



Teesmouth and Cleveland Coast SPA

Nutrient Modelling Summary

Date: October 2026

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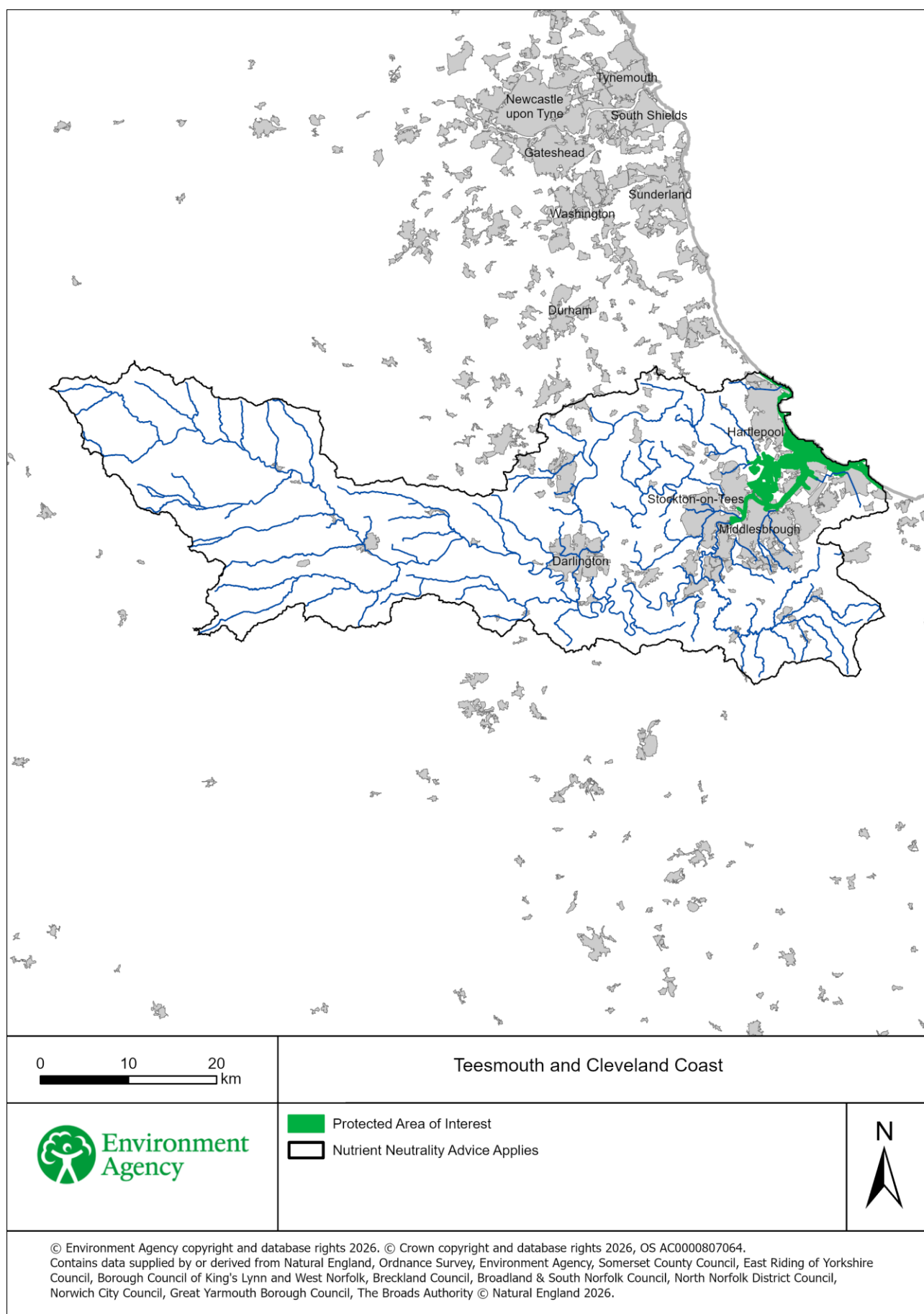
Introduction

This document provides summary outputs from the Environment Agency's water quality modelling for the Teesmouth and Cleveland Coast Special Protection Area (SPA) freshwater catchment (Map 1). We provide load source apportionment and freshwater concentrations entering the protected area under a range of scenarios. Our outputs will help those working on site restoration or designing nutrient mitigation schemes. 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 protected area are yet to be confirmed.

