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Nutrient Neutrality Assessment and Mitigation Strategy (NNAMS)

West Raynham Road, South Raynham

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Executive Summary

This report has been prepared by Enviren Ltd solely for use as part of a planning application associated with the construction of one dwelling off West Raynham Road in South Raynham (Grid reference: TF 87946 23808). The proposals are for one dwelling along with drives, gardens and infrastructure.

This report demonstrates that the development will achieve Nutrient Neutrality through the replacement of a septic tank at an adjacent property that is also owned by the client.

Contents

1. Introduction

1.1. This report has been prepared for Rose Mbure to support a planning application for the construction of one residential dwelling off West Raynham Road in South Raynham and demonstrates that through the replacement of a septic tank at an existing adjacent property, the development will achieve Nutrient Neutrality. The site itself is approximately 0.055Ha (550m^2) and currently constitutes greenspace. The construction of the new dwelling would result in an increase in nutrients discharging into the surrounding water network due to foul and surface water discharge from the proposed property if mitigation were not to take place (see **Appendix A**, **Appendix B** and **Appendix C**).
(Note: although being separate entities phosphorus and phosphates, as well as nitrogen and nitrates, have been used interchangeably throughout this report and to suit the specific usage in background information and reports)

2. Background Information

Site Location

2.1. The site is located in South Raynham on the eastern side of West Raynham Road. The application site is located 7.1 kilometres southwest of Fakenham centre and approximately 6.1 kilometres north of Litcham centre. The exact location can be found in **Figure 2.1**:

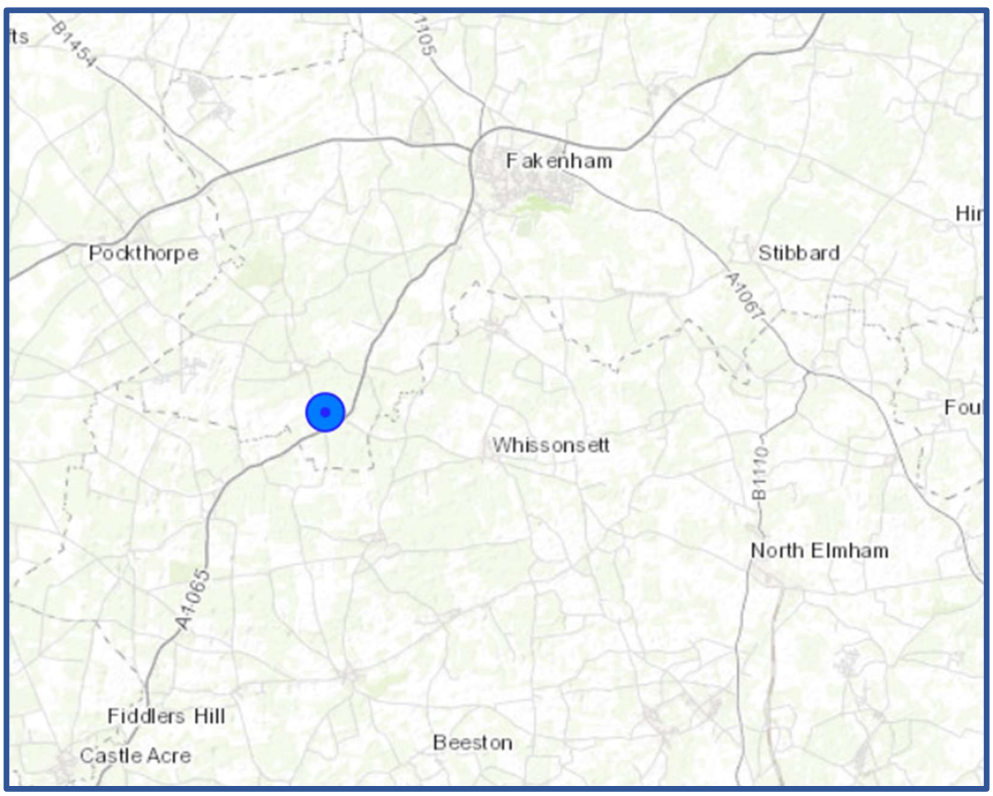

Figure 2.1 – Site Location

2.2. The development sits within the hydrological catchment of the River Wensum Special Area of Conservation (SAC) as indicated in **Figure 2.2**.

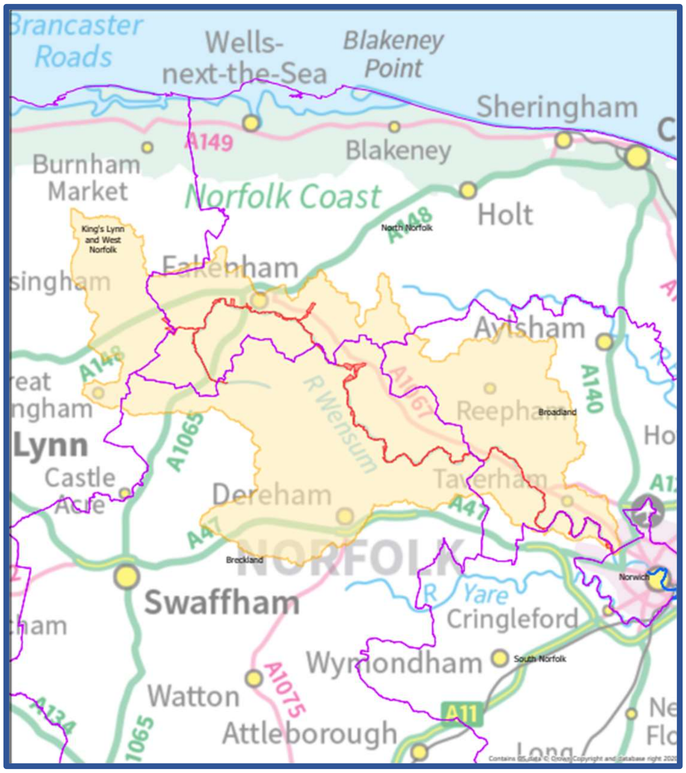

Figure 2.2 – Hydrological Catchment Plan

Site Hydrology

2.3. Interrogation of local topographical information identifies that surface water arisings from the site shall discharge to the south into an unnamed watercourse, this watercourse travels east and discharges into the River Wensum east of South Raynham.

