HOLLAM FARM, TITCHFIELD

FLOOD RISK ASSESSMENT
AND
NITRATE NEUTRALITY REVIEW

PREPARED FOR

CMS

Condon Drew Associates

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DOCUMENT HISTORY

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NOTICE

This document and its contents have been prepared and are intended solely for information and use by CMS in relation to an application for a development on the existing HOLLAM FARM, TITCHFIELD, Wiltshire.

TECHNICAL SUMMARY

Our Ref	1257
Site Name	HOLLAM FARM, TITCHFIELD
Client	CMS
Grid Reference	SU 543661 05477
Nearest Postcode	PO14 3QL
Site Size	1.8 ha
Site Proposals	Demolition of existing buildings and the erection of two dwellings with garaging and ecological enhancements.
Flood Risk (Rivers and Seas)	Very low to High
Flood Risk (Surface Water)	Very low to Medium
Flood Risk (Reservoirs)	Very low
Flood Risk (Other Sources)	Very low
Greenfield Runoff Rate (QBar)	1.2 l/s
SuDS Features Proposed	Permeable Paving
Foul Drainage Strategy	Gravity discharge from site to drainage ditch following PTP and reed bed system.

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1 INTRODUCTION

Brief

1.1 Condon Drew Associates Ltd (CDA) have been appointed by CMS (the Client) to prepare a Flood Risk Assessment (FRA) and surface and foul water drainage strategy to support a proposed residential redevelopment at Hollam Farm in Titchfield, Hampshire (the Site).

1.2 The proposed development comprises the demolition of existing buildings and the erection of two dwellings with garaging and ecological enhancements. The existing access from Titchfield Road (B3334) will be retained for the new properties.

Requirement for a Flood Risk Assessment

1.3 The site is shown to be located mostly in Flood Zone 1 on the Government Flood Map for Planning; however, a small portion of the site is within Flood Zones 2 and 3 at the western boundary. In line with advice from the NPPF, all developments affected by Flood Zones require a site-specific FRA.

Purpose of the Report

1.4 The purpose of the Report is to ensure that the site is not exposed to unacceptable flood risk post-development, and to confirm that the proposed development will not increase risk of flooding elsewhere.

1.5 The Report demonstrates that with respect to flooding risks, the Site is appropriate for development and is compatible with the NPPF and appropriate policies and best practice procedures in relation to flood risk.

Scope of the Risk Assessment

1.6 This FRA outlines the flood risk and drainage issues in relation to the development proposals. The purpose of this report is to demonstrate how the development complies with planning policy on flood risk (National Planning Policy Framework, and the supporting Planning Practice Guidance) and drainage.

1.7 The structure of this report is summarised below:

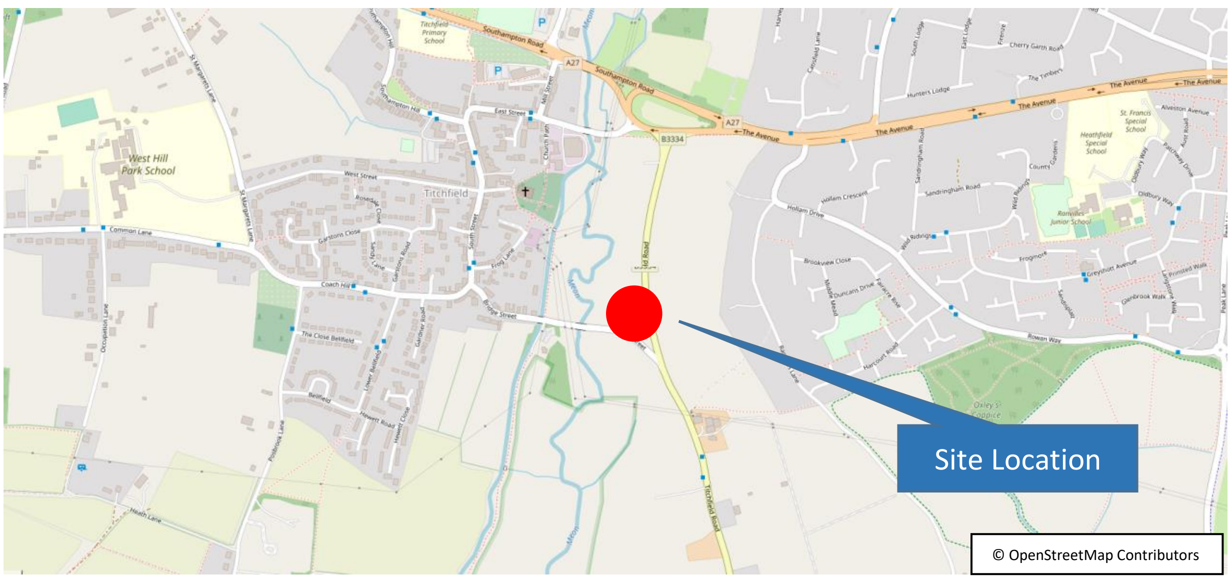
- Section 2: Describes the existing conditions with respect to flooding and drainage;
- Section 3: Provides a commentary on how flood risk from a range of potential sources may or may not constrain the development proposals;
- Section 4: Outlines the development proposals and suitability of the development;
- Section 5: Describes how surface water can be discharged from the site without increasing flood risk elsewhere;
- Section 6: Describes how foul water can be discharged from the site;
- Section 7: Considers the impact of Nitrates on the Site in line with the recent guidance published by Natural England;
- Section 8: Presents a summary of the report and identifies the main conclusions that can be drawn.

2 SITE DESCRIPTION

Site Location

2.1 The site is located to the west of the B3334, Titchfield Road, and north east of Bridge Street at the east of Titchfield. The site is part of Hollam Farm and is a vegetated area with several small outbuildings on. To the south of the site is the Hollam Farm house. To the west is farmland, beyond which is the River Meon. To the east and south is agricultural land. The site location in its local context is shown in **Figure 2.1** below:

Figure 2.1: Site Location



Topography

2.2 A topographical survey of the site was undertaken in September 2019 and is included in **Appendix A**. From the topographical survey, it can be seen that the site falls from east to west at a fairly consistent gradient of 1 in 10. Levels range from around 52.8mAOD at the eastern boundary to 48.4mAOD at the eastern boundary.

Hydrology

2.3 There are no watercourses on the site, although there is an ordinary watercourse at the western boundary which runs due west, discharging into the River Meon approximately 75m west of the site boundary. The River Meon is the nearest Main River (as designated by the EA) and flows due south to its discharge in the Solent.

Hydrogeology

2.4 According to the British Geological Survey (BGS), the bedrock geology at the site is London Clay Formation with superficial deposits recorded as Alluvium on the site.

2.5 Borehole logs available on the BGS indicate that ground water levels have been encountered at shallow depths (less than one metre).

2.6 Based on the above, it is unlikely that infiltration is a viable mode of discharge as a minimum clearance between groundwater and the base of any infiltration device will not be possible.

3 FLOOD RISK

National Planning Policy Framework

3.1 The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. The NPPF was revised in June 2019 with recent revisions including added onus on using opportunities provided by new developments to reduce the causes and impacts of flooding.

3.2 Flooding is addressed in Section 14 'Meeting the Challenge of Climate Change, Flooding and Coastal Change' of the NPPF. Footnote 50 to the NPPF states:

> *"A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use."*

3.3 The Planning Practise Guidance (PPG) supports the NPPF and was also updated, where required, in July 2019. **Table 3.1** (below) is taken from the PPG and sets out the Flood Zone Definitions.

Table 3.1: Flood Zones (PPG Table 1)

Flood Zone	Definition
Zone 1 **Low Probability**	Land having a less than 1 in 1,000 annual probability of river 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 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a **High Probability**	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)

Zone 3b **The Functional Floodplain**	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

3.4 **Table 3.2** (below) defines development by its vulnerability to flooding, with the majority of all development types covered. As can be seen, residential development falls under the "More Vulnerable" category.

Table 3.2: Flood Risk Vulnerability Classification (PPG Table 2)

Essential Infrastructure
• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly Vulnerable
• Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located

in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').
More Vulnerable
• Hospitals • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill* and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable
• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill* and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.

