

# Targeted Extension Strategies to Improve Water Quality Outcomes in the Australian Sugarcane Industry- the Herbert case study.

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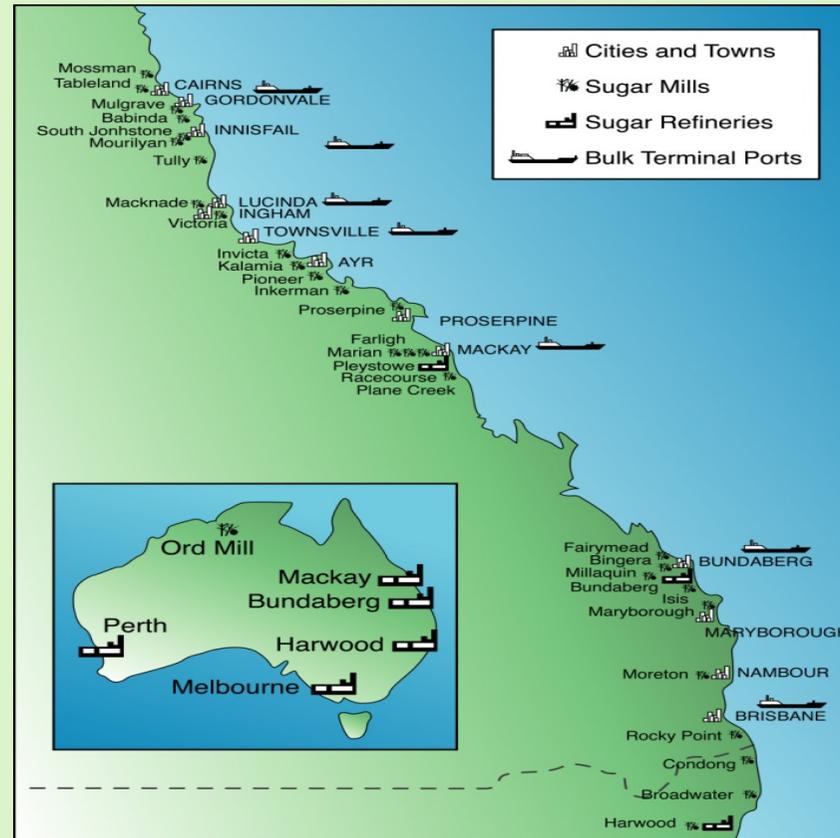
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# Introduction to the Australian Sugarcane Industry



- ▶ The sugarcane industry has been operating for over 150 years in Australia.
- ▶ The industry produces approximately 30M tons of sugarcane annually.
- ▶ Exporting globally 80-85% of what it produces.
- ▶ Australia is the third largest exporting sugar nation in the world, following Brazil and Thailand.



## Introduction to the Australian Sugarcane Industry



- ▶ The Australian industry is within the top 5 lowest cost production countries globally.
- ▶ The industry are world leaders in farming, harvesting systems, precision agriculture for sugarcane, sugar transport and loading systems.



# Managing Reef water quality



- ▶ Sugarcane farming is usually undertaken on the floodplain of the major river systems or their tributaries, which directly drain into to the Great Barrier Reef (GBR) lagoon, Australia.
- ▶ The Australian Government Reef Water Quality Protection Plan (Reef Plan) states that the majority of the nutrients, sediments and herbicides entering the GBR lagoon are derived from agriculture, primarily sugarcane and grazing. Thus, in recent years the sugarcane industry has been under significant scrutiny associated with agricultural runoff into the GBR lagoon.



# Managing Reef water quality



The industry is now the most regulated sugarcane industry in the world for environmental matters (especially concerning nitrogen and pesticide use), because of its close proximity to the Great Barrier Reef.



# Managing Reef water quality



- ▶ The Australian government is under pressure from UNESCO & green groups (like WWF) to ensure that the GBR is managed accordingly and protected for future generations.
- ▶ Both levels of government are committed to achieving improvements in Reef water quality.
- ▶ Reef targets are as follows:
  - ▶ A 80% reduction in nitrogen runoff
  - ▶ A 50% reduction in sediment
  - ▶ A reduction in PS2 herbicides(these targets are very ambitious)
- Government is very serious about meeting these targets and has now commission studies to investigate options like “Cap and Trade” , N reduction program and change of land use, with other such programs being considered also.
- Will the whole Reef Protection program go away soon? Definitely **NOT** !
- The next program on the horizon is the management of N<sub>2</sub>O losses focused on the Greenhouse Gas Emissions program.



# The Herbert Water Quality Monitoring Program (HWQMP)

- ▶ The HWQMP was established after agricultural industry (especially sugarcane) concerns that there was insufficient water quality data from specific land uses within the Herbert Catchment area.
- ▶ The sugarcane industry initiated the project to investigate the relative contribution of land use on the delivery of reef pollutant loads to the receiving waters of the GBR.
- ▶ The sugarcane industry engaged the local natural resources management (NRM) group to engage with government, funding agencies and other land users to develop a water quality monitoring program, which in turn would allow the various land user groups to develop targeted extension and industry specific management strategies if issues did arise.



# The Herbert Water Quality Monitoring Program



- ▶ The project monitored sediment, nutrient and pesticide concentrations in surface waters collected from various sub-catchments and capturing numerous land uses contributing to the Herbert River, end of catchment loads.



