



Pembrokeshire Coastal Forum: WP2 case study review for Llys y Fran reservoir

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Executive Summary

The Llys Y Fran Reservoir Catchment project, located on the Eastern Cleddau, Pembrokeshire, was developed as an investigation of the possible causes for four Blue Green algal blooms which occurred over the period of 1993 to 2011. Natural Resources Wales (NRW), Dŵr Cymru Welsh Water (DCWW) and Afonydd Cymru/Pembrokeshire Rivers Trust (AC/PRT), all of whom are partners of an existing group, the Blue Green Action Group, formed a unique partnership involving regulator, industry and a charity status organisation. This approach, new to both DCWW and NRW, was established with a mixture of financial and payment in kind contributions.

Initial landowner engagement at Llys Y Fran Catchment Project was launched at the county show, hosted by AC/PRT. A project officer was employed by AC/PRT to plan and deliver the catchment tasks with support of local PRT volunteers. Water quality monitoring was undertaken by DCWW and technical support for farm infrastructure surveys and biological water quality monitoring training was done by NRW.

The Llys Y Fran Catchment project is not complete as several reports are outstanding but overall the lack of agreement protocols, between the project partners, hampered project delivery. Adverse weather conditions and the lack of appropriate soil sampling conditions exacerbated the delays for soil sampling and walk-over surveys, which led to some targets not being achieved.

The overall aim to reduce the risk of Blue Green algal blooms may not be achievable until the information generated is collated and analysed, the landowners informed of the pollution prevention measures required and a review of which of the recommended measures have been implemented.

While this project has not been completed, the legacy of the catchment work is primarily with the training and knowledge transfer within the local and farming community, the two years of 60-minute interval water quality data that could be interrogated by an interested group, and the nutrient management recommendations to reduce nitrogen and phosphorus applications.

Possible payment schemes that could apply in this catchment range from visitor payment schemes, fishing passport schemes and upstream thinking as implemented by South West Water and West Country Rivers Trust.

1 Introduction

The Llys Y Fran Catchment project was nominated by Pembrokeshire Coastal forum as a case study that could illustrate the potential for payment for ecosystem services (PES) within a regulator, industrial and third party/voluntary sector partnership structure.

Llys Y Fran is a 212 acre reservoir site, created in 1971, and currently owned and managed by Dŵr Cymru Welsh Water (DCWW). The impoundment of the Afon Syfynwy, a tributary of the Eastern Cleddau arose from the need to increase the potable water supply to the Haven development areas in the early 1970s. At present there are no direct potable abstractions from the reservoir as the primary use is to regulate downstream riverine flows for potable abstraction at Canaston Bridge. However the Water Framework Directive criteria within the Cleddau catchment may change this to a potential potable supply in the near future.

The reservoir and the surrounding 350 acre country park is an important attraction for tourism and recreational activities such as anglers, water sports, walkers, cyclists and for members of the public interested in the countryside and wildlife. The Llys Y Fran visitor centre offers facilities for users of the reservoir, including hospitality venue, shop and a catering outlet.

In the summer of 2014 NRW declared that the Cleddau catchment was an area nominated as an “Amber” area. The Amber designation identifies the area as a potential Nitrate Vulnerable Zone (NVZ) candidate site, in accordance with the European Commission Nitrate Directive. Agricultural holdings located in the NVZ areas will have to comply with the NVZ regulations which may include a requirement to increase manure storage capacity from four to five months and a restriction for the timing and rate of fertiliser applications to land. There are an estimated 50 farms within the catchment which drains to the reservoir.

Nutrient enrichment of Llys Y Fran reservoir has given rise to several Blue Green algal blooms in the past. Blue Green Algae “bloomed” in 1993, 1994, 1996, 1997, 2009 and 2011 and the result caused public health issues and restrictions on recreational activities, such as angling and general public access for the reservoir. Following the latest algal bloom in 2011, the Blue Green Algal (BGA) Group, incorporating 10 -15 site interested groups, was set up to address the cause and subsequent management of the bloom incidents in the reservoir. One outcome for the BGA Group was the development of a Blue Green Response Plan which details the actions to be undertaken by partners such as the Local Authority and Local Health Board, when a blue green bloom occurs. Partners within the BGA Group included Environment Agency Wales, DCWW and Afonydd Cymru/Pembrokeshire Rivers Trust.

In December 2012 there was an invitation for third sector groups to work with DCWW to deliver Water Framework Directive (WFD) outcomes in key supply areas. The total available fund opportunity under the WFD budget was £400,000 and the project objectives were to:

- ❖ Fund on the ground and in water projects to improve ecology of the water environment
- ❖ Target water bodies or protected areas failing WFD objectives. Projects to target ground waters, ground water dependent wetlands, rivers, lakes wetlands and coastal areas in Wales
- ❖ For projects to be supported by DCWW match, funding applicants must have described how their proposal relates to DCWW operations or assets. This may have been directly related to reducing the impacts or effects of the operation of assets or discharge or involve upstream work which could reduce the burden on DCWW assets

In this scheme there was an opportunity to schedule the release of funds in accordance with partners’ needs. This suggests an opportunity for upfront partial draw down of funds or installed payments.

