Groundwater Use and Trends in South Australia

2013-14

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Government of South Australia
Department of Environment,
Water and Natural Resources

Total groundwater use in 2013-14

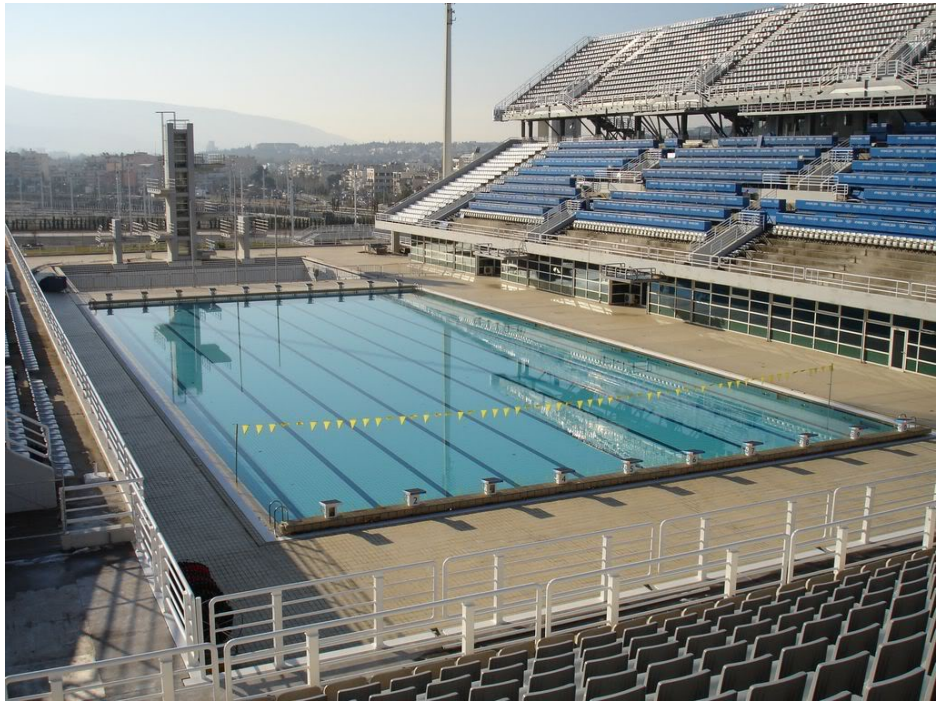
~550 GL

~550,000 million

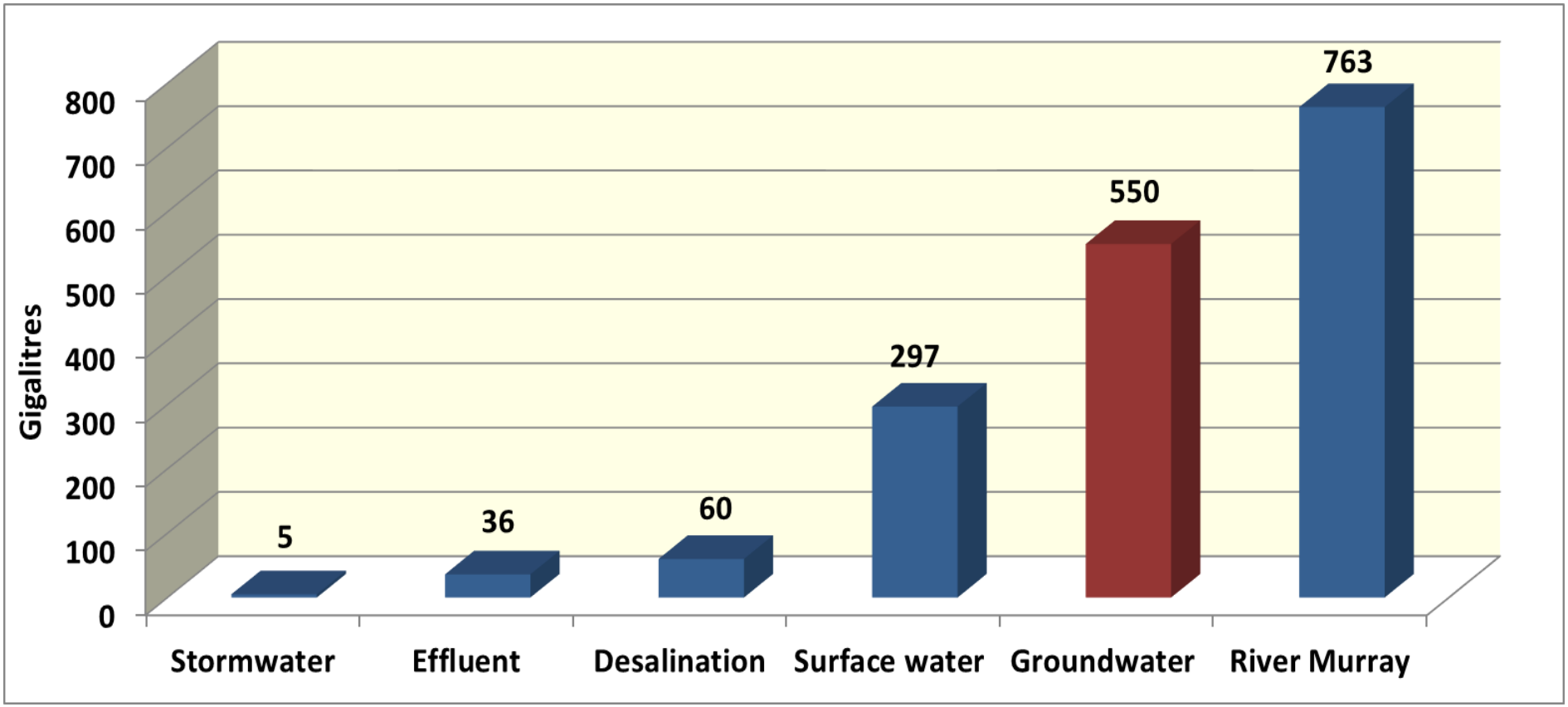
Almost 4 x Adelaide's water use for the same period

One gigalitre

~ 1,000 X

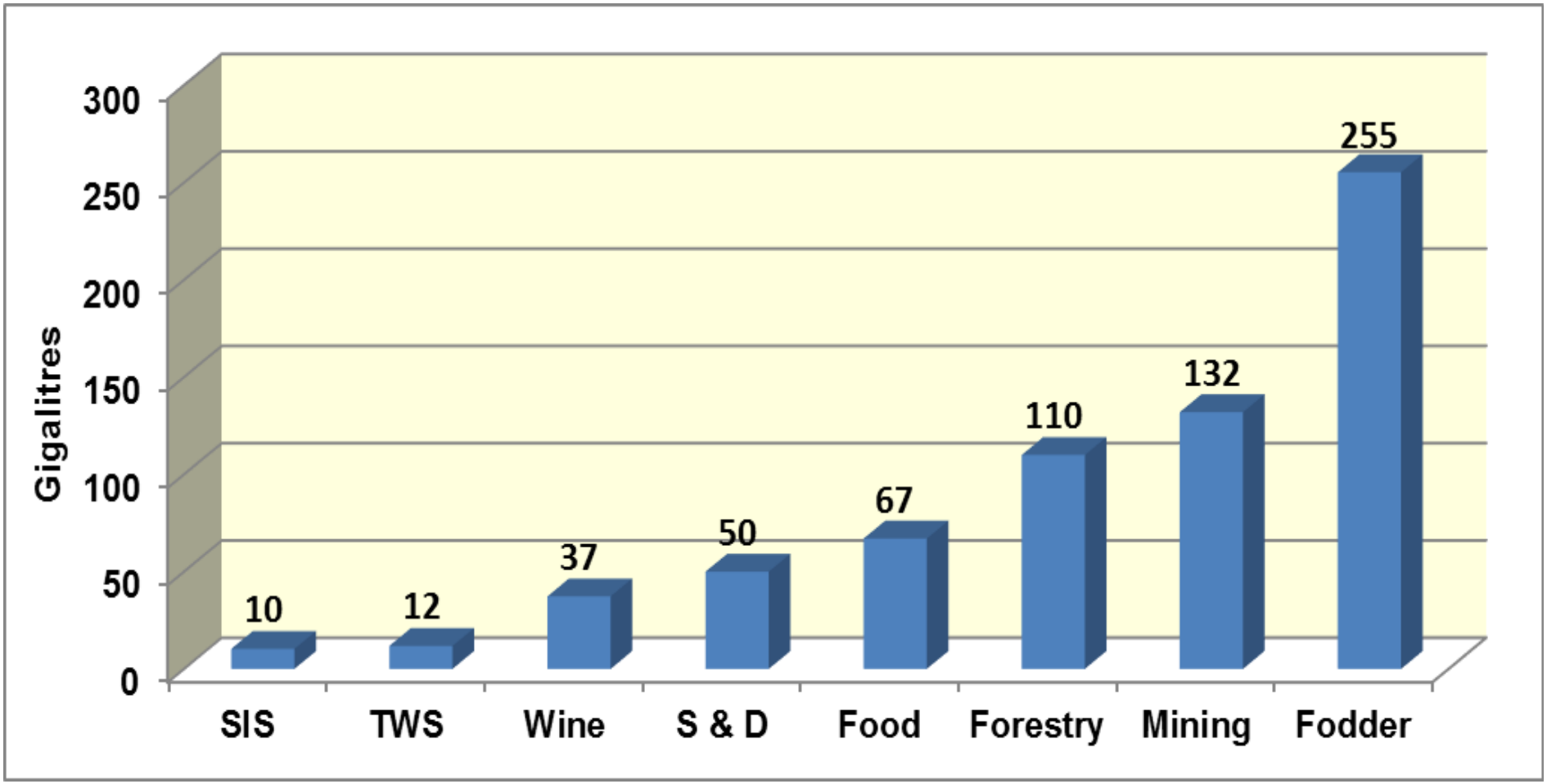


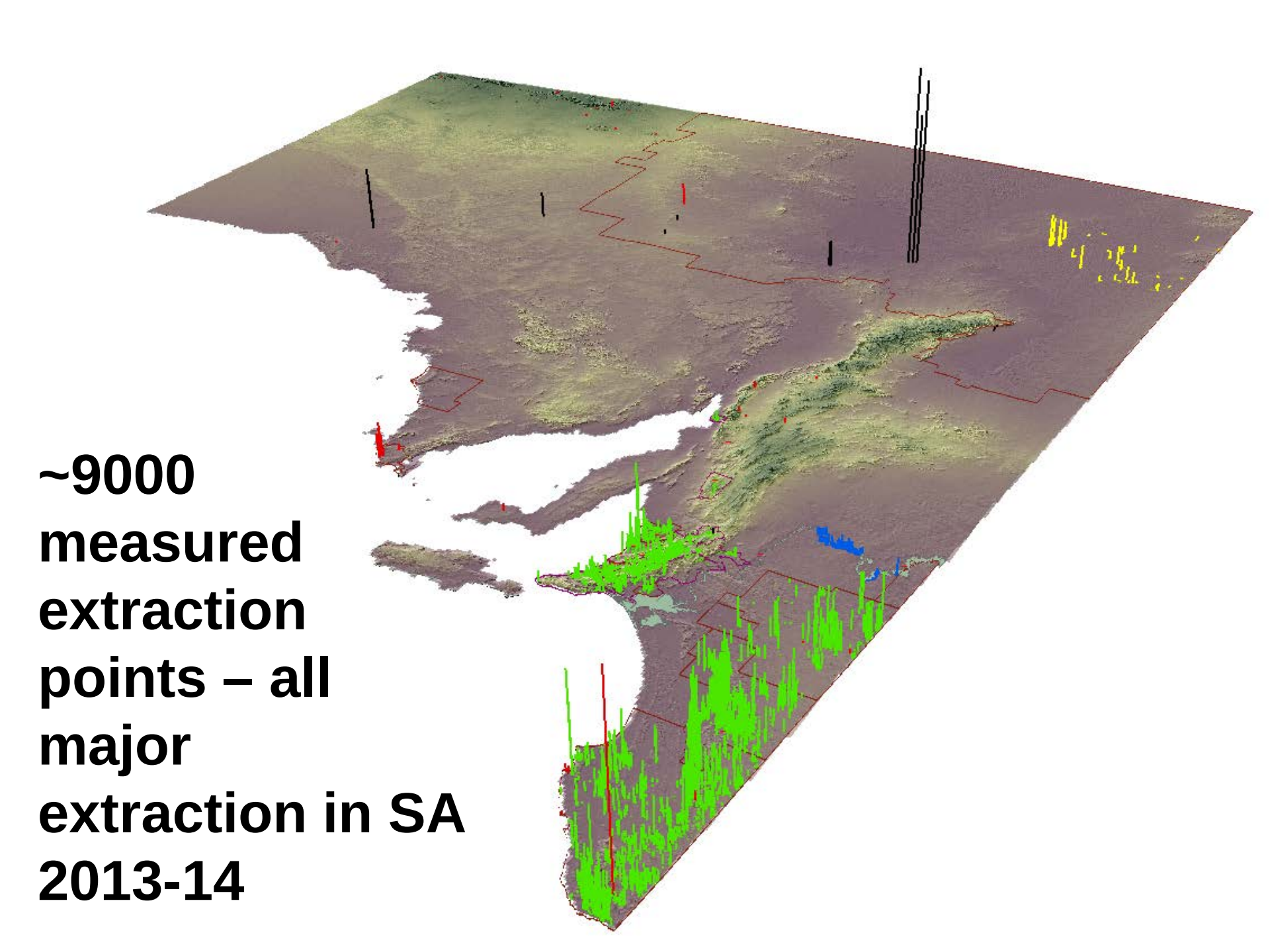
How does this compare to other sources ?



How groundwater is used

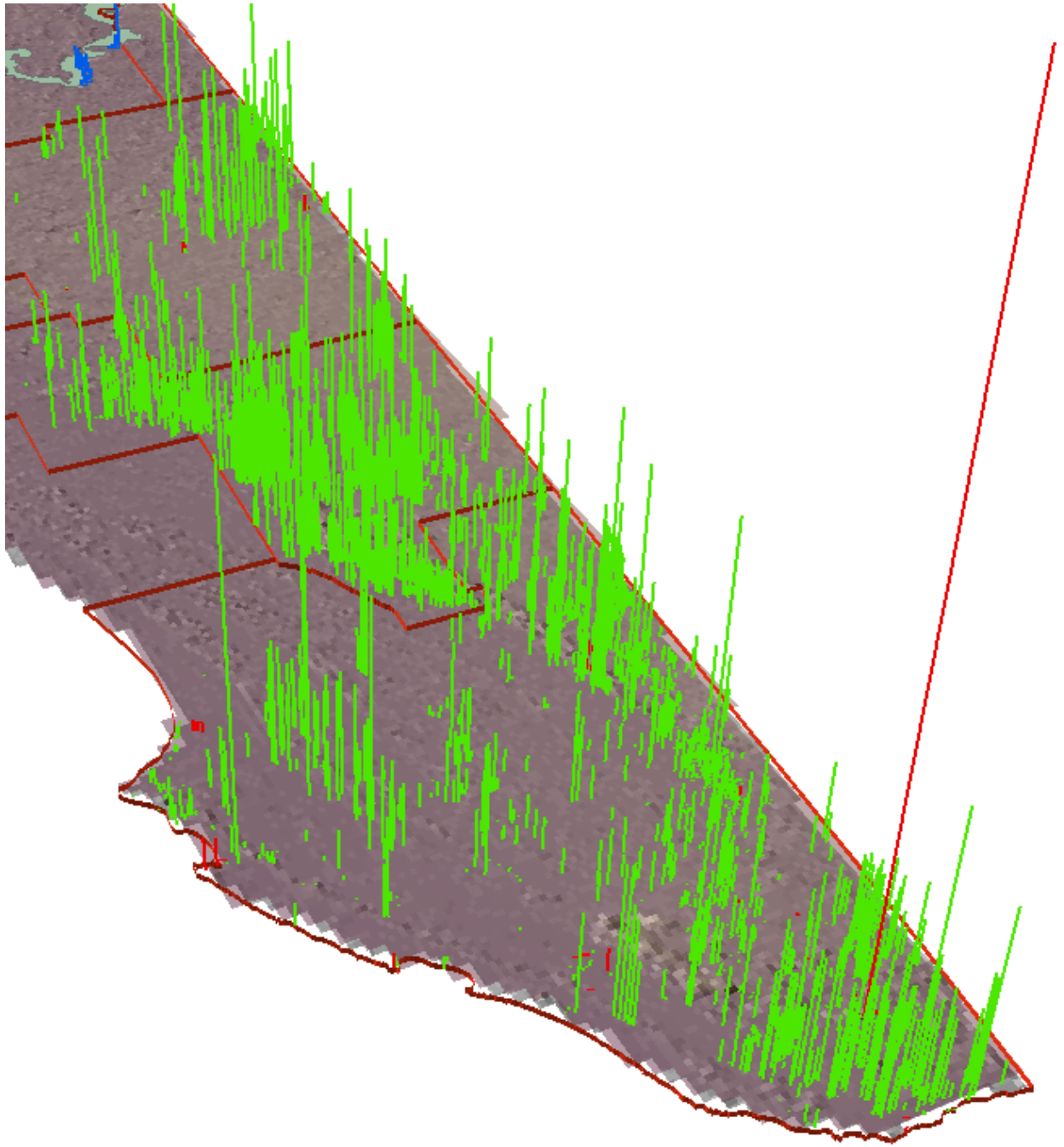
Irrigation (fodder, food, wine)
SIS, Mining, TWS, Stock and domestic

