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7th January 2016.

Aggregate Marine Licence Applications : Area 453 and 488.

Dear Mr. Morris,

These are the comments of Marinet Limited with respect to the formal application by Cemex UK and Tarmac Marine to the Marine Management Organisation for a licence to dredge aggregate (sand and gravel) from the seabed in Areas 453 and 488, English Channel.

Principal Features of the Application and Application Sites.

- Area 453 is located c. 9 Km off shore from the Sussex coast, and Area 488 (which is south of Area 453 and adjacent to it) is located c. 10 to 11 Km offshore.

- The application for Area 453 is to extract a maximum of 3,750,000 tonnes over 15 years, with a single year maximum extraction of 500,000 tonnes. Area 453 contains sand and gravel to a depth of 5 metres, and the application agrees to a restriction of 2 metres in the depth of extraction.

- The application in Area 488 is to extract 3,000,000 tonnes over 15 years, with an annual maximum of 500,000 tonnes. Area 488 contains sand and gravel to a depth of 10 metres, and there is no restriction on the depth of extraction (except for the statutory limit that 0.5 metres must remain on the cessation of dredging).

- The maximum that may be extracted in any one year is 1,000,000 tonnes (the two areas combined). The average annual extraction for the two areas combined is 450,000, based on a combined limit of 6,500,000 tonnes over 15 years.

- Both Areas will trail dredge with no screening. Area 453 will use a trailer suction hopper dredger (TSHD) with a capacity of 6,000m^3 ("The Reimerswaal"), and Area 488 will used a TSHD with a capacity of 1,575m^3 ("The City of Chichester"). Both Areas may be dredged by a TSHD with a capacity of 15,850m^3 ("Oranje") on what is described by the applicants as an "occasional basis".

- Sand and gravel from the dredging in these two Areas will be landed at South Coast Ports and in the Thames Estuary for use by the construction industry, some sand will be used for UK "beach recharge" projects, and some sand and gravel will be sold in continental markets in France, Belgium and Holland.

○ The depth of the sea in the two Areas is c.11m and the tidal current at peak spring tide is c. 0.8 m/s. The combined area of both Areas is 4.68 m^2.

○ The content of silt and fine sand in the proposed dredging sites Area 453 is 1% silt and 6-7 % fine sand, and in Area 488 it is 4% silt and 17% fine sand. The mobilization of fine and sandy sediment, discharged by the dredgers from their dredging overflow, will disperse to nearby areas and alter the nature of the seabed substrate.

○ The proposal is located within the Kingmere Marine Conservation Zone (MCZ), measuring 47.84m^2. Area 435 is situated wholly within the Kingmere MCZ, and Area 488 is similarly located within the MCZ except for about one-third of its area at its southern end.

○ The Kingmere MCZ provides protection within its area for the following features:
- ◦ The "broad-scale habitat" of subtidal mixed sediments and moderate energy intra-littoral rock.
- ◦ The "habitat feature of conservation importance (FOCI)" of subtidal chalk.
- ◦ The "species FOCI" of low mobility native oyster, *Ostrea edulis*.
- ◦ The "non English national guidance feature" of Black Bream, *Spondyliosoma cantharus*.

○ The MCZ is important for the breeding, spawning and aggregation of Black Bream. The applicants have volunteered not to dredge during the Black Bream breeding season, April to June.

Principal Issues for Evaluation.

We consider the following the principal issues requiring evaluation by the applicant's Environmental Impact Assessment (EIA) and by the regulator, the Marine Management Organisation.

○ The fish spawning and nursery grounds likely to be affected by dredging. These are recorded in the Environmental Statement, Chapter 7: Biological Environment, Table 7.13

Species	Spawning Area	Nursery Area
Black Bream	√	X
Brown Crab	√	√
Sole	√	√
Sand eel	√	X
Plaice	√	√
Cod	√	X
Sprat	√	X
Undulate Ray	X	√
Thornback Ray	X	√
Whiting	X	√
Lemon Sole	X	√

○ Adequacy of the sampling of the benthos (life on the seabed) in the dredging areas and surrounding areas which form the Kingmere MCZ. In particular, the presence of *Sabellaria spinulosa* (Ross worm), and the biotopes (community of species living on the seabed) known as SS.SCS.CCS MedLumVen (*Mediomastus fragilis, Lumbrineris spp. and venerid bivalves* in circalittoral coarse sand or gravel) and SS.SCS.CCS PomB (*Spirobranchus triqueter with barnacles and bryzoan crusts* on unstable circalittoral cobbles and pebbles), and their tolerance of disturbance by dredging.

- The evaluation of impact on the protected features of the Kingmere MCZ, namely:
  - The "broad-scale habitat" of subtidal mixed sediments and moderate energy intra-littoral rock.
  - The "habitat feature of conservation importance (FOCI)" of subtidal chalk.
  - The "species FOCI" of low mobility native oyster, *Ostrea edulis*.
  - The "non English national guidance feature" of Black Bream, *Spondyliosoma cantharus*.

Note: The distribution of subtidal mixed sediments and moderate energy intra-littoral rock (sand and gravel to a depth of one metre or less lying on bedrock, and which support biotopes SS.SCS.CCS MedLumVen and SS.SCS.CCS.PomB) are recorded in the Environmental Statement, Chapter 7: Biological Environment, Table 7.7 (Seabed Interpretation 2011, from Interpreted Sediment Map provided to Balanced Seas).

Note: The location of the Black Bream (*Spondyliosoma cantharus*) nesting grounds are recorded in the Environmental Statement, Chapter 7: Biological Environment, Fig 7.26 (Black Bream Nesting Grounds 2002-2013 [EMU 2013 and Technical Annex 7.3]).

Note: The location of the Native oyster bed (*Ostrea edulis*) is not identified anywhere in the applicant's Environmental Statement. It is however identified by Balanced Seas in their recommendation for MCZ classification

Note: The location of the subtidal chalk outcropping rocks is not specifically identified in the applicant's Environmental Statement, although it is anonymously identified in the ES as a Black Bream principal spawning site (located to the east of Kingmere Rocks and referred to in the ES as "Worthing Lumps").This chalk reef is identified by Balanced Seas in their recommendation for MCZ classification.

Principal Shortcomings in the Applicant's EIA.

The essential burden of argument in the applicant's Environmental Impact Assessment and related Statement (ES) is that, with the exception of adverse impact on the breeding sites of Black Bream located at Kingmere Rocks (which the applicant asserts can be mitigated by agreeing not to dredge during the spawning season from April to June) there is no adverse impact of sufficient magnitude or significance to prohibit dredging within the Kingmere MCZ.

The question facing the regulator (Marine Management Organisation) and all other interested parties is whether this assertion is correct.

