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## DUMPING AT SEA ACTS 1996 to 2000

Application by Shannon Foynes Port Company for Permit

I SUBMIT details under nine headings for the Agency's consideration re the above application. My point of view is derived from the EU Water Framework Directive and an interest in the ecology of the upper end of the Shannon estuary focussing mainly on dump sites A and B.

### Alternatives

I do not believe that there are no alternative sites to take the dredging spoil from Limerick as claimed by SFPC. Attachment A. 7, Photograph 1 of the application shows spoil being pumped into the Corcanree site which is owned the SFPC in 1956. The water body on the top right dried out after a few years and in the past fifty six years has been used to accommodate a few commercial buildings and the rest, approximately fifty acres, has been used to fatten dry stock. If the site was used in the past to take the dredge spoil why cannot it be used again? All that needs to be done is to pump it over the embankment.

### The Drowned River Valley

The Shannon estuary is seen in estuarine research as of the drowned river valley type. It followed the erosion at the mouth dated from rising sea levels after the last ice age and has all the type specific characteristics including the extensive sedimentation in the upper reaches. The origin of this material is not correctly understood by the applicant. Under the heading of Sedimentation and Accretion it is claimed that:

The Upper Shannon catchment area is subjected to varying degrees of run off and soil erosion, which contributed to the silt accretion in the estuary.

In fact the silt, which constitutes 60% of the spoil, and is derived from the erosion at the mouth is up from below rather than down from above. Solid material above the limit of tidal influence can be seen to be sand and sandstone gravel plus a mud of organic material. This originates in the upper catchment but there is practically no silt. How the material travels up the channel against the gradient is understood in estuarine research as flood dominance. Standard texts explain the process, e.g., Dyer, K.(1996) *Estuaries, A Physical Introduction*, Wiley, p.36. All I have to do is point up the two conditions which give rise to the phenomenon locally: (1) Tide tables produced by SFPC show the range of tides at Limerick at 7 m, which by any standard is macro tidal and (2) all the maps show that the estuary from Shannon Airport Jetty upstream is shallow. Quoting Dyer, *ibid* : *The combined effects of these two processes produce a short duration flood phase of the tide, and fast flood currents*. These fast currents take the fine material into suspension and are not matched at any other state of the tide in the absence of a strong spate coming down from the river above during the ebb.

### The Sites

Sites A and B are quite dissimilar. Depths at Site B are nearly three times those of Site A. B is in a much faster flow regime. Site B is also in the shipping lane.

The dredge site at the approach to Limerick dock is much more than I had previously thought. The proposed site is well defined in the application, but there is no comparison with area dredged previously in the area. Table 1 of the "Purpose of Operation" shows amounts dredged from the entrance to the dock and the dock itself but I cannot separate the two. I believe there is an important question here as to the extent that the dredging at the approach is maintenance dredging, which the applicant maintains throughout, or an extension of dredging under previous permits.

### The Model

The model available was the U.S. Army Corps of Engineering Open Water Disposal Model(STFATE). According to Aqua Fax STFATE "was unable to simulate the required disposal scenarios" at Site A. A linear relationship was found for the volume of dredge material and thickness of deposited material under constant hydrodynamic conditions (p. 10 of their report). I could go along with the linear relationship but would have to question the assumption of constant hydrodynamic conditions. Tides and volumes in the area are much influenced by weather, hydro-electric generation by the ESB and river spates. Tide tables produced by SFPT, p. 14 say: "Tides are influenced to an extent by the weather, South to West winds usually increase the height while North to East winds usually decrease it". The effect of spate can be seen by anyone with an eye for water hue: the river water and the tidal water are always different. Large volumes of brown water coming down from above will slow the velocities of water coming up under the influence of the moon.

STFATE was applied in Site B. Sampling was carried out on the bottom fauna. The results are of no great surprise, but there was no mention of zoo plankton in the water column. For the bottom fauna I got a figure of 1.82 using the Shannon-Weiner index of diversity which is short, but I am certain it would be much larger if the column zooplankton has been taken into account.

Under the heading of Model Theory, in 3.4 Aqua Fax say "In each case [successive grid areas] the current velocities were assumed to be uniform over the entire water depth and were input to the model as depth average velocities". There is no such thing as a flowing river with a uniform velocity over the entire dept of the water column. Average is just the sum of elements of a set divided by their number.

It has some descriptive value, though the median is often a better choice. Means have no predictive power whatever, unless they are used in conjunction with variance or standard deviation, and there is nothing coming to me that Aqua Fax do that.

If I were to advance somebody's education in the matter I would like to refer to a text I have: Orrin, P.H., et al., (2007) *Useless Arithmetic*, Columbia U. P. The authors make the point about the misuse of average but they also mention the U.S. Army Corps of Engineers and their models. They show in several chapters how badly the Corps of Engineers got it wrong in the area of beach behaviour, which is not that far removed from dredge spoil disposal. Beware of fancy graphics.

