Sustaining the Gwent Levels Sustainable Management Scheme:

Summary report

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For RSPB Cymru

yn rhoi cartref i fyd natur giving nature a home

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Cyllidwyd y prosiect hwn drwy Cymunedau Gwledig Llywodraeth Cymru - Rhaglen Datblygu Gwledig Cymru 2014-2020, a ariennir gan Lywodraeth Cymru a'r Gronfa Amaethyddol Ewrop ar gyfer Datblygu Gwledig.

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Lefelau Byw Living Levels

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Field with traditional drainage system; tractor: Yoke Creative/Living Levels
Shrill Carder Bee: Claire Fidler

Contents

Figures

Tables

Introduction

This report describes the Sustaining the Gwent Levels Sustainable Management Scheme project, before summarising its activities and outputs, and making recommendations for future actions and policy directions.

About the Gwent Levels

The Gwent Levels is a flat, low-lying area between Cardiff and Chepstow (see Figure 1). It is a Landscape of Outstanding Historic Interest, being recognised as an example of a landscape 'hand-crafted' by people as shown by the patterns of settlement, enclosure and, crucially, drainage systems. These drainage systems support significant concentrations of rare and protected wetland species, with the result that the vast majority of ditches on the Levels have been designated as Sites of Special Scientific Interest (SSSIs)[1]. As such, it is unique in Wales: whereas there is encouragement for upland areas to be re-wetted by blocking ditches to protect peatland habitats, reduce flooding risk, and protect and increase carbon storage, it is vital for the landscape and local wildlife in the Levels that ditches are regularly cleared. The responsibility for this depends on the type of ditch: Natural Resources Wales (NRW) has permissive powers to care for the rivers and main ditches (reens), while farmers are responsible for maintaining field drains, which form the majority of the drainage system.

Agriculture is the main land use on the Levels. However, as it lies between two major urban areas, is flat and has good transport links, being crossed by a major railway and the M4 motorway, the Levels has also been subject to a great deal of development pressure, particularly for industry and power generation.

Figure 1: Sustaining the Gwent Levels project area

[1] Chris Blandford Associates (2017) Gwent Levels Landscape Character Assessment.

There are significant issues, locally within the Levels and affecting the area at a wider scale, that need urgent attention. **Environmental** concerns primarily relate to poor water quality and the unfavourable condition of many SSSIs. For example, the Usk Management Catchment Summary[2] identifies a range of pressures that influence water quality within the study area, including diffuse pollution from agriculture and urban areas, and direct pollution from sewage and urban run-off. Further, surveys carried out by NRW between 2010 and 2012 show that the standing water feature of the Gwent Levels SSSIs was unfavourable, while the flora (plant) feature was only favourable on one SSSI (Whitson SSSI). More generally, the Levels, like the rest of Wales and the UK, have suffered the loss of wildflower-rich grasslands leading to declines in pollinating insects.

The complex pattern of land ownership within the Gwent Levels, with many landowners owning small fields or parcels of land and frequent changes in landownership, results in a lack of familiarity and understanding of the difficulties of **managing land** within a wetland system. This is a particular issue among new landowners coming from other areas.

Finally, the **policy and legal frameworks** concerned with agriculture and the environment are changing as the Welsh Government develops its own priorities and ways of working, and responds to the changes resulting from the UK's withdrawal from the European Union. Key concerns include addressing the climate and biodiversity crises, and developing appropriate policies to alleviate problems and maximise opportunities afforded by Brexit within the food, farming and rural development sectors.

About the Sustaining the Gwent Levels project

Sustaining the Gwent Levels was a collaborative Sustainable Management Scheme (SMS) project funded by the Welsh Government Rural Communities – Rural Development Programme 2014-2020 through the European Agricultural Fund for Rural Development. The project took place between 2018 and 2022 and the advisory and delivery groups were made up of staff from RSPB Cymru, Living Levels Landscape Partnership (LLLP), NRW, Gwent Wildlife Trust (GWT) and Farming Connect. This group is based around a subset of a wider partnership that has developed over a number of years through a mutual concern over the degradation of the local environment, with additional specific expertise brought in. The wider partnership (the Living Levels Landscape Partnership), which has funding from the Heritage Lottery Fund, includes amongst others RSPB Cymru, NRW, Gwent Wildlife Trust and Bumblebee Conservation Trust (BBCT).

The Sustaining the Gwent Levels scheme worked closely with farmers and other local partners to **develop the understanding, knowledge, skills and experience needed to deliver the sustainable management of natural resources within the Gwent Levels**.

[2] https://cdn.naturalresources.wales/media/679394/2016_updated_usk_catchment_summary_nrw.pdf?mode=pad&rnd=131596369400000000

In more detail, the project applied the *5 principles of future land management for Wales* as announced by the Welsh Government in its "Brexit and our Land" consultation in 2018[3], and succeeded in developing and demonstrating land management that:

- restores and protects nature, with a focus on SSSIs, pollinators, key bird species and traditional orchards;
- addresses natural resource issues, especially poor water quality; and
- secures public goods for society as well as producing sustainable amounts of high-quality food and other commodities.

It promoted the understanding of sustainable management of the Gwent Levels by:

- raising partners' and stakeholders' awareness and understanding of sustainable land management and its benefits, including socio-economic opportunities;
- working to improve the understanding of the need for public money to secure public goods;
- demonstrating sustainable land management to others including land managers and decision makers, and in doing so contributing to the development of new policies and practices;
- highlighting the benefits of cooperation in delivering statutory and local priorities through targeted action at the landscape scale; and
- building and strengthening relationships / interactions within and between communities, including rural, peri-urban and urban.

A further objective was to facilitate farmer / land manager engagement with new and developing policies, processes and mechanisms that have the potential to support sustainable land management. The project created a positive environment in which the Living Levels Landscape Partnership, farmers and landowners worked together to develop knowledge, skills and trust, so that challenges could be met collaboratively and adaptively during and beyond the lifetime of the initiative.

Delivering the project

The objectives were largely delivered through the employment of a Project Officer, Lewis Stallard, who coordinated the arrangements between the project partners, facilitated farmer engagement with the project, and engaged with local communities and stakeholder groups. He also managed the tendering processes for on-farm contract work and was responsible for gathering information for recording and reporting, as well as producing integrated guidance on the delivery of sustainable land management (within the context of the Gwent Levels) to inform and support future land management policies and delivery.

[3] 1) Keep farmers on the land, 2) Food production is vital, 3) Prosperous and resilient land management sector, 4) Public goods for public money, 5) Support that will be accessible to all. https://gov.wales/sites/default/files/consultations/2018-07/brexit-and-our-land-consultation-document_0.pdf p. 20-1.

By the end of the project, all the farm-based targets had been met or exceeded, with additional actions, specifically trials of herbal leys, being agreed or undertaken. The proposed landscape-scale activities were also successfully completed, specifically:

- an initial consideration of the opportunities offered by Payment for Ecosystem Services (PES);
- a programme of environmental monitoring and modelling; and
- an exploration of the effects of modern underdrainage systems, where drainage activities would lower the water table below its current level.

Outputs and findings

A considerable number and variety of outputs were produced during the Sustaining the Gwent Levels project – from individual on-farm assessments to discussions of landscape-scale issues. Table 1 provides a summary of these outputs, along with a brief outline of their main findings, which are then presented in more detail.

Table 1: Project outputs and key findings

Output / report	Author	Key messages
Farm case studies	Jane Ricketts Hein, Cynidr Consulting	Make schemes easily accessible to potential participants.
		Consider the financial and time costs to the participants.
		Include local knowledge when designing and delivering projects.
		A credible, personable and energetic project officer is vital.
		Investigate potential markets for products resulting from the project.
Gwent Levels Bird Nest Box Project	Richard M. Clarke, Goldcliff Ringing Group	Volunteers offer opportunities for projects to achieve more and develop their own skills.
		There are implications in terms of the cost, training and support of volunteers.
Farm economic assessments	Chris Clark, Nethergill Associates	**NB. Confidential exercise – results not publicly available**
		Farmers should be encouraged to work towards Maximum Sustainable Output.
		Mentoring support will be needed to achieve this.
Summary of farmer interviews	Chris Short and Stacey Hobbs, CCRI, University of Gloucestershire	The Project Officer's role is crucial, particularly in communication.
		The co-development of projects with local farmers is recommended.
		Reliable sources of information are needed; local discussion groups would be helpful.
PES and the Gwent Levels inc. **A resilient future for the Gwent Levels**	Jane Ricketts Hein, Cynidr Consulting (inc. Resources for Change Ltd.)	A variety of PES scheme possibilities is available, although mainly through developing food- and farming-related products.
		Detailed and careful consideration is essential in any PES scheme.
		Although having some potential use, PES schemes will not replace specific conservation schemes.

