

Marine aggregate production: the challenge of meeting the nation's needs without serious environmental consequences

Exploring the effects of dredging for marine sand and gravel



QCA Citizenship - Unit 12: Global Issues, Local Action



In this unit, pupils explore the nation's increasing needs for sand and gravel from marine sources, the strict controls imposed on its extraction and the environmental costs and benefits involved.

The Government's plans for a significant increase in house building, London's successful bid for the 2012 Olympics and the need for coastal defence schemes will require a sustainable increase in the supply of marine aggregates. Increasing environmental pressures on land-based resources make it likely that marine resources - currently providing for around 20% of our sand and gravel needs - will be critically important. Will increased marine aggregate dredging destroy archaeological remains, threaten our coastline and harm our already fragile marine wildlife, or are the current safeguards adequate? What are the worldwide implications of using marine aggregates and how do different countries control their production?

The unit also looks at two case studies - Hallsands in South Devon, a scheme from 100 years ago when scientific knowledge was minimal and social responsibility was a small consideration, and the North Norfolk coast, a modern scheme designed to avert serious environmental changes caused by natural coastal erosion.

The unit offers opportunities for first-hand research (site visits and questionnaire), the use of secondary sources (local press, radio and TV reports, internet), role-playing exercise (a public enquiry) and the production of a report which can be submitted to the Local Authority, the Environment Agency and the local marine aggregate producer.

Background information

- Marine aggregates fulfil around 25% of Britain's natural sand and gravel needs at the moment, but in some areas (e.g the Thames Estuary) this is as high as 50%
 - the seabed, the source of these marine aggregates, is owned and managed by the Crown Estate
 - planning applications for extraction are made to, and, provided that strict conditions are met, permissions are granted by, the Planning Minister in the Office of the Deputy Prime Minister, The Welsh Assembly Government or the Scottish Office
 - all proposals must be supported by Environmental Impact Assessments based on valid independent scientific research
 - the Crown Estate will only issue an extraction licence to an operator if the Government has decided to permit the dredging
 - where a licence is granted the site is continuously monitored for adherence to licensing conditions and environmental impact
 - 'exhausted' sites are also monitored for recolonisation by marine organisms in long-term studies

Why marine aggregates?

- Marine aggregates are used for
 - all forms of construction; houses, hospitals, schools, sports venues,
 - roads, footpaths and bridges (e.g. second Severn Crossing, QE bridge at Deptford)
 - underground pipes (e.g. freshwater supplies, motorway drainage, sewage)
 - tunnels e.g. Chunnel
 - harbour construction
 - coastal defences - sea walls and beach replenishment
- They are particularly valuable in coastal areas close to marine aggregate sources because they can be brought in directly by ships which
 - are built to match available harbour facilities

- can quickly extract and discharge up to 8,000 tonnes of aggregate (compared with a lorry which can carry 20 tonnes) very close to the area where it is needed
- reduce the need for large numbers of lorries on local roads (one shipload of 8,000 tonnes = 400 lorryloads) thereby reducing traffic volumes, exhaust emissions and noise pollution)
- They have the same origins as land-based aggregates, both having been deposited in Pleistocene times during the ice-ages when sea levels were far lower and current marine deposits were part of river systems
- They can often be extracted in an already naturally graded state to meet precise needs
- They are needed because
 - there are increasingly high environmental pressures on land-based operations, especially in the South-east - a major historical source of aggregates - where land availability is a problem and current supply sites are becoming exhausted
 - an ongoing sustained and sustainable supply of marine aggregates will be critical to allow for the realisation of
 - Government proposals to increase numbers of houses built, with parallel need for services and utilities
 - the London 2012 Olympic infrastructure
 - coastal defence schemes to protect communities and landscape

