



# Marine and Estuarine DIN Mitigation Strategy Developer Handbook



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## Quality information

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## Foreward

This Handbook has been developed as a collaborative output of the Welsh Government Marine Nitrates Development Taskforce. Established following NRW's 2025 marine condition assessments and the resulting need to address dissolved inorganic nitrogen (DIN) in affected Marine SAC catchments. Bringing together Welsh Government, Natural Resources Wales, Local Planning Authorities and Welsh Water to address the challenges facing our communities in delivering new homes and jobs whilst striving to address the issues facing the Marine environment. The Taskforce has sought to move at pace from issue identification to delivery; this Handbook forms an important component of that shared response, providing a consistent framework to support developers and decision makers in navigating marine DIN constraints with greater clarity and consistency.

## Table of Contents

Executive Summary .....	7
Introduction .....	7
Regulatory context .....	7
Step by step process for developers .....	8
Mitigation approaches under Habitats Regulations 2017 .....	8
Mitigation options for developers .....	8
Summary of developer responsibilities .....	8
Worked examples .....	9
1. Introduction .....	10
1.1 The dissolved inorganic nitrogen issue .....	10
1.2 Purpose of this Handbook .....	10
1.3 Objectives of this Handbook .....	11
1.4 Application of this Handbook .....	11
1.5 Structure of the Handbook .....	11
1.6 Future updates .....	12
2. Background .....	13
2.1 DIN as an issue in marine SACs .....	13
2.2 West Wales designated sites .....	13
2.2.1 Carmarthen Bay and Estuaries SAC .....	11
2.2.2 Pembrokeshire Marine SAC .....	12
2.3 Nutrient neutrality in Wales .....	13
2.3.1 Types of development affected .....	14
2.4 Habitats Regulations Assessment in Wales .....	15
2.4.1 Article 6 of the HRA .....	15
2.4.2 HRA process .....	16
2.4.3 Mitigation versus restoration .....	17
2.5 Current approach and guidance in Wales .....	18
2.5.1 Current National Guidance .....	18
2.5.2 Nutrient budget calculation and mitigation .....	18
2.6 Welsh Government nutrient calculator .....	19
2.6.1 Mitigation: Direct or indirect discharges to a SAC .....	20
2.6.2 Strategic scale mitigation solutions .....	20
2.6.3 Developer led mitigation solutions .....	20
3. Roles and responsibilities .....	21
3.1 The Welsh Government .....	21
3.2 Natural Resources Wales .....	21
3.3 Local Planning Authority .....	21
3.4 Planning and Environment Decisions Wales .....	22
3.5 Nutrient Management Boards .....	22
3.6 The Developer .....	22
4. Achieving DIN neutrality .....	23
4.1 Pre-application advice .....	23
4.2 Step by Step process for developers .....	23
5. Potential mitigation solutions .....	24
5.1 Overview of mitigation measures .....	24
6. Worked examples .....	24
6.1 Example A - SuDS mitigation .....	25
6.2 Example B - Land use change .....	31
6.3 Example C - Upgrading PTPs or septic tanks to more efficient PTPs .....	34
6.4 Example D - Water efficiency measures .....	38
6.5 Example E - Enhanced drainage ditch management .....	40

Appendix A Potential mitigation measures .....	42
A.1 Land use change .....	43
A.2 Agricultural management measures .....	49
A.3 Treatment wetlands .....	53
A.4 Other wetlands .....	60
A.5 Urban SuDS .....	63
A.6 Rural SuDS.....	68
A.7 Septic tank and PTP upgrades .....	72
A.8 Field boundary management.....	76
A.9 Water efficiency measures.....	80
A.10 Enhanced drainage ditch management.....	83
A.11 Removal of surface water/wastewater from the affected catchment.....	87
A.12 Willow systems .....	89
A.13 Nutrient credits .....	91
Appendix B General Framework for Mitigation Option Proposals .....	93
Appendix C Figures.....	95

## Abbreviations

**Table 0-1. List of abbreviations**

<b>Abbreviation</b>	<b>Description</b>
ANCB	Appropriate Nature Conservation Body
BMPs	Best Management Practices
BMV	Best and Most Versatile
CCC	Carmarthenshire County Council
CW	Constructed wetlands
DCWW	Dŵr Cymru Welsh Water
DIN	Dissolved Inorganic Nitrogen
ECJ	European Court of Justice
Eoi	Expression of Interest
HRA	Habitats Regulations Assessment
LPA	Local Planning Authority
l/p/d	litres/person/day
NMB	Nutrient Management Board
NRW	Natural Resources Wales
PE	Population equivalent
PEDW	Planning and Environment Decisions Wales
PTP	Package Treatment Plant
SAB	SuDS Approval Board
SAC	Special Area of Conservation
SFS	Sustainable Farming Scheme
SPA	Special Protection Area
SPG	Supplementary Planning Guidance
SuDS	Sustainable drainage systems
UKWRA	UK Water Reuse Association
WCPS	Woodland Creation Planning Scheme
WFD	Water Framework Directive
WwTW	Waste Water Treatment Works

## Glossary

**Table 0-2. Glossary of terms**

Term	Description
Appropriate Assessment	An assessment to evaluate the significance of the impacts of a proposed plan or project (either individually or in combination with other proposals) on Habitats Sites (National Site Network), in order to inform the decision-making process.
Development	Defined by Section 55 of the Town and Country Planning Act 1990 as “ <i>the carrying out of building, engineering, mining, or other operations in, on, over, or under land, or the making of any material change in the use of buildings or land.</i> ”
Diffuse	The movement of ions or molecules from an area of higher concentration to an area of lower concentration
Diffuse Pollution	Pollution arising from multiple, widespread sources (e.g. agriculture, surface water runoff), rather than a single discharge point.
Dissolved Inorganic Nitrogen	DIN refers to the bioavailable forms of nitrogen in water, namely nitrate (NO <sub>3</sub> <sup>-</sup> ), nitrite (NO <sub>2</sub> <sup>-</sup> ), and ammonium (NH <sub>4</sub> <sup>+</sup> ), which can contribute to declining water quality.
Eutrophication	The enrichment of water by nutrients leading to excessive algal growth, reduced oxygen levels, and ultimately harm to aquatic ecosystems.
Habitats Regulations Assessment	A Competent Authority must carry out an assessment under the Conservation of Habitats and Species Regulations 2017, known as a Habitats Regulations Assessment (HRA), to test if a plan or project proposal could significantly harm the designated features of a Habitat Site.
Nutrient Budget	The annual net balance of nutrient inputs and outputs associated with a development.
Nutrient Budget Calculation	An assessment quantifying the annual net balance of nutrient inputs and outputs associated with a development.
Nutrient Loading	The amount of nutrients entering a waterbody over a given time period, often measured in kilograms per year.
Nutrient Neutrality	A principle whereby a development must not increase nutrient loading (e.g. nitrogen or phosphorus) to sensitive water bodies.
Section 106 Agreement (Planning Obligation)	A legally binding agreement used to secure mitigation measures related to a development.

# Executive Summary

## Introduction

Dissolved inorganic nitrogen (DIN) enrichment has been identified as a significant issue in West Wales marine water bodies, notably at Milford Haven Inner Water Framework Directive (WFD) water body within the Pembrokeshire Marine Special Area of Conservation (SAC), and at Burry Inlet Inner WFD water body within the Carmarthen Bay and Estuaries SAC. Updated marine condition assessments published by Natural Resources Wales (NRW) in 2025 report unfavourable status for chemical indicators of DIN concentrations and related biological indicators.

The recognition of DIN as a nutrient issue in marine waters introduces new requirements for developers and local authorities in affected catchments. New developments that lead to an increase in nitrogen discharges directly to these sites, or to catchments draining to these sites, may contribute to the unfavourable condition of, or undermine measures to restore, these water bodies. **As such, relevant new developments that drain to the Milford Haven Inner water body or the Burry Inlet Inner water body, directly or indirectly, and introduce new or increased nutrient loads, will be required to demonstrate nutrient neutrality for nitrogen or secure appropriate and deliverable mitigation in order to be consented.**

This Developer Mitigation Handbook provides information and advice to support developers to adequately consider DIN in planning submissions. It explains:

1. How to quantify nitrogen loads.
2. Identify proportionate mitigation.
3. What information is needed to support robust planning applications.

The information and advice in this Developer Mitigation Handbook is also intended to support consistent and robust planning authority decisions on all relevant planning applications, ensuring that their obligations under the relevant environmental legislation are appropriately discharged.

## Regulatory context

The need for nutrient neutrality in the affected catchments stems from European case law, particularly the Dutch Nitrogen ruling, which established that where a protected site is in deteriorating condition, Competent Authorities cannot lawfully consent new activities that would increase pollutant loading without robust evidence that no adverse effect on site integrity will occur. This legal principle applies to the marine SACs affected by DIN, requiring a precautionary approach to all development with a potential hydrological pathway to these sites.

The Conservation of Habitats and Species Regulations 2017<sup>1,2</sup> (referred to as the 'Habitats Regulations 2017') derive from the EU Habitats Directive<sup>3</sup> (formally, "Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora"), which mandates the protection of natural habitats and species. The EU Directive requires Member States to designate SACs, prevent habitat deterioration and disturbance, and conduct appropriate assessments for projects affecting these sites. The UK transposed these obligations into domestic law through the 2017 Regulations.

Under the Habitats Regulations 2017, local planning authorities (LPAs) must conduct Habitats Regulations Assessment (HRA) where likely significant effects may arise. Developers are responsible for assessing and demonstrating that their proposals are nutrient neutral (for those new developments in affected catchments) or alternatively are acceptable by consideration of other in-combination mitigation.

NRW acts as the Appropriate Nature Conservation Body (ANCB), providing technical guidance on DIN pressures, conservation objectives, and the evidential thresholds required for Appropriate Assessment. Welsh Government provides the overarching policy framework, and have developed the All Wales Nutrient Calculator, which is now

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<sup>1</sup> UK Government. (2017). *The Conservation of Habitats and Species Regulations 2017* (Statutory Instrument 2017/1012). at: [The Conservation of Habitats and Species Regulations 2017](#)

<sup>2</sup> For the purposes of this report, the term "Habitat Sites" will be used to refer to "European Sites" as defined in the Habitats Regulations 2017. Specifically, in Part 6 of the Regulations, "Habitat Sites" refers to European sites within the UK, while in other provisions, unless stated otherwise, it pertains to European sites in England or Wales.

<sup>3</sup> Council of the European Communities. (1992). Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (OJ L 206, 22.7.1992, pp. 7–50) Available at: [Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora](#)

the principal tool for estimating DIN emissions from proposed developments and identifying any surplus that must be mitigated.

## Step by step process for developers

This Developer Mitigation Handbook provides a step-by-step process guide for developers to follow to determine their nutrient budget and mitigation needs. The nutrient neutrality process typically involves first confirming whether a development site, or any Waste Water Treatment Works (WwTW) that would serve the development, lies within a catchment affected by DIN requirements (i.e. the Burry Inlet water body catchment or Milford Haven Inner water body catchments). Where wastewater discharge from a development site or the WwTW serving a proposed development site are within DIN affected catchments, the net annual nutrient load of the proposed development must be calculated to establish whether it would result in an increase in nutrient loading. If no increase is identified, the planning application can proceed without mitigation. However, where an increase is predicted, appropriate mitigation is required to offset the increase in DIN that is generated. The mitigation will need to be implemented prior to occupation of the proposed development and maintained accordingly.

## Mitigation approaches under Habitats Regulations 2017

Under the EU Habitats Directive (transposed into UK law by the Habitats Regulations), it is important to distinguish between actions identified as being a general duty under Article 6(2) of the Directive and those requiring a project-specific assessment under Article 6(3) when DIN mitigation is required.

Article 6(2) imposes a general duty on public bodies to avoid deterioration of protected sites and prevent significant disturbance. Restoration measures undertaken under Article 6(2) are the responsibility of Government and public authorities and cannot normally be used as mitigation for new development, as they are required regardless of development proposals. The Handbook highlights that DIN mitigation for developers must generally be additional to restoration measures, not simply a re-badging of existing duties. However, a limited “integrated approach” may be permissible where developer contributions accelerate already-planned restoration works.

Article 6(3) sets the framework for HRA and Appropriate Assessment. Under this provision, any plan or project that may have a significant effect on a SAC must demonstrate no adverse effect on site integrity beyond reasonable scientific doubt. For DIN neutrality assessments, this means any nitrogen surplus identified in the calculator must be fully offset by secured, location-appropriate mitigation. Measures must be funded, deliverable, monitored, and maintained in perpetuity. Furthermore, as Wales currently lacks a nutrient credit market, all mitigation must currently be developer-led and tied directly to the development.

## Mitigation options for developers

This Developer Mitigation Handbook provides details in the appendix of thirteen potential DIN mitigation options for developers, with advice given as to the confidence in the approaches and their likely suitability. This includes consideration of regulatory requirements, time to effectiveness, nutrient removal rate, maintenance, indicative cost and how they might be legally secured. Some of the principal mitigation options include land-use change, sustainable drainage systems (SuDS), septic tank/package treatment plant (PTP) upgrades, and implementation of water efficiency measures. Mitigation must be certain and secured for the lifetime of the development.

## Summary of developer responsibilities

The developer is responsible for:

- Determining catchment location and whether any screening requirements apply.
- Determining their development’s nutrient budget.
- Identifying mitigation with sufficient scientific certainty.
- Demonstrating long-term deliverability, monitoring, and maintenance for the mitigation.
- Securing mitigation legally for the lifetime of the development (e.g., planning conditions, Section 106); and
- Ensuring mitigation is operational before nutrient loading occurs.

It is recommended that developers working in DN affected catchments consult with the planning authorities at the earliest opportunity for pre-application advice.

## **Worked examples**

This Developer Mitigation Handbook presents a series of worked examples demonstrating how the All Wales nutrient budget calculator can be applied to quantify the mitigation associated with SuDS, land use change, PTP/septic tank upgrades, water efficiency measures and enhanced drainage ditch management.

# 1. Introduction

## 1.1 The dissolved inorganic nitrogen issue

Dissolved inorganic nitrogen (DIN) has been identified as a significant issue in West Wales marine water bodies, notably at Milford Haven Inner Water Framework Directive (WFD) water body within the Pembrokeshire Marine SAC and at Burry Inlet Inner WFD water body within the Carmarthen Bay and Estuaries SAC. Updated marine condition assessments published by Natural Resources Wales (NRW) in 2025 report unfavourable status for chemical indicators of DIN concentrations and related biological indicators<sup>4</sup>. Previously, phosphorus in rivers was the primary nutrient of concern for certain Local Planning Authorities (LPAs) in West Wales<sup>5</sup>, and the recognition of DIN as a nutrient issue in marine waters introduces new requirements for developers and LPAs.

New developments that lead to an increase in nitrogen discharges directly to these sites, or to catchments draining to these sites may contribute to unfavourable condition of, or undermine measures to restore, these features. **As such, relevant new developments that drain to the Milford Haven Inner water body or the Burry Inlet Inner water body, directly or indirectly, and introduce new or increased nutrient loads, will be required to demonstrate nutrient neutrality for nitrogen or secure appropriate and deliverable mitigation in order to be consented**<sup>5</sup>.

## 1.2 Purpose of this Handbook

This Developer Mitigation Handbook is published as planning guidance and provides information and advice to support developers to adequately consider DIN neutrality in planning submissions within the Milford Haven Inner water body (Pembrokeshire Marine SAC) and Burry Inlet Inner (Carmarthen Bay and Estuaries SAC) water body catchments<sup>4</sup>.

It provides information and advice to support developers to adequately consider DIN in planning submissions. It explains:

1. How to quantify nitrogen loads.
2. Identify proportionate mitigation can be implemented and maintained.
3. What information is needed to support robust planning applications.

The information and advice in this Developer Mitigation Handbook is also intended to support consistent and robust planning authority decisions on all relevant planning applications, ensuring that their obligations under the relevant environmental legislation are appropriately discharged.

This guidance is primarily illustrated using residential development examples, but applies to all forms of development within the DIN nutrient neutrality catchment that have the potential to contribute new dissolved inorganic nitrogen (DIN) loads through domestic wastewater or surface water runoff, including employment, tourism, medical facilities/care institutions, education, mixed use and commercial schemes (see Section 2.3.1). Developments with effluent discharges permits must also ensure that there is no increase to DIN to habitats sites, but the permitting process is outside the scope of this report.

The guidance applies where domestic wastewater from new developments has a hydrological pathway to the affected water bodies, and it provides support for delivering compliance with the Habitats Regulations 2017.

Overall, the guidance aligns with and supports the Welsh Government's nutrient budget calculator<sup>6</sup>, NRW SAC planning advice<sup>5</sup> and Welsh Government guidance<sup>7</sup>, and seeks to provide additional guidance and advice to support developers to successfully bring forward planning applications in DIN nutrient neutrality catchments.

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<sup>4</sup> Natural Resources Wales (2025). Condition assessments for Welsh European marine sites (EMS). Available at: <https://naturalresources.wales/guidance-and-advice/environmental-topics/wildlife-and-biodiversity/protected-areas-of-land-and-seas/condition-assessments-for-welsh-european-marine-sites-ems/?lang=en> (Accessed: 3 February 2026).

<sup>5</sup> Natural Resources Wales / Advice to planning authorities for planning applications affecting nutrient sensitive Special Areas of Conservation (V5.1 – 22/10/2025). Available at: <https://naturalresources.wales/guidance-and-advice/business-sectors/planning-and-development/advice-for-planning-authorities/advice-to-planning-authorities-for-planning-applications-affecting-phosphorus-sensitive-special-areas-of-conservation/?lang=en> (Accessed: 3 February 2026).

<sup>6</sup> Welsh Government, Nutrient Budget Calculator. Available at: [Nutrient budget calculator | GOV.WALES](#)

<sup>7</sup> Welsh Government (2024) Practical planning guidance to support development, particularly the delivery of affordable housing, in Special Areas of Conservation river catchments affected by phosphorus [Online] Available at: [Planning Guidance - Development in SAC Rivers](#)

## 1.3 Objectives of this Handbook

There are four objectives of this guidance:

1. To provide a 'step by step' process for development management officers and developers of how to assess and develop appropriate mitigation solutions for nutrient neutrality assessment.
2. To provide an overview of on-site and off-site mitigation options building on the existing NRW Mitigation Menu<sup>8</sup>.
3. To provide clarity as to whether mitigation measures qualify as Habitats Directive Article 6(3) interventions rather than Article 6(2) measures<sup>9</sup>, consistent with NRW guidance on additionality and effectiveness at the time of assessment.
4. To provide worked examples to show how to estimate DIN reductions from some of these measures alongside outputs from the Welsh Government nutrient budget calculator or bespoke calculations.

## 1.4 Application of this Handbook

This Developer Mitigation Handbook has been developed in partnership between, and applies to the following LPAs whose areas are all partly located within the catchments of the Milford Haven Inner (Pembrokeshire Marine SAC) and Burry Inlet Inner (Carmarthen Bay and Estuaries SAC) water bodies:

- Carmarthenshire County Council.
- Swansea Council.
- Neath Port Talbot Council.
- Pembrokeshire County Council.
- Pembrokeshire Coast National Park Authority.
- Bannau Brycheiniog National Park Authority.

The application of this Developer Mitigation Handbook across these six planning authority areas supports consistency in decision making as well as the guidance provided to developers.

## 1.5 Structure of the Handbook

The Developer Mitigation Handbook has been presented in seven sections as follows:

- **Section 2 – Background:** Provides the technical and regulatory context, including nutrient neutrality in Wales, details of the development type affected, the HRA process, details of the DIN impact for some designated sites in West Wales, and the Welsh Government Nutrient Calculator.
- **Section 3 – Roles and Responsibilities:** Defines the roles and responsibilities of key stakeholders, including the Welsh Government, NRW, LPAs, Planning and Environment Decisions Wales (PEDW), Nutrient Management Boards (NMBs) and developers in delivering nutrient neutrality.
- **Section 4 – Achieving DIN Neutrality:** Explains when and how nutrient neutrality screening and assessment should occur within the planning process, including pre-application advice, calculation of nutrient impacts, and securing mitigation through legal mechanisms.
- **Section 5 – Potential Mitigation Solutions:** Provides an overview of potential mitigation measures that may be used to achieve DIN neutrality, outlining evidential requirements, practical considerations and potential limitations.
- **Section 6 – Worked Examples:** Provides practical case studies demonstrating the application of the Welsh Government Nutrient Budget Calculator and mitigation measures, illustrating compliance pathways for developers.
- **Appendix A** - Details of 13 mitigation options are provided in this appendix.

<sup>8</sup> NRW Mitigation Measures Menu (2025) Available at: [mitigation-measures-menu.xlsx](#)

<sup>9</sup> Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (1992) OJ L. Available at: <http://data.europa.eu/eli/dir/1992/43/oj> (Accessed: 7 January 2026).

## 1.6 Future updates

This Developer Mitigation Handbook has been prepared in March 2026 and is based on the current understanding and guidance of the nutrient neutrality issues affecting marine SACs and relevant mitigation approaches. Circumstances and information can change over time as this is an evolving issue, and developers should satisfy themselves of the latest policy positions and guidance at the time of their application through reference to the relevant NRW and LPA's websites. The relevant LPAs will endeavour to update online guidance and this Developer Mitigation Handbook as and when required but further case specific advice will depend on the proposal, the evidence submitted and the relevant authority's processes.

## 2. Background

### 2.1 DIN as an issue in marine SACs

DIN refers to the bioavailable forms of nitrogen in water, namely nitrate ( $\text{NO}_3^-$ ), nitrite ( $\text{NO}_2^-$ ), and ammonium ( $\text{NH}_4^+$ ). These compounds are essential for aquatic plant and phytoplankton growth and often act as the limiting nutrient in coastal marine ecosystems<sup>10</sup> (as opposed to riverine ecosystems which are phosphorus limited). Seaward DIN flux from terrestrial catchments play an important role in the development and persistence of eutrophication in coastal and marine ecosystems<sup>11</sup>. DIN sources vary by sector with ammonium and nitrate forms predominately found in wastewater discharges, and inorganic nitrate the dominant form from agricultural sources.

DIN is highly soluble and is less associated with sediments than phosphorus, thereby making it substantially more mobile. This high mobility enables rapid transport through catchments into estuarine and coastal waters. Once present, DIN can persist due to tidal exchange processes and long water residence times. Unlike phosphorus, nitrogen also undergoes transformations involving a significant gaseous phase; processes such as denitrification which converts nitrate into nitrogen gas, enabling its release to the atmosphere and reducing its persistence in aquatic environments. However, groundwater leaching introduces a lagged pathway, allowing nitrogen applied to land to enter surface waters long after initial application<sup>4,12</sup>.

Recent assessments by NRW<sup>13,14,15</sup> confirm that excessive DIN concentrations are a major cause of water quality failures in marine SACs, with these failures attributed primarily to diffuse agricultural pollution, as well as contributions from private sewage systems (e.g., septic tanks) and the water industry<sup>12</sup>.

### 2.2 West Wales designated sites

This Developer Mitigation Handbook focuses on two SACs in West Wales where DIN pressures have contributed to unfavourable site conditions. These SACs are associated with the following specific WFD Water Bodies:

- Carmarthen Bay and Estuaries SAC which includes the Burry Inlet Inner Transitional WFD Water Body.
- Pembrokeshire Marine SAC, which includes Milford Haven Inner Transitional WFD Water Body.

Figure 2-1 illustrates the location of the relevant SACs, WFD Water Bodies, DIN nutrient neutrality catchments, and the four Local Authorities and two National Park Authorities. Refer to Appendix C for individual figures for the Carmarthen Bay and Estuaries SAC and Pembrokeshire Marine SAC.

Both SACs are designated under the Conservation of Habitats and Species Regulations 2017<sup>16</sup> for the protection of Annex I habitats and Annex II species. NRW updated their condition assessments and conservation advice for Marine SACs in June 2025<sup>4</sup>. It was concluded based on these assessments that nutrient sensitive features at both sites are in unfavourable condition for both chemical (DIN) and biological (phytoplankton and macroalgae) indicators of nitrogen enrichment. As a result, new developments leading to an increase in nitrogen discharges to either site may contribute to the unfavourable condition of the designated site or make its restoration to favourable status more difficult to achieve.

There is a direct duty on Competent Authorities to help protect, conserve and restore Habitat Sites. When considering the potential for impact on these sites from new planning applications, the Competent Authorities may first apply the screening principles set out for nutrient sensitive SAC river catchments for types of

<sup>10</sup> Howarth, R.W., & Marino, R. (2006). Nitrogen as the limiting nutrient for eutrophication in coastal marine ecosystems: evolving views over three decades. *Limnology and Oceanography*, 51(1), 364–376

<sup>11</sup> Han, chenglong *et al.* (2024) 'Riverine fluxes of dissolved inorganic nitrogen may be underestimated, especially in the gated estuaries: Influence of suspended sediments'. Research Square. Available at: <https://doi.org/10.21203/rs.3.rs-4293347/v1>.

<sup>12</sup> Johnson-Marshall, S. (2025) 'Widespread Failure In Wales Marine Protected Areas', *Afonydd Cymru*, 25 June. Available at: <https://afonyddcymru.org/marine-failures/> (Accessed: 24 November 2025).

<sup>13</sup> Condition Assessments for the Designated Features of Ardal Cadwraeth Arbennig Bae Caerfyrddin ac Aberoedd / Carmarthen Bay and Estuaries Special Area of Conservation, June 2025. Available at: [condition-assessment-for-carmarthen-bay-and-estuaries-sac.pdf](https://condition-assessment-for-carmarthen-bay-and-estuaries-sac.pdf)

<sup>14</sup> Condition assessments for the designated features of Ardal Gwarchodaeth Arbennig Cilfach Tywyn / Burry Inlet Special Protection Area, June 2025. Available at: [condition-assessment-for-burry-inlet-spa.pdf](https://condition-assessment-for-burry-inlet-spa.pdf)

<sup>15</sup> Condition Assessments for the Designated Features of Ardal Cadwraeth Arbennig Sir Benfro Forol / Pembrokeshire Marine Special Area of Conservation, June 2025. Available at: <https://cdn.cyoethnaturiol.cymru/5nyjebcc/condition-assessment-for-pembrokeshire-marine-sir-benfro-forol-sac.pdf>

<sup>16</sup> Participation, E. (no date) The Conservation of Habitats and Species Regulations 2017. Statute Law Database. Available at: <https://www.legislation.gov.uk/uksi/2017/1012/contents> (Accessed: 8 January 2026).

development unlikely to significantly increase nutrient discharges, as well as NRW's advice on agricultural developments, domestic extensions, private treatment systems, separator toilets and permitted development<sup>2</sup>.

NRW Advice: [Natural Resources Wales / Advice to planning authorities for planning applications affecting nutrient sensitive Special Areas of Conservation](#)

In circumstances where any plans or projects have the potential to increase nutrient discharges within the affected catchment and the HRA screening principles do not apply, the potential for an adverse effect on site integrity should be subject to a HRA (described further in Section 2.4). NRW advise Competent Authorities that a conclusion of no adverse effect on site integrity could be drawn in an HRA through demonstrating nutrient neutrality for nitrogen, although other approaches could also be considered on a 'case by case' basis<sup>2</sup>.

Developers should first check whether a proposed development lies within a nutrient neutrality catchment by accessing the online map using the following link: [Marine SAC Freshwater Catchments Requiring Nitrogen Neutrality | DataMapWales](#).

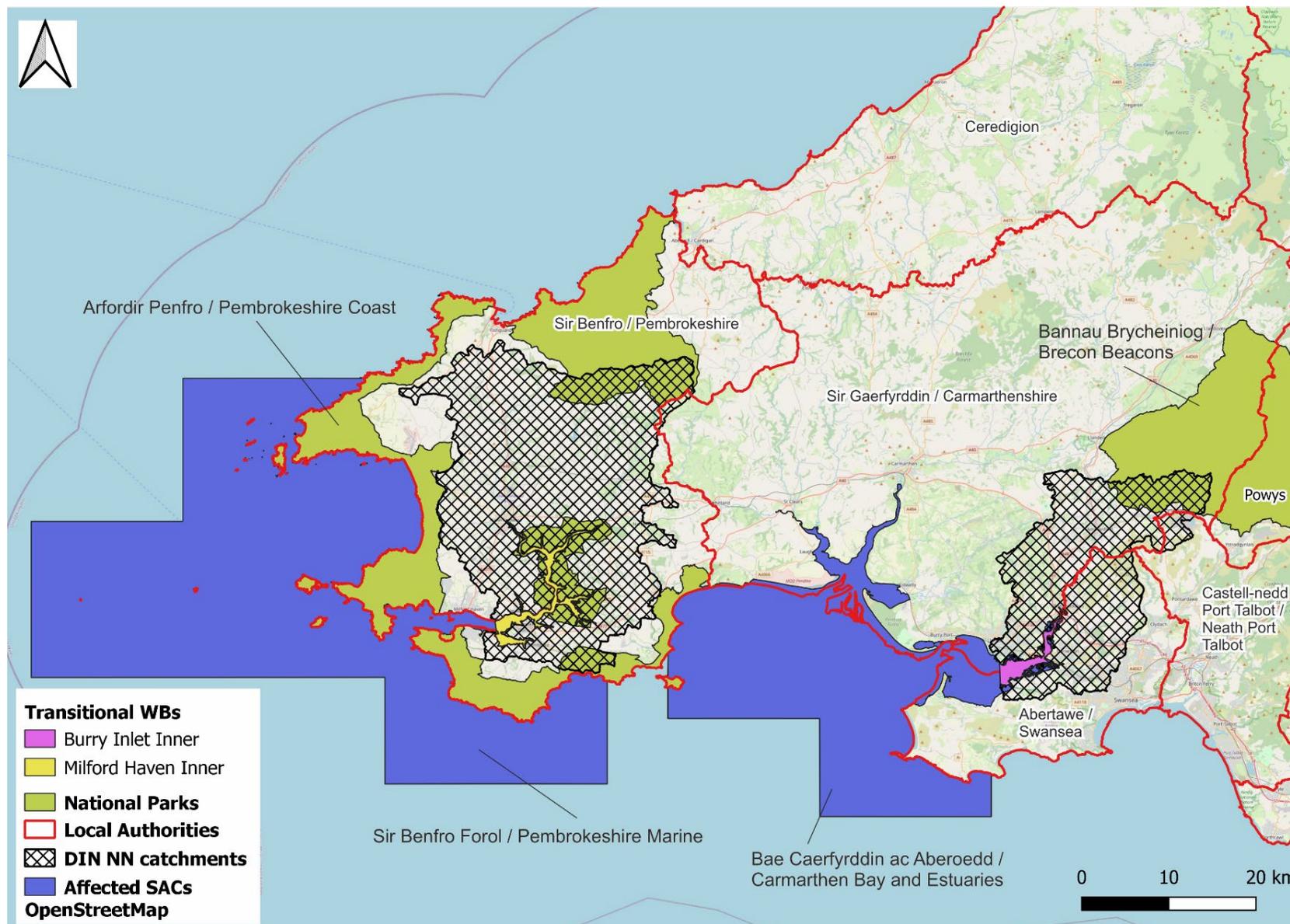


Figure 2-1 Location of the two SACs in West Wales (Carmarthen Bay and Estuaries SAC and Pembrokeshire Marine SAC) where DIN pressures have contributed to unfavourable site conditions (source: Welsh Government Data Map Wales online data)

## 2.2.1 Carmarthen Bay and Estuaries SAC



Figure 2-2 Burry Port, located within close proximity to the Burry Inlet Inner water body and Carmarthen Bay and Estuaries SAC

### Summary Description

The Carmarthen Bay and Estuaries SAC which is a large estuarine complex located between the Gower peninsula and Llanelli in South Wales. The site is primarily comprised of marine areas and sea inlets, with smaller areas of features such as tidal rivers, estuaries, lagoons, salt marshes, and sea cliffs. A part of the SAC is Burry Inlet Special Protection Area (SPA) and a Ramsar wetland, which are internationally important for overwintering wildfowl and waders that feed in the saltmarshes and intertidal areas<sup>17</sup>. Burry Port, which is located within close proximity to Burry Inlet Inner SPA is shown in Figure 2-2.

The Carmarthen Bay and Estuaries SAC was designated in 2004 under Article 4.2 of the Conservation of Natural Habitats and of Wild Fauna and Flora Directive (92/43/EEC) for habitat features under Annex I, and species features under Annex II<sup>13</sup>.

### Annex I habitats that are a primary reason for designation<sup>18</sup>:

- Estuaries.
- Mudflats and sandflats not covered by seawater at low tide.
- Atlantic salt meadows (*Glauco-Puccinellietalia maritima*).
- Salicornia and other annuals colonising mud and sand.
- Large shallow inlets and bays.
- Sandbanks which are slightly covered by seawater all the time.

### Annex II species that are primary reason for designation<sup>18</sup>:

- Twaite shad (*Alosa fallax*)<sup>19</sup>.

### Annex II species present as a qualifying feature, but not primary reason for designation<sup>18</sup>:

- River lamprey (*Lampetra fluviatilis*).
- Sea lamprey (*Petromyzon marinus*).

<sup>17</sup> Carmarthen Bay & Estuaries European Marine Site: Burry Inlet SPA (no date). Available at: <https://english.cbeems.org/the-ems/burry-inlet-spa/> (Accessed: 8 January 2026).

<sup>18</sup> Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd - Special Areas of Conservation (no date). Available at: <https://sac.jncc.gov.uk/site/UK0020020> (Accessed: 8 January 2026)

<sup>19</sup> Note that the 'Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd - Special Areas of Conservation (no date). Available at: <https://sac.jncc.gov.uk/site/UK0020020> (Accessed: 8 January 2026)' lists Twaite shad (*Alosa fallax*) as species that are a primary reason for selection of this site and Allis shad (*Alosa alosa*) as a qualifying feature, but not a primary reason for site selection.

- Otter (*Lutra lutra*).
- Allis shad (*Alosa alosa*).

### Conservation Objectives

The Welsh Government are responsible for delivering the Conservation Objectives of SAC sites in Wales. Objectives are set for each SAC with the intention of maintaining or restoring the qualifying features of the site to favourable condition, and to secure this in the long term. The measures that are being implemented to maintain or restore the site's qualifying features, are outlined in the 'Ardal Cadwraeth Arbennig Bae Caerfyrddin ac Aberoedd / Carmarthen Bay and Estuaries Special Area of Conservation' conservation objectives<sup>20</sup>.

## 2.2.2 Pembrokeshire Marine SAC



Figure 2-3 Part of the Milford Haven Waterway<sup>21</sup>

### Summary Description

The Pembrokeshire Marine SAC is an extensive estuary system in Pembrokeshire. The SAC includes the Milford Haven Waterway which forms one of the largest natural harbours in the world and includes a complex network of drowned river valleys, deep channels, sheltered bays and inlets<sup>22</sup>. Much of the Waterway is designated for its high conservation value. The SAC include extensive areas of intertidal mud and sandflats, saltmarsh, rocky shores, subtidal sediment habitats, seagrass beds, saline lagoons, and reef communities<sup>23</sup>.

