

Marine aggregates

Capability & Portfolio 2017



National overview

Why are marine aggregates important to Britain?

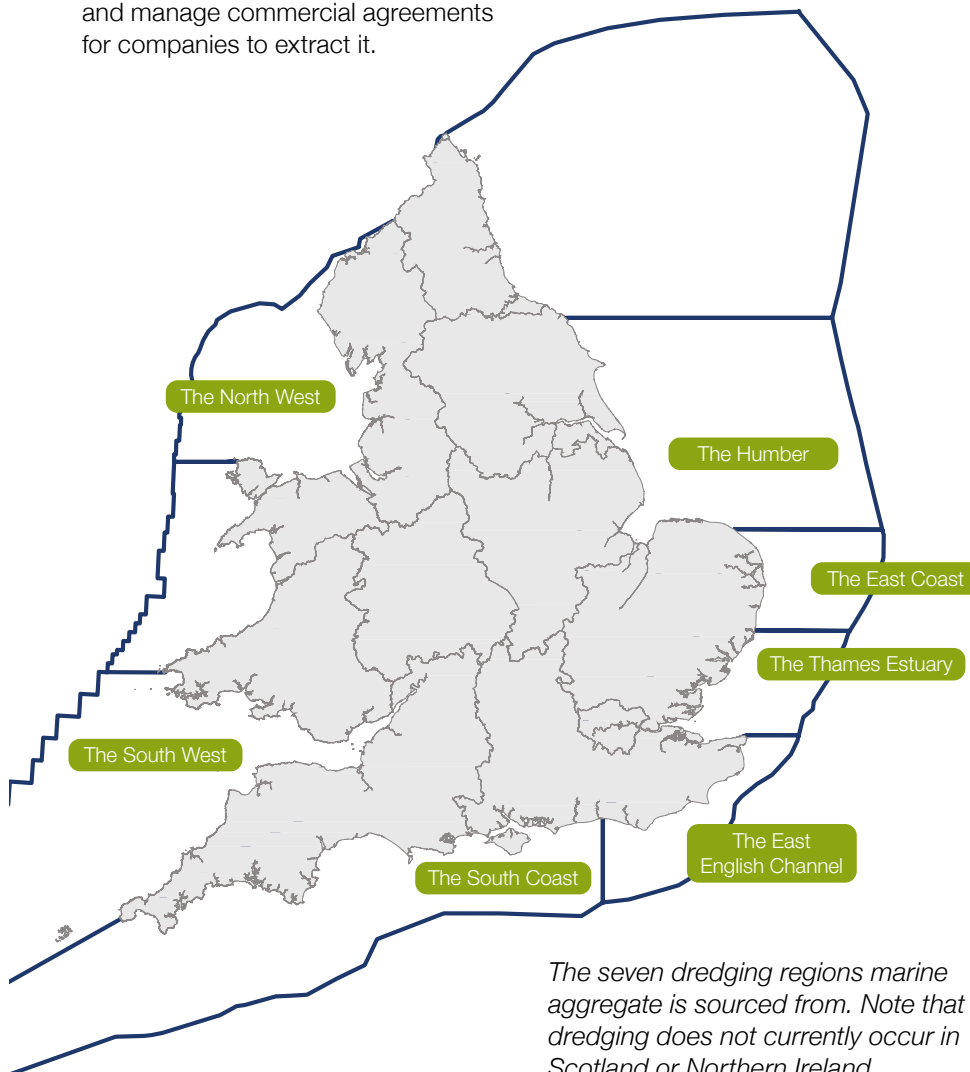
Britain has one of the world's most developed marine aggregate industries, extracting 15 to 20 million tonnes from the seabed annually. Much of this is used for building houses, transport infrastructure, replenishing beaches and improving coastal defences.

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.

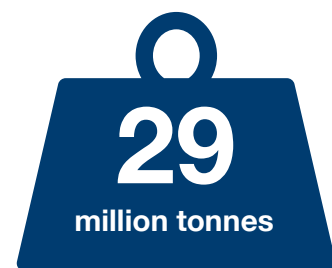
The Crown Estate owns almost all of the sand and gravel resources lying off of the coast of England, Wales and Northern Ireland and we award and manage commercial agreements for companies to extract it.

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.

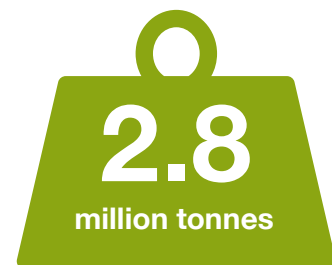
Unless otherwise stated, all figures in this document are correct to 31st March 2017.



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

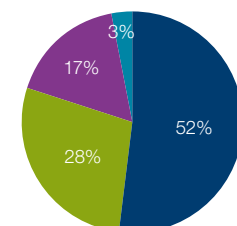


There is potential for demand to increase to **29 million** tonnes per year by **2030**



2.8 million tonnes of marine aggregate was exported to **Europe** in 2016 (**16%** 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**

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

350

million tonnes

Current national estimates suggest there are **350 million tonnes** of total current primary reserves

Region	Total current primary reserves	10 year average annual offtake	3 year average annual offtake	Peak average offtake during 10 year period	Annual permitted offtake (as at 31.03.2017)	Regional reserve life @ 10 year average annual offtake
		Primary (construction aggregate)				
Humber	57.82	2.09	1.41	3.19	5.60	27.69
East Coast	85.20	5.09	4.50	7.72	8.45	16.74
Thames Estuary	17.20	1.02	1.35	1.94	2.35	16.91
East English Channel	75.99	3.23	3.97	4.65	10.30	23.55
South Coast	89.47	3.57	3.04	4.75	7.53	25.08
South West	8.63	1.16	1.14	1.77	1.70	7.41
North West	15.26	0.38	0.27	0.74	1.30	40.48
TOTAL	349.57	16.53	15.68	21.10	37.23	21.15

All figures are in millions of tonnes
Totals are national averages and peaks not the sum of the regional figures

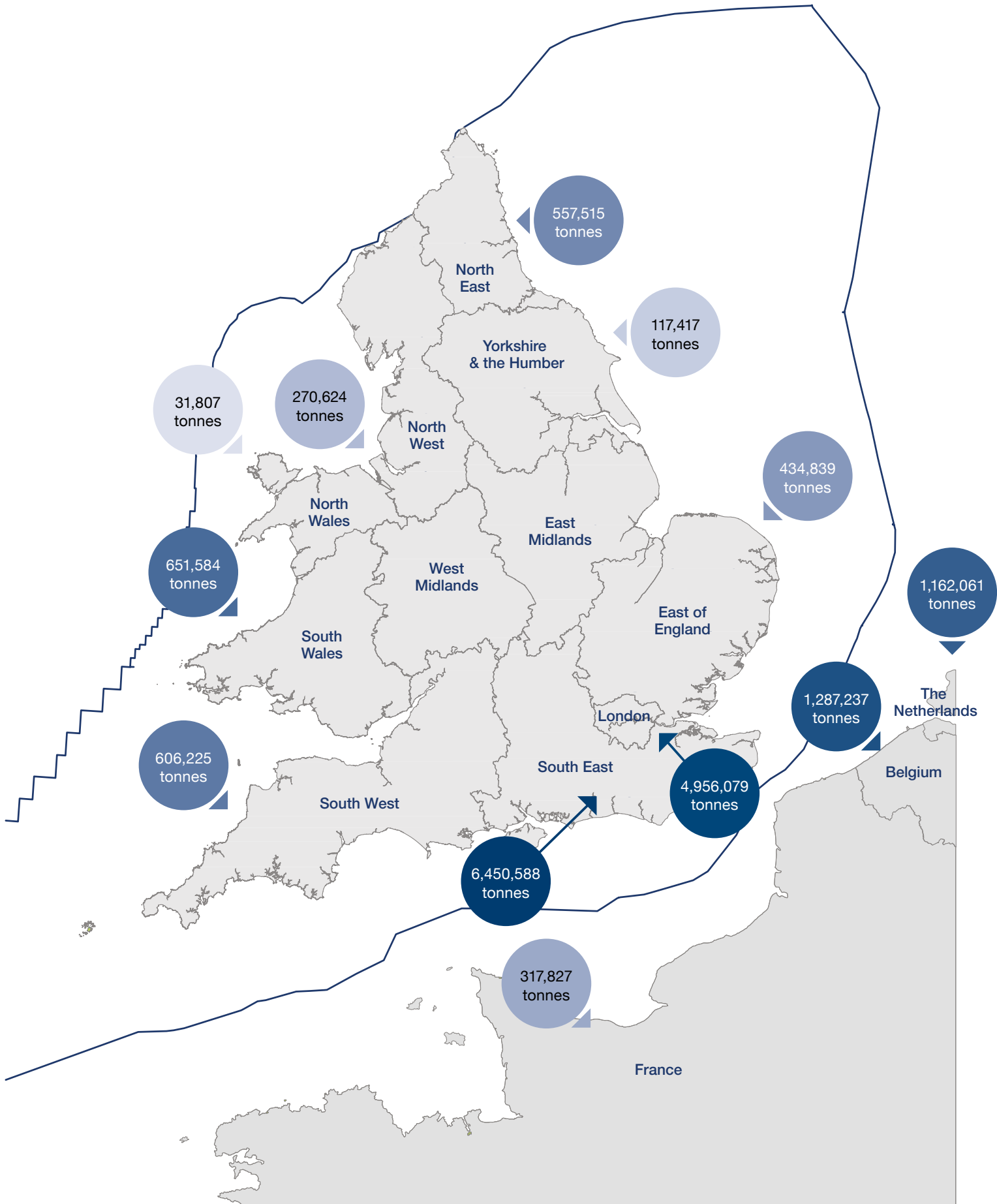


178

million tonnes

London and the Thames Estuary are supplied by the East Coast, Thames Estuary & East English Channel. These hold reserves of 178M tonnes, giving **London** and the **Thames Estuary** 20.5 years of production

