Marine Management Organisation

Use of beneficial dredged materials in the South Inshore and South Offshore Marine Plan Areas

September 2014

Use of Beneficial Dredged Materials in the South Inshore and South Offshore Marine Plan Areas

MMO Project No. 1073

Marine Management Organisation

Project funded by: The Marine Management Organisation

ABP mer
marine environmental research

Report prepared by: ABP Marine Environmental Research (ABPmer)

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This report should be cited as

MMO (2014). Use of Beneficial Dredged Materials in the South Inshore and South Offshore Marine Plan Areas. A report produced for the Marine Management Organisation, pp 57. MMO Project No: 1073. ISBN: 978-1-909452-31-2.

First published September 2014.

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Executive Summary

The Marine Management Organisation (MMO) is currently developing marine plans for the South Inshore and South Offshore mrine plan areas. As part of that process the South Plans Analytical Report (SPAR) was produced and consulted upon in late 2013. During the consultations, stakeholders identified the need to see dredged marine sediments more frequently used for beneficial purposes, and, if possible, to see the adoption of a strategic approach to co-ordinating their use. In response, the MMO commissioned ABP Marine Environmental Research Ltd. (ABPmer) to undertake this review.

The purpose of this study was to develop data and maps which describe the existing navigational dredging sites and the potential future opportunities for the beneficial use of dredged material in the South marine plan areas. This was done though the use of the MMO licensing Marine Consents Management System (MCMS), a review of key literature and consultation with a range of interested parties and practitioners. Based on the information received, mapped databases were produced and recommendations were provided about how to strategically co-ordinate the use of dredged material in the South marine plan areas. The information gathered and presented here is designed to help the MMO with developing marine plans that promote an integrated approach to the sustainable management of the South marine plan areas.

In the South marine plans areas there have already been a number of valuable completed projects and there are aspirations for more in the future. However, there is no clear drive towards realising these projects, which have to overcome a wide range of constraints, including timing of dredging and alternative use, compatibility of material, uncertainties relating to environmental impacts and issues associated with funding.

In order for more beneficial use projects to occur in the future, there is a need for more strategic oversight. There is also a need for communication mechanisms to facilitate linkages between those that are undertaking dredging work and those that need such materials for beneficial projects. The South marine plans offer a good opportunity to address many of the constraints and provide the clarity of guidance that is needed. As a starting point to this process, this MMO mapping project represents a very valuable way to begin linking potential sediment sources to potential locations of need. In addition, a range of associated strategic initiatives and solutions are needed and have been identified.

1. Introduction

1.1 Report background

The Marine Management Organisation (MMO) is currently in the process of developing the marine plans for the South Inshore and South Offshore marine plan areas. The South Inshore area encompasses the coastline stretching between Folkestone (Kent) to the River Dart (Devon) (see Figure 1). These areas are the third and fourth areas in England to be selected for marine planning, following on from the East Inshore and East Offshore areas[1].

The Government's high level marine objectives (Defra, 2009) which are reflected in the UK Marine Policy Statement (MPS) (HM Government, 2011) outline the vision for achieving sustainable development in the marine environment. The MPS facilitates and supports the production of marine plans and the MMO is writing marine plans for English waters with input from stakeholders. Marine plans present a vision for an area with objectives based on that vision and policies that are designed to achieve these objectives and achieve integrated management of marine resources. Partnership working among authorities will use the strategic overview outlined in the marine plan to co-ordinate management and achieve sustainable use.

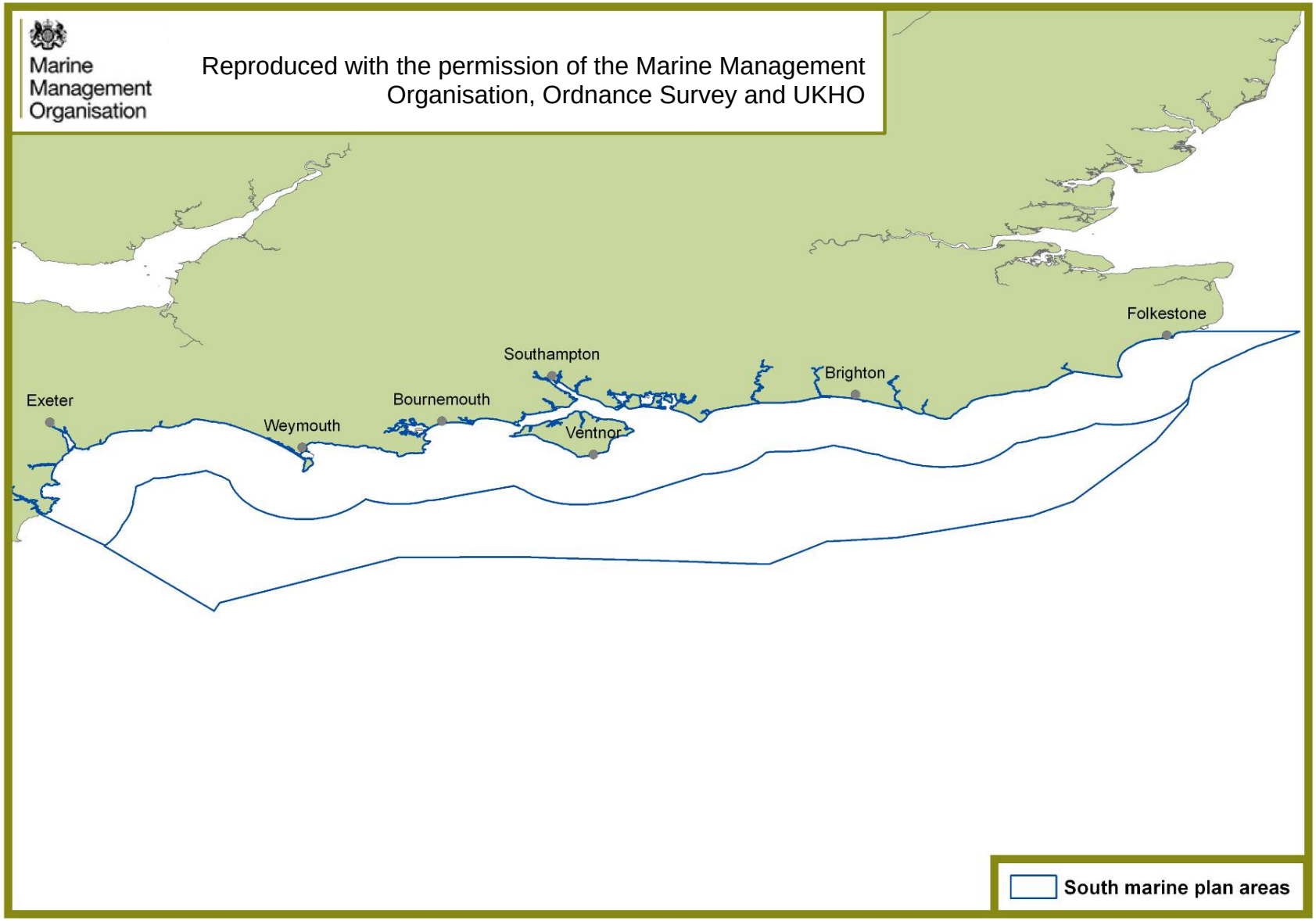
One key sustainable use practice in the marine environment involves the co-ordinated and beneficial re-use of sediments derived from navigational dredging. During consultations that were held in early stages of the development of the South marine plans (i.e. following circulation of the South Plans Analytical Report (SPAR) in September 2013 (MMO 2013a)) some stakeholders said that they would like to see dredged marine sediments beneficially re-used, and, if possible, to see the adoption of a strategic approach to co-ordinating the use of dredged materials.

This increasing desire amongst stakeholders and regulators is likely to have arisen, in part, because of the success of major beach replenishment projects such as those works at Bournemouth and also recent projects which demonstrate the effectiveness of using dredge arisings for habitat protection (e.g. in Lymington). It may also have been prompted by the challenges that have been observed with identifying beneficial use sites for major dredging projects such as the ABP Southampton Water Channel Deepening project.

In response, MMO has commissioned ABP Marine Environmental Research Ltd. (ABPmer) to review the use of beneficial dredged materials in the South Inshore and South Offshore marine plan areas. The scope and objectives of this work are summarised in the following section.

[1] For further information, please refer to the MMO website http://www.marinemanagement.org.uk/marineplanning/areas/index.htm

Figure 1: South Inshore and Offshore marine plan areas



1.2 Project objectives

The purpose of this study was to collate data and develop maps which describe the existing navigational dredging sites and the potential future opportunities for the beneficial use of dredged material in the South marine plan areas. For the purposes of this project beneficial use covers habitat creation, replenishment, coastal defence and subtidal disposal in estuaries. The information gathered about beneficial use is also designed to help MMO with developing marine plans that promote an integrated approach to the sustainable management of the South marine plan areas. In summary, therefore there are three core objectives for this project:

- **Objective 1**: Mapping existing sites of dredging activity (maintenance and capital)[2] and sites where dredged material has been used beneficially within the South Inshore and Offshore marine plan areas.

- **Objective 2**: Mapping potential future sites for dredging activity and where the material could be used/is needed in the future for beneficial use.

- **Objective 3:** Providing recommendations about how to strategically co-ordinate the use of dredged materials in the South marine plan areas. Including a review of barriers and challenges to the existing process and opportunities for improvements.

[2] For MMO definitions of maintenance and capital dredging please refer to https://www.gov.uk/apply-to-dredge-and-extract-aggregates

2. Project Approach

To address the three core objectives, a series of five iterative tasks were undertaken, and are described in Sections 2.1 to 2.5. These involved two distinct mapping tasks, a literature review, stakeholder surveys and the development of recommendations. A steering group consisting of representatives from the Environment Agency, The Crown Estate, Natural England and MMO was established to guide the work.

2.1 Task 1: Mapping known dredging and beneficial use sites

To achieve Objective 1 of this project (i.e. mapping existing dredging and beneficial use sites), an initial GIS mapping exercise was undertaken using MMO provided data files. Only data from 2011 onwards was considered, as that was the year in which the MMO licencing scheme started recording data in its current form. The MMO public register was consulted to obtain volume and dredged material type information.

A number of beneficial use sites from the period prior to 2011 were also identified and mapped using insights from the literature and stakeholder consultation processes that are described below.

Maps showing this spatial information are displayed in Section 4.1.

2.2 Task 2: Survey of stakeholders

To develop the database and maps for this project, a questionnaire-based survey of relevant industry, local authorities and government organisations was undertaken to inform Objectives 2 and 3 of this project, and to a limited extent, Objective 1. The main aims were to:

- Gain spatial information on previous and planned beneficial use projects, possible locations for future beneficial use, and planned future capital and maintenance dredging undertakings
- Obtain qualitative information on ‘lessons learned’ from past and future beneficial use projects (implemented or failed), as well as opinions regarding the possible future strategic co-ordination of beneficial use, and the role MMO could play in this.

Dedicated online questionnaire surveys were developed for three distinct stakeholder groups and a total of 44 interested parties were contacted which included:

- 15 Ports and Marinas targeting the main ports only and aiming to account for approximately 90% of the dredged material (capital and maintenance), and those harbours/marinas previously involved in beneficial use projects.
- 22 Local Authorities excluding those with relatively short and mainly estuarine shorelines.
- 7 Government Organisations and other relevant interested parties.

The results of this stakeholder survey are summarised in Annex 1, and the main insights discussed in Section 5.

2.3 Task 3: Literature review

In order to identify potential future dredging sites and beneficial use locations, a literature review of key strategic documents was undertaken.

To identify potential beach nourishment beneficial use sites the following documents were reviewed:

- The six Shoreline Management Plans (SMPs) covering the coastline along the length of the South marine plan areas[3]. Those sub-sections of coastline whereby 'beach nourishment' is listed as a potential management option were collated (excluding beach re-cycling and re-profiling projects).
- Publicly available Beach Management Plans (BMPs).

To identify potential intertidal recharge sites the following documents were reviewed. The assessments of Sites of Special Scientific Interest (SSSIs) in the South marine plan areas. Those sections of littoral and supralittoral sediment habitats whose condition is considered unfavourable due to coastal squeeze/erosion were collated, as these could presumably benefit from intertidal recharge in the future. Other relevant documents were also consulted; most notably the various studies produced for the Solent region including the Channel Coastal Observatory (CCO) Solent Dynamic Coast Study (CCO, 2008); the 'Biodiversity Requires Adaptation in Northwest Europe under a Changing Climate' (BRANCH) study[4]; and The Solent Coastal Habitat Management Plan (Bray and Cottle, 2003).

To further identify potential future capital and maintenance dredging locations, a review was undertaken of the Port Master Plans for major ports and harbours in the South marine plan areas.

Finally, to inform the recommendations for this project, a general literature search on beneficial use was undertaken.

2.4 Task 4: Mapping potential future dredging and beneficial use sites

Using the spatial information supplied by respondents to the survey, as well as that obtained through the document review, potential future maintenance and capital dredging sites, as well as beneficial use sites were mapped. These maps are displayed in Section 4.2.

Table 1 below lists the attributes of the six spatial data sets which were created as part of this project.

[3] These are (East to West): South Foreland to Beachy Head; Beachy Head to Selsey Bill; Selsey Bill to Hurst Spit (North Solent Shoreline); Isle of Wight; Hurst Spit to Durlston Head; and Durlston Head to Rame Head.

[4] http://www.greeninfrastructurenw.co.uk/climatechange/doc.php?docID=167

Table 1: The spatial data created as part of this project.

Database Name	Feature class	Source	Attribute Fields
Licensed Beneficial Use 2011 Onwards	Polygon (area)	MMO provided data; MMO public register.	As per MMO provided data, plus notes and beneficial use type
Licensed Dredging 2011 Onwards	Polygon (area)	MMO provided data, MMO public register.	As per MMO provided data; plus total and annual volumes and material.
Historic Beneficial Use Pre 2011	Point	Stakeholder survey, literature review, ABPmer database.	Description, location, volumes, material, type of beneficial use, source
Planned (non-licensed) Beneficial Use Projects	Point	Stakeholder survey	Description, location, volumes, material, type, source
Planned (non-licensed) Dredging Campaigns	Point	Stakeholder survey	Description, location, frequency, volumes, methods, material, source
Potential Future Beneficial Use Locations	Polygon (area)	SSSI condition review, SMPs, Solent Dynamic Coast Project	Material, source, site, unit ID (if applicable)

2.5 Task 5: Development of recommendations

This task involved developing high level guidance to highlight challenges, opportunities at the marine plan level. It was informed by the insights gained from the survey, but also from literature, the project steering group, discussions with stakeholders and expert judgement. These recommendations, which focus on the marine plan level, are outlined in Section 5.

3. Background to Beneficial Use Options

For the purpose of this study, a beneficial use project is understood to include any project where materials are derived from either maintenance or capital navigation dredging and are used for beneficial activities. These activities may include marine land-claim, beach replenishment, coastal defence works, intertidal recharge, subtidal (in-estuary) deposition/placement but exclude disposal at licensed sites at sea.

This section provides a context for the review of the beneficial use options and opportunities in the South marine plan areas.

3.1 Reasons for undertaking beneficial use projects

The practice of re-using capital or maintenance dredged material is recognised as being highly desirable for a range of environmental, economic and social reasons.

Negative effects (or impacts) which can be ameliorated or avoided include reducing the need to seek material from primary aggregates sources (whether they are on land or at sea) or reducing the need to dispose of excavated materials at marine disposal sites.

The environmental benefits of the use of dredged material can arise from the provision or protection of features which have important functions (e.g. for flood protection, ecology or amenity). There are also cost savings which can often be incurred as a result of beneficial use projects, as indicated within this project's survey responses (see Table A1.6 in Annex 1) and by the Construction Industry Research and Information Association (CIRIA, 2010), especially where a dredging location and a suitable beneficial use site are in relative proximity.

Drawing upon information contained within the literature as well as past project experience and the results of the questionnaire survey that was circulated to key parties for this study, the value of using dredged sediments can be summarised as follows (in no particular order):

- They provide fill material in land-claim projects which can avoid the need to use primary aggregate sources.
- They provide beach replenishment material that can be used as flood protection and again avoids the need for using aggregates from licensed sources.
- They can be placed in a manner which ensures that sediment is retained within an estuarine/coastal system and not lost thus providing benefits in terms of prolonging habitat sustainability and improving flood protection within that area.
- They can be used to protect and restore designated and deteriorating habitats (especially saltmarsh, but also mudflat), which also provide flood protection benefits.
- Additional benefits and ecosystem services identified in the survey responses include:

- Provision and protection of features with amenity value (i.e. beaches, footpaths and sheltered embayments)
- Improvement of the aesthetics of the environment especially in eroding systems
- Protection of mooring facilities and marinas
- Reduction in traffic impacts through sea transport of materials
- Providing a way of involving, educating and engaging communities in the management of their coastlines.

