Damwatch
Dam Engineering Specialists

Hutt River
Floodplain Management Plan

Mills Street Stopbank Alignment and Property Purchase

Date 17th August 2009

Greater Wellington Flood protection

Final Report

PO Box 1549, Level 5 Creo House, 57-59 Courtenay Place, Wellington 6140 Tel: +64 4 381 1300

Damwatch
Dam Engineering Specialists

Hutt River
Floodplain Management Plan

Mills Street Stopbank Alignment
And Property Purchase

Date 17th August 2009

Greater Wellington Flood Protection

Final Report

Approved for issue: 18/08/09

Stephen McInerney Date 18 August 2009

EXECUTIVE SUMMARY

The area at Mills Street has been an historical constriction in the Hutt River corridor since the construction of the first stopbanks in 1901-03. Refer to Figure 1 for location. The left bank stopbank was originally built around development as the area was badly affected by flooding during the 1890's.

The Hutt River Floodplain Management Plan (HRFMP), completed in 2001, is a key strategic document and along with the Otaki and Waikanae Floodplain Management Plans formed the basis for Greater Wellington's deliberations and capital commitment to improve the three "flood schemes". Council required that all three plans be completed before an overall capital commitment, and its staging, be approved as part of 2000-2010 Long Term Financial Strategy (now the LTCCP).

As part of floodplain management plan preparations, feasibility design was carried out for each scheme to produce cost estimates of potential structural improvements, river works and other components. It was always recognised that detailed design would further develop the plan feasibility designs and costings, and that there would be adjustments and changes to the concepts set out in the plan.

Implementation of the HRFMP has continued since 2001 with outstanding achievement, including completion of the Ava to Ewen reach ($16 million) and design for the Boulcott (Golf Clubs) stopbank. Detailed investigations for the Boulcott stopbank alignment determined that substantial benefits can be obtained by moving the "HRFMP" design channel transition (70 metre "narrow" channel to a 100 metre "wide" channel) from beside the Hutt Golf Club down to the Mill Street constriction. Moving this channel transition downstream, however, reduces available berm at the already constricted Mills Street location.

During the Boulcott investigations it became clear that many of the benefits of extending the wide channel downstream to Mills Street can be replicated if the widened channel can be extended even further down the river i.e. to Melling or below. Subsequent expert assessment has concluded that it is viable to extend the wide channel downstream. Introducing a wide channel at Mills Street also reduces available berm.

A further consideration is that the New Zealand Transport Agency (NZTA) has signalled over a number of years that there may be a need to widen SH2, to ease traffic congestion at Melling. The writer believes there will be a requirement for SH2 to encroach into the floodway at Block Road opposite Mills Street, by around 10 – 20 metres. In this event, to retain a minimal right

bank berm, the river channel will need to be relocated by a width approximately equivalent to the SH2 encroachment.

The combined land requirements of the relocated Boulcott transition, the flexibility to extend the widened channel further downstream than Mills Street and the need to make some provision for SH2 improvements cannot be accommodated within existing floodway land.

To safeguard these options, that will enable long term flood security at the Boulcott / City Centre area, it is recommended that Greater Wellington completes the full "Yellow" land parcel property purchase at Mills Street Lower Hutt. The "Yellow" land purchase is shown on Figure 2, the total estimate purchase cost is $2.4 million.

The additional benefits arising from purchasing the "Blue" land parcel shown on Figure 2 cannot be justified, based on current evidence. The additional purchase cost for the "Blue" land parcel is $3.6 million.

