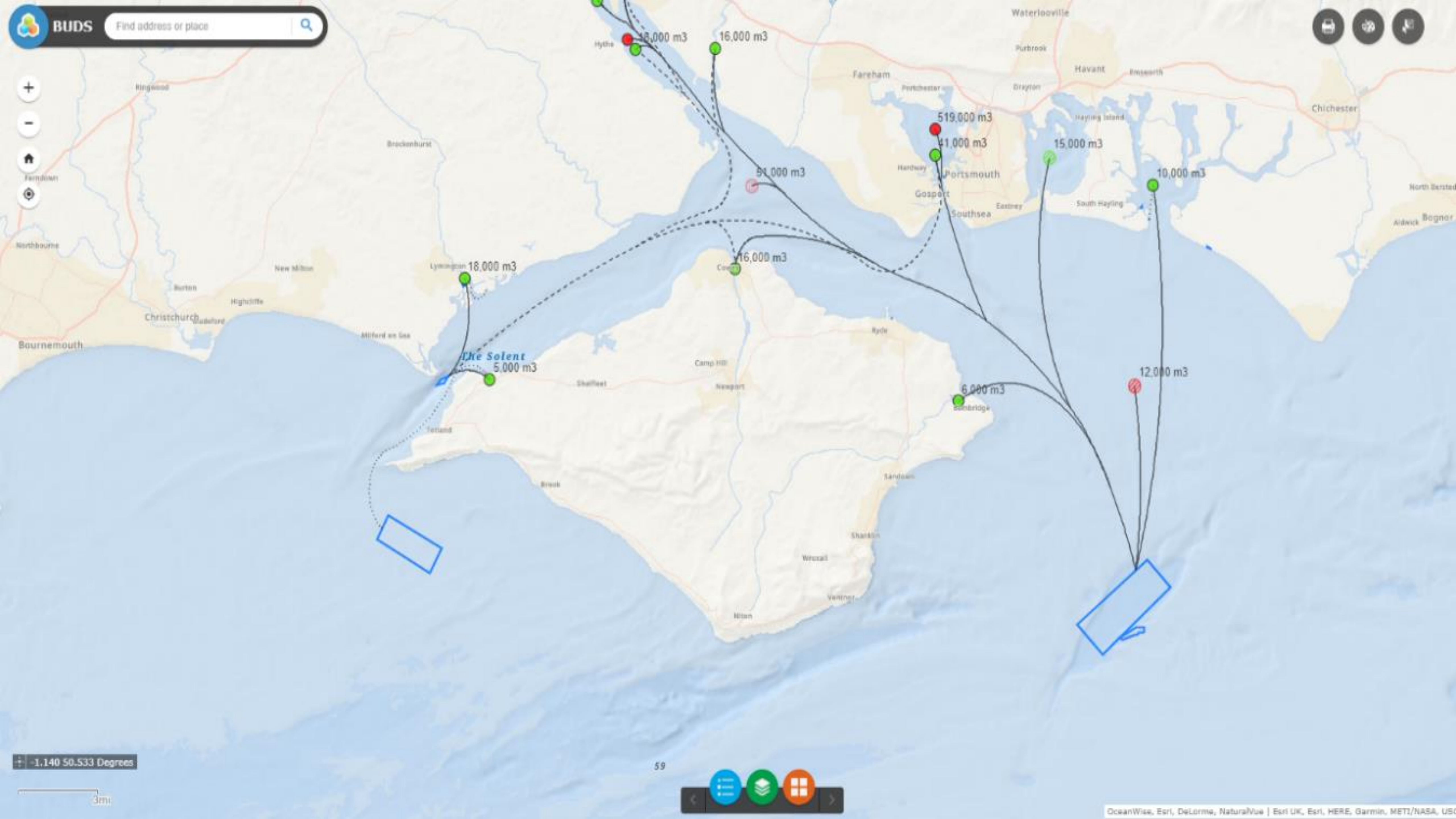
Solent Forum Meeting 23 March 2022
Novotel Southampton, 1 West Quay Road SO15 1RA

Progress with Beneficial Use of Dredge sediment in the Solent (BUDS)

Colin Scott


BUDS
Find address or place
16,000 m3
519,000 m3
41,000 m3
15,000 m3
10,000 m3
51,000 m3
18,000 m3
16,000 m3
5,000 m3
6,000 m3
12,000 m3
Waterlooville
Purbrook
Havant
Emsworth
Fareham
Portchester
Drayton
Chichester
Hayling Island
Portsmouth
Gosport
Southsea
Eastney
South Hayling
North Bersted
Aldwick
Bognor
Hythe
Ringwood
Brockenhurst
Ferndown
Northbourne
New Milton
Burton
Highcliffe
Christchurch
Bournemouth
Lymington
Milford on Sea
The Solent
Shalfleet
Camp Hill
Newport
Ryde
Totland
Brook
Sandown
Shanklin
Wroxall
Ventnor
Niton
-1.140 50.533 Degrees
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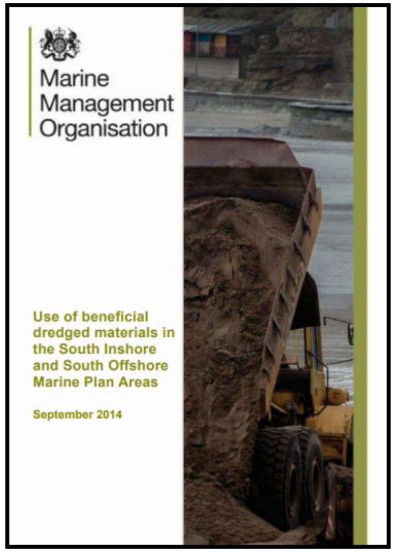
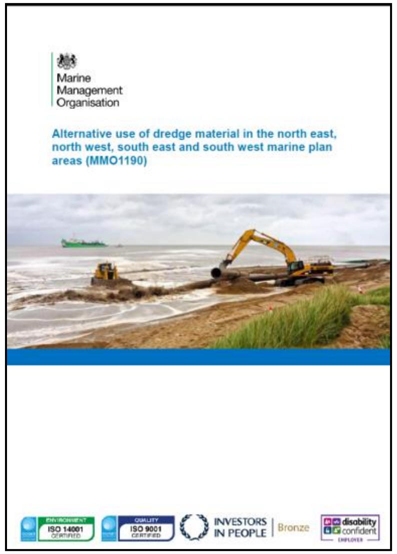
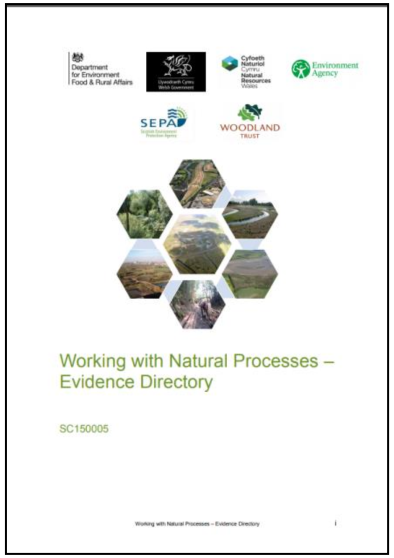
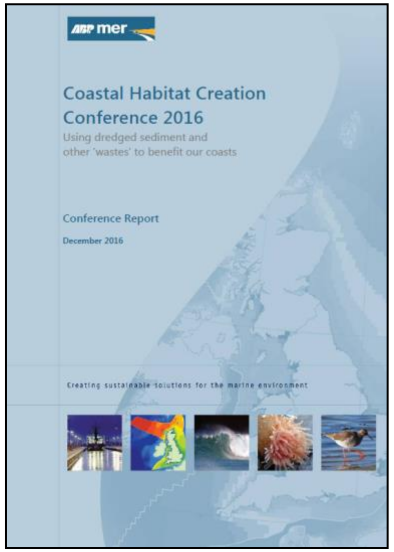
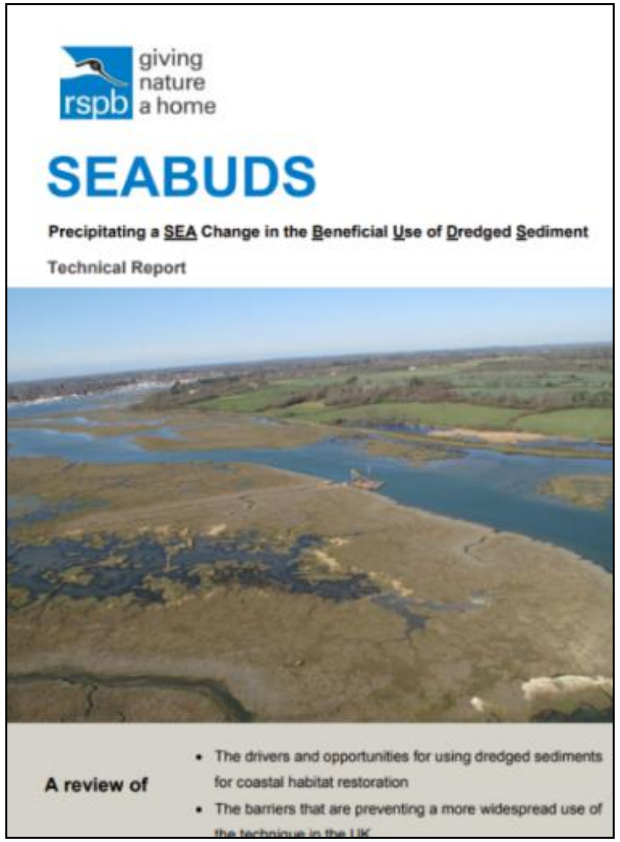
Introduction

