

# IWRM working in Trinidad and Tobago: A benefits analysis of the Adopt A River Programme

Integrated Water Resources Management (IWRM) is a process which promotes the coordinated development and management of water, land and related. WASA began the Adopt A River Programme in order to implement the short-term initiatives which would realise IWRM in local watersheds. The project has been ongoing for the past three years. This paper reviews the successes of the programme in light of WASA's IWRM Plan and also in terms of social, economic and environmental benefits to the watersheds in which work has been completed.

Sharda Mahabir  
Water Resources Agency  
February 9, 2015



## Contents

IWRM working in Trinidad and Tobago: A benefits analysis of the Adopt A River Programme .....	2
IWRM in Trinidad and Tobago.....	2
IWRM and WASA.....	2
The First AAR Project – The Guanapo Experience .....	6
Addressing Guanapo watershed issues .....	6
Benefits and achievements from the Guanapo Project .....	9
Expansion of the Adopt A River Programme.....	12
Summary of Adopt A River Achievements 2011 – 2014.....	13
Adopt A River and WASA’s Strategic Goals.....	13
Cost Analysis of the Adopt A River Programme .....	18
WASA Expenditure.....	18
Adopt A River Investments.....	18
Overall benefits of the Adopt A River Programme.....	21
The way forward.....	21
Bibliography .....	22

## TABLES

Table 1: Table of the suggested initiatives for IWRM in Trinidad and Tobago (WRA 2011).....	5
Table 2 –Priority listing of watersheds .....	7
Table 3 –WASA facilitated IWRM activities in the Guanapo Watershed.....	8
Table 4 – Benefits to the Guanapo Watershed from the Adopt A River Programme. <b>Error! Bookmark not defined.</b>	
Table 5 – Project details for 11 adopters under the Adopt A River Programme .....	14
Table 6 - WASA Adopt A River Expenditure .....	18

## FIGURES

Figure 1 – Locations of sampling sites in Guanapo and data from 2013 and 2014 .....	11
Figure 2 – WASA Adopt A River Expenditure versus the investments made into the programme via adopters.....	20

# IWRM working in Trinidad and Tobago: A benefits analysis of the Adopt A River Programme

## IWRM in Trinidad and Tobago

Integrated Water Resources Management (IWRM) is a process which promotes the coordinated development and management of water, land and related resources in order to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems (GWP TAC 2000).

Traditionally, an IWRM approach focuses on three basic pillars and explicitly aims at avoiding a fragmented approach of water resources management by considering the following aspects (GWP 2012):

- An **enabling environment** of suitable policies, strategies and legislation for sustainable water resources development and management,
- Putting in place the **institutional framework** through which to put into practice the policies, strategies and legislation, and
- Setting up the **management instruments** required by these institutions to do their job.

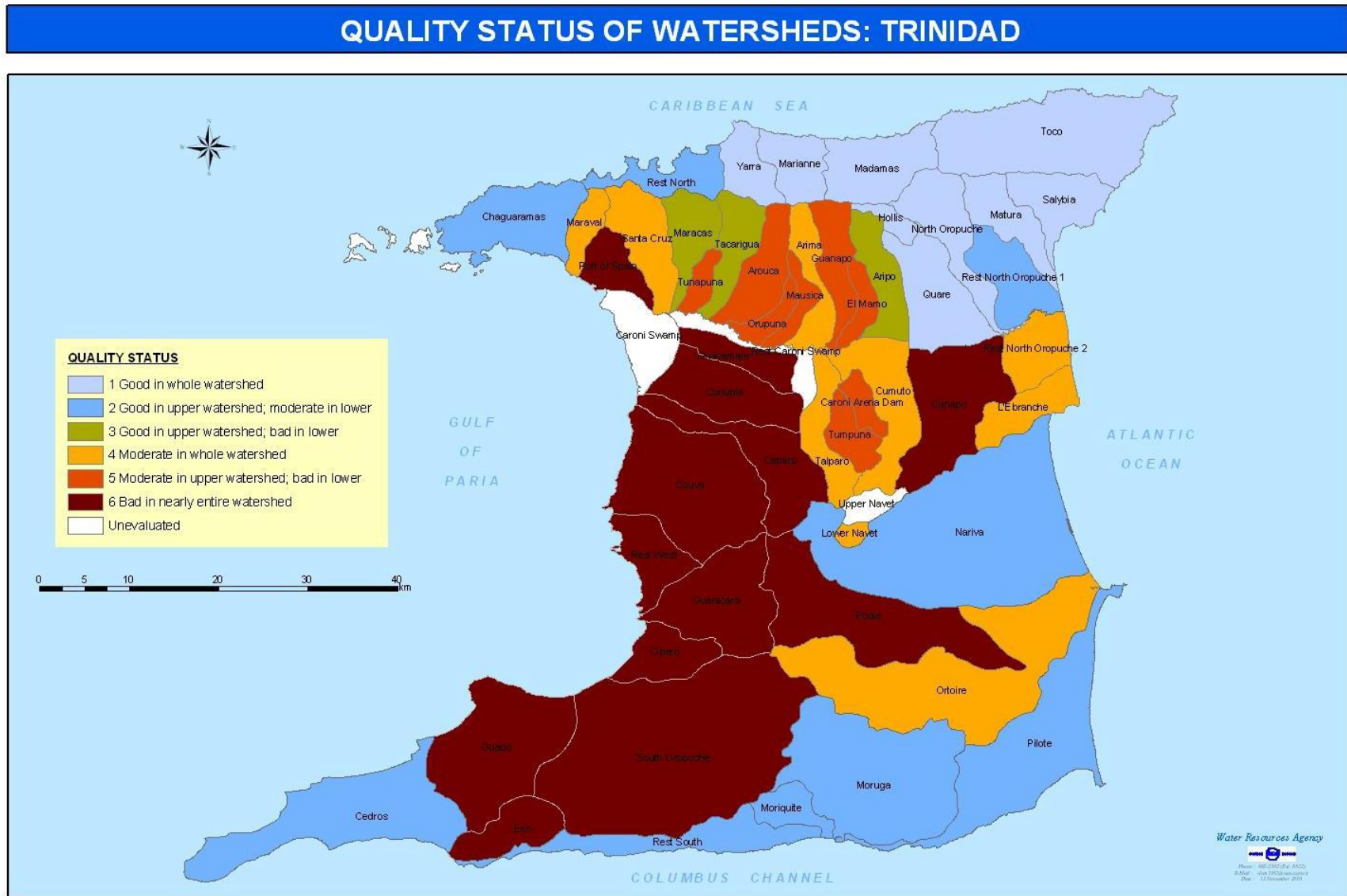
In Trinidad and Tobago, IWRM has been recognised as an important tool with respect to water management. In 2005, the Government of Trinidad and Tobago finalised a National Integrated Water Resources Management Policy, thereby providing the enabling environment for IWRM. The focus since has been on the development of the institutional framework and management instruments, via the formation of a committee to manage development in an IWRM manner. Prior to the Implementation of the Adopt A River Programme, the full potential of IWRM was not realised.