Delivery by region/country

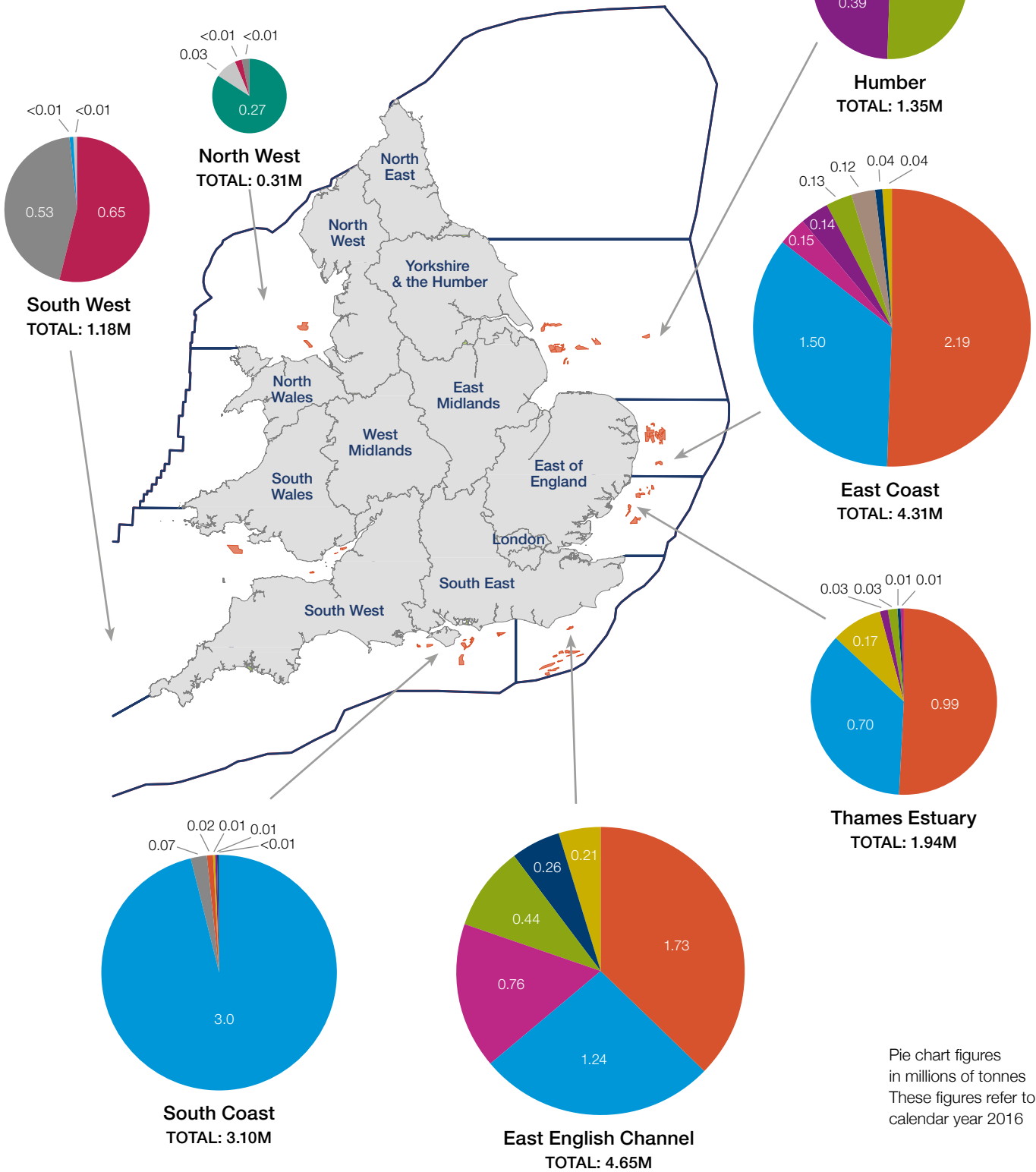


These figures refer to the calendar year 2016

Extraction and delivery by dredge region

Regions delivered to

- North East
- East of England
- London
- South East
- South West
- South Wales
- 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 2016

The Humber region

5.6

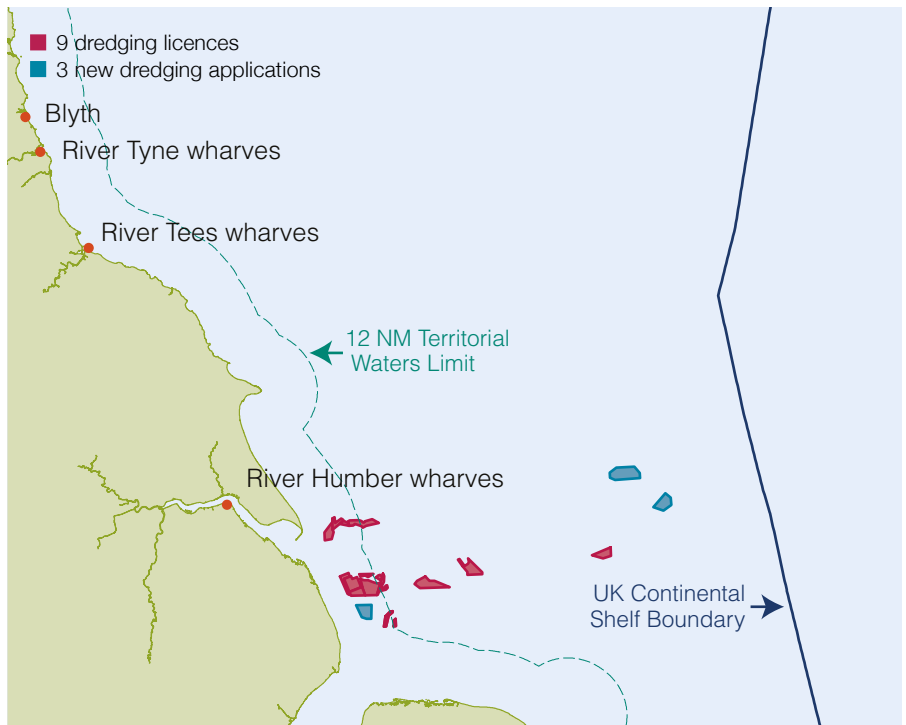
million tonnes can be extracted annually from 9 licences

27

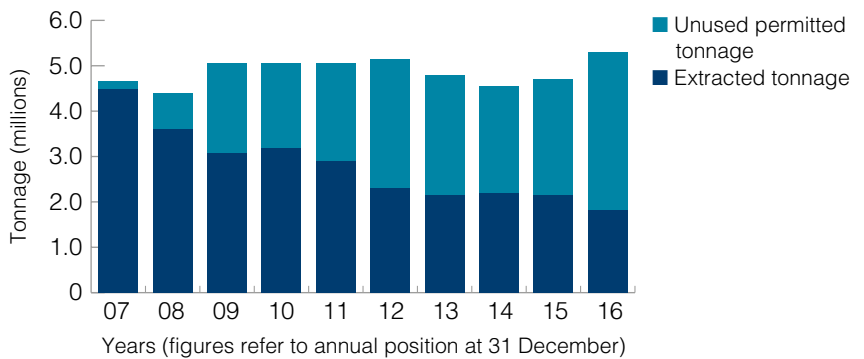
Current estimates suggest there are 27 years of primary marine aggregate production permitted

3

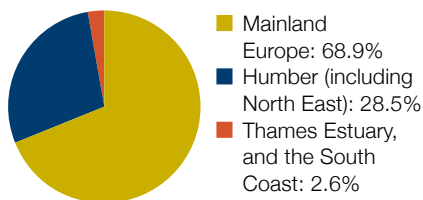
applications for licences could, if approved, increase the permitted tonnage by 1.9 million tonnes



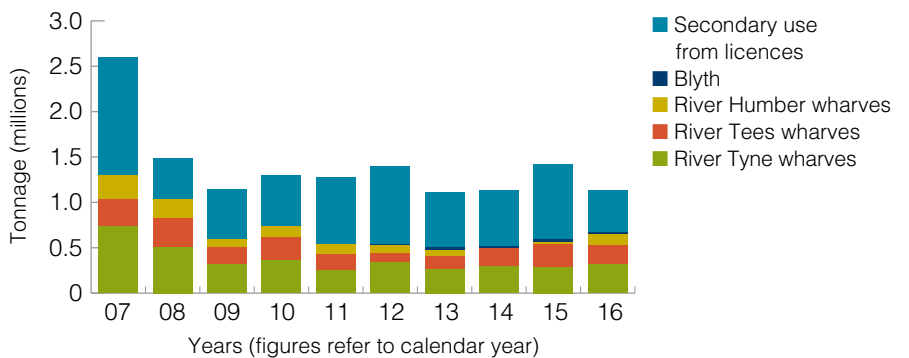
Permitted & extracted tonnage



During 2016 material extraction from the region was mainly delivered to:



Delivery of marine aggregate to the region



Sediments and indicative grain sizes



Fine sand
0.063 – 0.25mm



Medium sand
0.25 – 0.5mm



Coarse sand
0.5 – 2mm



Very coarse sand
2 – 4mm



Fine gravel
4 – 20mm



Medium gravel
20 – 40mm



Coarse gravel
40 – 63mm

The East Coast region

8.5

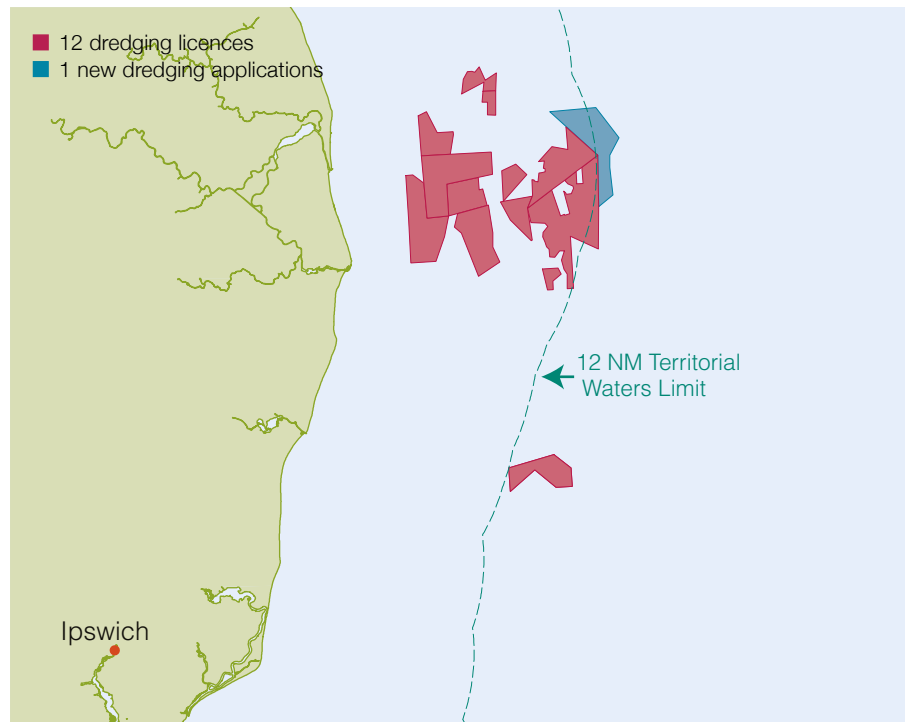
million tonnes can be extracted annually from 12 licences

16

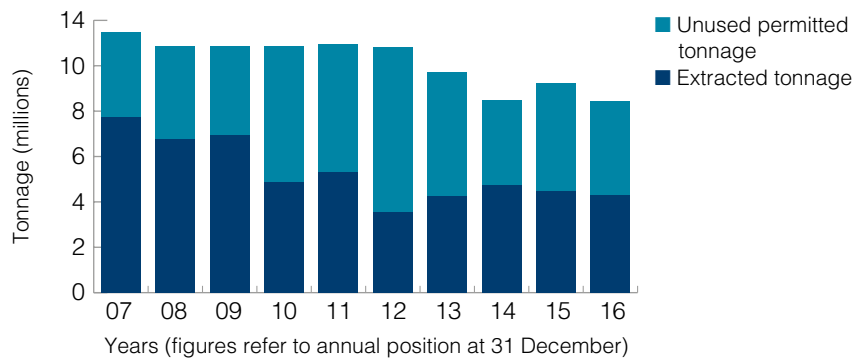
Current estimates suggest there are 16 years of primary marine aggregate production permitted