Site Description

2.4. The area to be developed currently constitutes greenspace. The site is approximately 0.055 hectares. The site parcel is bordered to the north and south by dwellings, to the east by trees and to the west by a road. As displayed on the mapping in **Figure 2.3** the site consists of greenspace. Access is present from the west.

Figure 2.4 – Aerial Reconnaissance Photography

3. Development Proposals

3.1. The development is to consist of 1 new dwelling. The existing greenspace is to be replaced with the new dwelling as well as driveways and gardens.

Foul Water Drainage

Proposed Replacement Package Treatment Plant

3.2. The Package Treatment Plant to replace the septic tank at the existing dwelling is to be a GRAF One2Clean, which is a Sequencing Batch Reactor (SBR) Package Treatment Plant (PTP) specifically engineered to treat nutrients from wastewater. The system is purely biological and does not require chemical dosing to achieve the high nutrient removals stated within the PIA certification (see **Appendix E**).

4. Nutrient Calculator – Observations influencing Results

4.1. A clear factsheet outlining the selections made in the Calculator Tool is provided in **Table 4.1**. The direct print of the Royal Haskoning DHV calculator is given in **Appendix A**, **Appendix B** and **Appendix C**. This section shall outline the observations made on the site, including proposed nutrient loads, pre-development nutrient loads and proposed land use loads as provided in the Royal Haskoning DHV calculator.

Table 4.1 – Royal Haskoning DHV – Nutrient Budget Calculator Factsheet

Info	
Planning reference number	2023/2058
Site address	9 West Raynham Road South Raynham Fakenham NR21 7HG
Site proposals	Construction of 1 new dwelling along with gardens, driveways and associated ancillaries.

Date	14/03/2024
Stage 1 – Nutrient Load from Proposed Dwelling	
Number of houses proposed	1
Onsite treatment works	Package Treatment Plant user defined
Total phosphorus load from additional population	0.12kg/year
Total nitrogen load from additional population	0.60kg/year
Stage 2 – Calculate existing (pre-development) nutrient load from current land use of the development	
Catchment	Wensum
Soil drainage type	Slightly impeded drainage
Rainfall band	700-750mm/year
With NVZ	Yes
Identified land use	0.055 – Greenspace
TP Load from current land use	0.00kg/year
TN Load from current land use	0.17kg/year
Stage 3 – Calculate TP load for the proposed development land use	
Identify proposed land uses of the development site	0.055 – Low intensity urban land
TP load from proposed land usage	0.01kg/year
TN load from proposed land usage	0.27kg/year
Stage 4 – Calculate the net change in nutrient load from the proposed development	
Total nutrient budget for the site	TP Loading: 0.16kg/year TN Loading: 0.84kg/year
Current TP loading	Development will generate additional Phosphate
Current TN loading	Development will generate additional Phosphate
Mitigation: Existing Septic Tank at existing dwelling	
Number of houses	1 *(132.2l/p/d following discussion with the Norfolk District Council's)*
Onsite treatment works	Default single-source septic tank
Annual wastewater TP load	1.05kg/year
Annual wastewater TN load	8.72kg/year
Mitigation: New GRAF One2Clean to be installed at existing dwelling	
Number of houses	1 *(132.2l/p/d following discussion with the Norfolk District Council's)*
Onsite treatment works	Package Treatment Plant (user defined)
Phosphorus discharge level (mg/l)	1.60
Nitrogen discharge level (mg/l)	7.90
Annual wastewater TP load	0.14kg/year
Annual wastewater TN load	0.72kg/year
FINAL – Comparison of Nutrient Budgets	
Existing Phosphorus Load from Existing Septic Tank	-1.05kg/year

Existing Nitrogen Load from Existing Septic Tank	-8.72kg/year
Proposed Phosphorus Load from Replacement of Septic Tank with Package Treatment Plant	+0.14kg/year
Proposed Nitrogen Load from Replacement of Septic Tank with Package Treatment Plant	+0.72kg/year
Proposed Phosphorus Load from New Dwelling (Current)	+0.16kg/year
Proposed Nitrogen Load from New Dwelling (Current)	+0.84kg/year
Net Change in Phosphorus Load (Current)	-0.75kg/year
Net Change in Nitrogen Load (Current)	-7.16kg/year

Key		
User Input	Automated Input	Displayed Return
		Displayed Return

5. Conclusion

5.1. As can be seen in this report, the nutrient arisings associated with the development have been extensively considered, along with off-site and on-site mitigation methods. The applicant will replace a septic tank in the adjacent property with a GRAF One2Clean Package Treatment Plant to offset the increase in nutrients generated by the proposed dwelling. The applicant shall achieve Nutrient Neutrality through the proposals and therefore nutrient arisings should not prevent planning permission being granted.

Table 5.1 – Pre and Post Mitigation Risk Assessment				
Pre Mitigation Risk				
Risk	**Description**	**Probability**	**Severity**	**Action to minimise risk**
Pollution of downstream water bodies.	Nutrients discharged from the development causing eutrophication downstream.	Looking at the hydraulic/ hydrological pathways, there is a medium likelihood of nutrient contamination.	Arisings from the development will be moderate.	Provide mitigation measures either through site controls or nutrient offsetting.
Post Mitigation Risk				
Risk	**Description**	**Probability**	**Severity**	**Action to minimise risk**
Pollution of downstream water bodies.	Nutrients discharged from the development causing eutrophication downstream.	Looking at the hydraulic/ hydrological pathways, there is a medium likelihood of nutrient contamination.	Arisings from the development will be offset through the replacement of a septic tank in the adjacent property.	No further action required.
High		Medium		Low

Appendix A Existing Septic Tank Calculations

(Press Alt + Left Arrow to return if using Hyperlinks)

Stage 1 **Calculate nutrient load (Kg/year) derived from the development as a result of increased population**

*Note: This calculation should only include the **additional** units resulting from the proposed development, including any development that will result in overnight accommodation. For land not currently in residential use, this will be the total units proposed by the development. However, for land already in residential use, this should only be the increase in units.*

The user should input the relevant number of dwellings into options a, b or c below. In the case of residential developments, only option a is required.

