

CORE MANAGEMENT PLAN INCLUDING CONSERVATION OBJECTIVES

FOR

Afon Eden – Cors Goch Trawsfynydd SAC

Version	Date	Summary of changes made	Approved by
Version 3	September 2022	Revision of water quality targets for river features, updated formatting, clarification of the relationship between Conservation Objectives and Performance Indicators	Euros Jones
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Preface

This document provides the main elements of Natural Resources Wales' management plan for the site(s) named. It sets out what needs to be achieved on the site(s), and advice on the action required. This document is made available through Natural Resources Wales' web site and may be revised in response to changing circumstances or new information. This is a technical document that supplements summary information on the Natural Resources Wales' web site.

One of the key functions of this document is to provide Natural Resources Wales' statement of the Conservation Objectives for the relevant Special Area of Conservation (SAC) and Special Protection Area (SPA) site(s). This is required to implement the changes through the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 in addition to the existing Conservation of Habitats and Species Regulations 2017. As a matter of Welsh Government Policy, the provisions of those regulations are also to be applied to Ramsar sites in Wales.

Vision for the site

This is a descriptive overview of what needs to be achieved for conservation on the site. It brings together and summarises the Conservation Objectives into a single, integrated statement about the site.

The purpose of the designation of SAC and SPA sites is to help secure the maintenance or restoration of habitats and species to favourable conservation status *for the foreseeable future*.

Given that we foresee a changing climate, despite the uncertainty of the nature, degree and timing of those changes, we must address the need to ensure the resilience of each site to that changing environment. This will be achieved in the first instance by ensuring favourable condition of the important features, since a healthy feature is likely to be more resilient to the effects of climate change than one which is already stressed. Secondly, consideration must be given to those structures, functions and processes which maintain or boost the resilience of ecosystems to climate stress, including the avoidance, reduction or mitigation of other stress factors such as invasive species, nutrient enrichment, habitat and population fragmentation.

This site forms part of a wider network and is ecologically connected with its surroundings and with other designated sites in the region. Although the focus of this document is on the individual site, the conservation objectives and management requirements need to be considered in the wider context. A connected network of sites is more robust than sites in isolation, and more resilient to pressures such as climate change.

Our vision for the Afon Eden – Cors Goch Trawsfynydd SAC is to maintain, or where necessary restore, the raised bogs, their associated areas of blanket bog, and the river to good condition so that all its typical and uncommon species (listed below) are able to sustain themselves in the long-term as part of a naturally functioning ecosystem.

To conserve the physical river by maintaining or restoring the ecological connectivity of riparian habitats and by allowing the natural processes of erosion and deposition to operate without undue interference. The quality and quantity of water, including natural flow variability, and the quality of adjacent habitats, are maintained or restored to a level necessary to maintain in favourable condition for the foreseeable future all the freshwater species listed below;

Floating water-plantain populations are able to maintain themselves on a long-term basis throughout their current distribution in the river and each population is able to successfully complete sexual and /or vegetative reproduction. The river provides sufficient habitat to support existing populations within their current distribution and also allows for future expansion and dispersal.

Atlantic salmon migrate into the catchment to spawn and go through their juvenile stages in the river and are present in numbers that reflect a healthy and sustainable population supported by well distributed good-quality habitat. These migratory fish are able to complete their migrations and life cycles largely unhindered by artificial barriers such as pollution, or depleted flows.

The freshwater pearl mussel population is maintained throughout its distribution in the river corridor. Within the river there is a sufficient supply of clean water, host brown trout and suitable habitat to support a long term, self-sustaining population.

The otter population thrives on the abundance of prey species and the widespread availability of undisturbed resting and breeding sites that are found along the river and its main tributaries.

The hydrology of the two raised bogs and their associated areas of blanket bog is intact and as a result there is active accumulation of *Sphagnum* moss peat. The bogs' surface is a mosaic of hummocks and wetter hollows with little encroachment of scrub and where purple moor-grass occurs it is a typical and desirable species of localised dominance of a wetland or lagg/fen vegetation community.

All factors affecting the achievement of favourable condition shall be under control. The presence of the Afon Eden – Cors Goch Trawsfynydd SAC and its special wildlife enhances the economic and social value of the area, by providing a high-quality environment for peaceful enjoyment by local people and visitors. The river catchment's functions of controlling flooding and supplying clean water are recognised and promoted through appropriate land management.

Site description

Area and Designations Covered by this Plan

Grid references: SH702349 to SH735223

Unitary authorities: Gwynedd

Area (hectares): 284.29

Designations covered:

Afon Eden – Cors Goch Trawsfynydd SSSI.

Afon Eden - Cors Coch, Trawsfynydd SAC.

Detailed maps of the designated sites are available on the Natural Resources Wales web site.

Outline Description

The Afon Eden/River Eden is a relatively unmodified river, mainly upland in character, of approximately 10km length. The watershed begins just south of Llyn Trawsfynydd, within an area of gently sloping and poorly drained land. The upper section of the catchment is slow-flowing with a number of deep pools along its length. In the lower two-thirds of the catchment the river flows more steeply into a narrow rocky gorge, with an adjacent area of forestry plantation, known as Coed y Brenin. The Afon Eden joins with the Afon Mawddach, just above the village of Ganllwyd, but the SAC boundary continues downstream to the tidal limit of the Mawddach at Llanelltyd. The Afon Eden is fed by a number of base-poor upland streams, which flow from the eastern flanks of the Rhinog mountains. The Arduwy leat takes the most acidic waters from the eastern tributaries to Llyn Trawsfynydd, with some of the leat water feeding back into the Afon Eden. This water is used to maximise the water available for HEP generation by the Maentwrog Power Station.

The area receives high average rainfall, which has contributed to the development of raised bogs, blanket bog, and transition mires and quaking bogs. Two areas of raised bog occur at the top end of the catchment, close to the watershed, where they were once part of a much larger extent of bog, much of which is now flooded by Llyn Trawsfynydd. Transition mires and quaking bogs occur in waterlogged situations where they receive nutrients from the surrounding catchment as well as from rainfall. They are located within the wetlands surrounding the areas of raised bog.

The ecological structure and functions of the site are dependent on hydrological and geomorphological processes (often referred to as hydromorphological processes), the quality of riparian habitats and connectivity of habitats. Animals that are highly mobile such as migratory fish and otters, are also affected by factors operating outside the site.

The river contains the largest known population of freshwater pearl mussels surviving in Wales, they are almost entirely confined to one section of the river. Historically the mussels were more widespread in the catchment. The mussels rely on brown trout parr hosting, for a short period of time, the glochidial larvae of the mussels on their gills, so the success of migratory and spawning fish in the catchment is crucial to their long-term survival. Atlantic salmon is also an important fish species that breeds in the Mawddach catchment.

In the slow-moving waters just upstream from Pont y Grible is a population of floating water plantain.

Outline of Past and Current Management

Farming and forestry have been and continue to be the main activities in the catchment; the main land use in the northern half of the catchment is predominantly rough grazing, with areas of semi-improved and improved grassland for sheep and cattle grazing and some forestry. The majority of the improved grassland, outside the SSSI/SAC, are located on the eastern slopes of the watershed. The Coed y Brenin forestry plantations dominate the southern portion of the catchment within a narrow rocky gorge. Peat cutting was practised widely on and adjacent to the two raised bogs.

Management Units

The area covered by this plan has been divided into management units to enable practical communication about features, objectives, and management. This will also allow us to differentiate between the different designations where necessary. In this plan the management unit divisions have been based on the following:

- SSSI boundaries
- Tributary confluences
- Natural hydromorphology
- Artificial barriers where they mark a change in river character
- National boundaries
- Unitary Authority Boundaries

- The tidal and navigational limit

The units include one or more Water Framework Directive waterbodies. As far as is practicable unit boundaries coincide with these waterbody boundaries.

Maps showing the management units referred to in this plan can be viewed on the Welsh Government's interactive website [Map Data Cymru](#).

The following table confirms the relationships between the management units and the designations covered:

NRW Internal Reference	SAC Management Unit	SSSI	Waterbody IDs within Unit
1	954	Afon Eden - Cors Goch Trawsfynydd	GB110064054630
2	957	Afon Eden - Cors Goch Trawsfynydd	GB110064054630
3	959	Afon Eden - Cors Goch Trawsfynydd	GB110064054630
4	958	Afon Eden - Cors Goch Trawsfynydd	GB110064054630
21	1561	Afon Eden - Cors Goch Trawsfynydd	GB110064054630
22	2446	Afon Eden - Cors Goch Trawsfynydd	GB110064054630
23	6562	Afon Eden - Cors Goch Trawsfynydd	GB110064054630
5	6862	Afon Eden - Cors Goch Trawsfynydd	GB110064054630
6	6863	Afon Eden - Cors Goch Trawsfynydd	GB110064054630
7	6864	Afon Eden - Cors Goch Trawsfynydd	GB110064054630
8	6865	Afon Eden - Cors Goch Trawsfynydd	GB110064054630
9	7337	Afon Eden - Cors Goch Trawsfynydd	GB110064054630
10	7339	Afon Eden - Cors Goch Trawsfynydd	GB110064054610
11	7341	Afon Eden - Cors Goch Trawsfynydd	GB110064048750
12	7352	Afon Eden - Cors Goch Trawsfynydd	GB110064048740
13	7354	Afon Eden - Cors Goch Trawsfynydd	GB110064048740
14	7359	Afon Eden - Cors Goch Trawsfynydd	GB110064054630

NRW Internal Reference	SAC Management Unit	SSSI	Waterbody IDs within Unit
15	7361	Afon Eden - Cors Goch Trawsfynydd	GB110064054630
16	7362	Afon Eden - Cors Goch Trawsfynydd	GB110064048750
18	7364	Afon Eden - Cors Goch Trawsfynydd	GB110064048740
19	7365	Afon Eden - Cors Goch Trawsfynydd	GB110064048740
20	7401	Afon Eden - Cors Goch Trawsfynydd	GB110064048750
25	7404	Afon Eden - Cors Goch Trawsfynydd	GB110064048710
24	7406	Aber Mawddach	GB110064048710

Note: Only units in the Afon Eden - Cors Goch Trawsfynydd (SSSI) and Aber Mawddach SSSI that are also part of the Afon Eden – Cors Goch Trawsfynydd (SAC) have been included in Table 1. The following units are also part of the aforementioned SSSI's but are not within the SAC boundaries and are therefore excluded from the above table; Afon Eden - Cors Goch Trawsfynydd (SSSI) - 955, 956, 7338, 7342, 7343, 7344, 7345, 7346, 7347, 7348, 7349, 7350, 7351, 7355, 7356, 7360, 7403, Aber Mawddach (SSSI) – 1559, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2409, 6460, 7171, 7166, 7172, 7170, 7169, 7168, 7167.

The features

Confirmation of Features

SAC feature (Annex I habitats and Annex II species)	Primary reason for site selection?	Relationships, nomenclature etc
Freshwater pearl mussel <i>Margaritifera margaritifera</i>	Yes	Eu Species Code: 1029
Atlantic salmon <i>Salmo salar</i>	No	EU Species code: 1106
Floating water-plantain <i>Luronium natans</i>	Yes	EU Species Code: 1831
Otter <i>Lutra lutra</i>	No	EU Species code: 1355
Active raised bog	No	EU Habitat Code: 7110

SSSI features are listed in the table below.

Designated Feature	Relationships, nomenclature etc
<i>Andromeda polifolia</i>	
Blanket bog -other ombrogenous mire-	Managed as a SAC feature
<i>Carex aquatilis</i>	
<i>Coenonympha tullia</i>	
Fen -topogenous mires in valleys, basins and flood plains-	
Flush and spring -soligenous mire-	

Designated Feature	Relationships, nomenclature etc
<i>Luronium natans</i>	Managed as a SAC feature
<i>Lutra lutra</i>	Managed as a SAC feature
<i>Margaritifera margaritifera</i>	Managed as a SAC feature
Marshy grassland	
Raised bog -ombrogenous-	Managed as a SAC feature
Running water -Group C rivers-	
Running water -Group D rivers-	
<i>Salmo salar</i>	Managed as a SAC feature
Standing water	
Swamp	

Features and Management Units

This section sets out the relationship between the designated features and each management unit. This is intended to provide a clear statement about what each unit should be managed for, taking into account the varied needs of the different special features. All features are allocated to one of seven classes in each management unit. These classes are:

Key Features

KH - a 'Key Habitat' in the management unit, i.e., the habitat that is the main driver of management and focus of monitoring effort, perhaps because of the dependence of a key species (see KS below). There will usually only be one Key Habitat in a unit but there can be more, especially with large units.

