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**#CSSW2023**

Conservation and Innovation: Changing the Regional Water Paradigm



# Urbanisation and its impacts on Water Use in the Lower Rio Cobre Alluvium Aquifer – Portmore, St. Catherine Jamaica

**Presenter: Romero Griffiths**

Water Resources Authority, Jamaica

Caribbean Science Symposium on Water  
March 21<sup>st</sup> – 22<sup>nd</sup>, 2023

# Introduction

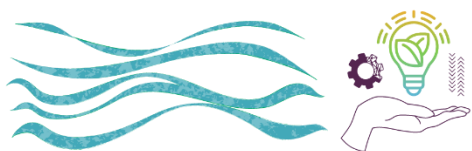


As of 2021, Jamaica's urbanization rate was 56.65% with the parishes of Kingston and St. Andrew, the city of Spanish Town & the municipality of Portmore being the destination choices.

The Statistical Institute of Jamaica's (STATIN) 2011 census report, highlighted that these four urban areas housed approximately 36.75% of Jamaica's total population.

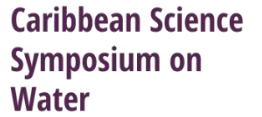
In contrast, 34% of Jamaica's population was living in urban areas in the 1960's. The increase may be as a result of the reduction in the agriculture sector (mainly sugar), as people who once benefited from agriculture rapidly migrated to seek an alternative income.

Portmore was developed to aide Kingston's rapid over-population.



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# Background



In less than 50 years, Portmore transformed from a sparsely inhabited swampy wasteland to Jamaica's second largest urban area.

The bulk of water in the Lower Rio Cobre Alluvium was historically used for Agriculture (flood irrigation)

Portmore's first residential scheme, Independence City, was built in 1962 (Jamaica's independence year).

Prior to Portmore's development, wells were used mainly to satisfy the growth of sugarcanes.



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# Portmore's Development Timeline



1962

Portmore's first residential scheme

1974

The Portmore #2 well was officially commissioned for public supply

1978

Classified as an Urban Area

1968 -1978, a rapid urbanization rate resulted in Portmore's classification changing from rural to urban

2003

Gained Municipal Status

2021

Domestic water was 58% of total water consumption



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# Portmore's Development Timeline



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# Research Question / Issue



The sprawling urbanisation of Portmore on historical agricultural lands and wetland, has resulted in a shift in water demand/use.



