Building Catchment Resilience (BCR) Tool

Water and WASH Futures

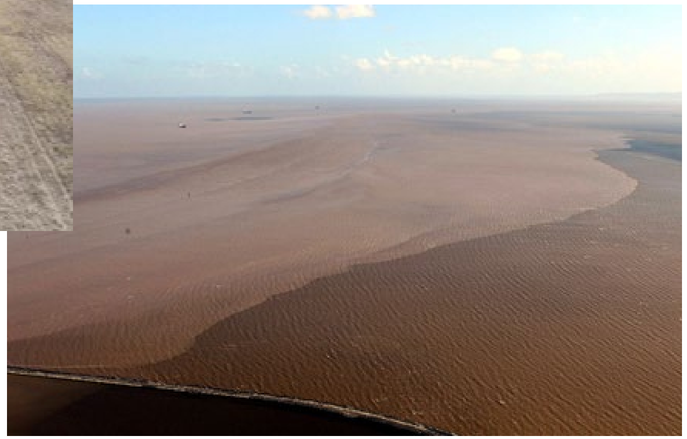
February 2023

https://www.catchmentresilience.org/

Diffuse pollution threatens our waterways and water security.
Without an integrated approach, there are likely to be significant ongoing environmental, economic and social costs

Local Impacts

- erosion of gullies and channels from intensifying rain events
- loss of valuable farmland
- flood damage to infrastructure



Further downstream

- increased costs of water treatment
- loss of water storage
- costs of dredging

Solutions are found upstream for impacts experienced downstream

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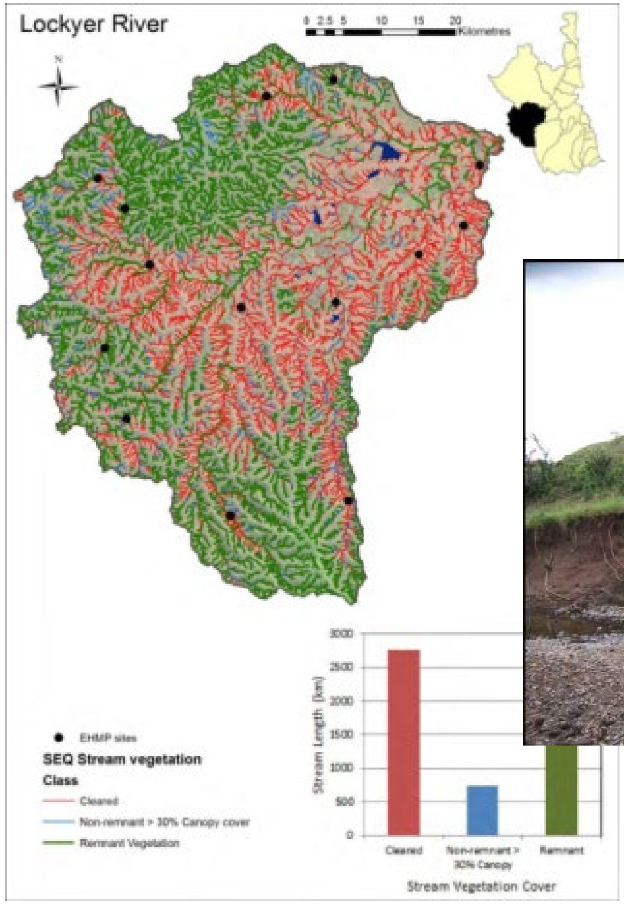
We understand the underlying causes

Clearing of catchment and riparian vegetation



Compounded by altered hydrology

Photos – Diane Bruhn

- Flashier flows in response to intense rain events
- Concentrated flow in gullies and channels

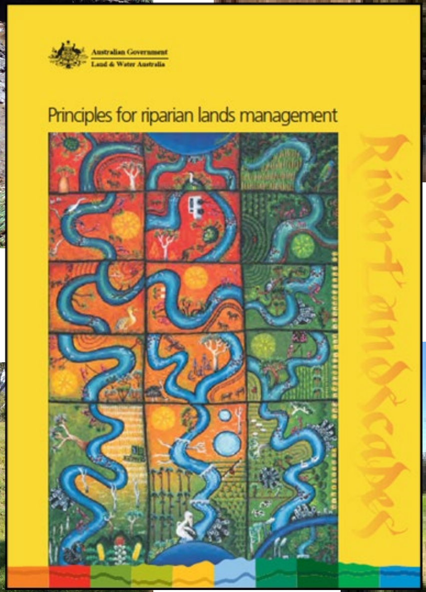
There are several on-ground actions we can take to improve catchment resilience

These include:

1. Riparian and riverbank rehabilitation (including revegetation, constructed pylon fields, to increase channel roughness)
2. Hillslope revegetation – including replanting, improved grazing and fire management
3. Gully remediation
4. Wetlands – reconnection; creation

These actions aim to slow the rate of flow; reduce erosion, and trap and transform nutrients and other pollutants

Q: What actions should we take and where is it best to do them?



