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PARLIAMENT

JOINT SELECT COMMITTEE ON

LAND AND PHYSICAL INFRASTRUCTURE

FIFTH SESSION (2019/2020), ELEVENTH PARLIAMENT

ELEVENTH REPORT

On

An Inquiry into the Measures for ensuring Water Security in Trinidad and Tobago

An electronic copy of this report can be found on the Parliament's website: www.ttparliament.org

The Joint Select Committee on Land and Physical Infrastructure

Contact the Committees Unit

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PARLIAMENT
REPUBLIC OF TRINIDAD AND TOBAGO

Joint Select Committee on Land and Physical Infrastructure

(including Land, Agriculture, Marine Resources, Public Utilities, Transport and Works)

An inquiry into the measures for ensuring water security in Trinidad and Tobago

Eleventh Report of Fifth Session 2019/2020, Eleventh Parliament

Report, together with Minutes

Ordered to be printed

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THE JOINT SELECT COMMITTEE ON LAND AND PHYSICAL INFRASTRUCTURE

Establishment

1. The Joint Select Committee on Land and Physical Infrastructure was appointed pursuant to section 66A of the Constitution of the Republic of Trinidad and Tobago. The House of Representatives and the Senate on Friday November 13, 2015 and Tuesday November 17, 2015, respectively agreed to a motion, which among other things, established this Committee.

Current Membership

2. The following Members were appointed to serve on the Committee:

- Mr. Deoroop Teemal - Chairman[1]
- Mr. Rushton Paray - Vice Chairman
- Mr. Franklin Khan
- Dr. Lovell Francis
- Mrs. Glenda Jennings-Smith
- Mr. Darryl Smith
- Mr. Nigel De Freitas[2]
- Mr. Wade Mark[3]

Functions and Powers

3. The Committee is one of the Departmental Select Committees, the functions and powers of which are set out principally in Standing Orders 91 and 101 of the Senate and 101 and 111 of the House of Representatives. These are available on the internet via www.ttparliament.org.

4. The Committee is mandated to inquire into areas related to Land, Agriculture, Marine Resources, Housing, Public Utilities, Transport and Works as listed in Appendix IV and V of the Standing Orders of the House of Representatives and Senate respectively.

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[1] Mr. Deoroop Temal replaced Mr. Stephen Creese w.e.f. 27.11.2018
[2] Mr. Nigel De Freitas replaced Mr. Rohan Sinanan w.e.f. 19.12.2016
[3] Mr. Wade Mark replaced Mr. Daniel Solomon w.e.f. 21.03.2017

Secretarial Support

5. Secretarial support was provided by Mrs. Angelique Massiah, Parliamentary Clerk II (Ag.) who served as Secretary to the Committee, Ms. Renee Batson, Assistant Secretary, Ms. Katharina Gokool, Graduate Research Assistant, Ms. Safiyyah Shah, Graduate Research Assistant and Mr. Jean-Marc Morris, Legal Officer I.

Contacts

6. All correspondence should be addressed to the Secretary to the Joint Select Committee on Land and Physical Infrastructure, Parliamentary Complex Cabildo Building, St. Vincent Street, Port of Spain. The telephone number for general enquiries is 624-7275 and the Committee's email address is jsclpi@ttparliament.org.

ACRONYMS AND ABBREVIATIONS

ABBREVIATION	ORGANISATION
MoPD	Ministry of Planning and Development
MoPD	Ministry of Planning and Development
MoRDLG	Ministry of Rural Development and Local Government
MoRDLG	Ministry of Rural Development and Local Government
MoWT	Ministry of Works and Transport
MPU	Ministry of Public Utilities
MPU	Ministry of Public Utilities
MSD	Meteorological Services Division
NGC	National Gas Company
ODPM	Office of Disaster Preparedness and Management
TCPD	Town and Country Planning Division
WASA	Water and Sewerage Authority

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INTRODUCTION

1. The Ministry of Public Utilities (MPU) is mandated to manage the nation's resources in such a manner as to satisfy its diverse customer base while respecting the constraints and carrying capacity of the environment.[4]

2. The Water and Sewerage Authority (WASA) is the state enterprise established under the Water and Sewerage Act, Chapter 54:40 with responsibility for the provision of an adequate and reliable water supply and the treatment and disposal of wastewater. Section 42 of the Act provides that, the authority has the responsibility for maintaining and developing the waterworks and other property relating thereto transferred to it by section 11 and for administering the supply of water thereby established and promoting the conservation and proper use of water resources and the provision of water supplies in Trinidad and Tobago. WASA is also responsible for the development and control of water supply and sewerage facilities.[5] Its mandate is "*Water Security for Every Sector. Deliver it, Sustain it,*[6][7]

3. The MoRDLG has jurisdiction over *inter alia* the management of the following:
    - Construction and maintenance of access roads, drainage and irrigation systems;
    - Local Government (including garbage collection and disposal);
    - Public health and sanitation; and
    - Waste management.[8]

4. The Division of Infrastructure, Quarries and the Environment's (DIQEs) core responsibilities include *inter alia* construction, development and maintenance of the road network and drainage systems.[9]
5. The Ministry of Planning and Development (MoPD) is the key collaborative Government Ministry which provides the necessary policy guidance and development, technical support, advice and

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[4] http://www.mpu.gov.tt/home/node/42
[5] Page 52-53 State Enterprises Investment Programme 2019 https://www.finance.gov.tt/wp-content/uploads/2018/10/State-Enterprises-Investment-Programme-2019.pdf
[6] https://www.wasa.gov.tt/WASA_AboutUs_visionmission.html
[7] http://www.mpu.gov.tt/home/node/42
[8] Gazette No 108 of 2017 dated October 11th, 2017
[9] http://www.tha.gov.tt/divisions/infrastructure-quarries-environment/

feasibility assessment for national advancement. Its principal mandate is national development which is focused on four main pillars, economic development, social development, spatial development and environmental development.[10]

6. The MoPD also serves as the focal point for international and regional agencies such as the Inter-American Development Bank (IDB), the United Nations system of agencies, the European Union and the Caribbean Development Bank.

7. The MoPD facilitates national development through:
    - coordinating all stakeholders in the development of Trinidad and Tobago's National Strategy for Development, Vision 2030;
    - co-ordination of national statistics;
    - environmental policy, planning and management;
    - national monitoring and evaluation;
    - socio-economic planning, coordinating and monitoring;
    - spatial development; and
    - technical co-operation on special projects and programmes *inter alia*.[11]

Background to Inquiry

1. Water is a limited (finite) and valuable resource that is essential to all life forms and is a vital component in the operation of an industrialised society. It is therefore essential for environmental social well-being and economic growth.[12]

2. Water security is one of the central pillars of human and environmental sustenance which have been codified in the Millennium Development Goals and the Sustainable Development Goals.[13] It is an important issue driving state stability and safety in many regions of the world.[14]

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[10] Ministry of Planning and Development website https://www.planning.gov.tt/content/about accessed on January 27, 2020

[11] Ministry of Planning and Development https://www.planning.gov.tt/content/about

[12] http://www.mpu.gov.tt/home/node/42

[13] https://www.wri.org/blog/2017/02/what-does-water-have-do-national-security

[14] https://www.wri.org/blog/2017/02/what-does-water-have-do-national-security

3. The UN-Water defines water security as "*the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability*". (UN-Water, 2013) In this regard, water security can be seen as the tolerable level of water-related risks to society.[15]

4. Goal 6 is to 'ensure availability and sustainable management of water and sanitation for all' (UNSDSN 2013).

5. Water security focuses on an efficient supply and reliable provision of safe and potable water to the citizens of Trinidad and Tobago as well as effective treatment of wastewater throughout the country.[16]

6. Global warming (climate change), over-extraction of water from aquifers[17], and contamination of surface and groundwater all threaten ecosystems and freshwater availability. Similarly, water security is threatened by recurring droughts and poor water regulation and management. In virtually every part of the world, water pollution is also occurring at a scale that continues to threaten human health and economic development for current and future generations. The ramifications of water resource loss are staggering.

7. In 2018, the United Nations estimated that roughly 3.6 billion people live in areas vulnerable to water scarcity and that number could reach 5.7 billion in 2050 (Burek et al., 2016).[18] The direct and indirect effects of water stress such as migration, food shortages and general destabilization transcend national boundaries.[19]As water stress increases in the coming years, prioritisation of water resources in domestic and global security policies will become even more essential.[20]

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[15] https://www.wri.org/blog/2017/02/what-does-water-have-do-national-security
[16] Page 35 PSIP, 2018 https://www.finance.gov.tt/wp-content/uploads/2018/10/PSIP-Trinidad-and-Tobago.pdf
[17] In geology, an aquifer is an area of rock underneath the surface of the earth which absorbs and holds water.
[18] Water Futures and Solution - Fast Track Initiative (Final Report) http://pure.iiasa.ac.at/id/eprint/13008/
[19] Water Human Right Treaty Water and National Security: What Connections? http://www.waterhumanrighttreaty.org/2017/03/water-and-national-security-what-connections/
[20] https://www.wri.org/blog/2017/02/what-does-water-have-do-national-security

8. Water affects everyone, therefore managing this precious resource requires balancing the interests of the many different user groups and individuals to resolve conflicts. Your Committee therefore deemed this inquiry as important.

REPORT SUMMARY

1. At its Forty Fourth Meeting held on May 21, 2019, the Committee agreed to an inquiry into the measures for ensuring water security in Trinidad and Tobago. Subsequently, the Committee agreed that the objectives of the inquiry would be as follows:
   (i) To examine the current strategies for ensuring water security and the effectiveness of these strategies;
   (ii) To determine the measures required for improving water security; and
   (iii) To determine the challenges with ensuring water security in Trinidad and Tobago.

2. The Committee thereafter sought to amass information on the subject matter through a request for written submissions and received same from the following stakeholders:
   i. Ministry of Public Utilities (MPU);
   ii. Water and Sewerage Authority (WASA);
   iii. Ministry of Rural Development and Local Government (MoRDLG); and
   iv. Ministry of Planning and Development (MoPD).

3. The written submissions were received from the stakeholders on the following dates as outlined in Table 1 below:

Table 1

Preliminary Written Submission received from Stakeholders

Date	Ministry/Entity	Appendix No.
February 11, 2020	Ministry of Public Utilities (MPU)	III
March 9, 2020	Water and Sewerage Authority (WASA)	IV
February 12, 2020	Ministry of Rural Development and Local Government (MoRDLG)	V
March 6, 2020	Ministry of Planning and Development (MoPD)	VI

4. Thereafter, the Committee held one (1) public hearing. The Minutes of the Meetings in connection with the hearing is attached at **Appendix I** and the Verbatim Notes at **Appendix II.**

5. At the first public hearing held on March 9, 2020, the following officials from the Ministry of Public Utilities and the Water and Sewerage Authority were present:

1st Public Hearing – March 9, 2020	
Ministry of Public Utilities	
Official	**Position**
Ms. Nicolette Duke	Permanent Secretary (Ag.)
Ms. Beverly Khan	Deputy Permanent Secretary
Ms. Sara Jade Govia	Water Sector Specialist
Mr. Kenneth Kerr	Chief Climatologist (Ag.) Met Services
Water and Sewerage Authority (WASA)	
Official	**Position**
Mr. Alan Poon-King	Chief Executive Officer (Ag.)
Mr. Sherland Sheppard	Director, Operations
Mrs. Denise Lee Sing Pereira	Director, Programmes & Change
Mrs. Sherry Dumas-Harewood	Director, Customer Care
Mr. Rajindra Gosine	Head, Water Resources Agency

6. The key issues discussed were:

- The Ministry's role as it relates to water security in Trinidad and Tobago;

- WASA's contribution to the establishment of water security
- WASA's mandate;
- Effective delivery and providing sustainable water supply;
- Wastewater Collection and treatment;
- Threats to water resource quantity and quality;
- Upgrade to booster stations and storage tanks;
- Sangre Grande water supply source;
- Priority list of leak repairs to mains across Trinidad and Tobago;
- Level of water in reservoirs;
- Balancing water supply and demand;
- Promoting the practice of water conservation;
- Sources of water for WASA's production;
- Water consumption in Trinidad and Tobago;
- Water scarcity in Trinidad and Tobago;
- WASA's performance based on regional and international standards;
- Non-revenue water;
- Increased storage of excess water as a result of floods;
- National Integrated Water Resources Management Policy;
- Integrated water resources management;
- Watershed protection and sustainability in Trinidad and Tobago;
- Risk assessment and projections based on climatic conditions;
- Incentivising rainwater harvesting;
- Months with the highest amount of rainfall;
- Water level projections at reservoirs in Trinidad and Tobago for 2020;
- Measuring WASA's performance;
- WASA's receivables in terms of arrears;
- WASA's debt recovery steps;
- Beetham Wastewater Reuse Project;
- WASA's Beetham Wastewater Treatment Plant;

- New water-reuse projects;
- Water tariff in Trinidad and Tobago;
- The Water Sector Improvement Programme;
- Customer service at WASA;
- Water distribution schedules; and
- The role of Desalcott in terms of water security.

7. The Committee thereafter requested additional information from the Ministry of Public Utilities, the Water and Sewerage Authority.

8. These responses were received on March 25, 2020 and May 15, 2020 respectively and are at **Appendix VII and VIII**.

9. The Committee also sought information from the National Gas Company on March 16, 2020 to assist in its deliberations. The NGC submitted the information by letter dated April 7, 2020. Refer to **Appendix IX**.

10. The Committee was scheduled to meet with officials from the Ministry of Rural Development and Local Government (MoRDLG), the Ministry of Planning and Development, (MoPD) on March 16, 2020. However, due to imminent Covid-19 pandemic the Committee was unable to so do. Therefore, the Committee was unable to complete it work on the matter.

CONCLUSION

1. As a result of the nationwide health and safety measures implemented to combat the global COVID-19 pandemic, parliamentary activity was significantly reduced.

2. Your Committee is of the view that the limitations posed by the pandemic prevented the Committee from continuing its inquiry and that this is now further compounded by the imminent dissolution of the 11th Parliament.

3. Your Committee has concluded that this matter requires further interrogation and therefore proposes that in the 12th Parliament, the Joint Select Committee on Land and Physical Infrastructure, continue its inquiry on this issue taking into consideration all the evidence/submissions received thus far, as well as evidence emanating from a continuation of its public hearing with the relevant stakeholders and submit a final report on this matter therein.

4. Your Committee therefore respectfully submits this Report for the consideration of the Houses.

Sgd.
Mr. Deoroop Teemal
Chairman

Sgd.
Mr. Rushton Paray, MP
Member

Sgd.
Mr. Darryl Smith, MP
Member

Sgd.
Mrs. Glenda Jennings-Smith, MP
Member

Sgd.
Dr. Lovell Francis, MP
Member

Sgd.
Mr. Franklin Khan, MP
Member

Sgd.
Mr. Wade Mark
Member

Sgd.
Mr. Nigel De Freitas
Member

APPENDIX I

MINUTES OF PROCEEDINGS

DATED MARCH 9, 2020

UNCONFIRMED MINUTES OF THE FIFTY FIRST MEETING OF THE JOINT SELECT COMMITTEE ON LAND AND PHYSICAL INFRASTRUCTURE, HELD (IN CAMERA AND IN PUBLIC) IN THE LINDA BABOOLAL MEETING ROOM (GRAND COMMITTEE ROOM 2), CABILDO BUILDING, PARLIAMENTARY COMPLEX, ST. VINCENT STREET, PORT OF SPAIN ON MONDAY MARCH 9, 2020 AT 2:00 P.M.

Present were:

Mr. Deoroop Teemal	Chairman
Mrs. Glenda Jennings-Smith, MP	Member
Mr. Nigel De Freitas	Member
Mr. Wade Mark	Member
Mr. Julien Ogilvie	Secretary
Ms. Renee Batson	Assistant Secretary
Mr. Jean-Marc Morris	Legal Officer I
Ms. Katharina Gokool	Graduate Research Assistant
Ms. Safiyyah Shah	Graduate Research Assistant

Excused were:

Dr. Lovell Francis, MP	Member
Mr. Rushton Paray, MP	Vice Chairman
Mr. Darryl Smith	Member
Mr. Franklin Khan	Member

PUBLIC HEARING WITH THE MINISTRY OF PUBLIC UTILITIES AND THE WATER AND SEWERAGE AUTHORITY

6.1 The meeting resumed at 2:40 p.m.

6.2 The Chairman welcomed representatives of the Ministry of Public Utilities and the Water and Sewerage Authority and introductions were exchanged.

6.3 The ***Appendix*** herein contains a summary of questions and concerns raised during the hearing.

[Meeting suspended at 4:56 p.m.]

Next meeting

7.2 The **Chairman** reminded Members of the Committee's decision to convene its second public hearing pursuant to its ***inquiry into the measures for ensuring water security in Trinidad and Tobago*** on Monday **March 16, 2020** at **1:30 p.m.**

ADJOURNMENT

8.1 The adjournment was taken at 5:04 p.m.

I certify that these Minutes are true and correct.

Chairman

Secretary

March 12, 2020

Appendix

51st Meeting of the Joint Select Committee on Land and Physical Infrastructure

Monday March 9, 2020 at 2:35 p.m.

Public Hearing Summary

Opening Remarks

Ministry of Public Utilities (MPU)

The Ministry's role as it relates to water security in Trinidad and Tobago

i. The subject of water security spans several agencies. Under the remit of the Ministry, the Water and Sewerage Authority (WASA) and the Meteorological Services Division are the major players;
ii. WASA provides water supply to the citizenry and the Met Services Division monitors the weather and climate that is linked to the water supply in our country;
iii. As part of the governing and oversight mandate of these agencies, MPU has developed a number of policies and high-level strategies for the short, medium and long-term that are aligned to Vision 2030 and the United Nations Sustainable Development Goals. These guide the strategic direction for related agencies;
iv. These strategic priorities include, but are not limited to:
    a. providing safe and reliable public utilities services to meet the needs of households, communities and businesses;
    b. expanding accessibility to public utility services to the currently unserved and underserved areas;
    c. streamlining the operations of public utilities to increase efficiency, productivity and financial viability; and
    d. promoting conservation and sustainable consumption.
v. WASA's implementation in respect of these priorities are intended to assist the Authority in providing water supply that is of an adequate quality and quantity to sustain the population of Trinidad and Tobago, as well as to ensure the sustainable use, conservation and protection of water resources;
vi. Performance indicators were also developed to benchmark WASA against regional and international utilities, as well as against its own progress. These indicators are aligned to the Ministry's priority areas and include:
    a. development of a customer-centric culture;
    b. operational efficiency;
    c. financial viability;
    d. organization redesign; and
    e. governance.

vii. WASA has some overarching water supply management issues to address and as such has been working with the Inter-American Development Bank to develop a water sector improvement programme. In order to achieve the objects of this programme, the following imperatives are to be undertaken:

a. implementation of metering throughout the population;
b. network optimization to replace strategic high-leakage mains;
c. service connection and debottling of the network;
d. climate change investments to increase storage, mitigate flooding and localize production; and
e. establishment of a performance-based culture in WASA.

WASA's contribution to the establishment of water security

viii. In order to achieve the goal of water security, as defined by UN Water 2013, a multipronged, multidimensional approach is necessary.

ix. The integrated approach to water management is a process that seeks to attain three main strategic objectives: efficiency, equity and environmental sustainability.

WASA's mandate

x. WASA is mandated to provide water and wastewater services to the population of Trinidad and Tobago.

xi. The provision of water services to the citizens requires the Authority to undertake several key activities associated with developing and maintaining water treatment sources, as well as transmission and distribution systems.

xii. WASA continues to develop new water sources, maintain existing ones and treat raw water sources to meet international drinking standards.

Effective delivery and providing sustainable water supply

xiii. WASA also focuses on its pipeline, transmission and distribution network, which has been enhanced through the construction of new service reservoirs across the country and booster stations in north, south and central Trinidad.

xiv. WASA has laid pipelines to provide connectivity to previously underserved areas in Trinidad and Tobago.

xv. Its leak repair programme has contributed to a reduction in the levels of unaccounted for water, while improving the level of service to customers.

Wastewater Collection and treatment

xvi. The Malabar wastewater treatment plant and collection system has been completed with funding secured through the Inter-American Development Bank (IADB).

xvii. The construction of this facility benefits approximately 30,000 residents and this is expected to increase to more than 108,000, upon completion of all phases on the collection system, which will serve the full Malabar catchment.

xviii. In Tobago, the construction of two new sewerage systems at Bon Accord and Samaan Grove resulted in over 400 new wastewater customers and improvement in the wastewater coverage to customers in the coastal areas of Crown Point, Pigeon Point, Black Rock, Golden Grove and Buccoo.

Threats to water resource quantity and quality

xix. The Water Resource Agency is working to minimize significant threats to watercourses which impact water availability, quality and flooding:
   a. indiscriminate wastage;
   b. indiscriminate dumping;
   c. sedimentation of streams through poorly-managed quarrying;
   d. disposal of industrial effluent discharged from non-functioning wastewater treatment plants;
   e. slash and burn agricultural practices; and
   f. agricultural runoff.

xx. Natural threats include the impact of climate variability and climate change through, reduced rainfall locally in recent years and the harsh 2019 dry and wet seasons.

xxi. Threats to the quantity and quality of our water resources are also occurring against a backdrop of increasing demand for potable water.

xxii. Although the resource is renewable, it is finite and must therefore be managed.

xxiii. Trinidad and Tobago is classified as water-rich but the reality is that without efficient water resource management, we will not avoid the faith of other water-deficient nations.

Upgrade to booster stations and storage tanks

xxiv. Contracts have been signed to commence work on four (4) booster stations and the project will commence soon.

xxv. The Quarry and the Guanapo tanks are approximately 95 per cent completed. Currently WASA is working to complete the interconnecting pipework, and to put those tanks into service. The tanks should be fitted and commissioned by the end of March.

xxvi. A review of the treatment process at the Matura Treatment Plant has to be executed due to deterioration of raw water quality during periods of heavy rainfall.

Sangre Grande water supply source

xxvii. Sangre Grande is supplied primarily from the North Oropouche water treatment plant, and also from other localized supplemental wells.

xxviii. Issues with the wells in Sangre Grande are currently being addressed to restore productivity.

Priority list of leak repairs to mains across Trinidad and Tobago

xxix. WASA has a listing that has been prioritized based on the level of leakage.

Level of water in reservoirs

xxx. The level of the reservoir is due to the variations in dry and wet season.

xxxi. Overall the rainfall is decreasing and since rainfall is the main source of water captured by the reservoir, the reservoirs will be impacted.

Balancing water supply and demand

xxxii. Climatic conditions have produced intense but shorter wet and dry seasons. Pump storage facilities not only capture water within their catchment, but from adjoining catchments which are then pumped to the reservoir. Therefore increased storage is necessary.

Promoting the practice of water conservation

xxxiii. WASA has been advocating for water conservation since the last two or three years.

xxxiv. The current volume of water that is being produced ought to be sufficient to supply the public.

xxxv. Several initiatives promoting conservation with young children in primary and secondary schools.

xxxvi. Water hose restriction has been implemented since January 2019 based on the water availability.

xxxvii. WASA is empowered by the Act to enforce action against persons in breach of the law and patrols are being done, and the relevant charges applied to persons in breach.

xxxviii. WASA intends to sustain these punitive measures, however more needs to be done.

xxxix. Measuring reduction in demand or usage is challenged through the limited metering component.

Sources of water for WASA's production

xl. The primary source of water that currently exists is via surface water sources, which accounts for about 50 to 60 per cent of our production, however, groundwater alternatives are being explored.

Water consumption in Trinidad and Tobago

xli. Consumption in the range of 580 litres per capita per day and includes an unaccounted for water level of approximately 50 per cent.

xlii. Consumption of 290 litres per capita per day is equivalent to 60 or 70 per cent which is more than the accepted standard.

Water scarcity in Trinidad and Tobago

xliii. According to the UN's benchmark, Trinidad and Tobago has more water per person than the UN benchmark of water scarcity.

xliv. However, Trinidad and Tobago is challenged to provide, treat and distribute this water to persons.

WASA's performance based on regional and international standards

xlv. WASA indicated that is performance can be rated as "good" when compared regionally in terms of access or coverage of water supply. Approximately 95 per cent of this country's population is covered.

xlvi. The challenge is in continuing that supply and having 24/7 supply.

Non-revenue water

xlvii. Non-revenue is defined as water lost as a result of leaks or physical losses, "commercial losses" and water that is used but not billed to households.

xlviii. As a result of no metering and high consumption figures, citizens use more water than they are actually billed for by WASA.

Increased storage of excess water as a result of floods

xlix. WASA has four impounding reservoirs – three in Trinidad and one in Tobago.

l. For example, within the Caroni River basin, the Arena Reservoir stores water for water production purposes;

li. When there is a flood event, WASA draws the water from the river and transfers it to storage facilities.

lii. Through collaborating with the Ministry, WASA is planning to execute projects in Cumuto and Ravine Sable's sandpits which would augment the current water supply.

National Integrated Water Resources Management Policy

liii. Submitted to Cabinet in early 2019 and it is pending a decision.

liv. This policy would have succeeded a previous policy completed1999 that WASA was charged with effecting.

Integrated water resources management

lv. Not unique to Trinidad and Tobago - a global process that is being championed by one of the UN's agencies.

lvi. In order to manage water resources, it requires integration and coordination with other managers of water. For example, the agricultural sector, watershed, or forestry, climatology.

lvii. Legislative groundwork exists, but policy decision as to whether the country is adopting integrated water resources management is outstanding. Accordingly, a study/report funded by the World Bank recommended the establishment of resource regulator where the policymaker (Ministry) should be separated from the service provider (the utility), and should be separated from the resource regulator (WRA).

Watershed protection and sustainability in Trinidad and Tobago

lviii. There are 55 watersheds in Trinidad, and 14 watersheds in Tobago.

lix. With respect to management of the watersheds, the Water Resources Agency works closely with other entities to execute its regulatory functions, for example, Environmental Management Authority (EMA).

lx. When a project is proposed and it is indicted that there will be a potential impact on the water resources, the entity would write to the WRA and request its input into the proposed project.

lxi. The public education components of the "Adopt a River Programme" entails::

- educating in the role of protection of their water resources;
- training to do simple water quality testing so that they could monitor their watersheds; and
- meetings at schools, primary schools, high schools, in order to foster greater stewardship.

lxii. With respect to amount of water within different watersheds, the region with the heaviest rainfall is primarily the north-east. An area of concentration would be like Hollis Reservoir.

Risk assessment and projections based on climatic conditions

lxiii. 2010 to 2019, compared to the cumulative rainfall in 1961 to 1990, was 5 per cent less.

lxiv. 2010 to 2019, compared to the cumulative rainfall in 1981 to 2010 was 11 per cent less.

lxv. Comparative analysis has revealed that the last decade has cumulatively produced the least amount of decadal rainfall since 1970 or the late 1960s.

Incentivising rainwater harvesting

lxvi. Rain water harvesting needs to become a priority.

lxvii. For example, in Australia rainwater harvesting has been incentivized by connecting toilets or washing machines to a rainwater tank. Through Government policy, schools also engage in rainwater harvesting to flush toilets.

Months with the highest amount of rainfall

lxviii. At some stations it is difficult to assess the monthly rain fall average as rainfall occurs irregularly in Trinidad and Tobago.

lxix. In north-eastern areas, the month of August is the highest producing month, whereas, in the western areas the month of June is the highest, and then in Tobago the month of November is the highest.

lxx. It depends on a number of climatic background factors.

Water level projections at reservoirs in Trinidad and Tobago for 2020

lxxi. The projected low point at Arena, occurring at the end of June 2020 is 29.9 per cent.

lxxii. The projected low point at Navet, occurring at the end of May is 44.4 per cent.

lxxiii. The projected low point at Hollis, occurring at the end of May is 34.3 per cent.

lxxiv. The projected low point at Hillsborough, occurring in July is 38 per cent.

Measuring WASA's performance

lxxv. MPU has set five strategic pillars and each of these pillars has performance indicators defining what WASA is expected to report on:

- Customer-centric culture – measured by WASA's response and handling of complaints, as well as time it takes to process new connections etc.;
- Operational efficiency – leak repair and road restoration status, as well as coverage and production of water and water storage;
- Financial viability – financial metrics including EBITDA margin, receivables, turnover ratio, liquidity and inventory turnover ratio; and
- Governance - implementation of WASA's preparedness and response strategy in times of a disaster, as well as statutory submissions.

lxxvi. WASA is the second best performing utility with 95 per cent service coverage behind Barbados and Belize which is at 100.

lxxvii. WASA is the highest ranking regional utility in terms of centralized sewerage coverage which is around 30 per cent coverage in all of Trinidad and Tobago. Regionally, the numbers vary between 2 to 17 per cent.

lxxviii. Non-revenue water is likewise an efficiency indicator with WASA's estimate around 40 to 50 per cent.

lxxix. WASA has the lowest water tariff in the region. Only Suriname within this hemisphere has a lower tariff than WASA.

lxxx. This low tariff spirals into all of the other problems relative to operations, as well as the value of WASA's receivables.

lxxxi. From a legislative perspective, Trinidad and Tobago has the most dated legal framework for Water in the region.

WASA's receivables in terms of arrears

lxxxii. Currently, WASA's receivables are valued at$827Mn

lxxxiii. This figure is disaggregated as follows:

- business and industrial, 4.4 per cent;
- residential 62.9 per cent;
- public sector at 8.5 per cent;
- water abstraction at 7.0 per cent; and
- industrial estate at 6.4 per cent.

- Government receivables are valued at $78Mn.

WASA's debt recovery steps

lxxxiv. Recovery is accomplished through encouragement and subsequently, enforcement.

lxxxv. Encouragement through telephone reminders, reminder notices and actual interactions with the customer, and enforcement through, disconnections.

lxxxvi. In the majority of cases WASA's customer base is not metered, therefore curve valves are installed to make the disconnections easier. Once a client is disconnected for more than three months, then legal action is take which would include serving a pre-action protocol letters outlining that property will be seized.

Beetham Wastewater Reuse Project

lxxxvii. The project was originally an NGC project, so WASA did not have direct involvement with respect to the management of funding for the project.

WASA's Beetham Wastewater Treatment Plant

lxxxviii. Water is collected from wastewater catchment spanning from Westmoorings to Mount Hope, treated and then discharged.

lxxxix. The aim of the Beetham reuse plant is to extract effluent from WASA's wastewater plant and then further treat that to produce industrial quality water for Point Lisas.

xc. That project did not happen so the water from WASA's Wastewater Treatment Plant currently is discharging into the environment.

New water-reuse projects

xci. Possibility of having the Pointe-a-Pierre refinery use effluent from the San Fernando Wastewater Treatment Plant, which is currently under construction.

xcii. The Pointe-a-Pierre refinery could then be considered for alternative use, including potable water supply.

xciii. The volumes are between 40,000 and 45,000 cubic metres per day, which equates to approximately eight to nine million gallons

Water tariff in Trinidad and Tobago

xciv. WASA has prepared a business plan that outlines WASA's expenditures and proposals going forward, and what type of tariffs could be considered.

xcv. It is under final review between WASA and the Ministry.

xcvi. Review that is currently being done is based on the proposed intervention of the IDB. It is estimated that the review will be completed within the next two to three months.

The Water Sector Improvement Programme

xcvii. Developed by the IDB in collaboration with the Ministry of Public Utilities and WASA

xcviii. Has a specific focus on non-revenue water reduction and that includes metering:

- it is a challenge for WASA to manage or have the ability to manage demand without metering; and
- it is also a challenge for an individual to manage demand without having that signpost of how much water you are actually using.

xcix. Non-revenue water (NRW) reduction through leak repair and pipe replacement and also pressure management:

- the need to establish or segregate the country into district-metered areas and measure the use and manage use and supply within those areas;
- establish district metered areas;
- manage flows and pressure within there; and
- specifically pinpoint leaks in the system, both in the network side as well as on the customer side.

c. WASA projects will accrue a 17 per cent internal rate of return.

ci. This programme is self-sustaining so there is no need to increase the subvention of the Government to service the debt, with the savings that WASA will get from more efficient and lean operations, the loan can be paid and/or serviced.

Customer service at WASA

cii. Primary mode of communication with customers is through the call centre.

ciii. WASA has increased the complement of staff within the call centre by approximately 25 per cent.

civ. Prior to getting more staff, up to 55 per cent of calls were retrieved, however this has since increased to 80 per cent.

Water distribution schedules

cv. These schedules are on the website, and will be updated based on any changes that would occur or based on water availability.

The role of Desalcott in terms of water security

cvi. Of WASA's yearly 220 - 240 million gallons of water, Desalcott produces and delivers 40 million gallons per day (16 per cent).

cvii. WASA's contract with Desalcott is until 2039.

cviii. Since Desalcott's source is sea water, it would not be subject to the issues associated with rain water.

cix. One issue that arises on an annual basis during the dry season, where there is less run-off from local rivers from South America, the salinity in the Gulf of Paria goes up, making the treatment process more difficult to achieve the daily output of 40 million gallons per day.

cx. The monthly bill paid to Desalcott is approximately US$6Mn.

cxi. WASA has some outstanding bills with Desalcott, and has made arrangements to settle arrears.

Committees Unit

March 13 2020

APPENDIX II

NOTES OF PROCEEDINGS

DATED MARCH 9, 2020

UNREVISED VERBATIM NOTES OF THE FIFTY-FIRST MEETING OF THE JOINT SELECT COMMITTEE APPOINTED TO INQUIRE INTO AND REPORT ON LAND AND PHYSICAL INFRASTRUCTURE (IN CAMERA) HELD IN THE LINDA BABOOLAL MEETING ROOM (GRAND COMMITTEE ROOM 2), PARLIAMENTARY COMPLEX, CABILDO BUILDING, OFFICE OF THE PARLIAMENT, ST. VINCENT STREET, PORT OF SPAIN, ON MONDAY, MARCH 09, 2020 AT 2.35 P.M.

