

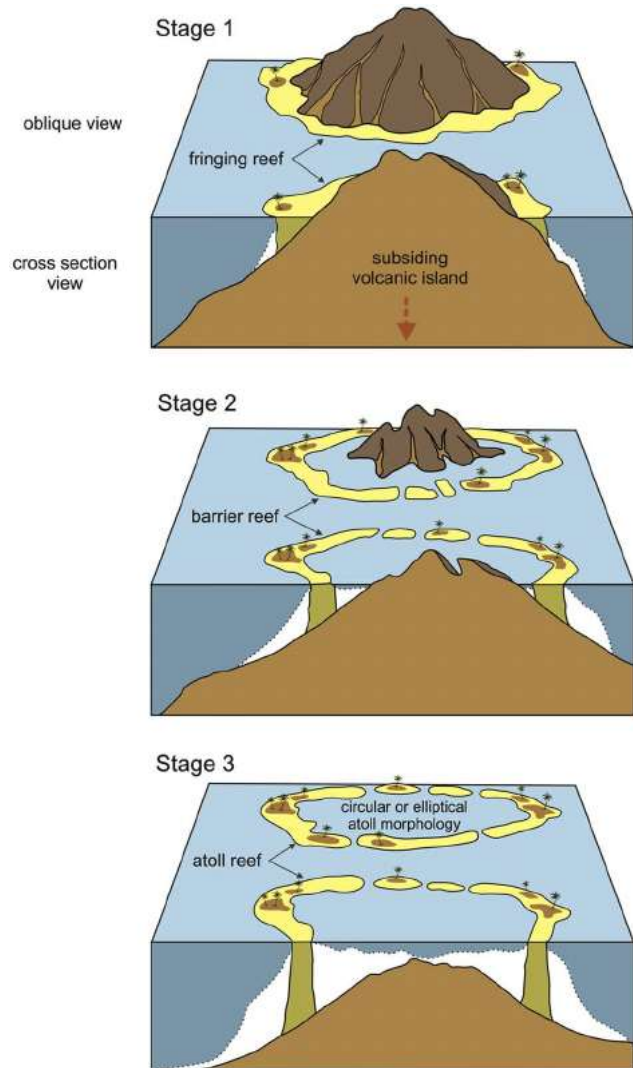
A SECTORAL FOCUS ON ATOLL ADAPTATION

ATOLLS VS VOLCANIC ISLANDS, COMPOUNDING IMPACTS AND ADAPTATION TIMING

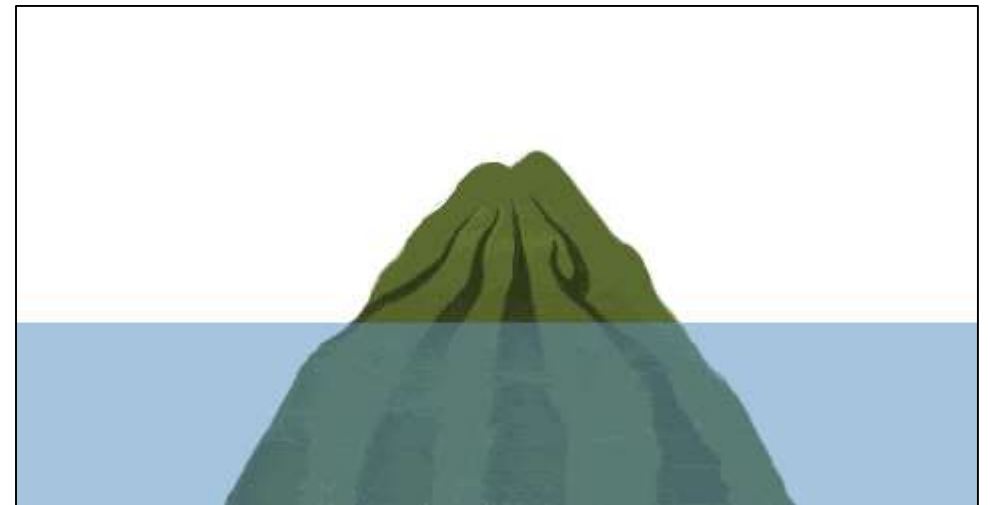


GEOSCIENCE ENERGY AND MARITIME DIVISION

Fundamental differences between atolls and volcanic islands



- A few million years...



Fundamental differences between atolls and volcanic islands









Nadarivatu hydro dam, Fiji

- A few million years...
- Energy resources



Matatoa solar farm, Tonga

					
Geo	Hydro	Bio	Ocean	Solar	Wind

Volcanic Islands

All Islands








Devil's point wind farm, Vanuatu

Fundamental differences between atolls and volcanic islands



- A few million years...
- Energy resources
- Agricultural resources



				
Narrow genetic base	Pests/disease impacts	Limited water supply	Poor soil nutrients	Salt water inundation
All Small Islands			Atolls	



