Managed Realignment for habitat compensation: Contributing to nature conservation or furthering biodiversity loss?

England's implementation of Article 6(4) of the EU Wild Birds and Habitats Directives at the coast.

Abigail Brady

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Supervisor: Chad Boda, LUCSUS, Lund University

Abstract

In England saltmarshes account for less than 0.5% of the land area, however they have a very high biodiversity value and provide significant economic and social worth. Climate change, continuous coastal urbanisation, and port development are a serious concern for coastal protection planners, city councils and the government. It is a challenge for these decision makers to balance the social, economic and environmental needs of these dynamic areas to ensure sustainable development. Providing habitat 'compensation', creating new intertidal habitats to replace those lost to developments and coastal protection schemes via Managed Realignment (MR), has been identified as the principal way to manage the loss of habitat and prevent biodiversity loss. However the few studies that do evaluate the effectiveness of this coastal management strategy indicate that the projects are not compensating fully for the original loss of habitat. Using a detailed literature analysis and purposive semi-structured interviews this paper sought to ascertain why England continues to use MR for intertidal habitat compensation when the science indicates that the projects do not prevent biodiversity loss and may even contribute to it. Furthermore the ambiguity of the legislation and the lack of reporting on past projects has led to confusion about what specifically should be conserved and how best to instigate it. This study addresses the seventh Sustainability Science question and argues that in order to evaluate whether MR can actually preserve nature or contributes to its loss habitat compensation needs to be rigorously defined.

Keywords: habitat compensation, managed realignment, biodiversity, conservation, sustainability science

Word count: 13974

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List of Abbreviations

BU – Bournemouth University

Defra – Department for the Environment, Food and Rural Affairs

EA – Environment Agency

EC – European Commission

ESCP – East Solent Coastal Partnership

EU – European Union

HIWWT – Hampshire and Isle of Wight Wildlife Trust

LPA – Local Planning Authority (such as PCC)

MMO – Marine Management Organisation

MR – Managed Realignment

NE – Natural England

NFDC – New Forest District Council

PCC – Portsmouth City Council

RSPB – Royal Society for the Protection of Birds

SAC – Special Area of Conservation

SPA – Special Protection Area

1. Introduction

The current rate of global biodiversity loss greatly exceeds precedent natural rates, jeopardising the ecological functions that support all life on earth (Steffen et al., 2015). The most predominant cause of this loss is changes in land use due to human activities (Steffen et al., 2015). In particular coastal wetlands are threatened by land reclamation and development and globally only an estimated 50% of saltmarsh[1] remains (Barbier et al., 2011). In England saltmarshes account for less than 0.5% of the land area, however they have a very high ecological biodiversity value and provide significant economic and social worth (UK National Ecosystem Assessment, 2011). Many of these areas are internationally important for biodiversity conservation and provide vital habitats for important migratory bird species (Atkinson, 2003). Despite these factors saltmarsh loss is still occurring at the English coast as a consequence of port developments or flood and erosion protection schemes.

Providing habitat 'compensation', creating new habitats to replace those lost to developments, has been identified as one way of managing the loss of this saltmarsh habitat and its associated protected bird, plant and invertebrate species. This method is governed under the EU Wild Birds and Habitats Directives which are explicitly established to conserve nature in Europe (European Commission, 2014b). However the European Commission (EC) concedes that "according to current knowledge it is highly unlikely that the ecological structure and function as well as the related habitats and species populations can be reinstated up to the status they had before the damage by a plan or project" (European Commission, 2007, p. 17). Thus the EC recommends that compensation strategies follow scientific best practice in order to overcome these technical constraints (European Commission, 2007). Yet, with regards to Managed Realignment[2] (MR) for intertidal habitat compensation in England, the science indicates that the projects are not compensating sufficiently for the loss of habitat (Elliott, Burdon, Hemingway, & Apitz, 2007; Mazik et al., 2010; Morris, 2013; Mossman, Davy, Grant, & Elphick, 2012).

Furthermore with about 75% of the English coast designated within the Natura 2000 network[3], and a significant proportion of that coastline at risk from increasing sea level rise and development projects (House of Commons Transport Committee, 2014; Stocker et al., 2013; UK National Ecosystem Assessment, 2011), MR for habitat compensation measures urgently need to be critically evaluated as to whether they are really fulfilling their objectives set out by the EC for the sake of

[1] Doody (2001, p. 63) defines saltmarshes as 'habitats containing halophytic plant communities and associated animals that are tolerant of sea water.'

[2] Managed Realignment is the deliberate realignment of sea defences inland in order to create an area in front of the defences to buffer wave action and provide an additional sea defence, create additional habitat, and reduce flood protection costs.

[3] Natura 2000 is a network of sites that are designated in the EU as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) under the Birds and Habitats Directives.

nature conservation. Therefore this thesis seeks to discover why England continues to use MR for intertidal habitat compensation when the science indicates that the projects will not provide sufficient compensatory habitat and thus not fulfil the requirements set out by the EU Wild Birds and Habitats Directives. In trying to determine the answer I worked closely with the East Solent Coastal Partnership (ESCP), an organisation of Local Authorities in the South of England, who have the task to potentially implement a MR habitat compensation project in Langstone Harbour, England.

2. Aims and Research Questions

This thesis intends to analyse the motivations, stakeholder roles, and practices that underlie MR habitat compensation projects in order to better inform the decisions for intertidal habitat compensation in England. Additionally my literature review of peer-reviewed and grey literature revealed that the stakeholder involvement and accountability is often unclear and not documented. Therefore part of answering my main research question has been to reveal which stakeholders are involved and who is to be held accountable if the schemes do not create the habitat required.

Main research question: **Why does England continue to use MR for intertidal habitat compensation when the science indicates that the projects will not provide sufficient compensatory habitat and thus fulfil the requirements set out by the EU Nature Directives?**

Sub-questions:

1) What are the motivations behind MR for habitat compensation in England? – To discover why habitat compensation occurs in the first place and why MR is perceived to be the most suitable method.

Sources of data	**Justification for use**
Scientific literature	Scientific reasons, 'natural' processes
Policy documents	Government and 'general' perceptions underlying the motivations
History books	Historical contexts that led to MR for habitat compensation
Shoreline Management Plans	Non-statutory plans to manage the coast that influence MR
Interviews	Practitioners, conservationists, local council etc. views of the reasons behind MR

2) Who are the decision makers for MR for habitat compensation in England? – To identify who is involved and specifically who is accountable for MR habitat compensation projects, if the projects are not successful.

Sources of data	Justification of use
Policy guidance documents	Formal government guidance stating who is involved in these projects
Interviews	Practitioners – insight into the informal roles, responsibilities and processes

3) How are MR for habitat compensation projects determined to be successful? – To identify what constitutes a successful project, with the purpose of ascertaining how the English government justifies MR habitat compensation projects to the EC.

Sources of data	Justification of use
Policy guidance documents	Formal government guidance stating what is considered to be 'successful'
Past project reports	Precedent standard of what is expected from a successful project
Interviews	Practitioners, conservationists, specialists – opinions on what is and/or what should be considered as a successful project

3. Methodology and Resources

I have based my research on a qualitative approach because my overall aim has been to analyse, understand and explain the underlying social contexts in which the sustainability challenge of MR for habitat compensation is portrayed.

3.1 Research approach

This study will directly address the seventh research question for Sustainability Science (see figure 1) and answer how the sustainability of MR for habitat compensation can be evaluated. In conducting research to answer this question I will investigate the interactions between: the environment – protecting important bird species and their associated habitat ecosystems; society – protecting communities from flooding and coastal erosion; economy – allowing for growth and development. This study will also partially contribute to answering questions four and six as it discusses trade-offs and management practices of human-environment systems.

1	What shapes the long-term trends and transitions that provide the major directions for this century?
2	What determines the adaptability, vulnerability, and resilience of human–environment systems?
3	How can theory and models be formulated that better account for the variation in human–environment interactions?
4	What are the principal trade-offs between human well-being and the natural environment?
5	Can scientifically meaningful "limits" be defined that would provide effective warning for human–environment systems?
6	How can society most effectively guide or manage human environment systems toward a sustainability transition?
7	How can the "sustainability" of alternative pathways of environment and development be evaluated?

Figure 1: Sustainability Science's seven major questions for research. Source: R. W. Kates (2011)

Although I have approached this dissertation from the perspective of Sustainability Science I have also incorporated some of the approaches from Ecological Economics. This is because, like sustainability science, it aims to study the interactions between natural and social systems and organise them sustainably, and it aims to provide both the science and the management of sustainability (Baumgärtner, Becker, Frank, Müller, & Quaas, 2008; R. W. Kates et al., 2001). However Ecological Economics also uses concepts, models and case studies to operationalise sustainability challenges in order to identify the relationships between society and nature (Baumgärtner et al., 2008). Therefore to operationalise the practice of MR for habitat compensation I have used these methods of abstraction to identify the relationships at play when implementing this type of project. Concepts have been identified from the scientific literature and interview analysis, models (flow diagrams) have been created from policy documents and expert knowledge, and a case study has been chosen as the one example of a 'complete' MR habitat compensation project. These methods are used to examine the sustainability challenge of biodiversity loss and provide tangible solutions that decision makers can apply.

In order to study and understand the relationship between ecological, societal and economic systems both Sustainability Science and Ecological Economics require an inter-disciplinary approach where knowledge from many different disciplines is produced and synthesised (Baumgärtner et al., 2008; R. Kates et al., 2000). Similarly in order to translate this knowledge into action the disciplines must connect science to society and thus a transdisciplinary approach is needed (Baumgärtner et al., 2008; Lang et al., 2012). These types of approaches are reflected in my research strategies (section 3.3.).

3.2 Epistemological and Ontological Perspective

The aim of this research is to answer *why* a particular event occurs, and in doing so investigate the interactions between natural and social systems in order to provide meaningful information for decision makers to act upon. My research approach is compatible with Critical Realism, which seeks not only to understand reality but to improve the human condition (Benton & Craib, 2010). Critical Realism acknowledges there are three levels of reality: the 'real' world of tendencies, powers, mechanisms etc, the 'actual' world of flows and sequences of events, and the 'empirical' world of observed events (Benton & Craib, 2010). I am interested in investigating all three levels of reality in order to get as holistic understanding as possible of why MR for habitat compensation takes place in order to better inform the decisions for biodiversity conservation in England. To do this I have used my own observations of the 'empirical' world, a variety of literature accounting for the 'actual' world, and interviews in order to try to comprehend the 'real' world. For this particular study I believe that the 'real' world can represented through an analysis of individual perspectives of those I interviewed and thus the overall 'reality' can be obtained through an amalgamation of all three levels (see figure 2).

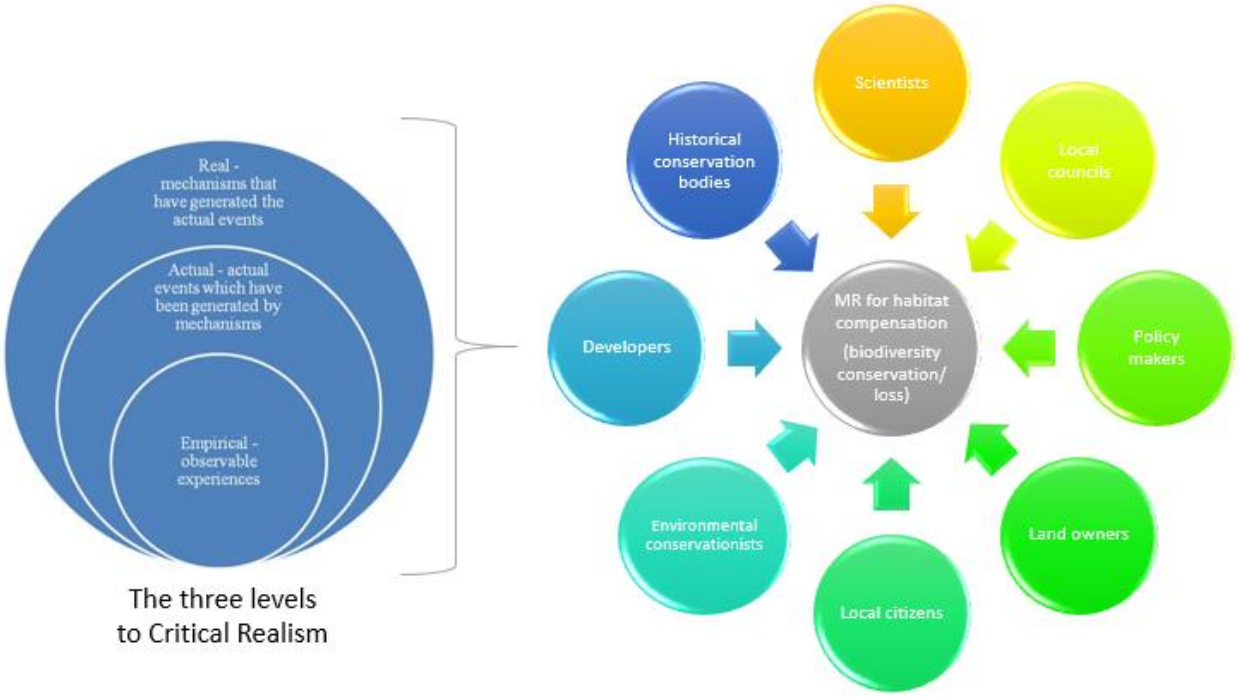


Figure 2: (Left) Roy Bhaskar's Three Levels of Reality. (Right) Author's own interpretation of how reality is discovered – via the many perspectives of stakeholders involved with the practice of MR for habitat compensation and the literature discussing it. (Left) Source: Lyubimov (2015) adapted from Mingers and Willcocks (2004).

I also acknowledge that I only have one interpretation of reality as a sustainability scientist, and that my values as a sustainability scientist will influence the conduct of my social research. I believe that it is not possible to be completely objective but that it is possible to reduce bias, thereby building a

coherent, consistent, credible and replicable project, via the choice of research area, formulation of research questions, selection and transparency of methods I use to collect and analyse data, and the approaches I use to evaluate the data.

3.3 Research strategy

The qualitative approach consists of a literature review and an interview analysis.

3.3.1 Literature review

An extensive literature review was undertaken firstly to inform the interview questions, secondly to substantiate or dispute the interview findings, and lastly to supply additional information to answer my research questions, that couldn't be obtained from the interviews. The review consisted of both scientific peer reviewed articles, grey literature such as books, policy documents and guidance, and online material from credible sources, such as government and environmental consultant websites. The key scientific literature underpinning the statement that 'MR for habitat compensation does not provide sufficient compensatory habitat' was obtained from searching the key words 'managed realignment habitat compensation' and 'managed realignment England' in several academic journal databases[4]. The results were then filtered so that only projects relating to the EU Wild Birds and Habitats Directives in England were used. This yielded four papers which directly addressed this topic. Further papers that assessed MR projects which were on sites used for habitat compensation were also studied but not used as they did not contain the information needed to assess their findings in relation to the EU Directives. Law literature was additionally used to further my inter-disciplinary understanding of England's interpretation of the concept of habitat compensation. The literature alone could not answer my research question therefore I used interviews as well.

3.3.2 Interviews and thematic analysis

Following the advice from Rowley (2012) ten face to face interviews were conducted lasting approximately one hour each[5]. A further three telephone interviews took place at the convenience of the interviewees, these lasted between 30 – 60 minutes. All of the interviewees were purposively chosen due to either their direct relation to the case in Langstone Harbour or their experience with MR for habitat compensation (see Appendix B for short profiles). Purposive sampling ensured their relevance and expertise with the topic (Bryman, 2012, p. 418), as the aim was not to get a general view of this topic but to answer specific questions. I interviewed representatives from the Environment Agency (EA), Natural England (NE), the Local Planning Authorities (which in this case was Portsmouth City Council (PCC)), the District Council (NFDC), conservation charities (Royal Society

[4] GeoRef 1785- and GeoBase 1980-, LUBsearch, Scopus, Web of Knowledge - Citation Databases 1899-, and Google Scholar (peer reviewed articles only).

[5] Initially the interviews were set to last 30 minutes, as advised by Rowley (2012), but all the interviewees were happy to be interviewed for longer.

for the Protection of Birds (RSPB), Hampshire and Isle of Wight Wildlife Trust (HIWWT)), the Marine Management Organisation (MMO), two different marine consultancies (ABPmer, HR Wallingford) and a professor of Geography from the Bournemouth University (BU) who specialises in MR research.

The technique of semi-structured interviews was used as it allowed me to discover the points of view of the participants in order to analyse the concepts underlying their answers (Bryman, 2008, p. 393). Each interview was directed with an interview guide which was created from my research sub-questions (see Appendix C). The purpose of the interviews was to collect qualitative data which could not be obtained from the literature to gain a deep insight into the answers of my sub-questions from each stakeholder perspective.

I used thematic coding (Bryman, 2012), also known as content analysis (Silverman, 2014), as the main technique for my data analysis (see Appendix D). I presented the themes in relation to my research questions and analysed them in connection with one another in order to gain a more sophisticated understanding of the social-natural systems interactions (Creswell, 2009, p. 189). I used the qualitative data analysis software MAXQDA to code and analyse my interview transcripts which were transcribed in full (see Appendix E), although omitting irrelevant word repetitions and garbled speech. Details of the meeting itself and prior interactions with my interviewees were also recorded above the transcripts so that the context of the interview could be fully understood. Once the presentation and discussion had been written up I sent copies to the interviewees to validate that I hadn't taken any quotes out of context.

To ensure that my research was conducted as ethically as possible I followed the principles set out by Bryman (2008, p. 118) to ensure that I do not cause harm to participants, obtain informed consent, do not invade their privacy, and do not deceive them.