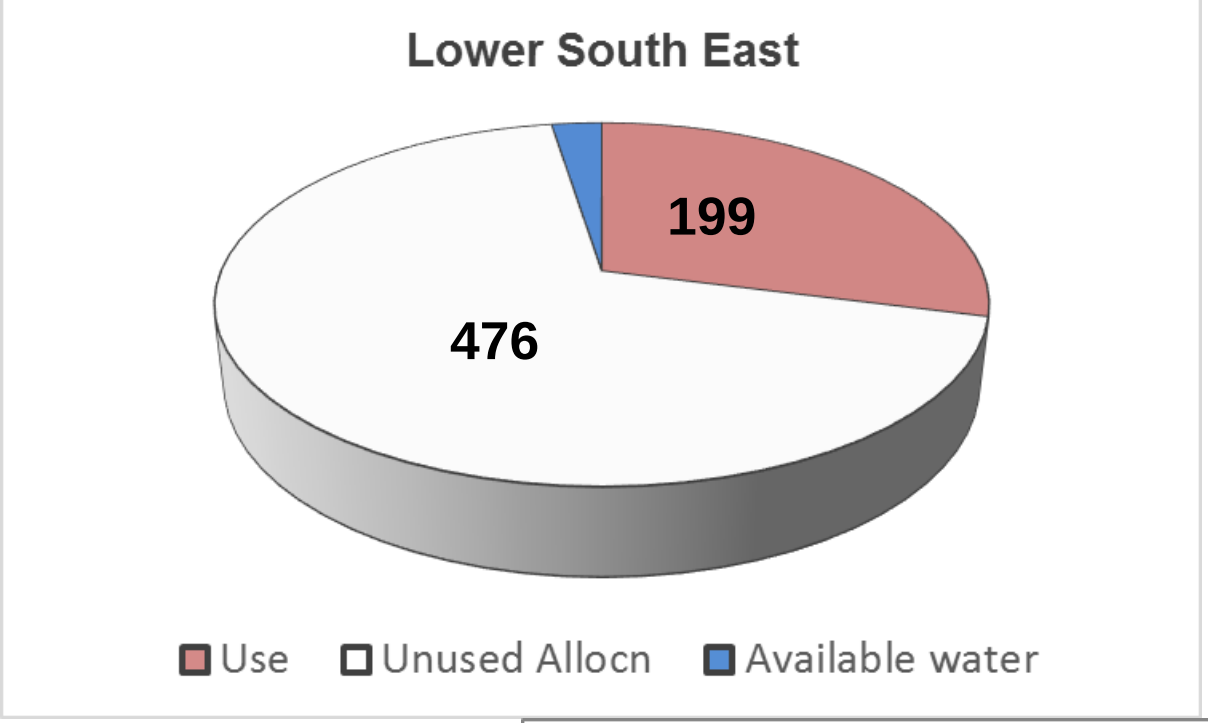


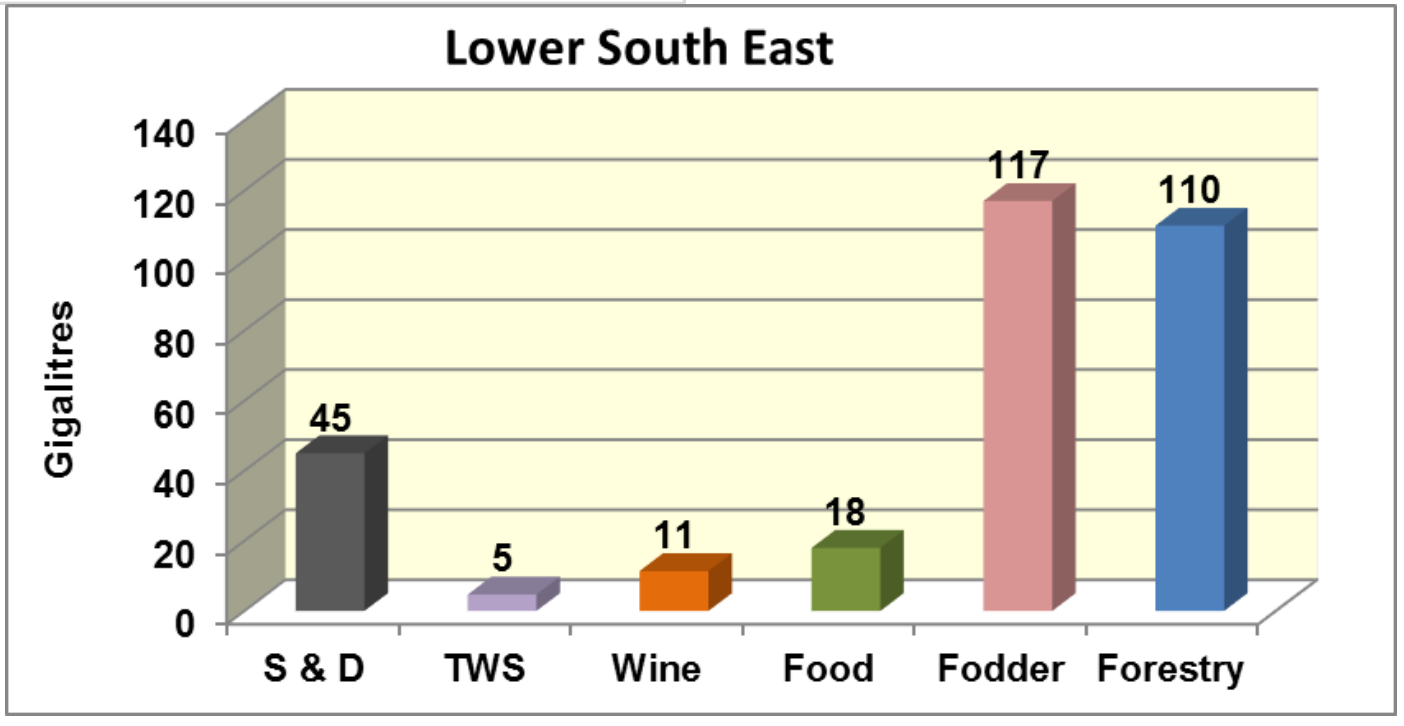


~9000 measured extraction points – all major extraction in SA 2013-14

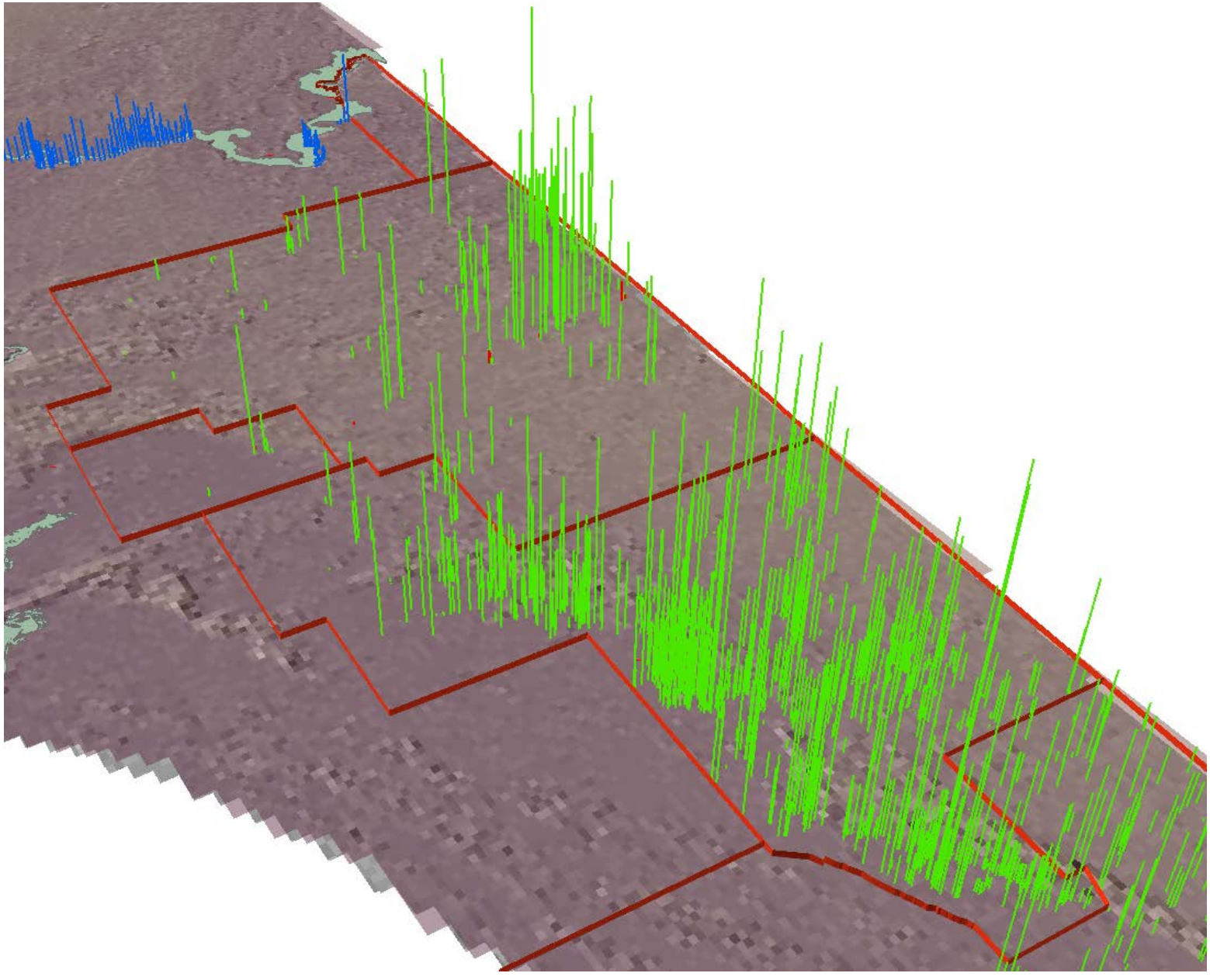
Lower SE

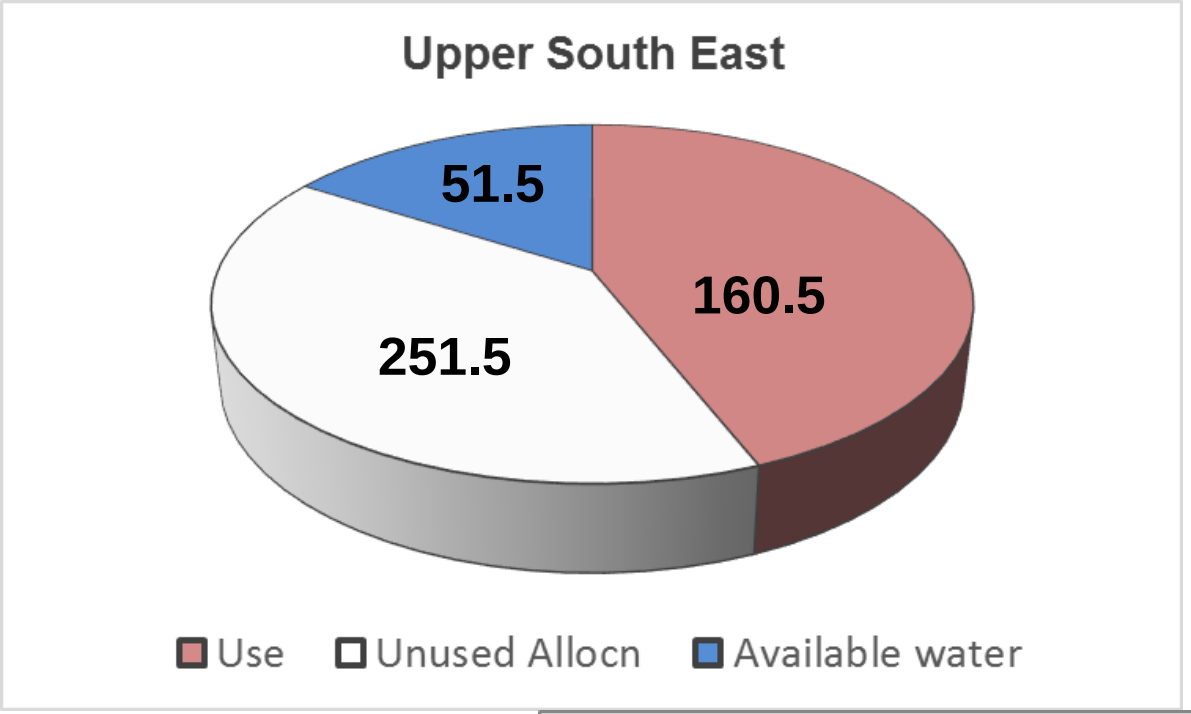


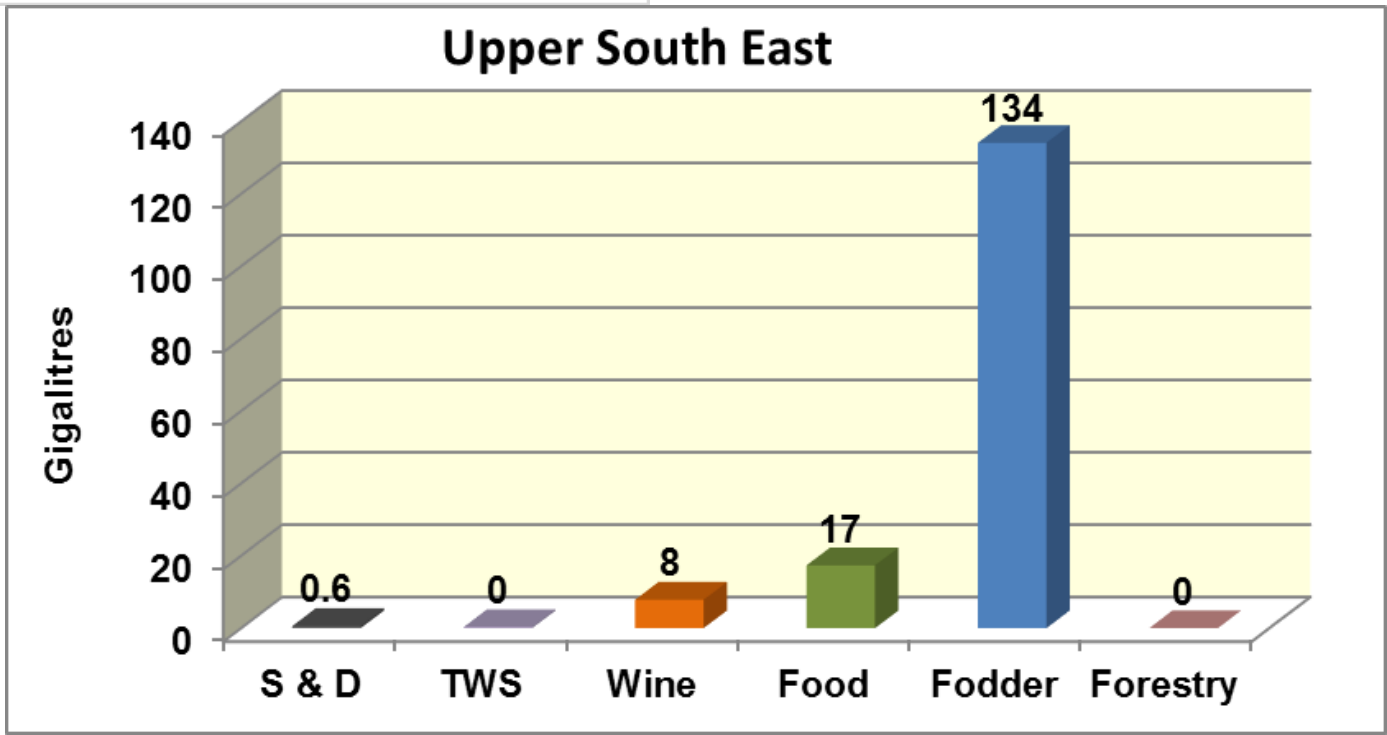

Lower South East
199
476
Use
Unused Allocn
Available water

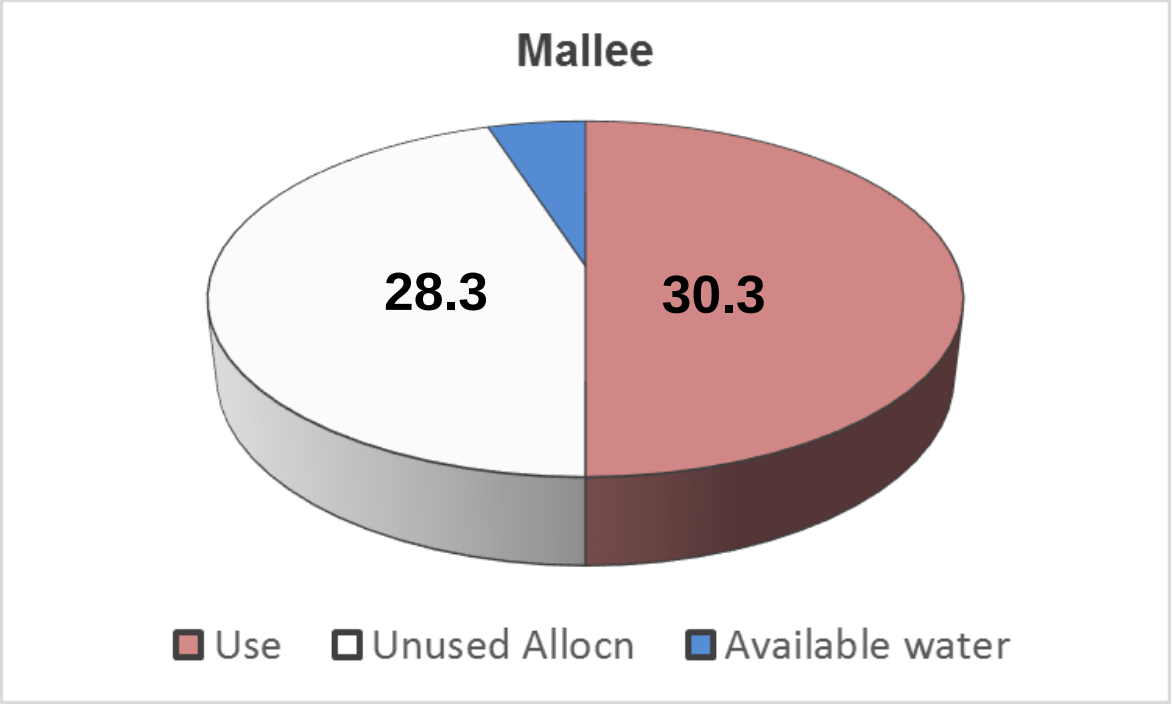

Lower South East
Gigalitres
140
120
100
80
60
40
20
0
45
5
11
18
117
110
S & D
TWS
Wine
Food
Fodder
Forestry

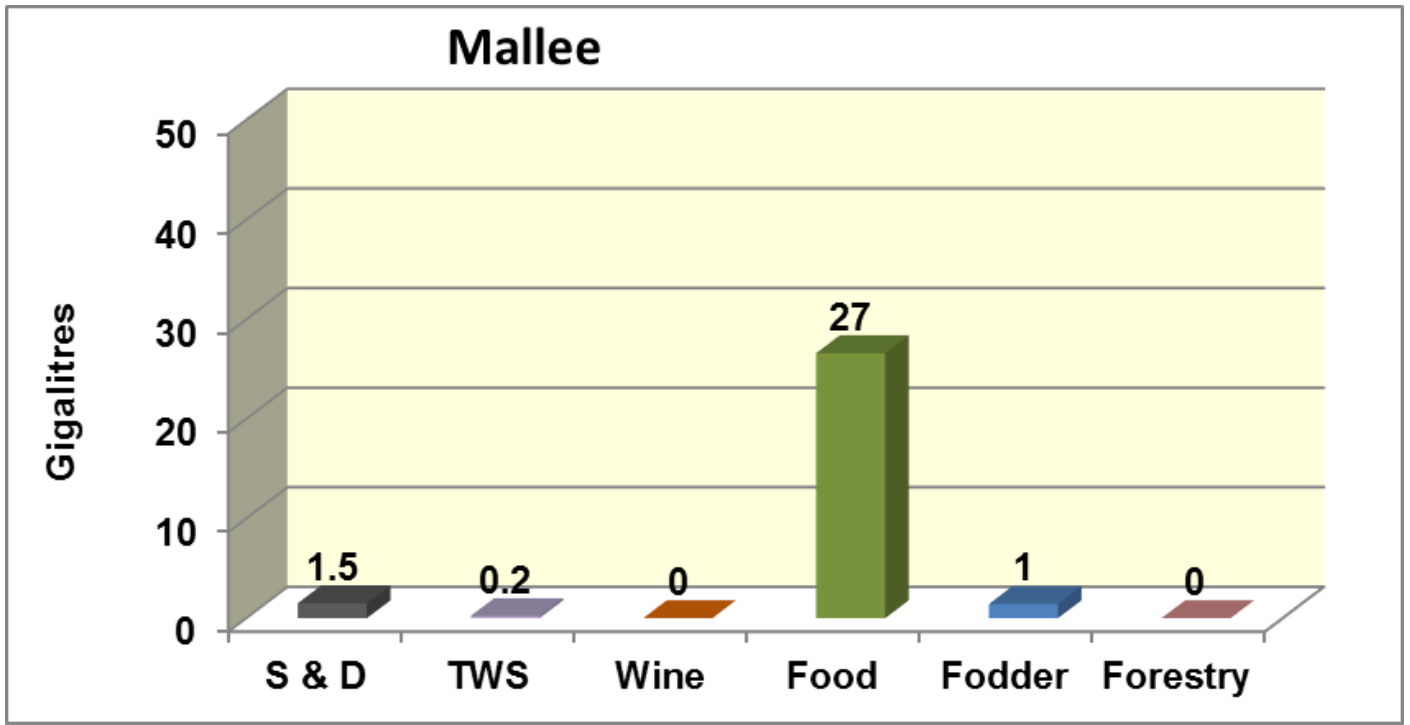
Upper SE and Mallee



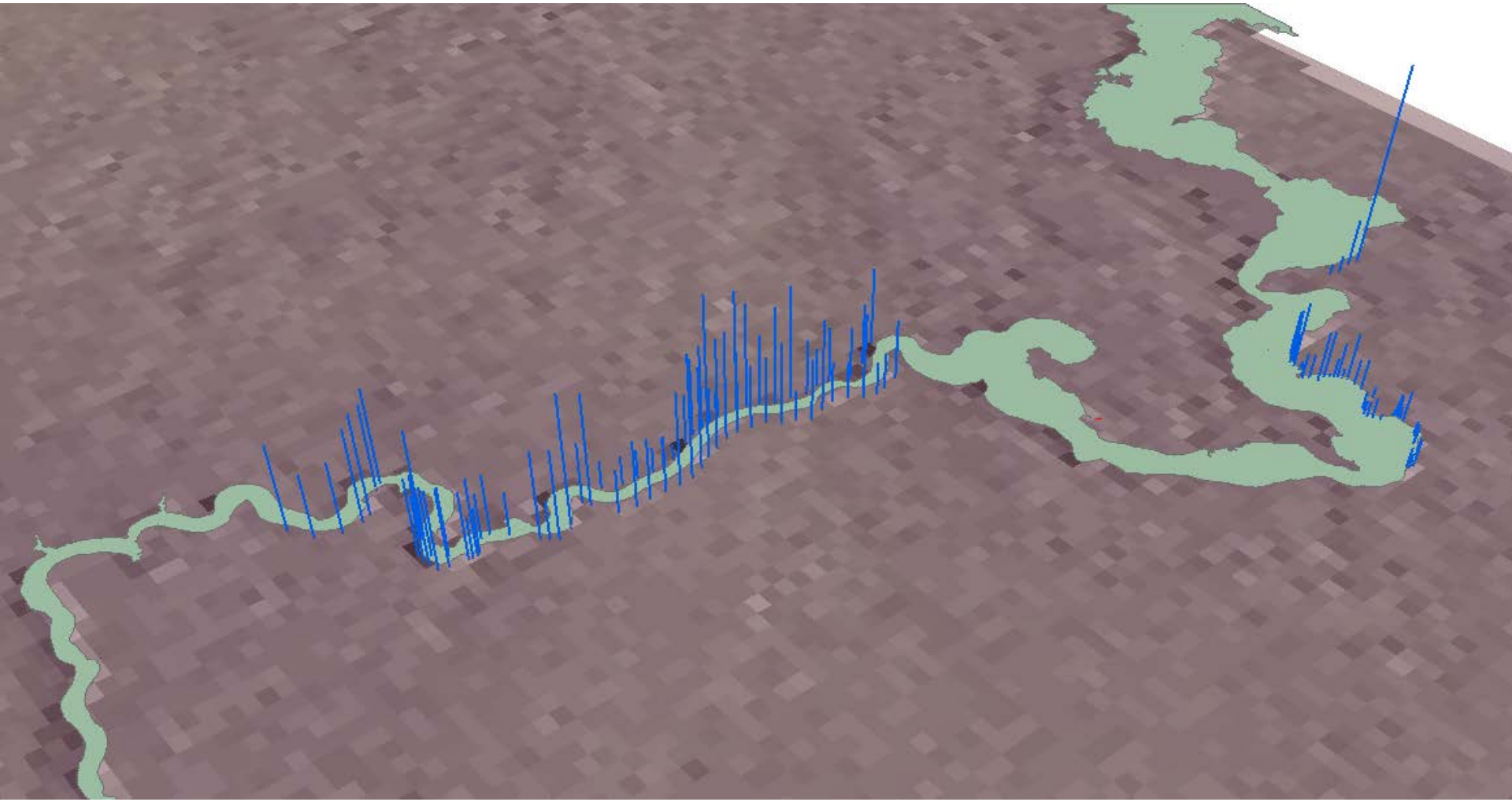

Upper South East
51.5
160.5
251.5
Use
Unused Allocn
Available water


Upper South East
Gigalitres
140
120
100
80
60
40
20
0
0.6
0
8
17
134
0
S & D
TWS
Wine
Food
Fodder
Forestry


Mallee
28.3
30.3
Use
Unused Allocn
Available water


Mallee
Gigalitres
50
40
30
20
10
0
1.5
0.2
0
27
1
0
S & D
TWS
Wine
Food
Fodder
Forestry

