Influences on farmer decision-making behaviour considering a payment for ecosystem services scheme: farmers' and scheme facilitators' perceptions

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Abstract

Agricultural diffuse pollution from metaldehyde (the most common active ingredient used in slug pellets) is a major concern in the UK as its rivers have frequently recorded levels of the pesticide unsafe for potable consumption. Payments for ecosystem services (PES) has gained popularity as a mechanism to generate improved environmental behaviours from farmers by offering them an incentive to manage their land to provide specific environmental benefits. To improve water quality at the point of extraction, Thames Water has used the PES approach to tackle agricultural diffuse pollution from metaldehyde. While there is a wealth of knowledge in the theoretical and experimental fields of PES, few empirical studies have examined how PES schemes encourage and sustain improved behaviours. To address this gap, this study investigated the influences on farmer decision-making behaviour considering their participation in Thames Water's PES scheme in four catchments.

Data collection comprised semi-structured interviews with 22 farmers and 8 project partner advisors (scheme facilitators) to gain insight into their perceptions of Thames Water's PES scheme concerning: the drivers and barriers for farmer participation; strategies used by the project partner advisors to support farmers' participation and behaviour change; and the success and sustainability of the scheme in changing farmers' behaviours and attitudes towards metaldehyde. The results concluded farmers' motivations for scheme enrolment were mainly dominated by non-economic motivations, with the provision of information, environmental enhancement and moral obligation particularly influential. Project partner advisors emphasised the need for a holistic approach towards improving water quality through their provision of advice to farmers and, in particular, providing tailored advice to each farmer. Crucially, behavioural and attitudinal changes in farmers' metaldehyde use were observed, with farmers improving their land management practices due to a better understanding of the environmental impacts of metaldehyde and more sustainable methods for slug management.

In conclusion, this study identifies approaches that are successful for influencing and supporting farmer decision-making behaviour. This will help inform the development of existing and future PES schemes as mechanisms for encouraging farmers' voluntary behaviour change. It will also assist those responsible for the facilitation of PES schemes to increase farmer engagement and generate advice that better resonates with farmers to achieve environmental goals.

Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of the University of Gloucestershire and is original except where indicated by specific reference in the text. No part of the thesis has been submitted as part of any other academic award. The thesis has not been presented to any other education institution in the United Kingdom or overseas. Any views expressed in the thesis are those of the author and in no way represent those of the University.

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List of Acronyms and Abbreviations

AES	Agri-environment scheme(s)
BMP	Best management practice
CLAD	Customer Land Database
CSF	Catchment Sensitive Farming
DEFRA	Department for Environment, Food and Rural Affairs
EU	European Union
FWAG	Farming & Wildlife Advisory Group
IFA	Innovation for Agriculture
MSG	Metaldehyde Stewardship Group
PES	Payment for ecosystem services
Promar	Promar International
RASE	Royal Agricultural Society of England
SW	South West
TPB	Theory of Planned Behaviour
UK	United Kingdom
WFD	Water Framework Directive
WTW	Water Treatment Works

Chapter 1: Introduction

Although the physical and chemical characteristics of natural waters vary considerably (as a result of land cover, proximity to oceans, local soils and geology), local ecological systems are particularly vulnerable to changes in concentrations of minerals and especially sensitive to chemicals artificially introduced to the environment (Adams and Greeley, 2000). Agriculture covers over 70% of land area in the United Kingdom (UK) and affects water quality through the release of nutrients and chemicals into the water environment (Holden et al., 2017). According to the Environment Agency (2018), agriculture and rural land management is responsible for 31% of waterbodies failing to achieve good status in England and Wales. Pollution from agriculture can emanate from a point source (e.g. failure of a chemical store), however diffuse pollution is considered to contribute a large amount of agricultural pollution. The term 'diffuse' is used to mean originating from numerous dispersed and unknown sources (Campbell et al., 2005). It is therefore more problematic to monitor and assign this type of pollution to specific practices or land areas (Holden et al., 2017).

Since the 1970s, the existence of pesticides in surface and groundwater has been acknowledged as an issue in the UK and has triggered much public concern (Matthiessen et al., 1992). In recent years, the development of analytical methods has resulted in the frequent observation of several pesticides at trace levels in rivers and groundwaters which were not previously detected (Croll, 1991). Since 2007, one of the pesticides frequently observed in UK rivers is metaldehyde (Gillman et al., 2012). Metaldehyde is the most common active ingredient used in slug pellets which are commonly applied in the autumn and winter months to control slugs and protect crops (chiefly vegetables, winter wheat and oilseed rape) (Lu et al., 2017). Due to the increasingly wet and mild climate the damage slugs caused to crops has increased (Glen, 2002). Consequently, metaldehyde has been widely applied to horticultural land and is estimated to have treated over 8% of the UK's arable crop area (Environment Agency, 2009). Once applied to land, its high solubility causes it to readily run-off under wet conditions into gullies, field drains and watercourses (Castle et al., 2018).

To comply with the European Union (EU) regulatory drinking water standards, traces of any pesticides in potable water cannot exceed 0.1µg/l. This presents a concern for the UK water sector as UK rivers have frequently detected metaldehyde at concentrations above this level

(Gillman et al., 2012; Kay and Grayson, 2014). Due to its physicochemical properties, metaldehyde is particularly hard to remove during conventional Water Treatment Works (WTW) cleaning processes, as well as Advanced Water Treatment (Lu et al., 2017; Castle et al., 2018). As a result, water companies have found removing metaldehyde from drinkable water at peak concentrations technically and economically difficult (Dillon et al., 2011). Besides, removing these contaminants by improving WTW almost entirely neglects their causes or confront the trails they leave in the environment, thereby only protecting people from exposure as an 'end-of-pipe' solution. Management of metaldehyde diffuse pollution is therefore considered most suitably tackled via prevention rather than cure (Ibrahim et al., 2019).

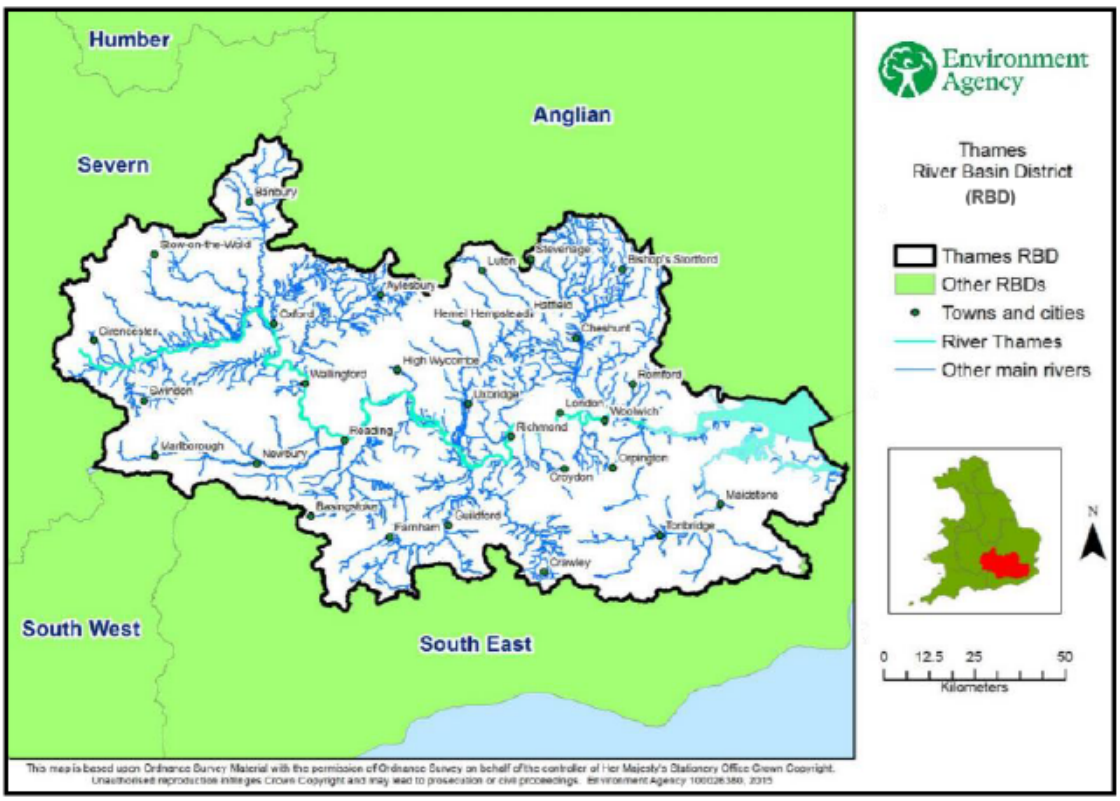
Due to the direct threat metaldehyde poses to wildlife, such as through animals consuming metaldehyde slug pellets and slugs or aquatic biotas contaminated by it (Stuart et al., 2012; Castle et al., 2017), DEFRA (Department for Environment, Food and Rural Affairs) made the decision in December 2018 to withdraw metaldehyde from all outdoor uses by 30th June 2020. However, this verdict was overturned in July 2019 due to legal challenges. Its withdrawal was conceded again in September 2020 and metaldehyde is now due to be completely phased out by 31st March 2022. Therefore, while it is still permitted, there is a need for voluntary action from farmers to adjust the agricultural usage of metaldehyde to manage its impact on the water environment. It is important to note that although this thesis acknowledges there are many ways land can be farmed and by different types of individuals (such as by landowners, land managers, tenants, small holders, share farmers and farmers), it uses the terms 'farmer' to cover them all. In their endeavour to protect and improve water quality the water industry has undertaken initiatives to inspire such action from farmers. For example, in 2008 the Metaldehyde Stewardship Group (MSG) launched a campaign called 'Get Pelletwise' (getpelletwise.co.uk/), an initiative which focuses on trying to get large-scale users of slug pellets to implement measures that prevent or minimise the movement of metaldehyde to waterbodies. To do this, the campaign promotes integrated pest management as a programme for slug control and has developed best management practice (BMP) guidelines for using metaldehyde. The measures recommended for BMP include maximum pellet applications and dosage rates per hectare; not applying pellets within a minimum of 10 metres of any field boundary or watercourse; and not applying pellets when heavy rain or strong wind

is forecast (Metaldehyde Stewardship Group, 2020). Through addressing farmers' behaviours regarding the implementation of BMP it is anticipated the affects from diffuse pollution at the catchment scale will be mitigated (Blackstock et al., 2010; Kay et al., 2012).

Over the past decade, researchers and policy makers have increasingly pursued new strategies to influence farmers' behaviour needed to tackle agricultural diffuse pollution (Blackstock et al., 2010; Vrain et al., 2014). Payment for Ecosystem Services (PES) is one approach that has gained popularity in this respect. Through PES, payments are offered by those who recognise and receive the benefits of the services provided by the environment ('buyers') to individuals or groups of farmers ('sellers') as incentives to engage in activities that support environmental improvement and the delivery of the specific ecosystem services (Morrison and Aubrey, 2010). While there is a wealth of accumulated knowledge in the theoretical and experimental fields related to PES, it remains uncertain how PES theory translates into practice to encourage and sustain improved behaviours (Prokofieva, 2016). Moreover, the studies that do exist tend to relate to developing countries which have different environmental and social contexts to the UK (Cook et al., 2017). It is therefore vital to comprehend examples of PES existing in the UK to assist future PES schemes applied in the country. To help organisations that facilitate such schemes increase farmer engagement and provide advice that better resonates with farmers, Mills et al. (2016) propose a better understanding of farmer decision-making behaviour is required. There has also been a call for more studies into how the behaviour of social referents (i.e. those highly connected and persistently prominent in a group) influence farmer behaviour (Espetvedt et al., 2013), particularly key advisors (Rose et al., 2018a), as the level of farmer engagement in schemes is considered to be strongly determined by the nature of their relationships with these individuals (Mills et al., 2016). In the Thames river basin, Thames Water (a private water utility company in the UK) have applied a PES approach with the aim of encouraging farmers to implement behaviours that mitigate agricultural diffuse pollution from metaldehyde. Le Moigne and Short (2019) conducted a desk study into Thames Water's metaldehyde mitigation projects in the Upper Thames, providing an overview of their PES scheme and its management outcomes. This master's study develops this previous research and addresses the research gaps mentioned by gaining insight into farmers' decision-making behaviour in consideration of Thames Water's PES scheme.

1.1 Thames Water's PES scheme

The Thames river basin located in Southern England encompasses 16,200km² of land (including 18 tributary catchments) draining into the river Thames (Figure 1). Covering 57% of its total area, arable agriculture is the catchment's main land use (Lu et al., 2017). Via the river Thames, Thames Water supply drinking water to around 15 million people (Thames Water, 2020).

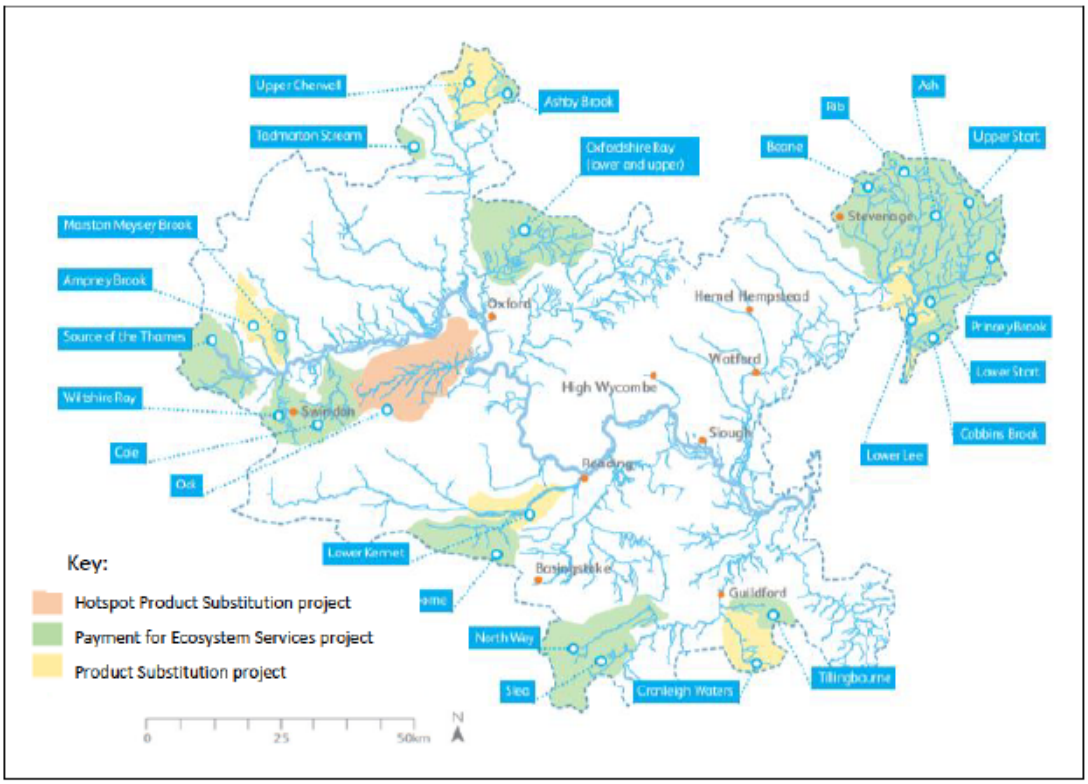


(Environment Agency, 2016)

Figure 1: Location of Thames river basin

Since 2013, Thames Water has implemented a range of metaldehyde mitigation projects in the Thames catchments where historical recordings of metaldehyde concentrations have frequently exceeded the UK's legal drinking water allowance (0.1 µg/l). The most common project they provide is their PES scheme (Figure 2). Through such initiatives Thames Water collaborates with rural communities and incentivises farmers to improve water quality through better land management practices that mitigate pollution from metaldehyde (Thames Water, 2018). This is with the aim of reducing metaldehyde levels below 0.1 µg/l in the river

catchments from which Thames Water abstract, thus negating the need for new or improved water treatment facilities.



(Thames Water, 2019)

Figure 2: Thames Water's metaldehyde mitigation projects 2019-2020

Farmers eligible to participate in Thames Water's PES scheme are defined as someone who runs a non-organic farm with land in arable rotation inside one of Thames Water's project areas. Although Thames Water has a desire for a degree of reassurance regarding water quality in the catchment, the decision to participate in the scheme is voluntary and the nature of the PES approach permits the farmer to decide what measures they implement to keep the water clean. The options include:

- Implementing practices, such as **integrated pest management** and **cultural controls,** that remove the need for slug pellets;
- **Spring cropping instead of autumn cropping** to avoid needing slug control in the most high-risk season for water quality;
- Taking a **risk-based approach** to slug pellet application;

- Only **using the minimum dose** of metaldehyde slug pellets required to control the slug problem;
- Using **ferric phosphate as an alternative** slug pellet if chemical control is required.

The PES approach employed by Thames Water is a 'one-to-many' 'output-based' scheme, where payments are provided by one buyer to multiple sellers in receipt of actual ecosystem services provided (Smith et al., 2013). The scheme works by Thames Water collecting weekly water samples at the downstream end of each catchment throughout the high-risk season (typically 12 times between September and December) to measure the concentration of metaldehyde in the water. As it stands, for each water sample that is clean (i.e. contains less than 0.1µg/l of metaldehyde) participating farmers earn a maximum of £1/ha of arable land they have within the project catchments. For any water samples with levels exceeding 0.1µg/l the farmers do not earn a payment (i.e. the payment is not added to the total payment farmers are rewarded at the end of the season). It is important to highlight the rate of payment has decreased with the development of the scheme (Table 1). It is also worth noting that the payment rate does not reconcile the cost difference for substituting metaldehyde (£10-15/ha) with ferric phosphate (£20-25/ha) as a slug management tool (ADAS UK Ltd, 2010), a method recommended to farmers to mitigate metaldehyde diffuse pollution.

Table 1: Development of Thames Water's PES scheme payment rate

Year	Calculation of PES payment
2013	**Exploration of the concept of PES**
2016	Amount of clean water produced by the waterbody
2017	£2/ha of arable land, based on the proportion of clean water samples
2018	£2/ha of arable land, based on the proportion of clean water samples
	£1/ha of arable land, based on the proportion of clean samples
2019	£1/ha of arable land, based on the proportion of clean samples

If all weekly samples are clean, each farmer who takes part receives an additional bonus payment of £250. Farmers are also paid an extra £100 for enrolling into the project if it is their first year of involvement. Further, by participating in the project farmers are entitled to receive on-going farm advice and a funded consultancy visit. To provide this advice and facilitate the PES agreements, Thames Water has employed four different project partners across the Thames catchments. This presented the opportunity to compare these different organisations in their facilitation of the scheme and their influences on farmers' decision-making behaviours.

1.2 Aims and objectives

The aim of this study was to understand the factors that influence farmers' decision-making behaviour considering their participation in Thames Water's PES scheme.

To achieve this aim, the specific objectives were:

1. To identify the drivers and barriers for farmers' decisions to participate in Thames Water's PES scheme;
2. To analyse the approaches used by the different project partners to support Thames Water's PES scheme in mitigating metaldehyde diffuse pollution by gaining sufficient participation and the provision of advice; and
3. To assess how the farmers and project partner advisors perceive the success and sustainability of Thames Water's PES scheme in changing farmers' behaviours and attitudes towards metaldehyde.

1.3 Thesis Structure

This thesis is divided into six chapters as set out in the table of contents. After this introductory chapter, Chapter 2 reviews the relevant literature concerning agricultural diffuse pollution, the PES approach for conserving water quality and farmer decision-making behaviour. Chapter 3 describes the research design and methodology, introducing the catchments and project partner organisations studied, and the methods used to collect data and the analysis that followed to achieve the research aim and objectives. In Chapter 4 the results from the analysis are presented and discussed, followed by Chapter 5 where the key findings of the results are

considered alongside the literature and their implications evaluated. Finally, Chapter 6 concludes this thesis by summarising the study's main conclusions, provides practical guidance for the future development of PES schemes and makes recommendations for future research on reflection of the study.

Chapter 2: Literature Review

In this chapter, the existing knowledge and literature concerning this study is reviewed in four parts. The first introduces the concern of agricultural diffuse pollution from pesticides and the management initiatives in the UK tackling it. The second section explains the theory of PES and contextualises the PES approach used by Thames Water. It then continues by presenting the role of intermediaries and financial incentives within a PES approach. The third section describes the factors considered in the literature to influence farmer decision-making behaviour regarding their participation in subsidised and unsubsidised environmental activities. Finally, the section reviews how research within the field has investigated farmer decision-making behaviour and rationalises the approach this study used to investigate the factors that influence farmers' decision-making behaviour considering their engagement in Thames Water's PES scheme.

2.1 Agricultural pesticide diffuse pollution

The application of agricultural chemicals, collectively known as pesticides, play a vital role in reducing crop losses and increasing agricultural production (Winter, 2003; Zhang et al., 2018). Since the mid-20th century there has been a worldwide shift towards greater monocultural and intensively operated farms in response to increasing populations and their consequential food demands. Accordingly, farm yields have dramatically increased along with large applications of fertilisers and pesticides (such as metaldehyde) needed to sustain this level of productivity (Novotny, 1999). As the treatment of pesticide levels in agriculture has intensified and detection methods have improved, so too have the rates of agricultural diffuse pollution from pesticides observed in surface and groundwaters (Croll, 1991). In turn, agricultural diffuse pollution has become a major concern as it affects the ability of water bodies to provide ecosystem services and functions (Patterson et al., 2013).

Diffuse pollution from agricultural land derives from extensive areas and reaches watercourses diffusely through various trails including drains, surface runoff and ground waterflow (Asfaw et al., 2018). In contrast, point source pollution represents events where pollutants are released directly into receiving waterbodies, such as through discharge pipes (Ongley, 1996). The

mobilisation of these diffuse releases occurs intermittently, typically simultaneous with weather events (D'Arcy, 2013). Each individual pollutant source may not cause a major problem, however when they combine and accumulate the full potential of the issue is revealed (Aukerman, 2004). Therefore, unlike point source pollution, diffuse pollution is difficult to predict, monitor and control as the specific location of the pollutant source is rarely identifiable (Carpenter et al., 1998; Campbell et al., 2005). The substantial challenges presented by diffuse pollution, in addition to the inadequacy of current WTW on some pollutants (e.g. metaldehyde) (Lu et al., 2017), has meant that remedial action has not been enough to counter the degradation of freshwater ecosystems (Collins et al., 2018). Hence, it is generally considered that managing diffuse pollution is most appropriately tackled via prevention rather than cure (Holden et al., 2017).

2.1.1 Initiatives tackling agricultural diffuse pollution

Although agriculture is not the only human activity to cause diffuse pollution (e.g. urban land, roads, housing, forestry and industrial activities can also be significant sources), it is generally observed as its main contributor (Collins et al., 2018; Dolan et al., 2012). With farmers' behaviours fundamentally influencing environmental quality and ecosystem service provision (Steg and Vlek, 2009), it is considered necessary to improve their behaviour to reduce the effects from diffuse pollution in waterbodies (Blackstock et al., 2010; Kay et al., 2012; Okumah et al., 2018). Substantial efforts and resources (including regulatory, guidance and voluntary actions) have been and continue to be used with this aim in mind. Despite regulatory command-and-control strategies (whereby governments set limits on a class of pollutants) being typically efficient in the regulation of point source pollution, they are less efficient in controlling those originating from diffuse sources (Lubell et al., 2002). Therefore, researchers and policy makers have increasingly pursued strategies to influence farmers' voluntary behaviour to mitigate agricultural diffuse pollution at source (Blackstock et al., 2010; Vrain et al., 2014). The 'Voluntary Initiative' (voluntaryinitiative.org.uk/), MSG (see Chapter 1) and the Catchment Sensitive Farming (CSF) programme (see Section 3.1.2) are some examples of initiatives in the UK that have sought to encourage voluntary action from farmers to control diffuse pollution at source by advising and educating them on BMP. Additionally, government-funded grants and agri-environment schemes (AES) (such as Countryside Stewardship) have

financially incentivised farmers to consider the environment, including water quality, in their decision-making (Dolman et al., 2012). Despite these efforts, agricultural diffuse pollution remains a persistent concern in the UK (Ibrahim et al., 2019).

