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Survey and Monitoring Report No. 54

Description of the subtidal macrobenthic community from a proposed marine farm east of Anchor Point, Admiralty Bay

by
R. J. Davidson
98A Quebec Road, Nelson
(03)546 8413

A report prepared for

New Zealand Marine Farming Association

August

1995

1.0 INTRODUCTION

This report presents a biological description of habitats, substrata and associated conspicuous macrobenthic species and communities from a proposed 6.0 ha marine farm area at Anchor Point, Admiralty Bay (Figure 1, 2).

The proposed site is located on the north-eastern coast of Admiralty Bay approximately 6.5 km south-west of Clay Point. The proposed site is located along a relatively straight piece of coast immediately east of Anchor Point (Fig. 1). The stretch of coast is part of a large promontory which extends into Admiralty Bay which includes Whangapoto Point, Camp Bay and Pukatea Bay (Fig. 1). The proposed site is fringed by relatively steep rock cliffs and hill side which is clad in regenerating scrub dominated by kanuka. The shoreline is dominated by bedrock which has been weathered to for a variety of bedrock faces, small stacks and promontories.

The subtidal ecology of Admiralty Bay has much in common with the other sheltered parts of the outer Marlborough Sounds particularly the south-eastern coast of D'Urville Island and Tasman Bay east of Croisilles Harbour (Davidson and Duffy 1992; Davidson and Brown 1994). Much of Admiralty Bay and the south-eastern D'Urville coast are characterised by a low diversity and biomass of large brown seaweeds, subtidal areas often colonised by dense bivalve species such as dog cockles and often high densities of the barnacle (*Balanus sp.*) growing on rocky substrata which often extends to considerable depths. Admiralty Bay reaches depths of up to 45 m but most of the bay is between 39 to 44 m depth (NZ Navy Chart 615). The shoreline of Admiralty Bay is typical of much of the Marlborough Sounds being dominated by a narrow rubble, bedrock or pebble/cobble intertidal zone with a backdrop of steep hill sides often with relatively rounded tops. Water residence times in this area are probably short compared to those recorded for the back-waters of the central Pelorus Sound such as Hallam Cove, and Crail and Beatrix Bays (Gibbs 1991).

The closest distance between the shore and proposed marine farm is approximately 50 m distance (Fig. 2). The proposed marine farm stretches 400 metres in length and is 150 m wide along its entire length. The proposed farm is orientated in an approximate east-west direction (Fig. 2). Depths along the inshore boundary were approximately 9 m (Point 1) to 10 m (Point 4), while depths along the offshore were consistently approximately 48.5 m (Points 2, 3). The proposed activity, details of farm structure and species are outlined by a report by R. Sutherland (PALMS) on behalf of the applicant (New Zealand Marine Farming Association).

The Marlborough Sounds lie at the northern end of the South Island, with Cook Strait to the north and east and Golden Bay and the West Coast to the west. The Marlborough Sounds area was formed by submergence of river valleys, the Sounds consist of approximately 1500 km of bays, passages, peninsulas, headlands, estuaries and beaches, often with an adjacent steep terrestrial topography. The Sounds are a resource of major environmental importance. In a nationwide report by the Department of Conservation, the Marlborough Sounds was identified as being of national conservation importance. The Sounds was also identified as having areas of international biological importance (Davidson et al ., 1990; Davidson et al., in press). These values will be important consideration in the soon to be produced Marlborough District Council Coastal Plan and District Plan.

Multiple use (marine farming, fishing, boating, housing, waste water disposal, port development, forestry, agriculture) have the potential to degrade the environment of the Sounds. Marine farming for example, can have considerable impact on the environment through habitat modification or lowering water quality (Kaspar et al., 1985; Gowan and Bradbury, 1987; Kaspar et al., 1988; Gillespie 1989; Gowan et al., 1990; Silvert, 1992). It is therefore important that all new marine farm proposals adequately identify natural values within and adjacent to a proposed marine farm.

The aim of this study was therefore to provide environmental information on the proposed site and to identify features of biological value which could be threatened by the establishment of the proposed marine farming activity.