HUTT RIVER - BOULCOTT REACH - OPTION 1
REVISED DESIGN CHANNEL

PLAN
Scale 1 : 1,000

HUTT RIVER / MILLS STREET

Date: 9 July 2009

TABLE OF CONTENTS

1.0 Purpose of this Report

The purpose of this report is:

- To provide an historic overview of the Mills Street area in providing Hutt River "flood protection",
- Outline the context of the Hutt River Floodplain Management Plan (HRFMP) in Greater Wellinton's long term strategic planning,
- Outline the assumptions, expectations and design bases for the HRFMP,
- Summarise progress on implementing the HRFMP,
- Describe the HRFMP Mills Street Lower Hutt improvement proposals and put them in context with other improvements,
- Outline the impact that detailed design, carried out for the Hutt / Boulcott Stopbank (Golf Clubs) improvements, has had for the Mills Street area and the river reach downstream,
- Consider stopbank alignments and property purchase options at Mills Street
- Draw conclusions on the Mills Street stopbank alignments and property purchase options and recommend a preferred property purchase.

2.0 Historic Overview

The area at Mills Street has been an historical constriction in the river corridor since the construction of the first stopbanks in 1901-03. The left stopbank was built around development as the area was badly affected by flooding during the 1890's; these floods became a key trigger for stopbank construction. Construction of the 1901-03 stopbanks ignored the constriction problem and the first opportunity to remove it was passed over. The second opportunity arose around the time of the Melling Cuts and stopbank raising in the 1960's, this second opportunity was also passed over.

3.0 Hutt River Floodplain Management Plan

The HRFMP was completed in 2001. It is a key strategic document, and along with the Otaki and Waikanae Floodplain Management Plans formed the basis for Greater Wellington's deliberations and capital commitment to improve the three "flood schemes". The aim was to provide an appropriate level of security for each scheme, and a consistent level of security within each scheme, over the next forty years - the proposed life of the plans. Council required that all three plans be completed before an overall capital commitment, and its staging, be approved as part of 2000-2010 Long Term Financial Strategy (now the LTCCP).

The management plans aimed to ensure, as far as that is possible with established flood schemes, a sustainable approach to flood risk reduction. This was achieved by using a combination of non-structural, structural, emergency management and environmental options

and techniques. The commitment to this approach required close working with the relevant District and City Councils, to ensure the non-structural and emergency management components would be a meaningful component. To support the community consultation programme there was wide publicity, newspaper feature articles, newsletters, public meetings and targeted group discussions for both the HRFMP and Living with the River. The latter was an issues document that preceded preparation of the HRFMP.

As part of floodplain management plan preparations, feasibility design was carried out for each scheme to produce cost estimates of potential structural improvements, river works and other components. It was always recognised that detailed design would further develop the feasibility designs and costings, and that there would be adjustments and changes to the concepts set out in the plan.

Historic development dictated that the balance between structural and non-structural measures on the Hutt River are heavily weighted in favour of structural solutions. The very high population at risk, high damage economics and the need to make provision for climate change lead to a much higher design standard for the Hutt River than the Waikanae and Otaki River schemes.

4.0 Constrictions on the Hutt River

At the time of preparation of the HRFMP it was recognised that there were a number of severe constrictions on the river – these included Woollen Mills Corner (Moera, left bank), Ava Railway Bridge, Autopoint / Daly Street (central city, left bank), Melling Bridge, Mill Street / Safeway Storage / Melling Substation (above Mills Street, left bank), Moonshine Bridge and the Maoribank / Harcourt Park Reach. The Ewen Floodway improvements completed in1996 had removed the old Ewen Bridge, the most critical constriction on the river, and improved the floodway at the location. The Ava Railway Bridge constriction has since been considerably improved.

For pragmatic reasons (very high cost to remedy), the policy adopted for the road and rail bridge restrictions was to advise LTNZ (now NZTA) and ONTRACK of the respective constrictions and agree that waterway improvements would be dealt with when the structures were replaced. Policy 11 in the HRFMP details the process. Provision is made in the HRFMP for land purchase and river works at Melling. The Moonshine problem is substantially a bridge waterway issue, rather than a channel issue, and will be a future NZTA responsibility to remedy.