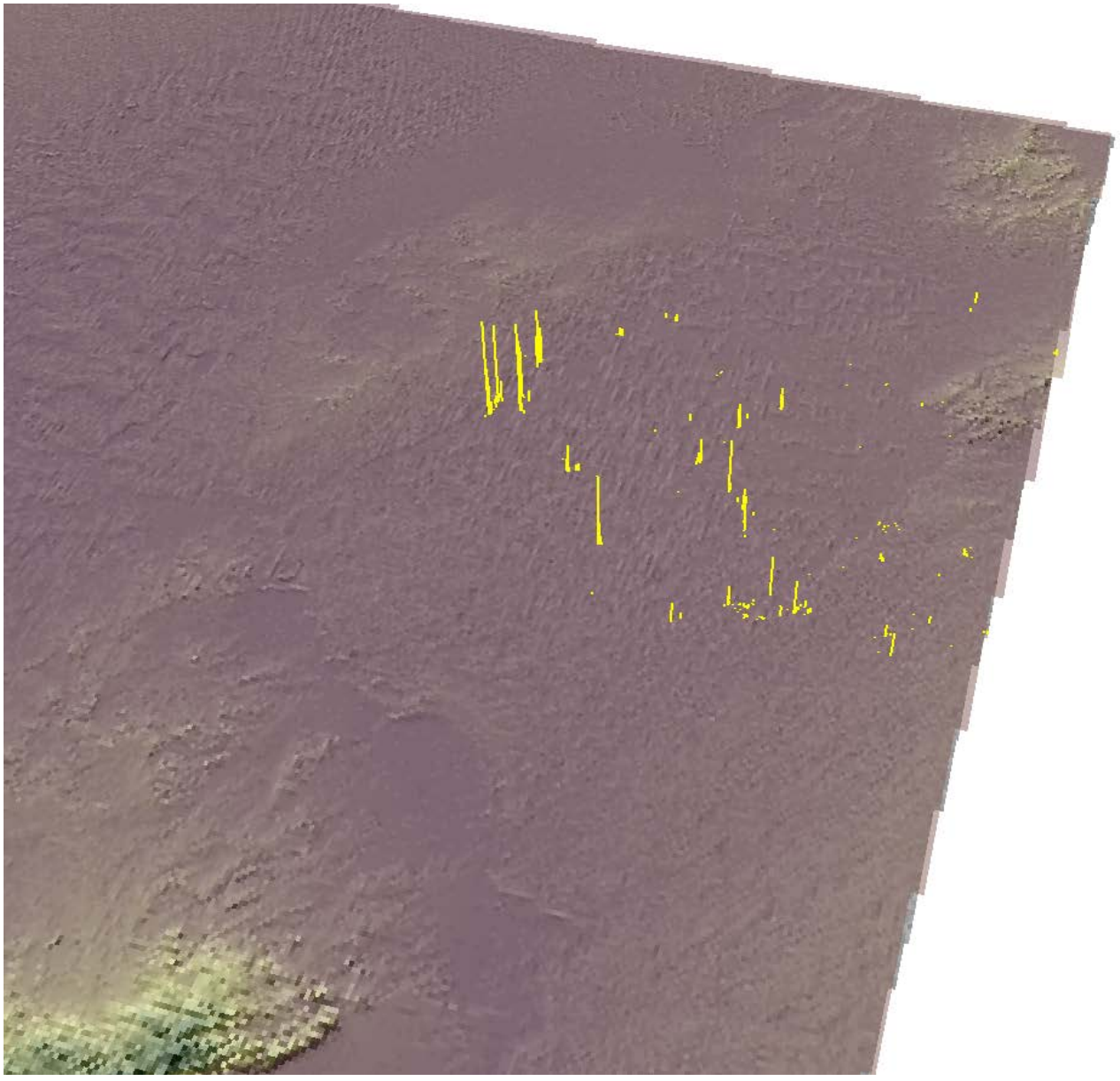
Riverland SIS



SIS

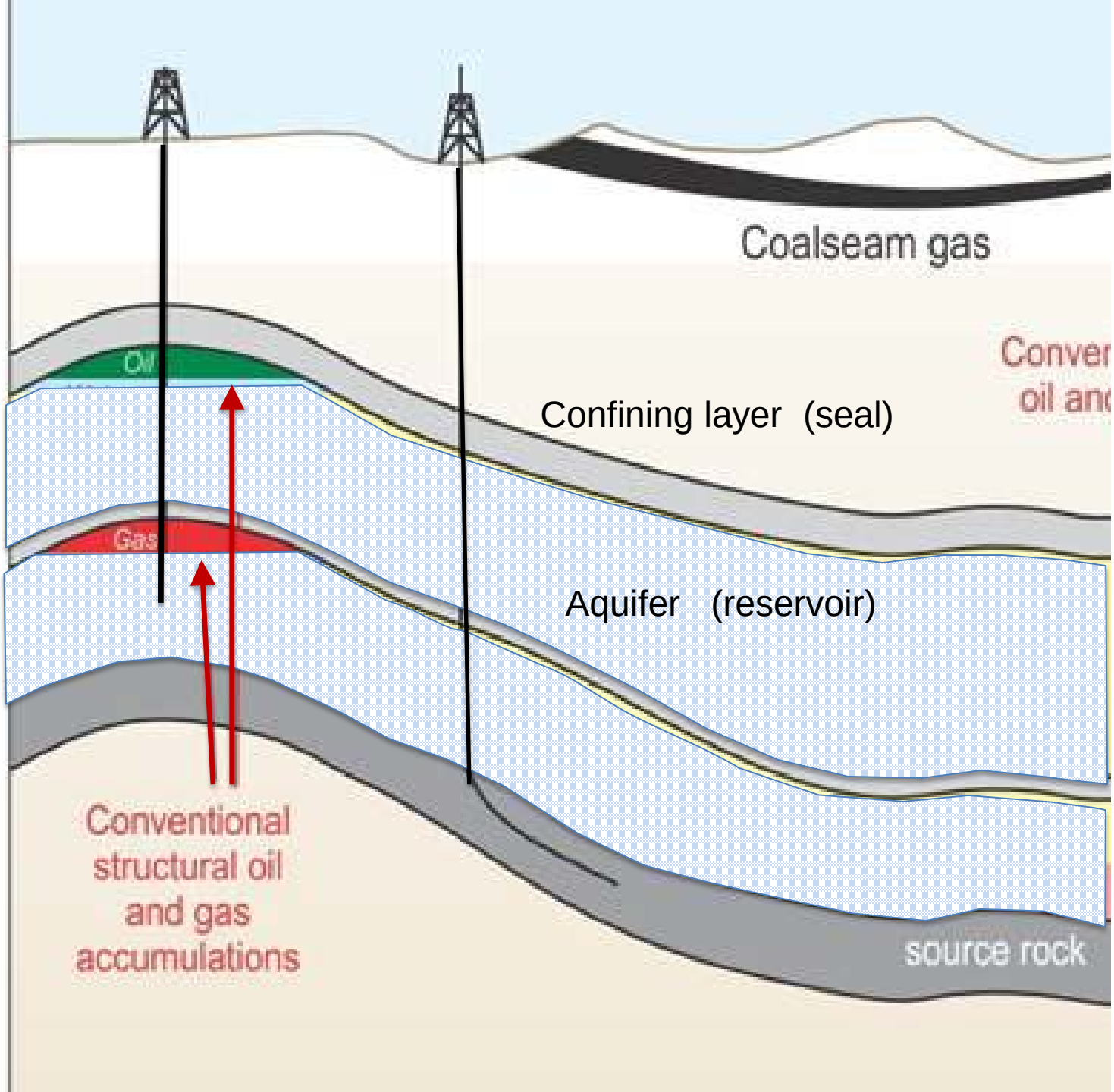
- 150 wells extracted 10.3 GL in 2013-14
- Assuming an average salinity of 20,000 mg/L, this equates to 206,000 tones of salt prevented from entering the river/floodplain
- Apart from the environmental benefits, this represents a saving of $2 million in costs to water consumers in SA

Cooper Basin

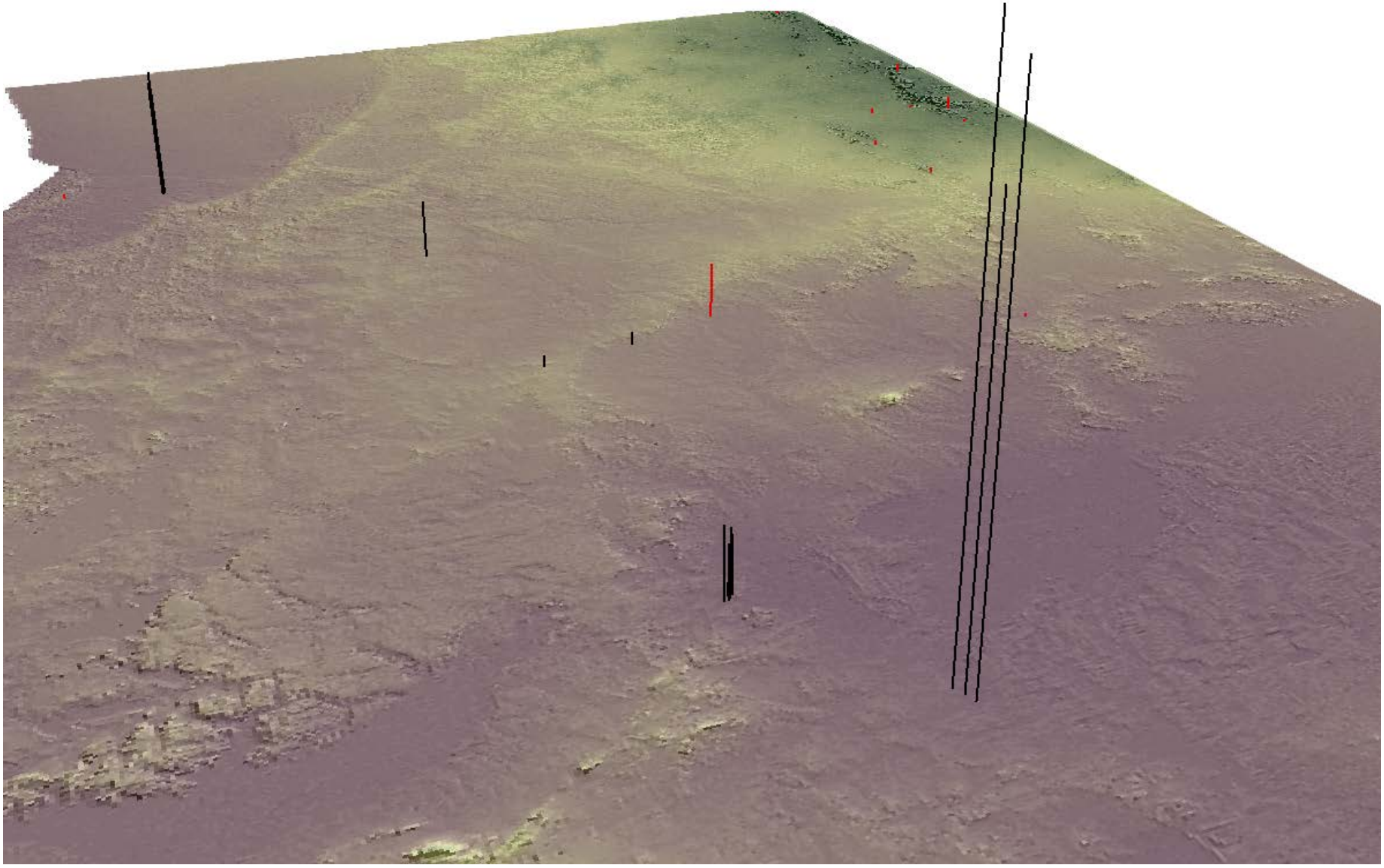


Co-produced water

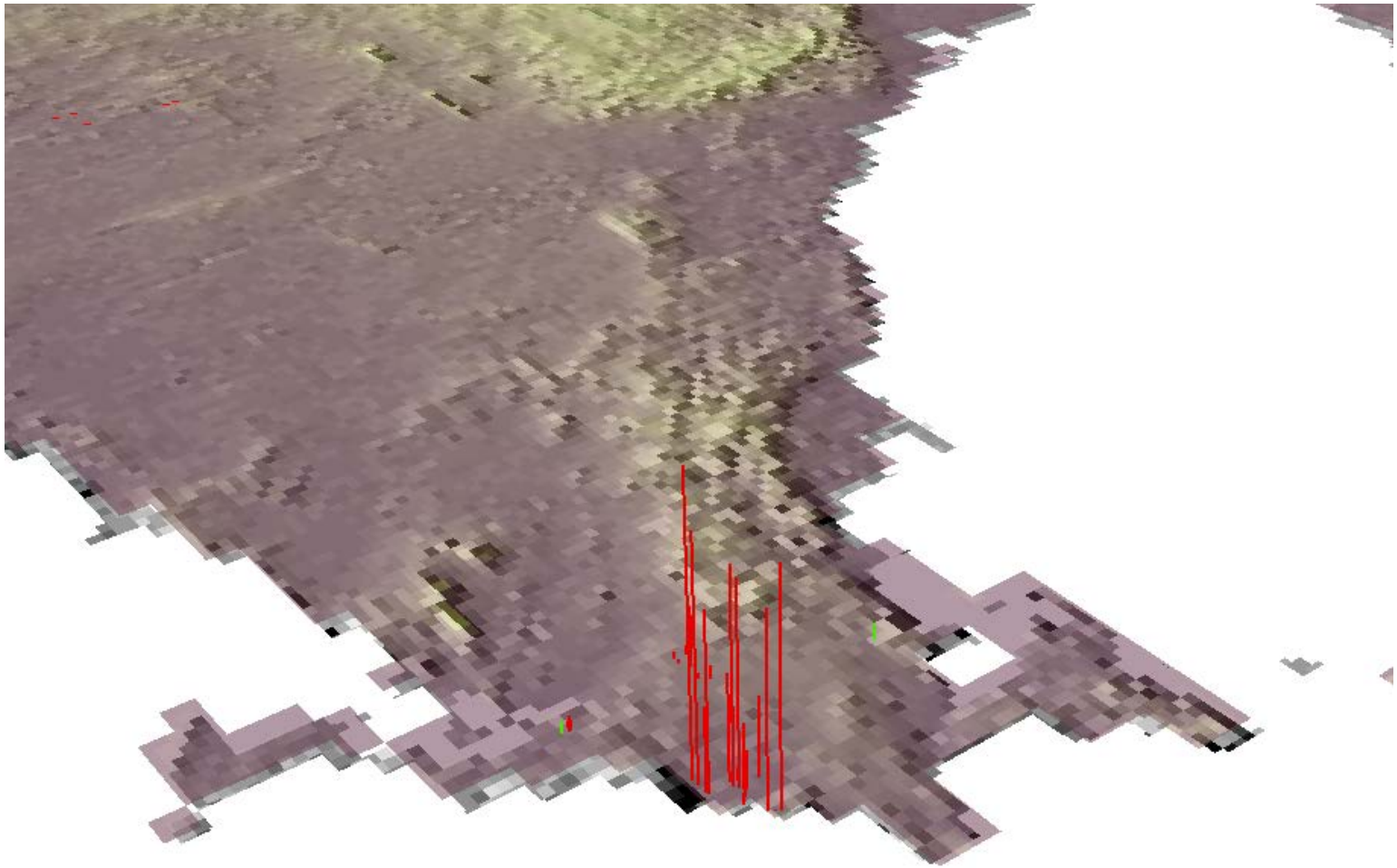
- 450 oil wells co-produced 14 GL of stock quality groundwater, mostly from aquifers within the GAB
- This water evaporates from lined ponds, or is discharged down inter-dunal corridors

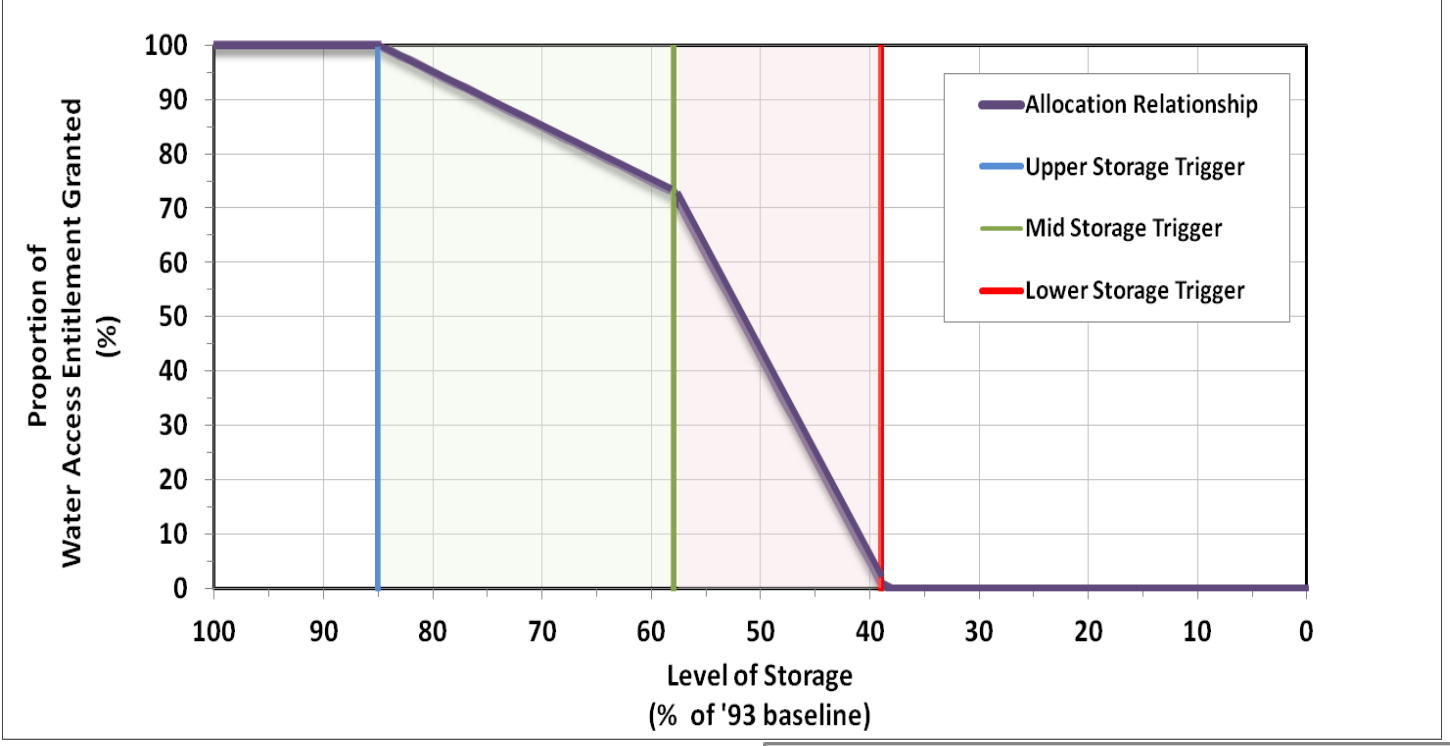

Coalseam gas
Oil
Gas
Confining layer (seal)
Aquifer (reservoir)
Conventional structural oil and gas accumulations
source rock

