PEACOCK D H LIMITED

GST Reg No 97918708 email: dave2mar@gmail.com Phone 021 02465899

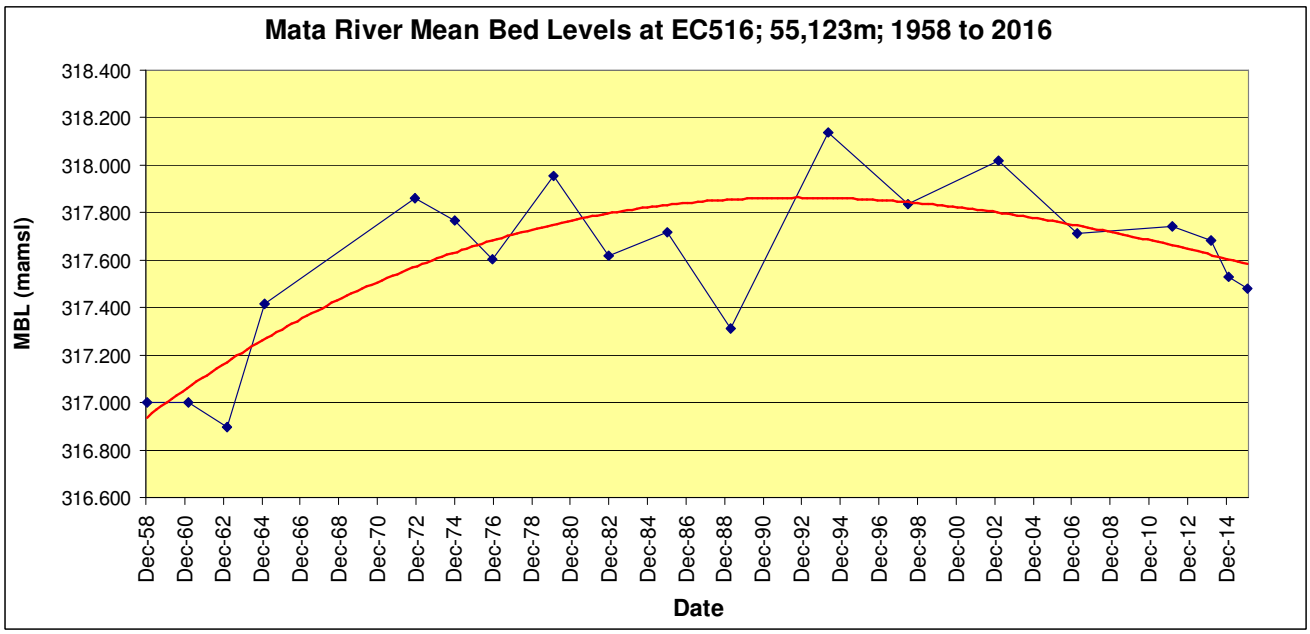
Mata River Bed Level Trends, 1958 to 2016.

Introduction:

The following trends in mean bed levels have been derived from cross section surveys by the former East Cape Catchment Board and the Gisborne District Council, commencing in 1958. Interpretation of these surveys has been compromised by the impact of shingle extraction operations nearby or upstream of some of these cross sections. Trends have been assessed starting at the most upstream cross section at bench mark EC516; Mata Road Bridge.

EC516; Mata Road Bridge.

This cross section is 55,123m upstream of the confluence with the Tapaeuroa River. The mean bed level (MBL) plot attached shows an aggrading river bed over the 22 years from 1958 to January1980, then degrading until March 1989. This degradation may have been due to bed scour from major floods (1980, 1982 and 1988) over this period, followed by an excess of bedload material reaching the channel in subsequent years. From 1994 to 2016 the channel has degraded by 0.66m. Over this 22 year period the average rate of degradation is 30 mm/yr.