The Unit will look at

- the current state of the industry -
 - the volumes produced
 - the methods used to extract marine aggregates
 - the benefits of and environmental issues involved in using marine aggregates
- the strict environmental safeguards and regulation process -
 - consultation
 - compulsory Environmental Impact Assessments
 - monitoring of where dredging is actually occurring (by 'black box' recorders)
 - regular environmental monitoring and review of licences

- the contrast between the potential problems caused by and the lessons learnt from badly managed dredging - for example at Hallsands (Start Point) 100 years ago - and the current situation of strictly regulated licensing for sites further offshore
- the way in which extraction for use in beach replenishment can help to safeguard our fragile coastline and help to mitigate the effects of rising sea levels

There are links to relevant websites such as the British Marine Aggregate Producers, (BMAPA), English Nature, the Environment Agency, ODPM, DEFRA and some overseas sites.

KS4 Citizenship unit 12 - Global Issues, local Action

Title: Marine aggregate production: the challenge of meeting the nation's needs without serious environmental consequences

Summary: in this unit, pupils explore the nation's increasing needs for sand and gravel from marine sources, the strict controls imposed on its extraction and the environmental costs and benefits involved.

Relevance: this modified unit is particularly suitable for Schools

- in the London area (2012 Olympics venues, business expansion and increased house building and the complex infrastructure needed to support them)
- the South-east generally (business expansion and increased house building)
- along the coasts of East Anglia, and Southern England and the Bristol channel - South Wales, Somerset and Avon (coastal erosion)

QCA Unit links:

- Citizenship unit 12 - Global Issues, local Action
- builds on Citizenship unit 7 'Local democracy' in the key stage 3 citizenship scheme of work.
- Citizenship unit 9 'Consumer rights and responsibilities' in the key stage 4 scheme.
- Science: links with the impact of humans on the environment (Sc2, 4b) and contexts through which science is taught, including: environmental; applications of science; and benefits and drawbacks of scientific and technological developments (breadth of study 1a, 1b, 1c in the programme of study for single science)
- Geography: this unit builds on the geographical enquiry skills developed at key stage 3, as well as on knowledge and understanding of environmental change and sustainable development (1a-d, 2c, 2e, 6k in the programme of study and unit 23 'Local actions, global effects' in the key stage 3 geography scheme of work). At key stage 4, links with the GCSE subject criteria for geography include: aspects of enquiry (3.1x); study of the interrelationships between people and the environment and the ways in which considerations of sustainable development affect the planning and management of environments and resources (3.1v)

- History: GCSE SHP (History Around Us) - building on pupils' understanding of aspects of local political history through two contrasting British case studies
 - Hallsands in South Devon, a dredging scheme carried out around 100 years ago when scientific knowledge was insufficient and social and environmental responsibilities were not a real concern
 - the North Norfolk coast, a modern scheme for coastal defence where up-to-date scientific knowledge and strict environmental controls were applied to the extraction and use of marine aggregates in a bid to reduce the social, economic and environmental impacts of continuing natural coastal erosion

The Modified Unit occupies 5 forty-minute lessons and involves 2 sets of coursework:

Lesson 1: pupils' current levels of knowledge about the sea and those who use it and what is happening locally, highlighting areas where research is needed

Coursework: web-based research into these areas

Lesson 2: preparation of presentations on current state of affairs locally

Lesson 3: pupils' presentations on current state of affairs locally, pupils organise themselves to represent the views of different interest groups ('stakeholders')

Coursework - research the views of the different stakeholder groups

Lesson 4: each group prepares a role-playing presentation for its stakeholder group at a public enquiry, if possible separating opinion from scientific fact.

Lesson 5: role-playing at a public enquiry

Opportunities for role-playing

A public enquiry into a proposal for a new marine aggregate dredging licence offshore in an area where

- a community is threatened by natural marine erosion processes which have been going on for centuries
- the local commercial fishermen and Sea Anglers' Association have concerns that catches will be jeopardised
- the Local Authority and the Environment Agency believe that the new source will provide material for critical coastal defence work in the area without jeopardising marine life or having any adverse effects on the coastline

Outcomes: Decisions are made based on the information provided by each interest group. The Local Authority, the Environment Agency, English nature, the local marine aggregate producer(s) and end-users and local media are given copies of the findings of the enquiry, which represent the opinions of young people in the area.



