



Water security in atolls through improved groundwater management

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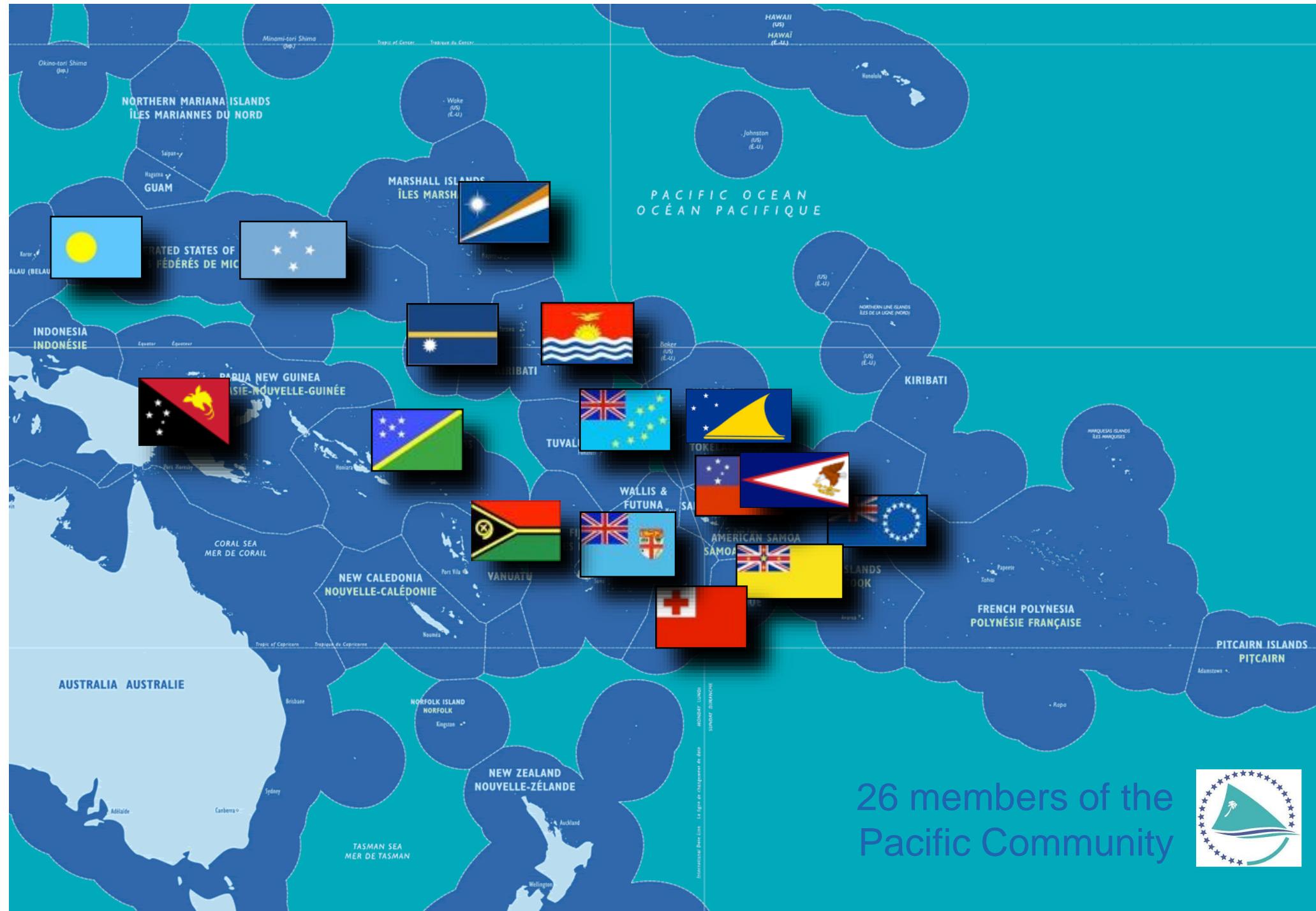
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Atoll only

Limestone

Volcanic

Volcanic, limestone and atolls - composite

Volcanic, limestone, sand, mixed - complex

26 members of the Pacific Community





Water security in the Pacific

What does it mean?

