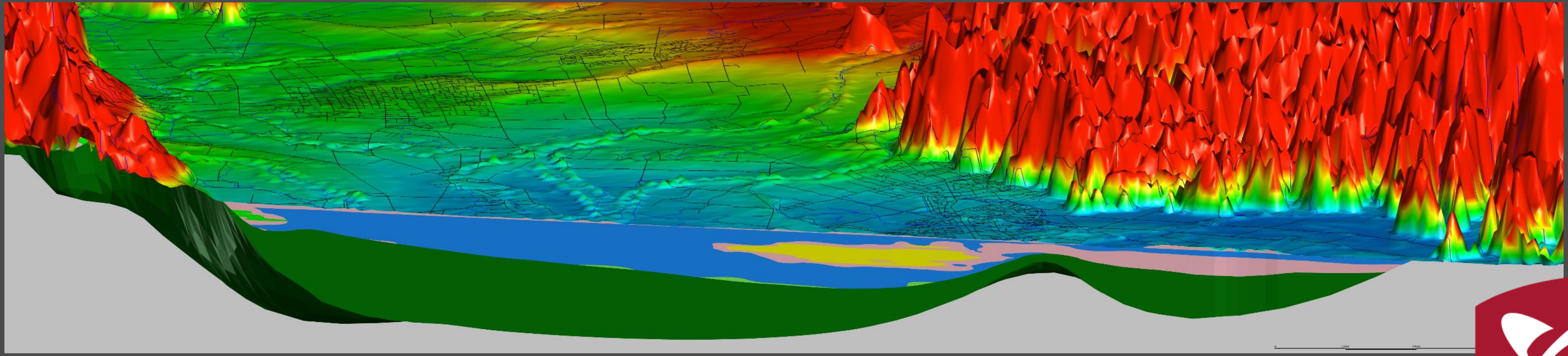
Materials beneath the Heretaunga Plains - A geological model



