BEFORE THE OTAGO REGIONAL COUNCIL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of an application for resource consents for Project Next Generation
BY	**PORT OTAGO LIMITED**
	Applicant

STATEMENT OF EVIDENCE OF MARTIN WILLIAM CAWTHORN ON BEHALF OF PORT OTAGO LIMITED
April 2011

LEN ANDERSEN
Level 3, Westpac Building
106 George Street
P O Box 5117, Moray Place
DUNEDIN 9058
Tel 03 477 3488
Fax 03 474 0012
Counsel: L A Andersen

ANDERSON LLOYD
Level 10, Otago House
Cnr Moray & Princes Street,
Private Bag 1959,
DUNEDIN 9054
Tel 03 477 3973
Fax 03 477 3184
Solicitor: J E St John

INTRODUCTION, QUALIFICATIONS & EXPERIENCE

1. My full name is Martin William Cawthorn. I hold a Bachelor of Science degree majoring in Zoology.

2. I have had 45 years specialist marine mammal research (whales and seals), including the following positions:

    a. 1962-66 Technical Officer (marine mammals) NZ Marine Department Research Division.

    b. 1966-71 Scientist, Whaling Section, Fisheries Research Board of Canada, Arctic Biological Station, Montreal, Quebec, Canada.

    c. 1976-87 Scientist (Marine Manimals/Deepwater Fisheries) MAF Fisheries Research Division.

    d. 1987-92 Senior Scientist (Marine Mammals) Department of Conservation.

    e. 1992 — established Cawthorn & Associates. Consultants specialising in marine mammals and fisheries and marine industrial interactions.

    f. Adjunct Lecturer, Institute of Veterinary and Biological Studies, Massey University.

3. My experience has included work in New Zealand, South West Pacific and Polynesia, Eastern tropical pacific, Central and South America, South Atlantic, Southern Indian Ocean, Southern Ocean/Antarctic, Western North Atlantic, Canadian Arctic, and the Norwegian Sea.

4. I have provided consultancy services to Australian, Canadian, Japanese, New Zealand, Norwegian and Tongan government agencies, and most recently to the United Kingdom's Government's Department of Environment Fisheries and Rural Affairs (2002-3) and the Australian Fisheries Management Authority (2008). I have also provided consultancy services to private aquaculture enterprises and participated in marine farm resource consent hearings regarding the potential effects of marine farms on marine mammals.

5. I have been a member of the Scientific Committee of the International Whaling Commission since 1977, a Charter Member of the Society for Marine Mammalogy since 1984, am a member of IUCN Species Survival Commission's Specialist Groups on Whales and Seals, and recipient of the New Zealand Antarctic Society Conservation Award (1984) for work on Hooker's sea lion and Antarctic minke whales. I was an instigator and co-author of the Marine Mammal Protection Act 1978. I was principal author of the Australian Fisheries Management Authority Code of Fishing Practice for the South East Trawl Fishery. I have been the recipient of 19 research grants from international and New Zealand sources.

6. I can confirm I have read, and agree to abide by, the Expert Witness Code of Conduct contained in the Environment Court consolidated Practice Note 2006. I have followed it in the preparation of this evidence. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

7. I have been requested by Port of Otago Ltd (POL) to prepare a statement of evidence regarding the potential effects of POL's proposed Next Generation project dredging programme on marine mammals resident on and found in the vicinity of Taiaroa Head.

EXECUTIVE SUMMARY

8. Four pinnipeds and seven cetacean species found in the Otago area are considered. Of these only New Zealand fur seals, New Zealand sea lions, Hector's dolphins and southern right whales are likely to be influenced by Project Next Generation.

9. Fur seals will be unaffected by dredging and other activities. Sea lions are adaptable generalist feeders and will be unaffected by activities within Otago Harbour or along the Otago Peninsula coast. The fur seal population is increasing.

10. Sea lions are recent colonists of Otago Peninsula. They are adaptable feeders and will not be disadvantaged by the harbour dredging operations. Their numbers are increasing locally.

11. Right whales are seen in most years around Otago Peninsula. However their numbers are very low and the potential risk to this species from dredge spoil dumping and vessel movements is considered to be very low.

12. Hector's dolphin observations are clustered off the entrance to Otago Harbour. This appears to be a result of the sightings collected from MV "Monarch" which has a relatively limited tour voyage plan. They are found in Blueskin Bay during the summer and move offshore in winter. The Otago Peninsula-Blueskin Bay population comprises about 20 individuals and is thought to be the southernmost population of this species on the east coast of the South Island. Despite numbers being reduced by recreational and commercial set-netting and other modes of fishing, the population has lived in the vicinity of Otago Harbour during 142 years of maintenance dredging and other activities within and around a very busy harbour.

13. Dredge spoil is relatively uncontaminated. Spoil disposal plumes at the A0 disposal site will have only a temporary effect. Sediment concentrations within the plume will be diluted to less than 20mg/l above background within a few kilometres of the disposal site, it will be unlikely to impact on planktonic or larger animals in the water column. Benthic foraging fish species are expected to rapidly exploit the material deposited on the seafloor. These fish species include many which are part of the diet of Hector's dolphin. Spoil dumping should have no effect on species recruitment.

14. The A0 spoil dump site has been selected so the turbidity plume is directed to the north and east away from the environment of Blueskin Bay.