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. Teesmouth and Cleveland Coast SPA and catchment with protected area highlighted and catchment where Natural England nutrient neutrality advice applies shown.

Models used

We used the Price Review (PR) PR19 and the PR24 [Simcat SAGIS models](#) 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 Tees catchment, 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 4) evaluate the effectiveness of nutrient reductions in point and diffuse sources to meet protected site targets and the diffuse sector share of those targets. In the 2030 Full Regulation and 2030 Theoretical Maximum scenario we have applied the Farmscoper v5 reductions (Tables 5 and 6) 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**	Bran Sands STW contribution removed.	Current activities as represented post model calibration.	PR24 Calibration
2030 At Permit	Bran Sands STW contribution removed.	Current activities as represented post model calibration.	PR24 At Permit
2030 Full Regulation	Bran Sands STW contribution removed.	Rural land use inputs reduced by Full Regulation values from Farmscoper v5 (Table 2).	PR24 At Permit
2030 Theoretical Maximum	Bran Sands STW contribution removed.	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.	7%
Theoretical Maximum	100% uptake of all measures in Farmscoper v5.	19%

Teesmouth modelled outputs

We estimate the freshwater nitrate catchment input load source apportionment to the Teemouth and Cleveland Coast SPA to be 49% point source and 51% diffuse source in

the Actual (2014 to 2020) scenario. Rural land use (47%) 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 51% in the 2030 At Permit scenario to 49% and 46% 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 Tees 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 Teesmouth and Cleveland Coast SPA including direct discharges to the Tees Estuary.

Scenario	Point Sources	Rural Land Use	Urban	Septic Tanks	Other
Actual (2014 to 2020)*	49.2%	47.4%	0.2%	0.1%	3.1%
2030 Optimistic**	33.1%	62.4%	0.2%	0.1%	4.1%
2030 At Permit**	45.2%	51.2%	0.2%	0.1%	3.3%
2030 Full Regulation**	46.7%	49.5%	0.2%	0.1%	3.5%
2030 Theoretical Maximum**	50.2%	45.7%	0.2%	0.1%	3.7%

*Includes Bran Sands STW and industrial discharges direct to the Tees Estuary.

**Includes only industrial discharges direct to the Tees Estuary due to the relocation of Bran Sands STW discharge planned for AMP8 delivery.

Table 4 shows the estimated in-river nitrate loads from each of the modelled freshwater watercourses entering the Teesmouth and Cleveland Coast SPA, as expected the main river Tees carries the greatest loads. These loads are estimated after calibration and after in-river processes have been simulated by Simcat SAGIS.

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

Location	Actual (2014 to 2020)	2030 Optimistic	2030 At Permit	2030 Full Regulation	2030 Theoretical Maximum
River Tees	4774.83	4774.83	5084.45	4857.53	4407.62
Lustrum Beck	359.50	359.50	351.16	325.93	277.23
Billingham Beck	255.26	255.26	280.76	264.97	234.21
Stainsby Beck	63.82	63.82	63.83	59.30	51.16
Dabholm Gut	43.30	43.30	43.30	39.89	34.78
North Burn	37.72	37.80	37.80	34.93	29.84
Marton West Beck	36.92	36.92	36.93	34.19	29.74
Greatham Beck	11.05	11.05	17.19	16.88	16.35
Cowbridge Beck	9.33	9.33	9.33	8.66	7.46
Hart Beck	2.38	2.38	2.38	2.24	1.99

