

BEFORE THE ENVIRONMENT COURT

Decision No. [2011] NZEnvC 69

ENV-2010-WLG-000080 & 81

IN THE MATTER

of applications under sections 316 and 320  
of the Resource Management Act 1991

BETWEEN

BEN & MIRANDA VAN DYKE and  
PAUL LE GROS (As Trustees of the  
B & M Van Dyke Family Trust)

Applicant

AND

NELSON CITY COUNCIL

First Respondent

Court: Environment Judge B P Dwyer  
Environment Commissioner W R Howie  
Environment Commissioner D Bunting

Heard: at Nelson on 27 - 29 September 2010

Counsel/ Appearances:

C Owen for Trustees of the B & M Van Dyke Family Trust  
K Beckett for the Tasman District Council

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INTERIM DECISION

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Decision issued: 23 MAR 2011

A: Findings made

B: Costs reserved



***Background***

[1] The Van Dyke Family Trust (the Trust), owns land on Jackett Island, a coastal barrier island lying between Motueka and the Kina Peninsula. Eight years ago the Trust built a new dwelling on the site of an older structure. At the time of construction the high tide location in front of the property was 55m from the dwelling. Erosion of the shore now puts the high tide location just 23m from the dwelling and erosion appears to be continuing.

[2] To the west of Jackett Island there is an estuary that drains to the sea through an outlet north of the island and also through an outlet to the south. The Moutere River enters the estuary at its northern end and flows out through the northern outlet.

[3] Port Motueka gains access to the sea through the northern outlet but access is restricted by the movement of an offshore spit/bar that is fed by sand from the Motueka River further to the north again. This spit grows from south of the Motueka River along but offshore of the coast in a southerly direction as sand is transported by the littoral drift.

[4] Historically, when the spit has extended to be roughly south of the northern Moutere outlet, it has naturally breached to give a more direct passage to the sea for water in the estuary and from the Moutere River. Storm conditions at sea or flood conditions in the Moutere River or a combination of the two, together with tidal flows initiate the breaching of the spit. The remnant spit is then deprived of sand supply from the Motueka River and it gradually washes ashore onto Jackett Island thereby replenishing the beach sand and preventing erosion of the beach.

[5] Attached is an aerial photograph showing the location and the features described.

[6] Recently, the spit has grown further to the south so that it now extends beyond the northern outlet of the Moutere River and terminates offshore of the Trust's land. Without there having been a recent breach of the spit and consequent replenishment of beach sand from the remnant spit, erosion of the Jackett Island shore by waves and



outlet currents has occurred. Erosion is progressing in a southerly direction along the Jakkett Island shoreline.

[7] There does not seem to be a good record of when breaches of the spit have occurred or of the environmental conditions (such as tides, winds, Moutere River flood flows), which applied at the time of each breach. Periodic spit breaches by floods of the Moutere Inlet are thought to occur every 10 – 15 years according to Dr R M Kirk<sup>1</sup>. The extent of the spit now is further to the south than at any time since 1881 based on nautical charts of 1887, 1927 and 1933 and more recent aerial photos.

[8] During the 1990's, the Tasman District Council (the Council) decided that a more permanent direct entrance to Port Motueka was needed. In 1996 the Council constructed a groyne in the form of a sand-filled geotextile *sausage* some 700m long and 1.5m in diameter, on the spit offshore of the northern side of the northern entrance. The groyne was designed to lie at an angle to the prevailing waves and to direct the southerly travelling sand offshore and so maintain a channel into the Port. However, it was constructed on an alignment nearly perpendicular to the wave direction and is now mostly buried under sand on the spit.

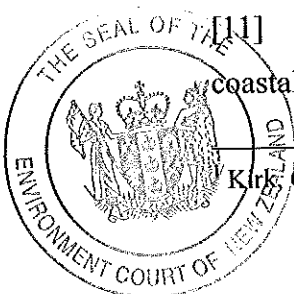
[9] These facts were agreed by the expert witnesses (Dr S T Mead for the Trust and Messrs EL Verstappen and J Dahm for the Council) in this case. In particular the experts agreed that the extreme southerly position of the distal (extreme) end of the spit is the cause of the erosion on Jakkett Island that is the subject of these proceedings.

[10] What is not agreed is the cause of the spit growing to the extent it has with no recent breaches. The Trust contends that it is because of the groyne which has stabilized the spit and allowed it to grow in length and volume thereby preventing it breaching. The Council says that the groyne has had no effect as it has been overwhelmed by the volume of sand transported along the coast and the spit growth is simply a natural process.

### ***The Application and the Law***

[11] Installation of the groyne was approved by the Minister of Conservation as a coastal permit (RC 930010B) for a restricted coastal activity on 20 April 1994.

Kirk, Coastal Sedimentation Report July 1990 quoted by Dr S T Mead.