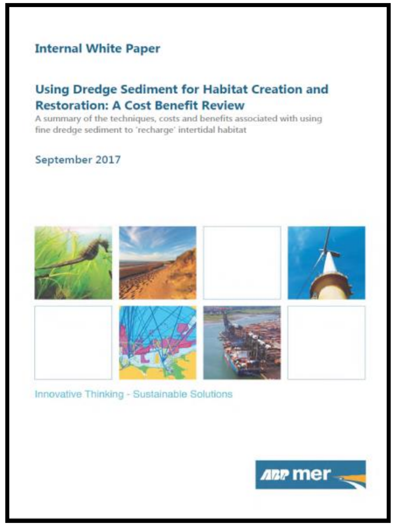


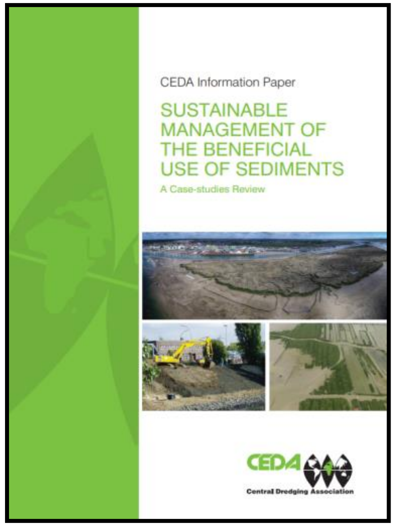


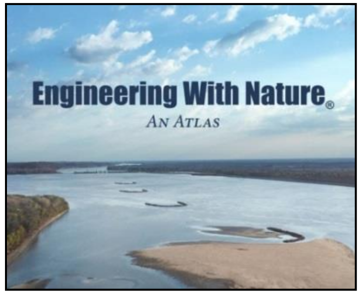


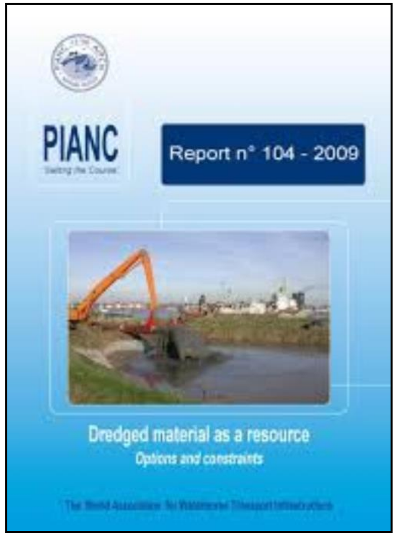




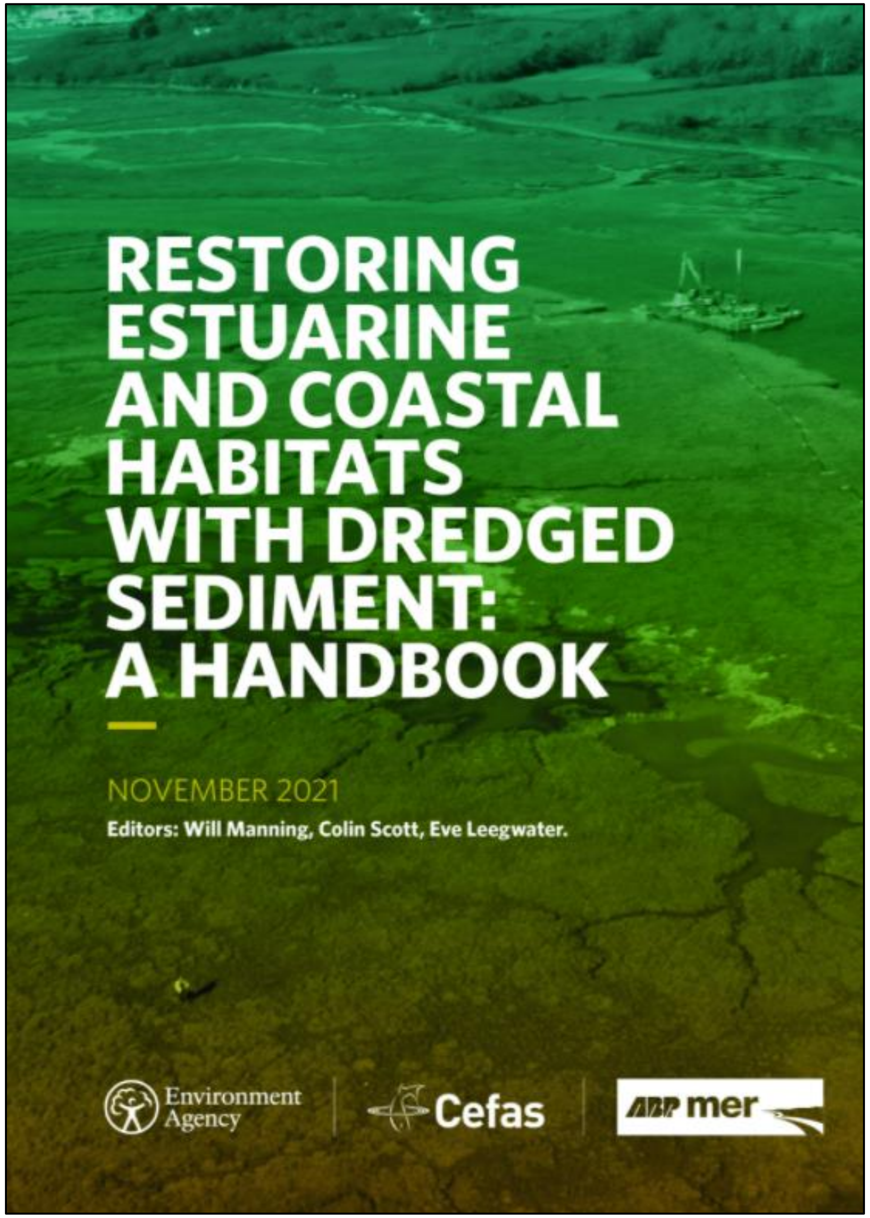


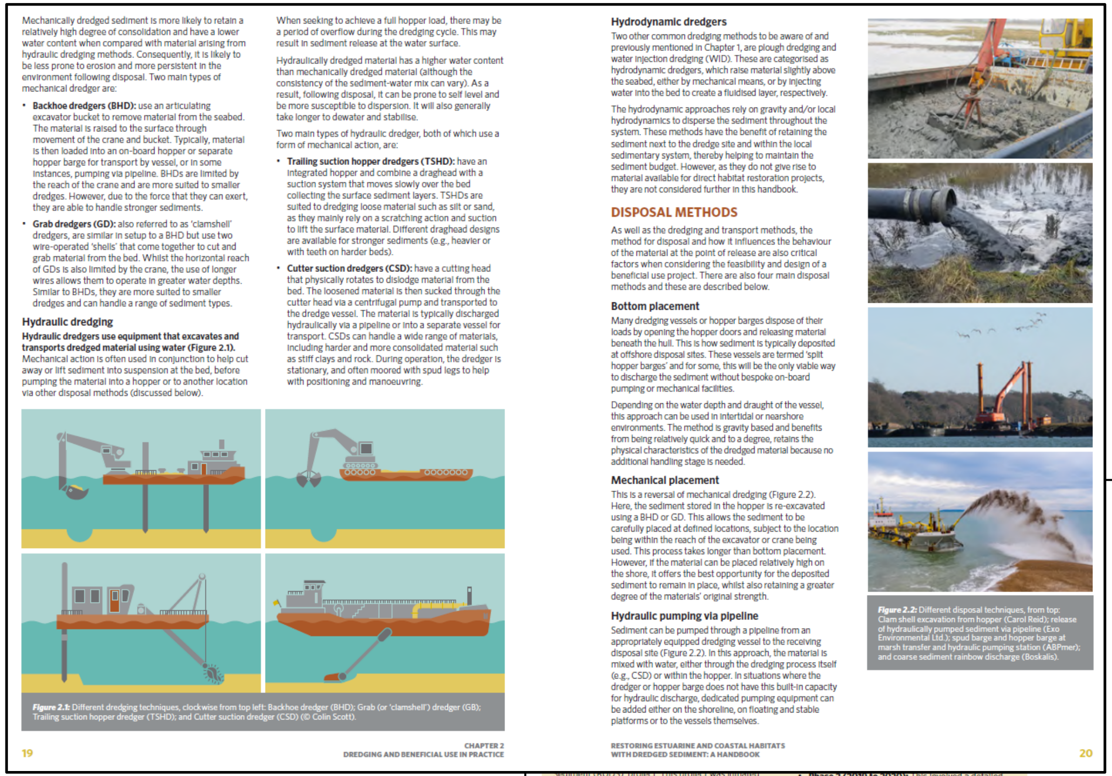






Introduction





Mechanically dredged sediment is more likely to retain a relatively high degree of consolidation and have a lower water content when compared with material arising from hydraulic dredging methods. Consequently, it is likely to be less prone to erosion and more persistent in the environment following disposal. Two main types of mechanical dredger are:

- **Backhoe dredgers (BHD):** use an articulating excavator bucket to remove material from the seabed. The material is raised to the surface through movement of the crane and bucket. Typically, material is then loaded into an on-board hopper or separate hopper barge for transport by vessel, or in some instances, pumping via pipeline. BHDs are limited by the reach of the crane and are more suited to smaller dredges. However, due to the force that they can exert, they are able to handle stronger sediments.
- **Grab dredgers (GD):** also referred to as 'clamshell' dredgers, are similar in setup to a BHD but use two wire-operated 'shells' that come together to cut and grab material from the bed. Whilst the horizontal reach of GDs is also limited by the crane, the use of longer wires allows them to operate in greater water depths. Similar to BHDs, they are more suited to smaller dredges and can handle a range of sediment types.

Hydraulic dredging

Hydraulic dredgers use equipment that excavates and transports dredged material using water (Figure 2.1). Mechanical action is often used in conjunction to help cut away or lift sediment into suspension at the bed, before pumping the material into a hopper or to another location via other disposal methods (discussed below).

When seeking to achieve a full hopper load, there may be a period of overflow during the dredging cycle. This may result in sediment release at the water surface.

Hydraulically dredged material has a higher water content than mechanically dredged material (although the consistency of the sediment-water mix can vary). As a result, following disposal, it can be prone to self level and be more susceptible to dispersion. It will also generally take longer to dewater and stabilise.

Two main types of hydraulic dredger, both of which use a form of mechanical action, are:

- **Trailing suction hopper dredgers (TSHD):** have an integrated hopper and combine a draghead with a suction system that moves slowly over the bed collecting the surface sediment layers. TSHDs are suited to dredging loose material such as silt or sand, as they mainly rely on a scratching action and suction to lift the surface material. Different draghead designs are available for stronger sediments (e.g., heavier or with teeth on harder beds).
- **Cutter suction dredgers (CSD):** have a cutting head that physically rotates to dislodge material from the bed. The loosened material is then sucked through the cutter head via a centrifugal pump and transported to the dredge vessel. The material is typically discharged hydraulically via a pipeline or into a separate vessel for transport. CSDs can handle a wide range of materials, including harder and more consolidated material such as stiff clays and rock. During operation, the dredger is stationary, and often moored with spud legs to help with positioning and manoeuvring.

Figure 2.1: Different dredging techniques, clockwise from top left: Backhoe dredger (BHD); Grab (or 'clamshell') dredger (GB); Trailing suction hopper dredger (TSHD); and Cutter suction dredger (CSD) (© Colin Scott).

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Hydrodynamic dredgers

Two other common dredging methods to be aware of and previously mentioned in Chapter 1, are plough dredging and water injection dredging (WID). These are categorised as hydrodynamic dredgers, which raise material slightly above the seabed, either by mechanical means, or by injecting water into the bed to create a fluidised layer, respectively.

The hydrodynamic approaches rely on gravity and/or local hydrodynamics to disperse the sediment throughout the system. These methods have the benefit of retaining the sediment next to the dredge site and within the local sedimentary system, thereby helping to maintain the sediment budget. However, as they do not give rise to material available for direct habitat restoration projects, they are not considered further in this handbook.

DISPOSAL METHODS

As well as the dredging and transport methods, the method for disposal and how it influences the behaviour of the material at the point of release are also critical factors when considering the feasibility and design of a beneficial use project. There are also four main disposal methods and these are described below.

