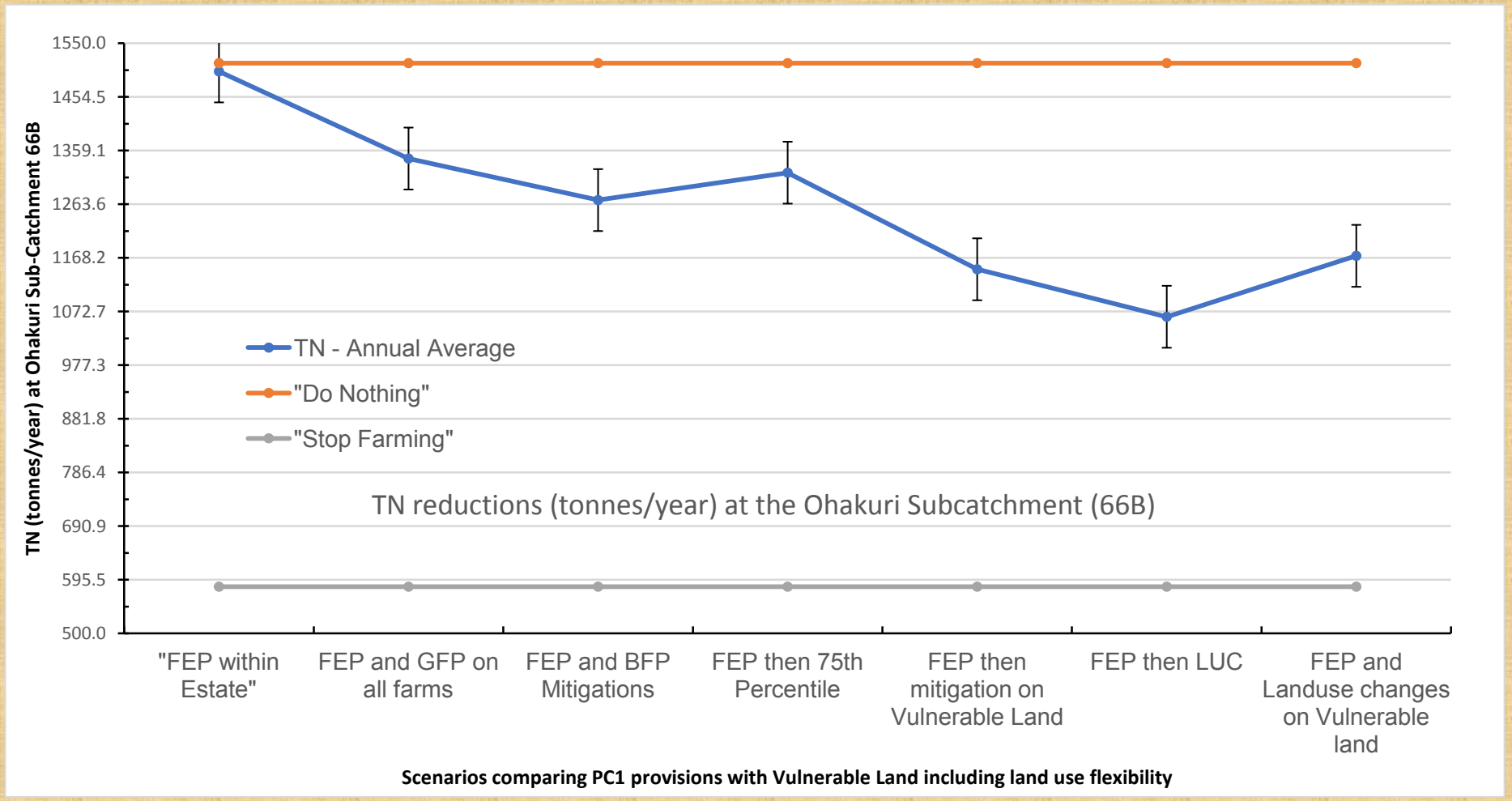
Wairakei Pastoral Limited

Plan Change 1

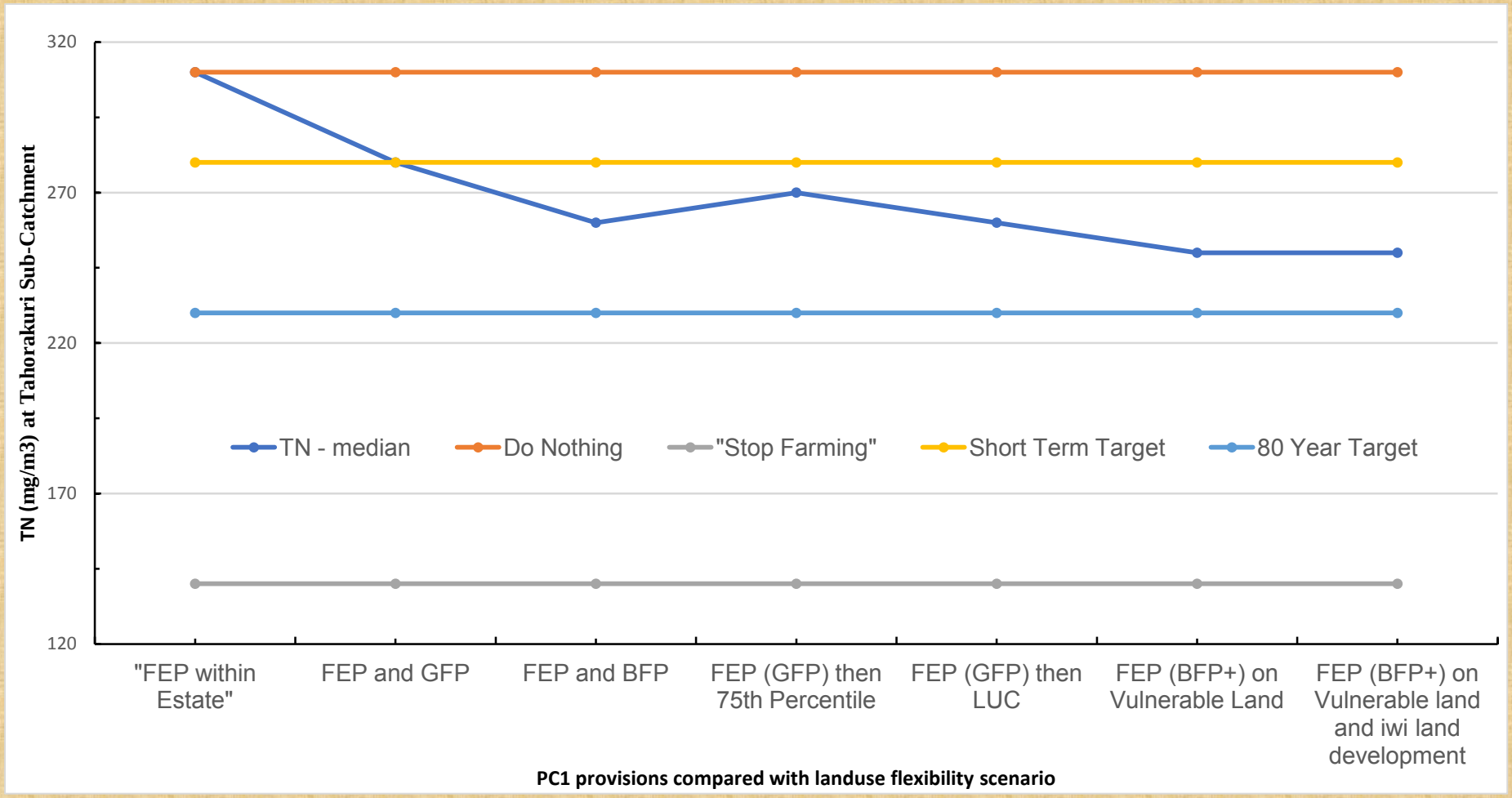
Block 2 Evidence

RDST Scenario results (figure 4 – Block 2 Evidence Mr. Conland)



TN reductions (tonnes/year) at Ohakuri (Sub-catchment 66B)

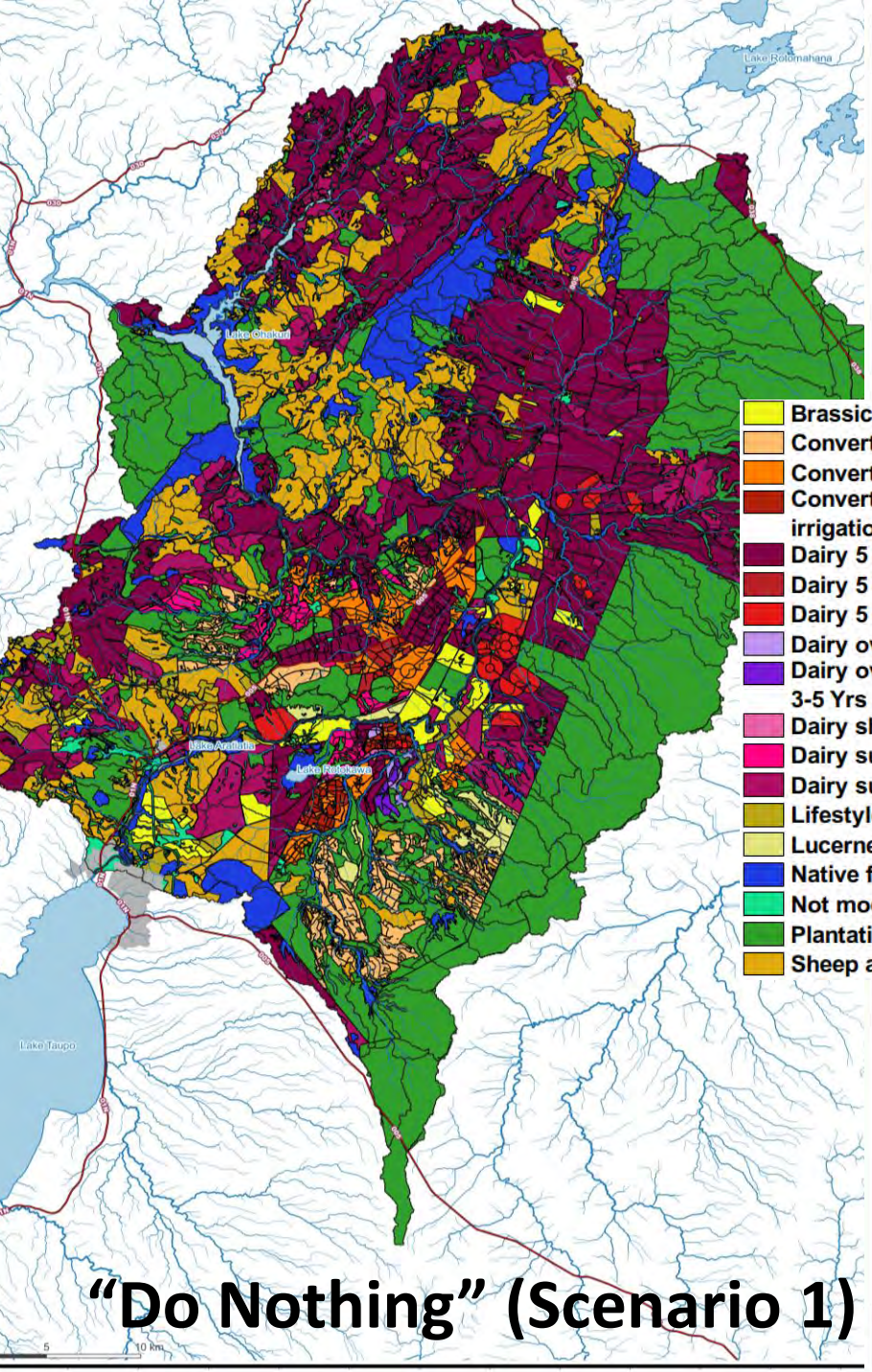
RDST Scenario results (figure 6 – Block 2 Evidence Mr. Conland)



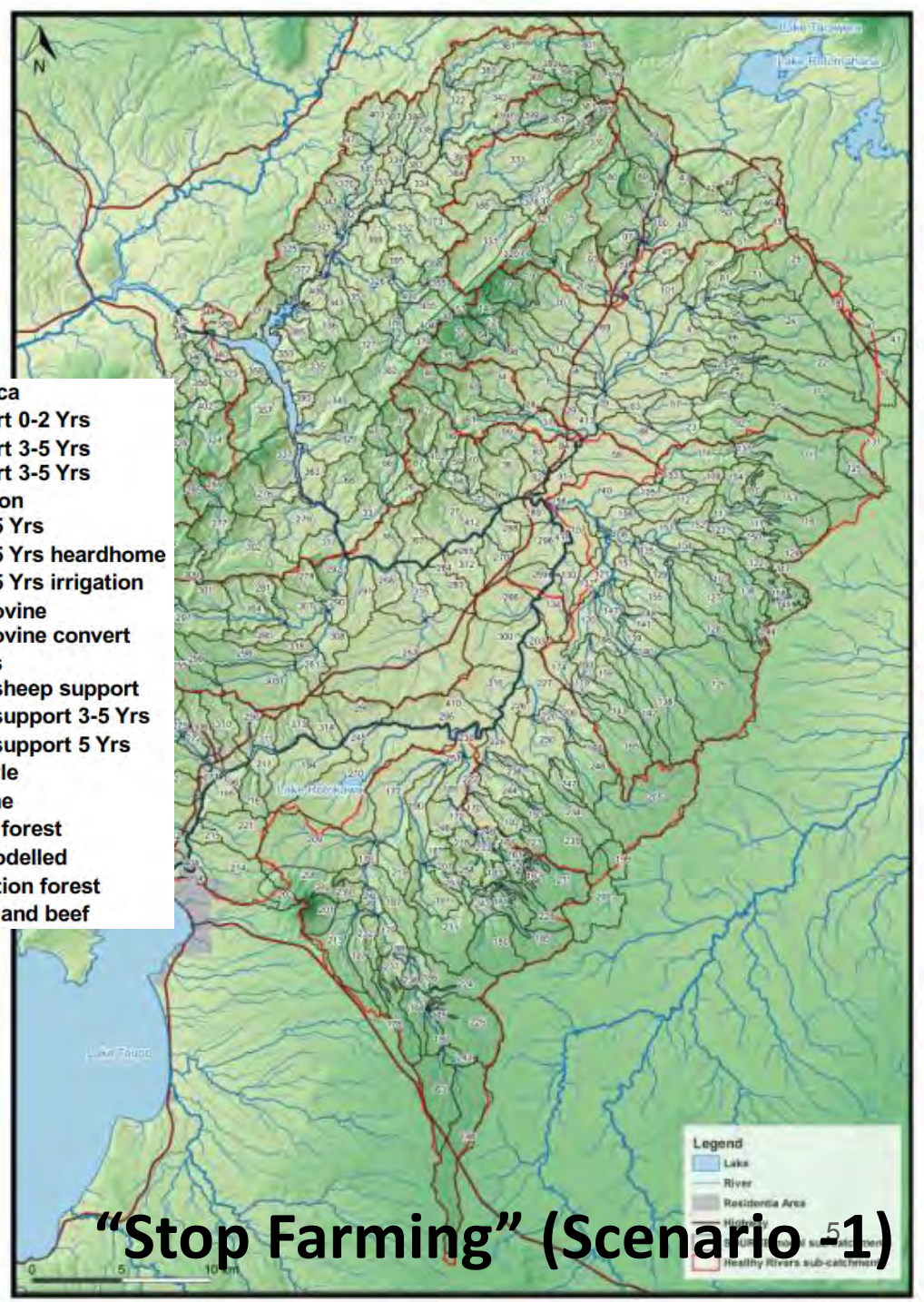
Investigation of land use flexibility at Tahorakuri (Sub-catchment 66A)

Slides For Mr Conland

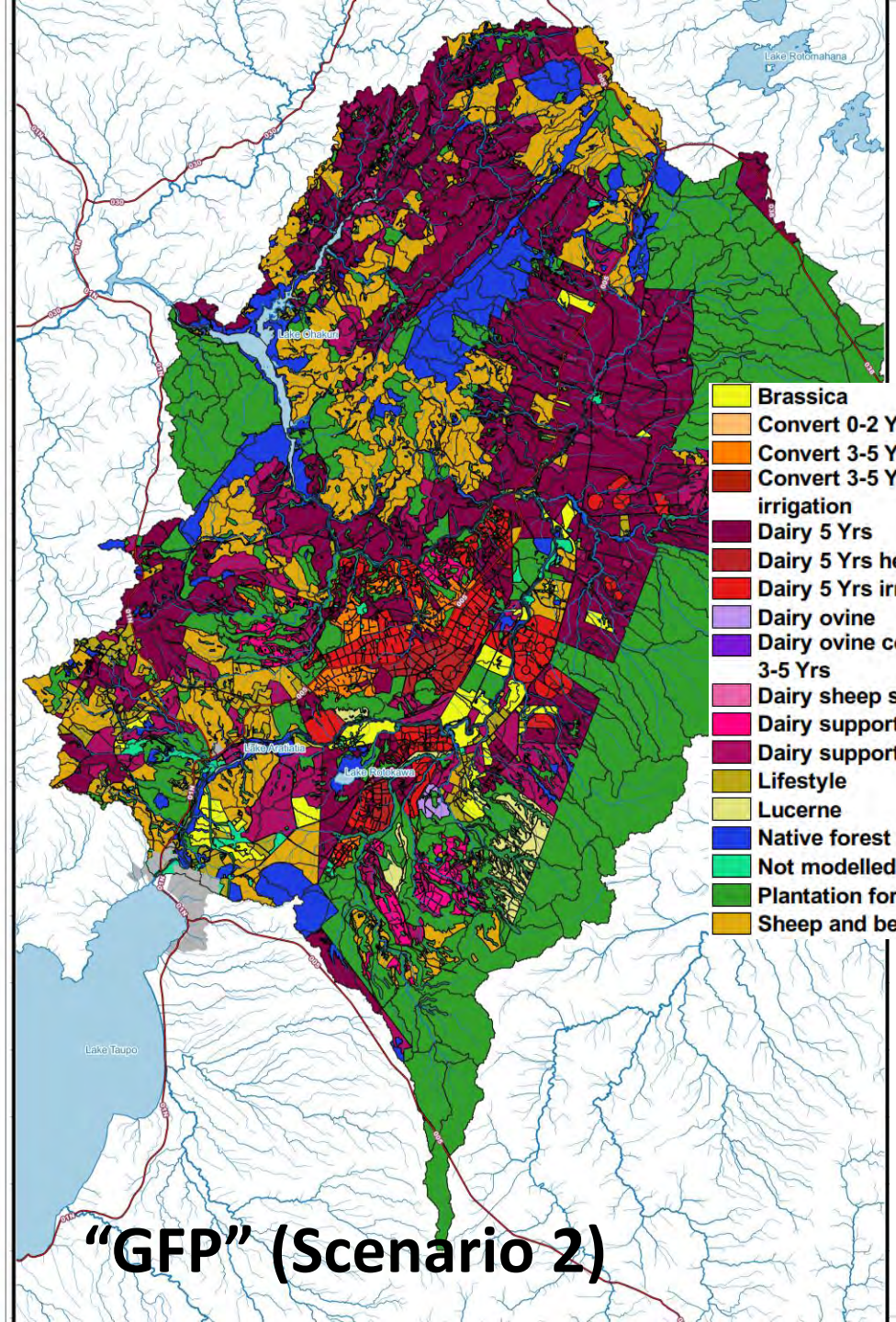
All figures are from Block 2 Evidence of Mr Conland



