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Annex F

1. **ASSESSMENT OF ACTUAL OR POTENTIAL EFFECTS ON THE ENVIRONMENT.**

2. **Ecological Effects:**

3. **Methodology**

4. The application site was visited on five occasions (26 of June, 15 of August 1999 and 23 of January, 17 May and 30 June 2000) to carry out an environmental impact assessment (EIA) on the area. The purpose of the EIA was to:

5. Evaluate the range of naturally occurring species and habitats at the site and investigate any likely negative effects from the proposed marine farm on these values.

6. Allow a comparison to be made between the benthos and seabed profiles of the proposed farm and the post-farming seabed of the adjacent NZMFA site.

7. Identify any potential species and habitats of significance to fisheries.

8. Allow the present survey to be compared with a previous environmental impact assessment performed by ourselves in July 1996 at a site immediately to the east of the NZMFA site and inside Long Reef Point.

9. Where necessary, investigate ways in which potential effects on significant natural values could be avoided or mitigated.

10. The subtidal investigative survey techniques used at the proposed site complied with the Department of Conservation's 'Guideline for ecological investigations of proposed marine farm areas'.

11. **Subtidal Transects (Appendix: Attachment A)**

12. Two dive transects were carried out in which a diver swam along a rope laid on the seabed and at 5 or 10 m intervals the depth, substrate type and marine life in a 1m strip alongside the transect line were recorded. Observations over a much wider area (5m) were made in the shallower water (<15m) where visibility was good.

13. Transect One

14. This dive transect traversed a total of 260m of seabed. From a point just inside the second inshore longline of the NZMFA site, the transect extended right through the proposed farm and to the adjacent shoreline.

15. Transect two

16. This transect, which traversed 150m of seabed, started at the western end of the innermost longline on the NZMFA site and headed towards shore and at an angle that was parallel to transect 1.

17. Manta board Survey

18. A further subtidal investigation was completed at the site (30 June 2000). This involved the following:

- A diver and a 1 metre square quadrat, which was attached to the manta-board-towing warp, were towed across the proposed site in a west-east direction.
- After a short distance, the boat would stop causing the quadrat to fall to the seabed.
- A diver then approached the quadrat and counted any organisms occurring within the quadrat.
- This was repeated 11 times.

19. The purpose of this quantitative subtidal survey technique was to:

- Attempt to sample the benthos in improved conditions after the previous survey had found visibility partially impaired by suspended silt above the seabed.
- And therefore expand on what was already known about the site from the previous ecological survey.

20. RESULTS

21. Subtidal Transect (Seabed Substrate and Profile):

*22. Gradation of Seabed Substrates and Seabed Profile (***Annex "H"***)*

23. The slope beneath the proposed farm was very gradual with depths on the relevant section of the transect ranging from 25m to 30m and on transect 2, from 27m to 30m (21-26m & 23-26m below chart datum). Substrate below the site consists of soft silty mud with a few areas of dead shell (mainly mussel shell). On transect 1, the inshore boundary of the site was approximately 90m from shore and the seabed slope began to steepen from this point with shoreward movement. At 60m from shore, the substrate had become gritty mud with small cobbles overlaying it. The slope became progressively steeper, and from 30m from shore, larger rocks and areas of base rock were seen.

24. Biota

25. The following synopsis represents the flora and fauna sampled during the subtidal survey (refer also to **Annex "H"**, shore profiles).

26. The relative abundance of species identified is noted on a five-point scale. The frequency with which each species occurs falls within an arbitrary range which translates as follows:

(1) Scarce (1-3 individuals)
(2) Occasional (4-6 individuals)
(3) Common (7-15 individuals)
(4) Abundant (16-40 individuals)
(5) Dense (41+ individuals)

