EXO Environmental

TERN AND SHOREBIRD HABITAT RESTORATION AT LANGSTONE HARBOUR

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Figure 1. RSPB seabird colony Baker's Island, Langstone Harbour (March 2022).

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Executive Summary: Tern and shorebird habitat restoration in Langstone Harbour

This document by Exo Environmental Ltd provides a shadow Habitats Regulations Assessment (HRA) of the proposed tern and shorebird habitat restoration works at Langstone Harbour. The Harbour has multiple conservational designations, and those of relevance to this project are the Solent Ramsar site and Special Protection Area (SPA) and the Solent Maritime Special Area of Conservation (SAC). Two areas are proposed for restoration works and this HRA describes the baseline condition of these areas, describes the proposed works and presents a screening in terms of potential impacts on designated features and site integrity.

Terns and shorebirds are designated features of the Ramsar site and SPA and are at risk of local loss as a breeding species due to the vulnerability of the required nesting habitat to tidal surges. The project aims to ensure long-term resilience of shingle habitats used for nesting by terns and shorebirds, as part of site management.

Two areas are proposed for restoration via shingle recharge, namely Hayling Island and Long Island. This proposed recharge will raise the level of the sites up to 3.6 mODN (average recharge height of 0.7 m) to create 1,820 m^2 and 2,200 m^2 restored tide resilient shingle nesting habitat at the two sites respectively. The total calculated tonnage to achieve this is 5,065 tonnes of shingle.

With respect to the SAC, the principal considerations are limiting habitat disturbance by vehicles carrying shingle, potentially affecting mudflat and saltmarsh. It is proposed that the use of bog mats will limit disturbance to the vegetation and existing substrate, with rapid recovery of vegetation. Shingle may also spill onto adjoining habitats, and this will be minimised via careful initial placement, use of larger cobbles on the sides and the use of brushwood fencing. Not all sites will require these measures. With these integral working methods, the potential impacts to designated features are assessed as negligible.

With respect to the SPA, the timing of works will avoid sensitive periods for birds such that disturbance will be minimised. Other possible impacts such as changes in the recharged areas will be of negligible significance. Ultimately, the works are intended to benefit an array of breeding and wintering birds, in particular little terns, sandwich terns and gulls, and as such the scheme will benefit the SPA.

The designated features of the Ramsar site overlap in practice with those of the SAC and SPA, and the impacts on designated features are assessed as negligible.

The conclusion of the screening at the Test of Likely Significant Effect stage is that the scheme will not impact the site integrity of the Solent Ramsar site and SPA nor the Solent Maritime SAC. The working methods are integral to the scheme and are not considered as mitigation in this context, and an Appropriat Assessment is not required.

1. Introduction

The Royal Society for Protection of Birds (RSPB) was founded in 1889 and is the largest nature conservation charity in the UK, consistently delivering successful conservation, forging powerful new partnerships with other organisations and inspiring others to stand up and give nature the home it deserves. As a registered charity with wildlife interests, a key element of their mission statement involves the species recovery of birds in the UK.

Following the 2018 Sustainable Shores report, funding has become available through the 'LIFE on the Edge' project to conserve and enhance tern and seabird nesting habitats in seven Special Protection Areas, of which Langstone Harbour is one. The work proposed here is led by the RSPB, with matched funding from Bird Aware Solent. Langstone Harbour is of very high value to nature conservation, with statutory international and Nature Directives (European) sites, and statutory national designations. Part is also designated as the West Hayling Local Nature Reserve (LNR).

This report presents a shadow Habitats Regulations Assessment (HRA) for the proposed habitat restoration at Langstone Harbour. Sections 2-4 provide background information on the baseline condition and proposed works and Section 5 screens the potential impacts in detail and includes supporting evidence and interpretation.

An HRA specifically considers two classes of designated sites:

> Ramsar sites are designated by international treaty and their designated features may variously include birds, other animals, plants, vegetation, and habitats.
>
> Special Protection Areas (SPA) and Special Areas of Conservation (SACs) together are termed Nature Directives sites. SPAs are designated for birds while SACs are variously designated for other animals, plants, vegetation, and habitats.

1.1 Project Aims

The RSPB are keen to ensure site resilience to present threats (including ongoing erosion) and create better suited environments for shingle-nesting and roosting birds. This habitat restoration will target two sites, with a small works area within each, namely:

West Hayling, and

Long Island.

Both locations will have existing shingle features recharged, this shingle recharge will add elevation, and some area, to existing shingle features to enhance habitat potential. Brushwood fencing (Figure 2) will be installed at two sites, to protect this new shingle from subsiding and migrating.

Figure 2. An example of habitat restoration: brushwood fencing installed by Exo Environmental at Mersea Island, Essex.

Also, one site will also have anti-predator measures introduced to encourage the success of shingle-nesting and roosting birds.

2. Shingle-nesting and Roosting Birds

Langstone Harbour is an important nature conservation site for wetland and coastal birds, with a number of designations in this regard. Of these species, those most likely to benefit from the proposed works are shingle-nesting and roosting species. A particular target species is the Little tern (*Sternula albifrons*) which is of international and national conservation concern and is listed as a feature of the Ramsar and SPA designations. Other shingle-nesting bird species will also benefit from works, including other species listed on the site designations and other species of importance, for example Sandwich terns *Thalasseus sandvicensis* and Black-headed gulls *Chroicocephalus ridibundus* respectively.

There is particular concern within the RSPB that Little terns could be lost as a local breeding species if works are not conducted to regenerate the shingle-nesting habitats. Numbers have dropped to as low as one breeding pair within recent years, and without appropriate action then the end of decades of nesting in the Harbour is a realistic prospect.

Predation is also a concern, and foxes are listed as a threat to Little terns within the 2019 Site Improvement Plan for Chichester and Langstone Harbours SPA. Therefore, the habitat restoration works will have a secondary focus of erecting anti-predator fencing, to protect shingle-nesting and roosting birds.

It is critical that the restoration works are of sufficient size to establish a sustainable (self-defending) colony therefore the created habitats need to be of at least 1,000 m^2 in area. This large size also aids the flight path of birds landing where the colony is enclosed by a fence.

Figure 3. Little tern and chick, copyright RSPB.

2.1 Little Terns

Habitat restoration is desperately needed for the Little tern, with anthropogenic activity and habitat decline amongst other factors, causing its near extinction in the Harbour before previous RSPB projects. Shingle recharging enhances habitat for Little terns, which prefer to nest on open shingle. After hatching, chicks are guided by parents to areas of saltmarsh with *Spartina* grass coverage. (Davies, 1978). This makes Langstone Harbour an ideal environment for Little terns. Little Terns are present in just three RSPB reserves. At Langstone Harbour, a count of 173 pairs in 1989 had dwindled to just 23 by 2013, with the specific threats at this location being predation by foxes and tidal surges associated with storm weather.

The RSPB had success in 2014 with the creation and enhancement of Little Tern breeding sites using shingle recharge, which resulted in the fourth most productive years since records began. These recharge sites were on Baker's Island and South Binness Island, both of which had good take up by Little terns and were not submerged by summer (nesting season) tidal surges. Terns are recorded breeding at sites across the harbour, close to the targeted recharge areas, thus it is likely that suitable shingle habitat would be readily utilised.

As habitat succession progresses, shingle banks make good nesting sites for a range of species, including Sandwich terns, Ringed plover and Oystercatchers. The works in the West Hayling LNR are intended to benefit species of gull.

Figure 4. Little tern chicks in a shingle nest site, copyright RSPB.

3. Langstone Harbour

Langstone Harbour is situated east of Portsea Island on the south coast of Hampshire. The area has multiple national and international conservation designations recognising both habitats and species present, and includes West Hayling Local Nature Reserve, one of four RSPB sites in the region. The harbour is unique due to its narrow mouth and shallow lagoon features, providing intertidal habitats suitable for migratory birds (Davies, 1978).

The areas targeted for habitat restoration in this project are all contained within the greater Langstone Harbour area and are low-lying islands (Table 1). These locations were selected to maximise benefits of works with respect to the species and numbers likely to use each location, and also logistical reasons.

Table 1. Tidal levels referred to Datum of Soundings and Ordnance Datum Newlyn.

	MHWS	MWHN	MLWN	MLWS
m CD	4.80	3.90	1.90	0.80
m ODN	2.06	1.16	-0.84	-1.94

3.1 Local Plan

Havant District Council local plan was put forward in 2011, with project relevant aims focusing on tourism and conservation within the region. This plan is accessible at: https://cdn.havant.gov.uk/public/documents/ADOPTED%20CORE%20STRATEGY%20.pdf

The local plan for Langstone Harbour states that:

> "*There is a strong marine related employment base on the island. Tourism and the day visitor economy are also important. Mengham/Gable Head District Centre provides a modest but successful retail centre. Overall employment opportunities on the island are limited and many people commute off the island to work.*" – Havant Borough Council Local Plan for Hayling Island, 2011.

Proposed project works are unlikely to impact this, but the harbour is a significant employment provider and tourist site, and project works should avoid disrupting this. The most likely impact would be the temporary closure of the Hayling Billy Trail, a popular tourist route, to facilitate safe access to the West Hayling project site, although this is likely to occur during late winter / early spring which avoids the main tourist season.

Policies CS11 and CS12 of the Local Plan state that:

> "*Both Chichester and Langstone Harbours are protected owing to their international nature conservation importance. Nature Conservation Protection Policies and the Habitat Regulations apply to flood and coast protection works and therefore works should not impact detrimentally on nature conservation interests in these areas.*" – Havant Borough Council Local Plan for Hayling Island, 2011.

This further outlines the need to ensure that conservation interests are firmly ahead of any flood defence or sea level rise protection works in some areas. This has relevance to the project in that proposed works must not *"be alien to their surroundings and the siting, design and materials should be appropriate to the locality"*.

Finally, birdwatching is an important tourist activity within the region, and the local plan is keen to encourage its growth, while specifying that: *"tourism provision will not be concentrated solely on Hayling Island, with further opportunities for tourism available elsewhere in the borough."* This is recognised in the project planning, with a variety of sites chosen, so if tourism were to increase following an uplift in rare bird numbers, it would not concentrate visitors to just West Hayling Local Nature Reserve on Hayling Island but distribute visitors across the other sites within the harbour.

3.2 Shoreline Management Plan.

The North Solent Shoreline Management Plan covers Langstone Harbour. Policy Unit 5APl01 - Langstone Harbour entrance to Portsmouth Harbour entrance (harbour) states:

> *"Due to the environmental designations within Langstone and Portsmouth Harbours, holding the defence line will continue to contribute towards the loss of European and national nature conservation designated habitats such as inter-tidal foreshore habitats, through coastal squeeze. These losses will need to be mitigated within the same designated area or compensated for elsewhere and delivered through the Regional Habitat Creation Programme. Opportunities for habitat mitigation and compensation have been detailed within the Appropriate Assessment of the final policies."*

As referred to above:

> *"The Regional Habitat Compensation Programme (RHCP) is a strategic programme run by the Environment Agency which seeks to replace habitats that are lost due to coastal squeeze or tidal inundation effects that arise from the management of coastal defences.*
>
> *Coastal Partners co-ordinates the RHCP in the Solent and South Downs area with the Environment Agency, covering an area between Hurst Spit in Hampshire to Beachy Head in East Sussex, including the north coast of the Isle of Wight".*

3.3 Designations

As previously stated, Langstone Harbour is a site of international, European and national significance for nature conservation environmental significance, with multiple conservation and wildlife protection designations. Both locations are within the international Ramsar site, European (Nature Directives) SAC and SPA designations, and the national SSSI designation (Table 2).

Table 2. The works sites in relation to the various designations that apply to Langstone Harbour.

Location	Ramsar	SAC	SPA	SSSI
West Hayling				(Units 7 & 12)
Long Island				(Unit 13)

In broad terms the designations cover (with full lists of designated features in the Appendix):

Chichester and Langstone Harbours Ramsar site, designated for the wider estuary habitat, the assemblage of wintering birds, plus breeding, transit and wintering species.

Chichester and Langstone Harbours SPA, various breeding, transit and wintering species.

Solent Maritime SAC, the wider estuary habitat plus various vegetation and habitat types.

Langstone Harbour SSSI, the wider estuarine habitat plus waders and wildfowl.

3.3.1 Chichester and Langstone Harbours Ramsar Site

Ramsar Sites are wetlands of international importance that have been designated under the criteria of the Ramsar Convention on Wetlands for containing representative, rare or unique wetland types or for their importance in conserving biological diversity.

The Chichester and Langstone Harbours Ramsar site was designated in 1987, for its estuarine habitats and birds, including nesting Little terns. The suite of birds listed on the citation includes several breeding species, wintering birds and also birds on passage. Both locations for works are within the designated boundary (Figure 5).