Afonydd Cymru Ltd, is a pan-Wales organisation established in 2008 in response to Welsh Government direction for one organisation to represent the nine Rivers Trusts in Wales. Afonydd Cymru (AC) and Pembrokeshire Rivers Trust (PRT) submitted a joint proposal with the Environment Agency Wales (EAW) titled ‘Llys Y Fran Catchment Improvement Project’. The delivery timescale was January 2013 to April 2014. This project looks to improve water quality and knowledge transfer within the Pembrokeshire community.

The area of study was the Llys Y Fran catchment including Llys Y Fran and Rosebush reservoirs, encompassing the River Syfynwy from the headwaters to the Llys y Fran dam and the seven tributaries feeding the reservoir. Six outcomes were presented.

Outcome 1: In addition to routine or statutory monitoring, increase water testing to understand nutrient contributions from Llys y Fran tributaries.

- ❖ Build upon data gathered during the Nutrient Budget Study by Leicester University (phase 1) in 1997
- ❖ Undertake water quality monitoring with volunteer support through AC/PRT

Outcome 2: Work with farmers to reduce impact of diffuse pollution arising from application of chemical and organic fertilisers.

Outcome 3: A programme of farm visits to offer guidance on pollution prevention as coordinated by the project officer, comprising.

- ❖ Inform all agricultural community in area
- ❖ Contact 90% of farms in catchment
- ❖ 2 workshops with aim of 70% attendance - one for dairy farms one for sheep farms
- ❖ Engage farming unions - National Farmers Union of Wales (NFU) and Farming Union Wales (FUW)
- ❖ EAW to visit 50 farms
- ❖ Soil sampling by AC/PRT volunteers on 65% of farms with 5 soil samples for each farms
- ❖ Identify 20 farms which require the greatest support to reduce pollution
- ❖ Of these 20 farms offer support through one-to-one agronomist help using Nutrient Management plans (NMPs)

- ❖ Moss sampling for pesticide monitoring as funded by EAW

Outcome 4: Walk-over surveys to identify opportunities for habitat and easement projects with the aim to increase the ecological status of the water body and deliver benefits for fish through:

- ❖ 50 Walk over surveys by PRT
- ❖ Off yard reports trained by EA to PRT
- ❖ ACPRT to present summary of findings

Outcome 5: Reduce instances of pollution from forestry land through:

- ❖ Walk-over surveys of forestry land
- ❖ Contacting forestry owners

Outcome 6: Promote efforts to maintain WFD status, tackle WFD failures and achieve favourable conservation status by including of community and other 'site interested groups' and evaluate how implementation of the work could be delivered by first, second and third sectors.

The project delivery timeline as provided in the proposal was January 2013 to the start of February 2015, with an agreed Memorandum of Understanding drafted for all partners of the management group. A key role of the management group was to facilitate operations between Local Authorities, farming unions, community councils etc. The role of the EAW was to provide staff and technical support and services but the role of DCWW was not specifically defined.

This proposal (Proposal 1) was not supported by DCWW under the WFD funding. However the proposal presented was scaled down and resubmitted under the Catchment Risk programme. This second amended proposal was accepted by DCWW.

Proposal 2 was a revised programme submitted to run from July 2013 to August 2014 over 3 stages. The aim was to get a better understanding of the influence of land management practices on the water quality of the Afon Syfynwy, a tributary of the Eastern Cleddau, which drains in to the Rosebush and Llys y Fran Reservoirs. The proposed milestones and funds allocation is summarised in

Table 1.

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Table 1: Proposal 2 milestones and funding

Timeline	Actions	% of funds
End of Sept 2013	feasibility work complete	80
End of Oct 2013	Landowner engagement completed 10 farms signed up	
End of March 2014	5 Nutrient Management Plans completed	20
End of August 2014	Evaluation report: project successes	

The overall aims of the revised proposal for Llys Y Fran were:

- ❖ Identify and employ a project officer
- ❖ Produce and agree a project plan logo and timescales
- ❖ Produce a budget plan
- ❖ Organise a project launch including promotional material
- ❖ Install sondes at Llys y Fran reservoir
- ❖ Study area the stretch being headwaters of the Afon Syfynwy to Llys y Fran reservoir dam and all feeding tributaries and the impoundment body at Llys y Fran
- ❖ Aim PRT to promote awareness for environmental issues and best practice, promote recreational enjoyment and restore damaged habitats

The defined roles for each partner organisation are as follows:

AC/ PRT:

- ❖ Project coordination
- ❖ Liaise with partners, SIGs
- ❖ Volunteer recruitment and training PRT contribution volunteers trained on walkover surveys and RIM invertebrate surveys
- ❖ Field/River walkover surveys and soil sampling
- ❖ Data collation

NRW:

- ❖ Farm visits and technical advice
- ❖ On yard farm assessments
- ❖ Training field staff
- ❖ NRW staff and technical input, links with NFU and FUW Farming connect

DCWW

- ❖ Funding
- ❖ Undertake Water Quality monitoring at 5 locations.

