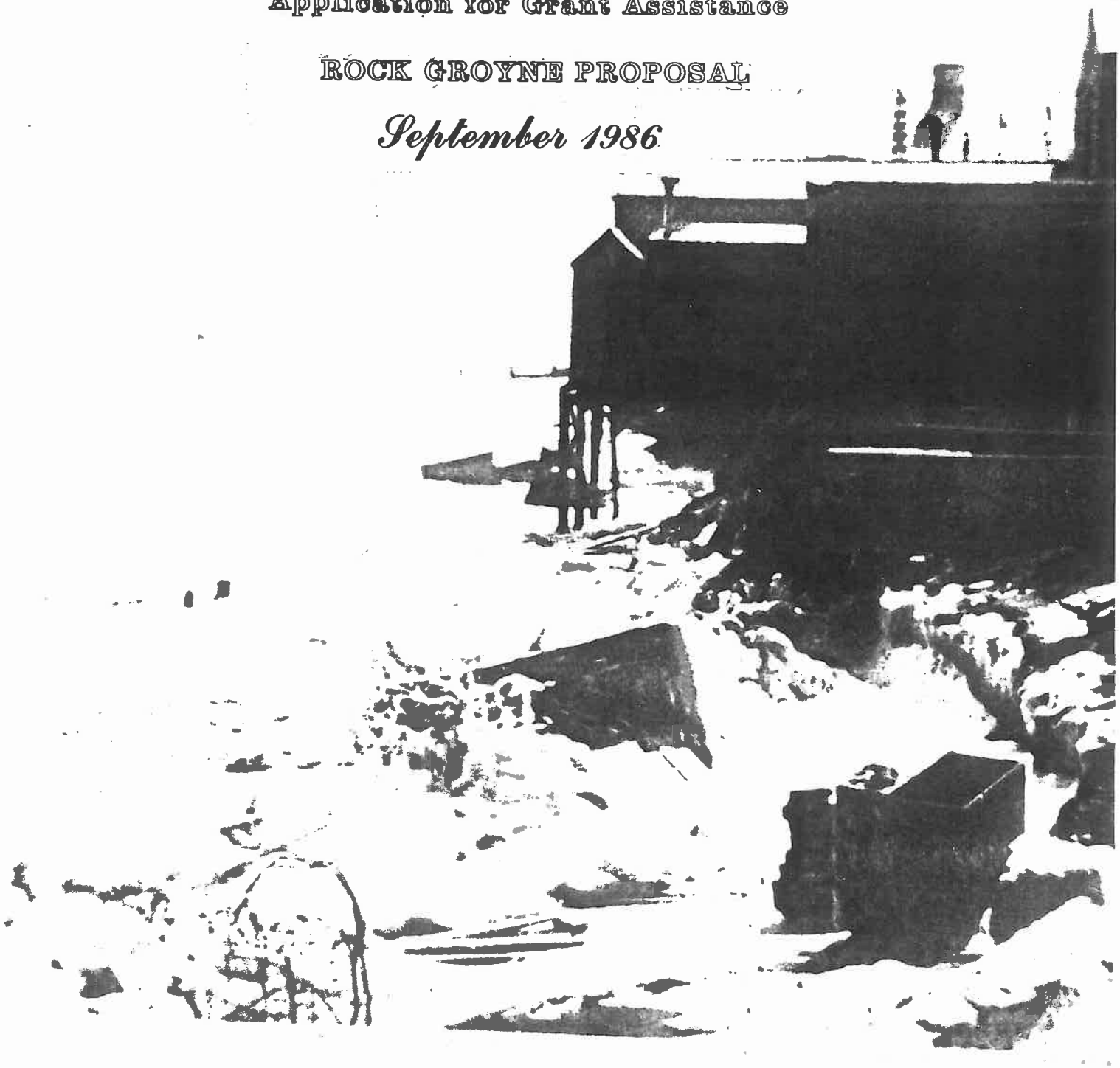
HOKITIKA BEACH SEA EROSION

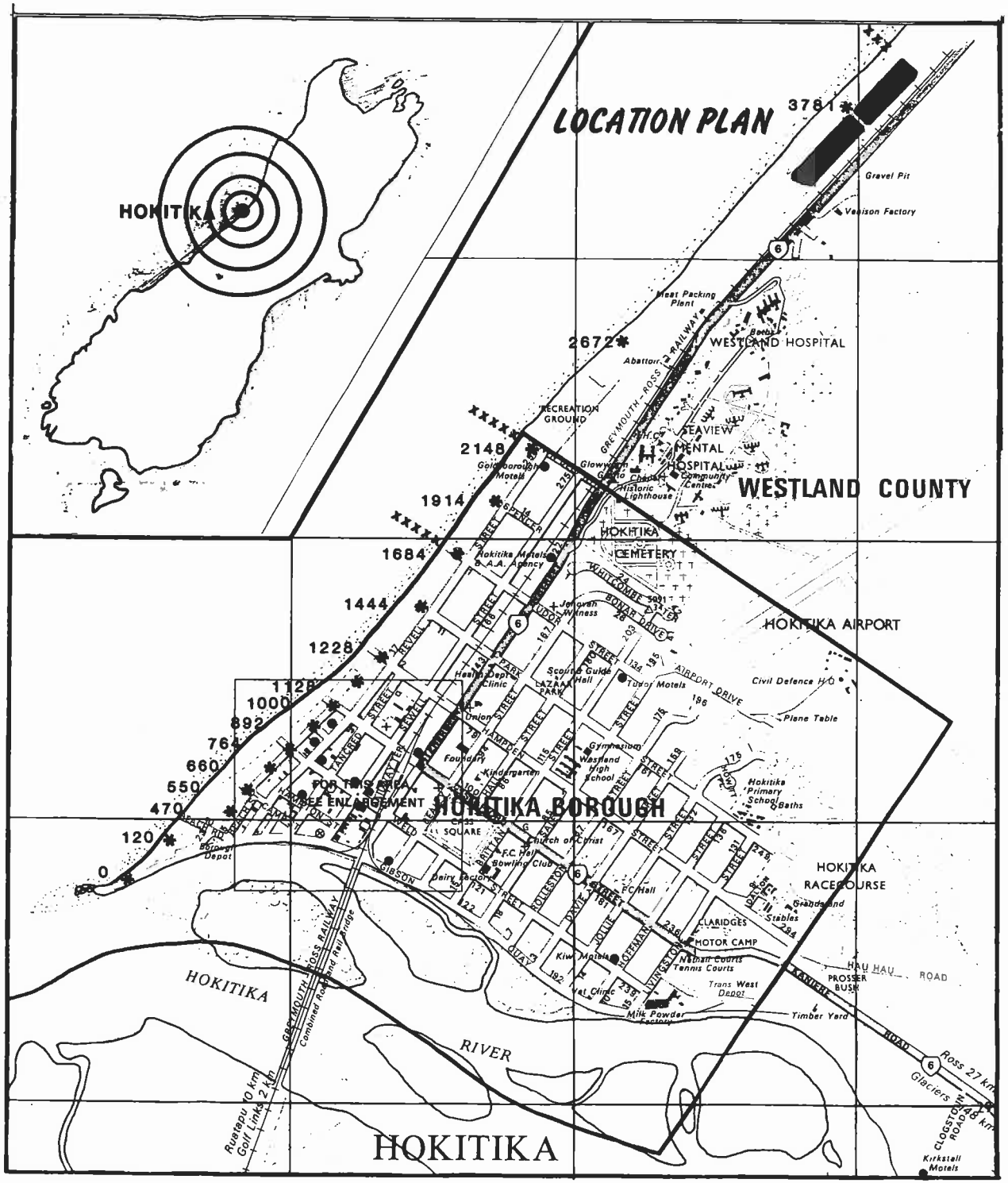
Application for Grant Assistance

ROCK GROYNE PROPOSAL

September 1986



HOKITIKA BEACHFRONT ROCK GROYNE PROPOSALS


LOCATION PLAN
HOKITIKA
WESTLAND COUNTY
HOKITIKA BOROUGH
HOKITIKA AIRPORT
HOKITIKA RACECOURSE
HOKITIKA
RIVER
HOKITIKA
WESTLAND HOSPITAL
SEAVIEW HOSPITAL
DENTAL
CEMETERY
RECREATION GROUND
Meat Packing Plant
Gravel Pit
Venison Factory
Abattoir
RAILWAY
GREYMOUTH - ROSS
Golden Borough Motels
Glowworm Grotto
Historic Lighthouse
Community Centre
Hokitika Motels R.A.A. Agency
Jehovah Witness
WHITCOMBE STREET
BONAR DRIVE
AIRPORT DRIVE
Civil Defence H.Q
Plane Table
Tudor Motels
Scouts Guide Hall
Health Dept Clinic
Union Street
Foundry
Kindergarten
Gymnasium
Westland High School
Hokitika Primary School
Baths
Post Office
Bridge Depot
Church of Christ
F.C. Hall
Bowling Club
Dairy Factory
Grandstand
Stables
CLARIDGES MOTOR CAMP
Motor Courts
Tennis Courts
Kiwi Motels
Nat Clinic
Trans West Depot
Milk Powder Factory
Timber Yard
PROSSER BUSH
HAU HAU ROAD
KANIERE ROAD
Ross 27 km
Glaciers
CLOGSTOUN ROAD
Kirkstall Motels
Rustepu 10 km
Golf Links 2 km
GREYMOUTH - ROSS RAILWAY
Combined Road and Rail Bridge
3781
2672
2148
1914
1684
1444
1228
1128
1000
892
764
660
550
470
120
0

HOKITIKA BEACH SEA EROSION

APPLICATION FOR GRANT ASSISTANCE

ROCK GROYNE PROPOSAL - SEPTEMBER 1986

CONTENTS

1. INTRODUCTION

This report is in support of application for National Water and Soil Conservation Authority approval and grant assistance for construction of rock groynes along Hokitika beach front.

2. BACKGROUND

2.1 LOCATION

Hokitika Borough fronts to the sea between the Hokitika River mouth and the Borough boundary at Richards Drive, see location plan, page 1.

2.2 HISTORIC SEA EROSION

Sea erosion has caused problems for Hokitika Borough since first settlement. Erosion appears cyclic with major erosion occurring in 1867, 1914, 1943 and current event - 1983 to date.

Dr. J.G. Gibb, reference 1, describes historic shoreline movements.

Plan numbers 906/209/2,3 & 5, pages 16 to 18, show historic shoreline and toe of foredune movements, 1867 - 1984.

2.3 HISTORIC PROTECTION WORKS

In 1914 timber groynes were constructed normal to shoreline to the design of Sharpe. See photos from "Ben Theim collection" dated 10 May 1914, pages 19 and 20.

From papers by Sharpe, reference 2, groynes appear to have been very successfull, the beach is reported to have aggraded rapidly. A key factor, identified by Sharpe, was the raising of the groynes one plank at a time as the beach built up. This reduced scour due to wave reflection and limited wave loading on the structures.