Water-compatible development
• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves. • Navigation facilities. • Ministry of Defence defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

3.5 **Table 3.3** (overleaf) considers the compatibility of the vulnerability classes from **Table 3.2** with the different Flood Zones from **Table 3.1.** As shown, residential developments are appropriate in Flood Zone 1.

Table 3.3: Flood Risk Vulnerability and Flood Zone Compatibility (PPG Table 3)

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

Key:

✓ Development is appropriate

✗ Development should not be permitted

Notes to **Table 3.3**:

- This table does not show the application of the Sequential Test which should be applied first to guide development to Flood Zone 1, then Zone 2, and then Zone 3; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;
- The Sequential and Exception Tests do not need to be applied to minor developments and changes of use, except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site;
- Some developments may contain different elements of vulnerability and the highest vulnerability category should be used unless the development is considered in its component parts.

† In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

* In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows and not increase flood risk elsewhere.

Sequential Testing

3.6 Whilst a small portion of the Site for the proposed development site is within Flood Zones 2 and 3, no development is proposed within either Flood Zone. All development within Flood Zone 1. As per Table 3 of the PPG, Flood Zone 1 is compatible with the 'More Vulnerable' class of developments. To this end, the Sequential Test has been applied, in that the development has been located in Flood Zone 1, and the Exception Test is not required.

Strategic Flood Risk Assessment

3.7 The Partnership for Urban South Hampshire (PUSH) Strategic Flood Risk Assessment (SFRA) was updated in 2016 and is the equivalent of a Level 1 SFRA.

3.8 The SFRA mentions Titchfield on four occasions:

- The extent of the River Meon's floodplain downstream of Titchfield;
- Climate change has may put additional pressure on settlements adjacent to rivers (such as Titchfield);
- Titchfield is one of the key areas at risk of flooding in Fareham Borough; and
- Groundwater flooding has been observed around Titchfield.

Lead Local Flood Authority Information

3.9 Hampshire County Council (HCC), as the Lead Local Flood Authority (LLFA) have produced a number of guidance documents which are available on their website. The *Hampshire Groundwater Management Plan* details the risk of groundwater flooding throughout the county and aims to make recommendations to identify, mitigate and maintain areas susceptible to groundwater flooding. The document "*Surface Water and Sustainable Drainage Guidance for Developers, Designers and Planners*" encourages the use of SuDS and highlights the importance of maintenance and required consents.

Sources of Flooding

3.10 The development site lies within Environment Agency (EA) Flood Zones 1, 2 and 3. The western section of the site is within Flood Zone 3, an area with a high probability of flooding, while the majority of the site is within Flood Zone 1, at low probability of flooding. A small band of Flood Zone 2 runs between Zones 1 and 3. All residential development is within Flood Zone 1.

3.11 As the residential development is with Flood Zone 1, this FRA has been prepared to demonstrate that the development will not increase flood risk elsewhere.

3.12 There are a wide range of potential flooding mechanisms which can cause flooding. Each potential source of flooding is discussed individually below:

Tidal Flooding

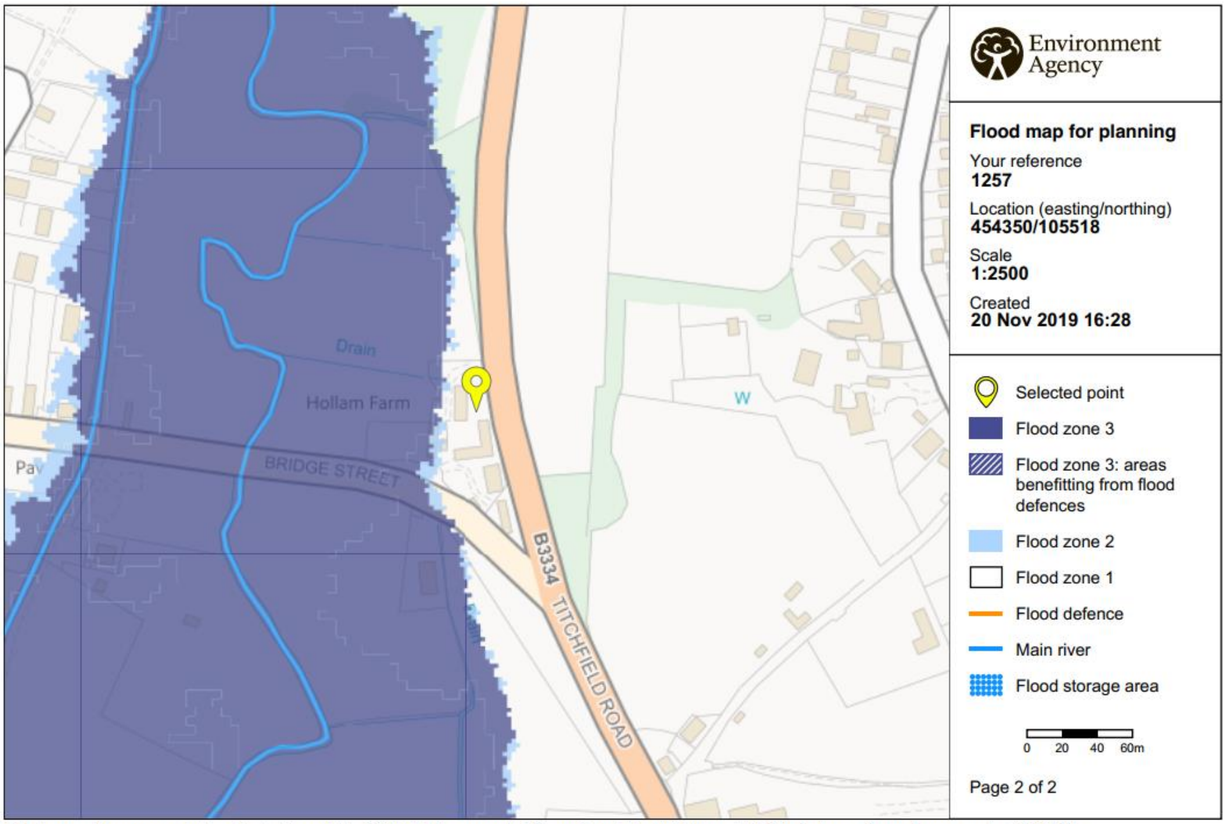
3.13 Tidal flooding occurs through inundation from the sea or estuarine waters. The Site is some 3.25km from the coast, and at an elevation in excess of 50mAOD. As such tidal flooding will not be discussed further in this report.

Fluvial Flooding

3.14 Fluvial flooding occurs through the inundation from rivers and watercourses. The area of Flood Zone 3 in the site is associated with flooding from the River Meon and extends approximately 85m from the River. The eastern 30m or so of the site is within Flood Zone 1 indicating that the development is located in the area of the Site that has a low risk of flooding from fluvial sources (<0.1% annual probability).

3.15 The Government Flood Map for Planning, shown in **Figure 3.1**, overleaf, shows the site in relation to Fluvial and Tidal Flood Zones.

