



Solent Marine Sites

Nutrient Modelling Summary

Date: October 2026

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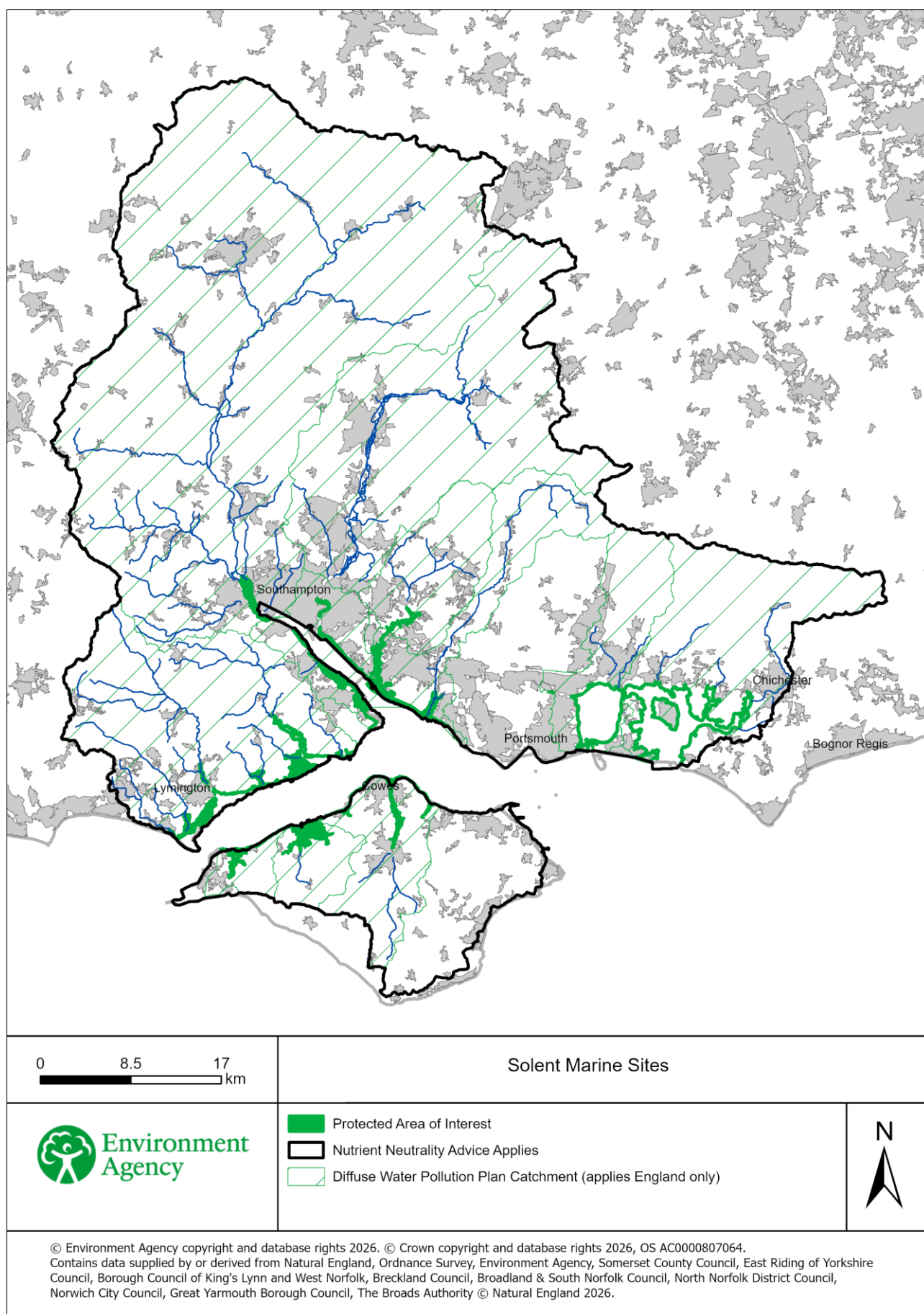
Introduction

This document provides summary outputs from the Environment Agency's water quality modelling for the Solent Marine Sites comprising Solent Maritime Special Area of Conservation (SAC), Solent and Southampton Water Special Protection Area (SPA), Chichester and Langstone Harbours SPA and Portsmouth Harbour SPA (Map 1). We provide load source apportionment and freshwater concentrations entering the Solent under a range of scenarios. Our outputs will help those working on Diffuse Water Pollution Plans (DWPPs), designing or co-ordinating nutrient mitigation schemes, and working on site restoration. We aim to support a general understanding of the catchment rather than give the level of detail needed to inform specific on-the-ground measures. Our detailed methodology is described in [Catchment statistics for nutrient pollution in protected areas](#).

