

Marine aggregates

Capability & Portfolio 2018



National overview

Why are marine aggregates important to Britain?

Britain has one of the world's most developed marine aggregate industries, extracting 15 to 20 million tonnes from the seabed annually. Much of this is used for building houses, transport infrastructure, replenishing beaches and improving coastal defences.

Onshore resources are becoming increasingly constrained, particularly in the South East of England and London. The marine aggregate industry meets around 20% of the sand and gravel demand for England and Wales.

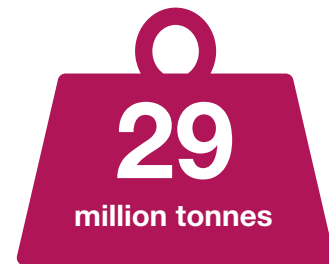
The Crown Estate owns almost all of the sand and gravel resources lying off the coast of England, Wales and Northern Ireland and we award and manage commercial agreements for companies to extract it.

This document is designed to help planning officers in local authorities understand the contribution that marine aggregates can make, by identifying offshore sources and providing information on supply routes. In turn, this is intended to support local authorities in complying with the National Planning Policy Framework, which requires mineral planning authorities to demonstrate they have a steady and adequate supply of aggregates for their requirements through Local Aggregates Assessments.

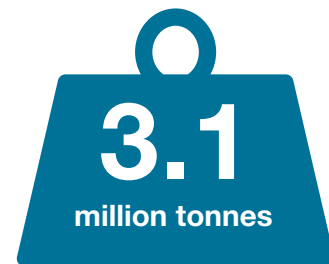
Unless otherwise stated, all figures in this document are correct to 31st March 2018.



50% of all ready mix concrete in London contains marine aggregate

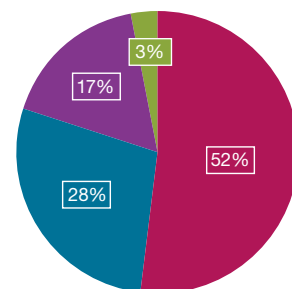


There is potential for demand to increase to **29 million tonnes** per year by 2030

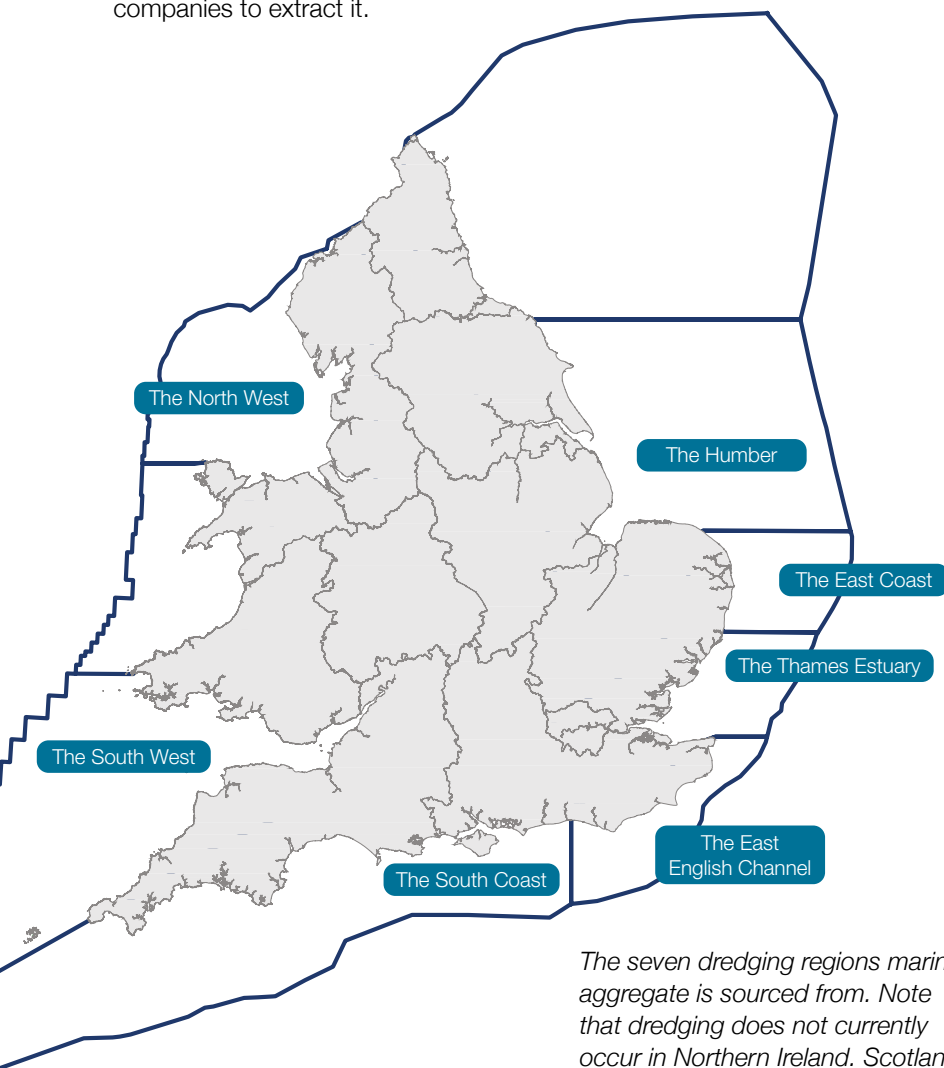


3.1 million tonnes of marine aggregate were exported to Europe in 2017 (**18%** of all marine aggregate landed)

Primary aggregate supply into and within London 2016



- Marine dredged sand & gravel = **5mt**
- Imported rock = **2.7mt**
- Imported land won sand & gravel from outside London = **1.6mt**
- Land won sand & gravel from London = **0.3mt**



The seven dredging regions marine aggregate is sourced from. Note that dredging does not currently occur in Northern Ireland. Scotland is the responsibility of Crown Estate Scotland.

Reserves and resources

Reserves and resources

The PERC code¹ defines “reserves” as the proportion of a mineral “resource” that can be mined for economic purposes

1 <http://inspire.ec.europa.eu/codelist/ClassificationAndQuantificationFrameworkValue/PERC>

21

Current national estimates suggest there are **21 years** of primary marine aggregate production permitted

343

million tonnes

Current national estimates suggest there are **343 million tonnes** of total current primary reserves

Region	Total current primary reserves	10 Year average annual offtake*	3 Year average annual offtake*	Peak annual offtake during 10 year period*	Annual permitted offtake (as at 31/3/2018)	Regional reserve life @ 10 year average annual offtake
		Primary (construction aggregate)				
Humber	50.90	1.96	1.52	3.15	5.90	25.99
East Coast	72.98	4.74	4.35	6.08	7.93	15.38
Thames Estuary	37.34	1.10	1.77	1.94	3.35	33.82
East English Channel	62.15	3.43	4.09	4.65	9.63	18.14
South Coast	99.43	3.47	3.31	3.94	8.63	28.66
South West	7.52	1.13	1.23	1.47	1.75	6.68
North West	12.56	0.34	0.30	0.52	1.30	37.49
TOTAL	342.88	16.16	16.56	21.10	38.49	21.21

All figures are in millions of tonnes

*Totals are national averages and peaks, not the sum of the regional figures



172

million tonnes

London and the Thames Estuary are supplied by the East Coast, Thames Estuary & East English Channel. These hold reserves of 172m tonnes, giving **London** and the **Thames Estuary** 18.5 years of production

Delivery by region/country

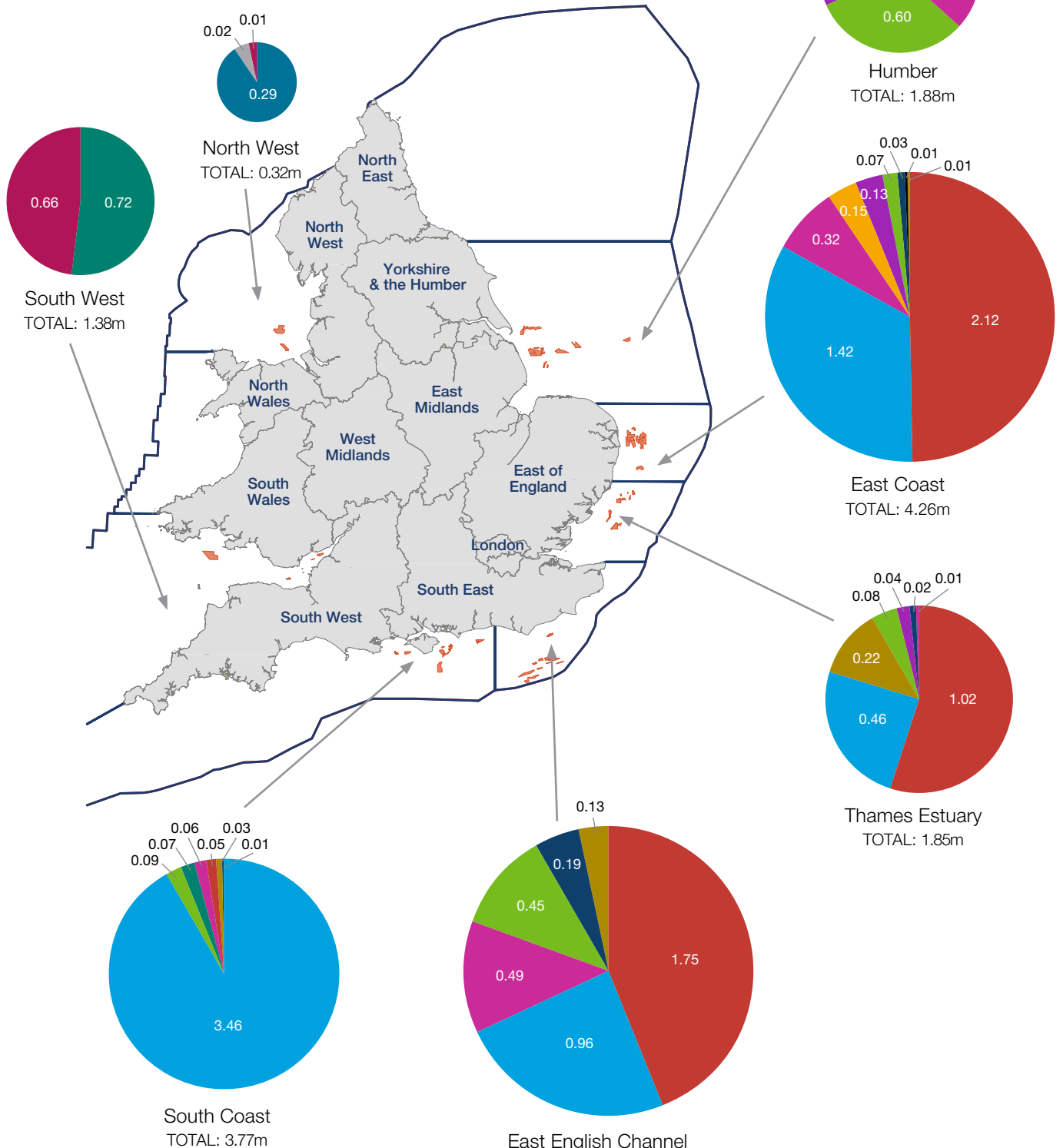


These figures refer to the calendar year 2017

Extraction and delivery by dredge region

Regions delivered to:

- North East
- East of England
- London
- South East
- South West
- South Wales
- Denmark
- North Wales
- North West
- The Netherlands
- Belgium
- France
- Yorkshire and the Humber



Pie chart figures in millions of tonnes
These figures refer to calendar year 2017

The Humber region

5.9

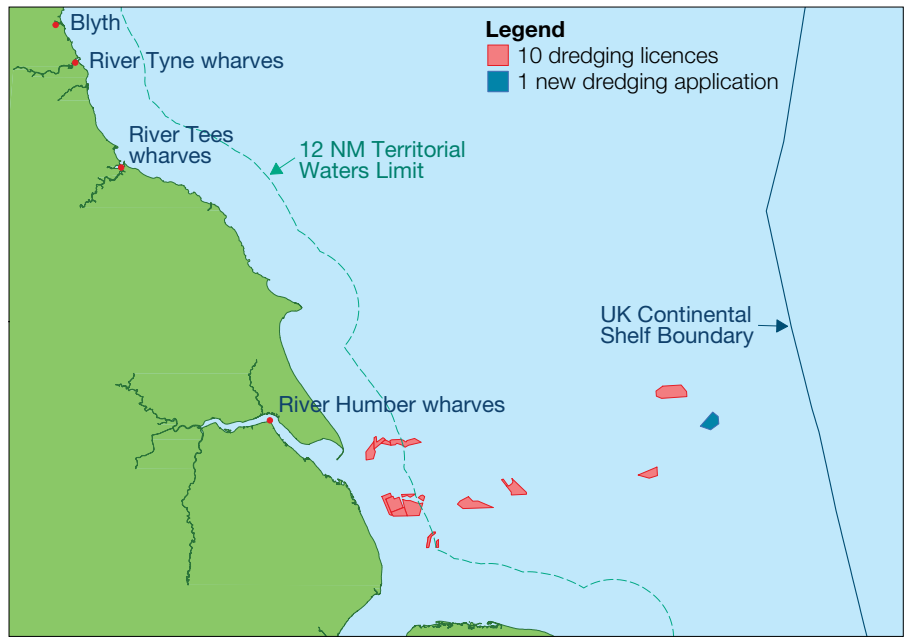
million tonnes can be extracted from 10 licences

26

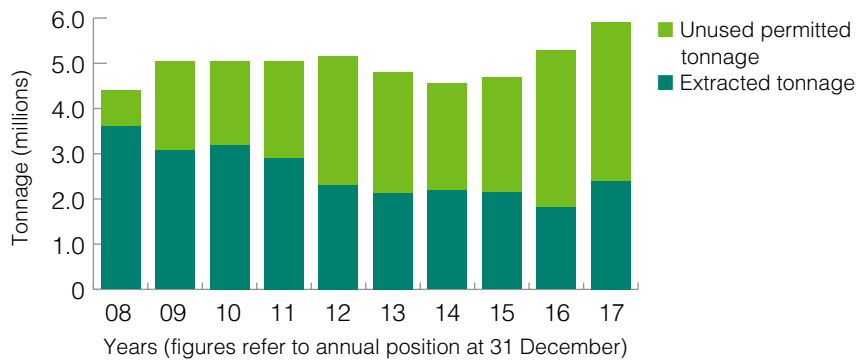
Current estimates suggest there are **26 years** of primary marine aggregate production permitted

1

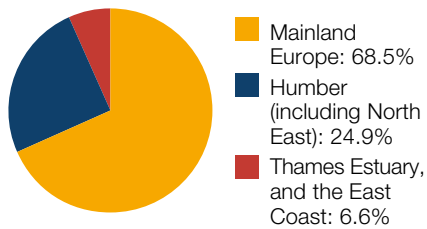
current application for a licence could, if approved, increase the permitted tonnage by **0.6 million tonnes**



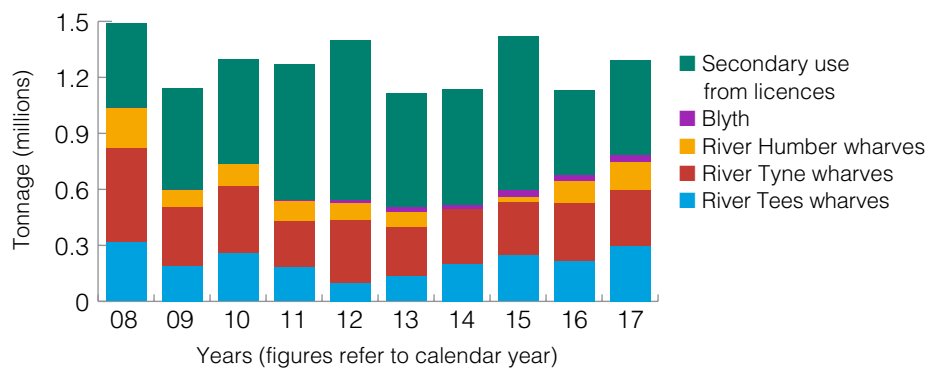
Permitted & extracted tonnage



During 2017 material extraction from the region was mainly delivered to:



Delivery of marine aggregate to the region



Sediments and indicative grain sizes



The East Coast region

7.93

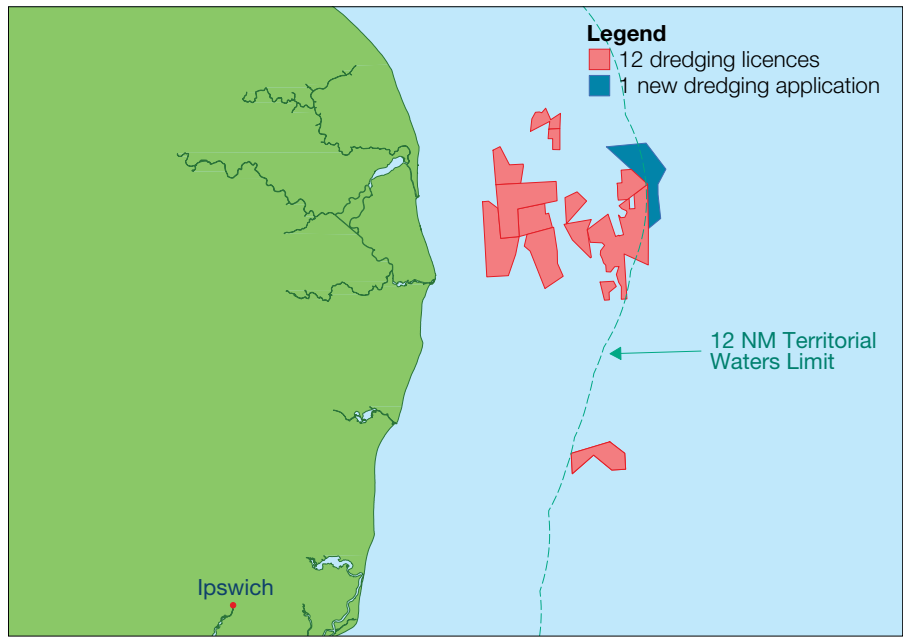
million tonnes can be extracted from **12 licences**

15

Current estimates suggest there are **15 years** of primary marine aggregate production permitted

1

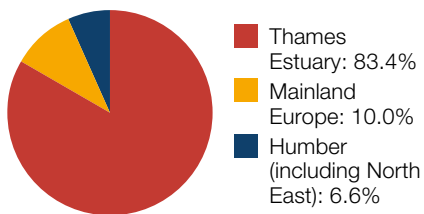
application for a licence could, if approved, increase the permitted tonnage by **0.5 million tonnes**



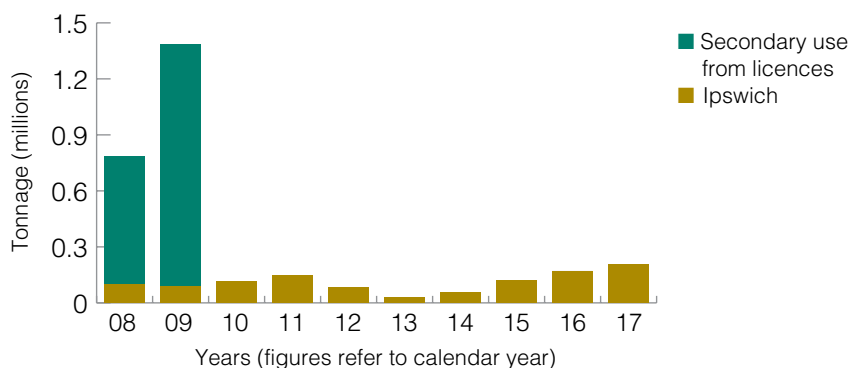
Permitted & extracted tonnage



During 2017 material extraction from the region was mainly delivered to:



Delivery of marine aggregate to the region



Sediments and indicative grain sizes



The Thames Estuary region

3.8

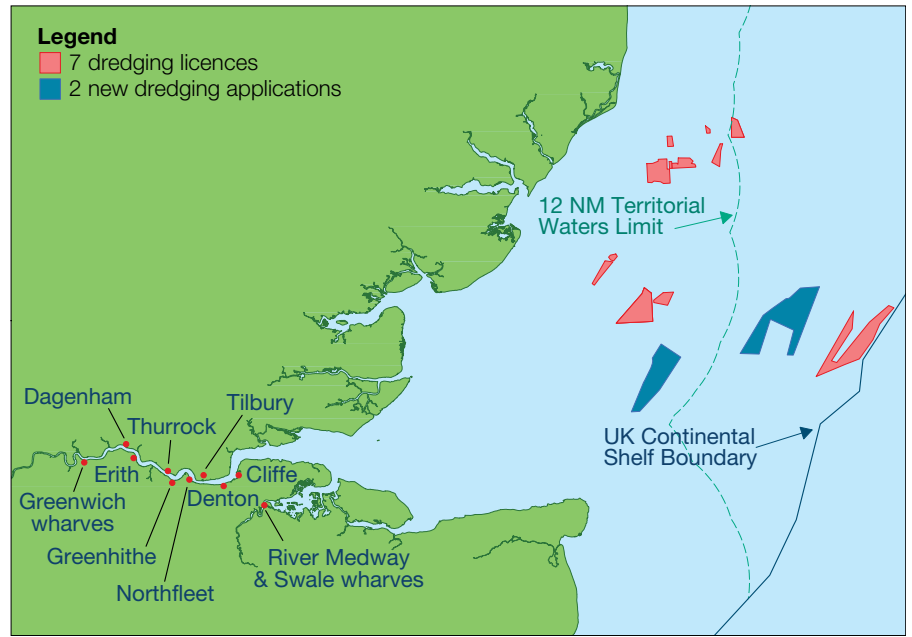
million tonnes can be extracted from 7 licences

34

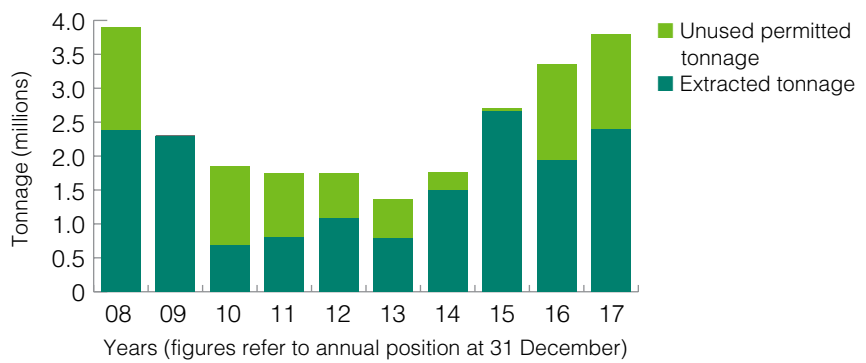
Current estimates suggest there are **34 years** of primary marine aggregate production permitted

2

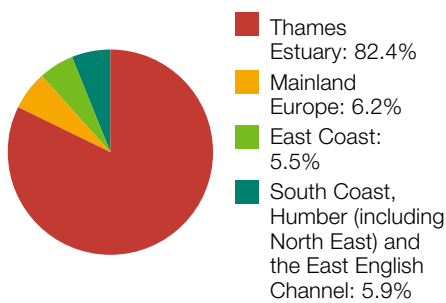
applications for licences could, if approved, increase the permitted tonnage by **1.05 million tonnes**



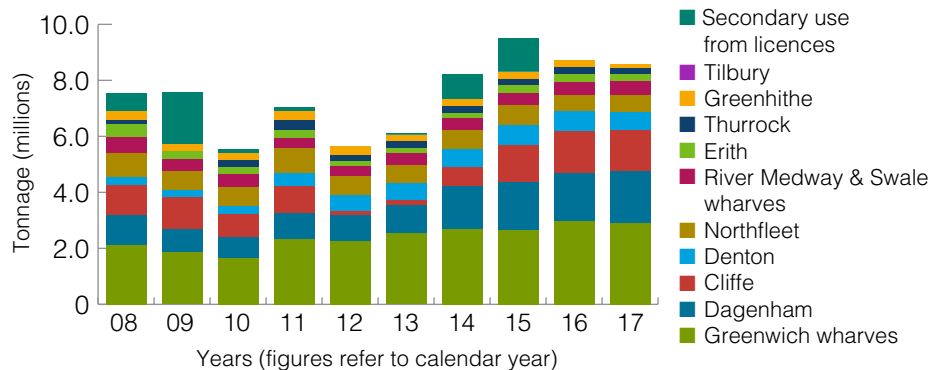
Permitted & extracted tonnage



During 2017 material extraction from the region was mainly delivered to:



Delivery of marine aggregate to the region



Sediments and indicative grain sizes



The East English Channel region

9.63

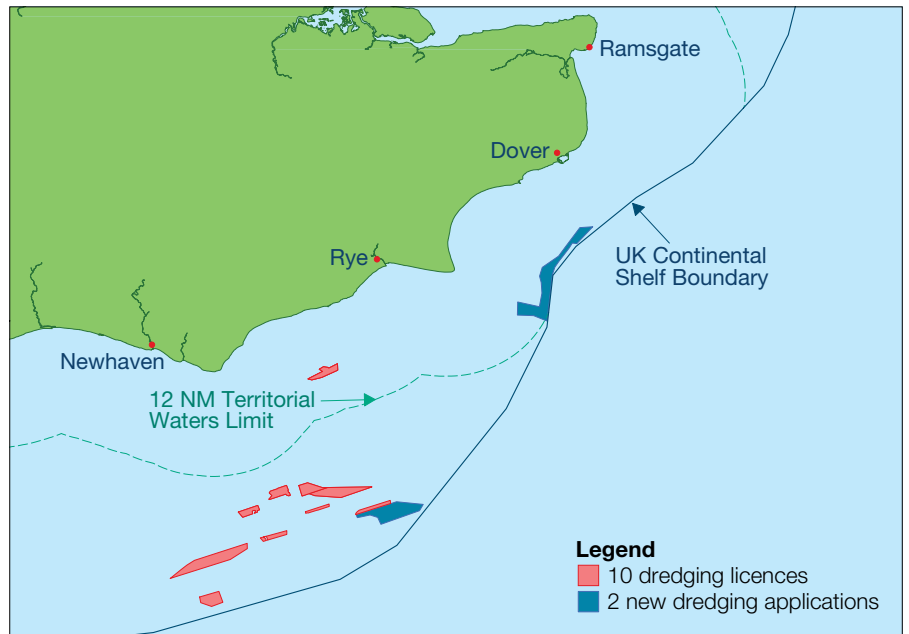
million tonnes can be extracted from 10 licences

18

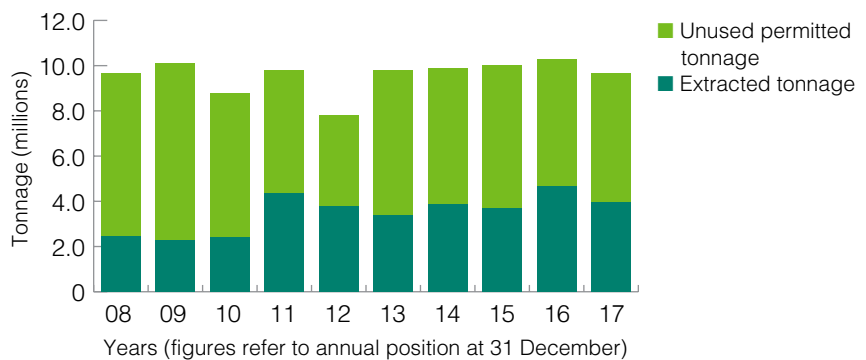
Current estimates suggest there are 18 years of primary marine aggregate production permitted

2

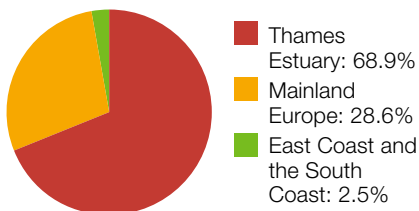
applications for licences could, if approved, increase the permitted tonnage by 1.3 million tonnes



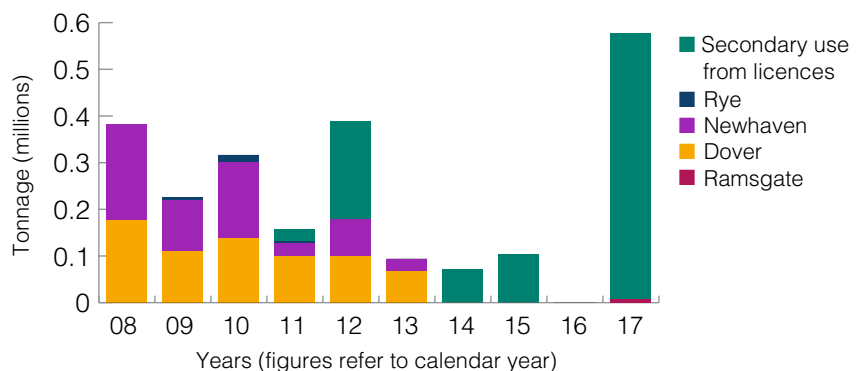
Permitted & extracted tonnage



During 2017 material extraction from the region was mainly delivered to:



Delivery of marine aggregate to the region



Sediments and indicative grain sizes



The South Coast region

8.63

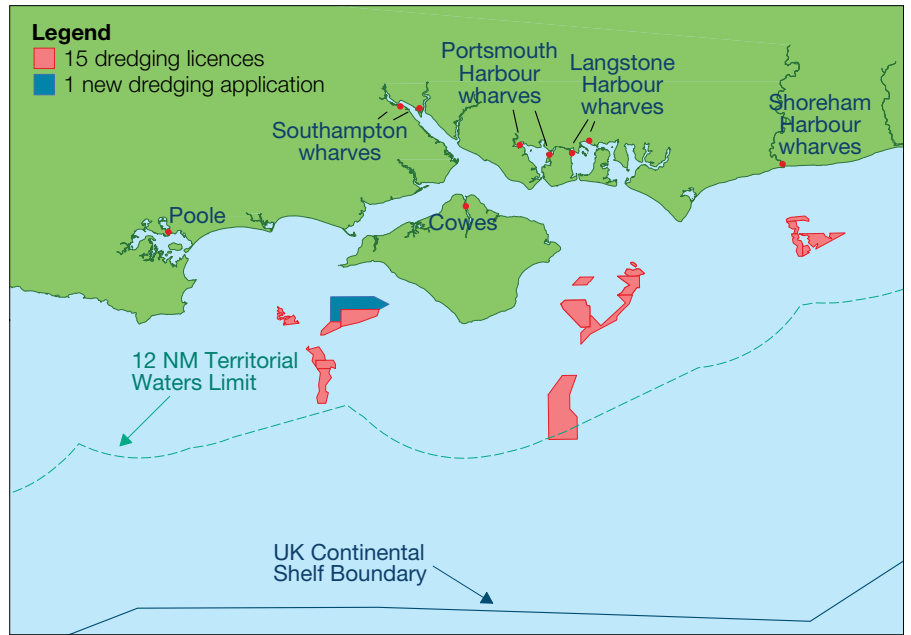
million tonnes can be extracted from 15 licences

