LIFE Project Number

LIFE07NATUK000948

FINAL Report

Covering the project activities from 01/02/2009 to 31/03/2014

Reporting Date

31/12/15

LIFE+ PROJECT NAME or Acronym

Anglesey and Lleyn Fens LIFE Project

Project Data

Project location	North West Wales, UK
Project start date:	01/02/2009
Project end date:	31/12/2013 **Extension date:** 31/03/2014
Total Project duration (in months)	62 months (including **Extension of** 3 **months**)
Total budget	5,401,793€
Total eligible budget	5,401,793€
EU contribution:	2,678,560€
(%) of total costs	49.59%
(%) of eligible costs	49.59%

Beneficiary Data

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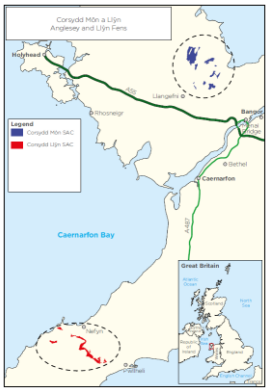
2. Executive Summary

The Anglesey & Lleyn Fens are located in north-west Wales (UK) and provide one of the core strongholds of base-influenced rich-fen habitat in the UK and the Atlantic bio-geographical zone. Twelve distinct sites are protected within two Special Areas of Conservation (SAC) designated specifically for *alkaline fens* (H7230); and c*alcareous fens with* Cladium mariscus *and species of the* Caricion davallianae (H7210), these two SACS also form the Anglesey & Lleyn Fens Ramsar site.



The two SACs are geographically and culturally distinct. The Anglesey (Corsydd Mon) SAC is centred on the Carboniferous Limestone block of east-central Anglesey and supports the majority of the Annex I habitat resource across the two SACs. This is spread across 8 sites ranging in size and complexity from the 295 ha **Cors Erddreiniog** fen complex (with its multiple broad valley-heads and seepage slopes), through to small sites such as **Waun Eurad** (< 4 ha) consisting of little more than a single discrete seepage face or basin. The Lleyn Fens (Corsydd Llyn) SAC comprises a chain of 4 sites occupying a prominent valley complex extending across much of the width of the Llyn Peninsula. The largest site, **Cors Geirch**, dominates the landscape of central Llyn and supports small pockets of rich fen set within a wide range of degraded fen and other wetland habitats. Both SACs are groundwater-fed – with limestone and calcareous drift serving as the respective primary source for lime rich water.

A common feature of the project sites is their occurrence in lowland valley-heads and wet basins located within intensively managed farmland. Both SACs sit at the fringe of the mountainous core of North Wales, with consequent pressure to support productive agriculture all year round. All of the sites are significantly smaller than they would once have been and the project aimed to tackle a number of critical issues:

- nutrient enrichment and drainage pressures
- management neglect
- insufficient grazing resulting from the isolation of these sites from their surrounding grazing units
- a general lack of essential infrastructure for enabling modern grazing practice
- water quality and water resource issues.

The main 3 pressures are water quality, water quantity and dereliction

Over time has meant that both Annex I features were in unfavourable condition at the inception of the LIFE project, with all existing conservation measures being insufficiently resourced and/or ineffective to offer realistic prospects for recovery. This led to the requirement for the current project.

The project has, of necessity, been complex, with over 30 actions and 13 concrete conservation actions (highlighted in bold in the following text) and a significant land-purchase action designed to address both the primary causes and the consequences of degradation. The ultimate objective was to bring the sites under favourable management and leave them in a condition where relatively low cost ongoing management is sustainable.

A significant complication in the delivery of the project is that both Annex I habitats generally occur as the minority element of a much wider degraded fen resource, only some of which is likely to be restorable to either target habitat. The main operational consequence of this has been the need to adjust grazing levels and the careful day to day management of grazing animals, including the use of temporary electric fencing.

The project actions can be divided as follows: actions to enable the resumption of traditional low intensity management, a substantial grazing project involving the local agricultural community, actions to restore appropriate hydrological conditions and reduce the sources and consequences of nutrient enrichment, actions to increase community interest in the sites and a sense of ownership and responsibility, and land purchase projects in specific cases where direct ownership offered the only viable and sustainable route to securing appropriate conservation management.

Actions to enable the resumption of low intensity management include a group of projects to replace or install basic essential infrastructure to enable secure grazing by farming stakeholders, including fencing (**C5** & **C6**) and construction of stock-handling facilities,

access tracks, bridges and parking/turning areas for cattle and sheep trailers (**A15**). Implementation of these actions also demonstrated to farming neighbours the willingness and seriousness of the conservation sector to proactively meet their core requirements for secure, efficient and safe grazing which could be integrated with their wider farming business. These actions collectively made over 500ha of fen habitat accessible and available as a valuable seasonal grazing resource and are regarded as one of the core successes of the project. The access and grazing infrastructure is durable and will only require routine maintenance during its anticipated lifespan of 20 years.

The second key set of actions to enable grazing management concerns measures to make the fen vegetation accessible and palatable to grazing animals through a combination of two main categories of mowing and biomass removal and also burning and scrub management. The mowing actions were split between sensitive mowing with hand-tools and mechanical harvesting. Hand mowing was applicable to alkaline fen with a micro-topography which would be damaged or destroyed by mowing to a uniform height (**C2**). Larger-scale mowing was used over areas of predominantly flat topogenous fen where close-cutting to a uniform height was essential as a means of breaking the dominance of long-established tall grasses and sedges (**C1**). Both approaches required innovative solutions which up until this project had not previously been applied in the UK at this scale or in this precise way. Implementation of action C1 required the procurement and adaptation for UK conditions of a Pistenbully™ fen harvester machine. This enabled mowing on a scale and rate not hitherto possible, achieving a cutting rate of up to 5 ha/day and a total cut hectarage of over 167ha.

Pistenbully fen harvester

Hand mowing was undertaken by teams of contractors using petrol powered strimmers with subsequent hand-raking of cut vegetation. This proved an important source of out-of-season employment for several local firms whose core business centres around highway verge management in the spring and summer: this important local economic benefit enabled the project to demonstrate its wider economic and social value to local communities. A total of 89 ha of alkaline fen seepage face and spring-head vegetation had been hand-mown by the end of the project, although this total includes areas re-cut to achieve the desired result.

Hand strimming of fen vegetation

For both mowing actions, the vast majority of cut biomass was removed from the sites (**C3**) and offered to and enthusiastically accepted as an alternative and free source of stock bedding by local farmers. This served to reveal another important link between the management of the sites and economic benefits to local communities. Ongoing rotational mowing will be needed because of inevitable difficulties in securing adequate grazing for all locations whenever it is needed. Furthermore, the all-pervasive influence of atmospheric nitrogen deposition is such that low intensity grazing alone is probably not capable of adequately managing vegetation structure and biomass across the whole suite of Annex I habitat locations.

Burning was historically important as a means of encouraging new growth for grazing animals: its gradual and ultimately total abandonment as a tool employed by the agricultural community resulted from changes in farming practice and earlier conservation dogma that almost any burning was likely to be harmful. The wider application of burning in the LIFE project (**C8**) followed earlier small-scale burning initiatives on a few of the National Nature Reserve sites and proved very successful in managing stands of calcareous fen over-run by purple moor-grass *Molinia caerulea* and bog myrtle *Myrica gale* in particular. Once again this action has demonstrated the willingness of the conservation sector to adopt and adapt traditional management practices to the mutual benefit of biodiversity and graziers. However, seasonal limitations and the need for very specific weather conditions ultimately limit the use of burning and the exceptionally wet years during this project limited burning to 60 ha, with additional mowing being undertaken instead. Nevertheless, burning remains an important tool for future management, especially in those areas where access for biomass removal is difficult. However, its effect on the insect population is an important consideration before burning.

Work to encourage and procure grazing has been one of the highlights of the project, not least because of its importance as the primary long-terms means of ensuring the sites are managed sustainably over long timescales. Grazing stock procured and maintained by the conservation sector (conservation stock) was already being employed on the National Nature Reserve

(NNR) sites, but this was only a partial solution at best because of the focus on low maintenance hardy ponies (which require significantly less husbandry effort than cows), their use in insufficient numbers (partly because of inevitable limitations on the availability of off-site grazing for periods when grazing had to be relaxed on the fens), and their inherent tendency to graze preferential locations at the expense of other areas needing grazing. Perhaps most importantly of all, the pre-LIFE focus on grazing by conservation stock lead to a perception that grazing by other partners was neither sought nor required, contributing to the disenfranchisement of the local agricultural community.

The production of grazing plans for all project sites was the first step in procuring grazing. These served to detail the ideal seasonal stocking regime, based on existing guidance, Project Officer's experience and NNR management team experience. This plan also highlighted necessary infrastructure such as fencing and where mowing was required. The requirement of the project for grazing by farming partners was discussed with many individual neighbouring farmers and was also promoted at meetings with the farming community, starting with the project sponsorship during its launch event at the 2009 Anglesey Agricultural Show of a key cattle breed class. Specific agreements were then negotiated with individual farming enterprises, enabling commencement of grazing by a wide range of cattle breeds, including both the anticipated hardy breeds such as Dexter, Highland and Welsh Black, and the less expected but enthusiastic use by some farming partners of more specialised and productive modern breeds and breed crosses such as Holsteins. In most cases, the resumption of cattle grazing followed a break of at least 30 years and this has led to a major change in the viewpoint of the farming community towards the fens. The project also utilised direct stock purchase as a means of securing grazing on some of the sites least attractive to grazing partners; the purchase of four Konik ponies and two Shetland ponies was a key element of this and demonstrated the need and scope for alternatives to the existing conservation herd of Welsh Mountain ponies.

Welsh Mountain Ponies grazing Alkaline Fen ponies

An innovative element in securing grazing concerned the use of farming cooperatives to act as local brokers in matching the requirements of graziers to the availability of grazing on specific sites. By the end of the project, over 500 ha of fen land had been brought into grazing management. Furthermore, our increased knowledge of the effectiveness of specific

grazing regimes means that updated guidance can be produced for use by other conservation managers (see **D11** below).

The negotiation of management agreements for parts of the fens under third party management (**C9**) has been a major success of the project, with agreements secured for some long-standing problem sites where poor relationships between the Countryside Council for Wales (now Natural Resources Wales) and owner/occupiers had frustrated previous attempts at securing favourable management. In total over 200ha of private land has been brought into management, all of which will continue long beyond the project life.

Hydrological restoration was one of the key challenges for this project, not least because many previous LIFE projects have focussed on addressing this element in the conceptually and practically much simpler concept of rain-fed blanket mires. Fens present a more complex restoration scenario because of the need to restore the all-important hydro-chemical influences of groundwater supply coupled with the need to prevent enriched water from the site catchments affecting the core oligotrophic Annex I habitats. Consequently, significant effort was devoted to improving our understanding (even if only to a conceptual level of the hydrological functioning of the sites) and the degree to which hydrological regimes could be modified to better match the likely hydrological supporting conditions for the key Annex I habitats (**A5**). This again will be written into important guidance for other practitioners.

Hydrological restoration focussed on restoring groundwater supply (**C11**) and in raising (or in some cases getting the water level right) water levels (**C10**), with the all important constraint of trying to limit the influence of enriched marginal water sources. Groundwater influence was restored through an ambitious and effective programme of blocking or bypassing marginal foot-slope drains and other drainage features acting to intercept groundwater, surface re-profiling, and reinstating through a variety of groundworks the influence of marginal springs. Much of this work was necessarily undertaken with measures to address water quality, including routing reconnected spring-lines through constructed treatment wetlands and the use of planted hedge-lines to act as buffers for surface runoff.

Measures to raise water levels included the use of conventional timber, plastic and peat dams carefully engineered to allow bypass flow in cases where this had to be accommodated; plastic sheet piling was also used to raise water levels along maintained ditch alignments where modifications to water levels was not acceptable to farming neighbours. Peat removal was used as a last resort option for raising water levels, but this was limited to contexts where the operation also served to reduce nutrient levels through the removal of enriched peat (see below). By the end of the project water levels had been raised over a total linear ditch length of 5.3km, with groundwater influence stretching to nearly 8km of fen. A very important aspect of re-engineering spring flow across fenland is to significantly increase the retention time of water within the wetland, thus reducing the impact of flooding within the catchment.

Management of nutrient regimes to the project sites was, as expected, a key challenge and was addressed through a range of mechanisms implemented both on and peripheral to the sites. Of the on-site measures, the projects to remove significant areas of dehydrated and enriched peat (**C13**) at **Cae Gwyn** (Cors Erddreiniog, Corsydd Mon SAC) and **Cors Ceidio** and **Mathan Uchaf** (Cors Geirch, Corsydd Llyn SAC) were the most ambitious and radical in nature, resulting in the exposure of over 20ha of wet low nutrient status peat, with clear indications already in the case of the earliest of these projects (Cae Gwyn, 2011) of a successional trajectory towards alkaline fen. Two of these initiatives (Cae Gwyn and Mathan

Uchaf) were also accompanied by significant projects to install peripheral water treatment wetlands (**C14**) located at key spring inputs were water quality testing (**A5, A6**) had demonstrated significant inorganic nitrogen loadings. Constructed wetlands were used at another 13 locations to address point source inputs of N enriched surface and/or groundwater and technical aspects of design, installation and monitoring were the subject of one of the two Knowledge Exchange doctoral research studentships supported by the project.

Important information on the actual requirement for fertiliser applications within the site catchments were provided by a LIFE funded contract let to the Agricultural and Development Advisory Service (ADAS) to provide participating farms with unbiased Nutrient Efficiency Reports (NER). 16 farms responded positively to written invitations to be included in the project, which was lower than anticipated in the bid, but far exceeded the number of fields anticipated (279 fields and 724 ha). Soil test results and nutrient efficiency studies identified opportunities at 12 out of the 16 farms to reduce the amount of fertilisers applied to the land, achieving an average saving of £16/ha. Subsequent contact with the participating farmers indicated that 12 of the 16 intended to change their nutrient management practice and adopt all of the NER recommendations. This represents a potentially highly cost-effective means of reducing leakage of excess nutrients into the fens from their catchments and is commended as an approach which could be utilised more widely under a Water Framework Directive Programme of Measures to address failing groundwater quality within the groundwater bodies underpinning the two SACs. The full range of nutrient reduction/remediation measures included in the LIFE project served as the basis for a technical workshop held in 2010 to discuss catchment level intervention options for reducing nutrient loading within the groundwater bodies of the two SACs.

Land purchase (**B1**) has been an important element of the project and one of its great successes, with significant acquisitions of fen habitat supporting alkaline or calcareous fen at **Cors Erddreiniog**, **Cors Bodeilio**, **Cors Cefn Uwrch** and **Cors Geirch** totalling 194 ha, well exceeding the project target. All of these acquisitions required very significant project management and staff input through negotiation and the fact that over 200ha of fen are now under permanent dedicated conservation management is one of the great achievements of the project. With the support of additional funding from the Welsh Assembly the project target and land purchase budget was exceeded.

Drone photograph of purchased land Cors Cefn Uwrch (action B1) showing effects of ditch blocking (action C10) and small peat scrapes (action C13)

Communication of project aims, actions and outcomes was undertaken at all levels throughout the five year period, with events for local primary schools, Universities, local community groups, local farming groups and naturalist/conservation groups. Engagement with CCW's Council and NRW's board and senior managers (to Chief Executive level) was also undertaken, with presentations and site visits on numerous occasions (NRW Chief Executive speeches after 12 months and 2 years of NRW being established have both highlighted the achievement of the Anglesey and Llyn Fens LIFE project). There were also technical/practitioner level meetings held with CCW/NRW officers and colleagues from Anglesey County Council and numerous site and/or evening meetings with groups of farmers, parish councillors and community groups to demonstrate the work of the project and the opportunities for using the sites for grazing and as a source of stock bedding. The Project Manager attended UK and Wales level LIFE workshops and advised on significant elements of the NRW Prioritised Action Framework LIFE project (LIFE11NAT/UK/000385) which commenced in 2012. Networking was taken a level further by close collaborative working the German Brandenburg Fens Project (LIFE08NAT/D/000003), which resulted in shared scoping trips to Poland, expert panel representation in Germany, a joint presentation to the IUCN Peatland Programme and presentations at the final conference. This networking has been highly successful and would serve as an excellent example for any other project considering joint working.

The LIFE project, CCW and the Wolfson Carbon Capture Laboratory at Bangor University co-hosted the second national IUCN UK Peatland Programme conference in September 2012, contributing two presentations (one joint with the Brandenburg Project) about the project and three field excursions to project sites. This helped show-case the LIFE project and more generally the LIFE instrument and also helped ensure the subsequent inclusion of fen conservation as a more explicit element of the IUCN work programme. The international delegation included representatives of the International Mire Conservation Group, the German Brandenburg Fens Project and Ireland's Bord na Mona, and invaluable feedback on aspects of the LIFE project already undertaken and planned was obtained.

In terms of staffing, the project benefited from five officers with turnover during the project of just one team member (the finance and admin officer). Full opportunity was taken of using student placements and also a Welsh language under-graduate training scheme: the incumbent of this role (Rhoswen Leonard) went onto achieve a First Class Honours Degree after her sandwich year placement with the LIFE project and returned for another years post-graduate employment with the fens LIFE team before embarking on a Doctoral Research Programme examining the effects of climate change on peatland habitats in Canada based at Birmingham University (UK). Rhoswen presented a paper on the Cae Gwyn Restoration Project at the UK Geological Society's Groundwater Dependent Terrestrial Ecosystems conference in February 2013. One staff member (Llion Jones) helped secure a full band upgrade (from B to C) during the project, and this helped him secure a permanent role within NRW at this band. All staff benefited from staff development programmes.

The project contributed to two Knowledge Exchange doctoral research studentships, with one PhD already submitted (West, 2014) and the other expected to be submitted in 2015 (Menichino – in prep.). Both PhD students have contributed to a wide range of international and national research seminars. During the last two years of the project, close-links were forged with Bangor University's Wetland Ecology and Conservation Masters Course, with two Masters students (Wayne Watkins and Bethan Wyn-Jones) serving as regular volunteers with the project and the project providing contributions to the taught element of the course.

A three day technical workshop held between the 9th and 11th October 2013 (**D11**) served as the primary means of disseminating the technical actions and outcomes of the project and was attended by 60 delegates drawn from the land-management, conservation, academic and local community sectors, together with delegates from the related LIFE projects in Brandenburg (Germany), the Romanian *LIFE for Marsh* project (LIFE11NAT/RO/000828) and a Danish Fen project. The illustrated proceedings of the workshop are due for publication at the end of 2015 (but outside the project period) and will provide key technical conservation management guidance and a record of what the project achieved.

Other key publications of the LIFE project include the fully illustrated layman's report, a leaflet covering the Cae Gwyn restoration project (Leonard, 2014), two leaflets introducing the project and a third covering key facts about peat and peatland habitats, as well as a leaflet published with the Isle of Anglesey County Council relating to Anglesey Wetlands. In addition, an innovative children's book was published which conveys key messages about peatland conservation through a traditional folk-tale narrative. This publication was developed as a collaborative venture with the German Brandenburg Fens Project, requiring cultural adaption for the two respective audiences and the production of three language versions (German, English and Welsh), together with an accompanying animated video. A case study covering this LIFE project also appears in the IUCN 2012 publication Demonstrating Success.

The LIFE project has contributed to or helped initiate a number of research projects, including inter-agency UK projects to develop methods for assessing significant damage to groundwater dependent ecosystems under the EU Water Framework Directive (SWS, 2010a&b) and a major DEFRA funded project to assess the flux of greenhouse gases from a range of lowland peatland types in good and poor condition. The project has contributed to an extension to this work to assess in more detail GHG flux from a range of the main management treatments applied during the project. This and the DEFRA funded project is likely to be highly influential in helping the development of a more refined suite of emission factors in support of the long-awaited wetlands supplement. The *LIFE* project was critical in demonstrating that

damage to the wetland SACs was of a scale sufficient to justify assessing the two groundwater bodies as in poor condition *sensu* the Water Framework Directive. This means that work will have to be targeted at addressing adverse water quality at a catchment level as part of River Basin Management Plans.

Monitoring of project actions focussed primarily on vegetation and hydrological responses. Vegetation monitoring has demonstrated that plots subject to intensive management operations are showing clear reductions in components such as graminoid (grass) cover, litter cover, dwarf shrub cover and vegetation height; similar reductions have occurred in *Cladium mariscus* and *Molinia caerulea* cover. All of these are significant prerequisites for attainment of favourable condition. Indeed, evidence from paired 'Treatment & Control' plots suggests that early intensive intervention using machine mowing (or similar) is likely to be an essential requirement in order to allow stock to penetrate the sward. Ongoing monitoring will be essential because the perennial character of most of the dominant species means that change is likely to be slow, and much of the monitoring was conducted only 1 or 2 years after applied management actions.

Hydrological monitoring has shown some spectacular improvements in the hydrological condition of sites, with an increasing influence of groundwater and raised and stabilised water levels.

Important legacy aspects of the project include the current 'after *LIFE'* planning phase and the Welsh Government funded Mawndir Mon project. The Mawndir Mon initiative was conceived as a bid for the Welsh Government Resilient Ecosystems Fund in 2012; the bid was successful, with an award of £80,000. The bid was heavily supported by LIFE staff and involves extending the ethos of restoring neglected derelict fen sites to the many non-statutory sites in the wider fens areas, together with constructed water treatment wetland installations in the catchment of Llyn Cefni and a major public engagement project, the Anglesey Wetlands Festival, held in July 2014 with an attendance of over 500 people.

The after LIFE planning phase is being undertaken as a complementary exercise to the NRW Natura 2000 Priority Action Framework LIFE project. Ongoing actions to support the original LIFE actions are being identified on a management-unit by management-unit basis for both SACs.

The Anglesey & Llyn Fens LIFE project has shown what can be achieved with dedicated funding and a strong focus of effort and resources. The project tackled all of the contributory causes of unfavourable condition on the fens, most of which had little prospect of being resolved with existing resources and mechanisms. A dedicated follow on project is needed to focus on (i) catchment level measures now required to address the causes of poor groundwater quality, and (ii) continuing measures to realise sustainable management of the sites through grazing and vegetation management measures, (iii) a major public/community engagement and access provision exercise, and (iv) continuation and extension of the project actions to realise its full ambition for these sites in terms of restoring hydrological and hydro chemical regimes. There is also a significant programme of work needed to consider notification of some key Annex I habitat omissions from the protected sites series in both fen areas.

The main report which follows provides an introduction to the specific aims and objectives of the project (Section 3), a description of the administrative system (Section 4), the Technical Report (Section 5.1) which summarises the project results (and includes reference to expected

outputs already submitted in previous reports and information annexed to the report), an overview of dissemination actions (Sections 5.2), evaluation of project implementation (Section 5.3) and the analysis of long-term benefits (Section 5.4). Comments on the financial report are provided in Section 6. Annexes are provided in Section 7.

Photograph taken by drone showing Cae Gwyn (action C13), the white "marl" is clearly visible even through the development of vegetation on the excavation site.

3. Introduction

3.1 Description of background, problem and objectives

The project was developed to tackle issues and factors affecting the condition of the Alkaline and calcareous Fens on the **Anglesey Fens SAC** and the **Lleyn Fens SAC**. Both of these sites are comprised of a number of smaller UK designated Sites of Special Scientific Interest. Mostly these SSSI are discrete Fen basins in their own right. Sub-projects or areas within SSSIs are identified by local names. These names are used in the report where an action, e.g. land purchase, targets a specific area within the SSSI/SAC.

Table 3-1: SAC, SSSIs and sub-projects

SAC	SSSI	Sub Projects/Areas	Description
Anglesey Fens SAC	Cors Erddreiniog	Cae Gwyn	Largest excavation site
		Cors Cefn Uwch	Separate basin where project adopted local name rather than South East Fen Basin. Land purchase and huge inroads with previous hostile owners
		Cors Nant Isaf	Largest land purchase, separate basin and hugely important purchase. Greatly improved relationships
		Spring Fields	Management agreement with previously hostile landowner. Important population of Annex 2 species *Coenagrion mercuralie*
		Bodgynda	Grazing/management section
		Tal Y Sarn	Grazing/management section
		Cae Leci	Grazing/management section
		Bryn Mwcog	Grazing/management section
		Cefn Du	Grazing/management section, large access track and long term access agreement
	Cors Bodeilio	Cors Y Plwyf	Separate system in Community Council ownership
		Fly Orchid Spring	Management section
		Bennett Fields	Management agreement area with previously hostile owner
		Cors Tyddyn Fieren	Land purchase and grazing/management section
		Cors Gwynan /Holt Fields	Management agreement section
	Cors Goch	Cors Castell	Separate basin
	Cors Y Farl		Separate Fen
	Waun Eurad		Separate Fen
	Caeau Talwrn		Separate Fen
	Gwenfro and Rhos Y Gad		Two separate basins
Lleyn	Cors	Tal Y Sarn	Land purchase and grazing/management section

SAC	SSSI	Sub Projects/Areas	Description
SAC	Geirch		
		Cors Ffynon Wen	Land purchase and grazing/management section bought from the farm Bodtacho Ddu
		Rhos Y Medre	Land purchase and grazing/management section between 2 other sections
		Cors Ceidio	Large reprofiling project and access improvement linking site, renamed from "Central Section"
		Gallt Y Beren	Land purchase and grazing/management section on previously hostile site. Access links
		Hendre	Management agreement and access section
		Mathan Uchaf	Large reprofiling project, land purchase,
		Allt Goch	Large purchase section
		Hendre	Grazing and management agreement section

The overall Project Objective is:

To bring 751 ha of fen within the Corsydd Mon/Anglesey Fens SAC and Corsydd Llyn/Lleyn Fens SAC into favourable or recovering condition through measures aimed at tackling the factors adversely affecting their condition and by delivering more sympathetic management. Specifically to:

- Address each of the factors responsible for the unfavourable condition of the Annex I fen features of these sites;
- Direct and facilitate change within the catchments of the project area to further tackle the causal factors of unfavourable condition.