We, Marinet Limited, have identified a number of shortcomings in the applicant's EIA which, both individually and in combination, lead to a contrary conclusion – namely, that the impact of dredging in area 453 and 488 may have significant adverse impact on the Kingmere MCZ. We use the word '*may*' in the preceding sentence because, firstly, we believe (and will demonstrate here) that the applicant's assessment of impact is incomplete and therefore its assertion of no adverse impact is, by definition, unverified; and secondly, because all statement of 'significance' with regard to impact are subjective – a position agreed to by the applicant itself in its ES (ref. Environmental Statement, Chapter 3, EIA Methodology, Section 3.6.31, titled: Evaluation of Significance). Accordingly, significance of impact must be based on evidence, and the burden of that evidence. It therefore follows that if the evidence is absent, incomplete, or the process for assembling the evidence is lacking in thoroughness and therefore in accuracy, any statement of significance must at best be questionable and, by the test of

the exceptional quality required because this application to dredge is occurring within a zone of high conservation importance, essentially invalid.

Accordingly, this is the process by which we have evaluated the efficacy of this EIA and its assertions and conclusions.

We now enumerate below, by titled bullet points, these principal shortcomings.

- Sediment Deposition and Sediment Plume.

Smothering of the fauna on the seabed and asphyxiation of marine life in the water column due to the suspension and subsequent deposition of sediment from the dredged seabed is recognized, both by the applicant and regulatory authorities, as a key matter. This is especially so in a Marine Conservation Zone where protected habitats and species need to maintained to a "favourable conservation status".

The applicant's EIA gives considerable space to this matter. Chapter 6 of the ES, Physical Environment, and two Annexes: Annex 6.1 Sediment Plume and Bedload Transport Modelling, and Annex 6.2 Sediment Plume and Bedload Transport Modelling Conceptual Report, address these matters.

The essence of the applicant's submission is that sediment deposition will be confined to the perimeter of the dredged areas and not extend beyond a few hundred metres, impacting on the Kingmere Rocks MCZ feature (Black Bream nesting site) in only a very minimal manner in its north west quadrant (ref. ES Chapter 6, Fig 6.18); and, the sediment plume will not elevate suspended sediment levels significantly above background.

In respect of Area 453 suspended sediment is predicted to be c.10-20 mg/l above background over the northern and central parts of the Kingmere Rocks MCZ feature during mid-ebb spring tide dredging conditions (ref Annex 6.1, Fig 7.3). In respect of Area 488 it is predicted to be c.5-20 mg/l over the whole Kingmere Rocks MCZ feature during mid-ebb spring tide dredging conditions (ref. Annex 6.1, Fig 7.13). In both of these foregoing modelled instances, the normal dredger ("Reimerswall" and "City of Chichester") were being employed. If the larger dredger ("Oranje") were employed, these background levels could be elevated as high as 50mg/l under certain circumstances (ref. Annex 6.1, Fig 7.30 and ES, Chapter 7, Biological Assessment, Fig 7.23 to 7.25).

Similar background sediment levels under similar dredging conditions were also predicted for the areas of "subtidal mixed sediments and moderate energy intra-littoral rock" (MCZ protected habitat) to the east and west of the dredging areas (ref. Annex 6.1, Fig 7.1 to 7.30).

On the basis of these models of sediment deposition and sediment plume, the applicant's EIA asserts that the impact of dredging in Area 453 and 488 on the MCZ features – "subtidal mixed sediments and moderate energy intra-littoral rock" and "Black Bream nesting sites" will be Negligible and "not significant" in terms of the EIA Regulations, with the proviso that dredging operation are suspended during the Black Bream nesting period, April to June (ref. Appendix 8.1 Report to Inform MCZ Assessment, section 3.2.3).

The applicant's assertions about no adverse impact from sediment deposition and sediment plumes on the MCZ features appear conclusive, until one studies Annex 6.2 a little closer. Then, the following facts emerge:

• In the matter of tidal currents, the following statement (ref. Annex 6.2, Section 3.3.2) is made by author, HR Wallingford Ltd:

"*In the vicinity of Areas 453 and 488, typical peak spring tide current speeds are about 0.8 m/s and peak neap tide current speeds are 0.5 m/s.*

"*These results from the flow model need to be confirmed with a more refined local bathymetry in place. The effects of large-scale bathymetric features such as Kingmere Rocks may influence currents in the area. This refinement of the model will be undertaken during the next phase of the study (see Section 7).*"

This statement brings to light the following points:

- The predictions made in the EIA are a model, based on desk-derived data and limited empirical data derived from site specific study of the dredging areas. The model therefore still needs to be ground-truthed.
- Current speeds, which influence the distance which sediment deposition and sediment plumes travel, still remain to be verified.

• In the matter of empirically verifying the conceptual model – an essential requirement of any forecast – the following statements are made in Annex 6.2, Section 7, by the author HR Wallingford Ltd

"***7.1. Introduction:*** *In the next phase of this study we will use detailed numerical models to investigate the plumes arising from dredging in Areas 453 and 488 and the effects of dredging on natural sediment transport.*

*"**7.2. Flow modelling:** The flow model developed and validated for the South Coast MAREA studies will be refined in the vicinity of the proposed dredging areas to include a more highly resolved bathymetry. The model will be re-run for a representative spring-neap cycle to form the hydrodynamic input for the plume dispersion and sand dispersion modelling.*

"7.3. Plume dispersion modelling: *For this task the SEDTRAIL-3D model (Spearman et al., 2003, 2007) developed by HR Wallingford will be used. This start-of-the art model computes the near field mixing of the dredging plume as well as the far-field dispersion under the action of currents. The model is able to reproduce the dispersion from any number of real dredgers moving and releasing in real time and space.*

"The model will be used to simulate an agreed representative period of dredging by representative dredging plant over a spring-neap cycle. The plume model will represent the dispersion of fine (silt/clay) and also any number of non-cohesive fractions. The dispersion of sand particles released by the dredging process once they have settled to the bed and have started to interact with the natural non-cohesive environment is considered below (see Section 7.4).

"The outputs from the study will be an assessment of the increases in suspended sediment concentration and deposition arising from silt and sand fractions. The assessment will be illustrated with visual and GIS outputs.

*"**7.4. Sand dispersion (bedload) modelling:** One of the important considerations of this study is the potential for sandy sediment released from dredging to disperse in such a way that the mix of sediment particles on the seabed is changed, potentially affecting the spawning habitats of Black Bream or characterises of other habitat features. This dispersion is a long-term process as demonstrated by measurements from the East English Channel which show the development of sand-dispersion bedform features only in the third year of dredging and only as a result of sustained and high rates of screening (East Channel Association, 2011).*

"We anticipate that the persistence (or otherwise) of sandy sediment arising from dredging on spawning areas / habitat features will be a pivotal issue for the regulators. Therefore a high degree of

confidence will be required in the results. For this task, we therefore propose to use the state-of-the-art SandTrack model (Soulsby and Mead, 2011)to simulate the long term dispersion (years) of sand particles released through the dredging process under the action of currents and waves.