Catchment scale approaches are considered best for tackling diffuse pollution issues and are promoted by the EU's Water Framework Directive (WFD) (Asfaw et al., 2018). Using a catchment's geographical boundary to define the project area, catchment management is a multi-stakeholder approach that considers multiple interdisciplinary resources (e.g. water, soil, air, land and biodiversity) as interconnected (Stewardson et al., 2017). Taking a spatially managed approach avoids overlapping and ignoring interests of stakeholders as likely with a more traditional fragmented approach (Cooke et al., 2020). Therefore, alongside environmental advice initiatives, this approach has been taken through local governance arrangements within landscape partnerships and catchment management initiatives (Mills et al., 2016). In addition to government bodies, water companies in the UK have increasingly turned to catchment scale strategies to reduce diffuse pollution at source. Indeed, such approaches have proven successful at managing the source of diffuse pollutants (Zhang et al., 2017; Melland et al., 2018; Davey et al., 2014), diminishing the necessity for economically intensive treatment solutions that only work as 'end-of-pipe' solutions (Ibrahim et al., 2019).

In the context of metaldehyde mitigation, an approach commonly used by water companies (including Thames Water) for mitigating metaldehyde levels observed at catchment level is product substitution. In such schemes, farmers are incentivised to substitute the use of slug pellets that contain metaldehyde for those that contain ferric phosphate (which are less environmentally damaging but more expensive (ADAS UK Ltd, 2010)). This works by water companies specifically providing farmers with payments to cover their costs of using the more expensive product (Ibrahim et al., 2019). However, by only subsidising one activity it is recognised the approach limits the practices available to farmers and so limits the potential improvement and sustainability of reduced pollutant levels observed in watercourses (Cooke et al., 2020). Thus, UK water companies have become increasingly interested in a more holistic PES approach to incentivise farmers' voluntary action to reduce metaldehyde diffuse pollution and improve water quality (e.g. Cooke et al., 2020; Le Moigne and Short, 2019).

2.2 Payments for Ecosystem Services (PES)

Termed as *"the benefits provided by ecosystems that contribute to making human life both possible and worth living"*, 'ecosystem services' as a concept has become progressively popular amongst academics and decision-makers as an approach to assign value to nature and direct decisions for environmental management (UK National Ecosystem Assessment, 2012, p.1). Economics have largely contributed to the publicisation and politicisation of ecosystem services, playing a key role in its development as an explicitly human-valued concept (Pesche et al., 2013). Still, the question remains, why do we need to value ecosystem services? In the late 1990s, scholars such as Daily (1997) and Constanza et al. (1997) defended the economic valuation of ecosystem services through their publications with the rationale *"we don't protect what we don't value"* (Myers and Reichert, 1997, p. xix). Since then, an extensive literature on ecosystem services and their economic appraisal has developed (e.g. Freeman, 2003; Aronson et al., 2007). As monetary considerations are thought to positively influence decision-makers' behaviour, applying an economic valuation to the environment has commonly been used in environmental policies (Froger et al., 2015). The growing popularity of the ecosystem services concept in policymaking is summarised by Daily and Ellison (2002) as the 'new economy of nature'.

PES is one approach used to measure and assign economic value to ecosystem services and incentivise local actors to contribute to their provision. In recent decades the use of PES as an instrument to promote and provide management of ecosystem services is a concept that has progressed from economic theory, to policy debate and ultimately into practice (Porras et al., 2013). As one of a set of market-based policy approaches, the idea of PES encourages service providers through economic incentives to implement environmentally sustainable production practices. Yet, unlike other schemes which subsidise sustainably produced products within existing commodity markets (e.g. government subsidies and certification), PES is different in that it sets up the direct purchase of ecosystem services through the creation of new separate markets (Wegner, 2015). In PES schemes, this is achieved through those who recognise and receive the benefits of the services provided by the environment ('buyers') offering payments to individuals or groups of landowners ('sellers') as incentives to engage in activities that support environmental improvement and the delivery of the specific ecosystem services (Morrison and Aubrey, 2010). Therefore, PES schemes assume the 'beneficiary-pays' principle

rather than the 'polluter-pays'. Due to the nature of natural resources requiring collective management, multiple land users are responsible for the fulfilment of the PES contract (Kaczan et al., 2017). Similarly, multiple buyers may provide the PES project and contribute to these monetary rewards.

A definition commonly cited for PES is provided by Wunder (2005):

> "... a voluntary transaction where ... a well-defined ecosystem service (or a land-use likely to secure that service) ... is being 'bought' by a (minimum one) ecosystem service buyer ... from a (minimum one) ecosystem service provider ... if and only if the ecosystem services provider secures ecosystem services provision (conditionality)".

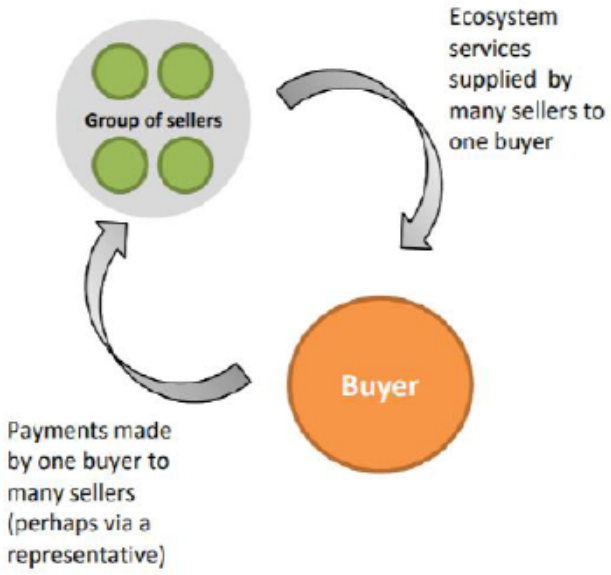
Wunder's definition of PES is linked closely to Coase's theorem (e.g. Coase, 1960) which assumes that, provided certain conditions, the issues of external effects (externalities) can be overcome via direct and private negotiation between the impacted parties irrespective of the original distribution of property rights (Sattler and Matzdorf, 2013). Yet, much academic debate surrounds the Cosean conceptualisation of PES and Wunder's definition has been widely disputed. For instance, Vatn (2010) argues that its criteria are too restrictive, especially regarding the voluntary aspect, as it results in the exclusion of schemes that involve government intervention as they cannot be viewed as voluntary transactions. Therefore, following the Pigouvian conceptualisation of PES, various forms of PES or PES-like (assisted or financed by government interventions) schemes exist. Focusing on these sources of funding, PES and PES-like schemes have been categorised into three broad types:

- private payment schemes, through privately organised transactions in which resource providers and beneficiaries of ecosystem services deal directly;
- public payment schemes, whereby the government disburses service users to improve ecosystem services on behalf of the public; and
- public-private payment schemes, which are funded by both government and private in order to pay service providers for the provision of ecosystem services (Smith et al., 2013).

Although historically PES schemes have been very popular in developing countries (chiefly those in Latin America) (Schomers and Matzdorf, 2013; Martin-Ortega et al., 2013), versions of what some academics consider as PES have been widely implemented across Europe, the United States and Australia (Ezzine-de-Blas et al., 2016; Kumar et al., 2014). One example

includes the EU's Common Agricultural Policy AES, where EU and national governments mutually offer funds to farmers in exchange for certain management practices (Thomson et al., 2014). These arrangements support an 'input-based' scheme (where payments are given in receipt of the implementation of specific land or resource management practices), as opposed to an 'output-based' scheme (where payments are given in receipt of actual ecosystem services provided) (Smith et al., 2013). Therefore, although conceptually similar, AES do not fit Wunder's (2005) definition of PES as the provision of payment is not conditional on the delivery of ecosystem services being secured.

Watershed protection PES schemes are one of the four main types of PES to emerge (Wunder, 2005). Often operating within one or a few targeted service areas or watersheds, PES schemes at catchment scale tend to be privately financed through direct market arrangements between private buyers and sellers. This is fitting with the 'true' market definition that supports the Cosean vision of PES (Kroeger and Casey, 2007). For instance, a water utility company paying upstream farmers on behalf of its customers to apply specific measures that result in the conservation or enhancement of water quality, as is the case with Thames Water's PES scheme. In such circumstances, this denotes a 'one-to-many' PES approach as one buyer (i.e. Thames Water) is paying multiple sellers (i.e. farmers) for the provision of enhanced water quality (Figure 3). By operating at smaller scales, private payment schemes are usually adapted to local influences and external factors, have better monitoring (which permits the execution of output-based schemes) and are less likely to be orientated towards political objectives, as compared to schemes with government intervention (Thomson et al., 2014).



(Smith et al., 2013)

Figure 3: Configuration of a 'one-to-many' PES scheme

Still, whilst the idea of PES is appealing, many have argued it is characteristically problematic due to its need to commodify nature. In this regard, the most instinctive and common criticism surrounding ecosystem services derives from ethical concerns with it maintained that some aspects of nature ought not to be for sale (McCauley, 2006). Ecological economists have critiqued the neoclassical conceptualisation of environmental values and reason the insufficiency of quantifying some values through a single measurement such as money (Martinez-Alier et al., 1998; Schulz et al., 2017). Others highlight feelings of risk towards oversimplifying ecological, economic and political processes through the use of the ecosystem services idea (Norgaard, 2010; Martin-Ortega et al., 2019). Therefore, whilst the notion of PES is attractive, it is conceptually and politically sensitive.

2.2.1 Intermediaries in PES

To help facilitate PES schemes, intermediaries are often employed to play an important role in both the set up and running of the schemes (Muradian, 2013). A range of professionals can act as intermediaries in PES either acting alone, as part of an organisation, or as a collaboration of collective groups that are by some means connected to the different PES stakeholders (Huber-Stearns, 2012). These are usually located within, but are not limited to, the public (e.g.

government), private (e.g. consulting firms) and civil society (e.g. non-governmental organisations) sectors and range from local to international scales (Kemkes et al., 2010; Swallow et al., 2009). Like the name suggests, intermediaries act as a go-between for groups or actors involved in PES schemes by bridging the knowledge gap between them (Vatn, 2010; Pham et al., 2010). Of most relevance to this study, these professionals often operate as a trusted and authoritative source of information and influence the behaviour of the PES stakeholders (Swallow, et al., 2009). For these reasons the role of intermediary role is considered a critical element for the success of a PES scheme (Environment Analysis Unit, 2016).

Despite the importance of these individuals, most research that assesses the practices, roles or effectiveness of intermediaries do not exceed theoretical considerations (Huber-Stearns et al., 2013; Pham et al., 2010; Bosselmann and Lund, 2013). Additionally, such studies have generally focused on PES schemes in developing countries where the actors and procedure involved can be constrained by factors such as income, capacity and other developmental impacts (Cook et al., 2017). There has also been little direct research attention towards the views of the professionals expected to carry out or already employed in these intermediary roles. Recently, Waylen and Martin-Ortega (2018) have sought to reduce these gaps by investigating the views of individuals working on environmental management who are anticipated to assume these intermediary positions. Their study revealed these individuals have inconsistent understandings of PES and uncertainty surrounding how best to facilitate the schemes. One major theme identified in the study as requiring additional research comprised topics concerning behaviour, persuasion and partnership working in PES. This thesis aims to address some of these knowledge gaps, namely those concerning the promotion/facilitation of PES to new audiences and approaches for effectively encouraging cooperation amongst participants.

2.2.2 Financial incentives

Conditional payments are a central theme in PES as they act to incentivise stakeholders to implement positive environmental behaviours that would otherwise not occur if there were no payments (Ferraro and Kiss, 2002; Sommerville et al., 2010). These payments are usually set up as cash rewards or incentives (Muradian, 2013). The form of direct payment is predicted to be

a more cost-effective way of funding improved stewardship of ecosystem services in comparison to indirect ways for achieving environmental and development goals (Ferraro and Simpson, 2002). The reliability and stability of these direct payments is important and often results in actors agreeing to receive lesser payments than they would accept from more unstable schemes that lack conservation goals (Kumar et al., 2014).

Kosoy et al. (2007) highlight that in order to work effectively the payments provided to upstream landholders in PES schemes should be at least equal to the 'opportunity cost' of the promoted land use (i.e. the cost of the behaviour change needed to improve water quality) but lower than the economic value of the environmental externality. Therefore, in instances where farmers are influenced by economic motivations, PES payments will help to reduce the loss in revenue as a result of implementing practices which will provide the ecosystem services. This is expected to result in improved socio-economic productivity (Pascual et al., 2010) and, in watershed schemes, encourage stakeholders upstream to be mindful when making choices about their own land use of the downstream effects they could cause (Kosoy et al., 2007). It is also anticipated the PES approach will provide an increased recognition for the value of many nature services generally taken for granted, both socially and economically, whilst simultaneously raising awareness of service existence and human effects, as well as improve the social relation between buyers and sellers (Thomson et al., 2014). However, recent studies, namely from in the Global South, have maintained the inappropriateness of schemes which only pay participants for the cost of delivering environmental services. Instead, they argue that a more constructive investment of resources is necessary which supports production opportunities and improves cultural capital as it is seen to improve the sustainability of the community (Kosoy et al., 2008; McAfee and Shapiro, 2010; Muradian et al., 2010). Hence, as well as paying land users, PES schemes often deliver non-monetary benefits including access to training, technical assistance, infrastructure improvements as well as access to expert advisors (Thomson et al., 2014), the latter being a key feature in Thames Water's PES scheme (see Section 1.1).

Through establishing incentives to encourage behaviour change, PES as a tool for environmental policy is more of a 'soft' or 'hands-off' approach for endorsing environmental conservation, acting to 'nudge' farmers to voluntarily change their behaviour (Runhaar et al., 2014). Thaler and Sunstein (2008) define a nudge as *''any aspect of the choice architecture that*

alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives" (p.6). Moreover, it is suggested that if a behaviour is assumed voluntarily it will likely persist over time (Ayer, 1997). Still, for as long as the concept of PES has existed, concerns about the behavioural implications of the approach relying on economic incentives to improve behaviour have been raised (Prokofieva, 2016). Although economic theory suggests enhanced performance will occur as a result of increasing the monetary incentives provided for an activity (Engel and Palmer, 2008), there is concern whether creating a precedent of payment will effectively change farmers' attitudes and result in positive results persisting beyond the scheme's duration (Hayes, 2012). Adding fuel to this concern, emergent evidence has suggested that similar voluntary incentive-based schemes (i.e. AES) in Europe are only having a limited, if any, effect on farmers' behaviours long-term (Burton and Paragahawewa, 2011). Further understanding from the literature concerning the impact of financial incentives, as well as other influences, on farmers' motivations and behaviour is provided later in Section 2.3.2.

2.3 Farmer decision-making behaviour

As a rural business sub-group, farmers have different motivations, behaviours and experiences compared to non-farmers. This is thought to be because farmers are often influenced strongly by tradition, such as through the desire for family succession of the farm (Gasson and Errington, 1993; Kuehne, 2014), as well as the cross-over between the farm in both personal and business contexts. Such influences result in a large variety of complex issues playing a role in the way they make business and broader management decisions (Ingram et al., 2009; Fish et al., 2003; Gasson, 1973; Morris and Potter, 1995). There is also consensus that environmental decision-making varies spatially due to diverse farming systems (Mills et al., 2016). As Siebert et al. (2006) posit, farmers' behaviour is a result of an interplay of intricate factors encompassing those which are agronomic, cultural, social and psychological interwoven in national, regional and specific farm contexts. Recognising that it is both these internal and external factors that impact an individual's responses, a main theme in the literature is the examination of the link between farmers' willingness (internal factors) and ability (external factors) to adopt behaviours.

2.3.1 Ability

Assessing farmers' ability to participate in AES, studies have found farm structural and management factors, such as farm size (Ahnström et al., 2009; Wilson and Hart, 2000), farm type (Wynn et al., 2001), time and labour (Dwyer et al., 2007), land tenure (Defrancesco et al., 2008), finance and profitability (Gasson and Potter, 1988; Dwyer et al., 2007) to influence farmers when making decisions about how to manage their farm. Farm household factors including age, level of education and length of residency (Wilson, 1996), as well as succession plans (Potter and Lobley, 1996), have also been found to largely influence farmers' participation in AES.

The literature suggests scheme characteristics also have a significant effect on farmers' ability to participate. Across Europe, research into several schemes have emphasised a positive relationship between farmers' participation in a scheme and the land management practices it requires fitting with their farm's existing management (Lobley and Potter, 1998; Wilson and Hart; 2000; Burton et al., 2008). When the practices needed to comply with the scheme are already existing on the farm, motivations for financial gain have been found to come into play (Van Herzele et al., 2013). Fish et al. (2003) describes this as an 'opportunist style of participation' as the scheme is viewed as an opportunity to earn extra income through little investment or work. Similarly, farmers are inclined to participate if the practices required of the scheme are easy to implement (Defrancesco et al., 2008; Ruto and Garrod, 2009; Niens and Marggraf, 2010).

2.3.2 Willingness

Behaviour is commonly assumed to partially stem from an individual's attitude (Albarracin et al., 2018). Core to an individual's attitudes is their personal beliefs and norms, influenced by their individual circumstances and characteristics. Hence, these are considered a key factor for determining farmers' behaviour (Rose et al., 2018b). These factors have also been found to affect farmers' self-identity (referring to how they view themselves as farmers) and general farming philosophy (Mills et al., 2016). The significance of farmers' motivations has been recognised in studies seeking explanations for farmers' voluntary behaviour, such as their decisions for undertaking conservation practices or participating in environmental schemes and activities (e.g. Greiner, 2015; Mills et al., 2018; Wilson and Hart, 2000). Depending on their

source, motivations are categorised as either 'intrinsic' or 'extrinsic'. Legault (2016) describes 'intrinsic' motivation as the desires of interest or enjoyment directly related to the individual's attitudes, values and beliefs. These intrinsic motivations lack an apparent reward other than the action itself. On the other hand, 'extrinsic' motivations are referred to as behaviours that are made in order to accomplish an outcome that is separate from the activity itself, such as to earn a reward.

It is thought that behaviours driven by intrinsic motives are more durable and resilient than those motivated by extrinsic reasons (Deci et al., 1999; Vilnai-Yavetz and Levina, 2018). Likewise, studies stress farmers need to be intrinsically motivated to adopt sustainable management activities to warrant the sustainability of improved environmental results (Matzdorf and Lorenz, 2010; Van Herzele et al., 2013; De Snoo et al., 2013). Intrinsic motivations are often revealed in an individual sense of accountability and responsibility for the environment, described by Frey and Stutzer (2008) as 'environmental morale'. Wilson and Hart (2000) found that there is a tendency for farmers to express more conservation-oriented motivations for participating in nature conservation practices. Presented as the 'new hypothesis', this discovery led them to argue these motivations deserved more attention from researchers interested in farmers' environmental decision-making behaviour. Since then, several studies have identified farmers' personal interests towards wildlife and devotion to the natural environment as intrinsic motivations for environmental activities (Jacobson et al., 2003; Herzon and Mikk, 2007; Mills et al., 2018). Farmers who perceive the significance of custodianship have also been found to have a positive attitude to environmental management activities (Mills et al., 2016). Beedell and Rehman (2000) suggest that the decisions of farmers who are members of environmental advisory groups are more inclined by conservation-related concerns. Intrinsic motivations might also concern impacts of social standing or reputational advantages, or feelings of moral responsibility (Burton and Paragahawewa, 2011).

Although considered more durable and resilient than extrinsic motivations, it is argued that intrinsic motivations can be weakened or overpowered by them (Ryan and Deci, 2000). As touched on in Section 2.2.3, experimental and behavioural research surrounding behaviour change has revealed a complex relationship between intrinsic and extrinsic motivations relating to financial incentives (Prokofieva, 2016). For activities where there is no ethical obligation or pre-existing motivation, the positive incentive of payments is expected to work

(Bowles and Hwang, 2008). Conversely, economic incentives can be less effective or even counterproductive among those who are entirely intrinsically motivated (Bowles and Polania-Reyes, 2012). The term used to describe when the force of a person's intrinsic motivation is lessened by their extrinsic motivation of gaining financial reward is 'crowding-out' (Neuteleers and Engelen, 2015). To reduce the potential for this effect occurring in PES arrangements, Ezzine-de-Blas et al. (2016) propose the payments provided through PES schemes should be designed so that they are viewed by the participants as an appreciation for their efforts. Moreover, it is advised that conservation programs consider the wide range of influences and aspirations of farmers in their design process to maximise their effectiveness and to minimise crowding out altruistic actions and intrinsic motivation (Greiner and Gregg, 2011).

There is limited literature concerning farmers' motivations for undertaking unsubsidised environmental activities. The research that does exist is of particular interest to this study as the payments offered through Thames Water's PES scheme are conditional on the farmer's local watercourse achieving metaldehyde levels below 0.1 µg/l and therefore not guaranteed. Work by Lokhorst et al. (2011) and Van Dijk et al. (2016) investigating farmers' motivations in this regard highlighted intrinsic motivations associated with farmers' personal norms and self-identity are significant in influencing their behavioural intentions. Building on this work, Mills et al. (2018) investigated farmers' motivations for undertaking unsubsidised environmental activities as compared to those for undertaking subsidised environmental activities. Their study found agronomic (soil management and crop production) and environmental motivations are more important motivations for farmers to undertake unsubsidised activities while financial reasons dominated their motivations regarding subsidised activities. Social concerns about pollution and its reputational impacts were also found to significantly motivate farmers to undertake unsubsidised environmental activities. Likewise, wishes to conform with social norms (Mills et al., 2016) and societal wishes (Beedell and Rehman, 2000; Karali et al., 2014), as well as to improve their social image (Michel-Guillou and Moser, 2006; Atari et al., 2009), have been found to influence farmers' pro-environmental behaviour.

2.3.3 Family, peers and advisors

As touched on above, farmer behaviour is not only determined by individual traits, but is also significantly influenced by other people. Studies have generally found the opinions of family,

friends, peers, trusted farm advisors and subject professionals are extremely persuasive to farmer decision-making behaviours, shaping what farmers perceive as the social norms for farm management (Rose et al., 2018b). In terms of AES and adoption measures, private advisors have been found to positively impact farmers' decisions through their promotion of AES measures (Lastra-Bravo et al., 2015; Niens and Marggraf, 2010). Receiving good information, along with clear communication, has also been found to increase farmers' perceived behaviour control (i.e. farmers feeling like they can do something) (Rose et al., 2018b). Thus, these trusted actors can influence farmers' behavioural decisions through their views and delivery of formal or informal advice, or through social pressure. It is also suggested that farmers are more eager to adopt a management scheme if they think enough of their peers would similarly do so (Kuhfuss et al., 2016). On larger farms evidence indicates that family members have a particularly significant influence on the decisions being made (Burton and Wilson, 2006; Blackstock et al., 2010).