In 1965 rock was placed at the north side of the Hokitika River mouth to train the river and to protect the foreshore. The river training works have been stable. However the adjacent foreshore protection rock slumped and was replaced in January 1979 by further rock 20 metres inland. This rock has been stable.

Hokitika Borough has made some attempts to halt the present erosion cycle. Lengths of sandbag wall were constructed in September 1984 and April 1986 but these lasted only a few days in heavy sea conditions. Demolition rubble and general fill has been dumped onto the beach at various stages. Much of this material has now been transported north along the beach.

The Borough has planted marram grass on the sand accreted over the last two years between Stafford Street and the river mouth.

2.4 COASTAL PROCESSES AND HAZARD ZONING

Dr. Gibb is currently working on a report to be titled, "Long, medium and short term solutions to problem of coastal hazards at Hokitika", reference 3. This report describes the coastal processes, defines the coastal hazard zone, describes long, medium and short term solutions in general terms and recommends appropriate action on the various time scales.

Plan number 906/209/1, page 21, shows the coastal processes over the period 1943 - 1984, in particular, the effect of the river mouth direction on coastal erosion.

Dr. Gibb's report should be read with this application to provide the background scientific information.

2.5 PREVIOUS APPLICATIONS

This application supercedes our applications of 2 August 1984 for a sea wall parallel to the sea front and that of 16 August 1984 for rock groynes. The current proposal varies in method of funding, location of groynes and other technical details.

This application follows on from Dr. Gibb's report to the Hokitika Borough Council on 26 August 1986 and incorporates Water and Soil staff recommendations set out in correspondence dated 14 January 1985 and 19 February 1985.

3. THE PROBLEM

Part of Hokitika Borough is located on the foredune between the river mouth and the Borough boundary at Richards Drive. See location plan, page 1.

Since 1982 the foredune has been extensively eroded, firstly at the south end of the beach and more recently at the north end. Since mid 1983 the southern end has steadily built up at a uniform rate of approximately 18,000 cubic metres per month. See plan number 906/225, page 22, showing change in beach volume with time between river mouth and Hampden Street.

Since April 1984 the northern section has eroded back at rates of up to 45,000 cubic metres per month. Plan number 906/226, page 23, shows beach volume between Hampden Street and Richards Drive. Also see photos showing extent of erosion in Tudor Street area at September 1986, page 24.

The present erosion threat is to residential properties over a distance of around one kilometre between Hampden Street and Richards Drive. The beach front has eroded back to within 17 metres of the nearest houses. Erosion rates of up to 10 metres per month have been recorded therefore the first houses could be directly effected within two months.

Plan number 906/227, page 25 shows the effect of 10, 20, 30 and 40 metres of further erosion on residential property west of Revell Street.

If erosion continues through the foredune, wave run-up could enter the trough between the foredune and backdune, which is extensively developed. Plan number 906/224, page 26, illustrates the trough-like nature of the area in which much of the township is located.

In summary the problem is that coastal erosion is immediately threatening residential property west of Revell Street and potentially threatening residential and commercial property located between the foredune at Revell Street and the backdune at Fitzherbert Street.

4. OBJECTIVES

The primary objective of any works proposal is to prevent further erosion of the foredune along the one kilometre of coastline currently under threat.

The second objective is to build up the beach along the eroded section to provide a reservoir of material as protection against future erosion.

5. ALTERNATIVES

5.1 WALL ALONG SEA FRONT

Rock is the only material considered suitable for a protection wall. Sandbags have failed on this coastline and timber structures are known to have failed in other areas.

A rock wall has the advantage of forming a final line of defence against the advancing erosion.

It has the disadvantages of high cost, (estimated to be in excess of $1 million for one kilometre of wall) and does not achieve the secondary objective of causing a build up of material on the beach.

5.2 GROYNES

Groynes have the advantage of trapping material that is moving northwards along the beach due to to the dominant westerly wave direction. This build up should have the effect of protecting the eroding coastline.

The disadvantage of groynes is that they can cause erosion on the downdrift side due to starvation while material collects updrift of the groyne. This is expected to be only temporary.

The extent of downdrift erosion can be controlled by incrementally raising the groynes while closely monitering the beach cross sections. Beach nourishment could be used to offset the downdrift erosion effect, see 5.3 below.

There are a number of different groyne types that could be used:

5.2.1 Timber post and plank.

This has the advantage of being simple to incrementally increase the height however in the hostile beach environment it is expected that such a structure would not survive in the longer term. There is also the danger of fires or vandalism destroying the protection at an early stage. The cost is comparable with rock groyne proposal.

5.2.2 Wire basket.

This has the advantage of using readily available material for filling the wire baskets but beach abrasion would be expected to destroy the wire netting in a short time. Initial cost is comparable with rock groyne proposal but repair costs would be high.

5.2.3 Rock.

This has the advantage of relatively low cost, (approximately $140,000 for three groynes), structure is massive, permanent, flexible and capable of topping up should settlement occur. There are sources of suitable rock within 10 kilometres of the beach. Existing rock wall at the mouth of the Hokitika River has demonstrated that such structures can withstand the harsh coastal environment with little maintenance after initial settling down period.

5.3 BEACH NOURISHMENT

Measured beach cross sections indicate that approximately 200,000 cubic metres of material has been eroded from the one kilometre section of Borough coastline currently under threat in just over a year. To replace this by carting in gravels would cost in excess of $600,000. Although this could be used to offset the erosion loss it has the disadvantage of not providing a solution in the long term as the material added to the beach will be continually transported north by littoral drift.

Beach nourishment combined with groynes would have the advantage that the groynes would trap the added material and this would offset the downdrift erosion effect of the groynes.

By using coarse gravels rather than sand for beach nourishment a more stable beach may be obtained.

5.4 RIVER TRAINING

The direction of flow in the Hokitika River mouth has been shown by Dr. Gibb to have a major effect on the Hokitika coastline. Training of the river could reduce both the frequency and magnitude of erosion. This alternative could provide the long term solution to the sea erosion problem.

A rock training wall 800 metres long would be required on the south side of the river mouth. The estimated cost of a 5 metre high wall is $900,000.

Training of the river mouth would not provide protection to the north end of Revell Street in the short term.

5.5 COASTAL HAZARD MAPPING - PLANNING RESTRICTIONS

This has long term advantages but does not provide a solution to the problem of immediate erosion threat.

5.6 RELOCATE HOUSES

Removal of houses from the foredune could remove the immediate threat to property however the threat to residential and commercial property in the trough behind the foredune would remain. The cost of relocating this large section of the town rules out this option.

5.7 DO MINIMUM

This has been the option chosen by the Borough to date. Monitering of beach cross sections, sandbag protection, planting marram grass and dumping of demolition and other materials along actively eroding sections all amount to minimum action.

This has had the advantage that further knowledge has been gained of beach behaviour before committing large expenditure to remedial works.

There is however increasing risk involved with this option as the erosion approaches residential properties. There is now direct threat to property valued at approximately $2 million plus possible threat to life.

This option is no longer considered tenable.

6. SELECTED PROPOSAL

The selected proposal is a combination of rock groyne construction and beach nourishment.

Groynes are to be constructed at right angles to the beach. The first is at Richards Drive with the objective of building up a wedge of material back towards Hamoden Street. To offset the downdrift erosion effect it is proposed to cart in coarse gravels from gold tailings east of Hokitika. The groyne is to be 100 metres long and the rock is to trenched into the beach by one metre. The initial height of the groyne is to be one metre above beach level. Top width is four metres to provide truck access for repairs and possible future increase in height.

Plan number 906/223, page 27, shows the rock groyne proposal.

A key feature of this proposal is the continued monitering of beach profiles after groyne construction. The information obtained then provides the basis for deciding on raising of the first groyne, construction of further groynes and the amount and rate of beach nourishment required.

The second groyne would be located updrift of the first in the vicinity of Tudor Street. The actual location would depend on the length of the sand wedge accumulated in front of the Richards Drive groyne.

A third groyne would be constructed just north of the Borough sewerage ponds to provide an accumulation of sand to offset any downdrift erosion effect of the Richards Drive groyne.

As stated the design of groynes will depend on the results of beach monitering after construction of the first groyne.

For estimating purposes the following total proposal is assumed:

GROYNE	A	Richards Drive	100 metres long, 1 metre high initially, 2 metres high ultimately.
GROYNE	B	Tudor Street vicinity	100 metres long, 1 metre high.
GROYNE	C	Sewerage Ponds	70 metres long, 1 metre high.

Beach nourishment requirement of 10,000 cubic metres at Groyne A is assumed.

Rock groyne specification

Rock to be sound, durable and mostly angular. Splitting of rock may be required to provide suitable shape.

Rock shall be graded as:

6 - 8 tonne	50 %
5 - 6 tonne	30 %
4 - 5 tonne	20 %

This grading is based on that used for previous rock work near mouth of Hokitika River and on specifications obtained on rock groynes placed at Noosa Heads, Queensland, Australia.

Rock shall be placed in a 1 metre deep trench and excavated material then pushed up against side of rock groynes.

Sideslopes above beach level to be 1 vertical to 1.5 horizontal.

Reference 4, "The effectiveness of groynes", by Brampton and Motyka, has been used in design of the groyne system.

7. ESTIMATE

This estimate includes GST.

Status is preliminary assessed cost.
MWD CCI = 2700 (assessed June 1986).

Item	Unit	Quantity	Rate	Amount
GROYNE A (100 METRES LONG)				
Excavation	cu. m.	636	$1.00	$636
Rock	tonne	2104	$10.00	$21,040
Cart in gravel (beach nourishment)	cu. m.	10000	$4.00	$40,000
Repairs during construction	tonne	100	$10.00	$1,000
				$62,676
Plus 5% contingency, plus 20% Board service charge : Total GROYNE A				$78,972
			say	$79,000
GROYNE B (100 METRES LONG)				
Excavation	cu. m.	600	$1.00	$600
Rock	tonne	2010	$10.00	$20,100
Repairs during construction	tonne	100	$10.00	$1,000
				$21,700
Plus 5% contingency, plus 20% Board service charge : Total GROYNE B				$27,342
			say	$27,500
GROYNE C (70 METRES LONG)				
Excavation	cu. m.	360	$1.00	$360
Rock	tonne	1206	$10.00	$12,060
Repairs during construction	tonne	60	$10.00	$600
				$13,020
Plus 5% contingency, plus 20% Board service charge : Total GROYNE C				$16,405
			say	$16,500

Estimate continued:

Item	Unit	Quantity	Rate	Amount
GROYNE A (FUTURE RAISING BY 1 METRE)				
Excavation	cu. m.	150	$1.00	$150
Rock	tonne	1230	$10.00	$12,300
Repairs during construction	tonne	60	$10.00	$600
				$13,050
Plus 5% contingency, plus 20% Board service charge : Total Groyne A Future Raising				$16,443
			say	$16,500
GRAND TOTAL				$139,500
			SAY	$140,000

8. STAGED CONSTRUCTION

It is proposed to construct the groynes in stages. Stage I is groyne A, at estimated cost $79,000. This is to be done as soon as financial approval is obtained and would take less than two months to complete.

