

ROSARY HOUSE
AERODROME ROAD, CANTERBURY

NUTRIENT NEUTRALITY ASSESSMENT

WOODCHURCH PROPERTY
DEVELOPMENTS

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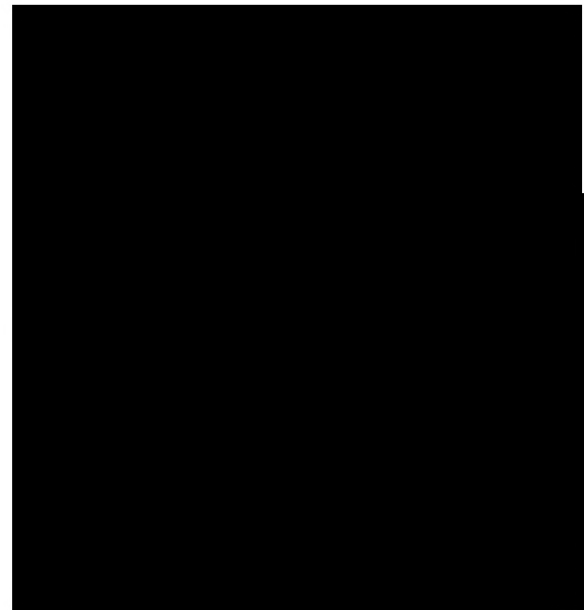
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Water Environment was commissioned by Woodchurch Property Developments to investigate and mitigate against the concerns raised by Natural England regarding the nutrient neutrality of the proposed development and the potential adverse effects in the Stodmarsh Special Area for Conservation, Special Protection Area, Ramsar and Site of Special Scientific Interest.

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EXECUTIVE SUMMARY

In 2018, the European Court of Justice refined the definition of plans and projects and ruled that mitigation needs to be in place to ensure that there will be no likely significant effect on the conservation status of designated sites. Additional nutrient loading to designated sites already in an unfavourable conservation status is not permissible unless mitigation is in place. This ruling has come to be known as 'The Dutch Case'.

In the Stour River catchment in East Kent, developments could adversely affect the designated site known as Stodmarsh. Several of the nature reserve lakes are in a state of eutrophication (an unfavourable conservation status) and therefore the ruling of the Dutch Case applies. Therefore, all developments in the catchment have to demonstrate 'nutrient neutrality' in order to ensure no adverse effect on the integrity of the designated site, meaning that the nutrients generated by the development must be less than or equal to the nutrients generated by the existing land use.

The application site is located on the eastern side of Aerodrome Road in Bokesbourne, to the southeast of Canterbury.

The proposal is a total of seven new dwellings, comprising a pair of bungalows, three detached and two semi-detached dwellings along with associated infrastructure.

The development will increase overnight sleeping accommodation on the site and the associated wastewater. Foul sewage from the site will discharge to Newnham Valley Preston Wastewater Treatment Works via new onsite infrastructure and the public sewerage. If unmitigated, the increased wastewater generated from the proposed development will increase the level of nutrients from the site.

It has been proposed to use a greywater recycling system to reduce water usage onsite, and hence the total wastewater produced. Further to this, a Sustainable Drainage Strategy (SuDS) including permeable paving, porous sub-base and infiltration to ground has been proposed and the phosphorus leaching from the site can be reduced accordingly.

In spite of this, the nutrient budget is still positive, and offsite offsetting of some form will be required to mitigate it.

ABBREVIATIONS

Acronym	Definition
DEFRA	Department for Environment Food and Rural Affairs
EA	Environment Agency
FCT	Favourable Condition Target
HRA	Habitat Regulations Assessment
LSE	Likely Significant Effect
NE	Natural England
ONS	Office for National Statistics
PTP	Package Treatment Plant
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Specific Scientific Interest
SuDS	Sustainable Drainage Systems
TN	Total Nitrogen
TP	Total Phosphorus
WwTW	Wastewater Treatment Works

1 INTRODUCTION

General Information

- 1.1 The application is for the construction of 7 new dwellings in Bekesbourne, Canterbury. The site is located to the eastern side of Aerodrome Road, and the total area is 0.53ha.

