COASTAL RESOURCES INVENTORY

UREWERA DISTRICT
WAIROA

UNIT ONE : FILE THREE
NUHAKA : PHYSICAL RESOURCES

FILE : COA 195

June 1988

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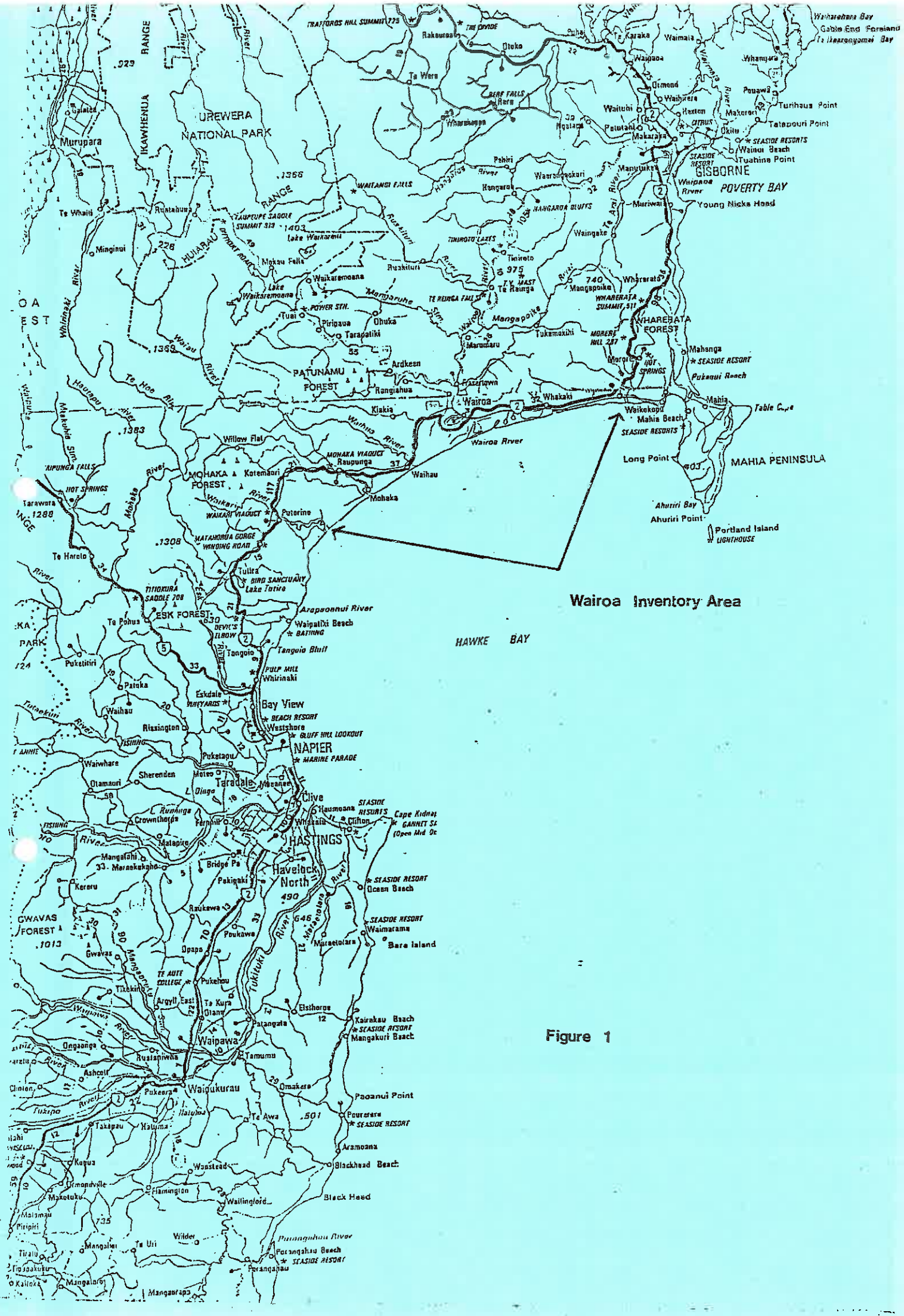
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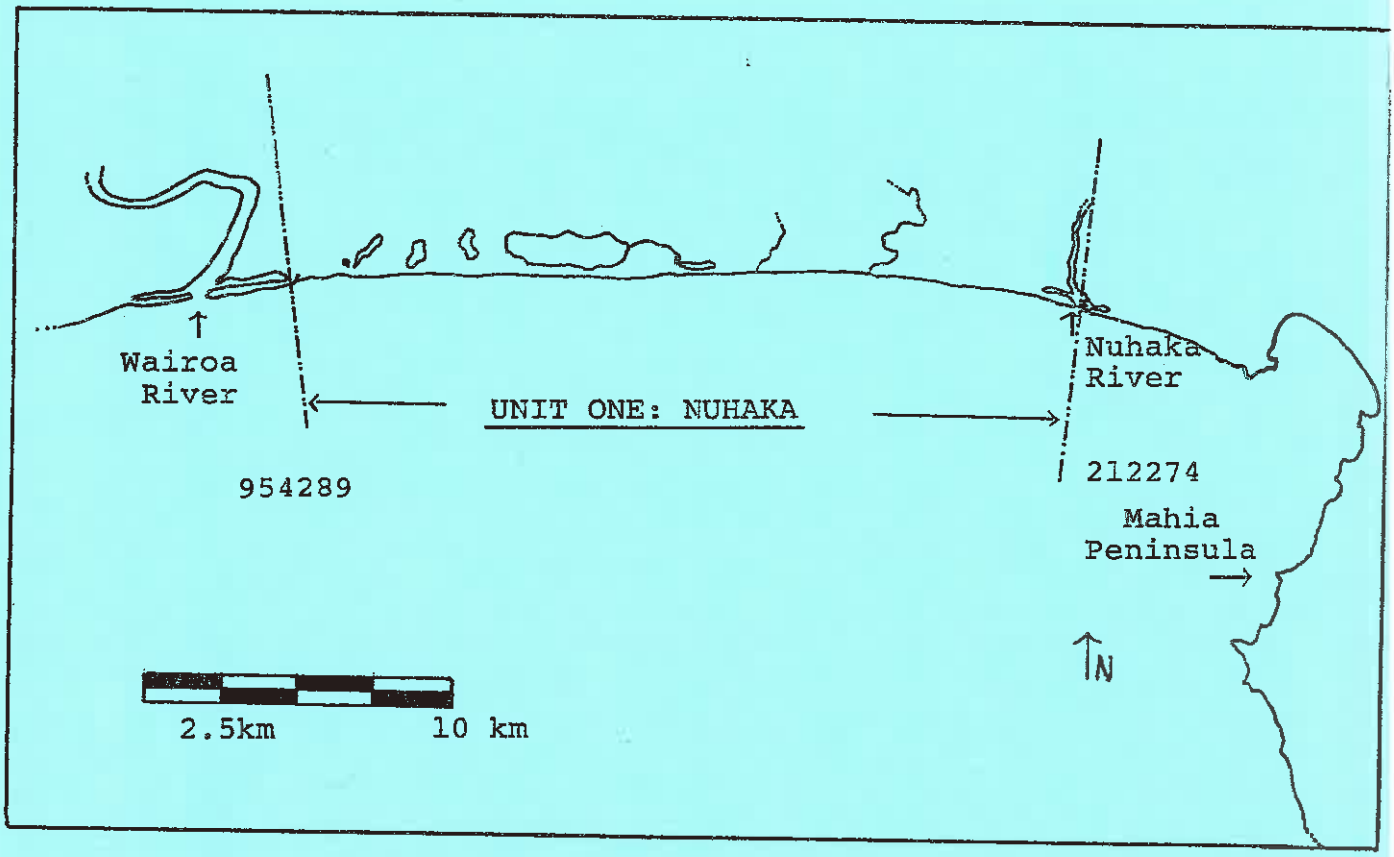


Map Ref. 1:25,000 Topoplot W 19 D X 19 D

Figure 2

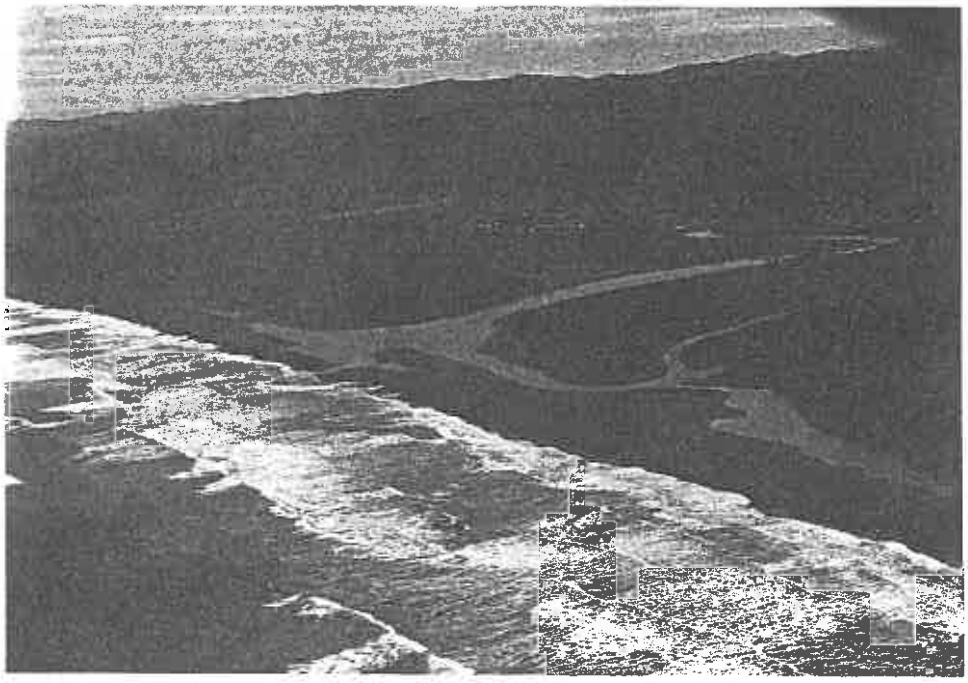
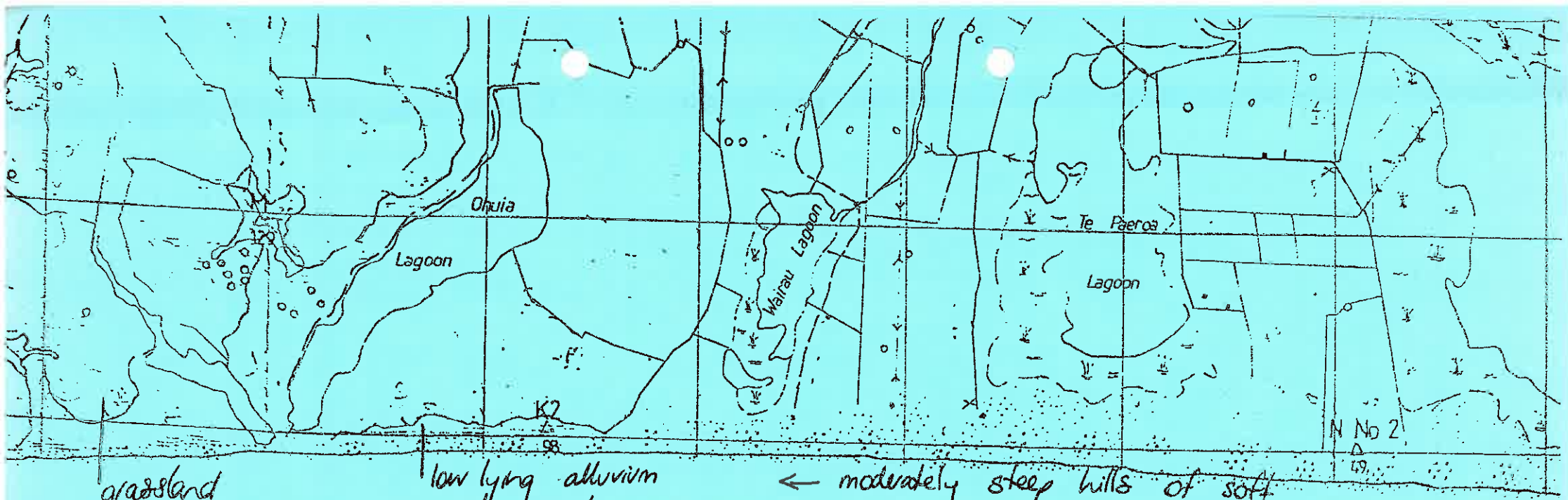


PLATE 2

Nuhaka River Mouth

Whakaki & Patangata


Ohuia
Lagoon
Wairau Lagoon
Te Paeroa
Lagoon
K2
98
N No 2
49
grassland
low lying alluvium and peat
high water table
← moderately steep hills of soft siltstone →
← 760 - 1000 mm annual rainfall →
Terrestrial
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Submarine
↑ direction of ocean swell and material transportation

Figure 3

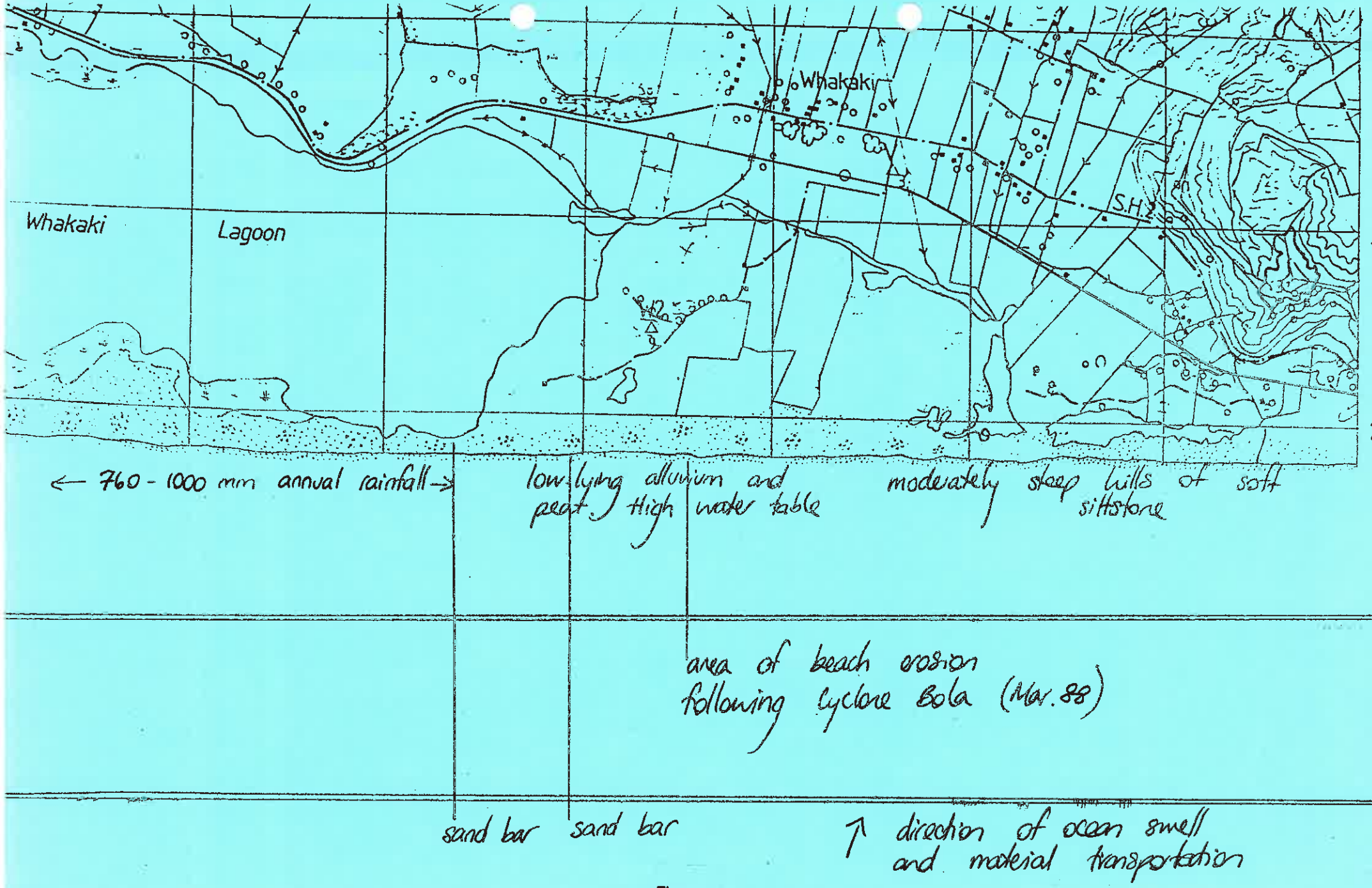
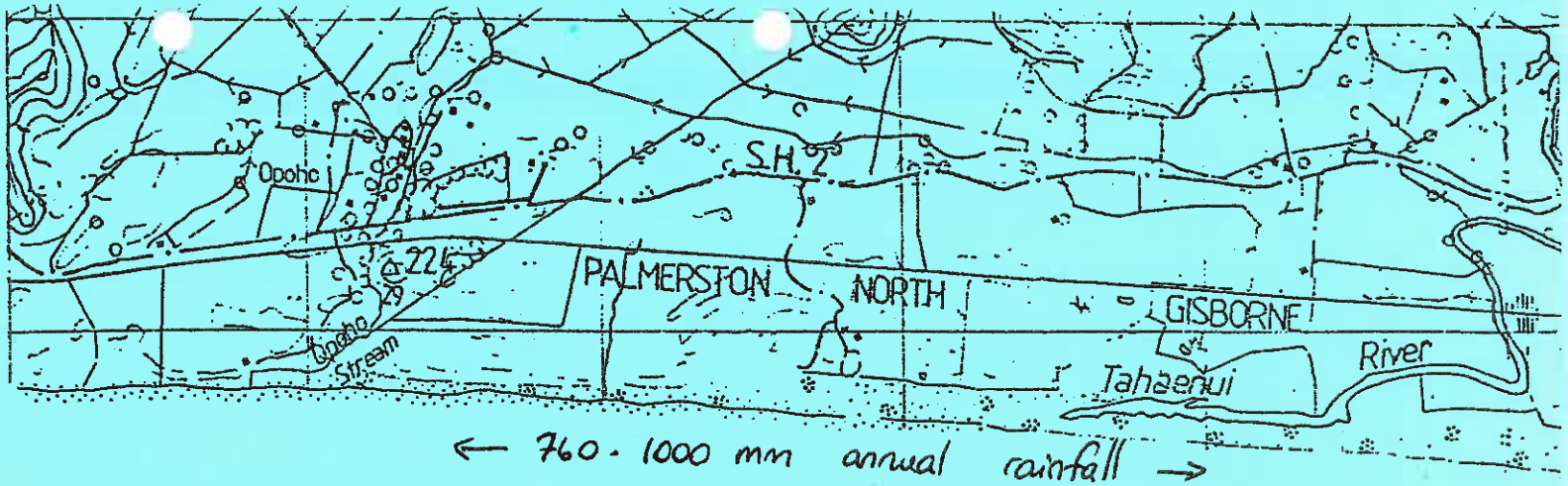