Monitoring Sustaining the Gwent Levels	Samuel Pike and Katie Metcalf, Environment Systems Ltd.	An online mapping tool could be developed to hold and visualise data.
		Additional manual interpretation of habitat data would increase its accuracy.
		Update habitat data regularly, rather than periodically re-map data.
		Incorporate ground survey data, using citizen science participants.
		Ensure that data sources are up to date, and guard against the loss of these data sources.
Ecohydrological studies of the Gwent Levels	Rigare Ltd. (inc Graham and Hammond, below)	There was little difference between drainage types (i.e., traditional grips vs modern underdrainage) with regard to ditch water levels.
		In-field wet-loving plant communities are likely to be affected by changing drainage types.
		The loss of field grips is likely to lead to agricultural intensification, with its associated environmental risks.
		NRW should review, record and formally document hydrological function and related management practices in the Levels.
		Further research into the hydrological effects of under-drainage in winter is needed.
Investigating ditch biodiversity in the Gwent Levels	Jonathan Graham and Martin Hammond	Maintaining ditch water levels is essential for submerged aquatic plant diversity.
		SSSI-notable plant and macro-invertebrate species were present at all sites assessed.
		High levels of duckweed - often linked to eutrophication - were also present at all sites.
Underdrainage and farming	Reading Agricultural Consultants	Underdrainage systems do not work where the water table is very high.
		The costs of underdrainage installation relative to likely returns are significant.
		"Spot drainage" of small wet areas in otherwise well-drained fields may be economic.
Wetland landscape restoration and maintenance – costings	Reading Agricultural Consultants	Comparisons of likely profits should be presented when trying to influence changes in farming practice.
		Agri-environment schemes should include currently ineligible ditches and re-consider the best ways and appropriateness of supporting hedge and ditch restoration and maintenance.
		Use length of boundary as the basis of payment, rather than field area.
		Include specified management practices in ditch-related agreements.

Capital works and on-farm assessments

A key element of the project was practical improvement to habitats, with the engagement of Levels farmers. As Table 2 shows, a variety of activities and assessments (leading in turn to physical on-farm changes) were undertaken, with targets being reached and often exceeded.

Table 2: On-farm targets and achievements

	Action	Target	Achieved	Notes	Partners
	Farms engaged with (no.)	10	28	including a 'core' group of 10 farms	
Capital works	Ditches (km.)	4	8.688	on 15 farms	Contractors, NRW, GWT, LLLP
	Pollards (no. trees)	30	40	on 7 farms	Contractors, GWT, NRW, LLLP
	Orchards (ha.)	6	6.04	16 sites on 15 farms	GWT, LLLP
	Water quality assessments (no. farms)		2	out of 2 eligible farms	NRW
	Nutrient management plans (no. farms)		9	out of 10 'core' farms	Farming Connect
	Pollinator surveys (no. farms)		8	out of 10 'core' farms	BBCT
	Farm economic assessment (no. farms)		2	out of 10 'core' farms	Nethergill Associates
	Nest boxes (no. farms)		8	out of 10 'core' farms, plus 2 additional	Goldcliff Ringing Group
Additional activities	Herbal ley trials – planned or undertaken (ha.)		9	on 2 farms	BBCT

Watercourses of different types are the crucial component of the Gwent Levels, as they serve multiple essential, practical (in farming and water management terms), ecological and cultural purposes. Appropriate management of the watercourses and sluices helps to regulate water flow, keeping levels high enough to act as "wet fences" and supplying drinking water for livestock in summer, while draining fields to avoid flooding during rainy periods. The relatively stable water level also provides essential habitats for many rare wildlife species and forms the basis for the widespread SSSI designations. In many areas, the quality of the ditches (and their ecological and therefore SSSI status) has deteriorated through lack of maintenance. NRW have permissive powers under legislation to maintain the rivers, main reens and about 137 km. of lesser reens, and took over this role from the Caldicot and Wentlooge Internal Drainage Board. However, the management of the remaining c.1200 km. of field ditches falls to individual farmers[4]. Areas where **ditch restoration** was undertaken are shown in Maps 1 and 2 in the Appendix.

The naturally high water table suits willow trees very well, these are an important landscape

[4] Chris Blandford Associates (2017) Gwent Levels Green Infrastructure Strategy

heritage feature, as well as providing nesting habitats for Tree Sparrows – an International Union for Conservation of Nature (IUCN) Red Listed species, meaning that it is of the highest conservation concern. Willows are traditionally **pollarded**, where the branches are cut back to the tree's trunk every few years to prevent the branches from growing too big and potentially splitting the trunk, as well as increasing the light reaching the ditches below and reducing the number of leaves falling into them, which would negatively affect the wildlife therein. Not every participating farm had suitable willows, but the locations of those trees that were pollarded are detailed in Maps 3 and 4.

Another element combining cultural heritage and nature conservation is **orchards**. Traditionally, almost every farm would have included an orchard with locally specific varieties of apples and pears, but most have been removed or allowed to die out. However, many of the participating farmers were keen to renovate old ones or plant new areas, and these are presented in Maps 5, 6 and 7.

A number of on-farm assessments were also undertaken, specifically looking at **water quality** and management (as part of NRW's wider Dairy Project), **nutrient management**, and pollinators and their required habitats. These resulted in reports to the individual farmers, sometimes recommending infrastructure and / or management alterations.

These elements were discussed in Sustaining the Gwent Levels: Farm case studies by Jane Ricketts Hein for Cynidr Consulting, which makes the following recommendations for building on the work already achieved by the Sustaining the Gwent Levels project:

- Make schemes' activities **easily accessible** to potential participants. Accessibility does not simply mean that the project is available, but is easy to engage with without adding to the administrative burden that farmers already face.
- Consideration of the **financial and time costs** to the farmers is vital. While some farmers – including a number of those already seeking to prioritise the improvement of biodiversity on their farms – are able to fund these types of activities to a certain extent, many more need help to do so.
- **Local knowledge** to design and deliver the project has an important role. Sub-contracting within the local community assists with engagement, while helping to keep financial benefits in the area.
- The importance of a credible, energetic **local project officer**, able to communicate appropriately and offer relevant assistance, cannot be overstated.
- Potential **markets** for any additional products resulting from the project should be investigated. This is particularly relevant for those farmers who were happy to forego agricultural land for orchard planting, but who also often hope that the produce will eventually provide an additional income stream.

Nest boxes

The Gwent Levels provides suitable feeding habitat for key bird species targeted by the project – Tree Sparrow, Barn Owl, Little Owl and Kestrel – but a loss of suitable nesting sites is thought to be limiting their populations. Some of these issues will be addressed by landscape management practices (including pollarding willows and the existence of

orchards) but, as these take time to become established, a nest box project was implemented. The aim was to help maintain and, where possible, increase the populations of these species by: providing suitably located nest boxes; monitoring and reporting on breeding successes; and raising awareness of these species among the wider communities. During the project, it was also found that volunteers were empowered through the development of transferable skills. The results were described by Richard M. Clarke of Goldcliff Ringing Group in the Gwent Levels bird nest box project: Final report, which records the following achievements:

Table 3: Nest box project aims and achievements

Aim	Achieved	Notes
Site 259 nest boxes	259 nest boxes sited in suitable habitats (see Map 8)	
Monitor & report breeding success	Some monitoring undertaken: successful breeding at 11 out of 17 Barn Owl nest boxes during 2020 and 2021	Restricted by Covid-19 regulations
Raise awareness of key species	25 landowners engaged with, 2 academic research studies contributed to, 2 articles: Gwent Ornithological Society's newsletter, 1 article: LLLP website, 1 presentation: Monmouthshire and Newport Local Nature Partnership.	
Volunteer skills development	26 volunteers involved with making nest boxes and monitoring, including a workshop with young people, 2 people trained by the Barn Owl Trust, 1 person gained Schedule 1 (Barn Owl) licence, 2 people trained in ladder safety.	

