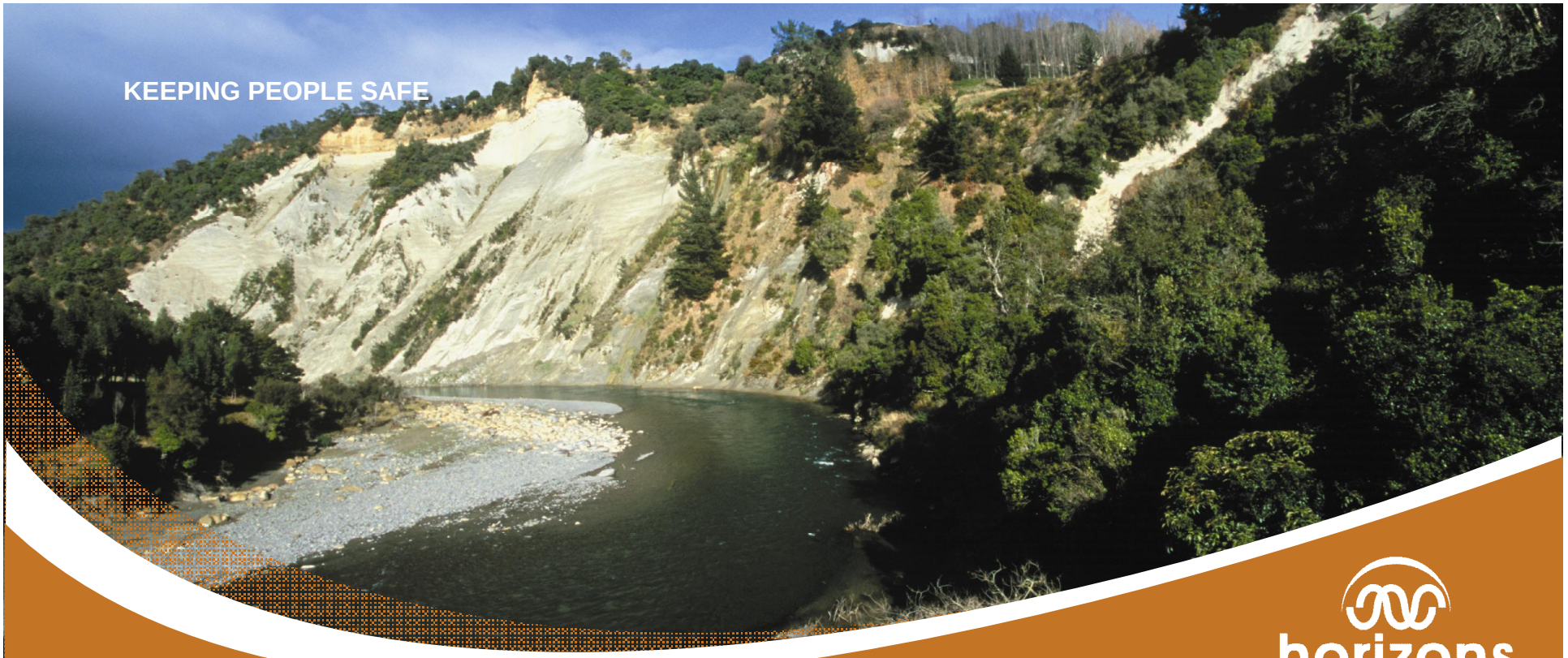

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ONE PLAN – LAND HEARING

A River Management Perspective

Flood Management
- The Council's Role

- HRC has the function, duties and powers under SC&RC Act 1941 of reducing risk to life and minimising/preventing damage to property and infrastructure, as a result of flooding and erosion.
- Council has confirmed integrated catchment management as its No. 1 strategic priority.
- Council is responding to high community expectations for appropriate standards of flood protection.
- Council recognises the need for both engineered and non-engineered measures.

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Flood Management – My Role as Group Manager, Operations

- To implement Council's policies and programmes in carrying out its flood management responsibilities.
- To manage a number of river management Schemes.
- To manage flood protection assets valued at $118 million.
- To provide our many communities with a safe environment and opportunity for economic prosperity.

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The Flood Risk Reality

- A number of the region's established communities are located on flood plains.
- Their safety and economic wellbeing is very much dependant on substantial flood and erosion protection infrastructure.
- Urban areas in particular should ideally not have been located in such flood prone areas.
- Risk avoidance - Non-engineered flood management measures appropriate for **new** development.
- Little choice other than to build flood defences or excavate river channels/berms in order to protect **existing** communities.
- My mission therefore is to provide our communities with the highest possible standard of protection, in the most sustainable manner and at least cost.

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Our Legacy

- Large dependency on stopbanks and significant dependency on dams in this region
- Consequences of intervention well understood but magnitude maybe under estimated.

Method	Measure	Value
Stopbanks	437 km	$83.9 m
Detention Dams	53 (No.)	$6.9 m
Other Structures	435 (No.)	$27.1m

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Our Legacy *cont…*

- Standard of flood protection dependant on the maintenance of channel and berm capacity.
- Capacity is reduced by bed aggradation, berm silting, narrowing of the active channel, vegetation encroachment.
- Bed aggradation (and degradation) generally related to gravel (as opposed to silt) movement – natural process largely influenced by larger floods - lateral erosion can be a significant factor.
- Gravel build-up can be managed to a large extent through extraction.
- Silt deposition on channel edges and flood berms is our greatest problem.