Fundamental differences between atolls and volcanic islands

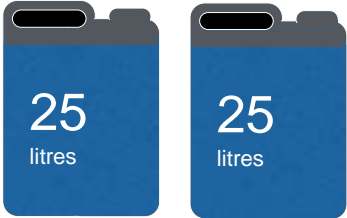
Vastly different **water use**

15 L/p/d



Minimum
“Sphere standard”

about
50 L/p/d



Atoll
communities

200 L/p/d and
more



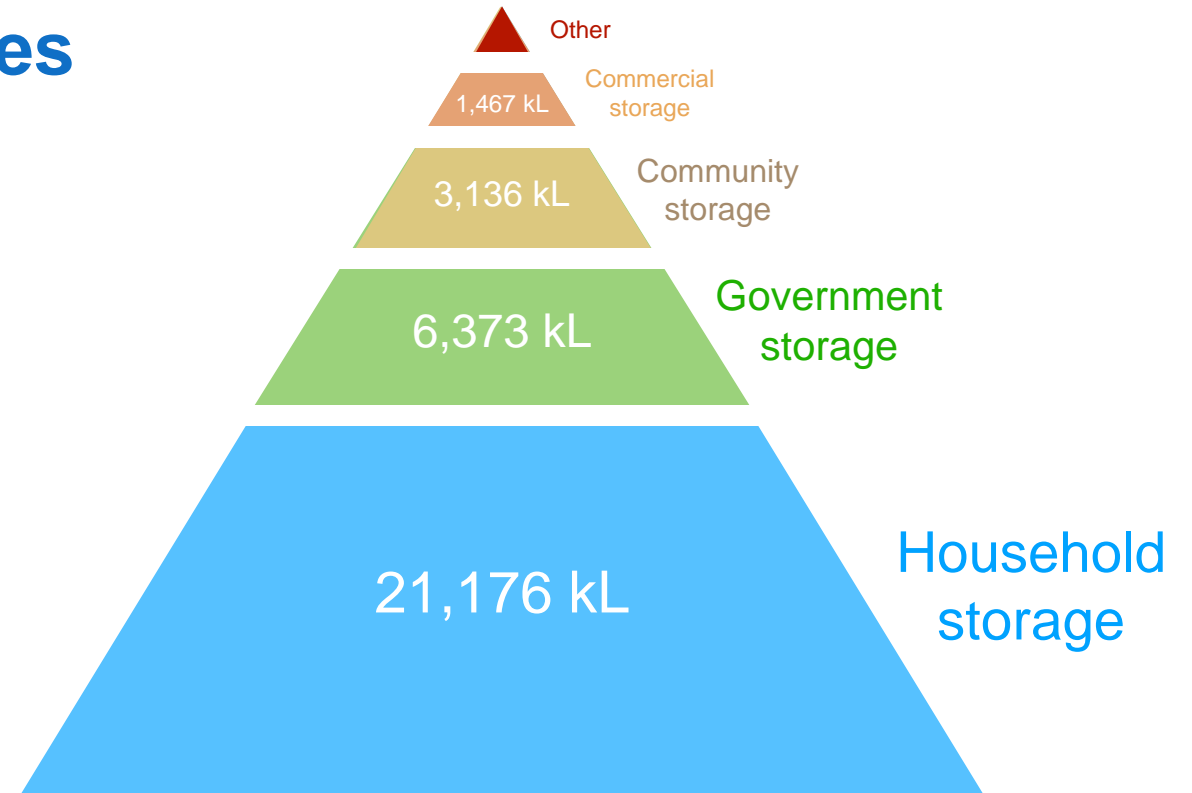
Pacific
neighbours

Fundamental differences between atolls and volcanic islands

Vastly different **water reserves**



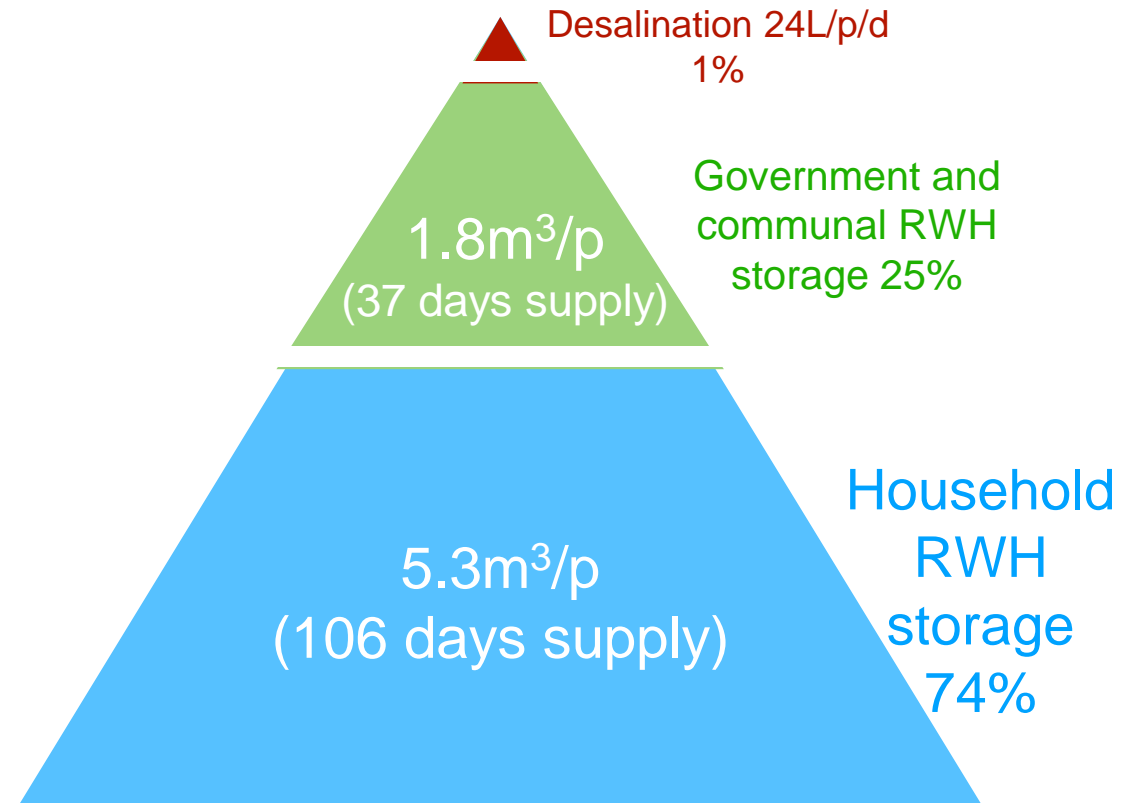