PRESENT

Mr. Deoroop Teemal	Chairman
Mr. Rushton Paray	Vice-Chairman
Mrs. Glenda Jennings-Smith	Member
Mr. Wade Mark	Member
Mr. Nigel De Freitas	Member
Ms. Angelique Massiah	Secretary
Ms. Katharina Gokool	Graduate Research Assistant

ABSENT

Mr. Franklin Khan	Member [*Excused*]
Dr. Lovell Francis	Member
Mr. Darryl Smith	Member

MINISTRY OF PUBLIC UTILITIES

Ms. Nicolette Duke	Permanent Secretary (Ag.)
Ms. Beverly Khan	Deputy Permanent Secretary
Ms. Sara Jade Govia	Water Sector Specialist
Mr. Kenneth Kerr	Chief Climatologist (Ag.) Met Services

WATER AND SEWERAGE AUTHORITY

Mr. Alan Poon-King	Chief Executive Officer (Ag.)
Mr. Sherland Sheppard	Director, Operations
Mrs. Denise Lee Sing Pereira	Director, Programmes & Change Assistant
Mrs. Sherry Dumas-Harewood	Director, Customer Care
Mr. Rajindra Gosine	Head, Water Resources Agency

Mr. Chairman: I welcome everyone to this meeting the 51st meeting of the Joint Select Committee on Land and Physical Infrastructure, pursuant to an enquiry into the measures for ensuring water security in Trinidad and Tobago, as well as welcome our viewing and listening audience.

I would like to remind all members and officials to please, if you can turn your cell phones off or place them on silent or vibrate, and to indicate to everyone that this hearing is being broadcast live on Parliament Channel 11, Parliament Radio 105.5 FM and the Parliament's YouTube Channel, *ParlView*, and to inform members of the viewing and listening audience that you can send your comments via email to Parl101@ttparliament.org, on our Facebook page at Facebook.com\ttparliament, or on Twitter@ttparliament.

I would like to welcome officials of the Ministry of Public Utilities and the Water and Sewerage Authority, and we would seek your introduction a bit later on. I would like to introduce myself. My name is Deoroop Teemal and I Chairman of this Joint Select Committee. I would like to invite members of the Committee to introduce themselves.

[*Introductions made*]

Mr. Chairman: Thank you members. I would like to inform all representatives here from the respective entities of the objectives of this particular enquiry. We have three key objectives, the first one being to exam the current

strategies for ensuring water security and the effectiveness of these strategies; (2), to determine the measures required for improving water security; and the third objective, to determine the challenges with ensuring water security in Trinidad and Tobago.

I would like to, at this point, invite the officials who are here to introduce themselves, following which I would ask for opening remarks to be made by one representative each, respectively from the Ministry of Public Utilities and WASA, please.

[*Introductions made*]

Mr. Chairman: Okay, thank you. At this stage, we would open with questioning from—before we go, the opening remarks, please, both from WASA and Public Utilities.

Ms. Duke: Thank you, Chair. Thank you for this opportunity to the committee to share the Ministry of Public Utilities' role as it relates to water security in Trinidad and Tobago. The subject of water security spans several agencies. However, under the remit of the Ministry, the Water and Sewerage Authority and the Meteorological Services Division are the major players. WASA providing the water supply to the citizenry and the Met Services Division, monitoring the weather and climate that is linked to the water supply in our country.

The Ministry of Public Utilities, as part of its governing and oversight mandate of these agencies, has developed a number of policies and high-level strategies for the short, medium and long-term that are aligned to *Vision 2030* and the United Nations Sustainable Development Goals to set the strategic direction for relate-related agencies. These strategic priorities include, but are not limited to providing safe and reliable public utility services to meet the needs of households, communities and businesses; expanding accessibility to public utility services to the currently unserved and underserved areas; streamlining the operations of public utilities to increase efficiency, productivity and financial viability; and promoting conservation and sustainable consumption.

WASA's implementation in respect of these priorities is intended to assist the Authority in providing water supply that is of an adequate quality and quantity to sustain the population of Trinidad and Tobago, as well as to ensure the sustainable use, conservation and protection of water resources.

To assist the Ministry in its oversight, performance indicators were also developed to benchmark WASA against regional and international utilities, as well as against its own progress. These indicators are aligned to the Ministry's priority areas and include: development of a customer-centric culture, operational efficiency, financial viability, organization redesign and governance.

The Ministry acknowledges that WASA has some overarching water supply management issues to address and as such has been working with the Inter-American Development Bank to develop a water sector improvement programme. In order to achieve the objects of this programme, the following imperatives are to be undertaken: implementation of metering throughout the population, network optimization to replace strategic high-leakage mains and service connection and de-bottling of the network, climate change investments to increase storage, mitigate flooding and localize production and establishment of a performance-based culture in WASA.

Members, the Ministry embraces its role as an advocate of the national vision, which fundamentally seeks the improvement of the quality of life of all its citizens. And, therefore, emphasis is placed on the provision of efficient, cost-effective and reliable public utility services throughout Trinidad and Tobago. The Ministry will continue to provide strategic guidance, support and facilitate WASA in delivering on its initiatives, so that the authority can continue to contribute to Trinidad and Tobago's socioeconomic development.

The Ministry, therefore, looks forward to the recommendations of the committee and as well as its other stakeholders, in moving this thrust forward. Thank you.

Mr. Chairman: Thank you. Mr. Poon-King, you are going for WASA?

Mr. Poon-King: Good afternoon, Chairman and members of the Joint Select Committee, and thank you for

having WASA here to provide information on our contribution towards the establishment of water security for citizens of Trinidad and Tobago.

In 2013, UN Water provided a working definition of "water security" as the capacity of population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being and socio-economic development for ensuring protection against waterborne pollutions and water-related disasters and for preserving ecosystems in a climate of peace and political stability. This definition is quite broad in its context. However, it is clear that it requires a multipronged, multidimensional approach in order to successfully achieve its goal, including the adoption of an integrated water resources management approach for dealing with this precious resource.

IWRM explicitly challenges conventional fragmented water development and management systems and places emphasis on an integrated approach with more coordinated decision-making across sectors. This integrated approach to water management is a process that seeks to attain three main strategic objectives: efficiency, equity and environmental sustainability. The process recognizes that exclusively top-down supply-oriented technically-based and sectoral approaches to water management are imposing unstainable high economic cost on society.

WASA is mandated to provide water and wastewater services to the population of Trinidad and Tobago. This means that the authority has a major role to play in the IWRM process and ultimately plans towards achieving water security.

It is important to note that in order to provide water services to our citizens, the authority must undertake several key activities associated with developing and maintaining water treatment sources, as well as transmission and distribution systems. In this regard, the authority continues to develop new water sources, maintain existing ones and treat these raw water sources to meet international drinking standards. Towards this end, some of the infrastructure development projects completed by the authority include construction of intakes and wells.

In order to effectively deliver and sustain a water supply to our citizens, the authority must also place focus on its pipeline, transmission and distribution network, which has been enhanced through the construction of new service reservoirs across the country and booster stations in north, south and central Trinidad. The authority has also laid critical pipelines to provide connectivity to previously underserved areas in Trinidad and Tobago and place great emphasis on its leak repair programme in order to reduce its level of unaccounted for water, while improving the level of service to customers.

Another key area of the authority's operation that requires equal attention regarding infrastructural development and maintenance is the area of wastewater collection and treatment, since this can have a major impact on public health and environment. To this end, a new Malabar wastewater treatment plant and collection system has been completed with funding secured through the Inter-American Development Bank. Through this programme approximately 30,000 residents are benefiting from the construction of the facility, and this is expected to increase to over 108,000, upon completion of all phases on the collection system, to serve the full Malabar catchment.

In Tobago there has also been a significant improvement in wastewater services, with the construction of two new sewer systems at Bon Accord and Samaan Grove. This has resulted in over 400 new wastewater customers and improvement in the wastewater coverage to customers in the coastal areas of Crown Point, Pigeon Point, Black Rock, Golden Grove and Buccoo.

As the Water Resources Agency leads in the IWRM efforts, we must all work to minimize the negative effects of activities that pose significant threats to our watercourses, which ultimately impact water availability, quality and flooding. These include indiscriminate wastage, indiscriminate dumping, sedimentation of streams through poorly-managed quarrying, disposal of industrial effluent discharged from non-functioning wastewater

treatment plants, slash and burn agricultural practices and agricultural runoff.

In addition to these anthropogenic activities, there are also natural threats to our water resources from the impacts of climate variability and climate change. This is evident by the reduced rainfall locally in recent years and the harsh 2019 dry and wet seasons in particular. These threats to the quantity and quality of our water resources are also occurring against a backdrop of increasing demand for potable water. Although the resource is renewable, it is finite and must therefore be managed to sustainably.

As a country, we urgently need to achieve a paradigm shift in the way we treat with our water resources. The narrative of Trinidad and Tobago being classified as water-rich must be tempered by the reality that without efficient water resource management, we will not avoid the faith of other water-stressed nations. This speaks directly to the ability of all sectors and stakeholders working collaboratively to achieve water sustainability for our nation. The authority remains committed to doing its part towards this end and will continue to work closely with other stakeholders to ensure that we remain on a path to achieving this goal. I thank you.

Mr. Chairman: Okay. So, we will now have questions being posed by members. Just as a reminder to bear in mind, that I am sure WASA has appeared many times before joint select committees, and is, from what I understand, scheduled to appear before other select committees in the very near future, so that it is just the objectives of the enquiry we are basically focusing on water security. We do not intend to get into all the detail operations, the nitty-gritty and all of those things regarding the authority itself, but more broad-based policy and directives regarding ensuring water security as based on the objectives I outlined at the beginning. Member Jennings-Smith.

Mr. Jennings-Smith: I would be very specific. I want to refer my first question to WASA. I want to refer to your own submission on page 7 where you indicated that four booster stations are to be constructed or upgraded in northwest Trinidad, the contracts are to be awarded and work is expected to be completed in the third quarter of 2020.

Now, I represent the constituency of Toco/Sangre Grande and I have complaints from those people every single month, in particular the people from Matura and Sangre Grande and the outlying areas. But I want to specifically focus on this question right now. You said that storage tanks have been constructed and commissioned at Four Roads, Diego Martin, Tucker Valley, Chaguaramas, Hololo, Cascade and Charlotteville, Tobago with two additional to be commissioned in Quarry, Valencia and Guanapo. And you also said that communities to benefit include Carenage, Petit Valley, Diego Martin, St. Ann's, Arima, Calvary Hill, Valencia and Charlotteville. Given the work that is expected to be completed in the third quarter of 2020 for the four booster stations, can you provide details on the status of the award of contract, the tendering process used to select the contracts, the contracts' cost and the contractor selected for the work?

Mr. Poon-King: Okay, first with respect to the four booster stations, we are at the stage where the physical work, we have signed the contracts, and so on, with the vendors and the work is scheduled to commence shortly. I will let Ms. Lee Sing Pereira provide the details of that.

The two contractors that were selected, it was an open tender and there were two contractors, Toshiba Water is one and the other is D. Rampersad.

Mr. Jennings-Smith: Okay, great. Could you tell me the status for the two additional storage tanks to be commissioned in Quarry, Valencia and Guanapo? And when will these be commissioned?

Mr. Poon-King: Right, so I will let Ms. Lee Sing Pereira provide those details.

Mrs. Lee Sing Pereira: The Quarry and the Guanapo tanks, they are approximately 95 per cent completed. Right now, what we are working on is the interconnecting pipework to just complete, to put those tanks into service. But those tanks are completed, 95 per cent substantially complete, and it is just the pipework now to close it off and do the testing.

Mr. Jennings-Smith: Could you give me a timeline as to when it will be commissioned? Because I realize that

residents of Valencia will get some level of impact, in terms of supply of water. So could you tell me when, the locality you are looking at.

Ms. Lee Sing Pereira: So we anticipate by the ending of this month, March, that those tanks should be placed and commissioned.

Mr. Jennings-Smith: I have another question for the Chairman. Now, you are aware that there is a station in Matura, and I have there in office for the past four years, and I have been asking questions about that particular booster station in Matura. I believe that the problem still exists. Can give me an update as to what is really happening in Matura? I know you are very well aware because I continue discussion with the area manager about that particular booster station in Matura.

Mr. Poon-King: Would this be the treatment plant in Matura?

Mr. Jennings-Smith: Yes, the treatment plant in Matura, because there is a problem with the tank, the pump, that every time rain falls there is no water and consistent it has been happening over the past few years. Can you tell me if any improvement work was done, and if so what was done?

Mr. Poon-King: No, no improvement work would have been done yet to that station. But based on what you have described, the plant as it is we need to review the treatment process, what would occur, during periods of heavy rainfall you will get a deterioration in the raw water quality, which will result in what you have described. So we will have to review that process. I have asked the Director of Operations, but he does not have firsthand information, so we will have to provide an update.

Mr. Jennings-Smith: And last question is that: Can you tell me where do the residents of Sangre Grande and outlying areas get water supply from?

Mr. Poon-King: Sangre Grande is supplied primarily from the North Oropouche water treatment plant, and we do also have localized wells to supplement the supply within Sangre Grande itself.

Mr. Jennings-Smith: Has any work been identified, in terms of, with regard to the supply of water to these areas within the last two years?

Mr. Poon-King: We have had issues with the wells in Sangre Grande and we are currently working on those to have them back up to full production. Other than that, well the North Oropouche, we have done work at North Oropouche which would have benefited Sangre Grande.

Mr. Jennings-Smith: Okay, thank you very much. Your submission also indicated that a list of high leakage mains has been developed by WASA, which takes into account the rate of leakage. Which areas are most affected by leaking mains?

Mr. Poon-King: The leaking mains would be across Trinidad and Tobago. So there is no area that I can, at this point, pinpoint to say this one is worse.

Mr. Jennings-Smith: So, in other words there will not be an opportunity to say that you have a priority listing to deal with those leaking areas?

Mr. Poon-King: There would be a listing that has been prioritized, based on the level of leakage. That could be provided.

Mr. Jennings-Smith: So you can provide this Committee with a list of the priority listing?

Mr. Poon-King: Correct.

Mr. Jennings-Smith: Okay, can you.

Mr. Chairman: Member De Freitas.

Mr. De Freitas: Thank you, Mr. Chairman. So we are dealing with water security today and a lot of what you have submitted to us speaks to the objective that WASA is trying to achieve, which is supply of water 24/7 supply of water to a large percentage of the papulation.

I have noticed, not just over the last year, probably before that as well, in treating with the amount of water in our reservoirs that WASA has been putting out, the percentage of water in the reservoir, to let the

population know exactly what is there. And this comes in quite handy. My first question is: Based on the data you have, the amount of water in those reservoirs, has it been trending upwards or downwards over time?

Mr. Poon-King: The levels in the reservoirs are due to the variations between dry and wet season. In the dry season, we could expect it the go down and in the wet season it is replenished. We do get from year to year, variations or fluctuations that occur. Last year in particular, the dry season was particularly harsh, and the wet season we had below normal rainfall.

I think I attended a conference with Dr. River recently and it was stated that overall the rainfall is decreasing, which would mean that the water in our reservoirs, because we draw water from rainfall, that would be impacted.

Mr. De Freitas: There is a reason I asked that question. Because what you are saying is absolutely true. But based on data you would be able to tell if it is going to be trending downwards. We all know about climate change. We all know the effect that it is having worldwide. One of the effects in Trinidad and Tobago is that in the rainy season you will get shorter periods of rainfall, so more water in a shorter period, which, ironically does not really affect the reservoirs. In other words it does not fill them up. And the dry season is a little bit longer. It is a little bit drier and you do not get as much rainfall and whatnot. My point is this, the data should be able to tell you, whether it be 10 years, 15 years, 20 years. If it is trending downwards, you might be able to get a rate at which it is trending downwards, and the question is: What plans are you all putting in place, given that the wider population does not know this. And in order to conserve water they would need to know this, change their behaviours, so that we can, you know, mitigate that problem.

Mr. Poon-King: I think the PS in her opening remarks had intimated that a programme that we are looking at currently, through the ministry, with the IDB, to look at the entire water cycle with respect to improvements in that regard. And certainly storage of water will be in that programme. We need to also look, and you indicated it, the water balance is supply and demand. So we need to ensure that the demand part of it is managed as well.

Insofar as the supply, which is the part you are speaking of, we do need to increase the storage that we have. And also we need to look at, and have been looking at, the variations that have occurred from years ago up to now, that it appears to the layman that we have shorter duration, higher intensity events.

Some of our facilities are what we call pump storage facilities. So they do not only capture water within their catchment, we get water from adjoining catchments and pump it up to the reservoir. So that needs to be looked at, in terms of do we need more capacity to deal with the shorter duration, higher intensity rainfall events that capture that water as well. So all of that is part of the process towards having water security.

Mr. De Freitas: Okay, so I understand where you are coming from with that. One of my major concerns is that we have no control, as human beings, in relation to how much rain falls in the rainy season. So if it is that, where we are located geographically, we are seeing a trending downwards in the amount of rainfall that we are getting in the rainy season; that is the starting point of the water cycle and everything changes. So for example, you may find that a particular well you have dug, which was dug to a particular depth because of an aquifer, you may need to dig a little deeper to get the same amount of water.

The reason I was talking about the population is because the snapshot of where we are in Trinidad and Tobago right now is that one, we are not providing 24/7 supply to 100 per cent of the population. That is one. Two, what you are supplying to those who are getting water, there are problems with leakages, and whatnot, but yet the reservoirs that we have are saying that they are not where we are comfortable for them to be. So if it is that we are not running at maximum level, but the reservoirs are still not where we are comfortable, then I am hard pressed to see how we are going to, you know, do better with that, given that the overall rainfall is seeming as though it is getting less with climate change.

So, my point is we are going down a road of, well yes we want to give 24/7 supply to as many people as we can in Trinidad and Tobago, but are you going to hit a problem where you are just not going to find the

water? The first thing in my mind is changing the behaviour. We need to move from water is bountiful and plentiful because we are on a tropical island close to the equator, to what Las Vegas and California and these places are doing, which is, you need to be conserving as much water as possible. Because you know what? There is just not enough. And they have a whole reuse policy and plan, in terms of dealing with their water supply. So are we moving from free use of water to conserving water? Because the trend is telling us we are going to run out if we keep doing this. That is what I want to hear from WASA. Is that what we are doing?

3.10 p.m.

Mr. Poon-King: Well, the message of conservation, we have been putting that to the public and this was, even two or three years ago before we had that bad dry season last year. So conservation and demand management as a whole needs to be done together with the water winning projects. When we look as the volumes of water we produce, we should have enough water to supply the public. Because of—

Mr. De Freitas: For how long? For how long will you take to meter? So somebody born today can be confident that they are good for when they turn 80 years old, 50 years from now?

Mr. Poon-King: Well, 80 may be a bit long to project. The primary source of water we currently have would be surface water sources, which account for about 50 to 60 per cent of our production. So our focus is always there to try to ensure that we protect that. We do have ground water and we have been looking at— As I said, can we store more surface water to add security of supply to that component?

And in terms of the ground water we are looking at alternative, previously untapped aquifers that would have significant volumes of water and that have not yet been tapped, that those we are looking to utilize as well.

Mr. Chairman: Mr. Poon King, you mentioned with regard to the conservation that member De Freitas is asking about. But how comprehensive? And how aggressive have been your water conservation programmes? How effective have they been thus far?

Mr. Poon-King: Okay. The water conservation initiative, we start at the school level, we do have a public education centre. So we have started with young children into secondary school as well and we have had different initiatives over the years, promoting conservation. That is coupled with the— where we currently have a water hose restriction in place since January of 2019 based on the water availability that we have had. All these are under the WASA Act that we are empowered to do. And we have been doing patrols and applying the relevant charges and so on, to people who are in breach.

I think we have where it has to be a consciousness that water is finite. And yes, the punitive measures will continue but more needs to be—that people recognize that this resource is something that we have now and we have to treasure it and utilize it properly for our personal use, industrial use, commercial use. It is literally what drives the economy of Trinidad and Tobago.

Mr. Chairman: Now, I am hearing you with those things and that has been the language that has been outside there, if you do not mind, for decades. And in terms of effective— because one, from your response it seems as okay, the enforcement aspect of it through whatever bylaws and laws under the WASA Act that we can put into place and the level of your resources to ensure compliance with those laws. But another aspect really hinges largely on public education and getting across to the public, "Look, this is a precious finite resource" and as member De Freitas is saying, it is not going to last forever. And due to, of course, climatic changes and whatever that we are hearing, it is even more imperative that we reduce consumption.

So I know, yes, the schools—we have been talking and a couple of things. But in terms of—do you all have a comprehensive public education strategy that identifies all facets of conservation, how it could be marketed? How you could enact it with the public? Do you have measurables to gain how effective it is being done? And are results being seen in the actual reduction in consumption?

Mr. Poon-King: In terms of measuring the reduction in demand or usage, the problem or one of the issues that we would face is the metering component where we have limited metering insofar as getting data on usage

and usage patterns. So the effectiveness, it would be difficult to measure. But we have been, I think, getting the message out consistent with our plan and again, the plan that the PS referred to with the IDB is a comprehensive proposal and it looks at both supply and demand issues including improving metering at that point.

Mr. Chairman: But specifically, in terms of your public education programme, would you be able to provide this Committee with such a programme that—what you all have in place?

Mr. Poon-King: Yes, that could be provided.

Mr. De Freitas: Mr. Chairman, I just wanted to add to what you are saying a little bit. I am a tad bit scared because we are at a stage globally where we are feeling the effects of climate change. We are no longer guessing, we are no longer projecting, we are no longer doing models. A lot of places are feeling the effects. And we are still at a point where we cannot categorically state what the demand is because we do not have the meters. It is nobody's fault.

But I am worried that as much as you indicated that there is still quite a bit of supply that we have not tapped into yet—I know how this thing works by way of the water cycle and I am worried that as we are moving forward and the years roll by, we are not going to be replenishing these stores that we are dependent on, and we are still not grasping exactly, whether through our conservation efforts, if the demand is going down at all. And that is what the Chairman is getting at because that is the most important part, that is where we will have the greatest effect, reducing that demand.

But at this current time, what I am hearing is that we do not even have a way to measure that because what I am hearing right now coming from WASA is that the reservoirs are 40 per cent or 50 per cent, please conserve. What I am hoping that we are hearing, based on empirical data, is the reservoirs are at 50 per cent, they are not being replenished because of climate change or whatever, if we continue using water the way we continue to use water, we will not have enough to supply the nation by so and so date.

They do it for oil. They could tell you that with oil based on consumption, supply, how much oil is in the ground, estimates. It does not have to be 100 per cent accurate but they can estimate by a certain year you are going to run out of oil. This is all data and trends and if that is the narrative then it is hard-pressed for somebody to say, "Well, you know, let me continue to use water the same way."

The other public education programme that could be done is that there is so much technology now: sensors on your taps in your house that if you are going to wash your hand—you see it in bathrooms in public spaces— you put your hand under, the water runs for a few seconds and it turns off. People in Trinidad and Tobago are still using, turn on your tap and you leave it while you brush your teeth. That cannot continue given what is coming. But we are not educating from a standpoint of, if we continue down this road, we are all going to be thirsty very soon, and that is what is scaring me.

I am just hoping you take what I say because it is not— I do not think it is too expensive or something, a hurdle that we cannot cross. It is just a matter of getting data out there, changing the narrative to really let the people know how important this is. We really do have to start conserving water because when I saw those numbers for those reservoirs for last year, it started to scare me. One bad dry season and "we in trouble".

Mr. Chairman: Mr. Mark, we will just continue along the lines, just before I go to you. Member De Freitas mentioned "one bad dry season", but I shudder to think two consecutive bad dry seasons, what our position would be? Or three consecutive bad dry seasons? And based on climatic changes, I do not think I am stretching my imagination too far because the possibilities are there.

In your wastewater infrastructure plan, Mr. Poon King, 2017 to 2022, which you were gracious enough to include in your submittals to the Committee as an appendix, on page 2, section 2.0 background, you indicated that the per capita consumption in Trinidad and Tobago is extremely high indicating that it encompasses both actual consumption and unaccounted for water. From what I understand is that our per capita consumption is in the range of—you can correct when you respond— maybe around 580 litres per person per day and what

we are aiming for is something substantially lower than that. Could you indicate what percentage of that consumption could be assigned to "unaccounted for water" out of that figure? And what is the target consumption, based on our present situation, that the Authority has as its target?

Mr. Poon-King: The figure of 580 litres per capita per day includes an unaccounted for water level of approximately 50 per cent and then—so, you would be left with around 290litres per capita per day in terms of consumption. So that figure, roughly, it is probably about 60 or 70 per cent at least above what it should be. So that needs to be reduced significantly—this is the 290 in addition to the unaccounted for water component. We need reduction on both components.

Mr. Chairman: In the responses from the Ministry of Public Utilities, the term "non-revenue water" is used instead of "unaccounted for water". Is there a difference in the terminologies, "unaccounted for water" and "non-revenue water", just for clarification before we move on?

Mr. Poon-King: I think for our purpose it would be interchangeable. Non-revenue water would normally be probably more applicable in a metered environment. We are not really metered so you can use non-revenue water or unaccounted for water at this time. It will have the same meaning.

Mr. Mark: Thank you, Mr. Chairman, thank you. Let me welcome all the representatives here this evening. The first thing I wanted to clarify based on what Mr. De Freitas raised a little earlier— and that has to do with the challenges that we face particularly in the period of climate change and scarcity of water supply. In reading the submission made to us by the Ministry of Public Utilities, we are told on page 6 of the Ministry's submission under institutional arrangements that, and I quote:

> In Trinidad and Tobago there is no shortage of water resources.

And as you go later down, we are told and I quote:

> The challenge is in continuity of supply of water.

Could you explain that to the Committee? So that we could be clear in our minds because we are hearing from our colleagues here that there is a finite supply of water. But we are hearing and reading, rather, that in Trinidad and Tobago there is no shortage of water resources and the challenge is really the continuity of the supply of water. Could you elaborate for us please?

Ms. Duke: Thank you for that question, member. I will ask our Water Sector Specialist to respond.

Ms. Govia: Thank you, PS. When we are looking at the benchmark that the UN has given to define water scarcity really what they do is they take the amount of water resources that you have available using rainfall and runoff and they divide it by the number of people that you have in your country. So there is a particular benchmark which T&T surpasses. So, according to the UN's benchmark, we have more water per person than their benchmark of water scarcity. The challenge that we have is in providing or treating and distributing this water to supply people so: how we harness this water; how we treat it; and then how we distribute it to get to people.

While WASA has done a really good job based on its Caribbean counterparts of giving access or coverage of that water supply— so around 95 per cent of the population is covered— the challenge is in continuing that supply with having 24/7 supply and that really is the problem or the focus of non-revenue water.

And just to be clear, non-revenue water is not just leaks or physical losses, it is also what we call "commercial losses" which is water lost in households and water that is used but not billed in households. And because we do not have metering and we have high consumption figures, we tend to use more water than we are actually billed by WASA.

Mr. Mark: Mr. Poon King, given the fact that we have heavy rainfalls, when we experience them, flooding is very dramatic in our country particularly over the last two to three years. The question of storage came up a short while ago. Is WASA taking measures or steps to construct more dams in Trinidad and Tobago in order

to preserve, to conserve water that is in excess supply during the rainy season having regard to all the global challenges that we are familiar with? And when we look at what took place last year and what can be repeated this year and beyond, is WASA taking any measure or initiatives to construct dams so that when we have, as I said, excess water through flooding, the water can be captured, treated, preserved and utilized in periods of heavy—or in periods of, let us, say scarcity? Could you help me in that area?

Mr. Poon-King: When— WASA has four impounding reservoirs; three in Trinidad, one in Tobago. When those would have been constructed, I think the primary objective of those particular projects would have been from a water supply perspective. So, for example, within the Caroni River basin, we have the Arena Reservoir, and while we store water there for water production purposes, ultimately, when you have a flood event and we are drawing water off of the river to put into storage, that in fact does contribute in some way to a reduction in the extent of flooding that may occur.

I think we are looking at increasing our impounded storage, I think, but the thinking now is a little bit different in that we are looking for projects that would not only provide water supply but also provide for a flood mitigation component. So we are, through the Ministry, looking at projects in Cumuto and Ravine Sable's sandpits to provide both water supply and flood mitigation going forward.

Mr. Mark: Any time frame, Sir?

Mr. Poon-King: Well that— again, the PS would have indicated the IDB programme and that whole consideration is within that programme.

Mr. Mark: As you talk about the IDB, you seem to have a lot of relations with that institution. Maybe you can commit pen to paper and share with us how many loans you have with the IDB, and for what purposes have these loans been contracted, and the value of these loans, and for what period of time these loans are for? I think that would be useful for us to understand what is taking place. You can put that in writing and submit it.

Let me ask the Acting Permanent Secretary. You told us in your submission that the Ministry is responsible for setting policy and high-level strategy, and that is to deal with water security. Do you have a policy, a written policy given that you set policies to deal with water security? Is there a policy in the Ministry of Public Utilities on water security in T&T?

Ms. Duke: Member, in 2018, the Ministry would have finalized a revised National Integrated Water Resources Management Policy. This was submitted to Cabinet in early 2019 and it is pending a decision. This policy would have succeeded a previous policy in 1999 that WASA was charged with effecting but it would have gone further to look at integrated water resources management and to speak to some of the things that must be put in place in order for us to have effective water supply and quality water supply.

Even though the policy has not yet been approved, building on that policy initiative of 1999, WASA is, in fact, implementing some activities that speak to areas of the Integrated Water Resources Management Policy. And I would just ask if I may, my Water Sector Specialist to elaborate on what some of those initiatives are.

Mr. Mark: Before she does that, can you share with us what is the current status of this policy that has been submitted? I do not know if you are in a position to do so. But from what I have read, this policy would have been submitted to the Cabinet, was it in February of 2019, if I am not mistaken? We are talking about one year and maybe going into some days later. Can you share with us, from your perspective, Permanent Secretary and from the Ministry's perspective, can you brief this Committee as to the current status of this policy that has been submitted and remains outstanding?

Ms. Duke: Member, unfortunately, I am not in a position right at this point to do that. But I could enquire.

Mr. Mark: All right, well, could the—.

Mr. Chairman: Please, before we go to you, Water Sector Specialist, I just have one or two observations regarding that Integrated Water Resources Management Policy. So I will just identify those so that maybe it

could be dealt with in the response at the same time. I think the Integrated Water Resources Management Policy is a step in the right direction. It does tie in with the Sustainable Development Goals that has been outlined for 2030 and really and truly, we need an integrated approach to water management, water security as adopted by many countries now throughout the world.

A couple of things, with regard to the policy, in that one, is that from what I gather is that a certain entity— it has not been given a name as yet, it has not been given a name in the policy per se— but a specific entity would be given certain lead responsibilities in terms of coordinating. I think there is a matrix that is attached into the policy and just a rough check I did, there are almost 22 other stakeholders in the water industry that is on that matrix. Some of them have lead responsibilities, but this certain entity that is being identified has certain lead responsibilities.

It is just that, you know, I would have thought that the policy would have gone a bit further at this stage. It would have clearly identified, probably in a bit more detail, the role and responsibilities of the entity. And bearing in mind, the paradox with the Water Resources Agency, in particular, where we have the Water Resources Agency lodged in WASA so both the abstractor of water and the regulator of water is within the same body, it would have addressed that anomaly in more detail and made a definitive recommendation that the Water Resources Agency be removed from the ambit of WASA.

And maybe gone so far as to say, look, in the formulation of this new entity that would be responsible for the integrated water resources management of the country, maybe the Water Resources Agency could be the seed agency, removed from WASA and be allowed to develop, seeing that it has a foundational basis already, and that agency be looked at to form the framework for a new integrated water resources agency with clear and definitive roles.

Ms. Duke: Member, your point is taken. Maybe when we speak to where the policy is now at, there may be room to relook that. That is something we can look at when we see what is happening with the policy before its approval.

Mr. Chairman: All right. It is just that— why was it not done together with the policy? Because also, to me, the policy did not address really— I mean there is certain legislation in place including the WASA Act. But the amount of legislation that is there that impacts on water and water security, is that the policy did not really go into any detailed investigation or even preliminary investigation at this stage into the sort of legislative framework that such an entity would have to be given in order for it to function effectively in terms of the lead responsibilities that have been assigned to it in the policy.

Because that legislative framework—I mean, the work has to be done, a review of all legislation pertaining to water and what the role of this entity is intended to be and what is the necessary legislation, whether new or amended legislation, that has to be put in place and I just felt that the policy should have addressed that, at least a first pass in that regard.

3.40 p.m.

Mr. Mark: I think somebody was supposed to—

Mr. Chairman: So at this time we would like to invite the inputs from your Water Sector Specialist.

Ms. Govia: Thank you. Just to go back a little bit, and I think this is to contextualize our goal for water security. Integrated water resources management is not something that is unique to Trinidad and Tobago. It is actually a global process that is being championed by one of the UN's agencies. But really, it speaks to the fact that water has a direct link with land use planning with the water environment, and in order to manage water resources, it requires integration and coordination with other managers of water. So, like the agricultural sector, watershed, or forestry, climatology and those types of agencies.

So, there is a particular model for that integrated water resources management, which the policy follows. So, it looks at the enabling environments, so the institution legislation which you mentioned. Then the

institutional setup which you are referring to, this agency that will manage water resources. And the policy says clearly, that the agency, whoever that is, will manage, monitor and regulate water resources. So it is calling in essence for a separation of the functions of water resources management that now lie with WASA through its Water Resources Agency. And of course, it recognizes that that institutional capacity exists in the Water Resources Agency.