Farmers' farming neighbours, local community and social networks play a significant role in motivating farmers' decisions to participate in AES (Ingram et al., 2009). Given that more continuous, robust and long-term behaviour change is needed, the literature advises that engagement with advice and support networks assist in creating interest and responsibility for what is the norm, both in personal and social senses (Dwyer et al., 2007; Pike, 2013). In the UK, this approach has been taken with farmers having increasingly engaged in environmental advice with local governance arrangements, including landscape partnerships and catchment management initiatives (Mills et al., 2016) (see Section 2.1.1). These approaches aim to alter farmers' social norms through the activities of group sharing and learning in addition to making individual farmers' farming practices more visible amongst their peers to re-establish the suitable standards for appropriate behaviours (Barnes et al., 2013). Such methods have been found to be successful in improving farmers' awareness and knowledge concerning the subject of diffuse water pollution (Sabatier et al., 2005; Mills et al., 2008). It is expected that this increased awareness will direct behaviour change towards the adoption of BMP and ultimately result in enhanced water quality. However, mixed evidence concerning the relationship between improved awareness and behaviour change and the impact it has on water quality exists in the literature (Okumah et al., 2018).

2.4 Approaches for farmer decision-making behaviour research

Research into farmer behaviour and decision-making has been prominent in agricultural studies. In the subject a strong focus has been on understanding the reasons behind farmers adopting or not adopting practices or technologies, as well as identifying what policy measures are aimed at farmers to encourage their behaviour change (Rose et al., 2018b). Since Gasson (1973) first suggested that farmers do not always make decisions based wholly from an economic rational, but alternatively they may put greater emphasis on social and personal factors, it has become recognised that farmers' motivations for their behaviour is not just for financial benefits (Garforth, 2015). In the following decades research into farmers' behaviour focused on the socioeconomic and structural factors that act as the driving forces to encourage farmers' decisions to participate in environmental behaviours (Defrancesco, 2008). Following the cultural turn[1], theoretical developments from the social sciences reflected a greater attention being put on research into agricultural behavioural change that is more culturally informed (Morris and Evans, 2004; Woods, 2004). This research recognised the necessity of comprehending the social and cultural characteristics affecting farmers in order to understand their behaviour (Burton, 2004). More recently, a clear line of enquiry into farmer behaviour studies is through the use of behavioural principles, focusing on the influence of farmers' attitudes and motivations, to explain farmers' decision-making behaviour (Ruto and Garrod, 2009; Defrancesco et al., 2008; Mills et al., 2018).

The 'behavioural approach' has become progressively significant in rural studies interested in understanding farmer response to things such as policy initiatives (Burton, 2004). In the context of farmer behaviour, this is one that emphasises individual farmers' willingness to change their behaviour by examining personal attributes including their motives, attitudes, perceptions and values that influence their decision-making processes (Morris and Potter, 1995). Thus, by applying a more social and psychological theoretical approach the simplicity of research using structural factors to explain farmer behaviour is counteracted. Due to its applicability and practicality in different contexts, the theory most commonly used to inform empirical research in the context of farmer decision-making behaviour is the Theory of Planned Behaviour (TPB),

[1] A trend emerging since the late twentieth century which has seen the humanities and social sciences increasingly focus on culture (Aitken and Valentine, 2006).

which is developed from Fishbein and Ajzen (1975) Theory of Reasoned Action (Michie et al., 2014; Davis et al., 2015; Rose et al., 2018b). The TPB attempts to predict and understand behaviour by measuring the underlying determinants of that behaviour with the assumption that an individual's behavioural intentions are determined by three variables: personal attitudes (behavioural beliefs), subjective norms (social influences) and perceived behavioural control (the extent to which an individual perceives ability to perform a given behaviour) (Ajzen and Madden, 1986). Although the focus of the model is more on predicting behaviour than on how to influence behaviour, the TPB is still helpful as an analytical framework to explain farmer behaviour ex post (e.g. Schroeder et al., 2015).

Rose et al. (2018a) contend that methods more generally associated with the social sciences need to be adopted by studies concerned with farmer decision-making, allowing for a deeper understanding of what influences their behaviour and providing insight into how and why this is. It is posited that without this there is an increased risk of crowding out other systematic perspectives, such as political perspectives (Castree et al., 2014), in studies of agricultural behavioural change. This approach also allows the incorporation of stakeholders that assist in guiding and designing policies that are overall more reliable, suitable, relevant, and applicable in practice (Rose et al., 2018a). Taking this into consideration, this study adopted a qualitative approach to research to achieve a deeper understanding into the factors that influence farmers' decision-making behaviour considering Thames Water's PES scheme. This was to allow the researcher to gain insight from the farmers and the scheme facilitators (project partner advisors) involved in the scheme, needed to achieve the research aim and objectives.

Chapter 3: Methodology

This chapter describes the methods used by this study to understand the factors that influence farmers' decision-making behaviour considering Thames Water's PES scheme. The chapter is divided into four main parts. The first introduces the catchments and project partner organisations studied in this thesis. In the two sections following, the methods this study applied to collect and analyse data in reflection of its interpretivist research philosophy are presented. Finally, the validity and reliability of the research approach is assessed.

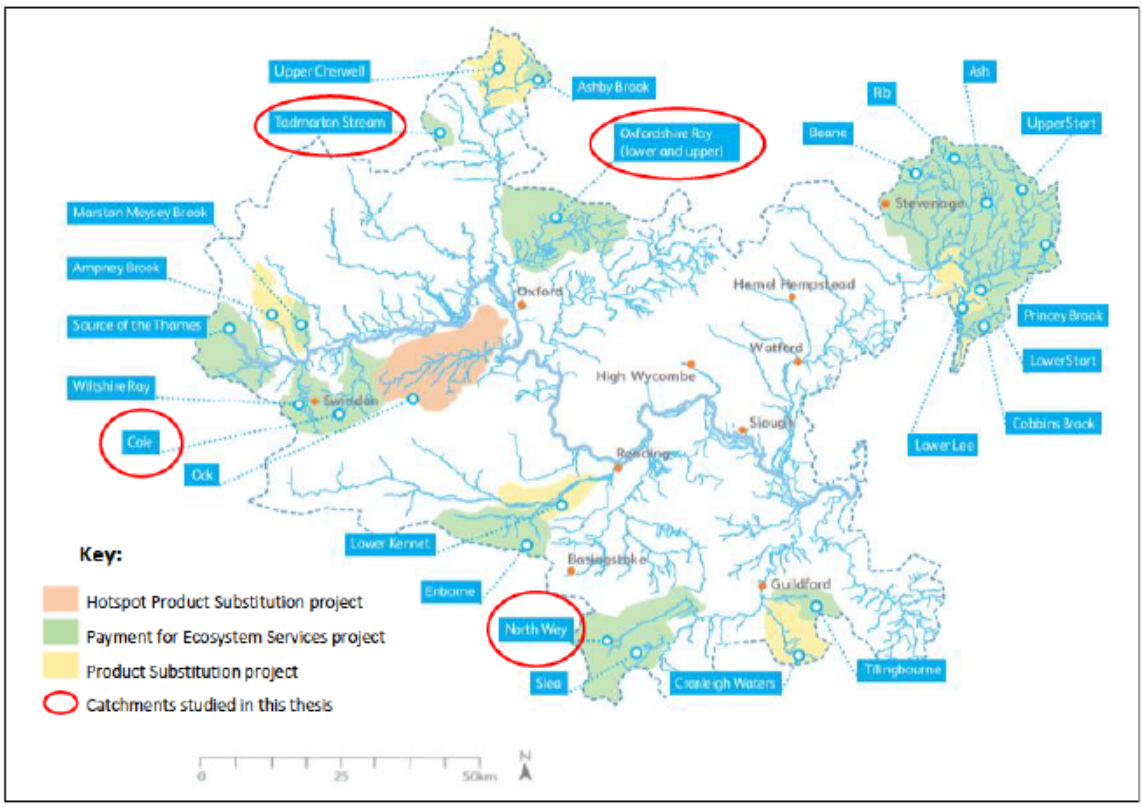
3.1 Study context

Thames Water has employed four different project partner organisations to facilitate and provide advice through their PES scheme across catchments in the Thames river basin (Appendix A). This presented the opportunity to compare the individual approaches taken by these different organisations and the influences they have on farmer decision-making behaviour concerning their participation in Thames Water's PES scheme and metaldehyde mitigation behaviours. The four catchments studied in this master's study were therefore selected as one of the four different project partners are responsible for facilitating the scheme in each. These project partners and their corresponding catchment are shown in Table 2 below. The locations of the study catchments are also indicated in the next section in Figure 4. The following three sections provide more detail concerning the catchments and the project partner organisations studied in this thesis.

Table 2: Project partner organisations and their assigned catchment

Project partner org.	Project partner org. type	Catchment
Farming & Wildlife Advisory Group	Farmer-led charity	Cole
Catchment Sensitive Farming	Government initiative	Lower Oxfordshire Ray
Promar International	Private consultancy firm	North Wey
Innovation for Agriculture	Research-led charity	Tadmarton Stream

3.1.1 Study catchments



(Edited from Thames Water, 2019)

Figure 4: Location of study catchments

Cole

The River Cole tributary is located in the Upper Thames catchment and drains the northern edge of the North Berkshire Downs until meeting the river Thames at Lechlade (Eden et al., 2000). Spanning 140 km², the catchment's land use is mainly arable agriculture apart from a significant urban development at Swindon draining into its headwaters (Hughes, 1992). The Cole catchment's geology is made up of a mix of sands, clays, chalk and limestone (Williams et al., 2004). This, along with the urbanisation in the upstream reaches around Swindon, results in the Cole having a rapid response to rainfall (Kronvang et al., 1998).

Lower Oxfordshire Ray

The River Ray is the main tributary of the River Cherwell and rises on the western slopes of Quainten Hill before flowing south-west and merging at Islip (Wild Trout Trust, 2014). The low gradient of the river, along with the geology of the catchment being predominantly clay, causes its flow regime to be very flashy and prone to prolonged flooding (Killingbeck et al.,

1989). The Oxfordshire Ray catchment spans a total of 287km^2. Yet, for their metaldehyde mitigation projects Thames Water has divided the catchment into two, designated by its upper and lower reaches. This research study focuses on the latter, termed the Lower Oxfordshire Ray catchment. Here, its main land use is agriculture and conservation management (McInnes et al., 2008), hence there are several SSSIs within the catchment including neutral floodplain grasslands and wet grasslands (Environment Agency, 2020a).

North Wey

The North Wey catchment spans an area of 137 km^2 (Environment Agency, 2020b). The River Wey is a southern tributary of the River Thames and rises as two main headwaters named the North Wey and the South Wey. The North Wey tributary is the highest part of the catchment, rising near Alton in Hampshire before it meets the South Wey at Farnham and eventually converges with the Thames at Weybridge. The catchment is predominantly in a rural estate with a mixture of arable, pasture and meadowlands. As a chalkstream, the North Wey is less reactive to specific rainfall events and has a more stable flow regime that varies seasonally (Jones, 2018).

Tadmarton Stream

The Tadmarton Stream catchment is the smallest examined in this study, taking in water from an area of around 21 km^2 in size. Part of the larger Cherwell catchment area, the stream is a feeder of the Sor Brook, a west tributary of the River Cherwell (Environment Agency, 2020c). Like the larger Cherwell catchment, the land use of the Tadmarton area is very rural and predominantly arable land (Oxfordshire Wildlife & Landscape Study, 2004). The geology of the Cherwell is predominantly impervious Lias clay, resulting in a flashy flow regime (Bell et al., 2012).

3.1.2 Project partner organisations

Farming & Wildlife Advisory Group (FWAG)

The two FWAG groups facilitating Thames Water's PES scheme are the East and South West (SW) clusters. Both are part of the FWAG Association, an umbrella organisation which encompasses many of the independent FWAG organisations representing farmers and

landowners in the delivery of wildlife conservation across the country (FWAG SW, 2019). Advisors from FWAG SW are responsible for delivering the scheme in the Cole catchment and are based locally. As farmer-led charities, FWAGs provide a range of independent advice, grant applications and training to farmers to enable their delivery of environmental improvements in the countryside and support the running of sustainable and profitable farm businesses (FWAG East, n.d.). FWAG SW also help fund and facilitate multiple projects related to environmental and wildlife conservation in their occupational area (FWAG SW, 2019).

Catchment Sensitive Farming (CSF)

CSF is an advice-led government initiative run by Natural England in cooperation with the Environment Agency and DEFRA. CSF's primary objective is to encourage voluntary action from farmers to reduce diffuse water pollution from agriculture to protect water bodies and the environment, in turn helping governments achieve WFD, National Emission Ceilings Directive and SSSI targets. Targeting areas where action is most needed, CSF primarily focuses on High Priority Areas for water quality (Environment Agency, 2019). The Lower Oxfordshire Ray catchment is one of these. The advice they provide to farmers is delivered by local CSF officers and includes free training, advice and support for grant applications and one-to-one advice for priority farms (Natural England, 2020). The CSF officers facilitating Thames Water's PES scheme in the Lower Oxfordshire Ray are based locally to the catchment.

Promar International (Promar)

Promar is a private consultancy organisation which specialises in the agricultural and commercial food and drink sectors in the UK and internationally (Independent Business Resource, 2014). Promar works with a variety of clients including farmers, processers and retailers, policy makers, government agencies and industry associations (Promar International, n.d). Services offered by Promar range from research and strategy, project management, environmental advice, farm finance, farm consulting and milking systems (De Lacy Executive, 2020). As well as being responsible for facilitating Thames Water's PES scheme in their designated catchments (including the North Wey), Promar is responsible for the administration of the scheme which includes liaising with all the project partners and administering all payments to farmers entitled through Thames Water's PES scheme. The advisors responsible

for facilitating this are based remotely from the Thames catchments in the surrounding area of Cheshire.

Innovation for Agriculture (IFA)

IFA is a charity set up by the Royal Agricultural Society of England (RASE) that works with agricultural societies to help farmers make best use of existing and emerging knowledge to make modern farming more sustainable, resilient, and productive (IFA, 2019). Prioritising knowledge in areas comprising precision livestock, animal health and welfare, soil and water as well as renewable energy, IFA brings new science and innovation to farmers both virtually and practically, in addition to technical centres around England (RASE, n.d.). IFA hosts a small team in Warwickshire with the advisors responsible for facilitating Thames Water's PES scheme in the Tadmarton Stream catchment based locally.

3.1.3 Farmers participating in Thames Water's PES scheme

To provide an indication of the rates of farmers participating in the scheme across the four catchments, the approximate number of farmers eligible and the number of farmers paid between 2018 and 2020 are presented in Table 3 below. It is important to note the number of eligible farmers is based on walkovers (conducted by the project partners in the initial sign up round) as well as Customer Land Database (CLAD) data (some of which is historical). Therefore, this only provides an approximate number of farmers eligible to participate in Thames Water's PES scheme in each catchment. This explains why the number of participants paid in the Cole catchment in 2019/20 is above the approximate number of those eligible in 2020. Due to all study catchments having achieved some metaldehyde levels below the UK's drinking water standard (0.1µg/l) between 2018 and 2020 inclusive, the number of farmers paid provides a good indication of those registered to the scheme in each catchment for each year.

Table 3: Farmers participating in Thames Water's PES scheme (study catchments)

Catchment	Approx. no. of eligible farmers	No. of farmers paid 2018/19	No. of farmers paid 2019/20
Cole	27	24	28
Lower Oxfordshire Ray	66	20	25
North Wey	40	32	36
Tadmarton Stream	12	8	9

3.2 Data collection

3.2.1 Methods considered

To gain the level of understanding this investigation required to achieve its aim and objectives, a qualitative approach to research was adopted. Widely applied as a qualitative research method, semi-structured interviews were considered most appropriate for this study as they allow the researcher to prepare an outline of topics and questions before the interview takes place, making the data collection process less time intensive and the resulting data from the different participants easily comparable (Cohen and Crabtree, 2006). In qualitative interviews, the application of open questions is used to provide the respondent with the freedom to select their own words and give a more in-depth response rather than give simple yes/no or tick box responses such as in quantitative surveys. The validity of the data collected is increased by the flexibility of the approach, allowing the researcher to adapt the interview according to the respondent's answers and so steer the interview in a particular direction, probe for a deeper understanding, or ask for more clarification (Creswell and Creswell, 2017).

To complement the information obtained from interviews, qualitative researchers commonly use observational methods as a tool for data collection (Jamshed, 2014). Similarly, this study intended to collect data by shadowing the project partner advisors when they provided advice to farmers regarding Thames Water's PES scheme as an accompaniment to the information obtained from the participant interviews. However, due to the Covid-19 pandemic featuring at the time of scheduled data collection, the methods were reduced to the technique of semi-structured interviews only. Although shadowing data would have been beneficial to the

research study, it was felt the data obtained from the semi-structured qualitative interviews conducted with the farmers and project partner advisors was sufficient in providing the in-depth data the study needed to achieve its research aim and objectives.

3.2.2 Interview design

A separate interview framework was created for the two sets of participants. Fitting with the semi-structured interview format, most of the questions used in the interviews were open-ended to allow participants to describe their perceptions and experiences of Thames Water's PES scheme. Once the interview questions were framed (guided by the study aims and objectives), members of the team at Thames Water responsible for their PES scheme were consulted to review the proposed questions. The comments received from these reviews were used to make minor revisions to the final versions of the interview frameworks before any interviews took place. A brief summation of the resulting farmer (Table 4) and project partner advisor (Table 5) interview frameworks are provided below. Full copies of the frameworks used in the interviews with farmers and project partner advisors are provided in Appendix B and Appendix C respectively.

Table 4: Summary of the interview conducted with farmers

Section	Question no.	Section objective
Part 1	1-4	To establish the characteristics of the farm
Part 2	5-8	To establish the characteristics of the farmer and explore how decisions on the farm are generally made concerning their farm
Part 3	9-14	To determine the farmer's experience of water pollution mitigation measures, views on metaldehyde, as well as their experience and involvement of Thames Water's PES scheme
Part 4	15-21	To explore the experiences and views of the farmer towards the project partner advisors responsible for facilitating the PES scheme in their catchment
Part 5	22-26	To explore the participant's views towards the success of the PES approach used by Thames Water and the future development of the scheme

Table 5: Summary of the interview conducted with project partner advisors

Section	Question no.	Section objective
Part 1	1-4	To establish the role of the advisor and project partner organisation in the context of the farming advisory sector and the PES project
Part 2	5-8	To establish the methods used by the advisor and the project partner organisation to approach farmers eligible to participate in Thames Water's PES scheme
Part 3	9-10	To establish the service and advice the advisor provides to farmers participating in Thames Water's PES scheme and how this is communicated
Part 4	11-15	To explore the participant's views towards the success of the PES approach used by Thames Water and the future development of the scheme

3.2.3 Recruitment of participants

To determine if a sample is suitable, Malterud et al. (2015) propose the concept 'information power', whereby the more information the sample possesses related to the study, the lower number of participants are required. To gain information power an appropriate sample must comprise of participants who have particular knowledge about, or have experience in, the subject being researched (Creswell and Clark, 2011). This ensures efficient and effective saturation of data with maximum information and minimum excess (Morse, 1991). To guarantee all participants had the experience necessary to inform the research aim, purposeful sampling was used to recruit the farmers and project partner advisors used in the study. These were all drawn from within the four Thames catchments selected to be studied (see Section 3.1). The researcher worked closely with the team in Thames Water responsible for the PES scheme to ensure transparency and used their assistance in the recruitment process.

For farmers, only those eligible to participate in PES were considered as potential research subjects. To recruit farmers, a closed question was added to the PES project 2019 post-season[2] survey provided to the farmers in the study catchments which asked if farmers were happy to be contacted regarding the research study. Only the details of those who agreed to be

[2] A survey delivered annually from Thames Water at the end of each registration season (January – February) to all farmers eligible to register onto Thames Water's PES scheme.

contacted were then provided to the researcher. All farmers whose details had been provided in the Lower Oxfordshire Ray, North Wey and Tadmarton Stream catchments were approached to be study participants. In the Cole catchment only eight farmers were approached due to a high number of farmers agreeing to be contacted in this catchment compared to other catchments. For those chosen to be contacted in the Cole catchment an effort was made to ensure the sample covered a range of farm sizes.

For advisors, a comparative framework was designed where advisors were categorised dependent upon their employer. Thames Water asked and achieved agreement from the two lead advisors from each project partner organisation involved in the facilitation of Thames Water's PES scheme. All prospective participants were first contacted by email where they were provided with information about the project (Appendix D) before they were contacted by phone to arrange a time and date to complete the interview. Details on the ethical considerations and safeguarding procedures taken by the study during this process is provided later in Section 3.2.5.

As Table 6 below shows, the resulting samples of participants interviewed were 22 farmers and eight project partner advisors. All the farmers included in the sample were registered to the scheme. The initial research design did intend to include non-participants as research participants, however given the popularity of the project as well as the difficulty in identifying sufficient non-participants in the catchments, they were not included in the study.

Table 6: Study participant samples

Catchment	Approx. no. of eligible farmers[3]	No. of farmers' details provided (registered to PES)	No. of farmers interviewed	No. of project partner advisors interviewed
Cole	27	14	8	2
Lower Oxfordshire Ray	66	6	6	2
North Wey	40	11	4	2
Tadmarton Stream	12	5	4	2

[3] The number of eligible farmers is based on walkovers conducted by the project partners in the initial sign up round as well as CLAD data, some of which is historical. Therefore, this only provides an approximate total number of farmers eligible to participate in Thames Water's PES initiatives in each catchment.

3.2.4 Handling of interview data

The interviews with farmers took place in March 2020 and with project partner advisors in April 2020. It is important to remind the reader that the decision to withdraw metaldehyde from outdoor use had been overturned and its reinstatement remained under consideration at this time (see Chapter 1).

The original intention of the study was to conduct all interviews face-to-face and in person. However, due to Covid-19 restrictive measures being imposed by the UK government halfway through their collection in March 2020, only 15 interviews with farmers were conducted on the farm (either at the kitchen table or in the farmer's office). The remaining seven interviews with farmers were then conducted via phone. All interviews with project partner interviews were accomplished through video call over Microsoft Teams. Although the interviews were not conducted at their usual place of work, the interviews still took place during their usual working hours and in their existing workspace at the time of consultation. With consent from each participant, the researcher recorded the audio and written notes throughout each interview.

3.2.5 Ethical considerations

Ethical clearance for this study was obtained from the University of Gloucestershire's Natural and Social Science Ethics Panel on the 06/02/2020. Procedures were implemented to ensure the protection of the study participants and the data collected in the study. This included all participants receiving participant information sheets explaining the process of their interviews and the use of the subsequent data, as well as the ethical considerations and safeguards put in place for the study. To ensure the participants were consensual to participating, written and verbal consent was obtained from each participant before their interview commenced. They were also given the opportunity to withdraw from taking part in the study throughout and after the data collection process. To safeguard the participants' confidentiality, all data files containing personal information were password protected and only available to the researcher when conducting the study. Study codes were also used instead of recording identifying information. To further mitigate the potential identification of the participants, each were assigned a pseudonym which they are referred to as throughout this thesis.