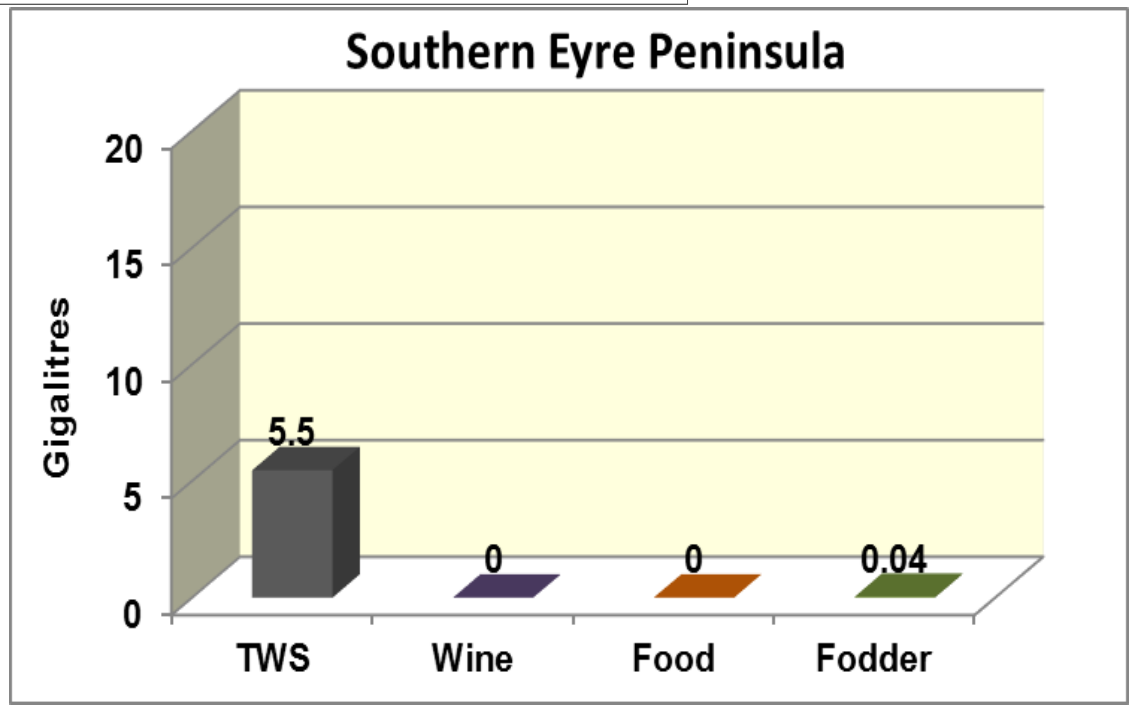
Far West



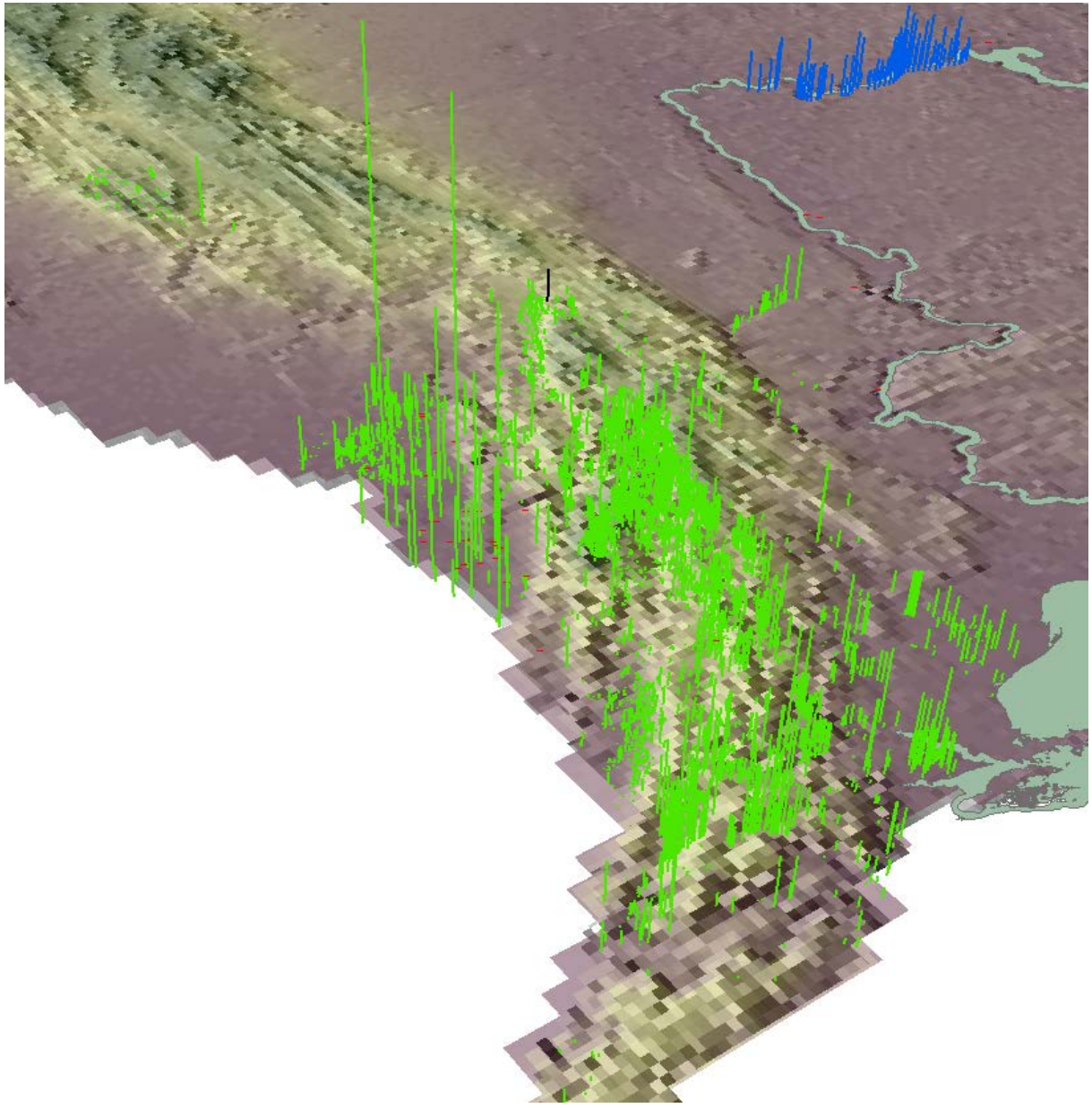
Southern Eyre Peninsula

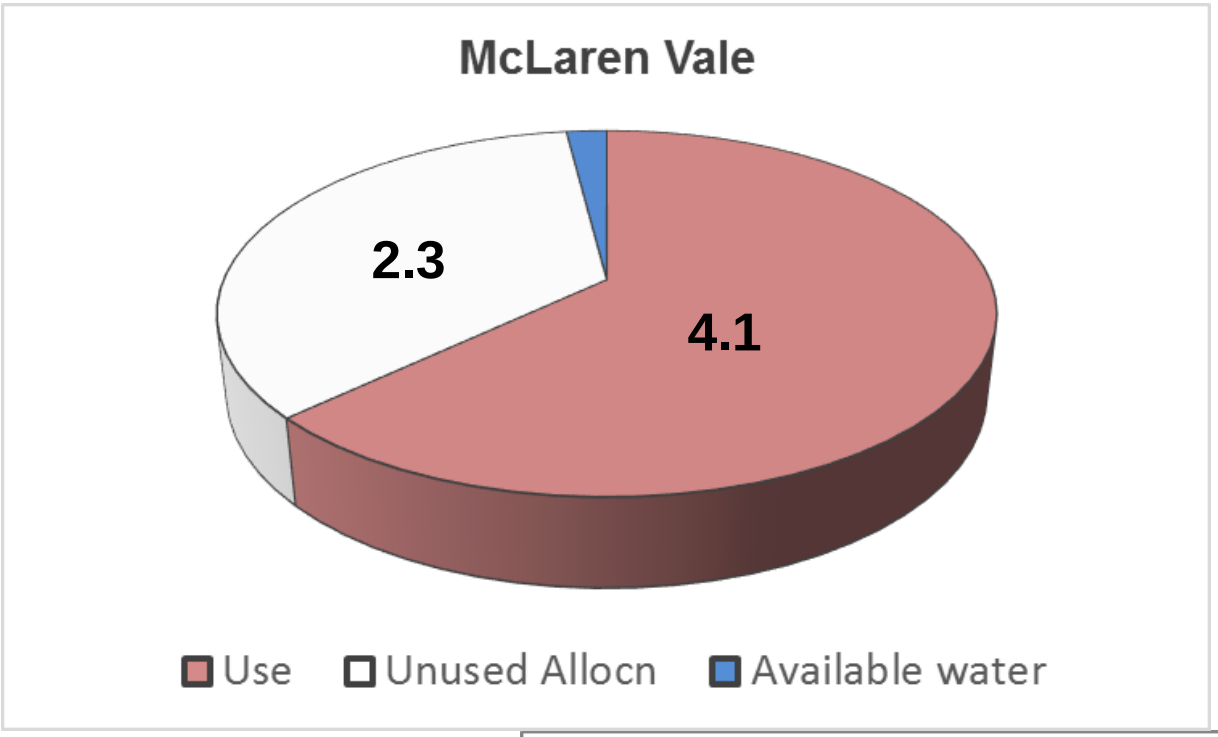


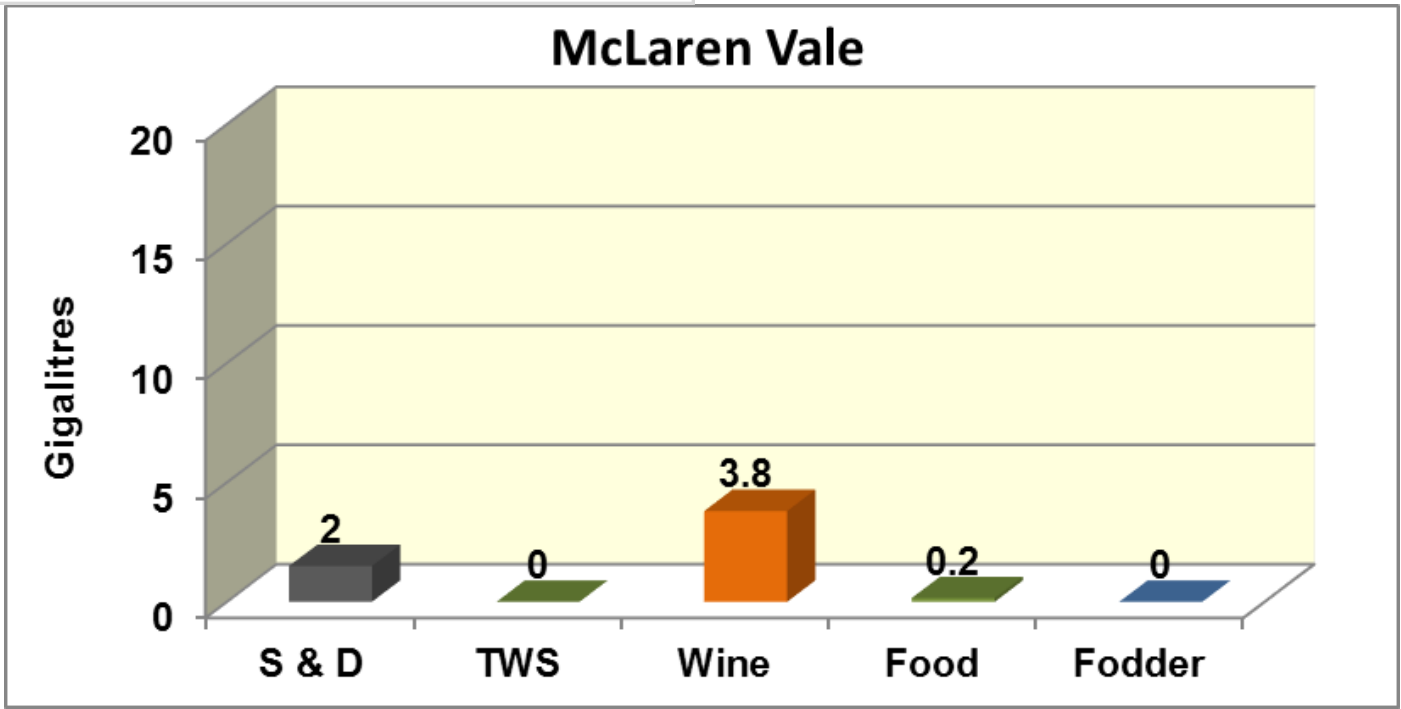

Proportion of Water Access Entitlement Granted (%)
100
90
80
70
60
50
40
30
20
10
0
100
90
80
70
60
50
40
30
20
10
0
Level of Storage (% of '93 baseline)
Allocation Relationship
Upper Storage Trigger
Mid Storage Trigger
Lower Storage Trigger

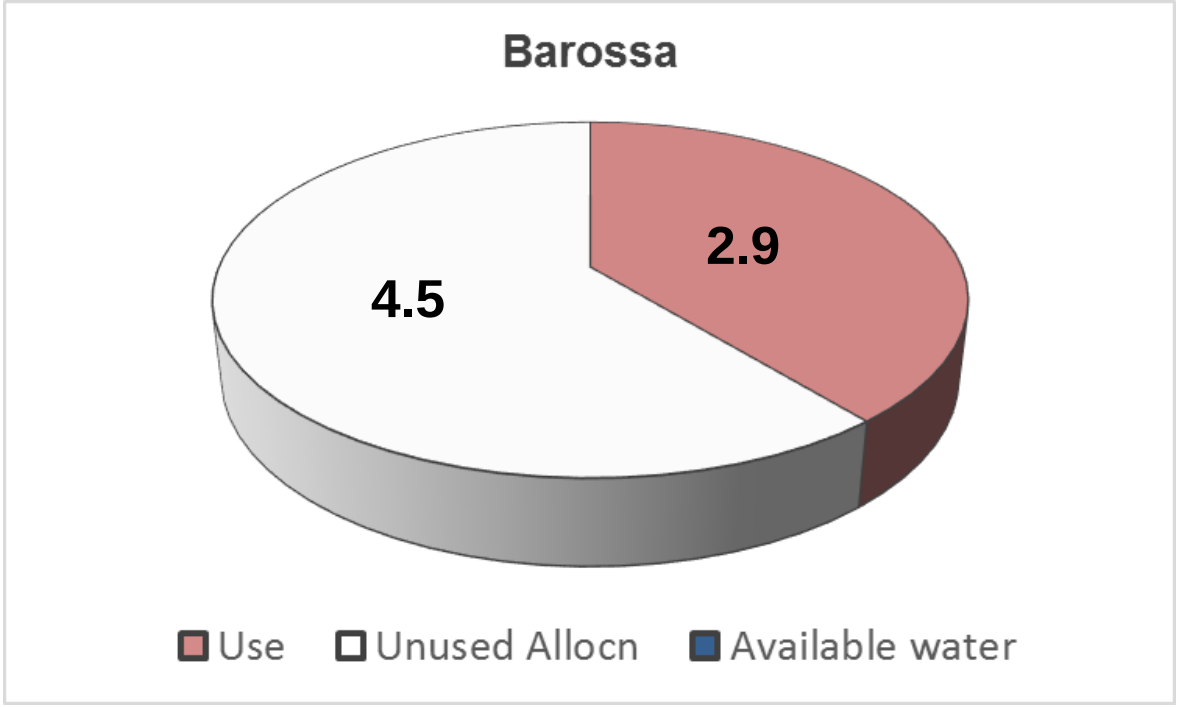

Southern Eyre Peninsula
Gigalitres
20
15
10
5
0
5.5
0
0
0.04
TWS
Wine
Food
Fodder