# The Herbert Water Quality Monitoring Program

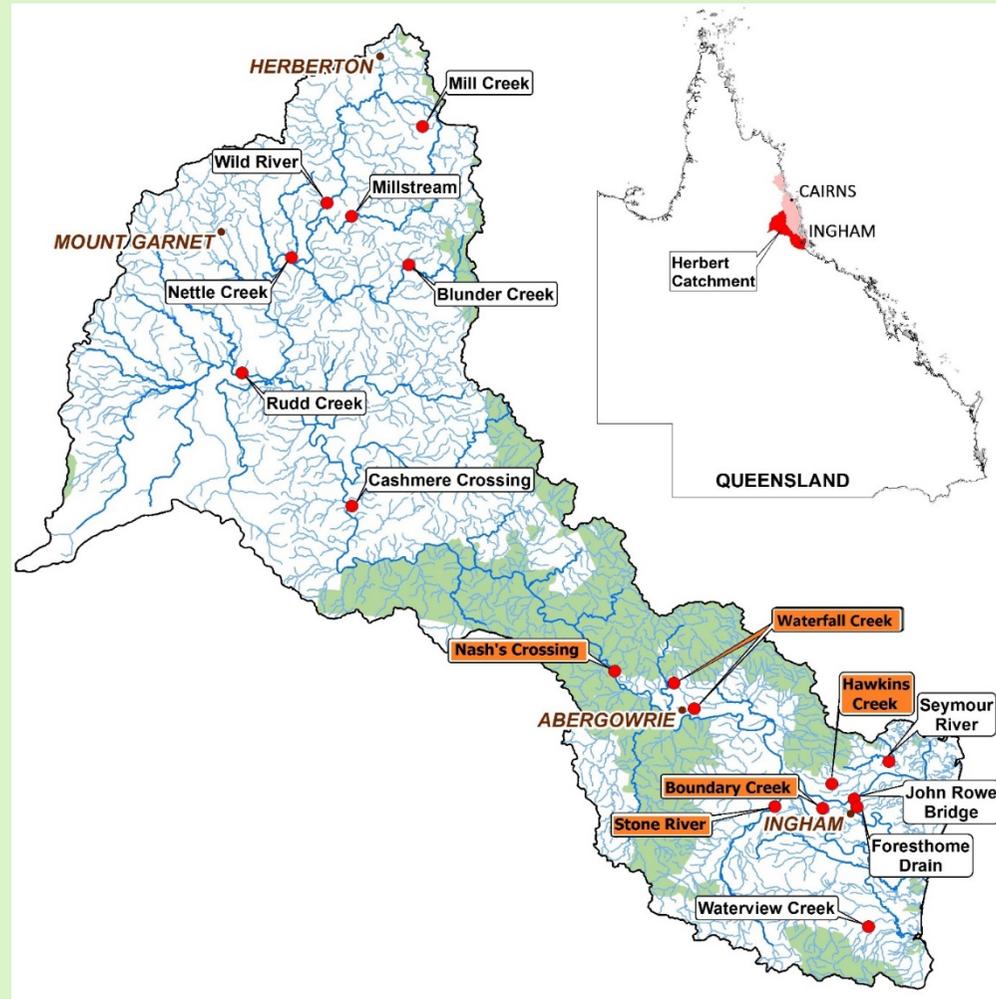


- ▶ Surface water samples were collected from 17 sites which cover the main land uses within the Herbert Catchment - rainforest, mixed cropping, urban, dairy, mining and grazing in the upper catchment; and sugarcane and urban in the lower catchment.
- ▶ The program commenced in July of 2011 and operated for 3 years to monitor water quality for the whole of the Herbert Catchment area.
- ▶ The Herbert sugarcane industry and State Government (through EHP) have continued to fund monitoring for the past 2 years post the initial project.

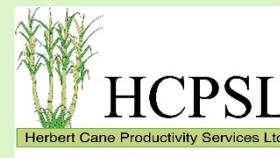




# The Herbert Water Quality Monitoring Program monitoring sites.



## Linkage projects associated with the sugarcane industry



- ▶ At the inception of the HWQMP concept it was proposed to create linkages to other projects or programs focusing on water quality in the sugarcane industry.
- ▶ In the sugarcane industry this project was linked to the following projects:
  - ▶ The Herbert Demonstration Farm project funded DAFF.
  - ▶ The Queensland Government Department of Natural Resources and Mines (DNRM) funded Rainfall Simulation Project and end of catchment monitoring under the Paddock to Reef program.
  - ▶ The Australian Government funded the inshore and reef water quality monitoring activities.
  - ▶ The DAFF funded Herbert Reef Plan Extension and Education project.
  - ▶ The Australian and Queensland Government funded Project NEMO (Nutrient Efficient Management On-farm).