15. The effects of any necessary blasting will be confined to the area from Port Chalmers to Acheron Head. The nearest marine mammals are sea lions hauled out at Aramoana and Te Rauone. It is most unlikely that any detrimental effects will be experienced by these animals. As Hector's dolphins and other species very rarely enter the harbour they are not expected to be affected. Surveys before and after blasting by

Port Otago Ltd at Beach St Wharf, Port Chalmers, in 1993, found that blasting had little effect on marine fauna, except for small schoolfish and a small number of larger fish in the immediate vicinity. Right whales and humpback whales are sufficiently distant from the blast site to be unaffected.

16. Hector's dolphins, right whales and seals are tolerant of vessel movements and the noise from dredging. It is most unlikely that there will be any detrimental effects to these animals from vessel activities and traffic. Killer whales, dusky dolphins and common dolphins are most unlikely to be affected by vessel noise and traffic.

DESCRIPTION OF OTAGO HARBOUR AND THE NEXT GENERATION PROJECT

17. Otago Harbour is a NE-SW trending narrow inlet, approximately 21km long and 2km wide, covering an area of 46km2.

18. I am advised by POL that project Next Generation will involve the removal of 7.2 million cubic metres of sediment and its deposition at authorised dumping sites offshore. It is proposed that some of the dredged sediment be disposed of at new site A0 about 6.5km north east of Taiaroa Head. At this point the adjacent continental shelf is only about 10km wide but widens to about 30km in Blueskin Bay to the north. This site was selected because it comes under the direct influence of the offshore northward trending Southland Current that will carry the sediment, ranging in grain size from silts and clay to fine sand, northward at a rate of 1-2.5 knots during periods of southerly wind (NZ Pilot 1971).

MARINE MAMMALS OF THE OTAGO COAST AND LOCAL WATERS

19. Four pinnipeds (seal and sea lion) species and seven cetacean (whale and dolphin) species have been reported from the Otago coast and adjacent waters. Fur seals and sea lions breed around the Peninsula, elephant and leopard seals are seasonal visitors usually occurring in the winter months. Fur seals prefer rocky foreshores to rest and breed on, whereas sea lions, elephant seals and leopard seals all prefer readily accessible shorelines and beaches. All marine mammals in

New Zealand are fully protected under the Marine Mammals Protection Act 1978. Those species with special conservation status (Hitchmough et al 2007) are listed below.

PINNIPEDS	**CONSERVATION STATUS**
New Zealand fur seals *(Arctocephalus forsteri)*	
New Zealand sea lion *(Phocarctos hookeri)*	Range Restricted
Southern elephant seal *(Mirounga leonina)*	Nationally Critical
Leopard seal *(Hydrurga leptonyx)*	
CETACEANS	**CONSERVATION STATUS**
Southern right whale *(Eubalaena australis)*	Nationally Endangered
Humpback whale *(Megaptera novaeangliae)*	Migrant, Threatened
Hector's dolphin *(Cephalorynchus hectori hectori)*	Nationally Endangered
Killer whale *(Orcinus orca)*	Nationally Critical
Common dolphin *(Deiphinus deiphis)*	
Dusky dolphin *(Lagenorynchus obscurus)*	
Bottlenose dolphin *(Tursiops truncatus)*	Range Restricted

New Zealand fur seal

20. The New Zealand fur seal population has been increasing since the cessation of all sealing in 1946. On mainland New Zealand this species now breeds as far north as Gannet Island off the Waitomo

coast (MWC pers obs). Non-breeding haulouts can be found from Stewart Island to the Three Kings Islands on both the east and west coasts of the country. It has been recorded that: "Regular breeding at Otago Peninsula began in the 1970s and since then has spread along 200km of the Otago coast north to Moeraki, North Otago, and south to Cosgrove Island, The Catlins. The nearest colonies outside this range are 200km north at Banks Peninsula and 50 km westward on islands in Foveaux Strait so fur seals at Otago can be treated as a distinct population. Fur seal pup counts appeared to be reaching a plateau in 2004. Preliminary estimates indicate that the plateau in pup production is likely to equate to a stable population size of about 20,000 to 30,000 fur seals at Otago" (Lalas, 2008).

21. New Zealand fur seals at Otago typically forage away from shore over the edge of the continental shelf and beyond where they target species of interest to commercial fisheries but not to recreational fisheries(Lalas 2008). Fur seals are predominantly nocturnal feeders feeding mainly on octopus, squid, and barracouta, which make up 90.8% by weight of stomach contents (Street, 1964). The number of species designated as commercial has increased through time and now includes practically all large prey of fur seals (Lalas,2008).

New Zealand sea lion

22. The New Zealand sea lion is New Zealand's only indigenous sea lion species. The balance of the breeding population is found at the Auckland Islands. The current population is approximately 10,000-12,000. Juveniles and non-breeding subadult animals roam widely; with the 1990 observation of a 4 year old male at Plimmerton Beach, northwest of Wellington, being the farthest north recorded (MWC pers obs)[1]. Sea lions were much slower than fur seals to re-colonise mainland New Zealand. Sub-adult males and some mature males began to haulout regularly on Otago beaches about 30 years ago and by 1999 the number of resident males had increased to about 110 (McConkey et al. 2002a).

