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Flood Risk Assessment

Proposed Glasshouse Development at

**Wicks Farm - East, Ford Lane,
Ford, West Sussex**

On behalf of

John Hall Consulting

April 2021

Document History and Status

Project Number 23482

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1 Non Technical Summary

- 1.1 This Flood Risk Assessment has been undertaken in accordance with the National Planning Policy Framework on behalf of John Hall Consulting in support of a Planning Application for the construction of a 1.3 hectare commercial glasshouse and associated irrigation reservoir together with a hardstanding area on land at Wicks Farm, Ford Lane, Ford, West Sussex.
- 1.2 This Assessment is to be read in conjunction with all planning, architectural and other reports that accompany the Planning Application for the proposed development.
- 1.3 The site is located in Tidal Flood Zones 1, 2 and 3.
- 1.4 The proposed development will incorporate a sustainable drainage system which will discharge surface water to an onsite irrigation reservoir.
- 1.5 Under normal circumstances 100% of water collected from the site will be re-used for irrigation and there will be no discharge of surface water from the site.
- 1.6 Only in the event of a 1:100 year +40% pluvial event occurring while the irrigation water level within the reservoir is already at the peak operational level will a discharge be made at a suitably restricted rate to the existing drainage ditches to the east of the site.
- 1.7 Sufficient additional storage will be provided within the reservoir above the level of the peak operational irrigation water for all storm return periods up to and including the 1:100 year rainfall event with an allowance for climate change.
- 1.8 Foul drainage will be discharged to the existing foul drainage system of Wicks Farm.
- 1.9 This report concludes that the proposed development will not increase flood risk elsewhere and is appropriate in this location.

2 Planning Policy Context

2.1 National Planning Policy Framework

2.1.1 The National Planning Policy Framework was updated in February 2019.

2.1.2 With regard to planning and flood risk the policy framework states that *‘when determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment.*

Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- a) 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;*
- b) the development is appropriately flood resistant and resilient;*
- c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;*
- d) any residual risk can be safely managed; and*
- e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.’*

2.1.3 With regard to major developments the NPPF states that *‘major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:*

- a) take account of advice from the lead local flood authority;*
- b) have appropriate proposed minimum operational standards;*
- c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and*
- d) where possible, provide multifunctional benefits’*

2.1.4 Major development is defined as follows:

‘For housing, development where 10 or more homes will be provided, or the site has an area of 0.5 hectares or more. For non-residential development it means additional floorspace of 1,000m² or more, or a site of 1 hectare or more, or as otherwise provided in the Town and Country Planning (Development Management Procedure) (England) Order 2015.’

2.2 Lead Local Flood Authority

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

2.2.2 As part of its role West Sussex County Council has commissioned and produced the following documents:

- Strategic Flood Risk Assessment - January 2010
- Preliminary Flood Risk Assessment - May 2011
- Local Flood Risk Management Strategy - May 2014

2.2.3 In addition to the above documents the West Sussex County Council Policy for the Management of Surface Water was updated in November 2018.

2.2.4 The above documents have been reviewed in the preparation of this report.

2.3 Arun District Council

2.3.1 Arun District Council has commissioned and produced the following documents:

- Strategic Flood Risk Assessment - February 2008
- Arun Strategic Surface Water Management Study - October 2016
- Combined Level 1 and Level 2 Strategic Flood Risk Assessment - November 2016

2.3.2 In addition Arun District Council has, in collaboration with Chichester District Council, produced a Surface Water Drainage Proposal Checklist dated November 2019 which outlines both councils' expectations and requirements for Surface Water Drainage proposals.

2.3.3 The above documents have been reviewed in the preparation of this report.

2.4 Local Planning Policy

2.4.1 The Arun Local Plan 2011 - 2031 was adopted in July 2018.

2.4.2 **Policy W SP1 – Water** states that *'Arun District Council will encourage water efficiency measures in order to protect the District's water resources and enhance the quality of the water environment which supports a range of habitats and ecosystems. Development will be encouraged to make active use of surface water as a design feature and permitted where it identifies measures to improve and enhance waterbodies, coastal habitats or provides additional flood relief.*

The Council will also support development that:

- a) *is appropriately located, taking account of flood risk and promotes the incorporation of appropriate mitigation measures into new development, particularly Sustainable Drainage Systems that reduces the creation and flow of surface water and improves water quality;*
- b) *reduces the risk to homes and places of work from flooding whilst increasing biodiversity;*
- c) *delivers a range of community benefits including enhancing the quality of life and providing greater resistance to the impact of climate change.'*

2.4.3 Policy W DM1 – Water Supply and Quality states:

‘1. Water supply

Development will be permitted where:

- a) *Sufficient water supplies can be provided prior to occupation to serve the development and;*
- b) *Provision of a water supply is not considered detrimental to existing abstractions, river flows, water quality, fisheries, amenity or nature conservation.*

To ensure that all new development of two dwellings or more are water efficient and reduce pressure on water abstraction sites, it must include measures that meet the optional standards of 110 l/person/day.

2. Water quality

To ensure good water quality in the District, all major developments must:

- a) *Illustrate, where necessary, how they have contributed to the protection and enhancement of waterbodies identified by the South East River Basin Management Plan objectives; and*

Demonstrate, where it will materially increase foul and/or surface water discharges, adequate drainage capacity exists or can be provided as part of the development. Where adequate capacity does not exist, there will be a requirement that facilities are adequately upgraded prior to the completion and occupation of development. In sewered areas, there will be a general presumption against the use of non mains foul water drainage.'

2.4.4 Policy W DM2 – Flood Risk states that *‘development in areas at risk from flooding, identified on the latest Environment Agency flood risk maps and the Council's Strategic Flood Risk Assessment (SFRA) will only be permitted where all of the following criteria have been satisfied:*

- a) The sequential test in accordance with the National Planning Policy Guidance has been met.*
- b) A site specific Flood Risk Assessment demonstrates that the development will be safe, including access and egress, without increasing flood risk elsewhere and reduce flood risk overall.*
- c) The sustainability benefits to the wider community are clearly identified.*
- d) The scheme identifies adaptation and mitigation measures.*
- e) Appropriate flood warning and evacuation plans are in place; and*

New site drainage systems are designed to take account of events which exceed the normal design standard i.e. consideration of flood flow routing and utilising temporary storage areas.

The reports prepared as part of the criteria above must take into account contingency allowances, taking climate change into account as set out in Flood Risk Assessments: climate change allowances section of the NPPG.

In locations where strategic flood defence or resilient and resistant construction measures are necessary within the site itself, proposals will be required to demonstrate how measures have been incorporated as an intrinsic part of the scheme in a manner which is compatible with the latest Strategic Flood Risk Assessment.

All development proposals must take account of relevant Surface Water Management Plans, Catchment Flood Management Plans and related Flood Defence Plans and strategies such as the Lower Tidal River Arun Strategy. The council may require financial contributions from development on sites where measures to address flood risk or to improve the environmental quality of watercourses have been identified by these Plans and Strategies.’

2.4.5 Policy W DM3 – Sustainable Urban Drainage Systems states that *‘to increase the levels of water capture and storage and improve water quality, all development must identify opportunities to incorporate a range of Sustainable Urban Drainage Systems (SUDS), appropriate to the size of development, at an early stage of the design process.*

Proposals for both major and minor development proposals must incorporate SUDS within the private areas of the development in order to provide source control features to the overall SUDS design. These features include:

- Green roofs*
- Permeable driveways and parking*
- Soakaways*
- Water harvesting and storage features including water butts.*

Proposals for major development must also integrate SUDS within public open spaces and roads, reflecting discussion with the appropriate bodies. SUDS must therefore be integrated into the overall design of a development and must:

- a) Contribute positively to the appearance of the area, integrating access to allow maintenance of existing watercourses and the system.*
- b) Effectively manage water (including its quality)*
- c) Accommodate and enhance biodiversity by making connections to existing Green Infrastructure assets and*
- d) Provide amenity for local residents (ensuring a safe environment)*
- e) Retain the existing drainage network of the site and the wider area,*
- f) Be maintained in perpetuity, supported through a Maintenance and Management Plan/Regime, including its financing, agreed with the Local Planning Authority.*

In order to ensure that SUDS discharge water from the development at the same or lesser rate, as prior to construction, developers must:

- f) Follow the hierarchy of preference for different types of surface water drainage disposal systems as set out in Approved Document H of the Building Regulations and the SUDS manual produced by CIRIA.*
- g) Undertake up to six months groundwater monitoring within the winter period.*
- h) Undertake winter percolation testing in accordance with BRE365.*
- i) The proposed drainage system must be designed to ensure that there is no flooding on a 1 in 30 year storm event.*
- j) The design must also take account of the 1 in 100 year storm event plus 30% allowance for climate change, on stored volumes, to ensure that there is no flooding of properties or the public highway or inundation of the foul*

sewerage system. Any excess flows must be contained within the site boundary, and within designated storage areas.'

2.4.6 Policy ECC SP1 – Adapting to climate change states that *'the Council will support development which is located and appropriately designed to adapt to impacts arising from climate change such as the increased probability of tidal and fluvial flooding; water stress; health impacts as a result of extreme temperatures and a decline in the quality of habitats and richness of biodiversity.*

In order to achieve this, development must be designed to take account of the following issues:

- a) Location (in relation to flood risk and vulnerability to coastal erosion);*
- b) Water efficiency;*
- c) Shade, cooling, ventilation, solar gain;*
- d) Connectivity to the green infrastructure network;*
- e) Layout and massing;*
- f) Resilience of buildings and building materials to extreme weather events;
and*
- g) Capacity of drainage systems and incorporation of Sustainable urban Drainage Systems (SuDS)'*

3 Existing Site

3.1 Site Location

- 3.1.1 The development site is located on farmland which forms part of Wicks Farm to the north of Ford Lane, Ford, West Sussex BN18 0DF. The site is centred on Ordnance Survey reference SU 993 042.



Image 1: Site Location

- 3.1.2 The site is bound to the north by the West Coastway railway line and to the south east and west by agricultural farmland.
- 3.1.3 The River Arun is located 1km to the east of the site.
- 3.1.4 A copy of the site location plan is located in Appendix 1 at the rear of this report.
- #### 3.2 Site Description
- 3.2.1 The site is approximately 4.6ha in area and currently comprises undeveloped agricultural land.
- 3.2.2 Existing ground levels are generally level at 5m AOD.
- 3.2.3 A copy of the existing site layout plan is located in Appendix 2 at the rear of this report.
- #### 3.3 Existing Drainage
- 3.3.1 The site currently has no positive surface water or foul water drainage infrastructure.

3.3.2 Rainfall currently discharges in part to ground and to a lesser degree overland as a greenfield runoff to the drainage ditches to the east which discharge to the River Arun.

3.3.3 Pre-developed greenfield runoff rates have been established using the HR Wallingford tool for Greenfield runoff estimation as follows:



HR Wallingford
Engineering & Construction

Greenfield runoff rate estimation for sites

www.uksubs.com | Greenfield runoff tool

Calculated by:

Site name:

Site location:

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030218 (2013), the SuDS Manual C753 (C88, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be used as the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:

Longitude:

Reference:

Date:

Runoff estimation approach:

Site characteristics

Total site area (ha):

Methodology

Ceas estimation method:

SPR estimation method:

Soil characteristics

	Default	Edited
SOIL type:	2	2
H0ST class:	N/A	N/A
SPR/SPRH0ST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	747	747
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is $Q_{SAAR} < 2.0 \text{ l/s/ha}$?