- Sufficient fresh water for a communities needs at all times for a variety of uses, potable, domestic, agricultural, and industrial
- Develop and manage from more than water source to meet their needs, (eggs and baskets)
- Water supply systems are affordable, and can be maintained and operated locally – self sufficiency.
- Develop management systems which can accommodate the variability of the water source, and the variable demands that are placed upon it.
- Pre positioned plans and management approaches to address water needs when a water source is threatened by natural events, eg. droughts, overtopping, cyclones
- Water quality is just as important as water quantity (*water, water everywhere, nor any drop to drink*) Samuel Taylor Coleridge 1874



Development of the sustainable yield concepts and definition

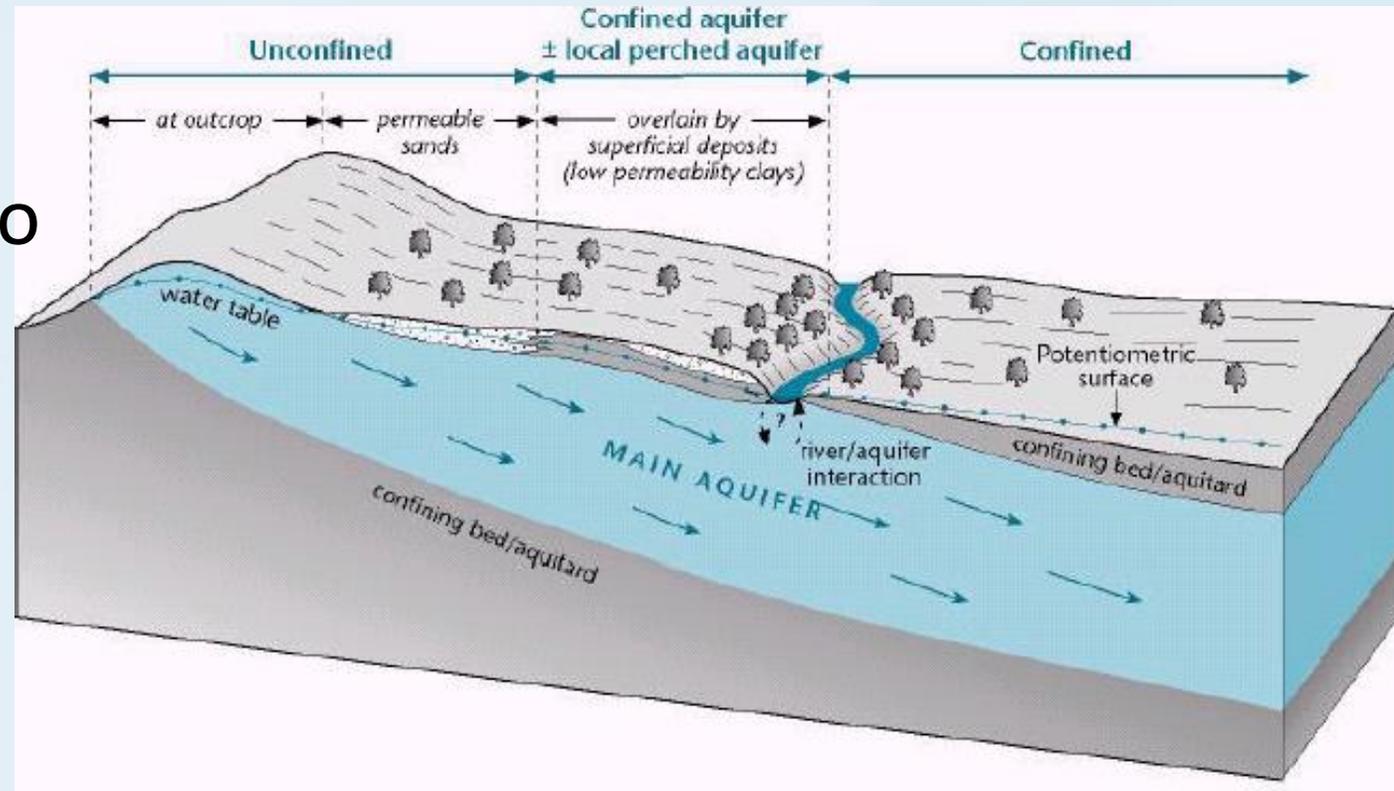
- Quantity of water that can be pumped permanently without dangerous depletion of the storage reserve (Lee 1915)
- Is the **pumping rate** that can be maintained **indefinitely** without **dewatering** or mining an **aquifer** (Sophocleous 2002)
- The groundwater extraction regime measured over a **specified planning time** frame that allow **acceptable levels of stress** and protects dependent **economic, social and environmental** values (Australian National Groundwater Committee)