		Value	Unit
1.	Calculate the additional population		
a	Number of dwellings proposed	1	dwellings
	Average occupancy	1.88	persons/dwelling
b	Number of **additional** rooms above 6 residents (sui generis) for houses in multiple occupation		dwellings
	Average occupancy	1.65	persons/dwelling
c	Number of rooms in a hotel or guest house proposed		dwellings
	Average occupancy	1.65	persons/dwelling
	Number of weeks open per year (1-52)		Weeks
	Average occupancy rate (1-100)		%
d	Number of bedspaces in student accommodation		dwellings
	Average occupancy	1	persons/dwelling
	Number of weeks open per year (1-52)		Weeks
	Average occupancy rate (1-100)		%
	Total population increase generated by the development	2	**Persons**

		Value	Unit
2.	Wastewater volume generated		
	Water use per person	132	Litres/person/day
	Wastewater volume generated by the development	**248**	**Litres/day**

Please select how the sewage from the proposed development will be handled, noting that a development must be handled by either a water recycling centre or onsite treatment plants, and cannot be handled by both. Consideration of wastewater loading is not required where a site drains to a WRC that does not drain in to the River Wensum or the Broads catchments

Is sewage to be handled by water recycling centre? No

Is sewage to be handled by Onsite treatment plants? Yes

3a. TP budget that would exit the Water Recycling Centre (WRC) after treatment

Note: If the sewage is to be treated by WRCs then the user should select "Yes" in the list above. If package treatment plants are to be used instead, then the user should select "No" above.

This is the process of collecting wastewater from houses and guiding it, via the sewage network, to a WRC (also known as sewage works). The nutrient concentration of the influent is calculated by multiplying the number of people by the expected water usage per day. The nutrient concentration within the effluent is calculated by applying the discharge level of the appropriate WRC. The nutrient loading is expressed in kg/year.

Confirm receiving WRC and discharge level	Value		Unit
Select the WRC the development will connect to	Aldborough Water Recycling Centre		
	Current discharge	Post 2030 discharge	
Phosphorus WRC discharge level	1.57	1.57	mg/l
Nitrogen WRC discharge level	25.00	25.00	mg/l

Note: Please use the drop down lists to select the WRC that the proposed development will be connected to. If the WRC is not known, then please select 'Unknown' from the drop down list.

The 2030 permit limits are included for guidance purposes only and cannot be relied upon until the Levelling Up and Regeneration Bill is passed into legislation.

Calculate the nutrient load discharged by the WRC	Value		Unit
	Current discharge	Post 2030 discharge	
TP discharged by WRC	0.00	0.00	kg/year
TN discharged by WRC	0.00	0.00	kg/year

3b. TP budget for Onsite treatment plants

Note: If the sewage is to be treated by on-site treatment plants then the user should select "Yes" in the list above. If wastewater treatment works are to be used instead, then the user should select "No" above.

On-site treatment plants are pre-manufactured treatment facilities used to treat wastewater in smaller communities or on individual properties. This concept is defined as decentralized wastewater treatment. The nutrient influent is calculated by multiplying the number of people by the expected loading per person. The nutrient effluent is calculated by applying the reduction efficiency. The nutrient loading is expressed in kg/year.

Calculate nutrient load after treatment	Value		Unit
Select the type of On-site treatment works	Default single-source septic tank		
Phosphorus discharge level	11.60	11.60	mg/l
Nitrogen discharge level	96.30	96.30	mg/l

Note: The user must input the reduction efficiency of the PTP. The efficiency of the PTP used must be evidenced. The evidence should include the test result documents from the lab (in English) and/ or measured effluent concentrations from real world applications. If the efficiency is unknown then a precautionary default value can be used

Calculate loading from wastewater with onsite treatment plants	Value	Unit
TP discharged by on-site treatment plant	1.05	kg/year
TN discharged by on-site treatment plant	8.72	kg/year

4.	Additional population load	Value Current	Post 2030	Unit
	TP load from additional population	**1.05**	**1.05**	**Kg/year**
	TN load from additional population	**8.72**	**8.72**	**Kg/year**

Appendix B Mitigation Package Treatment Plant Calculations

(Press Alt + Left Arrow to return if using Hyperlinks)

Stage 1 **Calculate nutrient load (Kg/year) derived from the development as a result of increased population**

Note: This calculation should only include the ***additional*** *units resulting from the proposed development, including any development that will result in overnight accommodation. For land not currently in residential use, this will be the total units proposed by the development. However, for land already in residential use, this should only be the increase in units.*

The user should input the relevant number of dwellings into options a, b or c below. In the case of residential developments, only option a is required.

		Value	Unit
1.	Calculate the additional population		
a	Number of dwellings proposed	1	dwellings
	Average occupancy	1.88	persons/dwelling
b	Number of **additional** rooms above 6 residents (sui generis) for houses in multiple occupation		dwellings
	Average occupancy	1.65	persons/dwelling
c	Number of rooms in a hotel or guest house proposed		dwellings
	Average occupancy	1.65	persons/dwelling
	Number of weeks open per year (1-52)		Weeks
	Average occupancy rate (1-100)		%
d	Number of bedspaces in student accommodation		dwellings
	Average occupancy	1	persons/dwelling
	Number of weeks open per year (1-52)		Weeks
	Average occupancy rate (1-100)		%
	Total population increase generated by the development	**2**	**Persons**
2.	Wastewater volume generated		
	Water use per person	**132**	Litres/person/day
	Wastewater volume generated by the development	**248**	**Litres/day**

Please select how the sewage from the proposed development will be handled, noting that a development must be handled by either a water recycling centre or onsite treatment plants, and cannot be handled by both. Consideration of wastewater loading is not required where a site drains to a WRC that does not drain in to the River Wensum or the Broads catchments

Is sewage to be handled by water recycling centre? No

3a. TP budget that would exit the Water Recycling Centre (WRC) after treatment

Note: If the sewage is to be treated by WRCs then the user should select "Yes" in the list above. If package treatment plants are to be used instead, then the user should select "No" above.

This is the process of collecting wastewater from houses and guiding it, via the sewage network, to a WRC (also known as sewage works). The nutrient concentration of the influent is calculated by multiplying the number of people by the expected water usage per day. The nutrient concentration within the effluent is calculated by applying the discharge level of the appropriate WRC. The nutrient loading is expressed in kg/year.