The factors to be addressed each represent a critical threat and are:

- Management neglect or inappropriate management on and adjacent to sites
- Nutrient enrichment
- Drainage
- Successional change (leading to scrub development and other undesirable changes)
- Inappropriate management of land outside direct conservation management, leading to cultural enrichment and ecological fragmentation
- Uncontrolled burning
- Climate change
- Ecological fragmentation
- Lack of information about the importance of the project sites and the need for wetland conservation management

Project Actions are designed to tackle these factors and ensure the appropriate management is put in place to achieve favourable management on the Anglesey and Lleyn Fen SACs.

3.2 Expected longer term results

To bring 751 ha of fen within the Corsydd Mon/Anglesey Fens SAC and Corsydd Llyn/Lleyn Fens SAC into favourable or recovering condition through a suite of measures aimed at delivering more sympathetic management. An overview of results is provided in Table 3-2 below:

	Expected Results –from Grant Agreement	Achieved	%	Comment	Afterlife
1	To bring 84 ha of alkaline fen and 104 ha of calcareous fen into favourable or recovering condition through a suite of measures aimed at delivering more sympathetic management Proposed new target based on evidence: 84.39 ha for alkaline fen 80.63 for calcareous fen	63.2 – 134.22 ha alkaline fen 63.9 – 121.05 ha of calcareous fen	range exceeds revised target	Quantification of achievement of this target is complicated because NVC mapping under Action A2 found less Annex 1 habitat (fen) than designated as SAC. Annex I of MTR presented a summary of the work. Mapped areas were 42.6 ha of alkaline fen and 42.5 ha of calcareous fen. EC letter of 01/03/13 (MTR) accepted the revised restoration targets. Detailed information on how the potential extent was calculated and evidence based targets produced is provided in *Annex 1 - Analysis of LIFE project actions carried out on current and potential extent of recorded and potential Annex I habitats 'Alkaline fen' and 'Calcareous fen with* Cladium mariscus *and species of the* Caricion davallianae'*, in relation to main objective and target*	Continue through place based teams and NNR management team
2	114 ha will be mown and harvested	257 ha	226%	Target exceeded.	Continue as per Afterlife Plan
3	Sustainable grazing management will be managed on 446 ha	502 ha	112%	Target exceeded	Continue as per Afterlife Plan
4	Scrub management will be applied to 60 ha	101ha	168%	Target exceeded.	Continue as per Afterlife Plan
5	Controlled burning will be applied to	61ha	36%	Weather and health and safety issues restrict	Continue as per

	Expected Results –from Grant Agreement	Achieved	%	Comment	Afterlife
	168 ha			burning opportunities. Target reviewed and considered in relation to cutting and grazing targets. Burning is a long term activity and weather dependant. The overall target of burning will be integrated with other activities within the Afterlife Plan	Operations Plan
6	Management Agreements will be negotiated on a minimum of 217 ha within, linking or critical to the integrity of the SAC	196.5ha	91%	Target not met but exceeded post project	Continue through place based teams
7	Constructed wetlands will be installed in 8 locations	13 locations	163%	Target exceeded	Develop use and potential through place based teams
8	15 ha of peat stripping and topographic re-profiling will be carried out	22 ha	146%	Target exceeded	Small scale works via place based teams/NNR teams
9	3479 m of hydrological pathways will be restored	5362 m	154%	Target exceeded	Review potential and need through place based teams
10	Water levels will be managed correctly along 5813 m of ditches	7942 m	136%	Target exceeded	Review potential and need through place based teams
11	66 ha of land will be taken into conservation ownership	194ha	293%	Target exceeded	Draw up priority purchase plan
12	76 ha of firebreaks will be created	1553m	n/a	Target is dependent on the ability to burn. Three	Dictated by NNR

	Expected Results –from Grant Agreement	Achieved	%	Comment	Afterlife
				wet years during the project made burning difficult. Firebreaks reported as linear measurements rather than area	operational plan
13	4 colonies of Annex II species will be brought back into favourable condition	4 colonies	100%	Target met for two species. Long term monitoring is required to determine success. A third species was found in a managed area and surveillance recorded *Coenagrion mercuralie* in a new location	Long term monitoring to review
14	Farm nutrient, biodiversity and diversification management plans will be written for 40 farms	279 fields 724.3 ha 16 farms	n/a	Although numbers of farms is below the target, the number of fields and ha well exceeds any estimates. This action is being developed by NRW Natural Resource Management and Natural Resource Planning teams	Place based teams to develop in the future
15	8 access gates designed by local school children will be installed	3 ‘gateways’	n/a	Target reviewed and changed. Three ‘gateways’ to the internet provided to schools and community centre, also photographs and final conference involvement with schools. Otherwise this access action was overtaken by general spend on access infrastructure to enable concrete conservation actions	
16	22 site signs will be erected, Website will be established	50 signs 1website	227% 100%	Target exceeded Micro-site updated to new NRW format. Layman’s Report added.	Project micro-site absorbed by NRW website

The table shows that almost every expected result has been exceeded through the project actions. The after LIFE plan, developed in conjunction with the LIFE PAF project (LIFE11NAT/UK/000385), will ensure that the gains achieved by the project will be sustained through the work of Natural Resources Wales and the Prioritised Implementation Plans (PIPs) for all Welsh SACs.

Drone aerial photograph of Cors Tyddyn Fieren (Land Purchase action B1), showing small scale peat scrapes (action C13), water level management and water connection (Actions C10 and C11), and pattern of grazing animal movement through the cut fen vegetation (action C4).

The project has also supported ecosystem goods and provided valuable learning to Welsh Government's implementation of natural resource management and the sustainable management of natural resources
http://gov.wales/topics/environmentcountryside/consmanagement/natural-resources-management/?lang=en

In terms of achievement the project has delivered ecosystem goods and services that are understood in layman's terms and appreciated throughout the fen catchments. Continued development of these is important within the Afterlife plan. Ecosystem goods and services supported by the project are summarised in Table 3-3 below:

Ecosystem Goods or Service	Issue/Action	Project Action	Benefit	Beneficiary	Beneficiary	Repeated
Water Quality	Healthy Fen	Whole project impacts on the state of a healthy fen	Reduced DOC and Sedimentation	Drinking Water	Improved Habitat	Mawndir Mon NRW Sites work
	Constructed Treatment Wetlands	Action A6 and C6	Reduced total Nitrate-N in water system, reduced loss of peat C resulting from inorganic N enrichment	Drinking Water	Improved Habitat	Mawndir Mon Afon Eden LIFE Project NRW Site work Natural England
	Hydrological actions	Action C10, C11	Increased retention of water within the fens, reduced DOC export	Drinking Water	Improved Habitat	
Economic	Increased Grazing / improved regime	Action C4	Increased land availability and infrastructure,	Farm Business	Improved Habitat	NRW Site work
	Increased Grazing / improved regime	Action C4	increased stock capacity for other areas	Farm Business	Demonstration	NRW Site work
	Conservation Groundwork, habitat restoration	Whole project	Increased company capacity	Company and Conservation work UK wide	Relevant action	Mawndir Mon LIFE Afon Eden Project NRW Site work
	Machine and hand cutting work	Actin C1, C2	Increased company capacity and extending shoulder of work season	Company and employees, longer work contracts, retention of staff, conservation work UK wide	Improved Habitat	NRW Site work
Flood Alleviation	Increased retention of	Action C10,	Significantly slows	Communities	Improved Habitat	Natural England

Ecosystem Goods or Service	Issue/Action	Project Action	Benefit	Beneficiary	Beneficiary	Repeated
	water in sites, spreading spring water across the Fen increases pathway of water from point of entry to outflow streams	C11, C6	down the speed and volume of water transmission to receiving waters			NRW Site work
Education	Educational animation and book, school ipads and photographs, Layman's book, signs	D actions	Improved understanding of the importance and links between conservation and people	Communities	Understanding of habitats	
	Increased use of local names, welsh names, place names eg Cors Cefn Uwch instead of South East Fen Basin, Tafod Y Gors instead of Butterwort	C9, D actions	Improved understanding of the importance and links between conservation, sites and their history and people		Understanding of habitats and people working with them	
	Technical guidance	All technical actions	Advanced technical guidance for practitioners across Europe	Practitioners, LIFE beneficiaries	Improved access to technical guidance on novel and effective restoration techniques	
Carbon	Reduced Carbon loss through damaged peat, increased peat formation and consequential future proofing of peat		Reduced impact of climate change	Communities	Mitigation against climate change, understanding of the importance of habitats to mitigation	

4. Administrative part

4.1 Description of the Management System

The project was led by the Countryside Council for Wales (CCW) until the establishment of Natural Resources Wales (NRW) on 1st April 2013. NRW assumed all the beneficiary roles of CCW and merged the previous partnership approach between CCW and the Environment Agency Wales. The merger and subsequent name change were addressed in the project modification approved by the EC on 18th December 2013.

The core project team established to deliver the project was:

Justin Hanson (Project Manager)
Dyfed Jones (Senior Project Officer
Llion Jones (Senior Project Officer)
Julie Stanley /Cecile Roberts (Finance and Business Manager)
Janine Guest (Senior Environmental Scientist)
Rhoswen Leonard (Assistant Environmental Scientist)

In addition to the core team, Natural Resources Wales input a lot of additional time and resources from other staff (on top of the expected support from the project board and teams etc). NRW has not claimed for this time as it was not part of the original project but the time and resources input should be acknowledged.

Peter Jones – significant input to all aspects of the project
Kathryn Birch – NVC survey and monitoring
Les Colley – Lleyn peninsula sites
Emyr Humphreys -Anglesey sites

The Project team inevitably lost members towards the end of the project. Llion Jones found a permanent post within NRW, Rhoswen Leonard left to pursue a PhD and Cecile Roberts left for a finance role in NRW.

The Welsh Government merged the roles of Countryside Council for Wales, Environment Agency Wales and Forestry Commission Wales to form Natural Resources Wales on 1st April 2013. This had a knock on effect on the project schedule as it involved disruption from moving offices, introducing new computer systems, new administrative procedures and the re-organisation of teams and directorates.

The Project Board was established to oversee project delivery and has continued to meet with membership remaining fairly constant. Nick Thomas was the management link throughout senior representation was provided by Alan Winstone and Sian Williams.

There were 12 meetings of the Project Board which ensured strategic direction throughout the operational phases of the project. Minutes were circulated and made available on the shared computer drive.

In the original project bid and agreement it was anticipated that the project would be phased according to preparatory actions, concrete conservation actions etc. However, in a project of

this size and complexity it was realised that this approach would involve substantial risk in relation to getting actual practical work started on the ground. Although preparatory actions were obviously carried out in advance of related actions, they were phased in and carried out concurrently with other actions e.g. planning applications or licences required to carry out specific works were carried out just prior to the action rather than all at once in advance. This meant that other preparatory actions could be carried out that would influence the outcome e.g. site action planning that could/would change detailed plans on the ground.

A number of changes were introduced during the delivery of the programme. Where these were potentially significant they were reported to the Commission through the schedule of progress reports.

The project required an amendment (Amendment No.1 to the Grant Agreement) to introduce four modifications:

1. To formally change the beneficiary from Countryside Council for Wales to Natural Resources Wales
2. To include a new action D14 networking with other projects
3. To extend the project by 3 months to 31/04/14
4. To amend the budget

The project extension was partly required to complete practical work following the loss of the specialist wetland harvester when it caught fire in March 2013.

Pistenbully wetland harvester during the fire at Cors Geirch SAC

Following the loss of the specialised equipment, the Commission, in its letter of 21st August 2013, acknowledged that a prolongation might be necessary. Although some of the remaining target of 43 ha under Action C1 could be achieved through other actions (e.g. burning) the extension allowed all targets to be met. The project extension also allowed several other actions to be continued through to the end of March 2014.

Revised C2 and C3 forms included in the amendment showed that Actions A1, A14, C1, C2, C4, C7, C8, C12, C13, C15, D1, D4, D8 and D14 would be extended. Project management

actions E1 and E2 were also extended. At the time of the submission of the modification request all action-by-action budgets were revisited and changes (overspending and underspending) were reported to the Commission.

Changes, not considered to be substantial with reference to Article 15 of the Common Provisions, were addressed through correspondence with the Commission.

4.2 Evaluation of the Management System

The main impact on project management during the project was caused by significant change programmes within the beneficiary. These included changes to policy, plans and processes, staff changes across the organisation and significant loss of resources to the project and its support. Without the well-structured LIFE templates and the detailed guidance the potential problems encountered by the change would have been more severe. As it was the main issue has been the length of time that it has taken to produce the final report and claim

The Project Board was initially made up of the three organisations with fiscal input i.e. CCW, EAW and Dwr Cymru (Welsh Water). The project, however, was led by a single beneficiary, CCW. Following the creation of NRW and the merger of CCW and EAW the project board continued with legacy body input and Dwr Cymru

The Board did carry out its strategic overview and provided good steer, sorting out blockages when required. However, the Project Board was too large and often considered items in too much detail. This caused confusion over roles and responsibilities with other groups.

Communication with the Commission and external monitoring team has been quick, easy and efficient. The management and project structure and support offered to LIFE projects is very high quality and based on a long experience of working on and delivering projects.

5. Technical Part

5.1 Technical progress per task

ACTION A1: REVISION/PREPARATION OF MANAGEMENT PLANS, INCLUDING LAND PURCHASED AS PART OF LIFE PROJECT.

Expected Result: Detailed management plans will be produced for newly purchased land, specifying how the land will be managed for the following five years

This action is incorporated into the After-LIFE management plan for each site, which is being aligned with the Wales PAF[1] and N2k LIFE project[2] matrix of costed site actions. The afterlife life plan is attached at Annex 2. During the project the action was replaced by Site Action Planning where detailed assessments of work required were planned in relation to pre-owned, purchased or private land. The value of the SAP approach was presented in PR1 (with a worked example) and demonstrated at the joint mission with the Commission on 11th October 2010. All land purchased during the project has been formally declared as National Nature Reserve and are attached at annex 3.

Indicative maps (included in the Grant Agreement) were used and amended through SAP taking into account all local and current detail, along with group site assessments. Work was then programmed into annual plans (see annex 4).

Issue	*Assessment*
Target	Target met by compiling detailed Afterlife management plan for integrated NRW action
Budget	Action carried out in house
Strengths	Detailed site by site (SAC by SAC and unit by unit) 6 year action plan carried out in association with NRW sites officers. Proposed action aligns exactly with PAF via NRW N2k project
Weaknesses	There is significant detail in aspects of the site planning and the risk is that it will not be updated annually as actions, priorities, staff and landowners change. Split of responsibility for SAC sites between NRW SSSI teams and NNR teams could lead to lack of co-ordination Budget and funding needs to be bid for on an annual basis, therefore although budget was available for priority mowing work in 2014/15 both on NNR and SSSI the future funding cannot be guaranteed.
Opportunities	5 year funding plan potential using costed Afterlife plan is possible which would allow co-ordinated and planned actions to further improve the sites
Threats	Competing NRW priorities and re-structure could potentially lead to temporary focus on different areas of work

[1] http://gov.wales/topics/environmentcountryside/consmanagement/conservationbiodiversity/habitatdirective/paf-for-natura-2000-sites/?lang=en

[2] LIFE11NAT/UK/000385 http://naturalresources.wales/about-us/our-projects/life-n2k-wales/?lang=en

ACTION A2 – NVC SURVEY

Expected Results: Detailed community/sub-community level maps, quadrat records, and site appraisal and description reports for each site. A collated report for each of the two SACs will be produced.

Vegetation surveys of all the sites included in the project (16 sites covering 738.5 ha) have been completed. This provides the single most important baseline against which to monitor medium and long term project impact. The survey methodology has been reported in PR1 and the value of the maps for targeting work (especially mowing) and monitoring, and also land purchase, were discussed with the Commission at their visit in 2010. The use of the UK National Vegetation Classification system produces detailed maps at 1:2,500 scale which can be converted to show Annex I habitat types.

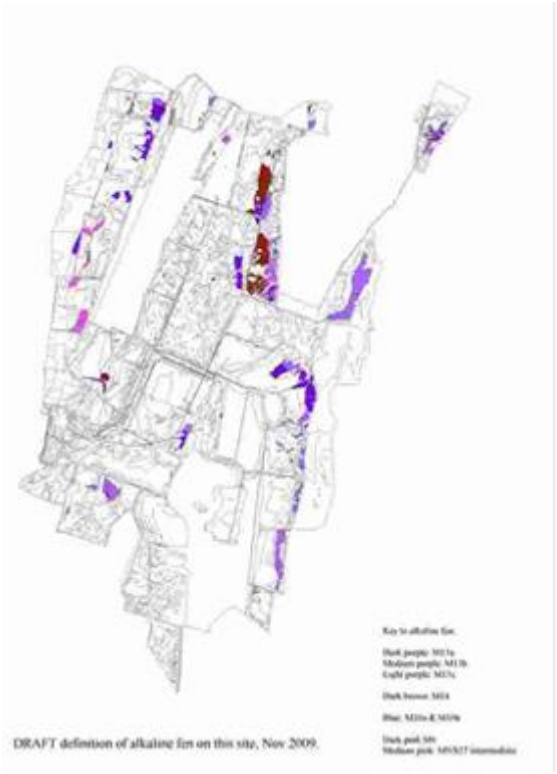


Figure A2.2a: results of full NVC survey for Cors Erddreiniog, showing the 152 communities mapped across 3592 polygons	*Figure A2.2b. Derivation of Fig. A2.2a confined to showing the distribution of NVC communities conforming to the Annex I habitat 'alkaline fen'*

Hard copy printouts from the GIS database and a report on the survey were submitted as Annex 1 of the mid-term report. Annex I habitats cover 11.5% of the overall mosaic of fen habitats. Generally, the larger fen sites, such as Cors Geirch SSSI and Cors Erddreiniog SSSI have relatively low proportions of good quality Annex I habitat (less than 10%) but some of the smaller sites can have up to 50% of Annex I habitat.

The report of the completed plant community surveys showed that there was less Annex 1 habitat than originally thought, for alkaline fen the surveys confirmed 42.6 ha against an estimated 84 ha and for calcareous fen the surveys confirmed 42.5 ha against an estimated

104 ha. The explanation for these differences was accepted by the Commission in its letter of 1st March 2013.

Annex 1 explains the habitat extent and potential restoration size (as requested by the Commission in its letter of 1st March 2013) i.e. showing where it will be possible to recover Annex 1 habitat will be used to plan a restoration plan as part of the after-LIFE conservation plan.

Target	Met
Budget	Action carried out in-house
Strengths	National Vegetation Classification survey of all sites was completed in time to produce maps showing the distribution of the two targeted Annex I habitats in time for use by the LIFE project. These maps proved invaluable for targeting management and restoration effort. The maps provide a reliable means of assessing the application of LIFE and other future actions on a plant community basis. The NVC maps provide the definitive resource for characterising the Annex I interest of these two SACs.
Weaknesses	The full site survey NVC maps contain significant detail which can be daunting, but filtering the information down to just Annex I habitats was found to be effective. NVC survey is resource intensive, but justified in view of the strengths of the approach.
Opportunities	Several non-statutory sites still await survey in both project areas. This will determine whether additions to the SSSI are needed and will also support future funding bids to secure favourable management. The NVC survey resource provides an invaluable baseline against which to judge change – future re-survey of selected parts of the project sites should be considered.
Threats	Survey of the LIFE project sites is now complete. However, completion of the Welsh Lowland Peatland Survey Programme of which this work formed a part is threatened. The survey team has been reduced (to just one FTE now) as result of staff being promoted to other roles and resource limitations have prevented recruitment of new staff.

ACTION A3: UNDERTAKE BASELINE ASSESSMENT OF CONDITION OF ALKALINE FEN AND CALCAREOUS FEN.

Linked to Action A4 and E4.01: Condition monitoring

Expected Results: Re-locatable monitoring plots will be installed on all project sites. Baseline vegetation composition and structure data will have been recorded

The action to set up the monitoring plots was completed between 2009-2011 by CCW SAC Monitoring Staff and the project team. The plots are being used to record changes in habitat quality but can also supplement the work carried out through Action A4. Photo-monitoring is an important component of establishing the plots. The report of the action (linked to Action A4 and Action E4.01) was submitted with the Mid-Term Report (MTR Annex 2.1).

Baseline condition assessment included monitoring of vegetation in i) plots established in earlier monitoring programmes (from 2003), ii) before and after LIFE plots and iii) paired plots established by the project and linked to a PhD study on plant responses to management. Results are presented in annexes 7 and 8.

Two additional studies were completed and reports submitted with MTR; a baseline vegetation transect at Cae Gwyn prior to peat extraction (Annex 2.2. of MTR) and a BSc thesis on the initial response of *Schoenus nigricans-Juncus subnodulosus* (M13) vegetation community to management changes on an Anglesey Fen (Annex 2.3 of MTR).

A poster on the work was included in the second Progress Report (Annex 2.1 of PR2). This was presented at two prestigious conferences in the UK. The results from studies initiated from the baseline assessments were presented at the final conference and will be part of the final conference proceedings. Further detail is located at Technical Report 4 Annex 5.

Target	Met
Budget	Delivered within budget but with significant in-house support also provided.
Strengths	These actions were delivered using well established methodologies and with a high quality of species identification and data collection. The conclusion of the work for action A3 (E.4.01) can be regarded as reliable, indicating that although only a small number of assessment points passed the criteria for favourable condition for the two habitats, there are nevertheless signs of a shift towards improving condition and that longer-term monitoring is necessary given the relatively short period between the application of restoration management and the monitoring work.
Weaknesses	The plot based approach followed the methodology employed by CCW/NRW for SAC condition monitoring. The methodology is onerous and time consuming and only provides information at a plot level. This action failed to capture more broadly based trends at stand/site level. Subjective walk-over assessments at this latter scale tended to suggest more significant improvement in habitat condition than the formal plot based monitoring was able to show. In hindsight, more broadly based stand/site-level assessments should have figured as a component of this action. This action would have been better delivered wholly in-house, but limited staff time necessitated out-sourcing elements of the work to contractors.
Opportunities	Continuation of the monitoring presents an important opportunity for tracking the longer-term improvements of the two habitats in relation to applied restoration management.
Threats	Insufficient resources to support ongoing condition monitoring and failure to continue implementing site management actions in the after LIFE era.

ACTION A4: ESTABLISH BASELINE PLOTS FOR DETAILED INVESTIGATION OF VEGETATION RESPONSE TO APPLIED MANAGEMENT.

Linked to Action E4.02: vegetation response to applied management

Expected results: Permanent plots will have been established and baseline data recorded to monitor the effects of key restoration actions. Results will be published in the final project report, with interim results produced for the baseline round. At project completion we will seek publication of results in the scientific literature.

The background to the work was presented in the first Progress Report. An opportunity arose to complete most of the work through a Knowledge Economy Skills Scholarship (KESS) PhD research project. The monitoring of comparative plots over the project period was an ideal experimental set-up for PhD study. The PhD title was 'assessment of vegetation and key plant species responses to the restoration of degraded rich-fen systems in north-west Wales'. Unfortunately the study got off to a slow start when the initial candidates withdrew from the project, but Mid-Term Report was able to report that Nina Menichino had started in July 2011 (initial findings in Annex 3 of MTR). The delay was not significant since the project team had already set out most of the plots with permanent plot markers. The study was also widened to include hydro-chemical monitoring.

Detail from this action was presented at the final conference and will be a part of the conference proceedings. Further detail, a paper from ecological engineering (annex 6) and extract from the final conference proceedings is at Annex 7 and 8 (Technical Report Nos 5, 6, 7 and 8.

Target	Met
Budget	Largely delivered in-house and PhD studentship
Strengths	This action was delivered using well established methodologies and with a high quality of species identification and data collection. Use of fixed plots gave confidence that observed changes were genuine. The conclusion of the work for action A4 (E.4.02) covering established stands of alkaline and calcareous fen can be regarded as reliable, indicating that there have been clear reductions in components such as Graminoid cover, litter cover, dwarf shrub cover and vegetation height. In addition to which, on plots where they were found, similar reductions have occurred in *Cladium mariscus* and *Molinia caerulea*. All of these are significant prerequisites for attainment of target habitat. Indeed, evidence from the paired 'Treatment & Control' plots suggests that early intensive intervention in the form of machine mowing (or similar) may be an essential requirement in order to allow stock to penetrate the sward. Monitoring of the recovery of vegetation after peat stripping and other restoration measures at Cae Gwyn can also be considered under this heading. This work has shown a spectacular vegetation response, with clear signs of the eventual development of alkaline fen. Cae Gwyn will be monitored annually as part of the afterlife plan and as part of a demonstration of the success of this type of work and to properly record the change in vegetation.
Weaknesses	This work was very time consuming and resource intensive, but this is an inevitable consequence of the necessarily rigorous methodology.
Opportunities	The permanent plots established as part of this work represent an extremely valuable asset for long-term study. Resources need to be found to ensure plots are maintained (namely that permanent markers remain in place) and that plot assessments are carried out into the future.
Threats	Insufficient resources to support ongoing condition monitoring and failure to continue implementing site management actions in the after LIFE era.