7. On the first section of transect 1 (in the area of the established longlines on the NZMFA site), a dense patch of medium sized (50-70mm) green-lipped mussels was noted (there presumably as a result of loss from the longline above). From this position to the inside boundary of the proposed farm, no macro-invertebrates were noted. However, at a point 155m from shore and again at 130m from shore, quantities of old mussel shell (again 50-70mm) were felt in the soft mud. Presumably the mussels occur here as a result of drop off from mussel lines located in this area prior to the formal establishment of the communal spat holding site in 1995. Inshore of the proposed site on transect 1, marine life remained sparse until a position of ≈50m from shore was reached. At this point, saddle squirts (*Cnemidocarpa* sp.) (4), and tube worms (*Galeolaria hystrix*) (1) were abundant in the cobble area and were also common further inshore. Two small scallops (*Pecten novaezelandiae*) (1) were also seen in this area. Inshore of 40m from the high water mark, many other species became common. Species noted included eleven-armed starfish (*C. calamaria*) (1), cushion star (*Patiriella regularis*) (1), common sea-urchin (*Evechinus chloroticus*) (2), common sea-cucumber (*Stichopus mollis*) (1), window shell (*Anomia trigonopis*) (2), a single basket sponge (*Anchorina alata*) (1), cat's eye (*Turbo smaragdus*) (4), limpets (*Cellana* sp.) (3), turret shell (*Maoricolpus roseus*) (2), and blue mussels (3). The only fish seen were blue cod (*Papapercis colias*) (1), spotty (*Notolabrus celidotus*) (4) and triple fin (*Forsterygium varium*) (3). No macro-algae were seen other than some tufts of the grape weed (*Caulerpa sedoides*).

8. Transect two covered only the area of the application and, as with the section of transect one that traversed seabed beneath the proposed farm, the seabed substrate down transect two was soft mud. No macro-invertebrates were observed down this transect and, while low visibility (because of silt suspended just above the seabed) may have contributed to this, shellfish or other hard bodied animals should have been identified by touch had they been present. As with transect one, a patch of dead mussel shell was encountered near the middle of the transect.

9. In the environmental assessment of the neighbouring site in 1995 by R.J. Davidson, two species of brachiopod (small red lamp shell (*Waltonia inconspicua* and *Magasella sanguinea*) were recorded in depths of 18-22m in moderate numbers. No brachiopods were recorded on either transect in the present survey. While this may have been partly due to the low visibility in depths below 18m, there is no reason to doubt Davidson's

conclusion in his 1995 survey that brachiopod numbers in the area are low in comparison with other Marlborough Sounds areas.

10. Manta Board Survey

11. No macro-invertebrates were encountered during this west-east traverse through the proposed farm. Again suspended sediments in the water column directly above the seabed limited visibility for much of the traverse.

26. Ecological Effects, Conclusion:

27. The potential affects of cultured animals bio-deposits on sedentary bottom dwellers beneath marine farms is likely to be substantial where marine farms are sited inappropriately over reefs or kelp beds associated with hard substrata. No hard-shore habitat was found within the site but was restricted to a narrow fringe extending a distance from shore. On transect one, the nearest area of rock (in the form of cobbles) was approximately 30m from the site boundary (large outcropping rock began within 30m of shore, i.e. ≈60m from the site boundary). Marine farm effects arising from the proposed operation will not impact the inshore habitat and communities identified in the environmental impact assessment. The growing lines will be ≈30metres distant from the hard-shore habitat at the proposed site's south-eastern corner (and a greater distance further from shore along remaining portions of the proposed site).

28. The extension of transect one under the inner longlines of the neighbouring spat holding site showed that the substrate type and habitat beneath the proposed site was similar to that beneath the existing NZMFA operation, which however, had a greater accumulation of small mussels on the seabed.