John Begg

"The future of our water" Thursday 1 June 2017

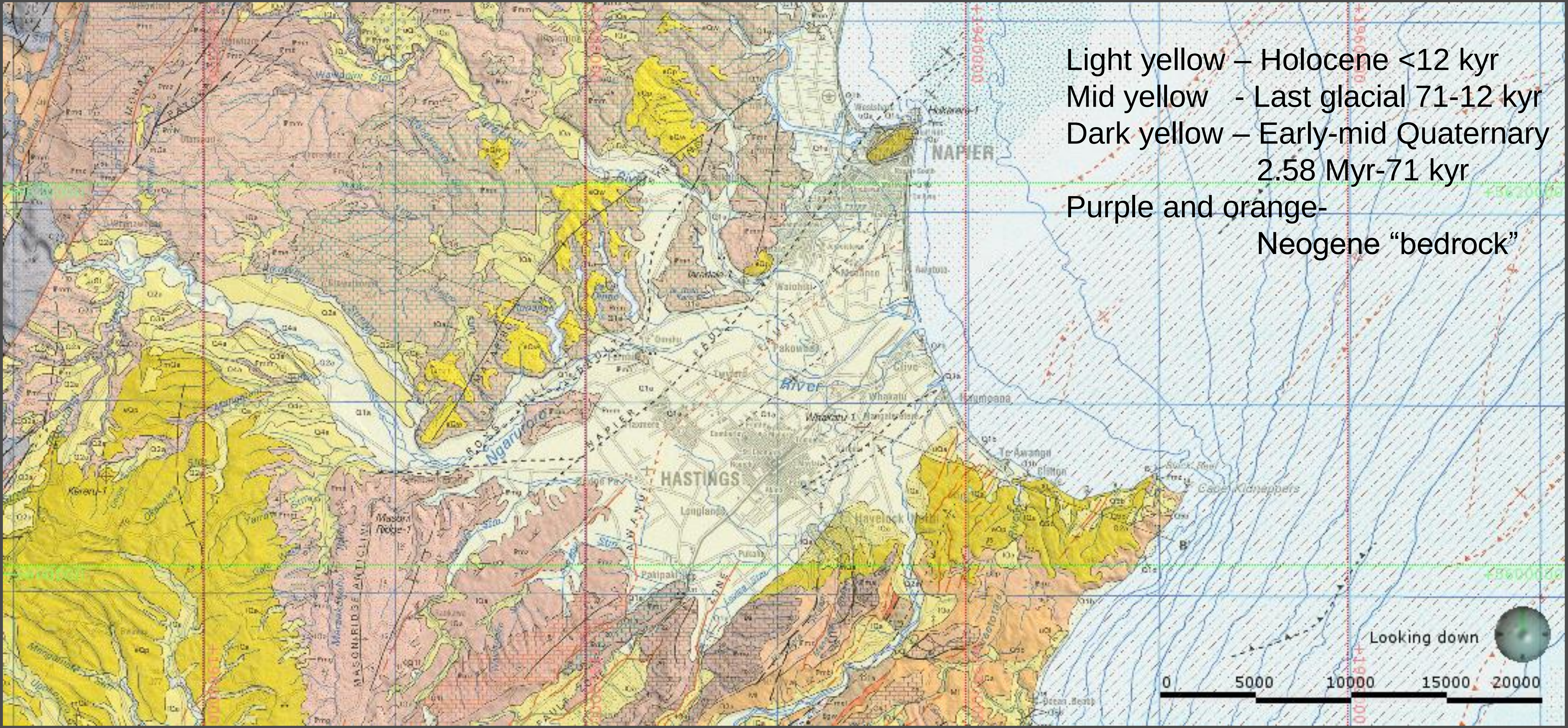
GNS SCIENCE
TE PŪ AO

Introduction

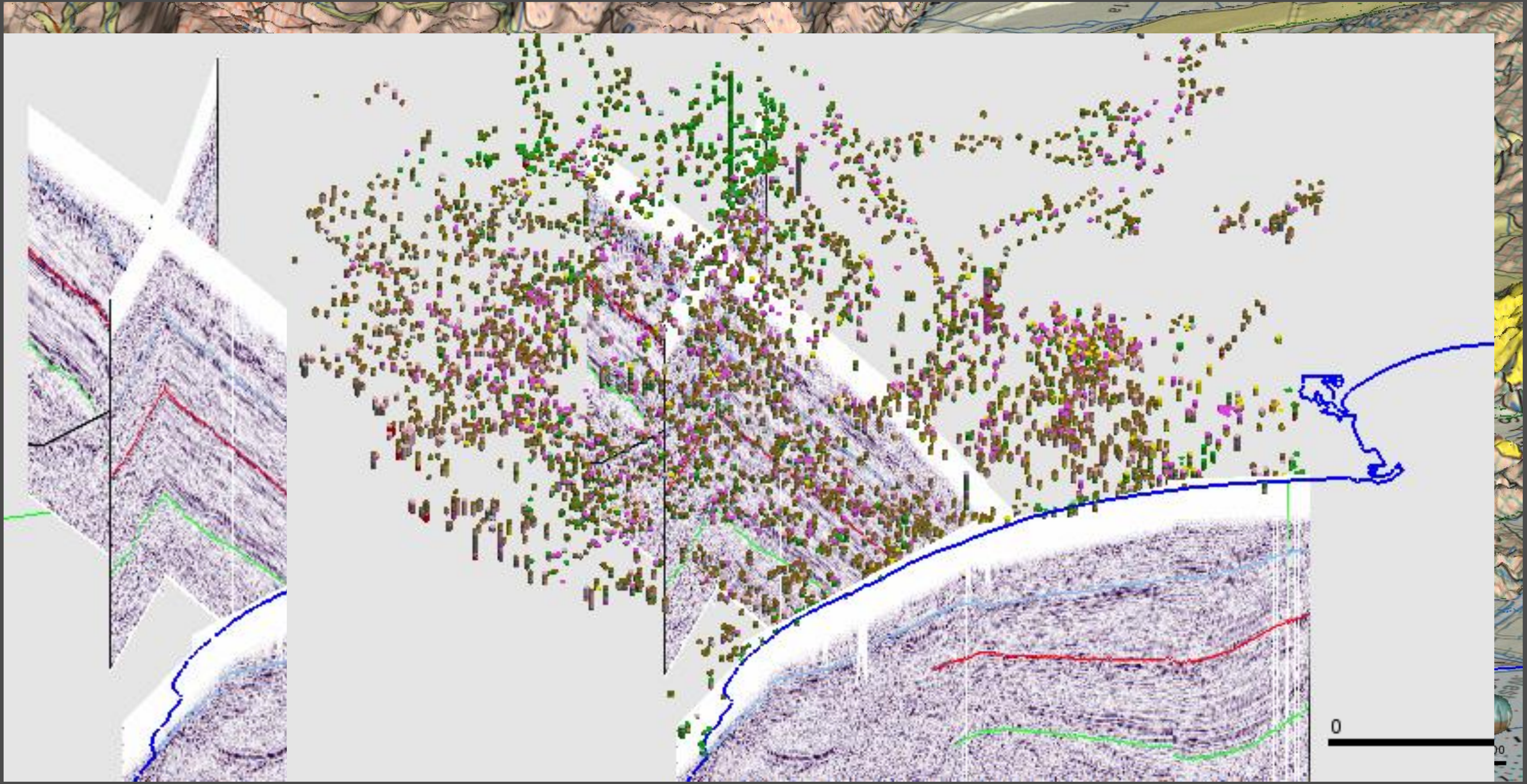
- **Our Heretaunga Plains geological modelling is nearing completion**
- **Funded by GNS Science’s MBIE core-funding (Urban Geological Mapping) plus a commercial contribution from HBRC**
- **Team: Katie Jones, Julie Lee, Conny Tschritter, myself**

