REGIONAL FORUM

People Water and Land – *Te Mana o te Tangata, te Wai, te Whenua*

Physiographics of Southland

26 July 2019

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What is physiographics?

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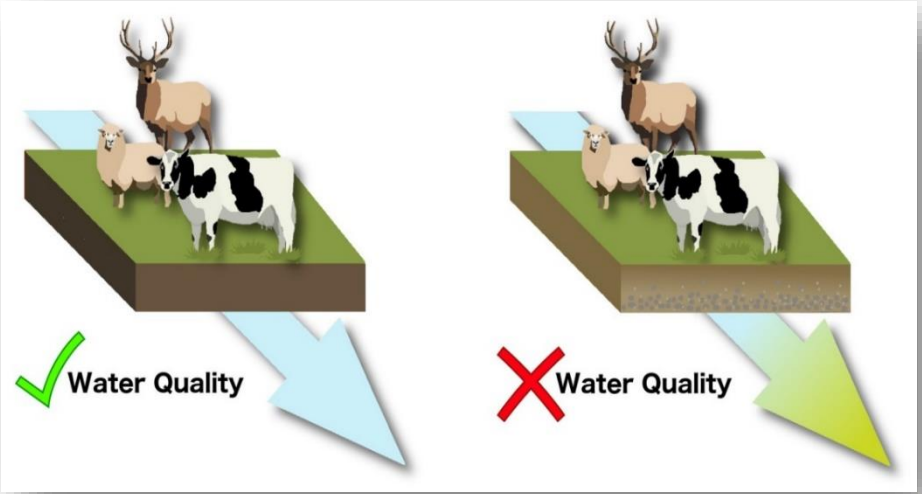
'Systems view' on links between landscape attributes and the main processes determining water quality (or hydrochemistry)



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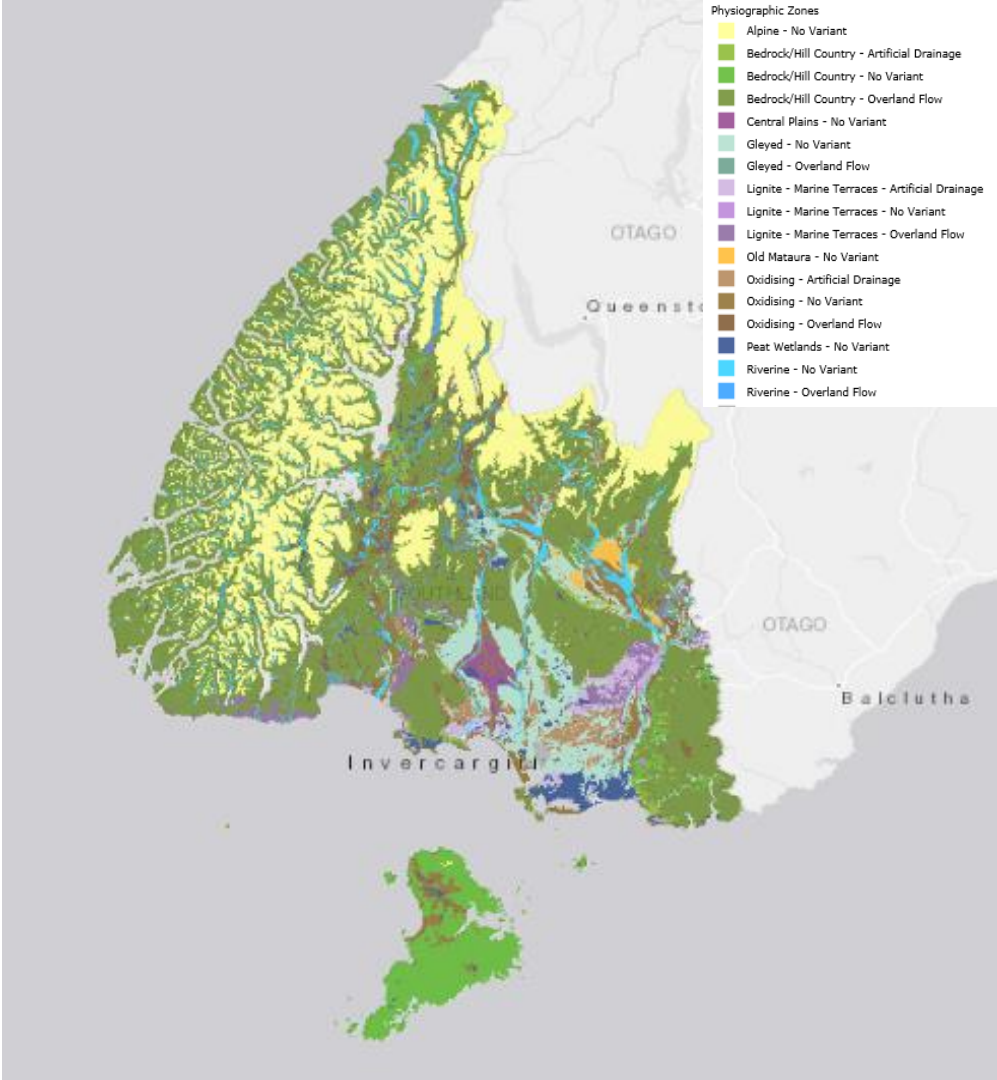
Where it started…

Water quality risk framework for Southland policy to help spatially target land use mitigations



Physiographics is a process…

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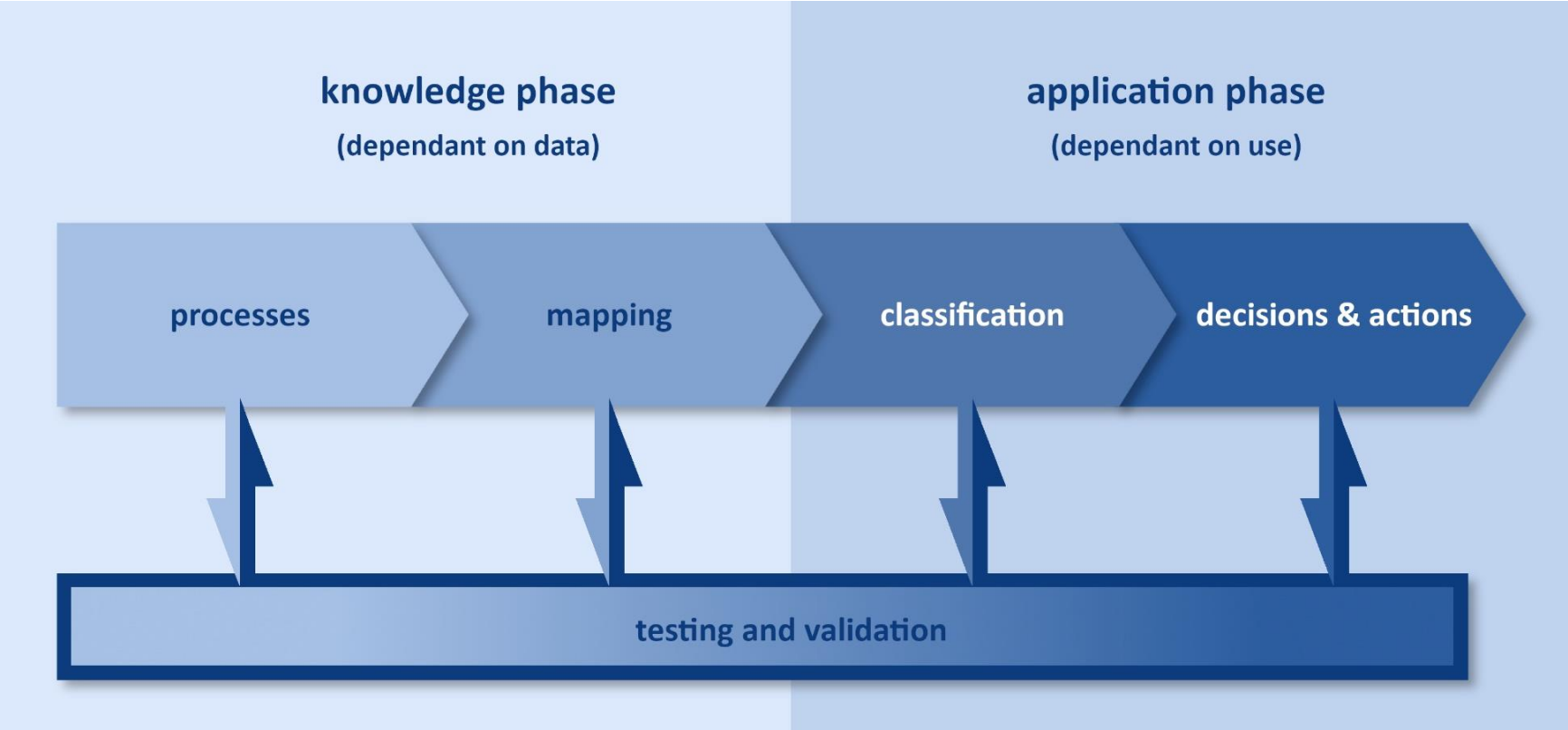