Whakaki
Whakaki
Lagoon
S.H.2
31
30
29
← 760 - 1000 mm annual rainfall →
low lying alluvium and peat. High water table
moderately steep hills of soft siltstone
area of beach erosion following cyclone Bola (Mar. 88)
sand bar
sand bar
↑ direction of ocean swell and material transportation
Terrestrial
Intertidal
Submarine

Figure 4



← 760 - 1000 mm annual rainfall →

Terrestrial

Intertidal

Submarine

↑ direction ocean swell and material transportation

Figure 5

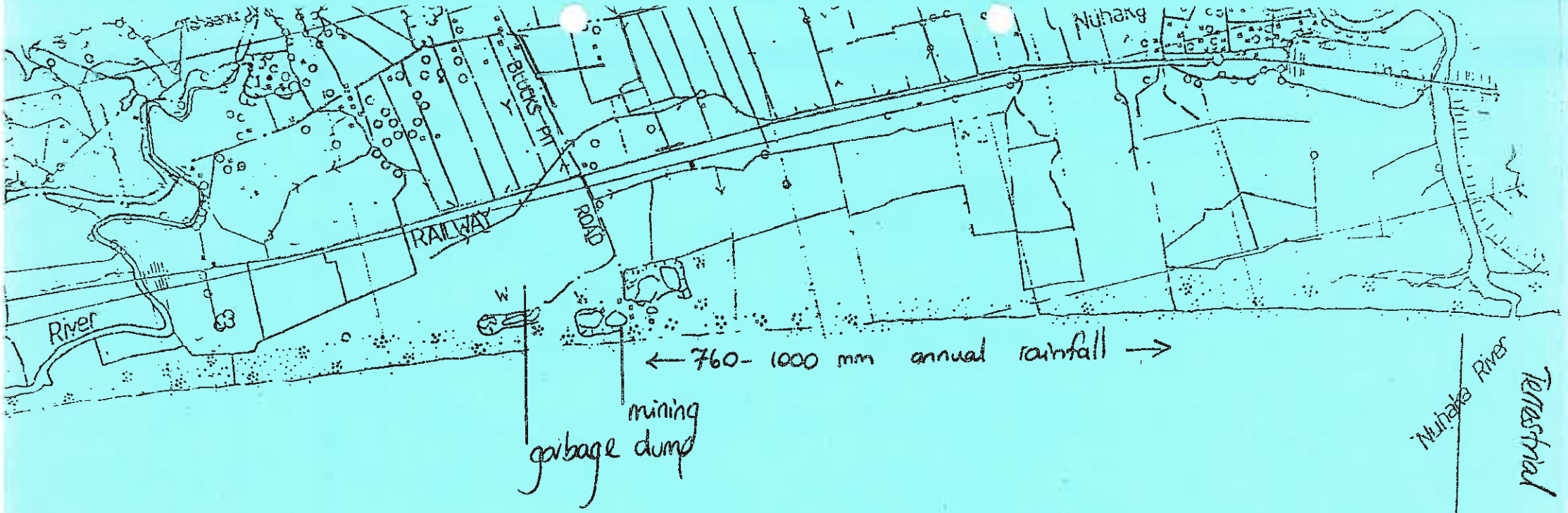

Nuhaka
BUCKS PIT
RAILWAY
ROAD
River
63
W
← 760- 1000 mm annual rainfall →
mining
garbage dump
Nuhaka River
Terrestrial
Intertidal
Submarine
food source of pumice and volcanic rock crystals to beach
↑ direction of ocean swell and material transportation

Figure 6

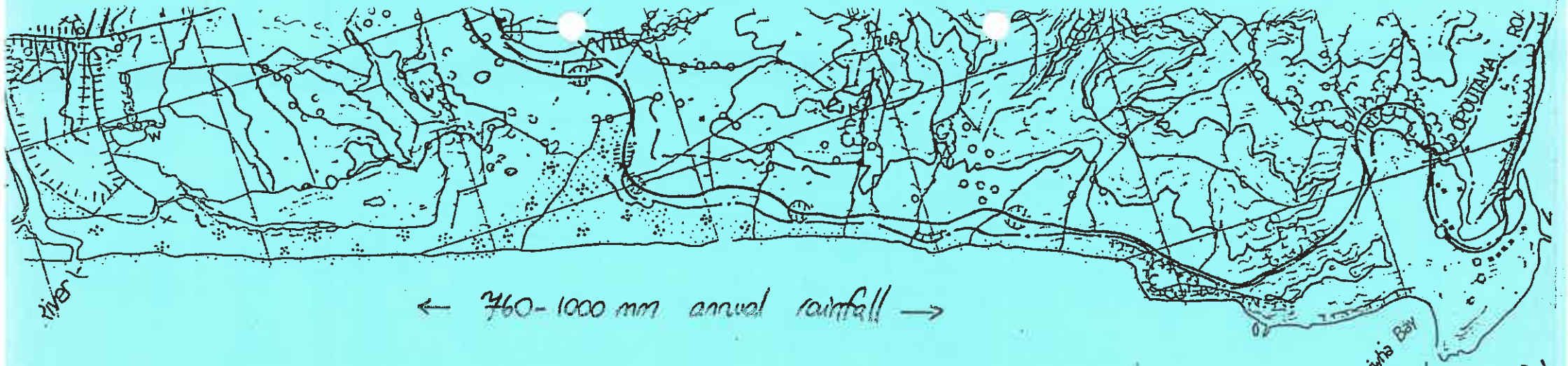

← 760-1000 mm annual rainfall →
Waitaniwha Bay
Terrestrial
Intertidal
Submarine
↑ direction of ocean swell and material transportation
reef system

Figure 7

1.0 FORM

1.1 Terrestrial

The shoreline depicted on any official map in New Zealand denotes Mean High Water Mark (MHWM).

The physiography of the Unit One area above MHWM is dominated by river and lagoon systems.

Rivers:	Nuhaka
	Tahaenui
Streams:	Waiatai (outlet of "little Ohuia"
	Waihorotuna)
Lagoons:	Waihorotuna
	Ohuia
	Wairau
	Karito
	Whakaki
	Patangata

The lagoons are set behind an area of rolling, unstable sand dunes with extreme wind erosion potential.

The area requires re-vegetation measures and stock control in order to prevent further coastal erosion. Present vegetation consists mostly of sedges, grassland, lupin, marram and blackberry.

The area between the Nuhaka and Tahaenui Rivers is dotted with small ponds and wetlands areas the size of which varies seasonally.

Whakaki and the smaller lagoons are set in moderately steep, fertile hills of soft siltstone; an area prone to severe soil slip erosion.
The lagoon areas themselves are in an area of low lying alluvium and peat with a high water table. The area between Ohuia and the Wairoa River bluff is mainly grassland, with low-lying alluvium and a high water table; an area where lagoon margins vary.

1.1.1 Geology

The coastal landscape has a basement of greywacke and argillite, draped with a thick blanket of younger sedimentary rocks. Problems of erosion arise from the softness of these later rocks.

The coastal lagoon and river flat areas have rich, versatile soils.

Land under 30m above sea level is confined to the lower Wairoa River Valley and the coastal plains to the East of Wairoa. This area is liable to flooding and has drainage problems.

Coastal soils, though they have a naturally high fertility, favour development of clayey textures. Changes in the native vegetation after pre-European and European settlement brought about falls in soil fertility.

The broad shape of the North Island is controlled by the position of hard rocks at its extremities. Hard igneous rocks form resistant bulwarks at North Cape, Cape Reinga, and Matakaoa Point, near East Cape. Similar resistant areas are found at Cape Brett, Great Barrier Island, Cape Colville, and the Wellington-Wairarapa coast where the rock is hard greywacke sandstone. Cape Egmont in contrast, is constructed from a large volume of volcanic lahars erupted from Mount Egmont. A protective apron of boulders from these lahars provides some resistance to erosion.

The west coast of the North Island has a relatively smooth outline, mainly as a result of the construction of spits across indented coastlines. Spits are well developed in the north, particularly the tombolo-like spits that join the North Cape area (Ninety Mile Beach) and Karikari Peninsula (Tokerau Beach) to the mainland. The northern harbours, as far south as Kawhia on the west coast and Ohiwa on the east coast are the result of a postglacial rise in sea level that drowned valley systems eroded during a glacial period. This rise in sea level of about 100 metres commenced some 15 000 years ago and reached its present level about 6000 years ago. During the rise, the northerly coastal drift progressively carried sand from the eroding Taranaki coast northwards possibly as far as Muriwai. In the central Bay of Plenty an abundant supply of volcanic material erupted inland has caused the coast to advance. Likewise a major flood of pumiceous ash brought down by the ancestral Waikato River about 20 000 years ago filled part of the low-lying Hauraki Gulf to form the Hauraki Lowlands.

South-eastwards from East Cape the coastal rocks are weak and the material that is sliding into the sea near Wairoa and Waimarama is being removed continuously. Hawke Bay is probably a downwarped area now emerging from the sea as evidenced by raised coastal terraces and the 1.8 metre uplift of Ahuriri Lagoon in the 1931 Napier earthquake. To the south the coast illustrates well the dual effects of faulting and tilting of the land. This is seen on the south Wairarapa coast at

surface but some are deep (with silt loam or sandy loam textures) overlying soft or fragmented rock at depths of three feet or more. The natural fertility ranges from very high to low according to the nature of the underlying rocks and of the native vegetation under which they were formed, and is commonly somewhat higher than that of related soils on the gentler slopes.

On the naturally fertile steepland soils, pastures grow satisfactorily in spite of problems of soil erosion. On the soils of low natural fertility, however, they are usually more difficult to establish and maintain, particularly where the soils are erosive, owing to the problem of controlling secondary growth which usually involves the concentration of stock with the aid of much subdivisional fencing. Consequently, on some of the less fertile, erosive soils, pastures should probably give way to afforestation or to protective forestry for soil and water conservation until satisfactory methods of pasture management are devised.

Soils of the Coastal Flats

The coastal flats north of Wairoa and the Wairoa River valley contain soils of high natural fertility and versatility and are suitable for the growing of lucerne, pumpkins, carrots, chaumoellier, grass and clover seed, wheat, mangolds, beans and barley. Two small areas on the Mahia Peninsula are listed as suitable for the growing of rape, choumoellier, barley, wheat, oats, red clover, subterranean clover, turnips and swedes.

Soils of the Terrace Lands

Terrace lands form a discontinuous border to both sides of the valley with the largest entire areas occurring at Ramoti and Frasertown. They are 100 ft above the level of the flood plain and resemble low hills with easy rolling surfaces. They are classified as Mohaka sandy loam.

The parent material is wholly rhyolitic volcanic ash sub-aerially deposited and including Taupo Pumice (8 in.) and Waimihia Lapilli (15 in.). The top 18in. is soft and loose and rests on older rhyolitic volcanic ash which is compacted into a pan. In winter the pan holds up the drainage waters and the surface soil can become waterlogged, but

1.2 Intertidal

In general terms the Hawke's Bay coastline is retreating. There are short term flutuations particularly in the alluvial beach areas. These fluctuations depend upon the frequency of storm events and erosion.

In the Whakaki - Patangata area following Cyclone Bola (March '88) were areas of beach erosion which created a more dramatic beach slope. In this area were noted patches of exposed medium sized gravel (ca. 1.5 - 3cm diameter) and also concentrations of similarly sized jasper.

1.2.1 Beach formation

Coarse gravel, if it is constantly exposed to beach movement, will soon be reduced in grade. Fine gravels, especially sand, are of more lasting properties.

Beach gravel in this area is of uniform greywacke* rock. This produces the "black sand" appearance.

(hardened silty sandstone)*

Beach gravel from Mohaka decreases in size in direct proportion to the distance from source.

At Whakaki the pebble size is considerably reduced (coarsest 2.0 - 3.4mm). Most pebbles are well polished, especially the jasperoid shale which is the hardest constituent.

At Nuhaka the pebbles are smaller (coarsest 0.84 - 2.0mm). They are well-rounded and polished, though some angular forms are found. The material is mostly monomineralic; 25% consists of volcanic rock crystals - new recruits for the beach.

At Waitaniwha (outside the Wairoa subdistrict) the pebbles are smaller still (coarsest 0.59-0.84mm).

Much of the coarse material contributed to the beach is eliminated by wave action. Pebbles larger than half an inch diameter are worn flat in this Unit. Any smaller than this are worn round.

Until the gravel becomes very fine all the smaller grades owe their smallness to impact, rather than abrasion. The action of impact, because of the heavy surf, maintains limits of grades between proportions of 5 to 1. That this is due to impact is shown by the finest grade anywhere always being angular.

(Ref: Marshall see File 1 6.0 References)

Sand, in New Zealand, is produced by the weathering action of atmospheric agents on surface rocks. Quartz and other more resistant minerals are by this action separated from those minerals that are subject to destruction by weathering. Grains of these stable minerals are carried by rain water to streams and then transported as sand to the coast. In the North Island the majority of beach sand is derived almost entirely from pumice sands, consisting mainly of crystals of feldspar with 25% quartz with some hypersthene and often hornblende.

Sand is not formed by beach action when there is gravel on the beach. Coarse sand is formed from gravel as a final result of abrasion after prolonged drift from the source of supply and long after coarse gravel is eliminated.

The more exposed a beach is the coarser the sand, as fine particles are lost in heavy weather and in suspension. Sand too is coarser at low tide than at high tide level.

1.3 Submarine

The main water current washing the Hawke's Bay coast is that of the colder Canterbury current.

(Ref. Morton & Miller 1968. The New Zealand Sea Shore pg. 336)

Offshore from the area between Whakaki and Patangata is apparently a sand bar (ca. 20m offshore) as waves break twice here before reaching the shore.

In general terms material is transported South to North by wave action and littoral drift. The coastal current moves at ca. 1 knot from South to North with the flood tide.
The tidal range in Hawke's Bay is small; not more than 4 ft.

The beach is fully exposed to heavy oceanic swell from the South and East but protected from the North in the lee of Mahia Peninsula. The SE swell is particularly heavy and nearly always breaking on the beach in this area. At the NE end of Hawke's Bay the period of swell is as much as 15 seconds with a wave length of 1152 ft and velocity of 76 ft per second.

(Ref. Marshall)

Wave action along this rough shoreline quickly eliminates coarse material brought by rivers. Within this Unit the Nuhaka River contributes a minute amount of beach sand derived from volcanic mineral crystals. This contributory effect from the Nuhaka is almost insignificant.

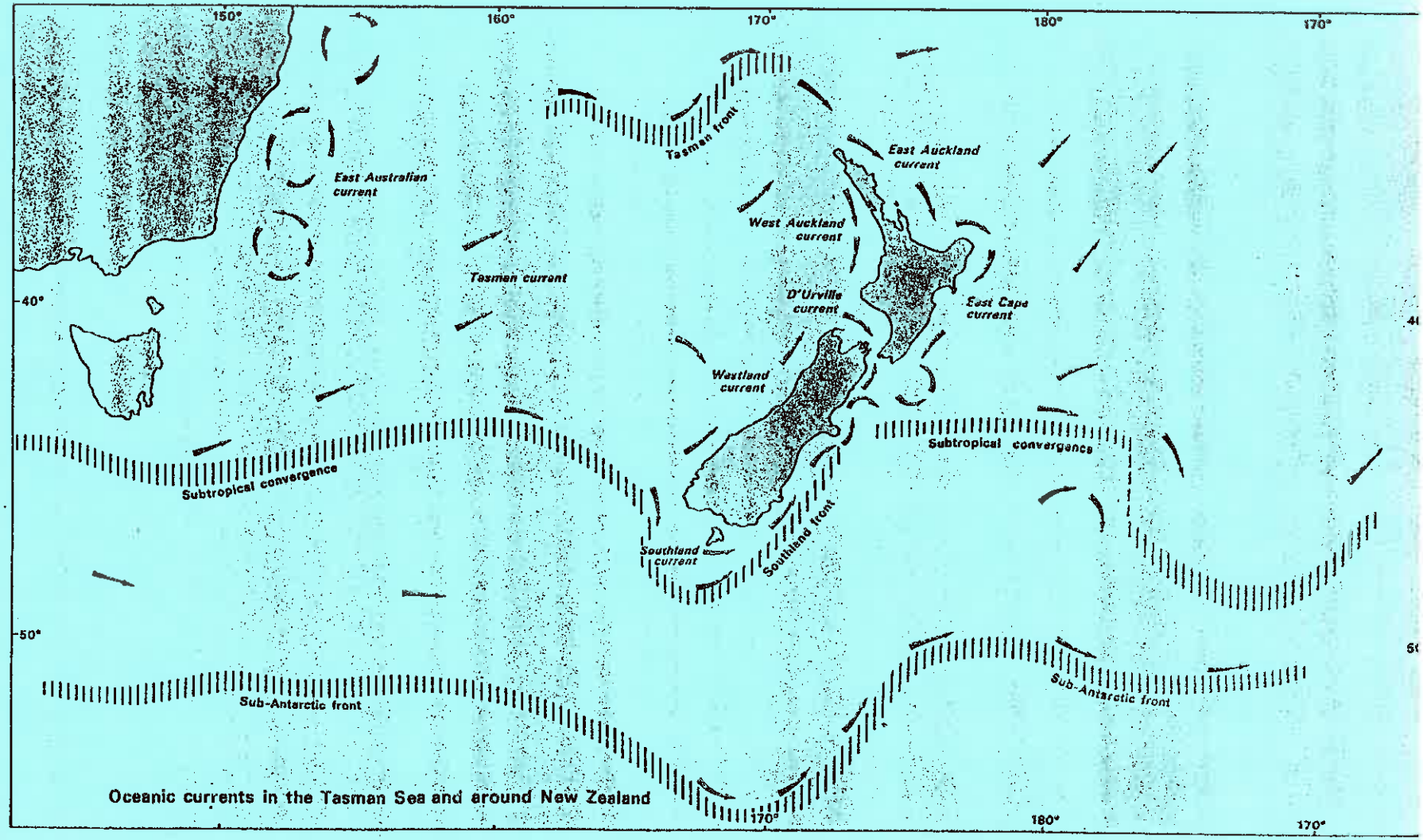
The beach profile in this Unit is steep with no outlying rocks or reefs. Coastal sediments are mainly medium to fine sized sand with mud having a subsidiary fraction of less than 20%. Volcanic particles off Nuhaka (pumice, etc) constitute less than 5%. Offshore from Ohuia granules and coarse sand constitute less than 20% of the sediment.

(Ref. NZ Oceanographic Institute Coastal Sediments map -Mahia)

EASTERN COASTS Flow around southern New Zealand contributes to the north-going *Southland Current* which moves along the east coast of the South Island. The current branches near Kaikoura. One branch moves offshore, the other continues northwards along the Marlborough coast, crosses the Narrows towards Wellington and then east around Cape Palliser. It may, on occasions, extend northwards along the east coast as far as Hawke Bay.