1

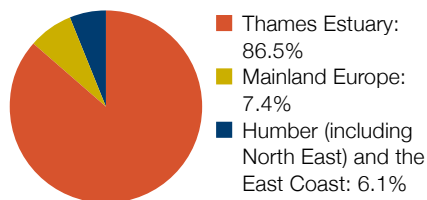
application for a licence could, if approved, increase the permitted tonnage by 0.6 million tonnes



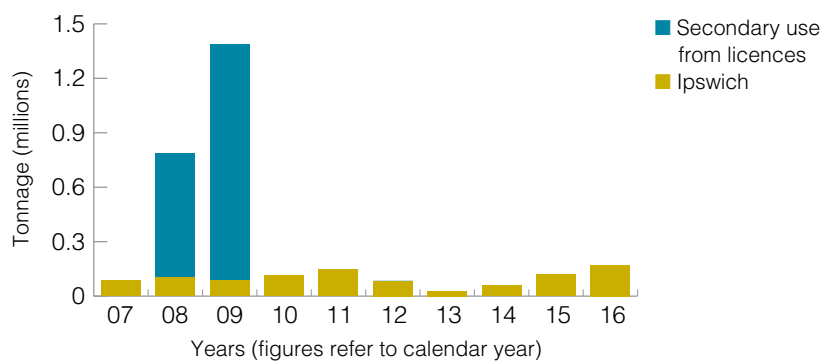
Permitted & extracted tonnage



During 2016 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

2.4

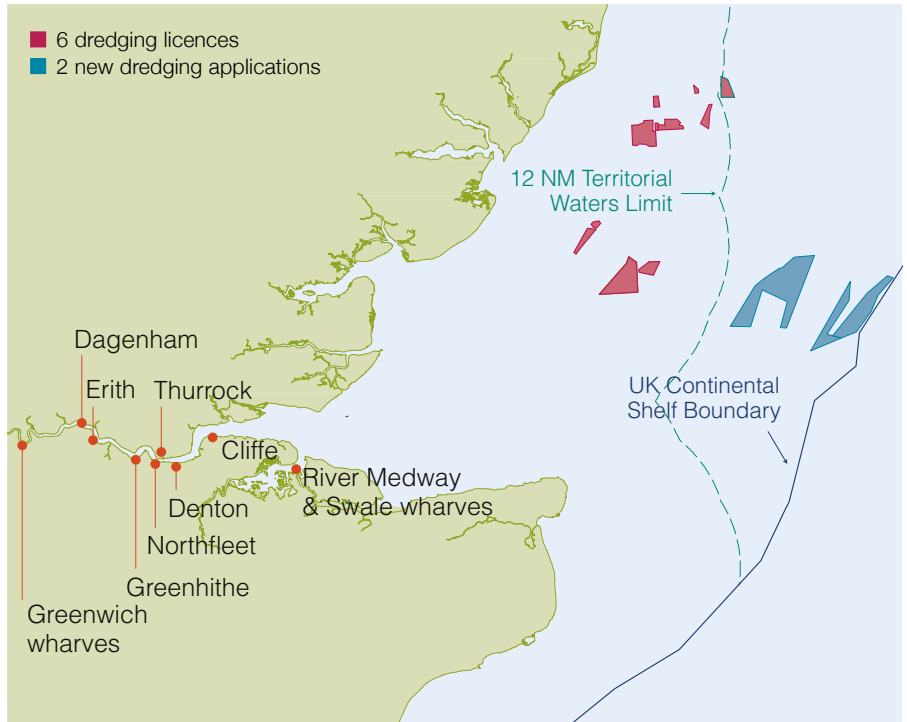
million tonnes can be extracted annually from **6 licences**

16

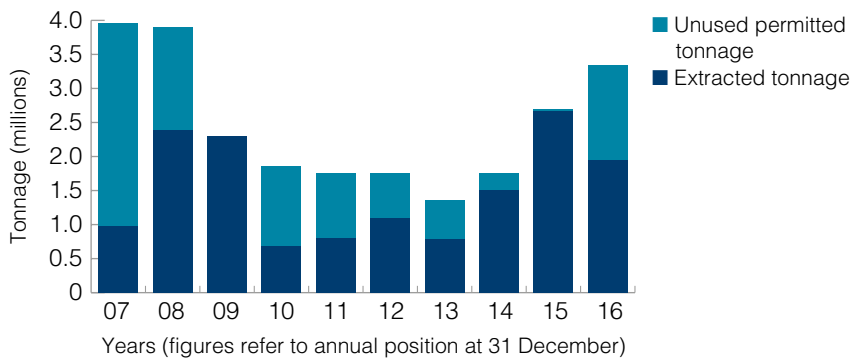
Current estimates suggest there are **16 years** of primary marine aggregate production permitted

2

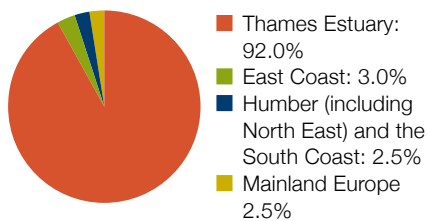
applications for licences could, if approved, increase the permitted tonnage by **3.6 million tonnes**



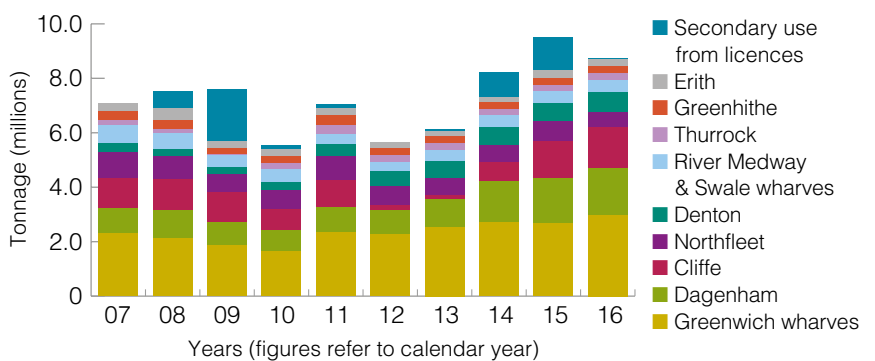
Permitted & extracted tonnage



During 2016 material extraction from the region was mainly delivered to:



Delivery of marine aggregate to the region



Sediments and indicative grain sizes



Fine sand
0.063 – 0.25mm



Medium sand
0.25 – 0.5mm



Coarse sand
0.5 – 2mm



Very coarse sand
2 – 4mm



Fine gravel
4 – 20mm



Medium gravel
20 – 40mm



Coarse gravel
40 – 63mm

The East English Channel region

10.3

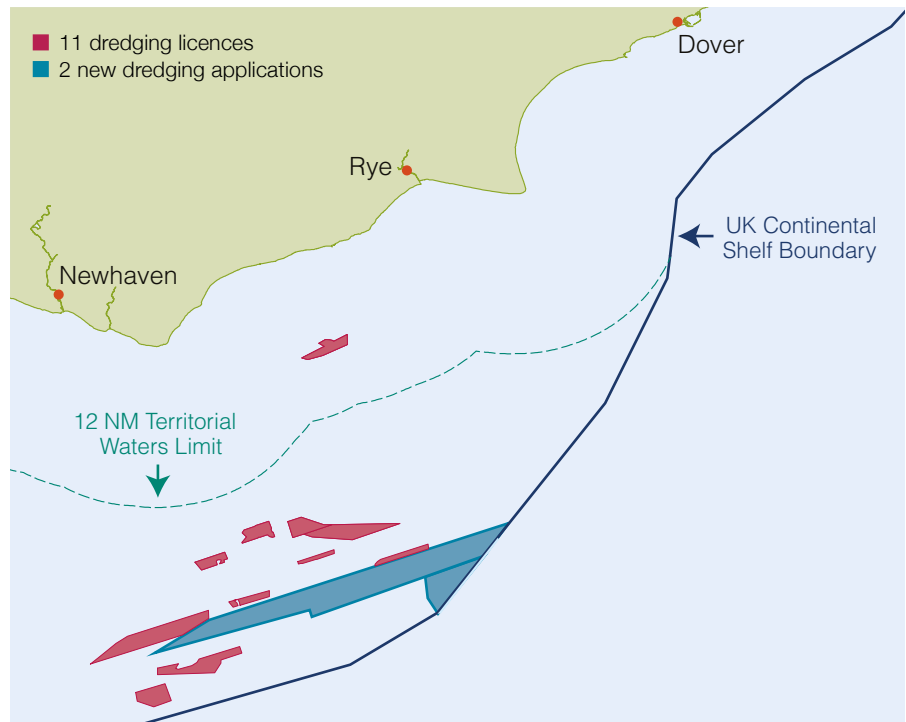
million tonnes can be extracted annually from **11 licences**

23

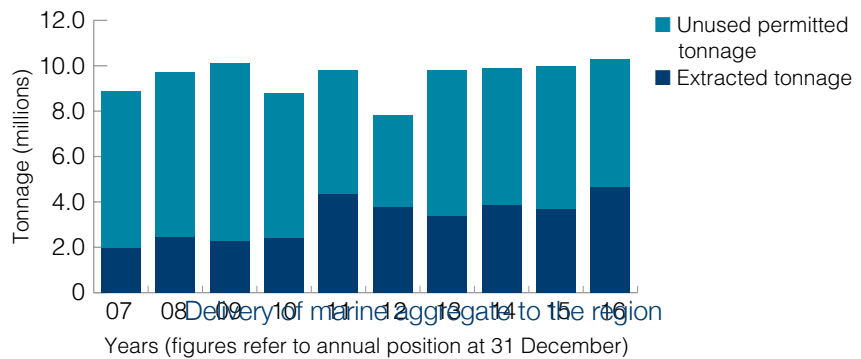
Current estimates suggest there are **23 years** of primary marine aggregate production permitted

