

Combining Site Testing and Technology for Discharge Resilience

Katie Beecroft, Brian Ellwood, Hamish Lowe, Cathy Campbell

Things are changing

- Land application is becoming well established
- We have NEW things to try and work with

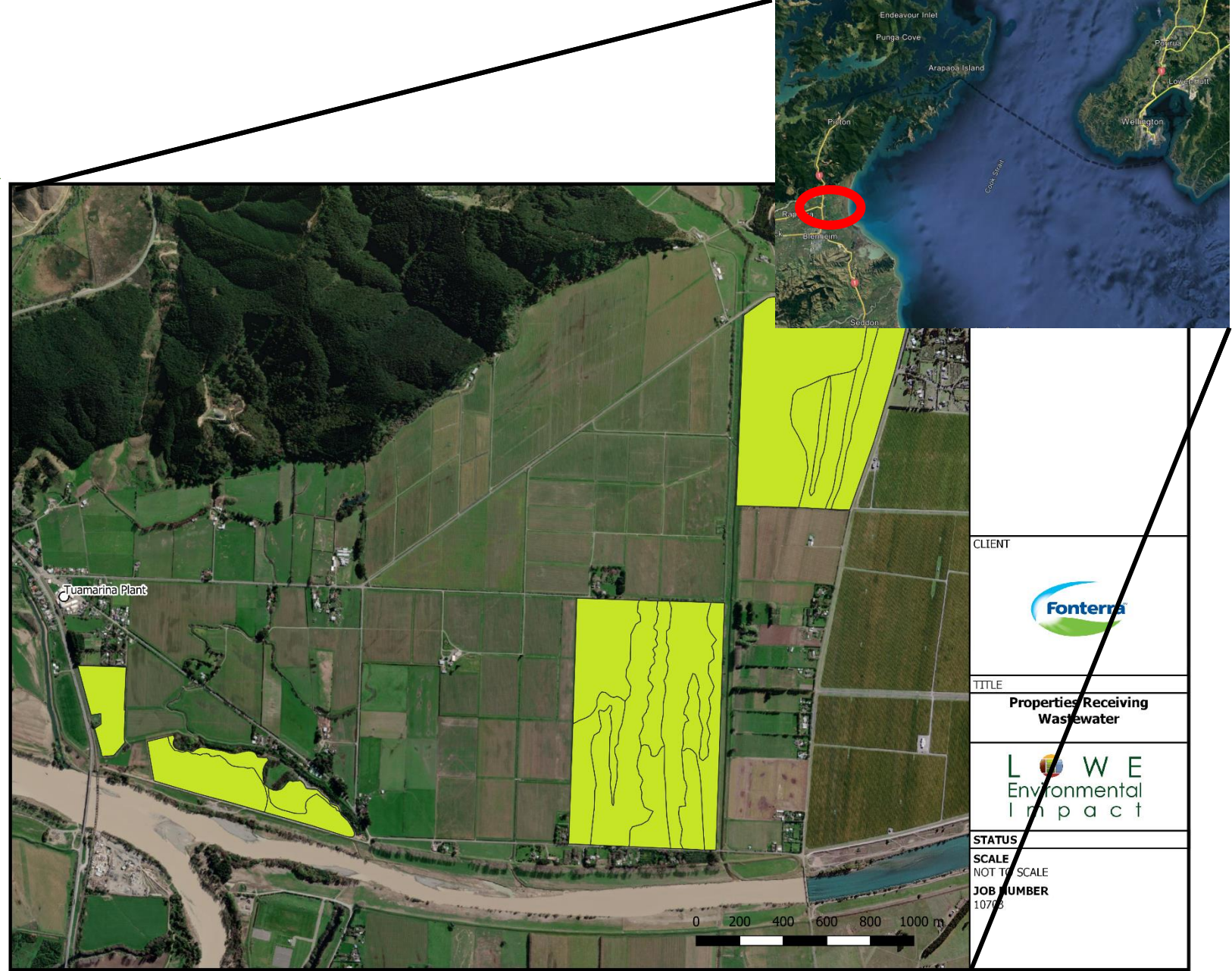


- How do we adapt?