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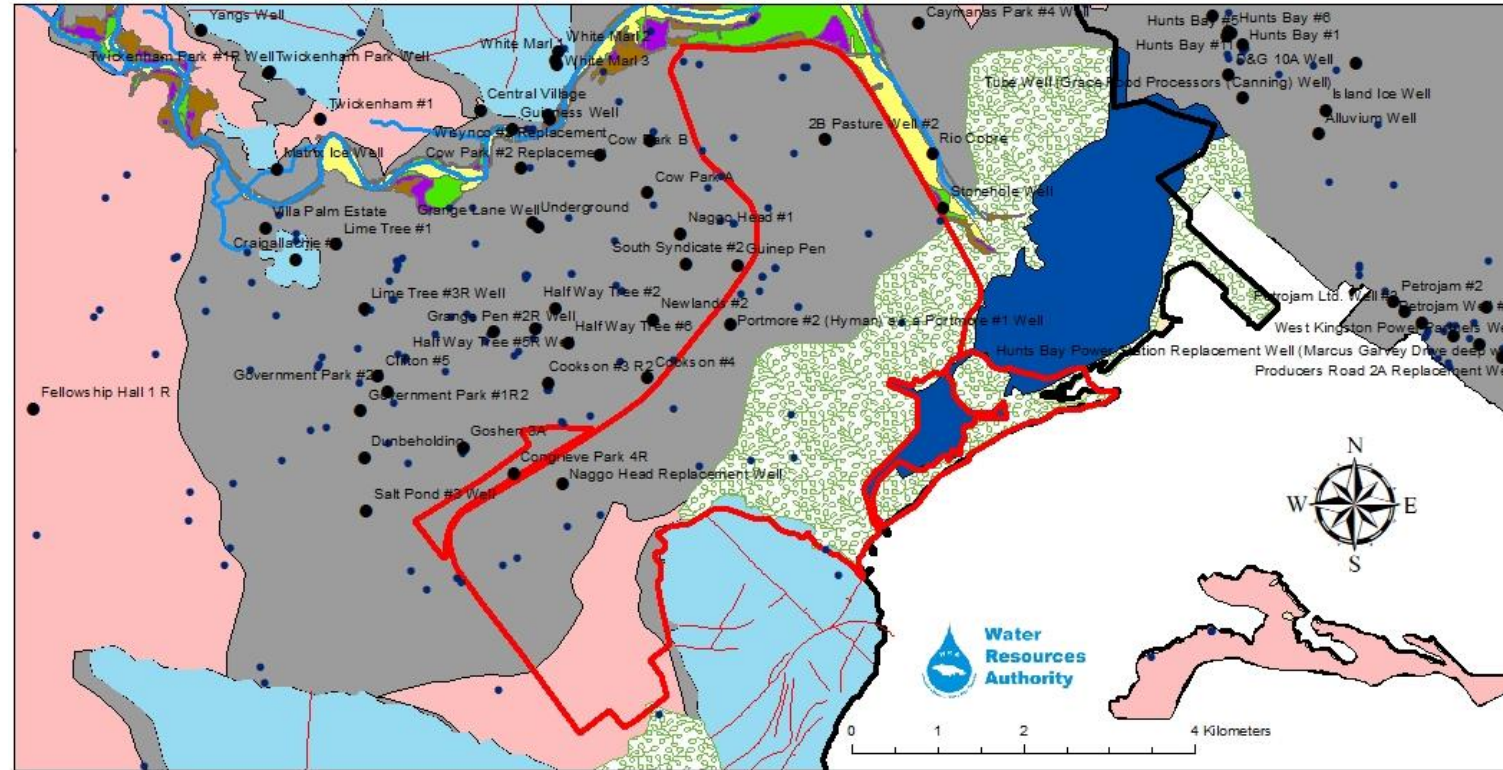


# Methodology

Assessed the change of water usage for selected wells.

Analysed the groundwater level data of monitoring wells.

Analysed abstraction data for historical and current pumping wells. Ensuring to highlight dominant demand.



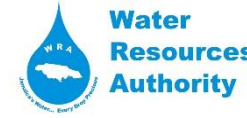
**Hydrostratigraphy Map of Selected Wells in Portmore, St. Catherine, Jamaica**

- |                          |  |                      |
|--------------------------|--|----------------------|
| ● Licensed Sources       | <b>Flood Return Period Hydrostratigraphy</b> |                      |
| • Wells                  | 10 Yr  | Alluvium Aquiclude   |
| — Rio Cobre              | 25 Yr  | Alluvium Aquifer     |
| — Faults                 | 50 Yr  | Limestone Aquifer    |
| ▭ Portmore               | 100 Yr                                       | Swamp/Marsh/Mangrove |
| ▭ Saint Catherine Parish | Parish Boundaries                            | Water Body           |



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# Results – Abstraction Water Demand



Water use data spanning from January 1966 – September 1982 highlighted the following;

- Total water usage of approximately 161,413,320m<sup>3</sup> from 42 wells was used for irrigation, which was the dominant demand at that time.
- Irrigation demand has since been reduced significantly.

Water use data spanning from April 1996 – April 2022 highlighted the following;

- Water usage of 107,254,391.60m<sup>3</sup> was withdrawn from 11 wells licensed for domestic use
- Water usage of    was withdrawn from x wells licensed for irrigation use
- Water usage of    was withdrawn from x wells licensed for domestic use

In 2021, domestic water use was the largest (58%) consumption volume in the aquifer.

This corresponds with Jamaica's current consumption pattern.