The Pembrokeshire Marine SAC was designated in 2004 under Article 4.2 of the Conservation of Natural Habitats and of Wild Fauna and Flora Directive (92/42/EEC) for habitat features under Annex I and species features under Annex II<sup>15</sup>.

<sup>20</sup> Natural Resources Wales (2025). Ardal Cadwraeth Arbennig Bae Caerfyrddin ac Aberoedd / Carmarthen Bay and Estuaries Special Area of Conservation. Available at: [conservation-advice-for-carmarthen-bay-and-estuaries-sac.pdf](https://naturalresources.wales/media/639589/SSSI_0282_Citation_EN0010ded.pdf)

<sup>21</sup> Pembrokeshire County Council Milford Haven waterway - Dyfrffordd Aberdaugleddau. Available at <https://newsroom.pembrokeshire.gov.uk/resources/milford-haven-waterway-dyfrffordd-aberdaugleddau> (Accessed 06 February 2026)

<sup>22</sup> Countryside Council for Wales (2002) Milford Haven Waterway (Summary Citation) [Online] Available at: [https://naturalresources.wales/media/639589/SSSI\\_0282\\_Citation\\_EN0010ded.pdf](https://naturalresources.wales/media/639589/SSSI_0282_Citation_EN0010ded.pdf)

<sup>23</sup> Pembrokeshire Marine Special Area of Conservation (2018) [Online] Available at: <https://cdn.naturalresources.wales/687999/eng-pembrokeshire-marine-reg-37-report-2018.pdf>

**Annex I habitats that are a primary reason for designation<sup>24</sup>:**

- Estuaries.
- Large shallow inlets and bays.
- Reefs.

**Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site<sup>24</sup>:**

- Sandbanks which are slightly covered by seawater all the time.
- Mudflats and sandflats not covered by seawater at low tide.
- Coastal lagoons.
- Atlantic salt meadows (*Glauco-Puccinellietalia maritima*).
- Submerged or partially submerged sea caves.

**Annex II species that are a primary reason for designation<sup>24</sup>:**

- Grey seal (*Halichoerus grypus*).
- Shore dock (*Rumex rupestris*).

**Species present as a qualifying feature, but not primary reason for designation<sup>24</sup>:**

- Sea lamprey (*Petromyzon marinus*).
- River lamprey (*Lampetra fluviatilis*).
- Allis shad (*Alosa alosa*).
- Twaite shad (*Alosa fallax*).
- Otter (*Lutra lutra*).

**Conservation Objectives**

The measures that are being implemented to maintain or restore the SAC's qualifying features are outlined in the 'Ardal Cadwraeth Arbennig Sir Benfro Forol / Pembrokeshire Marine Special Area of Conservation' conservation objectives<sup>25</sup>.

## 2.3 Nutrient neutrality in Wales

Poor water quality caused by nutrient enrichment is one of the main reasons many designated marine, estuarine and freshwater habitats in Wales are in an unfavourable condition. Excessive nutrients drive eutrophication leading to deterioration of site integrity. To restore water quality, reductions in nutrient inputs are essential, as well as controlling future increases in nutrient loads (including from new development).

Nutrient neutrality has therefore become a critical requirement for development in parts of Wales. Initially focused on phosphorus in riverine SACs<sup>26</sup> such as the River Wye, River Usk, River Tywi, River Teifi, River Dee, River Eden, River Glaslyn, River Gwyrfai and River Cleddau<sup>26</sup>, nutrient neutrality now also concerns total nitrogen (recorded as DIN) pressures following the publication of additional studies into the current conservation status of marine/estuarine SACs<sup>27</sup>.

Rather than a single policy announcement or legislative change, the Welsh approach to nutrient neutrality has evolved incrementally as NRW and LPAs responded to deteriorating water quality conditions at designated sites and the need to ensure compliance with the Habitats Regulations 2017<sup>1</sup>. This Wales-specific approach is aligned with the broader UK concept but has been shaped by local policy drivers and the regulatory roles of NRW and the Welsh Government (as outlined later in Section 3).

The need for nutrient neutrality originally stemmed from the European Court of Justice ruling in the Dutch Nitrogen case (C-293/17 and C-294/17), that if a European protected nature conservation site is in a deteriorating condition (such as due to excess nutrient levels that may also be forecast to increase) there are very limited circumstances under which further discharges of nutrients to a site can legally be permitted. As a result, in the absence of any empirically derived threshold by which additional aquatic inputs of nitrogen and phosphorus can be deemed nugatory or *de minimis*, it must be concluded that new development within the affected habitats site catchment could increase nutrient deposition into the protected sites above already harmful levels and thus

<sup>24</sup> Pembrokeshire Marine/ Sir Benfro Forol - Special Areas of Conservation (no date). Available at: [Pembrokeshire Marine/ Sir Benfro Forol - Special Areas of Conservation](#) (Accessed: 8 January 2026)

<sup>25</sup> Natural Resources Wales (2025). Ardal Cadwraeth Arbennig Sir Benfro Forol / Pembrokeshire Marine Special Area of Conservation. Available at: <https://cdn.cyfoethnaturiol.cymru/hejvule/conservation-advice-for-sir-benfro-forol-pembrokeshire-sac.pdf>

<sup>26</sup> Natural Resources Wales (2025). *Principles of nutrient neutrality in relation to development or water discharge permit proposals*. [Online] Available at: [Natural Resources Wales / Principles of nutrient neutrality in relation to development or water discharge permit proposals](#) (Accessed: 02 January 2026).

<sup>27</sup> Natural Resources Wales (2025). *Further action needed to protect Wales's marine protected areas*. [Online] Available at: [Natural Resources Wales / Further action needed to protect Wales's marine protected areas](#) (Accessed: 14 January 2026).

interfere with the ability of the site to achieve its conservation objectives and the integrity of the European protected nature conservation site. This is relevant because under Regulation 63 of the Conservation of Habitats and Species Regulations 2017 a LPA (i.e. the Competent Authority) cannot legally consent a plan or project that will have an adverse effect on the integrity of any European protected nature conservation site.

### 2.3.1 Types of development affected

New development, including housing or agricultural enterprises, can lead to increased loads of nutrients entering the catchments of the Burry Inlet Inner and Milford Haven Inner water bodies (and hence their respective affected SACs) from additional wastewater or surface water runoff<sup>5</sup>. NRW advice regarding nutrient neutrality applies to any development within, or served by a WwTW in, the DIN nutrient neutrality catchments that increase nitrogen levels. It is a matter for the LPA to determine whether a plan or project is likely to have a significant effect on an SAC. In general, the types of developments that may require assessment include, but are not necessarily restricted to, the following:

- **Residential development:** New homes or houses which may lead to an increase in occupancy within the DIN nutrient neutrality catchment.
- **Domestic extension with increased occupancy / change in use:** Any domestic extension or works that will lead to the creation of independent living accommodation as a separate planning unit may lead to an increase in occupancy by residents from outside a DIN nutrient neutrality catchment.
- **Non-residential development:** Developments expected to serve a population from outside of a DIN nutrient neutrality catchment and who are therefore not already served by residential connections to existing public or private sewers discharging within the DIN nutrient neutrality catchment. For example, this can include self-service and serviced tourist accommodation such as hotels, guest houses, bed and breakfasts, self-catering holiday facilities, camping and caravan sites, and potentially hospital/social care developments. New commercial or industrial developments, such as conference facilities, large retail sites or major tourist attractions may also result in the release of additional nutrients to the system. Industrial developments may require the discharge of process wastewater to watercourses that could contain nitrogen, and this may require an environmental permit from NRW and formal treatment systems, and this is not covered by this guidance. Furthermore, large developments that attract construction workers from outside of the nutrient neutrality catchment may also require consideration, depending on how foul water will be managed, even if the completed development itself does not require an assessment.
- **Temporary events:** Sites with planning consent to hold frequent seasonal events or ad hoc activities on a long-term basis should be considered permanent development. These include, but are not restricted to, seasonal wedding venues, touring caravan parks, outdoor activity venues, and potentially including other sui generis land uses as may be proposed.
- **Developments involving wastewater connections:** Any proposal that connects to public WwTW or uses Package Treatment Plants (PTPs) within a DIN nutrient neutrality catchment. In some cases, the proposed development may be physically located outside of the DIN nutrient neutrality catchment but the WwTW to which foul flows are direct is inside of the catchment.
- **Agricultural:** New agricultural developments involving the production, storage, management and spreading of organic manures and slurries, which have the potential to contribute towards the amount of nutrients entering a designated site (e.g. livestock housing or facilities and buildings for the treatment of livestock manure, slurries or other organic manures). Agricultural development that are not considered to have a likely significant effect on SAC features in relation to water quality impacts include covering an existing yard and roofing for manure / slurry or silage storage that does not impact the existing store structure.

#### Exemptions and exceptions cited by NRW<sup>5</sup>:

- Any development that improves existing water quality discharges by reducing the nutrient concentration of wastewater without increasing volume, or by decreasing the volume of wastewater produced without increasing the concentration of nutrients.
- Domestic extensions are considered by NRW to provide increased living space within existing properties that may not result in a change in the number of occupants. This is the case provided that the extension will not result in the creation of independent living accommodation, a separate planning unit and/or a change in use.
- Developments using PTPs: Where PTPs can be justified (i.e. it can be shown to the satisfaction of the LPA that connection to a public sewer is not feasible), small discharges to ground (<2m<sup>3</sup>/day) via a suitable drainage field are considered unlikely to have a significant effect on a SAC. For this to be the case the PTP should be built to the relevant British Standard (BS 6297:2007+A1:2008), the drainage field must be located

more than 40m from any surface water feature such as a river, stream, ditch or drain, located more than 50m from a SAC boundary, and at least 50m from any other known discharge to ground<sup>5</sup>.

- Developments intended to provide services, facilities, commercial sites, or places of employment (e.g., community buildings, schools etc.) for a local population already served by residential connections to existing public or private sewers discharging within the DIN nutrient neutrality catchment.
- Community or employment facilities serving an existing local population.
- Certain agricultural improvements with no livestock increase.

If in doubt, developers should contact the relevant LPA for advice as to whether a particular development requires a nutrient neutrality assessment.

## 2.4 Habitats Regulations Assessment in Wales

The approach to nutrient neutrality in Wales is underpinned by the HRA process. Water bodies designated as SACs are afforded specific legal protection derived from the Habitats Directive, transposed into Welsh law by the Habitats Regulations 2017 and retained, with post-Brexit amendments (not listed here), to ensure continuity.

Where a development has a potential impact pathway to a Habitat Site (including through nutrient enrichment), the Competent Authority must undertake HRA screening to determine whether a project, alone or in combination with others, is likely to have a significant effect on the integrity of SACs and SPAs. Within marine SAC catchments where nutrient limits are already exceeded, proposals that are likely to generate significant additional nutrient loading and cannot be screened out will trigger an Appropriate Assessment.

NRW has advised that any additional nutrient loading that cannot be screened out, however small, is unlikely to meet the “no adverse effect on site integrity” test without secured and deliverable mitigation. Nutrient neutrality therefore provides a practical mechanism for ensuring compliance with the Habitats Regulations 2017 by requiring development proposals to offset any increase in DIN emissions through appropriate mitigation measures. Other approaches may also be suitable and can be considered on a case-by-case basis.

### 2.4.1 Article 6 of the HRA

Article 6 of the Habitats Directive establishes the legal framework for protecting Habitat Sites, and is central to decision-making, as it underpins the requirement to avoid or fully mitigate additional nutrient loading to protected water-dependent sites. There are four key elements of protection provided under Article 6 of the Habitats Directive which are summarised in Table 2-1<sup>7</sup>. Table 2-1 distinguishes between Articles 6(1) and 6(2), which focus on proactive site management and addressing existing threats, and Articles 6(3) and 6(4), which introduce a step-by-step assessment process for evaluating the impacts of new proposed plans or projects. As such, Article 6(3) and Article 6(4) are generally of most relevance to developers.

**Table 2-1 An overview of Article 6 provisions\***

Article	Description
Article 6(1)	Wales shall establish necessary conservation measures corresponding to the ecological requirements of the habitats and species for which the site has been designated.
Article 6(2)	Wales shall take appropriate steps to avoid deterioration of natural habitats and significant disturbance of species.
Article 6(3)	Wales shall undertake an <b>Appropriate Assessment for new plans and projects</b> which are likely to have a significant effect on a designated site. Permission can only be granted having ascertained that there will be no adverse effect to site integrity, either alone or in-combination with other plans and projects.
Article 6(4)	Potentially damaging proposals can, nevertheless, be permitted in the absence of alternative solutions for imperative reasons of overriding public interest. Compensatory measures must be secured. Note that such an approach can only be adopted in exceptional circumstances with no such cases relating to nutrient neutrality in West Wales at the time of writing (March 2026).

\* ‘Member States’ in the original text has been replaced with ‘Wales’ as environmental protection is a largely devolved matter.

It is important to distinguish between actions identified as being a general duty under Article 6(2) and the project-specific assessment process under Article 6(3). Article 6(2) imposes a continuous obligation on the Welsh Government, NRW and LPAs (as the Competent Authorities) to avoid deterioration and disturbance of Habitat Protected Sites, regardless of whether a specific plan or project is proposed. On the contrary, Article 6(3) is focused on ensuring new plans and projects avoid or sufficiently mitigate any potentially significant adverse effects on the integrity of a Habitat Protected Site. A comparison of Article 6(2) and Article 6(3) of the Habitats Directive is presented in Table 2-2, highlighting their respective roles in ongoing site protection and the assessment of new plans or projects, and in the content of nutrient neutrality.

**Table 2-2 Comparison of Article 6(2) and Article 6(3) of the Habitats Directive**

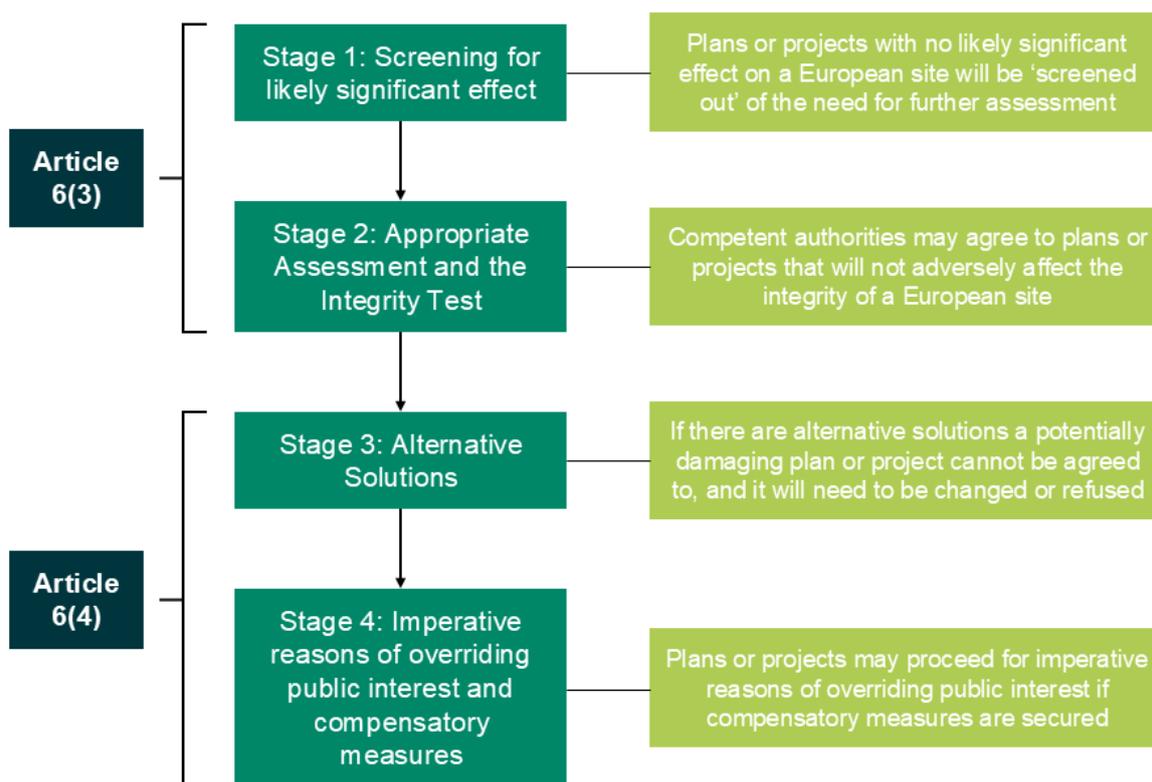
Feature	Article 6(2)	Article 6(3)
<b>Focus:</b>	Preventing deterioration / disturbance to a designated site in relation to ongoing activities.	Assessing <b>new plans / projects</b> that have potential to impact a designated site.
<b>Applies to:</b>	Existing activities within the catchment of the designated site which already present a risk to the site. It is a proactive ongoing duty upon the Welsh Government and LPAs as Competent Authorities; it does not apply at a specific point in time.	<b>Proposed developments (not yet operational)</b> within the catchment of a designated site. It is a reactive provision, which applies at a defined point in time when a decision is being taken as to whether to allow a potentially damaging project to be consented.
<b>Legal duty:</b>	Take “appropriate steps” to prevent the deterioration of protected habitats and significant disturbance of species within designated sites.	Conduct HRA before approval to demonstrate that potentially significant adverse effects on the integrity of a Habitat Protected Site are either avoided or sufficiently mitigated.
<b>Outcome:</b>	Continuous protection of the designated site.	Consent only if no adverse effect on the designated site.
<b>Example:</b>	Recent NRW Review of Consents supports reductions in nutrient emissions from existing WWTWs.	Removal of an old, poorly performing Package Treatment Plant (PTP) and replacement with a new, more advanced and higher performing model which reduces nutrient emissions, all other factors remaining the same.

## 2.4.2 HRA process

Under Article 6(3), Competent Authorities must undertake an Appropriate Assessment where a plan or project is likely to have a significant effect on a Habitat Protected Site and may only grant consent where they are satisfied that the proposal will not adversely affect the integrity of the site. These legal requirements cannot be waived or diluted, and the burden of demonstrating no adverse effect on site integrity rests with the developer. If a development is deemed to have no likely significant effect, then the project can be screened out and there will be no need for any further assessment. The four-stage approach to HRA is outlined in Figure 2-3. Further information and guidance on undertaking a HRA in Wales can be found on the Welsh Government website<sup>28</sup> and within the Welsh Government Development Plans Manual<sup>29</sup>. This can be reviewed by developers to aid process understanding but the HRA will be undertaken by the Competent Authority.

<sup>28</sup> Welsh Government (2025). Habitats regulations assessment (HRA) guidance. [Online] Available at: [Habitats regulations assessment \(HRA\) guidance | GOV.WALES](#)

<sup>29</sup> Welsh Government (2020). Development Plans Manual Edition 3 [Online] Available at: [development-plans-manual-edition-3-march-2020.pdf](#)



**Figure 2-3 Outline of the four-stage approach to HRA (adapted from Welsh Government’s Planning Guidance to developing in an SAC)**

Within HRA assessment, the concept of ‘reasonable scientific certainty’ is critical. The Competent Authority can only authorise a project if they are convinced, beyond reasonable scientific doubt, that no adverse effects on the integrity of the Habitat Site will occur. This is distinct from ‘absolute certainty’ which is not generally achievable in science. Sufficient certainty can be achieved for an Appropriate Assessment through rigorous application of precautionary values to data and expert judgment, provided the overall conclusion demonstrates with a high degree of confidence that there will be no adverse effects.

### 2.4.3 Mitigation versus restoration

Mitigation proposed by developers for new plans and projects under Article 6(3) should not involve the delivery of measures which are already identified as restoration measures (under Article 6(2))<sup>30</sup>, and which are associated with an appropriate and existing delivery mechanism. Furthermore, they should not hinder future delivery of required restoration measures. However, there may in future be exceptions as discussed below whereby an ‘integrated approach’ might be adopted. This is an emerging approach which should be kept under review as it is developed by Welsh Government.

Welsh Government’s guidance on this subject<sup>9</sup> (albeit to river SACs rather than marine SACs) indicates that *“implementation of restoration is a duty upon the Welsh Government and is delivered by public bodies and funds. Delivery targets and the rate of progress will therefore be constrained by available resources. Where appropriate steps are being taken to achieve the conservation objective targets, the need for mitigation from new development arises in recognition of the risk that the delivery of development might compromise the delivery of restoration. Under an integrated approach the effectiveness of proposed mitigation is evaluated against the improving baseline conditions in accordance with current delivery targets and the extent to which delays to the delivery of restoration targets have been avoided. Integrated mitigation may involve entirely new measures, but mitigation can be more closely integrated with the delivery of restoration where developer contributions:*

- *increase the scale, magnitude, or scope of planned restoration measures (over and above what would otherwise have been delivered); or*

<sup>30</sup> Article 6(2) restoration measures in West Wales include universal actions within the Sustainable Farming Scheme (SFS) 2026 such as the requirement for 10% of farm land to be managed as semi-natural habitat— thus restoring the nitrogen-stripping capacity of the landscape.

- *speed up delivery of planned restoration measures beyond what would normally be delivered, where the current implementation timescales risk meaningful ecological deterioration in the interim*<sup>5</sup>.

This approach was based on Welsh Government's review of draft Defra policy in respect of the concept of 'additionality' in the identification of compensatory measures for offshore wind farms in England and is considered good practice to apply in Wales.

At the time of publication of this Developer Mitigation Handbook (March 2026) Welsh Government are seeking to develop an integrated approach regarding SAC marine sites, whereby developers may fund restoration measures to speed up delivery of development. Developers are advised to frequently engage with the Welsh Government, NRW and LPA websites for the latest information as this approach progresses. Future iterations of the Developer Mitigation Handbook will cover new guidance as and when it is available.

## 2.5 Current approach and guidance in Wales

### 2.5.1 Current National Guidance

NRW has issued planning advice indicating that proposals with wastewater or surface-water pathways to nutrient-sensitive marine SAC sites require appropriate HRA, and that avoidance or mitigation of additional nutrient loading is necessary to meet the 'no adverse effect on integrity' test at the Appropriate Assessment stage (i.e. assessment of the project against conservation objectives to determine if site integrity would be harmed<sup>5</sup>).

[Natural Resources Wales / Advice to planning authorities for planning applications affecting nutrient sensitive Special Areas of Conservation](#)

The All Wales nutrient calculator and accompanying guidance has been developed by Welsh Government as a tool to assist developers in determining the nutrient budget for a development, to assess and mitigate any potential impacts<sup>5</sup>.

[Nutrient budget calculator | GOV.WALES.](#)

### 2.5.2 Nutrient budget calculation and mitigation

A calculation methodology including for nitrogen and was developed by the Welsh Government, originally in June 2025, building on the methodology developed by Carmarthenshire County Council in 2022. This methodology is now implemented through the new All Wales nutrient calculator<sup>31</sup>, updated in December 2025, which provides a free, standardised tool for assessing the nutrient impact of development proposals across Wales. It applies to developments within relevant SAC catchments, those increasing discharges to WWTWs draining to relevant SACs, or those increasing overnight stays or visitor numbers from outside the SAC catchment, as discussed earlier. It is recommended that developers use the new All Wales Nutrient Calculator as the basis for determining whether a development will generate a surplus in DIN.

Consistent with the precautionary stance embedded in HRA case law, mitigation must be 'certain, deliverable, and enforceable', ensuring no additional nutrient burden on already compromised environments. Thus, where a nutrient surplus is identified (i.e., it is not nutrient neutral) and where no Article 6(2) restoration 'headroom' can be relied on to avoid any likely significant effects, then suitable mitigation is required. Article 6(2) restoration 'headroom' refers to the surplus nutrient-reduction capacity created when NRW or other bodies take action to restore the marine SACs to a favourable condition. It should be ensured that the use of any such 'headroom' does not lead to decline in water body status.

Suitable mitigation for nutrient neutrality:

1. **Must be sufficiently robust and evidenced** to ensure that the intended DIN reduction is achievable with reasonable scientific certainty.
2. **Must be within the same catchment** of the relevant designated site and result in no detriment to the SAC.
3. **Must be secured** by the applicant by appropriate planning or legal mechanisms.
4. **Must be in place** or operational before occupation of the development.

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<sup>31</sup> All Wales Calculator - Carmarthenshire County Council (no date). Available at: <https://www.carmarthenshire.gov.wales/council-services/planning/nutrient-management-in-planning-and-development/all-wales-calculator/> (Accessed: 8 January 2026).

- 5. Must be suitably maintained** for the lifetime of the development. In Wales, nutrient neutrality **mitigation measures must be legally secured for the lifetime of the development**<sup>32</sup>, often described as ‘in perpetuity’.

## 2.6 Welsh Government nutrient calculator

The Welsh Government All Wales Nutrient Calculator is a decision-support tool designed to provide a consistent, evidence-based approach for use by developers when assessing the potential nutrient implications of new developments on designated water bodies in Wales. The calculator enables planning authorities and developers to quantify anticipated nitrogen and phosphorus loads arising from proposed residential or commercial developments and to evaluate whether these loads may contribute to adverse effects on nutrient-sensitive sites. The calculator and guidance are available at:

[Nutrient budget calculator | GOV.WALES.](#)

In December 2025, the Welsh Government published an updated version of the Nutrient Calculator which allows for determination of nitrogen loading in the catchments of the Carmarthen Bay and Estuaries SAC and Pembrokeshire Marine SAC.

The nutrient calculators are designed to quantify, on a precautionary basis, the nutrient loading of an area of land subject to a change of land use and population. Once it has been determined whether there is a nutrient surplus or deficit, then the extent of any required mitigation can be identified.

The tool consists of the following main ‘stages’:

- 1: Additional Nutrient Loading from Wastewater** - Identifies the additional nitrogen load (and/or phosphorus load depending on the site in question) as a result of changes in the population and the approach to wastewater management (e.g. connection to a particular wastewater treatment works (WwTW), Packaged Treatment Plant (PTPs) etc.).
- 2: Nutrient Loading from Pre-Existing Landcovers** - Calculates nitrogen load (and/or phosphorus depending on the site in question) from current land use. Agricultural land uses have nutrient loadings that consider local rainfall and soil type.
- 3: Nutrient Loading from New Landcovers** - Calculates nitrogen load (and/or phosphorus depending on the site in question) from new land use. The land use nutrient budget is then determined automatically within the calculator by subtracting existing land use from proposed land use.
- 3S: Nutrient Load Removed through Sustainable Drainage Systems (SuDS)** – Determines any reduction in nutrient loading relating to any SuDS that are to be included in the proposed development design; and
- 4: Final Nutrient Budget Calculation** - Calculates the total change in nitrogen (and/or phosphorus) loading as a result of the proposed development (sum of additional population loadings and land use loadings plus a precautionary 20% buffer).

Where SuDS are not being relied upon for Article 6(3) nutrient mitigation and provided that the development is SuDS Approval Body (SAB) compliant, the developer can assume that surface water discharges from the development site (derived through Stages 2, 3 and 3S above) are not contaminated with foul water or diffuse pollutants (i.e. are nutrient neutral). In this circumstance, the developer can simply determine the nutrient load from the development **from wastewater alone using Stage 1 and 4**. NRW outline this as follows in their guidance<sup>5</sup>:

*There is a presumption for all developments that rainwater is kept separate from foul wastewater and discharged in line with planning guidance on rainwater disposal. As such, new surface water discharges should not be contaminated with foul water or pollutants. For the purpose of nutrient balance calculations, surface water discharges would therefore not need to be considered as a source of nutrients. However, they may be taken into account for example when considering the potential benefits that could be achieved by utilising SuDS as part of a development proposal.*

It must be reiterated that should the developer choose to assume surface water is neutral under SAB, then SuDS cannot be used to generate additional nitrogen removal for Article 6(3) mitigation. Alternatively, should the

<sup>32</sup> Court of Justice of the EU (2018) C-293/17 and C-294/17 Available at <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:62017CA0293>

applicant wish to claim benefit from land use change and/or SuDs to a usage that has lower loadings of DIN, or wish to rely on nutrient mitigation from SuDS, then all of the above Stages (1-4 inclusive) must be applied.

Following determination of the final nutrient budget at Stage 4, **should there be a surplus of nutrients identified (i.e. any loading greater than 0 kg of nitrogen per year) then mitigation is required to achieve nutrient neutrality.**

The Welsh Government guidance document<sup>33</sup> accompanies the nutrient budget calculator created for Wales and provides step-by-step instructions on how to complete a nutrient budget using the calculator. The calculator is available in both English and Cymraeg. The calculator incorporates a range of input variables including wastewater generation, land cover, existing wastewater treatment works performance, population assumptions, occupancy rates, and surface water drainage arrangements.

For further information regarding how to calculate the nutrient budget of a new development using the Welsh Government Calculator, please refer to the Welsh Government guidance document.

## 2.6.1 Mitigation: Direct or indirect discharges to a SAC

NRW's advice distinguishes between direct discharges into a marine SAC (e.g. a WwTW outfall located within the SAC boundary), and discharges upstream within the catchment that ultimately flow to the SAC indirectly.

For developments whose wastewater is connected to WwTWs discharging directly into the marine SAC, NRW advise that mitigation measures will need to be implemented prior to the pollution pathway from the location where the development site run-off and wastewater input will have a direct impact on the site. In practice, this means mitigation needs to reduce the load at or before the outfall location. In this instance, diffuse agricultural or land use measures elsewhere in the catchment generally reduce background loading rather than demonstrably intercepting the specific development-derived load. This creates a higher evidential burden under Article 6(3) for mitigation for direct outfalls to a SAC (e.g. Llanelli WwTW and Gowerton WwTW).

If the discharge is indirect (i.e. upstream in the catchment of a marine SAC), then the mitigation measures can be upstream or downstream within the catchment, as long as it will provide the offsetting before the point at which the development impacts the marine SAC. As such, there is more flexibility with regard to mitigation options, and measures to reduce diffuse DIN load through agricultural or land use mitigation may be appropriate in this case.

## 2.6.2 Strategic scale mitigation solutions

Strategic scale mitigation solutions, such as large wetlands, are in place and under development in some nutrient neutrality catchments across England (e.g. by various LPAs and Natural England) thereby reducing nitrogen loading where previous discharges had higher loads and enabling developers to buy nutrient credits to offset development. However, for many LPA areas, including those in Wales, strategic solutions are not yet in place. A Technical Working Group has been set up in Wales (in November 2025) to look at developing nutrient trading schemes. The Technical Working Group is currently investigating pilot sites, and as such it will be some time until any such strategic solution will be in place. Therefore, developer led mitigation, either on site or off-site, are currently required to ensure new development is neutral in terms of DIN emissions in surface water runoff and wastewater directed to the Burry Inlet Inner and Milford Haven Inner water bodies.

## 2.6.3 Developer led mitigation solutions

In the absence of strategic scale mitigation solutions and a nutrient credit charging system, developer led mitigation will be required to ensure future development with a known DIN surplus can be made nutrient neutral. A common mitigation approach involves changing land use as part of the development site or at an off-site location also within the developer's control. For instance, land use change from agricultural land to woodland or greenspace to reduce nutrient export, although in some instances this can be unfeasible for smaller scale developments. Other approaches include the use of PTPs (where a connection to the mains sewer is not available), particularly where they discharge to ground. While PTPs do not eliminate DIN, they can achieve a higher standard of effluent treatment than conventional septic tank systems, thereby reducing nitrogen loading at source. When appropriately designed and located, this reduction can contribute to achieving nutrient neutrality for a development. Wetland creation and use of SuDS to encourage removal of nutrient from surface water runoff are also commonly applied mitigation approaches to larger developments. Mitigation approaches are explored in more detail in Section 5.

<sup>33</sup> Nutrient budget calculator: guidance (2025). [Online] Available at: [Nutrient Budget Calculator Guidance](#)

## 3. Roles and responsibilities

The roles and responsibilities of organisations involved in the nutrient neutrality process across Wales are outlined below:

### 3.1 The Welsh Government

The Welsh Government is responsible for the overarching policy, regulation and statutory framework in Wales<sup>34</sup>. The Welsh Government's role in nutrient neutrality is to set the national policy and regulatory framework that protects sensitive rivers and marine sites from nutrient pollution, provide the technical tools and guidance used to assess and mitigate impacts from development, and support wider catchment-scale solutions through funding and strategic planning<sup>35,36</sup>. The Welsh Government works alongside NRW and LPAs to ensure that new developments do not adversely affect the integrity of Habitat Sites, while enabling practical, consistent approaches to mitigation across Wales.

**General Contact:** [customerhelp@gov.wales](mailto:customerhelp@gov.wales)

### 3.2 Natural Resources Wales

NRW provides technical guidance and advice to LPAs, who are the Competent Authority regarding compliance with the Habitats Regulations 2017 (for planning applications made under the Town and Country Planning Act 1990). NRW's advice is based on the principles of nutrient neutrality and is tailored to the specific needs of each SAC. NRW's guidance is essential for planning authorities to determine whether a proposed development will have a significant effect on an SAC and to ensure that the requirements of the Habitats Regulations are satisfied prior to consent being granted. NRW must be consulted for the purposes of the Appropriate Assessment, as the Appropriate Nature Conservation Body (ANCB). NRW will advise on the implications of developments for a designated site's conservation objectives, but not on matters beyond their responsibilities as ANCB.

NRW's guidance is clear for new proposed developments in nutrient sensitive catchments (as described in Section 2.2) that if no screening principles apply to a development then a conclusion of no adverse effect on site integrity must be demonstrated, either through nutrient neutrality (with mitigation secured for the lifetime of the development) or other suitable approaches (to be considered on a case by case basis). NRW may play a critical role in such other approaches, where these rely on restoration being planned or achieved. It should also be noted that NRW are Competent Authority for water quality permitting, which is of relevance to the delivery of developments and nutrient neutrality mitigation approaches which require new or altered discharges to the water environment.

**General Contact:** [enquiries@naturalresourceswales.gov.uk](mailto:enquiries@naturalresourceswales.gov.uk)

**Regional Planning Team:** Southwest Wales - [swplanning@cyfoethnaturiolcymru.gov.uk](mailto:swplanning@cyfoethnaturiolcymru.gov.uk)  
Mid Wales - [midplanning@cyfoethnaturiolcymru.gov.uk](mailto:midplanning@cyfoethnaturiolcymru.gov.uk)

### 3.3 Local Planning Authority

LPAs in Wales play a crucial role in the nutrient neutrality process by being the Competent Authorities responsible for carrying out HRA. They must determine if a Habitat designated site will be harmed by a development proposal and ensure that the development proves nutrient neutrality to meet the HRA requirements. As such, developers will need to submit a Nutrient Neutrality Statement to the LPA, and this should contain sufficiently robust evidence that the development will result in neutral or reduced nutrients in the affected water bodies with sufficient certainty (i.e. beyond reasonable scientific doubt). LPAs should have regard to NRW advice, but it is the responsibility of the Competent Authority to ensure that the requirements of the Habitats Regulations 2017<sup>1</sup> are satisfied prior to consent being given. For this purpose, LPAs should obtain their own independent advice wherever necessary. However, as noted above, NRW must be consulted by the LPA on all Appropriate Assessments.