Alongside Simcat SAGIS models, we used the Farmscoper v5 decision support tool. Our outputs highlight the dominant nutrient sources under a range of scenarios, including future estimates based on planned water company investment up to 31 March 2030 (AMP8) and the wider implementation of rural land use measures.

We have not assessed the reduction in concentrations needed to meet targets because targets for the Solent are yet to be confirmed. Work is ongoing to establish targets for the sensitive features present within the Solent protected areas.

We have not incorporated additional nutrient contributions from any future development and growth including housing. Any additional future nutrient load will be assessed through the planning process led by the Local Planning Authority or through our permitting process.



Map 1. Solent marine protected areas and catchment with the area where Natural England nutrient neutrality advice applies shown.

Models used

We used the Price Review (PR) PR24 [Simcat SAGIS model](#) for this work alongside [Farmscoper v5](#). Simcat SAGIS (Source Apportionment Geographical Information System) integrates ArcGIS-based digital information management and visualisation with SIMCAT (Simulated Catchment), the Environment Agency's water quality model. Farmscoper is a decision support tool that can be used to assess diffuse agricultural pollutant loads and quantify the impacts of farm mitigation methods on these pollutants.

The PR24 Simcat SAGIS model is calibrated to 2014 to 2020 data, following nationally agreed model build and calibration standards across UKWIR (UK Water Industry Research). Since publication of the Indicative Catchment Statistics Report (Version 1.2, September 2024) we recalibrated the model to seek to improve representation of the Test and Itchen catchments, the results presented in this report will therefore differ from those presented previously.

The calibration process optimises the agreement between measured and simulated values through reasonable and systematic adjustments to model parameters and input data. We adjust the inputs where there is least confidence, those representing diffuse sources of pollution. The associated project overview document details the datasets included in the models. To assess confidence in the models, we compare the measured and simulated values. While Simcat SAGIS provides a robust framework for decision-making in wastewater investment, we have less certainty in the diffuse load estimates. As a result, we have lower confidence when using the models to assess the outcomes of measures that target diffuse sources, including those used here.

Farmscoper has undergone external peer review (Gooday et al., 2014), and the component models and methods used within Farmscoper have been published in the external literature. The assumptions, methods and resulting conclusions are therefore based on sound scientific principles. Farmscoper was developed as an advisory tool to aid policy makers. Farmscoper is now used more extensively and for a wider range of purposes than originally intended, therefore the consequences of assumptions and other uncertainties in Farmscoper outputs need to be considered when decision-making and users need to understand the assumptions, uncertainty, and limitations at the relevant scale of interest.

We used Farmscoper v5 to assess diffuse agricultural pollutant loads and to quantify the impacts of farm scale mitigation methods for a range of scenarios. This applies the agricultural planning assumptions for RBMP cycle 3 for land management measures ([Environment Agency, 2022](#)), as well as information from Defra project WT1594 ([Defra, 2019a](#)) We present outputs for two Farmscoper scenarios in this report to provide estimates of the reduction in nutrient losses from 'full regulation' and 'theoretical maximum' uptake rates in agricultural mitigation measures (Table 2).

Scenarios

The modelling scenarios (Table 1) evaluate how the load source apportionment and concentrations change under different future measures. In the 2030 Full Regulation and 2030 Theoretical Maximum scenario we have applied the Farmscoper v5 reductions (Table 2) to the rural land use sector inputs. We have based the point sector measures on the AMP8 water industry national environment programme agreed in December 2024 ([PR24 WINEP](#)).

Table 1: Summary description of the point and diffuse measures represented in the Simcat SAGIS Scenarios modelled.

Scenario	Point Sector Measures	Diffuse Sector Measures	Model
Actual (2014 to 2020)*	Observed discharge flow and quality (2014 to 2019). Where not available, defaults used.	Current activities as represented post model calibration.	PR24 Calibration
2030 Optimistic	Water company AMP8 quality permit limits incorporated where applicable**	Current activities as represented post model calibration.	PR24 Calibration
2030 At Permit	All discharges represented at permitted flow and quality values up to and including AMP8**	Current activities as represented post model calibration.	PR24 At Permit
2030 Full Regulation	All discharges represented at permitted flow and quality values up to and including AMP8**	Rural land use inputs reduced by Full Regulation values from Farmscoper v5 (Table 2).	PR24 At Permit
2030 Theoretical Maximum	All discharges represented at permitted flow and quality values up to and including AMP8**	Rural land use inputs reduced by Theoretical Maximum values from Farmscoper v5 (Table 2).	PR24 At Permit

*Previously referred to as the 'recent' scenario.