## IWRM and WASA

Whilst Trinidad and Tobago waits for the IWRM to become formalised, via institutional frameworks and management instruments, the major water supply company for Trinidad and Tobago, The Water and Sewerage Authority, has the financial burden of the implement of IWRM as a consequence of the degradation of watersheds (Map 1 and 2).

In 2011, WASA proposed an IWRM plan to reduce pollution in rivers and reduce some of the main challenges faced in the treatment of water for supply. The plan also addressed how Integrated Water Resource Management could be achieved locally through the water resources management functions of the Authority as well as new initiatives of the Water and Sewerage Authority. The plan identified challenges in the major watersheds in Trinidad and Tobago and made suggestions towards their improvement. There were long-term and short-term solutions identified for each watershed assessed (Table 1). For most of the watersheds, public education and participation, watershed rehabilitation activities and water quality monitoring were identified as important short-term initiatives for implementation.

Map 1 – Quality status of watersheds within Trinidad



Map 2 – Quality status of watersheds within Tobago

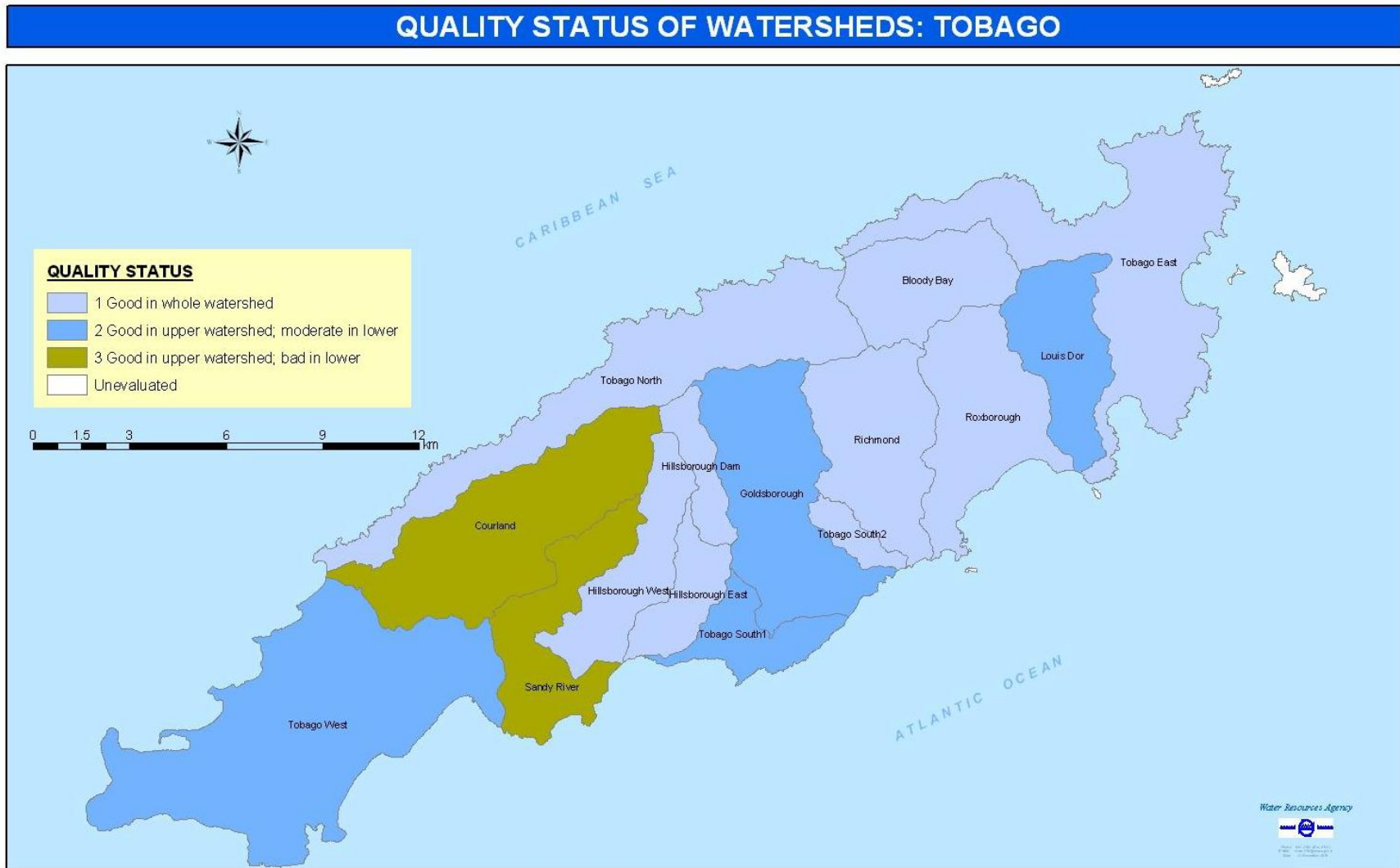


Table 1: Table of the suggested initiatives for IWRM in Trinidad and Tobago (WRA 2011).