Water quality data

Five water quality sondes were placed in Llys Y Fran reservoir and two of the feeder tributaries. The river sondes measured dissolved oxygen, turbidity, pH temperature and conductivity and ammonia and the reservoir sondes measured dissolved oxygen, turbidity, blue green algae (BGA) and chlorophyll a. Data was recorded on a 60-minute intervals. In addition to the monitoring, the sondes were set to trigger an alarm if the ammonia levels breached 3mg/l and in response NRW would investigate the cause of the elevated level. The ammonia monitoring identifies ammonia spike of 4mg/l in Poll Tax tributary however the baseline ammonia level is around 1 mg/l and 0.6 mg/l in Afon Syfynwy both upstream of Llys Y Fran reservoir. However these are peak values often associated with rain events and in general

the ammonia levels are less than 0.1 mg/l. East Scallock values tend to be higher with a baseline of around 6 mg/l in winter. East Scallock and Poll Tax tributaries and to a lesser extent Afon Syfynwy responded to an increase in ammonia during periods of rain.

Farm assessments

The combination of the off-yard and on-yard assessments formed the overall assessment report which is referred to as a water management report within the Glastir agri-environment scheme.

1. On-farm survey

The farm survey work was completed over the winter months. In order for nutrient planning surveys to be completed, the soil samples must be taken from the identified improved fields 12 weeks after the application of organic fertiliser. This requirement pushed the soil sampling period to December and late winter. In total 78 soil samples were taken. The soil results were included in the nutrient management plans.

2. Nutrient management

A nutrient management plan (NMP) was provided for five farms and these offered guidance on the management of soils and nutrients to provide maximum fertiliser efficiency and minimise the risk of causing nutrient loss. In addition the farms were provided with one-to-one consultation on the nutrient plans and land management. The overall outcome of the NMP was that the farms did not exceed 150 kgN/ha/yr and that most fields received 75 kgN/ha/yr. The standard for those outside a Nitrate Vulnerable Zone (NVZ) is 170 kgN/ha/yr and 250 kgN/ha/yr for farms outside an NVZ.

The NMP reports include advice and guidance on the efficient use of nitrogen and soil management and in particular the use of ryegrass; “a sward with over 50% ryegrass can utilise twice as much nitrogen as sward dominated by weed grasses” and “white clover being a legume is capable of converting atmospheric nitrogen in plant available nitrates and efficiently converting those into plant protein” as stated in most NMP reports.

The reports also include a section on the cost-benefit of the timely application of nitrogen. Example statements include “Each 1 kg of nitrogen applied should return 30kg of grass dry matter with the nitrogen costing around 80p/kg. The energy contained in 30kg of grass dry matter would convert into 60 litres of milk, worth around £18” and “30kg of grass dry matter will convert into 7 kg of liveweight gain on a 300 kg steer worth around £13.”

In these instances it is not clear if any of the other costs associated with either milk or beef production are accounted for.

Since the NMP reports were released the commercial price of nitrogen has increased by 4p /kg and market prices for milk and beef have fallen. The cost of the commercial merchant figures for fertiliser price (17 March 2015) is seen in Table 2.

Table 2: Average commercial price for fertiliser march 2015

Commercial fertiliser	Price per kg
Nitrogen	84p/kg
Phosphate	68p/kg
Potash	48p/kg

3. On-yard assessments

Farm infrastructure surveys were undertaken by NRW staff on four farms with the aim to reduce the risk of causing pollution to the nearby watercourses and groundwaters. An assessment of all yard areas included a risk assessment for yard management, livestock management, slurry management, silage storage and containment and fuel storage.

The on-yard assessment would identify areas where possible sources of nitrogen, usually in the form of ammonia from animal excreta can enter either ground water or surface water. The reports have not been made available and therefore potential savings in terms of dirty water/ slurry volumes cannot be ascertained or estimated.

4. Off-yard assessments

Assessment of improved fields for off-yard assessment were completed on five farms and these followed the same principles as used in the Glastir Advanced scheme¹. These covered issues such as stock drinking/watering access, feeding areas poaching in gateways soil erosion, soil compaction and ditch/drains connections to streams and rivers.

5. River walk-over surveys

River walk-over surveys were conducted in October 2013. However, poor weather conditions reduced the extent of river surveys completed. The river corridor and riparian habitat was surveyed along with a 2-minute invertebrate survey to provide a quick indication of water quality. The presence or absence of pollution-sensitive invertebrates is a common biological assessment tool for water quality. The data was shared with NRW and pollution prevention investigations were done in areas where water quality was identified as being poor.

