Written evidence in support of submission by Associate Professor M. F. Barker.

My Name is Mike Barker. I am a member of the academic staff of the Marine Science Department, University of Otago. I have been based at the Portobello Marine Laboratory since my appointment to the academic staff at the beginning of 1981. I hold the degrees of M.Sc (Hons) and Ph.D. I have published over 70 peer reviewed scientific papers on various aspects of the biology and ecology of marine invertebrates, most of these on species found in Otago Harbour or the Otago Continental Shelf.

The evidence I have presented relates principally to my concern for the ecological effects of increased suspended sediments within Otago Harbour as a result of dredging operations for the proposed "Project Next Generation". I believe the most significant effects are likely to be in the subtidal and intertidal habitats closest to Port Chalmers (Swinging Basin to Tayler Bend) where the dredged benthic sediments are mostly fine silts and clays (Silts are sediment particles with a grain size between 0.004 mm and 0.062 mm. Clay particles are smaller than 0.004mm).

Particles in this size range have a range of effects on marine habitats and invertebrates. Suspended sediments can decrease light levels affecting both microphytes and benthic primary producers, an important food source for many macrofaunal species. Suspended sediments can also clog filter feeding and respiratory structures requiring the organism to expend significant energy removing the particles or even prevent feeding and respiration altogether. Most species can tolerate these effects for short periods (hours or even several days) but the long term effects result in mortality. The deposition of suspended sediments onto the seafloor can adversely affect macrofauna by decreasing oxygen concentrations and changing sediment properties such as grain size, chlorophyll *a* and organic matter content. Sediments deposited onto hard surfaces in the intertidal or shallow subtidal can affect access to these surfaces by grazing molluscs.

We have a poor understanding of many of these processes, especially as they affect New Zealand species, or of the levels of suspended sediments that may be critical. In a short term (14 day) study (Nicholls *et al.* 2003), the effects of suspended sediments (of which clay to fine silt made up 0 to ~300mg/litre of the sediment used), was tested in the laboratory on 4 common macrofaunal species within the Auckland Region. Four of these showed behavioural changes or increased mortality in treatments with higher suspended sediment concentrations (the deposit-feeders *Echinocardium australe,* a tube building worm *Boccardia syrtis*, the wedge shell *Macomona liliana*, and one suspension feeder (the scallop *Pecten novaezelandiae*) while the deposit feeding snail *Zeacumantus lutulentus*, was apparently unaffected in this short term study. Only one of these species (*Macomona liliana*) occurs within Otago Harbour, but other closely related taxa do occur locally and might be expected to show similar effects. The longer term effects of high suspended sediments (weeks or months) are not known.

One important problem is that we have little information on the present levels of suspended sediments in the harbour. We do not know the size fractions of particles, how these change seasonally specifically in response to calm weather or storm events. Temporal data (1974/5) on harbour suspended sediments collected by Westerskov

(1980) show a range of from 2 to ~7mg/litre presumably over a range of calm to turbulent conditions. Data was also collected by Associate Professor John Jillett during the earlier (1977) capital harbour dredging operations and I understand that this information is being presented to the Hearing Panel in another submission. However it is worth noting that the suspended sediment levels of 200–350 mg/litre measured during dredging operations that coincided with storms were in the range that caused mortality of some benthic species in the study mentioned above.

If approval is given for dredging to occur I believe it is essential that a monitoring program is undertaken well before any capital dredging occurs. The timetable for monitoring and sites to be monitored need to be clearly identified. A requirement must be that dredging should cease or be reduced in extent or intensity once significant increases in suspended sediment levels are detected. A critical question is the level to set for suspended sediments as the longer term effects of such sediments are so poorly understood.

References

Westerskov, K., 1980. Aspects of the biology of the dredge oyster *Ostrea lutraria*. Unpublished Ph.D. Thesis University of Otago

Nicholls P., J. Hewitt and J. Halliday, 2003. Effects of suspended sediment concentrations on suspension and deposit feeding marine macrofauna Auckland Regional Council, Technical Publication 211; NIWA Client Report: ARC03267 National institute of Water & Atmospheric Research Ltd, Hamilton