



The place of freshwater research in NZ science

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WaterNZ, 20 September 2017



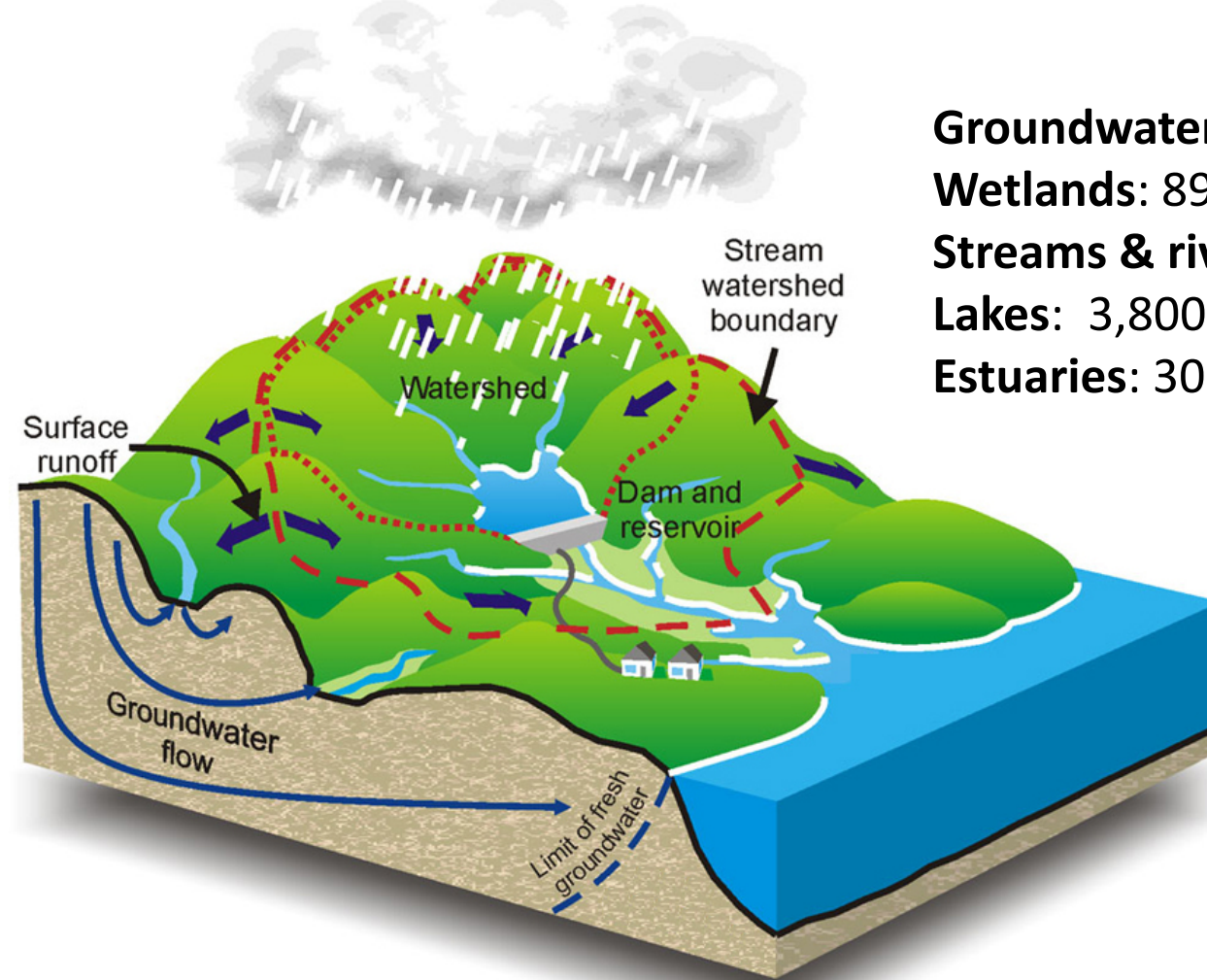
Outline

Our freshwaters

Research funding types and opportunities to interact

National Hydrological Project and related flow management tools

Our Freshwaters

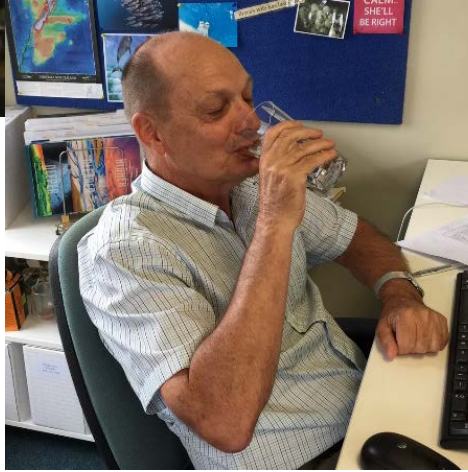


Groundwater: 600 billion m³
Wetlands: 89,000 ha = 10% of original
Streams & rivers: >413,000 km
Lakes: 3,800 lakes >1 ha
Estuaries: 300