4. Background

In this section I provide background information on the history of environmental conservation and coastal flood protection in England, how MR is said to fulfil the role of both flood protection and environmental conservation, and how development and environmental conservation are managed under the EU Wild Birds and Habitats Directives. I finish the section with a brief description of Farlington Marshes which exemplifies the complex decisions that must be made regarding nature conservation at the coast.

4.1 Environmental conservation in England

Economic development is often seen at odds with environmental conservation. The example of the Tragedy of the Commons (Hardin, 1968) explicates well what has happened historically in England,

where use of communal natural resources has gone unchecked and led to their destruction (Everett, Ishwaran, Ansaloni, & Rubin, 2010). However, despite the early exploitation of nature, England was one of the first countries in the world to pass a nature conservation law when parliament passed the Sea Birds Protection Act in 1869 (Martínez & Psuty, 2004). This was then followed by the Wild Birds Protection Act in 1872 (Williamson, 2013). However the first Act was passed to protect sea birds for the sake of maritime navigation rather than protecting the birds for their own sake (Hansard, 1869) and the second Act preserved only a few species at certain times of the year to ensure that the numbers were maintained for hunting purposes (Williamson, 2013).

More holistic conservation legislation didn't emerge until after the Second World War in 1949 when Nature Reserves began to be established as part of the National Parks and Access to the Countryside Act (Doody, 2001). Since then nature conservation legislation has increased and designations, such as Special Sites of Scientific Interest (SSSI), have been set up to prevent development on some of the country's most important ecological, geological, and historical sites (JNCC, 2015). The requirement for habitat compensation, however, did not come into effect until England adopted the EU Habitats Directive in 1994 (European Commission, 2014b). Prior to this if damage occurred to one of the protected sites then there was monetary fine but no requirement to replace the habitat that was lost.

The Habitats (Council Directive 92/43/EEC) and Wild Birds Directives (Council Directive 2009/147/EC) ("Nature Directives") together provide central pieces of legislation which underpin the conservation of nature in Europe. They form the basis for the Natura 2000 network of sites which national governments are responsible for identifying, designating and conserving as Special Protection Areas (SPAs) or Special Areas of Conservation (SACs) (JNCC, 2015). This network of sites protects over 1000 species of animal and all European wild bird species as well as over 200 habitat types (European Commission, 2014a, 2014b). England has transposed these Directives into The Conservation of Habitats and Species Regulations 2010 (the "Habitats Regulations") (as amended), Offshore Marine Conservation (Natural Habitats) Regulations 2007 (as amended), and parts of the Wildlife and Countryside Act 1981 (as amended) which strive to achieve the same objectives as the Nature Directives (Defra, 2012a).

Thus early nature conservation in England preserved nature for society's sake, for aesthetic enjoyment, to provide a place to escape from the big city smoke, and for hobbies such as bird watching, hunting and fishing (Evans, 1997). However through the establishment of such organisations as the RSPB, Wildlife Trusts and World Wide Fund for Nature, as well as legislation, such as the Habitats Regulations, England transitioned towards conserving nature for nature's sake as well as society's sake, and the government began to recognise the ecosystem services that were

provided by nature (Evans, 1997; UK National Ecosystem Assessment, 2011). This transition from an anthropocentric use of nature towards a more eco-centric view, is also evident in past and present coastal management practices.

4.2 Coastal protection

The first ever sea walls in England were thought to be erected to (re)claim land from the sea in order to gain more farmland, rather than to protect settlements (Jecock, 2011). However once people settled at the coast to farm then the banks were heightened and strengthened to protect the inhabitants (Jecock, 2011). Until the middle of the 20th century sea defence implementation was often left up to the church or individual landholder (Summers, 1978). However the 1953 East coast floods shaped the flood management practices in England for decades afterwards (Murphy, 2009). Over 300 people died and large amounts of property and farmland were damaged or destroyed as a result of a storm surge which overtopped or breached many of the East coast sea defences (Murphy, 2014). Following the disaster the stance of the government became one of 'hold the line' and the Waverley Committee was appointed to manage the sea and flood defences to ensure that England was properly defended should another storm surge hit again (Summers, 1978). However the Waverley Committee acknowledged that it could not protect all people, property and land as it was not economically possible, but the standard of the sea defences would be related to the type and quantity of property to be protected (Summers, 1978). This then resulted in a predominantly economically based appraisal of sea defence implementation (Murphy, 2009).

In the early 1990s the Ministry for Agriculture Forestry and Fisheries[6] set up Shoreline Management Plans (SMPs) to assess the risks of flooding and coastal erosion to people, property, and the natural and historic environments (Cooper, Barber, Bray, & Carter, 2002). These SMPs recognised the need for the coast to be managed over larger spatial and temporal scales in order to effectively manage risk (Cooper et al., 2002). Both the first and second set of SMPs revealed a shift from previous thoughts of providing a blanket solution of hard defences, to instead managing the risks associated with erosion and flooding with 'softer' solutions (Defra, 2005; Murphy, 2014). Additionally, it was at this time that the activity of land reclamation, which had been a practice in England for thousands of years, was deemed to be unsustainable[7] and instead reclaimed land was now proposed to be the most suitable land for MR (French, 2006).

4.3 Managed Realignment

MR is primarily implemented in England as a more sustainable approach to flood defences. Coastal management in the England can be broken down into two approaches: flood defence, and coastal

[6] Later becoming the Department for the Environment, Food and Rural Affairs (Defra).

[7] Nowadays land reclamation is still permitted but to a much reduced extent, where applications for harbours, ports and tidal barrages are more common than for agriculture (Doody, 2001).

(erosion) protection (Rupp-Armstrong & Nicholls, 2007). The Environment Agency defines four Shoreline Management Plan (SMP) policies to tackle flood and erosion hazards, these range from doing nothing to implementing hard sea defences (see figure 3).

1. **No active intervention** – There is no planned investment in defending against flooding or erosion, whether or not an artificial defence has existed previously.
2. **Hold the (existing defence) line** – An aspiration to build or maintain artificial defences so that the position of the shoreline remains. Sometimes, the type or method of defence may change to achieve this result.
3. **Managed realignment** – Allowing the shoreline to move naturally, but managing the process to direct it in certain areas. This is usually done in low-lying areas, but may occasionally apply to cliffs.
4. **Advance the line** – New defences are built on the seaward side.

Figure 3: The four Shoreline Management Plans. Source: Environment Agency (2014)

Historically the England has been prone to 'hold the line' and build hard sea defences such as sea walls, gabions, and groynes to protect urban areas and farmland (Pethick, 2002) and currently 46% of England's coastline is protected by hard sea defences (UK National Ecosystem Assessment, 2011). These hard defences have not allowed the coast to naturally respond to changes in sea level or wave energy and thus effects such as amplification of the tides, increased wave production and a reduction in sediment accretion have occurred (Pethick, 2002). These lead to increasing costs associated with maintaining defences as the natural coastal processes that protect the area can no longer take place and the hard infrastructure potentially magnifies the erosional processes (Morris, 2012).

The government in England has realised that it is not sustainable to continue building and maintaining hard sea defences (Turner, Burgess, Hadley, Coombes, & Jackson, 2007) and since Defra's *Making Space for Water* document was published in 2005 the policy of maintaining hard sea defences is only in place where the benefits of protecting the coast outweigh the costs of the defences (Defra, 2005). Defra (2005) emphasised that 'costs and benefits' will not just be assessed economically but will include environmental and social aspects as well. Thus the preferred method of coastal management is MR for flood prevention and erosion protection (Defra, 2005).

Defra and EA (2002, p. 1) define Managed Realignment (MR) as:

> Managed realignment means the deliberate process of realigning river, estuary and/or coastal defences. This may take the form of retreating to higher ground, constructing a set-back line of defence, shortening the overall defence length to be maintained, reducing wall or embankment heights or widening a river flood plain. The purpose of managed realignment schemes might be to:

- Reduce defence costs by shortening the overall length of defences to be maintained;

- Increase the efficiency and long term sustainability of flood and coastal defences by recreating river, estuary or coastal habitats and using their flood and storm buffering capacity;
- Provide other environmental benefits through re-creation of natural habitats; or
- Provide replacement habitats in or adjacent to a European designated site to compensate for habitat loss as a result of reclamation or coastal squeeze.

Realignment of defences generally involves repositioning the main line of defence further inland and either breaching or removing the present defences (Esteves, 2014). The main intention behind this method is to create 'accommodation space' within the coastal area in front of the new defences (Morris, 2012) and to provide additional protection with the new defences. The 'accommodation space' will then allow for sedimentation to take place and subsequent saltmarsh development, which will then act as a buffer for the new sea defences against the incoming tide and wave energy (Morris, 2012). Less money needs to be spent on the new sea defences as most of the flood protection has been provided by the saltmarsh (see figure 4).

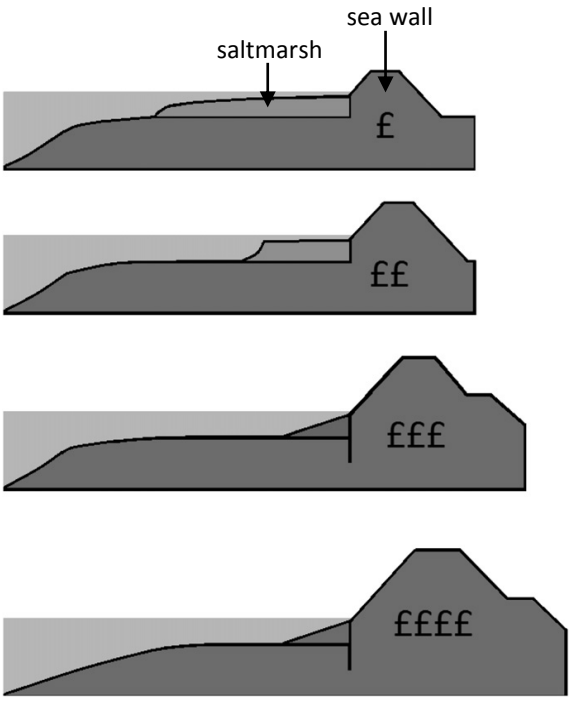


Figure 4: The importance of saltmarsh in front of sea defences. The more salt marsh there is in front of a sea defence the less energy that defence has to dissipate, thus the less money that has to be spent on its construction. Source Morris (2012, p. 62).

The theory behind MR is that the saltmarsh created will provide multiple functions[8] such as flood protection, habitat for marine flora and fauna, a reduction in sea defence costs, and amenity value (Esteves, 2014). The UK National Ecosystem Assessment (2011) calculates that up to 50% of wave

[8] Not all MR projects are implemented for habitat compensation, many have the objective to provide increased flood and erosion protection, and the creation of habitat is a secondary effect.

energy is dissipated by the first 10-20 meters of saltmarsh, and widely estimates that between £3.1 billion - £33.2 billion is saved annually on providing coastal defences where saltmarshes are in place in England. Thus, in terms of flooding protection, MR provides the transition from 'hard' sea defences to 'soft' sea defences as there is now the desire of the UK government to work with nature not against it (Lawton et al., 2010).

On the surface MR can be seen as the sustainable approach to coastal management because it takes into consideration social (protecting people and property), economic (protecting livelihoods and current development) and environmental (re-creating habitat) concerns. However when it is used for habitat compensation there is the belief that it is not adequate to prevent biodiversity loss from the damaged or destroyed Natura 2000 sites (Elliott et al., 2007; Mazik et al., 2010; Morris, 2013; Mossman et al., 2012). Elliott et al. (2007); Mazik et al. (2010); and Mossman et al. (2012) believe that intertidal habitat compensation should create habitats and species that are comparable to adjacent natural areas in order to be considered as sufficient compensation. Their studies on MR habitat compensation sites have shown a lower species diversity and abundance in invertebrates, bird species and plants, which has led them to conclude that MR for habitat compensation is not successful. Morris (2013) believes that MR is effective when compensating for saltmarsh but not mudflat, both of which are necessary for a functional intertidal ecosystem, and thus MR cannot compensate fully for the mudflat that is lost. However comparing adjacent natural areas to newly recreated sites may not be the best approach to assessing whether MR habitat compensation projects are successful. Nevertheless because of the ambiguity of the legislation regarding habitat compensation it provides a valuable starting point for a discussion of why MR for habitat compensation occurs in England.

4.4 Interpreting the legislation

The requirement for habitat compensation generally occurs as a result of either flood protection plans and projects, or port developments[9]. However habitat compensation is not the first step when considering how to deal with an activity that will potentially have a 'likely significant effect'[10] on a designated EU site. The English government sets out a hierarchy of how to manage developments or

[9] Nowadays ports in the United Kingdom (percentages for England were not available) handle 95% by volume and 75% by value of the country's imports and exports (House of Commons Transport Committee, 2007) and the present government's shipping strategy is to increase trade by "promoting the UK as a globally competitive location for shipping which encourages trade" (House of Commons Transport Committee, 2014, p. 6). Ports are becoming more integral for England as the country outsources increasingly more of its production and thus relies more heavily on imports (House of Commons Transport Committee, 2014). However the majority of ports in England are situated near or within Natura 2000 designated or proposed designated sites, and will potentially cause environmental damage as they aim to expand (Morris & Gibson, 2007).

[10] A "significant effect" is defined as an activity that would undermine an EU conservation site's objectives, such as damaging the quality of the habitat or displacing the species for which the site was designated (Defra, 2012a, p. 10).

plans that threaten biodiversity (see figure 5) as part of the Habitats Regulations Assessment (Defra, 2013) (also see Appendix F for a full description):

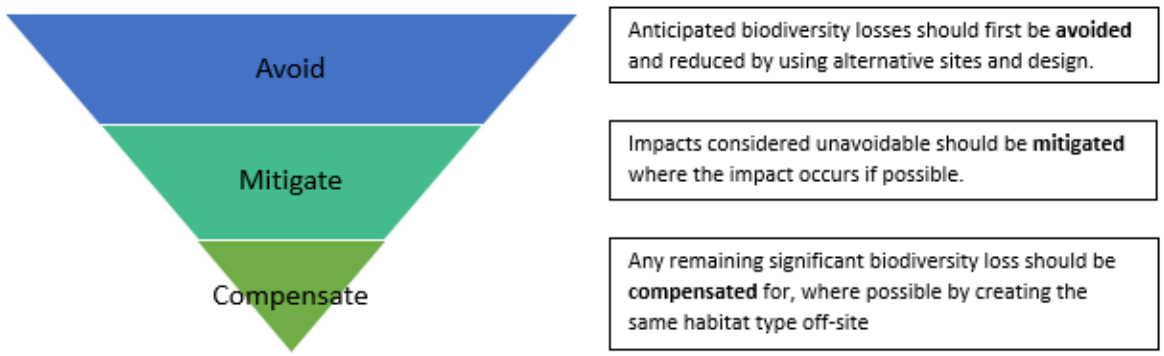


Figure 5: The 'mitigation hierarchy'. Created from Defra (2013, p. 4). Author's own diagram.

As a first step any potential losses to biodiversity should be avoided, promoters of a project should seek alternative options for their overall objective for development or plan. If they demonstrate that this is not possible then an Appropriate Assessment must be undertaken to determine what effects the activity will have on the site, if these are concluded to be negative then the competent authority should not grant authorisation of the project unless mitigation of the negative effects can be carried out or 'derogation' tests are met (Defra, 2012a). These derogation tests refer to 'limited circumstances' where an activity is permitted to continue even though it will cause adverse effects on the integrity of a designated EU site.

Under these circumstances the European Commission (2007, p. 3) states:

> If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.
>
> Where the site concerned hosts a priority natural habitat type and/or a priority species, the only considerations which may be raised are those relating to human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest.

Defra (2012a, p. 19) then translates this text into three derogation tests, in order for the activity or development to be permitted:

- There must be no feasible alternative solutions to the plan or project which are less damaging to affected European site(s)
- There must be "imperative reasons of overriding public interest" (IROPI) for the plan or project to proceed

- All necessary compensatory measures must be secured to ensure that the overall coherence of the network of European sites is protected

The definition or classification of 'imperative reasons of overriding public interest' (IROPI) then comes into question. The EC guidance document states that there is no official definition in the Nature Directives but the mention of "human health, public safety and beneficial consequences of primary importance for the environment" are stated and thus these are taken as examples of what IROPI means (European Commission, 2007, p. 7). However there is also mention of "other" IROPI with a more social and economic focus, but these IROPI can only be considered where it is in the *public* interest, although the project can come from the private or public sector (European Commission, 2007). In England the guidance is similar except it does not emphasise the 'long-term' nature of the public interest, which the EC guidance considers to be necessary to balance against the long-term conservation interests of the sites which are protected by the Nature Directives (Defra, 2012a; European Commission, 2007).

A further caveat under the Nature Directives is that where there are priority species or habitats[11] then normally social or economic reasons are not valid as IROPI unless an 'opinion' from the EC is sought and the activity is permitted (Defra, 2012b). However, where SPA and SAC sites are normally as equally important under the Nature Directives, the Birds Directive does not list priority species and thus does not receive the higher level of protection under the IROPI principle. Thus bird SPA sites are more vulnerable to projects and plans of a socio-economic nature than SACs are.

Habitat compensation itself is also not defined by the EU Nature Directives and so the guidance from the EC on Article 6(4), directly relating to habitat compensation, suggests that compensatory measures are "intended to offset the negative effects of the plan or project so that the overall ecological coherence of the Natura 2000 Network is maintained" (European Commission, 2007, p. 10) and that they provide the same "ecological structure and functions" as those habitats that were lost (European Commission, 2007, p. 18). In England the Defra (2012b, p. 5) *Habitats Directive: guidance on the application of article 6(4)* is worded slightly differently:

> The Habitats Directive seeks to create a coherent ecological network of protected sites.
>
> Compensatory measures can include, among other things:
>
> - The re-creation of a comparable habitat, which can in time be designated as a European site.
> - The re-creation of a comparable habitat as an extension to an existing European site.
> - In exceptional circumstances the classification of a new European Site for comparable features.