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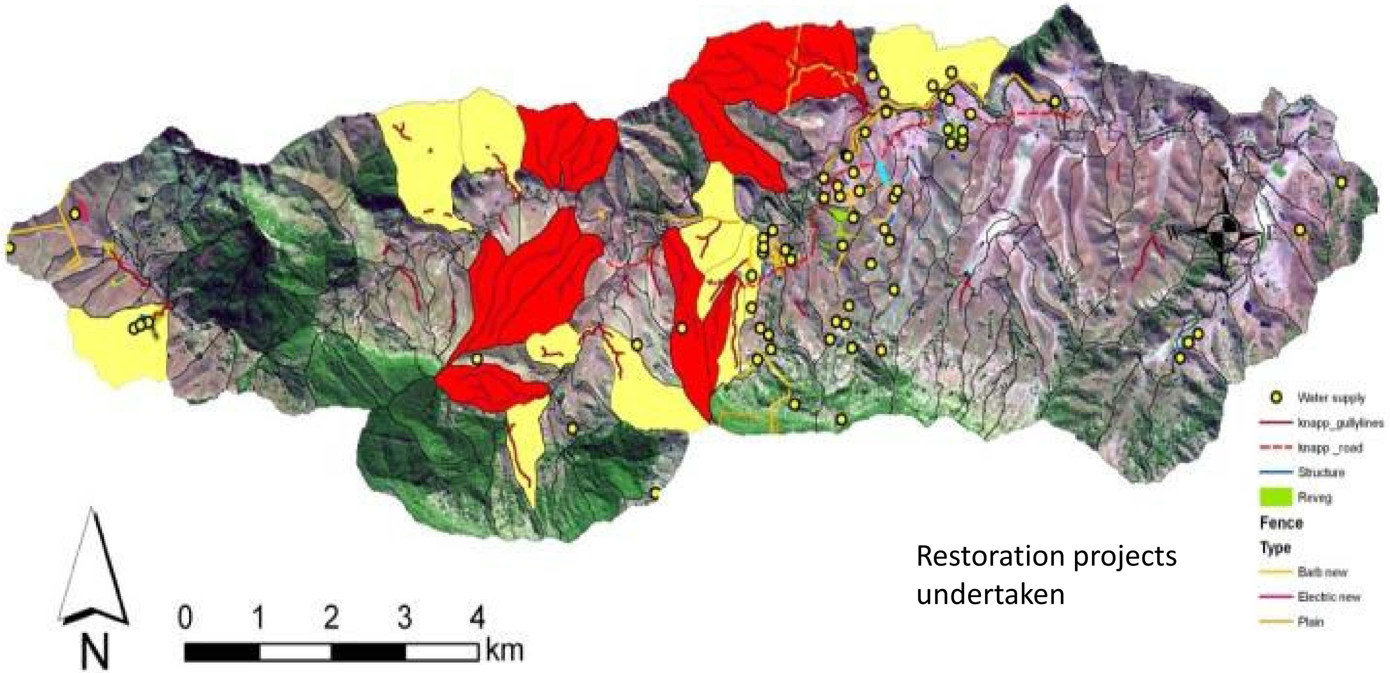
We need targeted investment.
To date, most investments have been poorly targeted and the benefits not fully quantified.

We often find most of the pollution comes from a small proportion of the channel network



Example from the Logan-Albert catchment:

- Red areas represent approx. 10% catchment area, and approx. 60% of sediment supply
- Yellow areas represent approx. 10% catchment area and approx. 20% of sediment supply
- Dots and coloured lines represent areas where investments have been made

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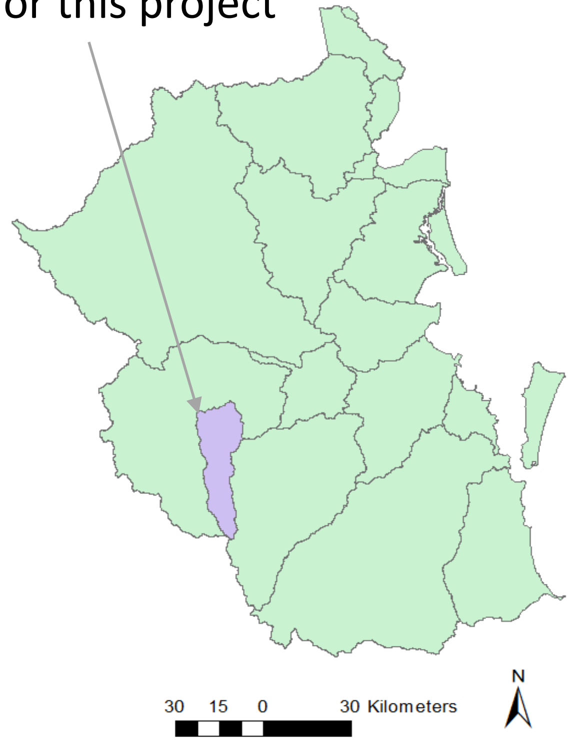
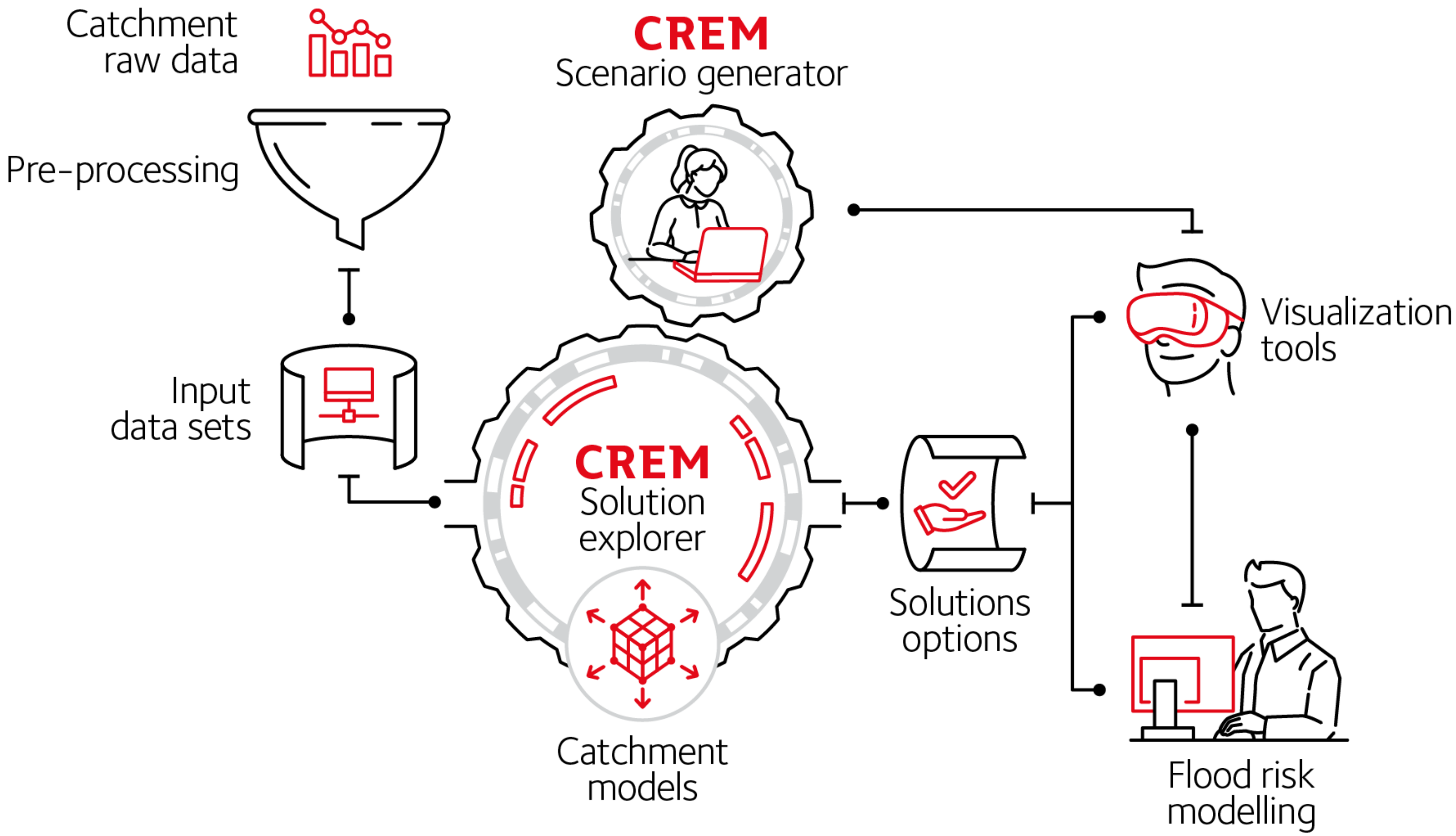
The Catchment Resilience tool has been developed to optimise investment in our catchments