Pathways & attenuation

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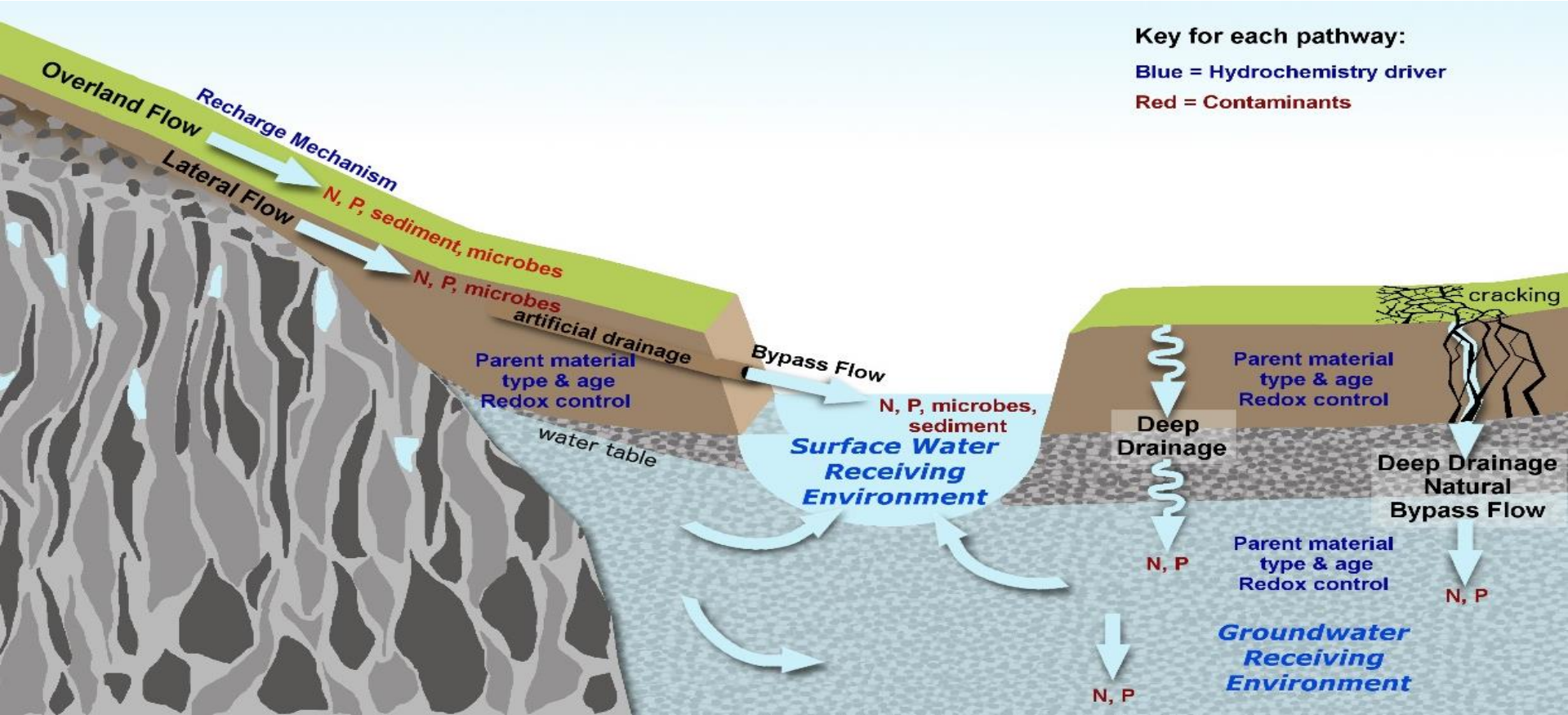

Physiographics use in pSWLP

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- Part of information suite to be considered when managing land use activities (rules)
- Promote GMP through farm plans (FEMPs)

Other uses of physiographics

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- Farmer engagement (Farm Focus Plans)
- Science programme (eg refining models)

Applications of physiographics

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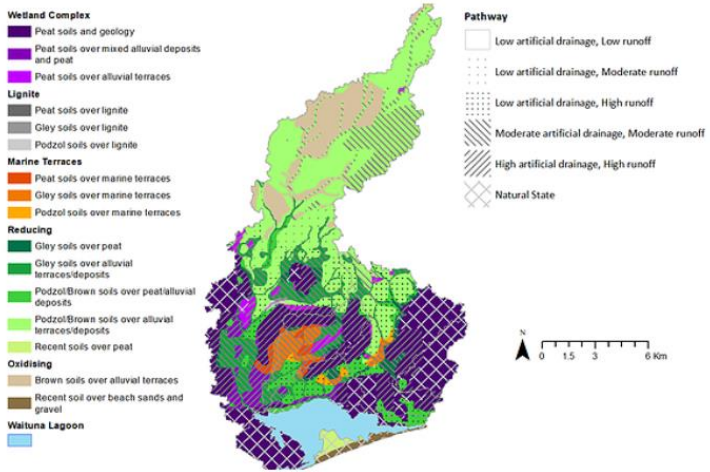
National

Regional

Catchment



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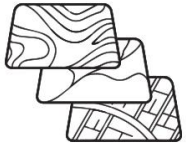
Hydrochemical and Water Quality Data

~30,000 sample results (surface water, groundwater, precipitation, and soil water)

