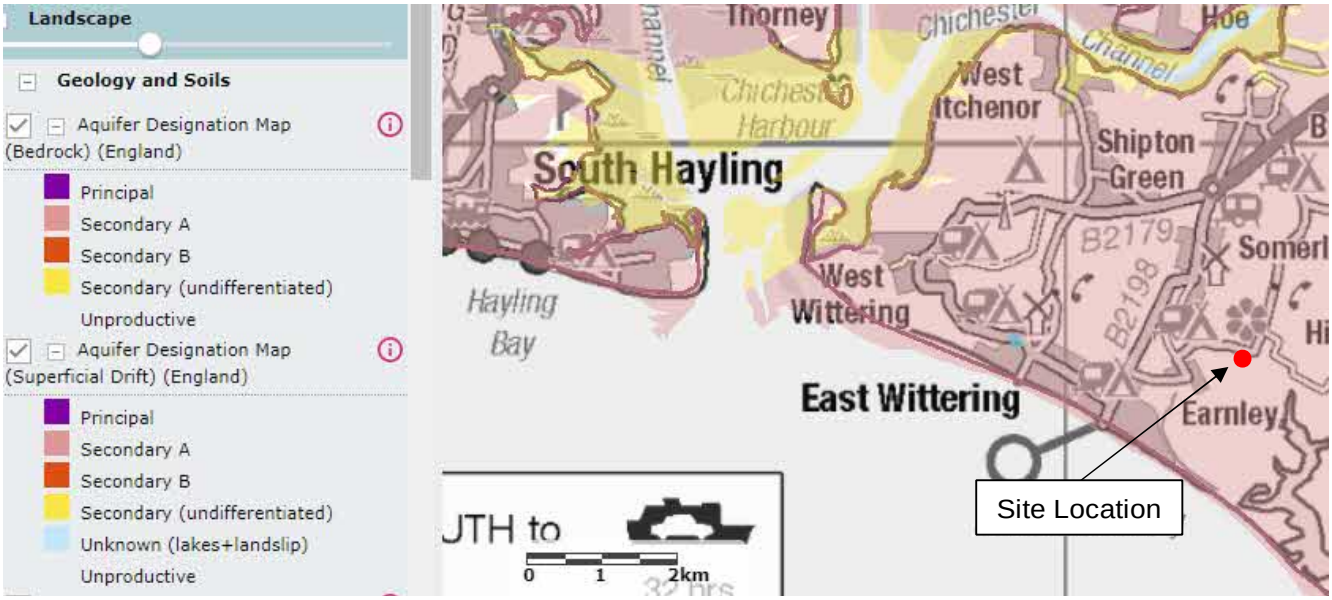

Figure 4. DEFRA Aquifer Designation Map

1.4.8 The Groundwater Vulnerability Map (**Figure 5**) confirms that the site also falls within a 'Medium-Low' groundwater vulnerability zone, which would indicate there is a moderate leaching potential associated with potential pollutants, high groundwater, and infiltration of soils.

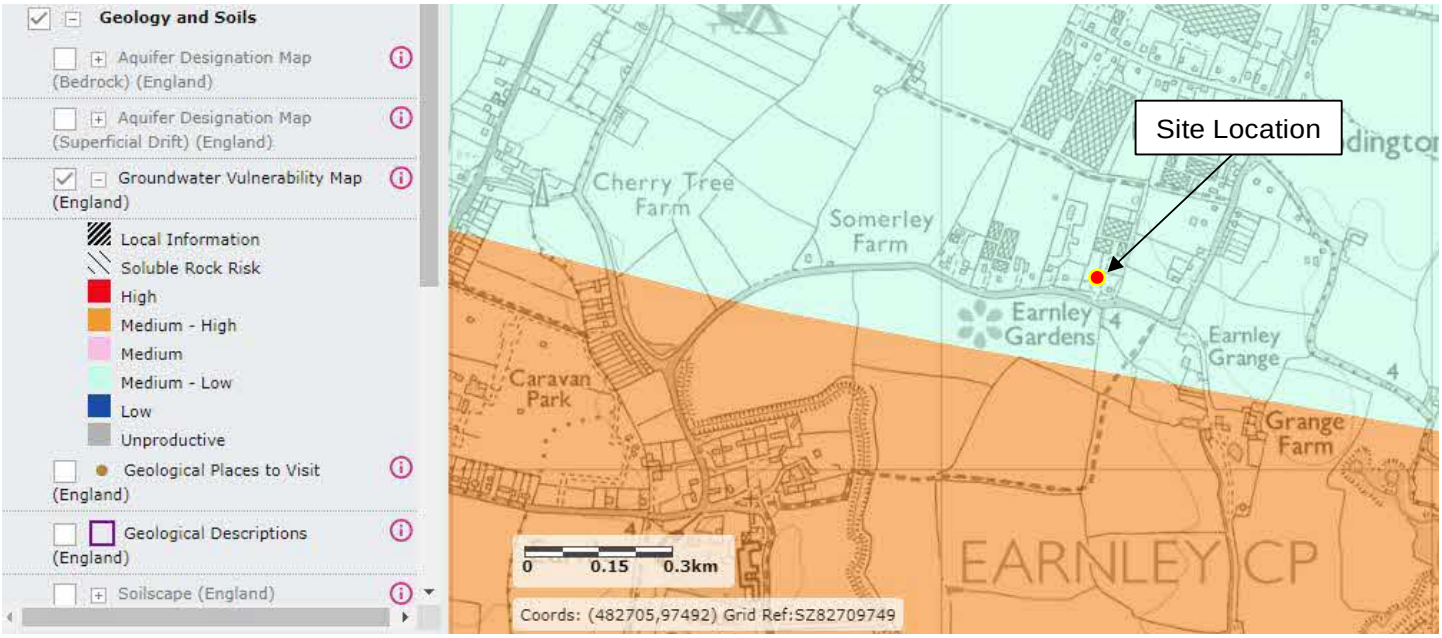

Figure 5. DEFRA Groundwater Vulnerability Map

1.4.9 The site is not indicated as within a Drinking Water Safeguard Zone, or within a Source Protection Zone.

1.5 Existing Drainage

1.5.1 The local sewerage Authority is Southern Water, who provides sewerage services within the area. Public sewer records are included within this report in **Appendix D**.