These statements bring to light the following points:

• The statements about impact of sediment deposition and sediment plumes on MCZ features made in the EIA are forecasts based on a model which, whilst the EIA's consultants may have expressed their confidence in, has **not** been properly ground-truthed and this process of verification **still requires** to be undertaken. All statements of impact are therefore **contingent** upon this additional process being undertaken.

• It is surprising and unsatisfactory that an application which may impact on the conservation features of a Marine Conservation Zone has been submitted where the validation of key matters – sediment deposition and sediment plumes – **remains absent**. This is especially so when the applicant knows the importance of this matter, and has been through a Scoping exercise with the regulator which has highlighted this imperative.

The conclusion, in our opinion, of the above evidence is that the application is, at the very least, **unproven**, and more likely given the degree of uncertainty that still remains over the factual accuracy of key data, is **invalid.**

We submit that it is simply **not acceptable** where impact on features of the marine environment and, specifically, the features of a Marine Conservation Zone and the surrounding ecology and structure within the MCZ – in short, what ecologists term as the "critical order" of the MCZ – have not been thoroughly and adequately assessed.

● Sediment Deposition and Sediment Plume: Turning Distance.

A factor which is nowhere evidenced in the EIA, and one must therefore conclude has been omitted, is the impact of sediment deposition and sediment plume dispersion on MCZ conservation features whilst the dredgers turn following their dredging run.

The dredgers will still be discharging overflow sediment during this manoeuvre. Therefore these discharges require to be taken into account in the calculation of the impact of sediment deposition and sediment plume dispersion.

The dredgers proceed at c. 1 knot (0.5 m/s) whilst dredging (ref. Annex 6.2, Section 4.4) but upon ending the dredging run they are likely to proceed at a much faster rater in order to execute the turning manoeuvre. It is probably reasonable to assume that they will execute this turning manoeuvre at a speed around half the maximum speed the vessel is capable of as they would not wish to spend unnecessary time on this task.

The key facts which need to be employed in the calculation of this impact on MCZ conservation features are as follows:

• This issue is particularly pertinent when dredging the eastern section of Area 453 – but the logic and need to calculate impact also applies to the western section of Area 435 and to Area 488.

• With regard to the eastern section of Area 435, HR Wallingford (Annex 6.2 , Section 5.22) states:

"Assuming that the limit of the active dredging in Area 453 is about 600 m from the Kingmere Rocks in an east-north-east direction and assuming that the current speed is at a maximum of 0.8 m/s (Section 3.3.2) it will take the plume 750 s to arrive at Kingmere Rocks by which time all of the sand fractions in the plume will have deposited with the exception of around half of the fine sand fraction."

The two key points to be noted here are, firstly, that the eastern boundary of Area 453 from Kingmere Rocks is approximately 600 metres; and secondly, the time taken for the plume to arrive at Kingmere Rocks by when all the sand will have been deposited on the seabed, with the exception of half of the fine sand, is 12½ minutes (750 seconds).

- The turning time for the dredgers upon leaving the dredging zone/path is 5 minutes (ref. Annex 6.2, Section 7.3 Plume dispersion modelling):

" • Dredging along a path of about 1 km with turning taking 5 minutes."

- The maximum speed of the "Reimerswaal" (Area 453) is 14.5 knots (ref. Annex 6.2, Appendix B, Table B1, Dredger details). Half speed is therefore 7.25 knots

The maximum speed of the "City of Chichester" (Area 488) is 11.0 knots (ref, Annex 6.2, as cited above). Half speed is therefore 5.5 knots

The maximum speed of the "Oranje" (Area 453 and 488) is 16. knots (ref. Annex 6.2, as cited above). Half speed is therefore 8 knots.

This means that the speed of the "Reimerswaal" is 13.4 kilometres per hour (7.25 knots), and in 5 minutes it will travel 1116 metres. Thus if we assume that the turning manoeuvre of the "Reimerswaarl" is shaped like a looped arc, it will travel half this distance (2½ minutes) before having turned around to re-approach the dredging site. Half of this distance is 558 metres. Knowing that the eastern limit of Area 453 is approximately 600 metres from Kingmere Rocks (ref. cited above), this means that the "Reimerswaal" will still be depositing sand on the seabed when it arrives at very close proximity to Kingmere Rocks. We know this because it takes the "Reimerswaarl" 12½ minutes to cease depositing sand (other than fine sand which continues for longer than 12½ minutes).

To assess the impact on Kingmere Rocks, this deposition of sand then needs to be assessed for how far the sand will travel before settling on the seabed which, in turn, is a function of current speed (still an uncertain entity (see Annex 6.2, Section 3.3.2 cited above) and the time the sand takes from the moment of discharge to the moment of arrival on the seabed.

It should also be added that the comments above refer to the larger grained sand discharged from the dredger's overflow, and do not include fine sand or the matter of the sediment plume, both of which will have an additional impact on Kingmere Rocks.

These matters are **not assessed** in the applicant's Sediment Deposition and Sediment Plume analysis. So the sediment deposition rate on the Kingmere Rocks **will be greater than** that forecasted in the applicant's conceptual model.

Similarly, the impact on the "subtidal mixed sediments and moderate energy intra-littoral rock" (MCZ protected feature) to the east, west, north and south of Area 453 has also **not** been assessed during this turning manoeuvre, whether performed in the eastern or western dredging sections of Area 453.

The same issues apply to the dredger, "City of Chichester" when dredging Area 488, and to the dredger "Oranje" when dredging Area 453 and 488.

It is, in our opinion, therefore clear that a significant aspect in the determination of the Sediment Deposition and Sediment Plume impact has been unassessed in the conceptual model, and is not a component of the additional ground-truthing exercise to be carried out by HR Wallingford (Annex 6.2, Section 7, cited above), and therefore statements in the ES about impact on the protected features of the Kingmere MCZ are **invalid.**

- Adequacy of Benthic Survey.

Given that the application is to dredge sand and gravel from the seabed in a Marine Conservation Zone one would expect the EIA's benthic survey to be of the highest order.

It is therefore very surprising to find that the benthic survey which the applicant commissioned, SeaStar Survey 2013, Annex 7.1, reports on just 12 sampling sites. None of these sampling sites are in the Kingmere Rocks. Moreover in Area 453, only the eastern dredging section is surveyed and the western dredging section has **no** sampling sites. In Area 488, only the southern dredging section is sampled, and the northern dredging section (the main dredging location in Area 488) in **not** sampled.

