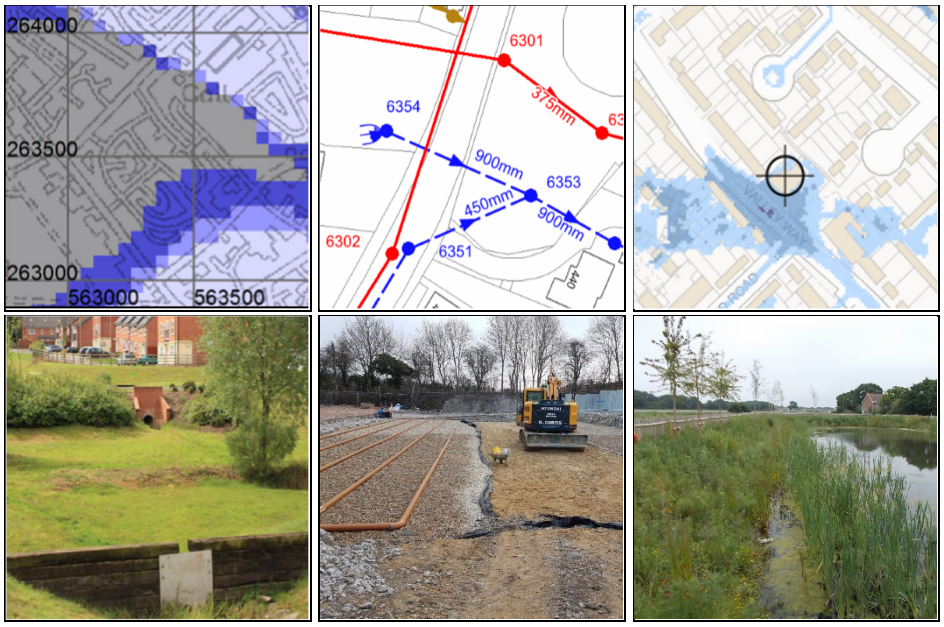

Nitrogen Nutrient Assessment

Land Adjacent 15 Billet Avenue, Waterlooville, Hants

Reference: 1849

Issue:	**Date:**
1	23/1/2021

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A	Existing & Proposed Site Layouts
B	Wastewater Treatment Information
C	Nitrogen Assessment & Mitigation
D	Conditions & Limitations

1. Introduction

1.1 Instructions were received from Peter Ernest Homes to undertake an assessment of the nitrogen nutrient impact for the proposed development of 4 dwellings on land adjacent 15 Billet Avenue, Waterlooville, Hants.

1.2 This assessment has been undertaken by A P Traves BSc CEng MIStructE MCIHT.

1.3 The client's attention is drawn to the conditions and limitations contained in Appendix D.

2. Development Description & Location

2.1 The site comprises an existing 0.427 Ha inset urban parcel adjacent 15 Billet Avenue, Waterlooville, Hants. The site extents are indicated on Martin Ralph Architects plan 16A-071-001-D contained in Appendix A of this report.

2.2 It is proposed redevelop the site for 4 dwellings. The proposed layout is identified on Martin Ralph Architects site plan 16A-071-010-L contained in in Appendix A of this report.

3. Background to Nitrogen Nutrient Assessment

3.1 The background to the issue is set out in current natural England Advice note version 5 of June 2020 - Achieving Nutrient Neutrality for New Development in The Solent Region (NEv5). Reference should be made to NEv5 for a more in depth understanding which is summarised in the following paragraphs.

3.2 The Solent water environment is internationally important and is protected under the Water Environment Regulations and the Conservation of Habitats and Species Regulations, as well as national protections. There are high levels of nitrogen and phosphorus nutrients in these waters and the evidence indicates these nutrients are causing eutrophication of the waters (excess mats of dense green algae which deplete oxygen as these subsequently decay)

3.3 The total nutrient content comes from a number of component parts:

i. Agricultural use of fertilisers, particularly in the latter half of the 20th century
ii. General coastal background content
iii. Nitrate within final discharge from sewage treatment works
iv. Diffuse urban rainfall runoff from urban surfaces

3.4 Since the late 1980's and early 1990's the agricultural sector has reduced the nitrogen content in applied fertiliser by around 35%. However, the Chalk aquifers which underly the region and which are the dominant source of river flows into The Solent contain a massive amount of legacy nitrogen mainly in the form of soluble nitrate, from decades of previous agricultural practice. It is anticipated that it will take decades from now for the nitrogen content in groundwater to gradually reduce.

3.5 Nitrate in treated sewage is the natural product of the breakdown of ammonia contained in human waste. Historic practice was that the permitted concentration of ammoniacal nitrogen in the treated discharge was limited so that the ammonia to nitrate conversion occurred at the treatment works and took up oxygen within the works and did not subsequently take up oxygen from out of the waters into which discharge was made to protect the receiving waters from deoxygenation ,ie that the discharge made would have a low Biological Oxygen Demand (BOD).