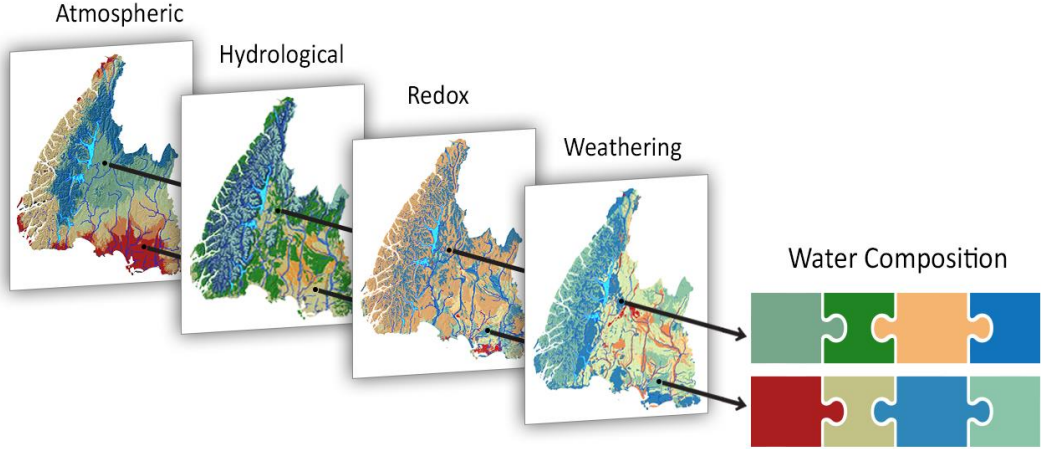
Geospatial Datasets

Elevation, soil, geological, hydrological, land cover, and land use.

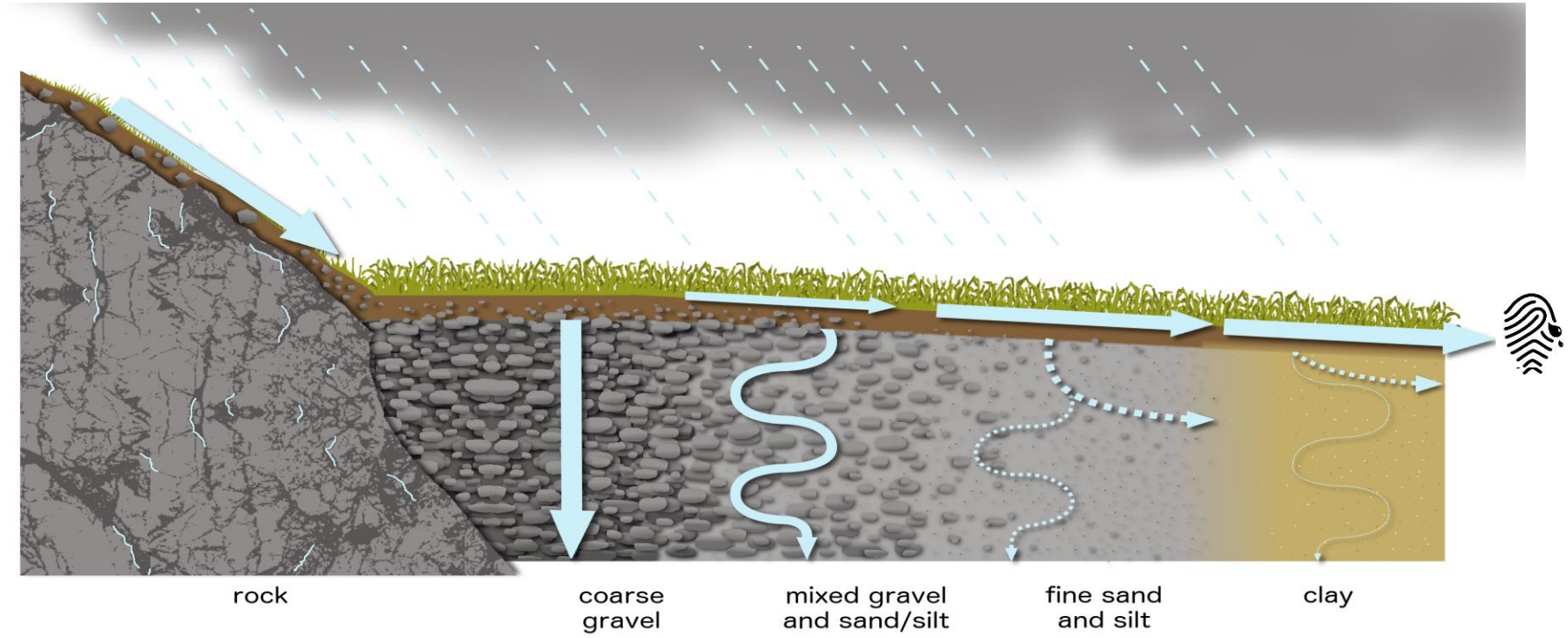


Conceptual Understanding

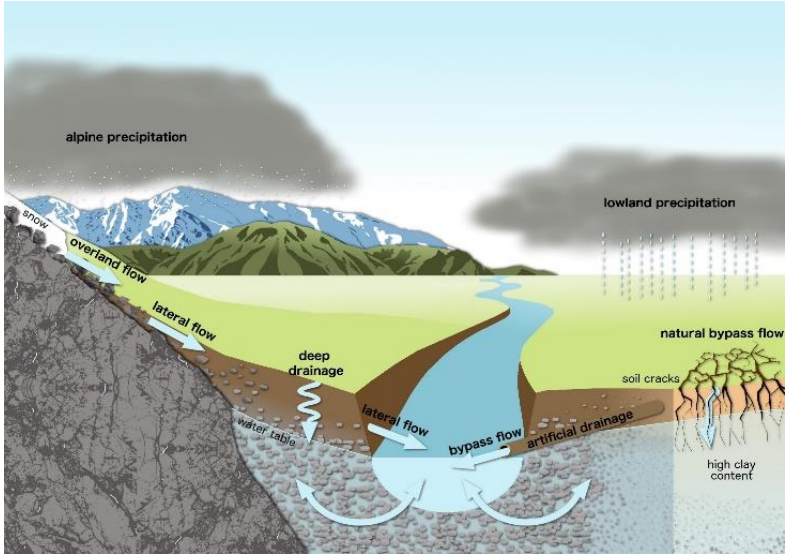
Dominant Process-Attribute Gradient Maps