ACTION A5: INVESTIGATIONS TO INFORM THE DETAILED DESIGN OF HYDROLOGICAL REPAIR AND PEAT STRIPPING ACTIONS.

Linked to: E4.03: Hydrological monitoring.

Expected results: The results of the investigations required here would be better informed site restoration actions with a higher probability of achieving their specific aims for each location, and ultimately favourable condition for the two Annex I habitats.

A background to the work was presented with the first Progress Report. The work included i) transect studies investigating water table gradients across drains, ii) investigations of seasonal water table behaviour, iii) stratigraphic studies and iv) surveys of water chemistry. The studies were particularly important for drawing up plans for the large peat-stripping actions.

Hydrological assessment of the sites, or actions, is important as the water level, flow or quality is a critical factor in restoring the Annex 1 habitats, alkaline and calcareous fens. Most of these studies were carried out in house, and some were in partnership with Environment Agency Wales, with work contracted out on specific actions e.g. Cae Gwyn, Bodtacho Ddu and Mathan Uchaf. The action was supported by the appointment of Rhoswen Leonard in 2012 to the post of trainee LIFE Project Officer to assist with the coordination of hydrological studies and reporting of the action under Action E4.03. A report on work at Cors Bodeillio was submitted as Annex 3 of the second Progress Report.

Over 120 dip-wells were installed across the sites and are still being monitored according to site or action. Ongoing work and long-term monitoring work is identified within the afterlife plan.

Annex 8.1 – 8.4 give details of the case studies where this action was carried out. The annexes are stand alone documents and as well as forming chapters within the conference proceedings they can be used to demonstrate innovation and best practice.

Target	Met
Budget	Costs varied, with actions carried out in-house being far more cost-effective. Contracted elements proved expensive, partly because of the lack of local capacity and the need to use remote senior-grade staff with high day rates and T&S requirements.
Strengths	Training courses for project staff were generally felt to be highly effective in equipping staff with the necessary skills to be able to understand in conceptual terms the hydrological requirements of sites. On-site and in-house investigations with specialist CCW/NRW (Peter Jones) mentoring proved to be the most effective means of delivering this action. Site visit team discussions about the restoration of hydrological regimes were highly effective. Monitoring of hydrological regimes before, during and after restoration have provided some of the most graphic demonstrations of project success. Some very valuable and transferable methodologies were developed.
Weaknesses	There was an opportunity at the start of the project to set up a strategic programme of investigation through a partnership agreement with an academic partner/s, but unfortunately this was never realised. This was due to a combination of factors, including uncertainty over available budgets, lack of staff time for developing the project scope, inflexibility over contractual arrangements and, to some extent, the failure of academic partners to seize the time-limited opportunity offered by the LIFE project. Academic involvement through a genuine partnership (as opposed to all costs being met by LIFE) would have added a significant extra dimension to the hydrological investigation programme and would probably have yielded publications in the refereed literature. Insufficient staff resources for maintaining the hydrological investigation/monitoring programme and writing up the results, particularly in the

	last year of the project. Periodic failure of automatic water level monitoring equipment.
Opportunities	The methodologies developed by the project for this action should be applied more widely, both elsewhere on the project sites and on other mire sites in the UK and Europe. The work undertaken for the LIFE project has demonstrated the significant further scope which exists for restoring more natural and sustainable hydrological regimes on the project sites. Follow on monitoring of sites in the post restoration era is a key opportunity (see also E.4.03). The need for further hydrological site investigations is also better defined.
Threats	Lack of resources or commitment for follow-on monitoring of hydrological regimes. Failure to adopt principles of good practice through using hydrological investigations to inform future management.

ACTION A6: PREPARATORY INVESTIGATIONS OF CONSTRUCTED WETLAND LOCATIONS AND DESIGN REQUIREMENTS.

Linked to C14: Construction of reedbed wetlands to tackle point-source pollution and E4.04: Water quality monitoring.

Expected results: Feasibility and detailed design studies for all 8 constructed wetland locations.

Early in the project a number of potential sites for constructed wetlands were identified. These were sites highlighted in the indicative maps, confirmed through water quality sampling and include sites with long-standing problems known to CCW's Review of Consents team. The main source of groundwater flow high in nitrate-N is agricultural sources.

An update on the work was presented in the Mid-Term Report identifying eight priority locations requiring constructed wetlands under Action C14. The programme of water quality monitoring under Action E4.04 will provide the before and after information to demonstrate the effectiveness of the wetlands. A second KESS PhD research study was secured with Bangor University and Mike West started in 2011 on the study 'design and construction of wetlands for water pollution treatment of nutrient-sensitive fen habitats'

Mike West, working with the project team, was responsible for design, construction and monitoring of the wetland sites. Details of the preparatory investigations and design requirements were submitted as Annex 4 of the Mid-Term Report.

Second Progress Report showed that, given the success of the action, the target was to be increased to a potential 12 sites.

The wetlands have been successful and the work with Bangor University and Centre for Ecology and hydrology (CEH) PhD student Mike West has been a very rewarding partnership. A follow on project led by Anglesey Council "Mawndir Mon" is installing a number of these wetlands in and around the catchment of the Fens, including six around Llyn Cefni reservoir.

In the future, NRW will continue installing these wetlands long after the project finishes in areas identified as priority before the project ends, or as part of the NNR management, or as part of agreements made with landowners.

Table 5-1: Locations for Constructed Wetlands.

SSSI name	Location	Preferred solution	Action
Cors Bodeilio	Inflow near car park	Constructed wetland	Built
Cors Bodeilio	Inflow near boardwalk	Constructed wetland	Built
Cors Bodeilio	Bodeilio Farm pond	2 x Constructed wetland	Built
Cors Erddreiniog	Mid-section springs (supplying Cae Gwyn)	Constructed wetland	Built
Cors Erddreiniog	Spring field (supplying Cae Gwyn)	Constructed wetland	Built
Cors Erddreiniog	Tal y Llyn	Constructed wetland	Built
Waun Eurad	Waun Eurad House	Constructed wetland	Built
Cors Bodeilio	Holt Land	1 x constructed wetlands	Built
Cors Geirch	Mathan Uchaf	3 x constructed wetlands	Built
Cors Geirch	Cors Ceidio	Constructed wetland	Built
Cors Hirdre	Cors Hirdre	3 x Constructed wetlands	Built
Additional built with input from LIFE project funded by Welsh Government	Frigan Cefni	Constructed wetland 6 x constructed wetlands	Built Built

The approach is also being adopted by Natural England on some sites following attendance at the final conference by North West Area staff.

Target	Exceeded
Budget	Covered by utilising external project partner – University of Bangor and CEH PhD into constructed wetlands – Mike West
Strengths	Very successful partnership with University of Bangor which has also seen Justin Hanson and Peter Jones as honorary lecturers within the biological science department, lecturing on undergraduate and post graduate taught courses. Partnership approach allowed exceptional value for money, built capacity within both organisations, developed a new skill and expertise within conservation management and has been demonstrated to many biodiversity and agricultural practitioners Wetlands have proved easy to construct and remove a significant amount of N from watercourses entering, or based within the catchment. The installation of these has continued with a Welsh Government funded project on Anglesey
Weaknesses	Long term maintenance and management has yet to be properly assessed, and applications for woodland, or flashier hydrological regimes will need amended designs
Opportunities	Opportunities for incorporation within Section 15 management agreements on future sites are already being explored. Designs using the same parameters and designed by the same PhD student are being used on the Eden Pearl Mussel LIFE project and within Mawndir Mon, the REF Welsh Government funded project
Threats	Regular reviews on operation and maintenance and monitoring of inputs is required to ensure that future operation matches current operation. Resources are required to

	do this

Outputs: (link to action E4.04)

ACTION A7: STAFF RECRUITMENT AND TRAINING.

Expected results: Staff will be well trained and therefore equipped to ensure that the Project is successful.

All staff successful recruited after some initial delays due to need to include staff with Welsh language skills.

At inception stage a request was made to the Commission to appoint a part-time Senior Environmental Scientist (accepted in Commission letter of 6th August 2009).

The project team remained unchanged expect for change in project administration office, from Julie Stanley to Cecile Roberts. The core project team worked closely with colleagues in CCW/NRW and capacity was increased by including two PhD posts within the 'team' and student placements. Some additional administrative help was also provided through the CCW European Funding Unit (Wayne Watkins).

The project budget was calculated assuming annual increments and inflation. Since the economic downturn increments have been frozen and inflation lower than predicted. The resulting headroom has been used for the new trainee post successfully competed for and won by Rhoswen Leonard, an increase in hours for the Administration Officer and a successful JEGS outcome for Llion Jones (which means an increase in his pay) and overtime for specific problems/issues. JEGS or Job Evaluation and Grading Scheme is a standardised process for evaluating what work, responsibility and pay a member of staff should be. In Llion's case, he was recruited at a CCW "B" band, but was actually carrying out work and responsibility at a higher grade. The evaluation agreed with this and he became a CCW "C" band. In terms of risk to the project this reduced significantly the chances that Llion would leave the project for other work.

A number of CCW personnel outside the core team but assisting with the project gave a considerable amount of time to the project. The Mid-Term Report listed 35 people giving 2902 hours of support. This support continued throughout the project but their time has not been claimed.

Target	Met
Budget	Underspent
Strengths	Team was well run and well-motivated. There was only one change to the team mid project which meant that skills and expertise were retained up until the final 6 months of the project.
Weaknesses	The team was slow to be recruited and inevitably people on fixed term contracts/temporary promotion left in advance of the end of the project. The team may have been under resourced to accommodate such a large and complicated project and two members of staff were absent for a length of time suffering from sick leave.
Opportunities	Project staff members have developed a huge skill set which should be utilised across the organisation in the best locations.

Threats	Restructuring NRW could lead to appropriate skill sets being temporarily diverted away from key areas of work

ACTION A8 & A9: MACHINERY PROCUREMENT & OTHER PROCUREMENT

Expected results: Appropriate machinery supplied at optimal cost.

The Grant Agreement included a list of expected equipment. The plan was to purchase two specialised machines for mowing: a bespoke wetland harvester and a cut-and-collect 'Softtrac'. Requirements were set out in the Inception Report (Annex 16). The first Progress Report gave the reasons for combining the specifications into one bespoke machine, a 'Pistenbully' wetland harvester with tipping hopper (with this machine there was no requirement to purchase a flail harvester).

Another change in terms of equipment was the decision for CCW to purchase trailers and a towing vehicle for grazing management rather than buying the equipment for the use of the grazing contractor. This way the equipment is retained by CCW/NRW. The change was accepted by the Commission in its letter of 1st March 2013.

Equipment purchased as foreseen included a chipper unit, flail mower, hand mower and baler, strimmers, chainsaw and electric fencing (list of equipment given in Mid-Term Report).

Second Progress Report reported need for a mobile cattle crush. This was accepted by the Commission in its letter of 21st August 2013.

Every piece of equipment purchased is listed on the NRW asset register (over £5,000), the Project asset register (over £500) for 'desirable items' e.g. camera, or on the Project tool list (smaller items).

'Other procurement' (Action A9 non-machinery items) included laptop computers, cameras and software licences.

The main issue for equipment was the loss of the Pistenbully Wetland Harvester to fire. Eventually, an insurance payment was received for £128, 500. A procurement exercise was then started during the LIFE project but due to timescales of advertisement and lead time (length of build time) and having to secure additional internal funding to make the difference up between the insurance payout and the cost of an alternative machine, this was not concluded by the end of the project. The machine, however, was acquired after the end of the project and is being used to deliver the afterlife plan.

Target	Met
Budget	Exceeded and adjusted
Strengths	Excellent procurement rules, systems and policies ensured that all spend within the project is well documented, appropriate and accountable.
Weaknesses	Under resourced Procurement team in CCW HQ meant that some procurements were delayed.
Opportunities	Training required for the delivery of procurement actions ensures that capacity within NRW increased
Threats	Delayed procurement meant delayed actions and a concertina effect on meeting targets

An inventory of equipment exists and is attached at Annex 9, Equipment has been shared between the Operational Services national nature Reserve staff where it is being used on the sites (and others). Most of the big and practical equipment is with the nature reserve team, the rest is shared between the Conservation Officers in the new Natural Resource Management Teams and the Terrestrial Ecosystem group headed up by Peter Jones where it is used to support local teams in managing sites.

A small amount of electric fencing supplies are left with the North Wales Wildlife Trust to help them graze their sites according to the LIFE management agreement.

ACTION A10: PURCHASE OF GRAZING STOCK

Expected results: A fully operational local Grazing Animals Project with all the necessary stock, handling infrastructure, and marketing strategy in place.

The purchase of livestock to re-establish grazing on restored fens started in 2010. The first Progress Report outlined the rationale for selecting Welsh Mountain Ponies as reserve staff had experience of handling these animals and there was a desire to increase the herd. There was, however, a policy with the long term aim of improving the quality of the herd as well as the numbers. 30 ponies were purchased by 2011 to match the requirements of grazing audits (full list given in Second Progress Report). In addition 14 ponies were acquired at no cost.

As the ideal stocking rate on the fens is summer grazing additional land was secured off-site to over-winter the stock.

In addition, the project received four Konik Ponies

The grazing of sites is well balanced between NRW owned stock and animals from local farmers. Further details are given under Action C8.

Target	Not met
Budget	Underspent
Strengths	Good quality stock was procured with advice from equine experts. This stock has greatly improved the NRW pony herd. Other stock acquired has been matched to specific sites and have increased NRW capacity to graze wet areas. Stock purchased for landowners has been limited to some ponies for one site. Clear definition developed and can be demonstrated between restoration grazing and maintenance grazing, this is a significant tool for conservation land managers.
Weaknesses	Shared equity system for purchase and lease of stock was prevented by complexity of rules and policies within CCW
Opportunities	Review shared equity scheme if relevant to future management
Threats	Stock management requires balance of sites, features and resources to manage them. Regular review of effectiveness of grazing on NRW sites is required annually and the ability to allow graziers 5 year grazing tenure rather than less than 12 month will help development of business and partnership

ACTION A11: CONTRACT SPECIFICATIONS

Contract specifications for procurement were reported in the Mid-Term Report. With the change from CCW to NRW new guidelines were introduced. The most notable difference was raising the threshold for a single tender quote from £2,500 to £5,000. The updated rules on procurement were submitted as Annex 5 of the second Progress Report.

ACTION A12 (FEASIBILITY STUDY) & C3 (BIOMASS REMOVAL)

Expected results: A detailed feasibility study identifying whether it is possible to create a sustainable composting business by adding value to by-products of fen restoration within the Anglesey and Lleyn fens project area

There is considerable overlap between the action to develop options for biomass removal (Action A12) and the practical removal and disposal of material (Action C3). There were concerns at the start of the project that it might be difficult and expensive to remove the large amount of cut material that would be generated by the project, especially during the restoration phase.

A feasibility study carried out by Greenfarm consultants was introduced in the first Progress Report. The report confirmed that a huge amount of biomass (58,000 tonnes) and peat (42,000 tonnes) would be generated. Composting on an industrial scale was a feasible option. Alternative uses included supplying energy through anaerobic digestion. However with project mechanical mowing about to begin in 2010 there was a need to find an immediate solution. Local farmers were approached and they were willing to take material as bedding for livestock, as feed and as compost. An open day aimed at farmers was a great success.

Following the feasibility study some more work was done with Menter Mon to investigate whether a social enterprise could be created to deal with the biomass. The feasibility study was submitted with the second Progress Report (Annex 6).

A hard copy is supplied with the final report as requested at Annex 10 (no electronic copy supplied)

Target	Met
Budget	Underspent
Strengths	A good and useful report on the development of an outlet has been developed and is available. The report identified that haulage and transportation costs mean that the most effective way to manage the waste material from the project was to use it within neighbouring farms
Weaknesses	Development of a suitable outlet is a complicated and significant business enterprise which deserves its own specialised project. Material is available if a machine exists to cut but this material is currently easily dealt with very locally to the sites where it is cut
Opportunities	Opportunities exist to explore the use of an outlet, but the feeling that the cut material was a huge risk to the project has not materialised due to local utilisation of the product
Threats	Transport costs, even to adjacent farms, will jeopardise the priority that farmers apply to collecting material. This could mean material sitting uncollected on the edge of sites for some time. This will risk increased nutrients locally within the site and will look unsightly

ACTION A13: LICENSES

Licenses reported include Environmental Impact Assessment (for Cae Gwyn re-profiling), Planning Permissions, Permitted Development Rights, Main River Works Consent, Regulation 48 Assessment under Habitats Regulations (for Cae Gwyn), Waste Exemption and carrier licenses for biomass removal, Single Farm Payment authority for grazing land, Mineral Planning licence (Cae Gwyn) etc.

As reported in the Mid-Term and second Progress Report, unforeseen, additional, costs have been accrued under this action where planning/mineral permission costs for peat excavation and access requirements were necessary.

Additional costs under this action are presented in the second Progress Report. These are reported under 'Other Costs'.

Target	Met
Budget	Overspent
Strengths	The need to apply for mineral and planning permissions on actions meant that process and procedure were followed and that additional careful planning was applied to actions in advance of their operation
Weaknesses	Additional unforeseen costs were incurred for both application costs (e.g. large excavations charged at a hectarage rate) and due to initial lack of expertise within the team additional costs were incurred using consultancy time
Opportunities	Skills learnt will mean that future large scale excavations can be planned and budgeted accurately and internal skills exist to secure relevant permissions.
Threats	If experience is not shared then similar works across Wales may be delayed while relevant permissions are granted

ACTION A14: CALCULATE CARBON BUDGET FOR PROJECT.

Expected results: A carbon budget which identifies the main sinks and sources of carbon resulting from project activities compared with the current situation.

With a small budget the original plan for this action was quite limited. However, the opportunity to broaden the scope of the PhD study (Action A4) helped provide information on carbon and greenhouse gas emissions under different management scenarios.

The project has also been able to link to other studies outlined in the first Progress Report and described in more detail in the Mid-Term Report. The studies included:

1. DEFRA contract CTE1103 Lowland peatland systems in England and Wales- evaluating greenhouse gas fluxes and carbon balance led by CEH (work at project site Cors Erddreiniog)

2. PhD investigations of DOC and gas fluxes: Both PhD students working under actions A4/E4.02 (plant responses) and A6/E4.04 (constructed wetlands) collected water quality, DOC and gas flux information. The information will measure the effect on carbon balance from cutting and grazing and the carbon dynamics in constructed wetlands.

3. Studies were set up to monitor dissolved organic carbon (DOC) and particulate organic matter (POC) prior to removal of peat at Cae Gywn to investigate the effect of excavations and peat removal.

These studies will contribute to calculations of the carbon budget over a 20 year period.

A contract has been underway with CEH to undertake full greenhouse gas measurement surveys at the established LIFE project sites at Cors Erddreiniog. Although the funding was not able to achieve a full and final report (an expensive work area) CEH undertook much of the work with a PhD study that has still yet to be finalised (it is still in the phase of unfunded write up). However, there will be a synthesis of the work with technical summaries associated with outputs from the project and final conference.

Target	Not met
Budget	Exceeded.
Strengths	The planned scope of work for this action far exceeded the original plans. The results of work undertaken will be included in the final conference proceedings. The rationale for the action was sound and stemmed from a desire to evaluate the impacts of project actions in terms of overall carbon balance. However, the action was not strictly essential to project delivery and proved to be a distraction from actions which were. The investigations commissioned in the last year of the project are set to provide invaluable data on greenhouse gas (GHG) emissions from vegetation subject to a range of LIFE project actions at Cors Erddreiniog. This component of the project was let to the Centre for Ecology and Hydrology in the final year of the project but although monitoring is still underway (funded as part of the afterlife project and not claimed as part of the project) no results have yet been finished. These data will also inform the development of emissions factors for wetland habitat management categories which will feed into national GHG accounting programmes and thus have an impact far beyond the LIFE project.
Weaknesses	Commencement of this project was delayed because a risk assessment of A actions in terms of whether they were critical to the delivery of core project B and C actions inevitably gave this action a lower priority. Delivery of this action is not in time for the final report
Opportunities	This action offered a significant and unique opportunity for the involvement of the academic sector in assessing changes in GHG flux during an unparalleled range of management interventions. This opportunity was communicated to local academic partners but they required funding for a significant proportion of the costs in order to be involved. This is disappointing given the unique opportunity which the project represented in terms of providing a wide range of management interventions.
Threats	This action was only implemented late in the project and reporting is still awaited. Delays over confirmation of funding complicated contract award and management.

ACTION A15 IMPROVEMENTS TO ACCESS INFRASTRUCTURE

Expected results: Improved access at all sites, with community involvement in the design of key access points.

The Grant Agreement outlined a suite of expected access works to enable under-managed areas of fen to be brought into management through mowing and grazing. The works included gateways (wide enough for machinery), tracks, culverts, hard-standings, temporary roads and purchase of land to enable access provision.

Changes to the outlined works were inevitable as they were linked to land purchases and management agreements over which the project did not have full control.

Progress, and changes to the original plans were reported in each technical report. Access is a long term requirement necessary to manage the sites into the future. This project has enabled access to previously inaccessible sites and access to new land purchased. One major difference to our plans was to ensure long term sustainable management access was provided to all new areas of land purchased, including land at Allt Goch (Lleyn SAC) and Maen Eryr (Anglesey SAC) purchased with funds outside the project but included in project actions.

The original action had plans to engage the local community with gates designed by schools but, due to the large spend on access tracks the gates were replaced with an information point in a local shop to provide an internet cafe, three ipads for community use including Bethel school, and Ysgol Goronwy Owen who have were both presented with LIFE liveried ipads at the final conference (the schools had carried out studies on the fens). Access works also improved public access to many of the sites.

One expensive aspect of this action related to the access track built at Cefn Du Farm (options to access Cors Erddreiniog were discussed in the first Progress Report). The NNR team leader regarded this as the only viable and dry access route into the centre of Cors Erddreiniog. It replaced the original plan to build on the track from Capel Coch. The reason for this was disputed legal ownership of the access, the field where land would have had to have been purchased had planning permission for housing, substantially raising the value, and a hydro-ecological view that the existing track across the fen from this location was hydrologically damaging and could be removed if an alternative access were installed.

As part of the Cefn Du access track it was necessary to remove the landowner's slurry and manure store. This was an old and leaking store that was polluting the fen. However, removing the store meant invoking legislation which meant building a new store meeting current strict legislation. A consultancy report was commissioned and a new store and tank were built for c. 100,000 Euros. Although expensive, the access and the removal of leachate to the fen were critical for site condition and management.

In more detail, the original indicative map for Cors Erddriniog showed an intention to improve the existing access from Capel Coch down into the main Fen basin. However, this involved purchasing a strip of land from an adjacent farmer to make the turning from the public highway safe. The farmer had planning permission for housing on the land and would only sell the land at inflated costs due to the planning potential. This meant the project reviewed all the access routes into the fen and agreed with the National Nature Reserve team and Peatland ecologist that the best entry would be along the ridge of dry ground through Cefn Du farm.

This land is dry, does not interfere with hydrology but is in private ownership. Detailed negotiations were entered into and agreement for 25 years of unrestricted access for NRW staff and contractors was agreed. The route would be along an existing track to the far, which would be upgraded and a route through two good silage fields. A route around the farm (and not through it) was also negotiated which meant moving an old slurry store. Moving of the store meant re-building according to new regulations. The need for the track, along with the benefit of removing leachate from the slurry into the fen was considered against the high cost

and the track and store were put out to tender and the contract won by Mulcair Ltd (see details in previous reports).

Target	Exceeded
Budget	Infrastructure improvements were generally delivered at reasonable costs and offered good value for money, although the original budget was far exceeded. The Cefn Du access track (Cors Erddreiniog, Anglesey Fens SAC) stands out as costly because of the requirement to undertake other associated infrastructure works necessary to control runoff from the owners manure store which posed a risk for the SAC. However, this still was a cheaper version than buying land with planning permission to enable access through the original route.
Strengths	Access improvements were a critical element of the project in that they allowed or greatly improved access to key parts of the project sites, thus enabling access for grazing and other project actions. Access improvements contributed a great deal to the image of the project by conveying a sense of purpose and commitment in bringing the sites under favourable management, with a significant element of this involving grazing by local farming partners. Access improvements created valuable local work and employment for a wide range of rural businesses, many of them associated with farming enterprises. This again contributed greatly to the image of the project and the management of the sites as part of the life of surrounding rural communities.
Weaknesses	Nearly all of the access improvements have proved essential in terms of the ongoing management of the sites. Main weakness is the knowledge that a small section of a protected site must often be used for access, parking, turnaround etc – without that the management of the site is almost impossible and certainly significantly more expensive in the future
Opportunities	The LIFE access improvement work will enable rationalisation and improvement of access to the project sites in general. One of the most important opportunities is provided by the Cefn Du access point on Cors Erddreiniog. This now enables potential removal of an extended section of 'floating' gravel track which runs parallel to the canalised main drain, allowing restoration of (i) a more natural channel morphology, (ii) a full uninterrupted seepage gradient from mire edge to mire centre and (iii) fewer vehicle movements on the main public access point to the site. This track parallel to the drain was installed c. 1992 and has served a key role in enabling site works, but it is not compatible with current good practice and thus poses a risk to NRWs image and reputation given (i) that equivalent tracks would be ruled out if proposed by third parties, and (ii) that NNRs are supposed to offer exemplars of good practice. This also applies to the recently constructed valley-head crossing referred to under weaknesses. Most of the LIFE access points provide opportunities for enhanced interpretation. Many of the access points offer excellent points from which to plan a much improved public access network across the sites.
Threats	Insufficient resources for upkeep of access infrastructure.