The degree and longevity of these benefits varies between projects depending upon their scale and frequency. Small-scale or temporary projects can offer short or medium term gains. An example of this are two recent silt recharge projects in the Lymington Estuary which have helped delay ongoing saltmarsh erosion. Longer-term gains can come from larger initiatives and those that use a mix of techniques. One good example of this is work at Horsey Island[5] which involved the placement of 200,000m^3 dredged silt (from Harwich Haven ports) behind a previously placed sand/shingle ridge and Thames lighter barges to regenerate a damaged saltmarsh. Given the pressures facing our coast, the beneficial re-use of material and coastal adaptation will be needed to help to manage the long-term changes to our coastline.

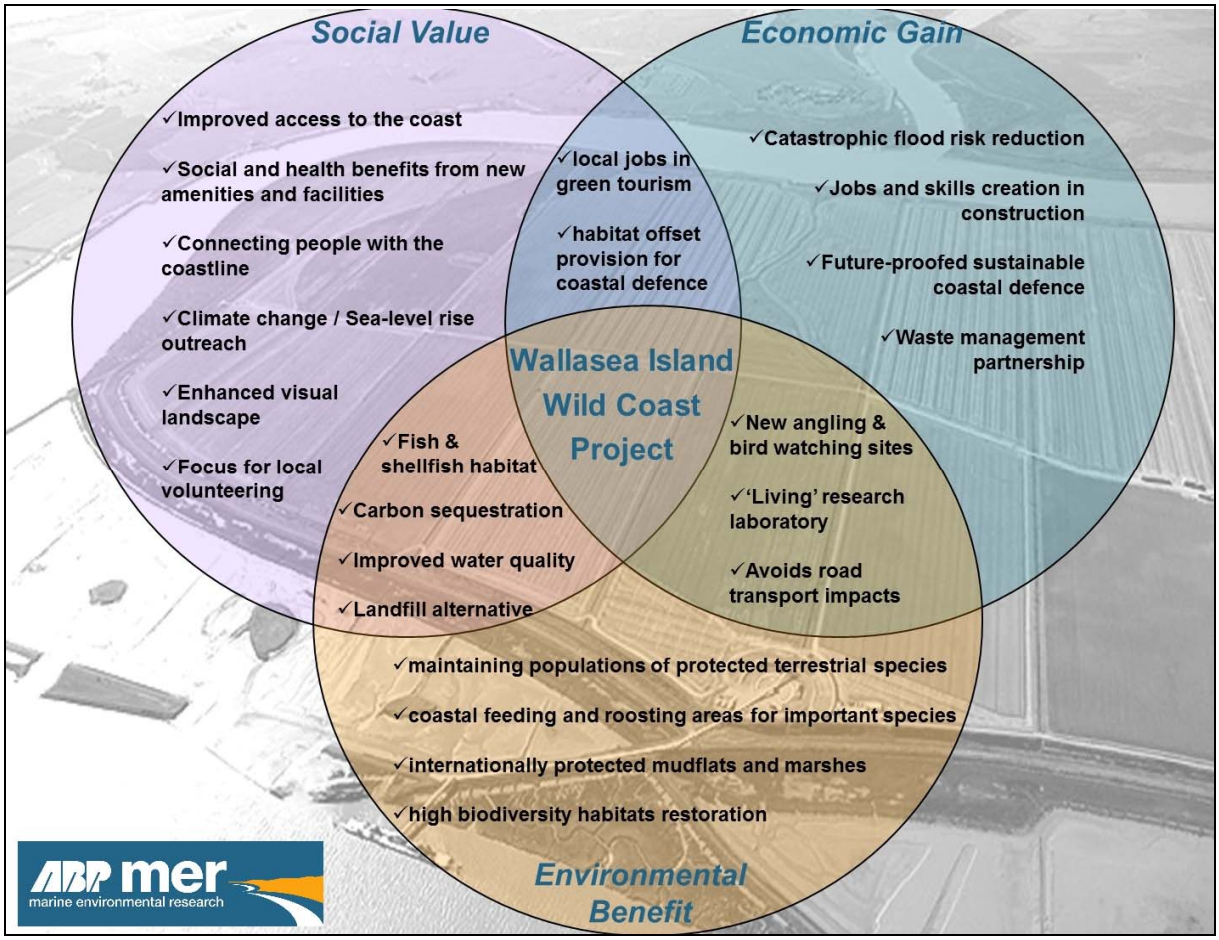
Longer-term gains can also come from repetition such as the work that is being carried out to sustain the beaches at Bournemouth using arisings from Poole Harbour or the regular subtidal deposition of sediments at Brownsea Roads in Poole Harbour to retain sediments within the system (see Section 4.1.2 for details). Even projects which might in themselves be small in scale but involve repeated year-on-year applications can promote long-term gains. These include the regular placement of around 2,000 to 3,000m^3 sediment at Maldon which has resulted in the stability and growth of saltmarshes (for example, Nottage and Robertson, 2005).

When dredging and recharge areas are in close proximity dredged sediment is often the same, or very similar, which is a benefit. This point was made within the CIRIA (2010) beach management guidance and within the survey responses for this review (Table A1.6, Annex 1).

Image 1 illustrates the type of sustainable development gains that may be provided using the large-scale Wallasea Island Wild Coast scheme. This site is not a typical marine beneficial use scheme. This is because of its scale (>700ha) and the fact that it involves land-forming with terrestrially-derived materials in advance of a managed breach. Indeed use of land material for a future marine habitat creation makes it a unique project in this country. However, many, if not all, of the benefits illustrated in Image 1 can be applied to marine beneficial use activities especially when undertaken at a large ‘flagship’ scale. It also recognises that additional social, educational and cultural gains can accrue from having a major project which includes an element of active engagement with local communities.

[5] http://ec.europa.eu/ourcoast/download.cfm?fileID=765

Image 1: Sustainable development benefits of Wallasea Island Wild Coast Scheme.



As well as recognising the benefits of such projects, it is important to note that they can also have adverse environmental impacts, which need to be carefully considered and assessed.

This is particularly relevant in designated estuaries and with respect to protected species. For example, in the South marine plan areas, a big issue for beneficial use projects in estuaries (e.g. Southampton Water) has been concerns over the potential impacts of temporarily increased suspended sediment concentrations on water quality, fish interests (particularly migratory salmonids) and achievement of Water Framework Directive thresholds. Also, the equipment used to discharge dredged materials can cause temporary damage to existing habitats. Such initial (potentially negative) impacts need to be considered against the longer term benefits of a given project and it is recognised that projects such as Horsey Island (Essex) have also been actively pursued as a conservation management measure for a designated site.

3.2 Background to beneficial use in South marine plan areas - national context

In total, there are 47 ports and harbours located within the South marine plan areas, including the major ports of Southampton, Portsmouth and Poole and many notable others. Occasional capital dredging and frequent maintenance dredging is undertaken in these ports, as well as in the many marinas and harbours along the south coast. For example, the capital dredging projects which are planned for the Port of Southampton alone over the next few years will involve the dredging of an estimated 12.2 million m^3 of dredged material (MMO, 2013b). Further details on actually planned and undertaken dredging campaigns are presented in Section 4.

The majority of the material dredged during capital and maintenance dredging campaigns in the South marine plan areas is currently disposed of at one of the 23 active marine disposal sites located in the Plan areas, most of which are at sea (MMO, 2013b) (Section 3.3.3 for a list of in-estuary disposal sites). Future dredging requirements are expected to increase as vessels become progressively bigger, and ports, harbours and marinas in general are seeking to expand (MMO, 2013b). It is also likely to change in response to climate change effects such as sea level rise and increased storm frequency.

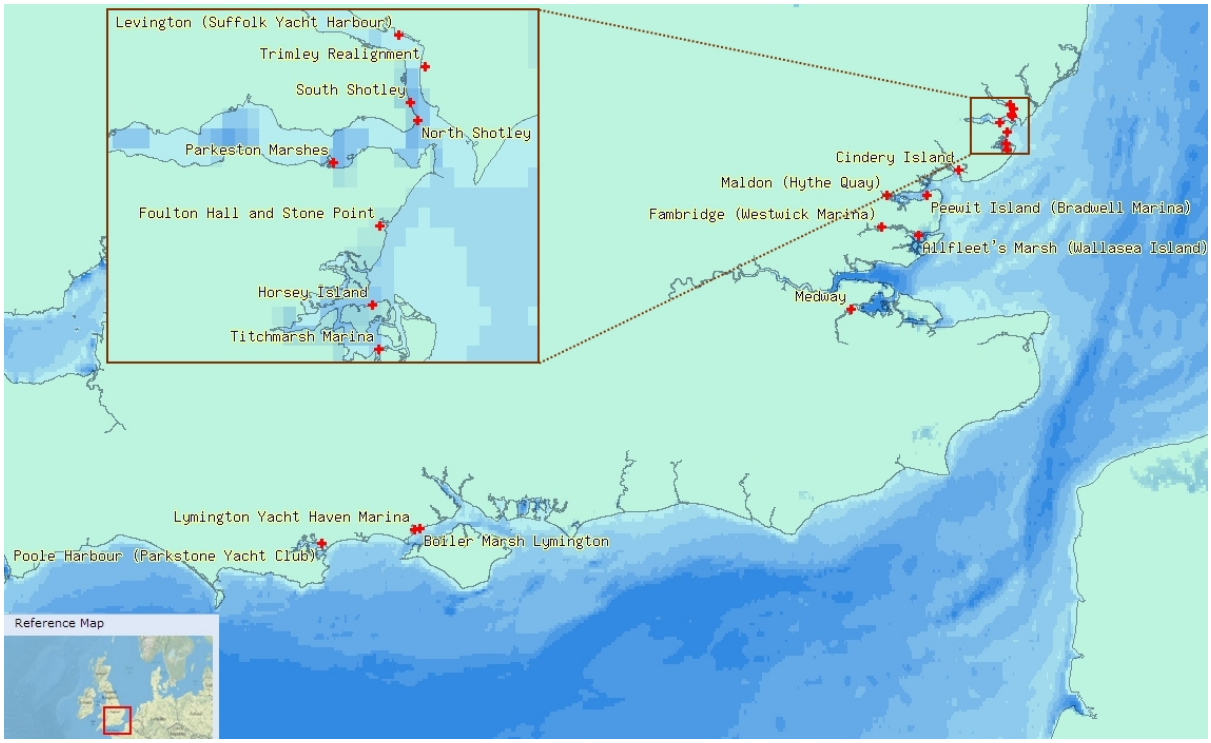
At the same time, there are also many areas of ongoing beach, intertidal mudflat and marsh erosion which are occurring for a range of either natural or anthropogenic reasons. These are often believed to partly be a function of limitations in sediment supply in relation to the changing hydrodynamic and wave conditions exacerbated by sea level rise and other climate change effects. Notwithstanding this erosion and the potential value of using dredged sediments to ameliorate such effects, very small percentages of the materials dredged during port, harbour and marina capital and maintenance dredging projects are currently used in a beneficial manner.

Within the South marine plan areas, a number of individual beneficial use projects have been undertaken in the past (see Section 4.1). For the most part these are projects which have involved the use of sand and gravel for the purposes of beach nourishment or coastal protection. These include the beach nourishment work at Bournemouth and Swanage using sand dredged from Poole Harbour.

By contrast fewer projects have involved the use of finer ‘silty’ materials for coastal habitat creation and protection. These have included some early small-scale trials in Southampton Water and Chichester Harbour as well as three larger projects in Poole Harbour and Lymington Estuary.

The relatively low number of projects that have involved the use of silt is also observed across the rest of the UK. ABPmer has developed a database on coastal habitat creation work which shows that only approximately 17 such projects have been undertaken nationally. These have been mainly in Essex and Suffolk as shown in Image 2.

Image 2: Location of habitat protection/creation beneficial use projects using silt in the UK (Source: ABPmer WebVision database).



By contrast it is notable that over 60 managed realignment projects have been undertaken nationally to create and restore coastal marine habitats[6]. Two of these projects (Allfleet's Marsh on Wallasea Island (see Image 3) and Trimley Marsh in Essex and Suffolk respectively) included the beneficial use of sediment as land forming materials prior to breaching the sea walls.

The more frequent use of coarser sediment for beneficial use such as beach nourishment and flood protection reflects the fact that there is often a clearer rationale for their application in relevant beach nourishment and flood protection projects. Therefore, there is a greater consensus on the reasons and imperatives for using such materials. By contrast, the relatively low number of projects using silt typically reflects the fact that there can be greater concerns about the environmental effects of using such sediments. There can also be less clarity about the net benefits and, therefore, more difficulties with securing the necessary consensus, permissions and funds.

In general though, the principles of beneficial use are well recognised and such work has been undertaken at a wide range of locations and using a wide range of techniques and materials in the UK and Europe. Alongside the practical experience, a lot of research and monitoring work has also been undertaken, or is underway, to understand the methods, effects and benefits of such schemes.

[6] This is based on the online database of managed realignment and regulated tidal exchange site that ABPmer has developed and keeps maintained (www.abpmer.net/omreg).

This research work includes projects such as the Cefas DECODE (Determination of the Ecological Consequences of Dredged Material Emplacement) project which considered the ecological effects of beneficial use. It also includes the ongoing CEAMaS (Civil Engineering Applications for Marine Sediments) project in which partners from Belgium, France, Ireland and the Netherlands are working together to address many issues related to the management and use of marine sediments.

As a result, there is a knowledge base which provides evidence for, and confidence in, this approach and its value (whether this is as a method for land claim, habitat protection, flood protection or for other benefits). This evidence has enabled several important and major beneficial use projects to be undertaken. This includes, as just one example, a set of sediment placement initiatives at Horsey Island in Essex (in 1998 and 2005) which employed a mix of different materials and techniques to achieve flood protection and habitat protection enhancements.

Image 3: Large-scale (550,000m^3) beneficial use of dredged silt for pre-breach land-forming at Allfleet's Marsh on Wallasea Island (taken by Defra).

More recently, this evidence base has also led to some very large-scale flagship projects in the UK and Europe. These include the RSPB's Wallasea Island Wild Coast project in Essex and the 'sand engine' experiment in the southern Netherlands. The latter 'sand engine' project is a 128 hectare area of sand that was placed, in 2011, along a narrow section of shore near Amsterdam (Stive *et al.*, 2013). This sand is 'sacrificial' in nature and is expected to integrate into the coastal transport pathways.

The net benefits that are provided by such projects are also being increasingly well recognised. This includes the social, economic and ecological benefits (Section 3.1). For example, within the South marine plan areas, the two recent projects at Lymington (undertaken in 2012 and 2013; Section 4.1.2) which act as mitigation for offsetting actual or potential developmental effects, highlight how this work can be inherently beneficial as a tool for coastal habitat protection and management.

As a result of such work, many aspects associated with the technical implementation, environmental effects and potential values associated with beneficial use are well understood. It is however also the case that the results from individual projects can be poorly reported when there is no official and ongoing mechanism for collating and issuing the results and reports.

3.3 Beneficial use techniques

There are a large number of different ways in which sediments can be beneficially used. Their use will depend upon aspects such as sediment grain size and volumes of the dredge arising and the relative location and needs of the potential receptor site.

In simple terms coarser sediments (sand and gravel) can be used for coastal protection and beach nourishment while finer silt can be used for habitat enhancement and protection. However, there are also examples of projects which have employed a mix of different sediment types.

It is therefore important that a use of sediments is judged according to needs, in the light of past experiences, and with reference to the full range of benefits that can accrue as well as the full list of beneficiaries. A general summary of the types of beneficial use that exist is presented below based on existing literature and feedback from consultees during this study. The following categories of re-use are reviewed and have formed the basis of the database and mapping work that has been undertaken:

- Beach nourishment.
- Intertidal recharge.
- Subtidal deposition.
- Temporary disposal at sea for later re-use.
- Re-use for land claim/land raising purposes (e.g. port developments).

3.3.1 Beach nourishment

Beach nourishment (also known as beach recharging) involves the importing of sand or gravel onto beaches to compensate for losses due to erosion (see, for example, CIRIA, 2010). If the source of material is derived from navigational dredging, then it is considered to be a beneficial use project for the purpose of this study.

The imported material may be placed on any position of the beach profile, from the subtidal to the non-tidal, and can be placed using various techniques, depending on factors such as grain size, volumes, source of materials and renourishment aims. Hydraulic methods would generally be used for marine based sources, including re-use of navigational dredged materials (CIRIA, 2010). Sand or shingle can be:

- Pumped via a pipeline from the source area to the site (only where the source area is close to the recharge site).
- Transported by hopper between the extraction area and the beach, and then
    - Pumped ashore through a pipeline (sinker or floating).
    - Directly discharged onto the beach by spraying from the bow of the vessel ('rainbowing').
    - Discharged onto the lower beach at high water via barges, including side dumper, flat top and split barges (following discharge from original dredging vessel).

Bulldozers are then generally used on the beach to redistribute sediment and produce the desired beach profile. The method of placing the recharge, including transport distances, often has the largest bearing on project cost (CIRIA, 2010).

The nourishment material should generally be as similar as possible to the indigenous sediment – regarding sediment size, grading and shell content. However, the grading is generally unlikely to be a perfect match, and inevitably, there has to be a compromise between availability, cost and performance.