QPA Modified Unit. Citizenship at KS4 Unit 12: Marine Aggregate Extraction Unit 12 Global issues, local action

About the unit

In this unit, pupils find out about local action in response to a global issue by investigating ways in which the Government's plans for increased house building and London's successful bid for the 2012 Olympics will affect the need for aggregates (sand and gravel) as materials for building houses, roads and venues with the associated utilities.

They investigate local plans and priorities for sustainable development (Local Agenda 21), in respect of both land-based and marine sources of aggregates. Through enquiry, they find out how local priorities are established and monitored, and how young people are consulted by the local authority.

They appreciate the extent to which sustainable development is now a concept affecting different aspects of local and national government planning and policy decisions. They learn how to contribute to local decisions that will influence quality of life and the environment in the future; how will marine extraction affect our archaeological heritage, coastline and wildlife?

They are able to translate their local investigation to a global scale – is marine aggregate extraction important in other areas, especially third world countries? What are its effects and what safeguards are in place? How do they compare with British standards?

This unit provides an opportunity to link with work on sustainable development in other subjects, including geography and science. It may be useful to plan teaching of this unit in conjunction with geography and science teachers to ensure progression and avoid duplication.

Where the unit fits in

This unit addresses the following aspects of the key stage 4 citizenship programme of study:

Knowledge and understanding about becoming informed citizens

Pupils should be taught about:

- 1f the opportunities for individuals and voluntary groups to bring about social change locally, nationally, in Europe and internationally
- 1j the wider issues and challenges of global interdependence and responsibility, including sustainable development and Local Agenda 21

Developing skills of enquiry and communication

Pupils should be taught to:

- 2a research a topical political, spiritual, moral, social or cultural issue, problem or event by analysing information from different sources, including ICT-based sources, showing an awareness of the use and abuse of statistics
- 2b express, justify and defend orally and in writing a personal opinion about such issues, problems or events
- 2c contribute to group and exploratory class discussions, and take part in formal debates

Developing skills of participation and responsible action

Pupils should be taught to:

- 3a use their imagination to consider other people's experiences and be able to think about, express, explain and critically evaluate views that are not their own
- 3b negotiate, decide and take part responsibly in school and community-based activities
- 3c reflect on the process of participating

This unit builds on unit 7 'Local democracy' in the key stage 3 citizenship scheme of work. It also links with unit 9 'Consumer rights and responsibilities' in the key stage 4 scheme.

Expectations

At the end of this unit

most pupils: know about the local plans and priorities for sustainable development

(Local Agenda 21). *They recognise that global issues such as sustainable development are connected with local and national government policies and action.*

They can cite examples of how their local authority monitors aspects of sustainable development, and measures, reports and consults on policies. They suggest ways in which they can contribute to local plans, and communicate the findings of an enquiry they make to members of the school and local community.

some pupils have not made so much progress and: recognise ways in which the local authority makes decisions that affect the local community. *They understand that some issues of global concern, eg those that relate to the environment, can be acted upon locally.*

some pupils have progressed further and: recognise the links between global concerns and local actions, and the connections between international agreements, eg *Agenda 21*, and national and local government policies. They know that policies for sustainable development affect the planning and management of local resources and environments through Local Agenda 21. They understand that many factors, including *people's values and attitudes, influence decisions.* They evaluate the effectiveness of Local Agenda 21 and suggest ways of bringing about change, drawing on the results of their enquiry. *They critically evaluate sources of evidence before using them in their investigations. They communicate their findings, drawing on a range of sources of information and using coherent arguments.*

Resources

Resources (*blue text* indicates suitability for teachers but probably not for pupils) include:

Paper publications:

- Dredging and the Coastline (Crown Estate)
- Aggregates from the Sea (BMAPA)
- Marine aggregates in concrete (BMAPA)
- Marine sands in mortars and Screeds (BMAPA)
- 2003 review (BMAPA)
- 04-05 Review (BMAPA)
- *Marine aggregate site restoration and enhancement (EMU Ltd. for BMAPA, the Crown Estate and English nature)*

Video presentations:

- Aggregates from the Sea (BMAPA, VHS, 13 mins)
- Ask the Experts about Marine Aggregates (BMAPA, CD, Quicktime videos on Resource management, Coastal erosion, Archaeology and Marine life).

Web sites (many more available via Google search):

- **British Marine Aggregates Producers' Association** (BMAPA): www.bmpa.org
- **the Crown Estate:** www.crownestate.co.uk
- **English nature:** www.english-nature.org.uk
- **DEFRA:** www.defra.gov.uk/environment/waste/aggregates/delivery.htm
- **Environment Agency: (east coast flooding)** www.environment-agency.gov.uk/subjects/flood/826674/882909/426221/?version=&lang=e
- **Sustainable development information:** www.nc.uk.net/esd
- **London Olympics:** www.london2012.ctad.net/downloads/London2012_webbrochure.pdf
- **BBC Devon:** www.bbc.co.uk/devon/outdoors/nature/hallsands.shtml
- **USA:** <http://woodshole.er.usgs.gov/project-pages/aggregates/>
- **Belgium:** www.deme.be/projects/proj_sub.asp?iID=14

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- - **Jamaica:** www.ncra.org/eias/StThomas/yallahs/L03_543YALLAHS_SUMMARY.pdf
 - **France:** www.sandgravel.co/extratio/france.htm

- **Links with other subjects**

In this section, references are made to the programme of study if there is one at key stage 4, or to the subject specific criteria on which GCSE courses are based. Some of these links have been included in the 'Points to note' section to illustrate these opportunities.

There are links and opportunities for work on sustainable development in many of the national curriculum subjects, and in other subjects. See the QCA website, www.nc.uk.net/esd.

Science: *links with the impact of humans on the environment (Sc2, 4b) and contexts through which science is taught, including: environmental; applications of science; and benefits and drawbacks of scientific and technological developments (breadth of study 1a, 1b, 1c in the programme of study for single science)*

Geography: *this unit builds on the geographical enquiry skills developed at key stage 3, as well as on knowledge and understanding of environmental change and sustainable development (1a–d, 2c, 2e, 6k in the programme of study and unit 23 'Local actions, global effects' in the key stage 3 geography scheme of work). At key stage 4, links with the GCSE subject criteria for geography include: aspects of enquiry (3.1x); study of the interrelationships between people and the environment and the ways in which considerations of sustainable development affect the planning and management of environments and resources (3.1v)*

History: *GCSE SHP (History Around Us) or modern world history – building on pupils' understanding of aspects of local and global political history*

RE: *Locally agreed and GCSE specifications offer opportunities for the study of and coursework on environmental and related issues, using local and global examples where religious beliefs and teachings are relevant*

