

RSPB Higham Marshes Habitat Enhancement Project



Water Vole (Rob Budgen, 2016)

**Non-European Site Receptor Ecological Site Assessment
Planning Application Proposal Supporting Documentation
Author: Will Tofts**

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1. Introduction

1. Background

This report is a supporting document containing the assessment of impacts, both positive and negative, on the species and habitats, present or otherwise, in the Higham Marshes project area as a result of delivering the habitat enhancements proposed within the project. The scope of this report refers to The South Thames Estuary and Marshes SSSI designated species and habitats as well as species categorised as being of conservation concern. Species and habitats that are designated as part of The Thames Estuary and Marshes SPA and Ramsar in addition to The South Thames Estuary and Marshes SSSI designation are assessed in the document 'Higham_Marshes_Ecological Site Assessment'; Report to Inform an Assessment Under the Habitats Regulations' and are not within the scope of this document.

Higham Marshes is a 177.2 hectare area of predominantly, grassland, bisected (North to South) by an area of common land, and Environment Agency Main river (East to West). The northern boundary comprises the Thames and its associated flood defences and to the south the Village of Higham and agricultural land.

The land is used for the conservation of various species of conservation concern, with active habitat management carried out by the RSPB to ensure the habitats are in the right and best condition for them to thrive. The RSPB entered into a management agreement with the Landowner in 2013. Work was carried out to isolate the site from the surrounding drainage system in 2014. Various other small-scale habitat improvement works have been carried out in the following years. In 2019 the RSPB purchased the land from the landowner, excluding Higham Common.

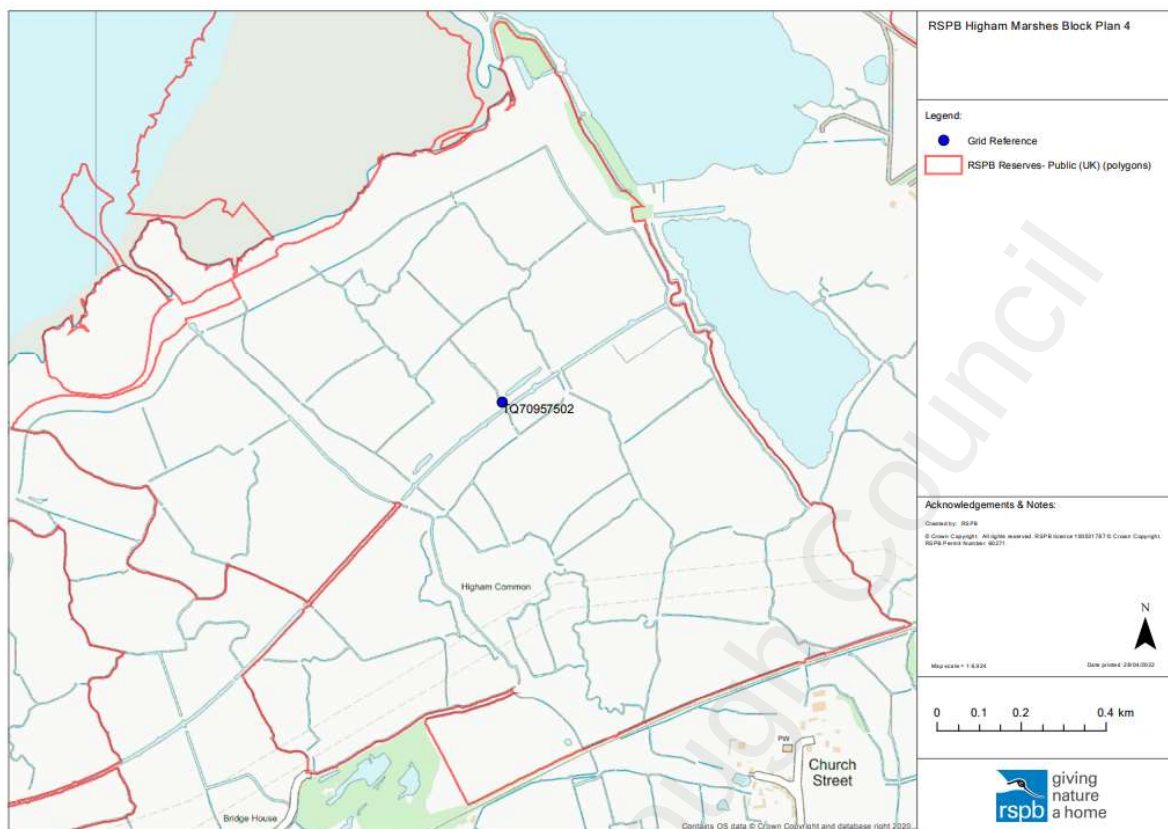


Figure 1: Higham Marshes Location

This project will deliver landscape-scale habitat restoration and innovative solutions for climate resilience in the Greater Thames Estuary. The RSPB working with partner organisations; Kent Wildlife Trust, Essex Wildlife Trust, Kent Wildfowling & Conservation Association and Elmley Nature Reserve Community Interest Company will restore and enhance 1,805 ha across 24 important Coastal and Floodplain Grazing Marsh (C&FGM) sites. This project seeks to make better use of freshwater across the landscape implementing 29 innovative smart solar pumps at 14 of the project sites, while also improving habitat

Across all 24 sites habitat conditions are failing to meet the needs of waders & other priority species. This project will work to address the below key issues facing the project sites:

1. Surface pools dry out, depriving wader chicks of food and habitat for other species. Existing hydrological systems are inefficient and do not provide the volume of water required to maintain wet features throughout the spring and summer, this is getting worse through climate change;
2. The lack of infrastructure to support grazing regimes which create the optimal grass sward structure that breeding waders need;
3. Lack of nesting habitat for waders;

1. Identifying species and habitats of conservation concern

The sources of data have been used to identify species and habitats of conservation concern specific to Higham Marshes

1. The South Thames Estuary and Marshes SSSI citation and presented in the document 'Higham_Marshes_SSSI'
2. Breeding bird data gathered by surveys using Smith & O'Brian
Higham_Marshes_Breeding_Birds
3. BTO Wetland Bird Surveys – presented in the documents Higham_Marshes_WeBS
4. Kent and Medway Biological Records Centre (KMBRC). A search of the entire Project Area with a 1km buffer. A number of datasets were obtained:
 1. Habitats (general) and presented in the document Higham_Marshes_Habitat Map
 2. BAP Priority Habitats and presented in the document Higham_Marshes_BAP Habitat Map
 3. Protected Species Inventory (PSI) and presented in the document Higham_Marshes_PSI
 4. Conservation Concern Species Inventory (CCSI) and presented in the document Higham_Marshes_CCS'.
 5. Kent Rare & Scarce Species Inventory (KRSSI) and presented in the document Higham_Marshes_KRSSI'.
 6. Bat records from Kent Bat Group (KBG & KBGR), specifically for known bat roosts, and presented in the documents 'Higham_Marshes_Bat Records and Higham_Marshes_Bat_Roost Map
 7. Historical Bird Data is presented in the document Higham_Marshes_Bird Summary.

5. The Project

1. Aims

This project aims to undertake engineering works to enhance the in-field topography and to repair hydrological bunds and culverts. This will allow the retention of surface water, being the foremost element of a wetland habitat restoration/enhancement, at the key times of the year – the breeding and wintering seasons. Since the early 1980s at Elmley Marshes on the Isle of Sheppey, this approach to converting wetland habitats has been tried and tested throughout the RSPB's tenure along the North Kent coast – and many other places in the UK. Other successful transformations have been delivered at Shorne Marshes, Northward Hill and Great Bells Farm where wetland fauna and flora now proliferate at levels not experienced previously or since the turn of the century – within an environment of widespread species declines.