[12] RC 930010B was subject to a number of conditions including Condition 12 which provided that the coastal permit was granted for a term of 15 years from the date it took effect. The coastal permit has now lapsed but the groyne remains in place without the Council having taken steps to remove it or obtain a further coastal permit. There are real issues about the extent to which the conditions of RC 93001B have (or have not) been complied with however that is not relevant to our current considerations.

[13] The Trust contends that the erosion being experienced at Jackett Island is an effect of installation of the groyne. It is concerned as to the potential effect of ongoing erosion on the Trust's land, more particularly that the dwelling which it has constructed on the land might be rendered uninhabitable or destroyed by erosion. The Trust sought both an interim enforcement order and an enforcement order requiring (in summary) the Council to remedy the effects caused by the ongoing presence of the groyne.

[14] The interim enforcement order sought by the Trust was as follows:

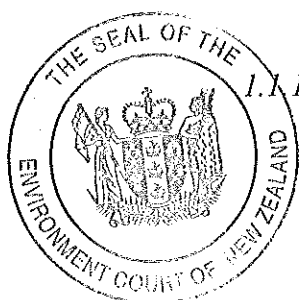
1. *Ben & Miranda Van Dyke & Paul Le Gros as trustees of the B & M Van Dyke Family Trust apply for an interim enforcement order under section 314(1)(b)(i) and/or (ii) and s 314(1)(c) to:*

*1.1 Require the Respondents to comply with their duties under resource consent 930010B (now expired), and/or to require the Respondents to remedy or mitigate adverse effects caused by either or both of them through the construction and continued (unmonitored) presence of a groyne/breakwater by:*

*1.1.1 Engaging an independent expert to undertake investigations into the use of semi-emergent berm(s) as a short term protective work, namely:*

*1.1.1.1 Deployment of a wave/current meter in front of the Applicant's property;*

*1.1.1.2 Development of an inshore wave climate, including extreme events;*



1.1.1.3 *Stability calculations of the existing shingle/small boulders during storm attack;*

1.1.1.4 *Shoreline response predictions and impacts (e.g. on the adjoining beach);*

1.1.1.5 *Ecological impact assessment of occasional disturbance of the shingle/small boulder area to construct and maintain the berm(s).*

1.1.2 *Commissioning, from an appropriately qualified independent expert, a hydrodynamic and sediment transport model of the Spit/Channel/Entrance/Island entailing:*

1.1.2.1 *Deployment of wave/current meters and sediment traps for at least 4-6 weeks;*

1.1.2.2 *The bathymetric survey of the area (Spit/Channel/Entrance/Island) both pre and post instrument deployment. The pre survey shall incorporate a bathymetric survey and production of a contour plan of the same area of seabed with the same scale and accuracy as the initial plan, showing the net changes in the contours since the last previous survey, in accordance with condition 6(1) of resource consent 930010B;*

1.1.2.3 *Sediment size sampling of the area;*

1.1.2.4 *Analysis of existing model grids and boundary conditions (tides, winds and waves);*

1.1.2.5 *Model calibration against field data; and*

1.1.2.6 *Scenario testing (e.g. do nothing, remove groyne, remove groyne and create 'breach' in various*



*locations, determine optimum positioning of beach nourishment materials).*

*1.1.3 Providing the information collected under 1.1 and 1.2 above to the Applicants.*

[15] The enforcement order sought by the Trust was as follows:

*1. Ben & Miranda Van Dyke & Paul Le Gros as trustees of the B & M Van Dyke Family Trust apply for enforcement orders:*

*1.1 Under section 314(1)(b)(i) to require the Respondents to comply with the Act by removing the groyne/breakwater which is no longer authorised by resource consent 930010B (now expired).*

*1.2 Under section 314(1)(b)(ii) to require the Respondents to avoid, remedy or mitigate any actual or likely adverse effect on the environment caused by or on behalf of the First and/or Second Respondent in respect of the construction and ongoing presence of the groyne/breakwater erected pursuant to resource consent 930010B; and*

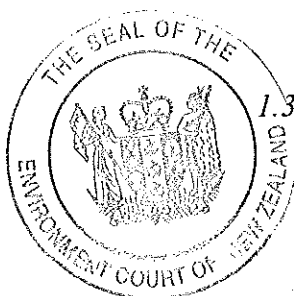
*1.3 Under section 314(1)(c) to require the Respondents to remedy or mitigate any adverse effect on the environment caused by or on behalf of the First and/or Second Respondent in respect of the construction and ongoing presence of the groyne/breakwater erected pursuant to resource consent 930010B (now expired); and specifically that they:*

*1.3.1 Undertake immediate coastal protection measures, namely either:*

*1.3.1.1 The creation of semi-emergent berm(s) in the vicinity of the Applicant's property; or*

*1.3.1.2 The installation of sand-filled geotubes in the vicinity of the Applicant's property; and*