Laidley Creek catchment was the focus for this project





Our aim was to develop a multi-objective investment tool with a visual interface to explore scenarios and trade-offs. Developed and tested in the Laidley Creek catchment but can be applied elsewhere.

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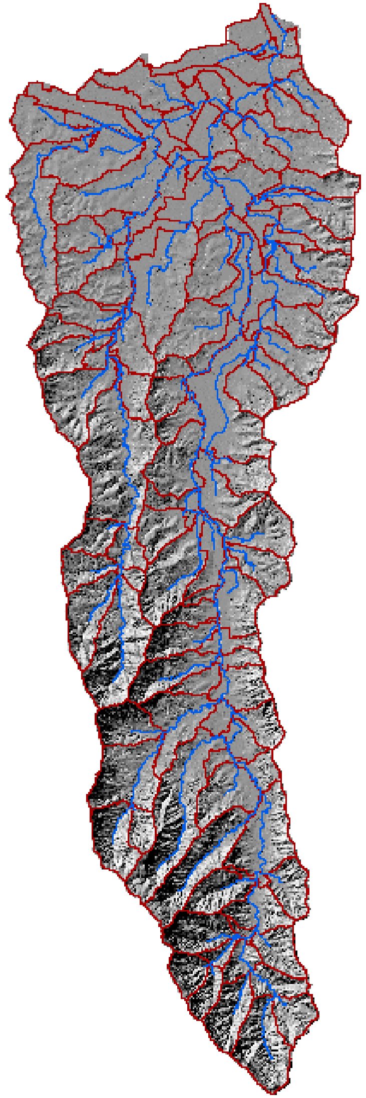
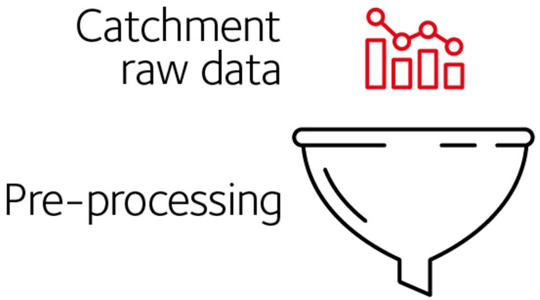
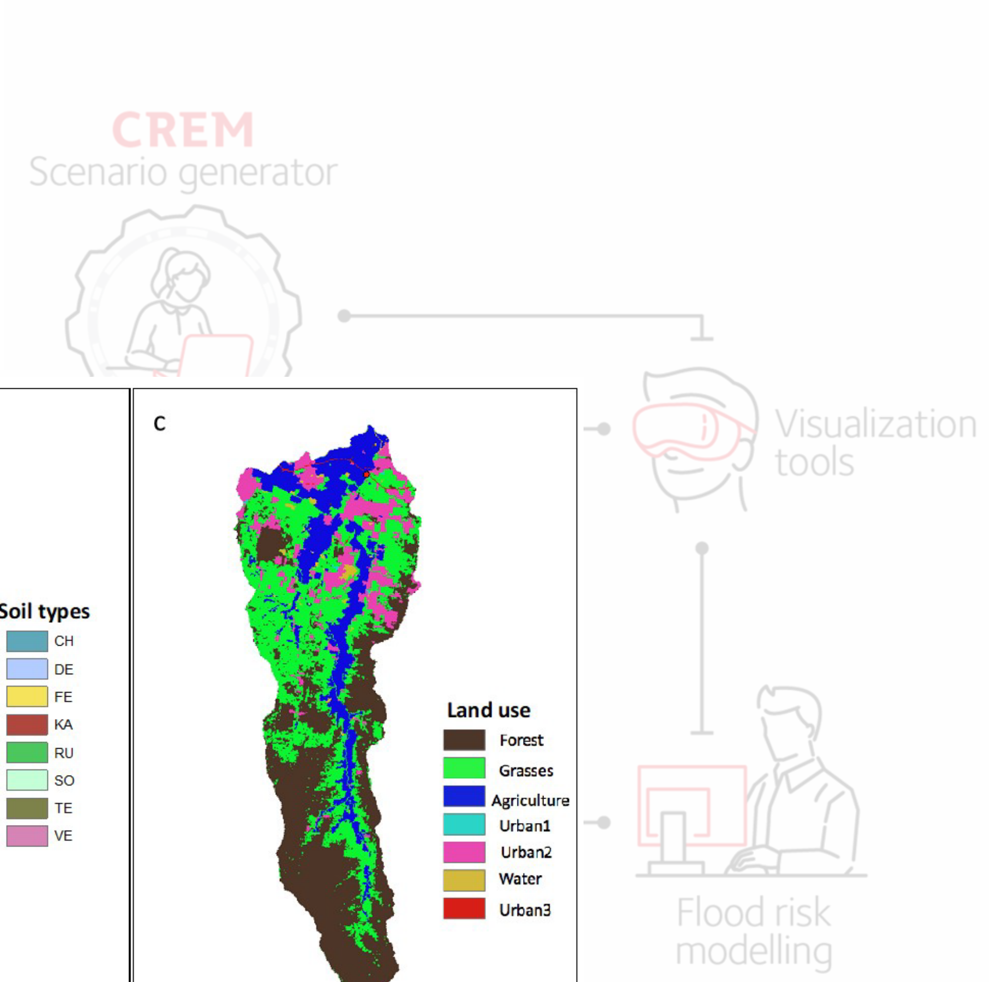
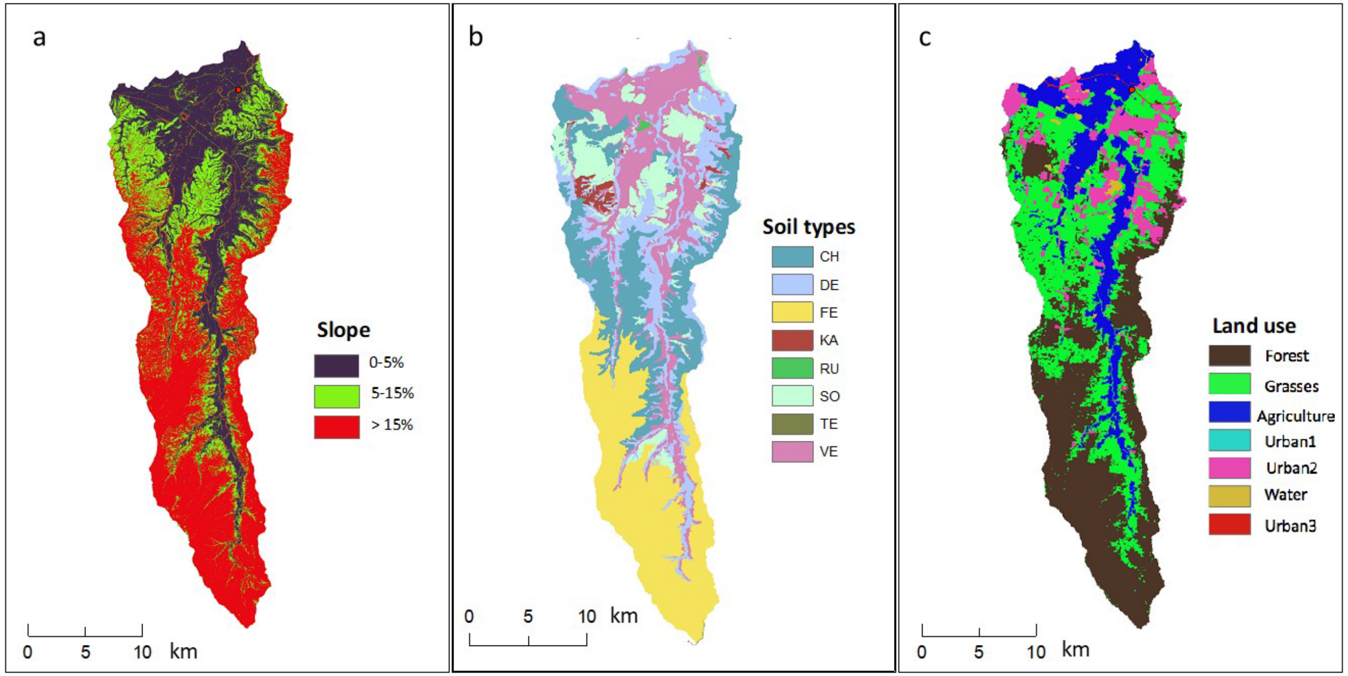
The tool builds on readily available catchment data sets