Further stages depend on the results of beach monitering after completion of stage I. The total construction period would not be longer than two years.

9. ECONOMIC JUSTIFICATION

Property to the value of approximately $2,000,000 between Hamoden Street and Richards Drive is currently under threat of sea erosion. The estimated cost of works proposed to alleviate this threat is $140,000, including GST.

It is not possible to calculate probability of further erosion occurring or estimate the final extent of the erosion cycle. Therefore no detailed economic analysis has been performed. However an indication of economic benefit can be gained by considering the number of houses that would need to be lost or relocated to give a positive return on the cost of protection. Assuming average house value of $40,000 and cost of shifting houses to new serviced section $20,000 per house, only four houses need be lost or seven relocated for the proposed works to show a positive return on investment.

The probability of losing four houses or having to shift seven is considered high.

10. ENVIRONMENTAL ASPECTS

10.1 WILDLIFE

Wildlife Service have been consulted and Mr. R.W.d. Simpson, Senior Wildlife Officer, Greymouth, has advised that, "the environmental impact of groyne protection would be minimal and no need for specific planning to protect wildlife or habitat values is foreseen".

10.2 VISUAL APPEARANCE

Improvement of the visual appearance of the sea frontage should be achieved. It has become a general tip head at present with various sorts of rubbish such as old sewer pipes, concrete, garden materials etc being tipped along the beach in an effort to halt the erosion. With the construction of the groynes there will be no need to dump rubbish and the visual appearance will be markedly improved.

10.3 HISTORIC INTERESTS

There will be no loss of historic interests by the erection of the groynes. Historic buildings and sites will be protected by the erection of the groynes.

10.4 VEHICLE ACCESS

The blocking of vehicle access along the beach will not be detrimental to the environment, in fact this may improve the beach environment for many users.

There are beaches to the north and south where vehicle access is available for firewood collection and other pursuits.

10.5 RECREATIONAL SIGNIFICANCE

The construction of the proposed groynes will have significant recreation benefits by stabilising the beach and providing shelter.

The present uses of the beach are walking, running and general beach combing.

Limited use is made of the beach for swimming, surfing, boating, fishing and picnicing. The construction of the groynes may encourage these uses.

11. LEGAL ASPECTS

It must be stated that the groyne proposal will cause increased erosion downdrift of the groynes as they trap material that would otherwise move north. This effect should be temporary, being worst while the groynes are filling with material. When spillage starts to occur past the groynes the beach downdrift would be expected to build, however back swirl effect may limit this buildup.

It is not possible to accurately estimate the extent of this increased erosion, however the effects can be controlled by careful monitering of beach cross sections, limiting the groyne height to no more than one metre above beach level and by beach nourishment as required.

Property boundaries have been investigated, see plan number 906/222, page 28. It may be seen that north of Richards Drive, where the erosion effect is expected to be greatest, the property boudaries are set back from the shoreline. This provides a considerable buffer strip for erosion downdrift of the Richards Drive groyne.

The groyne proposal involves higher risk than the alternative rock wall along the sea front. The groyne proposal has been selected largely on the basis of cost, $140,000 compared with $1,000,000 for the rock wall. It is known that the ability of Hokitika Borough to finance such works is strictly limited due to continuing committment to recently completed sewerage scheme.

The risk involved in the groyne proposal has been explained to the Hokitika Borough Council and their decision to finance the groyne proposal is made with this knowledge.

12. LOCAL SHARE

Hokitika citizens have formed a committee to raise funds for sea erosion protection works. This committee now has assured finance of $56,000 which it will provide to Hokitika Borough Council as local share on the rock groyne proposal.

Once work is commenced and the benefits demonstrated it is expected that further finance will be forthcoming to allow completion of the works.

13. APPLICATION FOR NWASCA APPROVAL

This Board hereby applies for NWASCA approval for rock groyne sea erosion protection works as described in this report.

The grant rate applied for is 30% in accord with current policy.

The total estimated cost of the project is $140,000.

Financial approval is sought for Stage I being the first groyne plus beach nourishment, at estimated cost $79,000. Local share of $55,300 is available. NWASCA grant requirement is $23,700.

Total grant requiremnt is $42,000.

14. SUMMARY

Part of Hokitika residential area is currently under threat of sea erosion.

Westland Catchment Board has prepared a rock groyne proposal to protect property from this erosion.

Hokitika Borough has sufficient local share available to complete stage I of the proposed works.

NWASCA grant assistance is sought for the prooosal, with immediate financial approval for Stage I.

15. REFERENCES

1. GIBB, Jeremy G; "The problem of sea erosion at Hokitika, Westland, New Zealand, and possible solutions." Proceedings of the 1985 Australasian Conference on Coastal and Ocean Engineering, December 1985.

2. SHARPE, H.H; "The erosion of the sea beach fronting the town of Hokitika and the remedial measures adopted" Proceedings of the New Zealand Society of Civil Engineers 2. 90-125. 1915.

3. GIBB, Jeremy G; "Long, medium and short term solutions to problem of coastal hazards at Hokitika". MWD Internal Report, September 1986.

4. BRAMPTON, A.H. and MOTYKA, J.M; "The effectiveness of groynes". Shoreline Protection. Thomas Telford Ltd, London, 1983.

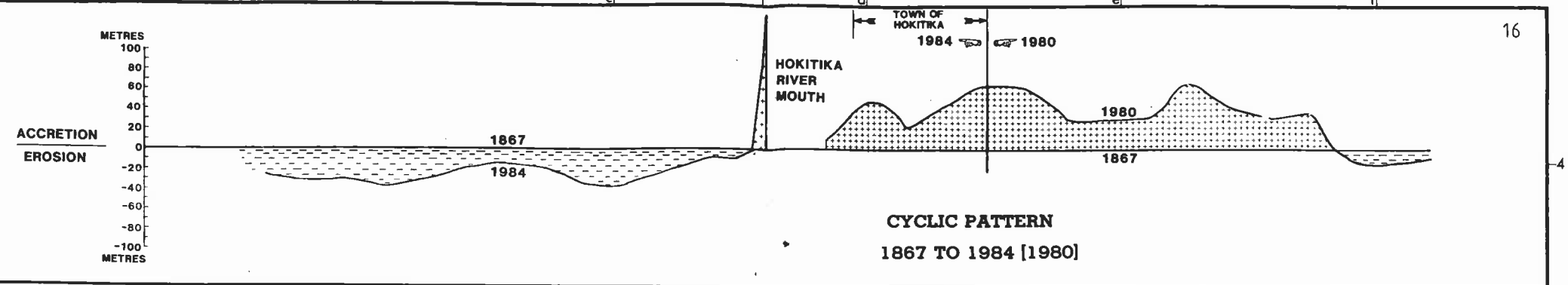
Report by: J. McF. Hamilton, Deputy Chief Engineer, and R.J. Daniel, Design Engineer.

Plans

&

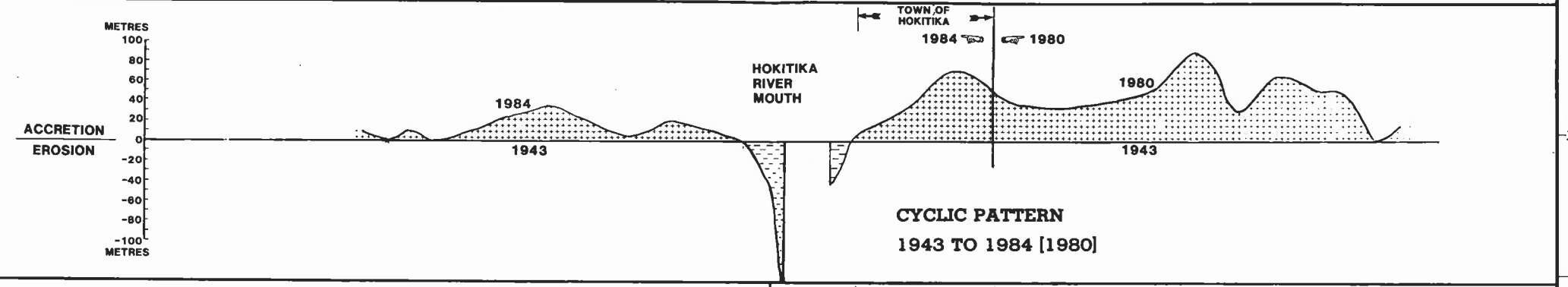
Photographs

16



CYCLIC PATTERN

1867 TO 1984 [1980]



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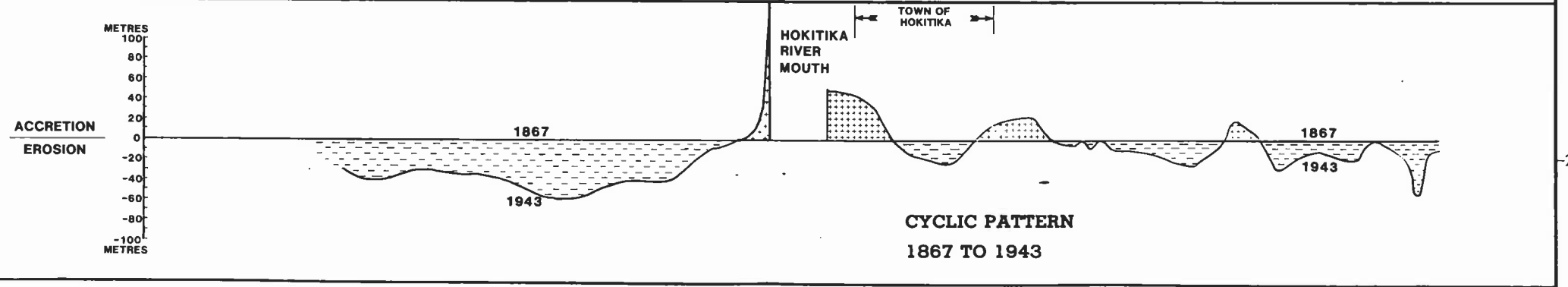

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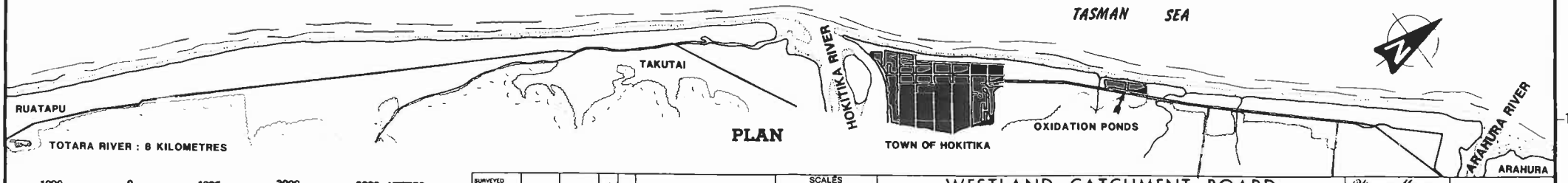