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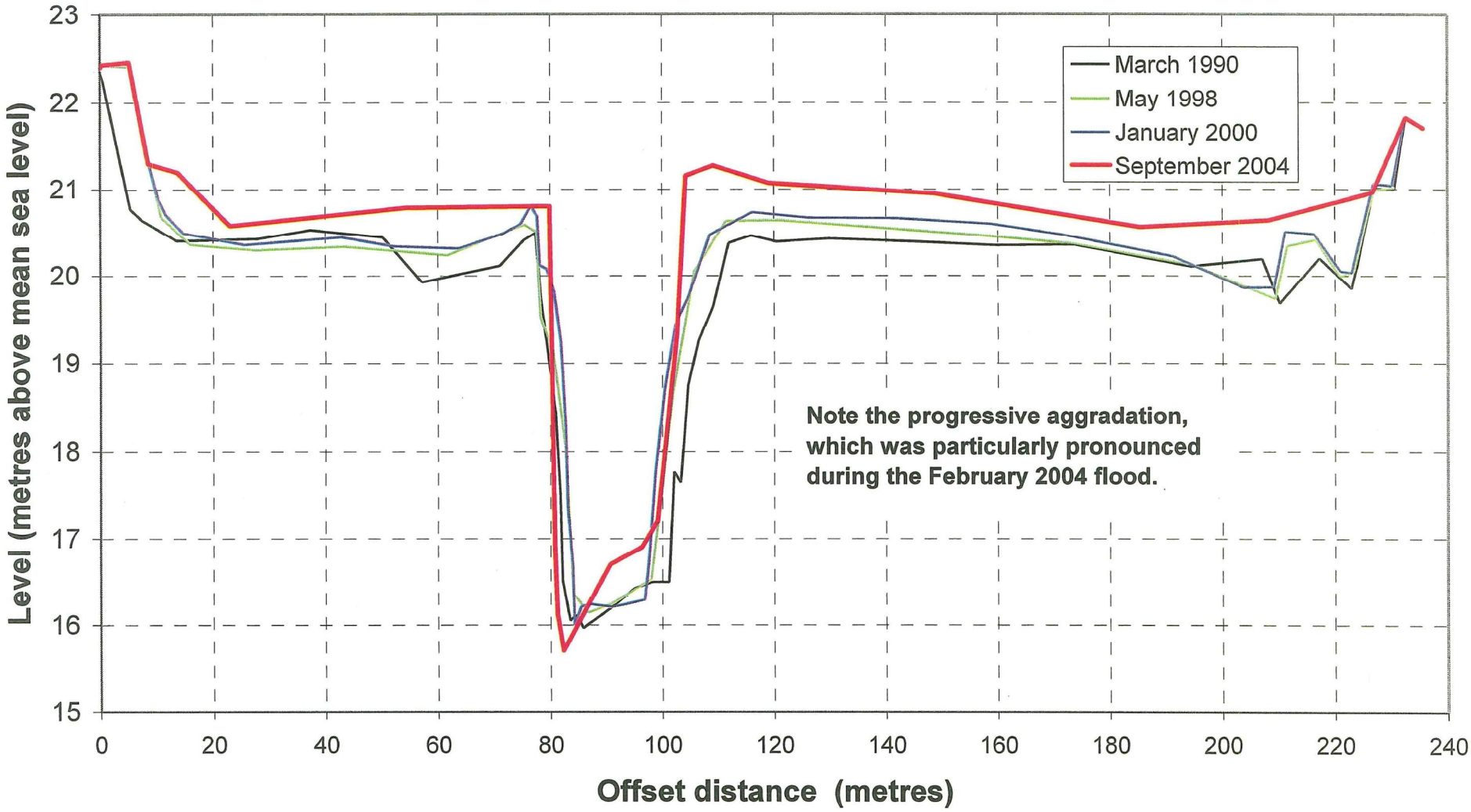
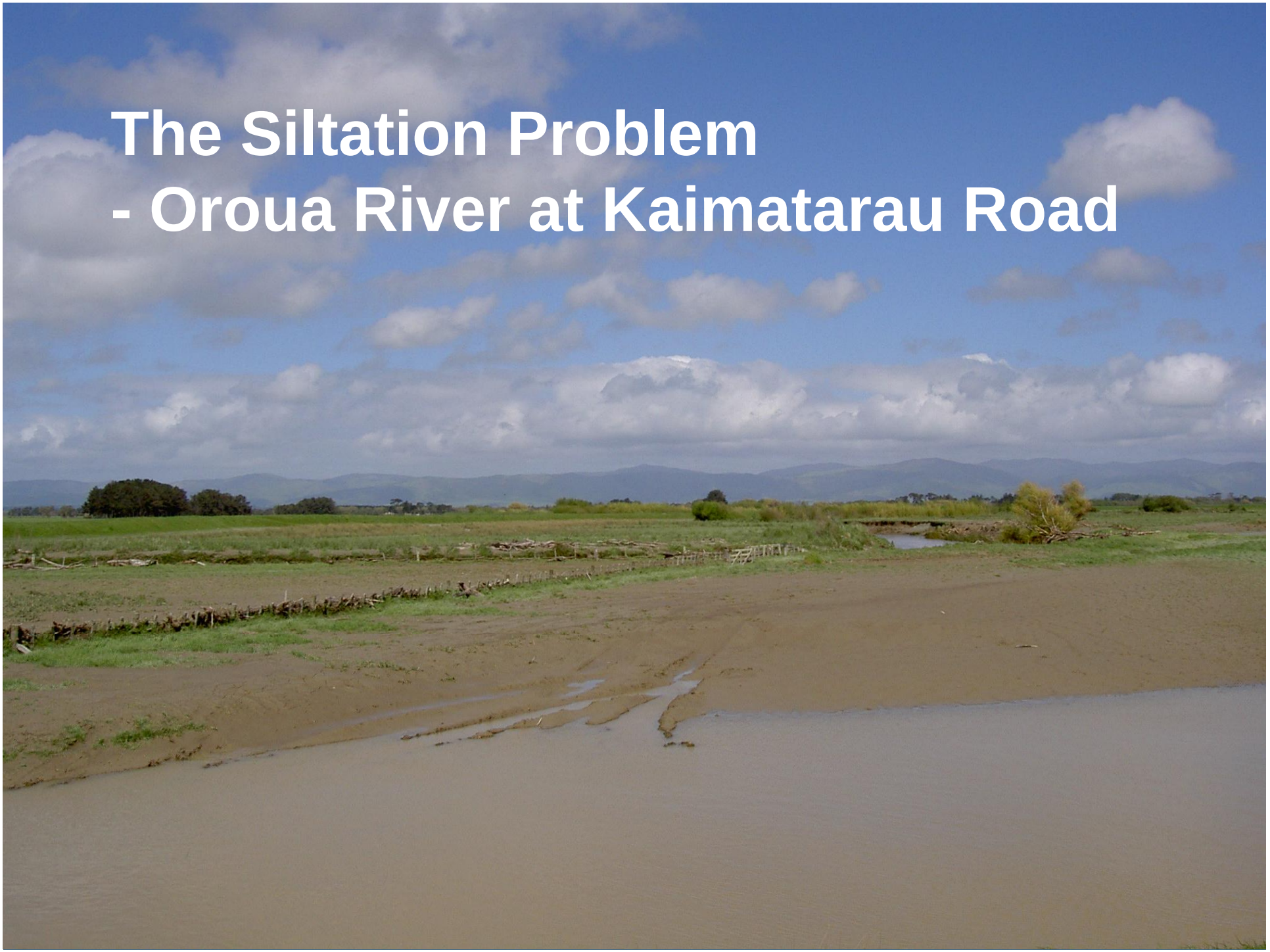
The Siltation Problem
- Oroua River at Kaimatarau Road



The Siltation Problem
- Oroua River at Kaimatarau Road



The Siltation Problem - Oroua River

Opus Investigations (2005) findings:

- For aggradation reach (13 km), average rate of silt deposition over 22 years = 15,000 m^3/year, and average rate of bed aggradation (gravel) =15,000 m^3/year.
- During 2004 flood, 300,000 m^3 of silt deposited in the same reach.
- Further survey required to confirm present rate of deposition, however staff and landowner observations are that the rate has increased dramatically.
- 500mmm silt drops in some areas during moderate flood events.

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The Siltation Problem - Oroua River *cont…*

- At past average deposition rate, the silt is marginally manageable.
- Current Scheme proposal allows for perpetual removal at a cost of $100,000 per year.
- If deposition rate increases, removal will be unaffordable.
- Channel capacity will be lost and flood risk will increase as a result.
- 66 km of stopbanks presently being raised – 600 mm aggradation allowance in design. $13.5 million cost - cannot practicably be raised further.

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The Siltation Problem - Oroua River *cont…*

Source of the Silt:

- Natural erosion processes acknowledged.
- Acknowledged that significant quantity comes from the degradation reach immediately upstream (bed degradation and lateral erosion).
- Erosion protection Scheme in middle reaches limits lateral erosion.
- Severe erosion is evident on steeper slopes in upper catchment, only 35 km from source to deposition problem.
- Can reasonably be deduced that accelerated erosion is elevating sediment load and resulting in increased flood berm siltation.

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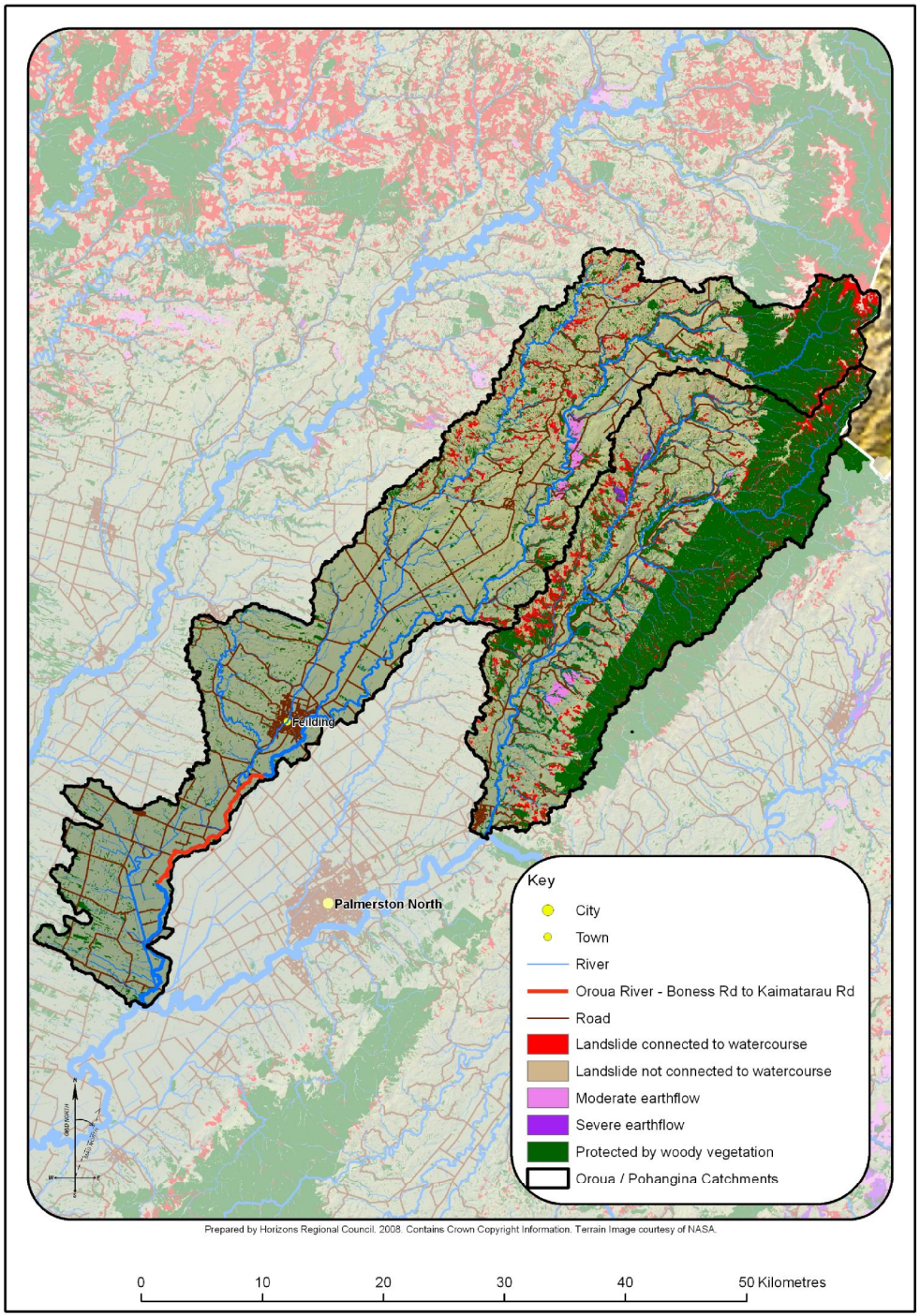

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The Siltation Problem - Lower Manawatu River

- Silt deposition reach extends over approximately 32 km.
- 1.6 million cubic metres over 10 years.
- $800,000 annual cost to remove is unaffordable.
- 40 km of stopbanks being raised – 20 years aggradation allowance in design.
- $5 million upgrade cost.
- Likely to be last occasion that banks are raised.