When Q_{SAAR} is $< 2.0 \text{ l/s/ha}$ then limiting discharge rates are set at 2.0 l/s/ha .

(2) Are flow rates $< 5.0 \text{ l/s}$?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRH0ST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{SAAR} (l/s):	1.97	1.97
1 in 1 year (l/s):	1.67	1.67
1 in 30 years (l/s):	4.52	4.52
1 in 100 years (l/s):	6.27	6.27
1 in 200 years (l/s):	7.26	7.26

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksubs.com. The use of this tool is subject to the UK SuDS terms and conditions and license agreement, which can be found at www.uksubs.com/terms-and-conditions.html. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrocad or any other organization for the loss of this data in the design or operational deterioration of any drainage scheme.

Image 2: Greenfield Runoff Calculation

3.3.1 The pre-developed greenfield runoff rates are as follows:

- Q_{bar} 2 l/s/ha
- 1:100 year 6.3 l/s/ha

3.3.2 There are no public foul sewers in the immediate vicinity of the site. The closest are located beneath North End Road approximately 1.3km to the west of the site.

3.3.3 A copy of the sewer records is located in Appendix 3 at the rear of this report.

3.4 Geology and Groundwater

3.4.1 British Geological Survey maps and borehole information confirm that the site is within an area underlain by silty clays with pockets of sand to a depth of approximately 1.5m below ground level over chalk.

3.4.2 Groundwater was encountered in October 2020 at a depth of 15m below ground level.

3.4.3 The online “Magic Map” available from Defra confirms that the site is located in an area where groundwater is classified as having a medium to high vulnerability.

3.4.4 A copy of the geological borehole data is located in Appendix 4 at the rear of this report.

4 Flood Zone, Flood Defences and Flood History

4.1 Tidal Food Zone

- 4.1.1 The site is located in Tidal Flood Zones 1 and 3 and potentially at risk of flooding during a 1:200 year tidal flood event.
- 4.1.2 The tidal flood level data supplied by the Environment Agency is based on the data model from 2010. The predicted climate change models were updated in December 2019.
- 4.1.3 Reference has been made to the Environment Agency's latest predicted sea level rise data at <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances> in order to establish the present day and future year tidal flood levels using the updated climate change predictions.
- 4.1.4 These are presented by the Environment Agency as a higher central allowance (70th percentile exceeded by 30% of the projections in the range) and an upper end allowance (95th percentile exceeded by 5% of the projections in the range).
- 4.1.5 The undefended 1:200 year tidal flood level supplied by the Environment Agency for 2010 is 3.07m AOD.
- 4.1.6 The predicted undefended levels based on the updated climate change predictions are as follows:
- 1:200 Year 2010 Flood level 3.07m AOD
 - 1:200 Year present day 2021 Flood level 3.133m to 3.146m AOD
 - 1:200 future Year 2125 Flood level 4.215m to 4.602m AOD

4.2 Fluvial Food Zone

- 4.2.1 The site is not at risk of fluvial flooding from anything less extreme than a 1:1,000 year flood event.

4.3 Flood Defences

- 4.3.1 There are flood defences on the banks of the River Arun in the form of an embankment. The Environment Agency have confirmed that the crest level is 4.12m AOD and that the estimated standard of protection is 1 in 200 years.

4.4 Flood History

4.4.1 Environment Agency

- 4.4.1.1 The Environment Agency map of historic flood incidents does not identify any historic incidents from any source in the vicinity of the site.

4.4.2 West Sussex County Council

- 4.4.2.1 Neither the Strategic Flood Risk Assessment dated January 2010, the Preliminary Flood Risk Assessment dated May 2011, nor the Local Flood Risk Management Strategy dated May 2014 identify any specific flood incidents in the immediate vicinity of the site.

4.4.3 Arun District Council

- 4.4.3.1 The Strategic Flood Risk Assessment dated November 2016 does not identify any specific flood incidents in the immediate vicinity of the site.
- 4.4.3.2 Copies of the available flood maps and correspondence are located in Appendix 5 at the rear of this report.

5 Flooding Potential

5.1 Tidal Flooding

5.1.1 As previously noted the present day 2021 and future year 2125 predicted tidal flood levels are as follows:

- 1:200 Year present day 2021 Flood level 3.133m to 3.146m AOD
- 1:200 future Year 2125 Flood level 4.215m to 4.602m AOD

5.1.2 The existing flood defences on the banks of the River Arun have a crest level of 4.12m AOD.

5.1.3 Based on the updated climate change predictions for sea level rise these defences should provide protection until at least the year 2098 and potentially up to 2117 in their current form.

5.2 Fluvial Flooding

5.2.1 The site is located within Fluvial Flood Zones 1, 2 and 3 and is not at risk of fluvial flooding.

5.2.2 However, the dominant flood risk with reference to the climate change data is from tidal flooding.

5.2.3 The site is not currently at flood risk from anything less extreme than a 1:1,000 year flood event.

5.2.4 The site will continue to stay protected from fluvial flooding from the existing flood defences until at least 2115.

5.3 Groundwater Flooding

5.3.1 The British Geological Survey borehole log information recorded groundwater at a depth of 15m below ground level in October 2020.

5.3.2 The mapping contained within Arun District Council's latest Strategic Flood Risk Assessment dated November 2016 identifies the location of the site as being within an area of 1 square kilometre where the geology is such that groundwater might emerge within 75% or more of that area. It is however immediately bordered by areas identified as 0%, less than 25% and 50-75%. No indication of likelihood is given, and the recorded October 2020 groundwater level does not give rise to concern on this particular site.

5.3.3 There are no records identified within West Sussex County Council's Strategic Flood Risk Assessment, Preliminary Flood Risk Assessment or Local Flood Risk Management Strategy nor in Arun District Council's Strategic Flood Risk

Assessments (2006 and 2016 update) or Strategic Surface Water Management Study of groundwater flooding affecting the site.

5.4 Overland Flow

- 5.4.1 The Environment Agency maps confirm that the site is not at risk of flooding from overland surface water.
- 5.4.2 The flood mapping contained within the various flood documents produced by West Sussex County Council and Arun District Council do not identify any associated history of flooding and the risk is identified as low.

5.5 Flood Routing

5.5.1 The natural route for flood waters to dissipate, should any event occur on the site, is towards the River Arun via the drainage ditches to the east of the site.

5.5.2 There is no associated flood risk to the downstream catchment area.

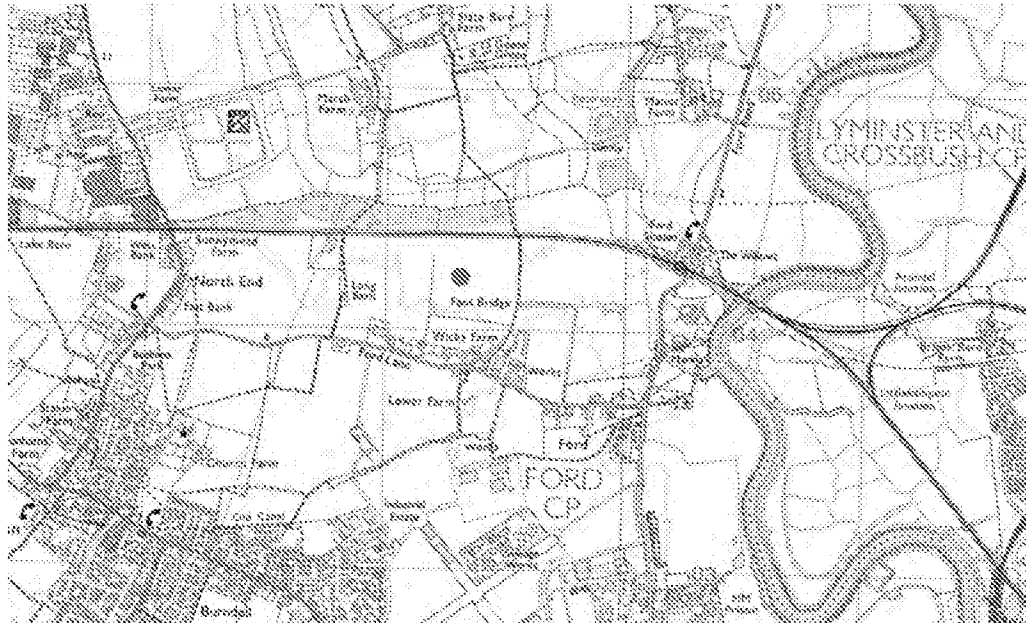


Image 3: Local Topography

6 Development Proposals

6.1 Description

6.1.1 The development proposals are for the construction of a 1.3ha glasshouse and an irrigation reservoir together with a hard standing area.

6.1.2 The areas of the various elements of the development are summarised as follows:

- Roof area 13,120m²
- Hard standing area 2,500m²

6.1.3 A copy of the proposed site layout plan together with an impermeable areas plan is located in Appendix 6 at the rear of this report.

6.2 Surface Water Drainage

6.2.1 Rainwater from the glasshouse roof will be collected and discharged to the irrigation reservoir via a syphonic drainage system and under normal circumstances will provide 100% rainwater recycling for irrigation.

6.2.2 Surface water runoff from the hard standing area will be collected within a voided subbase beneath a permeable surface which will provide treatment prior to being discharged by gravity at a restricted rate to the drainage ditches to the east of the site.

6.2.3 The reservoir will be sized with sufficient storage beyond the normal irrigation requirement to accommodate a 1:100 year storm event including an additional 40% to account for the predicted effects of future climate change.

6.2.4 Only in the event that the operational capacity of the reservoir is already full during a significant rainfall event will there be a surface water discharge from the reservoir.

6.2.5 The roof area discharging to the reservoir will be approximately 1.3ha and the equivalent Q_{bar} greenfield runoff at 2l/s/ha is 2.6l/s.

6.2.6 The hardstanding area discharging to the ditches to the east of the site will be approximately 2,500m² and the equivalent Q_{bar} greenfield runoff at 2l/s/ha is 0.5l/s.

6.2.7 Such low levels of restriction are impractical and HR Wallingford guidance recommends a maximum restriction of 5l/s. Rates of 2l/s are however now achievable and will be applied in this case.

6.2.8 Calculations have been prepared in order to determine the storage required beneath the hardstanding area as well as the additional storage required within the reservoir beyond its operational requirement to accommodate a 1:100 year return period storm occurring at a time when the irrigation reservoirs have their maximum operational water already available.

6.2.9 The calculations confirm the following:

- With a restricted discharge of 2l/s from the hardstanding area a depth of 230mm of 30% voided subbase will be required to accommodate a 1:100 year +40%. This will be discharged via a new drainage channel between the hardstanding area and the existing drainage ditches to the east of the site.
- With a restricted discharge of 2.6l/s from the glasshouse roof and 300mm of freeboard, an allowance of 575mm within the reservoir will be required above the maximum irrigation water level to accommodate a 1:100 year +40% storm. This will be discharged via a new drainage channel between the reservoir and the existing drainage ditches to the east of the site.