2. Site

Currently Higham Marshes is a functioning wetland system after works carried out by the RSPB in conjunction with the land owner in 2013/14. Work was carried out to isolate the marsh from the surrounding landscape drainage system. A abstraction licence was gained from the Environment Agency.

The site does have wildlife value hence its designation as internationally important as part of The South Thames Estuary and Marshes SSSI and Thames Marshes and Estuary Ramsar. However, nature was in a very different state at the time of the original designation as a SSSI in 1981 and its review in 1991. Higham Marshes as a whole comprises a fraction of the SSSI, and as a consequence, necessitates that the habitat must be of the very highest quality to ensure that it has real value for all of the designated and undesignated features that should be utilising the reserve and maximising its potential.

The site is split by Higham Common, with the whole site being SSSI, with the eastern 'Side' being within the Thames Estuary and Marshes SPA and Ramsar.

3. Description

This project seeks to improve the topography of the site to allow for better standing/surface water retention on site for the benefit of breeding waders.

The features listed above constitute the prime step in the hydrological strategy whilst another set of elements augments the strategy and constitute the enhancements that will bring the habitat up to the highest quality. These are:

Some of the hydrological control systems put in place during the initial restoration phase in 2013/14 have been damaged from use and now need replacing and upgrading. Drawings found in document Higham_Marshes_Design_Specification

NE4 – Install Culvert – **Drawing CUL2**
SE5 – Install Culvert – **Drawing CUL1**
NW – Repair bund – **Drawing BUN1 & BUN2**
NE – Repair bund – **Drawing BUN1 BUN2**

The features listed above constitute the hydrological strategy whilst another set of elements augments the strategy and constitute the enhancements that will bring the habitat up to the highest quality. These are:

1. **Rills and scrapes** – shallow excavations that will provide increased topographical variation and resilience to maintain surface water as water draws down over the breeding season. Starting in November, water levels will be raised to reach the peak extent by January/February and, beginning in April, water levels will be lowered steadily under full control until July when no, or little, surface water will be present across the fields. Subject to rainfall, some water will remain in the base of the rills and scrapes, but this will not be actively managed. Good levels of water will remain in the ditch network within the hydrological units, but the field surface will remain dry, or predominantly so, until November when the cycle is repeated. Whilst extensive surface water is highly valuable, if it is too shallow, such as would be created if only the strategy element was delivered, the surface water will evaporate too early for breeding waders to complete reproductive cycles. This will become more pronounced according to climate change predictions. Therefore, the increased topographical variation will compensate for this and provide much improved feeding opportunities. Design principles for rills and scrapes include:

2. **'Islands'** – shallow features that will remain above the peak surface water level to provide safe roosting and nesting locations. These are most necessary where the surface water becomes too extensive. Design principles for islands are relatively basic:
 1. Crest height is -100mm - 200mm above the peak surface water level per hydrological unit.
 2. Batters of the islands are either 1:10 or 1:20
3. Using the natural topography of the site, from remnants of when the site saltmarsh/land drainage systems to expand the rills system. Field and length below including scape size. Using a tractor mounted spoil spreader to carry out the works.
4. The rill system will mainly be made through the use of a tractor mounted soil spreader. Some rills will be created using a 22 tonne 360 to produce the spoil for the crossing points and plugs.
5. Works have been broken down into Priority 1 and Priority 2.

Priority 1 works

1. **NE1**
 1. Rill length – 440 meters – soil spreader
 2. Scrape size
2. **NE4**
 1. Rill length - 465 meters – soil spreader
 2. Rill length – 100 meters – 360 – **Drawing RIL2**
 3. Rotovate – 0.2 hectares
3. **NE5**
 1. Rill length – 581 meters – soil spreader
 2. Scrape size – 0.4ha
4. **NE6**
 1. Rill length -450 meters – soil spreader
5. **NE7**
 1. Rill length – 330 meters soil - spreader
 2. Scrape size
6. **NE8**
 1. Rill length - 148 meters soil spreader
 2. Rotovate - 0.4 hectare
7. **NE9**
 1. Rill length – 150 meters – 360 - **Drawing RIL2**
 2. Rotovate – 0.8 hectares
 3. Islands – create 8 islands within scape with site won material
8. **NE10**
 1. Rill length – 300 meters – soil spreader
 2. Scrape size – 0.2 hectares
 3. Rotovate – 0.4 hectares
9. **NW1**
 1. Rill length – 400 meters– soil spreader
 2. Scrape size – 0.1 hectare
10. **NW2**
 1. Rill length – 500 meters– soil spreader
11. **NW3**
 1. Rill length - 380 meters– soil spreader
 2. Scrape size – 0.12 hectares
12. **NW4**
 1. Rill length – 400 meters – soil spreader
 2. Rill length – 65 meters – 360 - **Drawing RIL2**
 3. Scrape size – 0.12 hectares
13. **SE4**
 1. Rill length – 900 meters
 2. Scrape size – 1.2 hectares

14. **SE8**
 1. Rill length – 600 meters of new rills
 2. Scrape size – 0.3 hectares

Priority 2

15. **NE1**
 1. Rill length – 4 meters – soil spreader
 2. Scrape size – 0.12 ha
16. **NE4**
 1. Rill length - 250 meters – soil spreader
 2. Scrape Size – 0.9 hectares
17. **NE5**
 1. Rill length –280 meters – soil spreader
 2. Scrape size – 0.18ha
18. **NE6**
 1. Rill length -60 meters – soil spreader
 2. Scrape Size – 0.15 ha
19. **NE7**
 1. Rill length – 360 meters soil - spreader
 2. Scrape size – 0.06ha
20. **NE8**
 1. Rill length - 148 meters soil spreader
 2. Rotovate - 0.4 hectare
21. **NE10**
 1. Rill length – 300 meters – soil spreader
 2. Scrape size – 0.2 hectares
 3. Rotovate – 0.4 hectares
22. **NW2**
 1. Rill length – 200 meters– soil spreader
 2. Scrape size – 0.2 hectares
23. **NW3**
 1. Rill length - 630 meters– soil spreader
 2. Scrape size – 0.15 hectares
24. **NW4**
 1. Rill length – 150 meters – soil spreader
25. **SE4**
 1. Rill length – 50 meters
 2. Scrape size – 0.05 hectares
26. **SE5**
 1. Rill length – 970 meters
 2. Scrape size – 0.25 ha
27. **SE8**
 1. Rill length – 200 meters of new rills
 2. Scrape size – 0.05 hectares

28. Baseline Data

1. **Avian species**

Breeding bird data is available for Higham Marshes from 2013, when the RSPB started the management agreement with the landowner, and 2021. Due to Covid, no data is present for 2020. Data is found in document Higham_Marshes_Breeding_Birds

Breeding data however is irrelevant to this project as work will not be carried out during the breeding season. The whole intention of the project is to improve the area for the breeding birds listed within the SSSI citation, and priority wet grassland species such as Lapwing and Redshank.

1. Garganey *Anas querquedula*,
2. Pintail,
3. Avocet
4. Bearded tit *Panurus biarmicus*.
5. Common tern

Data below has been taken from KMBRC data. WeBS data has been used to show the usage of the site by passage and wintering birds. The site over the last 6 years has had a good surveyor coverage and therefore bring the accuracy of the usage up.

