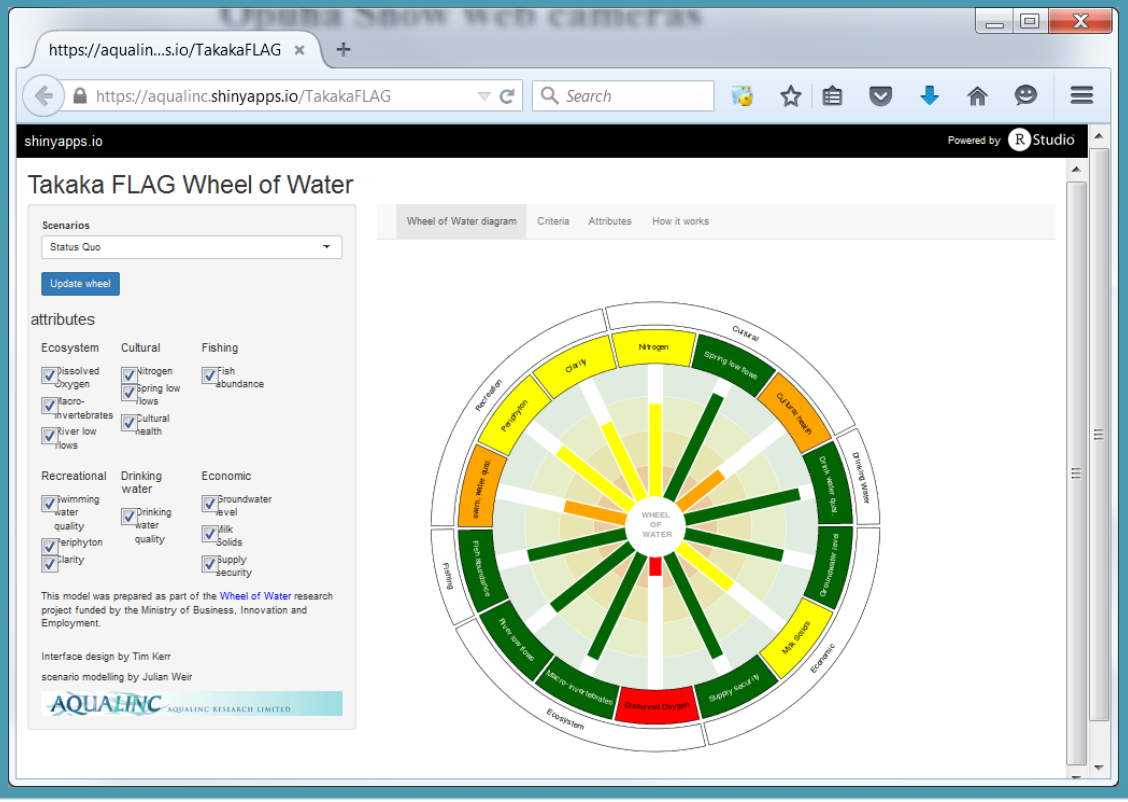
Wheel of Water
Criteria setting part II

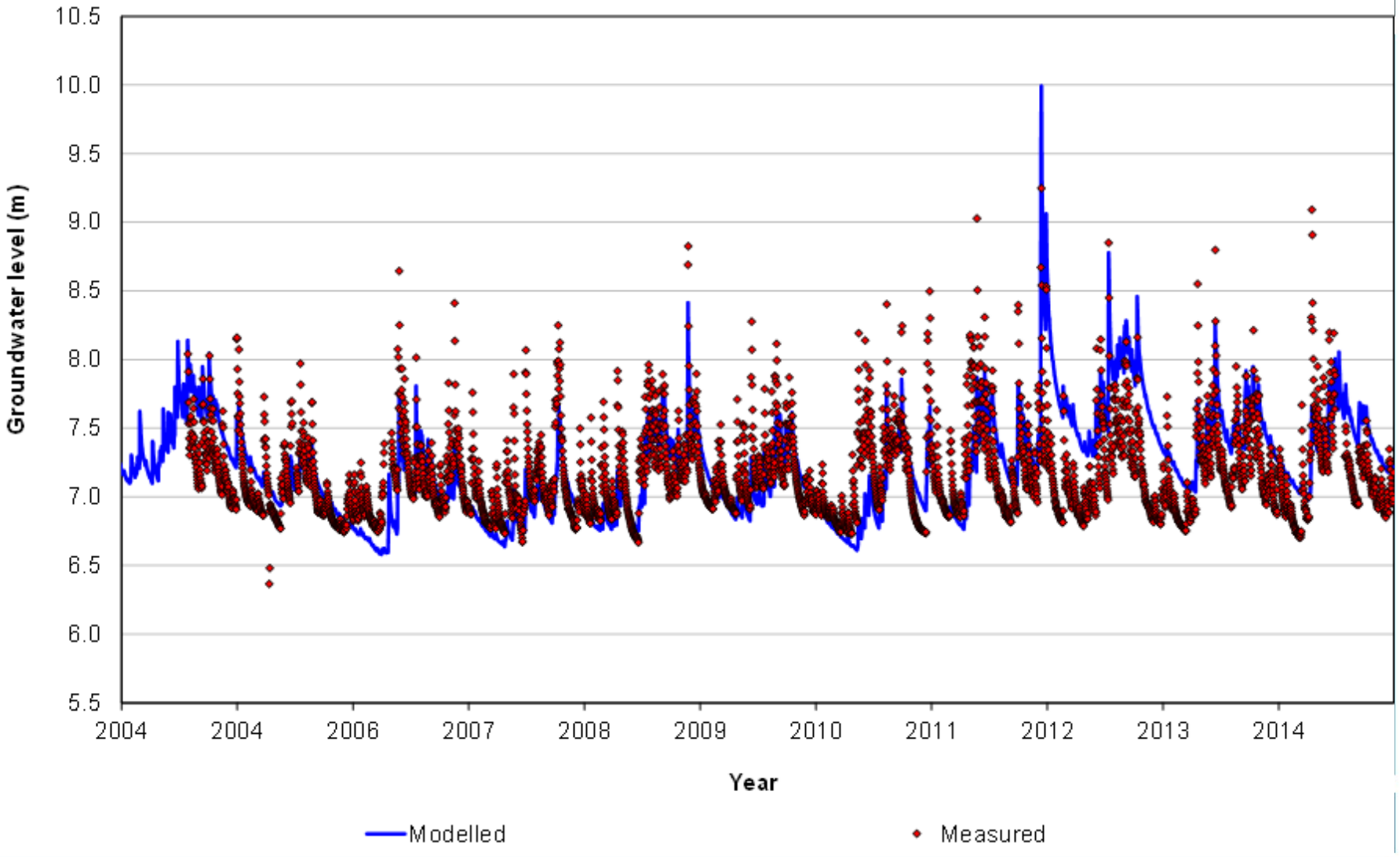
- https://aqualinc.shinyapps.io/TakakaFLAG



Groundwater (Economic)

- Minimum level at the fire station bore
- Takaka Unconfined Gravel Aquifer
- Scenarios values are from Julian's model

Julian's model



Modeled estimates

Scenario Name	Value (metres above sea level)
Status quo	6.6
No consumptive use	6.5
Double irrigation	6.9
All irrigation from groundwater	6.3
No Cobb Dam	5.8
No Waingaro River	6.2
Natural State	5.3