Figure 3.1: Government Flood Map for Planning

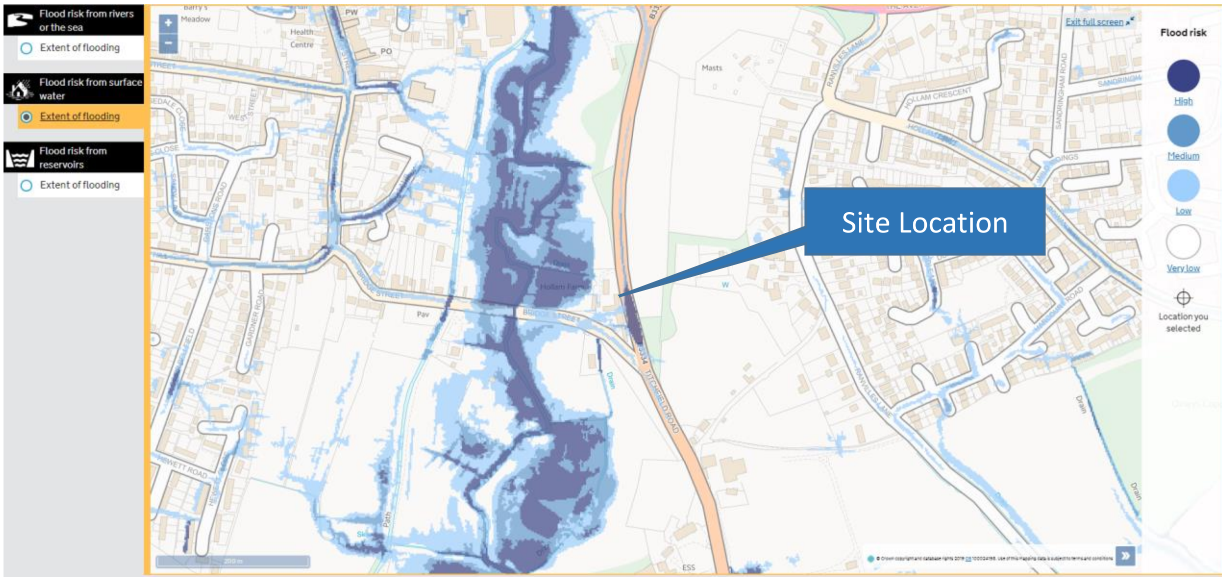


Surface Water Flooding

3.16 This form of flooding can occur during high intensity rainfall events as sheet runoff from fields or large hard paved areas.

3.17 The Government Flood Risk from Surface Water is shown in **Figure 3.2** overleaf. There are two channels of flood risk affecting the site, flowing from east to west from Titchfield Road to the River Meon. This appears to originate from a low point on Titchfield Road and flow through low points to the River.

Figure 3.2: The Government Long Term Flood Risk Information: Surface Water Flood Risk Map



Sewer Flooding

3.18 The SFRA does not mention any sewer flooding in Titchfield. Further investigation shows that there have been instances of sewer flooding in Titchfield, however these incidents have been some distance from the site. It is therefore considered that sewer flooding is not considered a risk.

Groundwater Flooding

3.19 The SFRA states that the River Meon is very sensitive to groundwater conditions as it has a highly permeable upstream geology. It also notes that there has been previous groundwater flooding observed around Titchfield. This is likely due to the permeability of the upstream geology interacting with the limited permeability of the London Clay Formation at the site.

3.20 The Groundwater Management Plan (GWMP) for Hampshire includes a map showing areas susceptible to groundwater flooding (Figure 7) and is included as **Appendix B**. This shows the site to be in a 1km square with less than 25% at risk of groundwater flooding.

Flood Risk from other Sources

3.21 There are no other sources identified as being a flood risk to the site. The Government Long term flood risk maps show the site not to be at risk of flooding from reservoirs.

Summary of Flood Risk

3.22 **Table 3.4** below summarises the flood risk to the site:

Table 3.4: Flood Risk Summary

Source	Probability of Flooding	Pre-Mitigation Flood Risk	Post-Mitigation Flood Risk
Tidal	-	-	-
Fluvial	<0.1% AEP	Negligible	Negligible
Pluvial	Low (<1% AEP)	Negligible	Negligible
Groundwater	Low	Low	Low
Reservoir Breaches	-	-	-
Sewer	Low	Low	Low
Other Sources	-	-	-

Flood Mitigation Measures

3.23 This Report provides evidence that the Site is not constrained by flood risk from any source. Evidence presented shows that any local risk of flooding is not high, and the residual risk is compatible with the proposed use. No additional mitigation measures are therefore necessary.

3.24 Consideration should be given to the surface water runoff from the site. A suitable surface water drainage strategy should be able to mitigate the existing flood risk to the site, whilst ensuring risk downstream is not increased.

4 PROPOSED DEVELOPMENT

Development Proposals

4.1 Proposals for the site comprise the Demolition of existing buildings and the erection of two dwellings with garaging and ecological enhancements.

4.2 Details of the development proposals are shown on the Architect's plans submitted with the application however, for reference, the proposed site plan is included in **Appendix C**.

Development Vulnerability

4.3 The land is currently classed as 'Less Vulnerable' with the proposed development to be classed as 'More Vulnerable.' However, as mentioned previously, the siting of all buildings in Flood Zone 1 means that a "More Vulnerable" development is appropriate.

Assessment of Pre and Post Development Areas

4.4 The existing site covers a total area of approximately 1.81Ha, with approximately 1.6 Ha of this to become Accessible Natural Greenspace. There are several farm buildings on site with the total impermeable area of the existing site measured as approximately 120m^2, or 0.012Ha. The access track has been taken as permeable material.

4.5 Proposals for the site include two dwellings with garaging, totalling 350 m^2. Due to the scale of development, the site is being treated as greenfield, with the addition of impermeable areas requiring surface water mitigation.

4.6 The proposed surface water drainage strategy has been produced with the contributing area for the network taken as the measured private area with a 10% tolerance added on to account for urban creep.

4.7 As 1.6 Ha of the site is to become Natural Greenspace, calculations have only been carried out for the 0.21 Ha where development is proposed.

Assessment of Pre and Post Development Surface Water Discharge Rates

4.8 An assessment of the existing greenfield runoff rates has been undertaken. All calculations are shown in **Appendix D**, with the rates for a variety of return events shown in **Table 4.1** overleaf:

Table 4.1: Greenfield Runoff Rates

Return Period	Greenfield Runoff (ls^{-1})
Q1	1.0
Qbar	1.2
Q30	2.8
Q100	3.7

4.9 Controlled discharge to qbar greenfield rates are proposed, meaning that the post-development runoff rates will be less than or equal to greenfield rates.

5 SURFACE WATER DRAINAGE STRATEGY AND SUDS

SuDS and Design Principles

5.1 It is proposed to employ solutions based on Sustainable Drainage Systems (SuDS) to manage surface water on the site.

5.2 The following goals should be met in order that the appropriate SuDS solutions are designed according to the relevant policy requirements and best practice guidance:

- The proposed development will not increase the risk of flooding elsewhere;
- The SuDS strategy will dispose surface water runoff from the proposed development;
- Risks are identified against the deliverability of the strategy;
- Betterments will be offered where possible;
- Residual risks will be identified, and mitigation measures will be put into place; and
- A maintenance schedule will be outlined.

Proposed Surface Water Drainage Principles

5.3 To ensure that surface water runoff from the site does not cause an increase in flood risk, the management of runoff has been considered via a sequential approach in line with Building Regulations and the NPPF. The following options for the disposal of surface water runoff were considered, in order of preference:

- To the ground (infiltration);
- To a surface water body;
- To a surface water sewer, highway drain or another drainage system;
- To a combined sewer.

5.4 Based on the ground conditions being London Clay formation, the proximity to the River Meon and historic boreholes (from the British Geological Survey) encountering shallow groundwater, infiltration has been ruled out as a means of surface water discharge. The second option in the hierarchy is controlled flow to a surface water body.

Proposed Surface Water Drainage Strategy

5.5 As explained above, it is proposed to discharge surface water runoff at a controlled rate to a surface water body. There is a drainage ditch at the west of the site, in the area proposed as Natural Greenspace. This feeds into the River Meon and will mimic the existing drainage regime.

5.6 A preliminary hydraulic model has been created for the site and, following guidance for Sewers for Adoption, includes no flooding within the 1-in-30 year event, and any flooding within the 1-in-100 year event is retained on site. The calculations for the model are included in **Appendix D**.

5.7 The layout of the drainage strategy is included in **Appendix E**.

5.8 An attenuation feature with volume of $16m^3$ is required. Due to the proximity of Flood Zones to the developable area of the site, it is unlikely that above ground storage will be viable. Permeable paving could however be used as the storage medium as this can be located outside of the flood zone. This will also aid in water quality by providing a treatment stage for surface water.

5.9 A flow control device can limit the discharge from the site to 1.2 l/s. This will require a 75mm orifice, which is generally considered to be a maintainable size.

