Early assessment of seawater intrusion of coastal aquifers in Eurobodalla Shire

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LOCAL GOVERNMENT NSW

MURRANG earth sciences

CSIRO

eurobodalla shire council

Why investigate coastal aquifers?

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Risks of Salinisation of coastal aquifers

- Alter load bearing capacity of soils
- Diminish soil fertility
- Loss of irrigation resource
- Production of nuisance gases
- Degradation of road paving, concrete and footings
- Rising damp
- Flux of weathering agents from Acid Sulphate Soils
- Altered drainage and inundation of low areas
- Chemical Reduction of previously unsaturated soils
- Expansion of ASS over time
- Not confined to nearshore areas

Apply the 6 Adaptation Planning Principles to coastal aquifers

1. Assess and evaluate coastal risks
2. Advise the public
3. Avoid building in coastal risk areas
4. Consider options to reduce existing land use intensity
5. Minimise exposure of development to coastal risks
6. Implement appropriate management responses

Starting from Principle 1

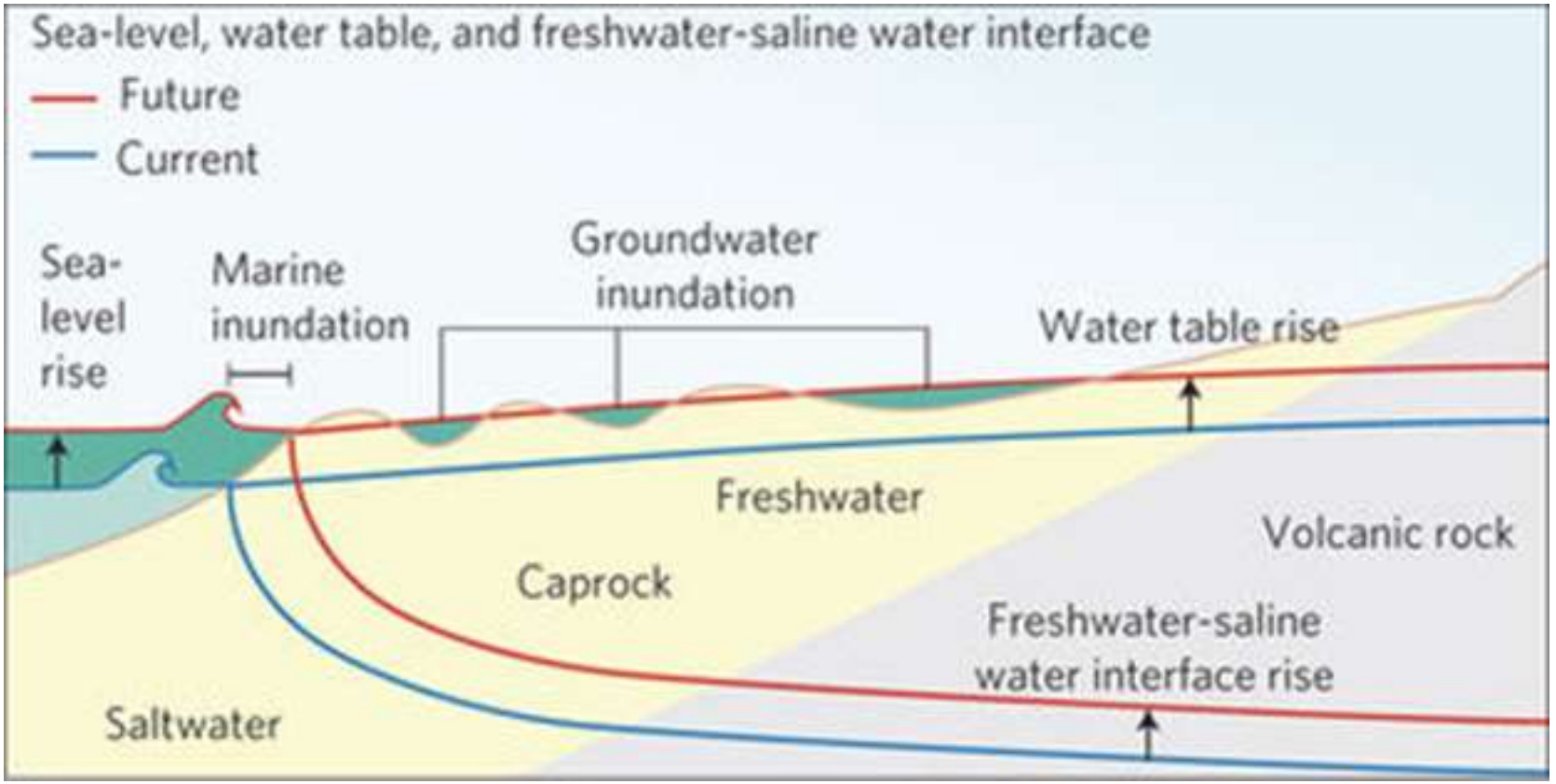
We know:

- sea levels are rising
- trend will continue
- Surface, tidal and storm inundation will occur

We don't know:

- Extent of tidal influence on coastal aquifers
- Potential for site specific impacts

Theoretical model of Coastal Aquifers



Tide + Groundwater + SLR = Projection of Risk

Right?

Not that simple I'm afraid

Groundwater is complex

- Soil properties
- Water chemistry
- Organic properties and processes
- Interaction with surface water and rainfall
- Interaction with tides
- Atmosphere
- Impacts reach beyond near coastal zone

Key messages

- Site specific knowledge is required
- Can’t on rely generic assumptions

Our study

Three study sites

- Surfside in Batemans Bay
- Broulee
- Narooma

Chosen because:

- Low lying
- Availability of monitoring wells
- Existing impacts observed

We started with

- No quantitative investigations or on-going monitoring groundwater in Eurobodalla Shire Council.
- 155 bores situated within the Surfside (9.7%), Broulee (83.9%) and Narooma (6.5%) study sites
- No monitoring and evaluation of domestic groundwater use and quality within the study sites.
- No open source baseline data for the groundwater quality and dynamics

Investigated

- Ground water height
  - ✓ Reduced level from surface
  - ✓ Rainfall
  - ✓ Tides
  - ✓ Atmospheric conditions
- Soil profile and chemistry
  - ✓ Development of Profiles
  - ✓ Texture
  - ✓ pH
  - ✓ Salinity
  - ✓ Heavy metals
- Water quality
  - ✓ Salinity
  - ✓ Total dissolved solids
  - ✓ Heavy metals
  - ✓ nutrients
  - ✓ Groundwater usability

