L W E
Environmental
I m p a c t

A new opportunity for intensive farming using wastewater to improve the environment

Hamish Lowe & Phil Lake - FLRC 2022

What's this about?

- Foxton community has made an effort to improve water quality
- Community wanted surface water in the Manawatu River above the Foxton Beach Estuary to improve
- Surface water discharges are abhorrent to Māori
- Change takes time and money
- Horowhenua District Council have just commissioned new land based wastewater system using a bull beef operation

Setting

- Past:
  - Treatment: oxidation ponds since 1976
  - Discharge: 100 % to the Manawatu River
- Change:
  - > 15 years to think about
  - 4 years to consent
  - 2 ½ years to construct
- Now:
  - Treatment: oxidation ponds (no change) + new storage pond
  - Discharge: 100 % to 65 ha of 145 ha farm used for grazing bull beef.

Challenges - Regulatory

One Plan = Regional Plan in the Horizons region

Conversion to irrigation = land use intensification = limit on leaching

But

Year-round wastewater irrigation increases nutrient leaching

So

Need to develop a holistic approach – not just at a farm level

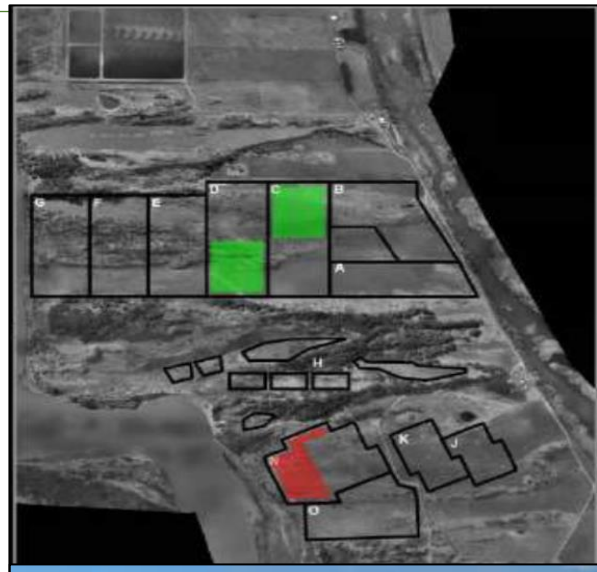
Stocking rates will increase

Challenges – Farm and Irrigation

Wastewater quality – nutrients and pathogens	So	Have good treatment
Wastewater flows – not regular and peaks in winter	So	Have storage capacity
Nutrient application and loss limits	So	Have sufficient land to stay within nutrient cap

Farm system

- 10-24 month old bulls
- Rotated in mobs of 70 to 100
- Ten 0.5 ha paddocks, 20 day rotation
- Repeated in 13 blocks
- Sell at a live weight of 575 kg at 2 ½ years old



Irrigation system

- Irrigation follows grazing
- 5 -20 mm applications
- 48 hour delay after irrigation before grazing
- Water balance
  - Not enough water in summer
  - Too much water in winter
  - Need storage
  - And relief valve – high rate irrigation