3.6 It has been recognised by the Environment Agency, water companies and OFWAT for some time that improvement of the Total Nitrogen (TN) content of discharge needs to be addressed. The water industry works in 5 year spending cycles/programmes referred to as Asset Management Plans (AMPs) and these three parties agree between them how much investment (which comes from increases in sewage bills) can be made in any AMP and

what will be delivered in terms of improvement for the investment permitted (affordable). Since the beginning of AMP4 in 2005 Southern Water have begun to systematically upgrade existing treatment works to provide 'nitrogen stripping'. This process has to be artificially 'forced' by careful and continuous control of the treatment process to create a low oxygen environment which 'debonds' the oxygen from the nitrate and stimulates the emission of gaseous nitrogen into the atmosphere (which is 78% nitrogen). This nitrogen release is thus stripped from the effluent that discharges into the receiving waters. It is not practicable to strip 100% of the nitrogen from the sewage, and the upgraded treatment works typically operate to a new TN permit level of around 10 mg/L compared to typical value of around 27 mg/L for traditional works without TN permit limits.

3.7 Treatment works upgrades are difficult and complex to plan and deliver in the context of three of the main constraints:

- There is little space at most works for the finished new infrastructure
- The existing works has to continue to operate during the upgrade and there is little room for this and the working space needed to construct the new infrastructure.
- The investment cashflow is regulated by OFWAT against bill increases and notwithstanding this there are a finite number of specialists to plan and deliver this so there can only be a limited rate at which the upgrades are delivered.

The economies of scale and immediate proximity to The Solent has dictated that it is the large coastal treatment works which have been prioritised by Southern Water in AMPs4-6 from 20005-2019. AMP7 investment and construction programme for 2020-2025 is now underway.

3.8 Wastewater Treatment Works (WwTW) upgrade programme is ongoing but in short it is not realistic to simply add a TN limit to existing permits as there will be no immediate change in performance of existing WwTWs. The upgrade programme will take decades to eventually deliver across the board improved TN performance.

3.9 The NEv5 methodology is aimed at planning permissions for proposed developments and does not address agricultural practice or the water industry AMP process. The NEv5 methodology is built off a single fundamental premise. This assumes that persons at work or using non-residential offices and commercial/retail premises must also live in the catchment. In the round this is a reasonable basis on which to look at the total sewage volume. However in zero rating commercial development from nitrogen loading it inherently means that residential developers fund the nitrogen nutrient mitigation of all non-residential commercial development in the region.

3.10 As set out in paragraph 3.4 there is a massive amount of largely agricultural legacy nitrogen in the Chalk aquifer below the region which forms the base flow to the rivers flowing into The Solent. The drinking water supplies in southern Hampshire are drawn from this groundwater and these rivers, and this typically contains 7-8 mg/L of nitrogen that does not stem from the proposed developments. The previous NEv2 methodology did not recognise that this represents around 85% of the nitrogen returned to the water environment from upgraded WwTWs and around 30% from traditional WwTWs. NEv4 gave a 2 mg/L allowance ie about 20% on upgraded WwTW effluent and 7% on traditional WwTW discharges. NEv5 maintains this level of allowance. Whilst this is only partial recognition it is better that the previous NEv2 that made no recognition at all. In effect residential developers will therefore also be funding the mitigation of the unrecognised legacy nitrogen predominantly from historic agricultural practices.

3.11 Natural England nitrogen assessment methodology v5 June 2020 considers nitrogen for:

1) Land use with regard to nitrogen contained in surface water run-off and infiltration.
2) Sanitation with regard to nitrogen content in the final treated discharge from the WwTW serving the development.

The assessment compares pre and post development quantities on nitrogen for the land use (1) and sanitation (2) to establish a final figure and then adds a 20% buffer to this.

3.12 Natural England advise the NEv5 methodology is advised for all types of development that would result in a net increase in population served by a wastewater system, including new houses, student accommodation, tourism attractions and tourist accommodation.

4. Derivation of Sewage Load

4.1 The NEv5 methodology uses a blunt 2.4 average household occupancy and 110 litres per head per day (lhd) for housing.

5. Wastewater Treatment Works

5.1 Foul water discharge from the site will outfall to the public sewer network and will be conveyed to Southern Water's Budds Farm WwTW about 5 Km south of the site. The WwTW undertakes traditional primary and secondary treatment and also undertakes nitrogen removal. Budds Farm WwTW has a Total Nitrogen permit limit of 9.7 mg/L. The WwTW and outfall location plans and works schematic are contained in Appendix B.

6. Land Use Component

6.1 It is proposed to retain a copse on the eastern 0.085 Ha of the overall 0.427 Ha parcel. Both the retained copse and existing site parcel are below the 0.5 Ha threshold NEv5 paragraph 4.63 identifies to trigger use of the 5 kg/Ha/yr green infrastructure rate. The site is inset within an urban area and therefore the urban rate of 14.3 kg/Ha/yr applies to the site both before and after development. There will inherently be no change in nitrogen from that land use component as a result of the proposed development.

7. Nitrogen Assessment

7.1 The NEv5 sewage loading, WwTW performance for TN and land use components have been input into the calculations contained in Appendix C.

7.2 The calculations also include the 2 mg/L allowance in water supply from NEv5 discussed in paragraph 4.41. The calculations also identify for the awareness of the LPA the actual nitrogen content removed from the environment in the water supply from the environment but not recognised in NEv5.

7.3 The calculations indicate that inclusive of the 20% buffer there would be a net nitrogen increase of **+3.11 KgTN/yr** from the proposed development.