Research Case Study

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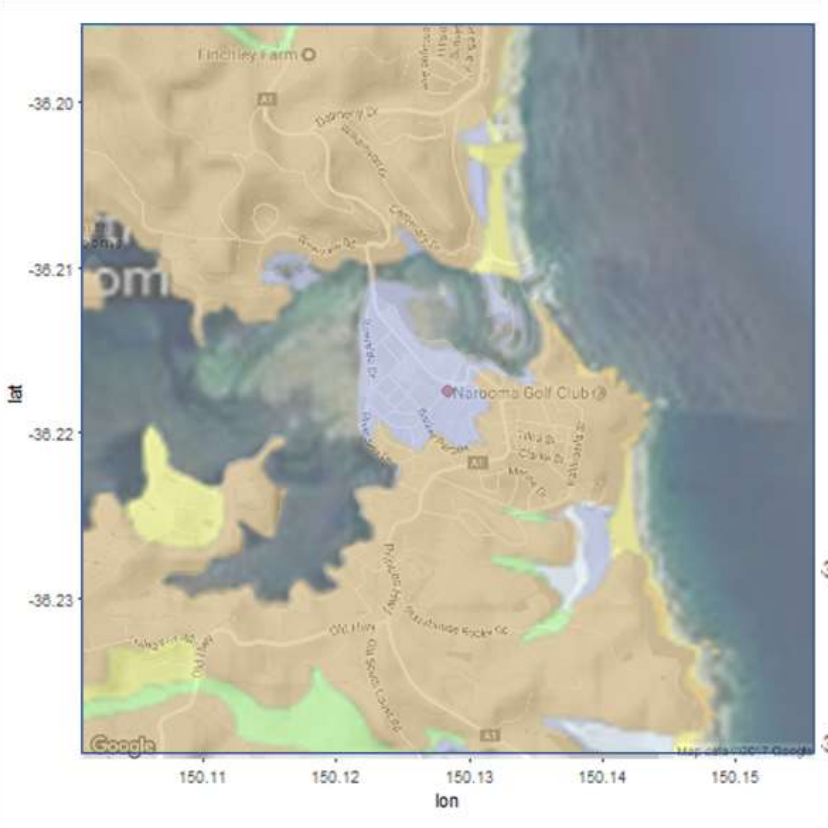
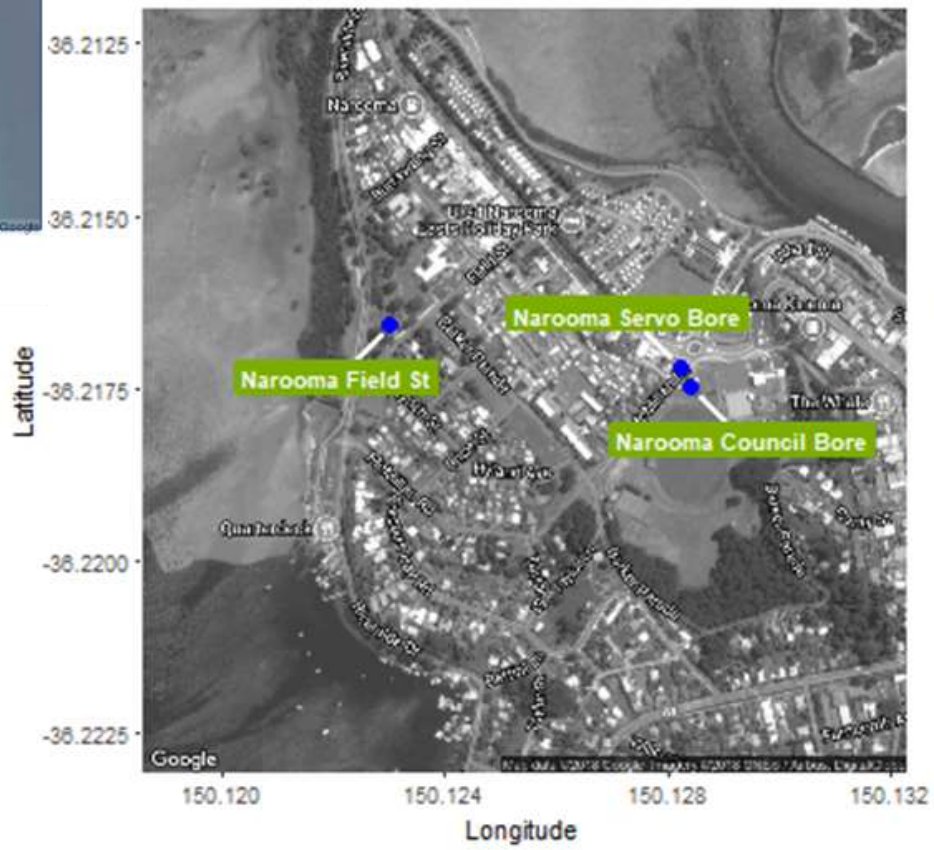
Narooma Flat