3.3 Data analysis

Recordings of the interviews were kept separate and transcribed via a naturalised approach. Adhering to this method of transcription, written language was prioritised over verbal language and so features of written language that do not actually occur in spoken talk (e.g. full stops, commas, paragraphing) were included and oral language and verbal tics (e.g. 'ums', 'ers') were excluded from the transcripts (Davidson, 2009). The use of this approach was justified as the primary interest of study was in the content of the data. The project partner transcripts were each transcribed into a Microsoft Word document. Due to the amount of farmer survey responses, all the audio recordings from the farmer surveys were transcribed directly into a Microsoft excel spreadsheet under the question headings they were in response to. This was the first form of sorting the data thematically and was intended to ensure time efficiency, as well as to help the researcher become familiar with the data generated from the interviews and 'get a feel' for the emerging patterns in the data (Sutton and Austin, 2015). For accuracy, once a transcript was completed, the recording was listened to again in its entirety and the transcript re-examined. Afterwards, the transcripts were input into NVivo 12 Pro, a qualitative data analysis computer software package, to assist in sorting and organising of the data.

The data from the farmer and project partner transcripts were analysed separately to look for patterns or themes in the data that facilitate systematic analysis (Nowell et al., 2017). The two data sets were then combined within a coding framework (Appendix E-G). To achieve this the study adopted the grounded theory approach to analysis which involved reading the transcripts several times and coding text fragments into themes and sub-themes to create the coding framework. The codes were formed from those created both prior to analysis (in relation to the questions asked in the participants' interviews) and from those emergent in the raw data. To form the latter, the initial step taken was the technique of open coding which involved reading through the data to assign tentative labels to chunks of data that summarise the phenomena emerging. This was followed by the process of axial coding which consisted of identifying relationships among the open codes and linking those already identified into overarching codes (Gallicano, 2013). Finally, through the process of selective coding, the different codes that had emerged during axial coding were grouped into one cohesive theme (Vollstedt and Rezat, 2019). Coding was a dynamic process which meant that every time a new

transcript was analysed new categories were added to the coding framework and transcripts were re-read according to the new structure. After all transcripts were analysed they were examined to see if there were any similarities and differences across the sub-groups (i.e. farmers and project partner advisors or across catchments) (Elliott and Gillie, 1998).

3.4 Validity and reliability judgement

Unlike quantitative research, which establishes validity and reliability of research results via statistical methods, there is no set criteria consistently used to assess qualitative research (Rolfe, 2006). Instead, qualitative researchers are obliged to be clear about how and why they choose to use certain criteria to ensure the 'soundness' and 'trustworthiness' of their inquiries (Tobin and Begley, 2004; Noble and Smith, 2015). Throughout this chapter the appropriateness of the qualitative methods used to collect and analyse the data has been justified and the measures applied to improve the quality of results have been openly presented. By using both farmers and project partner advisors involved in Thames Water's PES scheme as study participants, two different perspectives have been collected. By using a form of data triangulation (a strategy used to test the validity of the results through the merging of information from different sources (Carter et al., 2014)), a more a comprehensive understanding of the behavioural experiences of Thames Water's PES scheme has been achieved.

The recognition of the researcher's influence on the study (or 'reflexivity') is also important in qualitative research (Kuper et al., 2008) as, if unchecked, it can impact the trustworthiness of the data considerably (Brink, 1993). Accordingly, attention has been paid to the specific methodological challenges presented by the researcher's presence in the research process. The study does not assume all the study participants have accurately communicated their true experiences and accepts that the participants may have neglected or exaggerated elements relevant to the study (Robson, 2002). However, it is felt the strength of the data achieved though the saturation of information by confirming 'information power' from both samples, in addition to the rich textual nature of the data collected allowing for in-depth analysis, has meant the study can tolerate such contingencies. Besides, the aim of the study is not to include the whole range of experiences in relation to Thames Water's PES project, but to present

patterns in the data which are needed to understand the influences for farmers decision-making behaviour.

Chapter 4: Results

This investigation aimed to understand the factors that influence farmers' decision-making behaviour considering their engagement in Thames Water's PES scheme. This was with a consideration on how their project partner advisors support and encourage farmers' participation in the scheme and behaviours to mitigate metaldehyde diffuse pollution. To achieve this, data was collected and analysed from interviews conducted with 22 farmers and eight project partner advisors involved in Thames Water's PES scheme. To present the results found during analysis, this chapter falls into five main parts. Firstly, the characteristics of the farmers interviewed are summarised and presented. The second section presents and examines the factors identified as drivers and barriers for farmers' decisions to participate in the scheme. The next two sections then present the approach used and the advice provided by the different project partners in their facilitation the scheme. The final section reports how the farmers and project partner advisors perceive the success of the scheme.

4.1 Farmers' characteristics

Information concerning the farmers' characteristics collected during their interviews is presented below. This data was collected to allow for the examination of how the farmers' characteristics have influenced their decisions and behaviours when considering Thames Water's PES scheme and to inform interpretations of the results presented later in this chapter.

This is comprised of a series of factors associated with farmers, namely:

1. Key farm attributes - Farm type, farm size and land tenure details;
2. Personal characteristics - Farmer age, discussion group membership, environmental organisations membership and use of agronomists; and
3. Metaldehyde use prior to participating in Thames Water's PES scheme.

Due to the small sample size of project partner advisor participants, similar characteristics of the project partner advisors are not presented to reduce their risk of identification. Still, contextual information on the project partner organisations investigated in this study can be found in Section 3.1.2.

Key farm attributes

Below, Table 7 presents a summary of the information provided by farmers relating to their **key farm attributes.** This information includes the variables of farm size, land ownership and farm type. The size of arable area the farmers have eligible in the scheme (obtained from existing data from Thames Water) is also included.

Table 7: Farmer participant farm attributes

	Farm size		Arable area eligible in scheme		Land ownership			Farm type		
Catchment	**Average size of area farmed (ha)**	**Area farmed size range (ha)**	**Average size of eligible arable area (ha)**	**Eligible arable area size range (ha)**	**Wholly owned**	**Mixed owned & rented**	**Wholly rented**	**Mainly arable**	**Mixed**	**Mainly pasture**
Cole (n=8)	497	125-800	147	21-336	2	5	1	5	2	1
Lower Oxfordshire Ray (n=4)	226	40-600	42	8-101	2	2	0	2	2	0
North Wey (n=6)	425	180-900	253	99-418	3	2	1	6	0	0
Tadmarton Stream (n=4)	498	38-1500	56*	25-76*	3	1	0	2	1	1
All farmers (n=22)	**428**	**38-1500**	**144***	**8-418***	**10**	**10**	**2**	**15**	**5**	**2**

**Result does not include information from one farmer in the Tadmarton Stream catchment as information for the farmer was unavailable.*

As the table shows, the average sample for the total area farmed by the farmers interviewed in the Cole, North Wey and Tadmarton Stream catchments was relatively similar. In the Lower Oxfordshire Ray catchment this figure was comparatively smaller by around 200 ha.

There was considerable variation across the different catchments regarding the arable area eligible for the scheme. Out of the four catchments studied, the North Wey had the greatest average area of eligible arable land. Notably this was the only catchment where all those participating described their farm type as 'mainly arable'. The catchment with the smallest average area of arable land eligible for the scheme was the Lower Oxfordshire Ray catchment. The Tadmarton Stream catchment had the smallest range. However, it is important to note that information regarding the size of eligible arable area was unavailable for one farmer in the Tadmarton Stream catchment which has impacted this result.

Regarding land ownership, an equal number of farmers either wholly owned their farmland or farmed a combination of land which they owned and rented. Only two farmers wholly rented the land they farmed. Out of the three options farmers could select from, most farmers interviewed described their farm type as 'mainly arable'. However, in the Cole and the North Wey catchments the number of mainly arable farms was proportionally higher in comparison to the Lower Oxfordshire Ray and Tadmarton Stream catchments. The crops cited by farmers when describing their farming system included wheat, barley, oats, oilseed rape, beans and maize. For those defining their farm type as 'mixed', a combination of grassland and arable land was described with livestock including sheep, cattle and turkeys. For the two farmers whose farm type was 'mainly pasture', both stated that their main enterprise was sheep.

Personal characteristics

All farmers participating in this study provided information on their **personal characteristics.** This data was gathered to comprehend the farmer's individual characteristics and their use of external advice when usually making decisions concerning their arable farm area. These characteristics are presented in Table 8 following.

Table 8: Farmer participant characteristics

Catchment	Avg. age	Age range	No. of discussion group members	No. of environmental group members	No. who use an agronomist
Cole (n=8)	57	30-74	5	5	8
Lower Oxfordshire Ray (n=4)	58	36-70	3	0	4
North Wey (n=6)	58	30-75	2	2	5
Tadmarton Stream (n=4)	62	42-73	3	1	3
All farmers (n=22)	**58**	**30-75**	**13**	**8**	**20**

As Table 8 demonstrates, the average age for the farmers interviewed was 58. This was relatively consistent across all catchments, overall ranging from 30-75, and with the national average of 60 (Farm Business Survey, 2019).

Farmers were asked to identify any farming discussion or environmental groups they regarded themselves a member of (Appendix H). The organisations mentioned by farmers were divided via post-coding into two groups labelled as an 'environmental group' or a 'discussion group'. For the purpose of this study an 'environmental group' was characterised as an organisation which primarily focuses on the protection and conservation of the environment. A 'discussion group' was more broadly defined as an organisation which provides farmers with the opportunity to meet regularly but does not primarily focus on the protection and conservation of the environment. As the table shows, most farmers identified themselves as being a member of at least one of the eight discussion groups mentioned. Over a third of farmers identified themselves as being a member of at least one of the seven environmental groups cited. This suggests many of the farmers involved in the scheme have a strong personal interest in environmental protection and enhancement.

Almost all farmers indicated they regularly consult an agronomist about the production aspects of their arable land. The influence agronomists had on farmers' decisions to participate in the scheme is examined later in Section 4.2.1.

Prior metaldehyde use

Analysis of the interview transcripts allowed for the identification of the farmers' **metaldehyde use prior to participating in Thames Water's PES scheme.** This resulted in the farmers being categorised into one of three groups, shown in Table 9 below.

Table 9: Farmers' metaldehyde use prior to their participation in Thames Water's PES scheme

Catchment	Favoured the use of metaldehyde (active users)	Never needed to use metaldehyde (non-users)	Proactively avoided the use metaldehyde (active abstainers)
Cole (n=8)	7	1	0
Lower Oxfordshire Ray (n=4)	1	3	0
North Wey (n=6)	4	0	2
Tadmarton Stream (n=4)	3	0	1
All farmers (n=22)	**15**	**4**	**3**

As Table 9 indicates, most farmers stated that metaldehyde was their favoured method for slug management prior to their participation in the scheme (active users). This included most farmers in the Cole and North Wey catchments and half of the farmers in the Tadmarton Stream catchment. In the Lower Oxfordshire Ray catchment only one farmer stated that they had been an active user of metaldehyde prior to their participation in the scheme. The remaining three farmers in the catchment stated that they have never used metaldehyde (non-users) as they have not encountered a problem with slug control. Only three farmers stated that, although they had used metaldehyde in the past, they had made the proactive decision to avoid using metaldehyde before they participated in Thames Water's PES scheme (active abstainers). Reasons given for why these farmers had decided to abstain from using metaldehyde included bad experiences they had suffered, such as pellets being eaten by a pet and its observed inadequacy at controlling slugs. Instead, they explained that they prefer to use alternative methods such as preventative measures and ferric phosphate as they found them to be just as or more effective for slug control.

4.2 Drivers and barriers for farmers' decisions to participate in Thames Water's PES scheme

The farmers were asked to explain how they reached their decision to participate in Thames Water's PES scheme by drawing on the factors that motivated their participation (drivers) and the factors that acted to hinder their participation (barriers overcame). These are presented in the first two sections below. The section ends by comparing the factors identified by farmers with those identified by the project partner advisors.

4.2.1 Drivers for participation

As Table 10 below indicates, a wide range of factors were identified to have motivated farmers' decisions to participate in Thames Water's PES scheme. During analysis, these factors were categorised and are presented more broadly in four main categories.

Table 10: Farmers' drivers for their participation in Thames Water's PES scheme

Economic	**Environmental**
Financial payments (15)	Enhancement of the environmental quality of the watercourse (14) …to provide clean drinking water for the benefit of society (4) …for the benefit of wildlife (7)
Administration	**Social**
Administrative ease of the scheme (11) Access information provided by the scheme (6) Advisory services provided by the scheme (2) Perceived relevance to farming goals (5)	Agronomist's support (6) Improve public perception of farmers (5) [4]Prevent the ban of metaldehyde (3) Other farmers participation in the scheme (2)

**No. of farmers who mentioned driver = ( )*
**Total no. of farmers = 22*

[4] The withdrawal of metaldehyde remained under consideration at the time the interviews with the study participants took place

Economic Factors

The factor most identified by farmers to have motivated their participation in Thames Water's PES scheme was the potential for receiving **financial payments**, with 15 farmers mentioning this driver. However, the terms used by farmers to describe these incentives (including 'bribe', 'tactic' and 'sweetener') indicated that farmers recognised these were not significant funds and that money is not central to the scheme. Indeed, farmers commonly stated that the payments do not cover the difference in cost for using ferric phosphate instead of metaldehyde slug pellets.

How the financial payments influenced farmers' decisions to participate in the scheme appeared to depend on their attitude towards metaldehyde prior to their registration (see Table 9 in Section 4.1). For those identified as being non-users and active abstainers of metaldehyde prior to their involvement in the scheme it was indicated they had viewed them as an opportunity to financially gain from a policy they were already implementing. For example, one farmer stated:

> "I think basically it was a policy we were doing and I thought I might as well tick a box and get some funding for it" (Promar Farmer 6).

In contrast, farmers identified as active users of metaldehyde before their involvement in the scheme viewed the payments as a contribution that helps them satisfy their alternative and more significant motivations for changing their metaldehyde use through their participation in the scheme. As one farmer described:

> "…it's good when it's something you're wanting to do… [when deciding] between what you want to do environmentally and what you can do financially, it makes it easier… because it softens the financial penalty" (FWAG Farmer 5).

Thus, the incentive of receiving financial payments persuaded farmers to participate in the scheme as they alleviated the financial burden of using costlier ferric phosphate pellets they wished to pursue.

Environmental Factors

Data analysis revealed that all respondents recognised the **enhancement of the environmental quality of the watercourses** as a positive goal of the scheme. For 14 farmers, all active or non-users of metaldehyde prior to their participation, this was reported to have significantly driven their decisions to participate. It was found six (out of eight) of these farmers were members of an environmental group. This reinforces the interpretation that the farmers involved in the scheme have a strong personal interest in environmental protection and enhancement.

Farmers who stated environmental enhancement as a driver often related it to their recognition that, as they are the ones responsible for the land which they farm, they had a responsibility to implement measures on their farms to mitigate metaldehyde diffuse pollution. Many farmers who articulated this feeling reported it was triggered by their experience of learning about the environmental damage caused by metaldehyde through Thames Water's PES scheme. For example, one farmer said:

> "We were made aware of the problems of metaldehyde and…I think we felt responsible to help alleviate them... I wouldn't say it's a public duty, but you're almost bound to help. At the end of the day the water falls on our land… so we do have an obligation. Obviously metaldehyde and drinking water is quite a big issue and we've been shown graphs… when we use it, it [metaldehyde levels observed in the watercourse] really jumps up and it's something they can't really take out or its really expensive to take out of the water supply, so it was in our interests as much as everyone else's to not use it" (FWAG Farmer 4).

As the quote indicates, the information provided through the scheme prompted the farmer to recognise their metaldehyde use has a direct impact on the water quality, therefore they felt compelled to remedy and enhance the environmental quality of the watercourse. Moreover, the farmer indicates the negative effect metaldehyde has on the drinking water quality supply motivated their decision to participate in the scheme. Likewise, a total of four farmers stated how their decisions to participate in the scheme was driven by a sense of obligation for improving the water quality **to provide clean drinking water for the benefit of society.** This can also be considered as a social influence.

For seven farmers, their decisions to participate in the scheme was explicitly stated to have been driven by their desire to improve the environmental quality of the watercourse **for the**

benefit of wildlife. This was supported by their strong personal beliefs and attitudes towards the protection of the environment and their feelings of responsibility for improving the water quality for nature itself. As this farmer explained:

> "We're a big fan of the wildlife, we've got some fabulous wildlife here on the farm. Having two rivers on either side puts us in a uniquely lucky position. We've got kingfishers and all sorts of things so I'm desperately keen to make sure that we preserve the water quality and continue to benefit the wildlife we share the farm with" (CSF Farmer 1).

The quote also implies the farmer feels a sense of custodianship towards the land they farm. Those who similarly communicated views based around the concept of custodianship also stated a strong environmental drive for their participation. One farmer articulated the reason for this being their desire to pass on the farm in a better environmental condition to the next generation than they had received it.

The sense of moral obligations and responsibilities presented above were commonly complemented by the farmers describing their contribution to mitigating the effects of metaldehyde through their participation in the scheme as the *"right thing to do" (FWAG Farmer 3)*. One farmer was also found to describe feelings of happiness for performing this moral obligation.

Administration Factors

Another theme commonly mentioned by farmers when asked to explain the reasons for their decisions to participate in Thames Water's PES scheme were factors related to the scheme's administration. One of which was the **administrative ease of the scheme.** The data revealed 11 farmers perceived the scheme to be *"very easy to do and sign up to" (Promar Farmer 4),* thus acting to encourage their decisions to participate. Yet, how this influenced farmers' decisions appeared to vary dependent on their attitude towards metaldehyde prior to their registration. It was found that seven of these respondents were non-users or active abstainers of metaldehyde prior to their involvement in the scheme. Therefore, as it was 'easy to sign up to' it acted to positively influence their decisions to participate. For example, as this farmer (a non-user) stated:

"…it hasn't been a major thing really, it's quite a minor thing. It's a small amount of money to fill in a form, which I'm quite happy to do and confirm that we're not using metaldehyde. So, it isn't a big deal really, especially as it's so easy to sign up to" (CSF Farmer 4).

For the farmers who were active users of metaldehyde prior to their involvement in the scheme, it's administrative ease was not mentioned to be as significant a driver in their decisions considering their participation. Instead, the view that the scheme was easy to register into was recognised more as a positive aspect of the scheme that did not act to deter their decision to participate.

Analysis discovered the desire to gain information and advice offered as part of the scheme was a significant driver for farmers' participation. It was found six farmers were strongly motivated to participate in order to **access information provided by the scheme**. The reasons stated for this included personal interest in the water quality results and the wish to keep up to date with any developments in the PES scheme. It was found that most of those who mentioned this as a driver were active abstainers of metaldehyde prior to their involvement in the scheme. For two such farmers this was given as the main reason for their participation. Moreover, another two farmers, both advised by CSF in the Lower Oxfordshire Ray catchment, specifically mentioned they were strongly motivated to participate to benefit from the **advisory services provided by the scheme**. Both cited their interest in learning how to improve their farming practices to be more efficient, for example:

"…we're very keen on a number of levels not only to be environmentally responsible, but also from a financial point of view, not to waste any products, not for any product to go where it shouldn't. So it seemed to make sense [to participate], if they were going to advise us how" (CSF Farmer 1).

As evidenced, the desire to gain advice appeared to be driven by financial motivations as well as environmental considerations with the farmer wanting to minimise the risk of wasting products. The farmer continued:

"… it [the scheme's aims] fitted in with our [farming] ethics and everything else, it was a no brainer to say yes" (CSF Farmer 1).

The quote indicates the farmer was also driven to participate in the scheme as it positively fitted their farming goals**.** This was further identified in farmers' responses with five farmers

out of the 22 interviewed similarly stating the **perceived relevance of the scheme to their farming goals** acted as a driver to participate in Thames Water's PES scheme.

Social Factors

Social factors were also identified as drivers for farmers' participation in Thames Water's PES scheme. For instance, six farmers stated that it was important they gained their **agronomist's support** for the metaldehyde mitigation measures the scheme advised (i.e. changing to ferric phosphate and using cultural controls) before they proceeded to participate in the scheme. In two of these cases, farmer's agronomists appeared to play an even more central role in driving farmers' decisions. For example, when describing their initial thoughts surrounding the decision to participate in the scheme, one farmer stated:

"Our agronomist… was keen on the scheme with it ticking all the boxes... Anything chemical she sorts it out for me, I don't worry about that, and she's quite keen on doing her bit for the environment" (Promar Farmer 5).

This quote implies this farmer's agronomist significantly influences their decisions concerning the farm and so her support for the scheme, inspired by her own environmental drives, acted to drive the farmer's decision to participate in the PES scheme. In the other instance, the farmer's participation was specified to be primarily driven by the enthusiasm of their agronomist. The farmer indicated they followed the advice of their agronomist to enrol and only recognised the other benefits provided by the scheme, such as environmental enhancement of the watercourse, after registering to participate. However, the number of farmers who consulted their agronomists considering Thames Water's PES scheme is proportionally low compared to the 20 who admitted usually consulting an agronomist for advice (Table 8 in Section 4.1), suggesting that not all farmers considered it necessary to consult their agronomists and were satisfied with the advice provided by project partner advisors. This could be because farmers were satisfied with advice provided by their project partner advisors.

As previously mentioned as an environmental factor, farmers were driven to participate in the scheme to enhance the environmental quality of the watercourse to provide clean drinking

water for the benefit of society. This can also be considered a social factor. The data revealed some farmers wanted society to recognise their participation as they stated that a driver for their decisions to participate in the scheme was to **improve the public perception of farmers**. For the five farmers who mentioned this driver, all believed their voluntary participation would be viewed positively by the public and enhance their perception of farmers. For example, one farmer viewed the scheme as an opportunity to gain *"some good PR for farming" (FWAG Farmer 2)*.

Conversely, one farmer presented an alternative angle towards the public perception of farmers participating in the scheme related to its financial payments. They explained:

"I think bribing farmers not to pollute, well I just can't see that [being beneficial] at all... I don't think public money should be spent like that and I'm sure the public don't appreciate it either" (IFA Farmer 4).

This appeared to be in response to schemes more generally, especially as the farmer referred to the financial payments as 'public money' when they are in fact funded privately by Thames Water. Still, it is clear this farmer views farmers being financially rewarded to stop a negative behaviour as immoral and so perceived the public would view farmers' participation in the scheme negatively for this reason. It was indicated that this farmer's decision to participate in the scheme was strongly influenced by this perception as they agreed to participate only with the refusal of receiving payment. Instead, they cited access to information as their main drive.

Another factor found to have influenced farmers' participation in Thames Water's PES scheme was how they perceived their participation would be viewed by regulatory authorities.

"The target was to try and preserve metaldehyde… we knew that if we used it responsibly we would still be allowed to use it… and careful restrictive use is better than an outright ban. We knew there were problems with metaldehyde, and we knew if no one did anything about it would simply be banned" (Promar Farmer 3).

As the quote suggests, farmers hoped that voluntarily deciding to take part and change their behaviours towards their metaldehyde use would be looked upon favourably by regulatory policymakers and **prevent a complete ban on metaldehyde**. The data revealed a total of three farmers mentioned this as their prime driver for deciding to participate in the scheme. Aware the government was still deliberating the withdrawal of metaldehyde from outdoor use

(at the time of the interviews), these farmers therefore considered it important they were seen to be willing to participate in a voluntary scheme to prove to Thames Water and other public bodies that farmers could use metaldehyde responsibly to prevent a ban.

Finally, **other farmers participation in the scheme** was found to have driven two farmers to participate in Thames Water's PES scheme; albeit in different ways. For one such farmer, the opportunity the scheme presented to work with other farmers towards a common goal had encouraged their participation. In contrast, the other farmer indicated peer pressure had played a role in their decision to participate as they considered other farmers participating in the scheme would have viewed them as a polluter if they had not. The data revealed two farmers similarly recognised peer pressure to have driven farmers' participation in the scheme. As this farmer stated:

"I think what's useful is when a project like this… gets a number of farmers together to do it, the ones that would've just ignored it and carried on are carried along with the consensus" (IFA Farmer 3).