<sup>34</sup> Welsh Government (2021). *What our role is*. [Online] Available at: <https://www.gov.wales/what-our-role-is>

<sup>35</sup> Welsh Government (2023). *Relieving pressures on Special Areas of Conservation (SAC) river catchments to support delivery of affordable housing: action plan* [Online] Available at: [https://www.gov.wales/relieving-pressure-special-areas-conservation-sac-river-catchments-support-delivery-affordable?utm\\_source](https://www.gov.wales/relieving-pressure-special-areas-conservation-sac-river-catchments-support-delivery-affordable?utm_source)

<sup>36</sup> Welsh Government (2025). *Interim Planning Policy Statement on Development in SAC Rivers and Reminder of Restrictions on Permitted Development Rights in SAC Rivers* [Online] Available at: [https://www.gov.wales/sites/default/files/publications/2025-08/interim-planning-policy-statement-on-development-in-sac-rivers.pdf?utm\\_source](https://www.gov.wales/sites/default/files/publications/2025-08/interim-planning-policy-statement-on-development-in-sac-rivers.pdf?utm_source)

The LPA also plays a crucial role with regard to Article 6(2) measures for restoration, and tracking any development headroom that the measures enable, or could enable by their expansion.

For pre-application contact addresses at the various LPAs refer to Section 4.1.

## 3.4 Planning and Environment Decisions Wales

Planning and Environment Decisions Wales (PEDW) manage casework relating to the development and use of land in the public interest<sup>37</sup>. They are the specialist body for planning and environmental appeals in Wales and must ensure that development proposals comply with the Habitats Regulations 2017. PEDW acts as the Competent Authority when deciding on planning appeals or called-in applications. For appeals relating to developments with potential DIN impacts to a marine SAC it must conduct a HRA to determine if a project will have a likely significant effect on a marine SAC. PEDW relies on NRW as the statutory nature conservation body to provide evidence on the condition of marine SACs and the effectiveness of proposed mitigation measures. It is also part of PEDW's remit to conduct independent examinations of local planning authorities' development plans, and to process, examine, and consent large-scale infrastructure projects in Wales.

**General contact:** [PEDW.Casework@gov.wales](mailto:PEDW.Casework@gov.wales)

## 3.5 Nutrient Management Boards

The Tywi, Teifi and Cleddau Nutrient Management Board (NMB) have been established across West Wales in response to phosphorus failures in SAC rivers to provide a coordinated, catchment scale forum for understanding nutrient pressures and supporting river restoration. Operating at a strategic level, the Boards focus on evidence gathering, prioritisation and the coordination of long-term actions to improve water quality, including nature-based solutions. Their role is to support strategic planning at catchment scale. They do not have regulatory or enforcement powers and do not direct development decisions, but instead support strategic understanding and inform longer term policy, investment and catchment planning.

## 3.6 The Developer

Developers are responsible for assessing and demonstrating that their proposals are nutrient neutral (for those developments in nutrient sensitive catchments as described in Section 2.2) or alternatively are acceptable by consideration of other mitigation.

The [All Wales Nutrient Budget Calculator](#) is available to support nutrient neutrality assessments. Developers must design their projects to avoid or mitigate nutrient impacts for the lifetime of the effects. This may be through on-site or off-site mitigation measures (or a combination) - so that the development achieves nutrient neutrality. Developers must provide sufficiently robust information to the LPA, work with relevant specialists where needed, and ensure that any mitigation they rely on is secured, deliverable, and maintained for the long term.

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<sup>37</sup> Welsh Government (2021). Planning and Environment Decisions Wales (PEDW): What We Do [Online] Available at: [Planning and Environment Decisions Wales | GOV.WALES](#)

## 4. Achieving DIN neutrality

### 4.1 Pre-application advice

This handbook provides general guidance only. Applicants for development in affected water body catchments are encouraged to contact the LPA prior to submitting any application to ascertain what information would be required to be submitted as part of the application, in order to demonstrate no adverse effect on the Habitat Site integrity. The LPA will be able to offer pre-application advice before a formal application is submitted to guide developer through the process, which may minimise delays later in processing the application. Pre-application discussions can also help the developer and the LPA identify any areas of concern so that consideration is given to amending the proposal before the application is submitted. However, it is important to note that the advice and guidance provided at the pre-application stage does not guarantee that the proposal will be granted planning permission. Furthermore, the advice provided can only comment on the information submitted. Therefore, developers are encouraged to provide as much detail as possible at the pre-application stage. Pre-planning application contact details and processes for the relevant local authority can be found at the following websites (Table 4-1):

**Table 4-1 Relevant pre-planning webpages for the affected catchments**

Planning Authority	Pre-application advice webpage
Bannau Brycheiniog (Brecon Beacons) National Park Authority	<a href="https://beacons-npa.gov.uk/planning/applications/">https://beacons-npa.gov.uk/planning/applications/</a>
Carmarthenshire County Council	<a href="https://www.carmarthenshire.gov.wales/council-services/planning/planning-applications/pre-application-advice/">https://www.carmarthenshire.gov.wales/council-services/planning/planning-applications/pre-application-advice/</a>
Neath Port Talbot County Borough Council	<a href="https://www.npt.gov.uk/planning-and-building-control/planning-applications/pre-application-enquiries/">https://www.npt.gov.uk/planning-and-building-control/planning-applications/pre-application-enquiries/</a>
Pembrokeshire Coast National Park Authority	<a href="https://www.pembrokeshirecoast.wales/planning/planning-advice/pre-application-advice/">https://www.pembrokeshirecoast.wales/planning/planning-advice/pre-application-advice/</a>
Pembrokeshire County Council	<a href="https://www.pembrokeshire.gov.uk/planning-applications/pre-application-planning-advice">https://www.pembrokeshire.gov.uk/planning-applications/pre-application-planning-advice</a>
Swansea Council	<a href="https://www.swansea.gov.uk/preplanningadvice">https://www.swansea.gov.uk/preplanningadvice</a>

### 4.2 Step by Step process for developers

The nutrient neutrality process typically involves first confirming whether a development site lies within a catchment affected by DIN requirements, namely the Burry Inlet water body catchment or Milford Haven Inner water body catchment (see Section 2.2). Where discharge from a development site or the WwTW serving a proposed development site are within these catchments, the nutrient impact of the proposed development must be calculated to establish whether it would result in an increase in nutrient loading. If no increase is identified, the assessment can be submitted in support of the planning application; where an increase is predicted, appropriate mitigation is required to offset the increase in DIN that is generated. The process is summarised in Figure 4-1 with supporting detail in Table 4-2.

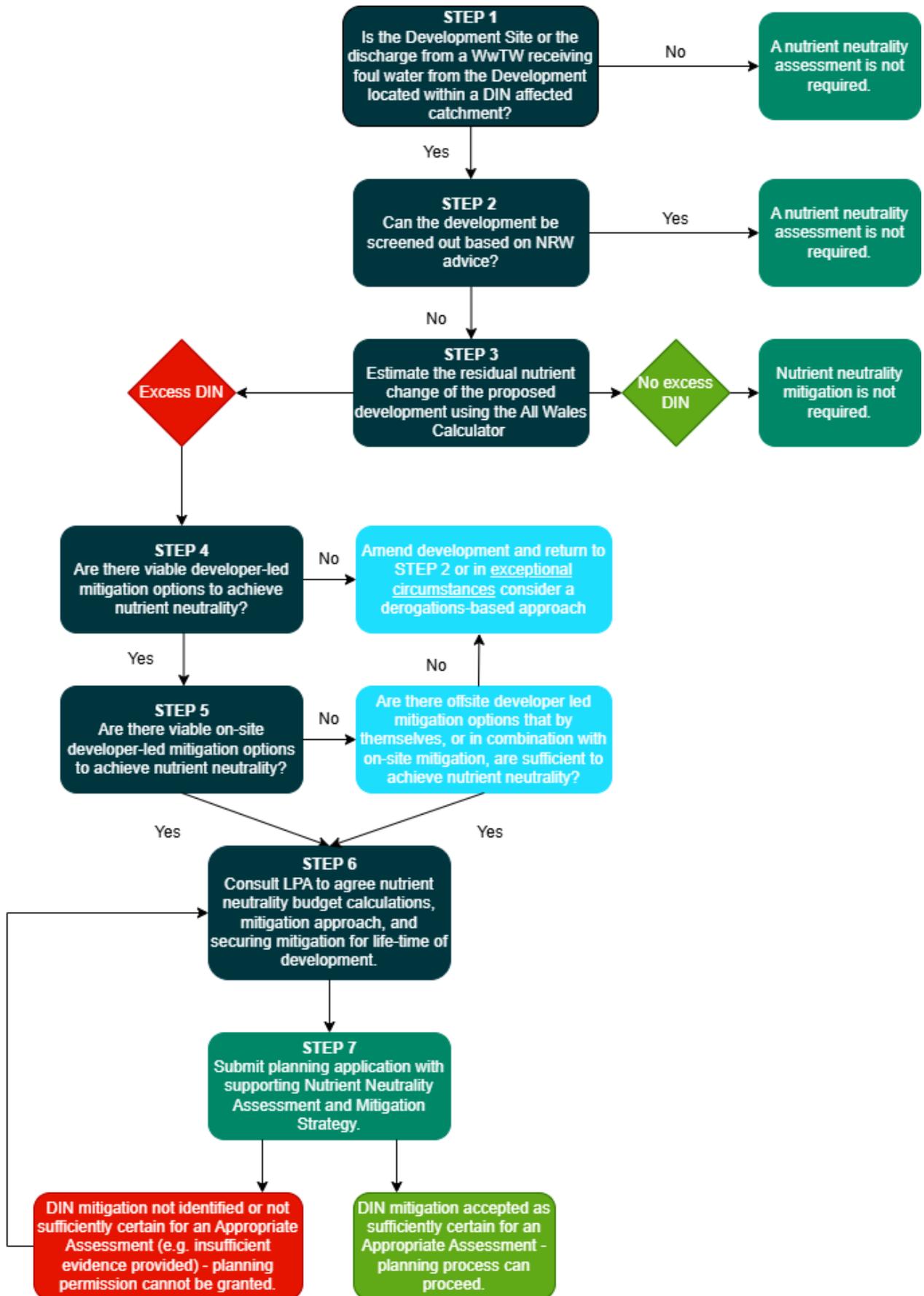


Figure 4-1 Nutrient neutrality assessment process

**Table 4-2 Supporting detail for the process of achieving DIN neutrality**

Step	Supporting Detail
<b>Step 1: Is the Development Site or the outfall from the WwTW receiving foul water located within a DIN nutrient neutrality catchment?</b>	<p>Developers can check whether a proposed development (or the outfall from the WwTW into which foul drainage will be directed) lies within a <b>nutrient neutrality catchment</b> by checking the following link: <a href="#">Marine SAC Freshwater Catchments Requiring Nitrogen Neutrality   DataMapWales</a>.</p> <p>If the development <b>is</b> within the DIN nutrient neutrality catchment then proceed to Step 2.</p> <p>If the development <b>is not</b> within the DIN nutrient neutrality catchment and does not connect to a WwTW whose outfall is within the catchment, then nutrient neutrality requirements do not apply. The development can be screened out of the HRA process with regard to likely significant effect of DIN on a marine SAC (although other potential likely significant effects may still apply). Proceed with planning process without nutrient neutrality assessment.</p> <p>It should be noted that whether nutrient assessment and any mitigation are required will depend on the Competent Authority's HRA, having regard to the location of the proposal, relevant impact pathways and best available evidence and advice from NRW.</p>
<b>Step 2: Does NRW advice indicate that the development can be screened out of nutrient neutrality requirements?</b>	<p>Developers should consult NRW advice at the following link to determine whether any <b>screening criteria</b> apply: <a href="#">Natural Resources Wales / Advice to planning authorities for planning applications affecting nutrient sensitive Special Areas of Conservation</a>.</p> <p>For example, there are criteria whereby a residential proposal can be screened out if it discharges to ground via a package treatment plant (PTP) and certain criteria are met. This would apply if the effluent flow is &lt;2m<sup>3</sup>/day, is discharged via a suitable drainage field, and built in accordance with criteria set out in the NRW advice. In this circumstance, it is considered unlikely for there to be a pathway for nutrients to enter the estuarine environment and have a significant effect on the SAC, and therefore nutrient neutrality can be screened out.</p> <p>If the development cannot be screened out a nutrient budget calculation <b>will be required</b>. Proceed to Step 3.</p> <p>If the development can be screened out, then nutrient neutrality is not required (proceed with planning process without nutrient neutrality assessment).</p>
<b>Step 3: Estimate residual nutrient change of the proposed development.</b>	<p>Developers must demonstrate that their proposal will not lead to an increase in DIN to the Burry Inlet Inner and Milford Haven Inner water bodies using appropriate evidence. The All Wales Calculator has been developed by Welsh Government as a tool to assist developers with this process (<a href="#">Nutrient budget calculator   GOV.WALES</a>). Input parameters to calculate the nutrient budget include:</p> <ul style="list-style-type: none"> <li>• Development details such as site location, SAC catchment, development type, number of dwellings and site area.</li> <li>• Drainage and wastewater assumptions: foul drainage route, wastewater treatment works serving the site, and any standard occupancy assumptions used by the calculator</li> <li>• Surface water information including: catchment details (rainfall, soil drainage type) existing land use(s), proposed land use(s). Note that where SuDS are not being relied upon for Article 6(3) nutrient mitigation and provided that the development is SAB compliant, the developer can assume that surface water discharges from the development site are nutrient neutral (see Section 2.6 for further detail).</li> <li>• Where the outcome of the nutrient budget calculation is that there is no excess DIN (i.e. 0 kgN/yr) then no further assessment or mitigation is required. Evidence of the nutrient budget calculation should be presented within the planning application.</li> </ul>

- Where the outcome is that the development will lead to an increase in DIN to the catchment of the SAC (i.e. >0 kgN/yr)) further assessment and the identification of suitable mitigation is required<sup>38</sup>. Proceed to Step 4.

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**Step 4: Are there developer-led mitigation options to achieve nutrient neutrality?**

Further details on potential mitigation options are provided in Section 5 of this Developer Mitigation Handbook and in Appendix A.

The adopted mitigation measures should be secured for the lifetime of the development and must demonstrate a quantifiable and reliable reduction in DIN to the affected water body, supported by evidence and referring to best practice advice from NRW. The outcomes must be sufficiently certain (i.e. reasonable scientific certainty as outlined in Section 2.4.1).

In the unlikely event that there are no mitigation options the developer may choose to consider whether a **derogation approach** can be taken. However, this is expected only in exceptional circumstances. It should be noted that this is explicitly not for the Competent Authority to propose or evidence that it is appropriate.

If the developer wishes to pursue a derogation due to being unable to achieve DIN nutrient neutrality, then the derogation provisions are set out in articles 64 and 68 of the Habitats Regulations<sup>1</sup>. It should be noted that the application of this approach is extremely rare and requiring the approval from Welsh Government. At the time of publication (March 2026) a derogations approach has not previously been used for nutrient neutrality in West Wales.

Article 64 indicates that where it is not possible to conclude 'no adverse effects to site integrity' from a proposed development, and a Competent Authority is minded to apply the derogation provisions, they must:

- Satisfy themselves that there are no alternative solutions to the plan or project subject to assessment.
- Take a decision as to whether the plan or project must be carried out for imperative reasons of over-riding public interest (subject to certain criteria).
- Satisfy themselves that necessary compensatory measures which ensure that the 'overall coherence of the National Site Network is protected' can be secured by the appropriate authority (the Welsh Ministers for Wales).

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**Step 5: Are there on-site developer-led mitigation options to achieve nutrient neutrality?**

Developers should consider the location of any mitigation relative to where the development will have its impact on the SAC to ensure that it avoids any increase in nutrients within the designated site. NRW are updating their guidance on this, but overall **measures should, where possible, be within the development site**. Where this is not achieved there must still not be detriment to the relevant SAC (or SAC sub-area):

- For developments whose wastewater is connected to WwTWs discharging directly into the marine SAC, the mitigation measure will need to be prior to the pollution pathway from the location where the development site run-off and wastewater input will have a direct impact on the site.
- If the discharge is indirect (i.e. upstream in the catchment of a marine SAC), then the mitigation measures can be upstream or downstream within the catchment, if it will provide the offsetting before the point at which the development impacts the marine SAC.

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**Step 6: Consult LPA to agree nutrient neutrality budget calculations, mitigation approach, and securing**

Pre-planning application contact details for the relevant local authority can be found in Section 4.1 of this document.

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<sup>38</sup> There is currently (March 2026) no empirically derived threshold by which additional aquatic inputs of nitrogen from a development to the designated sites can be considered *de minimis* (i.e. will not significantly impact the designated site). As such, any nitrogen budget above 0 kgN/yr currently requires mitigation. Nonetheless, the potential to apply the threshold-based approach should be kept under review in the event that minimum thresholds are defined for DIN in future. Refer to LPA web pages for any guidance that may be brought forward.

**mitigation for the lifetime of the development.**

Developers must prepare and submit robust supporting documentation as part of the planning application to evidence what mitigation is required, how it will be provided, secured, and maintained for the lifetime of the development, or the development effect as appropriate.

Any mitigation must be secured through appropriate planning conditions and / or legal mechanisms (e.g. Section 106) and implemented in advance of the nutrient impacts occurring, with arrangements in place to ensure long-term compliance.

Engagement with the local planning authority and, where necessary, NRW should take place throughout the process but is particularly recommended once a mitigation solution has been developed but prior to submission of the planning application.

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**Step 7: Submit planning application with supporting Nutrient Mitigation Assessment.**

A discretionary Nutrient Neutrality Assessment and Mitigation Strategy should accompany the planning application, outlining the nutrient budget for the development and a sufficiently certain mitigation approach, legally secured in perpetuity for the lifetime of the development. **Refer to Appendix B: General Framework for Mitigation Option Proposals** for details of what the LPA would require from such a submission.

Should no lawful mitigation be identified then planning permission cannot be granted.

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## 5. Potential mitigation solutions

### 5.1 Overview of mitigation measures

Where a site is within a catchment requiring nutrient neutrality and the nutrient budget calculation for the proposed development predicts an increase in DIN, appropriate mitigation will be required.

At the time of publication (March 2026) in Wales, there is currently no standardised nutrient credit system for development in the marine SAC catchments requiring DIN nutrient neutrality. Each mitigation proposal must therefore be developer led and must be assessed on its own merits under the Habitats Regulations 2017.

Following review of available mitigation options that can be adopted for DIN reduction, a long list of options for consideration by developers has been identified and presented in Table 5-1. The long list has considered the NRW Mitigation Menu<sup>8</sup> as well as numerous mitigation guides published by LPAs subject to DIN issues.

Table 5-1 includes a Red, Amber, Green (RAG) grading for the **current confidence** and **suitability** in the solution **for delivering DIN mitigation**.

With regard to **confidence**:

- **Red** = Low Confidence = the mitigation approach is complex to deliver for individual developers and / or difficult to secure in perpetuity. It is unlikely that a developer could meet the criteria of sufficient certainty without significant time and expense to develop the solution with multiple partners;
- **Amber** = Medium Confidence = the mitigation approach has precedent and can deliver nutrient benefits, but has complexities which make it onerous for the developer to demonstrate sufficient certainty (e.g. in terms of required monitoring or securing legally); and
- **Green** = High confidence = the mitigation approach is widely accepted in terms of nutrient benefits given appropriate design and implementation and are considered at the less onerous end of the spectrum in terms of securing in perpetuity with sufficient certainty.

With regard to **suitability**:

- **Red** = Low Suitability = the approach is not considered suitable for an individual developer at this stage and is more suitable for consideration at a strategic scale.
- **Amber** = Medium Suitability = the approach may be suitable for an individual developer but will require substantial investment to prove nutrient reductions and to maintain these in perpetuity.
- **Green** = High Suitability = the approach is considered suitable for individual developers with good potential to deliver and secure in perpetuity.

Those with Red or Amber ratings for confidence are not necessarily precluded from use in delivering neutrality and so may be suitable, but it is likely that a higher degree of evidence will be required to ensure sufficient certainty (i.e. beyond reasonable scientific doubt) that the stated nutrient reductions would be achieved in perpetuity. Hence, they are generally less recommended options.

A full description of each mitigation solution that is considered suitable on the long list is provided along with a discussion of additional considerations in Appendix A. These considerations have informed the RAG rating in Table 5-1.

The mitigation options listed and detailed in Appendix A are intended to help developers understand potential pathways and evidential requirements, rather than to guarantee acceptability of any single measure, which is subject to confirmation on a case-by-case basis. Furthermore, developers are not restricted to this list and may be able to define alternative or novel approaches to delivering DIN mitigation. However, these will also need to provide sufficient certainty in the DIN reduction in perpetuity and would be subject to agreement by the relevant LPA. The mitigation measures need to ensure the correct permissions and regulatory requirements are in place.

**Table 5-1 Long list of options for consideration at the development scale**

Option	Detail	Confidence	Suitability
<b>Land Use Change</b>	<p>Where one land use is converted to another land use that is perceived to export less DIN. Typically, resultant land uses include: woodland creation, orchard planting, cessation of agricultural farming or agro-forestry (e.g., silvopasture).</p> <p>The approach has high longevity (assuming land use change is secured in perpetuity through S106 agreements) and certainty if it is possible to secure monitoring to confirm that the new land use is maintained.</p> <p>To be acceptable as nutrient neutrality mitigation (under Article 6(3) of the Habitats Directive as implemented by the Habitats Regulations<sup>1</sup>) the land use change should be specific to the proposed development, funded and secured by the development, and <b>not</b> considered as a wider scale restoration activity for the SAC, which would be an Article 6(2) measure and unacceptable for DIN mitigation. NRW also advise that the potential for displacement of lawful nutrient producing activities to a differing site, rather than simple exchange, may need to be considered on a catchment basis. For example, agricultural land may be changed to woodland for nutrient reduction purposes, but if felling then occurred elsewhere to re-establish the lost agricultural land, then this would not be appropriate.</p>	High	High
<b>Urban SuDS</b>	<p>SuDS aim to reduce the volume and speed of runoff entering watercourses, thereby lowering flood risk and improving water quality. They achieve this by slowing flows, promoting sedimentation, and encouraging infiltration, allowing rainfall to percolate into the ground close to where it falls. Includes basins and ponds, filter strips and swales, constructed wetlands, soakaways, infiltration basins, gravelled areas, and porous paving.</p> <p>There is substantial evidence on nitrogen benefits of certain SuDS approaches, if correctly implemented, and is a suitable on-site approach for developers to reduce surface water nitrogen in runoff from their site.</p> <p>Note that if developers wish to claim the nutrient benefit of SuDS then they need to complete all stages of the nutrient budget calculator, including land use change (refer to Section 2.6 for further details).</p>	High	High
<b>Rural SuDS</b>	<p>Includes constructed wetlands as mentioned above (i.e. built for treating surface water not wastewater effluent), but also measures such as terrestrial sediment traps, drainage ditch blocking, and tree planting.</p> <p>There is substantial evidence on nitrogen benefits of certain SuDS approaches, if correctly implemented, and is a suitable on-site approach for developers to reduce surface water nitrogen in runoff from their site.</p> <p>Note that if developers wish to claim the nutrient benefit of SuDS then they need to complete all stages of the nutrient budget calculator, including land use change (refer to Section 2.6 for further details).</p>	High	High
<b>Septic Tank/PTP Upgrades</b>	<p>Replacing outdated septic tanks or PTPs with better performing models reduces DIN in effluent from the development. This measure can also be applied to additional existing properties to create a DIN surplus. However, it must first be confirmed that connection to the mains sewer is not reasonably practicable, in line with the Welsh Government Non-Mains Drainage Circular (008/2018).</p> <p>Manufacturer’s testing data for each product can inform the level of DIN reductions that are achievable. Nonetheless, developers will be required to demonstrate that the PTP will be subject to legally secured ownership and responsibility, ensuring that operation, maintenance and compliance are defined. This may be secured</p>	High	High

Option	Detail	Confidence	Suitability
	<p>through planning conditions, legal agreements, or other binding mechanisms as appropriate.</p> <p>There are also criteria whereby a residential proposal can be screened out of Appropriate Assessment where a PTP discharges to ground and certain criteria are met. This would apply if the effluent flow is &lt;math&gt;&lt;2\text{m}^3/\text{day}&lt;/math&gt;, is discharged via a suitable drainage field, and built in accordance with criteria set out in the NRW advice. In this circumstance, it is considered unlikely for there to be a pathway for nutrients to enter the estuarine environment and have a significant effect on the SAC, and therefore nutrient neutrality can be screened out.</p>		
<b>Treatment Wetlands</b>	<p>Includes free water surface (surface flow) wetlands, horizontal subsurface flow wetlands, vertical flow wetlands, french vertical flow wetlands, floating wetlands, hybrid wetlands. The removal of nitrogen in wetlands is largely a biogeochemical process, including microbial activity and plant uptake during the growing season.</p> <p>Nutrient removal from constructed wetland can be significant but is dependent on appropriate design. Due to the complexity of characterising flows and loads accurately, post-implementation monitoring is essential. Demonstrating the full nutrient removal potential of a wetland may take more than 1 to 3 years, as performance stabilises over time. In general, they are better suited to more strategic scale implementation but may be suitable options for individual developers in some circumstances.</p>	High	Medium
<b>Other Wetlands</b>	<p>Other wetlands that are not considered constructed or treatment wetlands but rather habitat creation such as in-ditch wetlands, ponds, and floodplain reconnection.</p> <p>While these wetlands can contribute to nutrient retention, their lack of controlled water inflows and uncertainty surrounding nutrient removal processes limits their suitability for formal nutrient neutrality calculations</p>	Low	Medium
<b>Water Efficiency Measures within a Development</b>	<p>Water efficiency measures rely on increased water usage efficiency in households (or other developments) to reduce the volume of wastewater (DIN loads). Approaches include rainwater harvesting, greywater recycling, and retrofitting lower water use fittings and appliances. This can be applied by a developer within their site or within off-site properties in order to generate nutrient 'headroom'.</p> <p>Manufacturer's product testing data (e.g. on flow control devices) provides a clear idea of water volume reductions that are achievable. For sufficient certainty, the Competent Authority will require evidence that a Maintenance and Monitoring Plan is secured and will remain in place upon sale of any affected property via a legal agreement.</p> <p>Regular data submissions to the LPA may be required to show metered water levels and evidence of appliance checks to demonstrate that the water efficient fittings are performing to the required standard to achieve the stated nutrient reductions.</p>	Medium	High
<b>Nutrient Credits</b>	<p>Purchasing nutrient credits from strategic mitigation schemes to offset nutrient pollution created by the development.</p> <p>This approach would have high confidence, but at the time of publication (March 2026) no such strategic schemes are operational in Wales or the affected catchments covered by this Handbook.</p>	High	Low
<b>Willow Systems</b>	<p>Willow systems are wetland basins, dominated by willows, for 100% evapotranspiration to air in summer and full storage in winter. Designed to treat and discharge all inflow water through evapotranspiration and thus there is no outflow from the system and hence no pathway to the designated site.</p>	Medium	High

Option	Detail	Confidence	Suitability
	Assuming correct design and implementation there is confidence in the DIN mitigation related to this approach. However, significant monitoring and maintenance (e.g. regular biomass harvesting) is required.		
<b>Field boundary management</b>	<p>Field boundary management interventions are nature-based solutions that reduce nutrient losses from agricultural land without the need for artificial or engineered structures. Includes riparian buffer strips, hedgerow re-establishment, and field buffers.</p> <p>Understanding of baseline nutrient load within the receiving environment prior to riparian buffer strip implementation is needed to provide the loading value to which the nutrient removal efficiency percentages can be applied to demonstrate nutrient benefit. This can be achieved by scheme specific monitoring or modelling but can be a significant task to achieve thus reducing suitability.</p>	Medium	Medium
<b>Enhanced Drainage Ditch Management</b>	<p>An approach that combines a two-stage channel cross-section with low-grade weirs and vegetation on the inset floodplain benches. The combination of these approaches within a single channel aims to increase hydraulic residence time within the drainage network, promoting a suite of natural processes that reduce onward nutrient transport.</p> <p>Assuming correct design and implementation there is confidence in the DIN mitigation related to this approach. However, there are substantial maintenance and monitoring requirements to ensure that the original design is maintained (e.g. periodic sediment removal may be required).</p>	Medium	Medium
<b>Agricultural Management Measures</b>	<p>Agricultural management measures potentially delivered as part of a DIN mitigation strategy involve optimising fertiliser use, improving crop and soil management, managing livestock and manure more effectively, and using buffers or landscape features to prevent nitrogen from reaching waterways or slow down the rate of leaching.</p> <p>Clearly demonstrating the magnitude of any benefit can be difficult, especially for measures that target diffuse sources of nitrogen. Any benefit can also be difficult to directly measure and monitor, as well as involving time lags. External economic, policy, and farm management pressures may also affect long-term delivery, with potential for displacement or leakage if reductions are offset elsewhere. They are therefore less suitable mitigation options than others, due to the level of effort and monitoring required to provide sufficient certainty.</p> <p>As with land use change, to be acceptable as nutrient neutrality mitigation under Article 6(3) of the Habitats Directive, the proposed measures should be specific to the proposed development (and funded and secured by the development).</p>	Low	Medium
<b>River Restoration</b>	<p>Reintroducing natural channel forms and processes (i.e., meanders, floodplain connectivity, riffle-pool sequences, and removing man-made features) to enhance catchment resilience by addressing hydrological, morphological, biological, and chemical processes<sup>39</sup>.</p> <p>Their effectiveness typically relies on coordinated, landscape-scale management and governance arrangements, making them impractical developer-led interventions. The effectiveness is also somewhat uncertain and there would be substantial monitoring requirements.</p>	Low	Low
<b>Ditch Blocking</b>	This approach involves blocking drainage ditches, usually in agricultural environments, by creating an impermeable dam which disrupts flow and raises the	Low	Low

<sup>39</sup> What is River Restoration? (no date) the River Restoration Centre. Available at: <https://www.therrc.co.uk/why-restore> (Accessed: 9 January 2026).

Option	Detail	Confidence	Suitability
	<p>water table level. This in turn can reduce DIN through enhanced denitrification as waterlogged conditions increase anaerobic soil conditions<sup>40</sup>.</p> <p>Their effectiveness typically relies on coordinated, landscape-scale management and governance arrangements, making them impractical developer-led interventions. There would be substantial monitoring requirements.</p>		
<b>Engineered Logjams</b>	<p>Structures of large wood and organic debris placed in rivers to mimic beaver dams, slowing flow and creating pools. These conditions promote nutrient removal through sedimentation and uptake by vegetation.</p> <p>While potentially effective for short-term mitigation, they require careful design and are not suitable as long-term solutions<sup>40</sup>. Substantial monitoring would also be required.</p>	Low	Low
<b>Peatland Restoration</b>	<p>Peatland restoration in Wales is currently supported through grants and under the National Peatland Action Programme, targeting carbon and nutrient outcomes<sup>41</sup>.</p> <p>This approach requires coordinated, landscape-scale management and governance arrangements, making them impractical developer-led interventions. The effectiveness is also somewhat uncertain and there would be substantial monitoring requirements.</p>	Low	Low
<b>Removal of surface water from the combined sewer network</b>	<p>This approach involves a development removing a known volume of surface water runoff from the combined sewer network (e.g. by re-directing to SuDS). The reduction in volume is then used to reduce the nitrogen loading calculated from the relevant WwTW. It is based on the principle that a WwTW with a nitrogen consent that operates at the permit concentration or close to it (i.e. 90% of the permit values), will have a direct relationship between nitrogen load passing through the WwTW and water use by a development.</p> <p>For example, for a WwTW with a permit of 9 mg/l nitrogen, it can be calculated that for each litre of water that passes through the works, 8.1 mg of nitrogen could be released into the water environment. If a household uses 150 litres, this equates to 1215 mg of nitrogen; if water use is reduced to 100 litres this equates to release of 810 mg of the nitrogen. As there is this clear relationship it is therefore possible to calculate the effect of removing water from the foul sewer and this can be considered as potential mitigation in certain circumstances.</p> <p>However, the principle only works where a receiving WwTW has a permit limit for nitrogen and is operating close to permit headroom. At the time of writing (March 2026) no WwTW in West Wales has a nitrogen permit, and so this approach cannot be adopted. There are also significant issues around quantifying the mitigation when the Combined Sewer Overflows (CSOs) are spilling and losing nitrogen direct to the environment, with large volumes of data needing to be collected. Therefore, this approach would be difficult to quantify with certainty even if there were WwTWs with nitrogen permits.</p>	Low	Low

<sup>40</sup> Carmarthenshire County Council, 2023. Nutrient Mitigation Options Technical Review. Guidance on phosphorus mitigation options for use in Carmarthenshire, Pembrokeshire, and Ceredigion.

<https://www.carmarthenshire.gov.wales/media/1232891/nutrient-mitigation-options-technical-review-west-wales.pdf>

<sup>41</sup> Natural Resources Wales / The National Peatland Action Programme (no date). Available at:

<https://naturalresourceswales.gov.uk/evidence-and-data/maps/the-national-peatland-action-programme/?lang=en> (Accessed: 9 January 2026).

## 6. Worked examples

The All Wales Nutrient Budget Calculator for DIN can be used to:

- Estimate nitrogen loading arising from development proposals.
- Assess whether a proposal would lead to a net increase in nutrient loading to DIN nutrient neutrality catchments.
- Test whether mitigation measures can reduce the calculated loading to an acceptable or neutral level.

The following section presents several worked examples demonstrating how mitigation measures can be applied to reduce nutrient levels arising from new developments. The following mitigation measures will be presented as worked examples in this section:

- Example A: SuDS.
- Example B: Land use change.
- Example C: Upgrading PTPs.
- Example D: Water efficiency measures.
- Example E: Enhanced drainage ditch management.

For more complete guidance on how to use the [All Wales Nutrient Budget Calculator](#) please refer to the Welsh Government Nutrient budget calculator guidance ([Nutrient budget calculator | GOV.WALES](#)). The worked examples below demonstrate necessary inputs to the calculator for each example, but it is not the intention of this section to reproduce the full details of the existing calculator guidance, which is updated as and when required by the Welsh Government.

## 6.1 Example A - SuDS mitigation

This worked example focuses on cases where SuDS are to be relied upon as a mitigation method.

### 6.1.1 Stage 1: Determining additional nutrient loading from wastewater

**What the developer needs to do:**

- Enter the number and type of dwellings.
- Confirm foul drainage route (mains sewer or private treatment).
- Identify the receiving wastewater treatment works (WwTW), where relevant.

**Worked example (refer to Figure 6-1 and Figure 6-2 for guidance):**

- Input proposed development: 10 residential dwellings and input postcode.
- Input receiving catchment: Carmarthen Bay and Estuaries SAC.
- Input water use efficiency: Default 120 l/p/d.
- Input WwTW: Carmel STW selected.
- Other fields will autofill.
- Outcome: Annual nitrogen load of **27.22 kgTN/yr** automatically calculated (Figure 6-2). HRA screening cannot rule out likely significant effects, therefore further calculations and mitigation required.