23. “Breeding on Otago Peninsula began in 1994 and by 2006 the female sea lion population totalled 11 individuals, all from a single matrilineal line. The number of females here is increasing at about 13% annually, all created by intrinsic growth, a scenario that predicts a population size of about 10,000 sea lions at Otago in another 50 years” (Lalas, 2008). A total of 45 pups have been born between 1994 and 2010 (DOC 2010).

24. New Zealand sea lions at Otago forage closer to shore than fur seals. The diet of sea lions from the Otago Peninsula is dominated by a variety of bony fish species such as barracouta, jack mackerel, flounder, octopus, skate, greenbone, red cod, paddle crab, ling and wrasse. These species demonstrate that off Otago, sea lions feed from the upper levels of the water column to the bottom and across the continental shelf. Deepwater species were notably absent (Lalas, 1997). Sea lions have also been observed foraging in Otago Harbour where they have been observed taking quinnat salmon and sea-run brown trout both species introduced for recreational fishing. Sea lions will also take fur seal pups and subadults, recently weaned elephant seal pups, and yellow-eyed penguins.

Southern elephant seal

25. Southern elephant seals are seasonal vagrants to New Zealand shores. They are the largest of all seals with mature males reaching 4.9m and between 3-4 metric tonnes while females reach 2.7m and about 600kg. The main New Zealand breeding stock of about 500-600 animals was concentrated at Campbell Island and a few the Antipodes Islands. Branded females from Macquarie Island frequently appeared at Campbell Island and, after opportunistic tagging of breeding animals at Campbell Island began in the early 1980s, Campbell Island animals were recorded at Macquarie Island. Between 1945 and 1986 there was a 95% decline in the elephant seal population at Campbell Island and a concomitant increase at the Antipodes Islands.

26. Outside the breeding season elephant seals roam widely and adult males and recently weaned pups of the year would occasionally haulout on beaches as far north as Coromandel. In the 1980s a small

breeding group began to produce pups at Nugget Point. Along the Otago coast, the frequency of elephant seal observations in recent years appears to have declined. Four adult males have been recorded involved in boat-strike accidents (J.Fyfe, DOC Otago, pers comm.).

27. The feeding habits of elephant seals in the New Zealand waters has not been studied in detail but fish, squids and small crustaceans are thought to be main items of their diet. They feed in deep water over the continental shelf and slope and can dive to at least 1500m.

Leopard seal

28. Leopard seals breed within the Antarctic pack ice. They tend to be solitary animals and roam widely outside the breeding season. Juveniles and the occasional adult haulout on beaches as far north as the southern coasts of the North Island during winter months. About 25 leopard seals have been recorded by DOC hauled out on accessible sandy beaches north and south of the Otago Peninsula between June and November (J.Fyfe, DOC, Dunedin, pers comm.).

29. Although in the Antarctic up to 50% of its diet is made up of krill, this species is a true carnivore taking penguins and sea birds and other seals. They are intolerant of excessive human attention and excessive noise.

Cetaceans

Southern right whale

30. Historically, southern right whales were one of the most frequently seen migratory whale species largely because of their habit of travelling close inshore, often accompanied by calves. The pre-exploitation population may have numbered more than 16,000 animals. At its lowest point in 1913 the population may have been reduced to as few as 14-52 individuals (Patenaude, 2003) by both shore-based and pelagic (open-sea) whaling.

31. That right whales had specific destinations on arrival in Zealand coastal waters is easily deduced from locations of early shore-based whaling stations. Along the coast of the North Island particularly the

north east, Bay of Plenty, and Hawke's Bay. On the west coast of the North Island, Kapiti Island, Mana Island and Porirua. Cloudy Bay on the eastern Marlborough coast was a major feeding ground, Kaikoura, Banks Peninsula, Otago Peninsula and in Foveaux Strait. At all these locations animals would linger for up to a week or more and the stock was virtually exterminated by whalers by the 1840s. Only three offshore right whaling grounds were found in the New Zealand region, the Auckland Islands, the Chatham Rise and, in the far north, southeast of the Kermadec Islands.

32. Some coastal right whaling lingered on until the early 1900s at stations in Northland, Bay of Plenty, Tory Channel, Kaikoura and in the subantarctic at Campbell Island. The isolation of Campbell Island may have saved the remnant of the subantarctic stock which, by the 1940s, was showing signs of recovery. However, in the 1960s Soviet whalers unlawfully took 129 right whales from Auckland Islands waters setting back the recovery even further.

33. Right whales' calving interval is 3-5 years with no evidence of multiple births. While southern right whale stocks in Australia are increasing at about 7%-13% pa. (Bannister,2001) researchers today believe right whales around the New Zealand mainland may be increasing very slowly. As of the last 25 years, there has been virtually no increase in the incidence of cow/calf pairs.

34. It has been postulated that the increase in whale sightings may be a result of increased public awareness rather than whale numbers *per se*. Right whales travelling along the coast have a propensity to swim very close to shore, entering harbours, inlets and bays where they are highly visible. Fortunately, being highly manoeuvrable, they very rarely strand.

35. Along the Otago coast 31 observations of southern right whales were recorded between 1994-2002. Of these, 11 sightings were recorded as being in the vicinity of Taiaroa Head, Aramoana Mole and Otago Harbour entrance. Three sightings of right whales were recorded at Otakou (cow + calf), Port Chalmers, and Otago Harbour in July, February and September respectively (Patenaude, 2003).

