

DATE:	12 April 2022	CONFIDENTIALITY:	Public
SUBJECT:	The Grange Nitrogen Neutrality Assessment & Mitigation Strategy		
PROJECT:	70093404	AUTHOR:	James Ellaway
CHECKED:	James Ellaway	APPROVED:	James Ellaway

INTRODUCTION

The Ministry of Justice (MOJ) is proposing to undertake internal modifications to The Grange residential facility in Waterlooville, Hampshire, PO7 5PL. The modifications will increase the number of single bedrooms from 22 to 25.

The site is located within the catchment of the Solent. The Solent and Southampton Water Special Protection Area (SPA) and the Solent Maritime Special Area of Conservation (SAC) are at risk of deterioration caused by eutrophication from increased nitrogen levels in the rivers discharging to the Solent.

A November 2018 European Court of Justice decision regarding the Habitats Directive has resulted in Natural England (NE) requiring all new developments containing overnight accommodation, and which are located in catchments draining to the Solent, to demonstrate nitrogen neutrality. On 16 March 2022, NE issued updated technical guidance and a calculation method that must be used to assess whether developments are nitrogen neutral.

The local planning authority (LPA) for the development, Havant Borough Council, is unable to issue decisions for new residential development in the catchment unless NE has been consulted and confirmed that they have no objection to the proposed development. NE will not provide this approval unless it can be demonstrated that the development is nitrogen neutral.

The Grange discharges foul flows to Southern Water's Budds Farm wastewater treatment works (WWTW). This WWTW has a total nitrogen (TN) discharge concentration permit limit of 9.7mg/l.

A nitrogen neutrality assessment is provided below.

NITROGEN NEUTRALITY ASSESSMENT

The proposed modifications to The Grange will result in the addition of three single bedrooms. As The Grange is an existing facility and the modifications are all internal with no external changes, the nutrient neutrality assessment considers only the change in the wastewater nitrogen load and no land use change is considered.

We have based the assessment on the latest version of NE's technical guidance (Nutrient Neutrality Generic Methodology, dated February 2022 and publicly issued on 16 March 2022).

A desktop water efficiency assessment of the existing fixtures and fittings in The Grange, assumed to be installed pre-2009, has determined that the existing water usage is 140 litres/person/day (lpd). The assessment is provided in Appendix A. We have assumed that the additional three residents will therefore have a water usage of 140 lpd.

The water efficiency assessment has identified that replacing/retrofitting water efficient devices to all existing water fixtures and fittings would achieve a water usage of <110 lpd. We have added the additional 10 lpd required by Natural England as a precautionary approach, to give a total future water usage of 120 lpd.

We have developed bespoke nitrogen load calculations for three scenarios:

1. The proposed additional three residents with the current water usage of 140 lpd.
2. The existing nitrogen load for 22 residents based on the current water usage of 140 lpd.

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3. The future nitrogen load for 25 residents based on the retrofitted water usage of 120 lpd.

The calculations are presented in Table 1.

Table 1 – Nitrogen Load Calculations for Three Scenarios

	Additional 3 Residents	Existing 22 Residents	Future 25 Residents
WWTW total nitrogen discharge concentration permit limit (mg/l)	9.7		
90% of the permit limit (mg/l)	8.73		
Acceptable nitrogen loading in wastewater (mg/l)	2		
Net WWTW average nitrogen discharge concentration (mg/l)	6.73		
No of single bedrooms	3	22	25
No of residents	3	22	25
Wastewater volume (litres/person/day)	140	140	120
Total wastewater volume (litres/day)	420	3,080	3,000
Total nitrogen load from wastewater (mg/day)	2,826.6	20,728.4	20,190.0
Additional total nitrogen load from wastewater (mg/yr)	1,032,415.7	7,571,048.1	7,374,397.5
Additional total nitrogen load from wastewater (kg/yr)	1.03	7.57	7.37
Precautionary buffer (20%)	0.21	1.51	1.47
Total nitrogen load from wastewater (kg/yr)	1.24	9.09	8.85

The calculation indicates that the proposed addition of three bedrooms and three residents to The Grange would generate an additional total nitrogen load to the Solent catchment of 1.24 kg per year. The proposed development is therefore not nitrogen neutral, and the nitrogen load must be mitigated.

MITIGATION STRATEGY

The water efficiency assessment (Appendix A) of the fixtures and fittings currently installed at The Grange (which are assumed to be pre-2009) has determined that the current water use is 140 lpd. Replacing/retrofitting water efficient devices into all existing fixtures and fittings would reduce the water usage from 140 lpd to 106.3 lpd. As required by NE's guidance, we have added a further 10 lpd to this value as a precautionary value, and rounded it to 120 lpd.

The nitrogen load calculations detailed in Table 1 indicate that the *existing* nitrogen load from the 22 residents, with a water use of 140 lpd, is 9.09 kg/year. Table 1 also indicates that the *future* nitrogen load for 25 residents, with a water use of 120 lpd, would be 8.85 kg/year.