2

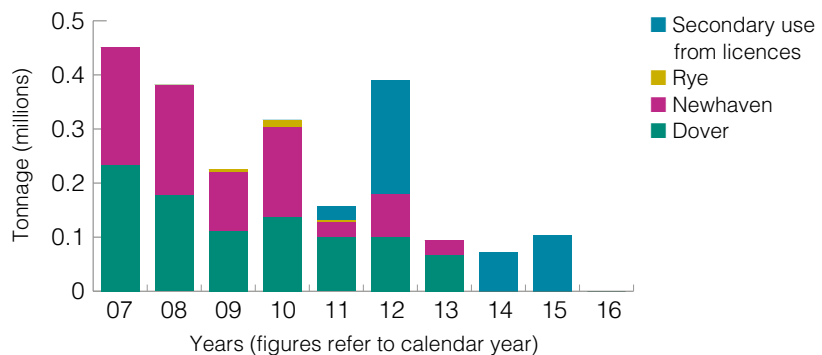
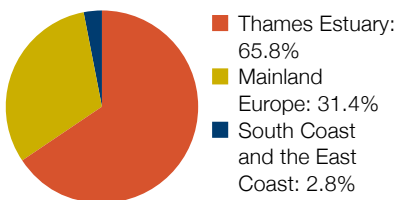
applications for licences could, if approved, increase the permitted tonnage by **2 million tonnes**



Permitted & extracted tonnage



During 2016 material extraction from the region was mainly delivered to:



Sediments and indicative grain sizes



The South Coast region

7.5

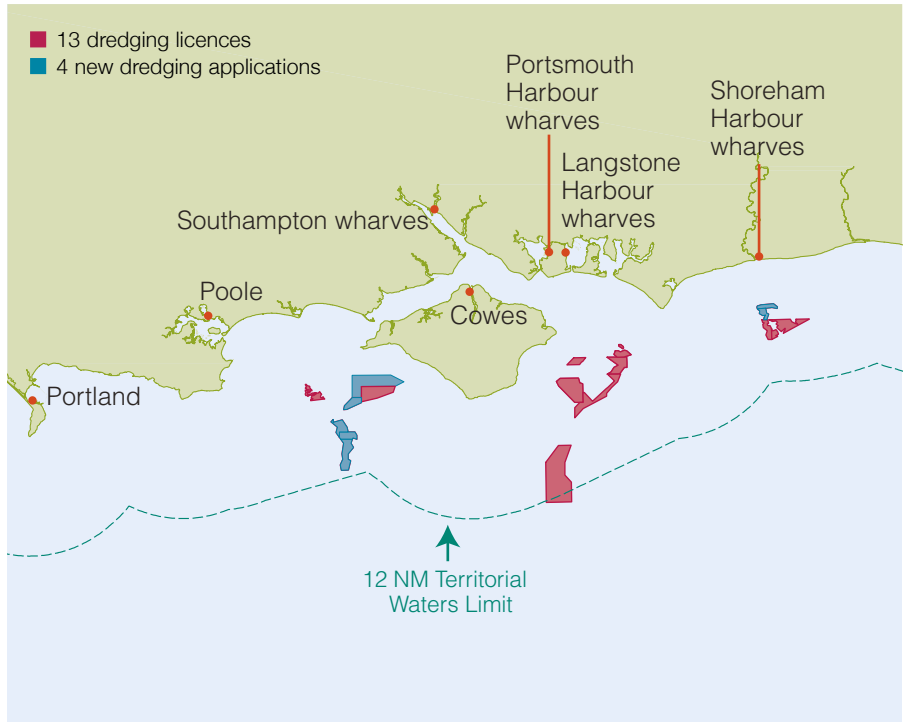
million tonnes can be extracted annually from 13 licences

25

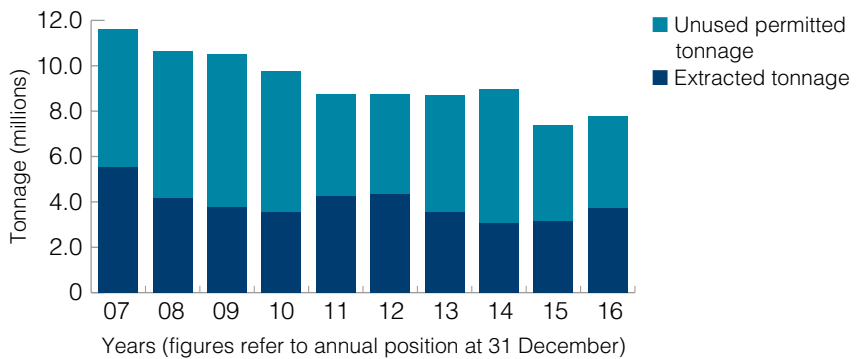
Current estimates suggest there are 25 years of primary marine aggregate production permitted

4

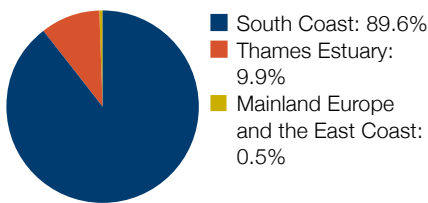
applications for licences could, if approved, increase the permitted tonnage by 1.4 million tonnes



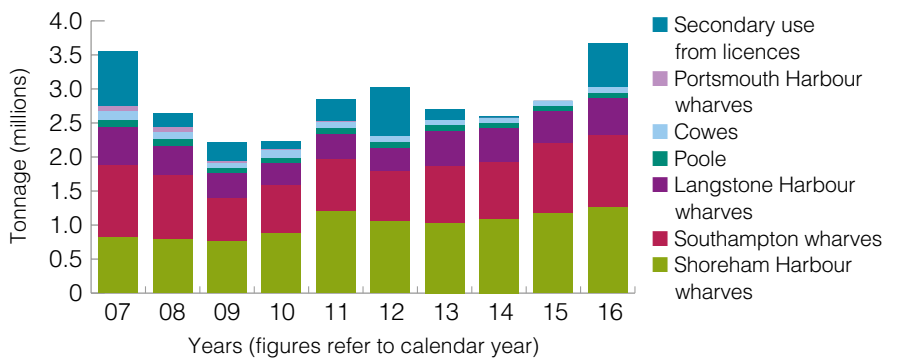
Permitted & extracted tonnage



During 2016 material extraction from the region was mainly delivered to:



Delivery of marine aggregate to the region



Sediments and indicative grain sizes



Fine sand
0.063 – 0.25mm



Medium sand
0.25 – 0.5mm



Coarse sand
0.5 – 2mm



Very coarse sand
2 – 4mm



Fine gravel
4 – 20mm



Medium gravel
20 – 40mm



Coarse gravel
40 – 63mm

The South West region

1.7

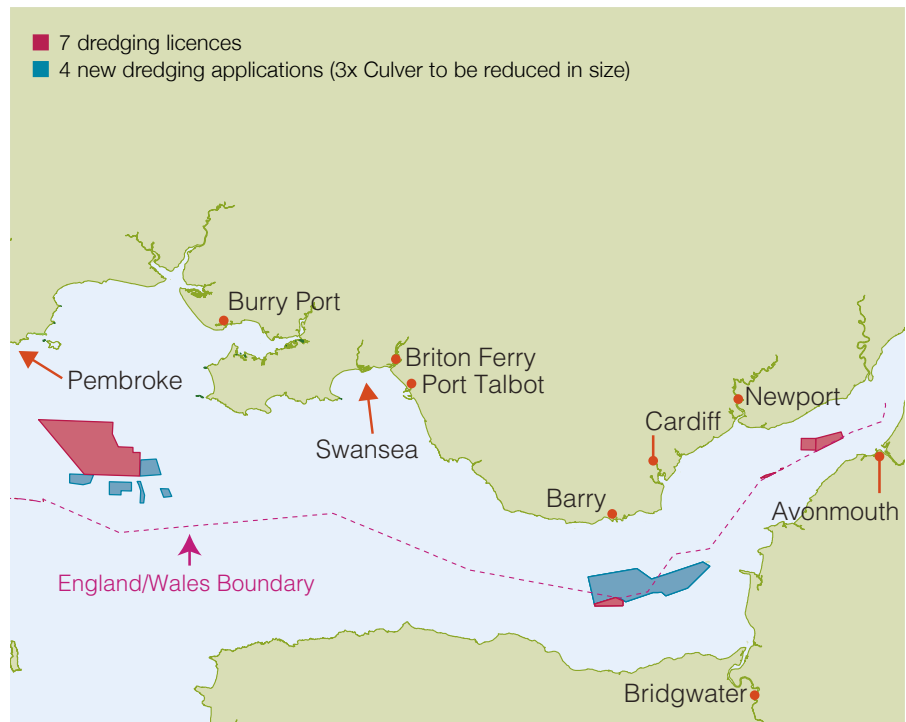
million tonnes can be extracted annually from 7 licences

7

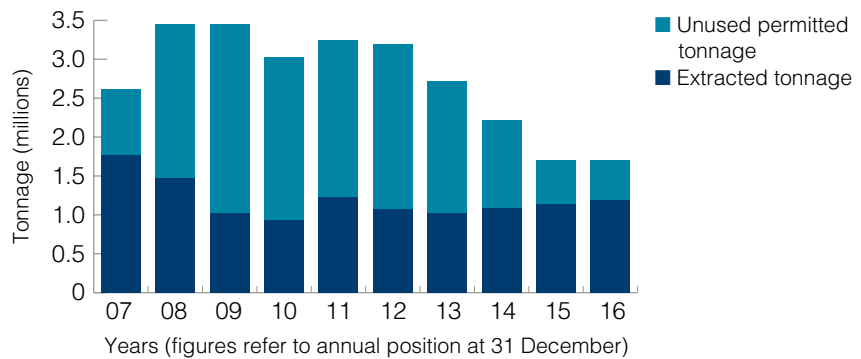
Current estimates suggest there are 7 years of primary marine aggregate production permitted

4

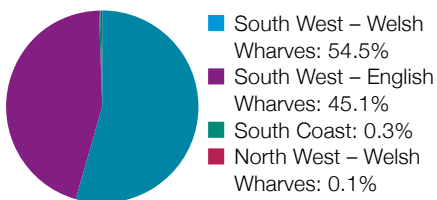
applications for licences could, if approved, increase the permitted tonnage by 2.6 million tonnes



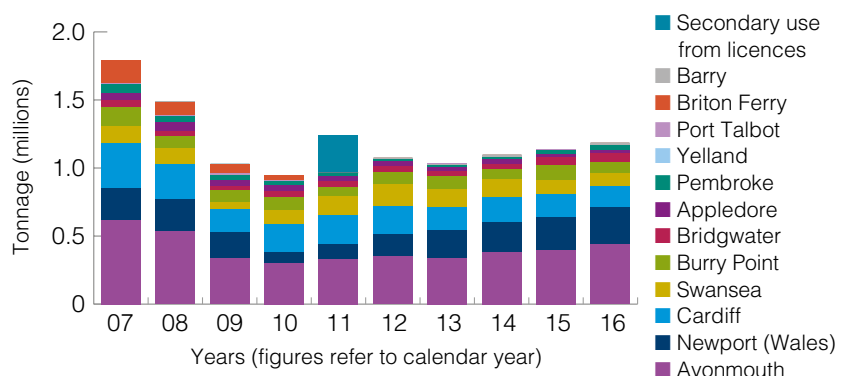
Permitted & extracted tonnage



During 2016 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 annually from 3 licences