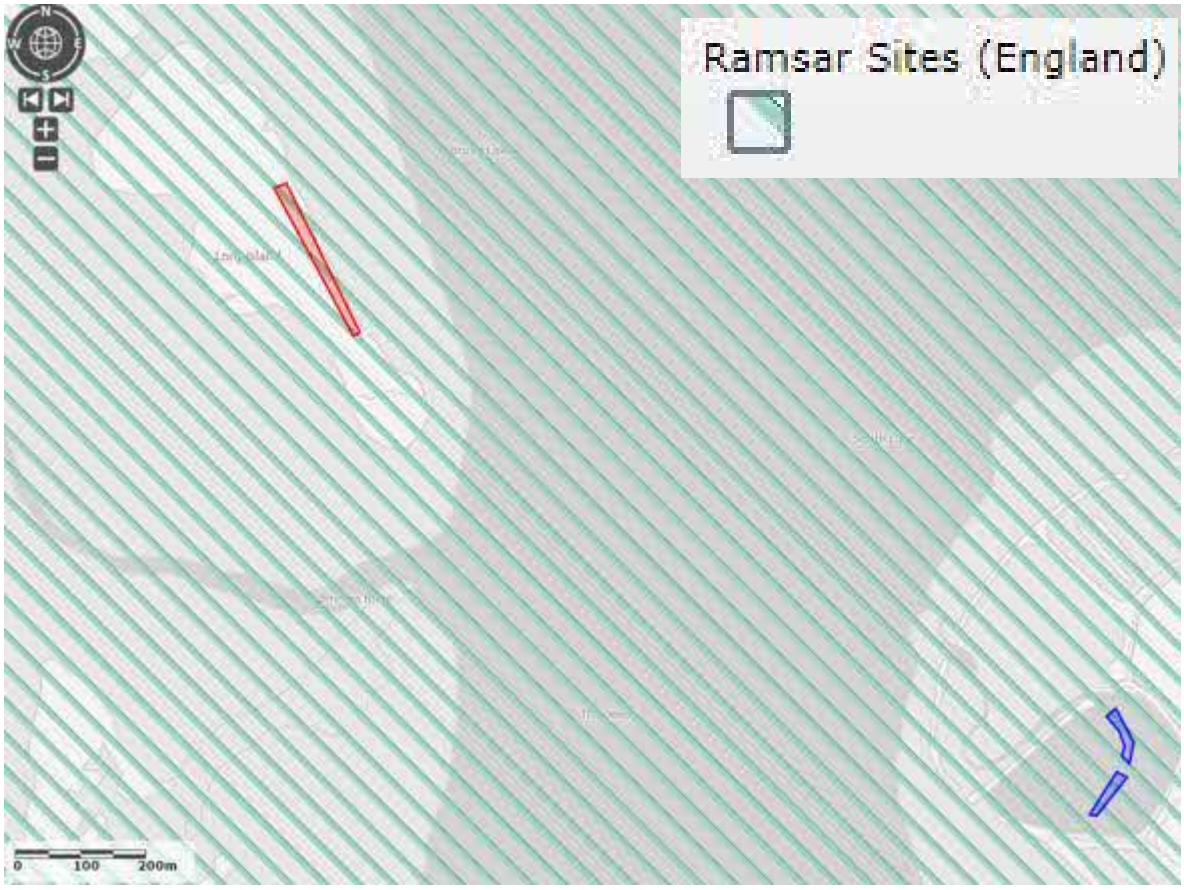

Figure 5. Islands selected for habitat restoration, with the overlapping Ramsar site designation. The location of works are: Hayling Island, blue; and Long Island, red.

3.3.2 Chichester and Langstone Harbours SPA

Special Protection Areas (SPAs) are protected areas for birds in the UK classified under: the Wildlife & Countryside Act 1981 (as amended) and the Conservation (Natural Habitats, & c.) Regulations 2010 (as amended) in England, Scotland and Wales.

The two islands are within the Langstone and Chichester Harbours SPA (see the earlier Ramsar site map, Figure 5). The suite of birds listed on the citation includes nesting Little terns, several other breeding species, wintering birds and also birds on passage.

3.3.3 Solent Maritime SAC

Special Areas of Conservation (SACs) are protected areas in the UK, designated under:

- the Conservation of Habitats and Species Regulations 2017 (as amended) in England and Wales (including the adjacent territorial sea), and
- the Conservation of Offshore Marine Habitats and Species Regulations 2017 in the UK offshore area.

These regulations require establishment of a network of important high-quality conservation sites that will make a significant contribution to conserving the habitats and species identified in Annexes I and II, respectively, of European Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, known as the Habitats Directive.

The SAC under which the project sites fall is the Solent Maritime SAC, of which Langstone Harbour is the westernmost area (see the earlier Ramsar site map, Figure 5). This covers the intertidal zone of this harbour, which is equivalent to units 7, 13 and 14 of the SSSI designation (see below). Some of the habitats in the SAC are widely distributed throughout the area, while others are of more restricted occurrence.

Both sites sit within the broad Annex I habitat of: 1130 Estuaries, and of the ten listed Annex I habitats those of greatest potential relevance are:

- 1320 *Spartina* swards (Spartinion maritimae)
- 1140 Mudflats and mudflats not covered by seawater at low tide
- 1220 Perennial vegetation of stony banks
- 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

Some of these Annex I habitats are present both sites, but it is likely they would make up only a small proportion of the greater total found within the Solent Maritime SAC.

Within the '1140 Mudflats' designation, there are further Eunis subfeature classifications listed on MAGIC, and those present close to the sites are listed in the appendix.

Table 3. Subfeatures listed on Magic maps under 1130/1140 Estuaries and Mudflats.

SAC Type/Subset	Description
A2.1E	Intertidal coarse sediment
A2.2E	Intertidal sand and muddy
A2.3E	Intertidal mud
A2.4E	Intertidal mixed sediments
A2.5E	Saltmarsh
A2.6.1E	Intertidal seagrass beds

3.3.4 Langstone Harbour SSSI

A key consideration of works within the Langstone Harbour SSSI is that all SSSIs are managed with the intention of achieving what is termed 'favourable condition'. This should reflect the condition with respect to designated features and appropriate conservation management (Table 4). The category of 'recovering' is also assigned to areas where appropriate management structures are in place, but not necessarily having resulted in relevant habitat changes. Natural England assesses the condition of SSSIs on a roughly 6-year cycle.

Table 4. Natural England's site condition descriptions.

Category	Description
Favourable	Favourable condition means that the SSSI land is being adequately conserved and is meeting its 'conservation objectives'; however, there is scope for the enhancement of these sites.
Unfavourable recovering	Often known simply as 'recovering'. SSSI units are not yet fully conserved but all the necessary management measures are in place. Provided that the recovery work is sustained, the SSSI will reach favourable condition in time.
Unfavourable no change or *Unfavourable declining*	This means that the special interest of the SSSI unit is not being conserved and will not reach favourable condition unless there are changes to site management or external pressures. The site condition is becoming progressively worse in the case of the declining category.
Part destroyed or *Destroyed*	There has been fundamental damage, where special features have been permanently lost and favourable condition can't be achieved

The assessments at Langstone Harbour were carried out in 2010, and again in 2018 as follows:

	% meeting area of favourable or unfavourable recovering	Favourable	Unfavourable - Recovering	Unfavourable - No change	Unfavourable - Declining	Partially destroyed	Destroyed	Not Recorded
Area (ha)	2,085.35	186.74	1,898.62					
Percentage	100.00%	8.95%	91.05%	0.00%	0.00%	0.00%	0.00%	0.00%

The 14 sites within the Langstone Harbour SSSI achieved a mostly 'recovering' status, with some achieving 'favourable'. Of these 14 units, three apply to this project (units 7 and 12 at West Hayling LNR and unit 13 at Long Island).

4. Restoration Sites

The shingle-nesting and roosting bird habitat restoration in Langstone Harbour involves very specific shingle recharge locations at two locations (shown in Figure 6 in orange):

Long Island, also within the Harbour's chain of low-lying islands.

The Oyster Bed Lagoon within West Hayling Local Nature Reserve.

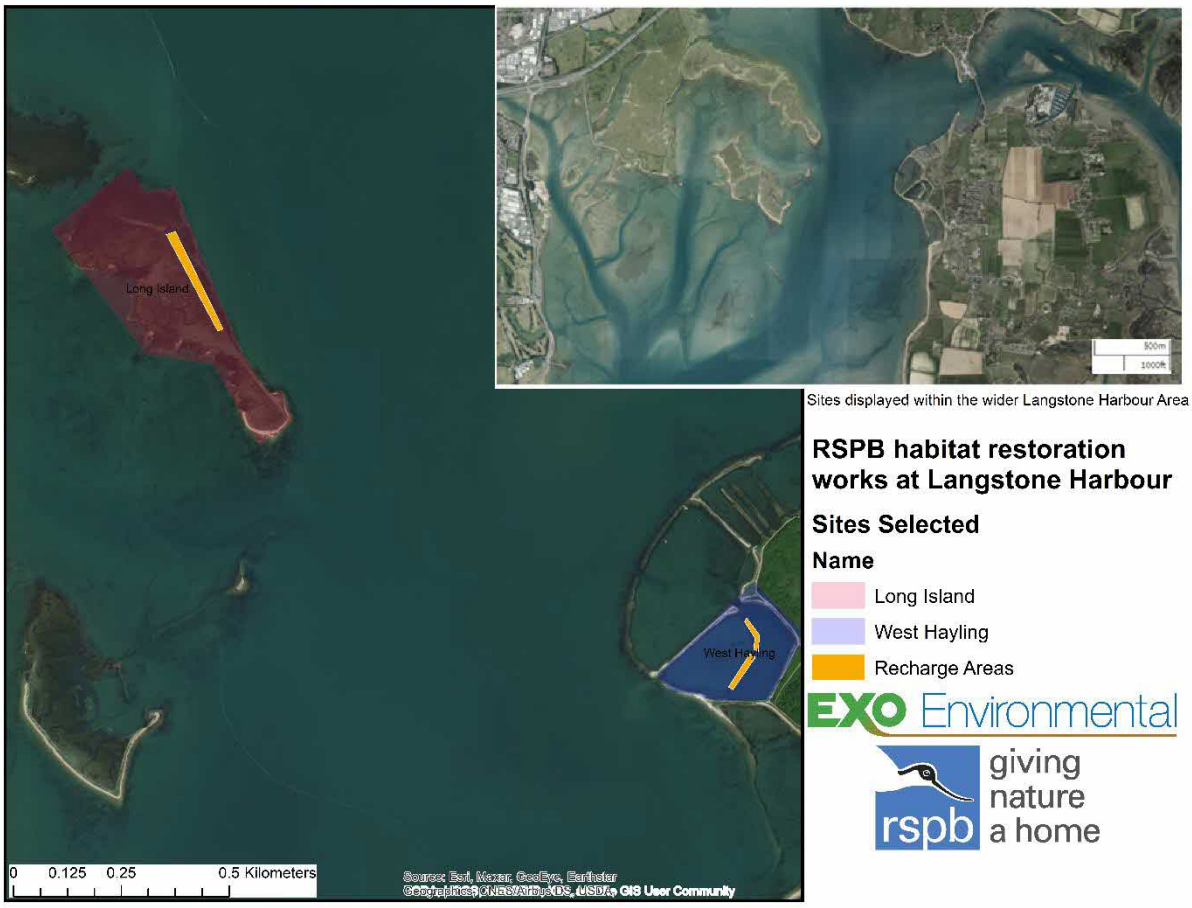

Figure 6. The two sites in a wider context. Esri/Garmin UK.

Shingle recharge will be carried out at both sites, with each targeted area to be raised by 0.7 m in elevation to approximately 3.6m ODN. This will require a mix of cobble sizes, specific to each location. The total shingle required for the project is calculated at 5,065 tonnes, to cover a combined area of 4020 m^2 across the two sites.

Additionally, there will be anti-predator fencing installed at Long Island. This is in line with the 2019 site management plan for Langstone and Chichester Harbours and protects the shorebirds and terns from predation from foxes.

4.1 West Hayling

Figure 7. Photo of West Hayling Oyster Bed Lagoon, taken by Exo Environmental Ltd, 25.03.2022.

Within the West Hayling LNR coastal lagoon there are two linear islands which historically ran as a single bund that divided the current lagoon into two separate oyster beds (as viewed on OS maps from the early 20th century). The current arrangement of two separate islands only partially dividing the lagoon is visible on OS maps from the 1950s.

