



WAIKATO
REGIONAL
FRESHWATER
DISCUSSION:
A FRAMEWORK
FOR GETTING
THE BEST USE
ALLOCATION
THROUGH TIME



**Waikato regional freshwater discussion: A
framework for getting the best use
allocation through time**

Issues and Opportunities

DRAFT For the consideration of the Waikato Regional Council Elected representatives.

Let's Talk Water

30 June 2016.

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Table of Contents

Executive summary	5
1 Introduction and background	8
Project intent and purpose of document	8
Process to date	8
Key messages	10
Introduction	11
2 Strategic issues and opportunities	13
Priorities	13
Summary of Issues	14
Better Information	15
Planning	15
Freshwater Management Units	16
Water flows and catchment yields	17
Water Usage Information	17
Supply and demand balance	17
Water foot printing	18
Water Accounts	19
Smarter methods for Allocation	19
A regulatory approach to the efficient allocation of water	19
Efficiency via transfers and trading	20
A price on water – a return to the public	21
A price on water – providing incentives through price signals	22
Iwi rights and interests	23
Issue	23
Engineering options	23
General	23
Lake Taupō	23
Reform, advocacy and decision-making	24
Providing information to the public	24
Resource management legislation reform and advocacy	24
Alignment with Regional plan	25
Transitional arrangements	25
3 Next Steps	26
4 Appendices	27
4.1 Parties engaged and feedback received	27
4.2 Context:	29
Water quality and quantity	29

All water is connected	29
Water is important	29
Global situation	29
Climate change projections	30
Present water allocation framework	30
Iwi rights and interests	30
New and emerging technologies affecting freshwater management	31
A fresh way of looking at freshwater	31
4.3 Freshwater Supply and Demand:	32
Surface waters	32
Cross boundary waters	32
Role of wetlands	33
Climate change influences on freshwater supply	34
Catchment influences	34
Groundwaters	34
Historic (legacy) demand	35
Current demand	35
Future demand	35

Executive summary

Water is New Zealand's foremost strategic asset. In its simplest terms, the New Zealand economy is primarily engaged in turning our rainwater into exports and experiences for visitors. In this way, Waikato water is critical to the interests of the wider regional community and the nation as a whole.

Regional councils and their predecessors have been charged with managing and allocating fresh water on a regional scale for the last 50 years. During that time the emphasis has changed from the direct regulation of discharges and takes to and from regional water bodies to the realisation that surrounding catchment use must also be managed to achieve community and iwi expectations for water.

Waikato Regional Council has recognised both the way it manages freshwater and the way society uses freshwater needs to change. Despite extending the regulatory envelope to include the management of land in the Lake Taupo catchment, a relatively homogenous management unit, and the region-wide regulatory prioritisation for allocation of extractable volumes, monitoring shows water quality is deteriorating in many areas with the clear implication that water allocation is not currently sustainable.

This report brings together the feedback received from the Let's Talk Water engagement process and the responses from the seven 'conversation starter' questions in the engagement document; to inform the definition and grouping of issues and opportunities. In particular, feedback on questions 1, 4 and 5 assisted with the definition and grouping of issues and feedback on questions 2,3,6 and 7 assisted with the type of responses to be considered.

The 'Let's Talk Water' initiative to address the freshwater resource and its management in a holistic way has been widely accepted and welcomed. Many parties have commented that this should have been done years ago.

There has been unanimous support from meetings and in the form of feedback received for this project to consider the future allocation of water well into this current century. The intergenerational approach (30-50 years) has not been challenged in any way, however, transition from the present system, while not explicitly mentioned in the report was picked up in discussions relating to a change in the way water is allocated. This will need to be carefully addressed in any subsequent strategy.

Another area implied in the way the allocation matters have been described with a focus on use for 'best value' is the lack of explicit recognition of the ecological and biodiversity values of our freshwaters. This was not intended, particularly with the inclusion of and emphasis on an understanding of Iwi rights and interests and the recognition of the ecological requirements to support the safe collection of kai. This role of our freshwater bodies is clearly one which will need to be explicitly stated and addressed in any subsequent strategy.

Access to additional policy instruments that enable use of a wider range of levers has been proposed in the 'Let's Talk Water' engagement and support documents and responses sought from interested and engaged parties. It is recognised that the regulatory tools have served well and point source discharges have either been eliminated or substantially cleaned up, the current management framework has reached the limit of its effectiveness and new tools are needed. In particular, tools that are designed to change behaviour of landowners regarding their effects on the region's water resources. These can be characterised as incentives and information to complement the current rule oriented framework.

The call for a wider suite of policy options has widespread support, often with cautions raised at not going too far down the market model at the expense of losing valuable existing regulatory tools that work. The key message is that new tools should not replace existing management but should be available to augment the current regulatory and educational approaches.

Meetings held during the March to May 2016 engagement period have provided an opportunity to clarify the differences between this project, as a region-wide look into the future of freshwater management, and current collaborative process to address freshwater water allocation in the

Waikato Catchment below Huka Falls using present tools (Healthy Rivers: Plan for Change / Wai Ora He Rautaki Whakapaipai (Healthy Rivers)).

It is recognised that in the absence of financial incentives, regulatory tools are currently being used in innovative ways in an attempt to create incentives for behaviour change. This is of interest to those currently observing the move towards regulation that supports the establishment of industry audited self-management schemes.

Some parties have gone further stating that it is premature to consider changing the way freshwater is allocated when the present tools are not used to full potential, with the most often cited example being failure to enforce current rules. This also reflects a misinterpretation of the existing situation where apart from the Lake Taupō catchment there is no regulatory framework covering the largest contributor to water quality outcomes - land use.

While no-one is claiming to predict future trends for the state and use of water, the assumptions identified as potential future influences have been accepted. This includes the recognition that technological advances (information and bio-technology) will alter the demand and the capacity to respond to future freshwater allocation. There has been wide support for the inclusion of changing climate influences (a current legal requirement) on both supply and demand for freshwater. No additional matters were suggested as meetings and feedback tended to concentrate on potential solutions.

The explicit statements linking water use to economic performance were not challenged and this has been assisted by the recognition of the embodied water in export products. So too are the explicit links made between water quality and water quality. When limits to water quality are expressed as concentrations of contaminants, the size of the receiving water body and the ambient concentration of the contaminant already in that water body or a contaminant that acts synergistically with it determines the resulting quality. This relationship is challenged by some parties with the example that some pollutants are toxic at extremely low concentrations and any amount of dilution will not reduce the effect. However, for common agricultural based land use, contaminants such as nutrients definitely are linked with volume.

Water storage was seen by many providing feedback as being an opportunity that should be given more attention, not only for the obvious opportunity to match up seasonal supply and demand, but also for assisting the achievement of water quality targets when particular water bodies are stressed. Examples of natural storage cited in the Summary supporting document to 'Let's Talk Water' such as in Lake Taupō, and the use of constructed storage for multiple use such as flood detention dams were recognised and discussed at meetings and in feedback. However, the discussion was not limited to large scale opportunities, with recognition that some opportunities are limited to specific catchments (a.k.a. Freshwater Management Units or FMUs), and that urban and property scale storage is necessary as well. This could include farm scale dams with associated wetland areas, and domestic rainwater tanks to enable demand to be shifted from times of low rainfall.

The opportunity to consider a price on water was assisted by the concurrent national debate over the export of high quality spring waters and the inability under present law to charge on a volumetric basis for this. This assisted the 'Let's Talk Water' engagement as it clarified that any charges were for administration of consents and in urban situations, the supply and reticulation of freshwater. These are costs that rural users are required to pay individually. It was noted that in urban situations where the costs of providing water supply and wastewater treatment services are transparent and linked to actual use, the per capita use is less than where these incorporated into annual rating charges.

There was clear support at meetings and in written feedback for a volumetric charge on water supply in all urban areas so that individuals could gain benefit from their own awareness and behaviour changes. The idea of a clear signal to create incentives for reduced water use was positively accepted at meetings. This extended beyond the pricing of volume extracted from a water body but also to the volume required by each water body to assimilate the contaminants discharged in the form of urban runoff and discharges from wastewater treatment works, industrial discharges and diffuse discharges of leachate from land use. The idea of a charge for this service provided by water bodies was received positively, particularly

as it has a dual purpose of providing a financial incentive to reduce the strength of effluent and it also (if hypothecated) has the bonus of creating funds to be directed towards projects advancing catchment integrity and security.

The interrelationship between water bodies was not questioned, although some parties did point out that the specific interactions between surface waters and ground water and then ground water and lakes and wetlands are not well understood in the catchment context, apart from the detailed study with respect to nutrient transport in the Lake Taupō catchment. These will need to be understood for the application and local acceptance of meaningful management interventions.