**Does not include any discharge flow increases that may be required to support growth.

Table 2: Percentage nitrate reductions applied to the rural land use sector in the Simcat SAGIS Scenarios, values produced through Farmscoper v5 modelling.

Scenario	Description	Reductions
Full Regulation	100% uptake of Regulatory measures, 25% uptake of Farming Rules for Water 'reasonable' Regulatory measures and 'current' uptake of voluntary measures.	4%
Theoretical Maximum	100% uptake of all measures in Farmscoper v5.	20%

Solent modelled outputs

We estimate the freshwater nitrate catchment input load source apportionment (including direct discharges) to the Solent to be 13% point source and 87% diffuse source in the Actual (2014 to 2020) scenario. Rural land use (76%) sources dominate the diffuse sector (Table 3). The source apportionment changes incrementally under the subsequent scenarios. When we apply the Full Regulation and Theoretical Maximum reductions to the rural land use sector, the contribution from the rural land use sector falls from 67% in the 2030 At Permit scenario to 66% and 62% respectively.

Input load source apportionment

Table 3 shows the estimated catchment nitrate input load source apportionment figures for each scenario modelled, combining estimates of loads to the freshwater catchment and direct discharges to the estuary. These loads are estimated after calibration, but before in-river processes have been simulated. We have greatest confidence in the point sector loads where monitoring data is available. Confidence reduces where the contribution from the sector is based on estimates rather than observed data, such as the diffuse sectors. Apportioning the input loads gives an indication of which sector is the dominant nutrient source.

Table 3: Estimated catchment nitrate input load source apportionment to the Solent including direct discharge estimates.

Scenario	Point Sources	Rural Land Use	Urban	Septic Tanks	Other
Actual (2014 to 2020)	13.0%	76.0%	1.7%	0.1%	9.2%
2030 Optimistic	10.1%	78.5%	1.7%	0.1%	9.5%
2030 At Permit	23.2%	67.2%	1.5%	0.1%	8.0%
2030 Full Regulation	23.8%	66.4%	1.5%	0.1%	8.2%
2030 Theoretical Maximum	26.9%	62.0%	1.7%	0.1%	9.3%