8. Mitigation

8.1 NEv5 Figure 1 subdivides the overall Solent catchment into 6 sub catchments. A copy of this Figure is contained in Appendix C.

8.2 The site lies in the East Hampshire subcatchment with a coastal WwTW discharge from Budds Farm WwTW. The proposed mitigation may be located within one of the following catchments, River Meon, Portsmouth Harbour. Medina Estuary, Wootton Creek, Medina Estuary and estuaries in between.

8.3 Section 5 of NEv5 sets out various types of hypothetical mitigation. However most of these are impractical for modest numbers of dwellings in an urban context where served by the public sewer. These are briefly discussed below:

8.4 Upgrade of the public treatment works is not viable in either cost or overall programme/time terms for small sites. Notwithstanding this the site is served by Budds Farm WwTW which has already been upgraded.

8.5 Installation of wetlands to treat foul and or surface water run-off from the site. Sites in urban catchments served by the public foul sewer network must connect to the public foul sewer

unless this is too far away to be viable. In most urban contexts the sites are within viable distance of public sewer connection and application for an environment permit for private treated effluent discharge would be refused. Notwithstanding this treatment will not remove 100% of the nitrogen so whether by public treatment works or private treatment plant there will always be some residual nitrogen within the final treated foul water discharge.

The regulatory hierarchy for discharge of site surface water run-off requires that infiltration discharge (eg sokaways and permeable pavements) is provided where possible. Nitrogen treatment wetlands need to permanently retain water and are contrary to national drainage policy on permeable sites.

On non-permeable sites a proportion of the rainfall events that occur within a year are short showers that result in the ground being wetted but do not develop any run-off. The amount of annual run-off (Hydraulically Effective Rainfall, HER) is generally in the region of about 2/3 of the annual rainfall. The amount of annual surface water run-off for a site is therefore finite and limited by the impermeably surfaced area and site HER. Compared to foul water the nitrogen content is also much lower and NEv5 Appendix 2 indicates that 3mg/L is deemed representative. For crude general illustration purposes, assuming a positively drained area of say 200m^2 per dwelling and assuming an HER of say 500mm per annum with the prescribed nitrogen concentration of 3mg/L this would suggest the finite amount of nitrogen within the surface water run-off to be around 0.3 Kg per dwelling. The nitrogen removal efficiency of stormwater wetlands varies and NEv5 Appendix 4 indicates a median removal rate from studies to be 37%. It is therefore implicit from this that the total mitigation potential for the illustration would be around 0.1 KgTN/yr. The corresponding illustrative buffered TN discharge for treated foul water effluent from 1 dwelling would be of the order of 2.9 KgTN/yr for traditional WwTW and around 0.8 KgTN/yr for a dwelling served by WwTWs with nitrogen removal technology. It is generally not possible to mitigate more than 3-12% of the residual foul water impact by treating 100% of the site surface water run-off, so other mitigation will usually be required anyway.

Nothwithstanding this the design of wetlands is a specialist activity and is not usually cost effective on a modest site scale. There is also a significant land take for the wetlands and there would be a requirement to set up and maintain a secured maintenance programme for operation of the wetland in perpetuity.

8.6 Some urban city authorities (eg Portsmouth CC) have a retrofit mitigation scheme whereby the increase in foul water effluent conveyed to the public WwTW from the site is offset by reducing the discharge from older existing housing stock by retrofitting modern water appliances. Havant BC are not known to be operating such a scheme.

8.7 The most common approach is one of land use offset whereby the increase in nitrogen at the site is offset by a corresponding reduction in nitrogen elsewhere in the subcatchment eg by change of use from farm land to woodlands or community open space etc. Some sites can achieve mitigation within their own site when farmland of relatively high existing nitrogen discharge is developed for housing such that the reduction in the nitrogen from the change in land use is greater than the increase from the new foul water loading. For all other developments the mitigation land and development land are at different locations. There are three potential approaches to securing the necessary mitigation land:

i. The applicant already controls a suitable area of private land.
ii. Some LPAs already control such land and buy in to their scheme can be made.
iii. Buy in to a third party scheme