2 Objectives

The aim of this study is to review and analyse the Llys Y Fran Catchment Project as delivered by three different sectors; a regulatory authority, an industry sector company and a third sector organisation. The three respective partners were Natural Resources Wales (formerly Environment Agency Wales), Dwr Cymru Welsh Water and Afonydd Cymru/Pembrokeshire Rivers Trust. Consideration of project inception, delivery and outcomes and the corresponding lessons learned will help to shape eco offsetting programmes in the future.

The Llys Y Fran review is one of four case studies and endeavours to capture information, lessons learned and opportunities with the view to facilitate future nitrate offsetting programmes and incorporate with in the development of a robust “Eco-banking” tool.

3 The Offset offer

Visitor Payback systems

Dwr Cymru Welsh Water own the visitor centres at Llys Y Fran and in line with the Nurture Lakeland project DCWW and other corporation linked to tourism or recreation in the catchment could consider a Visitor Payback Scheme (VPS).

¹ <http://gov.wales/topics/environmentcountryside/farmingandcountryside/farming/schemes/glastir/glastir-advanced/?lang=en>

Visitors or organisations relying on the income of the visitors to the reservoirs could make a small contribution to the catchment management of the reservoir. Nurture Lakeland raised almost £2 million over 18 years through a VPS scheme. Donations are made by either an opt-in or opt-out payment scheme and the funding of water quality improvement projects is released when project proposal meet the VPS criteria such as water quality monitoring, costs, resource etc.

The Llys Y Fran catchment is well defined but there is very little commercial businesses located directly within the catchment and therefore commercial funding may be challenging.

Fishing Passports in Wales

The Wye and Usk Foundation (WUF) has established a Fishing Passport Scheme for many rivers and still waters in Wales including the Teifi, Dee, Usk and Wye and the Eastern Cleddau is scheduled to join the Fishing Passport scheme in 2016. An example of the cost of a passport in wales is set out below:

A fishing passport for a Pontarddulais beat on the neighbouring Teifi Catchment would cost £15 per rod with a maximum of five rods per day. On the Wye at Fownhope the day rate ranges from £22 per rod for coarse fish to £30 to £37 per rod salmon with the maximum number of two rods. The daily rate per rod changes with the season and the appropriate fishing restrictions. The main service being purchased is the access to fishing beats

4 Participants

A range of partners are involved in the WUF passport scheme as seen in Figure 1. For the WUF scheme and the West Country Rivers Trust passport scheme, both organisations are charities acting as the providers and intermediary or broker while the buyer is the angler. The role of the angling clubs is not fully understood but it is presumed that a percentage of the price paid by the angler is given directly to the beat owner or angling club.

Pembrokeshire County Council would have a role as the seller as owner of some fishing beats on the Eastern Cleddau. DCWW as owner of Llys Y Fran reservoir and of a fishery could become involved as a seller and buyer.

There is a requirement for upfront funding for the development of fishing beats of the Fishing Passports and these costs are associated with landowner engagement and publicity/promotional material/database. The WUF scheme and the West Country scheme are linked and tokens are interchangeable between beats. The passport website also highlights other attraction of the areas and this could be used as an advertising point for many businesses.



Figure 1: Fishing Passport Scheme (Wye and Usk Foundation)

The fishing passport scheme could offer an opportunity for possible income to fund catchment improvements within the Easter Cleddau catchment and for Llys Y Fran Reservoir.

West Country Rivers Trust are working with South West Water in water quality improvements on the Upper Tamar. In this case, South West Water is funding infrastructure improvements within farming systems through a programme of advice and capital grants as approved by Ofwat. The aim is to improve raw water quality and quantity by

intervention on land not owned by the water company. The key water quality issues are nitrates, phosphates and agrochemicals.

In this instance the buyer is South West Water, the seller is the landowner and the broker is the West Country Rivers Trust. The procurement and contract management systems in place to establish a contract between a water company and a commercial company were not appropriate for working arrangement between the water company and the charity.

For DCWW, changes in project procurement and contract management processes are now in place to avoid the challenges in the future.

5 Barriers and Challenges

Challenges

1. Llys Y Fran water quality monitoring

The water quality data collected by DCWW over the two-year period (2013-2015) is currently held by DCWW. At the time of this case study review, the final readings from the 4 additional sondes placed in the catchment were being recorded with the view to remove the sondes by the end of March 2015. The water quality monitoring was taken at 60-minute intervals. The river determinands taken included oxygen, turbidity, pH, temperature, conductivity, Blue Green Algae cell counts, Chlorophyll a, conductivity and ammonium. The reservoir sondes measured pH, turbidity, dissolved oxygen, Blue Green Algae cell counts and Chlorophyll a. All data was transferred via telemetry to a password-protected website. River flow measurements were also undertaken at four locations. Telemetry alerts notified DCWW and NRW of ammonium level exceedance of 3 mg/l.