Freshwaters – “a hinge of Maori heritage” *Sir Tipene O'Regan*

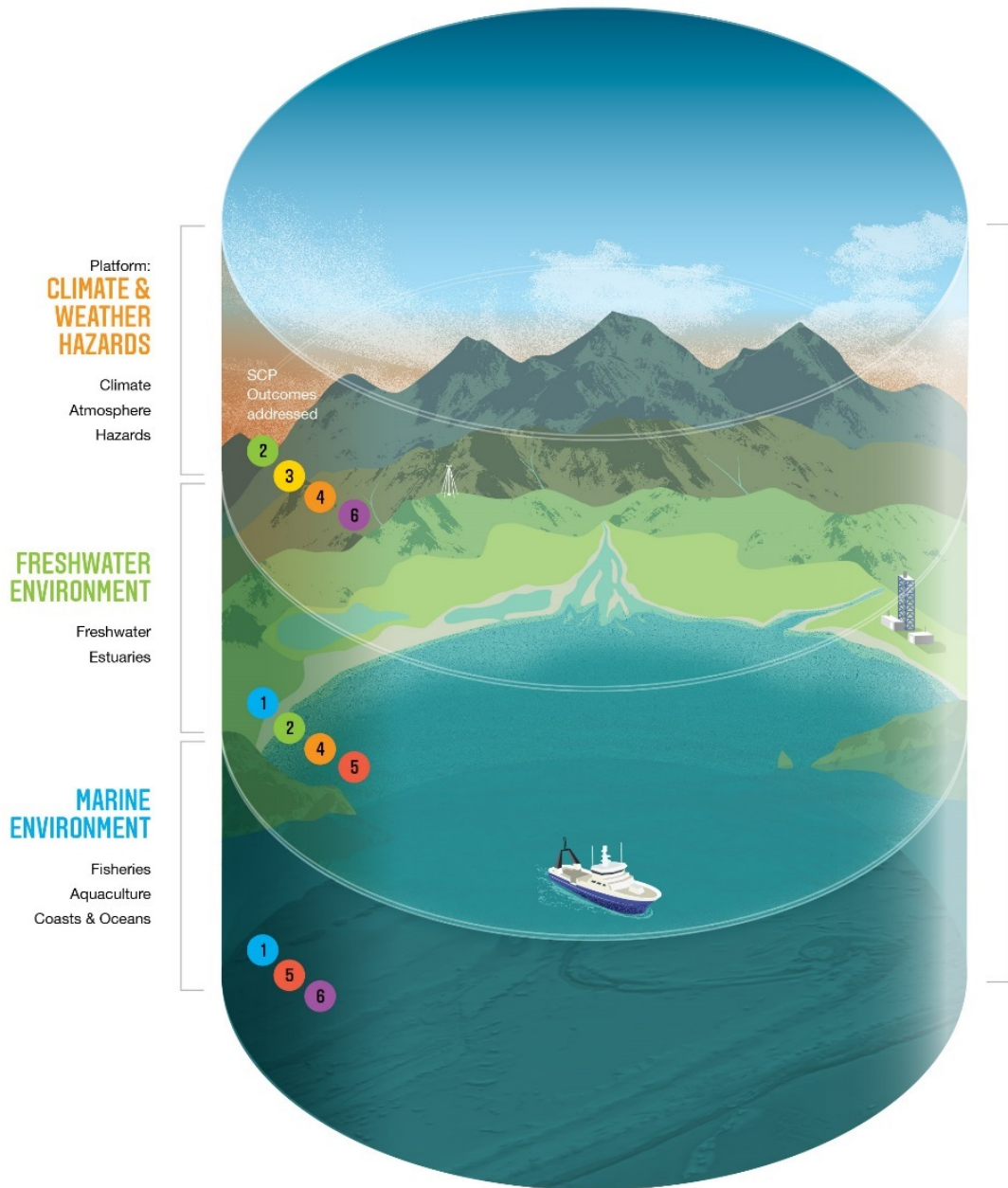


Freshwater ecosystem services – many \$B/y

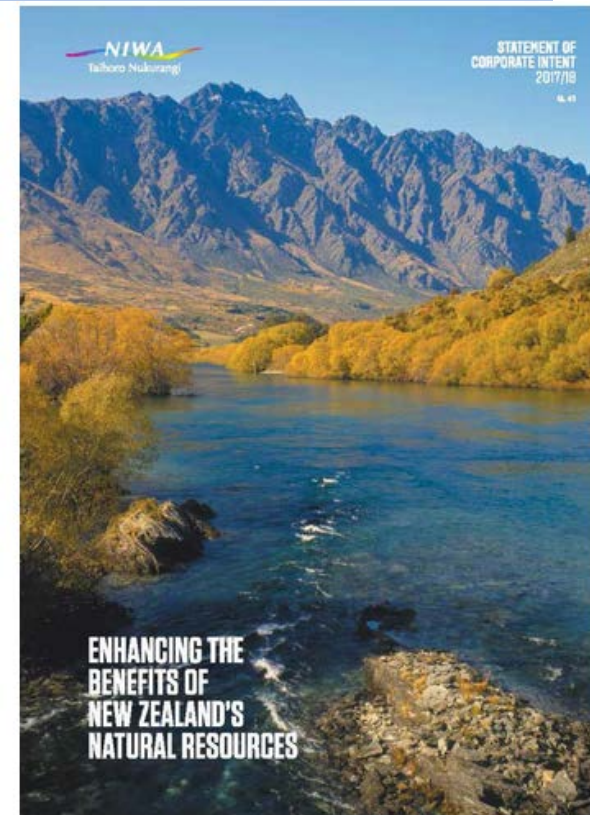


NIWA's science platforms

- 3 science platforms:
- **Climate & Hazards:** c. 223 staff, \$39M/yr
 - **Freshwater:** c. 232 staff, \$34M/yr
 - **Marine:** c. 255 staff, \$55M/yr of coast & ocean, fisheries, and aquaculture science



Environmental Information
Te Kūwaha (Māori development)
Pacific Rim

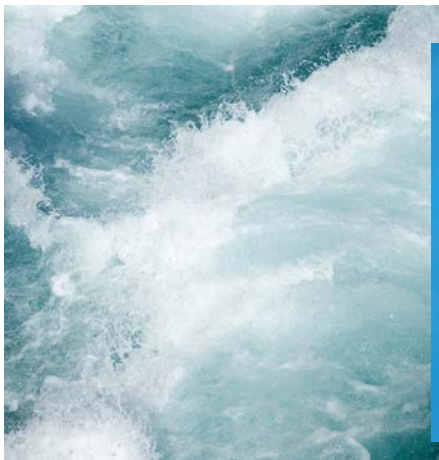
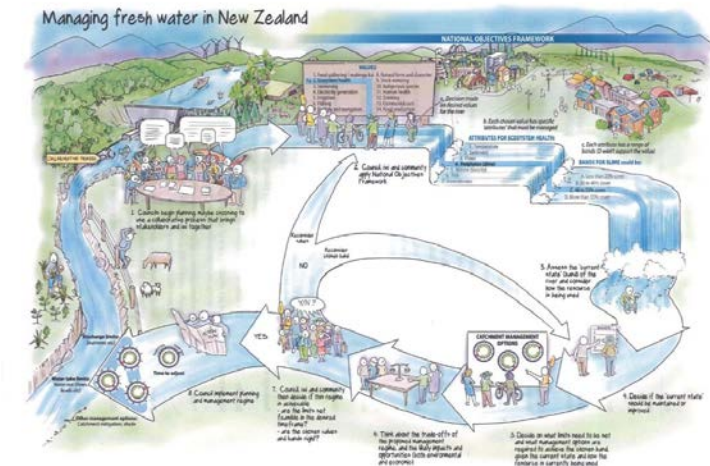
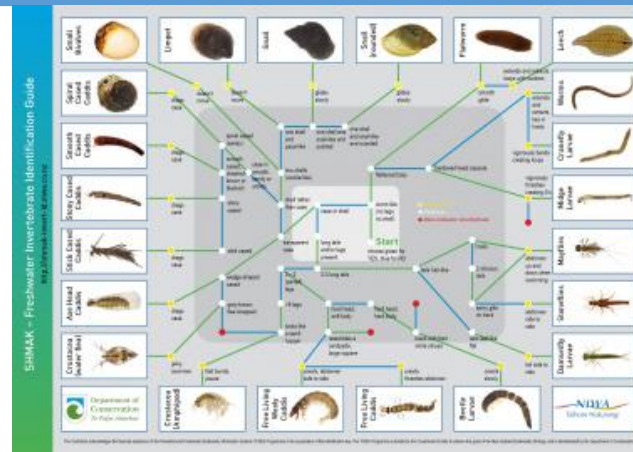