Nourishment campaigns are typically undertaken on a regular basis, thus it is reasonable to assume that a beach which has been re-nourished in the past may need to be re-nourished again in the future (CIRIA, 2010). The purpose of renourishment can be for both coastal defence (i.e. wider and/or higher beach) and improved amenity, or both. In the South marine plan areas the inter-relationship between dredging work in Poole Harbour and the regular nourishment of the Bournemouth or Swanage beaches are prime examples of this technique.

During the course of this study, it was also apparent that some stakeholders view certain techniques as beneficial use for renourishment which is not appropriate. This includes:

- The recycling of beach materials (i.e. the shifting of beach materials from an area of accretion to an area of erosion).
- The use of licensed marine aggregates for beach nourishment.

Where encountered during the stakeholder communication or mapping exercises, such projects were excluded from the spatial information produced for this study. However in future it would be more comprehensive to include this information as beneficial use.

3.3.2 Intertidal recharge

Intertidal recharge is a process by which dredged sediments are placed over or around intertidal mudflats and saltmarshes to either create or restore them or to protect them from ongoing erosion (Nottage and Robertson, 2005; Cefas, 2009; Defra and Environment Agency, 2007). This approach is especially valuable for protecting habitats that are perhaps sediment starved and where the introduction of dredge arisings will allow the habitat to cope with, or respond to, sea level rise. Intertidal habitats also fulfil a flood risk management function, as they are very

effective at dissipating or absorbing wave and tidal energy (e.g. Möller and Spencer, 2006).

Such projects can differ greatly in scale (i.e. the area of deposition or the volume of sediment used), and on the basis of the number and type of structures, if any, that might be put in place to retain sediments once they are deposited (Colenutt, 2001). Materials are generally pumped onto the intertidal area using pipelines. In the South marine plan areas two recent projects have been undertaken at Lymington by the Lymington Harbour Commission and Wightlink Ltd. (see for example Image 4).

Image 4: Wightlink Ltd. Recharge at Lymington (in March 2013) (taken by ABPmer).

The ethos for intertidal recharge projects is usually that the sediments are allowed to integrate benignly into the local environment with the whole process viewed very much as a 'sacrificial' one. In other words, the expectation is that the deposited sediment will eventually dissipate over time and contribute to the local sediment supply. While dissipation is likely to occur at varying rates depending upon the local conditions and the type and volume of the sediment deposited, the recharge materials often stay at the site of deposition for months or years and can also be topped up during regular maintenance dredging campaigns.

Most schemes use fine sediment from the navigational dredging of ports and harbours and, in so doing, provide a ‘beneficial’ use for this material. However other sediment sources have also been considered (e.g. terrestrial materials used for the Wallasea Island Wild Coast habitat creation project). Typically this kind of work is undertaken as mitigation (as opposed to compensation) for port activities and 17 such schemes have been undertaken in the UK to date.

3.3.3 Subtidal deposition

In many estuaries in the UK, fine materials dredged during maintenance and capital dredging campaigns are deposited in a subtidal location within the same estuary. The hypothesis behind this sediment retention approach is that there is a net balance between the amount of material being deposited and eroded in many tidal estuaries. Such a balance may be disturbed when an estuary is dredged, and continuous permanent removal of materials could eventually lead to erosion of intertidal habitats (Cefas, 2009). The placement of materials in shallow subtidal

areas can help to reduce the levels of wave exposure experienced by adjacent habitats and can contribute feeding sediments over the habitats as they are allowed to erode. Some notable national examples include the Humber estuary, the Stour and Orwell estuaries, the Dee Estuary and Poole Harbour. This technique has often been used to ensure that there is no net loss of sediments from a system following port developments or capital dredging.

Such placement can either be at an agreed within-estuary disposal site, or a beneficial use trickle charge site. The distinction between these is that the former is typically a subtidal location (from where the deposited sediment are naturally dispersed but retained within the system) while the latter is more targeted and designed such that some sediments can sweep up into adjacent intertidal areas.

Trickle charge sites can sometimes take place in the very low intertidal; but it is distinctly different from 'intertidal recharge' described in Section 3.3.2 in that sediment is not trapped using retaining structures such as brushwood fencing or geotextile sheets, but is instead deposited directly in the subtidal/low intertidal, using dredgers or barges (often split bottom barges). Then natural hydraulic processes are expected to gradually move material up the foreshore. This trickle charge approach was undertaken in a tributary of the Medway when 4,000m^3 of material was on the lower intertidal and then allowed to disperse[7].

It is noteworthy that, while the disposal of dredged sediment within estuaries can be considered as having indirect environmental benefit in terms of maintaining the sediment balance, this still constitutes waste disposal in regulatory terms (i.e. in relation to the Marine and Coastal Access Act 2009, the Waste Framework Directive and various International Conventions). Therefore, in MMO licencing terms, within-estuary deposit at a licensed disposal site where the primary reason is for disposal of unwanted material 'is not deemed as beneficial re-use'.

In the South marine plan areas, the following in-estuary (in-harbour) open disposal sites exist:

- Poole Harbour: 'Brownsea Experimental'
- Ryde Harbour: 'Ryde Harbour'
- Portsmouth Harbour: 'Basin 1 Naval Base Portsmouth' and 'Portsmouth Ballast'
- Chichester Harbour: 'Treloar Hole and 'Chichester Harbour'.

Further techniques employed during dredging itself, which also lead to retaining material in estuaries, were not specifically considered as beneficial use for the purpose of this project; these include: water column release, overspilling and water injection dredging.

3.3.4 Temporary disposal at sea for later re-use

Over the course of this study, a technique has been identified in the South marine plan areas. ABP Southampton and Westminster Dredging Ltd have secured a variation to a disposal licence to allow the placement of dredged materials on an

[7] http://www.ukmarinesac.org.uk/activities/ports/ph19.htm

existing marine aggregates licence area (which lies directly adjacent to the authorised disposal site). This can then allow the deposited materials to be collected for re-use at a later date. However, the type of re-use is not known for certain at this time.

3.3.5 Re-use for land claim/land raising purposes

One of the ports in the South marine plan areas is currently in discussions with regulators to obtain consents for re-use of 'fit-for-purpose' capital dredged materials for land raising and capping for the construction of a port expansion project. Such capital dredged material re-use for essentially land claim purposes is often practiced during major port expansion projects; the most notable recent UK example being the land claim undertaken to construct London Gateway Port in the Thames estuary. Coarse material (sand and gravel) is most suitable, as silt and clay generally consolidate over too long a period to be used for purposes which require heavy loading as outlined for example in guidance prepared by Burt (1996).

3.4 Outline of the legal and policy context

This section provides a brief summary overview of the legal and policy context for the beneficial use of dredge arisings. For a full review of the legal and policy considerations, it is most appropriate to refer to the relevant guidance documents.

For both the dredging and the disposal of sediment, a range of consents and permissions need to be obtained under a wide range of environmental legislation and policy considerations. Depending upon the location and nature of the work, these can include:

- Environmental Impact Assessment (EIA) under relevant EIA legislation.
- An Appropriate Assessment (AA) or at least application of the Habitats Regulations Appraisal (HRA) process under the Habitats Regulations.
- A Marine Licence from MMO. It is noteworthy that it is a condition of the licensing process for dredging projects to 'consider alternative means of disposal of dredged material before applying for a licence to dispose of dredged material at sea'. This is a requirement under the Directive 2008/98/EC on waste (Waste Framework Directive).
- A Water Framework Directive Assessment under the Water Environment (Water Framework Directive) (England and Wales) Regulations.
- Permissions from the landowner, Harbour Authority, The Crown Estate and/or any other parties with jurisdiction/ownership of the seabed (depending upon the nature and location of the seabed affected and the framing of relevant Harbour Acts).
- Consent and works licences from the Harbour Authority for projects which may affect navigation.
- Permissions from Natural England and any licences/consents for the protection of wildlife and protected species under the Countryside and Rights of Way Act.
- Permission and consent from the Environment Agency in relation to flood defence and water quality under the Land Drainage Act and other legislation.
- Planning Permission/Application from the Local Authority under the Town and Country Planning Act.

In addition there are a range of existing national, sectoral, regional and local plans (and their associated policies) which will need to be considered. These include coastal and port management documents (including SMPs), as well as: the National Planning Policy Framework (NPPF), the Department for Transport's National Policy Statement for Ports (NPSfP), marine plans and a range of local and regional plans and Waterfront Strategies.

It is understood therefore that beneficial use projects can require a wide range of consenting and licensing work depending upon the scale of the work. As discussed further in Section 5, these can present major challenges with respect to the realisation of beneficial use projects, especially where there are conflicts of opinion or uncertainties about effects.

However, the overarching aim of beneficial use is to facilitate sustainable development and realise strategic objectives for coastal and estuarine waters. The objectives of beneficial re-use are therefore in keeping with the principles laid out in planning (e.g. the NPPF) and they also typically garner support from many regulators and stakeholders. In addition they can have multiple benefits for local communities and those that use the coast. Therefore the necessary legal, planning and policy rationale exists and the existing consenting regime provides relevant and necessary controls. However, based on past experience highlighted via stakeholder survey (see Sections 4 and 5 of this report) there is potential for the existing process to provide a greater facilitation of beneficial use where logistical obstacles such as timing and material compatibility can be overcome.

4. Past, Present and Future Dredging and Beneficial Use

This section presents the outcomes of the spatial investigations undertaken for this study within the extents of the South marine plan areas.

4.1 Historic activity

This section presents the relevant mapping with regard to historic dredging and beneficial use activity in the South marine plan areas, together with brief descriptions of the data.

4.1.1 Licensed maintenance and capital dredging activity

As outlined in Section 2.1, only navigational dredging projects from 2011 onwards were considered, based on GIS files and data provided by MMO. Following advice only those projects listed as 'dredging' the GIS files were selected[8]. This showed that in total, at least 55 dredging campaigns have taken place in the South marine plan areas in this time period (or are licensed, so will soon be underway); 19 of these relate to capital dredging, four to combined capital and maintenance dredging, and 32 to maintenance dredging.

Volumes and material type were not detailed in the MMO provided database, but were derived from the MMO public register, where available. All the licensed and soon to be licensed dredging campaigns are listed in Table 2 and mapped in Figures 2a to 2c. One database has been produced for this dataset, showing dredging areas (polygons).

The table demonstrates that between 2011 and 2018, at least 30 million tonnes of material have been, or will be, dredged during capital dredging campaigns, with most of these campaigns yielding silt. Eight campaigns would also involve or have involved the dredging of sands and/or gravel, most notable the Southampton and Portsmouth (HMNB) campaigns. Percentages of materials obtained for Portsmouth show that up to 2.6 million tonnes of sand could be dredged, 2.2 million tonnes of gravel and the rest of the 6.2 million tonnes is made up of silt and clay. At Southampton, in relation to the approach channel dredge, some 9 million tonnes of fines (silt and clay) and 10.6 million tonnes of sands and gravel could be dredged and the remainder is accounted for by alluvium and peat/clay.

Licensed maintenance dredging campaigns could cumulatively lead to as many as 1.6 million tonnes of material dredged per annum over the next few years. Again, this would mostly be silt, with the exception of the Newhaven Ports, Poole Harbour (approach channel and Royal Motor Club) and Folkestone Harbour dredging campaigns, where sand is also dredged (up to *ca.* 280,000 tonnes per annum).

[8] The exception to this were additional schemes which were highlighted by the survey respondents, and noted to be licensed. Further investigation showed that these, and potentially many other dredging schemes, were classed as 'dredged material disposal (source site)' in the MMO system, and thus not picked up. Selected projects were included in the database, but investigating every record listed under the 'dredged material disposal (source site)' category was considered to be beyond the scope of this project.

Table 2: Licensed dredging campaigns (2011 onwards).

Applicant Name	Project Title	Licence Expiry	Volumes		Material type
			Total	Annual	
Capital Dredging					
Associated British Ports, Southampton	Main Channel (Marchwood) Widening Works	15/11/2013	900,000 tonnes	Not applicable	55% sand, 5% gravel, 40% silt
	Widening of Berths 204 and 205	24/04/2013	10,800 tonnes	Not applicable	Silt
	SACD; Berths 201/202	28/02/2018	23,200,000 tonnes	Not applicable	Ca. 46% sand & gravel; 39% silt & clay; 15% other
Bembridge Harbour Improvements Ltd	Bembridge Dry Stack	11/03/2016	1,500 tonnes	Not applicable	Not available
Environment Agency	Rye Harbour turning circle, Admiral Jetty	21/01/2014	1,500 tonnes	Not applicable	Silt
Hampshire County Council	Unblocking Tidal Sluice	19/11/2013	1,038 tonnes	Not applicable	33% cobble,33% gravel, 33% sand
HMNB PORTSMOUTH	HMNB Portsmouth Approach Channel Dredging and Associated Works	Not known	6,203,150 tonnes	Not applicable	42% sand, 36%gravel, 18%silt, 3% clay
Homes and Communities Agency	Kingston Marine Park	26/08/2016	475m^3	Not applicable	Not available
Kendall Bros (Portsmouth) Ltd.	Kendall's Wharf extension and capital dredge	Not known	7,056 tonnes	Not applicable	Silt
Marina Developments Ltd	Dartside Quay - Dredging to Hoist Dock	29/02/2016	120 tonnes	Not applicable	Slit
Oceanic Estates Ltd	Husbands Shipyard	31/10/2015	67,500 tonnes	Not applicable	Silt
Portsmouth City Council	Dredging\disposal adjacent to HMS Bristol	31/05/2013	Not available	Not applicable	Not available
Premier Marinas (Gosport) Ltd	Gosport Marina Piers A-D Reconfiguration	31/12/2013	17,500 tonnes	Not applicable	57% clay, 24% sand, 19% silt
Royal National Lifeboat Institution	RNLI Cowes	19/09/2012	350m^3	Not applicable	Silt and clay
Royal Southern Yacht Club Ltd	RAFYC & RSrnYC pontoon development	31/07/2014	18,900 tonnes	Not applicable	79% clay, 21% silt
Sandbanks Yacht Company Ltd	Sandbanks Yacht Company Access Dredging	03/01/2014	6,300 tonnes	Not applicable	47% clay, 53% sand
The Royal Motor Yacht Club	Marina Extension	01/07/2013	25,920 tonnes	Not applicable	
Trafalgar Wharf Ltd	Trafalgar Wharf Marina Basin Access Channel	09/04/2016	5,000 tonnes	Not applicable	Silt
	Trafalgar Wharf Wet Dock Improvements	29/07/2015	2,500 tonnes	Not applicable	Silt
Capital/Maintenance Dredging					
Bembridge Harbour Improvements	Bembridge Harbour and Pontoon Works	27/04/2015	54,000 tonnes	20,600 tonnes	Silt
Premier Marinas (Southsea) Ltd.	Southsea Marina Holding Pontoon Area	Not known	22,340 tonnes	10,820 tonnes	Silt
RNSA (Portsmouth Moorings)	RNSA Moorings Gosport	11/07/2015	14,400 tonnes	24,800 tonnes	Silt
Tarmac Ltd	Bedhampton Approach	29/05/2015	33,320 tonnes	11,100 tonnes	Silt

Use of beneficial dredged materials in the South marine plan areas

Applicant Name	Project Title	Licence Expiry	Volumes		Material type
			Total	Annual	
Maintenance Dredging					
Associated British Ports Ltd.	Port of Southampton Maintenance Dredge	13/09/2014	500,000 tonnes	200,000 tonnes	Silt
Birdham Pool Ltd	Birdham Pool Approach Channel Maintenance	Not known	9,500 tonnes	9,500 tonnes	Silt
BP Oil UK Ltd	Hamble Jetty and Approaches	07/02/2016	75,000 tonnes	25,000 tonnes	Silt
Cowes Yacht Haven	Maintenance Dredging 2014	Not known	45,000 tonnes	15,000 tonnes	Silt
Deacons Boatyard Ltd	[no information in database]	31/03/2014	8,400 tonnes	8,400 tonnes	Silt
Dean & Reddyhoff Ltd	East Cowes Marina	28/02/2016	56,100 tonnes	18,700 tonnes	Silt
Folkestone Harbour Company Ltd	Folkestone Harbour Dredging	06/02/2023	33,000 tonnes	3,300 tonnes	Sand
Hamble Yacht Services Ltd	Hamble Yacht Services - Port Hamble Berths	28/05/2015	10,000 tonnes	5,000 tonnes	Silt
Homes and Communities Agency	Hythe Marine Park	23/05/2016	30,000 tonnes	10,000 tonnes	Silt
	Woolston Riverside	14/05/2016	30,000 tonnes	10,000 tonnes	Silt
John Willment Marine Ltd	Universal Marina	11/12/2015	25,350 tonnes	8,450 tonnes	Silt
Marina Developments Ltd	Hamble Point Marina	30/04/2016	30,000 tonnes	10,000 tonnes	Silt
	Hythe Marina Village (Approach Channel)	31/10/2015	21,000 tonnes	7,000 tonnes	Silt
	Mercury Yacht Harbour	30/04/2016	30,000 tonnes	10,000 tonnes	Silt
	Northney & Ocean Village Marinas	19/12/2014	58,500 tonnes	19,500 tonnes	Silt
	Port Hamble Marina	07/11/2015	30,000 tonnes	10,000 tonnes	Silt
	Saxon Wharf	11/09/2015	29,250 tonnes	9,750 tonnes	Silt
	Shamrock Quay	30/11/2014	29,250 tonnes	9,750 tonnes	Silt
Newhaven Port & Properties Limited	Newhaven Maintenance Dredging	13/05/2015	1,920,000 tonnes	640,000 tonnes	70 %Sand, 30% silt
Parkstone Yacht Club (Haven) Ltd	Parkstone Yacht Club Haven	11/10/2015	26,379 tonnes	8,793 tonnes	Silt
Poole Harbour Commissioners	Poole Harbour - In Harbour Disposal	30/06/2016	126,000 tonnes	42,000 tonnes	Silt
	Poole Harbour - In Harbour Disposal	06/07/2013	36,000 tonnes	36,000 tonnes	Silt
	Poole Harbour Maintenance Dredging / Disposal	02/01/2016	210,000 tonnes	70,000 tonnes	50% sand, 50% silt
Premier Marinas Ltd	Brighton Marina Program 2012 - 2015	06/07/2015	149,997 tonnes	49,999 tonnes	Silt
	Gosport Marina	16/02/2015	30,000 tonnes	10,000 tonnes	Silt
RWE Npower Plc	Fawley Power Station	16/01/2013	67,710 tonnes	67,710 tonnes	Clay
The Royal Motor Yacht Club	Maintenance Dredging	Not known	1,760 tonnes	1,760 tonnes	77% sand, 23% clay
Trafalgar Wharf Ltd	Trafalgar Wharf Approach Channel	24/06/2016	16,800 tonnes	16,800 tonnes	Silt
Westminster Dredging Company Limited	Maintenance Dredging at HMNB Portsmouth	Not known	691,000 tonnes	231,000 tonnes	Silt
	Maintenance Dredging at SMC Marchwood	Not known	48,000 tonnes	16,000 tonnes	Silt
Yarmouth Harbour Commissioners	Yarmouth Harbour (IOW) Maintenance Dredge	Not known	9,965 tonnes	9,965 tonnes	80 silt 20%clay/gravel

Figure 2a: Sites of licensed navigational dredging activity (2011 onwards) in the South marine plan areas (West).