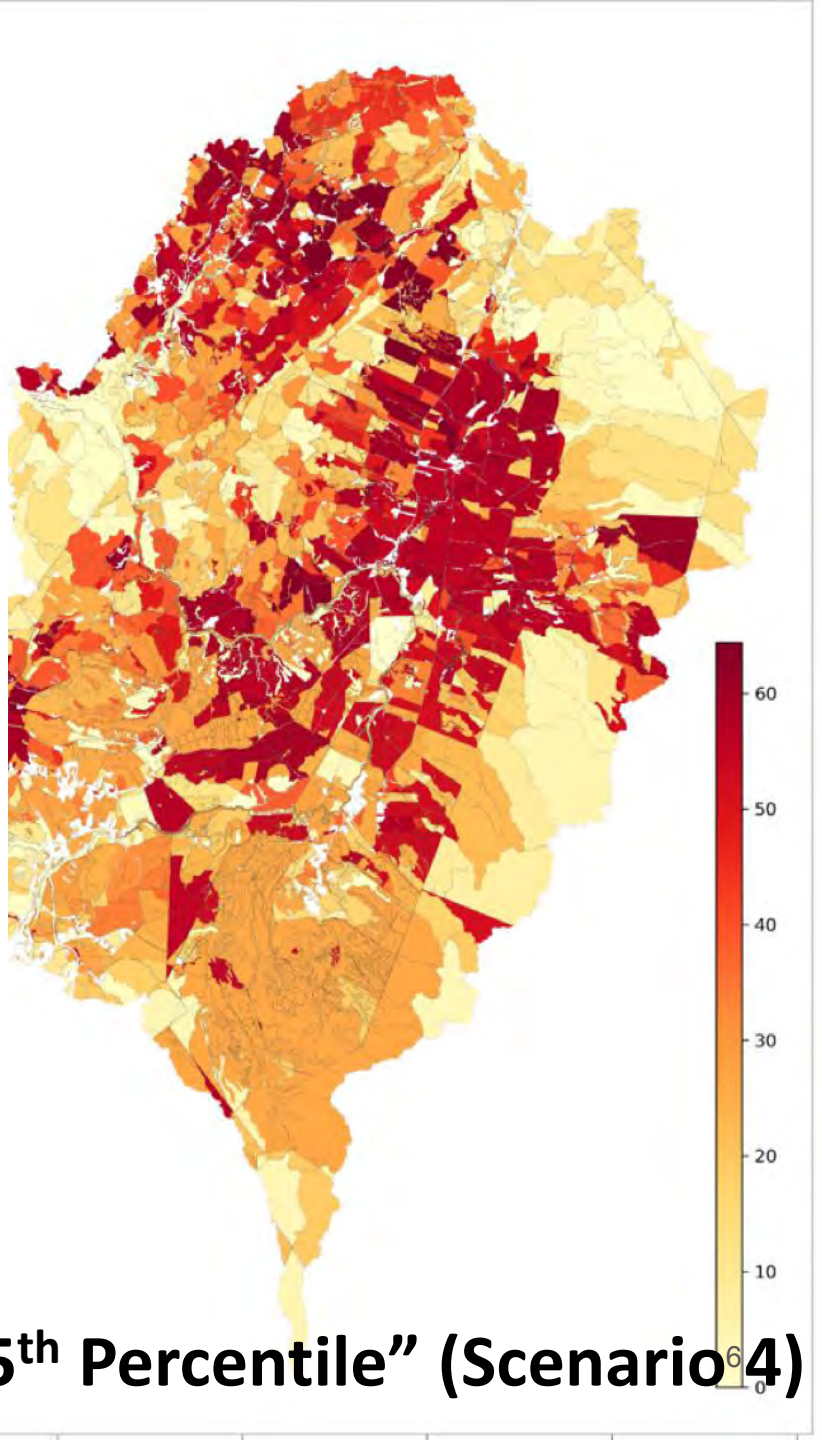
"Do Nothing" (Scenario 1)



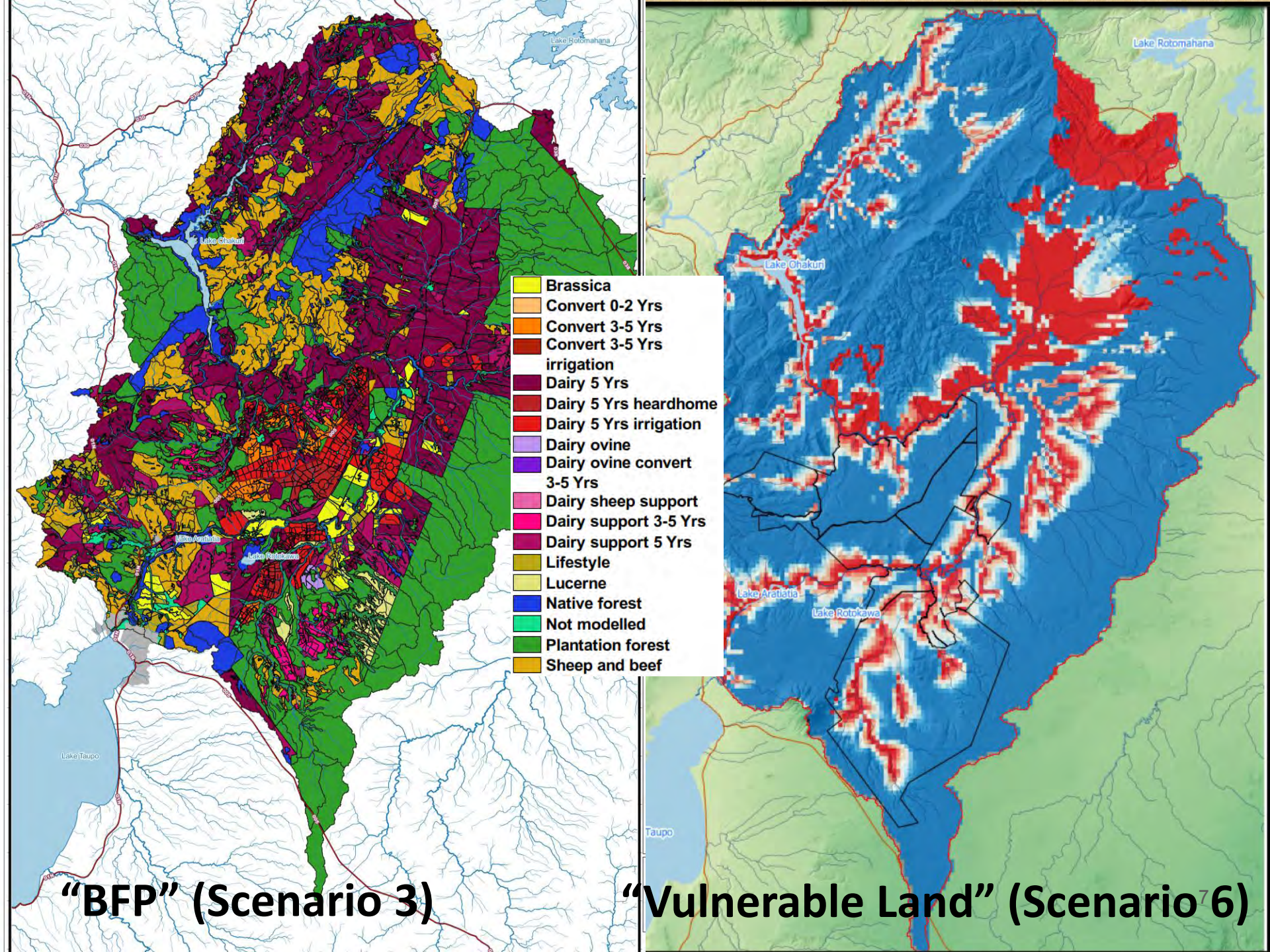
"Stop Farming" (Scenario -1)

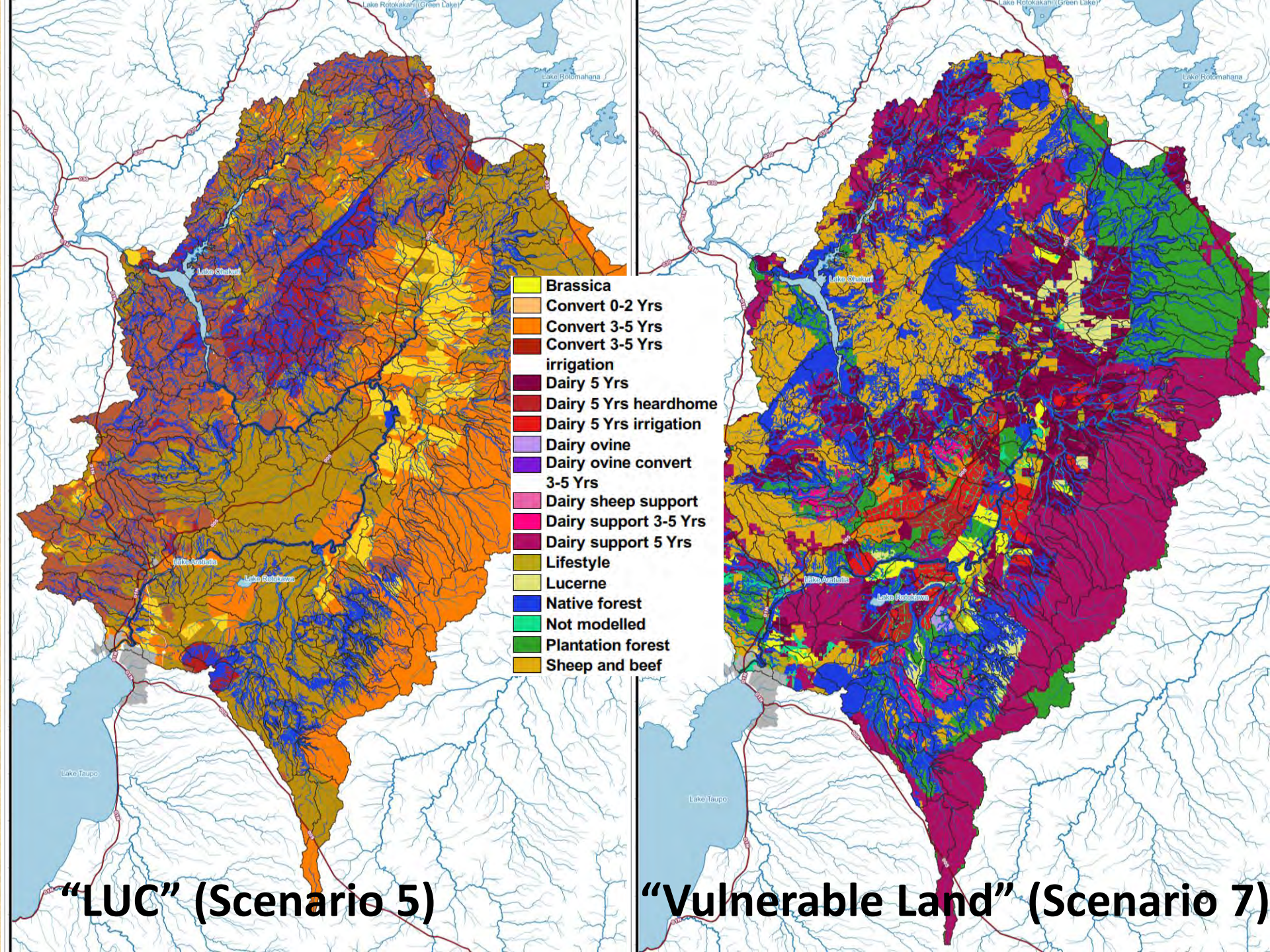


"GFP" (Scenario 2)



"75th Percentile" (Scenario 4)

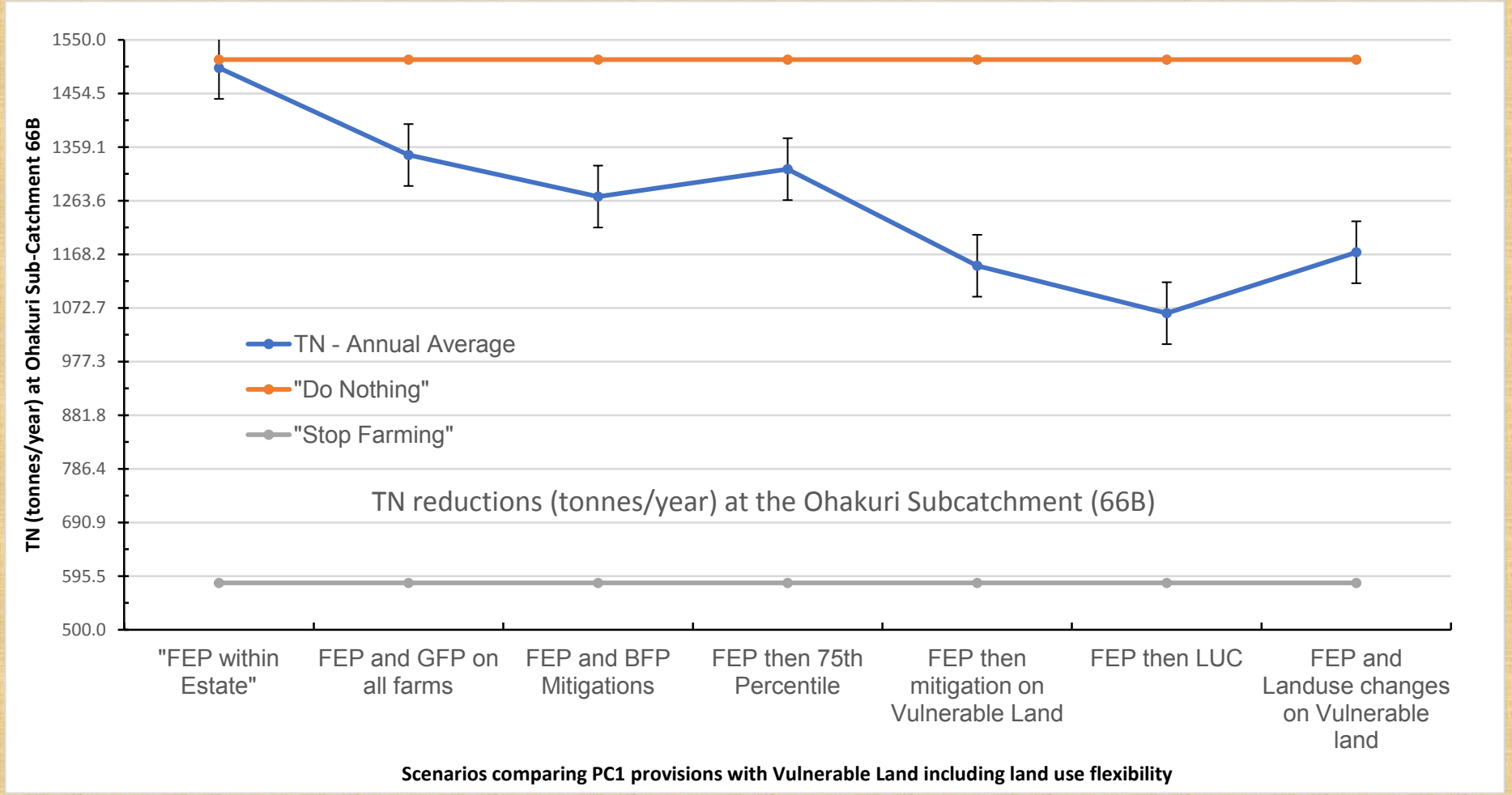

Lake Rotomahana
Lake Ohakuri
Lake Aratiatia
Lake Rotokawa
Lake Taupo
Brassica
Convert 0-2 Yrs
Convert 3-5 Yrs
Convert 3-5 Yrs irrigation
Dairy 5 Yrs
Dairy 5 Yrs heardhome
Dairy 5 Yrs irrigation
Dairy ovine
Dairy ovine convert 3-5 Yrs
Dairy sheep support
Dairy support 3-5 Yrs
Dairy support 5 Yrs
Lifestyle
Lucerne
Native forest
Not modelled
Plantation forest
Sheep and beef
Taupo
"BFP" (Scenario 3)
"Vulnerable Land" (Scenario 6)



“LUC” (Scenario 5)