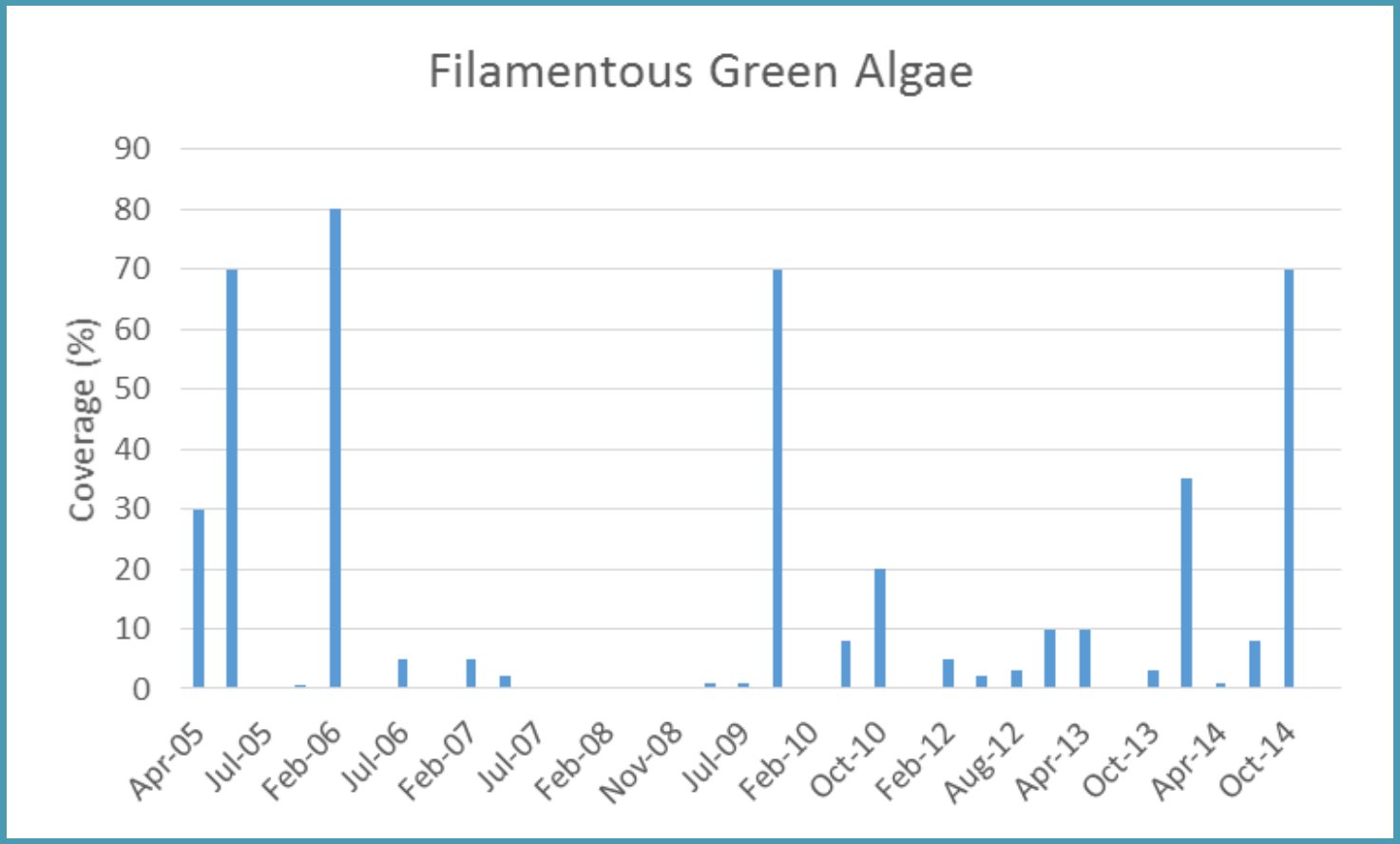
Criteria considerations

- Status quo is 6.6 m above sea level
- Pumping using a surface pump becomes difficult when groundwater is less than 6 m above sea level

