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Motueka River Flood Control Scheme Definition of Problems and Community Consultation

Prepared for Tasman District Council

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QUALITY STATEMENT

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Tasman District Council

Motueka River Flood Control Scheme
Definition of Problems and Community Consultation

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1 Overview

Tasman District Council's Ten Year Plan identified the need to review and reconstruct the current stopbanks on the Motueka River. Tasman District Council has more recently reviewed these plans and continues to consult with the community on this matter. Council concluded that there was a need to determine the best practicable and affordable flood control option.

Although the stopbanks have prevented major flooding in the past[1], they do not meet modern standards. It is known that the construction methods used did not provide adequate compaction of the central core of the banks. Recent investigations have shown that the current engineering fitness of the stopbanks is such that they would not hold up under sustained or repeated flooding events. It is therefore, considered that, in their current state they do not provide adequate protection to local residents and their assets.

The current flood control measures and stopbanks were discussed at length by submitters during the Ten Year Plan's consultation processes. While many submitters acknowledged the need for action, it was on the condition that adequate on-going public consultation was an integral part of the process. At the heart of the conditional agreement by the community was the need to better understand the risks posed by the current state of flood defenses. The community was concerned that any decision would take account of the balance between what is an acceptable level of risk, versus what the community was prepared to pay.

Under Section 78 of the Local Government Act 2002 the Council is obliged to consider community views and these must be considered at each of the four stages of the decision making process listed in section 78(2). These stages are as follows:

Stage 1 - Definition of problems and objectives

Stage 2 - Identification of reasonably practicable options

Stage 3 - Assessment of reasonably practicable options and development of proposal(s)

Stage 4 - Adoption of proposal(s)

The Project is working to achieve all 4 stages above, and this briefing is to report on Stage 1.

1.1 Introduction

The initial review of the Motueka flood control scheme occurred in 2006 with a view to upgrading the scheme to a 1% Annual Exceedance Probability (AEP) protection standard. This is a standard for which the scheme will be capable of withstanding a flood of a size that has a probability of occurring once every one hundred years. Phase 1 of the review involved a feasibility study and a preliminary design and costing report for the upgrading of the scheme to the 1% AEP standard.

The 1% AEP standard or the 1 in 100 year flood probability standard of protection was adopted in principle to bring the protection of the Motueka Township and the Motueka Flood Plain up to the nationally recognised minimum standard of protection afforded by similar flood protection schemes in New Zealand.

At this point the Tasman District Council presented this information to the community via the LTCCP process. The community feedback from this indicated further consideration needed to be given to affordability issues and other flood risk mitigation options.

1 In past events sandbags have had to be used to prevent breaches at some weak sections of the banks

1.2 The Problem

The Tasman District Council and the Community need to be able to understand the “problem” with flood control management in the lower Motueka River. To define and understand the problem the project team is working through various stages of investigation, by gathering data, undertaking modeling, and hydrology analysis, completing geotechnical investigations, talking with the community, looking at the history of flooding in the river and looking at changes to date and impacts of possible climate change in the future.

1.3 The Process

We are following the guidelines identified by the LGA (2002), and achieving this via a number of processes. These processes all form part of the Flood Management protocol requirements and along with the problem solving aspect of the project assist in achieving the overall objective.

1.4 The Objective

The overall objective is for the Tasman District Council to have an agreed, acceptable solution for flood control management for the Motueka Ward.

2 Definition of the Problem

This section describes the work completed to better understand the existing flood control scheme, the likely future rainfall and possible flood events and how the stopbanks are likely to perform. An important part of this work also included the understanding of the community issues and concerns. The outcome is a list of ‘possible’ options that can be considered for further refinement and assist in the development of reasonable practical options to be considered by the Council and community.

2.1 Summary Scheme History

The original Motueka stopbanks were constructed between 1951 and 1956 by the Nelson Catchment Board to accommodate the 1 in 50 year design flood (2% AEP) of 2830cumecs with a freeboard of 600mm.

The scheme consisted of 20.4 kilometres of stopbanking, channel improvements and realignment along with bank protection including Peach Island. The scheme was primarily designed to prevent flooding of the Motueka flood plain where tobacco and hop growing yielded high returns. Refer Appendix 3 for scheme location and layout of main stopbanks.

The scheme at the time also included control of other main waterways flowing across the Motueka and Riwaka coastal plains and included stopbanks along the Riwaka River and improvements to the Brooklyn and Little Sydney Streams.