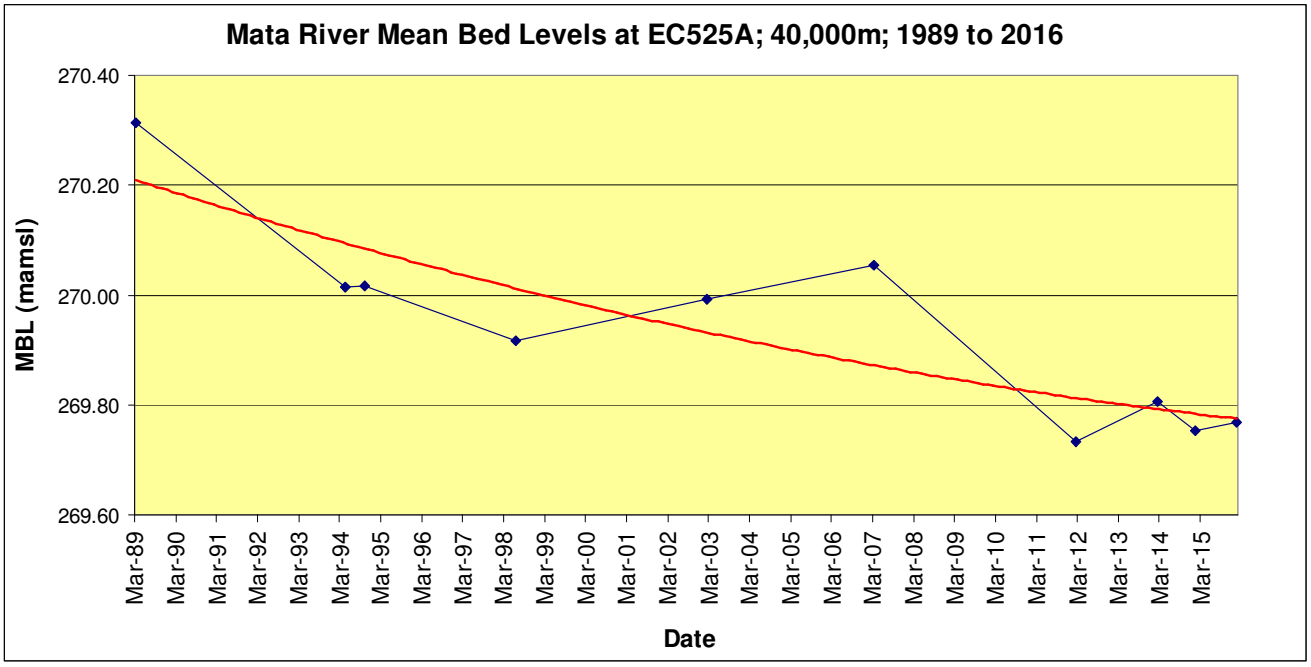


Two other cross sections were added nearby; EC515 at 55,004m and EC514 at 54.923m. These two sections were not surveyed between 1965 and 1998, however they both show degrading bed levels; since 2003 in the case of EC515, and since 1998 for EC514. Average degradation rates were 32mm/yr and 52mm/yr respectively.

There is no record of any shingle extraction upstream of these three cross sections over at least the past eight years, so the trend in mean bed levels appears to be “natural”.