*1.3.2 Create a channel through the sand spit, and use the material removed when building that channel to create a feeder beach for*



*central Jackett Island in order to allow the natural replenishment of sand on Jackett Island's seaward foreshore; and/or*

*1.3.3 Such other works as may be considered appropriate following further investigations; and*

*1.3.4 Undertake on-going monitoring to ensure the remedial works are sufficient and appropriate to address the actual or potential adverse effects arising from the groyne/breakwater.*

*1.4 Under section 314(1)(d) to require either or both of the Respondents to pay the Applicant \$100,000 to reimburse the Applicant for costs and expenses which it incurred, and is likely to incur, in avoiding, remedying or mitigating adverse effects on the environment, where the First Respondent and/or the Second Respondent have failed to comply with the conditions of consent 930010B Geotextile Groyne.*

[16] The Court declined to make the interim order sought without having heard from the Council. The Council opposed the making of either order. We considered both applications together.

[17] The parties adopted a common approach to the hearing, namely that the Court should determine, in the first instance, whether or not the erosion on Jackett Island was caused by the groyne. If that was found to be the case, the parties would then have the opportunity to consider the appropriate remedy.

[18] We did not understand there to be any dispute that if we found that the groyne was the cause of the erosion, orders of the kind sought by the Trust could be made by the Court pursuant to the provisions of s314 RMA which relevantly provides:

*(1) An enforcement order is an order made under section 319 by the Environment Court that may do any one or more of the following:*

*(b) Require a person to do something that, in the opinion of the Environment Court, is necessary in order to—*

*Ensure compliance by or on behalf of that person with this Act, any regulations, a rule in a plan, a rule in a*



- proposed plan, a requirement for a designation or for a heritage order, or a resource consent; or*
- (ii) *Avoid, remedy, or mitigate any actual or likely adverse effect on the environment caused by or on behalf of that person:*
- (c) *Require a person to remedy or mitigate any adverse effect on the environment caused by or on behalf of that person:*

[19] We will limit our considerations in this interim decision to the underlying issue described in para [17] (supra). We now turn to the evidence in that regard.

### *The Evidence*

[20] Mr B Van Dyke (a trustee of the Trust) had filed an affidavit in support of the applications but at the time of the hearing he was overseas. Consequently he was not cross examined. He recorded in his affidavit the sequence of erosion events he had witnessed, his attempts to halt erosion on the shore of Jackett Island, his communications with the Council, his conclusions as to the cause of the erosion and what needed to be done by the Council. He attached an extensive bundle of relevant documents supporting his views.

[21] Much of the material in Mr Van Dyke's affidavit was a matter of record and not in dispute. We have not placed any reliance on his views as to the cause of the erosion in reaching our conclusions. His daughter, Ms C M Van Dyke, also presented an affidavit which described in more detail the nature of the erosion in front of the Trust's property and she was available to answer any questions on behalf of the Trust.

[22] Dr Mead is an environmental scientist and Managing Director of ASR Ltd a marine consulting and research company. He is highly qualified and experienced in marine ecology and physical oceanography including hydrodynamic numerical modelling. He has 15 years experience in marine research and consulting on topics which include the design of coastal structures, the effects of marine construction and coastal erosion control. Dr Mead was engaged by the Trust to provide a report on the effects of the groyne. That report was provided to the Court as an annexure to Mr Van Dyke's evidence. Dr Mead also appeared as a witness.





[23] In his report Dr Mead traversed (and was critical of) the investigations, the design and the process followed before construction of the groyne. We do not need to examine or reach any conclusion on those matters at this time. Our task in this decision is to determine the effect of the groyne, if any, on spit behaviour, agreement having been reached on the link between spit growth and the consequent erosion on the shore of Jakkett Island.

[24] However, for the sake of completeness, we note that misgivings about the effects and effectiveness of the groyne were widely held at the time of application, so much so that the application for consent was initially declined. That decision was appealed by the Council resulting in a negotiated settlement to grant the consent for the period that has now expired.

[25] Dr Mead used aerial photographs from 1940, 1947, 1958, 1969, 1980, 1985, 2003 and 2006 to examine the extent of the spit. He concluded that following construction of the groyne, the spit both increased further south and increased in width to greater extents than previously recorded. Nautical charts show that between 1881 and 1933 the spit had not extended south of the Moutere River entrance.

[26] Dr Mead applied hydrodynamic modelling to the area to test predicted effects of the groyne and compare them with what has happened. He deduced that the groyne causes sand to accumulate on its littoral upstream side up to the groyne's full height of 1.5m and that it influences a very large area to the southwest of the groyne along its 700m length and for 300m in its lee or littoral downstream side.

[27] Dr Mead considered that the groyne has led to a spit that is larger than any previously recorded and is still increasing in size, with the elevation of the spit exerting influences which were initiated by the construction of the groyne. He also noted that notwithstanding high flood flows in the Moutere River (with the flow in 2005 being the highest since records began in 1933) there have been no breaches of the spit since construction of the groyne.