PSHE: *4a, 4c, 4d, 4e in the non-statutory guidelines*

What is Local Agenda 21?			
<ul style="list-style-type: none"> • about Agenda 21 and where it originated • about local action plans for sustainable development (Local Agenda 21) and priorities set by the local authority • to devise an enquiry into local priorities and plans for sustainable development • about the ways in which the local authority consults young people on its policies 	<ul style="list-style-type: none"> • Pupils brainstorm/concept map what they already know about local action plans for sustainable development of aggregate production (Local Agenda 21), drawing on their general knowledge and previous learning in geography and science. • Using a range of information sources, <i>eg school-based sources, the local library, websites (including the local authority site), visits from local authority or Local Agenda 21 representatives</i>, pupils investigate: <ul style="list-style-type: none"> – where did Agenda 21 originate? Pupils find out about the Agenda 21 agreement drawn up at the Rio Earth Summit in 1992. They could also find out about how international agreements on sustainable development signed up to by national governments impact on both national and local government policies, <i>eg by investigating how the UK government is controlling and monitoring the effects of land-based and marine aggregate extraction</i> – what are the plans and priorities for sustainable development in their local authority? How is their success being measured, ie what are the criteria for and indicators of their success? Are young people consulted on policies? How? • Pupils share their findings as a class, and agree on related issues and areas to be investigated further by small groups. 	<ul style="list-style-type: none"> • describe what sustainable development is and identify a range of local priorities • recognise the impact of international agreements on national and local government • use skills of enquiry to undertake research • recognise that global issues can be addressed by local action • identify how the local authority consults young people on its policies • communicate their findings to the class 	<ul style="list-style-type: none"> • Link with geography: this section builds on the knowledge and understanding of environmental change and sustainable development acquired at key stage 3. It also links with work in GCSE geography on the interrelationships between people and their environments, and on planning and managing environments and resources (3.1v). • The local authority may have a Local Agenda 21 representative with a specific remit to work with schools. • For information about Agenda 21, refer to the United Nations Sustainable Development website (see www.standards.dfes.gov.uk/schemes). Chapter 39 of the Agenda 21 agreement deals with assisting states in promoting sustainable development at both a national and international level, through enhancing the effectiveness of legal instruments and mechanisms.

What is Local Agenda 21? (continued)			
			<ul style="list-style-type: none"> • Sustainable development is about ensuring a better quality of life for everyone, both now and for generations to come. This means meeting four objectives at the same time, in the UK and worldwide:– social progress that recognises the needs of everyone <ul style="list-style-type: none"> – effective protection of the environment – prudent use of natural resources – the maintenance of high and stable levels of economic growth and employment • Further information about sustainable development is available at www.nc.uk.net/esd.
How is our community more sustainable?			
<ul style="list-style-type: none"> • to devise a survey of use of marine aggregate resources in locally consumed construction projects (e.g Southampton FC stadium, Millennium Dome, Canary Wharf) to compare with the local authority's published priorities for sustainable development • to carry out a survey, draw conclusions and present results 	<ul style="list-style-type: none"> • Pupils work in groups to undertake an enquiry into different areas affected by Local Agenda 21, eg the construction industry as consumers of marine aggregates. They consider the impact of policies for sustainable development on individuals and organisations by carrying out an audit of products, resources and services. A focus for the enquiry should be selected. • Taking aggregates (sand and gravel) as an example, pupils consider how much is produced locally and how much elsewhere. They also consider what has happened to the aggregate during its preparation for sale. How has it been processed and transported? How (road, rail) and how far has it been transported to the site where it will be sold or used? (the number of miles it has been transported can be referred to as 'aggregate miles' and the impact of transport methods compared to give an impact index)? What are the points of sale of aggregate products in the local area? • On a local area base map, pupils mark the location of features related to locally sourced aggregates, eg sand & gravel pits, licensed marine sites, •. 	<ul style="list-style-type: none"> • demonstrate enquiry skills as they develop a set of questions appropriate for use in interviews, questionnaires and discussions • identify examples of how Local Agenda 21 policy is impacting on individuals and the community, and assess whether their community is more sustainable as a result • choose and use appropriate statistical and graphical techniques (including ICT) to record, store, retrieve and present data • identify and compare the 	<ul style="list-style-type: none"> • Link with geography: a geographical enquiry into the percentage of aggregate resources and services provided locally (as opposed to sourced from abroad) will involve numeracy, statistical techniques, data handling, mapping (including GIS), reaching conclusions and presenting key findings. This builds on 1a–d, 2c, 2e and 6k in the key stage 3 programme of study; and links with GCSE criteria: aspects of enquiry (3.1x). • This section can be linked to or used to build on unit 7 'Local democracy' in the key stage 3 citizenship scheme of work.