1.5.2 Surface Water:

The sewer records **(Appendix D)** do not show any public surface water sewers within the vicinity of the site.

The nearest watercourse is adjacent to the site, on the eastern boundary, and is designated Main River. This flows southeast into the Grange Rife, which is within a tidally influenced area surrounded by sea defences. It is unclear if this is pumped into the Medmerry Harbour however there have been no indications in the Product 4 response that the site is tidally affected or be tide-locked.

Greenfield runoff rate (Qbar) has been calculated, using the online tool provide by Wallingford, to be 4.47l/s.

However, given that the site has 5005m^2 of hardstanding area, the average annual peak runoff (based upon a rainfall intensity of 50mm/hr) would be approximately 69.5l/s.

Investigation of existing site drainage (**Appendix A**) confirms that the greenhouses and other buildings have gutters which appear to discharge to the watercourse along the eastern boundary. Site investigation indicated drainage from the two smaller buildings to the south of the site may also discharge into the foul water sewer. Hardstanding areas appear to drain by overland flow towards the watercourse.

1.5.3 Foul Water:

Sewer records (**Appendix D**) show a public foul sewer running through the south of the site, with a manhole located close to the entrance to the site.

It is understood that the existing buildings on the site are connected to the public sewer.

1.5.4 Highway Drainage:

Runoff from Almodington Road would appear to flow over-the-edge into ditches either side of the road.

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2 PRO BABILITY

2.1 Sources of Information

2.1.1 The NPPF requires that all sources of flooding are considered being Tidal, Fluvial, Pluvial, Groundwat Sewers and Man-made reservoirs/canals.

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

Environment Agency Flood Maps for Planning

Long Term Flood Risk Assessment Surface Water Flood Risk Maps

Long Term Flood Risk Assessment Reservoir Flood Risk Maps

Local Authorities Strategic Flood Risk Assessment

Consultation with Local Authority/Lead Local Flood Authority

2.2 Flood Maps and Modelling

2.2.1 The Environment Agency's Product 4 Response details the flood risk to the development, as see **Appendix E** The Flood Map for Planning (rivers and sea) show that the site is located within Flood Zones 1,2 and 3.

2.2.2 The site is in Flood Zone 1 to the west and Flood Zone 2 to the east adjacent to the watercourse, with an area within the southeast corner of the site within Flood Zone 3.

2.2.3 Flood modelling indicates the southeast corner of the site at risk of flooding in an undefended 1% A (1-in-100 year) fluvial event, as well as the east and northeast of the site at risk of flooding i undefended 0.1% fluvial event.

2.2.4 The modelling used to provide the flood information and extents is taken from the JFLOW Almodington model which was completed by JBA Consulting in 2012.

2.2.5 Undefended flood levels for a 1 in 100 year event are indicated as 5.24mAOD. This could result in approximately 300mm of flooding in the east of the site, as well as flooding the access road. It is worth noting however, the other nodes are located at a lower elevation and not within flood extent indicating variance in flood levels across the site.

2.2.6 Flood levels for a 1 in 1000 year undefended scenario are between 4.82 and 5.37m AOD.

2.2.7 The Table below indicates the level of flood risk from rivers and the sea demonstrated by the diff Flood Zones within the Flood Map for Planning.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of ri or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)

Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,0 annual probability of river flooding; or land having between a 1 in 20 and 1 in 1,000 annual probability of sea flooding. (Land sho in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability c flooding; or Land having a 1 in 200 or gre annual probability of sea flooding. (Land shown in dark blue c Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be storec in times of flood. Local planning authorities should ident their Strategic Flood Risk Assessments areas of functi floodplain and its boundaries accordingly, in agreement the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

2.2.8 The Environment Agency's response with regard to flood risk from surface water indicated the site at very low risk of flooding, other than the south east corner. Almodington Road immediately adjace the site is also not at risk of surface water flooding, however it is to the east where the watercourse passes under the carriageway.

2.2.9 **Figure 7** shows that the site at 'very low' to 'medium' risk of surface water flooding. The majority of the site is at very low risk, other than the watercourse corridor. There is low risk of surface water flooding with depths limited at less than 300mm along Almodington Road, where site access is proposed.

Figure 7. Long Term Flood Risk Map; Flood risk from surface water

2.2.10 **Figure 8** shows that the site is not at risk of flooding from reservoirs.