So a number of models for the institutional set up of the organization have been put forward, including utilising the Water Resources Agency services. Because that is really where the capacity is and that has been put forward for a decision. And actually this separation is not new. It has been going on since the early 2000s where the recommendation was made out of a strategy that was funded by the World Bank to set up a resource regulator. So your policymaker which is the Ministry, should be separated from your service provider which is the utility should be separated from the resource regulator which is WRA.

So the legislative groundwork actually exists. What we are waiting on is a policy decision as to whether we are going to adopt as a country integrated water resources management, which has particular benchmarks of institution management, financial, and the enabling environment.

Mr. Chairman: Could this Committee be provided with those two items of information that you mentioned. One, the model framework for this integrated water resources management agency, and two, the legislative findings that you referred to.

Mr. Mark: Yes, may I continue, Mr. Chairman? In your submission Acting Permanent Secretary, you indicated that the public involvement in protection, conservation, management of watersheds constitute a central focus when it comes to the security of water supply. I was interested in the management of our watersheds. First of all, can you identify where these watersheds are located? Could you also advise this Committee whether public education initiatives on the protection and conservation of these watersheds have been pursued? What initiatives have been taken in that regard in terms of education? And to what extent these exercises that I have mentioned have been successful in protecting and conserving our watersheds? So it is a three-part question to get some clarification on.

Ms. Duke: Okay, member, in terms of—

Mr. Mark: Or if you want to put them in writing, you can do that but you can give us a tight summary of these concerns.

Ms. Duke: I think that the WRA would be able to address the questions that you have asked.

Mr. Gosine: Good afternoon, member. With respect to watersheds in Trinidad and Tobago, there are 55 watersheds in Trinidad, and 14 watersheds in Tobago. A watershed is defined as an area when rain falls they come to a common point. So, all of the land surface would be part of a particular watershed. With respect to management of the watersheds, the Water Resources Agency works closely with other entities who have regulatory functions. For example, we have EMA, when a project is proposed and they say that there would be some potential impact on the water resources, they would write to us and ask for our input into the proposed project. So, it could be with regard to whether its surface runoff which is going to be impacted, or infiltration into our aquifers would be impacted and so forth. So, we have a very close relationship with the EMA with regard to projects and their impacts on the water resources.

In addition, the Water and Sewerage Authority is part of the Mineral Advisory Committee which basically reviews applications for mining and quarrying. So, this Mineral Advisory Committee would review mining applications and the membership of this MAC is comprised of: Ministry of Works and Transport; EMA; Ministry of Health; Ministry of Finance; Town and Country Planning Development. And we basically try to work together to ensure what is being proposed would have as minimal impact as possible on the water resources. So, overall, we try to use our relationships even though with regard to legislation, WRA really does not have any legislation on its own in order to move forward with management of the water resources.

In addition, we have a public education component, as well as working with grassroots organizations and that programme is called the "Adopt a River Programme". And that basically to get the citizens in a watershed to become stewards of their environment. The Adopt a River Programme would train water warriors in the communities, and we basically would educate them in the role of protection of their water resources. We train them to do simple water quality testing so that they could monitor their watersheds. We have meetings at schools, primary schools, high schools, in order to foster this greater stewardship because the young people they are probably more in tuned with what is going on, and they could help guide the adults and nudge them along the right direction.

Mr. Mark: May I ask, you can put in writing, where these watersheds are located in Trinidad and Tobago? And if you can also indicate to this Committee, Sir, how successful have we been so far in preserving and ensuring longevity as it relates to these watersheds, re: management of it, and conservation of same? Could you just share with us, you know, what is the experience, or what the experience has been like thus far in preserving, conserving these watersheds?

Mr. Chairman: Could I also just add a couple things to what Mr. Gosine has indicated and what member Mark is asking for? Mr. Gosine, could you safely identify, or is there a clear identifiable agency that is responsible for watershed management in Trinidad and Tobago? Or is it spread among several stakeholders?

Mr. Gosine: It is spread among various stakeholders. When you look at the drainage division they give approvals of projects with regard to impacting river courses, right. So a lot of the projects, developments, would have to get drainage approval for any kind of development. You also have Town and Country Planning department and they basically would have to look at the current land use, and they may have to modify the land use if there is a particular project that is going to be done. Of course, we have the EMA whereby they issue a Certificate of Environmental Clearance with regard that give their conditions with respect to that proposed project.

However, if they sense that the project is of too great a scope they would require an environmental impact assessment before they would issue a CEC. So those are the key entities, Drainage Division, Town and Country Planning department, and EMA that basically have legislation whereby they have a role to play with regard to watershed management.

Mr. Chairman: Okay, thank you, but it seems as though there is no clear lead agency that has a primary responsibility for watershed management. And I am just wondering in terms of the Integrated Water Resource Management approach, whether we will be going in that direction in terms of the agency, the IWRM agency that would be charged with that primary responsibility for watershed management. Because from what I have looked at in terms of the responses that have been sent, it seems as though the Integrated Water Resource Management approach is also significantly suggesting that the supply of water, as much as possible, should be maximized from within the watershed resources itself.

I mean, we have cases where water is treated in Caroni and sent all the way down to south Trinidad, engaging, you know miles and miles of transmission lines and other than capital cost, the maintenance and the booster stations and everything that they require to take that water from Caroni and get it all down to south. And the integrated water management approach would be to say, well look, within the watersheds themselves, these are the potential sources of water. And we try to treat, we try to extract, treat and distribute within the watersheds itself, rather than cross watersheds distribution. Obviously, the thinking is that the benefits of minimizing cross watershed transmission is of course cost and getting the communities more involved and more active stakeholders in conserving what their watershed is producing. And I hope that the policy that we are looking at really would seek to maximize this aspect of the watershed management, and extraction and distribution of water within the watershed itself.

Mr. Gosine: Well, with respect to the IWRM policy, it is basically a decentralization of that process whereby

you have all these entities, these key stakeholders, working together. But in terms of, I think we just need to be working closer together much more to ensure that there are no gaps. With respect to water within different watersheds, when you look at the rainfall occurring in Trinidad, the areas with the heaviest rainfall is primarily the north-east, all right. An area of concentration would be like Hollis Reservoir. In addition, where we have the location of our aquifers we have some areas whereby you really do not have too many aquifers in that geographic area. As a result, they do basically export water out of watersheds.

But you are right in the sense that overall when you look at for example the United States, you have basically they would not allow water out of major river basins. Like you have the Great Lakes Compact between the Great Lake States of the US, and those provinces of Canada that share the Great Lakes. So, you basically have those kind of things in place to not export water out of large areas. But I think here in Trinidad, because of some of the population centres being in areas where rainfall is not as much as the north-east, for example the north-west, we have really no choice but to basically bring in water from where it is more abundant.

Mr. Chairman: Thank you. I think I see Mr. Kerr is here, and we have been talking a fair amount about climate change and its impact on the water security. I had the privilege of hearing Mr. Kerr deliver a short paper when we had an inter-parliamentary union seminar, I think sometime late last year. And, Mr. Kerr, in terms of the whole impact of climate change, in terms of what we are looking at, and from the view of the work of the Met Office, I am asking in terms of risk assessment and projections based on certain climatic conditions, the present case. What scenarios, what analysis are we looking at or have we done to come up with projections in terms of—I know long term is difficult—but in terms of medium term, short- to medium-term impact on water availability and water resources? Because Mr. Poon-King mentioned about the surface water and the impact of the rain fall. Is there marked isohyetal shifts coming out of rainfall patterns over the years, and what is projected for the short term? And also of concern is that remember although it is ground water, and we are extracting from wells the recharge of those aquifers is dependent on surface water.

Mr. Kerr: Thank you, Chair. Good evening again, and I want to just place it in context of member De Freitas, the question that he would have asked. And our analysis shows that we have seen a decline in rainfall. The last decade 2010 to 2019, when we compared the cumulative rainfall to the 1961 to 1990, 30-year period, we are seeing that that decade was 5 per cent less. When we compared the same decade with 1981 to 2010, we see that the cumulative rainfall was a whole 11 per cent less than that period. When we do decade to decade, we see that the last decade has cumulatively produced the least amount of decadal rainfall since 1970 or the late 1960s. So we are definitely seeing a trend with respect to the decline in rainfall and the projections is for that trend to continue.

So, for us, we have looked at the isohyetal and we have seen that there is a trend across Trinidad and Tobago, and the challenge though is that with respect to the extremes it depends on which index or which metrics you use, some are increasing, some are decreasing. But be that as it may, even to the point that member De Freitas made with respect to the high intense rainfall events, we are seeing the top 1 per cent of the heaviest rainfall events or those that are occurring at the 99 percentile are contributing more rainfall to the annual average. So the rainfall that we are witnessing is actually very, very intense and therefore the ability to capture that become even more a challenge, where the overall deficit in rainfall is occurring.

So, for us we are seeing these trends and we are hopeful that we in Trinidad and Tobago can climate-proof our water resource management. To that extent the Met Office has introduced a number of products that we provide to the Water Resource Management Agency that speaks directly to water security, and has to some degree enabled the Water Resource Management Agency to really help WASA with managing the water resource to the extent that we are a little more comfortable now than we would have been, had it not been for those kind of products and services.

Mr. Chairman: In the catchments where the reservoirs are located for the four major dams that Mr. Poon-King

mentioned, is it definitive that we are getting less rainfall in those catchments? And the trend is that we are going to continue to get less rainfall in those catchments?

Mr. Kerr: Well, let me put this in context. We are seeing the trends but each year is not the same. In the last six years it is informative to see that four of those six years in all the reservoir areas, were within the 10 per cent or 25 per cent, the lowest 10 and 25 per cent of the historical rainfall. So we are seeing those trends and they are happening more frequently now. One of the other things that we have to place there is that the El Niño phenomenon typically brings much dryer than usual conditions in Trinidad and Tobago, and since 2010 to now, we had this unusual phenomenon where we see three significant El Niño events in terms of the impacts happening in relatively short period of time. So those are the nuances that are happening within the rainfall distribution that has direct linkage to water security in Trinidad and Tobago.

Mr. Chairman: I know one aspect based on all the responses we have gotten is the whole thing about rainfall harvesting. Maybe particularly for agricultural use, but at the same time, not discounting it in terms of possible sources for winning water that could be treated and put into potable use. Is the Met Office in a position based on the work that you all are doing to point to any specific regions of catchments, where in terms of rainfall trends and patterns that rainfall harvesting could be optimized?

Mr. Kerr: Unfortunately, we are not able to pinpoint that. But what I can say is that the country in general needs to move to a level where we utilise rainwater harvesting in greater ways. As an example, in Australia rainwater harvesting has been incentivized to the extent that it has a greater uptake in residents. And it has been incentivized in a way where if you connect your toilets or your washing machine to a rainwater tank, then you get a particular payout from the Government. And then the Government by policy ensures that the education system, the schools, have rainwater harvesting to flush their toilets, and I feel that in Trinidad and Tobago policies to that effect can be used to really bring the change in behaviour in Trinidad and Tobago.

Mr. Chairman: My follow-up question is whether the Ministry of Public Utilities and WASA in terms of offering incentives for the use of rainwater, even in terms of the construction of cisterns and underground cisterns which in a lot of the islands is standard. You are building a house, you do an underground cistern at the same time. Whether in terms of are there any plans from Ministry or WASA to accelerate or to give more impetus to the whole aspect of rainfall harvesting outside of the agricultural sector?

Ms. Duke: We are actually at this point in time at the Ministry conducting some further research into the whole rainwater harvesting and how we can put it to use in terms of WASA's system, and we have one or two programmes that we wanted to make it complementary too, but we are still conducting that research.

Mr. De Freitas: Mr. Chair, I just want to jump in here and ask a question. Maybe the Ministry might know it or WASA might know if off hand. Which months in Trinidad and Tobago do we get the highest amount of rainfall usually?

Ms. Duke: I will ask Mr. Kerr.

Mr. Kerr: At some stations it is difficult to assess a particular month given how rainfall occurs irregularly in Trinidad and Tobago. So, what you may find is that on the north-eastern areas the month of August is the highest producing month, whereas, in the western areas the month of June is the highest, and then in Tobago the month of November is the highest. So, it depends on a number of climatic background factors. But what we are seeing, for example, is that the late wet season at Piarco in particular we are seeing what we call "a wetting" in that, October, November, December, over time since 1946 to now, the cumulative rainfall for those three months have increased, and increased statistically significant. The last three months of the year.

Mr. De Freitas: The reason I was asking that question is, I just quickly got some data from the press releases that WASA put out last year. And I have noticed that in March, using Hollis, we saw that there was 63.34 per cent capacity, and just a mere five months later in August of the same year, Hollis dropped to 18.91 per cent capacity. That is five months. That is a precipitous drop in five months. And I was just trying to compare that

to where the rainfall was, because you know, most people do not understand this but it is not a black and white line that you go through for dry season and wet season, it sort of blends. So, you know, it is not June and then all of a sudden this great amount of rain and what not.

And the reason I am asking that is because that is just one year and, you know, when you go over a decade for example, you can pick up trends. Does WASA take into account that type of data to sort of determine how it distributes its water? So, let me just go a little further, for February it is being reported already, Hollis is at 73.07; that is 2020, and obviously we will wait to see what happens in August. But is WASA looking at that? And then taking that into account to say well, listen in the month of June, July and August, the population of Trinidad and Tobago, given the fact that we are at the tail end of the dry season, so we have not had much rain, and the reservoir is expected to drop that low, because that is pretty low, 18 per cent is pretty low. You know, do they put programmes in place to ramp it up outside of telling the population to conserve? What else are you all doing to sort of treat with that? Because we do not want this year we find out it is at 15 or 10 if that is where it is trending based on what the gentleman said just a few moments ago.

Mr. Poon-King: Well, as Mr. Kerr had indicated, he does his analysis and within WASA through the Water Resources Agency we do do our projections for the reservoirs, and produce water at the treatment plants based on those projections. So, we do look at what is proposed. As I indicated, the last dry season was particularly harsh, and we amend our production levels to match the water that is available to ensure we have continuity of supply. So, I think in fact, we just got from Mr. Kerr projections, yesterday. So, again we will be reviewing and amending as required.

4.10 p.m.

Mr. De Freitas: This might be a lil bit premature. What projections you all have for August of this year? Would it be just as bad or would it be better?

Mr. Poon-King: I think I would let Mr. Gosine at WRA, he has some projections. I do not know if he has them on you but—

Mr. Gosine: Good afternoon member. So we received the six-month rainfall outlook yesterday and staff is currently, basically, trying to do the assessment. So the information I have is basically about a month old. Met Service provides basically three forecasts: one is called the outlook, which is the best estimate of the expected rainfall. They have an upper threshold and a lower threshold. For water supply purposes, it is prudent to use the lower threshold to help guide. What we do, two assessments, one for normal rainfall expected and then the lower threshold rainfall. So because it is a six-month forecast we received, this went from February to July. Right? So based on that and did you have a particular reservoir—Hollis, you said?

Mr. De Freitas: If you have all that is fine, it will be instructive to the population.

Mr. Gosine: Okay. Well, we had a low point in terms of capacity at Arena and occurring at the end of June and 29.9 per cent at the end of June, if we get the lower threshold rainfall from February through July.

Mr. De Freitas: That is actually the lower end of the rainfall?

Mr. Gosine: That is correct.

Mr. De Freitas: Okay.

Mr. Gosine: Right. So, it is basically a worst case scenario and when you are trying to stack for each month, however, as we have realized, sometimes the actual rainfall can be even less than the lower threshold. That has happened at times.

For Navet, we are in the better situation there. The low point would be at the end of May, and it will be about 44.4 per cent full. Navet has a redundant system whereby there is a lower reservoir and the dam is on an adjacent watershed, so water can be pumped from that lower reservoir to the upper reservoir. So that redundancy is of benefit to the Authority.

Hollis, the low point will be at the end of May and that will be 34.3 per cent capacity, and the production

we estimated to be 5 mgd. So if you produce more, the end of month capacity, I mean, the level will be less. Right? So it is that interplay. And at Hillsborough, Hillsborough is presently above average and the low point would be in July, 38 per cent.

Mr. De Freitas: That sounds really good. Just to continue on, based on the projections that you had for the lowest amount of rainfall that is projected to occur between that five-month period, at least two of the four that you have called out would be above what it was last year, and I think it is only one, which is the first one, which is Arena, if you hit that low mark, that would come in at lower than last year. So the projections sound good to me and like I said, it is instructive to the population to at least know that so that they could, in terms of their conservation, they keep conserving for their own benefit, WASA and water security.

Mr. Mark: In terms of performance indicators in order to assist to benchmark WASA against regional and international utilities and against its own progress over time, how does WASA rank against regional and international utilities? That is one. And how has WASA performed over the last few years in terms of its five performance indicators that you have identified? So that is the first question I would like you to pay attention to.

The other one, I know WASA has a lot of challenges and to overcome your infrastructural challenges, even your institutional barriers, you need revenue. So you go to IDB, as you said earlier, and then you get funding from the State through subsidies and subventions. Could you inform this Committee why WASA, in the face of a crisis of cash, would have allowed its receivables to reach this astronomical level of $1.6 billion? Could you share with us why WASA would have allowed this to happen and what measures, aggressive measures, are being taken by WASA to address this huge and astronomical level as it relates to your receivables of what I have seen to be about TT $1.6 billion? You could correct me if I am wrong, but that is what we are seeing. So my first question went to the performance indicators and the second one is in a crisis of cash environment, why has WASA allowed its receivables to reach that level? So Madam, please.

Ms. Duke: Yes, Member, thank you for the questions. In terms of how WASA stacks up against other utilities, I believe that was part of the first question, I will ask our Water Sector Specialist to speak to how WASA stacks up in terms of coverage and service to the citizenry, as well as to speak to some of the elements of the strategic pillars that we spoke about earlier like operational efficiency and so on, and then I will ask the DPS to share with us some of the reporting that WASA does based on what we have asked of them.

Mr. Chairman: Before you do, Madam Permanent Secretary, I think the member also specifically referred to the performance indicators that you have in your response. You had five performance indicators I think that you alluded to.

Ms. Duke: The Water Sector Specialist will speak to that.

Mr. Chairman: Yeah—to measure against those specific indicators?

Ms. Duke: Yes, she will.

Mr. Chairman: Okay. Thank you.

Ms. Duke: All right.

Ms. Govia: All right. We have set five strategic pillars and each of these pillars have performance indicators and we have defined what we actually want WASA to report on and specific to— So the five indicators which you have, one of them is a customer-centric culture, and we are measuring that by WASA's response and handling of complaints as well as the time it takes to process things like a new connection as well as a completion certificate which is in WASA's control. On the operational efficiency side, we are looking at their leak repair and road restoration status as well as their coverage and production of water, as well as water storage.

Financial viability: we have a bunch of financial metrics which include the EBITDA margin, their receivables, turnover ratio as you mentioned, their liquidity and their inventory turnover ratio. We are also requiring that they report on governance and the indicators for governance are specific to business continuity,

how they have been able to implement their preparedness and response strategy in times of a disaster as well as their statutory submissions to both the Ministry as well as the Parliament. And then the fifth indicator is—I think that was five—how WASA performs relative to other entities in the Caribbean? So both the Ministry as well as regional research bodies such as the Inter-American Development Bank have done a sort of performance benchmarking assessment of WASA.

And, as I mentioned before, water coverage is pretty high compared to other regional utilities. WASA is the second best performing utility with 95 per cent service coverage behind Barbados and Belize which is at 100—wastewater coverage, sorry. WASA is ranking the highest regional utility in terms of centralized sewerage coverage which is around 30 per cent coverage in all of Trinidad and Tobago. The rest, of course, are septic tanks. Regionally, the numbers vary between 2 to 17 per cent.

On the non-revenue water side which is another efficiency indicator that both the Ministry as well as other entities used, a lot of the regional utilities battle with non-revenue water. So WASA, the estimate is around 40 to 50 per cent and most of the utilities are around that with Jamaica at 60 per cent and most of the other utilities are actually tackling that. So, potentially that number would have gone down in the last two years.

From a governance and source of financial perspective, and it leads back to WASA's tariff, WASA has the lowest water tariff in the region, and I think only Suriname within this hemisphere has a lower tariff than WASA and, of course, that spirals into all of the other problems relative to their operations, as well as their receivable situation. Again, I mean, their account receivable is pretty high compared to other utilities, but one thing just to note is that from a legislative perspective, Trinidad and Tobago probably has the most dated water Act in the region. So it speaks to a wider issue of governance and how we have been managing our sector as a whole, not just the utility.

Mr. Mark: Yes, Mr. Poon-King, can you help us with the next question?

Mr. Chairman: Yeah, regarding the receivables, the 1.5 billion, I think it is.

Mr. Poon-King: So, just to correct the figure, member. The figure is about half of that, $827 million. It is still a significant figure, but just for correction. Insofar as what we are doing, the first mode of attack would be to disconnect properties. Well even before that, we contact customers encouraging them to make payment. The intent is never to stop the service but rather to collect the rate and then we go to disconnection and there are some other activities, so I will ask my Director, Customer Care, Mrs. Dumas-Harewood and she could give some more details on it.

Mrs. Dumas-Harewood: The debt recovery steps, we have two steps: encouragement and then we have enforcement. So for encouragement, we will use things like telephone reminders, reminder notices and actual interactions with the customer and then on the enforcement, we have disconnections, but because the majority of our customer base are not metered. We first, in the majority of cases, have to install curve valves so as to make the disconnections easier to do, and then thereafter once somebody is disconnected for more than three months, then we will take the legal action steps which would include serving the pre-action protocol letters to the extent of sale of property.

I think the first part of your question had to do with why would receivables reach to this level. I think in the majority of cases, if you cannot disconnect someone—that is the majority of the problem—then you have the instances of the government receivables, which is at the level let us say about $78 million, at this time, and then you have some other sectors where we have like abstraction and so on which are contributing. Nevertheless, the residential carries the highest receivables and, basically, being able to disconnect those customers easily will help WASA to reduce the receivables.

Mr. Mark: Mr. Chairman, before, can I ask the official, what percentage of this $800 million would you categorize as industrial, commercial, residential and governmental in terms of this 800—and thanks for the correction Mr. Poon-King—what percentage would you say, without you know, we could probably ask through

the Chairman to give us a listing because we would like to help you, so maybe you could give us just a percentage if you can. I have them in broad terms, but you may have it captured differently: industrial, commercial, governmental and residential as the case may be, in that kind of category.

Mr. Poon-King: I have the data, so I could provide it. In terms of percentages for business and industrial, 4.4 per cent. What I would do I would probably give the highest ones and that would be more instructive. Residential is 62.9 per cent; the next highest is public sector at 8.5 per cent and then water abstraction at 7.0 per cent and then industrial estate at 6.4 per cent. There are others but they are at lower levels.

Mr. Mark: But Mr. Poon-King, when we talk about residential, we are talking about ordinary residence in T&T or you are talking about, for instance—where is the bulk of this coming from, because I thought, you know, we had customers from a residential point of view, faithfully honouring their monthly or bi-monthly commitments. I am shocked to hear that 62 per cent is residential. Can you help us to clarify where are these people, this residential in Trinidad and Tobago?

Mr. Poon-King: I do not have—I can provide that.

Mr. Chairman: If you could provide that information in writing to the Committee, please, because I am sure when you appear in front of the PAC, I think it is next week, a lot of questions are going to be asked along these lines. I would just like to, in terms of where we are with the questioning, is to focus on wastewater reuse. All right? And, in particular, certain aspects in terms of, have we assessed or has any study been done to realistically assess the potential of wastewater reuse in terms of ensuring water security?

And, secondly, roughly if you have any figures, if not, you could give it to us in writing, how much wastewater effluent is generated from both WASA plants and the private sector plants in order that we get an overall picture of how much effluent is generated from our wastewater treatment plants and the potential or the feasibility—based on the effluent standards, you know, what potential is there to convert that wastewater effluent into water for reuse for both agricultural as well as industrial and even potable water use? And what is the status regarding the Beetham wastewater reuse project and the plans, whatever plans there are to get that water from that project into the mainstream supply? I know that the Ministry of Public Utilities in their response has referred this Committee to NGC, because they said as far as they are concerned they do not really have information, but in terms of WASA specifically and that Beetham wastewater reuse project.

Mr. Poon-King: With respect to the Beetham reuse, WASA's position is similar to that of the Ministry, that the project was originally an NGC project, so we did not have direct involvement with respect to the management funding and so on of the project.

Mr. Chairman: Could you advise the Committee is the plant operational? Is any of the effluent being used by WASA?

Mr. Poon-King: No. What is operational at the Beetham is WASA's Beetham Wastewater Treatment Plant where water is collected from our wastewater catchment which spans from Westmoorings to Mount Hope. Water comes to the wastewater treatment plant to treat and then discharged. The intent of the Beetham reuse plant was to take the effluent from WASA's wastewater plant and then further treat that to produce industrial quality water for Point Lisas. So that project did not happen so the water from WASA's Wastewater Treatment Plant currently is discharging into the environment.

Mr. Chairman: Okay. And your response to what I asked before, Mr. Poon-King.

Mr. Poon-King: With respect to water reuse as a whole, we are actively looking at a possibility of having the Pointe-a-Pierre refinery consider using effluent from the San Fernando Wastewater Treatment Plant which is currently under construction. So the dent there would be to pipe the water from the plant which is under construction to Pointe-a-Pierre to replace the water that is currently used or to augment the water that is currently used for industrial purpose and the Pointe-a-Pierre refineries could then be considered for alternative use, including potable water supply. There are a number of factors. It is currently being considered.

Mr. Chairman: Okay. And the newly constructed plants or upgraded plants at Malabar and those plants?

Mrs. Lee Sing Pereira: Good day, Chairman. When the Malabar Plant was conceptualized, what we had looked at is the same thing in terms of the use of the wastewater. The Malabar Plant and that catchment actually is just upstream of our Caroni intake which services the Caroni Water Treatment plant and, you know, when we looked in terms of the best use of the water it was really to return the water back to the Caroni River itself so that it could replenish the base flows in the Caroni River. So the intention always was for Malabar to replenish the Caroni River so that it can continue supporting the Caroni Water Treatment Plant.

Mr. Chairman: Okay. Just for Mr. Poon-King, but in consideration of the challenges in terms of surface water and the impact of it on climatic changes, is the authority really considering to investigate in further detail the potential of wastewater reuse as a possible source of water?

Mr. Poon-King: Yes, well as I indicated, we want to look at a volume of water that is viable and, certainly, as Mrs. Lee Sing Pereira had indicated, Malabar was considered and currently the San Fernando is being considered. The volumes we are looking at they are between 40,000 and 45,000 cubic metres per day ultimately around eight to nine million gallons. The smaller plants, it would be more challenging, so we are looking at, as I said, the main focus is that San Fernando plant as to how we could utilize that water. There is the potential for industrial application or potentially agriculture for the east of San Fernando and so on.

Mr. Chairman: Particularly, in terms of agriculture, because I know we are looking at the large outflows from the treatment where we have substantial quantities of effluent and may think that it might be more feasible for those large quantities, but actually the small to medium-sized plants, particularly in localized environments, may prove to be a lifesaver in terms of a crisis, particularly, in terms of scarcity, may be. I am just suggesting that may be for localized supply and, particularly, to build storage capacities in respective areas. It might be worthwhile looking into some of the medium-sized wastewater plants as well.

I would like to come to the whole question of tariffs. I mean, we have been told that our tariff or the charges for water consumption is the lowest in the Caribbean, and considering all the cash flow problems that WASA has and the amount of subsidies that have to go into WASA to keep it operational, I mean, what is the status with application for an increase in tariffs and what are the issues that you are really dealing with that you have so much problems in really getting a reasonable tariff for the water that is supplied?

Mr. Poon-King: In terms of tariff, we have WASA has prepared a business plan and that is currently under final review and it outlines WASA's expenditures and proposals going forward and what type of tariffs could be considered. So it is under final review between WASA and the Ministry and towards having it finalized going forward.

Mr. Chairman: Would you want to advise the Committee of a time frame, when it will be submitted? What sort of time is the RIC going to take based on your experience of all of these things? Because I mean, the intention may be there but maybe a year, two years or three years will pass and you know, you would not have.

Mr. Poon-King: What I would want to indicate is the review that is currently being done is based on the proposed intervention of the IDB. We are looking at that. So I think that we want to probably within two to three months to have that revision done and then to work with the Ministry towards having it considered thereafter. So that is one part. As to how long the actually process will take, that I cannot say.

Mr. Chairman: All right. In case you are wondering, we will be stopping at 5.00 p.m. So we do not intend to keep you all here into the wee hours of the night, not this time, but we have some questions that we have gotten from the public and we have selected two questions that I will be asking before we close off, but before we do, I would like to come back to the question of metering. Now, we know as part of the efforts to reduce consumption and manage consumption, the authority intends to get into a bulk metering programme. I know we would probably need some more details of it, but we will request that in writing from you, and the bulk metering programme would, of course, help you to assess where your water is being consumed and also I

understand it will allow you to do some degree of pressure management.

4.40 p.m.

But what are the reasons really? Maybe it might be funding, but in terms of the domestic metering programme because to me it is a catch-22 situation, you get into domestic metering, your revenues have the potential to drop significantly because it is a deterrent to excessive consumption but that could work against you, because the less water people consume, of course your revenues are going to drop. And in such a scenario where also your metering itself, if you could indicate to us what percentage have you accomplished with regard to domestic metering?

And seeing that you have put metering as one of the main pillars for the control of consumption rate, a deduction of consumption of water, what measures, what proposals does the Authority have specifically to really get this domestic metering going?—because it has been around for decades; we have been talking about metering. And the progress, if you could indicate the progress to us and what proposals you have to get this programme really going?

Mr. Poon-King: In terms of the residential metered customers, it is just at around 3 per cent; that is 2.97 per cent actually, so it is fairly low. Insofar as having the universal metering to address that there will be a significant capital investment to be done and that again is proposed under the IDB intervention for the water sector. So at that point the programme will take place where we will see the number or the percentage of customers, residential customers, who are metered to have that number increased.

Mr. Chairman: Could you give a little more details on the IDB intervention as you put it? Is it a short-term intervention? Is it going to be phased over the years to come? What are some of the details, if you could inform us, please?

Ms. Duke: The IDB intervention would be over a number of years, but I would ask the Water Sector Specialist to give you the key highlights of what it will concern.

Ms. Govia: The Water Sector Improvement Programme which was developed by the IDB in collaboration with the Ministry of Public Utilities and WASA has a specific focus on non-revenue water reduction and that includes metering, because Mr. Poon-King said earlier that it is a challenge for WASA to manage or to be able to manage demand without metering, but it is also a challenge for an individual to manage demand without having that signpost of how much water you are actually using. So you could be the most water conscious person in the world but if you do not know if there is a leak in your property, for example, because you do not have a meter there is no way for you to actually conserve.

So the metering is one of the infrastructure improvements that the Water Sector Improvement Programme is looking at. It is also referring to non-revenue water reduction from the perspective of not just leak repair and pipe replacement but also pressure management. So what we are saying is that—and the models have shown in terms of utility management that you have to establish district metered areas or discreet areas of supply and manage flows and pressure within there, and that will enable you to specifically pinpoint leaks in your system, both in your network side as well as on the customer side.

So we are saying we need to establish or segregate the country into district-metered areas and measure the use and manage use and supply within those areas. So those are the infrastructural changes that we are looking for as well as climate change investments. With the recovered NRW water and metering we have projected from a financial perspective that this entire programme will have a 17 per cent internal rate of return, and what that means is that with recovered NRW with metering, WASA can see an increase in revenue with a simultaneous decrease in their operating cost because they are now more efficient in terms of their operations. And this programme actually pays back for itself so there is no need to increase the subvention of the Government itself to service the debt, but the savings that WASA will get from their improved or their more efficient and lean operations they can actually now pay or service this loan.

And then the final pillar under the Water Sector Improvement Programme is sustaining the results which is instituting or establishing a performance-based culture within WASA to hold them accountable to particular benchmarks as it relates to their operations. So that is really the focus of the entire Water Sector Improvement Programme.

Mr. De Freitas: Mr. Chairman, let me just ask one question tied to that.

Mr. Chairman: Yes, please.

Mr. De Freitas: I may not have heard it, you may have indicated this before; in that Water Sector Improvement Programme, are there funds available for replacement of pipe work?

Ms. Govia: Yeah. So strategic pipe replacement.

Mr. Chairman: Would it be possible, the Committee would be requesting that if there are any reports regarding this Water Sector Improvement Programme, particularly the IDB inputs and proposals, if we could be provided with copies of those, please?

Ms. Duke: Yes.

Mr. Chairman: All right. We just have 14 minutes remaining and, I mean, we do have some more questions but I think what the Committee would do is review the questions that we have not brought up as yet and we would decide that we would send it to you in writing and you can respond in writing, or maybe if we need to get you all back in for another session. So we will let you know. But there are two questions here; we have some questions but some I would prefer not to ask. I have selected two from members of the public who have emailed in who are watching on.

The first one is: Can WASA listed measures in place to address the issues of customer service as there have been complaints of calls being dropped when calls are made about a potential leak? And the second question is: Does WASA have its water schedule for all areas on its website, if not why not? And where can this information be obtained? Mr. Poon-King.

Mr. Poon-King: Okay, first, with respect to the customer service part and the interaction with WASA, we do have our call centre which is the primary mode of communication with customers—well, for customers to communicate with WASA on service issues. We have increased the complement of staff within the call centre by approximately 25 per cent, and so we have been receiving or accepting more calls. Prior to getting the staff on we would have an acceptance rate of between 40 to 50 and 55 per cent. Last month we had an acceptance rate of 80 per cent.

What we are going to also have available is we have the WASA Services App where you can have the app put on your smartphone and you can make some requests. We still want to improve or increase the functionality of the app. Currently you can pay your bill, you can report a leak or you could request truck borne, and we are looking, as I say, to make it more functional so that it would provide for other services. And we also have where people can communicate via Facebook, via Twitter, via email, so that we do have other modes of communication that people can utilize. The second question was—if you could just repeat the second question for me?

