EFFECT OF STORAGE AND NITROGEN REMOVAL EFFICIENCY ON NITRATE LEACHING FROM LAND TREATMENT SYSTEMS

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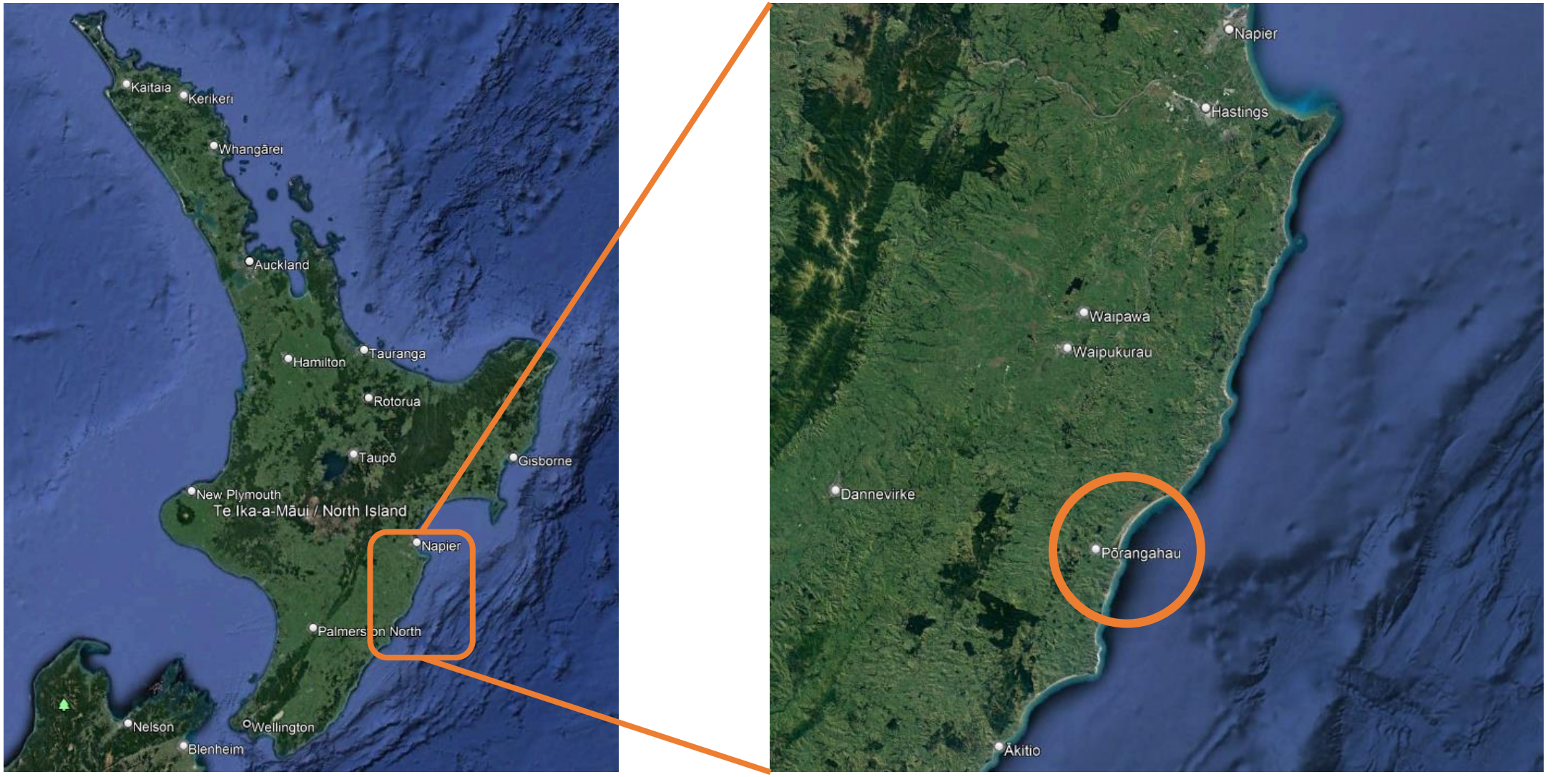
Presentation Outline

