

**AQUALINC**



# Understanding New Zealand's Freshwater: Groundwater

Helen Rutter  
Senior Hydrogeologist  
Aqualinc Research Ltd

GROUNDWATER

IRRIGATION

RESOURCE CONSENTS

FARM ENVIRONMENT PLANS

EFFLUENT MANAGEMENT

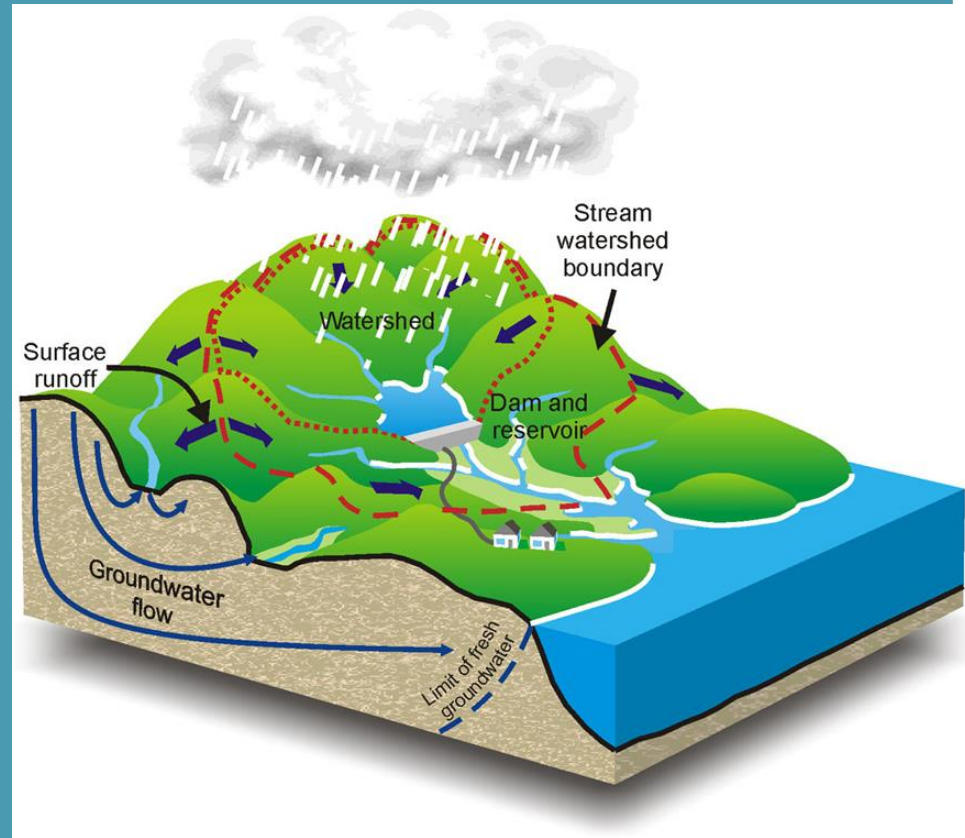
WATER MANAGEMENT

17 March 2017

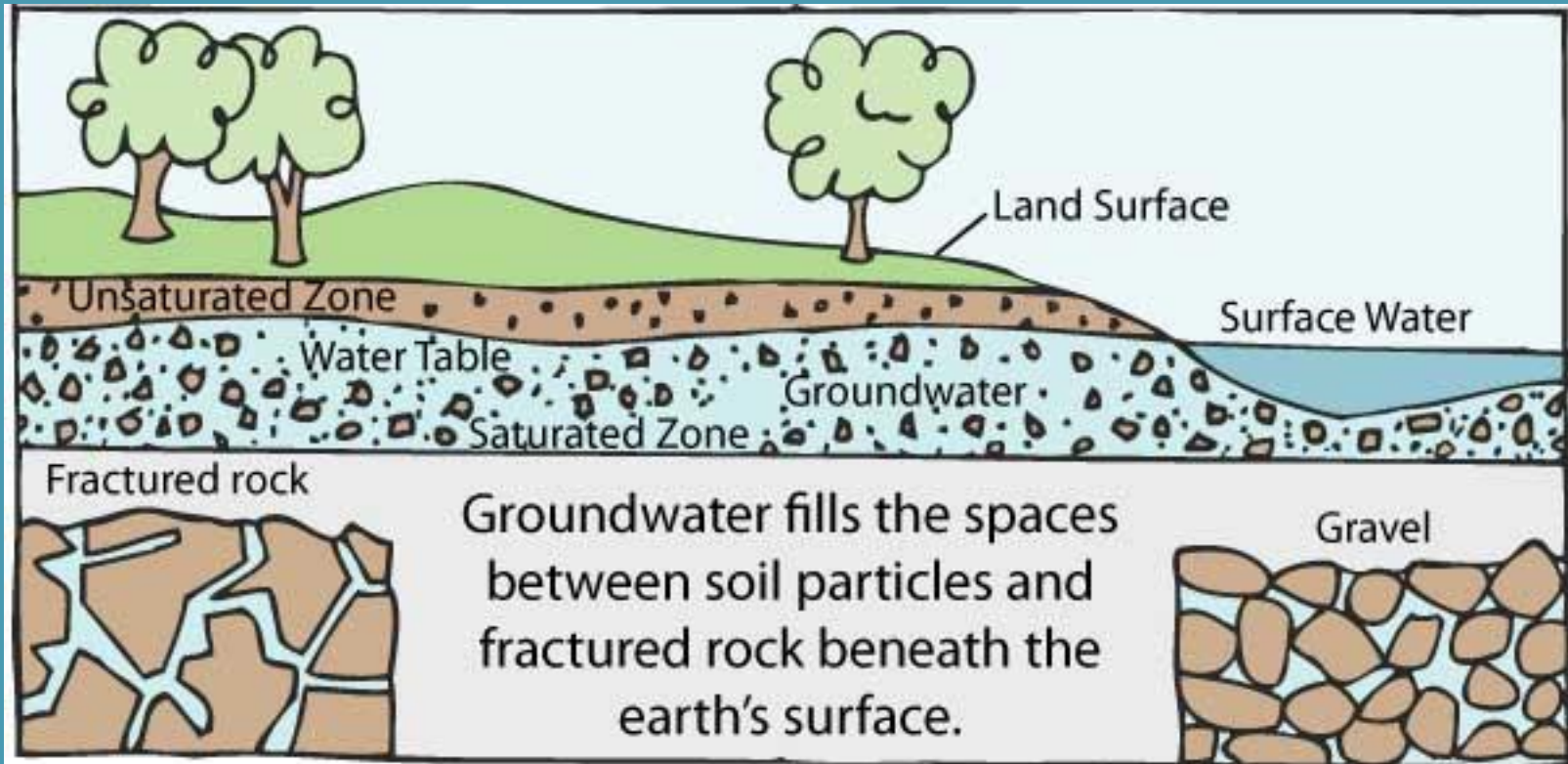
# Groundwater and the hydrological cycle



- Groundwater and surface water: two components of a single resource



# What is groundwater?



# Who is interested?



- Regional councils
  - Managing freshwater and effects of land use on freshwater
- Councils
  - Drinking water supply
  - Irrigation, aesthetics
- Farmers
  - Irrigation
  - Stock water
- Users
  - Domestic supplies
  - Surface water users
    - Fishing and recreation
- Maori