The present understanding of Waikato Region's natural resources, in particular the extent and quality of water resources, enables the current discussion but does not lead to solutions in all areas. Meaningful water resource management is dependent upon a sound evidential base relevant to and optimised for each spatial unit or FMU.

This paper identifies 17 issues and refines the six arranged focus areas of the Let's Talk Water engagement document into three groups:

1. Better information including – supply and demand balance and allocation pressures, water usage and freshwater climate science;
2. Smarter methods with an analysis of options including allocation methods and economic instruments; and
3. Focussed advocacy for legislative reform and ongoing decision-making.

The issues and discussion of opportunities are given a ranking that identifies the collection of information and its dissemination as being critical precursors to the analysis and selection of allocation and management methods. Many of the opportunities discussed are actions that can be executed under present legislation, but are not easily implemented without access to more innovative funding mechanisms or they would be more successful as part of a balanced response package, some of which may require legislative changes. In addition, the choice of policy options and the degree to which they are applied will vary with the specific issues to be addressed, as well as the physical, social and economic characteristics of each FMU.

It is anticipated that the Issues and Opportunities paper will provide a platform from which the regional community can knowledgeably and effectively engage in the national discussion regarding the use of new tools and systems for freshwater management. It will also be able to support the briefing of the incoming Regional Council – post October 2016 local body elections - with respect to freshwater management issues. In this way it will provide a platform from which to develop a region-wide freshwater management strategy and in places a rationale to guide the resourcing of work programmes, such as the review of information collection programmes and the development of complementary planning activities such as the review of the Waikato Regional Plan.

An overriding expectation of parties during the engagement process is that this is just the start of an ongoing discussion, which will need to be refined periodically as market and technological drivers and resource characteristics change, both from external influences and as a consequence of the exercise of new management opportunities as defined in this paper.

1 Introduction and background

Project intent and purpose of document

The overall intent of the project is to develop an agreed framework for getting the best use allocation of freshwater in the Waikato region through time.

This Issues and Opportunities paper summarises feedback received on the *Lets Talk Water* engagement and support documents. It does not purport to be a strategy in its current form but provides a step towards the development of a strategy by presenting a platform from which to prepare one. This will be role of the incoming Council following the October 2016 local body elections.

This Issues and Opportunities paper does not repeat information already contained in the two engagement documents. Instead, key matters from the preceding engagement documents are summarised in the Appendices to this paper (see 4.2 Context and 4.3 Freshwater Supply and Demand sections) to set the scene for the focus of this paper: the challenges we face (Strategic Issues) and the opportunities we have and seek to create to resolve them.

The focus of this paper is on the identification of the issues we face and the potential solutions, along with the implications of these. The structure therefore prioritises the next phase with an emphasis on the refinement and validation of issues, the identification of opportunities and where possible discussion of implications. Feedback on context and supply and demand information, has been included in the appendix so that duplication is minimised, and the document can stand alone.

Process to date

The project was initiated by the Waikato Regional Council in response to interest and concerns by the regional community on the future management of freshwater

This Issues and Opportunities paper advances the discussion on the management of the freshwater resources of the Waikato region. Issues have been distilled from a selection proposed by the Waikato Regional Council¹ for discussion in March 2016.

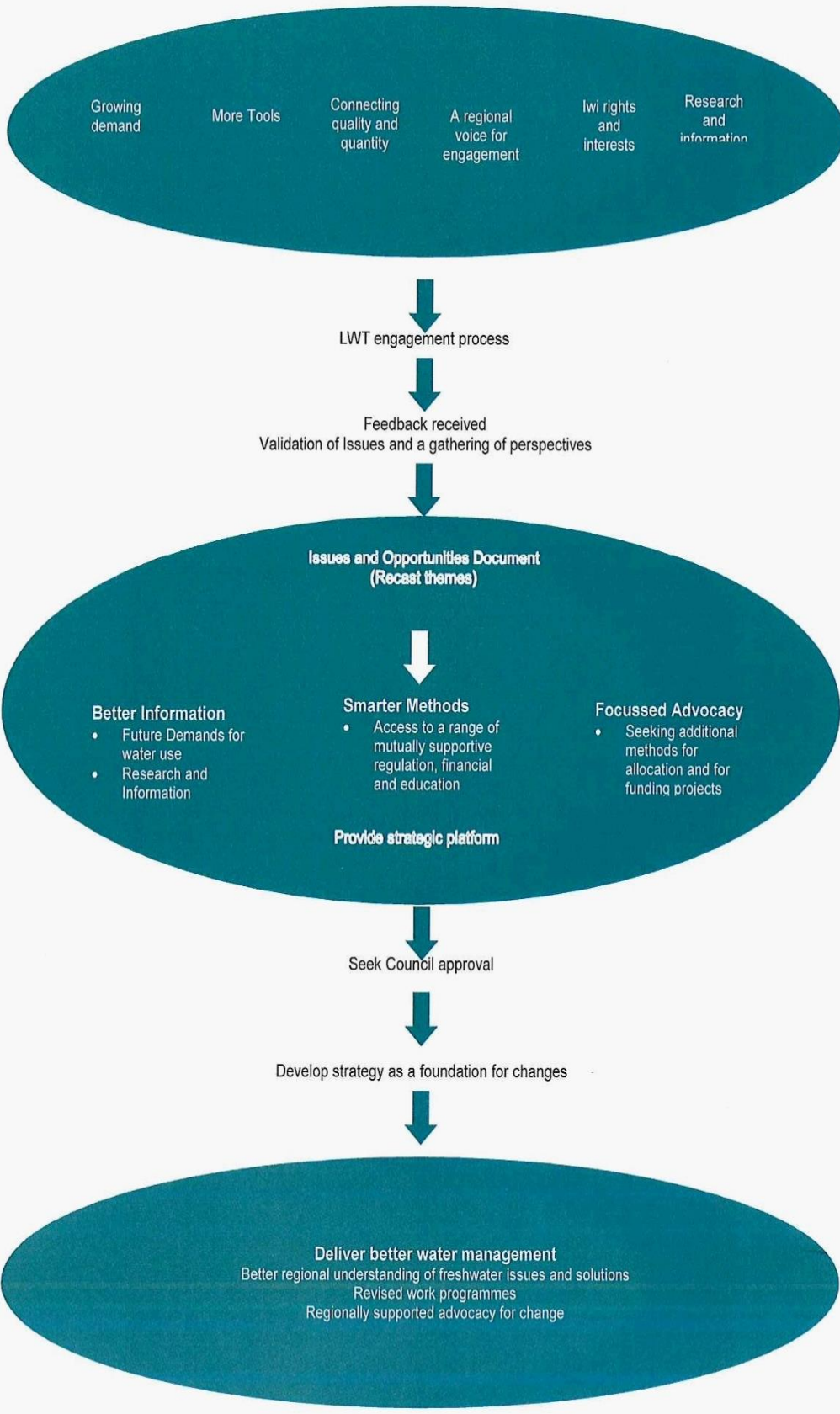
The Waikato Regional Council has been greatly assisted and encouraged by the generosity of interested stakeholders and partnering agencies over the engagement period from March to mid-May 2016. A range of engagement opportunities consisting of a combination of one on one meetings, telephone enquiries, small group and public meetings, were held with over 40 parties. These are identified in Appendix One, along with the parties who have provided feedback either through the Let's Talk Water website, formal submissions and/or email in Appendix One.

Direction in the form of verbal feedback was also received during the various engagement opportunities and this has been incorporated into the following section on key messages and where relevant into the reviewed Issues and updated discussion of Opportunities.

¹ Waikato Regional Fresh Water Discussion: A framework for getting the best use allocation through time, Summary support document to Let's Talk Water: Me korero e tātou mō te wai.
<http://www.waikatoregion.govt.nz/PageFiles/40487/Freshwater%20technical%20summary.pdf>

Let's Talk Water

LTW engagement document and
Summary support paper



Key messages

This section summarises the key messages received, what we have heard and what we have learned from the validation and engagement process. It is a synthesis of verbal communication during engagement meetings and written feedback received over March, April and May 2016.