Yet, both farmers did not express this factor had acted as a driver in their own decisions to participate. It is important to note that people are often unaware they are influenced by other people (Schlitz, 2016). Therefore, although only one farmer mentioned this factor as a driver in their personal decision to participate in the scheme, it does not necessarily mean others were not similarly influenced in this way.

4.2.2 Barriers overcome to enable participation

Overall, three factors were identified from the farmers' responses to have acted as barriers in their decisions to participate in Thames Water's PES scheme. Since farmers participating in this study did decide to participate in the scheme, it is clear these barriers did not outweigh the factors that motivated their ultimate decisions.

The most common barrier was their **perceived ineffectiveness of ferric phosphate** as a tool for slug management, with seven farmers mentioning this barrier. This was revealed to be caused by the farmers' preconceived attitudes towards the product:

"I was sceptical, I had my doubts about the ferric pellets whether they worked or not. There was a lot of doubt about them when they first came out and were very expensive as well" (CSF Farmer 3).

Farmers frequently identified the reason they had presumed ferric phosphate to be ineffective as a slug control was because, unlike metaldehyde, the application of ferric phosphate does not result in dead slugs on the surface of the soil after it has taken effect. Therefore, prior to participating in the scheme, farmers did not view it as effective a slug control as metaldehyde as they cannot visually observe its impact in the same way. There is evidence to suggest these views have changed since their participation (Section 4.5.2). As indicated in the quote above, and touched on earlier when discussing the financial payments, farmers also noted the expense of ferric phosphate as a deterrence for the use of ferric phosphate.

Analysis revealed that the success of the project is reliant upon other farmers' also participating in the scheme. Six farmers stated that it was important other farmers in their catchment were also participating as they explained that if they were not, it would be less likely reduced metaldehyde levels would be achieved. Therefore, they acknowledged a barrier to their participation would be **other farmers non-participation**. As one farmer explained:

"it was important that I wasn't the only one going down that road, the whole system works because everyone's involved in it. If you've only got one involved, you'd be penalised for the slightly more expensive chemical and then never actually reach thresholds of cleanliness at the test point" (FWAG Farmer 6).

This indicates farmers understand how the PES scheme works, recognising that high participation and engagement levels from farmers in the scheme increases the likelihood reduced metaldehyde levels will be observed in the watercourse, resulting in payment.

The final barrier mentioned by farmers was their **perceived irrelevancy of the scheme** to the farmer. For two out of the three farmers who mentioned this barrier, it was revealed they were deterred to participate in the scheme as they believed there was no behaviour change to be made. Both had never used metaldehyde, as they had not required any slug control (non-users), and so perceived their involvement in the scheme to be irrelevant to both themselves and Thames Water. Therefore, they originally believed themselves to be ineligible to participate. For the other farmer, their small area of arable farmland caused them to formerly assume they did not meet the criteria needed to be participate in the scheme.

4.2.3 Comparison with the views of project partner advisors

During their interviews, the project partner advisors were also asked what factors or characteristics they observed to influence farmers' in deciding whether to participate or not in Thames Water's PES schemes. The results discovered that insights from the project partner advisors correspond with results from the farmer interviews.

It was found that advisors from all project partner organisations similarly observed farmers' participation in Thames Water's PES scheme to be significantly driven by the incentive of financial payments, enhancement of the environmental quality of the watercourse and the advisory services offered through the scheme. Additionally, all project partner advisors highlighted the opinions of farmers' agronomists concerning the scheme and the effectiveness of ferric phosphate to have impacted farmers' decisions to participate in the scheme. Advisors from IFA and FWAG also perceived farmers' decisions to be motivated by their desire to prevent a total ban on metaldehyde. Advisors from IFA highlighted other farmers involvement and peer pressure as a driver of their participation and appeared to place more significance on these factors driving farmers' participation. This corresponds with the collective approach IFA emphasised for encouraging farmers participation in the scheme, presented later in Section 4.3.3. IFA also identified public perception to play a role in influencing farmers' decisions regarding their participation in schemes and similarly observed a farmer in their catchment refusing to receive payment through the scheme.

Project partner advisors identified farmers' perceived ineffectiveness of ferric phosphate and farmers' perceived irrelevancy of the scheme, in relation to their farm size and metaldehyde use, as barriers for participation. Project partner advisors also highlighted a potential barrier could be the perceived administrative difficulty of the scheme. However, due to the methods the project partner took to ensure the scheme's administrative ease (see Section 4.3.4), this perception was not identified as a barrier by farmers.

Although not mentioned by any farmers, one advisor perceived farmers' **perception of Thames Water** to have acted as an initial barrier to their involvement in the scheme. The advisor stated that some farmers who had experienced issues with the services of Thames Water, such as sewage and discharge problems, were initially dubious of the scheme as a result. However, this barrier was said to have only been encountered in the initial process of

approaching farmers. Another project partner observed that once a farmer's involvement in the scheme had developed, the farmer often separated their experiences with Thames Water. They explained:

> "…they [farmers] separate it into two elements… Thames Water as a company and then Thames Water in the engagement… and they have no problem with the engagement" (Promar Advisor 1).

As farmers do not align these two types of involvements, it indicates their perception of Thames Water does not continue to act as a barrier in their ongoing involvement in the scheme, thus suggesting why it was not mentioned by any farmer as a barrier to their participation in Thames Water's PES scheme.

4.3 Project partner approaches for gaining farmers' participation

In this section, the results relating to the project partners' role and approach in gaining and facilitating farmers' participation in Thames Water's PES scheme is presented. The results are presented in chronological order relating to the engagement and the approach the project partners used to encourage farmers' participation.

4.3.1 Pre-existing involvement with farmers in their catchment

Project partner advisors were asked whether they or their project partner organisation had engaged with the farmers in their target catchment before their involvement with Thames Water's PES scheme. All project partner advisors stated that they had not had any engagement with the farmers in their assigned catchment prior to the scheme. Advisors from FWAG, IFA and Promar stated that their organisation's active presence in the catchment was new along with their role in Thames Water's PES scheme. However, advisors from CSF noted the organisation did have an active role in the Lower Oxfordshire Ray catchment prior to the scheme as the catchment is one of CSF's 'high priority' areas. The CSF advisors recognised the presence of a previous representative in the catchment had been advantageous to them when approaching farmers about the scheme as the farmers were already familiar with the organisation they represent.

The benefits of having a reputable relationship with farmers was commonly stated by the project partner advisors, with all project partners having displayed an effort in wanting to develop a good farmer-advisor rapport in their catchment. This was initiated by each project partner by assigning one advisor to each catchment as the main contact to liaise with the farmers. As the quote below indicates, one advisor stated that their reasoning for this was to add more value to the advice they provide through the scheme.

"I'd like every farmer to know their own catchment representative and I'd like them to feel comfortable that they could go out and ask questions of us. And equally, I'd like to improve our relationship so that we're offering them… that added value" (Promar Advisor 2).

Similarly, all project partner advisors reasoned a good farmer-advisor relationship is important and beneficial as the two parties can become familiar with one another, enabling the advisor to provide more tailored advice and simplifying the administration of the scheme.

4.3.2 Targeting farmers for scheme participation

All project partner advisors proactively sought participants for the scheme with the common goal of getting as many eligible farmers as possible registered, a request Thames Water provided the project partners as part of their original tender. This involved ensuring that the data received from Thames Water regarding potential applicants was accurate and up to date prior to conducting any recruitment strategies. As one advisor summed up:

"they [Thames Water] gave us a list and said to us 'we want you to sign up a number of people for this scheme.' And as far as I know there was no limit to the number of people that we're able to service… the more the merrier. The more people we can get involved, the better" (CSF Advisor 1)

The reason given for wanting to recruit all eligible farmers into the scheme was described as for the benefit of spreading 'the message' regarding metaldehyde and its responsible usage, increasing the likelihood of farmers implementing metaldehyde mitigation measures and thus reducing metaldehyde levels observed in the watercourse. This included those who were not using metaldehyde as it was thought they would still benefit from the education provided through the scheme.

The data revealed two different approaches were taken by the project partners when enrolling farmers eligible for the scheme. For FWAG, Promar and IFA their aim was to gain participation

from as many farmers as possible in their initial sign up. However, CSF stated that they adopted a more gradual and targeted approach to gaining participation in the scheme. They described having a 'core group' of farmers already registered which they add to year on year by prioritising contacting farmers they think will be more interested to participate, such as farmers with larger areas of arable land. This could indicate why there is a lower proportion of farmers who are eligible to participate in the scheme in the Lower Oxfordshire Ray being paid through Thames Water's PES scheme as compared to the other catchments (see Table 3 in Section 3.1.3). Furthermore, as indicated above in Section 4.3.1, CSF's involvement with farmers in the Lower Oxfordshire Ray catchment was already established prior to Thames Water's PES scheme. Hence, one CSF advisor explained they introduce the scheme to farmers when providing their other services. They stated:

> "…the [Lower Oxfordshire] Ray catchment for us is all high priority… So, if you're already engaged with a farmer and you're talking to them about something else you can just bring in the PES project into the conversation" (CSF Advisor 2).

The data revealed **agronomists** were also approached as part of the project partners' promotion of the scheme in their catchments. To encourage farmers who are eligible to participate in the scheme, all project partners described welcoming agronomists, land agents, or anyone willing, to attend events. The delivery of these events is described in more detail later in Section 4.4.2. FWAG also stated that they conducted private meetings with agronomists working in the Cole catchment before their initial recruitment of farmers to the scheme. As one advisor stated:

> "…there has been concern from some landowners about how effective ferric phosphate is compared to metaldehyde, and... I think that, to some extent, is influenced by their agronomists… so whenever we've had events, we've always invited agronomists along as well, and kept agronomists in the loop in seeing what the project is" (FWAG Advisor 2).

Project partner advisors were keen to gain agronomists' support for the scheme as they were conscious farmers are influenced by their opinions, particularly regarding ferric phosphate. They were also found to recognise that, if agronomists supported the scheme, they could assist in promoting it to the farmers they individually advise.

4.3.3 Methods for approaching farmers for scheme participation

Questions were asked about the methods the project partner advisors used to gain farmers' initial entry into the PES scheme. As Table 11 shows, the project partners used multiple methods to approach farmers. The project partners' justification for how and why these methods were used is explained in sequence below.

Table 11: The communication methods used by the project partners to approach farmers for their participation in Thames Water's PES scheme

Project Partner	Written communication	Phone	Door-to-door	Group meeting	One-to-one farm visit
FWAG	X	X		X	X
CSF	X	X			X
Promar		X	X		X
IFA		X	X	X	X

The data revealed that all project partners advisors first engaged with the farmers via **written communication (email/letter)** and/or **verbal communication (phone)**. This was undertaken in order to introduce and familiarise farmers with the project partners, to gain their interest in the project, as well as to arrange a face-to-face meeting with the farmers to continue and complete the registration process. As Table 11 demonstrates, not every project partner used written communication initially to approach farmers, but they did all make contact via phone. This could be explained by the project partner advisors placing more worth on communication methods that allowed them to speak to farmers as it was reasoned, *"the most effective thing really [is] actually speaking to people" (FWAG Advisor 1).* This opinion was also mentioned in relation to their one-to-one farm visits with farmers. Furthermore, advisors from Promar and IFA visited **'door-to door'** when first approaching farmers about the scheme. As well as to introduce themselves to the farmers in person, they stated that this was to ensure they achieved contact with those they were struggling to communicate with via email or phone. Both project partners indicated this approach was useful because they had no previous engagement with farmers in the North Wey catchment and credited this method for allowing them to achieve a high level of participation in the scheme during their initial signup round.

To ensure they gained successful uptake of the scheme, advisors from IFA and FWAG stated that they had hosted a **group event** to introduce the scheme to farmers in their catchments. IFA advisors strongly emphasised this event as central to their approach in recruiting farmers in the Tadmarton Stream catchment to Thames Water's PES scheme. Both project partners described using an event as their typical approach for starting off projects in areas as it gives themselves and farmers a chance to meet and ask questions. They also stated that they use this approach as it allows farmers to see that other farmers and their agronomists are involved and supportive of a project. As one advisor explained:

> "…if you're trying to get good engagement in a scheme like this, the worry is, for farmers, that… someone else in the catchment will let them down. So, it's good for them to see that you can get everyone there and everyone else is nodding and smiling" (IFA Advisor 2).

A group event was credited by IFA advisors as their main method for recruiting farmers. However, they stated that this approach may not have been as successful if used in a larger catchment. They acknowledged that, as farmers are in closer proximity to one another, the geographically small size of the Tadmarton Stream catchment had been advantageous to them taking this approach as the events organisation was simplified and the likelihood of farmers being deterred to attend due to travel distances reduced. Advisors from CSF and Promar stated that they have also hosted events as part of their facilitation of the scheme (see Section 4.4.2), yet they did not emphasise the use of this communication method when describing their main approach used to gain farmers' participation in the scheme.

As shown in Table 11, all project partner advisors visited farmers for a **one-to-one farm visit**. Project partner advisors described this was for the benefit of making sure the data they had for the farmer was correct as well as to complete the enrolment process, as requested by Thames Water. This communication method was stated to be a central part of the approach taken by each project partner for recruiting farmers to the scheme as the project partner advisors were able to provide tailored advice to each farmer.

4.3.4 Presentation of Thames Water's PES to farmers

The project partner advisors were asked to explain how they described the project to farmers to encourage their participation. Unsurprisingly, all project partner advisors promoted the

financial incentive of conditional payments provided by Thames Water to encourage farmers to participate in the scheme. The data revealed project partner advisors also promoted:

1. the administrative ease of the scheme;
2. the environmental and financial impacts metaldehyde has on provision of clean drinking water;
3. the advisory services available to farmers through the scheme; and
4. the need for collective action when presenting Thames Water's PES scheme to farmers in order to gain their participation.

All project partner advisors promoted the **administrative ease of the scheme** as they acknowledged it to be an important factor for farmers when considering their participation in the scheme. Due to the way the payments are calculated, the project partner advisors commonly perceived the PES mechanism to be more confusing for the farmers to understand how they receive payment as compared to a product substitution scheme. To counter this, the project partner advisors stated the importance for keeping the registration and participation process for the scheme as simple as possible and implemented measures to support this. As one advisor described:

> "I think our approach was very much that there wasn't an awful lot of change that they needed to make to comply with this… I wanted to make it seem like it was rather a simple thing to get involved in, and to be honest it is" (IFA Advisor 2).

As the quote demonstrates, this was achieved by the project partner advisors endorsing the flexibility of the scheme in allowing the farmers to choose the metaldehyde mitigation methods most applicable to their farm. The same project partner advisor also described summarising the information provided from Thames Water so that it was easier for the farmers to understand how the scheme is relevant to them. They explained:

> "…Thames Water tend to send an A4 booklet, which is it's really nice, but there's quite a lot of writing on it. So, I summarised it down into a bullet point list and gave them [farmers] both, so the Thames Water copy and then the IFA copy, about essentially what it meant for their farming business" (IFA Advisor 2).

The advisor stated that they then went through this information personally with each farmer during their one-to-one farm visits, allowing the farmer to ask and have answered any questions they had there and then.

When explaining to farmers why there is a need for voluntary behavioural changes towards the agricultural use of metaldehyde, all project partner advisors indicated to having conveyed **the environmental and financial impacts metaldehyde** has on the provision of clean drinking water. One advisor described:

> "…a lot of farmers anyway, want to improve their environmental credentials or feel a degree of obligation to do so… you're tapping into that really, encouraging them to think about what it is that the metaldehyde's doing, helping them understand how expensive it is to clean out of the water… helping them see the bigger picture" (IFA Advisor 1).

As the quote indicates, the project partner advisors perceived it was important farmers understood the wider effects of their metaldehyde use with the intention to induce their environmental drives and custodian principles.

Project partner advisors also promoted **the advisory services available to farmers through the scheme** to encourage participation, particularly the one-to-one free consultancy visit each farmer is entitled to through the scheme. Such visits were described as a day visit from an agricultural consultant, funded by Thames Water, and arranged by the farmer's project partner on a topic of the farmer's choosing. As one advisor stated:

> "…for people who say that it's not necessarily worth their time signing up it's like, okay, 'you might not get paid that much but you can get a free consultancy visit which is actually worth quite a bit.' To… show that there are other sides of it which they can see as a monetary aspect" (Promar Advisor 1).

As the quote shows, project partner advisors were conscious the financial payments offered by Thames Water's PES scheme may not have been enough incentive for them to enrol. Therefore, the consultancy visit was promoted as another way farmers could gain economic value from participating in the scheme. This was stated as a manoeuvre especially used to encourage farmers already not using metaldehyde, as it was recognised that they would likely perceive the scheme irrelevant to them.

When promoting Thames Water's PES scheme to farmers, advisors from IFA were the only project partner advisors to cite there being a need for **collective action.** As indicated in

Section 4.3.3, this is likely because they placed a strong emphasis on using a group event to promote the scheme in their approach for gaining farmers' participation in the Tadmarton Stream catchment. Nevertheless, there is evidence to suggest that there was a wider awareness from farmers that collective action is beneficial for the project. For instance, the results presented in Section 4.2.2 signal it was important for farmers that other farmers were also participating in the scheme. This suggests they were aware that the more farmers involved and engaged in the scheme, the more likely they are to see improvements in water quality that result in payment. Therefore, it can be assumed that the importance of collective action has been promoted by the other project partner advisors when presenting the scheme to farmers in their respective catchments.

4.4 Project partner advisors' provision of advice

To comprehend the provision of advice from each project partner, all project partner advisors were asked to explain the nature and methods used to deliver advice they provided to farmers in their designated catchments. These findings are presented in the first two sections below. The final section presents the findings concerning the farmers' perceptions of their project partner advisors and the quality of the advice and service they received.

4.4.1 Advice provided by project partner advisors

All project partner advisors stated that one-to-one farm visits was their primary method for providing advice to farmers, often delivered through their initial registration or through their farmer-led consultancy visits. As expected, project partner advisors were found to reiterate the options suggested by Thames Water to reduce metaldehyde diffuse pollution in their advice to farmers (presented in Section 1.1). Project partner advisors emphasised they advise specific measures to mitigate metaldehyde use tailored to the needs and capabilities of each farmer as well as the attributes of their farm. It was highlighted that the project partner advisors did not perceive their role as dictating to farmers what they should do. Instead, they stated that they took the tactic of 'nudging' farmers towards a behaviour change so that they were able to make the decisions themselves. As one advisor stated:

"…in terms of the PES… it's just having those nudges, 'have you tried this' or 'have you considered that?' 'What are you doing about cover crops' or 'what are you doing about buffers?', or whatever it might be" (Promar Advisor 2).

Indicating project partner advisors recognise the PES approach used by Thames Water is an outcome-based scheme where farmers are rewarded on the condition of achieving reduced metaldehyde readings downstream, and not for the implementation of practices, as with input-based schemes. As the results show later in Section 4.5.2, it was clear that farmers were receptive to these suggestions and did change their behaviour where necessary.

Although project partner advisors described the advice they provided to farmers through the scheme to centre around the mitigation of diffuse pollution from metaldehyde, as well as BMP to improve water quality more broadly, they stated it was the farmer who led the overall course of these conversations. This was explained to be so the advice would be tailored to the needs of each farmer, thus capturing their interest as it is beneficial to them and increasing the likelihood the farmer will return to the advisor for advice in the future. As one advisor explained:

"…there's no point giving them a visit on one topic if it's not of interest to them because… they're not going to get anything out of it, nor are they potentially going to want anything in the future" (Promar Advisor 1).

This method for delivering advice also extended to their one-to-one consultancy visits. It was stated that farmers often wanted advice for improving their farm management practices. Although not necessarily in relation to metaldehyde or water quality specifically, the project partner advisors commonly communicated that any advice they were able to provide was worthwhile as all management practices are going to have an impact on water indirectly or directly. As one advisor said:

"…all of these things are so interconnected… this whole scheme is not just talking about what metaldehyde you use, it's actually about farm management… the money here is to encourage farmers to improve their systems and think about some of the dangers and risks in their systems" (IFA Advisor 2).

It suggests project partner advisors perceive increasing farmers' awareness and knowledge for holistically conserving water quality to be just as important as achieving reduced metaldehyde levels in the watercourses. They commonly explained the rationale behind this as the perceived

likelihood that the government would withdraw metaldehyde in the near future and so wanted to provide farmers with knowledge they could apply more generally to other pesticides, therefore increasing the long-term benefits on the water quality through the scheme.

4.4.2 Group events

Project partner advisors were questioned about the group events they have hosted as part of their scheme facilitation. These events were collectively described to occur once or twice a year, typically in a local community hall, in which the project partner advisors present information to a group of farmers. The provision of advice included information on scheme administration, guidance for following BMP for diffuse pollution mitigation, new practices and novel research. All local farmers, landowners, agronomists, groups, or anyone interested were welcome to attend these events. Project partner advisors also stated that it was anticipated that these events would attract more farmers to participate in the scheme as well as encourage their re-registration. Project partner advisors described these events as a good opportunity to engage with farmers and key stakeholders face-to-face, for knowledge sharing and to build a relationship with farmers in the catchments. However, one farmer from Promar noted the benefits provided through events are not widely achieved in the North Wey catchment due to low attendance rates. Instead, they noted that other social engagement methods may be more appropriate for engaging with farmers:

> "…maybe a short case study where it shows the impact before and after might be better? Or… an on-farm visit, because people always seem to love it when it's on the farm - something like that where they can physically see it, as opposed to being in a village hall" (Promar Advisor 1).

Being beneficial for farmers to observe actual examples of practices being successfully implemented in a social setting was similarly noted by other project partner advisors and often stated to be a possible avenue for future engagement through scheme.

4.4.3 On-going communication

As requested from Thames Water as part of their original tender, all project partners stated to being proactive in contacting farmers about events, scheduling post-season surveys and re-

registration. Project partner advisors also stated that they provide email updates of the scheme's achievements concerning their catchment's water quality and metaldehyde levels through monthly updates. A commonality in the project partner interviews was a perceived increase in farmers' interests and understanding regarding the water quality as a result of receiving these updates. As one advisor stated:

> "They all quite like the water quality updates that they get sent out… I think that really pushes people along and it's quite interesting because, if there has been a minor spike… a few people come back and say, "Oh, why do you think that was?" …having those regular updates, it just confirms what they're doing a little bit" (FWAG Advisor 2)

Accordingly, project partner advisors perceived this to have had an impact on farmers' behaviour and attitudes towards their metaldehyde use.

After the initial registration process, project partner advisors described advice and general communication with farmers to be reactive to farmers' requests. This extended to farmers' one-to-one visits for re-registration to the scheme as project partner advisors indicated this process could be completed over the phone to ease the administrative process if the farmer wished. One advisor explained:

> "…if they want to contact us, they can contact us as much as they want to. But in terms of how many times we're going to bother them, it's kept down to more of a minimum" (Promar Advisor 1).

Advisors from IFA and Promar were conscious of not wanting to 'harass' or 'pester' farmers. They explained that, as the payments provided through the scheme are low, farmers would likely view it as *"not worth their time"* (Promar Advisor 1) if they were disturbed often and could deter their re-registration to the scheme. For this reason, the same Promar advisor stated that they tend to 'batch up' issues to reduce the amount of contact they have with farmers. However, they reflected that from experience they have found farmers are happy to be regularly contacted by phone when needed and so recognised this approach is unnecessary.