At some time after the original scheme construction additional banks were constructed on the eastern side of the river. These are referred to as the Kiwifruit Banks, River Distance (RD) (10,900m to 11,760m) and Hurley Banks RD12, 960 to 14,100m). The stopbanks below the State Highway Bridge have also been modified and extended since the scheme was constructed. The legal status of these banks with respect to any scheme upgrade programme requires further investigation by Tasman District Council.

The original scheme stopbanks were constructed with a top width of 2.44m with river and land side batters of 1.5:1 and 2:1 respectively.

It needs to be noted that the river distances used from the start of the original scheme design and construction have a starting distance at the mouth of the river of 3500m.

Table 2-1: Lower Motueka River – Common Names and River Distance

Feature	River Distance*	Bank
River Mouth	3500	
Outlet Stopbank Spur	4160	Left
SH60 Bridge	4500	
Brooklyn Stream confluence	6300	Left
Fry's Island	6500 to 7500	Left
Blue Gum Corner	8500	Left
Peach Island Back channel confluence	9000	Left
Peach Island stopbank	9260 - 11760	Left
Woodmans Bend	10600	Right
Kiwifruit orchard stopbank	10900 - 11760	Right
Peach Island back channel start point	12910	Left
Hurley's stopbank	12910 – 14100	Right
*Note: River distance is based on the river mouth being at 3500m.		

2.2 Significant Floods

Significant floods that have been recorded and/or observed in the Lower Motueka Valley are the 1957, 1974, 1983 and 1990 floods. The largest flood recorded since flow gauging began in 1969 was the 1983 flood event estimated at about a 1 in 69 year return period (1.45% AEP), which reached to 200mm below crest level at some stopbank locations.

The stopbank below the State Highway 60 Bridge on the Left Bank was overtopped in the 1983 flood. No damage was caused and the stopbank held. There was one reported bank failure due to river bank lateral erosion during the 1957 flood event which is acknowledged as being larger than the 1983 event, when significant volumes of flood water accumulated in old channels on the outside of the stopbanks probably due to piping and foundation seepage under the Right Bank near river cross section 7250 opposite Fry's Island. The 1957 flood also overtopped the stopbanks at an upstream section of the Peach island stopbanks.

Other minor floods have occurred in the Lower Motueka in 1988 and 1997. The top water levels of these flood events did not reach the stopbanks. All of these larger floods resulted in minor flooding on the landward side of the stopbanks due to seepage underneath the stopbanks bubbling up into old flood channels and low points.

2.3 Motueka River Hydrology

The hydrology of the Motueka River is based on a number of rain gauges and flow gauges in the catchment, but most of the design hydrology has been derived from the Woodstock flow gauge site which has a long data record. A recent, short term flow data record has been captured at a level recorder at Woodman's Bend and this record has been used to determine a runoff increase factor between Woodstock and Woodman's Bend to allow extrapolation of historical flows at Woodstock to be translated to the Lower Motueka River Scheme.

The recorded data indicated that the flood flows past Woodman's Bend tend to last 40 hours or less, with a rise to peak of about 10 to 12 hours, and a fall of 20 to 30 hours. This information has been used in the geotechnical studies to assess the stopbank stability and resistance to flood events.

The design flows in the table are from the August 2010 Hydrology Review Report undertaken as part of the activities and were incorporated into the hydraulic modelling work.

Table 2-2: Design Peak Flood Events (m3/s)

Flood Event	Peak Flow Woodstock	Alexander Bluff (1.125 multiplier)	Mouth (1.24 multiplier)
2% AEP or 50yr ARI	2,060	2,316	2,554
2% AEP or 50yr ARI plus 11% climate change	2,287	2,571	2835
1% AEP or 100yr ARI	2,342	2,633	2,904
1% AEP or 100yr ARI plus 11% climate change	2,600	2,922	3,223

The peak design flood for use in the modeling was 2,922.

2.4 Hydraulic Modeling

Over the period from 2006 through to 2010 different types of hydraulic modeling have been undertaken and are summarized below.

2.4.1 Prefeasibility Stage 2006

The objective of the modelling in the prefeasibility stage was to assess the crest profile and establish whether it met the original 2% AEP (50year ARI) design standard along the full length of the stopbank.