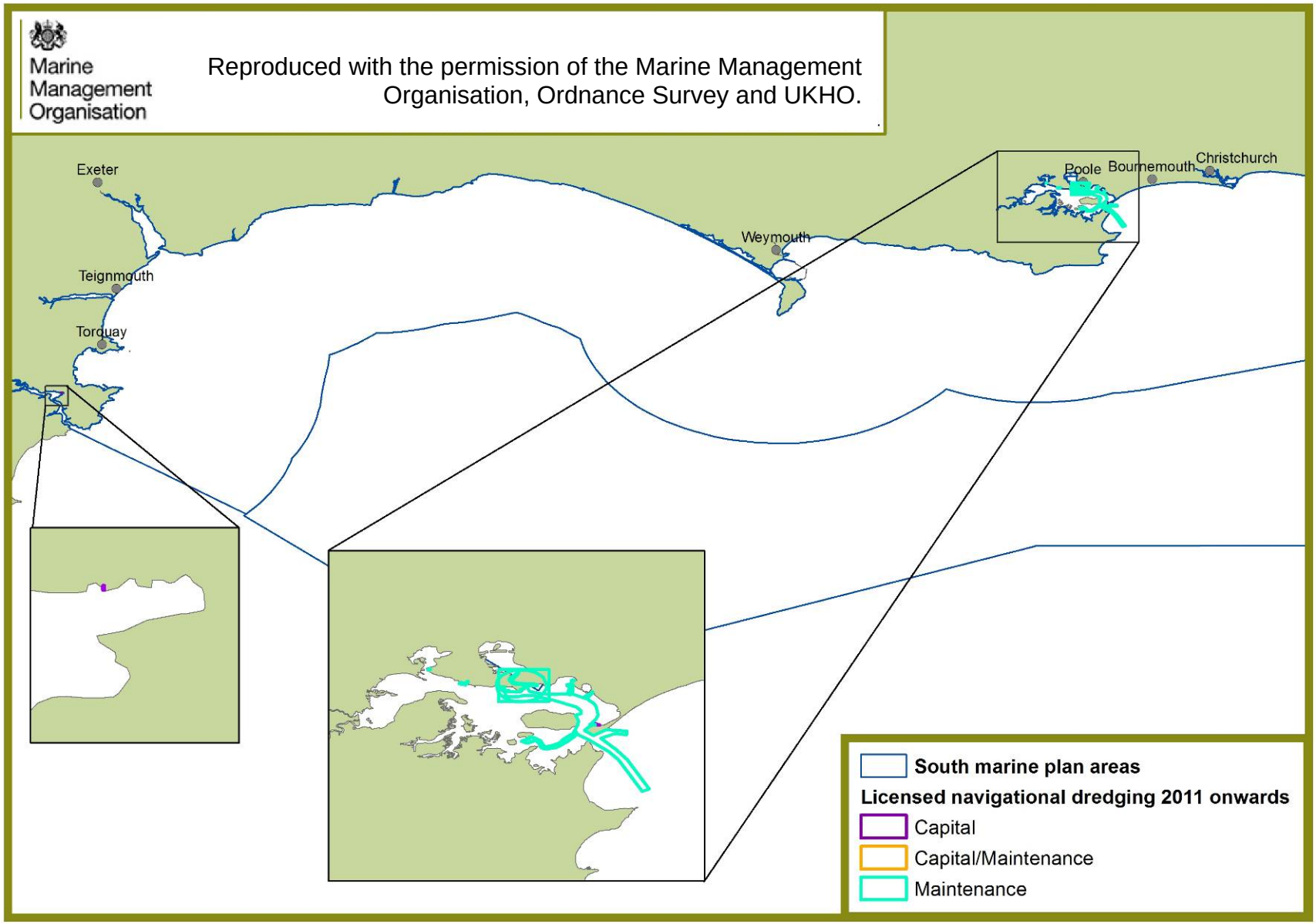


Figure 2b: Sites of licensed navigational dredging activity (2011 onwards in the South marine plan areas (central).

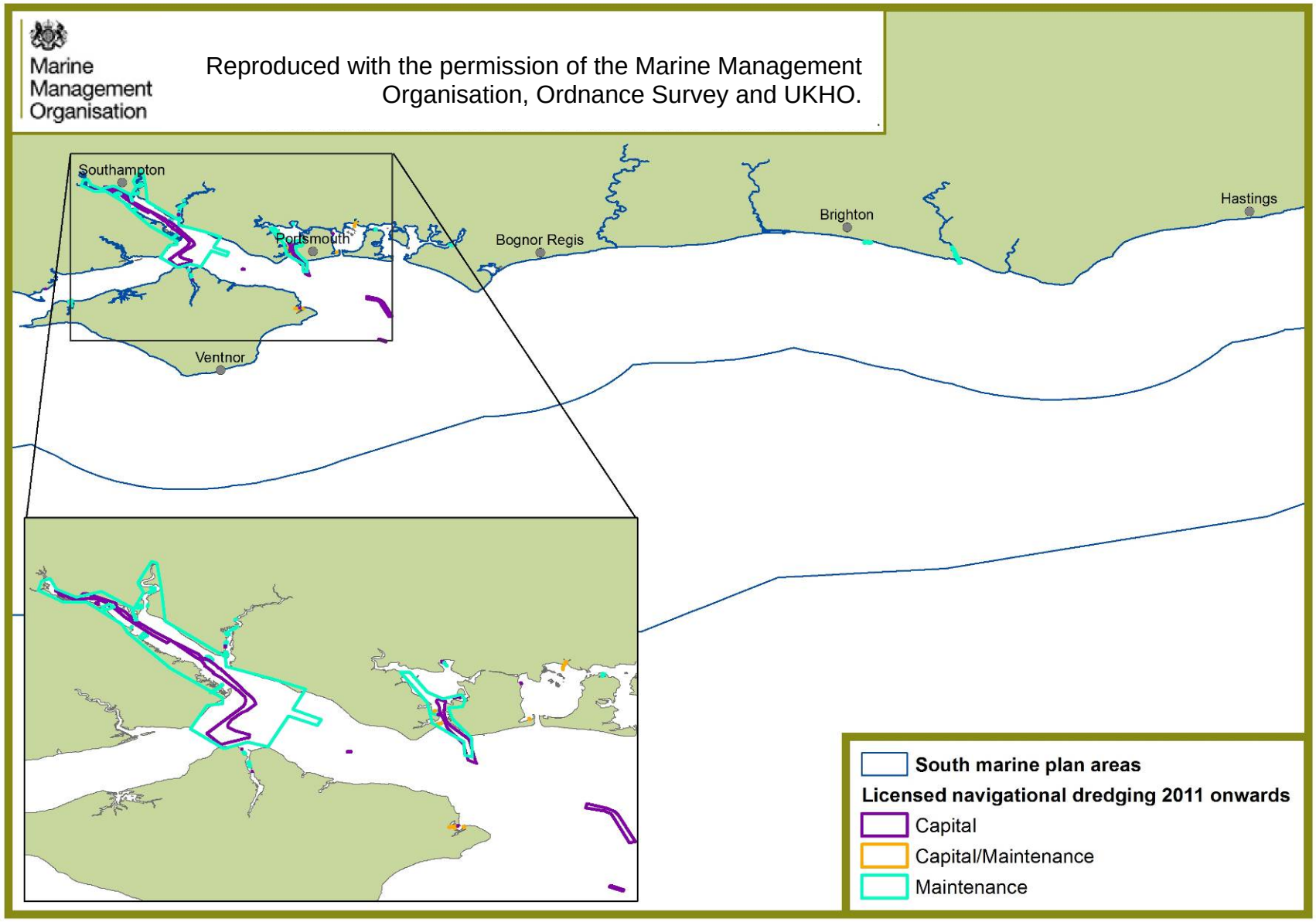
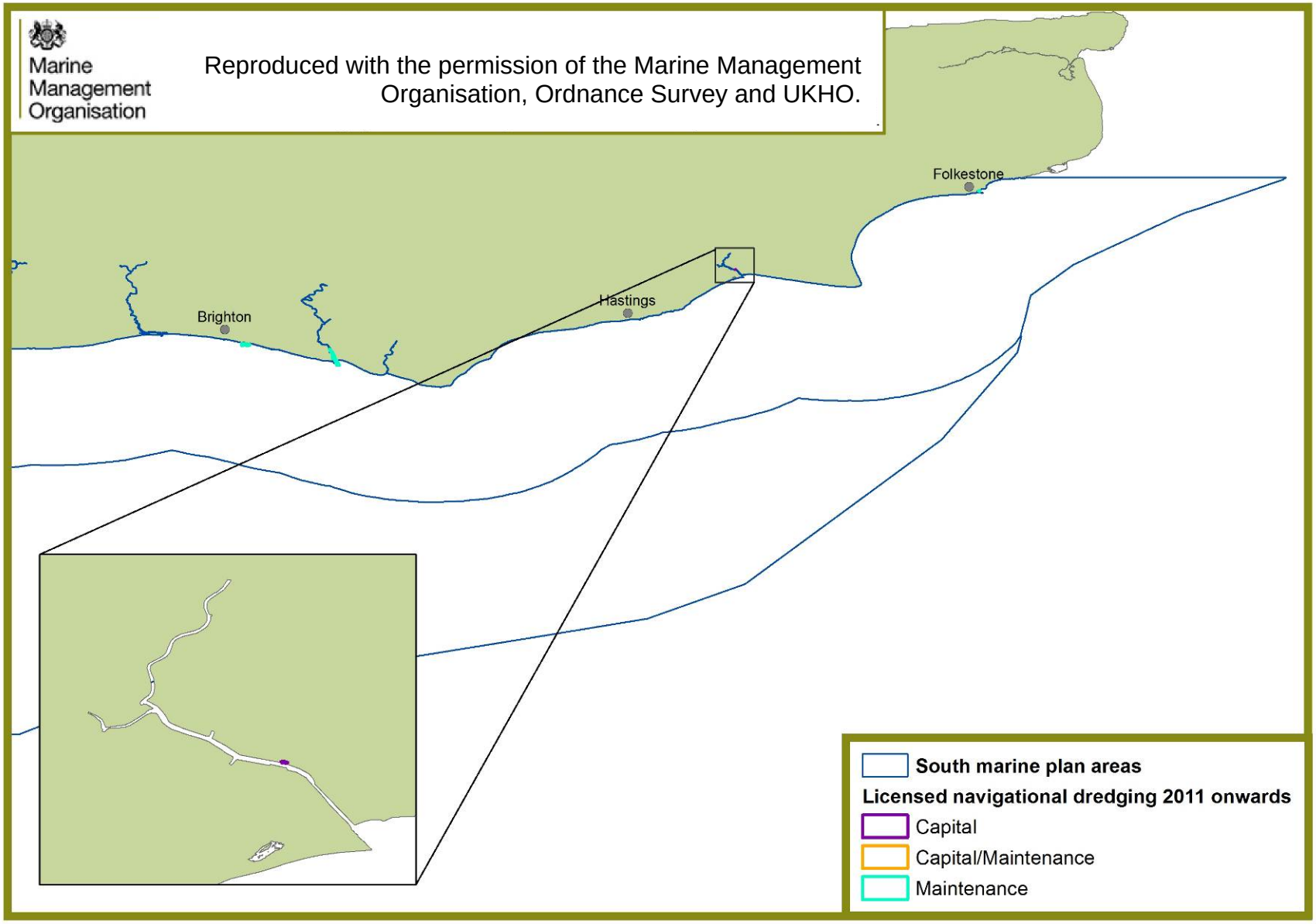


Figure 2c: Sites of licensed navigational dredging activity (2011 onwards) in the South marine plan areas (East).



4.1.2 Historic and licensed beneficial use activity

This information is contained in two spatial databases:

- Firstly, the pre-2011 projects were mapped based on the survey responses, ABPmer knowledge and a literature review (as point data)
- Secondly, licensed (and soon to be licensed) beneficial use projects from 2011 onwards were mapped based on the MMO database (as area (polygon) data).

MMO legacy data was not consulted, as this was not part of the scope of this project.

Table 3 below lists those projects contained in the databases, and Figure 3 depicts them spatially. The table shows that, to date, at least 15 beneficial use projects have been undertaken in the South marine plan areas, or will soon be commenced.

Three of these involve regular, ongoing, beneficial use, which is likely to continue on a similar basis into the future. These are: the Folkestone beach nourishment, the Blue Lagoon (Poole Harbour) intertidal recharge, and the Brownsea Island (Poole Harbour) in-harbour disposal.

Other projects may occur again in the future, though on a more irregular basis (e.g. Bournemouth beach replenishments, use of Treloar Hole disposal site); whereas others have been one-off projects, with no current plans to repeat the application of materials (e.g. Lymington Boiler Marsh). Planned future schemes which are not yet licensed are discussed in Section 4.2.2.