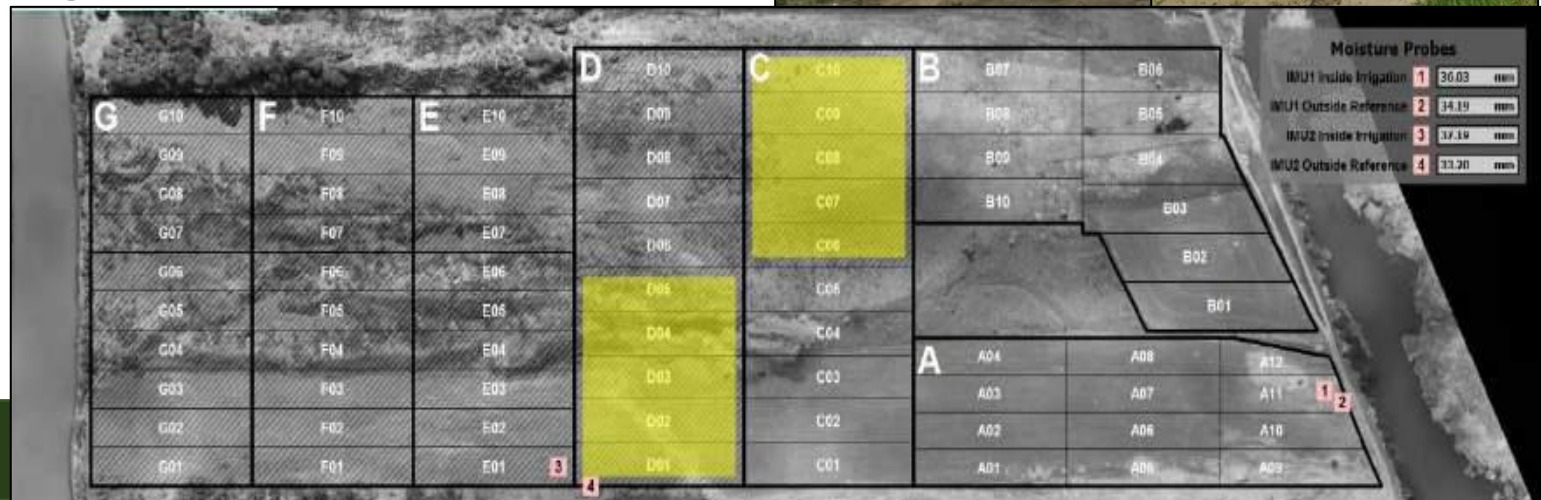
Soil and Land Characteristics

- Dune sands are subject to:
  - Wind erosion
  - Hydrophobicity when dry
  - Rapid drainage
  - Steep slopes in places
  - River erosion risk in places
- Alluvial flats are subject to:
  - Becoming waterlogged – silty and only 1-2 m above mean high tide
  - Inundation when the Manawatu River floods

System Design

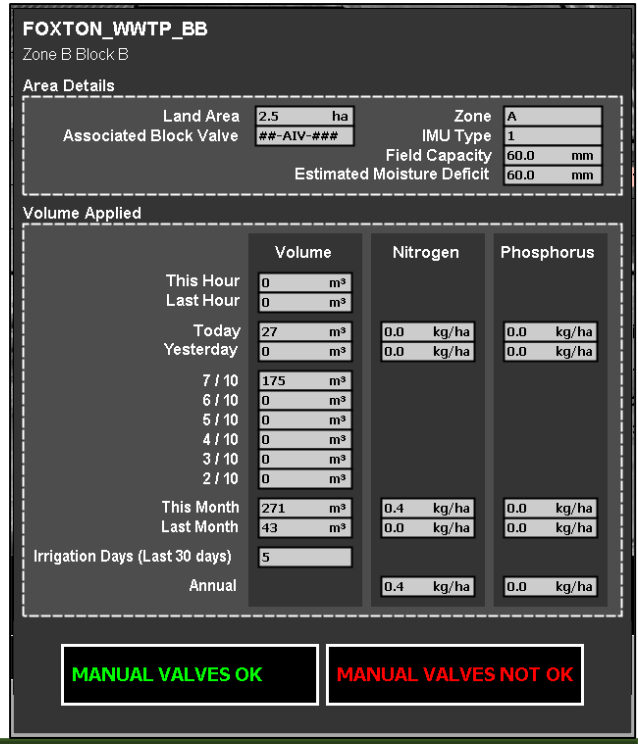
LOWE Environmental Impact

- Regular 0.5 ha paddocks accessed from central stock routes
- Sprinklers on fence posts or electrified in middle of paddock
- More intensive stock management required to look after infrastructure and animal health
- Soil moisture monitoring used to govern on alluvial soils



System Operation

- Lots of consent requirements – for council and farmer
- Key conditions included in operating system that:
  - Schedules irrigation
  - Locks out irrigation if:
    - Nutrient cap is reached
    - Too windy
    - Too much recent rain
  - Records irrigation event details
  - Calculates cumulative nutrient applications
  - Issues warnings and alarms



System Operation

- Environmental monitoring:
  - Soil moisture continuously (5 irrigated, 5 reference)
  - Groundwater quarterly at 6 bores (and 8 more around the WWTP)
  - Surface water 6-monthly at 2 drains
  - Soil quality annually across the farm

- Annual reporting includes:
  - Nutrient reporting
  - Farm management plan
  - Trend analysis