29

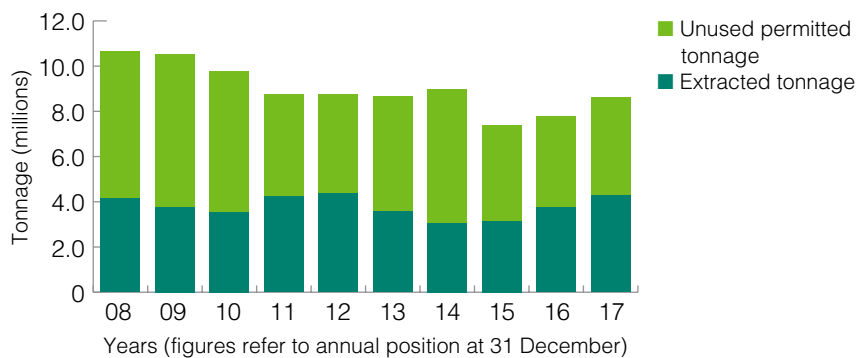
Current estimates suggest there are **29 years** of primary marine aggregate production permitted

1

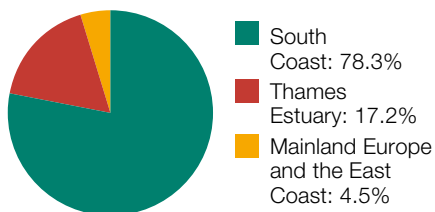
application for a licence could, if approved, increase the permitted tonnage by **0.3 million tonnes**



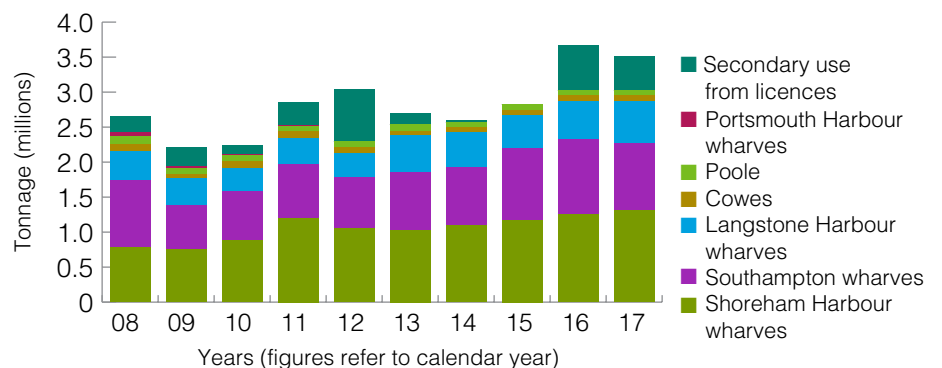
Permitted & extracted tonnage



During 2017 material extraction from the region was mainly delivered to:



Delivery of marine aggregate to the region



Sediments and indicative grain sizes



The South West region

1.75

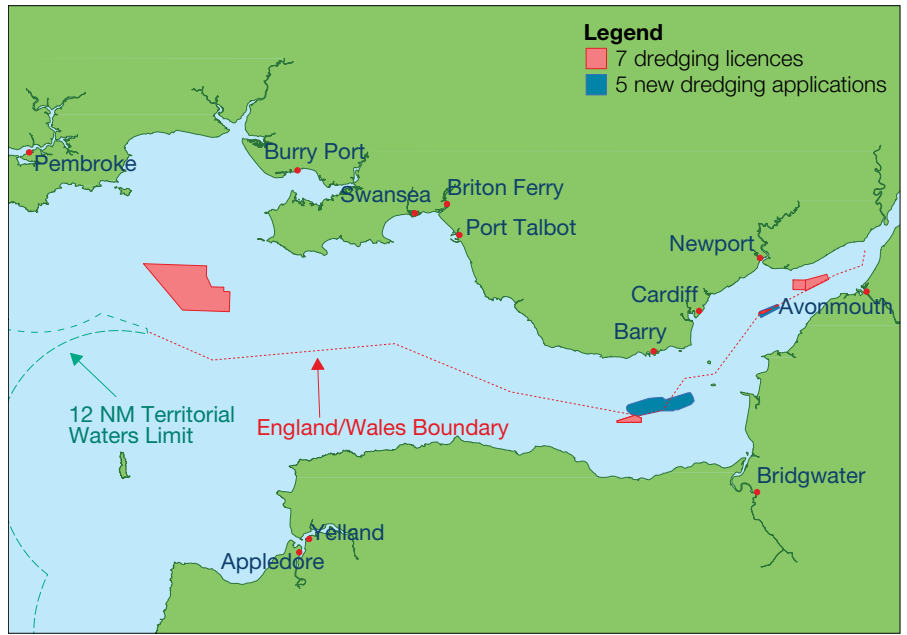
million tonnes can be extracted from 7 licences

7

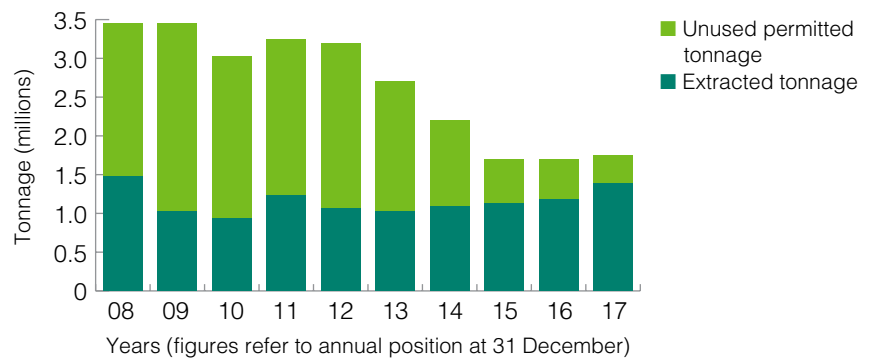
Current estimates suggest there are **7 years** of primary marine aggregate production permitted

5

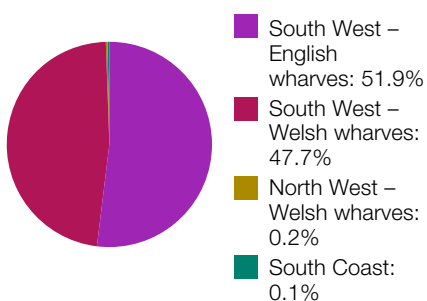
applications for licences could, if approved, increase the permitted tonnage by **2.05 million tonnes**



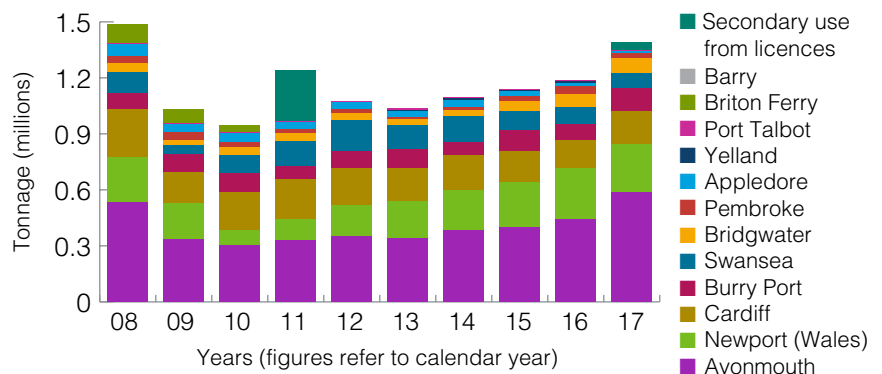
Permitted & extracted tonnage



During 2017 material extraction from the region was mainly delivered to:



Delivery of marine aggregate to the region



Sediments and indicative grain sizes



The North West region

1.3

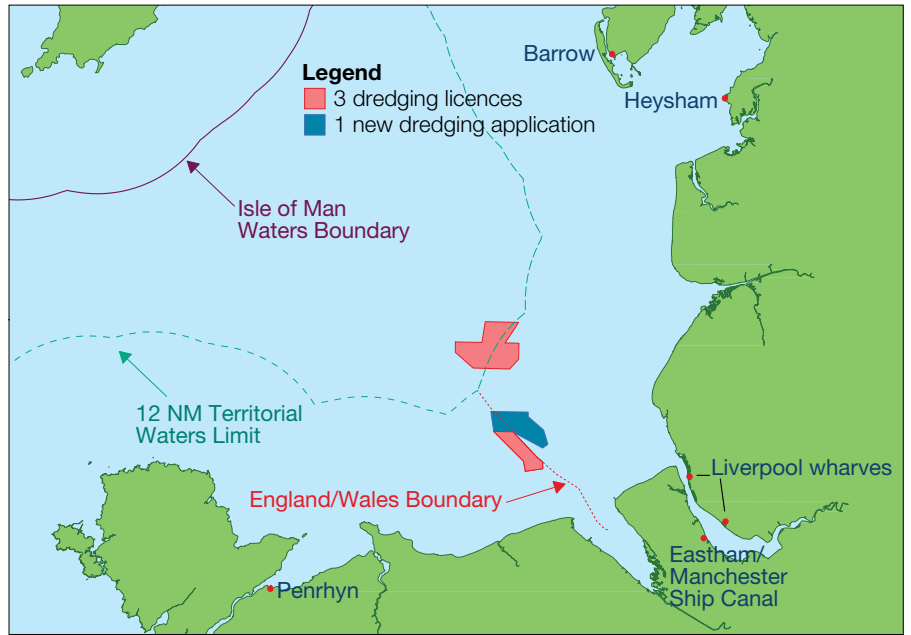
million tonnes can be extracted from 3 licences