While work to recruit volunteers, map and register nest boxes with the British Trust for Ornithology, monitor their use, and replace and site new boxes will continue, two issues may be highlighted:

- In addition to the points raised above, **volunteers** – whether as part of a group like the Goldcliff Ringing Group or British Trust for Ornithology, or as interested individuals – were essential in delivering this strand of the project. This allows for such projects to achieve more than would be possible using a limited number of funded staff alone, and provides opportunities for a wider set of people to develop and build upon their interests in a practical way.
- However, volunteers should not simply be seen as free labour: there is a cost implication (not just financial) in providing **suitable training and support**. In this case, further training by the Barn Owl Trust is planned, but is dependent on funding being found.

Farm economic assessments

As the Levels is a landscape largely created by human effort, it relies on farmers and land managers for its maintenance, but this incurs costs to farm businesses in terms of time,

effort and expense. In order to help farmers with this aspect of the protection of the Levels, the project offered some farmers the opportunity to undertake economic reviews with Chris Clark of Nethergill Associates, using their approach to farm economic analysis[5]. In essence, it is more economically advantageous for farmers to work within the natural system on their farms than to make up shortfalls in feed and health with bought-in products (termed "corrective variable costs", CVCs). These additional inputs usually increase with increasing stocking levels, which put pressure on the land's natural capacity to beyond its "Maximum Sustainable Output" (MSO) level.

The farm assessments involve detailed examination of the budgets of participating farms; thus, reports were only made available to the individual households concerned. However, the findings showed that farms have significant opportunities for profit improvement, usually by reducing stocking rates. The recommendations are that:

- Farmers should be encouraged to work towards **Maximum Sustainable Output (MSO)** by minimising or eliminating their corrective variable costs (CVCs). This will benefit profitability and is also the point at which environmental benefits are maximised.
- However, implementing these business and economic recommendations will almost invariably produce a need for **mentoring support** at farm level.

Farmer review of project

Given the essential role that Gwent Levels farmers played in delivering the SMS project, the Countryside and Community Research Institute, University of Gloucestershire undertook interviews with five farmers who were participating in the Sustaining the Gwent Levels scheme and five non-participating farmers, to explore their views about the project and help address any shortcomings. The findings were reported by Chris Short and Stacey Hobbs in Summary of farmer interviews for Sustaining the Gwent Levels project. Although their conclusions and recommendations were aimed primarily at refining the project, they also have a wider relevance.

- The **Project Officer's role** is critical particularly in communication, whether this is about the project itself or developing networks within existing and potential new participants and wider stakeholders.
- A number of innovations were suggested, including the introduction of herbal leys appropriate to the area and improved understanding of water level management. The **co-development of projects** with Levels farmers is suggested.
- As well as practical explorations of relevant issues, a need for reliable **sources of information** and **spaces for discussion** was highlighted.

[5] See: Clark, and Scanlon, B. (2019) Less is more: Improving profitability and the natural environment in hill and other marginal farming systems. Available from: https://www.wildlifetrusts.org/sites/default/files/2019-11/Hill%20farm%20profitability%20report%20-%20FINAL%20agreed%2015%20Nov%2019.pdf.

Payments for Ecosystem Services

The recognition of the profound effect that farming has on natural ecosystem processes, and the realisation that these processes are essential for wider (human and natural) survival have come to the fore in recent years. These have led to efforts to explore ways of ensuring that the sustainable management of natural resources is encouraged and paid for. The advantages to society from these processes are known as "Ecosystem Services" (ES) and, thus "Payment for Ecosystem Services" (PES) has become one way of encouraging activities that provide these benefits.

In order to explore the potential to reward farmers for providing such services in the Gwent Levels, a series of three workshops was conducted by Resources for Change Ltd, and the results presented in their report, A resilient future for the Gwent Levels interim report. These were then supplemented by a number of expert interviews conducted by Sustaining the Gwent Levels Project Officer, Lewis Stallard (2 interviews), Resources for Change Ltd. (1 interview) and Cynidr Consulting (14 interviews). The combined results were discussed in the report, PES and the Gwent Levels: Local opportunities for paying for Ecosystem Services by Jane Ricketts Hein for Cynidr Consulting, and these are summarised in Table 4.

Table 4: PES opportunities, possible benefits and constraints

PES opportunity	Possible benefits	Possible constraints	Potential mechanism	Potential lead partners
Farm products (existing & new food / drink)	Maintain viable farming systems; Economic & cultural benefits; Maintain farmland wildlife.	Balancing productivity with protecting / improving biodiversity; Time & expense marketing products.	Private markets; Public payment scheme.	Individuals (producers, consumers); Food, farming & environment groups; Welsh Government.
Fam products (willow coppice)	Environmental, wildlife & cultural benefits; Minor economic benefit.	Lack of market for products.	Private markets; Public payment scheme.	Individuals (producers, consumers); Arts & crafts organisations; Welsh Government.
Carbon capture (soil, salt marsh)	Climate benefits; Existing, established market.	May be difficult to access; Danger of 'greenwashing'; Potential exclusion from future schemes; Subject to global markets.	Formal market. (New schemes being developed.)	Commercial trading companies; Sustainable Soils Alliance (developing Farm Soil Carbon Code).
Water level	Maintain 'wet fences' & drinking water for livestock; Maintain & improve biodiversity & habitat; Reduce flood risk.	Need more information about flow; Initial investment to improve ditches.	Public payment scheme; Private schemes.	NRW; Welsh Government; Private companies (e.g., developers, insurers).
Water quality	Maintain & improving biodiversity and wildlife habitats.	Financial implications of addressing pollution; Behavioural change in farming practice.	Public payments scheme; Private schemes with environmental & farming organisations.	NRW; Welsh Government; Dŵr Cymru; Farming & environmental organisations.
Wildlife habitats	Include Water quality, and form the basis for tourism / leisure, education & health / well-being opportunities below.			
Tourism / leisure (walking / cycling)	Health; Engagement with the area; Economic.	Complexity of rights-of-way development & maintenance; Access.	Public payments schemes; Private schemes.	Variety, including tourism and transport organisations, local businesses and communities / individuals.
Education and Well-being / health	Engagement with farming, landscape & environment; Education; Health.	Access. Appropriate locations & activities.	Public payment schemes; Private schemes.	Variety, including education & health authorities; Environmental, arts & training organisations.

A variety of PES scheme possibilities appear to present themselves. Although sustainable food production is not always considered a PES activity, it perhaps offers the greatest scope for encouraging farming practices that are environmentally and financially sustainable. Carbon capture schemes are currently receiving a great deal of attention and, more locally, water quality and water level management are particularly important. There are also possibilities for capitalising on the benefits provided by good quality outdoor environments

for tourism, education, health and well-being. However, the overwhelming messages were that:

- PES schemes (specifically, those that are not simply promoting sustainably produced farm products) need very **careful and detailed consideration**. A well-defined vision of what the proposed scheme wishes to achieve, and sound understandings of both the Ecosystem Service itself and the potential market are vital. It is also essential to accept that neither nature nor markets always act as expected.
- While a well-designed and managed PES scheme does offer a potentially useful tool for supporting the sustainable management of natural resources, such schemes will **not replace specific conservation schemes**.

An improved understanding of a variety of ESs, particularly carbon capture and habitats, has been helped by recent modelling undertaken by the Environment and Rural Affairs Monitoring and Modelling Programme (ERAMMP)[6] for Welsh Government and, specifically for the Sustaining the Gwent Levels project, by Environment Systems Ltd.

Monitoring and modelling environmental opportunities and risks

As part of developing this better understanding, Environment Systems Ltd. designed and undertook a programme of monitoring and modelling for a variety of Ecosystem Services and habitats. Seven key themes were explored:

- wader habitats (represented by Lapwing);
- pollinator habitats (represented by Shrill Carder Bee);
- landscape connectivity (primarily represented by three species of bats that travel varying distance to feed, but also modelled in relation to other species and habitats);
- aquatic habitat (condition and connectivity of the ditches and reens);
- landscape structure (wooded features);
- water quality; and
- carbon storage.