[11] A priority habitat or species is classified as those that are in danger of disappearing.

This is of particular importance as there is no mention of ecological functions in this guidance from England and it is open to interpretation what a 'comparable habitat' might be. However these guidelines do indicate an end result – to create a site which in time can become designated as part of the Natura 2000 network, though there is no indication of how much time should be allowed for the site to achieve this. Furthermore the guidance permits the destruction of the site before it has been designated, providing a larger area of compensation is created and that the promoter "takes action" if the compensation is not successful (Defra, 2012b, p. 6). However, again, there is no mention of what this 'action' should entail.

Additional Defra guidance published four months afterwards goes into more detail about what compensatory measures entail but does not include the classification of a new European site (Defra, 2012a) which may be because this option is criticised for allowing for a net loss of habitat at member state level (European Commission, 2007). Again the guidance refers to the 're-creation of comparable habitat' as compensation for what is lost but adds that factors of: 'technical feasibility based on scientific evidence, provision of management and objectives, distance from the affected site, time to establish the compensatory measures, and whether the creation, re-creation, or restoration methodology is technically proven or considered reasonable' must be taken into consideration for these projects (Defra, 2012a, pp. 24-25). The factor of technical feasibility is potentially debatable for MR habitat compensation projects.

4.5 Exemplary Case: Farlington Marshes, Langstone Harbour, England

Farlington Marshes became the stimulus for my interviews with the stakeholders involved in MR for habitat compensation projects as it represents a highly debated complex case of nature-society-economy interactions (see Appendix A for a full description). The marshes are a nature reserve managed by the Hampshire and Isle of Wight Wildlife Trust (see image 1), and are part of the Natura 2000 network of sites. They are deemed environmentally and socially valuable because, on the one hand, they provide one of the last remaining freshwater grazing areas in the East Solent for important bird species, and much needed 'green' recreation space for the people from the (heavily urbanised) Portsmouth area (Chapman & Chatters, 2007). On the other hand they represent one of the few remaining sites in the Solent which can be used to compensate for intertidal habitat losses due to coastal flood protection measures (G. Holder, personal communication, 12/01/2015). The future of the marshes is increasingly debated because the cost to maintain the sea defences can no longer be covered by the EA's Flood Defence Grant in Aid as the site does not directly protect people and property. Furthermore the marshes themselves are subsiding and are at a growing risk of saltwater inundation due to rising sea levels. The East Solent Coastal Partnership (ESCP) are tasked with determining what would be the most sustainable future for Farlington Marshes and must not

only take into consideration environmental concerns but social and economic factors too (East Solent Coastal Partnership, 2013). However because the site is designated under the Nature Directives there is an increased priority for protecting the important habitats and bird species. The ESCP need to ascertain whether it would be technically feasible to MR the marshes as intertidal habitat compensation for the sea defences around Portsmouth, and then be able to compensate for the loss of the freshwater grazing marsh elsewhere; or whether they should try to preserve the habitat in situ. The next section of my dissertation analyses MR for habitat compensation in general but draws on the example of Farlington Marshes in order to answer my research questions and provide insights into the process for the ESCP.

Image 1: Photo of visitor sign at Farlington Marshes, taken by the author on 25/02/2015.

5. Presentation and Discussion:
Justification of Managed Realignment for habitat compensation

The analysis and discussion of the results of the interviews and literature research shall be structured via my sub-research questions in order to answer my main research question.

5.1 What are the motivations behind MR for habitat compensation in England?

This question was posed in order to discover why habitat compensation occurs in the first place and why MR is perceived to be the most suitable method. As a result of the Farlington Marshes example study and the interviews four main motivations were identified for MR for habitat compensation in England: legislation, common sense, coastal squeeze due to protecting people and property, and port development. These themes were then discussed by the interviewees in the broader context of trade-offs between the environment, society and the economy.

Legislation: The existence of the EU Nature Directives themselves came up as the only motivation for MR habitat compensation projects for the MMO interviewee, as a primary driver for the HR Wallingford, Portsmouth CC (PCC), and the NFDC interviewees, and was mentioned by all the other interviewees in relation to why MR for habitat compensation projects take place: "I think there's a lot of reasons, but ultimately I think it's a legal compliance issue" (D.Hayward, PCC, personal communication, 24/02/2015). The SPA and SAC designations which rely on the legislation to protect them can therefore be considered as part of the legislative reason for habitat compensation, for if one of these sites is adversely affected due to a plan or project implemented for Imperative Reasons of Overriding Public Interest (IROPI) then the loss would have to be compensated for. One of the EA interviewees even stated that the legislation technically overrides economic concerns and prioritises environmental ones: "if it came to a situation where we had ten million pound in total to spend nationally, and there was this legal driver to defend this [habitat], we would spend ten million pound in protecting people and birds rather than property because that's the legal driver" (A.Bishop, EA, 23/02/2015). However he did go on to say that politically this probably wouldn't be allowed to happen and the government could override the legal driver, although there would be consequences from the EU. Thus demonstrating that political will is an important factor when it comes to economic and environment interactions.

"Common sense": In terms of why MR is used as a method for habitat compensation there isn't an explicit reason given in EU or English legislation or guidance, just the statement that compensation needs to occur if a designated site is adversely affected (European Commission, 2007). Though this is probably because they are general documents which apply to all forms of habitat compensation (Defra, 2012a). This method is however advocated in the Defra (2005) *Making Space for Water* document and in England's guidance on coastal squeeze (Defra Flood Management Division, 2005).

Many coastal EU member states have used MR to compensate for intertidal habitat loss, though none as much as England (OMReg, 2015). In England MR is the favoured method: "for the past 20 years, MR has been seen as the clearest and most common sense thing to do in order to create compensatory habitat… in particular it is seen as the best way to achieve certainty of outcome within a dynamic, evolving coastline because you have a fixed area, you develop a fixed zone of habitat and you know that you have achieved habitat in that zone" (C.Scott, ABPmer, personal communication, 11/05/2015).

The ABPmer interviewee also went on to say that MR for habitat compensation also provides a range of tangible social, environmental and economic benefits that otherwise would not be evident if the projects weren't implemented and so the method, despite some uncertainties, is a sustainable coastal management strategy. I have found this to be particularly true when dealing with the effects of coastal squeeze.

Protecting people and property causes coastal squeeze: Every single interviewee mentioned coastal squeeze as one of the reasons for MR for habitat compensation. Many references were made to protecting people and property as a cause of coastal squeeze, and it was assumed that this was inevitable: "through basically health and safety reasons, so there's no other alternative – we have to defend people and property, or else there's going to be a health and safety implication to that, we can then have an impact on that Natura 2000 site" (A.Bishop, personal communication, 23/02/2015).

The way that England has transposed the EU Nature Directives means that they include the Shoreline Management Plans (SMP) as a 'plan or project' and so must compensate for any adverse effects on designated sites caused by this (Defra Flood Management Division, 2005). The SMP decision to 'hold the line' causes coastal squeeze so consequently England must compensate for the intertidal habitat loss it causes[12]. The choice by the government to interpret the EU Nature Directives in such a way as to include the SMPs under the Regulations, is something which other European countries haven't done yet (T. Collins, personal communication, 11/03/2015). Since the decision was made in 1994 to include 'hold the line' plans under that Habitat Regulations. There is no explicit reason given for why England accounts for coastal squeeze under the Habitat Regulations or the guidelines, just the mention of the "enormous effect" that flood and coastal erosion risk management measures (via 'holding the line') have on wetland and coastal environments and the concern to ensure that these measures are legally compliant with the EU Nature Legislation (Defra Flood Management Division, 2005, p. 1). Coastal squeeze can, however, be attributed to man-made

[12] A total of 7 MR projects have been carried out for habitat compensation due to coastal squeeze (OMReg, 2015) (see Appendix G)

plans or projects both in the present day and in the past, and therefore may be the reasoning behind Defra's decision to incorporate it under England's legislation.

Coastal squeeze occurs when hard sea defences prevent the natural backward migration of saltmarsh in response to rising sea levels (Pontee, 2013) (see figure 6). Although some scientists have claimed alternative reasons for the loss of saltmarsh, such as a change in intertidal biota, due to the invasion of cordgrass for example, causing a loss of pioneer plants leading to increased erosion (Hughes & Paramor, 2004), the generally accepted reason for saltmarsh habitat loss is coastal squeeze (Doody, 2004).

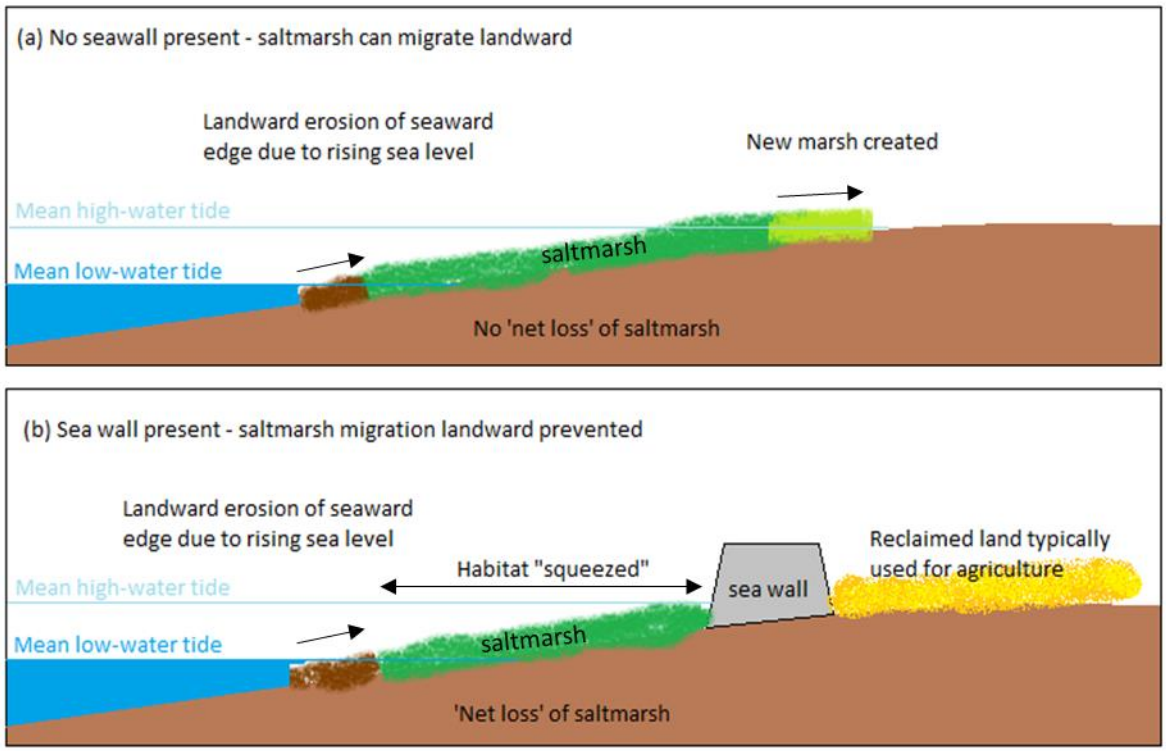


Figure 6: Coastal Squeeze. Saltmarsh responds to changes in sea level by either gradually migrating to higher land in times of sea level rise and/or erosion (a), or further into the sea in times of sea level fall and/or sediment accretion. However if a hard sea defence is in the way of the saltmarsh migration to higher land then this causes the lower parts of the salt marsh to die (b), because they become completely submerged by rising sea levels and cannot survive. As the sea level rises and the tidal frame becomes smaller, thus the habitable space for the saltmarsh is 'squeezed' until it cannot exist any longer. The saltmarsh may even disappear entirely leading to the sea defence itself becoming undermined. Adapted from Pontee (2013, p. 205).

Where land reclaim was the reason why the defences were initially built, now it is almost non-existent, so it no longer causes further coastal squeeze to happen. However in places where the land has been claimed and now settled upon the new motivation for coastal squeeze becomes protecting people and property. This motivator is not very easily addressed as it is not simply a matter of removing the sea walls and letting people and property flood. Aside from the ethical and moral implications of doing nothing to protect people's lives and assets, a lot of reclaimed coastal areas

have been altered and urbanised beyond the point at which the sea can regain the land and turn it back into saltmarsh. Thus MR, of areas without people and property, is seen as a way to 'make space for water' and 'work with nature' to alleviate the effects of coastal squeeze by providing space for the salt marsh to 'naturally' migrate backwards. Explicit mention of using MR as a way to reduce the effects of coastal squeeze on saltmarsh is mentioned in the Defra (2005) *Making Space for Water* document.

Port Development: This was recognised to be the third motivation for MR for habitat compensation projects, primarily from the legislative documents, as not all interviewees referred to coastal or estuarine developments on designated sites. The PCC, NFDC, ESCP and one of the NE interviewees stated the main motivation that arises in their organisations is coastal squeeze and did not mention the other motivation outlined in the legislation. This may be due to the fact that there have not been many recent significant port developments in the Portsmouth and Langstone harbours and so these interviewees have not had exposure to this type of motivation. Of those who did mention development they did not question why the development took place they just assumed, like protecting people and property, it *had* to: "I understand habitat compensation should take place when development will cause degradation or loss of designated habitat. Supposedly the developer should provide means to compensate that degradation or loss by regenerating a degraded environment or by creating the environment that is going to be lost" (L.Esteves, personal communication, 08/05/2015).

The majority of ports in England are situated near or within Natura 2000 designated or proposed designated sites (Morris & Gibson, 2007). This poses a problem for both nature conservation and the port developers to find a suitable balance. Since the EU Nature Directives were transposed into England's Habitats Regulations legislation in 1994 there have been 8 developments which have required 10 MRs for habitat compensation (OMReg, 2015) (see Appendix G). The documents outlining the specific IROPI statements are not readily available to the public, despite being in the public's interest, but it can be assumed that the IROPI statements for the port developments were of a social and economic nature.

Superficially, it would seem that the IROPI caveat in the legislation enables social and economic priorities to supercede environmental ones. However the way that England has transposed the EU Nature Directives appears to be more strict than other EU countries, leading to accusations of 'gold plating'. Some port developers believe that English legislation is going beyond what's required by the EU legislation, and is putting the country at an economic disadvantage compared to other European countries who have less strict rules about development (Morris, 2011). However the case law for the Nature Directives suggests that the EC have ruled against many of the other EU countries for their

failure to interpret the Nature Directives appropriately (Morris, 2011). This has also occurred in England, though to a lesser degree than some countries, where at least 3 port development proposals that have been turned down, on the grounds of insufficient planning to provide intertidal compensatory habitat or invalid IROPI cases (RSPB, 2012). Thus demonstrating that nature conservation is not easily surpassed by economic and social concerns.

Trade-offs: The government's response, when trying to balance protecting people and property, the environment, and the national economic interests, is to "defend where it is sustainable and affordable to do so" (Defra, 2010, p. 4) and to view the environment as an asset to be protected (Everett et al., 2010). However this is not so easily achievable within this current capitalist mode of valuation, where property and even people have an obvious monetary value (house prices and salaries), but much of the environment does not: "in theory, the policies take into account people and property and environment and heritage and finances and engineering feasibilities. So everything is equal importance and is factored in. In reality, I think it's fair to say that it's people and property that drive the policy. Because you have to make a financial case for each policy" (A.Colenutt, NFDC, personal communication, 27/02/2015). The EA also reduce the assessment of their projects and plans to a cost-benefit analysis, therefore if it is considered uneconomical to maintain hard sea defences (because they are not protecting assets that outweigh the cost of maintaining the wall) then the policy will be either to MR or for no active intervention (N.Reid, EA, personal communication, 19/02/2015). Where there is a designated site, however it becomes more complicated to ascertain the benefits of maintaining the site and proving that it is more valuable in situ than recreated elsewhere: "you get certain points in the economic score or the financial scoring system now, for recreating habitats. But you don't get any points for the protection of habitats i.e. if you maintained a defence to protect a coastal grazing marsh, you can't count the cost that you were avoiding by not having to recreate that coastal grazing marsh somewhere else. You're only allowed to sit on one side of the see-saw" (A.Colenutt, NFDC, personal communication, 27/02/2015). In this sense there is then an additional drive to recreate rather than conserve habitats subject to an economic scoring system, which may be the most economically sustainable but not environmentally. Nevertheless despite this economic approach to managing the environment, again the interviewees pointed out that the legal driver was stronger than the economic driver: "if there's a legal driver, that's the priority. So if, legally, we've got to defend Farlington Marshes, and it's going to cost ten million pounds to do so, and there's no alternative, then we would legally have to defend it…by law" (A.Bishop, EA, personal communication).

Another reason for implementing MR for habitat compensation, mentioned by the EA, ESCP and NE, was that England has adopted the approach of working with nature and not trying to defend the un-

defendable, which may even extend to people and properties as the government has no legal requirement to protect them (Defra, 2010). Thus again MR for habitat compensation is seen to be able to balance the trade-offs between society, the environment, and the economy; by providing flood protection for people and property, permitting economic development in the public's interest, and creating new habitat to replace that lost to coastal squeeze or development. Additionally all of the interviewees mentioned that MR creates a range of benefits not just habitat compensation for a particular species or habitat; it creates a sustainable flood defence because it works with natural processes, the habitat created provides many ecosystem services such as a carbon sink, nutrient recycling and water filtration, and can provide additional habitats to other species such as fish and mammals. This is why the method is especially popular for decision makers because it doesn't just fulfil one objective, but provides a range of services and benefits to both humans and wildlife.