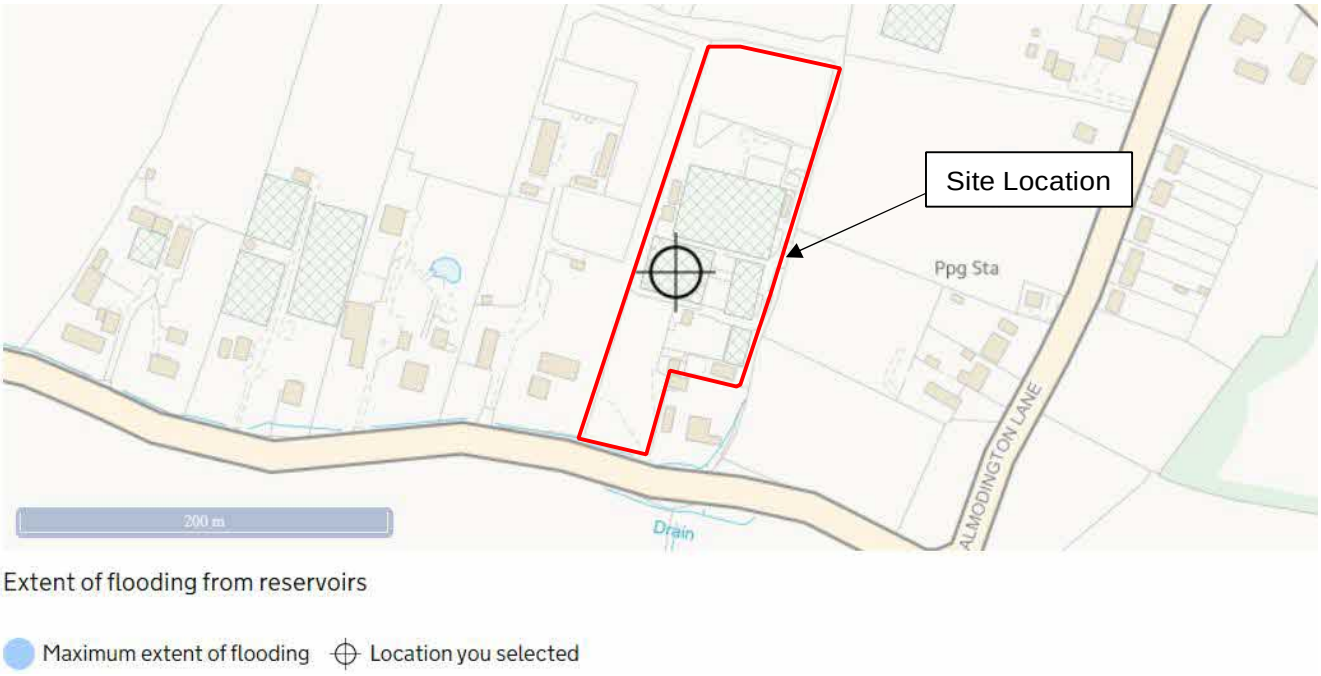

Figure 8. Long Term Flood Risk Map; Flood risk from reservoirs

2.3 Historic Flooding

2.3.1 The Environment Agency responded that they have no records of flooding in this area.

2.4 Summary of Flood Risk

2.4.1 The potential sources of flooding are:

Source of Flooding	Level of Risk
Rivers and Coastal	**High** The majority of the site is within Flood Zone 1 and 2 with an area of Flood Zone 3 within the southeast corner adjacent to the watercourse. The Product 4 response indicates variable flood levels across the site. It is recommended by the Local Planning Authority that buildings are positioned outside of Flood Zone extents and finished floor levels are above the worst case scenario flood level.
Surface Water	**Medium** The long-term flood risk for surface water is classifie as 'Very Low' (less than 0.1% annual probability) for the majority of the site, however there is an area the southeast corner and along the watercourse corridor at low to medium risk. There is also low risk of surface water flooding at the access, however depths are indicated to be below 300mm at this location.
Groundwater	**Medium** BGS records found the site to be situated above a Secondary Aquifer, and ongoing groundwater monitoring found presence of shallow groundwater. Local Authority Consultation indicated no history groundwater flooding, but a high risk level of groundwater emergence indicating shallow depths that may influence drainage of the site.
Sewers	**Medium** The SFRA indicated that the Manhood Peninsula has suffered numerous foul and surface water flooding incidents in the past, however there are n specific mentions to the site or its immediate surroundings.
Artificial Sources	**None** The site is not shown to be at risk of fl artificial sources.

3 PROPOSED DEVELOPMENT

3.1 Development Proposals

3.1.1 The proposed development is for 5 residential properties to replace the existing greenhouses and former tourism facility.

3.1.2 Residential development falls within the 'More Vulnerable' classification (Flood Risk and Coastal Change Table 2) and is appropriate in Flood Zone 1 and 2 (Flood Risk and Coastal Change Table 3).

3.1.3 Residential development is not considered appropriate within Flood Zone 3a, unless the Sequential and Exception Test were satisfied, however the proposed site layout has been set out Sequentially, to avoid positioning buildings within Flood Zone 2 or 3, and appropriate mitigation and assessment of flood risks will be made to ensure the site is safe for use.

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

3.1.4 The proposed development will decrease the hardstanding area of the site. The intensive use of Sustainable Drainage System (SuDS) methods and techniques within the boundary of the site (whilst adhering to the SuDS hierarchy as stated within Building Regulations (Part H) and The CIRIA SuDS Manual C753) will be utilised in order to provide a betterment in the rate of run-off generated by the site. This will provide benefits in terms of flood risk and drainage.

3.1.5 The existing development has 5005m² of hardstanding area that discharges at an uncontrolled rate to the existing watercourse and/or the existing foul water sewer. The proposed site results in a reduced area of hardstanding of 3976m², consisting of 1662m² of roofs and impermeable hardstanding, and 2314m² of free-draining permeable surfaces.

3.1.6 Surface Water and Foul Water drainage proposals are detailed in **Section 4** of this report.

4 PROPOSED DRAINAGE STRATEGY

4.1 Surface Water

4.1.1 The SUDS manual and Building Regulations set out a hierarchy of drainage methods to ensure that developments maximise the use of sustainable drainage techniques. The hierarchy favours infiltr 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	Yes	The architect has utilised areas of flat roof on this development with the intention t include areas of green roof.
Basins and Ponds (such as Constructed Wetlands, Balanc ing Ponds, Detention Basins, Retention Ponds)	Yes	Ponds will be depth limited by groundwater and not viable for infiltra but will provide attenuation prior to offsi disc ha rge.
Filter strips and swales	Yes	This would provide a valuable ecolo and amenity feature and provide op storage, however could be limited by h groundwater levels.
Infiltration Devices - Soakaways - Infiltration trenches and basins	No	Ongoing groundwater monitoring ha s found levels of less than 1.0mbgl, meanin traditional soakaway features are n viab le.
Permeable surfaces and filter d rains - Gravelled areas - Porous block paving	Yes	This could provide a shallow infiltratio measure where groundwater levels li depth of SuDS to provide free-draining permeable surfacing for proposed r a ds and hardstanding areas.

Tanked systems - Oversized pipes - Cellular tanks	Yes*	Viable, however this option would appea to be too restricted by groundwater le plus the requirement for sufficient cc meaning measures to counter flo would be required and may re attenuated flows becoming fluvially locked during high groundwater a river levels.

4.1.2 In line with the Drainage Hierarchy, infiltration measures are preferred for surface water drainage. This limited by the presence of shallow groundwater however, therefore this is likely to be limited to free-draining hardstanding areas.

4.1.3 Ongoing groundwater monitoring will confirm the viability of the proposals, and site-specific geotechnical testing will be undertaken prior to the commencement of the development, subject to groundwater monitoring findings and agreement with the Local Planning Authority.

4.1.4 It is proposed that the runoff from the roofs and impermeable areas is attenuated using 3 No. open ponds, and discharged to the existing watercourse on the eastern boundary at a controlled rate of 2.0l/s from each pond. The pond will be located within Zone 1 and all storage will be provide above the predicted flood level. This would result in an over 90% betterment to the existing runoff rates, based on the assumptions in **Section 1.5**.