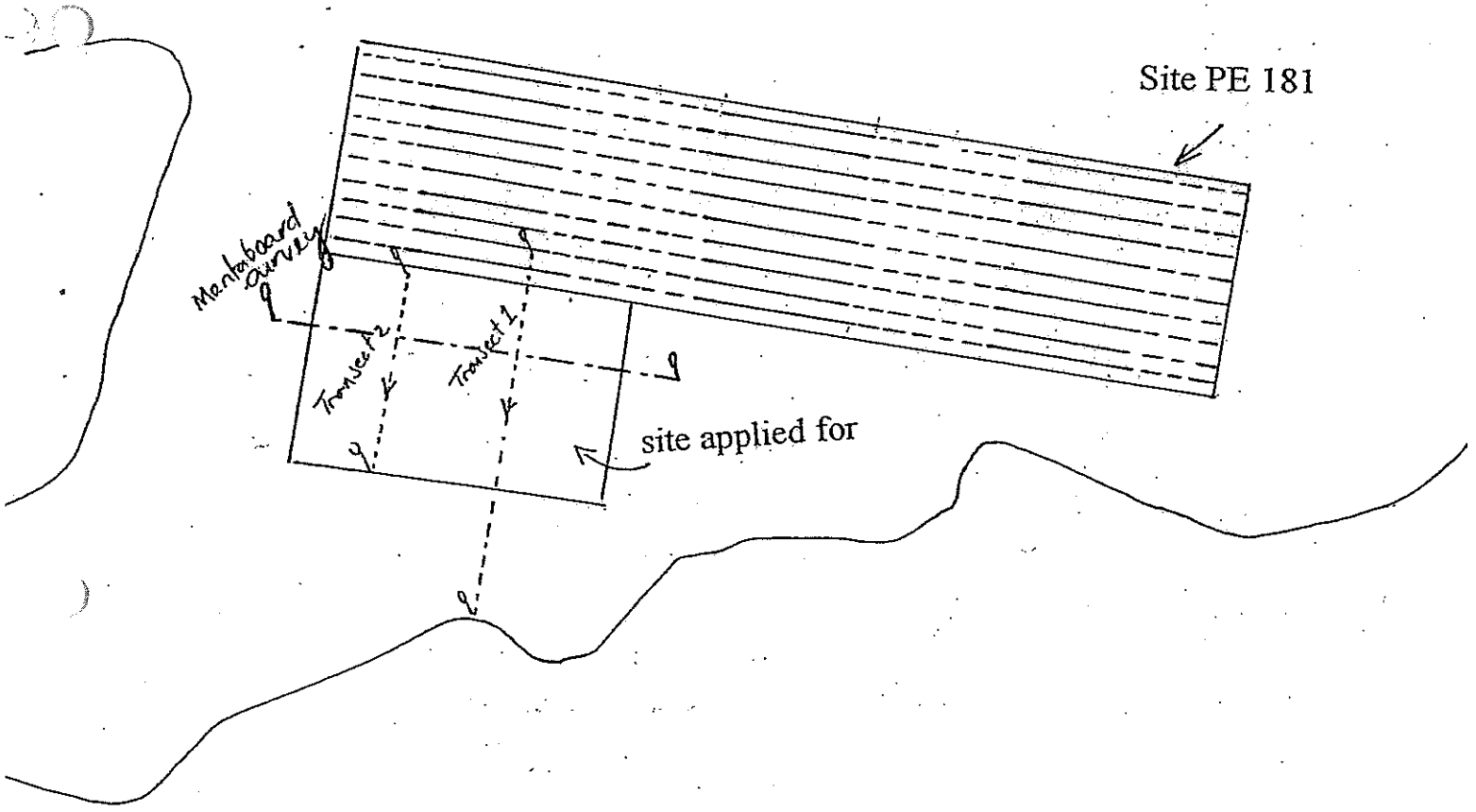
29. There was no significant difference between the benthos occurring over seabed beneath the proposed farm proper compared with the NZMFA site. And in fact, the seabed beneath the proposed site has already undergone some modification from previous NZMFA spat nursery operations.

30. The flora and fauna at the proposed marine farm site were significantly reduced compared with coastal marine areas closer to the head of Fitzroy Bay. Those species that were sampled during the survey are typical of those found in the middle area of

Pelorus Sound and no rare or particularly sensitive species or communities were observed.