The Herbert Demonstration site

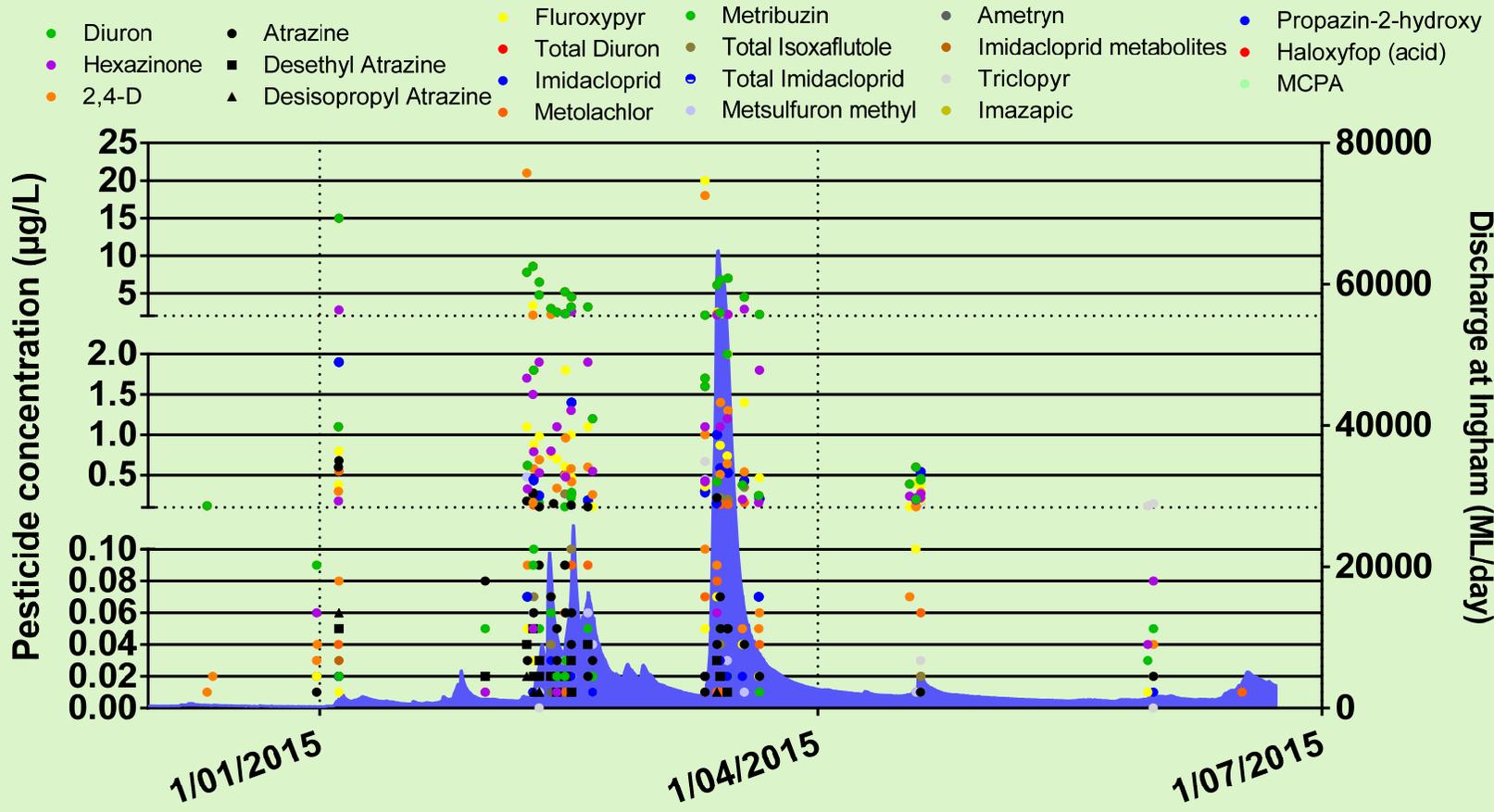
# Research findings



- ▶ Nitrogen levels and some pesticides, including diuron, hexazinone and atrazine, are frequently measured at concentrations exceeding the national guidelines for freshwater ecosystem protection in waters discharging from sugarcane sites in the Herbert sugarcane sub-catchment area (O'Brien *et al.*, 2014).