ACTION B1 LIFE LAND PURCHASES

Expected results: This action will lead to at least 66 ha of wetland, or land critical to its functioning being taken into conservation management in perpetuity. It will also restore at least 4 sites which historically supported populations of Annex II species but which currently lie outside of conservation management control.

Land purchase has been an essential component of the project without which it would not have been possible to restore overgrown and unmanaged fen habitat. The Commission generally accepted that the land purchase strategy as set out in Grant Agreement had to follow opportunities as they arose. Parcels of land have been known with different names throughout the purchase process. This is because protocol used to be to name them after the farmer selling them, or the farm selling them or after a compartment within the site. However, we changed the protocol and used the local name for the sites in the final naming. Although this may have caused some confusion during monitoring and assessment, it is very important to use the local names in helping to embed the sites and their management into the local community. Examples are "Cors Erddreiniog South East Fen Basin" became Cors Cefn Uwrch; or Bodtacho Ddu (farm name) became Cors Ffynnon Wen (White well marsh in English showing links to the calcareous deposits within the well water). Note that land registry records do not give names to parcels of land – the Land Registry Number is the only official reference to land parcels.

Seven areas of land purchase, using LIFE co-financing (this includes two parcels of land at Mathan Uchaf sto give eight individual parcels) were given provisional acceptance in Commission letters of 10th November 2010 and 6th September 2011. This was for the purchase of the following:

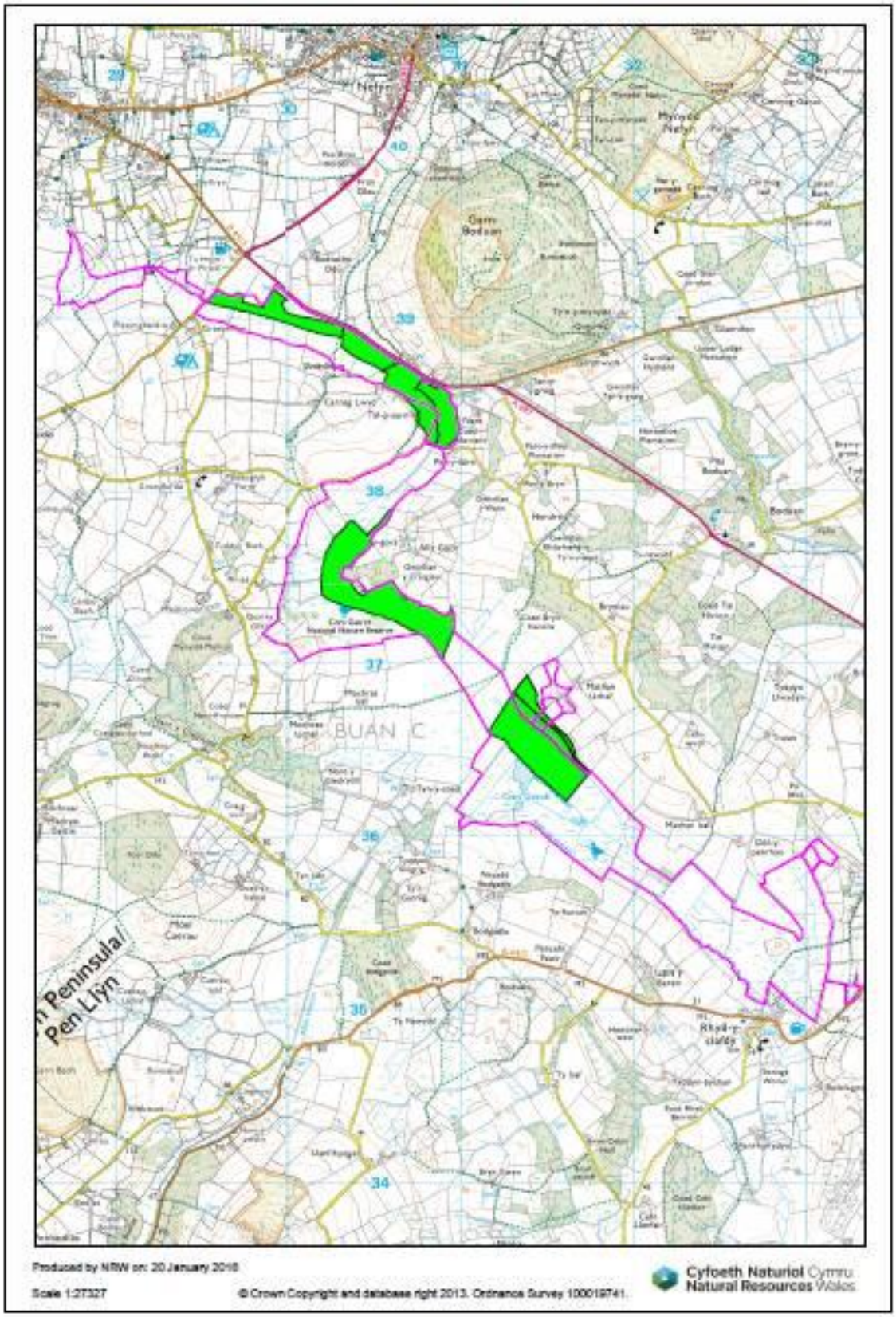
Site	SAC: non SAC	Included on indicative maps	Explanation	Issues	Other
Cors Tal y sarn (within Cors Geirch)	95:5	No	n/a		Agreed as a strategic spot in EC letter 10/11/10
Cors Nant Isaf (within Cors Erddreiniog)	100:0	Yes	n/a	Over official Valuation	Agreed given importance of land in EC letter 10/11/10
Cors Tyddyn Fieren (within Cors Bodeilio)	100:0	No	n/a		Agreed value of purchase in EC letter 10/11/10
Cors Mathan Uchaf (within Cors Geirch)	79:21	Yes	Land outside SAC is critical upslope, hydrological connection	Official valuation +7%	EC letter of 06/09/11 accepted

Site	SAC: non SAC	Included on indicative maps	Explanation	Issues	Other
			to Fen and will allow new seepage face		purchase of two parcels of land
Rhos Y Medre (within Cors Geirich)	100:0	No	High Priority SAC land including a small parcel of land linking LIFE purchases Tal Y Sarn and Cors Ffynnon Wen with NNR	Official valuation	
Cors Ffynnon Wen (also known as Bodtacho Ddu) (within Cors Geirch)	100:0	No	High priority annex 1 habitat under threat from under-grazing and pollution	Official valuation + 10%	
Allt Goch (also known as and Mr Dafis' land and Glan Y Gors Land) (within Cors Geirch)	Very small section outside SAC	Yes	Very high priority land in risk ownership. Previous attempts to purchase failed		Accepted a small area of land outside the SAC as a strategic spot in EC letter 10/11/10

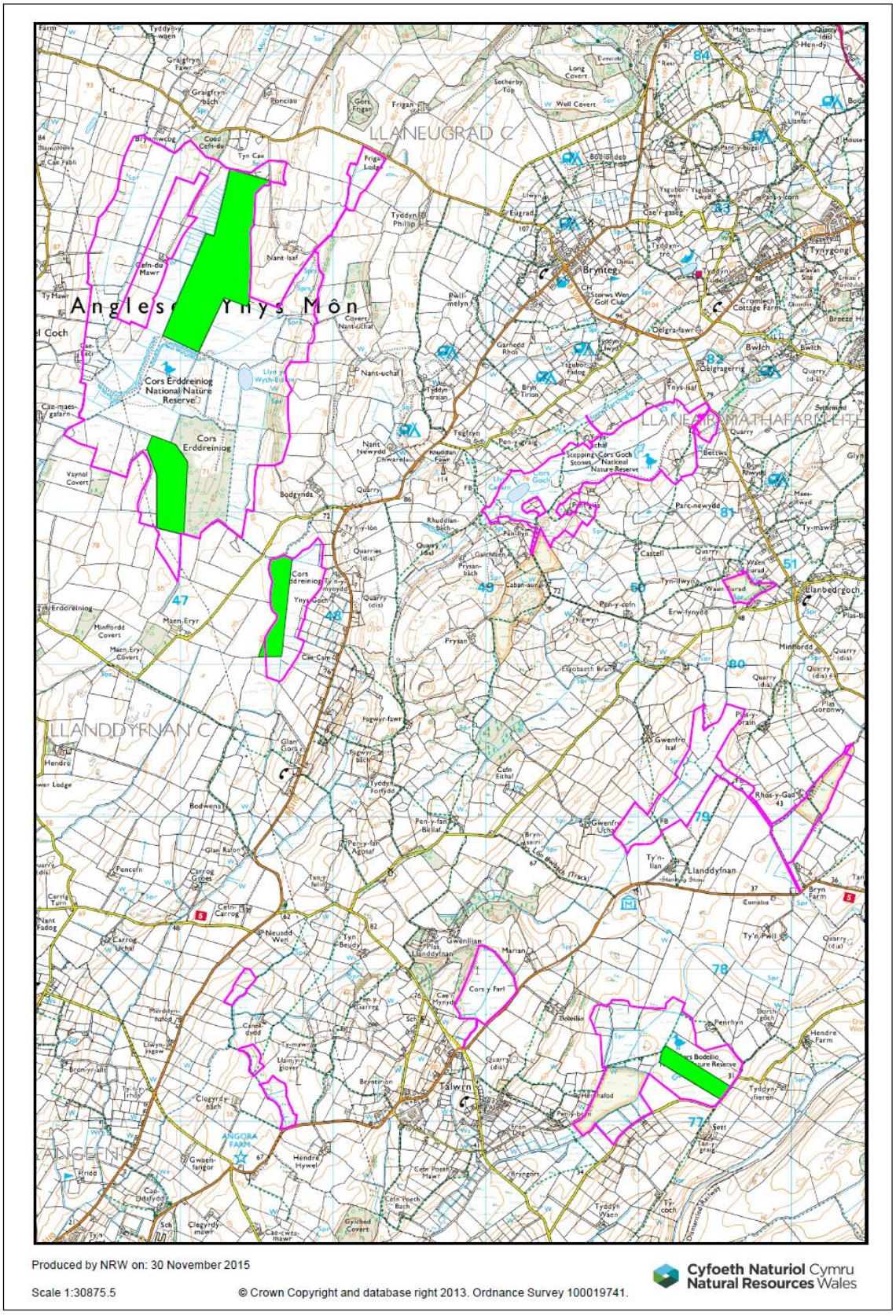
However, in total 10 parcels of land were purchased within the framework of the project (in addition to the 7 approved a further parcel was purchased at Mathan Uchaf and 2 large areas on Cors Erddreiniog bought from one owner and registered with one land registry title – Maen Eryr and Cors Cefn Uwrch) and are included in the Statement of Expenditure and note that we have instructed Geldard's solicitors Cardiff to include them also in the relevant covenant. However, it is also recognised that the total expenditure in the Land Purchase category has been exceeded and it is accepted that the costs for land purchase at Maen Eryr/ Cors Cefn Uwch (Cors Erddreiniog) will probably not be eligible. Additional funding was received from the Welsh Government for the purchase of Maen Eryr.

However, as previously reported the project was able to carry out restoration actions on all land purchased within the framework of the project.

Information and maps of seven land purchases (including two at Mathan Uchaf but not the land at Glan Y Gors which was purchased later) was included in the first Progress Report. Almost all of the land purchased was within the two project SACs. Where land purchase included 'strategic spots' outside the SACs, such as the source of seepage, the Commission provisionally accepted the costs. The Commission also gave its approval to the cost of some purchases exceeding the District Valuer's estimate by up to 10%.



Indicative map of Land Purchase on Llyn Peninsula showing from top to bottom: Cors Ffynnon Wen, Cors Tal Y Sarn, Rhos Y Medre, Allt Goch and Mathan Uchaf (1, 2 and 3)



Indicative map of Land Purchase Anglesey showing from top to bottom: Cors Nant Isaf, Maen Eryr, Cors Cefn Uwrch and Cors Tyddyn Fieren

When viewed like this it is easy to see the huge significance that land purchase has played in getting appropriate management on the SAC. All land purchase is shown in green, the pink line showing the SAC boundary. Detailed maps for Land purchase for each site is shown on the final project maps at annex 11

The second Progress Report reported that additional land purchase had been completed linked to the large scale restoration project at Mathan Uchaf. Two further parcels of land were purchased at Mathan Uchaf to avoid having to pay for more expensive mitigation works on neighbouring land.

All land purchased, apart from Mathan Uchaf 3 has been declared National Nature Reserve, the relevant documentation is at annex 3. The sale completion of Mathan Uchaf 3 was underway at the time of Declaration and as it was not in our ownership at the time it was not possible to put the land through our Council. The NNR declaration for MU3 will be carried out at a future date. You will notice in the NNR declaration maps that more land than was purchased was declared at that time. This is because there was a backlog of NNR declarations.

The cost of the seven areas of land purchase already accepted in principle by the Commission is shown in the table below.

Land purchase claimed in the final report is as follows and in the financial claim includes associated costs.

Name of Land	Ha	Land Registry	Date of Purchase	Cost	Covenant in Land Registry	NNR Declaration	Incl Strategic Spot
Cors Tal Y Sarn (Cors Geirch SSSI)	9.56	WA829635	25/03/2010	€95,355.62	Y	Y	Y
Cors Nant Isaf (Cors Erddreiniog SSSI)	34.4	CYM491916	30/03/2010	€352,815.80	Y	Y	N
Rhos Y Medre (Cors Geirch SSSI)	4.29	CYM525589	31/03/2011	€34,482.36	Y	Y	N

Name of Land	Ha	Land Registry	Date of Purchase	Cost	Covenant in Land Registry	NNR Declaration	Incl Strategic Spot
Cors Ffynon Wen (Cors Geirch SSSI)	6.09	CYM528107	31/03/2011	€49,923.95	Y	Y	N
Cors Geirch Mathan Uchaf 1 Land Purchase	12.33	CYM525268	31/03/2011	€128,873.46	Y	Y	N
Mathan Uchaf 2 Land Purchase	2.89	CYM553617	31/03/2011		Y	Y	Y
Cors Tyddyn Fieren (Cors Bodeilio SSSI)	5.52	CYM519185	17/01/2011	€53,685.66	Y	Y	N
Allt Goch (Glan Y Gors Cors Geirch SSSI)	18.47	CYM557106	28/03/2012	€212,539.21	Y	Y	Y
Note that in addition to these that additional costs such as valuation and stamp duty are included in the financial claim							

Two other areas of land purchase are included in the statement of expenditure.

Name of Land	Ha	Land Registry	Date of Purchase	Cost	Covenant in Land Registry	NNR Declaration	Incl Strategic Spot
Cors Geirch Mathan Uchaf 3	2.43	CYM586455	March 2013	€45,033.17	N	N	Y
Maen Eryr	19.13	CYM556336	March 2012	€218,526.24	N	Y	Y
Total				€			

Strengths	Excellent legacy which has brought a large area of land under conservation management control. Buying land ensures that there is no risk associated with its long term management
Weaknesses	Public perception of land purchase can vary, it can be seen as public bodies not making the most of their budget, however, initial high costs are rewarded with long term budget planning and lower resource requirement than if land remained in the ownership of unsympathetic owners. Buying land also enables targeted ownership of critical segments of hydrological jigsaws
Opportunities	A prioritised land purchase schedule will be produced as part of the afterlife management
Threats	Ownership of land brings absolute maintenance costs and resource requirement

ACTION C1: MOWING AND BIOMASS REMOVAL

Expected results: Mowing will achieve significant reductions in standing crop and dead biomass and together with grazing will result in increased species-richness and structural heterogeneity

The Pistenbully wetland harvester was purchased specifically to deliver this action. The first Progress Report reported on 13.8 ha cut in the first winter (2010-2011) which was a trial season. The trial season on Anglesey was critical in learning how the machine worked, how best to use it, logistics of transportation and to iron out any teething problems. The use of the machine was demonstrated to farmers to extend its work on to private land. The first Progress Report included an appraisal of the operation of the Pistenbully in terms of its impact on target vegetation. It was able to cope with all vegetation types and could achieve complete harvesting of cut biomass even when it was wind-blown and wet. It could also be combined with other actions, such as burning, and provided a good follow on treatment. Where the machinery exposed bare peat this was considered a bonus and the low ground pressure ensured that any ruts were relatively shallow. The trial period showed that access and the availability of hard-standing was a limiting factor that could be addressed through the A15 action budget. The trial period was also linked to Action C3 (biomass removal) and developed contacts with local farmers to provide the material for use a bedding in cattle sheds.

An unforeseen need of the project was somewhere to store the harvester because there was not at that time room in the NNR base. Thorough searches were carried looking at suitable accommodation but in the end Welsh Water, the project partner, agreed to loan the project a suitable work base. Costs incurred were thus minimal in terms of an access agreement across a field, and minor safety and security measures.

In its first full season of operation (September 2011- March 2012) the Pistenbully cut 67 ha of fen habitat on both Anglesey and Lleyn sites, mainly on CCW-owned land. The success of the work replaced burning on many sites with overall targets being exceeded.

The second Progress Report showed that 52.31 ha were cut in 2012-2013 until the machine was destroyed by fire in March 2013. The final season of work was carried out using a combination of tractor and mower on some dry areas of land, but mostly by using brush-cutters and strimmer blades. Although more expensive it meant that areas of thick *Cladium* dominated vegetation could be improved prior to grazing. The final area of land cut was 33.93ha

The target has been well exceeded and forms an important part of the afterlife plan management of the sites

The total project target for action C1 was a minimum of 58.64ha.Total achievement cut using the Pistenbully wetland harvester and other means brings the total to 167.04ha, exceeding the target by 108.40ha.

Year	Hectares
2010-11	13.80
2011-12	67.00
2012-13	52.31
2013-14	33.93

Project Target **Total Cut**	**58.64** **167.04**

The machine was also used in three site demonstrations, at the RSPB reserve in mid Wales; with the Snowdonia National Park Upland peat project at Fridd and with the Anglesey Grazing Animals Project at Cors Bodwrog on Anglesey. This was to demonstrate its ability and to highlight its availability post LIFE project to carry out Conservation works across Wales. The demonstrations were very successful and created a lot of interest. NRW has purchased a new machine with the insurance monies which will be used on all relevant sites.

Softrak machine purchased after the project to continue fen management

Target	Exceeded
Budget	*Acquisition cost* – requirement changed from two machines to one as a result of the open European procurement exercise. *Running costs* – contracted out as driving, diesel, maintenance, servicing, transport, all broken down as per ha cost. This compared very favourably with hiring a comparable machine and driver from a contractor.
Strengths	*Machine* - exceeded our expectations as a highly effective machine eminently well suited to the work. The machine coped with wind-lodged vegetation and light scrub and also very soft and in some cases submerged terrain. The vehicle only bogged-down twice during the project life. These observations indicate the original specification for the machine was correct. Another major benefit was the ability to plan and execute this work because the method chosen was not constrained by weather. *Biomass removal* – large-scale harvesting and removal of fen vegetation (rather than leaving cut material in situ) was very effective. This prevented smothering of light-demanding uncompetitive small dicots and mosses and also aided nutrient off take. This operation also made a radical difference to the accessibility of sites for grazing. A major additional positive benefit was that the visible effect of 'opening up' the fens changed the perception of the project and CCW/NRW in the local farming community.
Weaknesses	*Machine* – the weight of the machine meant that haulage contractors had to be used to move the machine between sites, with associated costs and a need to forward plan work. The forager unit was felt to be less robust than the rest of the machine, although it was still very effective. The movable chute introduced an additional

	weakness requiring repair on several occasions. The weight to track width ratio combined with the need to remove cuttings resulted in some erosion of the vegetation cover and peat at critical access pinch-points. *Driver training* – some quality control issues were encountered which could probably have been largely avoided by more intensive induction training.
Opportunities	Demonstration days were held at several locations around Wales and a register of interest compiled of potential users ranging from control of *Molinia* on upland bogs and marshy grassland to lowland grassland and heathland sites. Replacement of the machine following its accidental loss was a top priority for nature conservation in Wales. We recommended the purchase of a flat-bed lorry at the same time for greater flexibility in moving between sites. This recommendation is based on the experience of the German Friedrichshafen Project which was visited by LIFE project staff in 2009 during procurement of the Pistenbully.
Threats	Perception in some quarters that the machine was overly big and expensive – risk that machine might be under-utilised. Argument that task should be undertaken using a machine owned and operated by a contractor. This was the approach taken by the Brandenburg Fens project. For this to prove commercially attractive, a commitment would be needed to ensure a minimum amount of work was available – this would compromise flexibility of operation because of competing demands on the machines time. However, NRW has purchased a new machine, a larger version of the Loglogic Softrak cut and collect system.

ACTION C2 MOWING – HAND HELD MACHINERY

Expected results: Significant reductions in standing crop and dead biomass, which together with grazing will result in increased species and structural diversity. At least 58ha will be subject to this action across the project area.

As for mechanical mowing the first season (2010-2011) was used to gain experience. The action is targeted to more sensitive sites and sites with strong micro-topography which would be damaged by the larger machinery. Hand cutting (using strimmers) and raking was widely used on fen dominated by *Schoenus nigricans*. The success of the technique, and the easy adoption of the methods by contractors, was evaluated in the first Progress Report.

As the work progressed there was less tussocky alkaline habitat than first thought (informed by vegetation surveys) and more habitat could be cut under Action C1. An update was given in the second Progress Report and by the end of the project the target was exceeded with 13.11ha of alkaline fen in 2013-2014, bringing the total amount cut to 69.03 ha. This has involved re-cutting some areas that needed intensive management.

Annual cutting season	Hectares
2010-11	8.08
2011-12	20.09
2012-13	29.75
2013-14	13.11
Project Target	**57.68**
Total Cut	**69.03**

Target	Exceeded
Budget	Planned overspend in relation to other mowing and burning targets

Strengths	This action worked very well as a means of targeting mowing and biomass removal at sensitive stands of alkaline fen vegetation vulnerable to damage from action C1. The method proved very effective as a means of removing dense standing biomass and litter from inaccessible microsites, such as between dense tussock of *Schoenus nigricans*. Raking material and collecting it in builder's bags was effective, with these then dragged by hand to the edges of sites or removed using a lightweight tracked soft-track vehicle. The approach also demonstrated the potential community and employment benefits associated with fen management, the action proving off-season employment for teams normally employed for highway verge maintenance. The action was effective as means of enabling access by grazing stock and making the vegetation more attractive for grazing animals through the removal of dense litter and standing growth. This action could be targeted very precisely at individual stands of vegetation. This action is very straightforward and new teams of contractors can be easily trained in its execution.
Weaknesses	This action is relatively expensive on a £/ha basis but is the best option for sites vulnerable to damage from action C1. Removal of biomass collected into bags was occasionally problematic due to the remoteness of sites.
Opportunities	This action needs to be continued into the long-term as even the most optimal grazing regime will not always result in sufficient grazing of key stands of alkaline and calcareous fen. The action could easily be extended to other sites in the project area, including non-statutory sites where this action would prove invaluable as a means of enabling follow-on grazing.
Threats	Insufficient resources to fund this action in the future. Control of agricultural diseases limits on-foot access to sites by contractors. Perception that action amounts to 'gardening' and that broader-scale 'sustainable' measures such as grazing should be employed instead. This viewpoint was raised on several occasions during the project but is easily countered by the benefits of the approach and the knowledge that even idealised grazing regimes often do not deliver an appropriate focus of grazing effort on key stands of Annex I habitat.

ACTION C3 - BIOMASS REMOVAL

Expected results: Removal of all cut biomass and peat from project sites and its use in a composting outlet. This outlet will provide unique opportunities for disseminating information about the wider projects and its aims through actions D1-D5 and D8.

The plans for the removal and disposal of cut biomass were initially closely linked to Action 12 (composting study) but the project was fortunate to find a ready solution through local farmers who could use the cut material for animal bedding etc, some material has been supplied to a local composting initiative at Penhesgyn municipal refuse and recycling centre. The centre had been buying in straw bales to add dry carbon to the compost production initiative and was pleased to take many tonnes of cut material as paying for the transport was cheaper than purchasing straw.

With the expected costs for the action much reduced it was reported in the Mid-Term Report that the savings could be used to support the large-scale works under Action C13 to cover the costs of removing peat from the restoration sites.

Most of the budget was used to enable peat "biomass removal" and transportation of peat biomass and cut vegetation biomass under Actions C1 and C13.