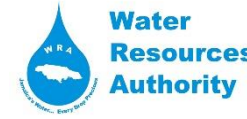


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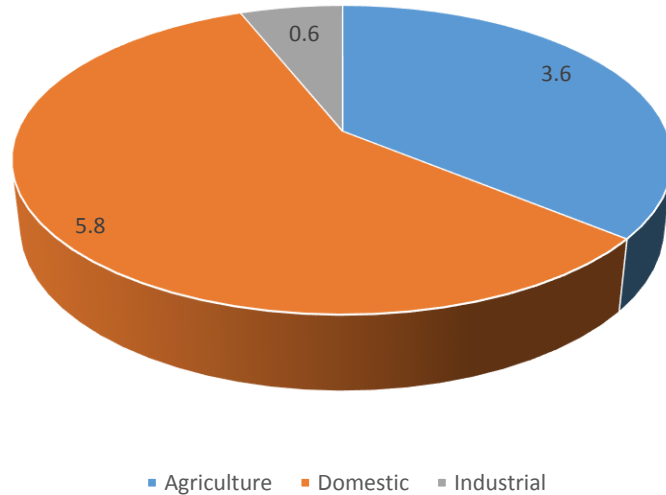
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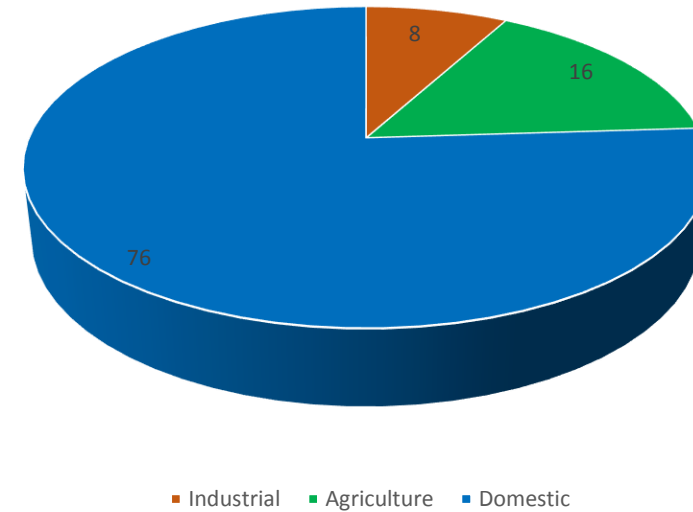
# Results – Abstraction Water Demand



2021 Consumption for Aquifer Mm3



Jamaica's 2021 Water Consumption %



Jamaica's current consumption deviates from the 75% agricultural water consumption global averages for the sector. However, total water withdrawal paints a different picture as these percentages will be adjusted to include non-consumptive water.