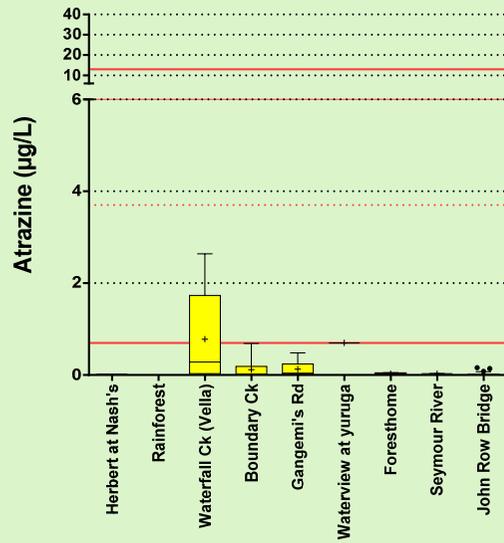


# Pesticides found

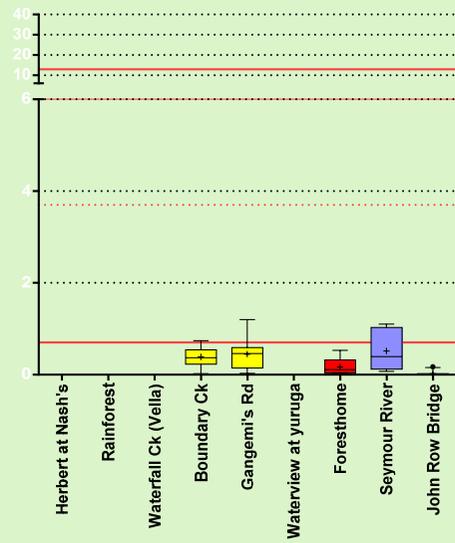


# Atrazine

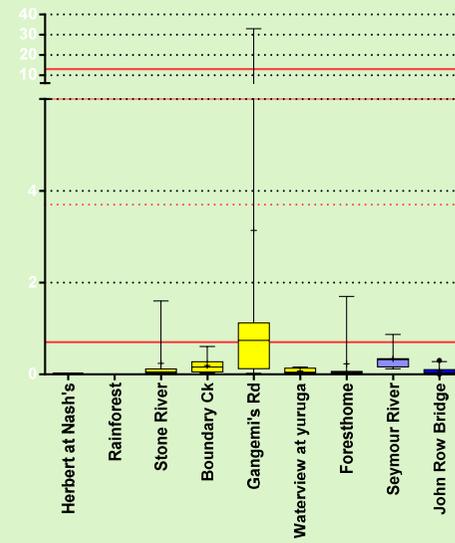
## 2011-2012



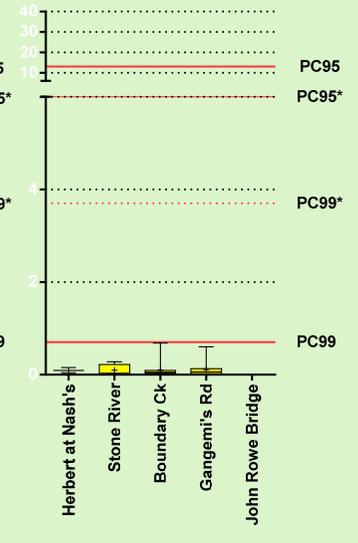
## 2012-2013



## 2013-2014



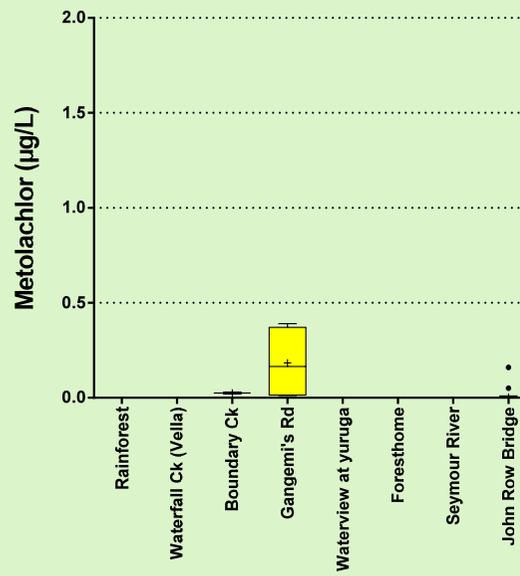
## 2014-2015



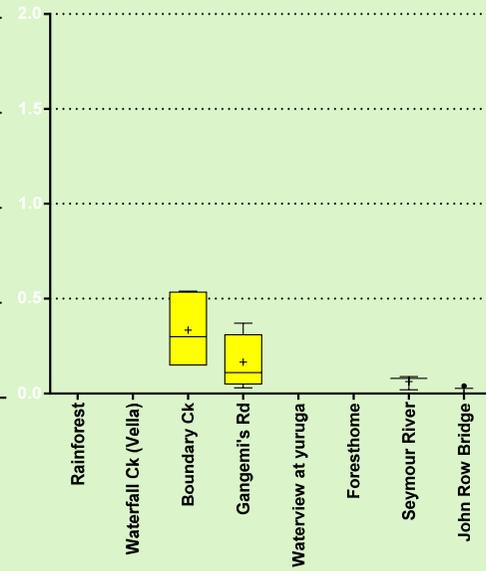
PC95  
 PC95\*  
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 PC99

# Metolachlor

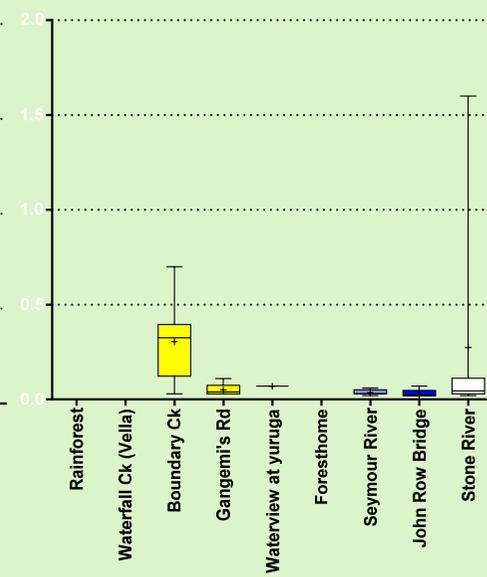
## 2011-2012



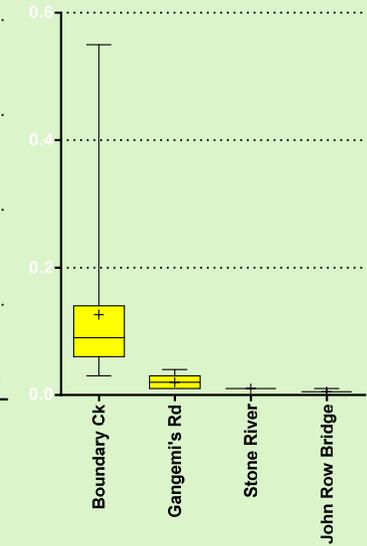
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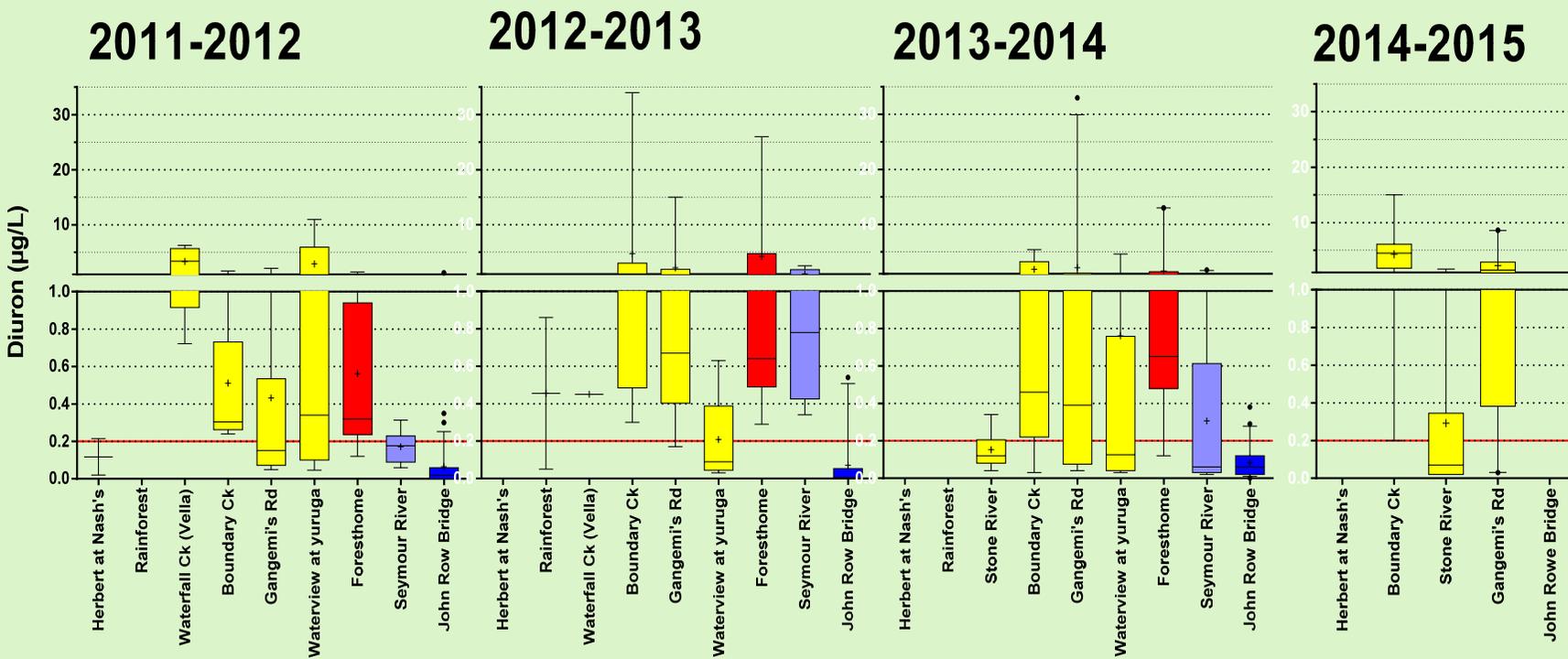
## 2013-2014