Target	Met
Budget	Exceeded
Strengths	Initial feasibility into the use of harvested vegetation and excavated peat found that the simplest and easiest solution to the product was to offer it to adjoining farmers. This worked so effectively that the development of a specialised unit was not required
Weaknesses	Transportation costs increase with distance from the produce and have to be balanced with collection. A composting unit would have meant employment within the region, but it would have been dependent on the cutting regime on NRW sites.
Opportunities	Review of cutting regime across the region when, and if, harvester is replaced
Threats	Relationships with adjacent landowners are critical to continuing this part of site management. Relationships are notoriously fragile and a way to co-ordinate the management of this in the future is critical. Continuation of the farmers/graziers meetings is a significant part of this management

ACTION C4: GRAZING

Expected results: Grazing will be employed over a total SAC area of 446 ha. All areas of alkaline fen will receive some level of grazing, the amount depending on their 'starting' condition as assessed under Action A.3. Approximately 90% of calcareous fen will be grazed, the remainder, comprising wet water-fringe vegetation, will remain naturally ungrazed.

Establishing the project grazing regimes required considerable preparatory work, including grazing audits, as outlined in the first Progress Report. The project employed a grazing coordinator (Cadwyn Cymru Link Wales) to help introduce cattle grazing to project sites and to prepare grazing licences.

Appropriate and sustainable grazing has been achieved on 502ha of fenland on Anglesey and the Llyn Peninsula which exceeds the target. This was achieved with a successful partnership with Cadwyn Cymru Link Wales. This target has been exceeded and is a very successful demonstration of what is achievable on wildlife sites combining biodiversity and the local economy. Annex 12 outlines the success of the grazing project.

It has involved many animals (both NRW ponies and privately owned cattle) and introduced animals to previously long term derelict land.

The only stock purchased in the project was the ponies purchased by NRW under Action A10.

Current privately owned cattle grazing sites include;

Site	Area	No. of Stock	Breed
Bodeilio main section including fly orchid spring	7.00ha	6	Dexters
Bodeilio - Caeau Bennet Fields	2.19ha	3	Dexters
Cefn Uwrch Land Purchase	7.00ha	5	Saler x Welsh Black
Bodgynda Erddreiniog	15ha	12	Saler x Welsh Black
Middle Section Erddreiniog	11.93ha	7	Dexters / Welsh Blacks
Sluice Gate Field Erddreiniog	15.64ha	10	Friesian young heifers 12month old
Cefn Du Erddreiniog	15.66ha	11	Dexters / Welsh Blacks

Bryn Mwcog Erddreiniog	34.09ha	60	Fresian young heifers 12month old
Tal y Sarn Gors Geirch	13.70ha	10	Hereford x Suckler cows
Nant Isaf Erddreiniog Land Purchase	34.41ha	48	Friesian young heifers 12month old
Cors Gwynan/Holt Land management agreement	5.5 ha	4	Dexters
Mathan Uchaf, Cors Geirch land Purchase	14 ha	8	Hereford x sucklers
Rhos Y Medre, Cors Geirch land Purchase	4.35 ha	4	Hereford x sucklers
Bronallt, Cors Geirch management aggreement	12 ha	9	Hereford cross
Cors Ffynnon Wen/Bodtacho Ddu, Cors Geirch	14.3 ha	9	Hereford cross

Target	Met
Budget	Underspent
Strengths	Very successful grazing action working in contract with Cadwyn Cymru Link Wales. Working with an established body within the agriculture sector meant that that contacts and networks with farmers willing to try conservation grazing were developed. Grazing on the sites initiated under the project has been continued with excellent results in terms of vegetation and relationships. A combination of pony grazing in the wetter, central and less accessible areas, combined with cattle grazing on the edges and more accessible sections of the site has worked very well.
Weaknesses	NRW ownership of animals increases resource requirement and risk. Working with adjacent landowners can lead to confusion over responsibility for fences, gates, escaped animals, welfare issues and it relies heavily on good relationships.
Opportunities	Extension of the grazing system and regime across a number of sites would be beneficial but will require resources to oversee and co-ordinate
Threats	Changes in agricultural policy, relationships, price of beef, zoonotic disease, NRW policy to grazing and animal husbandry

C5 TARGETING ANIMALS ONTO HABITATS WITH THE USE OF PERMANENT FENCING.

Expected results: Fencing will be erected to enable appropriate grazing.

Progress with fencing projects, including all sites, fencing type and lengths has been reported for each year. All anticipated additional fencing listed in the second Progress Report was completed in 2013-2014 establishing a further 2,350m of fence. This brings the total amount of fencing well over the original target with 15,503 m installed.

Year	Fence distance in meters
2010-11	3,640 meters
2011-12	6,463 meters
2012-13	3,050 meters
2013-14	2,350 meters
Total fencing completed	**15, 503 meters**
Target	**14,320 meters**

Target	Exceeded
Budget	Utilised
Strengths	Excellent progress with fencing over 14km of land. Excellent local contractors were used who we were satisfied met or exceeded our tightly defined specification for long term, maintenance free fencing. Fencing with post and rail or post and wire is a long term, agriculturally acceptable way to ensure that animals are targeted onto fen sites. This work has ensured that internal boundary fencing has been replaced, renewed or put in for the first time on an eco-agricultural basis
Weaknesses	NRW paying for the fencing of areas creates a perception that the fence is the responsibility of NRW rather than the land owner.
Opportunities	Continuation of this action is happening on all statutory sites
Threats	Budget requirement – fencing is quite and expensive action. But it is long lasting (circa 20 years) but due to the expense it is greatly appreciated by the farming community of an expression of NRW taking issues seriously

C6 CREATING TEMPORARY, CONFINED GRAZING WITH PORTABLE ELECTRIC FENCING.

Expected results: Temporary electric fencing will enable appropriate grazing.

Temporary electric fencing is an important management tool for both NRW and the North Wales Wildlife Trust and electric fence equipment has been deployed at several sites. The use of electric fencing can also keep livestock away from hazards.

Target	Met
Budget	Met
Strengths	Temporary electric fending is an excellent way of controlling stock in areas where permanent fencing is not possible, or appropriate, or only required for a short length of time. Many kilometres have been used at most of the project sites. It is a light and tried and tested stock management technique that with the use of solar energisers means that fencing can be left without the need to use and change batteries. Energisers and fences have been loaned to the North Wales Wildlife Trust to help grazing management on Cors Goch, the rest being retained by the NNR team
Weaknesses	Time and resources are required to put the fences up, which in areas of high growth can mean the need for strimming a pathway first. If grazing is not adequate for the site then vegetation will grow up against the fence wire and short the system out. Electric fences add risk for site visitors
Opportunities	There is plenty of opportunity to use electric fencing on and off the NNRs but it will require co-ordination
Threats	Cost of resource to construct the fence and replacement costs for single age energisers could reduce the future use of the technique

C7 SCRUB MANAGEMENT

Expected results: Scrub management will leave no more than scattered standing scrub across the majority of alkaline and calcareous fen.

The project has addressed the problems of scrub encroachment through contracts to remove scrub on a large scale and to reduce the reoccurrence of the problem by introducing grazing to many of the cleared sites. Techniques range from killing standing scrub with herbicide to clear fell and chipping operations.

By the second Progress Report the original targets had been exceeded with 95 ha cleared against a target of 60 ha. The use of management agreements will mean that further scrub work will be treated on privately owned land. Only a few areas were treated in the final year of the project. This action target has been exceeded and work has only been carried out on high priority NRW owned sites (C7), and those under agreement with landowners (C9). Scrub clearance has been completed on a further 8.3 ha of calcareous and alkaline fen since the last report. This has brought the project total to 95ha, exceeding the project target of 60ha by 35ha. The NRW sites where scrub was cleared were Allt Goch (Glan y Gors) and Maen Eryr (NRW owned section of Cefn Uwrch)

Use of C9 management agreements will mean that further scrub work will be required, particularly on Cors Cefn Uwrch and on other privately owned land

Target	Exceeded
Budget	Exceeded
Strengths	This action was highly effective as a means of removing undesirable woody vegetation and thus improving the condition of Annex I habitats and also enabling access by machinery and grazing animals. This action was also used to enable erection of stock-proof fencing. It can be a one-off activity in cases where follow-on grazing reduces or even eliminates scrub encroachment.
Weaknesses	This action can be of concern of local communities as it has the potential to greatly change the appearance of sites. By the same token, some stakeholders regarded scrub removal as evidence that sites were being taken under active management, to the benefit of local graziers.
Opportunities	Although the target was exceeded, there is considerable scope for further ongoing scrub management and its localised eradication – including parts of Cors Geirch and Cors Erddreiniog. Conversely, some parts of both sites could be allowed to succeed to wet woodland, particularly where existing herbaceous mire vegetation such as species-poor M25 has little potential for the development of alkaline fen or other less modified mire vegetation. This needs to be planned for in the after LIFE phase.
Threats	Insufficient resources to continue operation.

C8 REMOVAL OF LITTER BUILD-UP BY BURNING

Expected results: Burning has been identified as being necessary at 8 sites covering a total area of 168 ha.

Although burning is a recommended management tool for the maintenance of fen habitat the project was not able to meet the original targets for reasons explained in the progress reports. The main issue is that burning is very dependent on weather conditions.

Overall, throughout the project the opportunities to burn were very limited. The UK suffered very wet years for much of the project, and so the target was reviewed against the cutting and

mowing targets. The combination of burning and mowing was found to be a good solution and many of the areas originally considered for burning were improved through mowing.

The firebreak target is equally affected by this poor weather because fire breaks are only cut to facilitate the burning.

A total of 48.3 ha were managed through burning. The shortfall in the target of c. 120 ha was met by the increased outputs under Action C1.

Burning will be an extremely important aspect of the Afterlife plan and will be used along with cutting to keep the areas of land cut or burnt already in the best condition for grazing and bio-diversity. Equipment to facilitate long term burning management has been purchased and NRW has skilled personnel.

Target	Not met (but combined with mowing targets)
Budget	Overspent
Strengths	Burning is a very effective and traditional way of dealing with excess vegetation and litter. The NRW team are highly trained in burning and are able to control burns in an efficient and effective way. Burning dispenses with the need for removal of cuttings
Weaknesses	Very resource intensive and requires planning a number of staff to be available at a days notice to burn when weather conditions are right. Fire always comes with risk to people and property. There is no recorded history of burning on some sites and invertebrate fauna may have developed in its absence
Opportunities	There is scope for burning each year, areas are planned and if weather conditions and resources allow these can be burnt
Threats	Risk to people and property and invertebrates

C9 SECURING FAVOURABLE MANAGEMENTS THROUGH MANAGEMENT AGREEMENTS

Expected results: Secure agreements on 217 ha within and adjoining the sites

The focus on securing management agreements began in the second part of the project, with capital works (e.g fencing, scrub clearance, access work) being covered by the LIFE funding and recurring payments to be funded separately through CCW/NRW. By the Mid-Term Report the project had prepared a list of potential agreements and recommendations for management.

The single largest management agreement is with the North Wales Wildlife Trust for 84 ha. A further 13 agreements have been drawn up with private owners. The total area under agreement at the end of the project was 228 ha.

Although the target was not quite met (due to lengthy discussions with a number of owners being delayed post project) the target is close, and the amount of works carried out on the land hugely significant

Management agreements in place

Site Name	Owner	Size in ha
Anglesey		
Waen Eurad	Mr Davies	3.7*
Cors Y Plwyf	Community Council***	9
Glan y Gors, Bodeilio	Mrs Bennett	2.2
Cors y Farl	Plas Llanddyfnan***	10.5
Cors y Farl	Cae'r Mynydd Albert Owen	3.71
Rhos y Gad	Mr Richards	6.8
Cors Goch	NWWT	84.4
Cors Gwynan Bodeilio, Holt Land	Mrs Livingstone	5
Cors Cefn Uwch	Mrs Dutton	5
Cors Cefn Uwrch	Williams, Dolau	2.3**
Llyn Peninsula		
Hendre	Mr G W Jones	10.11
Gallt y Beren	Mr Parry	38.33
Penhyddgan	Mrs Mason	0.55
Bronallt	Mr Davies	9.8
Pencefn Fawr	Mr Heddwel Roberts	7.43
	Total to date	**196.5**

*legacy project staff have worked with the owners to increase the area under management agreement to help increase potential for invertebrate species. Potential for marsh fritillaries (*Euphydryas aurinia*), *Vertigo* species (already found in managed areas on this site) and southern damselfly (*Coenagrion mercuriale*) expansion

** under negotiation during project but signed post project (not included in total)

*** carried out under notice of Section 28 of the Wildlife and Countryside Act. Owners nervous of entering 5 year agreement but have agreed via a formal notice for hydro works, grazing, strimming etc on land

Land under management agreement schemes now exceeds the target (post project). The work on this target will continue post project and will account for even more land under sustainable management facilitated by the LIFE project approach.

Agreements are signed for 5 years, all relevant capital elements funded by LIFE but any recurring/ annual payments necessary are funded separately by NRW.

As reported previously, spend against these capital projects carried out under management agreement was noted in the project bid as C9 "other costs" but is now, sensibly, recorded and reported as C9 "external assistance". Note that actions carried out by this work are counted against the action target, while the area of land under agreement is counted against the C9 target.

A significant resource has been applied to this action in the final year of the project. The earlier years were spent developing a working relationship with landowners, several who have previously held a suspicious view of CCW and conservation. This has, for example, developed good relations on Cors Cefn Uwrch previously a "no go area" for CCW.

Original copies of all agreements are archived and are available for inspection at any time. Copies are attached at annex 13

Target	Almost met
Budget	Underspent
Strengths	Effective, recognised and acceptable method of agreeing works on landowners land with no impact on agricultural subsidies.
Weaknesses	Long process that can be easily delayed and so miss seasonal deadline for work
Opportunities	For future projects it would be advisable to have a list of agreements already signed that would allow a first season of work while the next set of agreements were signed up
Threats	NRW priority for spend

C10 – RAISE AND STABILISE WATER LEVELS

Expected results: Restored water table regimes will achieve improvements in habitat condition and also aid increases in the extent of both Annex I habitats. This action will be pursued along a total length of 5,800 m.

Sub-projects under this action required a considerable amount of investigative and preparatory work under Action A5, as well as considering Site Action Plans, potential land purchase and future management agreements. Examples were given in the first Progress Report (e.g. management agreement to allow water levels to be raised, the need to buy additional land to allow for future water levels, the need to create seals between drainage ditches and fen habitats or problems with covenants requiring land to be drained).

By the Mid-Term Report several actions had begun and further progress was reported in the second Progress Report. Studies had shown that in some cases the water levels should actually be lowered so the action focus is about getting water levels right.

This target was exceeded by 639m and the table below details the metres of water levels (e.g. ditches) per SSSI site. The details of where this work has been carried out are shown in the maps. It's important to note that the meterage of blocking does not in itself identify the area of influence of the blocked ditch. It is possible to state that a re-instated water level will have an effect between 10 and 50m on either side of the blocked ditch. In simple terms this could give a range of influence between (6452 x 10): (6452x50) = 64, 520 m^2: 322, 600m^2

Raise and Stabilise Water Levels C10	5813m
Achieved	m
Cors Bodeilio (Tyddyn Fieren, Large central section, interconnections to main drain)	1754
Erddreiniog (including Cefn Uwrch, Cae Gwyn piling, below Cae Gwyn,)	1206
Geirch (Mathan Uchaf,)	1769
Cors Hirdre	1090
Cors y Farl	371
Waun Eurad	262
Total	**6452 m**

Detailed case studies are at annex 14

C11 – RESTORATION OF CRITICAL HYDROLOGICAL PATHWAYS

Expected results: Restored hydrological pathways will achieve improvements in habitat condition and increase the extent of both Annex I habitats. Pathways will be restored along a total length of 3,479 m proximal to examples of both Annex I habitats and their wider supporting fen matrix.

The issues addressed were similar to those under Action C10 and for reporting the actions were often combined. The first Progress Report introduced some of the issues and studies including studies on expected 'base flows' of water to restoration sites (Cae Gwyn), the opportunity to extend the influence of existing seepage zones and to 're-plumb' springs to the fens).

By Mid-Term Report practical works were underway and an example of a case study covering Actions C10, C11 and C13 was presented for Cors Bodeilio.

This target was exceeded, below are the totals reported on an SSSI basis

Re-connecting Hydrological Pathways	3479m
Achieved	m
Cors Bodeilio (Fly Orchid Spring, Tyddyn Fieren)	1207
Cors Erddreiniog (Cae Gwyn – nanmt Isaf Springs, Middle Ground spring Hazelwood, Tal Y Llyn, Cors Cefn Uwrch, etc)	3268
Cors Geirch (Mathan Uchaf, Cors Ceidio, Tal Y Sarn, etc)	3467
Total	**7942 m**

Once again, restoration of a pathway does not represent the area of potential influence of a restored pathway. For example, reconnection of the spring water across Cae Gwyn, and below Cae Gwyn can be measured in linear length but the actual zone of hydraulic influence is much greater than just the sum of the linear meters

Combined C10 and C11

Target	Met
Budget	Met
Strengths	The hydrological actions undertaken represent some of the greatest achievements of the project. Some of the work required significant investigation to plan the detail of the work, as well as the cooperation of adjacent land-owners, culminating in some cases in the need to purchase land. Most of these projects evolved as they were executed, with detailed actions on the ground being fine-tuned from day to day. The highlights of the project include (i) restoration of spring flows and ground-water fed water supply regimes at Cae Gwyn, Mathan Uchaf and Cors Ceidio (ii) restoration of a key groundwater supply pathway at Cors Bodeilio, (iii) and restoration of target water levels at Cors Cefn Uwrch and Cors Hirdre. These projects have attracted significant interest from the wider peatland restoration community, with at least one equivalent project in England now being contemplated following the success of the LIFE experience.
Weaknesses	Our experience is that these projects take significant time and resources, with the

	larger projects consuming more effort than originally anticipated. This means that some other worthy projects could not be implemented due to lack of time and money, notably the groundwater pathway restoration project for fen adjacent to Llyn yr Wyth Eidion and at Cors Nant Isaf (Cors Erddreiniog). Some issues required action at a catchment level (notably reduction of nutrient loads in groundwater), but these were beyond the scope of the current project.
Opportunities	There are significant opportunities for further projects under this heading, including both projects listed under *weaknesses*. The Water Level Management Plan (WLMP) mechanism needs to be re-visited, with restoration of more natural axial drainage regimes a priority for Cors Geirch (Llyn Fens) and Cors Bodeilio, Cors Erddreiniog and Gwenfro (Anglesey Fens). The WLMP mechanism contributed funding to two of the LIFE project elements, but otherwise has failed to-date to deliver water level regimes commensurate with the delivery of Favourable Conservation Status. Implementation of the Water Framework Directive offers further opportunities for the restoration of hydrological and hydro chemical regimes, but whether the Directive will be implemented with the necessary ambition, energy and resources is highly uncertain.
Threats	Some of the projects undertaken during LIFE utilised engineered solutions to achieve the desired outcome, with longer-term and in some cases arguably preferable solutions (such as catchment-scale intervention or adjacent land purchase) rejected because they could not have been realised during the project life-time, if indeed in any realistic (<20 year) timescale. Our experience is that arguments favouring a 'wait and see' / 'wait until suitable circumstances develop' approach tend to be misused, leading to ongoing degradation with no clear timescale or mechanism for resolution. Future resources will inevitably limit what can be achieved.

C12 CONTROL OF WATER LEVELS IN THE MAIN DRAIN AT CORS ERDDREINIOG

Expected results: Better control of water levels within the main drainage feature at Cors Erddreiniog will prevent undesirable flooding by potentially nutrient enriched water, and also avoid periods of excessive summertime water table draw-down. This will help reduce emissions of dissolved organic carbon into receiving waters.

Unfortunately it was not possible to complete this action during the project, despite a considerable amount of effort. The action was not a pre-requisite for any of the project work as it is a 'down-stream' improvement which would reduce the costs of water purification in the public water supply.

Automation of the sluice is still desirable and is now a NRW project (previously it was to be a joint project carried out by the LIFE project and Environment Agency Wales – now part of NRW).

The design has been completed and accounts for half the project budget, but construction was not possible before the end of the project as more work was required on the design. In addition, minimum and maximum water table limits could not be set and it was felt that the existing manually operated sluice was fulfilling the role adequately. Remaining spend was used to meet other targets related to hydrological levels on Cors Erddreiniog However, a review of construction is an integral part of the afterlife plan.

Target	Not met. This project, although important to the functioning of the fen is not critical because there is currently a manually operated sluice. Half of the project budget was spent on a consultancy report that designed a potential sluice for Erddreiniog. However, this design was not acceptable to various teams within NRW. It did not take account of conservation objectives for the site and was lacking a fish pass. This work will be continued in the afterlife. There is no claim for this action.
Budget	Vired to other spend
Strengths	The advantage of an automated sluice is that it does not need manual operation.
Weaknesses	It will require monitoring and review to ensure it is functioning and will require maintenance
Opportunities	Opportunities will be explored over the next 3 years
Threats	Higher priority conservation work

ACTION C13 – PEAT CUTTING TO RESTORE AND RE-CREATE ALKALINE FEN AND CALCAREOUS FEN

Expected results: Peat cutting has been identified as a necessary activity over 15 ha on 6 sites. Investigations in Action A.5 will confirm the areas to be stripped. Exposed peat and open water will be allowed to re-vegetate naturally. Vegetation development will be monitored (Action E4.02). Hydrological regimes at cut-over sites will be monitored for at least twelve months post excavation (Action E4.03).

The action grew from initial plans for numerous small scale excavations to two very large restoration projects and a series of smaller works. The results, however, provide demonstration case studies of national and international interest.

The purpose of the action is to cut and remove surface peat layers to increase the extent and quality of fen habitats. Several project sites were outlined in the first Progress Report with the Cae Gwyn site within the Cors Erddreiniog SSSI being the largest and the most complicated. Preparatory investigations, including input from specialist contractors, were carried out including levelling and peat coring to work out just how much peat to remove. The sources of spring water were also quantified to plan for the rewetting of the fen allowing specifications for the work to be prepared (annexes in first Progress Report).

The outline of a further seven potential sites were presented in the first Progress Report. By the Mid-Term Report stage the works at Cae Gwyn were complete with some 40,000 tonnes of peat being removed and contoured into adjacent fields. The total area restored was 4.8 ha. Works were linked to hydrological actions through C10 and C11.

The project application expected to strip c. 30cm from sites to restore fen habitats but in some cases up to 60 cm were removed, increasing the cost of the action.

By the second Progress Report over 10 ha of peat removal had been completed at 15 sites with a further 3 sites planned. A second large site, 3.5 ha Mathan Uchaf within the Cors Geirch SSSI had been completed and the case study was presented in the report. The Mathan Uchaf project was carried out in partnership with Environment Agency Wales as part of the Water Level Management Plan. The infilling of a main ditch raised water levels but required the project to purchase additional strips of land and 2.75 ha at Mathan Uchaf was purchased in 2013.

The target was exceeded by a combination of very large and exemplar projects in some cases, and small (even tiny) replicated peat cuttings in other areas. Work is being carried over into the afterlife stage with NRW planning some medium size excavations which have been agreed in LIFE management agreements and works will be funded by NRW in the future. A project officer from Natural England who was impressed with the work during the Final Conference has started work on three excavations in Lancashire.

Colonisation of the flagship cutting "Cae Gwyn" is already exhibiting over 6 key species and continued monitoring is an integral part of the afterlife plan

C13 Peat Removal	Target 15ha
Achieved	
Cors Bodeilio (Central Cladium section, field adjacent, sleeper road past Ynys, Tyddyn Fieren, Reed fen near car park	1.38
Cors Erddreiniog (including Cae Gwyn, Cefn Uwrch, Cefn Uwrch next to M13 Below Cae Gwyn,)	6.42
Cors Goch	0.06
Cors Geirch (including Mathan Uchaf and Cors Ceidio)	14.53
Total	**22.39**

The action is well over budget, original costings underestimated the scale of works required, especially in terms of removing the peat biomass from the cuttings.

Final conference feedback during visits and talks showed a significant interest in this action.

Target	Met
Budget	This operation is inevitably expensive where undertaken on a scale sufficient to require use of machinery to move peat to disposal sites – costs for this activity ranged from several hundred thousand pounds for huge sites like Cae Gwyn to smaller-scale peat cuttings requiring only a single 360 degree excavator which were much cheaper and charged on a day rate.
Strengths	This is a very specific restoration activity usually limited to particular circumstances where peat and other substrate removal is required to simultaneously restore surface-wet conditions and remove nutrient-enriched peat. The method can be spectacularly effective; Cae Gwyn and Mathan Uchaf represent exemplar sites where peat removal has resulted in a radical improvement in site conditions, with alkaline fen already developing at the former site. Smaller-scale cuttings (<100m^2) were also found to be very effective in restoring oligotrophic wet conditions, with many examples now showing a significant cover of Charophytes.
Weaknesses	The significant cost of larger examples inevitably limits the use of this action. The disposal of excavated peat and other substrate types can be challenging and the availability of receptor sites may place a limit on the size and location of cuttings. Use of the method has sometimes been criticised because some regard it as under-mining the case for addressing the root causes of degradation. In the contexts in which the action was used in this LIFE project, this argument was felt to be invalid because addressing the fundamental causes of degradation would have required measures which had already been rejected by affected neighbouring third parties, and also because even if these measures could have been applied there was considerable uncertainty that sufficiently wet and oligotrophic conditions could be restored without peat removal.
Opportunities	Many significant opportunities remain for pursuing this action. The LIFE project

	has demonstrated what can be achieved and has also established a significant set of methodologies extending all the way from planning application to site investigations and assessment and ultimately delivery. Many areas of heavily degraded fen could successfully be targeted for this action. There are significant opportunities for developing a local market for excavated peat for use as a soil improver and additive for local composting schemes. Use of peat in such schemes would also offer opportunities for interpretation and education in sectors not otherwise easily reached through conventional conservation programmes.
Threats	Cost is an inevitable issue. Ideological objections to the concept of stripping and removing peat may be significant, but this LIFE project has demonstrated the very significant benefits offered by the method and the evidence relating to this needs to be continued and developed.