Because of the severity of the constriction at Woollen Mills, provision for property purchase and river works is included in the HRFMP to effect the improvements. In terms of providing an acceptable waterway the Autopoint / Daly Street area and Harcourt Park were ruled as unattainable because of very high land purchase costs. The policy adopted for these two locations was to "engineer" a reasonable risk cost balance, with special stopbank construction and very heavy rock bank edge reinforcement, within existing publicly owned land constraints. The latter includes taking the car parks in Daly Street.

5.0 The Mills Street / Safeway Storage / Melling Substation Constriction

The combined constriction at Mills Street is obvious from Figure 1. The HRFMP policy benchmark for a high security berm / stopbank erosion buffer is an 80 metre river berm with reinforced vegetative bank edge protections. A "best practice" example of 80 metre berms can be seen on the right bank opposite the Hutt Golf Club.

The Mill Street constriction is complex, the most significant intrusion is the Transpower Substation, followed by the Mills Street stopbank protrusion and then Safeway Storage. In the late 1990 Greater Wellington Flood Protection agreed with Transpower that relocation of the substation outside the floodway was not viable.

Transpower agreed that they would progressively relocate and flood proof replacement equipment 80 metres outside the design channel alignment. The retreat would take place as substation equipment reached the end of useful life. Their work commenced with a relocated and elevated control building at the back of the site. Their other relocation work will continue over a number of years, with the transmission pylon a key at risk asset. Setting this equipment behind the 80 metre line will permit a vastly improved waterway and lowered berm to be constructed.

Although an unsatisfactory development Safeway Storage was located 80 metres outside the design channel. Because it was a conscious decision by the promoter to locate within the floodway its risk from flooding or erosion is not a Greater Wellington priority and no specific protection is planned for this development.

HRFMP treatment of the Mills Street area intrusion is dealt with in Section 6

6.0 HRFMP Treatment at Mills Street

Erosion risk to the Mills Street Stopbank is fully recognised in the HRFMP. Appendix 4, Figure A14, indicates potential for alluvial erosion of the Hutt River berm up to and including the existing stopbank footprint.

The HRFMP set out a design channel alignment and widths that correlated with natural patterns of the river, within the physical constraint of the area. This channel was called the "narrow" channel. The adopted design channel width, from opposite the Hutt Golf Club through to Central Hutt, was 70 metres. With the Mills Street stopbank reconstructed within current land ownership, there was provision for a left a berm of approximately 55 metres. While a 55 metre berm is well short of the benchmark 80 metres, the cost and social impacts associated with property purchase could not then be justified against other priorities in the plan. The HRFMP river works plan at Mills Street was for the berm edge to be reinforced with rock, to provide an acceptable level of security. These premises formed the basis for HRFMP cost estimates.

7.0 HRFMP Progress

Since 2001 Council has maintained steady progress implementing the HRFMP. It has completed improvements on the Ava Bridge to Ewen Bridge reach, including realigning the river to provide security to the Alicetown stopbank, improvements at the Ava Bridge waterway and raising and strengthening both stopbanks at a total cost of around $16 million. Other HRFMP work includes a closure stopbank, flood gate and bank edge protections at Belmont, and rebuilding and raising the ring bank at Whirinaki Street, Upper Hutt.

Greater Wellington is now progressing with the detailed design and consent phases of the Boulcott / Hutt stopbank project. This project was brought forward by one year to meet community concerns following the January 2005 floods. The feasibility phase of the work included investigation of a number of stopbank alignments to determine a preferred alignment through the Hutt and Boulcott golf clubs. The Boulcott / Hutt designs are discussed in Section 8.

Investigations of the City Centre Reach were planned to commence in 2012. In terms of improving security this is the most complex reach on the river. It includes the constrictions at Mills Street, Melling Bridge and Autopoint / Daly Street and the constrained right bank area along Marsden and Pharazyn Streets.