- Location – Pōrangahau/Te Paerahi – Case study
- What is the Project? – Status Quo
- What is the Project? – Proposed
- Tweaking of Levers
- Nitrate Leaching – Why does it matter?
- Lever 1 – Storage
- Lever 2 – Wastewater Quality (N)
- Findings – Lever 1 & 2 vs Nitrate Leaching
- Conclusions

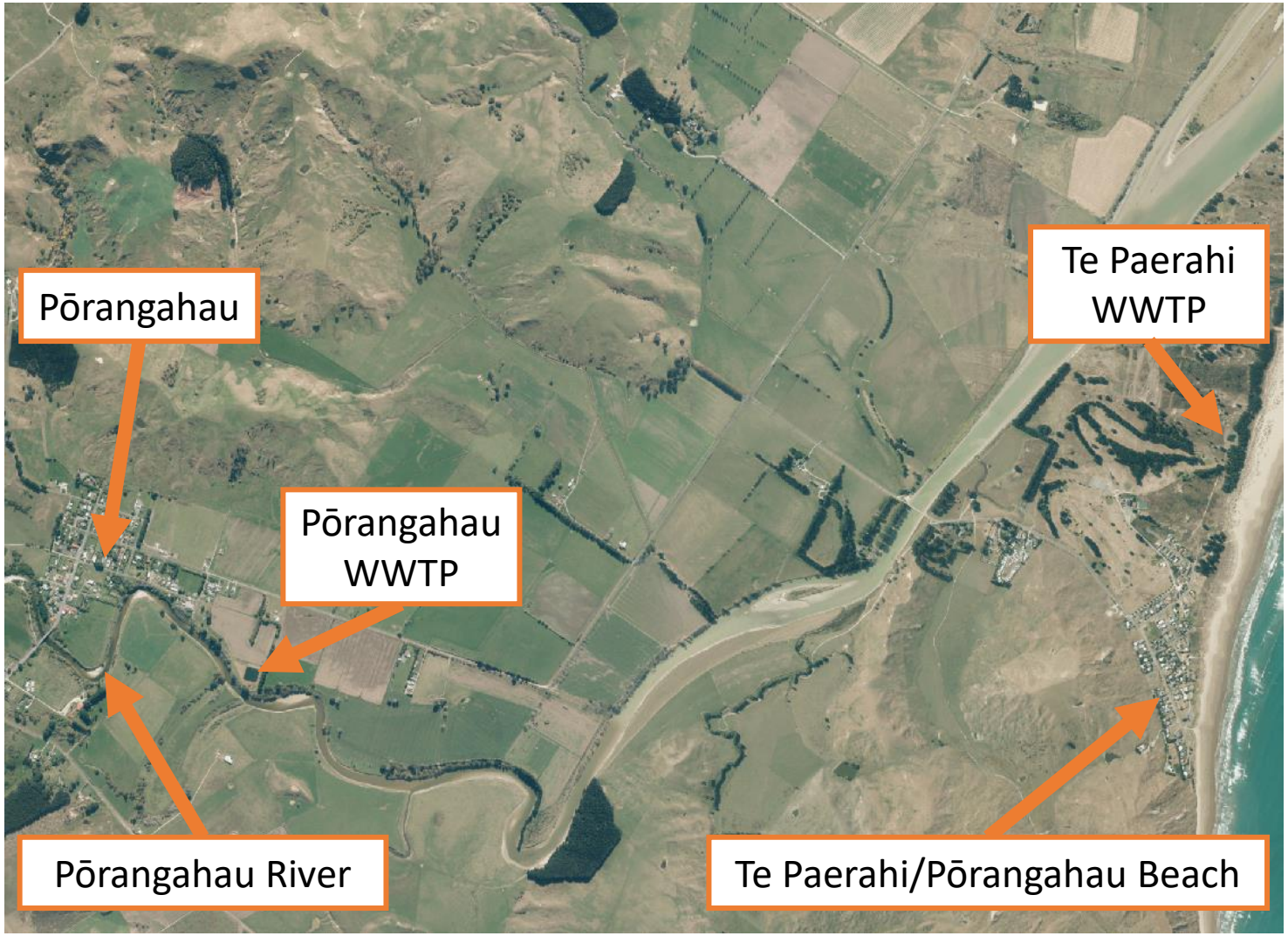
Location – Pōrangahau/Te Paerahi



What is the Project? - Status Quo

- Pōranghau Community → Pōrangahau WWTP → Pōrangahau River;
- Te Paerahi Community → Te Paerahi WWTP → Adjacent Dunes;
- Existing discharges are to culturally sensitive environments – Change is needed!