KS – a 'Key Species' in the management unit, often driving both the selection and management of a Key Habitat.

Geo – an earth science feature that is the main driver of management and focus of monitoring effort in a unit.

Other Features

Sym - habitats, species and earth science features that are of importance in a unit but are not the main drivers of management or focus of monitoring.

These features will benefit from management for the key feature(s) identified in the unit. These may be classed as 'Sym' (sympathetic) features because:

- (a) they are present in the unit but may be of less conservation importance than the key feature; and/or
- (b) they are present in the unit but in small areas/numbers, with the bulk of the feature in other units of the site; and/or
- (c) their requirements are broader than and compatible with the management needs of the key feature(s), e.g., a mobile species that uses large parts of the site and surrounding areas: and/or
- (d) key features (KH, KS) are closely associated with these features, and the conservation of key features depends on them being managed appropriately.

Nm - an infrequently used category where features are at risk of decline within a unit as a result of meeting the management needs of the key feature(s), i.e., under Negative Management. These cases will usually be compensated for by management elsewhere in the plan and can be used where minor occurrences of a feature would otherwise lead to apparent conflict with another key feature in a unit.

Mn - Management units that are essential for the management of features elsewhere on a site e.g., livestock over-wintering area included within designation boundaries, buffer zones around water bodies, etc.

x – Features not known to be present in the management unit

The tables below set out the relationship between the features and management units identified in this plan:

SAC Management Unit	954	957	958	959	1561	2446	6562	6862	6863	6864	6865	7337
NRW Internal reference number	1	2	4	3	21	22	23	5	6	7 Bronaber Stream	8 Eden	9 Eden
Water Framework Directive Waterbody	GB110 06405 4630	n/a	GB110 06405 4630	GB110 06405 4630	GB110 06405 4630	n/a	GB110 06405 4630	n/a	GB110 06405 4630	GB110064 054630	GB110 06405 4630	GB11 00640 54630
SAC Features												
Active Raised Bogs	KH		KH		KH	KH						
<i>Luronium natans</i>											KS	
<i>Lutra lutra</i>	Sym		Sym	Sym				Sym	KS	KS	KS	KS
<i>Margaritifera margaritifera</i>	KS	KS	KS	KS	KS	KS	KS	KS	KS	KS	KS	KS
<i>Salmo salar</i>									KS	KS	KS	KS
SSSI Features												
<i>Andromeda polifolia</i>	KS				KS	KS						
Blanket bog -other ombrogenous mire- <i>Carex aquatilis</i>	KH	KH	KH	KH	KH	KH	KH	KH	KH		KS	
<i>Coenonympha tullia</i>	KS		KS	KS	KS	KS	KS	KS				
Fen -topogenous mires in valleys, basins and flood plains-							KH					
Flush and spring -soligenous mire-				KH								
<i>Luronium natans</i>											KS	
<i>Lutra lutra</i>	Sym		Sym	Sym				Sym	KS	KS	KS	KS
<i>Margaritifera margaritifera</i>	KS	KS	KS	KS	KS	KS	KS	KS	KS	KS	KS	KS
Marshy grassland										KH		
Raised bog -ombrogenous-	KH				KH	KH						
Running water -Group C rivers-							KH					KH

Marshy grassland												
Raised bog -ombrogenous-												
Running water -Group C rivers-												
Running water -Group D rivers-										KH		
<i>Salmo salar</i>	KS	KS	KS	KS	No value	KS	KS	KS	KS	KS	KS	
Standing water												
Swamp												

Key	
	Bog units
	Main river Eden/Mawddach
	Tributaries
	Headwaters of Eden/Crawcwellt within bog habitat
	Bog units with no rivers

Conservation objectives

Background to Conservation Objectives:

a. Outline of the legal context and purpose of conservation objectives.

Conservation objectives for individual SACs and SPAs are required by the 1992 'Habitats' Directive (92/43/EEC) as implemented through the Conservation of Habitat and Species Regulations 2017 (As amended). The aim of the Habitats Directive is the maintenance, or where appropriate the restoration, of the 'favourable conservation status' (FCS) of habitats and species listed in the Annexes to the Directive (see Box). Therefore, FCS provides the overarching framework for defining the conservation objectives for individual SACs.

Although neither the Birds Directive nor the Ramsar Convention refer to FCS, Natural Resources Wales considers that the overall aim of both those legal instruments is sufficiently similar to FCS to make it practical and proportionate to use the same guiding principle when establishing the conservation objectives for SPAs and Ramsar sites, as well as SACs. Therefore, the Habitats Directive definition of FCS is considered to provide the overarching framework for conservation objectives for all SACs, SPAs and Ramsar sites in Wales.

Favourable conservation as defined in Articles 1(e) and 1(i) of the Habitats Directive: "The conservation status of a natural habitat is the sum of the influences acting on it and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species. The conservation status of a natural habitat will be taken as favourable when:

- its natural range and areas it covers within that range are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The conservation status of a species is the sum of the influences acting on the species that may affect the long-term distribution and abundance of its populations. The conservation status will be taken as 'favourable' when:

- population dynamics data on the species indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.”

The achievement of FCS is not an objective that applies at the level of the individual sites. Rather it is a wider objective to which each individual site contributes. Therefore, the conservation objectives for an individual site are intended to express what is considered to be that site’s appropriate contribution to achieving FCS. Since SACs are the most important mechanism in the Habitats Directive for achieving FCS, and the sites represent the most important areas for conservation of the Annex I habitat types and Annex II species, the objectives for each individual SAC should seek to ensure that the site makes a substantial contribution which properly reflects its importance in a local, national and European context and the particular reasons why the site was selected for inclusion in the UK National Sites Network of SACs. A similar approach is taken to setting conservation objectives for SPAs and Ramsar sites.

Achieving the conservation objectives of individual sites requires appropriate management and the control of factors which are influencing, or may influence, the features.

The conservation objectives have a number of specific roles:

- **Communication**
The conservation objectives should help convey to stakeholders what are the reasons for the designation and what it is intended to achieve.
- **Site planning and management**
The conservation objectives guide management of sites, to maintain or restore the designated habitats and species. They provide the basis for identifying what management is required both within the site boundary, and outside it, where achieving the objectives requires action to be taken outside the site.
- **River Basin Management Planning**
Conservation Objectives for aquatic and water dependent SAC and SPA features are also used as the “standards and objectives” referred to in Article 4 (1c) of the Water Framework Directive (WFD) (2000/60/EC). In 2009, Welsh Ministers decided that where SAC and SPA conservation objectives are more stringent than ‘Good Ecological Status’ (GES) as defined in the WFD, they (and the standards they contain) are the objectives referred to in Article 4(1c) of the WFD.

- Assessing plans and projects

Article 6(3) of the 'Habitats' Directive requires the assessment of proposed plans and projects in view of a site's conservation objectives. Subject to certain exceptions, plans or projects may not proceed unless it is established that they will not adversely affect the integrity of sites. There are similar requirements for the review of existing decisions and consents. Note that the assessment of plans and projects should be made in view of the entirety of the conservation objectives for the site, including the performance indicators.

- Monitoring and reporting

In addition to foregoing purposes, conservation objectives provide the basis for defining the evidence that will be used for assessing the condition of a feature and the status of factors that affect it. That evidence is contained in a sub-set of conservation objectives called 'performance indicators'. The performance indicators are those conservation objectives which are quantifiable and measurable, and which provide the basis for monitoring and reporting. The performance indicators are set out in an Appendix to this document.

The conservation objectives in this document reflect Natural Resources Wales' current information and understanding of the site and its features and their importance in an international context. The conservation objectives are subject to review by Natural Resources Wales in the light of new knowledge.

b. Format of the conservation objectives

Each conservation objective is a composite statement defining a site-specific aspiration for each designated feature. This composite statement contains clauses that correspond to all the elements of FCS, namely:

For habitat features:

- Extent should be stable in the long term, or where appropriate increasing*;
- Quality (including in terms of ecological structure and function) should be being maintained, or where appropriate improving;
- Populations of the habitat's typical species must be being maintained or where appropriate increasing*;
- Factors affecting the extent and quality of the habitat and its typical species (and thus affecting the habitat's future prospects) should be under appropriate control.

For species features:

- The size of the population should be stable or increasing, allowing for natural variability, and sustainable in the long term;
- The distribution of the population should be being maintained;
- There should be sufficient habitat, of sufficient quality, to support the population in the long term;
- Factors affecting the population or its habitat should be under appropriate control.

The elements above constitute a generic checklist or guide to the elements that should normally be included in the conservation objectives, in order to ensure that the site makes an effective and appropriate contribution to achieving favourable conservation status for the habitats and species for which it is designated.

There is one conservation objective for each designated feature listed above. In some cases, where there are distinct areas or forms of a designated habitat or separate populations of a designated species within a site, the conservation objective is sub-divided into different sections to enable different aspirations to be expressed for different occurrences of the features within the site.

As well as describing the aspirations for the condition of the feature, each conservation objective contains a statement that the factors which significantly affect the feature are under appropriate control.

Conservation Objective for Features 1 and 2: Freshwater pearl mussel and Atlantic salmon

There are generic conservation objectives for the physical habitat and water quality relevant to **freshwater pearl mussel and Atlantic salmon** which are defined below and should be met.

Generic Conservation Objectives for the physical habitat and water quality to be met for Freshwater pearl mussel (S1029) and Atlantic salmon (S1106)

Quality (including in terms of ecological structure and function) should be being maintained, or where appropriate improving.	Flow regime, water quality and physical habitat including substrate quality should be at least maintained in, or restored as far as is possible to, a near-natural state, in order to support the ecosystem structure and function across the whole area of the SAC.
There should be sufficient habitat, of	The standards for the elements of flow should be met as defined in section Appendix 1 . Flows

sufficient quality, to support the population in the long term.

should be at what is considered near-natural for a watercourse of this type and the flow will not be depleted by abstraction or physical modifications to the extent that:

- spawning or nursery sites of features, are damaged or destroyed.
- access to feature's spawning habitat is hindered.
- outward migration of features species is hindered.

Near –natural flow regime is defined as the characteristic pattern of a river's flow quantity, timing and variability in un-impacted conditions. The five components of flow: magnitude, frequency, duration, timing and rate of change influence the ecological integrity of the river ecosystem.

The standards for the elements of **water quality** should be met as defined in [Appendix 2](#). Potential sources of pollution will be considered in assessing plans and projects, and measures will be taken to control such pollution so as to meet levels that do not degrade the ecology of the river.

Physical habitat should be at least maintained in, or restored as far as is possible to, a near-natural state, in order to support the ecosystem structure and function across the whole area of the SAC. This includes the;

- *Structure and composition of the riparian vegetation*
 - The native tree cover, which should include sufficient regenerating, mature and over-mature trees and standing dead wood.
 - Dead wood should not be removed from the river.
 - The bankside vegetation should feature native plant communities supported by near-natural land-use adjacent to the river.
- *Physical river processes and features* - high degree of naturalness should be retained which is governed by dynamic processes resulting in a variety of physical habitat features, including a range of substrate types, variations in flow, channel width and depth, in-channel and side channel sedimentation features, erosion features and

	<p>both in-channel and bankside vegetation cover.</p> <ul style="list-style-type: none">- Predominantly unmodified ecological and hydromorphological processes and characteristics, should be at least maintained or restored where necessary. Physical modifications, including, but not limited to, revetments on alluvial rivers, using stone, concrete or waste materials, unsustainable gravel extraction, addition or release of excessive quantities of fine sediment, will be avoided where they impact on the capability of each species feature to occupy the full extent of its natural range.- Natural factors such as waterfalls, which may limit the natural range of a species features, or dispersal between naturally isolated populations, should not be modified.- Artificial widening or deepening of channels, and extensive reinforcement of banks, should be avoided where they affect the function and viability of a habitat.- No new barriers causing an impact on the capability of each species feature to occupy the full extent of its natural range, will be permitted. Existing, artificial barriers causing an impact should be modified as necessary to allow passage, e.g. weirs, bridge sills, acoustic barriers. No physical structures should impact on the connectivity of the habitat. There should be no man made barriers to the free movement of water, sediment and aquatic organisms that may affect the river-bed structure and hydrology downstream. <p>Existing invasive non-native species which threaten the conservation status of the SAC features will be controlled where feasible. No new introductions of invasive non-native species should occur.</p> <p>The standards for siltation should be met as defined in Appendix 1. Levels of suspended solids should be such that fish spawning or nursery habitats are not degraded.</p> <p>For species only;</p>
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	<p>All known breeding, spawning and nursery sites of species features should be at least maintained as or restored to suitable habitat.</p> <p>As a minimum, all waterbodies should be meeting Good Ecological Status under the Water Framework Directive. More stringent targets will be applicable for some determinants (see Performance Indicators section).</p> <p>All river SSSI habitat features should meet favourable condition. In some cases, the SAC habitat may not be underpinned by a river habitat SSSI feature. In this case, the target is to maintain and restore the characteristic physical features of the river channel, banks and riparian zone consistent with favourable condition of the SAC features.</p>
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There are also generic conservation objectives for population attributes relevant to **Freshwater pearl mussel and Atlantic salmon** which are defined below and should be met.

