

Making the connection between healthy waterways and healthy catchments

Stuart Bunn

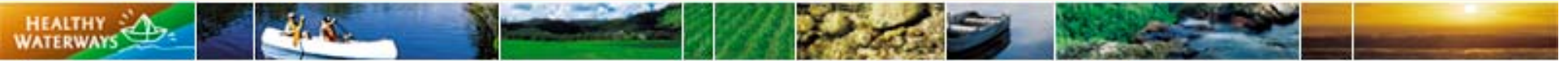
Australian Rivers Institute
Griffith University

**Eva Abal, Bill Dennison,
Paul Greenfield & Di Tarte**

Moreton Bay Waterways and Catchments Partnership

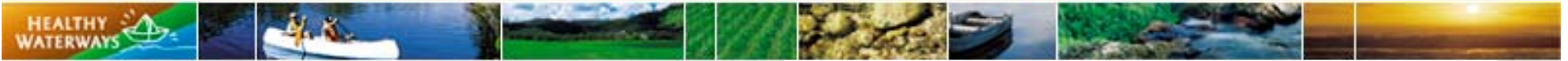


Outline

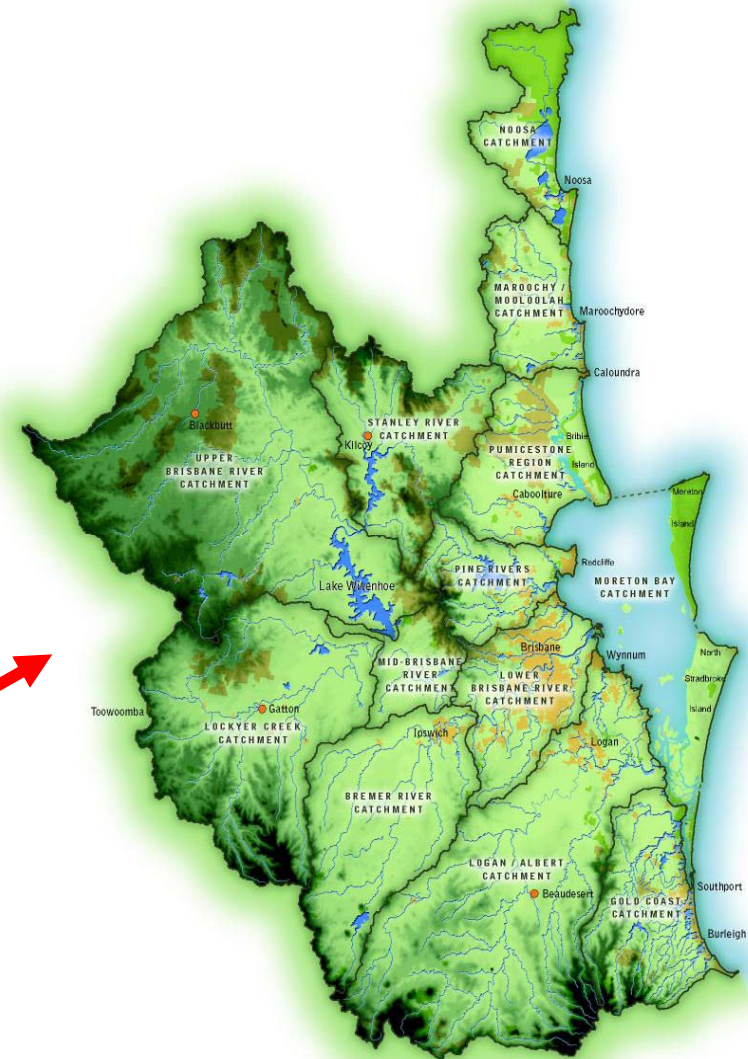


- Background to the study region: Moreton Bay catchment in eastern Australia - rapidly expanding population
- Development of partnership (science, managers, policy makers) to deal with issues affecting coastal waterways
- Development of science and monitoring program
- Communication with stakeholders
- Implementation of actions

Background to the study region



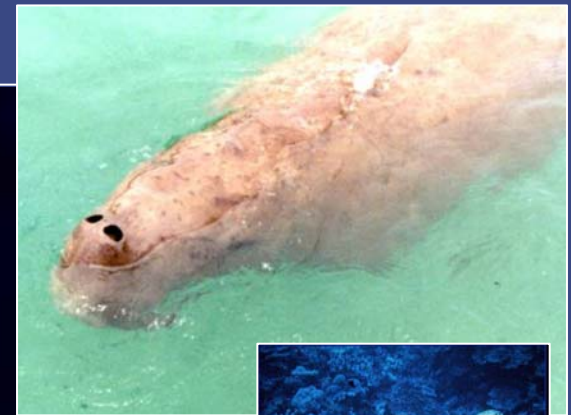
- ◆ 15 major catchments
- ◆ 22,672 km²
- ◆ 19 local government areas
- ◆ Population 2.5 m
- ◆ Fastest growing region in Australia



Importance of the region's waterways:



- High conservation significance (Ramsar)
- Major commercial and recreational fisheries
- Water supply (urban and rural)
- Recreation & transport



The human footprint:



Since European settlement:

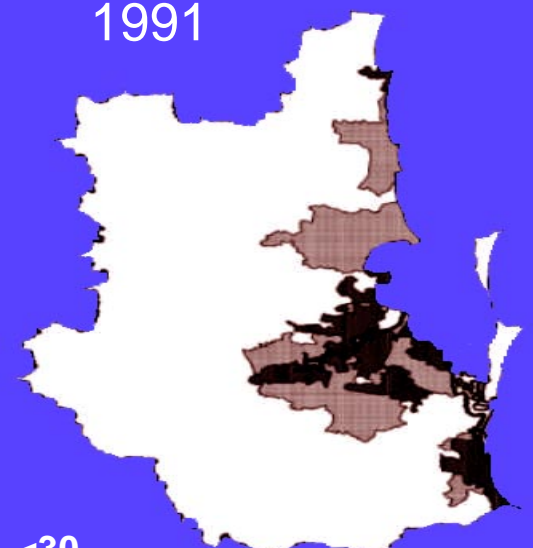
- 20% of original vegetation remains - less adjacent to streams
- Altered hydrology - dams & weirs
- Declining water quality (nutrients & sediment)
- Declines in aquatic diversity



1947



1991



 <30
30-250
250-5,000 Persons km⁻²

Catchments drain into Moreton Bay



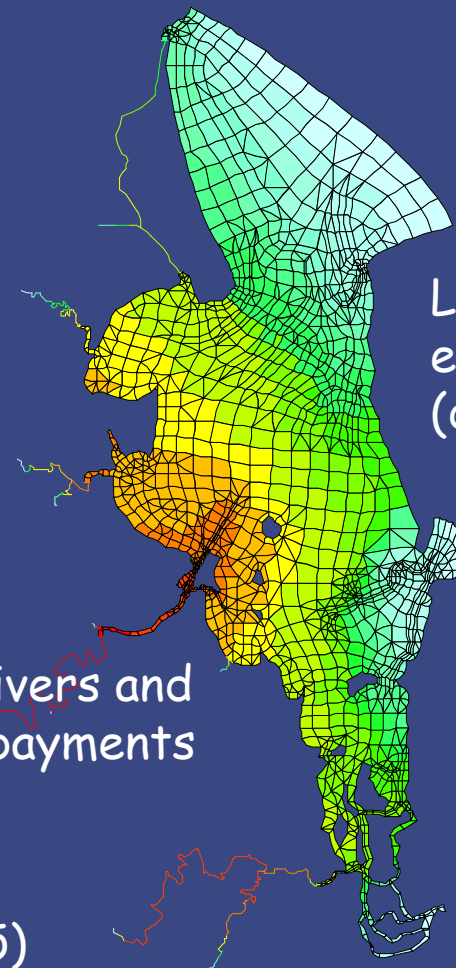
Catchment to Bay Ratio:

14:1

Brisbane River

Residence time (days)	
116 to 188	Red
73 to 116	Orange
62 to 73	Light Orange
58 to 62	Yellow-Orange
55 to 58	Yellow
51 to 55	Light Green
48 to 51	Green
45 to 48	Light Green
41 to 45	Green
38 to 41	Light Green
31 to 38	Green
24 to 31	Light Green
19 to 24	Light Green
9 to 19	Light Green
6 to 9	Light Green
0 to 6	Light Green

Residence Time



Lowest in eastern Bay (days)

Highest in rivers and western embayments (months)

Abal *et al.* (2005)

Key drivers for change



- Fast growing population
- Security of water supply (quantity and quality)
- Concerns about industry viability - tourism, fishing and agriculture.
- Increasing community expectations about improving water quality and ecosystem health

Recognition - cheaper to protect than to restore ...



Formation of the Partnership

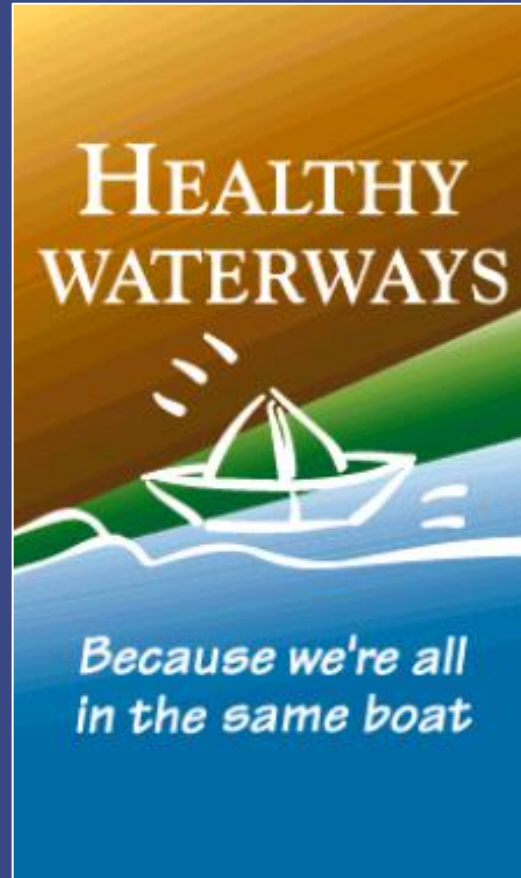


3 levels of government

- Local councils (6; 19)
- State Government agencies (6)
- plus Federal funding

Strong research support

- 3 Universities
- CSIRO
- 3 Cooperative Research Centres

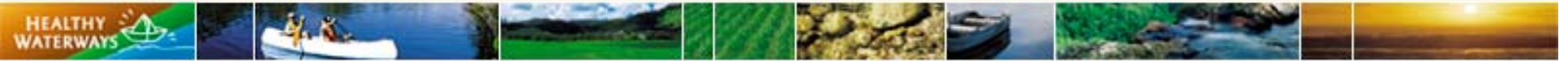


Community & industry advisory groups (>40)

- indigenous
- conservation
- catchment & landcare
- commercial industry
- rural industry

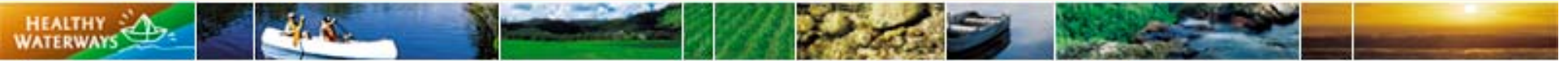


Developing a common vision:



“South-east Queensland’s catchments and waterways will, by 2020, be **healthy living ecosystems** supporting the livelihoods and lifestyles of people in South-east Queensland and will be managed in collaboration between community, government and industry.”

Achieving the vision:



Set values that reflect the vision

- numerous workshops with stakeholders

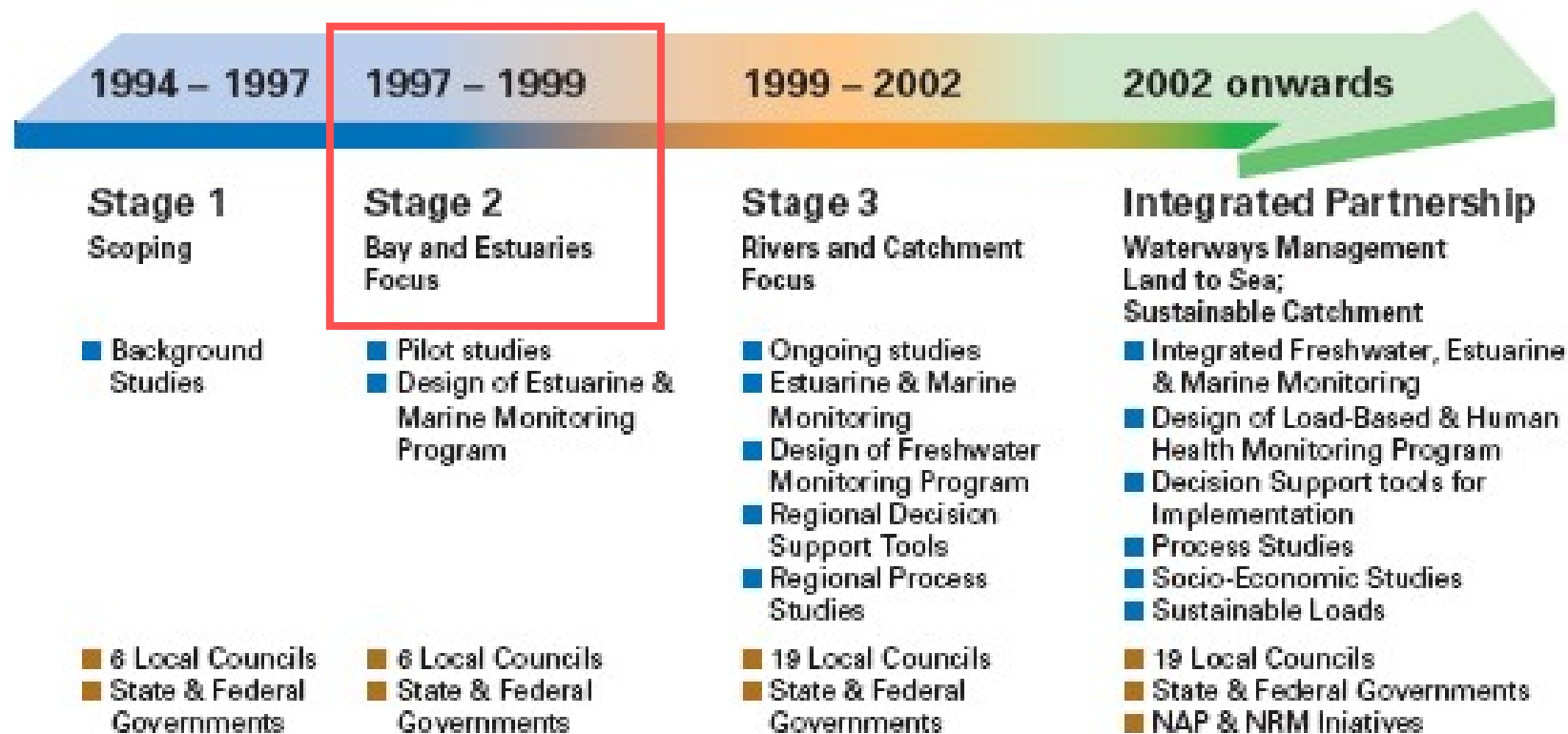
Measurable water quality or ecosystem health objectives that protect the values

