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Report To: Rangitaiki River Forum

Meeting Date: 20 October 2015

Report From: Ken Tarboton, General Manager Technical Services

Upper Rangitāiki Flood Managament Investigation

Executive Summary

This report provides an update on the River Scheme Sustainability (RSS) Project and the proposed Upper Rangitāiki Flood Management Investigation.

The purpose of the RSS Project is to strategically guide short-term operational and governance decision making to ensure that decisions around flood protection and mitigation through our Rivers and Drainage Schemes are sustainable long-term.

The initial phases of the RSS Project undertaken over the previous three years included developing the philosophy and vision of the project and undertaking investigation by way of six different workstreams. Progress on the project has been provided to various Council committees, to each River Scheme Liaison Group and an introduction was presented to the Rangitāiki River Forum (RRF) in November 2013.

Council recognises that engagement with tangata whenua as Treaty Partners, is an important component of the RSS project. Accordingly before a high level assessment of proposed engineering solutions is carried out, iwi and stakeholder engagement is necessary. This paper will be used to start engagement with the RRF, Te Uru Taumatua (TUT) and other key iwi partners and stakeholders.

1 Recommendations

That the Rangitaiki River Forum under its delegated authority:

1 Receives the report, Upper Rangitaiki Flood Managament Investigation.

2 Background

Floods have historically caused significant damage with high costs to River Schemes. However, it is not possible to accurately predict flood damage costs. This issue was raised by the councillors after flood damage to Rivers Schemes in recent floods (2010 and 2011) which added to on-going mitigation for the 2004 major flood event. It is not sustainable to build ever higher stop banks and we must consider the long term impact of our flood protection work. The question was asked whether the current levels of service, scheme management and escalating scheme

funding requirements are sustainable with known structural problems and climate change effects. As part of the Long Term Plan (LTP) process Council asked that priority be given to addressing these key questions and concerns and the River Scheme Sustainability Project was established.

3 Introduction

The purpose of the River Scheme Sustainability Project is to strategically guide management of the Bay of Plenty River Schemes into the long-term future out to the year 2100. This strategic approach is required to guide both operational and governance decision making to ensure "no surprises" and that short-term decisions align with the long-term goal of sustainable flood protection and mitigation through our Rivers and Drainage Schemes.

The project is expected to consider the long term risks of flooding hazard and provide a strategy and actions to manage the Flood Protection and Control Works Programme of schemes moving forward. Flood risk strategies may include retreat, adaption or defend. Flood management options in the longer term may or may not include the structural solutions currently employed. Non-structural and other alternative solutions will need to be evaluated.

A four phase project plan was developed for the River Scheme Sustainability project following a February 2013 Council Workshop. The first two phases of the project: (1) Philosophy and Vision and (2) Investigation, were completed by June 2015. The investigation phase included completion of the following six workstreams:

1. Rating feasibility assessment,
2. Economic analysis,
3. Flood risk gap analysis,
4. Climate effect investigation,
5. Optioneering investigation,
6. Ownership and governance review.

Reports on these completed works are available on request. In phase three of the RSS project, the analysis work will include further optioneering that includes cultural considerations.

4 Optioneering

The Optioneering workstream investigated the alternative soft and hard engineering options for flood mitigation. Optioneering roadshows were undertaken during May 2014 in discussion with the River Scheme Liaison Groups and internal staff. High-level optioneering reports were produced by consultants for each of the four major rivers and drainage schemes. Over 33 different flood mitigation options have been identified, including both structural and non-structural solutions. A Consolidated Optioneering Report is being prepared, which incorporates national and international examples of the 33 flood mitigation options. See Options matrix in Appendix 1.

These options included:

- new dams,
- flood storage wetland,
- managed groundwater recharge,
- interceptor channels,
- room for the river approach,
- ecological corridors,
- plan changes,
- land use changes, and
- new controlled floodable areas.

In addition to engineering solutions, catchment management planning trends were identified such as engineering solutions to become “greener”, greater focus on biodiversity and water quality, new governance structures, a greater role in catchment planning for iwi and an increase in the demand for rural intensification.