Generic Conservation Objectives for population attributes to be met for Freshwater pearl mussel (S1029) and Atlantic salmon (S1106)

<p>The distribution of the population should be being maintained or where appropriate increasing.</p>	<p>The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future. The natural range is taken to mean those reaches where predominantly suitable habitat for each life stage exists over the long term. Suitable habitat is defined in terms of near-natural hydrological and geomorphological processes and forms e.g., suitable flows to allow upstream migration, depth of water and substrate type at spawning sites, and ecosystem structure and functions e.g., food supply. Suitable habitat need not be present throughout the SAC but where present must be secured for the foreseeable future. Natural factors such as waterfalls may limit the natural range of individual species. Existing artificial influences on natural range, such as physical barriers to migration, should be modified where possible, to allow passage.</p>
<p>There should be sufficient habitat, of sufficient quality, to support the population in the long term.</p>	<p>Water quality should not be injurious to any life stage.</p> <p>All reaches within the site that contain, or should contain, Freshwater pearl mussel and Atlantic salmon under conditions of high environmental quality will comply with the targets given.</p> <p>While the current SAC boundary encompasses core areas of habitat for Freshwater pearl mussel and Atlantic salmon, the long-term security and resilience of the populations are dependent on suitable habitat both within and outside of the protected site boundary.</p>
<p>The size of the population should be stable or increasing, allowing for natural variability, and sustainable in the long term.</p>	<p>The population will be at least maintained or increasing and there will be evidence of recent recruitment.</p> <p>Extent and quality of available spawning habitat should be sufficient to maintain the population levels.</p>
<p>Factors affecting the population or its habitat should be under appropriate control.</p>	<p>Factors affecting the population or its habitat (including fishing, poaching, siltation, air pollution, abstraction, entrainment, discharges, engineering, gravel extraction, reservoir releases etc) should be under appropriate control.</p>

Performance Indicators based on targets given in the Common Standards Guidance Monitoring (JNCC 2015 and JNCC 2016) are in Appendix 1.

Conservation Objective for Feature 3: Floating water plantain *Luronium natans*

The vision for this feature is for it to be in favourable conservation status, where all of the following conditions are satisfied:

- The *L. natans* populations will be viable throughout their current extent in the Afon Eden and will be able to maintain themselves on a long-term basis. There will be no contraction of the current *L. natans* distribution in the Afon Eden and each *L. natans* population must be able to disperse and complete sexual and/or vegetative reproduction successfully.
- The river will have sufficient habitat to support existing *L. natans* populations within their current distribution and future expansion.
- All factors affecting the achievement of these conditions are under control.

Conservation Objective for Feature 4: Otter *Lutra lutra*

The vision for this feature is for it be in favourable conservation status, where all of the following conditions are satisfied:

- The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC, as determined by natural levels of prey abundance and associated territorial behaviour.
- The natural range of otters in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future. The natural range is taken to mean those reaches that are potentially suitable to form part of a breeding territory and/or provide routes between breeding territories. A number of potential and breeding sites have been identified (Lyles, 2006) in the upper reaches of the Afon Eden. The size of breeding territories may vary depending on prey abundance.
- The population size should not be limited by the availability of suitable undisturbed breeding sites. Where these are insufficient, they should be created through habitat enhancement and where necessary the provision of artificial holts. No otter breeding site is subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary,

- potentially harmful levels of disturbance are managed. Survey information shows that otters are widely distributed in the Mawddach catchment.
- The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat, and underpasses, ledges, fencing etc at road bridges and other artificial barriers.
- All factors affecting the achievement of these conditions are under control.

Conservation Objective for Feature 5 Active raised bog NVC communities M2, M17, M18, M25

The Cors Goch mires comprises a mosaic of ombrotrophic (rain-fed) bogs and minerotrophic (mire deriving nutrients from both rain, surface and ground water) mires. The raised bog vegetation comprises a mixture of M18 *Erica tetralix-Sphagnum papillosum* raised and blanket mire, M2 bog-pools and M17 *Scirpus cespitosus – Eriophorum vaginatum* blanket bog mire intersected with M6 *Carex echinata – Sphagnum recurvum/auriculatum* flushes. Areas of *Molinia caerulea – Potentilla erecta* mire (M25) fringe the core raised bog areas and are likely to represent a combination of cut-over raised bog and blanket bog. The raised bog habitat supports bog rosemary *Andromeda polifolia*, white-beak sedge *Rhynchospora alba* and *Sphagnum* mosses, including *S. magellanicum*.

The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied for both raised bogs management units:

- The location and distribution of the raised bogs and associated rands and fen lags will increase at the expense of less desirable vegetation communities
- The extent of the raised bogs and associated rands, fen lags and blanket bog (including those areas that are considered unfavourable or currently degraded) will be at least 157 ha. This area estimate is based on the extent of the management units within which the peat ‘domes’ are situated.
- The raised bogs will exhibit a near-natural zonation from the purely ombrogenous (rain fed) bog crowns, through sloping rand and wet lagg zones to adjacent blanket bog.
- The abundance and distribution of uncommon plants is maintained or increased. (Refer to Table 1).
- The typical species of the vegetation communities comprising the active raised bog SAC feature are frequent. (Refer to Table 2).
- The hydrological integrity of each bog will be restored and maintained and the development of scrub and encroachment of *Molinia caerulea* will be managed. The structure of the bogs are maintained and

restored to include bog pools, depressions, hummocks and hollows as a natural feature of the bog surface. Artificial drainage ditches or moor grips are not present as

- functioning drains.
- Invasive non-native species such as conifers, rhododendron, Japanese knotweed, Himalayan balsam and bridewort (*Spirea*) are not present within the SAC boundary.
- Each active raised bog management unit is free from all trees.
- All factors affecting the achievement of these conditions are under control.

Uncommon plants of the raised bog feature

Species	Status	Notes.
<i>Andromeda polyfolia</i>	Regionally Rare	M18
<i>Sphagnum magellanicum</i>	Locally uncommon - indicator of good quality raised bog	M18, M17

Typical species of the vegetation communities comprising the active raised bog SAC feature

NVC Vegetation community	Typical Species-constants and/or desirable*
Bog	
M17 <i>Trichophorum cespitosum</i> - <i>Eriophorum vaginatum</i> blanket mire. Characteristically frequent <i>Eriophorum vaginatum</i> , <i>Scirpus cespitosus</i> and <i>Molinia caerulea</i> .	<i>Calluna vulgaris</i> <i>Erica tetralix</i> <i>Eriophorum angustifolium</i> <i>Eriophorum vaginatum</i> <i>Molinia caerulea</i> <i>Narthecium ossifragum</i> <i>Potentilla erecta</i> <i>Scirpus cespitosus</i> <i>Sphagnum capillifolium</i> <i>Sphagnum papillosum</i>
M18 <i>Erica tetralix</i> - <i>Sphagnum papillosum</i> raised and blanket mire Particularly good quality blanket bog tending towards raised bog dominated by <i>Sphagna</i> . <i>Sphagnum papillosum</i> frequent (V-IV). <i>Sphagnum magellanicum</i> present often just few clumps.	<i>Calluna vulgaris</i> <i>Erica tetralix</i> <i>Eriophorum angustifolium</i> <i>Eriophorum vaginatum</i> <i>Sphagnum capillifolium</i> <i>Sphagnum papillosum</i> <i>Vaccinium oxycoccus</i> * <i>Sphagnum magellanicum</i> *
Associated mire and lag fen	

NVC Vegetation community	Typical Species-constants and/or desirable*
M25 <i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire	<i>Molinia caerulea</i> <i>Potentilla erecta</i>
M6 <i>Carex echinata</i> – <i>Sphagnum recurvum</i> / <i>auriculatum</i> mire	<i>Carex echinata</i> <i>Sphagnum recurvum</i> / <i>auriculatum</i> <i>Polytrichum commune</i> <i>Agrostis canina</i> <i>Potentilla erecta</i> <i>Viola palustris</i>

Assessment of status and management requirements

This section provides:

- A summary of the assessment of the status of each feature.
- A summary of the management issues that need to be addressed to maintain or restore each feature.

Status and Management Requirements of Feature 1: Freshwater pearl mussel *Margaritifera margaritifera* (Code: S1029)

Status of Feature 1

Unfavourable declining

The monitoring survey carried out by NRW in 2016 found that:

- The adult population density has declined, and the spatial extent has contracted since 2003.
- There is no evidence of recruitment to the population.
- Availability of suitable habitat continues to be a problem, in particular levels of siltation.

Management Requirements of Feature 1

In addition to meeting all the physical habitat, water quality and population attributes (tables 4 and 5), favourable conservation status will be achieved by the following measures:

1. Continue the work of the Pearls in Peril project to restore the habitat suitability for juvenile pearl mussels, in particular clean stable gravels.
2. Develop consistent and robust methodology for measuring redox potential in NRW as outlined in the revised CSM guidance for freshwater fauna (JNCC 2015). This method should be used to sample redox at repeat locations across the Afon Eden throughout the season in 2017.
3. Continue the work on captive rearing of pearl mussels and consider translocation when habitat suitability is restored.
4. Use the NRW Strategy for Freshwater Pearl Mussels in Wales in order to guide future work for pearl mussels on the Afon Eden.

Status and Management Requirements of Feature 2: Atlantic Salmon *Salmo salar* (Code: S1106)

Status of Feature 2

Unfavourable- no change

Atlantic salmon population on the Afon Eden is assessed using data collected for the Afon Mawddach of which the Eden is a major tributary. It is not known what proportion of the Mawddach salmon catch comes from the Eden nor from the other large tributary, the Wnion. The following life stages are assessed using Common Standards Monitoring (CSM) attribute targets (Table 3) (JNCC, 2015).

CSM Atlantic salmon population attribute data requirements

Population attribute	Method of assessment	Data requirements
Spatial extent	Electrofishing	Presence / absence data
Population density: juveniles	Quantitative, semi-quantitative & timed electrofishing	HABSCORE & National Fisheries Classification Scheme (NFCS)
c. Population density: adult run size	Fish counters where available Rod catch data	Annual rod catches Catch per unit effort (post 1994) Characteristic seasonal run pattern i.e. Multi sea winter component maintained: MSW / 1SW percentages & pre-post June 1 st catches

The salmon population was assessed in 2012 (Milner *et al.*) and the summary below shows that the feature is Unfavourable. The attribute targets were not met for adult run size and river morphology.

Summary of attribute targets

Attribute	Pass/Fail
Population	
Adult run	Fail
Juvenile population densities	Pass
River morphology	
Artificial barriers	Pass
Maintaining characteristic physical features	Fail
River substrate	Pass
Overall Assessment	Unfavourable based on failure of the adult run target

The genetic profile of the Eden population has already been artificially altered by hatchery releases although in more recent times stock has been bred from hens and cocks taken from the same river. The barriers to fish migration within the catchment need to be mapped and an assessment made of the impact of removing / mitigating the effects of artificial ones.

Management Requirements of Feature 4

In addition to managing the factors affecting the habitat, favourable conservation status will be achieved by the following measures:

1. Timing the launching of canoes to coincide with high flows.
2. Promoting awareness of the impact of overfishing pools during periods of low flows.
3. Continued presumption against stocking non-native fish and using live bait.
4. Implementation of catch and release for Salmon and Brown trout on the Afon Eden for the 2018 fishing season.
5. Implementation of policies set out in 'Know your River Mawddach 2015'.
6. Continued improvement of spawning habitat on the Afon Eden.