37

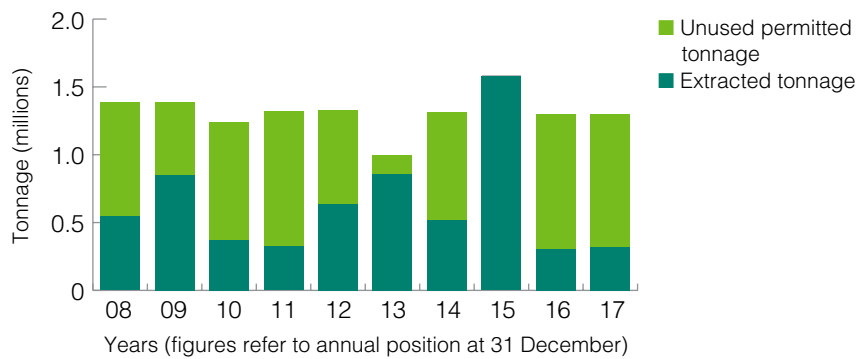
Current estimates suggest there are 37 years of primary marine aggregate production permitted

1

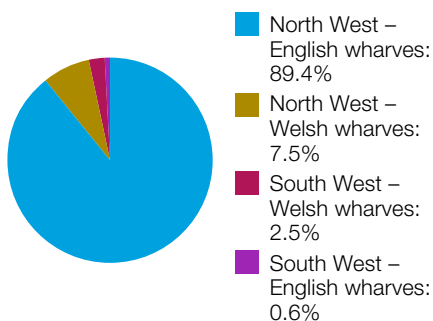
application for a licence could, if approved, increase the permitted tonnage by 0.5 million tonnes



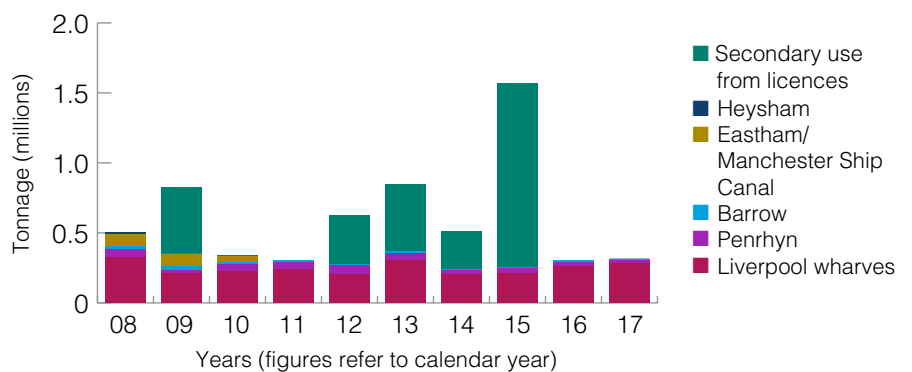
Permitted & extracted tonnage



During 2017 material extraction from the region was mainly delivered to:



Delivery of marine aggregate to the region

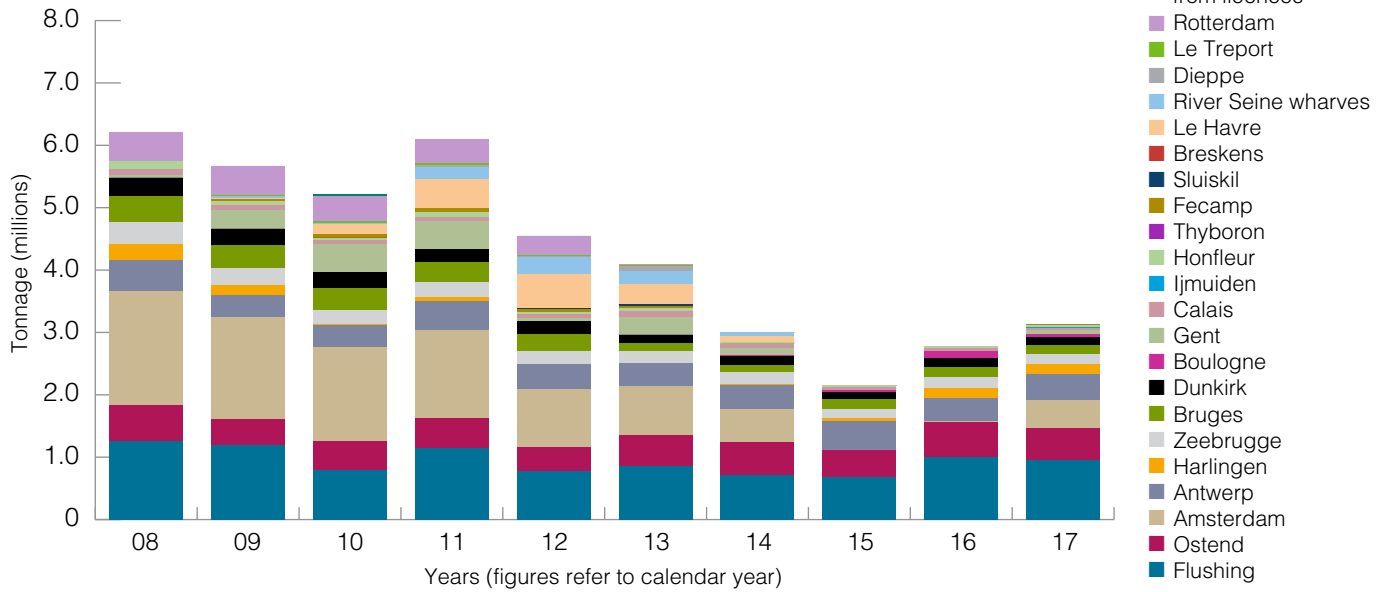


Sediments and indicative grain sizes

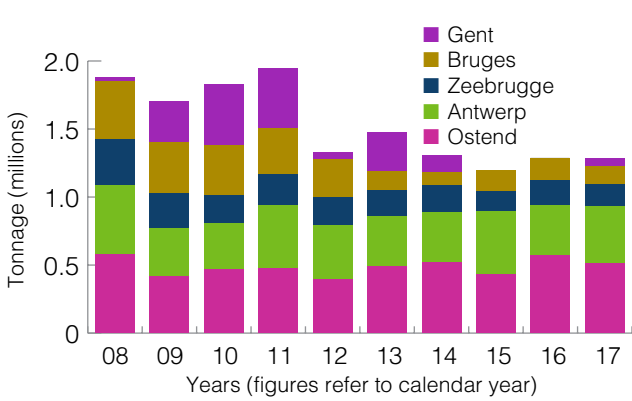


Exports to Mainland Europe from the UK

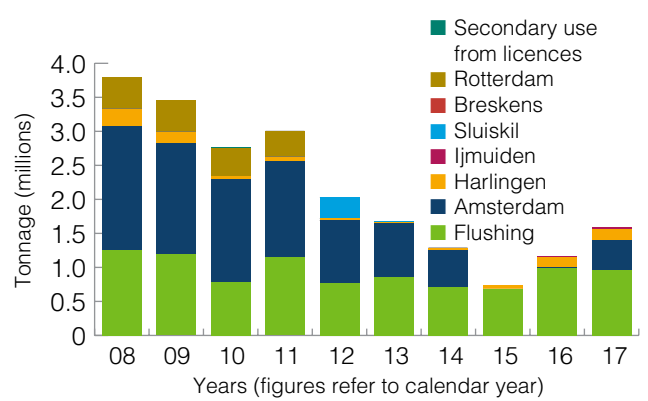
Delivery of marine aggregates to the region



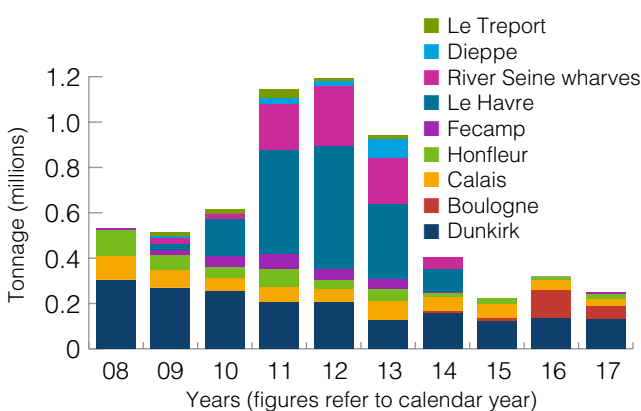
Delivery of marine aggregates to Belgium



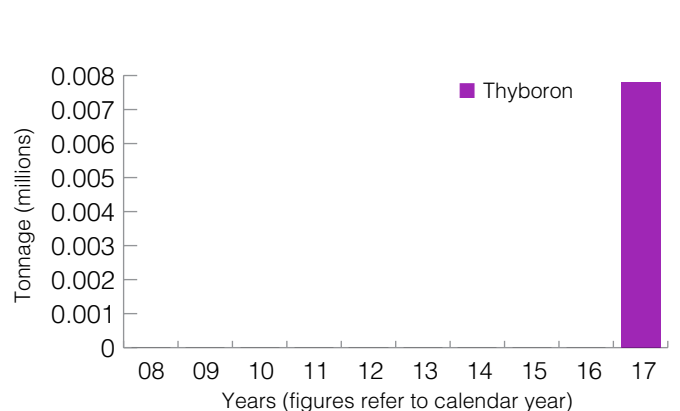
Delivery of marine aggregates to the Netherlands



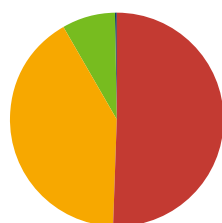
Delivery of marine aggregates to France



Delivery of marine aggregates to Denmark



During 2017 material extraction from The Crown Estate licensed areas was exported to:



- The Netherlands: 1.59
- Belgium: 1.29
- France: 0.25
- Denmark: 0.01

Exports total: 3.13m tonnes

Uses of sand and gravel around the UK

Image supplied by Boskalis Westminster Ltd



Coastal & flood defences

- 1 Minehead Beach
- 2 Sea Defences (reefs), Sea Palling
- 3 Thames Barrier, London
- 4 Clacton Beach
- 5 Colwyn Bay Beach
- 6 Pevensey Bay Beach
- 7 Lincshire Beach
- 8 Dawlish Warren Beach
(see case study page 17)