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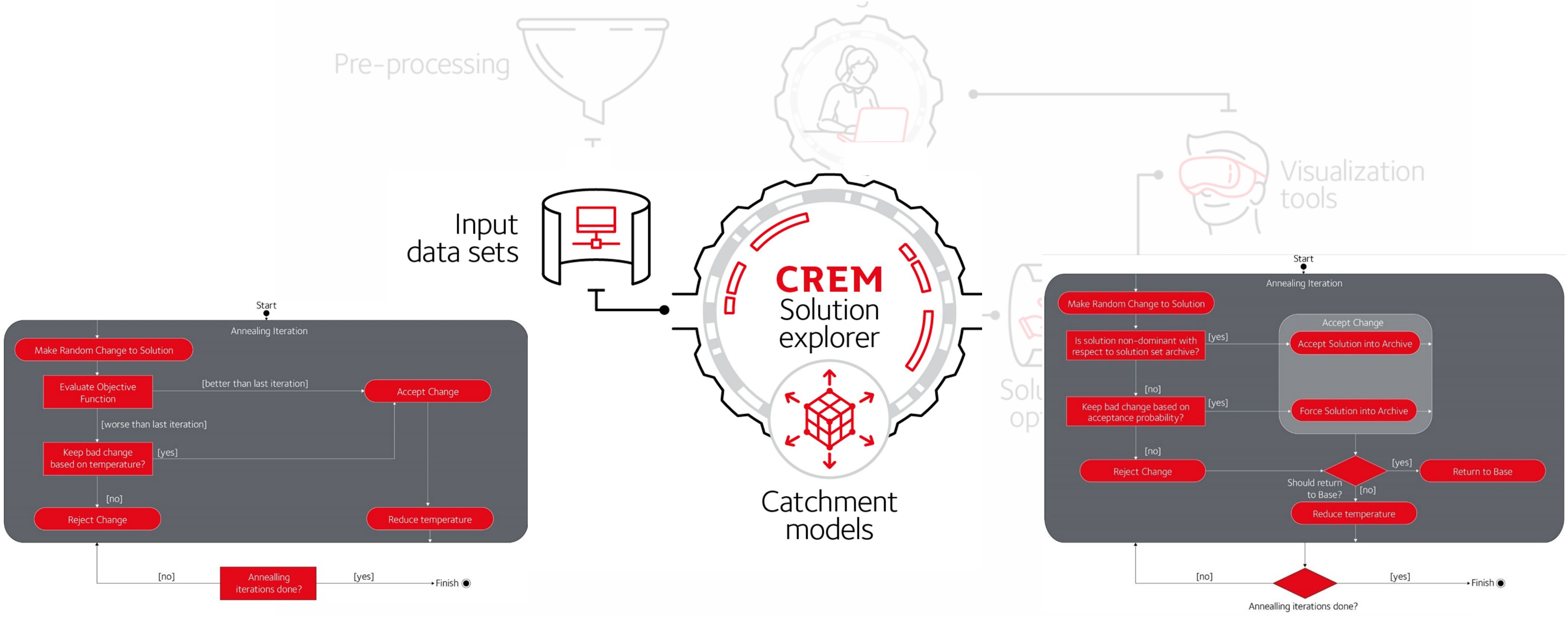
CREM Solution explorer houses the catchment models used to simulate the effect of various management actions

These are implemented with a view to optimise a management objective, or to identify useful trade-offs between several, possibly competing, objectives.