Two other currents are found off the east coast of the North Island. Between North Cape and East Cape is the south-eastward flow of the *East Auckland Current*, derived from the general eastward flow in the northern Tasman Sea which has passed around the northern tip of New Zealand. On approaching East Cape, part of this current is deflected offshore and part rounds East Cape to flow southwards along the coast as the *East Cape Current*. It passes seaward of the *Southland Current* and continues to about the latitude of Cape Campbell, (41°S), where it first turns east, and later north, to form a large anticyclonic eddy with a radius of 50-100 km. Its southwards excursion is limited by the Chatham Rise, a relatively shallow seabed feature which also determines the position of the sub-tropical convergence.

It has not been possible to quantify the currents shown on the maps since meteorological effects, tidal currents, and other forces can greatly modify the basic circulation. These water motions include wind-waves, swell, wind-induced currents, and storm surges. Variations in river outflows and land water run-off can also modify local circulation in coastal waters.



Oceanic currents in the Tasman Sea and around New Zealand

Figure 8

2.0 WATER

Water Quality is not assessed in the Unit One area. There are no discharges in to the sea or wetlands. However the areas where there is sand winning should be monitored.

The garbage dump at Bluck's Pit Rd should also be examined, probably as a District Council responsibility, for seepage and nutrient levels.

Water Quality checks on Primary River monitoring are carried out periodically by the Hawke's Bay Catchment Board. (contact Vicki Hansen for more information).

3.0 CLIMATE

Sheltered from the West by the Urewera mountain ranges, the whole Hawke's Bay region is protected from the predominantly westerly winds which flow over the North Island. This contributes to a generally sunny climate with mild winters. Cyclonic depressions which may form either in the tropics or in the Tasman sometimes pass near Hawke's Bay, giving winds from an easterly quarter and occasionally extremely heavy rainfall. This is accentuated by the vertical motion of the moist air stream forced over the high ground by onshore winds.

Temperatures are also effected by the mountain shelter. Reduced cloudiness, increased sunshine by day and readiation cooling at night create larger daily ranges of temperatures than on the West coast.

Mean Daily Range at Wairoa (C)

January 18.9
July 16.4

3.1 Meteorological Information

The nearest meteorological office with half hourly reports is at Gisborne aerodrome

ph. (079) 81221, 81224.

Weather information is also available from the Electrocorp Office in Wairoa, who monitor weather, wind and rain forecasts.

ph. (0724) 6101

Rainfall gauges and fire control reports are monitored at the Urewera National Park (Aniwaniwa)
ph. TUB 803
and Morere Scenic Reserve
ph. NK 861
The electrical station at Tuai also records rainfall.
ph. TUB 880.

3.2 Coastal Rainfall

Rainfall is variable due to episodic storm events. Dry spells during the equinox often cause near drought conditions. In winter high intensity rainfall over long periods produces large amounts of runoff and consequent flooding. Rainfall increases from 760-1000mm on the coast to 2500mm in the high country.

At Wairoa coastal rainfall has been measured at 1200mm annually, with 40 - 45% of the annual total occurring between May and August.

3.3 Wind

The sheltering effect of the mountains gives reduced cloudiness and at night high percentages of clear skies. Along the coast sea breezes occur in all seasons except winter. Winds also tend to be channelled down river valleys.

Wind tends to be NW - SE primarily because of funnelling effects of Hawke's Bay to the south and the Kaimanawa - Huiarau divide to the West.

3.4 Storm Events

Onshore storms often swell up from the South and SouthEast where the coastline is unprotected. Very rough swells develop, often closing river bars or at least building up sand bars at river mouths.
Flood conditions and heavy storms bring large amounts of debris, wood, dead stock, etc down rivers and on to the beaches. Cyclone Bola (March 1988) saw devastating flooding and damage to the Wairoa area; the worst since the 1985 floods.

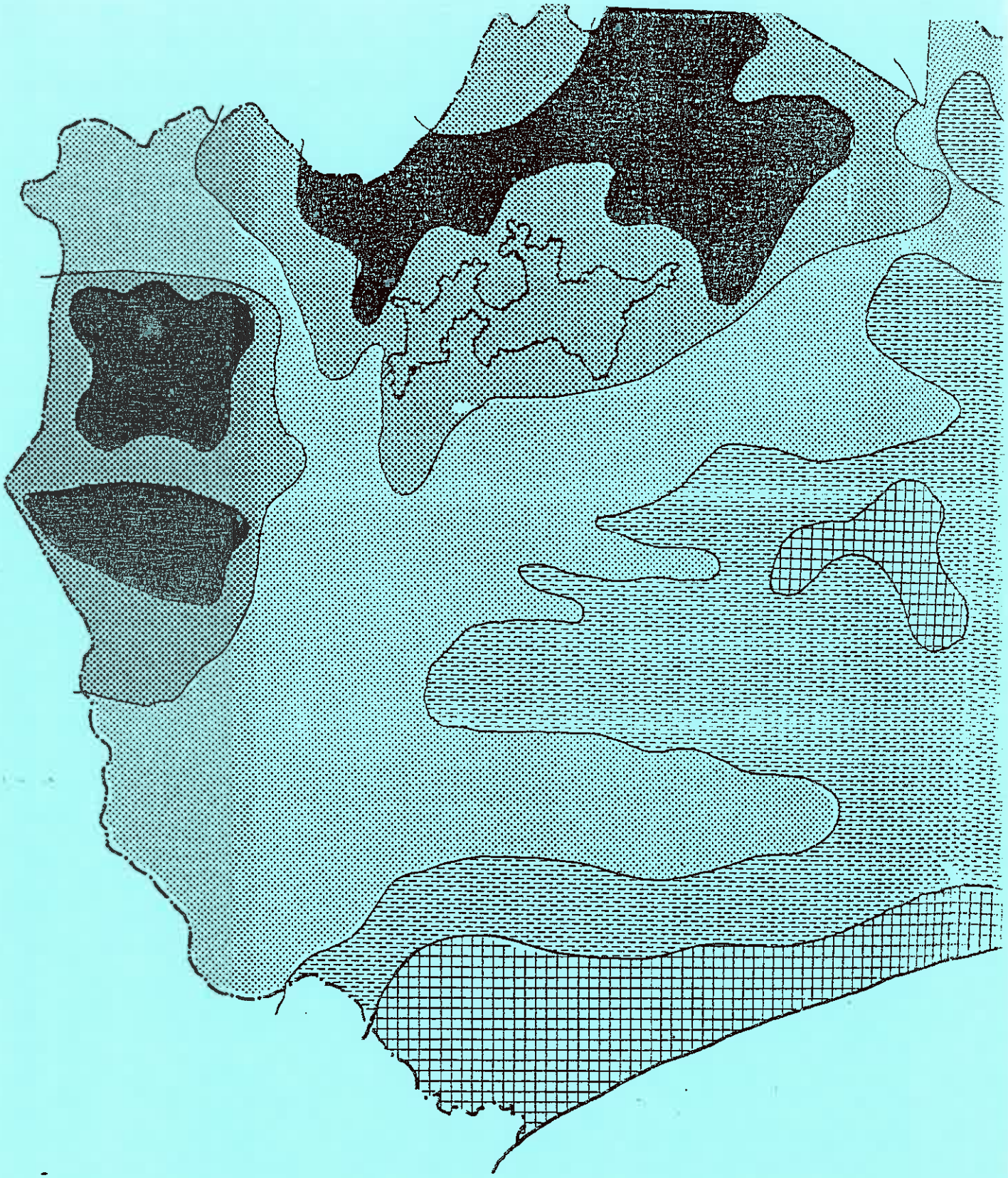
WIND

When a wind blows over calm water, ripples are formed because of friction between the moving air and the water surface. As the ripples become larger, friction is supplemtented by the pressure of the wind on the surface of the water slopes. The undulations build up into waves whose maximum height depends upon the wind's speed, duration, and fetch—the distance over which it blows.

New Zealand is situated well away from other land masses and lies in the path of westerly winds which prevail between latitudes 30°S and 70°S. As a consequence of the prevailing winds and the fetch conditions, New Zealand has a high energy wave climate, dominated by west and south-west storm waves. The west and south coasts can be classified as high energy shores. On the east coast, south of East Cape, the prevailing deep water wave is southerly and this coast is classed as a high energy lee shore. Parts of the coast are comparatively sheltered and are considered as low energy shores. These areas include the west Wellington coast, the northern coast of the South Island, the northern aspects of the Otago, Banks and Kaikoura Peninsulas, and Capes Campbell and Kidnappers. The north-east coast, between North Cape and East Cape, is considered a low energy lee shore. Earthquakes, volcanic eruptions, massive landslides, and other earth movements can also generate water movements. These waves, known as tsunamis, vary from a few centimetres to many metres in height.

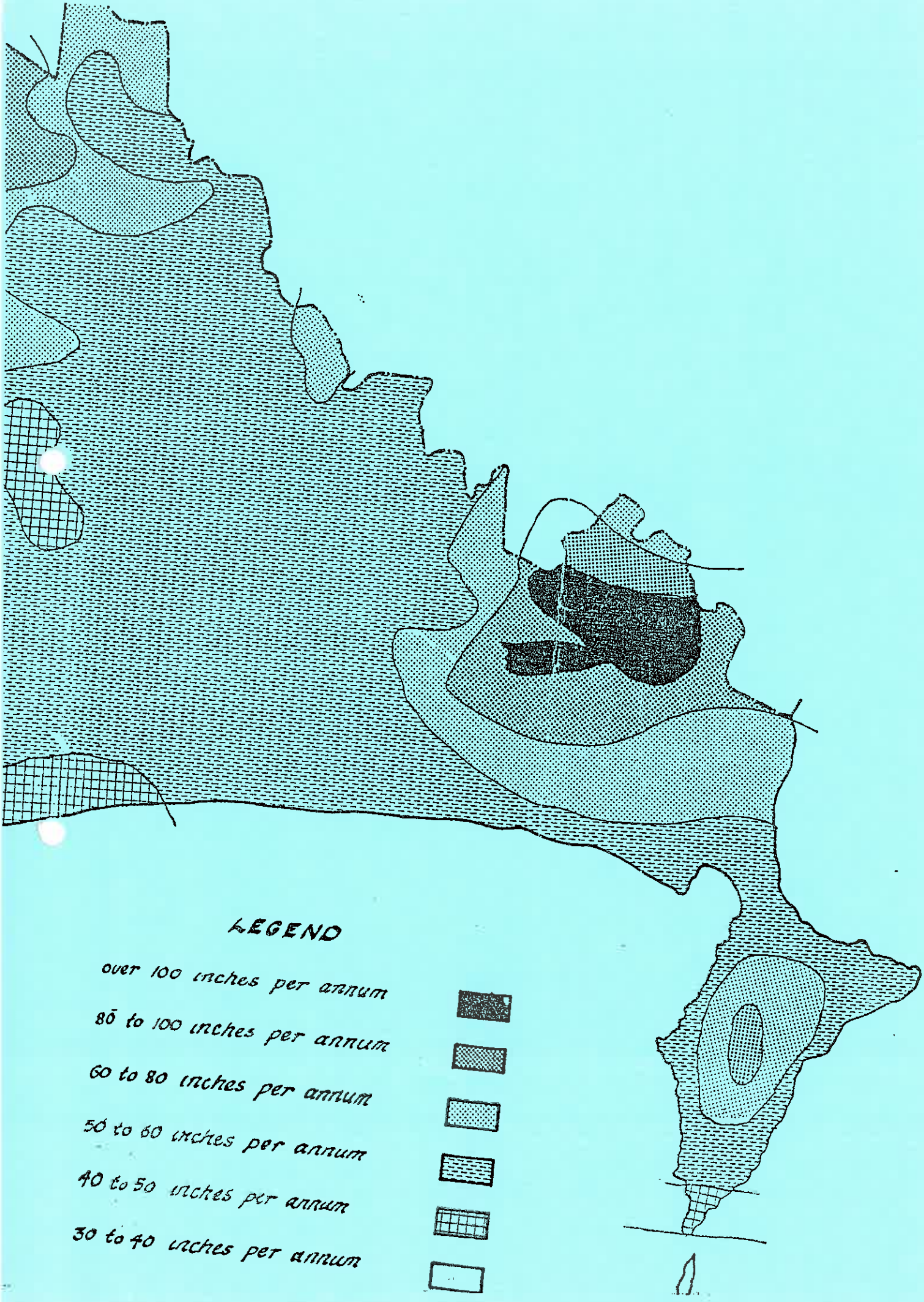
Water movements associated with waves result in a small net drift of water in the direction of the wave advance. This occurs because, in shallow depths, the water particles in a wave do not traverse a closed circle, but follow an open orbit. When waves break along a shore, a hydraulic head is established, and the water must return seaward. It can return directly, or it can flow along the shore as a current inside the breaker zone. It returns seaward in relatively narrow zones, in the form of rip currents. When waves approach a shore at an angle, and the in-shore end of the wave front is in shallower water than the rest of the wave front, wave speed at the in-shore end becomes relatively slower, and the waves are bent, or refracted. As a result, waves tend to align with depth contours and to parallel the shore. In reality however, they usually break at a slight angle to the shore and this results in a slow movement of water along the shore inside the surf zone. This is called a littoral current and can result in the longshore drift of sediment.

Currents in the upper layers of the ocean are mainly wind-driven and, if there were no continental land barriers, water movement would be mainly zonal in direction, as in the West Wind Drift around Antarctica. In effect the basic pattern of circulation in each ocean is a nearly-closed gyre. These gyres are formed because the currents are turned by land barriers and Coriolis force.



RAINFALL CONTOURS WAIROA COUNTY

Figure 9


LEGEND
over 100 inches per annum
80 to 100 inches per annum
60 to 80 inches per annum
50 to 60 inches per annum
40 to 50 inches per annum
30 to 40 inches per annum

COASTAL RESOURCES INVENTORY

UREWERA DISTRICT
WAIROA

UNIT TWO : FILE THREE
WAIROA : PHYSICAL RESOURCES

FILE : COA 195

June 1988

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1.3 Submarine

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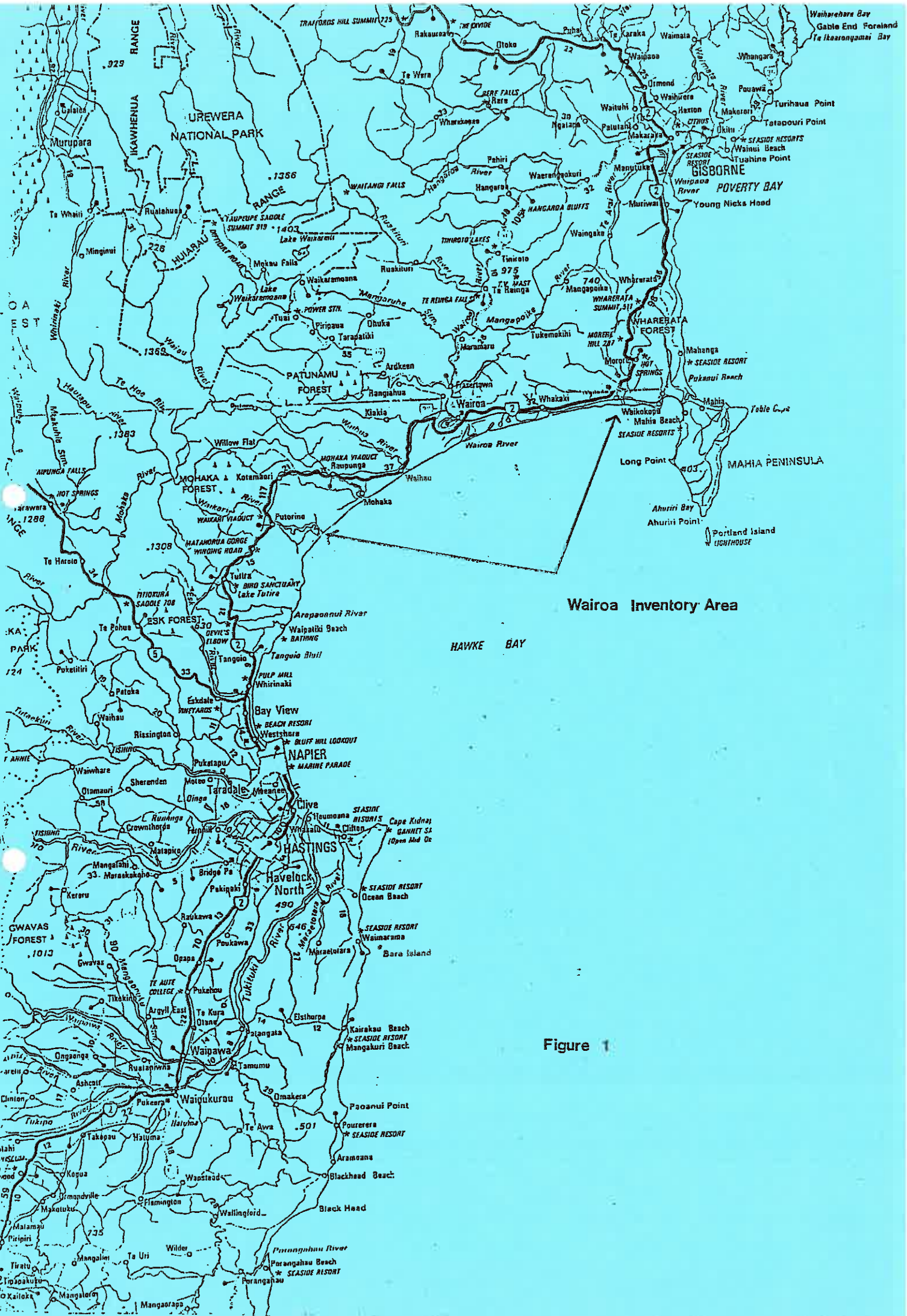
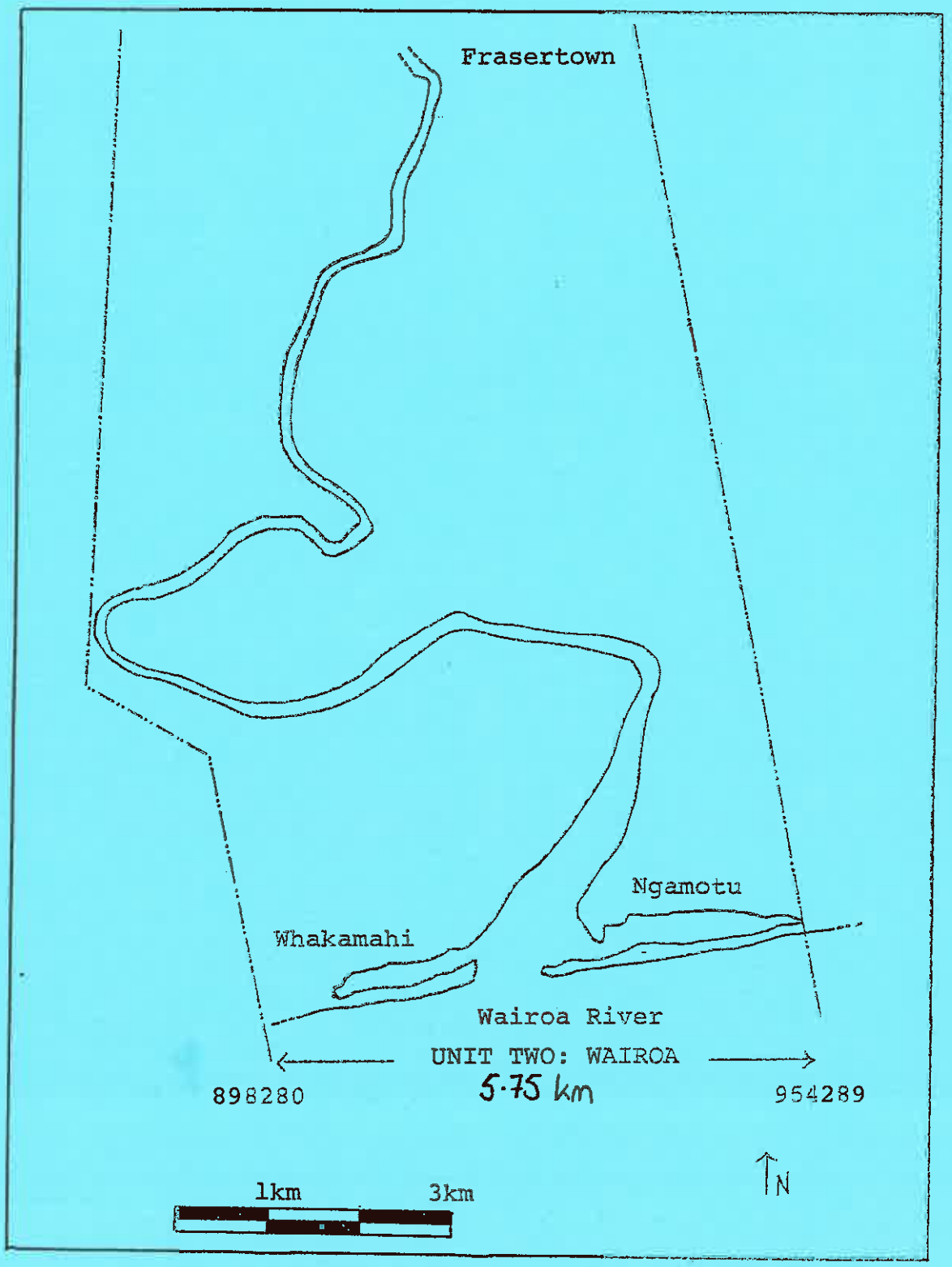
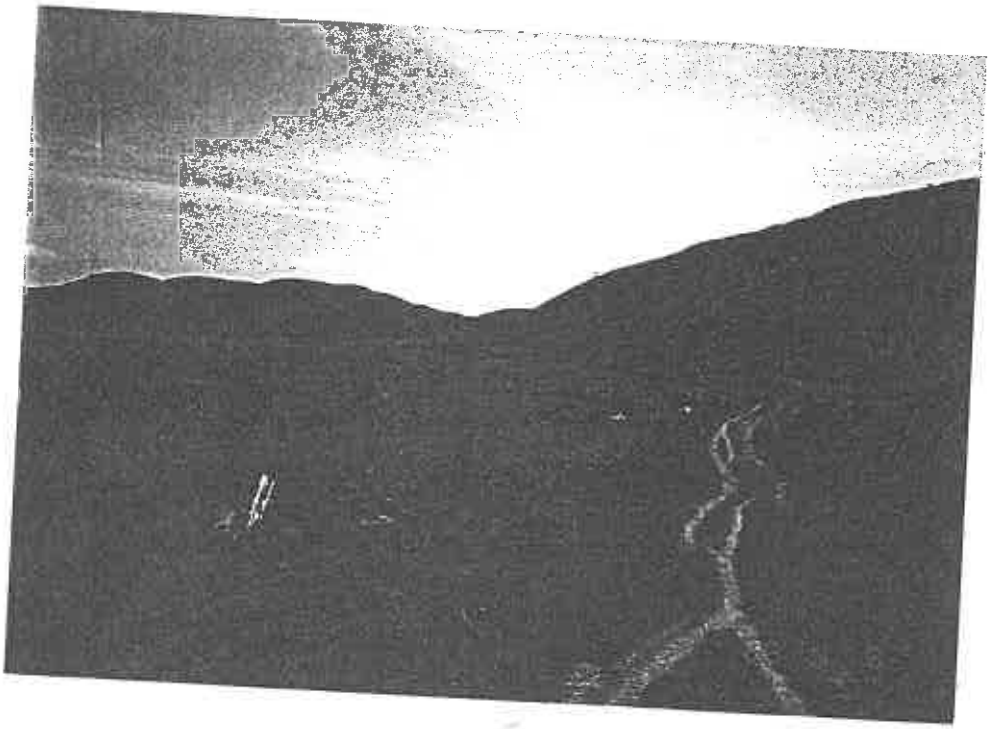