4.4.4 Farmers' perceptions of their project partner advisors

All the farmers were asked questions about the advice provided by their project partner advisors and how they interacted with them. In their responses, farmers reiterated the approaches to advice provision and communication that the project partner advisors

described. All farmers indicated they were happy with the quality of advice and service they received through their project partner advisors as part of Thames Water's PES scheme, often relating this to its administrative ease. As one farmer stated:

"I think they've done a good job. They've had a very light touch, so they don't bombard you all the time and it's kept very straightforward. I think they know that £500 doesn't go very far in farming so they don't want to be too demanding" (CSF Farmer 1).

This corresponds with the results from the project partners presented in Section 4.4.3 above, where project partner advisors voiced taking into consideration the level of payment farmers received through the scheme in their approach to its facilitation and frequency of communication. Farmers across all catchments similarly indicated a soft approach to communication and the provision of advice from their project partner advisors. This suggests that, although different, each project partner took a similar approach towards the on-going communication with the farmers in their catchments.

Most farmers stated that they were only reactive to the requests and information provided by the project partner advisors (such as arranging a free consultancy visit or regular email updates) and did not proactively communicate or seek further advice with their project partner advisors regarding the project. This implied they were happy with the advice they had already received and the results they had observed. This was clearly highlighted by one farmer's response who, when referring to their project partner advisors, stated:

"I'm quite satisfied with them. The updates I receive on the water quality are so far so good. So, I think their approach must have been good" (FWAG Farmer 4).

Farmers in the North Wey and Tadmarton Stream catchments indicated that they had limited knowledge concerning the organisations from which their project partner advisors facilitating the scheme were from (Promar and IFA respectively). Instead, they associated the project partner advisors more generally with Thames Water's PES scheme and not the project partner organisation. Similarly, these farmers stated to having no engagement with the organisations outside of the scheme. Farmers in the Cole and Lower Oxfordshire Ray, however, stated that their introduction to FWAG and CSF through the scheme had led them to pursue other services they provide outside the scheme e.g. assistance with Countryside Stewardship scheme applications.

4.5 Perceived success and sustainability of Thames Water's PES scheme

To comprehend the views towards the PES approach taken by Thames Water from the farmers and project partner advisors involved in the scheme, data was obtained from all participants concerning how they view the scheme to be successful and the sustainability of this success. The findings are examined in this section in three parts. The first summarises the farmers changed attitudes towards metaldehyde. The following two sections then go on to examine the farmers and project partner advisors' perspectives of the success of the scheme and its sustainability in turn.

4.5.1 Farmers current attitudes towards metaldehyde

To give an indication as to how Thames Water's PES scheme has changed farmers' attitudes and behaviours towards metaldehyde, farmers were asked to reflect on their attitudes to metaldehyde use prior to and since participating in the scheme. These are presented in Table 12.

Table 12: Farmers' previous and current attitudes towards using metaldehyde

	Attitude prior to participation in scheme			**Current attitude**		
	Favoured the use of metaldehyde	**Undecided**	**Actively against the use metaldehyde**	**Maintain a need for metaldehyde**	**Undecided**	**Actively against the use of metaldehyde**
Cole (n=8)	7	1	0	3	0	5
Lower Oxfordshire Ray (n=4)	1	3	0	0	3	1
North Wey (n=6)	4	0	2	2	0	4
Tadmarton Stream (n=4)	3	0	1	1	0	3
All farmers (n=22)	**15**	**4**	**3**	**6**	**3**	**13**

4.5.2 Farmers' perceived success and sustainability

Analysis of the data from the interview transcripts revealed farmers do perceive the scheme has been successful. The main themes identified in their explanations given for these perceptions are presented in the sub-sections below.

Water quality

Across all four study catchments, farmers reported the scheme has been successful in achieving **improved water quality** through a reduction of metaldehyde levels in their local watercourse. Over a third of farmers understood this to be the case as the water quality updates from Thames Water, provided through their project partner advisors, had told them so. For example, one farmer stated:

"Every time I have a notification through about the water quality, we're under threshold. So, I think we're in line for payment this year" (FWAG Farmer 6).

In another instance, a farmer stated that they assume the water quality has improved simply because their project partner advisor had given them no reason to suggest it had not. This suggests there to be a passive acceptance from farmers that the water quality is improving in their catchment. As the quote above suggests, this could be because it means they will receive payment. Another farmer similarly mentioned that one of the reasons they assume the scheme has been successful in achieving reduced metaldehyde levels in their catchment is because they have received payment. However, these were the only two instances found of farmers mentioning payment in relation to perceived water quality improvements. This suggests that the receipt of payment through the scheme may not be overly significant to farmers more generally.

Although farmers were accepting that metaldehyde levels in the watercourses had reduced, a minority of farmers raised doubts whether this was a success of Thames Water's PES scheme or as a result of other influences. For example, one farmer raised the point that the reduced metaldehyde levels may be a result of less farmers growing Oil Seed Rape. Another two farmers also commented that the weather may have had an effect of farmers' use of metaldehyde as they presented the argument that in recent seasons the conditions had not favoured slugs. Therefore, they highlighted that they could not say for definite that the scheme has been successful in this way.

Behaviour change

There is much evidence to suggest a change in farmers' behaviour regarding their metaldehyde use is as a result of the scheme. Furthermore, the results discovered that all farmers who favoured the use of metaldehyde prior to their involvement in Thames Water's PES scheme stated some form of behaviour change in their use of metaldehyde following their participation in the scheme. Analysis revealed this behaviour change was presented and perceived as a result of an increased awareness in a range of areas, namely:

1. the environmental impacts of metaldehyde;

2. the effectiveness of alternative methods to slug control; and

3. a more considerate use of metaldehyde.

The first type of behaviour changes the data revealed was that of an increased awareness of **the environmental impacts of metaldehyde**. Farmers commonly perceived there to be a greater awareness amongst farmers regarding the environmental impacts of their metaldehyde use and highlighted a shift in farmers' attitudes and behaviours towards their usage of it as a result. This was evident as most farmers reported they were unaware of the environmental impact of metaldehyde prior to their involvement in the scheme and referred to their own experiences of learning about its environmental impact to have triggered their behaviour change. As one farmer stated:

> "I don't think I was aware of the impact of the choice… I just thought there's two slug pellets but one's more expensive than the other, so we used to go for the cheaper one because we didn't actually realise it's [metaldehyde's] contents were so harmful. But now we know, I won't use it again" (IFA Farmer 2).

Like this farmer, most farmers stated that they have completely moved away from using metaldehyde and specified they would not return to using metaldehyde in the future as a result of this increased environmental awareness. For many of these famers, these strong views towards the environmental damage caused by metaldehyde appeared to result in similar strong views in support of the withdrawal of metaldehyde from the agricultural market.

Farmers also indicated an increased awareness for **the effectiveness of alternative methods to slug control**. As mentioned in Section 4.2.1, the potential payments from the scheme

prompted farmers to try alternative options to metaldehyde. In turn, this saw farmers recognise the effectiveness of these alternative methods to slug control. This included both cultural controls, via farmers introducing more mechanical control rather than chemical treatment as a preventative measure, as well as ferric phosphate, as an alternative pesticide to metaldehyde. As one farmer stated:

"I have not seen a negative side of changing… [and now] even on land that isn't in a scheme we just use ferric phosphate anyway because it means there's no danger of me putting any metaldehyde in any water course" (FWAG Farmer 2).

As the quote implies, the farmer had not observed any issues with changing products. This resulted in the farmer extending its application to areas of their farm not required for the scheme to further mitigate the risk of diffuse pollution from metaldehyde. It suggests the financial payments are not their main motivation for their behaviour and their behaviour change would likely continue without the receipt of payment from the scheme. Farmers commonly perceived that the accomplishment of altering farmers' behaviours towards metaldehyde use was largely dependent on the success of ferric phosphate. Thus, many participants remarked they believe farmers who have changed to using ferric phosphate will not return to using metaldehyde as they perceive them to be happy with the alternative product.

Although they were found to be aware of the negative impacts of metaldehyde, the data revealed that the participants who are currently undecided on their attitude towards the use of metaldehyde are less aware of the alternatives to metaldehyde as compared to farmers with a decided attitude towards its use. For example, one such farmer stated:

"If we did have a slug infestation then we would be looking to use some sort of slug product, might be metaldehyde, if there was anything else I would rather that than metaldehyde but quite often that is the only choice" (CSF Farmer 1)

This was inferred because they have not engaged with the advice regarding metaldehyde use as they explained they have never used metaldehyde and so perceived this advice to be irrelevant to them.

Not all participants were convinced by the efficiency of ferric phosphate over the effectiveness of metaldehyde in combatting slug problems. Rather, for the minority of farmers who

maintained there to still be a need for metaldehyde, their behaviour change was stated to be through an increased awareness **for a more considerate use of metaldehyde.** As one farmer described:

"Now we would use it just as and when we need it. We use it less as an insurance as we used to… there is still a market because when you have a serious problem… I think metaldehyde is more reliable, so I think to be able to call upon it as a backup is still very useful" (Promar Farmer 3).

Many farmers similarly indicated a change in their behaviour through their reduction of metaldehyde use as a preventative measure, instead considering it to be required as a 'back up' when other methods were not as effective at preventing or tackling the issue. The data also revealed an increase in farmers' knowledge regarding the potential risks related to the placement of metaldehyde. Stated to be discussed and agreed with their project partner advisors, this usually involved only using metaldehyde on land designated as low risk (for metaldehyde losses to watercourses) and ferric phosphate on higher risk land. This increase in farmers reflecting on their use of metaldehyde was also perceived by other farmer participants. Many commented they had noticed farmers were more considerate and understanding of their behaviours regarding BMP generally.

It is important to acknowledge that there is no evidence to suggest any unintended consequences of the farmers' behaviour change has been perceived as a result of the scheme. It was confirmed the direction of change was one way with no farmers who were actively against metaldehyde prior to their participation in Thames Water's PES scheme having changed their attitude or behaviour towards preferring the use of metaldehyde since participating in the scheme.

Longevity of scheme

The data revealed a willingness from farmers to increase their understanding and improve their practices to reduce the risk of diffuse pollution beyond metaldehyde to other pesticides. This appeared to be motivated by farmers wanting to make their farming practices more efficient, to continue the improvement in water quality, as well as for their own financial efficiency. Likewise, farmers were found to be complimentary of the PES approach Thames Water has taken because it educates farmers and allows them to make their own decisions, as

opposed to a complete ban on the use of metaldehyde. For this reason, farmers stated that they would be, and perceived other farmers to be, receptive of the scheme developing in the future. As one farmer commented:

"...if they move from metaldehyde to something else then I think there will probably be some longevity in it because they have the engagement of the local community, I don't think they would run out of good will" (CSF Farmer 1).

However, a few farmers were keen to highlight that any project incentivising farmers with financial payments would be positively received by farmers generally.

4.5.3 Project partners advisors' perceived success and sustainability

The data revealed the project partner advisors perceive the scheme has also been successful. Similar to farmers, project partner advisors identified an increase in farmers' awareness regarding the environmental impact of metaldehyde; the effectiveness of alternative methods to slug control, via the application of cultural controls and ferric phosphate; and a more considerate use of metaldehyde as successful outcomes of the scheme. Due to this increased awareness, as well as their observation that farmers' are satisfied with the results they have achieved through their behaviour change, the project partner advisors believe farmers who have changed their behaviour since participating in the scheme will not revert to their previous metaldehyde use. Thus, indicating project partner advisors perceive the sustainability of these behaviours.

Like farmers, all project partner advisors emphasised **improved water quality** through the reduction of metaldehyde in their catchments as a result of the scheme, evidenced to them by the data provided by Thames Water. Yet, the project partners also voiced some doubt concerning to what extent the results were due to the scheme or other influences. For instance, project partner advisors stated that they had observed the previous metaldehyde withdrawal from outdoor use to have influenced farmers' behaviour against the use of metaldehyde.

Project partner advisors also attribute the improved water quality results to the scheme having achieved **satisfactory participation from farmers.** As one advisor stated:

"I think you can definitely see when you look at the water quality results that get sent through, comparing this year to last year, that they are participating, and the water quality is improving" (Promar Advisor 1).

Overall, project partner advisors were found to place a strong emphasis on the scheme being a success as it has obtained high participation rates and collectively credited it as the main aspect that constitutes the scheme's success. This was because it has meant the educational benefits of the scheme had reached more farmers. One advisor commented:

"With all environmental change, it takes time and… you're never ever going to get a massive win very quickly… So, the success you get is more about how many farmers you can get involved, rather than the environment benefit" (CSF Advisor 1).

Implying the project partner advisors increasing awareness and educating farmers on the responsible use of metaldehyde to be just as, if not more, important than the actual benefit of reducing metaldehyde use.

However, the number of farmers enrolled deemed to be satisfactory varied across the different project partner hosts. Advisors from FWAG, IFA and Promar viewed the level of participation in their catchments as successful because they had enrolled most farmers eligible in the scheme. As water quality is reliant upon the responsible action of farmers collectively in a catchment, they voiced this to be an important factor for ensuring the future success of the scheme as it was more likely improved water quality would be achieved and result in payment, thus encouraging farmers to re-register to the scheme. In contrast, CSF advisors placed more emphasis on participation being successful in the Lower Oxfordshire Ray catchment due to the number of farmers participating continuing to increase year on year. The rationale for this was because it means they are increasingly engaging with new farmers, enabling the educational benefit of the scheme to continue and develop. These findings correspond with the approaches the project partners took to gain farmers' participation presented in Section 4.3.2.

Most project partners also indicated **improved relationships with farmers** as a successful outcome of the scheme. This included the improvement of farmers' relationships with other farmers as well as the relationships between the farmers and the project partner advisors themselves. However, how this was perceived by the project partner advisors varied across the project partners. Advisors from IFA perceived farmer to farmer relationships to have improved as they stated that the scheme has enabled farmers to bond with their neighbours more in the Tadmarton Stream catchment by working collectively towards a common aim. Furthermore, advisors from IFA, FWAG and CSF highlighted an improved relationship between themselves as advisors and the farmers in their catchments. As one advisor said:

"it's created links with farmers and the farming community in a new area, so I feel that's… a success. That it's helped to get to know people in different areas" (FWAG Advisor 2).

For FWAG and CSF, both sets of advisors stated that this had opened opportunities for them to extend the other forms of advice and services their project partner organisations provide to new farmers in new areas. This corresponds with the results from farmers presented in Section 4.4.4.

Longevity of scheme

Project partner advisors stated how they understand there to be an interest from farmers for the scheme's continuation in the future because they have received comments from farmers about water quality analysis updates concerning other active ingredients (i.e. propyzamide and carbetamide). The results revealed that generally project partner advisors perceive the PES approach taken by Thames Water towards metaldehyde mitigation as a good 'blueprint' that could be adapted for the mitigation of diffuse pollution from other agricultural sources. One advisor stated:

"I think the future has got to be more of a PES scheme and I don't think that's any real hardship for more forward-thinking farmers. As custodians of the land I think… farmers know what they should be doing but sometimes they need… that nudge, that reminder" (Promar Advisor 2).

As the quote indicates, this was presented together with the perception that farmers want to be more environmentally aware and sustainable. Thus, the project partner advisors perceived the PES approach to be more effective in the long-term as it presents the issue as a moral obligation and educates farmers more holistically on the more efficient use of chemicals and methods for diffuse pollution mitigation. However, the project partner advisors recognised that the mitigation of diffuse pollution from other active ingredients may not be as straightforward as metaldehyde, partially because there is not always a substitute product the farmers are able to fall back on as is the case for metaldehyde with ferric phosphate.

Chapter 5: Discussion

This study aimed to understand the factors that influence farmers' decision-making behaviour considering their participation in Thames Water's PES scheme. A better understanding of farmers' decision-making behaviours generated from this study will enable organisations that facilitate PES schemes to provide improved advice and engagement frameworks to encourage and support better environmental management on agricultural land. This chapter discusses the key results acquired from analysis of the farmers' and project partner advisors' transcripts in the wider context of the PES and farmer behaviour literature. Firstly, the chapter evaluates how well Thames Water's PES scheme functions as PES according to the literature. The chapter then goes on to discuss the key findings of the study with the literature in relation to the study's research aim and objectives.

5.1 How well does Thames Water's PES scheme function as PES?

Payments are a central theme in PES with schemes assuming the 'beneficiary-pays' principle as the resource users compensate landowners for the provision of ecosystem services. Kosoy et al. (2007) highlight that for PES to work effectively the payments provided to farmers should be at least equal to the amount it costs them to implement the promoted land use. However, this has not been applied in the case of Thames Water's PES scheme as the rate of payment provided may not automatically cover the cost of implementing the necessary practices (see Section 1.1). The results indicated that both sets of study participants recognised this was the case and thus money was not a central component in their decisions to participate in Thames Water's PES scheme. This PES approach aligns with Ezzine-de-Blas et al. (2015)'s proposal that the payments provided through the scheme should be designed to be seen by the participants as an appreciation for their efforts, aimed at reducing the potential for crowding out other motivations. Farmers most notably driven by the financial payments were those that presented an 'opportunist style of participation', as they were not users of metaldehyde prior to their participation in the scheme. Van Herzele et al. (2013) and Fish et al. (2003) conclude that farmers who already fulfil the criteria required of a scheme view their participation as an opportunity to financially gain. This seems to be the case here. Still, although farmers were not strongly motivated to engage in the scheme by the monetary incentive, the provision of advice

and information associated with it was found to be highly valued and influential as a mode of payment. This is interesting as studies into voluntary incentive-based schemes have often recorded financial reasons as the main motivation for why farmers decide to participate (Sutherland, 2010; Wilson and Hart, 2001; Morris and Potter, 1995; Schenk et al., 2007). In contrast, this study's findings suggest that PES schemes do not need to rely on financial incentives. Instead, other forms of payment may be appropriate for incentivising farmers' participation and behaviours. Lienhoop and Brouwer (2015) found technical advice to be a significant impact on farmers' choice behaviour concerning an afforestation scheme in Germany, with its provision reducing the level of payment farmers were willing to accept in return for their participation.

5.2 Drivers for farmers' participation in Thames Water's PES scheme

5.2.1 Environmental attitudes

For farmers who were actively using metaldehyde before participation in the scheme, their decisions were generally dominated by intrinsic motivations, particularly those related to environmental enhancement. Greiner and Gregg (2011) and Reimer and Prokopy (2014) similarly found drivers concerning environmental improvement overwhelmingly influenced farmers' participation in conservation-oriented activities. This is significant as multiple studies promote the importance of farmers' being intrinsically motivated to adopt sustainable management activities to secure sustained environmental improvements (Matzdorf and Lorenz, 2010, Van Herzele et al., 2013, De Snoo et al., 2013). With almost a third of farmers interviewed being members of an environmental group, this may be unsurprising as it suggests the farmers involved in the scheme generally have a strong personal interest in environmental protection and enhancement. This finding reinforces the understanding that farmers in such groups are more inclined by conservation-related concerns (Beedall and Rehman, 2000).

The farmers in this study understood the rationale for reducing their metaldehyde use to improve the environmental quality of the watercourse for the benefit of Thames Water and wider society. Accordingly, the farmers were found to feel an individual sense of accountability and responsibility to improve the environment (Burton and Paragahawewa, 2011; Mills et al.,

2018) with some farmers linking their custodianship to feelings of moral obligation. This supports the general perception that farmers view themselves as 'stewards of the environment' (Page and Bellotti, 2015) and relates to the Bourdieusian-inspired 'good farmer' notion. This concept has prompted a progressive literature which has sought to better understand agricultural practices in broader social contexts and developed a productive discourse around farmland conservation and environmentally sensitive farming practices by considering how they fit with good farming ideals and identities (Thomas et al., 2019; Burton et al., 2008). Furthermore, similar to Mills et al. (2016), this study observed environmental enhancement as a driver in relation to a farmer's desire to pass on the farm in a better environmental condition to the next generation. This is consistent with the concept of 'farm continuity', the idea that a farm belongs to a farmer's family through past and future generations and not exclusively to its contemporary individual holder (Siebert et al., 2006).

5.2.2 Social influences

While farmers' personal values signify intrinsic motivational factors, community and societal influences perform as extrinsic motivations of change (Ingram et al., 2009). Kuhfuss et al. (2016) suggest that farmers are more eager to adopt a management scheme if they think that enough of their peers would similarly do so. In this study farmers acknowledged it was important other farmers were also participating in Thames Water's PES scheme as, if they were not, their non-participation would have been a barrier in their decisions to participate. Crucially, this was because they recognised the PES payment is conditional on a collective effort from neighbouring farmers to perform behaviour that reduce metaldehyde levels to below UK drinking water standards. Likewise, Van der Horst (2011) suggest neighbours influence Scottish farmers participation in PES programmes and note similar considerations. Peer pressure was also indicated as an influence for farmers' decisions with one farmer mentioning they did not want to be perceived as a polluter of the watercourse if they did not participate the scheme. Burton (2004) and Burton and Paragahawewa (2011) suggest that some farmers are heedful of the potential judgement and disapproval they may experience from their neighbours if their behaviours do not mirror the cultural norms or expectations of their peers. Therefore, this social system can be used to incite farmers to adopt more environmental behaviours in a location (Mills et al., 2016). Research has also reported that farmers often participate in pro-

environmental activities to improve their social image (Beedell and Rehman, 2000; Michel-Guillou and Moser 2006; Atari et al. 2009). This study found that a driver for some farmers' participation in Thames Water's PES scheme and subsequent behaviour change was to improve the public and government's perception of farmers, partially to avoid bureaucratic regulation concerning metaldehyde. Karali et al. (2014) similarly found that behavioural changes among farmers in Switzerland to be driven by the goal of reaching societal acknowledgment.

A small number of farmers interviewed indicated that their agronomist played an important role in their adoption decisions. Farmers' private advisors can act to promote AES measures and impact farmers' to implement these practice (Lastra-Bravo et al., 2015). Niens and Marggraf (2010) found technical advice to be an important influence on farmers' willingness to adopt an AES in relation to the implementation of new measures. These findings were replicated in this study, therefore reinforcing the understanding that a trusted individual, such as a farm advisor, could be the best avenue for aiding the acceptance of a new scheme (Sutherland et al., 2013).

5.2.3 Scheme and farm characteristics

Research into several European schemes have emphasised farmers' participation in the scheme to be positively linked to the land management practices required by the scheme fitting with the farm's existing management (Lobley and Potter, 1998; Wilson and Hart, 2000; Burton et al., 2008). Likewise, this study found farmers' decisions to participate in Thames Water's PES scheme was encouraged by the scheme's objectives fitting with their current farm system and goals. Defrancesco et al. (2008), Ruto and Garrod (2009) and Niens and Marggraf (2010) similarly found that farmers are more likely to participate in a scheme if the practices it requires are easy to implement. The study also highlighted administrative ease to positively influence farmers' participation. This is significant as Karali et al. (2014) found the administrative registration procedure, in addition to the on-going and strict rules, to be key barriers to farmers participation in AES and organic farming in Switzerland. This was recognised by the project partner advisors and indicated by farmers to indeed be a barrier to participate in

schemes. Therefore, because they perceived Thames Water's PES scheme to be administratively relaxed, it was found to instead encourage their participation.