No.	Watershed	Short-term					Long-term	
		Public Education and Participation	Rehabilitation Activities	Water Quality Monitoring	Community Governance	Company Incentives	Legislation	Landuse Planning
1	Arima	x	x	x	X		x	x
2	Guanapo	x	x	x	X		x	x
3	Aripo	x	x	x	X		x	x
4	Mausica	x	x	x	X		x	x
5	Tacarigua	x	x	x	X	x	x	x
6	St. Joseph	x	x	x	X	x	x	x
7	San Juan/Santa Cruz	x	x	x	X	x	x	x
8	Arouca	x	x	x	X	x	x	x
9	Cumuto	x	x				x	x
10	Talparo	x	x				x	x
11	Tumpuna	x	x				x	x
12	Couva			x				x
13	Guaracara			x				x
14	Caparo		x	x				x
15	Killdere	x	x	x			x	x
16	Nariva	x	x	x			x	x
17	South Oropuche	x	x	x	X		x	x
18	South Cunapo	x	x	x	X		x	x
19	Guapo	x	x	x	X		x	x
20	Erin	x	x	x	X		x	x
21	Courland	x	x	x	X		x	x
22	Louis D'Or	x	x	x	X		x	x
23	Hillsborough West	x	x	x	X		x	x

Coming out of these recommendations, WASA began the Adopt A River Programme. The purpose of this programme was to implement the short-term initiatives which would realise IWRM in local watersheds (Table 1). In other words, Adopt A River was to become the ‘hands-and-feet’ of IWRM locally.

The Adopt A River Programme is defined as an initiative to involve communities and corporate entities in the improvement of watersheds throughout Trinidad and Tobago in a sustainable, holistic and coordinated manner.

In order to advise on watersheds to be adopted, a priority listing of watersheds, identifying the most critical watersheds, was created based on their status (Table 2, Map 2). In order to illustrate their commitment towards improving the country’s water resources, WASA adopted the Guanapo watershed which was identified as one of the most critical watersheds, requiring urgent attention, since it received water pollution from the Guanapo Landfill and from quarries. This pollution eventually empties into the Caroni River, above the Caroni Water Treatment Plant which is the largest source of surface water for Trinidad and Tobago.

This paper looks at the work completed over the past three years since WASA implemented the Adopt A River programme. It assesses the social, environmental and possible economic benefits of the programme.

## **The First AAR Project – The Guanapo Experience**

### *Addressing Guanapo watershed issues*

As part of their Adopt A River Programme, WASA surveyed the Guanapo community members and they indicated that their main issues were:

- **Poor drainage and no pavements**
- **Pollution from the landfill in the form of leachate**
- **Heavy silt runoff from the Heights of Guanapo Road and quarries**

In January 2012, WASA hosted a community meeting to involve the Guanapo community in the Adopt A River Programme. From this meeting, twenty-five (25) persons from the community expressed their interest in the project and came together to form the community organisation: GCEDO (Guanapo Community and Environmental Development Organisation). Later that year, in response to their needs, WASA then provided Water Warriors Training for these persons whereby they were educated on the issues related to water resources supply and trained in the use of water quality testing kits (Table 3).

Members of staff of the Chemistry Department, The University of the West Indies, attended the Guanapo community meeting and, understanding the plight of the residents who were concerned about the leachate from the landfill, they designed a project to assess the leachate and its impacts on the natural

*Table 2 –Priority listing of watersheds*

Watershed	Degradation	Water Quality	Aquatic Life	Water Supply	Location
Guanapo	Low	Medium	Low	High	<b>North</b>
Chaguaramas	High	Medium	High	Medium	<b>North</b>
Tobago West	High	Medium	High	Medium	<b>Tobago</b>
Maraval	High	Low	High	High	<b>North</b>
South Oropuche	High	High	Medium	High	<b>South</b>
Arima	Medium	Low	High	High	<b>North</b>
El Mamo	Medium	Low	High	High	<b>North</b>
Hillsborough West	Medium	High	Low	High	<b>Tobago</b>
Upper Navet	Medium	Low	High	High	<b>Central</b>
Mausica	Medium	Low	High	High	<b>North</b>
Talparo	Medium	High	Low	High	<b>Central</b>
Tacarigua	Medium	Low	High	High	<b>North</b>
Caparo	Medium	High	Low	High	<b>Central</b>
Cunupia	Medium	High	Low	Medium	<b>Central</b>
Poole	Medium	High	Low	Medium	<b>South</b>
Louis Dor	Medium	Medium	Low	Medium	<b>Tobago</b>
Couva	Medium	Medium	Low	Medium	<b>Central</b>
North Oropuche	Low	Medium	Medium	High	<b>North</b>
Tumpuna	Medium	Medium	Low	High	<b>Central</b>
Courland	Medium	Medium	Low	High	<b>Tobago</b>
Port of Spain	Medium	Low	Medium	High	<b>North</b>
Cumuto	Medium	Medium	Low	High	<b>Central</b>
Santa Cruz	Medium	Medium	Low	High	<b>North</b>
Pilote	Medium	Medium	Low	High	<b>South</b>
Aripo	Medium	Low	Low	High	<b>North</b>