Freshwater research spectrum

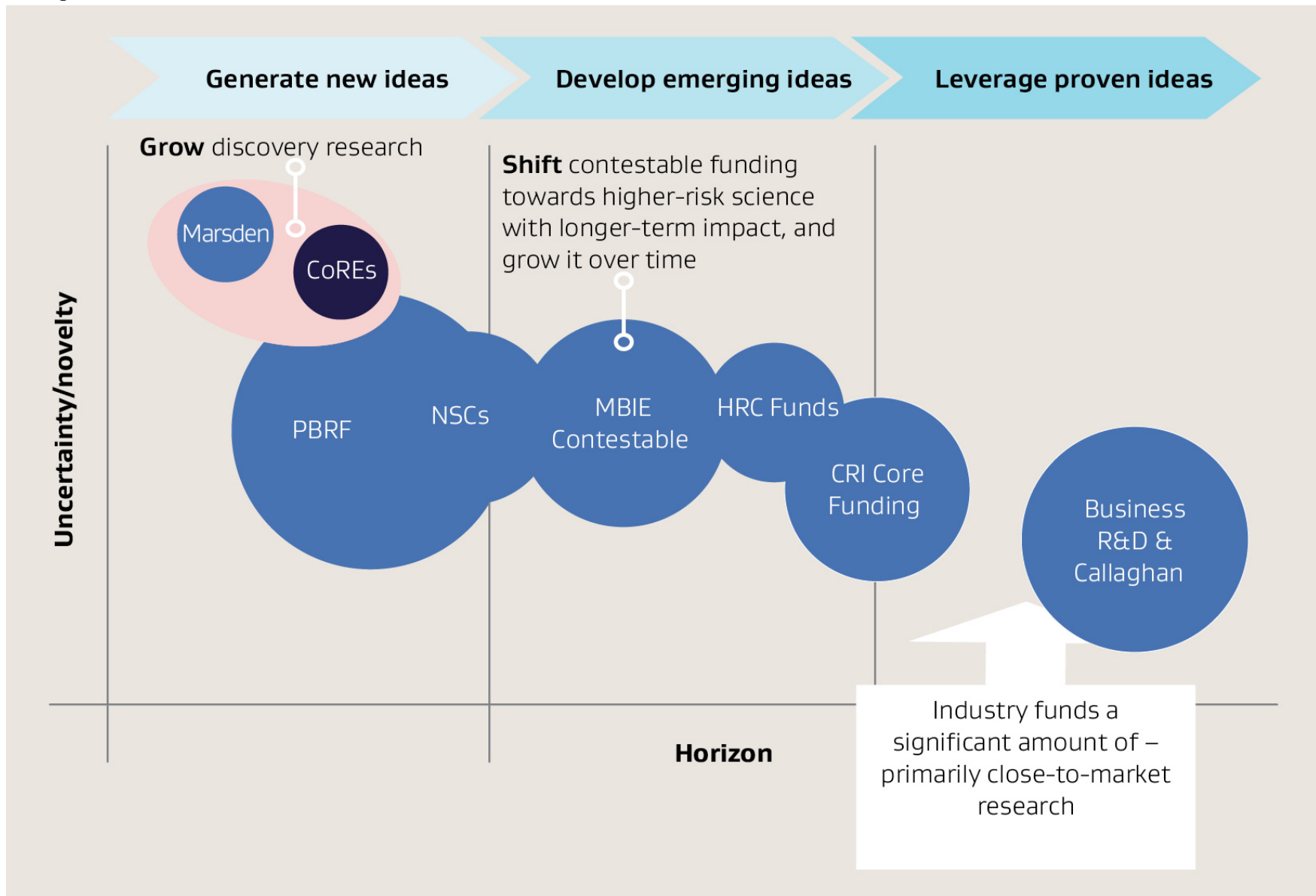
Curiosity

Applied

Management



MBIE on all science: horizons & funds; excellence & impact – NSSI 2017



2017 Ministry of Business and Innovation \$

Organisation success rates: 17% = 68 of 408 proposals

- NIWA 2 of 49 proposals (4%) – 1 Freshwater

Smart ideas: \$15M/y; \$0.4-1M ea.; 2-3 y.

- test promising, **innovative** ideas with **high potential for impact/benefit** to NZ
 - NIWA freshwater & estuaries - 1 of 7 successful

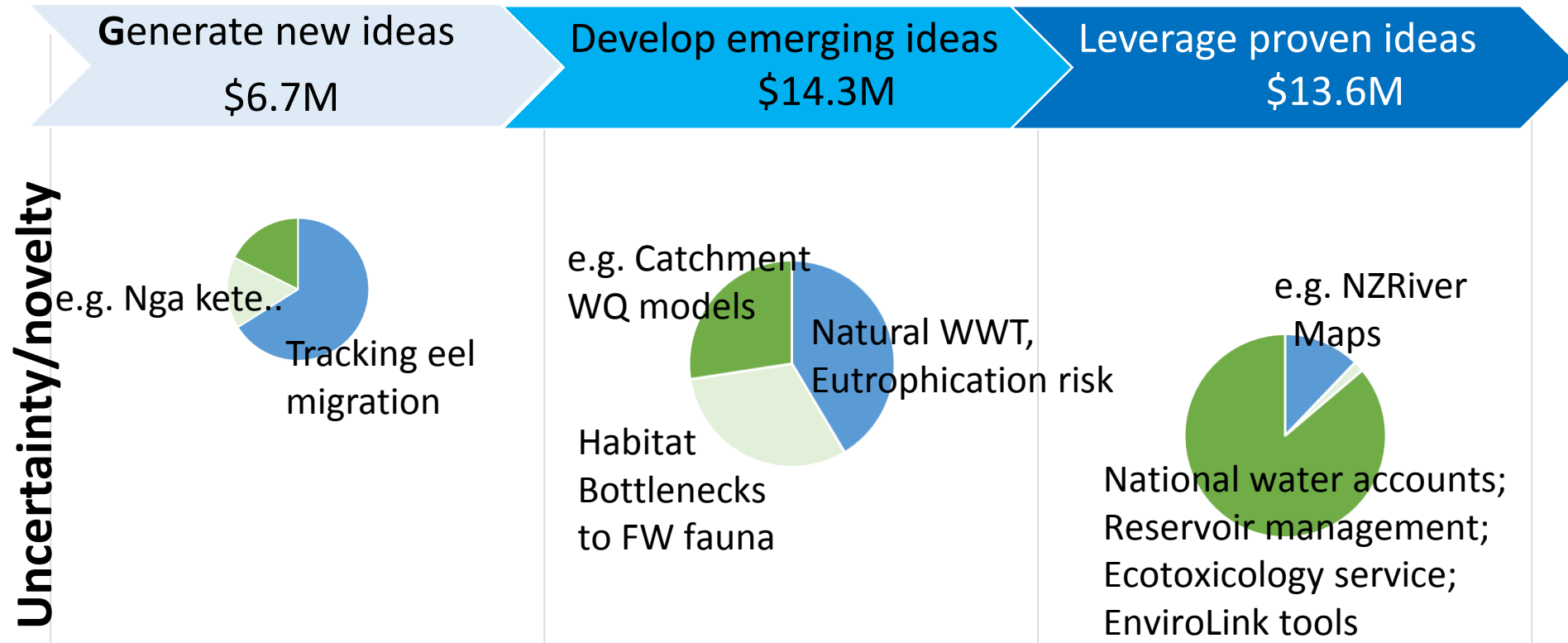
Research Programmes: \$42M/y, \$0.5-2.9M/y; 4-5 y

- ambitious, excellent, and **well-defined research** ideas
- have **credible and high potential** to positively transform NZ's future in areas of future **value, growth or critical need**
 - NIWA freshwater & estuaries - 0 of 6 successful

MBIE Freshwater related 2017 = \$6.9M/y

Lead Institute	Title	Years	\$/y	Type
Massey	Wastewater Treatment 'Advanced Extraction Modules': De-risking to enable end-user uptake	2	\$495K	Smart Idea
NIWA	Trace metal limitation of phytoplankton growth in NZ lakes	3	\$283K	Smart Idea
Lincoln Agritech	Magnetotactic bacteria for removing contaminants from manufacturing processes	2	\$500K	Smart Idea
GNS Science	Tracing Hot Spots and Hot Moments of Nitrate Contaminant Input to Freshwater	3	\$333K	Smart Idea
AgResearch	Transforming irrigation by surface-water assessment using acoustic detection and self-learning control logic.	3	\$333K	Smart Idea
Cawthron	Emerging organic contaminants – managing risk for a safer NZ environment and economy	5	\$1,121K	Prog
GNS	Our lakes' health : past, present, future	5	\$2,400K	Prog
Victoria	Improved sea-level rise projections for NZ to better anticipate and manage impacts	5	\$1,421K	Prog