Tuamarina Site

- Fonterra operated a dairy processing plant at Tuamarina
- Wastewater discharged
 - irrigation at 3rd party sites
 - surface water discharge to Wairau River
- Resource consents were due to expire

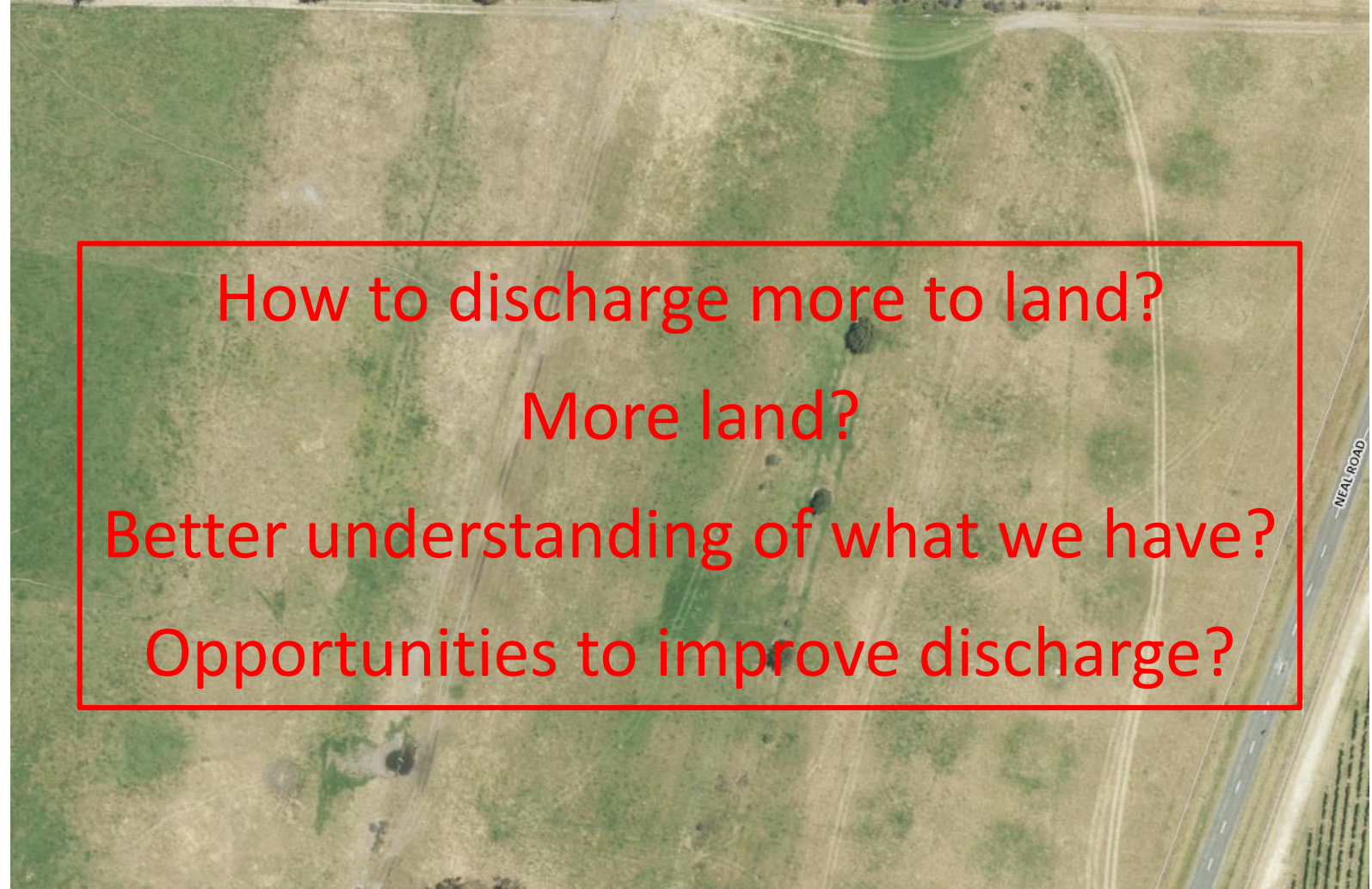
New Regulations



CLIENT	
TITLE	Properties Receiving Wastewater
STATUS	
SCALE	NOT TO SCALE
JOB NUMBER	10703

Future Discharge

- Objective:
 - to reduce surface water discharge
- Limitation:
 - issues with current irrigation regime for groundwater
 - need to consider future resilience



Operational Challenges

1. Limited staff hours available.
2. Properties are discontinuous and up to 5 km from plant
3. Third party landowner's cooperation – short notice of access of changes
4. Stock and crop rotations – 16 day stand down for grazing,
5. Existing system – K-line – manual system with limited system capacity