It is true that Kingmere Rocks is the subject of a drop down video survey, Fugro EMU Ltd 2013, Annex 7.2, but all video reports are in the northern section and the southern section has only one video report. Video reports are not superior to actual benthic sampling. This is a poor benthic sampling regime given the MCZ features and their exposure to possible adverse impact due to the dredging. Adverse impact can only be assessed in the long-term if the baseline benthic survey is of the highest order and detail. The applicant's benthic survey of Kingmere Rocks is clearly **not** of this order.

The applicant does assert (ES, Chapter 7, Biological Environment, 7.5.44) that it has sampled Area 453 and Area 488 more thoroughly by relying on four samples taken from a different survey done in connection with a benthic survey for Area 396/435 in 2013, but these samples are **not** included in the Area 453 and 488 Technical Annex 7.1.

This deficiency is further compounded by the ES Chapter 7 Report recording that the western section of Area 453 contains the Biotope SS.SCS.CCS MedLumVen whose intolerance of dredging is very high, and takes a considerable period of time to recover following dredging (4 to 7 years, ref. ES Chapter 7, 7.5.90 – and clearly longer in this context for the dredging is repeated and over 15 years), and whose sensitivity under EIA Regulations must be classed as "Moderate" (ref. ES Chapter 7, Table 7.5). Note: This is a subjective classification (ref. Environmental Statement, Chapter 3, EIA Methodology, Section 3.6.31, Evaluation of Significance, cited above) and given that dredging of this biotope is repeated, thus continually forestalling its recovery, we submit that it is not unreasonable to classify the sensitivity of this biotope in Area 453 as **"High".**

Accordingly it is our opinion that the applicant's benthic survey for Area 453 and 488 is seriously inadequate**.** It is inadequate not just because the sampling regime should be of the highest order given the nature of the location (Marine Conservation Zone) and so should have sampled the area with a thoroughness which has clearly not taken place; but is also inadequate because thoroughness in the documentary record is essential if the regulator is to be able to determine, on a factual basis, whether

adverse impact is occurring during the lifetime of the license, thus necessitating either a modification of the license or its termination.

To give but one example in addition to the impact on biotope SS.SCS.CCS MedLUmVen which is cited above. It is noted (ref. Annex 7.1 , Table 3.6 and 3.7 and Section 3.3, Biotope Designation and Section 7.5.71) that Area 453 and 488 have a strong presence of the species *Sabellaria spinulosa* (Ross worm) which has the proclivity to create biological reefs which, if this occurs, is protected under the EU Habitats Directive. The ES for Area 453 and 488 asserts that the density of *Sabellaria spinulosa* occurring in the dredging paths of these two sites is insufficient to conclude that reef formation is taking place. However if the western dredging site of Area 453 and the northern dredging site of Area 488 have not been specifically sampled for this feature, and they **have not**, then it is firstly invalid to assert that this feature does not exist, and secondly, impossible to protect this feature during the lifetime of the license should the feature be experiencing adverse impact.

Thus, for a number of reasons recorded above, we consider the applicant's benthic survey to be **deficient** and **seriously inadequate**. It does **not** merit approval by the regulator as a basis for the issuing of this license.

- Assessment of MCZ Features.

The MCZ features which require assessment in the applicant's EIA are recorded in Annex 7.1, North Owers Benthic Survey, Section 1.1.2 (Kingmere rMCZ), and specifically in Table 1.1, reproduced below:

Table 1.1 outlines the features proposed for rMCZ designation within the Kingmere area. Other features present within the area but not proposed for designation include blue mussel beds, *Sabellaria spinulosa* reefs, subtidal sands and gravel and the undulate ray (*Raja undulata*) (Balanced Seas, 2011).

Table 1.1. Features proposed for rMCZ designation within Kingmere (after Balanced Seas, 2011). NB. FOCI = Focus of Conservation Interest; ENG = Ecological Network Guidance **Feature Type**	**Feature Name**
Broad-scale Habitats	Subtidal mixed sediments
Habitat FOCI	Subtidal chalk
Species FOCI Low mobility	Native oyster (*Ostrea edulis*)
Non-ENG features	Black bream (*Spondyliosoma cantharus*)

The issue of Black Bream (*spondyliosoma cantharus)* and the smothering of its nesting sites has already been addressed, in part, in the earlier consideration of the adequacy of the sediment deposition and sediment plume assessments.

However these nesting sites, located in the Kingmere Rocks, and wider afield in the "Worthing Lumps" (subtidal chalk outcrops), do also need to be assessed in the context of the consequential impact of dredging on the subtidal mixed sediments (more specifically identified as "the 'broad-scale habitat' of subtidal mixed sediments and moderate energy intra-littoral rock" which feature a sand, gravel and boulder seabed veneers no greater than 1 metre in depth lying upon bedrock). The Kingmere Rocks and

the "Worthing Lumps" are a part of the forementioned 'broad-scale habitat' which, itself, predominates throughout the Kingmere MCZ and is open to impact by aggregate dredging in Area 453 and 488.

As earlier mention this 'broad-scale habitat' of subtidal mixed sediments hosts two biotopes of particular significance, although by no means exclusively. Other biotopes are present (ES, Chapter 7, Biological Environment) and it is often the case that two or more biotopes occupy the same space. Nevertheless, two biotopes do tend to come to the fore and these are SS.SCS.CCS MedLumVen (*Mediomastus fragilis, Lumbrineris spp. and venerid bivalves* in circalittoral coarse sand or gravel) and SS.SCS.CCS PomB (*Spirobranchus triqueter with barnacles and bryzoan crusts* on unstable circalittoral cobbles and pebbles).

The applicant's ES, supported by documented evidence, argues that these two biotopes are resistant to smothering by sand deposition and asphyxiation by the sediment plume (burial leading to starvation and asphyxiation in the water column). Hence the ES argues that, under the terms of the EIA Regulations, the impact of dredging activity in Area 453 and 488 would be "Negligible" on this MCZ feature.

However there are two factors which, in our opinion, the regulator needs to take into account before concurring with this opinion.

The first, as detailed earlier, is the incomplete nature of the applicant's sediment deposition and sediment plume assessment. As a result, the full measure of the impact of dredging on the MCZ 'broad-scale feature' of subtidal mixed sediments remains **unknown.**

The second concerns the question of tolerance. It is argued that these biotopes are tolerant of smothering and suspended sediment, and that levels of smothering and suspended sediment would need to be substantially higher than the levels forecast in the EIA before the marine animals in these biotopes died from starvation or asphyxiation.

This approach is akin to the LD50 approach to toxicity. Under this approach, toxicity is determined by establishing the lethal dose that will kill 50% of the population. Thus, if the dose is below the LD50 figure, it is not regarded as a lethal dose.