[28] Dr Mead concluded that the Motueka Spit has been fundamentally altered from its natural state as the result of installation of the groyne.



[29] Mr Verstappen (a resource scientist with the Council) holds a Master of Engineering (civil), is a member of the Institution of Professional Engineers, a member of the New Zealand Coastal Society and has had 30 years experience in river and coastal process related fields. He disagreed with Dr Mead's conclusions. He considered that the groyne has had only an initial and localized effect on sediment transport on the spit and that sand now simply overpasses the groyne and the spit grows in a southerly direction entirely due to natural causes.

[30] Mr Verstappen criticised the numerical model used by Dr Mead because it had not been used to analyse a 2D sediment transport model which is the process of most importance in this case and because the model had not been calibrated or verified. He also considered that Dr Mead's analysis of spit contours from aerial and other photographic evidence was incomplete.

[31] Attached to Mr Verstappen's evidence was the report commissioned by the Council from Dr Kirk (previously referred to), dated July 1990. The report presented the results of a limited technical investigation into the causes and nature of bar sedimentation which poses hazards to navigation and limits the effective utilization of Port Motueka. Mr Verstappen drew extensively on this report but we did not hear directly from Dr Kirk.

[32] Dr Kirk had described how the spit and bar is nourished by sand transported south along the coast by waves and wave induced currents, with periodic breaching by flood flows from the Moutere river. He estimated the longshore sand transport was about 47,500 cubic metres per year and the supply from the Motueka River was about 64,000 cubic metres per year. To improve navigation, he recommended the dredging of a channel through the spit with maintenance dredging as required.

[33] Notwithstanding Dr Kirk's recommendation, the Council decided to construct the geotextile groyne across the spit, seaward of the Moutere River outlet. The groyne was designed by BECA and completed in September 1996.

[34] Because the groyne did not function as designed, the Council commissioned another report from a firm called OCEL in November 1996. According to Mr Verstappen, OCEL concluded that the groyne height was too low and that the groyne



was functioning as a low, overpassing and storage structure with some bypassing occurring, but not as designed.

[35] Overpassing refers to sand passing over the top of the groyne. Bypassing refers to sand being passed along the structure and out to sea. The groyne was intended to cause a bypassing effect but had largely failed to achieve that. Mr Verstappen advised that in June 1997 OCEL concluded that the groyne was having little effect other than a local influence and for the spit it was *business as usual*.

[36] Mr Verstappen concluded that sand on the spit now overpasses the groyne with little or no influence from the groyne. He contended that spit growth is a natural process unaffected by the groyne and that the regular nature of the contour lines of the spit in 2001 support this view.

[37] In cross-examination, Mr Verstappen referred to a comparison of bathymetric data in 1997 and in 2001. He said the expected initial effect of the groyne in 1997 was quite evident but by 2001 it had greatly diminished. He said sand was overpassing the groyne rather than bypassing it offshore. He also agreed however that ... *you can't put a structure 700 metres long and initially having a 1.5metre height into an environment and not expect there to be no effect whatsoever*<sup>2</sup>.

[38] Mr Verstappen held serious reservations about the modelling results presented by Dr Mead. He considered them to give a general feel for the effects of the structure in the wave environment but he placed no reliability on the magnitude of effects such as wave height, water velocities and the extent of changes generated by the structure. He said ... *it would be dangerous... to look at the extent of the effect as depicted by Dr Mead's modelling, and the magnitude of any of those effects without going to a much more significant means of verifying and calibrating the model*...<sup>3</sup>.

[39] Mr Verstappen criticized the lack of a sediment transport component in Dr Mead's model and said that he preferred to rely on the extensive record of photographs and knowledge of the morphodynamic processes along this coast. These demonstrated to him that sand overpasses the groyne which is largely buried and that the current size,



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<sup>2</sup> NoE, page 178, lines 27-29.

<sup>3</sup> NoE, page 156, lines 39-42.

location and shape of the spit (which is now longer, wider and probably higher than at any time since 1881) is a natural phenomenon.

[40] The Council had Mr Verstappen's evidence reviewed by Mr Dahm who is a coastal scientist specializing in physical coastal processes and their management. He has an M.Sc, is a member of the Royal Society and the New Zealand Coastal Society and has had 27 years experience in river and coastal processes. He provided the Court with a statement based on the papers (reports, photographs and correspondence) provided by the Council and has not visited the site.