Based on the findings of the investigation phase and the RSS philosophy RSS principles were developed to assist the integration with other projects.

5 River Scheme Sustainability Principles

A set of RSS principles have been developed to guide future RSS work and to keep the 100-year sustainable focus in mind when updates are made to Asset Management Plans, the Infrastructure Strategy and future LTPs. Principles are included Appendix 2.

Principle number 10 highlights the importance of the 4 well-beings which incorporates the importance of cultural aspects.

Effective flood management delivers restorative outcomes across all well-beings*. A holistic approach to flood management ensures that the four well-beings of environmental, social, cultural and economic are enhanced.*

Consultation with Treaty Partners is necessary for a successful management of Bay of Plenty river schemes into the future. Cultural principles could be further incorporated into the RSS principles with the assistance of our Treaty Partners.

6 Rangitāiki Floodway Optimisation Using RSS Principles

Following the 2004 stopbank breach near Edgecumbe the Rangitāiki Floodway Project was identified to deliver upgrade works which are expected to reduce the flood water pressure on the river stopbanks. For a 1% Annual Exceedance Probability (AEP) flood event the project outcome was to divert 190 m^3/s of flood water down the floodway leaving 610 m^3/s to flow down the Rangitāiki River.

The current estimated overall cost of the floodway project is $21.5m. The estimated cost of the remaining work still to be completed is $13.7m with completion due in 2018/2019.

An opportunity was taken to undertake an optioneering assessment using the RSS principles to see if alternatives may reduce the cost of the project yet provide the same outcome. Initial results indicated that better flood forecasting techniques combined with improved operating rules at Matahina Dam, could provide more cost effective solutions. This is a soft engineering solution which could lower construction costs or provide future proofing against flood risk when considering climate change.

Other options such as upper catchment storage with irrigation or wetlands, alternative preferential floodable areas, consenting land use change and managed aquifer recharge could also be considered.

It was recognised that before high level assessment of these engineering solutions is carried out, iwi and stakeholder engagement is necessary. Engagement with the RRF is required by statute, Regional Policy Statement (RPS) and through various protocols and commitments to the Rangitāiki River Forum.

6.1 Engagement and Consultation

Council recognises that engagement with tangata whenua as Treaty Partners, is an important component of the RSS project. Consideration of cultural matters and tangata whenua feedback will be undertaken as part of the Optioneering workstream outlined above. Ongoing engagement is planned with the RRF and TUT. Consultation with the Rangitāiki-Tarawera Rivers Scheme Liaison Group, TrustPower and other key stakeholders will also be undertaken.

Initial engagement on the Upper Rangitāiki flood management investigation with the RRF and TUT will start with discussion of this paper and a presentation at the 20 October 2015 RRF meeting. This paper will be used to brief TUT shortly thereafter in a separate meeting.

It is recognised that further investigations into future flood management options may include matters of significance to Māori as the proposed investigation into flood management "*may affect the relationship of Māori and their culture and traditions and it must:* (according to RPS Policy IW2B)

1) *Recognise and provide for:*
   - i. *Traditional Māori uses and practices relating to natural and physical resources such as mahinga mātaitai (food gathering areas), waahi tapu (sacred places), papakāinga (village communities) and taonga raranga (art resources);*
   - ii. *The role of tangata whenua as kaitiaki of the mauri of their resources;*
   - iii. *The mana whenua relationship of tangata whenua with, and the role as kaitiaki of, the mauri of natural resources;*
   - iv. *Sites of cultural significance identified in iwi and hapū resource management plans; and*

2) *Recognise that only tangata whenua can identify and evidentially substantiate their relationship and that of their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga*

This paper provides background information on investigations to date. It is proposed that a workshop be held with representatives from the RRF and TUT, to discuss a draft proposed flood management investigation, and determine what cultural considerations would be needed to finalise the proposal.

The result of this workshop and engagement with the above parties will endeavour to incorporate how to include the assessment of cultural effects into the proposal prior to economic assessment work being undertaken.

7 Financial implications

The RSS project has a relatively small consultancy budget of $100,000 for the 2015/16 year. Investigations as part of the work planned for 2015/16 will be undertaken within this budget.