On the other hand there were arguments for keeping the habitat in place even if the monetary costs outweighed the monetary benefits. Within heavily urbanised areas, such as Portsmouth in Hampshire, 'green space' is highly socially valued as it is quite rare, therefore there is an argument to keep the freshwater habitat for the sake of the urban population as a place for recreation, aesthetic enjoyment, and access to nature (G.Holder, ESCP, personal communication 25/02/2015). This was also echoed by the RSPB interviewee when I asked him if it would be better for one or two large compensation sites[13] to be created instead of several smaller ones: "I think, although ecologically we could get by, by just having a few large sites somewhere…in terms of people's experience of nature and ability to go visit it or build it into their lives, it really limits what people can do, and I think that rather than necessarily going for what's absolutely optimal I think it's important that we make sure that people can visit things and that there's something near them" (J.Rhodes, RSPB, personal communication, 06/02/2015). Thus there is a trade-off between what is most economically viable, socially acceptable, and environmentally sound when considering and implementing these type of projects, which is a balance decision makers increasingly have to make.

5.2 Who are the decision makers for MR for habitat compensation in England?

This question was asked in order to identify who is involved and specifically who is accountable for MR habitat compensation projects, if the projects are not successful. Two themes were particularly discussed by all the interviewees: stakeholder involvement and accountability of those stakeholders to the MR habitat compensation projects.

Stakeholder involvement: One of the significant factors that either helped a proposal to be accepted or denied was whether the developer worked with NE and the wildlife charities to create a

[13] (Atkinson, Crooks, Grant, & Rehfisch, 2001) demonstrates that larger areas had more chance of providing a suitable habitat for birds than smaller ones.

suitable scheme that all stakeholders could agree to (RSPB, 2012). This was echoed by all the interviewees who continually stressed the importance of working with the regulators, and the wildlife charities in order to ensure that England is complying with the EU Nature Directives: "when we're taking forward any scheme proposal for flood protection and where we're recommending compensation we would always work with our regulators, Natural England and the Environment Agency, local development authority, a competent authority to make sure what we're proposing as compensation is adequate and sound" (G.Holder, personal communication, 25/02/2015).

Defra (2012b) has published guidance which outlines that there must always be a Statutory Nature Conservation Body, Competent Authority, and Appropriate Authority involved in habitat compensation projects. For MR habitat compensation projects the Competent Authority can vary between the Local Planning Authority (LPA), the Environment Agency (EA) and the Marine Management Organisation (MMO) depending on which type of assessment[14] needs to be carried out (Solent Forum, n.d.). Environmental Impact Assessments and Habitats Regulations Assessments are always needed with MR habitat compensation projects but depending on whether it's a port development, flood defence works, or if a water course is affected then additional assessments may be needed. However it is not enough just to include the obligatory stakeholders, inclusion of nature conservation charities, local citizens, and the landowner is vital for the implementation of a project (J.Allen, NE, personal communication, 27/02/2015). Additionally, depending on where the MR is taking place other stakeholders such as the National Farmers Union, historical conservation bodies and harbour authorities should also be consulted (A.Colenutt, NFDC, personal communication, 27/02/2015). As such there is no one go-to document to outline explicitly who is or should be involved in these type of projects. However it was clear from talking with each of the interviewees that they informally knew who they should talk to, but that stakeholders, who do not have much experience with these type of projects, would benefit from further guidance: "actual information on complying with them I think is lacking a little. I think there needs to be a good process document that kind of gives a flow of who you should consult" (G.Holder, ESCP, personal communication, 25/02/2015). Therefore with the interviewees I developed a stakeholder roles and responsibilities diagram, and a process chart to provide an overview of the stakeholder involvement in MR for habitat compensation projects (see figures 7 and 8). These were created to assist with my own understanding, inform those who are not familiar with the process, and to provide a formal reference for those involved.

[14] 1. Environmental Impacts Assessment (EIA) - MMO (waterside) or LPA (shoreside)
2. Habitats Regulations Assessment (HRA) – LPA or MMO
3. Water Framework Directive Assessment (WFD) - EA
4. Flood Defence Assessment (FDA) - EA
5. Design and Access Statement - LPA

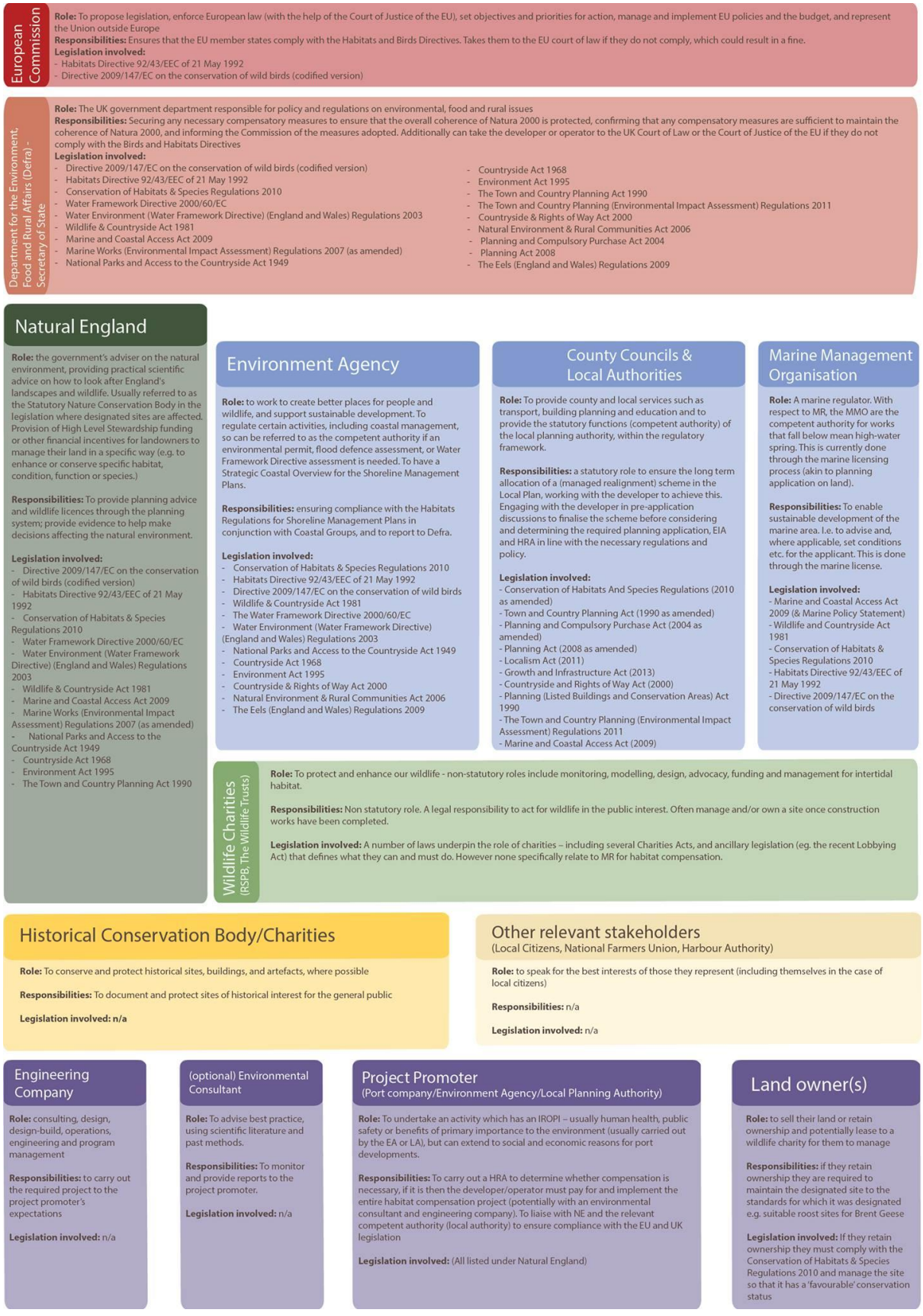


Figure 7: Stakeholder roles and responsibilities chart. Author's own illustration: compiled with help from the interviewees, outlining which organisations are (and should be) involved, in which capacities and governed by which legislation.

Figure 8: Managed Realignment for habitat compensation stakeholder process chart. Author's own illustration: Compiled with help from the interviewees, outlining the involvement of each stakeholder before, during and after MR habitat compensation projects.

Although working with all the stakeholders was stressed by them as important to the projects it was clear from speaking with the interviewees that not every stakeholder had an equal say or contribution. It is then optional whether other people or organisations are brought into the process and what weighting they are given in the decision making: “so we as the RSPB, and wildlife charities, we're keen on MR, we're keen for it to happen. I would say there are times when we would like more to happen than actually does and it's quite hard to…if there's a resistance within the EA and Defra to hearing that particular message…it could be hard to make our self heard” (J.Rhodes, RSPB, personal communication, 06/03/2015). Yet it seems that the wildlife charities do hold a significant amount of power when it comes to challenging habitat compensation projects and have taken a number of companies to court such as the Bristol Port Company, Associated British Ports and even Defra, and have won their cases for compensatory habitat requirements (RSPB, 2012). However the HIWWT interviewee did state that the decision to challenge a development very much depended on the monetary and legal resources of the charity and that they do not have enough money to challenge every unsuitable proposal (C.Chatters, HIWWT, personal communication 15/04/2015). Nevertheless, while NE has the final say when it comes to permitting or denying a project, it seems that the majority of MR for habitat compensation projects have been carried out in conjunction with the wildlife charities, particularly the RSPB and The Wildlife Trusts (RSPB, 2012) and so a mutual agreement has been made about how to establish and manage the site. Ultimately though the decision for habitat compensation projects rests with NE and so they are accountable for that decision.

Accountability: The ‘polluter pays’ principle applies to all MR for habitat compensation projects, so whoever is the promoter (developer/sea defence administrator) of the project must pay for the implementation (European Commission, 2007). However it is not necessarily the promoter who is accountable to the EC or English government if the project is not successful. It depends whether the project has been licenced by NE, because if it has and the promoter has followed NE’s advice then they cannot be held accountable for a project failure (G.Holder, ESCP, personal communication, 25/02/2015). On the other hand if the promoter had been negligent and not followed NE’s advice then they would be accountable (M.Pendle, HR Wallingford, personal communication, 18/02/2015). However there isn’t an established process for checking to see that the project promoter has followed NE’s advice (J.Allen, NE, personal communication, 27/02/2015). NE is generally reliant on the public or wildlife charities to inform them if a development is occurring and whether it is causing unlicensed destruction to an area: “I think the overall final check is basically unless someone raises a complaint it's assumed to be alright. So Defra will often take a view, but very seldom publicly, and

then unless the likes of the RSPB or Wildlife Trusts or someone else kicks up a fuss it will be assumed to be ok" (J.Rhodes, RSPB, personal communication, 06/03/2015).

Not many of the interviewees, other than NE, knew what the penalties would be for non-compliance with NE's advice but a few (EA, ABPmer, PCC) conjectured that they would be in the form of monetary fines and legal costs, as well as a reputational cost for the EA. There isn't an obvious document which outlines what the penalties would be if the promoter is non-compliant or if the project is carried out fully but is not successful. However the NE interviewee stressed that they wouldn't jump straight to fining the project promoter, rather they would work with them to help them become compliant (J.Allen, NE, personal communication, 27/02/2015). Likewise the ESCP interviewee stated that they would work with the NE and other stakeholders from the beginning to ensure that they never got into that situation (G.Holder, ESCP, personal communication, 25/02/2015).

Another factor of accountability is that there is no time-limit set for when the project must be deemed 'successful'. The guidance states that compensation measures can include: "the creation or re-creation of a comparable habitat which can in time be designated" (Defra, 2012a, p.24) and that compensatory measures should be in place before the adverse effect on the original site occurs. However it is acceptable for damage to occur before the compensatory site is fully functioning if additional compensation is provided (Defra, 2012a). Defra (2013) has developed an 'off-setting metric' to determine how much additional habitat must be compensated for to account for not only the habitat affected by the development but the residual losses of habitat as well. With regards to the coastal defence measures and the potential intertidal habitat requirements arising from coastal squeeze a ratio of 1:1 (habitat loss : habitat gain) is applied to offset predicted losses over the next 50 years.

In contrast to these coastal defence strategies, a minimum ratio of at least 1:2 (often more) has more typically been applied where the required habitat gains are associated with the compensatory requirements for an identified development (ABPmer, 2014) as all the developments have occurred ahead of when the sites have been determined to be successful. When asking the wildlife charities if they agreed with this the RSPB interviewee said that the RSPB would never ask for more than the legislation required, because although it may be better for the birds to have a more established compensatory habitat, legally they wouldn't be able to request this (J.Rhodes, RSPB, personal communication, 06/02/2015). So where the legal requirements for habitat compensation may strengthen nature conservation activities in some areas, in others they can hinder what is more ecologically favourable.

Where it may be more straightforward in the planning stage with NE to determine the amount of compensation that must be created it is not so easy after the project implementation to prove whether the compensation has succeeded or failed. Project targets are not always clearly defined against a set time frame (L.Esteves, BU, personal communication, 20/02/2015); which may be attributable to the lack of a defined time limit in the Nature Directives. Thus holding project promotors accountable in the event of an unsuccessful project could be difficult: "penalties are difficult because if there are no set targets, or set timeframes when you should achieve those targets, how can you set the penalty… when you don't know what you're supposed to do or when" (L.Esteves, BU, personal communication, 20/02/2015).

5.3 How are MR for habitat compensation projects determined to be successful?

This question was asked in order to identify what constitutes a successful project, with the purpose of ascertaining how Defra justifies MR habitat compensation projects to the EC. Several issues or themes emerged when the interviewees discussed what constituted success and how it is measured, these were: setting targets, success, monitoring, defining habitat compensation, and the complexity of dynamic environments.

Setting targets: Despite the Defra (2012a) guidance stating that targets need to be set for MR habitat compensation projects this has often not been the case, which makes it very hard to determine whether a site has provided successful compensation for what is lost (Elliott et al., 2007; Pendle, 2013). This is particularly true for coastal squeeze where the habitat being compensated for may be a past loss or a predicted future loss of a designated site which does not have the data for why the site was qualified in the first place (A.Colenutt, NFDC, personal communication, 27/02/2015) (see Manson & Pinnington, 2012 for example). Under the SPA and SAC qualifying features the numbers of birds, or extent of habitat and its species populations and density are recorded (JNCC, 2011, 2012). Under these circumstances it may be expected that the promoter of the project must compensate 'like-for-like' i.e. the same number of bird species or the same type and amount of habitat and species. However a lot of the sites designated in England were designated many years or decades ago and so the numbers recorded then for their qualifying features may not be the same as what exists nowadays (A.Colenutt, NFDC, personal communication, 27/02/2015). Additionally a significant number of sites in England are in an 'unfavourable' status[15], 46.2% Annex 1 SACs, 90% of Annex 2 SACs, and 42.6% SPA bird species, further complicating the targets that need to be achieved (HM Government, 2012). Thus there is potentially a drive to re-

[15] 'Unfavourable' status refers to: SPAs the species that are showing a decline. SACs where the habitats are in a 'bad and deteriorating', 'inadequate' or 'unknown' condition, or species are 'unknown' or 'unfavourable' and/or they are listed on the UK section 41 list of 'Habitats and species of principal importance for the conservation of biodiversity in England' (HM Government, 2012).

create new habitat that should be at a favourable status, according to both England's and the EU legislation, to replace what is in an unfavourable status: "if that habitat is re-provided somewhere else it could actually end up being far more valuable to the species than the habitat that we're taking away" (D.Hayward, PCC, personal communication, 24/02/2015).

Success: There is further debate about which factors or targets indicate success and the majority of interviewees stated quite a few different conditions. The ABPmer interviewee referred straight away to a 'like-for-like' habitat compensation but other interviewees found it harder to define: "the question of what makes a site successful has never been pinned down and I'm not sure we'll ever get a solid answer. Typically what we're looking for a site to do is to support the biodiversity of the area that it's in. Under the Habitats Regulations, what we're looking for it to do is to support the biodiversity of whatever it's compensating for, but it's got to fit into the wider picture of habitat in a given area" (N.Reid, EA, personal communication, 19/02/2015). The PCC and other EA interviewee referred to similar targets in which the value of habitat that is lost should be replaced, whether that is provided by hectares of the same habitat or creation of the functions. However Elliott et al. (2007); Mazik et al. (2010); and Mossman et al. (2012) assessed successful intertidal habitat compensation to be when the MR sites contained comparable species to the adjacent natural intertidal areas, and the HR Wallingford interviewee referred to the presence of climax saltmarsh species, such as sea lavender, as indicators that a saltmarsh has reached maturity and potentially could be counted as successful. Other interviewees referred indefinitely back to the legislation stating that success is when a site contributes to the Natura 2000 network or when NE determines that the site is successful[16]. Thus demonstrating that the ambiguity of the legislation has led to many different interpretations of what is successful but no real conclusion of what it should be in order to prevent biodiversity loss.

The RSPB interviewee, however, made a further distinction between success and designation: "[designation] is not necessarily the point of success – just the point at which it is eligible to be part of the N2K network. The point of success is when it supports the designated features (nb. not the full suite of species) lost on the 'lost' site" (J.Rhodes, RSPB, personal communication, 30/04/2015). Nevertheless the legislation just refers to the re-creation of a habitat that can be designated as a European site or as an extension to an existing site (Defra, 2012b, p. 5) and because what constitutes a 'comparable habitat' is unclear then a site designation could constitute success.

[16] T.Collins from Natural England had prepared a compensation guidance note (2004) which was used by NE's predecessors English Nature. With regards to habitat type this guidance note refers to the provision of: "normally "like for like" but "like for like" habitat need not always be selected so long as what is created or improved performs the same range of ecological functions as the lost or damaged habitat". Unfortunately this Note is no longer in circulation but has provided valuable insights into the process.