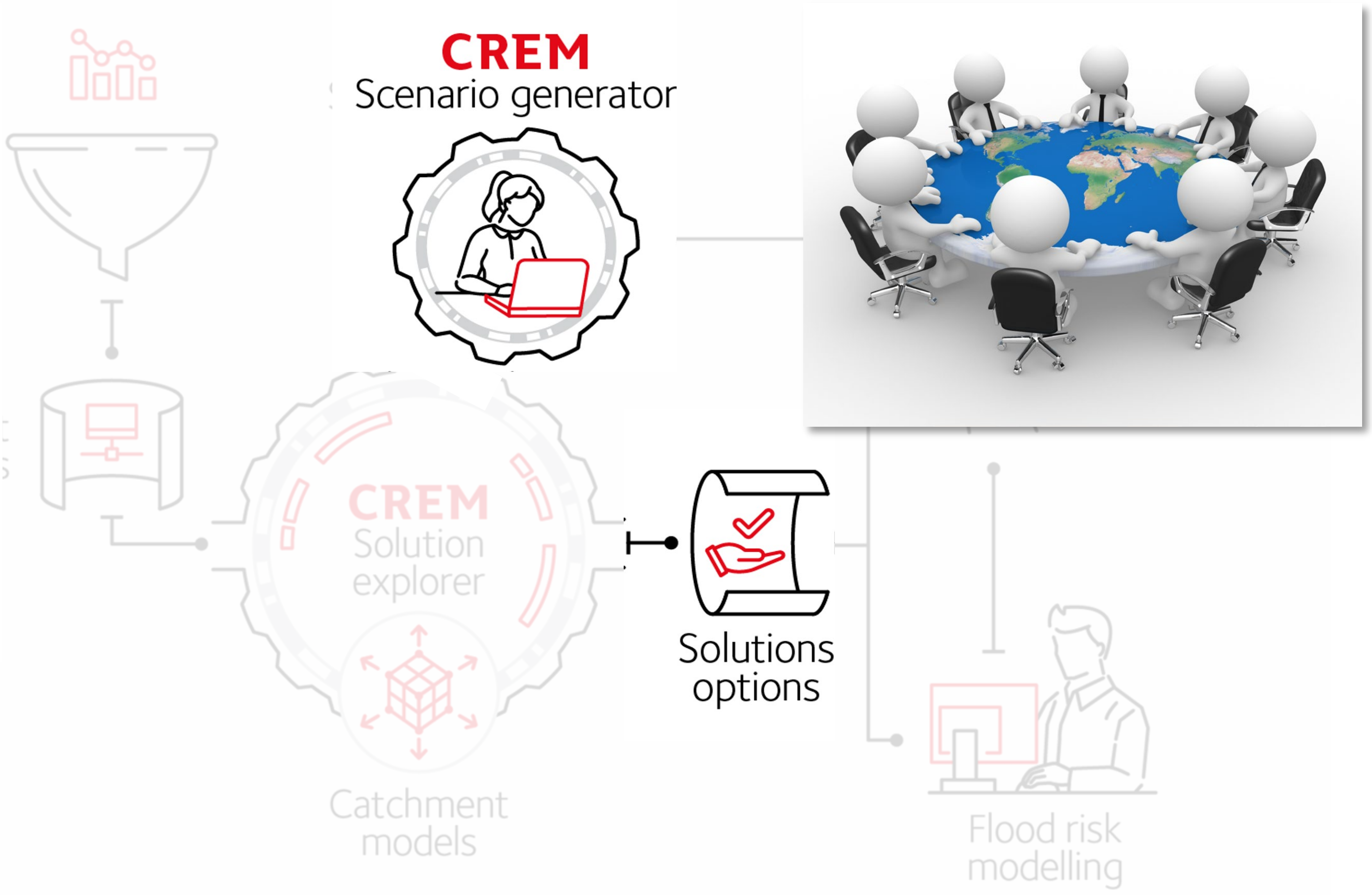
Single objective simulated annealing (SOSA)

Multi-objective simulated annealing (MOSA)

CREM Scenario generator allows stakeholders to build and load catchment planning scenarios

Some examples of the kinds of scenarios that can be explored:

- What trade-offs between implementation and opportunity cost will we find aim to halve sediment production?
- What trade-offs amongst pollutant production will we find with an implementation cost budget of $20M?