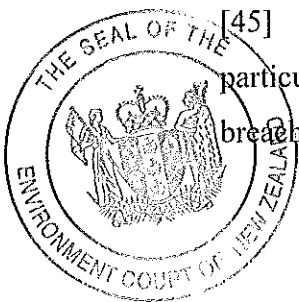
[41] Mr Dahm considered that there is no evidence to suggest the groyne has caused or had any discernible role in the recent spit extension. He referred to two processes which cause a breaching of the spit. The first process relates to varying sediment contributions from the Motueka River which can lead to the formation of a new spit further offshore and the distribution of sand in the old spit to the shoreline between the Motueka River and the Moutere outlet.

[42] The second process involves flood flows from the Moutere River, with a spit breach occurring at or near the Moutere outlet resulting in sand from the remnant spit washing ashore onto Jakkett Island.

[43] In the absence of these processes, the ongoing net input of littoral drift would lead to continuous progressive enlargement and extension of the spit over time.

[44] Mr Dahm said that in the period 1928-1933, the low tide spit extended some 1200m south of the Moutere outlet and parallel to the Jakkett Island shoreline. (When considered in conjunction with the photographs of the spit and Dr Mead's figure 5 showing the locations of the distal end of the spit in the years 1916 to 2009 it appears that the 1200m Mr Dahm referred to is from the position in 1881 rather than from the Moutere outlet.)

[45] All three experts referred to the area of the spit at the Moutere outlet as being particularly dynamic. Spit extension gradually moves the outlet southwards and breaching of the spit brings it back to the north.



[46] Mr Dahm said the groyne was readily overpassed by sand and while having initial local effects, he considered that it has had no discernible effect on spit extension, noting that the spit already extended past the location of the groyne at the time of its construction. He was critical of initial parameters of Dr Mead's model saying that Dr Mead had used bathymetry data from 1985 which was quite different from that existing in 1995 when construction of the groyne began and consequently the results are not reliable. He expected that eventually the spit will be breached and the existing effects alleviated.

[47] In cross-examination, Mr Dahm reiterated his view that *...the data is overwhelming, that it is a natural spit extension, that the effects of the groyne are local.* From aerial photographs taken at the time of construction of the groyne, Mr Dahm considered there was a pulse of sediment progressing down the outer side of the spit and that it simply overtopped the groyne. In respect of the modelling process, he agreed that uncalibrated modelling is a useful indication of the scale and spread of effects and is not an uncommon technique.

[48] Dr Mead responded to the evidence provided for the Council in a further comprehensive statement.

[49] He confirmed his opinion that the spit has never extended so far southwards since 1881, that the groyne is constructed in the most dynamic location on the spit and has stabilized and extended the spit, that known processes and modelling explain the effects and there has been no evidence to the contrary.

[50] Dr Mead considered that the structure does not function as a groyne but rather as a combination of a semi-emergent and a submerged breakwater or even a wave dissipation device, all of which retain and store sediment. Most of the length of the structure is buried. The structure is 1.5m high and within the first few years of its installation, trapped at least that additional depth of sand upstream and (after a period) downstream for much of its 700m length. Dr Mead said that the distance of the structure's influence upstream, is at least equivalent to its length and that downstream, the influence is apparent for at least 300m. Located as it is, directly offshore of the Moutere Inlet in the area where coastal and river flow processes meet, he says that the



structure has a very significant effect on natural processes. Accumulation and spit extension continues.

[51] Mr Verstappen suggested that additional sediment (Mr Dahm referred to it as a pulse of sediment) may have been added to the coastal processes by significant floods in the Motueka River in the few years before construction of the structure, but Dr Mead concluded, after a study of the historical river flows, that no unusual sequence occurred and that sediment supply to the spit would have been normal during that period.

[52] Dr Mead accepted Mr Dahm's criticism concerning the use in the model of bathymetry data that existed 10 years before construction of the structure. He re-analysed the processes using updated bathymetry, wind and wave data. Results from this work showed the influence of the structure is more severe than previously estimated, often along the whole length of the structure and for 200 – 500m in the lee of the structure. In his view the effects of the structure were well beyond localised.

[53] Dr Mead described a feedback mechanism which, he said, allowed the spit to grow once it had been stabilized by the structure. He contended that it is common for small offshore structures to have large onshore effects by altering wave energy distribution and consequent currents and sediment deposition. The structure constructed on the spit is not small in the context of the spit dynamics and he considered that it has had *hectares* of influence. If the sedimentation caused by the structure measures 700m by 700m on the upstream side and 700m by 300m on the downstream side, then 70ha is affected. If initial sedimentation effects were only over 300m either side of the structure cover, then the area affected would be 42ha.

[54] Dr Mead extended his modelling to include sediment transport processes and ran the model for the equivalent of 400 days in real time. The results showed how sediment piled up on the upstream side of the structure, eroded initially on the downstream side, deposited in the lee of the structure and finally filled in back to the lee side of the structure, just as had been observed in fact. He said that with the structure in place, we see in the model a build-up of sediment well over two times the size of when it is not in place.