Wastewater load input data		
Description of required information		Data entry column - user inputs required
Special Area of Conservation (SAC):		Bae ac Aberoedd Caerfyrddin/ Carmarthen Bay and Estuaries
Postcode:		SA4 0UB
Local Planning Authority (LPA):		Carmarthenshire County Council
Rainfall:		1404
Project type:		Residential
Development proposal (number of additional units):		10
Not applicable		Carmarthenshire County Council
Default occupancy rate:		2.3
Is this default value being used?		Yes
Not applicable		
Water usage per resident (litres/person/day):		120
Not applicable		
Wastewater treatment works:		Carmel STW
Not applicable		
Not applicable		
Phosphorus permitted limit (mg TPI):		5.00
Nitrogen permitted limit (mg TN/I):		27.00

Figure 6-1 Stage 1 of the SuDS mitigation example (input fields required by the developer are indicated by the red arrows). Note: values inputted above are indicative.

Final calculation of nutrient load from wastewater	
Description of values generated	Values generated
Additional population:	23.00
Annual wastewater production (litres):	1008090.00
Annual phosphorus load (kg TP/year):	5.04
Annual nitrogen load (kg TN/year):	27.22

Instructions | **Stage 1** | Stage 2 | Stage 3 | Stage 3S | Stage 4 | +

Figure 6-2 Stage 1 (final calculation of nutrient load from wastewater) of the SuDS mitigation example (final nitrogen outcome value from this stage is indicated by the red dashed box).

## 6.1.2 Stage 2: Defining the Baseline (Existing Land Use)

The baseline represents **existing conditions** on the site prior to development. The baseline is critical, as for claiming a SuDS benefit the mitigation is assessed against the *net change* in nutrient loading from land use as well as from wastewater.

Typically, this includes:

- Existing land use (e.g. agricultural, brownfield, greenspace).
- Existing nitrogen export rate (pre-filled or selected within the calculator).

### What the developer needs to do:

- Identify all **existing land use(s)** of the site. GIS analysis may be required to interrogate existing land use datasets (e.g. CORINE Land Cover Map from CEH<sup>42</sup>). Identified land uses from GIS analysis need to be aligned as closely as possible to the land uses adopted in the nutrient budget calculator, taking a precautionary approach where there may be any doubt.
- Determine **surface area** of each land use type.
- Select appropriate **soil drainage criteria** from drop down. Refer to Soilsclapes website for soil drainage information ([LandIS - Land Information System - Soilsclapes soil types viewer](#)).
- Rainfall automatically populates from entry of postcode at Stage 1.

### Worked example:

- Input existing land use: Woodland.
- Input site area: 0.6 ha.
- Input soil drainage: Impeded drainage
- Nutrient export rate is then derived automatically. In this case 1.8 kg TN/yr is generated from woodland (Figure 6-3).

### Tips:

- Baseline must reflect **current lawful use**, not historic or speculative scenarios. In the event of uncertainty regarding the lawful use status, an application for a Certificate of Lawfulness of Existing Use or Development may be appropriate provided the developer has sufficient evidence to confirm use.
- Overstating baseline export to reduce mitigation requirements is likely to be challenged.

<sup>42</sup> UK CEH Environmental Data Information Centre, CORINE Land Cover Map datasets for UK, Jersey and Guernsey. Available at: [CORINE Land Cover Map datasets for the UK, Jersey and Guernsey - EIDC](#)

4	<b>Physical characteristics</b>			
3	<b>Description of required information</b>			
4			<b>Data entry column - user inputs required</b>	
5	Soil drainage:	Impeded drainage		
6	Rainfall identified using postcode (mm/year):	1404		
7	Is this rainfall value correct?	Yes		
8	Not applicable	#N/A		
9	<b>Pre-existing landcovers</b>			
10	<b>Landcover</b>	<b>Area (hectares)</b>	<b>Phosphorus load (kg TP/year)</b>	<b>Nitrogen load (kg TN/year)</b>
11	Woodland	0.6	0.01	1.80
12			0.00	0.00
13			0.00	0.00
14			0.00	0.00
15			0.00	0.00
16			0.00	0.00
17			0.00	0.00
18			0.00	0.00
19			0.00	0.00
20			0.00	0.00
21			0.00	0.00
22			0.00	0.00
23			0.00	0.00
24			0.00	0.00
25			0.00	0.00
26	<b>Total:</b>	<b>0.60</b>	<b>0.01</b>	<b>1.80</b>
27	<div style="display: flex; justify-content: space-between; align-items: center;"> <span>&lt; &gt;</span> <span>Instructions   Stage 1   <b>Stage 2</b>   Stage 3   Stage 3S   Stage 4   +</span> </div>			

Figure 6-3 Stage 2 of the SuDS mitigation example (input fields required by the developer are indicated by the red arrows). Note: values inputted above are indicative. The final nitrogen outcome value from this stage is indicated by the red dashed box.

### 6.1.3 Stage 3: Nutrient loading from new landcovers

What the developer needs to do:

- Input proposed land use and site area. Overall site area must match that shown at Stage 2.

Worked example:

- Proposed land use: Residential (0.6 ha).
- Surface water nutrient load is calculated. In this case 15.7 kg TN/yr is generated from residential land (Figure 6-4).

**Tip:** Surface water runoff often forms a smaller proportion than wastewater but can still be material and should not be ignored.





Total nitrogen generated	
Description of nitrogen values generated	Values generated
Stage 1 nitrogen load (kg TN/year):	27.22
Stage 2 nitrogen reduction (kg TN/year):	1.80
Stage 3 nitrogen load (kg TN/year):	15.70
Stage 3S nitrogen load removed through SuDS (TN kg/year):	1.88
Nitrogen budget ((Stage 1 - Stage 2) + (Stage 3 - Stage 3S)):	39.24
Nitrogen budget + 20% buffer:	47.08 kg TN/year will be generated
Calculator version 3.0 - December 2025	

Figure 6-7 Mitigated Stage 4 of the SuDS mitigation example (final nitrogen outcome value is indicated by the red dashed box).

## 6.1.7 Securing and reporting mitigation

### What the developer needs to do:

- The developer will need to report the baseline, unmitigated, and mitigated nutrient budget outputs clearly within a Nutrient Neutrality Mitigation Strategy. The basis of all assumptions should be explained, and it should be demonstrated that the precautionary principle has been applied.
- Confirm how mitigation will be secured (conditions or legal agreement). This will include outlining responsibilities for the SuDS and how they will be maintained in perpetuity. Note that SuDS are mandatory in Wales and all new developments of more than one house or with a construction area of 100m<sup>2</sup> or larger require SuDS to be adopted by the SAB, unless otherwise agreed. Agreements over SuDS maintenance are therefore dealt with through the SAB approval process. Development cannot commence until SAB approval is given so in the case of a SuDS only mitigation solution no separate planning condition or legal agreement would be required.

**Tip:** Unsecured mitigation cannot be relied upon in an Appropriate Assessment.

## 6.2 Example B - Land use change

### 6.2.1 Unmitigated nutrient balance

Table 6-1 details a worked example in which a resultant budget of 32.66 kg TN/yr requires mitigation. For further detail on how to complete the unmitigated nutrient balance, refer to Sections 6.1.1 to 6.1.4 of this report or alternatively refer to the nutrient budget calculator guidance (see Section 2.5).

**Table 6-1 Example scenario**

Parameter	Inputs
SAC	Carmarthenshire Bay & Estuaries SAC
Development proposal (number of additional units)	10 homes
Water usage per resident (litres/person/day)	120 l/p/d
Default occupancy rate	2.3
Wastewater treatment works	Carmel STW
Pre-existing land cover	Residential
Proposed land cover	Residential (no land use change on site)
Resultant budget value	32.66 kg TN/yr

### 6.2.2 Nutrient load removed through land use change

#### What the developer needs to do:

- Apply the existing land use (including on-site and off-site land use) in Stage 2 of the nutrient budget calculator (Figure 6-8), and the proposed land use mitigation in Stage 3 of the calculator (Figure 6-9).
- GIS analysis may be required to interrogate existing land use datasets (e.g. CORINE Land Cover Map from CEH<sup>42</sup>). Identified land uses from GIS analysis need to be aligned as closely as possible to the land uses adopted in the nutrient budget calculator, taking a precautionary approach where there may be any doubt.
- The nutrient budget including off-site land use will automatically be determined by the calculator.

#### Worked example:

- There is no change in existing on-site land use, it remains as residential land in the existing and proposed scenarios.
- The off-site land use change is 1.4 ha of horticultural land (added at Stage 2) being converted to 1.4 ha of greenspace (added at Stage 3).

**Tip:** Land use assumptions from mapping must be evidence-based and defensible.



The mitigation would be subject to securing this land use change in perpetuity, for example through a Section 106 agreement, and consultation with the LPA? to confirm acceptability of the proposed approach.

Total nitrogen generated	
Description of nitrogen values generated	Values generated
Stage 1 nitrogen load (kg TN/year):	27.22
Stage 2 nitrogen reduction (kg TN/year):	47.52
Stage 3 nitrogen load (kg TN/year):	19.90
Stage 3S nitrogen load removed through SuDS (TN kg/year):	0.00
Nitrogen budget ((Stage 1 - Stage 2) + (Stage 3 - Stage 3S)):	0.00
Nitrogen budget + 20% buffer:	0 kg TN/year will be generated
Calculator version 3.0 - December 2025	

Figure 6-10 Mitigated Stage 4 of the land use change mitigation example (final nitrogen outcome value is indicated by the red dashed box).

## 6.3 Example C - Upgrading PTPs or septic tanks to more efficient PTPs

Firstly, the developer should check whether a residential proposal can be screened out if it discharges to ground via a PTP. This would apply if the effluent flow is <math>2\text{m}^3/\text{day}</math>, is discharged via a suitable drainage field, and built in accordance with criteria set out in the NRW advice. In this circumstance, it is considered unlikely for there to be a pathway for nutrients to enter the estuarine environment and have a significant effect on the SAC, and therefore nutrient neutrality can be screened out.

Where this is not the case, there may be opportunities to upgrade existing septic tanks (on-site or off-site) to create a nutrient deficit (i.e. headroom) that can be used to accommodate new development.

### 6.3.1 Stage 1: Determining additional nutrient loading from wastewater

#### What the developer needs to do:

- Enter the number and type of dwellings into the nutrient budget calculator.
- Confirm foul drainage route (private wastewater treatment – PTP or septic tank).
- Confirm that connection to the mains sewer is not reasonably practicable, in line with the Welsh Government Non-Mains Drainage Circular (008/2018)<sup>44</sup>.
- Engage early with the LPA and NRW to confirm that non-mains drainage with enhanced treatment could be acceptable within the SAC catchment.
- Confirm whether the PTP or septic tank discharges:
  - to ground (via infiltration), or
  - to surface water.
- Provide manufacturer's specifications, certification, or peer-reviewed evidence demonstrating:
  - Expected nutrient removal efficiency.
  - Consistency of performance under varying loads.
  - Suitability for the scale of development.

#### Worked example (refer to Figure 6-11 for guidance):

- Input proposed development and postcode: 1no. residential dwelling.
- Input receiving catchment: Carmarthen Bay and Estuaries SAC.
- Input wastewater treatment works: Default septic tank (or select bespoke septic tank if existing septic tank efficiencies can be evidenced).
- Outcome: Nitrogen budget of 9.71 kg TN/yr automatically populates. On this basis, HRA screening cannot rule out likely significant effects (Figure 6-12), therefore mitigation required.

#### Tips:

- If the calculator confirms nutrient exceedance, assume Appropriate Assessment will be required.
- Enhanced treatment cannot be used to justify non-mains drainage where a mains connection is feasible.
- Generic statements of 'improved treatment' are insufficient - performance standards must be specified by the developer, and certification provided for the chosen product.

<sup>44</sup> Welsh Government (2018). *Circular 008/2018*. [Online] Available at: [planning-requirements-for-private-sewerage-in-new-development-wgc-0082018.pdf](https://www.welsh.gov.uk/government/uploads/system/uploads/attachment_data/file/444444/circular-008-2018.pdf) (Last accessed: 13/01/2026)

Wastewater load input data	
4	
5	Description of required information
6	Special Area of Conservation (SAC): 
7	Postcode: 
8	Local Planning Authority (LPA):
9	Rainfall:
10	Project type: 
11	Development proposal (number of additional units): 
12	Not applicable 
13	Default occupancy rate:
14	Is this default value being used? 
15	Not applicable
16	Water usage per resident (litres/person/day): 
17	Not applicable
18	Not applicable
19	Not applicable
20	Not applicable
21	Wastewater treatment works: 
22	Not applicable
23	Not applicable
24	Phosphorus permitted limit (mg TP/l):
25	Nitrogen permitted limit (mg TN/l):

Figure 6-11 Stage 1 of the upgrading PTP mitigation example (input fields required by the developer are indicated by the red arrows). Note: values inputted above are indicative).

Final calculation of nutrient load from wastewater	
26	
27	Description of values generated
28	Additional population: 2.30
29	Annual wastewater production (litres): 100809.00
30	Annual phosphorus load (kg TP/year): 1.17
31	Annual nitrogen load (kg TN/year): 9.71
32	

Figure 6-12 Stage 1 (final calculation of nutrient load from wastewater) of the upgrading PTP mitigation example (final nitrogen outcome value from this stage is indicated by the red dashed box).

### 6.3.2 Unmitigated nutrient balance

This example includes a single dwelling with no land use change, hence no land use inputs are required at Stage 2 and Stage 3. There is a resultant budget of 9.71 kg TN/yr which equates to 11.65 kg TN/yr (once a 20% precautionary buffer has been applied at Stage 4) that requires mitigation. The below indicates how to determine the mitigation potential that can be gained from upgrading the septic tank to a PTP.

### 6.3.3 Nutrient load removed through upgrading septic tank to PTP

**What the developer needs to do:**

- Input the upgraded PTP system details into the nutrient budget calculator. A default PTP is available in the drop-down menu within the calculator. It is also possible to input bespoke PTP values from the dropdown menu to reflect a specific chosen product. However, this must be supported by the manufacturer’s certification of performance.

- Recalculate the nutrient budget to demonstrate wastewater loading from the PTP.

**Worked example:**

- Default PTP for one dwelling (Figure 6-13 and Figure 6-14)

Wastewater load input data	
Description of required information	Data entry column – user inputs required
Special Area of Conservation (SAC):	Bae ac Aberoedd Caerfyrddin/ Carmarthen Bay and Estuaries
Postcode:	SA4 0UB
Local Planning Authority (LPA):	<b>Carmarthenshire County Council</b>
Rainfall:	<b>1404</b>
Project type:	Residential
Development proposal (number of additional units):	1
Not applicable	Carmarthenshire County Council
Default occupancy rate:	<b>2.3</b>
Is this default value being used?	Yes
Not applicable	
Water usage per resident (litres/person/day):	120
Not applicable	
Wastewater treatment works:	Package treatment plant (PTP) default
Not applicable	
Not applicable	
Phosphorus permitted limit (mg TP/l):	<b>9.70</b>
Nitrogen permitted limit (mg TN/l):	<b>72.90</b>
Final calculation of nutrient load from wastewater	
Description of values generated	Values generated
Additional population:	<b>2.30</b>
Annual wastewater production (litres):	<b>100809.00</b>
Annual phosphorus load (kg TP/year):	<b>0.98</b>
Annual nitrogen load (kg TN/year):	<b>7.35</b>

Figure 6-13 Demonstrating how nutrient load is reduced through upgrading PTP at Stage 1 of the upgrading PTP mitigation example (input fields required by the developer are indicated by the red arrows). Note: values inputted above are indicative. The final nitrogen outcome value from this stage is indicated by the red dashed box.

Total nitrogen generated	
Description of nitrogen values generated	Values generated
Stage 1 nitrogen load (kg TN/year):	<b>7.35</b>
Stage 2 nitrogen reduction (kg TN/year):	<b>15.70</b>
Stage 3 nitrogen load (kg TN/year):	<b>15.70</b>
Stage 3S nitrogen load removed through SuDS (TN kg/year):	<b>0.00</b>
Nitrogen budget ((Stage 1 - Stage 2) + (Stage 3 - Stage 3S)):	<b>7.35</b>
Nitrogen budget + 20% buffer:	<b>8.82 kg TN/year will be generated</b>
Calculator version 3.0 - December 2025	

Figure 6-14 Mitigated Stage 4 of the upgrading PTP mitigation example (incorporates 20% buffer) (final nitrogen outcome value is indicated by the red dashed box).

### 6.3.4 Stage 4: Final nutrient budget calculation

To determine the final budget, manually **subtract the existing septic tank nitrogen budget** (11.64 kg TN/yr) **from the proposed PTP nitrogen budget** (8.82 kg TN/yr). In this case, using the default values within the calculator, this results in a final nutrient budget of -2.82 kg TN/yr. As such, the upgrade from septic tank to PTP results in a nutrient deficit (i.e. a negative value for nutrients) which means that nutrient neutrality is achieved.

The default values can be replaced with known treatment values in the calculator. It is also possible to determine the effect of replacing multiple numbers of septic tanks or PTPs using upgraded and higher efficiency models using the same approach but scaling up the number of dwellings as appropriate at Stage 1.

To ensure nutrient neutrality is delivered, the upgrades to higher efficiency PTPs must be delivered prior to occupancy of proposed developments.

## 6.4 Example D - Water efficiency measures

### 6.4.1 Unmitigated nutrient balance

This example includes a single dwelling connected to Carmel WwTW with no land use change, hence no land use inputs required. There is a resultant budget of 2.72 kgTN/yr which equates to 3.26 kg TN/yr (once a 20% precautionary buffer has been applied) that requires mitigation. For further detail on how to complete the unmitigated nutrient balance, refer to Sections 6.1.1 to 6.1.4 of this report or alternatively refer to the Nutrient budget calculator guidance (see Section 2.5).

### 6.4.2 Nutrient load removed through water efficiency measures

#### What the developer needs to do:

- Apply a reduced per-capita water consumption rate within the calculator, through reducing the default value to reflect the incorporation of enhanced water efficiency measures.
- Ensure the proposed water efficiency standard is secured through planning conditions, design specifications, or legal agreement.
- Recalculate the nutrient balance to reflect the reduced wastewater volume and associated nitrogen load.

#### Worked example:

- The default water use assumption of 120 l/p/d is replaced with 70 l/p/d (as a hypothetical example), reflecting the inclusion of high-efficiency fittings, appliances, and behavioural measures. The lower efficiency value must be suitably evidenced within the mitigation strategy.
- This reduction in water consumption proportionally reduces foul wastewater generation which is discharged to the wastewater treatment system.
- The proposed nutrient load from the development is automatically reduced within the calculator as a result of the lower per-capita wastewater volume (e.g. a reduction of 1.13 kg TN/yr, as shown in Figure 6-15 and Figure 6-16).

#### Tips:

- Assumptions must be evidence-based and achievable in practice.
- NRW may scrutinise:
  - Whether the proposed water efficiency standard is realistic for long-term occupation.
  - Whether it can effectively be enforced through planning conditions. An approach might include securing an appropriate maintenance and replacement schedule that would ensure nutrient savings are achieved in perpetuity.

10	Project type:	Residential
11	Development proposal (number of additional units):	1
12	Not applicable	Carmarthenshire County Council
13	Default occupancy rate:	2.3
14	Is this default value being used?	Yes
15	Not applicable	
16	Water usage per resident (litres/person/day):	120
17	Not applicable	
18	Not applicable	
19	Not applicable	
20	Not applicable	
21	Wastewater treatment works:	Carmel STW
22	Not applicable	
23	Not applicable	
24	Phosphorus permitted limit (mg TP/l):	5.00
25	Nitrogen permitted limit (mg TN/l):	27.00
<b>Final calculation of nutrient load from wastewater</b>		
<b>Description of values generated</b>		<b>Values generated</b>
27	Additional population:	2.30
28	Annual wastewater production (litres):	100809.00
29	Annual phosphorus load (kg TP/year):	0.50
30	Annual nitrogen load (kg TN/year):	2.72
31		
32		
33		

Figure 6-15 Nutrient load from wastewater using the default water usage per resident of 120 l/p/d (input fields required by the developer are indicated by the red arrows). Note: values inputted above are indicative. The final nitrogen outcome value from this stage is indicated by the red dashed box.

10	Project type:	Residential
11	Development proposal (number of additional units):	1
12	Not applicable	Carmarthenshire County Council
13	Default occupancy rate:	2.3
14	Is this default value being used?	Yes
15	Not applicable	
16	Water usage per resident (litres/person/day):	70
17	Not applicable	
18	Not applicable	
19	Not applicable	
20	Not applicable	
21	Wastewater treatment works:	Carmel STW
22	Not applicable	
23	Not applicable	
24	Phosphorus permitted limit (mg TP/l):	5.00
25	Nitrogen permitted limit (mg TN/l):	27.00
<b>Final calculation of nutrient load from wastewater</b>		
<b>Description of values generated</b>		<b>Values generated</b>
27	Additional population:	2.30
28	Annual wastewater production (litres):	58805.25
29	Annual phosphorus load (kg TP/year):	0.29
30	Annual nitrogen load (kg TN/year):	1.59
31		
32		
33		

Figure 6-16 Nutrient load from wastewater using water usage per resident of 70 l/p/d, taking into account water efficiency measures (input fields required by the developer are indicated by the red arrows. Note: values inputted above are indicative. The final nitrogen outcome value from this stage is indicated by the red dashed box).

## 6.5 Example E - Enhanced drainage ditch management

### 6.5.1 Unmitigated nutrient balance

Table 6-2 details a worked example in which a resultant budget of 16.33 kg TN/yr requires mitigation. For further detail on how to complete the unmitigated nutrient balance, refer to Sections 6.1.1 to 6.1.4 of this report or alternatively refer to the Nutrient budget calculator guidance (see Section 2.5).

**Table 6-2 Example scenario for enhanced drainage ditch management**

Parameter	Inputs
SAC	Carmarthenshire Bay & Estuaries SAC
Development proposal (number of additional units)	5 homes
Water usage per resident (litres/person/day)	120 l/p/d
Default occupancy rate	2.3
Wastewater treatment works	Carmel STW
Pre-existing land cover	Residential
Proposed land cover	Residential (no land use change on site)
Resultant budget value	16.33 kg TN / yr (including 20% buffer)

### 6.5.2 Nutrient load removed through enhanced drainage ditch management

#### What the developer needs to do:

- Calculate the nutrient budget from the proposed development, in this example a resultant budget of 16.33 kg TN/yr requires mitigation (Table 6-2).
- Identify an area of off-site agricultural land within the same catchment as the proposed development, and upstream of the point of impact from the development.
- Define the baseline nitrogen export from the identified agricultural land use (e.g. cereal cropping) using the Welsh Nutrient Calculator.
- Apply a nitrogen reduction factor of 28% (refer to Appendix A.10 for details of efficiency value) to the baseline agricultural nitrogen load to reflect the implementation of enhanced drainage ditch management measures.
- Determine the nutrient load saved by applying this 28% reduction (i.e. nutrient saving = existing load from cereal \* proposed load from cereal with 28% reduction in nutrient load).
- Subtract the nutrients saved in the agricultural setting from the overall development nutrient budget.

#### Worked example:

- An area of off-site cereal cropping is identified and is 3.5 ha in size. The existing nitrogen load exported is 65.38 kg TN/yr, and this can be calculated using the Stage 2 page of the Welsh Nutrient Calculator (see Figure 6-17).
- Enhanced drainage ditch management is assumed to reduce nitrogen losses from this land by 28%, reflecting measures such as increased ditch vegetation, reduced ditch clearance frequency, and improved ditch profiling (see Appendix A.10 for further detail on this mitigation approach).



# Appendix A Potential mitigation measures

## A.1 Land use change



Figure A-1 Tree planting (picture source: Nation Cymru<sup>45</sup>)

<p><b>Description</b></p>	<p>Land use change involves the permanent conversion of land uses with higher nitrogen export (e.g. arable or improved grassland) to land uses with lower nitrogen export such as:</p> <ul style="list-style-type: none"> <li>• Woodland.</li> <li>• Grassland.</li> <li>• Cessation of agricultural practices.</li> <li>• Agro-forestry (e.g., silvopasture).</li> <li>• Short rotation coppice.</li> </ul> <p>Where used these interventions must be supported by evidence of the existing land use and the reduced nitrogen export from the proposed land use (e.g. through reference to export coefficients in the All Wales nutrient budget calculator. They may be capable of reducing DIN loading via mechanisms such as reduced or eliminated fertiliser/manure inputs, increased plant uptake, enhanced denitrification, reduced soil disturbance and greater hydrological retention and infiltration etc<sup>46</sup>.</p> <p>Depending on the scale of a development, there may be potential for land use changes on-site within the development, but generally this option is undertaken off-site through identifying land within the wider catchment of the affected designated site that might be suitable for conversion to create a nutrient deficit.</p>
<p><b>Other regulatory requirements</b> (aside from the need to demonstrate compliance with the</p>	<p>Developers must comply with the following key requirements:</p> <ul style="list-style-type: none"> <li>• Water Resources (Control of Agricultural Pollution) (Wales) 2021: governs changes in land management practices (e.g., reducing or creating</li> </ul>

<sup>45</sup> <https://nation.cymru/news/millions-paid-to-organisations-outside-wales-to-plant-trees-on-welsh-farmland/>

<sup>46</sup> Natural England; DEFRA GOV UK (2025) <https://www.gov.uk/government/publications/the-benefits-of-woodland-creation-woods-and-water/the-benefits-of-woodland-creation-woods-and-water>

<p>Habitats Regulations tests for neutrality at the Appropriate Assessment stage).</p>	<p>fertiliser/organic material inputs) – updates to a farm’s risk mapping and Nutrient Management Plan may be required.</p> <ul style="list-style-type: none"> <li>• Environmental Impact Assessment Agriculture Regulations (Wales) - applies to permanent land use changes and may require a “screening decision from Welsh Government”. For guidance visit <a href="#">EIA Agriculture a4 document</a> and screening decision applications can be made at <a href="#">Screening decision application from</a>.</li> </ul> <p>For woodland creation<sup>47</sup>:</p> <ul style="list-style-type: none"> <li>• The Woodland Creation Planning Scheme (WCPS) requires an Expression of Interest (EoI) for a woodland plan of at least <b>0.25 ha</b>, or <b>0.5 ha</b> where the application is for agro-forestry.</li> <li>• For smaller planting proposals on agriculturally improved or low-environmental-value land, the Small Grants – Woodland Creation scheme<sup>48</sup> is available, covering planting areas between <b>0.1 ha and 1.99 ha</b> (subject to the site being shown as “low-sensitivity” on the appropriate map).</li> </ul> <p>This means that any woodland planting below 0.25 ha (or 0.5 ha for agro-forestry) must generally go through the Small Grants route (if eligible), whereas larger planting ambitions should be set out via a verified Woodland Creation Plan under WCPS. Developers funding a project themselves (as opposed to grant funded) are not technically restricted from planting by the eligibility criteria. However, they are legally bound by environmental and forestry regulations that mirror these limits and can make the process more complex for certain sizes. This would include Environmental Impact Assessment (Forestry) (England and Wales) Regulations 1999 and the UK Forestry Standard (UKFS).</p> <p>For woodland schemes, it is essential to demonstrate how permanence will be secured to provide long-term confidence in the mitigation strategy. Permanence relates to the legal and practical measures that ensure the land use remains in place for the required duration, which may include legal covenants or planning obligations that protect the site from future development and secure its continued dedication to nutrient mitigation for the lifetime of the development, or for as long as nutrient neutrality requirements apply.</p> <p>Long-term success of land use change as a DIN mitigation strategy depends on clear management plans, legal security, and ongoing maintenance (see later maintenance section). Developers must provide detailed information on the proposed approach, including tree species, planting layout, and a comprehensive long-term management plan for woodland creation.</p> <p>NRW also advise that the potential for displacement of lawful nutrient producing activities to a differing site, rather than simple exchange, may need to be considered on a catchment basis. For example, agricultural land may be changed to woodland for nutrient reduction purposes, but if felling then occurred elsewhere to re-establish the lost agricultural land, then this would not be appropriate</p>
<p><b>Time to effectiveness</b></p>	<p>The time required for land use change to deliver nutrient mitigation benefits varies depending on the chosen approach:</p> <ul style="list-style-type: none"> <li>• <b>Taking agricultural land out of use:</b> This can be implemented relatively quickly, as the main time investment lies in identifying suitable land, securing willing landowners, and negotiating legal agreements. Once agricultural activity ceases, reductions in nutrient inputs occur almost immediately although the full benefit might not be realised for a short period as residual excess nutrients are used up or leached from the enriched land</li> </ul>

<sup>47</sup> [Woodland Creation Planning Scheme \(January 2025\): rules booklet \[HTML\] | GOV.WALES](#)

<sup>48</sup> Welsh Government (2025). Small Grants – Woodland Creation scheme. Available at: [Small Grants – Woodland Creation scheme | GOV.WALES](#)

	<ul style="list-style-type: none"> <li>• <b>Woodland establishment:</b> Creating new woodlands requires several years for trees to become fully established and deliver maximum nutrient uptake and storage benefits. Early benefits begin as trees grow, but full effectiveness is achieved over the long term as canopy cover and root systems develop. It should be noted that for nutrient neutrality, mitigation must be in place and functioning when the development begins to discharge. Measures with delayed effectiveness may not meet this requirement without interim mitigation or Grampian conditions.</li> <li>• <b>Agro-forestry systems:</b> When agricultural land is converted to agro-forestry (trees integrated into farming systems), the tree species selection is critical. Faster-growing species will remove and store nutrients more quickly than slower-growing species, accelerating the mitigation effect.</li> </ul>
<p><b>Nutrient removal rate</b></p>	<p>Land converted to semi natural habitats such as natural wetlands, woodlands, or grasslands can offer a strong outcome for nutrients when designed and sited appropriately. For example, converting cropland to wetland found total nitrogen removal rate of 12.8% to 93%<sup>49</sup>.</p> <p>The effectiveness of land use change in reducing nutrient loads varies by intervention type and site design. Evidence from a literature review indicates the following broad trends and values:</p> <ul style="list-style-type: none"> <li>• <b>Arable → Woodland:</b> Delivers the largest and most consistent reductions in DIN due to the elimination of fertiliser inputs, increased plant uptake, and enhanced soil processes, with TN removal rates range from 12.8 – 93%<sup>49</sup>.</li> <li>• <b>Agricultural land → Non-agricultural land:</b> Typically, 16.23 to 22.75 kg/TN/ha/yr<sup>50</sup> removal potential.</li> <li>• <b>Fertiliser/manure use → Cessation of usage:</b> Typically 17.31 to 21.38 kg TN/ha/yr<sup>50</sup> removal potential.</li> </ul> <p>The All Wales Nutrient Budget Calculator<sup>6</sup> allows for inputting current and proposed land use areas for a site alongside catchment characteristics, to determine the nutrient budget resulting from land use change. This is considered a scientifically robust calculator by Welsh Government and NRW, and so is the most useful tool available to developers for determining a defensible land use budget change. Nonetheless, the mitigation strategy will need to be presented to the LPA and suitability considered on a case-by-case basis.</p>
<p><b>Wider benefits</b></p>	<p>Adopting land use change as a DIN mitigation strategy can deliver multiple co-benefits beyond nutrient reduction, including<sup>49,50</sup>:</p> <ul style="list-style-type: none"> <li>• <b>Carbon sequestration:</b> Newly established woodland and rewilded habitats capture and store atmospheric carbon, contributing to long-term emissions reduction.</li> <li>• <b>Aesthetic value:</b> Enhancing natural landscapes improves visual quality, creating more attractive and engaging environments for residents and visitors.</li> <li>• <b>Flood risk management:</b> Increased vegetation cover slows surface water runoff, improves infiltration, and reduces peak flows, helping to lower downstream flood risk.</li> <li>• <b>Biodiversity enhancement:</b> Rewilded areas provide a wider range of habitats, supporting greater species diversity and improving overall ecosystem resilience.</li> </ul>

<sup>49</sup> Arup, 2022. Nutrient Calculator Guidance for Wales: Evidence Report for Natural Resources Wales

<sup>50</sup> Royal Haskoning, 2023. Norfolk Nutrient Guidance. Nutrient Mitigation Solutions:

<https://www.southnorfolkandbroadland.gov.uk/asset-library/imported-assets/royal-haskoning-norfolk-nutrient-strategy-nutrient-mitigation-solutions-report-oct-2023.pdf>

	<ul style="list-style-type: none"> <li>• <b>The rewilded/woodland planted land area can reduce soil erosion:</b> Tree planting and ground cover vegetation stabilise the soil, reducing erosion.</li> <li>• <b>Additional pollutant removal:</b> through improved soil and additional vegetation cover.</li> </ul>
<p><b>Maintenance and management requirements</b></p>	<p>Since land use changes should be permanent, authorities require clarity on how the mitigation will be monitored and enforced over time. To achieve this, the land must follow a prescribed management regime for 80–125 years, with an expectation that its nutrient mitigation function continues in perpetuity. This long-term commitment ensures that the benefits of land use change are sustained and verifiable.</p> <p>Developers should include a detailed Maintenance and Monitoring Plan within their mitigation proposal. This plan must outline how the land will be managed throughout its lifetime, specifying activities, responsibilities, and reporting requirements. Details of how this plan would be secured are essential to having certainty in the long-term effectiveness of the mitigation approach.</p> <ul style="list-style-type: none"> <li>• For woodland schemes, appropriate management practices such as thinning and coppicing are expected for the duration of the agreement to maintain woodland health and functionality. Developers may also consider claiming annual maintenance payments for the first 12 years under the Welsh <a href="#">Woodland Creation Grant</a>. These payments can help offset initial management costs and encourage proper implementation.</li> <li>• For agro-forestry schemes, maintenance requirements are more intensive and integrated into the agricultural system<sup>51</sup>.</li> <li>• Separately, evidential certainty of effect must be demonstrated to confirm that the woodland will deliver the anticipated nutrient mitigation outcomes. This requires appropriate baseline data, monitoring arrangements (to demonstrate that the land use has been maintained and appropriately managed), and reporting mechanisms to verify performance over time. Where monitoring indicates that mitigation outcomes are not being achieved as predicted, suitable contingency measures should be identified to address underperformance and ensure continued compliance with nutrient neutrality requirements. The approach to maintenance and management, and how this is secured, should be agreed with the LPA alongside submission of the mitigation strategy.</li> </ul>
<p><b>Limitations / Concerns</b></p>	<p>The following limitations are associated with this DIN mitigation solution<sup>49</sup>:</p> <ul style="list-style-type: none"> <li>• In some catchments, large areas are needed to offset small developments.</li> <li>• The solution requires implementation at scale, which becomes more challenging with the need for landowner permissions and increasing costs.</li> </ul> <p>Loss of productive agricultural land in areas where there is a high proportion of Best and Most Versatile (BMV) agricultural land and where agricultural output may contribute significantly to food supply and food security in Wales / the UK. In some areas it may therefore be contrary to local policy and this needs review on a case by case basis.</p>
<p><b>Costs</b></p>	<p>High-cost solution for smaller developers as significant areas of land may need to be purchased and secured in perpetuity. Costs may be heavily dependent on the specific requirements of the development and the scale of mitigation needed.</p> <p>Agricultural land can benefit from agricultural tax relief, meaning that taking land out of active production on a long-term basis may remove this entitlement and create tax liabilities. This has the potential to make certain land-use changes</p>