- underpinned by sound science

Management actions to achieve these objectives

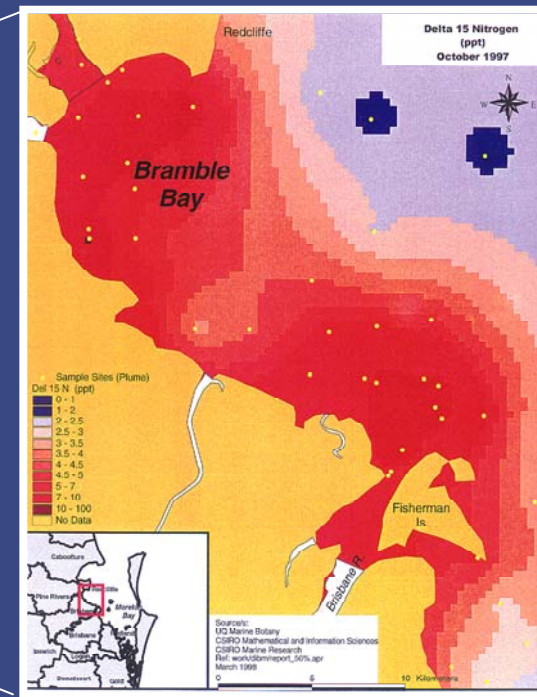
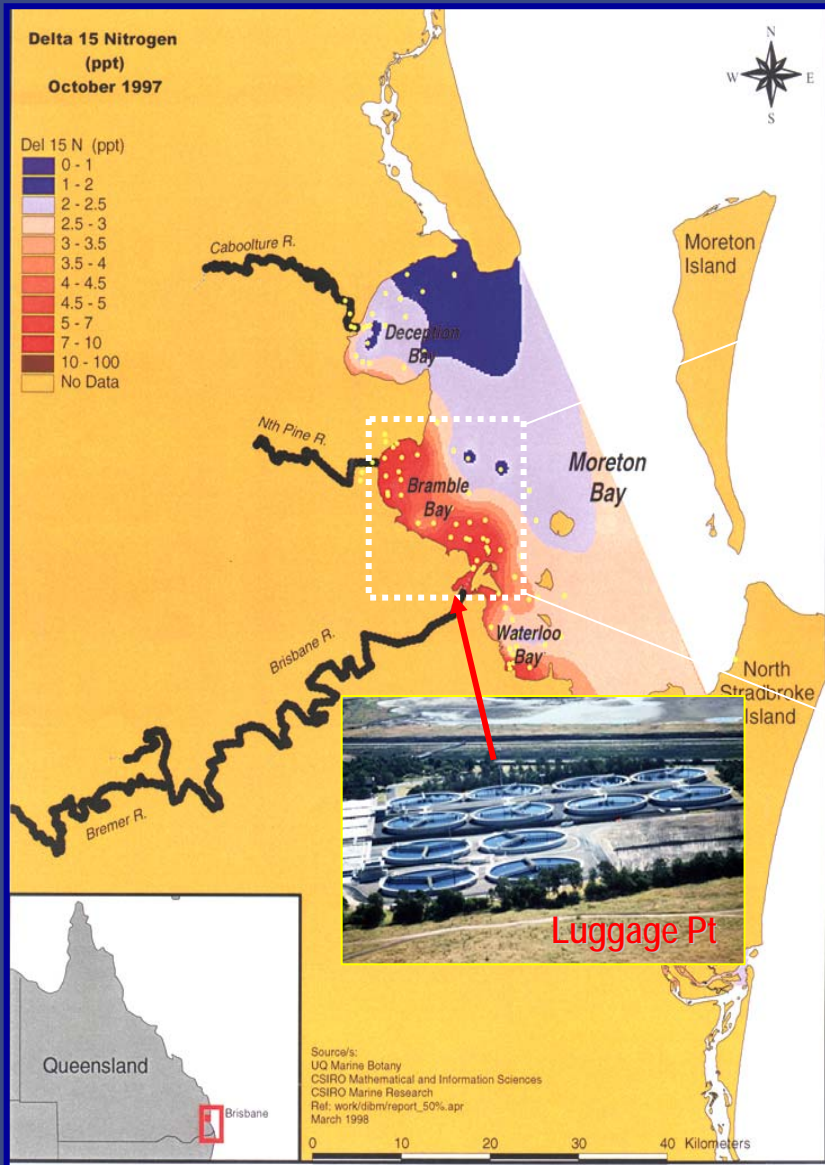
- working with policy makers

A staged approach: Stage 2- Moreton Bay



A staged approach was adopted by the Study, with each stage having a different focus, targeted objectives and clear outcomes.

Sewage Plume Mapping (using $\delta^{15}\text{N}$)

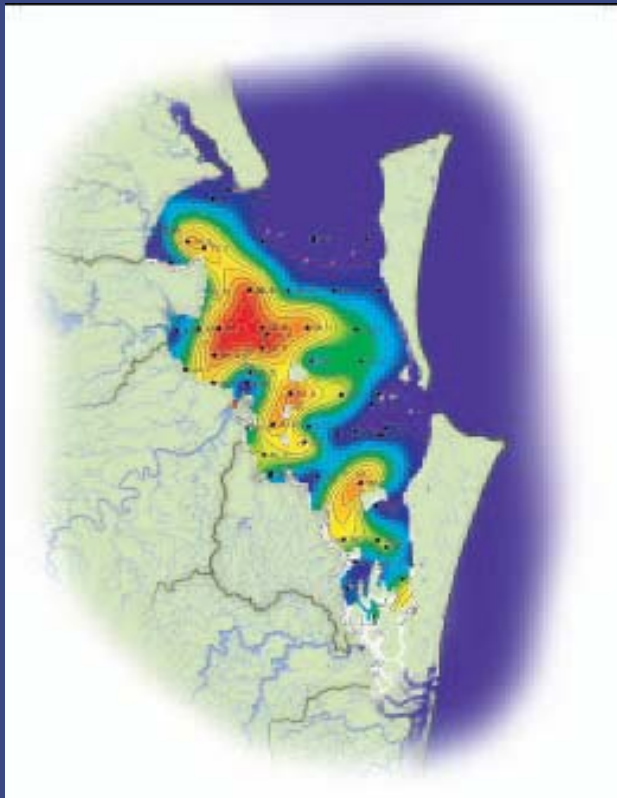


*Marine Botany, University of Queensland
CSIRO Mathematical and Information Sciences
CSIRO Marine Research*

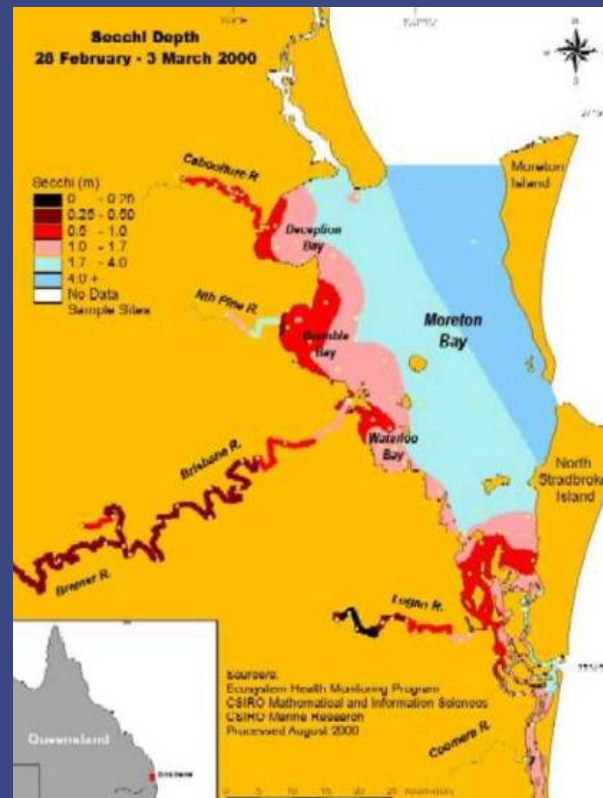
Sediments in Moreton Bay and seagrass loss