Overland Flood Routes

5.10 In setting the final external levels for the development it is important to ensure that if flows in exceedance of the 1 in 100 years plus 40% allowance for climate change storm event occur or a failure of the site surface water drainage system occurs, that suitable overland flood routes are provided within the development to ensure no localised flooding of the buildings occurs within the development. This will also allow the existing surface water flood routes to pass through the site with no adverse effect on the dwellings.

5.11 It is therefore proposed to direct overland surface water flows to the west of the site towards the small drainage ditch leading to the River Meon. This will mimic the existing situation. The site levels and layout will be set in order to maintain an overland surface water flood path through the development to this point.

Residual Flood Risk

5.12 If the above mitigation measures are provided as part of the development, it is considered that the primary residual flood risk would be as a result of some type of failure of the site's drainage system during the lifetime of the development. Regular, ongoing maintenance will therefore be required to ensure that the capacity of the system is maintained as it has been designed.

5.13 There remains a residual risk of a storm event that exceeds the capacity of the drainage system, as events beyond the 1 in 100 year plus 40% allowance for climate change storm event will not be catered for explicitly. This is in line with planning guidance as designing for more extreme storm becomes unviable due to the increased mitigation required versus the decreasing chance of such a storm occurring.

Future Maintenance Responsibilities

5.14 As it is anticipated that upon completion of the development the surface water drainage system will be maintained under a Management Company. This may change with emerging guidance in Sewers for Adoption 8th Edition, with the potential of additional adoption of SuDS features by Water Authorities.

5.15 Maintenance of SuDS features should be undertaken in accordance with guidance set out in the SuDS Manual (Ciria C753). The maintenance guidelines for permeable paving and soakaways are included in **Appendix F**.

Consents Required

5.16 As discharge is proposed into an ordinary watercourse, Land Drainage Consent will be required from HCC. As the watercourse is within the site boundary, no permission from riparian owners will be needed.

6 FOUL DRAINAGE ASSESSMENT

Proposed Foul Drainage Strategy

6.1 It is proposed that foul flows from the dwellings are treated in a Package Treatment Works installed onsite and discharged to the minor water course to the west of the developable area of the site following treatment. This is the same waterbody as the surface water discharge point.

6.2 The Package Treatment Works will need to be located 15m from any dwelling and be outside the Flood Zones. A potential location is shown on the drainage strategy shown in **Appendix E**.

7 NITRATE NEUTRALITY ASSESSMENT

Introduction

7.1 This section looks to address Natural England (NE) guidance, titled "Advice on Achieving Nutrient Neutrality for New Development in the Solent Region for Local Planning Authorities."

7.2 The guidance published by NE highlights the high levels of nitrogen and phosphorus within the water environment and their effect on eutrophication. The main aim of the guidance is to ascertain whether there will be a Nitrogen surplus or deficit as a result of the development. If a deficit, no mitigation is required, while mitigation in some form will be required if there is a nitrogen surplus.

Calculations

7.3 The guidance includes calculations to determine the net nitrogen surplus / deficit from a site. These are included as **Appendix G** and summarised in **Table 7.1** below:

Table 7.1 – Summary of four stages of Total Nitrogen Calculations

Stage	Description	Outcome
1	Calculate Wastewater Total Nitrogen load from Proposed Development	6.1 Kg/TN/year
2	Calculate Nitrogen load from Current Use	1.1 Kg/N/year
3	Adjust Nitrogen Load to Account for Future Land Use	3.1 Kg/N/year
4	Calculate Net Change in Total Nitrogen load that would result from the development	9.8 Kg/TN/year

7.4 Inputs into the calculations are outlined below.

- In Stage 1, as a Package Treatment Plant is to be used, the efficiency of the PTP has been based on a Kingspan BioDisc, with an efficiency of 61.2% (please see **Appendix H** for the certificate).
- Only the developable area has been assessed, as the majority of the site will not change use. This is in line with paragraph 4.59 of the guidance.

7.5 As can be seen from **Table 7.1** and the full calculations in **Appendix G**, there is a net Nitrogen surplus of 9.8 kg/year. This means that mitigation is required to achieve neutrality.

Mitigation

7.6 Mitigation for the site is proposed to be in the form of reed beds.

7.7 British Flows and Loads – 4, state that 3-bedroom properties are classed as five-person size systems. Preliminary calculations based on a population of ten (based on two 3-bedroom dwellings) show that a vertical flow reed bed 30m^2 is required. Nitrification will take place in this reed bed.

7.8 A horizontal reed bed approximately 60m^2 will be required for the denitrification.

7.9 As a factor of safety, it is assumed that an artificial stream or waterfall will be required at 30m^2.

7.10 This totals 120m^2 for the mitigation.

7.11 It is acknowledged that these sizes are indicative only and that detailed design of the reed bed system will be required.

7.12 It is proposed that the reed bed be located to the north of the proposed dwellings. This will ensure that the reed beds are located outside the Site of Importance for Nature Conservation (SINC) to the west. This will also be outside of the Flood Zones. If there is an ecological benefit from siting the reed beds elsewhere, this can be considered at the detailed design stage.

7.13 There is approximately 3000m^2 available for the reed bed system, with a potential location shown in **Appendix G**. It is proposed that a suitably worded condition can ensure that detailed design and installation of the reed bed system is undertaken prior to the habitation of the development.

7.14 There is also the potential for alternate or additional mitigation in the form of wetlands or additional reed beds to be incorporated into the ecological enhancements. These could provide additional mitigation which could be part of any 'credit' system in the borough.

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 This Flood Risk Assessment and Nitrate Neutrality Review has been prepared in support of a planning application for a development site at Hollam Farm in Titchfield. The report has been prepared to assess flood risk to the site from all sources and determine whether mitigation is required to achieve nitrate neutrality. It also produces a drainage strategy for the site that ensures flood risk downstream of the site does not increase as a result of the redevelopment.

8.2 In summary, this report demonstrates that:

- The site is in Flood Zones 1, 2 and 3, though all development is contained with Flood Zone 1, which is at low risk of flooding from fluvial and tidal sources. As the site lies partly within flood zones a site-specific FRA is required to comply with planning policy.
- The site has flow routes of surface water flood risk running from east to west through the site. These will not be impeded post development to allow passage of surface water to the River Meon.
- Proposals for the application site include the demolition of existing buildings and the erection of two dwellings with garaging and change of use of agricultural land to Accessible Natural Greenspace.
- The site comprises mostly wooded areas with some small farm outbuildings.
- The existing & proposed developments are classified as 'Less Vulnerable' and 'More Vulnerable' respectively according to Table 2 of the NPPG - Flood Risk & Coastal Change.
- In accordance to Table 3 of the NPPG – Flood Risk & Coastal Change, the proposed development is acceptable and there is no requirement for sequential and exception tests.
- There is low flood risk to the developable part of the site from all sources.
- The application site is underlain by London Clay Formation with limited infiltration potential. It is therefore proposed that controlled discharge to the existing watercourse at the west of the site is used for the drainage strategy.
- Attenuation in the form of permeable paving, or a tank will be provided for the site to ensure that there is no flooding off site during any rainfall event up to and including the 1 in 100 year

return period rainfall event with a 40% allowance for Climate Change.