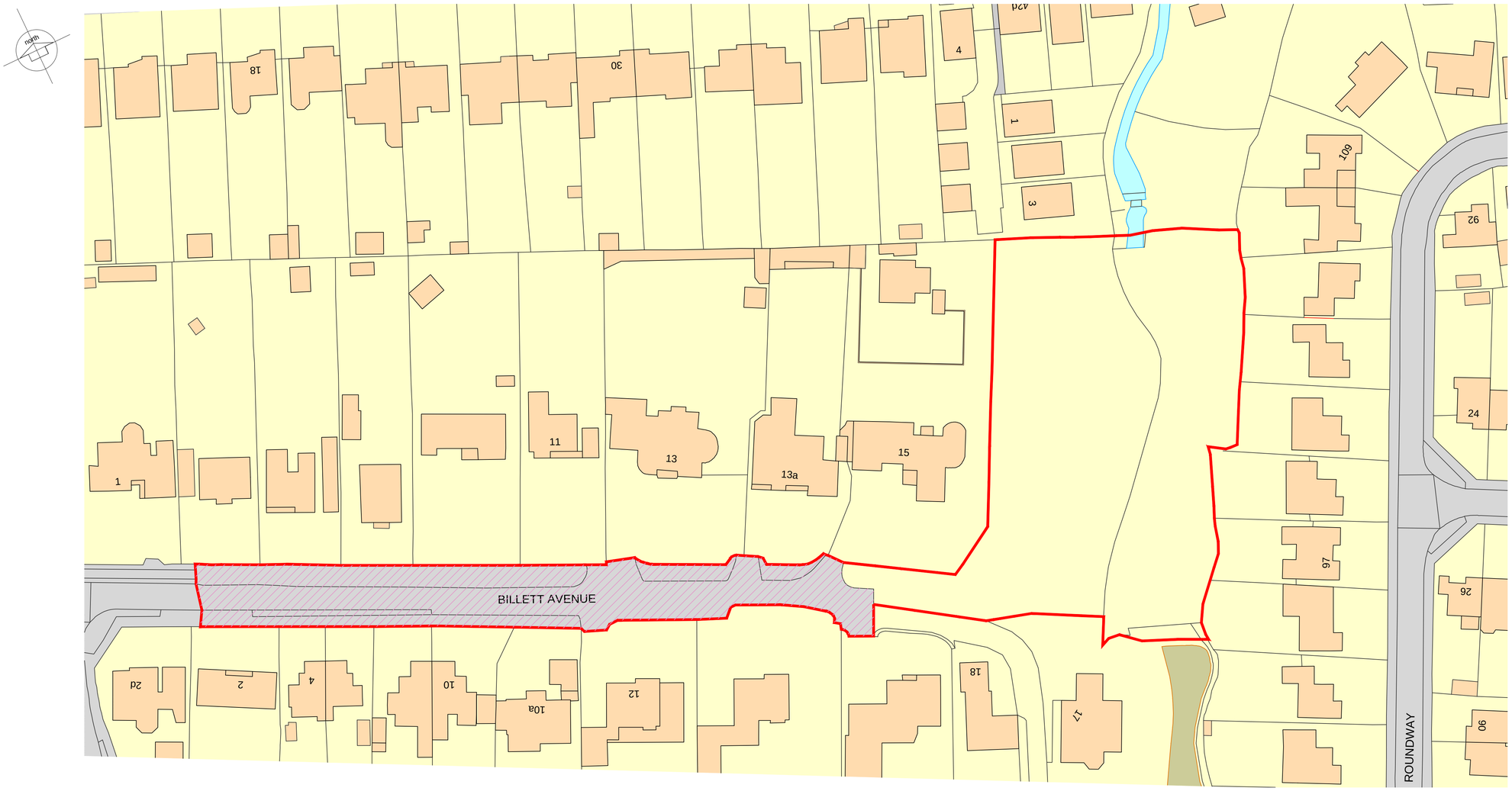
It is a requirement that the change in use at the mitigation site is legally secured in perpetuity and that necessary maintenance to ensure the new low nitrogen usage is also secured. Whilst hypothetically a suitably sized piece of land could be privately procured at a suitable location and taken out of farming use to provide an offset reduction in nitrogen on that land in perpetuity, the urban south Hampshire location of the site, means this may

be difficult to find as much nearby local land is similarly earmarked for potential future development. There are also likely to be confidence issues for the LPA in securing the perpetuity of this and questions as to future management. These confidences are satisfied in the current HIWWT scheme and it is likely to take time for LPAs to apply the same logic to independent proposals.

8.8 Havant BC have developed their own nitrogen mitigation scheme which opened on 18th August 2020. The scheme is only available to application sites within Havant borough. The scheme provides mitigation against effluent discharges made to Budds Farm or Thornham WwTWs and is therefore suitable for mitigation for the assessed site. The HBC mitigation scheme costs are set out in the updated HBC positional statement of 18 August 2020 as £1,235 per kg plus legal fee of £23. The anticipated costs for mitigation from HBC would therefore be of the order £4,000 on this basis.

8.9 Whilst there are other options theoretically existing and others may come forward in the future, at present the HBC scheme would appear to be the most favourable candidate for mitigation being more favourable economically and in terms of risk and timescale.

Appendix A



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BLOCK PLAN 1:200

Red line includes development area and area of "privately maintained road" (shown hatched) as per OS Plan data.

0 10 20 30

LOCATION PLAN - showing proposed development 1:1250

OS PLAN INFO

LAND ADJ TO 15 BILLETT AVENUE

NOTES:

This drawing has been prepared for the purpose of Planning and/or Building Regulations approval only, and is not to be used for any other purpose.

All dimensions to be checked on site and any discrepancy notified to The Martin Ralph Group. Written dimensions are to be used in preference to scaled dimensions.

This drawing is the property of The Martin Ralph Group and must not be reproduced, in part or whole, or deviated from, without their permission.

AMENDMENTS		DATE
D	UPDATED PLANNING	15.08.18
C	Planning Application Issue	23.01.18
B	General updates	11.01.17
A	General updates	13.12.17

CLIENT
PETER ERNEST HOMES LTD

PROJECT
RESIDENTIAL DEVELOPMENT
Land Adj to
15 BILLETT AVENUE,
WATERLOOVILLE

DRAWING TITLE
BLOCK PLAN AND LOCATION PLAN

DATE
MARCH 2017

SCALE
1:200, 1:1250 @ A1

DRAWING No. 16A_071 001

REVISION D

MARTIN RALPH
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Trees
existing trees being retained

New Hedge
Mature dense hedge to be planted in a raised retaining wall strip outside the 4.0m sewer exclusion zone.