C14 CONSTRUCTION OF REEDBED WETLANDS TO TACKLE POINT SOURCE POLLUTION

Expected results: Improvements in water quality to target levels of N and P as identified under Action A6, leading to improvements in the condition of areas of both alkaline fen and calcareous fen. Monitoring of output chemistry (Action E4.04) will be undertaken during the first year of operation to assess function.

The action followed the initial work described under Action A6 to identify the locations for constructed wetlands (annex provided in Mid-Term Report). The project benefitted from design ideas developed by the LIFE project LIFE05ENV/UK/000137.

This action is attracting a lot of interest from other conservation organisations (Anglesey Council, North Wales Regional Welsh Government Assembly Member, Natural England) and has now been replicated by the Afon Eden LIFE Scottish Pearl Mussel project and Welsh Government funded Mawndir Mon as this relatively simple method of reducing nutrient input and sedimentation from a range of sources. The action is also linked to A6 and E4.04.

However, constructed wetlands are only one option for reducing nutrients. Others would include controlling agricultural runoff through Management Agreements (Action C9), purchasing land to act as a buffer zone (Action B1) and working with farmers to promote best practice (Action D13).

Monitoring of the performance of constructed wetlands was carried out throughout the project supported by PhD research work. The issues studies through the research project included maintaining alkalinity, soluble calcium maintenance and nutrient reduction whilst retaining high calcium levels in out-flowing water. Annex 15 has details of the final output of Mike West's PhD.

The target has been exceeded (see action A6)

C15 ACTIONS FOR ANNEX 2 SPECIES

Expected results: Site specific conservation objectives define favourable condition for four species within the SAC sites. Management will target the habitat of Vertigo geyeri, V. moulinsiana, Coenagrion mercuriale and Euphydryas aurinia.

Habitat improvement for species was largely an indirect result of the overall habitat restoration programme, although some specific actions were carried out, e.g. hand strimming of known sites for southern damselfly.

Habitat for Southern damselfly *Coenagrion mercuriale* has been increased at four locations and during survey one was also seen at a new location where work had been carried out. These are improvements at the spring fields (described in the first Progress Report), creation at the top of Cae Gwyn, improvement within Cors Nant Isaf and adjoining ditch and creation of stepping stone areas in-between. Detail was reported in the second Progress Report. Work has also been done adjacent to Llyn Y Wyth Eiddion. Continued monitoring over the afterlife period will record how successful the population shift will be.

Monitoring of *Coenagrion mercuriale* populations at the Nant Isaf spring fields in 2013 yielded counts on transects through the best areas of at least 166 males, suggesting an overall total population of perhaps 1000 – 2000 (Sutton, 2013) (see annex 16). This report highlights the beneficial influence of LIFE mowing and grazing actions.

In addition Marsh Fritillary *Euphydryas aurinia* habitat has been improved in two locations on Cors Erddreiniog and at Waun Eurad which will hopefully be a potential stepping stone for this species which is characterised by shifting meta-populations.

Vertigo moulisana has been recorded in an area of Waun Eurad that was previously under thick scrub but where remnants of black bog vegetation were just visible. Scrub was cleared, alkaline fen has started to recover and the SAC monitoring team discovered the species in the previously unrecorded location.

Monitoring of *Vertigo geyeri* at Waun Eurad indicates that LIFE actions have resulted in an "increase in optimum habitat on the site" compared with the pre-LIFE assessment of 2007. Waun Eurad was (unintentionally) over-grazed for a period in 2014, leading to less litter cover than would normally be associated with good condition *Vertigo* habitat: however, grazing relaxation had allowed sufficient recovery by the time of the assessment later that year. These observations not only illustrate the need for caution in making judgements that significant damage has been caused by temporary heavy grazing, but also suggest that *Vertigo* populations may have responded well to the reintroduction of grazing following mowing at other LIFE sites.

This target has been achieved and further detail about the monitoring work on the Southern damselfly is available at annex 16

Target	Met
Budget	Overspent
Strengths	Tackling relevant species issues on the fens mostly requires a healthy functioning fen. Some specific tweaking to grazing pressure is required to allow for marsh fritillaries and specific focussed action is required in flushed areas for the Southern damselfly. Actions are relatively cheap and easy to implement. Scrub work on Waun Eurad which opened up black bog rush habitat had Vertigo spp. recorded for the first time and the same site had large areas of *Succisa pratensis* (foodplant of Marsh Fritillary) for the first year due to tweaking of grazing.

Weaknesses	The habitat can be perfect for a species but it may take much longer than a project for them to make use of it. In this case, anecdotal evidence of a Damselfly in a new location was recorded during a survey, but other than that it will take afterlife monitoring to record accurately if the species has moved.
Opportunities	There are opportunities to continue species work, and these must be considered on their own in addition to larger scale habitat works
Threats	Changes to grazing patterns can have short term devastating effects on invertebrate species that risk long term population impacts

ACTION E1 MANAGE PROJECT

The Project Board has continued to steer the project. The Project Management Group, however, met infrequently since the Mid-Term Report. This was because its function was being met by other groups or by individual meetings with stakeholders.

E1	Target	Met
	Budget	n/a
	Strengths	Good effective steering and advice from the Project Board helped the project progress.
	Weaknesses	Some meetings were dominated by discussions at too high detail. It is important to ensure that project board composition is pitched at the right level to avoid this, and to avoid duplication or replacement of project team meetings
	Opportunities	n/a
	Threats	n/a

ACTION E2 ESTABLISH FARMING LIAISON GROUP

See C4. This group is developing from the meeting of graziers using the sites. Excellent relations were developed and these are being built on by permanent staff managing the sites. Sites are still being grazed and as part of this, and working with partners, a minor part of the project to develop management cards will be discussed

E2	Target	Met
	Budget	n/a
	Strengths	Good relationships with farmers and graziers were aided by this group. Informal meetings helped understand what was required on each side and how practices and work plans could accommodate each other
	Weaknesses	Time to involve every farmer and landowner in the catchment is not possible without a very time consuming exercise. Targeted meetings and relations with the farming unions was necessary due to resource constraints
	Opportunities	Local farm meetings between NRW staff in place based teams and landowners is a must in the future
	Threats	Lack of landowner involvement will not get the best for sites, landowners, conservation or business

ACTION E3. MONITOR PROJECT PROGRESS THROUGH DELIVERY OF ACTIONS

E3	Target	Met
	Budget	n/a
	Strengths	Regular action and site monitoring ensured that all sites had some action and that actions progressed as planned. Complexity of sites and actions determined the frequency of monitoring
	Weaknesses	Expensive, complicated or political sites get more attention than smaller, less “exciting” sites
	Opportunities	n/a
	Threats	n/a

ACTION E4. UNDERTAKE SCIENTIFIC MONITORING OF RESPONSE OF ALKALINE FEN AND CALCAREOUS FEN TO APPLIED MANAGEMENT

E.4.01		See account for Action A3.
E.4.02		See account for Action A4.
E.4.03		See account for Action A5.
E4.04	Target	Fully met
	Budget	Action delivered within budget
	Strengths	This action proved highly effective in demonstrating the consequences of project actions on water chemistry.
	Weaknesses	It is perhaps inevitable that more monitoring would have been valuable.
	Opportunities	Ongoing monitoring of the long-term effectiveness of the constructed wetlands is an obvious priority. There are opportunities for integrating this work with NRW standard water quality programmes and also the current NRW project examining groundwater supply and quality on sites within the SACs.
	Threats	Insufficient resources/commitment for ongoing monitoring
E4.05	Target	Met
	Budget	Spent
	Strengths	See action C15 – species action is often part and parcel of habitat action – a healthy habitat should encourage the spread of species. In this project specific areas were chosen to try and expand the range of some of the relevant species on these sites. *Coenagrion mercurale* specific works were carried out in identified areas and detailed monitoring carried out by contractors. These monitoring reports identify the areas improved for the damselfly and record numbers associated. Marsh Fritillary grazing management was targeted on specific areas and has seen prolific increase in target habitat (scabious). And *Vertigo* species were found associated with new areas where scrub had been cleared off alkaline fen habitat
	Weaknesses	The long time that it takes for species movement or increase in numbers after works have been carried out require long term monitoring of the relevant sites
	Opportunities	Continued monitoring is necessary but is dependent on resources
	Threats	Lack of resources to monitor population change

ACTION E5: PRODUCTION OF AFTER-LIFE CONSERVATION PLAN

NRW is also the Beneficiary of the N2K Programme LIFE project (https://naturalresources.wales/about-us/our-projects/life-n2k-wales/life-n2k-wales/?lang=en). To ensure consistency, and to ensure that the Fens were properly accounted for in the PAF for Wales the two projects worked closely together, along with NRW Conservation Sites team staff to produce Prioritised Implementation Plans (PIPs) for the Fen SACs that would also effectively highlight all the work that that is required in the afterlife.
In addition to the PIPs a plan outlining the priority and the timings required for actions is included in this report. Further planning meetings chaired by Nick Thomas (Project Executive) ensure that these plans are taken account of during day to day work programming. Very detailed cutting/burning plans have been in operation for over 12 months, and renewal of agreements on critical land is underway using the NRW budget.
The afterlife plan spreadsheet, and the detailed cutting burning spreadsheet are at annex2. There is also an update on where action has been carried out in the covering letter and notes of afterlife meetings at annex 17

5.2 Dissemination actions

5.2.1 Dissemination objectives

The perception of the conservation agencies in and around the Fens was poor prior to the project. This was partly due to generational farming versus conservation issues, and partly due to organisational priorities. This project has allowed time to be spent rebuilding the relationships with landowners and neighbours.

In terms of dissemination it has been very important to concentrate on local groups, and national and international experts. The 'layman's book' will be distributed widely. A lot of effort and resources has gone into making a coffee table style of book, carrying important messages, lovely photos, and contact details along with explanations of complicated processes such as peat formation and eco-goods and services.

The book has been added to the project website (http://www.angleseyandllynfens.com/), and also promoted through Twitter via the N2k LIFE project.

5.2.2. Dissemination: overview per activity

ACTION D1 WEBSITE

Expected results: Project website, which will enable information about the project to be disseminated to a very wide audience. It will therefore contribute to raising awareness of the project, and ultimately to the achievement of the project's objectives.

The CCW website met the technical requirement for the project website which was to be in place 6 months after the project start. However, to go above this the project published a stand-alone project website which was operational by the time of the Mid-Term Report. The development of the project-specific site was noted by the Commission in its letter of 1st March 2013.

However, NRW policy is that it does not support micro-sites and so the information has been transferred to a section of the NRW website. A new home page has been created on the NRW website at http://www.naturalresources.wales/about-us/our-projects/anglesey-and-llyn-fens-life-project/?lang=en and material from the former micro-site has been incorporated. The original web-address http://www.angleseyandllynfens.com/ takes readers to the new address. NRW guarantees that the web-site will be updated annually, and maintained for 5 years, from the date of the final report (i.e. until December 2020). Maintaining the website will be a tool for dissemination in the afterlife period.

Target	Met at start of project but updates required
Budget	Underspent, work in house
Strengths	Useful tool for spreading information about the project, partners and funding bodies, along with project Facebook page. Current information on the website gives basic information about the project and will be updated with information from final report.
Weaknesses	Lack of opportunity to update did not take full advantage of the opportunities for dissemination
Opportunities	Pages on the NRW website will recognise and disseminate LIFE project input and

	opportunities
Threats	Loss of microsite due to change in NRW policies

ACTION D2 DESIGN CREATE AND ERECT PROJECT SIGNS

Expected results: Thirty signs in total. Two durable signs erected at each site within the project area and updated throughout the project. These signs will help improve awareness and understanding of the project among the key stakeholders and therefore gain support for our actions.

From inception the project has promoted its work, along with the LIFE logo and Natura 2000 logo. In particular, many project signs outlining the work of the project and the wetland harvester etc were erected on project sites. These signs were noted during the Commission's visit to the project in 2010 and during the first progress report. Many signs were erected between 2010 and 2012, and will only be replaced when final NRW/LIFE Project signage replaces them

Project sign on access gate to new land Cors Tal Y Sarn

In addition, good quality, small signs were erected at all project sites and all work areas. The specific works project sign was devised using the LIFE logo surrounded by the project name and this was also used on vehicles and stickers attached to equipment access points, gates, fences etc

Design of marker sign, page 27 of the layman's report shows one in place on a gate at mathan uchaf

A movable banner and pop up signs were also produced for LIFE events, agricultural shows, talks etc

LIFE banner at Nefyn Show

The additional signs had to wait until the end of the project because they refer to completed project actions etc, they have been designed to cover major actions on sites (e.g. Cae Gwyn and Mathan Uchaf), minor actions in various locations on simple wooden and rubber posts (e.g. grazing, ditch blocking) and some site based/project signs. These total 30 in all and will be deployed over the sites. The final cost of production and installation is not claimed within the project.

Orders have been let to Stuart Lloyd Associates Ltd for sign production. The cost of these additional signs (£7,000) is not being claimed in the project as the cost falls outside the project timescales, but the cost of earlier design work has been included when it fell into the project period.

The signs will be put in place by the National Nature Reserve estate team and photos of final signs in place will be forwarded to the Commission and external monitoring team.

Final signs will include:

10 main panels 1000 x 800mm in full colour on 3mm enamelled aluminium with clear protective coating. These will be put in place on areas where land has been purchased, or significant actions carried out and will be located at public access points at e.g. Cors Ffynnon Wen, Allt Goch, Cors Errdreiniog etc

3 types of management panels 640 x 450mm in full colour on 3mm enamelled aluminium with clear protective coating for use at 'flagship' locations such as Cae Gwyn, Fly Orchid Spring and Mathan Uchaf

4 types of minor panels 210 x 297mm in full colour on aluminium with protective coating to convey simple messages about four of the key actions; ditch blocking/water levels, grazing, cutting, water quality. There are six of each and they will be located in some of the smaller, but more accessible areas of relevant work

Examples of the signs are attached at annex 18

Target	Met
Budget	Overspent
Strengths	A combination of signs put up early in the project explaining works and aims have been very successful. These signs along with small LIFE project signs have fulfilled the target. In addition to this long term project end signs have been installed on sites which detail specific actions on sites. All signs are spread widely across the project sites and reach a variety of audiences
Weaknesses	Signs can date quickly, but with the right information will remain current for years
Opportunities	There are no opportunities for additional signs
Threats	Vandalism and loss of currency

ACTION D3 PUBLIC PROMOTION AND PROJECT MARKETING PUBLICATIONS

Expected results: 5000 copies of the leaflet will be produced initially, and at least 3000 distributed in the first 2 years of the project.

The action was broadened considerable as outlined in the first Progress Report. To reach target audiences the initial project leaflet (1000 copies at first) was circulated at the Anglesey County Agricultural Show and to raise the profile an information banner was produced and the project launch sponsored the best Welsh Black bull at the show (photos of the launch event were included in the first Progress Report).

Throughout the project has engaged with farmers (often through shows), local community councils and schools. The project has had information stands at many local shows and has brought the Pistenbully harvester to these to let people see the equipment. The project has been drawn to the attention of senior politicians in Wales.

Further leaflets have been produced introducing the project and outlining the work of the project; a technical leaflet about the work at Cae Gwyn and one about the importance of peatlands. These were distributed throughout the final year in addition to pop up displays and display boards. A leaflet programme for the final conference was produced (see below) and a leaflet was also produced with the Anglesey Council Mawndir Mon project about Anglesey Wetlands. Leaflets are located at annex 19 hard copies only.

We also invested a significant amount of resource in developing a very high quality layman's book (the Layman's Report). This is a high quality 'coffee table book' style that combines interesting and quality photographs with key information about the project, the sites, the partners etc. The book will go much further and wider than any of the other dissemination materials and will be a valuable way to share detail about the project and its achievements.

We have produced 'bags for LIFE' that are re-usable shopping bags, note books with LIFE covers and LIFE branded magnifying glasses, all of which have proved popular and successful. We used willow wands during the time of a Harry Potter film release to highlight scrub on the Fens and also let children indulge in a peaty lucky dip to get their hands into peat to feel what it was like.

Target	Met
Budget	Underspent
Strengths	Simple and effective way to disseminate information in a form that can be left in locations for pickup when staff not in situ.
Weaknesses	Can quickly become out of date, easy to waste material as people/partners can take away many leaflets and lose them in the future
Opportunities	Time proofed leaflets (peatland and Anglesey wetlands) can be re-printed, meaning that the legacy of the project and EC involvement will last well beyond the date of the project end
Threats	Out of date information can lead to confusion and non NRW branded literature is being phased out

ACTION D4 PRODUCE PROJECT NEWSLETTERS

Expected results: 400 copies of the newsletter will be produced and distributed every year during the project. This will result in local people and other interested parties being informed in detail of progress to date and forthcoming activities.

To supplement the public promotion work (Action D3) the project developed the idea of using a calendar rather than a project newsletter.

The calendar (500 circulated-and copy included in first Progress Report) contained key project and site information. This was a good way to get information visible in homes and businesses around the sites. In addition to this we used leaflet style letters to people within the catchment at different stages of the project to update them on important aspects of the project – these outlined the project and how contractors could get involved, the project and how it was working in partnership with ADAS and Farming Connect to offer free soil testing and how on certain sites when scrub work was being carried out that locals were welcome to help themselves to free firewood.

The Anglesey and Lleyn Fens LIFE project is offering a free one-off nutrient planning service.

This free soil testing and fertiliser planning service will give farmers a taste of how to create a Whole Farm Fertiliser Plan.

What is a Nutrient Plan?
Farmers aim to run profitable and efficient farms that make the best use of all resources available. Nutrient management planning plays an important part in maximising yields of grass and other crops grown. Research has clearly shown the positive benefits of maintaining soil pH, phosphate, and magnesium indices. This can be achieved by regularly sampling soil (every 3-4 years).

'A comprehensive nutrient management plan is based on up to date soil analysis so that a known base is used to calculate crop needs' says Aled Roberts of ADAS. Starting from a sound footing is far better than guess work as it provides information on soil reserves and identifies any requirements to correct deficiencies, or in some cases "over indulgence" from the use of bought in nutrients.

Are you utilising your manures to best effect by applying at the right time of the year? With Farm Yard Manure (FYM) currently valued at £7.90/tonne and slurry with a dry matter of 6 % valued at £3.70/m^3, considerable savings can be made in purchased inputs by using these effectively. FYM and slurry also provide valuable trace elements and organic matter to the soil. Balancing manures with the appropriate inorganic (bagged) fertiliser can potentially **save between £7 and £15/acre per silage cut**, by avoiding unnecessary applications. A nutrient management plan will take all these inputs into consideration.

What are the longer term benefits to the crop? Correcting soil pH by applying lime will give an improvement in nitrogen efficiency uptake, as well as improving some soil structural problems. This is an important part of reducing nitrous oxide emissions (a damaging greenhouse gas) caused by un-balanced nitrogen applications. Balancing organic and inorganic nitrogen sources is an important part of forward nutrient planning. The use of lime can improve the efficiency with which nutrients are recovered by a crop.

When to sample?
Soil sampling should be undertaken during autumn/winter/early spring period and it is important to avoid sampling within six weeks of fertiliser or three months of manure application.

Although project newsletters were to be produced later in the project, resources were used to concentrate on producing a lasting layman's report outlining the background to the project

work. This would supplement the ongoing community relations work reported in several other actions.

The book has been completed and published after the project with NRW money. It has been very well received both internally and externally. The book is intended to be read in conjunction with the final report as it contains much relevant background information and is set out to cover each action, results and eco-system services.

See annex 20

Target	Partially met
Budget	Underspent
Strengths	Newsletters are an accepted way of communicating issues to a wider audience. In this project alternatives were used with very good impact e.g. a calendar of images with key messages per month, letters with accompanying information about the project, the needs of the project, the potential for contracting work, the potential for soil sampling
Weaknesses	Newsletters can be ignored as there are many produced. In this case the lack of some newsletters will have reduced the impact that the project has had in specific areas.
Opportunities	NRW will consider the merit of updating newsletters throughout the afterlife period
Threats	Lack of resources and competing demands

ACTION D5 PRODUCE LAYMAN'S REPORT

Expected results: A layman's report will be produced in hard copy and electronically.

The layman's report has been designed as a person friendly 'coffee table' style book with good photographs and text explaining the project, its aims, its achievements, what the issues were, why it is important to work together, who the partners are (including LIFE). The book will be distributed widely and with additional spend is a longer term project resource and advertisement for who to seek help from in the future.

The layman's report is at annex 20 and is also available on the website.

Significant resource has been put into the layman's report as it has been identified as a key output from the project. It outlines the project and its achievements, who was involved, why and what is important. It is available in PDF on the website and is also being distributed in high quality hard copy. The design is intended to be attractive with good quality images that will entice people to dip in and out, being offered key messages each time they do. It is also intended as a prompt to peers who will see images and snapshots on information about major conservation actions which they can obtain further information about from the conference proceedings or other reports.

Target	Met
Budget	Exceeded
Strengths	High quality publication which is attractive and contains key messages in bite size format will ensure it will be picked up, leafed through, put down and then picked up again. Each time key images and pictures about the project have been divulged in a format that will stick.
Weaknesses	Printed book format is expensive and so limits the number that can be distributed. Distribution is costly.

Opportunities	Delivery of the book allows an opportunity to engage with stakeholders again
Threats	Expensive format can give wrong impression about the project

ACTION D6 TAKE PROJECT PHOTOGRAPHS

Expected results: High-quality photographs for use in a wide variety of project communications.

This action is complete and has been used to provide pictures for the D actions and progress reports. Examples of professional photographs taken by a social enterprise company The Cambrian Photographic Workshop were included in the second Progress Report.

In addition, school children were taken onto sites and asked to take photograph with project bought cheap digital cameras. These were then professionally framed and displayed at the final conference. At the end of the conference the pictures were presented to the schools and now hang on the walls. The schools also presented their own ibooks about the fens and their view of the project at the final conference.

Target	Met
Budget	Exceeded
Strengths	Many photographs have been taken both by project staff and contractors, compiling a huge and accessible library of images that is accessible to NRW and partners. Images have been used by Dwr Cymru in their annual report, Anglesey Council in a jointly funded leaflet, NRW in many publications. Two professional photographers were employed at different stages of the project concentrating on people and landscapes. Many of these images are used in the layman's report etc. In addition contractors were employed to take and repeat fixed point photographs at key sites and key stages of the project
Weaknesses	Sheer number of images creates a resource for storage and also ensuring that everyone is aware where and how to access the images in the future
Opportunities	Retaking the photo monitoring records is a critical part of afterlife recording and analysing success and advising future management
Threats	Resources required to re-take and restore and analyse results and apply relevant changes to management

ACTION D7 PRODUCE MEDIA RELEASES AND ARTICLES

Expected results: The action will result in information about the project and its progress being made available to a wide audience through all media.

Lists of media features were included in the first Progress Report and Mid-Term Report. These included press releases, newspaper articles, TV and radio interviews, YouTube videos and blogs. A wide range of media features continued throughout the project.

Overall the project has been advertised well in the media, and most recently has been prominent within the NRW internal newsletters.

Target	Met
Budget	n/a

Strengths	Media coverage of the project was good and attracted interest in what it was doing and raised awareness of the important messages behind the project
Weaknesses	Social media was not fully employed by the project
Opportunities	Social media and ongoing long term recording of the project success was requested by BBC Wales. This should be utilised to remind the key messages and to raise the profile of LIFE, NRW and conservation
Threats	Media stories always carry the potential to be misinterpreted or to be used to carry a different agenda.

ACTION D8 INFORM AND INCLUDE LOCAL PEOPLE

Expected results: Local people will be informed and consulted about our aims and activities throughout the course of the project

All the D actions have contributed to developing and improving local community relations. The landscape setting of the Anglesey and Llyn fens makes local people, and local farmers, the most important audience. From the start of the project the team made contact with local schools and community councils to inform them of the work and to encourage their participation. This is one reason why it was less important to produce newsletters but focus on meeting people.

The project was able to respond to opportunities as they arose. In the original plan, under Action A15, the intention was to engage with communities to produce new themed gates to some of the sites using a local blacksmith. The first Progress Report showed that one of the physical gates had been replaced by a virtual 'gate' by establishing an information gateway in a community shop close to a piece of fen owned by Llanddyfnan Community Council. Developing good relations such as this led to the signing of a management agreement for the Council's land.

The action included school visits, involving schools in developing the educational resource, community group meetings and talks, walks within the walking festivals, local news items and signage. In addition, the project developed and co-ordinated a wetland festival held (after the project end date) on Cors Goch nature reserve. Depending on resourcing this will become an annual event.