- **Main topics of this talk:**
  - Contributing data
  - Pleistocene sea level changes and associated consequences
  - Uncertainty
  - 3D distribution of shallow subsurface materials

Heretaunga Plains – 1:250,000-scale Geological map (Lee et al. 2011)



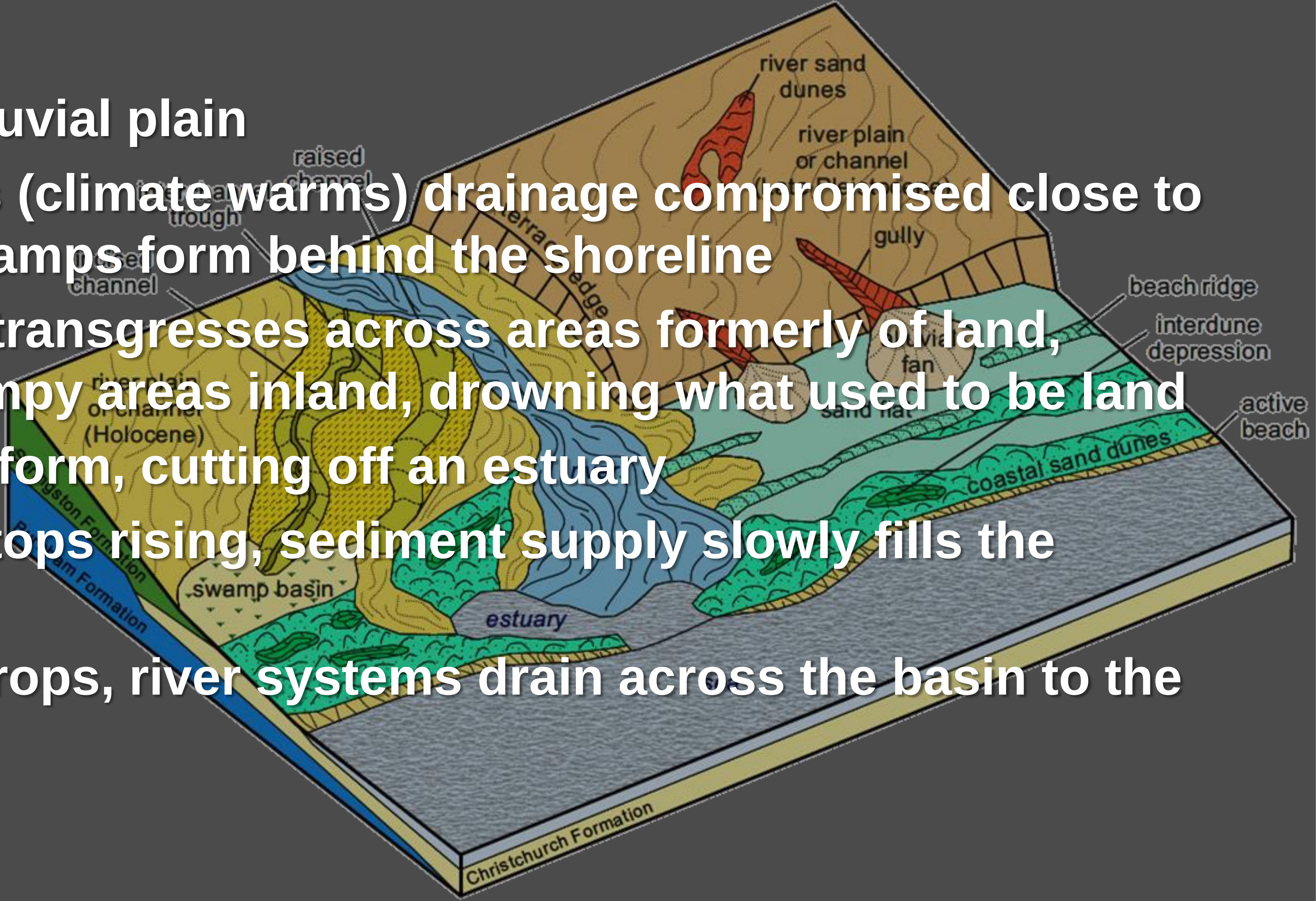
What data from underneath?