Status and Management Requirements of Feature 3: Floating water-plantain *Luronium natans* (Code: 1831)

Status of Feature 3

Favourable

Luronium natans has been recorded at only one location on the Afon Eden; along a stretch of river from Pont y Gribble (SH708304) for a distance of approximately 650m upstream. To maintain the known extent, distribution and occurrence of *Luronium* in the river it is essential that *Luronium* continues to be found in all marked sections along this stretch of river.

There should be surveillance of competition (not known to be a problem at present) from other aquatic plants including algal mats and invasive alien plants. Competition may result from a combination of other factors such as enrichment.

Management Requirements of Feature 3

In addition to meeting all the management requirements for the factors affecting the water quantity for the watercourse feature (listed above), favourable conservation status will be maintained by:

1. Retaining a presumption against dredging and gravel abstraction.
2. Trying to limit the number of canoes launching upstream of the *Luronium* beds and timing paddling to coincide with high water flows.

Status and Management Requirements of Feature 4: Otter *Lutra lutra* (Code:1355)

Status of Feature 4

Unfavourable

Overall favourable conservation status depends on both distribution and number of actual / potential breeding sites being in favourable condition.

Otter distribution – unfavourable.

Actual / potential breeding sites – favourable.

This assessment was made by consultant Geoff Liles in 2006 for the whole Mawddach catchment of which the Afon Eden is a sub-component.

Management Requirements of Feature 4

1. Management should aim to manage the factors affecting the watercourses and take additional action.
2. Retain and develop habitat suitable for breeding sites.
3. Retain a healthy food chain and supply within the whole catchment and improve the quality/quantity of the fish population.
4. Maintain existing good quality bankside vegetation for breeding otters including dense scrub, bramble, blackthorn & gorse, reed beds, deciduous woodland with an understorey and wetlands within the boundary of the SAC.
5. Ensure infrastructure for recreational activities are sympathetically located and this activity takes place at an appropriate scale.
6. Reduce the mink population by implementing control measures and Management Requirements of Feature 5: Active raised bog (Code: 7110)

Status of Feature 5

Unfavourable

The active raised bog was assessed as “unfavourable” after a site monitoring survey in July 2003. The main cause for concern on the site was the very low cover of Sphagnum and high cover of bare peat on the raised mire domes at that time. The southern dome has been overgrazed in the past but is now considered under-grazed because of the abundance and dominance of purple

moor grass in the lagg/fen, which is currently overgrown. The presence of the large drain on the margin of the northern dome is highly likely to be having a significant adverse impact as are the drains cut into the southern dome/bog. The two Cors Goch mire management units comprise 5 owner/occupiers each with different grazing patterns and stock (sheep and cattle).

A repeat vegetation and hydrological monitoring survey would be valuable to assist with restoration advice measures to restore the hydrology of the raised bog habitat and to manage it sympathetically.

Management Requirements of Feature 5

The main factors affecting the raised bog on this site are drainage, grazing, past burning and peat cutting.

Drainage

In the past, the peatland at Cors Goch has been subjected to drainage works in an attempt to improve the land for agriculture. The current landowners maintain most of the larger drains. The main ditch system in the northern one is currently maintained by Magnox Electric plc. as an overspill system for Llyn Trawsfynydd dam. The northern raised bog has a drain approximately 3m wide cutting through its western margin. The southern bog also has had several drains cut into it. A ditch up to a metre wide in places runs along the southern and western margins of the south dome and smaller mostly in-filled ditches also exist cutting across into the dome.

No new drainage ditches should be cut. Seek to infill or block existing ditches to create pools wherever possible.

Grazing

Grazing can be very significant on this habitat particularly where it has been affected by artificial drainage, as is the case here. Artificially drained bog will tend to have a taller vegetation height and more woody ericaceous growth, such as tall heather and scrub on the dome, and very vigorous *Molinia* in the lagg/fen, as this species is favoured by a good through flow of drainage water. It is easy then for the bog to become under-grazed. Restoring a more stagnant, high water table will naturally help to lessen *Molinia* dominance, as will grazing and trampled by cattle or ponies. Grazing by sheep will lead to unwanted changes in species composition, through selective grazing out of species like the regionally rare bog rosemary and heather and in increased *Molinia* dominance. Some short vegetation and small patches of exposed peat through poaching can increase the biodiversity providing habitat for species such as mosses and sundews to colonise. Bare peat should not however be extensive or eroding. Patterns of grazing are also important. Summer cattle and/or horse grazing will have the most benefit to the SAC feature. Supplementary feeding means that stock congregate in one area to feed and

dung leading to peat erosion and local nutrient enrichment which allows competitive ruderal weed plant species to establish to the detriment of bog species. Supplementary feeding tends to result in over grazing as more stock are held on the land for longer than it can naturally sustain. No supplementary feeding should be consented on the raised bog with the exception of mineral licks, which can help stock graze rank areas of vegetation.

To help attain favourable conservation status the grazing regimes would need to be adjusted:

1. Cattle/pony (not sheep) grazing regimes should be reinstated and bridges installed to facilitate stock movement. Stock may be encouraged to graze rank areas by mowing paths and by the placement of mineral licks. The erection of temporary/permanent fencing may also be appropriate.

Burning

Burning causes a decrease in the cover of fire sensitive species such as the Sphagnum mosses and may lead to an increase in those species such as purple moor grass *Molinia caerulea* which regenerate rapidly after fire. It has been the practice of the landowners to manage the raised bogs by burning in the past and it is likely that this (together with drainage and grazing) has had an effect on the cover of *Sphagnum*, the occurrence of bare peat and the cover of ericaceous species. The southern dome is believed to be recovering from a large fire which occurred some time ago. In 2002, moss cover was considered to be more sparsely distributed than is typical of such habitat probably as a result of past burning, a low water table and competition from other plant species.

2. No burning should be consented.

Peat cutting

Evidence of old peat cuttings are still visible on the surface of both domes. The cuttings to the east of the southern dome have developed into valuable habitat.

3. A presumption against peat cutting should be maintained.

Arduwy leat

This leat transports water out of the Eden sub-catchment and into Llyn Trawsfynydd before it is used by Magnox Electric to run a hydropower scheme at Maentwrog. It is likely that it affects the water table level in the blanket bog that surrounds the southern raised dome, but its impact is currently unknown.

Research is required into the impact of leat on the local hydrology.

4. Operation of leat should not be changed without appropriate assessment.

Old municipal dump at SH702346

Rubble and other material was dumped here sometime in the first half of the twentieth century and it has created a raised area that stands proud of the surrounding land. It is presumed that the rubble was dumped on top of the northern raised bog.

Research is required to assess the potential for bog restoration and extension of area by removing the rubble.

Action plan: summary

This section takes the management requirements outlined in Section 5 a stage further, assessing the specific management interventions required on each management unit. The table below is a summary of the information held in Natural Resources Wales' Actions Database for sites

Actions in Natural Resources Wales' actions database

NRW Internal Reference Number	Unique SAC Unit Number	Unit name	Summary of Conservation Management Issues	Action needed
1	954	Ty'n Drain	Bog rosemary - see factors affecting raised bog habitat. Water sedge - see factors affecting running water. Large heath butterfly - see factors affecting raised bog. Sufficient abundance of food plant is required for all stages of the lifecycle. The overall aim is to maintain a diverse mix of mire vegetation containing bog mosses, Hare's-tail Cottongrass and Cross-leaved Heath. Degraded bog does not provide suitable habitat for this butterfly. Burning. Drainage. Invasive scrub. Forestry. Grazing. Acid grassland. Cultivation. Stock feeding. Mowing. Fertiliser. Grazing. Drainage. Pesticides. Dumping of materials. Invasive scrub. Woodland & lower plants. Grazing. Non-native tree & shrub species. Woodland fragmentation. Recreation. Felling.	Yes

NRW Internal Reference Number	Unique SAC Unit Number	Unit name	Summary of Conservation Management Issues	Action needed
			<p>Wet heath. Drainage. Burning. Grazing. Stock feeding. Mowing. Dumping materials.</p> <p>Swamp and standing water. Stock feeding & watering points. Drainage. Water quality & quantity. Management of aquatic and bank vegetation. Invasive aquatic species.</p> <p>Active raised bog: Drainage. Grazing. Burning. Peat cutting. Ardudwy leat. Old municipal dump.</p> <p>Floating water plantain: Water quantity. Dredging. Water based recreation.</p> <p>Freshwater pearl mussels: Water quantity & quality. Water based recreation.</p> <p>Population of host salmonids. Illegal pearl mussel poaching. Forestry.</p> <p>Atlantic salmon: Water quality & quantity. Water based recreation during low flows. Overfishing in low flows. Fish stocking. poaching. Artificial barriers to migration.</p> <p>Otter: Water quality. Breeding habitat. Food supply. Recreation. Mink predation.</p>	
2	957	Berth Ddu	<p>Check for presence of rhododendrons and remove if present.</p> <p>Grazing rates need to be set on a compartment basis and may need to be increased or decreased, also grazing may need to be re-introduced in some areas, particularly where there are important lichen trees, as these should</p>	Yes

NRW Internal Reference Number	Unique SAC Unit Number	Unit name	Summary of Conservation Management Issues	Action needed
			not become shaded by a dense shrub layer, nor should the trunks become overgrown with ivy.	
4	958	Cefn Clawdd	Life Project going to raise water levels over the Raised bog area.	Yes
3	959	Tyddyn Sais	Remove rhododendrons, beech and conifers.	Yes
21	1561	Bryn Re	No known issues	Yes
22	2446	Cefn Gallt y Cwm	Watercourse: Hydromorphology, flow regime & water quality (chemical & biological). Suspended solids. Physical habitat. Diffuse & point pollution. Agricultural & forestry operations. Trunk road management & other urban land use. River Engineering. Recreation. Mining. Deposition of atmospheric pollution. Climate change. Atlantic salmon: Water quality & quantity. Water based recreation during low flows. Overfishing in low flows. Fish stocking. poaching. Artificial barriers to migration. Otter: Water quality. Breeding habitat. Food supply. Recreation. Mink predation.	Yes
23	6562	Muriau Bychain Isaf	No known issues	Yes
5	6862	Beudy Newydd	No known issues	Yes
6	6863	Aber	The river through this unit (Crawcwellt North) has been overdeepened and straightened leading to a loss of spawning habitat for	Yes

NRW Internal Reference Number	Unique SAC Unit Number	Unit name	Summary of Conservation Management Issues	Action needed
			salmonids as well as lack of juvenile habitat for pearl mussels. Ditches in the adjacent river corridor/surrounding fields lead to overly turbid water in high flow conditions. The dam on the Crawcwellt above and outside the SAC boundary is having several detrimental impacts on the SAC including introducing water of lower quality into the Afon Eden, changing the flow regime (taking out the higher and lower flows), loss of salmonids to Llyn Trawsfynydd and removing sediment (gravel) out of the system.	
7	6864	Bronaber Stream	River in this unit is largely unmodified but some banks are resectioned/reinforced. Interceptor on ditches from A470, needs checking to ensure it is working and there is no impact of the A470 on the unit.	Yes
8	6865	Brynteg bridge to Pont y Grible	This stretch of river has been dredged and straightened and there is currently a lack of clean stable gravels for juvenile pearl mussel recruitment. The dam on the Crawcwellt above and outside the SAC boundary is having several detrimental impacts on the SAC including introducing water of lower quality into the Afon Eden, changing the flow regime (taking out the higher and lower flows), loss of salmonids to Llyn Trawsfynydd and removing	Yes

NRW Internal Reference Number	Unique SAC Unit Number	Unit name	Summary of Conservation Management Issues	Action needed
			<p>sediment (gravel) out of the system.</p> <p>The river would benefit from boulders and gravel being put back in. There is an issue of high nutrient spikes particularly during the summer months from Bronaber sewage treatment works.</p>	
9	7337	Cae Gwyn ford to Ffridd Bryn Coch ford	<p>This stretch of river has been dredged and straightened and there is currently a lack of clean stable gravels for juvenile pearl mussel recruitment. The dam on the Crawcwellt above and outside the SAC boundary is having several detrimental impacts on the SAC including introducing water of lower quality into the Afon Eden, changing the flow regime (taking out the higher and lower flows), loss of salmonids to llyn Trawsfynydd and removing sediment (gravel) out of the system.</p> <p>The river would benefit from boulders and gravel being put back in.</p>	Yes
10	7339	Afon Crawcwellt S - Pont Llyn y Cafn section		No
11	7341	Afon Eden opposite Gelli Goch		Yes
12	7352	Afon Wen - Ty'n y		No

NRW Internal Reference Number	Unique SAC Unit Number	Unit name	Summary of Conservation Management Issues	Action needed
		Benrhos section		
13	7354	Afon Wen - Coed Bryn Prydydd section		No
14	7359	Afon Crawcwellt - leat section		No
15	7361	Pont y Grible grassland river section		Yes
16	7362	Afon Eden - Pont Gyfeiliau to Mawddach section		No
18	7364	Afon Wen - Moel Friog section		No
19	7365	Afon Wen - Dolfrwynog section		No
20	7401	Afon Eden - Afon Serw to Pont Gyfeiliau section		No
25	7404	Afon Mawddach - Eden confluence to Gelligemlyn section	Invasive non-native species including Rhododendron and Japanese knotweed are an issue here along the river edge.	Yes
24	7406	Afon Mawddach Gelligemlyn to Llanelltyd section		No

Glossary

This glossary defines some of the terms used in this **Core Management Plan**. Some of the definitions are based on definitions contained in other documents, including legislation and other publications of Natural Resources Wales and the UK nature conservation agencies.