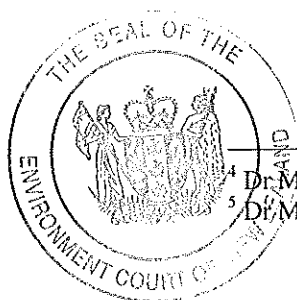


[55] Breaching of the spit is a key component in the dynamics of this area but Dr Mead said there is scant data on dates and processes, other than the estimate that breaching occurs every 10 – 15 years where the Moutere River and tidal compartment flows to the sea. Locating the structure in this active part of the spit with the induced sedimentation he says prevents or at least severely delays breaching in this area. However his modelling of the sand transport processes at the Moutere outlet did not include the Moutere River flows.

[56] Dr Mead concluded his further statement *...I have presented supporting data, numerical modelling and coastal process theory and understanding that strongly indicate that the construction of the 700m long by 1.5m wide (and 1.5m high) structure across the most dynamic part of the Motueka Spit has led to a Spit morphology that has never previously been recorded and is having a substantial erosive impact on Jackett Island. Mr Verstappen and Mr Dahm have presented no evidence and very little in the way of coastal process theory and understanding to support their assertion that the Spit's present location and configuration are within the range of "natural" variability<sup>4</sup>.*

[57] Dr Mead answered questions through examination and cross examination and also presented a supplementary statement of evidence. This comprised mainly references back to his evidence in chief with further explanation. Once again he reiterated that *...The spit is too wide and too high to breach with its previous regularity and has extended further south than ever recorded, causing aggressive and progressive erosion down Jackett Island<sup>5</sup>.*

[58] With reference to the modelling he had done, Dr Mead said that it is a very useful, high powered, indicative tool. The more data available the more accurate the model can be made but it is quite common to use uncalibrated models because they represent the physical processes in play and the various parameters and their values are quite well known. He said the model results closely resembled the sedimentation observed shortly after the structure was built.



<sup>4</sup> Dr Mead, Rebuttal Evidence 21 September 2010, para 51.

<sup>5</sup> Dr Mead, Supplementary Evidence 29 September 2010, para 34, lines 10-12.

*Evaluation and Findings*

[59] An important consideration in this case is the concept of a localised effect particularly in respect of the scale of the site. The Council's case is that such effects as there were from the groyne were confined to the immediate vicinity of the groyne and for a short time after construction. Once sand overpassed the groyne and mostly buried it, it had no further significant effect.

[60] Kirk estimated that sand transport along the spit from north to south is in the order of 47,500 cubic metres per year. The area where the structure induced the settlement of sand on the spit, including areas both upstream of the structure (for up to 700m) and in its lee (for about 300m), is somewhere between 42ha and 70ha. That area itself is a significant portion of the spit. If the additional sediment was on average 1 metre deep then that would represent storage of between 420,000 and 700,000 cubic metres or at least 10 years of littoral sand transport. Dr Mead's modelling showed the spit well over twice as wide with the structure as without it.

[61] The BECA assessment in May 1997 recorded that between 1995 and 1997, the structure stored some 110,300 cubic metres of sand. So it seems that the estimated annual littoral sand transport is being stored on the spit with little bypassing it.

[62] The 700m long groyne straddled the spit and extended into the sea below low tide. At 1.5m high it quickly induced a rise in the level of the spit of the same height.

[63] Dr Mead suggested effects evident within tens of metres of the structure could be described as *localized* and we agree. But we cannot describe the effects which emerged over the 4 years until 2001, when the bathymetry was redone, as localized. In the context of the natural size of the spit, the sedimentation in the few years after construction is more extensive than just localized.

[64] Not only has the spit greatly enlarged and heightened, it has rotated towards the shore thereby confining the Moutere outlet channel nearer to the shore. Dr Mead says this is to be expected as a shadow effect of the structure and was replicated in the model results. That is also an effect that cannot be described as localized.





[65] We find that even the initial effects of the structure were more widespread than the localized effects contended by the Council.

[66] We heard much debate about the usefulness of numerical modelling of the coastal processes which exert influence on this shore. It is not a new issue for us. No model is perfect and all have shortcomings. Analysis of coastal processes using uncalibrated and unverified models is common. They can provide an insight into the physics that govern the outcome and an indication of the likely outcome that can then be checked against the actual outcome.

[67] Dr Mead's analysis using his numerical model does just that. It uses known or deduced conditions and known physical relationships to produce, through an iterative process, predicted sand sedimentation areas. These were checked against observed sand deposition shortly after construction of the structure and significant conformity was found. We are satisfied that the early sedimentation patterns from the structure are not misrepresented by the modelling.

[68] Dr Mead's numerical model also indicated that the additional deposition of sand on the spit due to the structure was twice that which would have occurred without the structure. We accept that a significant additional deposition of sand has resulted from the construction of the structure.