Background

- 1.2 A Habitats Regulations Assessment (HRA) refers to the several distinct stages of Assessment which must be undertaken in accordance with the Conservation of Habitats and Species Regulations 2017 (as amended) to determine if a plan or project may affect the protected features of a designated site (any site which would be included within the definition at regulation 8 of the Conservation of Habitats and Species Regulations 2017, including candidate Special Areas of Conservation, Sites of Community Importance, Special Protection Areas and any relevant Marine Sites) before deciding whether to undertake, permit or authorise it. A risk or a possibility of such an effect is enough to warrant the need for an Appropriate Assessment. An Appropriate Assessment must contain complete, precise and definitive findings and conclusions to ensure that there is no reasonable scientific doubt as to the effects of the proposed plan or project.
- 1.3 In 2018, the European Court of Justice refined the definition of plans and projects and ruled that mitigation needs to be in place to ensure that there will be no likely significant effect on the conservation status of designated sites. Additional nutrient loading to designated sites already in an unfavourable conservation status is not permissible unless mitigation is in place. This ruling has come to be known as 'The Dutch Case'.
- 1.4 In the Stour River catchment in East Kent, developments could adversely affect the designated site known as Stodmarsh. Several of the nature reserve lakes are in a state of eutrophication (an unfavourable conservation status) and therefore the ruling of the Dutch Case applies. It has been found that the nutrients of highest significance in terms of water quality in Stodmarsh are nitrogen and phosphorus.
- 1.5 In practice, this means that all developments in the catchment have to demonstrate 'nutrient neutrality' in order to screen out a likely significant effect (LSE), meaning that the nutrients (nitrogen and phosphorus) from all surface water runoff and wastewater generated by the development must be less than or equal to the nutrients generated by the existing land use.

Scope of Study

- 1.6 The main objectives of this study are to:
- Provide an overview of Natural England's position in respect to water quality within the Stodmarsh Site of Special Scientific Interest (SSSI), SPA, Ramsar and SAC;
 - Present calculations, based on the absence of any mitigation measures, to outline the potential increase in nutrient loading as a result of the proposed development; and
 - Outline the mitigation strategy proposed to manage surface and wastewater from the proposed development and present supporting calculations in order to ensure that, from first occupation of the dwellings, the proposed development is nutrient neutral.

2 WATER QUALITY IN THE STODMARSH

Stodmarsh Designated Sites¹

- 2.1 The Stodmarsh Site of Special Scientific Interest (SSSI) is designated by Natural England for the following features of interest:
- Wetland habitats including extensive reedbeds, swamp and fen communities;
 - Open water habitats including lakes, ditches and lagoons;
 - Diverse breeding and non-breeding bird communities. Two rare British birds - Cetti's warbler and bearded tit - breed here in nationally significant numbers;
 - Varied invertebrate fauna, including multiple scarce moth species; and
 - An assemblage of vascular plants.
- 2.2 The Stodmarsh Special Protection Area (SPA) is designated for the following features and supported species:
- Bittern (Non-Breeding);
 - Gadwall (Breeding and Non-Breeding);
 - Hen Harrier (Non-Breeding);
 - Shoveler (Non-Breeding);
 - Breeding bird assemblage; and
 - Waterbird assemblage.
- 2.3 The Stodmarsh Ramsar site is designated, under criteria 2 of the Ramsar Convention, for:
- Wetland invertebrate assemblage;
 - Wetland plant assemblage;
 - Assemblage of rare wetland birds;
 - Bearded tit populations (Breeding and Wintering);
 - Bittern (Wintering);
 - Gadwall (Breeding and Wintering);
 - Hen Harrier (Wintering); and
 - Shoveler (Wintering).
- 2.4 The Stodmarsh Special Area of Conservation (SAC) is designated for the following qualifying species:
- Desmoulin's whorl snail.