Bottom placement

Many dredging vessels or hopper barges dispose of their loads by opening the hopper doors and releasing material beneath the hull. This is how sediment is typically deposited at offshore disposal sites. These vessels are termed 'split hopper barges' and for some, this will be the only viable way to discharge the sediment without bespoke on-board pumping or mechanical facilities.

Depending on the water depth and draught of the vessel, this approach can be used in intertidal or nearshore environments. The method is gravity based and benefits from being relatively quick and to a degree, retains the physical characteristics of the dredged material because no additional handling stage is needed.

Mechanical placement

This is a reversal of mechanical dredging (Figure 2.2). Here, the sediment stored in the hopper is re-excavated using a BHD or GD. This allows the sediment to be carefully placed at defined locations, subject to the location being within the reach of the excavator or crane being used. This process takes longer than bottom placement. However, if the material can be placed relatively high on the shore, it offers the best opportunity for the deposited sediment to remain in place, whilst also retaining a greater degree of the materials' original strength.

Hydraulic pumping via pipeline

Sediment can be pumped through a pipeline from an appropriately equipped dredging vessel to the receiving disposal site (Figure 2.2). In this approach, the material is mixed with water, either through the dredging process itself (e.g., CSD) or within the hopper. In situations where the dredger or hopper barge does not have this built-in capacity for hydraulic discharge, dedicated pumping equipment can be added either on the shoreline, on floating and stable platforms or to the vessels themselves.

Figure 2.2: Different disposal techniques, from top: Clam shell excavation from hopper (Carol Reid); release of hydraulically pumped sediment via pipeline (Exo Environmental Ltd.); spud barge and hopper barge at marsh transfer and hydraulic pumping station (ABPmer); and coarse sediment rainbow discharge (Boskalis).

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because the partnership is keen to see more of the Solent's dredged sediment used to restore its eroding intertidal habitats. Around 1 million m³ of fine sediment is excavated each year in this region. This is mainly placed offshore with no more than 0.02% of this material being directly used to beneficially protect and restore the Solent's deteriorating habitats.

The BUDS project recognises that a new collaborative and strategic management approach is needed in the Solent region if change is to be achieved. This needs to be built on a systematic, inclusive and evidence based process and to achieve this, the project is being carried out progressively in discrete phases as follows:

- **Phase 1 (2017 to 2018):** This involved an initial strategic overview of the region. It included a mapping study (Figure 2.16) to illustrate the dredging
- **Phase 2 (2019 to 2020):** This involved a detailed review of the practical options for carrying out restoration in one of the areas prioritised during Phase 1. The location identified was in the West Solent, near Keyhaven and Lymington. The Phase 2 review also included a uniquely detailed cost:benefit analysis of the available options, based on a natural capital assessment approach.
- **Phase 3 (2021 to 2022):** This phase will involve actively securing the necessary marine licences and permissions for beneficial use at a preferred site (or, ideally, a series of sites) in the West Solent. This will facilitate future beneficial use projects that will then take place during Phase 4. The process will also further improve understanding about the practicalities, costs, benefits and funding of beneficial use measures to underpin other projects across the Solent in the future.

Figure 2.16: Interactive map of dredging and disposal activities in the Solent, created during Phase 1 of the BUDS project (ABPmer).

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Considerations, feasibility studies and development of the project design

When selecting potential restoration sites and developing beneficial use proposals, existing dredging and disposal activities must be considered. Some of these have been described above and include the location of the activities, the arising sediment volumes and its physicochemical composition, the methods used and the resultant behaviour of the dredged material.

There are many other, often inter-related ecological and technical issues that must also be addressed. These include the nature and accessibility of the beneficial use disposal site, as well as the overall costs and net benefits (Figure 2.17). Developing a new project is therefore not always a simple process. To help with future feasibility studies and development in this sector, some of the main issues more specific to beneficial use to be aware of are reviewed in the following sections.

It is reiterated here, that the habitat specific restoration handbooks in this series also provide further details to inform the development of beneficial use projects, such as habitat specific project design, monitoring and potential funding streams.

Access to relevant information

One key issue worth emphasising, is that much of the information needed to make decisions and develop project plans is not readily available or clearly audited.

There is no central database from which information can be readily drawn about existing dredging methods or other key issues, such as the location of potential beneficial use sites, as described in the preceding section.

Some details are contained within and can be selectively extracted from individual and publicly available marine licences. Sediment sampling results and the locations and volumes associated with previous disposal works across the UK that form the LCLP and OSPAR returns, can also be obtained from Cefas. To do so, an 'Environmental Information Request' can be submitted to the Regulatory Assessment Team, providing a short description of the reason for the enquiry and either the boundary co-ordinates of the area of interest, or the name of the existing disposal sites of interest (e.g., to assess historical usage). However, a lot of other information can only be derived from further local and regional research and through consultations with sector specialists. Without any central database, bespoke investigations are required to obtain the main required information as part of any feasibility studies.

This lack of detail and transparency is itself a constraint to progressing projects. Moving forward, it is recommended therefore, that many of the details discussed here are collated as part of the 'Sediment Management Framework (SMF) online tool' currently being developed (Box 2.2). Any such efforts to improve data collation and communication will help with project planning and feasibility studies in the future.

Project benefits including full suite of ecosystem services	Stakeholder and community opinions and advice	Aims of relevant shoreline management, dredging and nature conservation plans	Beneficiaries and funding mechanisms
Project costs (including licensing and monitoring)	Environmental effects (positive and negative) of proposed restoration	Mitigation measures that may be required	Timing and frequency of dredging operations
Volume and reliability of dredge material resource	Dredging method (existing or potential)	Physical characteristics of the dredged material and disposal site(s)	Sediment quality and compatibility of dredge material and disposal site(s)
Location of dredging and transport distance to restoration site	Navigable access to restoration site	Environmental conditions at restoration site (e.g., tidal currents, wave exposure)	Restoration site morphology and need for sediment retaining structures

Figure 2.17: Examples of factors to consider during planning and delivery of a beneficial use project.