Action	A recognisable and individually described act, undertaking or project of any kind, specified in section 5 or 6 of a Core Management Plan or Management Plan , as being required for protecting, managing or enhancing one or more of the features for which a site is designated.
Attribute	A quantifiable and monitorable characteristic of a feature that, in combination with other such attributes, describes its condition .
Common standards	See JNCC common standards .
Condition	A description of the state of a feature in terms of qualities or attributes that are relevant in a nature conservation context. For example, the condition of a habitat usually includes its extent and species composition and might also include aspects of its ecological functioning, spatial distribution and so on. The condition of a species population usually includes its total size and might also include its age structure, productivity, relationship to other populations and spatial distribution. Aspects of the habitat(s) on which a species population depends may also be considered as attributes of its condition. Condition is considered favourable when all the conservation objectives are being met.
Conservation management	Acts or undertaking of all kinds, including but not necessarily limited to actions , taken with the aim of

achieving the **conservation objectives** of a site. Conservation management includes the taking of statutory and non-statutory measures, it can include the acts of any party and it may take place outside site boundaries as well as within sites. Conservation management may also be embedded within other frameworks for land/sea management carried out for purposes other than achieving the conservation objectives.

Conservation objective

The expression of the desired state of a **feature**, expressed as a composite statement defining the **condition** that we wish the feature to be in. Each feature has one conservation objective.

Core Management Plan

A Natural Resources Wales document containing the conservation objectives for a site and a summary of other information contained in a full site **Management Plan**.

Factor

Anything that has influenced, is influencing or may influence the **condition** of a **feature**. Factors can be natural processes, human activities or effects arising from natural process or human activities. They can be positive or negative in terms of their influence on features, and they can arise within a site or from outside the site. Physical, socio-economic or legal constraints on management of the site can also be considered as factors.

Favourable condition

See **condition**.

Favourable conservation status The Habitats Directive definition of **Favourable Conservation Status (FCS)** is given in full in section 4.

Feature

The species population, habitat type or other entity for which a site is

designated. The ecological or geological interest which justifies the designation of a site, and which is the focus of **conservation management**.

Integrity

See **Site integrity**.

JNCC common standards

A set of principles developed jointly by the UK nature conservation agencies to help ensure a consistent approach to monitoring and reporting on the features of sites designated for nature conservation, supported by guidance on identification of attributes and monitoring methodologies.

Key Feature

The habitat or species population within a **management unit** that is the primary focus of management and **monitoring** in that unit.

Management Plan

The full expression of a designated site's legal status, **vision, features, conservation objectives, performance indicators** and management requirements. A complete management plan may not reside in a single document but may be contained in a number of documents (including in particular **the Core Management Plan**) and sets of electronically stored information.

Management Unit

An area within a site, defined according to one or more of a range of criteria, such as topography, location of **features**, tenure, patterns of land/sea use. The key characteristic of management units is to reflect the spatial scale at which site management and **monitoring** can be most effectively organised. They are used as the primary basis for differentiating priorities for conservation management and monitoring in different parts of a site, and for facilitating communication with those responsible for management of different parts of a site.

Monitoring

An intermittent (regular or irregular) series of observations in time, carried out to show the extent of compliance with a formulated standard or degree of deviation from an expected norm. In monitoring of sites designated for habitat and species conservation, the formulated standard is the quantified expression of favourable **condition** based on **attributes**.

Operational limits

The levels or values within which a **factor** is considered to be acceptable in terms of its influence on a **feature**. A factor may have both upper and lower operational limits, or only an upper limit or lower limit. For some factors an upper limit may be zero.

Performance indicators

A subset of the conservation objectives that are quantifiable and measurable. They consist of **attributes** and factors together with their associated target values (or ranges of values) which provide the standard against which information from **monitoring** and other sources is used to determine the degree to which the **conservation objectives** for a **feature** are being met.

Plan or project

Project: Any form of construction work, installation, development or other intervention in the environment, the carrying out or continuance of which is subject to a decision by any public body or statutory undertaker.

Plan: a document prepared or adopted by a public body or statutory undertaker, intended to influence decisions on the carrying out of **projects**.

Decisions on plans and projects which affect SAC, SPA and Ramsar sites are subject to specific legal and policy procedures.

Site integrity

This is defined in Welsh Government policy as the coherence of a site's

ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it is designated.

Site Management Statement (SMS) The document containing Natural Resources Wales' views about the management of a site issued as part of the legal notification of an SSSI under section 28(4) of the Wildlife and Countryside Act 1981, as substituted.

Special Feature

See **feature**.

Specified limits

The levels or values for an **attribute** which define the degree to which the attribute can fluctuate without creating cause for concern about the **condition** of the **feature**. The range within the limits corresponds to favourable, the range outside the limits corresponds to unfavourable. Attributes may have lower specified limits, upper specified limits, or both.

Unit

See **management unit**.

Vision Statement

The statement conveying an impression of the whole site in the state that is intended to be the product of its **conservation management**. A 'pen portrait' outlining the **conditions** that should prevail when all the **conservation objectives** are met. A description of the site as it would be when all the **features** are in **favourable condition**.

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Appendix 1. Performance Indicators

These performance indicators are a sub-set of the conservation objectives and describe the evidence, including in particular obtained from monitoring of sites and features, that will be used to inform judgements about whether or not the conservation objectives are being met.

The assessment of plans and projects should be made in view of the entirety of the conservation objectives, including the performance indicators.

Performance indicators for physical habitat and water quality attributes for Freshwater pearl mussel and Atlantic salmon

Performance indicators for physical habitat and water quality attributes for Freshwater pearl mussel and Atlantic salmon

Attribute	Attribute rationale & other comments	Specified limits
A. Extent or Distribution	<p>River habitats are dynamic, and the extent can vary in response to natural environmental conditions. However, anthropogenic factors can have detrimental effects on the habitat and/or species distribution.</p> <p>Method of assessment - Mapping of the extent of the habitat and/or species distribution and comparison with the baseline.</p>	<p>There should be no decrease in the total area of river habitat. Some fluctuation in the overall extent and distribution of the habitat at the expense of other semi-natural habitats is acceptable as this is both natural and indeed desirable.</p> <p>No evident loss through anthropogenic causes.</p>
B. Quality or Habitat		
B.1 Water flow	<p>Flow affects a range of habitat factors of critical importance to characteristic flora and fauna, including current velocity, water depth, wetted area, substrate quality, dissolved oxygen (DO) and water temperature.</p> <p>Method of assessment – gauging station data & expert assessment from NRW Hydrologists. 6 years of daily flow data should be assessed.</p>	<p>Of the naturalised daily flow throughout the year the following should apply: Upper limit: Flow should not be more than 110%. Lower limit: Flow should be at least 90%</p>

Attribute	Attribute rationale & other comments	Specified limits
B.2 Water Quality	Method of assessment – data from three years of routine monitoring sites within each ‘reach’ should be obtained. Assessment against targets should be calculated using all samples within that 3-year period unless otherwise specified.	Specific targets for individual waterbodies are given Appendix 2 .
B.2.6 Macro-invertebrates	<p>Macroinvertebrates form a major part of the biological community of rivers and are sensitive to a range of environmental pressures.</p> <p>Method of assessment: Macroinvertebrate data. Species-level data recommended where possible. Ecological status under the WFD assessment using the WHPT, AWICS and PSI tools should be assessed.</p>	<p>Following targets should be met;</p> <p>a. general macroinvertebrates assessment - WHPT (Whalley Hawkes Paisley Trigg method for assessing river invertebrate communities) classification result should meet High Ecological Status</p> <p>b. AWICS (acidification tool) – (low alkalinity reaches only) AWICS classification results should meet High Ecological Status</p> <p>c. PSI (siltation tool) - When the PSI (Proportion of Sediment-sensitive Invertebrates) index is formally adopted under WFD target is that High Ecological Status should be met. Until formally adopted target is for the mean EQI for the assessment ‘reach’ should be 0.9 or more.</p>
B.3 Siltation	<p>Siltation is one of the most widespread pressures on rivers in farmed landscapes.</p> <p>Method of assessment – siltation targets are derived from RHS, or Proportion of Sediment-sensitive Invertebrates (PSI) may be used. Field observations may also be used</p>	<p>No unnaturally high levels as indicated by;</p> <ul style="list-style-type: none"> • ‘silting’ highlighted in section P (‘Overall characteristics – major impacts’) of the River Habitat Survey (RHS) Form, or • One-third or more of the total number of RHS ‘spot-checks’ in the ‘reach’ have silt (‘SI’) as the predominant channel substrate.
B.4 Habitat structure	Watercourses with a high degree of naturalness will be governed by dynamic processes which result in a variety of physical habitat features, including a range of substrate types, variations in flow, channel width and depth, in-channel and side-channel sedimentation features, erosion	

Attribute	Attribute rationale & other comments	Specified limits
	features and both in-channel and bankside vegetation cover.	
B.4.1 Channel planform	<p>Channel form should be generally characteristic of river type, with predominately unmodified planform.</p> <p>Method of assessment – assess planform using map data, aerial survey data, historical records and local knowledge.</p>	≤ 5% of the "reach" should be artificial, re-aligned or constrained.
B.4.2 Habitat Modification	<p>Modifications to the river habitat can cause detrimental effects to the flow, levels of sedimentation, physical structure etc.</p> <p>Method of assessment - Habitat Modification Score (HMS) is a metric derived from the RHS data.</p>	<p>≥65% or more of condition monitoring sites should fall within the <i>semi-natural</i> HMS class 1, with the remainder <i>predominantly unmodified</i> (class 2).</p> <p>No (or minimal) deterioration from the last monitoring cycle.</p>
B.4.3 Bank vegetation naturalness	<p>Majority of bank vegetation should be characteristically natural.</p> <p>Method of assessment – RHS score for bank vegetation naturalness.</p>	Mean SERCON score for the "reach" of 4 or 5.
B.4.4 Riparian zone vegetation naturalness	<p>Majority of riparian vegetation should be characteristically natural.</p> <p>Method of assessment – RHS score for riparian zone vegetation naturalness.</p>	Mean score for the "reach" of 4 or 5 ¹ .
B.4.5 Large woody debris	<p>Dead wood within streams/rivers plays an important role in increasing habitat diversity, providing shelter for fish, supplying a food source for aquatic invertebrates and slowing the passage of nutrients downstream.</p> <p>Method of assessment –River Habitat Survey (RHS) Data. At least 5 RHS sites should be examined for this target – if fewer than 5 sites are available, assessment 'reach' should be amalgamated. Targets should not be applied to 'reaches' where there is naturally occurring low tree cover e.g., an upland river, or</p>	<p>Within each "reach":</p> <ul style="list-style-type: none"> • EITHER 75% or more RHS sites have large woody debris 'Present' • OR 10% or more of RHS sites have large woody debris 'Extensive'