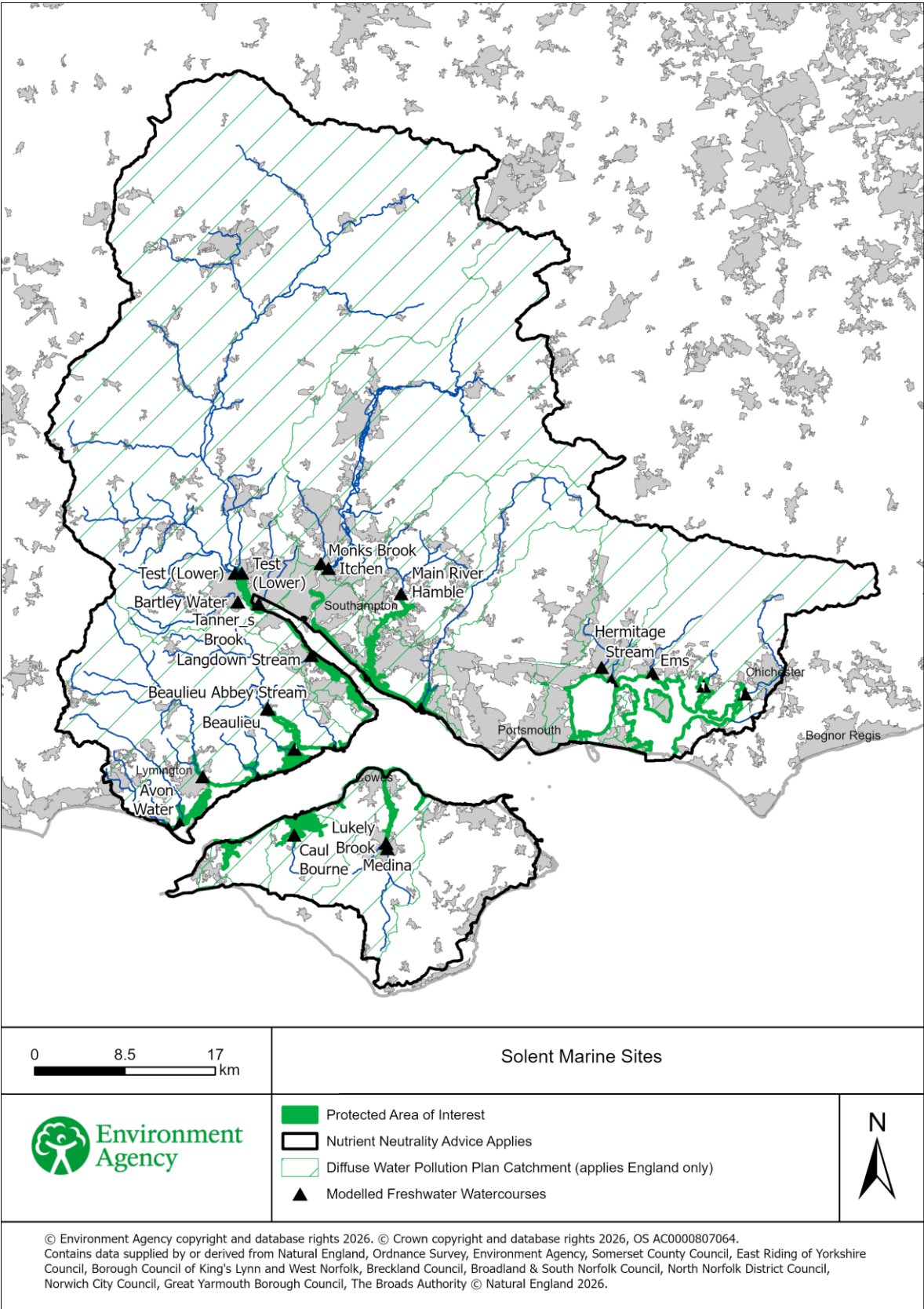
Table 4 shows the estimated in-river nitrate loads from each of the modelled freshwater watercourses entering the Solent, as expected, the rivers Test and Itchen carry the greatest loads. These loads are estimated after calibration and after in-river processes have been simulated by Simcat SAGIS.

Tables 6 and 7 provide the sector load values for both the total loads estimated to be entering the freshwater catchment (Table 6) and the total freshwater loads estimated to be entering the Solent (Table 7).

Concentrations

Table 5 shows the estimated input concentrations for each modelled watercourse to the Solent for each scenario (Map 2). The concentration in several of the watercourses does not change between the Actual and Optimistic or At Permit scenarios for example

Tanner's Brook, this is because there are no modelled point sources in the catchments. Highest concentrations are seen in the Itchen and Lavant rivers.



Map 2. Solent marine protected areas and catchment with locations of modelled points for each modelled freshwater watercourse highlighted.

Table 4: Estimated nitrate in-river load (kg/d) at each modelled freshwater watercourse to the Solent in descending order (excludes loads from direct discharges).