[69] Not all processes present have been included in the numerical model, particularly the important influence of flood flows from the Moutere River. We accept that the model does not give any indication of the effect of increased sedimentation on the spit or on the frequency or ability of the system to breach the spit when the river is in flood. It is probably axiomatic that a higher and wider spit and one which is reinforced with the structure, will take more effort from the river to breach. On the other hand a longer spit may induce more of a tendency to breach.

[70] The spit breaching mechanism at the Moutere outlet was not well analysed in the evidence. This mechanism seems to have been initiated by floods in the Moutere river eroding the shore-side of the spit. This allows a more direct route to the sea when coupled with sea conditions, either quiescent conditions allowing the river flow to dominate or possibly storm conditions with overtopping of the spit. One matter which



was agreed was that the area just offshore of the Moutere outlet is the most dynamic part of the spit due to the competition between the outflow of the Moutere river and the littoral sand drift.

[71] Compared to the erodibility of the sand forming the spit, the geotextile structure is non-erodible. Compared to the dimensions of the spit, the structure is of significant dimension. It is located precisely where the spit is most dynamic and where coastal and river forces are delicately balanced. It was inevitable that this structure would have a significant effect on that balance.

[72] Possibly, if the spit remained its normal size, the river might simply erode around the structure when conditions suited. However, with a spit more than twice as large as previously, we consider it is probable that the balance of forces giving rise to breaching of the spit has been drastically altered. This may be borne out by the failure of the river to force a breach in 2005 when there was a significant flood in the Moutere river.

[73] There was agreement amongst the experts that the spit was now further south of the Moutere outlet than at any time since 1881, although there was debate about how much further. Some measurements used as a reference were at low tide and some at high tide. The low tide spit in 2009 was approximately 2200 metres south of its position in 1881 and the high tide spit was about 1600 metres south of where it was in 1881.

[74] Since construction of the groyne, the spit has been consistently well south of the Moutere outlet. In 1928 and 1933 the low tide spit extended south of the Moutere outlet but not as far as in 2009 and prior to 2000, the high tide spit has always been north of the Moutere outlet.

[75] Factors other than the structure which could induce the spit to progress further south than has historically been the case might be, exceptional floods and sediment discharge from the Motueka River, exceptional sea storms providing greater littoral sand transport rates or fewer floods in the Moutere River. We were not given any evidence of these circumstances and Dr Mead considered conditions had not been abnormal since 1995.



[76] Spit growth could also be occurring as a natural function of the supply of sand and the littoral currents which have not to date, reached a state of natural stability, a possibility mentioned by Mr Dahm. Dr Mead's tracing of the spit position with time since 1881 (his Figure 5) does not support that theory and instead shows fluctuating positions until construction of the structure and an extending trend afterwards.

[77] Reference was made by Mr Dahm<sup>6</sup> to there being a pulse of sand arriving on the spit just at the time the structure was built, which overwhelmed it. That may well have been the case but it was not suggested that the natural spit development occurs uniformly. Deposition and erosion of sand on the spit can be expected to occur spasmodically and the timing of construction of the structure simply meant the storage of sand that it provided was filled promptly. In any event, it seems that the storage capacity of the structure has been able to accumulate most of the sand transported since it was built.

[78] The contours of the spit do not show any bump or deformity over the structure and that was said by Mr Verstappen<sup>7</sup> to demonstrate that it is having no effect on the spit. The difficulty with that proposition is that the contours, although uniform, are of a spit which is higher, wider and larger than previously and so, less erodible. Now that it is buried, the groyne structure cannot have a continuing influence on sand deposition, but the evidence shows that the groyne provided the opportunity for the spit to grow and bury it and that the spit has continued to grow subsequently.

[79] We conclude that the groyne has significantly influenced the ability of the spit to grow, extend and resist erosion. It has provided a stable feature right in the previously dynamic position where the eroding forces of the river caused breaches of the spit. It has captured virtually all of the sand moved by the littoral currents in the initial years and the enlarged and reshaped spit continues to grow and retain the sand.

[80] It was agreed by the witnesses that little sand presently passes the spit to deposit on the downstream shore of Jackett Island. Having now been mostly buried under sand, the natural processes of an enlarged spit are dominating. If natural processes begin



<sup>6</sup> Cf para 47 supra.  
<sup>7</sup> Cf para 36 supra.

erosion of the spit in the future then once the groyne is exposed it will again exert its non-erodibility and its capacity to induce storage of sand and inhibit breaching by the Moutere River.

**Result**

[81] For the foregoing reasons, we find that placement of the groyne structure on the offshore spit by the Council in 1996 has led to formation of the spit in its present form which in turn, has brought about the erosion on Jackett Island. On the basis of that finding we are able to consider the making of enforcement orders against the Council.

[82] As we have noted, the debate before us revolved around the underlying issue of the cause of spit formation. Now that we have determined that matter it is necessary for the parties to address the appropriate remedy in terms of s314 RMA. We will allow a period of 20 working days from issue of this decision for the parties to consider the implications of our findings and to discuss whether or not there is a mutually acceptable solution or way forward.