## 2014-2015



# Duiron

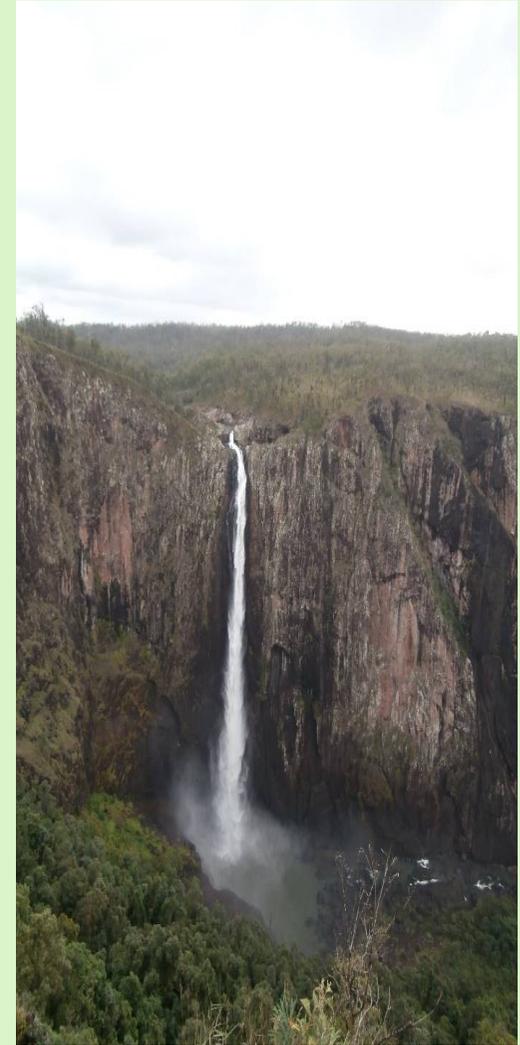


# Normalised total Photosystem II load (kg)

Site name	Total PSII 2009-2010 (kg)	Total PSII 2010-2011 (kg)	Total PSII 2011-2012 (kg)	Total PSII 2012-2013 (kg)
North Johnstone River at Tung Oil	9	29	21	
Tully River at Euramo	181	228	543	970
Herbert River at Ingham		86	204	1095
Barratta Creek at Northcote	129	97	148	906
Burdekin River at Home Hill	115	260	443	1424
Pioneer River at Dumbleton Head Water	333	301	261	1029
Sandy Creek at Homebush	181	189	65	83
Fitzroy River at Rockhampton	1967	1166	1455	2689
Burnett River at Ben Anderson Barrage Head Water	80	70	66	119

# The extension strategy

- ▶ As a part of the project an extension strategy was developed where-by the various project stakeholders were provided water quality monitoring results six months prior to the information being made public.
- ▶ This time allowed the various project stakeholders the opportunity to be informed of pending issues, develop strategies and implement activities when issues arose.