Land Treatment Challenges

1. Irrigation management constrained by consent conditions.
2. River flow variability
3. Soil variability
4. High groundwater
5. Land use change



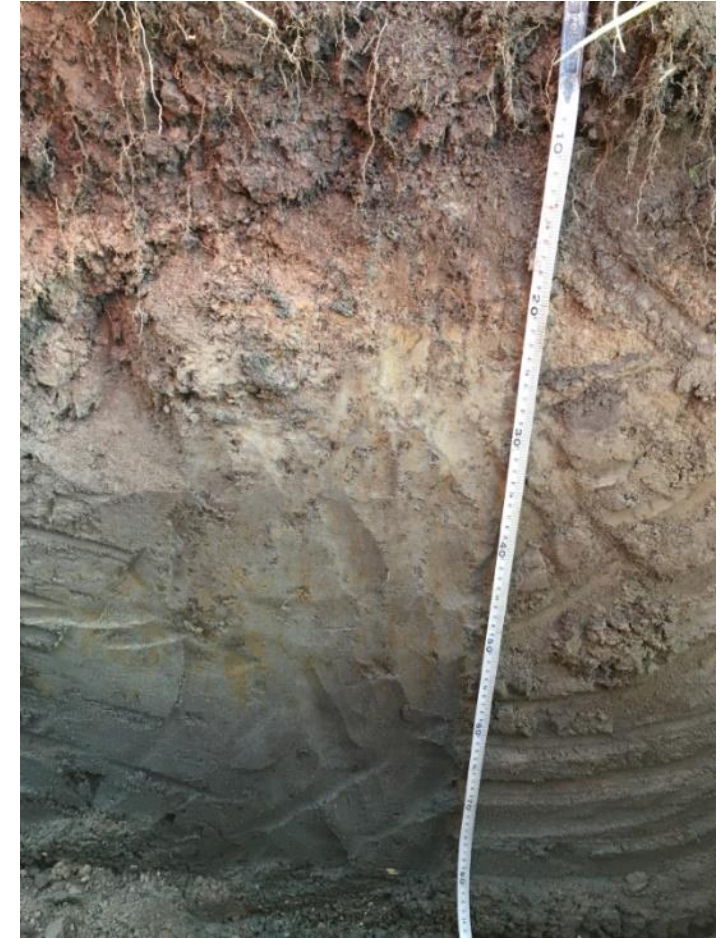
System Considerations

- Consenting Objectives
 - No river discharge
 - 100% land treatment
 - Minimise soil drainage
 - Cost effective
- Flexibility with infrastructure
- Integration with landowners
- Beneficial use
- Groundwater quality protected
- Operate within Consent

Soil Investigations

- Initial desktop and field survey of soil type distribution identified surface water flow paths, waterways and wet areas
- Walkover to map surface features and drainage paths
- Ten test pits across the multiple 3rd party farms for soil profile descriptions
- Plate Permeameter and Double Ring Infiltrometer