<sup>51</sup> Ricardo, 2023. Nutrient Mitigation Options Technical Review. Guidance on phosphorus mitigation options for use in Carmarthenshire, Pembrokeshire, and Ceredigion. <https://www.carmarthenshire.gov.wales/media/1232891/nutrient-mitigation-options-technical-review-west-wales.pdf>

	<p>economically unattractive and may act as a barrier to implementation. In some cases, when land no longer qualifies for agricultural relief, it may instead become eligible for payments through schemes such as the Sustainable Farming Scheme (SFS) 2026<sup>52</sup>, which can help offset the financial impact. Note that participation in SFS cannot be double counted, and any claimed nitrogen reduction would need to prove additionality.</p> <p>Land-use change measures - such as woodland planting, grassland conversion or establishing cover crops - also involve upfront capital expenditure. However, once established, ongoing maintenance requirements are typically low, and activities such as cutting or harvesting can provide product sales that partially or fully offset these costs.</p> <p>For woodland creation, annual maintenance payments are available for the first 12 years under the Welsh <a href="#">Woodland Creation Grant</a>. These payments can help offset initial management costs and encourage proper implementation.</p>
<p><b>Securing nutrient mitigation</b></p>	<p>Where agricultural production is simply ceased, early vegetation establishment is recommended to provide clear evidence that farming has stopped. Planting woodland or other vegetation communities incompatible with agriculture offers a practical way to demonstrate permanent land use change and secure nutrient mitigation<sup>51</sup>.</p>
<p><b>Additional considerations</b></p>	<p>The following considerations should also be considered:</p> <ul style="list-style-type: none"> <li>• Woodland planting is a viable mitigation method that can be easily implemented. There is a minimum requirement for 20% canopy cover at maturity, which is equivalent to approximately 100 stems per hectare<sup>53</sup>.</li> <li>• There is no fixed minimum or maximum size for mitigation land, but local policies may influence acceptable scale, especially for large woodland schemes.</li> <li>• Mitigation should prioritise farm types with the highest nutrient export coefficients, using tools like Farmscoper<sup>54</sup> to guide selection. Farmscoper is a decision support tool to assess and reduce diffuse agricultural pollution. However, Farmscoper has limitations in the Welsh context, as most assumptions and data are tailored to England. It is recommended to use the tool alongside other methods, and developers may consider analysing comparable catchments in England.</li> <li>• Calculations of nutrient reductions must also account for legacy nitrogen from historic fertiliser and manure applications<sup>52</sup>.</li> </ul>
<p><b>Long term performance</b></p>	<p>High longevity (assuming land use change is secured in perpetuity through S106 agreements) and certainty if it is possible to secure monitoring to confirm that this is maintained.</p>
<p><b>Type of measure in HRA terms</b></p>	<p>NRW nutrient neutrality guidance does not specifically endorse the use of catchment scale land use change to offset development under Article 6(3). As such, each mitigation strategy involving land use change would require consideration on a case-by-case basis. However, assuming that the land use change is specific to the development in question (i.e. not part of wider Article 6(2) restoration or compensation) and is secured and funded by the developer as mitigation for the specific development, then the approach should be acceptable in principle as Article 6(3) mitigation.</p> <p>There are examples in England for estuarine habitats sites where land use change has been successfully used as a mitigation measure and secured as a</p>

<sup>52</sup> Welsh Government, 2025, Sustainable Farming Scheme 2026. Available at: <https://www.gov.wales/sustainable-farming-scheme-2026-scheme-description-html>

<sup>53</sup> Natural Resources Wales (2025). Definition of trees and woodland. [Online] Available at: <https://naturalresources.wales/guidance-and-advice/environmental-topics/trees-woodlands-and-forests/definition-of-trees-and-woodland-for-forest-regulations/?lang=en>

<sup>54</sup> [Farmscoper Tool - CaBA](#)

	Section 106 agreement. A similar approach can be adopted in Wales through a Section 106 agreement.
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## A.2 Agricultural management measures



Figure A-2 Agricultural management measures (such as planting of cover crops)<sup>55</sup>

<p><b>Description</b></p>	<p>Agricultural management measures<sup>50</sup> involves optimising fertiliser use, improving crop and soil management, and managing manure more effectively to prevent nitrogen from reaching waterways. These less intensive farming practices aim to reduce nitrogen losses through leaching and runoff while maintaining farm productivity. Adding cover crops can also be used to reduce bare soil erosion during winter.</p> <p>These interventions reduce DIN loading via reduced or eliminated fertiliser/manure inputs, increased plant uptake, higher soil organic matter and enhanced denitrification, and reduced soil disturbance<sup>46</sup>.</p> <p>This is an off-site mitigation option undertaken within the wider catchment of the affected designated habitats site in order to create a nutrient deficit that will allow development to proceed.</p>
<p><b>Other regulatory requirement</b> (aside from the need to demonstrate compliance with the Habitats Regulations tests for neutrality at the Appropriate Assessment stage).</p>	<p>Developers must comply with the following key requirements:</p> <ul style="list-style-type: none"> <li>• Water Resources (Control of Agricultural Pollution) (Wales) 2021: governs changes in land management practices (e.g., reducing or creating fertiliser/organic material inputs) – updates to a farm’s risk mapping and Nutrient Management Plan may be required.</li> </ul>
<p><b>Time to effectiveness</b></p>	<p>The time required for agricultural management measures to deliver nutrient mitigation benefits varies depending on the chosen approach, but can generally be implemented in the short to medium term:</p> <ul style="list-style-type: none"> <li>• <b>Cessation of fertiliser and manure application / planting of cover crops:</b> This can be implemented relatively quickly, as the main time investment lies in securing willing landowners. Once agricultural activity decreases, reductions in nutrient inputs occur almost immediately,</li> </ul>

<sup>55</sup> Farmers Guide (2020). Bespoke cover crop solutions to improve soils. [Online] Available at: [Bespoke cover crop solutions to improve soils - Farmers Guide](#)

	<p>particularly during rainfall events. This method does not require any investments in infrastructure or planning permission.</p> <p>The uptake of this method will likely depend on the crop rotation and soil type<sup>56</sup>.</p>
<b>Nutrient removal rate</b>	<p>The effectiveness of agricultural management measures in reducing nutrient loads varies by intervention type. Literature indicates the following trends and values:</p> <p><b>Fertiliser/manure use → Cessation of usage:</b> Typically, 17.31 to 21.38 kg TN/ha/yr removal potential<sup>50</sup>.</p> <p><b>Planting of cover crops</b> has produced variable results. A review summarising the results of 16 studies found that cover crops typically reduced nitrate leaching losses by between 6% and 94%<sup>57</sup>. NO<sup>3</sup> leaching loss reduction of 30% to 60% are typical in the year of establishment<sup>56</sup>. According to Royal Haskoning, a conservative removal rate of 30% is expected to be applied for cover crops<sup>50</sup>. Given the high variability in these outcomes, any nutrient budget calculation incorporating them should apply a precautionary rate and must be explicitly evidenced.</p> <p>There is a degree of uncertainty in relation to nutrient mitigation related to various farm management practices as it is dependent on factors such as location, soil type and rainfall. As such, evidence would need to be compiled on a case-by-case basis within a mitigation strategy.</p> <p>Application of nitrogen by spraying leaves of crops, rather than by direct application of pellets to the ground, may bring the same benefits but result in much less nutrient loss to the soil / nearby watercourses<sup>58</sup>.</p>
<b>Wider benefits</b>	<p>Adopting agricultural management practices as a DIN mitigation strategy can deliver multiple co-benefits beyond nutrient reduction, including:</p> <ul style="list-style-type: none"> <li>• <b>Biodiversity enhancement:</b> Measures such as cover cropping, reduced tillage, and reduced fertilisers create more diverse habitats within agricultural landscapes, supporting pollinators, farmland birds, and soil biota, and strengthening overall ecosystem resilience.</li> <li>• <b>Additional pollutant removal:</b> Improved land management practices can reduce the mobilisation and transport of suspended sediments, agrochemicals, and other diffuse pollutants, improving water quality through enhanced filtration, sediment trapping, and reduced runoff.</li> <li>• <b>Soil improvements and enhanced crop yields:</b> Practices that improve soil structure and organic matter content, such as cover cropping, reduced compaction, and improved nutrient management, increase water retention and soil health, which can support more resilient cropping systems and contribute to sustained or improved crop yields over time.</li> </ul>
<b>Maintenance and management requirements</b>	<p>Variable depending on the intervention. In the case of cover crops as an example, annual maintenance includes the preparation, planting and cultivation of the crops, in addition to the intentional removal of the cover crop once it has served its purpose<sup>50</sup>.</p>
<b>Limitations / Concerns</b>	<p>This method would have a significant impact on crop yields<sup>56</sup>. There may also be concerns with the difficulty of securing the practice in the long term.</p>

<sup>56</sup> Newell Price, J., Harris, D., Taylor, M., Williams, J., Anthony, S., Deuthmann, D., Gooday, R., Lord, E., Cambers B., Chadwick, D., Misslebrook, T. (2011). An Inventory of Mitigation Methods and Guide to their Effects on Diffuse Water Pollution, Greenhouse Gas Emissions and Ammonia Emissions from Agriculture. Defra Project WQ0106.

<sup>57</sup> Kaspar, T. C., and J. W. Singer. (2011). "The Use of Cover Crops to Manage Soil." Soil Management: Building a Stable Base for Agriculture, edited by J. L. Hatfield and T. J. Sauer, American Society of Agronomy & Soil Science Society of America, pp. 321–337.

<sup>58</sup> Cutress, D. (2022). Feeding leaves not soil: An alternative route than the roots. Farming Connect. Business Wales. <https://businesswales.gov.wales/farmingconnect/news-and-events/technical-articles/feeding-leaves-not-soil-alternative-route-roots>

<p><b>Costs</b></p>	<p>Costs associated with reducing fertilisers on agricultural land will depend on the amount of fertiliser that is used. For the complete cessation of fertiliser, the following costs are likely to be involved:</p> <ul style="list-style-type: none"> <li>For costs associated with the cessation of fertilisers in arable farming, the estimated cost is likely to be around £1,274.39/ha/yr<sup>50</sup>. This includes savings in fertiliser and reduced use of fertiliser spreaders, however increased costs in reduced yield/forage replacement and soil testing. From a farm income perspective, cessation or significant reduction of fertiliser use may be more cost-effective than taking land out of production, as it avoids fertiliser costs while retaining some crop income. However, the resulting reduction in nitrogen losses may be limited, meaning that land use change may offer greater cost-effectiveness when assessed on a per-kilogram nitrogen mitigation basis.</li> <li>Cessation of fertiliser/manure application is expected to reduce arable yields by around <b>50%</b>, and grassland yields by about <b>30%</b>, based on an average grass yield of 8 t/ha<sup>50</sup>. However, the actual impact will vary between farms depending on factors such as existing fertiliser inputs, soil type and crop grown.</li> </ul>
<p><b>Securing nutrient mitigation</b></p>	<p>Legal agreements would need to specify the area and duration of fertiliser cessation, and periodic monitoring checks would be required to verify farming practices and monitor nutrient levels in runoff. This is likely to comprise three to four visits per year, including an initial round of sampling (incorporating seasonality) to establish the baseline conditions<sup>50</sup>.</p>
<p><b>Additional considerations</b></p>	<p>Mitigation should prioritise farm types with the highest nutrient export coefficients, using recognised nutrient loading assessment tools to guide site selection. Calculations of nutrient reductions should also account for legacy nitrogen from historic fertiliser and manure applications<sup>50</sup>, which may be difficult for a developer to achieve.</p> <p>The effectiveness of agricultural management practices in reducing DIN can vary due to site-specific factors such as soil type, hydrology, weather conditions, and cropping regimes, resulting in uncertainty in predicted outcomes. These measures are not inherently permanent and rely on ongoing implementation and compliance, requiring contractual, funding, and governance mechanisms to secure mitigation over the lifetime of a development.</p> <p>Demonstrating evidential certainty of effect can also be difficult as reductions are often diffuse, difficult to directly measure, and may involve time lags. External economic, policy, and farm management pressures may also affect long-term delivery, with potential for displacement or leakage if reductions are offset elsewhere.</p>
<p><b>Long term performance</b></p>	<p>Cessation of fertilisers is considered a temporary measure for use while longer-term solutions are developed and implemented. Prolonged cessation of fertiliser would have similar effects to taking land out of agricultural use entirely.</p> <p>The planting of cover crops would also be considered a temporary measure for use when land would otherwise be left bare during the crop rotation process, as they are typically used either prior to the main production cycle or post-harvest. Planting cover crops could be secured in perpetuity through management agreements, especially where land is leased<sup>50</sup>.</p> <p>Since there are limited mechanisms to create binding agreements with landowners, this approach is viewed as temporary.</p>
<p><b>Type of measure in HRA terms</b></p>	<p>NRW nutrient neutrality guidance does not specifically endorse the use of agricultural measures to offset development under Article 6(3). As such, further clarification may be required on a case by cases basis with NRW as to how this constitutes impact avoidance for a specific development rather than catchment</p>

	<p>level compensation (Article 6(2)). To be suitable under Article 6(3) it would be necessary to demonstrate that the mitigation would increase the scale, magnitude, or scope of potential planned 6(2) restoration measures (over and above what would otherwise have been delivered).</p>
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## A.3 Treatment wetlands



Figure A-3 Cromhall integrated treatment wetland<sup>59</sup>.

### Description

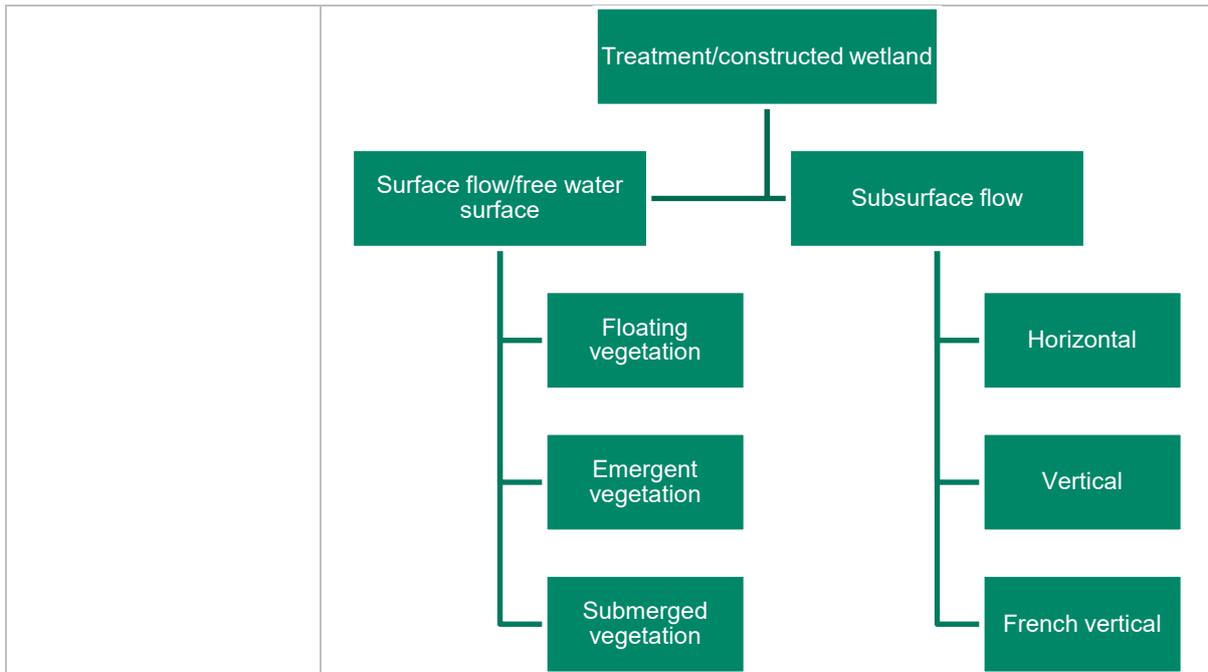
Treatment wetlands, also known as constructed wetlands (CW), are engineered systems designed to replicate the physical, chemical, and biological processes that occur in natural wetlands. They are designed and managed in a specific manner to treat a source of water which contains undesirable substances<sup>60</sup>. These systems can be integrated into the landscape to resemble natural ecosystems or can be constructed as discrete water management infrastructure.

The main types of treatment wetlands are presented in Figure A-4, including:

- **Free water surface (surface flow):** Water flows horizontally above the substrate.
- **Horizontal subsurface flow:** Water moves through a medium such as sand or gravel below the surface.
- **Vertical flow:** Water passes vertically down through the wetland and its substrate.
- **French vertical flow:** Comprised of two stages, with each stage containing alternately operated cells.
- **Floating wetlands:** A surface flow constructed wetland dominated by floating vegetation over the water column.
- **Hybrid wetlands:** Combine elements of multiple types.

<sup>59</sup> Davey, A. (2022) 'Wessex Water research reveals environmental benefits of wetlands', *H2O Global News*, 8 June. Available at: <https://h2oglobalnews.com/wessex-water-research-reveals-environmental-benefits-of-wetlands/> (Accessed: 27 November 2025).

<sup>60</sup> Natural England, 2022. Framework Approach for Responding to Wetland Mitigation Proposals.



**Figure A-4 Basic treatment wetland types.**

Importantly, the classification of a “treatment” wetland is based on:

- A fixed or closed water source.
- Has a low risk of uncontrolled water levels.
- Has been designed to be resilient to drought/flood conditions.
- Has a known likely range of inflow rates, hydraulic residence time and water quality.

Therefore, wetlands built for the purpose of treating water from an agricultural catchment that will be driven by rainfall and influenced by land use for instance, are not classified as a treatment wetland, with details of these as a nutrient management solution in Section 4.3.

In Wales, CW are an emerging mitigation option, and while they can deliver significant water quality benefits, their acceptance within nutrient neutrality assessments is currently determined on a case-by-case basis. Proposals are most likely to be supported where they treat a clearly defined source, provide quantifiable nutrient reductions, and are supported by robust monitoring that has been agreed with NRW.

In England, the Natural England framework approach for wetland mitigation focuses on the “free water surface” type of CW<sup>60</sup>. The following information is tailored to this type of CW, while Section A.4 focuses on other wetland types. However, it should be noted that this Natural England approach is referenced for technical context only, and in Wales NRW has not yet published an equivalent consolidated framework and proposals are currently assessed on a bespoke case by case basis. NRW guidance is provided at [Natural Resources Wales / Constructed wetlands for improving water quality](#)

**Other regulatory requirement** (aside from the need to demonstrate compliance with the Habitats Regulations tests for neutrality at the

Developers should refer to latest NRW guidance for constructed wetlands: [Natural Resources Wales / Constructed wetlands for improving water quality](#)

The guidance indicates that treatment wetlands designed primarily for water treatment typically require an Environmental Permit, which may cover wastewater discharge (to surface or groundwater), or both, depending on site-specific circumstances<sup>49</sup>. A permit is required for constructed wetlands treating:

<p>Appropriate Assessment stage).</p>	<ul style="list-style-type: none"> <li>• Treated sewage effluent.</li> <li>• Untreated sewage effluent (e.g., public sewer permitted overflow).</li> <li>• Contaminated water from mines/mineral activities.</li> <li>• Treated waste effluent from a waste operation (e.g., tertiary treatment of treated agricultural effluents).</li> <li>• Planning permission may be required through the Local Authority<sup>49</sup>.</li> </ul> <p>Guidance on how to apply for an Environmental Permit can be found here: <a href="#">Apply for a water discharge permit of groundwater activity permit</a></p> <p>With regard to CW for agricultural activities, effluents, liquors and washings regulated under current legislation cannot be treated in a CW. This includes silage effluent, slurry, poultry unit verandas, collecting yards, feeding areas and parlour washings, pesticides, biocides, including areas, equipment and washings that have been in contact with these products<sup>68</sup>.</p> <p>For schemes associated with WwTWs, such as those operated by DCWW, wetlands must meet specific criteria, including a population equivalent (PE) of less than 2,000 to minimise footprint, compliance with permit limits, and consideration of trade effluent composition<sup>61</sup>. It is essential to review the latest positions of both NRW and DCWW when assessing the suitability of wetlands as a DIN mitigation measure.</p> <p>CW for water quality improvement must not be located in<sup>62</sup>:</p> <ul style="list-style-type: none"> <li>• Flood Zone 3.</li> <li>• A water supply Source Protection Zone if the treated effluent is subsequently discharged to ground.</li> <li>• A site designated for nature conservation or geological importance unless there is no adverse impact on designated features or it can be shown to have a significant net benefit for the features of the site.</li> </ul> <p>In addition, CW must not be sited on existing priority habitats listed under Section 7 of the Environment Act<sup>63</sup>. If the proposal is likely to affect a SAC or protected area (as is the case for the DIN nutrient sensitive catchments) a HRA will be required<sup>64</sup>:</p> <ul style="list-style-type: none"> <li>• <a href="#">Find out if your wetland will be near a protected area</a></li> <li>• <a href="#">Read about HRA on the Welsh Government website</a></li> </ul> <p>To summarise, the regulatory requirements for treatment wetland you may need include:</p> <ul style="list-style-type: none"> <li>• <a href="#">Apply for a water discharge permit of groundwater activity permit</a></li> <li>• <a href="#">Planning permission from your local planning authority</a></li> <li>• <a href="#">Building regulations permission</a></li> <li>• <a href="#">Flood risk activity permit</a></li> <li>• <a href="#">Water abstraction or impoundment licence</a></li> </ul>
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<sup>61</sup> Arcadis, 2024: <https://www.carmarthenshire.gov.wales/media/yzoaapqe/carmarthenshire-nutrient-management-strategy.pdf>

<sup>62</sup> *Natural Resources Wales / Constructed wetlands for improving water quality* (no date). Available at: <https://naturalresources.wales/guidance-and-advice/environmental-topics/water-management-and-quality/constructed-wetlands/constructed-wetlands-for-improving-water-quality/?lang=en> (Accessed: 26 November 2025).

<sup>63</sup> UK Government. (2016). Environment (Wales) Act 2016. Available at: [Environment \(Wales\) Act 2016](#). Priority habitats with an ongoing review are available at: [Environment \(Wales\) Act Section 7 Terrestrial Habitats of Principal Importance | DataMapWales](#)

<sup>64</sup> *Natural Resources Wales / What to think about when planning your constructed wetland* (no date). Available at: <https://naturalresources.wales/guidance-and-advice/environmental-topics/water-management-and-quality/constructed-wetlands/what-to-think-about-when-planning-your-constructed-wetland/?lang=en> (Accessed: 26 November 2025).

	<p>In practice, CW proposals in Wales often require coordination across multiple regulatory regimes including planning, environmental permitting and HRA, and developers should be aware that the absence of a single, streamlined consenting pathway (as of March 2026) can affect programme and delivery timescales.</p>
<b>Time to effectiveness</b>	<p>Before nutrient mitigation can occur, it is estimated that a treatment wetland scheme for nutrient removal will take between 1-2 years to complete due to various design, planning, permitting, and construction requirements<sup>60</sup>.</p> <p>Once commissioned, the removal of nutrients requires vegetation and biofilms (communities of microorganisms, including bacteria and fungi, that attach to surfaces) to become established<sup>49</sup>. As such, consideration may need to be given to phasing of development, interim measures or conservative assumptions to ensure that mitigation is effective at the point when development discharges commence.</p>
<b>Nutrient removal rates</b>	<p>The removal of nitrogen in wetlands is largely a biogeochemical process, including microbial activity and plant uptake. Natural England considers that treatment wetlands offer one of the best outcomes per hectare of land for nutrient removal albeit this is very variable depending on site design. Generally, higher nutrient load inputs to a wetland provide greater potential for nutrient reduction<sup>65</sup>.</p> <p>The design objectives of treatment wetlands within the context of nutrient neutrality will relate to a reduction in DIN concentration, which will be expressed as a reduction in the overall load (from inflow to outflow) such as kilograms of total nitrogen being removed by the wetland per year<sup>66</sup>.</p> <p>Surface flow treatment wetlands can achieve up to 80% removal rate for TN<sup>49</sup> with an appropriate design. The Cromhall integrated constructed wetland in rural South Gloucestershire, a trial site, has shown &gt;60% removal in nitrogen and 62% in ammonia<sup>67</sup>.</p> <p>The nutrient removal rate of treatment wetlands can be highly variable due to a range of parameters; these include but are not limited to:</p> <ul style="list-style-type: none"> <li>• Inflow water chemistry (e.g., how much nutrients, organic carbon within the water).</li> <li>• How much water flows into the wetland over time, known as the hydraulic loading rate.</li> <li>• The physical layout of the wetland and pond geometry (e.g., size, aspect ratio, shape).</li> <li>• How the water moves through the wetland (i.e., residence time<sup>68</sup>, hydraulic efficiency<sup>69</sup>, short-circuiting<sup>70</sup>, mixing<sup>71</sup>, dispersion<sup>72</sup>, vertical velocity gradients<sup>73</sup>).</li> <li>• Design of engineered hydraulic structures (e.g., inlet-outlet configuration and number of).</li> </ul>

<sup>65</sup> Natural England (no date) *Nutrient Neutrality and Mitigation: A summary guide and frequently asked questions - NE776, Natural England - Access to Evidence*. Available at: <https://publications.naturalengland.org.uk/publication/6248597523005440> (Accessed: 27 November 2025).

<sup>66</sup> Association, T.R.T. and the C.W. (2022) *Constructed Wetland Hub, ArcGIS StoryMaps*. Available at: <https://storymaps.arcgis.com/collections/6543a2f8de0348f683187ff268a79687> (Accessed: 26 November 2025).

<sup>67</sup> Water Industry Journal (no date). Wessex Water has proven that a nature-based alternative to chemical dosing reduces phosphorus in treated wastewater. Available at: <https://www.waterindustryjournal.co.uk/wessex-water-has-proven-that-a-nature-based-alternative-to-chemical-dosing-reduces-phosphorus-in-treated-wastewater>

<sup>68</sup> The average time a parcel of water and DIN spends within the wetland.

<sup>69</sup> A measure of the ability of a wetland to distribute flow evenly throughout the volume.

<sup>70</sup> The premature exit of water due to the formation of preferential high-velocity transport pathways.

<sup>71</sup> Water parcels within a wetland exchange and homogenise their physical and chemical properties.

<sup>72</sup> The spreading of water as it flows through the wetland.

<sup>73</sup> Differences in water velocity at different depths.

	<ul style="list-style-type: none"> <li>• Age/maturity of the wetland.</li> <li>• Sediment/soil type.</li> <li>• Vegetation species, physical coverage, and planting density.</li> <li>• Animals living in or around the wetland.</li> <li>• Management and maintenance regime.</li> <li>• Climate and season.</li> </ul> <p>In the Welsh regulatory context, precautionary and site-specific assumptions are likely to be required supported by monitoring proposals to demonstrate ongoing performance.</p>
<p><b>Wider benefits</b></p>	<p>As well as offering a DIN management solution, treatment wetlands can be designed to have the wider benefits of:</p> <ul style="list-style-type: none"> <li>• Water reuse.</li> <li>• Aesthetic value.</li> <li>• Flood mitigation.</li> <li>• Biodiversity enhancement (increase in biodiversity value up to 183% than a low ecological value agricultural field<sup>74</sup>).</li> <li>• Carbon sequestration.</li> <li>• Biomass production.</li> <li>• Temperature regulation.</li> <li>• Recreation.</li> </ul>
<p><b>Maintenance and management requirements</b></p>	<p>The developer must be able to demonstrate the capacity to manage, monitor, and maintain the treatment wetland for its lifetime<sup>64</sup>.</p> <p>Treatment wetlands used for DIN mitigation require ongoing management to sustain design performance and removal efficiency. Seasonal vegetation management (e.g., harvesting, litter removal) is essential, and proposals should include maintenance plans that address these needs<sup>51</sup>. Periodic interventions, such as sediment removal (maybe every 5 to 10 years) and vegetation management according to their seasonal growth stages, help prevent wetlands from shifting from nutrient sinks to nutrient sources<sup>50</sup>. Maintenance plans should also cover upkeep of hydraulic structures and bed and bank stability<sup>50</sup>.</p> <p>Continuous monitoring is critical to assess nutrient removal efficiency and adapt maintenance regimes over time, particularly as wetlands are subject to seasonal changes in the uptake and release of nutrients<sup>50,51</sup>.</p>
<p><b>Limitations / Concerns</b></p>	<p>The limitations to adopting treatment wetlands as a DIN mitigation solution include<sup>49</sup>:</p> <ul style="list-style-type: none"> <li>• Land requirement is high and therefore increases cost.</li> <li>• Requirement of primary/secondary treatment if treating foul wastewater.</li> <li>• Designing, constructing and maintain a constructed wetland is complex.</li> <li>• Adjacent water table must not reach surface, increasing the complexity of site selection.</li> </ul> <p>Concerns associated with adoption of treatment wetlands include<sup>49,50</sup>:</p> <ul style="list-style-type: none"> <li>• Health and safety concerns around algal blooms, and so public access may have to be restricted.</li> </ul>

<sup>74</sup> Davies-Smith, A. (no date) *Luston Integrated Constructed Wetland (ICW)*, Herefordshire Council. Available at: <https://www.herefordshire.gov.uk/community/reducing-river-nutrients/luston-integrated-constructed-wetland-icw/>

	<ul style="list-style-type: none"> <li>• Potential mosquito habitat.</li> <li>• Risk of inundation of the wetland and surrounding land during extreme rainfall events or due to wetland structural failure<sup>75</sup>.</li> <li>• Unmanaged vegetation overgrowth and decay during die-back seasons can release nutrients back into the water, causing secondary pollution. Annual plant harvesting is one method used preventing nutrient re-release and maintaining removal efficiency over time.</li> </ul>																														
<p><b>Practical considerations</b></p>	<p>The typical ranges for parameter values in treatment wetland design for nutrient removal are detailed within the Natural England framework, and re-summarised below in Table 6-1.</p> <p><b>Table 6-1 Natural England typical ranges for treatment wetland design parameters for nutrient removal<sup>60</sup>.</b></p> <table border="1" data-bbox="518 658 1385 1099"> <thead> <tr> <th>Parameter</th> <th>Min</th> <th>Max</th> <th>Typical</th> <th>Notes</th> </tr> </thead> <tbody> <tr> <td>Depth (m)</td> <td>0.1</td> <td>0.3</td> <td>0.15</td> <td>Water depth should be stable throughout the year</td> </tr> <tr> <td>Width:length</td> <td>-</td> <td>-</td> <td>1:2 or 1:3</td> <td>Ideal range is 1:2 to 1:3</td> </tr> <tr> <td>Cell number</td> <td>2</td> <td>-</td> <td>2-5</td> <td>Avoid single cell systems</td> </tr> <tr> <td>Hydraulic residence time (hours)</td> <td>8</td> <td>-</td> <td>12-24</td> <td>If &lt;12 hours the design could be flawed</td> </tr> <tr> <td>Substrate N (mg/kg)</td> <td>-</td> <td>1000</td> <td></td> <td>If representative soil samples exceed this then mitigation may be required to prevent pollution.</td> </tr> </tbody> </table> <p>Wetland design is mainly carried out by specialist designers but there is an available <a href="#">detailed design guide</a> reviewed by the Constructed Wetland Association and partly funded by Natural England<sup>66</sup>. As according to NRW, the use of an accredited consultant is recommended, but states appropriate design standards should be met, covering:</p> <ul style="list-style-type: none"> <li>• Ability to achieve the water treatment and/or water storage needs.</li> <li>• Slowing and storing water to achieve the required hydraulic retention times.</li> <li>• Sizing.</li> <li>• Seasonal impacts.</li> <li>• Risk of leakage to ground from within the wetland, or during the construction of it, this is to be avoided.</li> <li>• Maintenance need.</li> <li>• Habitat creation.</li> <li>• Requirements of other legislation or permissions.</li> </ul> <p>Where possible, developers will prioritise on-site measures to reduce DIN before considering the use of CW.</p>	Parameter	Min	Max	Typical	Notes	Depth (m)	0.1	0.3	0.15	Water depth should be stable throughout the year	Width:length	-	-	1:2 or 1:3	Ideal range is 1:2 to 1:3	Cell number	2	-	2-5	Avoid single cell systems	Hydraulic residence time (hours)	8	-	12-24	If <12 hours the design could be flawed	Substrate N (mg/kg)	-	1000		If representative soil samples exceed this then mitigation may be required to prevent pollution.
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Substrate N (mg/kg)	-	1000		If representative soil samples exceed this then mitigation may be required to prevent pollution.																											
<p><b>Costs</b></p>	<p>Treatment wetlands are considered to have high set up costs but effective performance<sup>75</sup>.</p> <p>Potentially £44.82 to £72.24 per m<sup>3</sup> treated volume (costs from 2015)<sup>61</sup>.</p>																														
<p><b>Securing nutrient mitigation</b></p>	<p>According to Natural England, treatment wetlands can only generate nutrient credits (in England) if their design is based on an approved, evidence-based approach for calculating nutrient removal. At present, Wales does not operate a</p>																														

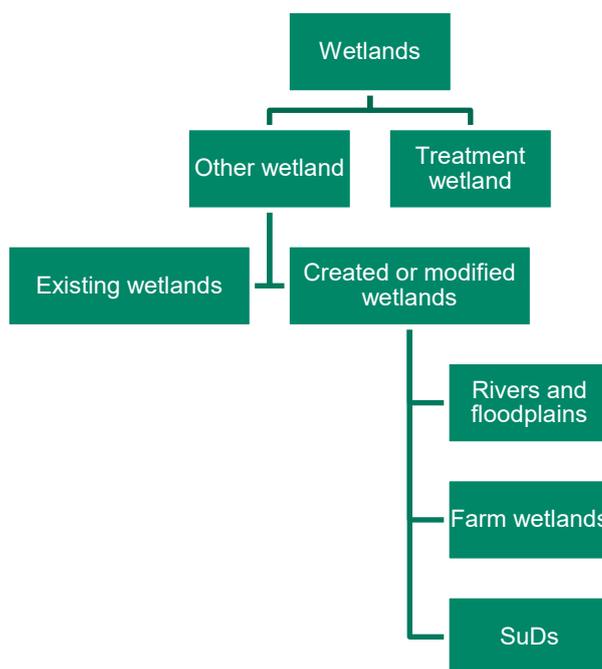
<sup>75</sup> Rural sustainable drainage systems (RSuDS) (2012). Bristol: Environment Agency.

