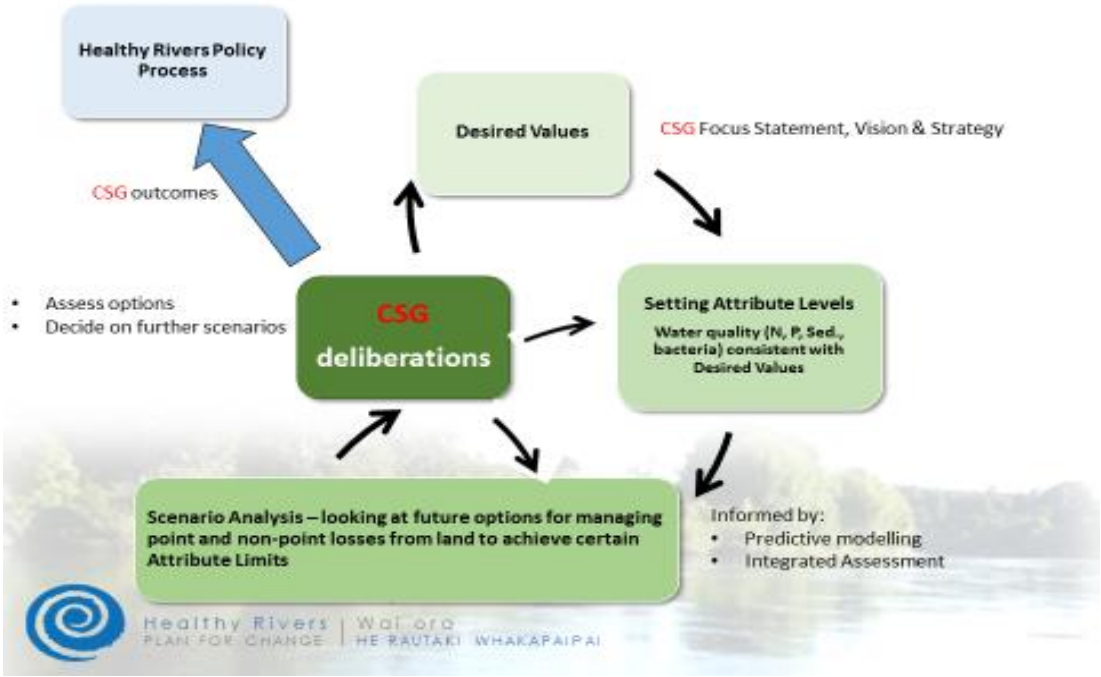
Healthy Rivers PLAN FOR CHANGE | Wai ora HE RAUTAKI WHAKAPAIPAI

Memo

Date:	24 August 2015
To:	The Collaborative Stakeholder Group
From:	Bryce Cooper, Chair, Technical Leaders Group
Subject:	Scenario modelling

The diagram below will be familiar to CSG members and provides a useful reminder of where we are at in the process. The attached draft report from Doole et al provides modelling outputs from the first set of scenarios developed by the CSG and provides the CSG with information to explore future options and their implications. As envisaged and as depicted in the diagram, this process is an iterative one with the CSG deliberations likely to lead to further scenarios being modelled and deliberated on before an agreed 'solution space' is reached.



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Before you read the draft report here are some things you might want to know:

1. The modelling described in the report has brought together much of the work of the TLG to date, combining the contributions and knowledge of numerous scientists and sector experts.
   As examples, it incorporates:
   - Updated data on farm costs and profit provided by the sectors
   - Updated data on mitigation options and their costs
   - Updated understanding of historic land use changes
   - Improved knowledge of groundwater age, nitrogen attenuation and lags
   - Calibrated catchment models developed for N, P, sediment, and *E.coli*
   - Calibrated models that link chlorophyll with nutrients and their ratios in a way that reflects our improved understanding of these dependencies
   - Calibrated models that link clarity with sediment and chlorophyll

2. Due to timing, we are aware that the CSG has not received TLG presentations on all of the technical work above that has been incorporated 'under the hood' of the scenario model.
   Likewise, not all related technical reports are yet ready for release to the CSG. Typically, draft technical reports have been provided and reviewed by TLG (or TLG-appointed reviewers) and review comments are with the authors for report finalisation and then TLG approval for release. No 'red flags' exist.

3. The TLG is confident we have a 'fit-for-purpose' modelling framework for exploring scenarios and assisting the CSG in its deliberations.
   The models use best available data, updated knowledge on system responses, have been appropriately calibrated (where that is possible), and operate at appropriate time and space scales.

4. The models have uncertainty associated with them and that needs to be recognised when interpreting the outputs (i.e., do not extend beyond their 'fit purpose').
   Models are imperfect representations of reality. In the scenario modelling there are various assumptions made, there is variability around the relationships used, and there is 'lumping' of processes that we know operate at shorter time-scales and finer spatial scales. This results in uncertainty associated with the model outputs but that does not invalidate their use. Once we have feedback from the CSG on scenarios they would like to further explore we will determine the sensitivity of key model outputs to variation in model inputs. This is normal procedure.

5. Model outputs provide important comparative signals on the nature of the changes required to meet water quality attribute limits, the locations of change, the relative magnitudes of change between scenarios, and the potential economic implications of those changes.
   [Note: the modelling represents where change has to occur but not where costs fall].

6. The modelling analysis was carried out at the scale of 74 sub-catchments across the Waikato and Waipa catchment, with most of those sub-catchments having a monitoring site at their downstream point thereby allowing the water quality predicted in the scenarios to be compared with current state. In addition to predicting contaminant losses from the distribution of land use and land management within the sub-catchments, 24 point sources from both industrial and municipal sources are included.

7. The scenario modelling was initially conducted using a constrained land-use change approach, informed by past changes. This is technically justifiable and realistic. Given that this approach fell short of meeting some of the water quality attribute limits in the scenarios, the model was also run in an unconstrained mode, where the model can change land-use as much as required in an attempt to search out an optimal mix to meet the scenario limits.

8. Three high level conclusions can be drawn from the scenario modelling (detail in the report itself):
   - Some of the water quality attribute limits in some of the initial scenarios are unlikely to be met with currently available mitigation tools and constrained land use change.
     (i.e., the 'tool box' has been emptied)
   - The costs for the more aspirational water quality scenarios are high.
     These costs arise from de-intensification of some land uses, land use change, point source improvements, and implementation of edge-of-field mitigations. CSG's decision making will be guided by the Policy Selection Criteria, which enables a deliberate discussion on a set of criteria wider than cost and allows for a weighing up of indicators that can't be measured in the same terms (i.e. numbers vs. narrative).
   - Improved water quality outcomes arise from using an unconstrained land use change version of the model but the changes appear unrealistic.
     The unconstrained model predicts afforestation of 400,000 ha of pastoral land (evenly split between dairy and dry-stock), with forestry reaching 70% of the total land area.

9. The scenario modelling is there to help the CSG. We believe the report has included the key outputs from the modelling that will help the CSG in its deliberations. We look forward to working through this with you at CSG#15 on Wednesday.