36. Data supplied by DOC, Wellington, provide more recent sightings information of southern right whales from the Otago Conservancy database:

    a. In 2006, there were 12 reported sightings with a total of 15-16 animals seen, including 1 calf;

    b. In 2007, 12 reported sightings totalling 8-10 individuals (4 whales were sighted 8 times in June);

    c. In 2008, one sighting of 3 whales;

    d. In 2009, 7 reported sightings of at least 8 individuals;

    e. In 2010, 7 reported sightings of 11 individual whales.

37. Of the 46 southern right whales observed between 2006-2010, two individuals were seen within the Harbour proper and 8 were clustered around the entrance between Heyward Pt and Rerewahine Point.

38. "The rarity of right whales along the main islands of New Zealand and their apparent increase in numbers in the Auckland Islands suggests a major shift in habitat use from pre-exploitation times or the loss of a component of a historically sub-divided stock" (Patenaude and Baker 2001). At a special workshop to assess the world wide status of right whales it was agreed that for management purposes, the right whales in New Zealand waters would be separated into two management groups, (1) New Zealand-Kermadec group and (2) the New Zealand subantarctic group.

39. Right whales are plankton feeders specialising in copepods a few millimetres long to krill about 25 millimetres long. They are surface skim feeders that swim slowly through swarms of krill with their mouths agape filtering these organisms from the water with their long baleen plates. Most of the krill these whales consume is estimated to be taken in about 120 days during the southern summer in the Southern Ocean (Hewitt and Lipsky 2002). However, they will feed opportunistically and take krill wherever they find them, inshore or offshore at any time of year (MWC pers obs).

Humpback whale

40. Humpbacks occur off both the east and west coasts of the South Island but are more frequently encountered off the east coast of Otago during autumn and winter on their northern migration. Sightings of single animals dominate the record but pods of 4-7 have been observed off St Clair and Taiaroa Head (Gibbs and Childerhouse, 2000).

41. Humpback whales migrating past New Zealand rarely feed, relying mainly on their accumulated fat reserves. They have been observed taking krill and lobster krill in New Zealand coastal waters on a few occasions only.

Hectors dolphin

42. Hector's dolphin is New Zealand's only endemic cetacean. This species occurs around the South Island (total population ca. 7,000-8,000 animals). Their distribution is fragmented and clumped concentrations are found off the West Coast, from Te Waewae Bay to Porpoise Bay, Banks Peninsula, and the northeast coast from Cape Campbell to Port Underwood.

43. The Otago population is thought to be separated into two small groups with that found between Taiaroa Head and Blueskin Bay numbering around 20 animals (S.Dawson pers comm. in James et al NIWA Client report: HAM 2008 —152 August 2009). This population may never have been large although it is most likely numbers were more numerous up to the 1960s. Slooten (2010) notes "We have found no recent evidence of Hector's dolphins occurring along the south Otago coast, from the Otago peninsula southward until Porpoise Bay, Catlins. The population off Blueskin Bay/Otago Harbour appears to represent the southernmost population of Hector's dolphins along the east coast of the South Island." "Historical records indicate that Hector's dolphin was formerly much more abundant in this region (e.g. Diver 1866)."(ibid).

44. D.H.Graham, biologist to the Marine Fisheries Investigation Station, Portobello, Dunedin noted, "Steaming up and down the Otago coastline on a fishery research launch has given me many opportunities to study the habits of Porpoises(sic) in their natural

element. (Graham, 1956)" His description of "porpoises" seen off Otago allows an unequivocal identification of Hector's dolphins. (From as early as the 18th century through to the mid 20th century the words "porpoise" and "dolphin" were used synonymously and have caused some confusion as dolphins and porpoise are quite different animals.)

45. In this area the dolphins spend summer months foraging opportunistically in water depths to 60-70m. They disperse further offshore during winter but as elsewhere appear to be limited by the 100m isobath. Several recognisable animals have been identified by crew of the MV "Monarch" as 'residents' with some being seen over the last six years. Off Otago Harbour mouth they normally can be seen in loose pods of 5-6 animals foraging along the tide lines and rarely, if ever, enter the Harbour proper (Sean Heseltine pers comm. 4/12/10).

46. Stomach contents from incidentally caught specimens show Hector's dolphins feed opportunistically throughout the water column taking schoolfish such as sprats, kahawai, yellow- eyed mullet, and squid, and benthic fish such as ahuru, red cod, flatfish, stargazers and Graham's gudgeon.

Killer whale

47. At least three mainland New Zealand sub-populations of killer whales are thought to exist; a regional North Island population, a regional South Island population, and one which transits between the two islands (Visser,2000). Killer whales occur across the Chatham Rise, east of Banks Peninsula, in all seasons, particularly in Spring, Summer and Autumn, coinciding with the fur seal pupping season around the Chatham Islands. They can also be seen off the Bounty and Antipodes Islands at the same time (MWC pers obs). It is highly likely therefore a fourth, offshore population, is present in the New Zealand region.

48. While some New Zealand killer whales are apparently sedentary with small home ranges, others have travelled 3,800 km, averaging 111km daily. At least one sighting of a pod of killer whales is made each year off the Otago Peninsula.

49. Coastal killer whales feed on large rays and are true carnivores attacking large whales through to small dolphins and seals. They remember preferred feeding areas and reappear seasonally, for example in the early summer coinciding with the fur seal breeding season. Sightings off Otago will probably increase as the numbers of fur seals and sea lions increases.