Sustainable yield estimates



Traditionally

- Estimates of sustainable yield calculated on a % of annual average rainfall recharge
- Determine a volume of water to be abstracted long term.
- Useful in large groundwater systems with longer residence times where the systems are less dynamic with residence time measured in 10's or 100's of years

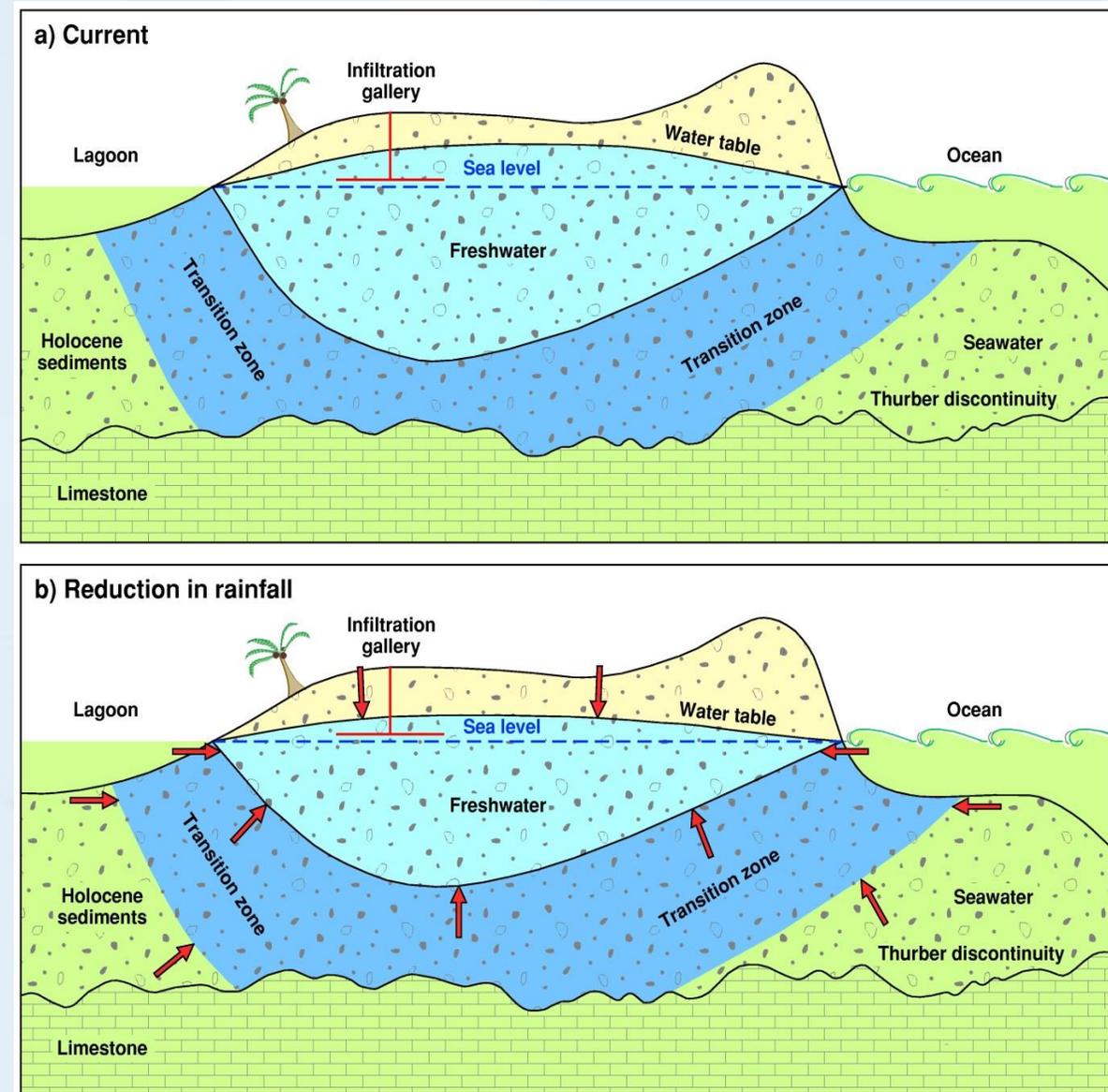


Sustainable yield in atolls



Do the same assumptions apply?

- Residence time are measured in months
- Fresh groundwater system very responsive to rainfall recharge and abstraction
- Quantity of abstraction is not a limiting factor, quality is.
- Thinning of the lens is natural and common. The lens recovers with returning rains



Application of sustainable yield in atolls

Traditional approach for groundwater development and management

- Identify the resource
- Determine a pumping yield for the well
- Define a sustainable yield based on rainfall
- Pump and forget – maintain water quantity
- Accept the salinity of the water quality provided – deterioration of water quality over time
- Water quality defines the use – poor water quality - lower beneficial use





Sustainable management in atolls

Consider a management approach for atolls which is **impact** based, focuses on **quality**, is **dynamic**, and more commensurate with the groundwater system it operates in.

A dynamic sustainable yield approach





Dynamic sustainable yield

- A longterm sustainable yield is determined based on average available recharge – long term abstraction under longterm recharge
- **Indicators** are put in place which **trigger** certain **responses**. (Rainfall percentile indices, salinity of water where the abstraction occurs)
- As recharge decreases salinity in the wells can increase. To avoid upconing and induce further salinisation the volume of water abstracted is reduced in sensitive wells to ensure acceptable water quality is maintained
- In effect a new short term sustainable yield is determined based on **impact** to the resource from climatic conditions at the time, → dynamic sustainable yield