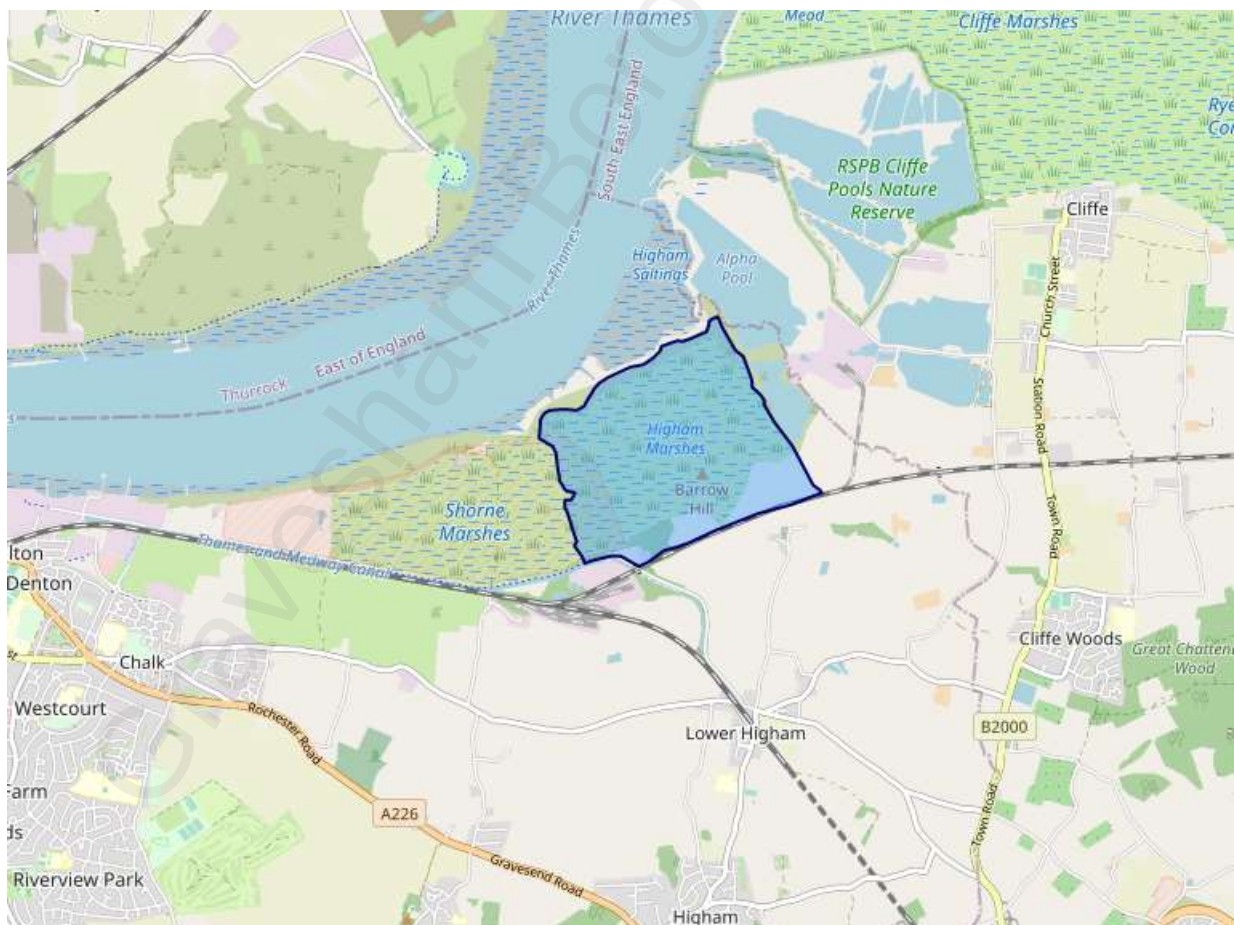


Figure 2: Higham Marshes WeBS sector

The following tables present peak count records for SSSI and species of conservation concern on passage and wintering for the last five and six seasons across the South Allhallows Marsh WeBS sector, which is the area under consideration for this application . Where undertaken, passage surveys were conducted during September and October following WeBS methodology with wintering surveys for the period between November and March also utilising the WeBS methodology.

Higham Marshes						
Passage SSSI species	2016	2017	2018	2019	2020	2021
Grey plover	0	0	0	0	0	0
Curlew	0	0	0	0	0	0
Black-tailed godwit	0	0	0	0	0	0
Redshank	0	0	0	0	0	0
Greenshank	0	0	0	0	0	0

Table 1: Peak count records for Higham Marshes between 2016 and early 2021 for each of the SSSI/BoCC designated species during autumn passage (Redshank -Autumn and spring passage). SSSI species are presented in bold type.

Higham Marshes						
Wintering SSSI species	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
European white-fronted goose	0	0	0	0	0	0
Shelduck	0	70	39	47	17	14
Gadwall	0	2	31	0	0	14
Teal	0	56	31	0	0	113

Grey plover	0	0	0	0	0	0
Curlew	6	121	86	0	60	63
Black-tailed godwit	0	9	156	0	0	0

Table 2: Peak count records for Higham between 2016/17 and early 2021/22 for each of the SSSI designated species during autumn passage (Redshank -Autumn and spring passage). SSSI species are presented in bold type. Brackets represent non-core count.

1. Non Avian Species

Non Avian SSSI species across Higham Marshes	
Higher Plants	
golden samphire <i>Inula crithmoides</i>	Not found on site since 1999
<i>Puccinellia fasciculata</i>	Not found on site since 2012. At TQ7075
least lettuce <i>Lactuca saligna</i>	Not found on site since 1980. At TQ77
saltmarsh grasses <i>Puccinellia</i> ,	<i>Puccinellia rupestris</i> found on site in 1980, no records since.
the glassworts <i>Salicornia</i> ,	<i>Salicornia fragilis</i> found on site in 1980. No records since.
sea aster <i>Aster tripolium</i>	Not present on project site
sea lavender <i>Limonium vulgare</i>	Not present on project site
sea purslane <i>Halimione portulacoides</i> ,	Not present on project site
divided sedge <i>Carex divisa</i>	Abundant and extensive across site
small goosefoot <i>Chenopodium botryodes</i>	Not present on site
golden dock <i>Rumex maritimus</i>	Found on site in 2012 but no records since TQ7274
slender hare's ear <i>Bupleurum tenuissimum</i>	Found on site in 2011 no site records since TQ7175
sea clover <i>Trifolium squamosum</i>	No records on site
sea barley <i>Hordeum marinum</i>	Found on site in 2017 but not within the area or scope of proposed works or any records since.

	TQ7175
bulbous foxtail grass <i>Alopecurus bulbosus</i>	Not present on site since 1987
other foxtails <i>Alopecurus</i>	Not present on project site
club-rush <i>Scirpus maritimus</i>	Present across project site
common reed <i>Phragmites australis</i>	Present across project site in ditches
fennel pondweed <i>Potamogeton pectinatus</i>	Present across project site in ditches
brackish water-crowfoot <i>Ranunculus baudotii</i>	Not present across project site.
soft hornwort <i>Ceratophyllum submersum</i>	Not Present on project site.
water soldier <i>Stratiotes aloides</i>	Found on site in 1997, but not within the area or scope of proposed works or any records since. TQ70337417
<i>Zostera angustifolia</i>	Not present on project site
<i>Z. noltii</i>	Not present on project site

Invertebrates

scarce emerald damselfly' <i>Lestes dryas</i>	No records on project site
<i>Lejops vittata</i>	Recorded in 1988 onsite at TQ77, no records since.
<i>Saldula opacula</i>	Not present on project site
dotted fan-foot moth <i>Macrochilo cribrumalis</i>	Not present on project site
<i>Bagous</i> (aquatic weevils),	<i>Bagous limosus</i> (1966), <i>Bagous tubulus</i> (1966) recorded on site, but none since years in brackets.
<i>Berosus</i>	<i>Luridus</i> not recorded since 1957
Great silver water beetle <i>Hydrophilus piceus</i>	Not recorded on site since 1987

Table 3: Non-avian SSSI species records. Records since the beginning of 2018 are presented in bold type

Non-avian conservation concern species across Higham Marsh

Mammals

Bat species:	All recorded flying. No roosts sites on site (see Higham_Marshes_Bat Roost)
Water Vole	Present on site. (Survey Results found in document Higham Marshes_Water_Vole

Reptiles	
Common Lizard	Last record on site 2000 at TQ77
Grass Snake	Present on site
Slow Worm	No records on project site since 1984
Adder	No records on project site
Amphibians	
Smooth newt	No records on project site
Great Crested newt	No records on project site
Fish	
Eel	No record on project site since 1980

Table 5 : Non-avian SSSI species of conservation concern records.