A site can be designated as part of the Natura 2000 network when "the site in itself holds a large enough percentage of the national population or meets the qualifying criteria and that can happen very quickly" (J.Rhodes, RSPB, personal communication, 06/03/2015). However the interviewee also mentioned that when farmland is MR there can be a high concentration of invertebrates due to the richly fertilized soils, so significant numbers of birds will be attracted to the site in the beginning because there is a lot of food, but after the nutrients have been 'used up' then the numbers drop (J.Rhodes, RSPB, personal communication, 06/03/2015). Therefore, technically, the sites can be designated as SPAs within the first few years whilst bird numbers are high. However if they are designated at this point, it becomes problematic to keep bird numbers at the level for which the site was designated, and if this isn't achievable they risk falling below the Natura 2000 objectives and being considered in an 'unfavourable' status.

Monitoring: The issues with setting targets for a successful MR habitat compensation project tie in very closely to problems with monitoring. Most, if not all, MRs that have been undertaken as habitat compensation projects have included a requirement for monitoring from NE (C.Scott, ABPmer, personal communication, 11/05/2015). These monitoring programmes often involve very detailed annual surveys in the first few years, but do not account for timescales longer than 10 years. The lack of long term monitoring perpetuates the lack of knowledge about natural processes in the intertidal area (Defra & EA, 2002). Therefore MR habitat compensation project outcomes in the long term are never certain because they are not recorded nor are the processes fully understood, and thus targets cannot be set for the long-term management of the site. Arguably then these projects should not take place due to the long-term uncertainty involved with feasibly compensating for the habitat that's lost, as it states in the legislation guidance that: "the feasibility and effectiveness of compensatory measures are critical to the administration of Article 6(4) of the Habitats Directive in agreement to the precautionary principle and good practice" (European Commission, 2007, p. 16). Therefore under the Precautionary Principle[17], where if there isn't scientific consensus that a plan or project will not cause harm then the burden of proof falls on those who implement the project, and if there is no proof (as there is no/very little long-term monitoring) then the project should not go-ahead. Nevertheless, NE accepts the short-term monitoring reports as proof that a site is heading towards its objectives (A.Bishop, EA, personal communication, 23/02/2015) "because you can't reasonably expect for Defra to provide a 'you must monitor this site for ever more' type... it would not be reasonable" (T.Collins, NE, personal communication, 11/03/2015).

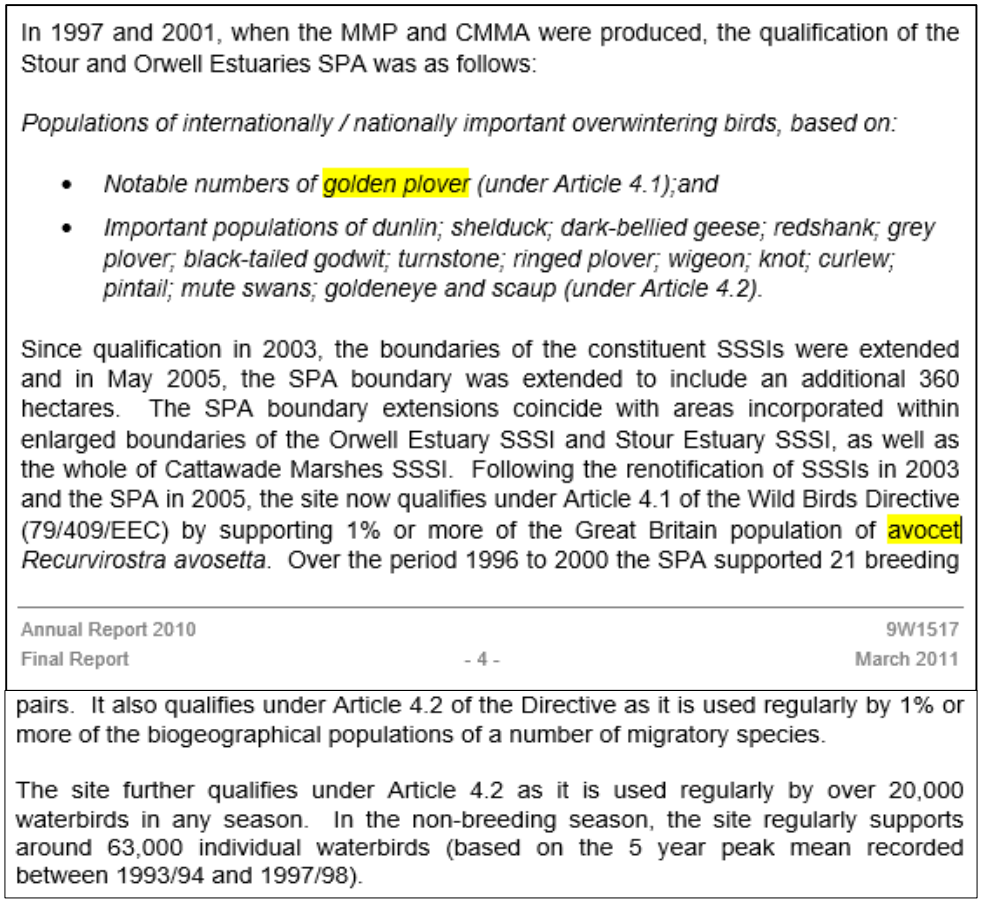
[17] Which is required by the Nature Directives (Defra, 2012a, p. 4).

Instead it is suggested that academics and alternative interested parties undertake the monitoring for the sake of scientific research about these processes. However there are problems with accessing the monitoring data: "one of the key issues in the UK is that quite a lot of the monitoring data are collected by the consultancy that have designed and implemented the projects and these data are not made available for researchers to analyse and the reports that come out of consultancies are very, very brief. Often there is a lack of detail on how they have reached their conclusions. In reality there is a lack of data availability for researchers to have an independent view of what is actually happening" (L.Esteves, BU, personal communication, 20/03/2015). Likewise when I questioned the environmental consultant interviewees and the EA interviewees they agreed that the reports should be made publically available but for whatever reasons weren't easily accessible: "there can also be a reluctance among those undertaking monitoring to publicise the reports and the results obtained, this is possibly for reasons of commercial sensitivity, but it would be a good thing if a way was found to address this issue and perhaps include commitments for the publishing results as a formal requirement of future programmes" (C.Scott, ABPmer, personal communication, 24/03/2015)[18]. This is a similar experience that I found when searching for and then having to request reports both from the port developers' environmental consultants and from the EA, there was very little available online and when I requested documents the few that I got back did not directly address the habitat compensation for which they were written for.

Additionally it seemed there is very little synthesis of the findings from the reports. Once a project has been completed and the monitoring is submitted to NE that project is deemed finished, and there is no resource within the EA or NE to analyse and report on the overall results (A.Bishop, EA, personal communication, 23/02/2015; J.Allen, NE, personal communication 27/02/2015).

Defining 'habitat compensation': The lack of definition of habitat compensation in the legislation has led to many questions about what exactly should be recreated and it was something that none of my interviewees could answer specifically. NE, as the Statutory Nature Conservation Body, has stated that the site must be able to be designated as part of the Natura 2000 Network but what exactly is expected as a qualification for designation is determined on a 'case-by-case' basis (J.Allen, NE, personal communication, 27/02/2015). It has been very difficult to obtain reports from both the EA and port developers in order to see what qualifying features were decided upon. However the final report for Trimley Marshes, the first MR site and the only one that has been designated thus far, describes what was decided as compensation and how that was fulfilled see (figure 9).

[18] ABPmer have put together a database about shoreline management projects and so far have 3 case studies of MR habitat compensation projects in England, though none are detailed enough to describe the exact habitat compensation requirements i.e. the qualifying features for the SPA/SAC (OMReg, 2015).



In 1997 and 2001, when the MMP and CMMA were produced, the qualification of the Stour and Orwell Estuaries SPA was as follows:

Populations of internationally / nationally important overwintering birds, based on:

- *Notable numbers of golden plover (under Article 4.1);and*
- *Important populations of dunlin; shelduck; dark-bellied geese; redshank; grey plover; black-tailed godwit; turnstone; ringed plover; wigeon; knot; curlew; pintail; mute swans; goldeneye and scaup (under Article 4.2).*

Since qualification in 2003, the boundaries of the constituent SSSIs were extended and in May 2005, the SPA boundary was extended to include an additional 360 hectares. The SPA boundary extensions coincide with areas incorporated within enlarged boundaries of the Orwell Estuary SSSI and Stour Estuary SSSI, as well as the whole of Cattawade Marshes SSSI. Following the renotification of SSSIs in 2003 and the SPA in 2005, the site now qualifies under Article 4.1 of the Wild Birds Directive (79/409/EEC) by supporting 1% or more of the Great Britain population of avocet *Recurvirostra avosetta*. Over the period 1996 to 2000 the SPA supported 21 breeding

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pairs. It also qualifies under Article 4.2 of the Directive as it is used regularly by 1% or more of the biogeographical populations of a number of migratory species.

The site further qualifies under Article 4.2 as it is used regularly by over 20,000 waterbirds in any season. In the non-breeding season, the site regularly supports around 63,000 individual waterbirds (based on the 5 year peak mean recorded between 1993/94 and 1997/98).

Figure 9: Excerpt from the Final Report on Trimley Marshes. Source: Royal Hasknoning (2011, pp. 4-5). MMP refers to Mitigation and Monitoring Package and CMMA refers to Compensation, Mitigation and Monitoring Agreement.

This document seems to signify that the habitat compensation does not have to replace exactly what is lost but must achieve a designation. Additionally it makes no mention of what was lost to the channel deepening, and the Trimley Marshes bird counts are not compared to the surrounding natural area. The results of the monitoring are presented in reference to the qualifying features of an SPA. Thus the site is deemed successful because it supported 1% or more of a qualifying SPA bird population in Great Britain, although it seems that Avocets *Recurvirostra avosetta* in the compensation have replaced the 'notable numbers of golden plover'[19] under Article 4(1). Additionally when the whole of the Stour and Orwell estuaries were assessed, as part of NE's 6 yearly Natura 2000 condition assessments (in 2010), Trimley Marshes was assessed as one of 3 (out of 21) 'unfavourable – declining' sites (Royal Hasknoning, 2011, p. 91). Despite being in a favourable[20] condition when it was incorporated into the Stour and Orwell estuaries SPA in 2005, its

[19] The particular species is not known as it is not specified in the report and the Stour and Orwell Estuaries SPA data form has since been updated and does not include golden plover.

[20] 'Favourable' conservation status: Intertidal habitats (i.e. saltmarsh, soft muddy and granular habitats) that, in combination, maintain the geomorphological form and functioning of the estuaries, so that they are capable

status has now declined as internationally important bird are numbers below the 1% threshold of the population in Great Britain, the reason for this is cited as coastal squeeze (Royal Hasknoning, 2011). Yet the report justifies the success of the site by stating: "The majority of key species are increasing in number in 2009/10 there is no reason to think that the site is not functioning well as intertidal habitat for the waterfowl population" (see figure 10) (Royal Hasknoning, 2011, p. 46) and "The period of monitoring as specified within the Mitigation and Monitoring Package is now complete and the ten years of monitoring has provided a clear indication of the development and successional changes within the site, a clear sign of the success of this habitat realignment site" (Royal Hasknoning, 2011, p. 47).

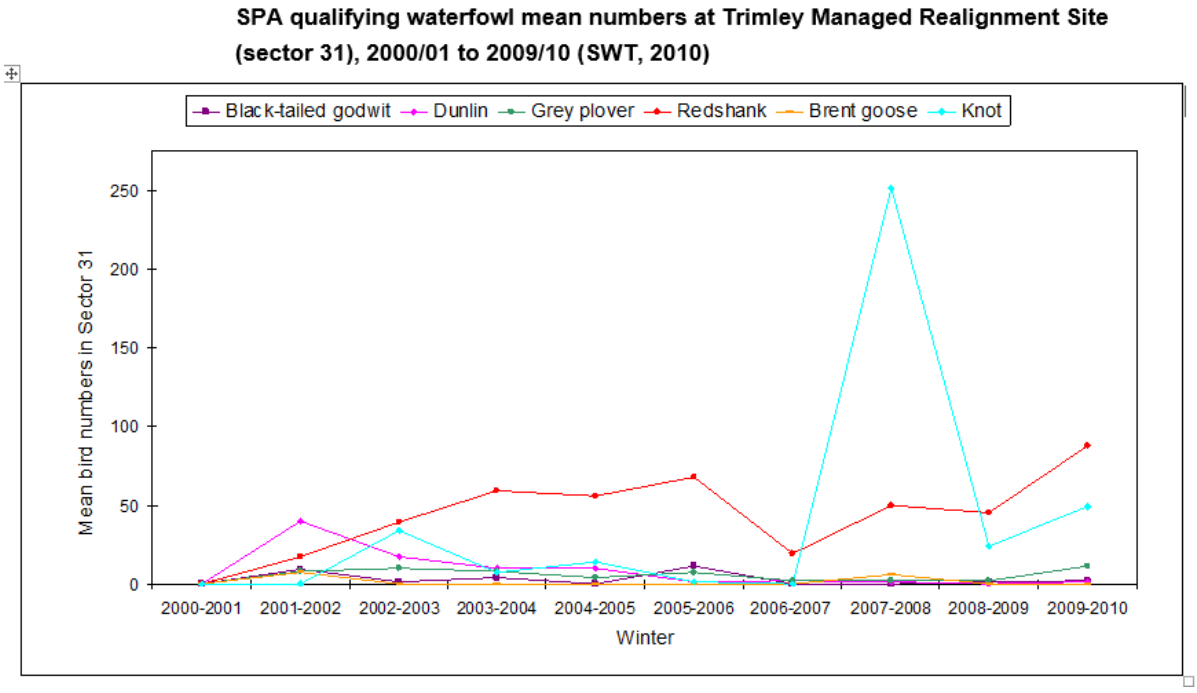

Figure 10: The wildfowl numbers recorded by the Suffolk Wildlife Trust at Trimley Marshes MR site, from 2000/1 to 2009/2010. The graph indicates that, despite the SPA site being in an 'unfavourable' status bird numbers in 2009/2010 are increasing. Source: Royal Hasknoning (2011).

So despite numbers of SPA qualifying waterfowl going down since the site was designated, there is an increase of bird numbers in the last year of monitoring and so that is how the site is determined to be successful. Yet if coastal squeeze continues without intervention then we can potentially expect the trend of bird numbers to go down. Consequently the site will not be able to contribute to the long-term conservation interests of the Natura 2000 sites, and arguably will not contribute to 'a

of sustaining the populations of internationally and nationally important overwintering birds for which the site qualifies (Royal Hasknoning, 2011, p. 4).

coherent ecological network' and thus is potentially in breach of the Nature Directives, resulting in biodiversity loss[21].

However, intertidal environments are very dynamic and change is inevitable as they evolve through time (L.Esteves, BU, personal communication, 20/02/2015). Consequently it is not easy to determine a point in a site's development at which to say that the project promoter has fulfilled their requirements and cannot be held responsible for any detrimental changes which may happen after that. NE has stated that the projects need to be designated, but usually only requires the project promoter to monitor for a maximum of 10 years after the site has been created (T.Collins, NE, personal communication, 11/02/2015), whether the site is designated or not. So far there are two projects which have exceeded the 10 year monitoring period and a further four sites finishing their monitoring period next year which have not yet been designated (see Appendix G). NE has assumed responsibility for the sites, as it signed of the habitat compensation in the first place, but it is unclear what happens if these sites never reach the threshold for the required designation[22].

Complexity of dynamic environments: The one scientific article which has investigated the long term evolution of intertidal MR habitat compensation sites suggests that the current practice will provide sufficiently for saltmarsh but is not creating the mudflat that is needed for the birds to feed on (Morris, 2013). This then has potentially serious implications for SAC habitats and species, and the designated bird species, for if there are plenty of roosting options but nowhere to feed then they cannot survive on the site. This concern was also raised by the ABPmer interviewee:

> So one of the main considerations with MR, in terms of their value for compensation, is that you can rarely, if ever, create habitats in perpetuity… this is because most MRs will accrete, especially those in estuaries… so mudflat will ultimately change to marsh over varying timeframes. So one might have compensated for a mudflat that will be sustainable for the next 100 years, but you're creating a mudflat that's sustainable for the next 50 or 20 or 10, depending on where you are. So you're not creating like for like in terms of their duration, so the question becomes have you delivered the same ecological function, have you delivered comparable habitats and also more widely have you preserved the integrity of the Natura 2000 complex? These are big questions and we're still wrestling with them today (C.Scott, ABPmer, personal communication, 11/05/2015).

[21] Trimley Marshes was the first MR habitat compensation project to be implemented, it is not necessarily representative of how subsequent projects have been carried out.

[22] It is also important to note that this form of coastal management is still a relatively new process and practitioners are still learning as sites develop (T.Collins, NE, personal communication, 11/02/2015).

The recent Medmerry MR site is compensating for coastal squeeze in the Solent but is only planned to compensate for the first epoch of intertidal habitat loss, and due to the heavily urbanised coastline there are virtually no places left to MR in the future (A.Colenutt, NFDC, 27/02/2015). This then presents a problem for the sustainability of MR for habitat compensation projects in this area. Both due to the lack of space to MR for the next epoch and if the MRs that have taken place are themselves subject to coastal squeeze, as Medmerry will eventually be subject to coastal squeeze too. This is even more urgent in light of the evidence that sea level rise is increasing (Stocker et al., 2013).

Elsewhere in England there is more space to MR but the problem still remains the same, as sea level rises coastal squeeze will accelerate, and more habitat compensation will need to be found to compensate for the losses of designated sites (which, in the future, may themselves have been compensations for previous lost sites). The situation can become more complex, such as at Farlington Marshes, if there is designated grazing marsh behind the designated intertidal area because that will then have to be compensated for too if the area is Managed Realigned (Gardiner et al., 2007). This cycle of loss and compensation is inevitable as the climate warms and sea level rises. Whilst it is admirable that England is compensating for coastal squeeze losses when other coastal EU member states are not, the choice decision makers must answer is whether they want to accelerate this habitat loss by allowing for developments on internationally important sites. Many trade-offs have to be made in order to find a sustainable balance between the environment, economy and society but with respect to biodiversity loss a decision needs to be made as to what is more important for a protected site: preserving the biodiversity as it is, allowing for 'natural' change (no active intervention), or recreating the site elsewhere.