Wairoa Inventory Area
HAWKE BAY
Figure 1



Map Ref. 1:25,000 NZ Topoplot W 19 D, X 19 D

Figure 2



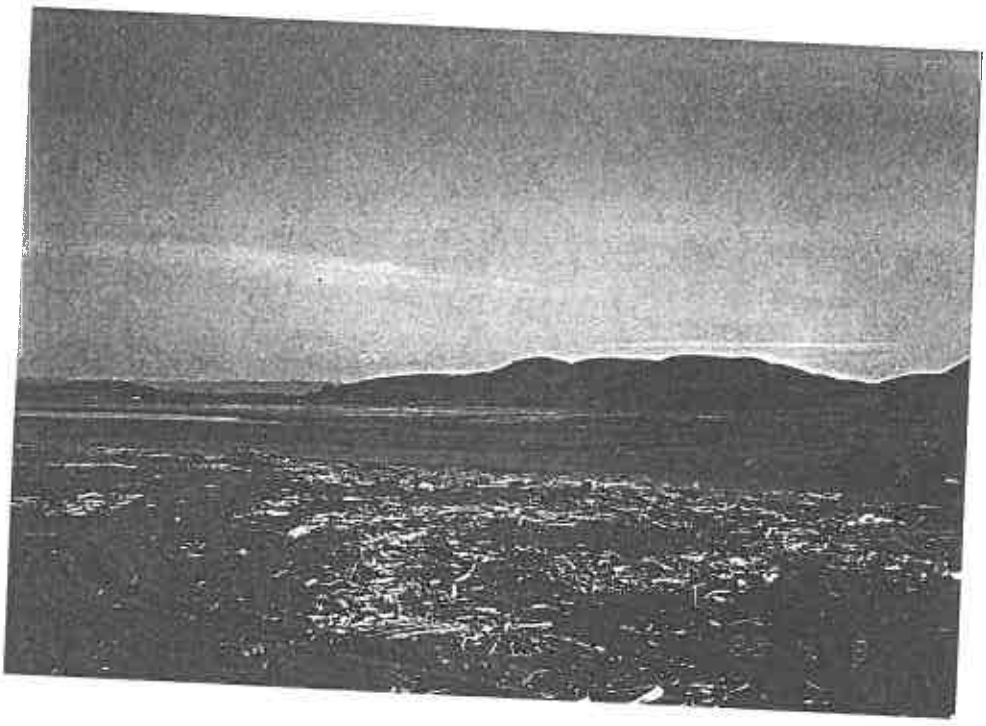
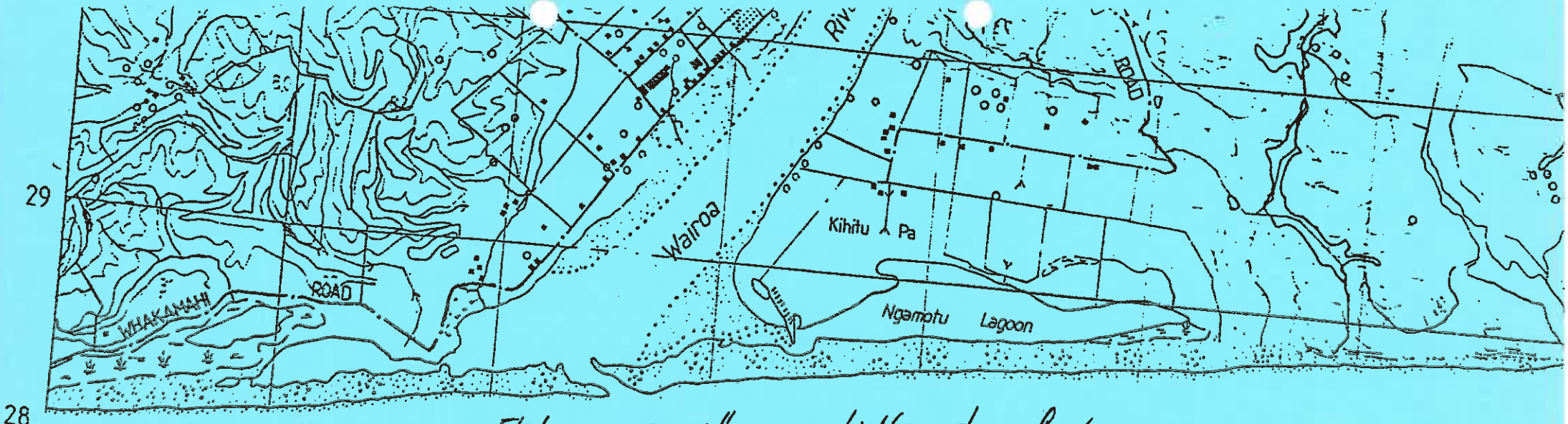


PLATE 2

Ngamotu Lagoon



Flat river valley - liable to flooding

Moderately steep farm hills of soft siltstone

ca. 1200 mm annual rainfall

TERRESTRIAL

Figure 3

1.0 FORM

1.1 Terrestrial

The shoreline depicted on any official map in New Zealand denotes Mean High Water Mark (MHWM).

The Unit Two physiography and boundaries are defined by the Wairoa River.

The river, part of the outlet system of Lake Waikaremoana, lies in a flat valley liable to flooding. The soils have some drainage problems but are generally fertile and versatile. In the river terrace area there is a slight wetness limitation due to slow subsoil drainage.
On both sides of the Wairoa River mouth are narrow estuarine areas behind the beach foredunes; Ngamotu and Whakamahi. The Ngamotu lagoon is set before rolling farm hills whilst the hills flanking Whakamahi are steeper.
Between the farm grasslands and the lagoons are areas of sedge (notably *Scirpus americanus* - an indicator of saline conditions), scrub and smaller dune covering plants.

The Whakamahi area is commonly dry from November through to March.

1.1.1 General Geology

The area has a basement of greywacke and argillite*, draped with a thick blanket of younger sedimentary rocks. These rocks often cause problems with erosion because of their softness. The river flat soils are recent; derived from alluvium.

**a rock whose degree of induration, ie hardness caused by heat or pressure, is higher than mudstone but less than shale.*

1.1.1 An historical View

Ted Peka at Ngamotu remembers the Ngamotu area before the 1931 earthquake. He believes the earthquake uplifted the channel and drained the lagoon. He states prior to this time the Ngamotu area was a real lagoon with a deep central channel.

surface but some are deep (with silt loam or sandy loam textures) overlying soft or fragmented rock at depths of three feet or more. The natural fertility ranges from very high to low according to the nature of the underlying rocks and of the native vegetation under which they were formed, and is commonly somewhat higher than that of related soils on the gentler slopes.

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Soils of the Coastal Flats

The coastal flats north of Wairoa and the Wairoa River valley contain soils of high natural fertility and versatility and are suitable for the growing of lucerne, pumpkins, carrots, chaumoellier, grass and clover seed, wheat, mangolds, beans and barley. Two small areas on the Mahia Peninsula are listed as suitable for the growing of rape, choumoellier, barley, wheat, oats, red clover, subterranean clover, turnips and swedes.

Soils of the Terrace Lands

Terrace lands form a discontinuous border to both sides of the valley with the largest entire areas occurring at Ramoti and Frasertown. They are 100 ft above the level of the flood plain and resemble low hills with easy rolling surfaces. They are classified as Mohaka sandy loam.

The parent material is wholly rhyolitic volcanic ash sub-aerially deposited and including Taupo Pumice (8 in.) and Waimihia Lapilli (15 in.). The top 18in. is soft and loose and rests on older rhyolitic volcanic ash which is compacted into a pan. In winter the pan holds up the drainage waters and the surface soil can become waterlogged, but

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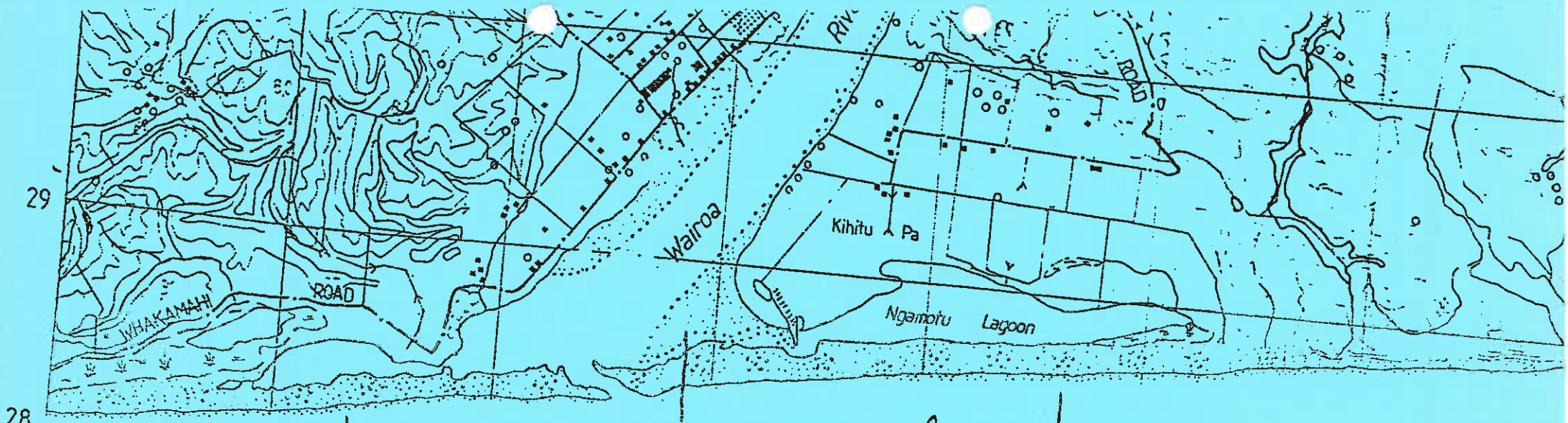


Whakamahi lagoon

Some contribution from river gravel to beach composition.

Ngamotu lagoon

INTERTIDAL

Figure 4

PLATE 3

Wairoa River Mouth

Wairoa bar from Pilot Hill

1.2 Intertidal

In general the Hawke's Bay coastline is retreating, though there are some short term fluctuations particularly in the alluvial beach areas such as the Wairoa River area. This action depends upon the frequency of storm events and erosion.

1.2.1 Beach Formation

Coarse gravel, if it is constantly exposed to beach movement, will soon be reduced in grade. Fine gravels, especially sand, are of more lasting properties. Beach gravel in this area is of uniform greywacke * rock. This produces the "black sand" appearance.

*(*hardened silty sandstone)*

Beach material from the Mohaka food source decreases in grade in direct proportion to its distance from source. The contribution of fine material from the Wairoa River is not significant to the beach content.

At the Wairoa River mouth the dominant grade of pebble is 0.84 - 2.0mm diameter. Fresh angles are not common. The coarsest diameter was 6.3mm and flattened in shape.

Much of the coarse material contributed to the beach is eliminated by wave action. Pebbles larger than half an inch diameter are worn flat in this area. Any smaller than this are rounded.
Until the gravel becomes very fine all the smaller grades owe their smallness to impact rather than abrasion. The action of impact, because of the heavy surf, maintains limits of grades between proportions of 5 to 1. That this is due to impact is shown by the finest grade anywhere always being angular.

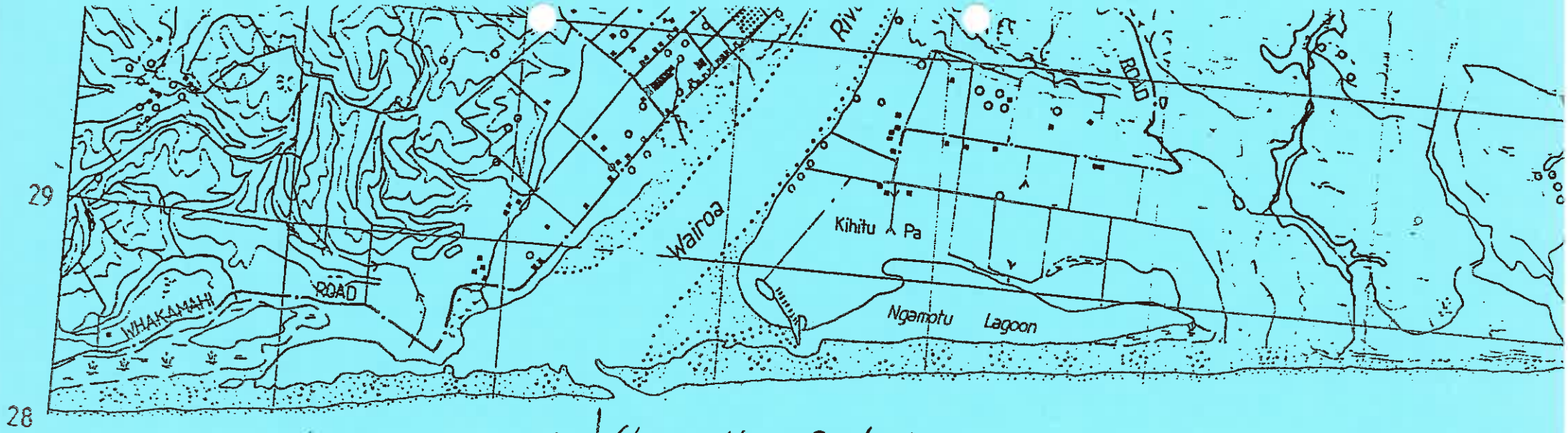
(Ref. Marshall)

Sand, in New Zealand, is produced by the weathering action of atmospheric agents on surface rocks. Quartz and other more resistant minerals are by this action separated from those minerals that are subject to destruction by weathering. Grains of these stable minerals are carried by rain water to streams and then transported as sand to the coast. In the North Island the majority of beach sand is derived almost entirely from pumice sands, consisting mainly of crystals of feldspar with 25% quartz with some hypersthene and often hornblende.*

**hypersthene: a mineral of the pyroxene group,*
hornblende: a mineral of the amphibole group.

Sand is not formed by beach action when there is gravel on the beach. Coarse sand is formed from gravel as a final result of abrasion after prolonged drift from the source of supply and long after the coarse gravel is eliminated. The more exposed a beach is the coarser the sand, as fine particles are lost in heavy weather and in suspension. Sand is coarser at low tide than at high tide level.

Along the Wairoa River banks the vegetation is predominantly grassland and sparse tree growth. Along tributory stream banks are willow which choke the waterways and make it difficult for whitebait to spawn.