Location

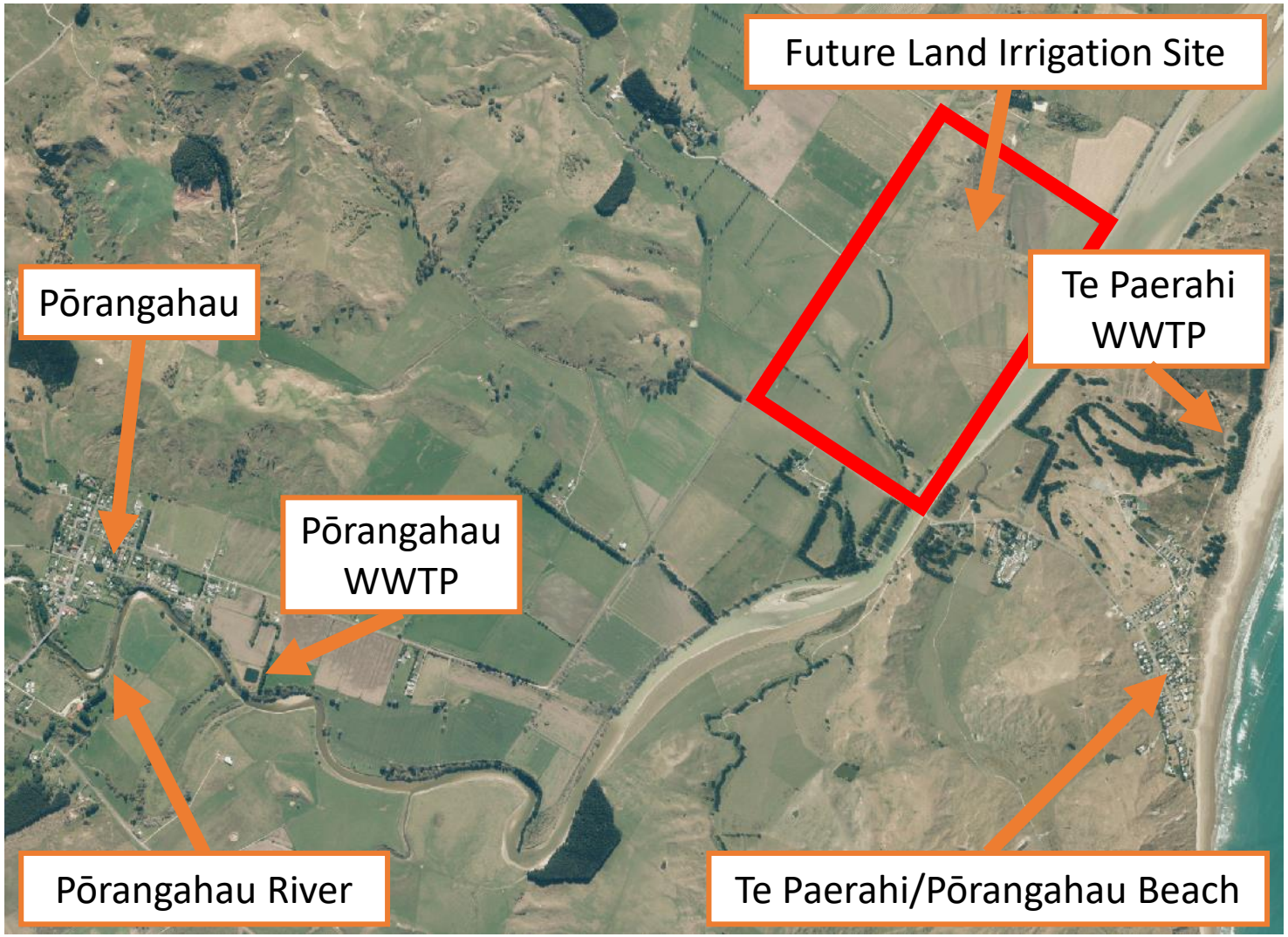

Pōrangahau
Pōrangahau WWTP
Te Paerahi WWTP
Pōrangahau River
Te Paerahi/Pōrangahau Beach

What is the Project? – Proposed

- Establishment of a common land irrigation site;
- Establishment of a new centralised BTF WWTP at the irrigation site;
- Construction of a 20,000 m^3 storage pond;
- Combination of high/low-rate irrigation to at least 40 ha;
- Cessation of both existing discharges; and
- Decommissioning of both existing WWTPs.