Attribute	Attribute rationale & other comments	Specified limits
	where it is removed for reasons of overriding public safety.	
B.4.6 Physical structures	<p>Artificial in-channel structures (such as weirs, dams, sluices, fords, groynes and culverts) may constitute barriers to the free movement of water, sediment and aquatic organisms, and may affect river-bed structure and hydrology downstream.</p> <p>Method of assessment - Use expert judgement to assess the “reach”. Data sources may include:</p> <ul style="list-style-type: none"> * Local/management personnel/expert assessment * Hydromorphological and walk-over surveys * River Habitat Survey (RHS) * Air photos * Fisheries personnel * Special surveys assessing structures * River Obstructions (EA dataset) * Rapid assessment methodology to assess obstacles to fish migration (SNIFFER project WFD 111) 	Structures should have no effect (or minor effect) on migration, sediment transport and/or habitat structure in the ‘reach’. Assessments should include the upstream ‘ponding’ effects that artificial structures have on flow patterns and habitat structure.
B.5 Negative indicator species	<p>Non-native species constitute a major threat to river systems through competition, introduction of disease etc.</p> <p>Method of assessment: assess data from macrophyte surveys, local records etc.</p>	<p>No high impact alien species established (i.e., self-sustaining populations) within the SAC boundary.</p> <p>High impact alien species defined at UKTAG classification of alien species working paper v8.pdf (wfduk.org).</p> <p>Non-native species or locally absent species (species that are native to Britain but can be damaging to areas where they are not normally present) should not cause an impact on site integrity.</p>

Performance indicators for Feature 1: Freshwater pearl mussel *Margaritifera margaritifera* (Code: 1029)

Performance indicators for feature condition for Freshwater pearl mussel *Margaritifera margaritifera*

Attribute	Attribute rationale & other comments	Specified limits
Distribution	<p>Should reflect distribution under near natural conditions. Freshwater pearl mussel distribution is currently (as assessed in 2003) confined to the stretch of river between Pont y Grible and Bronaber, with the majority of animals found at Gelli Goch.</p> <p>Method of assessment – Visual survey of riverbed</p>	<p>Lower limit: The distribution of mussels must not contract from its 2003 range (confidential due to species sensitivity).</p>
Population density	<p>≤ 5 mussels per m² within sample transects</p> <p>Method of assessment – Visual survey of riverbed</p>	<p>More than 5 mussels per square metre.</p>
Age structure	<p>National Fisheries Monitoring Programme salmonid data.</p> <p>Method of assessment – - National Fisheries Monitoring Programme for juvenile salmonids - HABSCORE or FCS data at each site to compare expected against recorded juvenile densities</p>	<p>Upper limit: None set. Lower limit: Adult mussels are present for each delineated section of river (705 adults in total – 2003 survey results). Lower limit: Report of one juvenile mussel of <65mm length during a site visit Recovery target value: Transect A: 50. Transect B: 45. Transect C: 150. Transect D: 40. Transect E: 70. Transect F: 90. Transect G: 130. Transect H: 85. Transect I: 45. At least 20% of population ≤65mm and at least some mussels ≤ 30mm.</p>

Performance indicators for factors affecting Freshwater pearl mussel

Factor	Factor rationale and other comments	Operational Limits
F1. Water quantity (flow)	River flow affects a range of habitat factors of critical importance to pearl mussels, including current velocity, water depth, wetted area, substrate quality, dissolved oxygen levels and water temperature. The maintenance both of occasional flushing flows and base flows, based on natural hydrological processes, is vital.	See B.1 above.
F2. Water quality	Refer to Appendix 2 .	Refer to Appendix 2 .
F3. Habitat extent including river morphology	Maintain the characteristic physical features of the river channel, banks and riparian zone.	See section B4 in table above.
F4. Habitat quality including river substrate	<p>Clean coarse sands & gravels provide suitable habitat for freshwater pearl mussels.</p> <p>Riverbanks should not be heavily shaded, but some shading provides shade, keeping water temperatures optimal for the species and reducing growths of filamentous algae.</p> <p>Elevated levels of silt and fine sand can clog substrates used by juvenile mussels and can impair adult feeding/respiration.</p> <p>Riverside vegetation, especially mature willow trees, provide shading which helps keep the mussels cool during hot summers.</p>	<p>Target:</p> <p><1% silt and fine sands in top 30 cm of substrates hosting juvenile and adult mussels.</p> <p><u>Monitoring targets:</u> In the core transects, the following number of sample points will be classed as suitable habitat: (A) 8/10, (B) 7/9, (C) 25/30, (D) 6/8, (E) 10/14, (F) 15/18, (G) 20/26, (H) 12/17, (I) 7/9, (J) 7/9, (K) 8/11</p> <p>Limits: Riverbank shading should not exceed 60% adjacent to the mussel beds.</p>
F5. Host fish population	Physical and chemical conditions need to be suitable for the well-being of all life stages of Brown trout including free access to the river network.	An abundant supply of juvenile Brown trout (0+ and 1+ year classes) is vital to the survival of the larval stage.
F6. Fisheries & species promotion	Net limitation orders are in place on the Mawddach. Rod licences are issued by NRW.	Assessment of plans and projects.

Factor	Factor rationale and other comments	Operational Limits
	<ul style="list-style-type: none"> • Over-fishing during low flows Salmon and trout become concentrated in pools during low flows and are vulnerable to overfishing. • Overfishing of adult salmon at sea. This practise was recently outlawed but it will continue to have an effect on salmon numbers in the short-term future • Stocking of non-native fish. Smolt releases from holding pond at Bronaber for sea trout & salmon. Competition with and predation of wild fish populations, introduction of disease, genetic alterations, impact on wider food chain. • Alteration to the natural age structure through fishery release strategy Shift in population structure from fry to parr stages. • Introduction of infectious diseases Reduction in salmonids population. • Introduction of mink and displacement of otter predation on salmon and trout stocks by both otter & mink. Mink are more generalist predators and tend to get pushed upstream by otters into the headwaters of a catchment where they impact upon the native aquatic fauna including salmonids 	<p>Insufficient data available on fish take.</p> <p>Insufficient data available on impact of release of hatchery bred fish on native population.</p> <p>Insufficient data on mink population in catchment.</p>
F7. Gravel abstraction	Loss of salmon and trout spawning grounds	Presumption against gravel abstraction.
F8. Invasive non-native species	Japanese knotweed is found growing next to the watercourses and is usually controlled via herbicides. Herbicide handled inappropriately may enter the watercourse and poison fish and invertebrates.	Assessment of plans and projects.
F9. Coarse woody debris (CWD)	It is natural to find CWD in watercourses and it assists with maintaining good water quality and can provide refuge areas for young fish.	Presumption against CWD removal from the watercourse except on grounds of health and safety. Assessment of plans and projects
F10. Illegal	Removal of salmonids	Insufficient data

Factor	Factor rationale and other comments	Operational Limits
fish poaching		
F11. Illegal pearl fishing	The level, if any, of freshwater pearl mussel poaching is not known. Pearl fishers remove the pearl from the adult mussel inevitably killing it. The price of pearl mussels has declined during the last decade due to imports of cultivated ones from China & this may reduce the demand for wild ones.	Any evidence of pearl fishing must be pursued as a Wildlife crime. Under RL1, WCA5, H & S Annex lia.
F12. Diffuse & point source pollution- refer to Appendix 2 .		
F13. Agricultural operations.	Refer to Appendix 2 .	Refer to Appendix 2 .
F14. Forestry operations	Refer to Appendix 2 .	Refer to Appendix 2 .
F15. Trunk road management & other urban land use.	Refer to B.4 above.	Refer to B.4 above.
F16. River engineering	refer to B.4 above.	refer to B.4 above.
F17. Recreation.	refer to B.4 above.	refer to B.4 above.
F18. Mining	Release of toxic substances can have a direct & cumulative impact on both fish and invertebrates.	Refer to Appendix 2 .
F19. Deposition atmospheric pollution	Refer to Appendix 2 .	Refer to Appendix 2 .
F20. Climate change	Water temperature is the trigger for adult mussels to release their glochidial larvae. Data from the Mawddach pearl mussel hatchery project suggests that the larvae are being released earlier in the season and in some years, this may not coincide with the presence of migratory salmonids. Refer to table 10	U.K. monitoring programme.
F21 Invasive non-native species	Locally absent species and invasive non-native species (INNS) may have a negative impact on FWPM through competition, predation or habitat modification.	No invasive non-native species likely to cause impairment of Atlantic salmon or brown trout populations.

Factor	Factor rationale and other comments	Operational Limits
		No introduction of other species (including INNS) which may impact FWPM populations.
F22 Translocation	FWPM moved about in the system by individuals with good intention but without assessing the new locations for suitability	Limit – translocation locations need to be able to cope with severe drought conditions. (Need a levelling survey to identify deepest parts of the system to ensure translocations can cope with extreme weather. (Ref confidential doc)
F23 Screening	The entrainment of juvenile and adult fish (including brown trout on which the freshwater pearl mussels rely as part of their life cycle) can lead to a loss of the population. This can be avoided through the use of screens at appropriate locations. It is also important that screens are used to prevent the escape of fish from fish farms and fisheries connected to rivers.	Effective screening on all intakes (fish farms and hydropower) and discharges.
F24 Unsustainable fishing	Fishing controls should be applied to all areas where brown trout are present within the Eden catchment.	All fishing should be undertaken sustainably without compromising any components of the stock.

Performance indicators for population attributes for Feature 2: Atlantic salmon *Salmo salar* (S1106)

Performance indicators for population attributes for Atlantic salmon *Salmo salar* (S1106)

Attribute	Attribute rationale & other comments	Specified limits
Distribution	<p>Juvenile Atlantic salmon should be present in all areas of the catchment to which they have natural access. A decline in the known distribution should be of concern.</p> <p>Method of assessment – mapping of the extent of spawning and comparison with the baseline.</p>	<p>As a minimum there will be no decline in spawning distribution within the SAC boundary. There will be no artificial barriers to migration within the catchment.</p>
Adult run size	<p>Method of assessment – fish counters, annual rod catches, egg deposition.</p>	<p>Total adult run size at least matching an agreed reference level, including an agreed seasonal patterns of migration characteristic of the river and multi-sea-winter component.</p> <p>Lower limit: NRW Conservation Limit for egg deposition met in at least 4 years out of five.</p> <p>The targets for this attribute are derived by fisheries specialists from NRW's salmon conservation limits for the Mawddach catchment.</p>
Juvenile density	<p>National Fisheries Monitoring Programme salmonid data.</p> <p>Method of assessment –</p> <ul style="list-style-type: none"> - National Fisheries Monitoring Programme for juvenile salmonids - HABSCORE or FCS data at each site to compare expected against recorded juvenile densities. <p>Assessment carried out by NRW's fisheries specialists.</p>	<p>Juvenile densities should not significantly differ significantly from those expected for the river type/ reach under conditions of high physical and chemical quality.</p>

Performance indicators for factors affecting the feature

Factor	Factor rationale and other comments	Operational Limits
F1. Artificial barriers	In all river types, artificial barriers should be made passable.	No artificial barriers significantly preventing adults from reaching existing and historical spawning grounds, and smolts from reaching the sea.
F2. Fish stocking	Stocking is undesirable within a designated site due to the risk to changes in the habitat and/or natural fish population via feeding behaviour, predation, disease transfer, etc.	Stocking of Atlantic salmon should not be routinely used as a management measure.
F5. Invasive non-native species	Locally absent species and invasive non-native species (INNS) may have a negative impact on Atlantic salmon through competition, predation or habitat modification.	No invasive non-native species likely to cause impairment of Atlantic salmon populations. No introduction of other species (including INNS) which may impact Atlantic salmon populations.
F4. Screening	The entrainment of juvenile and adult fish can lead to a loss of the population. This can be avoided through the use of screens at appropriate locations. It is also important that screens are used to prevent the escape of fish from fish farms and fisheries connected to rivers.	Effective screening on all intakes (fish farms and hydropower) and discharges.
F5. Unsustainable Fishing	Fishing controls should be applied to all areas where Atlantic salmon migrate to designated sites, within territorial waters. This should include estuarine coastal net fisheries, as well as fishing within a SAC from rod fisheries.	All fishing should be undertaken sustainably without compromising any components of the stock.