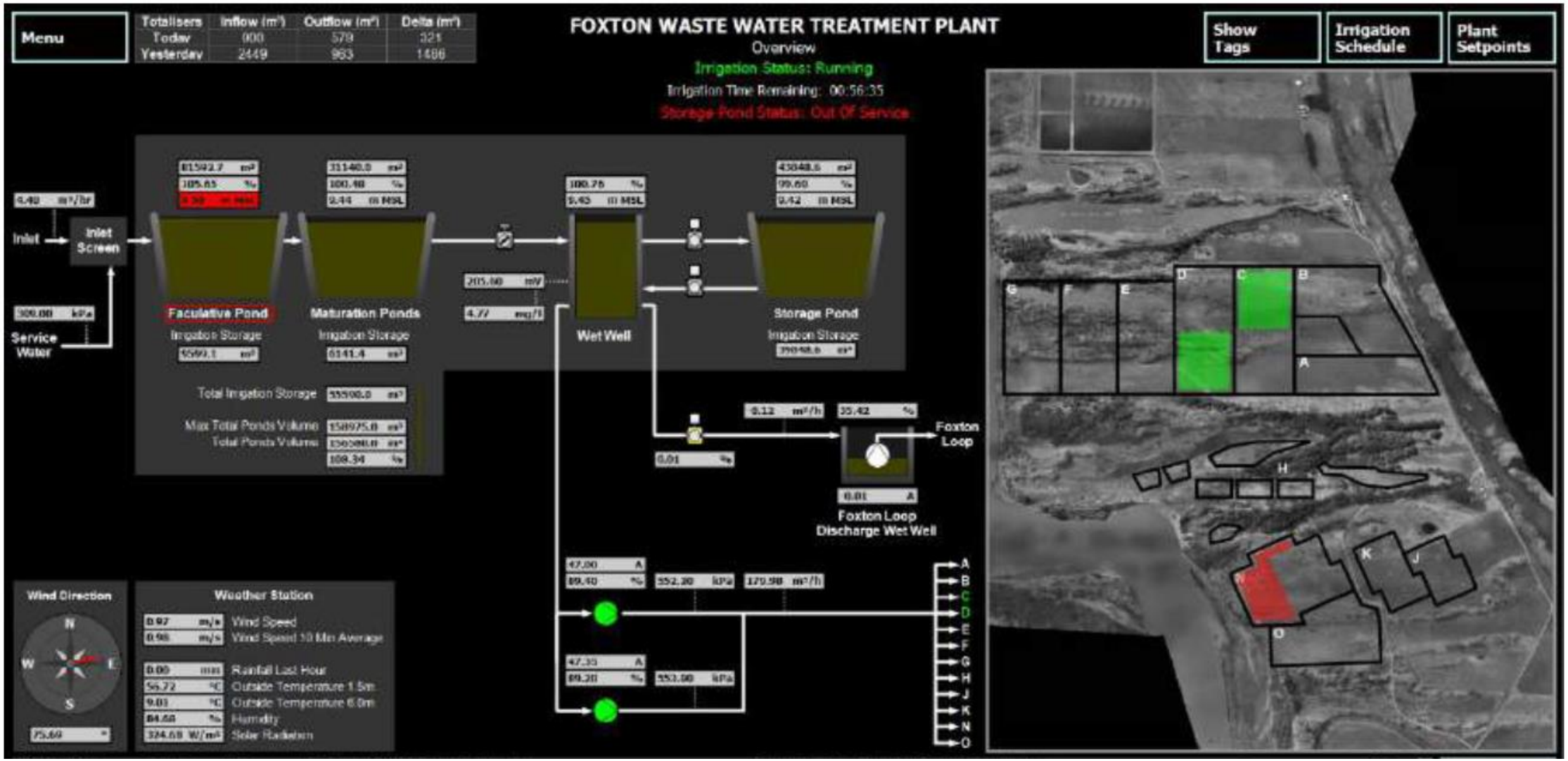
Volume Report

Irrigation Zones | North Blocks (IMU 1&2) | Middle Blocks (IMU 3) | South Blocks (IMU 1&2)