[83] We direct the Trust to file a status report at the conclusion of that period advising whether or not the parties have been able to reach agreement as to the appropriate remedy or whether further hearing time is required. If need be we will convene a judicial conference upon receipt of the status report.

**Costs**

[84] Costs are reserved and will be addressed at the final conclusion of these proceedings.

DATED at Wellington this 23<sup>rd</sup> day of March 2011  
For the Court:

B P Dwyer  
Environment Judge



"A"

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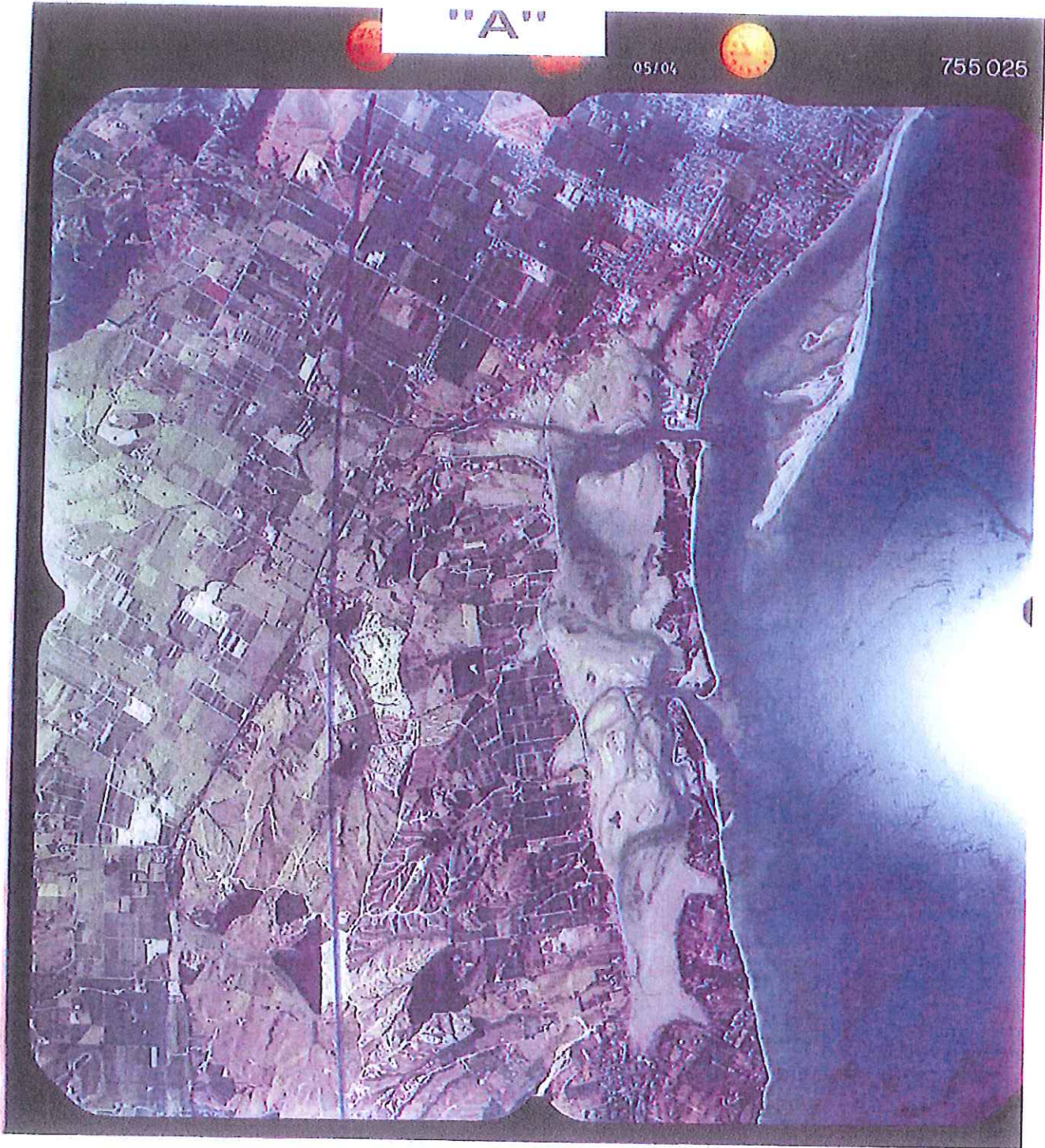


EXHIBIT NOTE

This is the annexure marked "A" referred to in the affidavit of Shaw Mead

sworn at Raglan on

this 31st day of August 2010 before me

*Gandy September 2010*

Signature

*Michael Blanchard JP*



Blanchard MPS, JP  
P.O. Box 19  
Raglan  
New Zealand