A comparison of top water level profiles from the 5%, 2% and 1% AEP flood events showed that the 1% AEP top water levels are between 200mm and 400mm higher than 2% AEP top water levels. The 5% AEP top water level profile is between 200mm and 300mm lower than the 2% AEP flood event.

Existing crests on both banks were close to the 2% AEP design standard (including a 600mm freeboard) but required increased heights of between 50mm and 300mm over significant sections of the stopbank scheme.

In order to assess potential effects of gravel aggradations/ degradations in the bed in the long term, a simulation including a 200mm rise in channel bed levels along the entire scope of study was modelled in a 2% AEP flood event. The results indicate that the top water profile was increased / decreased between 30mm and 70mm.

To assess the tidal influence, simulations of the 2% AEP flood event were run to coincide with the mean sea level rising, mean sea level falling and with neap tide. The tide cycle effects disappeared immediately upstream of the SH60 Bridge cross section.

The model was run with the State Highway 60 Bridge excluded. It was then rerun to include the SH 60 Bridge to assess the impact of the structure on the peak water level. The relative effect of the bridge's presence was minimal – 40mm at the upstream face of the bridge in a 2% AEP flood event. The 2% AEP event was assessed to be able to pass under the bridge with zero freeboard.

2.4.2 Preliminary Design Stage 2008

The Flood Protection Scheme Design Standard chosen in 2008 was defined as passing the 1% Annual Exceedence Probability flood event with Ministry for the Environment (MfE) projected climate change effects of rainfall increases and sea level rise as at 2090 and including a 600mm freeboard to the design crest profile.

With additional survey information available compared to the 2006 modelling, the model of the Lower Motueka River was able to include Brooklyn Stream and the overflow channel around Peach Island.

The effect on the main Motueka River channel of including the overflow channel on the flood control scheme was that peak water levels in the 1% AEP flood event (including climate change through the main channel of Motueka River were reduced by between 0.9m and 1.3m from the confluence of the Peach island back channel to Hurley's Stopbank at RD 13150m.

The effect of climate change discharge allowance (11% extra discharge) was to increase design crest levels by 230mm along the full length of the scheme in a 1% AEP event.

Portions of the left bank and the right bank were above the design crest level profile. For approximately 2.5km out of 8.5km on the left bank, and for approximately 2.8km out of 10.6km on the right bank the stopbank crest levels were between 0 and 500mm under the design crest profile.

2.4.3 2D Modelling in 2010

The availability of LiDAR survey information enabled 2D modelling to be undertaken for the study. In addition to the top water level profiles provided by the earlier 1D modelling the 2D modelling enables attenuation effects, flood flow depths and velocities to be study throughout the modelled area. This study included the assessment of spillways and secondary stopbanks involving the Motueka Plains as part of the flood scheme. The 2D modelling also enabled the flood effects from breaches and spillways across the flood plain to be assessed.

The modelling results indicate that apart from four relatively short sections on the left bank and three short sections on the right bank the river would just carry the 1% AEP without any freeboard. The modelling results also indicate any upgrade would need to provide a stopbank profile consistent with the modelled hydraulic profile and incorporate the design 600mm of freeboard.

2.4.3.1 Peach Island Scenarios Modelling

Three Peach Island scenarios were modelled to assess the impact of the Peach Island overflow channel and flood protection levels and the frequency of flood on Peach Island:

1) No overflow channel around Peach Island,

2) Peach Island Channel Operating

3) Increased Peach Island stopbank levels to exclude flooding from Peach Island.

The 2D modelling indicates that the Peach Island reach appears to take 20%, (500-600m3/s) off the peak part of the 1% AEP event (from 3000 m3/s to 2500m3/s) through backup flows in the main channel and back channel, and spilling into Peach island interior and also into the area behind the Hurley's stopbank (see Figure 2.1.below).