¹ Available at: designatedsites.naturalengland.org.uk [Accessed September 2021]

Water Quality

- 2.5 The focus of this report is on the evidence of degrading water quality in the Stodmarsh SSSI, SPA, Ramsar and SAC, henceforth referred to as 'Stodmarsh'.
- 2.6 There is evidence of poor water quality within Stodmarsh which is adversely affecting the aforementioned qualifying features of each of the Stodmarsh designations.
- 2.7 Algal Bloom and fish kill events have been observed in one of the Stodmarsh Lakes (SSSI Unit 010). Assessments by Natural England¹ have described the condition of this Lake as 'Unfavourable' and indicated high nutrient levels. Total Phosphorus has been measured at 1000µg/l where the target for SSSI lakes is 49µg/l. Eutrophication, which arises as a result of increased water nutrient levels, can lead to a reduction of fish and macrophyte populations. This in turn impacts food availability for SPA/Ramsar birds and the qualifying invertebrate community. The reason for this adverse condition is quoted as 'Freshwater pollution – Water Pollution – Discharge'.
- 2.8 The lake within SSSI Unit 007 has also been described as 'Unfavourable' and has been found to fail in reaching nationally agreed Water Quality targets, including an excess of nitrogen and phosphorus. The reason for this adverse condition is quoted as 'Freshwater pollution – Water Pollution – Agriculture/Run off'.
- 2.9 Lakes within Unit 001, 002 and 005 are described as in 'Favourable' or 'Unfavourable – recovering' condition and thus are not of concern for the purposes of this assessment.

Total Nitrogen and Total Phosphorus

- 2.10 It has been found that the nutrients of highest significance in terms of water quality in Stodmarsh are nitrogen and phosphorus.
- 2.11 The key measurement, with respects to nitrogen levels, is the amount of Total Nitrogen (TN). This includes organic and inorganic forms of nitrogen, both of which are available for plant growth and can contribute to algal blooming. TN is the sum of inorganic forms of nitrogen (nitrate-nitrogen (NO₃-N), nitrite nitrogen (NO₂-N) and ammoniacal nitrogen, (NH₄⁺-N and NH₃-N) and organically bonded nitrogen.
- 2.12 Similarly, in respects to phosphorus levels, the key measurement is the amount of Total Phosphorus (TP). TP includes all phosphorus components: phosphates, dissolved organic phosphorus, particulate phosphorus in algal and bacterial cells, and includes mineral particles such as clay.
- 2.13 Concentrations of TN and TP have been recorded within the lakes in SSSI Units 007 and 010 in excess of the Natural England SSSI Favourable Condition Targets (FCTs) of 49µg/l TP and 1.5mg/l TN. It is important to understand the mechanism by which these nutrients enter Stodmarsh. Some of the major sources of TN and TP have been identified as the following^{2,3}:
- Wastewater Treatment Works (WWTW) which outfall into the Stour upstream of the Stodmarsh;
 - Runoff from urban and agricultural land;
 - Flood waters from the River Great Stour (during both high flow and tidal events); and
 - Recycling of Nutrients within lake 007 itself.

² APEM, Stodmarsh SSSI, SPA and NNR Lake Hydrology Project Phase 1, April 2016

³ ATKINS, Stodmarsh Lake Hydrology Study, May 2016

- 2.14 In the case of TP, it has been estimated (Atkins 2016), that the dominant source of phosphate in the River Stour are Sewage Treatment Works, accounting for 50%-80% of concentrations in the river adjacent to Stodmarsh.

Strategic Approach

- 2.15 It is Natural England's current view⁴ that there is "uncertainty as to whether new growth (development) will further deteriorate the designated sites".
- 2.16 Natural England also state that "a likely significant effect on designated Stodmarsh sites (SPA, SAC and Ramsar site) cannot be ruled out due to the increases in wastewater from new developments coming forward in the Stodmarsh catchment".
- 2.17 Therefore, without the mitigation strategy outlined in this report, it could not be ruled out that the proposed development would input additional TN and TP into the Stodmarsh.
- 2.18 To address the uncertainty and the subsequent risk to Stodmarsh, the mitigation strategy outlined in this report will ensure that the proposed development does not add to existing nutrient burdens and provides certainty that the whole of the scheme is deliverable in line with the requirements of the Conservation of Habitats and Species Regulations 2017⁵ and in light of relevant case law⁶.
- 2.19 The latest Natural England guidance has been followed to ensure that the proposed development will be nutrient neutral (i.e. will not contribute to additional TN and TP in Stodmarsh).
- 2.20 In this report we implement the following staged approach. In Part 1 it is calculated, in the absence of any mitigation measures, the potential increase in TN and TP loading from the proposed development. In Part 2 a mitigation strategy is proposed and supporting calculations are presented which provide sufficient and reasonable certainty that the development will not contribute to an increase in TN and TP loading.
- 2.21 The Nutrient Neutrality calculations in this report are based on key inputs and assumptions based on the best available scientific evidence and research. To accommodate for the necessary level of uncertainty in these key assumptions a buffer is used when calculating levels of TN and TP. This buffer ensures that a precautionary approach is followed throughout.