The reality is that doses below the LD50 level are still lethal, even in very small amounts, if consumed or exposed to over an extended period of time. In other words, death can come as a result of exposure at lower dose on a cumulative basis over an extended period, and not just from a single dose or in a very short time frame.

Take for example, exposure to air pollution. Animals (and humans) do not just experience mortality from exposure to injurious materials in the air column when the EQL (Environmental Quality Limit) is exceeded, but can suffer serious injury to the organs of their bodies through prolonged exposure at lower levels over extended periods of time. The time taken to die may be longer, but the mortal event still occurs. The same principle applies to animals (and biotopes) in the marine world.

Whilst the reality we are dealing here is stress and the presence of materials which physically cause mortality, rather than toxicity per se, the principle of the LD50 analogy holds true and the serious shortcoming of the applicant's EIA is that it has made no attempt to assess the exposure of the 'broad-scale habitat' of subtidal mixed sediments (MCZ feature) to this kind of lower-level stress experience

over an extended period of time (15 years), and there is no doubt that this type of experience **will occur** as a result of dredging within Area 453 and 488.

In the wider context of the Kingmere MCZ's ecology, if certain of its key habitats are under stress and therefore experiencing conditions which are no longer "favourable" in MCZ terms, it is likely that the wider ecological system within the MCZ (fish spawning and nursery grounds, for example) will also be placed under stress. This means that the MCZ is then falling into an unfavourable set of ecological circumstances. A loss of "favourable" condition for a MCZ protected feature, which is not likely to be temporary in these circumstances due to licence period running for 15 years, is grounds for refusal of the application.

Indeed, the sensitivity of the subtidal mixed sediment biotopes to smothering is not unknown. For example, Natural England state in their Kingmere MCZ document "supplementary advice on conserving and restoring site features", page 20 :

"Within the infralittoral rock and thin mixed sediment feature at Kingmere MCZ, the circalittoral coarse sediment (A5.141 / SS.SCS.CCS) habitat types observed include biotopes that are known to have an intolerance to sediment smothering (GoBe Consultants Ltd et al., 2014). For example, the SS.SCS.CCS.PomB '*Pomatoceros triquester* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles' biotope identified to the north-east of Kingmere Rocks is known to have a high intolerance to sediment smothering (GoBe Consultants Ltd et al., 2014)."[1]

This serious shortcoming sketched out by us with regard to assessing the impact on MCZ features is not just a weakness of the EIA. It is also a failure by the applicant, specifically, to employ the highest standards to assess the impact on features of the marine world that are of **conservation importance**, and in a site so designated for this reason.

For this reason the applicant's EIA is, in our opinion, **deficient** and **seriously inadequate**.

An additional shortcoming with regard to the assessment of MCZ features concerning evaluation of the impact of dredging on the native oyster, *Ostrea edulis*.

Apart from identifying this species as of conservation importance (ref. Annex 7.1, North Owers Benthic Survey, Section 1.1.2 (Kingmere rMCZ), Table 1.1) and a protected feature in the MCZ recommendation by Balanced Seas, the EIA does nothing to assess the impact of dredging on this specific species and feature.

An uniformed reader of the EIA would be forgiven from concluding that the native oyster was not an issue in this application and EIA. Yet its presence and importance is clearly recorded by the applicant, whereas the evaluation of impact from dredging is conspicuous only by its absence.

[1]Footnote
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415313/Kingmere_MCZ_supplementary_advice.PDF

The key document to identifying the location of the native oyster in the Kingmere MCZ and surrounding area is "Balanced Seas Kingmere rMCZ No16, August 2011.[2] This document states (ref. page 9):

"Since oyster harvesting and cultivation is not permitted in this site under an IFCA byelaw restricting oyster dredging, stakeholders suggest that this stock of Native Oyster (*Ostrea edulis*) is a good example to protect (see FOCI map [ref. Balanced Seas[2], page 10]). They have noted that this species is distributed more widely across the site than is shown in the data (Seeley *et al.* 2010 DEFRA MB102 2B) and mainly found on Black Rock within the dredging application area (Balanced Seas Kingmere Site Meeting, February 2011). Subtidal chalk has also been selected as a habitat FOCI for protection."

It is our opinion that the Applicant's EIA for Area 453 and 488 has failed to adequately assess the location of native oyster sites and the impact of dredging upon them. Balanced Seas noted that these sites are more widely distributed than is shown in the data, and are mainly found on Black Rock within the dredging application area.

The applicant's EIA makes no reference to the Black Rock site, nor any reference to the Balanced Seas document and, presumably, their discussion with Balanced Seas at the time of the Kingmere rMCZ identification.

The applicant's EIA states (ES, Chapter 7, para 7.6.41):

"The MAREA identifies a number of species that have conservation importance, including the native oyster *Ostrea edulis*. The native oyster was not found during the REA, REC or the site specific macrobenthic survey the North Owers application areas and is no longer contained within the Focus of Conservation Interest (FOCI) for the Kingsmere MCZ. The main stocks of native oyster in the MAREA region are in the Solent, however their numbers have declined dramatically and production in most areas is low. Native oyster are found in highly productive estuarine and shallow coastal water habitats, on firm bottoms of mud, rock, muddy sand, muddy gravel with shells. Given the extensive surveys that have been undertaken for both this project and the Kingmere Reefs surveys conducted to inform the designation processs, and the lack of recent records for *Ostrea edulis* it is not considered to be present in sufficient numbers to warrant further discussion."

It must be observed that the applicant's benthic survey (SeaStar 2013) did not adequately sample either Area 453, 488 or Kingmere Rocks – ref. earlier evidence cited – and whilst native oyster may not be a statutorily listed feature of the MCZ it remains a Feature of Conservation Importance (FOCI) both locally and nationally. The applicant has therefore dismissed the presence and significance of this species in the MCZ and dredging areas in an unwarranted manner.

This is clearly a serious shortcoming of the applicant's EIA. Therefore in this regard the EIA is **deficient** and **seriously inadequate**.

- Impact on Fish Spawning and Nursery Grounds.

[2]Footnote http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwiI04S4p5DKAhXHvhQKHd1KAYQQFggfMAA&url=http%3A%2F%2Fwebarchive.nationalarchives.gov.uk%2F20120502155440%2Fhttp%3A%2Fwww.balancedseas.org%2Fgallery%2Fdownload%2F1044.pdf&usg=AFQjCNHiWwDLrpEEU-Cw1OlQmghaqKt8yw&bvm=bv.110151844,d.d24

2

The issue is whether removal of habitat in the dredging areas, and smothering of adjacent areas as a result of sediment deposition and sediment plumes, will adversely affect the spawning and nursery areas of protected and commercial fish and shellfish.