Changeable Sand bar

Exposed | beach face

Shallow secondary sand bar

↑ direction of ocean swell and material transportation

SUBMARINE

Figure 5

1.3 Submarine

The main water current washing the Hawke's bay coast is that of the colder Canterbury current.

(Ref. Morton & Miller 1968 The New Zealand Sea Shore pg. 336)

In general terms material is transported South to North by wave action and littoral drift. The coastal current moves at ca. 1 knot from South to North with the flood tide. The tidal range in Hawke's Bay is small; not more than 4 ft.
The beach is fully exposed to heavy oceanic swell from the South and East but protected from the North in the lee of Mahia Peninsula. The SE swell is particularly heavy and is nearly always breaking on the beach.
At the NE end of Hawke's Bay the period of swell is as much as 15 seconds with a wave length of 1152 ft and velocity of 76 ft per second.

(Ref. Marshall)

Wave action along this rough shoreline quickly eliminates coarse material brought by rivers. The wairoa River contributes some fine material to the beach supply but not to any significant effect.

Tidal influence within the Wairoa River extends as far up river as Frasertown and perhaps beyond. This obviously varies with flood conditions. The saltwater wedge is usually in the vicinity of the railway bridge, though this too varies.

The beach profile offshore shelves steeply with no outlying reefs. There is often a secondary shallow sand bar outside the mouth of the river. The bar is utilized by surfers but is a navigation hazard.

The offshore sediment is mainly medium to fine sand with mud constituting less than 20% of the content.

(Ref. NZ Oceanographic Institute. Coastal Sediments Map. Mahia)

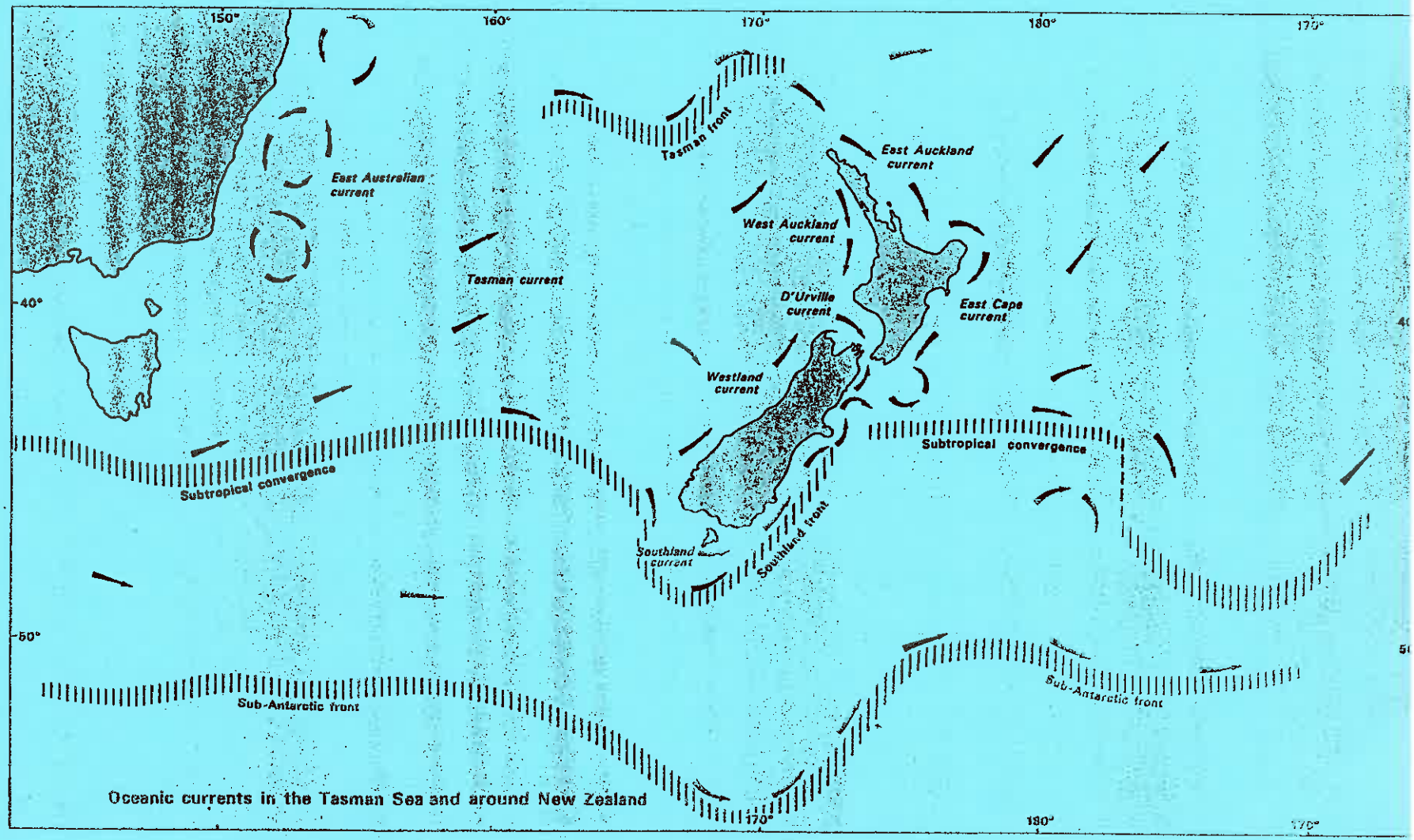

150°
160°
170°
180°
40°
50°
East Australian current
Tasman front
East Auckland current
West Auckland current
Tasman current
D'Urville current
East Cape current
Westland current
Subtropical convergence
Subtropical convergence
Southland current
Southland front
Sub-Antarctic front
Sub-Antarctic front
Oceanic currents in the Tasman Sea and around New Zealand

Figure 6

EASTERN COASTS Flow around southern New Zealand contributes to the north-going *Southland Current* which moves along the east coast of the South Island. The current branches near Kaikoura. One branch moves offshore, the other continues northwards along the Marlborough coast, crosses the Narrows towards Wellington and then east around Cape Palliser. It may, on occasions, extend northwards along the east coast as far as Hawke Bay.

Two other currents are found off the east coast of the North Island. Between North Cape and East Cape is the south-eastward flow of the *East Auckland Current*, derived from the general eastward flow in the northern Tasman Sea which has passed around the northern tip of New Zealand. On approaching East Cape, part of this current is deflected offshore and part rounds East Cape to flow southwards along the coast as the *East Cape Current*. It passes seaward of the *Southland Current* and continues to about the latitude of Cape Campbell, (41°S), where it first turns east, and later north, to form a large anticyclonic eddy with a radius of 50-100 km. Its southwards excursion is limited by the Chatham Rise, a relatively shallow seabed feature which also determines the position of the sub-tropical convergence.

It has not been possible to quantify the currents shown on the maps since meteorological effects, tidal currents, and other forces can greatly modify the basic circulation. These water motions include wind-waves, swell, wind-induced currents, and storm surges. Variations in river outflows and land water run-off can also modify local circulation in coastal waters.

2.0 WATER

Water Quality is assessed in this area by the Hawke's Bay Catchment Board, Napier as part of their primary river monitoring scheme.

(Contact Vicki Hansen for information, HBCB, Napier).

Within the Wairoa River are a number of legal discharges which need to be checked regularly.
At present not enough control is maintained over water quality.

The Wairoa District Council have water rights to discharge treated effluent and storm water in to the lower reaches of the river. Part of this agreement enables them to discharge untreated effluent during emergency situations.
Following Cyclone Bola (March '88) untreated effluent is being discharged in to the river from North Clyde.

The Waitaki Abbattoir has rights to discharge protein-removed effluent at the factory site in to the river. This is monitored only by the company. It is recommended that regular checks are also made by the Catchment Board.

(For further details see Unit 2 File 1 Pollution)

3.0 CLIMATE

Sheltered from the West by the Urewera mountain ranges, the whole Hawke's Bay region is protected from the predominantly westerly winds which flow over the North Island. This contributes to a generally sunny climate with mild winters. Cyclonic depressions which may form either in the tropics or in the Tasman sometimes pass near Hawke's Bay, giving winds from an easterly quarter and occasionally extremely heavy rainfall.

Temperatures are also effected by the mountain shelter. Reduced cloudiness, increased sunshine by day and radiation cooling at night create larger daily ranges of temperatures than on the West coast.

Mean Daily Range at Wairoa (C)

January: 18.9
July: 16.4

3.1 Meteorological Information

The nearest meteorological office with half hourly reports on weather is at Gisborne aerodrome.

ph. (079) 81221, 81224

Weather information is also available from the Electrocorp Office in Wairoa, who monitor weather, wind and rain forecasts.

ph. (0724) 6101

Rainfall gauges and fire control reports are monitored at the Urewera National Park (Aniwaniwa).

ph. TUB 803

and Morere Scenic Reserve

ph. NK 861

The electrical station at Tuai also records rainfall
ph. TUB 880

3.2 Coastal Rainfall

Rainfall is variable due to episodic storm events. Dry spells during the equinox often cause near drought conditions. In winter high intensity rainfall over long periods produces large amounts of runoff and consequent flooding. Rainfall increases from 760-1000mm on the coast to 2500mm in the high country.

At Wairoa coastal rainfall has been measured at 1200mm annually, with 40 - 45% of the annual total occurring between May and August.

3.3 Wind

The sheltering effect of the mountains gives reduced cloudiness and at night high percentages of clear skies. Along the coast sea breezes occur in all seasons except winter. Winds also tend to be channelled down river valleys.

Wind tends to be NW - SE primarily because of funnelling effects of Hawke's Bay to the south and the Kaimanawa - Huiarau divide to the West.

3.4 Storm Events

Onshore storms often swell up from the South and SouthEast where the coastline is unprotected. Very rough swells develop, often closing river bars or at least building up sand bars at river mouths.
Flood conditions and heavy storms bring large amounts of debris, wood, dead stock, etc down rivers and on to the beaches. Cyclone Bola (March 1988) saw devastating flooding and damage to the Wairoa area; the worst since the 1985 floods.

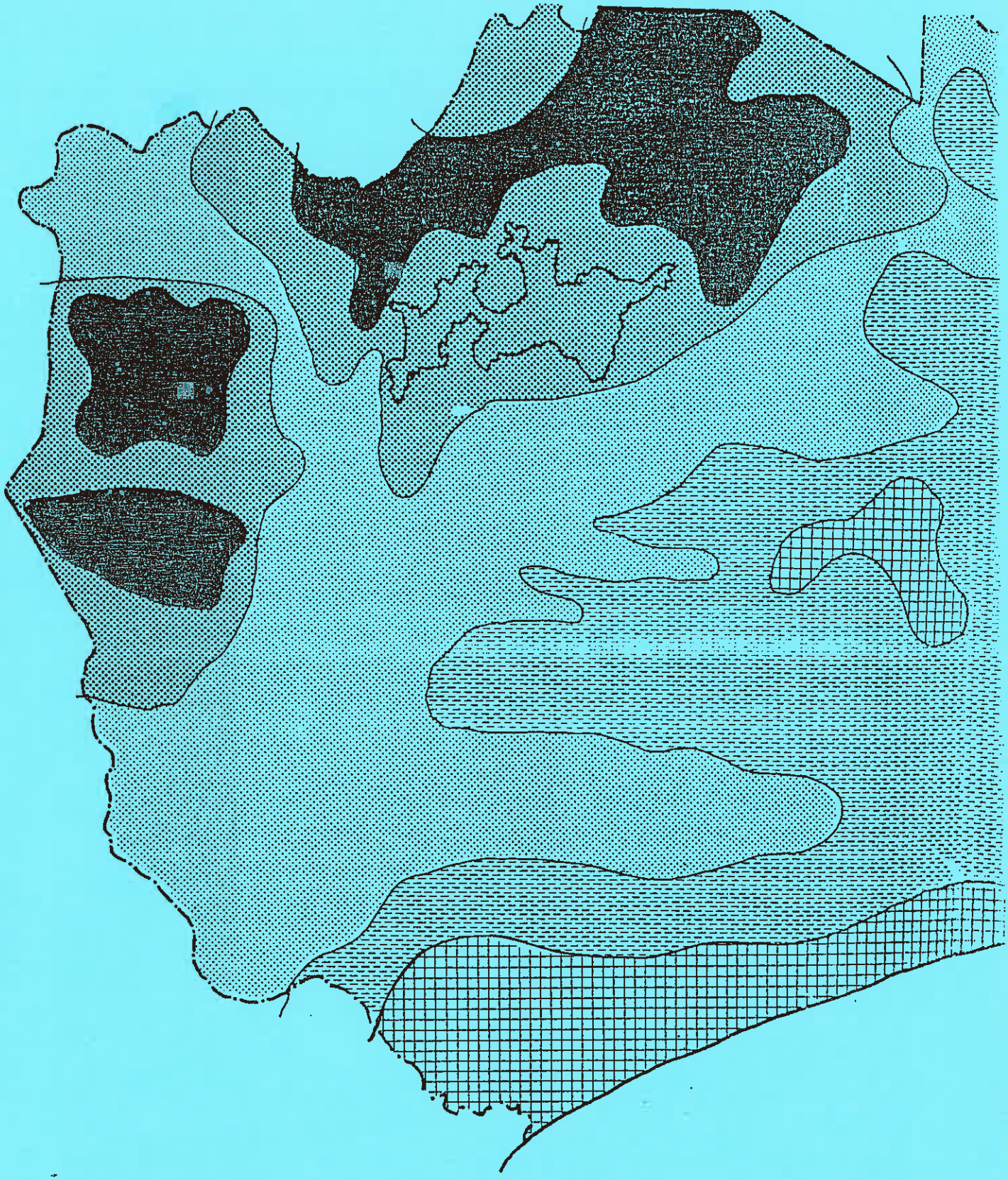
WIND

When a wind blows over calm water, ripples are formed because of friction between the moving air and the water surface. As the ripples become larger, friction is supplemtented by the pressure of the wind on the surface of the water slopes. The undulations build up into waves whose maximum height depends upon the wind's speed, duration, and fetch—the distance over which it blows.

New Zealand is situated well away from other land masses and lies in the path of westerly winds which prevail between latitudes 30°S and 70°S. As a consequence of the prevailing winds and the fetch conditions, New Zealand has a high energy wave climate, dominated by west and south-west storm waves. The west and south coasts can be classified as high energy shores. On the east coast, south of East Cape, the prevailing deep water wave is southerly and this coast is classed as a high energy lee shore. Parts of the coast are comparatively sheltered and are considered as low energy shores. These areas include the west Wellington coast, the northern coast of the South Island, the northern aspects of the Otago, Banks and Kaikoura Peninsulas, and Capes Campbell and Kidnappers. The north-east coast, between North Cape and East Cape, is considered a low energy lee shore. Earthquakes, volcanic eruptions, massive landslides, and other earth movements can also generate water movements. These waves, known as tsunamis, vary from a few centimetres to many metres in height.

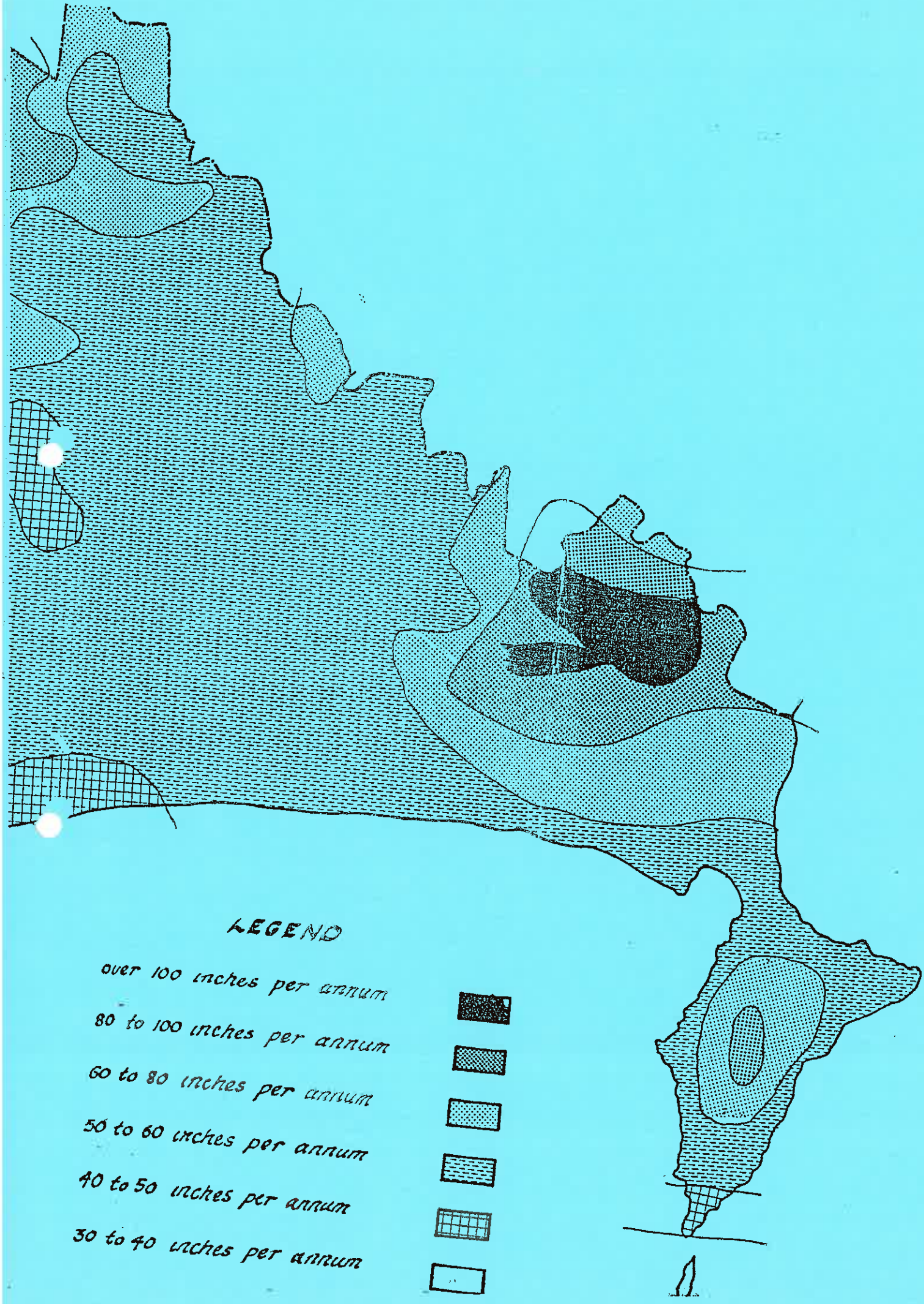
Water movements associated with waves result in a small net drift of water in the direction of the wave advance. This occurs because, in shallow depths, the water particles in a wave do not traverse a closed circle, but follow an open orbit. When waves break along a shore, a hydraulic head is established, and the water must return seaward. It can return directly, or it can flow along the shore as a current inside the breaker zone. It returns seaward in relatively narrow zones, in the form of rip currents. When waves approach a shore at an angle, and the in-shore end of the wave front is in shallower water than the rest of the wave front, wave speed at the in-shore end becomes relatively slower, and the waves are bent, or refracted. As a result, waves tend to align with depth contours and to parallel the shore. In reality however, they usually break at a slight angle to the shore and this results in a slow movement of water along the shore inside the surf zone. This is called a littoral current and can result in the longshore drift of sediment.