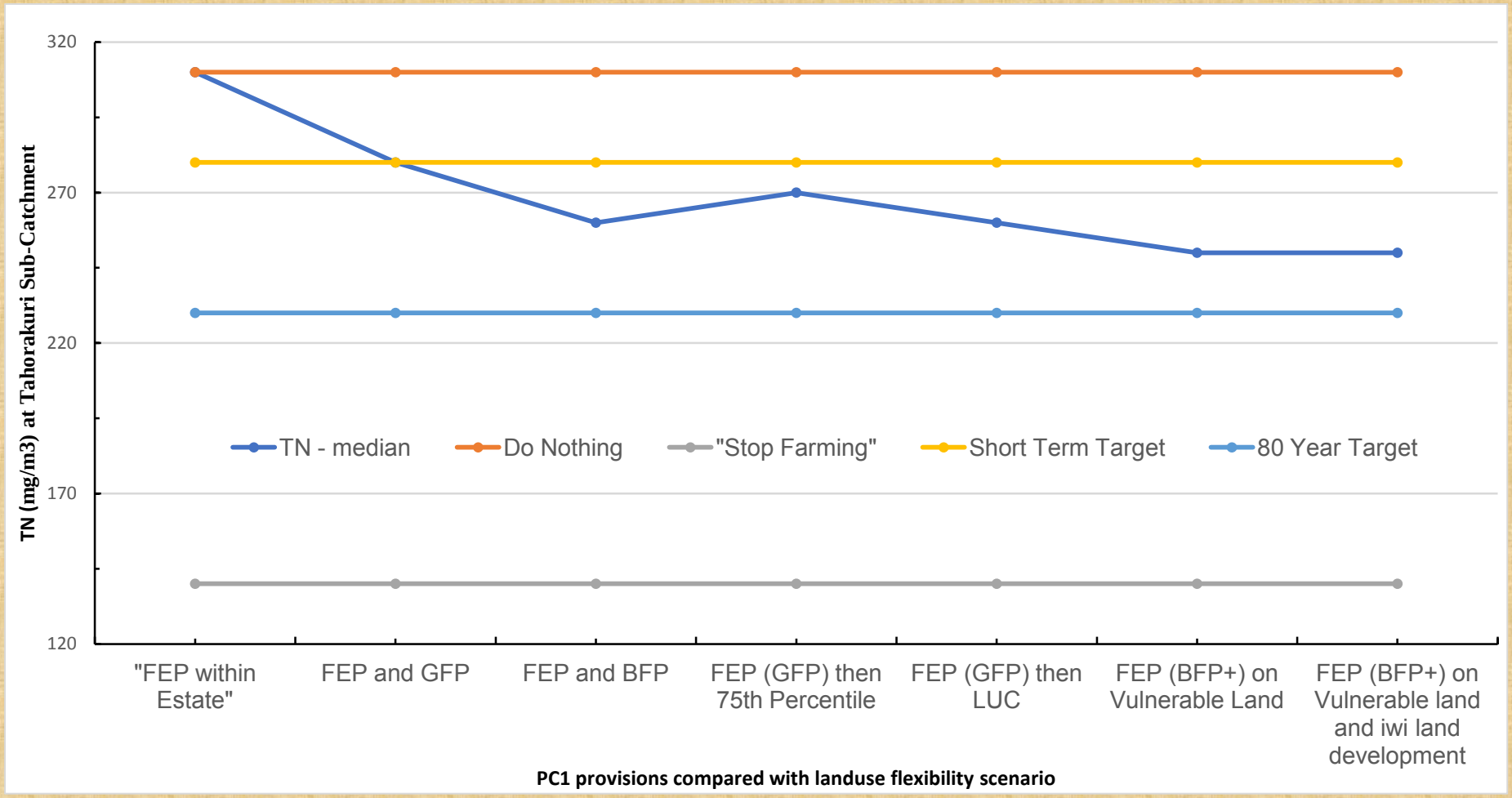
“Vulnerable Land” (Scenario 7)

RDST Scenario results (figure 4 – Block 2 Evidence Mr. Conland)



TN reductions (tonnes/year) at Ohakuri (Sub-catchment 66B)

RDST Scenario results (figure 6 – Block 2 Evidence Mr. Conland)



Investigation of land use flexibility at Tahorakuri (Sub-catchment 66A)

Slides For Mr Williamson

All figures are from Block 2 Evidence of Mr Williamson

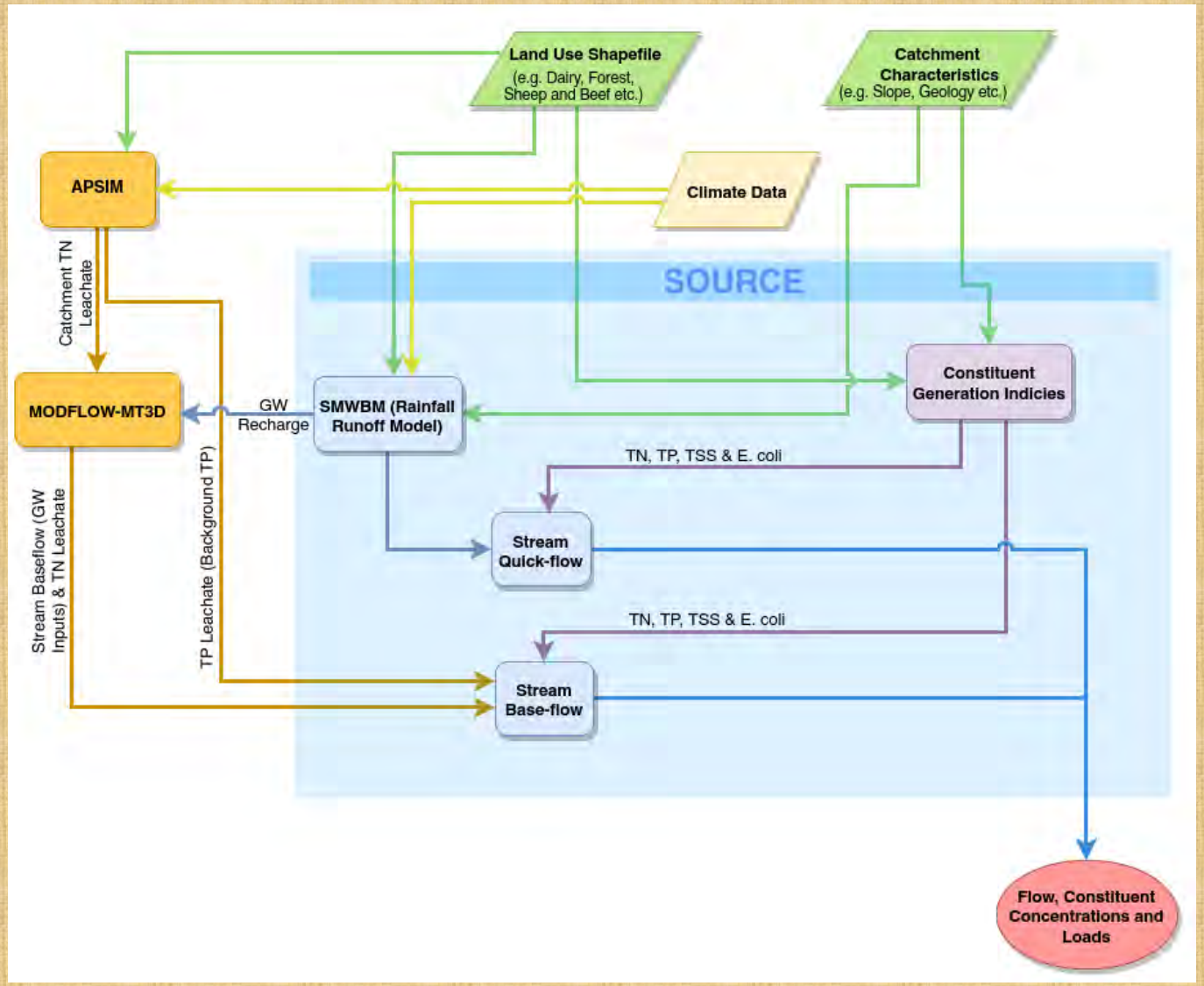


Figure 3. Schematic overview of RDST framework

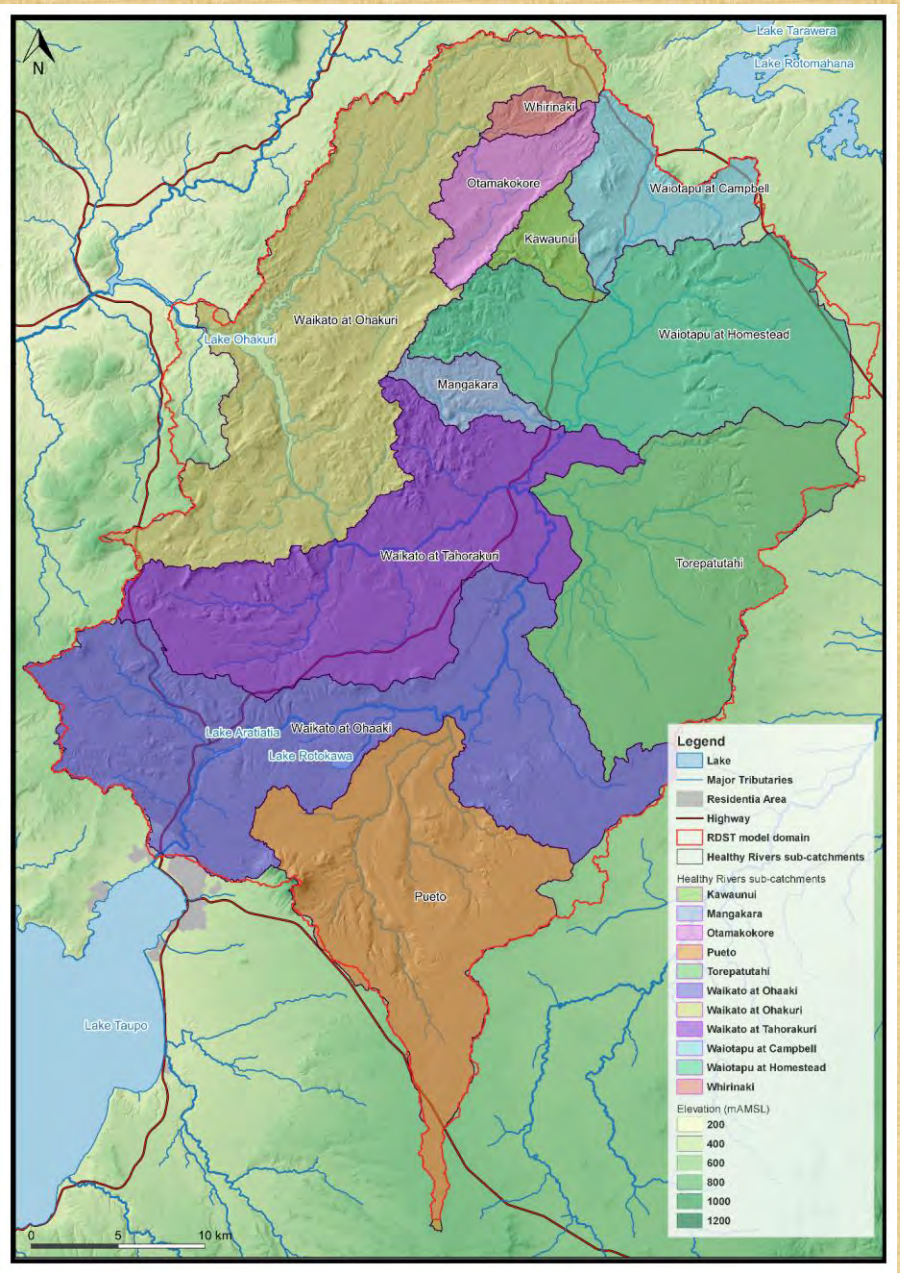


Figure 1. RDST model domain, Healthy Rivers sub-catchments and major tributaries.

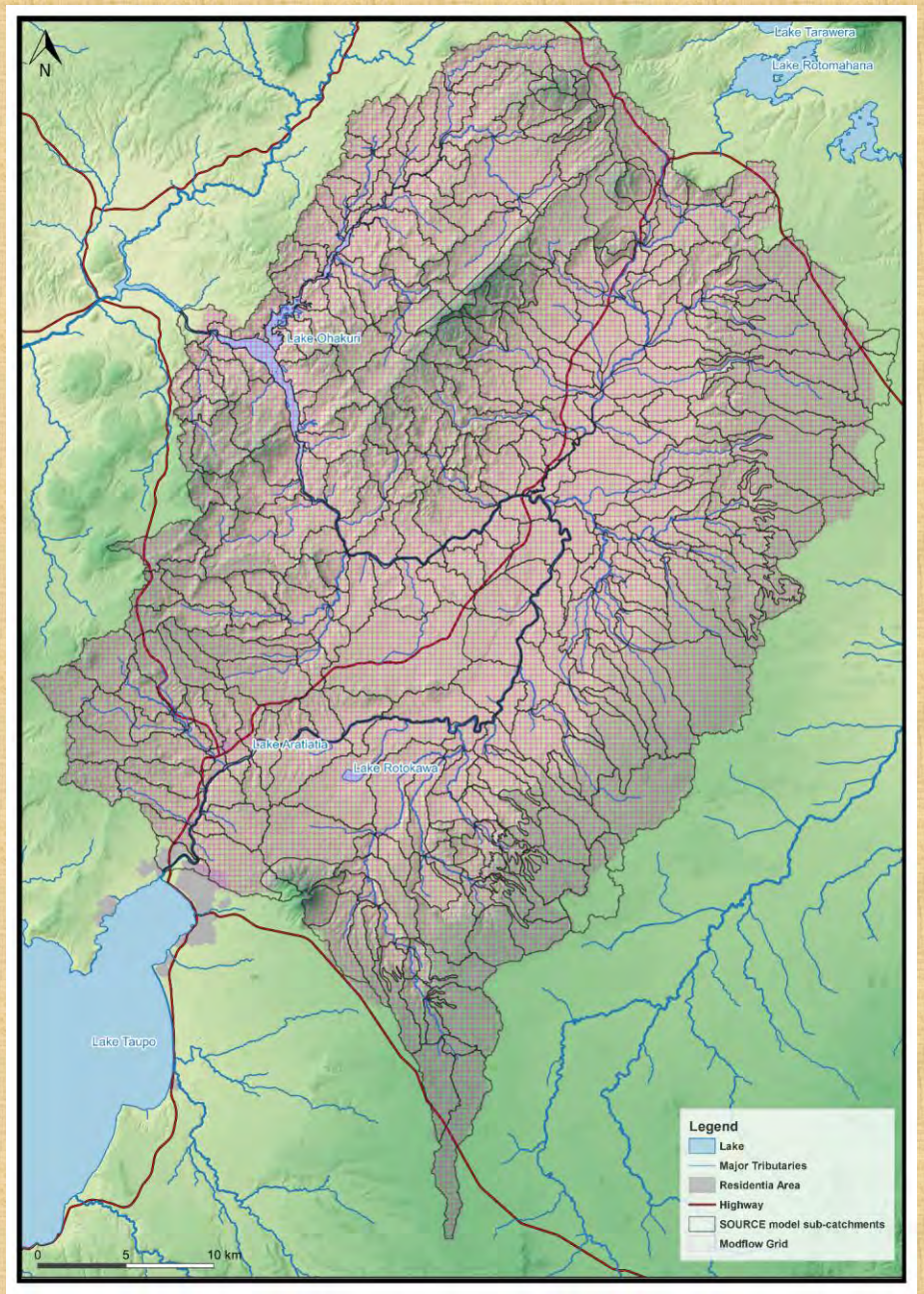


Figure 2. RDST model grid and sub-catchments.

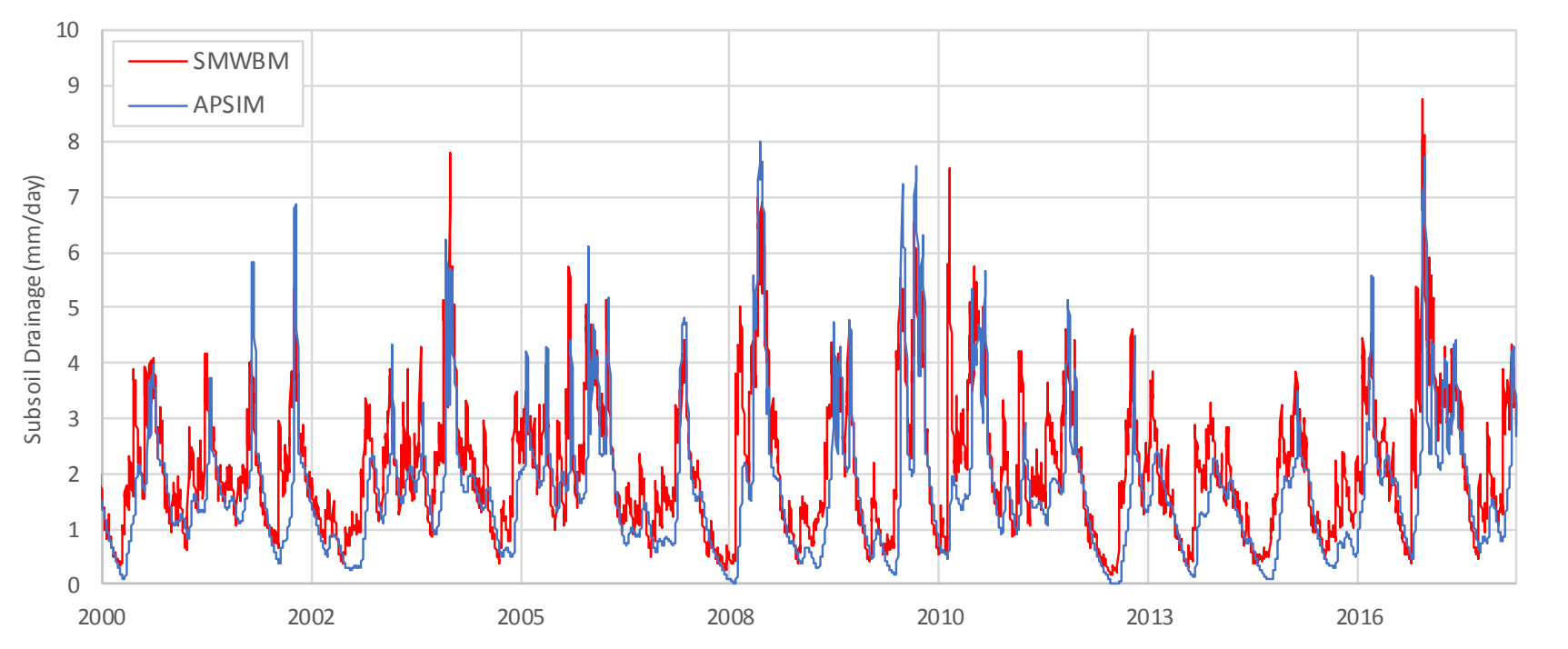


Figure 4. APSIM drainage benchmarking against SMWBM_VZ.