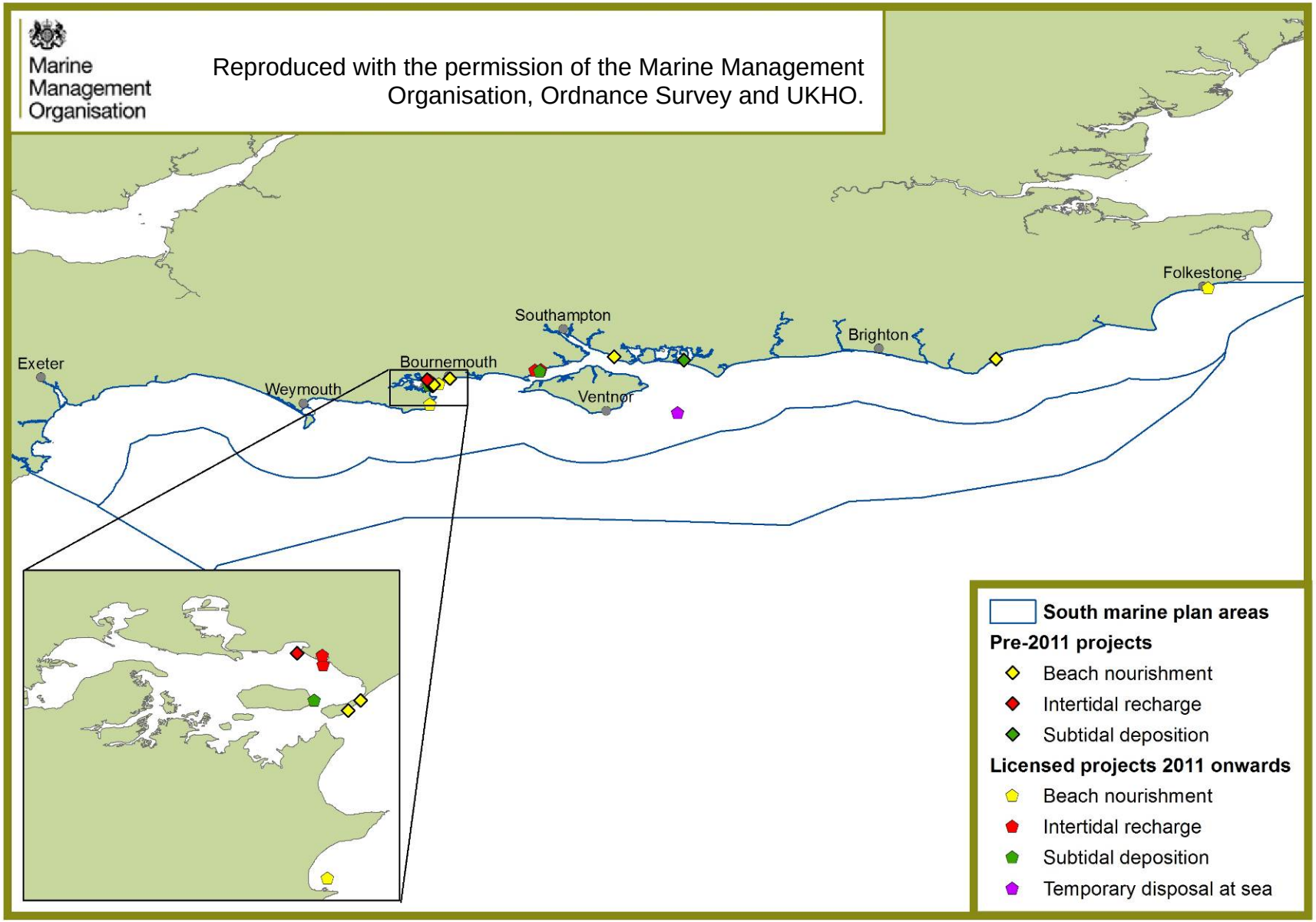
It is estimated that some 2.3 million tonnes of sands have been used due to the listed campaigns over the past 10 years (excluding the Stage 3 Bournemouth campaign, but including all others with volume figures)[9]. Intertidal recharge schemes account for a relatively modest amount of re-used fine sediments; approximately 17,000 tonnes. Subtidal recharge would have re-used some 175,000 tonnes, with most of this having been deposited at Brownsea Island in Poole Harbour since initiation of deposition in 2008, assuming annual deposition since then.

[9] This is based on conservative cubic metre to tonne conversion assumptions, and assuming that the annual volumes given were actually used. Conversions were based on published guidelines provided by the HELCOM Commission (2007) as well as experience of previous geotechnical testing of dredge sediments in UK waters.

Table 3: Past beneficial use projects.

Description provided by respondent/MMO database (those showing case reference number are in MMO database 2011 onwards)
Beach nourishment
Bournemouth Beach Schemes: Stage 3 (1988-90; 998,676m^3), Stage 4.1 (2006; 615,705m^3), Stage 4.5 (2010; 72,719m^3). Using capital dredge arisings (sand & gravel) from Poole Harbour Entrance
Folkestone Beach Deposition Site (MMO case reference MLA/2012/00324; licence end date: 06/02/2023; volume: 3,300 tonnes / annum (sand), though most likely every two years). Re-use of sand dredged from harbour on Sunny Sands beach.
Lee-on-the-Solent beach replenishment, following Southampton main channel dredge in 1997 (gravel)
Poole Bay: Shore Road and Swanage nearshore trickle charge trial using small annual maintenance dredged sand (allowing natural swell waves to move it on shore, similar to sand motor in the Netherlands). 30,000m^3 of sand every 2 years. (MMO case reference: MLA/2013/00353; licence granted recently)
Poole Beach (120,000m^3, sand)
Poole, Bournemouth and Swanage beaches - one major project (1.1m^3, Sand)
Sovereign Harbour - sandy material dredged from harbour placed on the intertidal sand platform to the east. Happened a couple of times a few years back (involving a few hundred m^3).
Intertidal recharge
Blue Lagoon, Poole Harbour - Lilliput Sailing Club; annual in conjunction with maintenance of Blue Lagoon access channel (600m^3) (MMO case reference MLA/2012/00042; licence end date: 31/10/2015; volume: 600 tonnes / annum (silt))
Lymington Estuary - Boiler Marsh (2012/13, Wightlink); muddy marina dredge arisings (MMO case reference 34989/101109/2, licence end date: 01/12/2014; volume: 2,000 tonnes (silt)). Applied over two years)
Lymington Estuary - Lymington Yacht Haven (2012/13, Lymington Harbour Commissioners); muddy marina dredge arisings (MMO case reference MLA/2011/00190/2; licence end date: 01/04/2013; volume: 4,000 tonnes (silt) (total over two campaigns)
Lymington Harbour – saltmarsh feeding trial. Place approximately 2,000m^3 of silt in Year 1, 3,500m^3 in Year 2 and 5,000m^3 in Year 3 (starting in 2014) – rather than disposing at Hurst disposal site (MMO case reference: MLA/2013/00410; licence granted recently).
Poole Harbour (Parkstone Yacht Club); 1994/1995 (see Dearnaley and Burt, 1996).
Subtidal deposition
Chichester Harbour (Treloar hole) in-harbour disposal to maintain sediment within harbour. E.g. 2008/09 Dredging Campaign Emsworth Yacht Harbour, 2008/09, 11,500m^3 (silt).
Poole Harbour - in-harbour disposal to maintain sediment within harbour - Brownsea Roads. Annual, since first trialled in 2008. (MMO case references 34727/100209, MLA/2013/00111; licence end dates: 06/07/2013 & 30/06/2016; volumes:36,000 & 42,000 tonnes / annum (silt))
Temporary disposal at sea
Southampton Water - disposal of capital dredge arisings in aggregates site for use at later date (2,000,000m^3; silt and gravel) (part of variation regarding MO case reference 34302/090114/7; licence granted recently).

Figure 3: Sites of historic and current beneficial use activity in the South marine plan areas.



4.2 Anticipated future activity

This section presents the relevant mapping with regard to planned dredging and beneficial use activity in the South marine plan areas, together with brief descriptions of the data. As outlined in Section 2, this data was derived from a combination of sources, including a literature review and the stakeholder survey. Future activity was mainly understood to refer to the next 10 years.

4.2.1 Anticipated maintenance and capital dredging activity

The stakeholder consultation survey work, Port Master Plans and MMO database provided results on planned navigational dredging campaigns, and the MMO database also contained schemes which were under application. These records were used to create the 'planned (non-licensed) dredging campaigns' database. The sites contained in the database are listed in Table 4, and are mapped in Figure 4. Survey records which clearly refer to records already in the MMO databases (and hence included under the '2011 onwards' database; see Section 4.1.1) were excluded. Over the next 10 years, at least five further distinct maintenance dredging campaigns (i.e. locations) and three capital dredging campaigns are planned in the South marine plan areas.

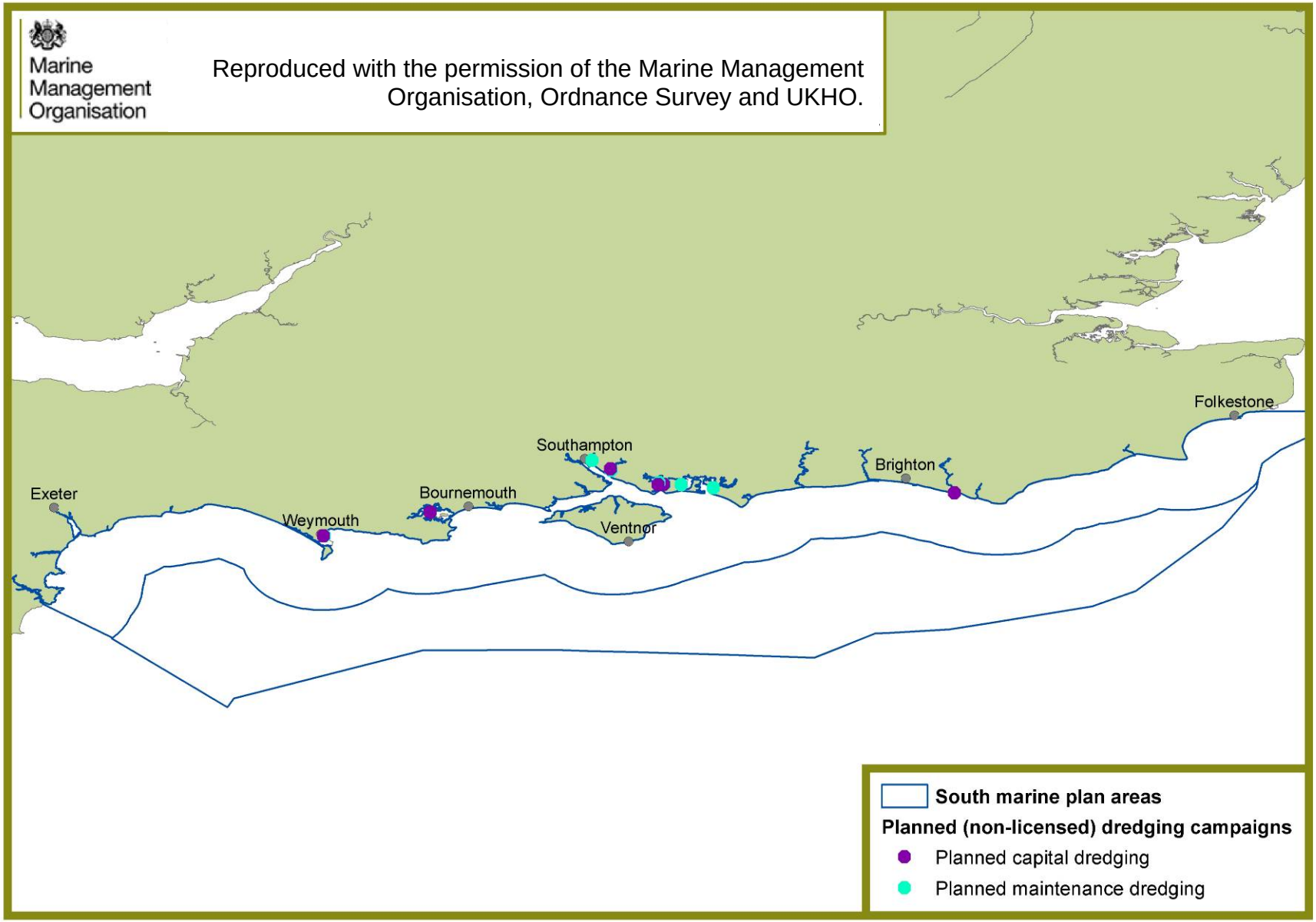
The results in Table 4 indicate that planned maintenance dredging campaigns could yield around 400,000 tonnes of material over the next 10 years.

With regard to capital dredging campaigns, these could lead to as many as 1million tonnes of material dredged over the next 10 years related to the four campaigns which provided volume information (please note: volumes converted to tonnes).

Table 4: Future dredging campaigns.

Location	Frequency	Volume per campaign	Material type
Planned Maintenance Dredging			
Portsmouth - Portsmouth International Ferry Port	Every 3 - 4 years	20,000 to 30,000m^3	Silt
Rivers Hamble and Itchen. Portsmouth, Langstone and Chichester Harbours	Annual	5000m^3 per site - totals around 20,000m^3	Silt
Weymouth Harbour	Every 2 years	Not known	Not known
Planned Capital Dredging			
Newhaven Port Limits	2015	500,000m^3	Sand, silt and chalk
Poole Harbour (Harbour Commissioners)	Unknown	Less than 100,000m^3	Silt
Portsmouth - Portsmouth International Ferry Port	2014	Approx. 10,000m^3	Clay
Portsmouth Harbour and River Hamble possibly	Unknown	probably around 5000m^3	Silt
Weymouth Harbour	Not known	Not known	Not known

Figure 4: Planned (non-licensed) dredging campaigns (next 10 years) in the South marine plan areas.



4.2.2 Anticipated Beneficial Use Activity

In this section, a distinction is made between actual beneficial use projects which are already planned (but not licensed), and stretches of coastline and shoreline which could particularly benefit from the application of beneficial use.

Planned projects

This information was derived from the survey responses; schemes which were mentioned by the respondents, but are already contained in the MMO licensing database, were not included (as they were in the 'Licensed Beneficial Use 2011 Onwards' database; see Section 4.1.2). Overall, two additional planned beneficial use projects were listed by respondents; the responses/details pertaining to these are listed in Table 5 below, and mapped in Figure 5. It should also be noted that six of the licenced schemes discussed in Section 4.1.2, are anticipated to be continued in the longer term, or have yet to commence (these are not re-listed in Table 5).

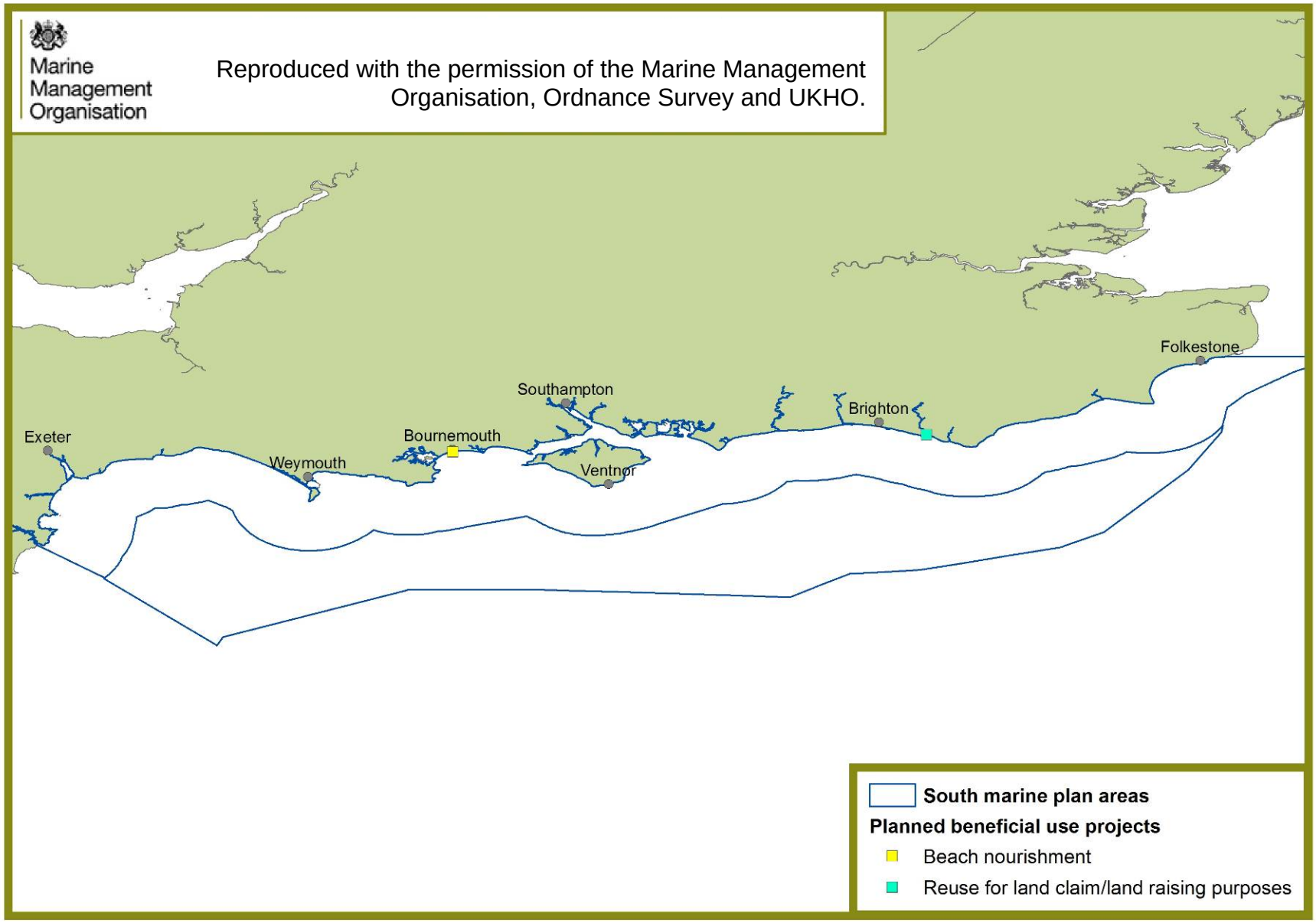
Together with these future licensed schemes, it is estimated that at least 1.5 million tonnes of sands may be used in the South marine plan areas over the next 10 years for planned/anticipated beneficial use campaigns, with most of this accounted for by the Bournemouth beaches schemes[10], and also assuming that the currently licensed Folkestone beach deposition mentioned in Table 3 is continued. The use of fine sediments for intertidal recharge and subtidal deposition could total some 0.4 million tonnes, most of this would be associated with the subtidal deposition off Brownsea Island in Poole Harbour (Poole Harbour Commissioners; see Table 3). Coarser materials could account for over 3 million tonnes of beneficial use, with most of this being due to the planned temporary disposal of Southampton dredge arisings at licenced marine aggregate Area 451 off the east coast of the Isle of Wight, as shown in Figure 3 (please note that the latter will also contain silt, i.e. fines).