The water quality data, gathered at 60-minute intervals over a two-year period is expensive to undertake but there is no provision in this or subsequent projects for the interpretation of the water quality data. However a blue green algal bloom has not occurred during the Llys Y Fran catchment project duration and the priority and allocation of funding may change.

The proposal suggests that the interpretation of the data is to be done by NRW but at present NRW does not have access to this information.

2. Memorandum of understanding or agreement

In the original proposal (Proposal 1) as submitted by PRT there is a requirement to produce and agree a memorandum of understanding (MoU) between the partners. Proposal 2 did not carry this requirement and there appears to be no signed agreement between all parties. Ideally the accepted proposal would have been discussed and agreed at the project inception and a written "agreement" or project initiation document (PID) put in place, which could act as a reference point to avoid project digression. If one partner wishes to vary the scope of the project then the agreement or PID would have to be updated and agreed by all partners.

3. Roles and responsibilities

The information held in Proposal 2 defines in outline the roles of each partner. However there are some business constraints for all parties involved and these constraints do not seem to have been declared at an early stage.

Afonydd Cymru is a limited company, gaining charitable status in 2012, but without a trading company that could be contracted by DCWW. In order to commence the project AC/PRT required advance payments but this caused a few issues between DCWW and AC/PRT which delayed the project initiation.

4. Data Management

The data collected for this project includes water quality data from 5 sondes over a two year period at 60-minute intervals, water resources, farm surveys, land management, nutrient management and farm infrastructure surveys. Some of this data is collated in the summary report and associated appendices but the project evaluation and challenges report is yet to be delivered.

Assimilation of data in a compatible format is essential. This includes how, when, where and in what format data is collated and what happens to that information after it has been gathered. The project proposal did not define how the data collected would be managed or interrogated. At present some data collated is not readily transferable between partners and it not in a useable format.

The 60-minute water quality data collected by the sondes in the Llys Y Fran reservoir and tributaries is extensive and detailed and is therefore of considerable value. However the interpretation of the data and how it can be applied to the future management of the reservoir and tributaries to management of a blue green event is yet to be considered.

5. Project initiation

The timescale for the delivery of the project is defined in the Proposal 2. However changes to this schedule were not updated on a regular basis and agreed by the three partners. The appointment of the Project Officer was undertaken by Afonydd Cymru/PRT with the view that the officer would be employed by AC, under the managerial responsibility of Lloyd Evans as one of the Directors of AC. The management of the Project Officer as a resource within the contract became confused as the project unfurled and this led to delays in project delivery.

The first role of the officer was to draft the project delivery plan which, after some time, was agreed by all partners. However this process delayed the project delivery schedule.

6. Funding

The funding constraints of each partner organisation gave rise to project delay, slippage and in some instance work not completed. As a charity, AC/PRT required some money to be released from the project budget at the project start and not to incur retrospective payments. However this was not made clear in Proposal 2. The original WFD project brief did allow for upfront payments but not in the catchment risk specification. The release of funds was required to pay for the Project Officer's salary for working 2 days per week. However, Proposal 2 implies that funds would be drawn upon the completion of tasks.

For projects, the release of funds can be made in advance of work completion and any such requirement for a project partner or contractor should be made apparent at the proposal stage so that adequate measures can be put in place. This would include the evidence required to submit an invoice such as report completion, stakeholder survey response, work shop completion, invoice details and frequency.

7. Financial Payment and Payment in Kind

The availability of resources and funds varies with all organisations. In this case study DCWW provided the match funding opportunity with partial money available from NRW and part payment in kind and some contribution of payment in kind from PRT. The payment in kind is often the provision of employed staff or volunteer time. The role of each partner organisation was defined in Proposal 2 but there is disparity between the partners as to the qualification of payment in kind and the value that this brings to the project.

A clear and accepted understanding of each partner's contribution in terms of payments in kind would be helpful before the project commences, in addition to a record of each partner's contribution as the project progresses.

8. Stakeholder engagement

The Llys Y Fran catchment is predominantly agricultural and it was decided to launch the catchment project at the County Show in August 2013. NRW and AC/PRT contacted 45 farmers located in the catchment to visit the county show stand, as hosted by AC/PRT. There appears to have been some disparity in the level of stakeholder engagement and promotion required, which led to a loss in working hours.