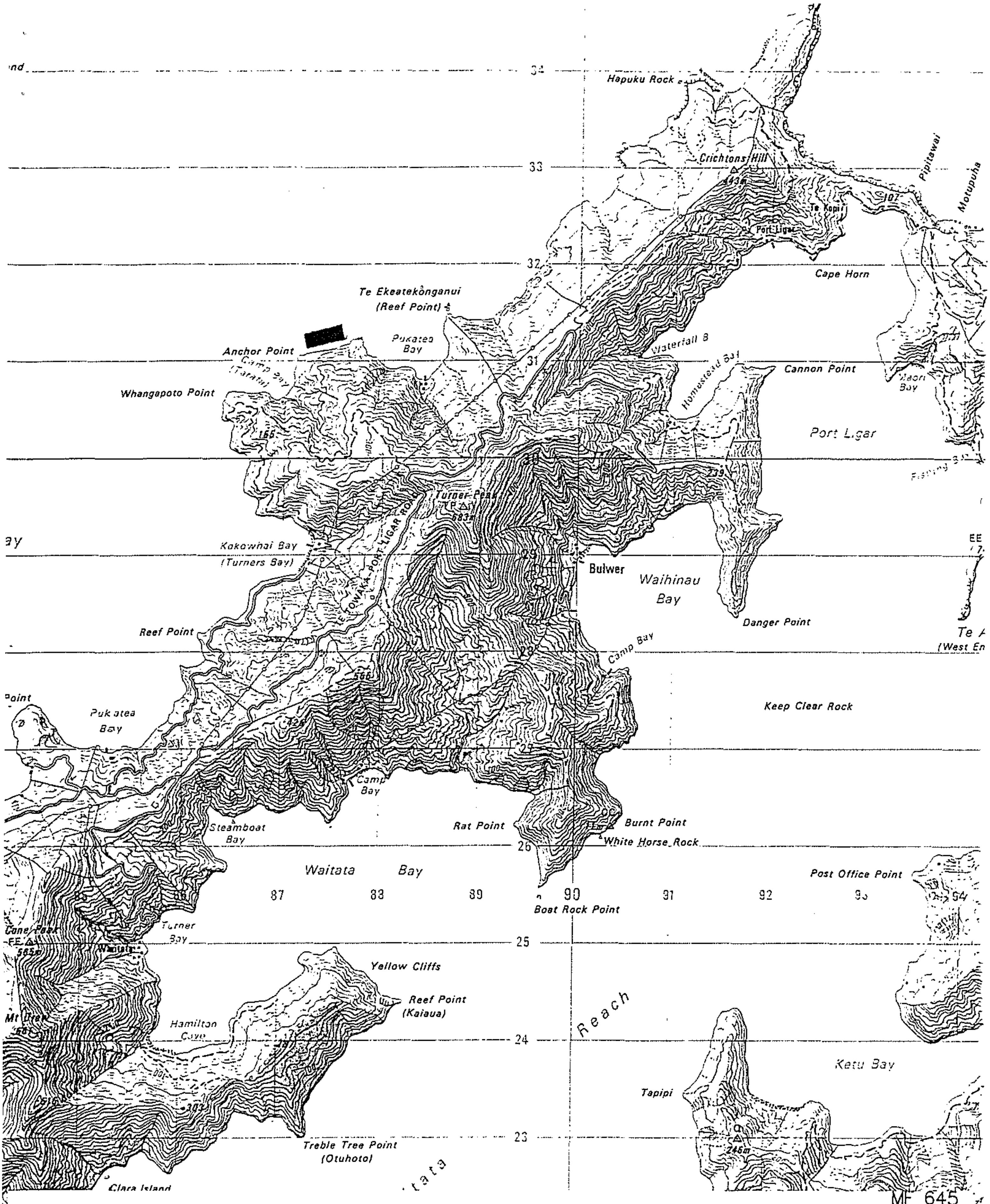

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Fig. 1. Locality Map of Proposed Coastal Permit Spat Holding Site

Applicant: NZ Marine Farming Assoc

LOCAL AUTHORITY: MARLBOROUGH DISTRICT	NELSON LAND DISTRICT	
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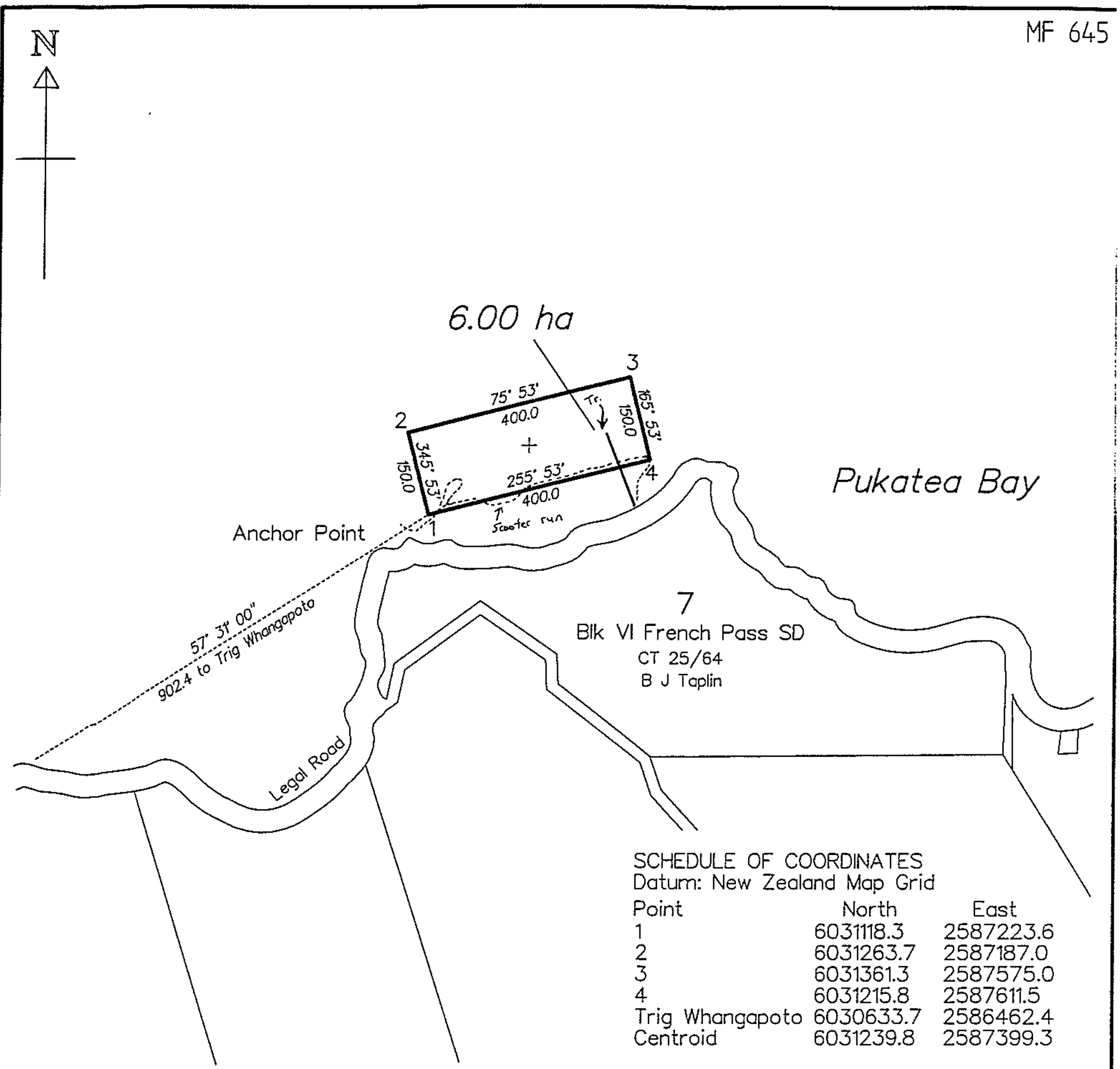