Although research has previously signalled farm structural and management factors to be linked to farmers' participation (Defrancesco et al., 2008), this study found no significant differences in motivations between the different farm size and farm type for farmers participating in Thames Water's PES initiatives. There was also no evidence to suggest land tenure influenced farmers' decisions. Land tenure has often been linked to contract length, with tenant farmers found to be discouraged by long contract lengths in AES (Ruto and Garrod, 2009). Due to Thames Water's contract being relatively short by renewing annually, it is therefore unsurprising farmers were not influenced by this factor.

5.3 The role of project partner advisors in facilitating Thames Water's PES scheme

5.3.1 Differences between project partners approaches

Thames Water employed four project partner organisations to facilitate their PES scheme. These were a mix of private, public and civil sectors and ranged from local to national scales (see Section 3.1.2). Despite their differences, the results and approaches applied across the different catchments for facilitating the scheme were found to be relatively consistent, however, some differences did occur.

The study revealed all project partners aim to recruit all eligible farmers in their catchments to the scheme. As the only project partner with a presence in their catchment prior to the scheme, CSF took a more gradual and targeted approach to recruiting farmers. They described having a 'core group' of farmers already registered which they add to year on year by prioritising contacting farmers they think will be more interested to participate. They also introduced the scheme to farmers through the other forms of advice concerning CSF and vice versa. In contrast, FWAG, Promar and IFA focused on recruiting as many farmers as possible in their initial sign up round and walkovers.

Generally, the more credible the advice provider, for example people from trusted networks or farming backgrounds (local if possible), the more it will positively influence farmer engagement and message uptake (Dwyer et al. 2007; Blackstock et al. 2010). Advisors from Promar and IFA recognised that farmers may not have been aware of their organisations prior to being contacted and so adopted methods to counter this in their approach for introducing the scheme, such as going door-to-door to introduce themselves to the farmers in person. Indeed, farmers with project partner advisors from Promar and IFA indicated that they had limited knowledge about their project partner organisations, instead associating their project advisors more generally with Thames Water's PES scheme and not the project partner organisation. For FWAG and CSF, however, it was indicated that farmers had a general knowledge about the function of these organisations. This was advantageous to the advisors as the scheme had opened opportunities for farmers to pursue the other forms of advice and services their project partner advisor/organisation provide outside the scheme. This suggests that the nature of the advisory organisation can present farmers with opportunities to engage in other environmental activities linked, but not central, to the PES scheme itself. This might become more important when the scheme expands or changes its scope in the future.

5.3.2 Role of project partner advisors as intermediaries

In Thames Water's PES scheme, intermediaries play a key role in setting up and running the scheme. Intermediaries also influence the behaviour of the PES stakeholders (Swallow, et al., 2009). As a result, they influence the whole process and can positively or negatively contribute to a scheme's success (Huber-Stearns, 2013). Farmers' levels of engagement are determined by the character of their relationships with these advisors (Mills et al., 2016) and markedly their trust of them (Sutherland et al., 2013). Project partner advisors also recognised the importance of building a reputable relationship with farmers and so each has assigned one advisor as the main contact for farmers per catchment. To help encourage farmers' participation, Dwyer et al. (2007) suggest messages and recommendations for action need to be specific to the individual and advocate using methods that facilitate this. Accordingly, project partner advisors highlighted providing on-farm advice to be significant in their approaches as it enabled them to tailor their advice to the needs of each farmer. This was to help each farmer understand how to change their individual behaviours and increase their perceived

behavioural control (i.e. so they understood that their individual actions could bring about a solution to mitigate metaldehyde diffuse pollution). Ingram (2008) highlights that the ability of farmers to take on environmental management practices is partly dependent on their knowledge, skills and consideration of the management requirements. The results from this study suggest this approach was effective in these regards as farmers were found to trust and be influenced by their project partner advisors' advice, evident through farmers' implementation of their recommended practices for metaldehyde mitigation and further engagement in their advisory services.

The focus of an intermediary's agenda can also influence farmer behaviour (Huber-Stearns, 2013). The project partner advisors were found to perceive the educational benefits of the scheme to be just as important as the actual benefit of reducing metaldehyde use. The rationale provided for this was their understanding that the government would withdraw metaldehyde in the near future and so wanted to educate farmers more holistically to provide them with knowledge they could apply more generally to other pesticides, thereby increasing the sustainability of the environmental benefits as a result of Thames Water's PES scheme. This explained why all project partner advisors aimed to recruit as many eligible farmers as possible in the scheme, including those who were already not using metaldehyde before the scheme was introduced. Farmers were found to be interested in developing their knowledge in this respect. This supports Mills et al. (2016) who found advice to be successful in encouraging farmer engagement by identifying an issue that is of interest to the receiver of it. As well as their interests, advisors were found to play on farmers' sense of duty by identifying water quality as an environmental and societal issue. Gorsuch and Ortberg (1983) suggest that captivating a person's morality can be influential as people often wants to do what they consider to be right, even if it is personally disadvantageous.

The role of intermediaries identified in the PES literature is largely in the role of a go-between for the stakeholders involved in PES schemes, with a focus on bridging the knowledge gap between them and core aims of the PES (Vatn, 2010; Swallow et al., 2009; Pham et al., 2010). In Thames Water's PES scheme, this was evident as project partner advisors acted to simplify the scheme's administrative process and information provided through the scheme. Advisors were aware that the farmers' perception of administrative difficulty concerning such a scheme could potentially deter their participation and so took actions to increase the actual and

perceived administrative ease of the scheme. This included only contacting farmers when necessary, through taking a more reactive approach to farmers requests, as well as simplifying and assisting in the process of registration to ensure that the scheme administration was easy to understand.

5.3.3 Project partners' role in facilitating social networks

When information and BMP are shared through a group comprising their peers, farmers become more accepting of the appropriate behaviour and their feelings of personal responsibility is increased (Barnes et al., 2013; Van Dijk et al., 2015; Mills et al., 2011). The project partners advisors recognised that farmers are influenced by social factors and stressed the importance of farmers being in a group setting, aware that if individuals perceive their response to be the group response it would improve their perceived efficiency of the behaviour (Dwyer et al., 2007). As part of their provision of advice, all project partners hosted events with the benefit of bringing together farmers in a group setting to discuss issues relating to metaldehyde and wider topics of interest. However, IFA and FWAG were the only partners to state a group event as part of their main approach in introducing farmers to the scheme. This was described to be fitting with their usual approaches which place importance on social networking. Project partner advisors from IFA highlighted the small catchment size of Tadmarton Stream had been advantageous to them for using the approach. Furthermore, they acknowledged such events may be more difficult to arrange in a larger catchment due to the organisation required and increased travel demands on farmers. Certainly, in the North Wey catchment it was highlighted that low attendance rates have been an issue. It suggests the characteristics of the catchment can limit the approaches the project partner is able to use as a strategy for engagement.

Project partner advisors also recognised that other social engagement methods which allow farmers to observe actual examples of practices being successfully implemented in a social setting would be advantageous to farmers, such as on-farm visits. By creating a setting where active learning can occur through visualisation and discussion, on-farm demonstrations can be influential and effective as a mechanism for innovation presentation (Pappa et al., 2018). Singh et al. (2018) concluded demonstration sites and field days positively influence farmers' adoption of conservation practices. Dwyer et al. (2007) suggest it is important to provide local

examples for farmers to learn from as local aspects need to be incorporated into policy. Project partner advisors therefore noted them to be a possible avenue for their future engagement strategies for increasing the educational benefits of the scheme.

Rose et al. (2018a) suggest that approaches for influencing decision-making needs to be distributed across many actors within a network. They advocate a need for identifying farmers' 'ring of confidence' and to invite and actively include these key decision-makers at project meetings, seminars, and demonstration events. Indeed, the project partners recognised that farmers do not make decisions alone and so implemented this strategy, inviting anyone interested in the event to attend including all farmers and landowners in the catchment as well as local agronomists, groups and trusts. They also recognised that agronomists can be important ambassadors for the scheme, as if they consider it as beneficial, they will recommend the farmers they advise to join. Therefore, it was found to be important for the advisors to connect with local agronomists and include them in the events to engage them in the scheme. Reed and Claunch (2017) and Helitzer et al. (2014) concluded that the contribution of family and peers at events significantly improved the uptake in adoption of farm safety practices.

5.4 Perceived success and sustainability of Thames Water's PES scheme

As presented in Section 4.5, both the farmers and project partner advisors have positive impressions of the outcomes of Thames Water's PES scheme. Farmers linked this to having observed reduced metaldehyde levels in the water quality update reports from Thames Water, provided through their project partner advisors. Both sets of participants also perceived a change in farmers' attitudes and behaviours concerning their metaldehyde use. Additionally, project partner advisors placed significance on the scheme being effective in gaining sufficient participation as a validation of its overall success because it reduces the risk of metaldehyde reaching the water supply. Suitable participation is often viewed as a key indicator of a scheme's success in this respect, as the greater the level of participation, the greater the likelihood it will achieve its goals (Wilson and Hart, 2000). This is especially the case in PES schemes where all land users in a catchment are collectively responsible for the fulfilment of the PES contract (Kaczan et al., 2017). Project partner advisors also emphasised high

participation rates to be important for enabling the awareness of metaldehyde and its responsible usage to reach farmers more widely. Likewise, both sets of study participants observed the scheme has been effective in increasing farmers' awareness of the environmental effects of metaldehyde and more sustainable land management practices for slug control. Previous research has also found that farmers' skills for land management and environmental awareness are positively enhanced through their participation in environmental schemes (Herzon and Mikk, 2007; Hodge and Reader, 2007; Mills, 2012).

Wynne-Jones (2013) proposes that the success of an AES is supported by participants gaining some amount of cultural understanding around the need for their behaviour change. Furthermore, it is implied that if farmers recognise the reasons why particular practices are being advised and the advantages for using them, they will more likely undertake them (Falconer, 2000; Wilson and Hart, 2000). However, mixed evidence concerning the relationship between improved awareness and behaviour change exists in the literature (Okumah et al., 2018). This study observed a direct relationship between the two, with most farmers' attitudes and behaviours towards their metaldehyde use found to have been triggered by their increased awareness and understanding for the need to mitigate metaldehyde levels in the watercourses through the project. Farani et al. (2019) also found an improvement in farmers' awareness concerning the negative effects of their unsustainable behaviours and the methods more suitable for natural resource management increased farmers' environmental attitudes. These understandings suggest there is a strong need for provision of information and education on the impacts of metaldehyde and these were met by Thames Water's PES scheme.

This study's findings also indicate an increase in farmers' awareness of improved land management practices towards the use of metaldehyde and the effectiveness of alternative methods to slug control as a result of the scheme. Risk perceptions are considered to be a chief factor for farmers refusing an innovation (Feder and Umali, 1993; Ghadim et al., 2005). However, experience or information concerning a new management practice may act to change a farmer's perception of it (Roussy et al., 2017). This study found evidence to support these suggestions. For instance, as Reimer and Prokopy (2014) found, some farmers emphasised the potential for payment provided by the scheme helped to reduce the financial risk for adopting improved practices (i.e. alternative methods to metaldehyde for slug control).

In turn, this allowed them to experience and improve their knowledge about the effectiveness of an improved use of metaldehyde and/or the alternative methods for managing slugs, ultimately resulting in farmers accepting this behaviour change. Both sets of participants also perceived the regular water quality updates provided from Thames Water (via their project partners) to help sustain farmers' behaviour change as they confirmed to farmers that their behaviour change has improved the water quality in their local watercourse. This relates to the concept of 'response-efficacy', the belief a person has that their actions can make a difference (Homburg and Stolberg, 2006), whereby the greater the level of perceived efficacy, the more likely they are to continue with the different behaviour.

Farmers and project partner advisors were found to be complimentary of the PES approach used by Thames Water, especially regarding its educational benefits and flexibility in letting farmers decide their actions for metaldehyde mitigation. Ayer (1997) suggests that if farmers choose to implement a behaviour voluntarily it is more likely to persist as it increases the likelihood it will become embedded in social norms. Indeed, this study found a shift in the farmers' social norms with all farmers who were actively using metaldehyde before their participation in the scheme having changed their metaldehyde use since, either by a complete shift to alternative methods for slug control or a more considerate and targeted use of metaldehyde. Some were found to have gone even further by extending their behaviour change to areas not required for the scheme. Significantly, citing environmental motivations, farmers do not anticipate themselves or others returning to their previous behaviour; a view supported by the project partner advisors. These findings are particularly striking given the short duration of the scheme and indicate that the 'crowding out' effect (the term used to describe when a person's intrinsic motivation is overruled by their extrinsic motivations (Neuteleers and Engelen, 2014)) has been avoided. Farmers also showed a willingness to improve their practices to reduce the risk of diffuse pollution from other active ingredients for environmental considerations. This suggests farmers are likely to continue engaging in Thames Water's PES schemes if its focus were to develop to mitigating pollution from other pesticides. Therefore, despite the impending withdrawal of metaldehyde, this study offers a hopeful contrast against research which has found insufficient evidence to suggest AES promote sustainable attitude and environmental change (e.g. Herzon and Mikk, 2007; Aughney and Gormally, 2002; Schenk et al., 2007).

Chapter 6: Conclusion

Building on Le Moigne and Short (2019)'s desk study, which focused on the development of the Thames Water metaldehyde mitigation projects in the Upper Thames, this master's study aimed to understand the factors that influence farmers' decision-making behaviour considering their participation in Thames Water's PES scheme. As a result, this thesis was able to focus on changes farmers made to reduce agricultural diffuse pollution from metaldehyde and increase water quality. To achieve its overall aim, the research was structured around three objectives:

1. To identify the drivers and barriers for farmers' decisions to participate in Thames Water's PES scheme;
2. To analyse the approaches used by the different project partners to support Thames Water's PES scheme in mitigating metaldehyde diffuse pollution by gaining sufficient participation and the provision of advice; and
3. To assess how the farmers and project partner advisors perceive the success and sustainability of Thames Water's PES scheme in changing farmers' behaviours and attitudes towards metaldehyde.

This study adopted a qualitative research approach to explore the perceptions of the farmers and project partner advisors involved in the scheme. It is the belief of the researcher that the data collected and analysed during this study was effective in meeting the research objectives. In the following section, the main findings concerning the research objectives are summarised. These findings are taken in consideration to provide practical guidance as recommendations for the future development of PES schemes. The limitations of the study are then discussed and recommendations for future research are made on reflection of this study. Finally, the concluding remarks regarding the research demonstrated within this thesis is presented.

6.1 Main research findings

Objective 1

The study revealed the influences of farmers' decisions to participate in Thames Water's PES scheme comprised economic, environmental, administration and social factors. Contrasting with studies concerning voluntary incentive-based schemes which show that farmers are often incentivised to participate through financial reward (Sutherland, 2010; Wilson and Hart, 2001; Morris and Potter, 1995; Schenk et al., 2007), this study found farmers' decisions to participate in Thames Water's PES scheme were not dominated by economic motivations. Although effective in nudging farmers to participate, the monetary payments offered by the scheme did not significantly influence farmers' decisions. Instead, as supported by Lienhoop and Brouwer (2015), the provision of advice and information associated with the scheme was highly valued and influential as an incentive for farmers' participation in the scheme.

The study confirms Mills et al. (2018) in finding intrinsic motivations concerning environmental enhancement, often related to feelings of moral obligation and the traditional notion of a 'good farmer', strongly influenced farmers' decisions regarding their participation in conservation-oriented activities. These were generally the dominant drivers for farmers who were actively using metaldehyde before their participation in the scheme. Social influences were also found to influence farmers' decisions to participate, with the engagement and perceptions of their agronomists and peers particularly influential. Additionally, farmers were driven by feelings relating to social obligation to engage in Thames Water's PES scheme as well as wanting to improve farmers' societal image, partially to avoid bureaucratic regulation concerning metaldehyde. This study also found farmers' decisions to participate in the PES scheme were encouraged by the scheme's characteristics, including it positively fitting with their current farm system and goals as well as the scheme's administrative ease.

Objective 2

The study revealed all project partners facilitating Thames Water's PES scheme aim to maximise the recruitment of eligible farmers in order to ensure greatest benefits are achieved. The approach taken by project partners reflected their existing role in the catchment prior to the scheme. Project partners advisors were found to promote the negative environmental and financial impacts of metaldehyde as well as the advisory services available through the scheme

to encourage farmers' participation. Moreover, aware that the farmers' perception of administrative difficulty of a scheme can deter farmers' participation, project partner advisors promoted the scheme's administrative ease and acted to simplify the administrative process.

Regarding their provision of advice, the approaches applied by the project partner advisors were relatively consistent and all perceived educating farmers on the issue of agricultural diffuse pollution to be just as important as providing cost-effective catchment management for metaldehyde. Reinforcing Dwyer et al. (2007), building a reputable relationship was significant to their approaches with project partner advisors highlighting the provision of on-farm advice, tailored to the farmer, to be significant in assisting farmers to see the applicability of specific measures for their farms. Social engagement was also considered advantageous for influencing farmers' decision-making behaviour. Supporting Rose et al. (2018a)'s appeal for a more 'distributed approach' to influencing farmer decision-making behaviour, project partner advisors recognised that farmers do not make decisions alone and so actively invited key decision-makers to attend project meetings, particularly local agronomists. However, catchment size was specified to limit the effectiveness of conducting group events. On-farm demonstration events were also indicated as an engagement strategy for increasing the educational benefits of the scheme in the future.

The study suggests the approaches used by the project partner advisors were effective as farmers were found to trust and be influenced by their project partner advisor's advice, fitting with Swallow et al. (2009) suggestions. In some cases, farmers were also found to have pursued other forms of advice and services provided by their project partner advisor/organisation outside the scheme.

Objective 3

Farmers and project partner advisors were complimentary of the PES approach used by Thames Water, especially regarding its educational benefits and by it allowing the farmer to choose how they would reduce metaldehyde diffuse pollution. Both sets of participants have positive impressions of the outcomes of Thames Water's PES scheme concerning improved water quality and farmers' improved behaviours towards their metaldehyde use. Project partner advisors also highlighted the scheme has been effective in gaining sufficient participation as a validation of its overall success. Crucially, a behavioural and attitudinal

change in farmers' metaldehyde use was observed as a result of the scheme. This was either through a shift to alternative methods for slug control or via the application of improved land management practices that manage metaldehyde diffuse pollution. The literature shows mixed evidence concerning the relationship between improved awareness and behaviour change (Okumah et al., 2019). This study found farmers' increased awareness of the negative effects of metaldehyde on the water quality and more sustainable methods for slug control did generate these changes. Moreover, the regular water quality updates from Thames Water were perceived to positively influence farmers' behaviour by confirming to them that their behaviour change is improving the water quality in their local watercourse (response-efficiency). A shift in the farmers' social norms was observed by the study with all farmers who were actively using metaldehyde before their participation in the scheme having changed their metaldehyde use since. Significantly, citing environmental motivations, farmers do not anticipate themselves or others returning to their previous behaviour even if the scheme were to stop; a view supported by the project partner advisors.

Farmers also showed a willingness to improve their practices to reduce the risk of diffuse pollution from other active ingredients. It was found that if the scheme's focus were to develop to mitigating pollution from other pesticides causing challenges from agricultural diffuse pollution, farmers are expected to engage. Still, project partner advisors highlighted the scheme may not be directly transferrable to new pesticides, partially because there is not always a viable substitute product the farmers are able to fall back on as is the case for metaldehyde with ferric phosphate. Therefore, continuing with the approach used by project partner advisors in taking a more holistic approach to educating farmers on improved land management practices that can be applied more generally to other pesticides is suggested as a sensible continuation for the future development of Thames Water's PES scheme.

6.2 Recommendations for PES

This study sought to improve the understanding of farmer decision-making behaviour considering a PES scheme in order to help the organisations and individuals that facilitate such schemes increase farmer engagement and provide advice that better resonates with farmers.

It is therefore important to highlight the overall recommendations considering this research. This study makes the following recommendations for existing and future PES schemes:

- Prior to setting up a PES scheme, research should be undertaken to determine the forms of incentives most appropriate for encouraging farmer engagement;
- The administrative process should be made simple and its transparency promoted to farmers in order to mitigate the perceived complexity of PES;
- Social networks should be used to incite farmer engagement and their adoption of more environmental behaviours within a location to set the social norms;
- Advice provision for particular measures should be tailored to the farmer and their farm, acknowledging each farmer has different needs and capabilities;
- Educational benefits and increasing farmer awareness and understanding of the problems and solutions the PES scheme is addressing should be central to its aims; and
- PES participants should be regularly updated with feedback concerning the PES objectives to encourage their response-efficiency and sustained behaviours.

6.3 Study limitations

It is first important to note this research study was interrupted by the UK's Covid-19 restrictions which consequently limited the methods for data collection available to the researcher. This resulted in the study abandoning its original intention to shadow the project partner advisors when they provided advice to farmers through Thames Water's PES scheme. Still, the appropriateness of the qualitative methods used to collect and analyse the data was justified and the measures applied to improve the quality of results openly presented in the study.

Nevertheless, this study is not without its limitations. The researcher's reflexivity is a markedly important limitation in a qualitative study as the researcher's beliefs and judgements have ultimately influenced all aspects of the study (Kuper et al., 2008). Quinney et al. (2016) suggest participants interviewed in their existing workspaces, as was the case in this study, can be problematic for gaining insight into certain experiences as the participants are in their professional mindsets. Hence, this study does not assume all the study participants have

accurately communicated their true experiences and accepts that the participants may have neglected or exaggerated certain experiences (Robson, 2002). Owing to its sample size, the study also accepts it does not include the whole range of experiences concerning Thames Water's PES project. It is understood the farmers who agreed to take part in this study are likely to be the those who are more actively on board with the scheme. Having focused on the specific phenomenon of Thames Water's PES scheme, the scope of the study findings is also limited and cannot make generalisations for all PES schemes.

6.4 Recommendations for further research

To build on the findings presented in this thesis, recommendations for future research are suggested. First, it is recommended to expand similar studies to explore farmer decision-making behaviour considering other PES schemes operating at catchment scale in the UK and other developed countries. It would also be beneficial for studies to include those eligible but not participating in such schemes to greater understand farmers' barriers for participation.

In light of the decision DEFRA made in September 2020, metaldehyde will be completely phased out by 31st March 2022. However, at the time this study conducted interviews with its participants the decision to withdraw metaldehyde from outdoor use had been overturned and its reinstatement remained under consideration. It would therefore be interesting to revisit this research topic in view of this to understand if and how farmers' views have changed since the withdrawal has been reinstated. This is especially of interest as this study revealed a significant driver motivating some farmers decisions to participate in the scheme was to prevent a bureaucratic ban on metaldehyde.

Finally, as this study had initially intended, another research recommendation would be to observe the actual application of advice provided to farmers from their project partner advisors (e.g. through the inclusion of on-farm visits or events). This would ground-truth the interview responses and be useful to support the study findings.

6.5 Concluding remarks

This study has increased understanding of farmer decision-making behaviour considering a PES scheme at catchment scale in a UK context. Ongoing issues regarding agricultural diffuse pollution makes it continually necessary to examine the factors influencing farmers and their resulting behaviours to update mechanisms for encouraging their voluntary behaviour change to mitigate its cause and effects. Hence, there is a continuous requirement to evaluate current mechanisms and discover new ones. The research has shown that PES can be effective for encouraging farmers' behavioural and attitudinal change. Additionally, it has empirically evidenced approaches that are successful for influencing and supporting farmer decision-making behaviour. This will help those that facilitate such schemes increase farmer engagement and provide advice that better resonates with farmers to achieve environmental goals. It is anticipated the work presented in this thesis will further inform the development of existing and future PES schemes as mechanisms for encouraging farmers' voluntary behaviour change.