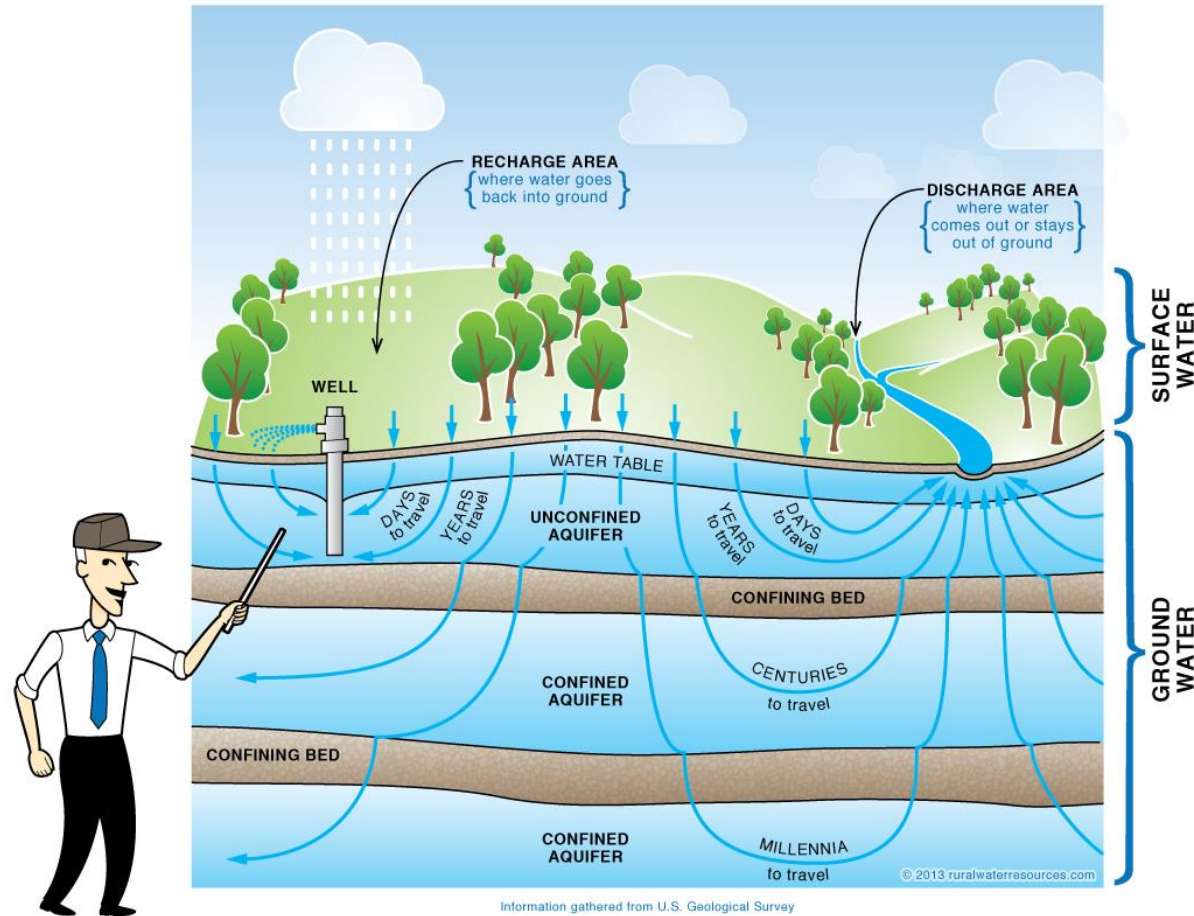


# Understanding flow paths



- Essential to understand flow paths in fresh water management

## Ground versus Surface Water



# Groundwater – a mysterious resource?



- From Frazier vs Brown (1861):
  - “ the existence, origin, movement and course of such waters, and the causes which govern and direct their movements, are so secret, occult and concealed, that an attempt to administer any set of legal rules in respect to them would be involved in hopeless uncertainty, and would be, therefore, practically impossible”





© Daniel Jarrett, 2014



# Why do we need to be concerned?

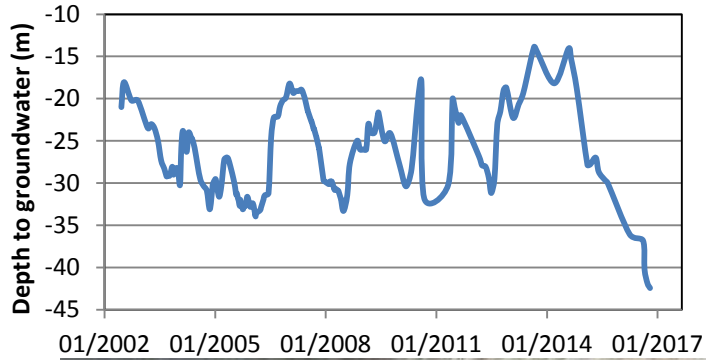


- Out of sight....
  - More difficult to observe and measure than surface water
- System is slow moving
  - Impacts might not show for a long time
  - Impacts difficult to mitigate once they occur

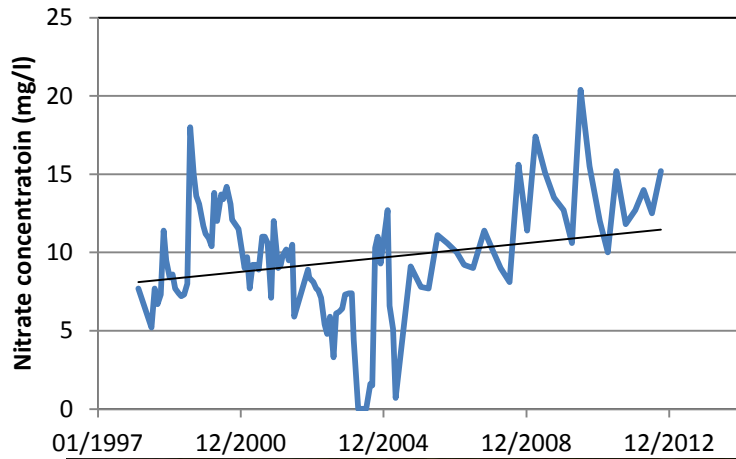




# What do we need to be concerned about? Quantity



# What do we need to be concerned about? Quality



# Understanding flow paths



- How will land use change impact on surface water?
- How connected is my well to the surface and possible contamination?
- What opportunity is there for nitrate removal in the groundwater system?
- Achieving NPS–FW Management objectives
  - Need to understand groundwater's role in terms of quality and quantity
  - Connection with surface waters