Currents in the upper layers of the ocean are mainly wind-driven and, if there were no continental land barriers, water movement would be mainly zonal in direction, as in the West Wind Drift around Antarctica. In effect the basic pattern of circulation in each ocean is a nearly-closed gyre. These gyres are formed because the currents are turned by land barriers and Coriolis force.



RAINFALL CONTOURS WAIROA COUNTY

Figure 7

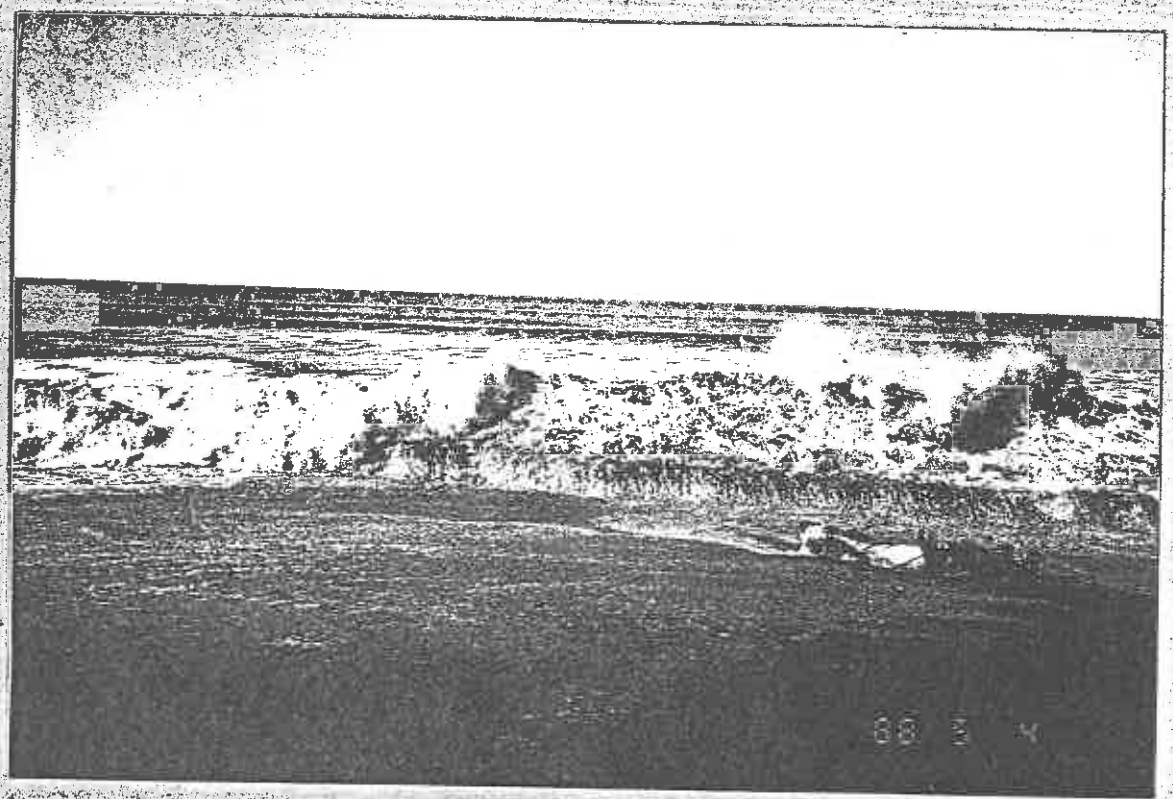

LEGEND
over 100 inches per annum
80 to 100 inches per annum
60 to 80 inches per annum
50 to 60 inches per annum
40 to 50 inches per annum
30 to 40 inches per annum

C.R.I.

UNIT THREE : FILE THREE

MOHAKA

PHYSICAL RESOURCES



COASTAL RESOURCES INVENTORY

UREWERA DISTRICT
WAIROA

UNIT THREE : FILE THREE
MOHAKA : PHYSICAL RESOURCES

FILE : COA 195

June 1988

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1.2 Intertidal
1.3 Submarine

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3.0 **CLIMATE**

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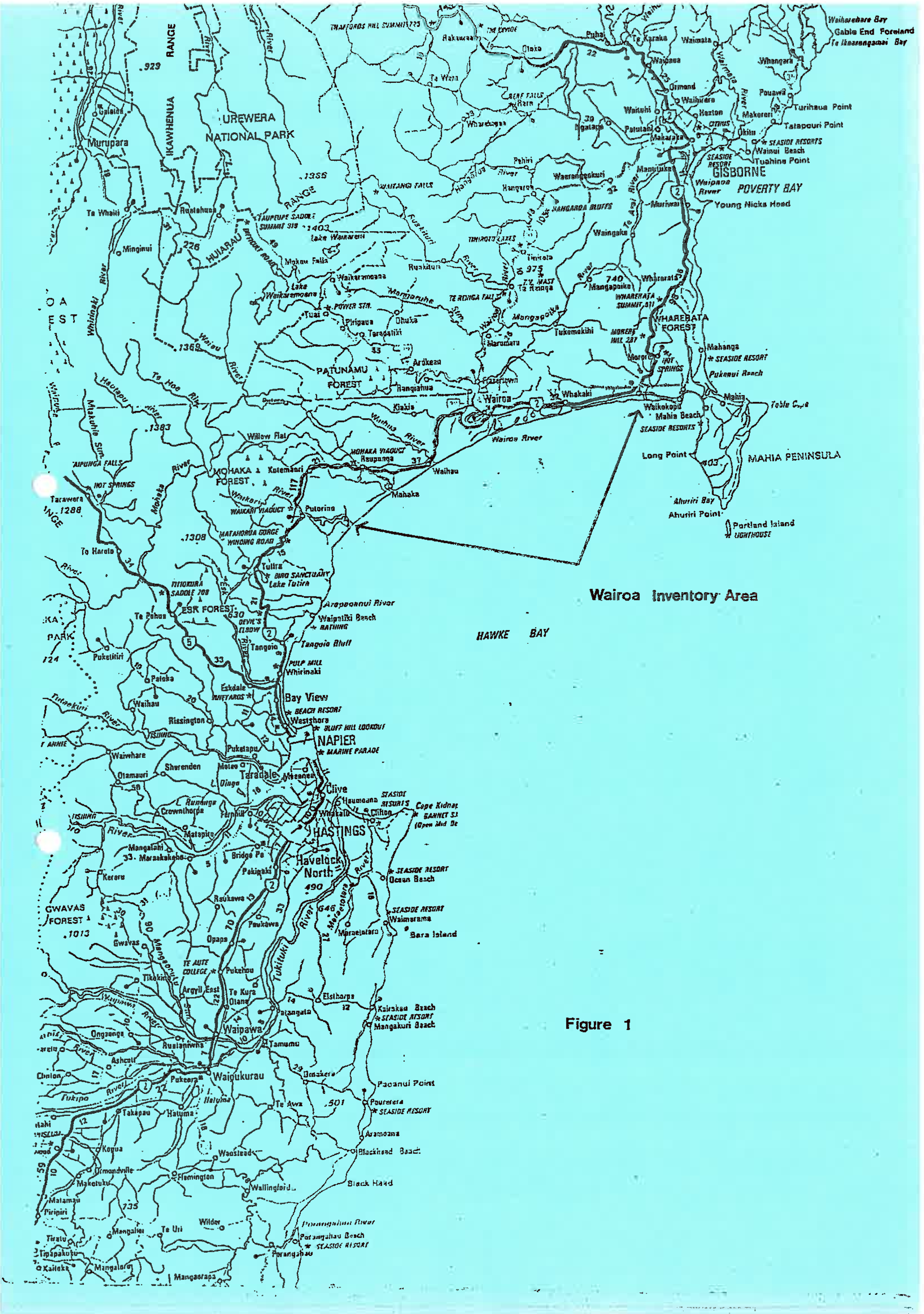
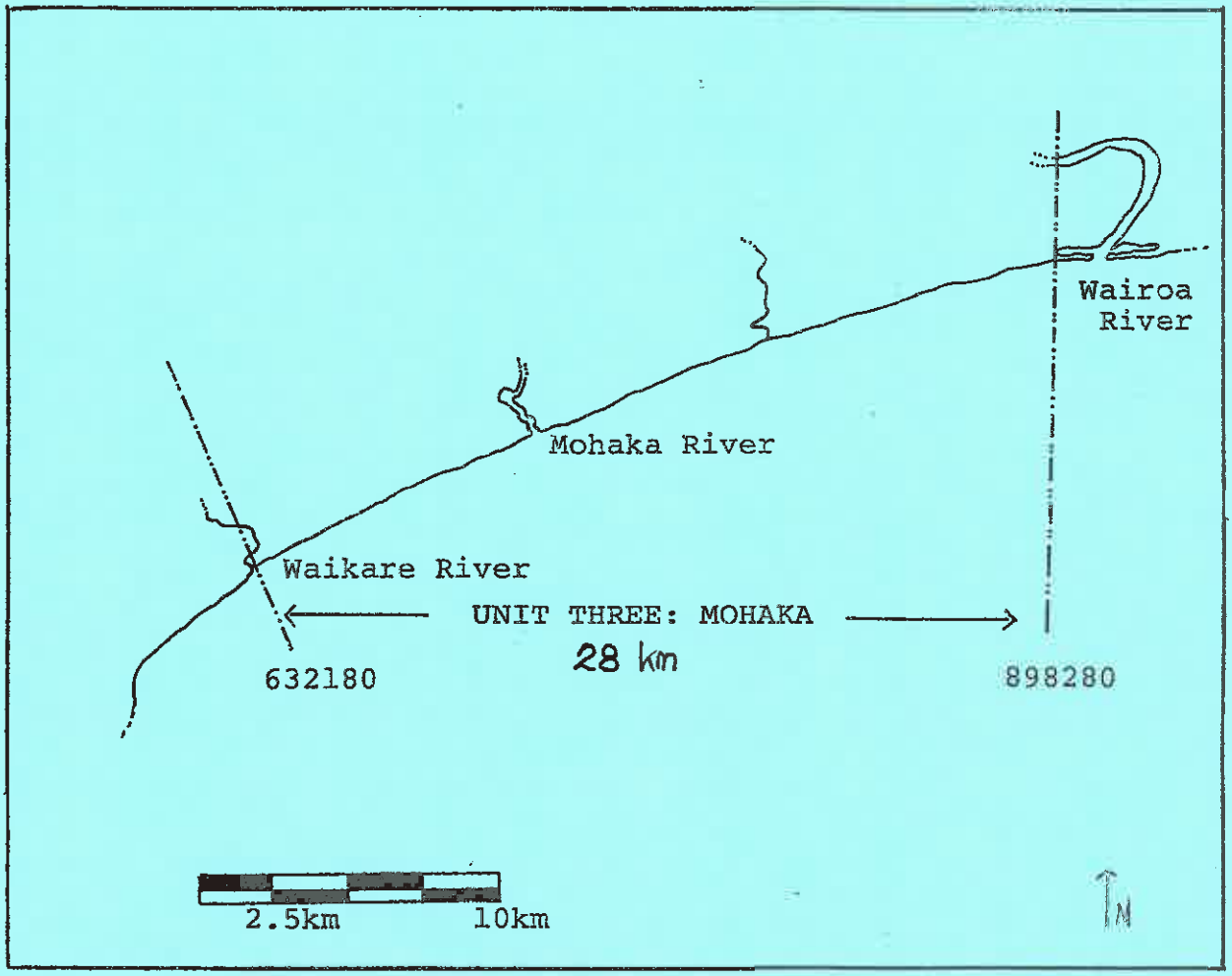


Wairoa Inventory Area

Figure 1



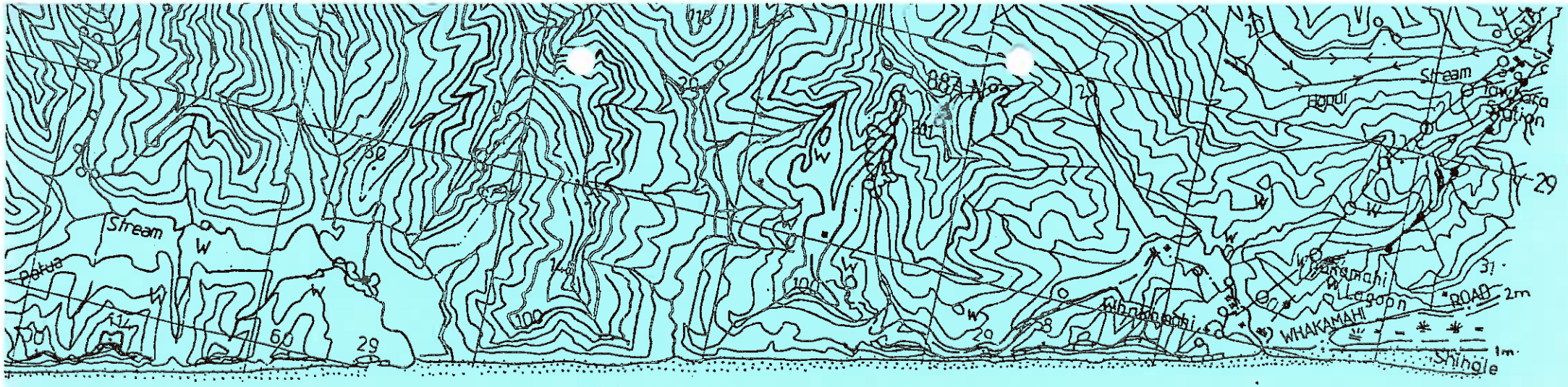
Map Ref. NZ Topoplot 1:25,000 W 19 C, W 19 D, W 20 A,C

Figure 2

PLATE 2

Waihua River

Waihua beach



← Steep cliffs - grassland

← 760 - 1000 mm annual rainfall →

Terrestrial

← Exposed Beach →

Intertidal

↑ direction of ocean swell and material transportation

Submarine

Figure 3

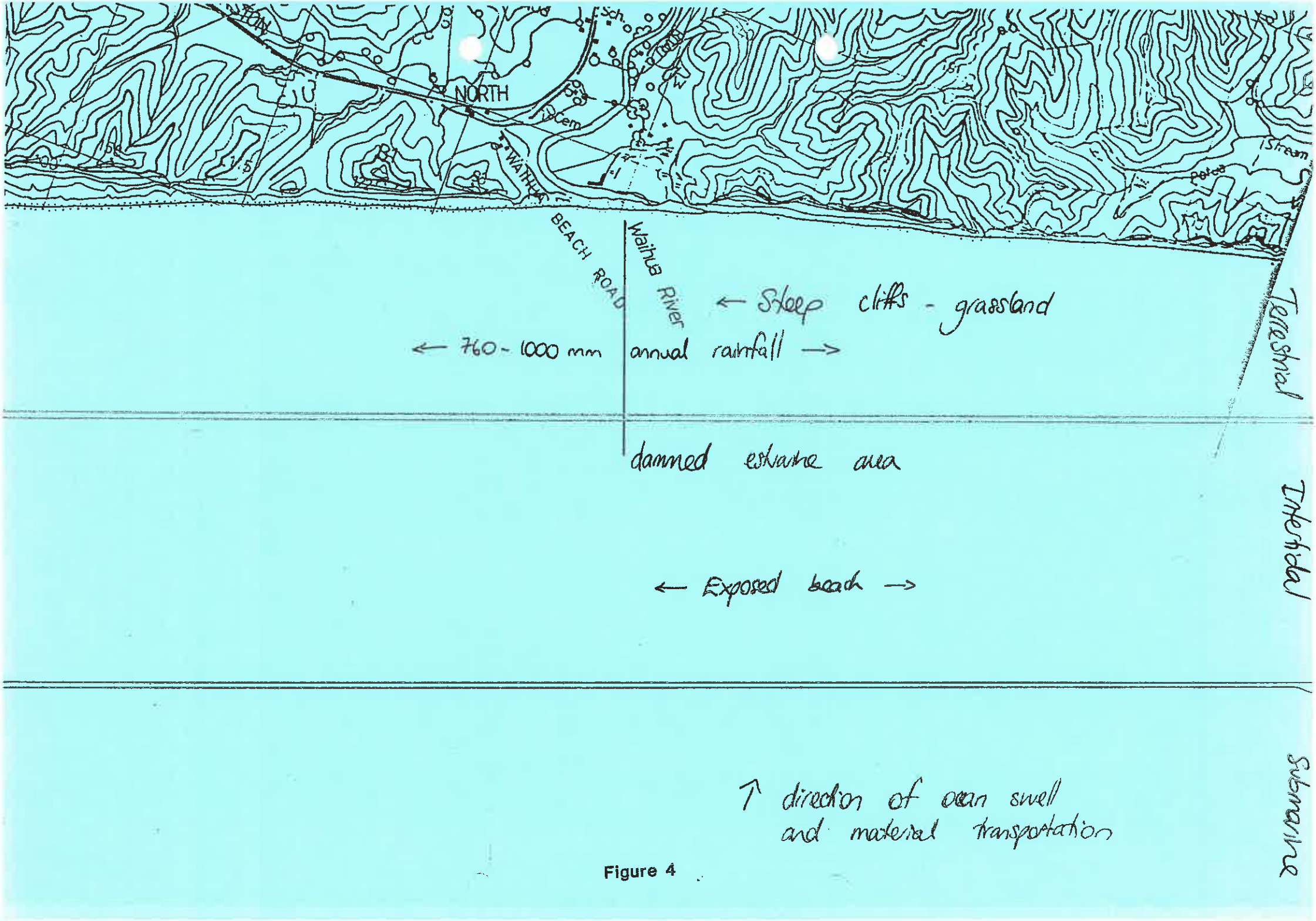
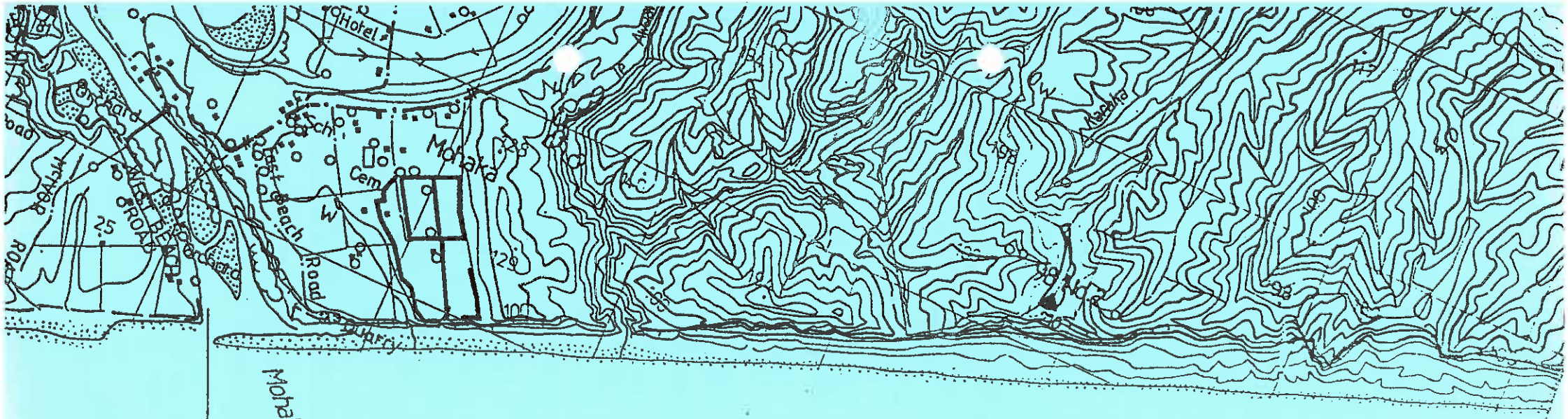