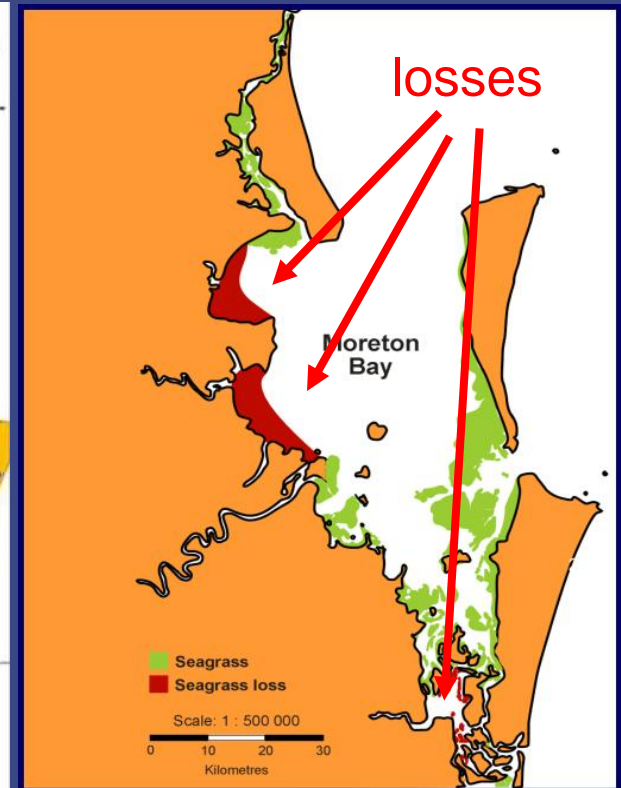
Sediments in the Bay



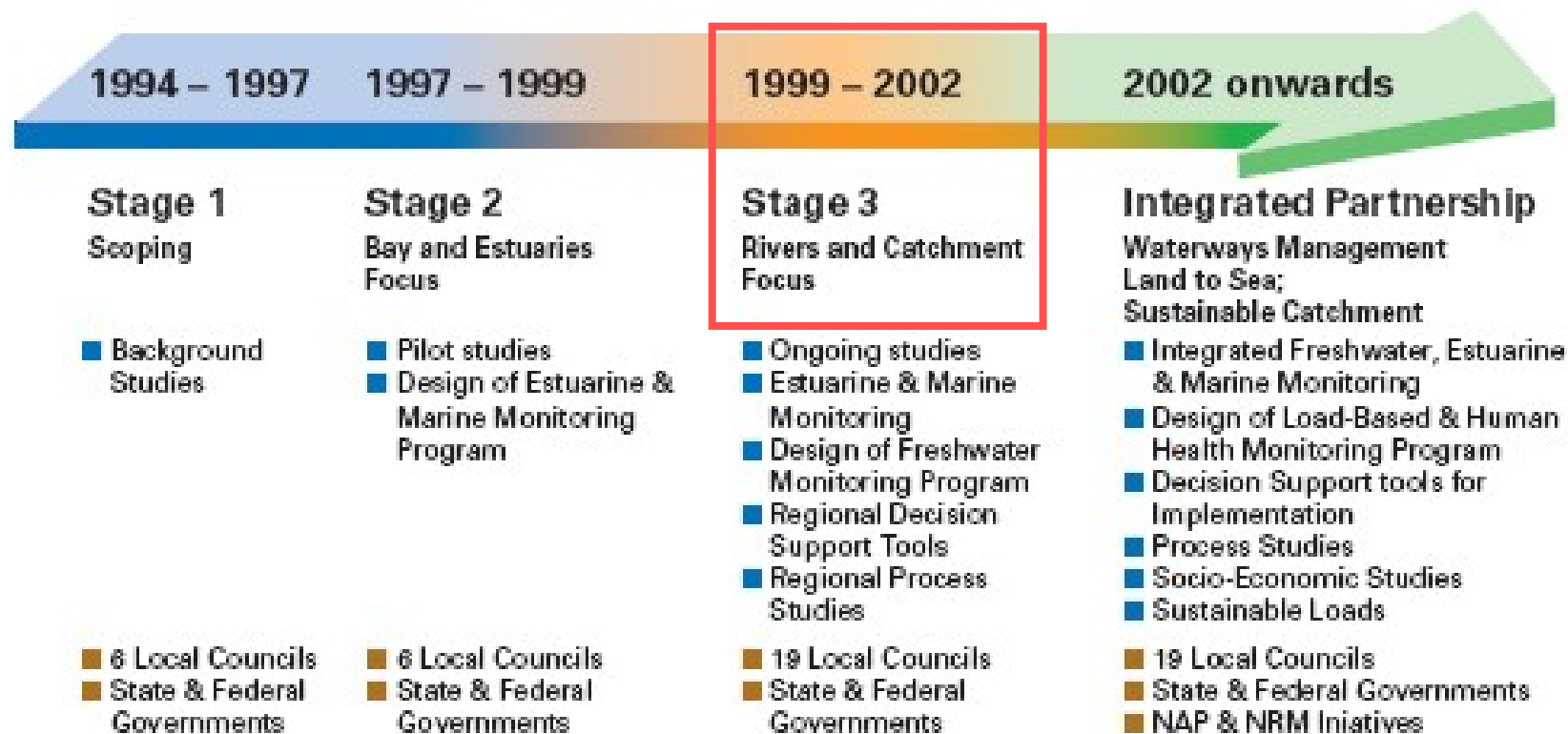
Turbidity



Seagrass distribution

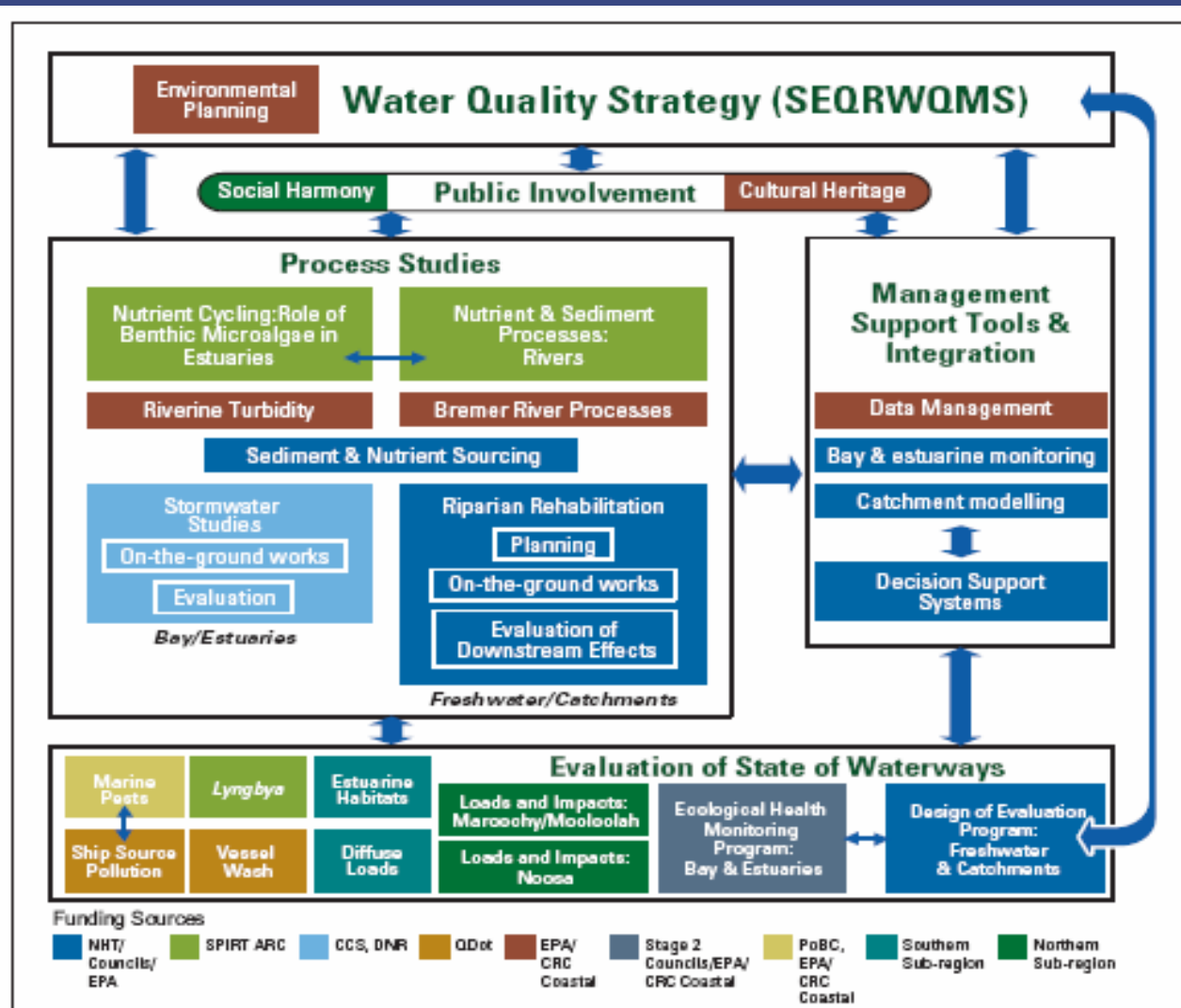


A staged approach: Stage 3- catchments



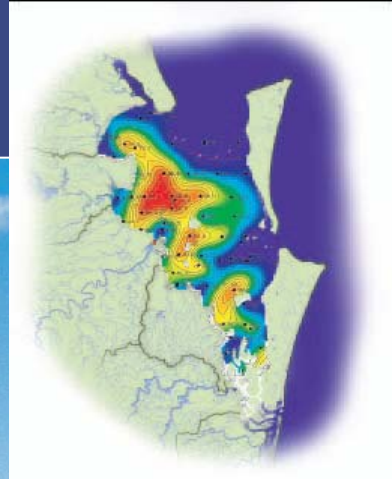
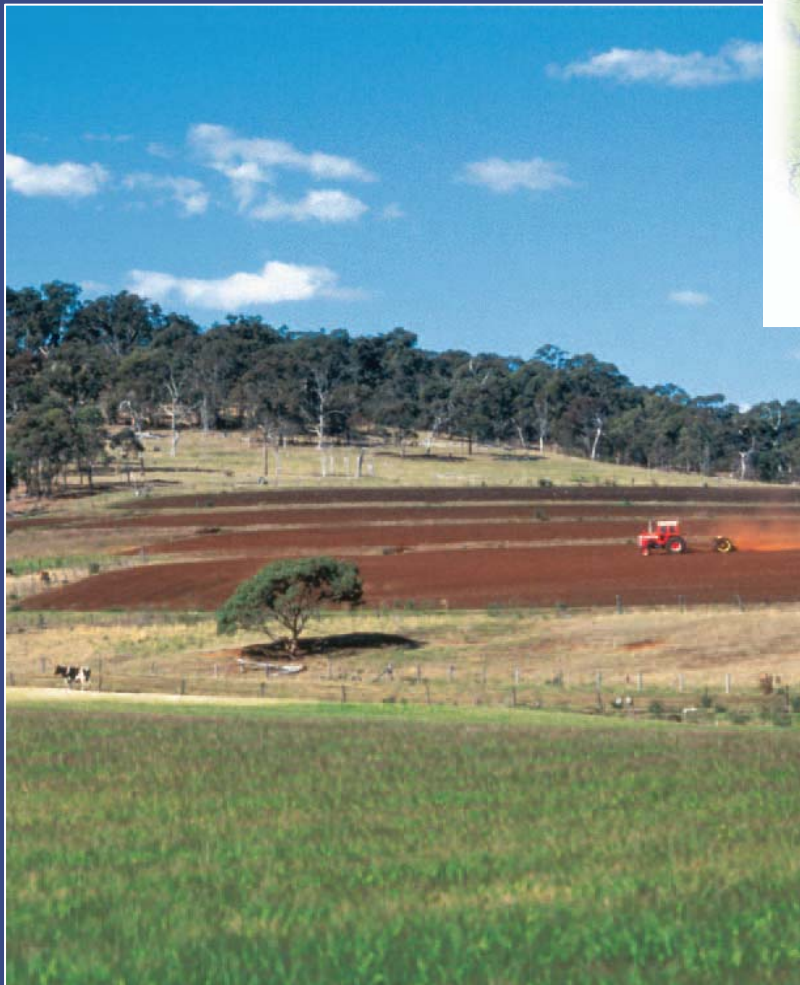
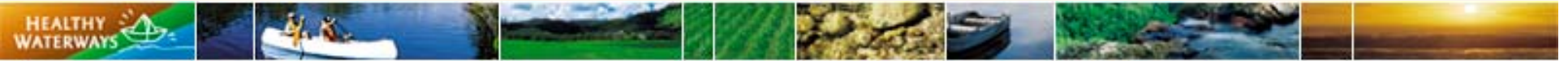
A staged approach was adopted by the Study, with each stage having a different focus, targeted objectives and clear outcomes.

Stage 3 Scientific Tasks



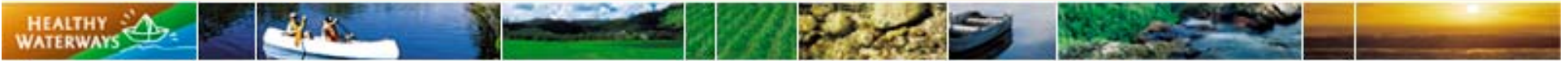
Stage 3 task architecture, showing the integration and linkages of tasks aimed at providing input into the development of the SEQ Regional Water Quality Management Strategy.

Sources of sediment in Moreton Bay

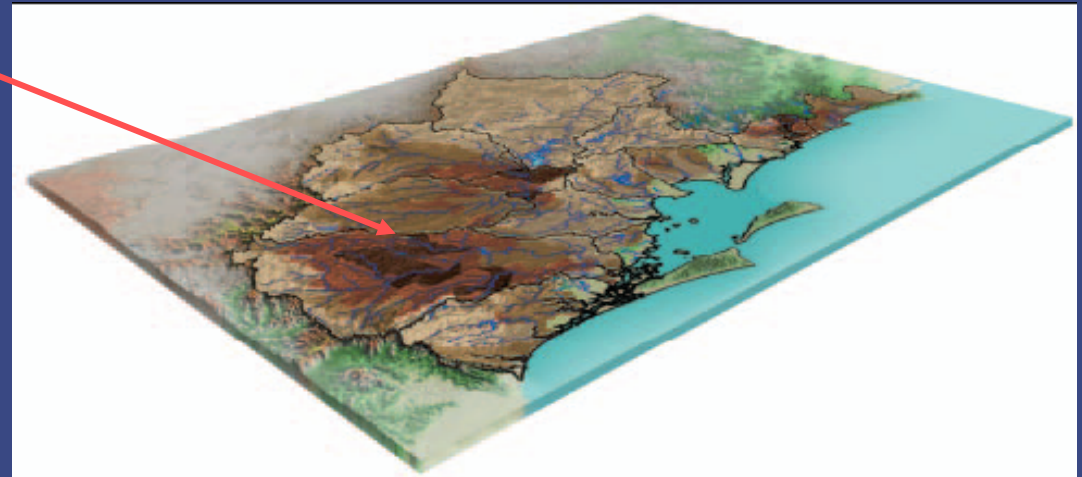
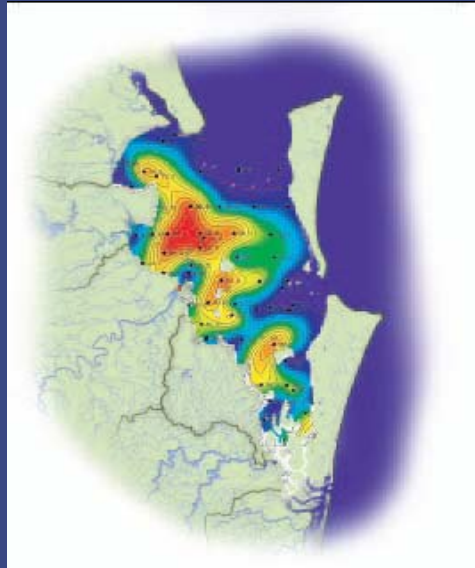


- Where does it come from?
- What are the processes that generate it?

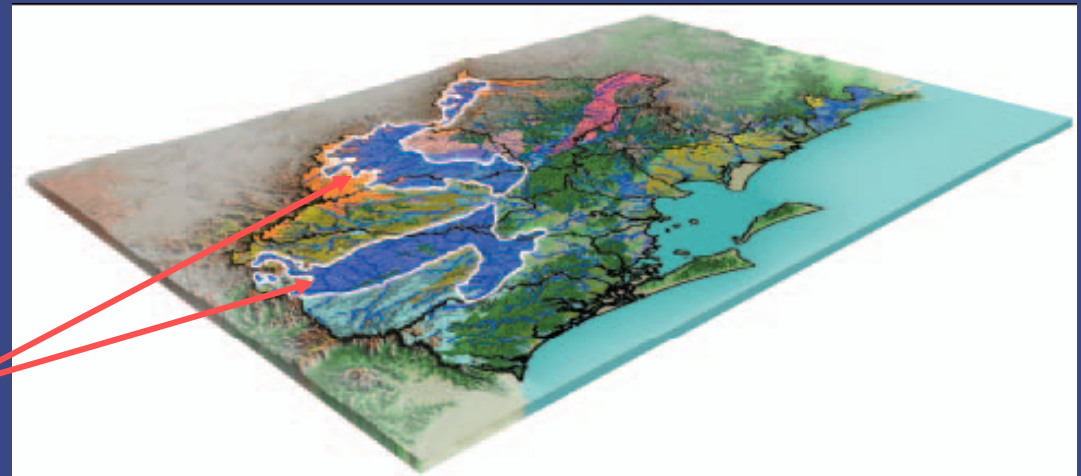
Source of sediment in Moreton Bay



Modelling suggests 70% sediment in Bay comes from <30% catchment area

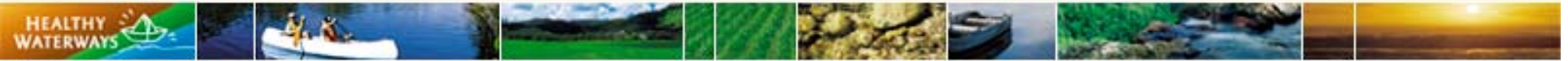


Tracer study confirms that most sediment comes from soils on Marburg formation rocks



Caitcheon & Howes (2005)

Dominant processes generating sediment?