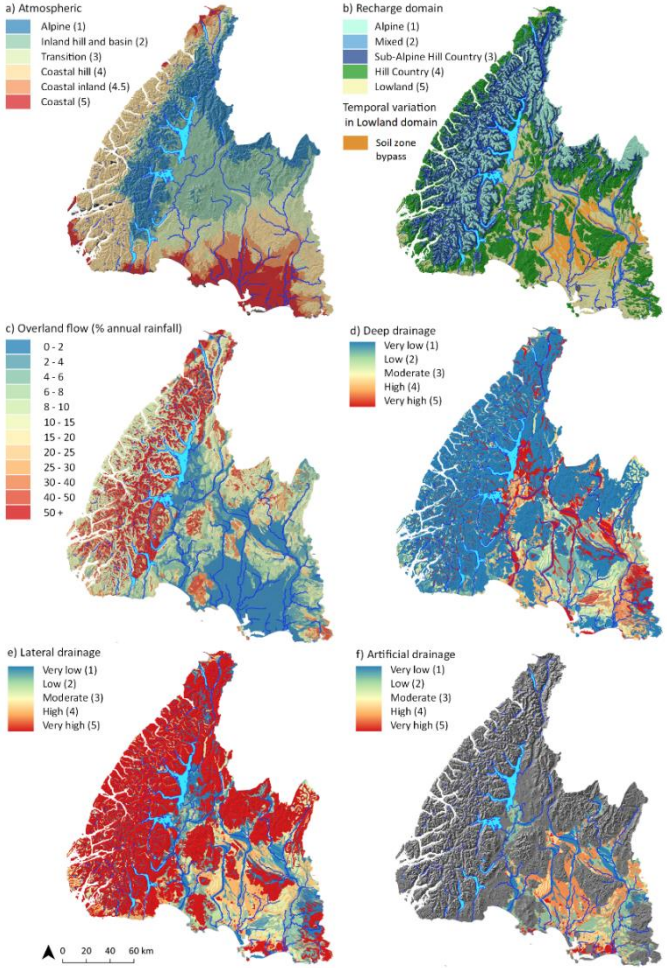


Simplified Hydrological Gradient Concept



Hydrological Process Attribute Gradient maps – regional scale





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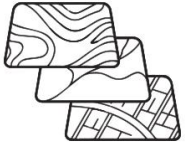

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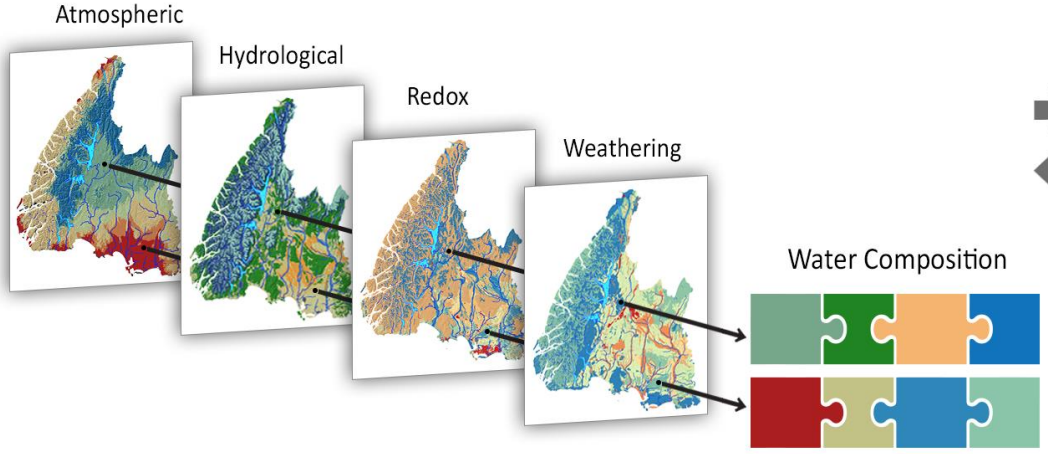


Numerical Model

Machine Defined Symbolic Regression

Estimate steady state water hydrochemical and quality. Tested against 93 long-term surface water monitoring sites comprising of ~7,000 samples.

Examples:

TN = f(LUI, BP, OLF, Atm)

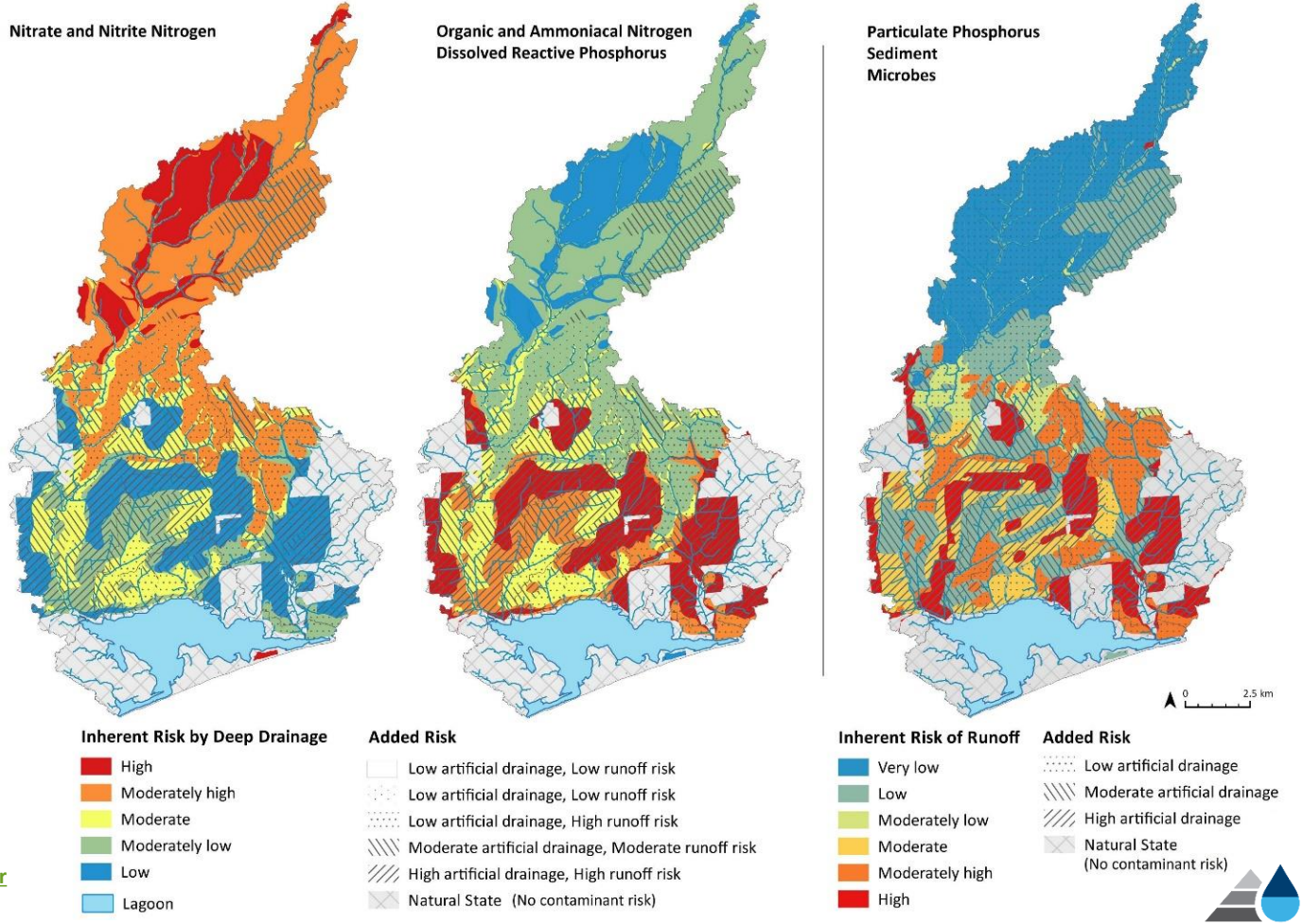
DRP = f(Atm, OLF, BP, GRP, LUI, GANC, DD)

E. *coli* = f(Atm, LUI, RCD, ART, OLF, BP)

Spatial variation in water quality is a function of the landscape and land use

- Built upon landscape data
- High accuracy: x-validated R^2 of 0.81 – 0.95 for TN, NNN, TP, DRP; R^2 of 0.72 – 0.73 for TSS and E.coli
- Using data to reveal the grain of the landscape most important to water quality outcomes