Monasavu Dam, Fiji: 133,000,000 kL



Funafuti rainwater reserves

Fundamental differences between atolls and volcanic islands

Available water source distribution Funafuti

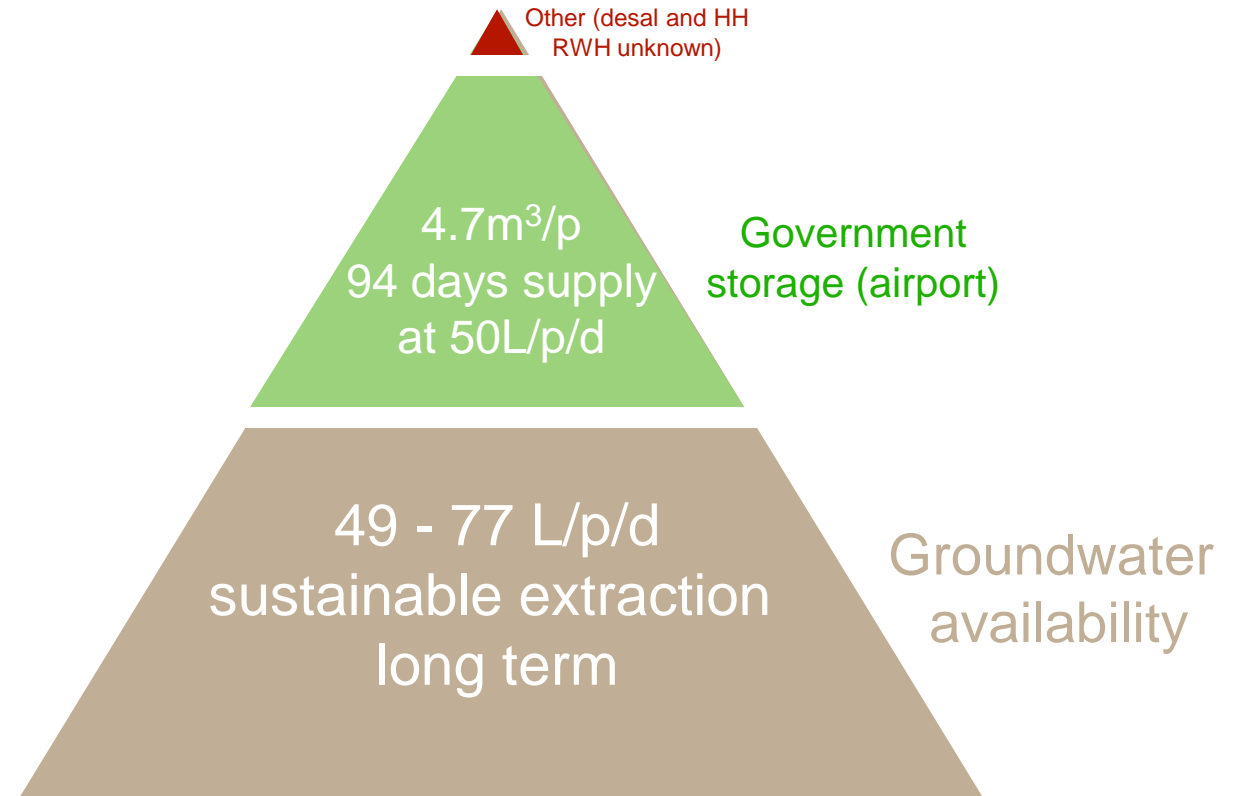


Funafuti water supplies

Assume 50L/p/d
1m³ = 1000L

Fundamental differences between atolls and volcanic islands

Available water source distribution Majuro



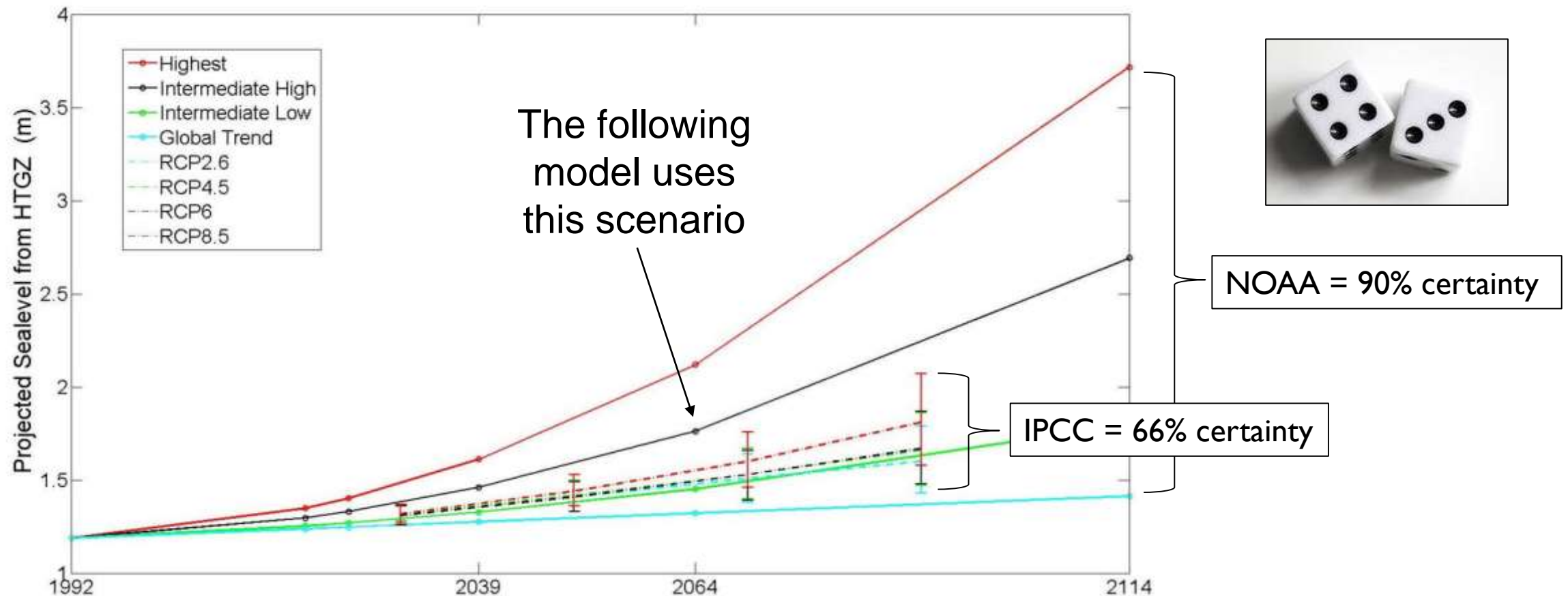