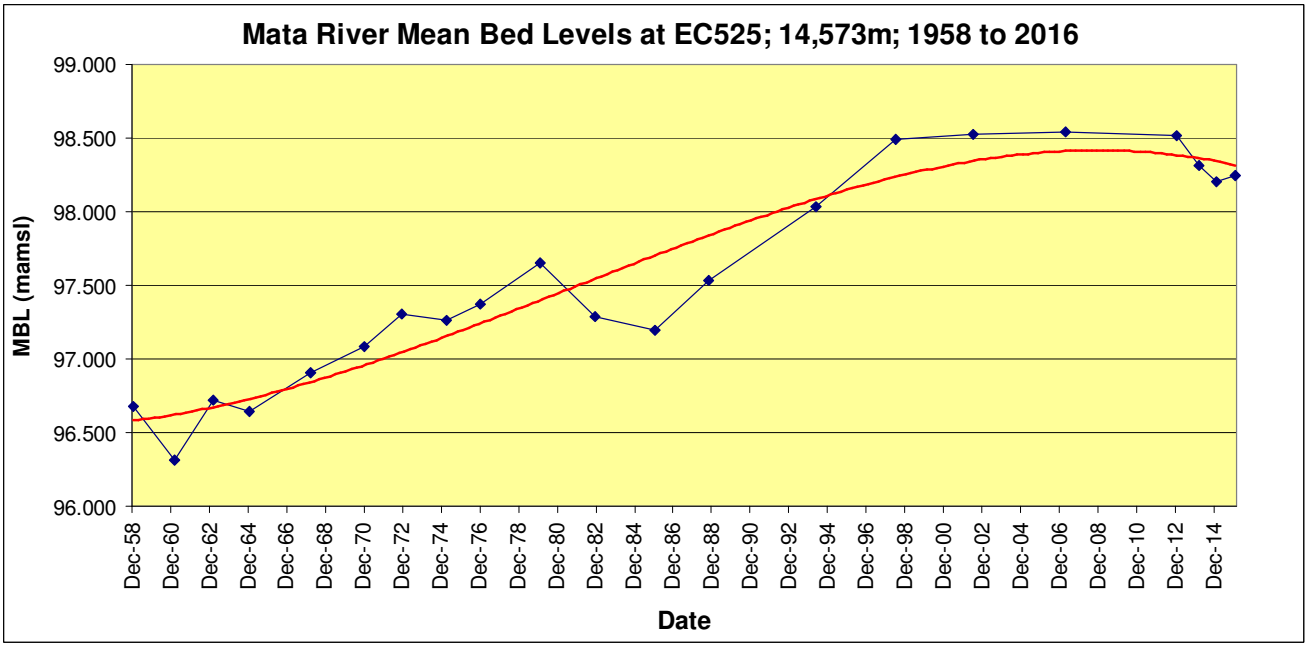
EC525A; Pouturu Bridge

The next downstream cross section is adjacent to the Pouturu bridge, approximately 40,000m from the confluence with the Mata river. Unfortunately the record is not as long as at EC516, the first survey being in 1989. However the MBL plot shows a drop of 0.3m between 1989 and 1994, fairly neutral between 1994 and 2007, and then a further drop of 0.29m by 2016; an average degrade of 30mm/yr over the past 9 years.
As for EC516, there has been no recorded shingle extraction upstream of this site for at least the last eight years.



EC525; Makarika Road Bridge

This cross section is 14,573m from the confluence of the Mata and Tapaeuroa rivers, and is the most downstream of all the cross sections on the Mata River. It is sited just upstream of the Makarika Road bridge. Unfortunately there is also a major shingle extraction site (RS 206002; Fulton Hogan), on the shingle beach through this cross section.



The above plot shows river bed aggradation of 0.98m at this cross section over the 22 year period between 1958 and 1980, at an average rate of 45 mm/yr. This is followed by a short period of bed degradation between 1980 and 1985, which may have been a result of scouring processes from major floods in the river in 1980 and 1982. (Note that while scour may occur during major floods, more bedload material is also released from headwater gullies which inevitably will be transported downstream and cause aggradation months or years later).

After 1985 the aggradation at this site continues until 1998, after which there is a 14 year neutral period (1998 to 2012), and channel degradation since then.

Discussion of Results:

All of the above MBL plots show similar trends, i.e., river bed aggradation followed by a neutral period, followed by a significant rate of degradation (averaging 30 to 50 mm/yr). The year at which the degradation commences is earlier (1994 to 2003) at Mata Rd bridge, occurs later (2007) at Pouturu bridge, and later still (2012), at the Makarika Road bridge. This is consistent with "downstream proceeding degradation", where the volume of bedload material entering the upper catchment river is less than the transport capacity of the river. This is probably the result of afforestation in the upper catchment closing down gullies, but further investigations would be required to confirm this.

Because of the shingle extraction on the same gravel beach as the Makarika Road bridge cross section, the MBL results at this site cannot be considered to be a reliable indicator of bed level trends.
An average of 18,500 cubic metres of shingle per year has been extracted from the Makarika bridge site over the past 8 years which is bound to have reduced the transport of shingle downstream, as the depositional beach has to be recharged with shingle again from upstream. Further upstream in the Waitahaia River, an average of some 20,000 m3 per year of shingle has been extracted over the past 8 years. This is expected to have a delayed effect at Makarika Bridge which may take many years (or one major flood) to transport bedload at "normal" (i.e., pre-shingle extraction operation) rates from the Waitahaia River into the Mata.