6.2.10 The various reservoir design levels are summarised as follows:

- | | |
|-----------------------------------|------------|
| • Top of reservoir bank | 6.500m AOD |
| • Top of 1:100 year + 40% storage | 6.191m AOD |
| • Maximum Irrigation water level | 5.925m AOD |

6.3 Foul Water Drainage

6.3.1 Foul drainage will be discharged to the existing foul drainage system of Wicks Farm.

6.3.2 A copy of the drainage strategy plans together with copies of the calculations and a plan showing exceedance event flow routes is located in Appendix 7 at the rear of this report.

6.3.3 A completed copy of Arun District Council's Surface Water Drainage Proposal Checklist together with supporting calculations is located in Appendix 8 at the rear of this report.

6.4 Water Quality

- 6.4.1 The proposed development is for commercial use. In accordance with CIRIA report C753 - The SuDS Manual, the pollution hazard level for this type of development ranges between low and medium depending on the use / area of the site.
- 6.4.2 The surface water scheme will include mitigation to ensure that surface water is suitably treated and any pollution risk adequately managed prior to irrigation re-use or in the event of a restricted discharge to the local watercourses.
- 6.4.3 Table 26.2 in Chapter 26 of CIRIA report C753 The SuDS Manual provides Pollution Hazard Indices for varying land types. Those of relevance to the development proposals are as follows:

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Commercial / industrial roofs	Low	0.3	0.2	0.05
Low-traffic roads	Low	0.5	0.4	0.4
Commercial yards and delivery areas	Medium	0.7	0.6	0.7

Table 1: Pollution Hazard Indices

- 6.4.4 The Pollution Mitigation Indices which are of relevance to the development proposals are as follows:

SuDS Type	Total suspended solids (TSS)	Metals	Hydrocarbons
Swale	0.5	0.6	0.6
Permeable pavement	0.7	0.6	0.7
Pond	0.7	0.7	0.5

Table 2: Pollution Mitigation Indices

- 6.4.5 Where multiple drainage components are used in series the individual mitigation index of secondary and tertiary components is lowered by 50% due to reduced performance associated with primary treatment.
- 6.4.6 The detailed drainage design will be undertaken such that its combined elements meet the target treatment level required for runoff with low to medium risk of pollution hazard thus demonstrating that the surface water drainage system for the site can be designed to adequately mitigate against the risk of pollution.

6.4.7 An outline drainage maintenance schedule is located in Appendix 9 at the rear of this report.

7 Safe Development

7.1 Flood Zone Compatibility

7.1.1 The site is located in Flood Zones 1, 2 and 3.

7.1.2 With reference to the Government Guidance on Flood Risk and Coastal Change at <https://www.gov.uk/guidance/flood-risk-and-coastal-change>:

- Table 2: Flood Risk Vulnerability Classification

Land and buildings used for agriculture are classified as less vulnerable.

- Table 3: Flood Risk Vulnerability and Flood Zone Compatibility

Less Vulnerable development is appropriate in Flood Zones 1, 2 and 3.

7.2 Risk to Others

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

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

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

7.2.4 Post development onsite flow routes for exceedance flows, should any ever occur will be via the new ditches connected to the east of the site.

7.2.5 The risk of surface water flooding to others due to the development proposals is reduced and the resultant risk is negligible.

7.2.6 Any alterations to the levels throughout the site will be outside of the defended fluvial modelled flood level and flood risk for the development and surrounding area will not be increased.

8 Conclusions

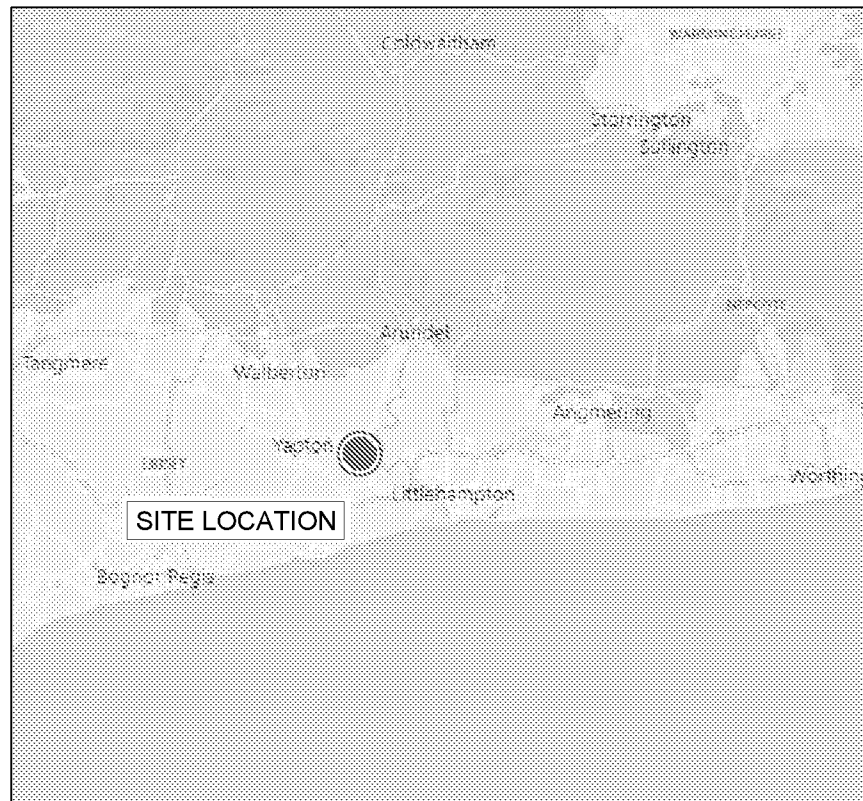
- 8.1 The site is located within Flood Zones 1, 2 and 3 and is partially at risk of tidal flooding during a 1:200 year tidal flood event.
- 8.2 Based on the updated climate change predictions for sea level rise these defences should provide protection until at least the year 2098 and potentially up to 2117 in their current form.
- 8.3 The type of agricultural use proposed is classified as less vulnerable and appropriate in Flood Zones 1, 2 and 3.
- 8.4 There are no historic records of flooding from any source affecting the site.
- 8.5 A suitable SuDS drainage system is proposed which accords with the requirements of national and local policy and will be primarily focused on 100% reused of captured rainwater for irrigation.
- 8.6 Under normal circumstances there will be no discharge of surface water from the site.
- 8.7 Only in the event of a 1:100 year +40% pluvial event occurring while the irrigation water level within the reservoir is already at the peak operational level will a discharge be made at a suitably restricted rate to the ditches to the east of the site.
- 8.8 Preliminary calculations confirm that sufficient additional storage can be provided within the reservoir above the level of the peak operational irrigation water for all storm return periods up to and including the 1:100 year rainfall event with an allowance for climate change.
- 8.9 Water quality improvement will be provided to mitigate against any risk to the receiving watercourses in the event that a restricted overflow is ever required.
- 8.10 Foul drainage will be discharged to the existing foul drainage system of Wicks Farm.
- 8.11 In terms of flood risk planning the proposed development is appropriate in this location, will not increase flood risk elsewhere and will provide improvement to immediately adjacent sites by managing surface water from all rainfall events up to the 100 year plus climate change event.

9 List of Appendices, Images and Tables

Appendix 1	Site Location Plan
Appendix 2	Existing Site Layout Plan
Appendix 3	Sewer Records
Appendix 4	Geological Borehole Data
Appendix 5	Flood Maps and Correspondence
Appendix 6	Proposed Site Layout Plan and Impermeable Areas Plan
Appendix 7	Drainage Strategy Plans and Calculations and Exceedance Event Flow Route Plan
Appendix 8	Arun District Council's Surface Water Drainage Proposal Checklist
Appendix 9	Outline Drainage Maintenance Schedule
Table 1	Pollution Hazard Indices
Table 2	Pollution Mitigation Indices
Image 1	Site Location
Image 2	Greenfield Runoff Calculation
Image 3	Local Topography

Appendix 1

Site Location Plan



TITLE		Site Location Plan	
		Wicks Farm East, Ford Lane	
		BN18 0FD - OS Ref: SU 993 042	
SCALE	1:10000 @ A3	PROJECT No.	23482
REPORT TYPE	Flood Risk Assessment	DRG. No.	01

Appendix 2

Existing Site Layout Plan



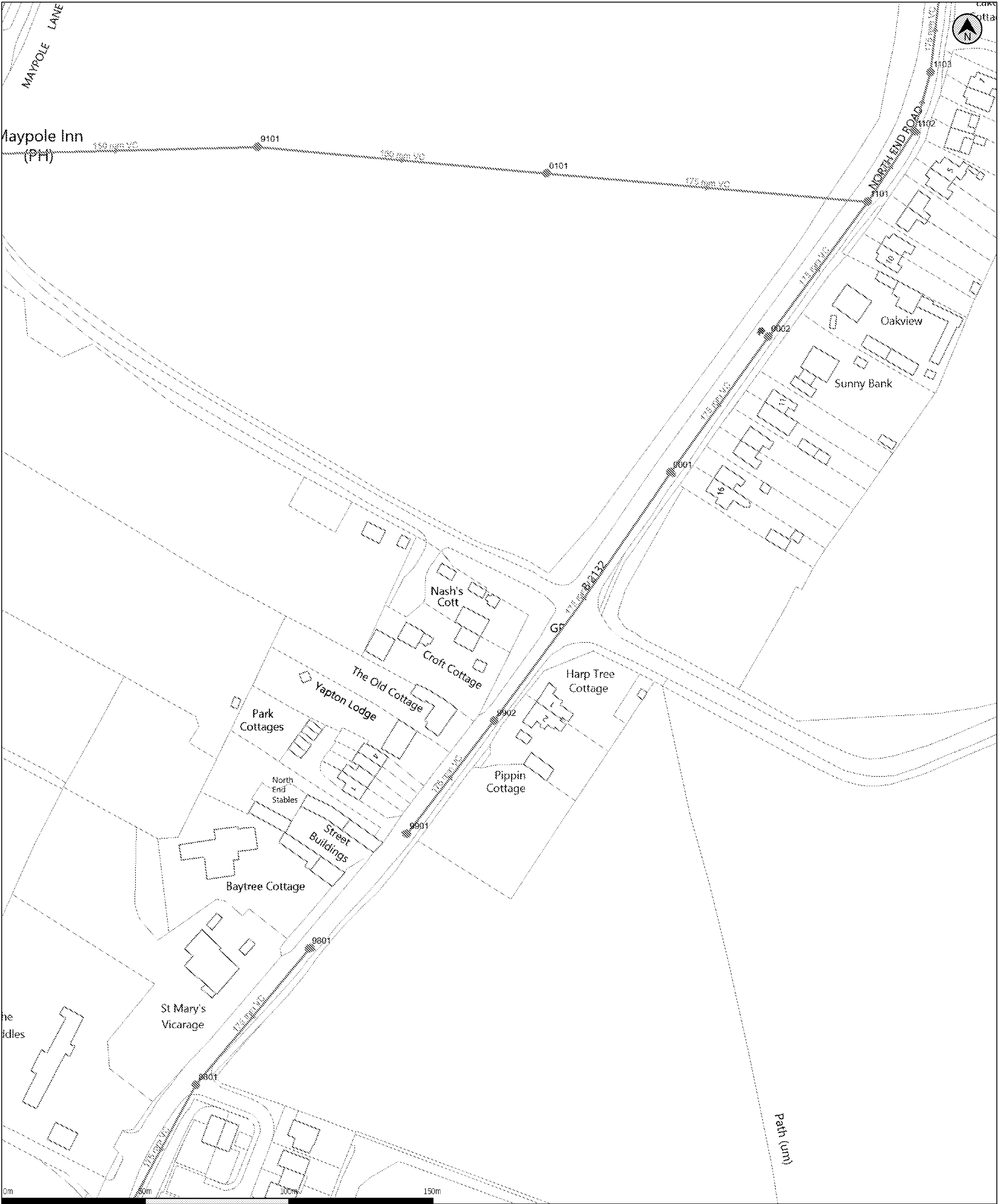
Existing Site
Access

-20m 0 20m 40m 60m 80m

TITLE		Existing Site Layout Plan	
SCALE		1:2000 @ A3	PROJECT No. 23482
REPORT TYPE		Flood Risk Assessment	DRG. No. 02

