Lateral salt seepage into shallow coastal aquifers from tidal drains after floodgate opening

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Objectives

(a) To assess the risk of lateral salt seepage associated with floodgate opening.
(b) Identify key factors that influence that risk.

Methods

- Piezometer transects on tidal, non-tidal and transition drains at multiple sites (Fig. 1).
- Detailed topographic, soil and groundwater surveys.
- Regular electromagnetic induction soil conductivity meter (EM38) transects.
- Water level and groundwater salinity monitoring .

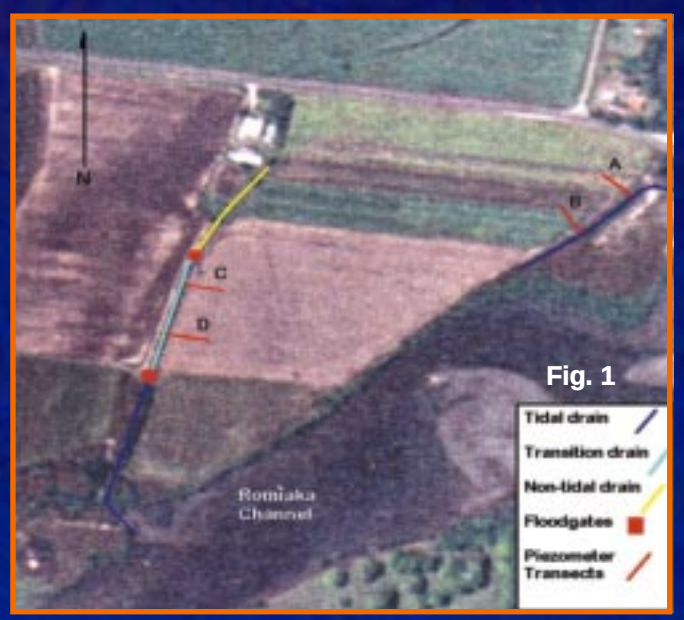
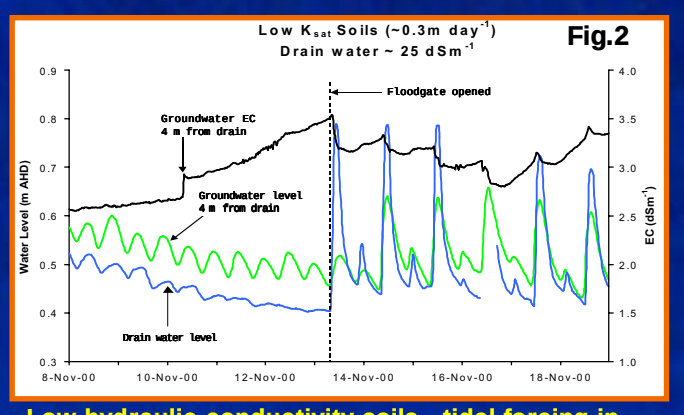


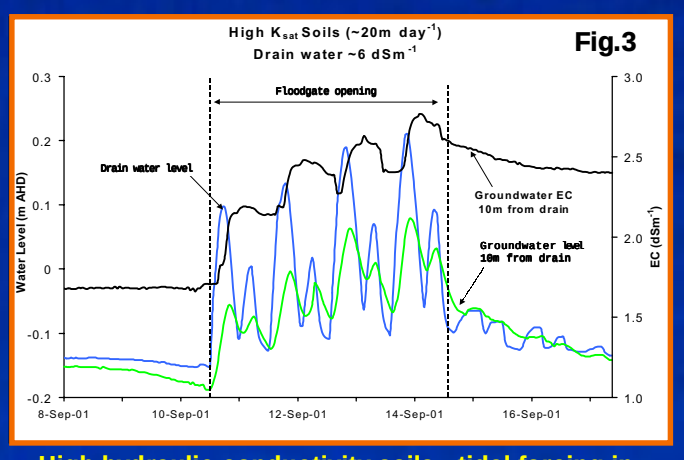
Fig. 1
One of the study sites in the lower Clarence River floodplain.