ORIGINAL SCALE OF INCHES

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SCALES
AS SHOWN
DATUM

WESTLAND CATCHMENT BOARD

HOKITIKA SEA EROSION

Historical Shoreline Movements 1867 - 1984 "A"

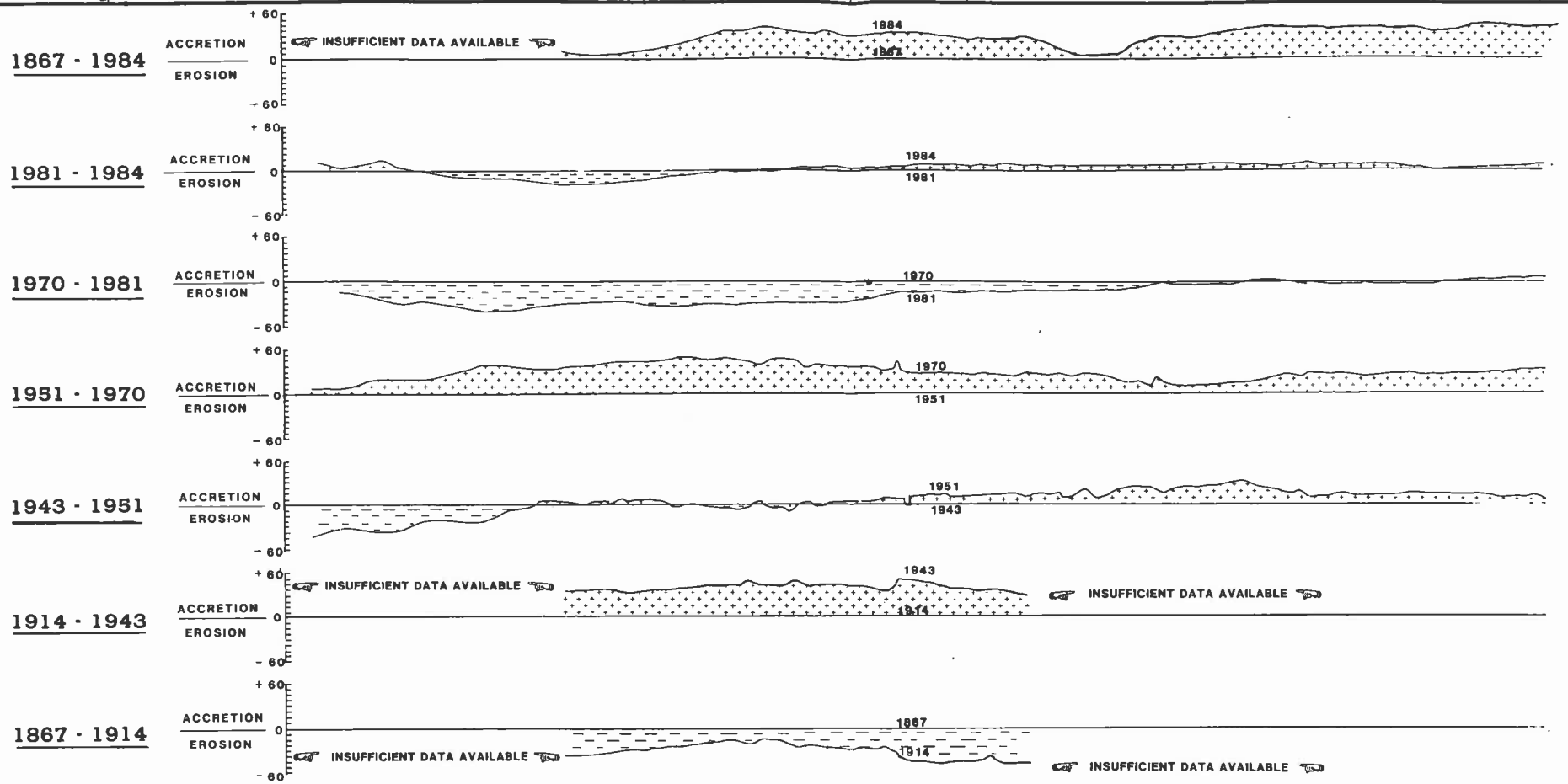
Wayne Moen
Nov 1984

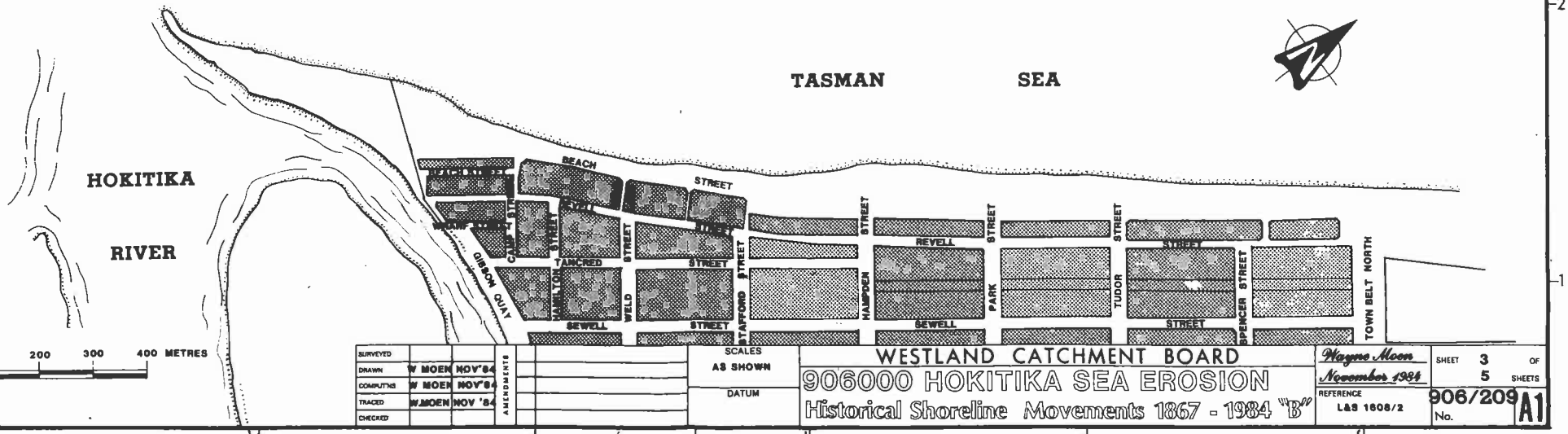
SHEET 2 OF 5 SHEETS

REFERENCE
LAS Photogram
1608/1-4

906/209 No

A1





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SCALES AS SHOWN

DATUM

WESTLAND CATCHMENT BOARD

906000 HOKITIKA SEA EROSION

Historical Shoreline Movements 1867 - 1984 "B"

Wayne Moen November 1984

REFERENCE L&S 1608/2

SHEET 3 OF 5 SHEETS

906/209 No.

A1

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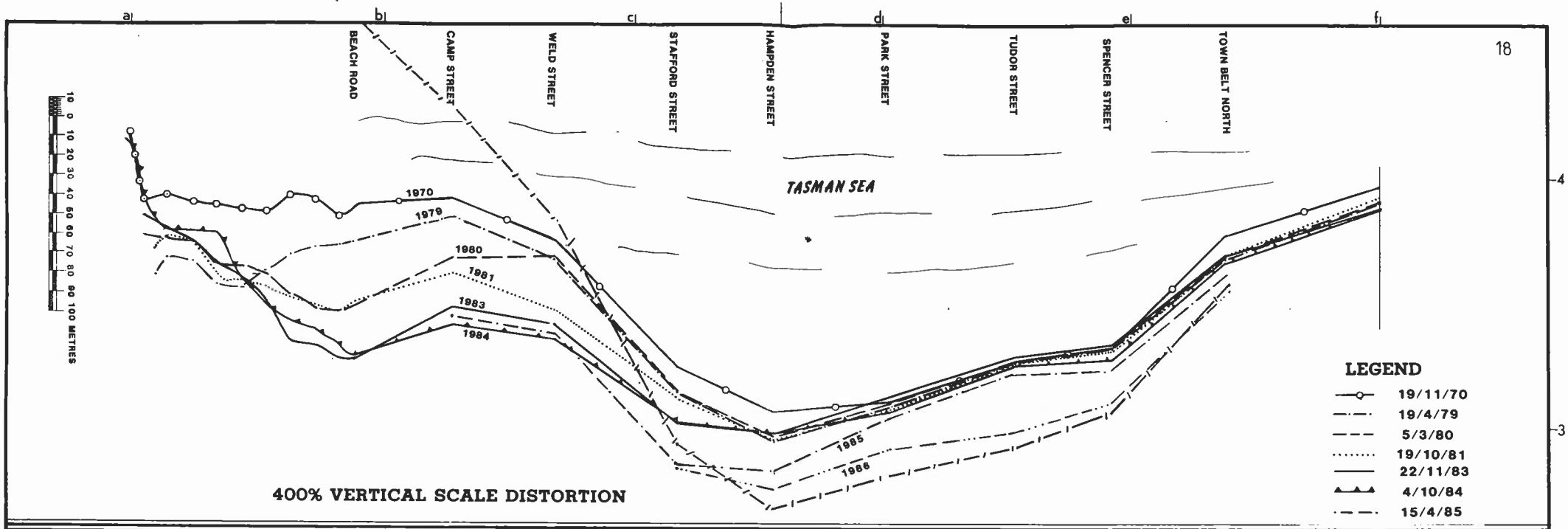