4.1.5 It is proposed that all captured runoff from the proposed hardstanding areas is contained up to the 100-year storm event including 40% climate change without exceedance. The drainage system has been designed to allow for minimum 300mm freeboard within the proposed ponds, as seen in the hydraulic modelling calculations in **Appendix F**.

4.1.6 This will ensure that there is no increase in the rate of run-off leaving the site, therefore no increase in the risk of flooding from this source.

4.2 Treatment

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

4.2.2 The simple index approach considers whether SuDS techniques are appropriate for the site. The state 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.

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

Total Suspended Solids (TSS).

Metals (M).

Hydrocarbons (H).

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

Residential Roofs and non-trafficked areas – very low/ TSS=0.2/ M=0.2/ H=0.05

Car parking and low traffic roads – low/ TSS=0.5/ M=0.4/ H=0.4

4.2.5 In accordance with C753 Table 26.3, the values of SuDS Mitigation indices are provided for proposed SuDS features:

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

Pond – TSS=0.7/ M=0.7/ H=0.5

4.2.6 As the pollution hazard index would not exceed any pollution mitigation index for any contaminant type, this indicates that the proposed SuDS methods would provide sufficient treatment for the proposed development.

4.3 Foul Water Drainage

4.3.1 There is a public foul sewer running through the site to the south, and confirmation of line & level is required to confirm that a gravity mains foul sewer connection would be viable.

4.3.2 Post development there may be an increase in foul water flows, which for a 5 residential property development would be approximately 0.25 l/s (based on Design and Construction Guidance B3.1). This is offset by the existing discharge from the previous site use, as well as any surface water runoff smaller buildings in the south of the site, and the significant reduction in the rate of discharge watercourse.

4.3.3 Recent changes to infrastructure and connection charges (OFWAT Charging Rules) place the onus o the sewerage undertaker to reinforce their network should there no longer be sufficient capa 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 th developer) covers alterations to the Existing Sewer Network and the sewerage undertaker remai responsible for the cost of reinforcing their Strategic Assets. The developer is responsible for connectin the development to the public sewer network.

4.4 Climate Change

4.4.1 NPPF sets out percentage increases to be applied to the peak rainfall intensity values used in the design of a surface water drainage system to allow for the effects of climate change.

4.4.2 In accordance with NPPF 'climate change allowances' update 16 March 2020, an increase of 20% should be applied for this development and a review should be undertaken to determine the in of an increase of 40%. A 40% level of climate change has been accounted for within the overall drainage strategy for the site.

4.4.3 The modelled flood levels provided by the Environment Agency have not taken into considerati climate change, however use of the 1 in 1000 event and the worst case flood level across the site, plus an allowance for freeboard for finished floor levels, is considered appropriate.

5 RESIDUAL RISK AND MITIGATION

5.1 Residual Risk

5.1.1 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. Flooding of properties and/or drainage infrastructure due to fluvial flood levels exceeding the extents of Flood Zone 2 in an extreme flood event.

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

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

v. Flooding due to blockage of the adjacent watercourse.

5.2 Mitigation

5.2.1 Consideration has been taken to the residual risks stated in Section 5.1, and the following mitigation measures are proposed:

The drainage strategy should be developed to capture runoff up to a 1 in 100-year critical rainfall event, with 40% allowance for climate change. However, should a more extreme rainfall event occur, there is the potential for the drainage system to be exceeded. Level design is such that exceedance would flow away from the proposed buildings towards the watercourse. Finished floor levels will be raised above the external levels to mitigate against the risk of internal flooding.

Flood Levels and depths have been provided by the Environment Agency for 4 No. Nodes across the site. JFLOW Flood Modelling flood levels vary greatly between nodes; therefore a reliable design flood level is difficult to assess from modelled levels, and discussion with LPA Drainage Officer (**Appendix C**) has been undertaken to confirm acceptable arrangement and FFLs. It was recommended that design for the worst case level was undertaken for FFLs (finished floor levels), with buildings located within Flood Zone 1.

Flood levels are predicted to rise as a result of climate change, and therefore the worst case level of 5.24mAOD is recommended to be used for consideration of FFLs. It is proposed that all buildings have a finished floor level of 5.55mAOD, which provides a 300mm freeboard above the worst case flood level from the JFLOW modelling results. Should the flood levels exceed the areas of freedraining hardstanding and ponds in an extreme flood event, this would still represent a significant betterment due to the reduction in hardstanding areas and the rem l of buildings within the floodplain extents resulting in a betterment in floodplain compensatic

It is also proposed that cover levels of drainage infrastructure including the ponds is at a minimum of 5.40mAOD, above the modelled flood levels. Hydraulic modelling has also considered the impact of surcharged outfalls in the design of the surface water drainage system.

The proposed drainage system would need to attenuate (and if possible, infiltrate) runoff up to the design event. Blockage of drainage system components has the potential to cause flooding on the site. Surcharged flows will likely travel overland to the watercourse, however the proposed maintenance regime will mitigate the risk of the system becoming blocked, as detailed in Chapter 8.

As seen in Section 1.3 and 1.4, it is considered that groundwater levels may rise to the surface. It is not likely that these would raise significantly above the surface but may inundate the surface water drainage system and nearby surface water drainage. Groundwater monitoring would indicate the maximum groundwater levels and therefore inform the surface water drainage design, whilst the raising of internal floor levels will prevent internal flooding. It is likely that any basement construction would be limited due to high groundwater levels.

The blockage of the watercourse adjacent to the site could result in exceedance from the watercourse corridor across the site. It is therefore recommended that riparian watercourse responsibilities are included within the Maintenance Schedule, to be made clear to the ultimate responsible party.

6 SEQUENTIAL AND EXCEPTION TESTS

6.1 Sequential Test

6.1.1 The area of proposed development is in Flood Zones 1 to 3. In view of this, the applicat sequential test is required.

6.1.2 The aim of the sequential test is to drive development to areas that are at a lower risk of floodin requires demonstration that there are no other sites that are at a lower risk of flooding that could supp the development, taking into consideration all planning constraints. The Local Planning Authority will determine if the Sequential Test has been satisfied.