# What has changed since 1861?

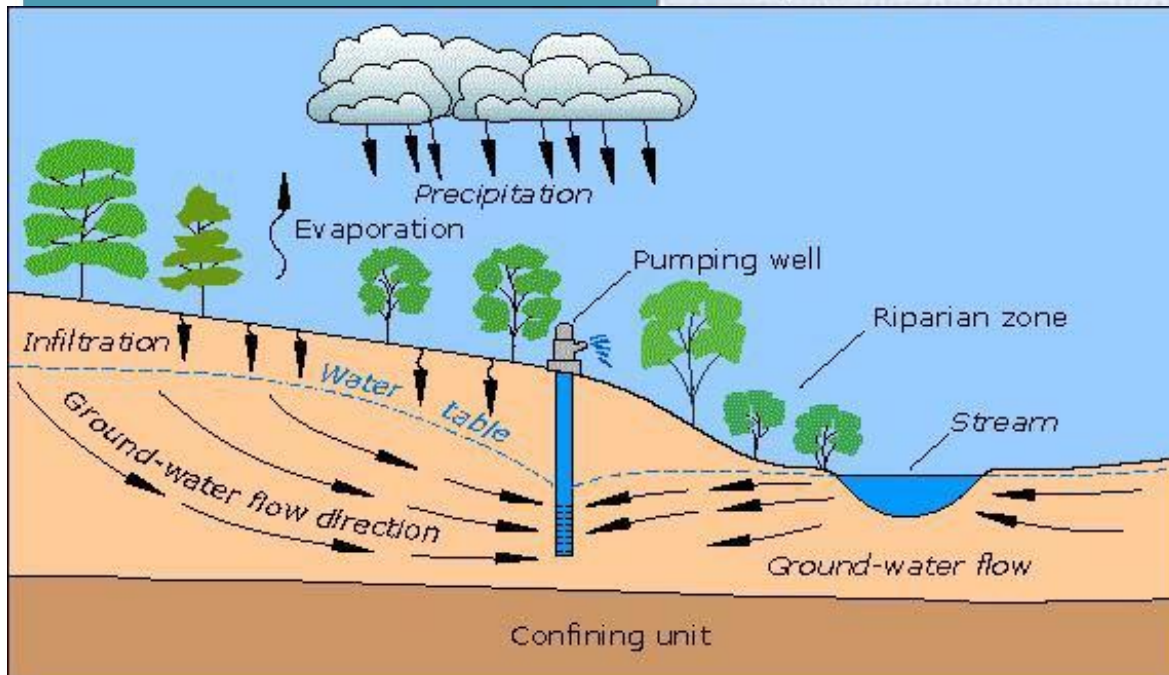
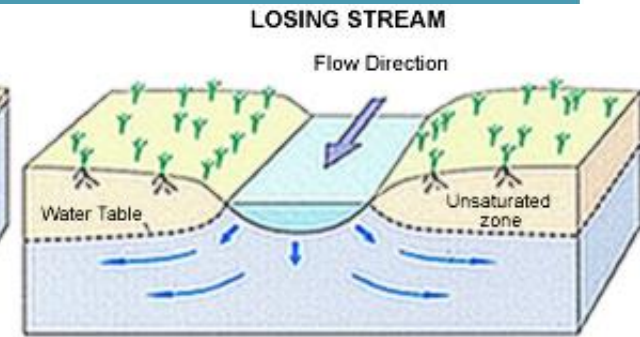


- Better understanding of the science through new data and techniques
  - Data collection
    - Water levels
    - Aquifer properties
    - Water chemistry
  - Techniques
    - Age dating
    - Tracer testing
  - Computer modelling of groundwater systems
- Need diverse set of skills