Made up of native varieties, the suggested varieties could include the following:
Blackthorn, Hazel, Laurel, Privet and Snowberry.
Most ornamental flowering shrubs such as:
Blackcurrants, Rasperries and Booseberries,

A variety of the above shrubs, smaller plants and fruit trees can be planted outside the sewer exclusion zone.

Mature Trees
mature trees to be planted in strategic places

Specific Trees suggestions:
T1 YEW
T2 RED OAK
T3 ENGLISH OAK
T4 BLACK WALNUT

SITE PLAN AS PROPOSED

LAND ADJ TO 15 BILLETT AVENUE

1:200

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key for cad drawing

Existing / surrounding buildings

Privately Maintained Road
Existing surface of Billett Avenue to made good as necessary.

Access Road
New access to be finished in Tegula type non-permeable material.

Access Drive
Contrasting coloured non-permeable paving outside each house.

Soft Buffer
Granular or grasscrete system

New Gardens
Grass and planting zones associated with individual properties.

Sofl Landscape
Grass and landscape areas in surrounding gardens.

Paving

Decking

AMENDMENTS		DATE
L	UPDATED PLANNING	15.08.18
K	Planning Application Issue	23.01.18
J	key amended	28.11.17
H	general update	07.11.17
G	general update	02.11.17
F	general update	27.10.17
E	Units 2 and 3 flipped - landscaping at front updated.	06.10.17

CLIENT
PETER ERNEST HOMES LTD

PROJECT
RESIDENTIAL DEVELOPMENT
Land Adj to
15 BILLETT AVENUE,
WATERLOOVILLE

DRAWING TITLE
PROPOSED SITE PLAN
landscape plan

DATE
JUNE 2017

SCALE
1:200 @ A1 1:400 @ A3

DRAWING No.
16A_071 010

REVISION
L

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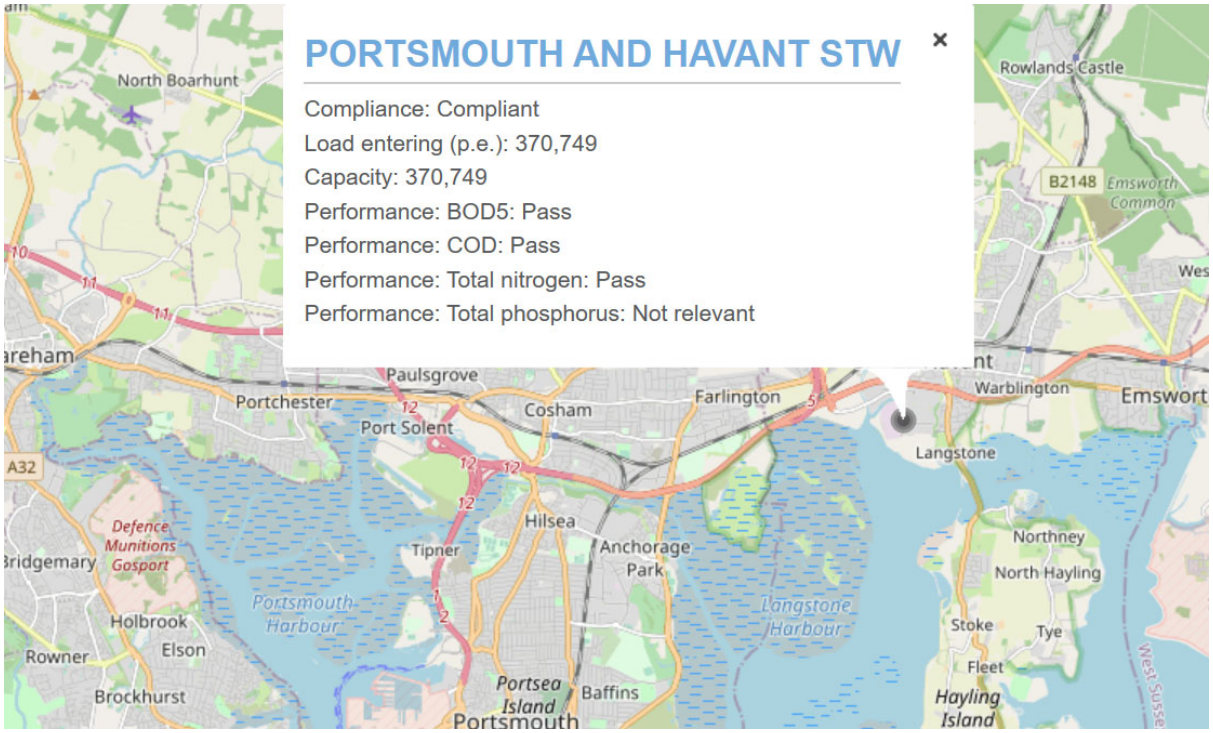
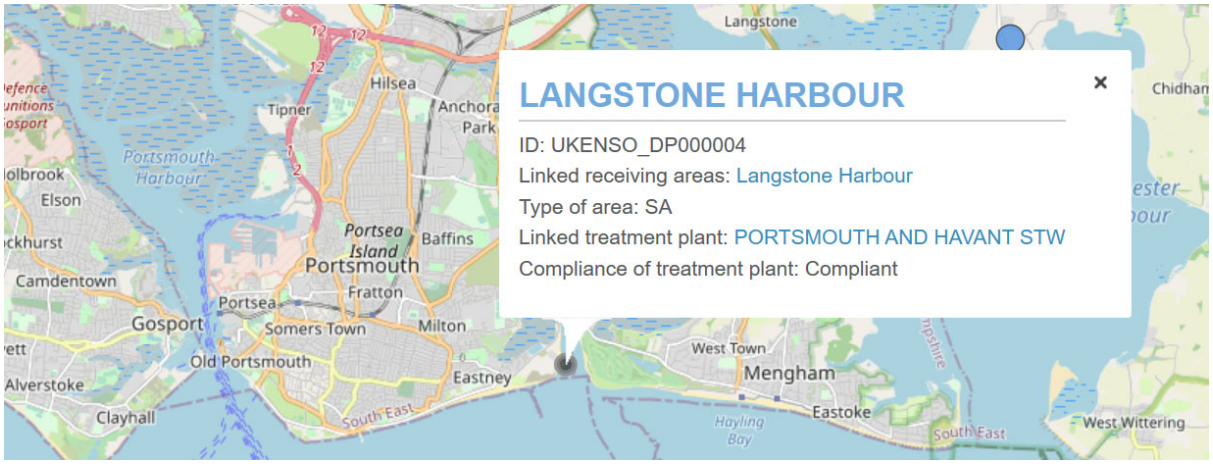
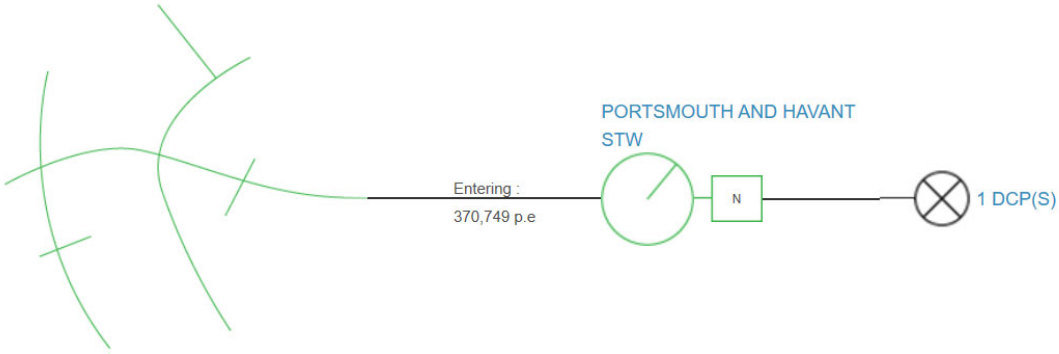
Appendix B