For each theme, four models were produced that examined:

- theme quality;
- theme connectivity or risk;
- opportunity for expansion; and
- scenario modelling considering the effects of a) maintaining the status quo, b) the intensification of industrial and agricultural pressures and c) a move towards high nature value farming.

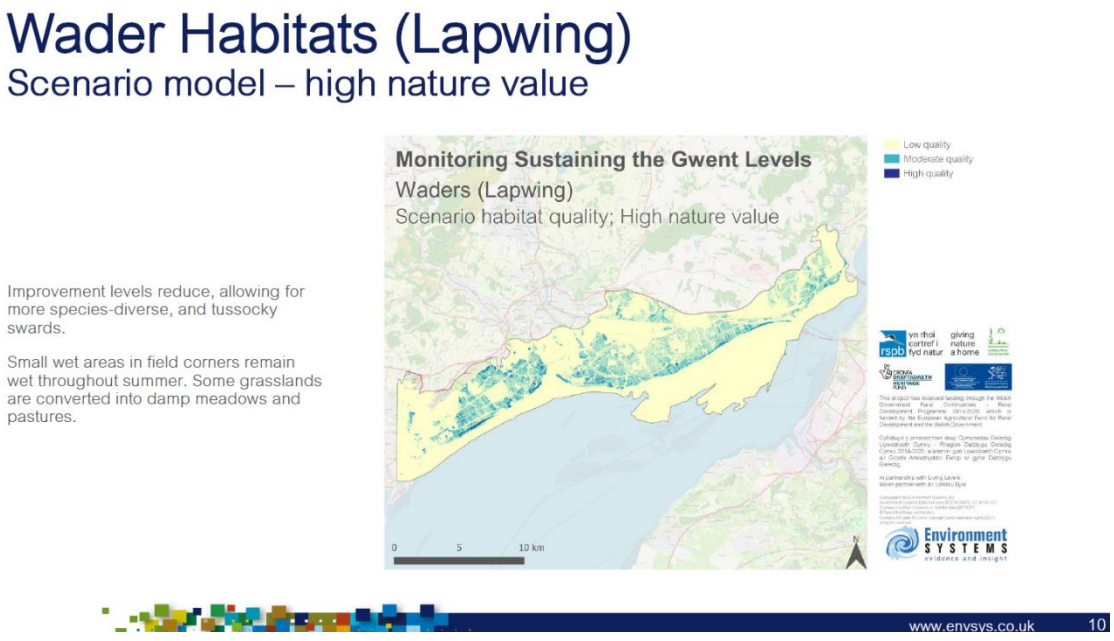
Environment Systems Ltd. used their own approach to modelling called SENCE (Spatial Evidence for Natural Capital Evaluation), which uses spatial data to grade the importance of any area of land into a simple categorisation of suitability / quality. This is based on sets of tailored scientific 'rules', informed by expert knowledge. Thus, the spatial data were

[6] https://erammp.wales/en/40

obtained from satellite imagery plus ancillary data from other sources, such as the National Forest Inventory and OSOpenData. These were further informed by historic surveys of the target species, in addition to contemporary field studies undertaken by the Sustaining the Gwent Levels Project Officer (and also Bumblebee Conservation Trust staff for the Shrill Carder Bee theme) with the co-operation of several of the participating farmers, and in consultation with experts from RSPB Cymru, BBCT, Bat Conservation Trust and NRW.

The results were presented in Monitoring Sustaining the Gwent Levels for the Sustainable Management Scheme project, with its accompanying Methodology report, both by Samuel Pike and Katie Metcalf for Environment Systems Ltd. Figure 2 gives examples of the resulting maps. The outcomes also serve to highlight some of the differing – and sometimes

Figure 2: Examples of habitat and ES modelling



conflicting – priorities between species and ecosystems; for example, tree planting has a strong positive effect on bat species, but a strong negative impact on lapwings[7]. The company suggests that an **online mapping tool** could be developed that holds and visualises the data. They also recommend that:

- The accuracy of the habitat data could be enhanced by **additional manual interpretation**, focusing on features with possible inaccuracies, such as silage fields, or older data.
- Habitat data are **regularly updated**, rather than periodically re-mapped, which would be more expensive.
- **Ground survey data** are incorporated into future iterations. There is a potential role here for public engagement and **citizen science** projects.
- Other **data sources** should be as up to date as possible, and steps should be taken to guard against the loss of any particular data sources in the future.

Understanding underdrainage

Underpinning all of the activities on the Gwent Levels is its physical context as a flat, low-lying site, reclaimed from the sea; thus, the area's hydrology and related management are key. The economic pressures on farming mean that there are strong incentives to intensify production in order to achieve maximum outputs from the land regardless of whether or not this is sustainable. In the wet pastures of the Levels, this can result in demands to underdrain the fields using below-ground pipes rather than relying on the traditional system of surface grips and ditches. There are two reasons for doing this: to attempt to dry them out and create an even surface, allowing animals to graze for longer without poaching the ground, and permitting easier access for tractors and other machinery. However, this risks damaging or destroying the cultural features of the landscape and also the habitats and species that are the reason for the SSSI designation of much of the Levels. Because of the SSSI status, permission must be gained from NRW before such works can be carried out. It is felt, though, that the hydrology of the area is inadequately understood and, given the requests to install underdrainage, a set of ecohydrological studies were commissioned as part of the Sustaining the Gwent Levels project.

Rigare Ltd. and associates were engaged to: provide a **conceptual model of the hydrological system** of the Gwent Levels, particularly in relation to SSSI features; assess how modern underdrainage systems may affect these features; explore the impact on wider habitats and biodiversity; explore how hydrological changes may affect drought and flood risk resilience; and explore how these changes may affect buried and surface archaeology. The results were presented in Ecohydrological studies of the Gwent Levels, South Wales by Low *et al* for Rigare Ltd. and associates. A number of pre-existing ideas are challenged in the report, including the idea that water flowing through the top layer of soil from the fields to the field-side ditches helps to maintain ditch water levels during the warmer months, whereas almost no lateral flow is now thought to occur during that period. The main conclusions were that:

[7] see Appendix C, "Monitoring Sustaining the Gwent Levels for the Sustainable Management Scheme project".

- There is little correlation between the ditch water depth and different field drainage types, thus the **ditch plant communities are unlikely to be sensitive to field drainage type**.
- However, as underdrainage results in the loss of field grips, it is possible that **in-field plant communities would be affected**, with the gradual loss of those depending on wetter areas.
- Any danger to buried archaeological remains is likely to occur **during underdrainage installation** rather than as a result of its use.
- However, the loss of field grips is likely to lead to the intensification of the field's use and the resultant **loss of topographical features**, including ridge and furrow.
- With regard to withstanding **drought and flood risk**, there was **little difference** between systems.
- Indirect effects of installing underdrainage include the possibility of **increasing stocking density**, with the potential for over-grazing, improvements to the sward by **reseeding** with more agriculturally intensive seed mixes and the potential for **nutrient run-off**, to the detriment of ditch flora and fauna.

Recommendations were also made:

- Although the direct effects of underdrainage are minimal overall, any permission granted in the future should consider the possible negative indirect effects of the potentially resulting **agricultural intensification**.
- That NRW review, record and formally document how the hydrological system functions, and how related management decisions are made.
- Further monitoring is undertaken to confirm the hydrological effects of underdrainage during the **colder months**.
- A study into the implications of **climate change** on the Gwent Levels is carried out as soon as possible.

The Rigare report was informed by an **assessment of the SSSI features** at the sites used to develop the hydrology model. These results were published by Jonathan Graham and Martin Hammond in Investigating ditch biodiversity in the Gwent Levels: a survey of vegetation and aquatic macro-invertebrates at 5 sites within the Gwent Levels. They found:

- Distinct differences in submerged aquatic plant diversity in ditches where water levels were lower, showing the importance of **maintaining adequately high water levels**.
- A variety of **SSSI-notable** and other plant and macro-invertebrate species, in addition to other aquatic vertebrate species (including elvers, and palmate and smooth newts) were **present at all sites.**
- However, most ditches with open water were dominated by **high levels of duckweed** at all sites. This is often linked to eutrophication, especially associated with a concentration of phosphate, and can negatively affect ditch fauna.