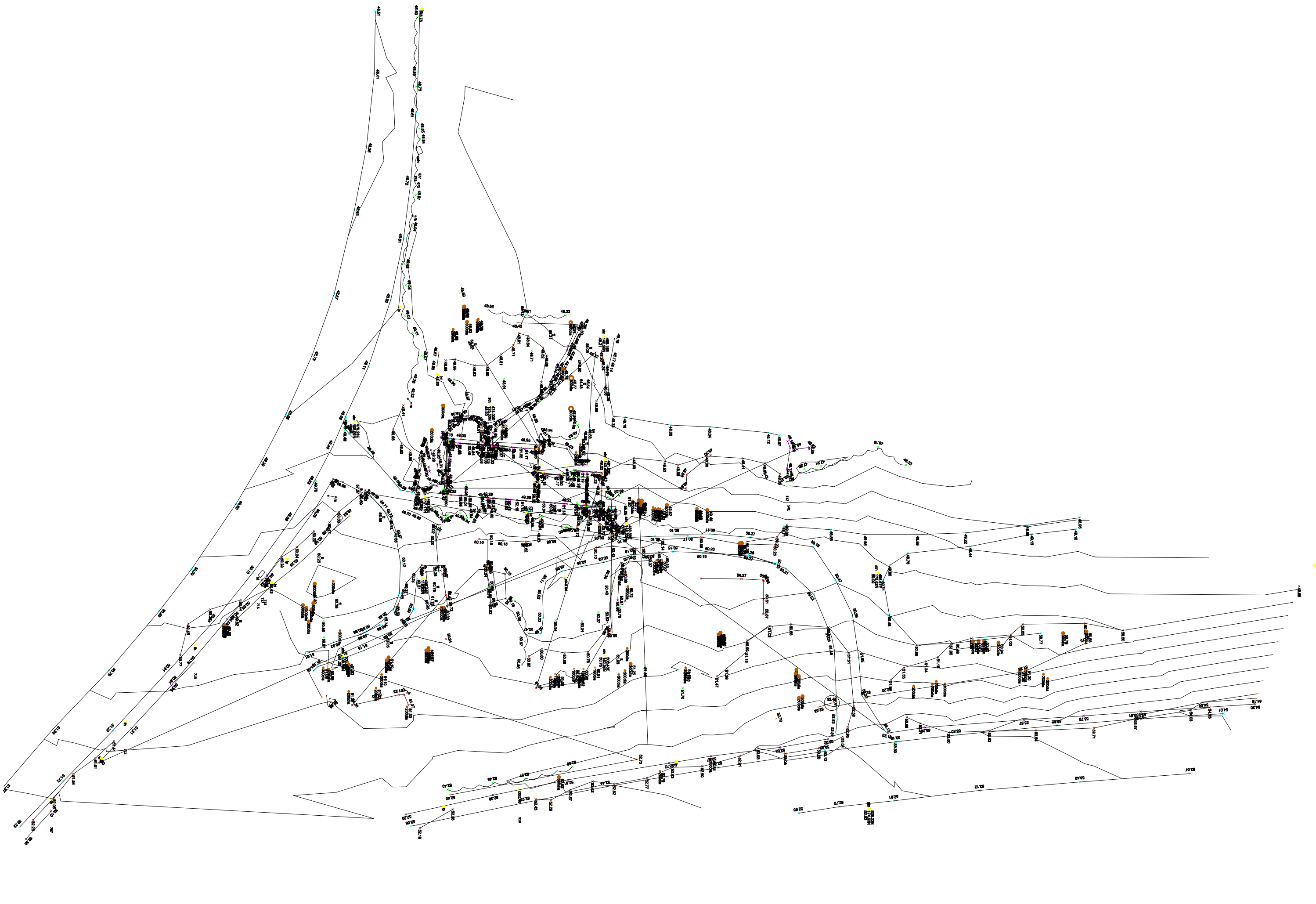
- Foul flows will be discharged via a gravity connection to the existing drainage ditch to the west of the site following treatment in a Package Treatment Works.
- Post development there will be a nitrate surplus of 9.8 kg/year meaning that mitigation will be required to achieve nitrate neutrality. This is proposed in the form of a reed bed with approximate area of 120m^2, though detailed design will confirm the size. This can be located in the remaining 1.6Ha of the site.