1. There is a clear understanding of the relationship and separation between this project and that of Healthy Rivers for change Wai Ora.
2. There is unanimous support for the 'Let's Talk Water' initiative, and for the Regional Council to lead it.
3. The 'Let's Talk Water' project is an opportunity to be bold but with a responsibility to be visionary. It is also an opportunity to test the community appetite for change.
4. Support for treating water as an integrated resource without compartmentalising into flow and quality and into separate water bodies, e.g. groundwater and surface waters.
5. There is insufficient knowledge of the interactions between ground water bodies and surface waters.
6. There is a clear expectation that this will be an ongoing process and that parties wish to remain engaged in the next phase. Many don't just seek further engagement but expect involvement with the next phases of freshwater management.
7. It is recognised that good information and accounting of water resources is absolutely essential – systems must be transparent and be capable of clear interpretation by the public.
8. There was too much emphasis on abstractive economic use of water and insufficient recognition of ecosystems and river health.
9. There was too much focus on water shortage and insufficient focus on flood flows – with the message that we should not manage the rivers, but should manage human settlements (natural hazards).
10. There is recognition of regional variability and that some solutions will not apply everywhere.
11. The role of wetlands in relation to water quality and quantity has been understated (covered in generic 'land use').
12. Efficient use should be prioritised - priority should be to reduce demand for water.
13. Activities that suit the capability of the land should be encouraged.
14. There is a need to ensure an orderly and planned transition from the current water and land use regime to any new method of allocation.
15. There is a recognition of the interconnection between water quality and water quantity, particularly when quality is expressed as concentrations of a contaminant.
16. There is an emerging understanding that most surface water bodies have already been allocated to the assimilation of contaminants from a variety of sources.
17. There is a perception that the current regulatory tools are not being applied rigorously and enforced and that this disadvantages law abiding users as well as passive users e.g. tourism.
18. Recognise the need for more tools education (e.g. embodied water in exports, good management practices) and financial instruments - taxes, royalties, charges.
19. Land use is changing (e.g. from horticulture to urban, from dairy to horticulture etc.) and water is needed in different places for consumption and for contaminant disposal.
20. Water meters for urban and rural use are widely supported.

21. The first in first served method of allocation is not seen to provide sufficient flexibility to allocate resources based on the value to the wider community.
22. Plan preparation should be seen as an investment not a cost and agility is potentially constrained as much by a lack of information as legal processes.
23. Water collection and storage is supported at a variety of scales and a range of technologies, both for abstractive use and for instream augmentation of base flows.
24. Storage will also be needed to cope with projected changes in rainfall and Lake Taupō will have a big role in this in the Waikato river catchment.
25. Solutions are available – and in many cases we have the technology - but difficult (expensive, unpopular, disruptive to status quo) to implement.
26. Of those that commented on the extension of management options to include economic instruments, charging for the strength of effluent as a proxy for a volume allocation of assimilative capacity was widely supported.
27. It was accepted that water management is now largely land management.
28. Of those that commented on the extension of management options to include economic instruments, there was no support for grand-parenting and for monetising of water.
29. Many parties recommended learning from existing knowledge and pointed in the direction of international experience and solutions to water allocation issues.
30. There was support for more research – resource definition and responses to different land uses.
31. A suggested approach was water sensitive design to mimic nature.
32. Caution was expressed by parties to ensure transitional processes are worked through collectively with those affected by a change in allocation regime.
33. The future conversation on water management will be complex and WRC needs to lead this.

Feedback from all sources has been incorporated into this paper, but not attributed to any particular party.

Introduction

Water is New Zealand's foremost strategic asset. In its simplest terms the New Zealand economy is primarily engaged in turning our rainwater into exports and experiences for visitors. In this way Waikato water is critical to the interests of the wider regional community, which includes iwi partners, recreational users, farmers, households (both within the region and outside), and industrial and other economic stakeholders, as well as Waikato Regional Council and local government organisations. Within these users there are a myriad of competing uses for the water – some of these are extractive but many are not; for example hydroelectricity, recreation and the assimilation of discharges.

Water is possibly the ultimate integrating resource. The cross cutting resource essential to all forms of life - the universal solvent. Most compounds and molecules essential for life are able to be dissolved in water and as result it is subject to the potential for contamination.

New Zealand's natural endowment of regular freshwater as a result of geographic and topographic conditions is its competitive advantage, however, water has the potential to be impacted by everyday activities and depending the way we use it and manage it we may

Pressure on fresh water resources has increased significantly in recent years, resulting in increasing efforts to regulate use and the condition (quality) of fresh water. There are many actors and agencies in the Waikato region concerned with the use and condition of the regional water resources. Each has a position and in many cases is also engaged in work programmes

actively seeking individual outcomes. These range from ensuring the sustainability of the resource to others directed towards securing access for specific uses.

The need to address water management is more critical than ever before. A more strategic approach is required that recognises the increasing pressures on the freshwater resources, and for that, a clear understanding of the resource, its value to society and interactions with other resources is required.

The relationship between and influences upon the supply and demand of water resources can be seen in the following stylised figure:



2 Strategic issues and opportunities

This section brings the strategic issues identified in section 7 of the Lets Talk Water summary Support document and matches them to opportunities and implications following the feedback received.

Issues around fresh water management have been referred to as a ‘wicked’ problem. This is because water is neither a private good nor is it a public good. As a result neither market-based instruments nor government intervention alone are applicable to solve the issues around the allocation and use of water. It therefore follows that an allocation regime that uses a combination of regulatory and market based instruments and persuasive methods will be required.

The structure of this section reflects the blocks of work that will be needed to address the matters identified in the Lets Talk Water Summary Support document and will inform strategy development. The following grouping of matters is proposed:

- **Better Information;** on the supply and demand balance and allocation pressures, water usage, freshwater climate science, measurement technologies data management and modelling opportunities
- **Smarter methods;** including analysis of options and access to a range of mutually supportive allocation methods and economic instruments; and use of potential engineering options to shift demand and or reduce intensity and or reduce impact
- **Focussed Advocacy;** seeking legislative reform and ongoing decision-making and for funding projects.

Priorities

In order to assist the next phase of the Lets Talk Water project, consideration of relative priorities has been attempted, based upon the following criteria.

High	This work needs to precede other work and should be undertaken first
Essential	This work is required to implement existing commitments and obligations (e.g. comply with the current law)
Important	This work creates conditions for future transition sustainable use of freshwater resources and provide the foundation for green growth initiatives in the region
Low	This work is useful but not urgent or critical but creates an opportunity to enhance understandings of the need for the work.

The natural time delay in catchment responses affecting cause and effect relationships complicate the opportunities to redress past decisions that have yet to show full effect. An example is the certainty with which past intensification and current pastoral use will impact future water quality outcomes. This has been described as legacy effects and will need to be accommodated. Another is the understanding that the future supply and demands placed upon our freshwaters will change as a consequence of from future projected climate change.

Consideration of the following table shows a prioritisation that highlights the need for evidence from which to base policy decisions. For this reason it is not appropriate to jump straight into management solutions, but to ensure that the information base supporting freshwater management including the:

- programme design, planning and co-ordination;
- data acquisition (collection or purchase)
- ordering and storage (databases)
- analysis (understanding of cause and effect relationships); and

- application (modelling),

is linked the wider social, economic and cultural imperatives

Summary of Issues

	Issue	Priority	Comments
Better Information	Planning	High	The experimental design for information collection programmes will need to be resourced
	Freshwater Management Units	Essential	All future accounting and management relates to FMUs. The identification of these will need to precede design and budgeting for information collection programmes
	Water Flow	High	A transition from flood to low flow situations will be needed to address water bodies at times of most stress.
Water Usage Information	Demand-supply balance	High	An understanding of future climate projections, location, frequency and intensity of supply, and legacy effects of demand from present and historic land use is needed to model scenarios.
	Water foot printing	Low	An understanding of the embodied water in export products and tourism services will assist understanding and choice of policy options.
	Water Accounts	High	This will allow modelling of future scenarios including supply and economic and social implications. Will also need to include existing use measures.
Allocation and Economic Instruments	A regulatory approach to the efficient allocation of water	Low	Currently the only option. Transitions are needed to almost total reliance on rules to one where rules complement and support other policy options.
	Efficiency via transfers and trading	Important	Theoretically an effective way for allocations to move to highest use. Good understanding of implications required to ensure unintended consequences are avoided
	A price on water – a return to the public	Low	This may be more related to raising revenue than as a mechanism for efficient allocation.
	A price on water – providing incentives through price signals	Important	This can be focussed on efficient allocation and can include abstracted volume and volume required to assimilate contaminants (effluent strength).
	Iwi rights and interests	Essential	A fundamental prerequisite already in statute for ½ of the region for water quality outcomes and a critical dimension for allocation for economic opportunity in the future.
Engineering options	General	Important	Many options can be adopted now, but requires location specific information and access to funding created by use of economic instruments: includes construction of wetlands, storage, aeration structures, shading etc.
	Lake Taupō	Important	Relevant as a natural storage opportunity for the Waikato River system. Current management provides for reliable summer flows to lower Waikato River

	Issue	Priority	Comments
Reform, advocacy and decision-making	Providing information to the public	Essential	Needed to redress a lack of awareness and understanding about pressures on freshwater – Changes will require resourcing and public acceptance of the increased costs and of their distribution.
	Resource management legislation reform and advocacy	Important	Any addition to the tools available to regional councils for allocation – such as market instruments either directly for allocation or to fund infrastructure and catchment enhancements will need legislative review. Review will need justification from information and modelling. Legislative reform need not be limited to RM reforms.
	Alignment with Regional plans	Important	The current review of the Waikato Regional Plan and the inclusion of the Regional Coastal Plan provide a number of opportunities. For instance the Healthy Rivers - Wai ora plan for change has already established protocols for the definition of FMUs and these can be applied to the remainder of the region. The next step should ensure that water quantity and quality are effectively integrated.
	Transitional arrangements	Important	Any move from the current rule based allocation framework needs to be planned with the input of current and potential users. This will allow recognition of existing investment in infrastructure and value of current consents to be realised.