Appendix 3

Sewer Records



(c) Crown copyright and database rights 2021 Ordnance Survey 100031673
Data updated: 21/12/20

Scale: 1:1250
Map Centre: 497986,104002

Date: 15/01/21
Our Ref: 474675 - 1

Wastewater Plan A3
Powered by digdat

23482 Wicks FarmEast



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2020 Ordnance Survey 100031673 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

Appendix 4

Geological Borehole Data



British
Geological
Survey

Geology of Britain viewer (classic)

[Try the 3D version of the Geology of Britain viewer](#)



[More BGS map viewers](#)

Surface
Geology

3D
Models

Borehole
Scans

Earthquake
Timeline

Borehole Scans

Click on a borehole to view
scan.

Borehole depth

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

[More on boreholes](#)

Navigation controls: Home, Previous, Next, Full Screen, Print, and a search bar.

Buttons: [Go to Location](#), [Switch Dashboard](#)

Scale: 100% to 0%

Geology Transparency

Grid Ref: 439710, 104001

SUS05E07

SUS05E09

SUS05E03

SUS05E04

POWERED BY
esri

SU 90 SE 36**9920 0414****Wick's Farm****Block H**

Surface level +5.0 m

Water not struck

August 1981

**Waste
Bedrock****1.5 m****1.5 m+****LOG**

Geological classification

Lithology

Thickness
mDepth
m

	Soil	0.3	0.3
Brickearth	Clay, very silty, brown, with angular and subangular flint pebbles, some peat particles and a few pockets of sand	1.2	1.5
Upper Chalk	Chalk, rubbly, with matrix of olive fine sand near top	1.5+	3.0

341094

WR38: Borehole record form

Borehole record

British Geological Survey
Natural Environment Research CouncilBritish Geological Survey
Natural Environment Research Council

Environment Agency

Form WR38 (1/01/11)

Form WR38 (1/01/11)

Form WR38 (1/01/11)

Water Resources Act 1991 (as amended by the Water Act 2003)

A Site details

Borehole drilled for Berry Farming LTDLocation Nicks Farm, Ford Lane, Arundel, BN18 0DQNGR (ten digits) SU99034 04143

Please attach site plan

Ground level (if known) _____ metres Above Ordnance Datum

Drilling company Nicholls BoreholesDate drilling commenced 7/10/2020 (DD/MM/YYYY) Completed 12/10/2020 (DD/MM/YYYY)

B Construction details

Borehole datum (if not ground level) _____ metres (m). Please tick if this is above ☐ or below ☒ ground level.
(point from which all measurements of depth are taken, for example, flange, edge of chamber)Borehole drilled diameter 225 mm from 0 to 24 m/depth

_____ mm from _____ to _____ m/depth

_____ mm from _____ to _____ m/depth

_____ mm from _____ to _____ m/depth

Casing material Solid uPVC liner diameter 225 mm from 0 to 9 m/depth
and type (for example, if plain steel, plastic slotted). Please record permanent casing details, not temporary casing.Casing material slotted uPVC liner diameter 225 mm from 9 to 24 m/depthCasing material with screen on endcap diameter _____ mm from _____ to _____ m/depth

Casing material _____ diameter _____ mm from _____ to _____ m/depth

Grouting details 13 bags of nikollet (6M sand to surface)Water struck at: 1. 15 m (depth below datum - mbd) 2. _____ m (mbd)

Form WR38 (1/01/11)

3. _____ m (mbd) 4. _____ m (mbd)

C Test pumping summary (Please supply full details on form WR39)

Test pumping datum _____ m. Please tick if this is above ☐ or below ☒ ground level.

(if different from borehole datum)

Pump suction depth _____ mbd

Water level (start of test) _____ mbd

Water level (end of test) _____ mbd

Type of test (for example, bailer, step, constant rate)

Pumping rate _____ m³/hour ☐ or litres/second ☐. Please tick as appropriate.for 1 days _____ hours, 1 mins _____Recovery to _____ mbd in 1 days _____ hours, 1 mins _____

(from end of pumping)

Date(s) of measurements _____ Pump started _____ (DD/MM/YYYY)

Pump stopped _____ (DD/MM/YYYY)

Please supply chemical analysis if available. If you have included this please tick this box ☐

WR38 Version 2, February 2011

page 1 of 3

WB38: Borehole record form

D Strata log

Geological classification (BGS only)	Description of strata	Thickness m	Depth (to base of strata) m
	• Brown clay, flint & Chalk	2	2
	• Rubble Chalk	14	16
	• Chalk and flint	14	30
	(continue on separate page if necessary)		
	Other comments (for example, gas encountered, saline water intercepted)		

E Completing this form

How long did it take you to fill in this form? _____

For Official use only

Date received (DD/MM/YYYY)

File

Consent number

BGS reference number

Accession number

Wellmaster number

SOBI number

MSR

LICID

Purpose

E reference number

Copy number

Entered by

WB38 Version 2, February 2011

Page 2 of 3

N.G.R. 9928. 0390

This feature is only
GEOLOGICAL
CLASSIFICATION

NATURE OF STRATA

If measurements start below ground surface, state how far.

Thanks

D. 224

Feet	Inches	Metres	Feet	Inches	Metre
------	--------	--------	------	--------	-------

3e

DRAFT

Eng. Smith

Brown Clay

Shark 2 Flints

1	-	0.30	1	-	0.30
---	---	------	---	---	------

3	9	1-13	4	9	1-40
---	---	------	---	---	------

20	3	684	25	-	7.62
----	---	-----	----	---	------

UPPER
COTTON

B.Y.

10/2/57

Appendix 5

Flood Maps and Correspondence

Flood map for planning

Your reference
23482

Location (easting/northing)
499297/104235

Created
14 Jan 2021 11:20

Your selected location is in flood zone 3, an area with a high probability of flooding.

This means:

- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see www.gov.uk/guidance/flood-risk-assessment-standing-advice)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

The Open Government Licence sets out the terms and conditions for using government data.
<https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Flood map for planning

Your reference
23482

Location (easting/northing)
499297/104235

Scale
1:2500

Created
14 Jan 2021 11:20

-  Selected area
-  Flood zone 3
-  Flood zone 3: areas benefitting from flood defences
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Flood storage area

0 20 40 60m

Page 2 of 2



Extent of flooding from surface water



Historic Flood Map





Notes:

The Arun SFRA is a strategic assessment of flooding. Users of the SFRA should be aware of this when interpreting the information presented. The user is directed to the SFRA reports which outline the uncertainties associated with the studies. Particular attention is drawn to the following:

- Flood extent boundaries are not considered definitive. Land adjacent to these areas may also be at risk.
- Some flooding mechanisms have not been included in the assessment. The 'coastal risk area' is based on advice from LA Engineers and requires further assessment.

Arun District Council SFRA

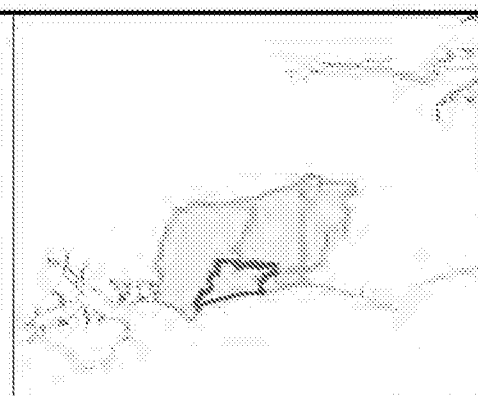
Map A1-F - Actual and Residual Risk of Flooding from Rivers



CAPITA SYMONDS

Legend

- Arun District Boundary
- Actual Defended Fluvial Flood Risk (1% AEP, 2008)
- Residual Defended Fluvial Flood Risk (0.1% AEP, 2005)



0 2 4
Kilometres

Scale at A3: 1:80,000

Date: 31/01/2008

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Map_A1-F.wor



Notes:

The Arun SFRA is a strategic assessment of flooding. Users of the SFRA should be aware of this when interpreting the information presented. The user is directed to the SFRA reports which outline the uncertainties associated with the studies. Particular attention is drawn to the following:

- Flood extent boundaries are not considered definitive. Land adjacent to these areas may also be at risk.
- Some flooding mechanisms have not been included in the assessment. The 'coastal risk area' is based on advice from LA Engineers and requires further assessment.

Arun District Council SFRA

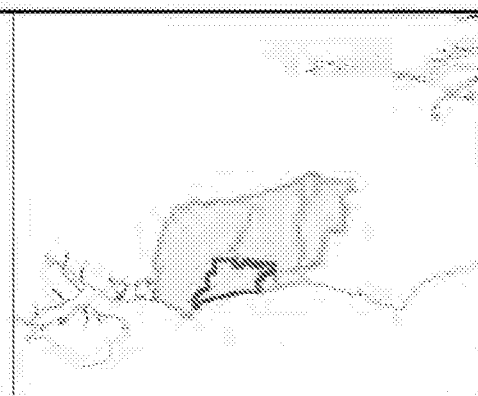
Map A1-T - Actual and Residual Flooding from the Sea



CAPITA SYMONDS

Legend

-  Arun District Boundary
-  Actual Defended Tidal Flood Risk (0.5% AEP, 2006)
-  Residual Defended Tidal Flood Risk (0.1% AEP, 2006)
-  Coastal Risk Area



0 2 4
Kilometres

Scale at A3: 1:80,000

Date: 31/01/2008

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Map_A1-T wor



Notes:

The Arun SFRA is a strategic assessment of flooding. Users of the SFRA should be aware of this when interpreting the information presented. The user is directed to the SFRA reports which outline the uncertainties associated with the studies. Particular attention is drawn to the following:

- Flood extent boundaries are not considered definitive. Land adjacent to these areas may also be at risk.
- Some flooding mechanisms have not been included in the assessment. The 'coastal risk area' is based on advice from LA Engineers and requires further assessment.