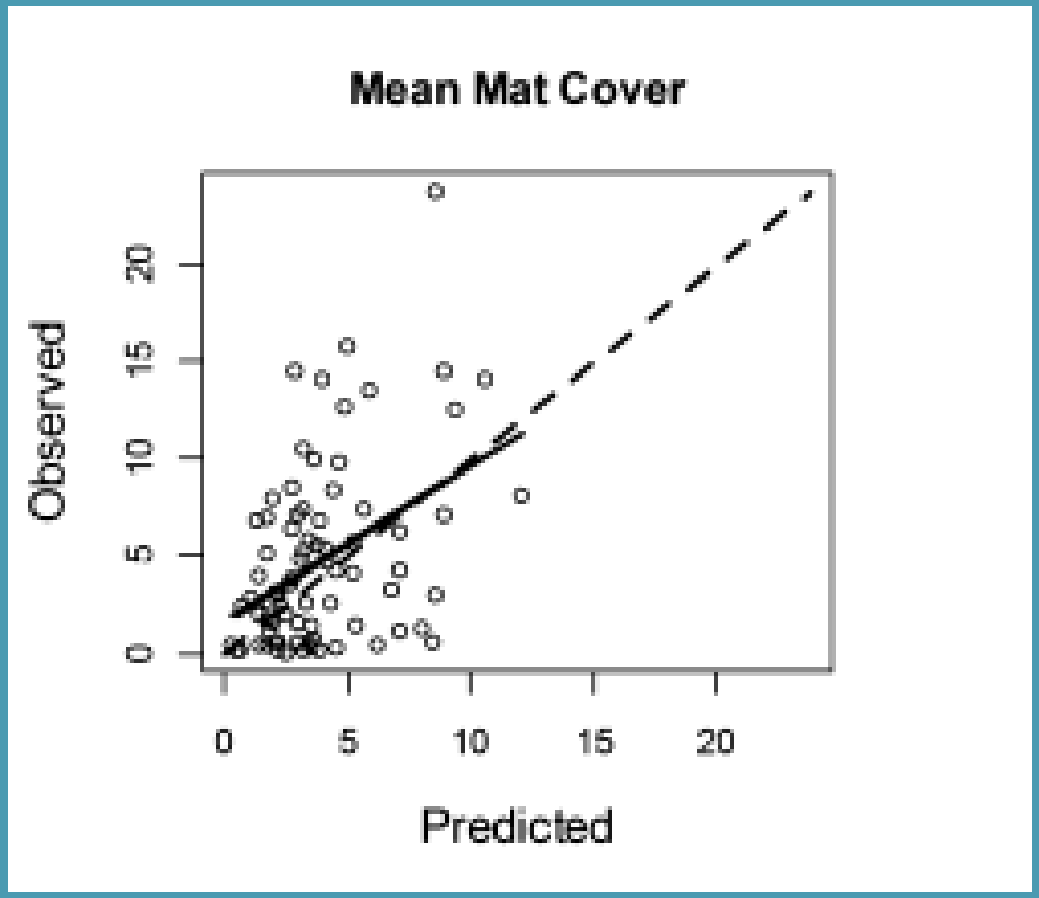
Periphyton (Recreation)

- Percentage coverage for the Motupipi at Reillys Bridge
- Scenario values are from a model that relates change in hydrology to the change in periphyton
- Model was derived from national observations
- The status quo was taken from observed (12.5 %)

Observed


Filamentous Green Algae
Coverage (%)
90
80
70
60
50
40
30
20
10
0
Apr-05
Jul-05
Feb-06
Jul-06
Feb-07
Jul-07
Feb-08
Nov-08
Jul-09
Feb-10
Oct-10
Feb-12
Aug-12
Apr-13
Oct-13
Apr-14
Oct-14