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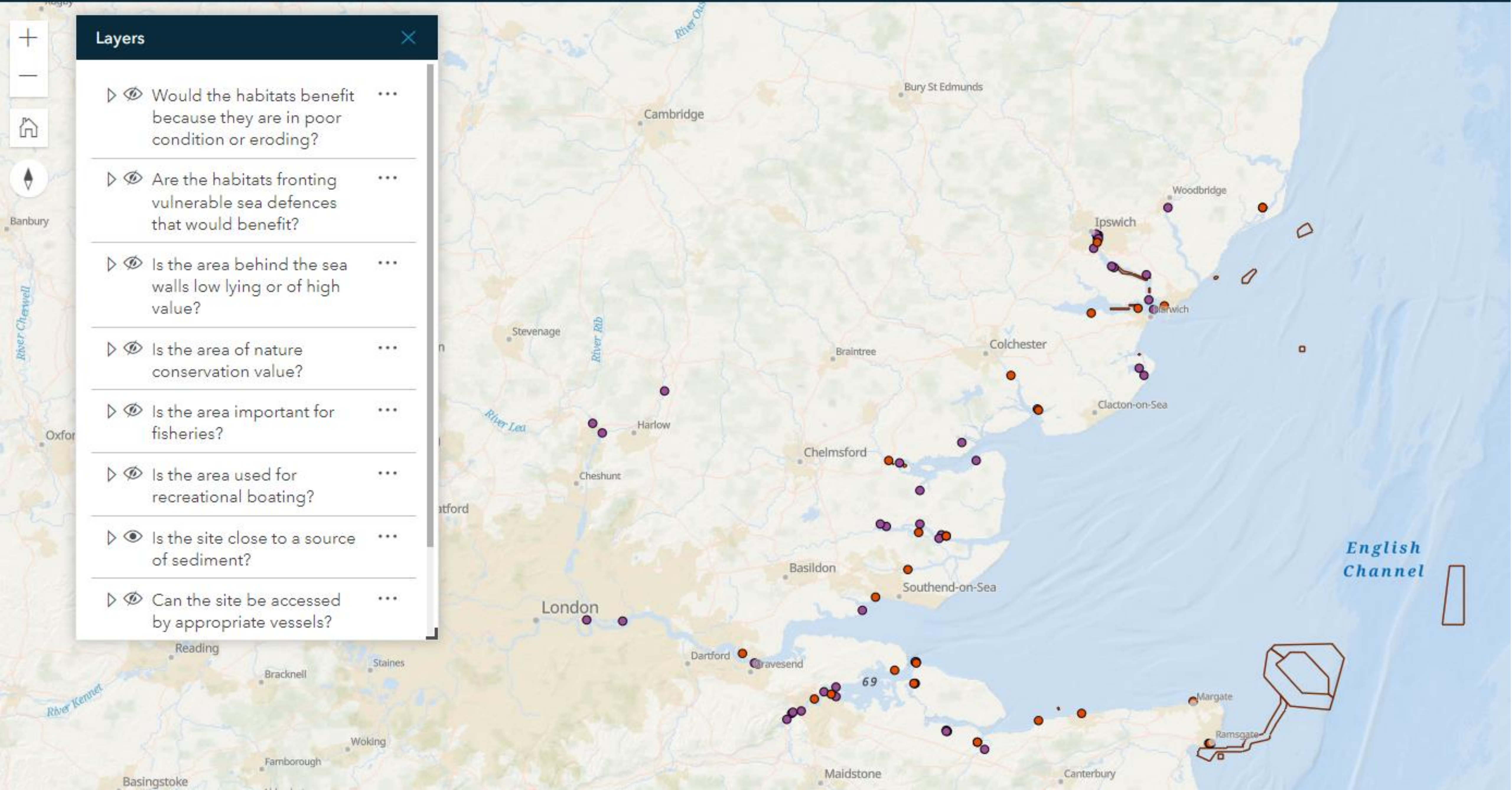
Blackwater & Colne Strategic Mapping Site