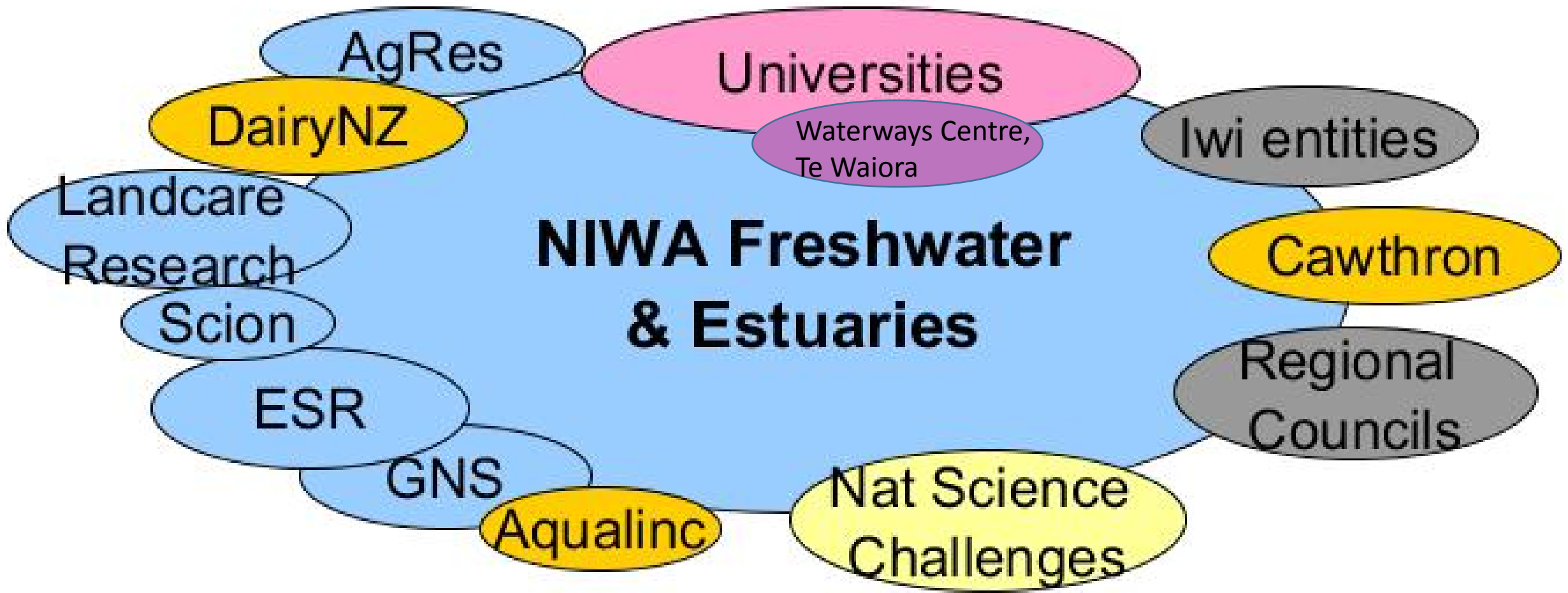
NIWA's freshwater funding horizon & examples



Horizon

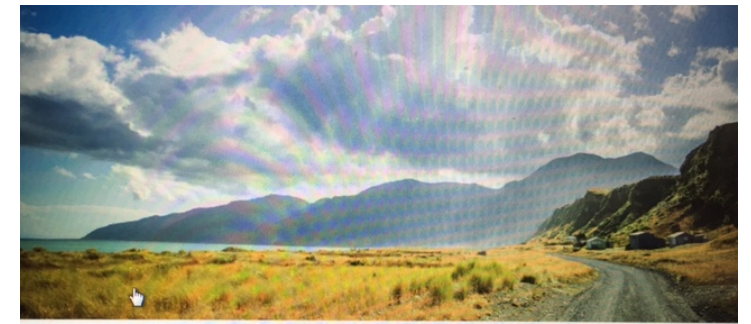
■ Strategic Science Investment Fund (SSIF = Core) ■ MBIE Contestable ■ End Users

NIWA view of freshwater science agencies

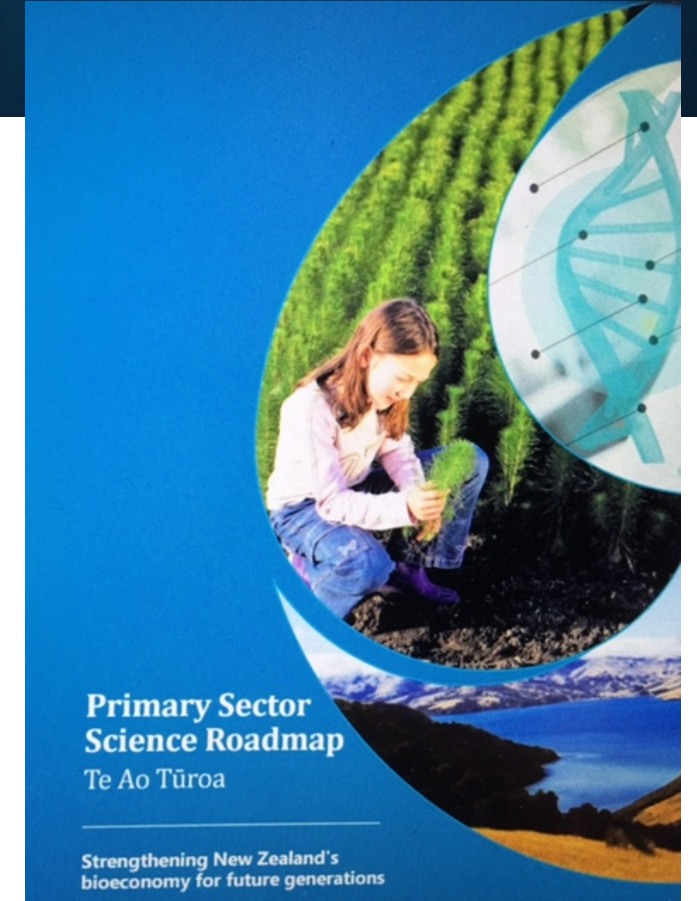


Influence and collaboration opportunities

- Research Strategy Documents
 - Conservation and Biodiversity Roadmap
 - Primary Sector Roadmap
 - Regional Council Special Interest Group Priorities
 - eg SWIM Research Strategy
- Relationships
 - National Water Research Advisory Panel
 - Co-development
 - Contracts
 - Research Fund bids (MBIE, HRC, MFE) – long shots
 - Student scholarships (e.g. Te Waiora)
 - National Science Challenges
 - 2019 second tranche opportunity
- Lobbying government