Confirm receiving WRC and discharge level	Value		Unit
Select the WRC the development will connect to	Aldborough Water Recycling Centre		
	Current discharge	Post 2030 discharge	
Phosphorus WRC discharge level	1.57	1.57	mg/l
Nitrogen WRC discharge level	25.00	25.00	mg/l

Note: Please use the drop down lists to select the WRC that the proposed development will be connected to. If the WRC is not known, then please select 'Unknown' from the drop down list.

The 2030 permit limits are included for guidance purposes only and cannot be relied upon until the Levelling Up and Regeneration Bill is passed into legislation.

Calculate the nutrient load discharged by the WRC	Value		Unit
	Current discharge	Post 2030 discharge	
TP discharged by WRC	0.00	0.00	kg/year
TN discharged by WRC	0.00	0.00	kg/year

Is sewage to be handled by Onsite treatment plants? Yes

3b. TP budget for Onsite treatment plants

Note: If the sewage is to be treated by on-site treatment plants then the user should select "Yes" in the list above. If wastewater treatment works are to be used instead, then the user should select "No" above.

On-site treatment plants are pre-manufactured treatment facilities used to treat wastewater in smaller communities or on individual properties. This concept is defined as decentralized wastewater treatment. The nutrient influent is calculated by multiplying the number of people by the expected loading per person. The nutrient effluent is calculated by applying the reduction efficiency. The nutrient loading is expressed in kg/year.

Calculate nutrient load after treatment	Value		Unit
Select the type of On-site treatment works	Package treatment plant (user-defined)		
Phosphorus discharge level	Please enter effluent concentration in cell to right:	1.60	mg/l
Nitrogen discharge level	Please enter effluent concentration in cell to right:	7.90	mg/l

Note: The user must input the reduction efficiency of the PTP. The efficiency of the PTP used must be evidenced. The evidence should include the test result documents from the lab (in English) and/ or measured effluent concentrations from real world applications. If the efficiency is unknown then a precautionary default value can be used

Calculate loading from wastewater with onsite treatment plants	Value	Unit
TP discharged by on-site treatment plant	0.14	kg/year
TN discharged by on-site treatment plant	0.72	kg/year

4.	Additional population load	Value Current	Post 2030	Unit
	TP load from additional population	**0.14**	**0.14**	**Kg/year**
	TN load from additional population	**0.72**	**0.72**	**Kg/year**

Appendix C Development Nutrient Calculations

(Press Alt + Left Arrow to return if using Hyperlinks)

Stage 1 **Calculate nutrient load (Kg/year) derived from the development as a result of increased population**

Note: This calculation should only include the ***additional*** *units resulting from the proposed development, including any development that will result in overnight accommodation. For land not currently in residential use, this will be the total units proposed by the development. However, for land already in residential use, this should only be the increase in units.*

The user should input the relevant number of dwellings into options a, b or c below. In the case of residential developments, only option a is required.

		Value	Unit
1.	Calculate the additional population		
a	Number of dwellings proposed	1	dwellings
	Average occupancy	1.88	persons/dwelling
b	Number of **additional** rooms above 6 residents (sui generis) for houses in multiple occupation		dwellings
	Average occupancy	1.65	persons/dwelling
c	Number of rooms in a hotel or guest house proposed		dwellings
	Average occupancy	1.65	persons/dwelling
	Number of weeks open per year (1-52)		Weeks
	Average occupancy rate (1-100)		%
d	Number of bedspaces in student accommodation		dwellings
	Average occupancy	1	persons/dwelling
	Number of weeks open per year (1-52)		Weeks
	Average occupancy rate (1-100)		%
	Total population increase generated by the development	**2**	**Persons**
2.	Wastewater volume generated		
	Water use per person	**110**	Litres/person/day
	Wastewater volume generated by the development	**206**	**Litres/day**

Please select how the sewage from the proposed development will be handled, noting that a development must be handled by either a water recycling centre or onsite treatment plants, and cannot be handled by both. Consideration of wastewater loading is not required where a site drains to a WRC that does not drain in to the River Wensum or the Broads catchments

Is sewage to be handled by water recycling centre? No

Is sewage to be handled by Onsite treatment plants? Yes

3a. TP budget that would exit the Water Recycling Centre (WRC) after treatment

Note: If the sewage is to be treated by WRCs then the user should select "Yes" in the list above. If package treatment plants are to be used instead, then the user should select "No" above.

This is the process of collecting wastewater from houses and guiding it, via the sewage network, to a WRC (also known as sewage works). The nutrient concentration of the influent is calculated by multiplying the number of people by the expected water usage per day. The nutrient concentration within the effluent is calculated by applying the discharge level of the appropriate WRC. The nutrient loading is expressed in kg/year.

Confirm receiving WRC and discharge level	Value		Unit
Select the WRC the development will connect to	Aldborough Water Recycling Centre		
	Current discharge	Post 2030 discharge	
Phosphorus WRC discharge level	1.57	1.57	mg/l
Nitrogen WRC discharge level	25.00	25.00	mg/l

Note: Please use the drop down lists to select the WRC that the proposed development will be connected to. If the WRC is not known, then please select 'Unknown' from the drop down list.

The 2030 permit limits are included for guidance purposes only and cannot be relied upon until the Levelling Up and Regeneration Bill is passed into legislation.

Calculate the nutrient load discharged by the WRC	Value		Unit
	Current discharge	Post 2030 discharge	
TP discharged by WRC	0.00	0.00	kg/year
TN discharged by WRC	0.00	0.00	kg/year

3b. TP budget for Onsite treatment plants

Note: If the sewage is to be treated by on-site treatment plants then the user should select "Yes" in the list above. If wastewater treatment works are to be used instead, then the user should select "No" above.

On-site treatment plants are pre-manufactured treatment facilities used to treat wastewater in smaller communities or on individual properties. This concept is defined as decentralized wastewater treatment. The nutrient influent is calculated by multiplying the number of people by the expected loading per person. The nutrient effluent is calculated by applying the reduction efficiency. The nutrient loading is expressed in kg/year.