Agglomerations : 1



Appendix C

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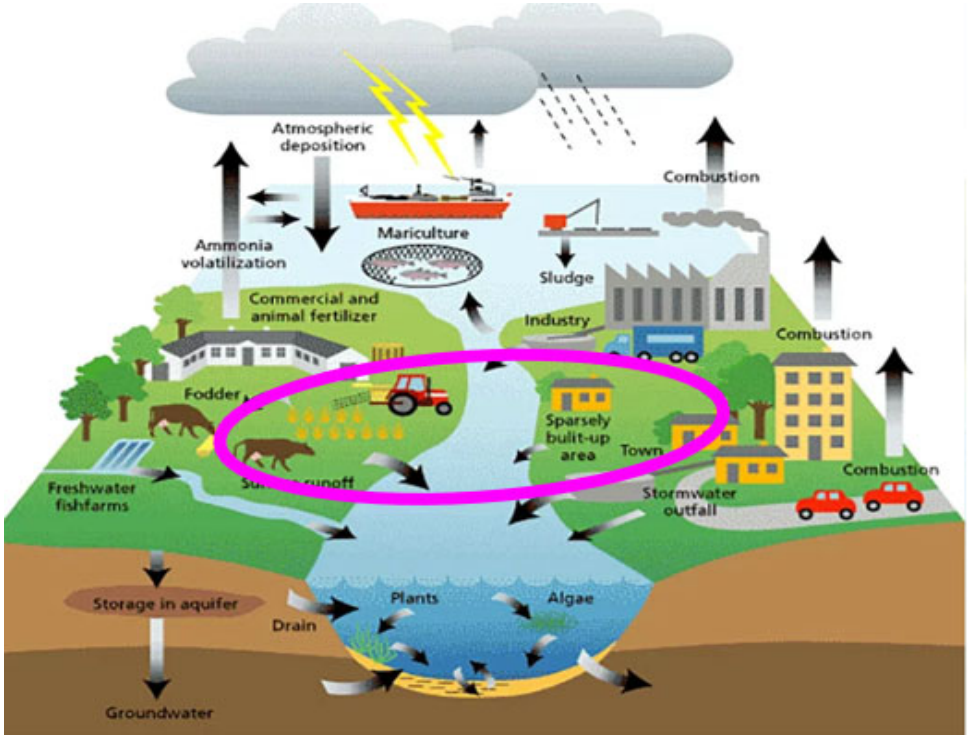
Site Ref 1849: land adjacent 15 Billet Avenue