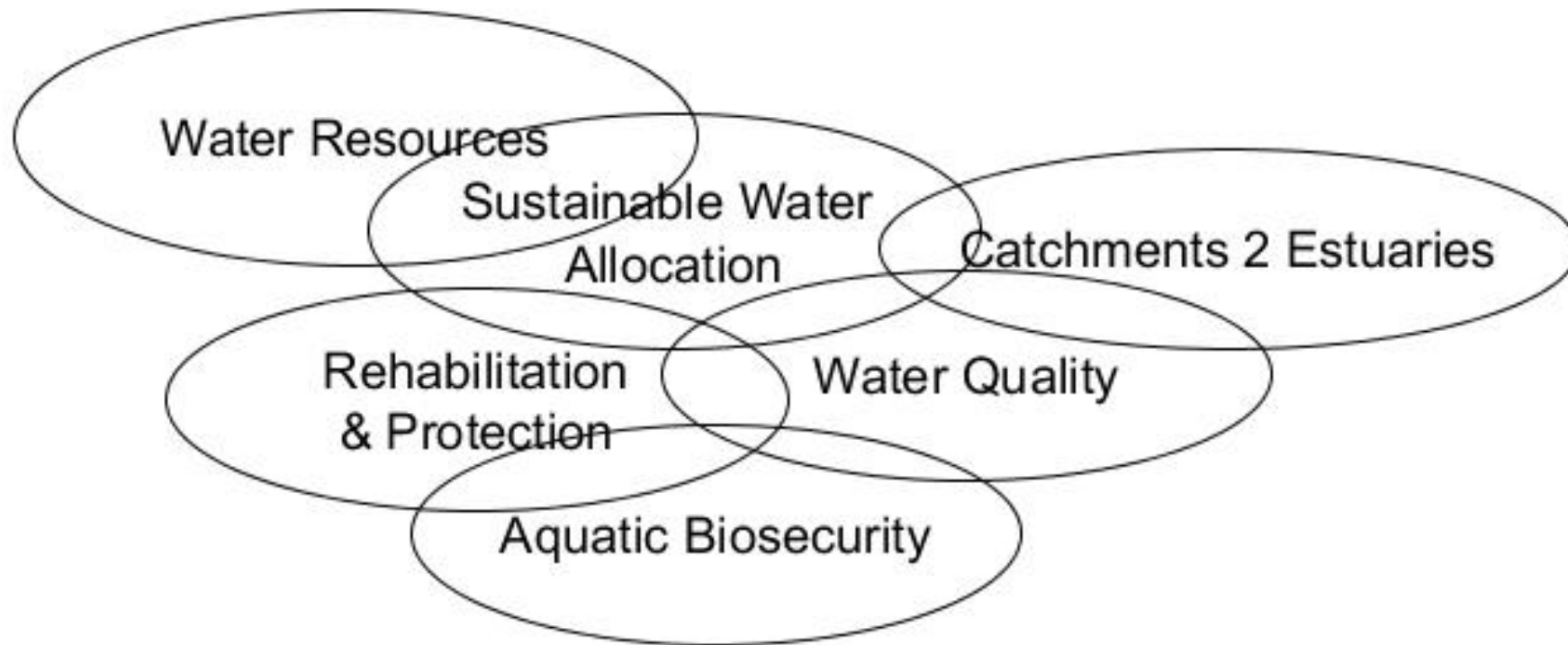
Conservation and Environment Science Roadmap



Primary Sector Science Roadmap Te Ao Tūroa

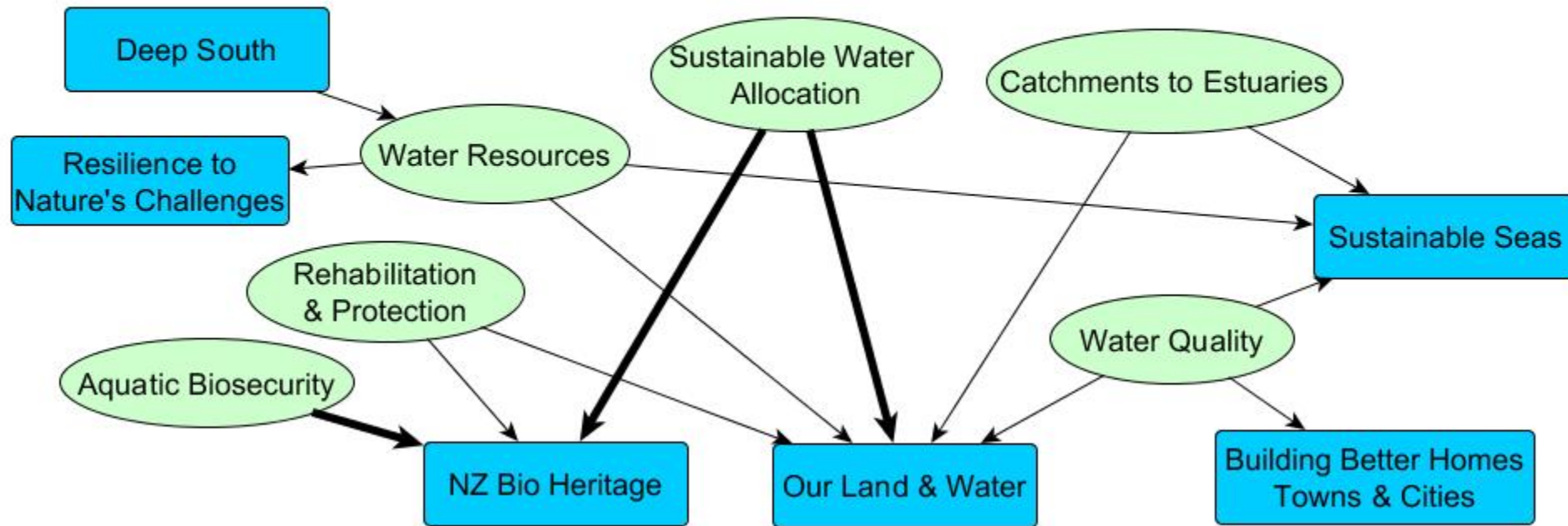
Strengthening New Zealand's
bioeconomy for future generations

Freshwater and Estuaries Programme linkages



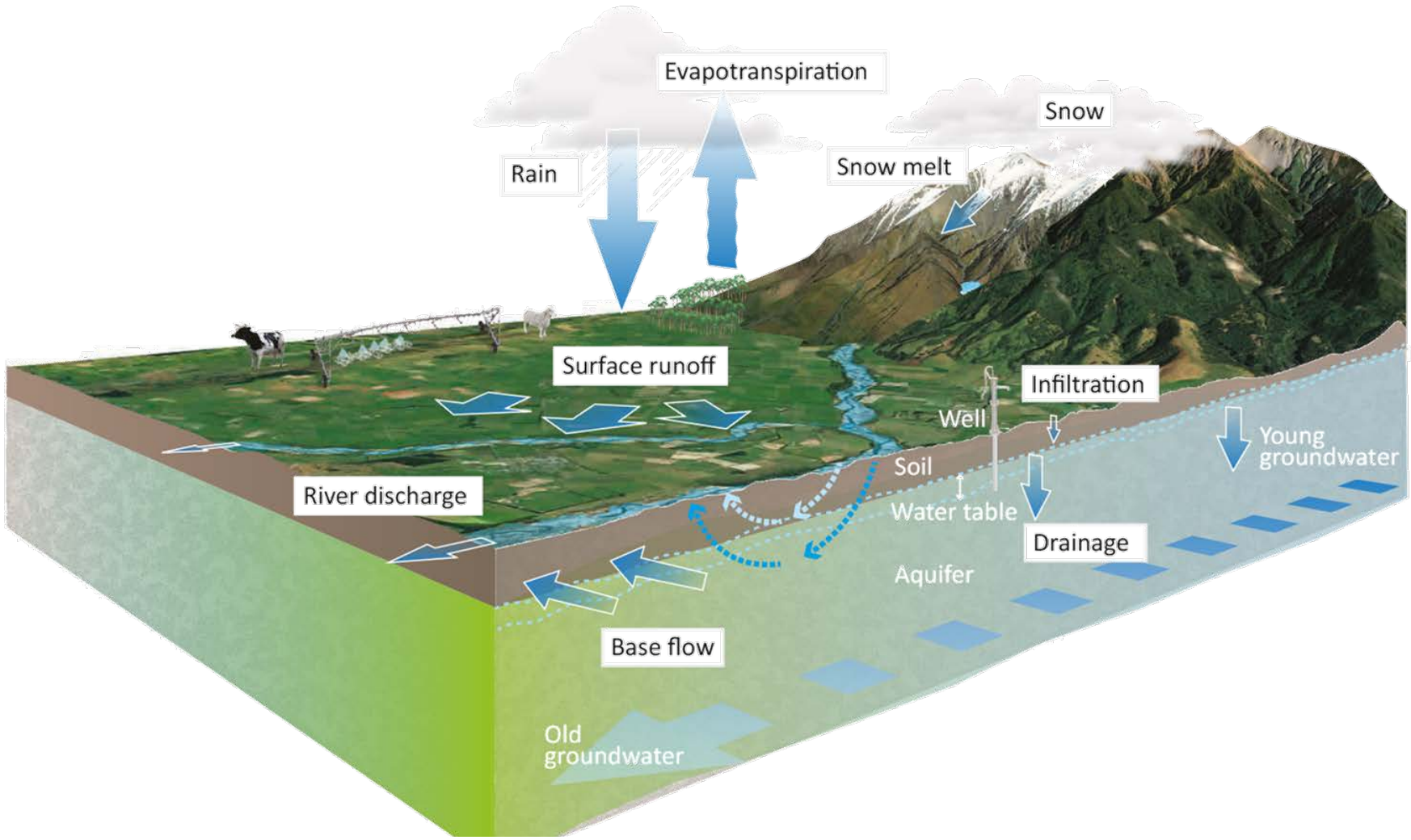
NIWA Water & National Science challenge links