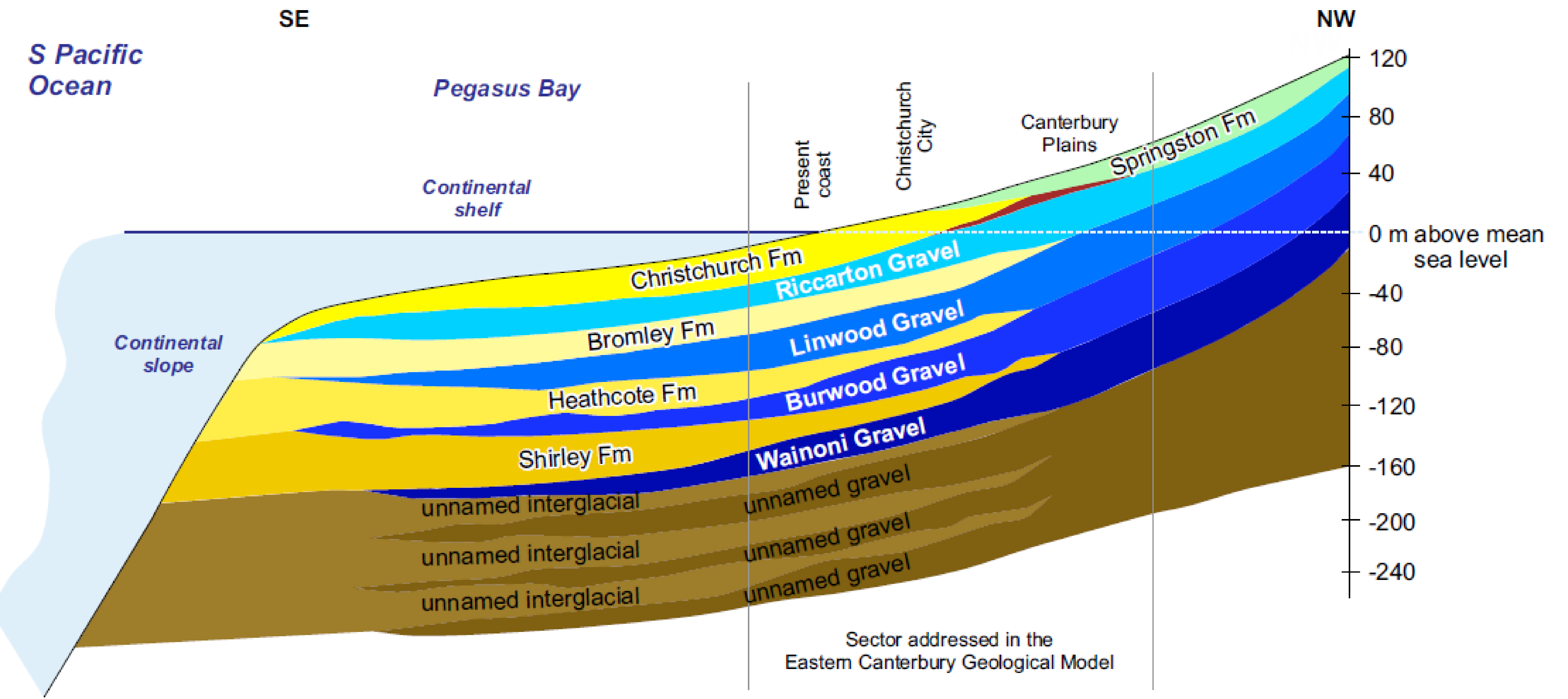
Pleistocene sea level change

As sea level rises and falls, huge environmental changes

- Low sea level: alluvial plain
- As sea level rises (climate warms) drainage compromised close to the coast and swamps form behind the shoreline
- Further rise, sea transgresses across areas formerly of land, pushing the swampy areas inland, drowning what used to be land
- Barrier bars may form, cutting off an estuary
- When sea level stops rising, sediment supply slowly fills the estuary
- When sea level drops, river systems drain across the basin to the new coastline



Conceptual geological model (as for Christchurch)



Uncertainty in geological data and models

- A geological map incorporates in-built uncertainty (including scale of depiction, linking of known data points etc)
- This uncertainty is represented on the map face
- But uncertainty is also present in geological data used in representing materials at depth (e.g. Seismic refraction profiles, Borehole logs, etc)
- Data denser is higher close to the surface and drops off with depth
- Our model summarises the 3D distribution of geological materials
- It is based on this conceptual model and available data
- However reality is far more complex, and the model needs to be modified as new data comes to hand