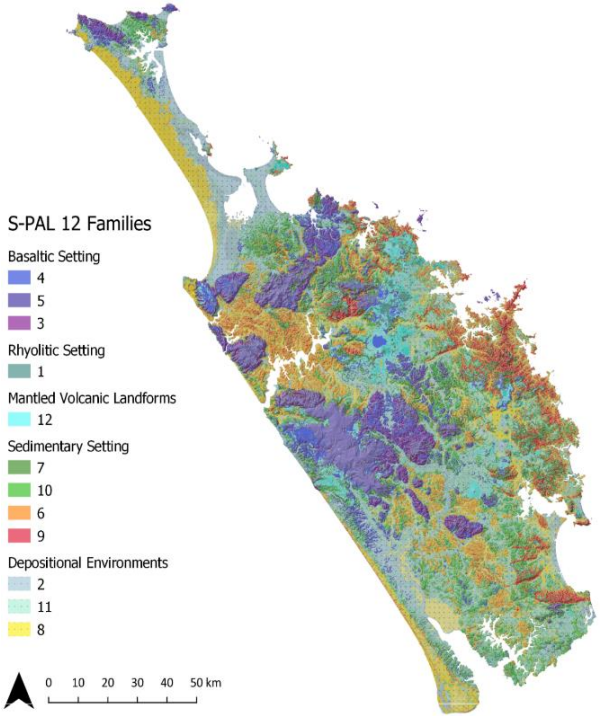
Spatial depiction of landscape controls over water quality - catchment scale

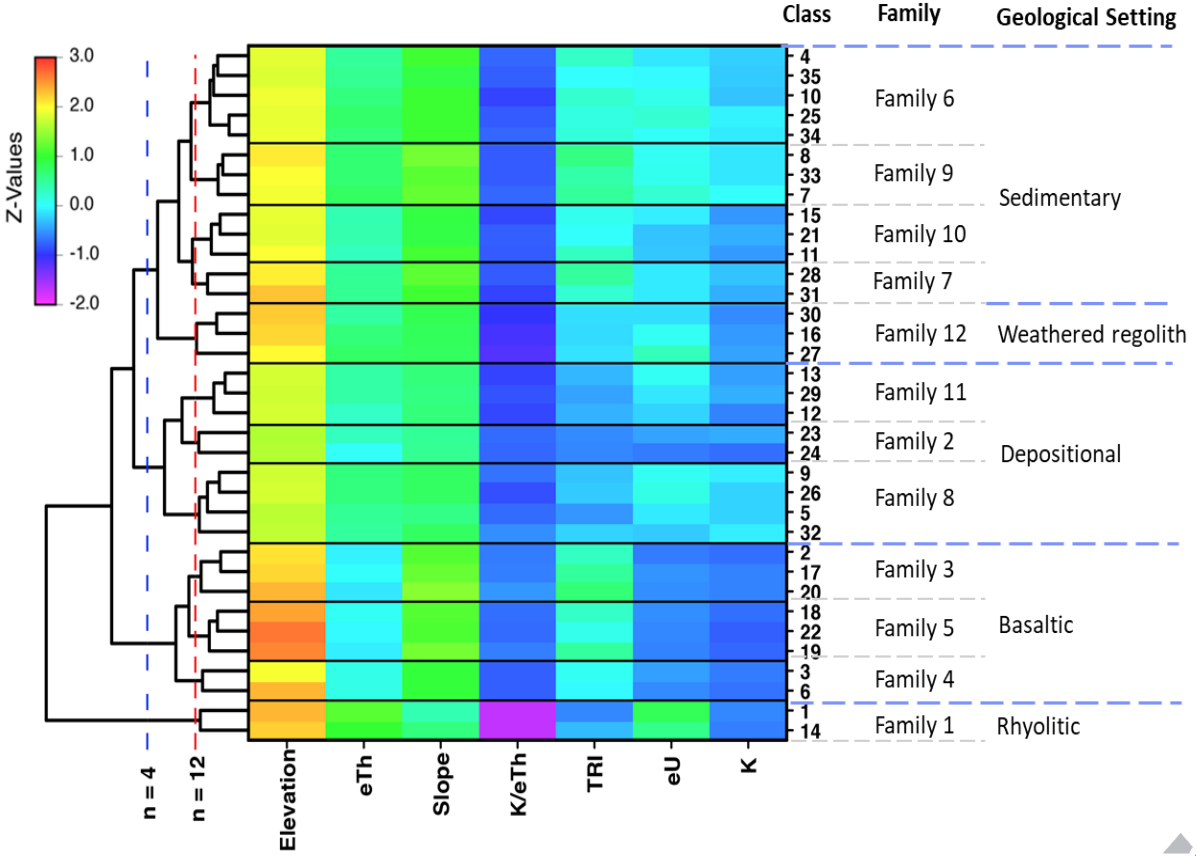


Living Water and Fonterra Co-operative: Tiaki Farm Environment Plans

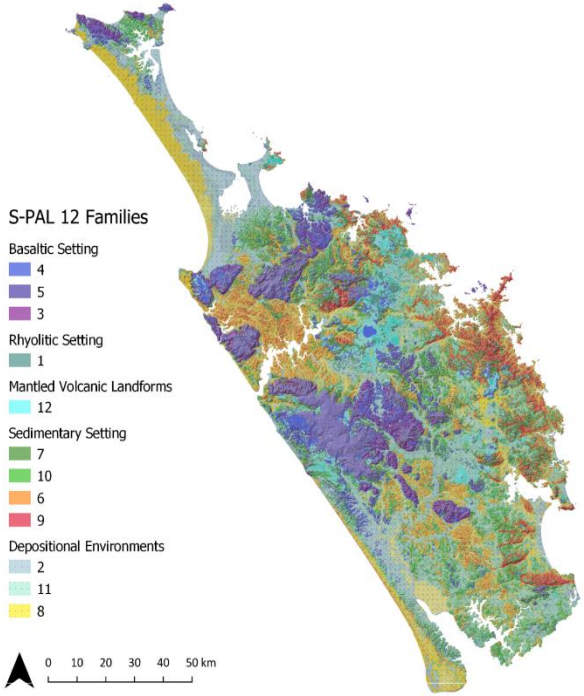
https://www.landwaterscience.co.nz/living-water