The removal of habitat must adversely affect fish and shellfish species. Those species which have spawning and nursery habitat in the dredging areas are recorded in Table 7.13 below (ES, Chapter 7, Biological Environment). Of this fact there can be no dispute. The applicant argues that the dredging sites vary in significance amongst the different species (being particularly important for sole, for example) and also argues that the spawning territory of most species is sufficiently widespread as to permit the loss of limited habitat, the dredging sites being 4.68^2 km in total. Also the applicant argues that dredging will cease from April to June in order to ensure that Black bream nesting sites at Kingmere Rocks are not adversely affected, and that this will also benefit other fish and shellfish species which spawn during this period.

- The fish spawning and nursery grounds likely to be affected by dredging. These are recorded in the Environmental Statement, Chapter 7: Biological Environment, Table 7.13

Species	Spawning Area	Nursery Area
Black Bream	√	X
Brown Crab	√	√
Sole	√	√
Sand eel	√	X
Plaice	√	√
Cod	√	X
Sprat	√	X
Undulate Ray	X	√
Thornback Ray	X	√
Whiting	X	√
Lemon Sole	X	√

Nevertheless, although dredging may cease between April and June, the actual habitat is being physically changed. Not only is the surface material being removed, revealing material beneath which may have a subtle but different character from the point of view of the fish species concerned, but also the dredger will be depositing back onto the dredging site itself a layer of fine sediment and clays which may, over the course of one year amount to deposition of several millimeters, and possible centimeters. This will distinctly alter the character of the seabed in the dredging site from the point of view of fish breeding species. Impact in the dredging sites must therefore be **Significant** under EIA Regulations, and affects all the species listed in Table 7.13.

With regard to sediment deposition at the Black Bream nesting sites (outside the period April to June) we have argued that this matter has been **inadequately assessed** by the EIA, see earlier evidence.

With regard to the smothering of breeding sites further afield and the asphyxiation of breeding fish during the planktonic (larval) stage, the applicant states (ES, Chapter 7, Biological Environment, para 7.6.64 and 7.6.65):

"The increase in SSC [suspended sediment concentration] may affect fish species with pelagic eggs, such as cod, sprat and plaice as silt could adhere to the egg surface, increasing the settling/sinking speed. As described within section 7.6.30 the duration of the larval phase within the ichthyoplankton can be up to 120 days and as such there may be an increased mortality of pelagic eggs if they sink before completion of this phase.

"In experimental conditions, the mortality of cod eggs was not affected after three days of exposure to 20 mg/l of clay, but mortality increased when the concentrations were 200 mg/l (Westerberg *et al*., 1996 in Birklund and Wijsman, 2005). These tolerance levels of SSC are well above the range of those predicted to be produced from the temporary sediment plumes expected to be generated during active dredging operations. The sensitivity of pelagic eggs to the impact of increased SSC is considered to be low. The effect of increased suspended sediment concentrations on pelagic fish eggs is therefore predicted to be ***Negligible***."

It must be observed that the applicant's evidence regarding the tolerance/impact of smothering of eggs and planktonic stages of fish species is very slender. Only one case study is cited from the literature to assert nil adverse effect (Westerberg *et al*., 1996 in Birklund and Wijsman, 2005) which is not overwhelming evidence by any standard, and it must be noted that this study has two deficiencies. Firstly, the cod eggs were only exposed to adverse circumstances for three days, whereas in actuality they will experience adverse circumstances of an almost daily basis due to the dredging. Secondly, as we have earlier observed, the LD50 test is not a truly appropriate means to assess adverse impact, with mortality also being caused by prolonged exposure to less severe adverse circumstances/materials over a longer period of time.

Accordingly we do not feel it warranted, on the basis of the evidence presented by the applicant, to declare that the impact on fish and shellfish species will be **Negligible** under EIA Regulations. This assertion has simply not been sustained by this EIA and its evidence.

Evidence on this matter may, in truth, be in poor supply. Therefore to make any categorical statement is not just "subjective" – see earlier discussion – but also untenable. Logic suggests that there is likely to be some impact, but whether it is Slight, Moderate or Significant under EIA Regulations is unknown. However, it is clear that most of the species under consideration here are under severe pressure due to historical over-fishing (not an issue assessed in this EIA, which it probably should have been) and therefore their spawning and nursery grounds require protection if these species are to be able to rebuild their populations.

As a result, there is a strong argument that the Precautionary Principle – legally recognised in environmental protection - should apply in this circumstance. This matter has not been assessed in this EIA, and we submit that there is a strong need for it to have been done so. Whether to forbid the dredging application on the grounds of the Precautionary Principle with reference to protection of breeding fish depends on an evaluation of the breeding importance of these sites, and the availability of alternative sources of the dredged material. We will consider the availability of alternative sources below, but suffice to say here on the matter of the importance of Area 453 and 488 to the overall breeding success and long-term viability of the fish and shellfish species in question, we feel this has been **inadequately assessed.**

- <u>Alternative Sources of Aggregate</u>.

Given the MCZ status of the applicant's sites, and the number of uncertain issues (for example, the impact on fisheries), it is essential to ask the question of whether there are alternative sources of aggregate (sand and gravel) which could meet the region's needs (the matter of export to Europe cannot be regarded as essential, although it may be commercially lucrative).

If there are, then this facilitates the answer to the question of whether dredging should be permitted in a MCZ and whether the Precautionary Principle should be deployed.

In the applicants assessment of these matters of alternative sources (ES, Chapter 5, Project Need and Alternatives) no reference is made in any meaningful form to the West Sussex Minerals Plan and, in particular, the Joint West Sussex Minerals Local Plan[3], March 2015, which considers the aggregate resources available in the county, the pattern of their mining during the last 10 years, and the different origin and way in which the county's aggregate needs are met.

Here we learn that the county is relatively abundant in land-based sources with mining permission, but that their use and percentage of share in meeting the county's need has fallen considerably over the last 10 years – by 65%. Further we learn that the land quarries available and operating are in part owned by one of the applicants for Area 435 and 488 and that a significant number of land quarries with mining permission are currently inactive. This fall in use of the land quarries is attributed to an increase in the supply of alternative sources – secondary/recycled and marine dredging. The sources, cited from the Joint West Sussex Minerals Local Plan, March 2015, are:

2.1.09. The ten years of land-won sales data is presented in Table 1 and Figure 1. This shows that sales have fallen from 784,000 tonnes to 276,692 tonnes (65%) over the ten year period since 2004 and have plateaued since 2009. The average sales figure over the 10 year period is 439,569 tonnes and for the past three years, sales have averaged at a much lower 281,564 tonnes. Notably, the average sales figure (439,569 tonnes) and sales since 2004 have been significantly lower than the apportionment for West Sussex that was set out in the South East Plan (910,000tpa). This is notwithstanding that at that time there was a high level of building going ahead despite the current relative downturn in the building infrastructure market. It is not possible to provide the split between soft sand and sharp sand and gravel for the year 2013/14 due to the operators advising there are confidentiality reasons, but the average split over the past 10 years is 92:8 (Soft Sand to Sharp Sand and Gravel).