Freshwater and Estuaries - NSC linkages

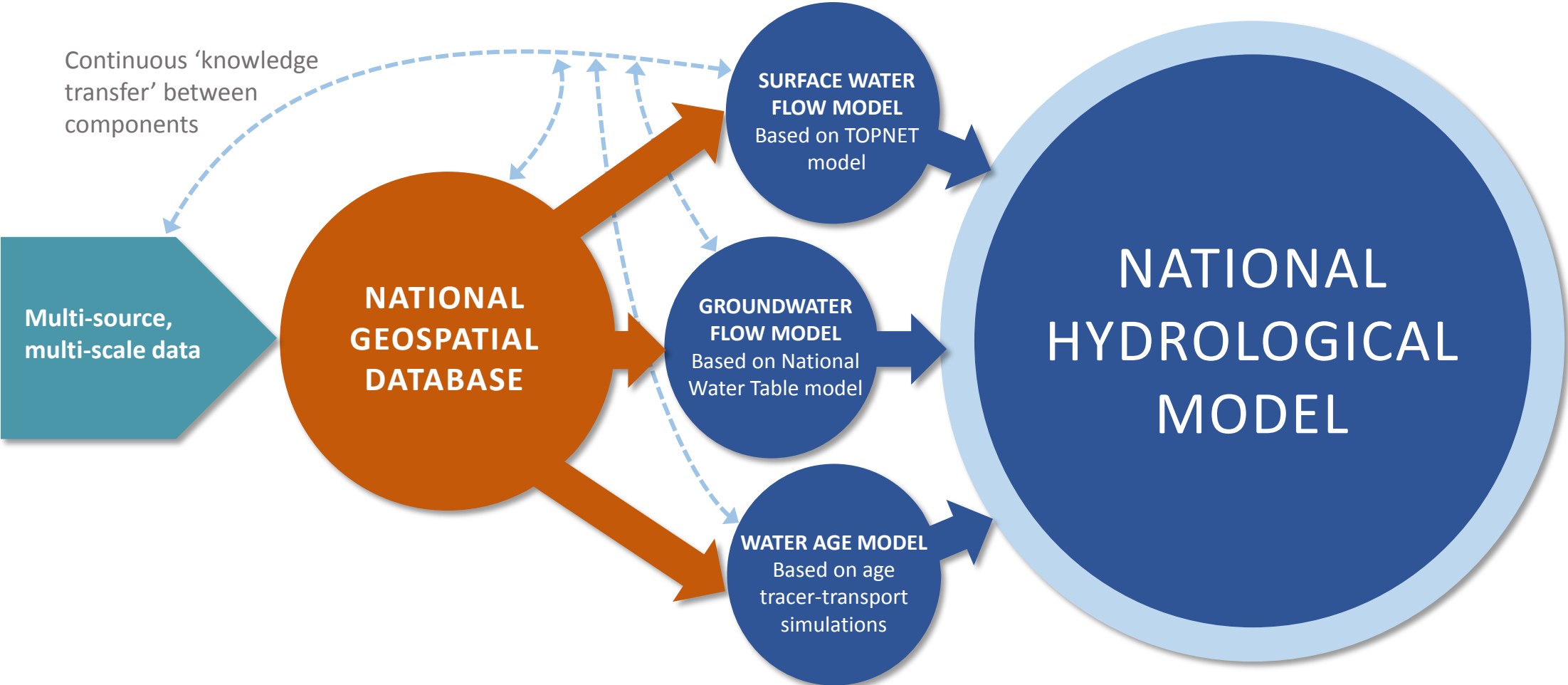


NSC's each have core programmes and contestable processes with varying timelines

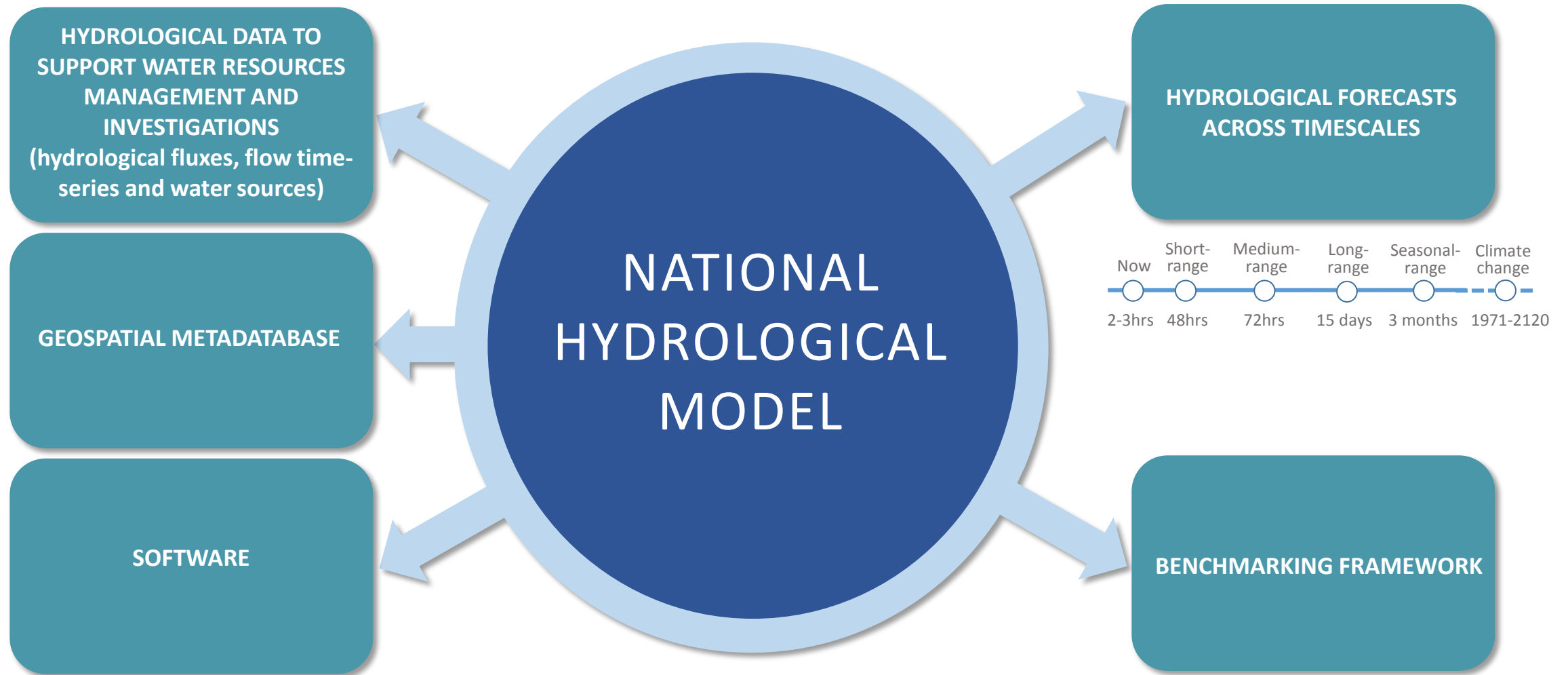
Eg. SSIF programme: National Hydrological Project – Setting