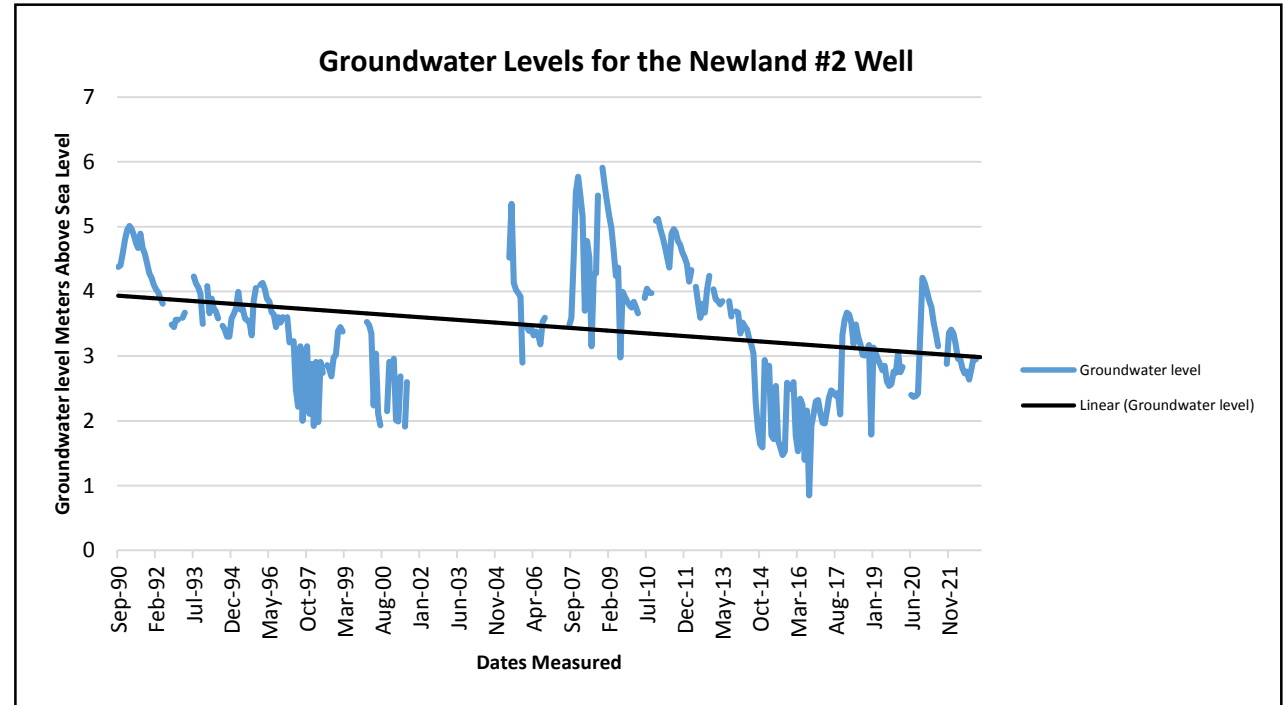


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# Results – Groundwater Level

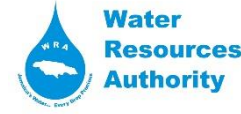
Newlands #2 well's groundwater levels for the period September 1990 – January 2023 shows a slight decrease in groundwater levels in the aquifer.



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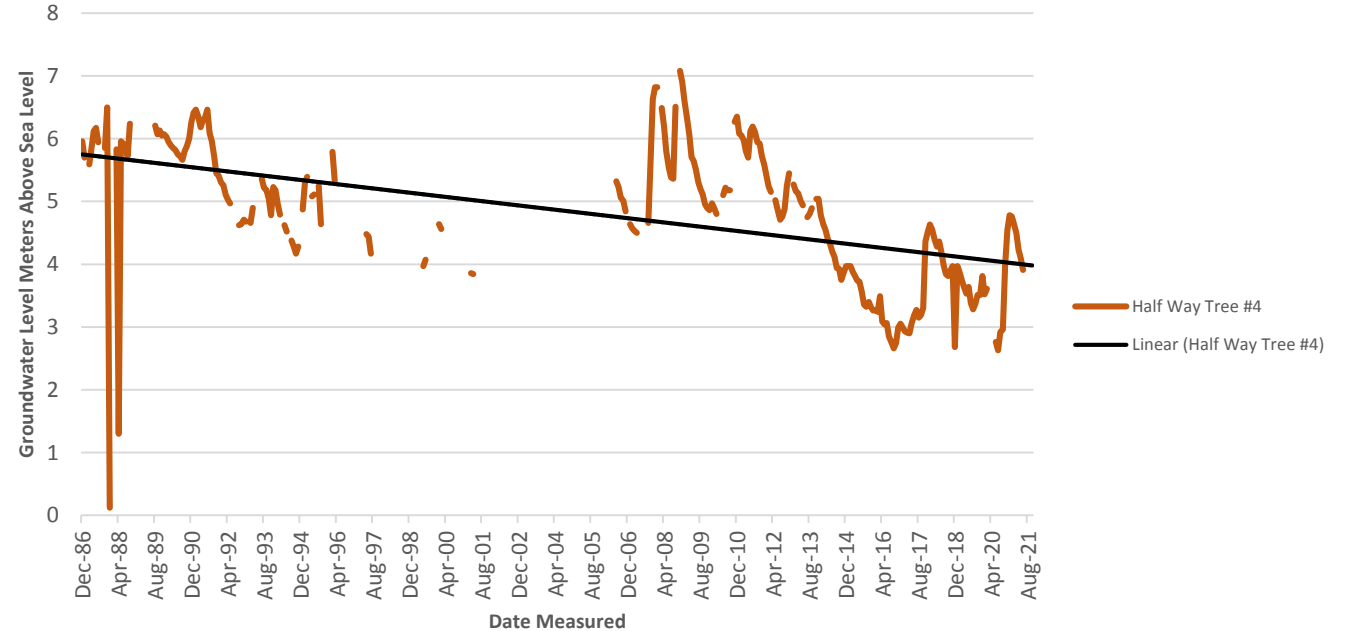
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# Results – Groundwater Level



