Water Resources of the Rio Cobre Basin of Jamaica using WEAP: Impact of climate variability

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Settings



• The Rio Cobre Basin is located in the southeastern section of Jamaica in the parish of St. Catherine. Its western boundary is with the parish of Clarendon. The eastern boundary follows part of the Ferry River as well as borders with St. Mary and St. Andrew. The northern boundary is with St. Ann and St. Mary. The Caribbean Sea borders St. Catherine to the south.

HYDROSTRATIGRAPHY AND GEOLOGY OF JAMAICA



alluvium.

Simplified geological map of Jamaica

(Mitchell, 2013)

18.5°N

Alluvium

Land Use in the Rio Cobre Basin



	Area (sq. km)	Percent (%)
Built up areas	245.3	20.91
Vegetated areas	812	69.21
Agricultural Lands	116	9.89
Total	1173.3	100

Created by M. Curtis (2017) Source: Google Earth Pro Imagery Date: 2017





Demand for potable water

			Base	Technical	
	2010	Supply	Demand	Losses	Deficit/Surplus
St. Catherine					
Spanish Town	148,606	11,759,274	6,687,284	3,513,339	4,720,651
Portmore & Greater		E E		A Z	
Portmore	172,114	13,734,198	7,745,117	4,944,311	1,044,770
			₹	Š.	
Goldmine	20,017	221,554	900,766	79,759	(758,971)
Old Harbour	99,541	3,624,152	4,479,354	1,304,695	(2,159,897)
Ewarton	60,605	5,448,844	2,727,217	3,516,718	(795,091)
Sligoville	3,774	600,000	169,826	216,000	214,174
Guys Hill	15,003	184,128	675,134	66,286	(557,292)
Sue River	3,455	210,511	155,458	75,784	(20,731)
	-				
TOTAL	523,115	33,782,661	23,540,156	12,161,758	

Source: Water Supply Plans, NWC (2011)

http://www.nwcjamaica.com/uploads/Advertisements/PPLan%20-%20PDF/Draft%20St.%20Catherine%20WS%20PPlan%20-%20October%2012%202011.pdf





Potable water Abstraction from Wells



- Abstraction from the Limestone wells have been greater than that from the Alluvium wells.
- The Alluvium wells decline in abstraction due to groundwater contamination with nitrates or saltwater intrusions.

Rainfall in the Rio Cobre Basin



• Upper Rio Cobre received more rainfall than the Lower Rio Cobre Basin for the period 2000-2015.

Recharge Calculation from Precipitation

• Estimated Groundwater Recharge calculations for tropical regions based on water fluctuations and rainfall depth.

• R= 1.35(P-14)^{0.5}

• Where R – Recharge

P – Precipitation (mm)

Recharge for the Rio Cobre Basin base on Rainfall



Direct Runoff from Precipitation

Estimated Direct Runoff from water budget equation was calculated using

Where R_{off} - Direct Runoff
and P - Precipitation (mm)

(Adeleke et at, 2015)

Direct Runoff from Precipitation



- Direct Runoff id greater in the Upper Rio Cobre than the Lower Rio Cobre.
- This calculation was done by using the estimated runoff for water budget (Bouwer, 1978).

Water Evaluation and Planning (WEAP)

- WEAP is an integrated water resources tool which helps in sectoral analysis of resources in an area and future predictions scenarios.
- This model calculates the water demand and supply base on resources and population within the basin.
- This model takes in groundwater and can be coupled with a groundwater model (SWAT or MODFLOW) for further groundwater analysis.
- WEAP has be used as a Decision Support System (DSS) which has been in the Tulkarem District in Palestine and drought management system in Tunisia in West Africa.
- Also in Speightstown in Barbados as a water resource assessment and decision support system and Nariva Basin, in Trinidad, Carriacou for Catchment modelling and assessment of the impact of climate change on water availability.

Preliminary WEAP Results



Water Demand in the Rio Cobre (2000-2015)





Scenario changes in water demand in the area



Scenarios creation in WEAP

- Scenarios will be similar to those of the IPCC climate scenarios A1, B1, A2 and B2 (Special Report on Emissions Scenarios (SRES))
- Before the scenarios are created some key assumptions growth will be made such as population growth and GDP will remain the same for the future period (2015-2030).
- Factors that will be included in scenario generation includes demographic and economic activity, water use patterns and pollution generation, water system infrastructure, allocation, pricing, environmental policy, component cost and climate change
- Accounts: Current Accounts (2000-2015)
- Future Prediction Years (2015-2030/2100)



On Going work

- ETO calculations for the Rio Cobre Basin
- Groundwater model (SWAT or MODFLOW) to be coupled with the WEAP
- Climate scenarios such as the SRES and RCP 1.5

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