BEFORE THE PROPOSED NATURAL RESOURCES PLAN HEARINGS PANEL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of Water allocation
AND	
IN THE MATTER	of the submissions and further submissions set out in the S42A Officer Report

---

SUPPLEMENTARY EVIDENCE OF DR MARK GYOPARI AND MR BRYDON HUGHES ON BEHALF OF WELLINGTON REGIONAL COUNCIL

TECHNICAL – Water allocation

20 November 2017

TABLE OF CONTENTS

1. INTRODUCTION 3
2. CODE OF CONDUCT 3
3. SCOPE 3
4. ASSESSMENT 3
5. CONCLUSION 5

1. INTRODUCTION

1.1 Our names are Dr Mark Gyopari and Mr Brydon Hughes. Our qualifications and experience were detailed in our statement of primary evidence for Water allocation dated 7 August 2017.

2. CODE OF CONDUCT

2.1 We confirm that we have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note and that we agree to comply with the code. Our evidence in this statement is within our area of expertise. We have not omitted to consider material facts known to us that might alter to detract from the opinions which we express.

3. SCOPE

3.1 We have been asked to provide evidence in response to Mr Williamson's suggested checklist (Table 5 of Mr Williamson's Statement of Evidence dated 28 August 2017).

4. ASSESSMENT

4.1 The proposed reclassification schedule provided by Mr Williamson is a prescriptive matrix scoring approach which individually weights factors that potentially indicate and influence the degree of hydraulic connection at a particular location according to a fixed scoring system. Such a fixed scoring system is considered too subjective given the often uncertain nature of information available to characterise a particular physical setting. The scoring matrix also does not address inevitable information gaps necessary to score a particular factor.

4.2 We therefore consider the scoring system to be too simplistic because it restricts more integrated professional judgement through balancing relevant contextual considerations and dealing with data deficiencies/gaps and uncertainties. Many hydrogeological environments in the region are highly heterogeneous and geologically complex - the scoring system is unable to address the associated uncertainty in the depletion analysis.

4.3 Stream depletion effects in any given hydrogeological environment reflect the combined influence of a range of factors which vary in significance in different hydrogeological settings. For example, the location, duration and rate of pumping can have a significant influence on the potential nature of stream depletion effects in some settings, whereas in others the physical and hydraulic characteristics of the geological environment can have greater influence. In addition, in many locations, there is limited information available to characterise the physical environment. As a result, there may be limited data to determine the appropriate weighting for an individual characteristic taking into account the potential uncertainty of available data. The uncertainty in data and analysis can

be particularly high where the geological environment exhibits heterogeneity.

4.4 As an alternative to a fixed scoring system, it is suggested that development of a conceptual hydrogeological model should form the basis of any assessment of hydraulic connectivity and potential stream depletion. Such a model would be developed on the basis of a similar range of physical and hydraulic factors but with each factor weighted to reflect its potential importance in the hydrogeological setting being assessed. This hydrogeological model would then inform application of appropriate analytical or numerical modelling to quantify potential stream depletion effects whilst also taking into account the potential uncertainty associated with heterogeneity of the geological environment at a relevant scale.

4.5 The table below provides the information that can be used to inform the conceptual model. Note that the individual factors listed are largely consistent with those proposed by Mr Williamson. The main point of difference is that the factors listed are intended to inform a conceptual hydrogeological model developed that recognises their importance in terms of potential stream depletion in a particular hydrogeological setting and allows for professional judgement where there is uncertainty, rather than assigning each an arbitrary weighting.

Proposed information requirements for evaluation of the streamflow depletion characteristics in order to change the classification of an individual groundwater take
Assessment of potential streamflow depletion characteristics and appropriate hydraulic connectivity classification for an individual groundwater take will be informed by development of a conceptual model which considers the hydrogeological and surface water context at a scale appropriate to the size of the abstraction. The conceptual hydrogeological model will be utilised as the basis to quantify the potential magnitude of streamflow depletion effects resulting from a proposed groundwater abstraction using either a numerical model or approved analytical model. The model should be cognisant of the sensitivity of the depletion assessment to observed geological heterogeneity. Considerations inherent in the assessment may include (but not be limited to): • Local and sub-catchment geology and hydrogeological environments; • Relative groundwater and surface water levels and temporal/spatial variation; • Mapping of groundwater flow nets; • Characterisation of the local and sub-regional groundwater environment including a conceptual or quantitative water balance; • Aquifer hydraulic response to pumping including evaluation of aquifer properties and any aquifer boundary and leakage effects derived from pumping test data collected in accordance with Schedule T; • Surface water hydrology (gauged losses/gains and temporal/spatial variability, flow statistics); • Measurement of streambed conductance, spatial variability or use of GWRC's mapped streambed parameters; • Hydrochemical and/or water quality data to assist conceptual model development.

5. CONCLUSION

5.1 Our evidence provides recommendations regarding Mr Williamson's suggested checklist (Table 5 of Mr Williamson's Statement of Evidence).