Increased Surface and Ground Water Stores through Stormwater Reuse

TECHNOLOGY DESCRIPTION

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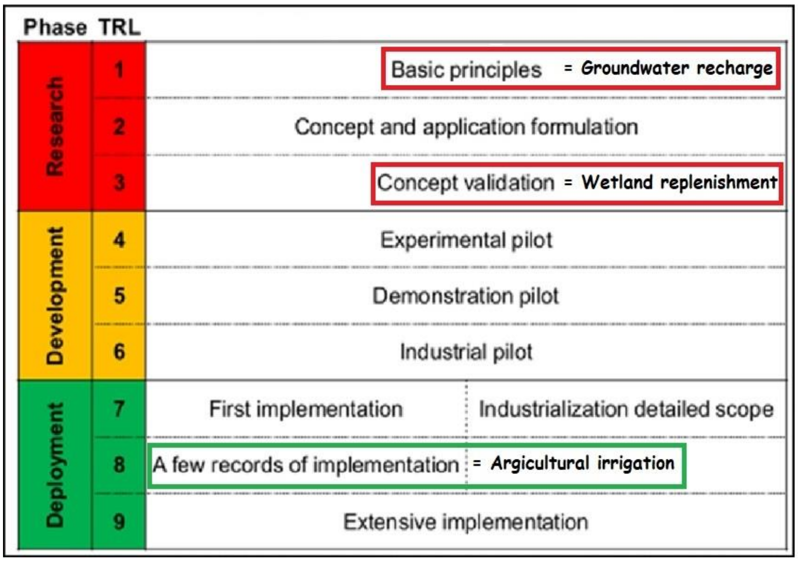
Stormwater reclamation involves the collection, accumulation, treatment, and storage of precipitation for reuse. Unlike rainwater harvesting, runoff is collected from *storm* drains, waterways and roadways instead of rooftops. Dams, ponds, and micro-catchments can be used to divert, slow or store runoff before it enters the receiving waters. After extreme rainfall and seasonal weather events, local watersheds are inundated with flash flood waters that quickly drain into the marine environment. Harvesting this water for non-potable uses, such as groundwater recharge, agricultural irrigation or replenishing natural wetlands, could provide social, environmental, and economic benefits – combating flooding and soil erosion and lessening nutrient loads discharged to marine waters[1].

CURRENT TECHNOLOGY READINESS LEVEL

The **T**echnology **R**eadiness **L**evels (TRL) is a method of estimating the current state of *maturity* of *S*tormwater *R*eclamation and *R*euse in Antigua and Barbuda.



Phase	TRL		
Research	1	Basic principles = Groundwater recharge	
	2	Concept and application formulation	
	3	Concept validation = Wetland replenishment	
Development	4	Experimental pilot	
	5	Demonstration pilot	
	6	Industrial pilot	
Deployment	7	First implementation	Industrialization detailed scope
	8	A few records of implementation = Argicultural irrigation	
	9	Extensive implementation	

The maturity of this technology is being assessed per desired *end use*, i.e., scores are estimated based on the current status of to *i.) groundwater recharge; ii.) agricultural irrigation;* and *iii.) wetland replenishment*. Based TRL scale *(pictured)*, the current levels achieved are *groundwater recharge* **Phase 1, Level 1** – technology concepts are understood by technical experts; *agricultural irrigation* **Phase 3, Level 8** – practice is demonstrated in some farming communities, and *wetland replenishment* is **Phase 1, Level 3** – usefulness of technology is validated, but practice is not systematically employed.

[1] Pavelic, P, Srisuk, K, Saraphirom, P, Nadeeb, S, Pholkern, K, Chusanathas, A, Munyou, S, Tangsutthinon, T, Intarasut, T & Smakhtine, V 2010, '"Balancing-out floods and droughts: Opportunities to utilize floodwater harvesting and groundwater storage for agricultural development in Thailand"', *Journal of Hydrology*, vol. 470-471.