Therefore this dissertation strongly urges decision makers to define what is meant by 'habitat compensation', at least at the national level, in order to determine whether MR can actually preserve nature or contributes to its loss. Alongside this, reports created by project promoters need to be made widely available in order to assess these projects and their outcomes, so that we know more definitively what we are losing and what we are saving. From the interviews MR for habitat compensation seems to be the most sustainable approach to managing biodiversity loss and NE, the environmental consultancies and wildlife charities seem to be happy overall with its approach towards nature conservation. However the lack of documents (and evidence) demonstrating this has led to the need for this research, and the recommendation that this process be made much more transparent in light of the increasing sustainability challenges at the coast.

6. Conclusion

The legacy of land use change from intertidal wetlands to arable farmland and urban settlements is creating a significant sustainability challenge for coastal planners and decision makers, namely that of preventing biodiversity loss. Coastal squeeze, caused by sea level rise and the implementation of hard sea defences to protect people and property, as well as developments along the coast, are resulting in intertidal habitat loss. In order to protect important species and habitats the EC has issued the Wild Birds and Habitats Directives which England has transposed into its own legislation. This legislation prevents plans or projects from damaging protected areas unless they have an Imperative Reason of Overriding Public Interest (IROPI). Coastal flood and erosion protection and certain port developments are allowed under the national legislation as long as they compensate for the loss of intertidal habitat that they cause. However these projects, usually carried out by realigning hard sea defences, have rarely been assessed as to whether they contribute to nature conservation (as the primary objective of the EC legislation) or result in biodiversity loss. Since the legislation came into force, only one MR habitat compensation site has been designated as part of the Natura 2000 network and thus is considered a success. Yet the long-term trend for this site is one of species decline. Additionally the few papers that have assessed other MR habitat compensation projects have determined that the projects do not create natural conditions and thus result in biodiversity loss. Yet whilst it may not be reasonable to expect these new sites to compare with adjacent natural habitat that is over 100 years old, there is a need for targets to be set and met before destruction of the habitat occurs in order to prevent biodiversity loss.

The lack of a definition of what constitutes habitat compensation and absence of a set timescale for when a site must 'successfully' compensate by, means that it not easy to ever reach a conclusion about the compensated sites. However, despite this uncertainty, 15 MR habitat compensation projects have been carried out and assumed to be on the path to success. Reports are written by the project promoters as part of the project agreement with Natural England but, apart from those, very few independent studies have investigated the evolution of the sites. This is of both detriment to Natural England's evidence based approach and to the knowledge base for intertidal habitat creation. Furthermore the lack of reporting and studies in the public sphere puts the environment at a disadvantage, as social and economic benefits can be assessed but the impact on the environment is kept hidden (Kramer, 2009). Although wildlife charities have the mandate to protect and enhance the environment they too have to make social and economic trade-offs.

In order to gain a balanced social, environmental and economic perspective many formal and informal stakeholders are involved in these type of projects, with each holding different priorities for the management of protected sites. However not all the priorities are represented equally and there

is a tendency for an economic analysis to decide the outcome of a project or plan. In the case of IROPI developments there may also be a tendency for the project promoter and Natural England to underestimate the impacts of a development and overestimate what they are able to achieve on the compensatory site (McGillivray, 2012). Yet this cannot be easily assessed as the data is not available to do so (see Appendix H).

The ambiguity of the legislation and the lack of reporting on past projects has led to confusion about what specifically should be conserved and how best to instigate it. Thus in order to address the seventh sustainability question: how the sustainability of MR for habitat compensation can be evaluated, habitat compensation needs to be defined. This study has examined the reasons behind MR habitat compensation projects, who is involved and in what capacities, and highlighted the issues with defining a successful project. Suggestions for further research would include: determining whether a 'like-for-like' habitat replacement, habitat comparable to the surrounding areas, or just habitat functions produce higher abundance and diversity of the protected species; obtaining past monitoring reports and compare the objectives to the outcomes to determine how suitable current methods of MR are for habitat recreation; undertaking independent long-term studies on the MR habitat compensation sites assessing a variety of ecological and geophysical features to get a better understanding of how these sites evolve; and synthesising and reporting these findings in the public domain for better transparency and representation of the environment – with the objective for nature conservation.

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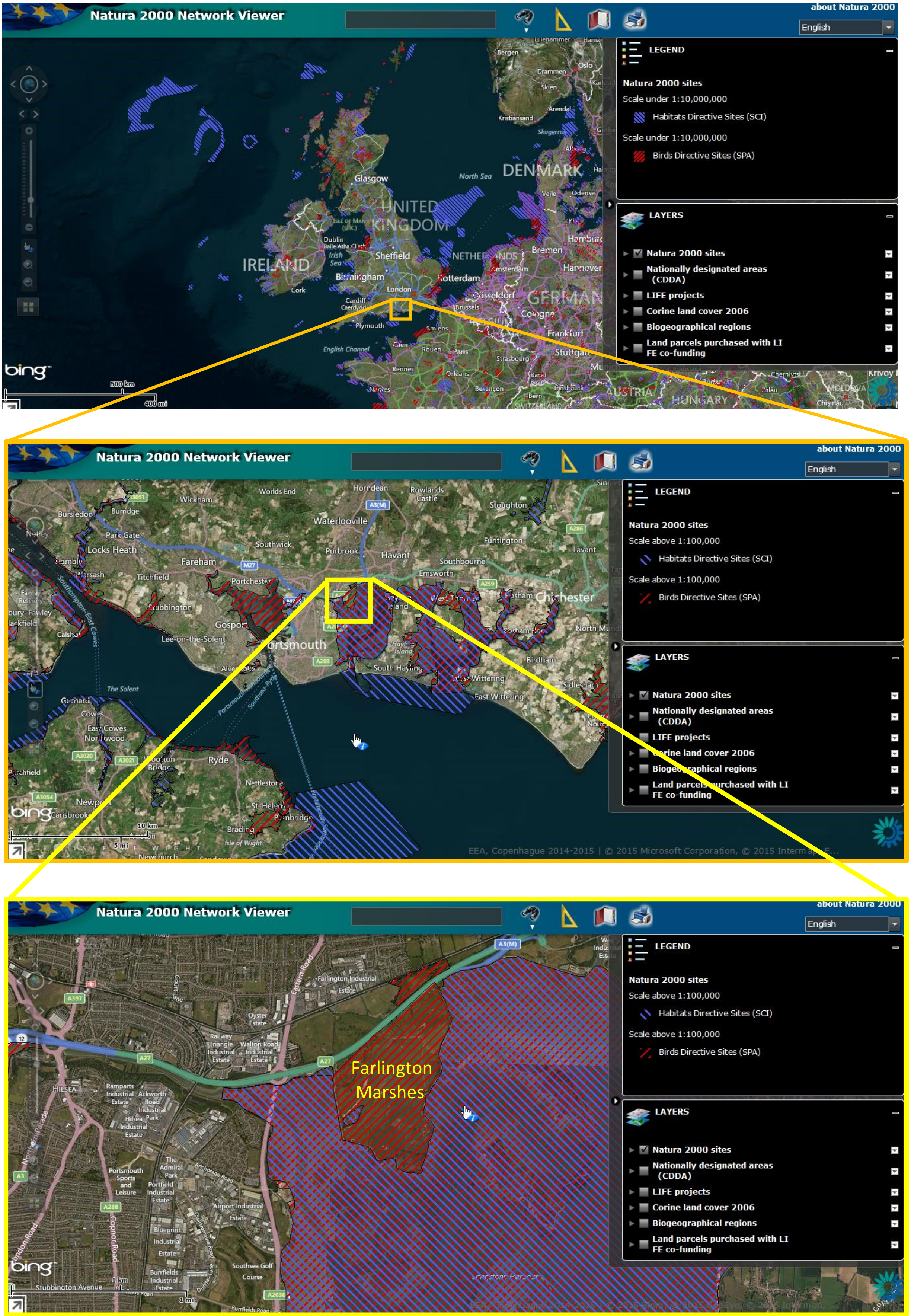
Appendices

Appendix A: Exemplary Case - Farlington Marshes, Langstone Harbour, Hampshire

Farlington Marshes nature reserve lies at the northern end of Langstone harbour and comprises of 120-125 hectares of coastal grazing wetlands (Chapman & Chatters, 2007; Natural England, 2013a). The marshes were created from embanking intertidal area in Langstone harbour between 1740 and 1773, and, unlike much of the surrounding areas, were left undeveloped (Chapman & Chatters, 2007). From 1962 onwards the marshes have been managed by the Hampshire and Isle of Wight Wildlife Trust (HIWWT) and in 1974 the area officially became recognised as a nature reserve (Natural England, 2013a). In 1987 it became designated as a Special Area of Protection (SPA) due to it being a key area for important waterfowl species (European Commission, 2013), particularly supporting internationally important Dark-bellied Brent Geese *Branta b. Bernicla* (East Solent Coastal Partnership, 2013). A small proportion of the marshes, called Shut Lake, is also designated as a Special Area of Conservation (SAC) for which this area is considered to be one of the best coastal lagoon areas in the United Kingdom (Natural England, 2013b). However some argue that the whole site should be designated as a SAC as it is one of the last remaining freshwater grazing areas in the East Solent (J.Allen, NE; A.Colenutt, NFDC, personal communication, 27/02/2015). In addition it is designated as both a Ramsar site and a Special Site of Scientific Interest (SSSI)[23], again due to its ability to support an internationally important intertidal system of invertebrates and migrant and overwintering waders and wildfowl (Natural England, 2003). Furthermore it is one of the largest 'green' areas in the Portsmouth area and provides important recreational space for the residents of Portsea Island in an otherwise heavily urbanised area (Chapman & Chatters, 2007). it is also deemed a special site for bird watchers, is regularly used by school students researching nature projects, and is part of "the Solent Way" long distance walking path (Chapman & Chatters, 2007). Therefore Farlington Marshes is regarded to be a very important site in the East Solent for both environmental and social reasons.

[23] SSSIs are designations within England and are designated to preserve the country's very best wildlife and/or geological sites
http://webarchive.nationalarchives.gov.uk/20140605090108/http://www.naturalengland.org.uk/ourwork/conservation/designations/sssi/default.aspx


Natura 2000 Network Viewer
about Natura 2000
English
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Land parcels purchased with LIFE co-funding
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Land parcels purchased with LIFE co-funding
Farlington Marshes

Figure A.1: Location of Farlington Marshes. Map 1: Screen shot of England with SPA (red lines) and SAC (blue lines) designations. Map 2: Screen shot of the East Solent area with SPA (red lines) and SAC (blue lines) designations. Map 3: Screen shot of Farlington Marshes in Langstone Harbour with SPA (red lines) and SAC (blue lines) designations. Source: European Environment Agency (2014-2015).

However the future of the marshes is uncertain due to rising sea levels, increasing storm intensity and subsidence of the marshes themselves. Because the marsh was embanked in the 17th Century it has been cut off from the natural sediment supply in the harbour and is consequently lower than the surrounding intertidal area (Chapman & Chatters, 2007) which leave it vulnerable to saltwater intrusion and flooding. The sea walls around the marshes are now considered to be at the end of their structural 'life' and currently there is a debate about who should pay for the defences to be maintained or whether the site should be considered for MR as intertidal habitat compensation for the coastal squeeze around Portsmouth (G. Holder, personal communication, 12/01/2015). The usual route for flood defence funds is through the Environment Agency's Flood Defence Grant in Aid which is allocated for the protection of people and property (G. Holder, personal communication, 25/02/2015). Because Farlington Marshes does not accommodate any people or property then the funding is not available for their maintenance so the Shoreline Management Policy (SMP) would typically be No Active Intervention or Managed Realignment. However the designation of the site as SPA, and partial SAC, further complicates the management of that site, because if damage occurred to the SPA and/or SAC site due to the SMP to Manage Realign or take No Active Intervention i.e. not maintain the defences, then compensation would need to be undertaken to ensure that England is not in breach of the EU Nature Directives (New Forest District Council, 2010).

Currently the SMP is to 'hold the line' until 2025 but then, pending further studies environmental studies, to potentially Manage Realign the site (New Forest District Council, 2010). A number of studies have already been conducted on the site (Atkins, 2010; Cope, Bradbury, & Gorczynska, 2008; Jonathan Cox Associates, 2010; King, 2010; Liley & Sharp, 2010; Stillman et al., 2009; Stillman, West, Clarke, & Liley, 2012) which have informed the East Solent Coastal Partnership (ESCP) about the marshes' use as a bird habitat, recreational space, and flood defence. Although these studies prove Farlington to be important to the network of sites as a high-tide roost site, because few such sites exist in the Solent, it is not clear whether it will be sufficient to Managed Realign the site and those high-tide roost functions compensated for. The ESCP are tasked with determining what would be the most sustainable future for Farlington Marshes and must not only take into consideration environmental concerns but social and economic factors too (East Solent Coastal Partnership, 2013). A further point of consideration is that Portsmouth City Council are the landowners of the site and as such may wish to use the site themselves as intertidal habitat compensation for further sea defence

works in the future, rather than having to purchase land elsewhere, if Farlington was MR on behalf of the EA's compensation schemes (A. Colenutt, personal communication, 27/03/2015). Although the city council would have to compensate for the bird roost site function that would be lost, it is potentially deemed less problematic than providing intertidal habitat elsewhere to compensate for coastal squeeze (G.Holder, personal communication, 12/01/2015). In this instance Farlington is valuable because of the potential (flood protection) development opportunities it can provide compensation for.

As of yet a conclusion about Farlington Marshes has not been reached but its case has highlighted issues with the process of MR for habitat compensation, particularly with how England deals with habitat losses from coastal squeeze and port developments. It appears from the discussions about Farlington Marshes that their future depends very much upon an economic appraisal of the site, where nature conservation is not valued as much as social and economic development. This case provided the stimulus for my investigation into MR for habitat compensation projects and provided many valuable insights into the process.

Images of Farlington Marshes from the walk around the sea wall. (From top left to bottom right) Shut Lake an SAC designated area as one of the best coastal lagoon areas in the United Kingdom; the reedbeds; birds flying over Point Field, birds (possibly Brent Geese) feeding in the Main Marsh; people walking around the sea wall, with a view back to Farlington Industrial site. Authors own photographs taken on 25/02/2015.

Appendix B: Interviewee Profiles

The interviewee profiles have been written by the interviewees themselves to ensure that they are accurate. As such they vary in detail but still demonstrate, through their experience, why the interviewees were purposively chosen.

Andrew Colenutt – New Forest District Council (NFDC)

I am currently the Bathymetry Technical Lead and Programme Manager for the National Network of Regional Coastal Monitoring Programmes of England, and Seabed Mapping Team Leader at the Channel Coastal Observatory (CCO).

My other roles include Coastal Projects Officer with New Forest District Council, and Knowledge Exchange Coordinator for the UK Marine Environmental Mapping Programme (MAREMAP), collaborating with government, academia and industry.

I was the Project Manager for the North Solent Shoreline Management Plan, and led a multi-disciplinary team of coastal engineers, scientists and planners, to develop management policies to address flood and coastal erosion risk within the Solent region. Through the SMP journey the issue of habitat mitigation and compensation was key, particularly with regard to offsetting coastal squeeze and either new or realignment of existing defences.

Anthony Bishop – Environment Agency (EA)

I work as a Principle Environmental Project Manager, this basically means I manage the environmental risk of flood risk management schemes by undertaking Environmental Assessments, habitat regulation assessments, and writing the various licences required e.g. MMO etc Some of this work we farm out to consultants as its resource heavy and we wouldn't have enough staff or expertise to cope, in these cases we review the consultants outputs and make sure they are adequate.

Background, I completed a MSc in Environmental Impact Assessment at Brighton Uni, and have worked in this current roll since Dec 2004.

The only Managed realignment scheme I have seen through from beginning to end was the Rye Harbour Habitat creation scheme. I have worked on various strategies that have recommended managed realignment for compensatory habitat such as the Portchester to Emsworth Strategy and the Pagham to East Head Strategy. Other fresh water habitat creation schemes (for compensatory habitat) I have worked on are Great Bells habitat creation scheme in North Kent.

Clive Chatters – Hampshire and Isle of Wight Wildlife Trust (HIWWT)

Head of Conservation (Policy and Evidence)

In my various roles I've had personal responsibility for managing coastal nature reserves and also contributing to the governance of statutory processes deciding priorities for coastal management.

For most of this period I have had responsibility for developing and delivering the Trust's science base and policy framework. This has led to me representing the Trust's evidence in numerous settings including public inquiries and select committees.

Colin Scott – ABPmer

Colin Scott is an Associate Consultant ABP Marine Environmental Research Ltd. (ABPmer). He has over 20 years' experience of consultancy work specialising in marine impact assessment, habitat creation and ecological monitoring. He has managed Environmental Impact Assessments (EIAs) for a range of developments many of which have affected designated European/Ramsar sites. Therefore he has undertaken numerous Habitats Regulations Appraisals (HRAs) and produced, where required under the Habitats Regulations, Appropriate Assessment information documents to accompany these proposals. A core element of his work involves designing, assessing and monitoring coastal habitat restoration projects such as Managed Realignments (MRs), Regulated Tidal Exchanges (RTEs) and saltmarsh sediment recharge projects. He has managed teams advising on projects such as the Environment Agency's 400ha MR site at Medmerry or Defra's 115ha Allfleet's Marsh MR scheme at Wallasea. He is also a lead advisor on the RSPB's new flagship 677ha coastal restoration project on Wallasea Island. In addition he was on the Panel of Experts for the EU ComCoast project that developed innovative solutions for habitat creation in Interreg coastal areas. He also manages the ABPmer online database (OMReG) and LinkedIn forum which review the lessons learned from MRs and RTEs across North West Europe. He also helps to organise and host ABPmer's regular habitat creation conferences.