Further downstream is the Kimberley Contractor's major shingle extraction operation which has excavated 71,400 m3 of shingle over the past two years. However an (unknown) proportion of this material has been excavated from the river berm which is not part of the active river bed. Just upstream of this site is the Aorangiwai stream where an average 23,599 m3 per year of shingle has been excavated over the five year period 2010 to 2014.

Unfortunately there are no other cross sections downstream of Makarika Bridge, so no mean bed levels are available in the vicinity of the Kimberley operation. However, from MBL trends at all the upstream sites it is most likely that this reach of the Mata River is also now degrading and probably at a faster rate than the other sites. From a site inspection by the author in May 2016, the river reach where the shingle extraction has been active appeared to be more typical of a degrading river rather than an aggrading one.

If shingle extraction from the present sites continues at current rates, then (all other factors being equal), future rates of river bed degradation in the lower Mata river could be expected to be at least equal to that over the past few years. The current rate of degradation may be sustainable for several years hence, but could not be verified until sufficient baseline mean bed level data from the proposed new cross section survey sites is available. Until that time regular site inspections should be carried out in order to anticipate any potential adverse effects.

A degrading river is by no means a bad thing as long as it's not too rapid or confines the channel too much. In terms of bank erosion a degrading river is usually preferable to an aggrading river, as an

aggrading river tends to deposit bedload onto shingle beaches, causing channels to divert into the adjacent river banks.

Recommendations for new cross sections:
While the current cross sections at the Mata Rd and Pouturu bridges provide adequate monitoring of MBL's in the upper Mata catchment, there is a need to improve the monitoring of bed level changes in

the lower reaches of the Mata River. Unfortunately the current site EC525 at Makarika Rd bridge is in the middle of a shingle extraction site, so it is totally unsuitable.

The following potential cross section locations have been selected from aerial photography:

i) In the reach 800m to 1.4km upstream of the Makarika Rd bridge; two cross sections about 200 to 300m apart;

ii) 400 to 500m downstream of Makarika Rd bridge; one cross section; and

iii) On the straight reach of river parallel to Puhunga Rd, 3.8 to 5.4 kms from the confluence with the Tapuaeroa river; two cross sections about 1km apart.

The establishment of bench marks at the above sites would of course be subject to site inspections and to agreements with property owners. The cost of establishment of sites and subsequent surveys could be charged to shingle extraction operators in the area; ie; Kimberley Contractors and Fulton Hogan.

Frequency of surveys:
Existing survey sites from Pouturu bridge upstream (EC514, 515, 516 and 525A) are not currently affected by shingle extraction operations, so MBL's derived from these sites can be considered as "baseline" data. It is recommended therefore that surveys are carried out annually at least for the next three years, and also after any significant flood; after which the frequency of surveys should be reviewed. Surveys should continue at the current Makarika Rd site, EC525, for at least two years to provide an overlap with the proposed sites a short distance upstream.

For the proposed new sites I would recommend that (at least while shingle extraction operations are active) surveys are carried out at least twice a year, in the early summer and late summer/ autumn, while river levels are low; and also as soon as practically possible after any significant flood.

Recording of shingle extraction volumes and "mining" of terrace land:
From an inspection of the Kimberley Contractors' shingle extraction site in May, it was observed that a proportion of the shingle extraction has come from a large terrace on the right bank. This material is from former river borne deposits but is no longer part of the active channel. It is recommended that a distinction is made in the shingle returns between shingle which is excavated from the "active" river channel and shingle "mined' from river terraces.

Consideration should also be given to the effects of "mining" the non-active terrace material, particularly what should happen if the river changes its course and a mined area becomes active river bed again. Questions as to the legal status of the river terrace land and its future land use should be raised, and it is recommended that a management plan to consider these issues is developed by the shingle extractor and submitted to the GDC.

Prepared by:

D Peacock
17th September 2016.