Performance indicators for population attributes for Feature 3: Floating water plantain *Luronium natans*

Performance indicators for feature condition

Attribute	Attribute rationale and other comments	Specified limits
A1. Species extent and abundance	Presence of <i>Luronium natans</i> recorded as plants that are attached to substrate. Detached fragments (unless obviously detached during monitoring) will not be counted.	Lower limit: <i>Luronium natans</i> will be present within each of Sections 1-3 along the Afon Eden (Annex 1)
A2. Sufficient habitat.	Submerged populations of <i>L. natans</i> require substrates comprising of mud or stable fine gravel or silt in depths of clear water up to 3m.	Sufficient good quality habitat should exist to support the expansion of existing populations. Extent of good quality habitat should not be reduced.

Performance indicators for factors affecting the feature

Factor	Factor rationale and other comments	Operational Limits
Water quantity (flow) Refer to factors affecting feature 1.		
F2. Recreation and Access	<i>L. natans</i> is recorded elsewhere across a spectrum of nutrient levels including fairly eutrophic canals, so it appears it is not highly sensitive to some enrichment. Water quality is set to protect the most sensitive feature.	Refer to factors affecting watercourses - feature 1.
F3. Dredging	Dredging could directly damage <i>L. natans</i> beds.	No dredging likely to affect <i>L. natans</i> should occur at Pont y Grible or other sections of the Eden where suitable habitat is found.
F4. Gravel abstraction	Loss of source material for river gravel beds. Physical removal of potential habitat.	Presumption against gravel abstraction.
F5. Recreation	Canoeing during periods of low flows & trampling of the riverbed could damage submerged populations.	No canoeing during periods of low flows and no up-stream access points in the vicinity of Pont y Grible.

Factor	Factor rationale and other comments	Operational Limits
F6. Competition from other aquatic plant species	<i>L. natans</i> cannot compete with other aquatic plant species including algae.	Review to assess if competition is an issue.

Performance indicators for Feature 4: Otter *Lutra lutra* (S1355)

Performance indicators for features' condition

Attribute	Attribute rationale and other comments	Specified limits
A1. Population Distribution	Although Performance Indicators are given it is difficult to assess the condition of the otter population distribution feature because of the relatively small size of the SAC areas compared to the typical home range size of otters. As otters are mobile animals occupying very large home ranges, the condition of the otter feature should be considered at the landscape level.	Upper limit: None set. Lower limit: Mawddach Sub-catchment: Afon Eden Otter signs found at 4 of the 6 OSW sites (66%)
A2. Breeding activity	Breeding Centres are used to provide an estimate of the number of females breeding in the system. They can only be a "best guess" but are based on our present knowledge of the size of otter home ranges, the juxtaposition of potential breeding sites, and records of breeding activity for the catchment.	Upper limit: None set. Lower limit: Breeding Centre: There should be no deterioration in, or loss of, bank side habitats within the assumed breeding centre.
A3. Actual & potential breeding sites.	Within the home range of a single female there may be two or more potential breeding sites. When this is the case, the female may use a different breeding site each year (Liles,	Lower limit: None set. Upper limit: Potential Breeding Sites: There should be no decline in the extent or quality of the 4 mapped potential breeding

Attribute	Attribute rationale and other comments	Specified limits
	<p>2003). Birth takes place in a Natal Den, either above ground in a small patch of cover (i.e., 1m x 1m) such as scrub or a pile of timber, or below ground, for example in a tree root system or a pile of boulders. Females often use a different natal den site each year (Liles, 2003).</p> <p>Although targets are set for the number of Potential Breeding sites within the SAC areas and wider subcatchments, the quality, habitat type, and location of sites is also important. Priority should be given to retaining existing sites. If the number or quality of sites does decline, alternative breeding sites can be created at nearby Habitat Improvement Sites.</p>	<p>sites (Eden sub-catchment) on the Eden. Liles (2003) Bryn Re & Gallt Cefn Deuddwr</p>

Performance indicators for factors affecting the feature

Factor	Factor rationale and other comments	Operational Limits
F1. Water quality – see Appendix 2 .		
F2. Water quantity (flow) – see performance indicators for factors affecting feature 1.		
F3. Food availability & riparian habitat	<p>The availability of food within the catchment is likely to be a major factor influencing both the distribution and breeding success of otters. Whilst the estuary is likely to support a range of fish species (particularly marine species), fish distribution on the rest of the system is patchy and, in places, very limited. The best parts of the Mawddach catchment for fish populations are the upper Eden (upriver</p>	<p>Upper limit: None set. Lower limit: Fish & amphibian biomass should stay within expected fluctuations.</p>

Factor	Factor rationale and other comments	Operational Limits
	<p>from forestry areas) and the Wnion, where salmonid distribution and spawning is considered to be fair to good. Amphibians appear to be well distributed throughout the catchment. On the Eden, ditches and streams within the extensive areas of marshy grassland in the upper reaches are likely to support good populations of breeding amphibians.</p>	
<p>F4. Gravel abstraction See factors affecting Atlantic salmon – feature 2.</p>		
<p>F5. Invasive alien species See factors affecting Atlantic salmon – feature 2.</p>		
<p>F6. Coarse woody debris (CWD)</p>	<p>Where CWD has accumulated alongside the riverbank it can create suitable sites for laying up couches and natal dens. See factors affecting Atlantic salmon – feature 2.</p>	<p>See factors affecting Atlantic salmon – feature 2.</p>
<p>F7. Illegal fish poaching- See factors affecting Atlantic salmon – feature 2.</p>		
<p>F8. Diffuse & point source pollution - See Appendix 2.</p>		
<p>F9. Agricultural operations - See factors affecting</p>		

Factor	Factor rationale and other comments	Operational Limits
features 1 and 2.		
F10. Forestry operations- See factors affecting features 1 and 2.		
F11. River engineering- See factors affecting features 1 and 2.		
F12. Recreation	Breeding otters can be sensitive to disturbance by humans and dogs so recreational areas should be sited at a distance from suitable breeding habitat and known breeding dens.	See factors affecting features 1 and 2.
F13. Mining	This factor can have an indirect impact on otter by affecting the food chain.	See factors affecting features 1 and 2.
F14. Deposition atmospheric pollution	Eutrophication and acidification can have an indirect impact on otter by affecting the food chain.	See factors affecting features 1 and 2..
F15. Climate change	Change in rainfall patterns and increased flooding could affect the otter breeding cycle and success rates if natal dens are flooded and feeding patterns disrupted.	See factors affecting features 1 and 2.

Performance indicators for Feature 6: Active raised bog (S7110)

Performance indicators for features' condition

Attribute	Attribute rationale and other comments	Specified limits
A1. Location and	The current location and distribution within the SAC must be maintained.	Lower limit: The current location and distribution within the SAC must be maintained. Upper limit:

Attribute	Attribute rationale and other comments	Specified limits
distribution of raised bog		None, naturally limited by geology, topography and rainfall
A2. Extent of raised bog	Two management units for each dome have been drawn up based upon SAC, habitat and land management boundaries.	Lower limit: The current extent within the SAC must be maintained. Upper limit: None, naturally limited by geology, topography and rainfall
A3. Uncommon plant species	The abundance and distribution of uncommon plants is maintained or increased. (Refer to Table 1).	Map
A4. Typical species	The typical species of the vegetation communities comprising the active raised bog SAC feature are frequent. (Refer to Table 2).	As a guide to frequency refer to published NVC tables.
A5. Structure	The structure of the raised bogs is maintained and restored to include bog pools, depressions, hummocks and hollows as a natural feature of the bog surface	Hummock/hollow microtopography will occupy the crown of both raised bogs.
A6. Hydrological integrity	Artificial drainage ditches or moor grips are not present as functioning drains. Ditches should be in filled or blocked to create pools.	Map current functioning drains and any other features contributing to the drying of the bogs and record bog surface topography-old peat cutting etc. Aspects of the hydrology may be indirectly assessed by interpreting the abundance of key peat forming <i>Sphagnum</i> mosses.
A7. Invasive non-natives species	Rhododendron and Japanese knotweed are examples of the type of plant species that can colonise wetter habitats. No invasive non-native species have been recorded at Cors Goch.	None within the SAC and preferably within a species-specific buffer around the SAC which may be the catchment.
A8. Tree cover	Raised bogs in Wales has been naturally tree-less for a long time. Trees are present occasionally where this habitat is in mosaic on drier areas such	When in favourable condition, raised bog and its associated rand, fen lagg and blanket bog is tree less

Attribute	Attribute rationale and other comments	Specified limits
	as acid grassland or out crops of rock away from grazing stock. Invasive tree species such as birch & willow should not be allowed to mature.	

Performance indicators for factors affecting the feature

Factor rationale and other comments	Operational Limits
<p><u>F1. Grazing & supplementary feeding</u> Pony or cattle grazing between May and September/October at a rate of 0.3LSU/year on <i>Molinia</i> dominated bog and 0.05LSU on raised peat/non <i>Molinia</i> bog. Supplementary feeding means that stock congregate in one area to feed and dung leading to peat erosion and local nutrient enrichment which allows competitive ruderal weed plant species to establish to the detriment of bog species.</p>	No winter grazing or supplementary feeding on the raised bog.
<p><u>F2. Burning</u> Raised bog should not be burnt, as burning damages important plant and animal species, especially bog mosses and invertebrates and interferes with the natural development of this vegetation. Past burning practice is likely to be at least partly responsible for the relative rarity of burning sensitive species. Burning, in combination with intense grazing, is also responsible for damage to the raised bogs. Burns scorch and kill bog mosses such as <i>Sphagnum magillanicum</i> and <i>S. papillosum</i> and other lower plants, removing the heather/ericaceous layer, to reveal the blanket of <i>Eriophorum vaginatum</i> underneath. The cotton grass recovers well from fire, benefits from the 'fertiliser' input of ash, and has then a competitive advantage over other plants which can only recolonise slowly. Thus, the NVC M18 bog community associated with intact mires in good condition is converted to the degraded NVC M20 and becomes unfavourable.</p>	No burning
<p><u>F3. Drainage</u> The wetland habitats and features are profoundly influenced by alterations to the natural drainage regime of the site. Raised bog is a nutrient-poor, rain fed system, which arises in areas with a wet, cool climate and a suitable topography (completely flat broad valley floor) with little or no water flowing in from surrounding land. Artificial drains cause the bog to dry out and to deteriorate adjacent to</p>	No new drainage ditches. We should also seek to infill/block existing ditches wherever possible.

Factor rationale and other comments	Operational Limits
<p>the drains. The drains may bring nutrients to the system and the vegetation changes because the bog is no longer only receiving nutrients from the rain. Also, if the drying peat surface becomes exposed, it then oxidises which releases nutrients into the system, and dissolved carbon into watercourses which ultimately feed into the Afon Eden. This results in similar changes to the sensitive vegetation as well as increased peat erosion. For these reasons, it is important that there should be no new drainage ditches dug in this habitat, and wherever possible old drainage ditches should be blocked or encouraged to infill. This habitat forms a natural sponge which, provided it is not ditched, helps to reduce floods lower down the river system in rainy times while providing plenty of water during summer droughts.</p>	
<p><u>F4. Arduwy leat</u> This leat transports water out of the Eden sub-catchment and into Llyn Trawsfynydd before it is used by Magnox Electric to run a hydropower scheme at Maentwrog. It is likely that it affects the water table level in the blanket bog that surrounds the southern raised dome, but its impact is currently unknown. Research is required into the impact of leat on the local hydrology.</p>	<p>Operation of leat should not be changed without consulting CCW and conducting an appropriate assessment.</p>
<p><u>F5 Invasive non-natives species</u> Invasive non-native species are aliens within the natural raised and blanket bog communities. Their invasive nature means they threaten the integrity of the habitat by competition, shading and often drying of the blanket bog by transpiration.</p>	<p>None within the SAC and preferably within a species-specific buffer around the SAC which may be the catchment.</p>
<p><u>F6. Peat extraction</u> In the past local people dug peat for fuel and the remains of old peat cuttings can still be seen today.</p>	<p>Peat cutting should not be allowed to resume.</p>
<p><u>F7 Dumped material</u> There are dumps including an old municipal dump at SH702346 which has rubble and other material and has created a raised area that stands proud of the surrounding land. It is presumed that the rubble was dumped on top of part of the northern raised bog.</p>	<p>Map current hard standing/dumps within and adjacent to SAC. Consider restoration to regain bog area.</p>
<p><u>F7. Nitrogen deposition</u> This air borne pollution leads to enrichment of vegetation and soils, and favours species such as <i>Molinia</i> at the expense of species associated with intact mires. Atmospheric N deposition at the site (estimated at 13.6 kg</p>	<p>Upper limit: 10 kg N/ha/yr Lower limit: None set</p>

Factor rationale and other comments	Operational Limits
<p>N/ha/yr – source www.apis.ac.uk) currently exceeds the estimated critical load for this habitat (5-10 kg N/ha/year). Reductions in atmospheric N deposition require policy implementation at a UK level, as well as local development control to place a limit on local point-source emissions.</p>	
<p><u>F8. Climate change</u> Peat bogs have an important mitigation role to play in managing the adverse impacts of climate change by acting as flood reservoirs and carbon sinks. Peat bogs are also highly sensitive to the predicted effects of climate change, namely increased winter rainfall and increasing incidence of summer droughts. Hydrological restoration is urgently needed to help 'climate-proof' the Cors Goch bogs.</p>	<p>U.K. monitoring of climate change.</p>

Appendix 2. Water Quality Standards

(As revised in Common Standards Monitoring guidance for Rivers, JNCC 2016)

River SACs designated under the Habitats Regulations 2017 (UK Gov, 2017) overlap river water bodies designated under Water Framework Directive Regulations (NRW, 2015; UK Gov, 2015). The water quality standards that apply come from the source legislation – i.e., for the water body the WFD Regulations standards and for a SAC the Habitats Regulations standards. Note that the words ‘targets’ and ‘standards’ are used under the various documents that sit under these two Regulations. We have interpreted these to mean the same thing and for this document we will use the term standard unless directly quoting from a specific document. Water quality standards for Special Area of Conservation (SAC) rivers are set via agreement at a UK level and presented in the JNCC Common Standards Monitoring (CSM) guidance (JNCC 2016).