6.1.3 However the proposed residential properties have been located Sequentially, outside of the a Flood Zones 2 and 3, therefore the Sequential Test is not required.

6.2 Exception Test

6.2.1 The proposed development is located Sequentially within Flood Zone 1, in accordance with Paragra 102 & 103 of NPPG Flood Risk and Coastal Change, therefore the Exception Test is not required, however, due to the proximity of Flood Zone 2 and 3, the implications of the Exception Test have been considered with respect to the safe use, access, and egress of the development.

6.2.2 For the Exception Test to be passed:

> *it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared*

6.2.3 As detailed in **Section 2**, the proposed dwellings are located within Flood Zone 1 and finished floor levels are set above the level of flood risk. In addition, the development will have sustainability benefits not limited to; provision of new development, sustainable drainage, and affordable housing. On review local area would appear to be predominantly residential and so the proposals would match the existing character of the area.

> *a site-specific flood risk assessment must demonstrate that 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*

6.2.4 The proposed drainage strategy will ensure that the development has a beneficial impact on flood risk on and off the site, with sustainable drainage to reduce the offsite runoff from the development, raised finished floor levels above the flood levels, and access and egress to higher ground in a flood even

> *within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location*

6.2.5 The development is located Sequentially within Flood Zone 1, with finished floor levels above residual risk flood levels.

development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of sustainable drainag systems'

6.2.6 As discussed in Section 4, the use of sustainable drainage measures are proposed. Raising of finished flood levels above flood levels with 300mm freeboard addresses the residual risk of extreme flood level with access and egress discussed in Section 7.

7 FLOOD RISK MANAGEMENT

7.1 Flood Warning

7.1.1 Due to the proximity to an area of Flood Zone 2 and 3, and suggested that all properties sign up to the EA's Flood Warning Service to receive information whenever flooding is expected that may affect the access and egress from the site.

7.2 Safe Access and Egress

7.2.1 Fluvial flooding along Almodington Road would limit access and egress from the site.

7.2.2 Surface water flooding along the access and highway is not indicated to inhibit access, with flood risk at very low to low and depths limited to below 300mm, and to the easterly direction.

7.2.3 Flood extents and levels indicate that in an extreme fluvial event, access and egress from the site would be restricted. However, due to the proposed properties being located within higher ground to the west, and finished floor levels above flood levels, access to an area of higher ground within and adjacent to the properties is viable. Additionally, the access has been moved to the west, within higher ground.

7.2.4 Widespread raising of levels along the existing highway and access is not viable, and therefore the restrictions to access and egress from the site during a flood event would need to be addressed within a Flood Evacuation Plan (FEP) for all prospective inhabitants of the development. Pedestrian and vehicular access to the west from the new access would still be viable in most flood events.

8 MAINTENANCE

8.1 Surface Water Maintenance

8.1.1 Maintenance plays an important part in the long-term performance of a surface water drainage system and will be required to ensure that it remains fully operational.

8.1.2 The responsibility for the maintenance of the surface water drainage system will lie with a managem company appointed by the Developer who will be made aware of specific maintenance task ensure that the surface water drainage system remains operational throughout its lifetime (i recommended that this document is made available to them).

8.2 Inlet, Outfall & Existing Watercourse

8.2.1 A proposed inlet and outfall will be required for the discharge from the pond into the flow control chamber and out to the boundary watercourse. It is recommended that maintenance of the inlet and outfall features and the existing ditch is carried out to ensure conveyance off the site and prevent th risk of blockages and flooding, with measures as follows:

Inspection, vegetation clearance and additional clearing/cleansing of potential outfa blockages will be required on an annual basis.

Desilting is recommended at least as follows: On completion of drainage works, Year 1, Year 3, then every 5 years.

8.3 Permeable Paving

8.3.1 The areas of permeable paving are designed to allow infiltration of surface water run-off through the surface course and into the subbase below.

8.3.2 The areas of permeable paving will require additional maintenance measures to ensure they operate as designed. Failure in carrying out this maintenance, could increase the risk of flooding. The additic measures are as follow:

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

8.4 Flow Control Chambers (HydroBrake or equivalent)

8.4.1 The proposed flow control 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.

8.4.2 The flow control device has an emergency (i.e. blockage) release, in the form of 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 c This will allow the system to drain down freely, until the blockage can be cleared.

8.4.3 The flow control chamber will require additional maintenance measures to ensure it operates 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

8.5 Maintenance Regime

8.5.1 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 operat are summarised in Table 1 below, along with the required frequency of works.

Drainage System feature	Proposed maintenance / remedial works	Required frequency of works
Inlet, Outfall & Existing Watercourse	Inspection, vegetation clearance and additional clearing/cleansing of poten outfall blockages	At least once a year
	Desilting	Year 1, Year 3, then every 5 years
Permeable Paving	Surface sweeping to reduce silt and deb ac cumulation.	Every 8 to 12 weeks
	Removal / management of weed grov	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
Flow Control Unit	As specified by manufacturer	As specified by manufacturer
	Inspection and additional cleansing as required.	Annual

Table 1. Proposed Maintenance Regime

8.6 Remedial/Repair Actions

8.6.1 Significant storm events may cause considerable damage to SuDS and their associated components. As such, it may be necessary to inspect and carry out essential recovery works to return the feature to full working order. Resetting of uneven blocks by lifting block area, removing bedding materia relaying to match original design are all actions which may need to be undertaken.

8.7 Accidental Spillages

8.7.1 It is not envisaged that any materials are to be stored onsite once the developme completed which could cause major spills and potential pollution issues within the drainage system. If this situation alters in the future consultation with a specialist will be required in order to confirm if an upgrades to the existing system are necessary.

8.7.2 Minor spillages of fuels and oils from motor vehicles will be dealt with by the catchpits and permeable pavement, by collecting and bio-degrading the hydrocarbons.

8.8 Future Alterations to the Development

8.8.1 Any future alterations to the permeable paving should be confirmed by a specialist. Where possible any future services are to avoid being located through areas of permeable paving. If new servic required to run through areas of permeable paving, services should be installed below the c permeable paving with the permeable system reinstalled above.