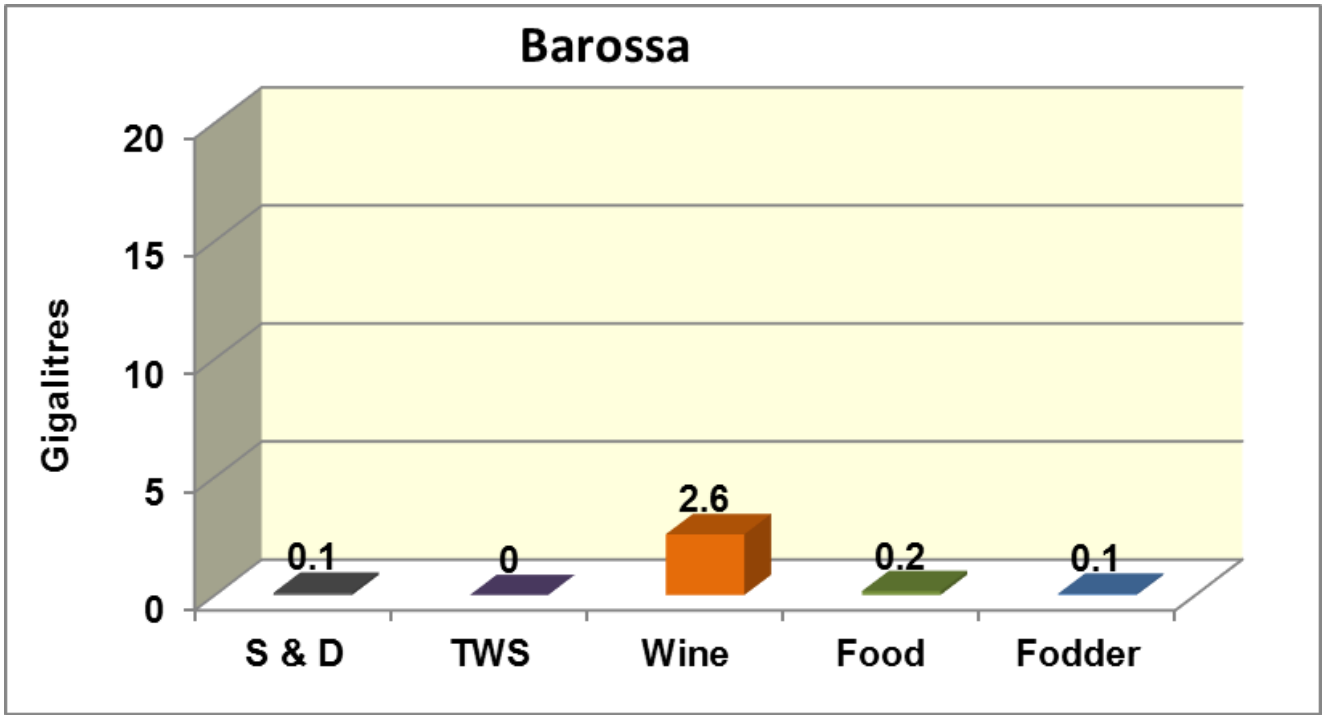
Mt Lofty Ranges

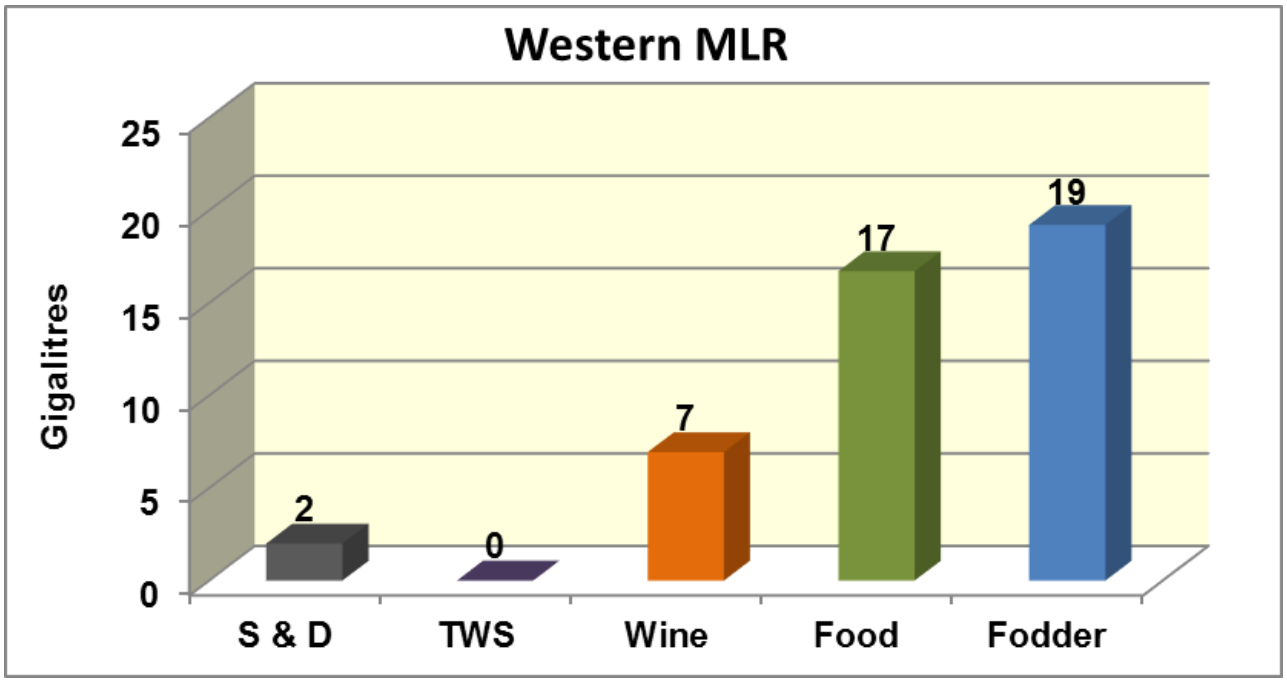


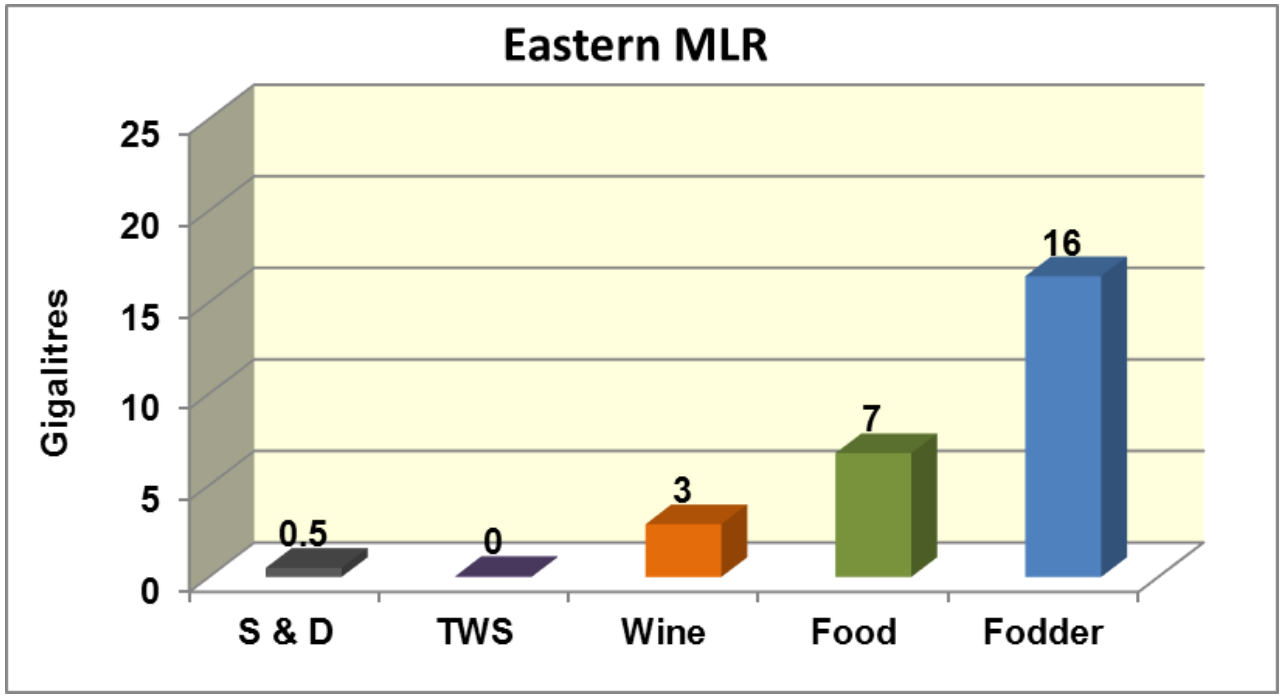

McLaren Vale
2.3
4.1
Use
Unused Allocn
Available water


McLaren Vale
Gigalitres
20
15
10
5
0
2
0
3.8
0.2
0
S & D
TWS
Wine
Food
Fodder


Barossa
2.9
4.5
Use
Unused Allocn
Available water

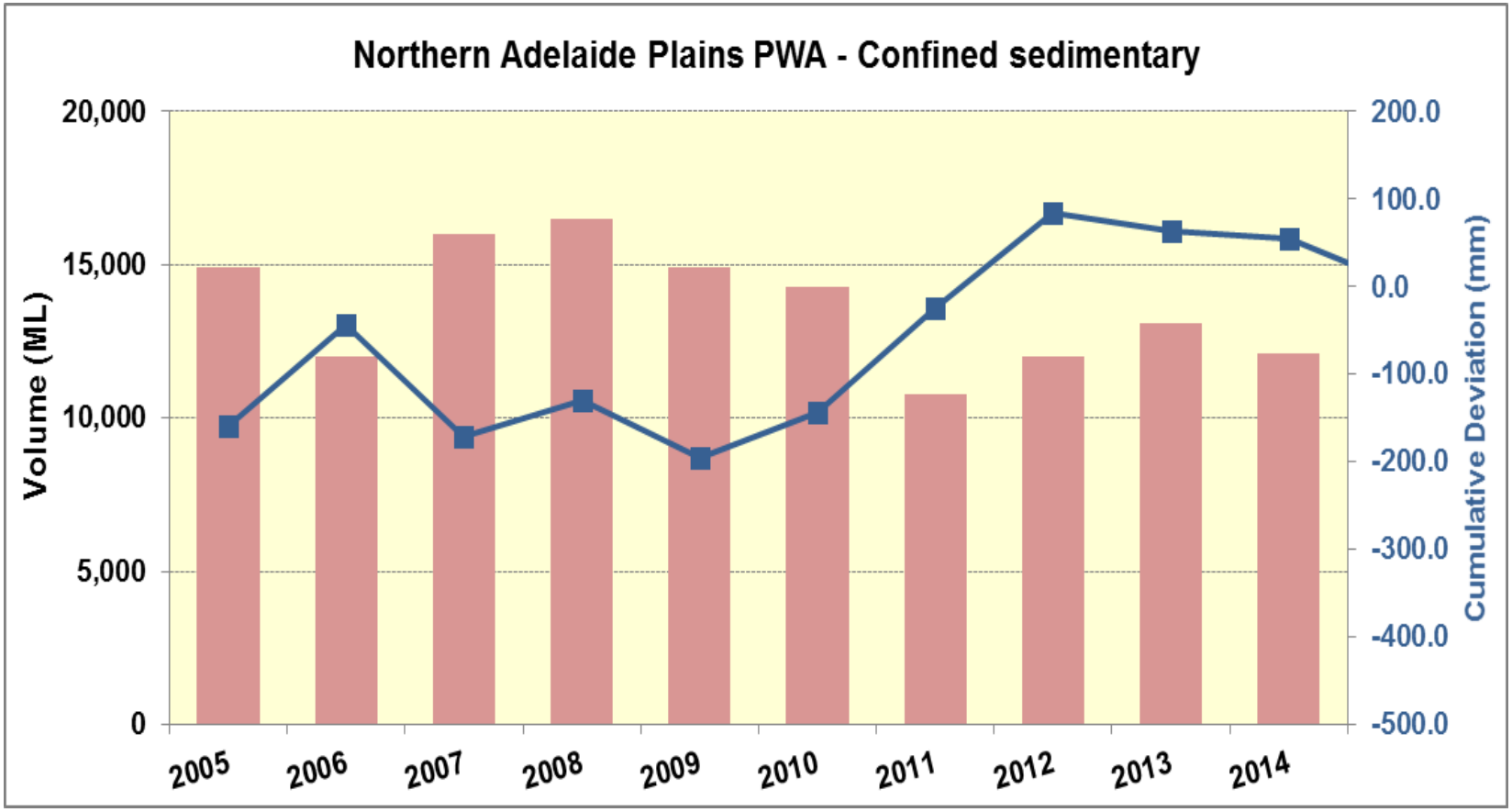

Barossa
Gigalitres
20
15
10
5
0
0.1
0
2.6
0.2
0.1
S & D
TWS
Wine
Food
Fodder

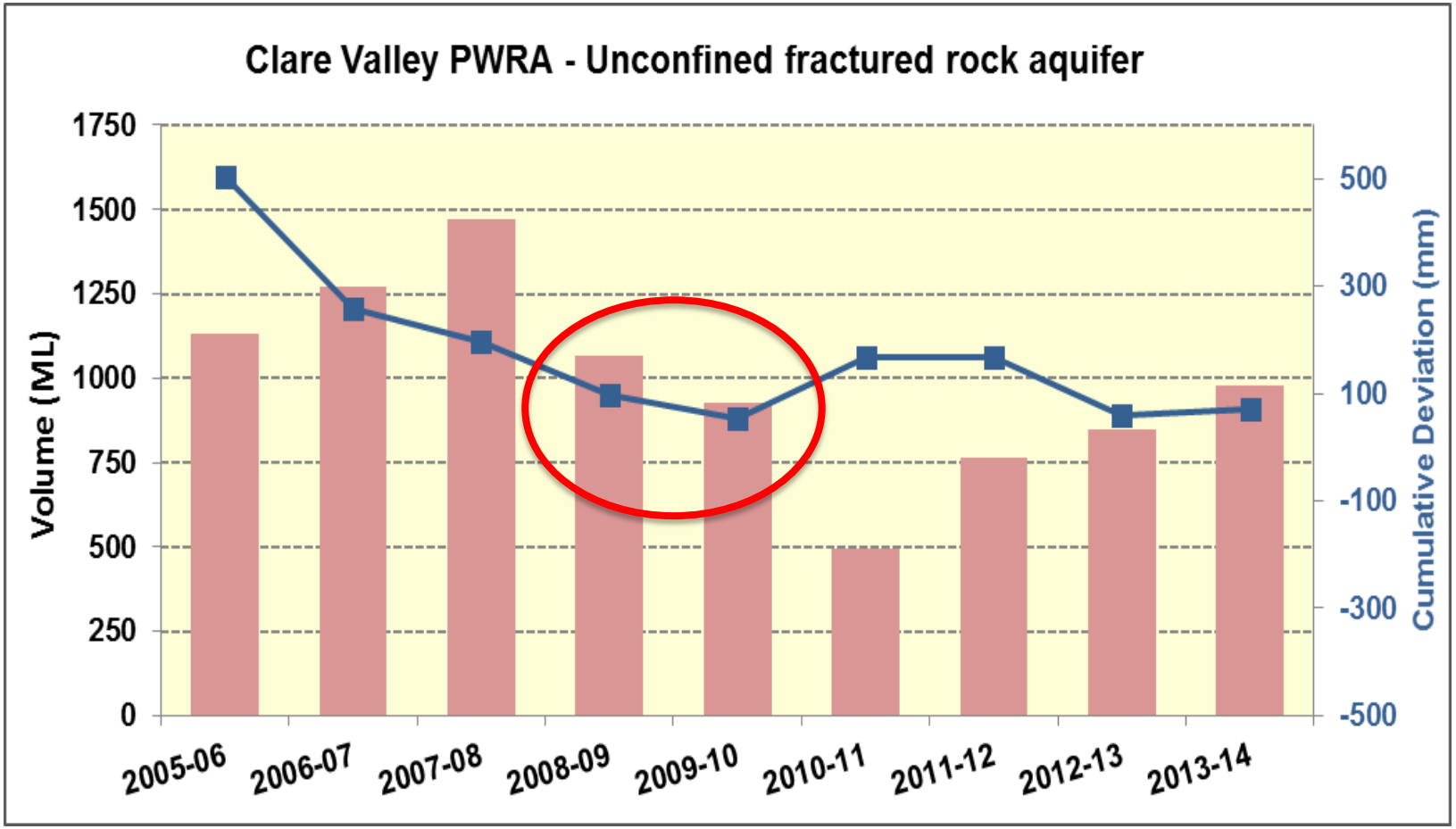

Western MLR
Gigalitres
25
20
15
10
5
0
2
0
7
17
19
S & D
TWS
Wine
Food
Fodder

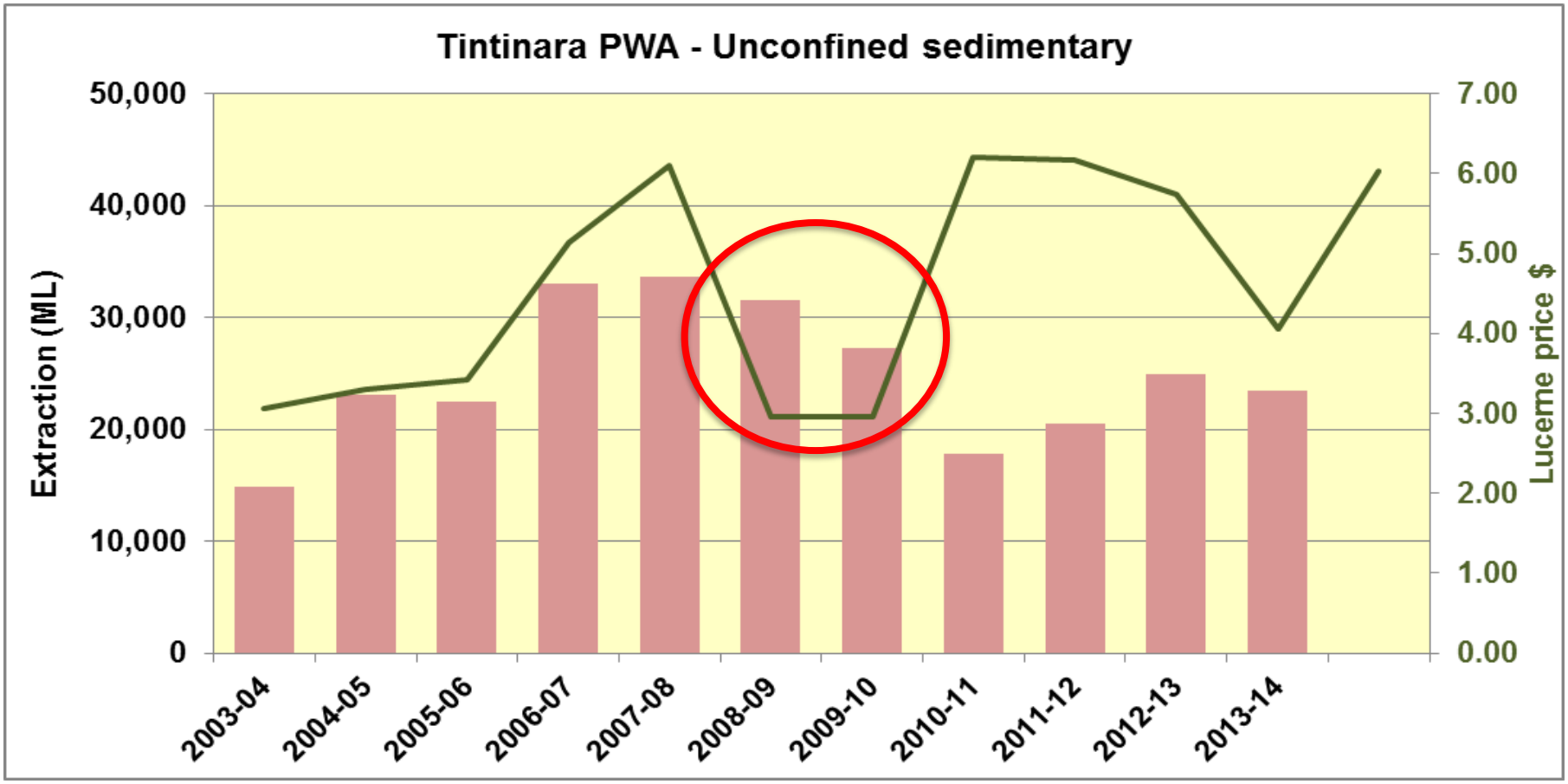

Eastern MLR
Gigalitres
25
20
15
10
5
0
0.5
0
3
7
16
S & D
TWS
Wine
Food
Fodder

Extraction trends

- Irrigation development has generally been stable over the last 10 years with annual variations in extractions due to climate, ie extractions increase during dry years v.v
- Other factors may influence extractions
  - commodity prices
  - aquifer capability

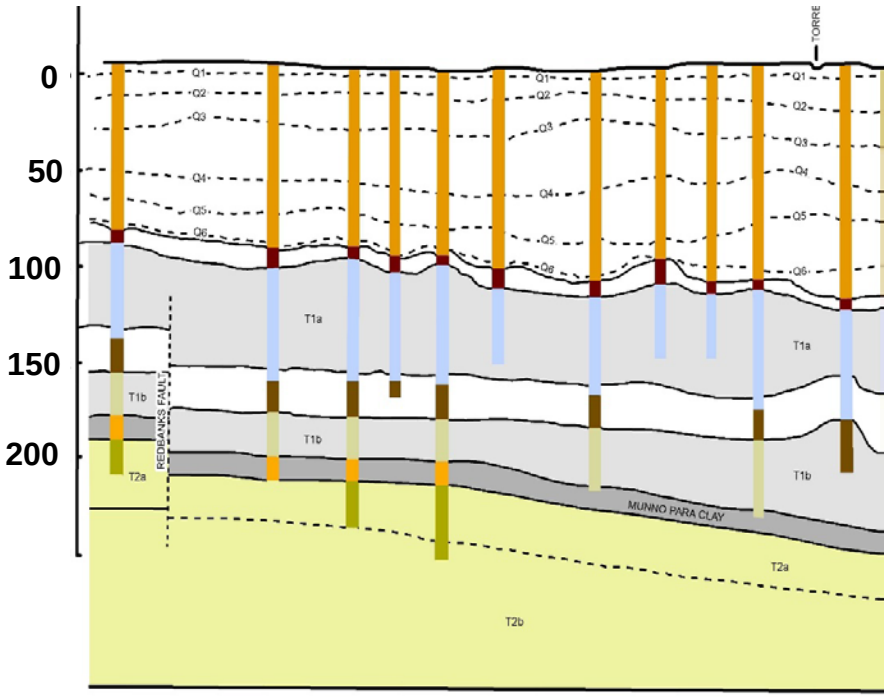

Northern Adelaide Plains PWA - Confined sedimentary
Volume (ML)
20,000
15,000
10,000
5,000
0
Cumulative Deviation (mm)
200.0
100.0
0.0
-100.0
-200.0
-300.0
-400.0
-500.0
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014


Clare Valley PWRA - Unconfined fractured rock aquifer
Volume (ML)
1750
1500
1250
1000
750
500
250
0
Cumulative Deviation (mm)
500
300
100
-100
-300
-500
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14

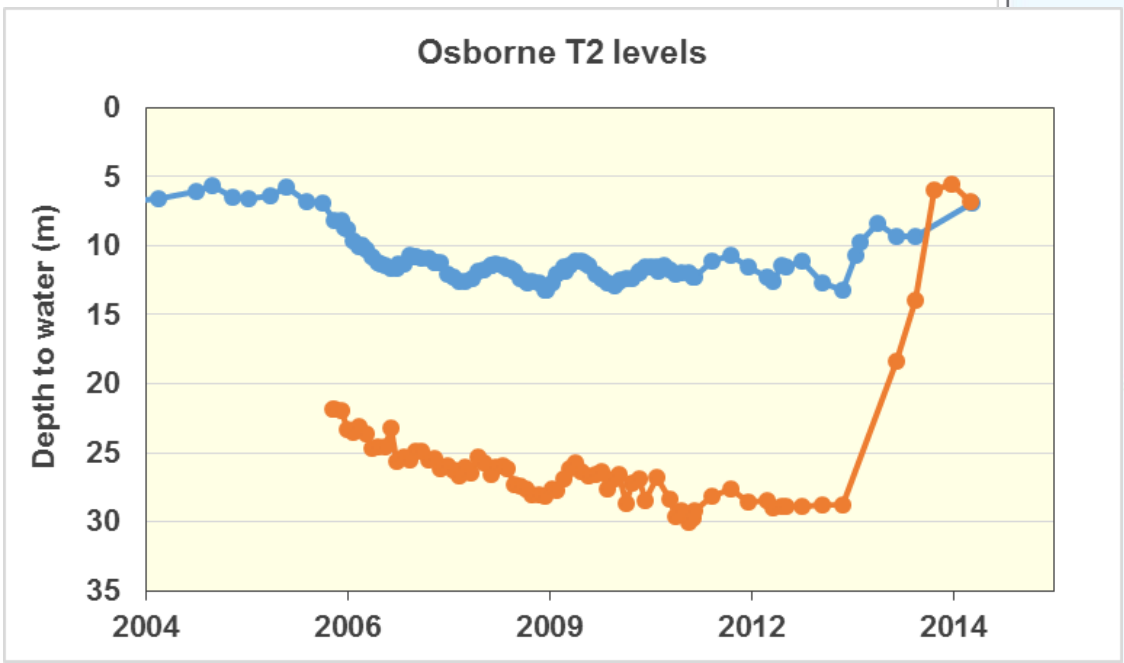

Tintinara PWA - Unconfined sedimentary
Extraction (ML)
50,000
40,000
30,000
20,000
10,000
0
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Lucerne price $
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14

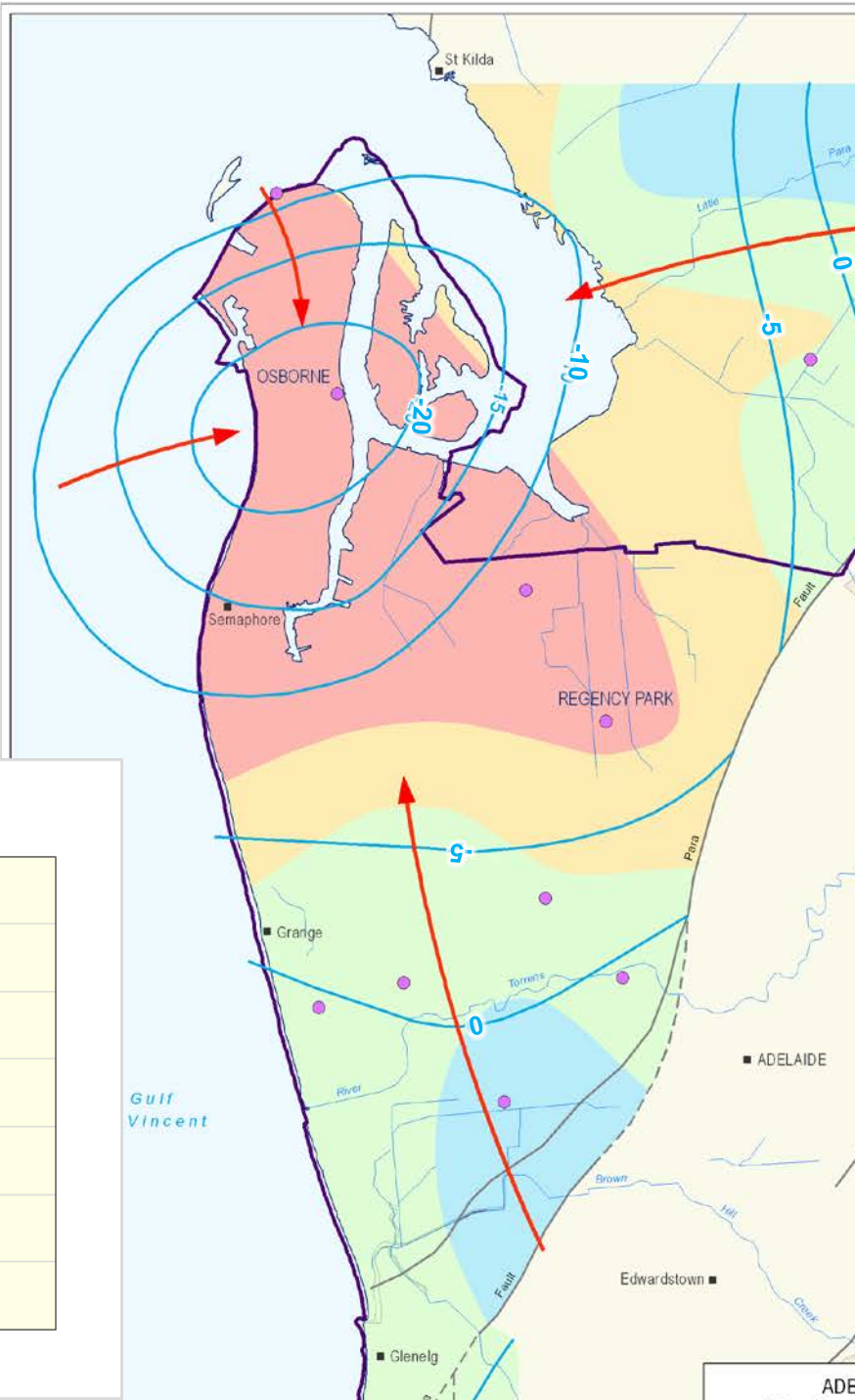
There have been decreasing extraction in some areas ;

- McLaren Vale, Barossa, Clare and NAP due to alternative sources of water becoming available (usually of better quality)
- Closure of Penrice operations at Osborne
- Decreasing urban demand on EP due ongoing use of water saving measures introduced during the drought

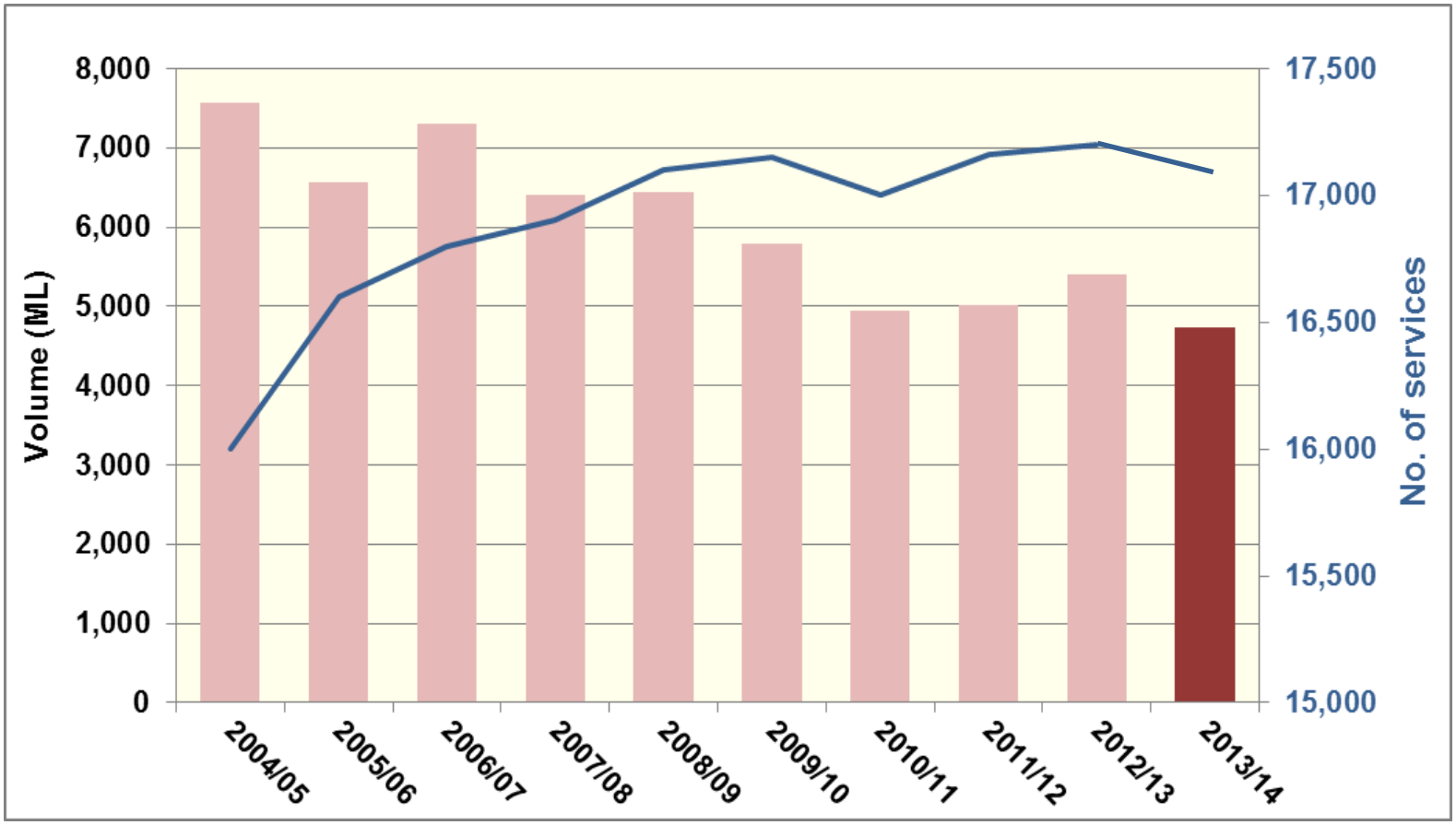


Geological and Hydrogeological Section (Taken from Gerges 2006)