LEARNING OBJECTIVES
PUPILS SHOULD LEARN:

POSSIBLE TEACHING ACTIVITIES

LEARNING OUTCOMES
PUPILS:

POINTS TO NOTE

	<ul style="list-style-type: none"> • In groups, pupils use case studies to investigate the impact of Local Agenda 21 on the aggregate usage policies of organisations in their community, <i>eg a local industry, the local council, a shopping centre, their school.</i> <ul style="list-style-type: none"> • What does each organisation do? • Where is it located? • What aggregate resources does it use? • What does it produce? • Does the organisation have a policy on sustainable development in respect of aggregate usage? • What measures have been introduced to make it more sustainable? • Are these monitored and evaluated? <p>If appropriate, pupils could invite members of the organisation to discuss changes within their industry/service and the policies and legislation that have had an impact.</p>	<p>views of different members of the community</p> <ul style="list-style-type: none"> • summarise key findings and draw substantiated conclusions • communicate key findings to their target audience in a presentation which uses ICT 	
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LEARNING OBJECTIVES
PUPILS SHOULD LEARN:

POSSIBLE TEACHING ACTIVITIES

LEARNING OUTCOMES
PUPILS:

POINTS TO NOTE

How is our community more sustainable?			
	<ul style="list-style-type: none">• Pupils compare their findings with the published targets in the Local Agenda 21 Plan and consider how the situation has changed since the Plan was published. They present a 'progress update' comparing their own findings with those of the local council. They draw conclusions about how sustainable usage of aggregates is in the local area is and whether there have been improvements in the last three years.		

What do we now know about local action and policies for sustainable development?			
<ul style="list-style-type: none"> to reflect on what they have learnt and on the process of enquiry how to share their findings with the school, local community and local authority how they could influence future policy how the school community could participate in, and contribute to, future Local Agenda 21 priorities 	<ul style="list-style-type: none"> In one or more of the following ways pupils present the results of their findings to other pupils and members of the local community: <ul style="list-style-type: none"> writing posters to explain the local issues and options writing leaflets/newspapers to explain the issues locally for sustainable development policy and encouraging other pupils to join the debate creating a website or page on the school website which updates pupils, parents and others on the local issues and school involvement/events organising school assemblies to explain the local issues and inform other pupils holding debates with Local Agenda 21 member organisations writing proposals for discussion in class and at the school council sending proposals which have been discussed at the school council to the Local Agenda 21 group/committee, suggesting how the school could be involved in discussing future priorities and planning future action Pupils reflect on what they have learnt about the impact of local policies and priorities for sustainable development, and on how they use their right to be consulted by the local authority to contribute responsibly to local decision-making. 	<ul style="list-style-type: none"> practise and improve their skills of reflection and self-assessment communicate their learning to others in the school and to the wider community plan practical steps towards implementing priorities 	<ul style="list-style-type: none"> Link with geography: this builds on unit 23 'Local actions, global effects' in the key stage 3 geography scheme of work; and GCSE criteria: values, attitudes and future decision-making (3.1vii). The Local Government Act 2000 requires local authorities to consult with young people during policy- and decision-making.

Lesson 1

In a teacher-led discussion, ask pupils to say what they know about relevant items from the following:

- the Government's plans for increased house building in the area
 - why are more houses needed?
 - where will they be built?
 - what infrastructure will be needed? (e.g you can't just build houses in a field - they need services)
 - what materials will be needed and where will they come from?
- the effects of the London 2012 Olympics
 - are new venues proposed for the local area?
 - how will they be serviced - what infrastructure will be needed, how may the local economy be affected
 - what materials will be needed and where will they come from?
 - will local traffic problems be reduced or increased?
- coastal erosion in the local area
 - is it a problem?
 - who is affected and how?
 - what's being done about it?
 - what should be done?
 - what materials will be needed and where will they come from?
- the commercial fisheries and leisure angling in the local area

This gives all pupils a chance to join in the discussion and feel that they have contributed to the pool of knowledge.