SCHEDULE OF COORDINATES
Datum: New Zealand Map Grid

Point	North	East
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Plan of Proposed Coastal Permit Spat Holding Site

NZ Marine Farming Assoc

Bearing variation Geodetic Datum 1949 to NZMG +11' 50"

SCALE 1:10,000

200 100 0 100 200 300 400 500 600 700 800 900 1000 metres

LOCAL AUTHORITY: MARLBOROUGH DISTRICT

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Fig 2. Transect and scooter run.

2.0 MATERIALS AND METHODS

The proposed site was qualitatively investigated on the 4th August 1995, using two subtidal survey techniques. Most of the inshore boundary and randomly selected parts of the adjacent subtidal shore between 3 to 22 metres depth were investigated by a free swimming diver assisted by an Apollo scooter. Results from this preliminary investigation were recorded on waterproof paper. Based on these findings a representative area within the proposed marine farm was selected and a 150 m lead-lined transect line marked at 5 m intervals was installed perpendicular to the shore (Fig. 2). This transect site was considered representative of features observed during the scooter run along the inshore boundary of the proposed marine farm.

Using SCUBA, depth, distance, substrate, habitat and associated conspicuous surface dwelling flora and fauna were recorded using waterproof paper, clipboard and a pencil. This process was terminated at a distance of 130 m from the low tide mark and at depth of 29 metres. The abundance of conspicuous macroinvertebrates, macroalgae and fish were estimated on a scale of 1 = uncommon (1 or 2 individuals observed), 2 = occasional (observed sporadically or occasionally in a particular zone or band), and 3 = common (regularly seen or forming a zone or patch).

The inshore and offshore boundaries were remote sensed for reef or unusual benthic features using a Furuno colour sounder. Two passes through random parts of the farm were also investigated using this method.

All depths presented in this report are adjusted to datum.

3.0 RESULTS AND DISCUSSION

3.1 Scooter Run

Results from the scooter run across random parts of the proposed farm and along the inshore areas of the proposed marine farm and adjacent coast suggested that:

1) substrata present were pebbles, cobbles, small and medium sized boulders, bedrock, silty broken shell/sand;

2) no bedrock habitat was recorded within the proposed marine farm, however, cobble and small boulder substrata were observed along the entire length of the proposed marine farm to a maximum depth of approximately 19 to 20 m;

3) Small patched of the macroalgae *Carpophyllum flexuosum* were observed within the proposed marine farm boundary;

4) no mud bottom was recorded within the depths investigated by divers and based on the signal return from the colour depth sounder it appeared that no substrata dominated by mud was located within the proposed farm boundaries;

5) sand substrata and broken and dead whole shell dominated the majority of the proposed marine farm area from a distance of 90 m from the high tide mark; and

5) patterns of substrata and communities appeared consistent along the entire length of the proposed marine farm area.

3.2 Profile

The intertidal shore adjacent to the proposed marine farm area was dominated by a combination of short bedrock bluffs and small promontories. The adjacent terrestrial environment was steep hill side in regenerating scrub dominated by kanuka.