8.3 There is therefore no flood risk or nitrate reason that the site cannot be developed as proposed.

APPENDICES

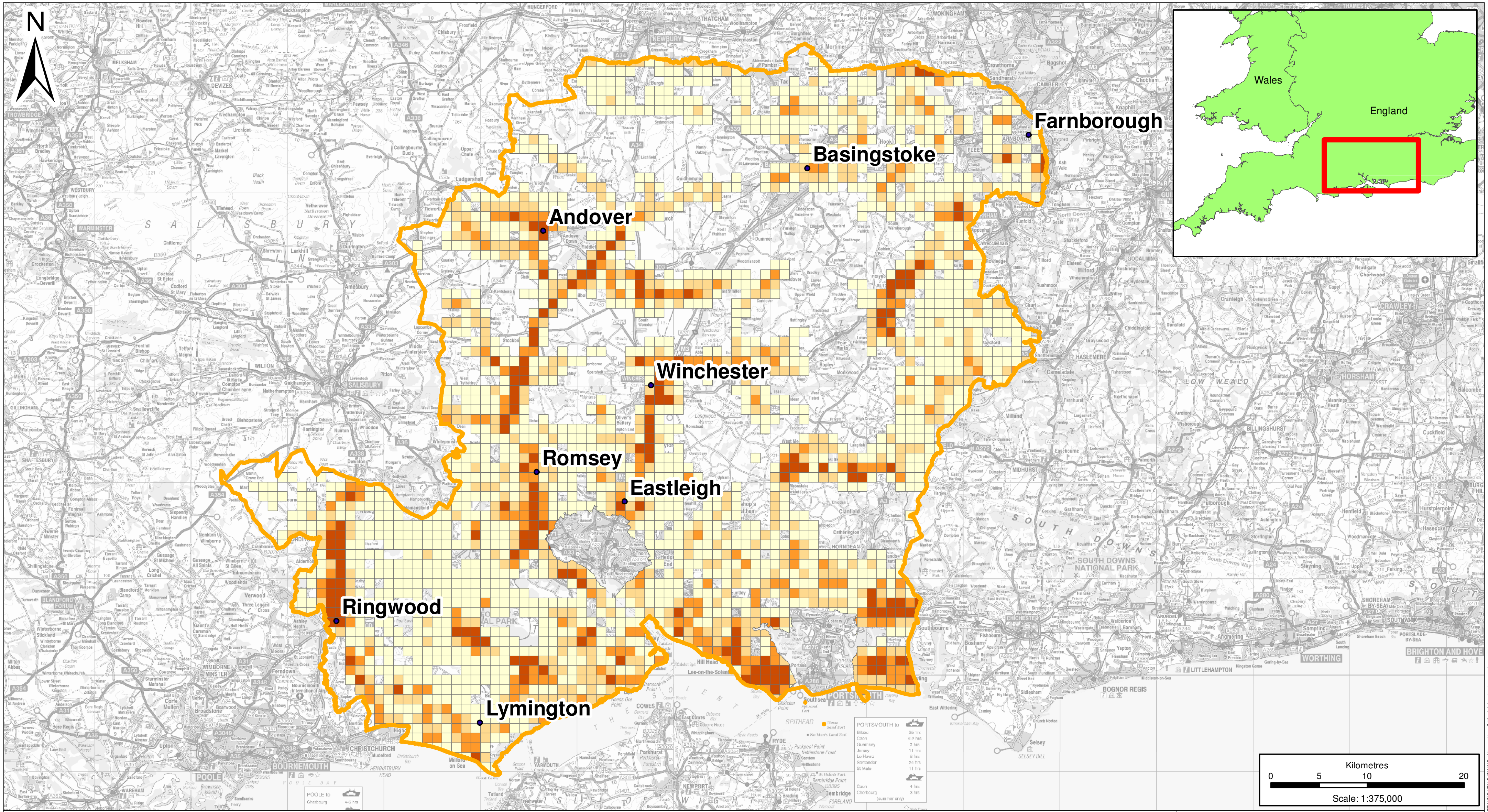
APPENDIX A

Topographical Survey



APPENDIX B

Groundwater Management Plan Map



Proportion of 1 km square susceptible to groundwater flood emergence

- >= 75%
- >= 50% <75%
- >= 25% <50%
- < 25%
- Hampshire County Boundary

Figure Number: 7
Job Number: 461312
Drawn By: CLK
Date: 01-05-2013

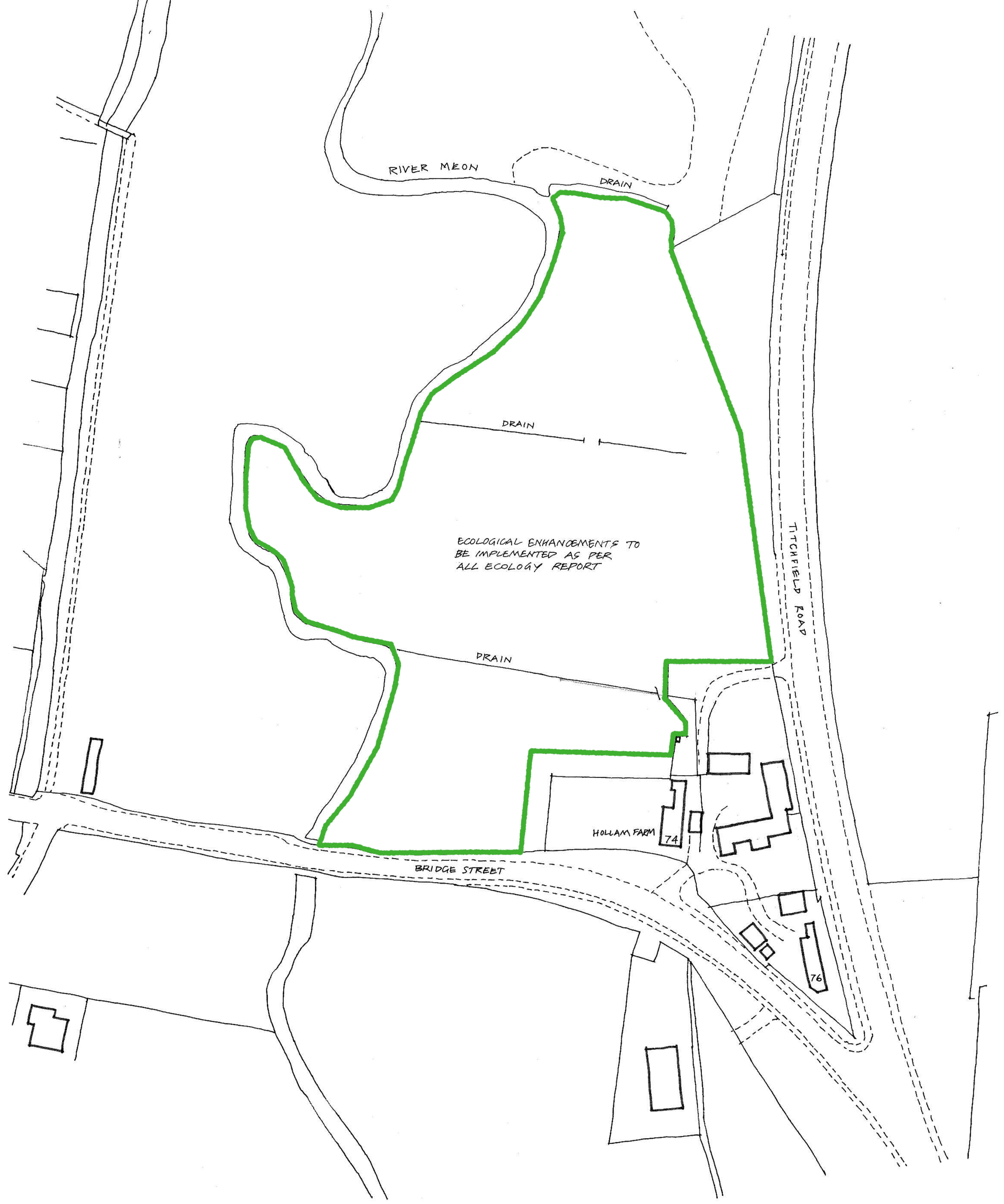
Hampshire GWMP

Figure 7 Areas susceptible to groundwater flooding

Halcrow
A CH2M HILL COMPANY

APPENDIX C

Development Proposals



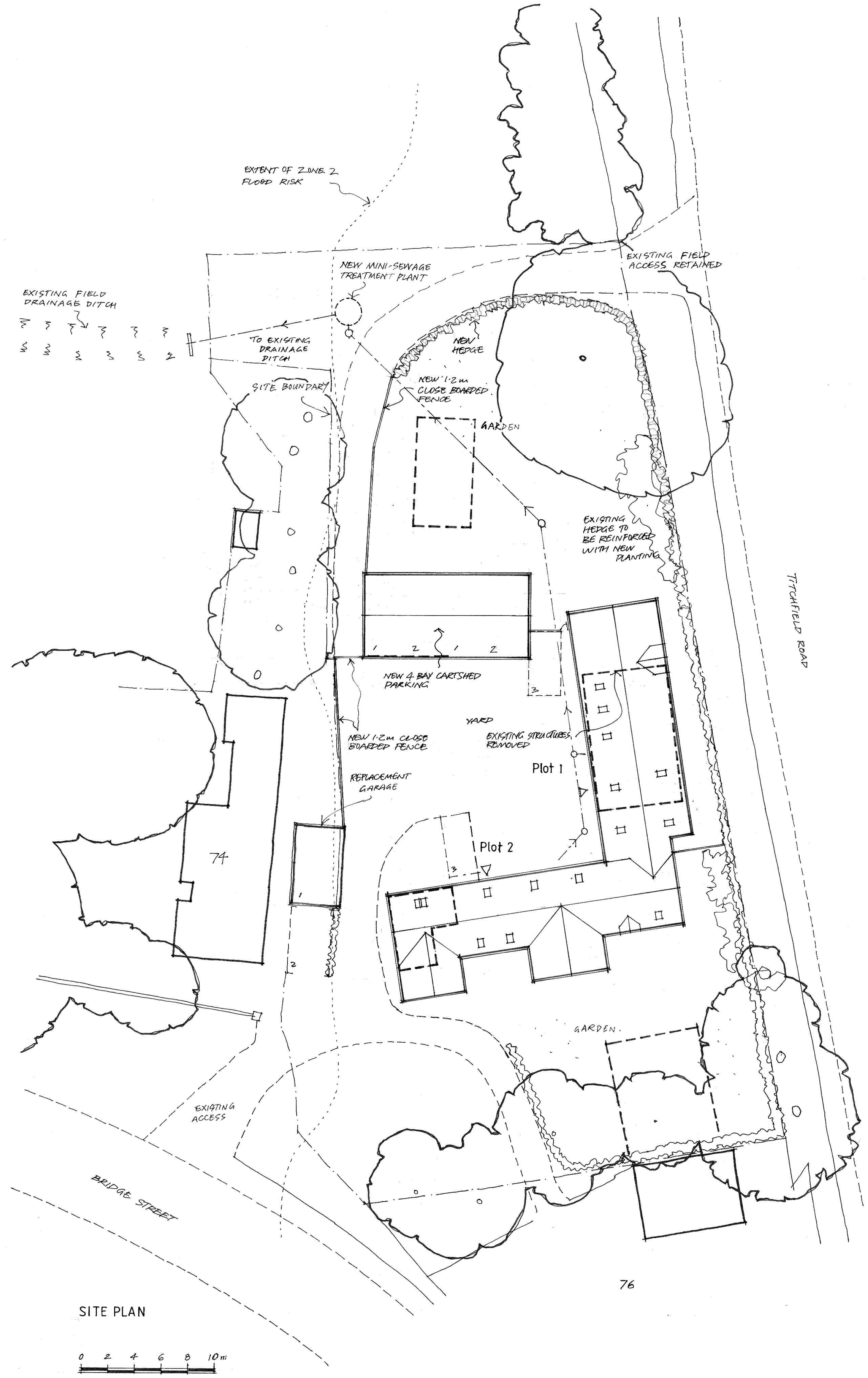
KEY

ECOLOGICAL ENHANCEMENTS

BLOCK PLAN

0 10 20 30 40 50m

scale 1:1,000



SITE PLAN

0 2 4 6 8 10m

scale 1:200

B	DESIGN SCHEME AMENDED BLOCK PLAN - ACCESS NOTE REVISED	SB	22/06/20
A	SITE BOUNDARY REVISED	SB	21/01/20
revisions		int	date

Contractors, Sub Contractors and Suppliers are to check all relevant dimensions and levels of site and buildings before commencing any shop drawings or building work.