Highlight gaps in this knowledge pool and divide pupils into groups to research these gaps.

Provide a set of paper resources and a list of web-based resources and as coursework groups of pupils then explore each relevant topic.

Lesson 1 resources

Paper publications suitable for students:

- Dredging and the Coastline (Crown Estate)
- Marine Aggregate Dredging and the Historic Environment (BMAPA)
- Aggregates from the Sea (BMAPA)
- Marine aggregates in concrete (BMAPA)
- Marine sands in mortars and Screeds (BMAPA)
- 2003 review (BMAPA)
- 04-05 Review (BMAPA)

Paper publication more suitable for teachers:

- Marine aggregate site restoration and enhancement (EMU Ltd. for BMAPA, the Crown Estate and English Nature)

Video presentations:

- 'Aggregates from the Sea' (BMAPA, VHS, 13 mins)
- 'Ask the Experts about Marine Aggregates' (BMAPA CD; Quicktime videos on Resource management, Coastal erosion, Archaeology and Marine life)
- London Olympics:
www.london2012.ctad.net/downloads/London2012_webbrochure.pdf
- Environment Agency: (east coast flooding) www.environment-agency.gov.uk/subjects/flood/826674/882909/426221/?version=1&lang=_e

Lesson 2

Using ICT, pupils, with teacher support, produce a presentation (poster- or PowerPoint-based). Within each topic themes could include:

- what is currently being done or what plans have been approved (building, infrastructure, coastal defences, marine extraction - local Authority website)
- what developments are planned under each of these headings
- what will be needed to implement these plans? (specifications for different types of materials)
- where the materials for the projects will come from (hard rock quarries, land-based aggregate sources, marine aggregate sources)
- what will be the environmental costs and benefits of using materials from these sources?
- what safeguards are in place and what further safeguards, if any, are necessary?

Lesson 2 resources

ICT - computer network, page layout programme, printer(s), PowerPoint, data projector

Lesson 3

Pupils give their presentations and the teacher rounds off the discussion by highlighting the important role of marine aggregates. Why are they so important to the construction industry?

- increasing demand partly fuelled by
 - the success of the London 2012 Olympics bid and its consequences
 - the Government's proposals for an increase in house building
 - the need to protect vulnerable coastal communities from the continuing natural effects of rising sea levels
- available land-based sources are being exhausted
- it is increasingly difficult to obtain permission for new sites or extensions of existing land-based sites especially in the South-east where land is at a premium

The theme of increased marine aggregate extraction is then introduced.

- what are current levels of production? (Details are given on the Crown Estate website)
- what effects might uncontrolled marine extraction have on
 - coastal erosion?
 - marine life?
 - archaeological heritage - prehistoric remains, shipwrecks of all ages
- what controls are currently in place to mitigate or to avoid these effects?
- what are the benefits of the use of marine aggregates over land-based aggregates? (reduction of environmental impacts involved in delivery e.g. traffic, noise and exhaust pollution; closeness of source to end user, speed of delivery, ability to grade when gathering)

The BMAPA website, videotape, CD and website give the Industry's overview of its activities and responsible actions. the Crown Estate website gives an overview of the regulatory process and volumes of marine aggregates currently produced).