40

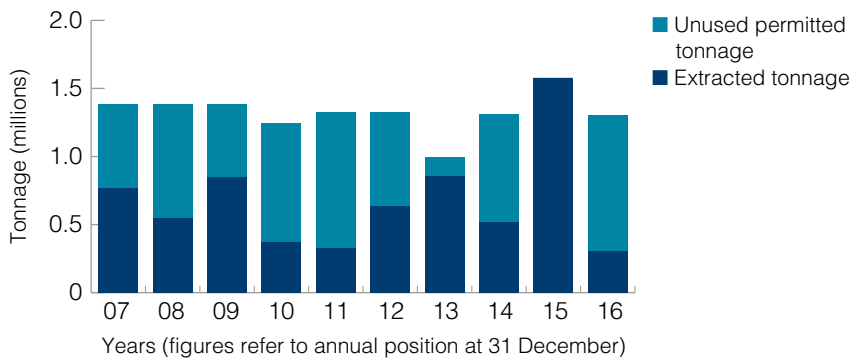
Current estimates suggest there are 40 years of primary marine aggregate production permitted

1

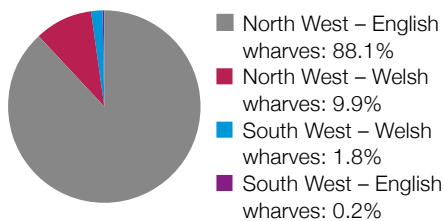
application for a licence could, if approved, increase the permitted tonnage by 0.5 million tonnes



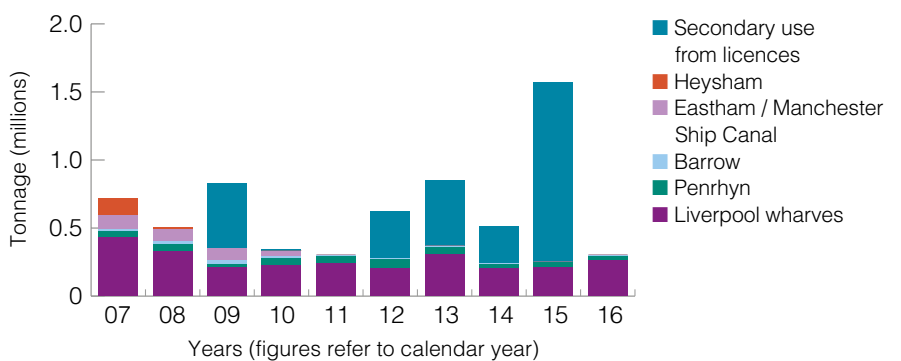
Permitted & extracted tonnage



During 2016 material extraction from the region was mainly delivered to:



Delivery of marine aggregate to the region



Sediments and indicative grain sizes



Fine sand
0.063 – 0.25mm



Medium sand
0.25 – 0.5mm



Coarse sand
0.5 – 2mm



Very coarse sand
2 – 4mm



Fine gravel
4 – 20mm



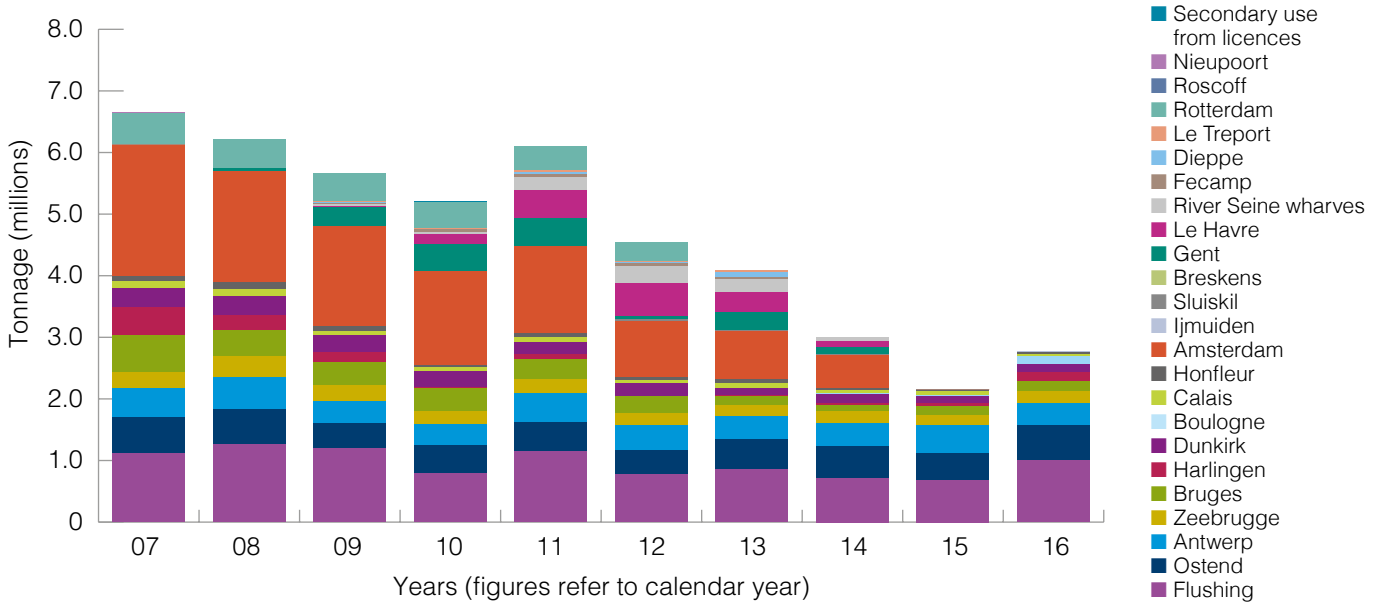
Medium gravel
20 – 40mm



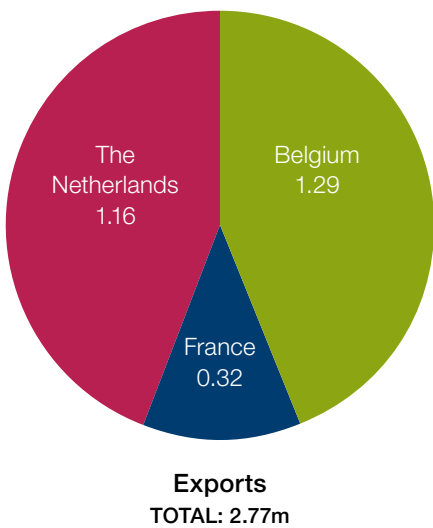
Coarse gravel
40 – 63mm

Exports to Mainland Europe from the UK

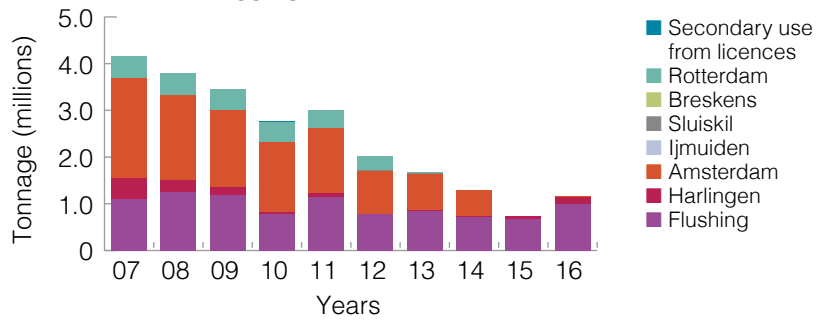
Delivery of marine aggregates to the region



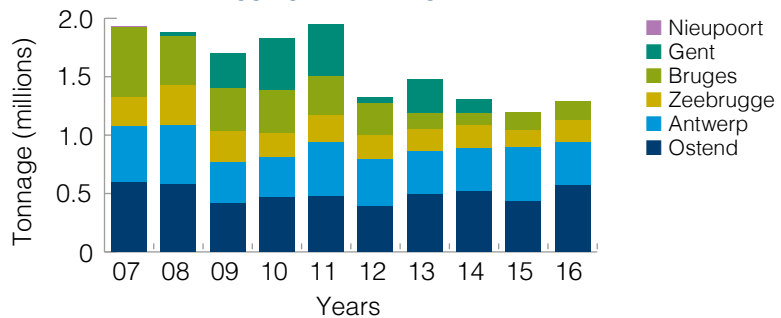
During 2016 material extraction from The Crown Estate licensed areas was exported to:



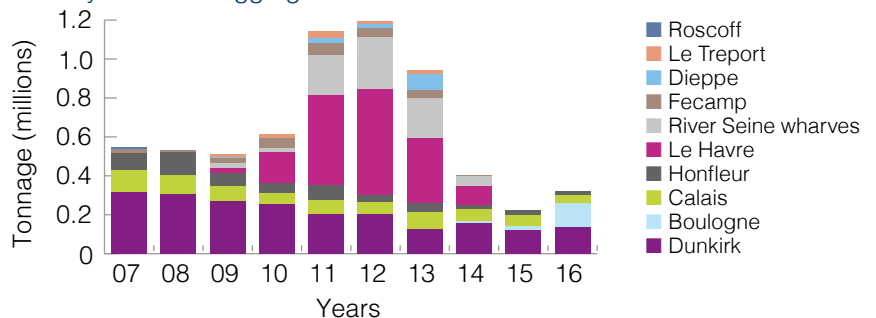
Delivery of marine aggregates to the Netherlands



Delivery of marine aggregates to Belgium



Delivery of marine aggregates to France



Uses of sand and gravel around the UK



Coastal and flood defences

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

Commercial development & regeneration

- 8 1 New Burlington Place W1 – London
- 9 20 Fenchurch Street (Walkie Talkie) – London
- 10 Cardiff Bay Barrage
- 11 Canary Wharf & London Docklands Developments
- 12 Central St Martins – London
- 13 Spinnaker Tower – Portsmouth
- 14 Superstore – Seaton
- 15 Rochester Riverside reclamation for future development
- 16 St James's Market – London

Energy & utilities

- 17 Newhaven Energy Recovery Facility
- 18 Liverpool Wastewater Treatment Plant
- 19 London Array Wind farm
- 20 Dungeness Power Station
- 21 Thames Tideway Tunnel