Katalin Maltai
Environmental Engineer

for General Manager Technical Services

13 October 2015

APPENDIX 1

RSS principles

MEMORANDUM

To: Regional Direction and Delivery Committee

From: Katalin Maltai **Date:** 15 September 2015

Environmental Engineer

File Ref: A2181182

Subject: **River Scheme Sustainability (RSS) principles**

A set of RSS principles have been developed to guide future RSS work and to keep the 100-year sustainable focus in mind when updates are made to Asset Management Plans, the Infrastructure Strategy and future LTPs. The following principles will also assist with the integration of the RSS work into the Catchment and Spatial Planning Programmes:

Principle 1

Flood risk management is a long-term 100 year process requiring a long-term strategic viewpoint in order to achieve outcomes. Given the long life and ongoing costs associated with this flood protection infrastructure we need to look at a range of factors, to enable a long term sustainable outcome. This will enable the best possible decisions to be made today considering an uncertain future tomorrow.

Principle 2

Long-term strategic thinking requires acceptance of uncertainty. Forecast uncertainty can be managed by the development of alternative scenarios to accommodate different possible future needs. Over a 100-year planning framework there is considerable uncertainty of exact flood levels.

Principle 3

Community agreed levels of service may change over time. Do not assume present day values will not change. People change their minds, circumstances change, and society becomes wiser and learns from the past.

Principle 4

Long-term decisions require a particular focus on inter-generational equity. Consider not only the present day benefit but also the long-term costs and benefits of these schemes. Benefits would also include social, environmental, cultural and economic factors.

Principle 5

Climate change is a significant factor in determining service levels for managing flood risk. Effects of climate changes such as sea level rise, more intense storms, salt intrusion, erosion, change in ground water levels in the coastal areas and land use change need to be considered as updated scientific data becomes available, and made meaningful in policy and plans so people have functional tools to manage flood risk.

Principle 6

Good quality decisions require an integrated catchment management approach to ensure factors across the whole catchment are taken into account.

Principle 7

Quality solutions will only be found after considering a mix of soft and hard engineering options.

Principle 8

Effective flood management is a community challenge requiring consultation and collaboration. Through this communities may learn to live with floods and be resilient as they adopt the measures of avoidance, mitigation and acceptance associated with flood management.

Principle 9

Flood mitigation measures are affordable and equitable to the communities they serve now and over the long-term.

Principle 10

Effective flood management delivers restorative outcomes across all well-beings. An holistic approach to flood management ensures that the four well-beings of environmental, social, cultural and economic are enhanced.

APPENDIX 2

Option Matrix

Part 1: Option Matrix

Structural /Non structural	Category	Option No.	Option	What can the option achieve?	Limitations
Structural	Storage	1.	New Dams(impounding structures for storage, irrigation, power generation etc)	• Flood storage in the headwaters and/or tributaries can obviate the need for channel works downstream. • Reservoir behind the dam can provide supply of water during dry seasons and for irrigation. • Hydroelectric power stations could be built on the dam.	• Could disrupt impact sediment conveyance dependent on River Type. • Could cause channel erosion for several kilometres downstream, with potential for bed/bank instability whilst channel. • Loss of land and ecosystem disruption. • Serious environmental effects associated with dam de-construction (e.g. sediment load downstream). • May have consequences for the mauri and wairua of rivers and meet with iwi resistance.
		2.	New dams (temporary flood flow storage structures)	• Flow attenuation • Potentially irrigation	• Possible disruption to sediment dynamics. • Could cause channel erosion downstream with potential for bed/bank instability. • Impact on longitudinal connectivity. • May have consequences for the mauri and wairua of rivers and meet with iwi resistance.
		3.	Detention Zones Temporary Flood Flow Storage	• Flood attenuation and storage (including diverting upstream flows detention basin; and improving drainage to divert flows to basin).	• Land take, impacts on current land use, availability of space. • Associated cost and design required. • Requires high level of maintenance (as lack of can deteriorate efficacy of the system).
		4.	Flood Zones	• Setting aside land in future planning (including development restrictions) for use of 'flood zones' or flood storage areas. • Essentially one area can be sacrificed to take the impact of flooding and protect other areas.	• Suitable land use requirements • Landowner compensation • Could involve lengthy/costly plan change process.
		5.	Bunding (including floodplain storage bunds, slow release)	• Can create flood plain storage. • Can enable flood flows to be diverted and stored for slow release after flood peak (i.e delaying flood peak).	• Stakeholder engagement (mainly famers) • Land take-impacts on current land use • Disruption of connectivity with the river. • Disruption to sediment conveyance.
		6.	Flood storage wetland / Wetland Restoration	• Runoff reduction through creation/restoration of non-floodplain wetlands (or wet woodlands) • Delay flood waters • Wetlands absorb pollution, treat water and provide habitats for animals and birds.	• Results in changed flow velocity. • Requires stakeholder engagement. • Maintenance and cost implications, including labour intensive set up and maintenance process.
		7.	Managed Groundwater / Aquifer Recharge(MAR)	• artificial introduction of additional recharge water into the groundwater system via infiltration mechanisms.	• Raised groundwater levels. • Affecting land drainage and management of lowland waterways.
	Conveyance	8.	Alternative river alignment	• Flood diversion • Re-meandering • Restoration of a braided system	• Change flow velocity and regime, altered sediment transfer. • Land take.