Finally, the broader relationships between agriculture and water management in the Levels, particularly their **economic impact** on farm businesses, were explored by Reading

Agricultural Consultants in Sustaining the Gwent Levels. Underdrainage and farming: Current state – future management. The report describes the factors behind the drive to drain land and the benefits that farmers get from reducing surface and soil water levels, before considering the costs of installing new and renewing existing drainage systems for a variety of farming types. By using standard assumptions for the costs incurred and benefits derived, the authors were able to calculate the payback periods for several scenarios, including previously undrained land used for dairy and arable farming, and land that has underdrainage systems in need of repair. They found that:

- Underdrainage systems rely on there being sufficient **separation between the water table and the mole drains** for them to work; this is not always possible when water levels are high.
- The **costs of underdrainage installation relative to likely returns are significant** and may be regarded as capital expenditure. These costs may be more acceptable for more intensively grown crops and those likely to generate a high return, such as maize or cereals, but this must be balanced against the risk of soil damage, especially with the former crop.
- "**Spot drainage**" of small areas in otherwise drained fields may be economic where they bring unproductive patches of land up to the workability of the rest of the field.
- Given the highly connected nature of the Levels watercourses, it is recommended that an **integrated vision of land management** is developed, based on Sustaining the Gwent Levels and other projects, and including wide stakeholder agreement.

Costing other environmental works

The recognition that maintaining the Levels' semi-natural resources and features has an economic cost was further explored by Reading Agricultural Consultants in their report, Wetland landscape restoration and maintenance in the Gwent Levels – costings. By breaking down habitat management requirements into their constituent tasks, they were able to provide costs for: the restoration and sustainable management of surface drainage features (reens, ditches and grips); grasslands and margins that are pollinator-friendly; hedgerows (in the Levels it is desirable to have hedges on only one side of a ditch to avoid excessive leaf fall and shading); and orchards. The financial implications for three theoretical farms of varying sizes and types were then modelled. The authors highlighted the importance of agri-environment schemes in funding these kinds of activities, and their recommendations revolve around improving the offer of such schemes:

- When seeking to change farmers' behaviour, options for change should include **comparisons of the profits** that are likely to arise, and **advice** should be provided.
- Some specific recommendations for **refining agri-environment schemes** were made. These included: widening the offer to include currently ineligible ditches, with the possibility of having ditches and their adjacent hedges as either a single combined or separate options; and taking account of the appropriateness of boundary features, as hedges are not always the best environmental option in the Levels.
- Use **length of boundary**, rather than field area, as the basis of payment. With many Levels' fields being long and thin, the areas that must be avoided during operations

such as muck-spreading are proportionately higher, resulting in increased losses of production.

- It is also suggested that including **management practices**, such as timing machinery and livestock access to the land, in ditch-related environmental agreements would enhance ecological benefits.

Means of engagement

As already mentioned, the presence of an energetic, personable and credible **Project Officer** has been key to successfully engaging with the Gwent Levels farmers and the variety of partners involved in delivering the Sustaining the Gwent Levels project. As well as practically assisting with tasks such as wildlife surveys and nest box workshops, the Project Officer acted as a recognisable contact for queries and as facilitator for the on-farm capital works (in conjunction with the Living Levels Natural Heritage Officer) and wider engagement activities.

A 60-page, full colour **advisory booklet** has also been produced, aimed at those interested in the land and water management aspects of the Gwent Levels. It introduces the history, wildlife and importance of the area, and the role of farming in producing and maintaining the landscape and its habitats. The greater part of the booklet provides advice on the improvement and sustainable management of the Levels' water, grasslands and woodlands. Hard copies were sent to all the farmers involved with the scheme, and it will be distributed as part of any follow-on project. It is also available to the public from the Living Levels 'Level Advice' English-language webpage[8].

For engagement with the wider public and interested stakeholders, a short **animation** and a **film** have been created, illustrating how farming is intrinsically connected with the Levels landscape and its wildlife. The animation, which was produced by Hepburn Photography, is available in English on the Living Levels webpage, and with English and Welsh commentary from RSPB Cymru's YouTube channel[9], while the film will be released shortly.

Recommendations / Next steps

The Sustaining the Gwent Levels project has enabled a wide set of activities and investigations to be undertaken, many of which have benefited from close co-operation with the Living Levels Landscape Partnership. The recommendations from these outputs and suggestions for further actions and policies can be grouped under four themes: Management and overview of the Levels; Monitoring and further investigation; Supporting nature-friendly agriculture; and Engaging with the wider community.

Management and overview: Perhaps one of the most useful features of both Sustaining the Gwent Levels and the Living Levels Landscape Partnership has been the multidisciplinary

[8] https://www.livinglevels.org.uk/level-advice (bilingual booklet available)
[9] Living Levels: https://www.livinglevels.org.uk/news/2022/3/9/level-advice (English).
RSPB Cymru YouTube channel: https://www.youtube.com/watch?v=qeDZLlTiofc (English), https://www.youtube.com/watch?v=5IkzhG4VbvA (Welsh).

approach taken. These efforts to work across subject areas, although often complex in their management, can help to strengthen positive outcomes and avoid negative unintended consequences by encouraging a broader understanding of issues and decisions. With this in mind, a cohesive management plan for the Levels should be developed. It must listen to a wide range of interests, including farmers, landowners and local residents, as well as all of the relevant local authorities, Welsh Government, NRW, and a variety of other conservation and community organisations and potentially interested parties, particularly those based around the Levels. This would build on the work and contacts already undertaken by Sustaining the Gwent Levels and LLLP. Beginning with the existing knowledge of the Internal Drainage District and its predecessor, the Internal Drainage Board, the remit could include drainage, water flow, and water and soil quality, but also have a landscape-scale view of the Levels. It should pay good attention to the local and regional social and economic contexts. Funding for activities and projects is normally short-term in nature: governments and other funders must look again at how the best ideas and most useful projects are supported and enabled to continue to deliver over longer periods.

Monitoring and further investigation: Outputs from the project have identified several specific gaps in the knowledge, for example, the need to ground truth some of the habitat data used by Environment Systems Ltd., and about the flow of water in the Gwent Levels. With diffuse and point source pollution felt by many to be major dangers for the Levels, further work in this area is essential. There is scope for citizen science to play a role in monitoring the natural and cultural environment, although over-reliance on such voluntary information should be avoided. An easily accessible online mapping tool would help with engagement for this.

Supporting nature-friendly agriculture: The involvement of the participating farmers has been crucial to the success of the project, and is something that can be built on for future. However, it is important that their engagement is not taken for granted and that they see benefits to continuing to support such schemes. While some elements of environmental protection are legal requirements, supporting nature-friendly agricultural practices may need a change of mind-set, as well as practical farm management, and help to do both is likely to be needed. The new Sustainable Farming Scheme will have an essential role, but there are wider possibilities, including developing markets for products coming from such less intensive and nature-friendly systems. Closing the gap between farmers and consumers is one way of helping with this. There may be opportunities for bespoke schemes promoting these products or other innovative ways of bringing nature back onto farms or protecting what is already there. However, any new scheme should be genuinely co-developed with all the participants.

Engaging with the wider community: With a significant population living and working on the edges of the Gwent Levels, many people have – or could potentially have – an interest in maintaining the area in good ecological condition, with thriving businesses and other opportunities. By including this wider community, projects that work for Levels' farmers and residents, as well as their urban neighbours, could be developed, including markets for farm produce, improvements to transport links, educational and health opportunities. A

number of organisations, including the Gwent Wildlife Trust, already work on some of these issues, but there is scope to increase initiatives like "green prescribing", or develop safer cycle and foot paths, particularly close to and connecting with built-up areas. The National Nature Service for Wales[10], being developed by the Wales inquiry of the Food, Farming and Countryside Commission could consider increasing its remit to include a more explicit focus on health, or a parallel body could be developed for this purpose. The urban communities themselves should be consulted regarding their needs, opportunities and how to address practical issues with gaining access to the Levels. This should also help to encourage responsible behaviour when visiting.