Sustainable groundwater management in atolls

- Uses rainfall as an indicator
 - 3-6 months shallow systems
 - 12 months for larger systemsto trigger a response – early warning
- Uses groundwater monitoring to assess lens status
- Uses salinity at the pumping well to identify impact and manage to agreed thresholds.
- Focus management on the top of the freshwater lens. Last to be impacted, first to recover



Operational groundwater management



- Considers
 - Spatial and temporal variability of rainfall, abstraction, and salinity
 - Relies on the observation and analysis of these parameters, - historical and forecast.
- Pragmatic – builds confidence for water operators/managers
 - Uses predefined triggers to vary abstraction and maintain agreed salinities
 - Pragmatic operational rules developed in a programmed approach – plan and prepare



Treatment plant , Bonriki
water reserve , Tarawa.
Kiribati, 2015

Summary



- We have a management approach that is technically robust, and fit for purpose,
- maintains water quality and maximises beneficial use of the resource
- provides warning, and makes use of existing monitoring systems
- Prescriptive approach and pragmatic responses – promotes accountability and identifies responsibility
- economically beneficial- cost benefits indicates that the management approach makes economical sense by considerably reducing costs when compared against no management,
- transferrable

Yay us!



Is that enough!

- How to get the approach accepted, and embedded or mainstreamed into Govt and its operations?
- How to communicate the messaging to the community to demonstrate its value and assist in behaviour change?
- Approaches to date – technical reports, workshops, role play.
- Requires time – building on relationships and opportunities from other project and Actions, refining and reshaping the approach to match the communities needs until it takes on its own life.
- Suggestions to mainstream?

Thank you