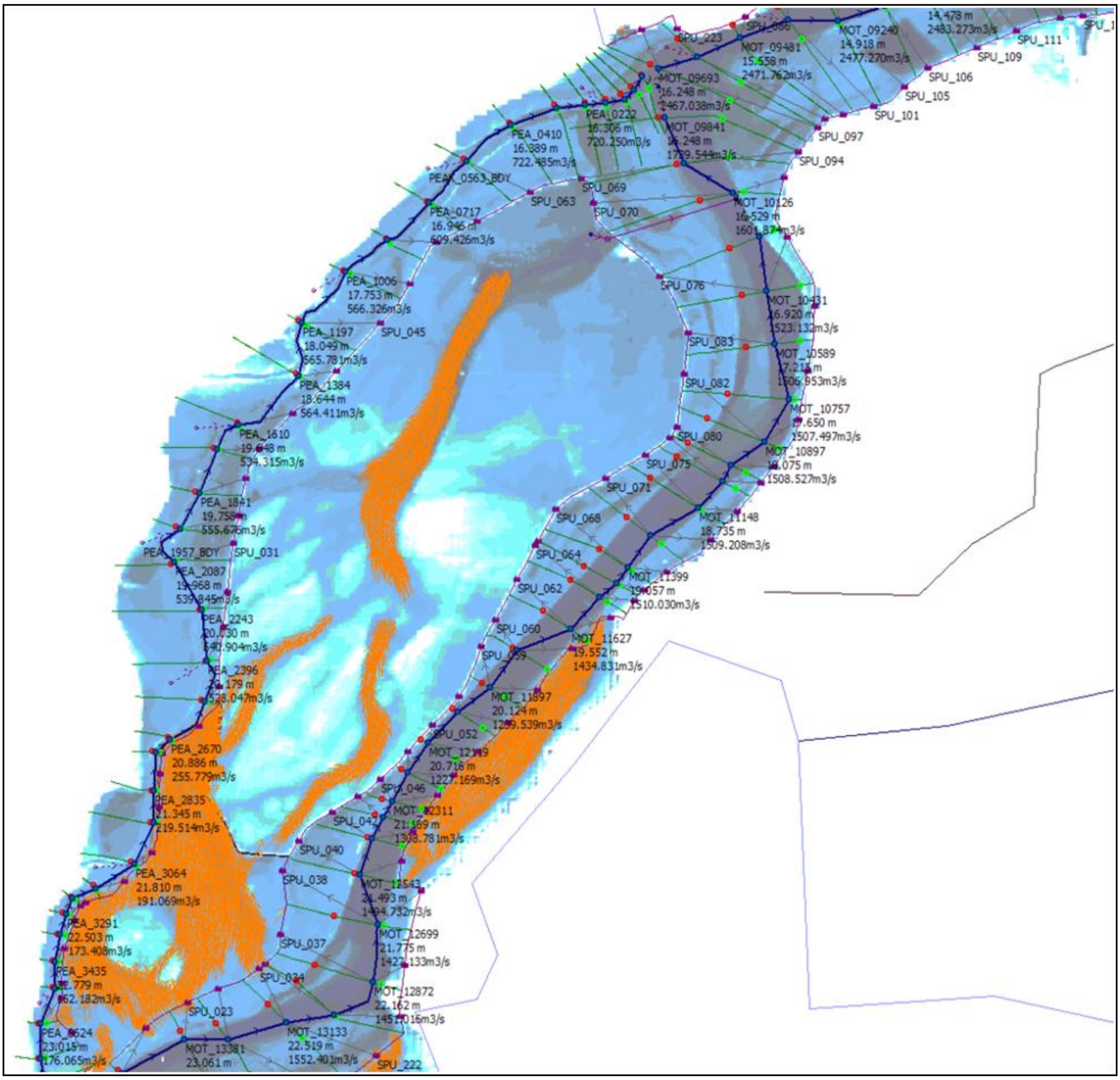

Figure 2-1: Motueka River at Peach Island

- flowing up the page Figure 2.1 above shows a snapshot of flows (orange areas) and depths (blue shading) at the time of peak river inflow, 2900m3/s for the 1% AEP event

The “no overflow channel around Peach Island” case showed that blocking off the channel behind Peach Island, and assuming Peach Island stopbanks are high enough to resist overtopping flows into Peach Island, causes all flows to pass through the main channel with a rise in top water level of 1 metre past Peach Island and serves to increase top water levels downstream of the Peach Island confluence.

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The “improved and engineered back channel around Peach Island” case was modelled to test whether simple improvements could be made to the channel to take more flows away from the main channel. Results indicate that significantly increased flows are not possible down the back channel without large earthworks removal. This is due to flow restrictions at the bottom end of the back channel.

Increases in the heights of the Peach Island stopbanks appear to cause only minor water level increases in the main Motueka River Channel. The Kiwifruit stopbank constriction on the main channel is partially removed by the overtopping of that stopbank at high flow rates.