"Over 500 people had a great day on Cors Goch this summer at the first ever Anglesey Wetland Festival. The free event attracted tourists and local people from across North Wales where they found out why Anglesey's wetlands are so important for wildlife, clean drinking water, flooding and carbon. It was a family orientated event with loads of things to do – in dry fields surrounding the marsh there was a big science tent where visitors got down and dirty with peat, marshland plants and animals, but also learnt why these places are still so important, there were guided walks to experience the sights, sounds and smells, storytellers reminding us how long people have been associated with them in our history. Families got to try out bushcraft, what grows in the hedges with the 'incredible edible hedgerow', willow weaving, bags and bunting, spinning and weaving – and topped off with music in the evening from Dawnsiwr Bro Cefni" – extract from joint media publication

One visitor posted on the festival Facebook page *"I recently travelled over from Hong Kong to visit my family and friends in Benllech. Whilst there, we were lucky enough to go to the Anglesey Wetland festival at Cors Gors. My two kids loved the activities from willow making*

to storytelling and all the opportunities for learning about the local wildlife. Myself, I enjoyed the walk along the planks of Cors Goch, learning about its fantastic history and wildlife. Since, I've told many people its 10m deep and 10,000 years old! All this was followed by a delicious locally sourced burger! All in all it was an excellent day and my only regret is that we missed the evening activities and music session. Hopefully next time!" J Parry, Sha Tin, Hong Kong

We have also collaborated with the German Fens project to produce an excellent educational resource in English, German and Welsh. This is a storybook with technical information on some pages. The story is about a girl who has an adventure on a mire, learns about the importance of wetlands and carbon etc, and also about working together to overcome difficult problems. The booklet has been hugely popular and led to the production of English, German and Welsh animation version of the story. A lot of resource and effort went into the production of this at the expense of some other actions.

The engagement of local people and especially schoolchildren in the project was highlighted at the final conference.

Target	Exceeded
Budget	Overspent
Strengths	Many guided walks for locals, tourists etc were carried out successfully, meetings with community councils and locals were held and two schools were heavily involved in developing educational material, attending the final conference. Portable pop-up information panels were produced and used regularly throughout the project
Weaknesses	Storage of pop up material, currency of educational material, local people and community councils have become dependent on project contacts and careful management of the change is required. Material designed in CCW format will become embargoed without NRW branding
Opportunities	Continued liaison with all stakeholders is critical and forms a crucial part of the afterlife
Threats	Project closure and staff resources will affect the way that liaison is carried in the future

Output: mires booklet

ACTION D9 DVD

Expected results: This action will lead to the production of a high-quality DVD/video that will increase awareness and understanding of the project and fen conservation.

Two main videos were produced on YouTube and a selection of smaller "events"

Both are about 12 minutes in length:

The first was produced with Natur Cymru towards the end of the Cae Gwyn excavation. Explain about the project and the fens work
https://www.youtube.com/watch?v=xVFaEpUMp-U

Also a video explaining the project and some of the actions with overlain text is at: https://www.youtube.com/watch?v=YMicyYZpXa8 this used aerial footage using 'drone' technology that was turned into a DVD shown at the final conference. This showed land

purchased, actions underway and key messages about the project. It is a highly effective way of sharing information. These videos were showing constantly during the final conference and proved an excellent way to describe and discuss actions. The videos were taken with mini drones

Numerous other smaller videos were produced (eg
https://www.youtube.com/watch?v=7er0QndsRTo
https://www.youtube.com/watch?v=E9F2FqE4nBQ
https://www.youtube.com/user/countrysidecouncil
https://www.youtube.com/watch?v=naVlfUMofsY ,
https://www.youtube.com/watch?v=hjg0h14iwNw these show some of the machinery and actions.

The 2 main videos explain in more detail the actions and reasons the project was undertaken.

In addition to this an excellent animation was produced in collaboration with the German Fens LIFE project. This can be seen on the website and a DVD is at annex 21

Target	Met and also combined with educational DVD
Budget	Overspent
Strengths	YouTube videos produced and shared online, also displayed at numerous events including final conference. Excellent way to display difficult to understand and visualize actions being carried out on site. Use of drones to fly over and record sites and actions caused good discussion and debate about the use of new technology. Involvement of head teachers to scope and review drafts of education DVD has made a very useful and curriculum friendly item
Weaknesses	Use of social media could have made more of small, concise video clips, after life work will involve more use of Facebook and YouTube, for example posting updates to progress on habitat restoration
Opportunities	Excellent opportunities to use drones and video clips online to demonstrate project actions and
Threats	NRW priorities and resources will impact on the wider sharing of material

ACTION D10 HOLD DEMONSTRATION DAYS

Expected results: The demonstration day will increase understanding of the project techniques and willingness to use them among local land managers.

Practical demonstration days were a key feature of the project helping to attract wide ranging audiences to see the work at first hand and to share experience. The focus on dissemination of conservation science and practice has been in the field rather than through the website, although as the project has come to an end the availability of knowledge on the website will become more important.

The following key events have been listed in previous reports:

Demonstration days for the local farming community

The project was central to a successful proposal to bring the joint IUCN UK Peatland Programme and British Ecological Society conference to Bangor in June 2012. This was a

major showcase of the work of the project to an expert international audience and fieldtrips were arranged to project sites.

The project hosted a visit from the SURF nature Interreg IVC project in 2011 (http://www.surf-nature.eu/ .)

The project hosted a conference trip for the Country Land Owners Association Wales conference in 2011

The project hosted a visit from the Chartered Institute of Ecology and Environmental Management in 2012

Field trips have also been arranged for the Botanical Society of the British Isles, North Wales Wildlife Trust and Natural Resources Wales staff.

Demonstration of project experience has also been provided off-site with a successful demonstration of the wetland harvester at an event in mid-Wales attended by the Welsh Wildlife Trusts, Glastir officers (Welsh agri-environment scheme), Environment Agency Wales and Countryside Council for Wales' staff and National Park staff.

The project had no need to publish a technical manual of its work as the experience was incorporated into the multi-agency publication 'The Fen Management Handbook' published in 2011 (see http://www.snh.gov.uk/about-scotlands-nature/habitats-and-ecosystems/lochs-rivers-and-wetlands/fen/). The project contributed several case studies and the handbook itself proved very useful for staff training.

Target	Exceeded
Budget	n/a
Strengths	Several excellent demonstration days were held covering peer groups, international practitioners and policy makers, landowners etc. These days were well attended and provoked discussion and debate about the applicability of the work to other areas. Two further days were held off site in mid and north Wales to demonstrate the wetland harvester and develop a work programme for the machine across other habitats and sites
Weaknesses	Although costs for the final conference were covered by the project and so allowed attendees to visit site demonstration days associated with the conference, other days rely on transport/accommodation costs being available for visitors. This can affect the distance that a demo day can reach out to. Numbers of attendees can affect the success of a day, or rely on high numbers of project staff being available for the day to ensure explanations and key messages reach the whole group
Opportunities	There are opportunities to extend the work, particularly as the habitats are expected to continue improving over time, and so a visit to some of the large scale restoration works will become more useful over time
Threats	Availability of resources to fund demonstration days and their organisation

ACTION D11 TECHNICAL WORKSHOP AND D12 PROCEEDINGS

Expected results: The seminar will result in information about the project and the restoration and conservation of alkaline and calcareous fens more generally being disseminated to and

discussed by a large number of professionals working in this field. It will inform and provide an opportunity to catalyse work to conserve alkaline and calcareous fens throughout Europe, thereby making a valuable contribution to efforts to maintain the integrity of the network of Natura 2000 sites established to protect this habitat.

This was an action completed at the end of the project although many aspects of project work and project monitoring were building up to this final dissemination event.

Substantial resource was put into putting on a high quality three day event in October 2013. As evidence of its quality the event was oversubscribed and included international attendees from numerous other LIFE projects. The event was an overwhelming success combining talks on all the major actions, activities, workshops and dedicated visits to back up the talks and presentations. Excellent feedback has been received about the event.

A list of attendees and the programme is at annex 22

Target	Met/exceeded
Budget	Spent
Strengths	An excellent final conference was held in October 2013. It was oversubscribed and included attendees from many other LIFE projects and practitioners across the UK and mainland Europe. Feedback from the event regarded the conference as highly applicable, current and successful. The 3 day event included presentation of the project aims, objectives, actions and successes and 3 demonstration events on site including local landowners, contractors etc.
Weaknesses	Organisation and facilitation of such a large and complicated event took a lot of resource from the project team
Opportunities	A lessons learned conference for UK projects allowing discussion on before, during and after life projects would be a useful workshop to organise
Threats	Resources for events are needed

ACTION D13 ADVISORY AND ADVOCACY WORK

Expected results: To bring about a major change in attitude among landowners within the project area. By the end at least 50% of these land managers will have a positive attitude towards conservation-based land management. This will represent a significant advance from the current situation, where the majority of landowners view such practices negatively.

The focus of the action has been in providing advice on ways to reduce nutrient loads entering the fen system. An initial report on the potential to offer grants to farmers to reduce runoff affecting the fen environment was submitted with the first Progress Report. This was prepared by the Welsh Farming and Wildlife Advisory Service FWAG Cymru.

The initial work led to the proposal for 'nutrient management plans' described in the second Progress Report.

All farms in the catchment were contacted by letter and 16 farms responded positively. The target was reviewed and it was thought more effective to offer more field-testing in relevant neighbouring fields, to fewer farms than fewer fields on more farms as had been originally planned. This meant that the number of fields selected at each farm varied. The total of 279 fields covered 724.3 ha. Soil sampling was carried out according to standard ADAS operating procedure SOP SOILS/007. Nutrient efficiency studies were undertaken by

analysing soil for pH, available phosphorus (mg/l), available potassium (mg/l), available magnesium (mg/l), calcium (mg/l), total nitrogen (%w/w) organic carbon (%w/w), and by collecting land management data for 2013 and that proposed for 2014 using a data collection template. Soil nutrient data were then compared against the predicted crop requirements for the coming year based on the DEFRA RB209 Guidance (DEFRA, 2010) and PLANET software, followed by an assessment of the supply of crop available nutrients that might result from planned applications of organic manures. For this purpose, slurry and farm yard manure (FYM) were analysed for the following: dry matter (%), total nitrogen (%w/w), ammonium nitrogen (mg/kg), nitrate-nitrogen (mg/l), total phosphorus (%w/w), total potassium (%w/w), total magnesium (%w/w) and total sulphur (%w/w). At the time of sampling there was very little farm yard manure and slurry available, as the majority of slurry and FYM had already been taken out to the fields.

An assessment of the potential usage of soil improvers in the site catchments was made via the Natural Resources Wales public register for Environmental Permitting (England and Wales Regulations, 2010) registrations under standard rules permits (SR2010 No 4 /5/6), for land-spreading of materials for agricultural and ecological benefit on the 16 farms participating in this study. There were no deployments registered under SR 2010 No 4 to any of the 16 farms; however, the registration is only for 12 months and this would be reviewed in October 2014. This work did raise some concern about the amount of material applied to areas outside of the 16 farms, but within close proximity to the sites and this point was highlighted to Natural Resources Wales permitting teams.

Each farm participating in this study was provided with a written Nutrient Efficiency Report including the soil analysis results, a colour-code field by field risk map summarising the risks associated with the phosphate index for each field, and recommendations for optimum rates of fertiliser application as determined by the land management practice forecasts for 2014 provided by the farm. The reports also included best agricultural practice recommendations, for example: not to apply organic manures within 10 metres of a water course. Each participating farm was invited to a workshop on 14th and 15th January 2014 in Anglesey and Pwllheli (Llŷn) respectively, so that the nutrient advisor could go through their farm plan and answer any queries. Any amendments to the reports were made and a hard copy of the final report sent to each of the participating farmers.

The study identified that there are opportunities at 13 out of the 16 farms to reduce the amount of fertilisers applied to the land, and save on average £16 /ha, with a range from an additional cost of £39.1 /ha to a saving of £60.6 /ha. Feedback from the two farmers (Anglesey farm #4 and Llŷn Farm #4) who only agreed to implement half of the proposed nutrient load additions suggests even greater savings could be possible.

For farms adjacent to the Anglesey Fens SAC the nutrient recommendations show a requirement to increase nutrient load of nitrogen by 4475 kg and phosphorus application by 423 kg, but reduce the potassium application rate by 6812 kg.

This equates to an overall cost benefit for the application of fertilisers only of £1409.80. The rather striking suggested requirement for additional nitrogen on Anglesey actually drops to 2874 kg after feedback from the farmers. For the Llŷn Fens SAC, nutrient recommendations are a reduction in the application of nitrogen by 3130 kg, phosphorus by 6118 kg and potassium by 7966 kg. This equates to a significant saving of £10,275.40 for fertilisers only.

All participating farmers where contacted by phone following receipt of the final Nutrient Efficiency Reports. Two farmers (one each on Anglesey and Llŷn) stated they only intended to implement half of the recommended nutrient additions, but 12 stated they would change their current nutrient application regime to adhere to advice provided in the reports. Furthermore, some of the participating farmers requested support for pollution prevention advice and options for alternative fertilisers, thus representing another positive outcome of the engagement process.

Detailed information about the soil sampling work is contained at annex 23– this contains the final conference report paper, and the report from the contractor

Target	Met
Budget	Exceeded
Strengths	Excellent relations with landowners were developed, and this was used to build up the specification and roll out of Farm Nutrient Management Plans to many of the surrounding local farmers. In order to remove any perceived prejudice on NRW views, a respected contractor was used to develop and deliver the nutrient advice. Part of the agreed contract was that NRW would not receive detailed nutrient enrichment locations in case this was used for any punitive measures. Excellent nutrient management work by the contractors was shared with farmers via a drop in session, and appointments, and nutrient application is expected to change around the fens as a result
Weaknesses	Lack of detail addresses and locations of significant problems weakened the NRW data set but when weighed up against the positives of data collection and advice provision to landowners it was not regarded as an issue
Opportunities	Repeat of this work is critical to the Fens management and will be part of the afterlife plan, a detailed case study has been shared with other catchment operatives in NRW and a set of meetings combining ex EAW and ex CCW officers covering water quality, agriculture and conservation has resulted in successfully extending soil and nutrient to additional farmers within the catchment. It has also led to the agri team concentrating effort on both SAC sites during the current year, and a project to collate evidence on the status of the groundwater and surface waters to steer future water framework and other action
Threats	Perceptions of designation of the areas as NVZ or other nutrient reducing legislation affects the take up by farmers, as does the approach and relationship between officers and farmers

ACTION D14 NETWORKING WITH OTHER LIFE AND NON-LIFE PROJECTS – "ALL FENS TOGETHER"

Early in the project the value of networking was recognised. As there was no action for networking in the original bid the Commission accepted the creation of Action A14 networking and this became part of the formal grant Agreement through the amendment to the project in 2013.

Networking has developed links with two German LIFE Projects dealing with fens - "Improvement of the breeding and feeding habitats for the Lesser Spotted Eagle (*Aquila pomarina*), as well as for the Corncrake (*Crex crex*) and the Aquatic Warbler (*Acrocephalus paludicola*) in the SPA Schorfheide-Chorin" LIFE10 NAT/DE/000012 and Kalkmoore Brandenburgs - Preservation and restoration of base-rich to alkaline fens ("brown moss fens", NATURA 2000 habitat type 7230) in Brandenburg LIFE08 NAT/D/000003

http://www.kalkmoore.de/ . The Project Manager attended an expert panel in Brandenburg which looked at planned and completed works on the Brandenburg Fens. Arrangements were also made for the German Project to present at the Final Conference.

Attendees from three LIFE projects attended the final conference, three from Brandenburg, two from Denmark and five from Romania.

This project benefitted enormously from the ability to visit, work with and network with similar projects.

Target	Met
Budget	Met
Strengths	Excellent relations with other LIFE projects were reflected in the turn out for the Final Conference. Strong and beneficial relationships have benefited projects involved and allowed joint working on a number of actions, getting better value for money and a pan-European perspective. Educational booklet and animation are one excellent example of this, along with ditch blocking and other hydrological actions
Weaknesses	Difficulties over travel, language, culture can affect joint working but in this case these were easily overcome
Opportunities	The experience of this UK project working so closely with the Brandenburg Fens is a case study that would help inform other UK, and probably other continental projects
Threats	Travel and associated costs

5.3 Evaluation of Project Implementation

Methodology applied:

The planning for this project was carried out in detail by a combination of CCW HQ and local teams, Environment Agency Wales (EAW) and North Wales Wildlife Trust (NWWT). Detailed knowledge of the sites gained over decades, enabled the production of indicative maps outlining prescriptions right across the suite of sites and landholdings. However, literal combining of the data from the maps and apportioned costs would not be possible and an element of prioritisation was always going to be made. That is, it would never be possible to carry out every practical action that every site officer wanted done on these sites as costs would be too high and so priorities were chosen and opportunities that were known about were chosen. The maps were made up of desirable, and potential actions but it was never expected that the maps would define the actions totally that the project would carry out. Site investigations, land ownership, opportunities as presented during the project, weather, machinery applicability etc all combine to dictate when, where, who, how and why work was carried out in different sections of the sites.

The project's main aim was to tackle the three major issues affecting the sites, and success of the methodology is best judged against these risks, in reference to the table of main targets presented earlier. However, it is important to note, and consider the considerable resource that went into reconnecting farmers with the fenland and the relationships between conservation and land management. Although the project has managed significant and exciting success, without the re-establishment of the fens within the local communities then any work would not be sustainable. Re-examining the table from 3.2 allows us to consider each method in terms of its success. Further information is also presented through the SWOT analyses under each project action.

	Expected Results –Grant Agreement	Issue Tackled Dereliction (D) Water Quality (WQ) Water Quantity (WR) Arrows indicate flow of change	Comment
1	To bring 84 ha of alkaline fen and 104 ha of calcareous fen into favourable or recovering condition through a suite of measures aimed at delivering more sympathetic management	D, WQ, WR	Application of all project conservation actions contribute to getting favourable management across the sites, and in increasing the potential area of alkaline and calcareous fenland. The project was very ambitious, and costs were originally higher with a greater number of staffing requirements. However, to make the project affordable cuts were applied to actions, and to staffing resources. This, in association with staffing issues during the project meant that some staff had to carry a much greater proportion of the project delivery. Interestingly, the scale of the project was not properly understood and some individual actions on their own (e.g. Cae Gwyn) were akin to a LIFE project on their own. Mapping was the only effective way to plan, record and measure project actions as the project was complex and involved many sites and many actions. Even so the mapping was still difficult to carry out and individual maps had to be prepared rather than trying to update the original indicative maps (see annex 11)

	Expected Results –Grant Agreement	Issue Tackled Dereliction (D) Water Quality (WQ) Water Quantity (WR) Arrows indicate flow of change	Comment
2	114 ha will be mown and harvested	D → peat formation → WQ and WR improvements → grazing → peat formation → WQ and WR improvements	Both methods of cutting the two different fen types were successful. Although never carried out on the scale that the project applied the hand cutting had been carried out at some springheads in the past. The purchase of the novel cutting machine and using it in this context was also very successful. Initial planning, followed up by excellent procurement ensured that a suitable machine was purchased, and suitable contractors taken on to a framework to achieve the challenging targets. The action is quick, efficient and can be carried out in any weather, although damage is unavoidable at pinch points where rutting will occur. Internal disagreements about methodology could have been managed better
3	Sustainable grazing management will be managed on 446 ha	D → peat formation → WQ and WR improvements → grazing → peat formation → WQ and WR improvements Relationships → grazing → peat formation → WQ and WR	The fens had become divorced from their cultural landscape. At the start of the project it was not understood how bad the relationships and the perceptions were, and how much resource was needed to turn the relationship round. However, introduction of grazing across a huge area, and the development of relationships with landowners, has made the grazing action sustainable.

	Expected Results –Grant Agreement	Issue Tackled Dereliction (D) Water Quality (WQ) Water Quantity (WR) Arrows indicate flow of change	Comment
		improvements	
4	Scrub management will be applied to 60 ha	→ WR → peat formation → WQ and WR improvements → grazing → peat formation → WQ and WR improvements	Initial plans underestimated the scale of scrub on parts of the site and the target was quickly exceeded. Excellent contractors on good frameworks ensured that the work was carried out well. Scrub removal can be emotive for local communities but good communication and free firewood to locals helped manage relationships
5	Controlled burning will be applied to 168 ha	D → peat formation → WQ and WR improvements → grazing → peat formation → WQ and WR improvements	Weather and health and safety issues restrict burning opportunities. Target reviewed and considered in relation to cutting and grazing targets. Burning is a long term activity and totally weather dependant. Weather conditions made this action difficult to apply and so cutting was used to make up the short fall. Initial plans to contract out work ran into difficulties in finding suitable contractors. Instead costs were used to purchase safety equipment for reserve staff. Although costly in resources this will ensure management of the sites relies on person power rather than budget in the future
6	Management Agreements will be negotiated on a minimum of 217 ha within, linking or critical to the integrity of the SAC	Application of all actions → peat formation → WQ and WR improvements Relationships → grazing → peat	Ensuring that a legal commitment applies to private land and that budget spent is accountable meant the need for using Section 15 of the Countryside and Rights of Way Act 2001 to enter into land agreements with private individuals.

	Expected Results –Grant Agreement	Issue Tackled Dereliction (D) Water Quality (WQ) Water Quantity (WR) Arrows indicate flow of change	Comment
		formation → WQ and WR improvements	The process is well understood, but is lengthy and resource intensive, and relies on farmers applying priority to completion of paperwork over pressing business needs. However, the target was exceeded due to good relationships
7	Constructed wetlands will be installed in 8 locations	WQ→ peat formation→ WQ and WR improvements	Simple and quick and effective system for reducing nutrient input to sites. Good partnership with local University. Now being applied to other sites and projects. Application of the construction method needs adaptation to different flow regimes etc
8	15 ha of peat stripping and topographic re-profiling will be carried out	WQ→ peat formation→ WQ and WR improvements	Novel method of tackling poor soil quality, or low water levels. Often used in conjunction with re-connection of hydrological pathways to spread lime rich water back across the improved soil. Techniques excellent, but careful planning required to ensure that hydrology, levelling, and ecology are all combined to best effect. Use of civil engineering companies on large quoted jobs requires an understanding of NEC contracts, the civil engineering processes and issues arising from large construction projects
9	3479 m of hydrological pathways will be restored	WR→ peat formation→ WQ and WR improvements	Good effective way to reconnect severed waterways back onto peatland. Contractors on call off contracts worked well
10	Water levels will be managed correctly along 5813 m of ditches	WR→ peat formation→ WQ and WR improvements	Long established techniques of ditch blocking, or use of piling to isolate areas of wetter ground up scaled

	Expected Results –Grant Agreement	Issue Tackled Dereliction (D) Water Quality (WQ) Water Quantity (WR) Arrows indicate flow of change	Comment
			and worked very well. Good call off contracts ensured work was easy to manage
11	66 ha of land will be taken into conservation ownership	Allows application of all actions	Resource intensive, and sometimes difficult to justify politically. The method of land purchase works well by taking the best, or most threatened land into ownership. Use of District Valuation of land prices can cause delays and does not afford a value to "conservation grade" land which can make it difficult to match landowner pre-conceptions, but the use of an independent, respected land valuer takes the argument out of negotiation.
14	Farm nutrient, biodiversity and diversification management plans will be written for 40 farms	WQ→ peat formation→ WQ and WR improvements Relationships → grazing → peat formation → WQ and WR improvements	Joint benefits underpin the success of this action. However, the complexity of this action requires a dedicated resource that the project did not have. Without the addition of additional staff the project action may have failed. Instead an excellent partnership approach ensured success. Concessions to landowners meant that it will not be possible to measure quantitative success

Many action successes are immediately visible e.g. removal of dense, old vegetation and mature scrub, extensive re-profiling or even the reconnection of spring water across drying out peatland. Others are harder to see but are just as important for long term success e.g. change in farming perception of NRW staff and National Nature Reserves, willingness to discuss, debate and work together, raising water levels below ground level, improving the long term quality of groundwater. However the success in restoring land to Annex 1 habitat is not possible to measure within such a short time frame. However, the Cae Gwyn peat re profiling paper at annex 5 is an excellent example of how an internationally significant and major restoration action carried out by the project is showing clear success even at this early stage.

However, in most cases, putting in the appropriate factors in relation to habitat requirement or removing causal factors of decline are the early visible successes but they do not actually show discernible increases in species, or diversity or even condition for many years. This will only get picked up in longer term monitoring in relation to the condition of the SACs, or those projects that have been high profile and chosen to act as flagships for the project e.g. Cae Gwyn.

During the project it became apparent that some high profile actions could not be funded under the initial budget, and others, with high budgets, would not be utilised. The ability to seek an amendment to adjust the project focus and success has been critical in achieving a long term sustainable future for the Fens. Consequences of not being able to seek an amendment would have meant not achieving targets in some cases, not being able to take advantage of opportunistic land purchases, and concentrating resource on non-productive actions.

5.4 Analysis of long-term benefits

1. Environmental benefits

a. direct/quantitative environmental benefits

Benefits to Annex I habitats

LIFE project actions have been successfully focussed on the Annex I habitat resource, with actions recorded for 90% of the alkaline fen resource (36.8 out of 41.1 ha) and 95% (40.3 out of 42.5 ha) of the calcareous fen resource (Annex 1. The difference between the restoration activity and overall habitat extent figures arises because of the difficulty of gaining agreement to undertake project actions on land under third party ownership/management: efforts to tackle these sites are ongoing and form part of the after LIFE work programme.

Initiating or significantly extending favourable / restoration management across the combined Annex I habitat extent of 77.1 ha has been the main beneficial impact of the project; these activities have actually extended over a much wider area of the overall SAC resource. Favourable management/restoration activity is the essential precursor for attaining favourable condition and the condition monitoring work clearly demonstrates improvements in condition which will be continued with full implementation of the after LIFE works.