	<p>formal nutrient credit trading system, and CW are therefore more likely to be considered as a bespoke/case by case mitigation linked to specific discharges rather than as credit generating schemes. Nonetheless, the evidence-based approach for calculating nutrient removal would still apply.</p> <p>It is essential to consider inflows and nutrient loads not only during the design phase but across the entire operational lifetime of the wetland. This includes accounting for periods of reduced performance, such as seasonal variations or temporary loss of removal efficiency.</p> <p>Due to the complexity of characterising flows and loads accurately, post-implementation monitoring is essential. Demonstrating the full nutrient removal potential of a wetland may take more than 1 to 3 years, as performance stabilises over time<sup>76</sup>.</p>
<p><b>Long term performance</b></p>	<p>The nutrient removal efficiency of CW is not constant and typically fluctuates with seasonal changes. Removal rates are generally lower in autumn and winter due to reduced biological activity and higher in spring and summer when conditions favour plant growth and microbial processes.</p> <p>The body of evidence on long-term performance remains limited, with few studies assessing nutrient removal efficiency beyond a 10-year operational period. However, available research suggests that performance can be maintained at an optimum level with a robust and consistent maintenance schedule<sup>74</sup>.</p> <p>Previous studies indicate that, in the absence of maintenance, treatment efficiency can decline significantly. Over five years, nitrate removal efficiency fell by 80.5% at an integrated CW in Norfolk, UK<sup>77</sup>.</p> <p>NRW recommends that CW designs are precautionary when calculating the rate of nutrient removal and when sizing the wetland. It will be important to demonstrate how the CW inflow source is linked to the development, to calculate nutrient load entering and leaving wetland, to be conservative with assumptions on performance, and to develop an adaptive Monitoring and Maintenance Management Plan. Areas of uncertainty may influence how wetlands are treated within HRA, reinforcing the need for robust monitoring and review.</p> <p>Ongoing monitoring should identify any poor performance early so that an adaptive management plan can be implemented<sup>62</sup>. The maintenance proposals should clearly outline roles and responsibilities, and a robust monitoring and review process should be secured for the lifetime of the CW.</p>
<p><b>Type of measure in HRA terms</b></p>	<p>CW have the potential to be used as an Article 6(3) mitigation approach, with precedent in England. However, there is at present no established routine consenting pathway in Wales for CW to be relied upon as nutrient neutrality mitigation under Article 6(3) and so the suitability of wetlands will be considered by local authorities and NRW on a case-by-case basis. Developers are encouraged to review NRW's Constructed Wetland guidance and seek Pre-application advice at an early stage: <a href="#">Natural Resources Wales / Constructed wetlands for improving water quality</a></p>

<sup>76</sup> [MSRFIN-1.PDF](#)

<sup>77</sup> Dykes, C., Pearson, J., Bending, G., Abolfathi, S., 2025. Impact of seasonal climate variability on constructed wetland treatment efficiency. *Journal of Water Process Engineering* 72, 107350. <https://doi.org/10.1016/j.jwpe.2025.107350>

## A.4 Other wetlands



**Figure A-5 Basic types of other wetland creation.**

<p><b>Description</b></p>	<p>Non-treatment or “open source” wetlands are CW features that improve water quality without controlled or quantified inflows. These wetlands typically intercept diffuse runoff from agricultural land or urban areas and therefore are often integrated into SuDS or habitat restoration schemes, including features such as:</p> <ul style="list-style-type: none"> <li>• Swales.</li> <li>• In-ditch wetlands.</li> <li>• Ponds.</li> <li>• Floodplain reconnection.</li> </ul> <p>While these wetlands can contribute to nutrient retention, their lack of controlled water inflows and uncertainty surrounding nutrient removal processes limits their suitability for formal nutrient neutrality calculations<sup>60</sup>. If the wetland has been designed taking the flows and loads into account and will receive water in a controlled (and quantifiable) way, these may be considered a treatment wetland and please refer to Section 5.2.3. In some circumstances this might include SuDS wetlands if appropriately designed and the nutrient uptake is quantifiable.</p> <p>Non-treatment wetlands differ from treatment wetlands as their hydrology is more variable and uncertain and the ability to manage and control water inflows and water levels is considerably more challenging. However, these wetlands can be designed, created, or restored as part of an overall strategy for managing nutrients in the aquatic environment and are thereby worthy of inclusion and consideration in delivering further nutrient (and wider environmental) benefit to larger development sites.</p>
<p><b>Other regulatory requirement</b> (aside from the need to demonstrate compliance with the Habitats Regulations tests for neutrality at the</p>	<p>For wetlands that are used to treat rainwater runoff from buildings housing livestock, with roof vents and/or tracks used by livestock, then an Environmental Permit will need to be applied for: <a href="#">Apply for a water discharge permit of groundwater activity permit</a></p>

<p>Appropriate Assessment stage).</p>	<p>If the wetland is a natural flood management feature, then the developer should adopt best practice from CIRIA<sup>78</sup>. Other permissions may be required, such as: <a href="#">Flood risk activity permit</a></p> <p>If the wetland is part of a SuDS management train, they must comply with the statutory national standards (also see later sections on SuDS): <a href="#">Welsh government advice on SuDS</a></p> <p>Wetlands must not be sited on existing priority habitats listed under Section 7 of the Environment Act<sup>79</sup>. If the proposal is likely to affect a SAC or protected area a HRA will be required<sup>64</sup>:</p> <ul style="list-style-type: none"> <li>• <a href="#">Find out if your wetland will be near a protected area</a></li> <li>• <a href="#">Read about HRA on the Welsh Government website</a></li> </ul>
<p><b>Time to effectiveness</b></p>	<p>For wetlands treating agricultural runoff, they are likely to be the least complex in terms of design, planning, and permitting, making them relatively fast to deliver<sup>50</sup>, especially compared to treatment wetlands.</p> <p>Nutrient removal begins after vegetation establishment, which is the primary mechanism for nutrient uptake.</p>
<p><b>Nutrient removal rates</b></p>	<p>Highly variable as it depends on design, inflow characteristics, and maintenance. There is currently no standard removal rate that can be assumed without monitoring.</p>
<p><b>Wider benefits</b></p>	<p>Similar to treatment wetlands, these wetlands can be designed to have the wider benefits of:</p> <ul style="list-style-type: none"> <li>• Water reuse.</li> <li>• Aesthetic value.</li> <li>• Flood mitigation.</li> <li>• Biodiversity enhancement (increase in biodiversity value up to 183%<sup>74</sup>).</li> <li>• Carbon sequestration.</li> <li>• Biomass production.</li> <li>• Temperature regulation.</li> <li>• Recreation.</li> </ul>
<p><b>Maintenance and management requirements</b></p>	<p>The maintenance and management requirements will likely include:</p> <ul style="list-style-type: none"> <li>• Install and maintain an upstream sediment forebay or removal device to prevent sediment accumulation<sup>80</sup>.</li> <li>• Empty sediment traps every 1–2 years.</li> <li>• Manage and potentially harvest vegetation to maintain nutrient uptake and hydraulic performance<sup>80</sup>.</li> </ul>
<p><b>Limitations / Concerns</b></p>	<p>The limitations and concerns associated with these range of wetlands include:</p> <ul style="list-style-type: none"> <li>• Lack of controlled inflows makes nutrient removal unpredictable.</li> <li>• Performance sensitive to seasonal variation and storm events.</li> <li>• Risk of sediment accumulation reducing wetland volume and function.</li> </ul>

<sup>78</sup> Natural Resources Wales / Constructed wetlands for slowing and storing water (no date). Available at: <https://naturalresourceswales.gov.uk/guidance-and-advice/environmental-topics/water-management-and-quality/constructed-wetlands/constructed-wetlands-for-slowing-and-storing-water/?lang=en> (Accessed: 12 January 2026).

<sup>79</sup> UK Government. (2016). Environment (Wales) Act 2016. Available at: [Environment \(Wales\) Act 2016](#). Priority habitats with an ongoing review are available at: [Environment \(Wales\) Act Section 7 Terrestrial Habitats of Principal Importance | DataMapWales](#)

<sup>80</sup> Bradley, J, Haygarth, P, Stachyra, K and WILLIAMS, P (2022) Using SuDS to reduce phosphorus in surface water runoff. C808, CIRIA, London, UK.

<b>Costs</b>	<p>Lower capital cost than treatment wetlands but variable depending on size, excavation, planting, and land acquisition.</p> <p>Ongoing maintenance costs for sediment removal and vegetation management.</p>
<b>Securing nutrient mitigation</b>	<p>Unlike treatment wetlands (see Section A.3), nutrient benefits cannot be claimed based on design alone. Nutrient reduction is possible through monitored performance or understanding of nutrient load from the land-use of the area in question<sup>60</sup>. Treatment wetlands offer greater certainty in perpetuity.</p>
<b>Additional considerations</b>	<p>Early engagement with regulators for HRA and SuDS compliance.</p> <p>Consider integration with biodiversity net gain and nature recovery objectives.</p>
<b>Long term performance</b>	<p>Performance fluctuates with seasonal changes, with reduced removal efficiency in autumn/winter and higher in spring/summer.</p>
<b>Type of measure in HRA terms</b>	<p>There is at present no established routine consenting pathway in Wales for CW to be relied upon as nutrient neutrality mitigation under Article 6(3). Suitability of wetlands will be considered by local authorities on a case-by-case basis.</p>

## A.5 Urban SuDS

This includes retrofitting SuDS into existing developments.

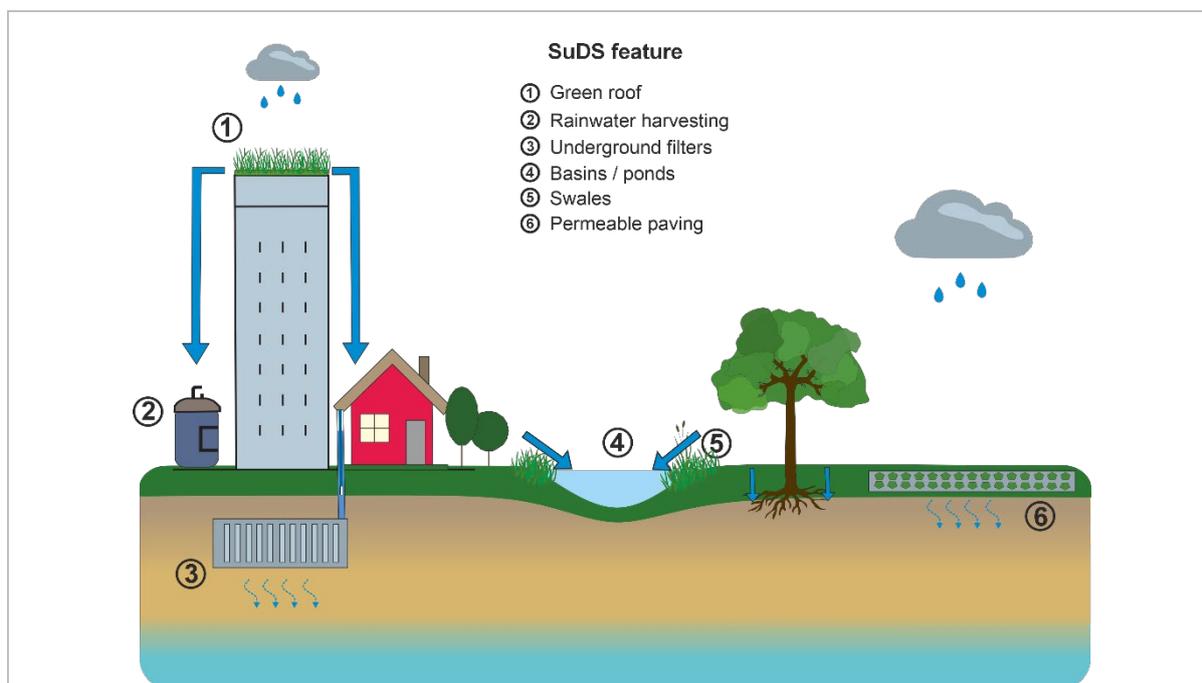


Figure A-6 Diagram of some urban SuDS.

### Description

Since January 2019, all new developments in Wales that include more than one building or have a construction area of 100 m<sup>2</sup> or more, must include SuDS for surface water<sup>81</sup>. This is Welsh Government legislation and detailed in its Schedule 3 of the [Flood and Water Management Act 2010](#).

SuDS is an umbrella term for a range of mitigation measures designed to manage urban surface water runoff within a development site by mimicking natural drainage processes. As such, they are an on-site mitigation measure. SuDS aim to reduce the volume and speed of runoff entering watercourses, thereby lowering flood risk and improving water quality. They achieve this by slowing flows, promoting sedimentation, and encouraging infiltration, allowing rainfall to percolate into the ground close to where it falls<sup>50</sup>.

Many SuDS offer water quality benefit and can treat and remove nutrients through sedimentation, filtration, adsorption, assimilation and microbial processes (promoting nitrification/denitrification). The main examples of urban SuDS include:

- **Wetlands** (see Sections A.3 and A.4).
- **Basins and ponds:** open depressions in the landscape that store and naturally treat water<sup>82</sup>.
- **Filter strips, swales and ditches:** use vegetation to filter and control flows<sup>87</sup>.
- **Soakaways and infiltration basins:** Design features that allow soakage into the ground<sup>87</sup>.

<sup>81</sup> Water, D.C.W. (no date) Sustainable drainage systems, Dŵr Cymru Welsh Water. Available at: <https://developers.dwrcymru.com/en/help-advice/regulation-to-be-aware-of/sustainable-drainage-systems> (Accessed: 16 December 2025).

<sup>82</sup> Sustainable surface water drainage (no date) Anglian Water Services. Available at: <https://www.anglianwater.co.uk/developing/drainage-services/sustainable-drainage-systems/> (Accessed: 12 January 2026).

	<ul style="list-style-type: none"> <li>• <b>Filter drains, permeable surfaces, green roofs, bioretention areas:</b> Allow water to percolate through a pervious surface into voided construction below to allow cleaning, storage and controlled release<sup>87</sup>.</li> </ul> <p>SuDS can be further enhanced with high-rate media filters or implemented in combination with proprietary measures such as Hydrodynamic vortex separators.</p> <ul style="list-style-type: none"> <li>• <b>High-rate media filters:</b> Materials used in filtration systems to remove excess nitrogen from stormwater runoff through processes such as sorption and adsorption.</li> <li>• <b>Hydrodynamic vortex separators and oil/water separators:</b> <a href="#">CIRIA C753 SuDS Manual</a> dictates that a sediment remove device such as these should be included upstream of a pond or retention basin.</li> </ul>
<p><b>Other regulatory requirement</b> (aside from the need to demonstrate compliance with the Habitats Regulations tests for neutrality at the Appropriate Assessment stage).</p>	<p>Those planning to develop SuDS schemes need to consider a range of relevant legislation, policy and guidance, including:</p> <ul style="list-style-type: none"> <li>• <a href="#">Planning Policy Wales</a> outlines the Welsh Government’s approach to land-use planning and is supported by a series of Technical Advice Notes. Under Section 79 of the Government of Wales Act (2006)<sup>83</sup>, the Welsh Government is required to promote sustainable development in carrying out its responsibilities<sup>84</sup>.</li> <li>• <a href="#">Local Development Plans</a> set out proposals and policies for the future use of land within the West Wales LPA areas.</li> <li>• Developers must gain approval for their drainage from a <a href="#">Sustainable drainage Approval Body</a> (SAB) independently from planning approval before construction can begin<sup>85</sup>.</li> <li>• SuDS must be designed and built in accordance with the <a href="#">Welsh Government statutory national standards for SuDS</a><sup>85</sup>.</li> </ul> <p>Some SuDS have the potential to introduce environmental risk. To mitigate this the developer may need to obtain permits and consents from NRW<sup>86</sup>. These may include:</p> <ul style="list-style-type: none"> <li>• <a href="#">Land drainage consent</a></li> <li>• <a href="#">Flood Risk Activity Permit</a></li> </ul> <p>Please see <a href="#">how to comply with SuDS standards</a> for further information. All permits and consents should be in place before approval from the SAB is sought<sup>86</sup>.</p>
<p><b>Time to effectiveness</b></p>	<p>Time to effectiveness varies by SuDS type. Vegetation-dependent systems require time for plants to establish before achieving full nutrient removal, while hard-engineered measures such as permeable surfaces are effective immediately.</p>
<p><b>Nutrient removal rates</b></p>	<p>NRW guidance indicates that there is a presumption for all developments that rainwater is kept separate from foul wastewater and discharged in line with planning guidance on rainwater disposal. As such, new surface water discharges should not be contaminated with foul water or pollutants. For the purpose of nutrient balance calculations, surface water discharges would therefore not need to be considered as a source of nutrients (see Section 2.6). However, they may</p>

<sup>83</sup> UK Government (2006). Government of Wales Act 2006. Available at:

<https://www.legislation.gov.uk/ukpga/2006/32/section/79>

<sup>84</sup> England and Wales (no date). Available at: <https://www.susdrain.org/delivering-suds/using-suds/legislation-and-regulation/england-and-wales.html> (Accessed: 12 January 2026).

<sup>85</sup> Natural Resources Wales / Sustainable Drainage Systems (SuDS) (no date). Available at: <https://naturalresources.wales/guidance-and-advice/business-sectors/planning-and-development/advice-for-developers/sustainable-drainage-systems-suds/?lang=en> (Accessed: 26 November 2025).

<sup>86</sup> Natural Resources Wales / How to comply with Sustainable Drainage Systems (SuDS) standards (no date). Available at: <https://naturalresources.wales/guidance-and-advice/business-sectors/planning-and-development/advice-for-developers/how-to-comply-with-sustainable-drainage-systems-standards/?lang=en> (Accessed: 12 January 2026).

	<p>be taken into account for example when considering the potential benefits that could be achieved by utilising SuDS as part of a development proposal.</p> <p>Where developers are seeking to use SuDS as Article 6(3) mitigation, the following discussion will be relevant.</p> <p>Processes and indicative nutrient removal rates for common SuDS components based on the NRW Mitigation Measures Menu are<sup>87</sup>:</p> <p><b>Retention basins and ponds:</b></p> <ul style="list-style-type: none"> <li>• Mitigation occurs through microbial conversion and plant uptake for growth<sup>87</sup>.</li> <li>• Around 85% to 90% total nitrogen for detention basin.</li> </ul> <p><b>Wetland channels and swales:</b></p> <ul style="list-style-type: none"> <li>• Aerobic microbiological activity in soils can break the ammonia down into nitrates, and plants will use the nitrates for growth<sup>87</sup>.</li> <li>• Around 50% total nitrogen for swales.</li> </ul> <p><b>Bioretention zones and raingardens:</b></p> <ul style="list-style-type: none"> <li>• Capture organic debris promoting microbial breakdown and enabling plant uptake of nitrates<sup>87</sup>.</li> </ul> <p><b>Pervious surfaces:</b></p> <ul style="list-style-type: none"> <li>• Concrete block permeable pavements do not reliably remove nitrogen from stormwater, grassed permeable surfaces provide better treatment<sup>87</sup>.</li> <li>• Around 70-80% total nitrogen for pervious surfaces.</li> </ul> <p><b>Filter strips:</b></p> <ul style="list-style-type: none"> <li>• Around 10% (as nitrate).</li> </ul> <p><b>High-rate media filters:</b></p> <ul style="list-style-type: none"> <li>• Their performance must be tested, and the test results must be presented for examination before the removal efficiencies that are declared for them can be assigned to the device and included in the nutrient neutrality calculations<sup>87</sup>.</li> </ul> <p>CIRIA C815 advice on using SuDS to reduce nitrogen in surface water runoff highlights that combined treatment trains can deliver measurable nitrogen reductions, with examples showing around 30% TN removal when multiple SuDS components are used in sequence<sup>87</sup>. Advised treatment trains include<sup>87</sup>:</p> <ul style="list-style-type: none"> <li>• Ponds → Bioremediation devices.</li> <li>• Lined infiltration devices → pond.</li> <li>• Manufactured sediment devices and/or pond → media filtration.</li> </ul> <p>Values adopted by developers should be precautionary and suitably evidenced, and so following guidance outlined in CIRIA C815 is considered good practice.</p>
<p><b>Wider benefits</b></p>	<p>The definition of sustainable drainage laid out in legislation and the statutory standards both highlight that SuDS need to deliver more than just surface water volume management<sup>88</sup>. Therefore, the design and delivery must identify how and if a SuDS proposal will deliver multiple benefits<sup>89</sup>.</p>

<sup>87</sup> Using SuDS to reduce nitrogen in surface water runoff C815F (no date). Available at: [https://www.ciria.org/CIRIA/Books/Free\\_publications/C815F.aspx](https://www.ciria.org/CIRIA/Books/Free_publications/C815F.aspx) (Accessed: 12 January 2026).

<sup>88</sup> Sustainable Drainage (SuDS) Statutory Guidance. Available at: <https://www.gov.wales/sites/default/files/publications/2019-06/statutory-guidance.pdf>

<sup>89</sup> See paragraph 2 of Schedule 3 to the 2010 Act.

	<p>Additional benefits for adopting SuDS as a DIN mitigation solution include<sup>90</sup>:</p> <ul style="list-style-type: none"> <li>• Reduced erosion for receiving watercourses.</li> <li>• Contribute to delivery of WFD compliance for water quality in receiving watercourses.</li> <li>• Improved amenity value of a proposed development.</li> <li>• Contribution to Local Biodiversity Action Plan objectives and sustainable development consistent with the Planning (Wales) Act 2015.</li> <li>• Contribution to health and wellbeing of those using a development through access to green space.</li> <li>• Local flood risk management associated with a new development.</li> <li>• Reduced urban heat island effect through shading and evapotranspiration<sup>91</sup>.</li> <li>• Some SuDS components (e.g., trees, swales, basins) can have a positive effect on local air quality<sup>92</sup>.</li> <li>• Noise buffering<sup>93</sup>.</li> <li>• Support development resilience to climate change through allowing for attenuation of future flows through appropriate design.</li> </ul>
<p><b>Maintenance and management requirements</b></p>	<p>Maintenance requirements are dependent on the feature, but may include:</p> <ul style="list-style-type: none"> <li>• Desilting.</li> <li>• Seasonal trimming and vegetation removal.</li> <li>• Seasonal litter and debris removal.</li> <li>• Visual inspection (annually).</li> <li>• Monitoring of inlet and outlet water quality is recommended.</li> </ul> <p><b>Permeable pavements</b> need to be regularly cleared of silt and debris to ensure permeability is preserved, current advice is a minimum of three surface sweepings per year. Removal of weed growth should occur every 3 months and should have ongoing monitoring for poor operation<sup>94</sup>.</p> <p>If filter media are included in SuDS treatment trains, which can deliver high nitrogen removal rates, then periodic replacement of the media is likely to be required. Timescales for replacement depend on the product in question.</p>
<p><b>Limitations / Concerns</b></p>	<p>The limitations associated with urban SuDS include:</p> <ul style="list-style-type: none"> <li>• Land availability.</li> <li>• Lack of research into the nutrient removal efficacy of many solutions.</li> <li>• Scale constrained by urban environment.</li> <li>• In DIN nutrient neutrality catchments, wetland channels and bioswales must be lined to prevent nitrate infiltration to groundwater, with surplus flows directed downstream unless the runoff has been pre-treated in a pond or basin<sup>87</sup>.</li> </ul>

<sup>90</sup> Statutory standards for sustainable drainage systems -: designing, constructing, operating and maintaining surface water drainage systems (2018). Cardiff: Welsh Government.

<sup>91</sup> Irfeey, A.M.M. et al. (2023) 'Sustainable Mitigation Strategies for Urban Heat Island Effects in Urban Areas', Sustainability, 15(14). Available at: <https://doi.org/10.3390/su151410767>.

<sup>92</sup> Air quality (no date). Available at: <https://www.susdrain.org/delivering-suds/using-suds/benefits-of-suds/Air-quality> (Accessed: 12 January 2026).

<sup>93</sup> Dealing with surface water: the new standards for sustainable drainage systems (SuDS) (no date). Available at: <https://research.senedd.wales/research-articles/dealing-with-surface-water-the-new-standards-for-sustainable-drainage-systems-suds/> (Accessed: 12 January 2026).

<sup>94</sup> [https://apps.eastsussex.gov.uk/environment/planning/applications/register/documents/datawright%20saved%20documents/scannedinfo/planning/lw-3396-cc/sd-07\\_greenacres%20maintenance%20schedule%20%28drainage%20systems%29%20aug%202018.pdf](https://apps.eastsussex.gov.uk/environment/planning/applications/register/documents/datawright%20saved%20documents/scannedinfo/planning/lw-3396-cc/sd-07_greenacres%20maintenance%20schedule%20%28drainage%20systems%29%20aug%202018.pdf)

<p><b>Costs</b></p>	<p>Variable depending on scale of development and SuDS approach used. For example, indicative costs noted by the Environment Agency (in 2015) include<sup>95</sup>:</p> <ul style="list-style-type: none"> <li>• <b>Swale:</b> Typically £10 - £15 per m<sup>2</sup> swale area.</li> <li>• <b>Filter drain:</b> Around £120 per m<sup>2</sup>.</li> <li>• <b>Soakaways:</b> Typically &lt;£100 per m<sup>2</sup> stored volume.</li> </ul> <p>Evidence shows that well designed SuDS systems are cheaper than traditional piped counterparts<sup>90</sup>, but SuDS do provide greater costs benefits on larger sites<sup>96</sup>.</p> <p>WSP estimated annual average maintenance costs of 0.5% of capital costs of drainage construction<sup>96</sup>.</p>
<p><b>Securing nutrient mitigation</b></p>	<p>Urban SuDS must be maintained according to statutory SuDS Standards for the lifetime of the development to ensure nutrient removal rate is maintained<sup>90</sup>. A maintenance plan should be secured to provide certainty for appropriate assessment, and should clearly identify who will be responsible for undertaking maintenance, this would be likely to be either<sup>88</sup>:</p> <ul style="list-style-type: none"> <li>• The SAB, who have a duty to adopt approved SuDS that serve two or more properties. Once adopted, the SAB is responsible for ensuring the surface water drainage system is maintained in accordance with mandatory National Standards.</li> <li>• Private owners and occupiers may be responsible for maintaining SuDS serving only their property provided systems are simple and easy to manage.</li> </ul>
<p><b>Additional considerations</b></p>	<p>SuDS are mandatory in Wales and all new developments of more than one house or with a construction area of 100m<sup>2</sup> or larger require SuDS to be adopted by the SAB, unless otherwise agreed. Agreements over SuDS maintenance are therefore dealt with through the SAB approval process. Development cannot commence until SAB approval is given</p> <p>Opportunity mapping for SuDS can help identify the best location, these may include mapping:</p> <ul style="list-style-type: none"> <li>• Development.</li> <li>• Infrastructure.</li> <li>• Topography.</li> <li>• Green space.</li> <li>• Flood risk.</li> <li>• Water quality.</li> <li>• Protected habitats.</li> <li>• Specific problems in the area.</li> </ul>
<p><b>Long term performance</b></p>	<p>There are risks to long-term performance if the SuDS are not maintained correctly. As such, the arrangement for long term maintenance and responsibility for SuDS must be suitably secured (usually through the SAB) and evidenced in any nutrient mitigation strategy using SuDS.</p>
<p><b>Type of measure in HRA terms</b></p>	<p>Suitable tool for nutrient neutrality mitigation under Article 6(3), if appropriately evidenced and secured.</p>

<sup>95</sup> Environment Agency (2015). *Cost estimation for SUDS - summary of evidence*. [Online] Available at: [https://assets.publishing.service.gov.uk/media/6034ee6c8fa8f54334a5a6a9/Cost\\_estimation\\_for\\_SUDS.pdf?utm\\_source](https://assets.publishing.service.gov.uk/media/6034ee6c8fa8f54334a5a6a9/Cost_estimation_for_SUDS.pdf?utm_source) (Accessed 14 January 2026).

<sup>96</sup> 'SuDS & Understanding the Cost Benefits', GeoSmart Information, 4 June. Available at: <https://geosmartinfo.co.uk/2019/06/suds-understanding-the-cost-benefits/> (Accessed: 12 January 2026).

## A.6 Rural SuDS



**Figure A-7 Vegetated swales or filter trenches, which remove pollutants from surface water prior to discharge to watercourses or aquifers<sup>97</sup>.**

### Description

Rural SuDS include features that attempt to mimic natural drainage processes to intercept/divert and/or improve infiltration and percolation of surface water run-off in rural areas.

Unlike urban SuDS (see Section A.5), rural SuDS typically operate at a larger scale, integrate with natural landscapes, and might require more heavy duty work (earthworks) due to the sheer size of the land available<sup>98</sup>. They can also function as off-site mitigation measures for pollutants carried in surface water runoff. Features include:

- **Constructed wetlands** (built for treating surface water not wastewater effluent).
- **Detention basin/pond:** Normally dry basins designed to temporarily store and slowly release runoff<sup>99</sup>.
- **Swales:** Broad and shallow vegetated open channels, designed to convey runoff<sup>99</sup>.
- **Sediment traps:** Containment area where sediment-laden runoff is temporarily designed, allowing sediment to settle before runoff is discharged<sup>99</sup>.
- **Sediment trap bund:** sediment trap bunds are an excavated in-field earth berm that intercept and traps sediment laden flows and associated pollutants via sheet flow before discharge to a watercourse.
- **Drainage ditch blocking.**

<sup>97</sup> Newcastle University (2026) [Online] Available at: <https://nclurbandesign.org/what-are-the-benefits-of-sustainable-drainage-systems-suds/> (Accessed: 5 January 2026).

<sup>98</sup> Sustainable Drainage in Rural vs Urban Environments, Soakaways Supplies. Available at: <https://www.soakaways.com/sustainable-drainage/rural-vs-urban-environments/>

<sup>99</sup> Rural sustainable drainage systems (no date) GOV.UK. Available at: <https://www.gov.uk/government/publications/rural-sustainable-drainage-systems> (Accessed: 12 January 2026).

	<ul style="list-style-type: none"> <li>• <b>Tree planting.</b></li> </ul> <p>The type of rural SuDS to choose for a scheme is dependent on the type of runoff being mitigated<sup>100</sup>, as shown in Table 6-2.</p> <p><b>Table 6-2 Appropriate application of rural SuDS</b></p> <table border="1"> <thead> <tr> <th>Field runoff</th> <th>Steading runoff (i.e., rainfall runoff from roofs and yards)</th> </tr> </thead> <tbody> <tr> <td>Sediment trap bund</td> <td>Swale</td> </tr> <tr> <td>Pond</td> <td>Sediment trap</td> </tr> <tr> <td>Wetland</td> <td>Pond</td> </tr> <tr> <td>Swale</td> <td>Wetland Constructed wetland</td> </tr> </tbody> </table> <p>Importantly, developers must not use rural SuDS for treating slurry, silage effluent, or pesticide contaminated runoff.</p>	Field runoff	Steading runoff (i.e., rainfall runoff from roofs and yards)	Sediment trap bund	Swale	Pond	Sediment trap	Wetland	Pond	Swale	Wetland Constructed wetland
Field runoff	Steading runoff (i.e., rainfall runoff from roofs and yards)										
Sediment trap bund	Swale										
Pond	Sediment trap										
Wetland	Pond										
Swale	Wetland Constructed wetland										
<p><b>Other regulatory requirement</b> (aside from the need to demonstrate compliance with the Habitats Regulations tests for neutrality at the Appropriate Assessment stage).</p>	<p>Those planning to develop rural SuDS schemes need to consider a range of relevant legislation, policy and guidance, including:</p> <ul style="list-style-type: none"> <li>• <a href="#">Planning Policy Wales</a> outlines the Welsh Government’s approach to land-use planning and is supported by a series of Technical Advice Notes. Under Section 121 of the Government of Wales Act, the Welsh Government is required to promote sustainable development in carrying out its responsibilities.</li> <li>• <a href="#">The LPA’s Local Development Plan</a> sets out proposals and policies for the future use of all land within the County.</li> <li>• Sustainable drainage and planning in Wales is guided by the National Assembly’s <a href="#">Spatial Plan (2008)</a>, which sets out a statutory vision and strategy for land use that all lower-tier plans must follow.</li> <li>• Developers must gain approval for their drainage from a <a href="#">Sustainable drainage Approval Body</a> (SAB) independently from planning approval before construction can begin. This applies to all new developments of more than one house or with a construction area of 100m<sup>2</sup> or larger. This requirement, under Schedule 3 of the Flood and Water Management Act 2010, ensures surface water drainage meets mandatory national standards.</li> <li>• SuDS must be designed and built in accordance with the <a href="#">Welsh Government statutory national standards for SuDS</a>.</li> </ul> <p>Some rural SuDS have the potential to have themselves an environmental impact. To mitigate this the developer may need to obtain permits and consents from NRW<sup>86</sup>. These may include:</p> <ul style="list-style-type: none"> <li>• <a href="#">Land drainage consent</a></li> <li>• <a href="#">Flood Risk Activity Permit</a></li> </ul> <p>Please see <a href="#">how to comply with SuDS standards</a> for further information. All permits and consents should be in place before approval from the SAB is sought<sup>86</sup>.</p>										
<p><b>Time to effectiveness</b></p>	<p>Immediately upon installation for interception or diversion SuDS.</p>										

<sup>100</sup> Rural Sustainable Drainage Systems: A practical design and build guide for Scotland’s farmers and landowners | CREW | Scotland’s Centre of Expertise for Waters (no date). Available at: <https://www.crew.ac.uk/publication/rural-sustainable-drainage-systems-practical-design-and-build-guide-scotlands-farmers> (Accessed: 22 December 2025).

	For features using vegetative interception and nutrient uptake, the vegetation establishment is required before its function.
<b>Nutrient removal rate</b>	<p>Dependant on the type of rural SuDS and evidence may be limited or lacking for some options. Some information is provided below:</p> <ul style="list-style-type: none"> <li>• <b>Swales:</b> Encouraged sedimentation and nitrogen removal through plant uptake<sup>99</sup>.</li> <li>• <b>Sediment traps:</b> Retention time assumed too short for nitrogen breakdown but could be used as a pre-treatment for other rural SuDS<sup>99</sup>.</li> </ul>
<b>Wider benefits</b>	<p>The definition of sustainable drainage laid out in legislation and the statutory standards both highlight that SuDS need to deliver more than just surface water volume management<sup>88</sup>. Therefore, the design and delivery must identify how and if a rural SuDS proposal will deliver multiple benefits<sup>89</sup>.</p> <p>Additional benefits for adopting SuDS as a DIN mitigation solution include:</p> <ul style="list-style-type: none"> <li>• Reduced erosion to receiving watercourses.</li> <li>• Habitat creation.</li> <li>• Biodiversity benefits if planted with native vegetation.</li> <li>• Improved amenity value for the proposed development.</li> <li>• Flood mitigation.</li> <li>• Recreation.</li> </ul>
<b>Maintenance and management requirements</b>	<p>Low to medium maintenance.</p> <p>Maintenance requirements are dependent on the feature, but may include:</p> <ul style="list-style-type: none"> <li>• Desilting.</li> <li>• Seasonal trimming and vegetation removal.</li> <li>• Seasonal litter and debris removal.</li> <li>• Visual inspection (annually).</li> <li>• Monitoring of inlet and outlet water quality is recommended.</li> </ul>
<b>Limitations / Concerns</b>	<p>The following limitations are associated with adopting rural SuDS for DIN mitigations:</p> <ul style="list-style-type: none"> <li>• Taking land out of agricultural use.</li> <li>• Choosing sites can be complex, leading to limited suitable land.</li> <li>• Potential high cost of earthworks.</li> </ul>
<b>Costs</b>	<p><b>Wetland:</b> Variable depending on size but costs may be significant.</p> <p><b>Silt traps and ditch blocking:</b> Significantly cheaper option but absolute nutrient removal potential is small in comparison to constructed wetlands.</p> <p><b>Silt traps:</b> Capital costs are likely between £1,000-£4,000 but depends on site specific factors, size etc.</p>
<b>Securing nutrient mitigation</b>	<p>If rural SuDS are not maintained in accordance with their basic guidelines, they will no longer treat runoff and will not secure DIN mitigation.</p>
<b>Additional considerations</b>	<p>Opportunity mapping for rural SuDS can help identify the best location, these may include mapping:</p> <ul style="list-style-type: none"> <li>• Development.</li> <li>• Infrastructure.</li> </ul>

	<ul style="list-style-type: none"> <li>• Topography.</li> <li>• Green space.</li> <li>• Flood risk.</li> <li>• Water quality.</li> <li>• Protected habitats.</li> <li>• Geology, including drift deposits (as clay-based rocks and clay drift deposits are likely to be impermeable).</li> <li>• Specific problems in the area.</li> </ul>
<p><b>Long term performance</b></p>	<p>Only risks to long-term performance are if the SuDS are not maintained correctly. As such, the arrangement for long term maintenance and responsibility for this must be suitably secured and evidenced in any nutrient mitigation strategy using SuDS. There may also be risk of contamination in rural areas, for example from slurry.</p>
<p><b>Type of measure in HRA terms</b></p>	<p>Suitable tool for nutrient neutrality mitigation under Article 6(3), if appropriately evidenced and secured.</p>

## A.7 Septic tank and PTP upgrades



Figure A-8 Package treatment plant<sup>101</sup>.