The subtidal shore profiles were initially an extension of the intertidal shore being dominated by a bedrock substrata with occasional boulders. This bedrock zone was initially clad in a relatively high percentage cover of large brown algae (*Carpophyllum maschalocarpum, C. flexuosum*). The macroalgae terminated at approximately 3.2 m depth (Fig. 3), while another deeper bed was observed between approximately 11.7 to 13 m depth and 65 to 75 m from the high tide mark. The bedrock/boulder zone ended in relatively narrow soft bottom dominated by broken shell/pebble/sand substratum approximately 2 m wide. Offshore of this narrow soft bottom shore was a hard shore zone dominated by small boulders/cobbles/broken shell. This substrata continued to depths of 21 m and a distance of 90 to 95 m offshore of the high tide mark. Beyond this hard substrata was a soft shore dominated by dead whole and broken shell/sand soft shore. Notable on the hard shores was the dense zone of the barnacle *Balanus* sp. between 6 and 21 m and hydroids *Solandaria racemosa* and *Pennaria* sp. On the soft shores at approximately 90 to 110 m from the high tide mark, dense beds of the dog cockle cobbles *Glycymeris laticostata* were observed. These appeared to be most common in a zone which appeared to extend along the coast at these depths of 21 to 26 m depth.

From the transects and scooter run a total of 36 conspicuous species of invertebrate, 8 algae, 2 ascidians and 7 species of bony fish were recorded. A list of species observed from the transect and scooter run are presented in Table 1, while the profile is plotted in Figures 3.

Tube worms mounds (*Galeolaria hystrix*) were not recorded in the present study, however, tube worm individuals were common.

Seven species of fish were recorded from the transects and scooter run. Spotty (*Notolabrus* *celidotus*), blue cod (*Parapercis colias*), opal fish (*Hemercoetes monopterygius*) and (variable triplefin (*F. varium*) were numerically the most abundant. Blue cod were dominated by small (< 300 mm length) individuals observed mostly on the rubble substrata. A low number of larger (> 300 mm length) cod were observed mostly around the boulder/bedrock zone below the macroalgae zone.

Brachiopods(*Magasella sanguinea*) was recorded in low numbers from the study area, mostly in depths below 18 m. *M. sanguinea* is the most widespread brachiopod recorded from shallow subtidal areas in the Marlborough Sounds (McKnight and Grange, 1991; Duffy et al. in prep; Chadderton et al., in prep). This species is most often recorded from broken/dead shell/sand substrata in depths greater than 8 m. Chadderton et al., (in prep) recorded it in highest densities in Pelorus Sound from their sample site in Hallam Cove and recognised *M. sanguinea* as a species which characterised their matrix habitat (sand/ shell substrata) in central Pelorus Sound. The author recorded this species of brachiopod in an average density of 4.1 per m^{-2} and in densities as high as 23.2 per m^{-2}. No quantitative data were collected in the present study but it is estimated that the brachiopods located in the proposed marine farm area were low in comparison to those recorded by Chadderton et al (in prep). Preliminary results suggest that parts of central Pelorus Sound, particularly in the Hallam\Garne Bay area may be characterised by dense beds of the brachiopod *M. sanguinea*.

Green-lipped mussel (*Perna canaliculus*) and blue mussels (*Mytilus edulis aoteanus*) were recorded at and around the low tide mark on the shore adjacent to the proposed marine farm.

Scallops (*P. novaezelandiae*) were rarely observed from soft substrata in the present study. The few small individuals observed were recorded from sand substrata in depth greater than 19 to 20 m depth.

One king shag (*Leucocarbo carunculatus*) was observed roosting on a rock stack immediately adjacent to the proposed marine area. This site is not recognised as a roosting site for this species (Schuckard 1994, Davidson et al in prep), however, the use of sites for roosting appears