Benefits to Annex II species

Monitoring of the Annex II species *Vertigo geyeri* at Waun Eurad indicates that LIFE actions have resulted in an "increase in optimum habitat on the site" compared with the pre-LIFE assessment of 2007. Waun Eurad was (unintentionally) over-grazed for a period in 2014, leading to less litter cover than would normally be associated with good condition *Vertigo* habitat: however, grazing relaxation had allowed sufficient recovery by the time of the assessment later that year. These observations not only illustrate the need for caution in making judgements that significant damage has been caused by temporary heavy grazing, but also suggest that *Vertigo* populations may have responded well to the reintroduction of grazing following mowing at other LIFE sites.

Monitoring of *Coenagrion mercuriale* populations at the Nant Isaf spring fields in 2013 yielded counts on transects through the best areas of at least 166 males, suggesting an overall total population of perhaps 1000 – 2000 (Sutton, 2013). This report highlights the beneficial influence of LIFE mowing and grazing actions.

Policy implications

Many of the techniques employed by the LIFE project would be relevant to the national Welsh agri-environment scheme Glastir, either as modifications of existing Glastir prescriptions, or as additional new ones. The overall approach of using local project staff to enable site management by third parties could also be adopted as existing Glastir Contract Managers are generalist posts with a very large geographical remit. Actions are now being identified within the Anglesey Fens sites catchment as part of Water Framework Directive Measures. However, at this stage it is by no means clear whether the primary mechanisms which Natural Resources Wales plans to deploy will be sufficient to yield appropriate water quality in groundwater. This suggests the need for a new mechanism to operate off protected sites but within their catchments which offers financially realistic incentives for nutrient reduction measures. The Water Level Management Plan policy mechanism also requires revision as its ambition does not appear to extend to restoring favourable hydrological regimes in all main river sections within the fens, nor indeed does it offer a means of progressing actions where third parties object to certain elements.

2. Long-term benefits and sustainability

The LIFE project has succeeded in demonstrating that commercial grazing of the sites by farming third parties is both attractive and economically viable, but only following measures to (i) render the sites secure for grazing stock and (ii) make the sites grazable in the first place, through initial mowing/burning and litter removal. The LIFE project has achieved many of the necessary elements of i and ii, though ongoing rotational mowing and burning are going to be required (but at much less intensity than the restorative LIFE phase). A key challenge concerns the ongoing need to work with local graziers to match sites to their grazing requirements: this takes time, knowledge of the sites and the farming perspective, and some resources to enable upkeep of essential site infrastructure. All of this has been carefully prescribed in the after LIFE project but resource limitations within NRW are a major threat to the ongoing delivery of this work.

Management as prescribed above should be sufficient to retain the current extent and distribution of the Annex I features indefinitely, but will also require the focussing of

effective measures within the site catchments to safeguard the all-important groundwater resource, to control point-sources of aerial pollutants and also to ensure surface water inputs of appropriate quality. At the present time it is by no means clear whether the Water Framework Directive measures proposed will actually be sufficient to deliver this.

Climate change poses a degree of threat to the alkaline fen feature in particular, but full realisation of the after LIFE measures should ensure that the physical supporting conditions are in the best possible state to support this feature in the future (see also below).

Realisation of the potential extent of the two Annex I habitats (see annex 25 Technical Report No. 3) would require funding and other resources in addition to those identified in the after LIFE plan. Expansion of the two habitats is urgently required to increase the resilience of these sites and the extent to which species can move between different structural and floristic elements as climate continues to change.

Grazing is critical to the survival of the associated Annex II species and all of the actions identified above should prove broadly appropriate for these. Specific actions to ensure calcium-rich runnels are retained will need to be targeted in areas of alkaline fen for southern damselfly. In the less intensive period of post LIFE project management, mowing and burning can be employed across smaller blocks and in a more focussed rotational regime than was possible during the main phase of project delivery.

3. Replicability, demonstration, transferability, cooperation

One of the key commercial applications of this project concerns agricultural grazing and the potential this offers for local farming enterprises to target niche markets for 'conservation produce'. This concept is still under-exploited in NW Wales, but the availability of large rich-fen sites in the two geographical centres for the project (Llyn and Anglesey) offers very significant scope for surrounding farming units to collaborate in developing produce lines and a market. This will also engender a greater sense of community ownership and involvement in the care of these sites and provide a tangible ecosystem service benefit for the wider community.

The fundamental approach taken by the LIFE project in using large-scale mowing and burning to make sites attractive to graziers is highly transferable to other wetland contexts in the UK and Europe. Dereliction (lack of management) is the primary factor influencing poor condition in fens in the UK, and many lowland fens suffer from their location within intensively managed agricultural catchments. Establishment of nodal centres of machinery and expertise for managing regional concentrations of lowland wetland (and other semi-natural habitats prone to dereliction) sites could be pursued.

Recycling of harvested biomass as animal bedding proved popular with local farming stakeholders and this could be developed as a means of off-setting part of the cost of mowing and biomass harvesting.

Both of these approaches are highly applicable to fens elsewhere in the UK and Europe.

4. Best practice lessons

The mowing, burning and grazing actions all represent existing best-practice, with their adaptation to suit the specific conditions encountered on the project sites. We suggest that biomass use as animal bedding could be developed as a means of providing local farmers with a reliable stream of material from different sites, with a small levy charged to help offset part of the cost of mowing: biomass removal in this way is actually viable on a free to user basis as it reduces the environmental impact of disposing large quantities of biomass on conservation sites. Use of produce marketing could be developed to develop a niche market for wetland meat, thus helping to create more demand and competition between farmers for grazing rights on the sites. The appointment of contracted grazing coordinators by the LIFE project proved successful and could be extended in the form of a dedicated post operating at regional level to link farmers to conservation grazing opportunities.

5. Innovation and demonstration

The main hydro ecological restoration elements of this project (notably A5 – site investigations, C11 – restore hydrological pathways, C13 – peat cutting and C14 – installation of constructed wetlands) were often employed collectively (see for example annex 5 and 25 Technical Reports 3 & 4) and represent important innovative and demonstration elements. The approach of examining firstly the hydro ecological requirements of the Annex I habitats and then the measures necessary to achieve these was an innovative use of the ecosystem approach. The overall philosophy could be applied widely on any wetland system and is a practical manifestation of the UK Wetland Framework Approach which has otherwise failed to achieve widespread use due to its complexity and size. Comparable hydro-ecological based models of restoration have been developed in mainland Europe, but have so far failed to achieve widespread uptake in UK contexts.

6. Long-term indicators of project success

Monitoring the condition of the Annex I features is the core measure of the success of applied actions and the follow-up after LIFE phase. This should be extended more widely than the current narrow focus on a relatively few stands across the project sites to provide a more widespread measure of the health of the Annex I resource. The hydrological status of the project sites is the key factor to monitor and needs to be consolidated and properly resourced as a formal NRW programme. Repeat plant community-level (NVC) survey of the Annex I features should be considered in 5 years' time, coupled with the use of remote sensing UAV technology to try and develop calibrated models which can assess key condition variables such as graminoid dominance and litter cover. Less direct indicators of success should be considered, such as grazing intensity and periodicity achieved in specific compartments.

The summary table below shows that the LIFE project has addressed the majority of the mapped annex I habitat in the fens (see also Annex 1).

Site Name	***Area of survey (ha)***	***Current extent H7230 (ha)***	***LIFE Activity H7230 (ha)***	***Current extent H7210 (ha)***	***LIFE Activity H7210 (ha)***
Cors Bodeilio	54.1	8.9	8.9	12.1	12.1
Cors Goch	37.7	5	5	8.7	8.7
Cors Castell	7.5	1.3	1.3	0.1	0.1
Bryn-Golau	7.6	0.5	0.5	0	0
C Erddreiniog	239.7	11.7	11.7	6.9	6.9

C C Uwrch All	30.3	1.5	1.125	4.2	3.15
Cors y Farl	12.4	0.4	0.4	5.2	5.2
Gwenfro	26.7	0.4	0.02	0.1	0.005
Rhos y Gad	10.6	1.4	0.07	0.1	0.005
Waun Eurad	3.9	1.7	1.7	0	0
Caeau Talwrn	21.3	0.6	0.03	0	0
Mon Total		33.4	30.7	37.4	36.2
Abergeirch	19.3	0.5	0.5	0	
Cors Geirch	224	6.2	4.9	5.1	4.1
Cors Hirdre	26.2	0.7	0.7	0	
Rhyllech Uchaf	10.8	0.3	0	0	
Llŷn Total		7.7	6.1	5.1	4.1
Totals		**41.1**	**36.8**	**42.5**	**40.3**

This project has improved greatly the habitat quality, and the factors affecting them. The SACs had, over time, fallen into a state of disrepair and needed a short, sharp, shock to rejuvenate them and enable the long term management required to be affordable.

Early indications from monitoring are that key indicator species are being found in areas with previously no records.

As Annex 1 clearly outlines the fact that the original extent of Annex 1 habitat was over-estimated means that reported increases will appear confusing. However, the annex also clearly explains the potential habitat increase that is possible with implementation of the afterlife plan, and continued management of the fen sites

NRW will ensure maintenance management continues in the fens to maximise their condition following project closure. This is both on the NNR sites, and those sites in private ownership. The fens are high maintenance sites and the afterlife plan and PAF reflect this. Grazing, water level and water quality are the key issues to manage and monitor.

In addition to the practical NNR and private land work funded by NRW an increase in catchment nutrient work is currently under preparation. This work will be led and managed by NRW natural resource management teams and will link closely with Water Framework Directive drivers and activities.

In some cases restoration work has removed the threats to that part of the site, for example where water levels have been raised permanently, or where damaged upper layers of peat have been removed, or where spring water has been reconnected to fenland. In other cases long term threat management has been achieved – for example where leases on land or rights to water have been acquired for 20 years or so, or where new fencing has been put in place that will protect, or encourage grazing in specific areas for the lifetime of the fence. However, no matter how much infrastructure is put in place the key overriding threats that will need constant care and management are landowner relations and groundwater quality.

Groundwater quality is a long term issue that the project has highlighted and has raised its profile to the highest rank so that WFD and other drivers recognise the importance of the fens. Landowner relations are critical to the continued success of the project and must have time and resource afforded to it.

NRW has recently re-organised its staffing resource in relation to the combined legacy bodies. New Natural Resource Management teams combine legacy agriculture, conservation, water resources, fisheries, bio-diversity, environmental management and sites teams. These teams have their worked planned and programmed by a new Natural Resource Planning team. This approach embodies the unique position that NRW has to manage the sites holistically. Synergy and efficiencies mean that wardening staff on the ground, and water quality, water resource and conservation team members will all work closely to ensure the best outcome for the project sites.

The Afterlife plan is an eagerly awaited plan that will ensure long term sustainable management of the Fen systems. It will be delivered on NNRs, and off NNRs on SSSIs, and within the surrounding catchment.

Detailed cutting plans have been with the NNR team and Sites teams since February 2014 and will be used to plan and prioritise work on the fens for the next 5 years. These cutting plans are at annex 2.3

Both this LIFE project and the NRW run LIFE N2k project met and agreed that production of the PAF components (i.e. PIPs – Prioritised Implementation Plans) needed to be one and the same document for the afterlife and the PIP process. Legacy project officers met with N2k staff, and sites staff to plan in detail the actions required on the sites. However, it has to be recognised that budget and priority will play a large part in delivery of the afterlife plan. There are currently the NRW staff in place to deliver the necessary actions, but deliverables will be agreed in work programmes on an annual basis.

The Afterlife plan/PIP for both sites are located at annex 2.1 and 2.2

The table below summarises, per action, the necessary afterlife activity. Note that this does not include all the aspirational actions as detailed in the PIPs.

What (action)	where	when	how	who	measure
A1 – management/catchment planning Natural Resource Planning	All sites: NNR SSSI catchment	Relevant work cycles	NNR management plan updates, Core SAC plans, incorporation into WFD cycles, Catchment water quality and AMP programme	Natural Resource Planning team & Conservation Technical specialists – Operations Delivery, NRM teams	Updated plans
A2 NVC programme	Plots within monitoring Repeat on All sites Potential designated sites	Monitoring cycle Planned programme As and when opportunity arises	Knowledge Strategy and Planning (KSP) work planning	Survey team	Updated survey programme
A3 & A4 (E4.01 & 2)	Monitored sites	4 yearly	Identify key quadrats and monitor sites for change	Sites/National Nature Reserves/KSP	4 yearly reports associated with interim management measures (e.g. grazing levels, burning, cutting mowing records)
E401	Monitored sites	5 yearly	Repeat subset of photo monitoring	NNR/Sites/Conservation Technical Specialists	report
E402	Stonewort pools	5 yearly	Repeat surveys		
	Cae Gwyn	Annually	1 day monitoring annually	KSP & volunteers	Annual monitoring record
A5	Cors Bodeilio Cors Geirch	Annually	Dipwell and borehole monitoring	KSP	Annual records
A6 & C4	Cors Bodeilio Llyn Cefni	Annually	Monitor in and out on selected wetlands	Bangor Uni/NRP/KSP & A&R	

What (action)	where	when	how	who	measure
A10	All NNRs	Annual	Review of grazing numbers and management compared to original project grazing audit	NNR, Conservation Tech Spec	Annual review
A12	All sites	Annual programme	Farming community meetings/individual owner meets to maintain relationships developed during the project	NNR, sites	Annual record of owners visited
A14	Cae Gwyn, Cors Erddreiniog	Bi-annually	Continue CEH monitoring of carbon, collaborate on UK projects and DEFRA project	KSP	Relevant papers published
A15	All sites where access improvements put in	5 yearly Annually	Review need for access across sites with potential to remove some. Maintain shared liability on Cefn Du		CMS report
B1	All sites	3 yearly	Review priority for land purchase around sites	NNR/Sites/KSP	NNR management plans
C1	As per cutting plan				Conservation Management System
C2	As per cutting plan				CMS
C4	See A6				CMS
C5	NNRs	As per existing site			CMS

What (action)	where	when	how	who	measure
		boundary reviews			
C7	As per NNR plan				CMS
C8	As per cutting plan				CMS
C9	SSSI	annually	Review additional sites and existing sites as agreements come to the end. Carry out remaining capital actions in LIFE agreements	Land Agency & Sites	Land Agency Database
C10	All sites	3 yearly	Review site water levels	Consv Tech spec, sites, NNR	Reports
C11	All sites	3	Review connection condition	Ditto	Reports
Afon Clai	Cors Erddreiniog	One off	Review potential to restore waterway to original course	KSP/Consv Tech Spec/NNR/Sites	CMS
C12	Cors Erddreiniog	One off	Review conservation objectives in relation to site water levels and feature condition	KSP/Consv Tech Spec/NNR	CMS/SAC plan
C13	All excavation sites	Annual	Review of condition and actions required to maintain e.g. grazing levels, water supply etc	KSP/NNR/NRP	CMS
C14	See A6	Annual			Reports
C15	Spring fields Waun Eurad	Annual	Monitor species movement and numbers	KSP	Reports
	Cae Gwyn	Annual	Monitor species	KSP	Reports

What (action)	where	when	how	who	measure
			number and movement		
D1	site	Annual	Review currency and update	NRP	Website
D8 & D10	SACs	Annually	Hold local events		CMS
D13	SACs	2015	Plan work programme of further soil sampling etc and link to WFD drivers	NRP and virtual WQ network/agri officers	Reports
E2	SACS	Annually	Hold annual grazier/farming liaison meetings on both SACS	NNR and Sites	CMS

As mentioned earlier in the report, eco-system service benefits related to this project are the key economic benefits. The table in Section 3.2 outlines the benefits but in terms of cost saving water treatment, flood alleviation and health and education are the hardest to measure, whereas direct economic benefit associated with grazing, bedding and contracting is easier to cost.

Eco-system services are often quite difficult to explain, but this project makes it very easy to demonstrate the wider benefits of the conservation work. Improved water quality in drinking water reservoirs, improved groundwater quality, flood retention, increased economic benefit from grazing, extension of the tourism season and facilities offered, opening up of additional public land for the health and welfare of locals and visitors, exploring the potential for fens trails to name just a few.

6. Comments on the financial report

6.1. Summary of Costs Incurred

PROJECT COSTS INCURRED				
	Cost category	Budget according to the grant agreement*	Costs incurred within the project duration	%**
1.	Personnel	869, 561	831,176.38	-4.41%
2.	Travel	9, 791	9,628	-1.66%
3.	External assistance	2, 153, 384	2,365,161	9.83%
4.	Durables: total non-depreciated cost			
	- *Infrastructure sub-tot.*	483, 211	457,334	5.36%
	- *Equipment sub-tot.*	391, 781	246,883	3.7%
	- *Prototypes sub-tot.*	0		
5.	Consumables	92, 084	95,075	3.25%
	Land Purchase / Rights	949, 447	1,258,062	32.5%
6.	Other costs	239, 794	168,843	-29.59%
7.	Overheads	**212, 740**	**292,188**	3.73%
	TOTAL	**5,401,793**	**5,724,349**	2.25

7. Annexes

7.1 Previously submitted administrative and procurement annexes

Inception Report
Annex 1 Additional hours recorded by non-project staff produced from CCW time recording system Tara and number of days of placement student
Annex 10 Risk Log
Annex 15 Collaboration agreement between CCW and EAW
Annex 16 Tender specification for wetland harvester
Annex 17 Project Board paper explaining the change to budgets to extend Environmental Scientist post

Progress Report 1
Annexes 1-3 Examples of minutes of Project Advisory Group and Project Board
Annex 6 Updated list of additional hours (2,660 hours)
Annex 13 Tender specification for surface re-profiling at Cae Gwyn, Cors Erddreiniog SSSI

Mid-Term Report
Annex 5 Updated list of additional hours (2902 hours)
Annex 1 of Mid-Term financial claim : Welsh Purchasing Card User Guide
Annex 2 of Mid-Term financial claim : Student Sponsorship Scheme –Rhoswen Leonard
Annex 3 of Mid-Term financial claim : Student Sponsorship Scheme –Rebecca Davies

Progress Report 2
Annex 1 Land purchase table
Annex 5 Procurement Guide NRW
Annex 6 Report of contract to GreenFarm Consultants for assessment of potential uses for biomass
Annex 12 Interim audit by Salisbury and Co

Additional administrative annexes submitted with Final Report

7.2 Technical annexes

Annex No	Description
1	Analysis of LIFE project actions carried out on current and potential extent of recorded and potential Annex I habitats ‘Alkaline fen’ and ‘Calcareous fen with Cladium mariscus and species of the Caricion davallianae’, in relation to main objective and target
2	AfterLife management Plan 2.1 Anglesey Fens PIP 2.2 Llyn Fens PIP 2.3 Detailed cutting and burning spreadsheet 2.4. After-LIFE plans per action
3	B1 Land Purchase National Nature Reserve declarations
4	Indicative maps to work programme detail ACTION A1
5	Jones, P.S., Hanson, J., Leonard, R.M., Jones, D.V., Guest, J., Birch, K.S. & Jones,

	L. (2015). *Large scale restoration of alkaline fen communities at Cae Gwyn, Cors Erddreiniog (Anglesey Fens SAC) - (LIFE project actions C13, C10, C11 & A5).* Final Report of the Anglesey & Llŷn Fens LIFE Project: Technical Report No. 4. Natural Resources Wales, Bangor. NOTE: Update report to be produced in 2015/16 and outwith formal EU reporting, based on vegetation monitoring in 2015 and ongoing hydrological monitoring.
6	Contrasting response to mowing in two abandoned rich fen plant communities N.M. Menichinoa,c,∗, N. Fennera, A.S. Pullina, P.S. Jonesb, J. Guestb, L. JonescaBangor University, Environment Centre, Wales, Bangor, Gwynedd, North Wales LL57 2UW, UKbAnglesey & Llˆyn Fens LIFE Project, Natural Resources Wales, Bangor, North Wales LL57 2DW, UKcCentre for Ecology and Hydrology, Environment Centre, Wales, Deiniol Road, Bangor, North Wales LL57 2UW, UK
7	KS Birch JE Guest S Sheperd & P Milner PS Jones & J Hanson. Responses of rich-fen Annex I and related habitats to restoration and management undertaken as part of the Anglesey & Llyn Fens LIFE Project. LIFE project action E.4.02. Final Report of the Anglesey & Llŷn Fens LIFE Project: Technical Report No. 7. Natural Resources Wales, Bangor. Shepherd, S., Jones, P.S. & Hanson, J. (2015). Monitoring of the response of alkaline fen and calcareous fen to applied management – habitat condition monitoring. (Action E.401). Final Report of the Anglesey & Llŷn Fens LIFE Project: Technical Report No. 8. Natural Resources Wales, Bangor. In draft.
8	 Stewart, N.F. (2015). Baseline survey of stoneworts and aquatic vascular plants in peat cutting and terrain reprofiling areas at Cors Erddreiniog and Cors Bodeilio NNRs, Anglesey. (Action A.4, linked to E4.02). Final Report of the Anglesey & Llŷn Fens LIFE Project: Technical Report No. 5. Natural Resources Wales, Bangor. Stewart, N.F. (2015). Baseline survey of stoneworts and aquatic vascular plants in peat cutting and terrain reprofiling areas at Cors Erddreiniog and Cors Bodeilio NNRs, Anglesey. 2nd Report. (Action A.4, linked to E4.02). Final Report of the Anglesey & Llŷn Fens LIFE Project: Technical Report No. 6. Natural Resources Wales, Bangor. In draft.
9	Inventory of Equipment
10	Hard Copy of Greenfarm Report
11	Maps showing actions carried out per site, per action in comparison to indicative maps
12	Grazing report
13	Copies of all signed Management Agreements ACTION C9
14	Jones, P.S., Hanson, J., Leonard, R.M. & Guest, J. (2014). Restoration of a key groundwater supply pathway and related hydrological restoration work at Cors Bodeilio National Nature Reserve (Life project actions A5, C10, C11, C13, E.4, E.4.03). Final Report of the Anglesey & Llŷn Fens LIFE Project: Technical Report No. 2. Natural Resources Wales, Bangor Jones, P.S., Jones, D.V., Leonard, R.M., Hanson, J., Guest, J. & Jones, L. (2014). Restoration of hydrological and hydrochemical regimes at Cors Hirdre, Corsydd

	Llyn SAC: results of water level monitoring and hydrological investigations 2012-14(LIFE project actions A5, C10 & C11). Final Report of the Anglesey & Llŷn Fens LIFE Project: Technical Report No. 1. Natural Resources Wales, Bangor
15	Constructed Wetlands: Mike West chapter for Workshop Proceedings and Ph.D Thesis.
16	Sutton, M. (2013). Southern Damselfly *Coenagrion mercuriale* on the Anglesey Fens: C.15 Actions for Annex II species. Report to Anglesey & Llyn Fens LIFE Project, 2013. Final Report of the Anglesey & Llŷn Fens LIFE Project: Technical Report No. 10. Natural Resources Wales, Bangor.
17	Afterlife Meeting Notes
18	Example of new signs
19	Copies of Project Leaflets
20	Laymans Report
21	DVD Lilly in the Fens DVD of collaboration with German LIFE project to produce: The film "Lilly in the land of mires" was produced with funding from the LIFE financial instrument of the European Community. It is a collaboration between the two EU Funded LIFE Nature Projects "Alkaline fens in Brandenburg", Germany and the Anglesey and Llŷn Fens LIFE Project in Wales, UK. Both projects aim to restore and improve very rare and special fen habitats.
22	Conference Programme, invite and Attendee list
23	Lathwood, T., Evans, G. & Jones, R. (2015). Soil sampling and Nutrient Planning, Anglesey and Lleyn Fens. Final Report of the Anglesey & Llŷn Fens LIFE Project: Technical Report No. 9. Natural Resources Wales, Bangor. In draft.
24	Assessment of the potential distribution and extent of the Annex 1 habitats Alkaline Fen (H7230) and Calcareous Fen (H7210) within the Anglesey and Llyn Fens SAC. Technical Report 3. Peter S Jones, Justin Hanson, Kathryn S Birch and Sam DS Bosanquet
25	Audit Report
26	Gallery of Photos
27	Dissemination material (hard copies)
28	DVD of project actions
29	Project Powerpoint
30	Original Financial Tool Kit (audited) superseded by new version
31	New finance toolkit superseding annex 30
32	Restoring hydrological processes – paper from technical workshop report
33	Output Indicators
34	Mandatory Information requested with final report. Summary table and sub annexes with information

7.3 Dissemination annexes

7.3.1 Layman's report annex 20

Considerable resource has been put into the layman's report as a high quality dissemination tool that goes well beyond the format described here. Annex 20 includes a PDF version of the report and a hard copy version.

7.3.2 After-LIFE Communication plan

Not compulsory for LIFE NAT.

7.3.3 Other dissemination annexes

In electronic format (on one or more CD-ROMs, memory sticks or DVDs appropriately labelled and indexed):

All the photographs produced during the project (in high quality, high resolution JPEG/TIFF format or better (e.g. RAW) – annex 26

All dissemination related products (brochures, scientific articles, guidelines, books, posters, newsletters, …) in PDF format; - annex 27

Videos (if relevant) annexes 21 and 28

Standard presentation illustrating the main actions and results of the project (set of slides / colour photographs, electronic images with captions) – annex 29