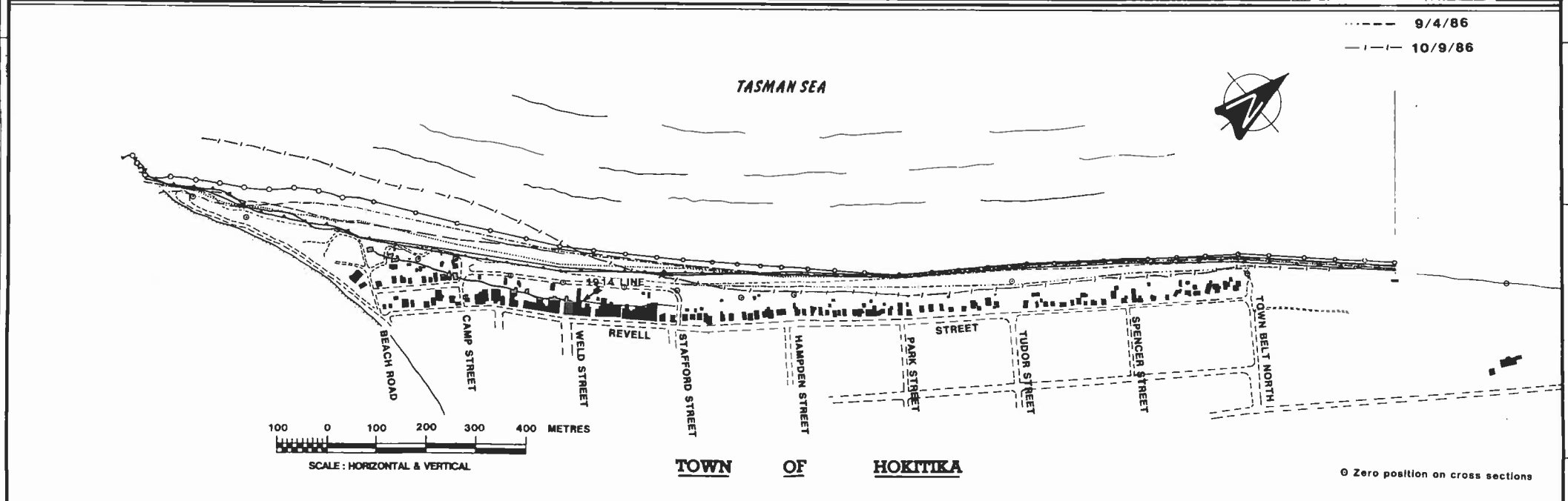

TOWN OF HOKITIKA

© Zero position on cross sections

ORIGINAL SCALE OF INCHES

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AMENDMENTS

SCALES

DATUM

WESTLAND CATCHMENT BOARD

906000 HOKITIKA SEA EROSION

Foredune Toe Movements - 1970 - 1986

Wayne Moen November 1984

SHEET 5 OF 5 SHEETS

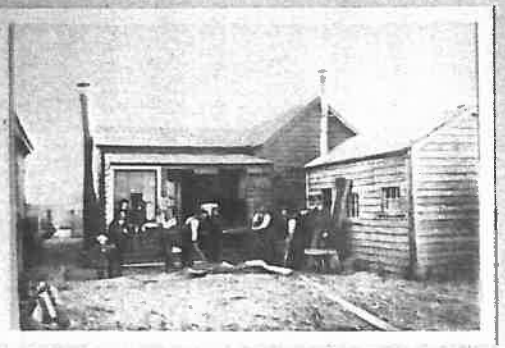
REFERENCE L & S PLANS

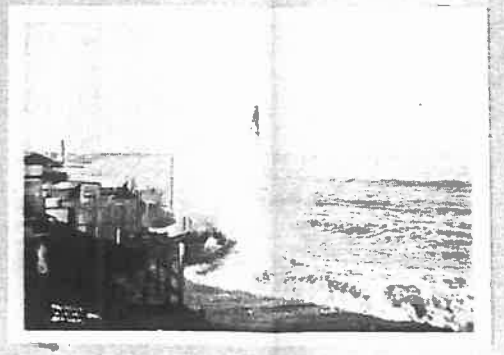
906/209 A1

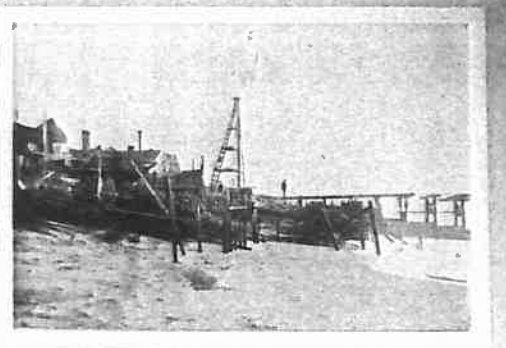
HOKITIKA BEACH EROSION

10 MAY 1914

Ben Thiem Collection.



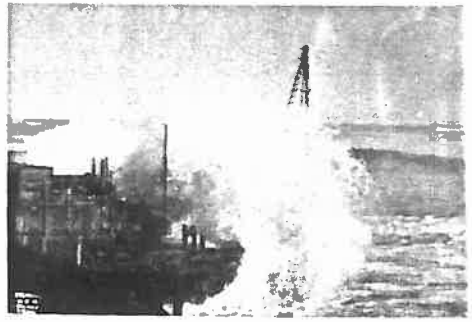


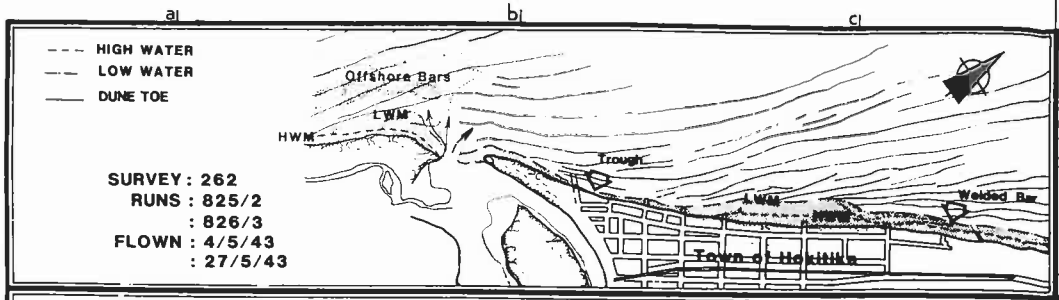


HOKITIKA BEACH EROSION

Ben Thiem Collection

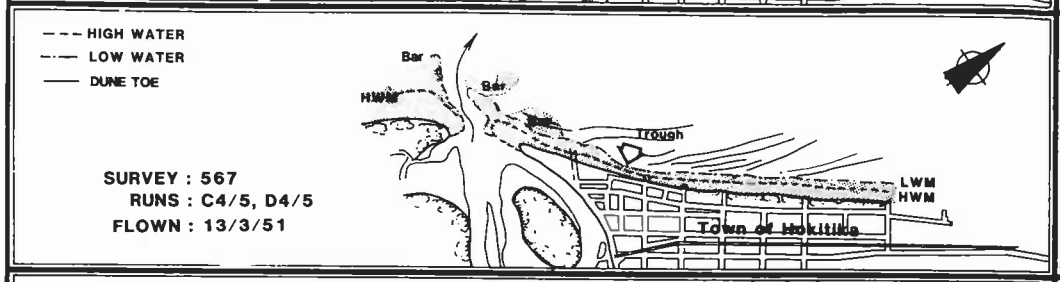
10 MAY 1914



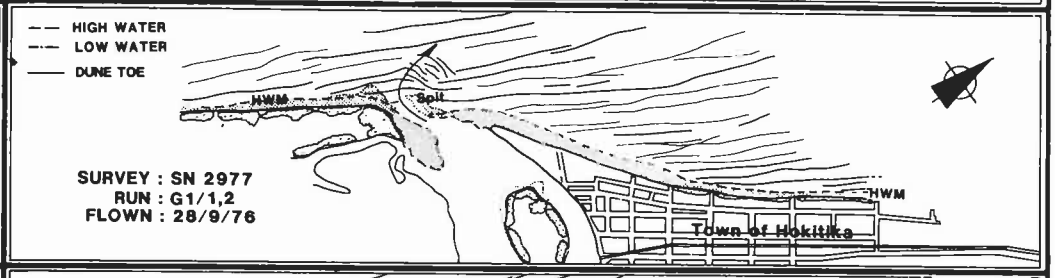


SURVEY : 262
RUNS : 825/2
: 826/3
FLOWN : 4/5/43
: 27/5/43

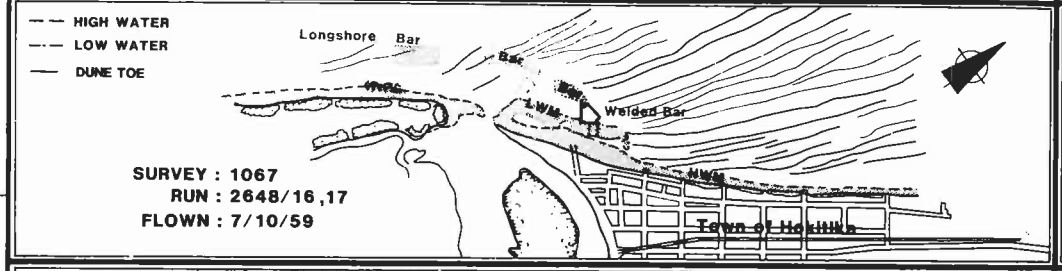
SURVEY : 3408
RUN 4506/1,2
FLOWN : 21/11/70



SURVEY : 567
RUNS : C4/5, D4/5
FLOWN : 13/3/51

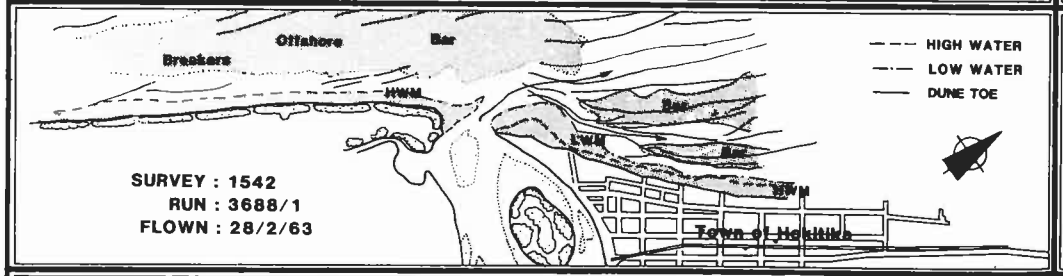


SURVEY : SN 2977
RUN : G1/1,2
FLOWN : 28/9/76

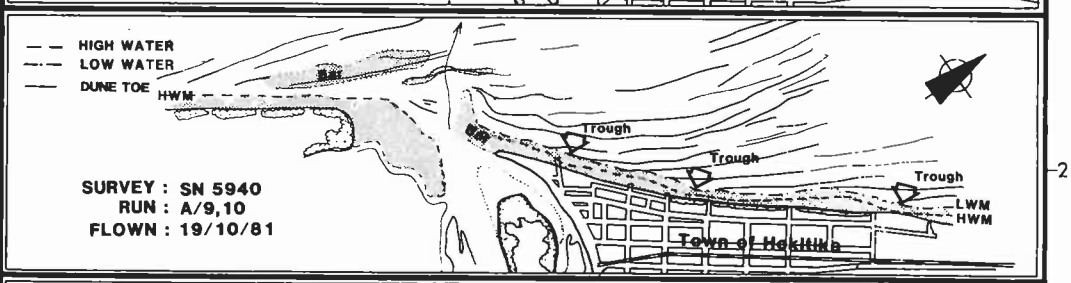


SURVEY : 1067
RUN : 2648/16,17
FLOWN : 7/10/59

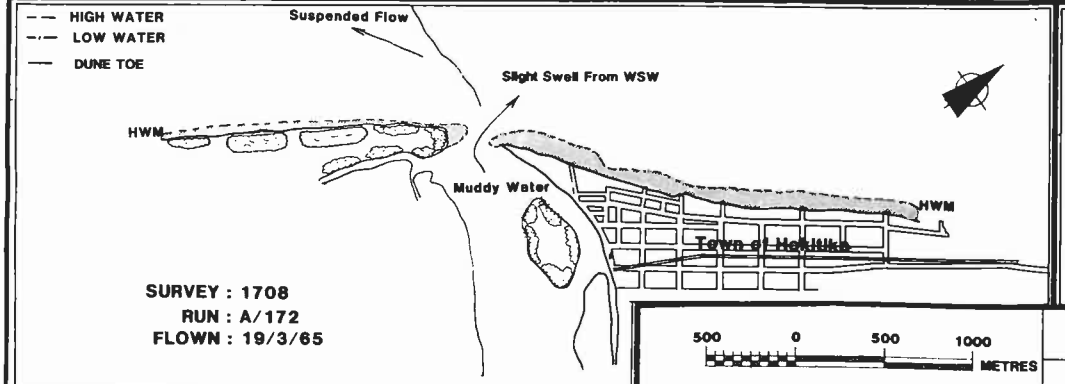
SURVEY : SN 5781
RUN : D1/2
FLOWN : 13/10/80