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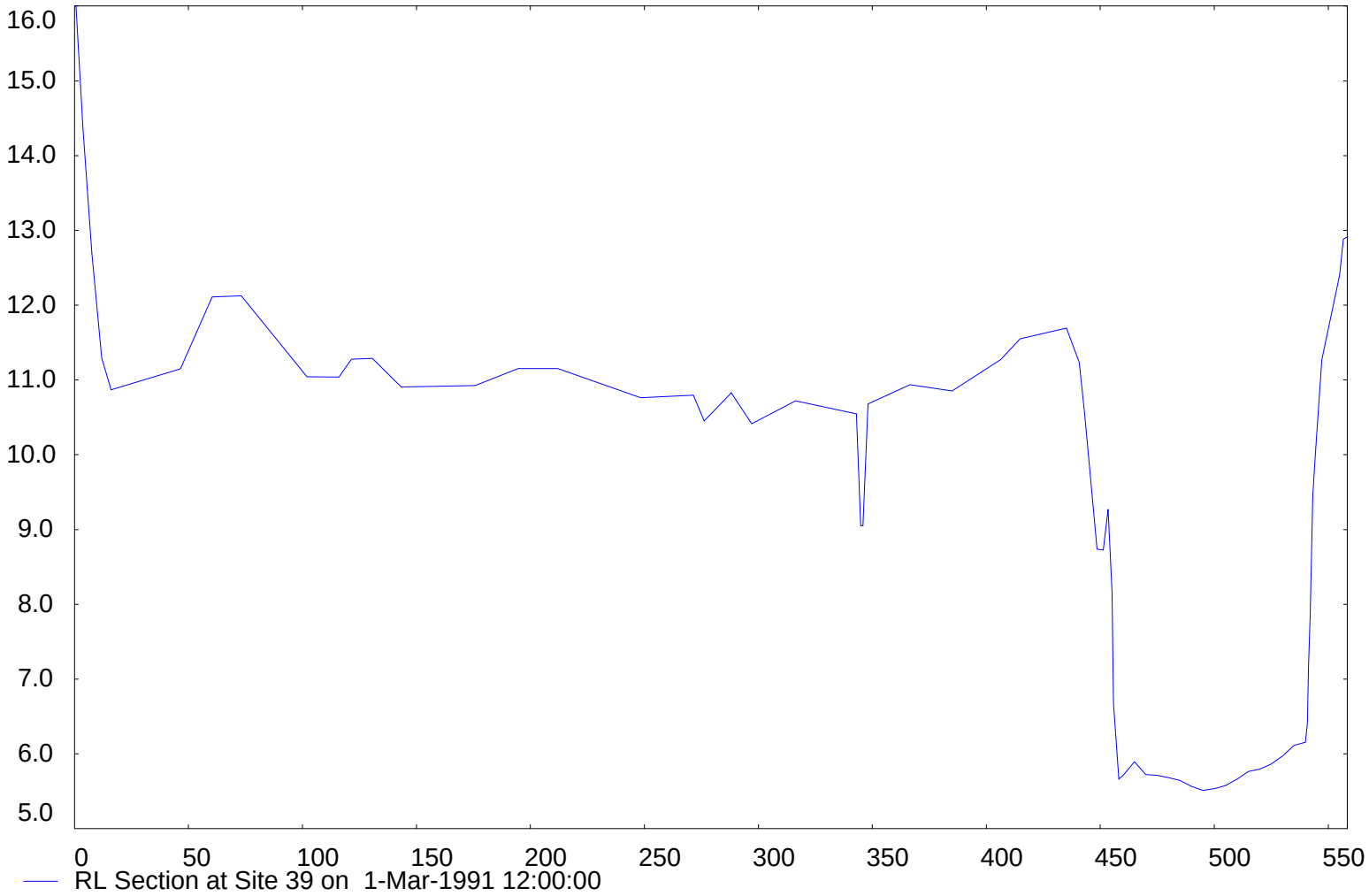
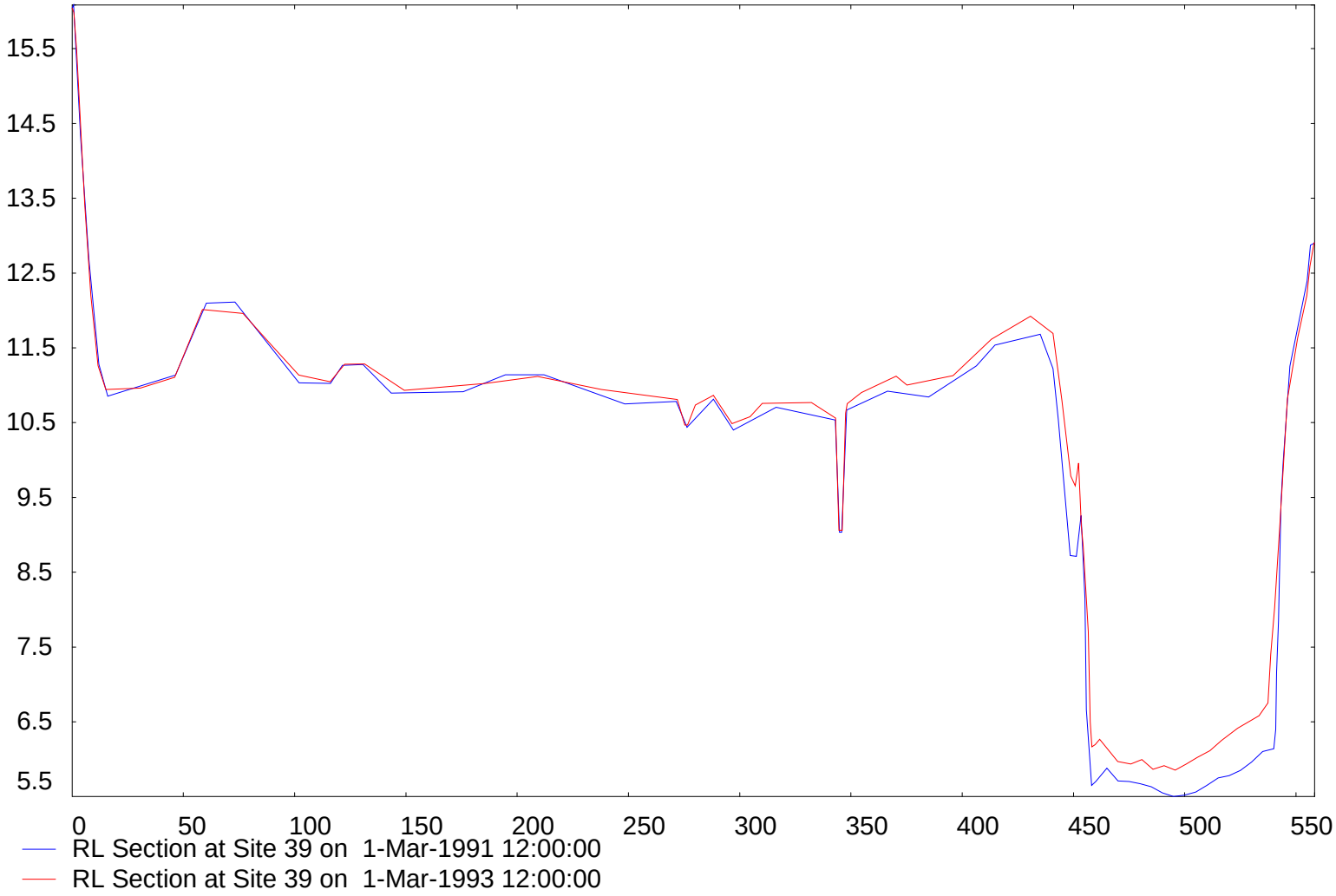
Lower Manawatu River Upstream
of Shannon-Foxton Road Bridge