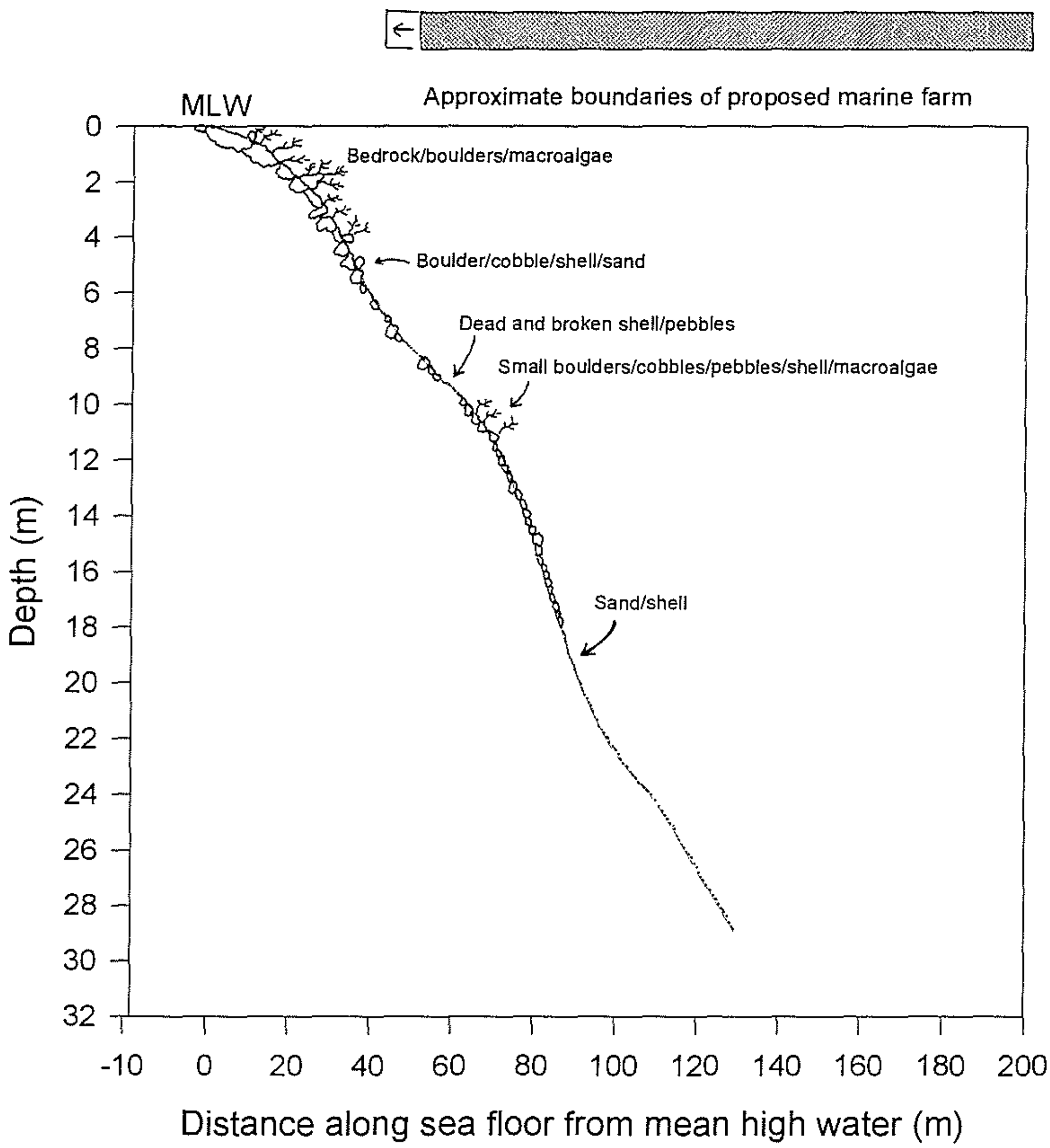

Figure 3 Subtidal shore profile, and substrata from a proposed marine farm site east of Anchor Point, Admiralty Bay.

Table 1 Species observed from Anchor Point, Admiralty Bay.				
Algae	**Common name**	**Invertebrates**	**Habitat**	**Common name**
Corallina spp.(3)	paint	SPONGIA		
Cystophora torulosa (2)		Ancorina alata (2)	rock/rubble	grey sponge
Cystophora sp. (2)		Aplysilla sulphurea (1)	boulder	sulphur sponge
Carpophyllum flexuosum (2)	wide flap-jack	Callyspongia sp. (1)	shell	glass sponge
Red foliose (1)	red alga	COELENTERATA		
Hormosira banksii (2)	Neptune's necklace	Culicea rubeola (2)	rubble	box anemone
Codium convolutum (3)		Actinothoe albocincta (1)	rubble/soft	anemone
Splachnidium rugosum (2)	bubble weed	Solanderia racemosa (3)	rubble	hydroid tree
		Pennaria sp. (2)	rubble	golden hydroid
		GASTROPODA		
		Atrina novaezelandiae (1)	soft	horse mussel
		Eudoxochiton nobilis (1)	rubble	noble chiton
		Monia zelandica (2)	rock/rubble	window oyster
		Cellana stellifera (2)	rubble	limpet
		Haliotis iris (2)	bedrock	paua
		Octopus maorum (1)	rubble	octopus
		Cookia sulcata (2)	rubble	Cook's turban
		Maoricolpus roseus (2)	sand/shell	spire shell
		Trochus viridus (2)	rubble	
		Turbo smaragdus (3)	rock/rubble	cats eye
		BIVALVIA		
		Chlaymys sp. (1)	rock	queen scallop
		Glycymeris laticostata (3)	soft	dog cockle
		Modilarca impacta (2)	rubble	Nestling mussel
		Mytilus edulis aoteanus (2)	rubble	blue mussel
		Pecten novaezelandiae (1)	soft	scallop
		Perna canaliculus (3)	rubble	green mussel
		POLYCHAETA		
		Brachiomma sp.(2)	sand/rubble	fan worm
		Galeolaria hystrix (3)	sand/rubble	tube worm
		Spirorbis sp. (3)	rubblerock	
		CRUSTACEA		
		Pagurus spp (3)	sand	hermit crab
		Balanus sp. (3)	rubble	barnacle
		ECHINODERMATA		
		Allostichaster insignis (1)	rubble	star
		Coscinasterias calamaris (2)	sand/shell	11 arm star
		Evechinus choroticus (2)	rock/rubble	kina
		Patiriella regularis (3)	sand/rubble	cushion starfish
		Pectinura maculata (2)	rubble	snake star
		Pseudechinus albocinctus (1)	soft	pink urchin
		Stichopus mollis (2)	sand/silt	cucumber
		BRACHIOPODA		
		Magasella sanguinea (2)	sand/shell	lamp shell
		ASCIDEACEA		
		Didemnium sp. (1)	rubble	cream ascidian
		Cnemidocarpa sp. (2)	rubble	saddle squirt
		BONY FISHES		
		Notolabrus celidotus (3)	rubble	Spotty
		Hemercoetes monopterygius (3)	silt	Opalfish
		Forsterygion varium (3)	rubble	variable triplefin
		Notoclinops segmentatus (2)	rubble	blue eye triplefin
		Parapercis colias (2)	rubble	blue cod
		Parika scaber (1)	rubble	leatherjacket
		Pseudolabrus miles (2)	rubble	scarlet wrasse