### Description

Septic tanks are attributed as one of the causes for excessive DIN causing the unfavourable and failing water quality within marine SACs<sup>12</sup>. It is suggested that these marine failures will be dominated by coastal discharges from holiday and caravan park septic tanks, as one of the sectors that is predominately unpermitted, so controls and enforcement on its impact to the environment are minimal<sup>12</sup>.

Replacing outdated septic tanks or PTPs with higher-efficiency models is an effective strategy for reducing nitrogen discharges from residential properties. This may be on-site mitigation for a development site, or off-site upgrades to other sites can also be made to generate a nutrient surplus (or 'headroom') by significantly improving wastewater treatment performance from other properties<sup>102</sup>. The replacement system(s) must be located upstream of the development it mitigates and must be in the same catchment<sup>101</sup>. It must also be shown to the satisfaction of the Planning Authority that connection to a public sewer is not feasible<sup>3</sup>.

PTPs comprise a primary settling chamber to remove solids, followed by a secondary chamber where aerobic bacterial biodegradation is promoted through continuous aeration. Some systems use moving media, such as discs, to provide surfaces for biofilm development. A final settling chamber removes humic and organic substances, producing a more highly treated effluent compared to conventional septic tanks<sup>49</sup>.

Septic tank upgrades are particularly suitable in areas where land-based mitigation solutions, such as constructed wetlands, are not viable. They are ideal

<sup>101</sup> *Package Treatment Plant Upgrade Scheme (2024) Lake District National Park*. Lake District National Park: hq@lakedistrict.gov.uk. Available at: <https://www.lakedistrict.gov.uk/planning/planning-for-nature-recovery/nutrient-neutrality/call-for-sites> (Accessed: 27 November 2025).

<sup>102</sup> NMF Norfolk. Septic Tank Upgrades Case Study: <https://www.nmfnorfolk.co.uk/assets/Website-Documents/Septic-Tank-Upgrades-Case-Study.pdf>

	<p>for smaller catchments or locations upstream of larger wastewater treatment works, offering a practical and space-efficient approach to nutrient reduction<sup>103</sup>.</p> <p>Equally upgrading the PTP or septic tank proposed for the development to a more efficient one may help remove or reduce the need for other neutrality mitigation<sup>65</sup>.</p>
<p><b>Other regulatory requirement</b> (aside from the need to demonstrate compliance with the Habitats Regulations tests for neutrality at the Appropriate Assessment stage).</p>	<p>All systems must meet British Standard BS EN 12566 and be installed by certified professionals. The sewage system needs to meet the required design and manufacturing standards and be appropriately located. The necessary planning and building control approval for the treatment system and discharge is also required.</p> <p>All septic tanks or small PTPs need to be registered as exempt or apply for an Environment Permit from NRW. Planning permission may also be required through the LPA.</p> <p>Discharges from septic tanks directly to surface water are not permitted and must instead be managed using an appropriate PTP or via discharge to ground (where eligible for registration). Although there is no single statutory deadline for upgrading all surface water discharging septic tanks, NRW's registration and permitting means that where a septic tank currently discharges to surface water, it will need to be replaced or upgraded to a compliant PTP as part of securing lawful discharge and therefore should be accounted for in mitigation planning<sup>104</sup>.</p> <p>The waste byproducts of septic tanks and PTPs are likely to be classified as sewage sludge and would need to be disposed according to NRW requirements<sup>105</sup>.</p> <p>A developer cannot install a private system if it is deemed "reasonable" to connect to the public sewer network (usually if your property is within 30 meters of one). It is also NRW's position that connection constraints associated with the standard of effluent quality that can be achieved at a wastewater treatment works, and/or the capacity of the SAC catchment to receive increased nutrient discharges and meet water quality targets, is not a valid reason to justify use of a private sewage treatment system in a sewered area.</p>
<p><b>Time to effectiveness</b></p>	<p>Relatively quickly once biofilms have become established<sup>49</sup>.</p>
<p><b>Nutrient removal rate</b></p>	<p>A case study in Norfolk<sup>102</sup> demonstrated a 267.51 kg/yr mitigation of nitrogen (455 estimated homes released). Products on the market can achieve over 80% nitrogen reduction.</p> <p>Upgrading a septic tank can create around 7kg of nitrogen headroom<sup>106</sup>.</p> <p>The amount of headroom can be determined by calculating the budget for the systems before and after, with this difference giving an idea of how much headroom can be gained.</p> <p>The developer must ensure the sewage system meets the required design and manufacturing standards.</p>
<p><b>Wider benefits</b></p>	<p>This solution is unlikely to deliver any wider benefits.</p>

<sup>103</sup> 'Your Partner for Nutrient Neutrality Solutions' (no date) CSG. Available at: <https://www.csg.co.uk/nutrient-neutrality> (Accessed: 24 November 2025).

<sup>104</sup> Natural Resources Wales (2025). *Register your septic tank or small sewage (package) treatment plant*. [Online] Available at: [https://naturalresources.wales/permits-and-permissions/water-discharges-and-septic-tanks/septic-tanks-and-private-sewage-systems/register-your-septic-tank-or-small-sewage-treatment-plant/?lang=en&utm\\_source=chatgpt.com](https://naturalresources.wales/permits-and-permissions/water-discharges-and-septic-tanks/septic-tanks-and-private-sewage-systems/register-your-septic-tank-or-small-sewage-treatment-plant/?lang=en&utm_source=chatgpt.com) (Accessed: 14 January 2026)

<sup>105</sup> Natural Resources Wales (2021) *Running and maintaining a septic tank or small sewage plant*. [Online] Available at: <https://naturalresources.wales/permits-and-permissions/water-discharges-and-septic-tanks/septic-tanks-and-private-sewage-systems/running-and-maintaining-a-septic-tank-or-small-sewage-plant?lang=en> (Accessed: 14 January 2026)

<sup>106</sup> Nutrient Credits - How to Guide (no date). Available at: [https://nutrient-credits.uk/guidance/how\\_to\\_guide.html](https://nutrient-credits.uk/guidance/how_to_guide.html) (Accessed: 19 December 2025).

<b>Maintenance and management requirements</b>	<p>In order to be accepted as a mitigation solution, there would need to be evidence that the PTP will need to be maintained and monitored throughout the development's lifetime and replaced with a new system of equal or better efficiency once it ceases to be operational<sup>107</sup>.</p> <p>The PTP needs to be maintained as advised by the manufacturer, but general annual maintenance includes<sup>107</sup>:</p> <ul style="list-style-type: none"> <li>• Servicing (e.g., pipe blockages).</li> <li>• Desludging.</li> <li>• Chemical dosing (if applicable).</li> <li>• Influent and effluent to make assumptions about nutrient loading to the drainage field.</li> <li>• PTPs should have detailed checks every 6 months<sup>108</sup>.</li> </ul> <p>The developer is required to keep a record of the checks completed when the tank is emptied for their own purposes and in case asked for the records by NRW or a prospective house buyer. These records must be kept for 5 years<sup>105</sup>.</p>
<b>Limitations / Concerns</b>	<p>The following limitations are associated with upgrading septic tanks for DIN mitigation:</p> <ul style="list-style-type: none"> <li>• If the system malfunctions and becomes non-compliant, the developer can face fines and costly upgrades.</li> </ul>
<b>Costs</b>	<p>PTPs are one of the most cost-effective nutrient mitigation solutions<sup>109</sup>. Indicative costs for the example PTPs mentioned in the nutrient removal section are provided below (these are indicative costs only and should not be relied upon).</p> <p>On average a PTP serving six people is estimated to cost around £7000 and operational costs, on average, are estimated to be £32,000 over 80 years<sup>50</sup>. A report published by Royal Haskoning<sup>50</sup> stated indicative costs for installing a PTP include capital expenditure of approximately £5000, followed by operational costs of between £100-200 per annum per PTP, depending on the product selected.</p>
<b>Securing nutrient mitigation</b>	<p>Developers will be required to demonstrate the PTP will be subject to legally secured ownership and responsibility, ensuring that operation, maintenance and compliance are defined. This may be secured through planning conditions, legal agreements, or other binding mechanisms as appropriate.</p> <p>In addition, a long-term maintenance and management plan must be provided, setting out inspection, servicing and desludging arrangements to ensure that the treatment performance is achieved.</p> <p>Where the PTP requires replacement or upgrade during the lifetime of the development, this must be undertaken in a manner that achieves as a minimum the same level of nitrogen removal performance as that assumed in the assessment. The mechanism by which this ongoing performance requirement is secured should be clearly defined and legally enforceable, to ensure that nutrient neutrality is not undermined over time.</p>
<b>Additional considerations</b>	<p>PTPs or septic tanks that discharge to ground should only be replaced by units that also discharge to ground, where conditions are appropriate for drainage<sup>110</sup>. For PTPs discharging to ground, developers should provide the results of infiltration testing with calculations to demonstrate that the drainage field size</p>

<sup>107</sup> Ricardo, 2024. Cumbria Nutrient Mitigation Solutions: [MSRFIN~1.PDF](#)

<sup>108</sup> Natural Resources Wales / Running and maintaining a septic tank or small sewage plant (no date). Available at: <https://naturalresources.wales/permits-and-permissions/water-discharges-and-septic-tanks/septic-tanks-and-private-sewage-systems/running-and-maintaining-a-septic-tank-or-small-sewage-plant/?lang=en> (Accessed: 22 December 2025).

<sup>109</sup> [https://www.lakedistrict.gov.uk/\\_data/assets/pdf\\_file/0018/62226/Guidance-note-on-the-Use-of-Package-Treatment-Plants-April-24-Final.pdf](https://www.lakedistrict.gov.uk/_data/assets/pdf_file/0018/62226/Guidance-note-on-the-Use-of-Package-Treatment-Plants-April-24-Final.pdf)

	<p>and design is appropriate for the volume of discharge proposed and follows the relevant British Standard.</p> <p>Failing systems should not be able to claim nutrient benefit or headroom beyond the default baseline for expected performance, i.e. poorly performing systems should not be rewarded.</p> <p>All septic tanks and PTPs undergo independent third-party testing that meet British Standards (BS EN 12566) and the certification sets out the mean concentration of the effluent from that system. Not all will have been tested for nitrogen as this is not a mandatory requirement of the British Standard, but where the certificate (or test results from the independent test if it was undertaken but not included on the certificate) can be provided, this is sufficient evidence of the concentrations that the effluent will achieve.</p> <p>Nutrient headroom (akin to the concept of 'credit') to enable development may be generated by larger scale developers by upgrading existing PTP and septic tank units in off-site properties. This could be the case where a developer proposing new houses might be able to replace septic tanks at existing neighbouring properties, or elsewhere provided the replaced units are appropriately located and it would be reasonable to connect to the public sewer<sup>110</sup>. Headroom can be calculated upfront, but maintenance is required to ensure efficacy in perpetuity<sup>107</sup>.</p> <p>Failing/poorly performing systems will not be able to claim nutrient headroom beyond the default baseline for expected performance<sup>110</sup>.</p>
<b>Long term performance</b>	Requires annual maintenance and emptying of sludge tanks, but with this performance should not deteriorate with time <sup>49</sup> .
<b>Type of measure in HRA terms</b>	Suitable tool for nutrient neutrality mitigation under Article 6(3), if appropriately evidenced and secured.

<sup>110</sup> Dorset Council: <https://www.dorsetcouncil.gov.uk/documents/35024/2469021/20230623+-+PTP+and+septic+tanks+-+DC+EA+and+NE+Guidance+note.pdf/4a910a5b-aae1-e7bd-ce0c-0bacf781a26b>



<p><b>Other regulatory requirement</b> (aside from the need to demonstrate compliance with the Habitats Regulations tests for neutrality at the Appropriate Assessment stage).</p>	<p>Hedgerow Regulations (2007) prevent the unnecessary removal of mature hedgerows.</p> <p>Dependent on scale of tree planting and change of land use, the developer may need to comply with the EIA Agricultural Regulations (Wales).</p> <p>The establishment of buffer strips in Wales does not require planning permission or any environmental permits when implemented as vegetative strips on agricultural land<sup>112</sup>. However, any associated physical works, structures or landscape changes should be checked with the local planning authority as these may constitute development requiring permission.</p> <p>Key considerations for adopting riparian buffers as a DIN mitigation solution specific to Welsh requirements<sup>113</sup>:</p> <ul style="list-style-type: none"> <li>• The Local Planning Authority has reviewed the proposal confirmed that it is possible to secure the mitigation in perpetuity.</li> <li>• Plant protection products must not be applied within 2 m of surface water.</li> <li>• Supplementary feeding must not occur within 10 metres of surface water.</li> <li>• Check that pesticides are not applied to the buffer strips.</li> <li>• Check the location of surface water and boreholes, springs and wells on the land before applying any plant protection products or undertaking any supplementary feeding.</li> <li>• Ensure that the buffer strips are wide enough to prevent any run-off or pollution (where appropriate this may require buffer strips to be wider than the minimum requirements).</li> <li>• Produce, update and keep a map the location of surface water and buffer strips so that it can be consulted prior to applying any pesticides or undertaking any supplementary feeding.</li> </ul> <p>General considerations that may be considered for adopting riparian buffers as a DIN mitigation solution<sup>111</sup>,</p> <ul style="list-style-type: none"> <li>• Evidence statement that the proposed buffer strip will not have an adverse impact on, or hinder restoration of, any protected sites or species or negatively affect existing habitats, or ability to achieve other environmental objectives.</li> <li>• The proposal should show how soils and hydrology at the deployment location won't compromise the efficiency of the riparian buffer.</li> <li>• The proposal should consider and ensure that the local hydrogeological conditions means that the source of nutrients doesn't bypass the buffer.</li> <li>• That the buffer is not required through another legal obligation.</li> </ul>
<p><b>Time to effectiveness</b></p>	<p>Once vegetation has established.</p>
<p><b>Nutrient removal rate</b></p>	<p>The nutrient removal efficiency of riparian buffer strips is highly dependent on buffer width, soil conditions, and hydrology. Wider buffers generally provide greater nutrient reduction due to increased infiltration, sedimentation, and plant uptake.</p> <p><b>Riparian buffer:</b> Total nitrogen removal can vary between 10% and 99% depending on width<sup>49</sup>.</p> <p><b>Field margin or forestry buffers:</b> Nitrate removal from around 25% to 100%<sup>49</sup>.</p>

<sup>112</sup> Welsh Government (2025). *Cross compliance: establishment of buffer strips (GAEC 1) (2025)*. [Online] Available at: <https://www.gov.wales/cross-compliance-establishment-buffer-strips-gaec-1-2025-html> (Accessed: 15 January 2026).

<sup>113</sup> Carmarthenshire County Council (2026). *Nutrient Management in Planning and Development*. [Online] Available at: <https://www.carmarthenshire.gov.wales/home/council-services/planning/nutrient-management-in-planning-and-development/further-information-and-questions/#> (Accessed: 15 January 2026).

	<p>Nitrate removal efficiency from 10% to 36% depending on width, soil, and crop type<sup>114</sup>.</p> <p>Sweeney and Newbold<sup>115</sup> reviewed literature on forested buffers and found median reported subsurface nitrate removal was enhanced from 55% at &lt;40m width to 89% at &gt;40m widths.</p> <p>For nitrogen removal the water table needs to be at least in the root zone of the trees.</p> <p>The nutrient removal efficiency is similar regardless of the location of riparian buffer strips (in field, field margins, riparian corridor) due to the overall chemical and physical removal processes active in these systems.</p>
<p><b>Wider benefits</b></p>	<p>The wider benefits include:</p> <ul style="list-style-type: none"> <li>• Aesthetic value.</li> <li>• Flood mitigation.</li> <li>• Biodiversity.</li> <li>• Connectivity for the movement of forest species.</li> <li>• Soil health.</li> <li>• Carbon sequestration.</li> <li>• Bank stabilisation.</li> <li>• Riparian shade.</li> </ul>
<p><b>Maintenance and management requirements</b></p>	<p>There is likely to be a need for a moderate amount of maintenance required for field boundary management measures:</p> <ul style="list-style-type: none"> <li>• Seasonal maintenance (e.g., vegetation removal) required to prevent buffer strip becoming a source of nutrient export.</li> <li>• Regular visual inspections and repeat photography will support early identification of any requirements for adaptive management and may help to highlight conditions whereby the nutrient removal being delivered could start to reduce; for example, problems related to vegetation or bank erosion<sup>116</sup>.</li> </ul>
<p><b>Limitations / Concerns</b></p>	<p>The limitations with adopting field boundary management for DIN mitigation include:</p> <ul style="list-style-type: none"> <li>• Understanding of baseline nutrient load within the receiving environment prior to riparian buffer strip implementation is needed to provide the loading value to which the nutrient removal efficiency percentages can be applied to demonstrate nutrient benefit<sup>116</sup>. This can be achieved by scheme specific monitoring or modelling but can be a significant task to achieve.</li> <li>• Implementation is needed at scale which is challenging due to landowner permissions.</li> <li>• If placed in a livestock field, then the area will need to be fenced.</li> <li>• Reduces the size of a field or may require displacement of animals to another field.</li> <li>• Limits access to watercourses for maintaining flood embankments, water supply and crossings.</li> <li>• Potential for excessive shade.</li> </ul>

<sup>114</sup> Lloyd, P., Mant, J., Yellowlees, R., Connor-Streich, G., Jones, C. 2024. Evidence base development for nature-based nutrient mitigation solutions. NECR538. Natural England.

<sup>115</sup> Sweeney BW and Newbold JD. 'Streamside Forest Buffer Width Needed to Protect Stream Water Quality, Habitat, and Organisms: A Literature Review' JAWRA Journal of the American Water Resources Association, 2014. 50(3): pages 560-584

<sup>116</sup> Natural England (2024). *Information on How to Deliver and Assess Riparian Buffer Strips for Nutrient Mitigation*. [Online] Available at: <https://publications.naturalengland.org.uk/file/4552090828144640>. (Accessed 15 January 2025).

	<ul style="list-style-type: none"> <li>• Potential to deflect watercourse flows, increasing wetness, and loss of local land.</li> <li>• There is a risk that changes in land management, including crop type or cessation of agricultural use, could reduce or negate the nutrient mitigation benefit attributed to buffer strips, particularly where nutrient loading assumptions are based on current farming practices.</li> <li>• Plant protection products must not be applied within 2 m of surface water and supplementary feeding must not occur within 10 m of surface water.</li> </ul>
<b>Costs</b>	Overall cost is considered low <sup>49</sup> . However, the cost of establishment can be variable due to fluctuations in costs for materials and dependent on buffer size/length. There are also potential long-term management costs.
<b>Securing nutrient mitigation</b>	<p>Where buffer strips are implemented, long-term nutrient mitigation relies on maintaining the strip in a way that prevents changes which could reduce effectiveness.</p> <p>Establishing vegetation early provides evidence that the buffer is functional and maintained. Legal agreements or management plans that prevent ploughing, cropping, or the application of plant protection products/supplementary feeding within the required distances, combined with ongoing monitoring and reporting of farming practices, offer a practical method to demonstrate the buffer will remain effective in perpetuity and secure the nutrient mitigation benefit.</p>
<b>Additional Considerations</b>	Nutrient headroom (akin to 'credits') can potentially be generated by reducing nutrient outputs to below quota targets, whereby the lower the nutrient output of a source, the greater number of quota targets are met, and nutrient headroom created. Therefore, should a riparian buffer strip outperform its predicted design capacity, this will be identified by the monitoring process and allow the additional nutrient removal to be used as nutrient headroom <sup>49</sup> .
<b>Long term performance</b>	<p>Performance can be kept at optimum with a well-established maintenance schedule, such as visual inspections and seasonal maintenance. The period and regularity of inspections will depend on the nature of the scheme and location, and whether other schemes are likely to be implemented<sup>111</sup>.</p> <p>Riparian buffer strips provide good certainty where they involve tree planting and fencing off from existing fields, meaning that land use will be maintained and not revert to agriculture. However, this needs to be secured in perpetuity.</p>
<b>Type of measure in HRA terms</b>	Suitable tool for nutrient neutrality mitigation under Article 6(3), if appropriately evidenced and secured, and not being implemented as part of existing Article 6(2) requirements.

## A.9 Water efficiency measures

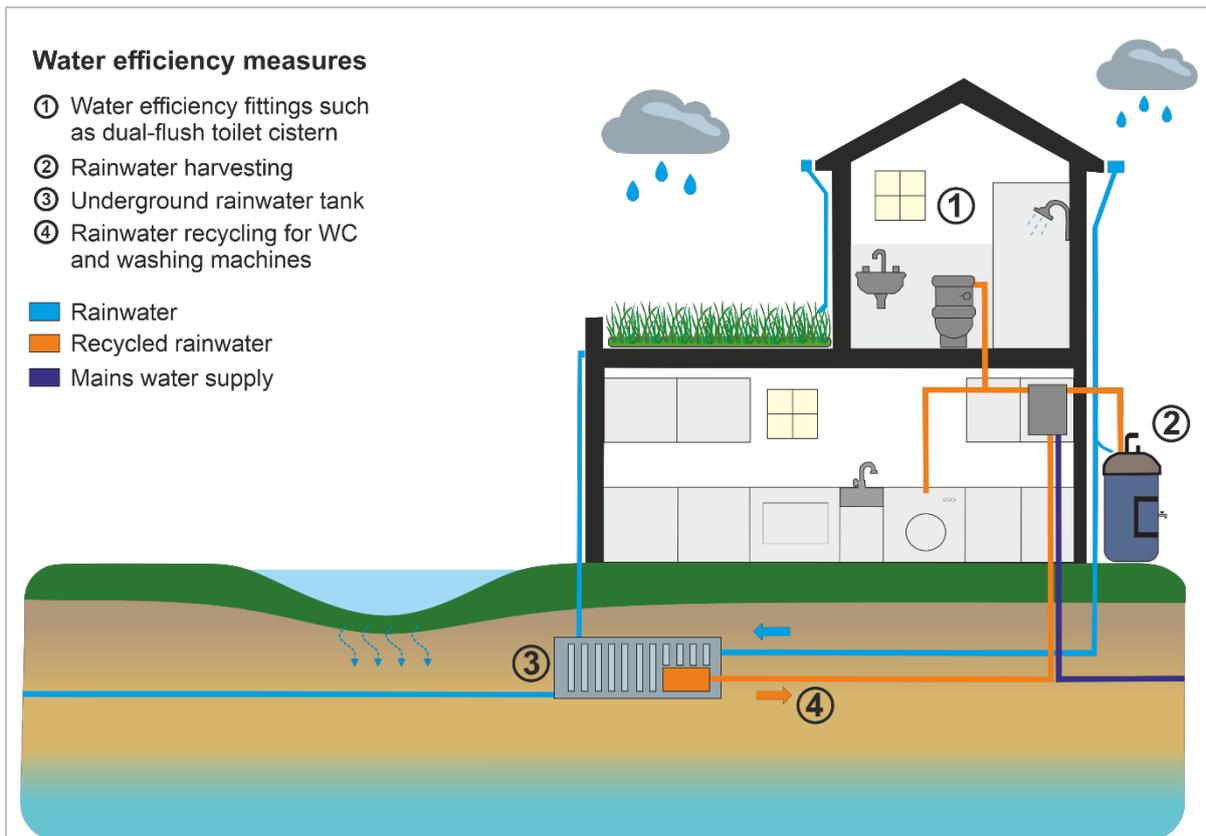


Figure A-10 Schematic of some water efficiency measures in a single dwelling.

### Description

Water efficiency measures rely on increased water usage efficiency in households to reduce the volume of wastewater (containing DIN loads) generated by single households<sup>74</sup>. This allows the water efficiency values used in Stage 1 of the nutrient budget calculator to be lowered from the 120 l/p/d which is generally used as a default precautionary value, and result in nutrient reductions.

New developers can secure lower water use efficiencies for their properties through water efficiency measures, while some LPAs in England have used this approach at scale (off-site) through retro-fitting council-owned properties to create a 'bank' of mitigation credits to allow housing to be built<sup>117</sup>.

This is most successfully undertaken through control of the flow rate entering a property, using a flow control device to a specified rate, as this reduces the risk of low water use fittings and fixings being removed overtime.

Other approaches include use of greywater recycling equipment to reduce the sewage outflow. Greywater is wastewater from showers, baths, washbasins, washing machines and kitchen sinks.

Rainwater harvesting can be undertaken for internal water use (i.e., WCs, washing machines).

Low-flow fixtures can be installed on numerous household appliances, including toilets, showerheads, and faucets designed to use less water than conventional models while maintaining good performance<sup>118</sup>.

<sup>117</sup> Ashford Borough Council (2024) Ashford Borough Council partners with Cenergist to help tenants save money and water and help protect the local environment. Available at: [Ashford Borough Council partners with Cenergist to help tenants save money and water and help protect the local environment](https://www.ashford.gov.uk/news/ashford-borough-council-partners-with-cenergist-to-help-tenants-save-money-and-water-and-help-protect-the-local-environment)

<sup>118</sup> Scalers, S. (2025) 'Low-Flow Fixture Installation: Save Water & Cut Bills', Splash Plumbing, 20 June. Available at: <https://www.splashplumbing.com/what-are-low-flow-fixtures-and-should-you-switch-this-summer-5-essential-benefits-for-water-conservation/> (Accessed: 19 December 2025).

<p><b>Other regulatory requirement</b> (aside from the need to demonstrate compliance with the Habitats Regulations tests for neutrality at the Appropriate Assessment stage).</p>	<p><b>Building Regulations 2010:</b> Approved Document G Sanitation, hot water safety and water efficiency (see G2 Water Efficiency)<sup>119</sup>.</p> <p>For rainwater harvesting, developers should discuss project specific needs and specifications with a supplier who is a member of UKWRA (UK Water Reuse Association). There are a range of rainwater harvesting solutions that meet <a href="#">BS EN 16941-1:2024 One-Site non-potable water systems – Systems for the use of rainwater</a> with compliant tanks from various materials, free standing or below ground<sup>120</sup>.</p>
<p><b>Time to effectiveness</b></p>	<p>Rainwater harvesting immediate after activation.</p> <p>Low-flow fixtures immediate upon installation.</p>
<p><b>Nutrient removal rate</b></p>	<p>If used for toilet flushing, a well-designed greywater system could save a third of the mains water<sup>121</sup>. Dual-flush toilet cistern likely reduces water use by between around 2% and 27%<sup>122</sup>.</p> <p>Installation of smart meters can result in household water usage (and waste production) between around 12-17% post installation<sup>123</sup>.</p> <p>Using low-flow fixtures can reduce water usage by around 30% to 50%<sup>118</sup>.</p> <p>As an example of nutrient reduction, using the All Wales nutrient budget calculator, a 1-bedroom house in the Pembrokeshire County Council area discharging to a PTP (using the default permitted discharge limit values) with default occupancy (2.22 persons per home) and a water efficiency of 120 l/p/d would generate 7.09 kg N/yr. Reducing water efficiency to 60 l/p/d would reduce water use to 3.55 kg N/yr with all other inputs unchanged.</p> <p>Evidence from manufacturers for stated performance statistics should be provided within a nutrient neutrality assessment and mitigation strategy to provide sufficient certainty for the Competent Authority.</p>
<p><b>Wider benefits</b></p>	<p>The wider benefits associated with adopting water efficiency measures includes:</p> <ul style="list-style-type: none"> <li>• Water resource efficiency.</li> <li>• Lower carbon footprint.</li> <li>• Greywater recycling reduces water supply and wastewater bills.</li> <li>• Reduces energy bills (e.g., using and heating less water)<sup>123</sup>.</li> </ul>
<p><b>Maintenance and management requirements</b></p>	<p>Water efficiency devices will need regular inspection and maintenance to ensure that the projected efficiency standards are maintained in perpetuity. The Competent Authority is likely to require evidence of this (e.g. submission of maintenance / monitoring outputs).</p>
<p><b>Limitations / Concerns</b></p>	<p>The main limitation associated with this mitigation solution is that it is difficult to enforce and manage (e.g. homeowner can replace fixtures and fittings) and thus regular evidence of compliance is needed that is legally secured regardless of whether home ownership changes.</p>
<p><b>Costs</b></p>	<p>Some indicative costs for water efficiency measures are as follows:</p>

<sup>119</sup> Welsh Government 2010 Building Regulations Approved Document G Sanitation, hot water safety and water efficiency Approved document part G (sanitation, hot water safety and water efficiency)

<sup>120</sup> [https://kb.goodhomes.org.uk/wp-content/uploads/2025/07/Water-Guide-GHA-July-2025\\_FINAL.pdf](https://kb.goodhomes.org.uk/wp-content/uploads/2025/07/Water-Guide-GHA-July-2025_FINAL.pdf)

<sup>121</sup> (No date) 'Greywater for domestic users: an information guide'.

[https://sswm.info/sites/default/files/reference\\_attachments/ENVIRONMENT%20AGENCY%202011%20Greywater%20for%20Domestic%20Users.pdf](https://sswm.info/sites/default/files/reference_attachments/ENVIRONMENT%20AGENCY%202011%20Greywater%20for%20Domestic%20Users.pdf)

<sup>122</sup> Gov UK (no date). *The Effectiveness of Converting WCs to Dual Flush* [Online] Available at:

<https://assets.publishing.service.gov.uk/media/5a7c369140f0b67d0b11f9f1/sw6-011-ts-e-e.pdf>

<sup>123</sup> [https://waterwise.org.uk/app/uploads/2024/09/J37880-Waterwise\\_Water\\_Efficiency\\_Strategy\\_Inners\\_Landscape\\_WEB.pdf](https://waterwise.org.uk/app/uploads/2024/09/J37880-Waterwise_Water_Efficiency_Strategy_Inners_Landscape_WEB.pdf)

	<ul style="list-style-type: none"> <li>• <b>Flow control device:</b> Evidence that utility bills cut by up to £360<sup>124</sup>. Range of products available, manufacturers to provide instrumentation quotes.</li> <li>• <b>Dual-flush toilet cistern:</b> Prices can vary, typically ranging from £30 for basic concealed units to over £100 for higher-end ceramic or complete close-coupled sets.</li> <li>• <b>Rainwater harvesting tank (for a single dwelling):</b> can vary depending on size varying from under £100 for basic water butts, to larger harvesting systems extending to between £2,000 to £4,000 (e.g. 1,500 – 7,500 litres).</li> </ul>
<b>Securing nutrient mitigation</b>	<p>For sufficient certainty, the Competent Authority will require evidence that a Maintenance and Monitoring Plan is secured and will remain in place upon sale of any affected property via a legal agreement.</p> <p>Regular data submissions to the LPA may be required to show metered water levels and evidence of appliance checks to demonstrate that the water efficient fittings are performing to the required standard to achieve the stated nutrient reductions.</p>
<b>Additional considerations</b>	<p>For rainwater harvesting, the choice of tank should be tailored to the specific site conditions, considering factors such as structural loading, ease of transportation, and installation requirements. It is essential to define the specifications for the tank, collection area, filtration system, pump, and control unit early in the design process to ensure cost efficiency and alignment with the development's requirements<sup>120</sup>.</p>
<b>Long term performance</b>	<p>Long term performance dependent on maintenance and/or replacement of water efficient devices. Appropriate maintenance and replacement schedule would ensure nutrient savings are secured in perpetuity.</p>
<b>Type of Measure in HRA terms</b>	<p>Suitable tool for nutrient neutrality mitigation under Article 6(3), if appropriately evidenced and secured.</p>

<sup>124</sup> Cenergist (2026). Reducing Energy Bills. [Online] Available at: <https://www.cenergist.com/water/reducing-energy-bills/>

## A.10 Enhanced drainage ditch management



**Figure A-11 Drainage ditch.**

<p><b>Description</b></p>	<p>Enhanced drainage ditch management is a method for managing agricultural drainage ditches and small watercourses in rural areas for nutrient benefits<sup>125</sup>. Enhanced drainage ditch management combines<sup>126</sup>:</p> <ul style="list-style-type: none"> <li>• Two-stage channel cross-sections (i.e., floodplains constructed alongside channelised ditches).</li> <li>• Low-grade weirs.</li> <li>• Allowing ditches to be vegetated.</li> </ul> <p>The combination of these three approaches within a single channel aims to increase hydraulic residence time within the drainage network, promoting a suite of natural processes that reduce onward nutrient transport, helping nutrients to become locked away in sediment or as part of organic matter (that may be removed periodically during routine maintenance). The design of the enhanced drainage ditch approach was developed by Greenshank Environmental and endorsed by Natural England<sup>126</sup>. In Wales, it will be necessary to engage with the relevant LPA on a case-by-case basis to ascertain suitability for a development.</p>
<p><b>Other regulatory requirement</b> (aside from the need to demonstrate compliance with the Habitats Regulations tests for neutrality at the Appropriate Assessment stage).</p>	<p>Regulatory requirements may include, but are not limited to, the following:</p> <ul style="list-style-type: none"> <li>• <a href="#">Environmental permits</a>.</li> <li>• Flood risk assessment.</li> <li>• Flood defence consent.</li> <li>• Wildlife licences.</li> <li>• Planning permission.</li> <li>• Ordinary watercourse consent.</li> </ul>
<p><b>Time to effectiveness</b></p>	<p>Typically, within the first growing season once vegetation establishes.</p>
<p><b>Nutrient removal rate</b></p>	<p>Total nitrogen load reductions range from around 10% to 77%, depending on climate, flow, and design. Analysis indicates that the highest nutrient removal efficiencies are likely to be achieved where multiple Best Management Practices</p>

<sup>125</sup> Natural England. (no date) NECR590 Edition 1 Enhanced Drainage Ditch Management: A framework approach for nutrient neutrality - NECR590, Natural England - Access to Evidence. Available at: <https://publications.naturalengland.org.uk/publication/5530993254203392> (Accessed: 12 December 2025).