New Use of Investigation



Soils



Soil Hydraulic Testing



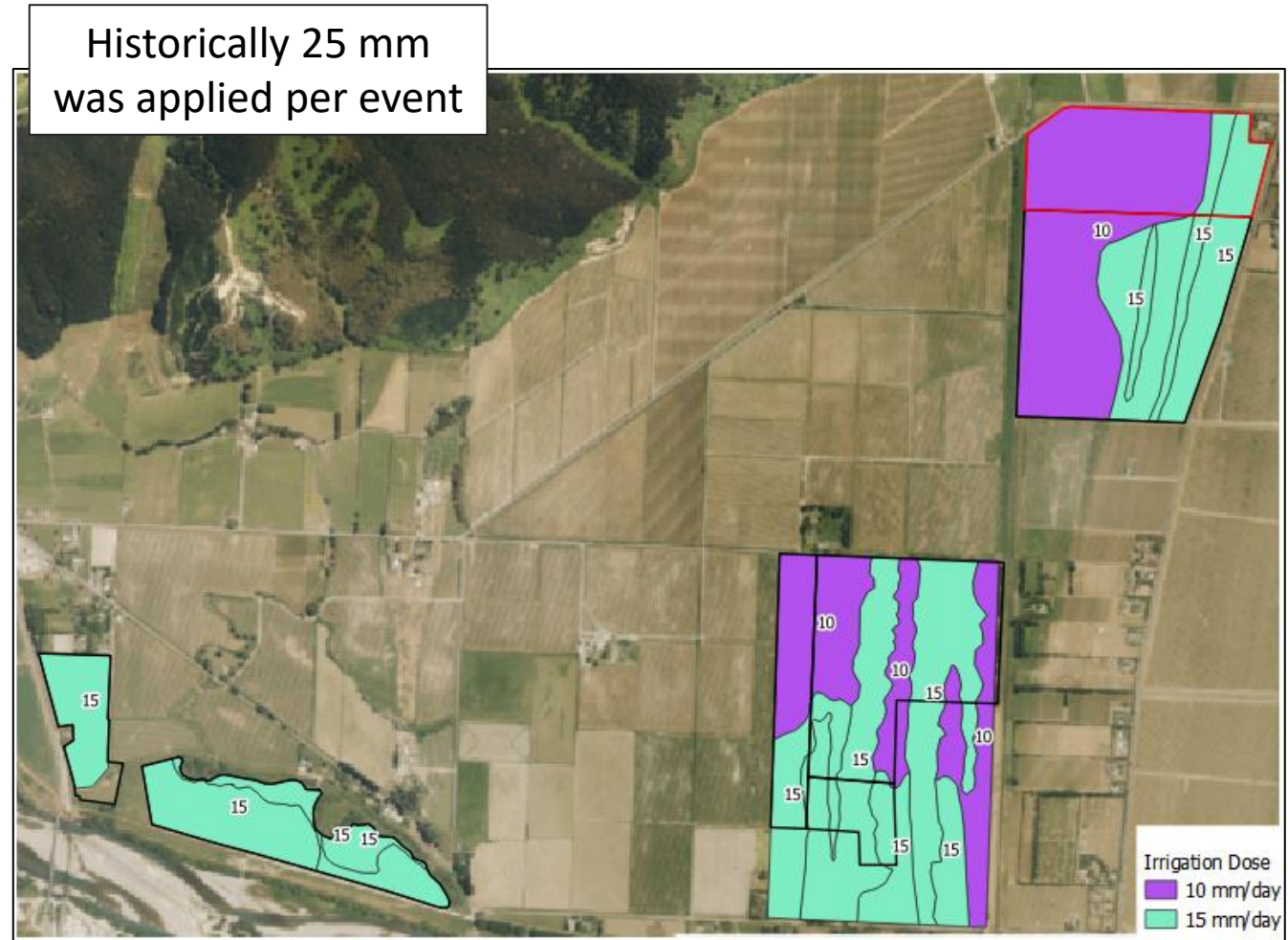
Soil Hydraulics

Soil type	K_{sat} (mm/h)	$K_{-40\text{ mm}}$ (mm/h)	Irrigation rate, wastewater (mm/d) based on 10% K_{sat}	Irrigation rate, wastewater (mm/d) based on 30% $K_{-40\text{ mm}}$
Waimakariri	203 ± 89	2.9 ± 1.8	488	21
Waimakariri	65 ± 17	2.7 ± 0.6	156	10
Rangitata	76 ± 33	1.4 ± 2.9	190	11
Taitapu	72 ± 91	4.5 ± 4.7	180	11
Fereday	120 ± 35	1.5 ± 1.0	288	11
Taitapu	515 ± 267	0.7 ± 0.2	1,237	5
Taitapu	69 ± 29	0.6 ± 0.3	165	4
Taitapu	272 ± 194	0.5 ± 0.3	652	4
Taitapu	17 ± 8	0.5 ± 0.4	41	4
Waimakariri	110 ± 77	1.5 ± 0.9	264	11