The site was turned into a nature reserve towards the end of the 20th century from an old oyster farm / landfill, and the islands in the lagoon were initially capped with a covering of shingle at that point. These were rapidly colonised by a Little tern colony which eventually gave way to a mixed black headed gull and Common tern colony. This succession of nesting species is a common phenomenon on the Solent coast.

These islands are now eroded with much of the shingle gone, with rubble and debris poking through. In any one breeding season, there is a high chance that they will be deluged by a large astronomical tide or a storm surge. This has resulted in substantial Black-headed gull and Common tern nest losses in multiple seasons over the past decade and a clear expectation of a greater frequency and increased losses in the future.

The main purpose of the recharge here is to restore the nesting site to give it a viable future as such for Black-headed gulls, Common tens and potentially Sandwich terns (based on observation that previous recharges at this site have been followed by

Sandwich tern prospecting or displaying 'interest' following works). The recharge will also provide a high-quality high tide roost during the winter for some of the birds on the Ramsar site and SPA designations. Notwithstanding the regeneration, it is unlikely that Little terns will nest here in the near future and certainly not without interventions to displace other species.

As viewed on 25 March 2022 (Figure 8), the substrate is dominated by a mix of rubble and coarse artificial aggregate with only a low (<20%) cover of gravel or finer material. The vegetation was sparse (<10%) cover with scattered ubiquitous terrestrial species, such as Yorkshire fog *Holcus lanatus*, and samphire *Salicornia* species as the only maritime species and on the lower slopes only.

In terms of Annex I habitats:

The vegetation on the islands is not an example, lacking species associated with the perennial vegetation of stony banks, such as annual drift line species, or species of the *Rumex crispus – Glaucium flavum*. The species present are widespread and ubiquitous.

Surrounding the islands is intertidal mud, albeit this is submerged for most of the time, and this is assumed to be an Annex I habitat (1140 'Mudflats').

Figure 8. West Hayling 31/05/21 copyright RSPB.

4.1.1 Problem Statement

The islands within West Hayling Local Nature Reserve's coastal lagoon have not been performing well for wildlife, due to ongoing erosion of loose shingle and flooding issues. Against a background of past and predicted losses of extent and quality of habitats, and consequential impacts on key coastal species, the project will deliver focused restoration of nesting habitats on this island.

Shingle recharge has been identified as necessary at West Hayling by the RSPB to address these issues for shingle-nesting and roosting birds. There is now the exciting opportunity to deliver the first part of a longer-term vision for the West Hayling site as part of this project.

4.1.2 Proposed Restoration

This is an opportunity to turn West Hayling back into a thriving shore bird location, raising the key shingle beds within the lagoon, and adding a profiled shingle layer to completely cover the exposed rubble, future proofing the breeding sites as much as possible against the immediate impacts of climate change.

By strategic placement of different grades of shingle, as well as providing for the development of vegetated shingle in certain locations, the project aims to be able to initiate a better long-term outcome for the wildlife using the site and address the present annual threat of total or near-total colony failure due to tidal flooding.

The primary aim of this project is to use shingle to increase the height of the main lagoon islands over a length of 182 metres split in two adjacent sites (A & B) (Figure 9) by 0.7m (to 3.6m ODN) (see Figure 9). This will create a habitat suitable for shingle nesting birds of 1,820 m^2 The estimated total amount of shingle required for the primary goal is 2,293 tonnes.

Figure 9. Oyster Bed Lagoon sites. These pre-existing banks will be recharged with a total 2293 tonnes of shingle to enhance nesting bird habitat (Esri Imagery).

The vision for the shingle placement is to have the bulk of material being larger cobbles which are more resistant to wave action but a heavy capping of smaller shingle more suitable for the ecological benefits required.

The works at West Hayling Local Nature Reserve is intended to generate a nesting site within RSPB managed land for shore nesting and roosting birds, whilst maintaining habitats that help the site qualify as a SPA for birds. This involves shingle recharging of anthropogenically created oyster beds to create nesting sites, whilst maintaining the protected ‘coastal lagoon’ conservation area.

4.1.3 Method

Shingle will be added to enhance the two former oyster beds within the lagoon, labelled site A and B in Figure 9 above. This will require 2293 tonnes of shingle to raise both beds up by 0.7m. The shingle required will be a mix of larger cobbles (100mm to 250mm) for foundation, which will then be capped by smaller shingle (10mm-50mm) to provide the ideal nesting habitat for the target species.

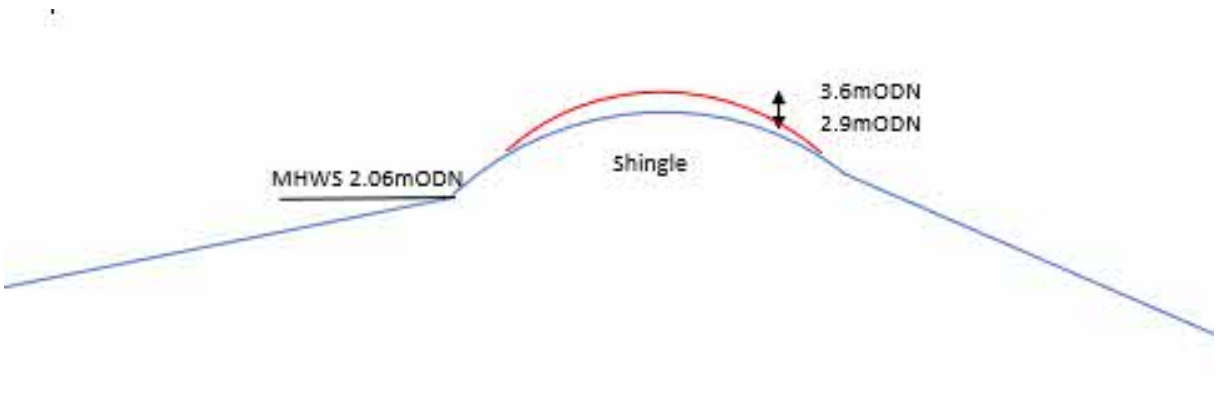

Figure 10. Profile of the proposed recharge).

Shingle can be brought via the Hayling Billy Trail which runs adjacent to the site and has been used for this purpose in the past. However, the Billy Trail is a public path so a temporary closure order will need to be in place for when the delivery of shingle commences and any damage to the access track would need to be made good at completion.

The path that continues from the Billy Trail to the site is too narrow for the dump trucks to reach the stockpile location, therefore smaller front loading tipper vehicles will be used to transport the shingle along the path on the northern edge of the lagoon. The options from here are the use of a temporary Bailey or pontoon bridge to get machinery across to the islands and/or potentially using an excavator to transport shingle from the stockpile to the islands are available.

4.1.4 Access

Access for West Hayling Local Nature Reserve will be plotted in a GIS to minimise potential disruption, and to help consider the overall design of the project, with respect to designated areas. For illustration, access is plotted in Figure 11 showing the different sections according to the suitability of vehicles.

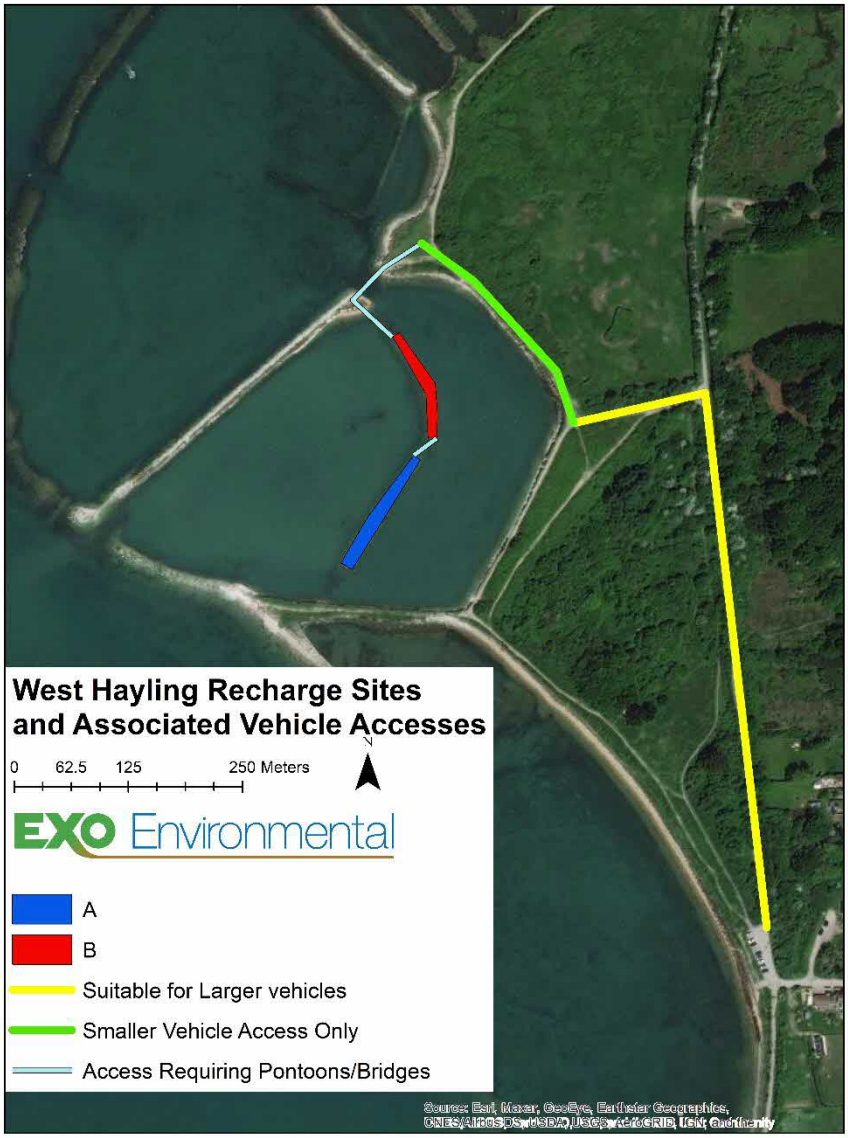

Figure 11. Aerial view of access suggested by RSPB, with red denoting areas they consider suitable for larger vehicles and yellow representing smaller frontloaded vehicle access to the stockpile.

4.1.5 Designation Impacts

In summary, West Hayling is within a Ramsar site and SPA and significant bird nesting sites are present, therefore special design considerations must be taken to avoid disturbance to nesting birds but with a need to also avoid transit and wintering periods when large numbers of birds will be present and potentially vulnerable to disturbance. As integral design consideration, the works will be carried out during the late winter, early spring in readiness of the bird breeding season and outside of important wintering / transit periods. This timing would also avoid the main tourism season.

The desired impact on nesting birds is positive.

The locality is understood to sit within the broad Annex I habitat of 1130 Estuaries, with the adjacent areas being 1140 'Mudflats'. This means that all works must be undertaken with caution to minimize potential impacts.

The impact on SAC designated land will be minimized by plotting the accesses. For this location, smaller front-loading vehicles will be used to access the Oyster Beds. The elevation modelling in the access map suggests this route can be via access along paths and boundaries of SAC habitats. Pontoons or Bailey bridges will to be used.

The intertidal mudflats within the lagoon will be crossed to access the site, but this would make up only >0.1% of the feature within the lagoon, and all relevant precautions will be taken with access (bog mats with two access routes to avoid compression, pontoons/bailey bridges to avoid directly driving across features, ensuring no migration of shingle).

From direct experience of other schemes, bog mats and timber matting are the most suitable surface protection and resultant compression is minor without rutting or other soil damage following works. Alternative surface protectors such as HDPE sheets are too flexible and bend, with resultant soil compression.

The selected route option is judged to be more practical and with lower impacts than accessing from the south. The route also avoids intertidal coarse sediments that is believed to be present in the west of the lagoon, as would be impacted by an alternative option using a barge for delivering sediment.

It is noted that MAGIC shows saltmarsh to be present within works areas (see the appendix), but direct field survey has confirmed that this is not correct.

From direct experience of other schemes, bog mats and timber matting are the most suitable surface protection and resultant compression is minor without rutting or other soil damage following works. Alternative surface protectors such as HDPE sheets are too flexible and bend, with resultant soil compression.

In terms of the SSSI, the West Hayling Nature reserve has two distinct units: 12 and 7. Unit 12 applies to the inland area of Hayling Island under RSPB control, which is described as 'Hayling Halt Landfill' in the most recent assessment. At that time, the site had only recently come under Higher Level Stewardship, and as part of this agreement, winter nesting bird sites were set for improvement. Unit 7 applies to the intertidal area of the reserve, described as 'Langstone Oyster Beds', which are the smaller series of intertidal lagoons, created as oyster beds but also used as key breeding sites for terns. This area is the specific target of the RSPB brief. As such, key characteristics will be preserved, but these will not be affected by the recharge works.