Calculate nutrient load after treatment	Value		Unit
Select the type of On-site treatment works	Package treatment plant (user-defined)		
Phosphorus discharge level	Please enter effluent concentration in cell to right:	1.60	mg/l
Nitrogen discharge level	Please enter effluent concentration in cell to right:	7.90	mg/l

Note: The user must input the reduction efficiency of the PTP. The efficiency of the PTP used must be evidenced. The evidence should include the test result documents from the lab (in English) and/ or measured effluent concentrations from real world applications. If the efficiency is unknown then a precautionary default value can be used

Calculate loading from wastewater with onsite treatment plants	Value	Unit
TP discharged by on-site treatment plant	0.12	kg/year
TN discharged by on-site treatment plant	0.60	kg/year

		Value		Unit
4.	Additional population load	Current	Post 2030	
	TP load from additional population	**0.12**	**0.12**	**Kg/year**
	TN load from additional population	**0.60**	**0.60**	**Kg/year**

Stage 2 **Calculate existing (pre-development) nutrient load from current land use of the development**

Note: Where development sites include existing areas that are to be retained, these areas can be excluded from the calculations in both Stages 2 and 3.

1.	Identify current land uses of the development site	Value	Unit

The user should select the value from the following drop-down list that applies to the development. Use the links below or navigate to the 'Introduction' tab to find instructions on how this information can be acquired.

Select the Catchment	Wensum	
Select the soil drainage type	Impermeable - drained for arable and grassland	
Select annual average rainfall band	700-750	mm/yr
Within Nitrate Vulnerable Zone (NVZ)	Yes	

Note: Use the Link in the introduction tab to find the appropriate catchment
Note: Use the criteria table in the introduction tab to identify if the soil type
Note: Rainfall can be identified using the map on the Rainfall tab
Note: Use the Link in the introduction tab to find out whether the development is in a Nitrate Vulnerable Zone (NVZ)

2. Input the area of the existing land use type(s)

Land use	Value	Unit	TP loading	TN loading	
High density residential		Hectares	0.00	0.00	Kg/yr
Medium density residential		Hectares	0.00	0.00	Kg/yr
Low density residential		Hectares	0.00	0.00	Kg/yr
Commercial / Industrial		Hectares	0.00	0.00	Kg/yr
Urban open space		Hectares	0.00	0.00	Kg/yr
Dairy		Hectares	0.00	0.00	Kg/yr
Lowland grazing		Hectares	0.00	0.00	Kg/yr
Mixed		Hectares	0.00	0.00	Kg/yr
Poultry		Hectares	0.00	0.00	Kg/yr
Pigs		Hectares	0.00	0.00	Kg/yr
Horticulture		Hectares	0.00	0.00	Kg/yr
Cereals		Hectares	0.00	0.00	Kg/yr
General arable		Hectares	0.00	0.00	Kg/yr
Allotments and city farms		Hectares	0.00	0.00	Kg/yr
Woodland (e.g. conifer, mixed, broad-leaved)		Hectares	0.00	0.00	Kg/yr
Greenspace	0.055	Hectares	0.00	0.17	Kg/yr
Shrub / heathland / bracken / bog		Hectares	0.00	0.00	Kg/yr
Water		Hectares	0.00	0.00	Kg/yr
Sum total	**0.055**	**Hectares**	**0.00**	**0.17**	**Kg/yr**

3. Calculate loading from current land usage

	Value	Unit
TP load from proposed land usage	**0.00**	**Kg/yr**
TN load from proposed land usage	**0.17**	**Kg/yr**

Stage 3 **Calculate nutrient load for the proposed development**

Note: This section should include all land uses within the proposed development. Where the proposed scheme is to create new wetlands, woodlands, nature reserves, etc. within the development site area, then this should be included within this section. Any offsite mitigation should not be included below, and should instead be inputted in the mitigation stages (if mitigation is required).

1.	Identify proposed land uses of the development site	Value	Unit
	High intensity urban land		Hectares
	Medium intensity urban land		Hectares
	Low intensity urban land	0.055	Hectares
	Commercial / Industrial		Hectares
	Open urban space		Hectares
	Allotments and city farms		Hectares
	Woodland (e.g. conifer, mixed, broad-leaved)		Hectares
	Green space		Hectares
	Shrub / heathland / bracken / bog		Hectares
	Water		Hectares

2.	Designed Wetlands / SuDS		
	Wetland / SuDS area		Hectares
	TP Banking coefficient		kg/ha/year
	TN Banking coefficient		kg/ha/year

Note: Please input the banking coefficient (i.e. the nutrient removal amount in kg/ha/yr) calculated for the designed wetland / SuDS. The calculated value should be justifiable with supporting evidence.

Sum total of land uses **0.055** **Hectares**

Note: The sum total of land uses must equal the development site area inputted in Stage 2 - the box will colour red if the areas do not match. Wetland refers to specific wetland related to a watercourse. For more information, please refer to the land use definitions in the help tab.

3.	Calculate loading from proposed land usage	Value	Unit
	TP load from proposed land usage	**0.01**	**kg/year**
	TN load from proposed land usage	**0.27**	**kg/year**

Stage 4 **Calculate the net change in nutrient load from the proposed development**

Note: This stage calculates the net change in TP and TN load to the catchment from the proposed development. This is derived by calculating the difference between the load calculated for the proposed development (wastewater, urban area, open space, etc.) and that for the existing land uses. The nutrient budget for the site has been calculated under current and post-2025 WRC permit levels, where applicable. The nutrient budgets under proposed Post 2030 permit limits are for guidance purposes only until the permit limits are put into legislation.

		Current	Post 2030	
1.	Identify the load from additional population	Value	Value	Unit
	TP Loading from additional population	**0.12**	**0.12**	**kg/year**
	TN Loading from additional population	**0.60**	**0.60**	**kg/year**
2.	Calculate net change in nutrient load from land use change	Value	Value	Unit
	TP load from land use change	**0.01**	**0.01**	**kg/year**
	TN load from land use change	**0.11**	**0.11**	**kg/year**
3.	Calculate nutrient budget for the development site	Value	Value	Unit
	TP budget for the site	**0.13**	**0.13**	**kg/year**
	TN budget for the site	**0.70**	**0.70**	**kg/year**
4.	Calculate precautionary buffer	Value	Value	Unit
	Buffer amount	20	20	%
	TP Precautionary buffer	**0.03**	**0.03**	**kg/year**
	TN Precautionary buffer	**0.14**	**0.14**	**kg/year**

Summary	
No. of dwellings	1
Onsite treatment plant	Package treatment plant (user-defined)
Current TP discharge concentr	1.60
Current TN discharge concentr	7.90
Post 2030 TP discharge concer	1.60
Post 2030 TN discharge concer	7.90
TP current land use	0.00
TP proposed land use	0.01
TN current land use	0.17
TN proposed land use	0.27

Note: The figures used throughout this model are based on scientific research, evidence and modelled catchments and represent the best available evidence. However, it is important that a precautionary buffer is used that recognises the uncertainty with these figures and ensures, with reasonable certainty, that there will be no adverse effect on site integrity. As such, a 20% precautionary buffer added to the nutrient budget.