We have a good appreciation of the current state of the water resources management. We have a good understanding of the state of the region's freshwater resources but do not have the same level of confidence in the cause and effect relationships between water bodies at all locations nor the trends in their quality characteristics. However, there is now an opportunity to undertake detailed planning to determine the appropriate content, sequencing and interdependencies for the work streams to add to this knowledge.

This will involve consideration of current sub-regional water and land management related work and reactive advocacy in response to initiatives from other agencies, including central government

Better Information

Planning

Issues

There is currently a lack of prioritisation and sequencing across all the initiatives in this area.

The Lets Talk Water project will involve a number of different future work streams, and there is currently a lack of coordinated planning and sequencing around these different work streams.

Opportunities and Implications

Further develop and implement the 'Land and Water Portfolio', a Waikato Regional Council internal organisation-wide science and information gathering plan to identify and align water-related information needs and highlight any gaps (including those identified in 'Let's talk water'), and to share and communicate the portfolio with external data and science providers.

As part of the development of a Corporate Science Plan, regionally identify all current and programmed water related science and research activities and determine the gaps in relation to:

- Current requirements for state of the environment and efficiency and effectiveness of plans; and
- Future modelling and trading requirements

Citizens, marae, schools and community groups, including landcare groups, should feel encouraged to contribute knowledge and information (volunteer monitoring) about the fresh water resources in their locality/rohe. In so doing this will add to the transparent and freely available knowledge of the region's water resources.

The University of Waikato, NIWA, Waikato-Tainui and Waikato Regional Council should continue to work together to establish a WaiOra Freshwater Institute to enable a multi-disciplinary approach to freshwater research for the Waikato region and New Zealand.

Regional parties interested in the achievement of agreed fresh water outcomes should be encouraged to establish a common fresh water database and contribute to its governance. For maximum effect, the regional fresh water database should be transparent, freely available, and live with accurate quality assured information.

All fresh water users that collect data on fresh water resources should be encouraged or incentivised to contribute to a common fresh water database.

Research institutes, schools, marae, community groups and industry are encouraged to develop applications that use available fresh water information to help achieve agreed regional fresh water objectives.

Freshwater Management Units

Issues

There is a risk that if the freshwater management units are developed poorly, they may lead to information which is less useful than it could be.

Waikato Regional Council is yet to develop an approach to determining the criteria for identifying FMUs. All policies in the National Policy Statement for Freshwater Management (NPS-FM 2014) are predicated on the establishment of FMUs and as the entire region must be included within a FMU, without these all other progress is compromised. Including the selection of representative sampling sites, cause and effect relationships specific to the relevant FMU, identification of infrastructure whose location and operation could result in non-achievement of national bottom lines for NPS-FM 2014, Appendix 2 attributes, establishment of accounting and reporting systems etc.

Nine FMUs have already been developed for the Healthy Rivers project and the determination of units needs to be consistent across the region. Without a consistent protocol the possibility exists for the determination of units to again be delegated through collaborative processes that could create data that is unable to be aggregated meaningfully into a regionally coherent whole.

Opportunities and Implications

To enable analysis and monitoring of fresh water outcomes to be undertaken at a spatial level which optimises the usefulness of the information. Decide on the number and location of the region's freshwater management units and design data/information systems to allow fresh water modelling and determine the appropriate freshwater management units for the remainder of the region.

To develop units which achieve this, the region needs FMUs which are meaningful in the way that the river catchments are managed and used. This should recognise appropriate social and economic spatial units as well as including surface water and groundwater interactions to support water accounts modelling and the regional plan review.

To set-up water accounts and models that are spatially flexible to enable information to be aggregated to current and any future FMUs.

To take an ecosystem services approach to water management, optimising multiple benefits (win-win) as outcomes, including economic, social and environmental, e.g. water yield, water quality, soil mineralisation, biodiversity, carbon sequestration etc.

Water flows and catchment yields

Issue

There is a lack of detailed understanding of potential future flow regimes and freshwater water yields. An improved understanding of hydrological interactions will be needed.

Opportunities and implications

To base minimum water flow requirements on robust data and an improved scientific understanding.

To improve Waikato Regional Council's understanding of hydrological issues, and how each catchment or FMU could change in the future.

To improve Waikato Regional Council's understanding of potential climate scenarios, how historical rainfall patterns might change, and what these could mean for fresh water yields.

To better understand the nexus between water quantity and quality.

To better evaluate and manage natural hazards associated with extreme flows, such as flooding and droughts.

Continue existing programmes to refine the technical and spatial understanding of surface water and groundwater linkages and interactions to determine the best source for allocation. This requires recognition and understanding of regional variability e.g. differences in responses in karst, peat, pumice and other geologies.

Clarify the hydrological role protecting and restoring seepages and small and ephemeral wetland ecosystems may play in sustaining adequate water quantity for all in the Waikato region.

Continue and accelerate programmed data acquisition to implement water allocation and water quality provisions of the Waikato Regional Plan.

Refine regional understanding of catchment scale, seasonal fresh water yields under Intergovernmental Panel for Climate Change (IPCC) climate scenarios, particularly for drought projections.

Water Usage Information

Supply and demand balance

Issue

There is a lack of current modelling of future supply and demand balances in different catchments under different scenarios, e.g. for different land uses and economic activities. This makes it difficult to robustly articulate future allocation pressures with any confidence, and to justify the need to change the current arrangements.

Opportunities and Implications

The development of forecast scenarios around supply-demand balance for each FMU unit. This would help to justify the need for a change in allocation framework and to better articulate the narrative of future demands putting pressure on limited resources. Additionally, the opportunity to gather (through water accounts) information suitable to simulate future water supply and demands on a sector, spatial and seasonal basis.

Refine regional understanding of catchment scale, seasonal fresh water yields under IPCC climate scenarios, particularly for drought projections.

Use the Waikato Integrated Scenario Explorer model (WISE) to identify scenarios of plausible future water demand and supply/availability against reference scenarios (how much/where/when) projecting land use change, demographics, industrial/commercial developments and climate change. This also needs to be aligned (and be not inconsistent with) any other Waikato Regional Council modelling work, including but not limited to Healthy Rivers project. It would also be able to support and inform the Waikato Regional Plan review.

Water foot printing

Issue

There is currently a relatively low awareness and recognition of the value of water embodied in the products and services from the region, both within Waikato Regional Council and externally. There is currently no framework for how this information could be used in decision-making which could limit the use of this information to education alone.

Opportunities and Implications

To obtain a large amount of potentially useful information about the value of water in different uses.

To do pilot studies, to help assess the value of this information, what it could be used for, and the cost of obtaining it. Pilot studies could be on:

- the water footprint of one water use
- the impact of water on one part of the Auckland economy.

To link water footprinting to the gathering of data for the water accounts and hence maximising the use of information for different purposes, including education (personal/household water consumption, footprint of products) and policy/regulation including best management practise for production processes or water use per unit area for various land uses. It is already understood that many horticultural crops do not need the same amount of water as pasture and that some crops only need water at certain times and not necessarily when river / catchment systems are at their most stressed, in late summer.

Seek recognition of the value for, and development of a consistent methodology for, determining the embodied contribution of fresh water in products and services (water footprinting) so as to better understand and quantify the strategic value of the fresh water resource to the region and nation. It is useful to know and understand, not just the per unit contribution of water but also how available it is and where it is coming from and what opportunities have been forgone for any particular use.

Undertake an analysis (potentially through support of targeted academic research) of the regional water footprint to allow an understanding of the contribution of Waikato water to:

- the Auckland economy
- national exports.

Once consistent methodology has been determined ensure all components of the regional water footprint of products and services are included in catchment water related decision making.

Regional footprinting analysis is potentially quite a large and complex piece of work and it could be relatively costly to obtain this information.