2.1.10. The general pattern of decline in sales could be attributed to an increase in the supply of alternatives (secondary/recycled and marine dredged) replacing the need for primary aggregates and/or a reduction in development levels due to the economic downturn.

Also, see the Tables at Appendix 1 at the foot of this submission.

[3] https://www.westsussex.gov.uk/media/4595/laa_march2015.pdf

It is therefore clear, from the foregoing and the Tables in Appendix 1, that land-based sources of aggregate (sand and gravel) in West Sussex are available in a quantity commensurate with the offshore license application, that these land-based sources are presently under-utilised, that one of the applicant companies owns the permit to mine some of these land-based sources, and that other non-active land quarries appear to be open to purchase.

Further, Marinet Limited has advised the regulator (H.M.G. MMO) and the quarry companies (BMAPA) that there is now available, with proven scientific and commercial accreditation, an alternative for marine sand based on the "manufactured sand" process developed by Kemco/Kayasand[4] which utilises waste rocks in land quarries. This means that the secondary/recycled constituent of land-sourced aggregate can be further boosted as an alternative supply.

These facts do, we submit, testify to the fact that, firstly, the supply of alternative aggregate has been **inadequately assessed** in the applicant's EIA and, secondly, that recent commercial developments are moving in a clear direction which confirms that marine sourced aggregate is no longer necessary to meet national needs, and hence this provide **clear evidence** that the Precautionary Principle can be employed here in protection of fish stocks and Kingmere MCZ features and other features of conservation importance (FOCI).

- MCZ Assessment.

The applicant in Appendix 8.1, *Report to Inform a Marine Conservation Zone Assessment*, makes a series of declarations. We reproduce these here, with our comment on their validity.

3.2.3

• The conclusion within the relevant chapter(s) is that the impact of deposition, and therefore a change in seabed sediment type and sedimentation rate on the benthic communities characterising the moderate energy infralittoral rock and thin mixed sediments within the MCZ will be of negligible to minor significance which is ***not significant*** in terms of the EIA Regulations.

Comment: This statement is **invalid** because the sediment deposition and suspended sediment plume study is incomplete, and the manner in which impact has been assessed on the benthic communities in this protected habitat feature is deficient and seriously inadequate. Therefore there is a real risk that this protected MCZ feature will lose its "favourable" conservation status over the long term.

• The conclusion within the relevant chapter(s) is that the impact of deposition, and therefore sedimentation rate, on the benthic communities characterising the subtidal chalk within the MCZ will be of negligible significance which is ***not significant*** in terms of the EIA Regulations.

Comment: This statement is **invalid** because the sediment deposition and suspended sediment plume study is incomplete, and therefore impact cannot be determined in a definitive manner. Therefore there is a risk that this protected MCZ feature will lose its "favourable" conservation status over the long term.

[4] http://www.marinet.org.uk/marinet-special-on-alternative-aggregate-to-marine-sand-interim-progress-report.html

• The conclusion within the relevant chapter is that the impact of deposition, and therefore sedimentation rate, with the agreed mitigation of a seasonal restriction on black bream will be of negligible significance which is ***not significant*** in terms of the EIA Regulations.

Comment: Whilst the seasonal restriction on dredging to protect black bream is a positive conservation measure, this statement is **invalid** because the sediment deposition and suspended sediment plume study is incomplete, and therefore impact cannot be determined in a definitive manner. Therefore there is a real risk that this protected MCZ feature will lose its "favourable" conservation status over the long term.

3.2.4.

• The conclusion within the relevant chapter(s) is that the impact of increased SSC, and therefore a change in suspended solids, on the benthic communities characterising the moderate energy infralittoral rock and thin mixed sediments within the MCZ will be of negligible to minor significance which is ***not significant*** in terms of the EIA Regulations.

Comment: This statement is **invalid** because the sediment deposition and suspended sediment plume study is incomplete, and the manner in which impact has been assessed on the benthic communities in this protected habitat feature is deficient and seriously inadequate. Therefore there is a real risk that this protected MCZ feature will lose its "favourable" conservation status over the long term.

• The conclusion within the relevant chapter(s) is that the impact increased SSC, and therefore a change in suspended solids, on the benthic communities characterising the subtidal chalk within the MCZ will be of negligible significance which is ***not significant*** in terms of the EIA Regulations.

Comment: This statement is **invalid** because the sediment deposition and suspended sediment plume study is incomplete, and therefore impact cannot be determined in a definitive manner. Therefore there is a risk that this protected MCZ feature will lose its "favourable" conservation status over the long term.

• The conclusion within the relevant chapter is that the increased SSC, and therefore a change in suspended solids, with the agreed mitigation of a seasonal restriction on black bream will be of negligible significance which is ***not significant*** in terms of the EIA Regulations.

Comment: Whilst the seasonal restriction on dredging to protect black bream is a positive conservation measure, this statement is **invalid** because the sediment deposition and suspended sediment plume study is incomplete, and therefore impact cannot be determined in a definitive manner. Therefore there is a real risk that this protected MCZ feature will lose its "favourable" conservation status over the long term.

3.2.5.

• The conclusion within the relevant chapter is that the impact of removal of species on the benthic communities characterising the moderate energy infralittoral rock and thin mixed sediments on which the black bream may feed within the MCZ will be of negligible significance which is ***not significant*** in terms of the EIA Regulations. Furthermore the seasonal restriction on dredging between April and June avoids disturbance to prey species during the peak black bream spawning period.

Comment: Whilst the seasonal restriction on dredging to protect Black Bream is a positive measure, this statement is **invalid** because the impact on the biotopes characterising the moderate energy infralittoral rock protected habitat is unknown due to the incomplete nature of the sediment deposition and

suspended sediment assessment, and this feature may lose its "favourable" status over the long term and no longer be able to support the feeding requirements of Black Bream to the same degree.

• The conclusion within the relevant chapter is that the impact of removal of species and disturbance of species, with the agreed mitigation of a seasonal restriction between April and June, on black bream will be of negligible significance which is ***not significant*** in terms of the EIA Regulations.

Comment: This statement is **invalid** as it is clear that the removal of species from the dredged areas will be **significant** thus possibly affecting the nursery (breeding) requirements of Black Bream and the impact on the needs of this species in relation to the characterising the moderate energy infralittoral rock protected habitat is unknown due to the incomplete nature of the sediment deposition and suspended sediment assessment, and this feature may lose its "favourable" status over the long term and no longer be able to support the feeding requirements of Black Bream to the same degree.

3.2.6.