A Geological model for the Heretaunga Plains

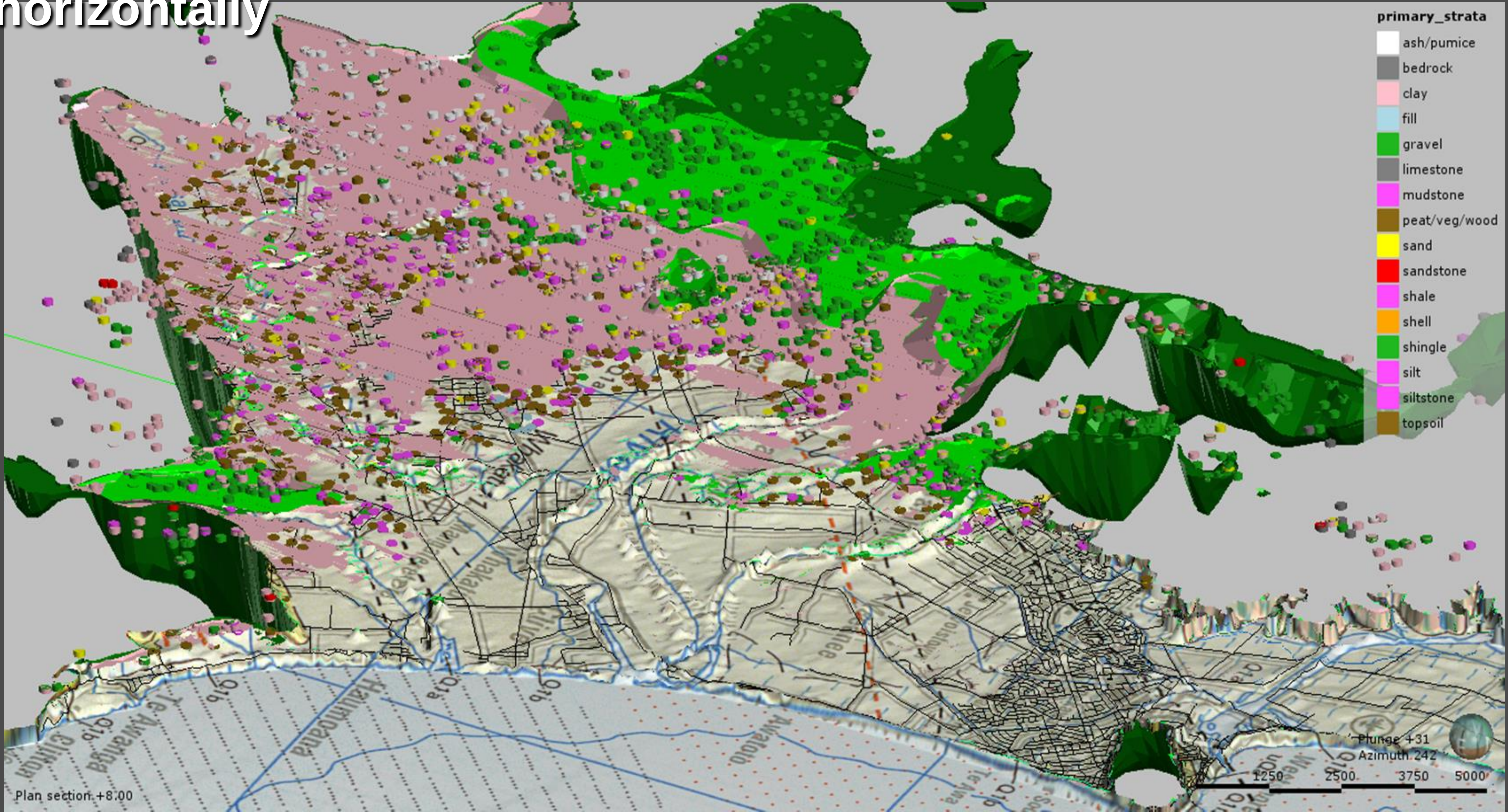
Gold colours – Neogene to Early Quaternary "basement"