NORTH
WAITHUA
BEACH ROAD
Waihua River
← Steep cliffs - grassland
← 760 - 1000 mm annual rainfall →
dammed estuarine area
← Exposed beach →
↑ direction of ocean swell and material transportation
Terrestrial
Intertidal
Subtidal

Figure 4



← steep cliffs - Grassland →

Terrestrial

← 760-1000 mm annual rainfall →

Food source for all Beach Gravel in Hawke Bay

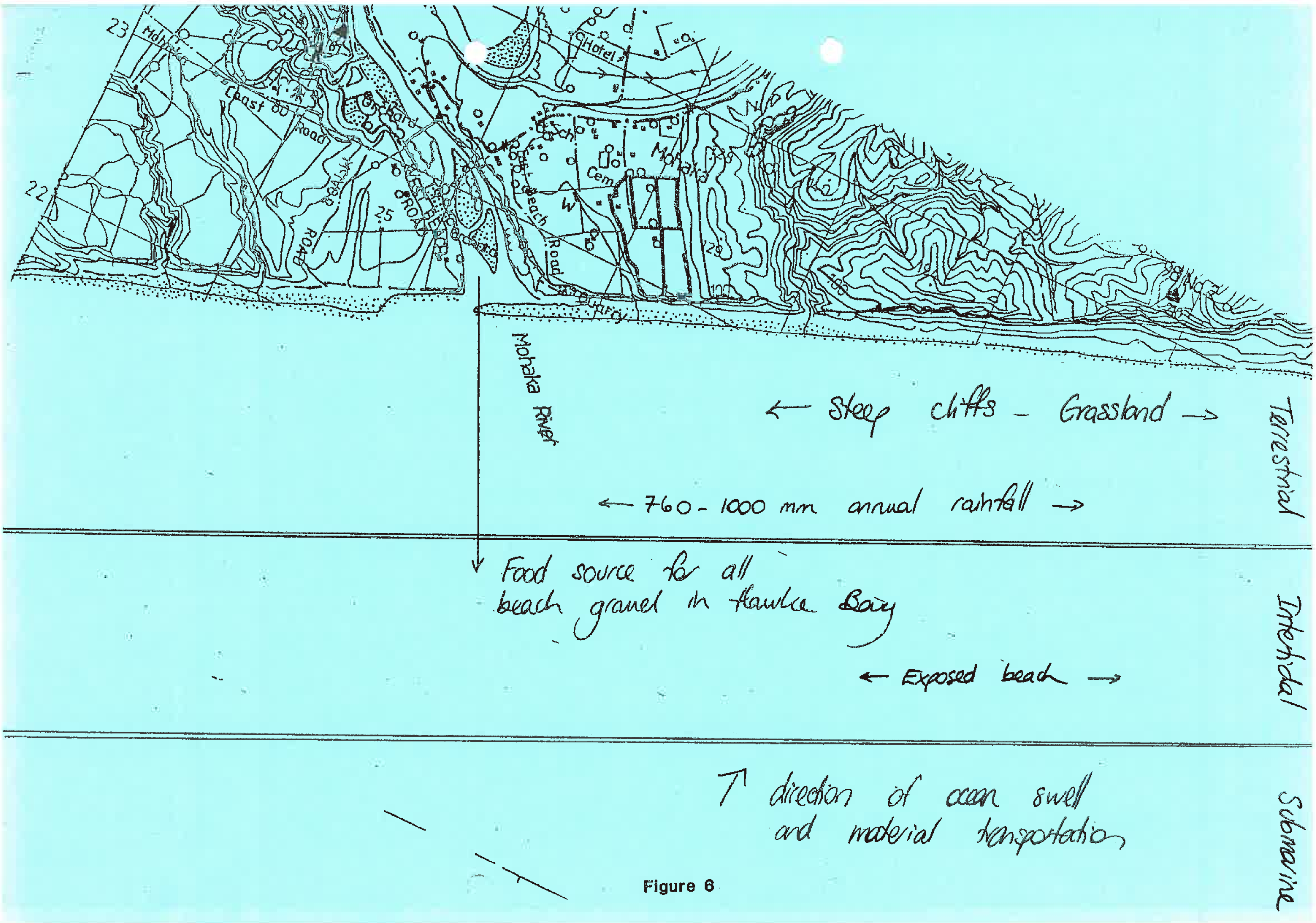
Intertidal

← Exposed beach →

↑ direction of ocean swell and material transportation

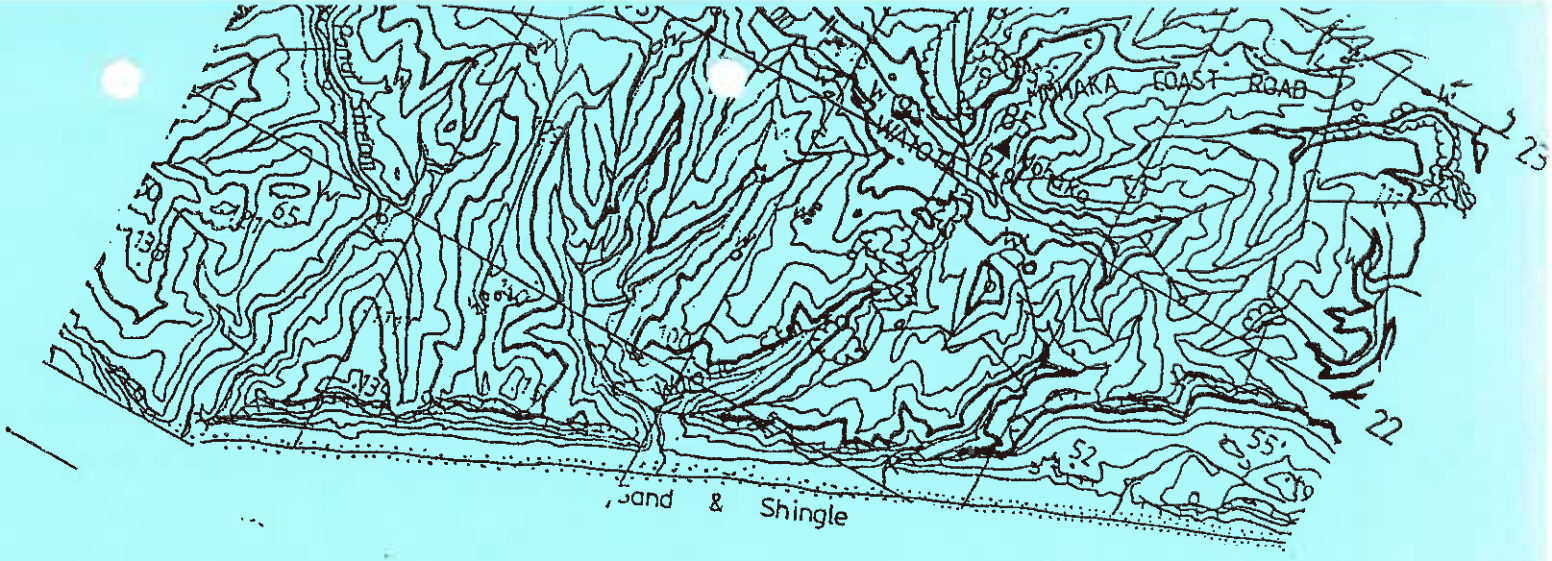
Subtidal

Figure 5



Mohaka River
Hotel
Coast Road
Road
ROAD
Beach Road
Cem
25
23
22
Terrestrial
← Steep cliffs - Grassland →
← 760 - 1000 mm annual rainfall →
Intertidal
Food source for all beach gravel in Hawke Bay
← Exposed beach →
Submarine
↗ direction of ocean swell and material transportation

Figure 6



← Steep cliffs – Grassland →

Terrestrial

← 760–1000 mm annual rainfall →

Intertidal

← Exposed beach →

Subtidal

↑ Direction of ocean swell and material transportation

Figure 7

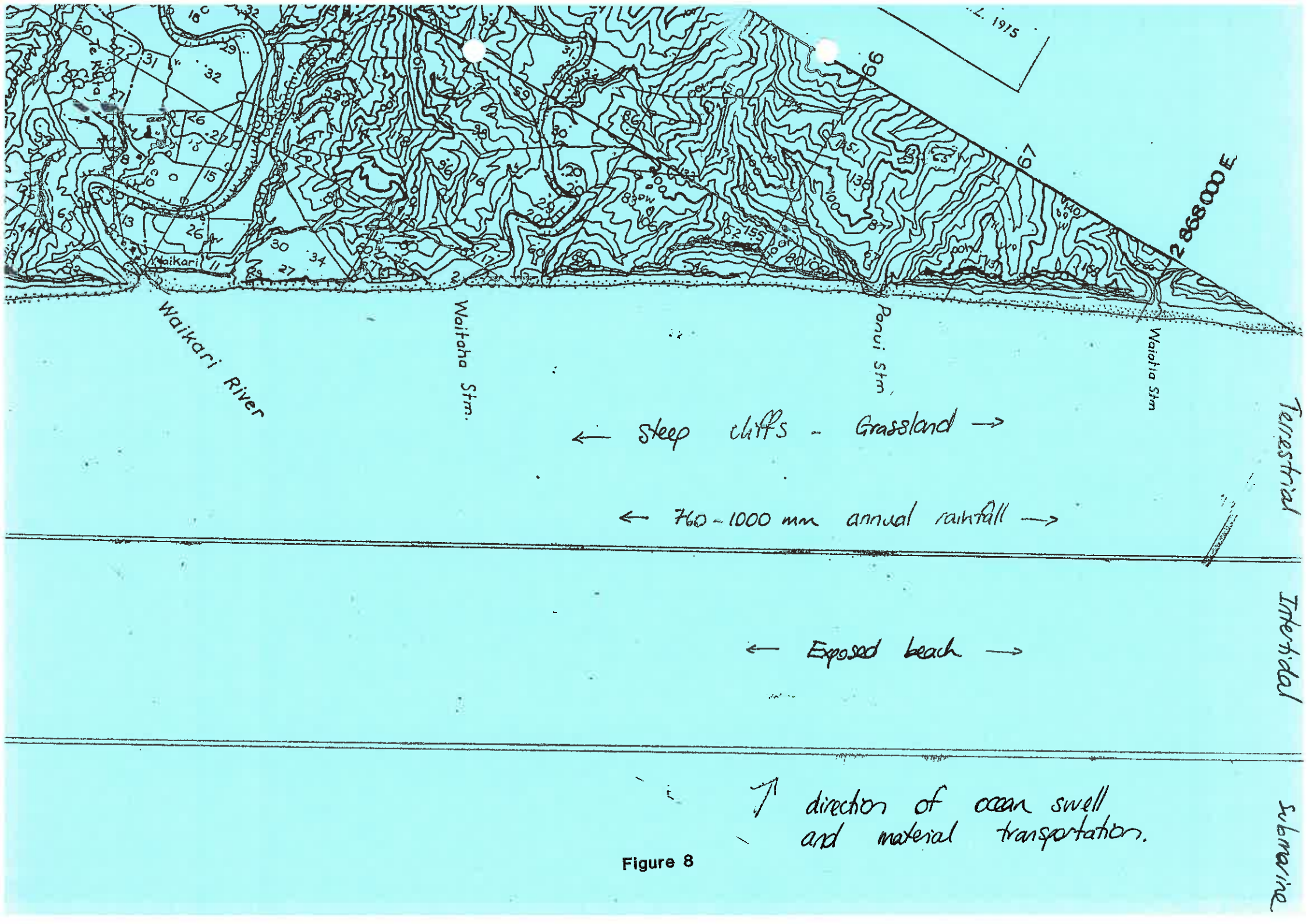

Waikari River
Waitaha Stm.
Panui Stm
Waiotia Stm
← Steep cliffs - Grassland →
← 760 - 1000 mm annual rainfall →
← Exposed beach →
direction of ocean swell and material transportation.
Terrestrial
Intertidal
Submarine

Figure 8

1.0 FORM

1.1 Terrestrial

The shoreline depicted on any official map in New Zealand denotes Mean High Water Mark (MHWM).

The physiography of the Unit three terrain above MHWM is characterized by steep grassland cliffs and the three river systems; Waihua, Mohaka and Waikare.

The streams in this Unit are: Potua, Waiotia, Ponui, Waitaha.

The cliff areas are generally fenced to prevent stock falling off the edge however the region is prone to severe erosion and soil slip. The area is liable to slipping because of the soft clay and greywacke as well as a lack of deep rooted vegetation to hold the subsoils. The cliffs are very steep and often the MHWM reaches right to the base of the cliffs creating more problems with wind and salt water erosion.

In the Potua Stream area are clay subsoils with a moderately high water table. The Mohaka River valley consists of flat river terraces with pumice soils formed on recent rhyolitic tephra over greywacke, gravels and sands. Between Mohaka and Waikare are steep hills of soft siltstone, with severe soil erosion potential.

Landforms along this portion of the Hawke Bay coast were deposited as marine sediments from two to half a million years ago. The rock strata are mainly sandstone, siltstone, limestone and conglomerate. The formations contain large numbers of fossils and some volcanic rocks and ash from Taupo eruptions. (Kingma, 1971)

The 1931 Napier earthquake caused severe changes to the Wairoa Hard area shoreline. At Old Man's Bluff a slip displaced ca. 40,000,000 m3 of earth. Four other smaller flow slips occurred at cliff faces between this bluff and the mouth of the Waihua River. Uplift from the earthquake reached almost three metres at Moeangiangi. (Marshall 1933)

COASTAL GEOMORPHOLOGY

The broad shape of the North Island is controlled by the position of hard rocks at its extremities. Hard igneous rocks form resistant bulwarks at North Cape, Cape Reinga, and Matakaoa Point, near East Cape. Similar resistant areas are found at Cape Brett, Great Barrier Island, Cape Colville, and the Wellington-Wairarapa coast where the rock is hard greywacke sandstone. Cape Egmont in contrast, is constructed from a large volume of volcanic lahars erupted from Mount Egmont. A protective apron of boulders from these lahars provides some resistance to erosion.

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surface but some are deep (with silt loam or sandy loam textures) overlying soft or fragmented rock at depths of three feet or more. The natural fertility ranges from very high to low according to the nature of the underlying rocks and of the native vegetation under which they were formed, and is commonly somewhat higher than that of related soils on the gentler slopes.

On the naturally fertile steepland soils, pastures grow satisfactorily in spite of problems of soil erosion. On the soils of low natural fertility, however, they are usually more difficult to establish and maintain, particularly where the soils are erosive, owing to the problem of controlling secondary growth which usually involves the concentration of stock with the aid of much subdivisional fencing. Consequently, on some of the less fertile, erosive soils, pastures should probably give way to afforestation or to protective forestry for soil and water conservation until satisfactory methods of pasture management are devised.

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1.2 Intertidal

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1.2.1 Beach Formation

Coarse gravel, if it is constantly exposed to beach movement, will soon be reduced in grade. Fine gravels, especially sand, are of more lasting properties.

Beach gravel in this area is of uniform greywacke* rock. This produces the "black sand" appearance.

*(*hardened silty sandstone)*

Beach gravel from Mohaka; the major food source for this beach, decreases in size in direct proportion to the distance from source.

At Waihua beach there are large crops of siltstone on the beach. The 'sand' in this area is very fine, often silty and with a large amount of silicates. Further towards Mohaka the gravel increases in size from fine to medium. Forty-five minutes walk towards Mohaka the gravel becomes large, with rocks up to 30cm diameter.

On the Hawke Bay beach the greater speed of pebble reduction may be due to its slower movement along the beach. The flood tide moves more slowly and the swell washes in at nearly right angles to the beach.

Much of the coarse material contributed to the beach is eliminated by wave action. Pebbles larger than half an inch diameter are worn flat in this area. Any smaller than this are rounded.

Until gravel becomes very fine all the smaller grades owe their smallness to impact, rather than abrasion. The action of impact, because of the heavy surf, maintains limits of grades between proportions of 5 to 1. That this is due to impact is shown by the finest grade anywhere always being angular.

(Ref. Marshall)

Sand, in New Zealand, is produced by the weathering action of atmospheric agents on surface rocks. Quartz and other more resistant minerals are by this action separated from those minerals that are subject to destruction by weathering. Grains of these stable minerals are carried by rain water to streams and then transported as sand to the coast. In the North Island the majority of beach sand is derived almost entirely from pumice sands, consisting mainly of crystals of feldspar with 25% quartz with some hypersthene and often hornblende.

Sand is not formed by beach action when there is gravel on the beach. Coarse sand is formed from gravel as a final result of abrasion after prolonged drift from source of supply and long after coarse gravel is eliminated.

The more exposed a beach is the coarser the sand, as fine particles are lost in heavy weather and in suspension. Sand too is coarser at low tide than at high tide level.

After Cyclone Bola (March 88) the amount of driftwood on the beach at the Mohaka River Mouth increased dramatically. Wood was piled often a metre high from low water to MHWM

1.3 Submarine

The waters of Hawke Bay may be derived from either the southward flowing East Cape current or the cooler, less saline water of the northward moving Southland current. Which current provides the inflow depends on the extremely variable northward extension of the Southland current.
The main inflow usually occurs along the mid-line of Hawke Bay. This separates in to two components which move in opposite directions along the coastal margins and leave the bay at its northern and southern extremities. The speed of the surface current may be affected by the prevailing winds.
(Bradford *et al.* 1980)

In general terms material is transported South to North by wave action and littoral drift. The coastal current moves at ca. 1 knot from South to North with the flood tide.
The tidal range in Hawke Bay is small; not more than 4 feet.