5.	**Total nutrient budget for the development site**	Value		Unit
	Total Phosphorus budget for the site	**0.16**	**0.16**	**Kg/year**
	Total Nitrogen budget for the site	**0.84**	**0.84**	**Kg/year**

Current TP loading

Development will generate additional Phosphate (Mitigation required) - Please progress to 'Mitigation current' tab

Post 2030 TP loading

Development will generate additional Phosphate (Mitigation required) - Please progress to 'Mitigation - post 2030' tab

Current TN loading

Development will generate additional Nitrate (Mitigation required) - Please progress to 'mitigation - current' tab

Post 2030 TN loading

Development will generate additional Nitrate (Mitigation required) - Please progress to 'Mitigation - post 2030' tab

Appendix D GRAF One2Clean Performance Certificate

(Press Alt + Left Arrow to return if using Hyperlinks)

Prüfinstitut für Abwassertechnik GmbH

PERFORMANCE RESULTS

Otto Graf GmbH
Carl-Zeiss-Str. 2 - 6, 79331 Teningen, Germany

EN 12566-3
Small wastewater treatment systems for up to 50 PT

Small wastewater treatment system one2clean
SBR plant in one two-zone polypropylene tank

Test report PIA2014-216B14.01.e

Nominal organic daily load*	0.27	kg/d	
Nominal hydraulic daily load	0.75	m³/d	
Material	polypropylene		
Treatment efficiency (nominal sequences)		Efficiency	Effluent
	COD	94.2 %	43 mg/l
	BOD_5	98.0 %	7 mg/l
	SS	96.3 %	14 mg/l
	NH_4-N**	98.3 %	0.5 mg/l
	N_{tot}**	87.0 %	7.9 mg/l
	P_{tot}	80.2 %	1.6 mg/l
Electrical consumption	0.63	kWh/d	

**at a test influent of ≥ 300 mg/l BOD_5 (mean)*
***determined for temperatures ≥ 12°C in the bioreactor*

Performance tested by:

PIA – Prüfinstitut für Abwassertechnik GmbH
(PIA GmbH)
Hergenrather Weg 30
52074 Aachen, Germany

This document replaces neither the declaration of performance nor the CE marking.

Notified Body No.: 1739

Certified according to ISO 9001:2008

ilac-MRA

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

Prüfinstitut für Abwassertechnik GmbH
geprüft - tested - testé

Elmar Lancé

November 2014

Appendix E Regional Background and Context

(Press Alt + Left Arrow to return if using Hyperlinks)

Following the ruling on the "Dutch N" (Case C-293/17 and C-294/17)[1] in November 2018 through the Court of Justice of the European Union (CJEU), as well as several other lower profile cases in Ireland, Natural England wrote a letter[2] to the affected Council in March 2022 identifying unacceptable phosphate and nitrate levels within the waterways of the Broads Special Area of Conservation and Ramsar Site and requested greater scrutiny of planning applications going forward which would increase nutrient loads into the water system[3], resulting in the Protected Area (SAC, SPA or Ramsar Site) reaching a point where the ability to return the site to favourable conditions would be compromised or necessarily limit the conservation objectives of the area.

As identified the site benefits from a pathway into the River Wensum SAC and subsequently into the River Yare which is hydraulically connected to the Broads Special Area of Conservation and Ramsar Site, this area is protected as an SAC (Special Area of Conservation) under the Habitat Regulations 2017, as well as being listed as a Ramsar Site (RS) under the Ramsar Convention (effective from December 1975), the Ramsar Convention being an international, intergovernmental treaty, provides a framework for cooperation and national action for the proper use and conservation of wetlands and their resources, this is ratified by UK planning law under paragraph 176 of the NPPF . The SAC and RS cover roughly the same area, however the SAC particularly pertains to the conservation of the habitats and species of the area, whereas the Ramsar protection covers the wetlands as well as the biodiversity in the contributing rhynes, ditches and waterways, including the floristic and invertebrate diversity. This is shared as a Designated Feature underpinning Sites of Special Scientific Interest (SSSI).

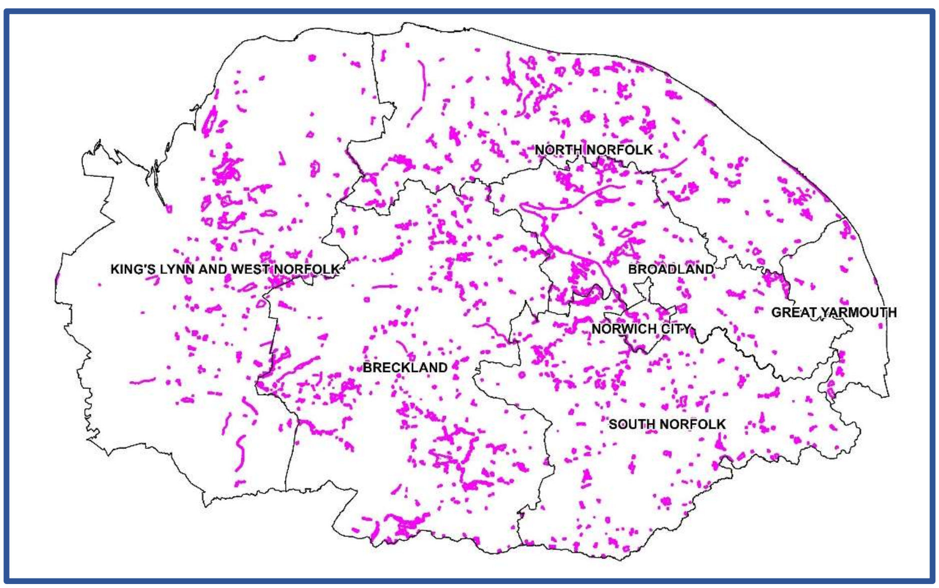

Figure E.1 – County Wildlife Sites Systems in Norfolk[4].