Green – gravels

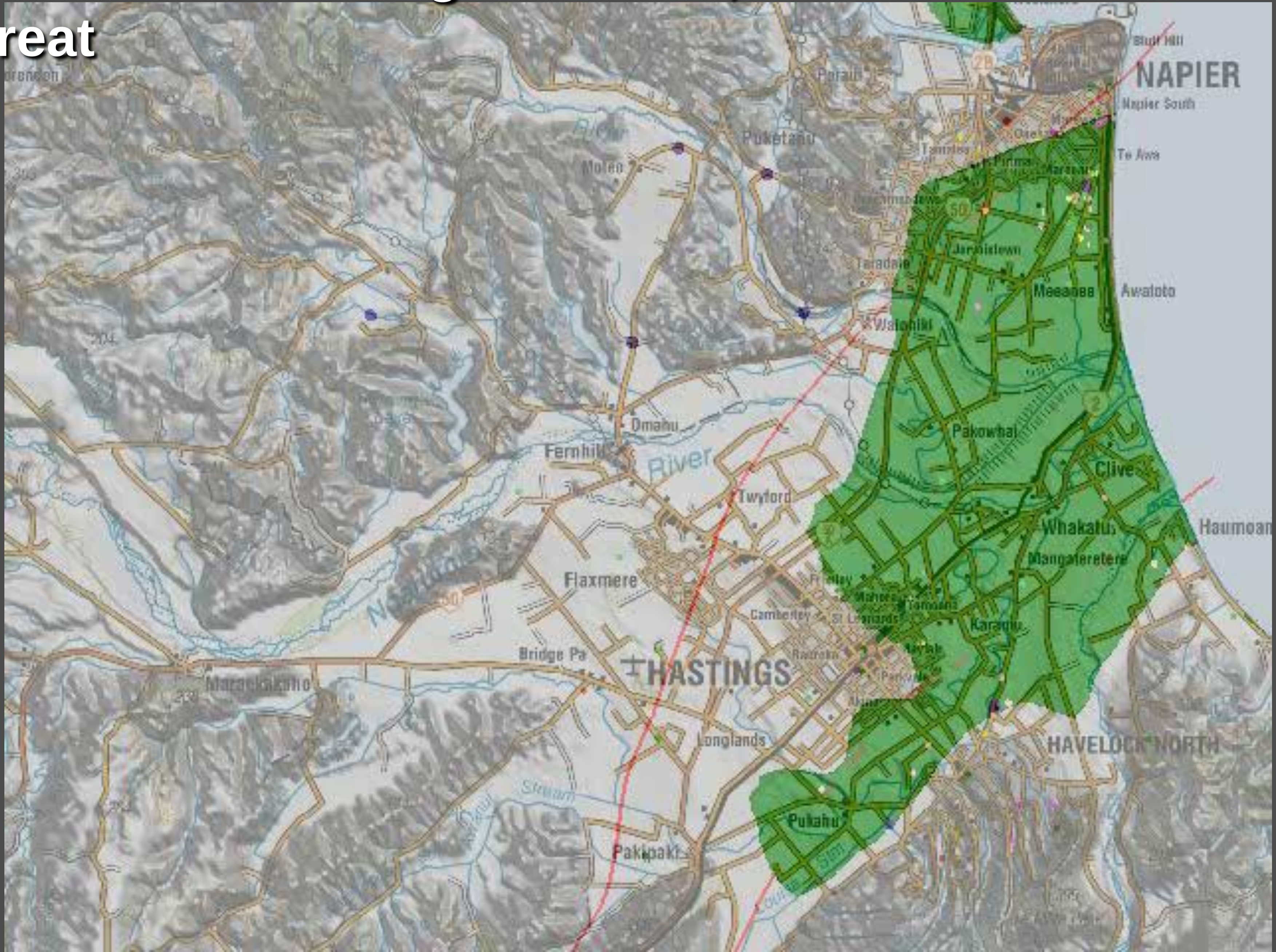
Pink – fine-grained materials

Blue – largely fine-medium Grained marine deposits

The model can be sliced, here across basin axis, along it and horizontally



A movie from the Geological model, Holocene sea level rise and retreat



Conclusions

- Last Glacial gravels have been modelled across the Heretaunga Plains and comprise the primary confined aquifer
- Modelled Holocene marine sand and silt and non-marine overbank silt deposits lie close to the surface across much of the area and comprise the aquitard/aquiclude
- Ngaruroro, Tutaekuri and Tukituki rivers have continued to flow through the Heretaunga Plains to the coast during the late Quaternary
- It is likely that development of the basin is structurally controlled
- In places, Holocene river gravels rest directly upon Last Glacial river gravels

Aquifers and earthquakes

Q: What happens to the aquifers when we have earthquakes?

- **Each earthquake is different, and subsurface materials differ from place to place, so no easy answer**
- **Immediate response may be a pressure spike**
- **Aquitards may be stressed or punctured**
- **There may be water release at or below the surface**
- **A process of aquifer “healing” restoring it to something resembling its pre-earthquake state over varying time frames**
- **Or changes may be permanent**