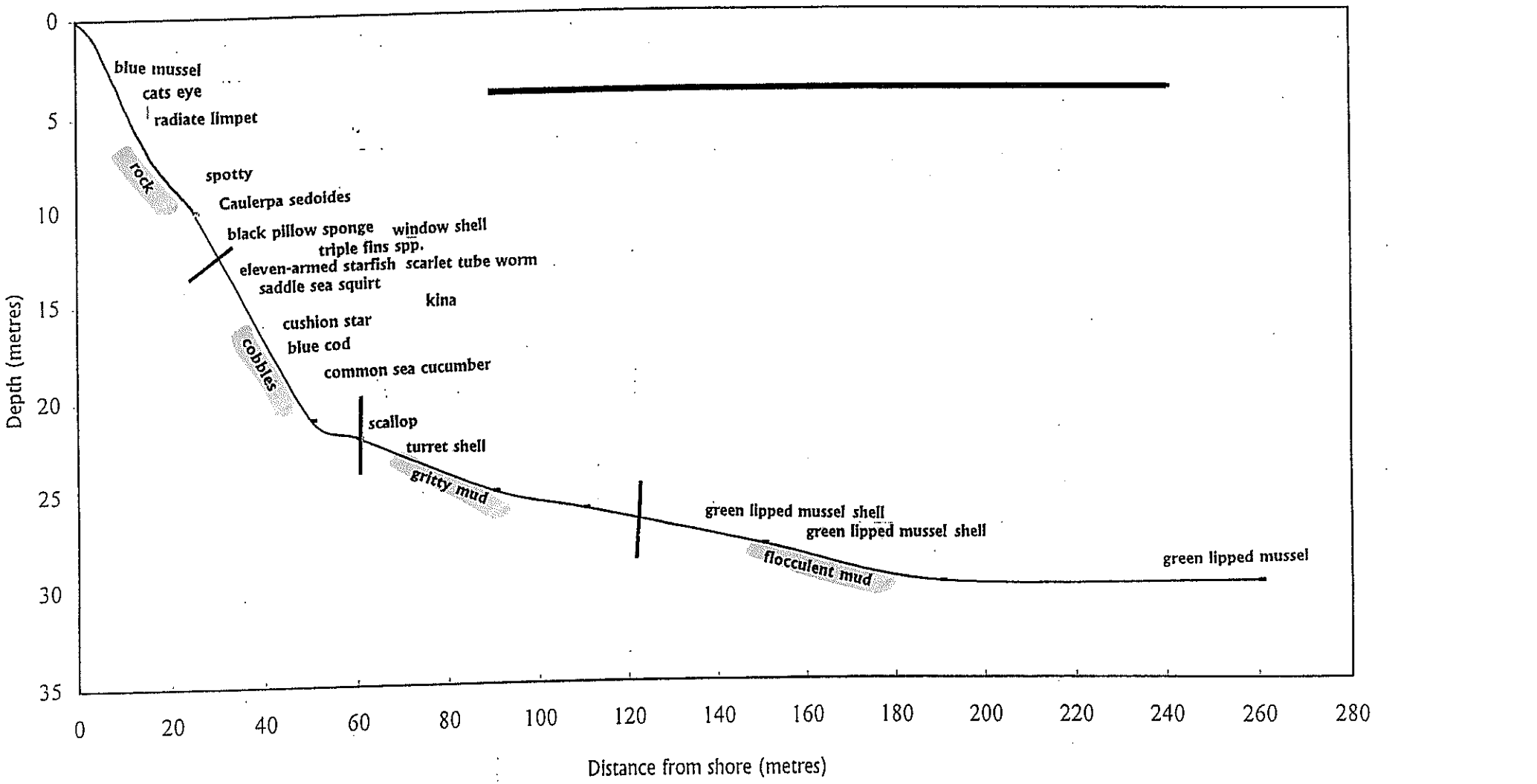
31. The recurrence of silt in suspension above the seabed partially explains the limited diversity of flora and fauna beneath the site as habitat shifts such as this would have an impairing physiological effect on filter feeding invertebrates, visually limited fish predators and algal species.

(2)Location of site and transects in relation to existing site(PE 181)
((approximate positions only)



Appendix D

A Seabed Profile Beneath the Proposed Marine Farm In Fitzroy Bay, Showing the Depth at Which Biota and Substrate Types Occurred Along a Visual Site Transect



Annex "I"

1 FURTHER ENVIRONMENTAL IMPACT ASSESSMENT AT THE PROPOSED SITE AND ADJACENT SITE (PE 181)

2 The following additional investigations were performed:

3 Comparison of Depth Contours at the Proposed site and adjoining site Pe181

4 On the 23 of January, I (Mike Bull) made a visit to the proposed site and, using a paper graph echo sounder, recorded the depth profile along the inside boundary of Pe 181 (running along the inside longlines currently in place at the site). I also recorded depth profiles from various points on the shore to adjacent points along this inside boundary, as shown in the attached plan. For each offshore run, a measured line was run out from the shore so that the depth could be accurately calibrated against the distance offshore. Measurements were taken during the top half of the tidal cycle.

5 The run along the inside longlines of Pe 181 (B-W on the attached plan) showed the most eastern line (B-C) to be in 17-19m of water. The depth then dropped sharply to the extent that, by the time the start of the next line was reached (C-K), the depth was 28m. Depth then remained at 27-28m (K-L-G-H) and was 26m at the presumed position of the most western anchor (W) (ref chart printout 1).