Majuro water supplies

Assume 50L/p/d
1m³ = 1000L

Compounding impacts of climate change on atoll sectors

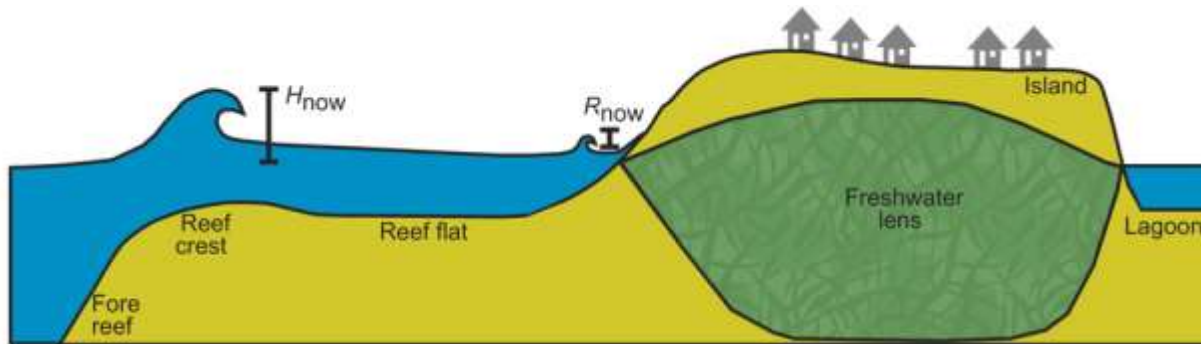
“Atoll countries in the Pacific will be the first nations to face extinction as a result of global warming. Rising sea levels could wipe them off the map in a matter of decades.”

Pres. Hilda Heine and Patrick Verkooijen; 10 April 2019; <https://www.washingtonpost.com/opinions>