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[1] C-293/17 - Coöperatie Mobilisation for the Environment and Vereniging Leefmilieu (Link-to-source)

[2] Natural England Letter to affected Councils - Advice for development proposals with the potential to affect water quality resulting in adverse nutrient impacts on habitats sites. (Link-to-source)

[3] Reg. 63 of the Habitats Regulations 2017.

[4] Norfolk Biodiversity Information Service – County Wildlife Sites (Link-to-source)

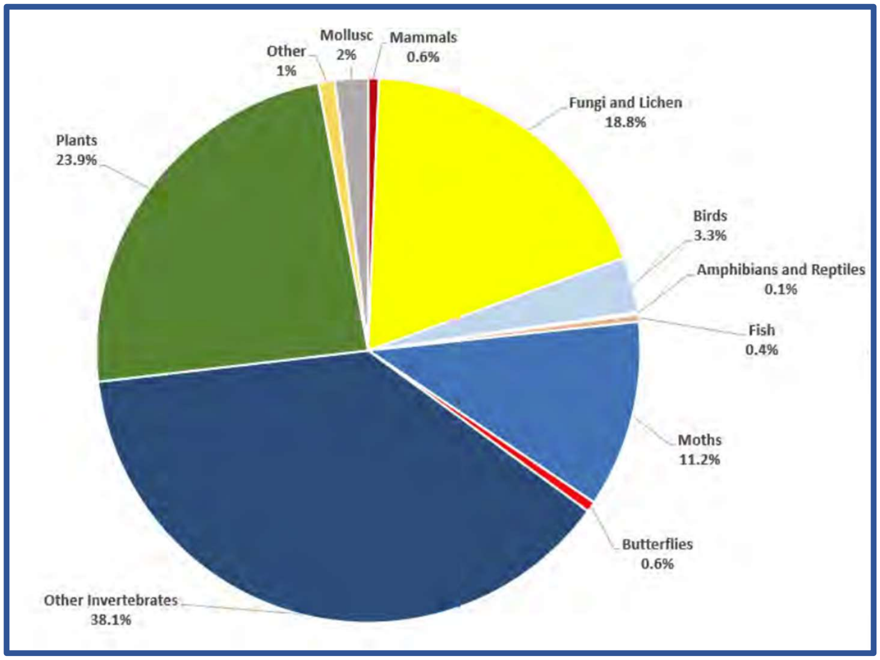

Figure E.2 – Species distribution of South Yare[5].

Figure E.3 – Species of The Broads waterways. From left to right: Watermilfoils, Chara Aspera and Pointed Spear-moss.

[5] South Yare Wildlife Group – State of the Natural Environment Report (Link-to-source)

Appendix F Nutrient Neutrality Underlying Science

(Press Alt + Left Arrow to return if using Hyperlinks)

Phosphorus is an essential nutrient for the continued and healthy growth of flora, including crops, garden plants and flowers. Phosphates provide the sugar-phosphate backbone for DNA and RNA and therefore are essential for reproduction, they also are essential for photosynthesis and are required for energy transfer in cells, forming an integral part of ATP (Adenosine Triphosphate) and ADP (Adenosine Diphosphate). Nitrogen is a key component of chlorophyll which allows plants to photosynthesise, as well as this it is a major constituent of amino acids, the building blocks of proteins. Additionally, Nitrogen is a key component of the nucleic bases that form DNA.

Phosphorus and Nitrogen are contained in large concentrations in NPK fertilisers used by farmers to ensure high crop yields and healthy plant growth, compensating for the loss of soil productivity associated with modern agricultural practises and the relative loss of the O-Horizon[6]. The relative lack of naturally occurring phosphorus and the disruption in the natural phosphorus cycle require phosphorus to be extracted from raw phosphate rock (a finite resource), this disturbs the natural balance of the region and often leads to nutrient pollution[7]. Nitrogen is typically produced artificially through the Haber-Bosch process which involves creating Ammonia (a key source of Nitrogen) through a reaction between Natural Gas and Air (which is principally made-up of Nitrogen)[8]. Beyond the cultivation of crops, phosphates and nitrates are found further down the supply chain in commercial waste associated with food production and processing. Phosphates are also useful additives in household detergents as they chelate calcium and magnesium ions preventing the deposition of limescale[9]. However the principal share of domestic phosphorus output comes from human waste as can be seen in **Figure F.1**.

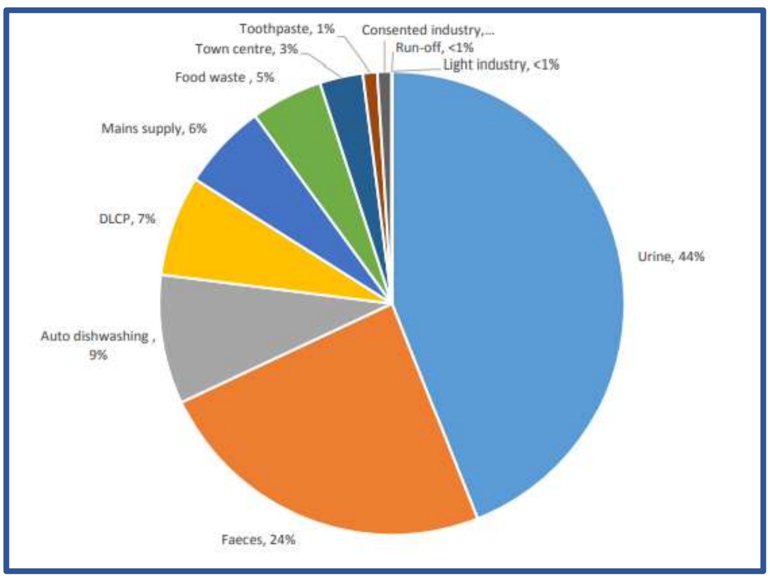

Figure F.1 – Breakdown of Phosphorus Arisings from Domestic Sources[10].