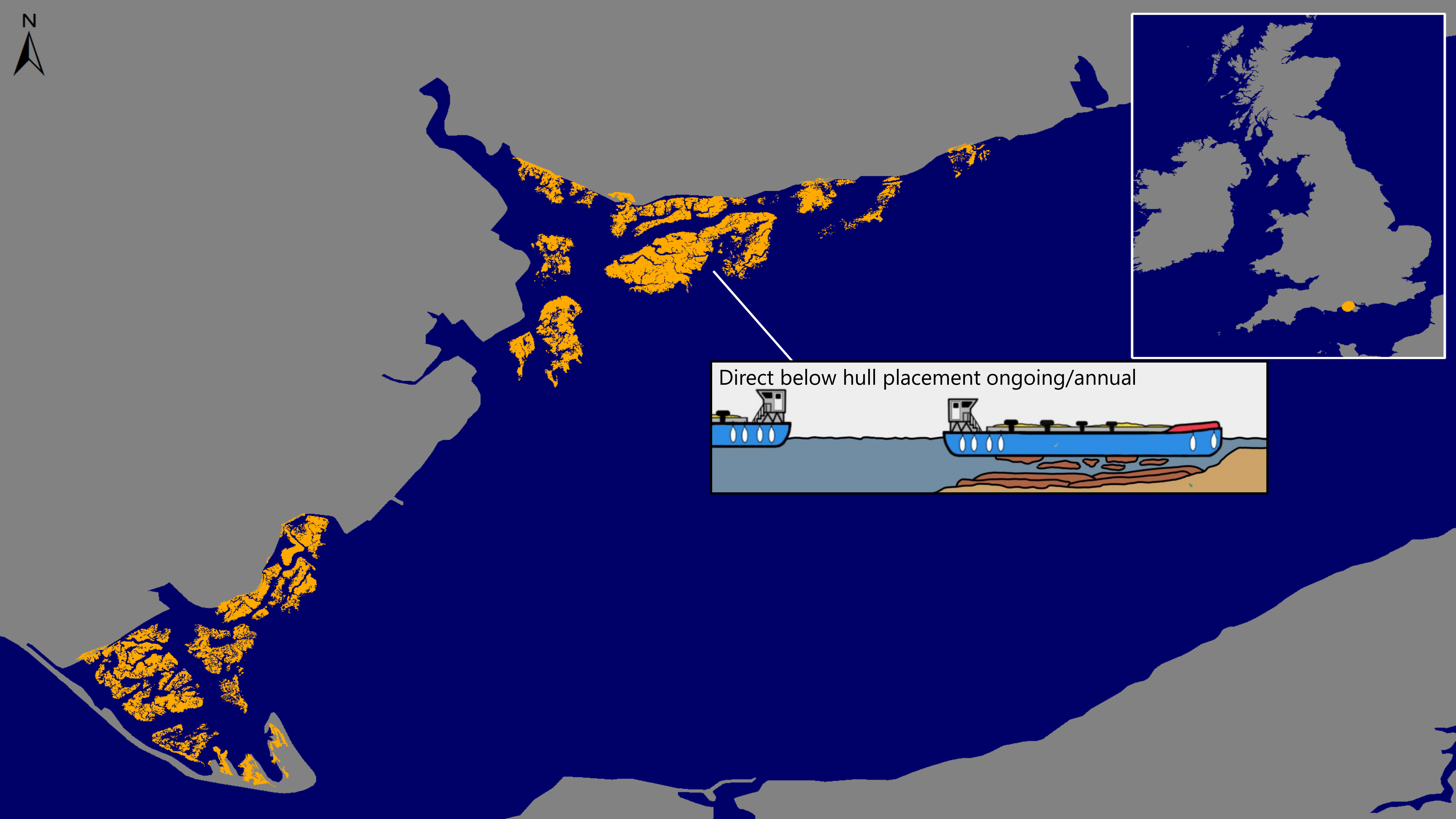
Layers

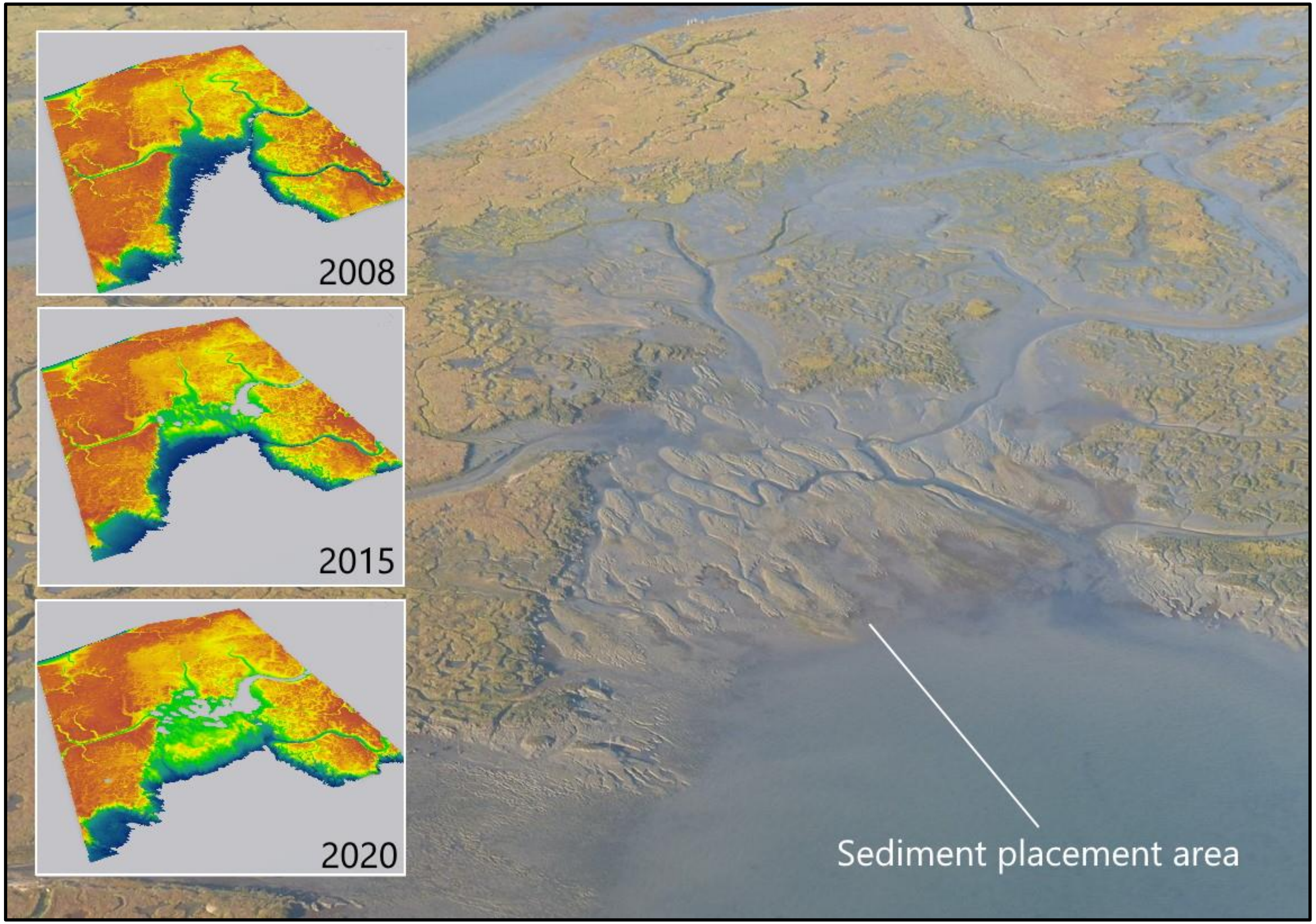
- Would the habitats benefit because they are in poor condition or eroding?
- Are the habitats fronting vulnerable sea defences that would benefit?
- Is the area behind the sea walls low lying or of high value?
- Is the area of nature conservation value?
- Is the area important for fisheries?
- Is the area used for recreational boating?
- Is the site close to a source of sediment?
- Can the site be accessed by appropriate vessels?