THE NATIONAL HYDROLOGICAL PROJECT – MAJOR COMPONENTS



National Hydrological Project – Primary Outputs



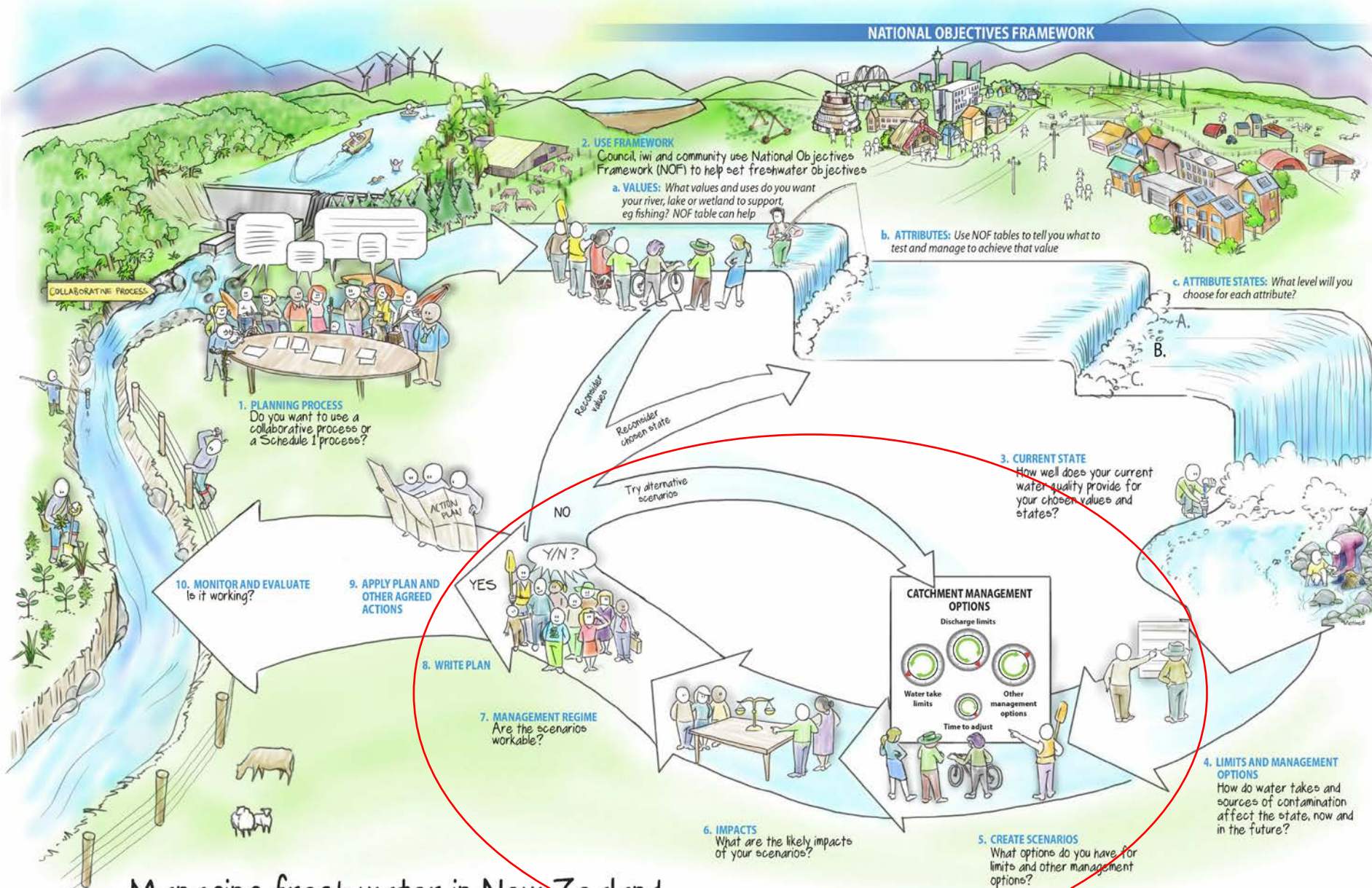
THE NATIONAL HYDROLOGICAL MODEL – MAJOR APPLICATIONS

- Hydrological modelling for policy development
- Water allocation and flow setting with CHES and other tools
- Water quality investigations (e.g., flow-corrections in trend analyses)
- Large-scale flow, flood and drought forecasting
- Designing water trading schemes
- Limit setting under the NPS
- Scenario testing for regional plans
- Consenting surface and groundwater abstraction
- Hydroelectric planning and operations design

EFSAP AND CHES: TOOLS FOR ASSISTING WATER ALLOCATION

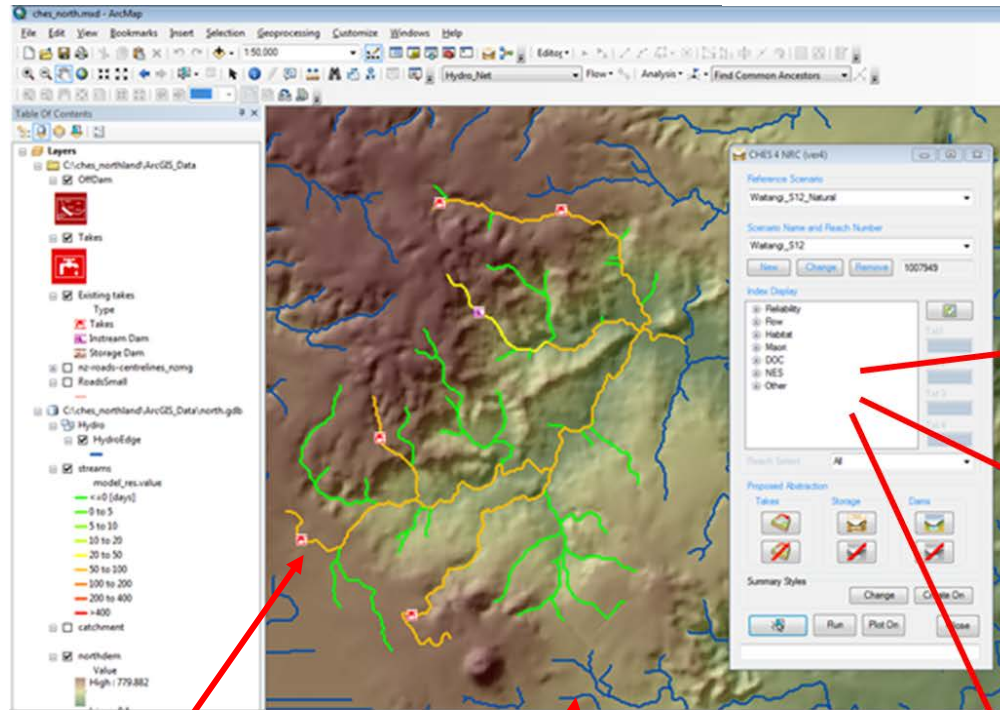
Vehicles to apply research products of Sustainable Water Allocation Programme (SWAP)