Mr. Chairman: The second question was in terms of the water schedules.

Mr. Poon-King: Right. So the schedules, yes, the schedules are on the website and we will be updating them based on any changes that would occur and where they need to be amended based on water availability. So that would be an ongoing process where we will have them updated going forward.

Mr. Chairman: So in terms of your customer service, the calls and all of those things, do you have an assessment system in place to assess how effective that face is, your customer face—

Mr. Poon-King: Yes, we can. We do record the number of calls we get in, the number we accept and respond to, and stuff, we do have that inform.

Mr. Chairman: And the Authority is satisfied that you have a fairly acceptable level of performance with

regards to that programme?

Mr. Poon-King: Well, I think based on where we were, we acknowledged that we had some groundwork to do so we did increase the staff. Our target is 90 per cent and we are currently at 80 per cent, so we still have a little work to do towards getting where we want to be.

Mr. Chairman: So we would have to start wrapping up, but before I invite brief closing remarks from both entities, just briefly if you can indicate to the Committee the role of Desalcott in terms of water security. They produce a fair amount of water that is purchased by WASA and in the context of security, medium and long term and your contractual arrangements with Desalcott, how do you see that? I mean, where specifically is the Authority with regard to that in terms of water security?

Mr. Poon-King: WASA, we currently have available for distribution depending on the time of year, between 220 and 240 million gallons of water. Desalcott produces and delivers to us 40 million gallons a day, so they are fairly significant. So it is around 16 per cent of our total distribution. In terms of the contracts, I believe the contract is enforced until 2039, so it was renegotiated and renewed. So we do have that contract in place for some time and going forward, and it would be for the delivering for 40 million gallons of water a day until the expiration of the contract.

In terms of water security, based on their source being sea water, it would not be subject to all the issues associated with rainfall. There is one issue that does come up on an annual basis where during the dry season where you have less run-off from local rivers and from South America, the salinity in the Gulf of Paria goes up making the treatment process a little more difficult to achieve the 40 million gallons of water a day. But they are, at this time, a significant component of our water supply infrastructure.

Mr. Mark: Just for a few seconds, through the Chair. Mr. Poon-King, what is the value to the taxpayers of this 40 million gallons per day? And does WASA owe or has any outstanding bills to this particular supplier?

Mr. Poon-King: Well, first, I do not know if you could clarify when you say—the first part of your question—

Mr. Mark: No, in other words, what do we pay as a nation state through WASA to this supplier, you know, in terms of the supply of water?

Mr. Poon-King: Okay. The monthly bill to Desalcott is approximately US $6million for the delivery of water, and at present we did have some outstanding bills with Desalcott and we have made arrangements to have those paid off.

Mr. Mark: Could you put that in writing and submit to us?

Mr. Poon-King: Certainly.

Mr. Chairman: Okay. So we could ask Ms. Duke, Permanent Secretary, for brief closing remarks, and afterwards Mr. Poon-King, any brief closing remarks, if any, before we wrap up.

Ms. Duke: Chairman, members, the Ministry of Public Utilities thank you for the opportunity to share today. We have certainly taken note of some of your observations, and as we move forward we will incorporate in our policies and plans. Thank you.

Mr. Poon-King: Similarly from WASA, I would like to thank the Committee on behalf of the WASA team. I look forward to—well, you have said further questions would be coming, but even beyond the question, to have the support that when the responses are provided that we get the support to having those recommendations implemented towards improving the water and wastewater services that we provide. Thank you.

Mr. Chairman: Yes, definitely the support would be there because the mandate of the Committee is really in terms of this particular enquiry. With all the concerns, the current situation with WASA and all the agencies involved with water security is to see if we can distil from all of it all, you know, a clear direction, a clear pathway, and whatever recommendations that this Committee could come up with to augment the tremendous work that is being done, because the Committee gathers that our intent is good. I mean, we are really working for

the welfare of the nation in ensuring water security and whatever recommendations we can come up with that would support and consolidate all of the efforts that are being made, we would certainly do so.

So I would like to thank everyone who came from their respective agencies and to thank all Committee members for their participation, to thank our viewing and listening audience, particularly for their inputs; and to thank the staff of the Parliament of Trinidad and Tobago, Mr. Julien Ogilvie who is standing in for Ms. Angelique Massiah, Secretary, and then all other support staff and the broadcast staff of Parliament for their input. Thank you very much. This meeting is adjourned.

4.56 p.m.: *Meeting adjourned.*

APPENDIX III

SUBMISSION FROM MINISTRY OF PUBLIC UTILITIES DATED FEBRUARY 11, 2020

Government of the Republic of Trinidad and Tobago
Ministry of Public Utilities
Office of the Permanent Secretary

MPU: 2/2/35 Vol VI

11th February 2020

Ms Angelique Massiah
Secretary
Joint Select Committee on Land and Physical Infrastructure
Parliament of the Republic of Trinidad and Tobago
Level G-9, Tower D
The Port of Spain International Waterfront Centre
#1A Wrightson Road
PORT OF SPAIN

Dear Madam,

RE: ***Inquiry into measurements for ensuring water security in Trinidad and Tobago***

Reference is made to your letter Parl:14/3/46-13 Vol I dated 30th January 2020.

Enclosed for your consideration are the Ministry's responses to the questions/issues posed by the Joint Select Committee on Land and Physical Infrastructure.

In accordance with your request, Twelve (12) copies are enclosed for your consideration and an electronic copy of the report has also been submitted to jselpi@ttparliament.org on the 12th February 2020. Should you require further information and /or clarification on the subject matter, please contact Ms. Arlene Collis, Senior Economist at 628-9500 Ext. 4218 or acollis@mpu.gov.tt

Yours faithfully,

Permanent Secretary (Ag.)
Ministry of Public Utilities

Enc.

Ministry of Public Utilities

Responses to the Joint Select Committee on Land and Physical Infrastructure

"Inquiry into measures for ensuring water security in Trinidad and Tobago"

Section 1. Current Measures for ensuring Water Security

(i) Describe the role of the Ministry of Public Utilities (MPU) as it pertains to water security.

Response:

According to the United Nations' (UN)-Water, water security is defined as:

> *"The capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability."*

The MPU is responsible for setting policy and high-level strategy to ensure water security as defined by the UN, in alignment with Vision 2030 and the UN Sustainable Development Goals 2030 (SDG). The policy developed by the MPU is in turn implemented by the agencies under the MPU and divisions within the MPU with responsibility for water, namely:

- **The Water and Sewerage Authority**

Mandated through the Water and Sewerage (WAS) Act to provide water supply and wastewater management services to the population and also give effect to the policy set by the Minister with responsibility for water. WASA also has responsibility to manage water resources through a division called the Water Resources Agency (WRA).

- **The Meteorological Services Division**

The MSD monitors weather and climate which are intricately linked to water supply in the country. This information is fed to WASA through WRA for input into future decision-making relative to securing water resources.

Further, the MPU also has oversight responsibility for projects financed under the Public Sector Investment Programme (PSIP) that are aimed to improve water security as conceptualised, developed and implemented by WASA in alignment with the policy mandates given by the MPU.

It is important to note that because water is ubiquitous, the sustainability of providing potable water supply is dependent on the management of the upstream side of the water supply chain, i.e. water resources, watershed management and by extension land use planning and management. Consequently, *"safeguarding sustainable access"* to water involves a number of other

stakeholders, specifically the Environmental Management Authority, Town and Country Planning Division, the Ministry of Agriculture, Land and Marine Affairs, Regional Corporations, Minerals Division and even the public who are all involved in the protection, conservation and management of watersheds which are central to security water supply.

ii **Does the MPU have any specific plans with regard to water security in Trinidad and Tobago?**

Response:

The MPU finalised a revised National Integrated Water Resources Management (IWRM) Policy in 2018 which was later submitted to Cabinet in early 2019 and is pending a decision. The goal of this Policy is *"...to provide not only a reliable water supply to meet present demands of all but to ensure sustainability of supply and the available water resources of the country to meet the needs of future generations."* To achieve this goal, the Policy set a number of objectives which are targeted at a range of stakeholders. In effect, IWRM is an internationally accepted approach recognising the spread of water-related responsibilities and therefore calls for involvement of all stakeholders (social, economic and environmental) in decision-making for a country's water resources. The specific targets of the National IWRM Policy (2018) are to:

- Adopt and implement Integrated Water Resources Management (IWRM).
- Create an appropriate institutional framework and organisational structure for effective management of the country's water resources.
- Develop and maintain an effective water resources/hydrological monitoring network and information system.
- Implement a water loss reduction programme.
- Improve security of water supply.
- Develop a water supply drought and dry season management plan.
- Develop and implement flood management plans.
- Implement a wastewater management programme.
- Implement approved projects addressing specific concerns or issues to improve water supply and/or water management which have been identified by stakeholders at national and community levels.

In addition to developing this Policy, the MPU has developed a long-term, no-regret strategy to achieving continuous water supply – Water Sector Improvement Programme (WSIP). The WSIP specifically focuses on: (i) infrastructural changes to reduce non-revenue water through network enhancements and metering, and build resilience to climate change (storage and flood mitigation), and (ii) institutional changes to enhance governance and performance improvements in water-sector agencies.

iii **Describe the Water and Sewerage Authority's reporting relationship to the Ministry.**

Response:

WASA is a statutory authority and according to the WAS Act it is only required to submit its Annual Report and Financial Audited Statements to the Parliament through the MPU. In addition, because WASA is provided with an annual subvention to cover its recurrent expenses, and receives capital funding under the PSIP, it reports monthly on its expenditure against each allocation or project line to the MPU. Progress and achievements relative to the capital expenditure provided by the Government is reported to the MPU, and documented in WASA's Annual Report.

The MPU, however, has gone further to develop performance indicators for WASA which it is requested to report on at various frequencies. These performance indicators assist to benchmark WASA against regional and international utilities, and against its own progress across time. Broadly, these performance indicators encompass the following strategic areas:

1. Customer Centric Culture
2. Operational Efficiency
3. Financial Viability
4. Organisational Redesign
5. Governance

iv Describe the leading practices in sustainable integrated water management

Response:

The Global Water Partnership (GWP) is one of the leading thought-bodies on IWRM which is the coined term for the sustainable management of water. GWP defines IWRM as *"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 and the environment."* The draft National IWRM Policy 2018 was developed utilizing the tools developed by the GWP, and various best practice and model documents such as the OECS Model Water Policy. The leading practices in IWRM involves 4 pillars:

1. Enabling environment – developing the policies and legislation necessary to manage water resources.
2. Institutional framework – to give effect to the policies and legislation.
3. Management instruments – tools and technology to manage water including water allocation, assessments and regulation.
4. Financial instruments (sometimes included under point 1) – creating the investment structures to finance water supply, address water-related emergencies, capacity building and balance development with environmental sustainability.

Specifically, IWRM requires a separation between the policy-maker, economic regulator, resource regulator and service provider. This governance structure should be mandated through water management legislation that defines roles, responsibilities and interrelationships, and facilitates autonomy of the regulators. Additionally, because there are a number of stakeholders in the water sector, the IWRM process calls for formalised inter-agency coordination and collaboration through mechanisms such as MoUs/MoAs.

v. **What is the status of the Beetham Wastewater Recycling Plant as it pertains to industrial uses?**

Response:

The Beetham Wastewater Reuse Plant is being managed by the NGC through an MOU with WASA agreed to in 2013. The NGC is therefore better positioned to respond to the status of the project.

vi. **What are the implications of converting the Beetham project into a water storage facility?**

Response:

The Beetham Wastewater Reuse project was initially conceptualised to supply 11 IMGD of water for industrial use by converting the high-quality, treated effluent from the Beetham Wastewater Treatment Plant (WWTP) to high-grade industrial process water. The Beetham Reuse project was conceptualised to include: i) a treatment plant with preliminary and secondary treatment, and UV disinfection, and ii) product water storage facilities at Beetham Reuse site that is 10% (1.1 IMG) of the plant design, and 7.1 IMG of storage located at the site of acceptance of the feedwater. While storage was included in the project design, the central component is the treatment facility. Therefore, the treated effluent from the Beetham WWTP will first need to undergo additional treatment (reuse plant) before it is stored and then later used for potable/industrial use. However, treated wastewater effluent that meets irrigation water standards without needing additional treatment (reuse) is a good source of supply for agricultural users.

vii. **Is the Beetham project being considered as a storage facility?**

Response

Given that the project is being managed by the NGC, the MPU cannot advise on whether there is consideration to convert to a storage facility. However, the treated effluent from the WWTP cannot be stored for potable or industrial use unless it undergoes further treatment.

viii. **If not, what are the plans for the Beetham project?**

Response

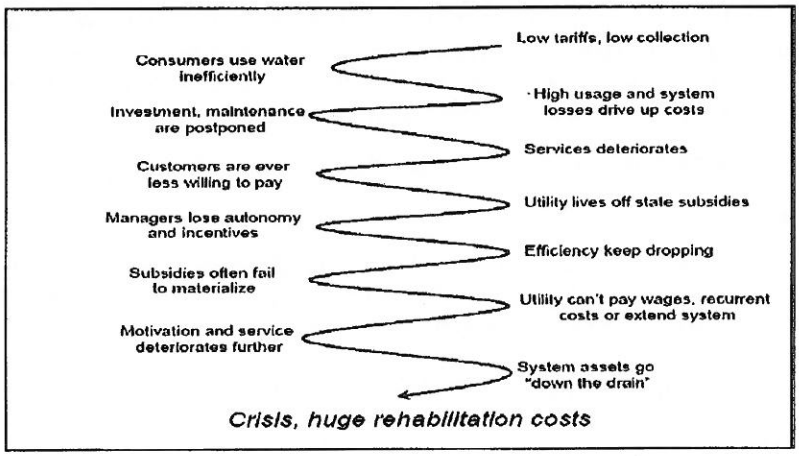
The NGC is better positioned to respond to the plans for the Beetham project. It should be considered that any decision on the Beetham Reuse project should take into account the market demand for this reuse water, particularly since the cost of reuse treatment is similar to desalination given that both facilities use similar membrane technology. A further investment decision should also consider how WASA intends to meet the existing 24/7 supply gap for the country and whether increasing production is the most cost-effective and sustainable strategy in comparison to reducing non-revenue water (NRW) and meeting the shortfall in localised areas on the extremities of the network using traditional water sources.

Section 2. Measures Required for Improving Water Security

ix. To what extent have current water security strategies been effective in securing water?

Response

WASA is still striving to meet the existing supply challenges of providing 24/7 water to the population. The 24/7 gap is caused by the fact that 40 to 50% of the water WASA produces (73% of demand) earns no revenue (non-revenue water, NRW). This is despite high volumes of water production (72% more than demand and 22% more than Jamaica) that is higher than demand (2 times the WHO, 200% Jamaica and 40% more than Barbados). The high NRW is divided in half between physical losses (pipes, facilities, valves, etc.) and commercial losses where actual consumption is greater than volume of water billed because of excessive use facilitated by no metering and economic incentive. The high NRW is a culmination of infrastructure and institutional issues that, according to the World Bank, is a spiral of decline as depicted below.



Spiral of Performance Decline of Utilities (New Designs for Water and Sanitation Transactions, World Bank, 2002)

In effect, water security strategies should include:

(a) Water supply of adequate quality and quantities to sustain life. This requires infrastructure to meet the demand needs including i) surface water intakes and groundwater wells to harness the natural water, efficient treatment systems, ii) a robust and interconnected network, iii) adequate water storage, and iv) metering of water moving around the network and reaching customers.

(b) Sustainable use, conservation and protection of water resources to ensure that the supply of water protects well-being, enhances socio-economic development and preserves vital ecosystems. Collection and treatment of wastewater is also a function of preserving the quality of the country's natural water resources.

(c) Safeguarding against the impacts of water-related disasters and climate change and variability. This involves building water and wastewater infrastructure that can withstand the risks posed by natural disasters and climate change and variability.

WASA's capital investment programme has been focused on expanding water supply and wastewater coverage and it has achieved this by providing access to water to around 95% of the population, and centralised sewerage services to around 20% of the country. While 50% of WASA's customers receive 24/7 supply, the remaining tend to utilise on-site storage (tanks) to buffer the impact of an infrequent supply. The strategy of both on-site storage and rainwater harvesting (especially for rural customers) has allowed the population to still maintain some resilience through regularity in their supply of water.

x. What institutional arrangements are necessary with respect to a water crisis?

Response

A water crisis, in this instance, is a situation of water scarcity which according to UN-Water is defined as *"scarcity in availability due to physical shortage, or scarcity in access due to the failure of institutions to ensure a regular supply or due to a lack of adequate infrastructure."* In T&T there is no shortage of water resources. According to the Water Resources Agency, T&T experiences rainfall that translates into 1,800 IMGD (Trinidad) and 100 IMGD (Tobago) of both ground and surface water. This equates to 0.5 IMG/person/year which is 25 times the UN water scarcity benchmark of 0.02 IMG/person/year. The challenge is in continuity of supply of water.

However, if a water-related disaster were to occur that would create a situation of water scarcity, the institutional arrangements that should be put in place should follow the approach used by Western Cape Province, South Africa in dealing with the drought of 2016/2017. The Western Cape Province was able successfully managing water in a time of water scarcity by taking the following steps:

(a) Convening of an Inter-Governmental Committee to evaluate drought/water crisis projects. This should include stakeholders such as Office of the Prime Minister, Ministry of Public Utilities and its agencies (WASA, WRA, Met. Division), the Environmental Management

Authority, Ministry of Agriculture, Land and Marine Affairs, Ministry of Local Government (and Regional Corporations), the Ministry of National Security and its agencies (Fire, Police and Defence Force), and the ODPM

(b) Prioritising funds to guarantee water supply to hospitals followed by schools and education facilities.
(c) Budget re-prioritisation and funding allocation for interventions outlined in the Drought/Water Crisis Risk Register.
(d) Publishing guidelines for standardising water restrictions and associated penalties.
(e) Appointing water specialists to manage water resources.
(f) Launching a water scarcity, communication and awareness campaign.
(g) Fast-tracking environmental permissions for urgent infrastructure projects that can improve the supply of water.

xi. Describe the role, if any of the MPU in educating the public on water conservation generally and the procedures in place for conserving water in a crisis.

Response

The MPU regularly collaborates with WASA and produces its own water conservation communication messages. The MPU has responsibility for setting policy and high-level strategy for the water sector and therefore has recommended water conservation and efficiency as a priority area for intervention given that the average domestic consumption is twice the WHO recommended rate. The draft National IWRM Policy 2018 puts forward the MPU's policy position on water conservation as follows:

(a) Introducing an equitable water tariff that is based on consumption which should be facilitated by the installation of universal metering.
(b) Encouraging water use efficiency, water reuse and recycling of wastewater.

The MPU primarily relies on WASA to educate the public given its mandate from the WAS Act to promote *"...the conservation and proper use of water resources..."* Notwithstanding, the MPU issues regular communication to facilitate public understanding of the water sector.

The procedures in place for conserving water in a crisis are specific to the WAS Act and enforced by WASA. This includes i) the power to prohibit or restrict temporarily use of hosepipes, and ii) provisions for WASA to make byelaws to prevent waste, undue consumption, misuse or contamination of water supplied by it or water purveyors.

Section 3. Challenges

xii. Describe the challenges with ensuring the availability, accessibility, quality and safety of water during a crisis.

Response

The response at Question (ix) outlines the present challenges to the continuous supply of water which in effect will worsen during a crisis. In addition to water infrastructure for supply which is distilled under Question (ix), it is important to note that the management of the upstream side of water supply, i.e. water resources, is critical to securing water during and outside of a crisis. However, the primary regulator of water (WRA) is a department within the major abstractor (WASA), naturally creating conflict in regulation. There is therefore no independent regulating body to monitor and allocate water resources to WASA nor to penalise WASA for over-abstraction. Even further, the responsibility for water resources regulation is essentially split between WASA/WRA, the EMA (water pollution), Town and Country Planning (land use planning), Local Government/Regional Corporations (land use planning enforcement), Ministry of Works /Drainage Division (flooding), Ministry of Agriculture (irrigation water and watershed management), Meteorological Services Division (weather and climate monitoring), Ministry of Health (potable water quality regulation), Regulated Industries Commission (economic regulation of water resources) and Tobago House of Assembly (environmental management in Tobago). The institutional arrangements presently do not exist to formalise cooperation between these stakeholders in times of a crisis.

xiii. What is being done to address these challenges?

Response

The MPU has drafted a revised National IWRM Policy 2018 which refers to water-related emergencies. The Policy outlines that Government should undertake the following:

- Prepare and update National Disaster Preparedness Plans and lists the events that these plans should address.
- Encourage water and water-related agencies to prepare Business Continuity Plans to ensure minimum service levels during periods of disaster.
- Ensure adequate routine surveillance of all major water facilities.

In addressing overarching water supply management issues the National IWRM Policy 2018 also refers, and assigns responsibility for the various prescriptions of the policy.

Further, the MPU has been working with the IDB on a WSIP which addresses the sectoral problems described under response to Question (ix). This WSIP ascertains that to achieve continuous supply the following must be undertaken:

(a) 100% metering of the population.
(b) Network optimisation to replace strategic, high-leakage mains and service connections, and de-bottleneck the network.
(c) Climate change investments to increase storage, mitigate flooding and localise production.
(d) Establishment of a performance-based culture in WASA.

This plan requires funding and external execution support.

xiii. Describe the Ministry's plans for metering as it relates to water security.

Response

The MPU acknowledges that metering is a critical, no-regret strategy that must be undertaken to manage demand. This has been a policy mandate set by the MPU and given to WASA for execution. WASA has made steps to procure bulk meters for one region in the country which will allow it to monitor water moving around its network. The majority of WASA's industrial and commercial customers are metered, however less than 4% of domestic customers are metered which is where the majority of demand is concentrated. The MPU has received various project estimates for a universal metering programme, including from WASA however funding to execute has not been secured.

APPENDIX IV

SUBMISSION FROM WASA DATED MARCH 9, 2020

Water and Sewerage Authority of Trinidad and Tobago

JOINT SELECT COMMITTEE ON LAND AND PHYSICAL INFRASTRUCTURE

Inquiry into Measures for Ensuring Water Security in Trinidad and Tobago

| MARCH 09, 2020 |

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CHAPTER ONE: CURRENT MEASURES FOR ENSURING WATER SECURITY

I. Provide information on:

WASA's current measures for ensuring water security:

Response: WASA has developed a Water and Wastewater Infrastructure Plan 2017 - 2022 (See Appendix 1).

Whether the current measures for ensuring water security are included in WASA's Strategic Plan; provide a copy of WASA's Strategic Plan

Response: Yes, WASA's Draft Strategic Plan does include measures for ensuring water security. Please see attached a copy of the Draft Strategic Plan 2017-2022 (See Appendix 2)

The measures in place to prevent water contamination:

Response: WASA has internal mechanisms to prevent water contamination, which includes securing of water sources and treatment facilities as well as monitoring of water courses and impounding reservoirs. The Environmental Management Authority subsidizes WASA's efforts with their own monitoring regime. These mechanisms include the following.

- Security is stationed at all manned water treatment facilities.
- All unmanned water treatment facilities are secured with fencing and signage.
- Automated water quality monitors are in service.
- Water sources are monitored by personnel from Water Resources Agency (WRA), WASA Security & WASA Operations Division (River Wardens, Mobile Operational Staff & the Quality Control Laboratory)

WASA's current sources of water and the respective levels:

Response:

TABLE 1 – CAPACITIES OF IMPOUNDING RESERVOIRS (FEBRUARY 14, 2020)

Reservoir	% Capacity
Arena	73.0
Navet	87.8
Hollis	80.1
Hillsborough	94.3

The stakeholders involved in water security:

Response: The following outlines the stakeholders involved in water security:

- Environmental Management Authority
- Regulated Industries Commission
- Ministry of National Security
- Ministry of Energy and Energy Industries
- WASA

II. Provide the status of the following programmes and initiatives:

The National Social Development Programme (Water Component):

Response:

The National Social Development Programme – Water Component (Bond Issue) involved the implementation of 513 projects to improve the water supply to communities experiencing either water shortages or restricted access to pipe-borne water. To date, 502 projects (approx. 98%) have been completed with 8 projects on hold and 3 no longer required because of system re-configuration. The Authority has not received NSDP funding for this programme since 2015. This programme has benefitted approximately 82,000 persons.

Water and Wastewater Construction/Refurbishment Programme:

Response:

WASTEWATER:

The Wastewater Construction/Rehabilitation Programme currently focuses on the construction of the Malabar and San Fernando Wastewater Treatment Plants and associated Collection Systems and the Maloney Wastewater Treatment Plant under the Multi-Phase Wastewater Rehabilitation Phase I Programme. Funding for Phases II and III is to be sourced in order to expand centralized wastewater coverage in Arima and San Fernando.

The Overall Loan Completion is 86% with the status of the San Fernando and Malabar components being as follows.

San Fernando

As at January 15, 2020, the project was 81.2% completed with an anticipated completion of December 21, 2020.

Malabar

The project was handed over to the Authority on January 1, 2020 and is being operated and maintained by the Authority.

The Modernization of the Wastewater Infrastructure Programme comprises the construction of the South West Tobago Wastewater Project as well as the Design and Construction of the Trincity Wastewater Treatment Plant. This Loan Operation is 78% complete with works completed in South West Tobago at Bon Accord and Samaan Grove. The project at Trincity has commenced and is in the Design Phase. The project is scheduled to be completed in September 2021.

Other wastewater initiatives include the refurbishment of wastewater treatment facilities at Beetham, Lange Park, Frederick Settlement, Edinburgh 500 and Couva North and South.

WATER

The Authority is pursuing projects in water production, transmission and distribution.

Production

Areas have been identified where there is potential for additional water production. The increased production from ground water can be realized from the rehabilitation of under producing wells and the drilling of new wells. The following works have been identified.

- 12 Wells are currently under construction as listed at Table 2
- 15 wells for rehabilitation are being tendered as listed at Table 3
- 3 wells in Tobago at Roxborough, Scarborough and Mary's Hill to start construction
- 16 new wells to be drilled as listed at Table 4
- Additional surface water source at Lopinot River to be constructed

TABLE 2 - LIST OF WELLS CURRENTLY UNDER CONSTRUCTION			
No.	**Name of Well**	**Constituency**	**Production / imperial gallons daily**
1	Arouca #8	Lopinot/ Bon Air West	79,200
2	Arouca #9	Lopinot/ Bon Air West	288,000
3	Arouca #10	Lopinot/ Bon Air West	64,800
4	Santa Cruz #10	St. Anns East	144,000
5	Santa Cruz #11	St. Anns East	152,640
6	Arima #14	Arima	288,165
7	Granville #17	Point Fortin	149,000
8	Granwood #1	Diego Martin West	200,000
9	Granwood #2	Diego Martin West	300,000
10	Carnbee	Tobago West	850,000
11	Calder Hall	Tobago West	400,000
12	Arnos Vale	Tobago West	737,000
TOTAL			**3,652,805**

TABLE 3 - LIST OF WELLS TO BE REHABILITATED		
PACKAGES	**WELL NAME**	**ANTICAPATED VOLUME GAIN imperial gallons daily**
Package 1	Arima #13	177,955
	Sangre Grande #1	439,938
	Sangre Grande #2	505,929
	Sangre Grande #3	659,908
	Aripo/Valencia ETI	499,770
Package 2	Tucker Valley #15	111,084
	Tucker Valley #17	98,766
	Tucker Valley #30	262,203
	Las Lomas #10	158,378
	Las Lomas #11	137,481
Package 3	Granville #13	45,974
	Granville #7(11)	24,197
	Granville #10	84,468
Package 4	Sangre Grande #4	499,770
	Paramin #2	43,994
Sub-Total		**3,749,814**

TABLE 4 - LIST OF WELLS TO BE DRILLED		
PACKAGES	**WELL NAME**	**ANTICAPATED VOLUME** **imperial gallons daily**
Package 1	Grande Riviere #2	57,412
	Matura #4	215,350
	Matura #5	215,350
Package 2	Chatham #18	215,570
	Erin #1 (Replacement)	242,000
Package 3	Arima #14	288,160
	Arima #15	288,160
	Aripo #2	293,439
Package 4	Piarco #8	74,570
	Piarco #9	74,570
	Piarco #10	74,570
	Piarco #11	74,570
Package 5	Las Lomas #12	237,567
	Las Lomas #13	417,941
	Moka #7	262,203
	Moka #8	262,203
Total		**3,293,632**

Transmission

Transmission pipelines have been identified for upgrade or installation to improve the capacity to distribute the water supply from the source to areas.

To date, 16.4 kilometres of 147.4 kilometres have been installed.

Booster Stations and Reservoirs

Four booster stations are to be constructed or upgraded in North West Trinidad. The contracts are to be awarded and work is expected to be completed in Third Quarter of 2020.

Storage tanks have been constructed and commissioned at Four Roads, Diego Martin; Tucker Valley, Chaguaramas; Hololo, Cascade and Charlotteville, Tobago with two additional to be commissioned in Quare, Valencia and Guanapo. Communities to benefit include Carenage, Petit Valley, Diego Martin, St Anns, Arima, Calvary Hill, Valencia and Charlotteville.

Four (4) new tanks are to be constructed in 2020 including Calvary Hill, La Filette and Sobo in Trinidad and Bloody Bay in Tobago. In total, the ten (10) storage tanks provide an additional storage volume of 3.3 million imperial gallons.

Replacement of high leakage mains

A list of high leakage mains has been developed by WASA, which takes into account the rate of leakage.

The table below provides a summary of the mains identified as high leakage for replacement over a 10 year period together with preliminary costs. Projects for the City of San Fernando are initially considered over a Ten Year period and are to be prioritised into Tranches for Years 1-5 and 6 - 10.

TABLE 5 - SUMMARY OF HIGH LEAKAGE PIPELINE

REGION	Distance/km		Estimated Cost	
	YEARS 1 - 5	YEARS 6 - 10	YEARS 1 – 5	YEARS 6 - 10
North	59.3	43	$ 197,568,390.00	$ 156,220,725.00
South	57.4	23.4	$ 257,651,496.00	$ 95,940,000.00
Tobago	25.7	34.4	$ 96,756,424.00	$ 142,291,540.00
SUB-TOTAL	**142.4**	**100.8**	**$551,976,310.00**	**$394,452,265.00**
City of San Fernando	**21.7**		**$91,989,893.00**	

1.9 kilometres have been replaced to date.

Continued reduction of Non-Revenue Water with Bulk Metering and Pressure Management

Bulk metering is to start in North West Trinidad. 40 District Metered Areas (DMAs) have been established in North East and Central Trinidad with an additional 120 DMAs to be established throughout Trinidad and Tobago. These DMAs will also include pressure management.

Demand reduction with the expansion of universal metering.

This proposes metering of all segments including domestic customers on a phased basis.

III. Provide the status of the following PSIP programmes:

1. The water supply project to La Brea Industrial Development Company Limited and Union Industry Estate - four (4) work packages under Water Supply to LABIDCO and Union Industrial Estates which encompasses the following:

1a. completion of the Savonetta Booster Station:

Response: Savonetta Booster was completed in August 2018 and has been put into operation.

1b. completion of upgrade of existing Booster Station at South Oropouche:

Response: Upgrade of South Oropouche Booster Station was completed in August 2019.

1c. completion of installation of 17 km of pipeline from the South Oropouche Booster Station to the La Brea Station:

Response: Installation of 15.7 kilometres of pipeline from South Oropouche Booster Station to the Union Industrial Estate was completed in March 2018.

1d. commencement of works on Vessigny Tank, with respect to demolition of the storage tank in Sobo:

Response: Demolition of existing storage tank at Sobo was completed.

1e. Non-Revenue Water Reduction Programme:

Response: The purchase of Three (3) Backhoes and Two (2) Dump Trucks is in progress. The purchase of the equipment will assist in the leak repair programme. Installation of 1.9 kilometres of pipe in Blue Basin is in progress.

1f. Upgrade works on the Carlsen Field and Maloney Water Treatment Plants:

Response: Upgrade works at the Carlsen Field and Maloney Water Treatment Plants (WTPs) are on-going. Upgrade works on the treatment process at Carlsen Field is completed and the plant is back to full capacity. Remaining works are on the building and civil structure. Works on Maloney WTP are expected to be completed in March 2020.

1g. Water Distribution System in Tobago:

Response: The following provides an update on the Water Distribution System in Tobago:

i) Upgrade works of Charlotteville Intake and Service Reservoir were completed in September 2019 and November 2019 respectively. These works included the construction of:
   - a new raw water intake
   - new treatment facility
   - 100,000 imperial gallon service reservoir

ii) Approximately 900 metres of 150 millimetre PVC pipe were installed along All Fields Phase 3 and pipeline placed into service May 2019.

iii) The installation of 700 metres of 150 millimetre PVC pipe is to be installed along Mt. Grace Trace, Tobago.

1h. Water Security Programme for Tobago:

Response: The Project is 90% completed and the Draft Final Report was submitted by Consultant with completion scheduled for June 2020.

1i. Rehabilitation Works for the Hillsborough Dam:

Response: The Bathymetric Survey and Environmental Impact Survey have been completed.

The Enabling Works at the Hillsborough are in progress and are expected to be completed in April 2020 to facilitate commencement of desilting works by end March 2020 with a duration of 30 months.

1j. Drought and Dry Season Water Supply Management Plans:

Response: The Project is 90% completed and the Draft Final Report was submitted by the consultant with completion scheduled for June 2020.

1k. Community Water Improvement Programme:

Response: The Community Water Improvement Project includes 13 projects with a scope to install 10.0 kilometres of pipe to be installed at a cost of $13.324 Million to benefit 3,187 persons. To date, 1,970 metres have been installed (see Table 6).