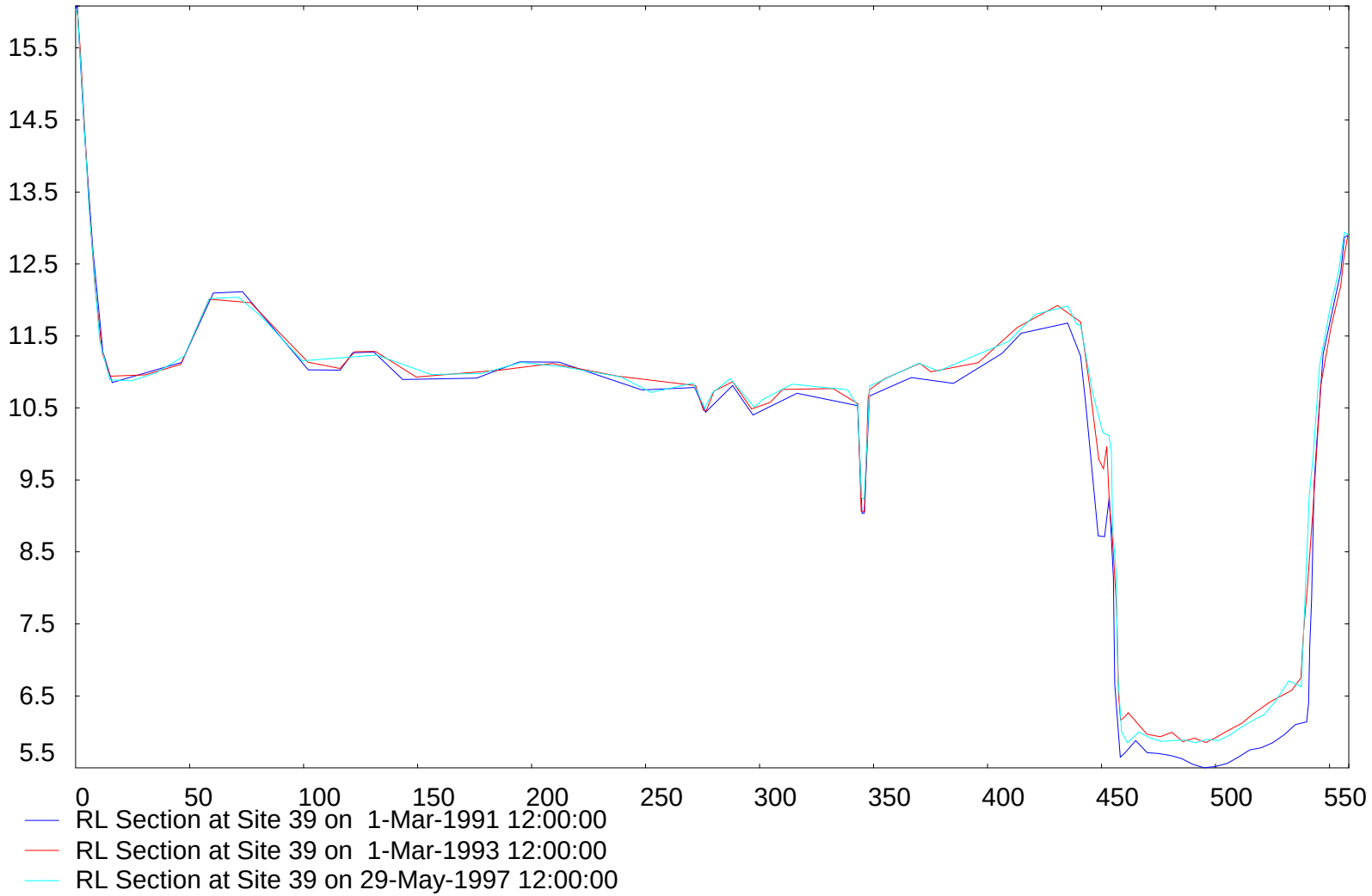
Manawatu River 3.8 km Upstream of Opiki Bridge



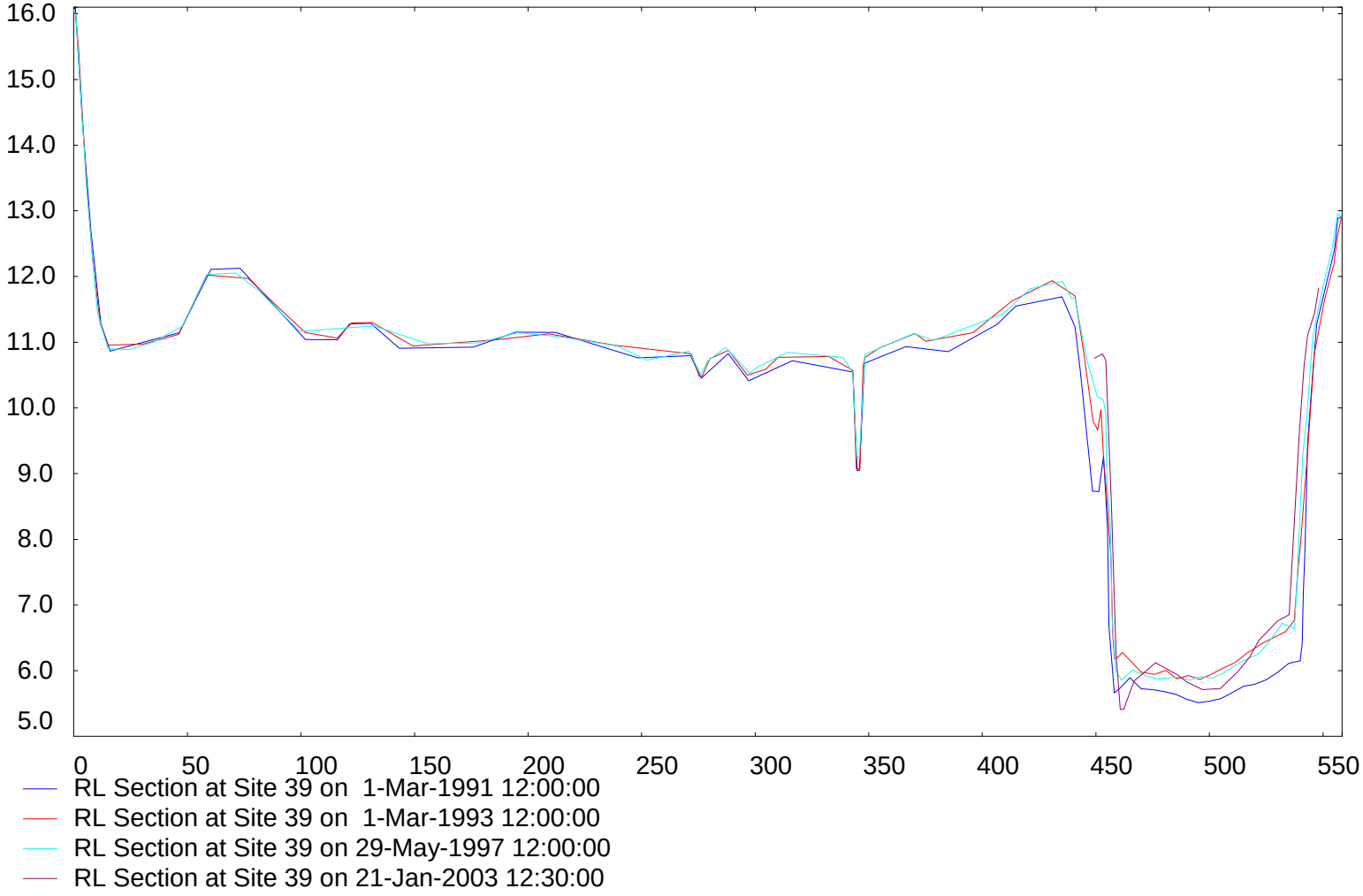
Manawatu River 3.8 km Upstream of Opiki Bridge