Two separate water vole surveys were carried out in April 2022 covering the whole area where work will be undertaken in relation to this application. No signs (Burrows, Feeding stations or latrines) were found in the project area where works that would impact on water voles. Results of the surveys are found in the Appendix 2

2. Habitats

To ensure RSPB's assessments as to which habitats are present across the application area, data from KMBRC was used for analysis. The maps are presented in the documents Higham_Marshes_Habitat Map and Higham_Marshes_BAP Habitat Map

Habitats across Higham Marshes	
BAP Habitats	
Neutral grassland Semi-improved Grazing marsh pasture	All compartments
Habitats	
Water: Open standing water, brackish	Present as ditch network across the application area and flight ponds

Table 6 : BAP habitat present on Higham Marshes.

6. Potential impacts and project design and delivery mitigation

1. Design

The design has been formulated to have a positive, long term impact on the European sites at Higham Marshes. Whilst the design does propose a good level of intervention to unlock the reserve's latent potential, the design process has considered the appropriateness of the scale of intervention. For example, the topographical enhancements proposed – rills and scrapes. Whilst widespread, they are not considered to be excessive. The scale designed is considered the minimum required to be effective in enhancing the site for target and designated species. The aerial snapshot of Elmley NNR on the Isle of Sheppey at Figure 6 shows a large number of rills per field that will thoroughly maximise each field's value to breeding and wintering waders. Whilst dramatic when viewed from the air (less so on the ground), this approach is ecologically sound and would be considered a 'gold-standard' design. However, a 'gold-standard' design of this complexity significantly increases the complexities of delivery and brings with it an extended period of disruption where the habitat will take longer to 'settle'.

For this reason we have decided to carry out the management through the use of a 'soil spreader.' This piece of machinery allows for targeted management without causing damage to other parts of the site while also being able to work quickly and effectively. It should also be noted that whilst the cost of delivery for the design for the area in this project is far from cheap, a 'gold-standard' design would be prohibitively expensive in the current funding environment. A design that is gold standard on paper but can't be delivered due to not being able to source the funding is thoroughly useless to a habitat and the species that it seeks to transform and increase respectively.

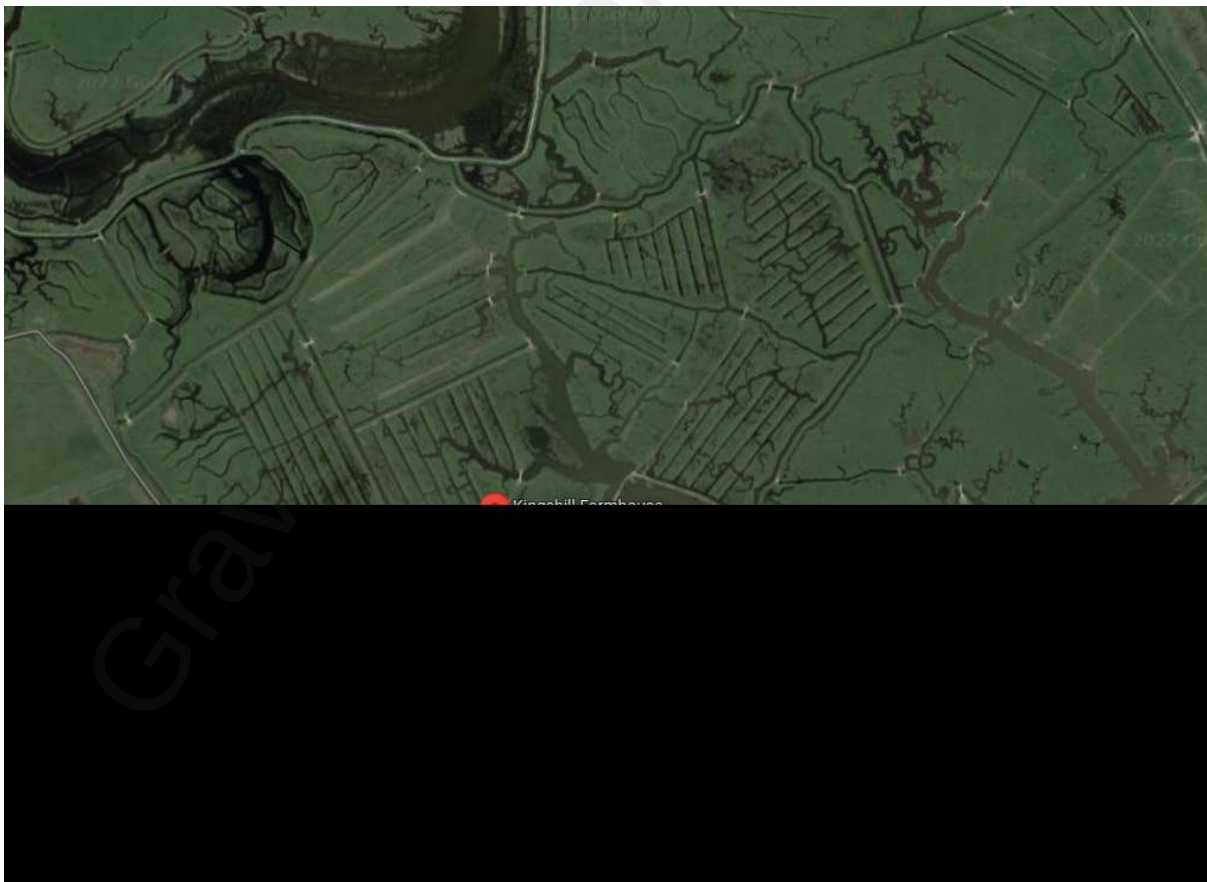


Figure 6: 'Gold-standard' rill creation at Elmley National Nature Reserve on the Isle of Sheppey¹.

In 2021, the entire project received funding from UK Government's Green Recovery Challenge Fund (GRCF). Being subject to the very short timescales for both application and delivery as defined by GRCF requirements has meant that the entire project has not been redesigned to be 'gold-standard' to take advantage of the potentially increased funding for a 'gold-standard' scheme but will be delivered as per the originally conceived rationale. A very good example of habitat transformation that has provided inspiration for the originally conceived scheme is Great Bells Farm, directly adjacent to Elmley NNR on the Isle of Sheppey, and shown in Figure 3 below.