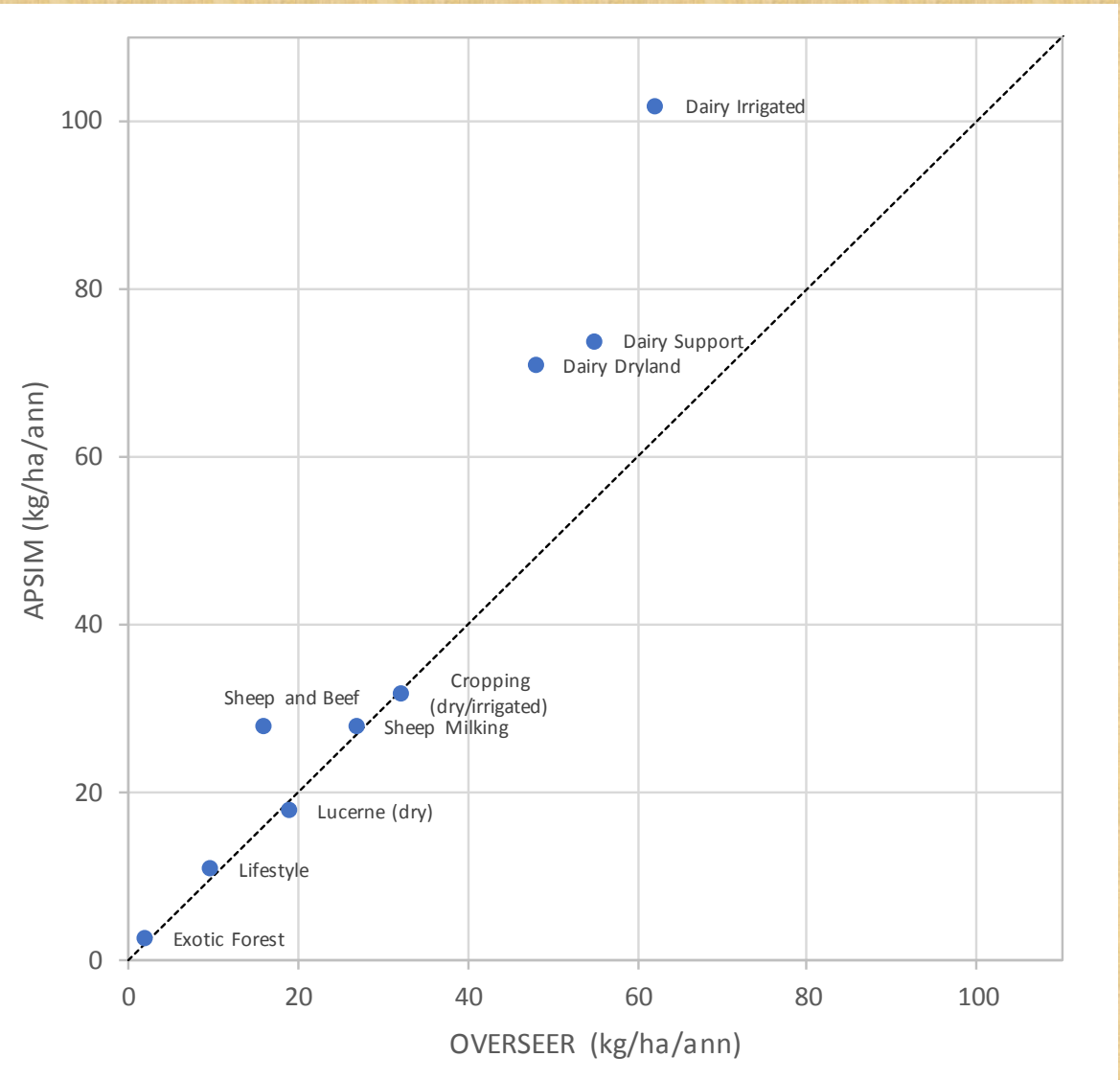


Figure 5. APSIM nitrogen leaching rate benchmarking against OVERSEER.

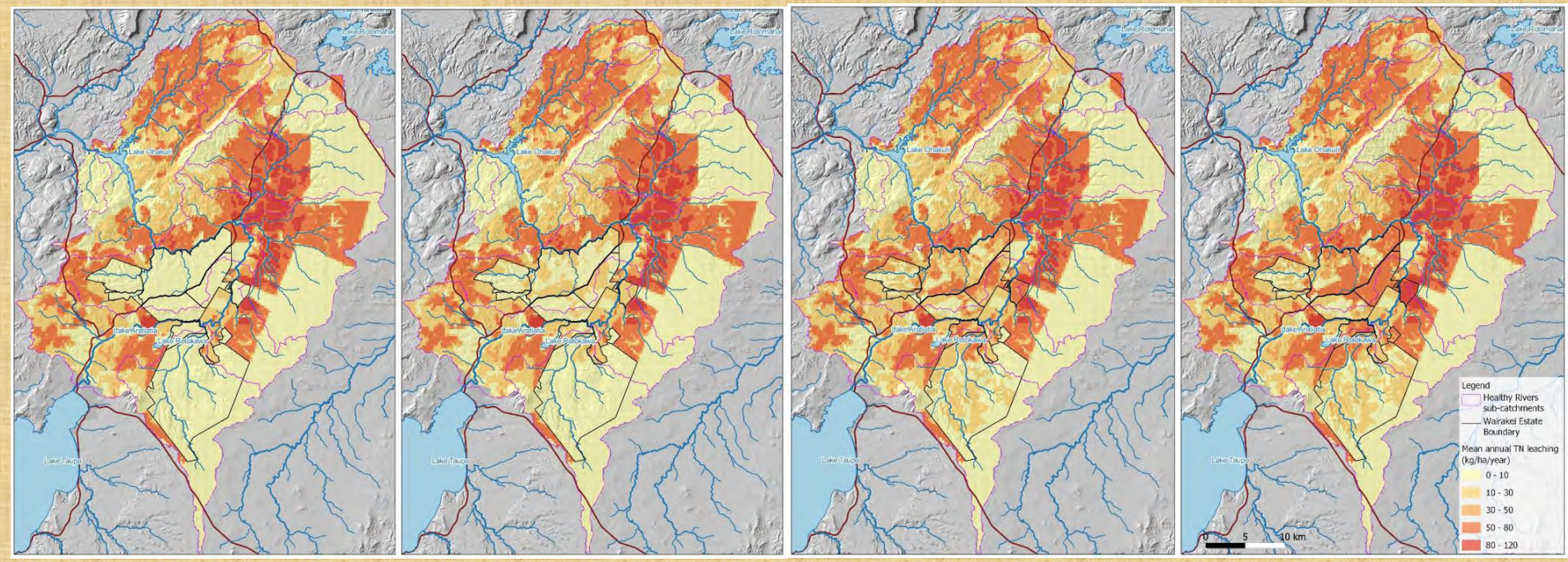
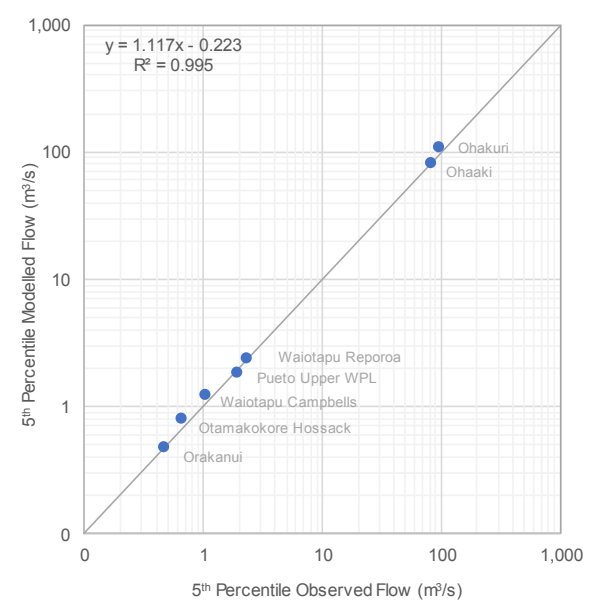
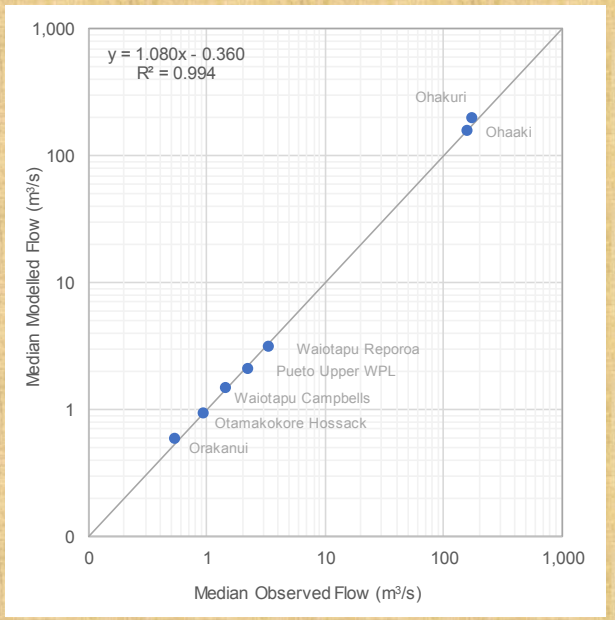


Figure 13. Spatial distribution of average annual TN loading (kg/ha/yr) for four periods of time from 2005 to 2018.





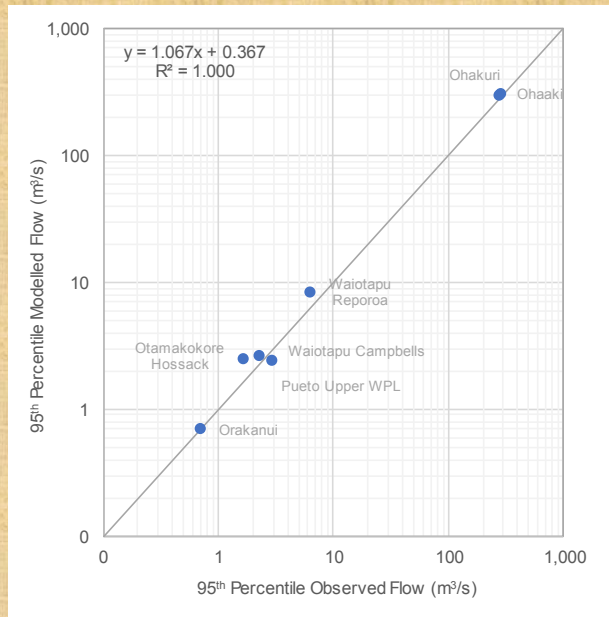
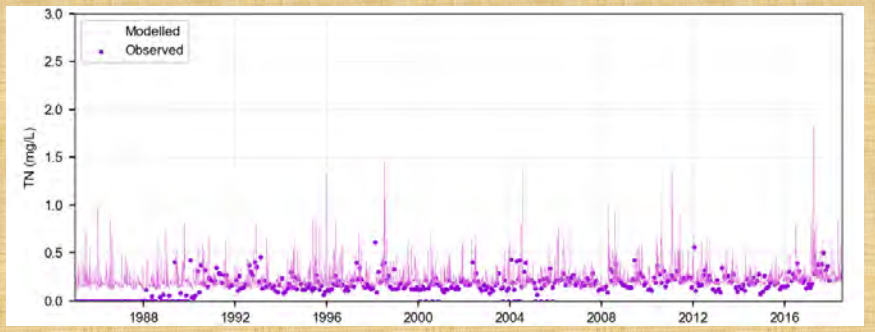
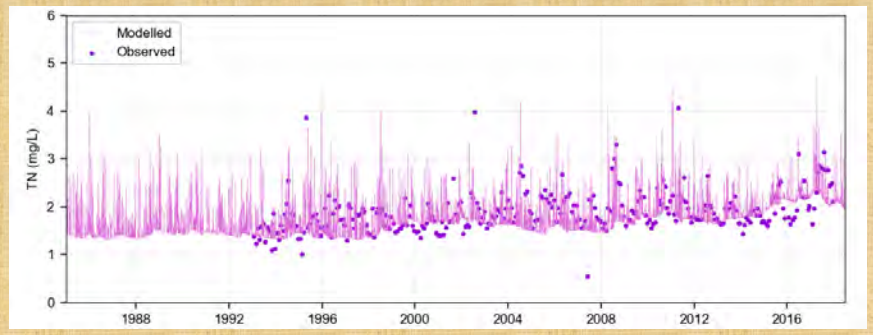


Figure 24. Scatter plot of observed and modelled 5th percentile, median, and 95th percentile flows.

Lake Ohakuri Tailrace



Waiotapu River at Homestead Road



Pueto Stream at Broadlands Road

Figure 25. Constituent calibration time series examples for TN.

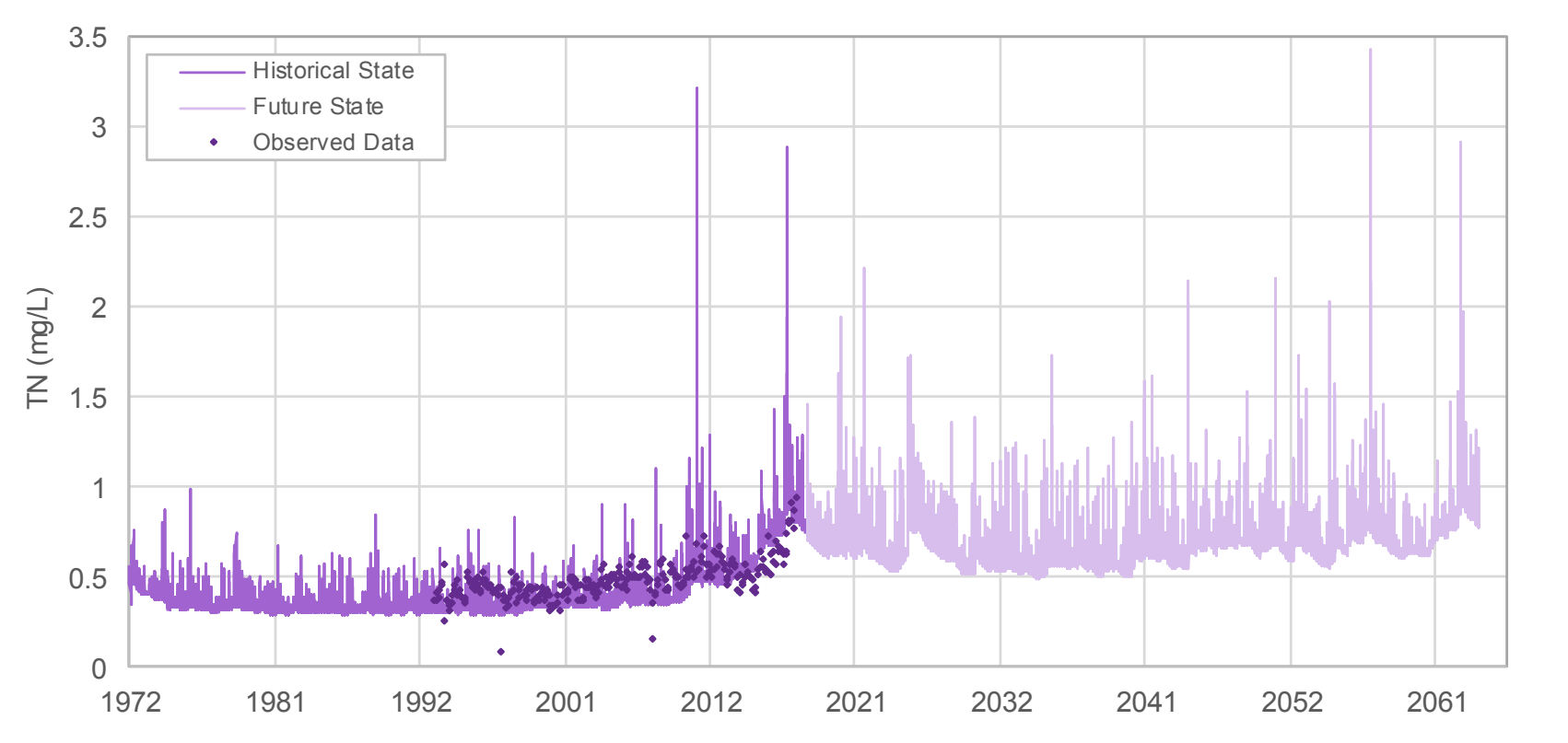


Figure 33. RDST simulation of TN in the Pueto Stream for historical (1972 to 2018) and future state (2018 to 2064).

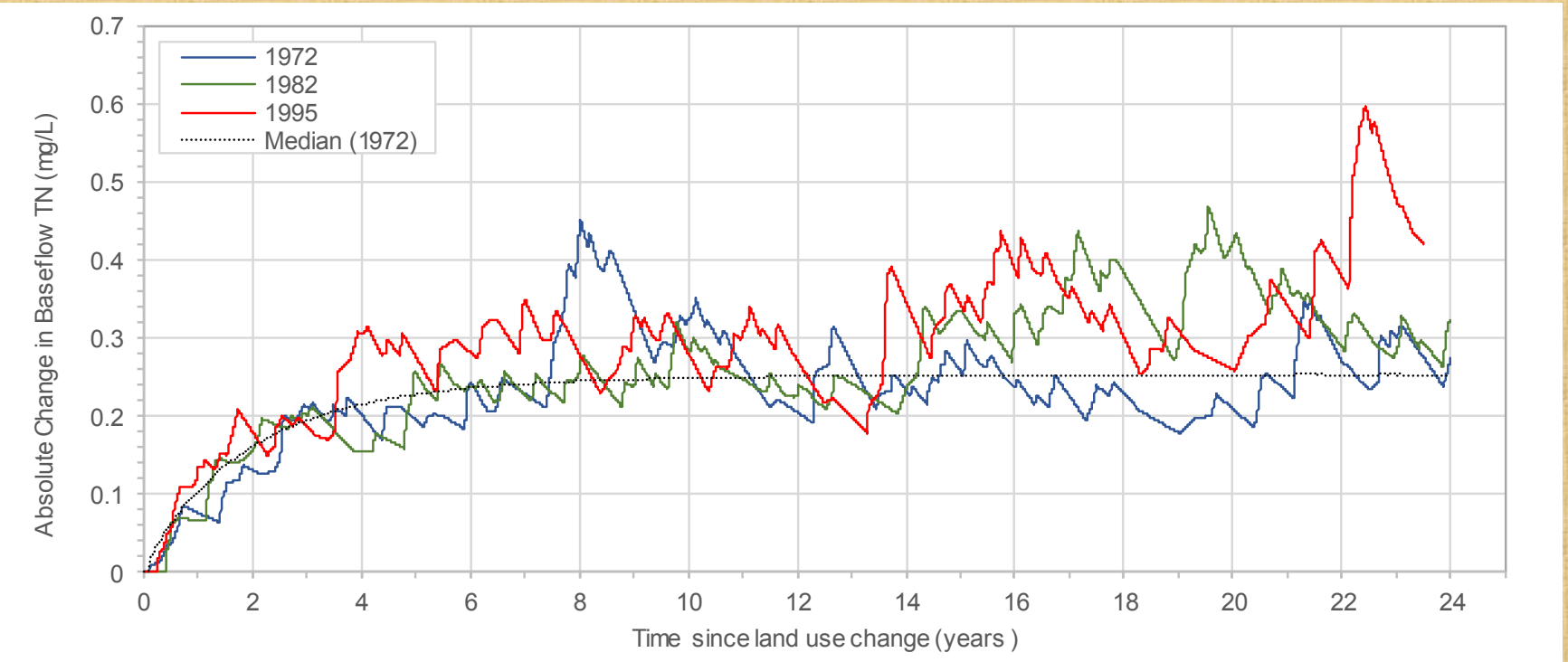


Figure 34. Impact on Pueto Stream baseflow concentration (considering groundwater only) since conversion.