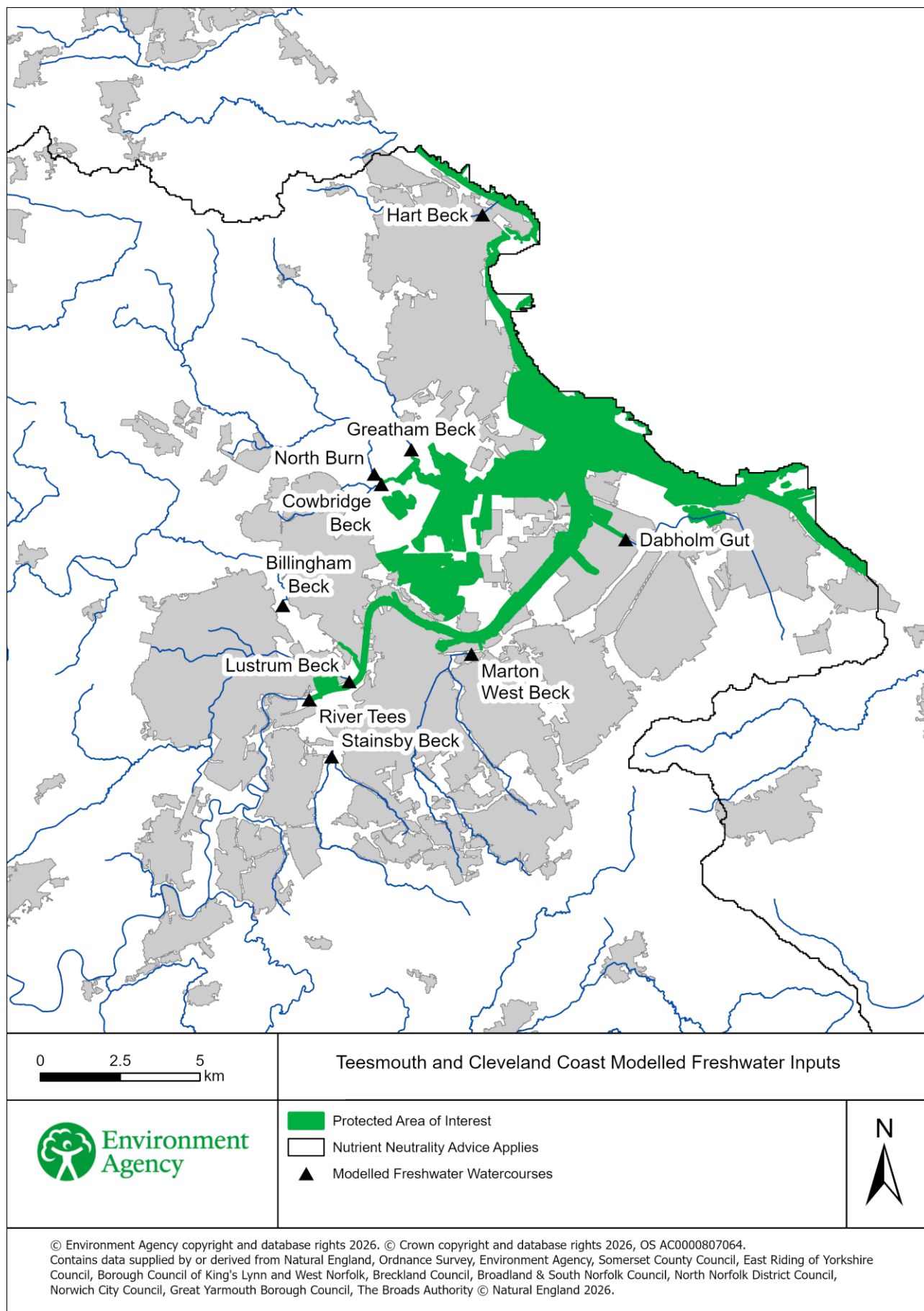
Tables 6 and 7 provide the sector load values for both the total loads estimated to be entering the freshwater catchment (Table 6) and the total freshwater loads estimated to be entering the Teesmouth and Cleveland Coast protected area (Table 7).

Concentrations

Table 5 shows the estimated input concentrations for each modelled watercourse to the Teesmouth and Cleveland Coast SPA for each scenario (Map 2). The concentration in several of the watercourses does not change between the Actual and Optimistic or At Permit scenarios e.g. Cowbridge Beck, this is because there are no modelled point sources in the catchments. Highest concentrations are seen in the Lustrum Beck.