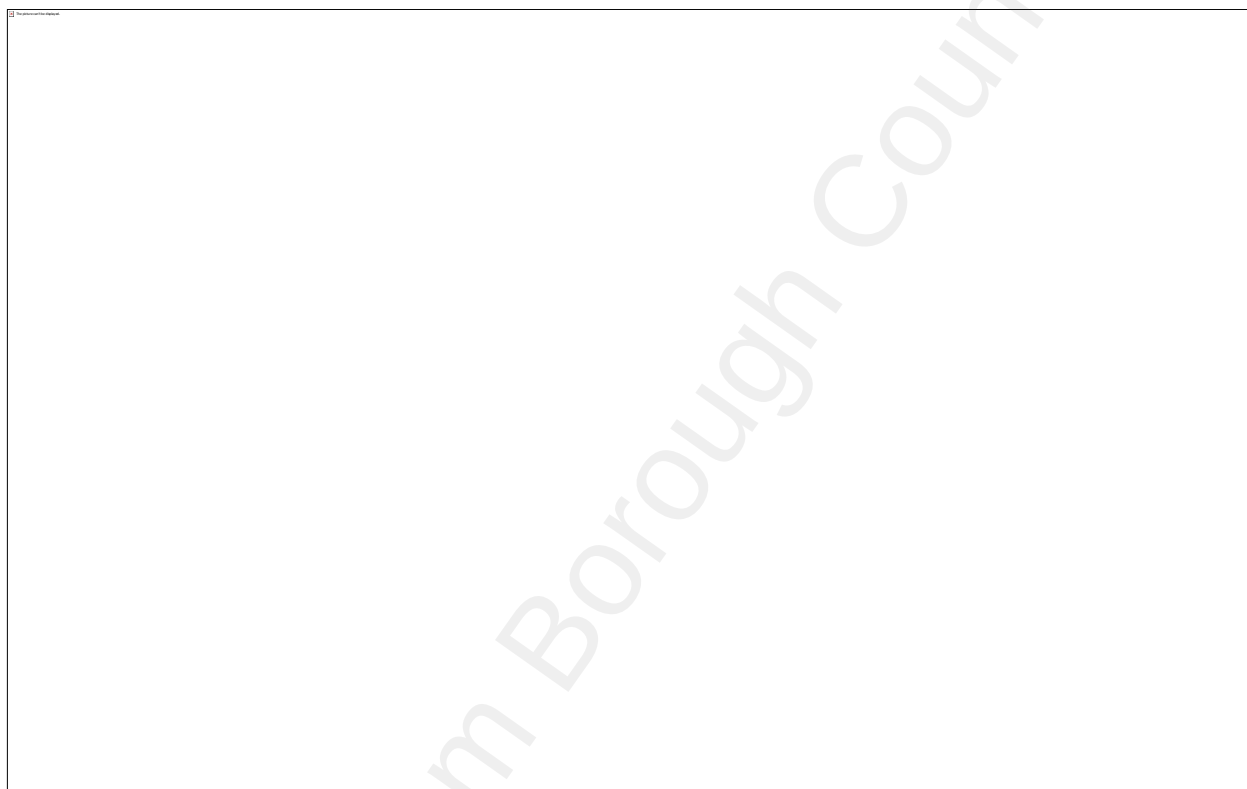


Figure 7: Great Bells Farm Nature Reserve on the Isle of Sheppey. The image on the right shows the site before transformation and the image on the left shows the site immediately after transformation activities.

Finally, as defined by GRCF funding requirements, the entire project needs to be delivered before 31st March 2023. We are planning to deliver the works across the entire project area between July and December 2022 (inclusive) which coincides with the least active period in respect to birdlife although careful planning and phasing will still be required to accommodate non-avian receptors. However due to timescales involved in gaining the correct consents, it is possible this will overrun into, January 2023.

¹<https://www.google.com/maps/place/Kingshill+Farmhouse+at+Elmley/@51.382979,0.7927445,22.04m/data=!3m1!1e3!4m1!1m7!3m6!1s0x47d92a60f453d695:0x5a6818ee2b6674a!2sElmley,+Sheerness+ME12+3RN!3b1!8m2!3d51.389223!4d0.775235!3m7!1s0x47d92afbfffffb:0x266196219d1ea42!5m2!4m1!1i2!8m2!3d51.381041!4d0.794507>

2. Groundworks Periods

Whilst this report focusses on Higham Marshes, delivery will not be in isolation. Therefore, activities across the entire project area are taken into consideration. During the creation of the enhancements and associated structures it is envisaged that machinery movements and construction noise will cause the following impacts without appropriate mitigation:

1. Disturbance to:
 1. Breeding, passage and wintering birds.
 2. Non-avian species.
2. Injury to, killing/destruction of:
 1. Nests/eggs/chicks of ground-nesting birds.
 2. Non-avian species.
1. Degradation/loss of habitat.

4.2.1. Birds

To avoid impacts to breeding birds, the groundworks will be undertaken between August and February at the very latest.

Whilst the aim is to finish groundworks by the end of November 2022, events may require work into January and February to allow completion of the programme as defined by GRCF timescales. The works will be undertaken during the passage season. The nature and present quality of the habitat results in the lack of any significant birds using Higham Marshes during this period.

Two further defining factors will ensure that there is no potential pathway for interaction with any passage species in the proposal:

1. The passage period is currently dry across the application area and the majority of the entire project area. The site is unsuitable and unattractive to SSSI passage species.
2. On the extremely slight chance that SPA/Ramsar passage species might choose to utilise unenhanced areas of Higham Marshes during this period:
 1. Even within each of the operational work areas, the activities are localised, meaning that any negative impacts are negligible at best and minimal at worst.
 2. The two scenarios of delivery will have inherent mitigation:
 1. All operational units worked on at the same time in one year. An unlikely scenario in all practicality but, if enacted, timescales for activity are fully expected to be condensed. The impact of this approach would be negligible at worst to passage SPA/Ramsar species.
 2. All operational units worked on in one year but only one, two or three at the same time. One, two or even three units can be enhanced while the remaining units remain as undisturbed refuge areas. Once the units being enhanced are completed, they become attractive refuge areas whilst the unenhanced units are being transformed.
 3. Higham Bight and RSPB Cliffe Pools and the saline lagoons is the main receptor site on the peninsula for passage birds and is located 2.5km south west of the site.

Where works extend into the wintering season, the scenario and impacts on wintering birds would be akin to point 2bi and 2bii above.

4.2.2. Non-avian species

Several non-avian SSSI species are found on site. However, they are all away from the works location and therefore not impacted by destruction of or Degradation/loss of habitat. A water vole survey and vegetation survey has been carried out by Greener Thames Project surveyors in April and May,, no signs of presence were found around the work areas. Results of these surveys are shown in Appendix 2.

Divided Sedge and Sea Club rush are two species that are present on site and are abundant and the dominant across all areas. Although the works may reduce their extent, due to their ecology of being rhizomatous, will recolonise the area in the following year.

Soft Hornwort is present on site, though there will be no impact due to no works occurring within the ditch systems, except at existing crossing points where culverts are being installed. These culverts will increase the ditch area on site positively impacting on this species.

However, and aside from necessary interactions to deliver the scheme, the standard operating procedure of keeping vehicle tracking and stockpiling of materials and machinery to the minimum, and least sensitive, areas necessary will minimise any additional negative effects.

4.2.3. Degradation/loss of habitat

The habitat of Lowland Wet Grassland in the application area as designated under various synonyms in the SPA/Ramsar and SSSI citations is present in name only. Both sites suffer from inappropriate water management for the habitat to be what it is supposed to be. Therefore, the designated area will benefit practically from the restoration to the appropriate habitats and management.

The creation of a reservoir to store water could be construed as a loss of habitat. However it is also the creation of habitat in itself, as well as being able to enhance and improve the existing habitat on the site. The reservoir will create open water habitat that will benefit wintering wildfowl such as dabbling/diving duck and grebes. The design will allow for emergent vegetation, replacing that lost through the building of it, which will benefit breeding birds such as reed bunting, reed warbler and breeding duck species.

Superficially, the cutting of new rills and scrapes could be construed as loss or degradation. However, this is not the case but an immediate enhancement – even without a green cover. They provide immediate access to soil invertebrates for species that feed on these. In fact, established rills and scrapes can become choked with vegetation. At this point their value to waders reduces significantly. As such, the prescribed management technique is to rotavate these features to control the vegetation and re-expose the soils.

Furthermore, there are two methods for rill creation where one is to remove all material completely and to use a spoil spreader. The former method will delay the re-vegetation process thereby increasing their longevity as effective foraging locations, however the speed of which the soil spreader can work and the detail at which it can works makes it preferable for this project.