to vary from season to season. The importance of this site to king shag is unknown to this author.

4.0 DISCUSSION OF POTENTIAL IMPACTS ON THE BENTHOS OF BIVALVE MARINE FARMS

In a study on the effects of mussel aquaculture, it was recognised that build-up of shell debris and increased sedimentation rates directly below mussel farms strongly influenced benthic communities (Kaspar et al., 1985). Deposition of shell debris can ultimately smother natural benthic communities (Author pers. obs.). The impact of a mussel spat holding farm may vary depending on management practices such as the size of mussels and the holding period. It may also depend on environmental factors such as storm events which may result in increased shell deposition. Until the effects of mussel spat holding has been documented, it may be most appropriate to assume that the impact be comparable to that of a mussel farm.

The areas of benthos investigated below the proposed marine farm were dominated by a combination of hard shores, located in the initial 40-45 m of the proposed farm and soft shores dominated by shell and sand over the remaining farm area. No mud substrata was recorded by divers or as was indicated by the strength of the colour sounder echo.

Sand substrata down to the depth investigated was colonised by moderate number of species dominated by filter feeders including dog cockle beds, brachiopods, sponge, and scallop. Dog cockles and the brachiopod were ranked as common in abundance. The dense dog cockle beds appeared to be principally between 20 and 26 m depth.

Hard shores within the proposed marine farm boundary were colonised by a relatively high diversity and abundance of species dominated by filter feeders including the barnacle *Balanus* sp., hydroids *Solandaria racemosa, Pennaria* sp. and a variety of encrusting invertebrates and one species of brown macroalgae.

This area may be representative of exposed coastal areas in Admiralty Bay stretching from Whangapoto Point to Clay Point (Davidson and Brown 1994, Grange 1995). The dominance of coarse substrata and associated filter feeders often in high abundances seems consistent in these parts of Admiralty Bay.

Shell debris and particulate matter from mussels may considerably modify the hard and soft shore habitats recorded from the present study. Sessile species including dog cockles from the soft substrata and encrusting species from the cobble/boulder area would probably be smothered by any shell debris originating from a mussel farm, while the mobile species such as the opal fish or scallop would probably relocate. The sand habitat itself would probably be altered with the deposition of shell material and particulate matter, especially in shallow areas.

5.0 CONCLUSION

The aims of the study were to provide a biological description of the benthos under and adjacent to a proposed marine farm east of Anchor Point, Admiralty Bay and to identify potential threats to any subtidal ecological values posed by the proposed activity.

The soft and hard shore communities recorded from the present study were dominated by species that are widespread and common throughout the subtidal shores of the sheltered outer Marlborough Sounds where low turbidity and sedimentation appear to play an important role in determining benthic sediment composition (Dell 1951; Estcourt 1967; McKnight 1969, 1974; Roberts and Asher 1993; McKnight and Grange 1991; Davidson and Duffy, 1992; Davidson, 1994; Davidson and Brown 1994; Duffy et al. in prep; Chadderton et al., in prep, Chadderton and Davidson in prep). No rare or threatened species were recorded from the study area, however the presence of the barnacle (*Balanus* sp.) appears to be a feature of the eastern Admiralty Bay/eastern D'Urville Island area (Davidson and Brown 1994). The presence of dog cockle beds and the hydroid *Solandaria racemosa* are features of areas influenced by tidal currents and often coarse sediments. Scallop numbers observed in the present study appeared very low.

The substrata under most of the proposed marine farm was dominated by soft substrata in the form of sands with variable components of broken and dead whole shell material. The inshore 40 to 45 m of the proposed marine farm was dominated by a hard substrata zone of cobble and small boulders. The associated flora and fauna from these areas was represented by a moderate to high diversity of species some of which formed dense beds. It would be expected that the abundance and diversity of species would decline with greater depth. This pattern was observed between 20 to 28 m depth.