Hillslope erosion

Key issue in steeper pasture and intensively cropped floodplain

Solutions:

- promote ground cover
- maintain soil structure
- trap eroded sediments



Illustration of channel and hillslope erosion processes. Channel erosion includes gully and streambank erosion and hillslope erosion includes sheetwash and rill (shallow [<20 cm] channel) erosion.

Dominant processes generating sediment?

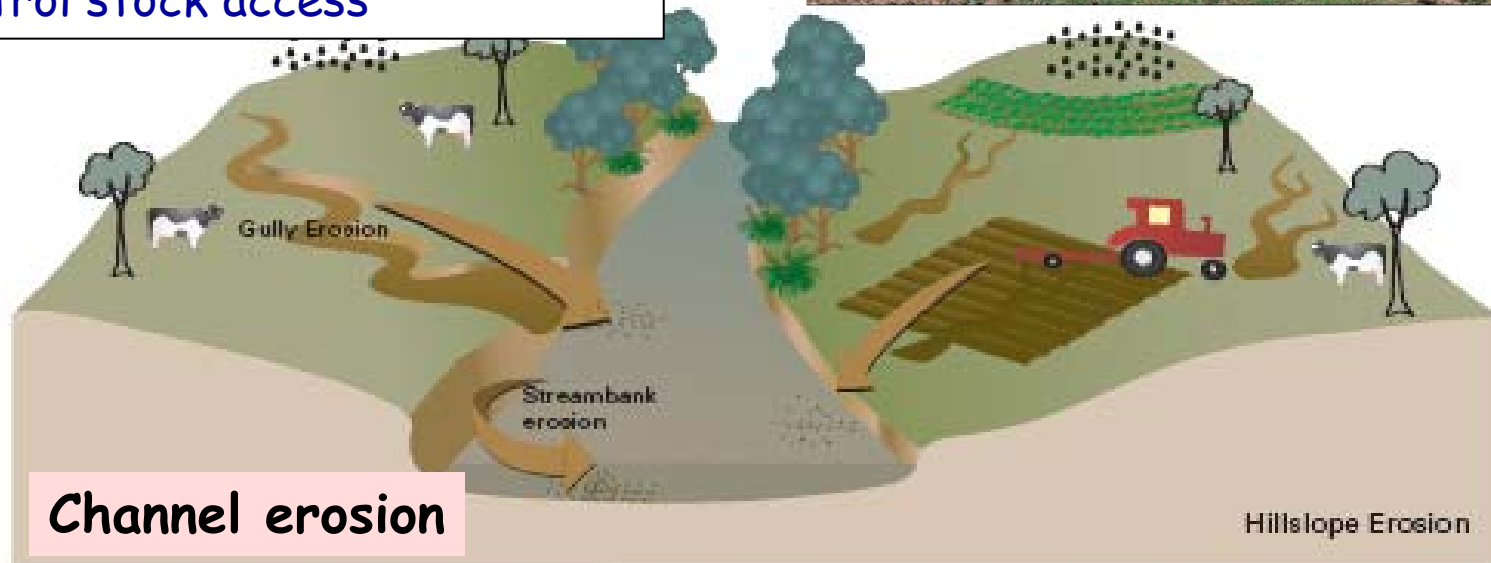


Channel erosion

Promoted by high stream energy, riparian vegetation clearing, and floodplain degradation

Solutions:

- protect riparian vegetation
- re-establish riparian vegetation
- control stock access



Channel erosion

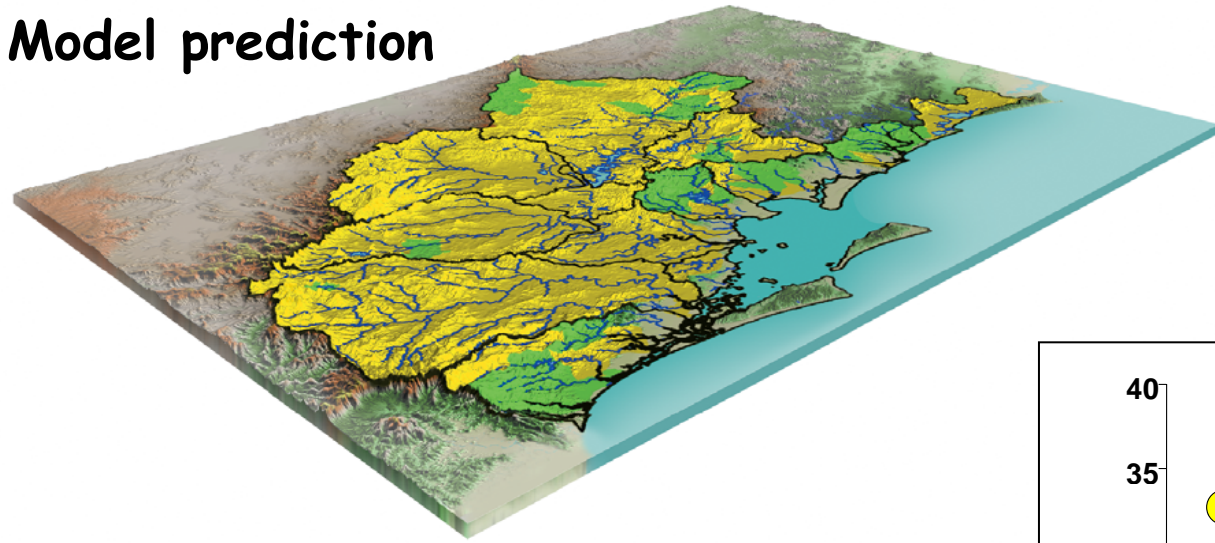
Hillslope Erosion

Illustration of channel and hillslope erosion processes. Channel erosion includes gully and streambank erosion and hillslope erosion includes sheetwash and rill (shallow [<20 cm] channel) erosion.

Channel erosion dominates in the region



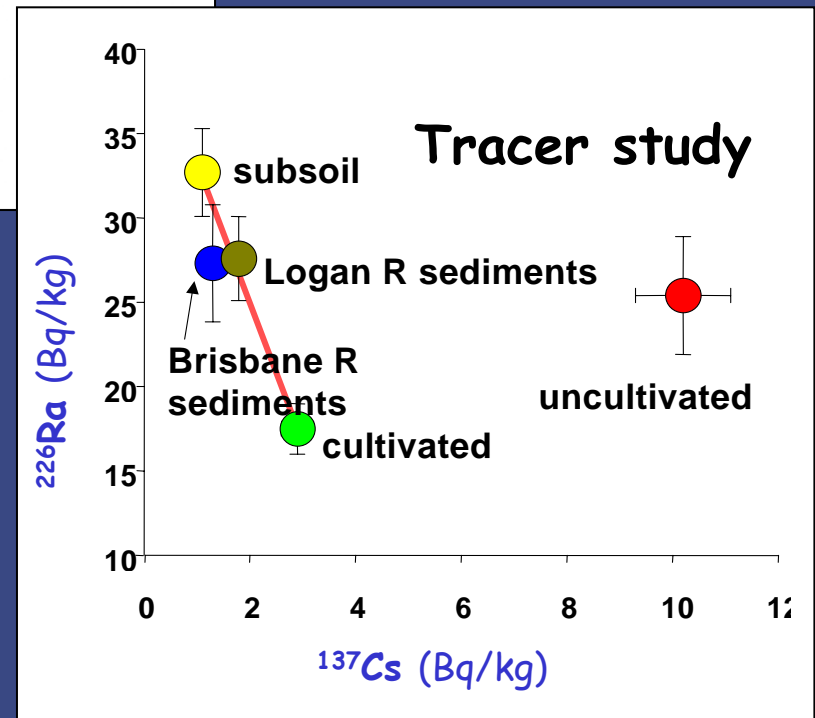
Model prediction



Hillslope:channel erosion ratio

- 0-1 (channel erosion dominates)
- 1-10 (hillslope erosion dominates)

- Channel erosion is source of most sediments delivered to the lower Brisbane & Logan Rivers
- Other source is cultivated surface soils



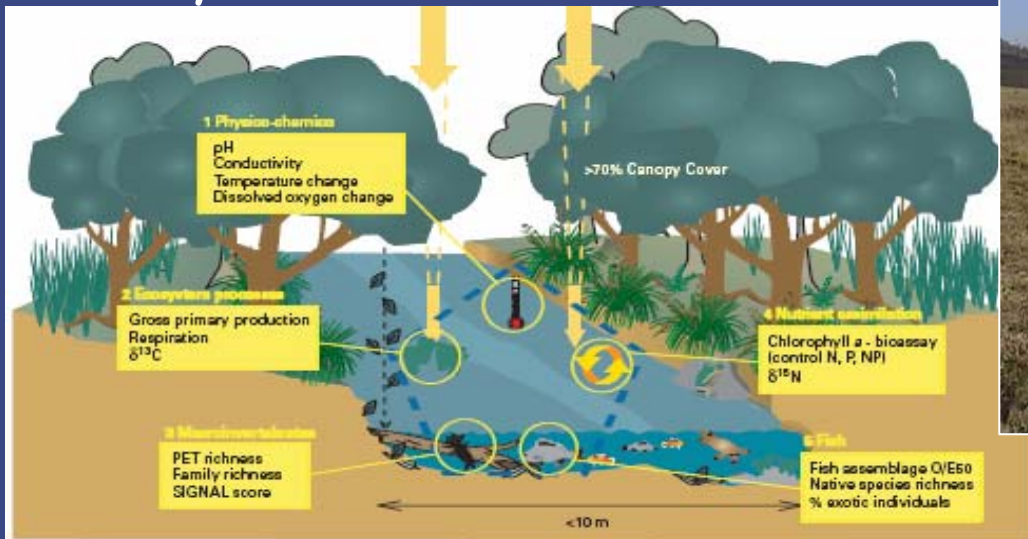
Caitcheon & Howes (2005)

Degraded riparian lands



About 50% of the 48,000 km of streams in SEQ has poor riparian condition

Riparian condition also has a large influence on stream ecosystem health



Recommendations for riparian management



High flow events

Riparian rehab. for:

- filtering sediments & nutrients
- stabilisation
- altering water flows

Streams are dry most times of the year

Permanent flowing streams

Riparian rehab. for:

- stream health
- stabilisation
- wildlife corridor
- habitat protection

Riparian rehab. for:

- stabilisation
- wildlife corridor
- habitat protection

SQIDS/Wetland

Canopy cover > 70%

Nutrients

Using Decision Support Software

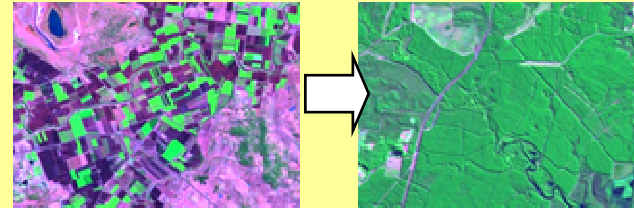


EMSS

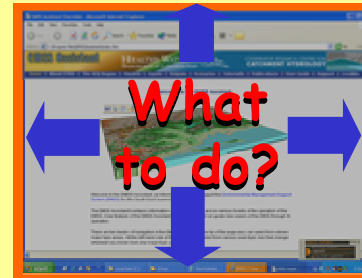
- Synthesise process understanding of the system (links catchment to water)
- Facilitates decision making process to select actions to best protect waterways



Land use and land management change



Wastewater Treatment (city)



Wastewater treatment (industrial)

Stream bank re-vegetation

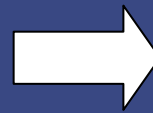
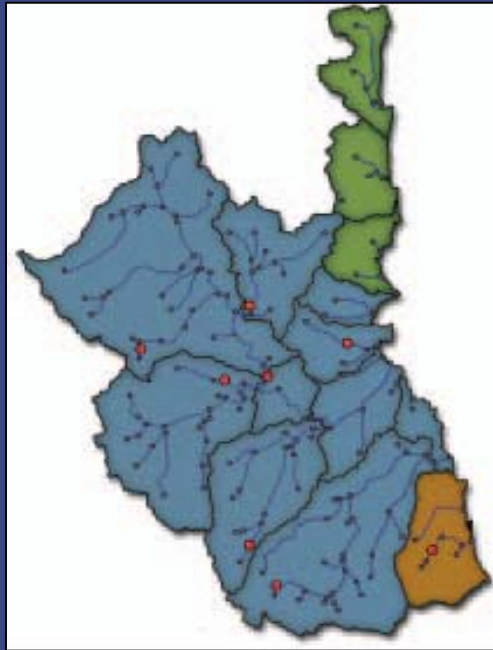