The creation of the various lips will result in short term degradation, but this is mitigated by using locally won topsoil to cover the features which allows the vegetation to regenerate naturally. Whilst this strategy is a little slower than seeding with purchased seed, within a couple of seasons, these

features look like they have always been there and uses the purest form of provenance – seed and root sources directly from the immediate vicinity.

The creation, repair and re-engineering of ‘plugs’, dam and culverts utilises the same principles as perimeter lips but are so isolated that even short-term degradation is negligible. However, the logistics of delivery could easily create unacceptable levels of short-term degradation to the habitat per se i.e. it is entirely inappropriate to have hordes of machinery tracking wherever they like and damaging field surfaces. As per the mitigation for damage to divided sedge, vehicle tracking via specified haul routes and stockpiling of materials and machinery will be kept to the minimum, and least sensitive, areas necessary.

4.3. Post-enhancement operational period

The project will result in seasonal habitat condition changes across the entire project area from predominately dry grassland to functional and dynamic wetland habitats. This will transform Higham Marshes into the very definition of a Lowland Wet Grassland as designated under its various synonyms in the SPA/Ramsar citations. The long-term impacts are significantly positive for designated species that currently using the site and those that will colonise as a result of delivering this project. The impacts and, where required, mitigation for each designated species are presented in the following section.

2. Assessment of likely significant effects on ecological receptors.

1. Predicting and characterising ecological impacts

In accordance with the Institute of Ecology and Environmental Management (IEEM) Guidelines for Ecological Impact Assessment in the UK (IEEM 2006), when describing impacts, reference is made to the following, where applicable:

3. **Confidence** in predictions (levels of certainty that an impact will occur as predicted), based on the following four-point scale:
 - o Certain/Near Certain ($\geq 95\%$ probability)
 - o Probable (50–95% probability)
 - o Unlikely (5–50% probability)
 - o Extremely Unlikely ($\leq 5\%$ probability)
4. **Magnitude** – if an impact is deemed to be significant then its magnitude, in quantitative terms, should be assessed
5. **Extent** – the area over which an impact occurs
6. **Duration** – the time for which an impact is expected to last
7. **Reversibility** – a permanent impact is one that is irreversible within a reasonable timescale or for which there is no reasonable chance of action being taken to reverse it; a temporary impact is one from which a spontaneous recovery is possible
8. **Timing and frequency** – whether impacts occur during critical life-stages or seasons

1. Direct and indirect ecological impacts.

Both direct and indirect impacts are considered within this assessment. A direct impact is directly attributable to a defined action such as the physical loss of a habitat or the immediate mortality of an individual of a particular species. Indirect impacts are attributable to an action, but which affect ecological resources through effects on an intermediary ecosystem, process or receptor. An example of an indirect effect would be the loss of an important prey species for a predator.

The following tables show that whilst some short term and negative impacts will be experienced, they are both reversible and easily mitigated. The overriding impact of undertaking the habitat enhancements is significant, long term positive for the SSSI and conservation concern receptors.

5.3 Scoped out species and habitats

Tables 7 and 8 summarise the designated SSSI species and habitats that:

1. Will not be impacted negatively by the delivery of the project as they have not been recorded in the application area for a minimum of three years.
2. Are likely to be impacted positively in the long-term over the post-enhancement operational period.
3. Will never be impacted positively or negatively as they are not found in a Lowland Wet Grassland habitat.

SSSI species assemblage	Rationale for scope out	Other Observations
Breeding birds		
Garganey	Pairs present most years, no confirmed successful breeding. Works not being carried out in breeding season.	The habitat enhancements will have a direct, long-term positive impact. It is expected that these species will start to breed at the application area with the following confidence levels:
Pintail		
Avocet	Have never been recorded breeding in the application area due to the site not meeting their requirements. Works not being carried out in breeding season.	1. Garganey; Probably.
Bearded tit		2. Pintail; Extremely Unlikely
Common tern		3. Avocet; Probably. 1. Bearded Tit, Common

Tern, **Extremely Unlikely**

Breeding Bird Assemblage	Current assemblage consists of good numbers of Lapwing, yellow wagtail, meadow pipit, skylark and redshank. Works not being carried out in breeding season.	The habitat enhancements will have a direct, long-term positive impact. Certain/Near Certain
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Wintering birds

European white-fronted goose	Have never been recorded wintering in the application area due to the site not meeting their requirements.	The habitat enhancements will have a direct, long-term positive impact. It is expected that this species will start to utilise the application area during winter in a range of numbers, small to large, with the following confidence levels: Unlikely.
Shelduck	Have been recorded as wintering on or near in the application area.	The habitat enhancements will have a direct, long-term positive impact. It is expected that most of these species will start to utilise the application area during winter in a range of numbers, small to large, with the following confidence levels: Likely
Gadwall		
Teal		
Black-tailed godwit		
Curlew		
Grey plover	Have never been recorded wintering in the application area due to the site not meeting their requirements.	The habitat enhancements will have a direct, long-term positive impact. It is expected that these species will start to breed at the application area with the following confidence levels: 2. Grey Plover; Extremely Unlikely.

Passage birds

Grey plover	Have never been recorded On autumn passage in the application area due to the site not meeting their requirements.	The habitat enhancements will have a direct, long-term positive impact. It is expected that most of these
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		species will start to utilise the application area during winter in a range of numbers, small to large, with the following confidence levels:
		Extremely Unlikely
Curlew	Have never been recorded On autumn passage in the application area. application area due to the site not meeting their requirements	The habitat enhancements will have a direct, long-term positive impact. It is expected that this species will start to utilise the application area during winter in a range of numbers, small to large, with the following confidence levels:
		Probably
Black-tailed godwit	Have never been recorded On autumn passage in the application area. application area due to the site not meeting their requirements	The habitat enhancements will have a direct, long-term positive impact. It is expected that most of these species will start to utilise the application area during winter in a range of numbers, small to large, with the following confidence levels:
		Probable
Redshank	Have never been recorded On autumn passage in the application area. application area due to the site not meeting their requirements	The habitat enhancements will have a direct, long-term positive impact. It is expected that most of these species will start to utilise the application area during winter in a range of numbers, small to large, with the following confidence levels:
		Certain/Near Certain
Greenshank	Have never been recorded On autumn passage in the application area. application area due to the site not meeting their requirements	The habitat enhancements will have a direct, long-term positive impact. It is expected that most of these species will start to utilise the application area during winter in a range of numbers, small to large, with the following confidence levels:
		Unlikely

Invertebrates

scarce emerald damselfly <i>Lestes dryas</i>	Hasn't been recorded on the application area in last 3 years	The habitat enhancements are designed to have a direct, long-term positive impact on this species with a confidence level of Certain/Near Certain . It is expected that this species may start to recolonise the application area with a confidence level: Probable
<i>Lejops vittata</i>	Hasn't been recorded on the application area in last 3 years	The habitat enhancements are designed to have a direct, long-term positive impact on this species with a confidence level of Certain/Near Certain . It is expected that this species may start to recolonise the application area with a confidence range from Unlikely
<i>Saldula opacula</i>	Hasn't been recorded on the application area in last 3 years	The habitat enhancements are designed to have a direct, long-term positive impact on this species with a confidence level of Certain/Near Certain . It is expected that this species may start to recolonise the application area with a confidence range from Unlikely
dotted fan-foot moth <i>Macrochilo cribrumalis</i>	Hasn't been recorded on the application area in last 3 years	The habitat enhancements are designed to have a direct, long-term positive impact on this species with a confidence level of Certain/Near Certain . It is expected that this species may start to recolonise the application area with a confidence range from Unlikely
<i>Bagous</i> (aquatic weevils),	Hasn't been recorded on the application area in last 3 years	The habitat enhancements are designed to have a direct, long-term positive impact on this species with a confidence level of Certain/Near Certain . It is expected that this species may start to recolonise the application area with a confidence range from Unlikely
<i>Berosus</i>	Hasn't been recorded on the application area in last 3 years	The habitat enhancements are designed to have a direct, long-term positive impact on this species with a confidence level of Certain/Near Certain . It is