The abundance of sands in Admiralty Bay and other parts of the outer Marlborough Sounds is probably a result of relatively low sediment deposition levels, currents, wave action and the proximity to the clean waters of Cook Strait. This has resulted in a greater proportion of broken shell and sandy substrata often down to considerable depths. Shell debris would probably modify these habitats and communities, particularly the hard shore and soft shores between 20 to 26 m depth where dense dog cockle beds were observed.

Soft bottom habitats and their associated species recorded in the present study are widespread in the inshore sheltered outer Marlborough Sounds.

The importance of a rock stack where a king shag roosted during the study is unknown to the author.

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Appendix 1: Additional information to Survey and monitoring report No. 54 "Description of the subtidal macrobenthic community from a proposed marine farm site east of Anchor Point, Admiralty Bay" by R.J. Davidson for New Zealand Marine Farming Association.

Enclosed is an approximately 120 m long shore profile (Figure 1) depicting the western end of a proposed marine farm in Admiralty Bay. This profile was constructed from spot dive data which was collected from Point A to Point B depicted on Figure 2. No distances from shore in relation to habitats and substrata are therefore included.

The depths at which most substrata and habitats occurred was comparable to those recorded from a shore profile collected from the eastern end of the proposed marine farm (see full report by Davidson for the applicant). Notable exceptions were 1) the absence of a dead and broken shell/pebble zone at 9 m to 10 m depth; and 2) and absence of macroalgae at 10 m to 12 m depth at the western end of the proposed marine farm. Most importantly, the depths where rubble substrata terminated in a soft bottom habitat and the depth range of dog cockle beds were consistent along the entire length of the proposed marine farm (see full report by Davidson for applicant).

At the time of the initial survey (prior to Department of Conservation guidelines) a second profile was not collected due to the consistency of subtidal habitat and substrata patterns observed over the entire length of the proposed marine farm. Data presented in this appendix, constructed from notes made during this investigation depict this consistency.