*Table 3 –WASA facilitated IWRM activities in the Guanapo Watershed*

Issues	Parties involved	Solutions	Accomplishments	Status
Poor drainage and no pavements	Ministry of Works and Infrastructure	Provide pavement and drainage along the La Retreat Road	WRA met with Ministry officials to request paving	La Retreat Road drainage and pavement completed
	Heritage Limestone	Maintenance of the Heights of Guanapo Road	WRA met with the Quarry and won his commitment for maintaining the road	The road is maintained – holes are filled, landslides are removed – by the quarry operator.
Pollution from the landfill in the form of leachate	UWI	UWI implemented a project to assess the impact of the leachate on the Guanapo catchment	WRA sits on the committee, has provided field support and facilitated project documentation including grant application	UWI project 80% completed
	SWMCOL	SWMCOL has done more work on the leachate pond to reduce breaks and runoff. They have also established a second pond in the area. SWMCOL has engaged the LSA to re-acquire lands to establish a water treatment plant for the leachate	WRA has facilitated community meetings with SWMCOL  WRA has attended LSA site visits, conference and meetings	Work ongoing. Frequency of leachate pollution events has reduced.  Initial meetings and site assessment completed. LSA to begin community meetings soon.
Heavy silt runoff from the Heights of Guanapo Road and quarries	Heritage Limestone	Quarry Operators maintain the Heights of Guanapo Road	Met with the Quarry Operator to win his support for maintaining the road	Road is maintained however, need to approach Quarry operator to assist in better drainage along the road
	Ministry of Agriculture	Ministry of Agriculture intends to implement a project to introduce check dams and Gaussian baskets along the road at locations where runoff is heavy	This idea came about based on the AAR Committee on which the Ministry representative sits. WRA has attended meetings, workshops and facilitated fieldtrips.	Initial discussion and field trips completed. Proposal being drafted.
Social Issues in the Guanapo	UWI/UNGEF	Teaching the community food production skills to provide income	Facilitated GCEDO meetings and grant process	Inception Meeting scheduled for end of October

environment. The University team won \$1 million Trinidad and Tobago Dollars (TTDs) in funding from their Research Impact Fund (UWI RIF) and this project began in 2012 (Table 3). WASA and The UWI engaged the Solid Waste Management Company (SWMCOL), who are responsible for the landfill, in the assessment of the leachate and since then, they have collectively been working on improving the waste management strategy for the landfill (Table 3).

Since the inception of the UWI Guanapo Project, further works have been undertaken at the Guanapo Landfill to help reduce the leachate runoff into the river. A second pond was installed since the first could not handle the large volume of leachate coming from the landfill. Other works include terracing of the landfill and better drainage within the compound as well as improved drainage leading away from the landfill. It is hoped that in the long-term, these changes would result in a reduction in the environmental impacts.

At the inception of the project, WASA and the Ministry of Works approached the quarry operator of Hermitage Limestone and he gave his commitment to maintain the Heights of Guanapo Road. Discussions have begun again with the quarry operator to look at engineering techniques to solve the run-off issue such as check-dams.

Further, realising that the Guanapo community also suffered from social issues, the UWI engaged UN/GEF in a sustainable livelihood project whereby members of the community will be taught aquaponics and small crop farming. WASA facilitated the grant proposal process for this project and continues to support the development of projects in the area. This means that a new issue was added to the list and solutions were also found within this area.

### *Benefits and achievements from the Guanapo Project*

Overall, the Guanapo Adopt A River Project has had overwhelming social and environmental benefits to the watershed and the community.

A major social benefit of this project is the increased consciousness of the community about water pollution and their willingness to address relevant authorities with their concerns (Table 4). Since 2012, WRA representatives receive phone calls for any pollution incidence in the area, especially from the farmers in the area. This is especially important since the farmers use the river water for irrigation. Further, the community has conducted a clean-up to remove garbage which washed into the river from the landfill. The community members have also become more involved in community activities and representation at their local and regional levels. This has resulted in a greater awareness of their plight as well as better representation of their interests.

Aside from the above social benefit, there have also been extensive environmental benefits with a reduction in the number of incidence of leachate pollution to the Guanapo River.

Another important benefit of this project was the funding which was won from the United Nation’s Global Environmental Programme and the University of the West Indies. (Table 4).

The Guanapo Water Warriors training was an achievement for WASA because it was the first water quality training done by WASA in a community. It was also the first successfully completed project under the AAR and the first project to provide water quality data from a community group to WASA.

A very important benefit of the programme is that it encouraged polluters to make positive changes with respect to their environmental impacts without highlighting their faults. Companies which have environmental impacts from effluent discharge in many instances cannot find financially viable methods of improvement which do not hard their company’s image. The Adopt A River Programme is an avenue for companies to change their pollution image whilst, at the same time, making positive changes in their pollution impacts.