Commercial development & regeneration

- 9 1 New Burlington Place W1, London
- 10 20 Fenchurch Street (Walkie-Talkie), London
- 11 Cardiff Bay Barrage
- 12 Canary Wharf & Docklands Developments, London
- 13 Central St Martins, London
- 14 Spinnaker Tower, Portsmouth
- 15 Superstore site raising, Seaton
- 16 Land reclamation, Rochester Riverside
- 17 St James's Market, London

Energy & utilities

- 18 Energy Recovery Facility, Newhaven
- 19 Wastewater Treatment Plant, Birkenhead
- 20 London Array Wind Farm
- 21 Nuclear Power Station, Dungeness
- 22 Thames Tideway Tunnel, London
(see case study page 16)
- 23 Hinkley Point C Nuclear Power Station, Bridgwater

Community & leisure

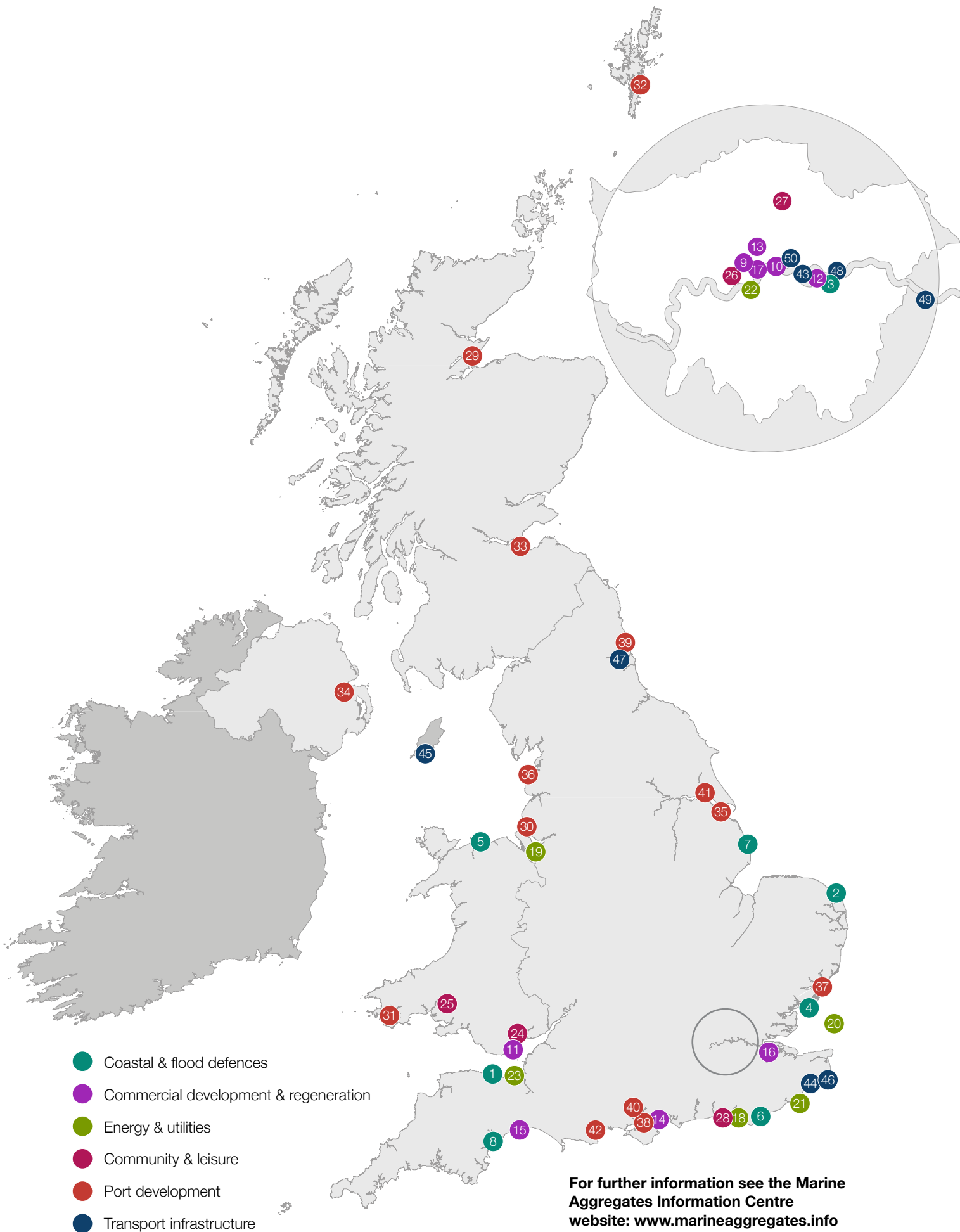
- 24 Principality Stadium, Cardiff
- 25 National Botanic Gardens of Wales, Great Glasshouse, Carmarthenshire
- 26 The Darwin Centre, Natural History Museum, London
- 27 Northumberland Development Project, Tottenham Hotspur FC, London
- 28 British Airways i360 Observation Tower, Brighton

Port development

- 29 Nigg Yard, Cromarty Firth
- 30 Liverpool2 Container Terminal
- 31 Oil Terminal, Milford Haven
- 32 Lerwick, Shetland Islands
- 33 Leith Docks, Edinburgh
- 34 Belfast
- 35 Grimsby
- 36 Fleetwood
- 37 Container Terminal, Felixstowe
- 38 Breakwater, Cowes
- 39 Blyth
- 40 Container Terminal, Southampton
- 41 Green Port Hull
- 42 Nr 1 South Quay, Poole
(see case study page 18)

Transport infrastructure

- 43 Canary Wharf Underground Station, London
- 44 Channel Tunnel Rail Link
- 45 Ronaldsway Airport Extension, Isle of Man
- 46 Ferry Terminal, Dover
- 47 Gateshead Millennium Bridge, Newcastle-upon-Tyne
- 48 City Airport, London
- 49 Queen Elizabeth II Bridge, Dartford
- 50 Crossrail, London



Case study: construction use

Thames Tideway Tunnel, London

The Thames Tideway Tunnel is an under-construction 25km (16mi) tunnel running mostly under the tidal section of the River Thames through central London. It will provide capture, storage and conveyance of almost all the combined raw sewage and rainwater discharges that periodically overflow into the river.

Tarmac has supplied dredged material for several aspects of the Thames Tideway Tunnel project.

It is a requirement of the project that all materials are delivered by river, and a new barge loading machine was installed at Greenwich wharf to enable this.

- 110,000 tonnes of ballast as dredged material was supplied from Greenwich wharf to the Chambers wharf construction site. The material was used as part of a coffer dam infill project to allow shaft construction for the tunnel boring machine

- 70,000 tonnes of unprocessed as-dredged sandy gravel was supplied from Greenwich wharf by barge to a site near the King Edward Memorial Park on the Thames. This unprocessed aggregate was needed for tunnel backfill operations and consistently met the backfill specification
- At time of publication, Tarmac is also supplying processed marine sand from Greenwich wharf which is mixed with limestone crushed rock for concrete to build the tunnel structures

The Thames Tideway Tunnel is due for completion in 2023. It will connect 34 of the most polluting combined sewer overflows (CSOs) via transfer tunnels, and is expected to reduce the number of overflow events to a maximum of four per CSO per year at time of commissioning.



25km

Length of tunnel under central London



180,000 tonnes

Unprocessed marine aggregate used to support construction, in addition to processed material for tunnel structures



Image supplied by Tarmac

Case study: coastal adaptation use

Dawlish Warren Beach Management Scheme, Devon

Image supplied by the Environment Agency



Dawlish Warren is an eroding sand spit at the mouth of the Exe Estuary in Devon and plays a vital role in protecting key infrastructure and approximately 2,900 properties from flooding.

The Environment Agency Dawlish Warren Beach Management Scheme (BMS) implemented a balanced and sustainable solution consisting of:

- Removal of gabion baskets from the dune face along the length of the sand spit
- Construction of a new revetment at the western end of the spit
- Refurbishment, extension and replacement of timber groynes

- Installation of a 'GeoTube' defence buried in the dunes at the 'neck', the narrowest point of the Warren. The defence consists of 460m of giant bags, pumped full of sand to create compacted sand bags up to 2.85m high

Dredging operations for the beach recharge commenced on 1 June 2017 and completed before 24 July 2017 (school summer holidays).

Construction of the £12m scheme finished in October 2017, 2 months ahead of programme and £2m under budget. This was achieved through the application of best practice delivery techniques.

Image supplied by the Environment Agency



Case study: land reclamation

Nr 1 South Quay, Poole, Dorset

Poole Harbour Commissioners opened the first phase of its masterplan, the new South Quay in early 2018.

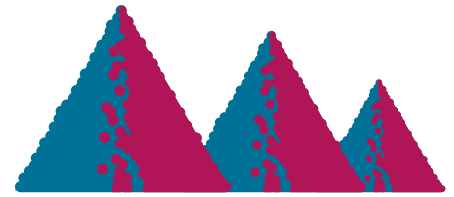
The Port of Poole is a Trust Port managed by Poole Harbour Commissioners (PHC). PHC extensively consulted and the Board approved the PHC Masterplan in 2013; identifying 'Nr 1 South Quay' as the first major development.

The function of the new deep water quay is to protect and retain existing trades in the port whilst diversifying and attracting new trades. The quay serves to improve the port's capacity

and capability to deal with a wide range of shipping and marine activities including yacht loading, cruise activities and bulk cargoes.

The quay has been constructed through reclamation of the harbour bed on the south east corner of the port estate. The quay is 200m long, 40m wide and has a deep berthing pocket immediately to the south.

Enabling works commenced in late 2016 with capital dredging to clear the construction footprint of soft silts and peats. Approximately 40,000m³ of material was dredged and disposed offshore at licensed dumping grounds.



107,000m³
marine sand used
for reclamation

200m
length of quay



40m
width of quay



Subsequent maintenance dredging undertaken within harbour channels produced approximately 80,000m³ of coarse sands which was bottom-dumped over the footprint of the new quay to provide a stable underwater berm in advance of the main piling works.