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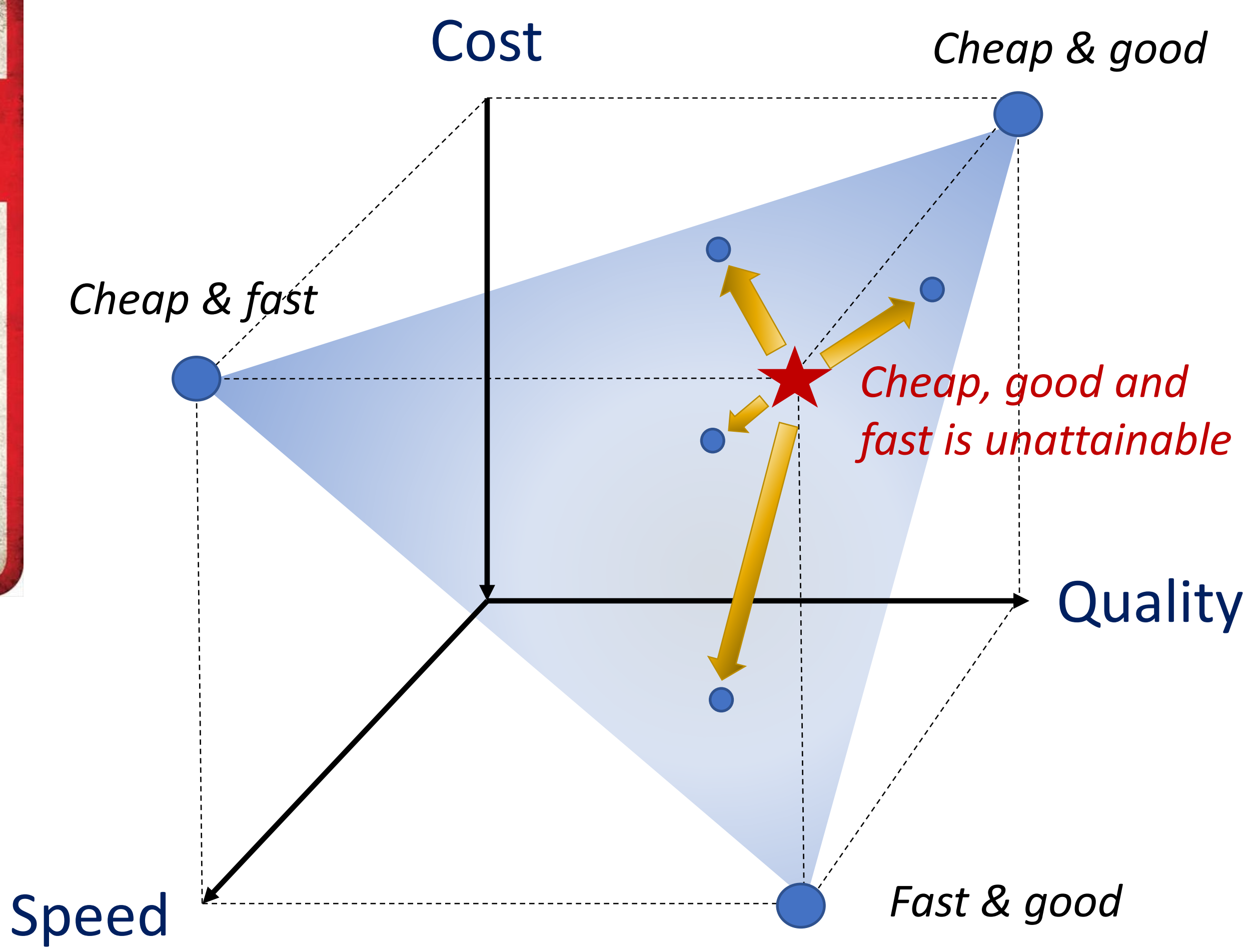
The models identify the optimal solutions



There is a range of options you could choose, depending on how you wish to trade off cost, speed or quality.

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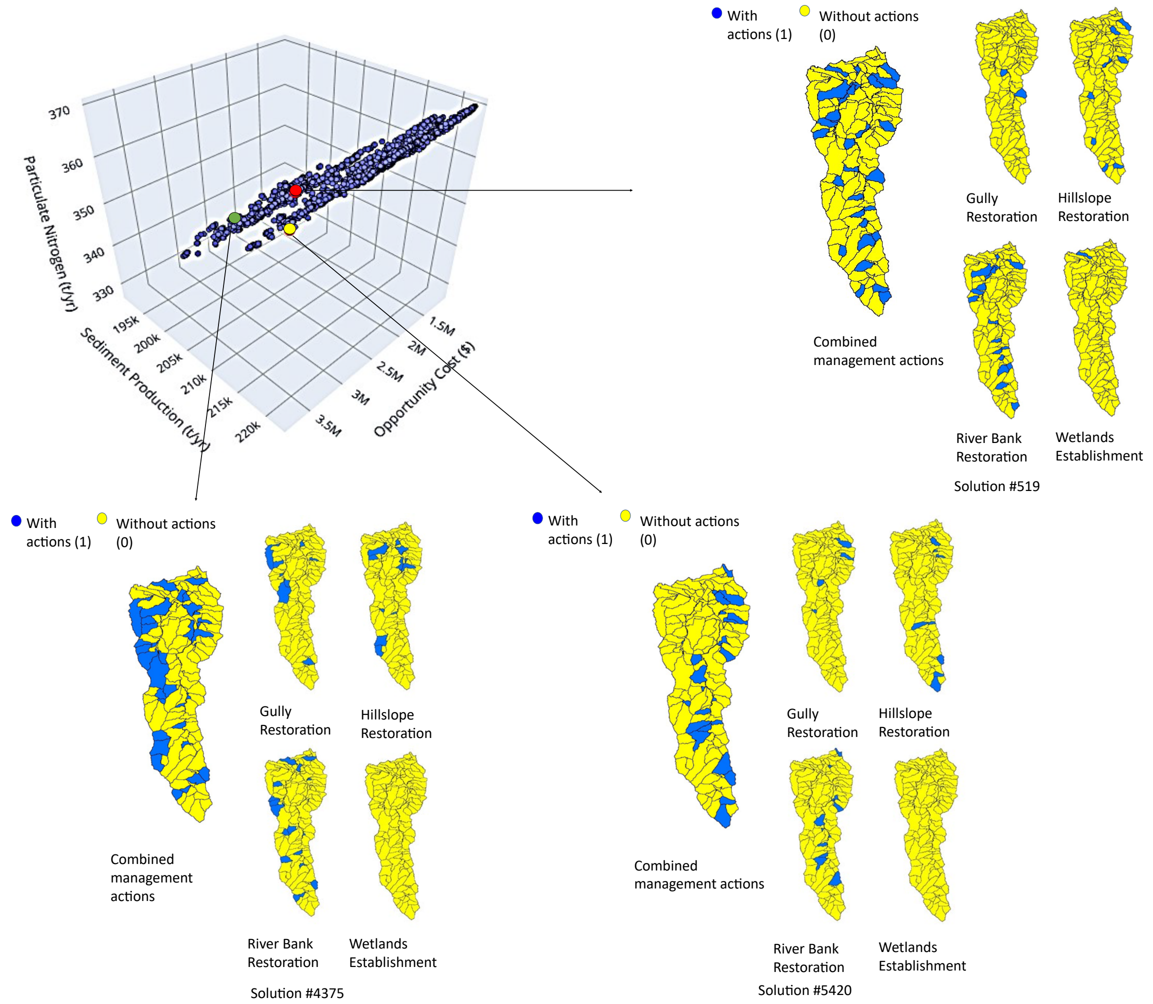
For any scenario, a range of optimal solutions can be considered

e.g. Scenario:

What range of outcomes for sediment and nitrogen reduction can we achieve with an implementation cost budget = $20 million?