Community & leisure

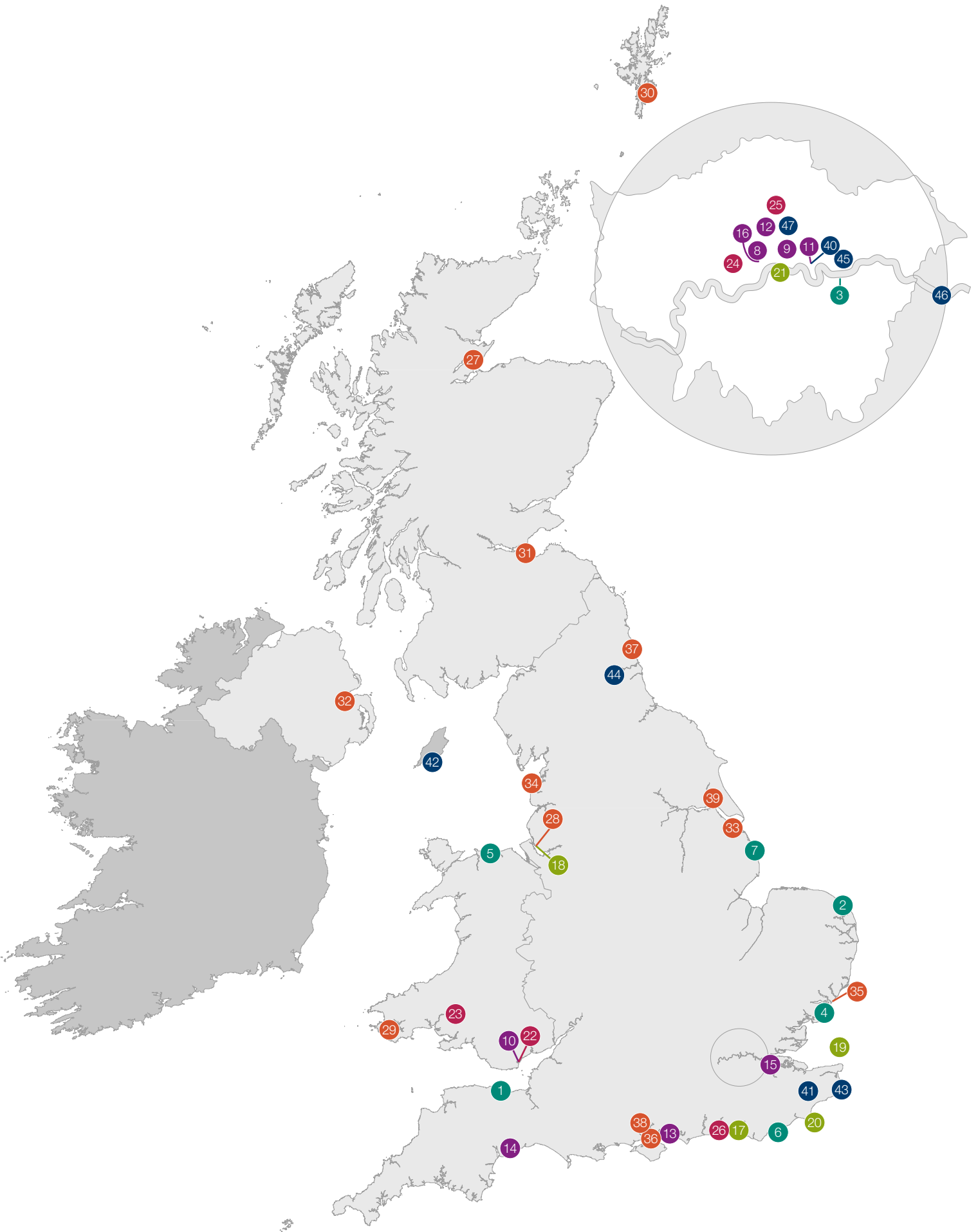
- 22 Cardiff Millennium Stadium
- 23 National Botanic Gardens of Wales, Great Glasshouse – Carmarthenshire
- 24 The Darwin Centre, Natural History Museum – London
- 25 Northumberland Development Project – Tottenham (see case study, page 16)
- 26 British Airways i360 Observation Tower – Brighton

Port development

- 27 Nigg Yard Cromarty Firth
- 28 Liverpool 2
- 29 Milford Haven Oil Terminal
- 30 Lerwick Harbour
- 31 Leith Docks – Edinburgh
- 32 Belfast Harbour Development
- 33 Grimsby
- 34 Fleetwood Port
- 35 Felixstowe Berth 9 Extension
- 36 Cowes Breakwater
- 37 Blyth
- 38 Southampton Berth 201 and 202
- 39 Green Port Hull (see case study, page 18)

Transport infrastructure

- 40 Canary Wharf Underground Station
- 41 Channel Tunnel Rail Link
- 42 Ronaldsway Isle of Man Airport
- 43 Dover Ferry Terminal
- 44 Gateshead Millennium Bridge
- 45 London City Airport
- 46 Queen Elizabeth II Bridge – Dartford
- 47 Crossrail



For further information see the Marine
 Aggregates Information Centre website:
www.marineaggregates.info

Case study: construction use

Northumberland Development Project – Phase 2, London

The Northumberland Development Project is located in Tottenham, North London and includes the construction of a new multi-use stadium for Tottenham Hotspur Football Club as the focal point for the regeneration of the local area.

Phase 1 of the project involved the construction of Lilywhite House which includes a supermarket, university technical college and club administration offices.

Phase 2 is the construction of the new stadium which is currently underway.

The future Phase 3 will provide homes, shops and a hotel.

Tarmac has commenced concrete supplies for the new Tottenham Hotspur Stadium utilising an on-site Ultra Mobile concrete plant.

The plant is fed with marine aggregates from Tarmac's River Thames wharves.

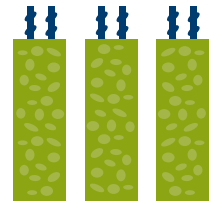
Demands of up to 1,000 tonnes per day and an estimated total demand of 150,000 tonnes will see this state of the art stadium host both football and NFL events.

↑↓ **45m** height
🪑 **61,559** seats
£ **750m** cost (est.)

72,000 m²
concrete will
be poured



1,101
concrete
columns



150,000
tonnes
of aggregate to be
used in the stadium



>1,000
tonnes
per day of aggregate

IMAGE SUPPLIED BY TOTTENHAM HOTSPUR FOOTBALL CLUB



Case study: coastal adaptation use

Lincshore Beach Replenishment, Lincolnshire



IMAGE SUPPLIED BY VAN OORD UK LTD



22.5m tonnes

of marine sand placed on the beaches



30,000

homes and businesses



30,000

static caravans



35,000

hectares of agricultural land

...which were previously at risk have been protected

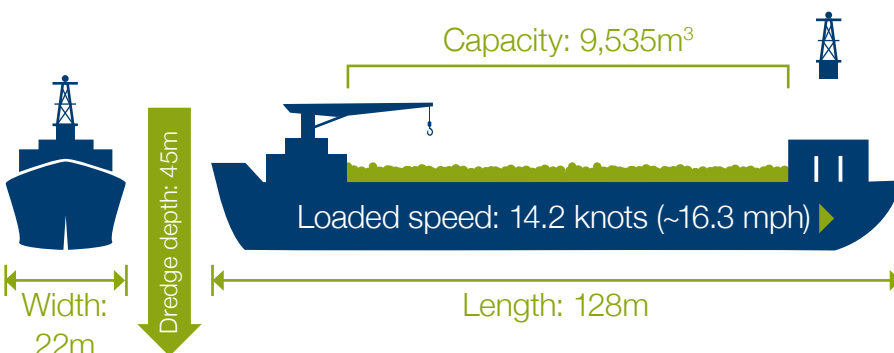
The Lincshore scheme began in 1994 and covers a 24km stretch of coastline between Skegness and Mablethorpe in Lincolnshire.

The scheme manages the coastal flood risks to 30,000 residential and commercial properties and approximately 35,000 hectares of land and areas of interest otherwise at risk of permanent loss.

Since the project began more than 15 million m³ (~22.5 million tonnes) from marine sources has been placed on the beaches of Lincolnshire.

In 2017, around 350,000 m³ of sand from Area 481 has been extracted by Van Oord to replenish the beaches.

The 2017 campaign was undertaken by the dredger HAM 316:



Case study: land reclamation

Green Port Hull

Associated British Ports converted the Alexandra Dock site in Hull into a new bespoke site for wind energy, named Green Port Hull. The site delivers world-class offshore wind turbine blade manufacturing, assembly and servicing facilities as its centrepiece.

The conversion of the 54 acre site which now hosts SiemensGamesa's offshore wind turbine manufacturing facility, involved the infilling of part of

the dock, dredging of a berth pocket and a 7.5 hectare reclamation.

Approximately 1 million m³ of marine sand from the Humber Estuary were pumped into the dock to fill 1/3 of the water area and stored for the reclamation.

The facility produced its first blades in late 2016, and dispatched its first turbine components in early 2017 for use in the Dudgeon Shoal offshore wind farm.



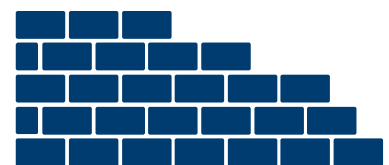
1 million m³
marine sand used



7,500 m³
Eke Mobius dredger
hopper capacity

650m

The length of new quay wall



7.5 ha
land reclamation

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 dredged year on year.

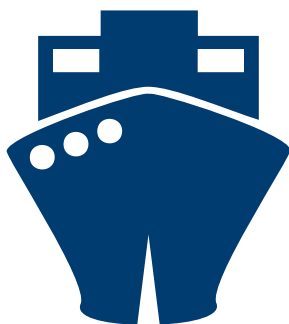


Via our Electronic Monitoring System, we ensure all dredging is undertaken in the correct locations, and every licence application must be supported by a full Environmental Impact Assessment

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:

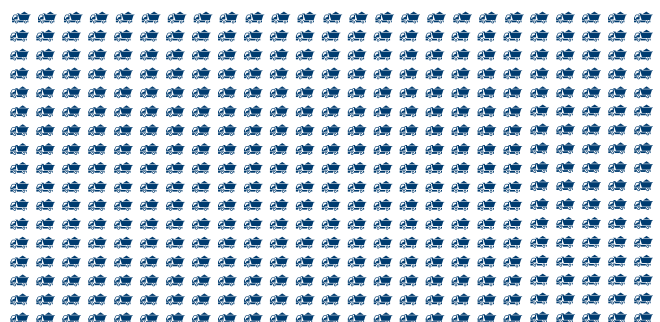
1 dredger
(of 8,500 tonnes)



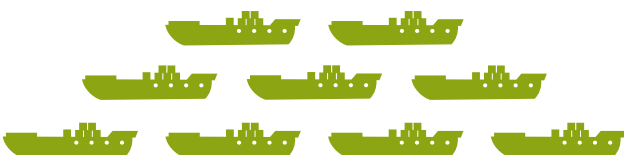
95 train hopper wagons
(of 90 tonnes)



425 aggregate lorries
(of 20 tonnes)



9 barges
(of 1,000 tonnes)



Regional Seabed Monitoring Plans (RSMP)

The RSMP is an innovative approach to monitoring being adopted by the UK marine aggregate dredging industry. It aims to ensure the seabed can support recolonisation, and the return of a similar animal community after dredging has ended, thereby improving environmental sustainability.

Underpinning the approach is an extensive dataset used to understand the relationship between animal communities and sediment composition.

The data (33,198 grab samples from 777 surveys) originate from government and wider industry sources, and represent the

accumulated knowledge from 48 years of benthic surveys, spanning large parts of the UK continental shelf (Fig. 1). This is the largest ever collation of such data, providing new insights into the distribution of seabed animal communities. Approximately one third of the data originates from the marine aggregates sector.