# Data collection and analysis



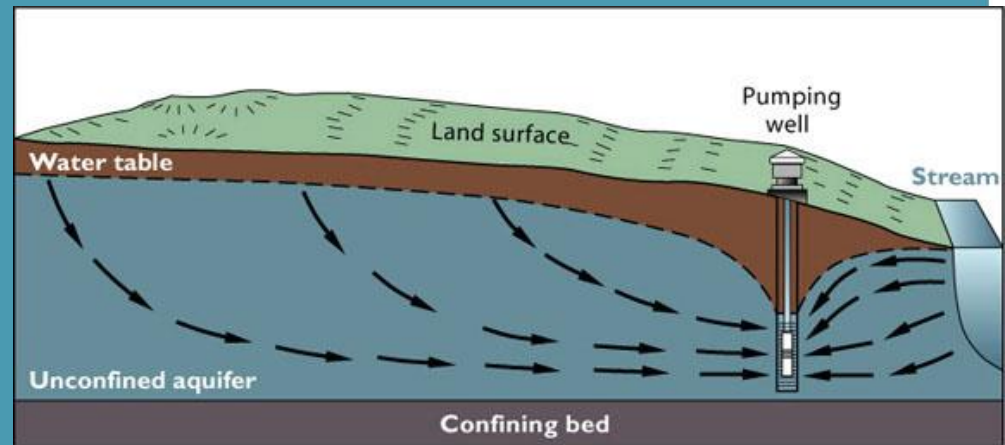
- Groundwater levels
- Aquifer tests
- River gauging



# Age dating



- Use natural tracers (tritium, C14, etc)
- Can get a mixture of different aged water
- Mean age may be misleading





# Tracer testing



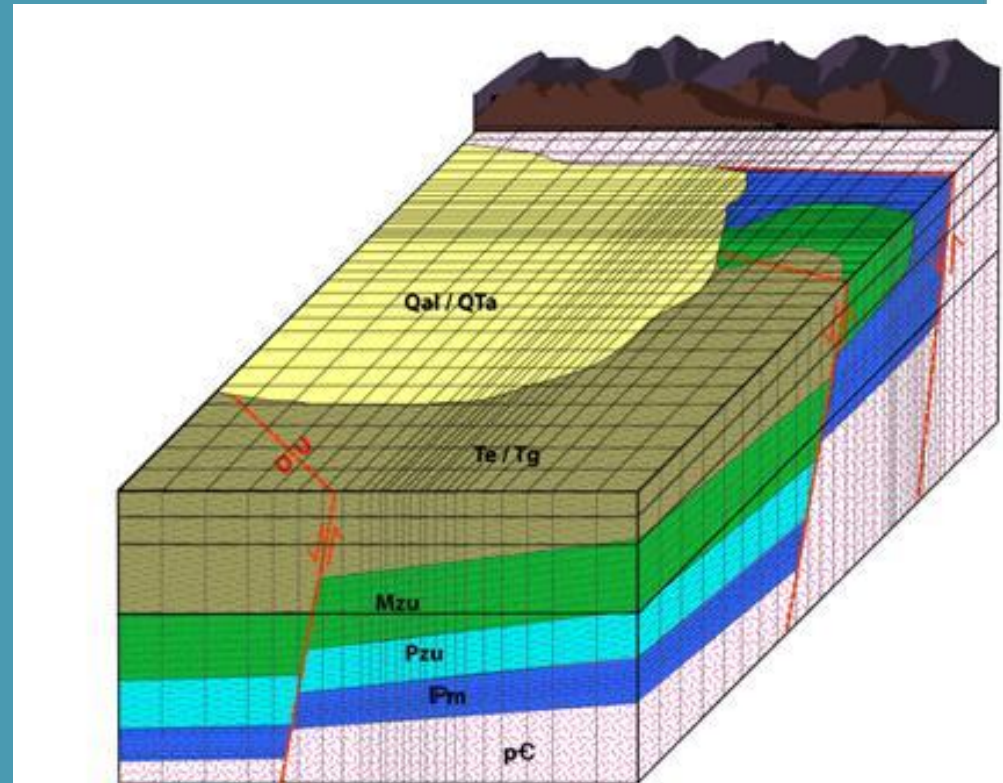
- Introduce tracer (dye) at a source area
- Monitor to see if it turns up at a well
- Can confirm a pathway



# Modelling



- Set up model to represent reality
- Calibrate it so that water level responses and river flows represent measured data
- Test out different 'scenarios'



# Conclusions



- Groundwater is the connection between land use and groundwater/surface water quality
  - Need to understand flow paths to understand impacts of land use change
- Groundwater also important in its own right
- Groundwater modelling is a key way to investigate management options
- Understanding and managing groundwater properly requires a multi-disciplinary approach



Thank you



Helen Rutter  
h.rutter@aqualinc.co.nz