There are many positive elements upon which continuing support for the sustainable management of the Gwent Levels could be developed. These should form the basis for a further holistic project that is co-designed by all the stakeholders and helps to meet the requirements of the Wellbeing of Future Generations (Wales) Act 2015[11], as well as newer developments such as "Llwybr Newydd: the Wales Transport Strategy 2021"[12]. Suggestions for future policy attention and actions are:

Policies:

- The Sustainable Farming Scheme must support agriculture and land use that protects and encourages wildlife, habitats and ecosystem services, as well as food production.
- Strengthen habitat, soil and water quality protection, including sufficient resourcing of NRW, protect what already exists, prevent pollution, degradation and loss, but also ensure that there are appropriate tools for enforcement.
- Support nature's role in providing health, education and leisure opportunities.
- Support funding sources that enable stability for successful projects over much longer periods.
- More locally, develop landscape scale policies for the Levels.
- Support local democracy initiatives, at which local voices are more likely to be heard.

Actions:

- Develop an integrated vision and plan for the Levels, including for the landscape, the variety of habitats and the local communities.
- Formalise the best management practices of wet habitats and work to address the gaps in knowledge identified with regard to water flow throughout the Levels.
- Establish a farmers' discussion forum for those involved in working in this unique habitat.
- Establish a food hub or other market outlets that link farmers directly with urban residents. Explore how to provide good quality food directly to communities,

[10] https://www.gwasanaethnaturcenedlaethol.cymru/
[11] https://gov.wales/sites/default/files/publications/2019-08/well-being-of-future-generations-wales-act-2015-the-essentials.pdf
[12] https://gov.wales/llwybr-newydd-wales-transport-strategy-2021-html#section-65092

perhaps with cookery lessons or advice, especially for those on low incomes or with less confidence or experience in using fresh produce.

- Develop a citizen science monitoring programme to ground truth data gathered by Environment Systems Ltd, and link it to an online mapping tool.
- Work with urban residents to assess what they need to gain access to the Levels and enjoy the area responsibly.

Reports and other resources

For Sustaining the Gwent Levels SMS

Clarke, R.M. (2021) Gwent Levels bird nest box project: Final report Goldcliffe Ringing Group: Goldcliff, Gwent.

Graham, J. and Hammond, M. (2022) Investigating ditch biodiversity in the Gwent Levels: a survey of vegetation and aquatic macro-invertebrates at 5 sites within the Gwent Levels.

Low, R. (2020) Ecohydrological impact assessment on the proposed Wentlooge Farmers' Renewable Energy Hub, Gwent Levels Rigare Ltd: Abergavenny.

Low, R., Mould, D., Taylor, A., Graham, J. and Hammond, M. (2021) Ecohydrological studies of the Gwent Levels, South Wales Rigare Ltd and associates: Abergavenny.

Pike, S. and Metcalf, K. (2021) Monitoring Sustaining the Gwent Levels for the Sustainable Management Scheme project [Maps] Environment Systems Ltd: Aberystwyth.

Pike, S. and Metcalf, K. (2021) Monitoring Sustaining the Gwent Levels for the Sustainable Management Scheme project: Methodology Report Environment Systems Ltd: Aberystwyth.

Reading Agricultural Consultants (2022) Sustaining the Gwent Levels. Underdrainage and farming: current state – future management Reading Agricultural Consultants: Woodcote, Reading.

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Resources for Change Ltd. (2020) A resilient future for the Gwent Levels interim report Resources for Change Ltd: Llangattock, Powys.

Ricketts Hein, J. (2021) PES and the Gwent Levels: Local opportunities for paying for Ecosystem Services Cynidr Consulting: Glasbury-on-Wye, Powys.

Ricketts Hein, J. (2021) Sustaining the Gwent Levels: Farm case studies Cynidr Consulting: Glasbury-on-Wye, Powys.

RSPB Cymru: Cynnal Lefelau Gwent ffilm wedi'i animeiddio – https://www.youtube.com/watch?v=5IkzhG4VbvA (Welsh); Sustaining the Gwent Levels animated film – https://www.youtube.com/watch?v=qeDZLlTiofc (English).

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Short, C. and Hobbs, S. (2020) Summary of farmer interviews for Sustaining the Gwent Levels project CCRI: Cheltenham.

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Dickie, I. and Neupauer, S. (2021) ERAMMP Report-40: SFS Logic Chains. Report to Welsh Government (Contract C210/2016/2017) (UKCEH 06297/06810) https://erammp.wales/en/40

Living Levels Landscape Partnership Project website: https://www.livinglevels.org.uk/

Natural Resources Wales (2016) Usk Catchment Management Summary NRW: Cardiff. Available from: https://cdn.naturalresources.wales/media/679394/2016_updated_usk_catchment_summary_nrw.pdf?mode=pad&rnd=131596369400000000

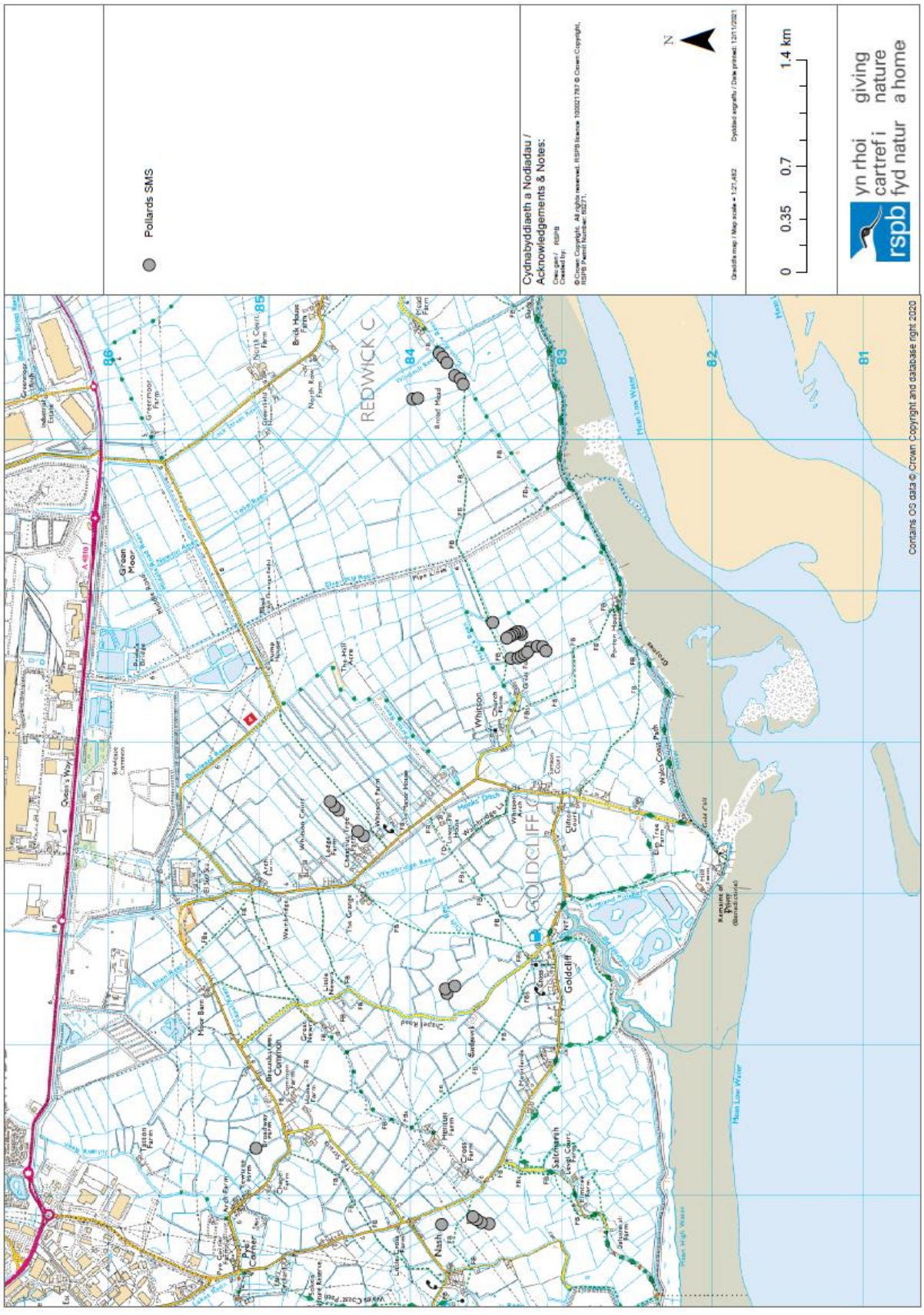
Welsh Government (2018) Brexit and our land: Securing the future of Welsh farming [Consultation] Available from: https://gov.wales/sites/default/files/consultations/2018-07/brexit-and-our-land-consultation-document_0.pdf