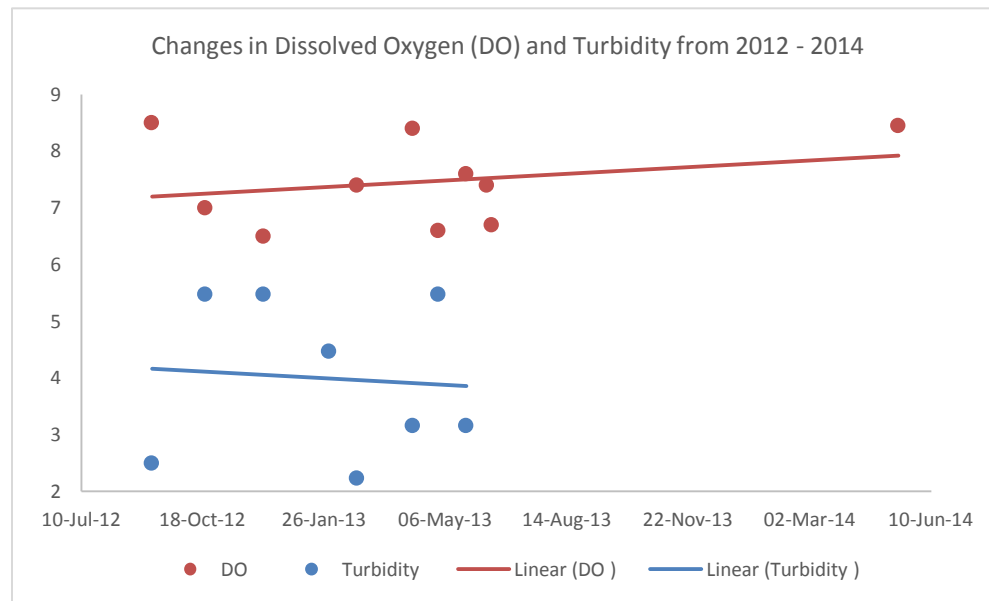
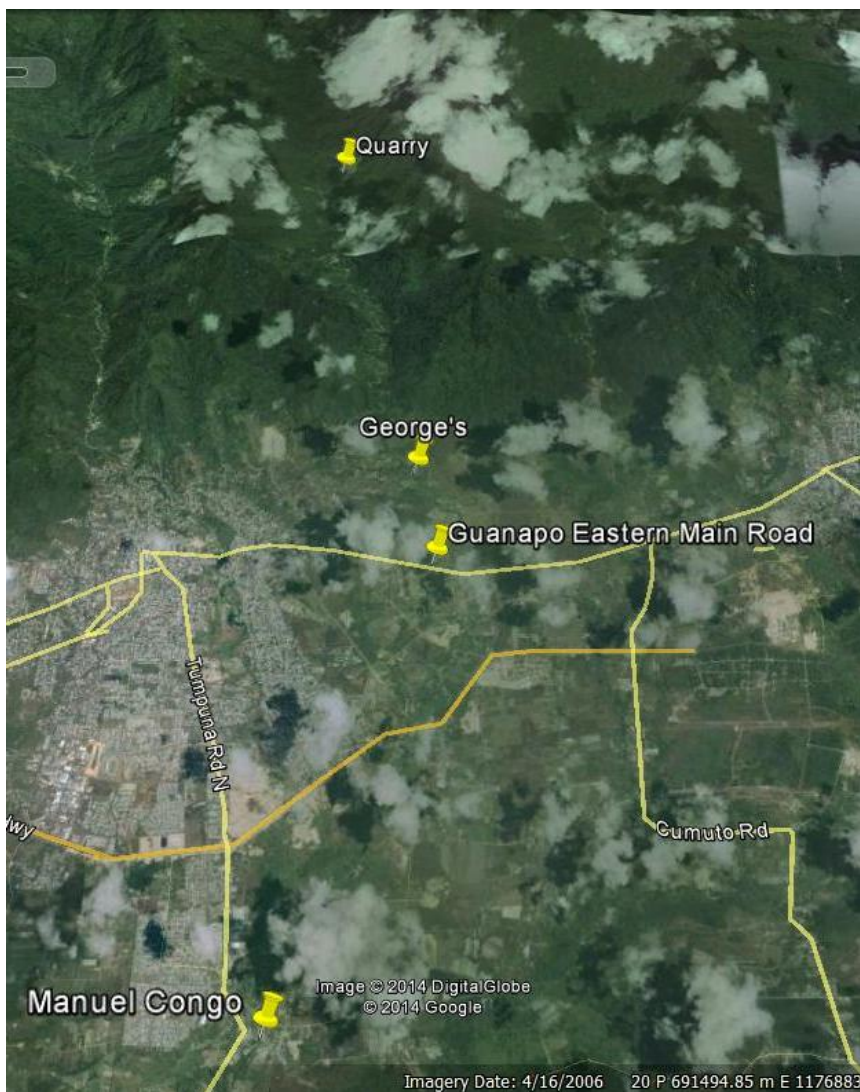
The Guanapo Project began as a water training programme and cascaded into holistic, coordinated projects, involving multiple stakeholders, and addressing all of the main issues identified by the community. Within a two year period, the project was able to multiple from one to six stakeholders addressing the four main issues within the watershed, with support of the community.

The Guanapo experience is an excellent example of the implementation of an integrated approach towards water management. The collaboration facilitated by WASA has resulted in very important changes within the watershed (Table 1). Overall, the Guanapo Adopt A River Project was able to address the major issues identified as well as complete most of the short-term projects suggested in WASA’s IWRM Plan (Table 1).

*Table 4 – Benefits to the Guanapo Watershed from the Adopt A River Programme.*

Benefit description	Benefit type	Benefactors
A reduction in the leachate running into the Guanapo River	Environmental	Community, WASA, farmers in the area
Better community behaviour- they are more vigilant of pollution incidences and dump less in the river.	Social, Environmental	Community, WASA, farmers in the area
External investments in the improvement in the watershed e.g. fixing the road. Fixing the road means greater accessibility to resources.	Social, Environmental, Economic	Community, WASA, farmers in the area, Quarry operators
External investments in the improvement of the community	Social, Environmental	Community, WASA, farmers in the area
Water quality data generated by the community - For 11 months, the Guanapo community collected water quality data which they submitted to WASA. Data was collected from four sites (Map 1) for 2012 to 2013 and shows an improvement in the water quality over a short period of time (Figure 2).	Social, Environmental	Community, WASA, farmers in the area

Figure 2 – Locations of sampling sites in Guanapo and data from 2013 and 2014



GCEDO results for Turbidity in 2012-2013, show a decrease in this parameter which indicates an increase in water quality.

GCEDO data for dissolved oxygen in 2012-2013 was compared to results in 2014 as well and shows an increase in water quality with respect to this parameter as well.