• The conclusion within the relevant chapter is that the impact of a change in water flow rates including sediment transport on the moderate energy infralittoral rock and thin mixed sediments will be of negligible significance which is ***not significant*** in terms of the EIA Regulations.

Comment: This statement is **invalid** because the water flow rates and sediment deposition and suspended sediment plumes still remain to be fully assessed, thus raising the possibility that the moderate enenegy infralittoral rock protected habitats may los their "favourable" conservation status.

3.2.7

• The conclusion within the relevant chapter is that the impact of noise on black bream, with the agreed mitigation measures, will be of negligible significance which is ***not significant*** in terms of the EIA Regulations.

Comment: This conclusion is not contested.

Summary.

We do not believe that the applicant's EIA has demonstrated "Negligible" impact on the MCZ protected features or that impact is "not significant" under EIA Regulations. To the contrary, the evidence recorded here suggests that profound doubts remain concerning possible adverse impacts, and it is to be noted that the applicant has submitted an Environmental Statement where key aspects of evidence have yet to be compiled and assessed, particular with regard to sediment deposition and sediment plumes and their impact on MCZ protected features. This serious deficiency has made many of the applicant's assertions **invalid.**

We also do not believe that the applicant has adequately assessed the deposition of sediment and the impact of sediment plumes whilst the vessels are turning on their dredging runs. This renders many of their assertions regarding impact **incomplete** and **invalid.**

We do not believe that the applicant's benthic surveys were as through as might be expected, with key locations either unsampled or done so in a manner below the highest standards, and that this is not acceptable when dealing with a MCZ and its protected species and habitats. Hence, many conclusions were rendered suspect, and this means that this aspect of the EIA was, under the EIA Regulations, **unsatisfactorily** performed.

We do not believe that the applicant has adequately assessed the likely impact on commercial fish and protected species, particularly the native oyster (*Ostrea edulis*), and this therefore renders many of their assertions regarding impact **incomplete** and **invalid.**

We do not believe that the applicant has adequately addressed the matter of alternative sources of sand and gravel available to the companies, and the failure to adequately perform this requirement of the EIA Regulations makes this application **invalid.**

Our overall assessment of this application is clear. It is not tenable, and should be **rejected.**

Yours sincerely

S. D. Eades
Director, Marinet Limited.

Notes:

1. Appendix on land-based aggregate resources in West Sussex and their utilisation, see below.

2. One of the aspects of MCZ designation is that it does not actually provide for the protection of the ecosystem as a whole within its boundaries, though it is clear that if aspects of that ecosystem are damaged by human activity, whether in the short term or the long term, the viability of protected features and habitats may be compromised. In this context, the applicant cites a statement by BMAPA (British Marine Aggregate Producers Association) in its ES, Chapter 1, Background, para. 1.2.3, which reads:

Of significance to the preparation of this ES and the operation of CEMEX and TML is the BMAPA sustainability policy which states: "Responsibly managed and controlled, the industry's impacts are limited and relatively short-term. It does not, therefore, compromise the use of the marine environment by future generations. The industry is sustainable in that it causes no lasting damage to the seabed and will not compromise development and use by future generations or sea-life."

This statement advances the proposition that marine aggregate dredging can, if managed and controlled responsibly, result in no lasting damage. However dredging will, regardless of intention, interfere with an area's marine ecology. This fact is given. So, at issue, is the question of whether BMAPA's assertion is necessarily correct. In order to employ a tool to assess this issue the ecological perspective maintains, in the words of Aldo Leopold[5] "A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise."

This perspective gives us an important yardstick to use when assessing the dredging industry's claim that it is sustainable; and to this specific tool must be added another which is essentially the first principle of the ecological perspective, stated here in the words of Edward Goldsmith[6] "The Biosphere is the basic source of all benefits and hence of all wealth, but will only dispense these benefits to us if we preserve its critical order."

Therefore what must be determined now in this application, in a special area (MCZ), is whether the critical order on which we depend, is being preserved or damaged.

Appendix 1

[5] Aldo Leopold, A Sand County Almanac, Oxford University Press, 1953, cited in E. Goldsmith, p.82, 1992 , see below.
[6] Edward Goldsmith,The Way: An Ecological World –View, published by Rider, p.xvii, 1992.

2.1.12. The current supply of land-won aggregate in West Sussex comprises 7 sites, all of which were operating before the designation of the South Downs National Park which now forms part of the plan area. These are presented in Table 3 below and shown in **Map A2, Appendix A**. In 2013/14, the total permitted reserve of land won sand and gravel in West Sussex was 3,759,400 tonnes.

Table 3: Permitted Sand and Gravel Quarries in West Sussex (2013/14) Soft Sand

Location	Site	Operator	Status
SDNP	West Heath Quarry, West Harting, Petersfield	CEMEX UK Operations	Active - Winning and working of sand.
West Sussex	Rock Common Sandpit, Washington, Pulborough	Dudman Group Ltd.	Active - Sand extraction. Concrete batching plant. Aggregates recycling.
West Sussex	Sandgate Park Quarry, Water Lane, Sullington, Storrington	CEMEX UK Operations	Active - Winning and working of sand.
West Sussex	Washington Sand Pit, Hampers Lane, Sullington	Britaniacrest Recycling Ltd.	Inactive - Permission granted for mineral extraction until December 2015.
West Sussex	Chantry Sand Pit, Chantry Lane, Storrington	Dudman Group Ltd.	Inactive – Holds permitted reserves.
Sharp Sand and Gravel			
West Sussex	Hambrook Gravel Pit	No current operator	Inactive – Permitted for gravel extraction.
West Sussex	Land at Kingsham, South of Chichester, Chichester, West Sussex, PO19 8XH	Dudman Group Ltd.	Unimplemented permission for gravel extraction.

Table 11: Ten year average sales from each aggregate source Year	**Land won sand and gravel**	**Secondary and recycled aggregates**	**Marine won sand and gravel**	**Imported crushed rock**	**Total**
2004	784,000	560,000	562,461	249,706	2,156,167
2005	703,000	525,000	819,520	358,809	2,406,329
2006	573,000	519,000	624,609	423,758	2,140,367
2007	495,000	519,000	1,013,983	401,952	2,429,935
2008	408,000	622,000	997,223	445,117	2,472,340
2009	287,000	629,000	1,097,571	456,037	2,469,608
2010	301,000	630,000	1,095,543	712,149	2,738,692
2011	284,000	446,000	1,302,204	794,568	2,826,772
2012	284,000	446,000	1,610,489	825,853	3,166,342
2013	276,692	442,000	1,762,721	877,401	3,358,814
3 Year Average	**281,564**	**444,667**	**1,558,471**	**832,607**	**3,119,321**
10 Year Average	**439,569**	**533,800**	**1,088,632**	**554,534**	**2,618,545**