Table 5: Estimated nitrate concentration (mg/l) at each modelled freshwater watercourse to the Teesmouth and Cleveland Coast SPA in descending order.

Location	Actual (2014 to 2020)	2030 Optimistic	2030 At Permit	2030 Full Regulation	2030 Theoretical Maximum
Lustrum Beck	9.37	9.29	9.29	8.65	7.41
Stainsby Beck	6.40	6.40	6.40	5.96	5.17
Billingham Beck	5.65	5.44	6.21	5.93	5.38
Greatham Beck	4.15	4.16	6.09	6.01	5.89
Dabholm Gut	3.93	3.94	3.94	3.61	3.12
North Burn	2.55	2.55	2.55	2.37	2.03
Marton West Beck	2.25	2.25	2.25	2.10	1.87
River Tees	2.15	2.09	2.23	2.15	2.00
Cowbridge Beck	2.10	2.10	2.10	1.95	1.69
Hart Beck	1.23	1.23	1.23	1.15	1.00



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 Teesmouth and Cleveland Coast SPA (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)	Point (%)	Rural Land Use (%)	Urban (%)	Septic Tanks (%)	Other (%)
Actual (2014 to 2020)	4644.7	7.7	1461.8	5882.7	22.7	13.7	0.6	382.6	49.2%	47.4%	0.2%	0.1%	3.1%
2030 Optimistic	1650.3	7.6	1461.8	5882.7	22.7	13.7	0.6	382.6	33.1%	62.4%	0.2%	0.1%	4.1%
2030 At Permit	2174.4	7.6	3007.8	5882.7	22.7	13.7	0.6	382.6	45.2%	51.2%	0.2%	0.1%	3.3%
2030 Full Regulation	2174.4	7.6	3007.8	5495.8	22.7	13.7	0.6	382.6	46.7%	49.5%	0.2%	0.1%	3.5%
2030 Theoretical Maximum	2174.4	7.6	3007.8	4726.8	22.7	13.7	0.6	382.6	50.2%	45.7%	0.2%	0.1%	3.7%

*Includes estimate for sewage works and industrial discharges direct to the Tees Estuary.

Table 7: Estimated nitrate 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 Teesmouth and Cleveland Coast SPA.

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)	Point (%)	Rural Land Use (%)	Urban (%)	Septic Tanks (%)	Other (%)
Actual (2014 to 2020)	4125.6	7.1	1458.9	4191.9	15.9	8.0	0.3	213.1	55.8%	41.8%	0.2%	0.1%	2.1%
2030 Optimistic	1141.6	7.1	1458.9	4201.2	15.9	8.0	0.4	217.3	37.0%	59.6%	0.2%	0.1%	3.1%
2030 At Permit	1471.8	7.1	3005.0	4202.9	15.9	8.0	0.4	217.6	50.2%	47.1%	0.2%	0.1%	2.4%
2030 Full Regulation	1471.8	7.1	3005.0	3920.2	15.9	8.0	0.4	217.6	51.9%	45.3%	0.2%	0.1%	2.5%
2030 Theoretical Maximum	1471.8	7.1	3005.0	3366.1	15.9	8.0	0.4	217.6	55.4%	41.6%	0.2%	0.1%	2.7%

*Includes estimate for sewage works and industrial discharges direct to the Tees Estuary.

References

Defra (2019a). A national scale assessment of current and future actions to reduce diffuse pollution of water by agriculture. [Report by ADAS for Defra project WT1594](#): 1-47.

Environment Agency (2022). Water quality: what 3 future environmental land management schemes can achieve by 2027. [Water quality: what 3 future environmental land management schemes can achieve by 2027](#).

Gooday, R. D., Anthony, S.G., Chadwick, D.R., Newell-Price, P., Harris, D., Duethmann, D., Fish, R., and A. L. a. W. Collins, M. (2014). Modelling the cost-effectiveness of mitigation methods for multiple pollutants at farm scale. [Science of the Total Environment](#) (468-469): 1198-1209.

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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