1l. Integrated Water Improvement Programme North West Trinidad:

i. Refurbishment of 3 booster stations and construction of 1 booster station are to commence during 2nd Quarter of Fiscal Year 2020.

ii. The installation of 1,500 metres of 300 millimetre pipe from Four Roads Water Treatment Plant to Goodwood Park Crescent along Morne Coco Road/Western Main Road is in progress.

1m. Completion of Phase 1 works on the construction of the Avocat Well:

Response: Works scheduled to start in February 2020.

1n. Completion of works to Carlsen Field Water Treatment Plant:

Response: Upgrade works on the treatment process at Carlsen Field is completed and the plant is back to full capacity. Remaining works are on the building and civil structure are to be done.

1o. Completion of construction of two (2) new service reservoirs in Guanapo and Four Roads:

Response: Construction of the Guanapo Service Reservoir is in progress with a scheduled completion of March 2020. The Four Roads Service Reservoir has been completed and is in service.

1p. Commencement of a booster station at Calvary Hill:

Response: Works on Calvary Booster station is in progress with a scheduled completion of April 2020.

TABLE 6 - SUMMARY OF PROJECTS UNDER CWIP			
No	**Project**	**Project Details**	**Status Completed**
1	Battoo Boulevard	Installation of 103m of 100mm PVC along Battoo Boulevard Extension	100%
2	Phipps Trace, Talparo	Installation of 922m of 100mm PVC along three (3) Streets (Phipps Trace Extension, Farook Avenue, Un-named Street).	100%
3	Lemon Drive	Installation of 371m of 100mm PVC main and 53m of 50mm PVC main along Mendez Drive (Installation of 53 m of 100 mm PVC Main from Mendez Drive Booster to corner Mendez Drive and Lemon Drive and Installation of 318 m of 100 mm PVC from Lot No. 10 Lemon Drive to end of Lemon Drive)	100%
4	Beverly Heights, Santa Cruz	Installation of 547m of 100mm PVC mains to be installed along Beverly Heights extension and Construction of Booster Pumping Station	28%
5	Wharton Street, off Warden Road, Point Fortin	Installation of 1,663m of 100mm PVC along Wharton Road, Point Fortin	30%
6	Beach Road, Palo Seco	Installation of 456m of 150mm pipe along Beach Road from SS Erin Road to LP No. 7	40%
7	Solomon Street off Delhi Road, Fyzabad	Installation of 200m of 100mm PVC along Solomon Street off Delhi Road, Fyzabad	95%
8	Boyack Hill and Unnamed Trace No. 4, Santa Flora	Installation of 346m of 100mm PVC and Appurtenances along Boyack Hill and Unnamed Trace No. 4, Santa Flora	91%.
9	Tattoo Trace, Valencia	Installation of 1,400m of 150mm PVC on Tattoo Trace Valencia	35.2%
10	Plantation Road, Valencia	Installation of 1,700m of 150mm PVC from Plantation Road to Tattoo Trace along Valencia Main Road and Installation of a Booster at the corner of Plantation and Valencia Road	6%
11	Green Hill, off Covigne Road	Installation of 250m of 50mm PVC main from base Green Hill, off Covigne Road, Diego Martin	34%
12	Texeira Extension, Diego Martin	Installation of 100m of 50mm PVC main from base Texeira Extension, Diego Martin	61%
13	Comparo No. 2 Fishing Pond, Sangre Grande	Installation of 1,937m of 150mm PVC main from the existing End Valve to Comparo No. 2 Junction	35.2%

IV. Describe the measures being put in place by the WASA to ensure availability, accessibility, quality and safety of water.

Response:

WASA has identified vulnerable areas throughout both islands and has developed mitigation strategies against reduced rainfall and production deficit that are unique to each area. These considerations include source of supply, population, topography and resource availability. The measures to be implemented include Network Management, System Interconnectivity, Alternative Supply, Operation of Transmission/Distribution Systems, management of production and distribution from Water Treatment Plants, Equipment Reliability, Dry Season Schedules, Rigid Monitoring of affected Areas, Water Trucking, Operationalizing Additional Filling Bays, Operationalizing Communal Tanks and partnering with Regional Corporations.

Availability:

a. WASA has redundant power supply systems/ standby generators at critical treatment facilities
b. Water treatment facilities have treatment chemicals stored on site
c. Where practicable, WASA utilizes automation in treatment processes
d. The cadre of Process Plant Operators is sufficiently large to facilitate easy deployment of staff

Accessibility:

WASA has undertaken the extension of the distribution networks to permit access of previously unserved communities through the now closed NSDP and the current Community Water Improvement Programme.

Quality & Safety of Water:

WASA's treatment and distribution processes comply with the Guidelines for Drinking Water Quality of the World Health Organization.

V. What are the measures being undertaken by the WASA to eliminate water loss by evaporation?

Response: Given the climate of Trinidad and Tobago, the reservoirs are normally replenished by the end of the Annual Wet Season. WASA is not aware of efficient and practical methods for reduction of evaporation at impounding reservoirs.

VI. Will water rates increase during a crisis?

Response: No, rates are dictated by the Regulated Industries Commission and there is no facility to increase same during a crisis.

VII. What is the status of metering?

Response: Metering continues on a three-pronged approach:

1. Domestic,
2. Commercial/industrial and
3. Bulk/source

Domestic: Domestic metering currently stands at approximately 4% of the domestic customers. Recent policy decisions have ensured that all new residential developments are metered prior to final approval.

Commercial/industrial: Commercial metering stands at approximately 50%, with a scheduled project to take this to 80% by the end of 2020; Industrial customer metering currently stands at 99%.

Bulk/source: Bulk metering continues with approximately 15% completion. The completion of the North West Bulk Metering Project will take this to 20%.

VIII. Have plans regarding sustainable groundwater development and resource management been implemented?

Response:

Plans for **Groundwater development and resource management** include:

1. Monitoring of water levels and abstraction of several aquifers to determine safe yields to reduce long-term risks including deterioration of water quality
2. Advice on optimal sites for news wells to maximise efficient production within established safe yields and provide for recharge.

IX. Which industries currently demand the largest water supply?

Response: The industries that currently demand the largest water supply from WASA are within the Energy Based Sector. Table 7 below provides a listing of large water users and their demand based on the water supplied by the Authority.

X. What is being done to promote water efficiency in agriculture?

Response: The Authority promotes conservation of water in general with emphasis on the residential segment; there is no initiative specifically promoting water efficiency in agriculture.

TABLE 7 - INDUSTRIES DEMANDING THE LARGEST WATER SUPPLY		
No	**Company**	**Monthly Consumption (m3)**
1	Methanol Holding Ltd(M 5000)	1,000,378
2	PCS Nitrogen Trinidad Ltd.	461,045
3	Nu Iron	218,585
4	AUM	111,788
5	Caribbean Nitrogen Company Ltd	90,951
6	Caribbean Development Company Ltd	84,660
7	Nitrogen (2000) Unlimited	82,438
8	Point Lisas Nitrogen Limited	81,142
9	Tringen II (B)	78,630
10	Jaleel Investments Ltd	74,070
11	AUM Plant	60,530
12	Point Lisas Nitrogen Limited	57,457
13	Titan Methanol Company	42,190
14	Caribbean Gas Chemical Limited (CGCL)	37,321
15	Trinidad Generation Unlimited	19,200
16	Atlas Methanol Plant	18,984
17	Yara Trinidad Ltd	12,850
18	Air Liquide T&T Limited	12,798

XI. Describe WASA's reporting relationship to the Ministry.

Response: WASA's responsibilities to the Ministry are identified in the **Water and Sewerage Act Chapter 54:40**, in particular Sections:

9. (1) it is the duty of the Authority to carry out the policy of the Government in relation to water and sewerage and subject to this Act the Authority shall have and exercise such functions, powers and duties as are conferred upon it by this Act and by any other written law.

10. In the exercise and performance of its functions, powers and duties under this or any other written law the Authority shall act in accordance with any special or general directions of the Government, given to it by the Minister; but subject to this section, the Authority shall, when exercising and performing its functions, powers and duties, be subject to the control or direction of no other person or authority.

XII. What are the measures in place to reduce contamination of water supplies during a crisis?

Response: The Authority has a Disaster Preparedness & Business Continuity Plan which provides a structured framework for responding to emergencies/upset conditions. Prevention of water contamination during a crisis is undertaken by monitoring of raw water sources, adequate treatment at the facilities and active monitoring along the transmission and distribution systems. Where pipelines can be contaminated due to breakages, sections of the pipeline can be quickly isolated and disinfected.

XIII. Provide information on the water resources that are impacted by rainfall and those that are not impacted by rainfall, including their Long Term Averages and current capacities.

Response: WASA accesses water supply from 3 types of sources – surface, ground and desalinated. Groundwater sources (supplied by wells) and Desalination Plants (operated by entities external to WASA abstracting water from the sea) are generally not impacted by rainfall but Surface Water sources are impacted. Comparisons of current capacities and Long Term Average production of the sources are provided at Table 8.

Current levels of production of the larger surface sources and comparisons to Long Term Averages (LTAs) are provided in Tables 9.

TABLE 8 - WASA WATER RESOURCES

Source	Current Capacity (mgd)	Long Term Average (mgd)
Ground Water	58.2	55.9
Surface (Major)	139.6	137.9
Desalination	46.6	36.2
Total	**244.4**	**230.0**

TABLE 9 - WATER RESOURCES IMPACTED BY RAINFALL		
Reservoir	**Current Capacity** February 14, 2020	**Long Term Average** February 14, 2020
	(%)	**(%)**
Arena	74.21	91.25
Navet	81.48	89.47
Hollis	73.07	85.87
Hillsborough	96.17	88.12
Production Facility	**Normal Production (mgd)**	**Long Term Projection (mgd)**
North Oropouche WTP	22.00	20.20
L&N WTP	1.00	0.84
Acono WTP	0.28	0.25
Caura WTP	3.00	2.82
Guanapo WTP	3.00	2.85
Aripo WTP	3.00	2.91
Blanchisseuse WTP	0.14	0.12
Tyrico WTP	0.24	0.21
La Filette WTP	0.36	0.32
Las Cuevas WTP	0.08	0.07
Trinity WTP	0.50	0.44
Kings Bay WTP	0.42	0.29

XIV. In the event of a crisis does WASA have enough water trucks to distribute water to the nation?

Response: Depending on the duration of the crisis and its extent, WASA can provide truck borne water supply to limited numbers of customers. WASA currently has a fleet of 66 tankers available including 7 WASA Tankers with a total carrying capacity of approximately 115,000 gallons.

XV. Will WASA charge citizens for truck-borne water supply in the time of a crisis?

Response: As part of the Authority's mandate to deliver potable water to its customers, truck-borne water service is provided free of charge to customers whose account is in good standing.

XVI. What are the collaborations in place to treat with a water crisis?

Response: The Authority collaborates with the following entities:

1. Trinidad and Tobago Meteorological Service (TTMS) who provide projections on the severity of the Dry Season upon which plans are formulated for water supply particularly from Surface Water Sources.
2. The Office of Disaster Preparedness of the Ministry of National Security and the Tobago Emergency Management Agency on acute issues which may arise.
3. Regional Corporations for delivery of service to residences beyond WASA's distribution network.

CHAPTER TWO: MEASURES REQUIRED FOR IMPROVING WATER SECURITY

XVII. Does the country have enough reservoirs to supply the nation in a time of crisis?

Response: Reservoir levels vary seasonally, so production is adjusted to balance customer needs and water conservation. WASA manages storage and production levels to maintain service to customers while having adequate volumes stored to respond to different scenarios which may arise including extended periods of below normal rainfall.

XVIII. Has WASA considered encouraging citizens to participate in rainwater harvesting as a water security measure?

Response: Yes. This initiative is being undertaken by the Adopt a River Programme through Public Education and through the construction of Integrated Rain Water Harvesters in partnership with Habitat for Humanity.

XIX. Has WASA been aggressively replacing aged pipes? Did the Authority implement the recommended Pipe Replacement Programme? If so, what is the status of aged pipes to be changed?

Response: The Authority has identified high leakage pipelines for replacement but has not been replacing the pipelines at the required rate due to funding limitations with approximately 1% being completed to date.

XX. What are the implications to encouraging the use of underground cisterns to retain water from rainfall for consumption?

Response: Trinidad and Tobago has a history of storing rain water to supplement pipe-borne water supply. Implementation of such a system reduces demand for potable water from the public distribution system improving service levels to customers on the network.

XXI. Does Trinidad and Tobago have a Water Resources Strategy and Master Plan? If not, please explain why.

Response: Yes, a Water Resources Management Strategy for Trinidad and Tobago was completed in 1999 by DHV Consultants BV/Lee Young and Partners for the Government of Trinidad and Tobago.

XXII. To what extent has the Water Resource Agency (WRA) been effective in ensuring that there is a reliable and sustainable supply of water?

Response: WRA provides frequent assessments of available surface and groundwater resources to support the efforts to provide a reliable water supply. The assessment includes additional water which may be available from existing and new sources. In addition, the Agency recommends abstraction limits for all water sources based on natural recharge rates, environmental demands and salinity risks. The recommended abstraction limit is the management tool used by the Agency to ensure sustainability of the resource.

XXIII. In the event of a crisis, what measures are in place to guard reservoirs, treatment plants, pump stations and other vulnerable locations across the utility's vast network?

Response: The first level of deterrent at WASA facilities includes perimeter fencing, lighting and secured facilities. This is supplemented by a security presence, comprising in-house and contracted staff, who would be either static or mobile. Additionally some locations are equipped with camera surveillance systems to assist in the monitoring of these sites. Depending on the level of threat, the services of relevant arms of government including the Trinidad and Tobago Police Services and the Trinidad and Tobago Fire Service would be engaged as required.

XXIV. Does the WASA require new security procedures including technological solutions to detect and monitor contaminants and prevent security breaches?

<u>Monitor Contaminants:</u>

Response: Yes, with an ever-increasing population and greater industrialization, the threat of pollution is ever present. As such, wide spread implementation of remote monitoring of water resources is prudent. WASA is implementing a closed circuit camera system to permit monitoring of key facilities complemented by static and mobile security personnel.

Specifically with respect to water quality on the Caroni River, WASA has a Water Quality Monitoring System (WQMS) for monitoring the raw water within the catchment supplying the

Water Treatment Plant in Piarco. There are seven (7) monitoring stations upstream within the Caroni River Catchment.

Security Breaches:

XXV. Response: The Security Services Department (In-house and contracted) is the first responder at WASA's facilities and have been trained in emergency response procedures for various crises. Additionally the Authority has established formal linkages with the Office of Disaster Preparedness and Management (ODPM), which is mandated to coordinate relief efforts in the occurrence of natural disasters and other hazards which may inadvertently contribute to social unrest. Depending on the level of threat, linkages with the Trinidad and Tobago Police Service (TTPS) are used to assist in patrols to secure water resources and infrastructure.

XXVI. Has the Authority examined other models for ensuring water security in other jurisdictions? If so, is consideration being given to implementing a similar model in Trinidad and Tobago to ensure water security?

Response: Water security in other regions revolve around the reduction of non-revenue water and water efficiency. WASA is following a similar model with reduction of leakage and demand management. Additional water sources are being explored with the drilling of new wells and the rehabilitation of existing wells. The exploration of bedrock water is also being pursued.

There was an IDB Technical Exchange Mission held over the period January 28-31, 2019 whereby representatives of the Ministry of Public Utilities and WASA attended technical visits to National Water Commission in Kingston, Jamaica and Water and Sewerage Corporation in Nassau, Bahamas in relation to Non-Revenue Water Reduction Projects.

CHAPTER THREE: CHALLENGES

XXVII. Describe the challenges associated with ensuring water security in Trinidad and Tobago.

Response: The catchment areas in Trinidad and Tobago are spread across both islands in diverse terrain and topography. Anthropogenic activity in such catchments negatively affects the yield from both surface and ground water sources resulting in reduced water availability in the established water surplus areas. Apparent change in climate has manifested in seasonal fluctuations from the norm with respect to rainfall patterns. This has reduced the reliability of supply of the raw water available for treatment. With an aged, and in some areas, under capacity infrastructure, delivery to customers is below targeted levels. High demand through excessive consumption further compounds the supply demand imbalance.

XXVIII. What is being done to address these challenges?

Response: WASA collaborates with agencies responsible for development which may impact on water resources including quarrying, housing, industrial, commercial and agriculture. Such collaboration is aimed at protecting the water resource and providing for sustainable potable water production. With respect to the infrastructure, upgrade is proposed in collaboration with the Inter-American Development Bank towards undertaking works to renew the infrastructure to provide improved regularity and reliability of supply. This also includes management of demand through conservation and metering.

WATER INFRASTRUCTURE DEVELOPMENT PLAN 2017 -2022

1.0 INTRODUCTION

By virtue of the Water and Sewerage Authority Act 1965, the Water and Sewerage Authority has the responsibility for delivery of water and wastewater services to the population of Trinidad and Tobago. Since its formation, there has been an increase in potable water production from 205 mega litres daily (MLD) to the current level of approximately 1,106 MLD. There has also been an increase in demand over the period resulting in a deficit in supply when compared to demand. To distribute water via the pipeline network with this supply – demand imbalance necessitated water being provided on a limited scheduled basis. This has resulted in large volumes of storage on individual properties so that water is available to customers when the pipe borne supply is off. While this is a necessity, the need to fill these high volumes of storage further exacerbates the water supply problem by imposing continuous peak demands on the system.

This document estimates the supply and demand for the period 2017-2022 and identifies a strategy to meet demand on a sustainable basis.

2.0 BACKGROUND

The potable water production capacity in Trinidad and Tobago has been estimated at 1,106 MLD. This water is used to supply a population of 1,310,888 persons. For comparison, the relative productions and populations in other jurisdictions is at Table 1.

Based on the comparisons presented, the volumes of water being produced appear to be adequate to meet the demand. Based on the deficit which occurs, the per capita consumption in Trinidad and Tobago is extremely high (encompassing actual consumption and Unaccounted for Water). As such, this would inform strategies to manage demand and supply to create a balance to meet the requirements of the population.

Table 1 - Comparison of per capita demand and Unaccounted for Water

COUNTRY	POPULATION SERVED	PER CAPITA (lpcd)	UNACCOUNTED FOR WATER (%)
Barbados	287,733	505	49
Grenada	109,111	396	20
Jamaica	2,889,187	296	66
St. Vincent & the Grenadines	120,000	225	20
Trinidad & Tobago	1,310,888	808	50
Uganda (NWSC)	3,400,000	74	39
Singapore (PUB)	4,190,000	150	4.8
Barcelona (Spain)	2,870,460	205	16.4

3.0 ESTIMATION OF SUPPLY AND DEMAND

Supply and demand projections have been estimated and a summary, is provided in Table 2.

Table 2: Supply and Demand

	DEMAND	PERIOD	
		2017 - 19	2019 -2022
	*Average Daily Demand	614 MLD	651 MLD
	Unaccounted for Water	50 %	40 %
	Demand	1228 MLD	1085 MLD
	SUPPLY		
	Supply Capacity	1106 MLD	1153 MLD
	New Production	46.6 MLD	33.3 MLD
		1152.6 MLD	1186.32 MLD
	DEFICIT/ SURPLUS		
	Average Daily Deficit /Surplus	(75.6 MLD)	101.32 MLD
	Deficit in Dry Season (assuming a seasonal peak factor of 1.15 and 10% reduction in supply)	(1228X1.15) – (1152.6 X 0.90) (374.8 MLD)	(1085 X 1.15) – (1186.32 X 0.90) (180MLD)

- Based on a per capita demand of 343 l/c/d (75.5 gal/c/d)

4.0 STRATEGIES TO BALANCE SUPPLY AND DEMAND

As is apparent from 3.0, even with the initiatives for increasing water availability and reducing demand, there will be a risk of deficit being realized in the Dry Season, depending on its severity. As such, strategies are proposed to address both supply and demand to mitigate impacts of the Dry Season.

4.1 POTABLE WATER SUPPLY

WASA currently has an estimated supply of 1,106 MLD. Strategies are required to address the following issues.

- Seasonal variations in quality and quantity of flow
- Availability of increase raw water sources for treatment
- Increase treatment capacity
- Maintenance of plant to have production capacity to treat available raw water

4.1.1 Seasonal Variation

4.1.1.1 Quantity

Seasonal variations are most marked at the surface water sources with raw water availability being reduced by as much as 50% at some sources. To address this, strategies include:

- Reduction in reliance on surface water sources by development of ground and desalination sources and the use of Water Reuse
- Provision of impounding storage to mitigate against reductions in base flows experienced in the Dry Season.

4.1.1.2 Quality

Variations in raw water quality can impact potable water production. In the case of surface water, degradation of materials has resulted in raw water of an inferior quality (when compared to design parameters when plants were constructed) being received for treatment. This results in reduced production rates even when water is available in adequate quantities in the respective sources negatively impacting in operation of treatment facilities and final water output. This situation affects the Northern Range Valley (NRV) Water Treatment Plants including Guanapo, Aripo, Caura, Acono and Luengo-Naranjo impacting communities in the East-West Corridor.

To address this situation, strategies include:

- Protection of catchments and aquifers to reduce degradation done to anthropogenic activities to maintain raw water quality within treatable limits
- Improvement of treatment processes to meet the requirements based on current and projected raw water qualities

4.1.2 Transmission

Raw water availability for surface, ground and desalinated sources generally do not coincide geographically with where the demand exists. In Trinidad, the highest rainfall levels are achieved in North East of the island. As such, the larger water treatment plants are located in the North Central to North East of the island including North Oropouche, Hollis and Caroni (the exception being Navet in Central Trinidad) but with the majority of the demand existing in North West and Central Trinidad

In Tobago, the largest demand is in the South West of the island with the major sources (including Courland, Hillsborough and Bacolet Wells) existing to the east of this major demand centre.

As such, transmission networks are required to transmit water from where it is available to where it is required and this is reflected in the pipeline networks in the two islands where the networks transmit water from where it is available to where it is required (see Figures 1 and 2).

The densities of the respective pipeline networks are indicative of the population and demands in the areas.

Booster stations are also required to improve the transmission capacity and pressures to supply elevated areas and communities at the extremity of the distribution system.

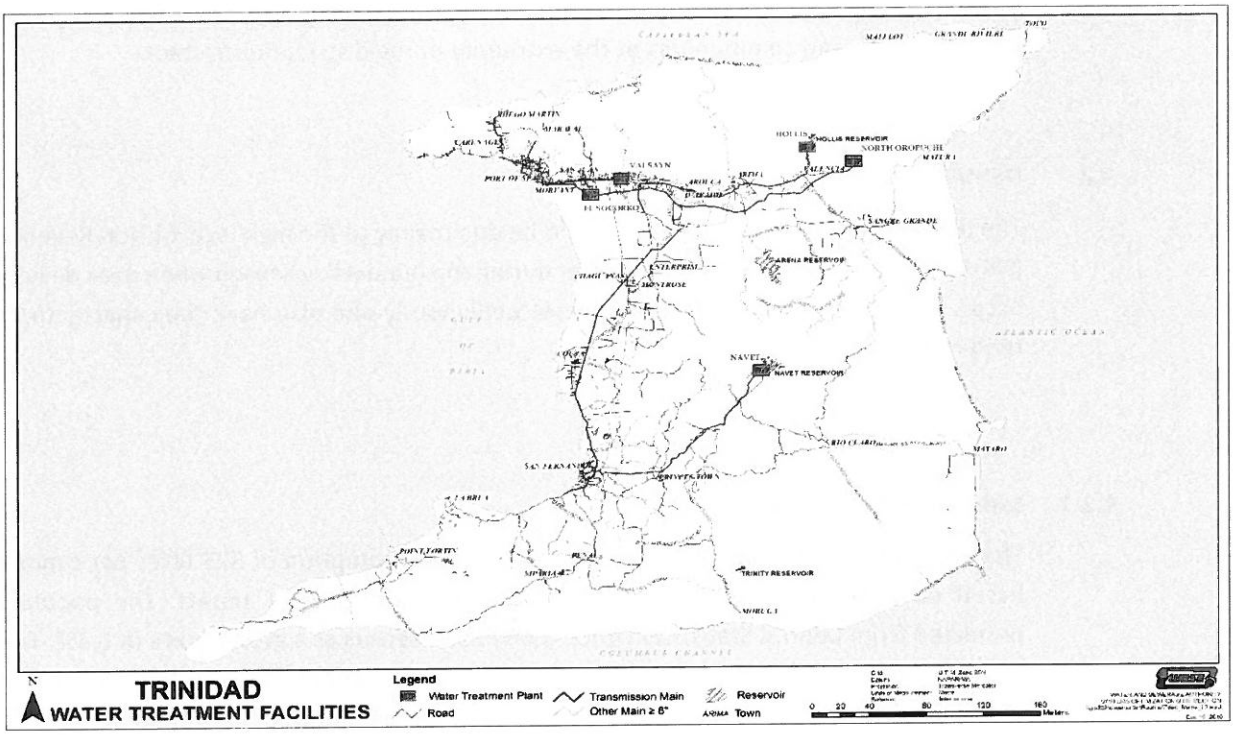
4.2 DEMAND

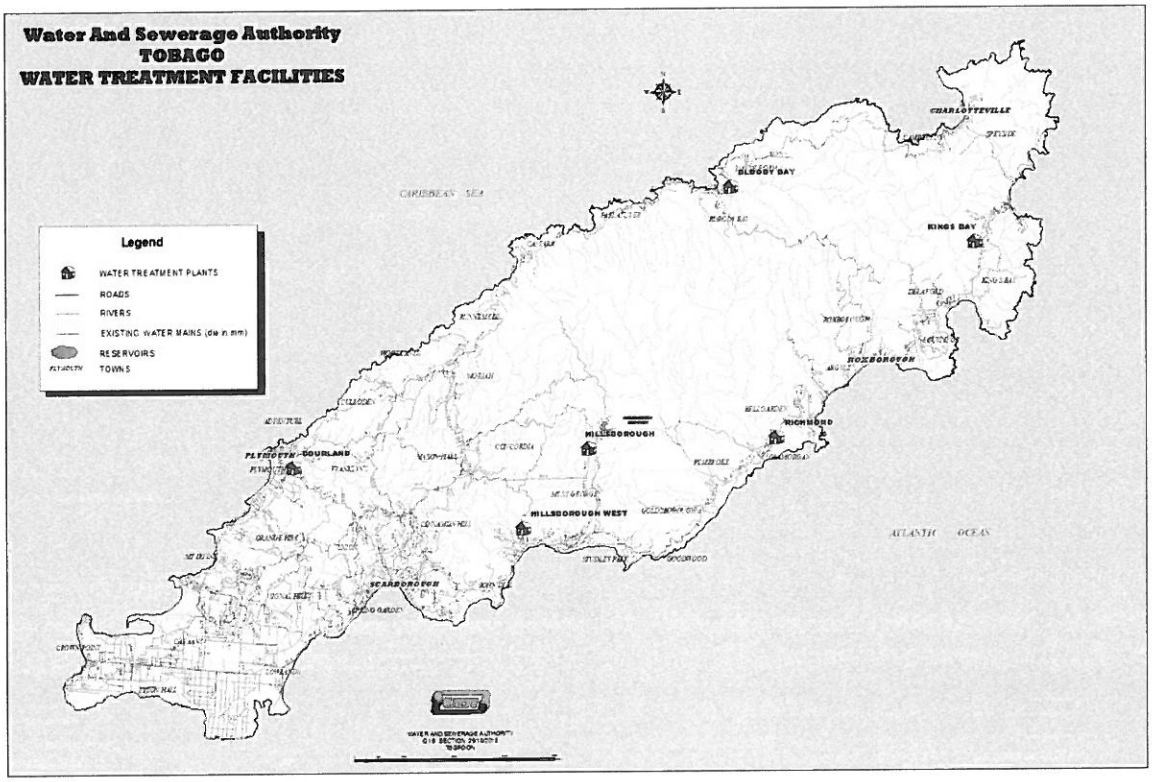
The demand is in excess of what it should be due mainly to the high level of Non Revenue Water (NRW). This situation is increases further during the Annual Dry Season when peak daily demands occur. The systems will also have to meet peak hourly and also have the capacity to meet the requirements for firefighting.

4.2.1 Estimation of Demand

The estimation of demand is based on a per capita assumption of 373 litres per capita per day based on Japan International Corporation Agency (JICA) 1991 report. The population was projected from Central Statistical Office (CSO) 2011 census at a growth rate of 0.3%. This would be better informed if meters are installed on customers' connections to reflect the demographics of the country and the results used to extrapolate for the entire customer base.

Figures 1 & 2 – Maps of Trinidad & Tobago showing treatment facilities and pipeline network





This will be complemented by data from bulk meters on production sources and at key locations on the transmission system.

Data from these systems would permit better assessment of demand and better inform strategies and projects to meet the projected demand.

4.2.2 Reduction of Demand

Several initiatives need to be pursued collectively to reduce demand including:

1. Three complementary projects are proposed.
   (a) Introduction of Universal Metering Programme
   (b) Increase of Tariff
   (c) Update of Customer Cadastre

   It is to be emphasized that all three of these projects must be implemented; leaving out any will reduce the effectiveness of the others.
2. Continuation of Network Pressure Management Programme including establishment of District Material Areas and Service Storage.
3. Installation of Bulk Meters and SCADA to permit real time management of production sources and transmission and distribution networks
4. Replacement of high leakage pipelines on the transmission and distribution systems.
5. Develop and Implement water conservation projects in
   a. Schools, universities, government buildings, public areas including reconfiguration of water reticulation/ plumbing incorporating low usage plumbing and toilet fittings including no water urinals.
   b. Residential properties including low usage toilets and fittings.
   c. Private Sector Organizations (including hotels, carwashes, restaurants) to reduce consumption with recognition of improvement.
6. Intensification of Public Education including Primary and Secondary schools build on the "In the Know Quiz".
7. Revision of legislation to promote conservation and provide for appropriate penalties for breaches.

It is to be emphasized that these measures require implementation of appropriate tariff to make the measures for conservation financially beneficial to customers.

The reduction in Non-revenue water is projected as follows:

Table 3:NRW Reduction Trinidad

YEAR	% NON- REVENUE WATER REDUCTION
1	2
2	1
3	2

4	2
5	3

5.0 DELIVERY PHILOSOPHY AND INFRASTRUCTURE

The concept for water delivery in Trinidad and Tobago is pinned on three main initiatives.

- Win more water
- Install transmission capacity to transfer additional supplies into areas of shortfall (whether chronic or seasonal)
- Reduce demand as outlined at 4.2.2 above

The concepts for Trinidad and Tobago are as follows.

5.1 Additional Water Supply Projection

Additional water supply is projected from the following list of projects with the anticipated production increase shown over the 5 year period.

Table 4: Additional Water Supply Projection

YEAR	Total MLD	1	2	3	4	5
Tobago Ground Water	13.69	9.13	4.56	0.00		
Cove Desalination	6.85			6.85		
Well Development/Rehabilitation	5.93	2.28	2.28	1.37		
Avocat Wells	0.91			0.91		
Lopinot River	2.28			2.28		
Well Development	10.95		6.85	2.74	1.37	
San Fernando Reuse to Petrotrin	6.85		6.85			
Aripo Mega Water Shed	45.64				0	22.82
North Coast Intake and WTP	9.13				0.00	9.128
TOTAL MLD	**102.24**	**11.41**	**20.54**	**14.15**	**1.37**	**31.95**

5.1.1 Additional Water Supply - Trinidad

5.1.1.1 Well Development/ Rehabilitation

This programme is targeted at existing wellfields where work is required to maximize sustainable output. Wellfields for consideration of these works include Arouca, Las Lomas, Chatham, Penal, Granville, Point Fortin and Fyzabad. Existing infrastructure will be utilized to accept and transmit the additional proposed 5.93 MLD.

5.1.1.2 Avocat Wells

These wells will be drilled in untapped aquifers. The water quality is to be determined and treatment required will be determined after a test well is drilled.

5.1.1.3 Lopinot River

This project entails the construction of an intake and treatment facility. The anticipated production is 2.28 MLD and will supply new developments in the area.

5.1.1.4 Well Development

The drilling of 11 new production and 2 observation wells to produce 10.95 MLD. These wells are to be sited in aquifers with untapped potential to permit a comparable reduction in abstraction from aquifers where current production exceeds the safe yield. Areas include Santa Cruz, Arima, Chatham, Granville, Oropune, Stonebright and South Maloney.

5.1.1.5 San Fernando Reuse to Petrotrin

With the construction of a new wastewater treatment plant at San Fernando and expansion of the associated collection system, it is projected that 45 MLD of effluent will be available for reuse applications. Phase 1 of the project will realize an effluent volume of 20.5 MLD. Of this volume, it is proposed to obtain 6.85 MLD of industrial grade water for piping to Petrotrin, Pointe-a-Pierre.

Benefits will be derived as follows.
The additional water and increased transmission capacity will permit the delivery of additional supply to South Trinidad via the existing San Fernando Booster Station. With existing connectivity to the Navet Transmission System, redistribution of flows on this system can be effected to impact South East Trinidad.

Supply to South West Trinidad will be possible via existing infrastructure. Additional transmission capacity is to be installed in South West Trinidad to support proposed industrial development at the Union and LABIDCO Industrial Estates as follows.

1. Installation of an additional pumpset at the existing South Oropouche Booster Pumping Station.
2. Installation of 16.4 kilometres of 600 mm diameter pipe along the proposed Solomon Highway Extension with storage being provided at the proposed Vessigny Reservoir.

5.1.1.6 Aripo Megawatershed

This project will involve abstraction of 45 MLD of water from the Aripo Mega Watershed identified under the Trinidad Bedrock Programme to be used in conjunction with the Cumuto, Guanapo, Aripo, Hollis and North Oropouche Water Treatment Plants to supply North East Trinidad thereby removing the exclusive dependence on surface water sources. This project is expected to yield 22.82 MLD in year 5 and 22.82 in year 6.