Arun District Council SFRA

Map B - Residual Risk from Breach



CAPITA SYMONDS

Legend

- Arun District Boundary
- Main River
- Modelled Fluvial Breach Extents - Residual Risk
- Modelled Tidal Breach Extents - Residual Risk
- ▲ Proposed Breach Locations



0 2 4
Kilometres

Scale at A3: 1:80,000

Date: 31/01/2008

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Map_B.wor

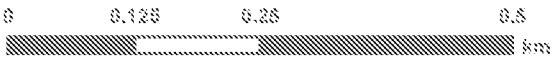


Key Plan



Legend

- Arun District SFPA boundary
- Main Rivers
- Aidingbourne Rife
- Ash Grays
- Barnham Lane Ditch
- Barnham Rife
- Bock Ditch
- Deasy Ponds Ditch
- East Poling Oram
- East Springs Ditch
- Ferring Rife
- Forebridge Rife
- Lidsey Rife
- Little Tortington Stream
- North Barning Ditch
- Pegham Harbour Channels
- Pegham Rife
- River Arun
- Rope Walk Ditch
- Ryebank Rife
- Shrotony Manor Ditch
- West Poling Oram
- Ypton Rife
- Ordinary watercourse



REF	Date	Comments
A	June 2016	
B		
C		

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ARUN DISTRICT COUNCIL

LEVEL 1 SFRA: APPENDIX B WATERCOURSES

Sheet No. 34 of 48 Inner Number: AGC_34

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Notes

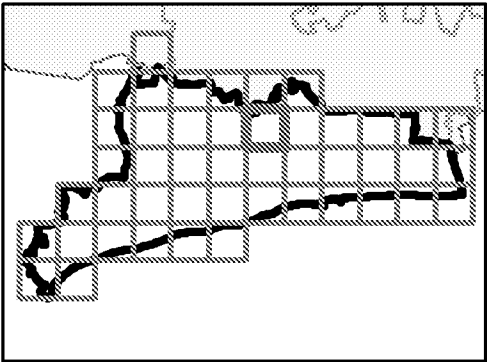
Zone 1: Comprised of land having a less than 1 in 1,000 annual probability of river or sea flooding in any year.

Zone 2: Comprised of land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding or 1 in 200 and 1 in 1,000 annual probability of sea flooding in any year.

Zone 3a: This zone comprises land assessed as having a greater than 1 in 100 annual probability of river flooding or a greater than 1 in 200 annual probability of flooding from sea in any year.

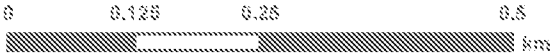
Zone 3b: This zone comprises land where water has to flow or be stored in times of flood (the functional floodplain). The SFRA identified this Flood Zone as land which would flood with an annual probability of 1 in 20 years, where detailed modelling exists. In the absence of detailed hydraulic model information, a precautionary approach has been adopted with the assumption that the extent of Flood Zone 3b would be equal to Flood Zone 3a. If development is shown to be in Flood Zone 3a, further work should be undertaken as part of a detailed site specific

Key Plan



Legend

- Arun District SFRA boundary
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2



REF	Date	Comments
A	June 2016	
B		
C		

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ARUN DISTRICT COUNCIL

LEVEL 1 SFRA: APPENDIX C FLOOD ZONES

Sheet No. 34 of 48 Index Number: AGC_34

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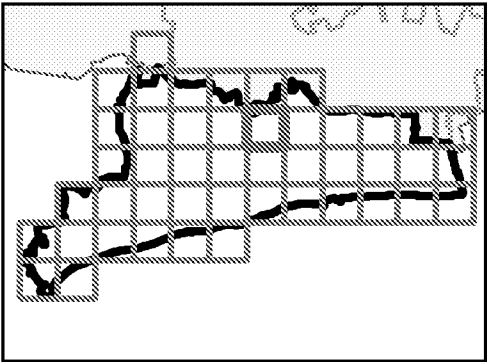
Notes

Hydraulic modelling has been undertaken as part of this SFRA to provide updated climate change flood mapping in the Arun District for Flood Zone 3a. This modelling followed the latest guidance for climate change in FRAs/SFRAs released by the Environment Agency in February 2016 (and updated in April 2016). Climate change for fluvial events has been based on the Higher Central estimates for the years 2031, 2061 and 2111. Present day flood risk information is available for comparison. Arun District is within the South East River Basin District and therefore allowance are:

- 2031 = +15% flows
- 2061 = +30% flows
- 2111 = +45% flows

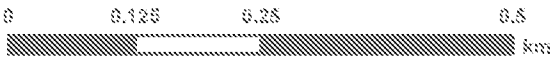
For tidal/coastal models, undefended case still water level and defended case still water level with wave overtopping simulations have been completed to inform future flood risk within the Arun District. Again, climate change allowance predictions are for the years 2031, 2061 and 2111, with present day outputs for comparison.

Key Plan



Legend

- Arun District SFRA boundary
- Present Flood Zone 3a
- Future Flood Zone 3a (2031)
- Future Flood Zone 3a (2111)
- Future Flood Zone 3a (2061)



REF	Date	Comments
A	August 2016	
B		
C		

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ARUN DISTRICT COUNCIL

**LEVEL 1 SFRA: APPENDIX D
CLIMATE CHANGE MAPPING**

Sheet No: 34 of 46 Index Number: ADC_34

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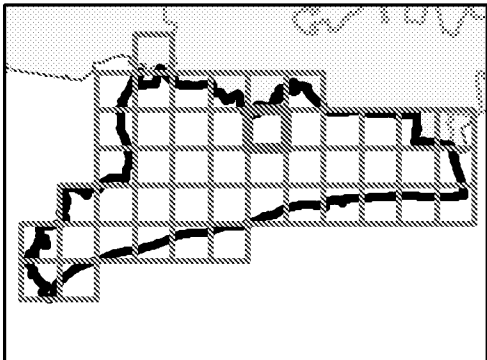
Notes

The updated Flood Map for Surface Water (uFMSW) shows the flooding that takes place from the 'surface runoff' generated by rainwater (including snow and other precipitation) which:
(a) is on the surface of the ground (whether or not it is moving), and
(b) has not yet entered a watercourse, drainage system or public sewer.

The uFMSW will pick out natural drainage channels, rivers, low areas in the floodplain and flow paths between buildings but it will only indicate flooding caused by local rainfall.

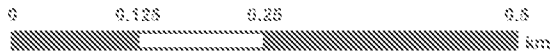
Note: The uFMSW shows predictions of flooded areas but does not show whether individual properties will be affected by surface water flooding or have been affected in the past. The uFMSW should not be used to predict if individual properties will flood.

Key Plan



Legend

- Arun District SFRA boundary
- uFMSW 30-year extent
- uFMSW 100-year extent
- uFMSW 1,000-year extent



REF	Date	Comments
A	June 2010	
B		
C		

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ARUN DISTRICT COUNCIL

LEVEL 1 SFRA: APPENDIX E SURFACE WATER FLOOD RISK

Sheet No. 34 of 48 Index Number: AGC_34

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Notes

The Areas Susceptible to Groundwater Flooding (ASiGWF) is a strategic scale map showing groundwater flood areas on a 1km square grid. The data was produced to annotate Indicative Flood Risk Areas for Preliminary Flood Risk Assessment (PFRA) studies and allow the Lead Local Flood Authorities (LLFAs) to determine whether there may be a risk of flooding from groundwater.

This data shows the proportion of each 1km grid square where geological and hydrogeological condition show that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring. It does not take account of the chance of flooding from groundwater rebound. This dataset covers a large area of land, and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding.

The ASiGWF data should be used only in combination with other information, for example local data or historic data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale where finer resolution datasets exist.

Key Plan



Legend

-  Arun District SFRA boundary
-  < 25%
-  >= 25% < 50%
-  >= 50% < 75%
-  >= 75%