8.9 Responsibility and Adoption

8.9.1 The Developer is responsible for management and maintenance and this includes the entirety incurred costs of this ongoing work, until such time that adoption of any elements of the drainage system is agreed with the relevant authority. Should the Developer wish to recuperate costs associated wi these works, they will need to agree the basis for this with property inhabitants.

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9 OFFSITE IMPACTS

9.1.1 The proposed development will utilise sustainable drainage measures in order to decrease runoff from the development compared to the existing site, and therefore will not cause an increase in flood risk offsite.

9.1.2 Post development foul water flows will contribute an increase to the sewer network compared to the previous use – it is expected that the peak foul sewer flow will be approximately 0.25l/s.

9.1.3 The effects of climate change have been considered in the design of the surface water drainage system, to ensure there is no off-site impact.

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10 SUMMARY

10.1.1 This Flood Risk Assessment is based on Flood Maps, the Local Authority's Strategic Flood Risk Assessment, consultation with the Environment Agency and the Local Authorities, Flood Modelling Data, and Public Sewer Records.

10.1.2 The existing site consists of an industrial property that encompasses the majority of the site.

10.1.3 The existing site has a total area of approximately 1.55Ha, with the existing site consisting of housing, parking, and a number of large nursery greenhouses.

10.1.4 The site lies within Flood Zone 1, 2 and 3. The proposed site layout and level design will minimise flood risk to the site and its users with properties set out Sequentially within Flood Zone 1 and raised above flood levels.

10.1.5 The proposed development will reduce the area of buildings within the flood extents, improving floodplain capacity. In addition, the proposed drainage strategy will reduce surface water runoff rates to the watercourse by approximately 90% up to the design event. This will benefit the risk of fluvial and surface water flooding off site.

10.1.6 Post-development surface water run-off will be managed through permeable free-draining surfacing and ponds, with controlled outfalls to the watercourse, with the proposed system to be informed by site-specific geotechnical investigation subject to the conclusion of winter groundwater monitoring.

10.1.7 The wastewater from the proposed development will discharge to the public foul sewer network, with connection arrangement to be confirmed subject to site investigation.

10.1.8 In conclusion, it is possible to develop the site for residential use safe from flood risk and will provide a betterment in terms of surface water drainage.

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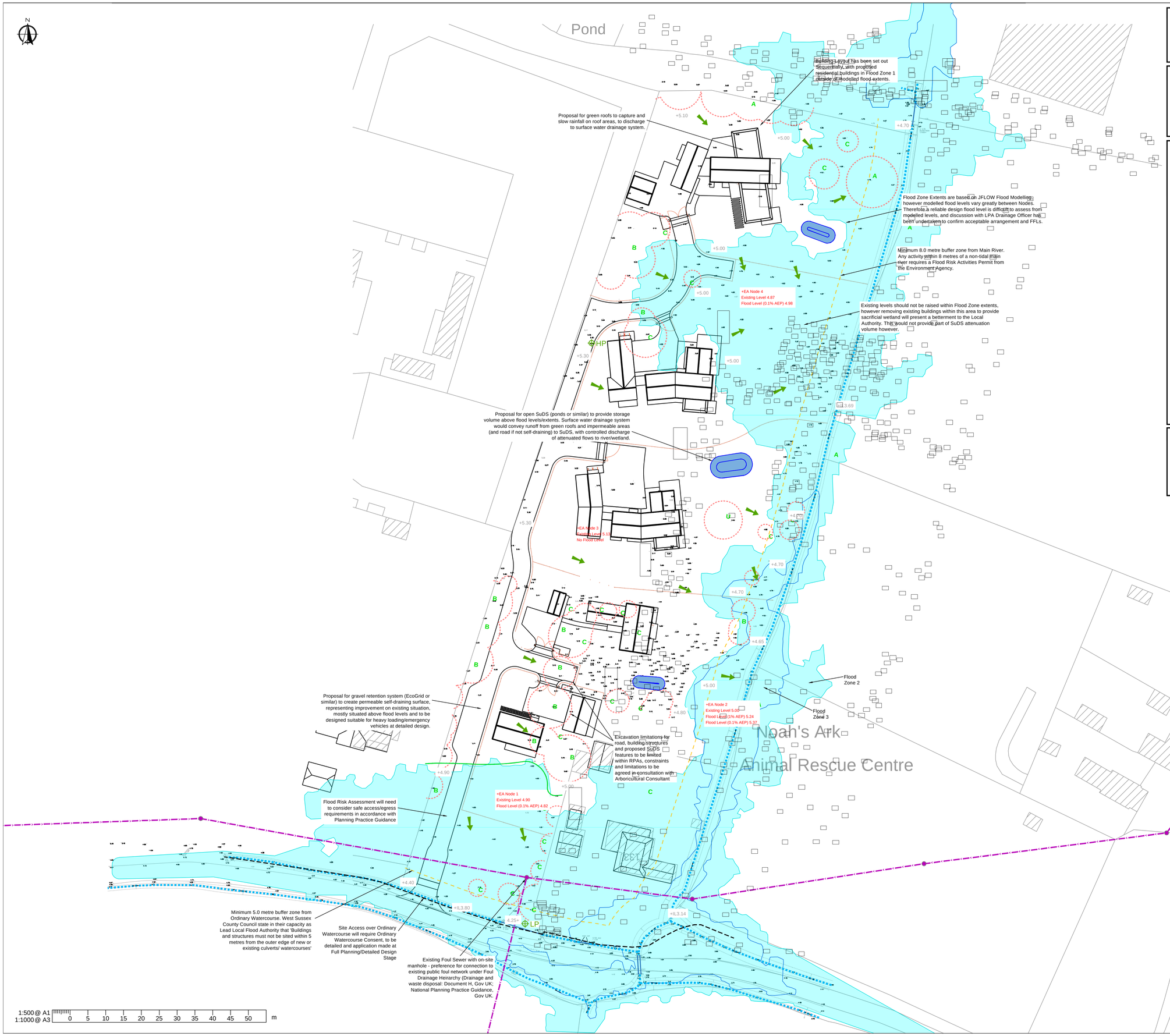
DRAWINGS