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Retrofitting of water efficiency measures into The Grange, to achieve water usage of no greater than 110 lpd (prior to addition of the precautionary 10 lpd required by NE), would therefore deliver a nitrogen neutral development.

CONCLUSION

Without mitigation, the proposed addition of three single bedrooms to The Grange residential facility would increase the nitrogen load discharged to the Solent catchment by 1.24 kg/year.

Replacing/retrofitting water efficient fixtures and fittings throughout The Grange would deliver a future nitrogen load for 25 people that is lower than the existing nitrogen load for 22 residents.

The addition of three single bedrooms can therefore be mitigated through the replacement/retrofitting of water efficiency measures to the property to achieve a water usage of no greater than 110 lpd.

This mitigation approach should be discussed and confirmed with Natural England and Havant Borough Council.



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APPENDIX A – WATER EFFICIENCY ASSESSMENT

TECHNICAL NOTE

DATE:	12 April 2022	CONFIDENTIALITY:	Internal
SUBJECT:	Water Efficiency Assessment		
PROJECT:	Cushman Wakefield Water Efficiency Planning Review	AUTHOR:	K Aggett
CHECKED:	J Ellaway	APPROVED:	J Ellaway

INTRODUCTION

WSP was contracted by Cushman Wakefield to review water neutrality options for the addition of three single bedrooms to an existing 22-bedroom structure, The Grange, Waterlooville, Hampshire, P07 5PL.

Water has not been high on the agenda for most businesses, largely because it is relatively cheap compared to power, however, with ever tightening regulations and many parts of England, especially the southeast and east, already water stressed, local authorities are already imposing restrictions beyond the minimum level of compliance of 125 litres per person per day (l/p/d) for new developments mandated in the Building Regulations 2010¹.

Table A is taken from the Code for Sustainable Homes: Technical Guide. November 2010 and describes the maximum indoor water consumption per person per day in litres to achieve higher code compliance levels, 6 being the most sustainable.

Code Level	Maximum Indoor Water Consumption in Litres per Person per Day
Level 1 (★)	120
Level 2 (★★)	120
Level 3 (★★★)	105
Level 4 (★★★★)	105
Level 5 (★★★★★)	80
Level 6 (★★★★★★)	80

Table A: Code Levels for Mandatory Maximum Standards in Indoor Water Consumption²

Local stipulations for the Solent region specify a recommended maximum Per Capita Consumption (PCC) of 110 l/p/d³ for new developments.

¹ Approved Document Part G of Schedule 1 and Regulation 36 to the Building Regulations 2010.

² Table 1.3 from [Code for Sustainable Homes: Technical Guide. November 2010 \(publishing.service.gov.uk\)](https://www.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/444444/code-for-sustainable-homes-technical-guide-november-2010.pdf)

³ Summary advice on achieving nutrient neutrality for new developments in the Solent Region, non-technical summary June 2020

SCOPE

This document assesses the status of existing water utility fixtures associated with the property, estimating the current PCC before exploring least-cost retrofit measures to:

- 1) Reduce PCC to the recommended 110l/p/d.
- 2) Offset PCC for the proposed development.
- 3) Explore further reductions / alternative approaches.

Table B describes commonly used water efficiency interventions such as dual flush toilets and tap inserts, their approximate unit cost and expected water savings in litres per day (l/p/d)

Fitting	Water Saving (l/p/d)	Approximate Unit Cost (£)
Dual Flush Toilet	8	Approx. bulk price £29.99
Shower Aerator (insert and head)	16.5	Avg aerator insert ~£3. Shower heads could be up to £30
Tap Inserts - WHB aerators/restrictors	5	Approx., various available
Eco-Flow Insert - Kitchen Tap aerator	7	
Bubblestream Insert - Kitchen Tap aerator	7	
Water Butt	38	Max retail, bulk will reduce. This is for a larger capacity.

Table B: Approximate Unit Cost (£) & Average Water Saving (l/p/d) for Water Efficient Fittings

The proposed development will convert existing rooms to three bedrooms, each containing one basin tap, plus the installation of one shower, one toilet and one washbasin. The development will therefore result in the following additions to the existing water utilities:

- 4 No. additional basin taps.
- 1 No. additional shower.
- 1 No. additional WC.

The existing property fixtures are assumed to have been installed prior to 2009, and the assumed flow rates are provided in Table C (Existing Baseline).

Options

Table C outlines alternative approaches to reduce existing flow rates. The baseline per capita consumption for the existing structure assumes fittings (other than appliances) were installed pre-2009; the PCC is estimated at approximately 140.07 l/p/d falling above current minimum requirements (max. 125l/p/d).