⁴ Natural England, Advice on Nutrient Neutrality for New Development in the Stour Valley Catchment in Relation to Stodmarsh Designated Sited – For Local Planning Authorities. November 2020

⁵ Conservation of Habitats and Species Regulations (England and Wales) Regulations 2017

⁶ Including Wildlife and Countryside Act 1981, Countryside and Rights of Way Act 2000 and Rural Communities Act 2006

3 SITE DESCRIPTION

Location

- 3.1 The application site is located on the eastern side of Aerodrome Road in Bekesbourne, to the southeast of Canterbury.
- 3.2 The site boundary and location in respect to the Stour Valley catchment is shown in Figure 1. The site is located in the Upper Stour Operational Catchment, and sewage from the development will be conveyed to Newnham Valley Preston Wastewater Treatment Works (WwTW).

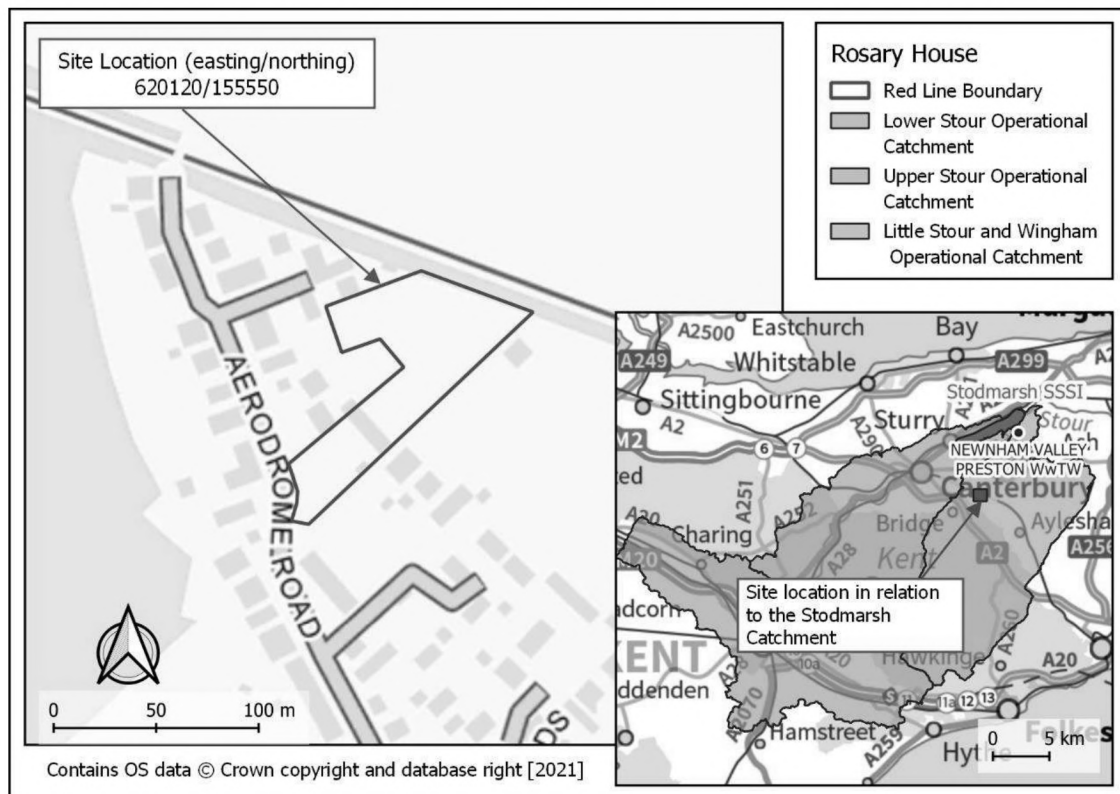


Figure 1: Site Location

- 3.3 The total site area has been measured as 0.53ha, and it comprises 0.308ha of reptile habitat, as identified by an ecologist, and 0.22ha of existing house and gardens.