A summary of potential impacts on the designated features in relation to West Hayling is presented in Table 4.

Table 5. Summary of potential impacts on designated features in the vicinity of West Hayling.

Site	SAC	SPA	SSSI	Ramsar
West Hayling	Access will lead to an area of lagoon being crossed by pontoon or bailey bridge, but this should have only a very minor and temporary impact on the lagoon and related Annex I habitats.	No impacts are expected, as works will conducted out of nesting season for SPA species. Works will also be timed to avoid sensitive periods for wintering and transit species.	No impact expected as long as good practice maintained (pg33 – WFD).	As for the SPA and SAC features.

4.2 Long Island

Figure 12. Photo of the shingle ridge on Long Island, taken by Exo Environmental Ltd, 25.03.2022.

Long Island is one of the four major islands within Langstone Harbour. There is currently a shingle ridge (Figure 13) which was formerly exposed shingle but is now covered a dense sward of sea couch *Elytrigia atherica*. The 1940s aerial photograph shows the ridge, but it is not clear as to the extent of vegetation; aerial photographs from the late-1990s onwards show a sparse vegetation with exposed shingle initially but a continuous vegetation cover by the 2010s. It is assumed the development of vegetation over the former shingle is the result of natural succession coupled with reduced disturbance at following wider saltmarsh development limiting exposure to storm surges.

The site is currently not used by breeding seabirds outside of sporadic attempts on the southern shingle. Restoration of the shingle habitat on the ridge as planned will allow for rapid colonisation by Little terns, Ringed plovers and Oystercatcher. With careful management over time, it's likely that a gull and Sandwich tern colony will eventually colonise this area in succession, allowing for more flexible breeding opportunities within the harbour for the SPA species.

A vegetation survey was undertaken on 25 March 2022. The upper parts of the ridge has a near-single species cover of sea couch with a low cover (<2%) of saltmarsh species such as sea beet *Beta vulgaris subsp. maritima*. The sides of the ridge has an intermediate cover of saltmarsh and couch-dominated vegetation. The flat terrain adjacent to the ridge has

a saltmarsh vegetation classed as SM14 *Halimione portulacoides* salt-marsh community, with the main species being sea purslane *Halimione portulacoides* with frequent to occasional saltmarsh grass *Puccinellia maritima*, sea aster *Tripolium pannonicum*, cordgrass *Spartina* species, sea lavender *Limonium* species and shrubby sea blight *Suaeda vera*.

With reference to Annex I vegetation types:

The ridge is not an Annex I habitat (1220 Perennial vegetation of stony banks), being a dense sea couch sward (Figure 17). It lacks species associated with the pioneer phase of vegetated shingle, such as drift line annuals and the later *Rumex crispus – Glaucium flavum* vegetation, and neither is it an example of a late-stage scrub vegetation.

The saltmarsh vegetation is an Annex I habitat, being the NVC SM14 *Halimione portulacoides* salt-marsh community which is recognised as a sub-type of 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*).

The intertidal areas are the Annex I 1140 Mudflats and sandflats not covered by seawater at low tide. If exposed shingle were present, then there would be the potential for a high-quality breeding and nesting site for birds, as long as predator issues are addressed.

Figure 13. The targeted ridge on Long Island is a shingle feature, and as such, the saltmarsh area listed at magic maps is inaccurate.

4.2.1 Problem Statement

Long Island has not undergone the same recharging works as elsewhere (e.g. Baker's Island), but Long Island formerly supported the shingle areas necessary to provide a nesting and overwintering habitat to birds. However, these areas are currently overgrown and underperforming, making a shingle recharging necessary if this habitat is to support a nesting bird population. Brushwood fencing will be needed on the southwestern side to pin back this shingle and ensure there is no migration of shingle onto adjacent Annex I saltmarsh habitat.

In addition to deterioration in the shingle habitat, fox predation is a likely factor limiting the success of nesting birds.

4.2.2 Proposed Restoration

Increasing the height of section of the ridge/embankment on Long Island (Figure 14) by approximately 0.7 m (to 3.6 mODN) will provide an area which remains above water level in most expected conditions (MHWS is 2.06 mODN). The raised area will need to have a suitable surface for breeding and roosting birds (i.e fine grade shingle or sand) but be durable enough to stand up to expected tidal conditions in this location. The initial vision is for the creation of a ridge formed of shingle cobbles capped with finer grade shingle over a length of 220 metres, creating a habitat of 2,200 m^2. The amount of shingle required for this recharge is approximately 2,772 tonnes.

In addition to shingle recharging, a brushwood fence is proposed to keep the shingle in place and prevent the material spreading over the saltmarsh. These fences ar conventionally used as an energy dampener, slowing erosive processes. However, in this proposed project, the nature-based solution of a brushwood fence would trap, control and contain shingle, preventing its migration onto saltmarsh areas during tidal events.

Figure 14. Long Island shingle area, which will be supplemented by 2772 tonnes to become a ridge of elevation 1m. (Esri Imagery).

Figure 15. *Profile of the proposed recharge.*

4.2.3 Method

The shingle recharging of Long Island will be coupled with the erecting anti-predator fences. The anti-predator fencing will follow a simple boundary around the study area (see the appendix).

The use of a barge with a crane will be required to offload the shingle to Long Island via a shallow draft pontoon. Tracked dumpers in combination with light weight excavators will distribute the shingle evenly across the project area. During a high spring tide, the fully loaded barge will depart Kendall's Wharf and land on the east side of Long Island

(Grid reference SU 70184 04260, marked in yellow on Figure 16). From there, the shingle will be offloaded using a crane, in combination with dumpers and excavator, and subsequently the barge will return to the wharf to be reloaded and ready for the next high tide. Because of the amount of shingle required for the Long Island project area, it is expected that at least 5-7 barge loads will be needed (depending on size of barge) to complete the operation. This would give a time frame of one week in favourable weather.

Brushwood fencing would then be installed to keep this shingle from migrating. This nature-based solution would be erected by inserting poles into the ground and filling the middle with locally sourced plant and wood material. The design of this fencing is attached in the appendices. Some additionally side supports may be needed. This fencing would be non-intrusive but would preserve the character of the site whilst ensuring resilience.

4.2.4 Access

Access on this island will use using light weight tracked dumpers and excavator(s) across a Annex I saltmarsh and mudflat habitat (Table 16). As such, all measures to avoid compaction are needed:

Two unloading points are proposed, which will reduce the load on any one specific area and limit the likelihood of longer-term impacts to vegetation and substrate. The shortest possible routes have been plotted to reach the shingle bank. This should lead to only a fractional percentage of Long Islands' habitats being temporarily affected.

Bog mats or timber matting will be used for soil protection along the access routes.

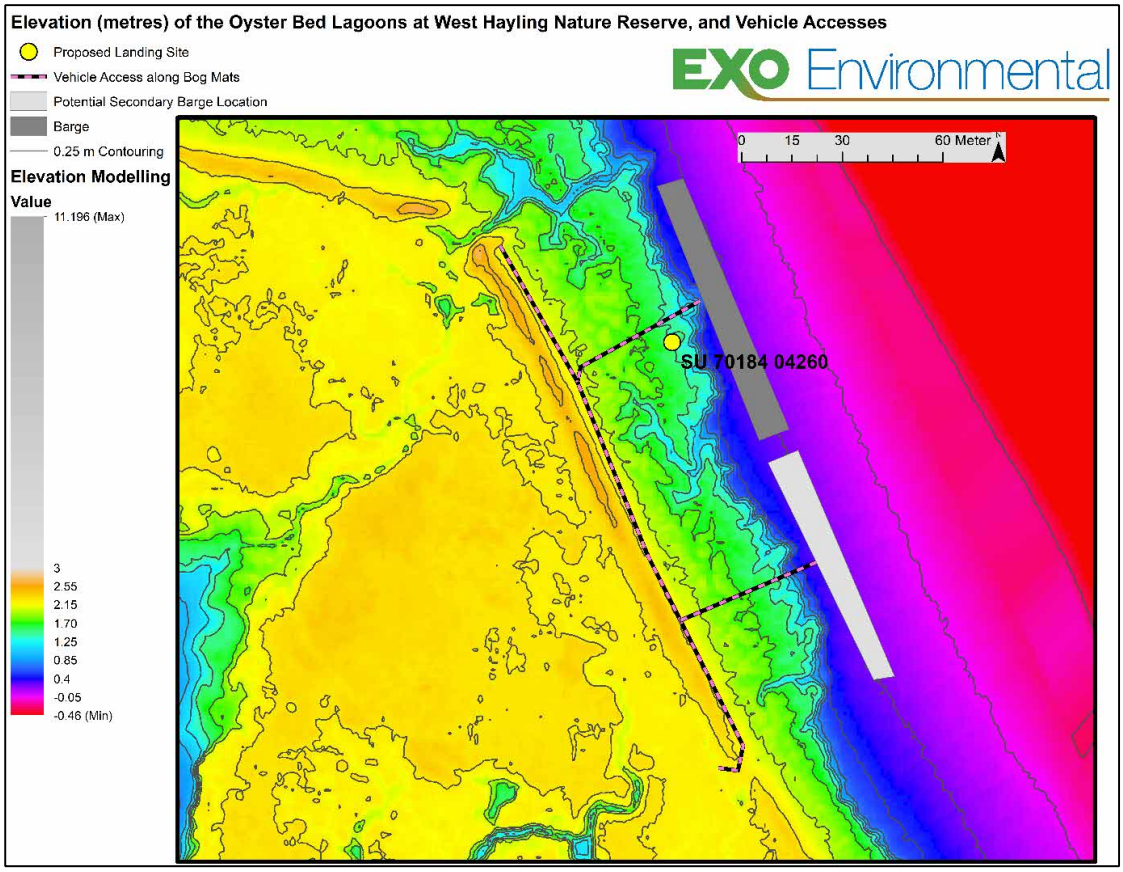

Figure 16. Barge sittings for Long Island with a second location added - this will allow unloading in two areas, minimising compression on mudflats.

4.2.5 Designation Impacts

In terms of Annex I habitats as identified from MAGIC and the field survey:

The ridge does not support Annex I vegetation.

Saltmarsh habitat on either side of the ridge is Annex I vegetation.

The intertidal mud is an Annex I habitat.

The design considerations and access planning have aimed to avoid Annex I habitats. However, for access there will be an inevitable requirement for saltmarsh to be traversed. This means that in two locations, land vehicles must access the site using bog mats over Annex I saltmarsh and mudflat.

Where this is the case, access plotting has ensured minimal distance. Vehicles will exert a low ground pressure and are spread within two locations to reduce time period of compression. This should leave only a temporary impact on relevant habitats, and in the case of the saltmarsh vegetation this will be evidenced as 'compressed' foliage rather than ground disturbance. The barge will also access the site at high tide, so as to minimise disturbance to mudflat.

The most recent evaluation of the SSSI units in which these islands are located suggests that the area is recovering, but there is still a risk to the area from anthropogenic nitrogen levels (Table 5). This is not relevant to this project.

A summary of potential impacts on the designated features in relation to Long Island is presented in Table 5.

Table 6.- Summary of potential impacts on designated features in the vicinity of Long Island.

Site	SAC	SPA	SSSI	Ramsar
Long Island	Access will lead to an area of saltmarsh being driven across, but this contributes to less than 0.1% of total saltmarsh area on Long Island, despite multiple access routes being used with the intention of reducing compression.	No impact expected as works are conducted out of nesting season for SPA species	No impact expected as long as good practice maintained (pg33 – WFD)	No impact as bird species are unlikely to be present, and site is not a frequented location

5. Habitats Regulations Assessment Screening

5.1 Introduction and Background

This section presents a summary of the scheme and potential impacts in relation to the Ramsar site and Nature Directives sites only, in the context of the Habitats Regulations Assessment (HRA) process.

5.2 Impact Assessment: SAC Annex I Habitats

This section considers the three Annex I habitat types within which the sites sit, or which are within the vicinity of sites. This assessment also applies to the habitat and vegetation features of the Ramsar site designation.

5.2.1 : 1130 Estuaries

The sites sit within this broad Annex I habitat, but for detailed consideration of impacts reference is made to the Annex habitat types associated with discrete vegetation of habitat types.

5.2.2 1140 Mudflats and mudflats not covered by seawater at low tide

The key considerations for mudflat are as follows:

Hayling island. The access route has been designed to minimise the area which will need to be traversed, and a pontoon or bailey bridge will be used to cross the mudflat area to restrict the extent of mudflat disturbed and to limit overall compression. Impacts would be expected to be temporary.

Long Island. Barge access will be at high tide to get as close to the saltmarsh as possible, but where vehicles will need to cross the mudflat then bog mats will be used to minimise compression. Two access points are proposed to further minimise disturbance to individual areas. Impacts would be expected to be temporary.