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Appendices

Appendix A: Thames Water's request for tender to project partners

Request for quotation – farmer engagement work Autumn 2020

Background

Following the introduction and development of our catchment management initiatives for protecting water quality in AMP 6, Thames Water needs to continue to undertake farmer engagement as part of our metaldehyde mitigation projects in AMP 7. Catchment-specific projects require significant landowner engagement, in order to ensure that all relevant landowners are aware that the project is happening, understand why it is needed and how it works, and are encouraged to participate.

Thames Water invites you to quote for farmer engagement work for 2020 metaldehyde mitigation projects in the areas where you are already delivering for 2019. Please note that this year we are not asking for quotations to include events for each project. Instead a regional events programme request for tender will be released separately. **Please note, these projects will go ahead subject to metaldehyde remaining legal for use in the outdoor environment. If the legal status regarding use of metaldehyde changes, we reserve the right to not proceed, adjust or cancel the services required to deliver the project.**

Project approaches

Thames Water continues to run two different types of project. In most catchments, a Payment for Ecosystem Services approach will be taken. In a small number of areas, a product substitution approach continues.

Thames Water Payment for Ecosystem Services (PES) approach

Under PES, the value of services provided by ecosystems (i.e. the environment) is recognised by those receiving the benefits, who then pay the caretakers/managers of the ecosystem to take actions to maintain or improve the service provided, where these actions go beyond what is legally required. In the case of Thames Water, the essential "service" is a consistent supply of water reaching abstraction points which is "clean", i.e. contains less than 0.1µg/l of metaldehyde. Metaldehyde pollution is problematic in autumn and winter when slug pellets are applied to autumn sown crops. Thames Water is therefore paying non-organic farmers for taking measures to protect water quality during this time, with payments based on the "service" provided, i.e. the time period for which water at the downstream end of the catchment is clean.

The decision of how to keep water clean is left to the farmer, but options include:

- Integrated pest management to avoid the need for slug pellets, for example using cultural controls such as stubble rakes and rolling seedbeds.
- Using ferric phosphate slug pellets if chemical control is required.
- Take a risk-based approach, using ferric phosphate slug pellets on higher risk fields (for example those close to watercourses, with heavy soils and underdrainage, and steep slopes), and metaldehyde only on lower risk fields.
- Only use the minimum dose of metaldehyde slug pellets required to control the slug problem, for example only treating particularly affected areas of fields, and/or using a low dose (1.5%) metaldehyde product.
- Spring cropping instead of autumn cropping, to avoid needing slug control in the most high-risk season for water quality.

We ask farmers to indicate in advance how they plan to approach slug control during the autumn. However, we recognise that slug pressure and other factors can vary significantly throughout the growing season. Consequently, we would expect that some farmers will need to change their approach, and there is no penalty for deviating from the plan. A post-season survey will include asking what farmers actually did in terms of slug control, and if they used metaldehyde, the reasons why.

Farmers will be paid £100 for enrolling in the project (in their first year of involvement), and will be asked to discuss the project with the Contractor prior to the start of the season to confirm their intended method for slug control in order to protect water quality, while also confirming their arable area (as defined for the BPS) within the project catchment boundary.

Thames Water will collect weekly water samples at the downstream end of the catchment to measure the concentration of metaldehyde in the water, typically 12 samples between September and December. Farmers will be paid a maximum of £1 per hectare of arable land within the catchment, if all water samples are clean. For every water sample with a metaldehyde concentration exceeding 0.1µg/l, a twelfth of the payment will be deducted.

Each farm will receive an additional bonus payment of £250 if all weekly samples are clean (i.e. contain less than 0.1µg/l of metaldehyde).

Thames Water product substitution approach

Under product substitution Thames Water is asking non-organic farmers to use ferric phosphate slug pellets, instead of metaldehyde slug pellets, and offering a subsidy of £1 per kilogramme of ferric phosphate slug pellets used on autumn-sown crops. In order to receive the subsidy, farmers must submit a claim by 04 December 2020 detailing the mass of ferric phosphate pellets they have used and showing proof of purchase.

Task description

The task will consist of 6 main phases for both project types. Key deadlines are summarised in Appendix 1.

Phase 1 – Initial engagement and farm visits

Spring/summer 2020

For this phase of the work a Thames Water "Farmers Guide to Metaldehyde Mitigation Projects" will be available to share with agronomists and farmers specifying the details of the project.

Contact all agronomists known to be working in the catchment to make them aware of the details of the upcoming project and the engagement work which is due to be carried out.

Contact all farmers known to use metaldehyde to make them aware of the details of the upcoming project. Offer to meet with the farmer to explain and discuss the scheme and offer 1:1 farm advice relevant to the project objectives, including but not limited to soil management and pesticide handling.

Contact all non-organic farmers known to use only ferric phosphate slug pellets, explaining the details of the upcoming project and that even though they do not use metaldehyde, they would be eligible for participating in the project.

Contact farmers who have not confirmed whether or not they use slug pellets, and if they are found to use them, include them in the engagement work.

As contact is made, update the project database to include any new information and a summary of the visits and advice provided.

Phase 2 – Registration for the projects

From spring to end of September 2020

Those who register for the project should be added to a project mailing list for water quality updates, along with any relevant agronomists, or where appropriate and agreed with the farm, additional relevant parties involved on farms participating in the project, for example owners/managers/contract farmers etc.

PES projects

Those farmers who choose to be part of the PES project must register. This can either be done in person during a visit, over the phone or by written correspondence. The farmers will need to provide their contact details and the amount of arable land within the project catchment. The Contractor will be required to assist in working out this area, which may involve looking at a map with the farmer to clarify, especially if farmers have land on the edge of the catchment boundary. The Contractor will provide the verified arable area to Thames Water and update the land ownership and use database and/or shapefile for the catchment as appropriate. Farmers also need to confirm with the Contractor their proposed method of keeping water clean. Payment details will also be required, but these do not necessarily have to be collected by the Contractor undertaking the farmer engagement work.

Registration should ideally be completed prior to the start of autumn planting and must be completed at the very latest by Friday 25 September 2020.

The Contractor will be required to liaise with Thames Water, Promar and the farmers to ensure that all payment details and arable areas have been provided and received by 31 October 2020.

Product substitution projects

Farmers do not have to register in advance for product substitution projects, but registration is strongly encouraged and can be either be completed in person during a visit, over the phone or by written correspondence. Registration involves providing contact details, and although this is not compulsory for product substitution projects, it means we can estimate claim numbers in advance, send water quality updates to registered farmers and gauge levels of interest and engagement. Payment details are not required during the registration stage for product substitution projects, but instead will be collected at the time of claiming.

Phase 3 – Newsletter

Late May/June 2020

For this phase of the work Thames Water will provide a newsletter template and guidelines regarding fonts/colours etc. in order to align newsletters between all projects.

Produce and circulate a newsletter to all agronomists and eligible farmers in the catchment. This newsletter should remind farmers and agronomists about the project and the deadline by which they must register, updating on relevant local agricultural activities and events, and providing information relating to matters of interest identified during farm visits and meetings. This is to be approved by Thames Water prior to distribution.

Phase 4 – High risk season

September to December 2020

At the end of September, October, November and December, Thames Water will provide water quality update infographics with the latest sample results from the project catchment. The Contractor will be required to send these by email to the project mailing list.

Product substitution projects

In late November/early December the Contractor may be required to liaise with Thames Water and Promar to confirm that all expected subsidy claims have been submitted and received by the deadline (04 December 2020).

Phase 5 – Post season survey

January 2021

Following the high risk season the Contractor should contact all farmers identified who are known to use slug pellets (not just those who registered for the project) to verify their slug pellet use.

Questions will be provided by Thames Water, but will include topics such as:

- slug pressure,
- whether they used cultural controls,
- whether they needed to use slug pellets,
- what kind of slug pellets they used and when.

The results of this survey should be recorded and provided to Thames Water by 12 February 2021 in a template which will be provided.

Phase 6 – Final report

February 2021

A brief report should be provided to Thames Water by 26th February summarising:

- the work completed for the project,
- the results from the post season survey,
- any details of farmer experience,
- a summary of additional farm advice provided through the project (number of days/visits and topics covered, see below),
- any lessons learnt that could be applied in future years.

Ongoing farm advice

Throughout the project

Throughout the project, Thames Water is willing to contribute towards the provision of ongoing farm advice. The quotation should allow for a number of days of ongoing advice for relevant farmers in the catchment, to be invoiced for if used. The number of days will be specified for each catchment. The focus of this advice should be relevant to the project aims but should be directed by what each farmer would like advice about. Topics can include, but are not limited to, soil management, pesticide handling, or Countryside Stewardship application support. Thames Water will be interested in knowing the topics covered but does not need to know full details of what is discussed.

Updates

Throughout project

During the main periods of farmer engagement, Thames Water will expect regular updates regarding progress (which farmers have been successfully contacted and whether they have registered for the project). Ideally these should be provided in the form of the database provided alongside an update call. An up to date copy of the database and any accompanying shapefiles should also be provided to Thames Water at the end of the project. In order to transfer

sensitive data (i.e. farmers' details) between Thames Water and the Contractor, Thames Water's secure file transfer system must be used.

Farmer/agronomist events

The provision of farmer/agronomist event(s) will now form a separate tender. Thames Water is looking to increase awareness of wider water quality issues and it is envisaged that offering events on a regional basis will help to increase attendance and levels of engagement.

The full tender details will be available in due course, but event(s) costings are not required as part this submission.

Thames Water project partner meeting

Thames Water expects to run a meeting in spring 2021 to review the projects from autumn 2020, lessons learned and plans for autumn 2021. We expect this to be a whole day event. Please account for a minimum of one person from your organisation attending in your time costs (we are happy to allow for more than one person).

Quotation requirements

Quotations should include a proposed methodology and clear breakdown of costs. Thames Water is committed to ensuring personal data are kept safe and that all of our dealings with personal data comply with the Data Protection Laws.

Appendix B: Farmer interview framework

Part 1: Characteristics of farm

1. Farm size: Total area of the holding/farm?

   …… hectare …… acres

2. Land ownership: Is the land that you farm

   Wholly owned / Mix of owned & rented / Wholly rented /

   Contract farm / Other

3. Which best describes the farm type of the farm?

   Arable: Crops / Pastoral: Animals / Mixed: Crops and animals

   If mixed: Approximately how much of your farmland is used for arable farming? .....

4. How would you describe your farming system on the holding? [Open discussion]
   Cover:
   - *What are the main farm's main enterprises?*

Part 2: Characteristics of farmer

5. How old are you?

6. Are you a member of any farmer discussion groups?

7. Are you the decision maker on the farm? Y / N

If no, who is?

8. Can you explain to me who you consult regarding decisions about…?

   a. Production aspects of enterprises?
   b. Environment aspects (such as what measures to use to mitigate issues on the farm and what schemes to enroll onto)?

Part 3: Knowledge and experience of the scheme

9. Can you tell me about the issues this farm experiences relating to issues with water pollution and the measures you have implemented on your farm to try and mitigate these?

10. Can you tell me what you understand Thames Water's metaldehyde mitigation initiatives to be and what they are trying to achieve?

11. Can you explain to me how and why you got involved in Thames Water's PES scheme? [Discussion]

Cover:

- *Where did you first heard about and what their initial thoughts were?*
- *Why did you decide to register to the project?*
- *What influenced your decision? (e.g. Other farmers/discussion groups; advisors; financial incentives; environmental benefits)*
- *Main motivating factor?*

12. To meet the requirements for payment, what changes did you make on your farm?

    - *If change was made: Why did you choose the option(s) you chose?*

13. Can you explain what your current thoughts are towards using metaldehyde? [Discussion]
    Cover:
    - *Were you actively using metaldehyde prior to your participation?*
    - *Have you changed how you use it since participating? How? Why?*
    - *Did you avoid using Metaldehyde this year? If no, why not?*

14. By participating in PES, what has been the overall impact on your holding/business?
    Prompt: Has it been a positive, neutral or negative experience?

Part 4: Project partner delivery

15. What is your opinion towards **[project partner]?**
    Prompt: Are they a trustworthy source?

16. Before Thames Water's PES scheme, had you had much contact with **[project partner]?**
    If yes, what about?

17. What kinds of advice has **[project partner]** provided you through the scheme? [Discussion]

    Cover:

- *Specifically, for mitigating metaldehyde diffuse pollution on your farm?*
- *Generally, for improving water quality in the **[catchment]** catchment?*

18. Have you requested any other forms of advice from **[project partner]?**

19. How did they communicate this advice with you?

20. How did the advice and interaction you received from **[project partner]** influence your decisions for managing your farm?

21. Are you happy with the advice/interaction you have received or are receiving from **[project partner]**?

Part 5: Success of the scheme

22. Do you think Thames Water's PES scheme has been successful? How? [Discussion]

23. Do you think farmers' behaviours towards metaldehyde will persist long-term?

24. Do you think the general attitude of farmers has changed towards…
    a. Metaldehyde?
    b. Water quality?

    As a result of the scheme or other?

25. What are you views of the PES approach? How could it change/develop?

26. Specifically, to this project, are there any ways you think it could improve?

End of questioning.

Do you have any other comments you would like to make about Thames Water's Payment for Ecosystem Services initiatives?

Y / N

Appendix C: Project partner interview framework

Part 1: The advisor and the project partner

1. What is your job title?

2. How would you describe your organisation?

3. How would you describe your organisation's role within Thames Water's PES Metaldehyde mitigation project? [Discussion]

Cover:

- *When did you first get involved in Thames Water's PES initiatives? Has your involvement changed over time?*
- *How does the project fit in with your organisation's other work and roles?*

4. Before you were involved in Thames Water's PES initiatives, had you/ **[project partner]** had any contact with farmers within the **[catchment]** catchment?

   Y / N

   If yes: Regarding what?

Part 2: Project partner's role and approach

5. Can you explain how you go about approaching farmers about the scheme, what approach(es) did/do you take? [Discussion]

Cover:

- *How do you target which farms you approach for the scheme? Is there a minimum registration target?*
- *How have you found it best to engage with farmers?*
- *How do you promote the PES scheme to farmers?*

6. What information do you find farmers want to know before they decide whether to participate or not?

7. What do you think the biggest influences are for whether a farmer decides to participate in the scheme or not?

8. Why do you think farmers decide not to participate?

Part 3: Advice

9. What service do you provide to farmers who register to the scheme? [Discussion]
   Note if different approaches are taken for different farmers.

Cover:

- *What advice/ mitigation measures are you recommending to farmers to comply with the scheme?*
- *How is the advice delivered and how regularly do you communicate with farmers?*
- *How many advisors do you have working on the PES scheme in the catchment?*
- *How do farmers generally react to the advice?*

10. How does this advice fit alongside the other advice **[project partner]** provide to farmers?

Part 4: Success of the scheme

11. Do you think Thames Water's PES scheme has been successful? How? [Discussion]

Discussion about the sustainability of the PES results:

12. Do you think farmers' behaviours towards metaldehyde will persist long-term?

13. Do you think the general attitude of farmers has changed towards…
    a. Metaldehyde?
    b. Water quality?

    As a result of the scheme or other?

14. What are you views of the PES approach? How could it change/develop?

15. Specifically, to this project, are there any ways you think it could improve?

End of questioning.

Do you have any other comments you would like to make?

Y / N

Appendix D: Email inviting participants to interview

Sent to both farmers and project partners:

Dear [name of participant]

I am a master's student from the Countryside & Community Research Institute (CCRI) and the University of Gloucestershire carrying out work as part of my master's research study.

Sent to farmers:

I am contacting you as you recently stated your interest in being part of my research study. The aim of the study is to explore the influences on farmer decision-making behaviour considering the PES scheme with a focus on the advice provided by the project partner advisors facilitating the project. Therefore, I would like to invite you to be interviewed about your participation in Thames Water's Payment for Ecosystem Services (PES) metaldehyde mitigation project.

In the coming days, I will contact you by phone to identify a time for me to visit/phone you to conduct the interview survey. The interview will follow a semi-structured format where I will ask you a series of questions that I have prepared beforehand. It should take no more than 60 minutes and will involve a discussion about your farm business, your views towards the scheme provided as well as how and why you decided to participate in the scheme. This will help shape more suitable arrangements and advisory services for this scheme and other similar.

Sent to project partner advisors:

I believe Thames Water has contacted you about my intention to interview you as part of my research study into Thames Water's Payment for Ecosystem Services (PES) metaldehyde mitigation project. The aim of the study is to explore the influences on farmer decision-making behaviour considering the PES scheme with a focus on the advice provided by the project partner advisors facilitating the project. This will help shape more suitable arrangements and advisory services for this scheme and other similar. Therefore, as you are a project partner advisor of Thames Water's PES scheme, I would like to invite you to interview.

The interview will be face to face via video call and will follow a semi-structured format where I will ask you a series of questions that I have prepared beforehand. I would like to use the video call software Microsoft Teams, however if you would prefer to use another communication method please let me know as I can be flexible. The length of the interview should take no more than 60 minutes and will resemble questions designed to explore your organisation's role as a project partner, how you approach farmers and administer advice as part of the scheme, as well as your views regarding the PES scheme and its effectiveness in achieving its goals.

Sent to both farmers and project partners:

Your participation in the survey is voluntary and the information you provide is covered by data protection legislation. Your answers will be treated confidentially and used only for this research. Accordingly, any personal data will not be attached to your interview data in order to minimise any identifying factors. The survey has been approved by the University of Gloucestershire Ethics procedure. For more information you can read our privacy statement here

http://www.ccri.ac.uk/data-protection/. Before the interview I will check that you are happy with these terms and conditions and ask you to read and sign a consent form.

For more detail on the research study and how your data will be used, I have attached a participant information sheet to this email for you to read. Additionally, if you have any questions or comments about this study, please feel free to email me directly on [email].

Thank you very much for helping with this important study.

Yours sincerely,

Stacey Hobbs

MSc by Research in Environmental Sciences student

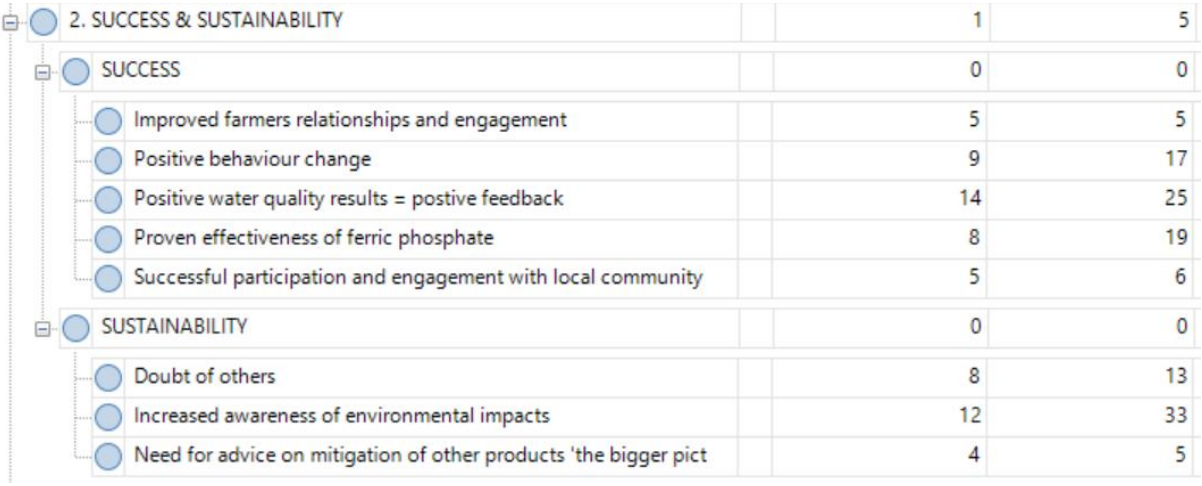
Appendix E: Farmers' participation drivers and barriers coding tree

1. FARMERS' DRIVERS & BARRIERS FOR PES PARTICIPATION	1	1
Barriers	0	0
Doubt in effectiveness of ferric phosphate	9	14
Perceived irrelevancy	6	8
Ease of implementation	0	0
Ease of implementation	6	11
'No hassle' registration of PES	10	19
Economic motivations	22	31
'Softens the financial penalty'	9	11
'Was doing it anyway so thought I might as well'	7	10
Educational motivations	0	0
Gain education & advice	3	4
To keep informed	4	5
Environmental motivations	17	32
Fits current farming system & goals	7	8
Personal interest in environment	7	8
Responsibilty - 'It is the responsible and right thing to do'	18	32
Involvement of other farmers	11	17
Important other farmers participated & were engaged	8	9
Peer pressure	7	8
To feel part of the team	7	7
Public perception	5	10
Disagreement with being paid for doing 'the right thing'	4	7
Improve public perception	5	10
Remain out of bureaucratic control	6	10

Appendix F: Project partner approach and advice provision coding tree

3. PPs FACILITATION OF PES	0	0
FACILITATION	0	0
Communication & engagement with farmers	0	0
1. Written & phone introduction	7	10
2. Face to face engagement with farmers (prior reg)	0	0
Door to door knocking (IFA, Promar)	3	3
Preference face to face on farm advice delivery	5	12
Engagement post reg.	0	0
Fear of pestering	4	6
Keeping farmers regularly updated	5	9
Targeting farmers 'the more the merrier'	3	3
Group meetings	7	12
Difficulty engaging with farmers (Promar)	1	2
Involvement of agronomists	4	4
'The more the merrier'	3	6
PROVISION OF ADVICE	1	1
Advice provided by PPs for metaldehyde mitigation	0	0
Best practice	5	10
Important to educate farmers more generally	5	7
Simplifying information & advice	2	4
Farmer oriented	0	0
Advice made relevant to the farmer	5	9
Choice of method and frequency of advice engagement	7	12
Reactive to what the farmer wants to talk about	6	12
Relationship with farmers	0	0
Importance of farmer-advisor relationship	2	4
Important to build relationship	3	8
Previous presence of PP with farmers prior PES (CSF)	1	3
Scheme entry on PP's other services (CSF, FWAG)	3	3

Appendix G: Participants' perceived success and sustainability coding tree



2. SUCCESS & SUSTAINABILITY	1	5
SUCCESS	0	0
Improved farmers relationships and engagement	5	5
Positive behaviour change	9	17
Positive water quality results = postive feedback	14	25
Proven effectiveness of ferric phosphate	8	19
Successful participation and engagement with local community	5	6
SUSTAINABILITY	0	0
Doubt of others	8	13
Increased awareness of environmental impacts	12	33
Need for advice on mitigation of other products 'the bigger pict	4	5

Appendix H: Farmer memberships environmental and discussion groups (Farmer participants)

Catchment	No. of discussion group members	Discussion groups mentioned	No. of environmental group members	Environmental groups mentioned
Cole (n=8)	5	Agriculture and Horticulture Development Board, Country Land and Business Association, Pasture Fed Livestock, National Farmers' Union, The Arable Group	5	Farming and Wildlife Advisory Group, Farmer Guardians of the Upper Thames, Marlborough Downs Space for Nature, Wiltshire Wildlife Trust
Lower Oxfordshire Ray (n=4)	3	Bicester Farming Club, National Farmers' Union	0	
North Wey (n=6)	2	European Dairy Farmers, The Arable Group	2	Farming and Wildlife Advisory Group, Game and Wildlife Conservation Trust, Selbourne Land Partnership
Tadmarton Stream (n=4)	3	Country Land and Business Association, National Farmers' Union, Oxford Down Sheep Breeders Association	1	Biology Agriculture Soil and Environment