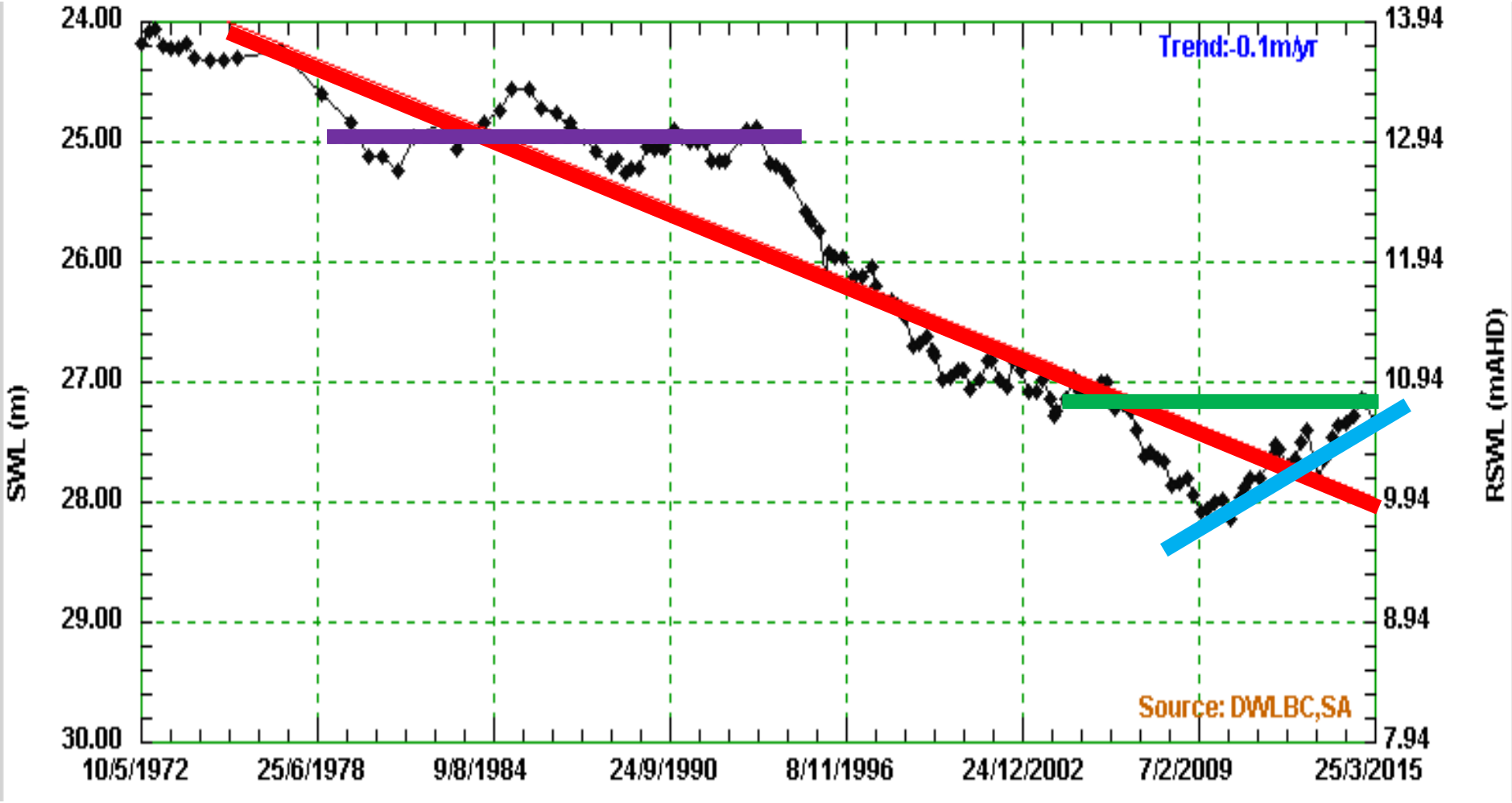
Eyre Peninsula – declining TWS demand despite more connections



Water level trends

- The interpretation of water level trends can be quite subjective and often doesn't give a true indication of the status of the resource
- Recent trends reported in Groundwater Status Reports for the prescribed areas

  www.waterconnect.sa.gov.au
- In general, long term trends show a relationship to climate



“if you torture the data enough, it will tell anything you want “

Northern Adelaide Plains PWA

T2 aquifer

2014 Groundwater level and salinity status report

Government of South Australia
Department of Environment, Water and Natural Resources

Southern Basins PWA

Uley South lens

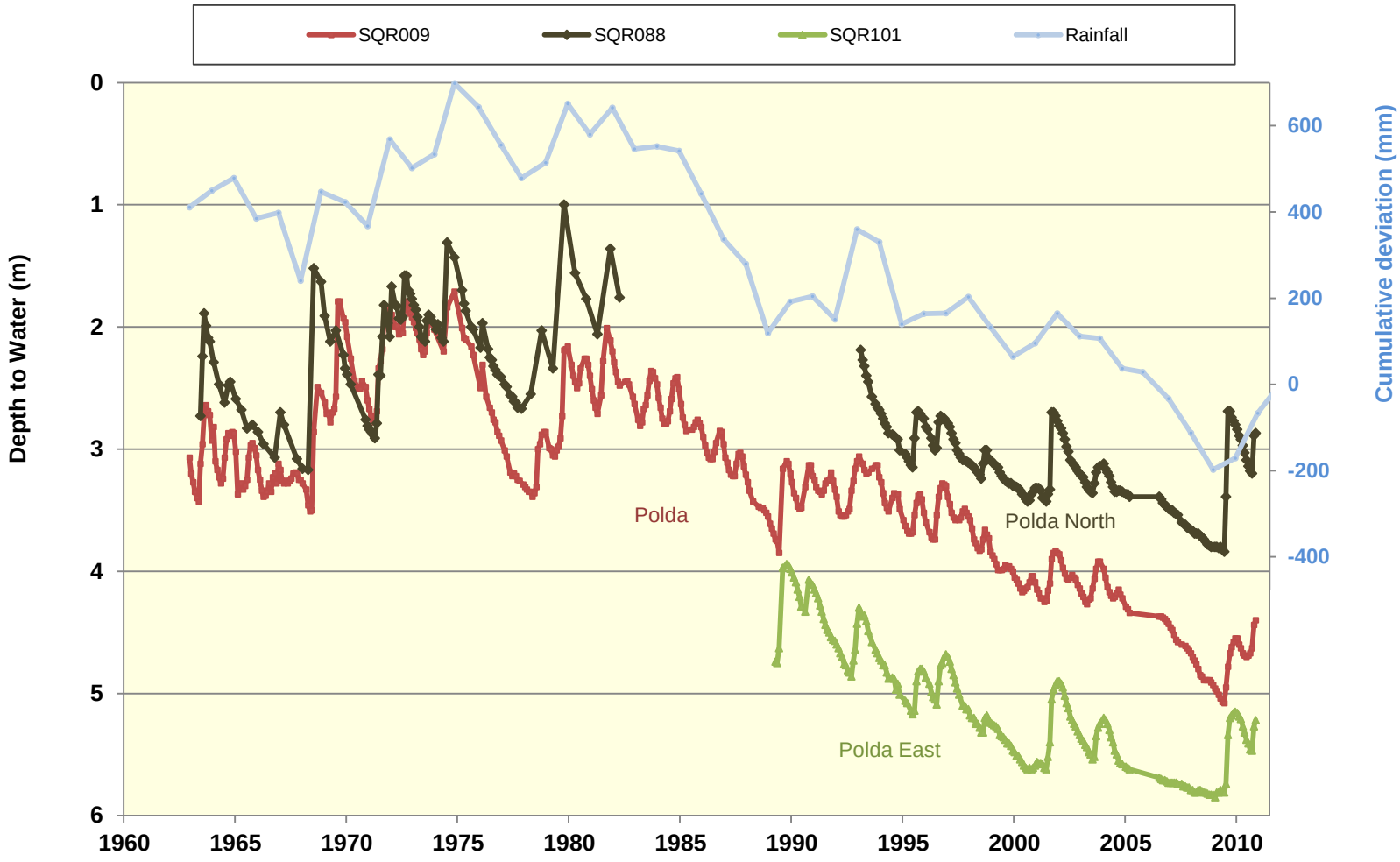
2014 Groundwater level and salinity status report

Government of South Australia
Department of Environment, Water and Natural Resources

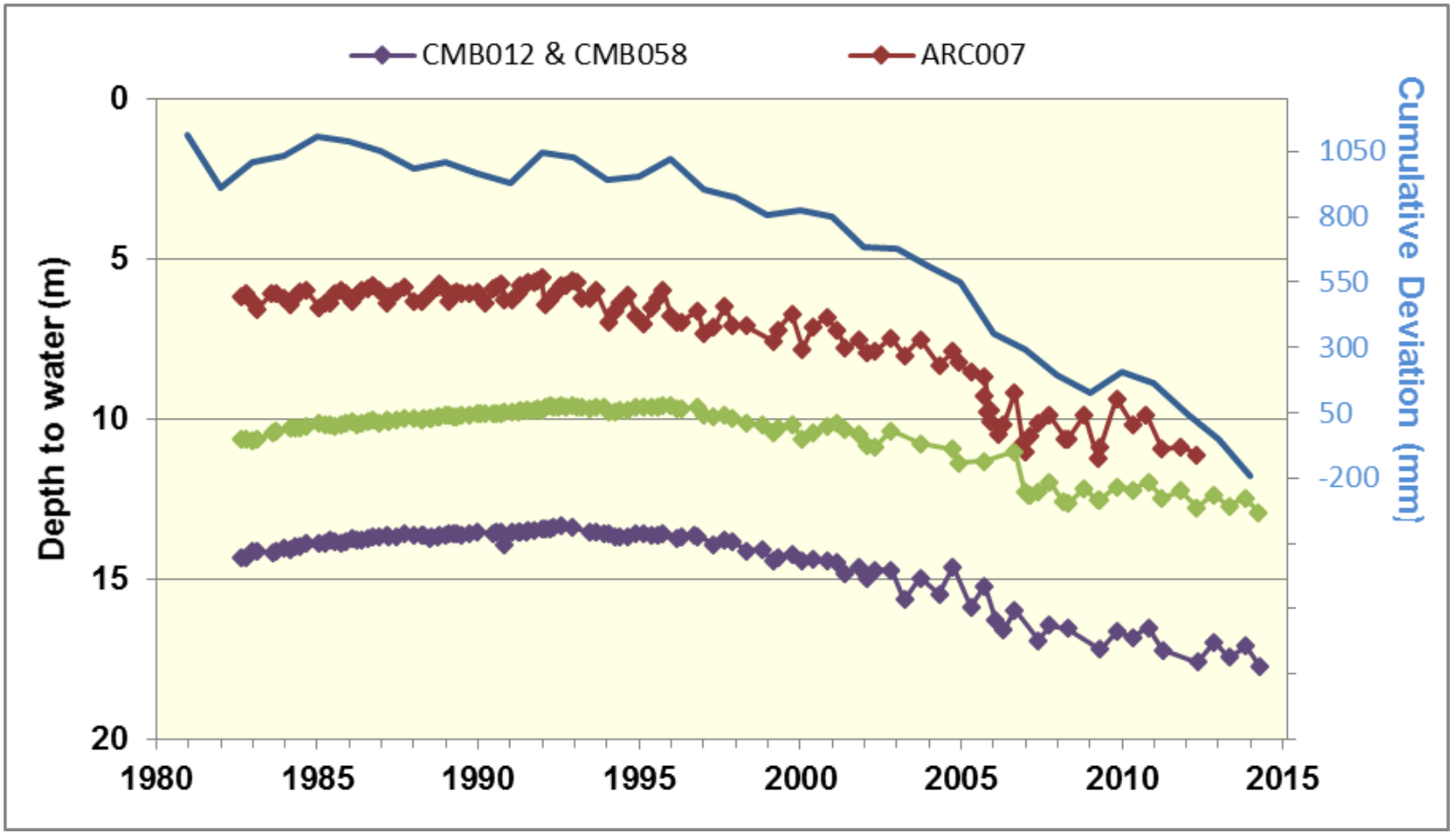
Unconfined aquifers

- Water levels generally respond to recharge from rainfall ie fall in dry years, rise in wet years
- Very few examples of extraction being the dominant driver of water level trends

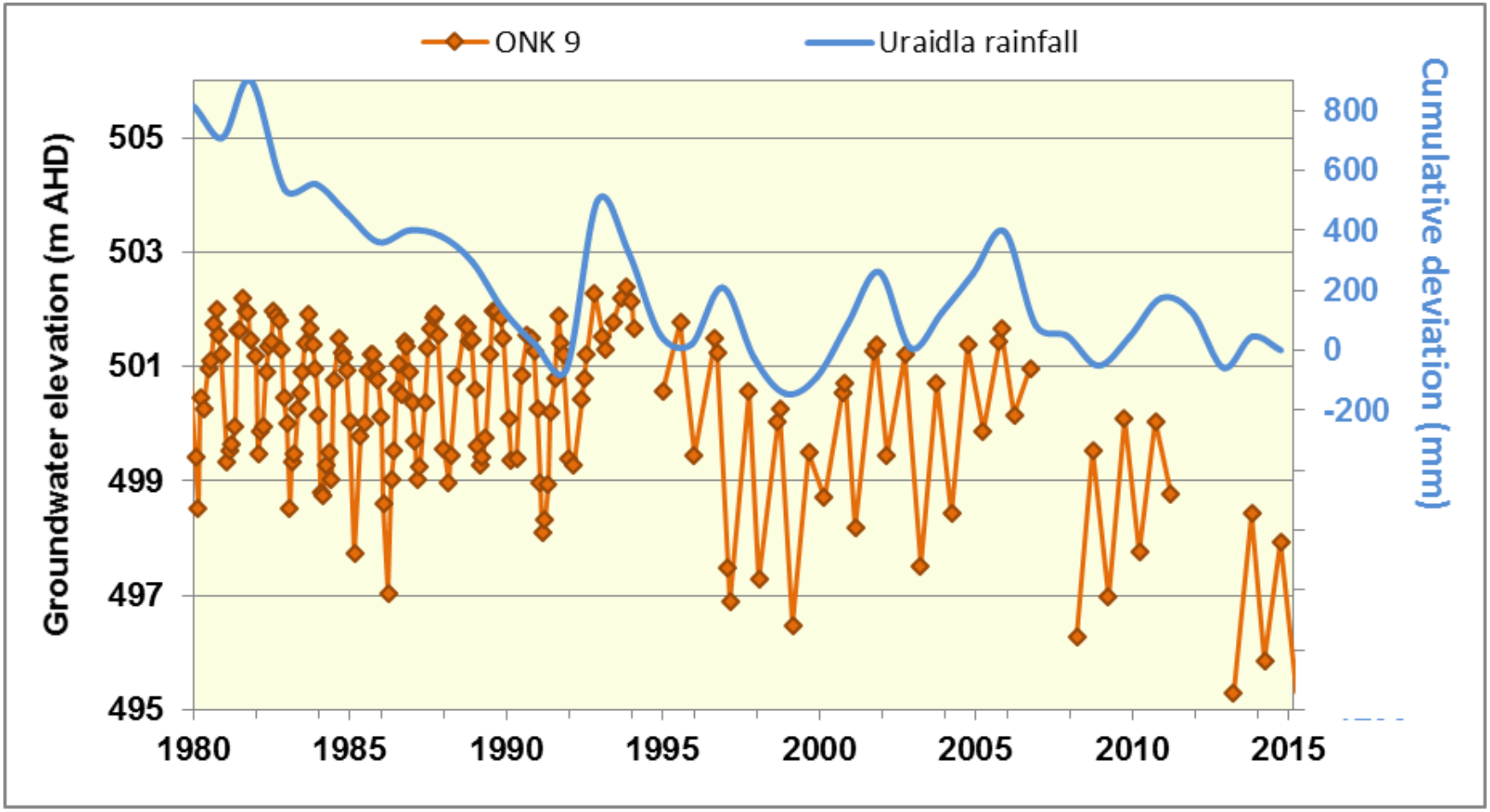
Eyre Peninsula – shallow limestone aquifer