5.1.1.7 North Coast Intake and WTP

The North coast of Trinidad from Maracas Bay to Blanchisseuse has a shortfall in the water supply. This project entails utilizing available surface water sources with the associated transmission system.

5.1.1.8 Salybia and Matura River Intakes and Water Treatment

This project is proposed to treat water from the Salybia and Matura Rivers to realize a production of 54.7 MLD with interconnection to the transmission grid to permit transfer of water to South East Trinidad as well as to supplement existing supplies in the North East of the island. This project will be realized after 5 years.

5.1.2 Additional Water Supply in Tobago

5.1.2.1 Tobago Ground Water

Development of additional bedrock wells will be undertaken to produce an additional 13.69 MLD with installation of localized pipelines to connect to existing networks. Additional well development will be pursued in Tobago.

5.1.2.2 Cove Desalination Plant

The proposed site for the Cove Desalination Plant is the Cove Industrial Estate in South West Tobago with pipeline identified for installation to permit transmission of the water to the Crown Point, Buccoo and Scarborough. An initial production of 6.85 MLD is recommended in year 3 with further analysis will be undertaken to determine if addition production is required based on the success of NRW initiatives.

5.1.2.3 Hillsborough Reservoir

The Hillsborough Reservoir will be dredged to provide additional storage of approximately 60 million gallons. While this will not result in an increase in rated capacity of the treatment facility, it will provide additional storage to mitigate against reduced base flows which occur during the Annual Dry Season.

6.0 ROLLOUT OF WATER DEVELOPMENT PLAN 2017-2022

To execute the strategies outlined at 4.0 above, the related projects to be executed are described at **Appendix I**. While projects have been identified to address the supply / demand imbalance, others will better quantify the extent of the problem and inform continuation or amendment of the strategies.

These projects are to be executed over the five year period 2017 -2022. The projects are expected to be funded under the Development Programme in the current fiscal year and the upcoming fiscal years. This commitment of funding is required to permit implementation towards achievements and sustaining of a consistent, reliable pipe borne water supply to all segments of the population. The total estimated capital cost of the Water Infrastructure Plan for next five years is **$3.2Bn**.

6.1 PRIORITIZED PROJECTS

The following projects were prioritized by having a high impact on addressing the Supply and Demand deficit and should be undertaken within the first three (3) years of the development plan:

- Increase in water production by
    - Tobago Groundwater - 13.69 MLD
    - Cove Desalination - 6.85 MLD
    - Well Development/Rehabilitation - 15.52 MLD
    - Avocat Wells - 0.91 MLD
    - Lopinot River - 2.28 MLD
- Demand Reduction by
    - Universal Metering – together with Tariff increase and Customer Cadastre update
    - Network and Pressure Management
    - Replacement of high leakage mains
- Improve transmission capacity by
    - Install 9 Km of 900mm pipe from Claxton Bay to San Fernando
    - install 16.4 km of 600mm pipe from South Oroupouche to La Brea
    - 12.2 km of 400mm pipe (cross country)between Torrib Tabaquite Road and San Pedro Road to supply New Grant- Tableland - Rio Claro
    - 5 km of 300 mm pipe to connect wells under Tobago Groundwater Project
    - Install additional pump sets El Socorro Booster Station
    - Install additional pump sets South Oroupouche Booster Station
    - Construct Savonetta booster
    - Construct Maracas Valley Booster
- Improve reliability by the construction of Service Reservoirs at
    - Hollolo
    - Quare
    - Four Roads
    - Tucker Valley

Capital Cost Component for 5 Year Plan

Strategy	Project	Estimated Cost	Description of Works	Implementation Year	Impact
OBJECTIVE: Increase Water Production					
Develop New Sources	Avocat Wells (0.2 mgd)	$4,200,000.00	Drilling of test well to determine water and design of required treatment facility. Converting to production after the quality and treatment is determined	2018- 2020	Improved supply to Sewlal Trace, Dehli Road, Fyzabad
	Tobago Ground Water (4.0 mgd) Package I - Les Coteaux (0.75 mgd) Carnbee (0.5 mgd), Signal Hill (0.35 mgd), Calder Hall (0.4 mgd) Package II - Scarborough (0.7 mgd), Mary's Hill (0.6 mgd), Roxborough (0.7 mgd)	$17,000,000.00	Drilling and equipping of seven production wells	2018 - 2019	Improved Class of supply from two to five days per week to seven days per week Crown Point, Bon Accord, Shirvan Road, Black Rock, Lowlands, Carnbee, Arnos Vale, Les Couteaux, Tablepiece, Mary's Hill, Roxborough and Louis D'or.
	Well Development /Rehabilitation	$22,000,000.00	Drilling of new wells and rehabilitation of existing wells. Arouca 3 wells total prod 0.5 mgd, Las Lomas (0.2mgd) Penal (0.1mgd), Point Fortin (0.1mgd) Fyzabad (0.1mgd)	2017 - 2022	Increased water availability to customers

Strategy	Project	Estimated Cost	Description of Works	Implementation Year	Impact
Develop New Sources	San Fernando Reuse (from San Fernando WWTP to Petrotrin Impounding Reservoirs, Point-a-Pierre)(4mgd)	$104,000,000.00	Installation of transmission pipeline from San Fernando WW to Petrotrin Pointe-a-Pierre	2017 - 2019	San Fernando and environs and provision of a water supply to CGCL. Survey of route in progress
	Aripo Megawatershed (10mgd)	$45,000,000.00	Hydrological study and welling drilling to produce 10 mgd	2019 - 2023	North east Trinidad from Wallerfield to Arouca including Talparo and Cumuto
	North Coast Intake and Water Treatment Plant (2 mgd)	$30,000,000.00	Development of new intake and pipelines	2019 - 2022	North Coast from Maracas Bay to Blanchisseuse
	Lopinot River (1mgd)	$25,000,000.00	Development of new intake and treatment facility	2018 - 2020	La Resource, Trestrail Development, Lillian Heights
	Confirmation of feasibility of Matura & Salybia WTPs (12 mgd)	$1,000,000.00	Consultancy on feasibility	2018	
	Detailed Design & EIA - Matura & Salybia WTPs	$7,500,000.00	Detailed Design & EIA - Matura & Salybia WTPs	2020 - 2021	
	Drilling of 11 production in Santa Cruz (2) (0.3 mgd), Chatham (1) (0.22 mgd), Granville (1) (0.15 mgd), Oropune (4) (0.35 mgd), Arima (1) (0.1 mgd), Stonebright (1) (0.15 mgd) and South Maloney (1) (0.13 mgd) & 2 observation wells in Stonebright and South Maloney to produce water to permit reduced abstraction from current overpumped aquifers	$31,000,000.00	Drilling of 11 production in Santa Cruz (2), Chatham (1), Granville (1), Oropune (4), Arima (1), Stonebright (1) and South Maloney (1) & 2 observation wells in Stonebright and South Maloney. Depth of wells in north, 150 - 300 ft, depth of South wells 800 - 1200 ft.	2018 - 2021	Increase water availability to Customers
	Sub-Total	**$286,700,000.00**			

Strategy	Project	Estimated Cost	Description of Works	Implementation Year	Impact
Construct New Water Treatment Plants	Louis Dor WTP (0.22 MIGD)	$7,000,000.00	Design and construction of a new WTP to treat ground water with high iron	2018 -2021	Louis D'or (off takes) & Main Rd, Bay Ridge, Rose Hill, Top Hill & John Gully, Windsor & John Gully
	Bacolet WTP (1.41 MIGD)	$24,000,000.00	Design and construction of a new WTP to treat ground water with high iron and Hydrogen sulphide	2018 -2021	Bacolet (Traffic Light - Cemetery) Mc Kay Hill,Upper S/boro, Young Street, Lower Scarborough, Sangsters Hill, Mt Marie, Shaw Park,Pumpmill, Wilson Road - Cost Cutters, Smithfield
	Carnbee WTP (1.25 MIGD)	$15,000,000.00	Design and construction of a new WTP to treat ground water with high iron and Hydrogen sulphide	2018 -2021	Carnbee Main Road, Carnbee#1, Joefield Trace,Sherwood Park Ext, Lower Bob Manswell Trace,Riseland Gardens, Upper Bob Manswell Trace,Upper Sherwood Park
	Santa Cruz WTP	$15,000,000.00	Design and construction of a Surface water treatment plant to filter sediments and debrie	2020 -2022	Improved water supply to Santa Cruz
	Quare WTP (6500 m3/day)	$22,400,000.00	Design and construction of a Surface water treatment plant to filter sediments and debrie	2020 -2022	Improved water quality to Valencia
	Sangre Grande WTP	$18,000,000.00	Design and construction of a new WTP to treat ground water with high iron	2019 -2021	Sangre Grande, Turure, Guaico
	Sub-Total	**$101,400,000.00**			

Strategy	Project	Estimated Cost	Description of Works	Implementation Year	Impact
Increase Impounded storage	Desilt Hillsbourgh Reservior	$85,000,000.00	Procurement of specialist services and equipment for the desilting of Hillsborough	2018 -2021	Additional storage capacity by 256,000 cubic meters resulting in improved level of supply during the dry season to Mount St George, Whim, Concordia, Goodwood
	Sub-Total	**$85,000,000.00**			
Take over Treatment Plant	Maloney	$3,000,000.00	Take over of plants from BPTT	2019 - 2020	
	Stonebright	$3,000,000.00	Take over of plants from BPTT	2020	
	Sub-Total	**$6,000,000.00**			
Refurbish Water Treatment Plants	Charlotteville Intake Upgrade (480 m3/day)	$8,524,600.00	Design and construction of a new raw water intake and water treatment plant	2018	Improved reliability and water quality to Charlotteville
	Hillsborough (1.65 MIGD)	$13,000,000.00	Design, supply and installation of water treatment equipment inclusive of all civil, process, mechanical, electrical and instrumentation requirements	2018 - 2020	Improved reliability and water quality
	Courland (2.4 MIGD)	$6,000,000.00	Refurbishment of the Intake and Supply and Installation of two new filters	2018 - 2020	Improved reliability and water quality
	Richmond (6500 m3/day)	$2,342,931.00	Supply of two spare pumpsets	2019	Improved reliability and water quality

Strategy	Project	Estimated Cost	Description of Works	Implementation Year	Impact
Refurbish Water Treatment Plants	Petrotrin Guayaguayare (6651 m3/day)	$14,000,000.00	Upgrade of the existing La Wai Intake and Design and Construction of the new Pilote Intake; Design and Construction of new clearwell, Highlift Pumping Station and Plant Electrical System; Design and Construction of new clarification, filtration and chemical dosing systems	2018 -2020	Improved water supply Guayaguayare, Galeota Port, BPTT
	Caroni (75 MIGD)	$95,860,000.00	Refurbishment/Upgrade of the Original Plant's Coagulation and Flocculation/Sedimentation Basins Process Units, Filter Unit Valves, High Head Station Valves, Floccuation Unit, Chlorinator Complex chlorinators, New Raw Water Station Transformer, Upgrade of the Plant Process Instrumentation and Control System; Refurbishment of the Sludge Lagoons; Upgrade of the Electrical Power Systems at Caroni and Arena Dam, Refurbishment of the Arena Dam Tower Valve Tower valves; Installation of a new Powdered Activated Carbon System	2018 - 2021	Improved reliability and water quality
	Carlsen Field (3.4 MIGD)	$5,000,000.00	Supply and Installation new Underdrains for Fliter #2, Supply of Filter Media for Filter #2, Supply of Buoyant Media and Clarifier components for Clarifiers 1 & 2, Fabrication and Installation of a new 3-Level Access Stairway	2017 - 2019	Improved reliability and water quality
Refurbish Water Treatment Plants	Caura (2.5 MIGD) (Including Turibidity)	$7,500,000.00	Supply and installation of filter media for three filters, supply and installation of two new backwash blowers, supply and installation of new actuated filter valves,	2018 - 2020	Improved reliability and water quality

Strategy	Project	Estimated Cost	Description of Works	Implementation Year	Impact
			upgrade of the chemical systems, suppoly of highlift pump		
	Aripo (8460 m3/day) (including turbidity)	$7,500,000.00	Supply of new high scale clarification system, modification / improvement of the chemical dosing system and installation of desilting equipment	2019 - 2020	Improved reliability and water quality
	Acono (2400 m3/day) (including turbidity)	$7,500,000.00	Supply of new high scale clarification system, modification / improvement of the chemical dosing system and installation of desilting equipment	2021 - 2022	Improved reliability and water quality
	Luengo Naranjo (0.96 MIGD) (including turbidity)	$5,500,000.00	Supply of new high scale clarification system, modification / improvement of the chemical dosing system and installation of desilting equipment	2022	Improved reliability and water quality
	Guanapo (18750 m3/day) (including turbilidity and clearwell)	$8,000,000.00	Supply of new high scale clarification system, modification / improvement of the chemical dosing system and installation of desilting equipment	2018 - 2019	Improved reliability and water quality
	Stonebright (1259 m3/day)	$4,387,500.00	Refurbishment of the filters; Design and construction of new aerator and chlorination systems; Refurbishemnt of the plant's electrical and lighting systems; Installation of perimeter fencing	2020	Improved reliability and water quality
	Maloney (1735m3/day)	$3,000,000.00	Refurbishment of filters	2018	Improved reliability and water quality
Refurbish Water Treatment Plants	El Socorro (21361 m3/day)	$5,500,000.00	Refurbishment of the highlift station check valves and filter valves; Repairs to the leaking cleawell; Repairs to leaking aerator roof	2018 - 2020	Improved reliability and water quality
	Valsayn (26516 m3/day)	$7,500,000.00	Replacement of 12" pipeline mains from Highlift Station to B Station, Repairs to	2020 - 2021	Improved reliability and water quality

Strategy	Project	Estimated Cost	Description of Works	Implementation Year	Impact
			leaking clearwell; Construction of new chlorination room and rehabilitation of pumpsets		
	Navet (86363 m3/day)	$20,000,000.00	Rehabillitation works for the High and Low Dam	2019 - 2020	Improved reliability and water quality
	Siparia	$3,000,000.00	Rehabilitation of wells	2021	Improved reliability and water quality
	Maraval (15,000 m3/day)	$12,000,000.00	Design and construction of a new chemical complex; Installation of new isolation valves for seperating surface water clearwell from the ground water clearwell and for the ground wate clearwell; rehabilitation of five filters and installation of one new filter; Rehabilitation of filter pump and highlift pump starters and backwash blower motor starter, Installation of new backwash tank	2019 - 2020	Improved reliability and water quality
	North Oropouche (90900 m3 day)	$30,000,000.00	Installation of backup feeder to raw water station, refurbishment of the service reservoirs, filter valve and actuator replacement, refurbishment of the plant SCADA System, installation of new raw water polution monitoring system, replacement of electrical and process monitoring instrumentation, new HSE equipment for chemical containment.	2019 - 2021	Improved reliability and water quality
Refurbish Water Treatment Plants	Chatham (10300 m3/day)	$7,500,000.00	Refurbishment of filters	2019 - 2020	Improved reliability and water quality
	Freeport (11727 m3/day)	$6,540,000.00	Installation of new highlilft pumpsets, actuated filter valves, sedimentation basin valves, new backwash storage tank, rehabilitation of the plant process and instrumention system, refurbishment of the plant SCADA System	2020 - 2022	Improved reliability and water quality

Strategy	Project	Estimated Cost	Description of Works	Implementation Year	Impact
	Minor Upgrade at other plants	$15,000,000.00	As Required	2019 - 2022	Improved reliability and water quality
	Dam Inspection and Refurbisment	$22,000,000.00	Navet Low Dam, $8M, Hollis $12M, Arena $2mM for procurement of contractor	2019 - 2022	Maintain safe operation of dam facility
	Installation of chlorine safety systems at WTPs & Booster	$15,000,000.00		2019 - 2021	HSE requirement to in stall safety systems
	Installation of Sodium Hypochlorite disinfection Systems	$25,000,000.00	Installation of Sodium Hypochlorite disinfection Systems at Caroni, Queens Park Savannah Wells, King George V, Maraval, Four Roads, Tacarigua, Valsayn	2019 - 2022	HSE requirement to eliminate the use for chlorine gas for disinfection
	Sub-Total	**$357,155,031.00**			
OBJECTIVE: Transmission of water					
Install Transmission capacity for redundancy	Maraval - Coblentz BPS to St. Clair	$6,500,000.00	Installation of pipeline from Coblentz Bst to St Clair	2020	Improved supply to Maraval from 3 days per week to 4
	Lopinot - Priority Bus Route to Lopinot	$25,100,000.00	Installation of piepline from Priority Bus Route to Lopinot	2021 - 2022	Improved supply to Surrey and Mac David
Install Transmission capacity for redundancy	Mausica Road from Churchill Roosevelt Highway to Eastern Main Road	$5,005,000.00	Installation of piepline from Churchill Roosevelt Highway to Eastern Main Road along Mausica Road	2020	Reliability of water supply by providing another source of supply to Red Hill, Arouca Clever woods
	Sub-Total	**$55,605,000.00**			

Strategy	Project	Estimated Cost	Description of Works		Implementation Year	Impact
Increase Transmission Capacity	Install 5 km of 900mm Ductile Iron pipe from Caroni WTP to Flow Central Station		$45,000,000.00	install 5 km of 900mm Ductile Iron pipe from Caroni WTP to Flow Central Station	2020 - 2021	Increased transmission capacity to improve supply from Piarco to Westmoorings
	Install 9 Km of 900mm Ductile Iron pipe from Claxton Bay to San Fernando		$80,000,000.00	Install 9 Km of 900mm Ductile Iron pipe from Claxton Bay to San Fernando	2019 - 2021	Increase transmission capacity to San Fernando booster improving level of supply from 1 day per week to 4 days per week
	install 16.4 km of 600mm Ductile Iron pipe from South Oroupouche to La Brea		$72,600,000.00	install 16.4 km of 600mm Ductile Iron pipe from South Oroupouche to La Brea	2018	Water supply to CGCL, Union Industrial Estate, LABIDCO
	12.2 km of 400mm Ductile Iron pipe (cross country)between Torrib Tabaquite Road and San Pedro Road to supply New Grant- Tableland - Rio Claro		$40,260,000.00	12.2 km of 400mm Ductile Iron pipe (cross country)between Torrib Tabaquite Road and San Pedro Road to supply New Grant- Tableland - Rio Claro	2019 - 2021	Improved supply to New Grant-Tableland - Rio Claro
	14.4 km of 200mm HDPE along Naparima Mayaro Road between Torrib Tabaquite and San Pedro Roads to supply New Grant- Tableland - Rio Claro		$38,700,000.00	14.4 km of 200mm HDPE along Naparima Mayaro Road between Torrib Tabaquite and San Pedro Roads to supply New Grant- Tableland - Rio Claro	2019 - 2022	Reduced level of leakage

Strategy	Project	Estimated Cost	Description of Works		Implementation Year	Impact
Increase Transmission Capacity	8 km of 300mm Ductile Iron pipe from Reform Road to Malgretoute along Naparima Mayaro Road	$24,900,000.00	8 km of 300mm Ductile Iron pipe from Reform Road to Malgretoute along Naparima Mayaro Road		2019 - 2022	Improved level of supply from Reform to Malgretoute
	13km of 400mm DI Transmission and 200mm PVC Distribution main from Sangre Grande Booster to North Manzanilla	$118,300,000.00	13km of 400mm Transmission and 200mm Distribution main from Sangre Grande Booster to North Manzanilla		2019 - 2021	Plum Mitan, Manzanilla
	5 km of 600 mm DI pipe between Salybia WTP and Mathura WTP	$30,500,000	5 km of 600 mm DI pipe between Salybia WTP and Mathura WTP		2022 - 2024	Start of Construction works
	500m of 200mm DI from Calvary Booster to Calvary Road.	$1,500,000.00	500m of 200mm DI from Calvary Booster to Calvary Road.		2019	Improved reliability and supply from three days to four days per week to Alenore Gdns Ph 2,3, Calvary
	5km of 300mm DI Main from Guanapo WTP to Broadway, into Columbus, Prince, De Gannes and King Street	$20,500,000	5km of 300mm DI Main from Guanapo WTP to Broadway, into Columbus, Prince, De Gannes and King Street		2020 - 2021	Arima and environs
Increase Transmission Capacity	1.7km of 300mm DI along Karamath Road from Caura Royal Rd to El Dorado Rd	$7,100,000	1.7km of 300mm DI along Karamath Road		2019	Upper Tunanpuna

Strategy	Project	Estimated Cost	Description of Works	Implementation Year	Impact
	15 km of 300mm DI and 200 mm PVC pipe along North Coast Road from proposed Yarra WTP	$44,550,000.00	15 km of 300 and 200 mm pipe along North Coast Road from proposed Yarra WTP	2019 - 2022	Las Cuevas to Blanchissuese
	3.4 km of 600mm Ductile Iron pipe to interconnect proposed Tobago Desal Plant to network	$13,416,400.00	3.4 km of 600mm Ductile Iron pipe to interconnect proposed Tobago Desal Plant to network	2019 - 2020	Southwest Tobago
Increase Transmission Capacity	12.2 km of 400mm Ductile Iron pipe along Claude Noel Highway, Store Bay Local Road & Shirvan Road to transmit water from proposed Tobago Desal Plant	$40,443,000.00	12.2 km of 400mm Ductile Iron pipe along Claude Noel Highway, Store Bay Local Road & Shirvan Road to transmit water from proposed Tobago Desal Plant	2019 - 2021	Southwest Tobago
	5 km of 300mm Ductile Iron pipe to connect wells under Tobago Groundwater Project	$15,565,000.00	5 km of 300mm Ductile Iron pipe to connect wells under Tobago Groundwater Project	2018 - 2019	Improved Class of supply from two to five days per week to seven days per week Crown Point, Bon Accord, Shirvan Road, Black Rock, Lowlands, Carnbee, Arnos Vale, Les Couteaux, Tablepiece, Mary's Hill, Roxborough and Louis D'or.

Strategy	Project	Estimated Cost	Description of Works	Implementation Year	Impact
Increase Transmission Capacity	6.1km 300mm DI mains from Trinity Access Road to the Bois Jean Jean Market.	$18,757,500.00	6.1km 300mm ductile DI mains from Trinity Access Road to the Bois Jean Jean Market.	2018 - 2021	Improved Class of supply from two days per week to five days per week to Moruga, Bois Jean Jean
	Upgrade Tobago Transmission Network	$3,500,000.00	Upgrade Tobago Transmission Network from Pembroke to Richmond	2018	
	Installation of 7km of 900 mm DI Transmission mains from Salybia WTP to Mathura				
	Installation of 9 km of 900mm DI main from Flow control to Valsayn	$95,000,000.00		2020	
	Sub-Total	**$647,591,900.00**			
OBJECTIVE: Distribution of water					
Optimise Distribution Network	Redesign transmission & distribution system in the City of San Fernando	$2,000,000.00	Redesign transmission & distribution system in the City of San Fernando	2020	Design works
	Redesign transmission & distribution system in the City of Port of Spain	$2,000,000.00	Redesign transmission & distribution system in the City of Port of Spain	2021	Design works

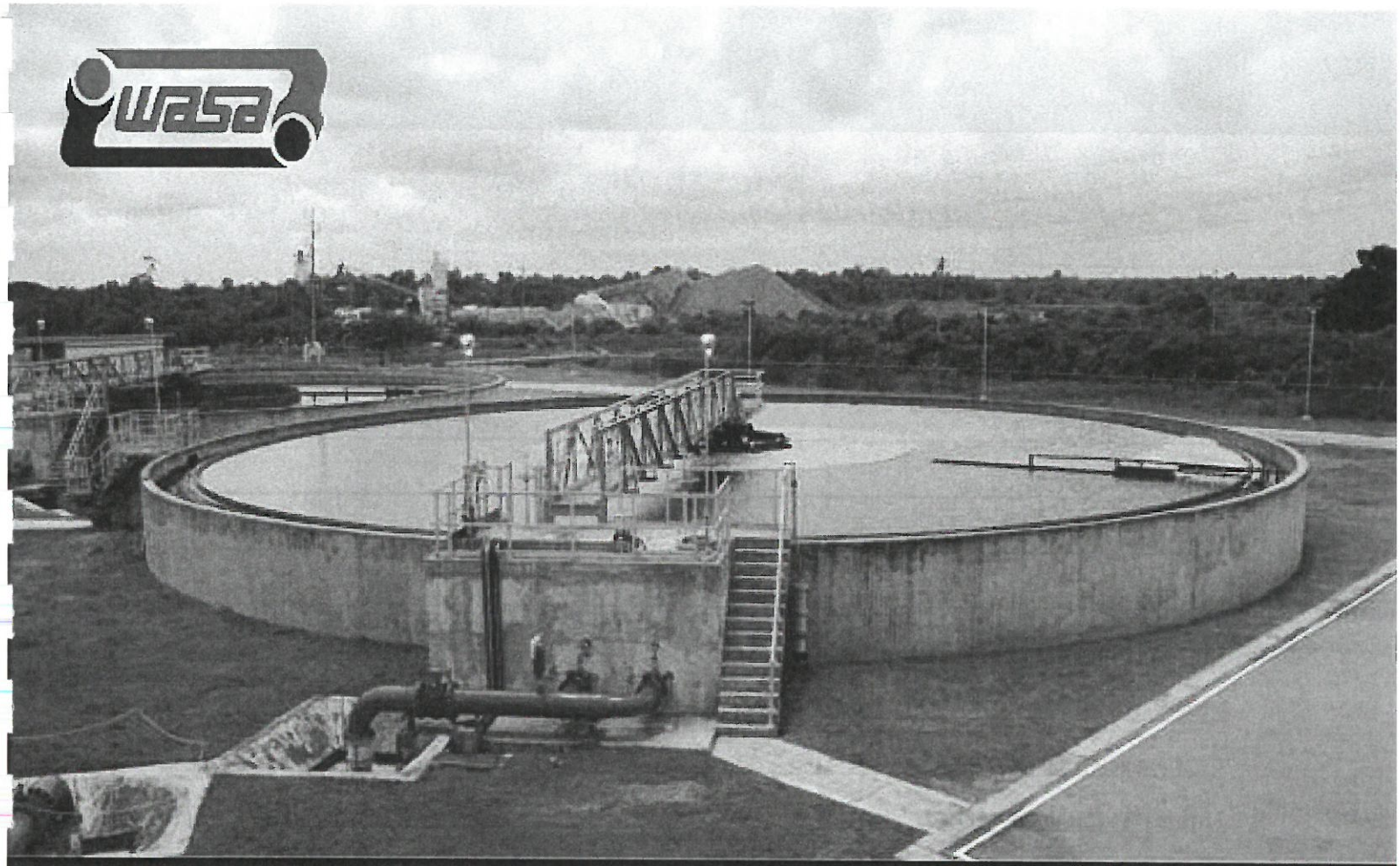
Strategy	Project	Estimated Cost	Description of Works	Implementation Year	Impact
	Upgrade Tobago Distribution Network	$21,950,000.00	Upgrade Tobago Distribution Network	2018 - 2023	Replacement of undersized mains
	Sub-Total	**$25,950,000.00**			
Expand Network	Install pipelines in unserved communties	$34,630,000.00	Extension of distrbution network	2020 -2022	
Construct Booster Station	Lopinot Booster	$3,000,000.00	Construction of a booster station Duty: 750 IGPM @150 PSI	2020	Surrey and Mac David
	Maracas Valley Booster	$3,000,000.00	Construction of booster station. Duty: 750 USGPM @102 PSI	2018	Improved level of supply from two to three days per week to five days per week to Maracas Valley
Construct Booster Station	Calvary Booster	$2,500,000.00	Construction of booster station. Duty: 1.14 IGPM @120 PSI	2018	Improved reliability and supply from three days to four days per week after completion of piepline and tank
	Future booster	$10,000,000.00	Construction of booster station as required	2019 - 2022	Caiman Booster, Upper Buena Vista and as required
	Sub-Total	**$18,500,000.00**			
Refurbish Booster Stations	Clarke Road	$1,500,000.00	Upgrade of booster	2020	Improved supply to Clarke Road and Penal Rock Road
	El Socorro	$3,000,000.00	Refurbishment of booster station	2019	Improved reliability to Lady Young, Morvant, Belmont, Port of Spain, Woodbrook, Westmoorings
	Refurbish Boosters	$30,000,000.00	Location to be determined based on priority		
	Sub-Total	**$34,500,000.00**			

Strategy	Project	Estimated Cost	Description of Works	Implementation Year	Impact
Install Distribution Storage	Charlotteville	$2,000,000.00	Construction of 100,000 IG GFS service reservoir	2018	Improved reliability and water quality to Charlotteville
	Four Roads	$3,500,000.00	Construction of 500,000 IG GFS service reservoir	2018	Improved reliability and a minimum four days per week supply Diego Martin Main Rd, Morne Coco Rd, Victoria Gardens & environs
	Quare	$3,000,000.00	Construction of 500,000 IG GFS service reservoir	2018	Improved reliability of supply. Maintainance of existing 24/7 supply to Valencia
	Hololo	$2,500,000.00	Construction of 100,000 IG GFS service reservoir	2018	Improvement in class of supply from three days to 5 days per week Hololo Rd & St Anns Rd
	Vessigney	$10,000,000.00	Construction of 750,000 IG GFS service reservoir	2018 - 2019	Reliability of supply to Union Industrial estate
	Tucker Valley	$3,000,000.00	Construction of 500,000 IG GFS service reservoir	2018	Improved reliability and class of supply to 24/7 to Carenage
	Guanapo	$4,500,000.00	Construction of 300,000 IG GFS service reservoir	2018 - 2019	Arima and environs
Install Distribution Storage	Calvary Hill	$4,000,000.00	Construction of 300,000 IG GFS service reservoir	2019	Alenore Gdns PH 2,3, Arima Blanchissesue Road
Install Distribution Storage	Paramin Level 3	$3,000,000.00	Construction of 100,000 IG GFS service reservoir	2022	Paramin
	Basta Hall	$2,500,000.00	Construction of 500,000 IG GFS service reservoir	2022	Basta Hall
	Pointe a Pierre	$5,000,000.00	Construction of 1 Million IG GFS service reservoir	2022	Gasparillo

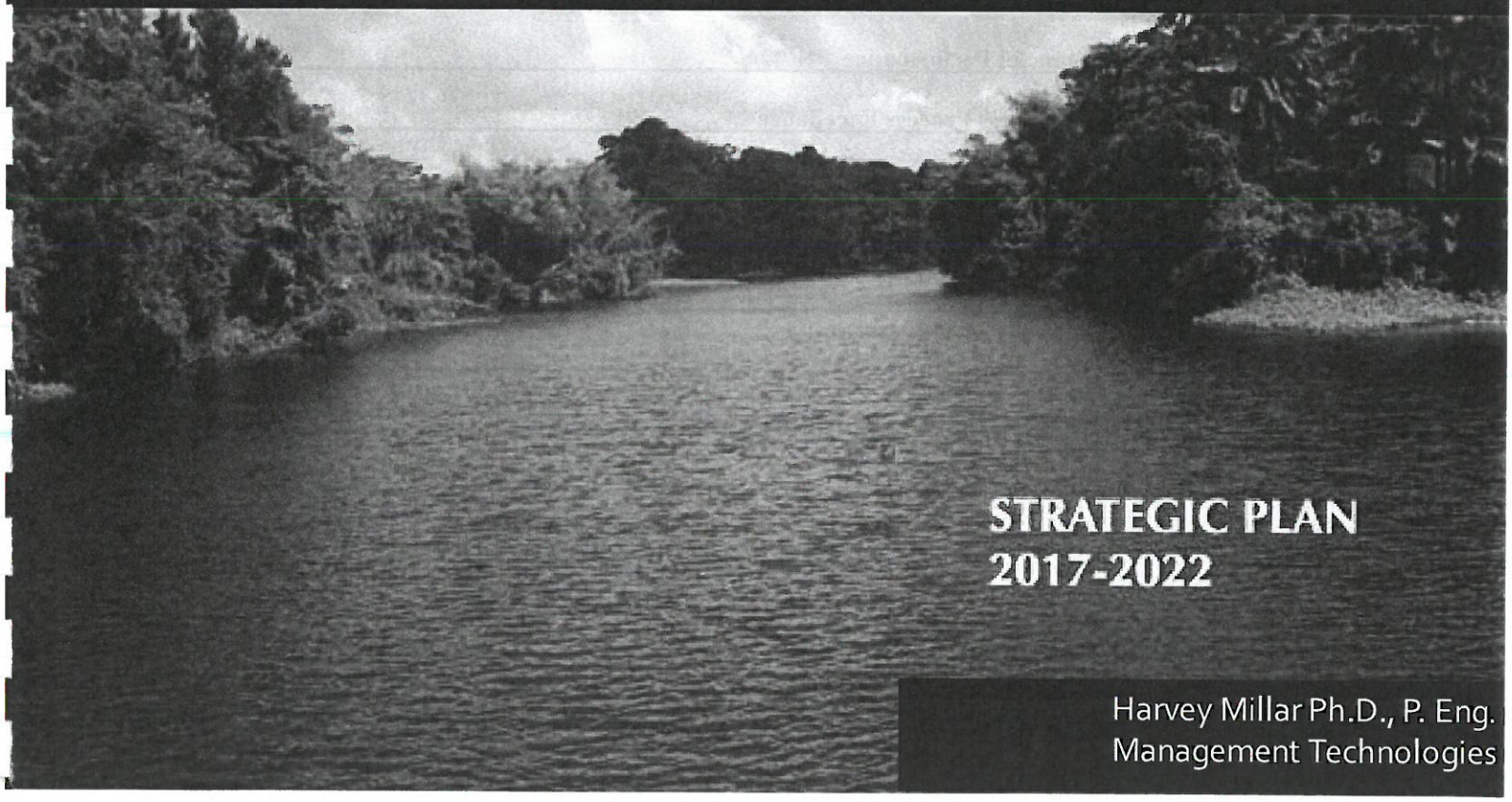
Strategy	Project	Estimated Cost	Description of Works	Implementation Year	Impact
	Sub-Total	**$32,500,000.00**			
	SUB-TOTAL - Increase water availability to Customers	**$1,685,531,931.00**			
		OBJECTIVE: Reduce Demand			
Implement Universal Metering Programme	Install 80,000 meters	$480,000,000.00	Installation of 80,000 meters in the first 5 years with the programme continuing to install a total of 314,000 meters	2019 - 2027	Manage Demand. Reduce NRW. Increase Authorty Revenue
Increase Tariff	Apply rates by RIC for recovery	0			
Obtain accurate customer data	Update of Customer Cadastre	$15,000,000.00			Manage Demand
Obtain Supply Data	Install Bulk Meters	$14,500,000.00	Installation of meters on production facilities and offtakes	2018 - 2022	Manage Demand and data gathering
	Develop and install SCADA on production , transmission and distibution systems to permit remote monitoring and control	$136,000,000.00	Installation of SCADA on various facilities throughout Trinidad and Tobago	2019 - 2022	Manage Demand. Real time monitoring. Reduction in customer response times. Provide timely feedback to customers.
	Sample Survey for demand	$750,000.00			
	Sub-Total	**$646,250,000.00**			