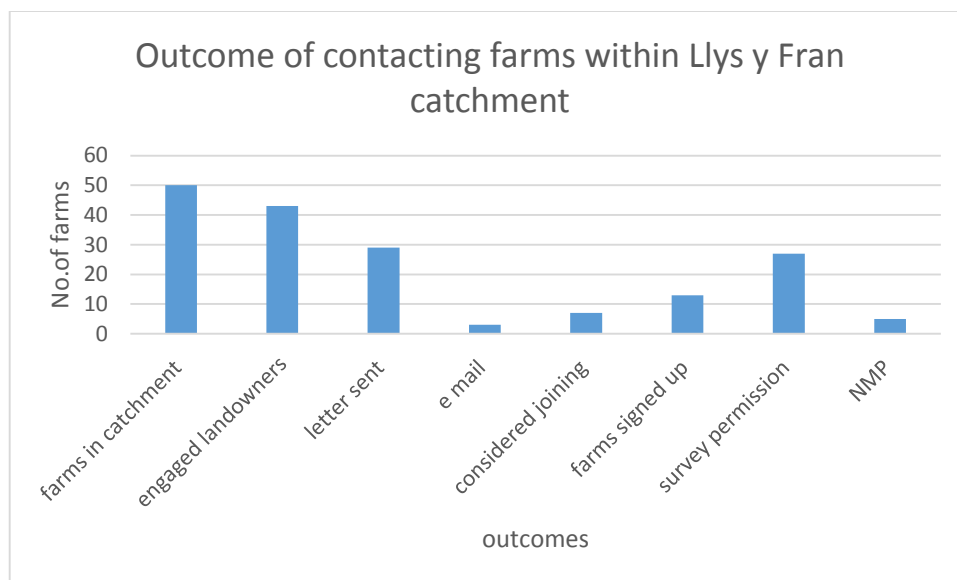


Figure 2 Engagement activity with farms in LLys Y Fran catchment

In summary 45 farms were contacted by letter, e mail or visited by the Project Officer. The project identified a willingness for farmers to participate and more than half allowed access for surveys etc. However, the number of farms receiving nutrient management plans and water management plans was less than 10%. The cause of this disengagement is not fully understood but it may be as a result of one or more of the following:

- ❖ Poor weather conditions making the fields prone to damage thereby restricting access
- ❖ Poor weather conditions putting stress on farm resources including time
- ❖ Inclusion of the regulator (NRW) as a partner could deter uptake
- ❖ Soil sampling has to be scheduled in a certain timeframe based on the applications of fertilisers to land. The project soil sampling regime did not fit in with the fertiliser applications schedule of the participating farm.

The provision of soil sampling, analysis and the offer of a free nutrient management plan with one-to-one support from an agronomist was taken up by four farms. The soil sampling was done between December and February and the Nutrient Management plan delivered the following June. Funds were made available to offer 10 farms this expensive survey work but these were not offered as there was insufficient time to complete the necessary soil sampling by the Project Officer. As 10 people were trained in soil sampling, it is not known why the soil sampling role was not delegated to other personnel, thereby releasing the project officers time for drafting the summary report.

There appears to be a general willingness for landowners to participate but the management of this needs to be carefully considered. There are certain times of the year when farmers may be more open to participation according to the particular sector of farming - dairy, beef and sheep, arable or mixed. Allowance for this may help with increasing the level of participation.

9. Information provision back to participants

The overall project timeline seems to have lost momentum in the final 6 months. Part of this is due to poor weather conditions but in general there has been no feedback to those 45 farms contacted initially. Four farms have received the nutrient management plans but no farms have been informed of the survey results, water management plans or potential pollution risks.

An article in the Biodiversity Partnership newsletter was provided but offering feedback to the landowner of the catchment would facilitate future collaborative working.

10. Knowledge transfer within the Community

One objective of this project is to increase community awareness of the problems of Llys Y Fran reservoir, the impact it has on the local economy and the importance of the reservoir catchment upon the Eastern Cleddau and Milford

Haven. Twelve AC/PRT volunteers delivered on the project and eight people were trained in soil sampling, of which six are volunteers. Of these volunteers trained, three delivered 46 hours of soil sampling. Ten volunteers received biological monitoring training and four people were trained to undertake walk-over surveys; three surveys were completed. The combination of biological assessments and walkover surveys provided and delivered 87.5 hours of biological investigation on the river.

11. Measurement of project outcomes

The aims and goals of the Llys Y Fran project are defined in the proposal but the project targets are not clearly defined and as a result, the measure of project success in terms of value for money is difficult to assess. For instance in order to assess the value of community engagement and knowledge transfer, feedback from the farming sector (of both participant and non-participant farms) is required as well as feedback from community groups and volunteers. As an example of the value and legacy of training and increased knowledge for land management and soil sampling, Afonydd Cymru/Pembrokeshire Rivers Trust staff and volunteers partnered with Coed Cymru for the delivery of land management support as funded by the Nature Fund in Pembrokeshire. Some of the farms contacted within the Llys Y Fran project may be eligible for support under the Nature Fund.