### Impact on Benthic Fauna and Flora

I don't have to work too hard on this one at all. Both consultants Aqua Fax and RPS make the point that the effect of dumping in Sites A and B will have severe negative impact on the biota. What I cannot let go, however, is the claim that the impact will be short lived. Both consultants make the point but RPS say it over and over in their report. They are wrong. To understand the position one must come to terms with the boundary which exists between mud and water when the tide is in and mud and the atmosphere as the tide drops. In both dump sites there is a mucilaginous layer at the interface produced by bacteria sessile diatoms and to some extent blue-green algae. This gives the sediment a cohesion which prevents the kind of erosion that it would otherwise be subjected to. I have often been surprised to find an interesting pattern of sessile diatoms at a site and to find the pattern intact as I visited the same place a week or two later. If this cohesive layer is removed or buried erosion will follow. Given strong water movements in the area the eroded material will settle over adjacent areas compounding the damage. So, re-colonization will be inhibited. If the erosion is continual, say every month the boundary layer will never be re-established. The process is explained well in Little, C. (2006) *The Biology of Soft Shores and Estuaries*, Oxford U. P. The author also explains other well known processes like flocculation and the distribution of detritus which none of the consultants enter into.

### Biodiversity of Aquatic Organisms

It is well known that the biodiversity of aquatic organisms in an estuary is inversely related to distance from the mouth to the tidal freshwater zone. Both Aqua Fax and RPS mention this and they might give the impression that the loss of species at dump sites is of no great significance. Diversity is discussed in McLusky, D. S., et al., (2006) *The Estuarine Ecosystem*, Oxford U.P. In chapter 2 the authors explain that things are not as simple as Aqua Fax and RPS would suggest, i.e., that it is

related to salinity and problems of osmoregulation. As I read it the jury seems to be out at this point and it is not known what causes the low diversity. But the authors make the point, p.22, "Estuaries are characterized by having abundant populations of animals, but with relatively few species." How does one reconcile that with the sampling of benthic invertebrates taken at Site B which showed such low numbers. Well, "abundant populations" says nothing about where or when they are found. If you only sample a substrate which has all the signs of being stressful and ignore the zooplankton in the water column you are bound to get an anomaly. I have sampled the water column between Site A and B in the summer with a hand net and found I was getting more numbers than I could conveniently count, mainly copepods and mycids.

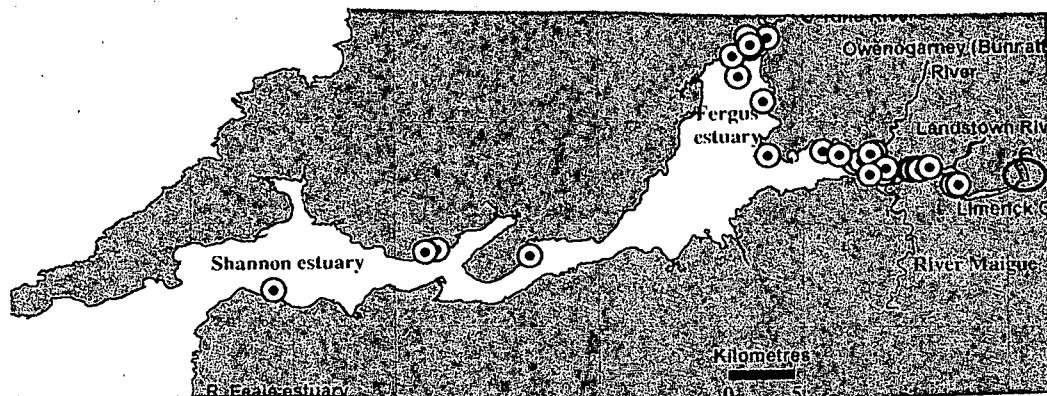
### Phytoplankton

There are no angiosperms in the channel from Limerick down to Site B. This arises from the difficulty of maintaining a root in soft mud subject to strong water flow and the difficulty of photosynthesising through several meters of turbid water.

The sensible thing then is to float. Primary production then is planktonic. It is exactly as one would expect and it is given high status within the WFD. The report on which the high status was based and which appears in the Shannon RBD Management Plan was prepared by RPS when they were acting for the RBD. It is somewhat surprising then that RPS do not go into any detail about it in their report to the applicant. They do mention the obvious, i.e., that increased turbidity will reduce the ability to photosynthesise. It is an area that would lend itself to numerical analysis, but RPS do not oblige us with this; they tend to be prescriptive in their approach.

### Fish

Aqua Fax do not go into fish at all in their report. RPS do mention four species in connection with Natura: three lampreys and the salmon. There is no mention of smelt (*Osmerus eperlanus*). This species is mentioned in the Irish Red Data as vulnerable. It only occurs in three estuaries in the Republic: Waterford, the Foyle and the Shannon with the latter population being by far the largest. The fish is well known in Limerick. The mating swarm seen on a calm night in February on the right bank is quite a sight. There is an account of the fish in a special issue of the Royal Irish Academy, *Threatened Irish Freshwater Fishes*, Quigley, D.G.T. et al (2004). The authors show the greatest concentration of spawning and nursery areas (highlighted in black) coinciding with dump Sites A and B, viz.



WFD

RPS mentioned the WFD in their report. They rightly say that it goes hand in hand with the Habitats Directive. They also go into the designation of the Shannon at Limerick as a Heavily Modified Water Body. I have been in contention with the Shannon RBD over this for some time. After failing to resolve things locally I had to go to the Minister before Christmas. I could not go into the matter here but I had a reply from the Minister's office saying that a substantive response would be forthcoming after the Agency's Implementation Monitoring sub-Group considered the technical details. I suggest that your office contact the sub-Group to see what it is all about.

If I succeed in making my point I do not see how the Agency could grant a permit to the present applicant without setting aside the law relating to the WFD.

Yours truly,



Please note: Appendix B , p. 51 of the RPS report on HMWBs is illegible in the download. I hope to get a legible copy somewhere. There may be nothing in it worth my commenting on; otherwise I shall be back on it at a later state.

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