## Expansion of the Adopt A River Programme

WASA's involvement in the Guanapo watershed demonstrated a successful IWRM approach via the Adopt A River Programme and as a consequence, many other organisations and community groups opted to join the programme. The cascading that was observed in Guanapo was also observed for the overall project. That is, when word of the Adopt A River successes in Guanapo was spread, other organisations and agencies willing approached WRA to join the programme.

Within one year, The Adopt A River Programme received recognition within the local business community as a fora through which corporations and business could pursue corporate social responsibility projects. As such, the number of adopters increased from 1 in 2011 to 5 in 2012. In 2012, at the launch of the Adopt A River Programme, five (5) adopters signed a Memorandum of Understanding (MOU) with WASA to pursue projects in different areas. They were:

- ❖ Guanapo Community and Environmental Development Organisation (GCEDO)
- ❖ The University of the West Indies
- ❖ ROSE Environmental Limited
- ❖ Caribbean Youth Environmental Network (CYEN)
- ❖ Phoenix Park Processors Ltd.

From 2012 to 2013, the number of adopters more than tripled from 5 to 17. To date, of the seventeen (17) organisations registered with the Adopt A River Programme, nine (9) of which are active participants whilst eight (8) are still working on their proposals and project details. A summary of ten (10) active organisations, their activities and progress in priority watersheds is included in Table 3.

In total, at the conclusion of these seventeen (17) projects, the following thirty-four (34) sub projects will have been achieved:

- ✓ At least ten (10) educational activities which would include fairs, exhibitions, lectures and fieldtrips
- ✓ At least five (5) videos outlining pollution issues in at least four (4) watersheds to be aired on local television and made available via the internet
- ✓ Seven (7) clean-up exercises in at least four (4) watersheds across the two islands
- ✓ Three (3) reforestation projects in at least three (3) watersheds across the two islands
- ✓ Six (6) water quality testing exercises through registered organisations – four (4) of these were done via WASA's Water Warrior's Programme whilst the other two (2) were undertaken by educational institutions (e.g UWI and UTT).
- ✓ Aside from the four (4) community based water quality testing exercises listed above, WRA has also concluded water quality training in three (3) other communities, thus bringing the total

number of communities receiving training to seven (7). Most of the community groups continue water quality monitoring on a regular basis.

## **Summary of Adopt A River Achievements 2011 – 2014**

Over the past two years, the Adopt A River Programme has been able to:

1. Commence work in seven (7) of the twenty-three (23) watersheds or thirty percent (30%) of the watersheds listed in WASA's IWRM plan (Map 3).
2. In total, the number of sub-projects already completed is 18 which is 53% of the total number of sub-projects quoted above.
3. Bring about a change in the perception of communities with respect to rivers as illustrated by the community support in Guanapo.
4. Complete training in at least 7 communities of which 4 (57%) have been collecting water samples and analysing on their own
5. Successfully participate in at least 5 educational and awareness campaigns which include the national environmental fairs such as SanCity and SciTechnoFest

## **Adopt A River and WASA's Strategic Goals**

The Water and Sewerage Authority has been pursuing a corporatization model in order to improve the Authority's operations and business practices and attain greater levels of efficiencies.

One model of Corporate Governance being seriously considered is the PUB Singapore Model, which has over the past ten years, changes the perception of the public towards water by encouraging everyone in the 3P (People, Public and Private) sectors to take joint ownership of Singapore's water resources management (PUB 2010). In particular, PUB Singapore has an "Our Water" Programme which allows schools and organisations to adopt waterbodies and look after them.

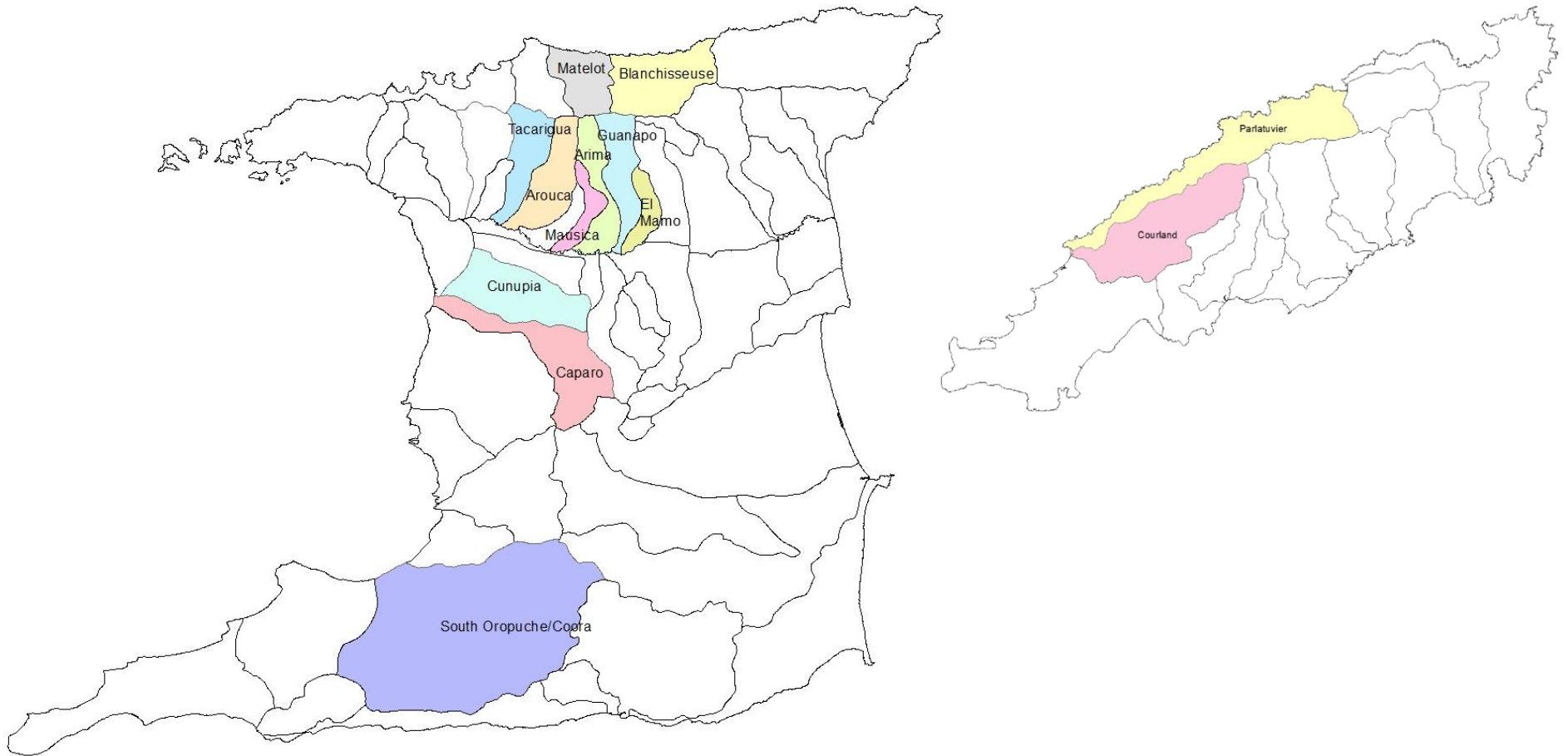
The Adopt A River Programme in Trinidad and Tobago has many similarities with the PUB Singapore 's "Our Waters" Programme and hence, can be said to have met at least one of the strategic goals of the Authorities' corporatization process.