8.0 The Golf Clubs Stopbank Design

Detailed investigations for the golf clubs stopbank alignment determined that substantial benefits can be obtained by moving the HRFMP design channel transition (a 70 metre "narrow" channel to a 100 metre "wide" channel) from beside the Hutt Golf Club down to the Mill Street constriction. The benefits include:

Flood levels reduced by around 300mm, with associated:

- Reduction in stopbank heights
- Reduction in stopbank construction costs
- Increased stopbank security
- Reduced visual and land impacts on the golf clubs
- Reduced traffic impacts at Connolly Street (sight lines etc)
- Easier access to neighbouring properties in Connolly Street
- Reduced flood flow through the Golf Clubs – lower velocities, erosion risk and less debris

The wider channel results in:

- Lower velocities in the main channel
- Reduced turbulence in the main channel
- Better security from berm erosion
- Better flow continuity
- Lower bank edge protection costs

The wider channel also builds in flexibility to manage increased climate change flood flows.

9.0 Mills Street Stopbank

As noted in Section 6 the original HRFMP 70 metre design channel, developed within existing floodway land, allowed a 55 metre berm at the Mills Street constriction. A 55 metre berm is well short of the benchmark 80 metres, but to remain within existing floodway land the HRFMP river works plan made provision for bank edge rock reinforcement to provide acceptable erosion security.

Narrow 70 metre Channel Option (Existing Floodway Land)

The effect of moving the 100 / 70 metre transition downstream to Mills Street, within existing floodway land, is to reduce available berm from 55 metres to 45 metres. In isolation a relocated channel transition can be made viable in existing land by further increasing the weight of rock in the bank edge protections, but there is a net corresponding reduction in security.

It is also became clear from the Boulcott / Hutt investigations that many of the benefits of extending the wide channel downstream to Mills Street (noted in Section 8) can be replicated if the widened channel can be extended even further down the river i.e. to Melling or below.

A further consideration is that the New Zealand Transport Agency (NZTA) has signalled over a number of years that there may be a need to widen SH2, to ease traffic congestion at Melling. While NZTA has recently advised that they have initiated investigations to clarify their requirements, reporting of the investigations is not imminent. The writer believes that there will be a requirement for SH2 to encroach into the floodway at Block Road opposite Mills Street, by 10 – 20 metres. To retain a minimal right bank berm the river channel will need to be relocated by a width approximately equivalent to the SH2 encroachment, leaving a left berm width of approximately 30 metres.

Table 1 indicates that within existing land, and for the three scenarios above, there would be an available left bank berm of 17 metres. A berm width of 17 metres is neither economically viable nor sustainable in terms of adequate flood security. In summary this means that it is not possible to accommodate the combination of a relocated golf club wide channel transition, the flexibility to widen the channel downstream of Mills Street (to take advantage of the benefits noted above) and to make some provision for future NZTA widening of SH2 *within existing Council owned floodway land.*

Wide Channel options

Based on the benefits obtained by moving the Boulcott wide channel transition down river to Mill Street, and when the property at 41A Mills Street came up for purchase, Council officers assessed two property purchase options. The two potential purchase parcels are shown on Figure 2 and are called "Yellow" and "Blue".

Table 1 shows available berm widths at the critical Mills Street location for an upgraded stopbank within:

- the existing floodway land,
- the "Yellow" property parcel, and
- the "Yellow + Blue" property parcels

and for:

- the HRFMP 70 metre narrow channel,
- a "trial" channel below Mills Street widened to 90 metres

Table 1: Available Berm Widths for three land options

Downstream Design Channel Width (metres)	Available Berm Width (metres) [1]		
	Existing Land within floodway	"Yellow" Land Purchase	"Yellow + Blue" Land Purchases
70	30	55	60
90	17	42	50

Note: (1) – The "Available Berm Width" shown in Table 1 makes provision for a 15 metre river relocation to compensate for possible future SH2 floodway encroachment.

If there is future SH2 widening this will have a direct effect on channel hydraulics and dynamics, almost certainly requiring river relocation and extensive bank protections. In that eventuality it is considered that NZTA will need to be a party to sunk costs for land purchase, and cost for channel relocation and channel protections. A contribution from NZTA should be factored into overall income.