Proposed Development

- 3.4 The proposal is a total of seven new dwellings, consisting of a pair of bungalows with a barn hip roof to the front of the existing dwelling, Rosary house, and; three detached and two semi-detached dwellings arranged in a cul-de-sac behind Breckenridge, Lysander, The Haven, Sycamore Cottage and Rosary House.
- 3.5 The site plan for the proposed scheme is attached in Appendix A.
- 3.6 A Sustainable Drainage (SuDS) strategy has been included in the proposed development, in order to deal with surface water runoff and to promote best practices and sustainability, as well as providing benefits on water quality (e.g. through filtration through a porous media). The elements of the strategy include permeable paving (or porous asphalt) over a porous sub-base allowing for infiltration at the base and underground geocellular storage allowing for infiltration at the base and the sides.

4 PART 1: CALCULATING THE NUTRIENT BUDGET

Natural England Methodology

- 4.1 In December 2019, Natural England (NE) issued guidance⁷ on the methodology to calculate nutrient neutrality. This guidance lays out the process of calculation and provides a worked example.
- 4.2 Stage 1 of the calculation is to calculate the nutrient load from the additional wastewater that will be generated by the development. This stage specifically only includes new overnight stays in the development, as it is assumed that any additional wastewater generated by diurnal use would be accounted for elsewhere. In accordance with the NE guidance, a water usage of 110 litres per person per day (l/p/d) has been used in the calculations.
- 4.3 At Newnham Valley Preston WwTW, there is a licence limit of 1mg/l for TP to be introduced in 2024, and no limit for TN. According to the guidance, the concentration in additional sewage effluent from the development should be taken as, 27mg/l of TN, the average in the catchment, if there is no limit given, or as 90% of any given licence limit. These concentrations will then be multiplied by the total amount of additional wastewater to get the total load. Using this approach, effluent concentrations of 27mgN/l and 0.90mgP/l were used for the WwTW.
- 4.4 Stage 2 of the calculation is to consider the existing land use on the site. Using the ADAS Farmscoper tool, loading factors were determined for all different agriculture uses within the catchment. These are listed in Table 1.

Table 1 - Diffuse Annual Loading Factors in the Stour Valley Catchment

AVERAGE NUTRIENT LOSS PER FARM TYPE IN STOUR MANAGEMENT CATCHMENT AREA		
	Nitrate- Nitrogen (kg/ha/year)	Phosphorus (kg/ha/year)
Cereals	27.30	0.36
Dairy	58.30	0.49
General Cropping	27.90	0.28
Horticulture	18.50	0.18
Pig	60.30	0.34
Lowland Grazing	12.20	0.24
Mixed	31.50	0.27
Poultry	60.30	0.34
Average for Catchment Area	23.50	0.28

- 4.5 Using these loading factors, and the areas of various land-uses on the site, the existing nutrient load from diffuse sources can be calculated.
- 4.6 Stage 3 of the calculation describes the typical land-uses after development as Suitable Alternative Natural Greenspace (SANG), open space and urban land. These have diffuse annual loading factors as shown in Table 2.

⁷ Natural England, Advice on Nutrient Neutrality for New Development in the Stour Valley Catchment in Relation to Stodmarsh Designated Sites – For Local Planning Authorities. December 2019

Table 2 - Diffuse Annual Loading Factors by Land Use Type

AVERAGE NUTRIENT LOSS FROM NON-FARMING LAND USES		
	Nitrate- Nitrogen (kg/ha/year)	Phosphorus (kg/ha/year)
Urban	14.30	0.83
SANG/Open Space	5.00	0.14
Woodland	5.00	0.02