Development Nitrogen Assessment



Change in nitrogen content of runoff from the site

	Existing Land use type:	Nitrogen Load (kg/Ha)	Area (Ha)	Nitrogen discharge (Kg/yr)	
1	N/A	0.0	0.000	0.000	
2	N/A	0.0	0.000	0.000	
3	N/A	0.0	0.000	0.000	
4	N/A	0.0	0.000	0.000	
5	Urban area	14.3	0.427	6.106	
6	SANG/Low nitrogen	5.0	0.000	0.000	
7	Open space	5.0	0.000	0.000	
		TOTAL SITE AREA (Ha)	**0.427**	**6.106**	**Kg/yr Existing load**

Land use load values taken Natural England values June 2020

Urban area = *includes built form, gardens, road verges & any small areas of open space in the urban fabric*

	Proposed Land use type:	Nitrogen Load (kg/Ha)	Area (Ha)	Nitrogen discharge (Kg/yr)	
5	Urban area	14.3	0.427	6.106	
6	SANG/Low nitrogen	5.0	0.000	0.000	
7	Open space	5.0	0.000	0.000	
		TOTAL SITE AREA (Ha)	**0.427**	**6.106**	**Kg/yr Developed load**

CHECK: Do existing and proposed land areas match? Yes

CHANGE IN NITROGEN LOAD FROM RUNOFF **0.000** **Kg/yr**

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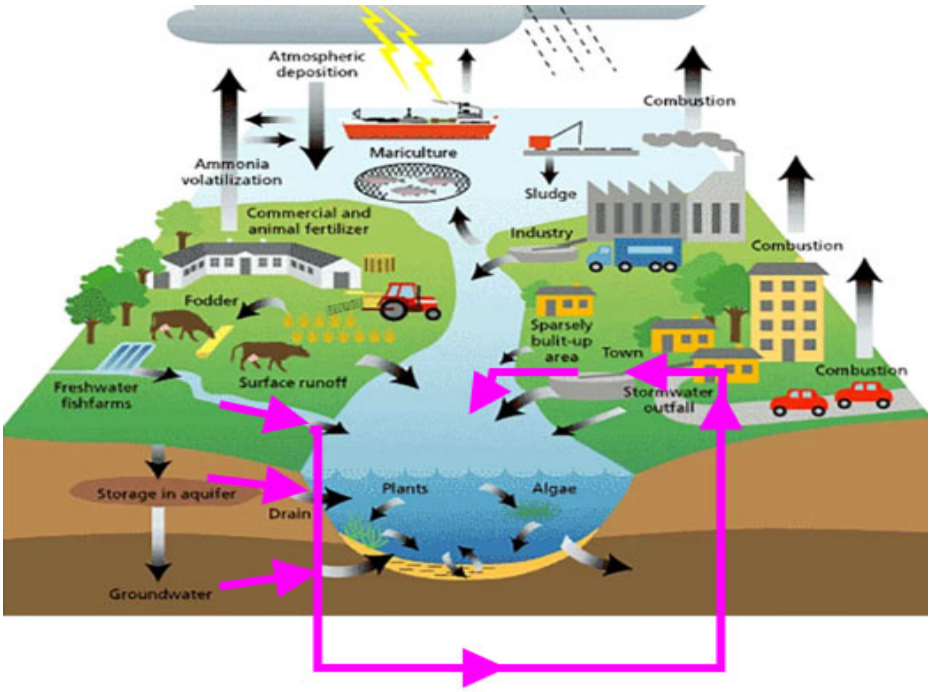
Site Ref 1849: land adjacent 15 Billet Avenue

Development Nitrogen Assessment



Nitrogen content in wastewater works outfall

Waste Water works	Budds Farm				
WwTW discharge permit limit for Total Nitrogen (TN)			9.7	mg/l	(27.0 default)
Discharge at 90% of permit limit			8.730	mg/L	100% at default
Deduct NEv5 allowance against water supply (2mg/L)			**6.730**	**mg/L**	
Additional dwellings proposed	**4**	Final No	4	Existing No	0
Average poulation per dwelling	2.4				
Water consumption per capita	110	litres/person/day			
Daily water consumption	**1056**	x 365 days =	**385440**	**L/year**	
NITROGEN IN WATER DISCHARGED			**2.594**	**Kg/yr**	Caution applies

Mains water provider	Portsmouth Water			nitrogen comprises both nitrogen from development + not from the development but from the external environment.
Water supply zone/works	PW Nelson			
	Nitrate NO_3	Nitrite NO_2	Ammonia $NH4_3$	
compound mg/L	34.6	0.002	0.016	
as nitrogen mg/L	7.82	0.001	0.012	**Residual non development part**
Nitrogen content taken from envirnoment			**7.833**	
of which omitted from 2mg/L allowance			**5.833**	**mg/L** 2.25 **Kg/yr**