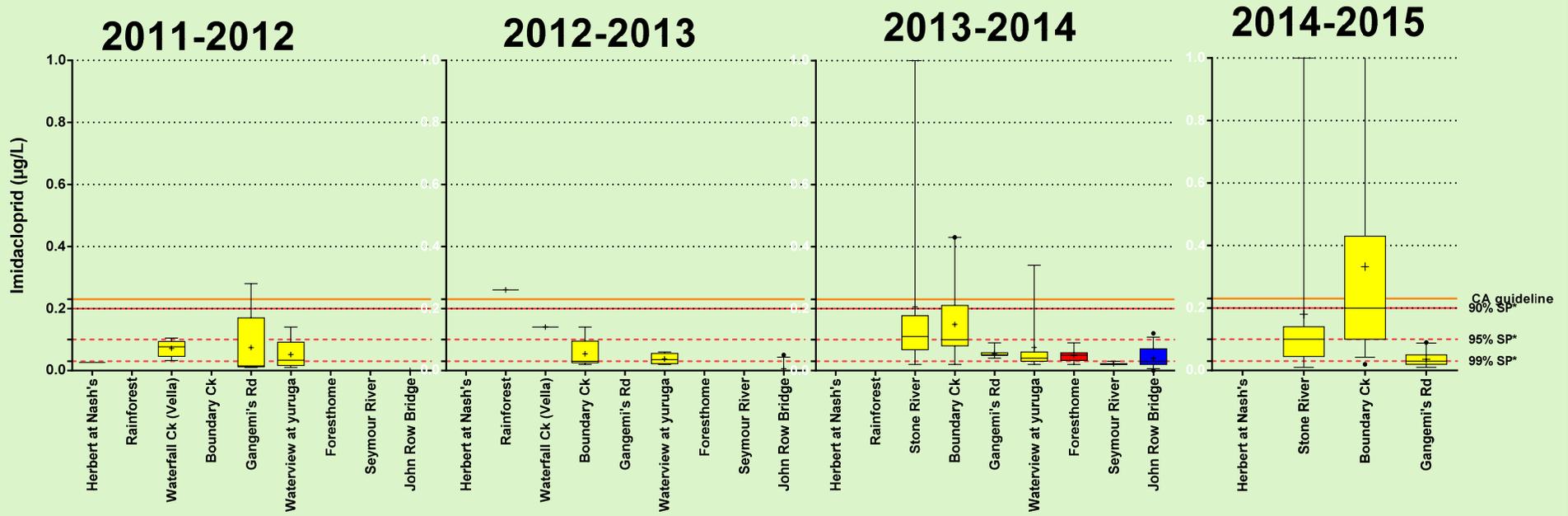
## Response to Duiron issues



The Herbert industry has responded to the Duiron issue by:

- ▶ Moving to alternative chemistries
- ▶ HCPSL is working with Chemical companies (like DOW, Arysta and Sumitomo) to find alternative herbicides to replace Duiron
- ▶ Promote the use of dual herbicide application equipment
- ▶ Work with growers to better manage the timing and placement of herbicides in the farming system.

# Imidacloprid



## Sugarcane industry response to Imidacloprid issues

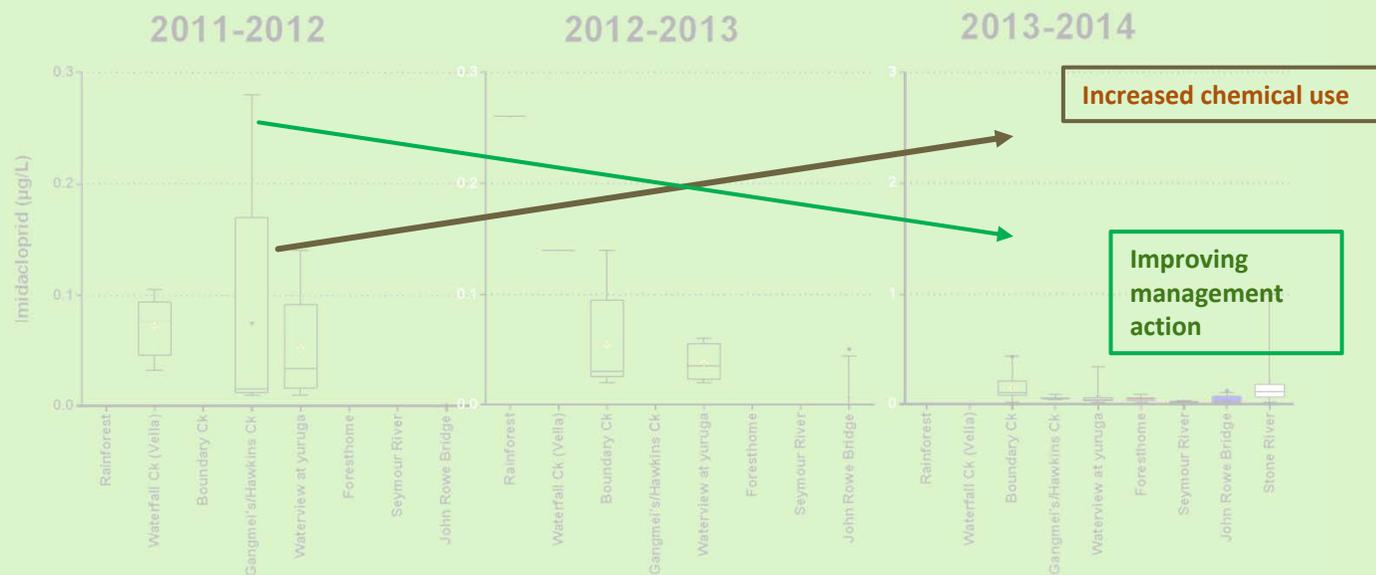


- In response to high levels of Imidacloprid, HCPSL conducted a number of grower shed meetings throughout the district in late August- early September 2012 to inform growers of the impending risks associated with the improper use of imidacloprid, its impact on water quality and recommendations for effective sugarcane grub control with minimal runoff; over 150 growers attended the meetings.

