Presentation Notes Ms Karen Wilson

Monday 22 May 2017

Proposed Southland Water and Land Plan hearing

Slide 1 – Application of physiographics

Reference:

Relates to para 3.116 - 3.117 in S42A report.

Hughes, B, Wilson K, Rissmann, C and Rodway, E (2016). *Physiographics of Southland: Development and application of a classification system for managing land use effects on water quality in Southland.* Environment Southland publication 2016/11. 117p. [Chapters 1 and 5]

A water quality risk assessment framework was developed to assist land managers in identifying appropriate mitigations to reduce the effects of land use on water quality in the Southland region. Some important to notes about the water quality risk assessment are:

- The assessment is qualitative. This means that risk is assessed in comparison to other parts of Southland.
- Water quality refers to nitrogen, phosphorus, sediment and microbes. Other contaminants, such as heavy metals and hydrocarbons, were not considered in the risk assessment.
- This is a risk assessment so assesses potential water quality outcomes rather than predicting actual water quality. The realisation of water quality risk is dependent on land use.

Slide 2 – Classification system

Reference:

Relates to para 3.117 - 3.119 in S42A report.

Hughes, B, Wilson K, Rissmann, C and Rodway, E (2016). *Physiographics of Southland: Development and application of a classification system for managing land use effects on water quality in Southland.* Environment Southland publication 2016/11. 117p. [Chapters 6, 7 and 8]

The classification system that we applied the water quality risk assessment to is made up of 9 physiographic zones and 8 variants. The physiographic zones represent land areas that share similar landscape attributes that control water quality outcomes. These landscape attributes include things like geology, soil drainage, climate, and topography. A distinguishing feature of the physiographics is that it considers how the combination of these attributes affects water quality and water composition.
Within the physiographic zones, variants have been used to identify areas where there is additional water quality risk when soils are wet. In essence, the variants represent localised areas where there is additional risk of overland flow or artificial drainage at certain times of year.

Slide 3 – Water quality risk

Reference:

Relates to para 3.120 - 3.125 in S42A report.

Hughes, B, Wilson K, Rissmann, C and Rodway, E (2016). *Physiographics of Southland: Development and application of a classification system for managing land use effects on water quality in Southland.* Environment Southland publication 2016/11. 117p. [Chapter 3]

To assess water quality risk, we asked ourselves two key questions:

- What drainage pathways do contaminants use to move through the landscape,
- What natural processes can affect contaminants as they move through the landscape?

We identified 4 key drainage pathways; namely:

- overland flow, which is also referred to as surface runoff;
- artificial drainage which includes mole, piped and open drains;
- lateral flow which is water moving laterally through, or immediately below the soil profile; and,
- deep drainage which refers to water moving down through the soil profile into underlying aquifers. We considered 2 types of deep drainage: matrix flow and natural bypass flow. Natural bypass flow occurs when water moves through macropores, such as cracks and worm holes, effectively bypassing much of the soil matrix.

For natural processes, we grouped these into two types:

- we looked at dilution potential, which can reduce contaminant concentrations but does not influence loads. For this we considered both water flux (i.e. the volume of water) and mixing (i.e. ratios of water derived from local and distal sources).
- The second type was attenuation processes. As Dr Rissmann discussed, an important attenuation process is redox, which can reduce nitrate concentrations and loads through denitrification. However redox can increase dissolved phosphorus concentrations under certain conditions. The other attenuation process we considered was filtration and sorption. This can reduce microbes, sediment and phosphorus but has little effect on nitrogen because it is so soluble.

We did not consider attenuation or dilution processes within surface water receiving environments because this is a water quality *risk* assessment.

Slide 4 – Regional scale maps

Reference:

Relates to para 3.126 in S42A report.

Hughes, B, Wilson K, Rissmann, C and Rodway, E (2016). *Physiographics of Southland: Development and application of a classification system for managing land use effects on water quality in Southland.* Environment Southland publication 2016/11. 117p. [Images are Tables 16, 18 and 20 on pages 36, 38 and 41 respectively]

For each of the 4 drainage pathways, and 3 types of attenuation and dilution processes, regional-scale maps were produced that assessed the likelihood of these occurring at all points across Southland. This slide shows a few of these maps as examples.

Slide 5 – Water quality risk assessment

Reference:

Relates to para 3.127 and Appendix B17 in S42A report.

Hughes, B, Wilson K, Rissmann, C and Rodway, E (2016). *Physiographics of Southland: Development and application of a classification system for managing land use effects on water quality in Southland.* Environment Southland publication 2016/11. 117p. [Table 14 pg 116]

Using the regional-scale maps, and by understanding the characteristics and processes occurring within each physiographic zone, we were able to develop a water quality risk table.

The water quality risk assessment adopted is binary, meaning either a high or low risk was assigned to each zone and variant.

As I explained earlier, the water quality risk assessment was undertaken independent of land use. For instance, the Alpine physiographic zone is identified as having a high risk of nitrogen, phosphorus, sediment and microbial loss from overland flow due to the inherent characteristics of this zone, such has high rainfall, steep slopes, thin soils and so on. Whether the risk is realised will be dependent on land use within this zone.

Slide 6 – Validation

Reference:

Relates to para 3.115 in Section 42A report.

Snelder, T, Hughes, B, Wilson K, and Day, K (2016). *Physiographic Zones for the Southland Region: Classification system validation and testing report.* Prepared for Environment Southland by LWP Ltd, Christchurch. 73p. [Page vii]

Validation of the classification system and associated water quality risk assessment was undertaken independent of Environment Southland.

The key question we asked ourselves was: *are there differences between the physiographic zones and have they been characterised correctly?*

To answer this question, we undertook statistical testing on both the landscape attribute data that had been identified as important in influencing water quality outcomes, and we tested the water quality data itself.

The results showed that for both the landscape attributes and river water quality data, the physiographic zones strongly discriminated the data. Variation in groundwater quality data was less well explained by the physiographic zones however there are several possible reasons for this which Dr Rissmann may which to expand on. This study did not do any testing to try and explain the results found.

We also tested hypothesis developed from the underlying conceptual models for individual physiographic zones and testing showed the results were largely consistent with expectations.