Water supply values taken from Water Company, water supply zone data August 2019

Caution applies

TOTAL CHANGE IN NITROGEN = 0.000 & 2.594 = 2.594 **Kg/yr**

Apply 20% buffer ie factor by 1.2 x 1.20

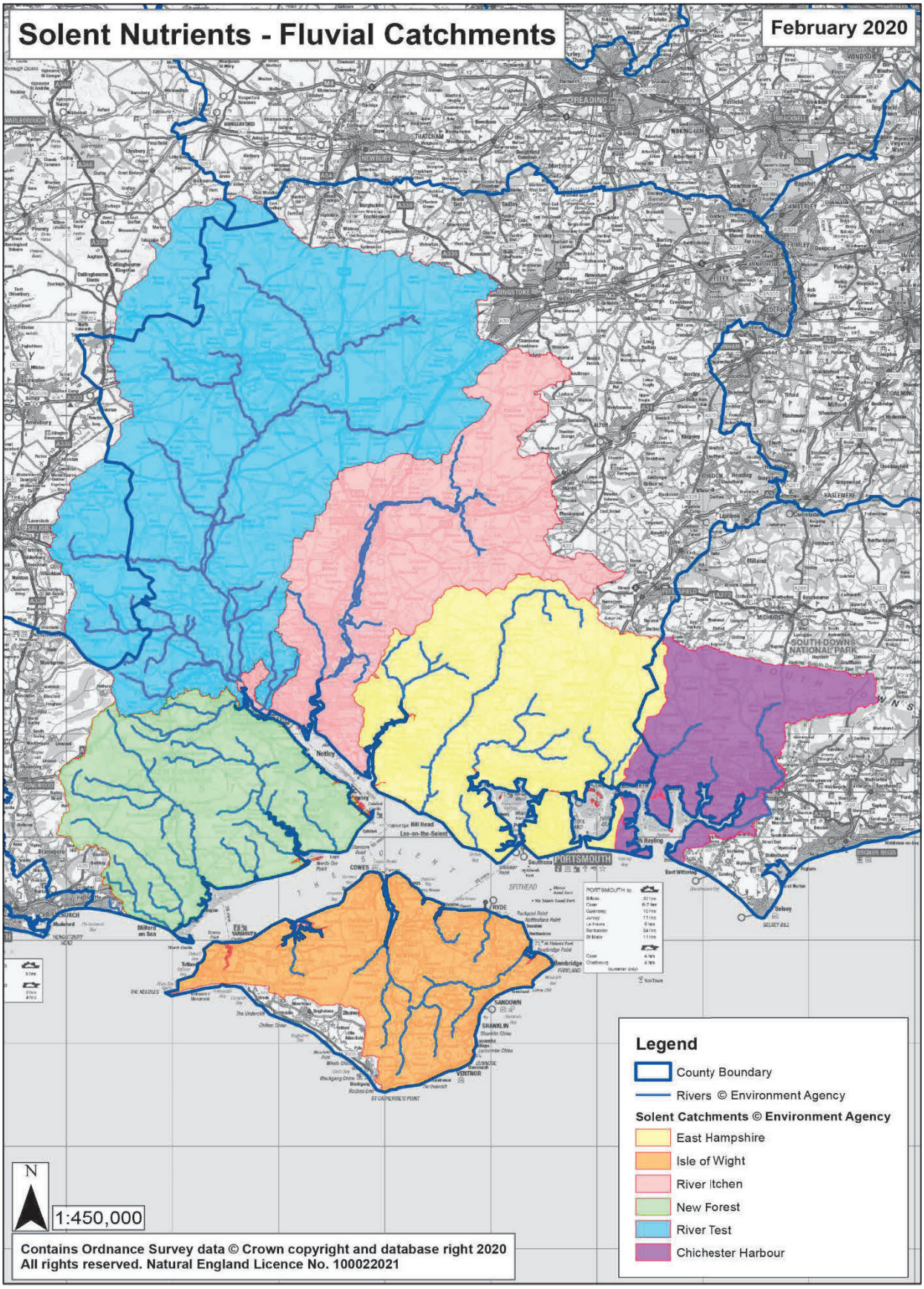
+ values indicate increase to mitigate
- values indicate reduction ie tradeable credit

net increase-mitigation required

3.113 **Kg/yr**

Caution applies

Figure 1 Solent Catchment Area *Contains public sector information licensed under the Open Government Licence v3.0*



Appendix D

CONDITIONS AND LIMITATIONS OF NITROGEN NUTRIENT ASSESSMENT
May 2020

Aqua Callidus Consulting Ltd is constituted as a limited liability company in accordance with the Companies Act 1989 (with registered number 11390910 and with its registered office at Kintyre House, 70 High Street, Fareham, Hants, PO16 7BB).

1. The report is confidential to the clients stated in the report and has been prepared to their instructions for their own purposes and it is not permitted to disclose this report to other parties (except NHBC, Local Authority, the Client's own Solicitors and Professional Advisers) without the prior consent of Aqua Callidus Consulting Ltd.

2. This report has been prepared by Aqua Callidus Consulting Ltd, with all reasonable skill, care and diligence within the terms of contract with the Client incorporated in our Standard Terms of Business.

3. The copyright of this report remains the property of Aqua Callidus Consulting Ltd.

4. Aqua Callidus Consulting Ltd disclaims any responsibility to the Client and others in the respect of any matters outside the scope of this report.

5. No liability for the contents of this report is accepted to any parties other than the client stated in the report.

6. Unless stated otherwise the nitrogen assessment is based on site specific information provided by the client and manufacturers and wastewater companies public information on the performance of wastewater treatment plants and works. No liability is accepted for the accuracy of such third party information.

7. Unless stated otherwise the nitrogen assessment is undertaken as a desktop assessment and no site visit has been made.