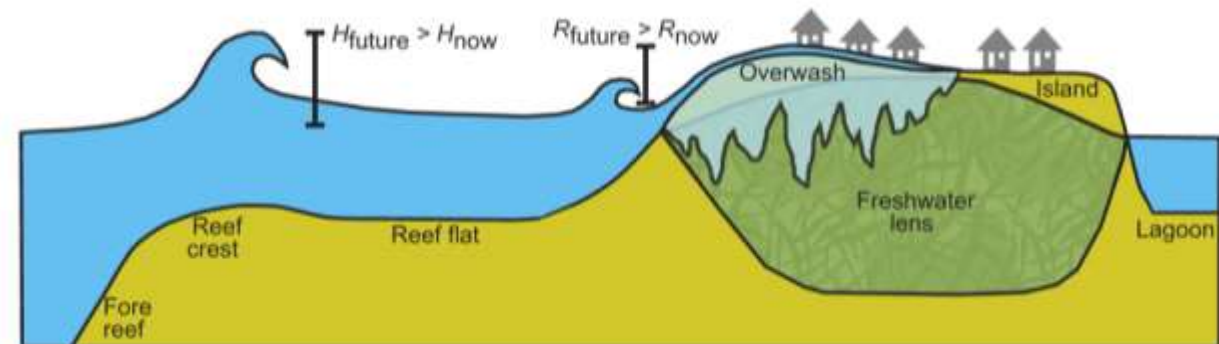


Compounding impacts of climate change on atoll sectors

Groundwater vulnerability to **inundation**

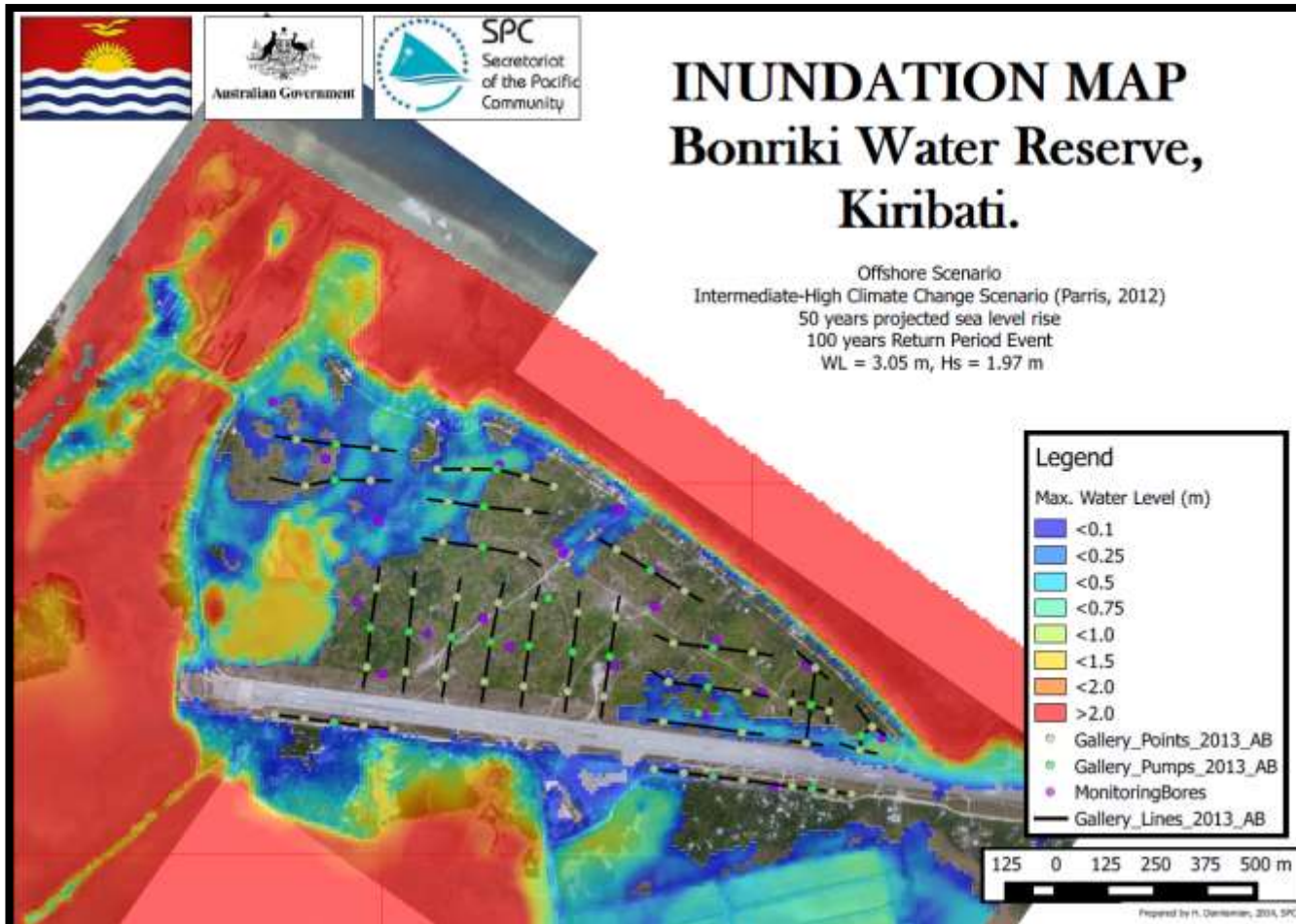


- = Atoll
- = Present sea level
- = Present groundwater



- = Future elevated sea level
- = Future groundwater
- = Salinized groundwater due to overwash