How it works

Baseline

- An array of sampling stations is established across each region, with a focus on extraction areas and their zones of potential secondary effect.
- Before dredging, grab samples are collected from each station and analysed for animal and sediment particle size composition.
- Using the large dataset, the animal community type is established for each sampling station (Fig. 2).

Fig .1. Study area and sample locations

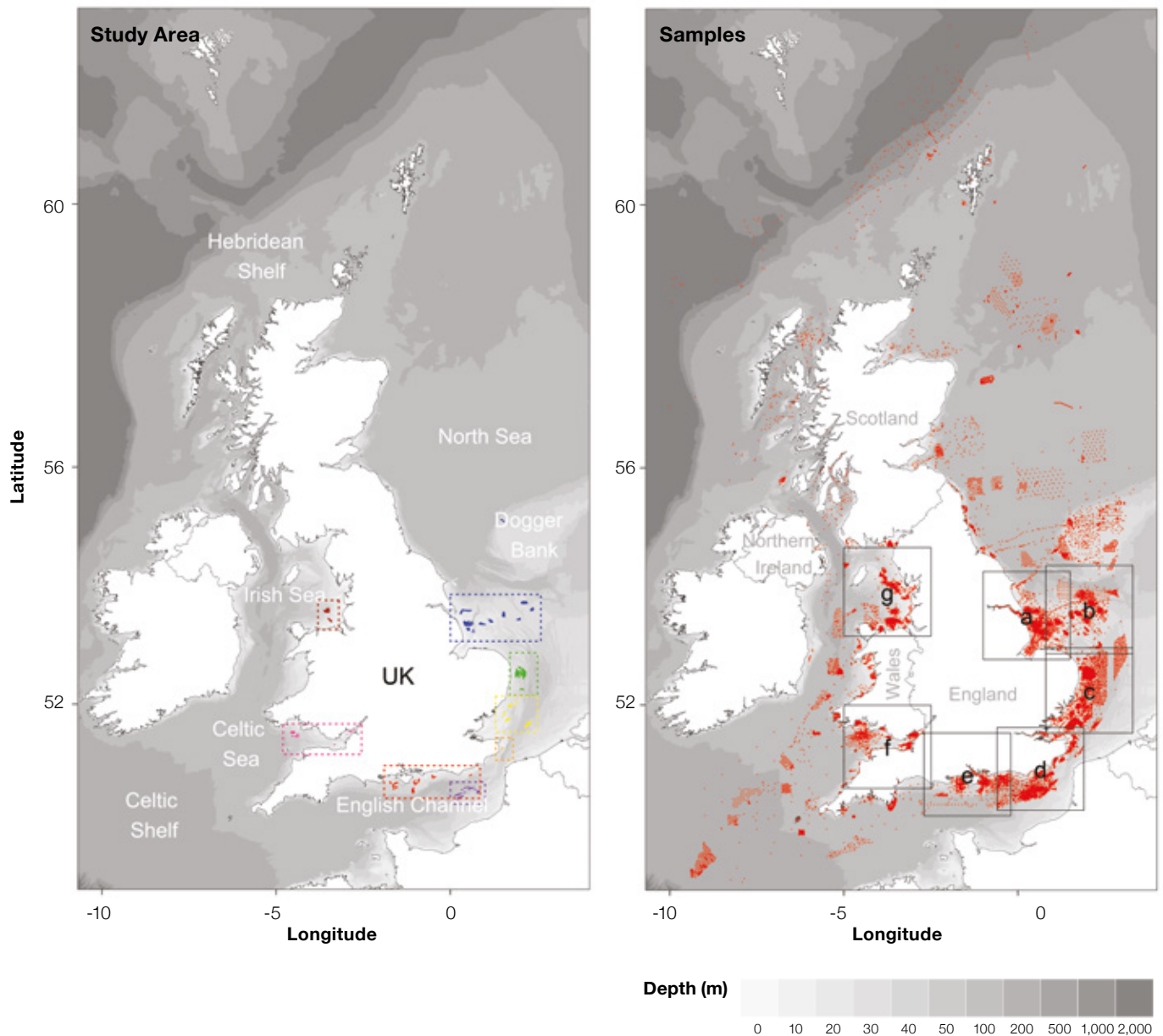
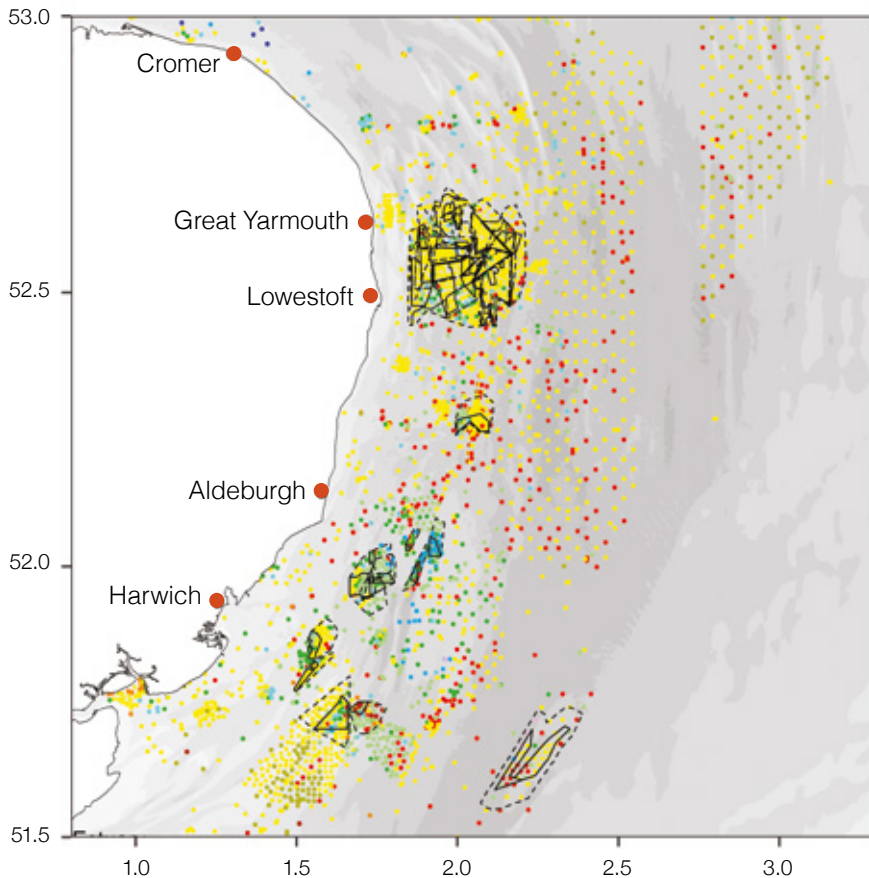


Fig. 2. Animal community identity of stations from the Anglian and Thames dredging regions. Note that RSMP stations form a subset of these points



Monitoring

- Once dredging begins, sediment composition is routinely monitored to check conditions remain favourable for recolonisation.
- Where sediment conditions change as a result of dredging, and are unlikely to support the return of the

original animal community (Fig. 3), then management measures can be used to help bring conditions back within acceptable limits.

- Monitoring stations outside the influence of dredging are used to: (i) help differentiate between natural and dredging induced sediment

change, and (ii) check the health of faunal communities in the wider region. These communities will have an important role in the recolonisation once dredging activities have finished.

Implementation

Baseline RSMP surveys were undertaken during 2014/15 across the main aggregate dredging regions, which resulted in over 3,500 seabed sediment grab samples being collected. Data from these surveys, together with those from existing datasets, have been used to: (i) establish a baseline assessment of animal community across the UK (Fig. 4), (ii) assess the relationship between animals, communities and sediments, and (iii) develop a methodology for assessing the ecological significance of changes in sediment composition. Full details of this work can be found in Cooper and Barry (2017).

Following completion of the RSMP baseline, the first monitoring survey commenced within the South Coast region during 2017. Further RSMP monitoring campaigns are planned for the Anglian / Thames and Humber regions in 2018 and 2019 respectively.

Work is also underway to develop an on-line application to automate the analysis of RSMP monitoring data, identifying stations where changes in sediment composition require further investigation.

Fig. 3. Mean composition of sediments from the different animal communities

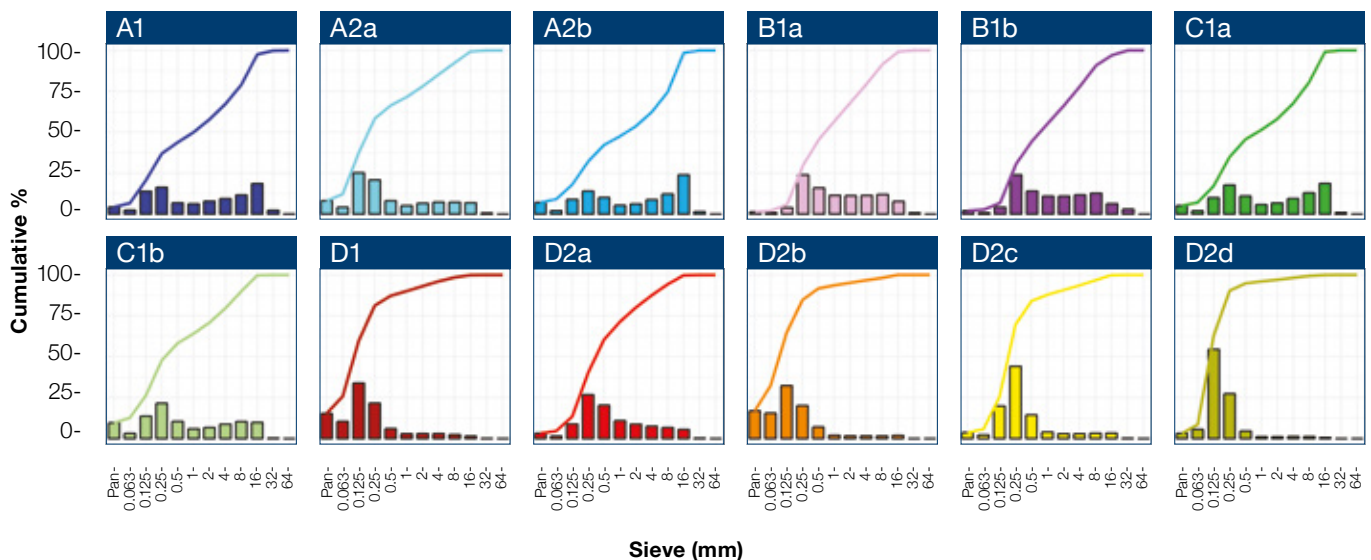
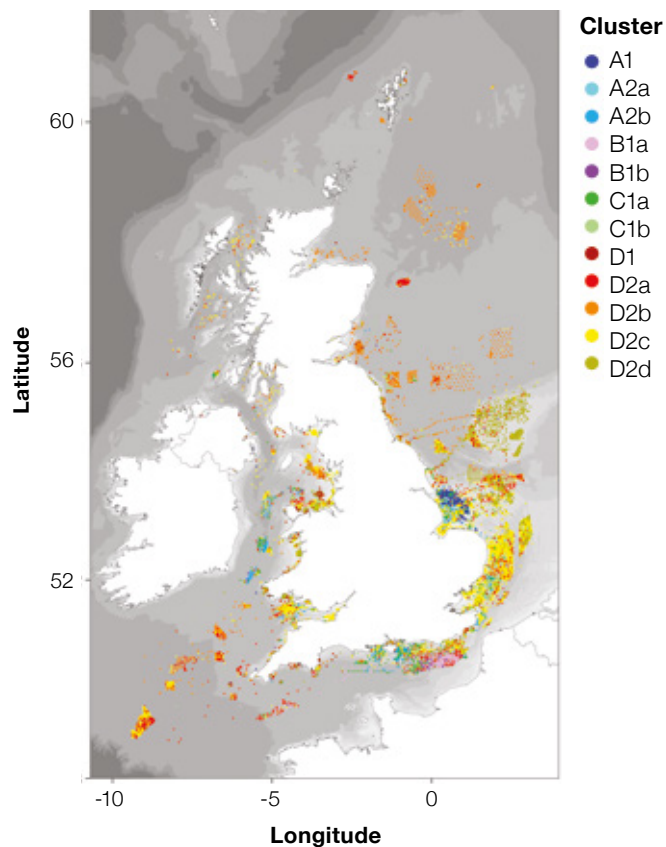