Strategy	Project	Estimated Cost	Description of Works	Implementation Year	Impact
Reduce leakage on transmission and distribution network	Replace High Leakage Mains - Navet Waterworks to TCO Booster Station. Install 6km of 900mm DI	$37,870,000.00	Replace High Leakage Mains - Navet Waterworks to TCO Booster Station		Reduction in level of NRW
	1.7km of 400mm DI along Caura Royal Road	$8,160,000.00	1.7km of 400mm DI along Caura Royal Road	2019	Reduction in level of NRW
	Replace 20 km High leakage distribution pipelines in Pleasantville / Green Acres/Coconut Drive , San Fernando; Diamond Vale, Diego Martin; Dow Village, Point Fortin	$39,630,000.00			
	Replace 138 km High leakage distribution pipelines across North Trinidad, South Trinidad & Tobago	$561,045,337.31	Replace 157 km High leakage distribution pipelines across North Trinidad, South Trinidad & Tobago	2018 - 2022	Reduced level of leakage
	Implement Network and Pressure Management System - Caroni North, Caroni South West, Navet & South West Tobago	$119,634,000	Establishment of District Metered areas, network analysis, pressure management	2018 - 2022	Manage Demand. Establishment of NRW levels, Pressure management and identification of projects to improve the level of supply and recommend infrastructure upgrade
Reduce leakage on transmission and distribution network	Replace 5 km of 44" main on the North Oropuche Transmission system	$60,000,000.00	Replace 5 km of 44" main along the North Orpouche transmission system in areas	2019 - 2022	Improved reliability

Strategy	Project	Estimated Cost	Description of Works	Implementation Year	Impact
			prone to land slippage		
	Sub-Total	**$826,339,337.31**			
Water Conservation	Repair /reconfiguration of water systems in schools , public buildings	$20,000,000.00		2020	Demand management
	Install low usage toilets and fittings (including no water urinals) in WASA facilities	$1,000,000.00		2019	Demand management
	Revision of legislation to Promote conservation including penalities for breaches, reduced taxes on low usage fittings	$1,000,000.00		2019	Demand management
	Sub-Total	**$22,000,000.00**			
Promote Rain Water Harvesting	Develop Systems for non - potable applications	$250,000.00			
	Provide Financial incentives for use	*			
	Sub-Total	**$250,000.00**			
	SUB-TOTAL - Manage demand	**$1,494,839,337.31**			
	TOTAL	**$3,180,371,268.31**			



Water and Sewerage Authority Trinidad and Tobago



STRATEGIC PLAN 2017-2022

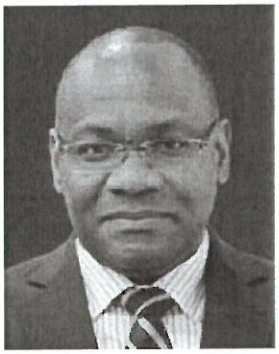
Harvey Millar Ph.D., P. Eng.
Management Technologies

Contents

Abbreviations

24/7	Twenty-four hours per day, seven days a week
CSFs	Critical Success Factors
EMA	Environmental Management Authority
GORTT	Government of the Republic of Trinidad and Tobago
GWS	Guaranteed Water Standards
HRIS	Human Resource Information System
HS&E	Health Safety and Environment
IADB	Inter-American Development Bank
ICT	Information Communication Technology
IDF	Infrastructure Development Fund
IT	Information Technology
KRA	Key Result Area
MGD	Millions of Gallons per Day
NSDP	National Social Development Programme
NUGFW	National Union for Government and Federated Workers
OSH	Organizational Safety and Health
OSH	Occupational Safety and Health Authority and Agency
OWS	Overall Water Standards
PAS	Performance Appraisal System
PSA	Public Service Association
PSIP	Public Sector Investment Programme
RIC	Regulatory Industries Commission
SLA	Service Level Agreement
SMT	Senior Management Team
SOPs	Standard Operating Procedures
UFW	Unaccounted for Water
WASA	Water and Sewerage Authority
WHO	World Health Organization

Message from Our Chair



The Water and Sewerage Authority (the Authority) plays a pivotal role in the daily lives of all citizens. People from all walks of life are dependent upon the Authority for their existence. Every visitor to our shore utilises our services. Every small business or major industry is dependent upon the Authority for the success and viability of its venture. The impact of the Authority upon our everyday lives is readily apparent. That is why we as an Authority are constantly striving to do better, be better at performing our role, recognizing the impact we have on the lives of the citizens of Trinidad and Tobago.

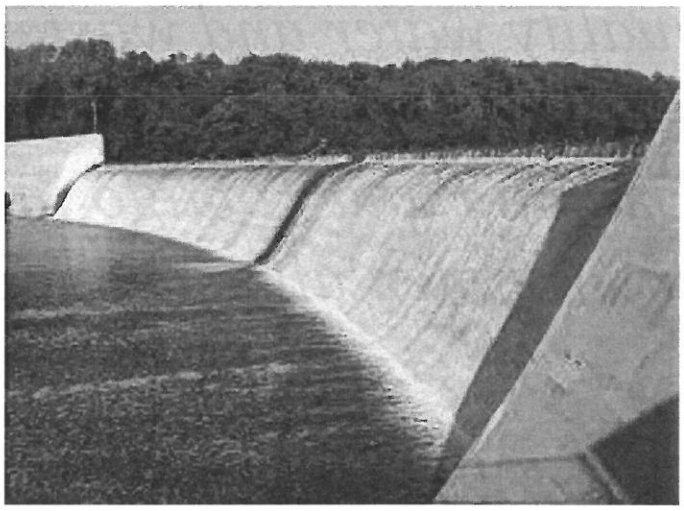
Our Government was elected with a mandate to improve the quality of the water and wastewater services in Trinidad and Tobago. This a commitment given to the people of Trinidad and Tobago that must be kept. Our job is to identify the areas that need strengthening without crying foul at the ills that befell us in the past.

With this in mind, the Board embarked upon this initiative to solicit the views of the management in compiling a strategic plan that will chart the way forward for us as an organisation charged with providing a service in the 21st century that will meet the needs of a growing population and the developmental needs and goals of the nation. The services of an internationally reputed expert in the area was sought to assist and channel the thoughts and ideas in the minds of those working in the Authority into a coherent and understandable document that will be a roadmap for years to come.

Since this is a plan that was developed with the input of management over the course of three intense days of discussion it is expected that management will be very familiar with what is proposed and will be in a position to implement it seamlessly under the guidance and oversight of the Board.

I will like to thank all participants, Board members and the facilitator Dr Millar for participating in the process. I believe what has been produced here once implemented will lead to a transformation of the Authority for future generations.

Excellence in providing clean water, anytime, anywhere…



Our Vision

The best performing water and wastewater utility in Latin America and the Caribbean!

Our Mission

To provide readily available, reliable quality water and wastewater services at a reasonable price to the people of Trinidad and Tobago in a safe and environmentally sustainable manner.

Our Values and Guiding Principles

Our strategy cannot succeed without the appropriate set of core values that will define how we do business. Our core values and guiding principles are articulated below.

Figure 4. Core Values & Guiding Principles

Respect	We will treat our customers and stakeholders equally with appreciation and value devoid of discrimination, as diversity is recognized in the inherent worth of every human being.
Excellence	We will provide the best quality service and customer care that would translate into the highest levels of customer satisfaction and organizational sustainability.
Accountability	We will demonstrate due diligence, fairness, and prudence in decision making embracing cutting edge knowledge and best practices as part of our culture. We will consequently take full ownership of actions when we succeed and when we fail. And when things go wrong, we will commit to making to finding the solutions to make it right.
Professionalism	We will preserve our corporate image through people, who are self-regulated, committed to upholding the highest standards of their respective professions, and are examples that positively influence and enhance the communities in which we operate.
Integrity & Ethics	We will conduct our business with consistency and reliability, staying true to our value promises, while ensuring our actions are in-keeping with the highest standards of ethical practice in the pursuit of our mandate.
Transparency	In our operations, we will be upfront and visible about the actions we take. We will demonstrate honesty, open communication, and the sharing of pertinent information with the public, our stakeholders and our partners.

Our Strategy Map

Our 2017-22 strategic plan is captured using the Balanced Scorecard (BSC) tool referred to as a strategy map. The map shows the strategic themes that will define our focus over the next 5 years.

WASA as a public enterprise receiving tax payer funds to deliver a service on behalf of the people of Trinidad and Tobago must first and foremost create value for taxpayers. In meeting its fiduciary responsibility, it must seek to earn public trust and have a brand image as an entity that has integrity at the highest level.

With increasing pressures on the national fiscal purse, WASA is increasingly expected to become financially self-sufficient thereby reducing its reliance on public funding. As such our key financial themes, will emphasize: 1) revenue growth as a primary vehicle for substituting government subventions; 2) reduction of operating cost through a focus on optimizing the operating cost structure of WASA; and 3) reduction of the WASA's significant outstanding debt and receivables. WASA's current receivables stands at $1.6b and needs to be addressed with great urgency. Collection of outstanding revenues will put us on a path towards financial security.

Our customer/stakeholder focus reflects three strategic themes: 1) improving water and wastewater services; 2) enhancing service delivery to all our customers, and 3) reducing the negative environmental impact of our operations.

Accomplishing our strategic priorities require a strong and deliberate focus on our operational enablers. We are committed to strengthening our structural enablers which include: improving our processes, enhancing demand management for water, strengthening stakeholder engagement, managing enterprise risks, and innovating new products and services. Our infrastructural enablers (the intangible assets) will focus on improving current and building new employee skills, creating a culture of innovation and entrepreneurship, improving IT integration in our processes, strengthening our governance practices, and improving our knowledge management capacity through a focus on data capture and data analytics.

Beyond showing the cause and effect relationships that will drive our strategy, the map serves as a visual tool for easy communication of our strategy, both internally to our employees and externally to our stakeholders and to the public.

We firmly believe our strategy is comprehensive, integrated, and bold. Realizing the strategy over the next 5 years will require substantive change in the way we do business. This is in-keeping with Einstein's belief that problems cannot be solved on the same level at which they were created. Hence our culture, practices, structure, and relationship with our internal and external stakeholders must be adapted to the strategy.

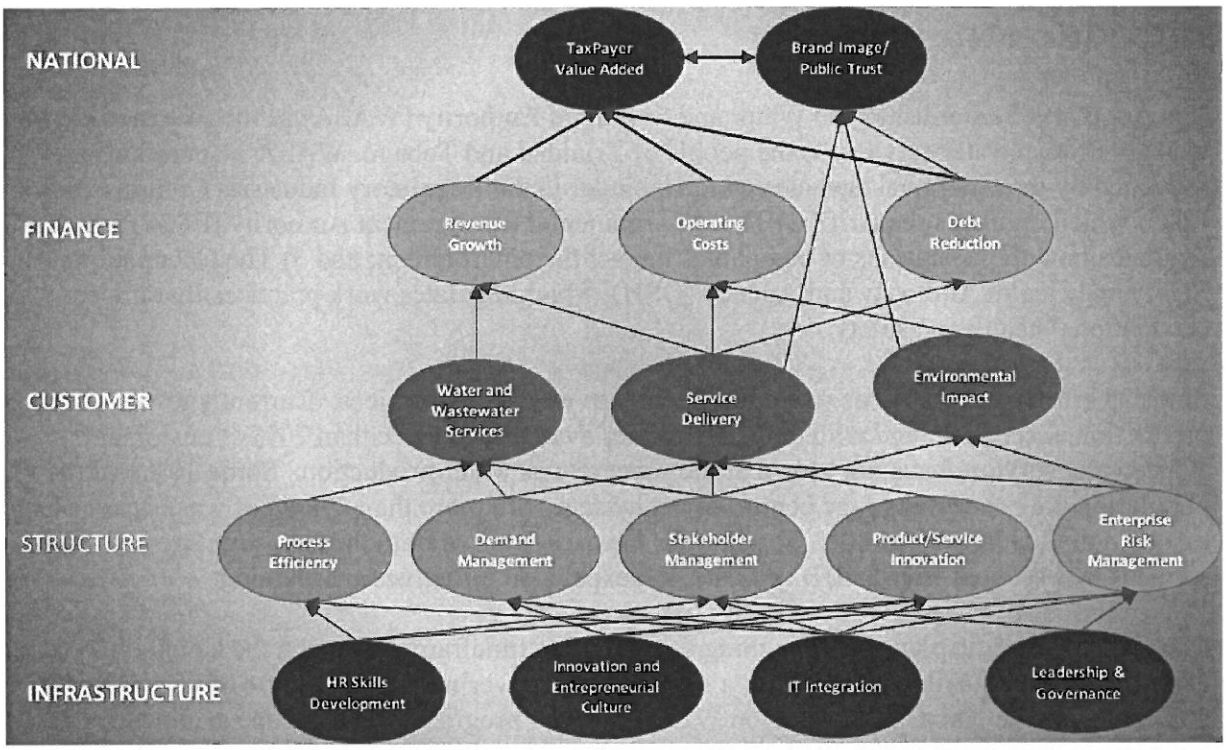
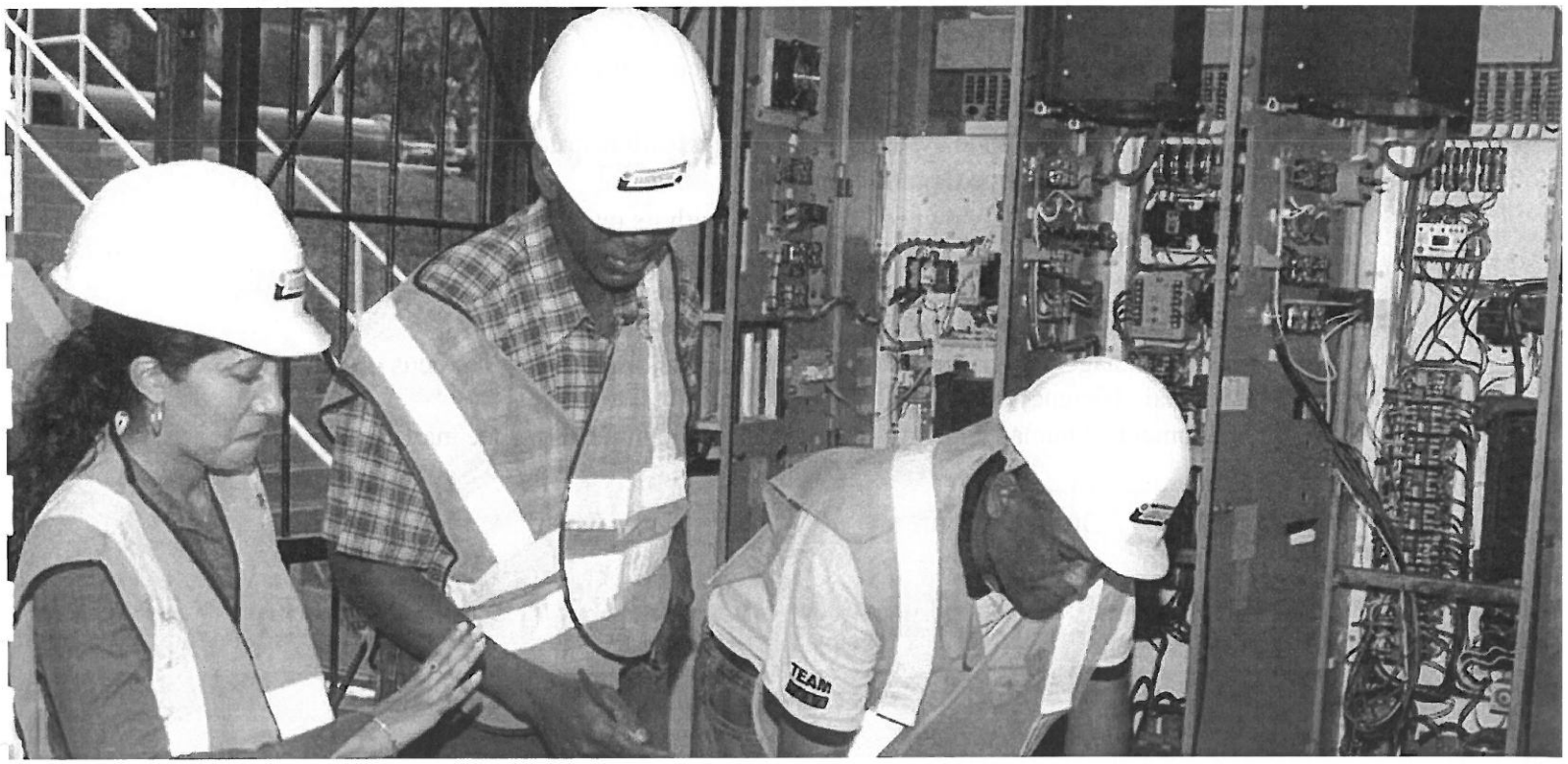


Figure 1. Our Strategy Map for the 2017-2022 Strategic Plan



Introduction

The Act of 1965 established the Water and Sewerage Authority (WASA) as the sole provider of water and wastewater services to the people of Trinidad and Tobago. WASA's operations are regulated by three national agencies which include: 1) the Regulatory Industries Commission (RIC) which regulates the tariff; 2) The Environmental Management Authority (EMA) which regulates how the operations of companies impact the environment; and 3) The Occupational Safety and Health Authority and Agency (OSH), which regulates work practices that impact occupational health and safety.

Since its creation, WASA has worked diligently to expand its services. Currently levels of water production exceed 233*mgd* with daily 24/7 water available to more than 70% of customers. Wastewater services have not grown at the same rate as water production. Some 30%+ of the population are connected to the central sewer system with more than 29*mgd* of wastewater being treated daily. However, in 2012, funding for the expansion of both the infrastructure and services was secured from IADB. To date, the expansion initiatives are ongoing.

The current strategic plan is approaching the end of its timeframe. As such the Council of Commissioners signalled the need for a strategic plan covering the period 2017-2022. This 2017-22 strategic plan is predicated on WASA's arc of progress which began several years ago, but notably articulated in the 2012-17 strategic plan. The plan at the time recognized the GORTT's commitment and vision to the development of the water sector and as such focused on three broad themes: water security; protection of water resources; and protection of the environment. The plan included several short and medium term initiatives such as[1]:

- Expand the water coverage to 95% and deliver 24/7 service to 88% of its customers.
- Provide wastewater services that will expand centralized treatment systems to 34% of the population, to improve effectiveness of sewage treatment and reduce negative impact on the environment.
- Recover full cost of water and wastewater services through appropriate and adequate tariff and improved operational efficiency.
- Implement enterprise wide systems and an organisation structure which are in alignment with a High-Performance Organisation.
- Transform into a publicly owned corporation with its own corporate identity.

In pursuit of GORTT's vision and the accompanying strategic thrust, WASA embraced a new business model that would hopefully lead to several positive outcomes[2]:

- Bring the management of services closer to the customer through a focus on improved operational efficiency
- Development of human capacity (talent management, performance management)

[1] WASA 2012-2017 Strategic Plan
[2] ibid

- Protection of the environment (conservation and protection of water resources)
- Establishment of a corporatization framework
    - Expounding the legal relationship between GORTT and WASA
    - Improving governance practices
    - Developing a commercial orientation
    - Improving organizational accountability

The articulated business model is captured in Figure 2.

Figure 2. WASA's Proposed Business Model (2012-17)

As the 2017-22 strategic plan was being developed, it was a widely held that view that the business model was still relevant and should be embraced as a guiding framework over the 2017-22 period.

Progress to Date

Since 2015, WASA has made significant gains consistent with many of the objectives articulated in the plan. A summary of our key accomplishments is presented below.

Upgrade of Pipeline Network

- Installed / replaced 300km out of 6000km of pipeline throughout Trinidad.
- Completed projects include: Hollis Main, Beetham, Caroni Dualing, Santa Cruz, Maracas St Joseph, Moruga, Freeport and Chase Village 3. Tobago - Courland Transmission replaced, pipeline replaced from Mt St George to Richmond and Bacolet to Signal Hill.

Development of new water sources

- Tobago 8 new wells and 5 wells in production (2 MGD per day).
- DESAL Point Fortin. DESALCOTT (expansion of 30 to 40 MGD per day). Works in Progress: Lopinot & Pilote

Pursuance of tariff increase

- Applied for increase in abstraction rate
- Established a committee to pursue increases with RIC

Expansion of revenue streams

- Established a Business Enhancement Unit, which charges for external jobs such as HDC Trestrail - pipework, service reservoir, water treatment plant.
- Vacumaster rentals.
- Started to charge support services, such as relocation of pipelines to accommodate other agencies
- Created a plan for a bottled water business.
- Charge for Water and Wastewater Training Courses to public
- Market some facilities for recreation, picnics etc.
- Revenue from projects such as upgrade to Petro Guya Water Treatment Plant

Reassessment of Procurement Processes and Procedures

- Reassessment of Procurement Processes completed by Pricewaterhouse. WASA to review and implement.
- Tender and Procurement Policy being revised

Integration of IT Platforms

- Oracle introduced and is integrated with inventory, finance, procurement. To be expanded to include HRIS, CIS.

Creating a High-Performance Organization

- Restructuring Exercise to ward optimal organisational structure
- Introduction of a Performance Appraisal System - Improving culture of performance
- Initiating a Workforce Audit to identify available competencies
- Development of an integrated information system- 90% HR/Payroll; Procurement and Financial Reporting
- Introduction of Automated Operational Systems- SCADA, GIS and ARMs Job Management System

Strengthening Legal and Governance Framework

- Monitoring compliance with laws and regulations e.g. FOIA, OSH EMA, SEC Filings
- Corporatisation readiness thru corporate governance action plan
- Introduction of the corporate Governance work model
- Implementation of code of ethics and business conduct and signing of annual declaration
- ERM framework with policy towards integrating risk management
- Development and implementation of critical policies including corporate performance reporting policy
- Completing outstanding audit financial statements for disclosure

Expansion of wastewater coverage

- Projected expansion from 30% to 47% coverage upon completion of Malabar and San Fernando Projects
- Completed refurbishment of small package plant- Cantaro, Orange field, Mountain Dew, Bon Aire, Orchards Gardens, Lange Park etc.

Expansion of communication channels

- Expansion of WAN from 20 satellite sites to 45 sites resulting in increased network connectivity. This will improve telecommunications in inter departmental calls and impacting on reduction of telecommunication toll charges by 65%
- Increased data services resulting in increased access to Application (CIS, ARMS, HRIS etc.)
- Expansion of radio communication from analog to digital (upgraded infrastructure and capability resulting in improved inter-island communication)
- Expansion of the use of email

- Increased wireless communication
- Online Tendering Process
- RFPs uploaded online- improved procurement process
- Paperless requisition
- Utilisation of Social media-Facebook, twitter
- Corporate webpage application
- Public Education Centre in T&T to promote good water conservation practices
- Adopt a River Programme -voluntary community outreach programme with corporate and government entities to improve rivers and watersheds

Challenges Faced by WASA

WASA like all organizations, has had and will continue to have its share of challenges. Progress is rarely a road travelled without speed bumps along the way. We are guided by the principle that "*Failures are finger posts on the road to achievement.*" - C.S. Lewis

As we look forward to the 2017-22 planning cycle, there are several shortcomings that we've observed on our path to progress that if we learn from them and are conscientious about avoiding past mistakes, we will succeed greatly. In our analysis of our operations and practices over the last 5 years, we've made the following observations which needs to be addressed. Our 2017-22 strategic plan takes into consideration these issues by determining which are strategic and which are operational in nature, then though a prioritization process, determine which, if any, of the issues are adopted as strategic or operational priorities.

Water Security/Water Supply

- Inadequate Funding for operational, capital and maintenance works
- Aging infrastructure
- Improper / inadequate Water Shed Management
- Pipeline leaks
- Consumer wastage
- Inadequate physical security
- Lack of enforcement or inadequate legislation to protect the catchment area and pollution of water sources
- Inadequate metering
- Lack of demand management

Protection of Water Resources

- Catchment degradation due to unplanned development,
- Water quality degradation due to quarries, discharges from industries, indiscriminate dumping, non-compliant wastewater treatment plants
- Illegal and over abstraction from surface and groundwater sources
- Urbanisation and associated drainage which impacts recharge of aquifers and rivers
- Poor enforcement by regulators and weakness in the WASA Act – overreliance on other agencies
- High water leakage from network
- High usage and wastage by customers results in need for increased production and extraction
- Poor physical planning by regulators
- Climate change/variability need to be factored in design and strategies for supply development

Protection of the Environment

- Non-compliant effluent discharge into water courses
- no established protocol for ecological needs assessment
- no rigorous process for enforcement of wastewater treatment plant requirements

- monitoring for continuous compliance with wastewater standards
- managing chemical usage and disposal of chemicals
- managing and disposal of decommissioned assets
- monitoring and surveillance of land assets to protect watersheds or water courses
- ineffective legislation to enforce against pollution of water courses
- need for land use planning and national land use planning

Wastewater Collection and Treatment

- Lack of Funding and competing resources to water
- Poorly designed private developments
- Inadequate customer based coverage
- No Policies for wastewater - inadequate regulation
- Inadequate resources to monitor wastewater discharge
- Underdeveloped and unexpanded Reuse System
- Insufficient centralised wastewater collection systems

Water Safety and Security

- Lack of independent testing of water supply
- Testing does not cover wide enough range of parameters
- Lack of regulations /enforcement governing dumping of solid-waste and other pollutants into the waterways
- Potential terrorist attack on water supply
- Management of Impact of natural disasters
- Inadequate inspection and maintenance of dams and mains
- High percentage of leakages on our transmission and distribution mains
- Destruction of aquifer recharge zones and surface water sources
- Inability to adapt to climate change and climate variability

Forging the Journey Ahead

It is important for us to look back at our performance with regards to our approach to implementing the 2012-17 strategic plan. We learnt that it was hard to routinely assess how well we were implementing the strategic plan, for while we were completing several activities, we had not established a rigorous system of performance monitoring and evaluation that was focused on the desired outcomes inherent in the plan. We captured output data on activities completed, but not outcomes data showing a clear link between our investments and the results achieved.

In addition to inadequate performance monitoring and measurement, we did not create an alignment of rewards and benefits to drive commitment to the plan. The plan was not properly communicated nor devolved; there was no risk assessment of the strategy; and there was a lack of enforcement of accountability for performance. Further, the implementation strategy did not call for a system of reallocating strategic and operational work among mangers and staff. Performance appraisals were not modified to capture the strategic goals articulated in the plan. As such, strategic results that were accomplished were not the product of the existence of an effective *managing for results* framework, but rather because of the professional disposition of some individuals.

Going forward, a definitive model for implementation of the plan is being adopted. WASA is committed to performance monitoring and measurement in the context of its strategy. That will

allow us to quickly assess what is going wrong and what is going right, and where necessary, make the appropriate course corrections needed to successfully deliver the strategy. As part of our process of *managing for results*, we will begin to report annually on the performance of the strategic plan. Our Board of Commissioners will strengthen its oversight for strategy, and our senior management team will develop a stronger orientation towards strategy.

The Strategic Planning Methodology

The strategic planning methodology used by the consulting firm we engaged, Management Technologies, is shown in the figure below. The process is an in-depth, deliberate soul-searching methodology that was both efficient and effective. The key steps in the process (which is nonlinear, but rather iterative) are as follows:

1) An assessment of the external environment to develop a clear understanding of the salient factors in the business and operating environments and how these exogenous factors are impacting our customers, stakeholders, and the organization. Environmental factors influence customer/stakeholder expectations of WASA. These factors also influence the expectations of our employees as well.
2) Engage all key stakeholders (internal and external) in a process that focuses on identifying what they value, and how they would define success for WASA. Our stakeholders will tell us if we are delivering value; and only if we are doing so in an efficient and effective manner will they view us as a successful organization. That information is crucial in assisting WASA in identifying its strategic priorities for the next planning cycle
3) All stakeholders will articulate their wants and needs which will represent their desired results from WASA. We analysed the data to deduce and establish our customer and stakeholder value propositions. We hold the view that our success is tied to our ability to deliver on our value promises to each market segment, and that our mission must be defined in the context of our value propositions.
4) After articulating the customer/stakeholder value propositions, we reviewed and affirmed our mission, vision and values principles.
5) With our vision, mission, values and value proposition defined (what we call our success model), we assessed our performance against that success model to identify critical gaps between what is expected and what we deliver.
6) The result of the analysis was then used to identify strategic priorities and corresponding initiatives.
7) The operational enablers (drivers) linked to the strategic priorities were subsequently identified and assessed. The assessment led to the identification of several operational priorities. We then developed initiatives to address the operational priorities
8) The process we used ensured alignment and balance between the strategic priorities that will deliver our value propositions and our internal operating capacity to execute the strategic initiatives.
9) All strategic and operational priorities, expressed as desired results/outcomes, have corresponding performance measures and indicators which will form the basis of the monitoring and evaluation framework for the strategic plan

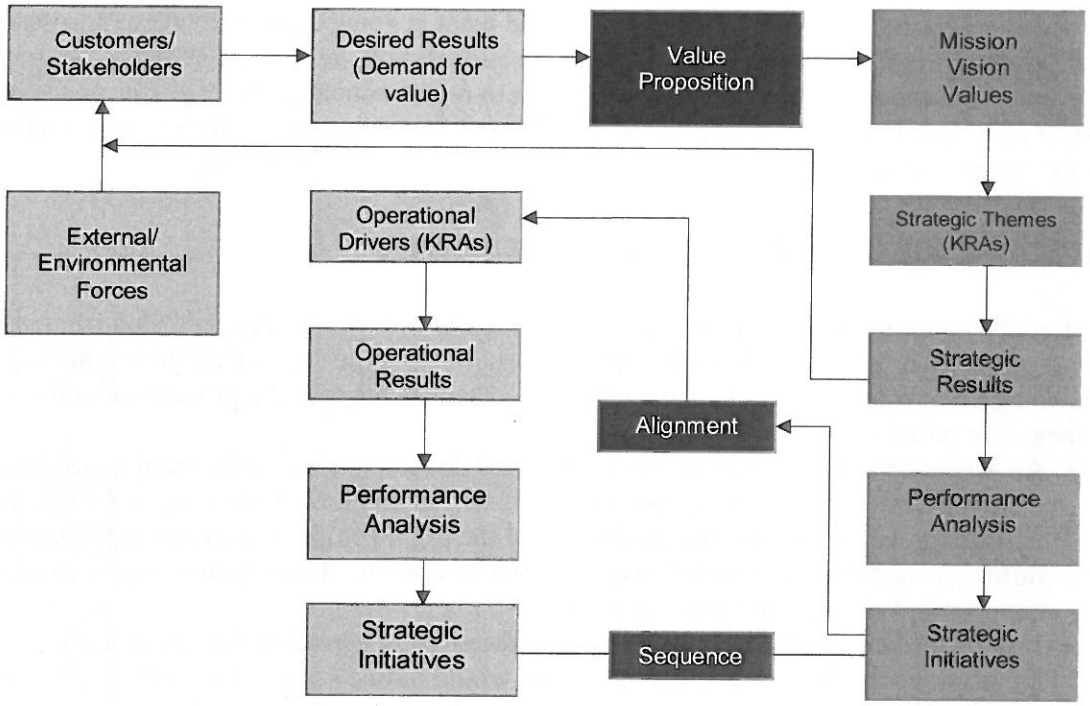


Figure 3. A Schematic of the Strategic Planning Process Used

Value Propositions

Figure 4 shows WASA's key customers and stakeholders. We view the successful delivery of value to these various segments as WASA's mission. While each customer/stakeholder will identify a list of desired results, ultimately, WASA must decide within the confines its legal mandate, what subset of these desires it can and will promise. In the following paragraphs, we articulate WASA's promise to each of our key customer/stakeholder groups.

