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3rd October 2013.
Your ref. MLA/2013/00119.

Dear Lindsey, Marine Aggregate Licence Application: MLA/2013/00119.

I am replying on behalf of Marinet, and Pat Gowen our Marine Aggregate Dredging campaigner, with respect to your letter of 24th September 2013, ref. MLA/2013/00119, arising from the marine aggregate dredging licence applications for Areas 212, 240, 328B and 328C.

As you know, we have questioned the validity of the meteorological data used in the wave model of the East Anglian MAREA (Marine Aggregate Regional Environmental Assessment) which is currently being used to justify marine aggregate licence applications in the East Anglian area. The Marine Management Organisation (MMO) has now stated, in your reply of 24th September, that it has discussed and examined the matter with the companies concerned in the construction of the MAREA wave model (HR Wallingford Ltd and Nortek UK Ltd), along with the MMO's technical advisors at CEFAS (Centre for Environment, Fisheries and Aquaculture Science), and the MMO has come to the conclusion that the "meteorological data used in the study is robust, timely and appropriate for its intended use."

As you note in your letter of 24th September, we ourselves have also contacted HR Wallingford Ltd and Nortek UK Ltd through letters dated 26th August. Nortek UK Ltd has replied by telephone to inform us that their SWAN equipment is solely used for measuring current wave patterns, and not for prediction. We have spoken with HR Wallingford Ltd on the telephone and they have declined to reply to any matter concerning their wave model in relation to a licence application, and that all enquiries about their wave model must be directed through the Marine Management Organisation for an answer.

The matters we have raised about the wave model are fundamental because if the wave model is inaccurate then so also are the forecasted rates of erosion along the coast due to wave action which will have been intensified by offshore aggregate dredging, in combination with other factors such as greater wind speeds, the greater frequency of storms, and rising sea levels due to climate change. As a result, this wave model requires very careful scrutiny.

In the light of your reply of 24th September, let us re-examine the issues in question:

1. We ask: has the wave model used offshore meteorological data from the area in question for its winds speeds ?

You reply: the wave modelling study does not use measured offshore wind data to drive it; instead modelled wind data has been used.

We comment: the fundamental principle validating all scientific procedures and conclusions is that they are based on observed, measured facts. In this case, actual measured wind speeds - all the more important in this instance because offshore wind speeds are very different from onshore wind speeds, and are location specific. Therefore the fact that the wave model has not used actual data, but rather modelled data, makes the wave model fundamentally flawed in terms of scientific principles. On the evidence before us, there can be no other conclusion.

It appears that the Marine Management Organisation (MMO) and its scientific advisers are prepared overlook this, and your letter of 24th September asserts that the model has validity because the model is compared against measured data from buoys and satellites. However if this data from buoys and satellites is not only available, but also is definitively accurate, why has it not been used in the first place ?

We regret to inform you that we conclude that the wave model, and the MMO's subsequent analysis of its veracity, has fallen short of the scientific principles and rigour required to prove its integrity because the wave model is not grounded in actual measured offshore meteorological data. The evidence still points, despite your reply, to the fact that the scientific basis of the wave model is fundamentally flawed.

2. We ask: what is the source of the data (e.g. precise location and who supplied the data) ?

You reply: the waves used were derived from conditions close to the relevant part of the SWAN model boundary. For example, when modelling waves from the north east, conditions derived from Met Office point 474 was used (Fig. 1). . . . Wind conditions blown over the model were chosen to match each offshore wave condition by correlating the wind and wave data (Fig 5). . . . The winds were therefore those most likely to have occurred at the same time as the offshore waves. In order for large waves to occur, strong winds must have occurred. By applying the wind conditions over the SWAN wave model area, the wave is sustained.

We comment: firstly, it is clear that when modelling waves, weather conditions derived from Met Office points 472, 473, 487, 488, 580 and 581 (those locations encompassing the area of study in MAREA) were available, whereas Figure 5 cited by your reply of 24th September 2013 refers only to data from Met Office points 481, 488 and 474. It is to be noted that Met Office point 481 is *outside* the boundaries of the MAREA area, and that points 474 and 488 are close to the periphery. Those areas at the centre of the MAREA area - namely 473, 487 and 580 - appear not to have been used. Secondly, we note that none of this available raw data has actually been used to construct the model itself, only to test the so-called validity of the model which derives from yet another model, namely the Met Office European model (ref. your reply of 24th September to our Question 1 about the nature of the actual meteorological data used).

Accordingly, we must inform you that the source of the data appears to lack scientific rigour and credibility. The actual data that exists from the MET Office points (cited above) appears not to have been used as the raw data for the wave model, and when this data has been used to test the wave model it has selected from Met Office points that are either outside the boundaries of the area of study (MAREA) or are located at the periphery of the boundary. This is not sound science. Regrettably, we once again suggest to you that the wave model is fundamentally flawed.

3. We ask: over what time period was the data collected and used as source data for the model ?

You reply: the purpose of Technical Note DDR4472-04 [in other words, the MAREA Wave Study undertaken by HR Wallingford Ltd] was to compare the effects of the pre-dredge, present and post-dredge bathymetries on waves. For such a comparative study, the absolute test conditions

selected are not critical. The critical issue is that the same conditions are tested for each bathymetric layout so that a direct comparison can be made.

We comment: the MMO and HR Wallingford Ltd have both failed to answer our question. We still do not know the time period over which the raw meteorological data has been collected - indeed, assuming it has been collected. The evidence is still absent on both counts. The absence of this data continues to seriously question the veracity of the scientific basis of the wave model.

Accordingly, we again perceive that a serious deficiency in raw scientific data exists and, in spite of your reply, our perception persists. We repeat, the scientific basis of the wave model remains unproven and hence is, one must conclude, seriously flawed.

Conclusion.

We believe we have asked valid questions about the scientific basis and principles of the MAREA wave model.

The MMO asserts that it has examined these questions with scientific rigour but, as we have explained above, it does not appear that this "scientific rigour" is one in which one can have a great deal of confidence. Observed facts are the basis of the scientific process. Hypotheses and models rest upon facts. In this case there are too many unanswered questions relating to the use and absence of raw data by the wave model. Further, where raw data appear to have been employed their relevance is uncertain and unclear.

As a result, we have a wave model which may be grounded in theory. However, we also have a wave model which is not fundamentally grounded in facts. This is not good science. This means that assertions about the wave regime and its erosive force on the adjacent coastline are highly suspect.

Equally important, we have a wave model which is not fit for purpose; and so it is not capable of validating the marine aggregate dredging licence applications in which it has been employed.

We know you think differently. We have explained to you, with clear reasoning, why we think differently from you. Accordingly may we recommend to you that the resolution of this matter is to place all the evidence and argument before an independent expert for their arbitration and opinion. We await your advice.

Yours sincerely

S. D. Eades
On behalf of Marinet.

cc. D Levy (Marinet chair)
P Gowen (Marinet marine aggregate campaigner)