2.5 Geotechnical Risk Assessments

Geotechnical risks such as piping under the stopbanks and foundation stability, along with the structural stability of the original banks including piping and seepage issues have been identified as major drivers for the Motueka scheme upgrade.

Geotechnical investigations were undertaken between 2006 and 2010 including a walkover survey, soil testing, seepage analysis and an assessment of the potential failure modes.

The potential failure modes for the existing Motueka stopbank system are considered to be:

- Slope instability caused by the effect of soil saturation during flood conditions
- Overtopping of the stopbank resulting in soil erosion
- Piping (the transportation of soil by water seepage) either through the stopbank itself or through the foundation resulting in uncontrolled seepage flows that erode the stopbank or its foundation
- Roots from vegetation on the river bank either increasing the likelihood or piping or physically damaging the stopbanks if ripped out under flood conditions
- River erosion damage to either the stopbanks or their foundations
- Interference with the stopbank.

Each of the failure modes discussed above has been included in an initial qualitative risk assessment. The assessment has been on a qualitative basis, which relies on judgment and experience in addition to the surveys and analysis work, to make assessments of the risks.

Once potential failure modes have been identified the second step in the assessment process was to assess the likelihood of each failure mode occurring. The likelihood is described in terms of being rare, unlikely, possible, likely or almost certain as described in Table 2-3.

Table 2-3: Likelihood Description

Occurrence Description	Likelihood
Rare	The event is conceivable but only under exceptional circumstances
Unlikely	The event might occur under very adverse circumstances
Possible	The event could occur under adverse conditions
Likely	The event will probably occur under adverse conditions
Almost certain	The event is expected to occur

The third step of the assessment was to assign a potential consequence to each of the failure modes. The consequences are described no effect, minimal, moderate, significant or disastrous effect as defined in Table 2-4.

Table 2-4: Consequence Description

Effect Description	Shutdown Consequence
No effect	Stopbanks fully contain flood
Minimal effect	Stopbanks contain flood but limited surface flooding from under-seepage
Moderate effect	Short term flooding of agricultural land
Significant effect	Flooding of urban areas
Disastrous	Complete failure of stopbank system and widespread flooding

The final step after the likelihood and consequence are assigned was to rank the failure modes as very low, low, moderate, high or very high risk using the matrix table (Table 2-5). For example, if the risk is considered possible and the consequence is considered significant, then the risk of it occurring was determined as high.

Table 2-5: Likelihood Verse Consequence Rating Matrix

Risk Assessment Matrix					
	Consequence				
Likelihood	No effect	Minimal effect	Moderate effect	Significant effect	Disastrous effect
Rare	Very Low	Very Low	Low	Low	Moderate
Unlikely	Very Low	Low	Moderate	Moderate	High
Possible	Low	Moderate	Moderate	High	High
Likely	Low	Moderate	High	Very High	Very High
Almost certain	Moderate	High	High	Very High	Very High

The geotechnical risk profile table for the existing stopbanks is set out below

Risk Assessment of the Motueka Stopbanks

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Description		Description	Rating
The event is conceivable but only under exceptional circumstances	Rare	Stopbanks fully contain flood	No effect
The event might occur under very adverse circumstances	Unlikely	Stopbanks contain flood but limited surface flooding from underseepage	Minimal effect
The event could occur under adverse conditions	Possible	Short term flooding of agricultural land	Moderate effect
The event will probably occur under adverse conditions	Likely	Flooding of urban areas	Significant effect
The event is expected to occur	Almost Certain	Complete failure of stopbank system and widespread flooding	Disastrous