Fig. 4. Distribution of animal communities from the baseline dataset



Clear benefits of approach:

- Clear scientific rationale
- Allows for change
- Effective licence condition
- Environment defines limits of acceptable change
- Ability to differentiate between statistical and ecological significance
- Reduced monitoring costs
- Regional perspective
- More consistent and better quality data
- Simpler reporting and assessment

The RSMP has been designed by Dr Keith Cooper, a restoration ecologist from the Centre for Environment, Fisheries and Aquaculture Science (Cefas). The work has been funded by Defra, the MMO, The Crown Estate, BMAPA, and Welsh Government, and has the support of all stakeholders.

Reference

Cooper, K.M. and Barry, J. A big data approach to macrofaunal baseline assessment, monitoring and sustainable exploitation of the seabed. *Scientific Reports* 7, Article number: 12431 (2017), doi:10.1038/s41598-017-11377-9

Better for operators, regulators and statutory advisors

Good practice guidance: extraction by dredging of aggregates from England's seabed

The good practice guidance has been produced by the British Marine Aggregate Producers Association and The Crown Estate as a replacement for the original Marine Minerals Guidance 1: extraction by dredging from the English seabed, originally published in July 2002 by the Office of the Deputy Prime Minister (now Department for Communities and Local Government) but subsequently withdrawn.

This document has been produced by the British Marine Aggregate Producers Association and The Crown Estate in consultation with Defra, the Marine Management Organisation, Natural England, JNCC, Historic England and Cefas.

Dredging of sand and gravel from the seabed is long established in England to secure material used as construction aggregate, for beach nourishment and for land reclamation. The supply of aggregate from marine sources is vital for maintaining supply, particularly to markets in London and the South East of England. Export of marine aggregate also makes a

contribution to the UK's balance of payments.

Planning, environmental assessment, licensing, and monitoring of marine aggregate dredging has evolved significantly in recent years. Along with changes to the statutory licensing regime, and advances in the scientific understanding of the impacts of aggregate dredging operations, the marine aggregate industry has also implemented voluntary good practices to mitigate and manage the effects of its operations.

The present document provides an overview of the marine aggregate



industry for all stakeholders on the ways in which it works, and the planning, licensing, environmental assessment, monitoring, mitigation and management methods that are employed to protect the environment and other seabed interests and to ensure the sustainability of the industry.

www.bmapa.org/documents/BMAPA_TCE_Good_Practice_Guidance_04_2017.pdf

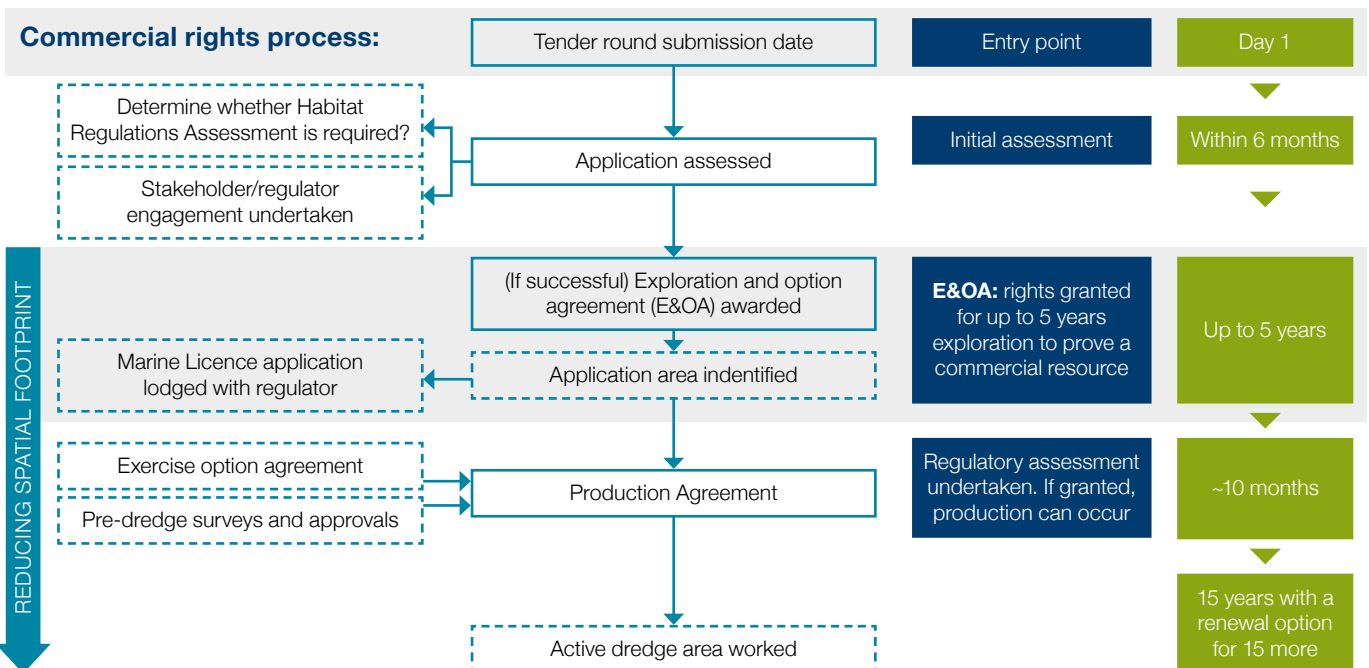
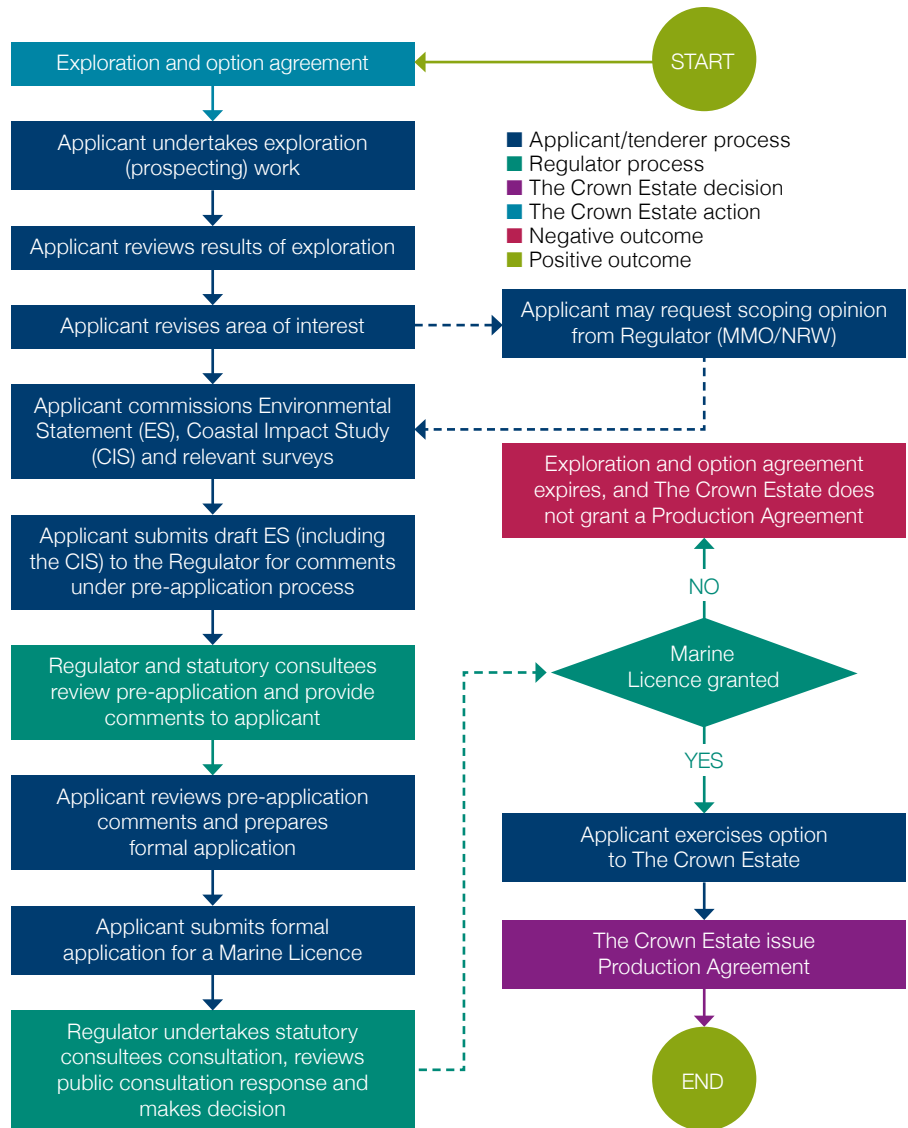
Obtaining rights for sand and gravel extraction

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 2 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 an independent commercial business created by an Act of Parliament. Our role is to make sure that the land and property we invest in and manage are sustainably worked, developed and enjoyed to deliver the best value over the long term. 100% of our annual profits are returned to the Treasury for the benefit of the public finances. The Crown Estate's portfolio is one of the most diverse anywhere in the world, our business includes the whole of Regent Street, much of St James's, numerous regional shopping centres, hundreds of thousands of acres of rural land and coastline, and the seabed of England, Wales and Northern Ireland.

London

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

www.thecrownestate.co.uk

 [@TheCrownEstate](https://twitter.com/TheCrownEstate)

November 2017

Links and useful references

The Crown Estate

www.thecrownestate.co.uk/energy-minerals-and-infrastructure/aggregates

www.thecrownestate.co.uk/energy-minerals-and-infrastructure/research

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