Environmental Management Support System

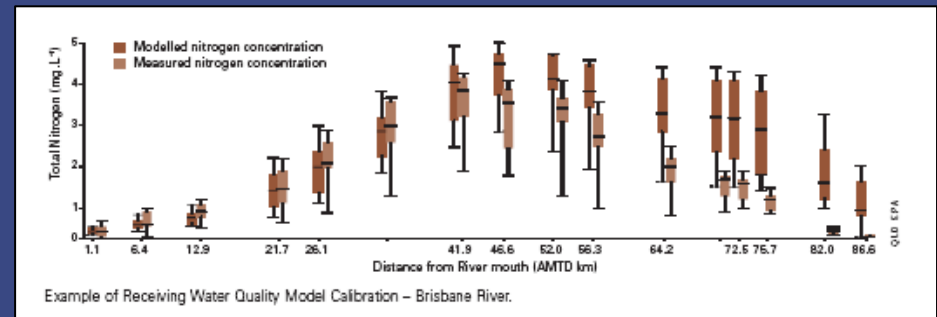
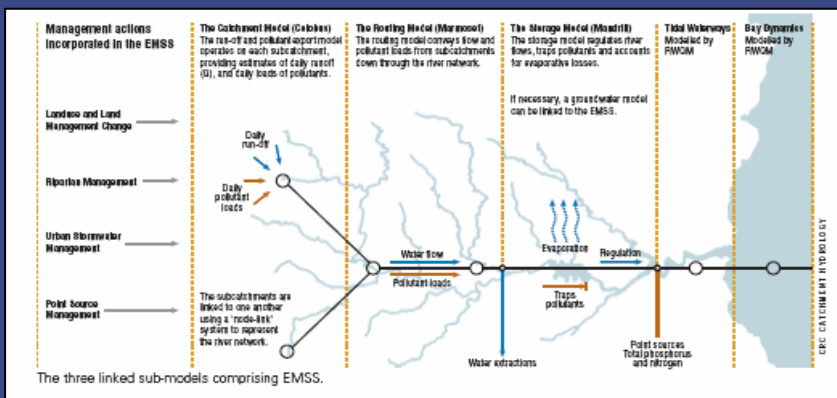
Using Decision Support Software



EMSS



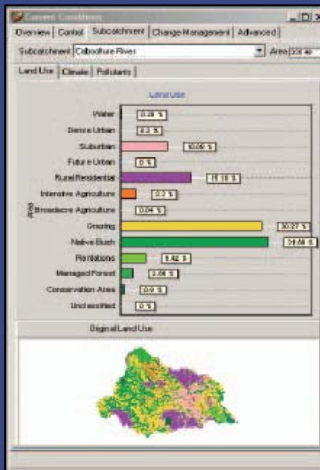
Receiving Water Quality Model



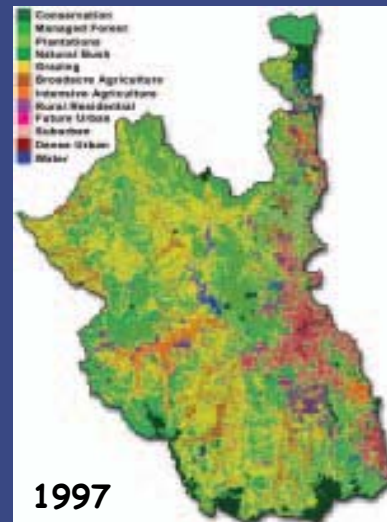
Example of Receiving Water Quality Model Calibration – Brisbane River.

Vertessey & McAlister (2005)

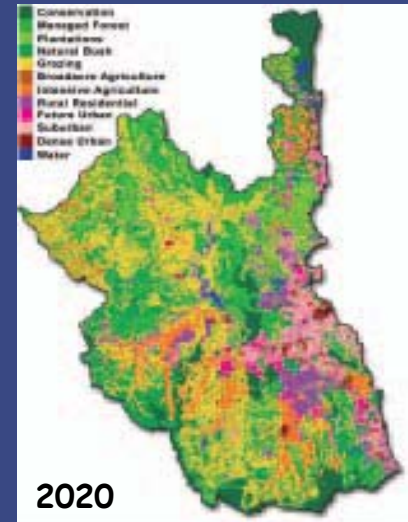
Scenario testing



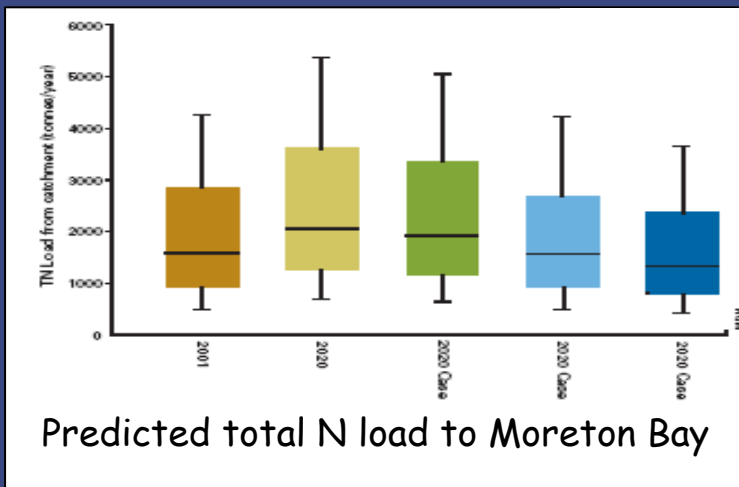
Past



Present



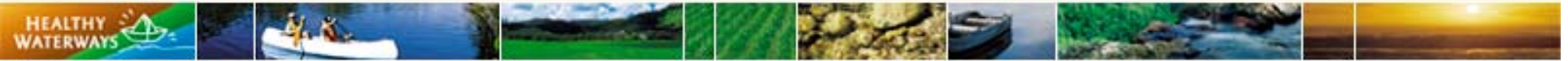
Future



- Current TN loads
- 2020 "do nothing" scenario
- 2020 achieve objectives for future urban land
- 2020 achieve objectives for future urban land + SQID retrofit
- 2020 achieve objectives for future urban land + SQID retrofit + riparian management

Vertessey & McAlister (2005)

Ecosystem Health Monitoring Program

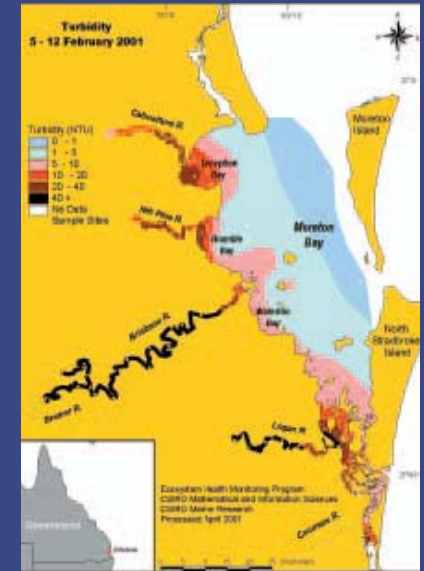


Assess effectiveness of environmental protection measures (e.g. stormwater controls, STP upgrades, riparian vegetation)



Estuarine and marine EHMP
 - Designed stage 2
 - Implemented Stage 3

260 sites (sampled monthly)



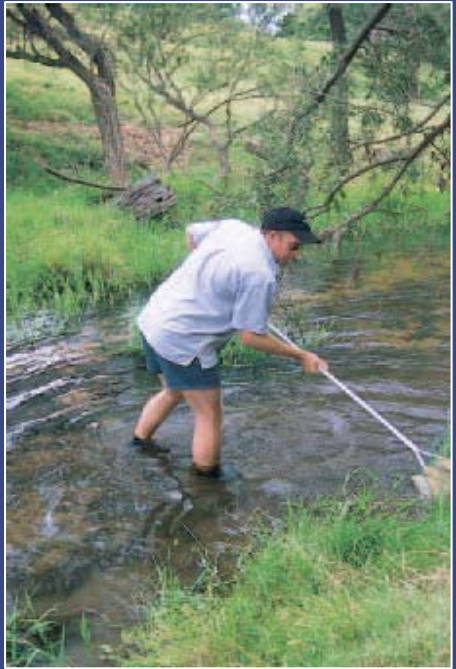
Ecosystem Health Monitoring Program



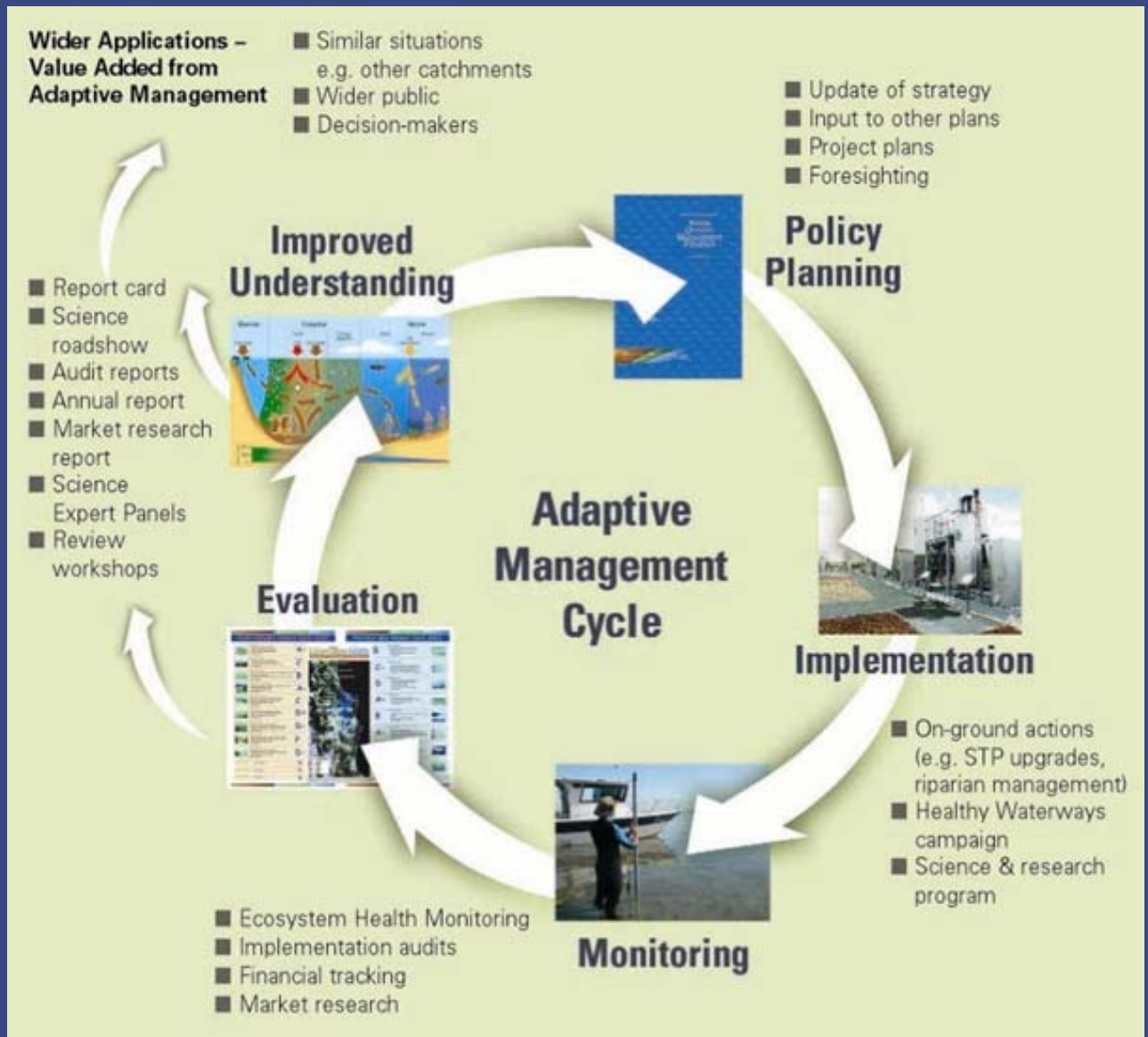
Freshwater EHMP - Designed stage 3 ; Implemented 2002



120 freshwater sites (sampled 2x/yr)

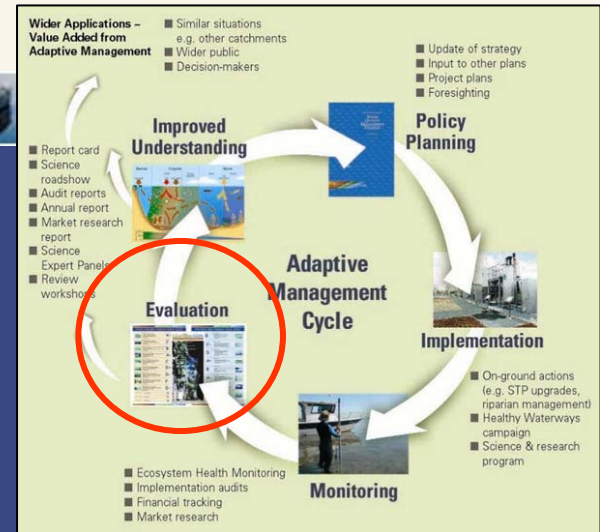


Adaptive management framework



- ongoing knowledge acquisition
- critical role of monitoring
- continuous improvement in the identification and implementation of management.
- effective communication of knowledge for policy/planning

Report cards on progress



Ecosystem Health Monitoring Program

A comprehensive monitoring program

The Ecosystem Health Monitoring Program (EHMP) delivers a regional assessment of ecosystem health for the waterways of South East Queensland. With its "catchment to coast" philosophy, the program targets both freshwater and estuarine/marine environments. In an area extending from Noosa in the north, south to the NSW border and west to Toowoomba. The EHMP uses rigorous science to identify waterway health incorporating a range of biological, physical and chemical indicators. The monitoring of appropriate indicators for the estuarine/marine component of the EHMP started in Moreton Bay in 1999, expanded north to the Sunshine Coast in 2001 and south to the Gold Coast in 2002, and now includes 250 monitoring sites. The EHMP expanded into the freshwater catchments in 2002, with a total of 120 freshwater sites now being monitored in South East Queensland's rivers and streams.