R.J.Davidson

7/10/95

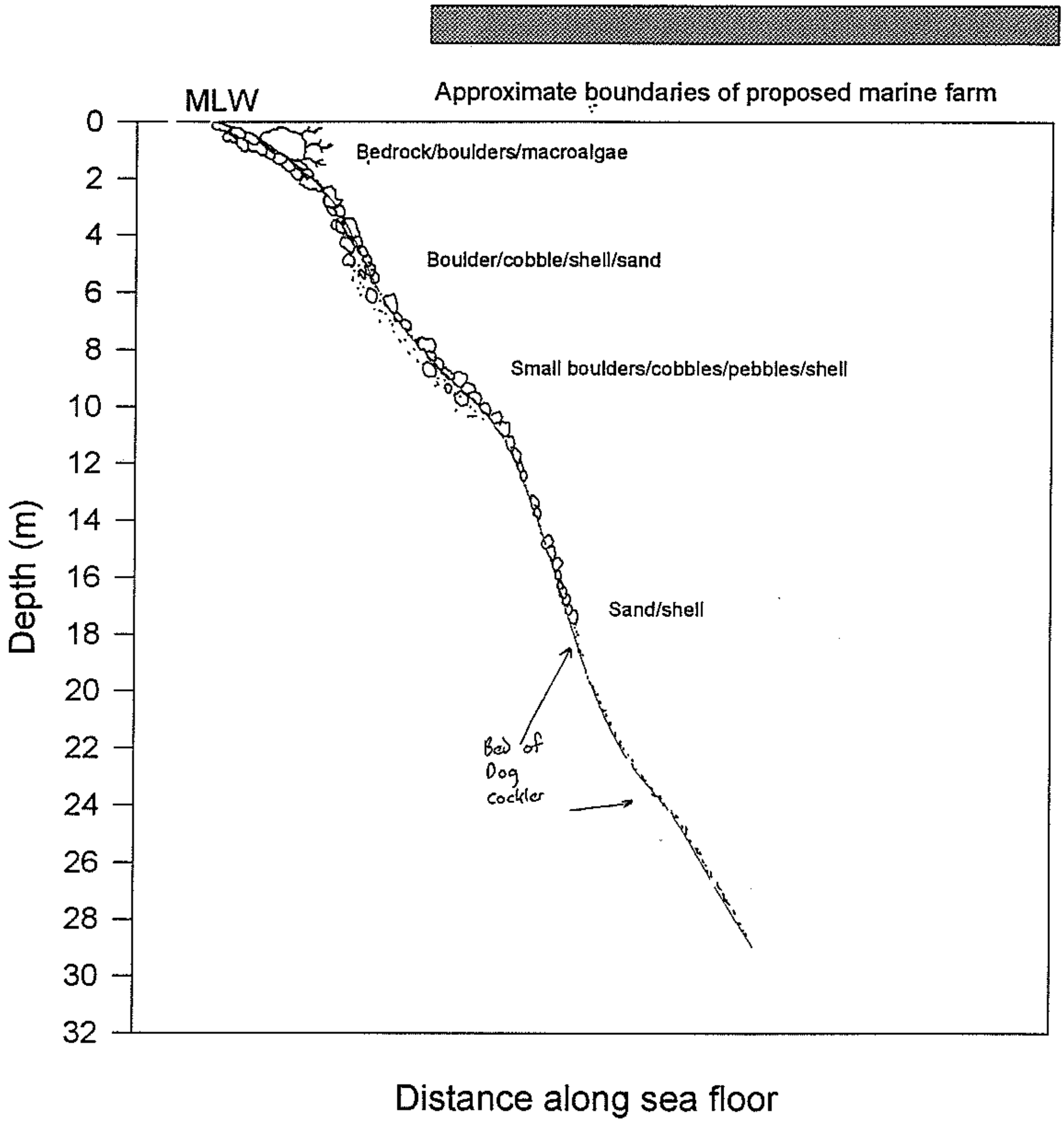

Figure 1 Subtidal shore profile, and substrata recorded from a spot dive at a proposed marine farm site east of Anchor Point, Admiralty Bay.

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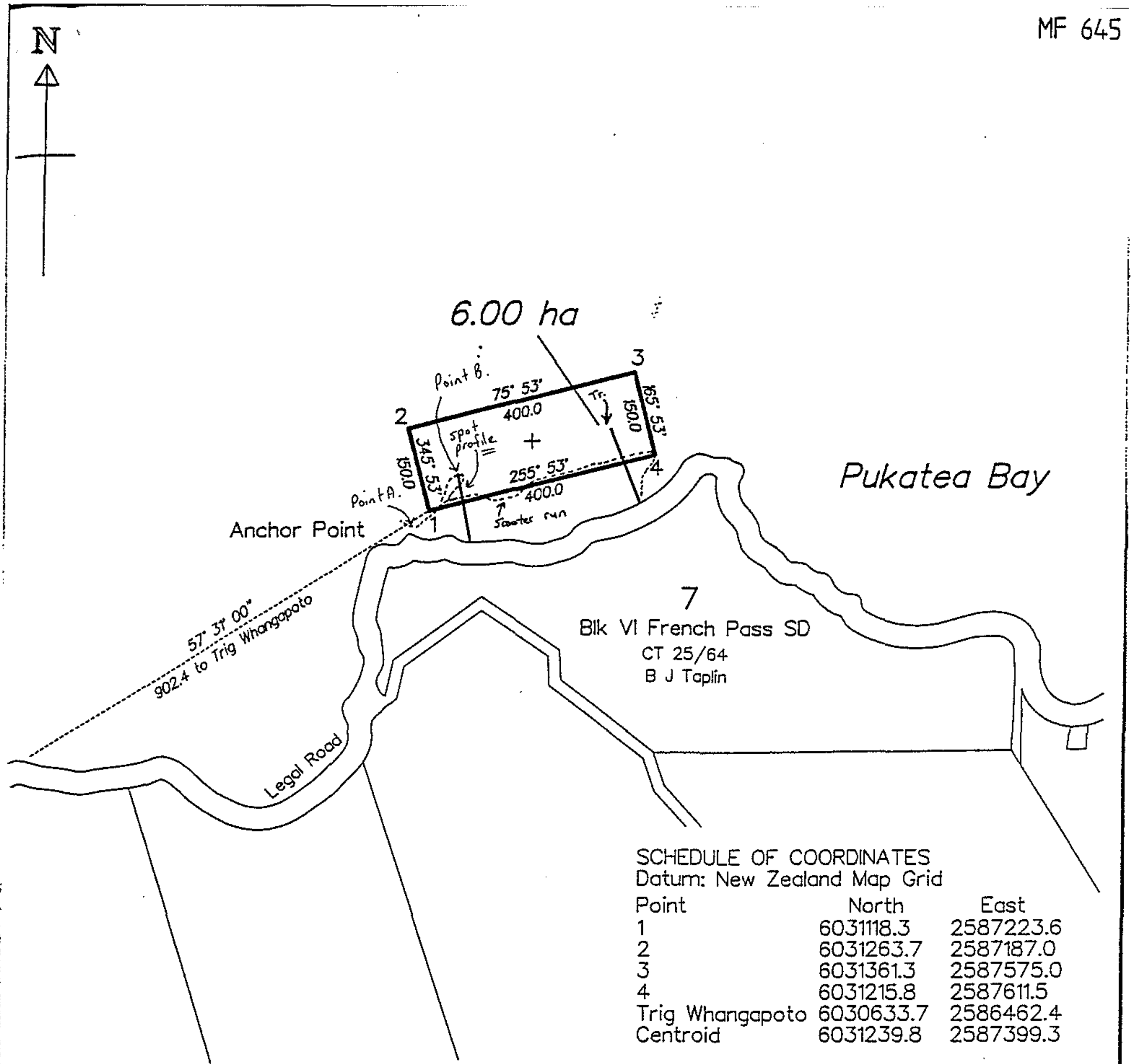

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Plan of Proposed Coastal Permit Spat Holding Site

NZ Marine Farming Assoc

Bearing variation Geodetic Datum 1949 to NZMG +11° 50"

SCALE 1:10,000

200 100 0 100 200 300 400 500 600 700 800 900 1000 metres

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Fig 2. Transect and scooter run.