Model

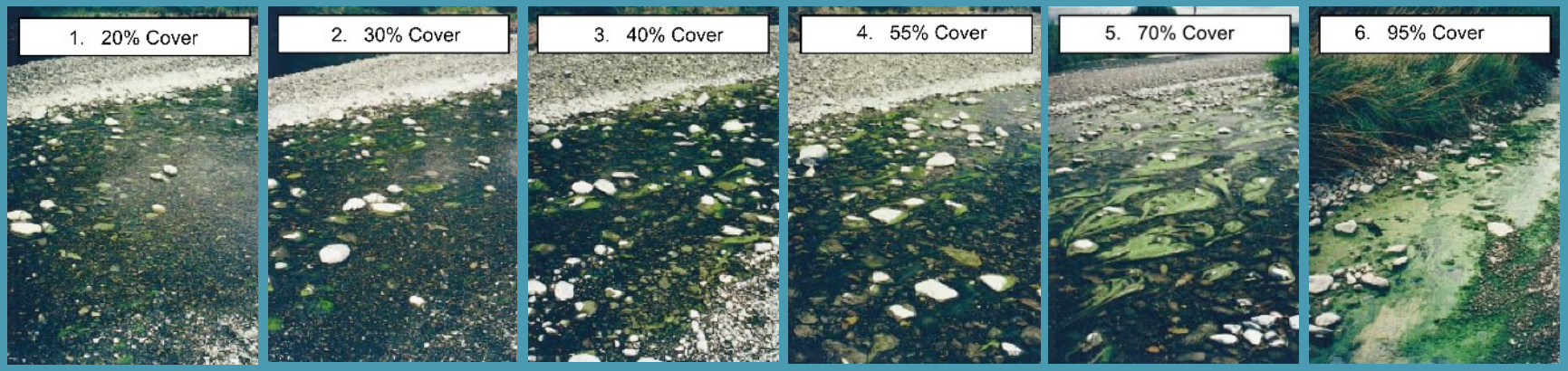


Modeled estimates

Scenario Name	Value (% coverage)
Status quo	12.5
No consumptive use	5.4
Double irrigation	17.2
All irrigation from groundwater	27.4
No Cobb Dam	12.0
No Waingaro River	11.4
Natural State	1.0

Criteria

- 60 % coverage is recommended recreational maximum according to the NZ periphyton guidelines.
- 0 % coverage is the best case for swimming
- 67 % is the worst possible case from the model



Macro-invertabrates (Ecosystem health)

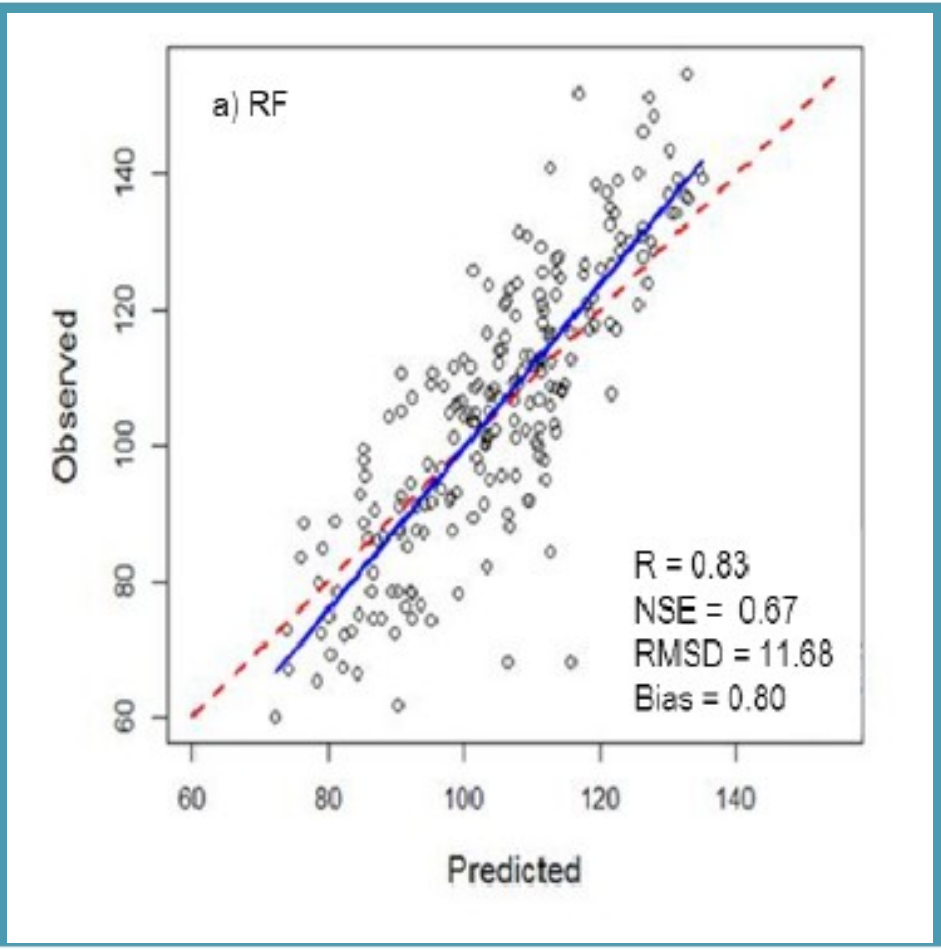
- Macroinvertebrate Community Index (MCI) score at Kotinga
- MCI is a standard measure of macroinvertebrate abundance biased to pollution intolerance