Main construction works commenced in early 2017 when 180 king piles and 300 sheet piles were driven to retain the hydraulic fill. In total, circa 107,000m³ of dredged sands produced over three separate dredge campaigns was used in the reclamation, all dredged from harbour channels and having the additional benefit of ensuring main channels are maintained at charted depths.

Completion was achieved in early 2018. The development of Nr 1 South Quay ensures the Port of Poole remains competitive as both a regionally and nationally significant port.

Sustainability and stewardship

The Crown Estate has a commitment to being a responsible landlord, which includes minimising the impact that marine aggregate dredging has on the natural environment, helping local communities and preserving archaeological finds.

Although the quantity of sand and gravel potentially available from marine sources is vast, the industry is aware that it is extracting from a large but ultimately finite natural mineral resource and is keen to ensure that these valuable minerals are used in the most efficient and effective manner possible.

We work in partnership with industry, regulators and stakeholders to improve the sustainability of the sector, in particular reducing the area of seabed licensed that is dredged year on year.

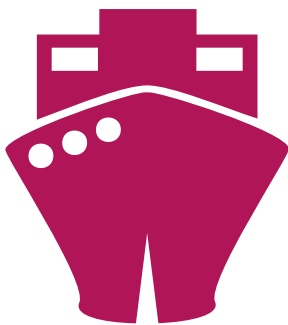


Via our Electronic Monitoring System, we ensure all dredging is undertaken in the correct locations, and every licence application must be supported by a full Environmental Impact Assessment

including a Coastal Impact Study to determine whether a marine licence (essentially the planning consent) can be granted, a process governed by the Marine Licensing process.

To deliver 8,500 tonnes takes:

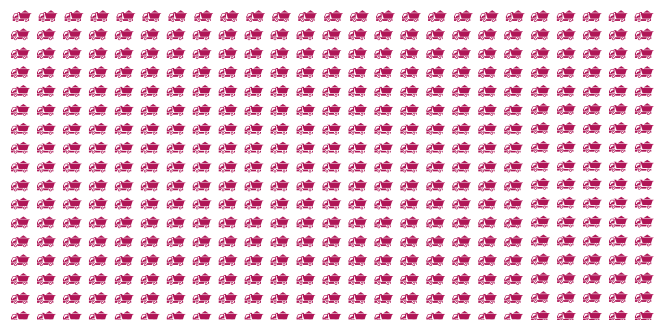
1 dredger
(of 8,500 tonnes)



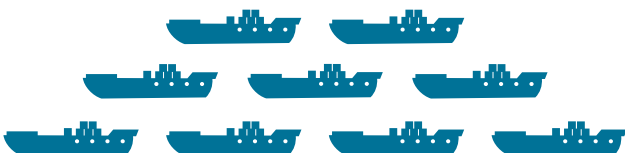
95 train hopper wagons
(of 90 tonnes)



425 aggregate lorries
(of 20 tonnes)



9 barges
(of 1,000 tonnes)



Electronic Monitoring System upgrade

The Crown Estate Electronic Monitoring System (EMS) was launched in 1993 in order to track the activities of vessels on licensed dredging areas. Over this period, the system has logged in excess of 600,000 hours of dredging activity and 1.8 million kilometres of vessel track.

When fitted on a vessel, the EMS automatically records the date, time and location of all dredging activities. EMS data logs are encoded for security purposes and analysed by The Crown Estate to ensure compliance with both Marine Licences conditions and the terms of their commercial agreements.

EMS data plays an important role in research and assisting in the targeting of annual monitoring studies undertaken by licensees. It also assists in shaping policy for future dredging initiatives and activities.

The existing EMS is a PC based solution, used alongside a variety of sensors attached to dredging equipment. An EMS programme, provided by The Crown Estate, is responsible for collecting the recorded dredging data, packaging and encrypting it for onward transmittal.

The current EMS solution has been in operation for over a decade and as such is reaching the end of its operational life. Over the last several

years, The Crown Estate carried out an exhaustive investigation into options for a replacement. In 2017, The Crown Estate appointed Foreshore Technology Ltd as the provider of a new, third generation EMS.

The new EMS represents a significant change in the approach to monitoring dredging activity. It will entail the use of a standardised system across all vessels, and provide a 'one stop shop' approach where all installation, maintenance and breakdown repair services are delivered by the EMS provider.

This rollout will be complete by the end of 2018.



Fully independent system utilising dedicated GPS



A dedicated acoustic sensor to indicate dredging



Dedicated industry helpdesk and repair service



Tamper proof system with encrypted data outputs





Key features of the new EMS

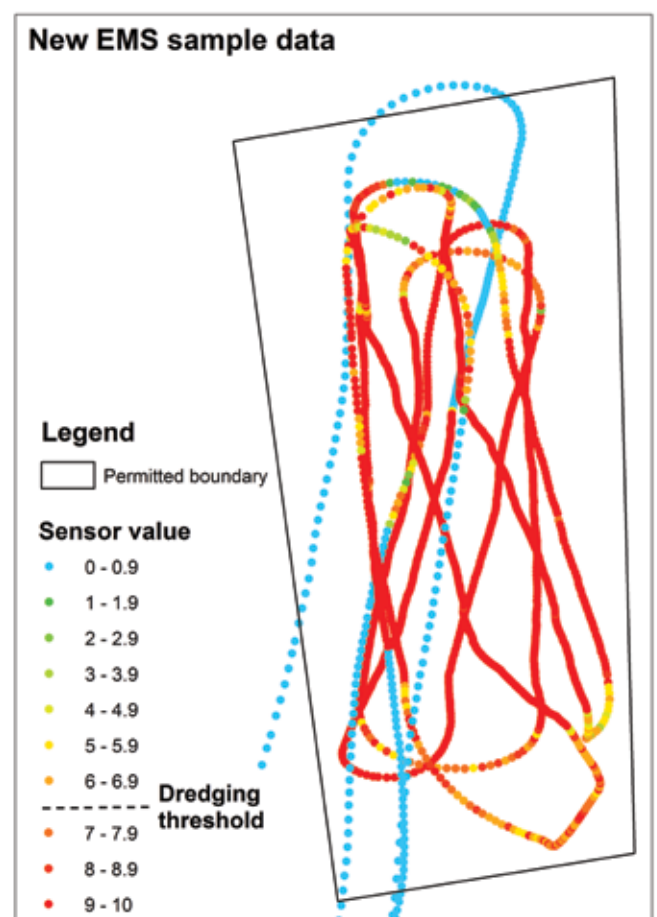
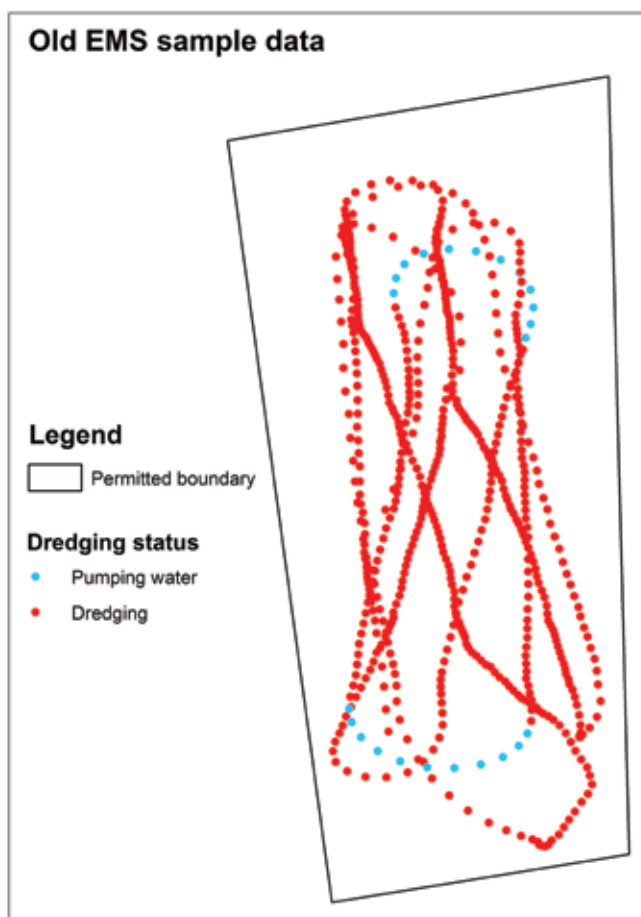
- A robust, secure black box based system, which utilises a simple, stable operating system
- An independent differential GPS to track vessel position
- An independent acoustic sensor to indicate vessel dredging status
- A display unit which gives vessel crew key information
- A data log recording frequency of ten seconds (three times more frequent than at present)
- A dedicated helpdesk and system repair facility
- A web portal where all recorded information can be accessed by authorised personnel

The new system is sufficiently future-proof that further capabilities and inputs may be added during its lifetime, under the guidance and agreement of the EMS Management Group, formed of The Crown Estate, its managing agent and representatives of the dredging industry.

Once the new system has been rolled out to all UK construction

aggregate dredgers, focus will move to the development of a system variant suitable for temporary use. It is envisaged this system would utilise much of the same technology as the regular system but be deployable at short notice and therefore be suitable for dredgers undertaking specific projects such as beach nourishment contracts. Trials of this system are due to start in 2019.

The 2018 upgrade will ensure the EMS remains fit for purpose for the future and will allow for improved, higher resolution data outputs for use by The Crown Estate and other stakeholders.



The Marine Aggregates Application: a new tool for analysis and reporting of monitoring data

As previously reported, the Regional Seabed Monitoring Plan (RSMP) is a new approach to assessing the effects of aggregate dredging (TCE, 2017). The RSMP aims to ensure the seabed is left in a condition which will support the return of the original animal community type after dredging, thereby improving sustainability. Underpinning the approach is a detailed understanding of the relationship between seabed animal communities and sediments (Cooper & Barry, 2017).

Following completion of the RSMP baseline surveys in 2014/15, the focus has now switched to monitoring, with a 5-year revolving programme of regional assessments. The first region to be monitored was the South Coast in 2017, and this will be followed by the Thames Estuary and East Coast (Anglian) (2018), Humber (2019) and East English Channel (2020). Extraction sites in the North West and South West are also being monitored using the RSMP approach, albeit on a site-by-site basis.