David Hayward – Portsmouth City Council (PCC)

I graduated from the University of Portsmouth in 2006 with a First Class BA in Human Geography. I started working in Portsmouth City Council's Planning Policy team in 2007. Over that time I have taken on a large amount of work areas including housing projections, strategic nature conservation, low carbon design, energy infrastructure and capacity, sustainability.

During my time at the city council I have led on a number of city-wide and sub-regional work regarding the Habitats Regulations, principally the Solent Disturbance and Mitigation Project. I was principally responsible for leading a working group which put together the Interim Mitigation Strategy which has since been rolled out across fifteen local authorities (http://tinyurl.com/pdl46c5).

Since 2013 I have been involved in a Solent wide research project, led by the Eastern Solent Coastal Partnership, looking at the evidence base regarding the Solent's Natura 2000 Network. This work includes informing the discussions regarding the future of Farlington Marshes and any potential managed realignment as part of the North Solent SMP. The city council is the landowner of Farlington Marshes as well as the local planning authority and so the competent authority under the Habitats Regulations. As such, our responsibilities and legal obligations regarding the site are extensive. During my time at the city council I have also gained a Masters with Merit in Spatial Planning from the University of Reading and been seconded to Southampton City Council to provide support to the Development Management on implementing sustainability policy for planning applications.

Gavin Holder – East Solent Coastal Partnership (ESCP)

Coastal Project Engineer for the Eastern Solent Coastal Partnership (ESCP).

I take a lead environmental role within the ESCP, to advise our ongoing Coastal Flood and Erosion Risk Management (CFERM) Programme. This involves undertaking Environmental Impact

Assessment work, to ensure our CFERM activities are environmentally acceptable, or preferably, beneficial.

I am also involved in studies to better understand bird movements within the Solent, which will help advise future coastal change schemes, delivering the policy set at the Shoreline Management Plan and strategic level.

The ESCP

The ESCP comprises of four Local Authorities working together to provide coastal management services to our communities and the environment. Portsmouth City Council is one of these authorities, and is the Landowner at Farlington Marshes, although the day to day management is carried out by the Hampshire and Isle of Wight Wildlife Trust. We are working with the Environment Agency, who currently maintain the defences around Farlington Marshes, to confirm the policy and future management at this site.

Jack Rhodes – Royal Society for the Protection of Birds (RSPB)

I'm a Water Policy Officer at the RSPB, responsible for flood and coastal management policy and support. I've been involved in managed realignment for nine years, working on projects such as Medmerry[24] and Hesketh for the RSPB and previously Jacobs Engineering.

Josie Allen – Natural England (NE)

Profile was created from the interview transcript as Josie was unable to provide one in time. It should also be noted that Hilary Crane from NE also provided me with very helpful guidance for my dissertation in Josie's absence.

Conservation and Land Management Adviser at Natural England.

I've been with Natural England for 2 1/2 years. The patch that I work in is land management, so I basically deal with the terrestrial side of the East Hampshire Coast, so my patch goes from the Estuary of the rivers Itchen and Hamble all the way down the coast with the border with Sussex which falls sort of halfway through Chichester harbour, so Farlington Marshes falls right in the middle. I am more landowner based, EA flood defence concerns, sea defence repairs, landowner consents etc. I do more in land but it's not so relevant to MR for habitat compensation.

Luciana Esteves – Bournemouth University (BU)

My research interests are related to environmental change in coastal areas driven by natural and human-induced process and the implications to coastal management. In particular, I am interested in how climate change will affect the frequency and intensity of extreme events and the implications to coastal flooding and erosion hazards, risks and vulnerability. My recent works concern the long-term sustainability of managed realignment and other adaptation alternatives to reduce flooding and erosion risk to people, property and the economy. I have worked closely with researchers and

[24] Medmerry is a large MR for habitat compensation project for coastal squeeze that was completed in 2013 in the North East Solent area.

practitioners concerned with coastal management in the UK, in Brazil and across Europe. I use GIS to quantify shoreline change rates and predict future changes in shoreline positions and apply geostatistics and extreme value analysis. Currently, I lead and teach the units on Physical Geography and Marine Geography at Bournemouth University.

Marie Pendle - HR Wallingford

Profile was created from the interview transcript as Marie was unable to provide one in time.

Water Quality Scientist at HR Wallingford

I started working for MAFF in the Directorate of Fisheries Research and through them I did an HNC in applied biology. I finalised with a masters which actually looked at MR. Working for the Directorate of Fisheries Research I was in the environmental division and I moved from doing benthic ecology which was my original specialism to the regulatory team, round about in the year 2000, and once I was within the regulations team quite a lot of different applications for licences crossed the desk and many of those included MR aspects.

Nick Reid – Environment Agency (EA)

South East Habitat Creation Manager, Environment Agency

Nick has been working for the Environment for 15 years, gaining experience in the fields of asset management and incident response before taking up his current role in 2012 as the lead of the Habitat Creation Programme in the South East. His work is focussed mostly on the Thames Estuary and the Solent, ensuring that the environmental impacts of coastal flood defences are mitigated or compensated for, in line with the Habitats Regulations. This means finding new sites with potential for transforming into either intertidal or freshwater habitat, with the ultimate aim of becoming part of the Natura 2000 network. His view of the coast in the South East is that it provides a home to hundreds of thousands of people, birds and other species, all of which must be accommodated and given the space and environment to thrive. He is always on the lookout for 'the next Medmerry'.

Pete Cosgrove – Marine Management Organisation (MMO)

For the past 18 months I've worked as a Marine Plan Implementation Officer for the Marine Management Organisation (MMO). Part of the marine planning process is to ascertain a strong evidence base from which marine planning decisions can be based on and informed by. Shoreline Management plans and components of these are one part of this evidence base, so the marine planning team should be aware of likely, proposed and current sites identified for managed realignment and habitat compensation. From a personal perspective, I have not been actively involved in designation or management of any habitat creation projects but have watched the works on the South coast progress with interest.

As part of the wider remit of the organisation, the MMO are a regulatory body that issue marine licenses to authorise works within the marine area. Any proposal to create habitat that falls below the level of mean highwater would almost certainly require a marine license and therefore, MMO consent. The level of MMO involvement with managed realignment projects is objective and as an organisation our input is relatively small compared to the likes of the EA or Natural England.

Tim Collins – Natural England (NE)

Principal Specialist – Coasts & Flood Management

Tim works as the principal specialist for coastal and flood management issues in Natural England's sustainable development team. His role includes leading the organisation's specialist advice on flood and coastal erosion risk management. He works closely with Defra, Environment Agency and coastal local authorities to secure better approaches to coastal management that embrace the needs of the natural environment. Aware that most Natura 2000 compensation projects in England were coastal he recently led a research project to investigate the "Effectiveness of Natura 2000 compensation measures in England"; it is anticipated that the findings of this study will be published in summer 2015.

Following the December 2013 North Sea tidal surge Tim co-ordinated Natural England's work associated with the recovery from tidal surge, storms and floods of winter 2013/14. This included setting up an emergency grant scheme to assist with essential repairs on nature reserves enabling them to reopen to the public.

Before the creation of Natural England Tim was Head of Coastal Conservation for English Nature for nine years. In this role he also acted as their coastal geomorphologist. Prior to that he worked for two coastal local authorities in Yorkshire where he was Spurn Heritage Coast Officer for 7 years, among other things, he led innovative work that secured a more sustainable approach to the management of the 5km long, and highly dynamic, sand and gravel spit of Spurn Head at the mouth of the Humber.

Appendix C: Interview Guide

Introduce myself. Check that it is ok with them to record the interview, state that they can remain anonymous if they wish, and that nothing that they have said will be written in the dissertation without their prior consent. Leave my contact details so if they have any questions for me then they can get in contact or ask me before/after the interview. TURN ON RECORDER

"Thank you for meeting with me today. I am conducting my Masters dissertation on managed realignment for habitat compensation in England. I became interested in this topic after I heard about the proposed managed realignment of Farlington Marshes in Portsmouth, and had many questions about why it needed to take place and how it could be implemented. This led to more broad questions about the policies and science involved with intertidal habitat compensation as a whole. The purpose of the interview today is to find out, from your perspectives, about the process of managed realignment for habitat compensation in England, with a few questions at the end specifically relating to Farlington Marshes.

I have asked to interview you as you have an interest in Farlington Marshes and managed realignment for habitat compensation in general.

The interview should last approximately 30 minutes and it is completely voluntary so if you want to stop or if you have any questions please feel free to ask me at any time. I'll begin by asking some general questions about yourself."

To find out a bit about my interviewees backgrounds – social context

Please tell me a bit about yourself, starting with your educational background, then what led you to work with managed realignment, and how long you have been working in this field…

1. To determine whether there is a definition of habitat compensation, not provided by the guidance.

What do you understand habitat compensation to mean?

2. To discover why habitat compensation occurs in the first place and why MR is perceived to be the most suitable method.

2.1	**What are the reasons behind Managed Realignment for habitat compensation?** (Biophysical processes, cultural theories, political viewpoints, conservation targets, economical, legal etc.)
2.2	Who decides that managed realignment for habitat compensation must occur in the first place? (Shoreline Management Plan – New Forest District Council)
2.3	Who are the usual stakeholders in this type of project? How have they been identified? Who is excluded? Why?
2.4	Who supports MR for habitat compensation most? Who is most against it? (EU Commission, UK government, local authority, NGOs, the public, conservationists, businesses…)
2.5	What are the advantages?
2.6	What are the disadvantages?
2.7	Are there alternative strategies?

3. To identify which regulations MR for habitat compensation must comply with and what the penalties are for non-compliance.

3.1	**Which EU and UK policies require MR for habitat compensation?**
3.2	How do you know about these policies? Where do you get your information?
3.3	What are the penalties for non-compliance? Are they enforced? By who?
3.4	Has the 'zero option' ever been chosen? By who? Why/why not?

4. To identify who is responsible and thus accountable for MR habitat compensation projects, in order to discern from them how they justify their practices.

4.1	**So if the XX identify the need for MR for habitat compensation (through the SMPs) who then should or does take on that project? And why that organisation?**
4.2	Are there any formal documents to say who should take on these type of projects?
4.4	Who implements the projects – actually carries out the work?
4.5	Who are the project implementers accountable to? Who checks the projects? How

	often? Do they monitor them sufficiently?
4.6	What is a successful MR project outcome? How do you measure success? When is the success measured i.e. 3 years later, 5 years later?
4.7	Who is responsible for the consequences if the project does not comply with the Habitats and Birds Directives? Who should be responsible?
4.8	Where are these successes or failures recorded? Do they have to be reported? If yes to whom?
4.9	If the European Commission has acknowledged in the Guidance Document for the Habitat directive that MR cannot fully restore habitat, why does the EU/England/yourself continue with habitat compensation projects? What are the incentives and disincentives?
4.10	Do you use scientific literature to inform the decision making? If so what types? (Peer reviewed articles, grey literature from past projects, reports from the EA?) From the scientific literature that I have reviewed on this topic, it suggests that managed realignment for habitat compensation is rarely successful, in what other ways do you legitimise these projects?
4.10	Who pays for the managed realignment for habitat compensation projects? Who should pay for them?

Questions Specific to Farlington Marshes

5. To discover why this specific site has been considered for intertidal habitat compensation, in order to see if all the stakeholders involved have the same viewpoints.

5.1	**Why was Farlington Marshes identified as a site for intertidal habitat compensation?** (crumbling sea walls, compensate within the SPA/SAC rather than mitigate elsewhere, habitat banking?) What evidence is used to justify this site as a potential MR site?
5.2	What will be the advantages of the managed realignment of Farlington Marshes?
5.3	What will be the disadvantages of the managed realignment of Farlington Marshes?
5.4	What evidence would be needed in order to preserve Farlington Marshes (to justify that it is an important roosting site for birds)?
5.5	If the benefits of MR are mostly environmental, who do you think should be responsible for paying for its maintenance and upkeep?
5.6	Are all relevant people consulted about this project? (Including the public - especially if it is

	in their 'interest'?) Who is left out? Why?
5.7	Flood management works can only take place if "there are no alternative solutions, and it is necessary for imperative reasons of overriding public interest, and any necessary compensatory measures are secured to ensure that the overall coherence of Natura 2000 is protected". Therefore have any 'alternative solutions' been identified prior to the proposal to manage realign Farlington Marshes?
5.8	Which project within Portsmouth was/will be implemented because of 'imperative reasons of overriding public interest'? What are those reasons?
5.9	Managed realignment for habitat compensation must 'ensure that the overall coherence of Natura 2000 is protected'. How will the managed realignment Farlington ensure this?

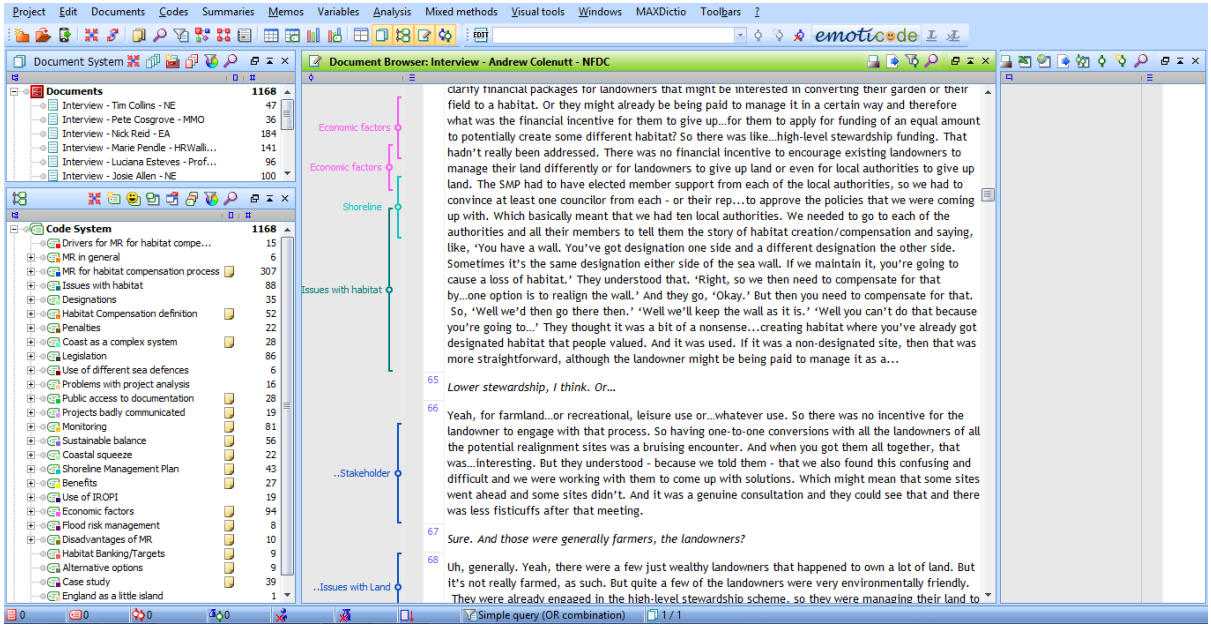
Thank you for your time. Do you have any questions for me?