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Table 3: Project delivery summary

Date	Event or Action	Outcome
2009 - 2011	Blue Green Algae blooms	
22-Feb-2012	DCWW farm event	14 farms attend
	Blue Green Algae Action response Group set up	Incident response programme set up
8th August 2013	Letter from Afonydd Cymru to farms informing of project for Blue Green Algae. Partners DCWW NRW	Visit county show , return post card, letter or email to register interest
13-15th August 2013	County Show	45 farms invited -4 farms attended
Oct/Nov 2013	WQ monitoring	4 additional sondes put in
Oct-13th 2013	Farm meeting	6 farms confirm to join with 2 considering
Sept -2013	Training	8 people trained soil sampling, 10 people trained for invertebrate monitoring and 4 people trained for walkover survey
Oct-2013	3 survey of catchment walkover surveys	upstream Preseli WTW, farthing hook to farthing hook mill & the glen croft and Velindre farms
17 Dec to 19th March 2013	Soil sampling	75 soil samples taken
Feb-2014	Pembrokeshire Bio Diversity Partnership newsletter	Provides update on Llys Y Fran project
Jun-2014	Individual nutrient management plans	5 nmp reports completed and sent to farms
Jul-2014	Nutrient summary report	soil management planning summary report issued
Oct-2014	Project summary report	Project summary report issued
Mar-2015	outstanding work	Evaluation report/ evaluation of success Feedback to Farms Data review

Possible Resolutions

1. Data Management and Communication links

Compatibility of data between partners, where it is stored and transferred between partners, data interpretation and use, confidentiality and data security is very important. A website-based portal or a shared portal between the partners may have helped to facilitate the sharing of data. The sharing of all data as it is collected and during the duration of the project may have highlighted at an early stage that some data sets were not compatible. Quality assurance checks of the information gathered at key points in the project may have raised compatibility issues.

The method by which data is uploaded and accessed needs to be considered at the project proposal stage so that all parties can ensure that there is adequate provisions made. For many volunteer/third sector organisation the access to IT/phones/cameras/PPE equipment may not be available and may have to be accounted for, and costed, within the proposal.

As an example the nutrient management plans offer an opportunity to monitor the changes that can occur at a farm level if the recommendations are adopted to reduce nitrogen and phosphate applications to land in kg/ha. However, at present the reports are in a pdf format and any data required to monitor the success of the Llys Y Fran project for nutrient loads has be extrapolated from a pdf document. Cost-benefit analysis of the nutrient advice offered by the agronomist would have been a useful incentive for the farmer to change the nutrient management activities.

2. Roles, responsibilities and priorities

The roles and responsibilities of each partner should be clearly defined and maintained. Any changes must be in agreement with all parties. A contract agreement, partnership agreement, memorandum of understanding or project initiation document may help to formulate and clarify this.

Any restrictions, encumbered by all partners, would be highlighted during this process of agreement. As an example the invoicing requirements and partial upfront payments of Afonydd Cymru and the contracting restriction for Dwr Cymru Welsh Water.

3. Financial Payment and Payment in Kind

The mixture of financial and payment in kind and the risk of failure of a project delivering value for money is problematic. The value of financial contribution, time, equipment, laboratory analysis, training expertise and technical expertise can be overcome. The invoicing profile, costs and costs or value or equivalent for payment in kind could be quantified and measured. However, an agreement needs to be put in place of the value, resource and quantity of each service. This would allow a comparison across the sectors and an open-book offer of value for each contribution made. An example would be an hourly rate for each organisation, analysis costs and equipment hire costs.

4. Stakeholder engagement

There appears to be a general willingness for landowners and the community to participate in this project but the management of this needs to be carefully considered as the project momentum varied. The length of time required to recruit landowners and participants is often underestimated in this and other PES projects and some of this is related to Data Protection Act matters.

Offering feedback on the on-yard and off-yard and walk-over surveys and the outcome of the project to date would help to revive the project momentum and catchment interest. Using the venue at Llys Y Fran may help to recruit new local interested parties and the fishing passport scheme may bring new local and national collaborators to the project.

5. Knowledge transfer within the Community

At present there is no funding available to consider the data collected to date and this presents a risk for future water quality projects as the lack of feedback or project closure may deter future community participation. The water quality data may prove useful as comparative data if there is an algal bloom in the future. It is suggested that the partners consider working with local schools and colleges so that ongoing data collection can occur on Llys Y Fran or existing data sets be reviewed by university students etc.. There are cheap, sustainable methods for measuring water quality that could be considered. The visitor centre at Llys Y Fran could display this ongoing work.

6. Measurement of project outcomes

The aims and goals of the Llys Y Fran project are defined in the proposal but the project targets are not clearly defined and as a result, the measure of project success and the concept of value for money is difficult to assess. For instance, in order to evaluate the value of community engagement and knowledge transfer, feedback from the farming sector, of both participant and non-participant farms, is required as well as feedback from community groups and volunteers. As an example of the value and legacy of training and increased knowledge for land management and soil sampling, Afonydd Cymru/Pembrokeshire Rivers Trust staff and volunteers have partnered with Coed Cymru for the delivery of land management support as funded by the Nature Fund in Pembrokeshire and some of the farms contacted within the Llys Y Fran project may be eligible for support under the Nature Fund.