Appendix: Maps of capital works

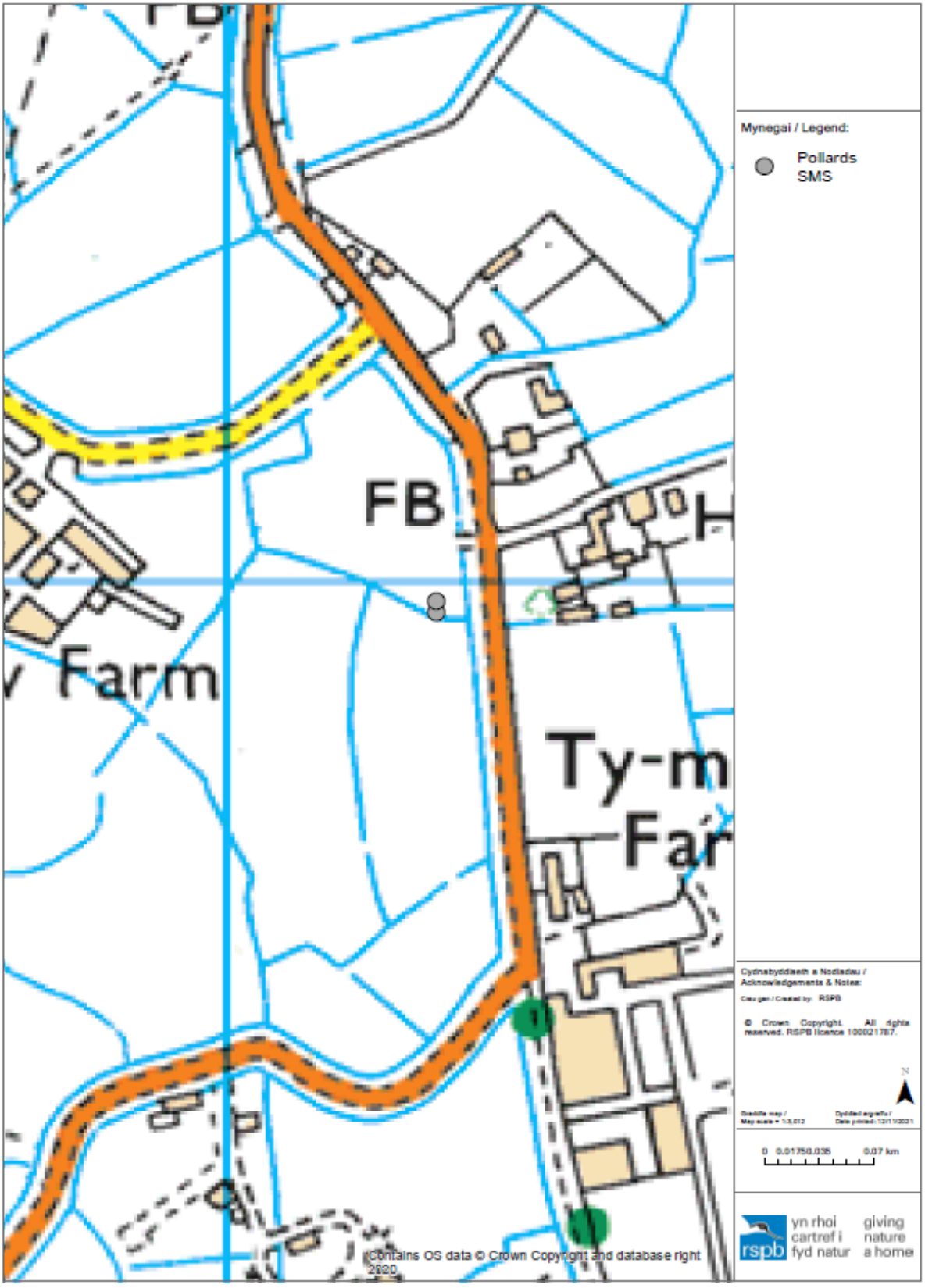
Map 1: Ditch restoration – Caldicot Level