# Sugarcane industry response to Imidacloprid issues

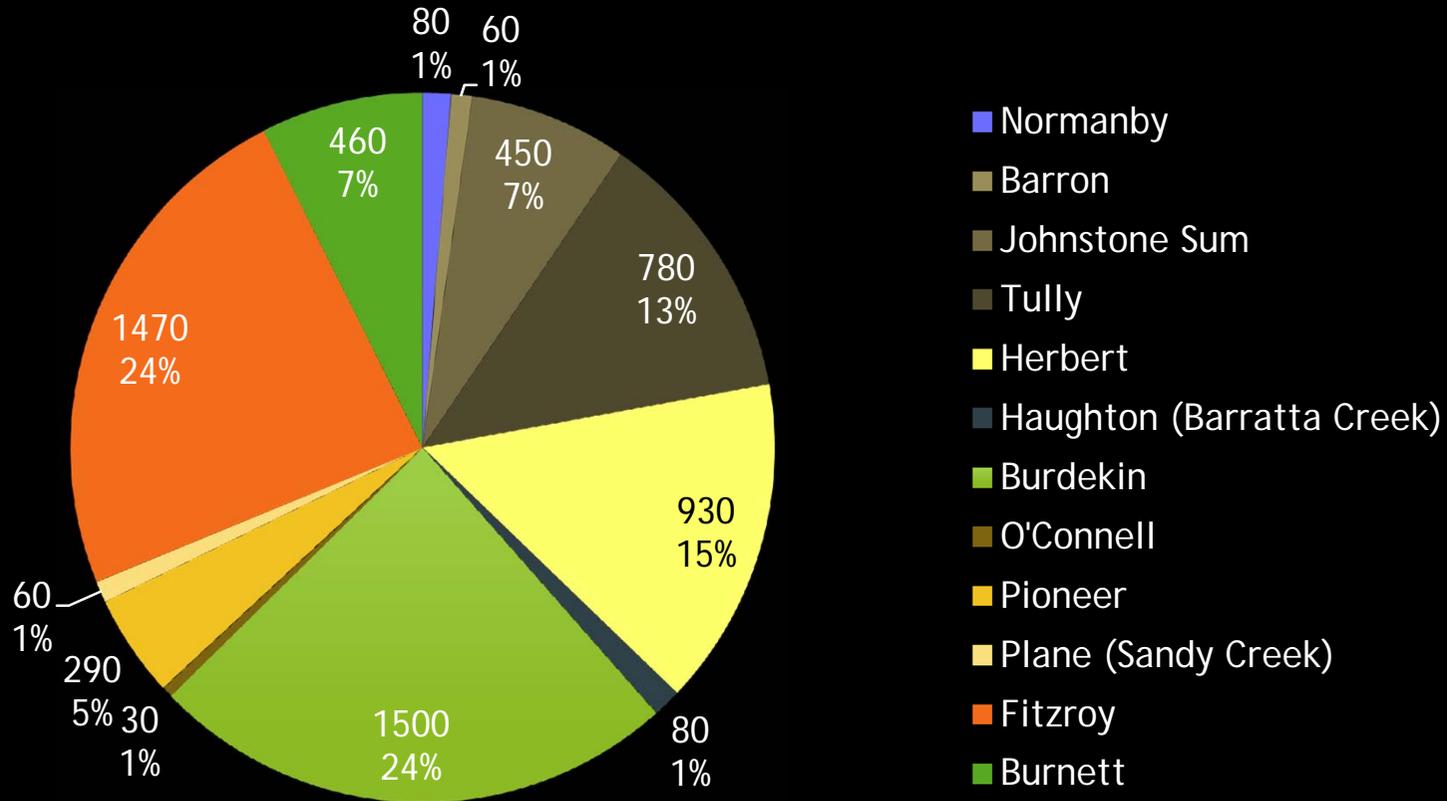


- Since the targeted extension approach in late 2012, associated with product timing and placement there has been considerable reductions in imidacloprid levels detected in water samples in the sugarcane sub-catchments monitored by the HWQMP.



Comparing years for imidacloprid levels found in water quality samples taken as a part of the HWQMP

## Annual average dissolved inorganic nitrogen load (t) 2006-2014



## Sugarcane industry response to nitrogen issues

- ▶ In response to the elevated levels of nitrogen in water quality samples collected by the HWQMP and research undertaken by the associated linkage projects.
- ▶ The Rainfall Simulation project validated that sub-surface application fertiliser in sugarcane crops had the lowest nitrogen runoff losses when compared to other application methods available to the industry (Cowie *et al.*, 2013).



# Sugarcane industry response to nitrogen issues

- ▶ Since the inception of the Australian Government's Reef Rescue grants program, HWQMP, and reporting of the Rainfall Simulation trial results, there has been a significant shift from surface fertiliser application to sub-surface application, in the Herbert cane growing region. Surface application of fertilisers reduced from 78% of area treated in 2008 to 38 % of area treated in 2013, for the Herbert sugarcane growing region.



# Sugarcane industry response to nitrogen issues



The Herbert industry has undertaken the following:

- ▶ Changed practice from surface applications to sub-surface applications.
- ▶ Adoption of Enhanced Efficiency Fertilisers- like Entec™ and AgroMaster™, with ~30% of Herbert growers assessing or farm scale adoption. HCPSL has been a leader in the research concerning EEFs in the industry.
- ▶ Industry adoption of a controlled traffic farming system
- ▶ Reducing nitrogen inputs through the adoption of the 6 Easy Steps nutrition (BMP) program to district averages of:
  - 1996- 213kgN/ha
  - 2006- 149 kgN/ha
  - 2016- 145kgN/ha (data supplied by IPL).