project

HOLLAM FARM
TITCHFIELD

drawing

Site Plan

& BLOCK PLAN

scale 1:1000 @ A1 / 1:200 @ A1 — date Oct '19

180325-05 — B

drawing no — rev

FOWLER ARCHITECTURE & PLANNING

19 High Street
Pewsey
Wiltshire
SN9 5AF

01672 569444
enquiries@faap.co.uk

APPENDIX D

Hydraulic Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	0.600
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
Permeable Paving	0.043	5.00	50.000	1200	714.290	140.665	0.750
S1			50.100	1200	713.380	143.606	0.871
FCC			50.200	1200	712.621	164.855	1.171
Outfall			48.250	1200	701.586	166.160	0.150

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	Permeable Paving	S1	3.079	0.600	49.250	49.229	0.021	150.0	150	5.06	50.0
1.001	S1	FCC	21.263	0.600	49.229	49.087	0.142	150.0	150	5.50	50.0
1.002	FCC	Outfall	11.112	0.600	49.029	48.100	0.929	12.0	150	5.56	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.818	14.5	8.2	0.600	0.721	0.043	0.0	81	0.842
1.001	0.818	14.5	8.2	0.721	0.963	0.043	0.0	81	0.842
1.002	2.929	51.8	8.2	1.021	0.000	0.043	0.0	40	2.145

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	3.079	150.0	150	Circular	50.000	49.250	0.600	50.100	49.229	0.721
1.001	21.263	150.0	150	Circular	50.100	49.229	0.721	50.200	49.087	0.963
1.002	11.112	12.0	150	Circular	50.200	49.029	1.021	48.250	48.100	0.000

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	Permeable Paving	1200	Manhole	Adoptable	S1	1200	Manhole	Adoptable
1.001	S1	1200	Manhole	Adoptable	FCC	1200	Manhole	Adoptable
1.002	FCC	1200	Manhole	Adoptable	Outfall	1200	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FSR	Winter CV	0.840
FSR Region	England and Wales	Analysis Speed	Normal
M5-60 (mm)	20.000	Skip Steady State	x
Ratio-R	0.400	Drain Down Time (mins)	240
Summer CV	0.750	Additional Storage (m³/ha)	20.0

Simulation Settings

Check Discharge Rate(s)	✓	100 year (l/s)	3.7
1 year (l/s)	1.0	Check Discharge Volume	x
30 year (l/s)	2.8		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 years	2.40
Greenfield Method	IH124	Growth Factor 100 years	3.19
Positively Drained Area (ha)	0.220	Betterment (%)	0
SAAR (mm)	752	QBar	1.2
Soil Index	4	Q 1 year (l/s)	1.0
SPR	0.47	Q 30 year (l/s)	2.8
Region	7	Q 100 year (l/s)	3.7
Growth Factor 1 year	0.85		

Node FCC Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	49.029	Product Number	CTL-SHE-0049-1200-1171-1200
Design Depth (m)	1.171	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.2	Min Node Diameter (mm)	1200

Node Permeable Paving Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	49.500	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	220	Depth (m)	0.275
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.30	Length (m)	19.000		

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.57%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	Permeable Paving	29	49.523	0.273	4.7	1.0329	0.0000	SURCHARGED
30 minute winter	S1	29	49.523	0.294	3.8	0.3328	0.0000	SURCHARGED
30 minute winter	FCC	30	49.523	0.494	3.5	0.5585	0.0000	SURCHARGED
15 minute summer	Outfall	1	48.100	0.000	0.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	Permeable Paving	1.000	S1	3.8	0.668	0.262	0.0542	
30 minute winter	S1	1.001	FCC	3.5	0.486	0.244	0.3743	
30 minute winter	FCC	Hydro-Brake®	Outfall	0.9				3.7

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.57%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	Permeable Paving	60	49.621	0.371	7.6	6.6483	0.0000	SURCHARGED
60 minute winter	S1	60	49.621	0.392	2.9	0.4429	0.0000	SURCHARGED
60 minute winter	FCC	60	49.620	0.591	1.9	0.6685	0.0000	SURCHARGED
15 minute summer	Outfall	1	48.100	0.000	0.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	Permeable Paving	1.000	S1	2.9	0.571	0.201	0.0542	
60 minute winter	S1	1.001	FCC	1.9	0.499	0.133	0.3743	
60 minute winter	FCC	Hydro-Brake®	Outfall	0.9				11.1

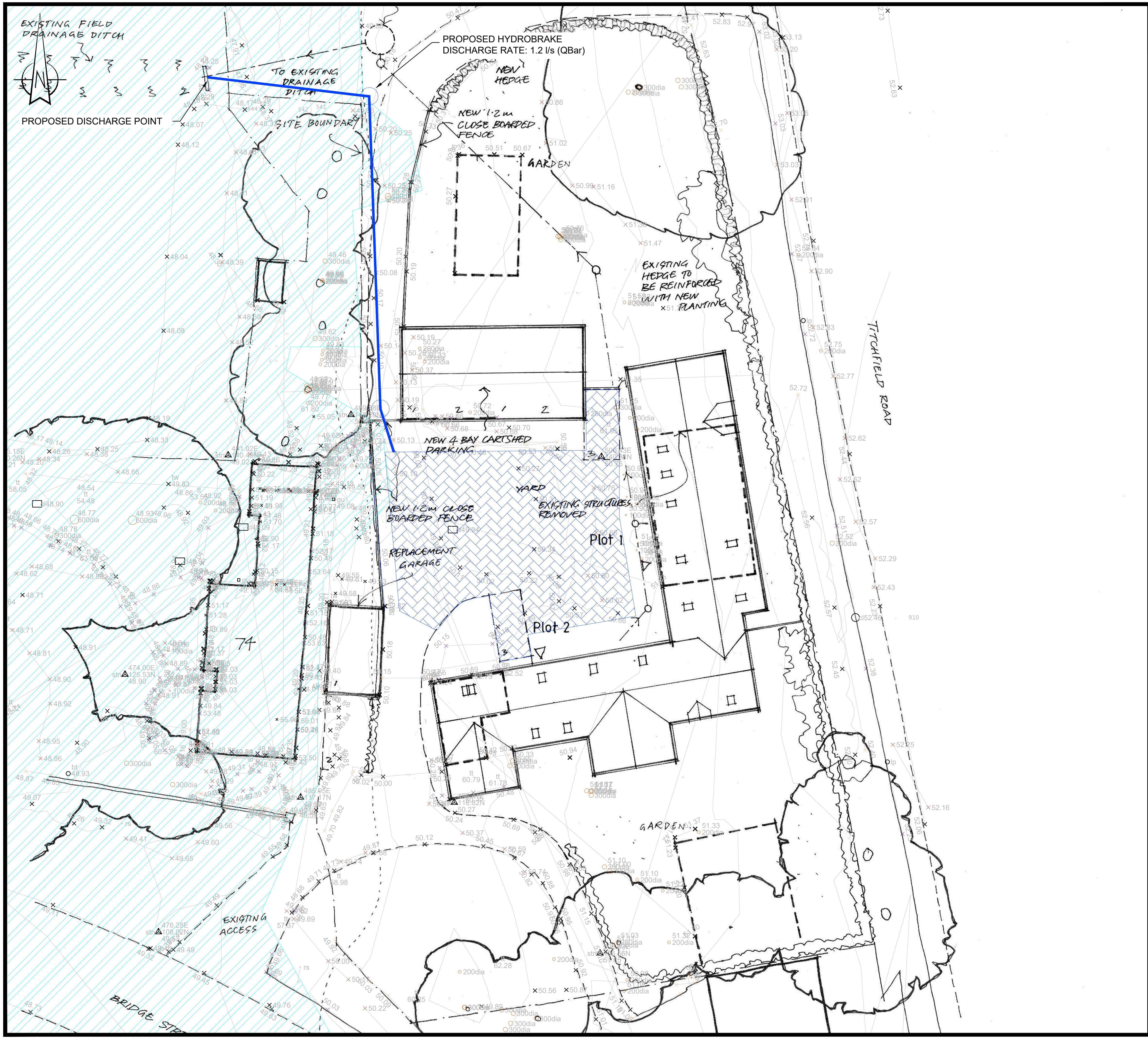
Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.57%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	Permeable Paving	118	49.916	0.666	8.6	16.1386	0.0000	FLOOD RISK
120 minute winter	S1	118	49.915	0.686	1.9	0.7763	0.0000	FLOOD RISK
120 minute winter	FCC	118	49.915	0.886	1.5	1.0015	0.0000	FLOOD RISK
15 minute summer	Outfall	1	48.100	0.000	0.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	Permeable Paving	1.000	S1	1.9	0.512	0.132	0.0542	
120 minute winter	S1	1.001	FCC	1.5	0.474	0.104	0.3743	
120 minute winter	FCC	Hydro-Brake®	Outfall	1.1				19.5

APPENDIX E

Drainage Strategy



NOTES

1. Do not scale from this drawing.
2. This drawing is for illustrative purposes only and not for construction.
3. This drawing is to be read and printed in colour.
4. All dimensions are shown in meters, unless specified otherwise.