Structural /Non structural	Category	Option No.	Option	What can the option achieve?	Limitations
		9.	Interceptor channels with diversions	• Can capture water flows and divert them to a relief channel running parallel to the main channel reducing flood risk.	• Improper alignment of the interceptor channel may lead to inadequate level of service. • Placement of a relief channel may require augmentation of the stop banks (e.g. raising their heights). • Also requires sediment catch basin along the interceptor channel.
		10.	Intercatchment transfers	• Flood flow transfer. • Water flow for irrigation and urban areas.	• Water quality issues between catchments. • Altered flow and sediment regime (environmental flow impacts if not done correctly). • Infrastructure costs. • May have consequences for the mauri and wairua of rivers and meet with iwi resistance.
		11.	Repositioning of stop banks	• Avoids the need for more adverse forms of channel treatment (such as removal of bed substrate through channel enlargement). • Meanders, pools, riffles and substrate can be preserved. • Increase storage of flood water. • Protect property and culturally significant sites.	• Embanked flows" may still cause localised adjustment in channel due to higher stream powers. • May require land take, compensation etc.
		12.	Channel Improvements with multipurpose use	• Can increase conveyance capacities of the channels under consideration and thereby reduces risks of fluvial flooding.	• Land take – requires space around the river channel for multipurpose use.
		13.	Pump station improvements	• Can increase the current capacities of the pump stations and/or add new pump stations thereby reducing flood risks outside stop banks. • Some concurrent improvements of feeder channels may be necessary.	• Increasing the capacities of multiple pump stations at the same time can be costly. • However, this can be achieved in phases by prioritising the respective pump stations.
		14.	Removal of obsolete structures	• Removal of hard engineering structures that modify the natural flow and sediment regime, including weirs, locks, floodgates, sluices and erosion control structures.	• Altered sediment delivery, change to erosion patterns. • Altered channel dimensions. • Altered flow dynamics.
		15.	Higher Stopbanks	• Increased capacity.	• High costs. • Often not sustainable (tidal areas).
		16.	Room for the River	• Utilising the natural characteristics of the floodplain for flood management.	• Attitude change. • Collaboration. • Complexity.
		17.	Flood gates at headwaters	• Flood gates at headwaters.	• Possible disruption to sediment dynamics • Could cause channel erosion downstream with potential for bed/bank instability • Impact on longitudinal connectivity • May have consequences for the mauri and wairua of rivers and meet with iwi resistance.