101 Initial Constraints Plan
102 Impermeable Areas
103 Preliminary Surface Water & Foul Drainage Strategy



-LEVELS KEY-

+10.850	Existing Spot Level
	Overland Flow Arrow
HP	Ultimate High Point
LP	Ultimate Low Point

-DRAINAGE CONSTRAINTS KEY-

- Existing Watercourse
- Existing Culvert
- Existing Foul Water Drain/Sewer
- Main River 8.0 metre / Ordinary Watercourse 5.0 metre Buffer
- Root Protection Zone (Refer to Arb Report)

-SURFACE WATER CONSTRAINTS-

- Surface water disposal should be managed in view of the SuDS hierarchy;
  1. Infiltration
  2. Watercourse
  3. Public Surface Water Sewer(s)
- A BGS Search found the underlying strata to consist of Raised River & Beach Deposits and Clay Bedrock, with shallow groundwater expected.
- Ongoing groundwater monitoring has so far groundwater levels less than 1.0mbgl, with testing ongoing to inform detailed design.
- It is proposed to use a permeable surfacing on the road and driveways, however given restrictions with high groundwater it is considered that this may not be able to provide additional storage volume without being tanked. It therefore may be preferable to consider it as a gravel-based free-draining surface. This would represent a betterment to the existing site.
- Given the underlying Strata, low-lying nature of the site and high groundwater, traditional infiltration SuDS are deemed unlikely to be feasible subject to additional investigation. It is therefore proposed that open SuDS features such as ponds could capture runoff and discharge at a controlled rate.
- The areas within the existing flood zones will remain and/or become free of structures, a benefit in terms of flood zone compensation, and localised flooding to the area.
- Green roofs would also provide a benefit to the surface water drainage system and reduce attenuation volume required, however rainwater harvesting would not contribute to the volumes required despite other benefits.
- The drainage strategy has been designed for up to a 1-in-100 year storm event, with the allowance of 40% for climate change.
- Finished floor levels should be set above existing ground levels and the modelled flood level with a minimum 300mm freeboard allowance.

-FOUL WATER CONSTRAINTS-

- Foul water disposal should adhere to the following hierarchy;
  1. Public Sewer
  2. Private Treatment Plant
  3. Septic Tank and Drainage Field
  4. Cesspool
- The proposed development should therefore discharge into the existing public foul sewer on site, off Almodington Road.

A1

N O TES

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-	Revised Issue	30/11/2020
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Drawing Status: FOR PLANNING