Half Way Tree #4 well's groundwater levels for the period December 1986 – October 2021 shows fluctuation and a slight decrease in groundwater levels in the aquifer.

Groundwater Levels for the Half Way Tree #4 Well



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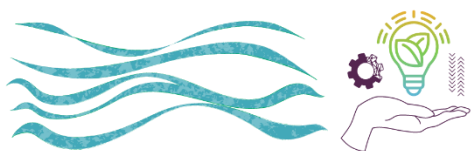
# Discussion



Farmers practiced flood irrigation and needed massive withdrawal volumes for agriculture. This high rate of unchecked well drilling and pumping degraded the aquifer's water quality (saline intrusion) and led to the 1969 implementation of a moratorium (no new drilling) on the Rio Cobre Basin. Since the collapse of the sugar industry, a lot of the irrigation wells are out of operations while some has been converted for domestic and industrial use.

Well Name	Date of Completion	Original Owner	Current Owner	Comments
Government Park #1	April-1959	National Irrigation Commission	National Water Commission (NWC)	Well was re drilled in 1992 by NWC
Half Way Tree #4	January-1959	Frome Monymusk Land Co	National Irrigation Commission (NIC)	
Portmore #2	March-1947	Caymanas Estate Limited	National Water Commission (NWC)	Was rehabilitated for public supply in 1974
South Syndicate 2	July-1986	Agro 21 Corporation	National Irrigation Commission (NIC)	

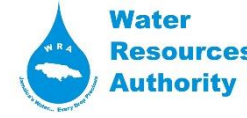
Currently, WRA issued 18 agriculture, 9 domestic and 2 industrial licences for the aquifer.



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# Discussion



These 11 domestic wells operate non-stop to meet Portmore's increasing water demand. Portmore's population was 182,153 in 2011, a 16% increase to 2001's population of 156,469. Domestic water demand increased from 64,821.26 m<sup>3</sup>/month in 2001 to 75,461.32 m<sup>3</sup>/month in 2011.

Decreasing groundwater levels for the period indicates that the aquifer is not recharging fast enough even with the implementation of the moratorium, the reduction in the quantity of wells being pumped and the adaptation of improved farming methods such as drip irrigation.

Portmore's urbanisation (on agriculture and wetland), climate change (reduce rainfall) and the rate of pumping might be factors that are influencing the Lower Rio Cobre Alluvium's recharge rate but at the moment, more studies need to be done.

The rapid urbanisation of Portmore coupled with the collapse of the sugar industry has shifted water use in the Lower Rio Cobre Alluvium.



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# Recommendations



Increase domestic storage capacity to reduce the need for constant pumping.

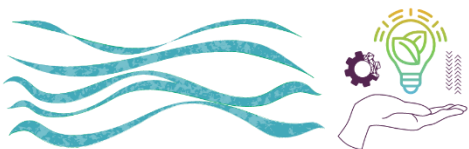
Re-use treated water for agriculture.

Promote construction that increases the use of smart water technology eg. Water saving faucets.

Increase watershed management which promotes infiltration and reduces run-off.

Increase water usage efficiency per capita in Jamaica generally & specifically Portmore.

Increase public education on water conservation methods.



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# THANK YOU

## Any Questions?



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