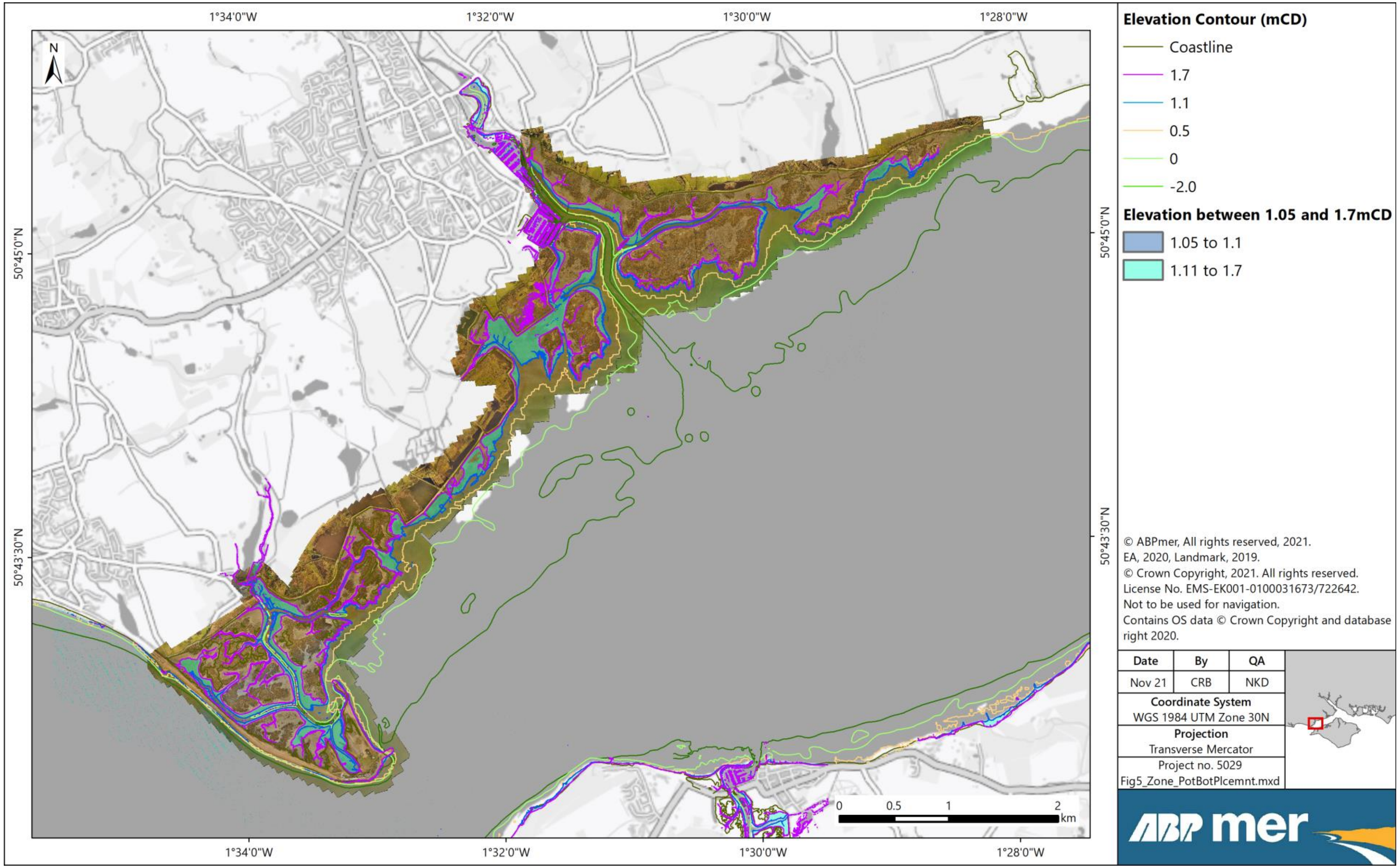
Introduction

New projects winter 2021/22
Mersea and Horsey

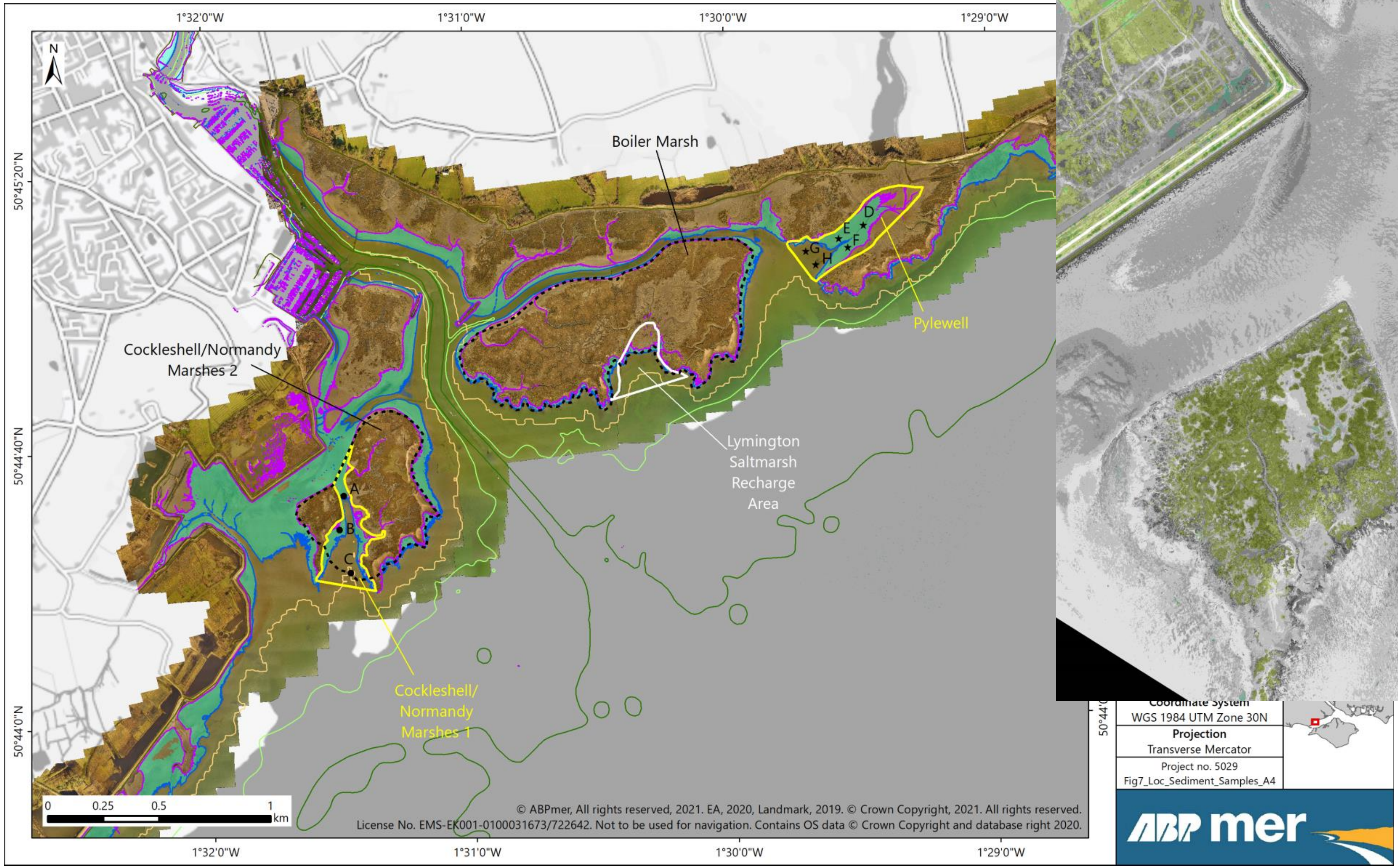

N
Direct below hull placement ongoing/annual

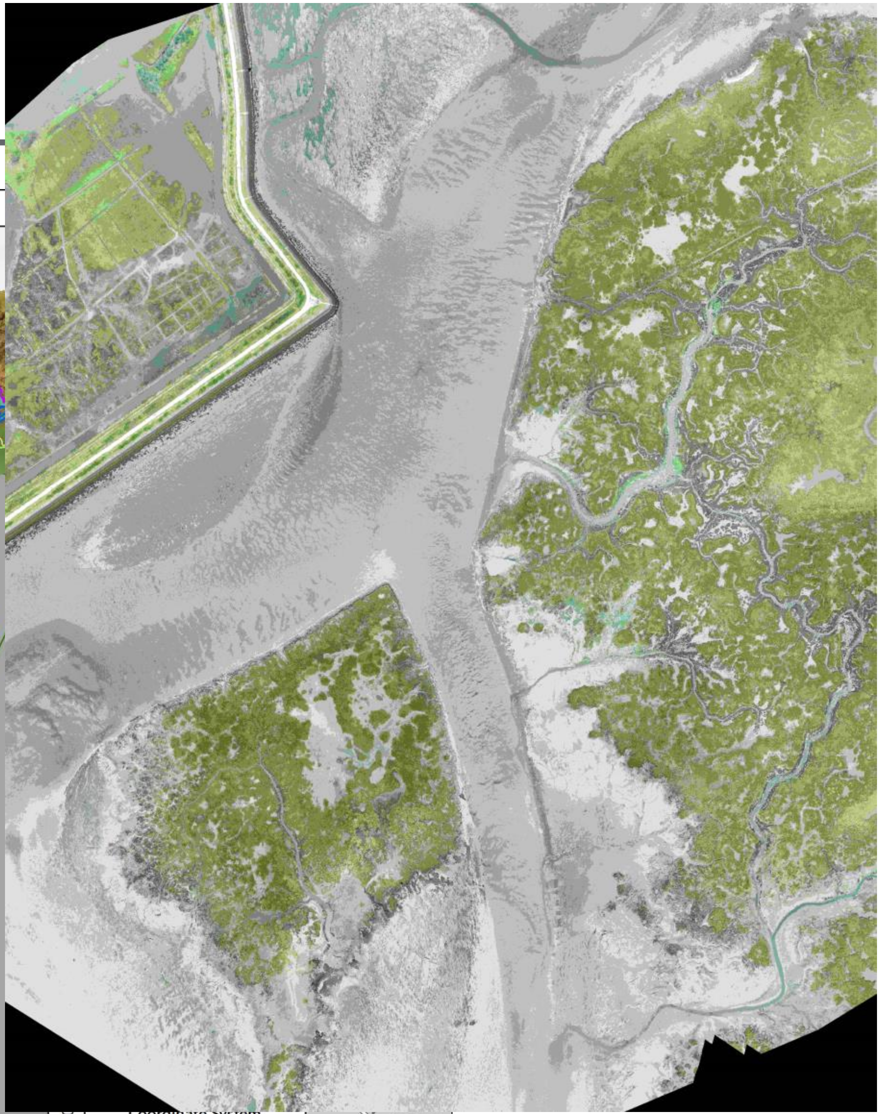

2008
2015
2020
Sediment placement area

Solent Forum BUDS Phase 3

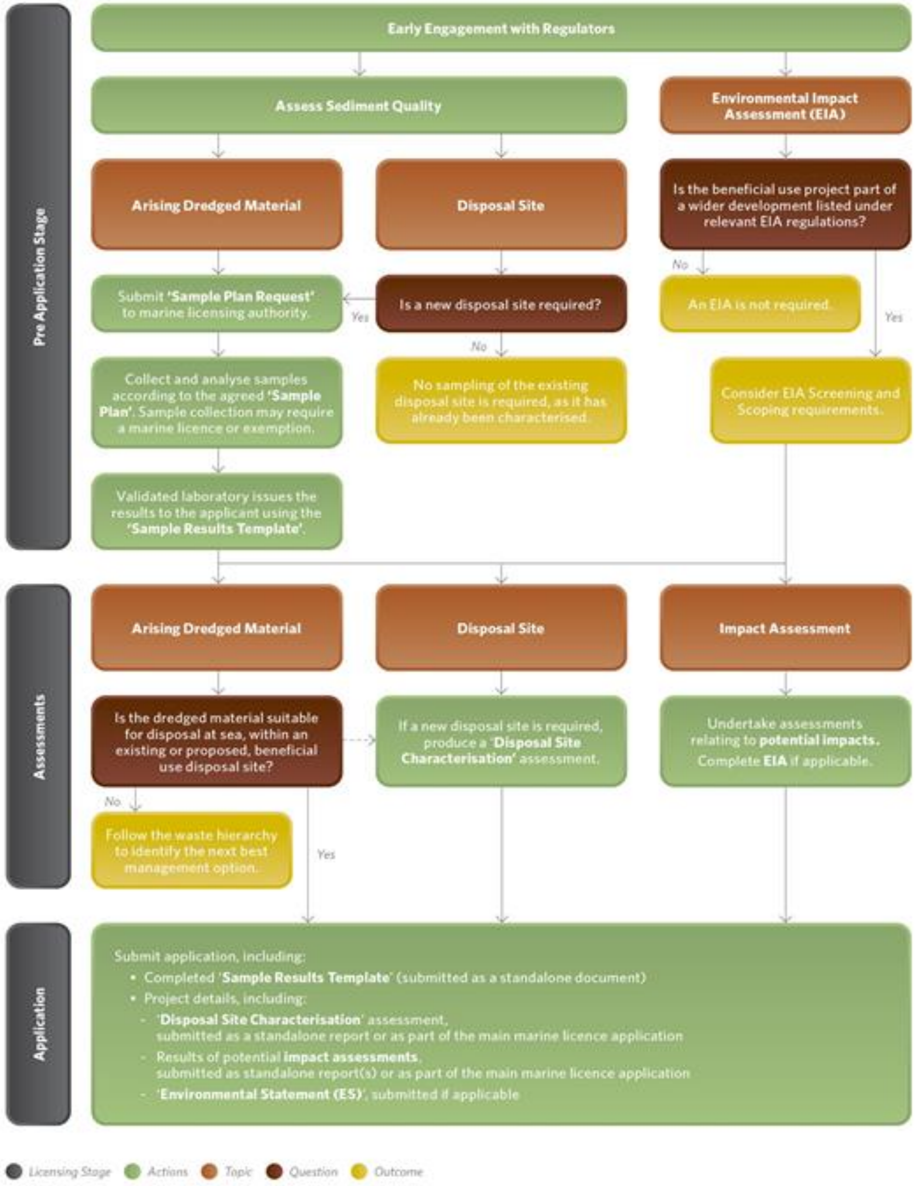


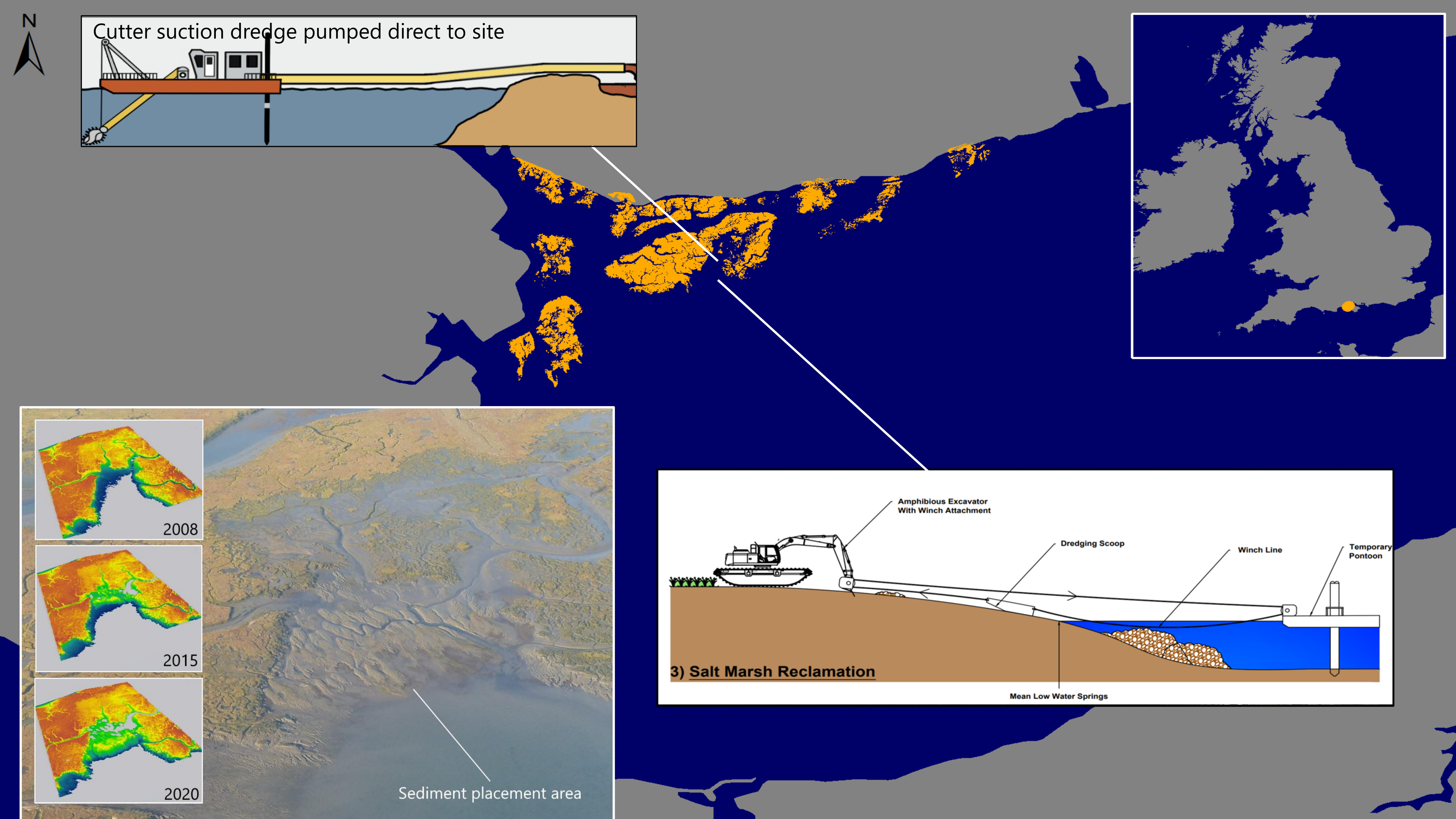
Solent Forum BUDS Phase 3





Solent Forum BUDS Phase 3




N
Cutter suction dredge pumped direct to site
Amphibious Excavator
With Winch Attachment
Dredging Scoop
Winch Line
Temporary
Pontoon
3) Salt Marsh Reclamation
Mean Low Water Springs
2008
2015
2020
Sediment placement area

Thank you for your attention

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