Catchment	River	Actual (2014 to 2020)	2030 Optimistic	2030 At Permit	2030 Full Regulation	2030 Theoretical Maximum
Eling and Bury Marshes	Test (Lower)	6728.3	6457.6	6538.7	6353.4	5331.0
River Itchen	Itchen	5688.9	5412.7	5528.2	5412.3	4800.1
Eling and Bury Marshes	Test (Lower)	2300.7	2201.5	2219.8	2156.6	1806.6
Lee on the Solent	Meon	1604.8	1604.8	1620.2	1559.4	1319.1
Chichester Harbour	Lavant (Sussex)	962.6	960.1	983.1	961.0	838.0
Isle of Wight	Eastern Yar (Lower)	890.5	883.4	898.2	855.7	730.2
Langstone Harbour	Lavant (Hants)	618.4	618.4	618.4	597.9	498.7
Upper Hamble Estuary and Woods	Main River Hamble	269.7	269.7	302.2	291.2	258.3
Chichester Harbour	Ems	268.6	268.6	268.6	261.5	221.9
Isle of Wight	Medina	242.7	242.7	243.8	232.5	193.4
Portsmouth Harbour	Wallington below	185.6	185.6	194.5	187.7	161.9
Isle of Wight	Lukely Brook	127.5	127.5	127.5	121.5	103.8
Chichester Harbour	Bosham Stream	127.0	127.0	127.0	123.7	105.4
River Itchen	Monks Brook	119.7	119.7	118.7	116.1	102.4
Newton Harbour	Caul Bourne	103.4	103.4	106.7	100.1	84.3
New Forest	Lymington River	95.5	95.5	131.9	129.6	124.3
New Forest	Avon Water	78.6	73.5	75.1	72.7	67.0
New Forest	Danes Stream	64.2	64.2	64.2	61.9	55.8
Eling and Bury Marshes	Bartley Water	62.4	49.3	54.2	53.6	51.0
Isle of Wight	Blackbridge Brook	53.9	53.9	53.9	51.7	45.1
New Forest	Dark Water	53.7	53.7	53.7	51.5	45.2
Langstone Harbour	Hermitage Stream	44.8	44.8	44.8	44.3	41.9
New Forest	Sowley Stream	35.0	35.0	35.0	33.5	29.5
Solent	Alver	33.0	33.0	33.0	32.3	29.7
Eling and Bury Marshes	Tanner's Brook	32.9	32.9	32.9	32.8	32.4
New Forest	Hatchet Stream	29.5	29.5	34.3	33.4	31.1
Isle of Wight	Monktonmead Brook	27.7	27.7	27.7	27.1	24.8
New Forest	Beaulieu	12.9	12.9	12.9	12.6	11.6
New Forest	Langdown Stream	8.3	8.3	8.3	8.3	8.3
New Forest	Beaulieu Abbey Stream	1.1	1.1	1.1	1.1	0.9

Table 5: Estimated nitrate concentration (mg/l) at each modelled freshwater watercourse to the Solent in descending order.

Catchment	Freshwater Input	Actual (2014 to 2020)	2030 Optimistic	2030 At Permit	2030 Full Regulation	2030 Theoretical Maximum
River Itchen	Itchen	8.45	7.92	8.14	7.99	7.20
Chichester Harbour	Lavant (Sussex)	6.36	6.33	6.26	6.16	5.59
Langstone Harbour	Lavant (Hants)	6.29	6.29	6.29	6.10	5.18
Eling and Bury Marshes	Test (Lower)	6.19	5.76	5.73	5.58	4.75
Isle of Wight	Lukely Brook	5.85	5.85	5.85	5.60	4.88
Eling and Bury Marshes	Test (Lower)	5.80	5.40	5.40	5.27	4.51
Lee on the Solent	Meon	5.78	5.78	5.86	5.66	4.87
Newton Harbour	Caul Bourne	5.11	5.11	5.27	4.98	4.30
Chichester Harbour	Bosham Stream	5.00	5.00	5.00	4.90	4.36
Isle of Wight	Blackbridge Brook	4.70	4.70	4.70	4.51	3.94
New Forest	Hatchet Stream	4.39	4.39	4.90	4.78	4.47
Isle of Wight	Medina	4.04	4.04	4.07	3.89	3.18
Chichester Harbour	Ems	4.03	4.03	4.03	3.96	3.60
Isle of Wight	Monktonmead Brook	3.31	3.31	3.31	3.22	2.92
Isle of Wight	Eastern Yar (Lower)	3.29	3.24	3.31	3.18	2.79
Upper Hamble Estuary and Woods	Main River Hamble	2.95	2.95	3.47	3.37	3.09
Portsmouth Harbour	Wallington below	2.93	2.93	3.23	3.14	2.82
New Forest	Danes Stream	2.72	2.72	2.72	2.63	2.39
New Forest	Langdown Stream	2.66	2.66	2.66	2.66	2.66
Langstone Harbour	Hermitage Stream	2.37	2.37	2.37	2.35	2.24
Eling and Bury Marshes	Tanner's Brook	2.26	2.26	2.26	2.26	2.24
New Forest	Sowley Stream	2.15	2.15	2.15	2.09	1.91
New Forest	Avon Water	1.90	1.70	1.75	1.71	1.63
Solent	Alver	1.81	1.81	1.81	1.77	1.63
New Forest	Dark Water	1.80	1.80	1.80	1.74	1.56
Eling and Bury Marshes	Bartley Water	1.69	1.28	1.40	1.39	1.32
River Itchen	Monks Brook	1.67	1.67	1.62	1.59	1.42
New Forest	Lymington River	1.20	1.20	1.95	1.94	1.92
New Forest	Beaulieu Abbey Stream	0.51	0.51	0.51	0.50	0.46
New Forest	Beaulieu	0.30	0.30	0.30	0.29	0.28

Input load figures used to calculate source apportionment

Table 6: Estimated nitrate catchment input loads, including direct discharge loads (kg/d), and source apportionment after calibration but before in-river processes have been simulated. These are estimates of total catchment loads and not estimates of the loads entering the Solent (see Table 7).