KEY

- PROPOSED SURFACE WATER SEWER
- PROPOSED PERMEABLE PAVING (16m³ TOTAL VOLUME)
- EXISTING FLOOD ZONE 2 OUTLINE

REV	DETAILS	DRAWN	CHECKED	DATE
A	Updated for revised layout	MRM	BJC	22.07.2020

CLIENT:

CMS

PROJECT:

HOLLAM FARM, TITCHFIELD

DRAWING TITLE:

INDICATIVE SURFACE WATER DRAINAGE STRATEGY

SCALES:	SHEET SIZE:
1:250	A3

DRAWN:	CHECKED:	DATE:
MRM	PD	21.12.2019

cda
Condon Drew Associates

DRAWING NUMBER:	REVISION:
1257-501	A

APPENDIX F

Maintenance Guidelines from the SuDS Manual

TABLE 20.15 Operation and maintenance requirements for pervious pavements

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

APPENDIX G

Nitrate Neutrality Calculations and Mitigation Plan

JOB REF:	1257	CALC SHEET REFERENCE	NN
SHEET	1 of 2	DATE	22/07/2020
PROJECT	Hollam Farm		

Condon Drew Associates

NITRATE NEUTRALITY CALCULATION SHEET

Stage 1: Calculate TN from the development

Step	Measurement	Value	Unit	Explanation
Development Proposals	Increase in Population	2	Residential Dwellings	
1	Additional Population	5	Persons	Based on household of 2.4
2	TN prior to treatment Based on 3.5 Kg TN per person per year	17	litres / day	4.8 (step 1) x 3.5 Kg TN per person per year
3	Receiving PTP TN reduction efficiency	61.2	%	Efficiency of PTP used must be evidenced (See report Appendices)
4	TN Discharged after PTP Treatment	6.5	Kg TN / year	38.8% of 16.8
5	Acceptable N loading (as defined in paragraph 4.40) Based on 110 l per day per person	1,056	mg TN / day	Total waste water from development (110l x 4.8 persons) x Acceptable N loading of 2 mg/l
6	Convert acceptable TN loading to TN Kg / Yr	0.4	Kg TN / year	Divide by 1,000,000 x by 365 days
7	TN discharged - acceptable N loading (@ 2 mg/l)	6.1	Kg TN / year	6.5184 (step 4) - 0.38544 (step 6)
TN		6.1	Kg TN / year	

Stage 2: Calculate Nitrogen Load from Current Land Use

Step	Measurement	Value	Unit	Explanation
1	Total Area of Existing Agricultural Land	0.22	Ha	Agricultural Land Lost to Development
2	Identify Farm Type and confirm Nitrate Loss	5	Kg/ha/yr	From Table to right; Average used if several farm types
3	Multiply Area by Nitrate Loss	1.1	Kg/N/yr	0.22 ha x 5 Kg/N/yr
N-Load		1.1	Kg/N/yr	

N Loss (kg/ha)	
Cereals	31.2
Dairy	36.2
General Cropping	25.4
Horticulture	29.2
Pig	70.4
Lowland Grazing	13
Mixed	28.3
Poultry	70.7
Average	26.9

Stage 3: Calculate Nitrogen Load from Future Use

Step	Measurement	Value	Unit	Explanation
1	New Urban Area	0.22	Hectares	Area of development changing from agricultural land to urban land use.
2	N-Load from future Urban Area	3.1	Kg/N/year	0.22 ha x 14.3 Kg/N/year
3	New SANG/Open Space	0.0	Hectares	Area of development changing from agricultural land to SANG / Open Space
4	N-Load from SANG/Open Space	0.0	Kg/N/year	0 ha x 5.0 Kg/N/year
5	Combine N-Load from Future Land Uses	3.1	Kg/N/year	3.146 Kg/N/year + 0 Kg/N/year
N-Load: Future Land Use		3.1	Kg/N/year	

Condon Drew Associates

JOB REF:	1257	CALC SHEET REFERENCE	NN
SHEET	2 of 2	DATE	22/07/2020
PROJECT	Hollam Farm		

NITRATE NEUTRALITY CALCULATION SHEET

Stage 4: Calculate Net Change in Nitrogen Load from the Development

Step	Measurement	Value	Unit	Explanation
1	Identify N-Load from Wastewater (Stage 1)	6.1	Residential Dwellings	See Table 1
2	Calculate Net Change in N from Land Use change (Stage 3 - Stage 2)	2.0	Kg/N/year	3.146 (stage 2) - 1.1 (stage 3) = 2.046Kg/N/year
3	Determine nitrogen budget – the Total Nitrogen wastewater load for the proposed development plus the change in nitrogen load from land use change (the latter figure may be positive i.e. the change in land use will generate more nitrogen, or negative i.e. the change in land use will generate less Nitrogen)	8.2	Kg/N/year	6.13296 (step 1) + 2.046 (step 2) = 8.17896Kg/N/year
4	Where TN budget is positive add 20% precautionary buffer	9.8	Kg/N/year	8.17896 Kg/N/year x 1.5
Total Nitrogen that needs to be neutralised		9.8	Kg/N/year	

Outcome

Nitrogen Deficit.

Key

1	User inputted information
2	Calculation based on Natural England Guidance
3.0	Link to value in previous table
4.0	Output value

NOTES

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KEY

- VERTICAL FLOW REED BED
- HORIZONTAL FLOW REED BED
- ARTIFICIAL POND
- EXISTING FLOOD ZONE 2 OUTLINE

REV	DETAILS	DRAWN	CHECKED	DATE

CLIENT:

CMS

PROJECT:

HOLLAM FARM, TITCHFIELD

DRAWING TITLE:

INDICATIVE REED BED LOCATION

SCALES:	SHEET SIZE:
1:250	A3

DRAWN:	CHECKED:	DATE:
MRM	BJC	24.07.2020

Condon Drew Associates

DRAWING NUMBER:	REVISION:
1257-901	A

APPENDIX H

Package treatment Plant Certificate

Prüfinstitut für Abwassertechnik GmbH

PERFORMANCE RESULTS

Kingspan Environmental Limited
College Road North, Aylesbury, HP22 5EW UK

EN 12566-3, Annex B
"Small wastewater treatment systems for up to 50 PT"

Small wastewater treatment system BioDisc
Rotating disc unit with one reed bed

Nominal organic daily load	0.29 kg BSB_5/d		
Nominal hydraulic daily load	1.20 m^3/d		
Material	glass reinforced plastic (GRP)		
Treatment efficiency (nominal sequences)		Efficiency	Effluent
	COD	93.0 %	39 mg/l
	BOD_5	98.0 %	4 mg/l
	SS	98.2 %	6 mg/l
	NH_4-N*	88.4 %	3.8 mg/l
	N_{tot}*	61.2 %	18 mg/l
	P_{tot}	51.7 %	3.8 mg/l
Electrical consumption	1.3 kWh/d		

** determined for temperatures ≥ 12°C in the bioreactor.*

Performance tested by:
PIA – Prüfinstitut für Abwassertechnik GmbH
(PIA GmbH)
Hergenrather Weg 30
D-52074 Aachen

This document replaces neither the declaration of conformity nor the CE marking

Notified Body Nr.: 1739

Certified according to ISO 9001:2008

DAkkS Deutsche Akkreditierungsstelle D-PL-17712-01-00

Prüfinstitut für Abwassertechnik GmbH — geprüft - tested - testé

Elmar Lancé October 2013