	EFSAP	CHES
Name	Environmental Flow Strategic Assessment Platform	Cumulative Hydrological Effects Simulator
Aim	What should water limits be (minimum flow, maximum take)?	What & where are the consequences of proposed water use plans/schemes?
Assessing	Planning Scenarios	Planning or Development Scenario
User	Policy, Planner	Planner, Developer, Consultant
Scale	Region	Catchment
Hydrological basis	Flow-duration curves	Flow time Series

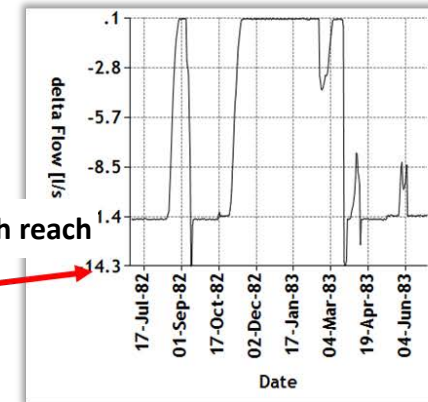


CHES: input, calcs, & output

ArcGIS add-in



30 years of daily hydrological model output for natural/existing regime (e.g. TopNet)



Time-series plots at each reach

Maps of time-averaged results (e.g. physical habitat for key species, take reliability, morphological change)

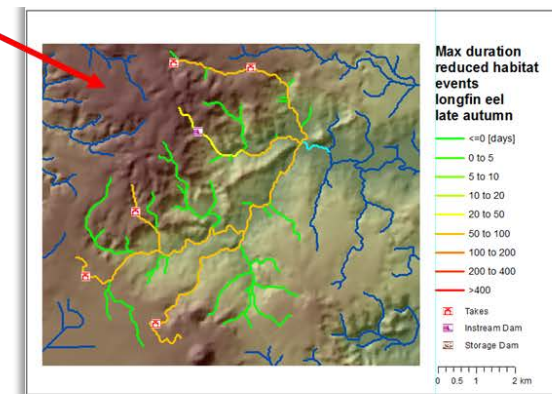
Space-time summary tables comparing scenarios

Water takes, storage devices + operating rules entered in DB

CHES calculates daily-mean flow everywhere for multiple scenarios

Summary for drought year 1982-83

	MA	60%	RAT	NES
Value: Reliability				
Reliability R1 River Takes	37.33	23.75	38.73	1.67
Reliability R2 River Takes	63.68	64.52	66.44	12.85
Value: Flow Properties				
% Days less MALF	92.62	92.36	91.94	90.75
% delta Days less MALF	1.98	1.72	1.30	0.11
Value: Ecological Values				
Habitat: deltaH	-13.00	-10.79	-4.05	-0.15
Habitat: # D decrease	94.28	94.34	59.60	32.61

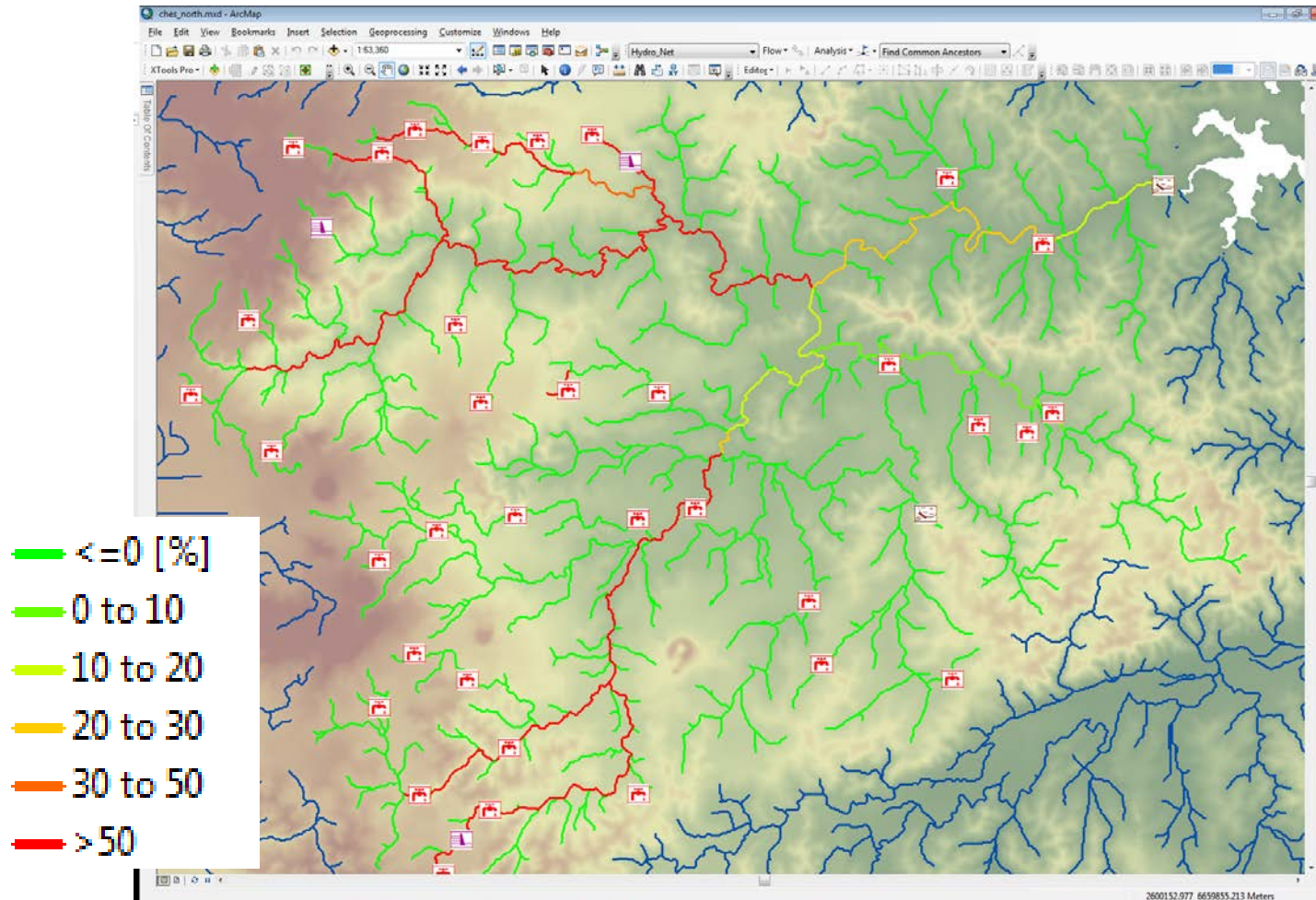


CHES: Example map output (Waitangi, Northland)

Summary for drought year 1992-93

Year	0	10	20	30	40	50
1992-93	1	1	1	1	1	1

% Time not complying with NES rules



Water takes



Conclusions

- Freshwaters are invaluable to NZ identity and economy
- Freshwater Research ca. \$50M/y
 - many gaps and ‘Cinderellas”, e.g. wastewater treatment, swimmability, ecotoxicology, urban water

Main opportunities to get involved:

- CRI Strategic Science Investment Funds
 - Enables linked strategic programmes & agility
 - National Hydrological Project and flow management tools
 - Aquatic biosecurity and restoration
 - Water quality and eutrophication
 - Catchments to estuaries
- MBIE
 - National Science Challenges –tranche in 2019
 - Envirolink – information delivery to Regional Councils
 - Research Programmes and Smart Ideas - long odds for funding supporting research
- Contractual partnerships