Table 5: Future beneficial use projects.

Description	Type of Beneficial Use
Bournemouth beach - continuing need to replenish Bournemouth beach for the next century, in line with SMP2 (210,000m^3 every 3 years. Material: sand and gravel).	Beach nourishment
Newhaven Port East Quay Expansion Project in 2015. Use fit for purpose material for land raising and capping (subject to EA de-watering permits; ca. 300,000m^3). Discussions in progress with EA and the local Planning Authority.	Re-use for land claim/land raising purposes

[10] This is based on conservative cubic metre to tonne conversion assumptions, and assuming that the annual volumes given are actually used. Conversions were based on published guidelines provided by the HELCOM Commission (2007) as well as experience of previous geotechnical testing of dredge sediments in UK waters.

Figure 5: Planned (non-licensed) beneficial use projects in the South marine plan areas.



Stretches of coast which could benefit from beneficial use

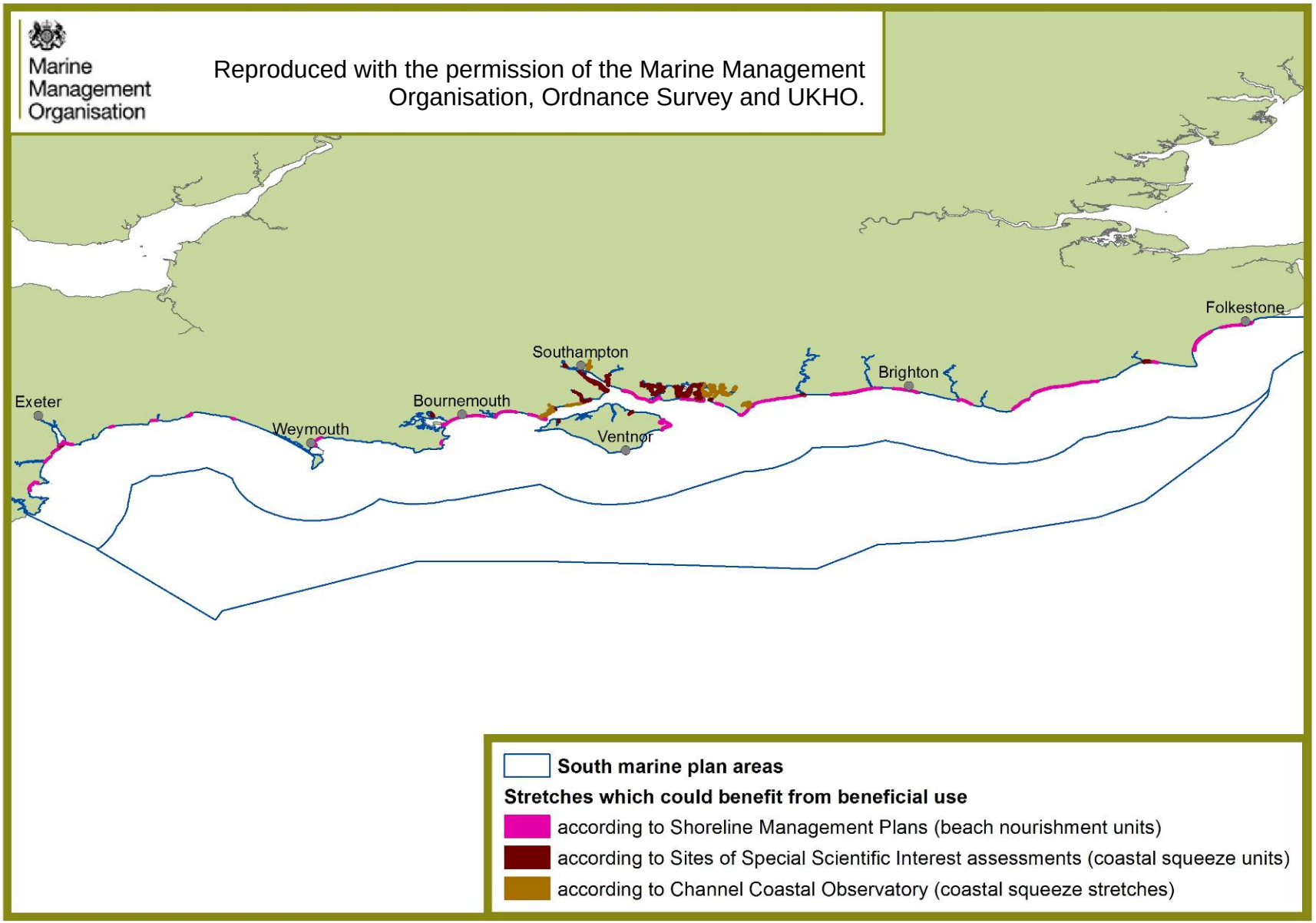
Stretches of shoreline and coastline in the South marine plan areas which could benefit from future beneficial use have been identified, based on the literature review outlined in Section 2.3 and the survey responses. The survey responses are summarised in Table 6 below and agreed with literature searches in terms of area covered. These were not mapped separately, as the literature review insights were found to cover all of stretches mentioned, and in more detail. Overall, based on the SSSI condition reports, and the relevant SMP and Solent Dynamic Coast Projects review, a large percentage of the shoreline and coastline in the South marine plan areas could theoretically benefit from beneficial use[11], as can be seen in Figure 6 (approximately 395km out of 1,711km of shoreline in the South Inshore Marine Plan Area).

Table 6: Stretches of coast which could benefit from beneficial use listed by respondents.

Stretches which could benefit from Beneficial Use in the future
All of Bournemouth beach, for coast protection. 210,000m^3 every 3 years; 7,000,000m^3 over the next 100 years.
Poole sea frontage beach replenishment in accordance with the SMP
Other sites/lots of opportunities within the Solent.
Strategic multi-site beach recharge within Christchurch Bay

[11] Please note that the other Solent studies listed in Section 2.3 did not yield any additional stretches of shoreline which could benefit from beneficial use. Only those shoreline stretches identified by the Solent Dynamic Coast project as suffering from coastal squeeze which did not overlap with a similarly assessed SSSI unit were mapped.

Figure 6: Shoreline stretches in the South marine plan areas which could benefit from future beneficial use



4.3 Summary and discussion regarding data collection

In this section, the insights gained with regard to the data collection on current and future navigational dredging and beneficial use activities undertaken for this project are summarised and discussed. Recommendations are then made with regard to data collection and capture.

4.3.1 Summary of navigational dredging and beneficial use activities

Navigational dredging

As outlined in Section 2.2, this project aimed to and obtained data on approximately 90% of the material derived from dredging campaigns. Some licensed dredging campaigns are thought to have been missed off the 'licensed' database created for this project, and reported on in Section 4.1.1, due to these having been classed as 'dredged material disposal' only on the MMO system. Where these were then not listed by a survey respondent (as happened with the Newhaven and Southampton campaigns), they would not have been included in the GIS-based databases created for this project. This may be because harbour authorities are a competent authority and require a disposal but not a dredge licence to carry out these activities.

The number of schemes this would affect is unknown, but dredging campaigns at Teignmouth and several marinas are known to fall under this category. However, it is not thought that campaigns which are not captured by the 'existing/licensed' database account for more than 10% of the material dredged in the South marine plan areas.

This project has found using a simple calculation that licensed and planned (not yet licensed) maintenance dredging campaigns could yield up to 2 million tonnes of material every year. Over the next ten years, assuming that all the annual tonnages given are actually dredged every year (this is considered unlikely), approximately 20 million tonnes could be dredged in the South marine plan areas.

Based on the results obtained during this project (and displayed in Tables 2 and 4), at least 15 million tonnes of this material is likely to be finer sediments (i.e. silts and clay). By contrast, coarser materials (sand and gravel) could account for approximately 4.5 million tonnes (with less than 1% likely to be gravel).

With regard to licensed and planned capital dredging campaigns, over the next 10 years, these could yield up to 31 million tonnes of material. A very large percentage of this is accounted for by two major planned campaigns in Southampton and Portsmouth (the former of which has recently commenced). Together, these are likely to produce some 29 million tonnes of dredging materials, whereby 11 million tonnes of this could be fine sediment, and 16.5 million tonnes sands and gravel.

Beneficial use projects

Relatively few beneficial use projects are known to have been undertaken in the South marine plan areas to date (approximately 12 in total). Over the past 10 years, these would have re-used approximately 2.5 million tonnes of materials derived from navigational dredging. The vast majority of this was sand, whereas fine materials would have accounted for less than 0.2 million tonnes.

Over the next 10 years, at least nine beneficial use projects are likely to be undertaken in the South marine plan areas, many of which relate to regular campaigns. These could lead to some 1.5 million tonnes of sands being re-used during beach nourishment campaigns, and 0.4 million tonnes of fines being re-used applying intertidal recharge or subtidal deposition techniques.

Other beneficial use techniques could account for over 3 million tonnes being re-used, with most of this being coarser materials, and related to the planned temporary deposition of Southampton capital dredge arisings at a licensed marine aggregates site.

4.3.2 Discussion

Given that up to 50 million tonnes of dredged materials could be available in the South marine plan areas over the next 10 years, and only around 5 million tonnes of this is currently envisaged to be re-used in planned projects, there is clearly scope for the increased application of beneficial use in the South marine plan areas. It should be noted that this figure is likely to be an over-estimate, and that not all of this material would necessarily be suitable for beneficial use (e.g. contamination issues, grading issues).

At least half of this overall material would be fine (i.e. clay and silt); such materials have been re-used in relatively small quantities in the past. Maintenance dredging campaigns in particular tend to yield high percentages of fine sediment, and rarely coarser materials. A significant percentage of the coarse material yielded during past maintenance and capital dredge campaigns has already been re-used, most notably on the Bournemouth beaches and at Folkestone.

Section 4.2.2 showed that significant stretches along the open coast of the South marine plan areas are likely to require beach nourishment in the future. However, many of these beaches are shingle beaches, particularly to the east of the Solent. Gravelly materials are not frequently dredged, particularly not in close proximity to the beaches east of the Solent, and transport distance is a key factor in whether or not beneficial use projects can be cost effective. The recently commenced Southampton approach capital dredging campaign, and the planned Portsmouth approach capital dredging campaign, could yield very significant amounts of coarser materials, potentially up to 16 million tonnes.

Regarding fine sediment re-use, there is clearly very significant scope for increasing the application of this given the amount of fine material dredged during dredging campaigns. This is particularly the case as large areas of intertidal habitat in the South marine plan areas are subject to erosion, with the estuaries and harbours of the Solent region considered a hotspot for this. The Solent is also the location of many dredging campaigns, so increasing beneficial use in this region should be seen as a particular area of focus; this is also supported by the views of respondents to the stakeholder survey.

4.3.3 Recommendations regarding future data collection and capture

This project sought to achieve an improved evidence base on Beneficial Use of dredged material. The data collected could, if needed, be further improved by a number of measures. These include:

- Reviewing licensed projects which are classed as ‘dredged material disposal’ in the MMO system, to ensure that licensed (post-2011) dredging campaigns are included in the database. It must be noted that harbour authorities can dredge using just a disposal licence.
- Reviewing the MMO’s ‘legacy’ licensing data for further historic beneficial use and dredging campaigns
- Contacting more stakeholders, and reviewing more local documents to ensure further stretches which could benefit from future re-use are identified. For example, there are likely to be intertidal habitats in estuaries east and west of the Solent suffering from coastal squeeze, but which were not identified as such, as they might not be designated as SSSIs.

As beneficial use projects are not necessarily captured as such in the MMO system due to licensing definitions, the creation of a separate dataset might want to be considered for beneficial use projects, to ensure projects are not missed and lessons can be learned.

Equally, an explanation of what MMO would define as an ‘alternative use of dredged materials’ project could be useful to marine licence applicants. This project has found that the recording of some activities means extraction of MMO data related to beneficial use is not comprehensive and requires linking to the public register for quality assurance.

5. Conclusions and Recommendations

5.1 Objective 1 and 2 (review of project findings)

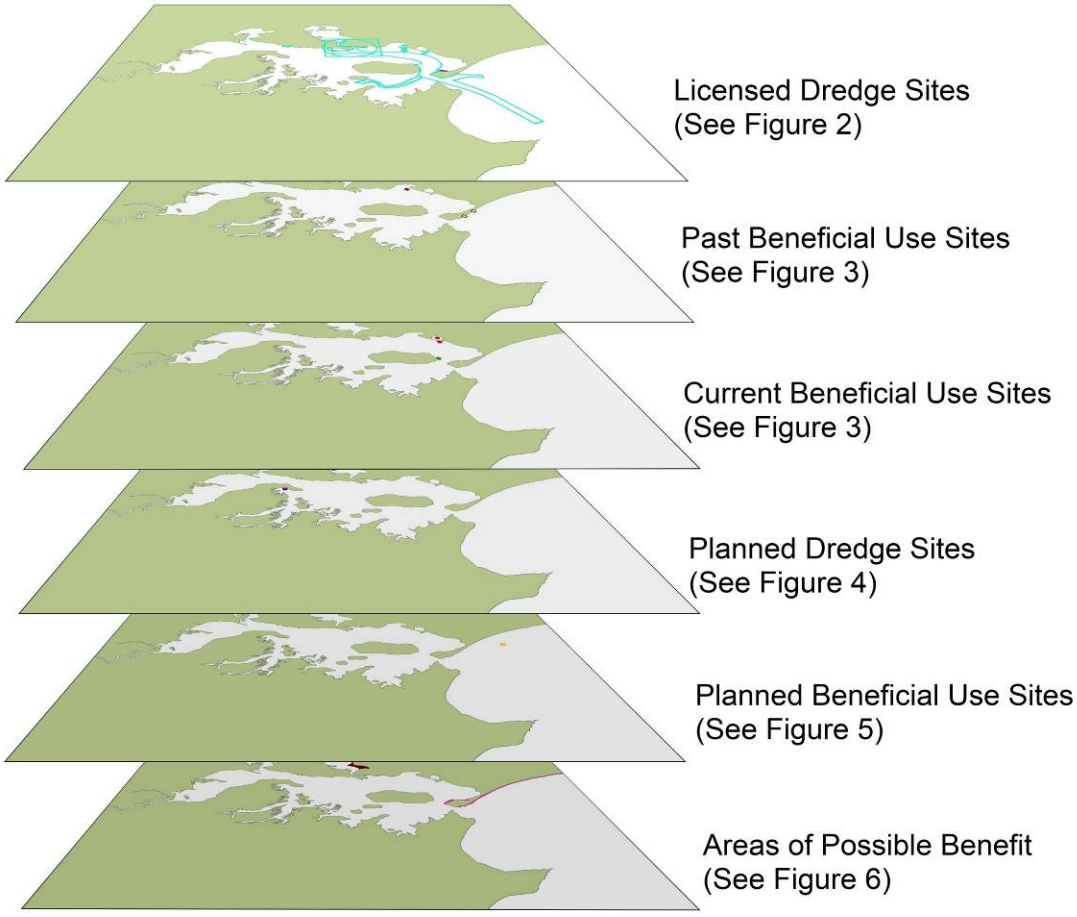
The work undertaken for this project (as informed by stakeholder consultations and reviews of literature) has described the status of existing knowledge and experience on the subject of beneficial sediment re-use. This has covered areas within the South marine plan areas and further afield. It is clear that, while several projects have been carried out, including a significant amount throughout the South marine plans coastal areas, the vast majority of dredged material is still taken to licensed disposal sites and not used beneficially.

Certainly, significant amounts of material will be available for beneficial use consideration in the future depending on its suitability based on a number of criteria, as summarised in Section 4.3.1. Furthermore, there is a clear message from consultees on this project that opportunities for beneficially using marine sediments are being missed. There is also frustration (expressed by several local authority and port respondents) that beneficial use is a subject that has been discussed for decades but that progress with implementation has been slow, for reasons explained below.

This situation has arisen because of the several challenges which exist with respect to project implementation (Tables A1.6 to 9, Annex 1). These challenges include the difficulties of maintaining clear lines of communication between regulators, coastal managers and ports, harbours or dredging operators. It is also due to environmental concerns (especially about the effects on designated sites and protected species) that exist with respect to using dredged arisings. Timing of material availability and use has been a significant issue for carrying out beneficial use projects.

There are also challenges associated with funding such projects and, linked to that, a lack of clarity about agreed approaches, as well as a failure to clearly identify the beneficiaries and the multiple benefits that are provided. These issues often arise because of the narrow views being taken about a project’s objectives and an absence of solutions, advice and direction at strategic and local scale. More generally, it may also be due to an insufficiently widespread recognition that these materials are a resource to be used for sustainable development and not waste products presenting problems for disposal. Under EU legislation (Waste Framework Directive) it is a requirement that the applicant look for alternatives for disposal and local knowledge should enhance this.

Image 5: Schematic description of GIS layers created for the mapping work (Objectives 1 and 2).