Common dolphin

50. Common dolphins are the most abundant of all cetaceans seen around New Zealand, however little is known of their population size or seasonal distribution and movements. In summer they travel as far south as the Snares Islands (MWC pers obs) and in winter they are infrequently seen in Otago waters. It is believed that in general they are mostly associated with waters of 14°C in the region of the Sub-tropical Convergence east of Banks Peninsula. Common dolphins form pods of 5-10 but, like dusky dolphins, will aggregate into 'super-schools' of 1,000 or more animals. These massive aggregations are not uncommon in Cook Strait.

51. Common dolphins usually prey upon small schoolfish such as anchovies and sardines, jack mackerel and squid.

Dusky dolphin

52. Dusky dolphins are normally found in cooler waters offshore toward the continental shelf edge (200-500m) in New Zealand waters. They are most frequently sighted just north of the Otago Peninsula, off Kaikoura and the Marlborough Sounds and range south as far as the Snares Islands. The South Island population of dusky dolphins is estimated to be about 12,000-20,000. Some of these animals may be sedentary while others make seasonal migrations along the coast in winter from Kaikoura to Admiralty Bay where they feed on anchovies and other small schoolfish. Incidental sightings of this species off the Otago coast suggest this species is most commonly in the area between October and March. They normally travel in pods of 5-10 animals but at times aggregate into 'super-schools' to as many as 500-600.

53. In New Zealand continental shelf waters, most dusky dolphins feed on mesopelagic (middle depth) fishes and cephalopods, such as lantern fishes and squids, when they migrate toward the surface with the onset of nightfall.

Bottlenose dolphin

54. In New Zealand waters, bottlenose dolphins are found distributed from close inshore to well offshore. Elsewhere in the world the "offshore" dolphins are larger and darker coloured than their "inshore" counterparts. While resident populations of bottlenose dolphins are found in the Bay of Islands, Marlborough Sounds, Milford and Doubtful Sounds, and may be semi-permanent or permanent residents in those areas, they all appear to be large animals up to about 4m maximum length.

55. Little is known about their movements but they do occasionally occur off Otago Peninsula and have been sighted off Lyttelton and Akaroa.

56. Bottlenose dolphins have a varied diet which includes squid, mullet, mackerel and other small schoolfish all taken in the upper part of the water column.

EFFECTS OF DREDGE SEDIMENT DISPOSAL ON PINNIPEDS AND CETACEANS

57. The dredged spoil to be disposed of at the A0 site will consist of silt clay and sand, similar to that in the vicinity of the disposal sites. A sediment plume will develop in the water at the site as each dredge-load of sediment is dumped. The sediment will be transported away from the site by the prevailing north trending current and will temporarily affect water clarity. There will also be a sediment plume off the harbour entrance with the outgoing tide while dredging is in progress. The settlement rates of sand, silt and other benthic material depends on the particle size with the largest being the most rapidly deposited and fine sand and silt being carried northward by the Southland Current. James et al (2009) state, "Indications are that concentrations of suspended sediment in the plume would be below levels likely to impact directly on fish or shellfish eggs, larvae or

adults."…" It is probable that dredge spoil disposal will also attract some fish that will forage on benthic organisms exposed in the dredged material at the time of each release at the disposal site"(ibid).

58. Fur seals from Otago Peninsula typically forage from the time they leave their haulouts and breeding rookeries, but spend most of their feeding time working in waters in excess of 22m and up to 78km from the shore. It is most unlikely that dredge sediment will have any significant effect on their feeding behaviour or food supply.

59. Sea lions from Otago have a different feeding regime from those at the Auckland Islands, which has been described as marginal feeding habitat. There, sea lions forage over the entire Auckland Island Shelf diving continuously while at sea for squid, hoki, red cod and octopus. At the Auckland Islands sea lions have been recorded as having the deepest and longest dive durations recorded, plus the longest distances travelled during foraging trips of any otariid (Robertson and Chilvers 2011). Off Otago, four satellite tagged animals travelled a maximum distance of 79km, dived to a maximum depth of 127m and spent a maximum time at sea of 26 hours (Auge, et al. 2009).

60. Both fur seals and sea lions are highly adaptable and forage over a wide area of the coastal shelf. It is most unlikely that any impacts from dredging and sediment disposal will have any detrimental effect on these animals. It should be noted that both fur seals and sea lions have established themselves in an area where regular boat traffic and maintenance dredging has been a feature of the area for 142 years. The development of the entrance channel across the bar, channels, turning basins and berthing areas has been possible only by extensive continuous dredging since 1868. Rock has been removed by blasting over 4 periods, 1930s, 1950-55, 1966-67, and 1990-2000. Despite these periodic disturbances, the fur seal and sea lion populations on Otago Peninsula have increased steadily.

61. Five dolphin species (including killer whales) are found off the Otago coast. Only one of these, Hector's dolphin, can be considered a resident population in the Otago Peninsula to Blueskin Bay region.