5.2.3 1330, Atlantic Salt Meadows

This Annex I habitat is only present at Long Island:

Saltmarsh will need to be traversed by vehicles from the barge, and bog mats will be used to minimise compression with two access points are proposed to further minimise disturbance to individual areas. Impacts on vegetation are expected to be 'crushing' of foliage without ground disturbance. Impacts would be temporary and without visible effects after one growing season.

Brushwood fencing would be used to limit migration of shingle onto adjacent saltmarsh. This would be in conjunction with careful and suitable methods for unloading trucks and distributing shingle during the construction phase.

5.2.4 Direct Impacts on Annex I Habitats

Estimates for the areas of Annex I habitat affected by access works are provided in Table 7. In all cases these are temporary impacts with the scheme designed to avoid longer term impacts (e.g. by shingle migration).

Table 7. Summary of direct impacts on Annex I habitats. In the context of Long Island and the wider Langstone Harbour all the areas affected as minor. In all cases these are very minor proportions of the total area of each Annex I habitat in the SAC, based on 1140 'mudflats' having an area of 5059ha and 1130 'saltmarsh' having an area of 6633ha.

SAC Feature	Area of island / site affected	Long term impacts / affected area (m^2)
1140 Mudflats and mudflats r covered by seawater at low tide	West Hayling: <18m^2 Long Island: <60m^2	Zero
1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	West Hayling: 0m^2 Long Island: <180m^2	Zero

5.3 Impact Assessment: Ramsar and SPA Birds

5.3.1 Qualifying Ramsar and SPA Features:

The Harbour supports a large and rich assemblage of wildfowl and waders, and the Ramsar and SPA designations cover the assemblage of wintering birds, and various wintering birds and transit birds.

The works are timed to avoid the nesting season and also periods when birds on transit or wintering would be sensitive to disturbance.

5.4 Screening (Test of Likely Significant Effect)

The screening for the construction and access is shown in Table 8. The scheme has been designed with ecological considerations as being paramount, as part of overall site management and recognition of the different features for which the sites are designated. These measures are considered to constitute integral working methods.

With respect to the birds (SPA and Ramsar site), negative impacts will be avoided mainly through the timing of works and their short duration with incidental consequences from any habitat impacts also being negligible. Disturbance and other impacts on birds are assessed as being of negligible significance, with the overall scheme being beneficial.

With respect to habitats, the main considerations are potential encroachment of shingle onto saltmarsh and damage vehicle access, both of which will be avoided through working methods. The disturbance to Annex I vegetation and habitat will be small in total and relatively small in the context of the wider SAC. This disturbance will be temporary.

The conclusion of the screening is that impacts from the scheme will be insignificant and not impact the site integrity of:

Chichester and Langstone Harbours Ramsar site.
Chichester and Langstone Harbours SPA.
Solent Maritime SAC.

There is sufficient confidence in this assessment for an Appropriate Assessment to not be needed.

Table 8. Screening Test of Likely Significant Effect.

Designated site	Construction phase			Operational phase
	Habitat loss from recharge	Nose and disturbance from works	Access routes	
SAC	Gravel could migrate from areas onto adjacent areas of Annex I habitat during installation. At the outset, it is intended that the works will be undertaken carefully, to avoid spillage of gravel onto saltmarsh through simple measures such as avoidance of overfilling of vehicles and depositing the shingle carefully. Applicable during construction and operation will be the integral design measures to avoid spill and migration of shingle, namely a combination of using larger cobbles in areas facing wave action (Hayling Island) and the use of brushwood fencing to limit	SAC features are not vulnerable to noise and disturbance,	Annex I habitats will have temporary protection mats installed to prevent damage to the ground and vegetation and bogging of vehicles. Routes will be determined using GIS to minimise the travel distance over Annex I habitats (saltmarsh, Long Island; and mudflat, Hayling Island). At Long Island the barge will have an arm to limit the need for vehicles to cross the mudflat. Impacts on vegetation and habitats will be minor and temporary.	Measures will be taken to prevent migration of gravel onto saltmarsh at Long Island via the use of brushwood fencing (following initial careful placement of shingle). At Hayling Island, the use of larger cobbles on the sloping sides will limit the slippage of gravel from the islands. Over time vegetation will develop on the shingle to further stabilise. Long term effects are therefore considered negligible Along the access routes the recovery of vegetation and mudflats will be rapid and visible changes to the structure and composition of vegetation

Designated site	Construction phase			Operational phase
	Habitat loss from recharge	Nose and disturbance from works	Access routes	
	migration of gravel (Long Island). Habitat loss as a result of recharge is therefore assessed as negligible.			and habitats are not anticipated after one growing season. There will be gains in the area of vegetated shingle expected to be equivalent to the Annex I 1220 Perennial vegetation of stony banks.
SPA	The loss of other habitat areas such as the sea couch sward at Long Island and the ephemeral vegetation on the Hayling Island site are considered to be of negligible significance for the designated species. I.e. these are unlikely to be foraging or nesting habitat of relevance.	Works will be timed to avoid the nesting season and periods of particular sensitivity (winter and while birds are on passage). While birds would be disturbed in the vicinity of works, this will	The access routes and works areas will not be available for foraging during works, with rapic recovery of conditions afterwards. Since the use of these areas will be at times when birds will be less sensitive to disturbance and the overall area will be very small, this is assessed as being of negligible significance.	Works are intended to create new nesting areas, and enhance current areas, ensuring site resilience to predatory species and sea level changes / storm surges. This will benefit some of the species for which the SPA and Ramsar site are designated (i.e. Little terns and Sandwich terns in particular), without negative impacts on other species.

Designated site	Construction phase			Operational phase
	Habitat loss from recharge	Nose and disturbance from works	Access routes	
		be a temporary impact of negligible significance in the short and long term.		
Ramsar	As for the SPA and SAC assessment.	As for the SPA and SAC assessment.	As for the SPA and SAC assessment.	As for the SPA and SAC assessment.
SSSI	As for the SPA and SAC assessment.	As for the SPA and SAC assessment.	As for the SPA and SAC assessment.	As for the SPA and SAC assessment.

6. Water Framework Directive (WFD) and 'Good Practice'

The water framework directive (WFD) aim is for all water bodies to be classified at a good status. As indicated within the SSSI condition report in 2018, the water quality in Langstone Harbour is assessed as good, but this is borderline. It is also worth noting that Natural England (through Magic maps) identifies the harbour as of high sensitivity to WFD conditions, as a result of SAC types 1130, 1140 and 1330.

Therefore, to ensure works have no impact on SSSI designation, works must be undertaken in a way to avoid any effect on water quality. This includes ensuring no refuelling occurs onsite and as good practice, all vehicles will have oil spill kits in case of incident, and all actions will be logged. Strict pathogen protocols are followed, with a 'check, clean, dry' policy on all the contractors employed on site. This will involve all equipment being subjected to a thorough cleaning procedure prior to use, as well a detailed visual check looking for signs of any biological material present on th equipment. A precautionary approach will be employed during the works, with any biosecurity threat identified to be disposed of appropriately.

Overall, the potential impact of invasive non-native species (INNS) as a result of the works is considered low, with measures to minimise the risk and allow early identification and treatment of any potential threat to biosecurity.

In conclusion, the proposed works associated with habitat restoration, including the shingle recharging, at Langstone Harbour are not expected to cause or contribute to a deterioration of the status of the water body or jeopardise the water body achieving good status in the future.

7. Conclusions

Little terns and shorebirds are a designated feature of both the Ramsar site and SPA and are at risk of local loss as a breeding species due to the vulnerability of the required nesting habitat to tidal surges and predation. The project aims to ensure long-term site resilience of shingle habitats used for nesting by Little terns and shorebirds, as part of site management.

Two areas are proposed for restoration via shingle recharge, termed Hayling Island and Long Island.

With respect to the SAC, the principal considerations are limiting habita disturbance by vehicles carrying shingle, potentially negatively affecting mudflat and saltmarsh. It is proposed that the use of bog mats and timber matting will limit disturbance to the vegetation, with rapid recovery of vegetation and mudflat. Shingle may also spill onto adjoining habitats, and this will be minimised via careful initial placement, use of larger cobbles on the sides and the use of brushwood fencing. With these integral working methods, the potential impacts to designated features are assessed as negligible.

With respect to the SPA, the timing of works will avoid sensitive periods for birds such that disturbance will be minimised. Other possible impacts such as changes in the recharged areas will be of negligible significance. Ultimately, the works are intended to benefit Little terns in particular, and as such the scheme will have a positive effect on the SPA.

The designated features of the Ramsar site overlap in practice with those of the SAC and SPA, and the impacts on designated features are assessed as negligible.

The conclusion of the screening at the Test of Likely Significant Effect stage is that the scheme will not impact the site integrity of the Solent Ramsar site and SPA nor the Solent Maritime SAC. The working methods are integral to the scheme and are not considered as mitigation in this context, and an Appropriate Assessment is not required.

8. References:

All available online as of 04/04/2022

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Langstone Harbour Board Conservation: https://www.langstoneharbour.org.uk/conservation

RSPB details on WHNR: https://www.rspb.org.uk/reserves-and-events/reserves-a-z/langstone-harbour/facilities

RSPB LIFE on the edge: https://www.rspb.org.uk/our-work/conservation/projects/life-on-the-edge/

Solent Maritime Conservation area (SAC): https://sac.jncc.gov.uk/site/UK0030059

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Specific SSSI view: https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=s1001182

SSSI general background and reasonings: https://www.woodlandtrust.org.uk/blog/2019/03/sssi-definition/

Water framework directives: https://ec.europa.eu/environment/water/water-framework/info/intro_en.htm

9. Appendices

9.1 Designated Features

Table 9. Birds listed as designated features of the Langstone and Chichester Harbours Ramsar site and SPA.

Langstone and Chichester Harbours Ramsar site
Ramsar criterion 1:
Two large estuarine basins linked by the channel which divides Hayling Island from the main Hampshire coastline. The site includes intertidal mudflats, saltmarsh, sand and shingle spit and sand dunes.
Ramsar criterion 5. Assemblages of international importance:
Species with peak counts in winter: 76480 waterfowl
Ramsar criterion 6. Species/populations occurring at levels of international importance:
Species with peak counts in spring/autumn: Ringed plover, *Charadrius hiaticula* Black-tailed godwit, *Limosa limosa islandica* Common redshank, *Tringa totanus totanus*
Species with peak counts in winter: Dark-bellied brent goose, *Branta bernicla bernicla* Common shelduck, *Tadorna tado*ma Grey plover, *Pluvialis squatarola* Dunlin, *Calidris alpina alpina*
Species regularly supported during the breeding season: Little tern, *Sterna albifrons albifrons*
Chichester and Langstone Harbours SPA
A046a *Branta bernicla bernicla*; Dark-bellied brent goose (Non-breeding) A048 *Tadorna tadorna*; Common shelduck (Non-breeding) A050 *Anas penelope*; Eurasian wigeon (Non-breeding) A052 *Anas crecca*; Eurasian teal (Non-breeding) A054 *Anas acuta*; Northern pintail (Non-breeding) A056 *Anas clypeata*; Northern shoveler (Non-breeding) A069 *Mergus serrator*; Red-breasted merganser (Non-breeding) A137 *Charadrius hiaticula*; Ringed plover (Non-breeding) A141 *Pluvialis squatarola*; Grey plover (Non-breeding) A144 *Calidris alba*; Sanderling (Non-breeding) A149 *Calidris alpina alpina*; Dunlin (Non-breeding) A157 *Limosa lapponica*; Bar-tailed godwit (Non-breeding) A160 *Numenius arquata*; Eurasian curlew (Non-breeding) A162 *Tringa totanus*; Common redshank (Non-breeding) A169 *Arenaria interpres*; Ruddy turnstone (Non-breeding) A191 *Sterna sandvicensis*; Sandwich tern (Breeding) A193 *Sterna hirundo*; Common tern (Breeding) A195 *Sterna albifrons*; Little tern (Breeding) Waterbird assemblage

Table 10 - SPA species present within the Langstone Harbour SPA.