In summary, some of the key constraints to implementation (based on the literature and the survey responses) are as follows:

- **Obtaining consents and licences:** Securing the necessary permits as well as securing a consensus 'buy in' from all consenting bodies and their advisers can take a long (and often prohibitive amount of) time. Difficulties associated with obtaining permissions and consents (including MMO marine licences) were identified as being particularly prominent by many survey respondents (see Table A1.7 in Annex 1). These issues are often related to uncertainty relating to environmental impacts (and associated risk averse approaches), particularly for projects in/near designated sites. There is also an identified inflexibility in the process, with good reason, which means that projects cannot always be adaptable and respond to opportunities or constraints as they arise. Both sediment provider and recipient having sight of license documents could improve coordination.
- **Timing of activities**: It is often a major challenge to achieve concurrent dredging and recharge operations, particularly as there is often uncertainty regarding the timing of dredging, as well as the exact volumes and grades of material (and limited flexibility of projects to adapt their specifications) that will be dredged or can be used.

- **Transport Logistics**: It can be difficult to find mechanisms to get material from source to site; especially where there might be a need for long transport distances or where double-handling may be needed (i.e. transfer from one vessel to another).
- **Sediment composition and compatibility:** Linked to the issue of logistics, there can be a difference between the types of sediment that are dredged and the types which are needed. Often, maintenance dredged materials are mostly fine grained, and thus their re-use potential can be limited in locations (such as the south-east) where mostly gravel would be required along the beaches. However, as noted in Section 4.3, there are also many sites where the type of sediment at the source sites is very similar to an adjacent site of need (e.g. where marshes are eroding next to maintained harbours).
- **Sediment contamination and treatments:** In certain locations contamination may mean that sediment is inappropriate for many beneficial use activities and may require particular treatments.
- **Cost and funding:** Individually and collectively, all of the issues highlighted above have cost implications, and deposition at official offshore disposal sites is often the cheaper option as a consequence. In addition, the commitment and/or resources of local/regional government organisations can be lacking, according to several survey respondents. To address this issue, there is a need to identify beneficiaries and multiple benefits of individual projects.

Overall it is therefore recognised that there are many advantages from beneficial use projects (as described in Section 3.1) and there are many beneficiaries (e.g. Environment Agency, developers and local communities/partnerships). However, the operating frameworks for both potential suppliers and potential end users are not necessarily aligned. This means that marrying sediment source to re-use sites can be difficult and lead to time delays and costs. This, in turn, can result in problems with financing and budget allocation. This has been highlighted in the literature (e.g. CIRIA, 2010) and in this project's survey responses (see Table A1.7).

5.2 Objective 3 (recommendations for strategic approach)

This study has confirmed that the implementation of beneficial use projects is being limited by a range of factors and it is often the regulatory/consenting regime that is cited by stakeholders as being the main limiting factor. It is not necessarily the process of the consenting regime itself that is the problem, but what is clear is that there are several challenges focused around that process which can cause delays and present obstacles.

What is clearly absent and is required for the future, is greater guidance and more strategic clarity on this subject. This is needed to create a policy climate in which beneficial use is viewed as a relevant, realistic and even necessary option for coastal management in the future. Creating such a climate, and applying regulations in a reasonable and proportionate way, will help to empower those who are interested in doing such projects.

The development of the South marine plans offers a significant opportunity to improve this clarity of guidance and begin to address many of the constraints that exist. This has been started within this work which has highlighted the issues as well

as identifying and mapping sediment sources and sites of potential use. While this project and the continuing maintenance of the resulting data will be useful in defining relevant locations, it can be only the start of the process. In order to overcome the key constraints, a range of policies, initiatives and solutions will be needed. In particular, it is recommended that policies and measures are identified for the South marine plans which will help galvanize all stakeholders and engage them in the process of beneficial use work. These policies and measures could include the following:

- **A clear statement about the need for, and value of, beneficial use**. Although a lot of work has been done in this field, there is still a lack of clarity and consensus among stakeholders about the relative merits of, and imperatives for, beneficial use (e.g. with regard to longer term benefits of intertidal recharge). It will be important to have statements and policies which identify these key benefits and especially the key drivers that are pertinent within the South marine plan areas (e.g. delaying losses of eroding saltmarsh habitats). This can contribute towards achieving a consensus position for and from regulators and one which forms the policy backdrop to the implementation of individual projects and other related initiatives (Section 5.3).
- **A recognition that there are multiple beneficiaries.** Linked to the preceding point, it will be valuable to include statements and polices which identify the range of different parties that can gain from these identified benefits. This will promote a mechanism for engaging a range of regulators, stakeholders, partnerships and local communities. This along with clarity of objectives will provide a climate in which funding sources can be identified and the practice of Payments for use of Ecosystem Services could be explored.
- **The promotion of flagship project(s) in the region.** Within the South marine plan areas, it will be especially useful to identify a site or sites (from large to small scale and including muddy or coarse grained locations) which can become established beneficial use receptor locations and then identify mechanisms for the regular use of such sites. These can be flagship sites which help communicate this work to all interested parties and communities.

These recommendations can be applied to writing the South marine plans and consequent marine plans. However, these policies could have broader lessons for coastal management and it is recommended that there is a related and wider consideration of this consenting process. Three issues that could be considered as aspirations for the future are:

- **The development of estuary or water body size sediment management plans.** These could support River Basin Management Plans.
- **The development of 'dredge disposal protocols'**. A mechanism could be identified by which materials can be deposited at agreed locations without the promoter having to repeat the full application and consenting regime on each occasion. Such a process would be akin to the Maintenance Dredge Protocols and could be linked directly to these. This would be particularly useful in facilitating flagship projects. However, each location would need to be considered as a disposal site under OSPAR and characterised as such. Regular material analysis would also still be required as part of this approach.

- **The identification of mechanisms by which parties needing sediment should consider beneficial use options.** A formal (licensing) mechanism which requires those parties needing sediment to recognise and register the relevant potential receptor sites could facilitate future beneficial use projects (and other related initiatives as reviewed in Section 5.3). This would be equivalent to the requirement which exists now (through the Waste Framework Directive) for those with available dredged sediment to review and identify alternatives. Officially registering both donor and receptor sites will maximise the opportunities for matching one with the other. This has been attempted previously and any new attempt should explore the reasons for past failure.

Such measures could be prompted by the impetus that is created at a regional level by marine plan polices and could be developed by a focus group of experts from a range of organisations.

5.3 Further recommendations for the future

The recommendations that were identified in the preceding section would help to promote greater beneficial re-use. They could also provide a focal point that can draw together coalitions of participants that are keen to promote such work and can help to make the established processes work more efficiently. However, on its own, this is unlikely to address the practical challenges that exist with undertaking beneficial use. This includes dealing with issues at a local level, addressing concerns about the environmental effects and overcoming logistical hurdles to implementation.

To address these issues, it is recommended that the following are pursued:

- **The creation of a 'Market Place' (online) Tool.** It would be valuable to create a mechanism/tool (e.g. online website) which can allow implementers and regulators to understand location of donor sites, possible receptor locations, timings of material availability, the locations of key information resources and scientific evidence. This could be a 'market place' where those parties with dredged material and those in need of such material can communicate. It could also include the latest understanding and evidence relating to environmental impacts and species sensitivities. To support this, it would be valuable to ensure that MMO licensing data made accessible through the public register provides a full set of relevant data and that this data is clear and accessible. Outputs from this project will be publically availble to support the creation of a market place tool by the wider community.
- **Updated guidance.** It would be valuable to create clear, non-technical guidance for marine users which describes the information and licence requirements. This may clarify the role of beneficial use projects within the existing regulatory frameworks (e.g. under the Water Framework Directive and Habitats Regulations).
- **Improved communication of the lessons learned.** Although many research initiatives have been pursued over several years on this subject, it is often the case that the lessons which have been learned are not collated for effective use. Whilst methodology of a project is generally well explained, the results of monitoring the project over time are not as well disseminated (e.g. in relation

to the environmental effects). There is a need for enhanced communication of such issues to provide a more solid evidence base and one which marine users and regulators can look to improve the design and consenting of future projects.

- **Advice on Funding.** It will also be essential to clarify the potential funding streams (including Payments for Ecosystem Services) and potential funders. This would be linked to the clarity of objectives and benefits described in the first point above. This would help implementers to undertake the work and get beneficiaries to pay. Such beneficiaries could include:
    - The Environment Agency where a development provides flood/coast protection
    - Developers where there are habitat mitigation or compensation benefits (this will need to include a simple means for calculating benefit) or biodiversity offset values
    - Local communities, partnerships and charities where there are multiple benefits.

5.4 Summary

This review was undertaken for MMO in response to stakeholder feedback during the early developmental stages of the South marine plans (i.e. the production of the SPAR). The advice from stakeholders was that opportunities for beneficially using dredged materials, and making possible cost savings or achieving many net benefits, were being missed in the south.

This ‘under-realisation’ of beneficial use projects has been recognised for many years now. This is not just on the south coast but across the UK as a whole, and this is notwithstanding the fact that the amount of experience and expertise that exists on this subject, and the amount of research that has been carried out, is varied and extensive.

In the South marine plan areas, there have already been a number of valuable completed projects and there are aspirations for more in the future. However, there is no clear drive towards realising these projects, and they generally have to overcome a range of constraints, including uncertainties relating to environmental impacts and issues associated with funding.

In order for more beneficial use projects to occur in the future, there is a need for greater guidance and more strategic oversight. It could also be encouraged through creation of relevant communication mechanisms to facilitate linkages between those that are undertaking dredging work and those that need such materials for beneficial projects.

The South marine plans offer a great opportunity to address many of these constraints and provide the clarity of guidance that is needed. As a starting point to this process, the spatial databases created for this project represent a very valuable way to begin linking potential sediment sources to potential locations of need. In addition, a range of associated strategic initiatives and solutions identified in this work are needed.

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Annex 1: MMO Beneficial Use Survey Analysis

As also described in Section 1.2, the three core objectives for this MMO project are

- **Objective 1**: **Mapping existing sites** of dredging activity (maintenance and capital) and sites where dredged material has been used beneficially within the South Inshore and Offshore marine plan areas
- **Objective 2**: **Mapping potential future sites** for dredging activity and where the material could be used/is needed in the future for beneficial use
- **Objective 3**: **Providing recommendations** about how to strategically co-ordinate the use of dredged material in the South marine plan areas. Include a review of barriers and challenges to the existing process and opportunities for improvements.

In order to develop Objectives two and three of this project, and some extent also inform Objective 1, a questionnaire survey with relevant stakeholders was undertaken. The questionnaires sought to gather information on:

(1) **Previous and planned beneficial use projects** (for mapping).
(2) **Possible locations for future beneficial use** (for mapping).
(3) **Planned future capital and maintenance dredging** undertakings (ports and marinas only) (for mapping).
(4) **'Lessons learned' from past beneficial use project** (implemented or failed), as well as opinions regarding the possible future strategic co-ordination of beneficial use, and the role MMO could play in this.

Three dedicated online questionnaire surveys were developed for three distinct stakeholder groups. Due to the short duration and scope of the project, the number of contacts was restricted to 44. The groups (and number of contacts) were:

- 15 ports and marinas (targeting the main ports only (aiming to achieve approximately 90% of the dredged material (capital and maintenance)), and those harbours/marinas previously involved in beneficial use projects)
- 22 Local Authorities (excluding those with relatively short, and mainly estuarine, shorelines)
- 7 Government Organisations and other relevant interested parties.

Invitations to the survey were sent out by MMO on 14 February 2014, these were preceded by an introductory letter. In total, 16 responses were received (one of these over the telephone);

- Five from the 'Local Authority' respondent group
- Seven from the 'Ports and Marinas' respondent group
- Four from the 'Government Agency (and Others)' group (two of which from different branches of the same organisation, the Environment Agency).

The responses for each of these categories are now summarised in turn; the respective summary tables present the responses in the language of the respondents (with minor editing to summarise and anonymise, where appropriate):

A1.1 Previous and planned beneficial use projects

Overall, ten past beneficial use projects were listed by respondents; the responses pertaining to these are listed in Table A1.1. Some respondents listed projects which would not be considered beneficial use according to the definitions applied for this project – this related to the use of marine aggregates from licensed sources, and also the recycling of beach materials. This information was retained, and is held by MMO, but is not included in this report. The information on those projects which were not included in the MMO database for projects from 2011 onwards were mapped in the 'Historic Beneficial Use Pre 2011' spatial data layer. All historic beneficial use projects known in the South marine plan areas including those not solely derived from the survey information are shown in Figure 3 in the main report.

Table A1.1: Past beneficial use projects listed by respondents.

Respondent Sector	Description	Information (location, volumes, material, type (of beneficial use))
Local Authority	Bournemouth Beach Improvement Schemes: Stage 3 (1988-1990), Stage 4.1 (2006), Stage 4.5 (2010). Each using capital dredge arisings from Poole Harbour Entrance	Location: Bournemouth beach. Volumes: 998,676m^3; 615,705m^3; 72,719m^3 respectively measured on beach. Material: sand and gravel. Type: beach replenishment
Local Authority	One minor project on Poole Beach	Location: Poole Beach. Volumes: 120,000m^3. Material: Sand. Type: beach replenishment
Local Authority	One major project covering Poole, Bournemouth and Swanage beaches	Location: Poole, Bournemouth and Swanage beaches. Volumes: 1.1million m^3. Material: Sand. Type: beach replenishment
Local Authority	Lymington Harbour LHC/Wightlink recharge and retention of muddy arisings for saltmarsh stabilisation	Location: Lymington River. Volumes: not provided. Material: fine-grained arisings. Type: habitat creation/stabilisation
Ports	Maintenance dredging of Blue Lagoon access channel	Location: Blue lagoon. Volumes: not provided. Material: not provided. Type: not provided.
Ports	Beach replenishment, Lee-on-the-Solent, following Southampton main channel dredge in 1997	Location: Lee-on-the-Solent. Volumes: not provided. Material: not provided. Type: not provided.
Other	Sandy material dredged from Sovereign Harbour, placed on the intertidal sand platform to the east. Happened a couple of times a few years back.	Location: Sovereign Harbour, Eastbourne, East Sussex. Volumes: a few hundred m^3. Material: Sand. Type: negligible replenishment
Other	Saltmarsh recharges at Lymington for Wightlink and Breakwater project.	Location: not provided. Volumes: not provided. Material: maintenance dredge arisings so mainly silt. Type: habitat restoration
Other	Disposal of dredged material in Chichester Harbour (Treloar hole) to maintain sediment within harbour	Location: Chichester Harbour (Treloar hole). Volumes: not provided. Material: maintenance dredge arisings so mainly silt. Type: in estuary deposition
Other	Poole Harbour - disposal within harbour to maintain sediment	Location: Poole Harbour. Volumes: not provided. Material: maintenance dredge arisings so mainly silt. Type: in estuary deposition

Overall, five planned, distinct, beneficial use projects were listed by respondents; the responses pertaining to these are listed in Table A1.2. The information on those projects fed into the spatial data layer 'Planned Beneficial Use Projects'. All planned beneficial use projects known in the South marine plan areas are shown in Figure 5 in main report.

Table A1.2: Future beneficial use projects listed by respondents.

Respondent Sector	Description	Information (location, volumes, material, type (of beneficial use))
Local Authority	Continuing need to replenish Bournemouth beach for the next century, in line with SMP2.	Location: Bournemouth beach. Volumes: 210,000m^3 every 3 years. Material: sand and gravel. Type: replenishment for Coast Protection
Local Authority	A trial to look at using small quantities of annual maintenance dredged sand by placing it within the near shore zone (allowing natural swell waves to move it on shore, similar to sand motor in the Netherlands).	Location: Shore Road, Poole. Volumes: 30,000m^3 every 2 years. Material: Sand. Type: replenishment
Ports	Continuation of existing - using maintenance dredging of access channel	Blue lagoon, Poole Harbour
Ports	Disposal of capital dredge arisings in disposal site for use at later date.	Location: disposal site. Volumes: up to 2,000,000m^3. Material: sand and gravel. Type: re-use at a later stage/commercial aggregate
Ports	Newhaven Port East Quay Expansion Project in 2015. Use fit for purpose material for land raising and capping (subject to EA de-watering permits). Discussions in progress with EA and the local Planning Authority.	Location: Newhaven Port East Quay Expansion area - Windfarm Construction Port Project. Volume: 300,000m^3. Material: sand, silt and chalk. Type: land raising.
Other	No specifics, but a number of ports and harbours (ABP Southampton, Hamble) have expressed an interest in carrying out schemes - but need more work to progress	
Other	Use of dredged material from the Southampton Approach Channel Capital Dredge for construction materials	Location: Southampton Water. Volume: Up to 1 million m^3 (estimated). Material: sand and gravel. Type: Construction aggregates

A1.2 Possible locations for future beneficial use

All respondents, except those belonging to the 'ports and marinas' group, were asked to list stretches of shoreline which could particularly benefit from future beneficial use. Four distinct locations were listed by the respondents; as shown in Table A1.3. This information was not combined with the information derived from the literature review, as the latter yielded more specific data. All shoreline stretches which could benefit from future beneficial use of dredge in the South marine plan areas are shown in Figure 6 in main report.