62. Common and dusky dolphins occasionally enter the Harbour and will stay for several days at a time. Both these species feed through the water column on schoolfish up to the size of jack mackerel. It is most

unlikely that they will be adversely impacted by the material from any sediment plume at the existing and proposed A0 disposal sites

63. The resident pod of 20 Hector's dolphins spend the summers foraging in Blueskin Bay north and west of Taiaroa Head. Their winters are spent at depths over 60m. Concentrations in the sediment plume in the water column are diluted to less than 20mg/l within a few kilometres of the A0 disposal site. Except for the area over the A0 disposal site and immediately downstream, there are unlikely to be any significant impacts on their ability to forage successfully. Bräger et al. (2003) found that Hector's dolphins appeared to prefer more turbid waters, regardless of the season. The authors suggested that an affinity for highly turbid water could be an asset in prey capture for an acoustically dependent predator such as Hector's dolphin. "Spoil dumping can alter the sea bed environment that, with dumping, becomes a 'hotbed' of diversity with rapid ingress of benthic feeding fish species such as gurnard, flatfish, ahuru and red cod - all prey items of Hector's dolphin" (R.Sneddon, Cawthron Inst. pers comm.). Any displacement of food species will be temporary only and effects on Hector's dolphin will be temporary and negligible.

64. Killer whales are cooperative social, visual and acoustic hunters. It is most unlikely they would choose to forage around the area of the A0 disposal site.

65. Right whales are the only large whales which might feed opportunistically on plankton in the area of Blueskin Bay and Otago Peninsula. It is most unlikely that any temporary sediment plume will have any detrimental effect on these animals.

EFFECTS OF NOISE AND BLASTING ON MARINE MAMMALS

66. Hearing in marine mammals is vital for their survival in the marine environment. It is used to navigate, echolocate food, maintain group cohesion, communicate, recognise predators and avoid such threats as shipping, stationary man-made structures, moorings, wharf piles and cables. Hearing acuity and sensitivity varies between species due to evolutionary diversification of auditory anatomy and selection pressures on the way different animals utilise sound.

67. The marine environment is characteristically “noisy”. Ambient sounds in shallow waters vary with sea state, precipitation and wind that can have significant effects at low frequency (140dB in the frequency range 1Hz-10Hz). Ambient sound produced by light rain is typically broadband up to 25kHz at about 90dB, and for heavy rain about 130dB. Lightning strikes on water as random events during storms can produce sound levels up to about 250dB (ref. 1µPa at 1m) (Huson & Assocs 2009).

68. In addition to the ambient sound there is a substantial contribution from general ship and small-craft traffic. Marine mammals tend to be adapted to life in noisy underwater environments and typically have hearing thresholds less sensitive than those adapted for hearing in air (Parvin et al,2005). For this reason, it has been suggested marine mammals can tolerate high levels of noise (N.Hegley, pers comm.) For example, in 1992, sea trials were held in Tasman Bay to assess the efficacy of a commercially produced “seal scrammer’ designed to keep seals from attacking caged salmon, the unit produced a trilling, pulsed sound of 212dB(ref.1µPa at1m) in the frequency range of 1-45kHz. Common dolphins were attracted to the sound from 3 km and one swam with its head 50cm from the sound source for 5 minutes before departing (MWC pers obs).

69. The following are some typical source levels for sounds generated by some toothed whales, humpback and southern right whales:

Source	**Broadband source level (dB re 1µPa at 1m)**
Bottlenose dolphin	125 – 173
Spinner dolphin	108 - 115
Humpback song	144 – 174
Sthn.right whale	172 - 175

70. Small areas of rock on the sides of the navigation channel in the vicinity of Port Chalmers, Rocky Point and Acheron Head may have to be removed. If they cannot be removed mechanically it may be necessary to use explosives to blast the rocks apart before removal. “The US National Marine Fisheries Service(NMFS) considers that underwater Sound Pressure Level (SPL) above 190dB re 1µPa msp (impulse) could cause temporary hearing impairment in harbour seals

and sea lions and SPL above 180dB re 1µPa msp (impulse) could cause temporary hearing impairment in whales (Salgado Kent and McCauley 2006)". "The injury threshold is identified as 180dB re 1µPa msp for cetaceans (toothed and baleen whales) and 190 dB re 1 µPa msp for pinnipeds(seals). NMFS states that cetaceans should not be exposed to underwater noise exceeding 180 dB re 1µPa msp to avoid permanent physiological damage to hearing" (Salgado Kent and McCauley 2006).

71. Ballagh in a memo to POL (24/3/2011) used the 1992/93 blasting records from the Beach Street wharf to derive a worst case relationship between underwater pressure and charge weight, using the basic relationships from other blasting documents. He calculated the blast pressures, sound levels, and distances from the blast in metres for 5kg and 20 kg charges. He noted "I think it is unlikely that a significant pressure wave would travel past Aramoana, the attenuation involved in the 90° turn would be large. Therefore it is unlikely that any effect could be detected past the heads".

72. The position of the possible blast sites at Port Chalmers, Rocky Pt and Acheron Head are roughly 4km from Aramoana and Te Rauone where sea lions haul out. This is far enough for the pressure wave from any rock blasting to have attenuated sufficiently to be of no threat to these animals.

73. In the unlikely event that dolphins were in the inner harbour at the time of a detonation they could suffer a temporary hearing threshold shift or some other auditory damage. However, the appearance of dolphins in the Harbour is apparently an uncommon event and the likelihood of this occurring is remote. It is more likely that if blasting is necessary, the increased activity around the detonation site would act as a deterrent to marine mammals rather than an attraction.