Results

- Tidal forcing in shallow groundwater adjacent to drains on the floodplain was observed (Fig. 2 & 3).
- In most floodplain soil landscapes hydraulic conductivity is low and salt seepage is largely confined to the first few metres next to the drain (Fig. 4).
- However, in very high hydraulic conductivity soils significant salt seepage can occur (Fig. 3 & 5).
- Key influencing factors are;
  1. Hydraulic gradient of the groundwater; long term effluent trending gradients help prevent lateral movement of salt.
  2. Hydraulic conductivity of soil in the intertidal elevation range.
- Overtopping of saline water is a more serious potential problem in low elevation areas.



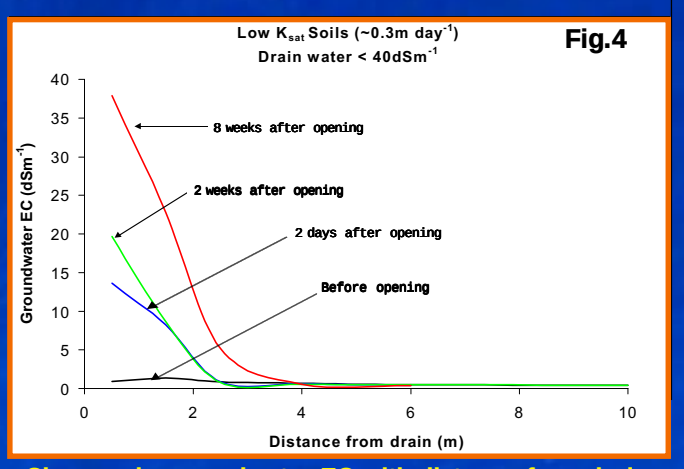
Low hydraulic conductivity soils - tidal forcing in shallow groundwater and changes in groundwater EC adjacent to drain after floodgate opening.



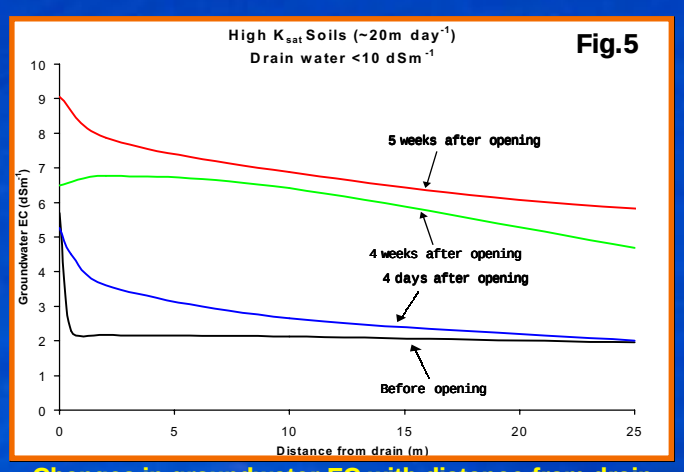
High hydraulic conductivity soils - tidal forcing in shallow groundwater and changes in groundwater EC adjacent to drain after floodgate opening.

Conclusions

- It is important to know local elevations and confine tidal ingress water to the drain. Greater surety of water level control can be achieved via sluice gates or mini - tidal floodgates .
- It is important to assess soil hydraulic conductivity at the site.
- Once overtopping occurs salt may be slow to leach out.



Changes in groundwater EC with distance from drain over time at a low hydraulic conductivity site.



Changes in groundwater EC with distance from drain over time at a high hydraulic conductivity site.

Implications

- Areas most at risk include;
- Land below local high water adjacent to drains with low sides or open / leaky secondary structures.
- Sites with very high hydraulic conductivity.
- At risk geomorphic units include;
  - Low elevation ASS backswamps
  - Channel infills
  - Low alluvial toes

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