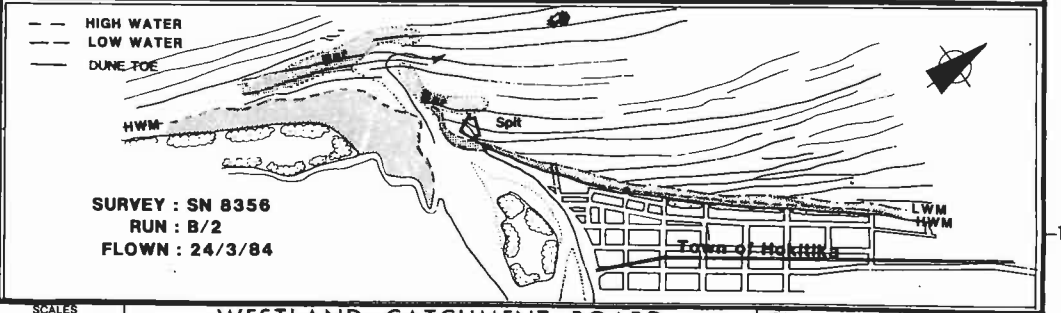
SURVEY : 1542
RUN : 3688/1
FLOWN : 28/2/63



SURVEY : SN 5940
RUN : A/9,10
FLOWN : 19/10/81



SURVEY : 1708
RUN : A/172
FLOWN : 19/3/65



SURVEY : SN 8356
RUN : B/2
FLOWN : 24/3/84

21

ORIGINAL SCALE OF INCHES

500 0 500 1000 METRES

SCALES

DATUM

WESTLAND CATCHMENT BOARD

906000 HOKITIKA SEA EROSION

Coastal Processes 1943 : 1984

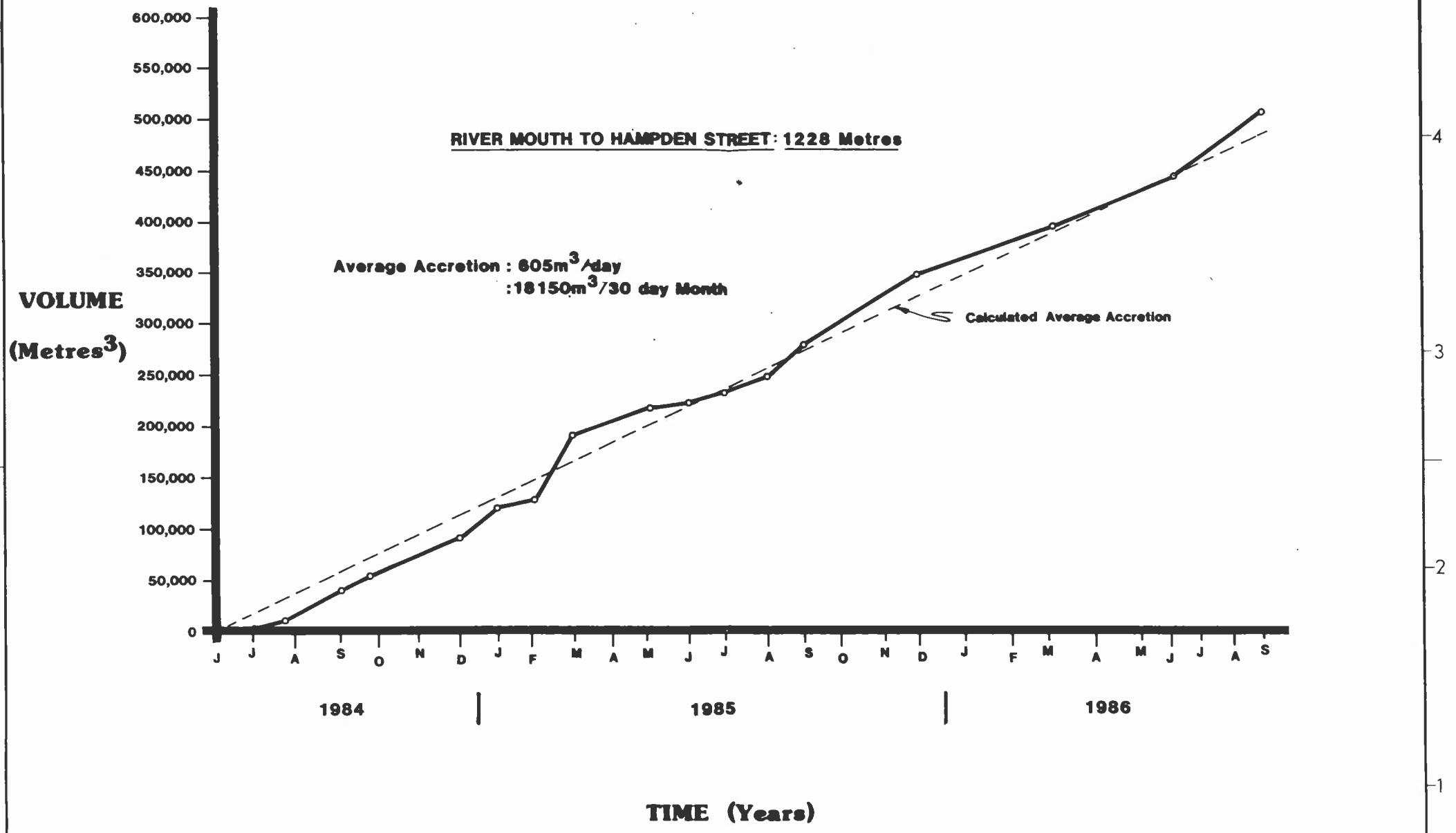
Wayne Moon
October 1984

SHEET 1 OF 5 SHEETS

REFERENCE

906/209 No.

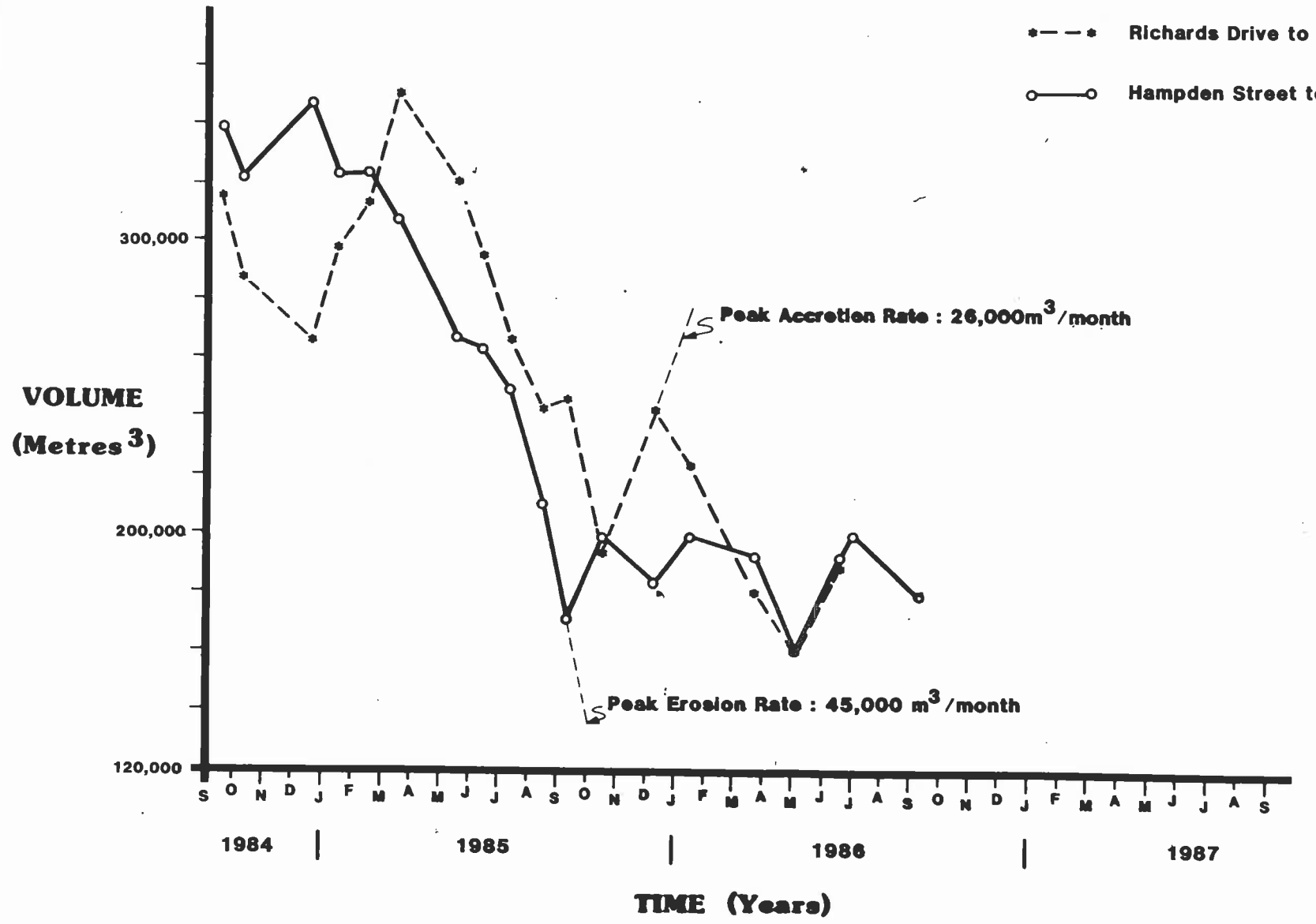
A1



SURVEYED			AMENDMENTS		SCALES	WESTLAND CATCHMENT BOARD	SHEET 1 OF 1 SHEETS
DRAWN	W Moen	9/86				906000 HOKITIKA SEA EROSION	Engineer
COMPUTATIONS	B Fauth	9/86			DATUM	: Build-up after Maximum Erosion	15th 1986
TRACED						:14 June 1984 to 10 September 1986	REFERENCE 906/225 No. A2
CHECKED		9/86					