A partnership approach

The EHMP was established in response to requests by the 19 Local Governments and other stakeholders in South East Queensland for provision of an independent audit of the effectiveness of environmental protection and management measures undertaken by their agencies. The program is managed by the Moreton Bay Waterways and Catchments Partnership on behalf of the various stakeholders and is implemented by a large team of experts from the Queensland Government (Natural Resources and Mines, Environmental Protection Agency, Queensland Health Scientific Services), universities (University of Queensland, Griffith University) and CSIRO.

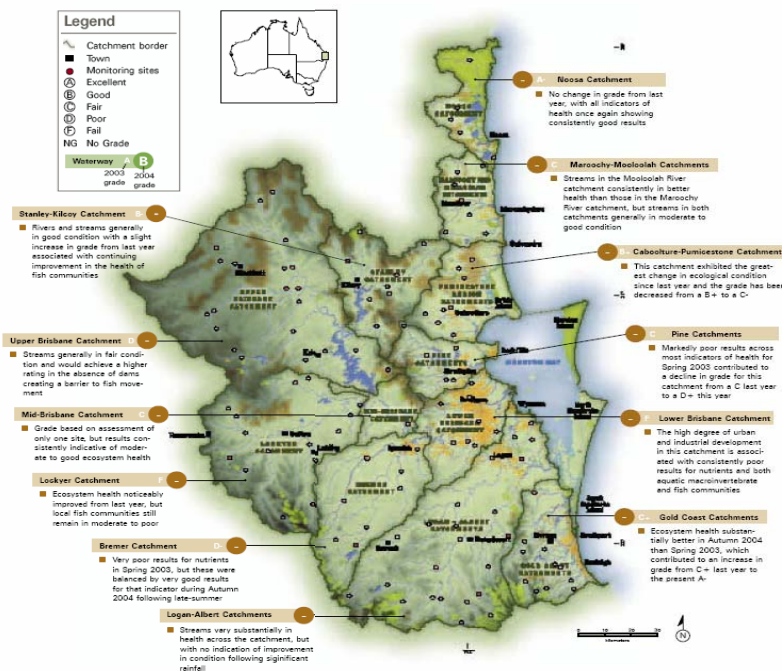
Integrated into an adaptive management framework

The EHMP reports on regional ecosystem health condition, which can be used to provide long-term feedback on the effectiveness of management actions undertaken to protect South East Queensland catchments, waterways and Moreton Bay, and to identify emerging issues that may require management intervention. To achieve this, the program is embedded into the Partnership's adaptive management framework that links monitoring to management objectives and regular review and evaluation of the effectiveness of our actions.

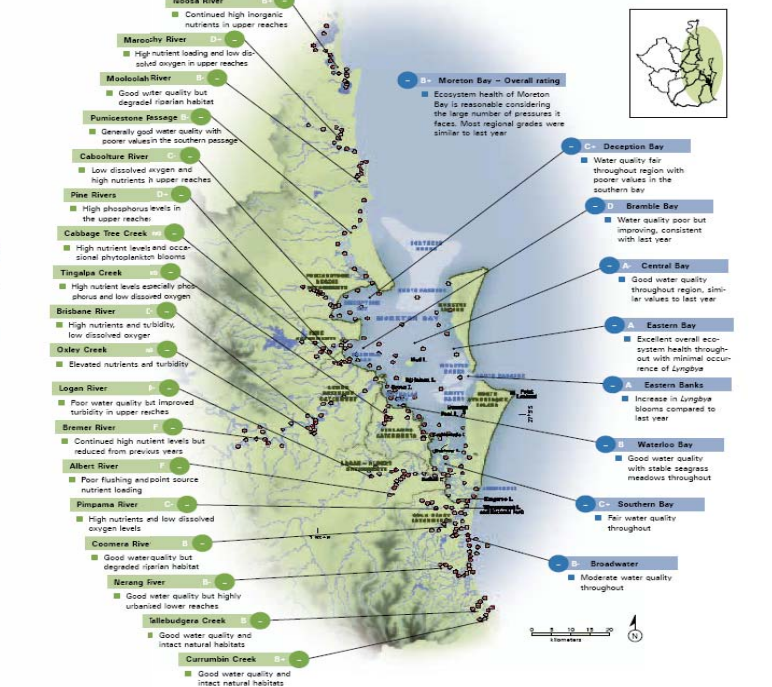
The EHMP has received national and international recognition, and is considered one of the best comprehensive marine, estuarine and freshwater ecosystem health monitoring programs in Australia.

Detailed information on the indicators and methods employed in the EHMP can be found in the Ecosystem Health Monitoring Program 2002-2003 Annual Technical Report published by the MBWCP, or by visiting the Healthy Waterways website at www.healthylwaterways.org.

Freshwater Report Card 2004



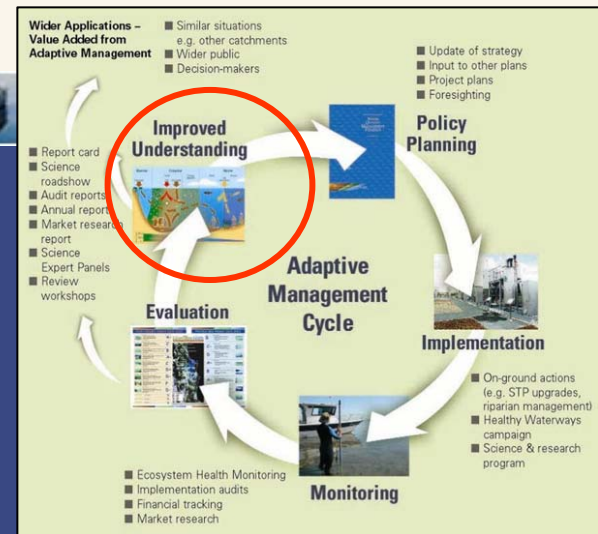
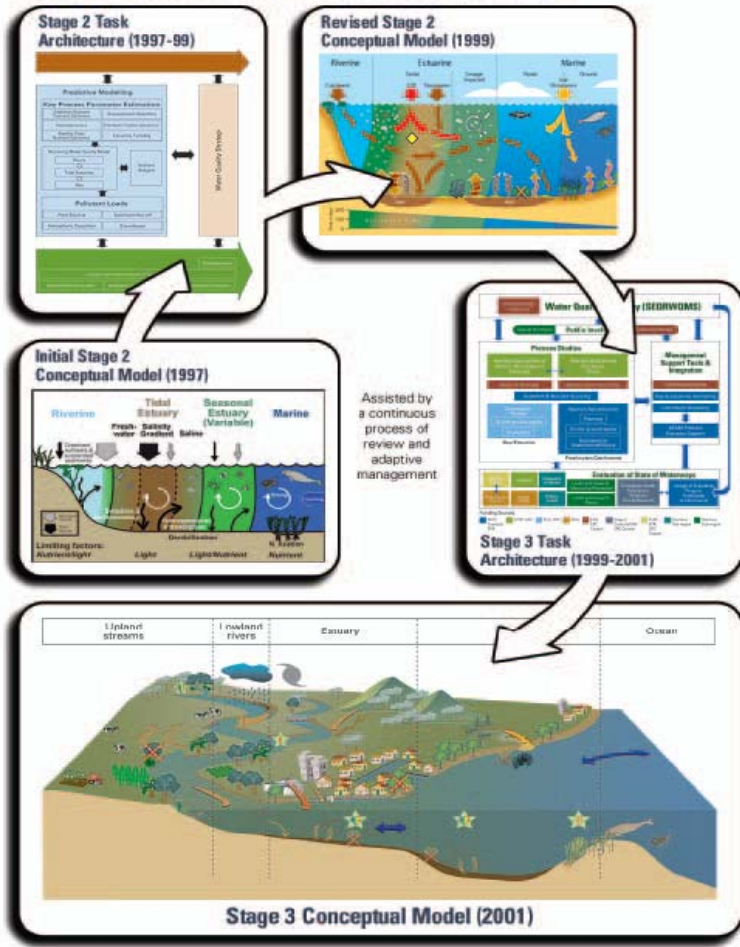
Estuarine and Marine Report Card 2004



Improvement of understanding

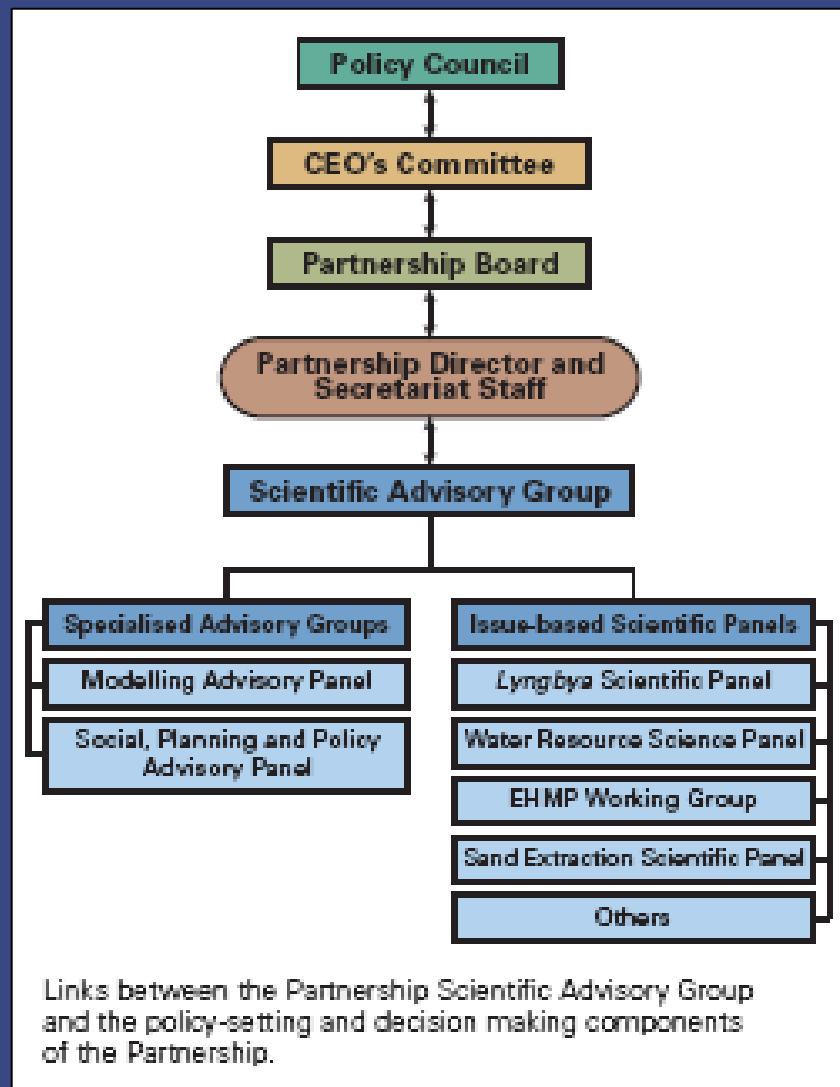


How our understanding of SEQ waterways evolved

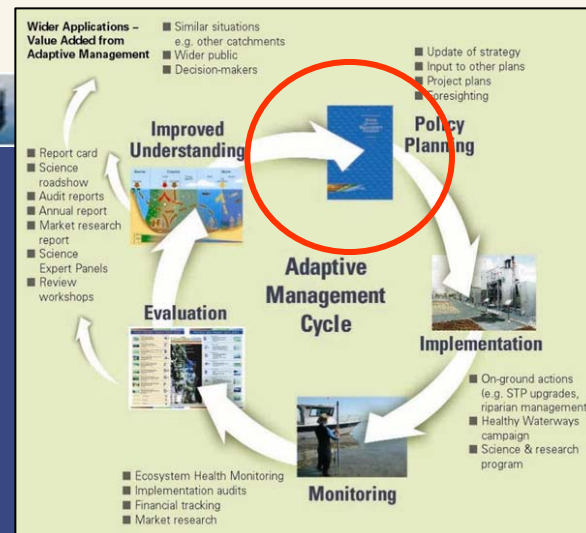


Continual refinement and testing of conceptual models

Links to policy



Links between the Partnership Scientific Advisory Group and the policy-setting and decision making components of the Partnership.