REF	Date	Comments
A	June 2012	-
B		
C		

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ARUN DISTRICT COUNCIL

LEVEL 1 SFRA: APPENDIX F AREAS SUSCEPTIBLE TO GROUNDWATER

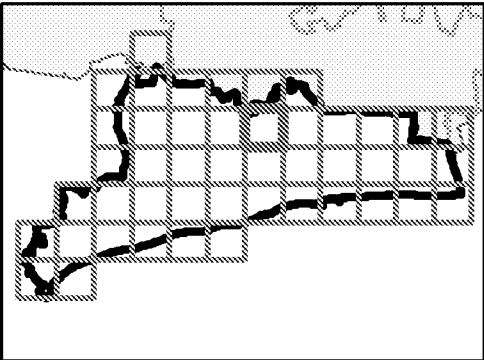
Sheet No. 34 of 48 Index Number: ADC_34

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Key Plan



Legend



Arun District SFRA boundary



Gap in Littlehampton defence

Defence type and maintainer



Embankment, Environment Agency



Embankment, Private



Embankment, Unknown



Wall, Environment Agency



Wall, Local Authority



Wall, Private



Shingle Beach, Environment Agency



Shingle Beach, Local Authority



Shingle Beach, Littlehampton Harbour



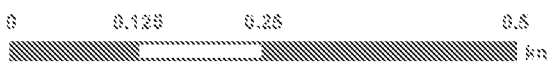
Shingle Beach, Private



Shingle Beach, Worthing Borough



Unknown



REF	Date	Comments
A	June 2016	
B		
C		

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ARUN DISTRICT COUNCIL

LEVEL 1 SFRA: APPENDIX I DEFENCES

Sheet No. 34 of 48

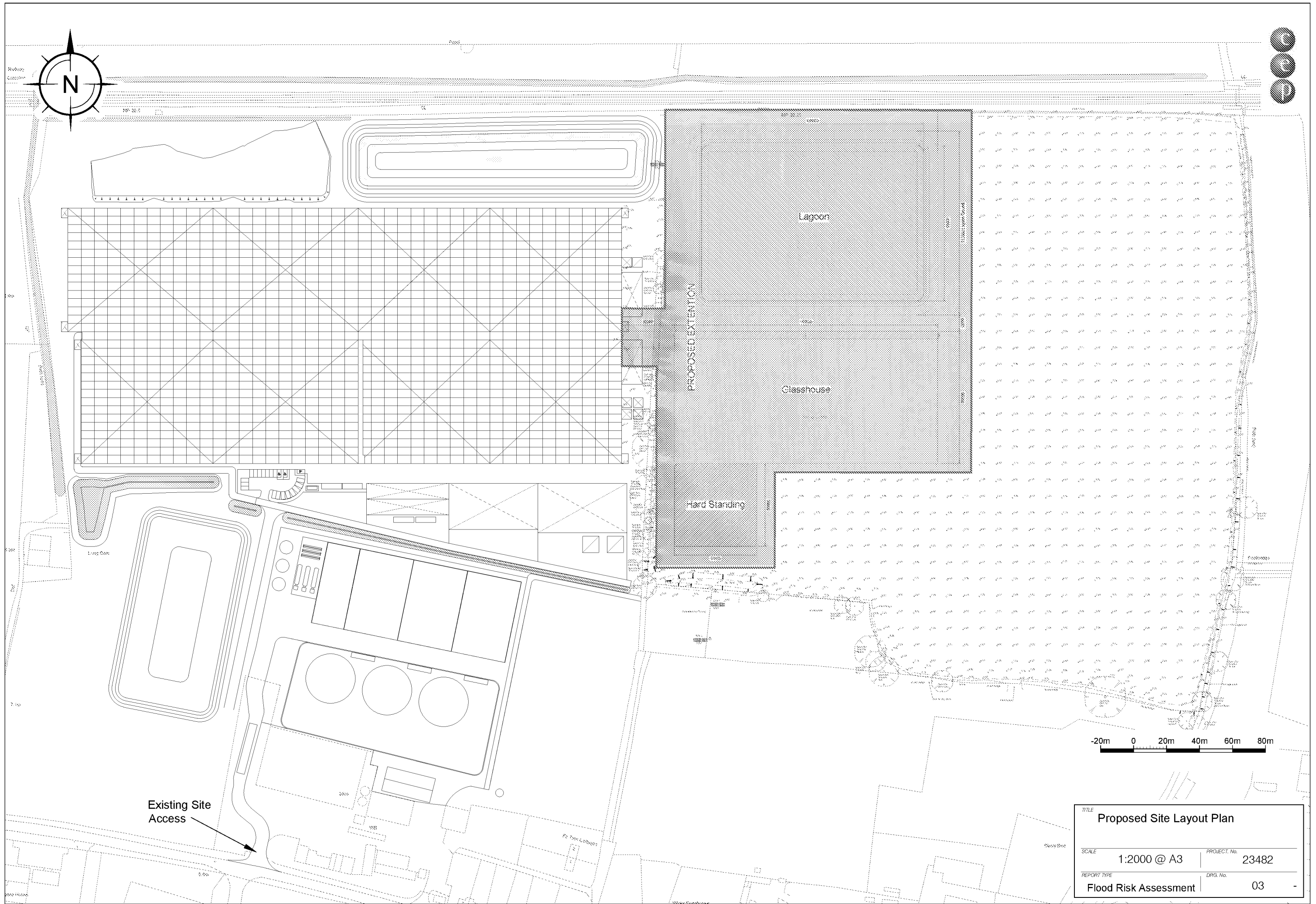
Index Number: AGC_34

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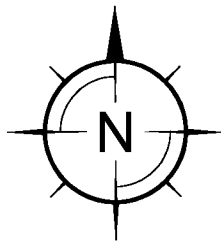
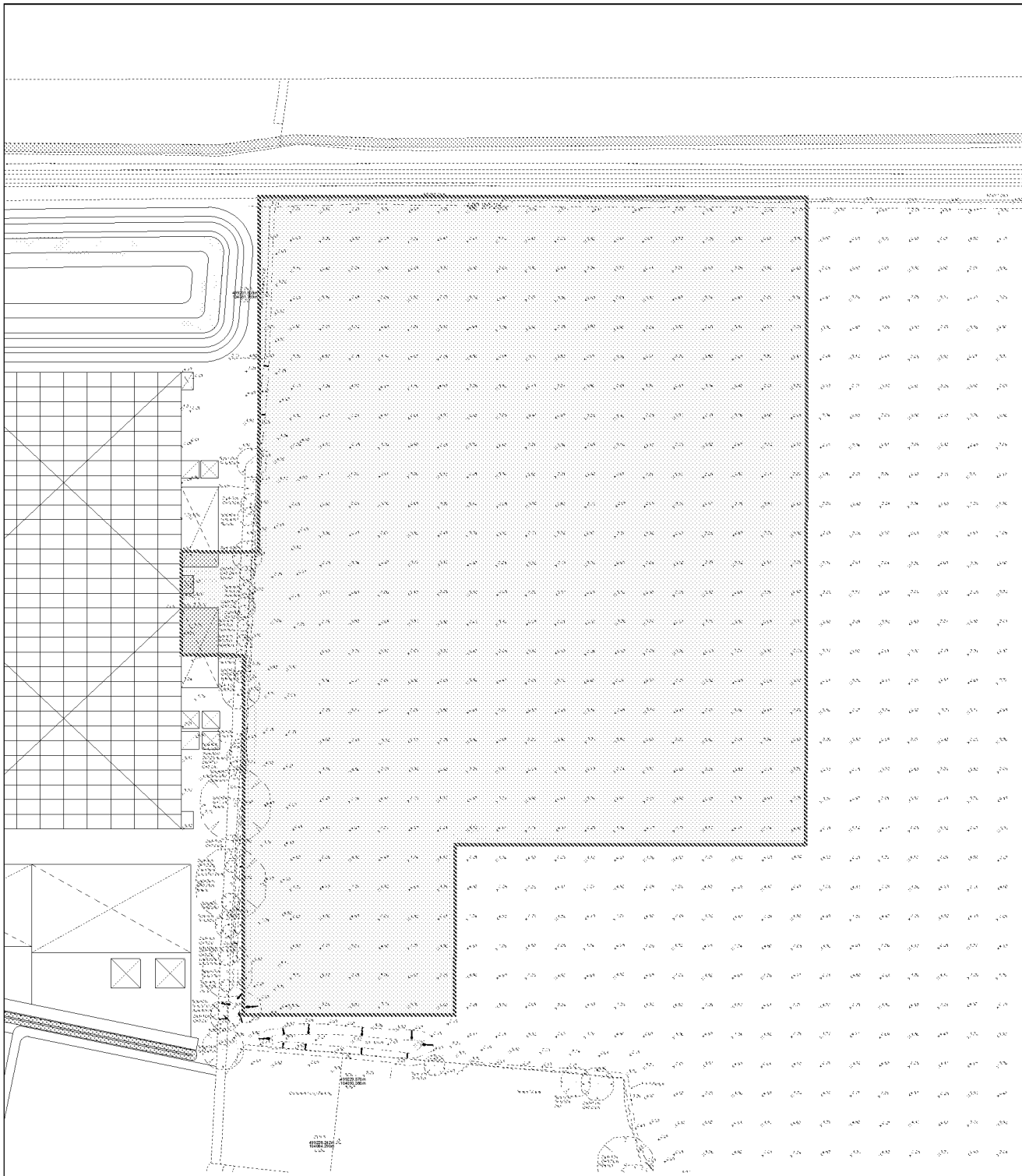
Appendix 6

**Proposed Site Layout Plan
and Impermeable Areas Plan**



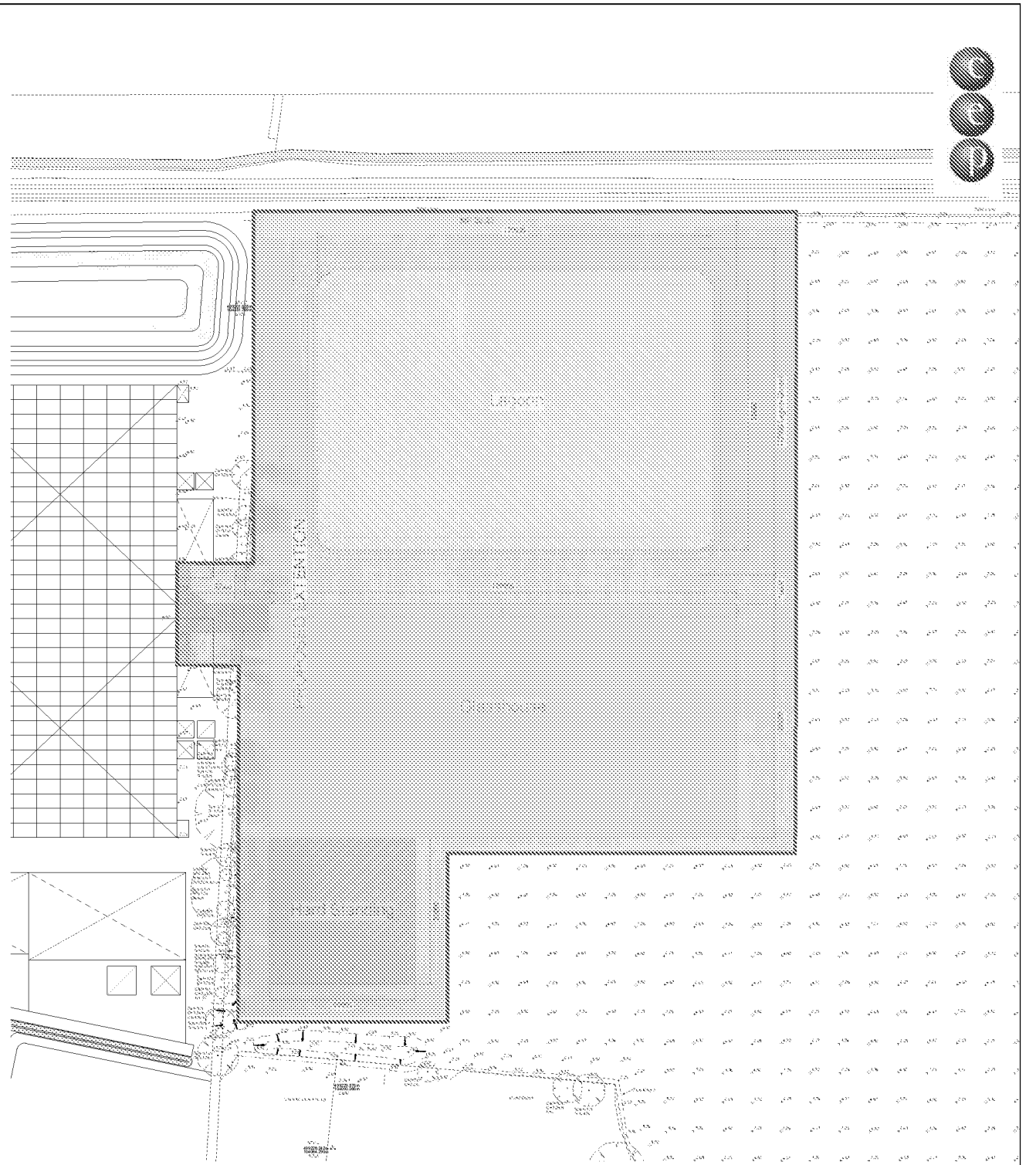
Existing Site
Access

TITLE		Proposed Site Layout Plan	
SCALE		1:2000 @ A3	PROJECT No. 23482
REPORT TYPE		Flood Risk Assessment	DWG. No. 03



Legend - Existing Areas

- 49,990m² Soft Landscaping
- 200m² Hard Landscaping
- 46,280m² Site Boundary



Legend - Proposed Areas

- 49,990m² Soft Landscaping
- 200m² Hard Landscaping
- 12,803m² Reservoir
- 12,800m² Glasshouse
- 46,280m² Site Boundary



TITLE Existing and Proposed Impermeable Areas Plan			
SCALE 1:2000 @ A3		PROJECT No. 23482	
REPORT TYPE Flood Risk Assessment		DRG. No. 04	

Appendix 7

**Drainage Strategy Plans and Calculations
and Exceedance Event Flow Route Plan**



 The Civil Engineering Practice BN41 1RA www.civil.co.uk		File: Yard.pfd Network: Storm Network 1 Steve Doughty 19/01/2021		Page 1 23482 Wicks Farm Surface Water Storage Yard Area	
---	--	---	--	--	--

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.850	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	Cover Level (m)	Depth (m)
1	0.250	5.000	0.330

Simulation Settings

Rainfall Methodology	FEH-13	Skip Steady State	✓	2 year (l/s)	0.0
Summer CV	0.850	Drain Down Time (mins)	240	Check Discharge Volume	✓
Winter CV	0.850	Additional Storage (m³/ha)	0.0	100 year 360 minute (m³)	
Analysis Speed	Normal	Check Discharge Rate(s)	✓		