Protected Species/Feature	Does the species occur within the footprint of proposed work (shingle, saltmarsh or mudflat)
Common tern, *Sterna hirundo* - A193,	Yes
Bar-tailed godwit, *Limosa lapponica* - A157	Yes
Wading Curlew, *Numenius arquata* - A160	Yes
Dark-bellied Brent goose (DDBG) , *Branta bernicla bernicla* - A675	Yes
Dunlin, *Calidris alpina alpina* - A672,	Yes
Grey plover, *Pluvialis squatarola* - A141,	Yes
Little tern, *Sterna albifrons* - A195	Yes
Pintail, *Anas acuta* - A054	Unlikely
Red-breasted merganser, *Mergus serrator* - A069	Unlikely
Redshank, *Tringa totanus* - A162	Yes
Ringed plover, *Charadrius hiaticula* - A137	Yes
Sanderling, *Calidris* alba - A144	Yes
Sandwich tern, *Sterna sandvicensis* - A191	Yes
Shelduck, *Tadorna tadorna* - A048	Yes
Shoveler, *Anas clypeata* - A056	Yes
Teal, *Anas crecca* - A704	Yes
Turnstone, *Arenaria interpres* - A169	Yes
Waterbird assemblage	Yes
Wigeon, Anas penelope - A050	Yes

Table 11. Designated features of the Solent Maritime Area SAC.

Habitat	Importance	Reasoning for Solent Maritime SAC
1130 Estuaries	Annex I (Primary reason for designation)	The Solent encompasses a major estuarine system on the south coast of Eng with four coastal plain estuaries (Yar, Medina, King's Quay Shore, Hamble) and fou bar-built estuaries (Newtown Harbour, Beaulieu, Langstone Harbour, Chich Harbour). The site is the only one in the series to contain mor physiographic sub-type of estuary and is the only cluster site. The Solent and its inlet are unique in Britain and Europe for their hydrographic regime of four tide day, and for the complexity of the marine and estuarine habitats present within area. Sediment habitats within the estuaries include extensive estuarine flats, c with intertidal areas supporting eelgrass *Zostera* spp. and green algae, sand a shingle spits, and natural shoreline transitions. The mudflats range from low variable salinity in the upper reaches of the estuaries to very sheltered almos marine muds in Chichester and Langstone Harbours. Unusual features includ presence of very rare sponges in the Yar estuary and a sandy 'reef' c polychaete *Sabellaria spinulosa* on the steep eastern side of the entranc Chichester Harbour.
1320 *Spartina* swards (Spartinion maritimae)	Annex I (Primary reason for designation)	Solent Maritime is the only site for smooth cord-grass *Spartina alterniflora* in the UK and is one of only two sites where significant amounts of small c -grass *S. maritima* are found. It is also one of the few remaining sites for Townsend's cord-grass *S.* x *townsendii* and holds extensive areas of common cord-grass *Spartina anglica*, all four taxa thus occurring here in close proximity. It has additional histori and scientific interest as the site where *S. alterniflora* was first recorded in the U (1829) and where *S.* x *townsendii* and, later, *S. anglica* first occurred.
1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Annex I (Primary reason for designation)	The Solent contains the second-largest aggregation of Atlantic salt meadows in south and south-west England. Solent Maritime is a composite site composed of a l number of separate areas of saltmarsh. In contrast to the Severn estuary, th meadows at this site are notable as being representative of the ungrazed type support a different range of communities dominated by sea-purslane *Atriplex portulacoides*, common sea-lavender *Limonium vulgare* and thrift *Armeria maritima*. As a whole the site is less truncated by man-made features than other parts of t south coast and shows rare and unusual transitions to freshwater reedswam

Habitat	Importance	Reasoning for Solent Maritime SAC
		alluvial woodland as well as coastal grassland. Typical Atlantic salt meadow is still widespread in this site, despite a long history of colonisation by cord-grass *Spartina* spp.
1110 Sandbanks which are slightly covered by sea water all the time	Annex I (Secondary reason for designation)	Present as a qualifying feature, but not a primary reason for selection of this site.
1140 Mudflats and sandflats not covered by seawater at low tide	Annex I (Secondary)	Present as a qualifying feature, but not a primary reason for selection of this site.
1150 Coastal lagoons	Annex I (Secondary reason for designation)	Priority feature. Present as a qualifying feature, but not a primary selection of this site.
1210 Annual vegetation of drift lines	Annex I (Secondary reason for designation)	Present as a qualifying feature, but not a primary reason for selection of this site.
1220 Perennial vegetation of stony banks	Annex I (Secondary reason for designation)	Present as a qualifying feature, but not a primary reason for selection of this site.
1310 *Salicornia* and other annuals colonizing mud and sand	Annex I (Secondary reason for designation)	Present as a qualifying feature, but not a primary reason for selection of this site.
2120 "Shifting dunes along the shoreline with *Ammophila* arenaria (""white dunes"")"	Annex I (Secondary reason for designation)	Present as a qualifying feature, but not a primary reason for selection of this site.
1016 Desmoulin's whorl snail *Vertigo moulinsiana*	Annex II (Secondary reason for designation)	Present as a qualifying feature, but not a primary reason for selection of this site.

9.2 Additional Figures Relating to Species and Habitats

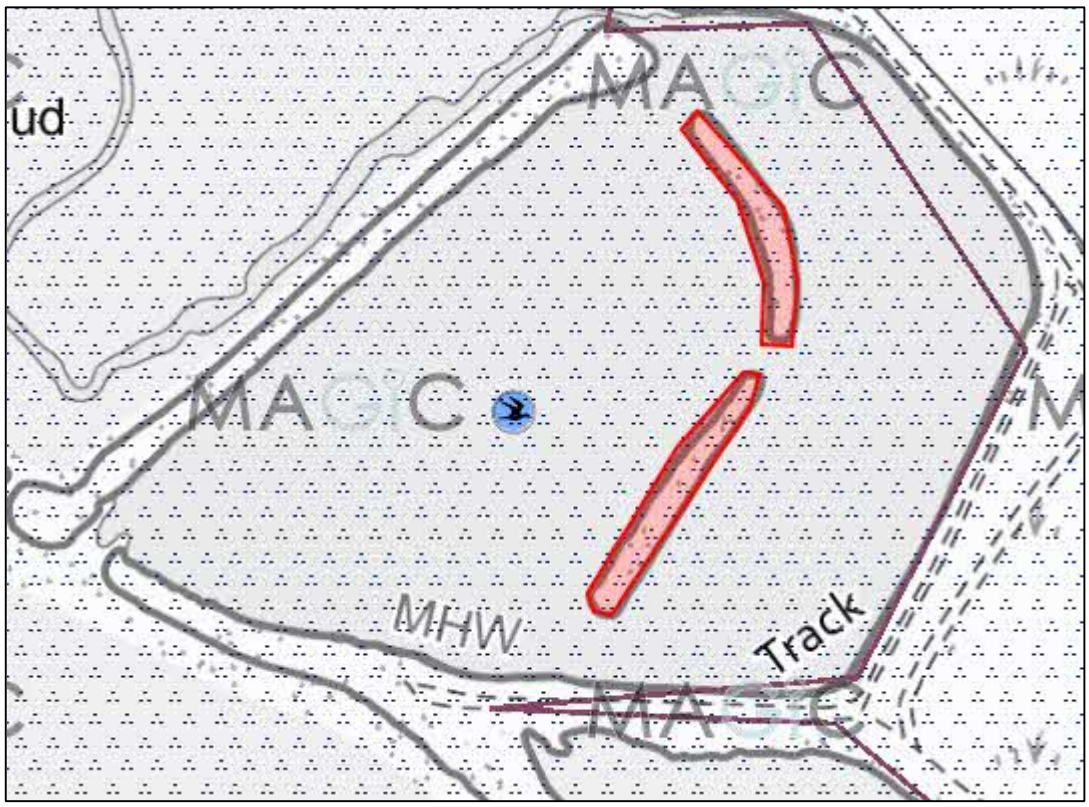


Figure 17. WHLNR is located within the Chichester and Langstone Harbours SPA, as listed at https://magic.defra.gov.uk/magicmap.aspx . It is also home to a significant seabird nesting area. Scaling - 1:2500.

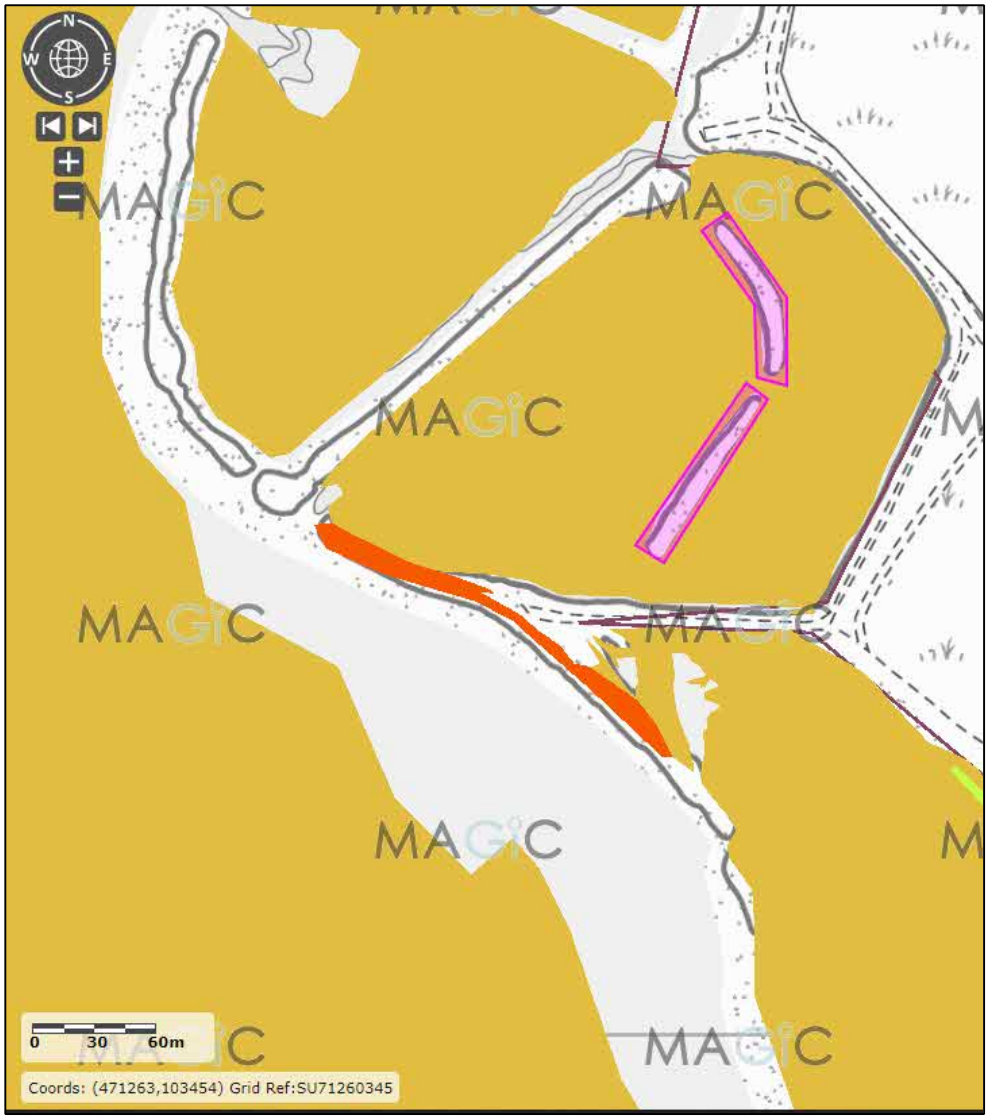


Figure 18. Intertidal features, listed as subfeatures of SAC 1130/1140, in proximity to West Hayling LNR. https://magic.defra.gov.uk/MagicMap.aspx.