Risk Areas	Risk descriptions	Likelihood	Consequence Description	Consequence	Risk Level	Comments
Slope stability	Widespread failure of stopbank during design flood due to slope failure	Rare	Widespread flooding	Disastrous	M	
Slope stability	Isolated failure of stopbank during design flood due to slope failure	Possible	Localised flooding	Significant effect	H	Consequence could be reduced if sections of stopbanks that threaten urban populations were upgraded.
Overtopping	Overtopping along large lengths of stopbank causes widespread erosion failure and flooding	Unlikely	Widespread flooding	Disastrous	H	Stopbank has variable freeboard therefore unlikely to fail along long lengths.
Overtopping	Overtopping at isolated locations causes erosion of stopbank and localised flooding	Possible	Localised flooding	Significant effect	H	Consequence could be reduced if controlled spill sections were installed to prevent the possibility of overtopping sections of stopbanks that threaten urban
Piping failure	Widespread failure of stopbank during design flood due to internal erosion of stopbank material by seepage flows.	Rare	Widespread flooding	Disastrous	M	
Piping failure	Localised failure of stopbank during design flood due to internal erosion of stopbank material by seepage flows.	Possible	Localised flooding	Significant effect	H	Consequence could be reduced if sections of stopbanks that threaten urban populations were upgraded.
Piping failure	Widespread failure of stopbank during design flood due to internal erosion of foundation material by seepage flows.	Rare	Widespread flooding	Disastrous	M	
Piping failure	Localised failure of stopbank during design flood due to internal erosion of foundation material by seepage flows.	Unlikely	Localised flooding	Significant effect	M	
Piping failure	Flow under stopbank without piping failure	Likely	Localised flooding	Minimal effect	M	
River erosion	Widespread failure of stopbank due to river erosion	Rare	Widespread flooding	Disastrous	M	
River erosion	Localised failure of stopbank due to river erosion	Possible	Localised flooding	Significant effect	H	Consequence could be reduced if sections of stopbanks that threaten urban populations were well protected from river erosion.
Vegetation	Tree roots in stopbank initiate piping failure of stopbank	Possible	Localised flooding	Significant effect	H	Risk could be reduced by control of vegetation along river banks
Vegetation	Tree ripped out of river bank during flood which damages stopbank and results in breach	Possible	Localised flooding	Significant effect	H	Risk could be reduced by control of vegetation along river banks

Table 2-6: A Qualitative Risk Assessment

2.6 Geotechnical Risk Review

The standard of design adopted for a stopbank system is a matter of managing risk, the more conservative the design standard the less risk of a stopbank failure. While precedence is a valuable assessment tool it must be used with caution and can only be relied on if all of the conditions remain the same. For example, a flood of the same level but a longer duration would place the stopbanks under additional stress because of an increased level of saturation of the stopbanks.

A simple way of viewing the existing stopbank system is that, based on precedence and as indicated by the analysis to date the stopbank system would '*possibly be stable'* during a design flood event. The community must decide whether this is an acceptable standard or whether it should be upgraded so that *'it will almost certainly be stable'.*

A number of the failure modes identified in the review assessment were judged to be at a high risk level as set out in Table 2-4. To address these high risk areas it is recommended that a range of mitigation measures are considered to either reduce the likelihood of the failure modes occurring or reduce the consequence of the failure mode if the failure mode does eventuate. By comparing the effectiveness of various mitigation measures with their cost, it is envisaged that an overall best balance of cost and risk for the community can be developed for the scheme options where it is proposed to retain the existing stopbanks in some form.

In particular it is recommended that consideration is given to which parts of the stopbank should be considered for remedial works to have the greatest impact on lowering the risk profile to surrounding people and property.

These mitigation measures include:

- Upgrade only the sections of stopbank that protect the most valuable assets i.e. ensure that if a failure were to occur it would not threaten the most important assets
- Incorporate engineered spill points that limit the level that the river can reach. These would need to discharge the water into areas where short term inundation does not cause excessive economic loss. Controlling the river level would remove the need to provide additional freeboard and could be used to keep the water levels on the banks within precedence levels. If water levels and stopbank water retention times could be kept within precedence levels there would be increased confidence in the ability of the stopbanks to resist failure modes associated with slope stability and piping
- Install drainage systems and/or stability berms in areas that are known to experience under-seepage and sand boils during flood events to safely collect water and resist uplift pressures
- Assess risks at all penetration points of the stopbank structure and upgrade if necessary
- Improve the maintenance regime on the stopbanks. The stopbanks should be kept well vegetated with grass cover. Any large trees with root systems that penetrate into the stopbank should be removed
- Improve river protection works. This would be targeted at areas that are known to suffer erosion in significant flood events
- Instigate a regular inspection and monitoring system. This could involve a regular formal walkover inspection of the system to assess its condition and look for signs of human interference. There are situations on other nearby stopbanks where landowners have modified the stopbank (eg. partially excavating the slope) without realising the implications their actions may have on safety. Currently similar monitoring on flood control structures occurs in the Hawkes Bay.