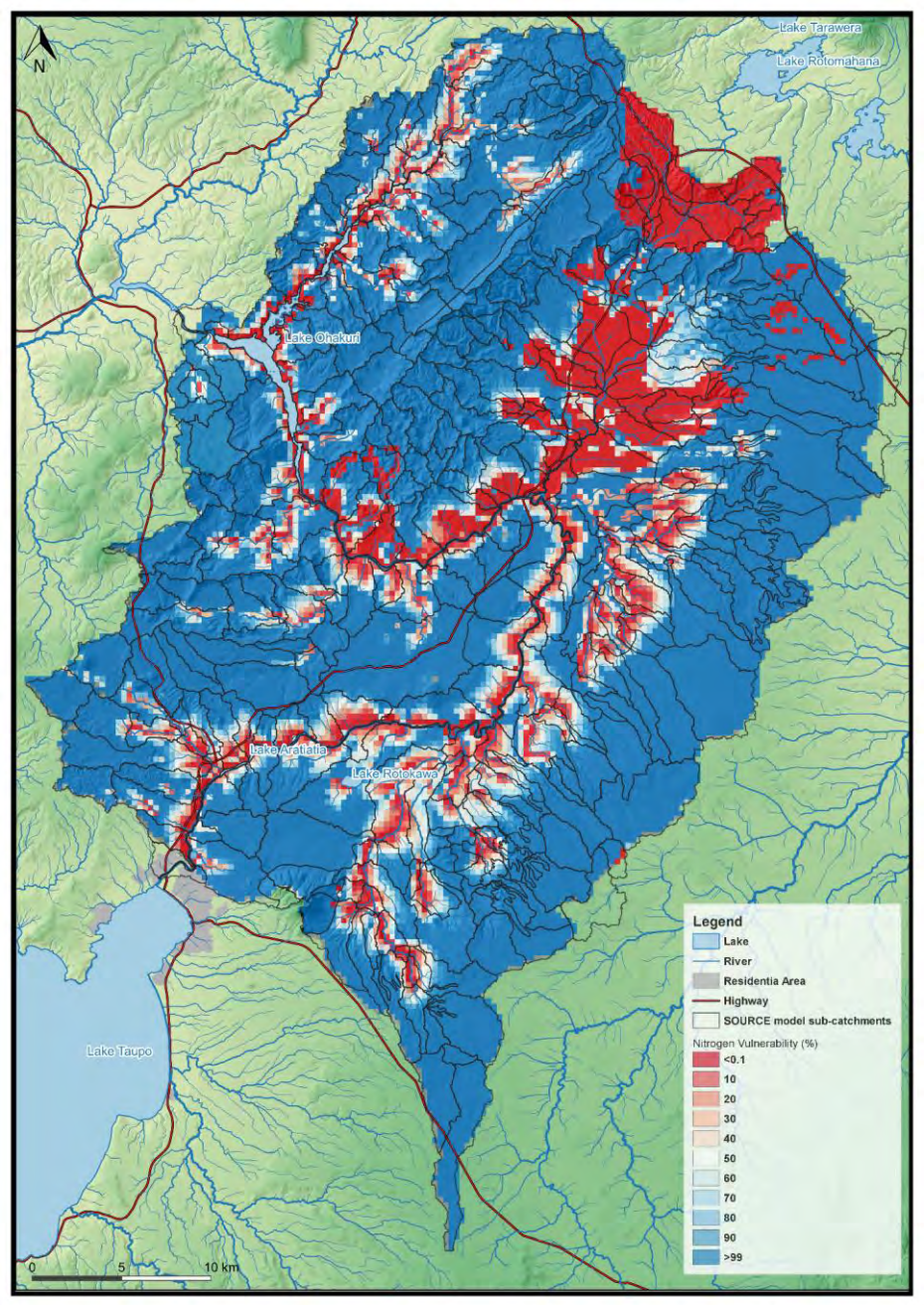


Figure 35. RDST Nitrogen Vulnerability Map.

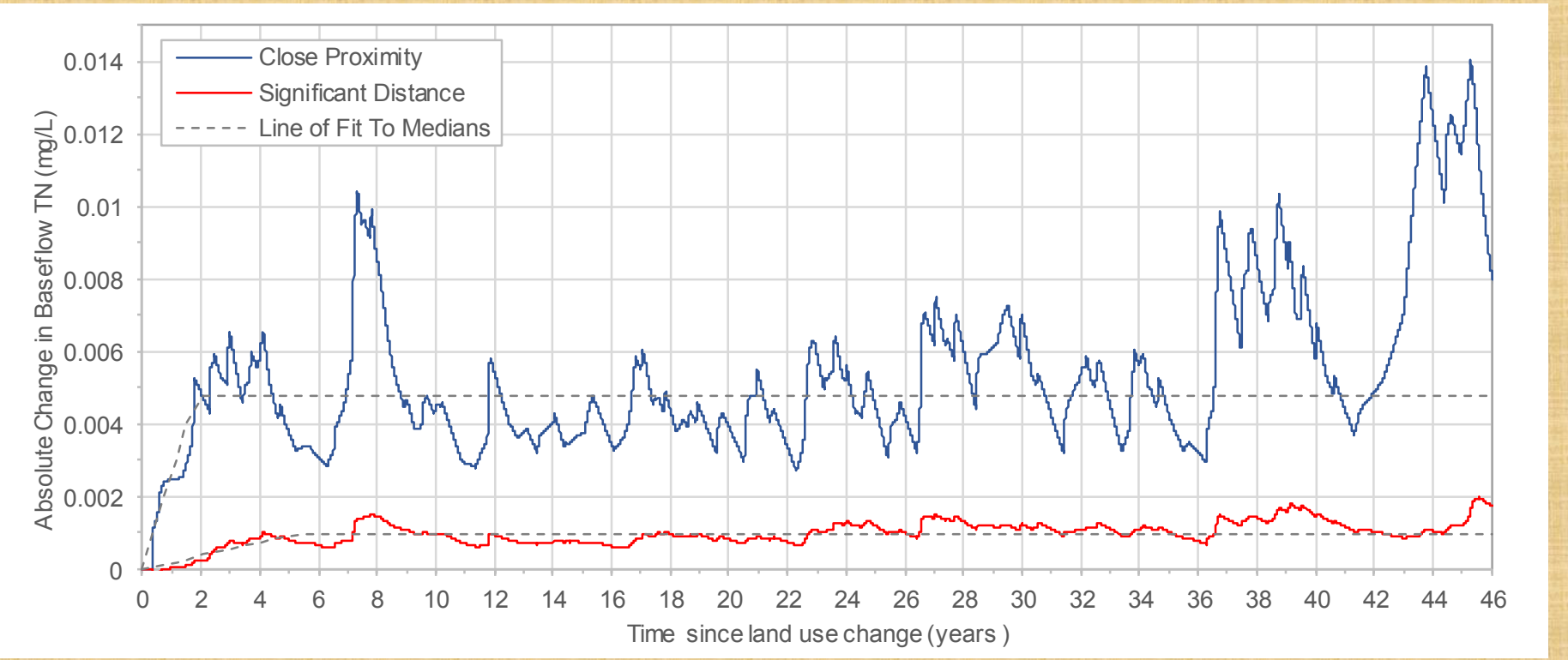
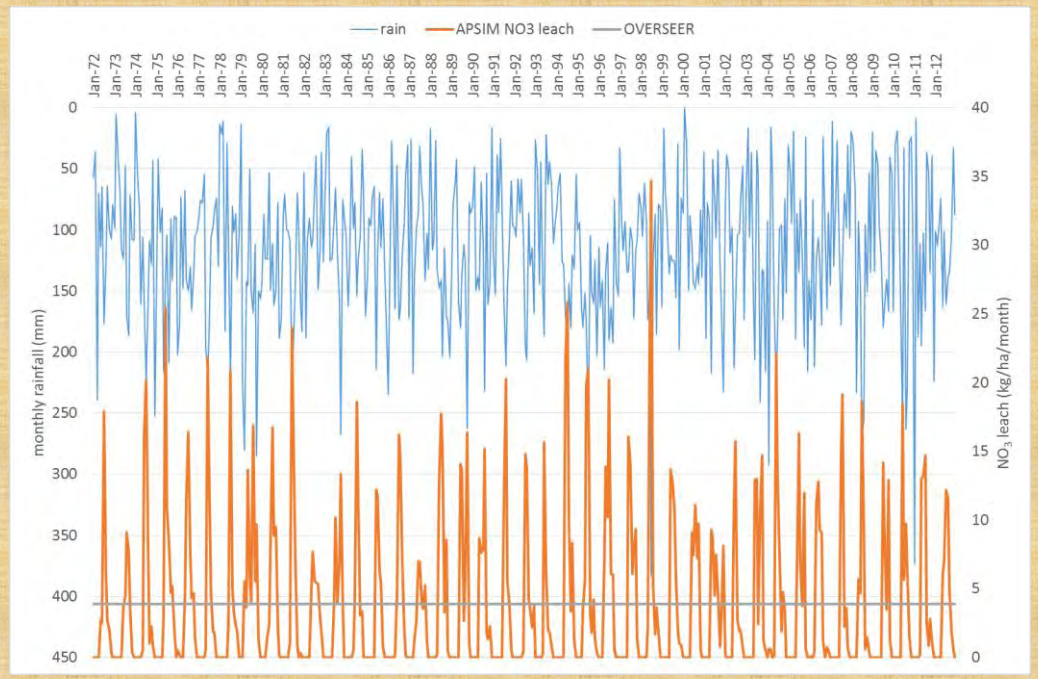


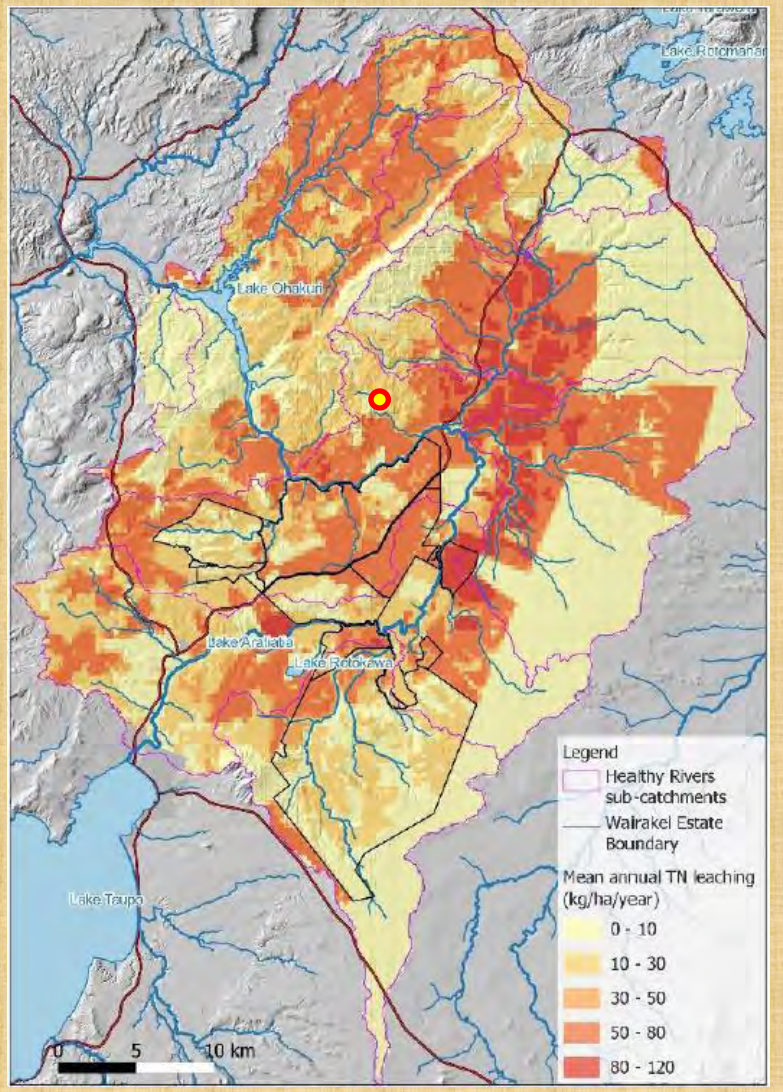
Figure 37. Timeseries showing timing of concentration change following land use change in Pueto Stream with a) sub-catchment in close proximity to a stream, and b) a sub-catchment significant distance from a stream.

Slides For Dr Cresswell

1) Spatial and temporal resolution

APSIM compared to OVERSEER
Dryland dairy >10 years





2) Land use conversion

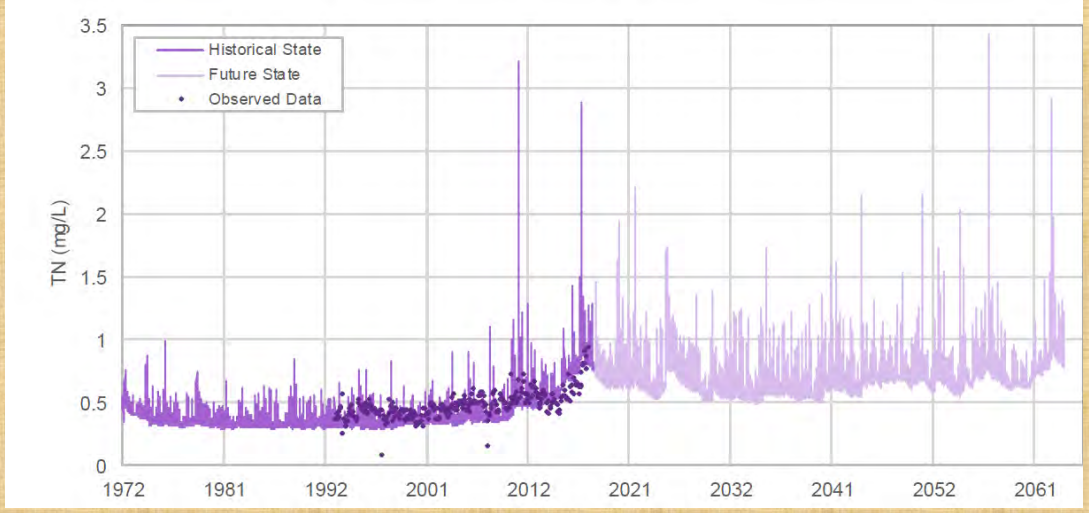


Figure 33. RDST simulation of TN in the Pueto Stream

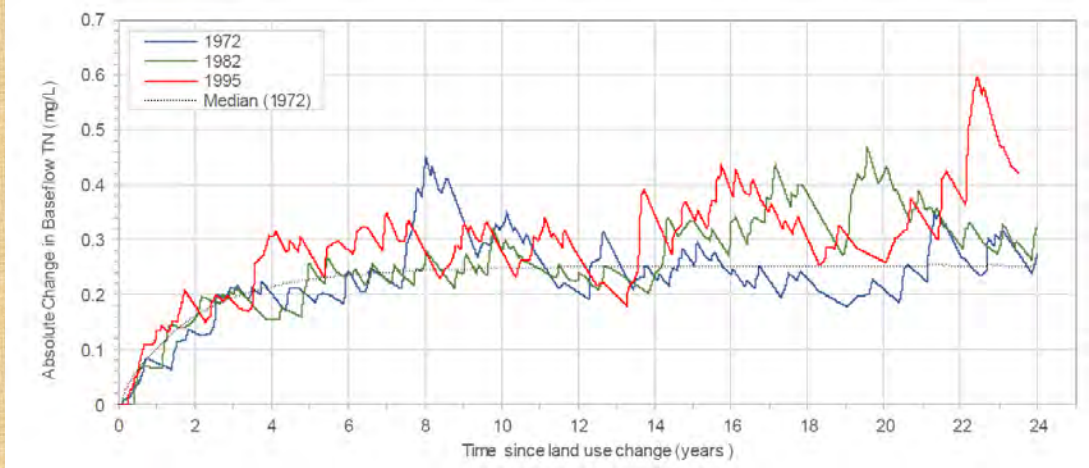


Figure 34. Impact on Pueto Stream baseflow concentration (considering groundwater only) since conversion.

3) Nitrogen dynamics

→ nitrogen vulnerability map

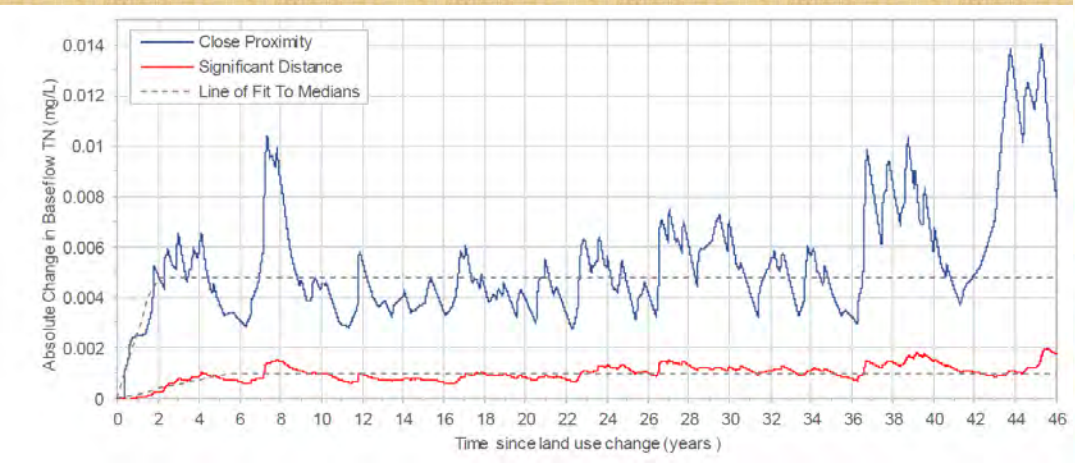


Figure 37. Timeseries showing timing of concentration change following land use change in Pueto Stream with a) sub-catchment in close proximity to a stream, and b) a sub-catchment significant distance from a stream.