Table 5 – Project details for 10 adopters under the Adopt A River Programme

No.	Adopter	River/Watershed	Educational Activities	Videos	Cleanups	Reforestation	Testing	Status
1	R.O.S.E Environmental Services	Marianne	x		x			Four testing kits were donated. Clean-up exercises to begin next year.
2	Guanapo Community Environmental Development Organization (GCEDO)	Guanapo	x	x			x	Water testing completed
3	University of the West Indies	Guanapo	x				x	Project 80% completed, final project document being drafted
4	Caribbean Youth Environment Network (CYEN)	Arima and Courland	x	x				Project 50% complete
5	Phoenix Park Gas Processors Limited	Donation of a national mobile lab	x		x		x	Project still outstanding
6	Social Justice Foundation	Coora and Tumpuna	x	x			x	Regular national water monitoring ongoing.
7	University of Trinidad & Tobago	Arima	x		x		x	Project 25% completed
8	Dorcas Women’s Group	Matelot	x		x			Project to begin
9	Anse Formage Community Group	Courland	x	x	x	x	x	Project underway. Group has received water quality monitoring equipment.
10	Collect A Car Association	Cunupia	x	x	x	x		Project ongoing.



Map 3 – Priority watersheds being addressed through the Adopt A River Programme







Members of UWI working together with community members during sampling exercises in Guanapo



Members of CYEN's Water Caravan during one of their school visits which was featured on local television CNMG



Members of the Anse Formage Group and Scotiabank during their clean-up exercise in Courland, Tobago.





Mayor Boodhan addressing members of Scotiabank and Collect a Car Association's joint clean-up and reforestation exercise in Cunupia.



Youths from Siparia testing water from the Coora River with help from representatives of the Social Justice Foundation



Youths from Siparia and Carlsen Field being trained during the Adopt A River Water Champions Programme. The Carlsen Field group samples the Caparo River which flows through Chaguana.

## Cost Analysis of the Adopt A River Programme

### WASA Expenditure

A comparison was done of the money spent on the Adopt A River Programme over the past three years versus the amount of money invested into the programme by adopters or other financiers.

WASA expenditure in this analysis does not include the amount of time dedicated by staff members on the Adopt A River Projects. This was not included because Adopt A River is not the only core function of the staff members and hence, allocating time spent by different staff members was difficult to quantify. Further, the cost per staff member would differ based on position and seniority.

Table 4, summarises the amount of money invested by WASA into the Adopt A River Programme over the past three years. The annual expenditure is based on number and size of event within each year. In fact, Training Programmes require less money when compared to the cost of public events such as the Launch of the Programme or the Steering Committee.

*Table 6 - WASA Adopt A River Expenditure*

Year	Expenditure	Event
2012	\$45,670.24	Training in Cumaca and Guanapo
2013	\$267,079.02	Launch of AAR, Launch of Steering Committee, Training in Mausica and South Oropuche
2014	\$26,753.40	Training in Courland, Coora and Carlsen Field; Adopt A River Steering Committee meetings
<b>TOTAL</b>	<b>\$312,749.26</b>	<b>Amount of money WASA spent from 2012-2014</b>

### Adopt A River Investments

When compared to the amount of money which has been invested in the programme by adopters (Figure 5), the values indicate that the Programme is self-sustaining. By the second year of the programme, WASA was able to get adopters to invest almost twice the amount of money that was spent on the project.