	SEDIMENT PRODUCTION (T/YR)	NITROGEN LOAD (T/YR)		COSTS ($)		DESCRIPTION
		Dissolved	Particulate	Implementation	Opportunity	
Current state	222,991	176	371	0	0	No actions
Solution #519[1]	207,169 (7%)	165 (6%)	352 (5%)	19,984,399	2,340,376	Low DN option
Solution #4375[1]	191,060 (14%)	168 (4%)	333 (10%)	19,883,584	2,090,764	Low sediment option
Solution #5420[1]	196,028 (12%)	171 (3%)	327 (12%)	19,395,545	1,451,665	Low PN option

Nitrogen offset = $5.74m / yr (@$120 kg)
Carbon credit ~$9m over 25 years



* Opportunity Cost = income foregone by not using that land for its current purposes and reflects a minimum amount of compensation required to implement a management option in a location

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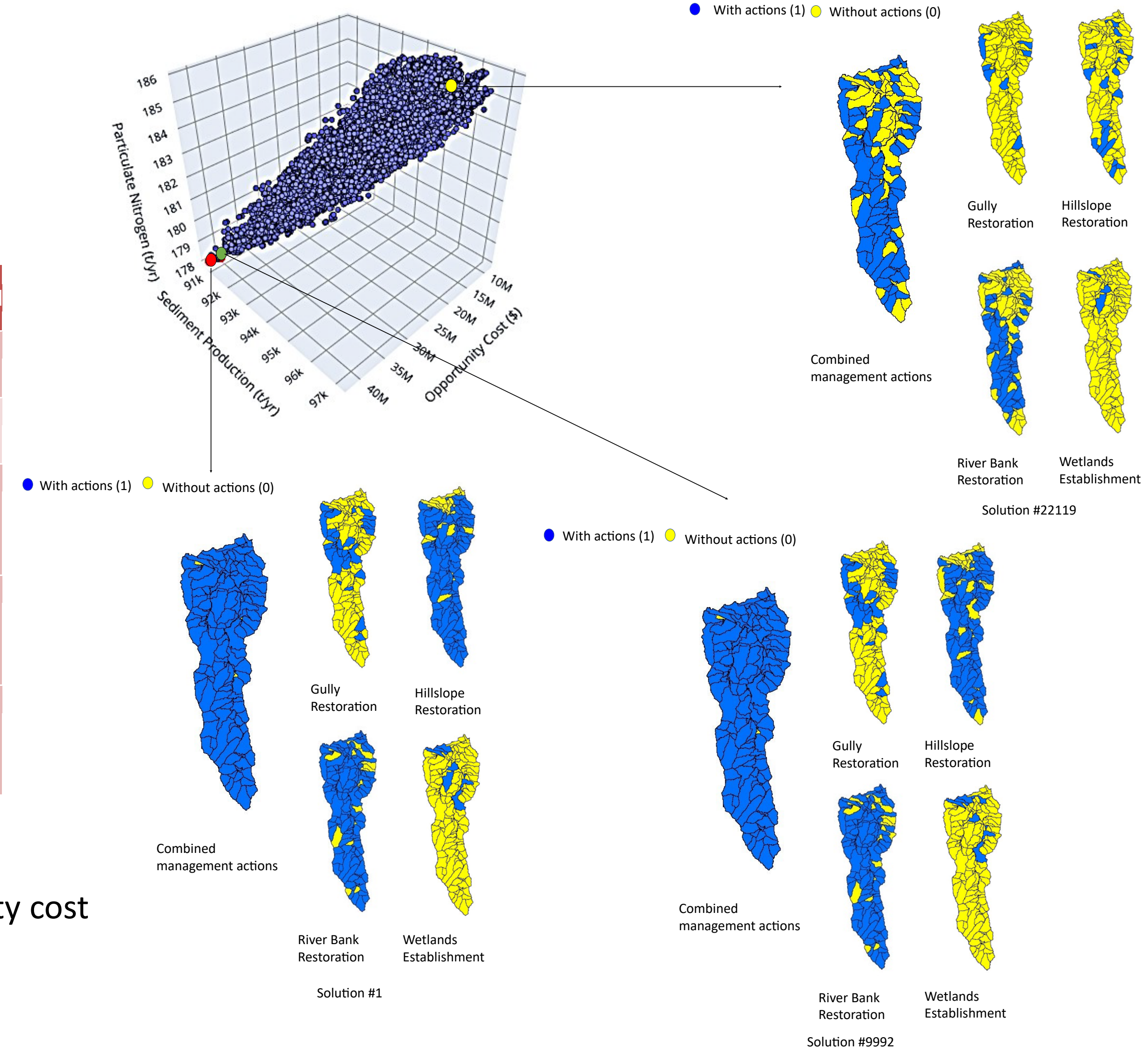
For any scenario, a range of optimal solutions can be considered

e.g. Scenario:

What are the costs and benefits associated with halving the particulate nitrogen load?

	SEDIMENT PRODUCTION (T/YR)	NITROGEN LOAD (T/YR)		COSTS ($)		DESCRIPTION
		Dissolved	Particulate	Implementation	Opportunity	
Current state	222,991	176	371	0	0	No actions
Solution #1	90,746 (59%)	88 (50%)	178 (52%)	417,178,083	41,934,098	Min DN
Solution #9992	90,829 (59%)	90 (49%)	178 (52%)	399,732,159	40,123,490	Min SED
Solution #22119	95,512 (57%)	133 (25%)	185 (50%)	116,333,026	12,800,043	Min Imp



Ambitious target with high implementation and opportunity costs but with considerable benefits. Main trade-off is between dissolved N and opportunity cost