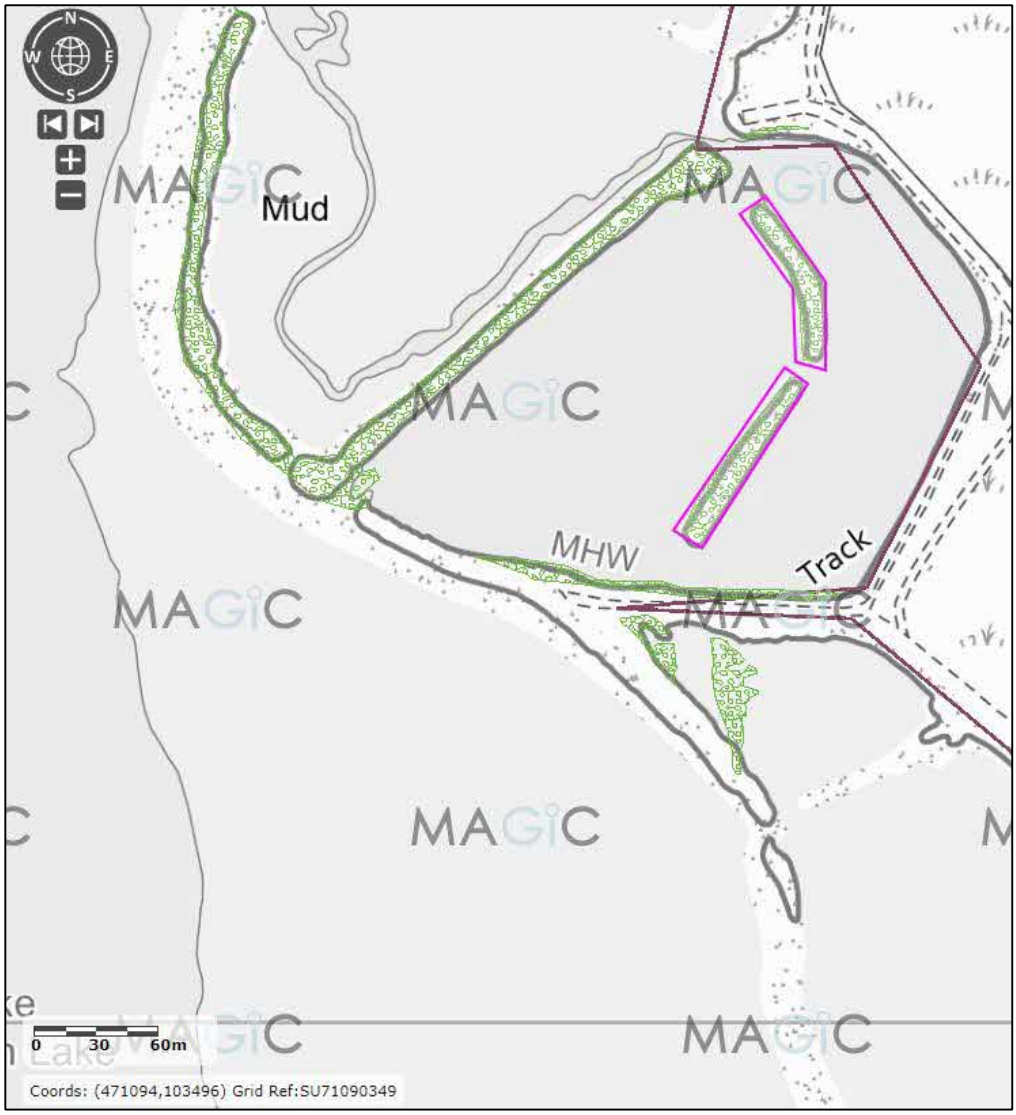


Figure 19. SAC listed Saltmarshes (Subfeature A2.5E) in West Hayling LNR https://magic.defra.gov.uk/MagicMap.aspx. As noted in the main text, this mapping is not an accurate reflection of habitats within works areas.

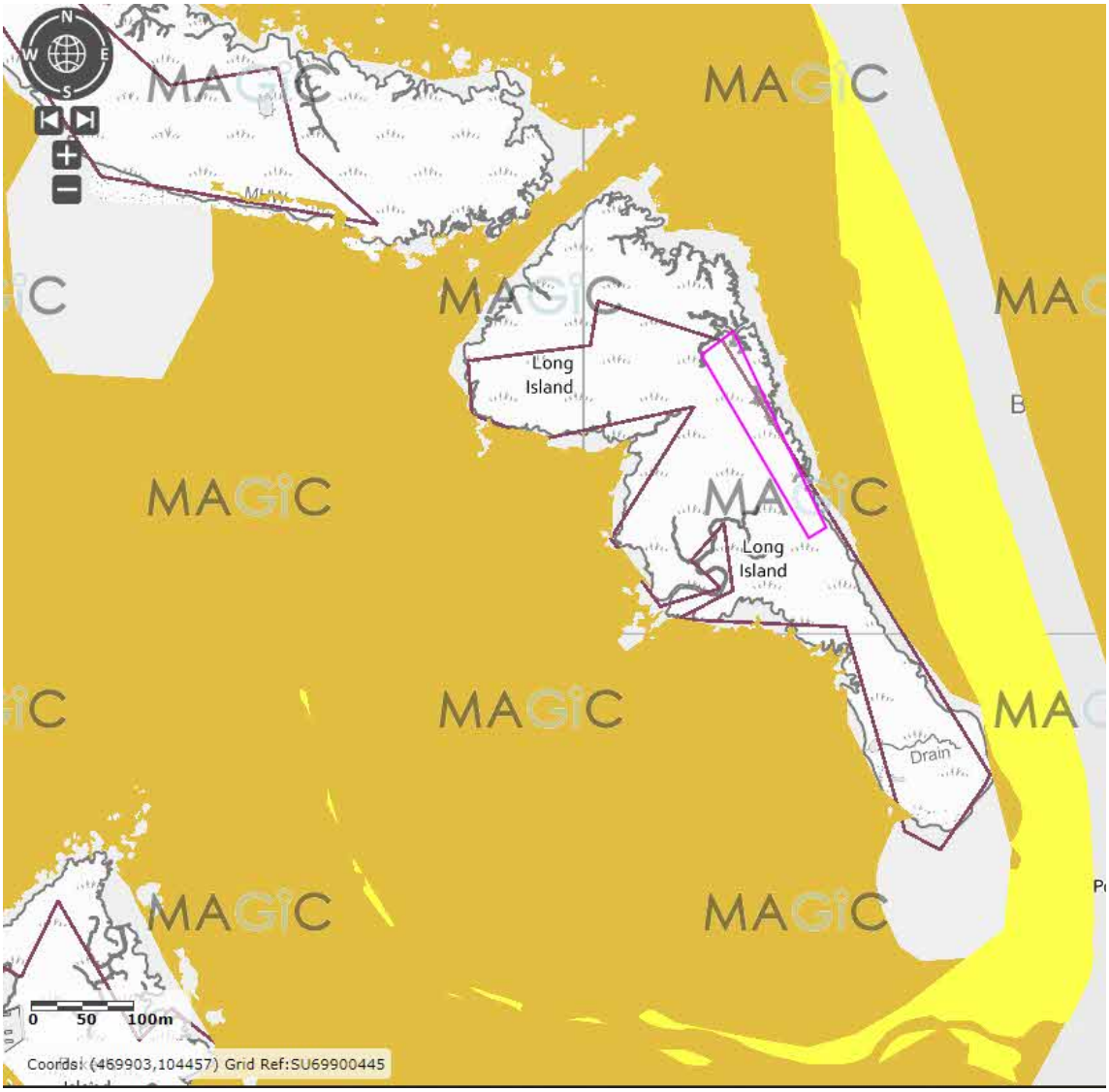


Figure 20. SAC and SAC subfeature features 1130/1140 around Long Island.

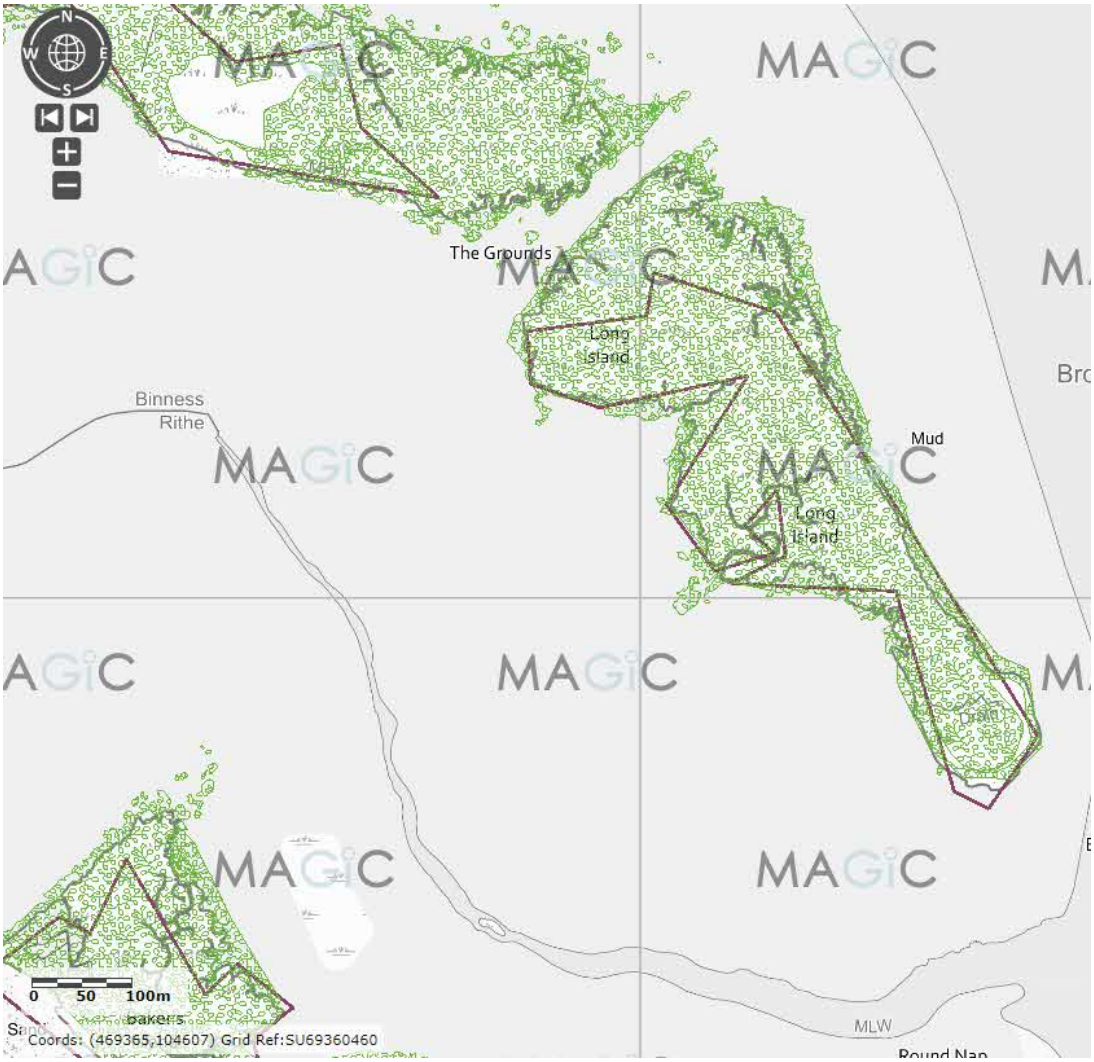
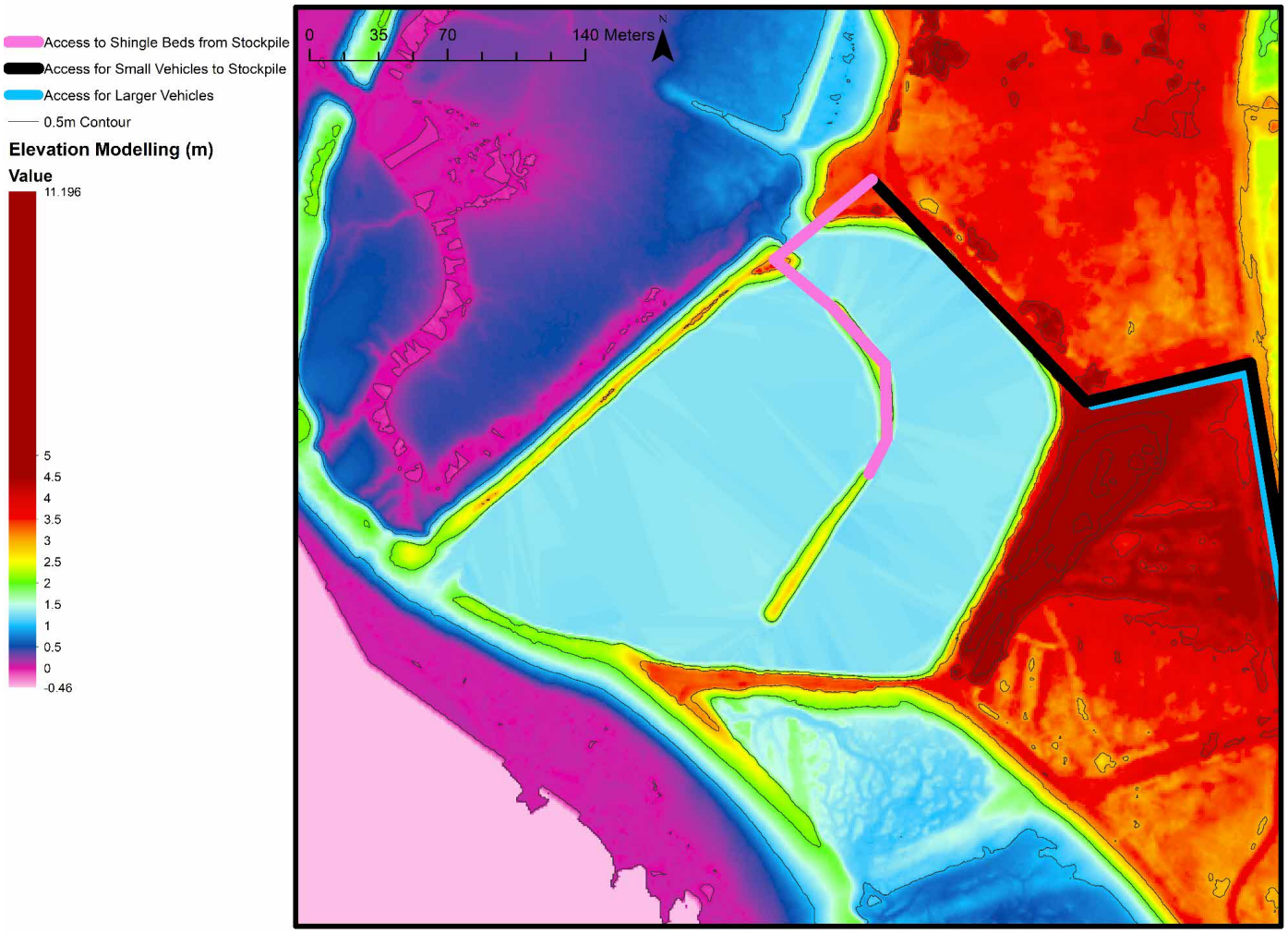