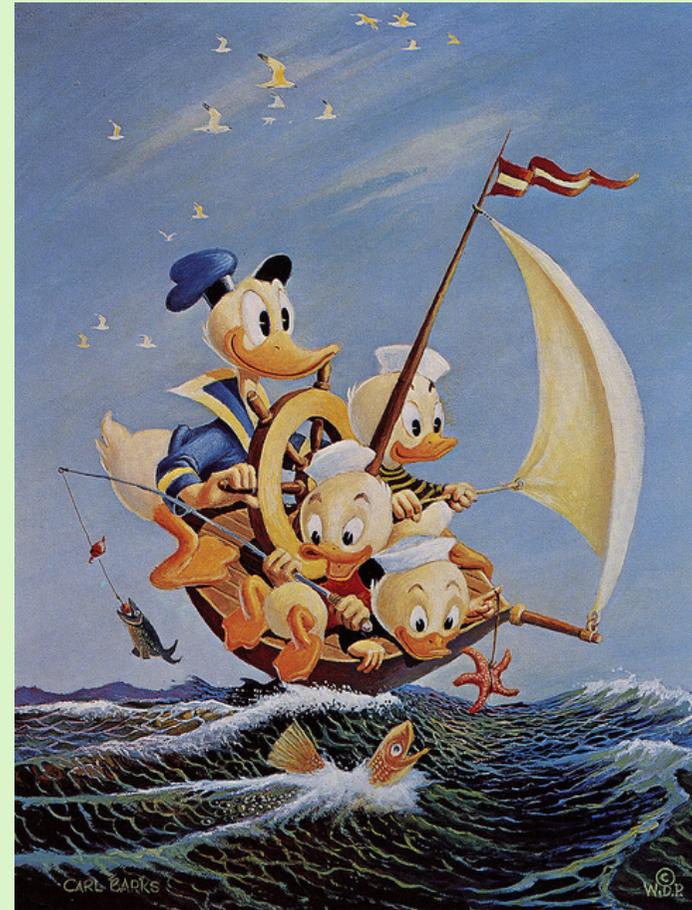
# Conclusion

- ▶ The HWQMP has definitely shown that extension programs can have an impact on water quality entering the Great Barrier Reef (GBR) lagoon, if they are well planned, targeted and managed accordingly.



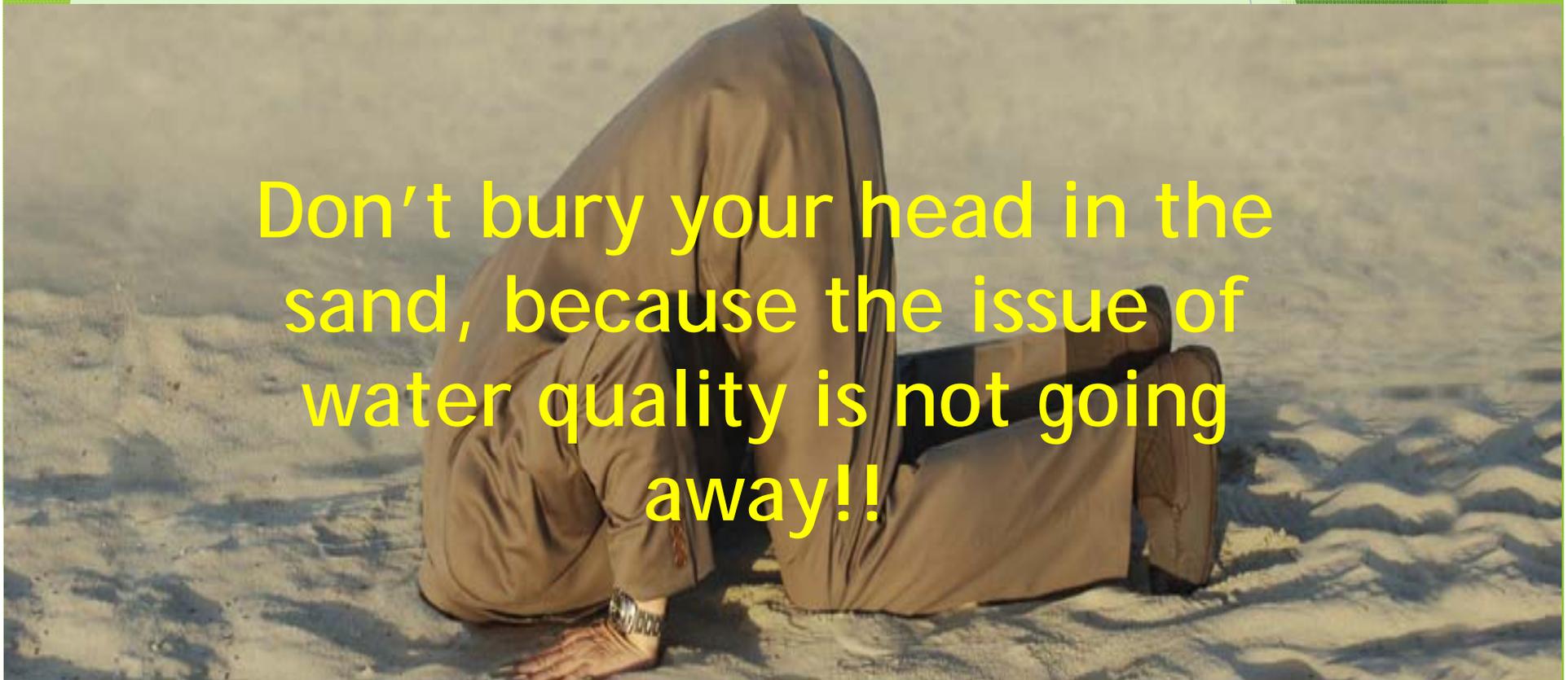
## Conclusions specific to the Burdekin

- ▶ The Burdekin is not the only sugarcane region that has nitrogen and pesticide issues to deal with- you are not alone.
- ▶ Targeted extension programs can lead to positive environmental outcomes, without compromising industry productivity and profitability.
- ▶ Seek and invest in local data to base your farm management decisions upon- steer your own ship and take responsibility for the issue at hand.



## Conclusions specific to the Burdekin

Don't bury your head in the  
sand, because the issue of  
water quality is not going  
away!!



# Thanks



Special thanks to:

- ▶ The Queensland government, SRDC, SRA, QDAF, EHP and local governments for funding the initial project.
- ▶ Support by the associated agencies (HCPSL, Terrain NRM, JCU Tropwater, CANEGROWERS Herbert River), Queensland government agencies