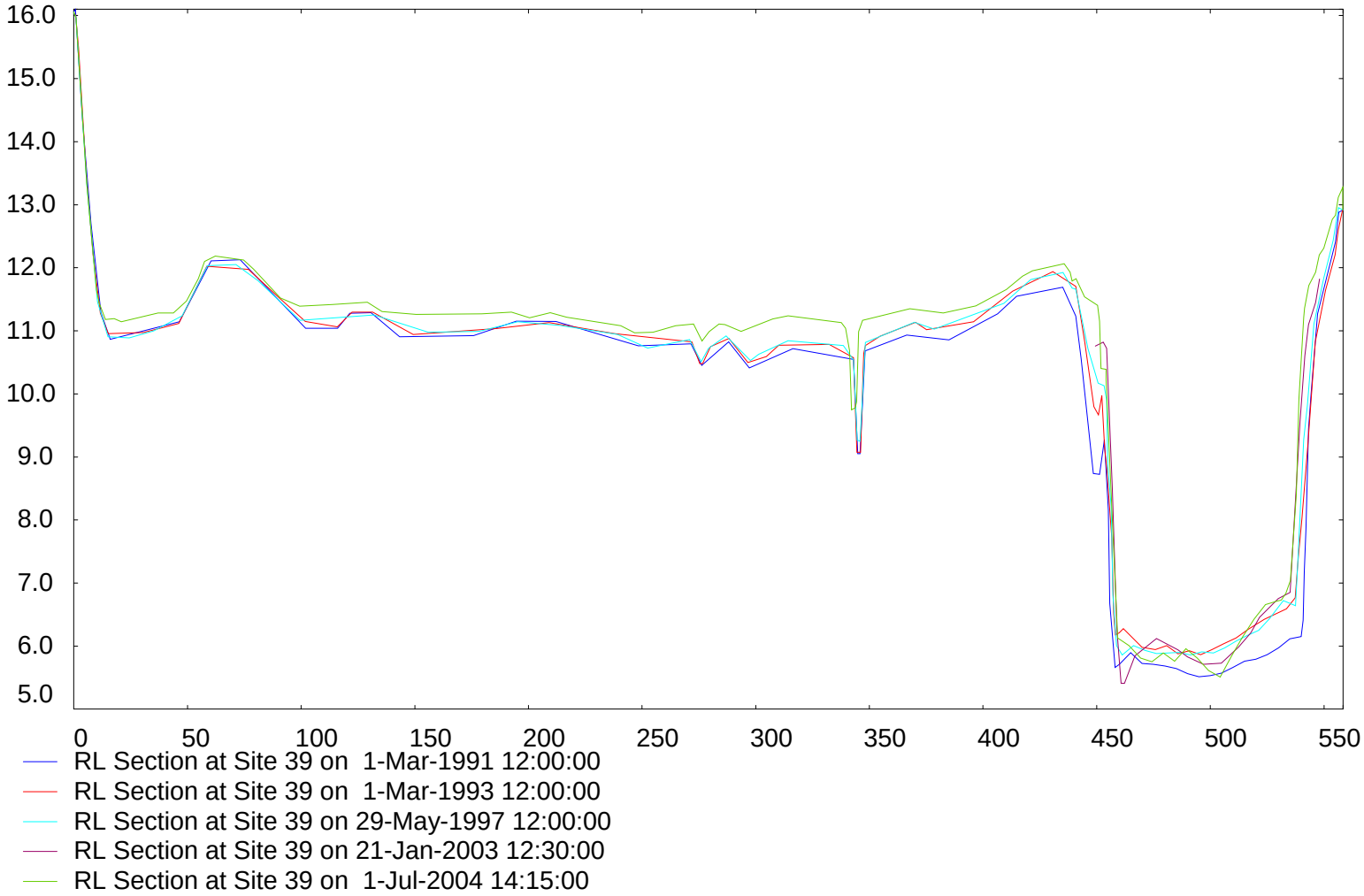
Manawatu River 3.8 km Upstream of Opiki Bridge



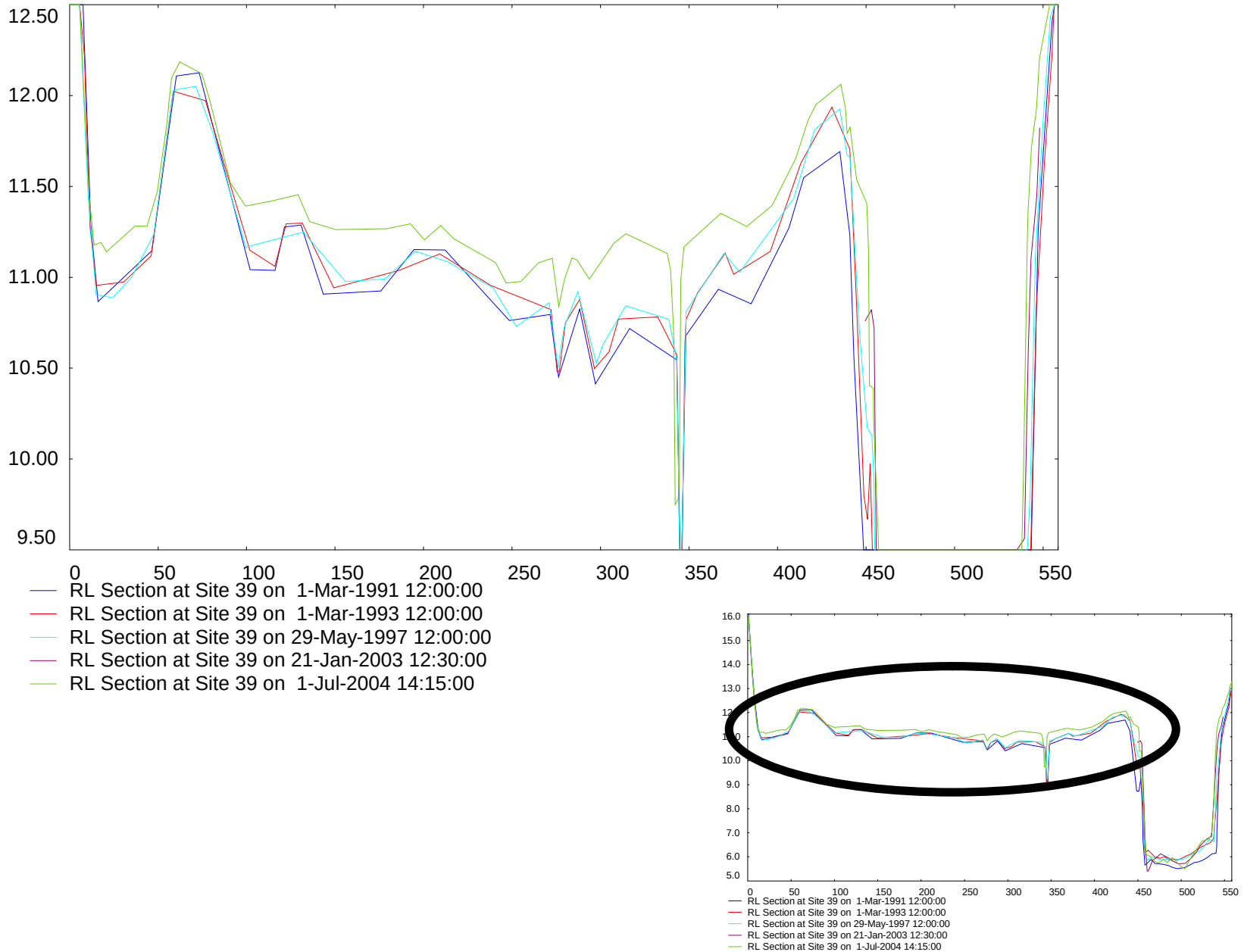
Manawatu River 3.8 km Upstream of Opiki Bridge



Manawatu River 3.8 km Upstream of Opiki Bridge

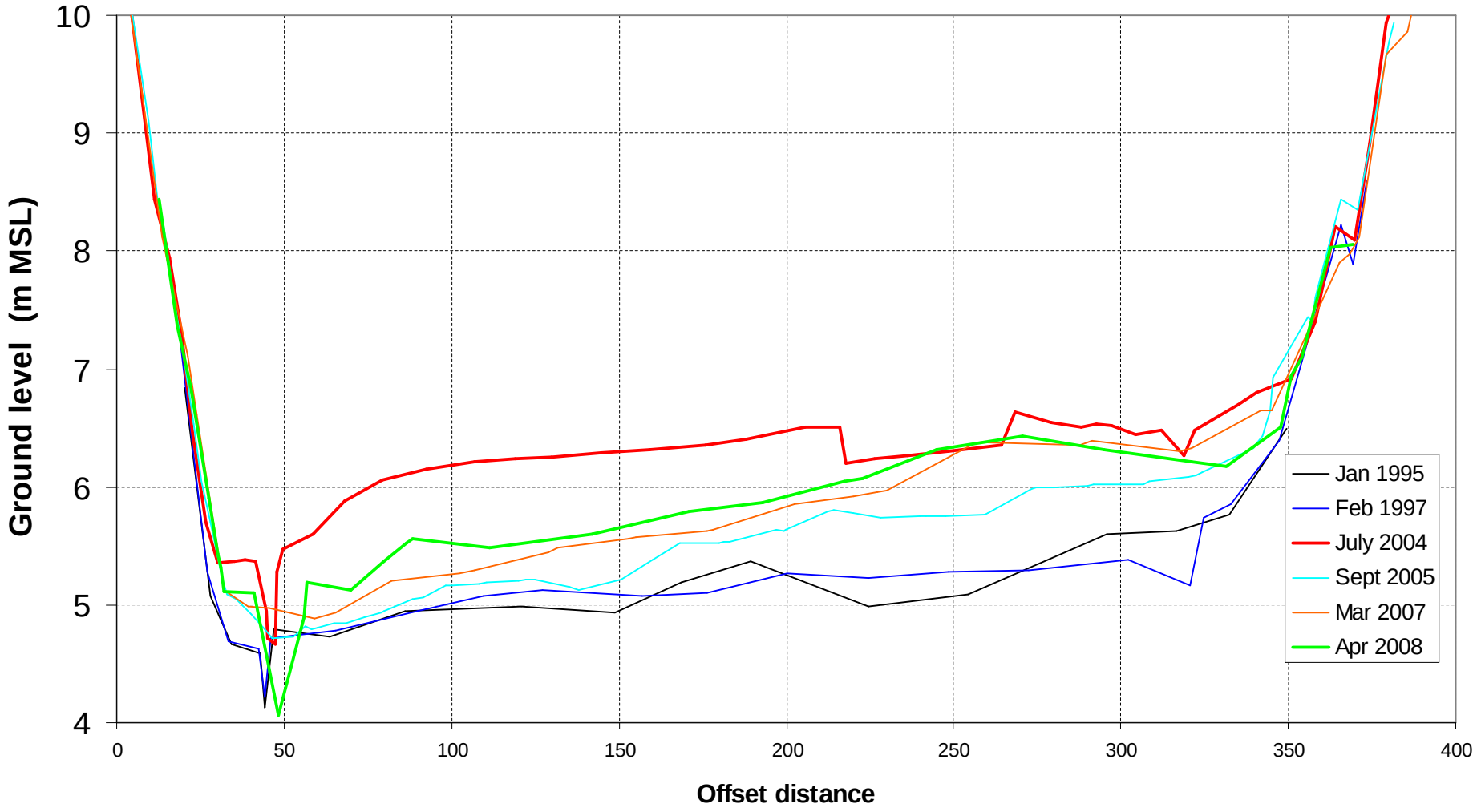


Manawatu River 3.8 km Upstream of Opiki Bridge




Lower Manawatu River
Moutoa Floodgates

Siltation of Moutoa Sluicegates Inlet between 1995 and 2008 - Typical Cross section.