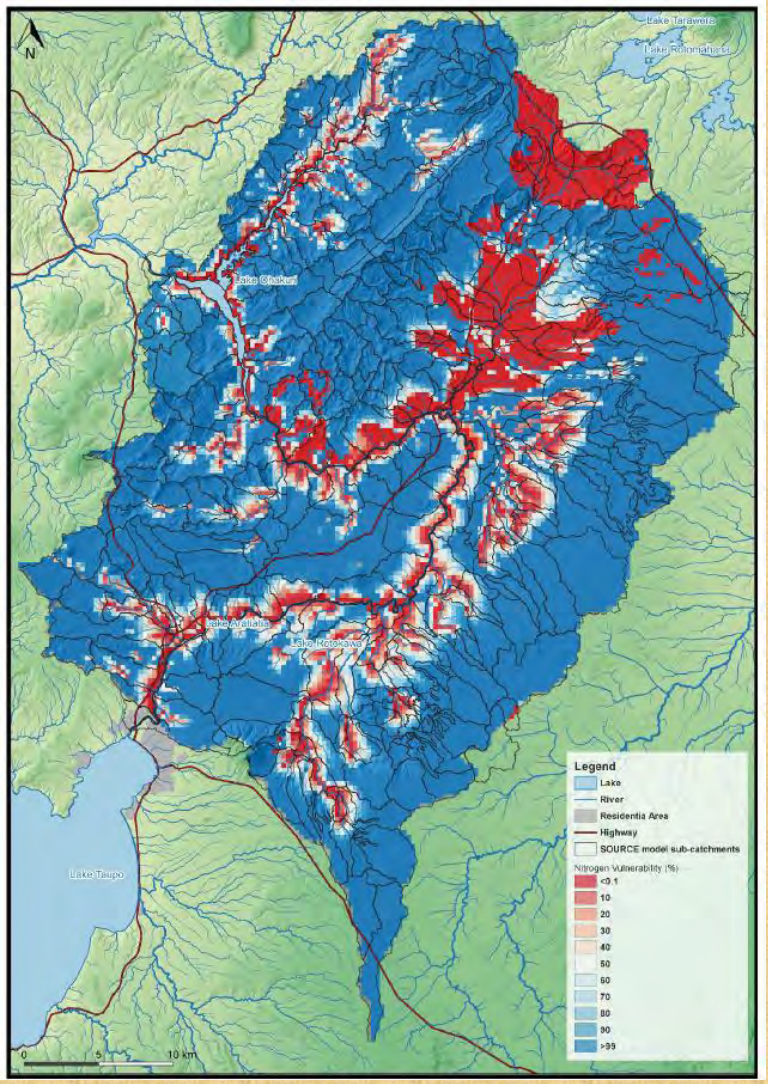


Figure 35: RDST Nitrogen Vulnerability Map.

Slides For Dr Jordan

All figures are from Block 2 Evidence of Dr Jordan

Assessment criteria for Decision Support Tools (DST)

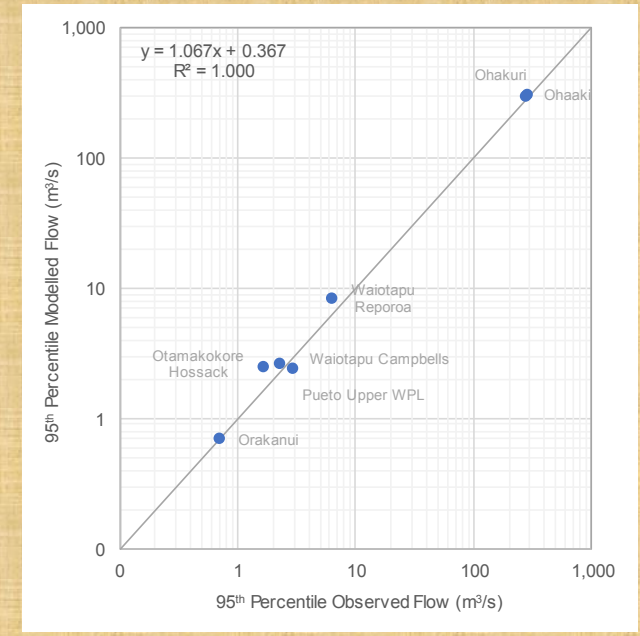
- Appropriate spatial resolution?
- Appropriate temporal resolution to assess water quality statistics?
- Appropriate representation of temporal dynamics?

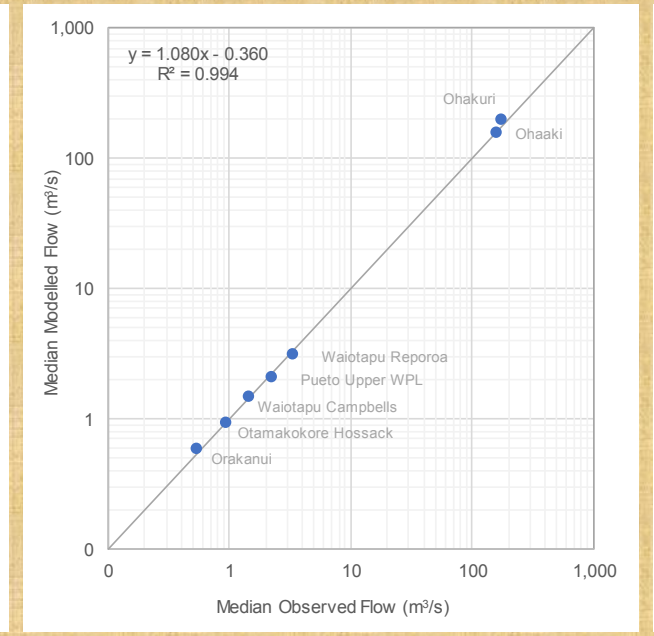
Ruahuwai Decision Support Tool (RDST)

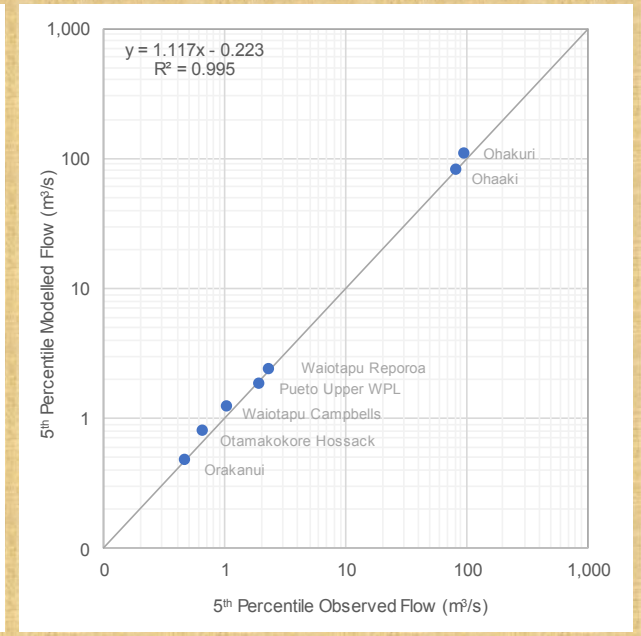
Model layout

- 415 model sub-catchments
- Daily climate from NIWA VCSN at 5 km resolution

RDST Calibration: flow percentiles



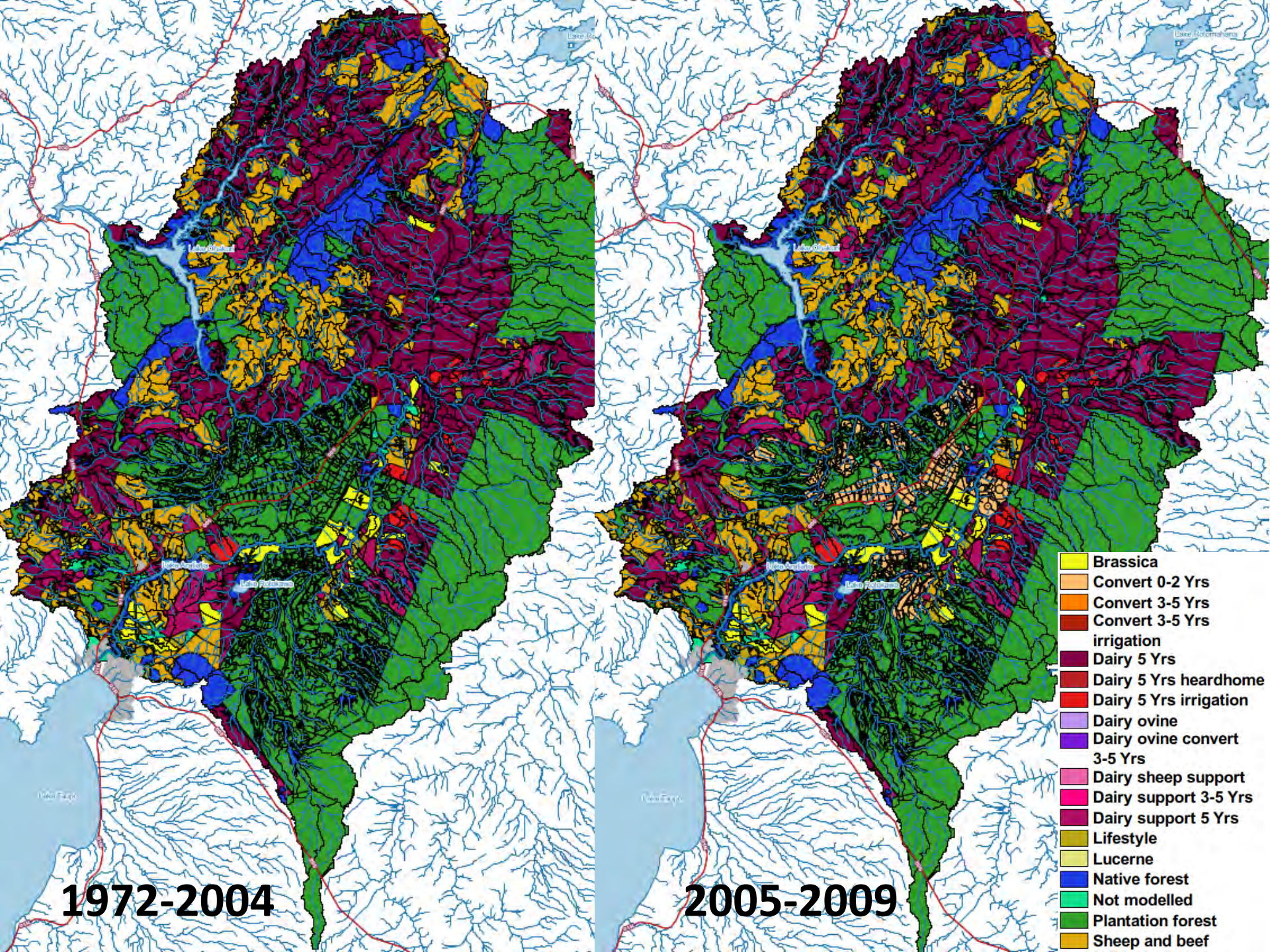


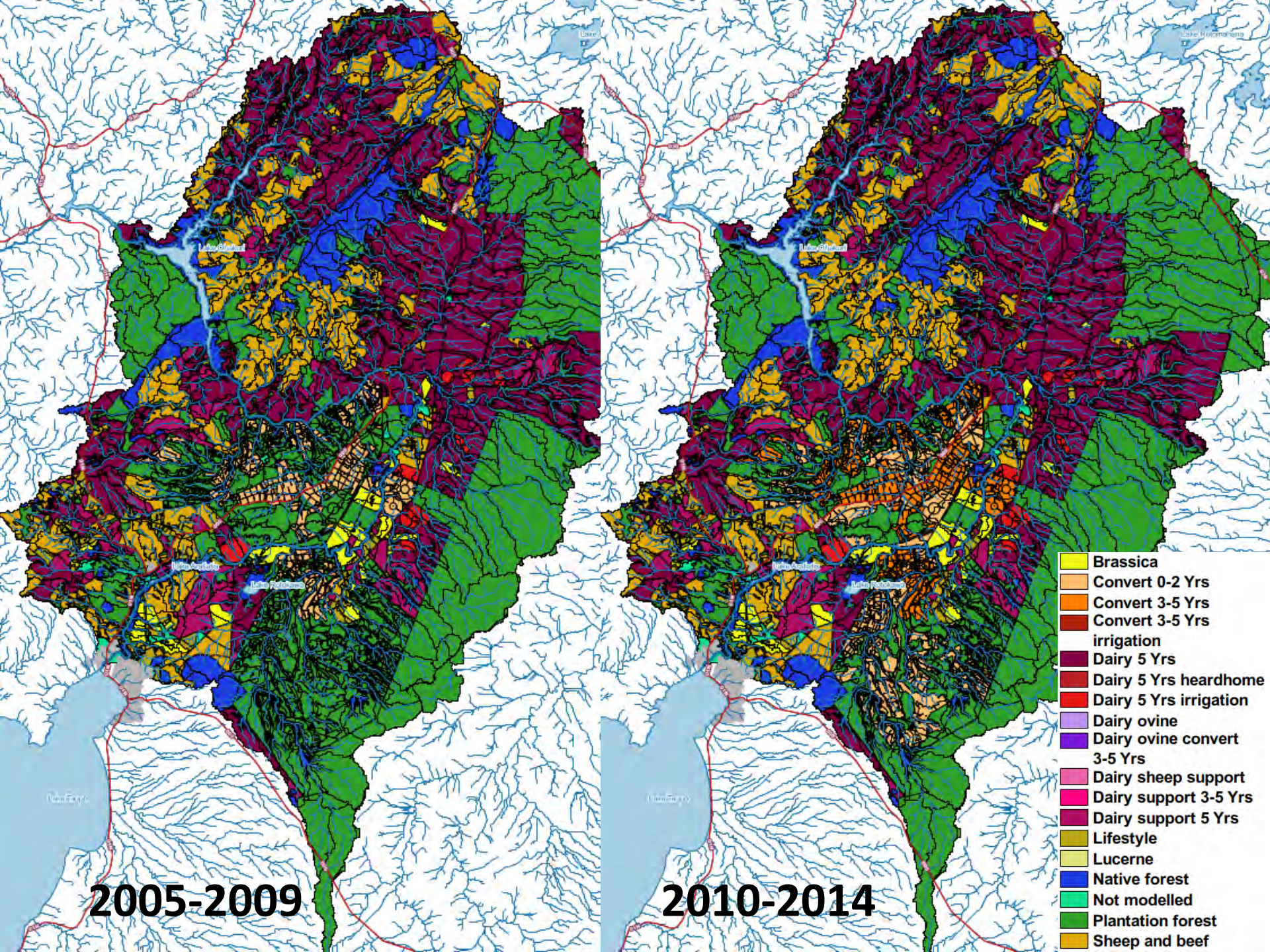


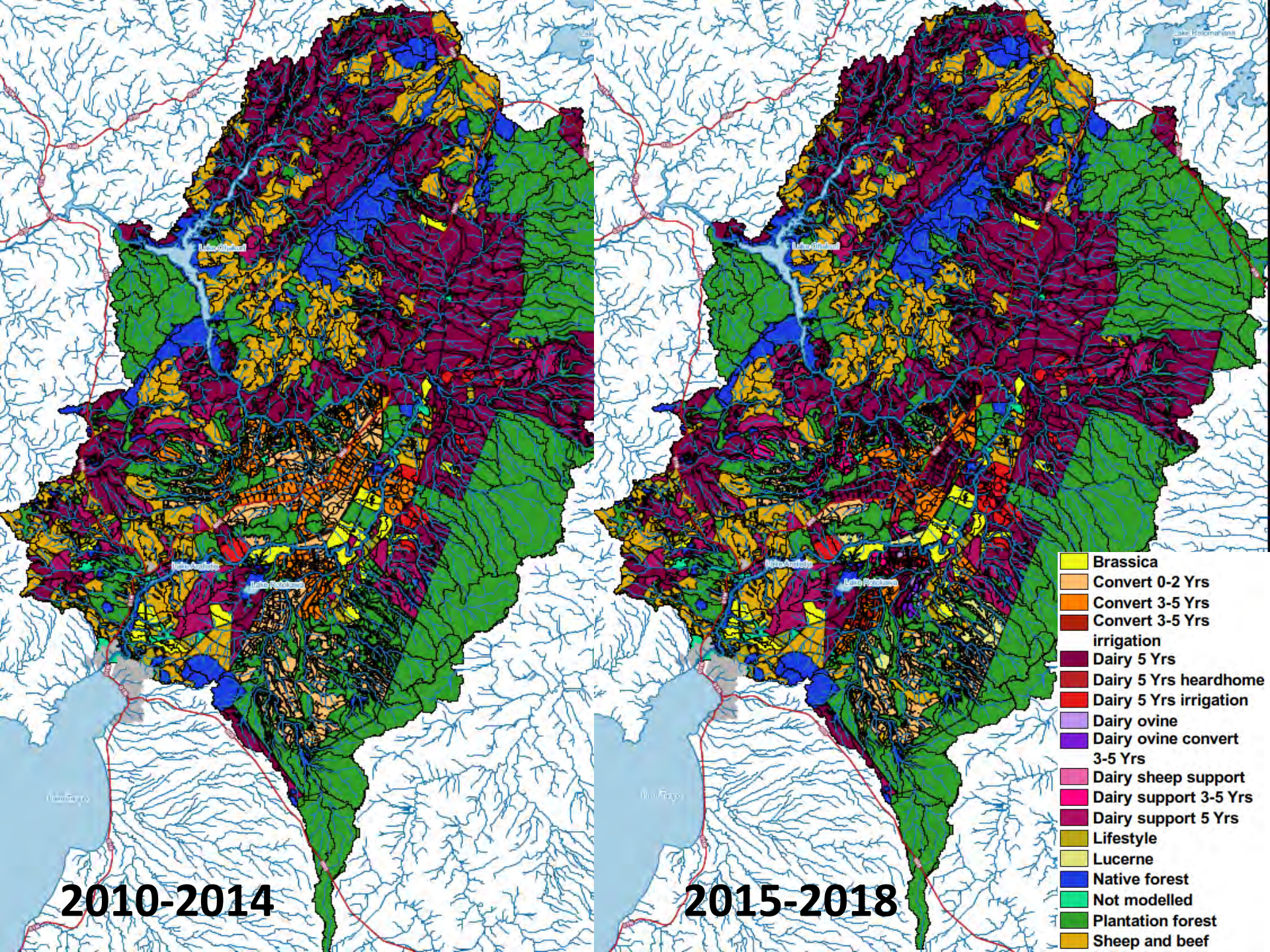
High flows (95th percentile)

Median flows

Low flows (5th percentile)