<sup>126</sup> Enhanced Drainage Ditch Management for Nutrient Transport Reduction (no date). Available at: <https://www.greenshank-environmental.com/blog/enhanced-drainage-ditch-management-for-nutrient-transport-reduction> (Accessed: 12 December 2025).

	<p>(BMPs) are implemented in combination within a single drainage ditch. Optimised designs should therefore incorporate all three BMPs identified above, as their combined application improves flow attenuation, residence time and overall confidence in nutrient mitigation delivery<sup>126</sup>.</p> <p><b>Precautionary estimate:</b> 28% total nitrogen reduction<sup>126</sup>.</p>
<b>Wider benefits</b>	<p>The wider benefits for adopting enhanced drainage ditch management for DIN mitigation include:</p> <ul style="list-style-type: none"> <li>• Natural flood management.</li> <li>• Biodiversity improvements.</li> <li>• Water resource management.</li> </ul>
<b>Maintenance and management requirements</b>	<p>Enhanced drainage ditch management requires ongoing maintenance that may include:</p> <ul style="list-style-type: none"> <li>• Periodic sediment removal to maintain capacity.</li> <li>• Vegetation management (mowing, weed control or removal when overgrown).</li> <li>• Inspections after high-flow events for structural integrity.</li> <li>• Adaptive vegetation management to balance habitat and hydraulic performance.</li> </ul>
<b>Limitations / Concerns</b>	<p>The following limitations are associated with adopting enhanced drainage ditch management schemes:</p> <ul style="list-style-type: none"> <li>• Requires permanent loss of agricultural land.</li> <li>• Unsuitable for large (&gt;5 m wide) or high-energy channels.</li> <li>• Slopes &gt;3% require engineered weir spacing<sup>125</sup>.</li> <li>• Risk of groundwater contamination in <a href="#">Source Protection Zone</a>.</li> <li>• High-intensity rainfall may damage structures (weirs)<sup>126</sup>.</li> <li>• Increased surface-groundwater connectivity may mobilise other pollutants<sup>126</sup>.</li> </ul>
<b>Costs</b>	<p>While installation costs will vary for each project, depending on ditch length, excavation requirements, weir installation and planting, enhanced drainage ditch management is generally expected to have lower capital costs than more land-intensive approaches such as land use change or the creation of constructed wetlands, which typically require larger areas of land and more extensive earthworks.</p>
<b>Securing nutrient mitigation</b>	<p>To justify the costs of deploying an enhanced drainage ditch management scheme, a desk-based approach is needed to estimate the potential nutrient reduction, following the methodology of Strock (2025):</p> <ul style="list-style-type: none"> <li>• Delineate the catchment draining to a ditch.</li> <li>• Identify the land uses in the catchment.</li> <li>• Link land uses to Farmscoper<sup>127</sup> export coefficients describing nutrient export from each land use. Farmscoper is a decision support tool to assess and reduce diffuse agricultural pollution. However, Farmscoper has limitations in the Welsh context, as most assumptions and data are tailored to England. It is recommended to use the tool alongside other methods, and developers may consider analysing comparable catchments in England.</li> </ul>

<sup>127</sup> ADAS, Farmscoper: Decision support tool to assess and reduce diffuse agricultural pollution. Available at: <https://adas.co.uk/services/farmscoper/>

	<ul style="list-style-type: none"> <li>• Calculate the total nutrient export from land use in the catchment, which is the nutrient input to the scheme.</li> <li>• Apply precautionary 28% reduction to estimate mitigation potential.</li> </ul>
<p><b>Additional considerations</b></p>	<p>Proposals for enhanced drainage ditch management that will have high confidence and be able to claim the estimated nutrient savings will have to provide all the required information for:</p> <p><b>Design objective:</b> proposals should define the sources of nutrients to the scheme, estimate the baseline nutrient load input (using monitoring data, the <a href="#">recommended modelling approach</a>, or other modelling, with detailed justification), and show how nutrient credits have been calculated.</p> <p><b>Feasibility:</b> the proposal must include information on the following requirements:</p> <ul style="list-style-type: none"> <li>• Topography and levels.</li> <li>• Geology and hydrogeology.</li> <li>• Soil and sediment.</li> <li>• Flood risk.</li> <li>• Protected site, species and invasive non-native species.</li> <li>• Land use and ownership.</li> <li>• Rights of way and public access.</li> <li>• Bird strike risk.</li> <li>• Nature recovery.</li> <li>• Services and infrastructure.</li> <li>• Regulatory considerations.</li> </ul> <p><b>Design process:</b> It is recommended that proposals should adhere to the <a href="#">design criteria</a> listed by Natural England<sup>125</sup>. However, for Wales early liaison is required with the LPA to determine suitability of the approach for a development.</p> <p><b>Implementation plan:</b> should show sufficient consideration to how the scheme will be implemented, providing information on:</p> <ul style="list-style-type: none"> <li>• Site clearance and earthworks.</li> <li>• Vegetation establishment and management.</li> <li>• Outline management plan.</li> </ul> <p><b>Post-implementation monitoring:</b> drainage ditch management schemes will require monitoring to ensure the system maintains its original design (i.e., visual inspections, fixed-point photography), but proposals will not need to use monitoring to validate the number of nutrient credits claimed.</p>
<p><b>Nutrient credits</b></p>	<p>Credits can be claimed based on estimated nutrient reduction; additional credits possible if performance monitoring demonstrates higher removal<sup>125</sup>.</p>
<p><b>Long term performance</b></p>	<p>The process of nitrogen removal from agricultural drainage is dependent on microbial denitrification<sup>127</sup>, which will exhibit variable rates depending on seasonal climate and the residence time (i.e., improved removal under low-flow and warmer conditions). However, an average 28% nitrogen reduction performance can be assumed, provided the above requirements are undertaken and evidenced.</p>
<p><b>Type of measure in HRA terms</b></p>	<p>Suitable tool for nutrient neutrality mitigation under Article 6(3), if appropriately evidenced and secured. However, NRW nutrient neutrality guidance does not specifically endorse the use of enhanced drainage ditch management measures to offset development under Article 6(3) and so this would be considered on a case-by-case basis.</p>



## A.11 Removal of surface water/wastewater from the affected catchment

<b>Description</b>	<p>In some cases, it may be possible to discharge or infiltrate surface water to a river or aquifer that is not hydrologically connected to the affected site. This may be appropriate to developments close to the border of a nutrient neutrality catchment.</p> <p>Removal of wastewater via tankering to a WwTW in a non-nutrient neutrality affected catchment is also an option, subject to the acceptance of this by DCWW who will review proposals on a case by case basis. Nonetheless, a connection to mains should always be pursued where at all possible.</p> <p>These options reduce DIN loading to the impacted waterbody/area.</p>
<b>Other regulatory requirement</b> (aside from the need to demonstrate compliance with the Habitats Regulations tests for neutrality at the Appropriate Assessment stage).	<p>The discharge of surface water into a river or aquifer will require:</p> <ul style="list-style-type: none"> <li>• <a href="#">Permit to discharge to surface water and groundwater</a>.</li> <li>• <a href="#">H1 Environmental Risk Assessment</a>.</li> </ul> <p>To tanker wastewater, developers must<sup>128</sup>:</p> <ul style="list-style-type: none"> <li>• Demonstrate site suitability for tankering.</li> <li>• Confirm receiving WwTW has capacity and meets treatment standards.</li> <li>• Comply with all applicable waste management regulations and the <a href="#">Waste Duty of Care Code of Practice</a><sup>129</sup>.</li> </ul>
<b>Time to effectiveness</b>	<p>Immediate upon diversion or commencement of tankering, with DIN load reduction occurring as soon as flows are removed from the affected hydrological network.</p>
<b>Nutrient removal rate</b>	<p>Effectively achieves 100% removal of DIN from diverted volume, determined by flow and concentration metrics.</p>
<b>Wider benefits</b>	<p>The wider benefits associated with removal of surface water/wastewater from the affected catchment include:</p> <ul style="list-style-type: none"> <li>• Rapid nutrient-neutral compliance.</li> <li>• May provide interim mitigation while permanent solutions are implemented.</li> <li>• May reduce pressure on overloaded local WwTWs.</li> </ul>
<b>Maintenance and management requirements</b>	<p>The following maintenance and management requirements are likely expected with adopting these solutions:</p> <ul style="list-style-type: none"> <li>• Regular inspection and servicing of diversion infrastructure (pumps, valves, pipework).</li> <li>• Maintain accurate records of volumes diverted or tankered, including dates and receiving WwTW details.</li> <li>• Periodic review of permits and capacity agreements with WwTW.</li> </ul>
<b>Limitations / Concerns</b>	<p>The removal of wastewater via tankering to a WwTW outside the affected catchment is a complex and costly process<sup>130</sup>, with the following limitations:</p> <ul style="list-style-type: none"> <li>• Risk of environmental overflow during pump or tanker failure.</li> <li>• Frequent tanker movements may cause noise and disruption.</li> </ul>

<sup>128</sup> <https://www.folkestone-hythe.gov.uk/downloads/file/2025/id-333873-3-mm7>

<sup>129</sup> <https://www.gov.uk/government/publications/waste-duty-of-care-code-of-practice>

<sup>130</sup> <https://www.watercorporation.com.au/-/media/WaterCorp/Documents/Developing-and-Building/Subdividing/Wastewater-tankering.pdf>

	<ul style="list-style-type: none"> <li>• High financial liability and ongoing operational costs.</li> <li>• Shared tankering points can lead to scheduling conflicts.</li> <li>• Dependent on WwTWs capacity.</li> <li>• Carbon emissions and air quality impacts from transportation, and the option is not self-sustaining and subject to outside issues / influences.</li> <li>• Requires robust contingency planning for breakdowns or extreme weather.</li> <li>• Risk that the catchment into which the receiving WwTW is located is also classified as affected by nutrient neutrality restrictions.</li> </ul>
<b>Costs</b>	<p>There is an application charge to cover the costs of determining permits, as well as an annual fee<sup>131</sup>.</p> <p>Tankering costs vary by distance and volume, which are typically charged per load.</p> <p>Infrastructure costs for diversion (pipework, pumps) depend on proximity to discharge point or tanker access. Over the long term, this option is likely to incur greater costs than measures such as SuDS or PTP upgrades. It would typically be considered a mid to high cost mitigation option, with overall cost dependent on the length of time for which the measure is implemented.</p>
<b>Securing nutrient mitigation</b>	<p>Developers must provide evidence of permanent removal, including flow data, agreements with receiving WwTW, and compliance documentation.</p>
<b>Additional considerations</b>	<p>Developers must ensure that they are not displacing environmental impacts to adjacent catchments.</p> <p>Developers may need to assess cumulative effects on receiving water bodies.</p> <p>Tanker transport routes should avoid <a href="#">Air Quality Management Areas</a>, and potentially other sensitive locations.</p>
<b>Long term performance</b>	<p>Effective indefinitely if infrastructure is maintained and permits remain valid. Performance depends on WwTW capacity and ongoing compliance with applicable environmental regulations.</p>
<b>Type of measure in HRA terms</b>	<p>DCWW will review appropriateness of this approach on a 'case by case' basis. Suitable tool for nutrient neutrality mitigation under Article 6(3), if accepted by DCWW and appropriately evidenced and secured.</p>

<sup>131</sup> Natural Resources Wales / Guidance on applying for and complying with water discharge permits (no date). Available at: <https://naturalresources.wales/permits-and-permissions/water-discharges-and-septic-tanks/discharges-to-surface-water-and-groundwater/guidance-on-applying-for-and-complying-with-water-discharge-permits/?lang=en> (Accessed: 19 December 2025).

## A.12 Willow systems



Figure A-12 Willow planting.

<b>Description</b>	Willow systems are wetland basins that are dominated by willows, for 100% evapotranspiration to air in summer and full storage in winter. They are designed to treat all inflow water through evapotranspiration and therefore there are no outlets from the system <sup>8</sup> .
<b>Other regulatory requirement</b> (aside from the need to demonstrate compliance with the Habitats Regulations tests for neutrality at the Appropriate Assessment stage).	<p>Developers must comply with the following key requirements:</p> <ul style="list-style-type: none"> <li>• Environmental Impact Assessment Agriculture Regulations (Wales) - applies to permanent land use changes and may require a “screening decision from Welsh Government”.</li> <li>• This mitigation measure may require an Environmental Permit.</li> <li>• Planning permission may be required through the LPA.</li> <li>• Any harvesting will need to comply with the Wildlife and Countryside Act 1981.</li> </ul>
<b>Time to effectiveness</b>	Uptake rates could be poor initially, but this will improve with time as the willows get larger and their growth rates increase.
<b>Nutrient removal rate</b>	Willow systems can achieve high total nitrogen removal efficiencies, reported to be up to approximately 85% to 100%.
<b>Wider benefits</b>	<p>The wider benefits for adopting willow systems for DIN mitigation include:</p> <ul style="list-style-type: none"> <li>• Carbon sequestration.</li> <li>• Aesthetic value.</li> <li>• Flood mitigation.</li> <li>• Biodiversity enhancement and pollination.</li> <li>• Biomass production.</li> <li>• Recreational value.</li> </ul>
<b>Maintenance and management requirements</b>	<b>Biomass harvesting:</b> half to one third of the system will need to be harvested every two to three years. A comprehensive maintenance plan including silt removal measures will need to be submitted as part of the design.

<b>Limitations / Concerns</b>	There is little information available on regulations. Suspended sediment will accumulate and need to be periodically removed and disposed of.
<b>Costs</b>	The overall costs of willow systems are generally low.
<b>Securing nutrient mitigation</b>	<p>Where willow systems are implemented, long-term nutrient mitigation relies on maintaining the system in a way that prevents changes which could reduce effectiveness.</p> <p>Establishing willows early provides evidence that the system is functional. Legal agreements or management plans, combined with ongoing monitoring, offer a practical method to demonstrate the system will remain effective in perpetuity and secure the nutrient mitigation benefit.</p>
<b>Additional considerations</b>	As willow systems produce high biomass, they have the potential to create a new energy/economy stream.
<b>Long term performance</b>	Willow systems will improve with time as willow growth rates increase. High longevity (assuming the willow system is secured in perpetuity through S106 agreements) and certainty if it is possible to secure monitoring to confirm that this is maintained.
<b>Type of measure in HRA terms</b>	Suitable tool for nutrient neutrality mitigation under Article 6(3), if appropriately evidenced and secured.

## A.13 Nutrient credits

<p><b>Description</b></p>	<p>Nutrient credits allow developers (or LPAs at a strategic level) to offset nutrient pollution (e.g., DIN) generated by development by funding off-site mitigation activities such as creating wetlands, woodlands, or other land-use changes that reduce nutrient loading. This approach balances nutrient inputs to sensitive catchments and supports compliance with SAC requirements.</p> <p>In Wales, there is currently (March 2026) no standardised nutrient credit system for nutrient neutrality for development in the marine SAC catchments requiring nitrogen neutrality. Nonetheless, affected LPAs and Welsh Government are exploring strategic scale solutions and so it is anticipated that credit systems will be available in due course. Developers should frequently visit LPA websites for updates in this regard.</p> <p>There is precedence in England for implementation of credit schemes in marine SAC catchments. Numerous LPAs operate credit schemes on a continuous basis, meaning applications can be made at any time until the available credits run out. Credits are calculated on an offset per year basis in units of kg/year. Developers must first calculate their nutrient budget using the relevant catchment-specific Nutrient Budget Calculator<sup>132</sup> and then apply to the relevant credit scheme.</p>
<p><b>Other Regulatory Requirement</b> (aside from the need to demonstrate compliance with the Habitats Regulations tests for neutrality at the Appropriate Assessment stage).</p>	<p>No credit system is currently available in Wales and so regulatory requirements are to be determined.</p>
<p><b>Time to Effectiveness</b></p>	<p>Credits are effective immediately upon allocation, as they represent mitigation already secured and operational<sup>133</sup>.</p>
<p><b>Nutrient Removal Rate</b></p>	<p>Developers can calculate their nutrient budget using the Nutrient Budget Calculator for the relevant catchment. Credits are issued in kg/year, matching the nutrient load requiring offset.</p>
<p><b>Wider Benefits</b></p>	<p>The wider benefits of strategic schemes can be found in previous sections of this guide, but generally include:</p> <ul style="list-style-type: none"> <li>• Habitat creation and biodiversity enhancements.</li> <li>• Carbon sequestration from woodland and wetland schemes.</li> <li>• Flood risk reduction.</li> </ul>
<p><b>Maintenance and management requirements</b></p>	<p>The developer has no direct responsibility for maintaining the mitigation land. This obligation lies with the credit provider, who must ensure compliance for the agreed duration (80–125 years).</p> <p>Developers must retain documentation proving credit purchase and linkage to their development.</p>
<p><b>Limitations / Concerns</b></p>	<p>The limitations and concerns associated with mitigating DIN by buying nutrient credits include:</p> <ul style="list-style-type: none"> <li>• Limited availability of credits in high-demand SAC catchments.</li> </ul>

<sup>132</sup> Nutrient Neutrality | Greenshank Environmental (no date). Available at: <https://www.greenshank-environmental.com/nutrient-neutrality> (Accessed: 19 December 2025).

<sup>133</sup> Terms and conditions: nutrient mitigation scheme (no date) GOV.UK. Available at: <https://www.gov.uk/government/publications/natural-englands-nutrient-mitigation-scheme-for-developers/terms-and-conditions-nutrient-mitigation-scheme> (Accessed: 22 December 2025).

	<ul style="list-style-type: none"> <li>• High upfront cost per dwelling.</li> <li>• Efficacy of nutrient offset by nutrient credit schemes is debated<sup>134</sup>.</li> <li>• Credits do not absolve developers from demonstrating nutrient neutrality in planning documents.</li> </ul>
<b>Costs</b>	<p>Nutrient credit costs in England typically range from £2,500 to £7,000 per dwelling, depending on catchment and nutrient type<sup>132</sup>. Likely costs for future schemes in Wales are unknown at the time of publication of this document.</p> <p>Additional administration fees may apply.</p>
<b>Securing nutrient mitigation</b>	<p>Once credit schemes are available, identify a nutrient credit scheme operating within the same SAC catchment as the development. Next, confirm that the scheme delivers reductions for the same nutrient.</p>
<b>Additional considerations</b>	<p>Credits should be considered a last-resort mitigation option, where on-site or integrated measures cannot fully address nutrient impacts. Experience in England indicates that credits can be expensive and so credits may generally be best used to 'mop up' any residual nutrient surplus.</p> <p>Early engagement with LPAs and NRW is essential to avoid delays.</p> <p>Credits are catchment-specific and cannot be transferred across SAC boundaries.</p>
<b>Long term performance</b>	<p>Mitigation is secured for 80–125 years, with periodic monitoring by the credit provider and oversight by regulators. Performance depends on effective long-term land management and compliance with scheme obligations.</p>
<b>Type of Measure in HRA terms</b>	<p>Nutrient neutrality credit schemes would be specific to the nutrient issue, and as such could be used as Article 6(3) measures in Wales, should such a scheme come forward.</p>

<sup>134</sup> New Scientist (no date) River pollution 'offsets' for homes in England and Wales may not work, New Scientist. Available at: <https://www.newscientist.com/article/2384196-river-pollution-offsets-for-homes-in-england-and-wales-may-not-work/> (Accessed: 22 December 2025).

# Appendix B General Framework for Mitigation Option Proposals

Deployment of any of the mitigation solutions detailed in Sections 5 and 6 will require a supporting mitigation proposal that will provide information on feasibility and supporting technical assessments and/or plans detailing how the quantity of DIN mitigation will be determined. This section describes some key area that should be covered in a mitigation proposal. The list detailed below is not an exhaustive checklist, but should provide a guide on the kinds of information that will be submitted with a good mitigation proposal. A proposal should aim to include as much information as possible on every point in the list, regardless of the mitigation solution being implemented. This guidance corresponds to that published by Carmarthenshire County Council with regard to phosphorus mitigation options in Carmarthenshire, Pembrokeshire and Ceredigion<sup>135</sup>.

## Design objectives:

- A proposal for a mitigation solution should have clearly defined objectives. Objectives should aim to state a realistic reduction in DIN that a mitigation solution can achieve, based on the best available evidence. Where a DIN mitigation solution cannot estimate a reduction in DIN loading before it has been implemented, it should state the requirement for monitoring to establish DIN load reductions.
- The target DIN source for reduction should be clearly defined. Any variation in the DIN load to the mitigation solution should be estimated and considered. All other sources of DIN should be outlined if known.
- Any additional benefits that a solution is aiming to achieve should be detailed.
- The long-term performance of the solution should be described, as well as any potential variability in this performance.

## Feasibility assessment:

- List the factors that could affect DIN removal performance and might impact getting the proposal approved. Common factors related to mitigation deployment site that might impact feasibility include:
  - Topography.
  - Soil characteristics (type, grain size, hydraulic conductivity, soil nutrients).
  - Source Protection Zone locations.
  - Geology and hydrogeology.
  - Groundwater vulnerability.
  - Proximity to Flood Zone 2 and 3.
  - Proximity to designated sites or priority habitats.
  - Location of historic monuments and archaeological sites.
  - Proximity to strategic land allocation areas.
  - Proximity to key infrastructure.
  - Previous land use.

## Design overview:

- The design overview should provide a high-level conceptualisation of the mitigation solution.
- The design overview should recognise the potential for further iterations of a design to incorporate feedback from stakeholders and new evidence.
- The framework for how DIN loading to a solution and DIN load reductions will be calculated should be clearly set out.

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<sup>135</sup> Carmarthenshire County Council, 2023. Nutrient Mitigation Options Technical Review. Guidance on phosphorus mitigation options for use in Carmarthenshire, Pembrokeshire, and Ceredigion [nutrient-mitigation-options-technical-review-west-wales.pdf](#)

- The design overview should reference any requirements for management and maintenance of a mitigation solution to maintain DIN removal functions.

**Detailed design of the solution:**

- Detailed design should include any features and design elements that are fundamental to the functionality of the solution.
- The design should include the specific information about a solution, such as dimensions, vegetation planting plans, flow rates into and out of a solution and other details that describe how the solution will be built / developed.
- The detailed design should make an explicit link between how a solution's design will promote the processes that remove DIN.
- Where possible, the detailed design should be used to show how a solution will result in a quantified reduction in DIN loading.

**Implementation of the solution:**

- A Construction / Deployment Plan for the solution should be provided.
- This plan should show the key steps required for the delivery of a solution so that it will achieve any stated DIN removal performance.
- This plan should also clearly state any required delivery partners and their role in the implementation of a solution.

**Monitoring Plan:**

- A Monitoring Plan should be provided. This should include information on:
  - The group responsible for monitoring the solution.
  - The monitoring period.
  - The sampling strategy.
  - Baseline monitoring (prior to implementation of a solution).
  - Operational monitoring (post-implementation).
  - Monitoring methods.
  - Reporting proposals, including how monitoring will be linked to maintenance requirements.

**Management and Maintenance Plan:**

- A Management and Maintenance Plan should include:
  - The maintenance requirements to ensure DIN removal functionality for the lifetime of a solution.
  - The maintenance actions that need to be implemented if functionality reduces.
  - The group responsible for completing these actions.
  - How maintenance will be financed over the lifetime of a solution
  - How maintenance actions will be logged and reported to a responsible body, if required.

# Appendix B Figures

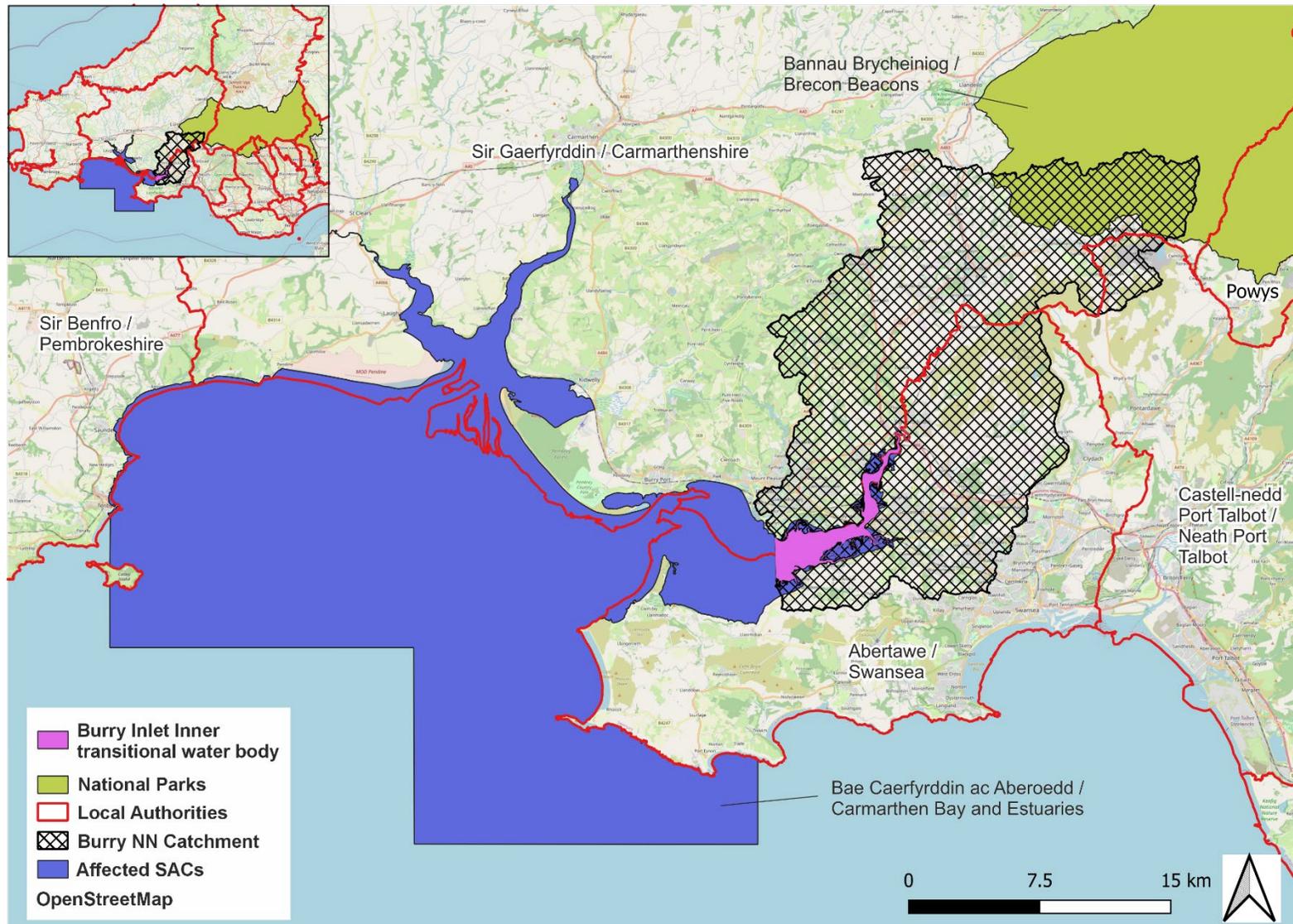


Figure C-1 Location of the Carmarthen Bay and Estuaries SAC in West Wales where DIN pressures have contributed to unfavourable site conditions (source: Welsh Government Data Map Wales online data)

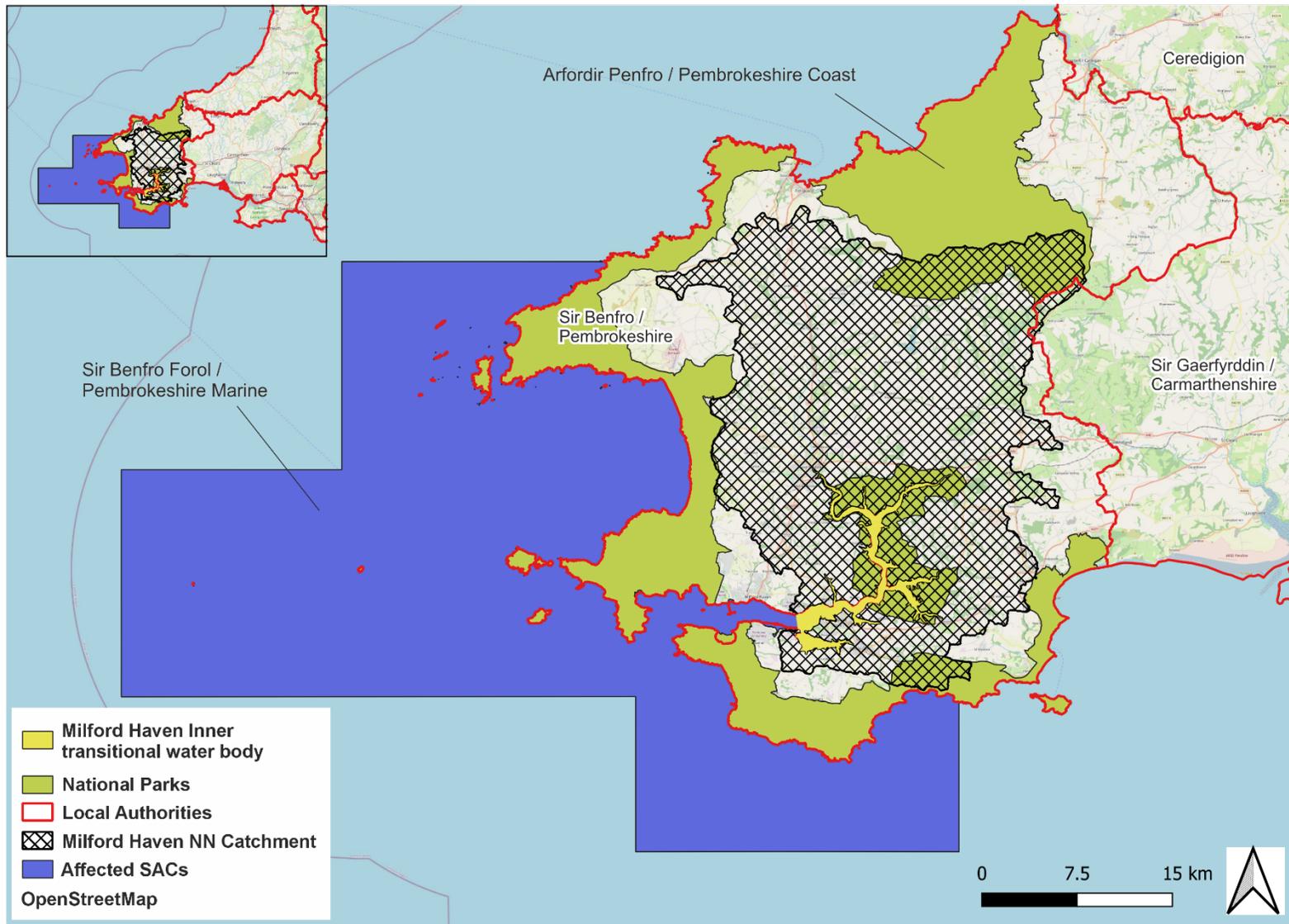


Figure C-2 Location of the Pembrokeshire Marine SAC in West Wales where DIN pressures have contributed to unfavourable site conditions (source: Welsh Government Data Map Wales online data)

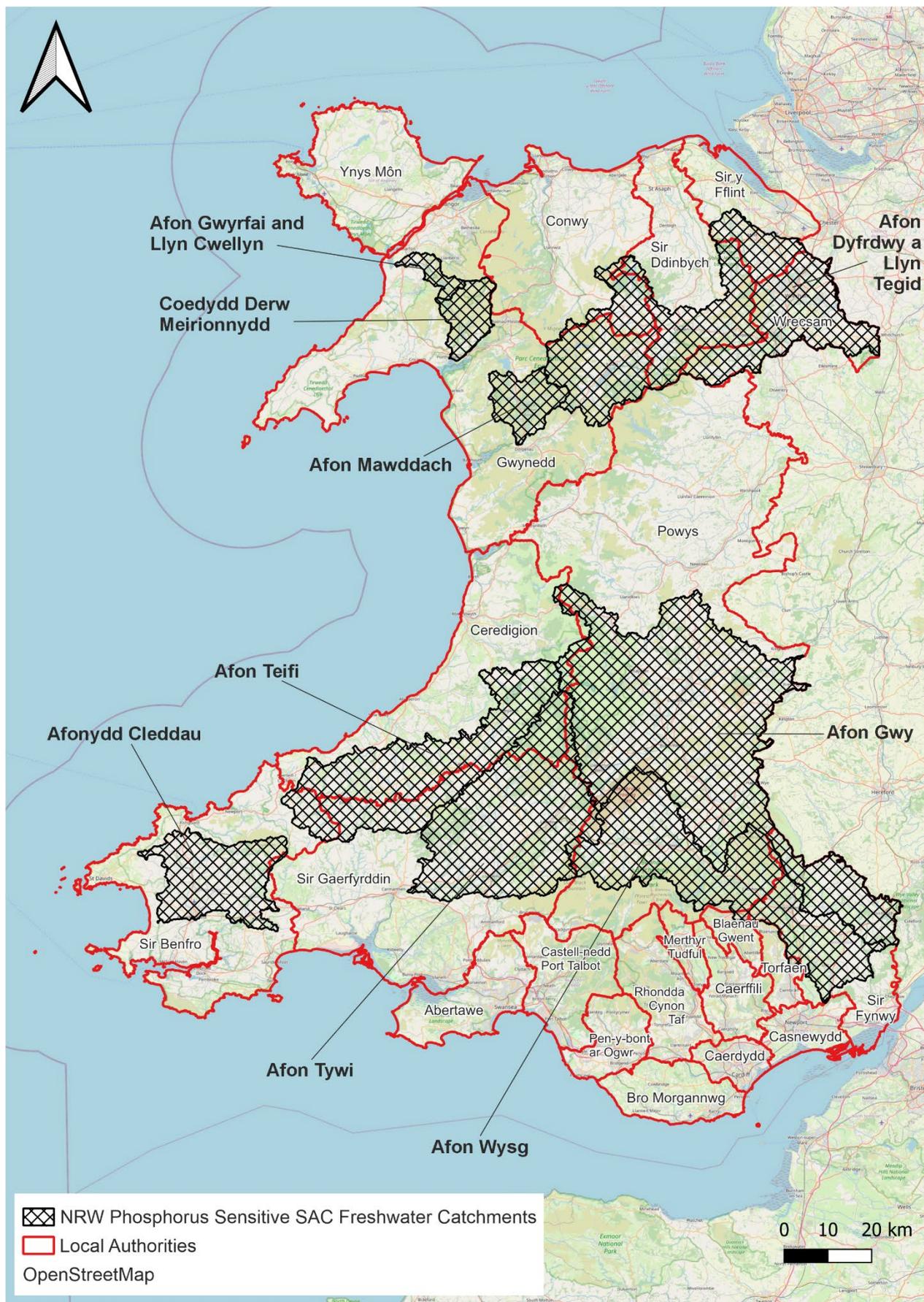


Figure C-3 Location of phosphorus sensitive SAC freshwater catchments in Wales.



<https://www.carmarthenshire.gov.wales>