Water Accounts

Issue

There is currently a lack of clarity on the water data needed for environmental reporting (Ministry for the Environment (MfE) / Statistics NZ), NPS-FM 2014 and the Vision & Strategy for the Waikato River.

There is a lack of data on actual water use, including quantity, timing, location/catchment and use by sector and land use.

Opportunities and implications

To obtain a large amount of potentially useful information about the impact of water on the economy.

To gather targeted water data relevant for planning and decision-making using an accepted framework (water accounting).

To integrate water data with land use, economic and demographic drivers, including modelling future supply and demands.

Proceed with developing environmental accounts in collaboration with Statistics NZ and the MfE with a priority to construct a regional water account database. The water accounts database should be designed to enable interoperability with spatial integrated modelling (e.g. WISE model) to link the water accounts database to locations (regional catchments, freshwater management units, aquifers etc.) and to water demand (population, economy) and efficiency (water use by sector or outputs, such as per kg of milk solids produced or per capita municipal use).

Develop a set of water accounts to enable the interactions between water use and economic indicators to be modelled.

Smarter methods for Allocation

A regulatory approach to the efficient allocation of water

Issue

Regulation under the RMA is the key tool that has been used to allocate water (and regulate discharges – which can, in principle be interpreted as an allocation for the purposes of water quality objectives). Typically, however, regulation is recognised as a relatively inefficient way of achieving objectives if used in isolation. That raises the question: What is the alternative?

Opportunities and implications

Under the RMA, regional councils have the responsibility of managing water resources, including allocating water. Currently, the approach is to first set aside the amount of water that is judged to be required for ecological purposes. This recognises the fact that the wellbeing of the region – including the regional economy – is dependent on a healthy water resource. The remainder (the 'allocable flow') is then available for allocation to users, largely on a 'first in, first served' basis. This approach to the allocable flow is increasingly viewed (feedback) as not an ideal method for enabling water to be used in its highest value use.

If Waikato Regional Council is going to be able to make judgements about which uses of water should be preferred over others, we need a robust set of criteria for determining those priorities (bearing in mind that, to some extent, this already occurs – an amount is set aside for ecological purposes, and municipal supplies also have a priority in some circumstances). It has been accepted by the regional community and the broad approach, whereby ecological and essential human uses are prioritised should remain, and so the remainder of this discussion is about the allocable flow *after* ecological needs have been satisfied. In the case of the Waikato

river catchment, ecological needs have been interpreted by the Vision and Strategy and have been quantified in terms of four contaminants as attributes to the NPS-FM 2014.

There is another practical difficulty: only those consent applications that we know about are able to be ranked. When an application for a consent to take water comes in, we have no way of knowing what other applications there may be in future. Hence, as well as a set of criteria to guide prioritisation there would also need to be some alignment of consent expiry dates so that sets of consents could be weighed up at the same time.

A decision-making process for water allocation – including prioritisation criteria and common expiry dates – was indeed developed as part of the Variation 6 plan change process, but this was abandoned on the basis of advice that such an arrangement would not be practical and would be expensive to implement following the 2009 Resource Management Amendment Act which introduced the Discount regulations for Consent processing.

Common expiry dates may allow consents to be compared with each other and prioritised, but there are several other concerns with this. Firstly, feedback has pointed out that, for business purposes, it would be best to be able to align consent terms with investment cycles – which can be very different for different sectors and different uses. Secondly, managing periodic influxes of consent applications may be challenging for the Waikato Regional Council.

There is an opportunity to reconsider the first-in, first served approach, but this would firstly require amendments to legislation to allow a feasible alternative. A regulatory alternative to first-in, first served allocation, will need advocacy to central government for legislative change.

To support this advocacy, we would need to be able to present a persuasive argument that a robust set of criteria can be developed that would allow Waikato Regional Council consents officers to make judgements about which was the highest value use of water. Designing such a set of criteria is likely to be challenging. For example, Waikato Regional Council is unlikely to ever have better information about the ‘value’ of water to different sectors (let alone *within* sectors) than the users themselves. So, given our aim is for allocable water to be able to move to its ‘highest value’ use, we would need to be able to collect and assess (potentially commercially sensitive) information from consent applicants as part of consenting decisions.

Another consideration is how such a set of criteria should take account of an emerging understanding of Iwi rights and interests in water resources in regard to the state of the freshwater bodies, and also opportunities for allocation for economic purposes.

Efficiency via transfers and trading

Issue

Market-based approaches are, in theory, an effective way of allowing resources such as water to their ‘highest value’ uses. Transfers and trading of water between users, combined with a regulatory approach, has the potential to improve the value obtained from water. Designing an appropriate system of transfers needs to be done with care to avoid unintended consequences.

Opportunities and implications

Subject to certain conditions, market systems can be highly effective at moving resources into their highest value uses. If one person, who doesn’t have access to water, has a higher value use for that water than the person who *does* have access to it, there is potential for a mutually beneficial exchange (provided there are no external costs or other unintended consequences).

If such a system of trading rights to use water existed, then the allocable portion of the water resource could arguably move to its highest value use regardless of method of initial allocation. Water might be allocated on the basis of first-in, first served, but there would be incentives for it to move to its highest value use subsequently.

The Waikato Regional Plan allows consent holders to transfer water around, subject to certain constraints. However, to date, such transfers have been limited. There may be various reasons for this. For example, it may be because:

- until recently, we haven't been in the situation of being fully-allocated, so there has been no need to transfer;
- The water allocation module of the Waikato Regional Plan is relatively new, and consent holders are still getting used to the idea of transfers;
- The 'insurance' value of water to current consent holders is higher than the value they could get from a transfer;
- Transactions costs (such as the effort required to search for someone to transfer to/from) are too high; or
- The regulatory constraints placed on transfers mean that it is seldom a useful option (for example, by limiting the circumstances where this can happen, transfer markets are relatively 'thin').

It may be timely to evaluate the ability to transfer water under the Waikato Regional Plan to determine why there has been relatively little use of these provisions. A recent report by Sapere Research Group (*'Towards more efficient use of freshwater resource in the Waikato Region'*) provided a range of suggestions for ways in which the market for transferring water could be improved, including ways to improve the clarity and certainty of water consents, and ways in which the costs of transfers might be reduced. These suggestions provide a good starting point for investigating whether we can make allocable water move to its highest value use via mutually beneficial transfers. A review of international examples of different options for systems of trading and transfer may also provide some useful pointers for some advantages or pitfalls of market-based approaches.

Clearly, any such review, aimed at making transfers easier, will need to include well-specified rules in which a market might operate. This is important to make sure that market-based uses of water do not override the broader goals and aspirations of the community. An example of this could be where tourism operators or recreational users, who benefit from higher water quality in-stream, may not easily be able to coordinate themselves to participate in a water transfer market.

A price on water – a return to the public

Issue

If 'no one owns water', then there is no recourse for anyone to seek a return on it other than those who use it. There is an argument, however, that the public should be able to capture a share of the rentals that private users of the resource are currently appropriating.

Opportunities and Implications

Many people get a great deal of value from the water they use, whether it be consumptive or non-consumptive uses. But beyond administrative and cost recovery-type charges, they don't pay for the water they use. In the case of publicly-owned resources, a common approach is to charge a 'royalty' or 'rental' on the use of water. The idea of this is to provide a return to the owner of the resource for its use. Mineral resources in New Zealand are an example of this: all mineral resources are generally deemed to be owned by the Crown. People can extract and sell the minerals, but must pay royalties to the Crown to do so.

There are a variety of ways of designing resource rentals. They could be a relatively simple charge per unit allocated, through to a much more complex calculation based on the profit derived from the use of the resource. In general, the former is typically relatively easy (and cheap) to administer, but will have other effects too (such as affecting firms' production decisions); the latter can be complex and costly to administer and may open up opportunities for evasion, but is likely to be less distortionary for production. (It is noted that affecting firms production decisions may be exactly the intention of a price on water. In that case, it is not so much a 'royalty' as a user charge. Such charges are discussed further in the next section.)

Recent public debate about water bottling plants in Ashburton, Hawke's Bay and elsewhere suggest there is support for something along the lines of a resource rental for water. However, regional councils, as managers of water resources, have no power to charge such rentals.

Indeed, the insistence from central government that 'no one owns the water' makes it difficult to justify such a policy. If no one owns the water, who would users pay? It is also noted that if iwi rights and interests are akin to some kind of 'ownership', that is also likely to have implications for any policies in respect of royalties.

The rationale that the public is entitled to share in the returns earned on the use of public resources is not new, and it applies in New Zealand to other resources. In the first instance, there is an opportunity to advocate for a change in government rhetoric from 'no one owns the water' to 'everyone owns the water'. That will, in turn, help to justify further legislative changes that enable a royalty to be charged on water.