1972-2004
2005-2009
Brassica
Convert 0-2 Yrs
Convert 3-5 Yrs
Convert 3-5 Yrs irrigation
Dairy 5 Yrs
Dairy 5 Yrs heardhome
Dairy 5 Yrs irrigation
Dairy ovine
Dairy ovine convert 3-5 Yrs
Dairy sheep support
Dairy support 3-5 Yrs
Dairy support 5 Yrs
Lifestyle
Lucerne
Native forest
Not modelled
Plantation forest
Sheep and beef


2005-2009
2010-2014
Brassica
Convert 0-2 Yrs
Convert 3-5 Yrs
Convert 3-5 Yrs irrigation
Dairy 5 Yrs
Dairy 5 Yrs heardhome
Dairy 5 Yrs irrigation
Dairy ovine
Dairy ovine convert 3-5 Yrs
Dairy sheep support
Dairy support 3-5 Yrs
Dairy support 5 Yrs
Lifestyle
Lucerne
Native forest
Not modelled
Plantation forest
Sheep and beef


2010-2014
2015-2018
Brassica
Convert 0-2 Yrs
Convert 3-5 Yrs
Convert 3-5 Yrs irrigation
Dairy 5 Yrs
Dairy 5 Yrs heardhome
Dairy 5 Yrs irrigation
Dairy ovine
Dairy ovine convert 3-5 Yrs
Dairy sheep support
Dairy support 3-5 Yrs
Dairy support 5 Yrs
Lifestyle
Lucerne
Native forest
Not modelled
Plantation forest
Sheep and beef

RDST Calibration: TN for Pueto Stream at Broadlands

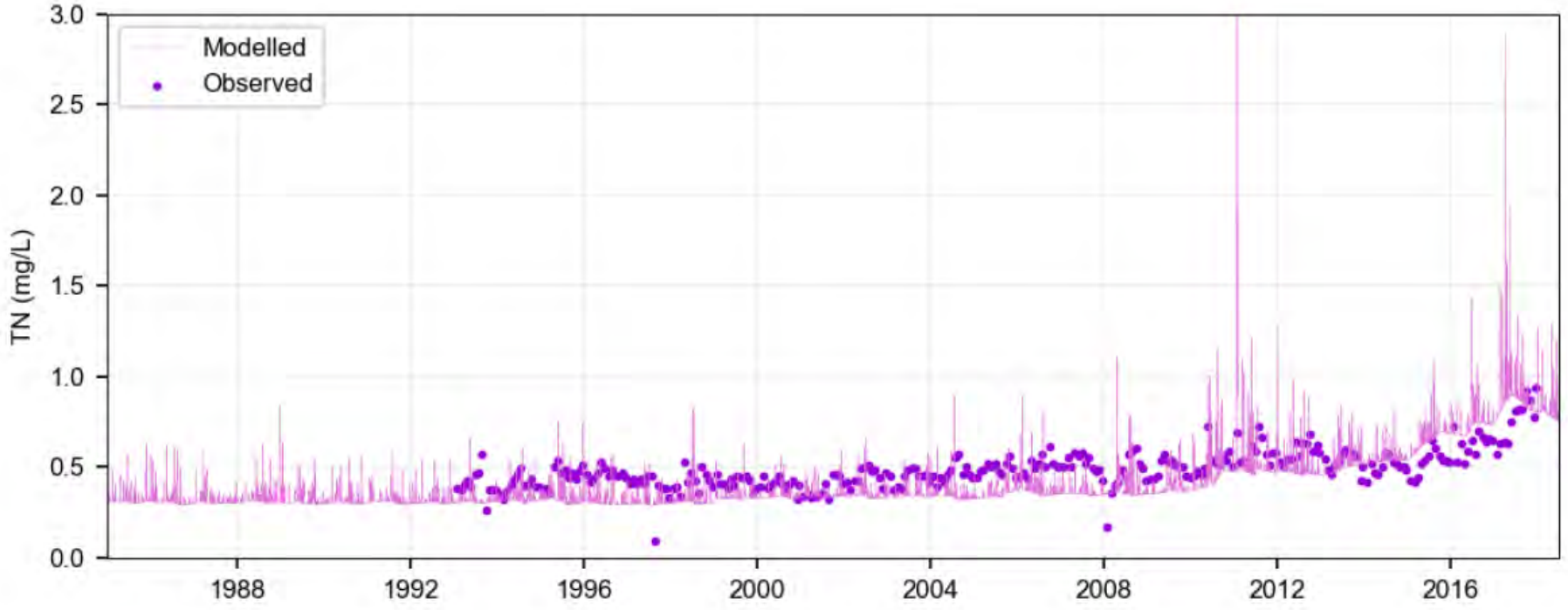


Figure 13. Comparison of measured and modelled TN at Pueto Stream at Broadlands.

RDST Calibration: TP for Pueto Stream at Broadlands

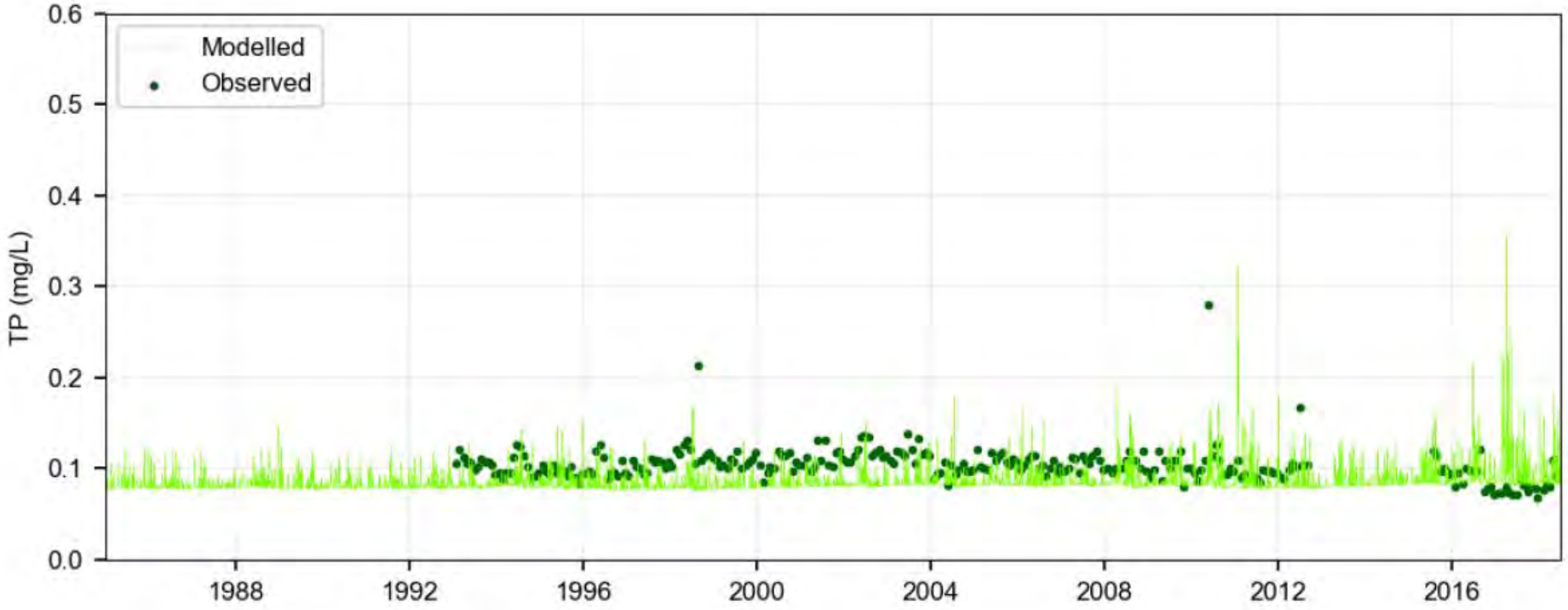


Figure 40. Comparison of measured and modelled TP at Pueto Stream at Broadlands.

RDST Calibration: E. coli for Pueto Stream at Broadlands

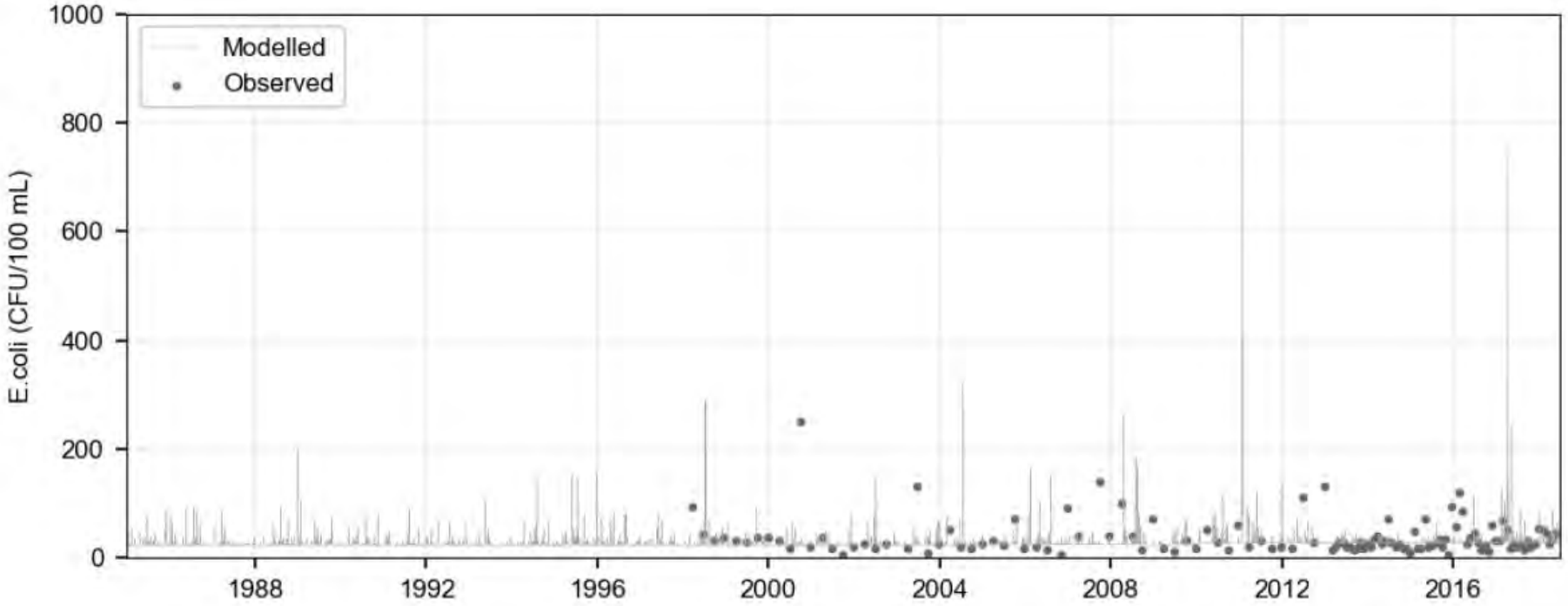
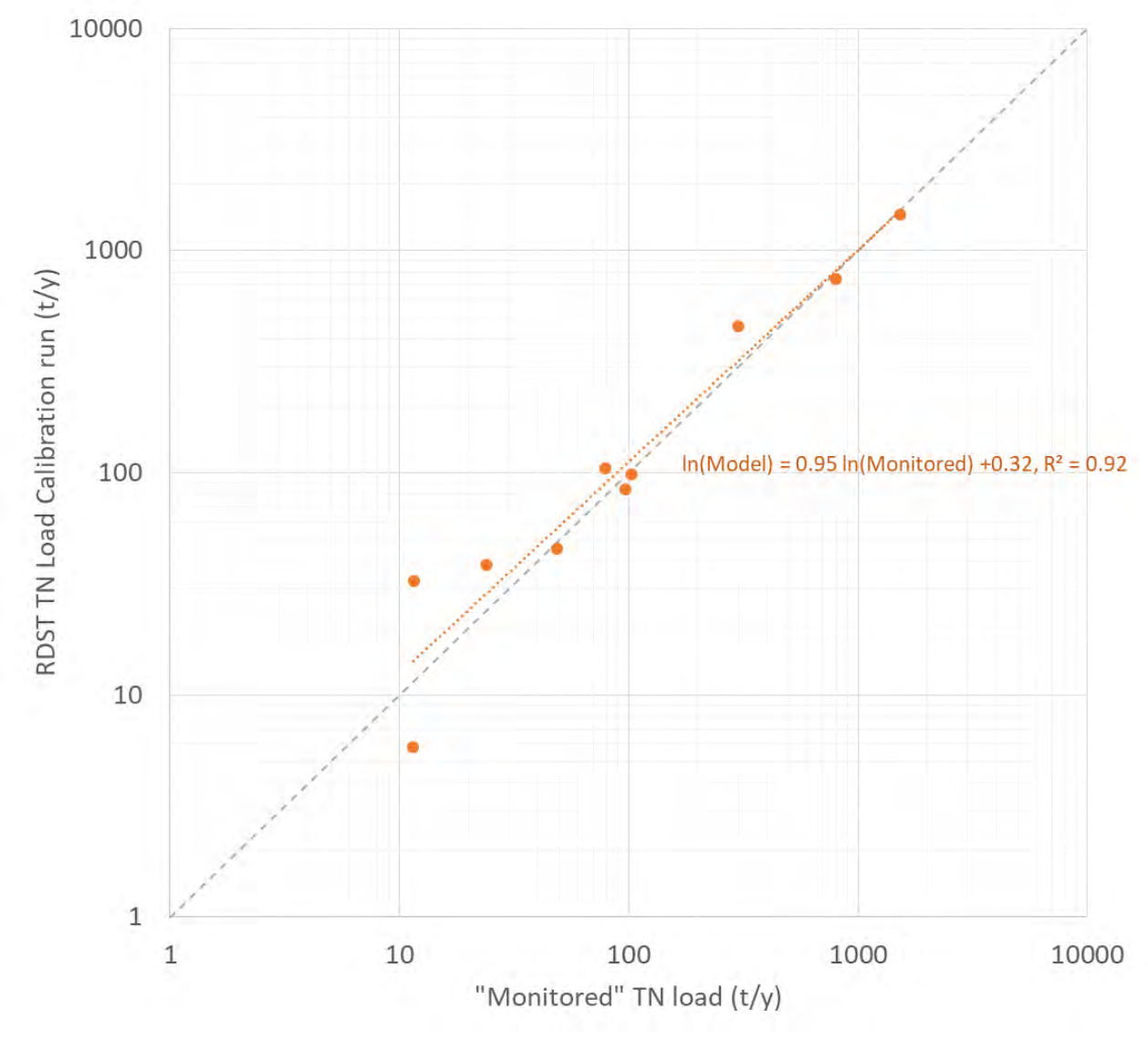
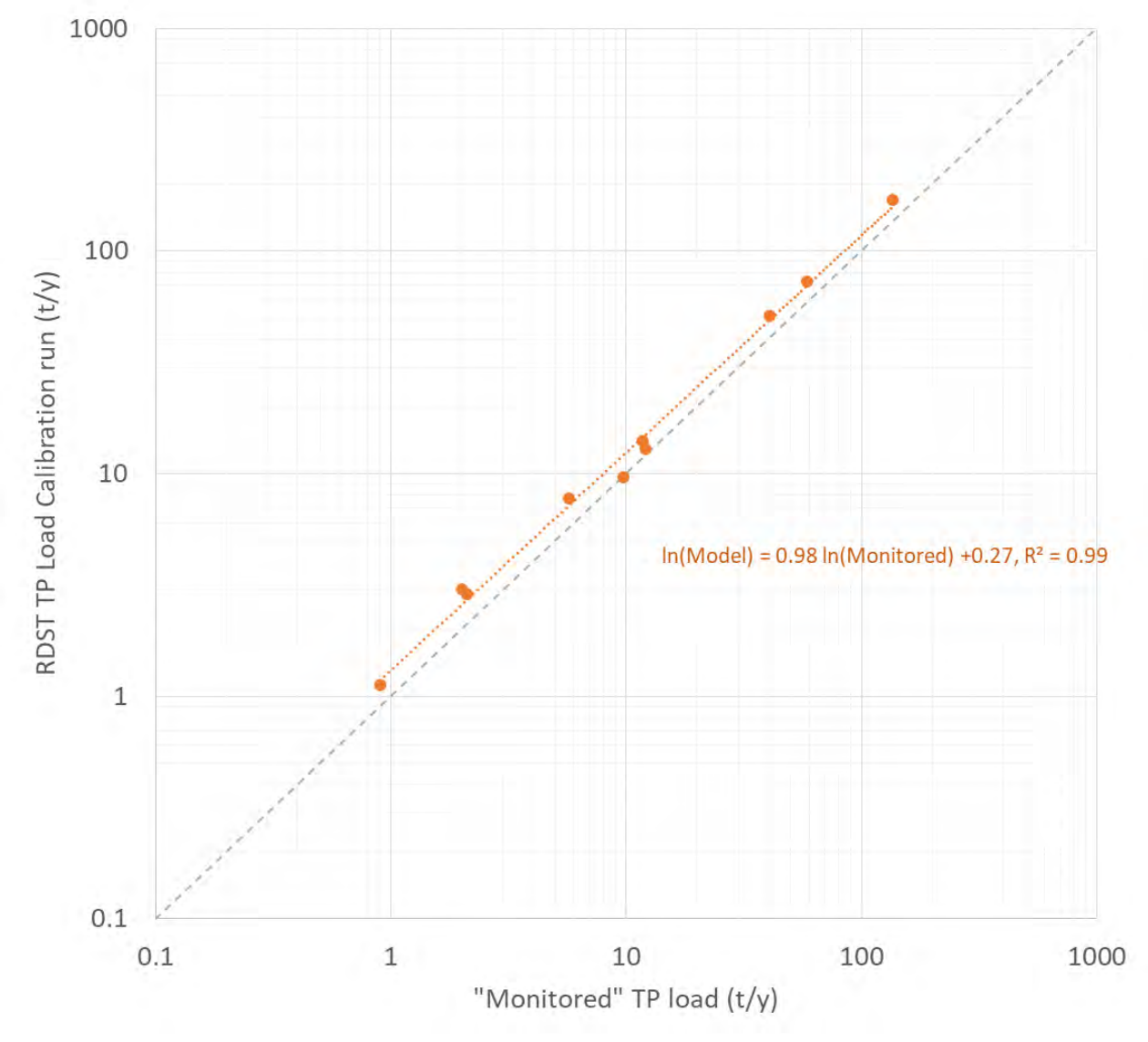


Figure 86. Comparison of measured and modelled *E. coli* at Pueto Stream at Broadlands.