Land Irrigation Site

Location


Future Land Irrigation Site
Te Paerahi WWTP
Pōrangahau
Pōrangahau WWTP
Pōrangahau River
Te Paerahi/Pōrangahau Beach

Tweaking of Levers

- What are levers?
- Focus here is on levers assisting with nitrate-N management.
- Lever 1 – Storage
- Lever 2 – Wastewater Quality (N)

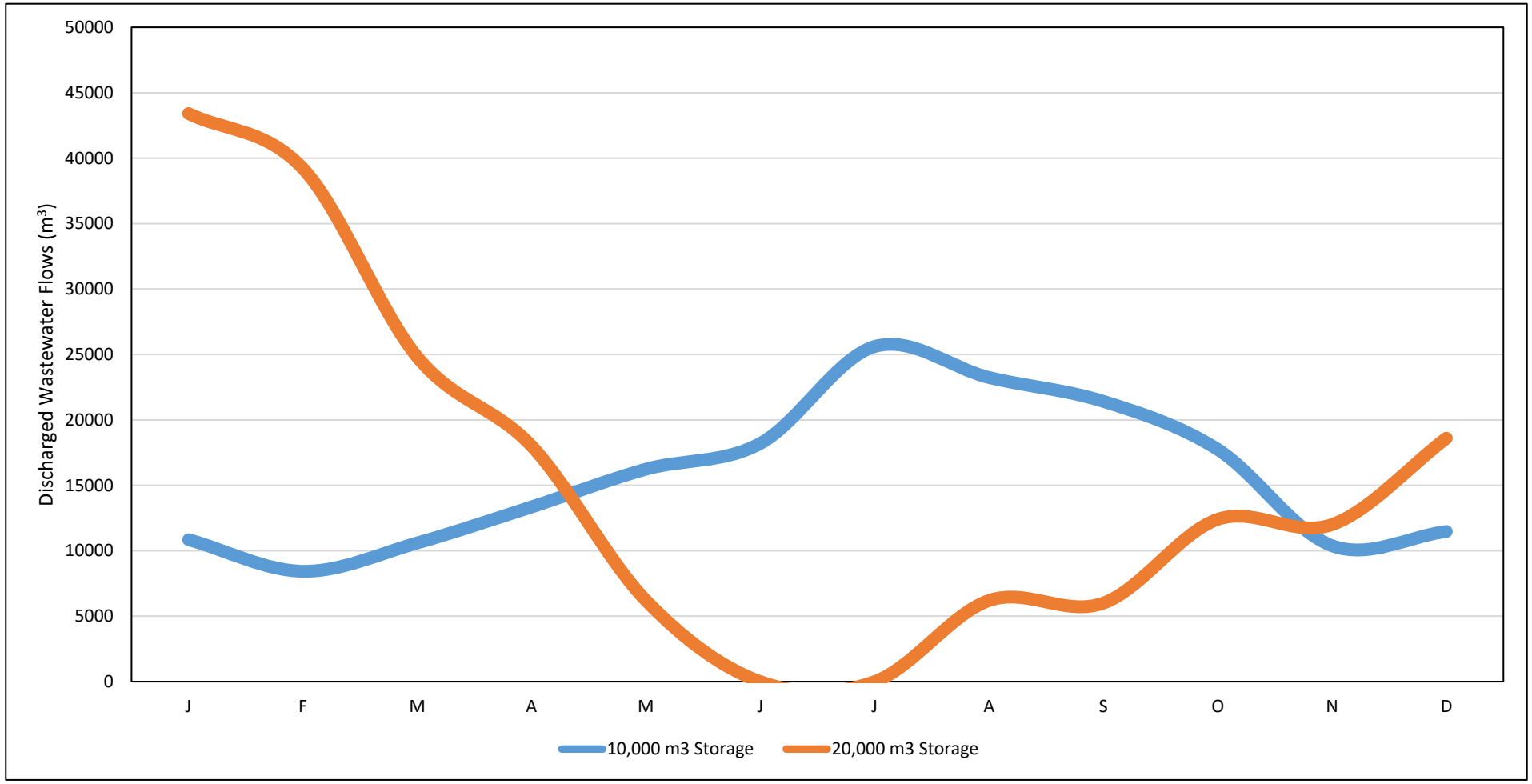
Nitrate Leaching – Why does it matter?