A price on water – providing incentives through price signals

Issue

Prices can be a highly effective way of providing incentives for water users to use resources more efficiently. However, putting a price on water would also raise important questions of equity.

Opportunities and implications

Price signals can affect the choices we make. Carefully done, they have the potential to improve efficiency of resource use. At present, water users may have to pay for administration charges and monitoring on a cost recovery basis. They also may face infrastructure costs (either through their own infrastructure – such as pumps and pipes, or through the payment of volumetric charges or rates for municipal infrastructure), which can indeed be considerable. These costs have limited value in providing an economic incentive regarding water use – although they can potentially be designed to provide incentives. Volumetric charging for water provides clear signals to users, and creates incentives to use water as efficiently as possible (here we are referring to 'technical' efficiency, which is not the same thing as 'economic' efficiency). However, regional councils have no power to charge for water in this way.

In theory, a price could be set on water such that the allocable flow was equal to the demand for water from those who could extract the most value from its use. In reality, setting such a price would be practically impossible (for example, the information that would be required does not exist, or would be prohibitively expensive – although an auction based approach may address this problem). Moreover, there are considerable ethical issues with such an approach to pricing.

A more reasonable approach might be to impose a modest annual charge on consent holders that did not exclude users who were less able to pay, while still creating some incentive effect. This approach could also provide a source of revenue that could be recycled into supporting projects that would enhance the water resource in the region. This could be directed towards the FMU that is the location of the use. Users may face increased costs through water pricing, but they may also have access to funding for projects that are required to meet their consent conditions.

This approach could also be extended to address water quality issues. For those requiring a consent to discharge to water, an annual charge could be levied. This would encourage consent holders to minimise their discharges, and also create revenue to fund water quality projects. Ideally this would apply regardless of whether the discharges were from point sources (i.e. out the end of a pipe) or diffuse sources (such as run-off or leaching from farmland), but this would require satisfactory ways of measuring or estimating discharges.

If prices are able to be adjusted flexibly enough, they could even provide incentives that respond to specific seasonal or local conditions. For example, prices might be higher when water is relatively scarce and cheap when it is abundant – creating an incentive to take and store water in times of plenty for use when it is scarce (such incentives arguably already exist to some extent, but this mechanism could enhance them).

A change in legislation to give regional councils to have the power to charge consent holders for the volume of water, or the strength of their discharges would be a powerful tool in the

resource management kit. This may be a controversial policy, so it is envisaged that any such proposal would be accompanied by safeguards – for example, some sort of national guidance or oversight on the level of charging.

There may also be opportunities to align some of the funding tools from local government legislation (e.g. targeted rates, differentiated general rates) and our communities' resource management goals for water. Investigations into such possibilities could also address whether any such changes should be 'fiscally neutral'. That is, it could look at changing the basis of local government revenue from property-based rates to resource use, *without* changing the overall amount of revenue collected.

Iwi rights and interests

Issue

The development of any economic framework will need to be cognisant of iwi rights and interests – There is no international precedent – we are on our own

Opportunities and Implications

To develop a framework or consultation process which factors in how iwi rights and interests can be incorporated into an economic allocation and trading framework

Ensure that any fresh water trading framework is developed within an understanding of, and provides a benefit towards, an emerging understanding of iwi rights and interests for fresh water.

Engineering options

General

Issue

There is currently a lack of analysis of the merits of the potential engineering options, whether they are cost-effective, under what circumstances they're best used and whether they're preferable to or could be used in conjunction with economic instruments and regulation.

Opportunities and implications

To use engineering options to optimise the use of existing resources

To better understand the relative merits of different engineering options and to determine the best circumstances for each use. They are linked to the specific circumstances of achieving freshwater management objectives at a specific location (FMU) and will need to be integrated into the mix of policy tools chosen for each FMU.

Engineering options are typically and technology specific as, they cost money to design, construct and maintain and add benefit to the freshwater users in a particular FMU.

We need to actively explore opportunities for environmental engineering solutions to existing and emerging water management issues such as storage, wetland construction, instream structures to mitigate the effects of historic use and the projected change in meteorological conditions.

Lake Taupō

Issue

Consideration of using Lake Taupō as a natural reservoir needs to be prioritised amongst the other potential engineering options

Opportunities and Implications

Consider the merits of using Lake Taupō as a natural reservoir for not only direct use that supports economic activity but to allow for the assimilation of past and present intensification of land use.

A thorough understanding of the hydrology and the projected future supply (rainfall and additional inputs) would need to be modelled first.

Reform, advocacy and decision-making

Providing information to the public

Issue

There is a current lack of public awareness and understanding pressures on the region's freshwater resources.

There is currently no detailed plan for communicating the existing information. WRC needs to understand how it can maximise the effectiveness of the communication to the public.

Opportunities and implications

To better educate the public around fresh water usage arrangements and future pressures, and mitigate misinformation.

To help prepare the public for change in water allocation frameworks and the reasons for it.

To provide information that might be useful to the academic and research community.

To identify people, community and Maori/iwi aspirations and values of freshwater, including direct and indirect uses, as well as non-use values.

To use effective science communication methods (behavioural science) and tools (visualisation, infographics) to not only inform people but change their attitude and behaviour.

Make information available to the public about the state of, and pressures on, fresh water in the region, and of implications for communities meeting desired social and economic outcomes so that everyone can help be part of the change that is needed.

Resource management legislation reform and advocacy

Issue

In many areas, Waikato regional council has yet to determine its preferred alternative to current water allocation arrangements e.g. first in first served

Opportunities and Implications

Provide robust justification for the advocacy in the form of evidence of system failure in any particular FMU, or the potential inability to cope with the modelled scenarios.

Advocate to central government agencies, ministers and to political parties for reform of the Resource Management Act (RMA) to include an alternative mechanism to the 'first in, first served' approach for initial allocation of fresh water, potentially for a secondary market..

Advocate to central government agencies, ministers and to political parties for reform (better alignment) of the RMA and/or the Local Government Act to allow the recoupment of fresh water monitoring costs in cross boundary situations. Currently the Local Government Act does not allow the recoupment to include cross-boundary charging. Additionally, the Local Government Act has a sustainable development focus compared to the sustainable management focus of the RMA.

Advocate to central government agencies, ministers and to political parties for reform of the RMA to include the ability to use economic instruments for the management of fresh water

resources. Reform is required to allow differential charging for volume of water taken and strength of discharges (either point source or diffuse) as this requires an instream assimilative allocation. Economic instruments are required for example to:

- provide recognition and financial benefit to those landowners who positively contribute to the seasonal base flow of surface water bodies and the recharge of groundwater aquifers through land use change
- incentivise future land use change that positively contributes to seasonal base flow of surface waters and to the recharge of groundwater aquifers
- incentivise the taking of water during times of plenty for use in times of scarcity
- incentivise the surrender of water allocations during times of scarcity
- incentivise the efficient use of water that is taken from either surface water or ground water aquifers.

Alignment with Regional plan

Issues

The present central government approach of incremental changes to the current regulatory system has resulted in more complexity for plan development and increasing costs for policy and plan preparation decision making and often implementation as well.

Opportunities and Implications

To give any fresh water objectives in the Regional Plan a sound platform, learn from the Healthy River process with respect to the identification of FMUs .

It is important to continue support for efforts to reduce the time and costs of policy and plan making that will contribute to increased plan agility.

To ensure the Regional Plan review process effectively integrates water quantity and quality and takes into account other aspects of the 'Let's Talk Water' discussion.

Transitional arrangements

Issue

Failure to consider transitional arrangements has the potential to create barriers when moving to a new allocation framework.

Opportunities and Implications

Recognise the investment currently involved in the economically productive use of freshwater resources.

Recognise that a new allocation framework will require time to develop and for parties to adjust to, which may include the use of funding sources not directly related to freshwater management but which may have a freshwater management co-benefit e.g. funding for carbon sequestration under the Emissions Trading Scheme that promotes land use changes.

The creation of a transition pathway that confers certainty for freshwater users and the regional community will be a priority and will need to be addressed in subsequent decision-making.

3 Next Steps

The Issue and Opportunities paper will provide a framework from which the region community can knowledgeably and effectively engage in the national discussion regarding the use of new tools systems for freshwater management. It will also be able to support the briefing of the incoming Regional Council with respect to freshwater management issues. In this way it will provide a framework and in places a rationale to guide the resourcing of work programmes such as the review of information collection programmes and the development of complementary planning activities such as the review of the Waikato regional plan.

An overriding expectation of parties during the engagement process is that this is just the start of an ongoing discussion which will need to be refined periodically as market and technological drivers and resource characteristics change, both from external influences and as a consequence of the exercise of new management opportunities as defined in this report.