- 4.7 Stage 4 of the calculation is the final stage. At this point, the totals from Stage 1 and Stage 3 are added together, and the total from Stage 2 is subtracted. If there is a surplus (i.e. the proposed total is higher than the existing total), a buffer of 20% is added on to the total, and this is then referred to as 'the nutrient budget'. If the nutrient budget comes out as less than or equal to zero, then the development has achieved nutrient neutrality.
- 4.8 In July 2020, Natural England released updated guidance which, among other changes, detailed the methodology for the use of Package Treatment Plants (PTPs) onsite. This instituted a change to Stage 1 of the calculation. Instead of water use, it was assumed that each person in the development would generate 3.5kgN/year and 0.99kgP/year. The PTP treating this waste would then remove a percentage in the calculations. This change only applies if the site will be using a PTP to treat wastewater.
- 4.9 The Natural England Guidance was updated further in November 2020⁸. This update clarifies when Natural England considers PTPs appropriate and raises questions about their certainty when used in sewered areas.
- 4.10 All the calculations set out in this section can be seen in full in Appendix B of this report.

Additional Wastewater

- 4.11 Office for National Statistics (ONS) 2011 Census gives a national statistic of 2.4 people per household in England⁹. NE recommend using this value, unless there is clear evidence that a higher or lower number is appropriate.
- 4.12 Using the national average of 2.4 people house, the proposed 7 new homes will give a future population of 16.8 people.
- 4.13 Based on the TN (27mgN/l) and TP (0.90mgP/l) limits at Newnham Valley Preston WwTW, with an average water consumption of 110l/p/d, it has been calculated that the future wastewater nutrient loads from the proposed development will average 18.21kgN/year and 0.61kgP/year.

Land-Use Change / Surface Water Runoff

- 4.14 Prior to development, the land comprises reptile habitat and the existing house and garden. The reptile habitat has been designated as 'SANG/Open Space' and the existing house and garden have been designated as 'Urban'. The existing loads from the existing development have therefore been calculated as 4.71kgN/year and 0.23kgP/year.
- 4.15 After development, the site will consist of houses and gardens, and have therefore been designated as 'urban'. The future surface water loads from the development have therefore been calculated as 7.58kgN/year and 0.44kgP/year.

⁸ Natural England, Advice on Nutrient Neutrality for New Development in the Stour Valley Catchment in Relation to Stodmarsh. November 2020

⁹ Available at: <https://www.ons.gov.uk/> [Accessed 14/10/2021]

- 4.16 This therefore equates to an increase in loading from surface water of 2.86kgN/year and 0.21kgP/year due to the development.

The Nutrient Budget

- 4.17 The future nutrient loading for the proposed development, as a result of increased wastewater and surface water loads exceeds the existing nutrient load by 21.08kgN/year and 0.82kgP/year.
- 4.18 Including the recommended 20% buffer, these calculations set the 'nutrient budget' for the proposed development as 25.29kgN/year and 0.98kgP/year.
- 4.19 The following section outlines the proposed mitigation strategy for the reduction of this additional nutrient loading to zero, i.e. to establish nutrient neutrality.

5 PART 2: MITIGATION STRATEGY

- 5.1 As the development will result in an increase in nutrient load, mitigation will be required to achieve nutrient neutrality. The mitigation strategy presented in this section has been designed to reduce the nutrient budget to zero.
- 5.2 All calculations for the proposed mitigation strategy are included in full in Appendix B of this report.

Mitigation Through Installation of Greywater Recycling

- 5.3 The use of greywater recycling can typically reduce water consumption – and more importantly for nutrient neutrality: sewage generation – by approximately 25 litres per person per day (l/p/d). This is because it would typically only be feasible to use greywater for flushing toilets.
- 5.4 By decreasing the daily water consumption from 110l/p/d to 85l/p/d, the total wastewater load will decrease by approximately 20%; from 18.21kgN/year and 0.61kgP/year to 14.07kgN/year and 0.47kgP/year.