- Treated wastewater contains nitrate-N;
- Nitrate-N is highly mobile, flowing with water;
- If nitrate is not up taken, leaching will occur;
- Nitrate facilitates adverse environmental effects;
- Avoidance of leaching = better environmental outcomes.

Lever 1 – Storage

- Large pond holding treated wastewater;
- Allows for greater irrigation flexibility;
- When plants don't need water, sent to storage and held until when plants do need the water;
- Provides wet weather buffering;
- Potential to reduce nitrate leaching through avoidance of irrigation when soil moisture is high (i.e. winter);
- Larger storage pond → more targeted irrigation → less leaching.

Storage – Changing the way we irrigate



Irrigation to 40 ha of farmland, however 20,000 m^3 storage allows for greater use of deficit irrigation therefore more plant uptake and less drainage, thus less risk of N leaching.

Lever 2 – Water Quality (N)

- WWTPs remove contaminants/nutrients – (N);
- Wastewater irrigation, N needed to grow grass;
- More N = Greater grass growth;
- Greater N removal = Greater cost to WWTP design & more sludge;
- Regional Councils typically want high effluent quality parameters;
- With higher storage, can we have a higher N conc. wastewater, whilst maintaining the same environmental effects as low storage but low N conc. wastewater?
  - i.e. Does 25 g/m^3 of total N and low storage equal the same environmental effects as 35 g/m^3 of total N and high storage?

Findings – Lever 1 & 2 vs Nitrate Leaching

LWE Environmental Impact

- Overseer^{FM} Modelling Total N Concentration by Storage Volume

Lever 2 – Wastewater Quality (N)

Lever 1 – Storage	**25 g/m^3**	**30 g/m^3**	**35 g/m^3**
10,000 m^3	35 kg N/ha	38 kg N/ha	38 kg N/ha
*20,000 m^3 (No Change)	31 kg N/ha	33 kg N/ha	33 kg N/ha
20,000 m^3 (Increased Stock)	33 kg N/ha	34 kg N/ha	36 kg N/ha

Conclusions

- Storage can assist with reducing N leaching losses;
- Can allow for greater wastewater concentrations to be maintained;
- First thoughts were a greater difference in N loss than that modelled;
- Debate around Overseer's accuracy of losses;
- Debate around Overseer's data resolution to accurately model losses (N and hydraulic loadings are relatively low).

LOWE Environmental Impact

Advice AEE Agricultural Analysis Application Approachable Assessments Assimilation Assistance **Biosolids** Capability Client Communications Communities Compliance Compost **Consents** Consultation Contamination Coordinate Council Cultural Current Data Degradation **Design** Detention Developments **Discharges** Documentation Drafting E. coli Ecosystems Effects Engagement Environment Equipment Evidence Excellence Experienced Expert Facilitating Farming Feasibility Fieldwork First-flush Fit-for-purpose Flooding Fun Geology Graphs Greywater Groundwater Guidelines Handbag Hazardous Hydraulics Innovation Interpretation Investigation **Irrigation** Land Landfills Landscape Land-treatment Leaching Lodge **Management** Metals Microbiology **Modelling** Monitoring NES **Nitrogen** **Nutrients** Onsite Optimisation Organics Overseer Papers Pathogens Phosphorus Plain-english **Plans** Preparation Presentations Project Quality Relevant Remediation Reports Research Review **Sampling** Scientific Septage Sludge **Soil** Solutions Spreadsheets Standpipes Stormwater Strategy Support Surface Water Sustainability Systems Team Testing Timely **Treatment** Validation **Wastewater** Water Water-balance Waterways

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