MCI

- Scale from 0-200
- 0 is no macroinvertebrates
- 200 is best possible score
- Observed at Kotinga:

16/12/2002	145
19/11/2003	133
25/10/2005	115
19/02/2015	118

Model


a) RF
Observed
Predicted
60
80
100
120
140
R = 0.83
NSE = 0.67
RMSD = 11.68
Bias = 0.80

Modelled Estimates

- Status Quo taken to match observed average (128)

Scenario Name	Value (MCI)
Status quo	128
No consumptive use	122
Double irrigation	117
All irrigation from groundwater	128
No Cobb Dam	128
No Waingaro River	125
Natural State	150

Criteria

- Default set to values according to MfE userguide

Category	User guide class	Value (MCI)
Green	Excellent	> 119
Yellow	Good	100-119
Orange	Fair	80-99
Red	Poor	< 80

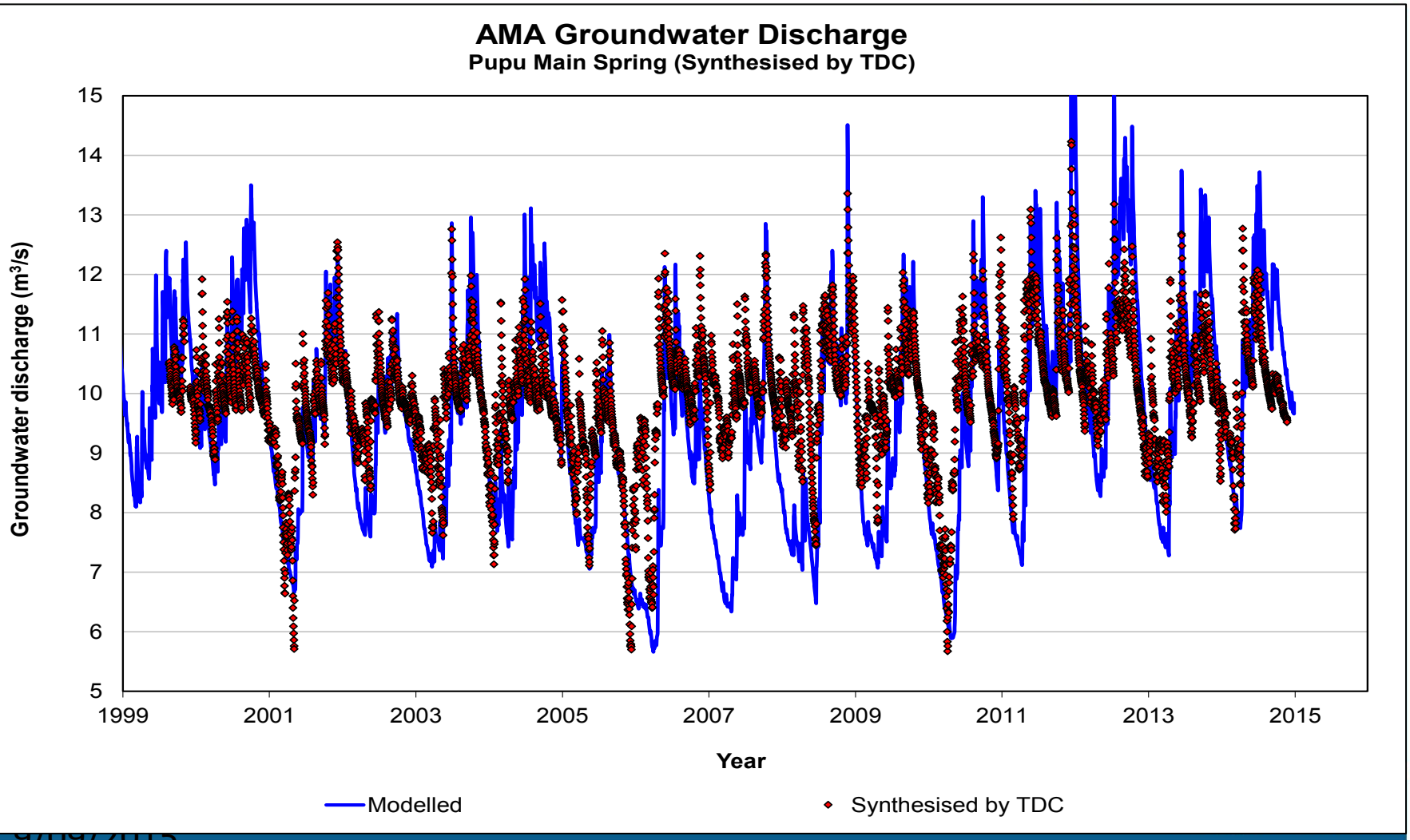
Drinking Water criteria

- Default green set to NZ drinking water standards

Spring flow quantity (Cultural and spiritual)

- Seven day mean annual low flow at Te Waikoropupu Springs (litres per second)

Model


AMA Groundwater Discharge
Pupu Main Spring (Synthesised by TDC)
Groundwater discharge (m³/s)
15
14
13
12
11
10
9
8
7
6
5
1999
2001
2003
2005
2007
2009
2011
2013
2015
Year
Modelled
Synthesised by TDC

Modelled values

Scenario Name	Value (litres per second)
Status quo	7290
No consumptive use	7430
Double irrigation	7110
All irrigation from groundwater	6990
No Cobb Dam	6500
No Waingaro River	6910
Natural State	5830

Criteria

- Minimum set to “natural” scenario (5830 l/s)
- Maximum set to 7500 l/s (nearest 100 l/s above the “no consumptive use” scenario.
- Default mid ranges set to equal steps within this range.

Dissolved Oxygen
Scenario values

- “Status quo” set to average (80%)
- Roger Young attributed some of the low DO to land use and stock access
- “Double irrigation” given reduced DO (70%)
- “No consumptive use” and “Natural” given increased DO (90 %)

Criteria

- National policy statement B standard (50 %) was set as the minimum
- The red-orange boundary was set to 20th percentile of the observed DO from observed lowland sites as given in the Ministry for the Environment “trigger values” report (98 %).
- The green-yellow boundary was set to 80 th percentile (105 %)