K_{sat} : 17 – 515 mm/h
 $K_{-40\text{ mm}}$: 0.5 – 4.5 mm/h

Irrigation Dose

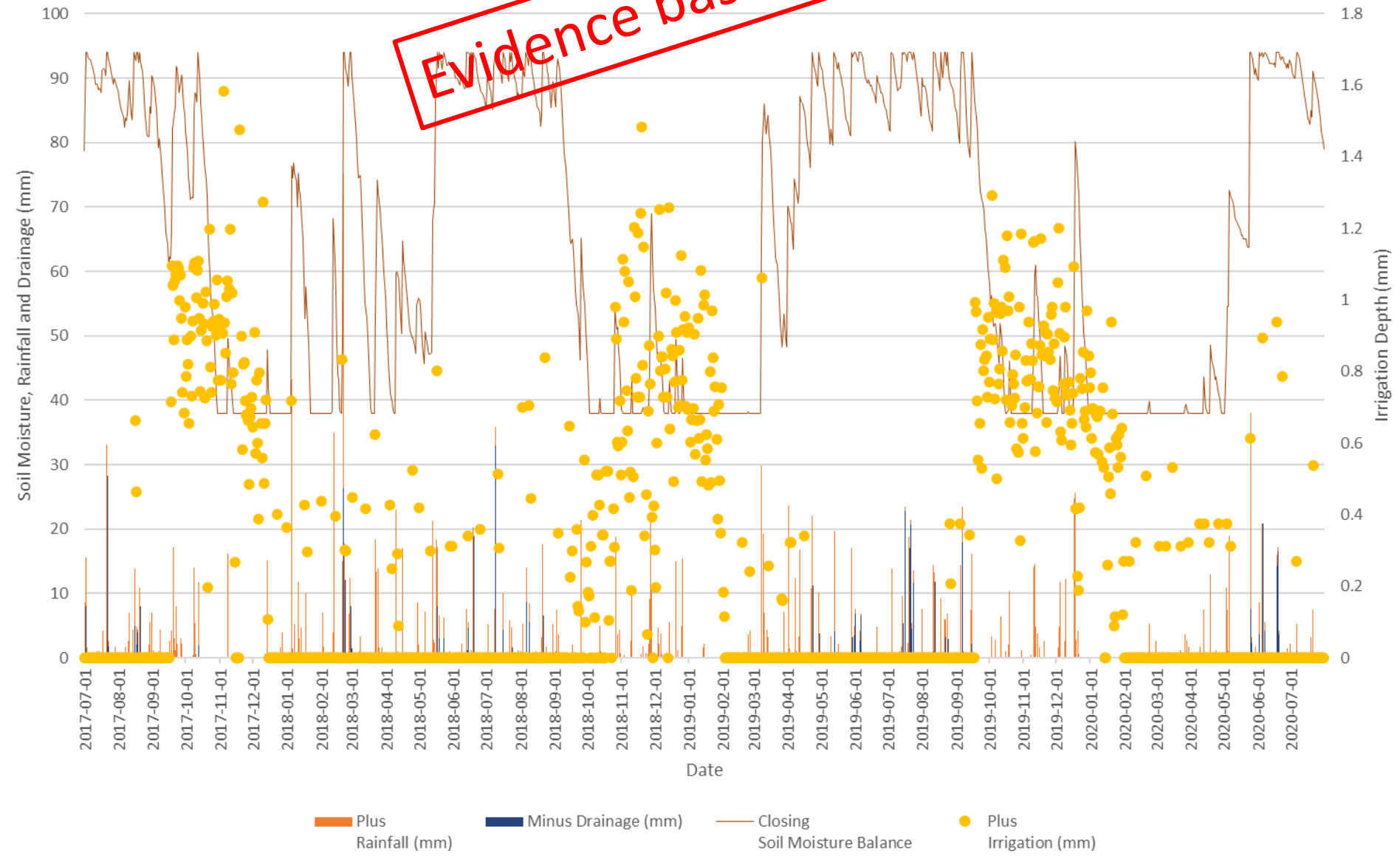
Soil type	Design Irrigation Rate (mm/day)	Proposed Application Dose (mm/day)
Waimakariri	70	15
Waimakariri	65	15
Rangitata	34	15
Taitapu	108	15
Fereday	36	15
Taitapu	17	10
Taitapu	14	10
Taitapu	12	10
Taitapu	12	10
Waimakariri	36	15



Water Balance

Evidence based approach

Representative Daily Soil Moisture Balance



Irrigation System Changes

- Application matched to soil properties
- Irrigation automation (pulse application)

Irrigation area	High	Low
Cycle depth (mm)	3	2
Cycle run time (min)	30	20
Cycles per day	5	5
Dose depth (mm/day)	15	10
Event depth (mm)	30	20



Resilience through scheduling

New Use of Established Technology

Conclusions

- New Regulations
 - New consent
 - New Investigations
 - Soils are in good physical and chemical health.
 - Complex mix of soils treated carefully to limit ponding and bypass flow.
 - New Technology
 - Added automation to convert from existing manual system.
- =
- The proposed irrigation regime limits drainage
 - Greater area irrigated per day
 - More flexibility where and when to irrigate
 - No river discharge is achievable

L O W E Environmental I m p a c t

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