4 Appendices

4.1 Parties engaged and feedback received

Engagement (48)	
<ol style="list-style-type: none"> 1. MfE & MPI 2. Department of Conservation 3. Combined meeting, water policy officials Central government (MPI, MfE, DPMC, Treasury) 4. Office of the Parliamentary Commissioner for the Environment 5. Minister for the Environment 6. NZ First 7. NZ Greens 8. NZ First 9. NZ Labour 10. NZ Labour 11. Fonterra 12. The Tatua Co-operative Dairy Company Limited 13. Oji Fibre Solutions 14. NZ Steel Limited Waiuku 15. Mighty River Power 16. Martin Jenkins 17. Wairarapa Moana Incorporation 18. Landcorp 19. Steering Group of Waikato Means Business 20. Meeting of Waikato Chief Executives 21. Dairy NZ 22. Irrigation NZ 23. Horticulture New Zealand 24. Forestry Industry Liaison Group 	<ol style="list-style-type: none"> 25. Massey University 26. Waikato University 27. Plant and Food Research 28. ICM What's Hot Session 29. Staff lunchtime session 30. Whitianga office of WRC 31. Taupo office of WRC 32. Waikato-Tainui Bi-annual Meeting 33. Ngati Tuwharetoa 34. Iwi leaders 35. LGNZ 36. Resource Managers Group 37. FutureProof Water Policy Group 38. SOLGM Midlands/Central Combined Branch meeting 39. Hauraki District Council 40. HCC, WDC and Waipa DC water shared services 41. Waikato Region Planning Managers 42. Lower Waikato Catchment Committee 43. Hamilton and Waikato Tourism 44. Hamilton Youth Council 45. Lakes and Waterways Action Group 46. Morgan Foundation 47. Environmental Defence Society 48. ACRE

Written Feedback Received (26)

Organisations

1. Taupo Forest & Bird Society
2. ACRE
3. Oji Fibre Solutions
4. Lakes and Waterways Action Group
5. Hamilton & Waikato Tourism
6. Tongariro Taupo Conservation Board
7. Watercare Services Limited
8. Matamata Piako District Council
9. Waikato Federated Farmers
10. Auckland Council (officers)
11. Mighty River Power
12. Contact Energy
13. Raukawa Charitable Trust
14. Great Lake Taupo
15. Destination Coromandel
16. Future Proof Sub Regional Growth Partners
17. LandCorp (Taupo)

Individuals

18. Reihana Robinson
19. Grahame Webber
20. John Longden
21. Peter Bacchus
22. Laurie Burdett
23. Gifford McFadden
24. Jocelyn Reeve
25. Ricky Millen
26. Tom Chi

4.2 Context:

Water quality and quantity

- Water quality is a dimension of quantity as it is the allocation of a volume to assimilate the impact of the discharge and the two should be managed in an integrated manner, yet this is rarely the case. All things being equal (and they are not because of different land use, geology, topography, climate, season, use etc.), the higher the volume of water in a water body, the more contaminants (either from land or direct discharge) that the water body can assimilate without causing detrimental environmental effects (sustainability). The corollary is that the more water that is allocated for use outside the water body, the more sensitive it is likely to become to water quality degradation.

All water is connected

- All water resources are connected but are measured and managed separately according to water body type e.g. surface water (rivers, lakes, estuaries) or groundwater.
- There are multiple influences on the supply and demand side of the water use equation. Not all are able to be controlled or influenced by human actions. Some will need to be accommodated.

Water is important

- Regional surveys over the last 18 years have consistently showed water condition and availability for use is currently the biggest concern of the regional population. This is increasing in importance
- Water quality is seen as the primary issue facing the region in the next 20 years.

Global situation

- Water is a finite resource. Only 2.5 per cent of the planet's water is fresh water and of that only 1.3 per cent is available surface water. Available surface waters are distributed unevenly.
- Global fresh water supplies are drying up through over exploitation of groundwater aquifers and pollution of groundwater and surface water.
- New Zealand is well endowed with water, on a per capita or a land area basis. However, it is also unevenly distributed between and within regions.
- The main threat to global freshwater supplies is over drawdown of aquifers and use of surface waters to assimilate the effects of discharges and land use.
- As clean fresh water becomes scarcer, its value will increase and we can expect access to be more keenly contested.
- The interconnected global economy can also be expected to exert a climate change influence on water demand as the international effects of climate change shift growing zones to different places. As mentioned, New Zealand can expect fewer changes in supply than many other countries and may be at a relative advantage with respect to an ability to grow pasture and crops.
- It is recognised that the 'best' use of water will change over time. This will be in response to the changing value of water as the international value of water changes. This is likely to occur in response to an expanding global population, projected negative climate effects in current global food bowl regions which are

already stressed through groundwater aquifer drawdown and contamination of source aquifers.

- New Zealand brands itself as clean and green. For example, Tourism NZ's long running 100% Pure New Zealand brand campaign. There are others too that leverage this image, like Anchor. To maintain access to high value premium markets we need to maintain an internationally positive perception to New Zealand brands.

Climate change projections

- The way the region receives water is expected to change (frequency and intensity of rainfall) into the future with time, geography and seasonality. Expected changes include more severe extremes with more frequent dryer (drought) conditions in the north and east with similar amount but higher intensity rainfall events in the south and west.

Present water allocation framework

- Fresh water allocation (for direct use outside water bodies and within water bodies for assimilation of contaminants) has been devolved to regional authorities for nearly 50 years. This was originally to Regional Water Boards under the Water and Soil Conservation Act 1967, and from 1991 to Regional Councils and Unitary Authorities.
- Regional authorities have the sole delegated role for managing the nation's water resources.
- Central government has provided regional authorities with regulatory tools (initially water rights and now resource consents) to undertake this task.
- Central government influences national water management in three ways:
 - changes to the legislation
 - national policy and standards
 - Treaty of Waitangi settlement legislation.
- The current 'first in, first served' allocation system has achieved positive changes to direct discharges and abstractions from water bodies (rivers lakes and aquifers).
- Questions are starting to be asked about the usefulness of rules as the primary policy lever to incentivise behavioural change with respect to the major influence to water quality – the intensification of pastoral land use.
- This is interpreted regionally and in accordance with the capacity and resourcing of each region.
- Regional management of water resources is limited to regulatory processes – regional policy statements, plans and resource consents.
- The present 'first in, first served' convention for water allocation and duration of resource consent authorisations advantages present users and creates barriers to new entrants who may have more efficient or more economically valuable uses with less effects from accessing the resource.

Iwi rights and interests

- At the time of writing, interpretation of the Treaty of Waitangi on iwi rights and interests with respect to fresh water (allocation) is unresolved and is promoting a sub-regional resolution based upon Treaty of Waitangi settlement agreements. Tribal rohe is the

locus of such settlements, which may or may not accord with the physical extent of freshwater resources (e.g. surface water catchments)

New and emerging technologies affecting freshwater management

- In the future, technological changes will determine the way we use, measure and manage our water resources. Such changes are not limited to information technologies, but also production efficiencies, water recovery and treatment, and biotechnologies.
- New technologies could be disruptive to existing uses of land and by implication water use, and if prevented from accessing water may economically disadvantage the region's economic or ecological prospects.
- The changes are important and so is the rate of change which puts pressure on the current regulatory system of plan development preparation to respond. A more agile system is required.

A fresh way of looking at freshwater

- Water foot printing allows an understanding of the embodied or hidden water in products and services coming from any particular region.
- It is an accounting tool that links product supply chains and environmental effects to determine the overall water content and water demand of a product.
- Not only does water foot printing link water quantity and water quality dimensions of catchment wide activities, it can make the link between point and non-point (diffuse) inputs.
- As global pressures on water resources increase, the need for an understanding of the embodied water content of regional products and services will become more relevant.
- A consistent and agreed methodology is needed to quantify the embodied water in products and services in order to provide an evidential comparison between uses including products, catchments and regions.

4.3 Freshwater Supply and Demand:

This section summarises the characteristics of the region's surface and ground waters. It identifies understandings of the effects of current land use and the potential for future demand from both agricultural, industrial and urban demands. It also provides commentary on the reasonably foreseeable effects of climate change on both supply and demand

- Waikato region has a diverse geology and topography and land use that creates spatial differences in water yields.