In terms of nitrates eco-offsetting, there is potential to review the data collected so far and use the ADAS Farmscoper tool to assess the impact of implementing these mitigation methods.

6 Credit valuation and economic assessment

Economic valuation of the nutrient reduction needs to account for and resource savings and associated costs for land managers associated with the nutrient management planning exercise, the walk-over surveys and farm infrastructure assessments. In most instances this can be converted in to £ per kilogram of nitrogen. This value could be compared to the cost-benefit of meeting Water Framework Directive requirements. For example, the cost of nitrate removal at a water treatment works was estimated in 2009 at £0.041 million².

In terms of recouping the costs, there are number of opportunities where the benefits of the scheme can be valued and paid for. These include a 'fishing passport' and a visitor payment scheme. These are considered briefly below.

The angling passport scheme model in the Wye and Usk Foundation for the Teifi catchment offers some indicator of financial exchange but the Eastern Cleddau may not be of the same fishery status as the Teifi and therefore this figure should be treated with caution. The fishing passport website also offers information on places to visit and stay and therefore it will be an advantage for businesses in the area to participate. The value of the contribution will depend on the fishery status of the river, the improvements that can be achieved to improve the quality of the fishing "experience" and the contribution to tourism. The socioeconomic value of fishing for the Eastern Cleddau is complex, for example the fishing passport covers both migratory and non-migratory fish which inhabit both marine and freshwater systems and the valuation would have to encompass both the marine and freshwater benefits.

Llys Y Fran has the potential to improve its importance as a recreational water for the locality, bringing sailing and canoeing interests to the area with the possibility of prolonging the tourist season through winter events. The value of this additional service to the area is difficult to quantify as it will relate to the uptake and added value perceived by bodies such as the Royal Yachting Association (RYA).

7 Opportunities

The opportunities for Eco-banking which can be drawn from the Llys Y Fran catchment project are varied. The development of the Fishing Passport Scheme for the Eastern Cleddau is one opportunity being developed by the Wye and Usk Foundation and will be in place in 2016. There is potential for DCWW, as a landowner and fishery owner to join this scheme and for the payments by anglers to bring future funding to support water quality improvement on the Eastern Cleddau.

Visitor Payment Schemes could be used at the DCWW visitor centre as a voluntary financial contribution and this fund could support water quality improvements within the catchment.

The use of funds as permitted by Ofwat under the five year Asset Management Plans (AMP) schemes (currently entering AMP 6) for the improvement of raw water quality could provide a future funding stream if the Llys Y Fran

² Environment Agency (2009) Valuing the benefits of reduced drinking water treatment as a result of WFD measures. Final Report June 2009. Report prepared by Entec UK Limited

reservoir was to be used a water source for potable supply, rather than as a compensatory flow reservoir. The financial benefit of improving the quality of water, within the catchment, sourced for potable supplies is often driven by the cost of additional treatment at the water treatment works.

8 Conclusions

The experiences gained from the Llys Y Fran Catchment Project have been valuable in understanding the business constraints of the regulator, an industrial partner and a charity status organisation. The challenges faced in this project are not unique as they are often cited as problems in other PES projects. An important step in the Llys Y Fran project would be to step up a formal agreement between all partners and to refer back to this on a frequent basis. This would reduce the risk of 'project creep' in roles, responsibilities and funding.

The sharing of the challenges experienced in this and other projects is helping to forge better project delivery in the future. As an example, DCWW has already changed the procurement and partnership arrangements to overcome these challenges and continue to work with charity organisations.

The status of the reservoir as a compensatory flow reservoir and therefore the priority of the water quality within the overall DCWW programme may change. The implementation of the NVZ regulations and the requirement to comply with the WFD may bring about a realignment of water quality priorities for the area. In addition, the implementation of the fishing passport scheme, scheduled for the Eastern Cleddau in 2016, will invite more angling interest for the locality.

Communicating and working with all the 'site interested groups' and members of the public can be very time consuming and part of this is due to the statutory requirements of the Data Protection Act. It is therefore unavoidable and future projects should account for sufficient time to engage with all stakeholders.

There are some outstanding tasks yet to be delivered in this project. The data gathered is yet to be collated and reviewed by all project partners and at this point it would be of value to develop a future action plan that could help to support the Blue Green Action Group. The feedback from pollution investigations and a subsequent revisit of those sites which have been undergone a biological assessment may indicate the current water quality status. In terms of nitrates eco-offsetting, there is potential to review the data collected so far and use Farmscoper tool to assess the impact of implementing these mitigation methods.

9 Poster for Website one side of A4 must be circulated to company before release to PCF for approval. To be uploaded onto website