74. Hector's dolphins are normally found outside the Harbour entrance. As Ballagh notes, "…it is unlikely that any effect (of blasting) could be detected past the heads"; the risk to these animals is, in my view, so small as to be infinitesimal. As noted above, the 142 year history of maintenance dredging and blasting does not seem to have had any detectable adverse effect on this species.

75. The historic sightings record of migrating humpback and southern right whales suggests that both species will be sufficiently far offshore to be unaffected by any pressure waves from blasting within the Harbour. As Ballagh states, "…it is unlikely any effect (of blasting) could be detected past the heads." (Ballagh 24/3/2011).

EFFECTS OF SHIP MOVEMENTS

76. POL's proposal to deepen and widen the existing navigable channel in Otago Harbour will enable vessels of a larger size and displacement to transit the channel. Concerns have been raised regarding the wake effects from larger vessels. It is likely, however, the proposed modification of the channel will result in a reduction of the magnitude of the wakes generated by commercial vessels currently transiting the channel. This is due to a reduction of the blockage ratio of the vessels in relation to channel depth and cross-sectional area. There will also be a reduction in the sea-bed scour beneath the vessels due to the lower blockage ratio and greater clearance beneath the vessels and the channel bed (Pullar,A . and Single,M. 2009).

77. Sea lions are known to haulout at Aramoana and Te Rauone. Any reduction in ships' wake magnitude will prevent disturbance to these animals from higher wake waves causing them to spread further along the shore of the channel.

78. It is unusual for dolphins to show avoidance behaviour around large and small vessels which they will approach and leave of their own volition. Richardson (1995) states "we know of no clear evidence that toothed whales have abandoned significant parts of their range because of vessel traffic"(p.262). Otago Harbour is not unusual in having transient right whales occur near the harbour entrance. Table Bay, South Africa is a congregation point for right whales, despite very heavy ship traffic. The larger baleen whales are not as nimble as small toothed whales in restricted water. The remote possibility of an Otago Harbour dredge vessel striking a right whale while in passage to a designated dumping ground, cannot be discounted. In East London Harbour, South Africa, in October 1984, a 110m hopper dredge struck and killed a southern right whale calf which, with its mother, surfaced directly in front of the dredge as it passed a breakwall (Laist et

al.2001). In an analysis of 58 collision accounts Laist et al (2001) found that "serious injuries to whales may occur infrequently at vessel speeds below 14 knots and rarely at speeds below 10 knots". I am advised by POL that the maximum speed of the New Era dredge is 8-9 knots, depending on conditions. The risk of contact with a whale by New Era in this case is negligible. I am also advised by POL that mid-size or larger dredges have steaming speeds up to 15 knots maximum; hence the potential risk of contact could be greater. However, larger dredges have a substantially greater load capacity than New Era and make fewer journeys to and from the disposal site reducing the potential for adverse contacts with whales en route (L.Coe, POL pers com). Given that Laist et al (2001) stated that injuries to whales may occur infrequently at vessel speeds below 14 knots, I consider that the risk level in this case is minor to negligible.

79. Information supplied to me by POL details the number of vessel movements into and out of Otago Harbour. These data include all vessel movements to and from both Port Chalmers and the berths at Dunedin, but do not include pilot vessels, tugs, inboard or outboard powered commercial small craft and recreational vessels. Approximately 4,945 commercial vessel movements occurred between 30/07/2009 and 27/03/2011 amounting to about 7.8 large vessel movements per week. Despite this traffic, the population of Hector's dolphins has apparently remained stable, fur seals and sea lions have increased, and there is no record of a dredge vessel being involved with any right whale in the 142 year history of maintenance dredging in Otago Harbour.

Noise when Steaming

80. The possible effect on both right whales and Hector's dolphin from a dredge making regular trips to and from the disposal site should be considered as it will cross the southern part of Blueskin Bay where these animals have been regularly sighted. Ballagh has calculated the sound level for the "New Era" dredge when steaming. Sound levels range from 165 dB re 1µPa at 1 metre from the centre of the sound source of the dredge to 120 dB re 1µPa at 1000 metres. These values are well within the normal range of source levels for ships under way and should cause no problems to animals accustomed to shipping

with similar or greater sound levels. As the trips to the disposal site are punctuated by the time taken for the dredge to fill with material, the additional noise produced by the dredge when steaming will not be continuous. On this basis I believe the adverse effects of noise will be negligible.

CONTAMINANTS

81. Sediment cores extending to a depth below that to be dredged were collected from five sites representative of locations and materials to be dredged. Samples were analysed for potential contaminants including heavy metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and petroleum hydrocarbons. The results from those analyses were compared with ANZECC guidelines. No contaminants exceeded the guidelines indicating there are unlikely to be issues with contamination during dredging or at the disposal sites (James, et al 2009).

82. More recent examination of adverse effects associated with the proposed dredging and disposal operation were carried out in February 2011 by Dr C.W.Hickey of NIWA. Part of his study specifically addressed chemicals which biomagnify in food chains. These contaminants are largely below detection and Dr Hickey concluded no additional risk would be experienced by marine mammals or humans concerning seafood associated with the dredging operations. On the basis of these conclusions I believe any adverse risk to marine mammals from bioaccumulation of contaminants associated with dredging and spoil dumping will be very close to zero.

RESPONSE TO SUBMISSIONS

83. I believe the discussion provided in the above evidence addresses the concerns raised in submissions.

PROPOSED CONDITIONS & ENVIRONMENTAL MANAGEMENT PLAN

84. In my view the conditions recommended by the Regional Council, together with the Environmental Management Plan proposed by POL,

will appropriately mitigate potential adverse effects on marine mammals.