Upper South East - unconfined aquifer



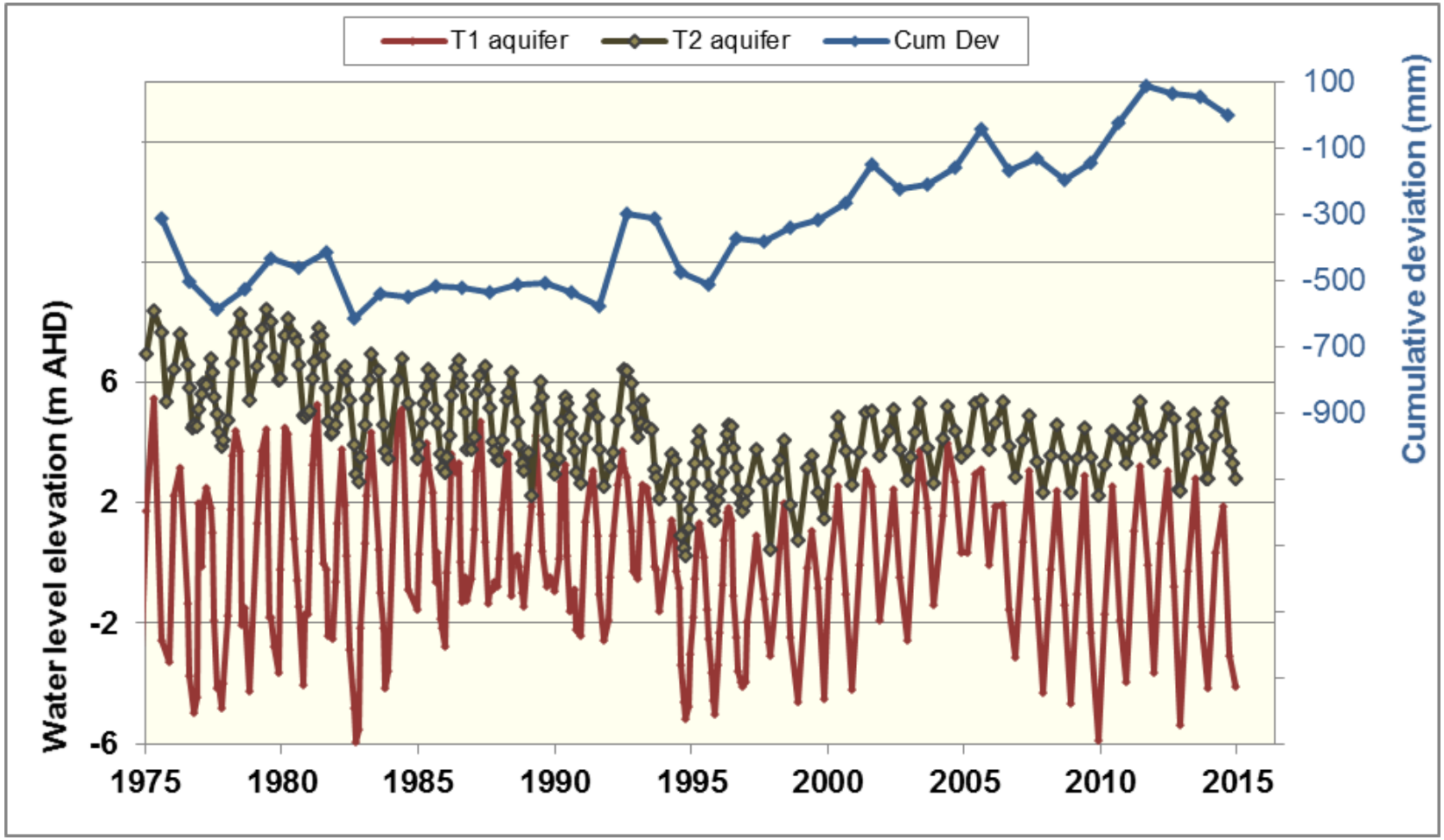
Mt Lofty Ranges - unconfined aquifer



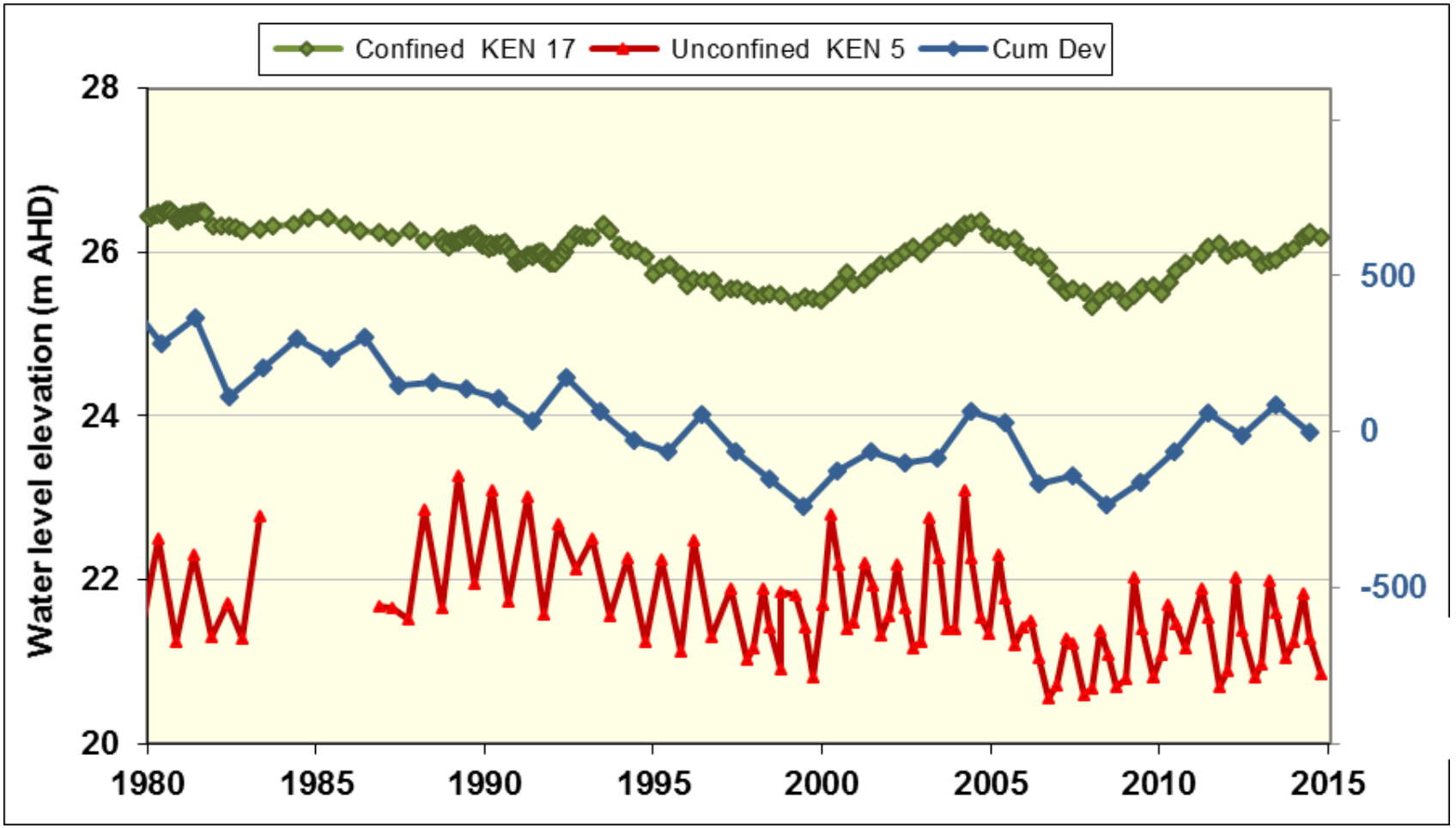
Confined aquifers

- Pressure levels show a strong response to extraction
- Extraction in turn, responds to rainfall ie higher extraction in dry years, lower in wet years
- Hydrostatic loading may be important in some areas

NAP – confined aquifers



South East – confined and unconfined

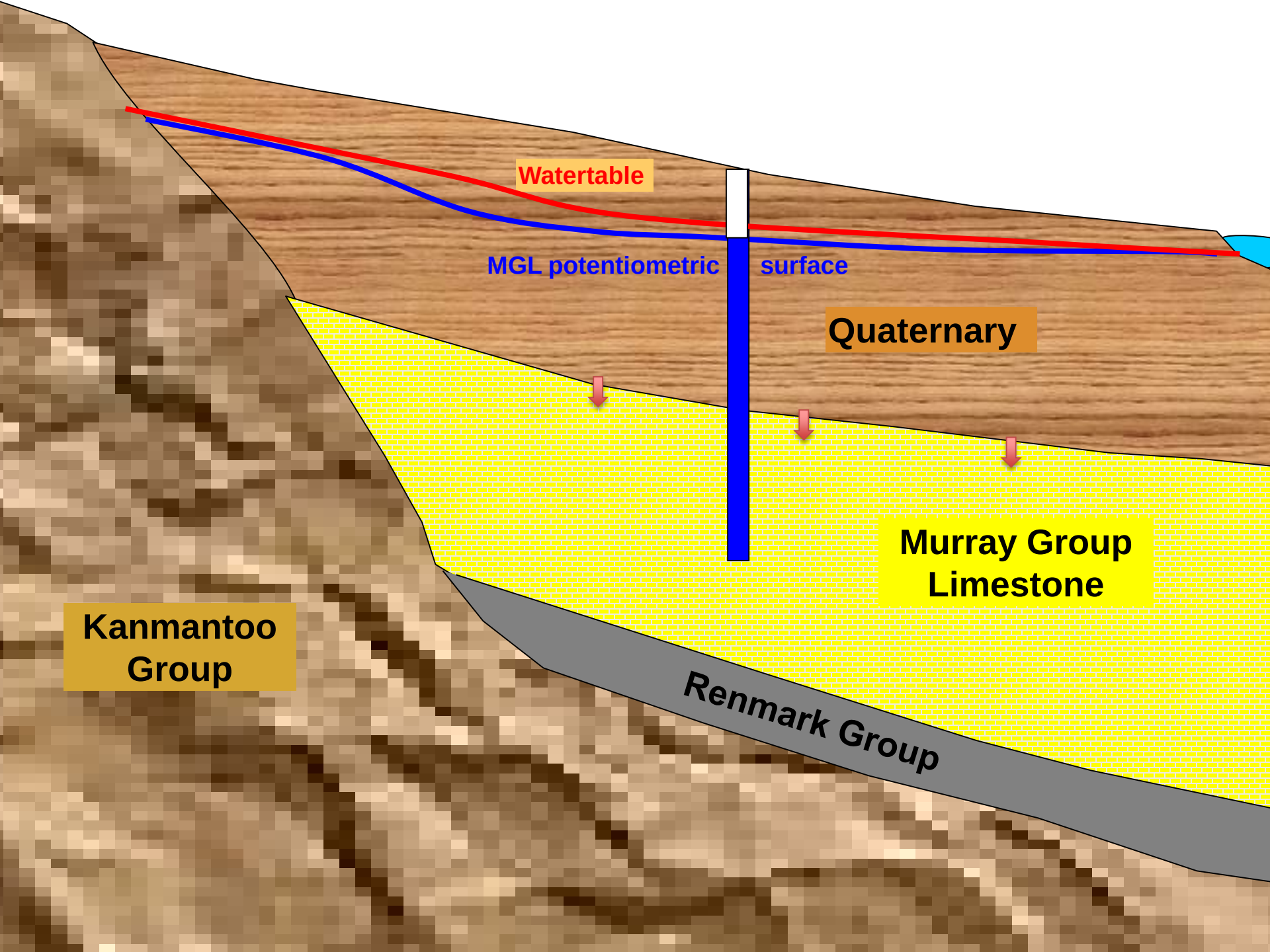


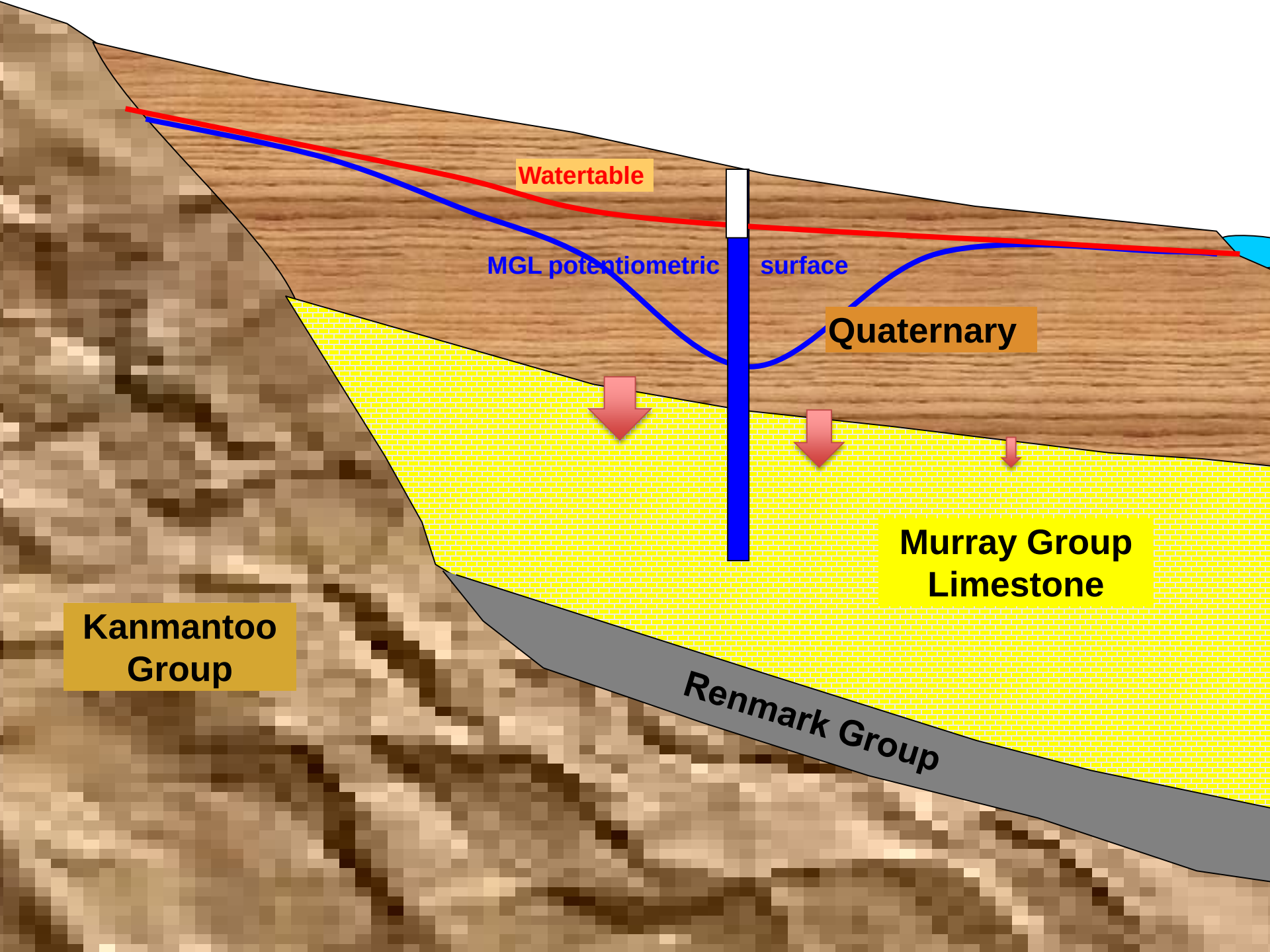
KEN 17 – completed in confined aquifer at 224m depth

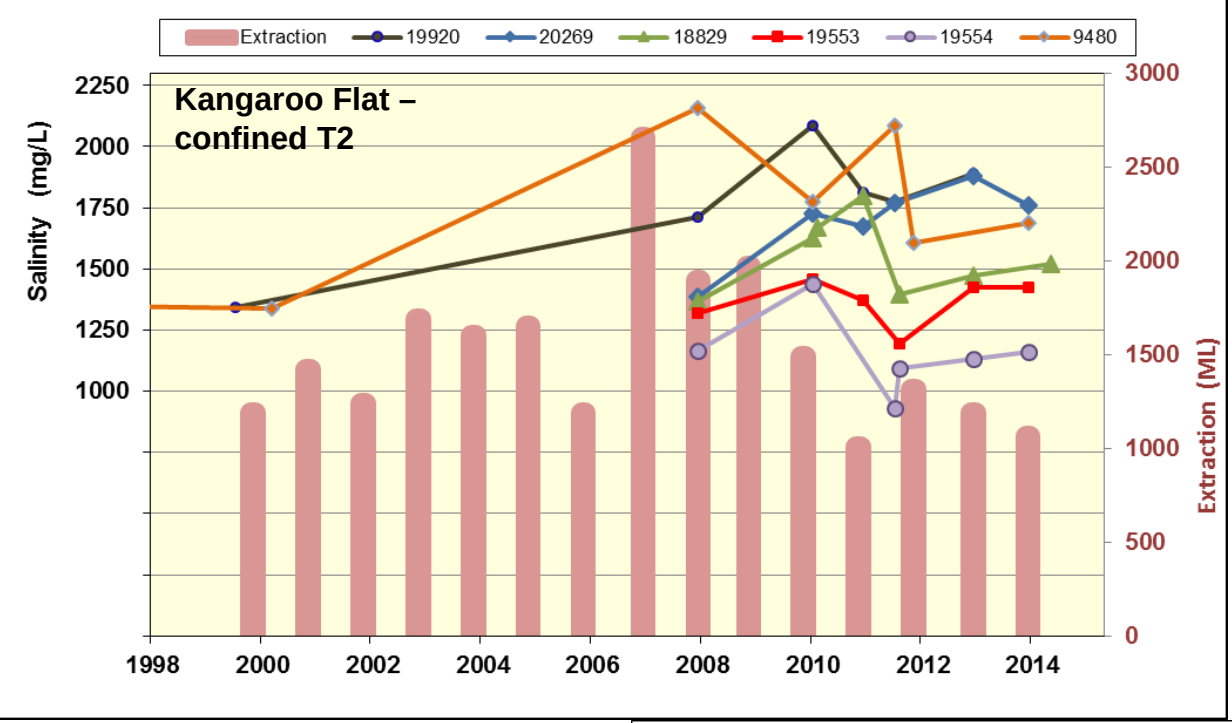
Salinity trends

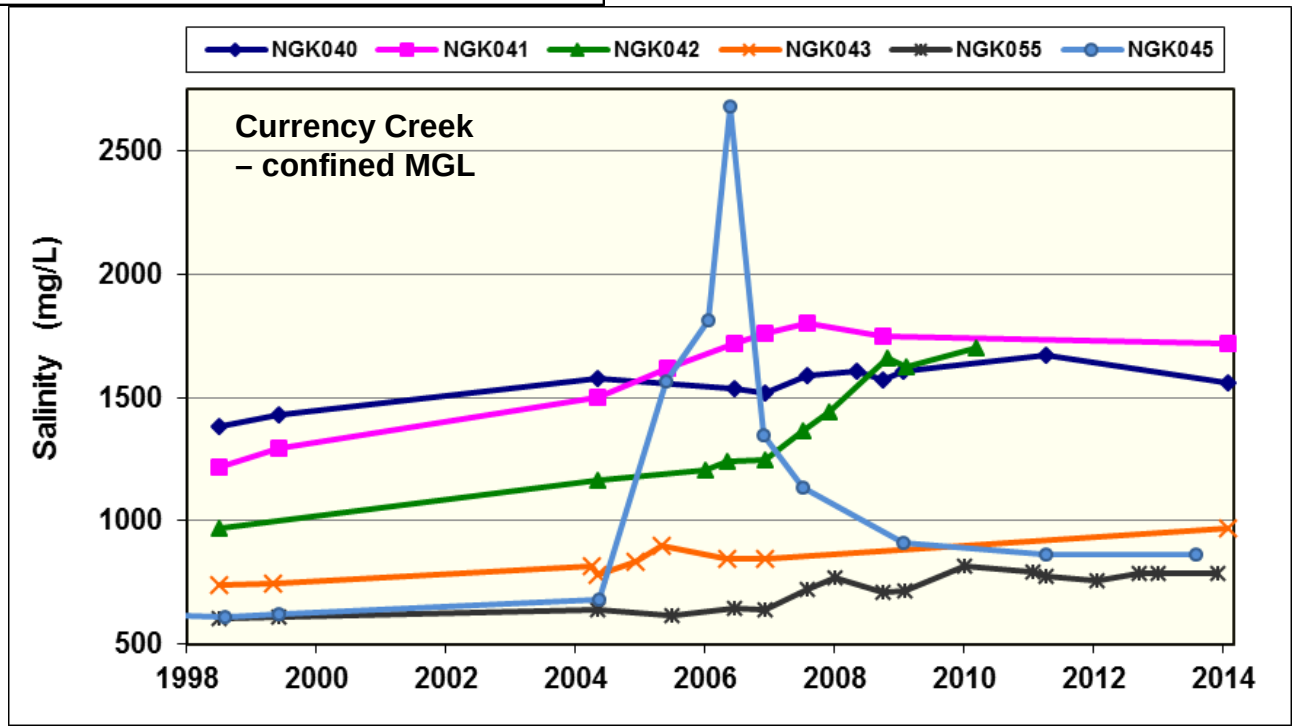
SA's groundwater 'hot-spots' due to adverse salinity trends

- Angas Bremer, Currency Creek and Kangaroo Flat areas – salinity increases due to downward leakage from overlying shallow saline aquifers
- In general, these increases are reversible if extractions decrease


Watertable
MGL potentiometric surface
Quaternary
Murray Group Limestone
Kanmantoo Group
Renmark Group


Watertable
MGL potentiometric surface
Quaternary
Murray Group Limestone
Kanmantoo Group
Renmark Group

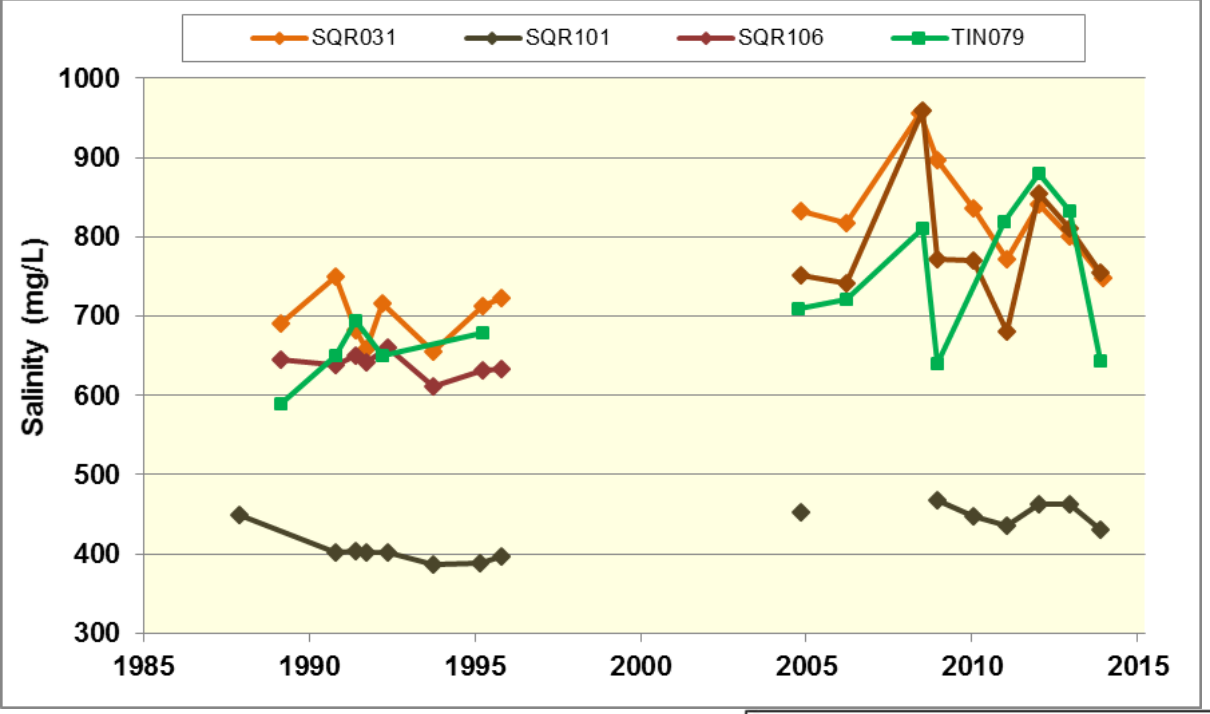

Extraction
19920
20269
18829
19553
19554
9480
Kangaroo Flat – confined T2
Salinity (mg/L)
Extraction (ML)
2250
2000
1750
1500
1250
1000
3000
2500
2000
1500
1000
500
0
1998
2000
2002
2004
2006
2008
2010
2012
2014

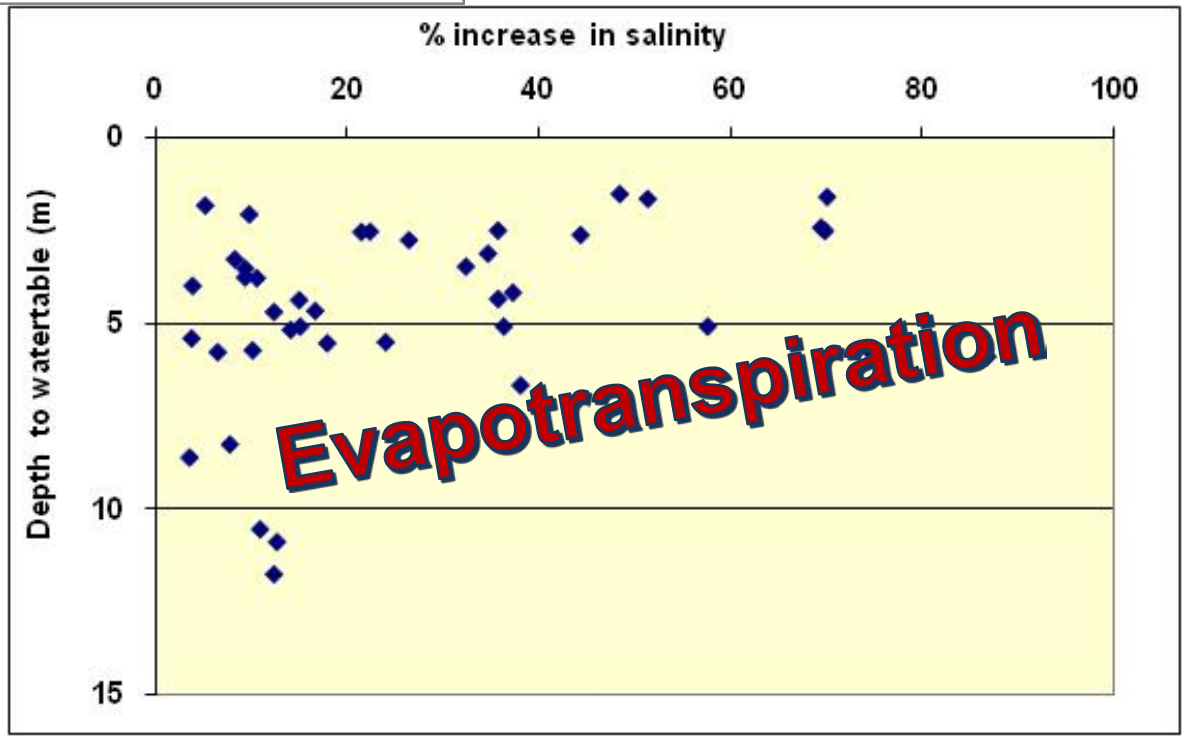

NGK040
NGK041
NGK042
NGK043
NGK055
NGK045
Currency Creek – confined MGL
Salinity (mg/L)
2500
2000
1500
1000
500
1998
2000
2002
2004
2006
2008
2010
2012
2014

Salinity trends

Other ‘hot-spot’ is the Polda Basin

- Long term decline in water levels due to below average rainfall – sat thickness reduced by ~50%
- Rise in salinity during the drought when no freshening recharge occurred
- Cause of salinity increase ?