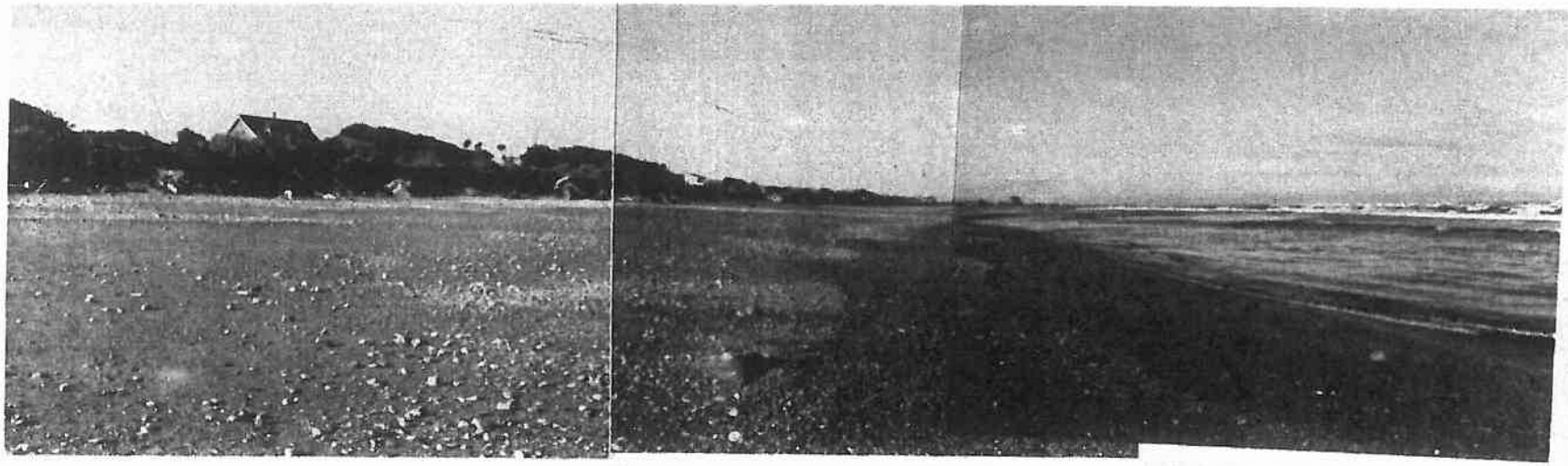
ORIGINAL SCALE OF INCHES

GRAPHIC SCALES



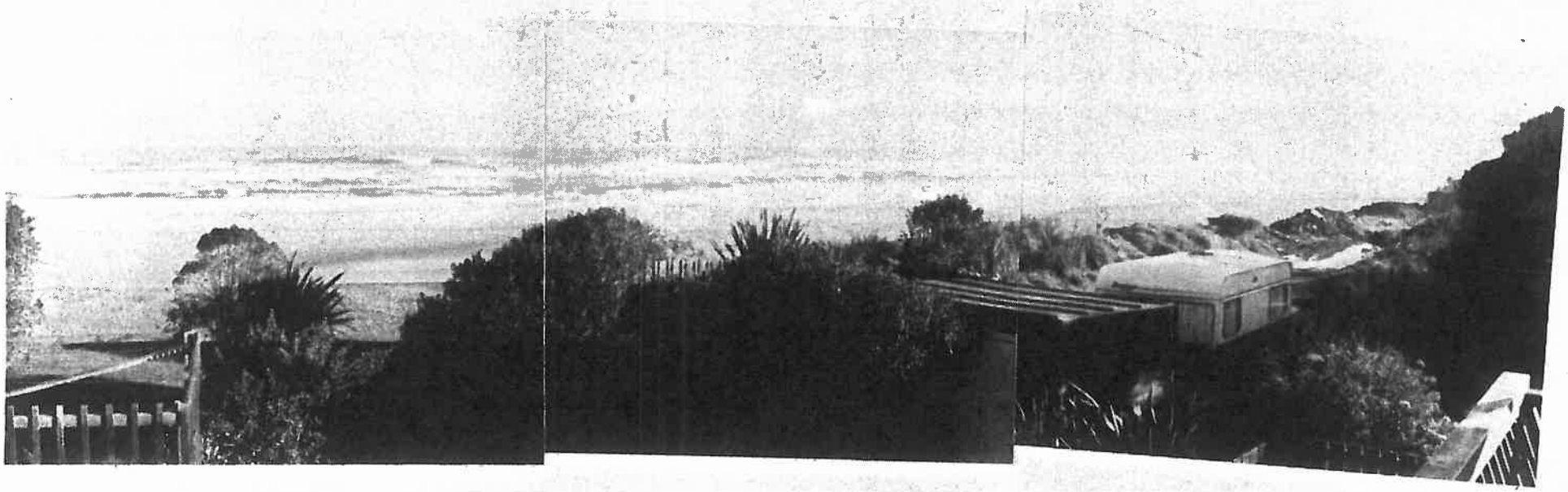
SURVEYED			AMENDMENTS		SCALES	WESTLAND CATCHMENT BOARD	SHEET 1 OF 1 SHEETS
DRAWN	R Daniel	9/86				906000 HOKITIKA SEA EROSION	
COMPUTNS	R Daniel	9/86			DATUM	: Beach Erosion Volume	Engineer
TRACED	W Moen	9/86				: 18 September 1984 to 10 September 1986	REFERENCE 906/226
CHECKED							No. A2