Table A1.3: Stretches which could benefit from beneficial use.

Respondent Sector	Stretches which would benefit
Local Authority	All of Bournemouth beach. Coast Protection. 210,000m^3 every 3 years; 7,000,000m^3 over the next 100 years.
Local Authority	Poole sea frontage beach replenishment in accordance with the SMP
Local Authority	Other sites within the Solent.
Local Authority	Strategic multi-site beach recharge within Christchurch Bay
Other	Lots of opportunities in the Solent

A1.3 Planned capital and maintenance dredging

The ports and marinas respondents listed ten distinct planned maintenance dredge campaigns and five planned capital dredge campaigns; listed in Table A1.4. Information on those projects was fed into the spatial data layer 'Planned Dredging Campaigns'. All known planned dredging projects in the South marine plan areas are shown in Figure 4 in main report.

Table A1.4: Future dredging campaigns reported by respondents.

Location	Frequency	Volume	Method	Material
Planned Maintenance Dredging				
Portsmouth International Ferry Port, Portsmouth	3 - 4 years	20,000 to 30,000m^3	Trailer suction and ploughing	Silt
Blue Lagoon, Poole Harbour	Annual	600m^3	suction/pumped discharge	Silt
Berths and approaches to the Port of Southampton	Twice per annum	200,000 - 250,000 tonnes	Trailing Suction Hopper Dredger (TSHD)	Silt
Weymouth Harbour	Every 2 years	Not known	Not known	Not known
Newhaven Port Limits	3 times per year	140,000m^3	Suction, ploughing, water injection	Sand and silt
Poole Harbour	Annual	35,000m^3 (silt); in harbour areas), 58,000m^3 (sand and silt, main shipping channels)	Grab only for in-harbour areas; TSHD and grab for main shipping channel	Silt and sand
Rivers Hamble and Itchen, Hampshire. Portsmouth, Langstone and Chichester Harbours + various others	Annual	5000m^3 per site - totals around 20,000m^3	Backhoe	Silt
Planned Capital Dredging				
Portsmouth International Ferry Port, Portsmouth	2014	Approx. 10,000m^3	Backhoe and ploughing	Clay
Approaches to/Main Channel of Port of Southampton (Marine Licence L/2013/00064)	2014 (first phase)	up to 4,000,000m^3	TSHD and backhoe	All material types
Weymouth Harbour	Not known	Not known	Not known	Not known
Newhaven Port Limits	2015	500,000m^3	Backhoe and suction	Sand, silt and chalk

Location	Frequency	Volume	Method	Material
Portsmouth Harbour and River Hamble possibly	unknown	probably around 5000m^3	Backhoe	Silt

A1.4 Lessons learned from beneficial use projects

The following five tables list the summarised and anonymised responses for those questions of the survey which requested qualitative information. The answers were used to inform the Section 5 of the main report.

Table A1.5: Stakeholder survey responses: strategic lessons learned from undertaking/planning projects.

Respondent sector	Response
Local Authority	With past projects, it was difficult to co-ordinate grant aided funding with several Local Authorities involved and to get local legal agreements signed. A planned small scale trial for nearshore trickle charging is proving difficult to implement, as everyone wants a computer model built to predict how the sand will move. They can't accept that models are not accurate or even available to predict the movement of fine grained sand within the nearshore/surf zone. The trial should be undertaken and closely monitored; this could then be used to validate future computer models.
	Early communication between the potential provider of material and the end user for aligning timing or works, type and volume of material to be produced and the requirements for the end user. Need improved co-ordination and more streamlined process to ensure assessments, licences and consents are available for both provider and recipient of material
Ports	Early consultation with EA, MMO, NE and LA.
Other	Needs to be significant will to make it happen. Often link between material 'creator' and 'receiver' missing, with neither the time, money or incentive to make happen. Concerns that over-regulation are off-putting to some, so regulators and advisers could do more to facilitate to give confidence to these projects. Most effective approaches are where the amount of resources required to make happen is minimal (e.g. disposal within harbour). Lymington breakwater recharge disproportionately expensive and unsustainable in current form, need to take lessons learnt by the Lymington projects and roll out to other similar operators in similar locations. The more we do these projects, the greater the understanding and the more comfortable everyone will be, in time making the process easier
	Greater collaboration required amongst affected and interested parties. Centralised management of resource/planning. Early identification of both use and material availability

Table A1.6: Stakeholder survey responses: positive outcomes of beneficial use projects.

Respondent sector	Response
Local Authority	Transport by sea is preferred by local people; this also enables transport of larger volumes in without damaging designated features.
	Good/excellent use of dredged material. Several years of excellent Coast Protection, and also excellent amenity value of replenished beach.
	Re-use of all available sand from a major harbour capital dredge (for renourishment). If a planned small scale trial (nearshore trickle charge) were proven to work, the major benefits would be: the ability to use small annual maintenance dredge arising; schemes which would currently not be grant aided may become affordable.
	Improved beach performance and aesthetics due to use of native, local, material which is similar/same to existing beach material. Reduced impact on local highways, communities and inland sources of material due to delivery from marine plants.
Ports	Viable maintenance dredging (whilst replenishing mudflats).
	Less imperative to seek land won aggregate.
	Marginal cost benefits (which depend on us being prepared to manipulate the dredging programme, which does not always work). Good will and brownie points. Beach nourishment has big advantages for the local communities.
	Reduce material disposed at sea. Cost savings in transferring to adjacent land area. Reduced amount of material needed to be trucked onto site.
Other	Better understanding of how to make these schemes work, increased confidence. Better understanding of environmental impacts and ecological response. Successful recharge of saltmarsh habitats (Lymington). Dredged material retained in Harbours (Poole and Chichester).
	Reduced cost. Reduced waste. Sustainable resource management. Habitat creation. Material availability to suit unplanned project requirements.

Table A1.7: Stakeholder survey responses: obstacles to undertaking beneficial use.

Respondent sector	Response
Local Authority	On the face of it this sounds like a good idea, but dredged material is of very varying quality in terms of grading (often mostly fine silt) and quality (contaminated by organic, inorganic and animal material). In our region, dredged material is the wrong grading for re-use as beach material; also it comes from a commercial port and a marina, so could be contaminated.
	Historic projects took some time to bring to fruition. Planned project is also taking an inordinate amount of time.
	Licencing requirements (e.g.in past, 3 marine licences for what in engineering terms was one scheme: 1 for each LA involved, despite them all being in the same coastal cell). Obtaining licences. E.g. current application for nearshore trickle charge trial for which everyone has requested modelling even though models can't correctly predict these processes yet. Monitoring of the trial would help validate future models. Concerns of NE and Cefas have been over-come, but local fishermen continue to object and will always do so.
	Often there is uncertainty regarding the timing of material becoming available, as well as regarding the volumes and grades of material that would be available. Initial particle size analysis results from suppliers may not reflect the actual volumes and grade of material; this may result in recharge schemes not being able to proceed due to volume/grade/delivery method becoming more expensive. These uncertainties may impact the licencing, consenting and EIA processes, the delivery options (i.e. by land or sea) and therefore costs.
Ports	Obstacles to future use: 1. The dredged material will not be suitable for use as fill in reclamation areas. 2. Prohibitive costs for disposal to land based tips. 3. Dredged material not suitable for land based tips.
	1. There is a frustration that money that could be spent on coastal defences is having to be used to pay the Crown 2.A considerable amount of cost/ time was spent in developing SMPs and relevant strategies. This seems to be totally ignored by MMO when licensing is undertaken. 3. MMO does not appear to have the expertise to determine licences. At its inception, it was promised that commercial reality would be at the forefront of their decision making. It appears that an applicant is expected to agree with all potential objectors so that MMO do not have to make any controversial decisions. 4. Due to the existing Maintenance Dredging Protocols (which were produced spending considerable effort); the licensing process should be straight forward. 5. The Defra family have spent considerable sums of money in developing strategies. However, one of the major issues on beach replenishment is the fine sediments that come out of the material; studies on how these fines react (should have taken place within the strategy) were not undertaken, consequently allowing legitimate objections from fishermen, etc.
	Licensing - mostly unreasonable and unjustified obstruction/objection from Natural England who seem to operate unchallenged by the Licensing Authorities. Problems increased by higher levels of silting as result of silt retention policies.
	Limited enthusiasm from local authorities or NE to pursue a project (for re-use of capital dredging arisings). MMO licensing delays are frustrating, and could mean that opportunities to re-use materials are lost.

Respondent sector	Response
	To past use: Financial reasons have stopped projects in the past (for beach nourishment).
	Maintenance dredged material is too fine for land reclamation or flood defence use.
	It's virtually impossible to get the various agencies - NE, EA & LPA's to sit and talk about this process in a meaningful way. It is unreasonable for a dredging applicant to try to find suitable sites; the agencies MUST know where they have issues. There seems to be a view that the dredging industry is not keen - but this is not the case. Meaningful discussion needs to be commenced, which needs to include potential contractors (who know more about dredging) and sites. The agencies need to action this, and give positive encouragement, otherwise time and money is wasted. There have been numerous examples over the past 20 years of trying beneficial use, but these tended to get stopped by the EA who clearly do not understand about beneficial disposal. Communication and action please!
Other	In the SE: distinct mismatch between material dredged from Harbour entrances (sand and silt) and that required on beaches (gravel). There is very limited scope for more regular beneficial use. For capital dredges, knowledge about when and what volumes of suitable material are available is key. This would require additional detailed surveys which might be quite costly and not recoverable through beneficial use. Small scale recharge of Lymington Saltmarsh with Harbour dredgings seems to work well but would be difficult to scale up without damaging saltmarshes by smothering them with sediment. Generally, the use of finer materials to prop up foreshore levels is contentious as travel paths of this sediment type into the harbour mouths are uncertain. Sandy foreshore intertidal recharge is difficult; this can only occur at high tide, whereas discharge at sea can happen 24/7. So only a few tides might fit in (e.g. Sovereign Harbour).
	Logistics - how best to get material from source to site. Environment - initial concerns about environmental impacts of disposal and subsequent queries at licensing stage. Design - how best to maintain material in situ, lessons learnt quickly but resource intensive. No party really has the time to organise beneficial use given other pressures (time, logistics, finances, staff). Question over who pays for additional information to inform regulatory process (e.g. EIA, HRA), the creator or the receiver, often different parties so different priorities. Who will align?
	Timing of project against demand from beneficial uses. Specificity of material against design for beneficial use projects - inability of project to adapt specification to allow available material to be used. Decision making frameworks of both potential suppliers and end users. Financing and budget allocation. Legislative and licensing - lack of regulatory drivers. Apparent lack of innovation to adapt to constraints and opportunities. Commercial confidentiality.

Table A1.8: Stakeholder survey responses: opinions on how beneficial use could be strategically co-ordinated.

Respondent sector	Response
Local Authority	Via the Coastal Groups of the Environment Agency
	Through a beach Management Plan for a coastal cell.
	Integrated planning programme for material providers and potential end users. Need to integrate/dovetail the funding, licencing, assessments and consents required for end users with the timetable for material becoming available and delivered Review of sediment samples, PSA taken prior and during the dredging campaigns to maximise certainty of type, volume and grade of material potentially available, and cost, for beneficial use. In terms of LAs current and future work programmes, operations and schemes need to be identified in their MTPs and receive approved allocation of resources, in advance of confirmation of materials becoming available. The cost of material and cost of delivery will significantly influence whether beneficial use is a viable and cost effective option.
Ports	Someone needs to take charge and make timely decisions. Similar conversations have been ongoing for over 10 years, yet little has been achieved (with the exception of Lymington Marshes). The EA disagrees with Natural England in terms of whether sediment is needed in estuaries. Everyone seems to blame the Habitats Regulations for inaction.
	By better awareness and easy facilitation.
	Cefas could include in their reports on the material samples, what beneficial use they foresee for the material. It would then also be useful to send their reports to the EA and NE offering the material for any projects they may have.
	Strategically co-ordinated' - a bit ahead of yourselves here. The first step is to get the agencies to agree that it is a viable option. Once the principle is accepted THEN you can consider co-ordination. The key point is that the potential producers (contractors and site owners/agents) MUST be involved as any method needs to be practical. Plans that do NOT consult these will be unsustainable. Are we frustrated – yes.
	Beneficial use is a great idea, and should be fully encouraged by everyone. Strategic co-ordination should be via the SMPs. What the Plan says should be implemented, there should be less planning / recycling of information, and more spending on on the ground measures. The EA needs to actively support the SMP strategy, including by financing necessary studies (e.g. effects on fish from nearshore trickle charging), which the local organisations (who want to make it work) don't necessarily have the resources to undertake. The EA needs to concentrate money on practical studies associated with ground trials and monitoring and less talking. The evidence base re. Beach nourishment per se is good, the schemes in Poole Bay have been very well monitored.

Respondent sector	Response
Other	Beneficial re-use has been considered previously under the auspices of the Strategic Coastal Programme Initiative (SCPI), a national initiative involving Coastal Groups, Environment Agency (NCPMS, Procurement and FCRM), with support from Westminster Dean & Dyball, to identify efficiencies in procurement and placement of foreshore management materials. This included the re-use of dredged material, and was based on the work of a working group looking at opportunities in the Pevensey Bay area. The idea was that such working groups could be emulated around the country, adding local knowledge to the information in the Medium Term Plan (MTP) about volumes, costs/efficiencies, geographical opportunities and constraints etc., adding consistency of approach and sharing good practice. It was found that most opportunities exist at a regional rather than national level, so Coastal Groups could provide a forum for forming similar groups - not just for dredge re-use but for other materials too. The Initiative sought to use GIS to facilitate these efficiencies. There may be some lessons for a strategic approach in the southern area from the various initiatives using dredged materials in the East marine plan area.
	To make this beneficial, dredge and depositions sites need to be close, so the co-ordination seems best to occur at a local level.
	MMO to take greater role in ensuring that options for beneficially re-use are fully investigated. A SEA of environmental issues and impacts (along with shadow HRA) could provide small operators with sufficient baseline information to progress their consent applications.
	An effective, centrally co-ordinated, sediment exchange mechanism. Regulation through marine planning and licensing. Flexibility of finance/budget allocation for public bodies. Flexible approach to engineering design. Willingness to embrace innovative approaches to coastal adaptation and management. All the various parallel running schemes which are trying to further beneficial use should be aligned/unified somehow.

Table A1.9: Stakeholder survey responses: opinions on the role MMO could play in the strategic co-ordination.

Respondent sector	Response
Local Authority	Working with NE and the EA to act as facilitator to get projects going.
	By permitting long term policies so that beach replenishment could be undertaken as and when material becomes available. We are aspiring to have a disposal site at the up drift end of the Bay so local dredging contractors can place sand as and when they dredge. This would ensure a more sustainable approach and be cheaper for all. Currently they would take it to an offshore disposal site which is lost from the system into deep water.
	Make available material widely advertised. Streamline licensing and consenting.
	Streamlining planning, licence and consents process, and integrate with funding streams for providers and recipients of material. Strengthen local/regional level involvement of MMO teams with providers and recipients of dredgings. Integrate programming of dredging and potential beneficial use schemes
Ports	The most difficult part of a Marine Plan is where the shore meets the sea and it is important that MMO understands the projects they are asked to licensed, and move them on in a timely manner. They need to incorporate the SMP measures into the Marine Plans.
	Leadership!
	By advising and helping the process, particularly at the investigation and permissions' application stages.
	Encourage Cefas to produce data within their reports to make it easier for Port Authorities to offer their dredged material to the authorities. It then puts the onus on the authorities to find a beneficial use. If they can't, then so be it - the material goes for sea-disposal.
	MMO could force the agencies to meet so there can be a sensible, adult, conversation. At present conflicting conditions are issues, which we routinely challenge and get altered. We could quote many insane (or to be charitable - uninformed) conditions suggested by the EA particularly. Their preference if asked about anything is to run away from a decision (they regularly refuse to meet on site) and use the 'precautionary principle'. Some sort of system could then be devised - sources, sinks, etc. This would then match dredging with beneficial.
	Should be managed locally.
Other	If Coastal Groups were the primary forum within which working groups on SCPI-type work could sit, MMO would be involved via its involvement with the Coastal Group, which also discusses the drawing up of the MTP in detail. MMO would be needed around the table - alongside NE - to not only help develop GIS information on opportunities and constraints using understanding gleaned from the marine planning process, but also flag up licensing requirements and discuss WFD (TRAC) or habitats (MCZ) considerations.
	Any co-ordination needs to match extraction and deposition sites by location AND timing. So not sure how much lead in time MMO has. If one targets maintenance dredging, there is a finite number of locations which one could look at whether there is a principal beneficiary close buy, if there is, then timing becomes important, if there isn't, then no further co-ordination is necessary.
	MMO to take greater role in ensuring that options for beneficial re-use are fully investigated. A SEA of environmental issues and impacts (along with shadow HRA) could provide small operators with sufficient baseline information to progress consent applications.
	Regulation though marine planning and licensing. Centrally managed resource planning. Management of a sediment exchange concept.