Compounding impacts of climate change on atoll sectors

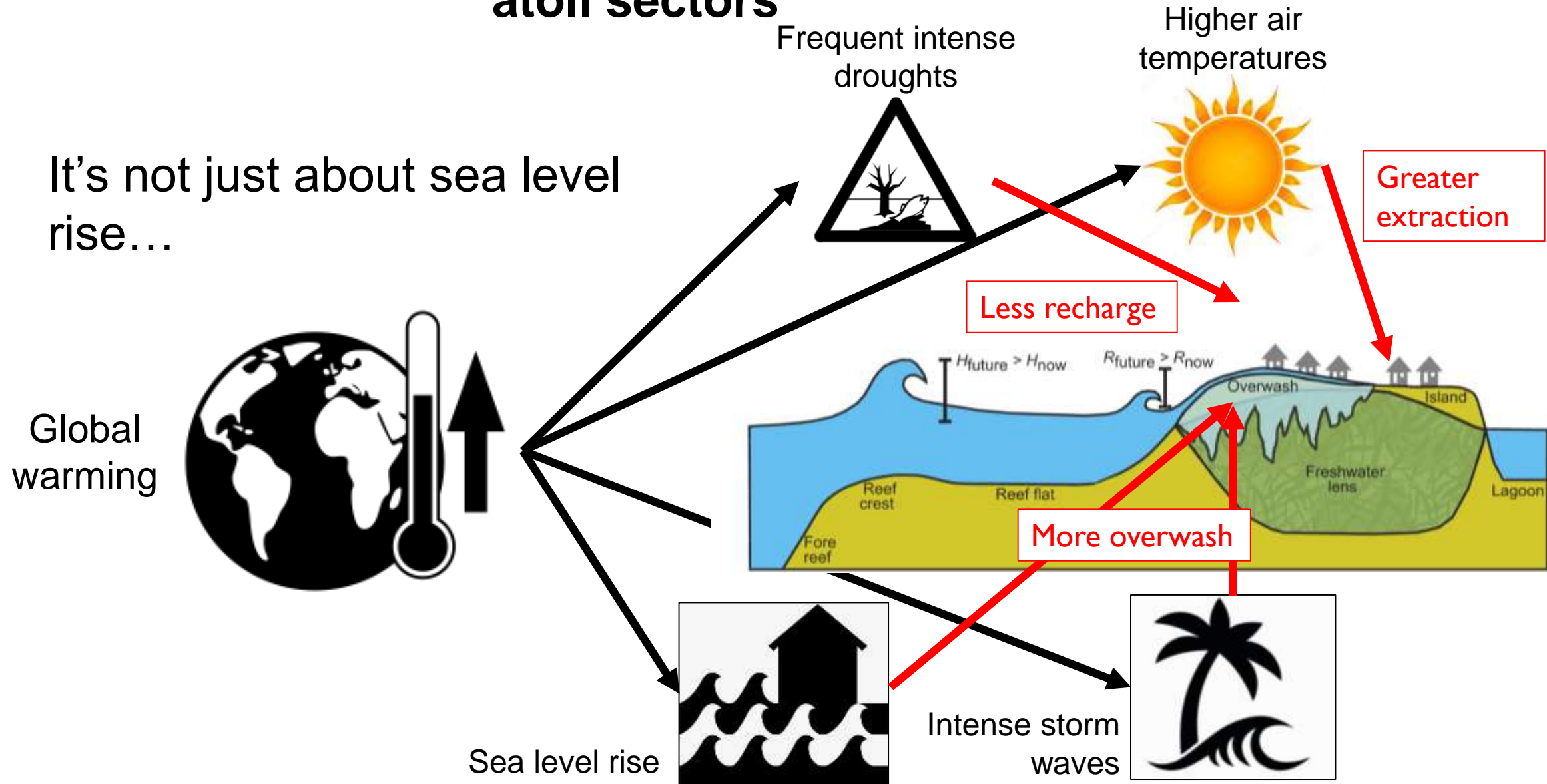


Key Findings:

- Groundwater impacted only where inundation occurs
- Groundwater recovers with rainfall recharge
- Recovery of 2-6 years dependent on recharge scenario
- Extraction and the rainfall recharge are the most critical

Inundation modelling under 4 different SLR projections, and 3 probability events: 20, 50, 100 yr RI. (72 scenarios reviewed)

Compounding impacts of climate change on atoll sectors

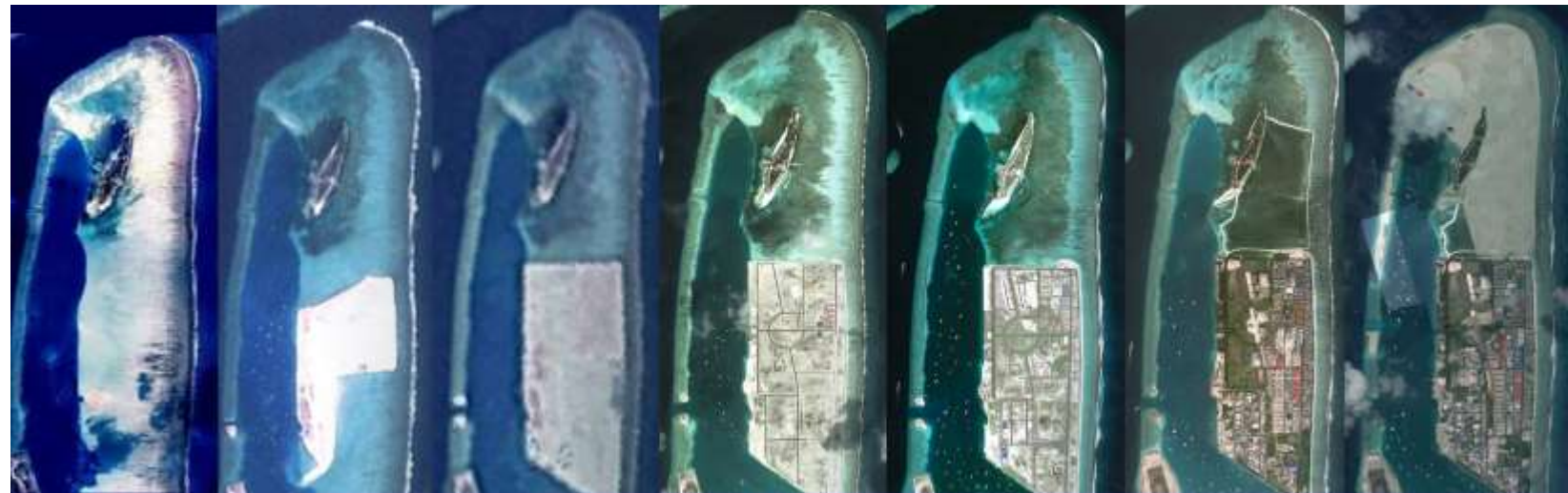


Atoll adaptation: timing is everything



Maldives are island building: pumping sand from surrounding atolls and depositing it on shallow reefs fortified with walls 3m above sea level (higher than the highest island at 2.5m ASL)

<https://www.newscientist.com/article/2125198-on-front-line-of-climate-change-as-maldives-fights-rising-seas/>



<https://thatmaldivesblog.wordpress.com/2017/10/16/happy-birthday-hulhumale-reclaimed-island-gallery/>

Atoll adaptation: timing is everything

Island building can be rapid...



<http://time.com/4341510/south-china-sea-artificial-islands/>

Atoll adaptation: timing is everything

Island building can be rapid...