Great silver water beetle <i>Hydrophilus piceus</i>	Hasn't been recorded on the application area in last 3 years	expected that this species may start to recolonise the application area with a confidence range from Unlikely
		The habitat enhancements are designed to have a direct, long-term positive impact on this species with a confidence level of Certain/Near Certain . It is expected that this species may start to recolonise the application area with a confidence range from Likely

Higher Plants

common reed <i>Phragmites australis</i>	Is present on site	The habitat enhancements are designed to have a direct, long-term positive impact on this species with a confidence level of Certain/Near Certain . It is expected that this species may start to recolonise the application area with a confidence range from Certain
divided sedge <i>Carex divisa</i>		
club-rush <i>Scirpus maritimus</i>		
soft hornwort <i>Ceratophyllum submersum</i>		
soft hornwort <i>Ceratophyllum submersum</i>		
bulbous foxtail grass <i>Alopecurus bulbosus</i>		
<i>Puccinellia fasciculata</i>	Have not been recorded present in the application area in the last 3 years.	Certain/Near Certain for no change and no impacts positive or negative.
saltmarsh grasses <i>Puccinellia</i> ,		
the glassworts <i>Salicornia</i> ,		
<i>Zostera angustifolia</i>		
<i>Z. noltii</i>		
water soldier <i>Stratiotes aloides</i>		
golden dock <i>Rumex maritimus</i>		
sea clover <i>Trifolium squamosum</i>		
slender hare's ear <i>Bupleurum tenuissimum</i>		
least lettuce <i>Lactuca saligna</i>		
golden samphire <i>Inula</i>		

crithmoides

sea barley *Hordeum marinum*

small goosefoot *Chenopodium*

botryodes

fennel pondweed *Potamogeton*

pectinatus

sea aster *Aster tripolium*

sea lavender *Limonium vulgare*

sea purslane *Halimione*

portulacoides

brackish water-crowfoot

Ranunculus baudotii

Mammals

Water Vole

Present on site – records from PTES survey from 2019. Scoped out as not present in areas where work is happening on ditch edges (see appendix 2).

Certain/Near Certain for no impacts positive or negative during delivery of the enhancements. The habitat enhancements are designed to have a direct, long-term positive impact on this species with a confidence level of **Certain/Near Certain**. It is expected that this species may start to recolonise the application area with a confidence range from **Likely**

Bat Species

No Roost/Maternity Sites within application area. But used for feeding.

Certain/Near Certain for no impacts positive or negative during delivery of the enhancements. The habitat enhancements are expected to have a direct, long-term positive impact. Increased quantities of water held on site will lead to increased forage opportunities for *Pipistrellus* spp and Daubenton's bats with a confidence level of **Certain/Near Certain**.

Reptiles

Grass Snake	Have not been recorded present in the application area in the last 3 years	Certain/Near Certain for no impacts positive or negative during delivery of the enhancements. The habitat enhancements are expected to have a direct, long-term positive impact on grass snakes.
Common Lizard	Have never been recorded present in the application area, they have on nearby sites.	Certain/Near Certain for no impacts positive or negative during delivery of the enhancements. The habitat enhancements are expected to no change and no impacts positive or negative.
Slow Worm		
Adder		
Amphibians		
Smooth newt	Have never been recorded present in the application area they have on nearby sites.	Certain/Near Certain for no impacts positive or negative during delivery of the enhancements. The habitat enhancements are expected to have a direct, long-term positive impact on smooth newts.
Great Crested newt	Have never been recorded present in the application area.	Whilst the habitat enhancements would definitely benefit these species with a confidence level of Certain/Near Certain , colonisation would be assessed as Extremely Unlikely
Fish		
Eel	Not recorded by likely to be present.	Certain/Near Certain for no impacts positive or negative during delivery of the enhancements. The ditch cleaning and hydrological improvements are expected to have a direct, long-term positive impact on this species with a confidence level of Certain/Near Certain .
Habitats		
Mudflats	Not part of the site application area	Certain/Near Certain for no impacts positive or negative during delivery of the enhancements.
Littoral sediments (mud and sand flats)	Not part of the site application area	Certain/Near Certain for no impacts positive or negative during delivery of the enhancements.

Coastal saltmarsh	Not part of the site application area	Certain/Near Certain for no impacts positive or negative during delivery of the enhancements.
Seagrass (<i>Zostera</i>) beds	Not part of the site application area	Certain/Near Certain for no impacts positive or negative during delivery of the enhancements.
Coastal lagoons	Not part of the site application area	Certain/Near Certain for no impacts positive or negative during delivery of the enhancements.
Vegetated shingle	Not part of the site application area	Certain/Near Certain for no impacts positive or negative during delivery of the enhancements.

Table 7: : Assessment of scoped out conservation concern ecological receptors

5.4 Assessment of predicted likely effect of the delivery of enhancements on the South Thames Estuary and Marshes SSSI ecological receptors currently present in the application area.

SPA species or assemblage	Activity/Source of impact	Nature of potential impacts on receptor	Significance of impact on receptor	Confidence level	Mitigation required	Residual significance	Confidence Level
Breeding birds							
Garganey – Birds/Pairs present yearly, no confirmed successful breeding Pintail – One record of nest in 2017.	Changes in habitat from a principally dry system to functional and dynamic wetland habitats with appropriate ongoing management	Direct Long term positive	Significant positive The enhancements and ongoing management will provide vastly superior habitat conditions resulting in increased numbers of breeding birds including an increase in species appropriate to a functioning wet grassland habitat	Certain/ Near Certain	None - None – works happening outside of breeding season	n/a	n/a
	Disturbance to breeding birds and destruction of nests during habitat enhancement and engineering works	Direct Temporary negative	Significant negative	Certain/ Near Certain	None – works happening outside of breeding season	None	Certain/ Near Certain
Spring Passage							
Redshank – low records on spring passage	Changes in habitat from a principally dry system to functional and dynamic wetland habitats with	Direct Long term positive	Significant positive The enhancements and ongoing management will provide vastly superior habitat conditions	Certain/ Near Certain	None	n/a	n/a

appropriate
ongoing
management

resulting in increased numbers of
spring passage birds including an
increase in species appropriate to
a functioning wet grassland
habitat

Disturbance to
spring passage
birds during habitat
enhancement and
engineering works

Direct Long
term positive

Significant negative

Certain/ Near
Certain

Undertake works outside None
of the breeding season
2022 (Mar-Jun inclusive)
as is planned. Works will
be complete prior to the
breeding season 2023

Certain/ Near
Certain

Autumn Passage

Grey plover –no records

Changes in habitat
from a principally
dry system to

Direct

Significant positive

Certain/ Near
Certain

None

n/a

n/a

Curlew – no records

functional and
dynamic wetland
habitats with
appropriate

Long term
positive

The enhancements and ongoing
management will provide vastly
superior habitat conditions
resulting in increased numbers of
Autumn passage birds including
an increase in species
appropriate to a functioning wet
grassland habitat

Black-tailed godwit –
no records

Redshank - low and
sporadic records

Greenshank – no
records.