As noted above it is not sustainable to construct a wide channel downstream of Mills Street, within existing floodway land, and still provide acceptable security e.g. for the "trial" 90 metre downstream channel, rock protections for a 17 metre wide berm are not sustainable.

Wide Channel - "Yellow" and "Yellow + Blue" property Parcels

An initial assessment by Gary Williams, a river engineer who specialises in river processes, indicates that a "trial" 90 metres wide channel between Mills Street and the City Centre reach is physically possible. At Mills Street berm widths of 42 and 50 metres respectively are available with the "Yellow" and "Yellow + Blue" land purchases.

Hydraulic analyses undertaken by Philip Wallace for the same "trial" 90 metre channel indicate that water levels can be lowered by up to 400mm over much of the Boulcott reach to Melling Bridge. Velocities are substantially reduced, for example adjacent to Mills Street, from 4 m/sec to 3.5 m/sec. Philip Wallace is a computational hydraulics expert.

The benefits of extending a wide channel below Mills Street are substantially the same, and build on, the benefits set out in Section 8 for the Boulcott widening. The full downstream extent of benefits will depend on the opportunities for widening the floodway that arise from the traffic management and bridging solutions agreed for Melling.

The reports prepared by Messrs Wallace and Williams are available for review.

10.0 Property Purchase Options

"Yellow" Property Parcel

It is clear that the minimum property purchase option is the "Yellow" land parcel. Purchase of this parcel is necessary if provision is to be made for accommodating the relocated Boulcott channel transition, retaining the flexibility to construct a wider channel downstream of Mills Street and provision for future SH2 widening and. The rationale for the purchase is set out in Section 9.

"Yellow + Blue" Property Parcel

Purchasing both the "Yellow + Blue" property parcels would provide a wider berm than the "Yellow" parcel (50 metres compared with 42 metres). It would provide higher overall security, although not achieving the ideal 80 metre berm that would be provided with a "greenfield" opportunity.

For the 90 metre "trial" channel the benefits from this difference in berm widths (8 metres) become increasingly harder to justify in terms of the additional land purchase. The hydraulic analyses indicate that there is almost no difference in flood levels arising from the wider berm ("Yellow + Blue" land purchase) and the main channel velocities are approximately the same. The inference is that there will be little difference in main channel turbulence and berm erosion potential.

The decision then effectively hinges on the difference in erosion resistance between the 50 metre and 42 metre berms. The additional rock weight required, to give the "Yellow" berm near equivalent erosion resistance to the "Yellow + Blue" berm, would be more than covered by the approximate $3.6 million required to purchase the "Blue" property parcel.

Purchase of the "Blue" parcel would also dramatically escalate trauma for the affected residents and the local community, with the purchase of approximately 8 further properties.

In summary the additional benefits arising from purchasing the "Blue" land parcel along with the "Yellow" parcel, and providing a wider berm, cannot be justified on current evidence.

11.0 Conclusions

The following conclusions are drawn from the above assessment:

1. Land currently owned by Greater Wellington in the Hutt River floodway does not enable the combined requirements / provision to relocate the wide "golf club" channel transition down to Mills Street, retain flexibility to construct a wider channel downstream of Mills Street and make provision for future SH2 widening. It is considered that provision for all of these eventualities is essential to ensure acceptable long term flood security.

2. To enable the provisions noted in 1, a minimum property purchase option is the "Yellow" land parcel and it is recommended that purchase of this property parcel be completed in full.

3. The additional benefits arising from purchasing the "Blue" land parcel cannot be justified, based on current evidence. The additional purchase cost for the "Blue" land parcel is $3.6 million.

12.0 Recommendations

To safeguard options that enable provision for long term flood security at the Boulcott / City Centre area, it is recommended that Greater Wellington completes the full "Yellow" land parcel property purchase, as shown on Figure 1, at Mills Street Lower Hutt. The total estimated land purchase cost is estimated to be $2.4 million.