Although not currently in the Pacific



Lagoon clamshell
Tarawa-
2016

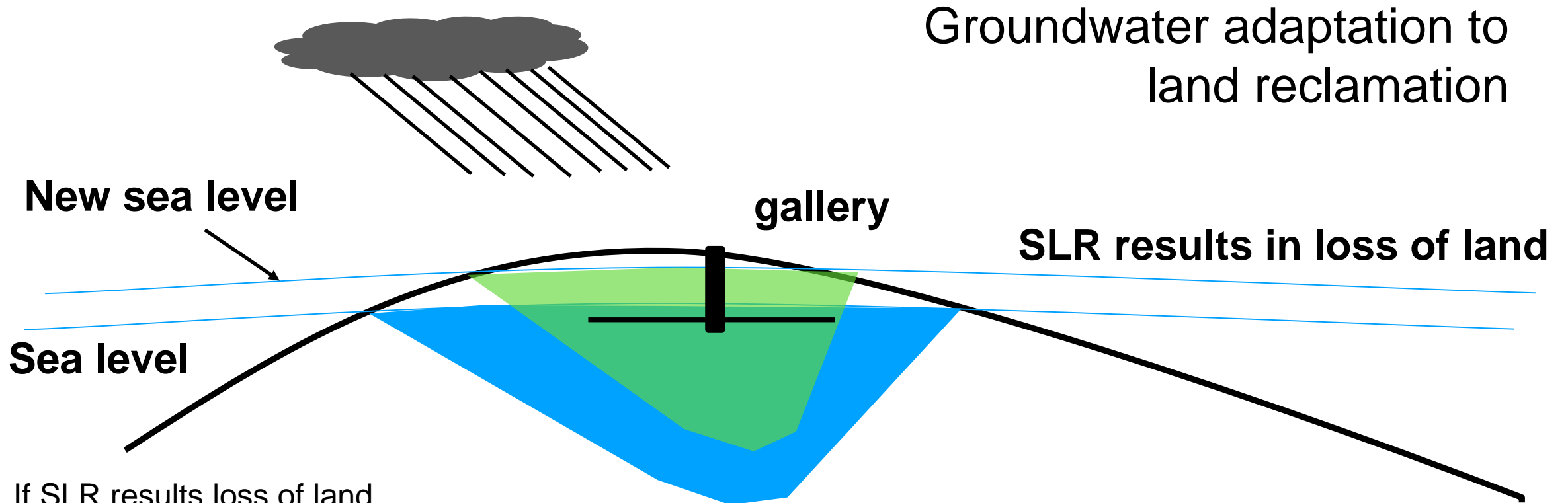


Beach mining -
2016



Repairing
breach ocean
side geotextile
bags Funafuti

Atoll adaptation: timing is everything

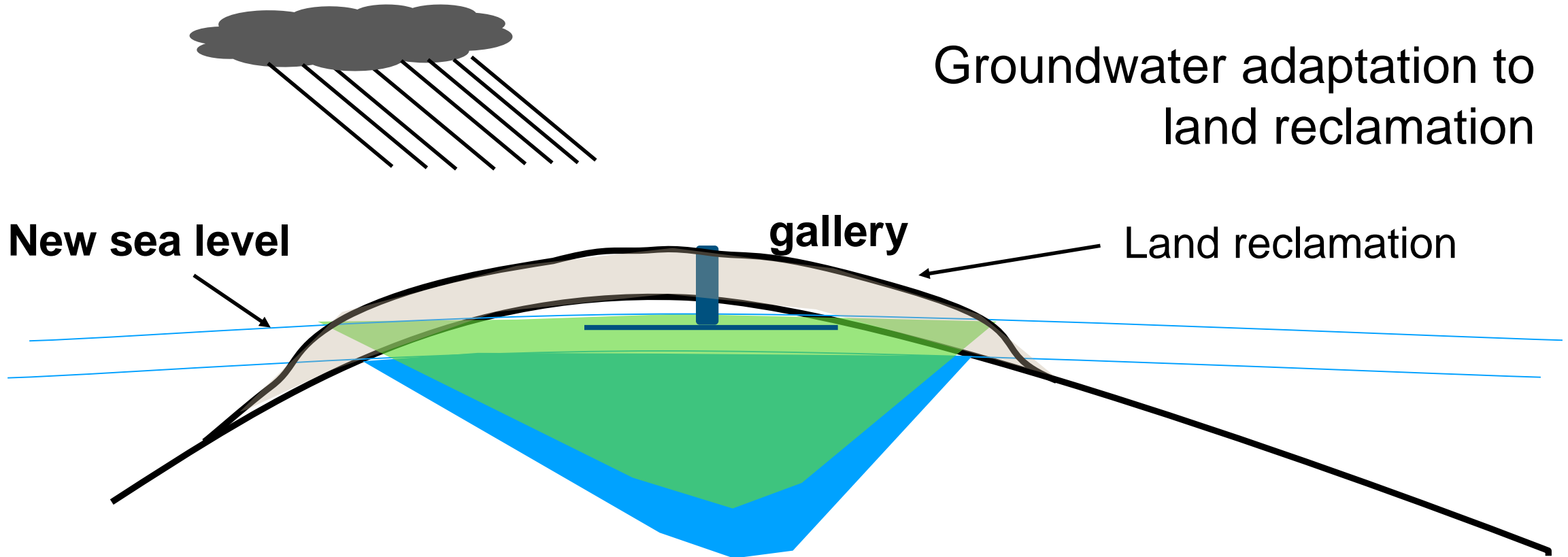


If SLR results loss of land

- freshwater lens lifts with rising sea level
- freshwater lens reduced,
- infrastructure impacted, water quality can be compromised