ORIGINAL SCALE OF INCHES
GRAPHIC SCALES

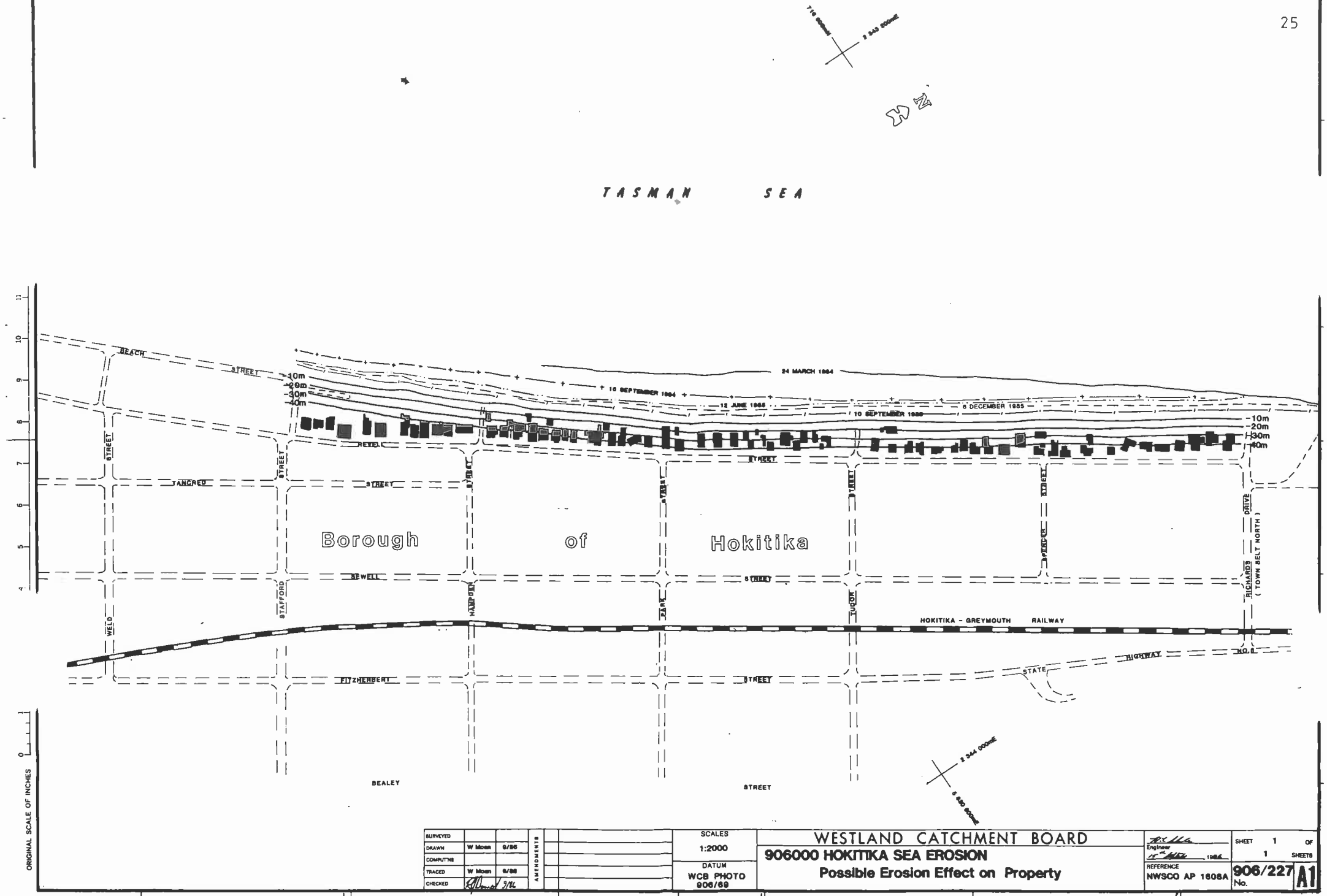


10am TUES . 9 SEPT. 1986

TUDOR STREET LOOKING SOUTH G.NICHOLLS HOUSE ON LEFT



FROM BALCONY OF G.NICHOLLS HOUSE LOOKING N/W



SURVEYED			
DRAWN	W Moen	9/86	
COMPUTED			
TRACED	W Moen	9/86	
CHECKED		9/86	

AMENDMENTS

SCALES 1:2000

DATUM WCB PHOTO 906/69

WESTLAND CATCHMENT BOARD

906000 HOKITIKA SEA EROSION

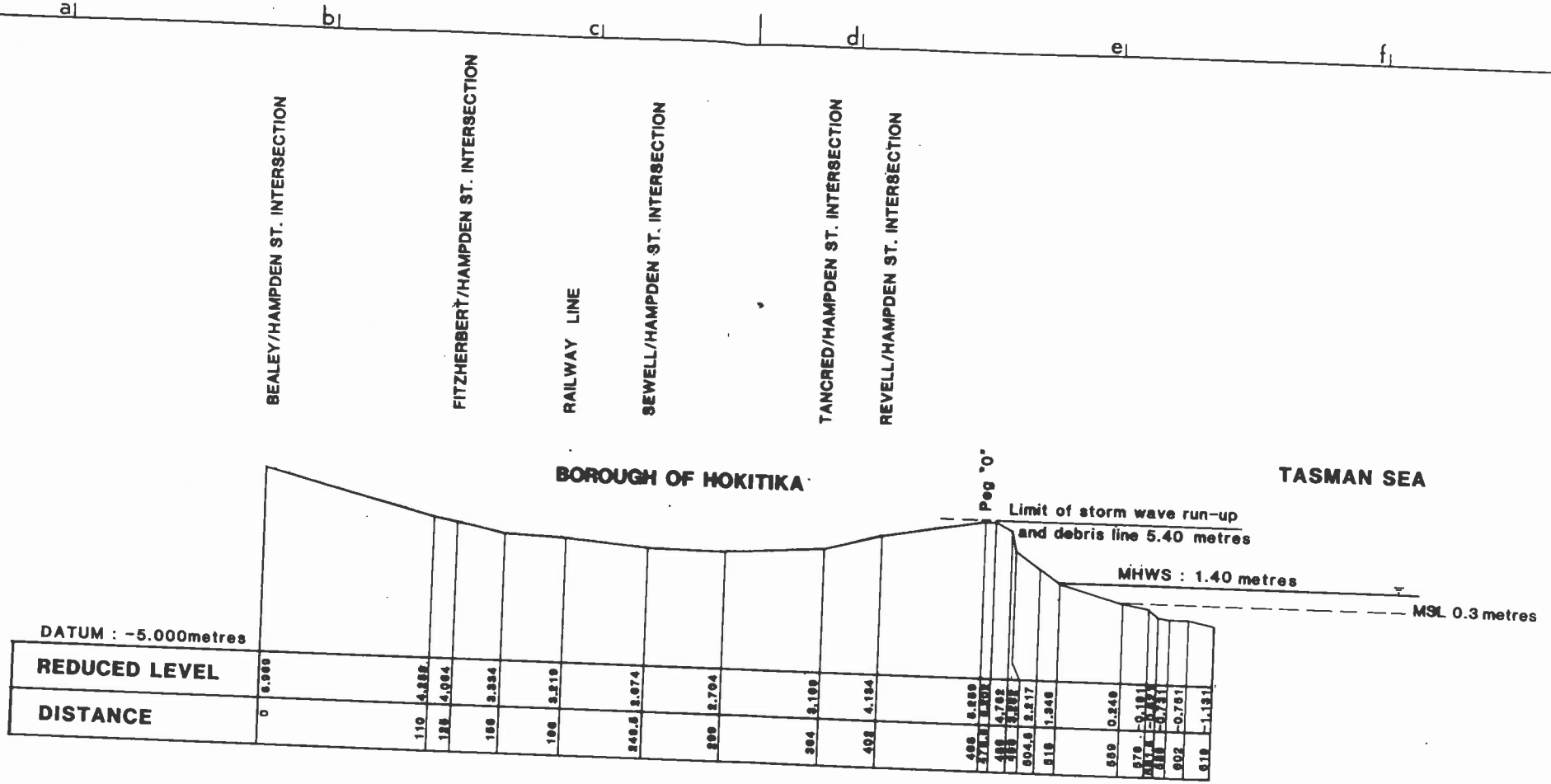
Possible Erosion Effect on Property

Engineer

REFERENCE NWSCO AP 1608A

SHEET 1 OF 1 SHEETS

906/227 No. A1



CROSS SECTION ON HAMPDEN STREET : BEALEY STREET TO SEA
AS AT 10 SEPTEMBER 1986

SCALE 1:200

SURVEYED	W MOEN	9/86	AMENDMENTS
DRAWN	W MOEN	9/86	
COMPUT'NS	W MOEN	9/86	
TRACED	W MOEN	9/86	
CHECKED		9/86	

GRAPHIC SCALES:

SCALES: AS SHOWN

DATUM: L&S MSL LYTTELTON

WESTLAND CATCHMENT BOARD

906000 HOKITIKA BEACHFRONT EROSION

Cross Section on Hampden Street

Engineer

1986

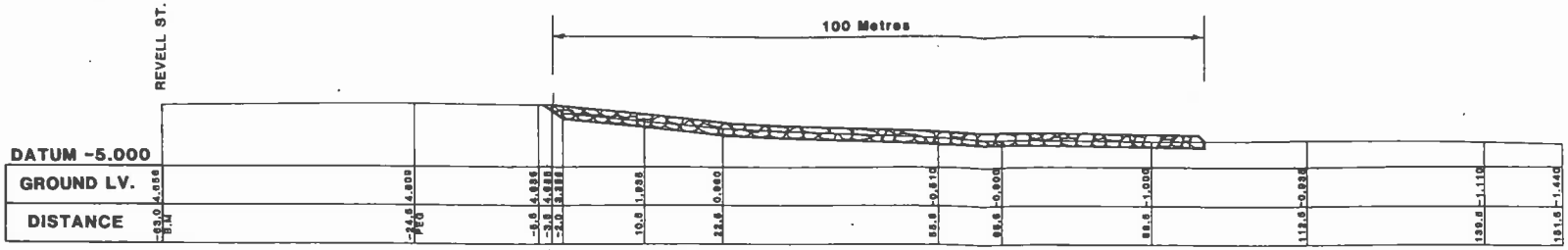
REFERENCE: LB 195

SHEET 1 OF 1 SHEETS

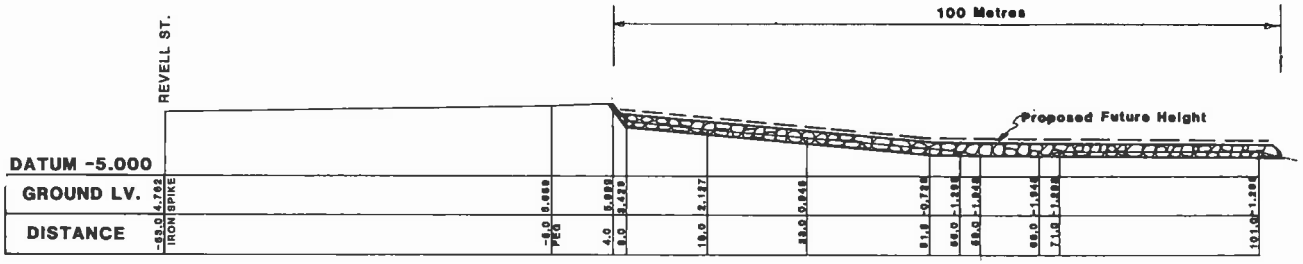
906/224 No.

A2

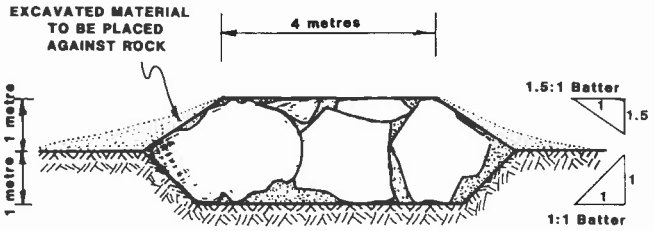
ORIGINAL SCALE OF INCHES



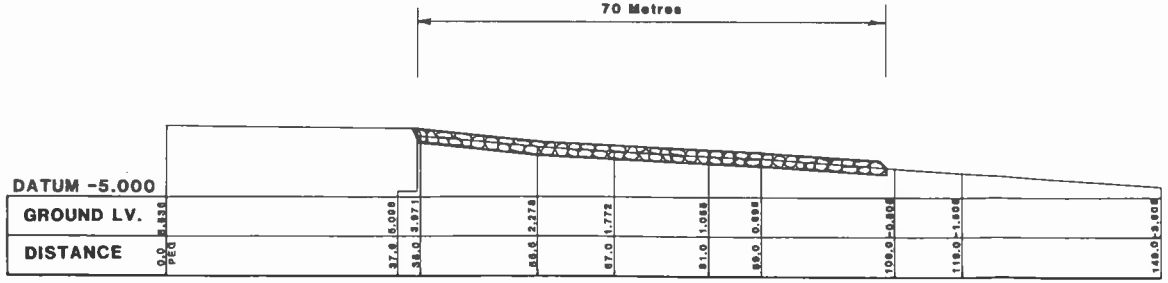
GROYNE "B" : (TUDOR STREET)



GROYNE "A" : (RICHARDS DRIVE)



TYPICAL GROYNE CROSS SECTION
1:50



GROYNE "C" : (SEWERAGE PONDS)

ROCK GRADING

4-5 Tonnes : 20%

5-6 Tonnes : 30%

6-8 Tonnes : 50%

SURVEYED			
DRAWN	W Jolly	8/86	
COMPUTED	R Daniel	8/86	
TRACED	W Moon	8/86	
CHECKED			

AMENDMENTS

SCALES 1:400

DATUM L&S

WESTLAND CATCHMENT BOARD

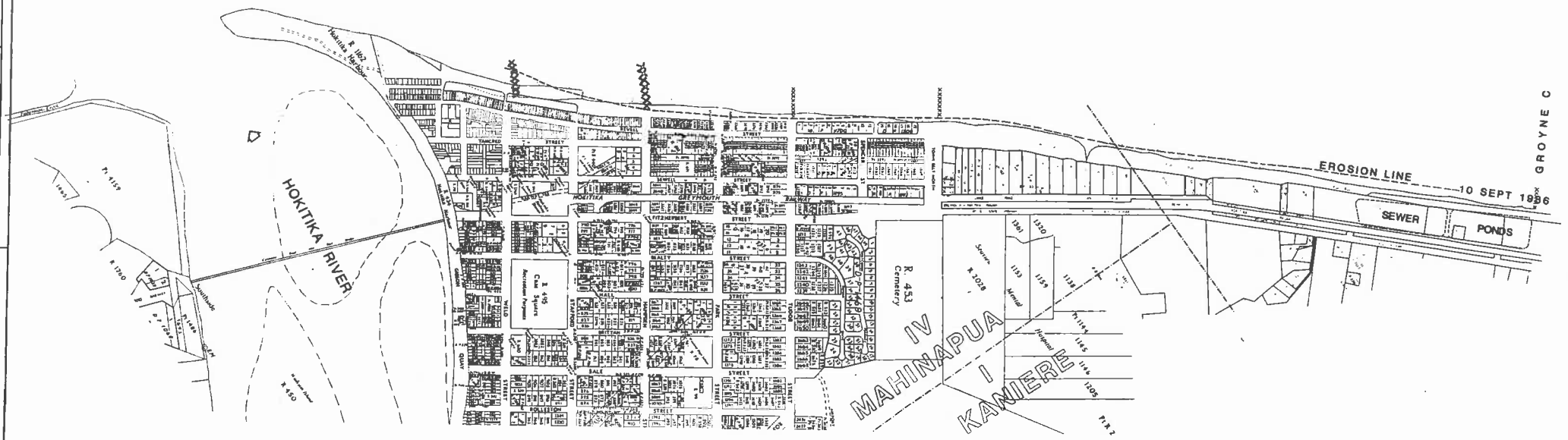
906000 HOKITIKA SEA EROSION
ROCK GROYNE PROPOSAL
SEPTEMBER 1986

Engineer 15th March 1986

REFERENCE

SHEET 1 OF 1 SHEETS

906/223 No A1



SURVEYED			AMENDMENTS		SCALES
DRAWN					
COMPUT'NS					DATUM L & S
TRACED	W.J.	9:86			
CHECKED		16.9.86			

GRAPHIC SCALES

ORIGINAL SCALE OF INCHES

RC04049 – Coastal Erosion Protection; location of rock groynes – WDC – Hokitika
September 2004
Existing xxxxxx
Proposed xxxxxx

Engineer
15th October 1986

SHEET 1 OF 1 SHEETS

REFERENCE NZMS 188 BLOCK SHEETS J32/4.4 J32/15.18

906/222 No.

A2