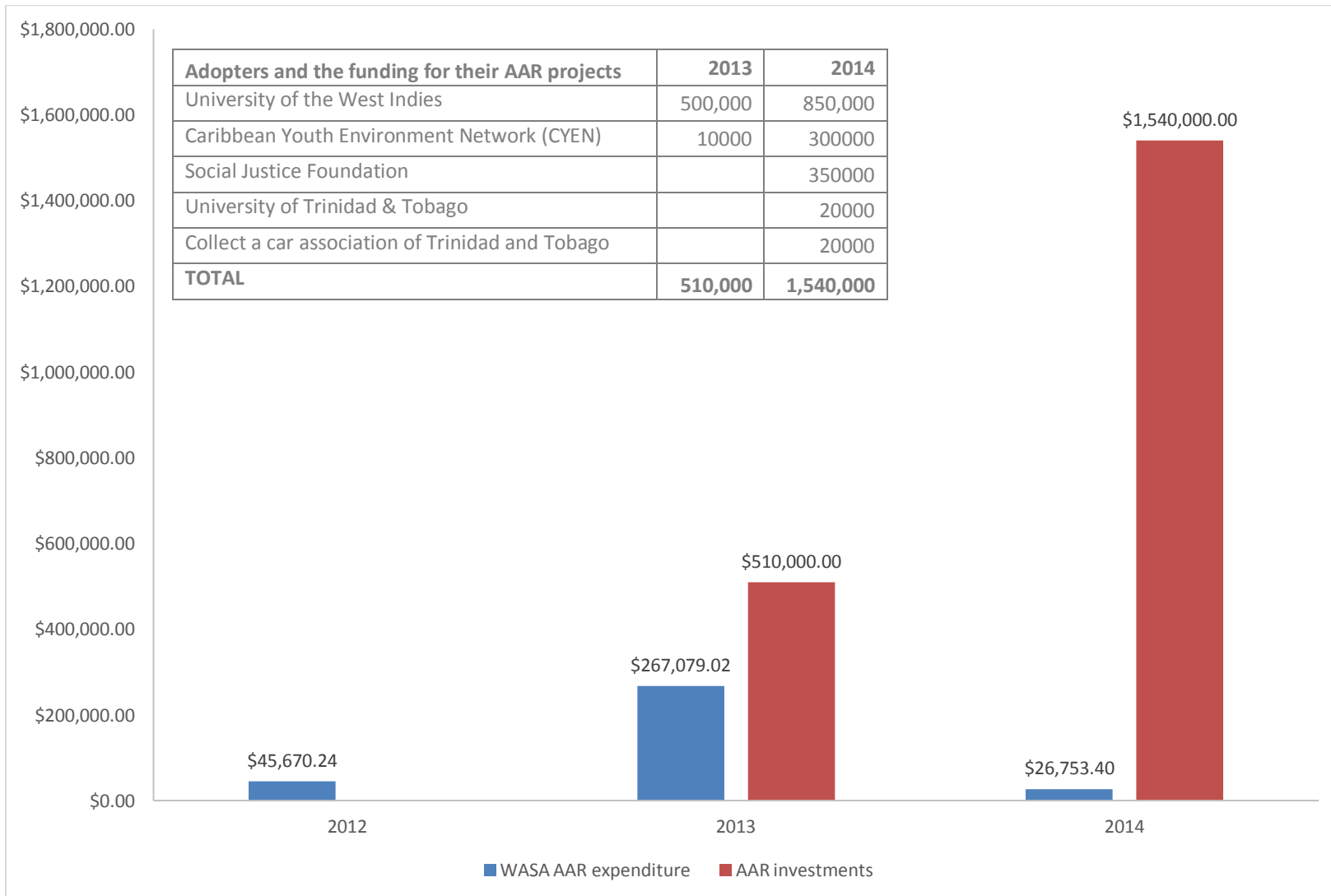
By the third year, two things were clear:

1. WASA needed to invest less money into the Adopt A River Programme and,
2. The Adopt A River Programme received almost 60 times the amount of money invested by WASA.

So far, two adopters have received funding from the international grant agencies – UN GEF whilst another is on their prospect list for receiving funding. UWI Guanapo Project is self-funded in the amount of one million dollars (\$1,000,000.00TT). This means that the Adopt A River Programme, as an

environmental programme, is recognised locally and internationally. The financial contributions made by local and international groups and adopters indicated that the programme is financially viable and self-sustaining.

**Figure 2 – WASA Adopt A River Expenditure versus the investments made into the programme via adopters.**



## Overall benefits of the Adopt A River Programme

1. Provides an avenue for open dialogue between stakeholders to make positive changes in watersheds
2. Brings about coordination between Government Agencies, community groups and Tertiary Educational Institutions
3. Raises the awareness of people and changes their perception with respect to water and the environment
4. Facilitates social benefits towards communities which is important because people cannot reduce their environmental impacts if they cannot take care of themselves
5. Reduces environmental impacts
6. Provides an avenue for Corporate Social Responsibility and hence, marketing for companies
7. Financially or economically viable
8. Provides an avenue to express and implement IWRM principles locally, that is, it has become the implementation arm or the 'hands and feet' of the IWRM process

It is predicted, based on the successes realised within a short space of time, that the Adopt A River Programme will expand to include more adopters, addressing issues in most of the watersheds thereby resulting in better raw water quality in local rivers, especially those used for water supply.

## The way forward

In order to further realise the benefits of IWRM and AAR in the long-term, it would be prudent to pursue the following:

- Formalise the IWRM committee – this is a committee which will consist of all the major stakeholders and which will meet on a regular basis to make coordinated and holistic decisions with respect to managing our water resources in this country
- Utilise the formalised IWRM committee to facilitate meeting the achievement of the long-term goals of IWRM (Table 1)

- Increase the visibility of the success of the programme through a more comprehensive communication plan which would share the success stories to the employees of WASA and the public
- Identify and allocate Sustainable funding for the AAR Programme
- Win the support of other agencies for example, the Ministry of Environment and Natural Resources through newspaper articles and radio announcements

## Bibliography

Global Water Partnership Technical Advisory Committee (GWP TAC) 2000. Integrated Water Resources Management. Global Water Partnership. Stockholm, Sweden.

Global Water Partnership (GWP) 2012. IWRM Pillars. <http://www.gwp.org/The-Challenge/What-is-IWRM/IWRM-pillars>.

WASA. 2011. IWRM Plan for WASA. The Water and Sewerage Authority, Farm Road, St. Joseph.