3 The Review Process

Under Section 78 of the Local Government Act 2002 the Council is obliged to consider community views and these must be considered at each of the four stages of the decision making process listed in section 78(2). These stages are as follows:

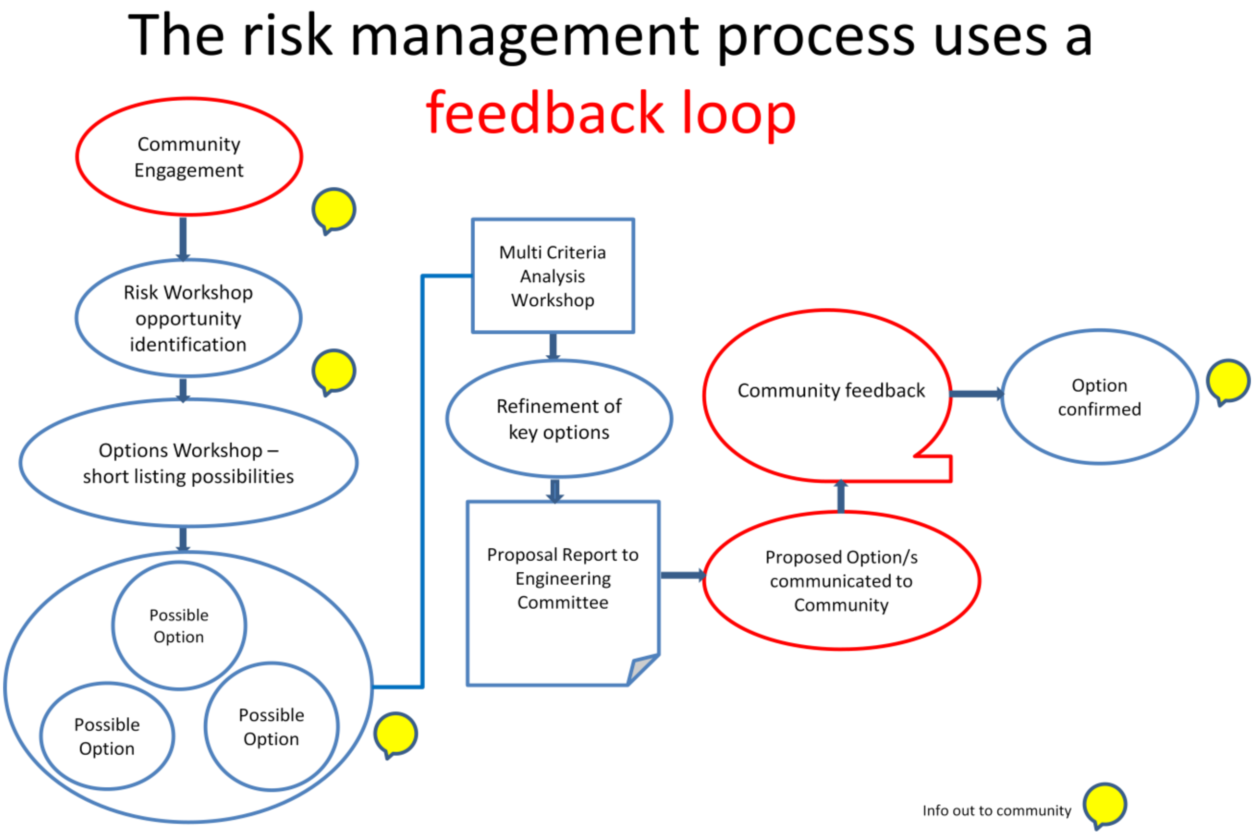
Stage 1 - Definition of problems and objectives
The problem definition is covered in Section 2 above and as part of the Community engagement outcomes detailed in Section 3.1 below.

From this information a list of 'possible' options will be developed. An initial review of these 'possible' options will be undertaken. These 'possible' options and the status quo will be further refined and developed to enable the identification of reasonably practical options to be undertaken in Stage 2.

Stage 2 - Identification of reasonably practicable options
This work would involve Council developing the preferred 'possible' scheme options to a preliminary design stage, allowing more accurate assessment of scheme costs and benefits.

Stage 3 - Assessment of reasonably practicable options and development of proposal(s)
As well as identifying the costs and benefits of each scheme option the residual risks associated with each option including the status quo would also be quantified. This will provide a rational basis for establishing an acceptable balance between the level of protection and the acceptability of the residual risks weighed against the scheme costs.