Mitigation through Built Design to Reduce Urban Phosphorus Export

- 5.5 A SuDS strategy has been designed for the proposed development. The elements of the strategy include permeable paving (or porous asphalt) over a porous sub-base allowing for infiltration at the base and underground geocellular storage allowing for infiltration at the base and the sides.
- 5.6 As the majority of phosphorus export from urban land is via particulate phosphorus, the urban leaching rate would be significantly lowered due to percolation and infiltration through the permeable paving and the porous sub-base, in addition to the infiltration into the ground. The particulate component may be almost entirely removed.
- 5.7 In the NE Guidance, the range of P export from small urban catchments is listed as 0.245-0.83kgP/ha/year, and the higher range is used in most cases, due to the precautionary principle.
- 5.8 It is further mentioned in the guidance that the P export rate can be reduced through built design through maximising permeable surfaces and implementing sustainable drainage strategies. It is therefore proposed that the lower rate of 0.245kgP/ha/year is used.
- 5.9 This does not affect the nitrogen load but reduces the surface water phosphorus load from 0.44kgP/year to 0.13kgP/year.

The Mitigated Nutrient Budget

- 5.10 The combination of both mitigation measures will reduce the total budget from 25.29kgN/year and 0.98kgP/year to 20.32kgN/year and 0.45kgP/year. This will have to be offset through land-use improvements elsewhere within the catchment.

Offsetting Through Offsite Land-use Change

- 5.11 Land-use change can be done anywhere in the Stour Valley Catchment and involves changing the use from one with a high nutrient export to one with a lower nutrient export.
- 5.12 Typically, this is accomplished through converting agricultural land to woodlands or through provision of constructed wetlands near a watercourse. It could also be accomplished, although this is not typically seen, through the conversion of high-intensity agricultural land to lower intensity agricultural land (e.g. converting wheat fields to sheep pasture).

- 5.13 To offset through land-use change to woodlands, 1ha – 3ha of agricultural land will need to be converted to woodlands, depending on the type and intensity of agriculture. The primary advantage of this is that woodlands are cheap, and there is minimal maintenance and operation required.
- 5.14 There have been two sites identified as suitable for offsetting, which have both been used as grazing pastures in the past and are likely to continue with this use in the absence of any other development. They would both be classed as 'Lowland Grazing' and so, according to the table of offsetting requirements appended in Appendix B, 2.82ha of land-use change from agricultural to woodland will be required to offset the nutrient budget from this development.
- 5.15 The first site is located in Patricxbourne and is known as the "Land below Keeper's Field". It consists of 6.24 acres of land, which translates to 2.524 hectares.
- 5.16 The second site is located in Bridge and is known as the "Great Pett Farm Site". It consists of 1.32ha of land.
- 5.17 Maps showing both sites can be found in Appendix C. The total area for both sites combined is 3.84ha. The exact division of how much each site will be converted to woodlands has not yet been decided and should be added as a pre-occupation condition.

6 CONCLUSIONS AND RECOMMENDATIONS

- 6.1 This assessment demonstrates that, with the outlined mitigation and offsetting strategy in place, the proposed development of 7 homes will not increase nutrient loading in Stodmarsh.
- 6.2 Following the procedure outlined in the latest Natural England guidance it has been demonstrated, through the implementation of the proposed mitigation and offsetting strategy, that the proposed development will result in an overall betterment in Total Nitrogen load to the designated site and will not increase the Total Phosphorus load.
- 6.3 A SuDS strategy has been designed for the proposed development. The elements of the strategy include permeable paving (or porous asphalt) over a porous sub-base allowing for infiltration at the base and underground geocellular storage allowing for infiltration at the base and the sides.
- 6.4 This has allowed the reduction of the phosphorus leaching rate from surface water.
- 6.5 In addition to this, it has been proposed to make use of greywater recycling systems onsite to reduce the total wastewater load from the site.
- 6.6 The remainder of the nutrient budget will be offset through offsite offsetting.
- 6.7 Management and maintenance of the proposed mitigation strategy components should be carried out in accordance with the manufacturer's guidance and specification.

APPENDIX A: SITE PLAN

The following drawing are referenced within the body of this report:

- OSG Architecture Drawing No. 20-0925-10-C – Proposed Site Plan

APPENDIX B: CALCULATIONS

The following calculations have been referenced within the body of this report:

- Nutrient Neutrality Calculations and Offsetting Requirements

APPENDIX C: OFFSETTING LOCATIONS

The following maps have been referenced within the body of this report:

- Map showing "Land Below Keeper's Field"
- Map showing "Land at Great Pett Farm"