Surface waters

- The total regional surface water use (including irrigation) is 1.7 million m³ per day. Nearly half of this is for irrigation of pasture and crops.
- Regular monitoring of the water quality of surface waters provides an indication of catchment responses to the past and current uses, and of the success of the present water management regime. The results are not encouraging as they show a decline in water quality highlighting the need for a change in the way water is managed, and by implication, the way land is used throughout the region.
- These worsening surface water conditions, particularly for total nitrogen, indicate that in some catchments our past (and by extension current) water management is not working. This is not because of a lack of ambition, it is because we are now approaching real ecological limits and we are effectively asking more of our fresh water ecosystem services than ever before.
- The current regulatory approach of the RMA has worked well when managing activities (take and discharges) directly to water. We now need to manage the fresh water resource indirectly by managing land uses. This will require a new approach.
- Lake Taupō is a significant natural storage of surface water for the Waikato River catchment. No similar surface water storage influences the Hauraki Plains river systems.
- The headwaters of the Waihou river in the east of the Hauraki plains is supplied year round by pristine spring waters flowing from and through the Mamaku Plateau
- The quality of Waikato region's surface waters have changed over the last 20 years, despite point source discharges being rigorously controlled. Most notable is an increase in total nitrogen from most sites, an indicator of rural intensification.
- Of particular concern is the time lag it takes for the effects of land use intensification to become measurable in the region's surface waters. It is understood that this may be in the order of many decades, meaning that the diffuse source of nutrient contaminants to surface waters reflect the activities of last century. This means that there is a considerable 'load to come' (see Legacy Issues in the demand section).
- Seasonality is important for water use. Most of the region's surface waters are at or near full allocation during the summer with less allocation stress during the cooler winter months.
- For different reasons, the Lake Taupō catchment (Hydroelectric generation) and the Piako/Waitoa catchment (cumulative effects of permitted activities associated with pastoral farming) surface water systems are fully allocated all year round.

Cross boundary waters

- Lake Taupō receives an annual 20 per cent increase in flow from the diverted waters of the Whanganui and Ranganui catchments through the Tongariro Power Scheme.
- Water is collected from the:
 - western side of Ruapehu, Ngauruhoe and Tongariro mountains that originally formed the catchment of the Whanganui river
 - southern side of Mt Ruapehu that originally formed part of the Whangaehu catchment
 - eastern sides of the three mountains that originally contributed to Tongariro River (this water is the only component that would historically have contributed to the Waikato region)
 - western side of the Kaimanawa Ranges that historically drained into the Ranganui catchment via the Moawhango River and Mangaio Stream.
- The Kawa aquifer is critical to the continuation of horticulture and in particular market gardens that spans the Northern Waikato / Auckland regional boundary in the vicinity of Pukehohe
- The Mamaku plateau is a considerable source of spring waters to both the Waihou River and potentially to streams in the western Bay of Plenty.
- In addition to the 'hidden' water embodied in the export products from the region, water directly leaves the Waikato River catchment in the north of the region from three consented activities:
 - Watercare's take from the Waikato river at Tuakau;
 - Watercare's dams on the south side of the Hunua ranges; and

Role of wetlands

- 95 per cent of the region's wetlands have been drained for pastoral agriculture, typically these were groundwater discharge zones which would have attenuated catchment responses to high flows and land derived contributions to estuaries and coastal waters.
- The interconnections between surface water and groundwater and the role of wetlands across the region are not well understood and require further work to determine spatial implications.
- Seepages and small and ephemeral wetlands support unique flora and fauna and provide a range of ecosystem services. These can include:
 - denitrification (reducing nitrate levels in surface waters)
 - carbon sequestration (via the accumulation of plant matter)
 - filtration and storage of particulates from surface flows (including organic and inorganic matter, as well as phosphorus and bacteria)
 - attenuation of surface water flows (via direct adsorption from rainfall, and adsorption via interception of surface flows).
- The value of the ecosystem services provided by seepages and small and ephemeral wetlands in upper catchment valleys has not yet been quantified, regionally or nationally, presenting a significant knowledge gap.
- The ability of small wetlands in the upper reaches of water catchments to delay the release of intercepted and stored water in times of stress (drought) has been inferred from anecdotal observations by landowners.

- All these benefits of wetlands contribute to increasing the resilience of catchments to projected climate impacts.

Climate change influences on freshwater supply

- Climate change projections are expected to change the frequency, location and intensity of rainfall globally, nationally and within the region. This will change the viability (costs and potentially location) of water dependant activities.
- Climate change projections of sea level rise indicate a decrease in the region's fresh water resources in the lower reaches of major river systems, particularly in the Hauraki plains.
- Sea level rise will place current infrastructure at risk and prompt the inland migration of the coastal marine area. This will require a transition of the boundary between fresh water and the coastal marine area and a spatial reduction of the regional fresh water resource.
- Projected changes in meteorological conditions include an expectation of less rainfall across the region overall, but the rainfall we do receive will arrive quickly in the south and west of the region and in the Coromandel ranges.
- Projected climate change conditions suggest receiving water bodies may be less able to assimilate the effects of contaminants to water bodies in the future as warmer waters hold less dissolved gasses (e.g. oxygen). This may be interpreted as more in situ demand from the water body.
- Land use change that reduces the buffering and flow attenuating ability of deeply rooted trees and substitutes that for shallow rooted pastures, deprives the remainder of the catchment of resilience to projected changes in climate (both flood and drought events).

Catchment influences

- Catchment responses to meteorological events have changed and are dynamic. The changes in catchment responses from past land use changes and to intensification of present uses are not likely to have reached equilibrium and the effects are not fully understood. This is compounded by the projected future effects of climate change and the future distribution of rainfall.
- Increased land use intensification (rural and urban) have degraded the quality and changed the habitats of lowland waterways to the extent that many are no longer fit for swimming and as sources of food and ability to maintain conditions for life. This compromises our international environmental credentials and our increasingly valuable tourism industry

Groundwaters

- Groundwater is largely derived from rainwater that has travelled through the soil to underground aquifers, making up approximately 90% of the region's freshwater resource.
- Groundwater and surface water are recognised as different bodies of the same resource. Until a better understanding of the linkages between the two water bodies are known and uncertainty reduced the allocation from groundwater is conservative.
- When too much groundwater is taken:
 - the level of the groundwater left (water table) is lowered;

- springs and seeps can dry up with less water flowing into streams (during extended dry periods, the base flow of streams are maintained by groundwaters);
- land may subside;
- increasing competition for use

Historic (legacy) demand

- There is an ongoing requirement for water to be available at times of low flow to provide for the assimilation of diffuse nutrient inputs from historic land use change and land use intensification.
- The impact and future duration of the demand will need to be modelled geographically in combination with other projected variables such as future precipitation to estimate the extent of this 'locked in' demand.
- This historical use will create an ongoing legacy affecting future assimilative capacity

Current demand

- The current regulatory allocation regime does allow for transfers of allocated water, but this is bureaucratic and infrequent with the best example coming from the matching of water requirements from the industries clustered at Waitoa.
- Seasonality is important – both for irrigation and in situ uses. When working to limits it is important to consider the intra-annual variability and address 'worst-case' situations rather than manage/allocate on the basis of annual averages.
- The demand for high in situ water quality is often seen as a constraint on pastoral farming. But this need not be the case if the product is high quality and targeted to high value markets. It appears it is more a constraint to high volume commodity production.
- Auckland receives 60 per cent of its annual water supply from the Waikato catchment – 37 per cent from the Mangatangi and Mangatawhiri dams and a further 23 per cent from the Waikato River.

Future demand

- If behaviour change for water doesn't change more water will be required to support current and projected population growth in Auckland.
- Tourism is one of New Zealand's largest export industries, second only to the dairy industry in terms of foreign exchange earnings. It directly employs 4.7 per cent of the New Zealand workforce and indirectly employs a further 3.1 per cent.
- New Waikato tourism Plan includes its premier Game changer based on the Waikato River, including:
 - Improving visibility and accessibility, and a
 - focus on water based activities and river edge accommodation.
- Increased expectation of safe water experiences, including navigability of the Waikato river

- Demand for water can also be expected to change with a changing climate. This may initially be in the form of businesses seeking to re-establish historic rainfall patterns through make up irrigation.
- Due to the time lag between effects from land use change and current use intensification, there will be a legacy of demand for in situ assimilation capacity into the future. The magnitude of this is unknown.
- Asymmetric population growth within the Waikato region will alter future demand for water with those rapidly expanding populations (Hamilton City, Waikato and Waipa Districts) needing to become ever more efficient with use and those with decreasing populations becoming challenged by the increasing costs of servicing fewer people.
- Expansion of Auckland urban areas into the Pukekohe area is already displacing market gardening into the Matamata area with the expectations of increasing population and for municipalities supplying potable water and water for industries. A waste water assimilative demand could also be anticipated.
- High and increasing costs of doing business in Auckland along with high population growth have created conditions for businesses to investigate relocation to the Waikato region where reverse sensitivity issues can be more cost-effectively managed. Investment will increase demand on water resources.