The siltation problem - Lower Manawatu River

Source of the silt:

- Oroua catchment as above. Still high sediment load downstream of confluence.
- Pohangina catchment – erosion protection Scheme in lower reaches – significant accelerated erosion in upper catchment.
- Note with satisfaction SLUI priority (highest) accorded those two catchments.

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The siltation problem - Lower Manawatu River

What does the future hold?

- Will silt removal be affordable in 20 or 30 years time?
- Again likely that community will be faced with a progressive reduction in protection standard once aggradation allowance has been expended.
- Scheme has been highly successful, incumbent on present generation to prolong it's effective operation as long as possible.
- Any measure that will retard capacity loss should be supported.

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The Siltation Problem - Rangitikei River

- Almost 40 years of survey records show progressive loss of capacity in lower river (15 km).
- Mean bed level rising 30 mm /year.
- Dramatic impact on performance of flood protection Scheme.
- Current programme to raise 17 km of stopbanks.
- Capital cost $6.2 million ($8.8 million with loan servicing).
- 20 years aggradation allowance included in design.
- Present indication of accelerated silt deposition post-2004.

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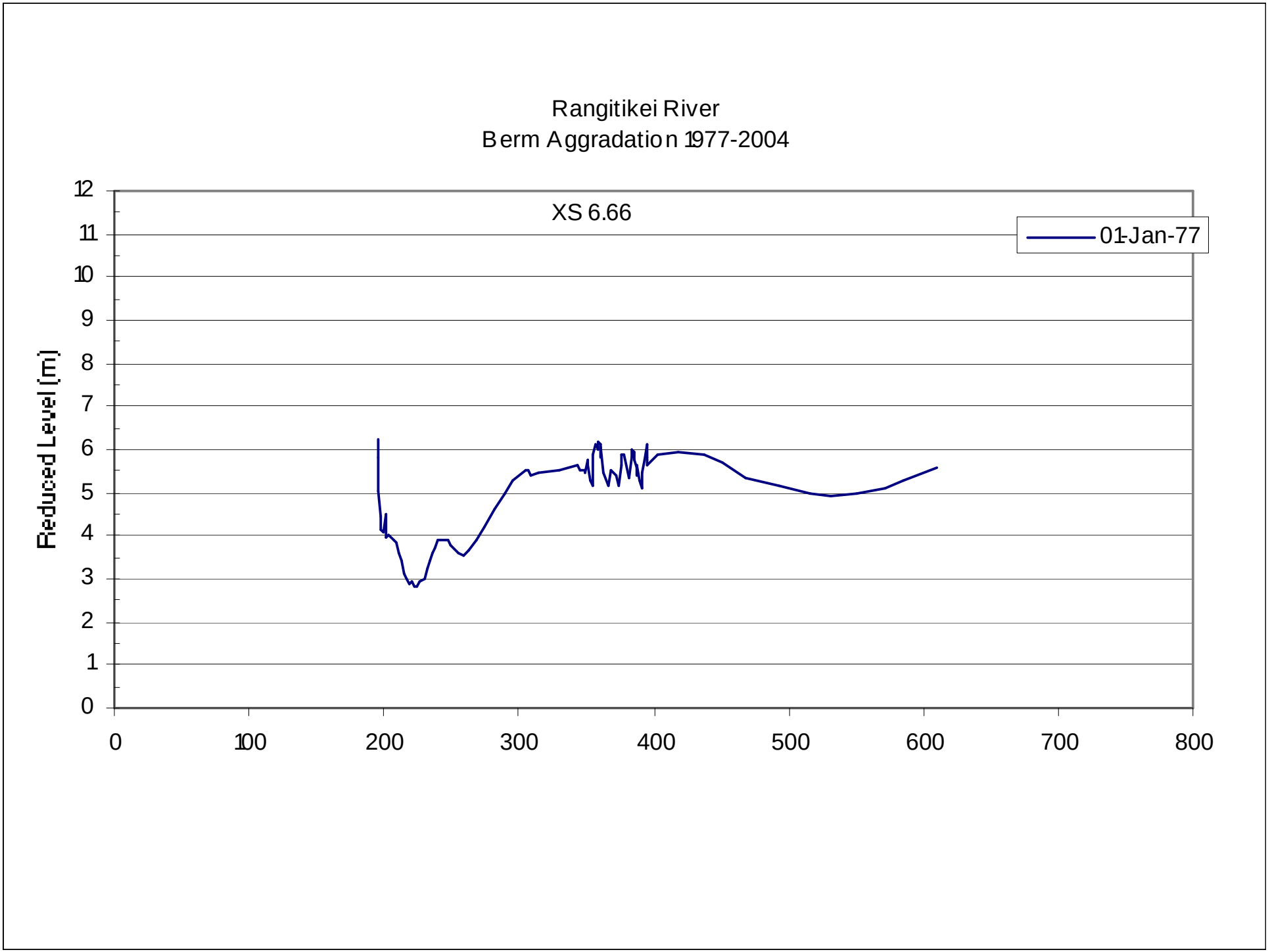
Rangitikei River
Berm Aggradation 1977-2004
XS 6.66
01-Jan-77
Reduced Level (m)
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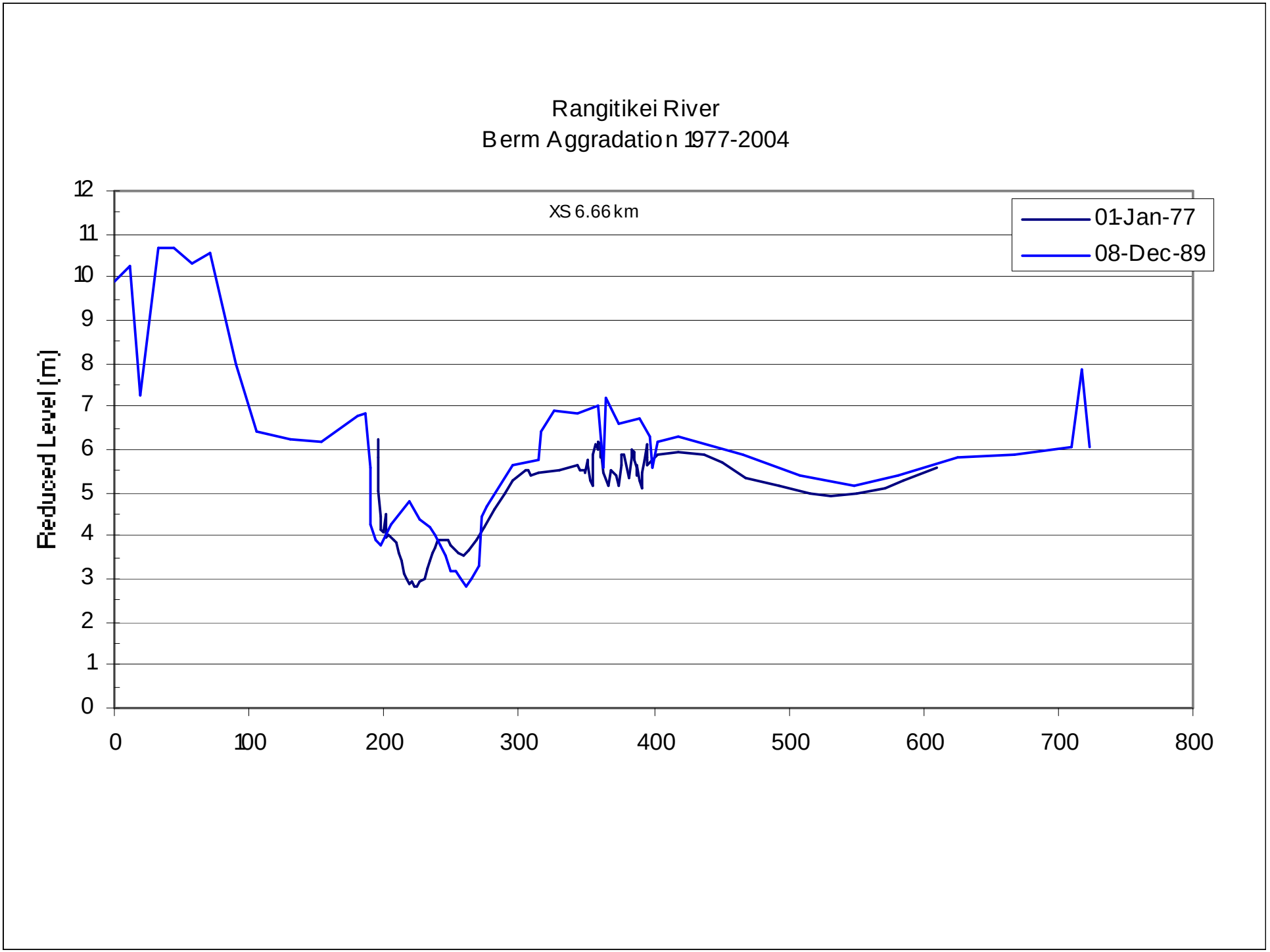
Rangitikei River
Berm Aggradation 1977-2004
XS 6.66 km
01-Jan-77
08-Dec-89
Reduced Level (m)
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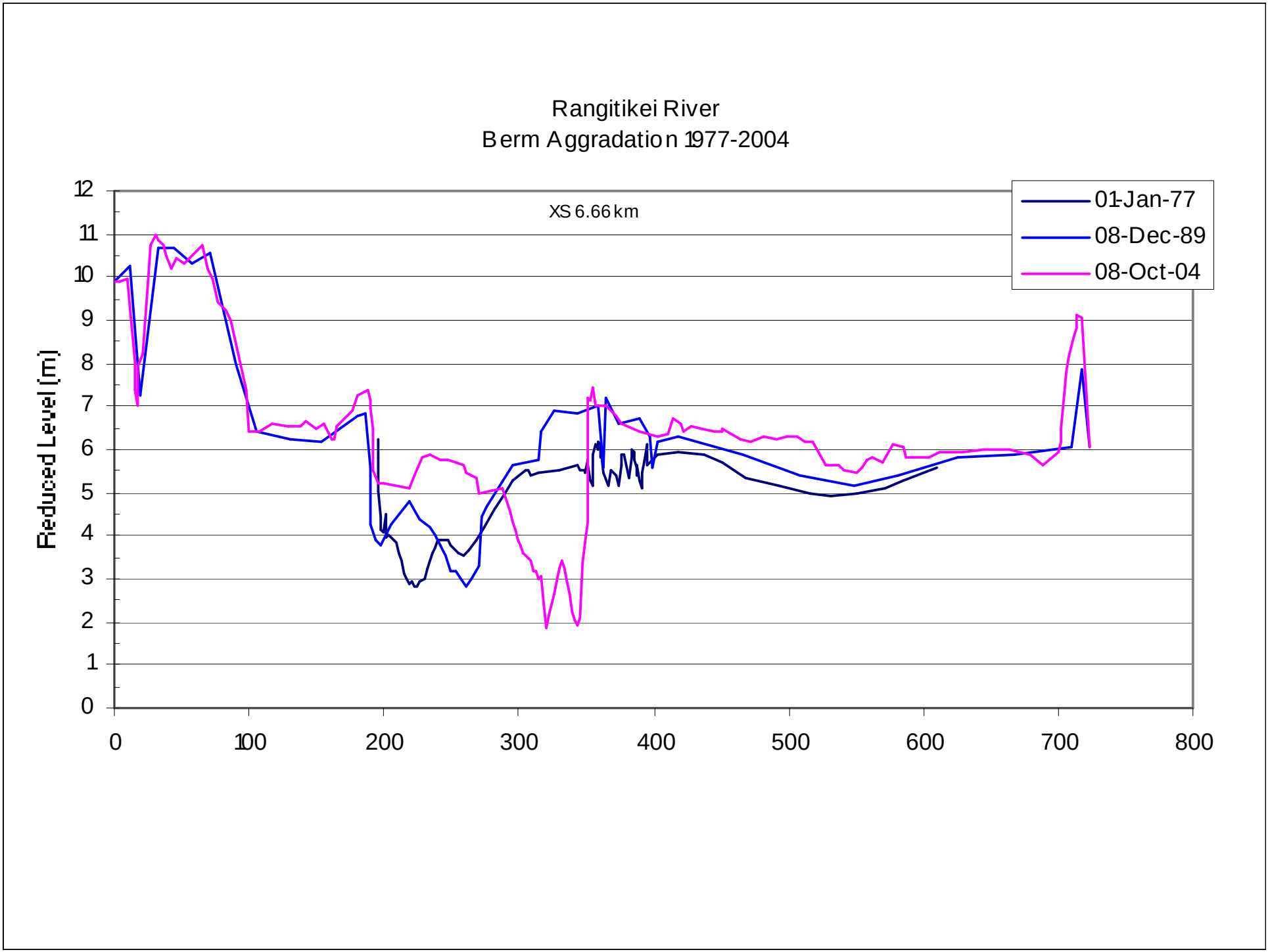
Rangitikei River
Berm Aggradation 1977-2004
XS 6.66 km
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08-Dec-89
08-Oct-04
Reduced Level (m)
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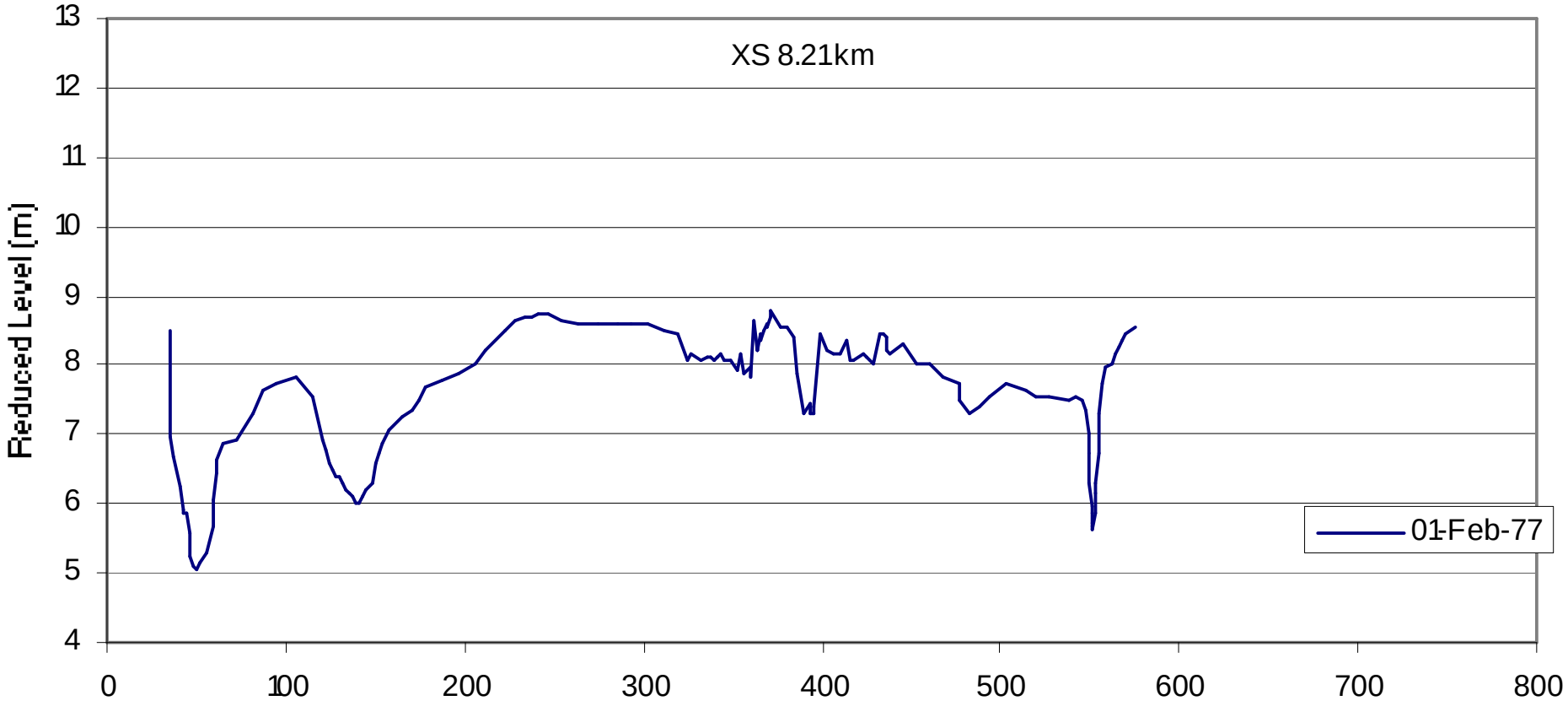
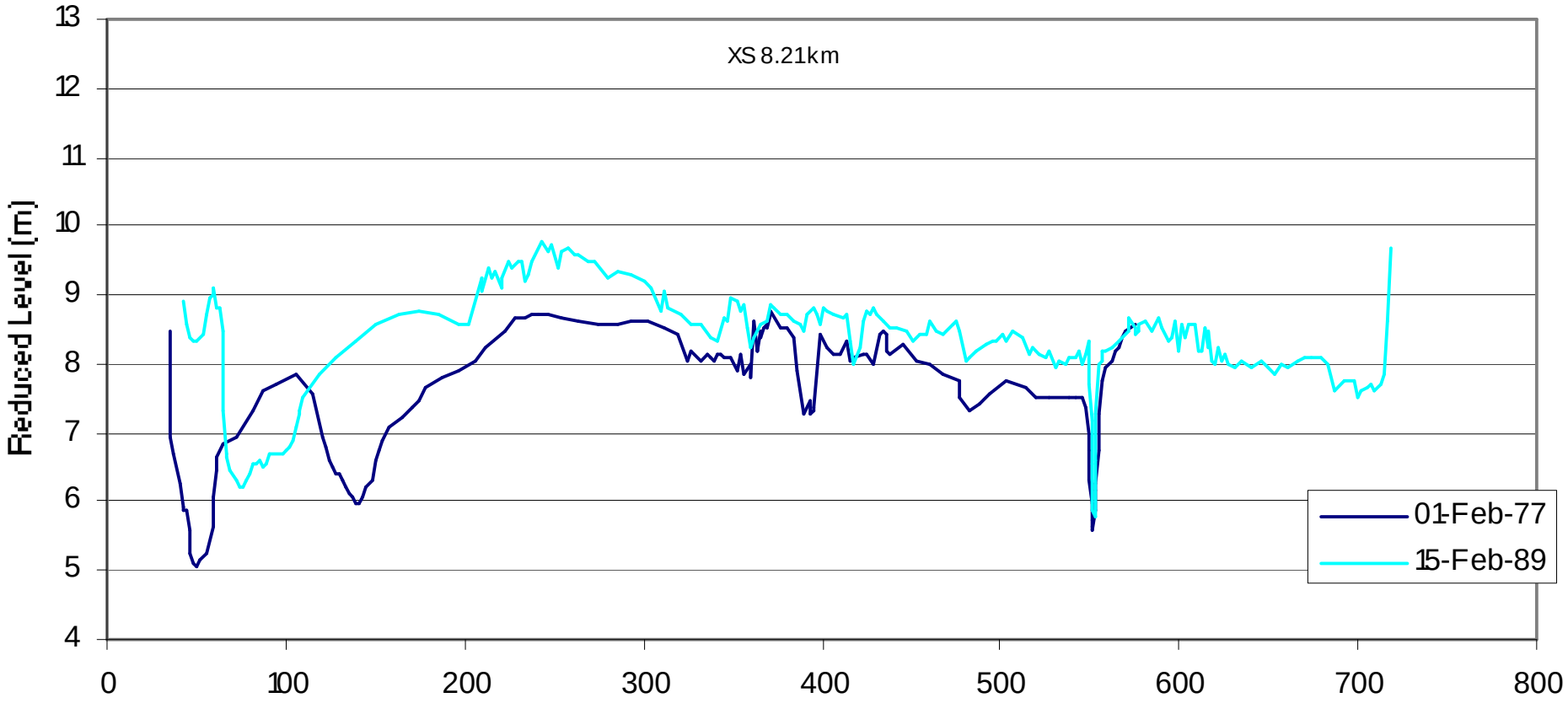
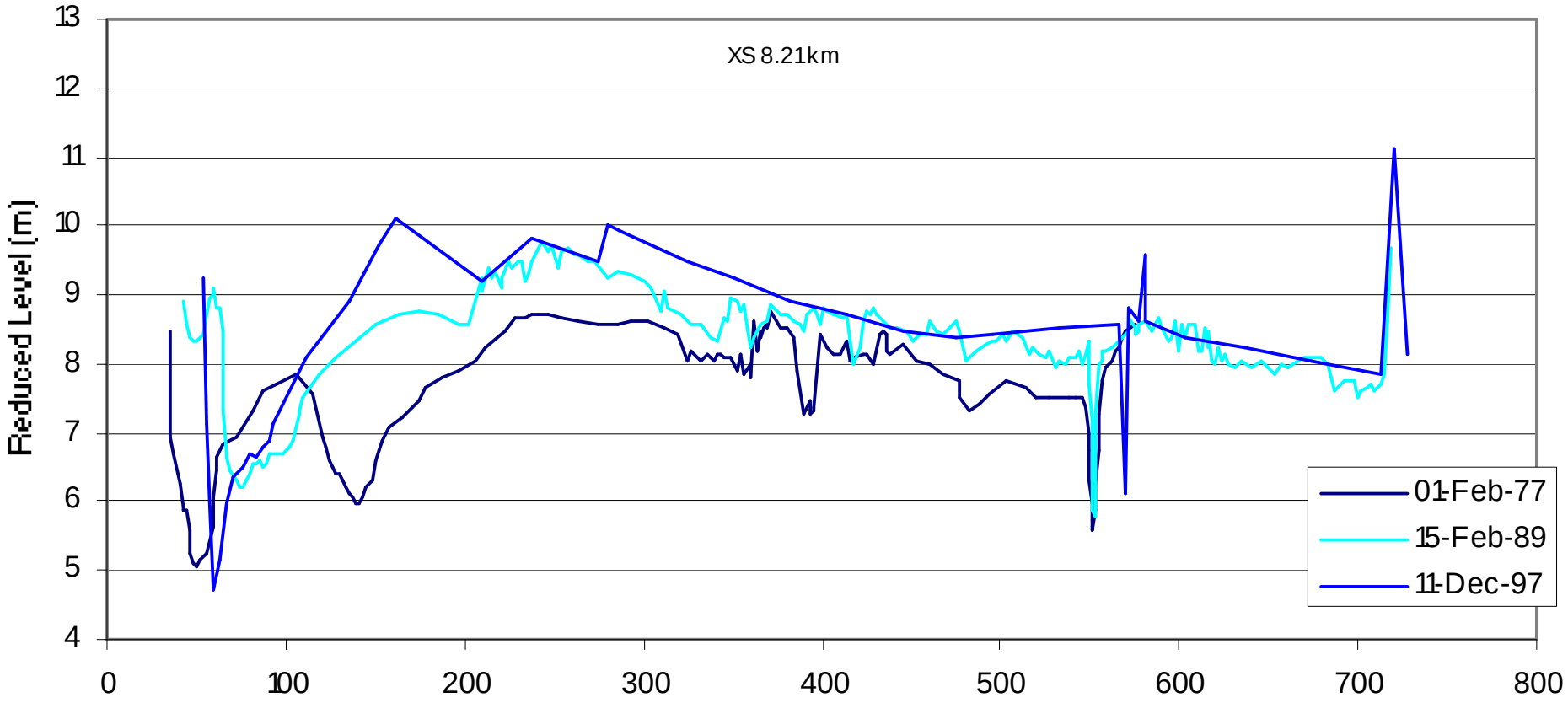
Rangitikei River
Berm Aggradation 1977-2004