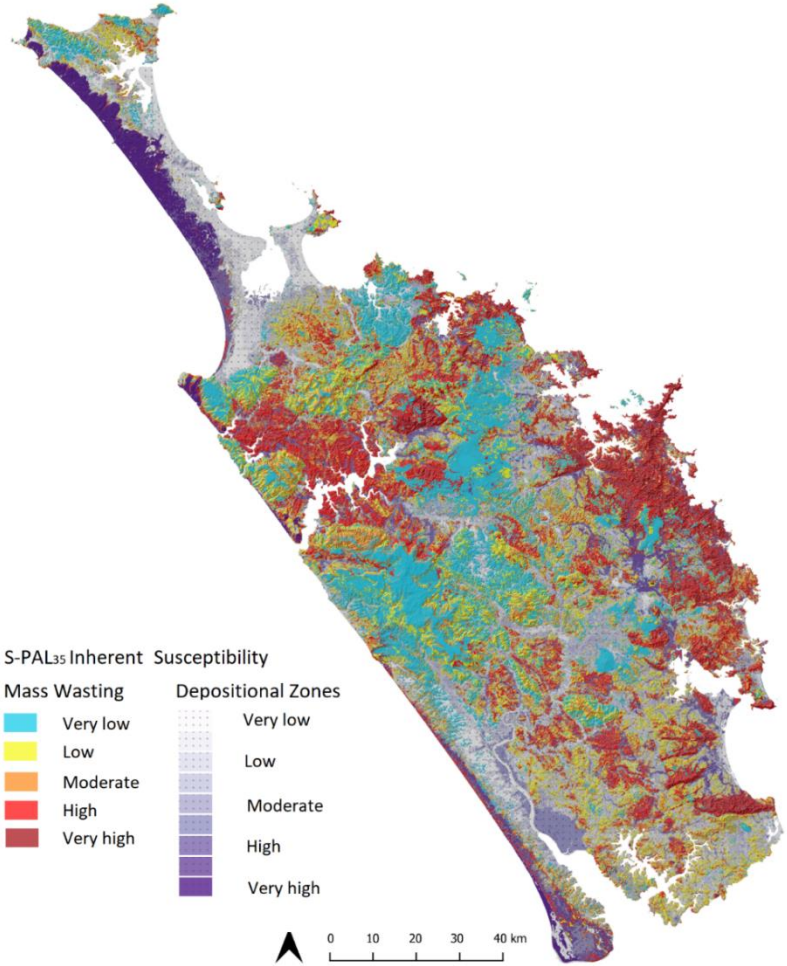
Example of a Genetic Classification for Erosion