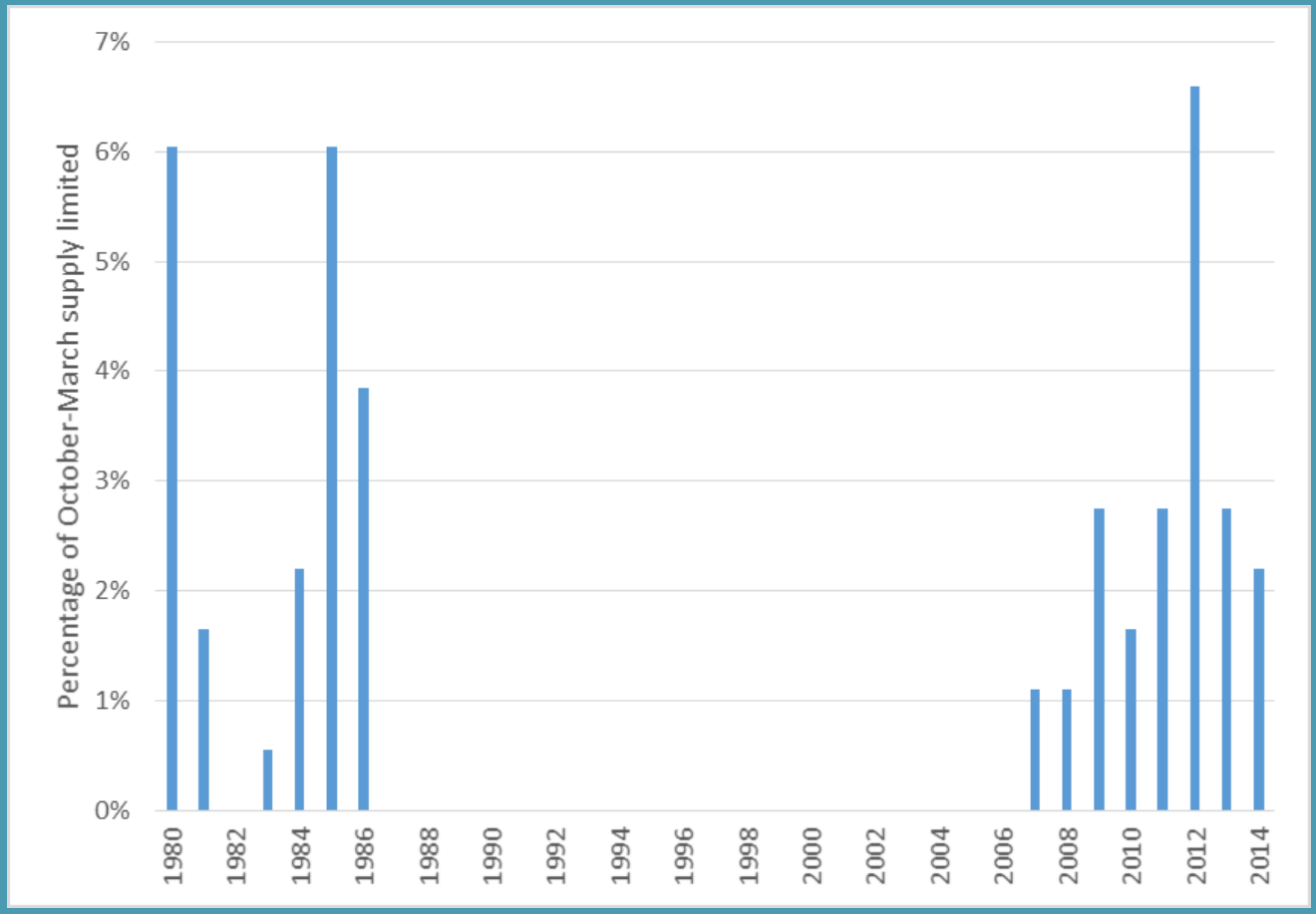
Swimming water quality Criteria

- Default used the Ministry for the Environment "Overall Recreation Risk" categories

Category	User guide class	Value (E.Coli per 100 ml)
Green	Very low risk	< 130
Yellow	Low risk	130-260
Orange	Moderate risk	260-550
Red	caution	> 500

Supply security (economic)

- Percentage of time that October-March average daily flows are less than 1.657 m^3/s at the Harwoods recorder.



Scenario values

- Taken from flow modelling.
- “No Cobb Dam” and “Natural” : 6%
- All other scenarios: 2 %

Criteria

- Minimum set to 100 % loss of supply
- Maximum set to no loss of supply
- Arbitrarily set other values

Category	Value (% of time without supply in summer)
Green	< 3.3 %
Yellow	3.3 %
Orange	6.6 %
Red	> 10 %

Cultural Health Index (cultural and spiritual)

- Cultural stream health (on a scale from 1 to 5)
- Multiple person subjective assessment of:
  - catchment land use,
  - vegetation,
  - River bank modification,
  - River bed condition,
  - River channel modification,
  - water quality,
  - habitat variety.
- Currently we have no “status quo” value. Default to 2.5

Scenario

- Different scenarios affect:
  - River bed condition (by nutrient changes)
  - Catchment land use (“natural”)
  - Vegetation (“natural”)
  - Water quality (by nutrient changes)
  - Water clarity (by nutrient changes)

Scenario Name	Change in CHI for stream health
Status quo	0
No consumptive use	+0.5
Double irrigation	-0.5
All irrigation from groundwater	0
No Cobb Dam	0
No Waingaro River	0
Natural State	+1

Criteria

- Default use classes from Ministry for the Environment guideline

Category	MfE guide	Value (CHI)
Green	Excellent stream health	3.75 - 5
Yellow	Above average	2.5 – 3.75
Orange	Below average	1.75-2.5
Red	Poor stream health	1 – 1.75

Halelujah!

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