The beach is fully exposed to heavy oceanic swell from the South and East but protected from the North. The SE swell is particularly heavy and nearly always breaking on the beach in this area. At the NE end of Hawke Bay the period of swell is as much as 15 seconds with a wave length of 1152 feet and a velocity of 76 feet per second.
(Ref. Marshall, 1933)

Wave action along this rough shoreline quickly eliminates coarse material brought by rivers. The sediments of 'Wairoa Hard' contain a significant proportion of gravels and pebbles (2 - 10cm diameter) mixed with mud and sand. In Hawke Bay, this gravel, pebble, sand and mud mixture is only found in the 'Wairoa Hard' area and off the mouth of the Tukituki River. The gravel zone of the 'Wairoa Hard' extends for over 24km along the coast from the Moeangiangi River to the Waihua River and from close inshore to a depth of 35 to 45m. The mud and sand that surround the gravel and pebbles may exceed the bulk of the larger sediments.
(Ref. Pantin 1966)

Between Wairoa and Waihua the dominant fraction of sediments are granules and coarse sand. At Waihua cobbles and pebbles are less than 20%. Between Mohaka and Waikare close in shore the sediments are medium to fine sand, further out the sediments have less than 20% cobbles and pebbles.
(Ref. NZ Oceanographic Institute Coastal Sediments Map. Mahia)

The seafloor of the 'Wairoa Hard' is shallow and gently sloping which is typical of Hawke Bay. For most of the 'Wairoa Hard' the 20 and 40m contours are 4.5 and 10km offshore. There are no large reef systems in the area, except a small mussel reef at the Waihua River mouth.

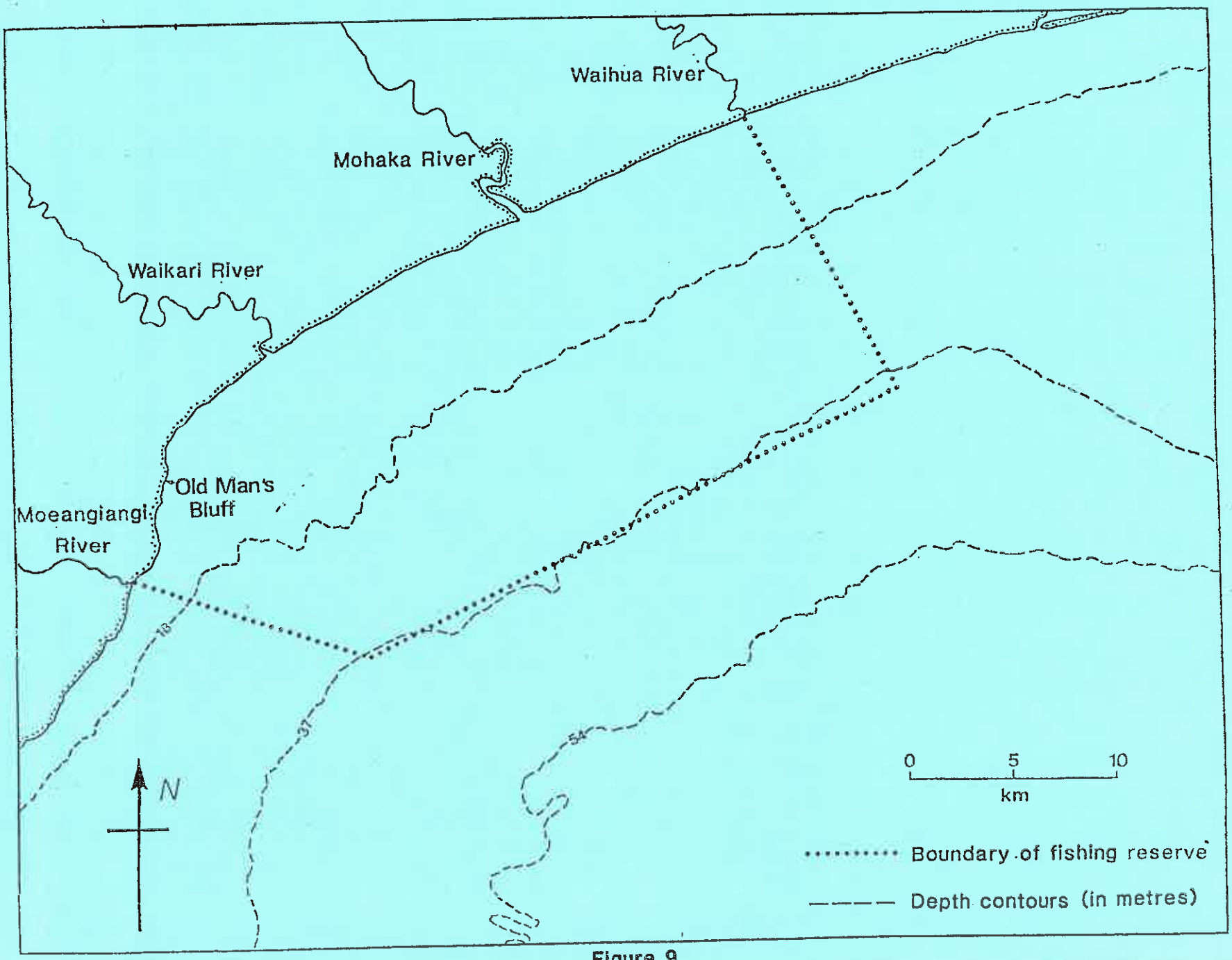
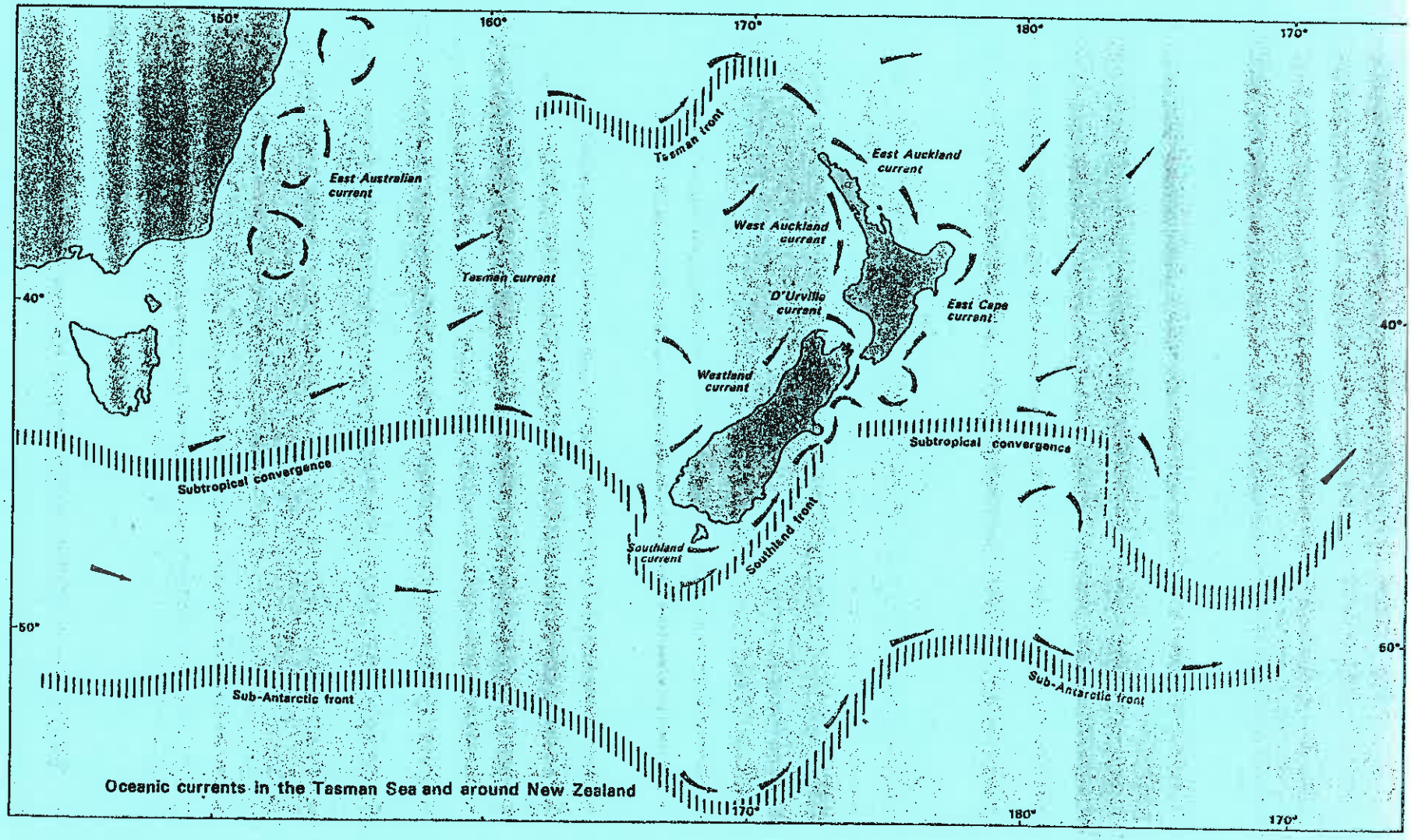

Waihua River
Mohaka River
Waikari River
Old Man's Bluff
Moeangiangi River
18
37
54
N
0
5
10
km
Boundary of fishing reserve
Depth contours (in metres)

Figure 9

EASTERN COASTS Flow around southern New Zealand contributes to the north-going *Southland Current* which moves along the east coast of the South Island. The current branches near Kaikoura. One branch moves offshore, the other continues northwards along the Marlborough coast, crosses the Narrows towards Wellington and then east around Cape Palliser. It may, on occasions, extend northwards along the east coast as far as Hawke Bay.

Two other currents are found off the east coast of the North Island. Between North Cape and East Cape is the south-eastward flow of the *East Auckland Current*, derived from the general eastward flow in the northern Tasman Sea which has passed around the northern tip of New Zealand. On approaching East Cape, part of this current is deflected offshore and part rounds East Cape to flow southwards along the coast as the *East Cape Current*. It passes seaward of the *Southland Current* and continues to about the latitude of Cape Campbell, (41°S), where it first turns east, and later north, to form a large anticyclonic eddy with a radius of 50-100 km. Its southwards excursion is limited by the Chatham Rise, a relatively shallow seabed feature which also determines the position of the sub-tropical convergence.

It has not been possible to quantify the currents shown on the maps since meteorological effects, tidal currents, and other forces can greatly modify the basic circulation. These water motions include wind-waves, swell, wind-induced currents, and storm surges. Variations in river outflows and land water run-off can also modify local circulation in coastal waters.



Oceanic currents in the Tasman Sea and around New Zealand

Figure 10

2.0 WATER

Water Quality is not assessed in the Unit Three area, except as part of the Hawke's Bay Catchment Board Primary River Monitoring scheme. Areas of particular concern are where there is shingle or sand winning as in the Mohaka River. Local residents have expressed some concern recently over silting in the lower reaches of the Mohaka. This may be a consequence of flooding but also possibly some degree of mismanagement in the forestry areas. The HBCB have noted in their study of macro-invertebrates that there has been a decline in the fauna populations and an increase in siltation, possibly two related issues.

For more information contact Vicki Hansen, HBCB, Napier

3.0 CLIMATE

Sheltered from the West by the Urewera mountain ranges, the whole Hawke's Bay region is protected from the predominantly westerly winds which flow over the North Island. This contributes to a generally sunny climate with mild winters. Cyclonic depressions which may form either in the tropics or in the Tasman sometimes pass near Hawke's Bay, giving winds from an easterly quarter and occasionally extremely heavy rainfall. This is accentuated by the vertical motion of the moist air stream forced over the high ground by onshore winds.

Temperatures are also effected by the mountain shelter. Reduced cloudiness, increased sunshine by day and readiation cooling at night create larger daily ranges of temperatures than on the West coast.

Mean Daily Range at Wairoa (°C)

January 18.9
July 16.4

3.1 Meteorological Information

The nearest meteorological office with half hourly reports is at Gisborne aerodrome

ph. (079) 81221, 81224.

Weather information is also available from the Electrocorp Office in Wairoa, who monitor weather, wind and rain forecasts.

ph. (0724) 6101

Rainfall gauges and fire control reports are monitored at the Urewera National Park (Aniwaniwa)
ph. TUB 803
and Morere Scenic Reserve
ph. NK 861
The electrical station at Tuai also records rainfall.
ph. TUB 880.

3.2 Coastal Rainfall

Rainfall is variable due to episodic storm events. Dry spells during the equinox often cause near drought conditions. In winter high intensity rainfall over long periods produces large amounts of runoff and consequent flooding. Rainfall increases from 760-1000mm on the coast to 2500mm in the high country.

At Wairoa coastal rainfall has been measured at 1200mm annually, with 40 - 45% of the annual total occurring between May and August.

3.3 Wind

The sheltering effect of the mountains gives reduced cloudiness and at night high percentages of clear skies. Along the coast sea breezes occur in all seasons except winter. Winds also tend to be channelled down river valleys.

Wind tends to be NW - SE primarily because of funnelling effects of Hawke's Bay to the south and the Kaimanawa - Huiarau divide to the West.

3.4 Storm Events

Onshore storms often swell up from the South and SouthEast where the coastline is unprotected. Very rough swells develop, often closing river bars or at least building up sand bars at river mouths.
Flood conditions and heavy storms bring large amounts of debris, wood, dead stock, etc down rivers and on to the beaches. Cyclone Bola (March 1988) saw devastating flooding and damage to the Wairoa area; the worst since the 1985 floods.
Rough swells and inland flooding bring large amounts of debris to beach areas particularly around river mouths. The Mohaka River often has huge amounts of debris at its mouth.

WIND

When a wind blows over calm water, ripples are formed because of friction between the moving air and the water surface. As the ripples become larger, friction is supplemtented by the pressure of the wind on the surface of the water slopes. The undulations build up into waves whose maximum height depends upon the wind's speed, duration, and fetch—the distance over which it blows.

New Zealand is situated well away from other land masses and lies in the path of westerly winds which prevail between latitudes 30°S and 70°S. As a consequence of the prevailing winds and the fetch conditions, New Zealand has a high energy wave climate, dominated by west and south-west storm waves. The west and south coasts can be classified as high energy shores. On the east coast, south of East Cape, the prevailing deep water wave is southerly and this coast is classed as a high energy lee shore. Parts of the coast are comparatively sheltered and are considered as low energy shores. These areas include the west Wellington coast, the northern coast of the South Island, the northern aspects of the Otago, Banks and Kaikoura Peninsulas, and Capes Campbell and Kidnappers. The north-east coast, between North Cape and East Cape, is considered a low energy lee shore. Earthquakes, volcanic eruptions, massive landslides, and other earth movements can also generate water movements. These waves, known as tsunamis, vary from a few centimetres to many metres in height.

Water movements associated with waves result in a small net drift of water in the direction of the wave advance. This occurs because, in shallow depths, the water particles in a wave do not traverse a closed circle, but follow an open orbit. When waves break along a shore, a hydraulic head is established, and the water must return seaward. It can return directly, or it can flow along the shore as a current inside the breaker zone. It returns seaward in relatively narrow zones, in the form of rip currents. When waves approach a shore at an angle, and the in-shore end of the wave front is in shallower water than the rest of the wave front, wave speed at the in-shore end becomes relatively slower, and the waves are bent, or refracted. As a result, waves tend to align with depth contours and to parallel the shore. In reality however, they usually break at a slight angle to the shore and this results in a slow movement of water along the shore inside the surf zone. This is called a littoral current and can result in the longshore drift of sediment.

Currents in the upper layers of the ocean are mainly wind-driven and, if there were no continental land barriers, water movement would be mainly zonal in direction, as in the West Wind Drift around Antarctica. In effect the basic pattern of circulation in each ocean is a nearly-closed gyre. These gyres are formed because the currents are turned by land barriers and Coriolis force.

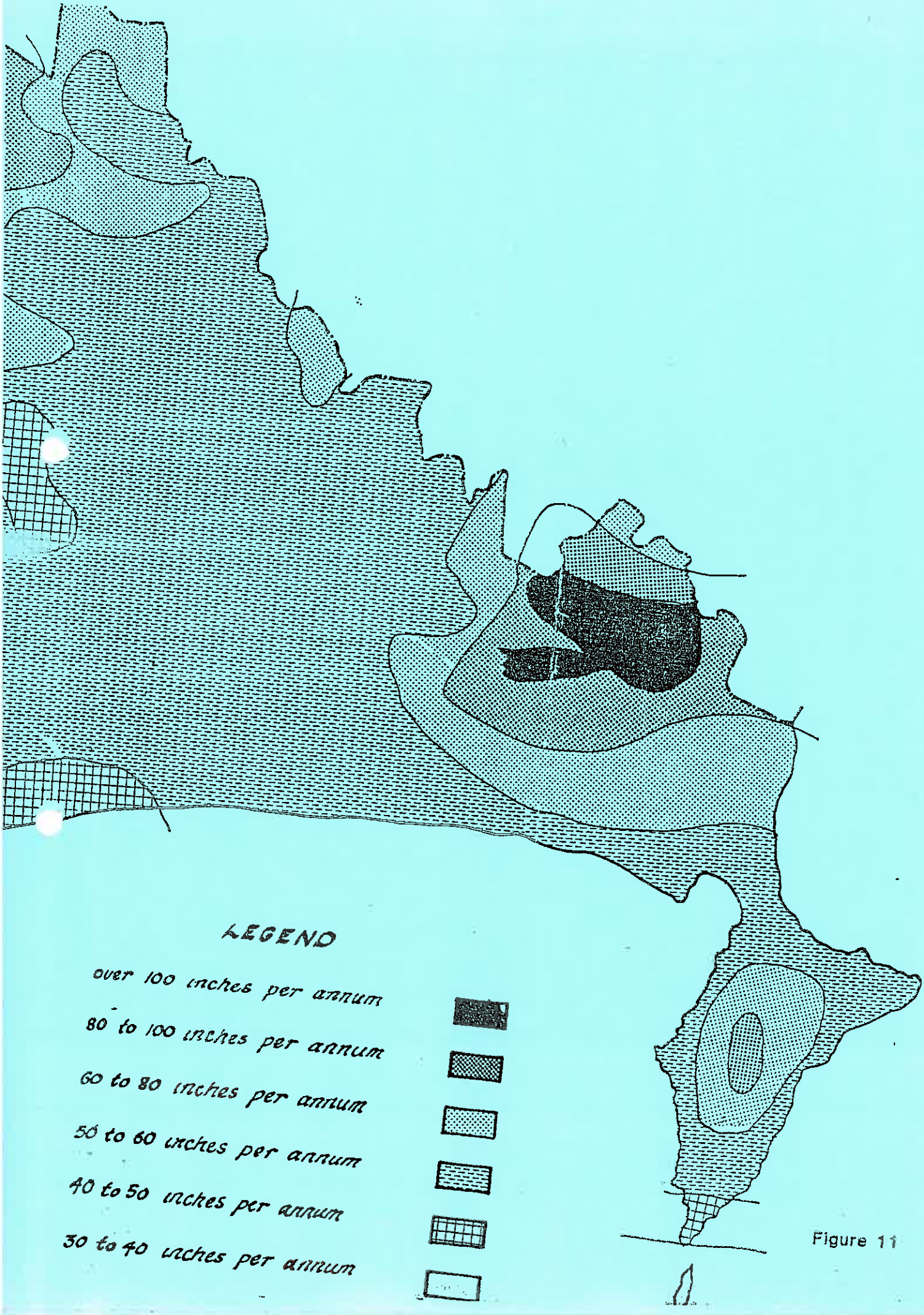

LEGEND
over 100 inches per annum
80 to 100 inches per annum
60 to 80 inches per annum
50 to 60 inches per annum
40 to 50 inches per annum
30 to 40 inches per annum

Figure 11

RAINFALL CONTOURS WAIROA COUNTY