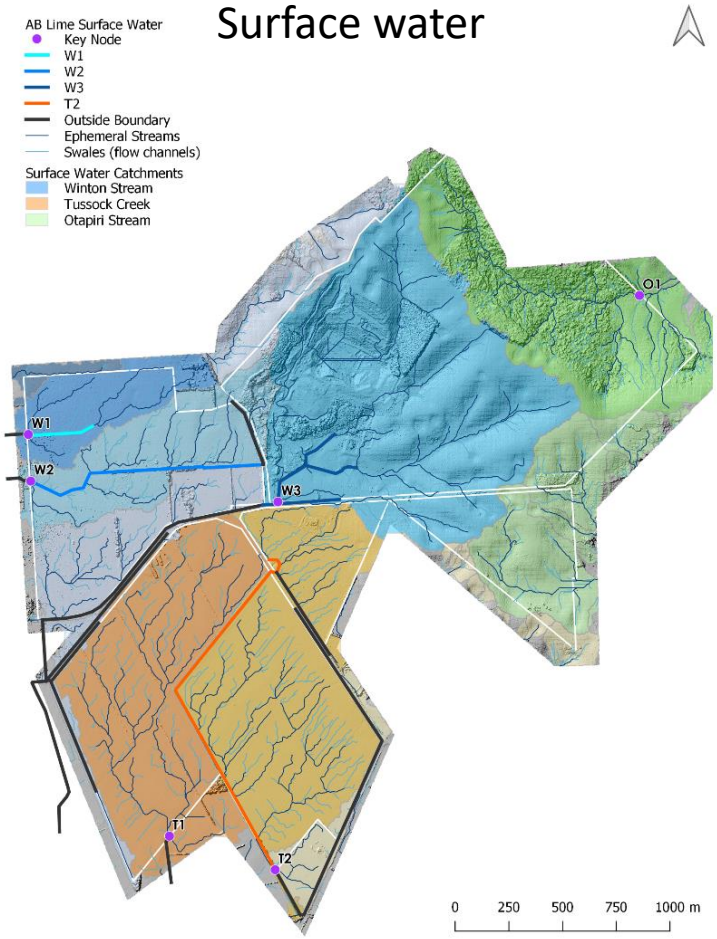
Erosion susceptibility
- Regional Scale



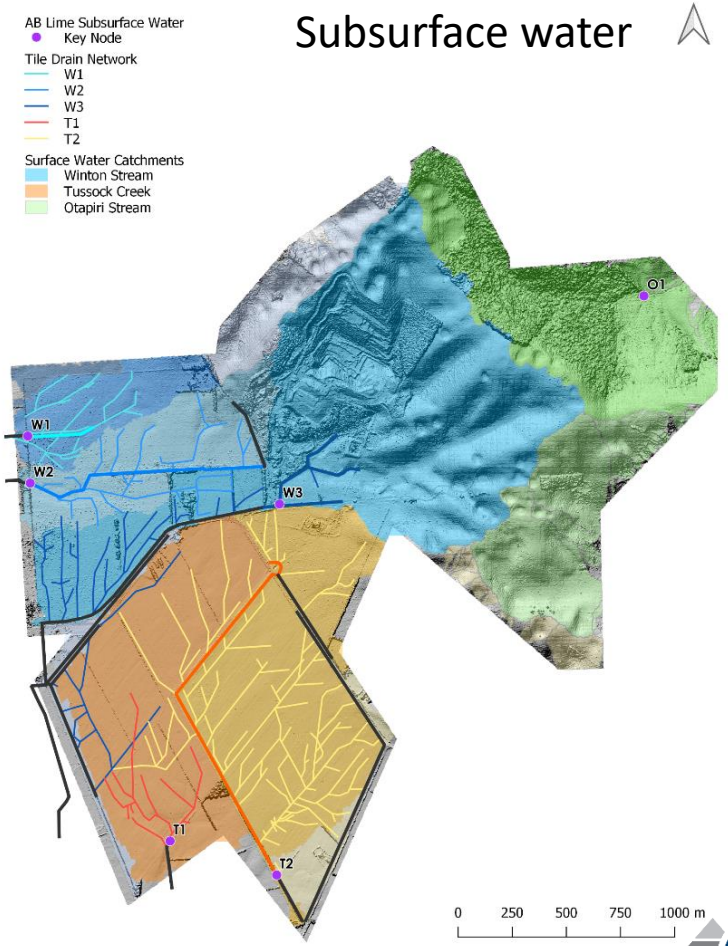


Farm scale

Surface water

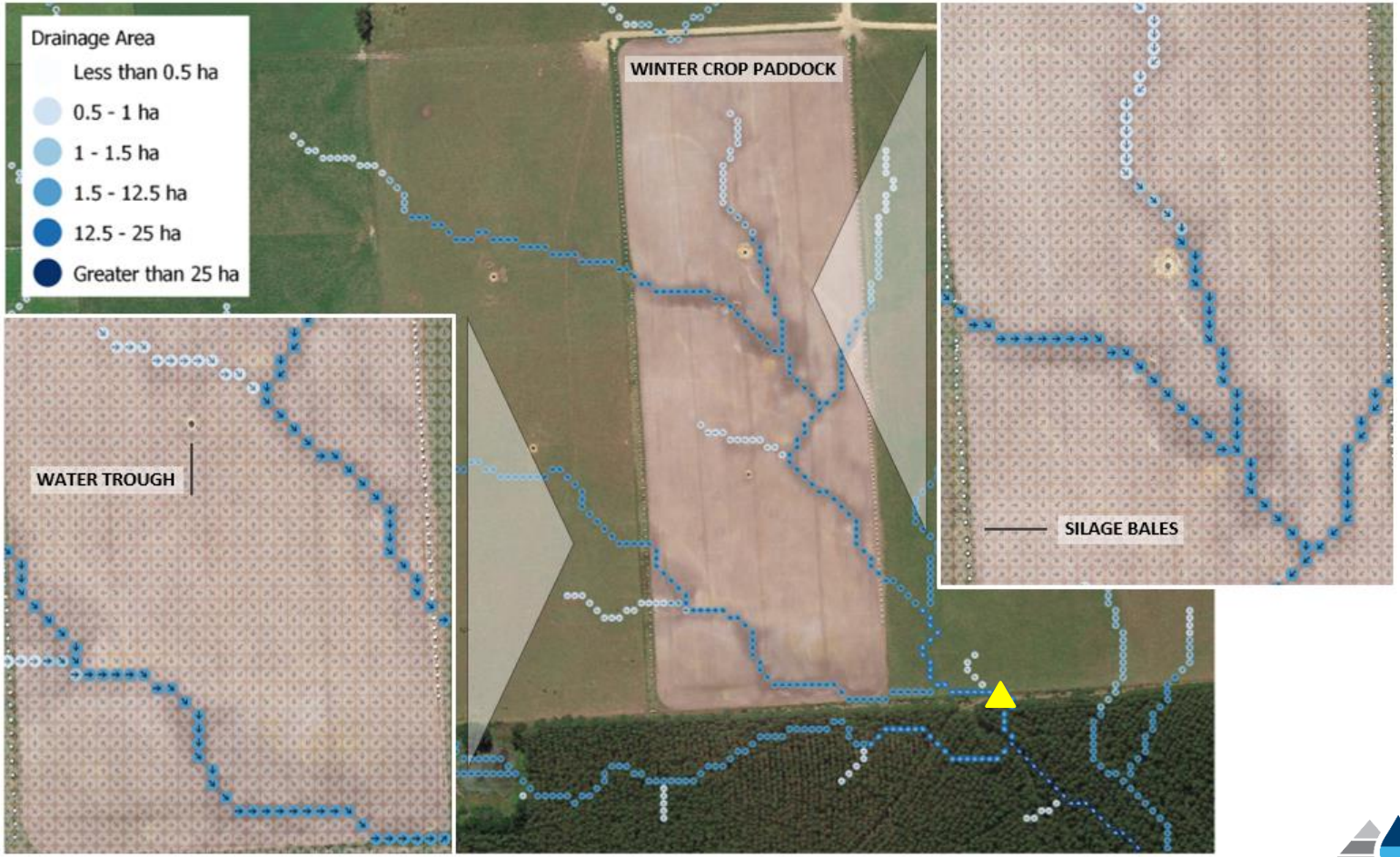


Subsurface water

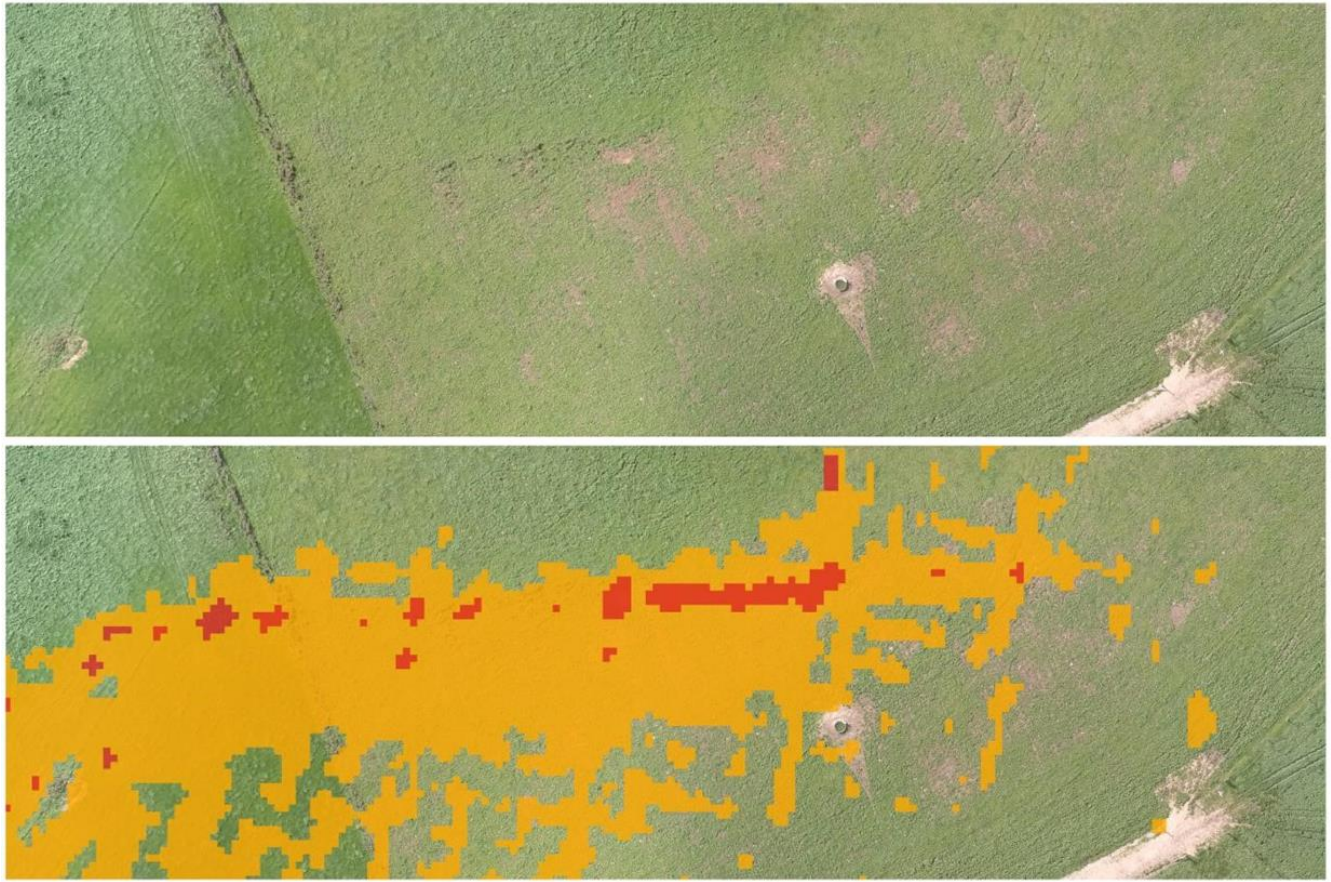


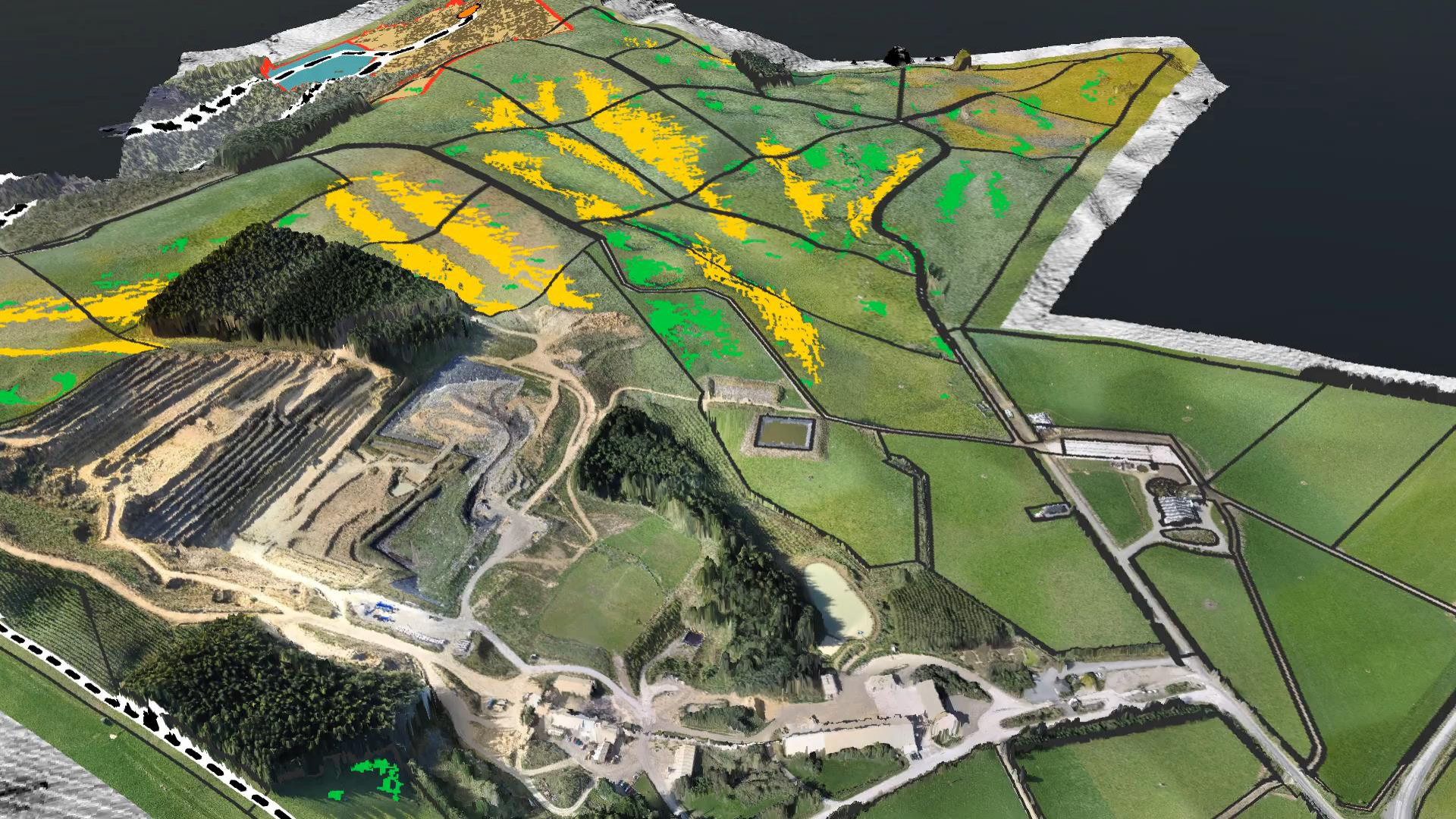
Farm scale

- hydrology



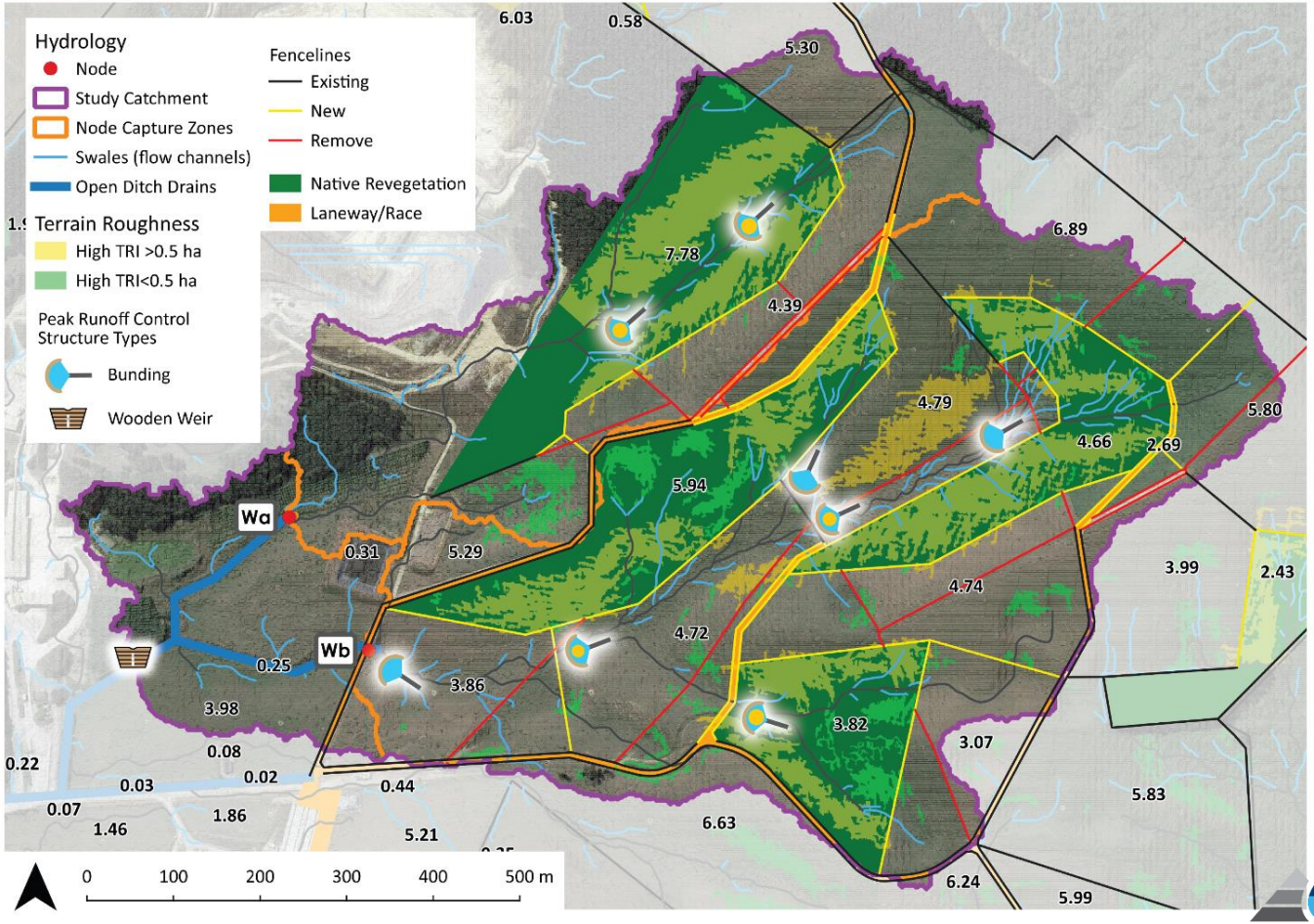
Farm scale
- Erosion control





Farm Modification

- Planting
- Paddock optimisation
  - Fences
  - Water troughs
- Peak runoff control
  - Bunding
  - Wooden weir



Key messages

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- Physiographics is an approach to understanding the role of the landscape
- Physiographic outputs are defined by its use
- When linked to mitigations, Physiographics can help improve the effectiveness of on-farm decisions
- Physiographics is an important tool in the toolbox (e.g. a potential allocation framework)

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