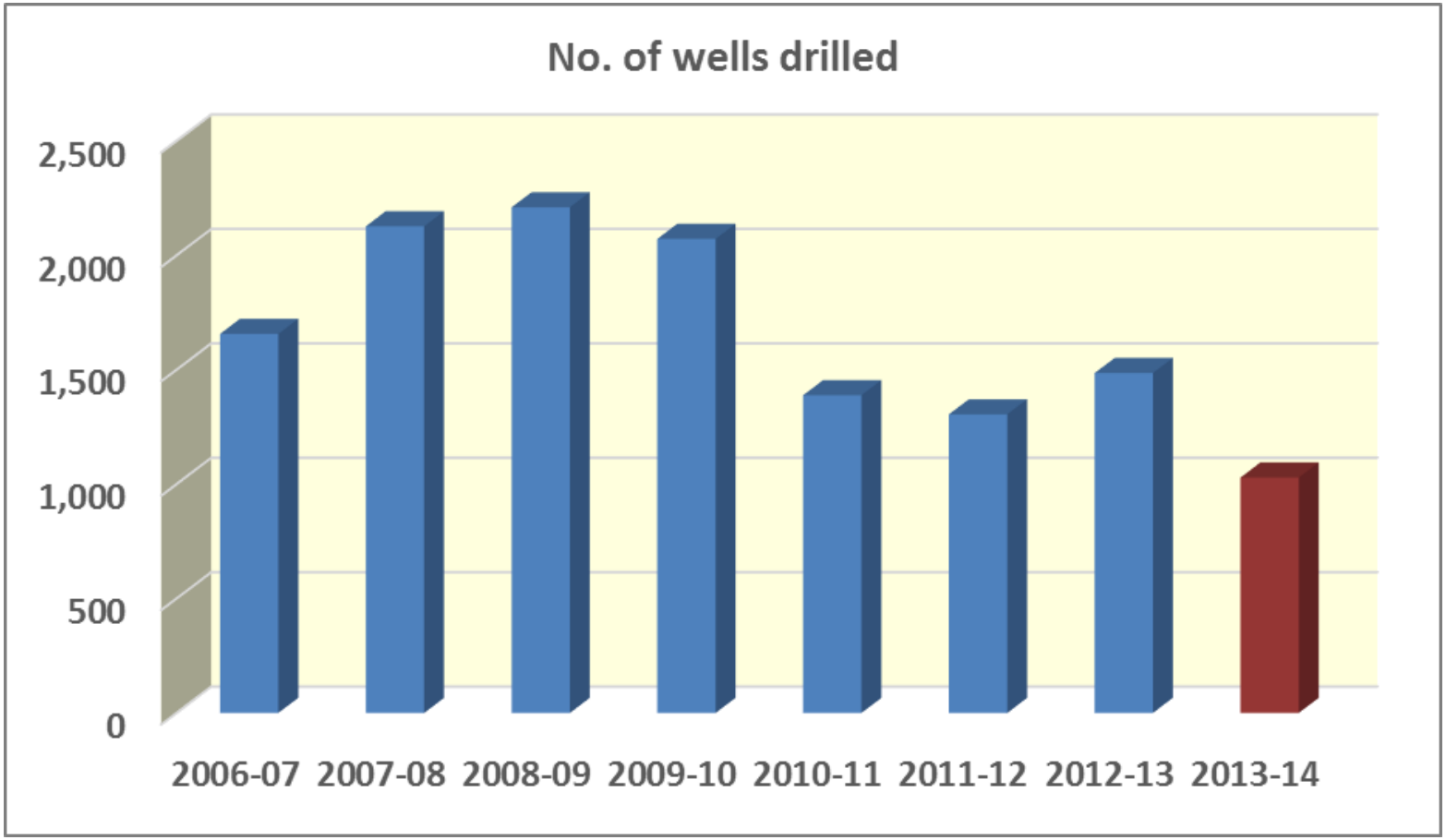

SQR031
SQR101
SQR106
TIN079
Salinity (mg/L)
1000
900
800
700
600
500
400
300
1985
1990
1995
2000
2005
2010
2015


% increase in salinity
0
20
40
60
80
100
Depth to watertable (m)
0
5
10
15
Evapotranspiration

Drilling activity

1020 water wells drilled in 2013-14

Climate driven also ?



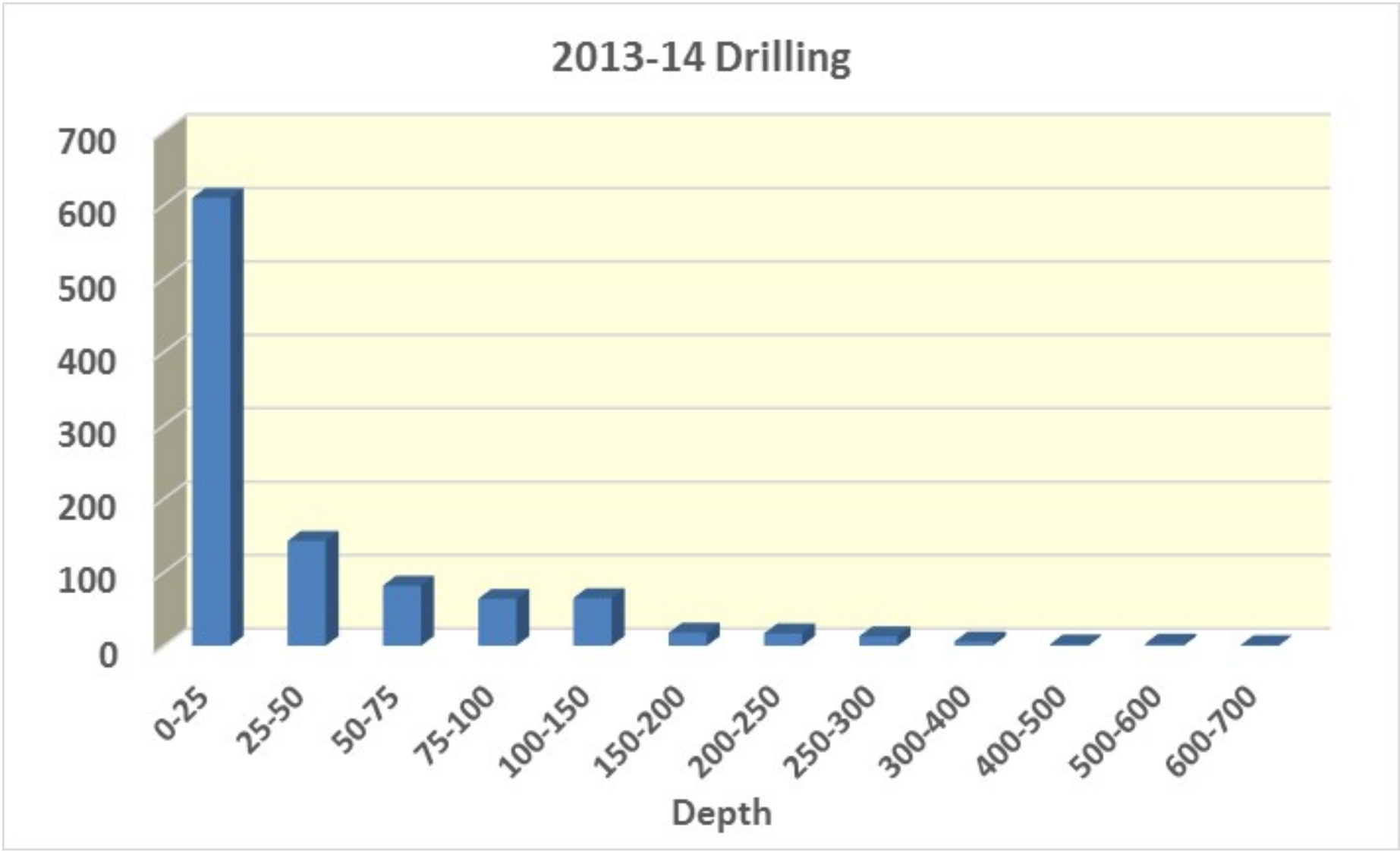
Of the 1020 water wells,

610 wells less than 25m deep, of these 450 are investigation/monitoring contamination

143 wells from 25 to 50m deep, of these 39 are investigation/monitoring contamination

60 wells greater than 150m deep

6 wells greater than 400m deep


2013-14 Drilling
700
600
500
400
300
200
100
0
0-25
25-50
50-75
75-100
100-150
150-200
200-250
250-300
300-400
400-500
500-600
600-700
Depth

Groundwater information products

For sustainable management of groundwater systems to occur, a good understanding of how these systems work is essential, for ;

- Hydrogeologists who investigate the resource
- Decision makers who manage the resource
- Community who use the resource

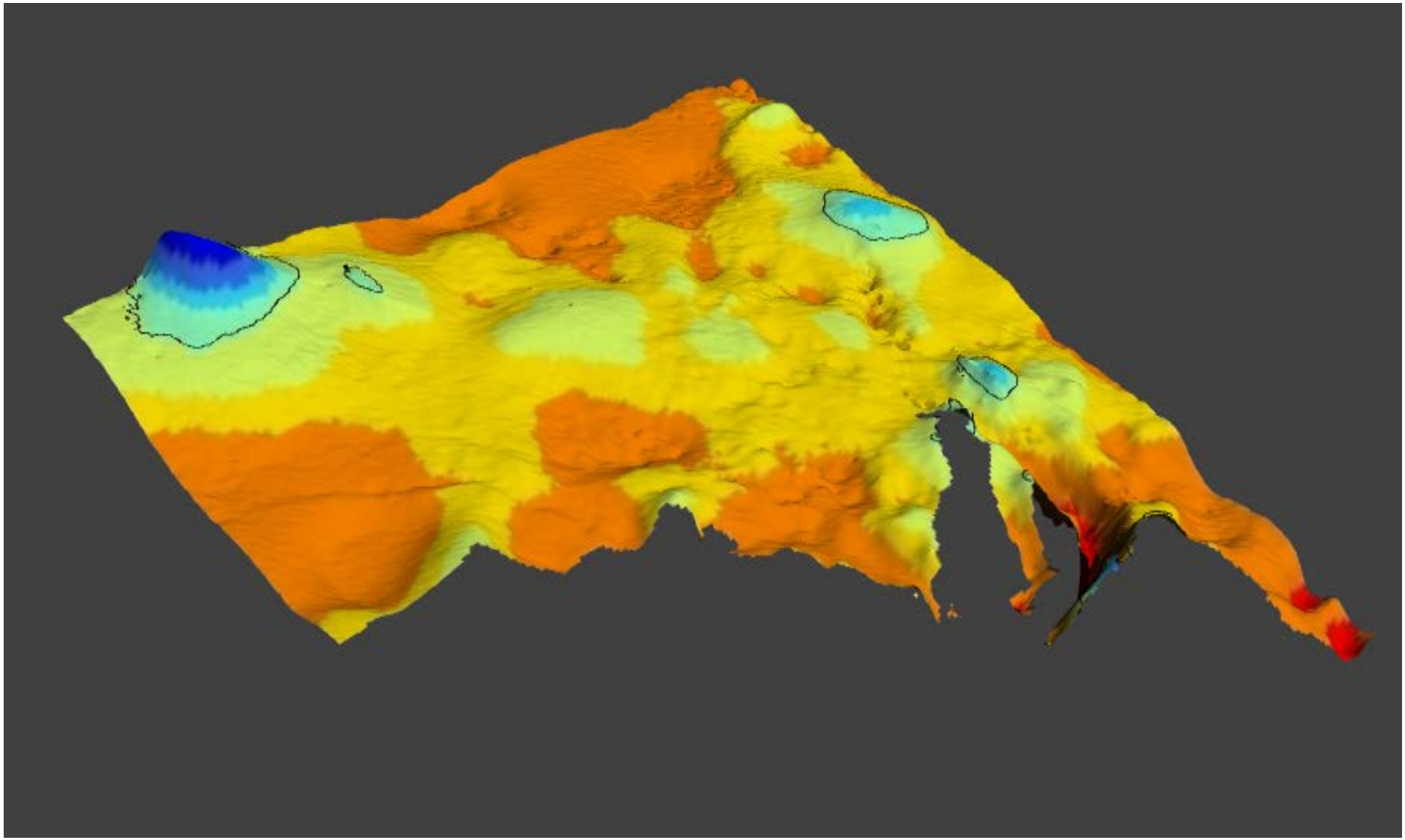
3D visualisation

This understanding is hard to achieve, given that groundwater occurs below the ground surface and is hidden from view;

Visualisation of groundwater systems in 3D is valuable tool to enhance the understanding

But comprehensive and accurate data is required to create meaningful visualizations

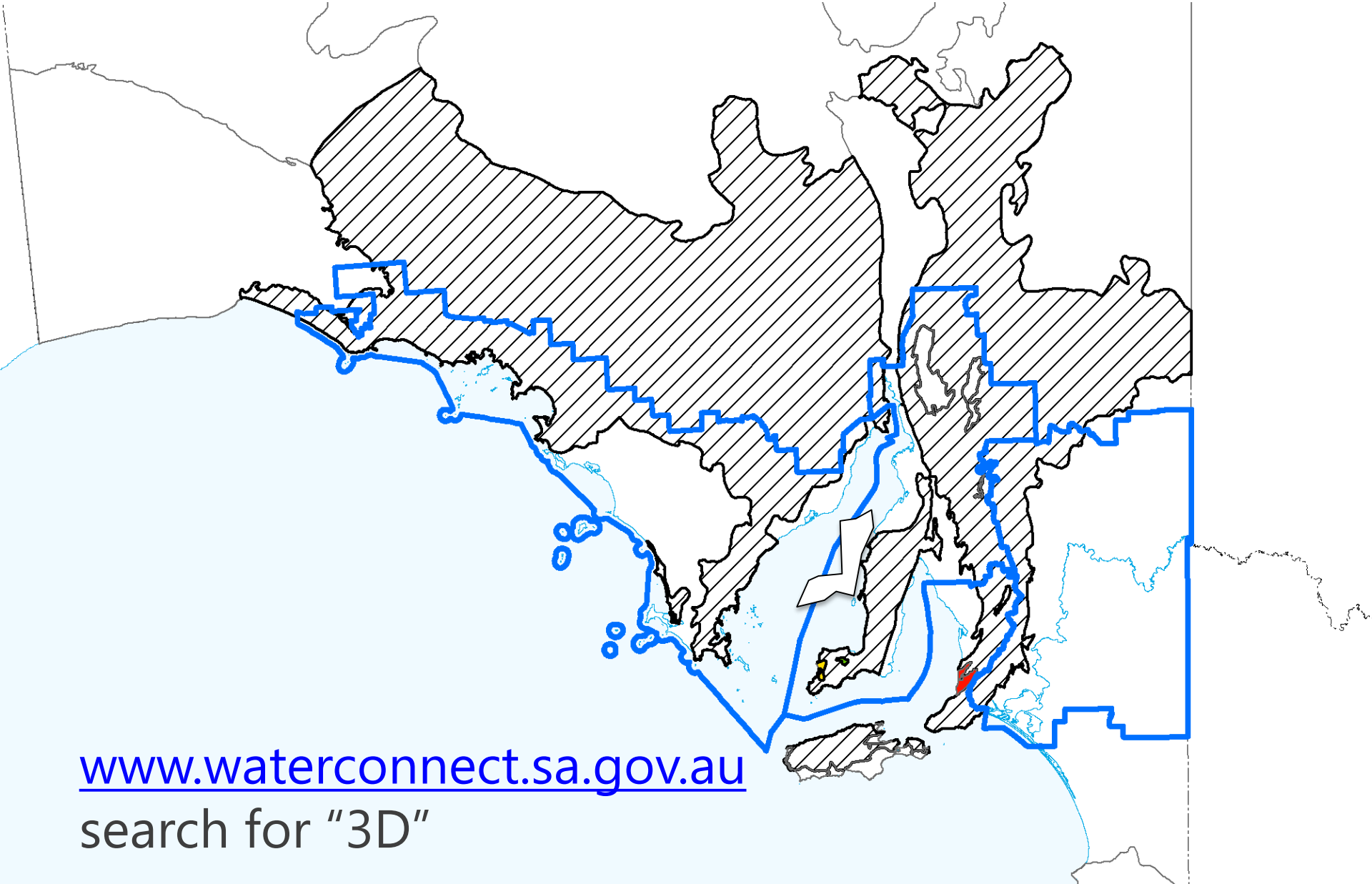
2012-13 rainfall



Web based products

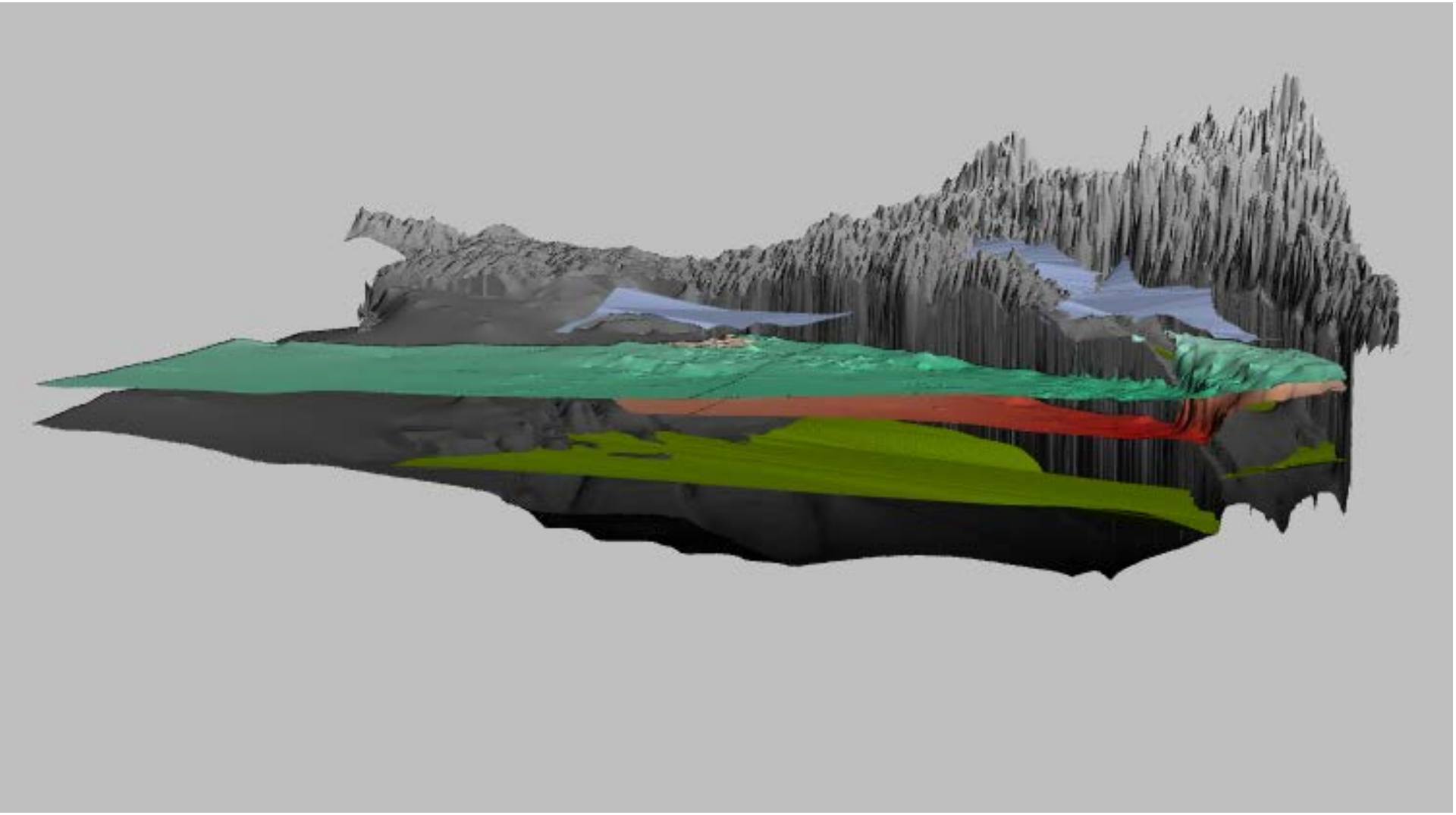
- The public does not always have access to hydrogeologists and appropriate software eg ArcScene etc
- Web based products such as the 3D PDF format enable the public to access some visualisations at any time

3D PDF products



www.waterconnect.sa.gov.au
search for “3D”

Central Adelaide



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Government
of South Australia

Department of Environment,
Water and Natural Resources