6 The run from the shoreline to the eastern most buoy of the first longline (A-B) showed a steep gradient from the shoreline to a depth of 19m at the first buoy (B1), which was 85m offshore. The sounding run was then continued out to the eastern most buoy of the second longline offshore (point B2), which was 105m offshore and in a water depth of 24m (i.e. both these two inner longlines are still on the subtidal slope) (ref chart print-out 2).

7 The next run was begun from shoreline (point D) and headed offshore to the western-most float on the eastern-most longline (D-C) (ref chart printout 3). Again the subtidal slope dropped steeply and was at 17m in depth at 65m offshore of the position at the end float on the inside longline (point C1). It continued to drop and

was at 24m in depth at the second longline (90m offshore) (pointc2) and 29m in depth at the third longline (110m offshore) (point C3).

8 A run of 235m was then made from the shoreline (point E) and through the proposed positions of the easternmost floats of the proposed site (F-G) and then to the easternmost float on the existing westernmost inshore longline (point G). This transect (chart printout 4) showed a steep slope to a point 60m offshore where the depth was 19m then a more gradual slope of 24m in depth at a point 90m offshore which is the proposed position of the most inshore longline. From there onwards, the slope was very gradual reaching 27-28m at a point 235m offshore, which was the position of the existing innermost longline in that area (point G).

9 A 200m run made inshore from the western-most float on the western most inshore longline (H-J) (see chart printout 5) showed a gradual shallowing from 27m at point H to 21m at point J, with the depth being 25m at a distance of 150m from point H (i.e., at the inner boundary of the proposed site).

10 The final run carried out was off the shore from point N to the proposed site of the innermost anchor on the proposed site (point M). This distance was calculated as being 60m offshore and at this point, was in a depth of 20m (ref chart printout 6).

11 **Conclusion**

12 The innermost longline of the proposed site will be in deeper water and will be further away from the subtidal slope than the innermost longline of Pe 181's most easterly block. The depth and seabed profile beneath the proposed site's offshore longline positions are similar to the majority of the seabed covered by Pe 181.

13 The depth of water beneath suspended culture ropes, the seabed substrate type and the lateral distance of the culturing ropes from the subtidal slope areas most frequented by spotties and other mussel eating fish species are generally considered the important factors in determining whether a farm site is likely to suffer from fish predation (see also G. D. Carbines MSc thesis on the ecology and early life of spotties around Marlborough Sounds mussel farms). The proposed site occupies a similar depth, overlies similar seabed and is situated further away from

the subtidal slope than the innermost longline of Pe 181's eastern most block. The proposed site's longlines will be in deeper water and further from the subtidal slope than this (Pe 181) longline. This suggests that, if managed properly, the proposed operation is less likely to create difficulties from the point of view fish predation than parts of Pe 181's site.

14 Current Patterns in the area

15 Little is known of current patterns in the vicinity of Fitzroy Bay[1]. On the same occasion that the depth profile work was undertaken, some preliminary data on currents in the area were also gathered. A large current drogue was suspended 1-3m below a buoy and deployed inside the established longlines on Pe 181. Due to the drogue's close proximity to these longlines and the fact the lengths of Pe 181's longlines were known, it was possible to plot reasonably accurately by eye the movement of the drogue over the two-hour period concerned. The resulting plots are shown in the attached figure.

16 Current direction in both runs was in a long-shore direction to the east of the site (tide 1-3 hrs before HW) and estimated current speeds were (x) 13.3 and (y) 4.7 cm/sec respectively (ref. Sounding chart).

17 In a recent seminar on productivity issues in Pelorus Sounds, M. James of NIWA indicated that average current speeds for Marlborough Sounds mussel farms ranged from 5-6 cm/sec.