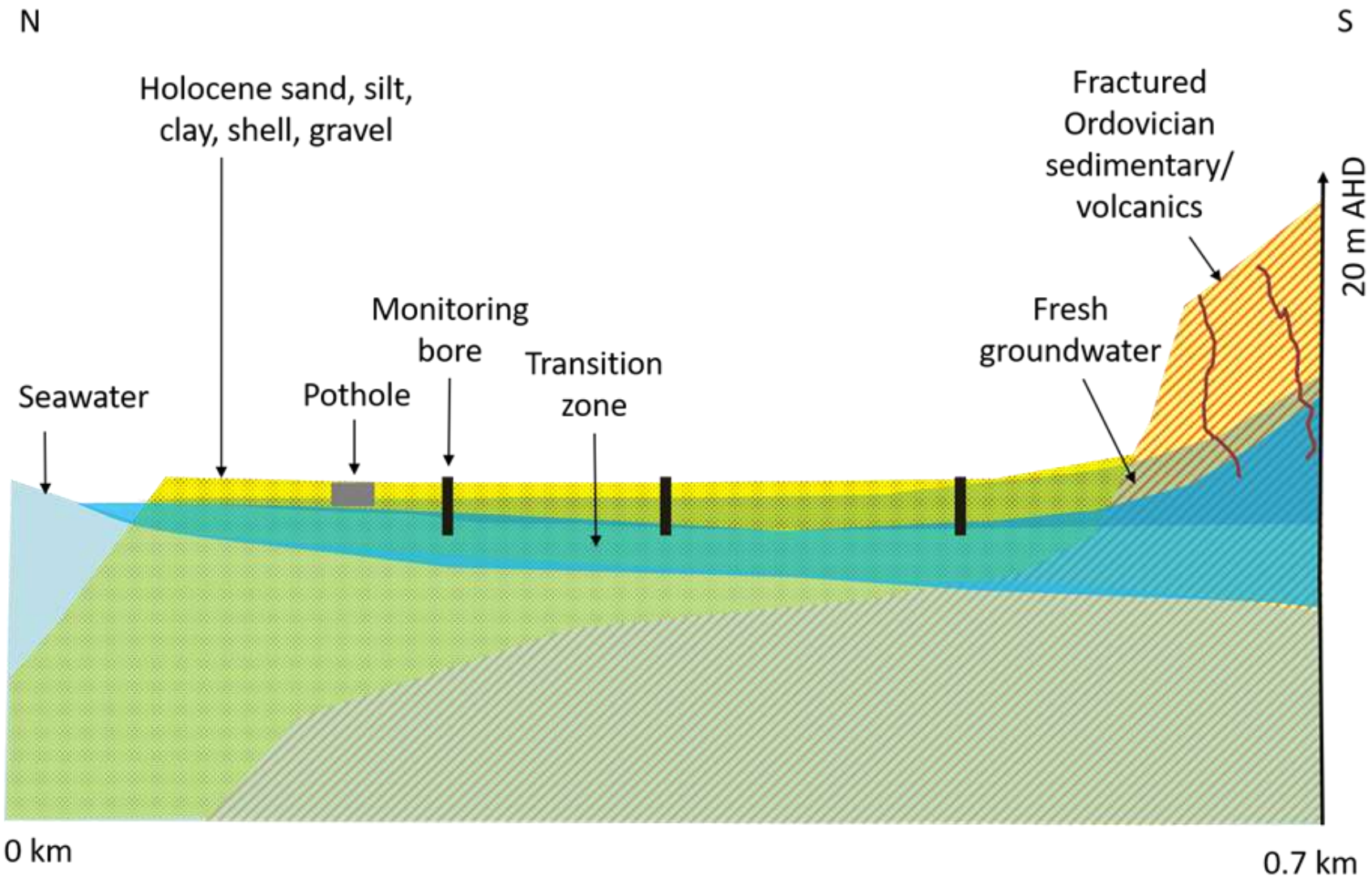


- Calcarosols
- Chromosols
- Dermosols
- Ferrosols
- Hydrosols
- Kandosols
- Kurosols
- Kurosols, Natric
- Organosols
- Podosols
- Rudosols
- Rudosols (Alluvial)
- Rudosols and Tenosols
- Sodosols



Group
- Freshwater
- Groundwater
- Seawater
- Tapwater

Conceptual model of salt-water intrusion at Narooma



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Results

- Groundwater close to surface
- Sandy hydrosols, low nutrients indicates periods of extended inundation
- High sodium at oval bore may indicate stronger influence of sea water than other study sites
- Prolonged use for irrigation could result in breakdown of soil structure
- Further research required to determine the surface/groundwater relationship particularly through drought.

Adaptation Case Study

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A


B


C


D

Adaptation Case Study – Reality Check

- Solves small part of the problem
- Groundwater sites often exposed to additional hazards and constraints
- Additional project costs, filling may not be an option across entire site
- Can private development afford this option?
- Impossible to apply fill across all properties in one hit
- We need an understanding on how all hazards interact to prepare a site specific adaptation strategy

Adaptation Case Study

- Long term monitoring required to better understand surface/groundwater/tidal relationships
- Simple monitoring such as observing vegetation health can commence now
- Communication of potential impacts can be conveyed to council engineers, work crews, field staff now
- Needs to be incorporated into existing and long-term strategic planning and hazard management
- Better incorporated into flood and coastal hazard studies and adaptation planning

Conclusions on project outputs

- longer term monitoring required to make reliable conclusions
- Need to expand sites to include clay rich soils
- strong link between surface water and ground water = strong potential for contamination
- Actions can commence now independent of additional date
- Community education relating to potential contamination risk to aquifers
- Planting and preserving taller trees
- Monitor vegetation health
- Change purchasing behaviour

Actions can commence now independent of additional data

- Community education relating to potential contamination risk to aquifers
- Plant and preserve taller trees
- Monitor vegetation health
- Change purchasing behaviour to resilient materials
- Change approaches to asset maintenance and renewal
- Incorporate current knowledge into commenced flood studies at Narooma
- Review flood development codes in areas where groundwater and floodwater coincide.