CLIMATE RATIONALE OF THE TECHNOLOGY

Precipitation patterns across the Caribbean have been significantly altered by climate change and variability. In recent decades, Antigua and Barbuda has predominantly experienced prolonged drought periods interspersed with intense flooding rains. Moderate to severe rainfall events result in destructive flash flooding on land and unfiltered runoff making its way into the marine environment. Flooding in the island's center and southwest coast is exacerbated by poor drainage infrastructure and the practice of infilling naturally existing pond networks for residential developments. This presents both a problem and a potential opportunity for *reclaiming stormwater* during periods of abundance and utilizing surface and ground water stores over an extended period. ***S*tormwater *r*eclamation** will provide flood mitigation benefits while simultaneously generating increased water volumes for the Water Utility, farming communities and the natural environment.

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

***S*tormwater *h*arvesting** will be concentrated in the Christian Valley watershed on the southwest coast of Antigua. This would facilitate seepage or direct injection to recharge the aquifer that supplies APUA's southern well fields. Full diffusion of the technology would be phased, with **Phase 1** – a period of forty-eight (48) months for planning, design and execution of the relevant institutional arrangements and budget of approximately USD 500 000 | XCD 1 344 100; and **Phase 2** – an additional sixty (60) months (minimum) for implementation works – construction of diversion canals, micro-catchments and injection wells with an approximate budget of USD 3 000 000 | XCD 8 064 600.

AMBITION FOR TECHNOLOGY READINESS LEVEL

The proposed goal for **t**echnology **r**eadiness over a ten (10) year period is outlined in the table below, with an aim to increase APUA's groundwater extraction by an additional 0.3mgd to offset demands on desalination.

Technology Readiness for Stormwater Reclamation and Reuse by Target Year 10

TECHNOLOGY END USE	PHASE 1 (YR 1 – YR 4)	PHASE 2 (YR 5 – YR 10)
▪ **Groundwater recharge**	Phase 1 (Research), Level 3	Phase 3 (Deployment), Level 8
▪ **Agricultural irrigation**	-	Phase 3 (Deployment), Level 9
▪ **Wetland replinishment**	-	Phase 2 (Development), Level 5

EXPECTED IMPACTS OF THE TECHNOLOGY

***S*tormwater *r*eclamation** at the proposed scale will result in the overarching positive impacts of flood mitigation and augmenting APUA's freshwater stores. Other longterm secondary impacts include moderating saline intrusion into shallow aquifers, providing erosion control after heavy downpour or severe climate events, reducing discharge load to marine waters, and rehabilitating wetland ecosystems by improving their ability to provide ecological and environmental benefits. In addition, during the implementation works there is potential for job creation for skilled and unskilled workers and significant business opportunities for civil/earthworks companies and businesses along the supply chain for construction materials.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

The main relevant water sector policy is the *P*ublic *U*tilities *A*ct (1973) which gives APUA unilateral powers for management of the State's freshwater resources. Thus, the Water Utility would maintain responsibility for facilities and infrastructure installed to facilitate groundwater recharge. Complementary policies to assist with technology deployment and sustainability include the Integrated Water Resources Management (IWRM) Policy, Environmental Protection and Management Bill, 2019 and National Strategic Biodiversity Action Plan 2014-2025. Collectively they provide social, economic and environmental guidelines that establish a foundation of best practicies for deployment activities.

PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

A key institutional arrangement to facilitate technology deployment is the development of a *S*ustainable *P*rocurement *P*lan for the equipment and materials to be used in the implementation works of installing diversion canals, micro-catchments and injection wells. This plan will complement the existing Government of Antigua and Barbuda's Tenders Board Act (2002) and Procurement Administration Act (2011), as well as the Department of Environment's Sustainable Public Procurement Policy.

COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

The consultancy cost associated with development of the comprehensive *Sustainable Procurement Plan* for equipment and materials is estimated at USD 20 000 | XCD 53 765.

USEFUL INFORMATION

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LINKS TO TNA REPORTS

https://tech-action.unepdtu.org/country/antigua-and-barbuda/