Stage 4 - Adoption of proposal(s)
A risk management approach has been adopted for the development and the selection of a preferred option that could be put forward to Council and the community. The diagram below sets out the risk management process adopted for this project.



3.1 Community Engagement

To assist in the understanding of the flood control ‘problem’ Council have engaged with the community in order to identify the issues and concerns for the review of the Motueka flood control scheme.

Over the period between February and May 2010 a number of community meetings and feedback forums where held. A local Motueka market stall was set up to gather first hand community feedback and provisions were made for views to be expressed through the Tasman District Council website.

The community issues and concerns were taken into consideration in the flood modelling and geotechnical analysis described in the section 2 above. They will be then taken through a process of analysis and workshops that produce a number of “possible” options for flood control management.

A summary of the issues raised during the community consultation is detailed in the tables below under the headings:

- The Stop Bank
- Motueka State Highway Bridge
- Costs of any Upgrade
- Gravels
- The Concerns/Risks
- Suggested Improvements.

The Stop Bank

Issue raised by the Community during consultation
A full replacement stop bank upgrade is not required.
The existing stopbanks have worked since the 1950's and they continue to work
There are some areas along the banks that are of concern and need to be repaired, these are: • Woodmans corner • Blue Gum Corner • Sinclairs • Water that comes up behind the banks. Brooklyn Stream
Stopbanks were not built to modern standards so they may not offer as much protection as is required.

Motueka State Highway Bridge

Issue raised by the Community during consultation
Motueka State Highway Bridge restricts the river flood flows. Gravel has built up around the Bridge which restricts the water.
If you remove the gravel this could cause further problems with stability of the bridge
It carries services to the other side, so it is important that it doesn't wash away. Also important for access to avoid community isolation.

Costs of any Upgrade

Issue raised by the Community during consultation
If you removed and sold the gravel this will fund any required upgrade.
The community has already paid and continue to pay for river protection.
The whole district should be paying for anything required – it is not the communities' issue that they live next to the river.
Cannot afford a water system and stopbanks at the same time. Cannot afford a 'gold plate' solution. Excessive increases in rates would have a slow but debilitating effect on the local community, many of whom were already 'double rated'
If something has to be done, make sure you use local contractors.

Gravels

Issue raised by the Community during consultation
There has been significant build up of gravels and stones in many places along the river and these stop the water flowing freely in a flood. Remove the exposed gravels from river berms and river bed.
Large scale gravel extraction would cause major problems to the river environs and watertable.

The Concerns/Risks

Issue raised by the Community during consultation
Timber and other debris carried in flood waters could cause major damage.
A tsunami/tidal wave could cause significant flooding of Motueka town centre – not the river.

Flash flooding a major risk to people and animals.
Motueka river is significant to local Iwi and Maori generally.
Flood controls could restrict access to the river.
Effect of climate change.
Risk to the services (sewage, water etc)
Parts of the community don't mind if they get wet feet
Could be a loss of confidence for future development if the area is flooded.
Must protect lives and the town.
Horticulture land is too important to the future of Motueka to be flooded.

Suggested Improvements

Issue raised by the Community during consultation
Open up some of the old flood plains and old river courses.
Open up the channel behind Peach Island.
Use further rock wall protection for 'patching up' the existing stop banks.
Give the eastern bank of the river a high level of flood protection compared to the western side allowing waters to inundate the western side of the river to protect the Motueka town.
Dredge and widen the mouth of the Motueka River to increase the dispersion of flood water to sea
Further investigation is required to gain a better understanding of the strength of the stopbanks, the community can then understand the risks versus the benefits of possible options.
Undertake better maintenance of the river berms to clear rubbish and fill in holes that have been created.
Continue to upgrade the stormwater drainage system.
Use planning to reduce risks (e.g. don't allow buildings or structures to be built close to the river).
Create a spill way
Have certain points on the banks that can be broken through to release pressure in a major flood.
Do more at the top of the river to reduce volumes of water downstream.

It should be noted that The Council newsletter "Protecting Your Community from Floods" issued in July 2010 identified and addressed many of the issues described above.

4 Conclusion and Recommendation

That Council receives the report on the definition of the Problem and objectives and proceeds to the next stage - the identification of reasonably practicable options for the Motueka Flood Control scheme. Council has completed the definition of the problem and objectives for the Motueka Flood Control Scheme and it is recommended that Council proceeds to the next stage is being the identification and assessment of reasonable practical options.