Scenario	STW* (kg/d)	Intermittents (kg/d)	Industrial* (kg/d)	Rural Land Use (kg/d)	Urban (kg/d)	Septic Tanks (kg/d)	Highways (kg/d)	Atmospheric Deposition (kg/d)	Background (arising from cress/ fish farms abstractions) kg/d) (kg/d)	Point (%)	Rural Land Use (%)	Urban (%)	Septic Tanks (%)	Other (%)
Actual (2014 to 2020)	3215.6	10.7	426.6	21335.5	470.9	26.5	0.9	1670.8	921.5	13.0%	76.0%	1.7%	0.1%	9.2%
2030 Optimistic	2353.4	10.7	394.1	21335.5	470.9	26.5	0.9	1670.8	921.5	10.1%	78.5%	1.7%	0.1%	9.5%
2030 At Permit	6926.6	10.7	432.8	21335.5	470.9	26.5	0.9	1670.8	868.6	23.2%	67.2%	1.5%	0.1%	8.0%
2030 Full Regulation	6926.6	10.7	432.8	20600.4	470.9	26.5	0.9	1670.8	868.6	23.8%	66.4%	1.5%	0.1%	8.2%
2030 Theoretical Maximum	6926.6	10.7	432.8	17007.1	470.9	26.5	0.9	1670.8	868.6	26.9%	62.0%	1.7%	0.1%	9.3%

*Includes estimate for sewage works discharges direct to the Solent.

Table 7: Estimated nitrate in-river freshwater and direct discharge loads (kg/d) and source apportionment after calibration and in-river processes have been simulated. These are estimates of the loads entering the Solent.

Scenario	STW* (kg/d)	Intermittents (kg/d)	Industrial* (kg/d)	Rural Land Use (kg/d)	Urban (kg/d)	Septic Tanks (kg/d)	Highways (kg/d)	Atmospheric Deposition (kg/d)	Background (arising from cress/ fish farms abstractions) kg/d) (kg/d)	Point (%)	Rural Land Use (%)	Urban (%)	Septic Tanks (%)	Other (%)
Actual (2014 to 2020)	2819.6	10.6	307.7	16791.4	423.5	20.0	0.8	1195.3	514.3	14.2%	76.0%	1.9%	0.1%	7.7%
2030 Optimistic	1608.6	10.6	307.7	16791.1	423.5	20.0	0.8	1195.3	514.3	9.2%	80.4%	2.0%	0.1%	8.2%
2030 At Permit	6905.1	10.6	307.7	16792.3	423.5	20.0	0.8	1195.3	514.3	27.6%	64.2%	1.6%	0.1%	6.5%
2030 Full Regulation	6905.1	10.6	307.7	16210.4	423.5	20.0	0.8	1195.3	514.3	28.2%	63.4%	1.7%	0.1%	6.7%
2030 Theoretical Maximum	6905.1	10.6	307.7	13387.6	423.5	20.0	0.8	1195.3	514.3	31.7%	58.8%	1.9%	0.1%	7.5%

*Includes estimate for sewage works discharges direct to the Solent.

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List of abbreviations

ADAS – UK-based independent agricultural and environmental consultancy, previously National Agricultural Advisory Service (NAAS).

AMP8 WINEP – Asset Management Plan 8 (2025 – 2030) Water Industry National Environment Programme - [Water industry national environment programme \(WINEP\) methodology - GOV.UK](#)

CSMG – Common Standards Monitoring Guidance – includes guidance on the appropriate standards and targets for designated sites [Common Standards Monitoring Guidance for Freshwater Habitats | JNCC Resource Hub](#)

DWPP – Diffuse Water Pollution Plan

NEAP-N – ADAS model providing annual 1 km grid loadings of nitrate.

PR – [Price Review https://www.ofwat.gov.uk/regulated-companies/price-review/](https://www.ofwat.gov.uk/regulated-companies/price-review/)

PSYCHIC – ADAS model providing annual 1 km grid loadings of Phosphate.

SAC – Special Area of Conservation

SAGIS – Source Apportionment Geographical Information System

SPA – Special Protection Area

SSSI – Site of Special Scientific Interest

UKWIR – United Kingdom Water Industry Research

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