Disturbance during
habitat
enhancement and
engineering works
in one intensive
phase across all 8
operational units

Direct
Temporary
negative

Significant negative

Certain/ Near
Certain

Whilst not directly
required according to the
assessment of
significance, a mitigation
strategy will be enacted
which is set out in
Section 5.2

None

Certain/ Near
Certain

Disturbance during Direct habitat enhancement and engineering works in one year across all 8 operational units but only one, two or three worked on at the same time	Temporary negative	Not significant	Certain/ Near Certain	Whilst not directly required according to the assessment of significance, a mitigation strategy will be enacted which is set out in Section 5.2	None	Certain/ Near Certain
Numbers of autumn passage birds are expected to remain low across the application area before works are completed and very low and sparsely distributed in areas not enhanced due to the habitat not meeting their requirements.						

Wintering Birds

Shelduck – no records since 2016/17	Changes in habitat from a principally dry system to functional and dynamic wetland habitats with appropriate ongoing management	Long term positive	Significant positive	Certain/ Near Certain	None	n/a	n/a
Gadwall - multiple records			The enhancements and ongoing management will provide vastly superior habitat conditions resulting in increased numbers of wintering birds including an increase in species appropriate to a functioning wet grassland habitat				
Teal – multiple records yearly							
Curlew -							
Black-tailed godwit -							
	Disturbance during Direct habitat enhancement and engineering works in one intensive phase across all 8 operational units	Temporary negative	Not significant	Certain/ Near Certain	Whilst not directly required according to the assessment of significance, a mitigation strategy will be enacted which is set out in Section 5.2	None	Certain/ Near Certain
			Numbers to date are very low and sparsely distributed across the application area and similarly low and sparsely distributed for the extent of area available to				

		wintering birds at Higham Marsh due to the habitat not meeting their requirements		This scenario is considered highly unlikely and would only occur if significant delays in starting are experienced		
Disturbance during Direct habitat enhancement and engineering works in one year across all 8 operational units but only one, two or three worked on at the same time	Temporary negative	Not significant	Certain/ Near Certain	Whilst not directly required according to the assessment of significance, a mitigation strategy will be enacted which is set out in Section 5.2	None	Certain/ Near Certain
Disturbance during Direct habitat enhancement and engineering works during latter stages of the project if not completed by December 2022	Temporary negative	Not significant	Certain/ Near Certain	Whilst not directly required according to the assessment of significance, a mitigation strategy will be enacted which is set out in Section 5.2	None	Certain/ Near Certain
				This scenario is considered highly unlikely and would only occur if significant delays in starting are experienced		

Invertebrates							
• Invertebrate assemblage; including SSSI assemblage and: Beetles Damselflies Dragonflies Flies	Changes in habitat from a principally dry system to functional and dynamic wetland habitats with appropriate ongoing management	Direct Long term positive	Significant positive The enhancements and ongoing management will provide vastly superior habitat conditions resulting in increased numbers of invertebrates including an increase in species appropriate to a functioning wet grassland habitat	Certain/ Near Certain	None	n/a	n/a
	Loss of invertebrates during habitat enhancement and engineering works	Direct Short term negative Reversible	Moderate negative Individuals lost through excavations and excessive vehicle tracking routes	Certain/ Near Certain	Keep vehicle tracking across site and work areas to the minimum area necessary i.e. use specified haul routes Keep stockpiling of materials and machinery to the minimum, and least sensitive, area necessary Undertake the enhanced surface water regime as soon as feasible to promote the increase in species appropriate to a functioning wet	Not significant	Certain/ Near Certain

grassland habitat

Higher Plants

SSSI Species Assemblage.	Changes in habitat from a principally dry system to functional and dynamic wetland habitats with appropriate ongoing management	Direct	Significant positive	Certain/ Near Certain	None	n/a	n/a
Plants present on site, Common reed, divided sedge, sea club rush and soft hornwort		Long term positive	The enhancements and ongoing management across the application area will ensure that the area becomes functioning floodplain grazing marsh with significantly enhanced sub-environments				
	Degradation/loss of habitat during habitat enhancement and engineering works	Direct	Moderate negative	Certain/ Near Certain	Keep vehicle tracking across site and work areas to the minimum area necessary i.e. use specified haul routes	Not significant	Certain/ Near Certain
		Short term negative	Stands of plants lost through excavations and excessive vehicle tracking routes				
		Reversible	Only sea club rush and divided sedge will be impacted through works and movement on site. Both species are abundant and prevalent across the site, and will recolonise the areas of works within a year.		Make all possible efforts to programme the delivery of the works during dry/drier conditions		
					Rotavate any significant rutting caused by vehicle movements Keep stockpiling of materials and machinery to the minimum area		

necessary

Remove all unrequired materials immediately from areas as they are finished

Allow vegetation to re-colonise naturally (from soil seed bank and surrounding vegetation)

Undertake the enhanced surface water regime as soon as feasible to promote the re-vegetation process

Reptiles

Grass Snake – No record on site in last 3 years	Changes in habitat from a principally dry system to functional and dynamic wetland habitats with appropriate ongoing management	Direct Long term positive	Significant positive The ditch enhancements and ongoing management will provide vastly superior habitat conditions resulting in an increase of grass snake most especially if this species is present	Certain/ Near Certain	None	n/a	n/a
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Loss of species during habitat enhancement and engineering works	Direct Long term negative	Significant negative Individuals lost during creation or repair of dams, culverts and crossing points	Certain/ Near Certain	Cut vegetation where dams, lips, culverts and crossing points are to be created or repaired during the active period after the breeding season (July to September) as a precursor to undertaking groundworks If present, remove all potential refugia/hibernacula (stones/rocks, metalwork, wood) from the work locations. Place the removed items outside the area needed to conduct the works to maintain local presence of refugia/hibernacula Maintain vegetation as very low until features have been created, restored or repaired Allow vegetation to recolonise naturally from the seed bank and other	Not significant	Certain/ Near Certain
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on-site sources

Undertake the enhanced surface water regime as soon as feasible to promote the increase in grass snake prey species appropriate to a functioning wet grassland habitat

Fish

Eel

Changes in habitat from a principally dry system to functional and dynamic wetland habitats with appropriate ongoing management

Direct

Long term positive

Significant positive

The ditch enhancements and ongoing management will provide vastly superior habitat conditions resulting in an increase of eels if this species is present

Certain/ Near Certain

None

n/a

n/a

Loss of eel during habitat enhancement and engineering works

Direct

Long term negative

Significant negative

Individuals lost during ditching works.

Certain/ Near Certain

Silt to be left on bank to allow movement back to water before being 'smoothed' out.

Not significant

Certain/Near Certain

Habitats

Wet Grassland	Changes in habitat from a principally dry system to functional and dynamic wetland habitats with appropriate ongoing management	Long term	Significant Positive	Certain/Near Certain	None	n/a	n/a
		Positive	The enhancements and ongoing management will provide vastly superior habitat conditions resulting in increased numbers of breeding/wintering/passage birds, as well as improved non avian assemblage, including an increase in species appropriate to a functioning wet grassland habitat.				
Ditches		Direct	The ditch enhancements and ongoing management will provide vastly superior habitat conditions	Certain/Near Certain	None	n/a	n/a
		Positive	resulting in an improved water quality, habitat for ditch system assemblages (avian and non-avian) and				

Table 8: Assessment of effects to extant conservation concern ecological receptors.

3. Conclusion

This report has demonstrated that the project has been designed in a way that no likely significant negative effect will occur to The South Thames Estuary and Marshes SSSI and other ecological receptors of conservation concern across the application area.

Furthermore, the designated interest of South Thames Estuary and Marshes SSSI will benefit from the delivery of this project with long term significant positive effects that will enhance the conservation value of The South Thames Estuary and Marshes SSSI and Higham Marshes for other ecological receptors of conservation concern.

Appendix 1



Appendix 2

Gravesham Borough Council

Gravesham Borough Council

Gravesend Borough Council

Gravesham Borough Council