[6] O-Horizon – Britannica (Link-to-source)
[7] Environment Agency - Phosphorous and Freshwater Eutrophication Pressure Narrative (Link-to-source)
[8] Brittanica – Haber-Bosch process
[9] European Commission - Phosphates and Alternative Detergent Builders (Link-to-source)
[10] Environment Agency - Phosphorous and Freshwater Eutrophication Pressure Narrative (Link-to-source)

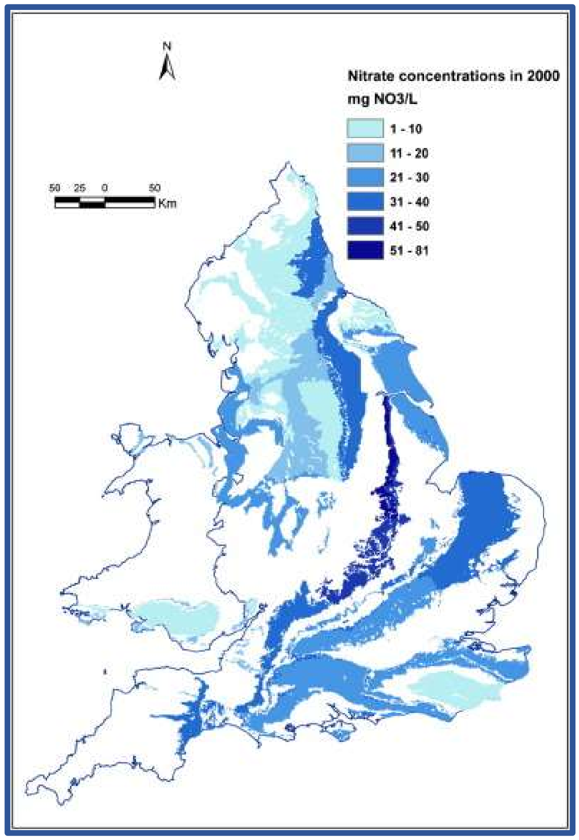

Figure F.2 – Nitrate Concentrations in Major Aquifers of England and Wales[11].

When nutrients are over sprayed due to variations in soil quality and the need to ensure proper nutrient spread, the excess is washed off the land by overland flows, these are either taken up by surface water sewer systems or discharged directly into local irrigation channels/open water courses[12]. Domestic nutrient arisings are usually taken away by foul/combined sewers into Wastewater Treatment Works (WwTWs), the treatment works employ Appropriate Treatment, Secondary Treatment or Advanced Treatment depending on the Population Equivalent of the Agglomeration they serve, the Downstream Receptor and depending on the quantity of Industrial Waste they are expected to accept. The treated water is then discharged into an appropriate receiving body, often rivers or watercourses[13]. Alternatively residential effluent is treated by a Package Treatment Plant and discharged into a watercourse directly or discharged to ground through a suitable Secondary Treatment Measure.

When nutrients enter the watercourse, they are taken up by aquatic plants which benefit in the same way as land based plants. However, high nutrient loads attract rapidly propagating plants such as Algae and Duckweed (*Genus Lemna*), which in the case of the former form dense monocultures called Algal Blooms (often called HABs – Harmful Algal Blooms)[14], this excessive plant/algal growth is called **Eutrophication**, the particular concern of Natural England is so called "Hyper Eutrophication".

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[11] ScienceDirect – The changing trend in nitrate concentrations in major aquifers due to historical nitrate loading from agricultural land across England and Wales from 1925 to 2150 (Link-to-source)

[12] HR Wallingford – Greenfield Runoff Rate Estimation (Link-to-source)

[13] UK Government - Waste water treatment works: treatment monitoring and compliance limits (Link-to-source)

[14] UK Government – Algal Blooms (Link-to-source)

Figure F.3 – Example of at Surface Eutrophication.

5.2. Eutrophication is an excessive growth of filamentous Algae/Lemna which form in “mats” on the surface, these mats produce effects such as shading and smothering, which prevents sunlight reaching submerged oxygenating plants, which in turn die off and reduce the dissolved oxygen in the water body, additionally once the nutrient concentrations reduce there is a die-back of the Algal Blooms, which degrade at the bottom of the waterbody, this degradation is highly oxygen intensive and further removes dissolved oxygen. This lack of oxygen causes anoxia/hypoxia to species within the eco-system, which the environment can take years to recover from, if at all.

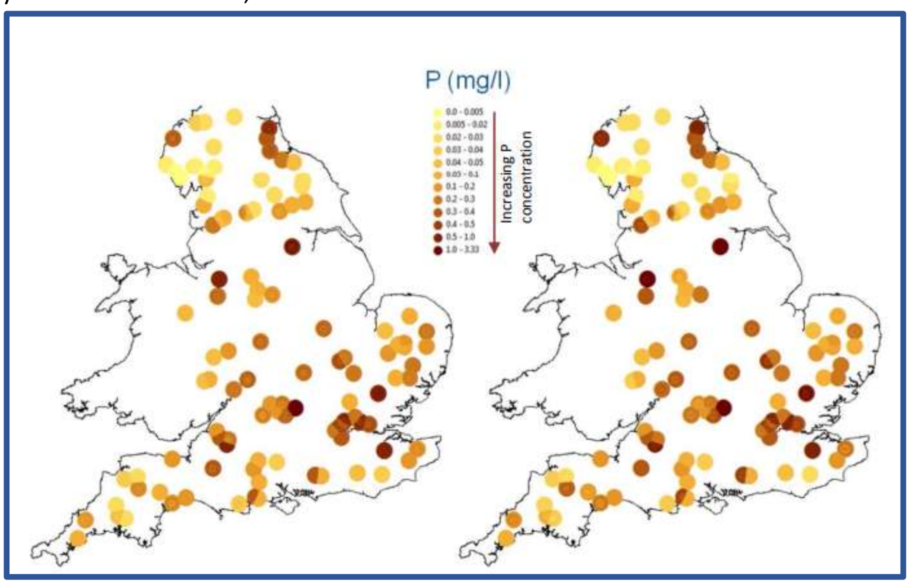

Figure F.4 – Estimated Phosphorus Concentrations for Study Sites as per Environment 2050s phosphorus concentrations Agency Report[15].

[15] Environment Agency - Climate change and eutrophication risk in English rivers (Link-to-source)