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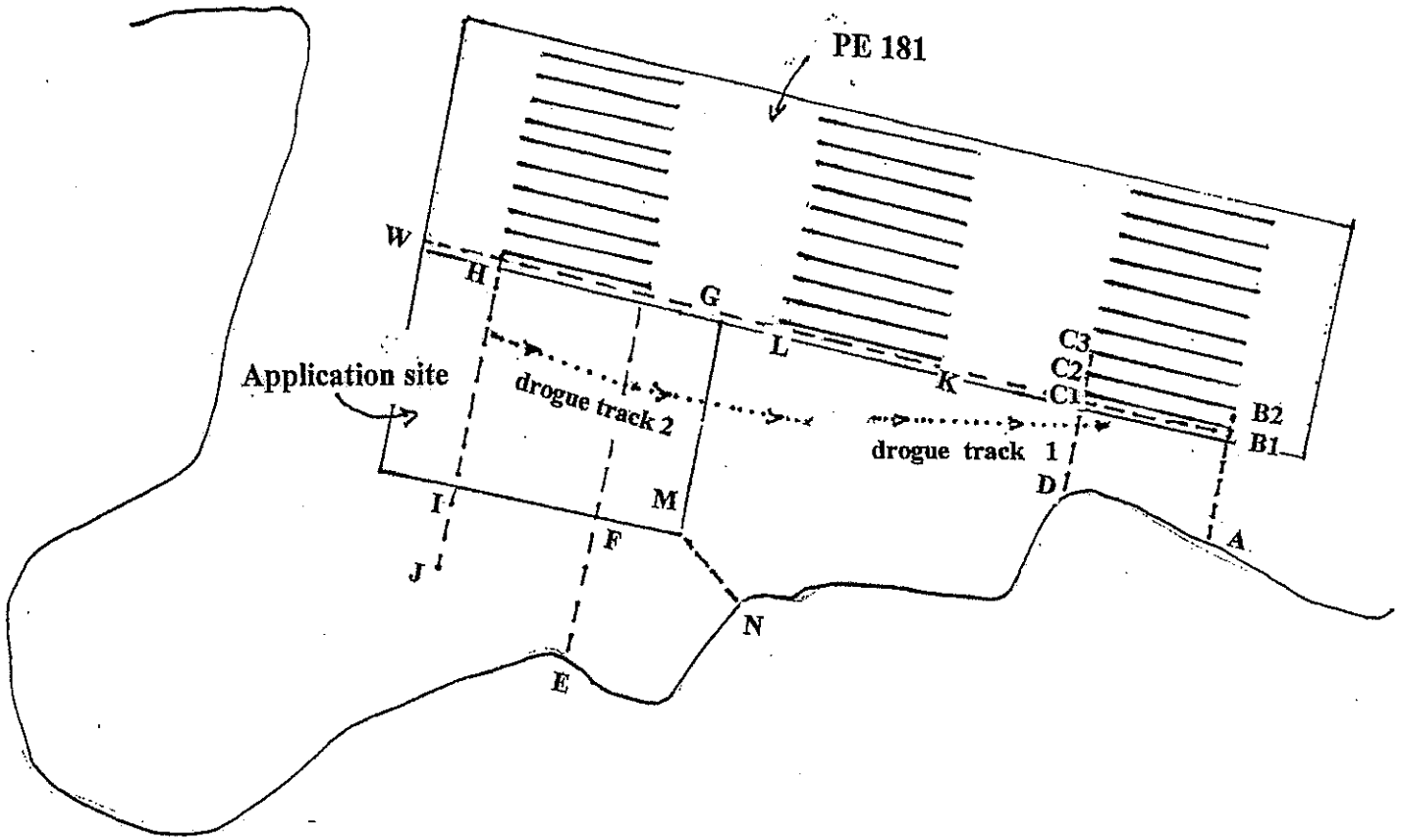
1 . No evidence was produced on this aspect by the NZMFA in its application for site Pe 181 in 1995.

Plan showing sounding chart in relation to Pe 181 and the current application.



tance / Depth measurements by transect (m)

B2	D-C3	E-G	H-J	N-K
	10/02		10/27	10/02
/03	20/04	20/09	20/27	20/06
/05	30/06	30/11	30/26	30/10
/7	40/10	40/14	40/26	40/12
/10	50/13	50/16	50/26	50/15
/12	60/14	60/19	60/26	60/20
/15	65/17	70/21	70/26	
/18	70/19	80/22	80/26	
/19	80/22	90/24	90/26	
0/23	90/24	100/25	100/26	
5/24	100/27	110/26	120/26	
	110/29	120/27	140/26	
		140/27	160/24	
		160/28	180/24	
		180/27	200/21	
		200/27		
		220/28		
		235/27		

Drogue current measurements.

Track 1 time 9.17-9.37 = 20min
distance = 160m
speed = 13.3 cm/sec

Track 2 time 9.46-11.11 = 85 min
distance = 240m
speed = 4.7 cm/sec