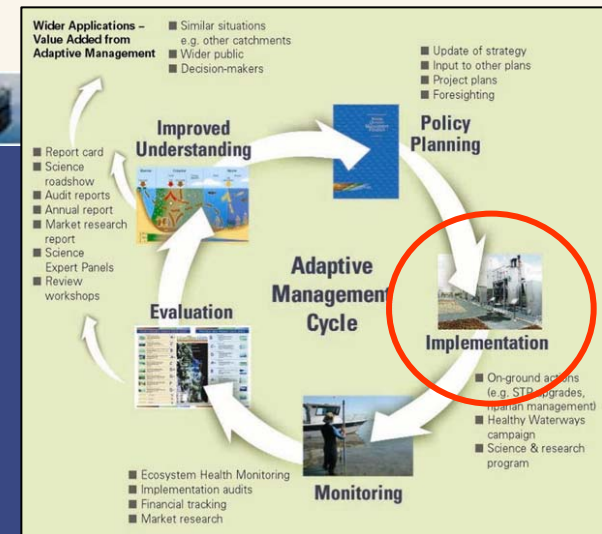
Strong link between science and policy makers



Targeted management actions



Sewage Treatment Plant upgrades



Stormwater Quality Improvement Devices

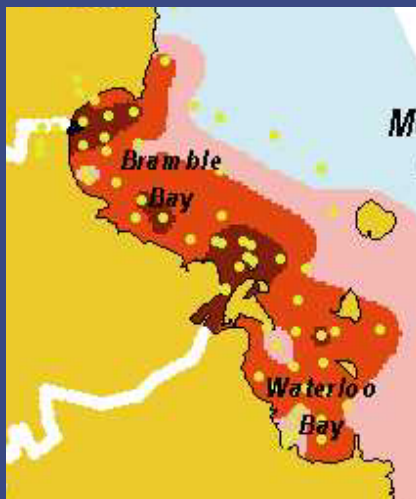
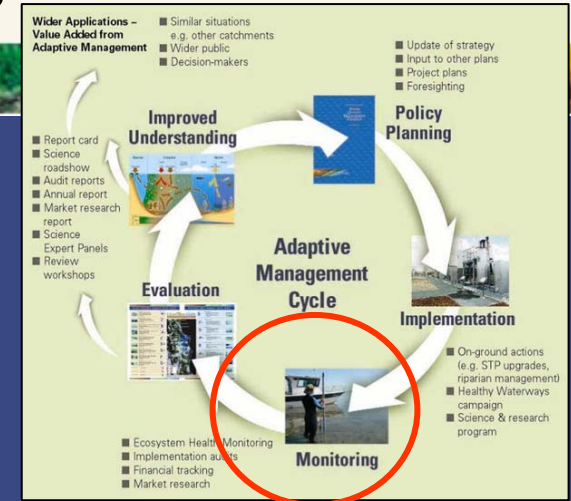
Riparian Rehabilitation



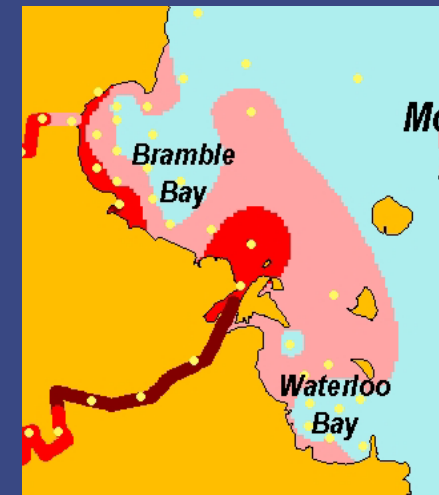
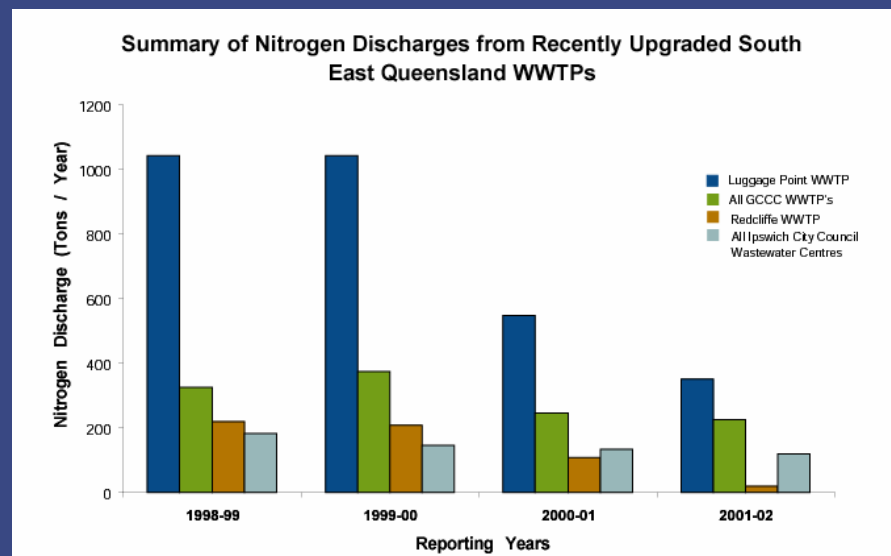
Effectiveness of management actions



~\$500M commitment by local government to reduce wastewater



$\delta^{15}\text{N}$ Sewage Plume 1998 (summer)



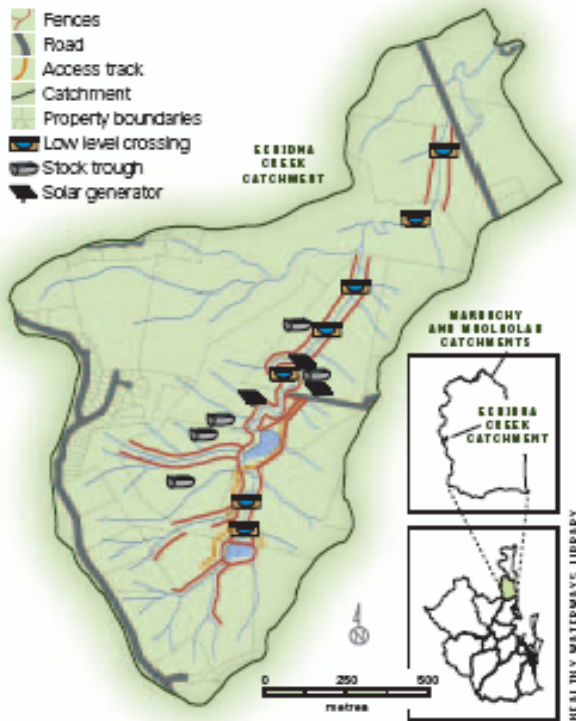
$\delta^{15}\text{N}$ Sewage Plume 2001 (summer)

Riparian rehabilitation experiments



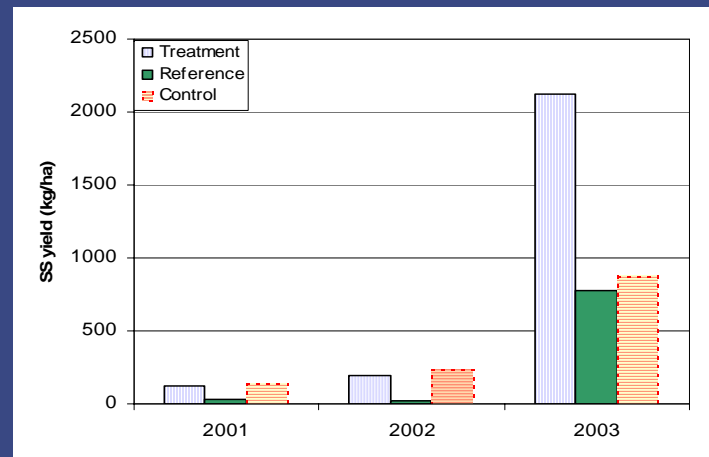
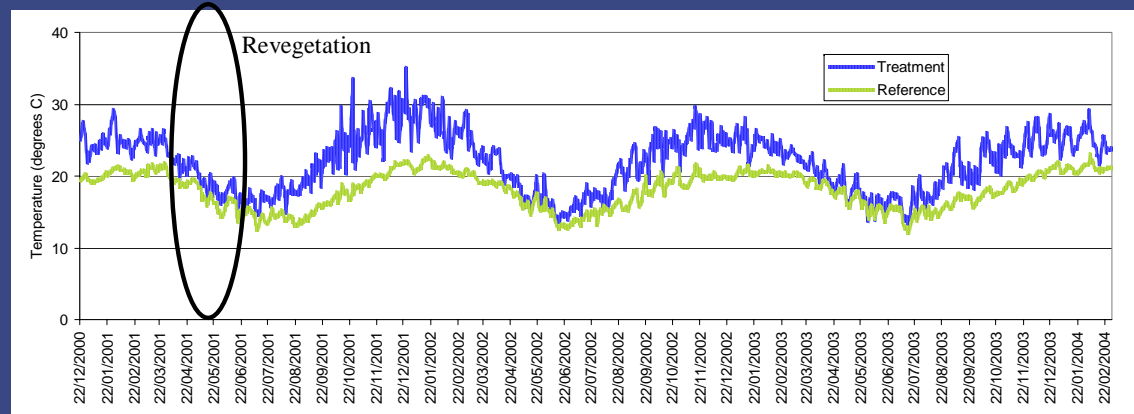
Echidna Creek case study

- Fences
- Road
- Access track
- Catchment
- Property boundaries
- Low level crossing
- Stock trough
- Solar generator



Echidna Creek, a tributary of the South Maroochy River, is a focal catchment in the riparian rehabilitation demonstration projects.