Structural /Non structural	Category	Option No.	Option	What can the option achieve?	Limitations
		18.	Tidal Gates	• Tidal gates at downstream end of the river.	• Possible disruption to sediment dynamics. • Could cause channel erosion downstream with potential for bed/bank instability. • Impact on longitudinal connectivity. • May have consequences for the mauri and wairua of rivers and meet with iwi resistance.
Non Structural	Policy	19.	Land-use Controls (including land and soil management practices along river)	• Improve water quality. • Sediment control. • Flood risk management benefits. • Land use change can result is reduction in runoff, increase infiltration etc. • Links to WQ limit setting in NZ. • Includes Farm Integrated Runoff Management (FIRM) principles.	• Impact on flood hydrology, flood peaks. • Impact infiltration capacities. • Soil compaction. • Potential implications due to heavy reliance on agriculture and cattle. • Longevity of changes susceptible to policy changes (land use, development). • Land take. • Potentially less effective in the long term. • Stakeholder engagement.
		20.	Flood Risk Management	Different precautions taken to ensure that the risks of flooding in areas are lowered.	• Engagement from public and landowners is paramount.
		21.	Managed retreat	• Estuarine surge attenuation through restoration of intertidal habitats including managed realignment (allowing the shoreline to advance inward unimpeded). • Make room for flooding. • Increase biodiversity.	• Land loss. • Schemes are unpredictable. • Stakeholder engagement needs to be successful to achieve this.
		22.	Reduction in Level of Services	• Accepted reduction in flood protection.	• Consultation and engagement.
		23.	Turning pasture to ecotourism, wetland, forestry or aquaculture etc	• Reduce water quality issues. • Reduce erosion. • Reduce time to peak of floods.	• Land take. • Loss of pasture land.
	Catchment Managemen t	24.	Natural Flood Management (NFM)	• Natural techniques for runoff reduction. • Floodplain storage and sediment management. • Restoration.	• Changed surface water runoff and flow velocities. • Affected riparian drainage and magnitude. • Frequency and duration of flooding.
		25.	Slowing the Flow (through land management practices)	• Woodland planting (including upland, floodplain, riparian, gully or cross sloop woodlands).	• Changed surface water runoff and flow velocities.
		26.	Agricultural and upland drainage modification	• Runoff reduction – blocking of drains.	• Altered sediment delivery to the water column. • Changed flow dynamics.

Structural /Non structural	Category	Option No.	Option	What can the option achieve?	Limitations
Augmentation		27.	Bio-mimic Solutions/ Woody debris	Emulating nature. For example: • Planting within channel to take up water. • Re-instatement of woody debris to slow flow, flow attenuation. • Re-creation of a former channel patter (e.g. remeandering and/or braiding). • Ecological benefits. • Mosaic farming to improve flashiness of floods.	• Possibility only localised benefits. • May reduce drainage efficiency in normal flow conditions. • Where involving farming, investment required to change farming practices.
		28.	Ecological corridors	• Floodways or corridors planted with marginal vegetation i.e. riparian buffer zones. • Improving biodiversity (or restoring it to its natural state). • Improve water quality.	• Stakeholder engagement and collaboration is paramount. • Results in change flow velocities.
		29.	Modify or enhance structure	• Structural modification or enhancement of existing hard flood risk management and land drainage structures to improve ecological value and/or changes to the operational regime of structures to improve the flow and sediment regime.	• Changed flow velocities. • Changes hydraulic roughness. • Disconnecting floodplain connectivity. • Impacted riparian drainage. • Altered bed and bank stability.
		30.	Sediment Management	• Removal of sediment through reach restoration (re-meandering; re-braiding). • Sediment traps or riparian planting (bank restoration).	• Altered sediment and flow regimes, altered hydraulic roughness, land take.
		31.	Gravel Management	• Gravel removal is sometimes necessary to promote free passage to flood flows and allows maintenance for river schemes. Shifting gravel on a riverbed can help increase water flow in a concentrated channel.	• Uncommon to remove gravel outside the channel due to the significant cost of transporting large amounts of gravel. • The extraction and placement of gravel within a channel is much more common.
		32.	Wave energy dissipation	• Beach management (e.g. beach recharge) • Sand dune restoration • Restoration of intertidal habitats	• Beach nourishment sand often erodes faster than the natural sand on the beach.
		33.	Landownership /Lease back/ Flood Compensation	• Purchasing land to flood. • Compensate landowners for flooding.	• High cost. • Long term benefit. • Complexity.