To support the analysis and reporting of RSMP data, the Centre for Environment, Fisheries and Aquaculture Science (funded by the British Marine Aggregate Producers Association and The Crown Estate) is developing the Marine Aggregates App (MAAP) (https://www.benthosapps.net/ma_tool/), an on-line application developed using the R Shiny package. R-Shiny web applications allow users to interact with underlying data and complex analyses, without the need for any technical expertise.



Figure 1. Baseline tool screenshot

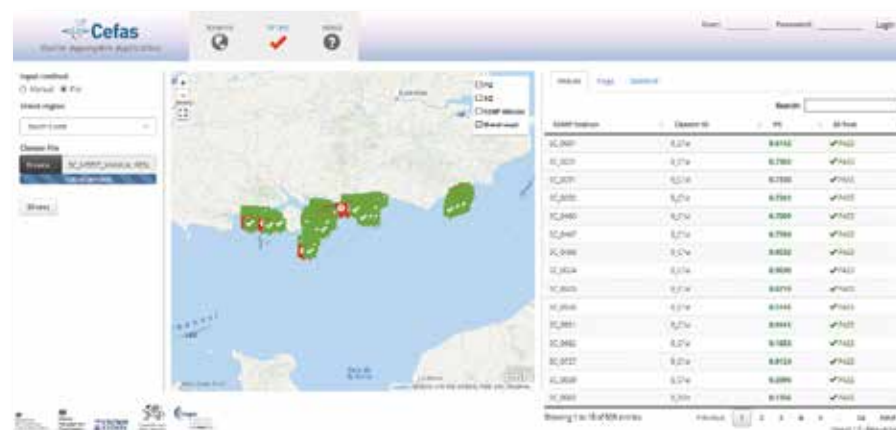


Figure 2. M-test tool screenshot

References

Cooper, K. M. & Barry, J. A big data approach to macrofaunal baseline assessment, monitoring and sustainable exploitation of the seabed. *Sci. Rep.* **7**, (2017).
 The Crown Estate, 2017. Marine Aggregates Capability & Portfolio 2017. London. 24pp.

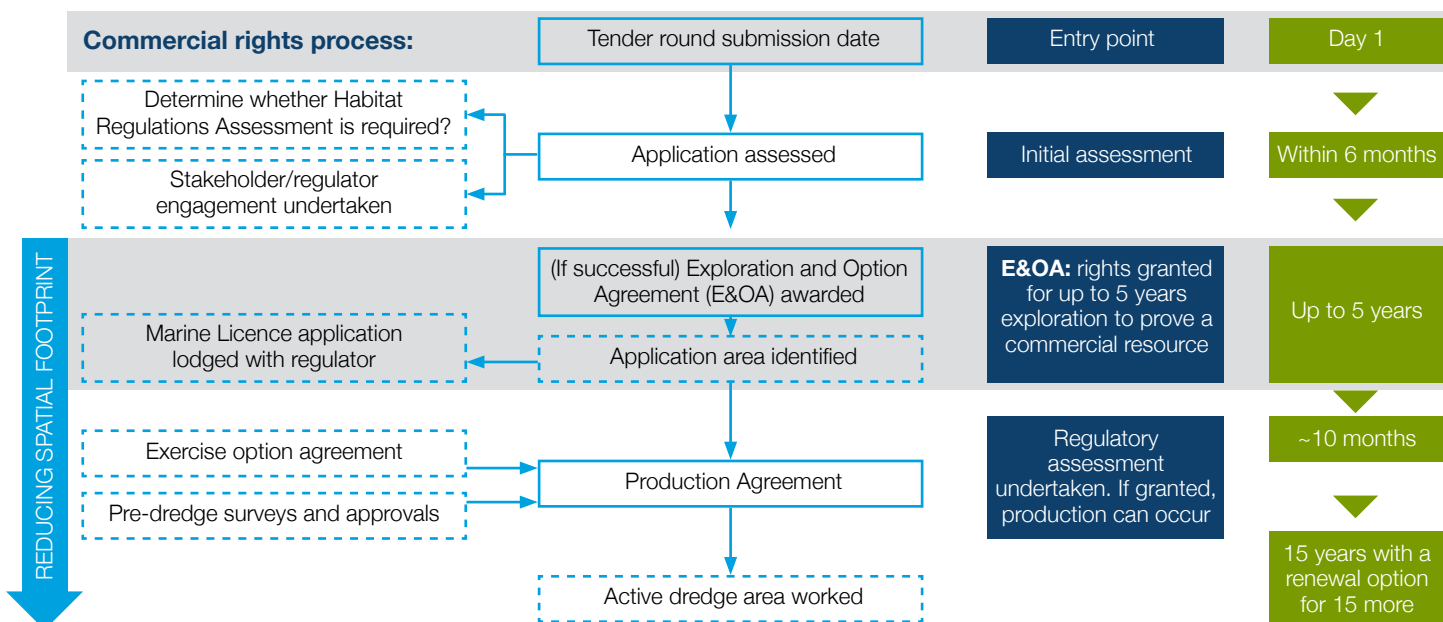
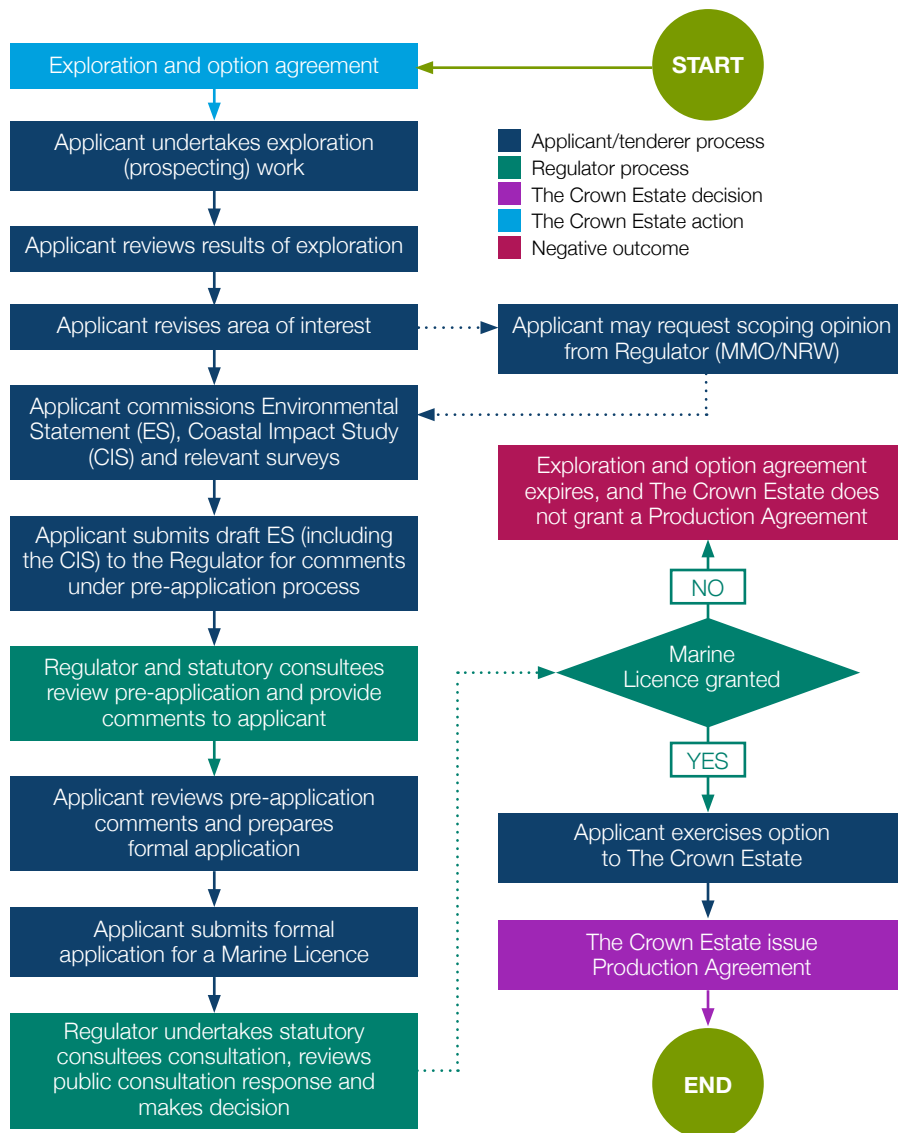
Obtaining rights for sand and gravel extraction

To obtain a licence from The Crown Estate for the rights to extract marine aggregates from the seabed, a number of stages are involved.

- The first stage is to identify an area of interest and submit a tender bid during a Marine Aggregates Tender Round (usually held every two years by The Crown Estate).
- Once a bid is submitted the tenders will be assessed by The Crown Estate and rights may be awarded.
- Once the commercial rights have been secured from The Crown Estate then the second phase of the application process commences.
- The successful tenderer is then required to apply for a Marine Licence (environment and legal rights/permissions) from the regulator (Marine Management Organisation in England, and Natural Resources Wales in Wales).

Only if a Marine Licence is received will the applicant be able to request The Crown Estate issue a Production Agreement for extraction to commence.

The Marine Licence and commercial rights processes are summarised in the following flowcharts.



The Crown Estate is a £14bn real estate business specialising in commercial property in central London, prime regional retail and offshore wind. It also has a substantial rural and coastal portfolio and manages the seabed around England, Wales and Northern Ireland. Established by an Act of Parliament, as an independent commercial business, it returns 100% of its annual profits to the Treasury for the benefit of the public finances. This has totalled £2.7bn over the last ten years.

London

The Crown Estate
1 St James's Market
London
SW1Y 4AH
T 020 7851 5000

www.thecrownestate.co.uk

 @TheCrownEstate

October 2018

Links and useful references

The Crown Estate

www.thecrownestate.co.uk/en-gb/what-we-do/on-the-seabed/minerals-dredging/

Marine Aggregate Information Centre

www.marineaggregates.info

British Marine Aggregate Producers Association

www.bmapa.org

Marine Management Organisation

www.gov.uk/mmo

Natural Resources Wales

www.naturalresourceswales.gov.uk

British Geological Survey – Minerals UK

www.bgs.ac.uk/mineralsuk