Map 2: Ditch restoration – Wentlooge Level

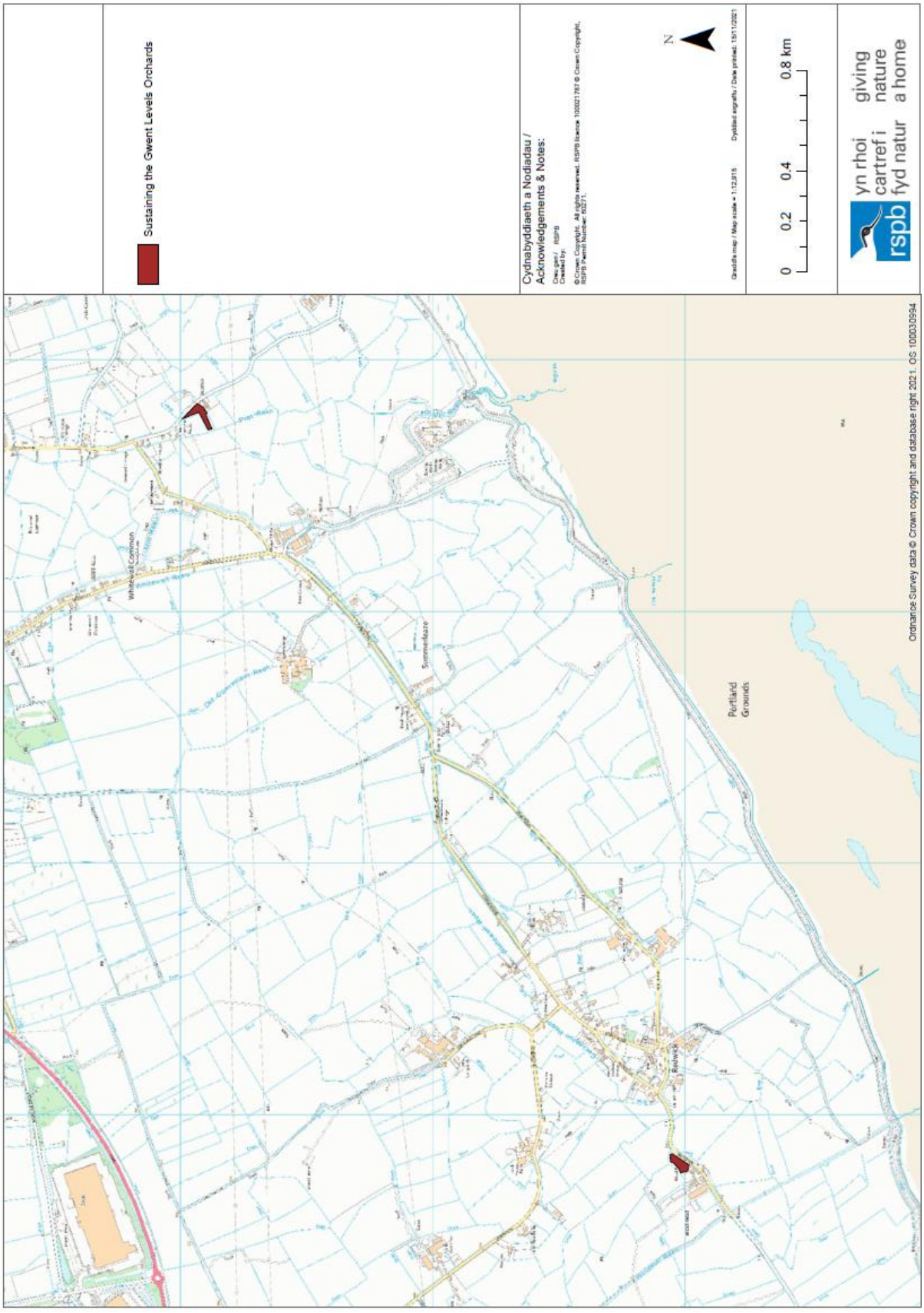
Map 3: Pollards – Caldicot Level



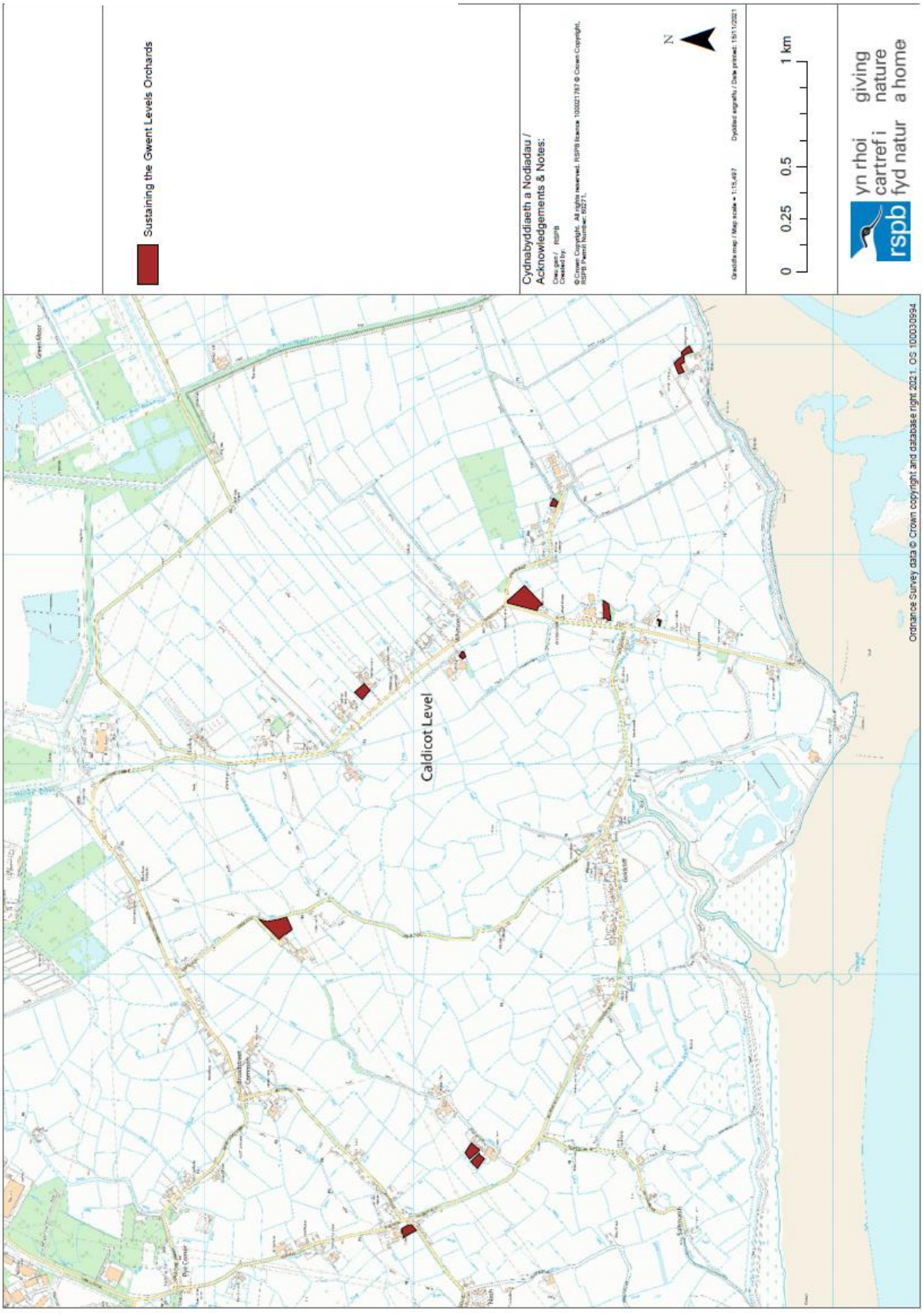
Map 4: Pollards – Wentlooge Level



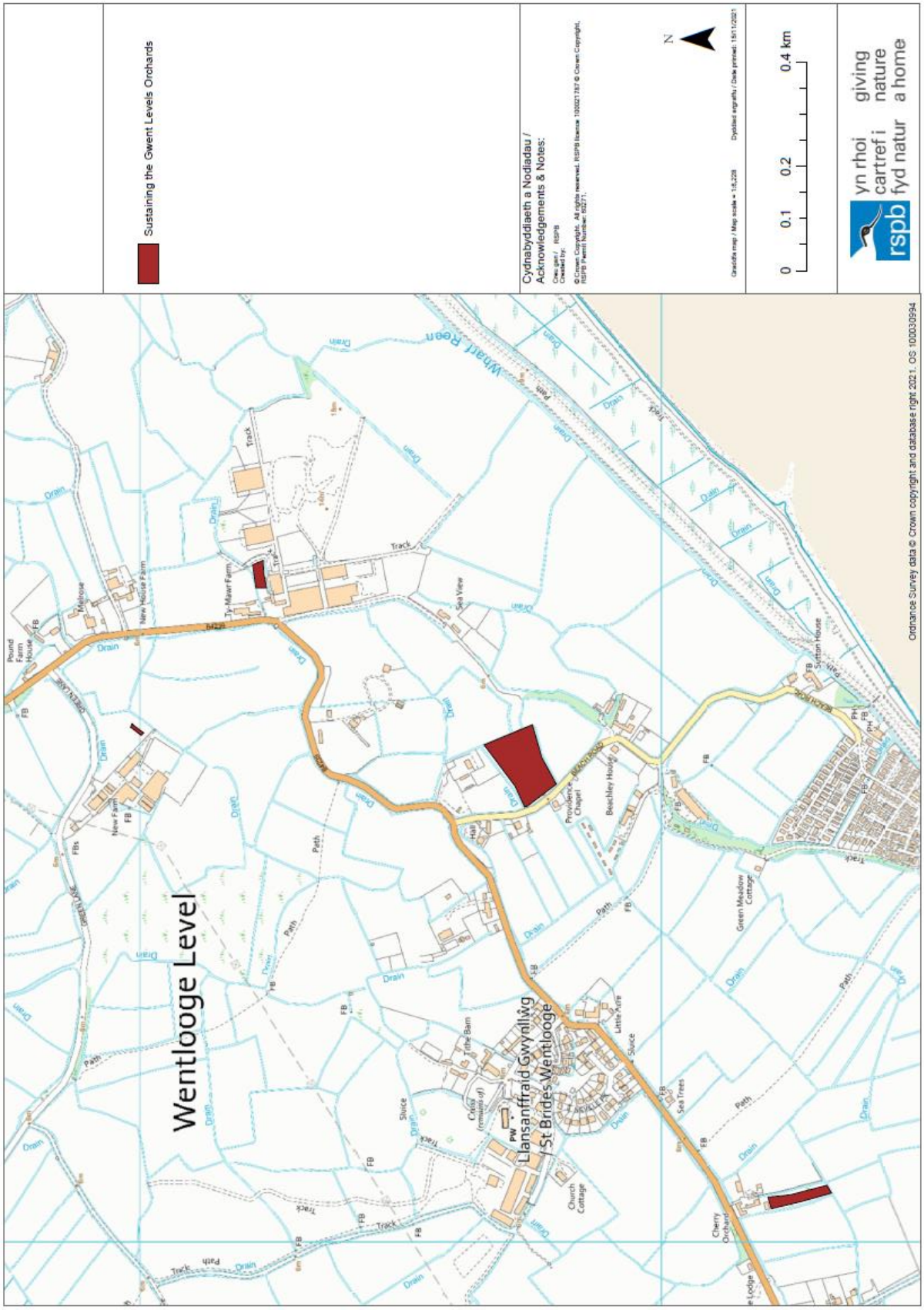
Map 5: Orchards – Caldicot East Level



Map 6: Orchards – Caldicot West Level



Map 7: Orchards – Wentlooge Level



Map 8: Nest boxes