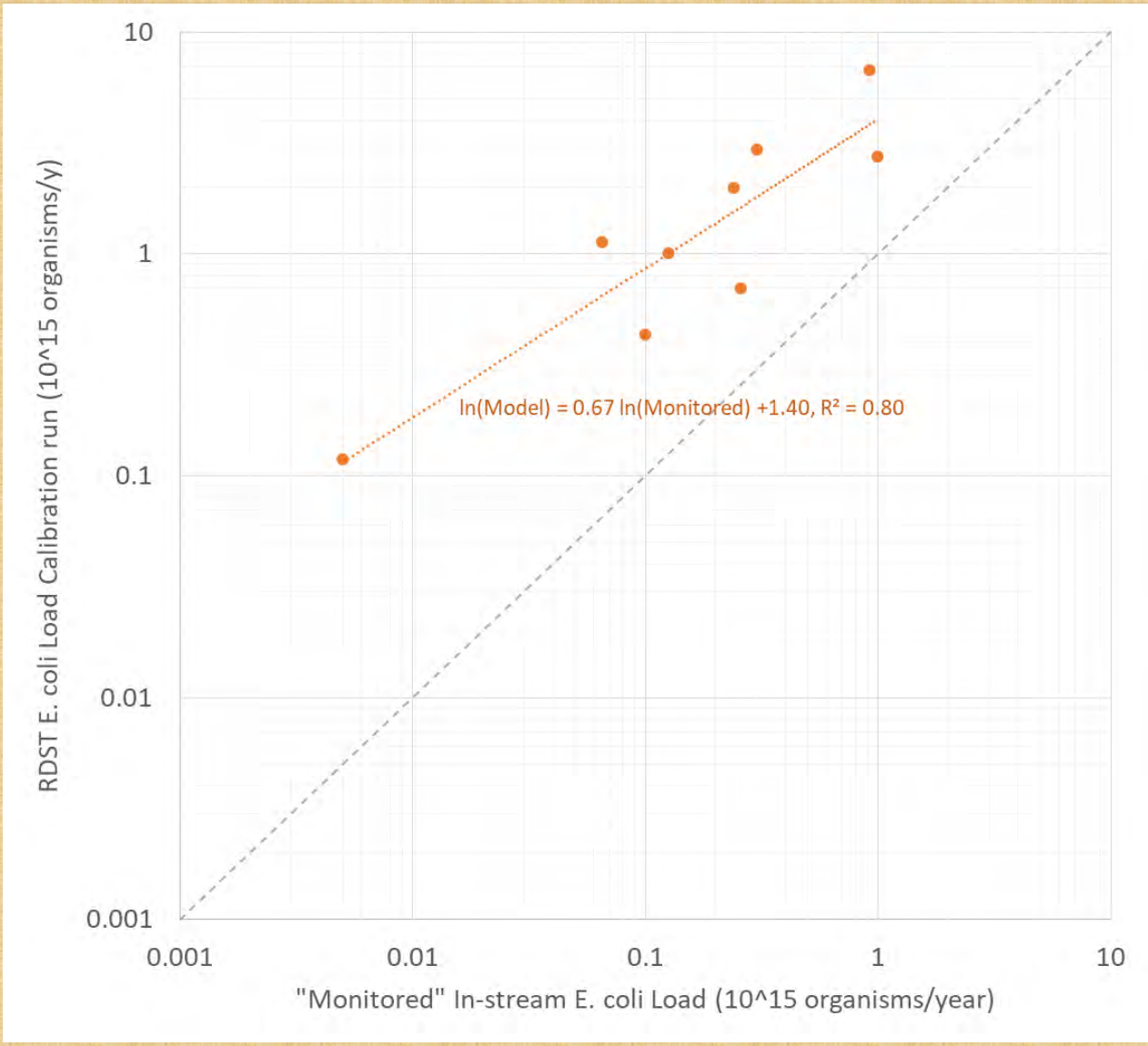
RDST Calibration: TN mean annual loads



RDST Calibration: TP mean annual loads



RDST Calibration: E. coli mean annual loads



RDST and HRWO Calibration: E. coli 95th percentile

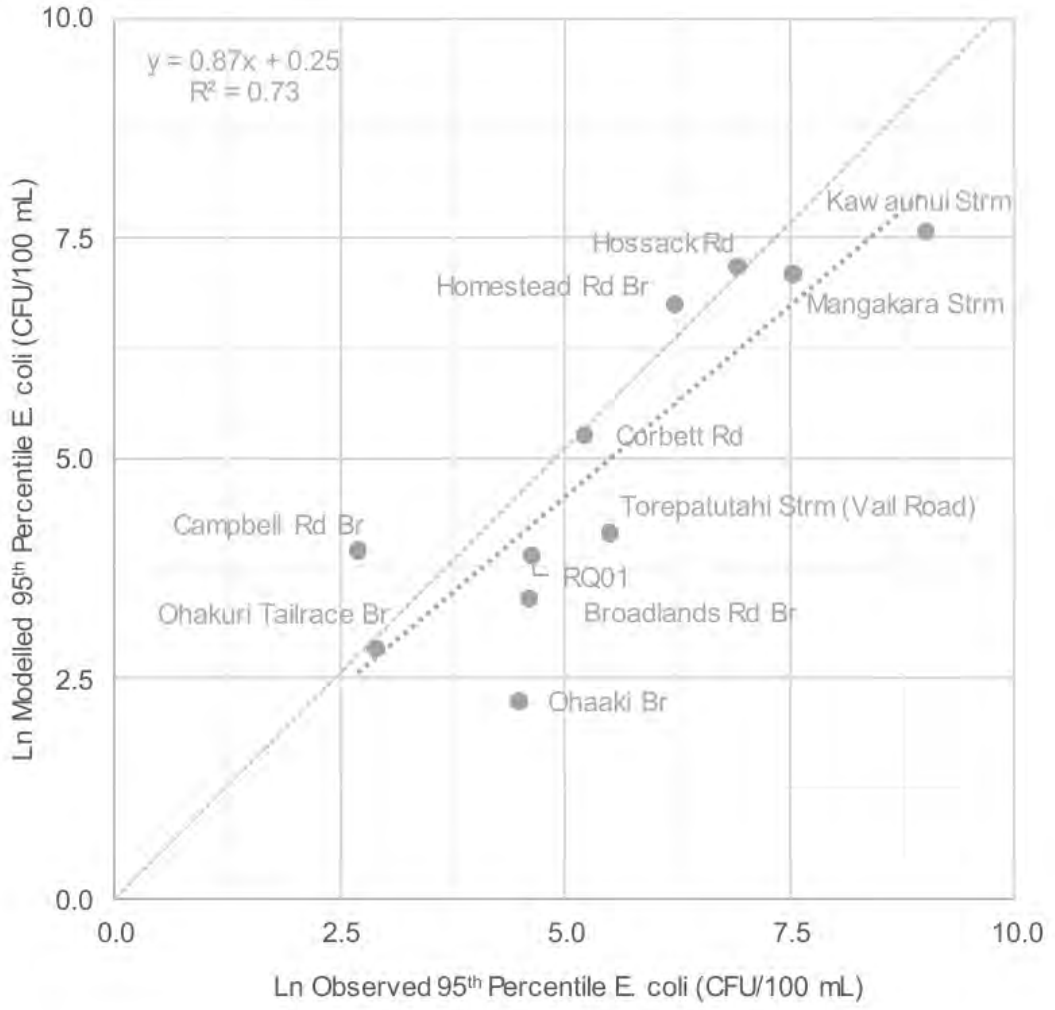


Figure 77. Comparison of observed and modelled 95th Percentile E. coli concentrations.

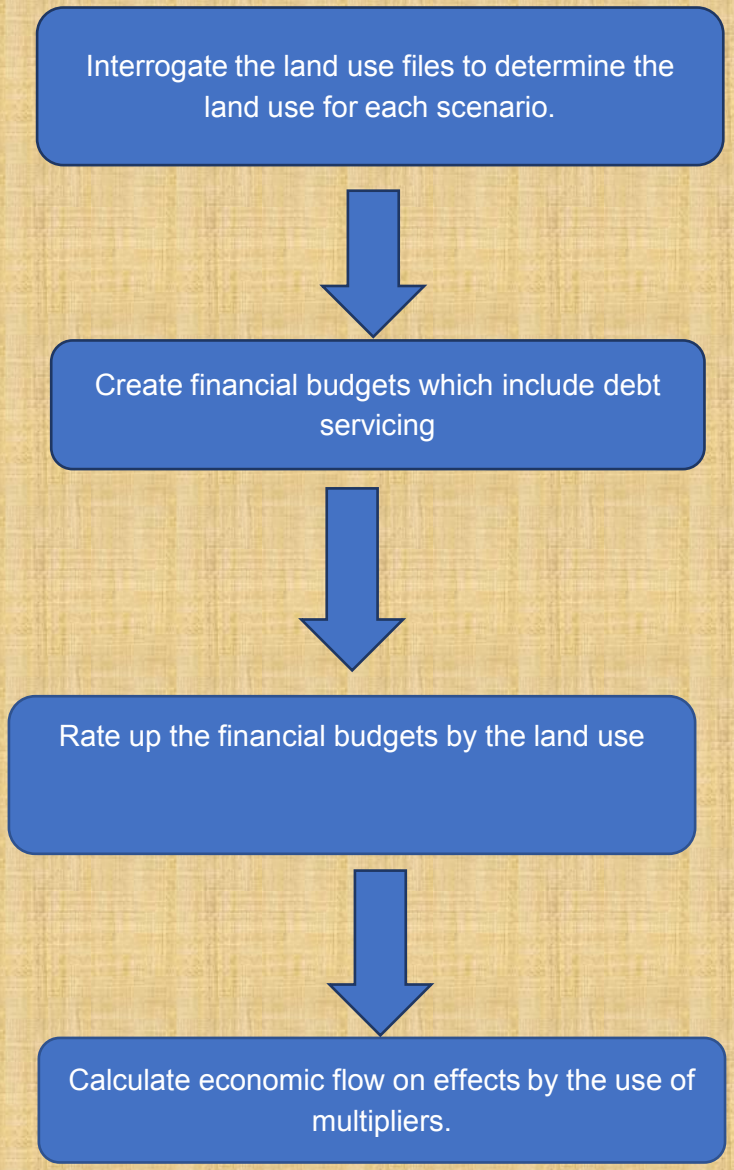
Overall assessment of RDST

- Appropriate spatial resolution?
  - ✓ 415 sub-catchments
- Appropriate temporal resolution?
  - ✓ Water quality statistics derived from daily time step
- Appropriate representation of temporal dynamics?
  - ✓ Land use change explicitly represented (4 maps)
  - ✓ Temporal evolution of contaminant concentrations
  - ✓ Scatter plots of flows, loads and concentrations

Slides For Mr Ford

All figures are from Block 2 Evidence of Mr Ford

Figure 1: Methodology for economic modelling



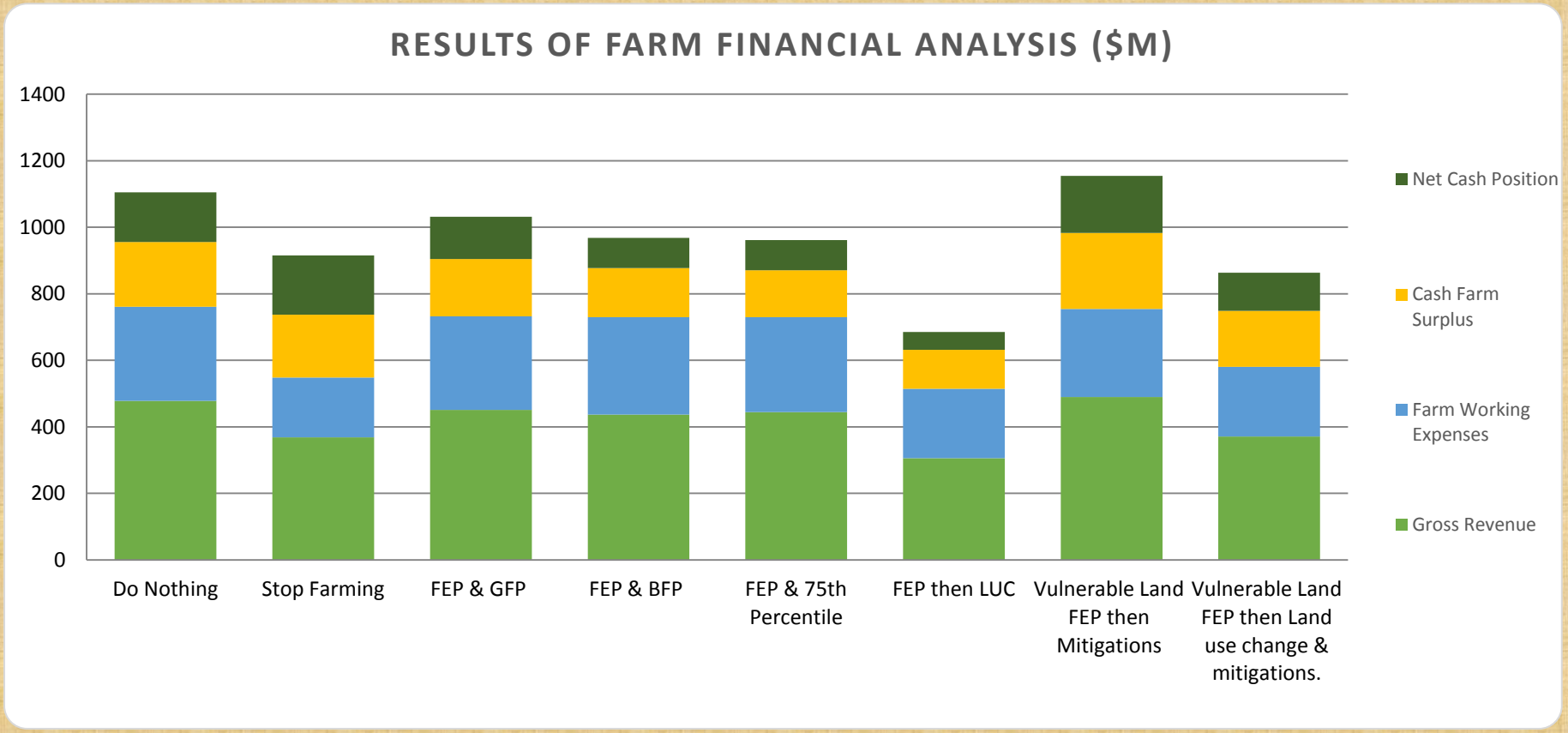


Figure 2: Results of Financial Modelling of the RDST Scenarios

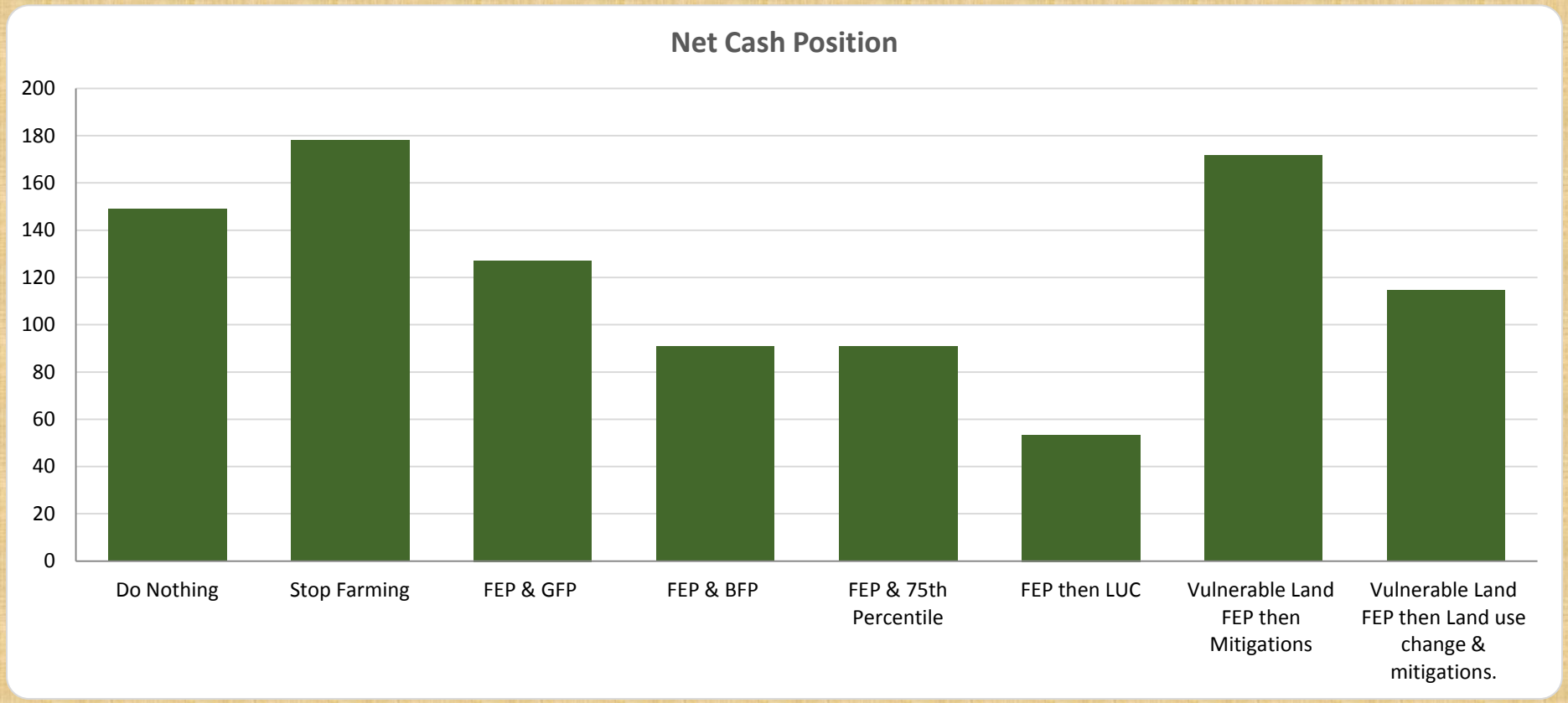


Figure 3: Net Cash Position of the scenarios modelled in the RDST model

	Do Nothing	Stop Farming	FEP & GFP	FEP & BFP	FEP & 75th Percentile	FEP then LUC	FEP then Mitigations on Vulnerable Land	FEP then Mitigations + Land use change
Gross Output $ m	532	524	510	517	517	330	563	414
Value Added $ m	555	361	349	356	356	282	400	307
Employment FTE	797	788	769	776	776	494	828	660

Table 4: Flow on Impact of the scenarios run in the RDST model