Zone / IMU	This Hour	Last Hour	Today	Yesterday	This Month	Last Month	Nitrogen Today	Nitrogen Yesterday	Nitrogen Month	Nitrogen Last Month	Annual Nitrogen	Phosphorus Today	Phosphorus Yesterday	Phosphorus Month	Phosphorus Last Month	Annual Phosphorus
IMU 1 Volumes	0 m³	0 m³	0 m³	0 m³	1260 m³	2056 m³	0.0 kg/ha	0.0 kg/ha	1.9 kg/ha	2.6 kg/ha	71.9 kg/ha	0.0 kg/ha	0.0 kg/ha	0.4 kg/ha	0.5 kg/ha	11.5 kg/ha
IMU 2 Volumes	0 m³	0 m³	580 m³	0 m³	7555 m³	21783 m³	0.5 kg/ha	0.0 kg/ha	6.0 kg/ha	16.6 kg/ha	164.4 kg/ha	0.1 kg/ha	0.0 kg/ha	1.2 kg/ha	3.2 kg/ha	27.0 kg/ha
IMU 3 Volumes	30 m³	105 m³	384 m³	408 m³	2113 m³	8997 m³	1.3 kg/ha	1.4 kg/ha	7.3 kg/ha	31.0 kg/ha	38.3 kg/ha	0.3 kg/ha	0.3 kg/ha	1.4 kg/ha	6.0 kg/ha	7.4 kg/ha
Zone A Volumes	0 m³	0 m³	0 m³	0 m³	71 m³	142 m³	0.0 kg/ha	0.0 kg/ha	0.3 kg/ha	0.5 kg/ha	99.2 kg/ha	0.0 kg/ha	0.0 kg/ha	0.1 kg/ha	0.1 kg/ha	15.8 kg/ha
Zone B Volumes	0 m³	0 m³	0 m³	0 m³	732 m³	1560 m³	0.0 kg/ha	0.0 kg/ha	4.0 kg/ha	8.6 kg/ha	158.3 kg/ha	0.0 kg/ha	0.0 kg/ha	0.8 kg/ha	1.7 kg/ha	25.1 kg/ha
Zone C Volumes	0 m³	0 m³	0 m³	0 m³	764 m³	1856 m³	0.0 kg/ha	0.0 kg/ha	4.2 kg/ha	10.2 kg/ha	176.3 kg/ha	0.0 kg/ha	0.0 kg/ha	0.8 kg/ha	2.0 kg/ha	29.0 kg/ha
Zone D Volumes	0 m³	0 m³	0 m³	0 m³	783 m³	2605 m³	0.0 kg/ha	0.0 kg/ha	4.3 kg/ha	14.4 kg/ha	224.7 kg/ha	0.0 kg/ha	0.0 kg/ha	0.8 kg/ha	2.8 kg/ha	35.7 kg/ha
Zone E Volumes	0 m³	0 m³	0 m³	0 m³	907 m³	983 m³	0.0 kg/ha	0.0 kg/ha	5.0 kg/ha	5.4 kg/ha	184.4 kg/ha	0.0 kg/ha	0.0 kg/ha	1.0 kg/ha	1.1 kg/ha	29.8 kg/ha
Zone F Volumes	0 m³	0 m³	0 m³	0 m³	988 m³	1225 m³	0.0 kg/ha	0.0 kg/ha	5.5 kg/ha	6.8 kg/ha	180.0 kg/ha	0.0 kg/ha	0.0 kg/ha	1.1 kg/ha	1.3 kg/ha	29.1 kg/ha
Zone G Volumes	0 m³	0 m³	0 m³	0 m³	1086 m³	1879 m³	0.0 kg/ha	0.0 kg/ha	6.0 kg/ha	10.4 kg/ha	215.8 kg/ha	0.0 kg/ha	0.0 kg/ha	1.2 kg/ha	2.0 kg/ha	33.6 kg/ha
Zone H Volumes	30 m³	105 m³	384 m³	408 m³	2113 m³	8997 m³	1.3 kg/ha	1.4 kg/ha	7.3 kg/ha	31.0 kg/ha	38.3 kg/ha	0.3 kg/ha	0.3 kg/ha	1.4 kg/ha	6.0 kg/ha	7.4 kg/ha
Zone J Volumes	0 m³	0 m³	0 m³	0 m³	229 m³	195 m³	0.0 kg/ha	0.0 kg/ha	2.6 kg/ha	2.3 kg/ha	4.9 kg/ha	0.0 kg/ha	0.0 kg/ha	0.5 kg/ha	0.4 kg/ha	1.0 kg/ha
Zone K Volumes	0 m³	0 m³	0 m³	0 m³	228 m³	40 m³	0.0 kg/ha	0.0 kg/ha	2.4 kg/ha	0.4 kg/ha	2.7 kg/ha	0.0 kg/ha	0.0 kg/ha	0.5 kg/ha	0.1 kg/ha	0.6 kg/ha
Zone N Volumes	0 m³	0 m³	0 m³	0 m³	2301 m³	10617 m³	0.0 kg/ha	0.0 kg/ha	10.4 kg/ha	48.3 kg/ha	84.9 kg/ha	0.0 kg/ha	0.0 kg/ha	2.0 kg/ha	9.4 kg/ha	16.5 kg/ha
Zone O Volumes	0 m³	0 m³	580 m³	0 m³	726 m³	2838 m³	2.9 kg/ha	0.0 kg/ha	3.7 kg/ha	13.4 kg/ha	46.8 kg/ha	0.6 kg/ha	0.0 kg/ha	0.7 kg/ha	2.6 kg/ha	9.1 kg/ha

CLOSE

SCADA Overview



Environmental Outcomes

- Reductions in nutrient discharges into the Manawatu River:
  77 % for N and 97 % for P
- Beneficial pasture growth and modest herd increases (30 %)
- Improved erosion and pasture resilience

Summary

LOWE Environmental Impact

- It is possible to **cease wastewater discharges to surface water**
- Need right soils and ability to **manage winter flows**
- **Intensive beef is a solution**, particularly as it uses a rotational grazing approach that allows irrigation to cease for short periods
- **Automation** is key, both for operation and compliance reporting
- Overall better outcomes can be achieved **despite intensified land use**

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