However, having two sets of standards for the same area of river can lead to confusion as to which apply in a given situation. This Appendix sets out the standards for water quality attributes for river water bodies in the Afon Eden-Cors Goch Trawsfynydd SAC. Where they are more stringent, WFD Regulation 2017 standards are adopted as the CSM standards.

A2.1. Organic pollution

Table A2.1a provides the values for the physio-chemical attributes to be applied across all river types. Standards apply throughout the assessment unit, not just at sparsely distributed monitoring sites.

The standards for Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) and un-ionised ammonia are the same for all river water bodies whereas the standard for total ammonia varies according to river type and previous WFD Regulations classification for ammonia (Table A2.1a). For the 90%ile total ammonia the CSM target is 0.25mg/l. However, if High Status under WFD is being reached for a water body for certain river types then the more stringent WFD standard at 0.2mg/l is applied. This is due to the no deterioration principle. Total ammonia standards for each waterbody are given in Table A2.1b.

Table A2.1a. Organic pollution standards for SAC rivers.

Organic pollution attribute	Unit	Test Statistic	Target
Dissolved Oxygen (DO)	% saturation	10%ile	≥85
Biochemical Oxygen Demand (BOD)	mg l ⁻¹	Mean calculated over a 3-year period	≤1.5
Total Ammonia	mg l ⁻¹	90%ile	Varies by water body. See Table 2.1b.
95%ile un-ionised ammonia	mg l ⁻¹	95%ile	≤0.025

Table A2.1b. Total Ammonia standards for river water bodies in the Afon Eden SAC.

* Reason for total ammonia standard: some water bodies that meet WFD high status for ammonia have the WFD high target of 0.2 mg l⁻¹, all other water bodies have the CSM target of 0.25 mg l⁻¹.

Water Body ID	Water Body Name	SAC Units	Total Ammonia (90%ile, mg l ⁻¹)	Reason for total ammonia standard*
GB110064048750	Eden - lower	7341, 7362, 7401	0.2	WFD (high)
GB110064054630	Eden - upper	954,957, 959, 958, 1561, 2446, 6562, 6862, 6863, 6864, 6865, 7337, 7359, 7361	0.2	WFD (high)
GB110064048710	Mawddach - lower	7404, 7406	0.2	WFD (high)
GB110064048740	Wen (Mawddach)	7352, 7354, 7364, 7365	0.2	WFD (high)

Water Body ID	Water Body Name	SAC Units	Total Ammonia (90%ile, mg l ⁻¹)	Reason for total ammonia standard*
GB110064054610	Crawcwellt South	7339	0.2	WFD (high)

2. Reactive phosphorus

Phosphorous standards are set according to altitude, alkalinity, and river size, with the tightest targets in low alkalinity, high altitude headwater areas, reflecting natural variation (JNCC 2016). River Habitat Survey (EA, 2003) river flow categories are used to determine river size.

The process also includes an alignment procedure to ensure that standards are never less stringent than the Water Framework Directive (WFD) phosphorus standard for the same water body. If the WFD standard is more stringent than the CSM standard, then the WFD standard applies.

Individual phosphorus standards for all waterbodies in the Afon Eden SAC are given in Table A2.2. As explained previously, the WFD phosphate standard has been applied where it is more stringent than CSM targets.

Table A2.2 Phosphorus standards and typology for river waterbodies in the Afon Eden SAC. * Phosphorus standard to be applied to annual and growing season means. Standard calculated from annual mean expressed in µg L⁻¹ SRP. ** Reason for phosphorus standard: CSM (near natural/max allowable) are derived from the CSM guidance for Rivers and WFD (good/high) from the relevant Water Framework Directive standard.

Water Body ID	Water Body Name	SAC Management Unit(s)	Phosphorus standard* (µg l ⁻¹)	Reason for phosphorus standard**	CSM_Alt type	CSM_Alk type	River size
GB110064048750	Eden - lower	7341, 7362, 7401	5	Freshwater Pearl Mussel	high Alt >80m	low Alk <50mg/l	River
GB110064054630	Eden - upper	954,957, 959, 958, 1561, 2446, 6562, 6862, 6863, 6864,	5	Freshwater Pearl Mussel	high Alt >80m	low Alk <50mg/l	River

		6865, 7337, 7359, 7361					
GB110064 048710	Mawddac h - lower	7404, 7406	10	CSM (near natural)	High Alt >80m	low Alk <50mg/l	River
GB110064 048740	Wen (Mawddac h)	7352, 7354, 7364, 7365	10	CSM (max allowable)	high Alt >80m	low Alk <50mg/l	Head- water
GB110064 054610	Crawcwell t South	7339	5	CSM (near natural)	high Alt >80m	low Alk <50mg/l	Head- water

3. Trophic diatom index

The standard should be equivalent to WFD high ecological status using the current version of the diatom classification tool (via light microscopy). This is a tool developed to measure increases in nutrient concentrations through assessing degree of change in floristic composition in benthic diatoms (algae) in streams and rivers.

4. Acidification

This standard only applies to assessment units whose water body type is classified as siliceous or peat. Other types have good buffering ability and so will not be affected by acidification. See tables 4a and 4b for standards for all water bodies in the Afon Eden SAC.

Four of the WFD water bodies in the Eden SAC is classed at risk of acidification (Hankin *et al.* 2014). However, to comply with CSM guidance, acid targets have been applied for all river water bodies. **Note that monitoring and reporting will only be carried out for water bodies classified as either 'at risk' or 'probably at risk'**. If ANC data is available, then water bodies should be assessed against the ANC standard but if ANC data is not available then pH should be used.

Table A2.4a Acidification targets for SAC rivers.

*Acid Neutralising Capacity; ** Dissolved Organic Carbon

Targets for acidification	Method of assessment
<p>ANC*: Mean ANC for all waters > 80</p> <p>pH (Clear waters with DOC**<10 mg L-1): mean > 6.54</p> <p>pH (Humic waters with DOC>10 mg L-1): mean > 5.1</p>	<p>Analysis of water chemistry data from environment agencies. At least 36 samples (3 years of data) are required, which must include winter samples.</p>

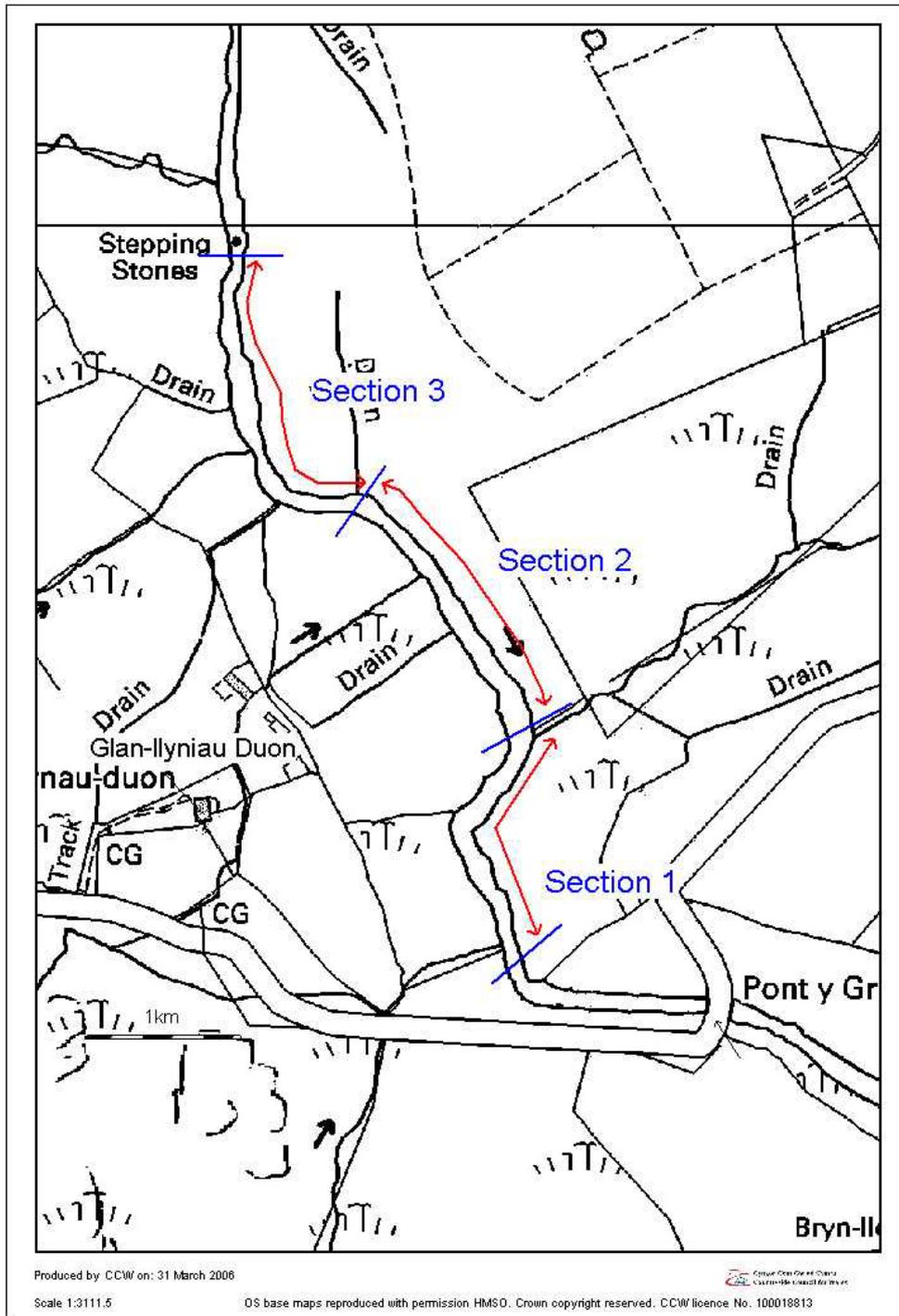
Table A2.4b. Acidification targets for river waterbodies in the Afon Eden SAC.

Water Body ID	Water Body Name	SAC Units	Acidification risk	Acid Neutralising Capacity (ANC)	pH
GB1100640 48750	Eden - lower	7341, 7362, 7401	Probably at risk	>80	>6.54
GB1100640 54630	Eden - upper	954,957, 959, 958, 1561, 2446, 6562, 6862, 6863, 6864, 6865, 7337, 7359, 7361	Not at risk	>80	>6.54
GB1100640 48710	Mawddach - lower	7404, 7406	Probably at risk	>80	>6.54
GB1100640 48740	Wen (Mawddach)	7352, 7354, 7364, 7365	Probably at risk	>80	>6.54

Water Body ID	Water Body Name	SAC Units	Acidification risk	Acid Neutralising Capacity (ANC)	pH
GB110064054610	Crawcwellt South	7339	Probably at risk	>80	>6.54

Annex

Lurionium natans monitoring sections on the Afon Eden



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