Atoll adaptation: timing is everything

Groundwater adaptation to land reclamation

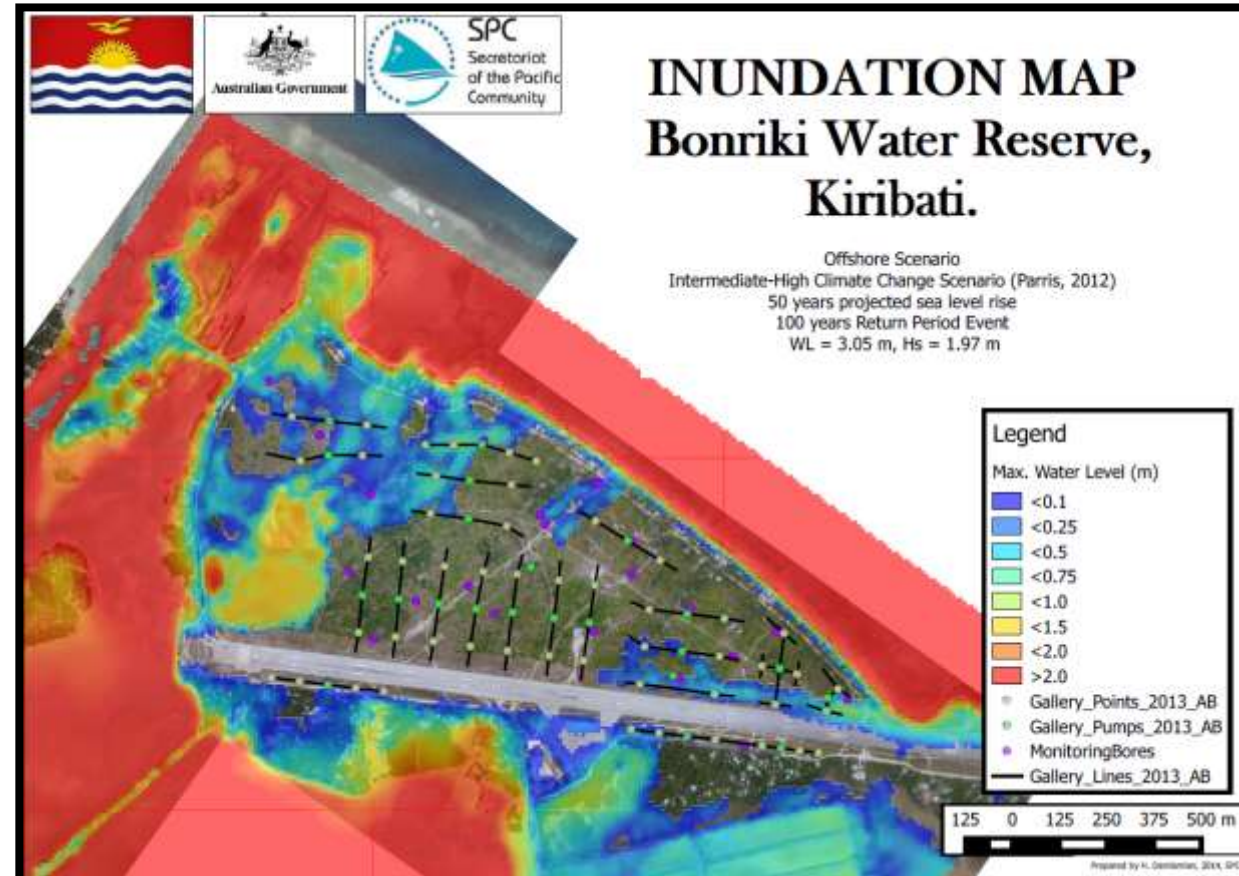
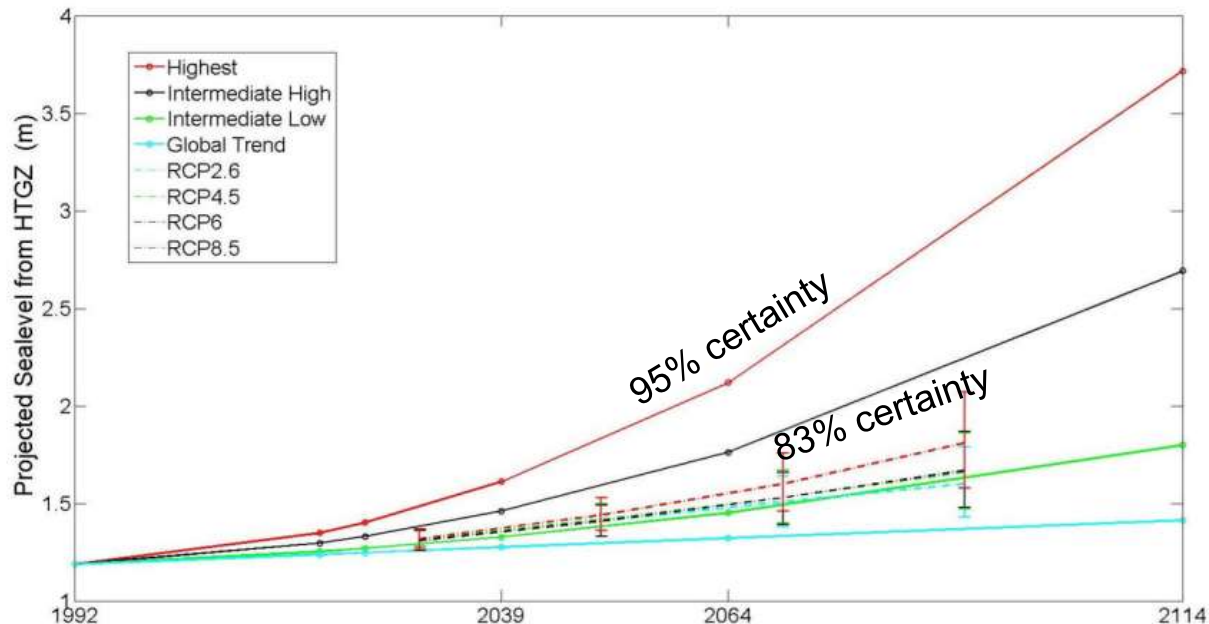


Reclamation with sand dredging, land area maintained or increased

- freshwater lens develops 15 years,
- size of freshwater lens retained

Atoll adaptation: timing is everything

- Science can do more than identify the problem.
- Future scenario or probabilistic modelling allows us to make risk informed decisions.



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