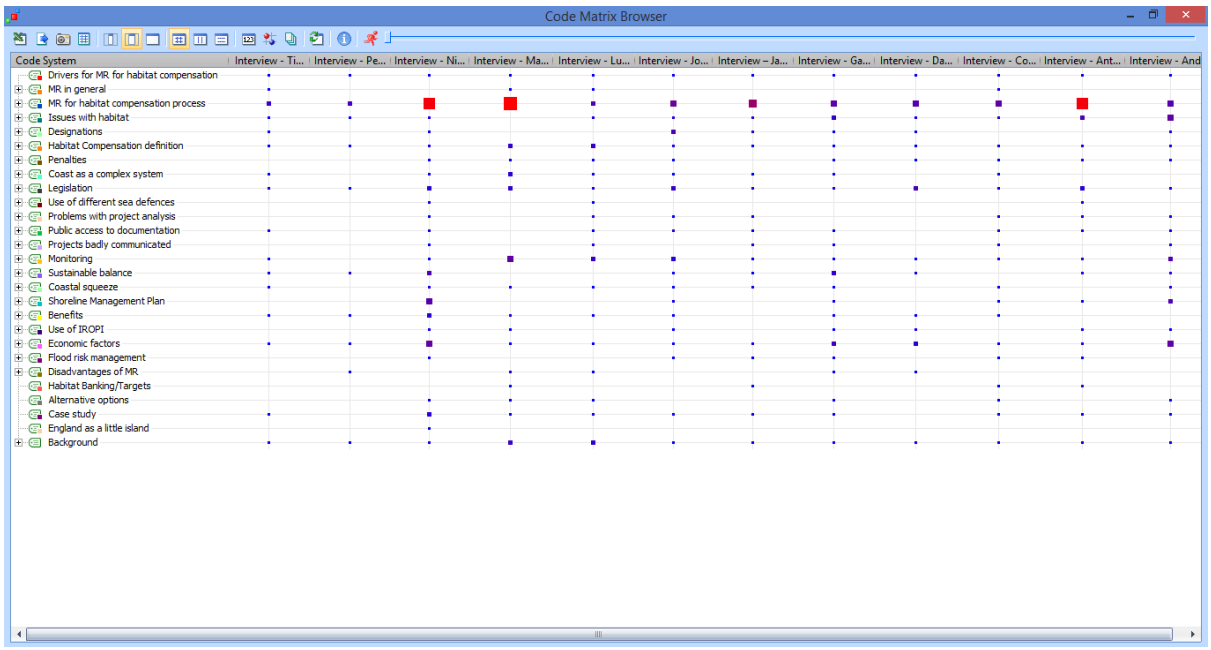
Appendix D: Code table

Themes	Sub-themes	Example quotes
Legislation	Legal driver	"I would say it's down to legislation"
	No choice	"if you lose it, you have to compensate"
Common sense	-	"it just becomes a common sense thing to do"
Coastal squeeze due to protecting people and property	Protecting people and property	"we're making these plans to protect the public"
	Coastal squeeze	"compensate losses of the impact of coastal squeeze"
	Shoreline Management Plans	"with our SMPs we have one of typically three policies: hold the line - is where we get coastal squeeze"
Port Development	Economic development	"They've said we want to build a port… big investment on their part but it's got an environmental impact"
Trade-offs	Sustainable balance	"So any policy should be technically, economically and environmentally sound"
	Other benefits	"It's not just about habitat creation, it actually helps improve their standard of protection, stops flooding, protects the caravan site, it's good for local economy, for the businesses, people love it, to come and visit because there's new habitat establishing"
	Economic factors	"you have to make a financial case for each policy"
	Legal priority	"if there's a legal driver, that's the priority"
Stakeholder involvement	Regulators involvement	"we would always seek the advice of our regulators"
	Lacking guidance	"information on complying with them [site designations] I think is lacking a little"
	Unequal input	"more and less weight is given to different stakeholders and in some cases it seems like unfairly little"
Accountability	Lack of project inspection	"no, nobody goes out every time and has a look"
	Penalties	"there's no clear document I can find that tells me what the implications would be if we didn't comply with the regulations"
	No set time-frames	"if there are no set targets or set timeframes, when you should achieve those targets, how can you set the penalty"
	Habitat ratios	"Where we're talking about coastal squeeze it's much more a case of one for one replacement in hectare terms"
Setting targets	Lack of targets	"to regulate things you do need to have set criteria, parameters and targets and timeframes shaped to those targets, otherwise there's no point"
	Designations	"there are certain sites that are designated because it was a good idea… But there's no supporting evidence available"
Success	Unknown	"the question of what makes a site successful has never been pinned down" ;
	"like for like"	"you have to deliver like for like as far as you're

		feasibly able”
	Achieve a designation	“The point of success is when it supports the designated features”
	Habitats Directive objective	“it’s to meet the objective of creating the habitats that are required under the habitats directive”
Monitoring	Lack of long-term monitoring	“the good practice perhaps should be year 1 monitoring, year 5 monitoring, year 10 monitoring. But what tends to happen is we do year 1, 2, 3, 4 and then that's it”
	Problems with project analysis	“the reports that come out of consultancies are very very brief and we have no idea how they have reached those conclusions”
	Lack of public access to documentation	“it's actually quite difficult to get those full monitoring reports out”
Defining habitat compensation	Lack of definition	“I think there is no actual definition, we have a lot of Guidance examples and what could be considered”
	Issues with habitat replacement	“There was an issue about timescales about how long it takes for certain habitat types to be recreated”
	Lack of defined time limit	“no set targets or set timeframes”
Complexity of dynamic environments	Dynamic environment	“you can't conserve them they're dynamic flexible systems, they change, it's the nature of being coastal they change”
	Complex to compensate	“you're not creating like for like in terms of their duration”

Appendix E: Thematic coding screen shots using MAXQDA software



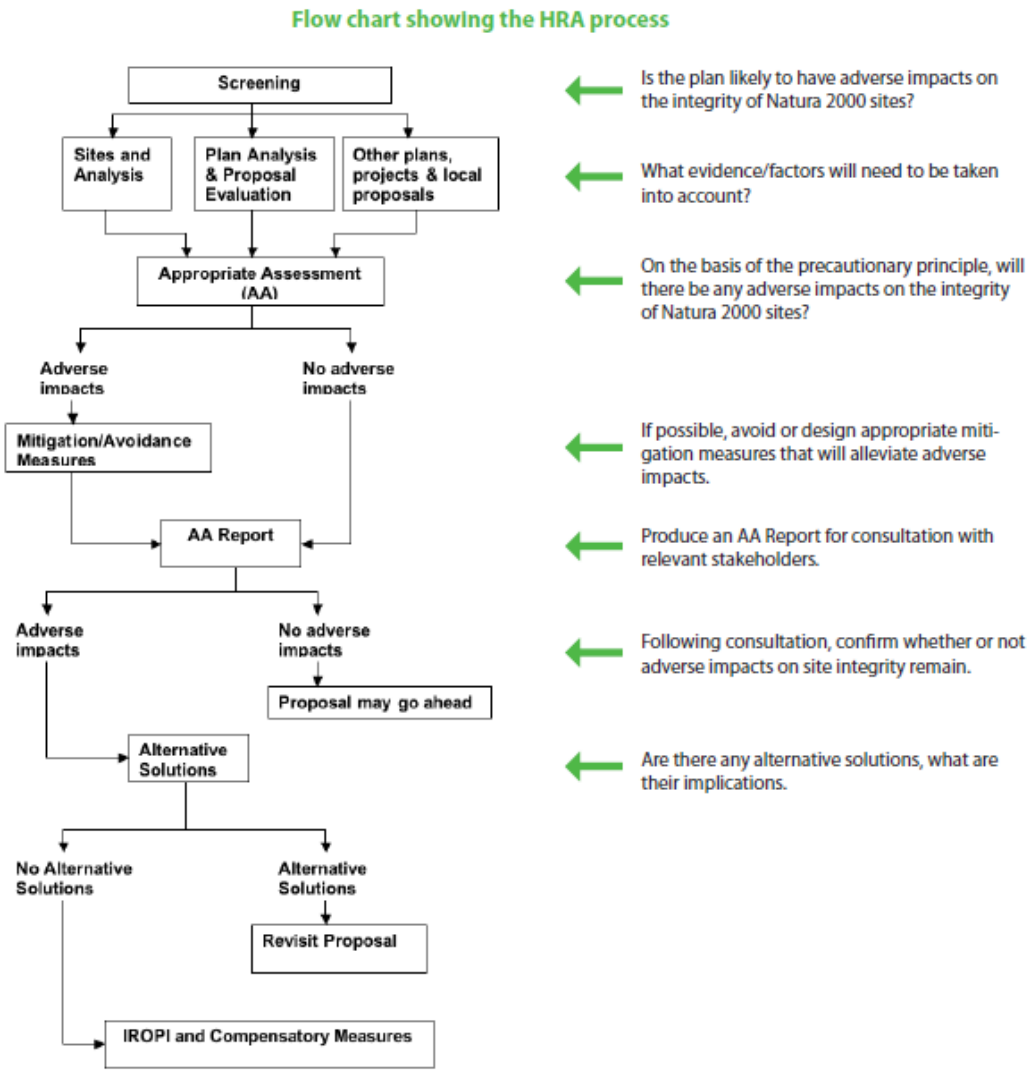


Screen shots of the coding system I used to analyse my interview transcripts.

(Above) Coding A.Colenutt's transcript using both pre-defined codes (resulting from the literature) and emergent codes (resulting from new themes identified in the transcripts). The codes to the left of the screen shot were condensed into smaller groups of themes once all the transcripts had been analysed.

(Below) A code matrix of all the interview transcripts showing me who discussed certain themes the most/least, hyperlinked back to the coded segments so that I could ascertain why that was, as well as relate the themes back to the contexts that the organisations/people came from.

Appendix F: Habitats Regulations Assessment



Source: East Hampshire District Council (2012)

Appendix G: List of MR habitat compensation projects

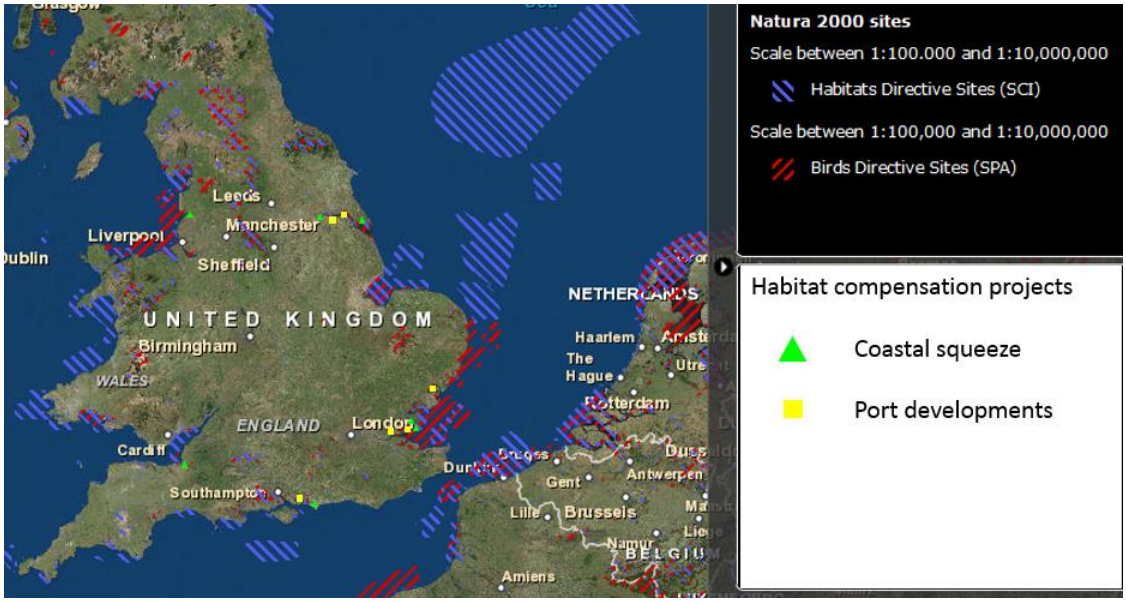
Dates	Name of MR for habitat compensation	Reason	Source
1998	Trimley Marsh, River Orwell, Suffolk	Harwich Haven Port Authority – dredging for Felixstowe Port	RSPB
2002	Brandy Hole, River Crouch, Essex	Environment Agency project – coastal squeeze at Hullbridge, River Crouch, Essex	OMReg, RSPB
2003	Trimley and Shotley Marshes, River Orwell, Suffolk (habitat enhancement)	Harwich Haven Port Authority – Trinity III Terminal extension	Royal Haskoning
2003	Paull Holme Strays, Humber Estuary, Lincolnshire	Environment Agency – coastal squeeze on the Humber Estuary	OMReg
2005 - onwards	Wallasea Island, Crouch Estuary, Essex	RSPB, Environment Agency, Crossrail – creation of new habitat in compensation for past coastal squeeze in Essex and Suffolk, some might be sold as compensation for other developments in the future	RSPB, (J.Rhodes, personal communication, 06/03/2015)
2006	Chowder Ness, Humber Estuary, Lincolnshire	Associated British Ports - port extension to create a new roll-on roll-off ferry terminal	OMReg
2006	Welwick, Humber Estuary, Lincolnshire	Associated British Ports - port extension to create a new roll-on roll-off ferry terminal	OMReg
2006	Allfleets Marsh (Wallasea Island), Crouch Estuary, Essex	Defra – port developments in Medway and Orwell Estuaries (reclamation of intertidal mudflat)	OMReg
2006	Alkborough, River Humber,	Environment Agency – coastal squeeze on the Humber Estuary	Manson & Pinnington, 2012
2007 - ongoing	'Site X', Kent	London Gateway, P&O (now Dubai World Ports), Shellhaven, Essex – construction of major containment port	RSPB
2008	Hesketh Out Marsh, Ribble Estuary, Lancashire	Environment Agency and RSPB – coastal squeeze AND Lancashire City Council – improvement of sea defences damaging designated sites	OMReg, RSPB
2008 (not yet implemented)	Steart, River Parrett, North Somerset	The Bristol Port Company – building of a deep sea container terminal on the Severn Estuary	RSPB
2010	Stanford Wharf, Stanford-le-Hope, Essex	London Gateway, P&O (now Dubai World Ports), Shellhaven, Essex – construction of major containment port,	OMReg
2010 (not yet implemented)	Potentially: Grain Marshes, All	Environment Agency – coastal squeeze in the Thames Estuary until 2100	RSPB, Environment

	Hallows Marshes, St. Mary's Marsh, West Canvey Marshes, Bowers Marsh		Agency
2013	Cobner Point, Chichester Harbour, Hampshire	Associated British Ports – port development at Southampton	OMReg
2013	Medmerry, Selsea peninsula, East Sussex	Environment Agency – coastal squeeze at Portsmouth	OMReg
2014	Steart, River Parrett, North Somerset	Environment Agency – coastal squeeze in the Severn Estuary	WWT

Schemes that were rejected:

Date	Scheme	Reason for objection	Source
1996-2004	Dibden Bay, Associated British Ports, Southampton Water, Hampshire – construction of a container terminal	ABP initially stated there was no adverse effect on the designated sites, Natural England (then English Nature), RSPB and others disputed this. The Secretary of State ruled there was not sufficient grounds for an IROPI – the disbenefits outweighed the benefits	RSPB
2000-2004	Bathside Bay, Hutchison Ports (UK) Limited, Harwich, Essex – construction of major container port	RSPB challenged at a public enquiry that less damaging alternative solutions could be taken instead. The project has not since been followed up.	RSPB
2010	Barrow Port Area Action Plan, Cumbria – build a cruise ship facility.	The Appropriate Assessment (AA) was legally flawed, little evidence for compensatory habitat and no substantive evidence for a need of a cruise ship facility	RSPB

Sources: RSPB, 2012; Environment Agency, 2012; Manson & Pinnington, 2012; OMReg, 2015, WWT, 2014: http://steart.wwt.org.uk/



Map of MR habitat compensation sites. Map source European Environment Agency (2014-2015). Locations sourced from Appendix F.

Appendix H: Limitations

One of the most significant barriers to the research was obtaining the reports on MR projects for habitat compensation. I tried several different angles to obtain the reports ranging from Freedom of Information requests from the Environment Agency and Natural England, to emailing the project managers at the environmental consultancies used by the port developers. I only managed to obtain the Trimley Marshes report because it had been 'signed off' by Natural England and so the port authority and environmental consultancy were happy for me to have a copy. The Medmerry report became available to me in late March 2015 as it had just been completed as part of the first year monitoring agreement. The Medmerry report contained virtually no information about the compensation of coastal squeeze, so it could not be used as a reference (but could be used as an example of the lack of reporting in relation to the compensation objectives). The Trimley Marshes project report contained the information I needed but, as it was the first MR habitat compensation project to be implemented, it is not necessarily representative of how subsequent projects have been carried out. Nevertheless it has provided a valuable starting point for discussions. My difficulties with obtaining reports further highlight one of the main points in my thesis regarding transparency and synthesis of project findings and outcomes.

The second limitation I faced was understanding the legalities of habitat compensation under the EU's Nature Directives and England's Habitats Regulations. I had tried to contact two environmental lawyers in England to provide me with an accurate account of the case law surrounding habitat compensation projects, but did not get a response from either. It seems that the projects are very much determined on a 'case-by-case' basis, as to what is acceptable as compensation and what is not, and the decisions are constantly changing at the European level (see the 'Briels case'[25]). The latest guidance from England contains examples of what has and hasn't been allowed as compensation but these are brief and do not provide any information about the overall outcomes of the projects. My thesis would have benefitted from validation by an environmental lawyer that I was interpreting the guidance appropriately, but again this experience highlights the difficulties faced by stakeholders when carrying out these type of projects. Namely that the guidance can be interpreted in a variety of different ways and without a solid definition of what constitutes habitat compensation it is hard to determine whether England is complying with the Directives or in breach of them.

It would have been additionally beneficial to speak with a representative from the European Commission who presides over these type of projects to ascertain the EC's opinion and to determine

[25] http://gavclaw.com/2014/05/16/habitat-directive-ecj-rejects-mitigation-measures-in-briels-and-forces-infrastructure-works-into-the-compensation-procedure/

whether they had a more solid definition of habitat compensation since the last guidance in 2007. However this was not within the scope of this thesis.

Additionally I wanted to seek the views of all stakeholders involved with these type of projects and so I asked locals/visitors to Farlington Marshes for their opinions on the potential MR of the area. However, because none of them had previously heard about the requirement for habitat compensation, nor had been involved with the process before, the short interviews did not yield any particular themes or substantial information. Upon reflection I should have asked locals who had previously been involved in the recent Medmerry habitat compensation scheme further along the East Solent coast. This potentially would have generated more extensive insights into the process from their point of view. This could then be a further research suggestion to enhance the transparency of MR for habitat compensation projects.

Due to the nature in which I engaged with this topic, I somewhat limited myself to practitioners within the Solent area. I tried to balance this south coast focussed project by interviewing 'general' experts in this field which is why there are two interviewees from Natural England and two from the Environment Agency as well as two different environmental consultants. However because Farlington Marshes was the stimulus for the project a lot of conversations centred on the Solent rather than other MR habitat compensation sites. If I were to undertake this research again (or take this thesis further) I would try to get a more holistic view of the MR habitat compensation projects in England by talking to practitioners involved in each of the projects. This then may also help with obtaining the reports from each of those projects.

Furthermore I have been discussing an EU law just within the context of England, and apart from looking at a few law case studies of MR habitat compensation projects, I have not investigated how other countries have interpreted the legislation. Other coastal member states may have already decided on an environmentally sustainable definition of habitat compensation that could be of benefit to England. Therefore if I were to expand this research I would include findings from other EU member countries where possible.

Lastly the technique of thematic coding was new to me and although there is basic information about this method in social science books it was not clear how I should implement the technique. Therefore I have included a code table as well as screen shots of my coding in an effort to make the process as clear to external persons as possible. Furthermore the transcripts can be made accessible if needed in order to ascertain how I consistently obtained my results (overall themes). This is so that my research can be replicable and credibly used in further studies.