Client: Oslac Ltd

Project: Earnley Meadows, Aldingbourne Rd, Earnley, Chichester PO20 7JR

Drawing Title: Flood Risk & Drainage Initial Constraints Plan

Scale	Date	Drawn By	Checked By
1:250	Nov '20	DJL	LDF

Drawing No.: D1879-101

Rev.: A

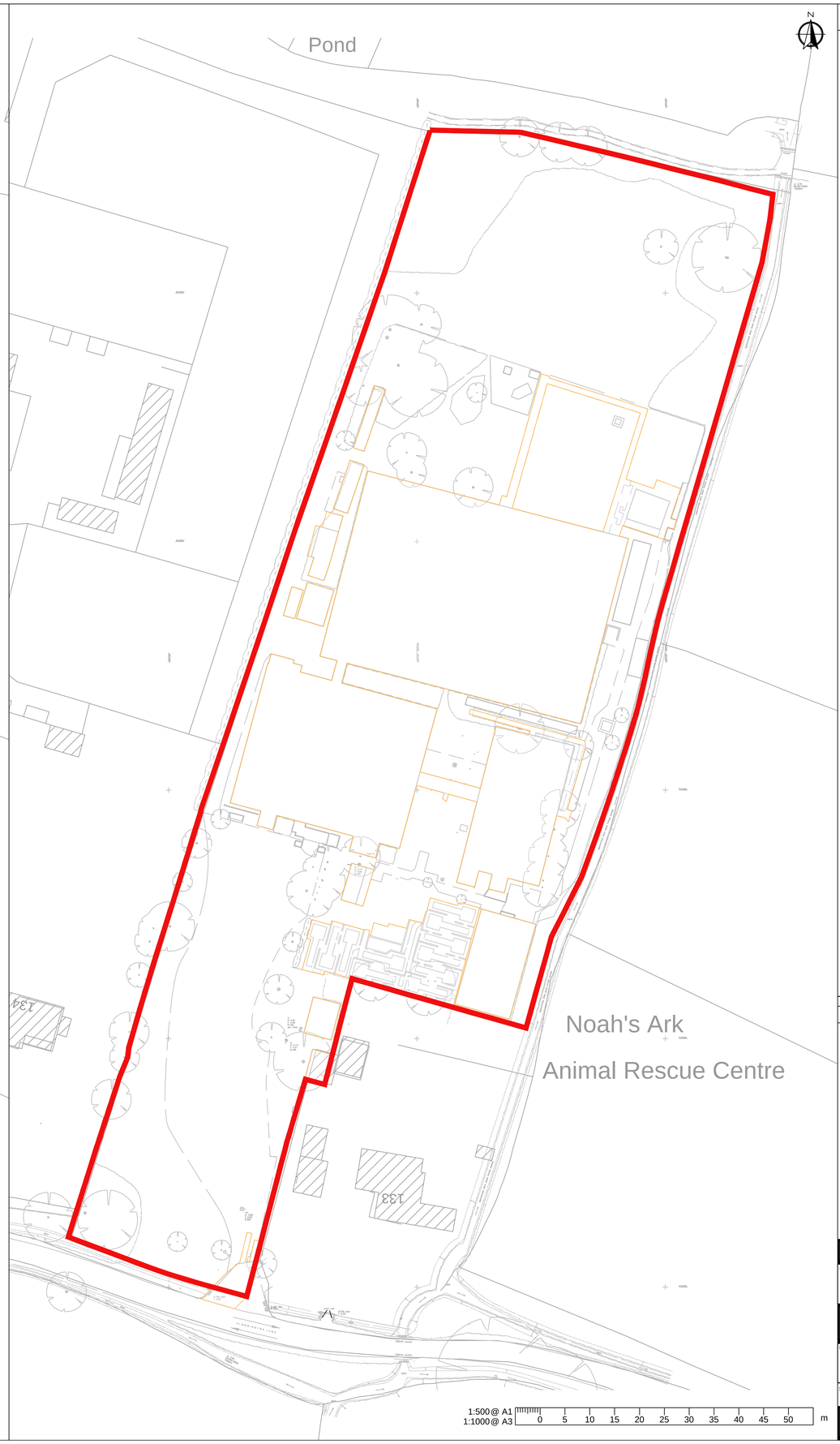
-CATCHMENT KEY-

Proposed Catchment (Roof)
TOTAL = 1412m^2

Proposed Catchment (Impermeable)
TOTAL = 250m^2

Proposed Catchment (Permeable Paving)
TOTAL = 2314m^2

Existing Catchment (Hardstanding)
TOTAL = 5005m^2



NOTES

A1

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Drawing Status: PLANNING

Client: Oslac Ltd

Project: Earnley Meadows, Aldingbourne Rd, Earnley, Chichester PO20 7JR

Drawing Title: Impermeable Areas

Scale	Date	Drawn By	Checked By
1:500	Nov 2020	DJL	LDF

Drawing No.: D1879-102

Rev.: -

-LEVELS KEY-

+10.850	Proposed Spot Level
FFL ###	Proposed Finished Floor Level
	Overland Flow Arrow
LP	Ultimate Low Point

-DRAINAGE CONSTRAINTS KEY-

- Existing Watercourse
- Existing Culvert
- Proposed Surface Water Manhole & Drain
- Proposed Surface Water Headwall
- Proposed Flow Control Manhole
- Free-Draining Gravel-based Surfacing
- Permeable Block Pavement
- Green Roof
- Existing Foul Water Drain/Sewer
- Foul Water (Private Drain/Public Sewer)
- Proposed FW Manhole
- Main River 8.0 metre / Ordinary Watercourse 5.0 metre Buffer
- Root Protection Zone (Refer to Arb Report)

-SURFACE WATER CONSTRAINTS-

- Surface water disposal should be managed in view of the SuDS hierarchy;
  1. Infiltration
  2. Watercourse
  3. Public Surface Water Sewer(s)
- A BGS Search found the underlying strata to consist of Raised River & Beach Deposits and Clay Bedrock, with groundwater monitoring so far finding groundwater at less than 1.0mbgl.
- It is proposed to use a gravel-based free-draining permeable surfacing on the road and driveways, with pedestrian paths as permeable free-draining block paving. This would allow capture and infiltration of runoff on the proposed hardstanding areas into the permeable deposits above groundwater levels, and represent a betterment to the existing site.
- Groundwater monitoring, though not complete, indicates that groundwater is too high to utilise traditional infiltration features. It is therefore proposed that open ponds could runoff and discharge at a controlled rate of 2.0l/s for each of the 3. No outfalls. This represents a significant betterment compared to the existing site runoff.
- Green roofs would also provide a benefit to the surface water drainage system and reduce attenuation volume required, however rainwater harvesting would not contribute to the volumes required despite other benefits.
- The drainage strategy has been designed for up to a 1-in-100 year storm event, with the allowance of 40% for climate change.
- Finished floor levels should be set above existing ground levels and the modelled flood level with a minimum 300mm freeboard allowance for all habitable structures.

-FOUL WATER STRATEGY-

- Foul water disposal should adhere to the following hierarchy;
  1. Public Sewer
  2. Private Treatment Plant
  3. Septic Tank and Drainage Field
  4. Cesspool
- The proposed development will discharge into the existing public foul sewer on site off Almodington Road.
- Confirmation of proposed foul site arrangement is dependent on confirmation of line & level of the existing foul sewer.

Pond

Proposal for green roofs to capture and slow rainfall on roof areas, to discharge to surface water drainage system.

Building Layout has been set out Sequentially, with proposed residential buildings in Flood Zone 1 outside of modelled flood extents.

Permeable block paving with 350mm thick self-draining sub-base and permeable geotextile filter within paths

Proposal for gravel retention system (EcoGrid or similar) to create permeable self-draining surface, representing improvement on existing situation, mostly situated above flood levels and to be designed suitable for heavy loading/emergency vehicles at detailed design.

Permeable block paving with 350mm thick self-draining sub-base and permeable geotextile filter within paths

Proposed Flow Control Manhole Node 2 Design Flow 2.0l/s, Head 0.7m CL 5.200 IL 4.513

Proposed Outfall Node 1 CL 4.800 IL 4.250

Proposed Pond, Node 3 CL 5.400 IL 4.550 18.7cu.m Min 300mm freeboard up to design event

Minimum 8.0 metre buffer zone from Main River.

Existing levels not to be raised within Flood Zone extents

Proposed Flow Control Manhole Node 5 Design Flow 2.0l/s, Head 0.8m CL 5.200 IL 4.495

Proposed Outfall Node 4 CL 4.800 IL 4.250

Proposed Pond, Node 6 CL 5.400 IL 4.550 37.7 cu.m Min 300mm freeboard up to design event

Indicative foul drainage proposals subject to confirmation of:
- SVP Locations
- Existing Site Constraints
- Services Proposals
- Confirmation of existing public foul sewer line & level

Proposed Flow Control Manhole Node 8 Design Flow 2.0l/s, Head 0.8m CL 5.200 IL 4.499

Proposed Outfall Node 7 CL 4.800 IL 4.250

Proposed Pond, Node 9 CL 5.400 IL 4.550 12.5 cu.m Min 300mm freeboard up to design event

S106 Foul Sewer Connection
- Connection to existing public sewer with new manhole within site boundary.
- 'Line & Level' to be agreed with Southern Water Clerk of Works under Section 106 Agreement.
- Reconstructed manhole if required, subject to investigation of line, level and condition

Site Access over Ordinary Watercourse will require Ordinary Watercourse Consent, to be detailed and application made at Full Planning/Detailed Design Stage

Noah's Ark Animal Rescue Centre

ALMODINGTON LANE

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

A1

NOTES

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Drawing Status: FOR PLANNING

Client: Oslac Ltd

Project: Earnley Meadows, Aldingbourne Rd, Earnley, Chichester PO20 7JR

Drawing Title: Preliminary Surface & Foul Water Drainage Strategy

Scale	Date	Drawn By	Checked By
1:500	Dec 2020	DJL	LDF

Drawing No. D1879-103 Rev. -