Rangitikei River
Berm Aggradation 1977-2004



Rangitikei River
Berm Aggradation 1977-2004




Rangitikei River
Berm Aggradation 1977-2004
XS 8.21km
Reduced Level (m)
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15-Feb-89
11-Dec-97
08-Oct-04

The Siltation Problem - Rangitikei River

- Inevitable progressive loss of flood carrying capacity.
- Uneconomic to remove vast volumes of silt and gravel.
- Increasing channel instability and threat to stopbank integrity.
- Difficult to avoid conclusion that present standard of protection won't be able to be maintained in the longer term.
- Must pursue measures that will prolong Scheme's effective operation.

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Conclusion

- Communities located on Oroua, Manawatu and Rangitikei flood plains are dependant on effective operation of flood Schemes.
- Effectiveness is being compromised by deposition of silts and gravels.
- An unknown proportion of those silts is derived from entirely natural erosion processes.
- Another unknown proportion of silts is derived from lateral erosion in the ‘mid’ catchments.
- De-vegetation and land disturbance in the steeper upper catchments, is elevating sediment levels in the streams and contributing to channel and berm aggradation in the lower reaches.

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Conclusion *cont…*

- Stopbanks are presently being raised largely in response to that aggradation – works accelerated by the 2004 storm event.
- Strong indication that rate of siltation has increased post-2004 storm impacts.
- Unlikely that further stopbank raising will be feasible.
- Silt being removed where practicable/affordable – not from main river stems.
- Affordability of removal is an issue now – will it be any more affordable in 20 to 30 year's time?

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Conclusion *cont…*

- We are ‘buying some time’ with present upgrade works – need to use that time to best advantage.
- Initiatives at a National level recognise total catchment approach to flood risk management.
- One Plan Land Chapter objectives, policies and methods for addressing accelerated erosion seem eminently worthy of support.
- Future generations will not thank us for wasting the next 20 years.

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