Nitrogen offset = $33.6m / yr (@$120 kg)
Carbon credit ~$31m over 25 years

Sediment reduction >50%
Flood risk reduction

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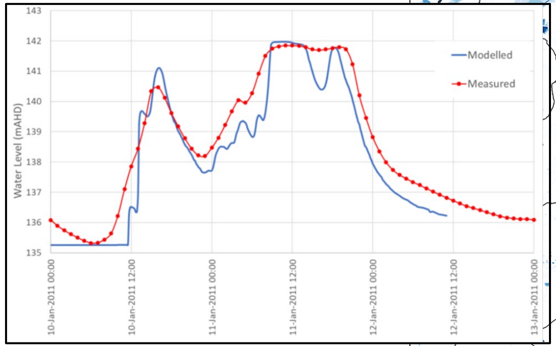
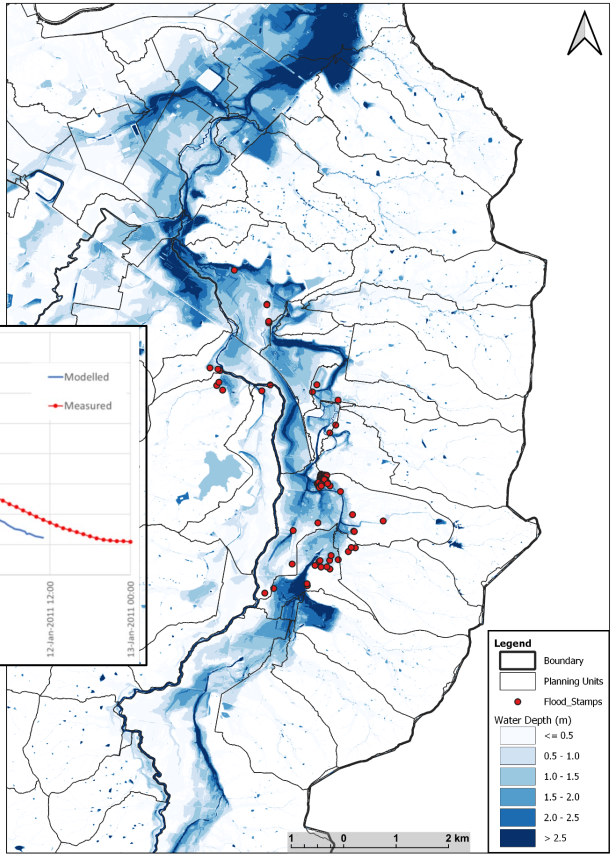
We can use the proposed catchment solutions to explore other benefits – including flood risk

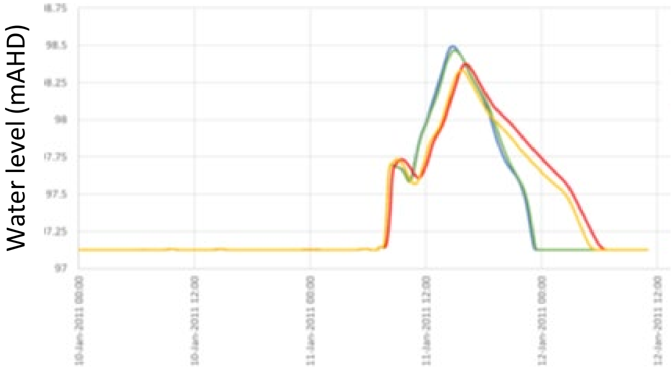
Flood risk modelling





Rain-on-grid model of 2011 flood

Downstream at Laidley

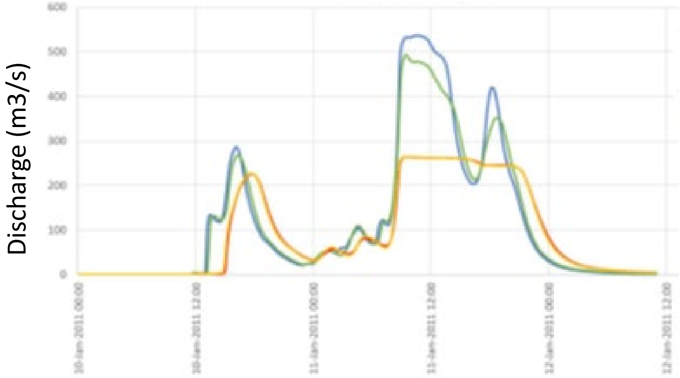


Scenarios:

- Base case 2011
- $20m investment
- Halve N load – high cost
- Halve N load – low cost

(Halve N load scenarios) reduce flood levels by at least 10cm, delaying the peak by approximately one hour

Upstream at Mulgowie



Scenarios:

- Base case 2011
- $20m investment
- Halve N load – high cost
- Halve N load – low cost

(Halve N load scenarios) reduce in stream discharge flow rates by approximately 50%

Also estimate other catchment-scale benefits:
e.g. river health score

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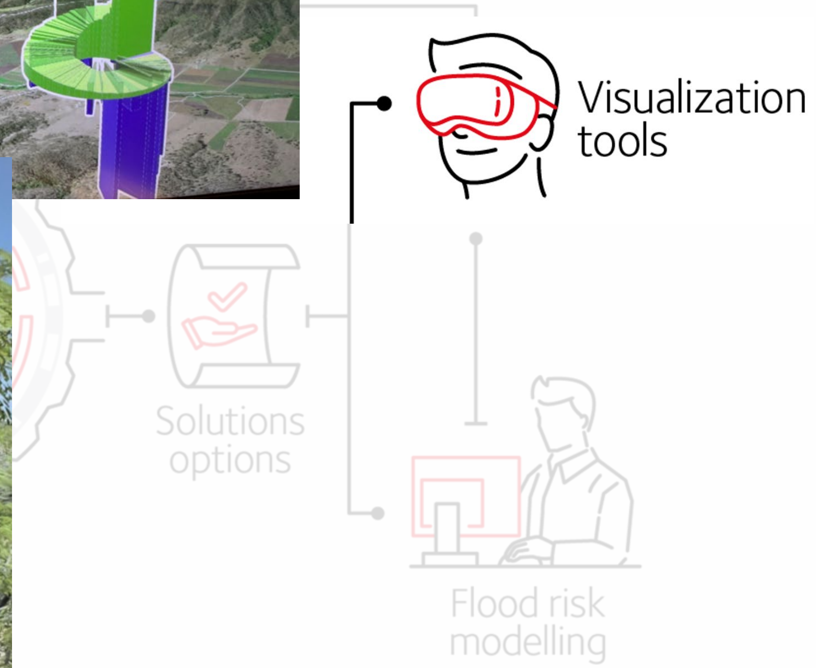
Visualization tools



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Thank you

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https://www.catchmentresilience.org/

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