Two contrasting resource packs provide background to

- Hallsands - what has happened since uncontrolled dredging took place 100 years ago close inshore when knowledge was insufficient to forecast the effects of aggregate extraction, and attitudes towards conservation were very different and responsibility for

the welfare of coastal communities was deemed less important than the needs of the British navy

- the North-east Norfolk coast where since Roman times there has been natural erosion of the coastline, with well-documented loss of villages. It has been clearly shown that marine aggregate dredging is not increasing coastal erosion, but is providing critically important material for a major coastal defence scheme protecting the area between the villages of Happisburgh and Winterton

Pupils divide themselves into groups representing stakeholders, for example:

- the local construction industry - the end user of the product
- a marine aggregate supplier - the provider of the product
- the local authority - responsible for the implementation of LA21 and sustainability in the area
- the Environment Agency - responsible for coastal defences in the area
- the local Trawler Association (commercial sea fishing)
- English Nature - government body responsible for Nature Conservation
- The local Residents' Association - suffering from the effects of coastal erosion
- a research consultancy which has provided independent research from geologists, marine ecologists, archaeologists and coastal process experts on the effects of the proposed extraction

Coursework - research the positions of the different groups, differentiating where possible between opinions and scientific research and facts

For more able pupils extension work could investigate marine aggregate issues elsewhere in the world - e.g. in Continental Europe, the United States, the West Indies.

- **Belgium:** www.deme.be/projects/proj_sub.asp?iID=14
- **France:** www.sandgravel.co/extratio/france.htm
- **USA:** <http://woodshole.er.usgs.gov/project-pages/aggregates/>
- **Jamaica:**
www.ncra.org/eias/StThomas/yallahs/L03_543YALLAHS_SUMMARY.pdf

Lesson 3 resources

ICT - computer network, page layout programme, printer(s), PowerPoint, data projector

Video presentations:

- 'Aggregates from the Sea' (BMAPA, VHS, 13 mins)
- 'Ask the Experts about Marine Aggregates' (BMAPA CD; Quicktime videos on Resource management, Coastal erosion, Archaeology and Marine life)

Websites

- **British Marine Aggregates Producers' Association (BMAPA):**
www.bmpa.org
- **the Crown Estate:** www.crownestate.co.uk
- **English nature:** www.english-nature.org.uk

Lesson 4

Each group prepares a role-playing presentation, which clearly separates fact from opinion, to be given at a public enquiry into a proposal to increase marine aggregate extraction offshore.

Strict time limits are given for the duration of the presentation: say 5 minutes absolute maximum. Each group should present their case in more or less the same way, for example:

- the current situation
- what is proposed or how the proposals will affect the group's interests
- how the proposals should be amended if at all
- safeguards which are needed to minimise the impact of the proposals

the need for the resource and the benefits which may arise from its exploitation

Lesson 4 resources

ICT - computer network, page layout programme, printer(s), PowerPoint, data projector

Flipcharts or other poster paper

Writing materials - felt-tips

Lesson 5: the public enquiry

Ideally the Local Authority is asked if the Council Chamber or another public meeting room is available and, if possible, a member of staff or a Councillor is asked to chair the meeting (he/she must be fully briefed beforehand).

If not, the classroom or assembly hall is arranged as for a public enquiry and the teacher acts as Chairperson.

Each group presents their case: at the end the Chair sums up each case and a vote is taken on the proposal.

If the proposal is approved any necessary safeguards are listed; if not, then recommendations are made to enable progress to be made.

The results of the enquiry, based on the layout of a genuine public enquiry record (the Local Authority should be able to provide a template) can be made available stakeholders:

- the Local Authority
- the Environment Agency,
- English nature
- the local marine aggregate producer(s) and end-users
- local residents
- commercial fishery and sea anglers' association representatives
- the local media

so that the pupils feel that their opinions and research have been taken account of.

For more able pupils extension work could investigate marine aggregate issues elsewhere in the world - e.g. in Continental Europe, the United States, the West Indies.

Lesson 5: resources

- Local Authority Council Chamber or another public meeting room if available
- if possible, a member of staff or a Councillor is asked to chair the meeting (he/she must be fully briefed beforehand).
- If an LA room is unavailable the classroom or assembly hall is arranged as for a public enquiry and the teacher acts as Chairperson.

ICT - laptop, data projector, screen

Poster boards for hand-produced materials