Storm Durations

360	600	960	2160	4320	7200	10080
480	720	1440	2880	5760	8640	

Climate Change

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Soil Index	1	Betterment (%)	0
Greenfield Method	IH124	SPR	0.10	QBar	
Positively Drained Area (ha)		Region	1	Q 2 year (l/s)	
SAAR (mm)		Growth Factor 2 year	0.90		

Pre-development Discharge Volume

Site Makeup	Greenfield	SPR	0.10	Storm Duration (mins)	360
Greenfield Method	FSR/FEH	CWI		Betterment (%)	0
Positively Drained Area (ha)		Return Period (years)	100	PR	
Soil Index	1	Climate Change (%)	0	Runoff Volume (m³)	

Node 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	4.670	Product Number	CTL-SHE-0078-2000-0230-2000
Design Depth (m)	0.230	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	4.670
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	



Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	2500.0	0.0	0.230	2500.0	0.0	0.231	0.0	0.0



Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
480 minute winter	1	464	4.893	0.223	17.8	166.9729	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
480 minute winter	1	Hydro-Brake®	2.0	64.5

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.850	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	Cover Level (m)	Depth (m)
1	2.583	6.500	0.575

Simulation Settings

Rainfall Methodology	FEH-13	Skip Steady State	✓	2 year (l/s)	0.0
Summer CV	0.850	Drain Down Time (mins)	2000	Check Discharge Volume	✓
Winter CV	0.850	Additional Storage (m³/ha)	0.0	100 year 360 minute (m³)	
Analysis Speed	Normal	Check Discharge Rate(s)	✓		

Storm Durations

360	600	960	2160	4320	7200	10080
480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
10	40	0	0
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	1
Greenfield Method	IH124	Growth Factor 2 year	0.90
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 2 year (l/s)	
SPR	0.10		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m³)	

Node 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	5.925	Product Number	CTL-SHE-0083-2600-0575-2600
Design Depth (m)	0.575	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.6	Min Node Diameter (mm)	1200

Node 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.925
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	12369.0	0.0	0.575	12826.5	0.0

Results for 10 year +40% CC Critical Storm Duration. Lowest mass balance: 99.97%

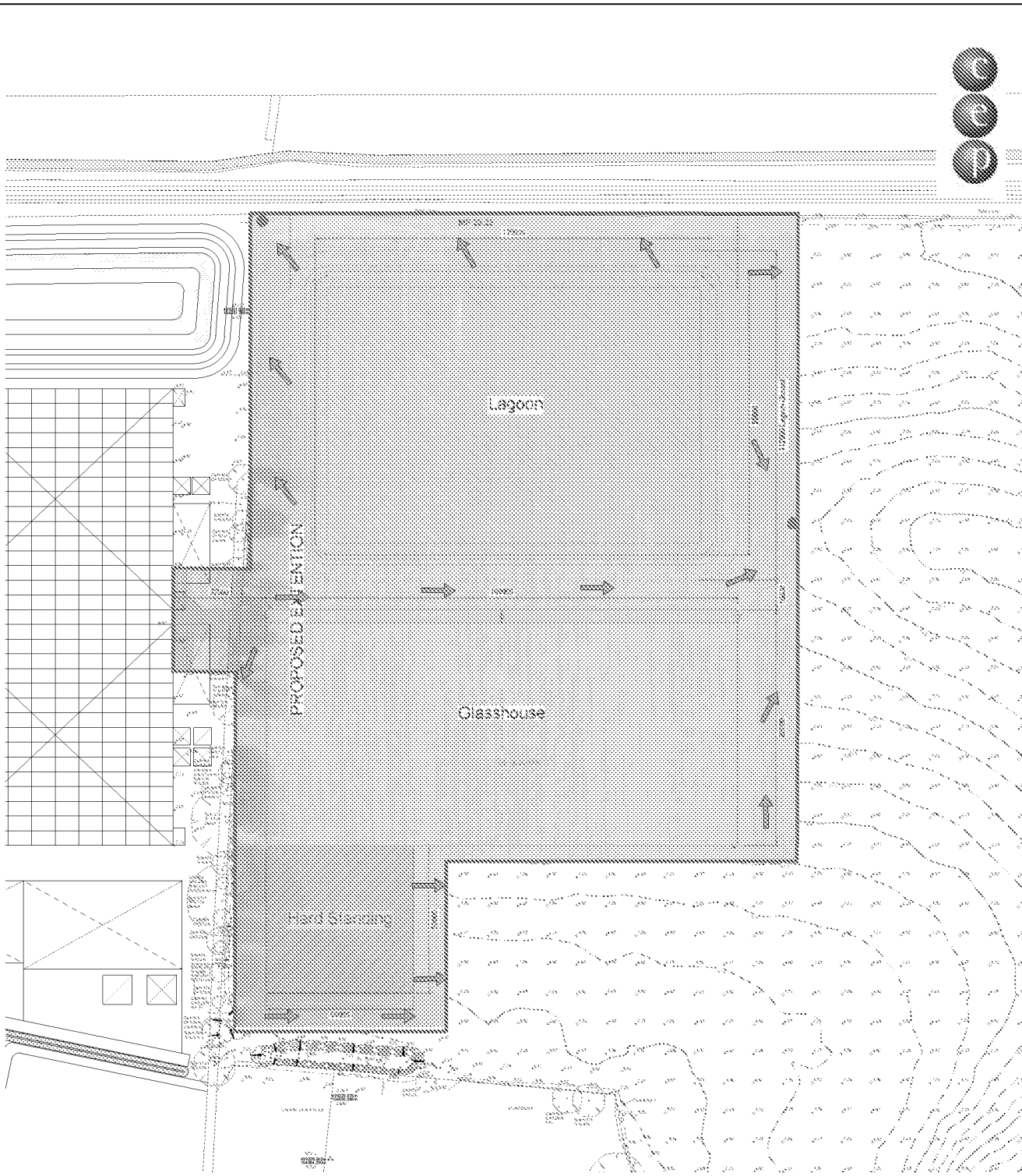
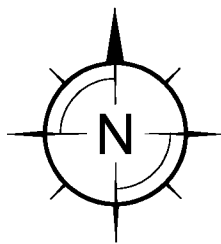
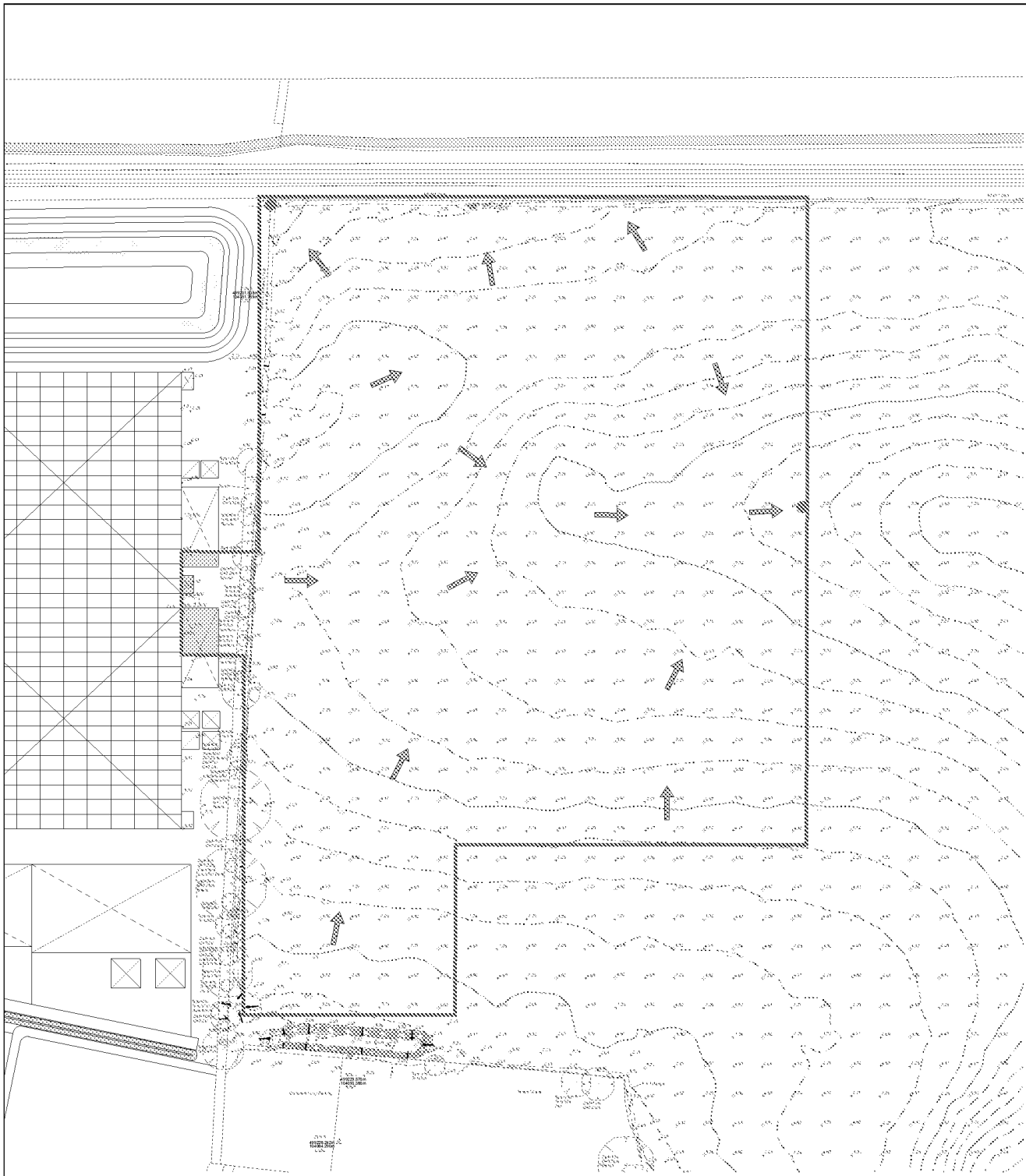
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
10080 minute summer	1	7740	6.112	0.187	20.9	2324.6550	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
10080 minute summer	1	Hydro-Brake®	2.6	1287.1

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
10080 minute winter	1	9600	6.191	0.266	18.1	3313.3370	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
10080 minute winter	1	Hydro-Brake®	2.6	1364.8



LEGEND

..... Contours 0.1m intervals

➔ Exceedance Flow Route

● Site Low Points



TITLE Existing and Proposed Exceedance Flow Route Plan			
SCALE 1:2000 @ A3		PROJECT No. 23482	
REPORT TYPE Flood Risk Assessment		DRG. No. 06	

Appendix 8

**Arun District Council's Surface Water
Drainage Proposal Checklist**



Surface Water Drainage Proposal Checklist

This 'Surface Water Drainage Proposals Checklist' has been designed to clearly define Arun District Council's and Chichester District Council's expectations and requirements for any surface water drainage proposals, submitted for appraisal by the council's Engineers, during the planning process.

Please be aware that it is in your interest to provide all of the requested information, as this will allow the council's Engineers to quickly and efficiently review your proposals. The omission of any requested information may lead to delays in the planning process.