Water Efficiency Measure >>	Baseline			Plus 1 WC, plus 1 shower, plus 2 basin taps, £18.			Install 15x low flush fixtures to existing WCs, fit 6x shower aerators, £75.			Retrofit all basin taps with low flow inserts, £216			Greywater recycling for WCs, £918			Retrofit all basin & kitchen taps, and showers with low flow inserts, £295		
Reduction Scenario Baseline Position per Approved Document Part G, Section 1 and Regulation 36 of the Building Regulations 2010.	Existing Baseline			Proposed Development			Proposed Development (Offset <110 l/p/d)			<100 l/p/d (optional)			< 100 l/p/d greywater			< 110 l/p/d Alternative (systematic) Approach		
Code Level (existing) >>	FAIL			FAIL			1/2			3/4			3/4			1/2		
Measure >>	Fittings Nr	Flow/ Volume	PCC l/p/d	Fittings Nr	Flow/ Volume	PCC l/p/d	Fittings Nr	Flow/ Volume	PCC l/p/d	Fittings Nr	Flow/ Volume	PCC l/p/d	Fittings Nr	Flow/ Volume	PCC l/p/d	Fittings Nr	Flow/ Volume	PCC l/p/d
Kitchen tap(s) Capacity to overflow (litres)	7.00	9.00	13.03	7.00	9.00	13.03	7.00	9.00	13.03	7.00	9.00	13.03	7.00	9.00	13.03	7.00	6.00	11.83
Dishwasher(s) (litres/place setting)	1.00	1.25	4.10	1.00	1.25	4.10	1.00	1.25	4.10	1.00	1.25	4.10	1.00	1.25	4.10	1.00	1.25	4.10
Waste disposal unit (litres/use)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WC(s) ave. effective flush vol. (litres)	14.00	7.50	30.17	15.00	7.50	30.17	15.00	3.06	12.32	15.00	3.06	12.32	15.00	7.50	30.17	15.00	7.50	30.17
Washing Machine(s) (l/kg dry load)	4.00	8.17	15.61	4.00	8.17	15.61	4.00	8.17	15.61	4.00	8.17	15.61	4.00	8.17	15.61	4.00	8.17	15.61
Tap(s) excl. Kitchen flow rate (l/min)	34.00	9.00	14.38	38.00	9.00	14.38	38.00	9.00	14.38	38.00	4.00	7.19	38.00	9.00	14.38	38.00	3.00	5.75
Bath(s) Capacity to Overflow (litres)	2.00	180.00	18.02	2.00	180.00	18.02	2.00	180.00	18.02	2.00	180.00	18.02	4.00	180.00	18.02	2.00	180.00	18.02
Shower(s) Flow rate (l/min)	5.00	10.00	39.77	6.00	10.00	39.77	6.00	6.00	23.86	6.00	6.00	23.86	6.00	10.00	39.77	6.00	6.00	23.86
Water Recycling (greywater) (l/p/d)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	45.89	45.89	0.00	0.00	0.00
Water Offsetting (rainwater) (l/p/d alt. to greywater)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
External usage allowance (l/p/d)			5.00			5.00			5.00			5.00			5.00			5.00
PCC after Reg. Compliant savings (l/p/d)	140.07			140.07			106.31			99.12			98.31			109.33		
Estimated unit cost (£ GBP, indicative)				18			75			216			918			295		

Table C: Per Capita Consumption, Baseline and subsequent reduction options

Note: PCC values quoted above have been normalised by 0.91. It is assumed that existing fittings were installed pre-2009. Costs are indicative only and do not include installation costs. PCC inclusive of 5 l/p/d external usage allowance.

CONCLUSIONS AND RECOMMENDATIONS

The existing structure is assumed to have pre-2009 fittings, although appliances such as washing machines are assumed to have been replaced with more modern machines. Based on the fittings shown in the plans provided, the current PCC is estimated to be 140.07 l/p/d.

Ongoing maintenance costs, reliability, fairness and the level of disruption caused have been considered beyond simply offsetting PCC for the lowest material cost.

The Proposed Development amounts to adding one WC, one shower and four basin taps, resulting in no impact on PCC which would remain at 140.07 l/p/d.

Installing 15 low flush fixtures to existing WCs (~£4 each) and fitting six low flow shower aerators (~£2.50 each), for a total cost of around £75, would result in a PCC of 106.31 l/p/d.

The alternative option to retrofit low flow inserts to all basins considers fairness, aiming to ensure the performance of all fittings will be consistent throughout the property, would have a slightly higher cost of ~£216 and would result in an improved PCC of 99.12 l/p/d.

The greywater option, though more costly at around £918, would be less disruptive, impacting only the proposed areas of work (the toilets).

The final systematic approach again considers consistent performance of fittings throughout the property, but avoids modifications to WCs, proposing savings from basin and kitchen taps and showers as an alternative, resulting in a PCC of 109.33 l/p/d at an estimated cost of £295.00. In this option, the 5 l/p/d external use allowance is offset using a large capacity water butt (unit cost ~£38).