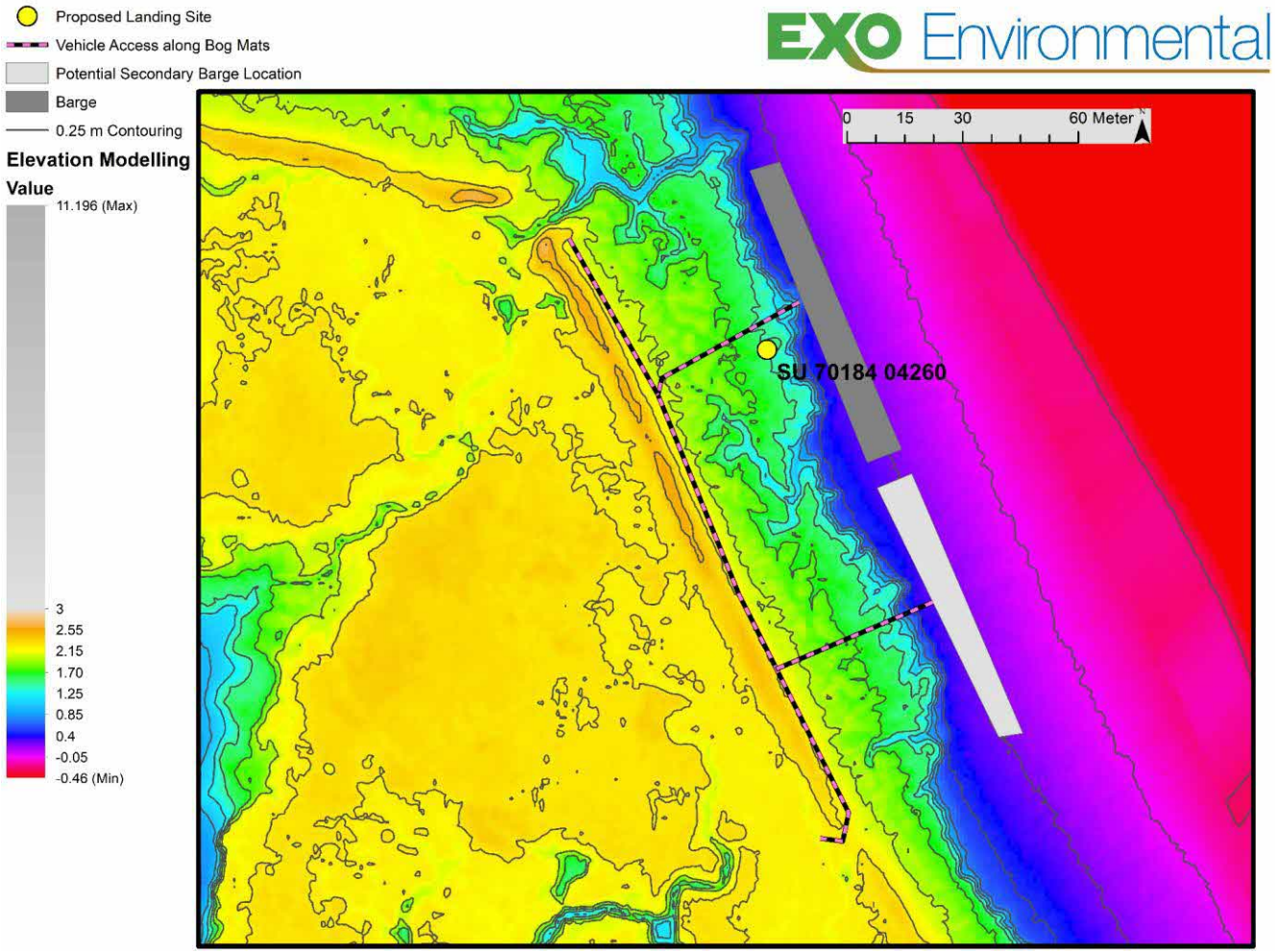
Figure 21. Long island is shown to also have Saltmarsh (1140/A2.5E) SAC coverage, but the area targeted for recharge is shingled and not saltmarsh, as shown by photos taken on 25.03.2022. https://magic.defra.gov.uk/MagicMap.aspx. As noted in the main text, this mapping is not an accurate reflection of habitats within works areas.

9.3 Additional Figures Relating to Works

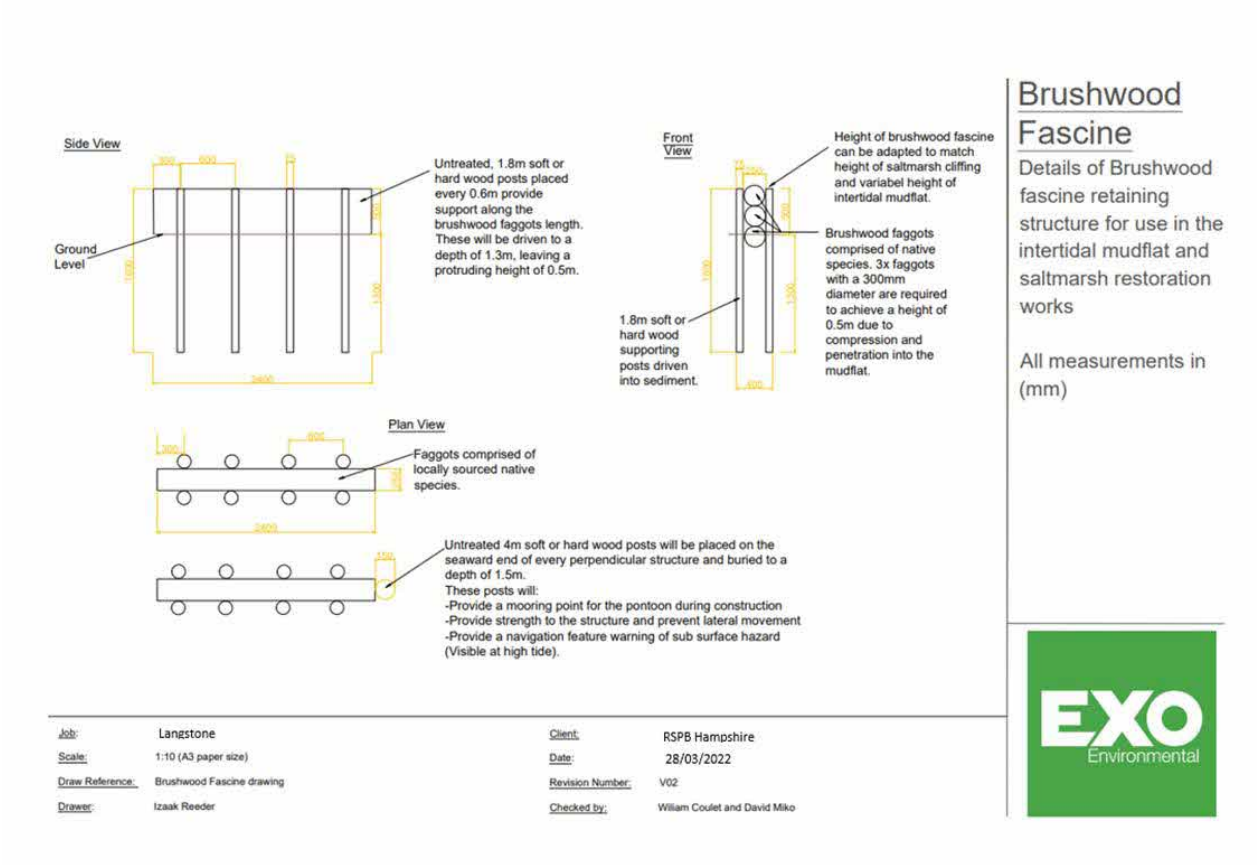
Access to WHLNR Oyster Beds, against Elevation



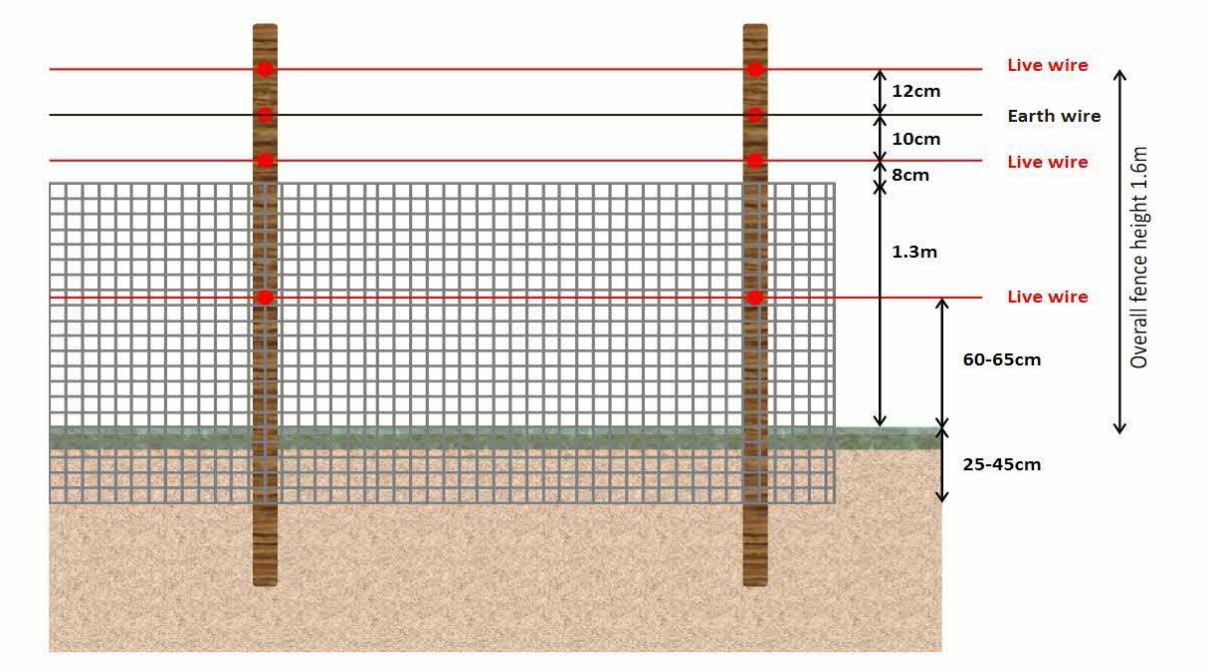
Elevation (metres) of the Oyster Bed Lagoons at West Hayling Nature Reserve, and Vehicle Accesses



9.4 Brushwood Fence Design



9.5 Predator Exclusion Fence Design



Wire mesh: Tornado RL 23/240/5 C5.

Wooden posts: sweet chestnut (better) treated with a wood preservative safe for marine environment. Forest Stewardship Council (FSC) certified, ideally locally grown and manufactured. 2.4 metre full round 100mm posts at 4 metre intervals. Full round 150mm 3 metre strainer posts where needed at changes of direction. Minimal external fence features, such as strainer post stays.

Electric wire:

Live strand (1) 0.60-0.65m above ground and off-set by 80mm
Live strand (2) c.8cm above the top of the mesh fence
Earth/neutral strand (1) c.18cm above the top of the mesh fence
Live strand (3) c.30cm above the top of the mesh fence

Electric fence gate: Bespoke gates (1.5m wide) within the perimeter. Meshed as per fence. Electric wires as per fence and isolator steel springs across gates for safe access. 30cm wire netting apron butted against the gate lying flat on the ground surface and pegged at intervals.

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