This document will be of help to any applicant, or drainage consultant, preparing to submit a 'Discharge of Conditions Application' relating to surface water drainage conditions. Alternatively, it can also be used earlier in the planning process, if the applicant wishes to avoid pre-commencement conditions relating to surface water drainage. The Town and Country Planning Regulations now require pre-commencement conditions to have the prior agreement of the applicant regarding their wording and use. Therefore, if you wish to avoid pre-commencement conditions, in relation to surface water drainage, you will need to submit proposals that provide the information requested in this checklist and also align with the requirements of the following documents:

West Sussex Policy for the Management of Surface Water (WSCC)

'Supplementary Requirements for Surface Water Drainage Proposals'. (Arun DC)

'Supplementary Requirements for Surface Water Drainage Proposals'. (Chichester DC)

By submitting all of the information requested by this checklist you will enable the council's Engineers to determine whether your proposals follow the hierarchy for sustainable drainage and will adequately drain the site.

Please be aware that it will be difficult for the council's Engineers to undertake a timely assessment of your application if you fail to provide any of the information requested.



Surface Water Drainage Proposal Checklist

Ground Investigation Results			
Results Required	Results Provided?		
Winter groundwater monitoring results (Please refer to guidance note 1 below)	Yes	No	X
Period of winter groundwater monitoring ^{Note 1}	From	DD/MM/YYYY	
	To	DD/MM/YYYY	
Maximum recorded groundwater level	mAOD mBGL		
Winter infiltration test results ^{Note 2}	Yes	No	X
Date of winter infiltration testing	DD/MM/YYYY		
Details of the location and depth of the infiltration testing ^{Note 3}	Yes	No	
Minimum infiltration rate ^{Note 4}	m/s		

Guidance Notes

1. A full winters groundwater monitoring should be undertaken, (October to March inclusive) to enable the peak annual groundwater levels to be established. The extent of winter monitoring for developments of less than 5 properties should be discussed with the council's Engineers.
2. Infiltration testing should be undertaken during the wet winter months (typically January) and in line with BRE365, or a similar approved method. Tests should be repeated 3x, to replicate saturated ground conditions. Please note that infiltration testing is to be carried out at a time and depth agreed with the Councils engineers.
3. Infiltration testing should be undertaken at the location and depth of any proposed infiltration structures. This must be above the maximum recorded groundwater level in that vicinity.
4. The minimum infiltration rate obtained at the location and depth of the proposed infiltration structures should be used to inform the design of the structures.

Proposed Method of Surface Water Disposal			
Infiltration On-site, via soak-away structures	Yes	No	X
If on-site infiltration is not to be used, has justification for this been provided? ^{Note 5}	Yes	X	No
Attenuation (on-site) with a restricted discharge to a watercourse on, or adjacent to, the site	Yes	X	No
Attenuation (on-site) with a restricted discharge to a surface water sewer on, or adjacent to, the site	Yes	No	X
Attenuation (on-site) with a restricted discharge to a foul water sewer on, or adjacent to, the site	Yes	No	X

Guidance Notes

5. If on-site infiltration is not being used to drain the site you will need to provide evidence that demonstrates on-site infiltration is unviable.

Drainage Design: Supporting Calculations					
Calculations Required			Calculations Provided?		
Infiltration	Half-drain time for 10 year event (plus climate change allowance)	Yes		No	
		Hours			
	Half-drain time for 100 year event (plus climate change allowance)	Yes		No	
		Hours			
	Calculations demonstrating that the 1 in 100 year event, plus climate change allowance can be accommodated on-site. Note 7	Yes		No	
Attenuation and Subsequent Restricted Discharge	Lowest base level of infiltration structure	mAOD mBGL			
	Has the design sought to provide treatment of potential contaminants? E.g. hydrocarbons.	Yes		No	
Attenuation and Subsequent Restricted Discharge	Pre-development run-off rate calculations	Yes	X	No	
		9.2l/s			
	Proposed discharge rate Note 6	4.6l/s			
	Calculations demonstrating that the 1 in 100 year event, plus climate change allowance can be accommodated on-site. Note 7	Yes	X	No	
	Has the design sought to provide treatment of potential contaminants? E.g. hydrocarbons.	Yes	X	No	
	If your proposed scheme incorporates any impermeable lined attenuation features we require calculations to demonstrate that appropriate resistance to floatation (due to groundwater levels) is catered for in the design	Yes		No	X
	If you propose discharging into or altering an ordinary watercourse; have you sought Ordinary Watercourse/Land Drainage Consent? Note 8	Yes	N/A	No	
Attenuation and Subsequent Restricted Discharge	If discharging to a watercourse, piped system or the sea, has the proposed drainage network been modelled against predicted top water levels for the 1 in 100 year storm event plus climate change allowance, within the existing system? Note 9	Yes		No	X

Guidance Notes

- Any proposed discharge rate must be less than, or equal to, the pre-development rate. Greenfield sites must use the mean flow rate (Qbar) and be based upon the area occupied by the development, ignoring significant open spaces. Please note that the minimum acceptable discharge rate is 2l/s when using formal flow control devices, unless otherwise agreed. Additionally, if you are developing a brownfield site, we expect you to provide fully detailed plans of the existing surface water drainage arrangements on site, including impermeable areas, gullies, outfalls, pipes & diameters, manholes, etc. We generally seek 50% betterment in terms of run off from brownfield sites.
- The appropriate factor of safety from the table below must be applied to your calculations to ensure your design is fully in accordance with CIRIA R156/ CIRIA C753.



Factor of Safety Table						
Size of Area to be Drained	Consequences of failure					
	No damage or inconvenience		Minor inconvenience, e.g. surface water on car park		Damage to buildings or structures or roads.	
	Cv=1.0	Cv=0.75	Cv=1.0	Cv=0.75	Cv=1.0	Cv=0.75
<100 m ²	1.5	2	2	3	10	13
100m ² to 1000m ²	1.5	2	3	4	10	13
>1000m ²	1.5	2	5	6.5	10	13

8. Ordinary Watercourse/Land Drainage Consent will need to be sought, ideally in parallel with planning permission, if you propose discharging into, culverting or altering a watercourse.
9. Modelling is required to ensure that problems, such as surcharged outfalls, are addressed.

Plans/Drawings/Diagrams				
Required		Provided?		
Plan detailing the location of groundwater monitoring and infiltration testing		Yes	No	NO
Detailed drainage layout plan ^{Note 10}		Yes	No	YES
Construction detail plans ^{Note 11}		Yes	No	NO
Exceedance flow route plans ^{Note 12}		Yes	No	YES
Impermeable area plan		Yes	No	YES
If ground levels are being raised ≥ 300mm above existing levels and is unavoidable, have fully detailed plans been provided, together with drainage proposals, to address any potential drainage related issues.		Yes	No	NO

Guidance Notes

10. Drainage layout plans should include:
 - All surface water drainage pipes labelled with; diameters, pipe materials, falls and invert levels.
 - All infiltrating and attenuating structures (including permeable paving) labelled with; dimensions, invert and cover levels.
 - All manholes labelled with; cover levels, invert levels, cover types detailed.
 - All silt traps clearly labelled with sump depths.
 - Control structures with outflow rates and invert levels.
 - Proposed/existing levels of any areas subject to ground raising, together with suitable measures/detailed drawings for the associated management of surface water runoff. Please note that ground raising should be avoided unless there are exceptional circumstances.
11. Site specific construction detail plans should be supplied if your proposed drainage scheme includes any of the following elements: pipe bed and surround; infiltrating structures; attenuating structures; manholes; catch-pits/silt traps; control devices; permeable paving; headwalls.



12. Unless specifically requested by the council's drainage engineers 'Exceedance Flow Route Plans' are only required for developments of more than 5 residential properties or more than 0.5ha of commercial development .

Appendix 9

Outline Drainage Maintenance Schedule

Drainage Maintenance Schedule



The Civil Engineering Practice
11 Tungsten Building
George Street
Fishergate
Sussex
BN41 1RA

Project	Wicks Farm - East, Ford Lane, Ford, West Sussex
Project Number	23482

By S Burgess

Date 9 April 2021

1 Schedule of Maintenance

- 1.1 Once appointed the Contractor will prepare a site specific method statement for the control of silt and other pollutants during construction. CIRIA Report C532, Control of water pollution from construction sites, provides further guidance on this.
- 1.2 The Contractor will maintain the proposed drainage system during construction and until the handing over of the site.
- 1.3 Upon completion, responsibility for regular and corrective maintenance of all elements of the drainage system will be passed on to a Site Operator and managed by them.
- 1.4 An initial pre-handover inspection of the scheme will be undertaken to ensure that it has been constructed as designed.
- 1.5 The following maintenance schedules detail the typical tasks to be undertaken at different intervals and is based on the maintenance requirements outline in Chapter 32 of CIRIA document C753 'The SuDS Manual'.

Maintenance Schedule	Required Action	Frequency
Regular / Occasional Maintenance	Inspections and reporting on the whole drainage system	2 monthly or after significant storm events*
	Litter and debris removal – trash screen, catch pits, Hydrobrake control device, swales, permitter ditches, pond and reservoir	Monthly or as required
	Grass Cutting – swales, pond and reservoir	Monthly or as required
	Weed and invasive plant control – swales, pond and reservoir	As required
	Shrub Control – swales, pond, permitter ditches and reservoir	As required
	Aquatic and shoreline vegetation management	As required
	Surface and foul water pipework, channel drains, headwalls and fin drains – jetting / rodding	Every 2 years or as required
	Remove sediment and debris from silt trap chambers, channel drains and inlet chambers	6 monthly
	Remove sediment and debris from swales, pond and permitter ditches and reservoir	Once a year
	Inspection of foul pumping station	Once a year



* During the first year of operation inspections will usually be carried out monthly and/or after significant storm events to ensure that the system is functioning as designed and that no damage is apparent.

Maintenance Schedule	Required Action	Frequency
Corrective Maintenance	Remove debris and/or blockages from the drainage systems including, trash screen, silt traps, channel drains, fin drains, Hydrobrake control device	As required
	Repairs to access chambers, pipework, silt traps, manhole covers, fin drains, channel drains, headwalls, trash screens and grilles	As required
	Inspect inlet, outlet from downpipe and gullies for blockages, standing water and clear	As required
	Service and/or repair foul pumping station apparatus	As required/ when alarm indicates
	Replace Hydrobrake control device	As required/every 25 years
	Replace foul pumping station	As required/every 10 years

Indicative Schedule of Maintenance for the Proposed Drainage System

- 1.6 Provisions will be made to replace any infrastructure that has reached the end of its serviceable design life and will be replaced on a like for like basis as far as reasonably practicable.
- 1.7 A copy of the Hydrobrake specifications are attached at the rear of this document.

2 Financing

- 2.1 The regular and corrective maintenance of all elements of the drainage system will be managed and funded through by the Site Operator:-

Inspection / Action Required	Gullies, Channels, Fin Drains and Gutters	Catchpits / Inspection Chambers	Surface and Foul Water Pipework	Headwalls and Trash Screen	Pond / Swales / Reservoir	Hydrobrake Control Device	Foul Pumping Station
After leaf fall in Autumn	✓	✓					
Monthly	✓				✓		
2 Monthly	✓	✓	✓	✓	✓	✓	✓
6 Months	✓	✓		✓			
1 Year					✓		✓
2 Years			✓				
10 Years							✓
25 Years						✓	
When alarm indicates							✓

Drainage System Maintenance Summary