temperature regimes



sediment yield



November 2001

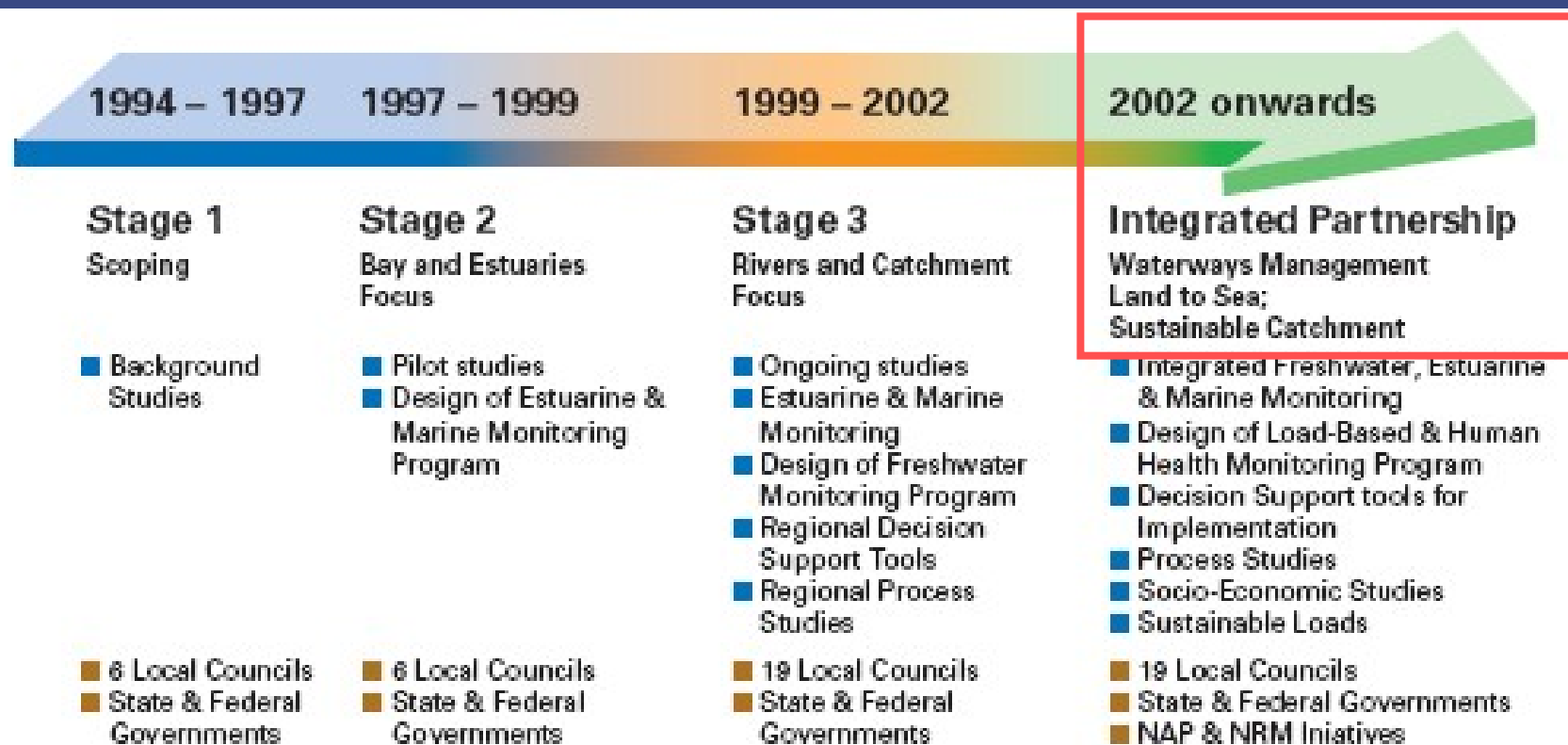


February 2003



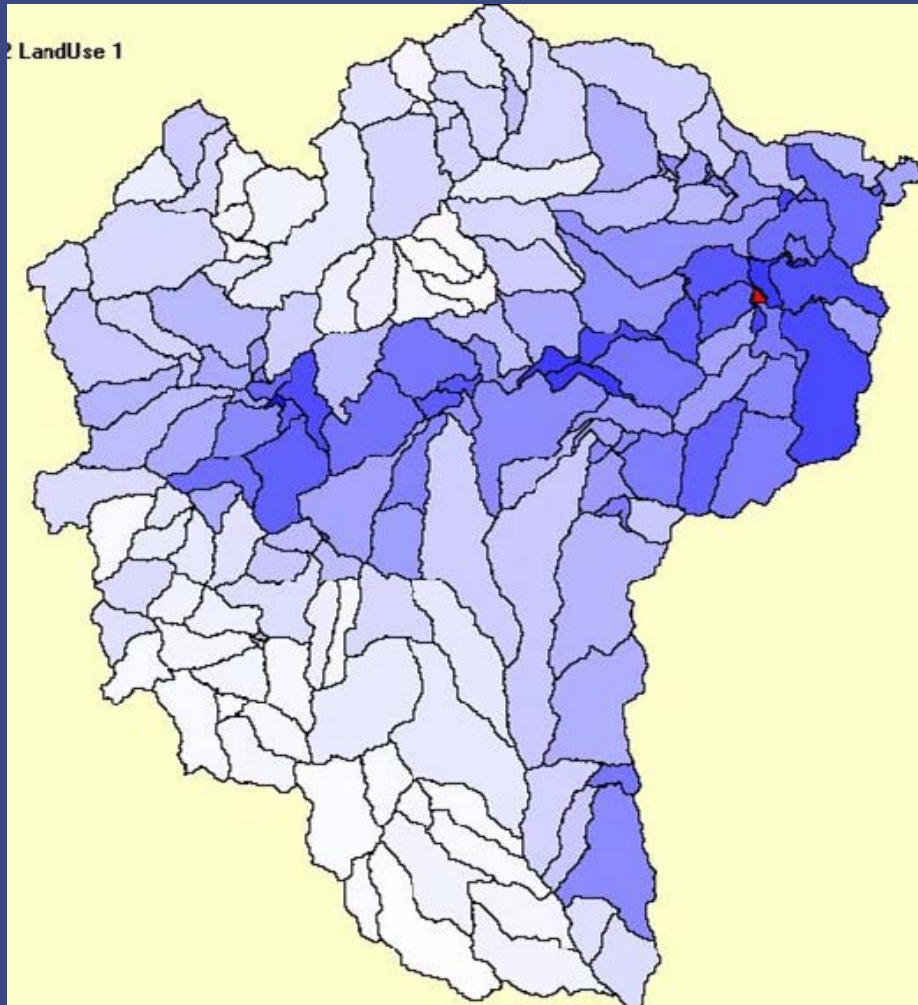
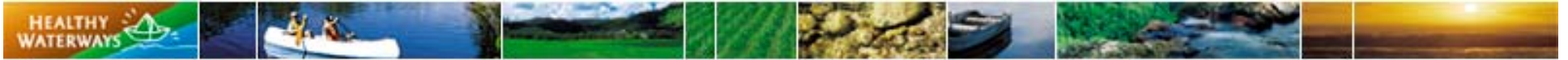
March 2004

The future

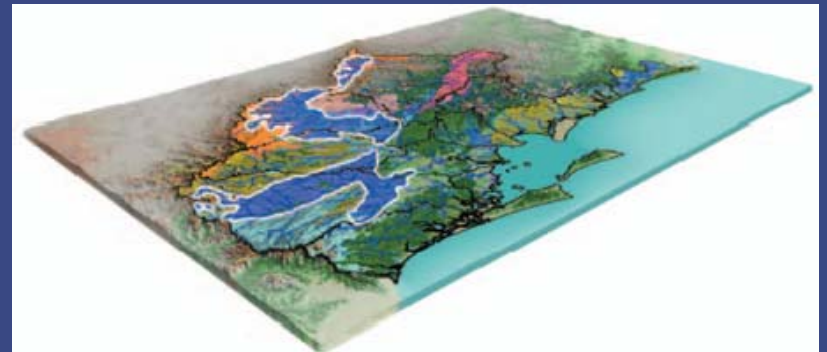


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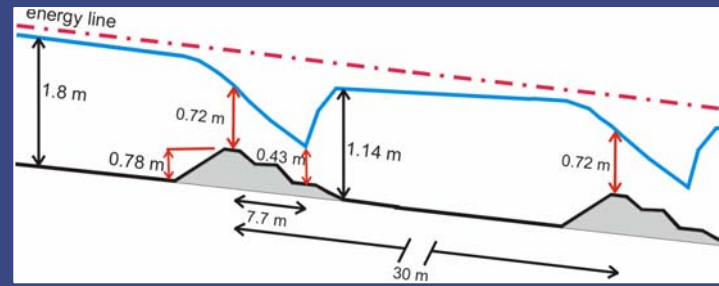
Subcatchment scale - 'priorities'



Ex. Lockyer Scoping Study
We can identify the areas which are exporting more sediment



What restoration is required?



channel/bank restoration?



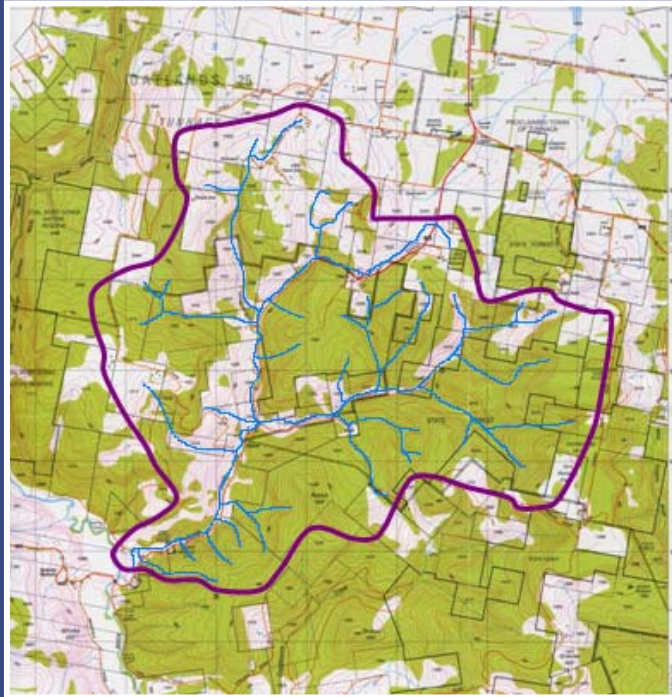
riparian revegetation?

gully stabilization?

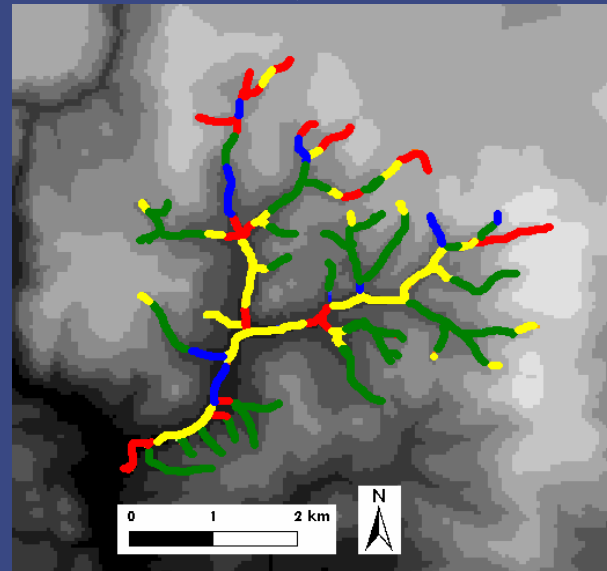


Also can provide this advice now

Where in the landscape?



- are there priority areas?
- eg high sediment yield
 - eg low riparian shade

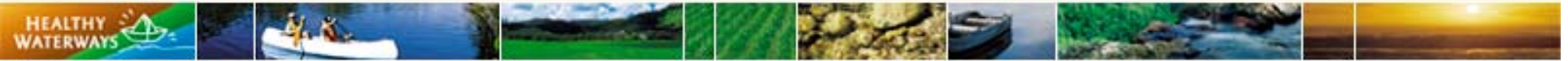


What is the optimum size and spatial arrangement of restoration?

- eg one large continuous section or several small ones?

Cannot fully answer this

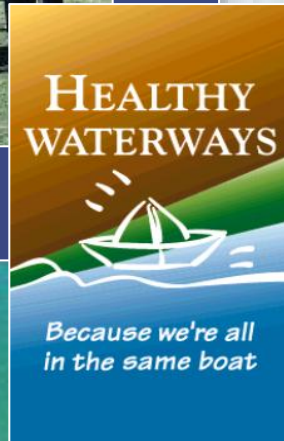
Summary - Key lessons



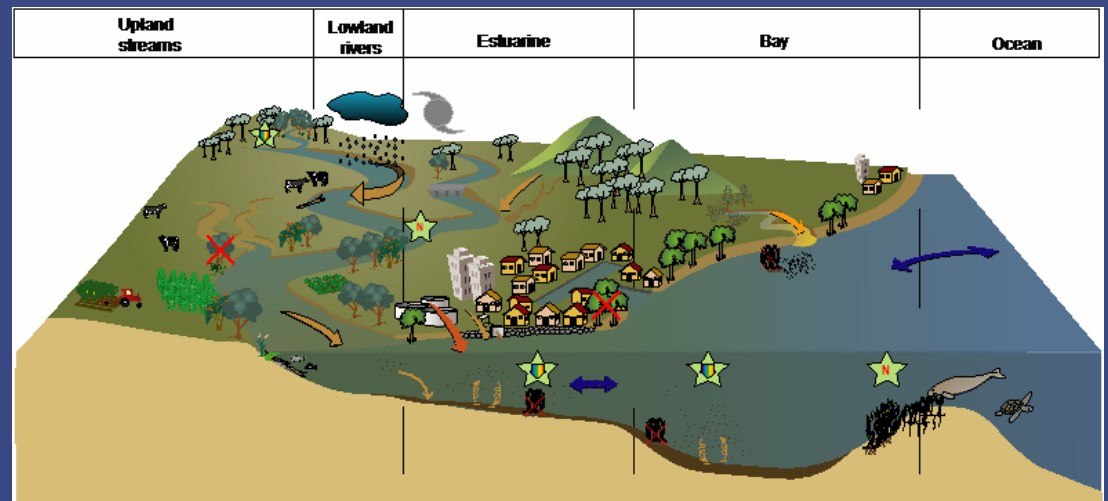
Common Vision



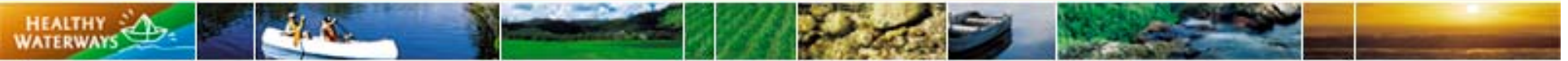
Committed Individuals



Defensible science and effective communication



Science involvement in cultural celebration



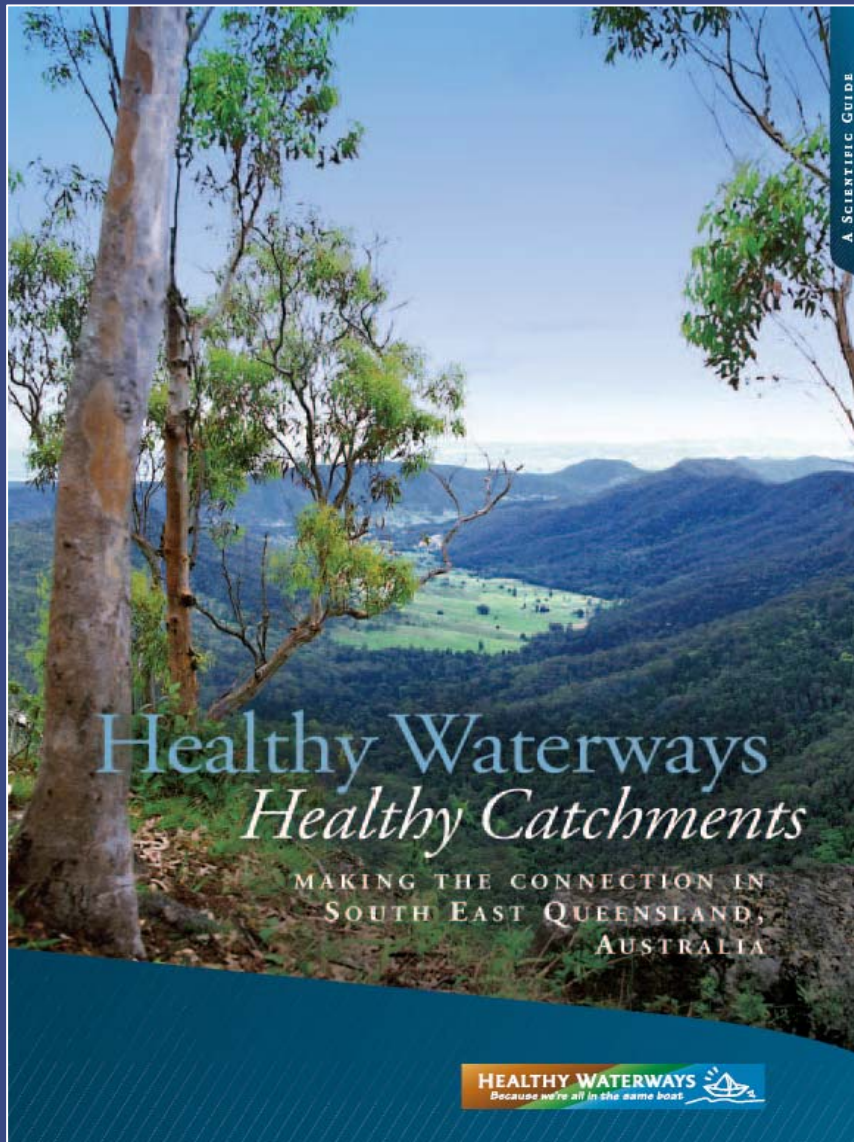
Annual Riverfestival and International Riversymposium



'Managing rivers with climate change and expanding populations'
4th - 7th September 2006

www.riversymposium.com

Science book - 2005



Thankyou



<http://www.healthywaterways.org>