Martin William Cawthorn

REFERENCES

Anon. New Zealand Pilot. 13th edn. 1971 Taunton.

'The Hydrographer of the Navy'

Auge`, A, Chilvers,B.L., Davis, L., Moore A. 2009

'New Zealand sea lions:Doom or Bloom?' Department of Conservation

Ballagh,K. 2011 Memorandum to Port Otago Ltd.

Bannister,J. 2001. Status of southern right whales (Eubalaena australis) off Australia. J. Cetacean Res. Manage. (Special Issue) 2, 103-110

Brager, S, Harraway J.A., Manley BFJ. 2003. 'Habitat selection in a coastal dolphin species (Cephalorynchus hectori).' Marine Biology 143:233-244

Diver,P. 1866 Brighton and environs (p15). Mitchell. Dunedin

Gibbs N, Childerhouse S. '200 Humpback whales around New Zealand.' Conservation Advisory notes No.257, Dept of Conservation, Wellington.

Graham,D.H. 1956. A Treasury of New Zealand Fishes. A.H. & A.W.Reed, Wellington

Hawke,D.J. 1989. Dusky dolphins *Lagenorynchus obscurus* on the continental shelf near Otago Peninsula, south-east New Zealand. New Zealand Natural Sciences 16:113-116.

Hewitt,R.P. and Lipsky, J.D. 2002. Krill. Pp. 676-684 (in) Encyclopedia of Marine Mammals. Eds. W.F.Perrin, B.Wursig, Thewissen,J.G.M. Academic Press,San Diego.

Hickey,C.W. 2011 Statement of Evidence on behalf of Port Otago Ltd before the Otago Regional Council, April 2011.

Hitchmough R; Bull P; Cromarty P. (compiler). 2007. 'New Zealand

Threatened Classification System lists — 2005.' In Threatened Species

Occasional Publication 23: 210

L.Huson & Assocs 2009. Underwater Noise Impact Assessment. Gladstone LNG Project. Report to URS Australia Pty.Ltd.

James M; Probert K; Boyd R; Sagar P. 2009. 'Biological Resources of Otago Harbour and offshore: assessment of effects of proposed dredging and disposal by Port Otago Ltd.' NIWA Client Report HAM2008-152 Aug.2009

Laist,D.W., Knowlton,A.R., Mead,J.G., Collett, A.S., Podesta,M. 2001.

Collisions between ships and whales. Marine Mammal Science 17(1):35-75.

Lalas, C. 1997. 'Prey of hooker's sea lions *Phocarctos hookeri* based at Otago Peninsula New Zealand.' In Hindell, M and Kemper, C (Ed) *Marine Mammal research in the Southern Hemisphere. Vol.1 status, ecology and medicine*. Surrey Beatty & Sons, Chipping Norton, 130-136

Lalas,C. 2008. 'Recolonisation of Otago, southern New Zealand, by fur seals and sea lions: unexpected patterns and consequences.' Proceedings of the Conserv-Vision Conference, University of Waikato 2-4 July 2007

McConkey, S., Heinrich,S, Lalas,C., McConnell, H., McNally, N. 2002a 'Pattern of immigration of New Zealand sea lions *Phocarctos hookeri* to Otago, New Zealand: implications for the management of the species.' *Australian Mammalogy*, 24,107-116

Parvin,S.J.;Workman,R.; Bourke,P, and Nedwell,J.R 2005. Assessment of Tidal Current Turbine Noise at the Lynmouth site and predicted impact of underwater noise at Strangford Lough. Rept. No.628R0102.

Patenaude,J.N. 2003 'Sightings of southern right whales around 'mainland' New Zealand.' Science for Conservation 225. Department of Conservation, Wellington.

Patenaude,J.N. and Baker,C.S. 2001. Population status and habitat use of southern right whales in the sub-Antarctic Islands of New Zealand. J.Cetacean .Res. Manage (Special Issue) 2, 111-116

Pullar,A. and Single,M. 2009. Vessel effects as a result of a deeper channel in the Lower Otago Harbour. Report prepared for Port Otago Ltd. Shore Processes and Management Ltd.

Richardson,W.J. 1995. Documented disturbance reactions. In: Marine mammals and noise. Richardson,W.J.; Greene, C.R.; Malme,C.I,; and Thomson, D.H.(eds). San Diego, USA. Academic Press; pp.241-324.

Robertson,B.C. and Chilvers, B.L. 2011. The population decline of the New Zealand sea lion *Phocarctos hookeri* : a review of possible causes. Mammal Review (2011)

Slooten,L. and Benjamins,S. August 2010. Potential impacts of Project next generation on Hector's dolphins and other marine mammals.

Sneddon, R. 2009. Assessment of the impacts to benthic ecology and marine ecological resources from proposed capital dredging and spoil disposal offshore from Lyttelton, Port Company Ltd. Cawthron Rept. No. 1421 74 pp plus appendices.

Street,R.J. 1964. Feeding habits of the New Zealand fur seal *Arctocephalus forsteri.* N.Z.Mar. Dept. Fisheries Tech. Rep. 9.

Visser,I. 2000. Orca (Orcinus orca) in New Zealand waters. Unpub. PhD thesis. University of Auckland.