WASA's Stakeholder Value Propositions

Residential Customers

- Delivery of reliable and quality water and wastewater services at a reasonable price
- Timely and quality road restoration
- Equitable distribution of water
- Timely response to repairs
- Excellent customer service including communication (face to face, email)

Commercial Clients

- Timely response to action service requests
- Reliability of water supply
- Enforceable Service Level Agreements (SLAs) for high value clients
- Quality water supply

- Accuracy and fairness in client billing
- A process for redress of service failures
- Timely approval for land development
- Transparent process for Administration of Land Development Approval

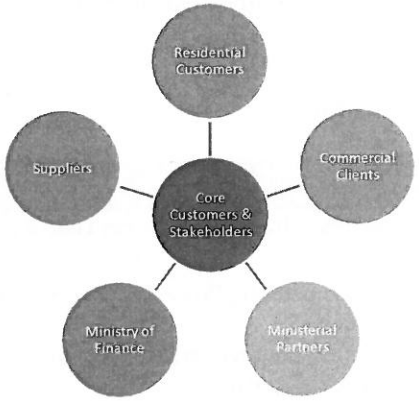


Figure 4. WASA's Key Stakeholders

GORTT /Ministerial Partners

- *Regulators:* compliance and efficiency
- *Ministry of Public Utilities:* implementation of government policy
- *Min of Works and Min of Energy, Ministry of Agriculture:* coordination /collaboration of work/ compliance/ infrastructural development and support
- *Ministry of Local Government:* satisfy community/municipal needs
- *Ministry of Health/ Ministry of Education:* sustainable supply of water to hospitals and health facilities and schools
- *Housing:* infrastructure support and waste water management
- *Environmental Agencies:* Compliance with standards /management of water sources
- *Min of Labour:* Proper employee relations practices
- *THA:* Equitable treatment/provision of services for infrastructural development

GOVTT/Min of Finance

- Value for money, (return on investments),
- Financial accountability,
- Fiscal prudence (stay within budget).
- Support GORTT development plan.
- Timely financial reporting.
- Financial sustainability/Self sufficiency

Suppliers

- Transparent and efficient procurement process
- Timely Payments
- Sustainable long term partnership
- Timely and effective communication and Knowledge on the strategic direction

Critical Drivers of the Value Proposition

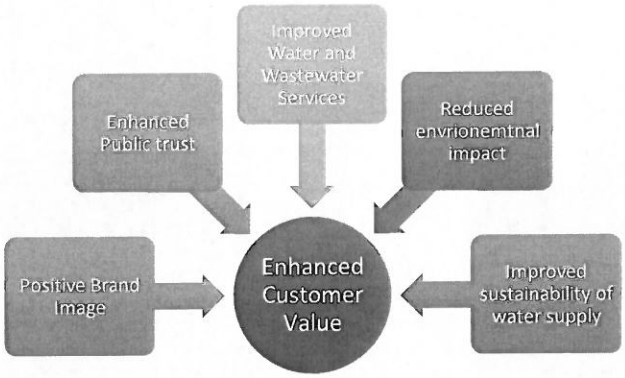
To develop both strategic and operational priorities, we examined the levers/drivers that will impact the value proposition. Then by analysing the status of these drivers we identify strategic and operational priorities that will have the greatest impact on delivery of value to our customers/stakeholders.

Table 1: Drivers of the Value Proposition

Value Component	Dimensions/Components
Sustainable & Reliable (24/7) Water Supply	Network infrastructure, water courses,
Responsive Service	HR Competence, Processes, Org. Culture, IT infrastructure, Operations planning
High quality water and wastewater services	Facilities, HR competence, Technology Integration, Equipment, Testing, Risk management
Affordable portable Water	Infrastructure, Operating costs, Water Supply, Water loss control, payment collection
Public Health and Safety	Testing, State of infrastructure,
Environmental Sustainability	Risk assessment and planning, risk mitigation, environmental data,
Corporate Social Responsibility	Community Engagement, Employee Volunteerism
Public Trust	Quality of Water and Wastewater Services, Level of transparency in operations, Communication with the Public
Financial Sustainability	Operational excellence, fiscal management, innovation, entrepreneurship

STRATEGIC PRIORITIES

Strategic Priority: Maximizing Customer/Stakeholder Value



Desired Result: *Positive brand image*

Measures/Indicators

- % of individuals rating our image as satisfactory or very satisfactory (by customer/stakeholder segment)

Initiatives

- Train employees to develop improved customer interface
- Greater SCADA coverage to enable accessibility to quality information
- Create and design customer communication strategy
- Enhance social media engagement with customers
- Integrate customer communications
- Improve internal communications between communications and operation

Operational Drivers/CSFs

- IT infrastructure to support customer facing processes
- Strong branding and communication department with required skills in communications and public relations

Desired Result: *Enhanced public trust in WASA*

Measures/Indicators

- Reduction in customer complaints
- Improvement in customer satisfaction survey results
- % of the public rating WASA as trustworthy

Initiatives

- Development of (Internal and External) Communications Plan to improve the communication of service disruption as well as the effectiveness customer service interface
- Close the Information Gap among departments through the implementation of mechanism that provides the real-time status of leak repairs, pipeline line maintenance

activities etc. that are creating a disruption in water supply

Operational Drivers/CSFs

- Public sensitization
- Care and concern for customers
- Effective management of the water supply
- Interdepartmental cooperation
- Effective project management and completion

Desired Result: *Improved water and wastewater services*

Measures/Indicators

- Level of customer satisfaction with water and wastewater services
- % of bulk metering program implemented.
- % of households connected to the centralized sewer system
- Implementation of the medium-term wastewater plan for Trincity catchment.

Initiatives

- Implement bulk metering programme to provide data to inform decisions on water distribution
- Implement universal metering to reduce water demand and to increase collections.
- Improve pressure management to reduce losses and improve level of service.
- Increase wastewater coverage and enhanced treatment to reduce risk to public health and environment in Chaguanas and Trincity catchments.
- Bring on board Adopted WWTPs

Operational Drivers/CSFs

- Skilled HR e.g. Sufficient trained staff and equipped construction crews
- Stakeholder engagement
- Procurement of goods, works and services
- Technical specifications
- Regulatory approval and compliance
- Enhance GIS and modelling capabilities

Desired Result: *Reduced environmental impact*

Measures/Indicators

- % Compliance with Water Pollution Rules
- % Compliance with WRA guidelines

Initiatives

- Develop a plan for water and wastewater facilities to achieve 100% compliance with Water Pollution Rules
- Develop a programme to achieve 100% Compliance with WRA recommended water abstraction guidelines
- Implement the Adopt a River Programme to improve quality of the nation's river and watersheds

Operational Drivers/CSFs

- Effective water quality monitoring to ensure compliance with quality standards
- Effective senior leadership
- Active performance monitoring
- Staff and stakeholder training
- Effective stakeholder engagement

Desired Result: *Improved sustainability of the water supply*

Measures/Indicators

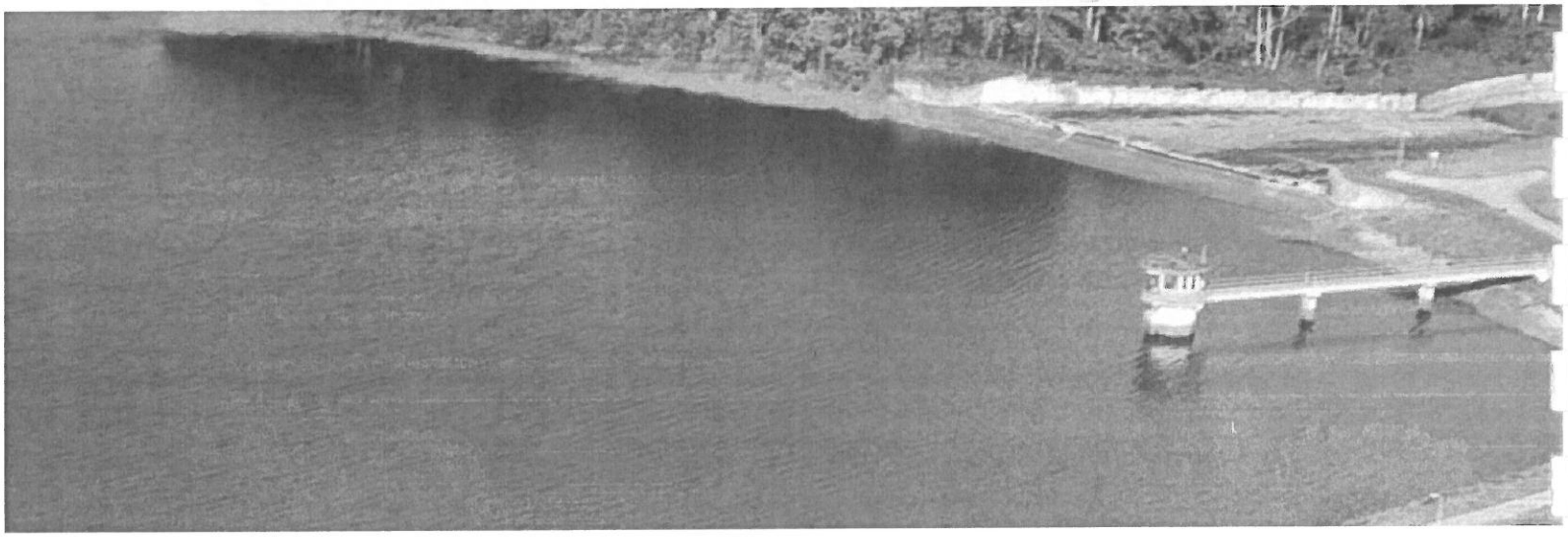
- No. of meters implemented.
- Percentage Reduction in customer usage (583 to 350 per capita)
- Percentage Reduction in Illegal Connections
- # of Industrial Users utilizing alternative water reuse
- % reduction in UFW

Initiatives

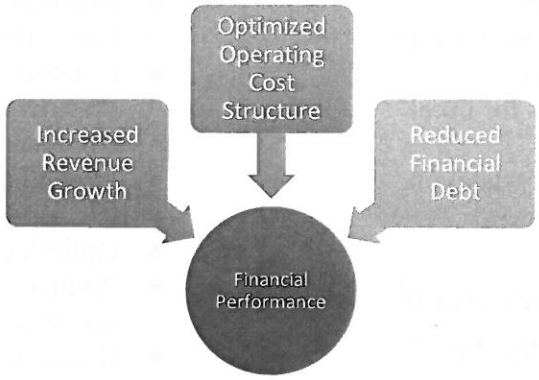
- Phased implementation of residential Metering
- Public education on conservation and demand management process
- Develop and implement policy and procedures for demand management
- Engage in private sector partnership/international funding agencies (IADB) to fund expansion of Residential Metering Programme
- Influence the usage of water efficiency systems through tax incentives.
- Increase penalties (wastage, illegal connections etc.)
- Introduction of water reuse programs for industrial users
- Reduce water loss

Operational Drivers/CSFs

- Government approval for change in policy for metering
- Effective board governance for policy direction
- Executive management for driving the change to demand management philosophy
- Private sector partnerships for funding programme
- Effective relationships with international funding agencies



Strategic Priority: Financial Performance



Desired Result: *Increased revenue growth*

Measures/Indicators

- Annual revenue growth rate
- % revenues from new products and services

Initiatives

- Growth in customer base
- Regular collection drives and increased debt collection
- Develop a new strategy to achieve Tariff review
- Establish new industrial areas for rate categorization
- Develop new products and services such as: bottled water; and specialist services
- Develop and implement a programme to update customer database, regularize illegal connection and re-classify customer accounts and meter commercial customers
- Re-submit application for tariff review to water rate and abstraction rate by Sep 2017

Operational Drivers/CSFs

- Ability to develop new products and/or services (the capacity to innovate)
- Efficiency of work processes
- The ability to sensitize the public to influence desired behaviours such as: timely payment of bills; reduced wastage of water resources; reduced illegal connections

Desired Result: *Reduced financial debt*

Measures/Indicators

- Debt ratio
- Debt to equity ratio
- Capitalization ratio
- Cash flow to debt ratio
- Interest coverage ratio

Initiatives

- Convert the Non-GORTT guaranteed loans to GORTT guaranteed loans
- Up to date external audit of financial statement to facilitate additional bond financing to reduce debt
- Classify outstanding debt to determine statute barred balances

- Seek reduction of interest rates on existing loans

Operational Drivers/CSFs

- The capacity to negotiate with lenders, GORTT, etc.
- Effective processes for fiscal management
- Real time (or timely data) on financial indicators

Desired Result: *Reduced operating cost structure*

Measures/Indicators

- Administrative costs
- Cost of services provided
- Gross margin
- No. of staff per 1000 connection
- % reduction of unaccounted water reduction

Initiatives

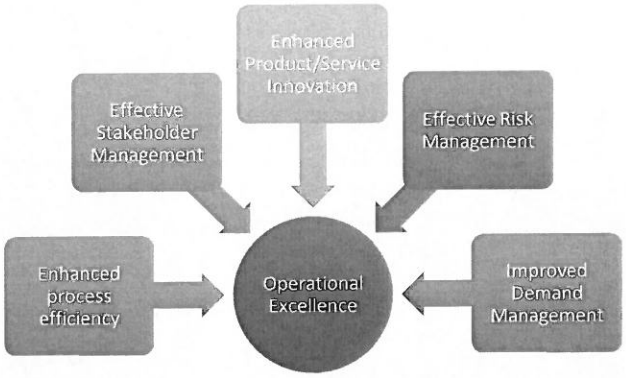
- Reduce # of employees per customer connections
- Audit power consumption at facilities to reduce operating costs
- Assess process efficiency to reduce chemical consumption
- Renegotiate contract with desalination companies to reduce cost
- Introduce technology to automate satellite facilities
- Introduce technology to provide security coverage and reduce static costs
- Review lease arrangements to reduce/rationalize rented accommodations
- Equip in-house resources to provide ground maintenance
- Introduce e-billing to reduce printing and mail/courier costs
- Review job description to allow for PPOs to undertake preventative maintenance
- Reduce demand including introduce low consumption fittings
- Conduct review of internal control systems for key operations
- Right size human capital
- Expand automation system (SCADA)
- Optimize Chemical, and Power
- Reduced water demand to optimize water production costs
- Reduced unaccounted water to lower unrecoverable revenues
- Business process reengineering to enhance process efficiency and lower process costs

Operational Drivers/CSFs

- Executive management
- Human Resources Department

ENABLERS

Structural Enablers: Business Process Excellence



Desired Result: *Enhanced Process Efficiency*

Improving process efficiency will focus on achieving improved management & completion of WASA projects, better alignment between process performance and strategy, improved procurement of goods, works and services that drive quality and customer satisfaction, and improved processes for effective fiscal management.

Measures/Indicators

- % of projects completed on time
- % of projects completed within budget
- % of projects completed to the required quality
- % of core business processes in compliance with set service standards
- % of leaks repaired within 24 hours
- % of permanent Road restoration works completed within 48 hours
- Reduction in breaches of the Procurement process

Initiatives

- Conduct training for staff in project planning and management
- Develop a system for monitoring and enforcement of service standards
- Develop service level agreements (SLAs) between departments linked to core business processes
- Conduct a process review to ensure alignment with the strategic plan
- Review and reengineer where appropriate core business processes that impact the strategy
- Review the current system for procurement against industry best practices with a view to redesigning it in-keeping with best practices
- Develop a system to improve access to expenditure information for better budgetary control and management e.g. Move order reconciliation
- Develop a framework for better collaboration and rationalization of budgets within Divisions
- Review and improve the company's policy on procurement of goods and services

Desired Result: *Effective Customer & Stakeholder Management*

Effective stakeholder engagement is crucial to WASA's success. With a focus on customer and stakeholder management, we seek to improve the effectiveness of customer communications, enhance public awareness and sensitization around responsibility to WASA with respect to timely payment of bills, reducing water wastage, reducing illegal connections, enhancing value from strategic alliances with local and international partners, and improving advocacy with government to achieve the regulatory environment that enables the effective functioning of WASA.

Measures/Indicators

- Annual number of engagement activities by stakeholder category
- % of stakeholders indicating that they feel positively engaged with WASA
- Number of downloads of app and usage
- Social engagement statistics

Initiatives

- Implement effective Social Media Campaign to collect and disseminate information w.r.t. to water services. E.g. Electronic trouble report/leak line "app"
- Conduct regular media updates on major initiatives and projects related to improved water and wastewater services
- Implement effective social and traditional media campaign to improve collections, water conservation and wastewater controls
- Greater community visibility and enforcement of regulations (Water Police)
- Create incentives for customers to conserve water and report illegal connections
- Implement electronic leak detection process
- Adopt government to government alliances, water authority to water authority alliances.
- Design creative ways to engage and lobby government and other stakeholders to help WASA's achieve rate increase goals

Desired Result: *Enhanced Product/Service Innovation*

Currently WASA operates as a cost centre within the current infrastructure of public enterprises in Trinidad and Tobago. It has an expressed desire to operate as a profit centre by: 1) updating the tariff to be in line with international tariffs for water and wastewater services; and 2) diversifying its revenue streams by offering new products and/or services. The latter requires WASA to build adequate capacity for innovation in product and/or service development. As such WASA will embark on a transformation that will see an embrace of an entrepreneurial culture and a culture of innovation.

Measures/Indicators

- % of new product and/or service ideas selected for funding
- Annual number of new product and service ideas per 100 employees
- Annual aggregate $ impact of new ideas
- The benefit/cost ratio of new ideas implemented in each fiscal year

Initiatives

- Utilization of local and regional data for innovation-informed leadership and decision-making
- Application of technology to optimize energy and chemical usage to reduce operating cost
- Conduct extensive training in creativity and problem solving for decision-making staff
- Establish a system that encourage and support staff creativity and application of technical/engineering knowledge to provide day to day solutions to reduce plant downtime and comply with RIC Standards for water and wastewater
- Extend Customer interface for complaints, payments to be responsibility of all staff and utilise technology and e-water payment to increase revenue and customer satisfaction rating.

Desired Result: *Effective Enterprise Risk Management*

Our focus on risk management will see to improve regulatory compliance with water and wastewater quality standards, improve compliance with health and safety standards, enhance business continuity, embed a risk management culture across the company, improve water security and enhance water availability throughout the country.

Measures/Indicators

- % Compliance with Environmental Management Authority (EMA) /Regulated Industries Commission (RIC) standards for WTPs
- % Compliance with EMA/RIC standards for WWTPs
- Accident frequency rate
- Injury Severity Rate
- % close out of recommendations from LTI investigations
- % close out of safety non-compliance
- Annual # of tool box meetings held
- Annual # of safety management walks
- % of facilities with Fire Certificates
- Annual # of drills/emergency exercises conducted
- % close out of recommendations from emergency exercises
- % of Divisions with Risk Registers
- % completion of ERM Programme
- % completion of ERM structure

Initiatives

- Enhance/decentralise laboratory services to water and wastewater Treatment facilities
- Conduct an audit of process efficiency at water and wastewater Treatment facilities
- Establish/strengthen framework for monitoring compliance with EMA/RIC standards
- Meet with RIC to confirm (Overall Water Standards (OWS) & Guaranteed Water Standards (GWS)
- Review and revise policy for adoption and implementation of RIC standards
- Implement safety based performance targets
- Conduct training of all managers and executives on occupational health & safety responsibilities
- Revise job descriptions to include safety responsibilities
- Review and revise collective agreements to include HSE requirements
- Conduct safety orientation and Training for all staff on safety policy and standards

- Develop policy to improve health, safety & environmental Requirements in contracting Services
- Re-Implement safety non-compliance notices
- Implement Safety Incentive Programme
- Implement service level agreements between departments
- Implement disaster preparedness and business continuity plan
- Integrate IT business continuity with organizational BC plan
- Development and implementation of Divisional risk registers and Response plans
- Develop and implement risk Management program
- Establish risk management structure as per approved ERM policy
- Develop risk based performance targets for divisional managers

Desired Result: *Effective Demand Management*

Historically we have focused our water management activities on the supply side. We will pursue a complementary strategy of managing the demand for water and wastewater services as part of our approach to water security.

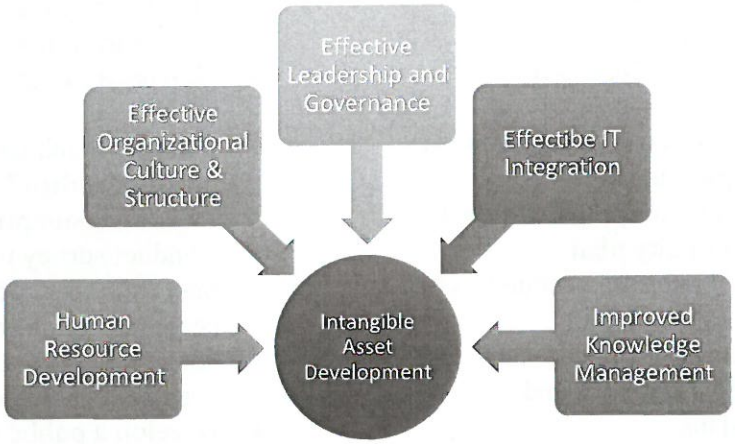
Measures/Indicators

- Annual level of non-revenue water
- Per capita consumption
- No. of visible leaks
- Chemical consumption per m3 production
- Output/input of plant
- Level of industrial effluent

Initiatives

- Implement bulk metering of sources and transmission mains
- Universal metering for billing and monitoring
- Pressure management - reduction of pressure at distribution system to reduce consumption
- Conduct survey to update customer base (correct account type, no of accounts, identify illegal connections) for accurate billing and consumption pattern
- Develop a public education campaign promoting the benefits of water conservation using low flow fixtures
- Develop a progressive tariff structure to recover cost and promote conservation
- Introduce incentives to conserve water
- Advocate for government incentive to facilitate the use of low flow fixtures
- Promote rainwater harvesting for domestic customers by education
- Promote recycling of water by customers
- Conduct study to determine areas of major leakage mains and its cause
- Wastewater discharge loading
  - Enforce water pollution rules
  - Enforce the trade effluent standards
  - Monitor grease traps
- Improved plant efficiency

Infrastructural Enablers: Intangible Asset Development



Desired Results: *Human Resource Development*

HR is a critical asset for any corporate strategy. Human resource development in the context of our strategy will seek to Improve the skills and capacity among construction, repair, and maintenance crews, strengthen leadership capacity in managing for performance and management of change, and enhance our capacity in managing for environmental sustainability.

Measures/Indicators

- Percentage of the workforce with the required strategic skills
- Percentage of leaders with the required competency in performance and management of change
- Percentage of staff with the required competency in managing for environmental sustainability
- # of employees per water connections

Initiatives

- Establish the required competency standards for construction, repair and maintenance crews
- Assess competency of the construction, repair and maintenance crews against the competency standards
- Conduct continuous Construction/Repair/Maintenance training programme and implement interventions based on identified gaps from the competency assessment
- Establish the leadership attributes and behaviours required for performance and change management
- Assess leadership capabilities based on requirements and determine gaps
- Conduct continuous Leadership Development programme and implement interventions based on identified gaps
- Identify environmental sustainability and capacity requirements
- Conduct assessment of the capacity to manage for environmental sustainability
- Conduct continuous environmental sustainability training programme and implement interventions based on identified gaps

Desired Result: *A strategically aligned organizational culture and structure*

Successful strategy implementation is not possible without an alignment of culture and structure. We will work towards establishing a strong customer-centric culture as part of the DNA of WASA employees, improving inter-departmental collaboration and cooperation, creating the cultural shift to demand management, adopting a strategic shift to value for a "value for money culture", developing a values-based culture, and adopting a strong performance-based culture.

Measures/Indicators

- % of customers rating WASA's culture as customer-centered
- Internal customer satisfaction rating
- Level of compliance with inter-departmental service level agreements
- Core Values Index
- % staff that meets minimum standard of performance reflecting care for customers on performance appraisals
- Degree of Structure-Strategy Alignment

Initiatives

- Develop and implement customer Care Policy and procedures.
- Retrain all staff on Customer Care Policy & Procedure
- Establish customer care performance targets for divisions
- Review organizational structure of customer care to realign with operations division
- Implement Programme for "One WASA"
- Develop and implement a "Relationship Building" plan
- Train all employees on use of core values of ethical conduct in decision making
- Create a corporate value index (CVI) on ethical conduct & core values
- Enhance annual compliance survey to include core values on ethical conduct
- Amend the performance appraisal system to include new core values
- Conduct customer survey on Organizational performance
- Establish and publish corporate performance dashboard
- Create performance bonus system for departments
- Introduce performance monitoring and evaluation unit to continuous assess organizational performance

Desired Result: *Strategic Leadership and Governance*

With the Board's responsibility for oversight, we will focus on enhancing Board governance and improving Board effectiveness in its strategic oversight role

Measures/Indicators

- Compliance with Best Practices
- 360 Evaluation with Management

Initiatives

- Adoption of Best Practices on Board Governance
- Develop required Board and management level policies
- Conduct Training and professional development for Board in Corporate Governance
- Develop Board Charter and conduct annual Board evaluations

- Develop a Board Strategic Oversight Process

Desired Results: *Enhanced ICT Integration*

Our desire to have a strong performance-based culture rooted in operational excellence will require that we leverage technology in all our core business processes. As such, we will expand our efforts in ICT integration to ensure that we transform WASA into a highly technology-enabled business.

Measures/Indicators

- Number of applications that share information seamlessly (number of applications integrated)
- Number of new ICT-enabled services
- % of core business processes that leverage ICT
- Annual savings attributed to ICT
- % of operating budget allocated to ICT integration

Initiatives

- SCADA integration i.e. centralize the automation of all facilities whereby remote monitor and operations are possible thereby improving the operational efficiency
- Change out legacy software system i.e. outdated applications
- Data cleansing i.e. establish referential connection, correction and structure of data input
- Review and identify core processes for ICT integration
- Harmonize/standardize ICT platforms across WASA

Desired Result: *Knowledge Management*

The availability of good and timely data information for decision making is crucial to the success of the strategic plan. We will ensure the creation and dissemination of critical information when and where needed to facility effective implementation of the strategic plan.

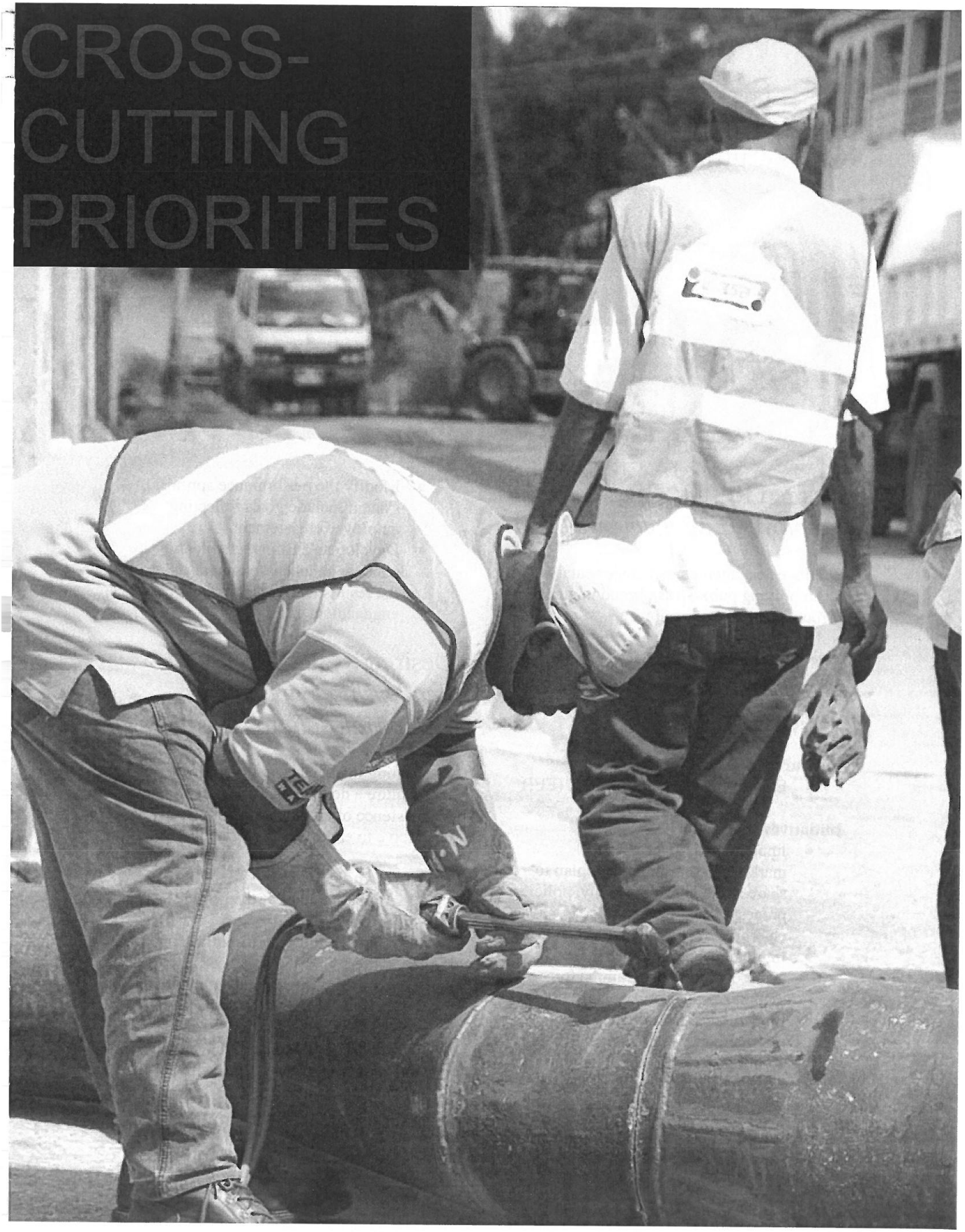
Measures/Indicators

- Information accuracy and quality
- Information timeliness
- Degree of availability of information for decision making
- Ease of access to information for decision making

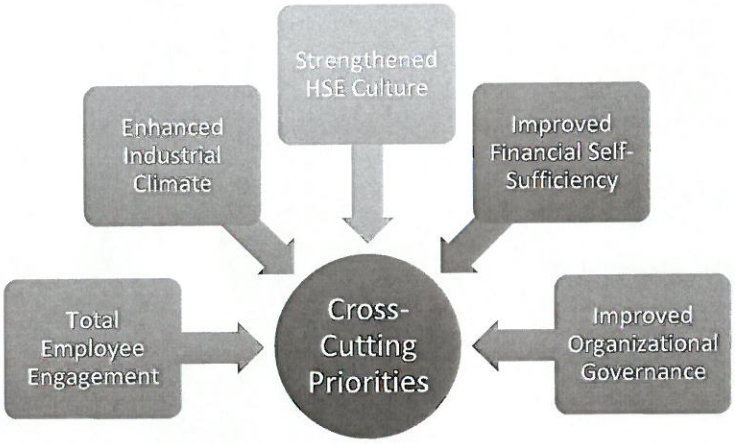
Initiatives

- Integrate existing business software to make data accessible enterprise wide
- Set-up a Steering Committee to identify, collect and validate key strategic and operational data and update existing business software
- Develop capacity in data analytics, business intelligence, metrics and information-driven decision making
- Develop and implement a system of corporate and departmental dashboards for keeping employees informed of WASA's performance

CROSS-CUTTING PRIORITIES



Cross-Cutting Priorities



Desired Result: *Total Employee Engagement (TEE)*

Employee engagement is a major catalyst for improving public trust, brand image, corporate social responsibility, a collaborative organizational culture, and improving employee morale and productivity. During the planning cycle, we will commit to improving employee engagement.

Measures/Indicators

- Employee Engagement Index (EEI)

Initiatives

- Implement an internal marketing/communication plan to share strategies, philosophy, policies, processes, and performance enterprise wide.
- Implement an employee incentive and recognition programme to recognize and motivate staff.
- Implement a performance management system to achieve corporate objectives and support the development of all employees
- Modify the performance appraisal system include goals reflecting employee engagement
- Develop an EEI instrument and conduct annual assessments using the results to drive the employee engagement strategy

Desired Result: *Improved Leadership Capacity & Industrial Relations*

Succeeding in developing the strategic plan will require a devolution of leadership and the existence of an industrial climate that is conducive to employee performance.

Measures/Indicators

- Annual number of employee grievances
- Annual number of disciplinary matters
- Number of health and safety issues
- Level of employee absenteeism
- % of employees rating the industrial climate favourably
- % of employees who have received leadership training

Initiatives

- Develop a leadership development plan focusing on industrial relations, financial management and employee Supervision
- Develop a mentorship program involving senior managers mentoring middle managers
- Develop a talent management plan to expand the leadership capacity within WASA
- Establish a practice of monthly non-crisis meetings with the union
- Implement an effective performance appraisal system
- Train all managers in industrial relations and industrial law

Desired Result: *Strengthened HSE Culture*

The nature of WASA's operations is such that employees, particularly those who do field work are constantly exposed to health and safety risks. The health, safety and welfare of every employee is important to WASA. As such, as we undertake major initiatives which involve infrastructure projects, HSE must be a concurrent priority.

Measures/Indicators

- # of management-led safety briefings/talks
- reduction in HSE incidents
- % of employees fully aware of HSE policies
- % compliance with HSE policies

Initiatives

- Identify and implement safety based performance targets for departments
- Implement a safety incentive programme
- Conduct an HSE audit to identify "Hot Spots" for corrective action
- Mandate departments to report monthly HSE performance indicators
- Create and publish a corporate dashboard on safety performance

Desired Result: Financial Self-Sufficiency

WASA's drive towards financial self-sufficiency will necessitate a system wide effort to identify opportunities to can lower costs while enhancing revenues. In-keeping with the GORTT's desire to wean WASA off the public purse, we will engage this issue with a full-throttle approach.

Measures/Indicators

- Profitability
- Positive cash flow
- % debt reduction
- % of operating OPEX requested from GORTT

Initiatives

- Develop the business case and corresponding advocacy strategy for a tariff increase
- Implement universal metering to maximize revenue collection
- Develop a cost containment strategy focused on reducing operating expenditure
- Develop a demand management strategy focused on reducing UFW, water leaks, and water consumption
- Improved operational efficiency by redesigning costly processes. E.g. consider the development of a *zero-paper* strategy - going paperless
- Develop a strategy for increasing the collection of outstanding rates
- Leverage employees' creative capacity to produce new revenue generating ideas for products and services

- Develop a strategy for water reuse commercial sectors such as the use of processed wastewater for farming, washing the fascia of commercial buildings, vehicles, cleaning industrial sites, etc.

Desired Result: Enhanced Organizational Governance

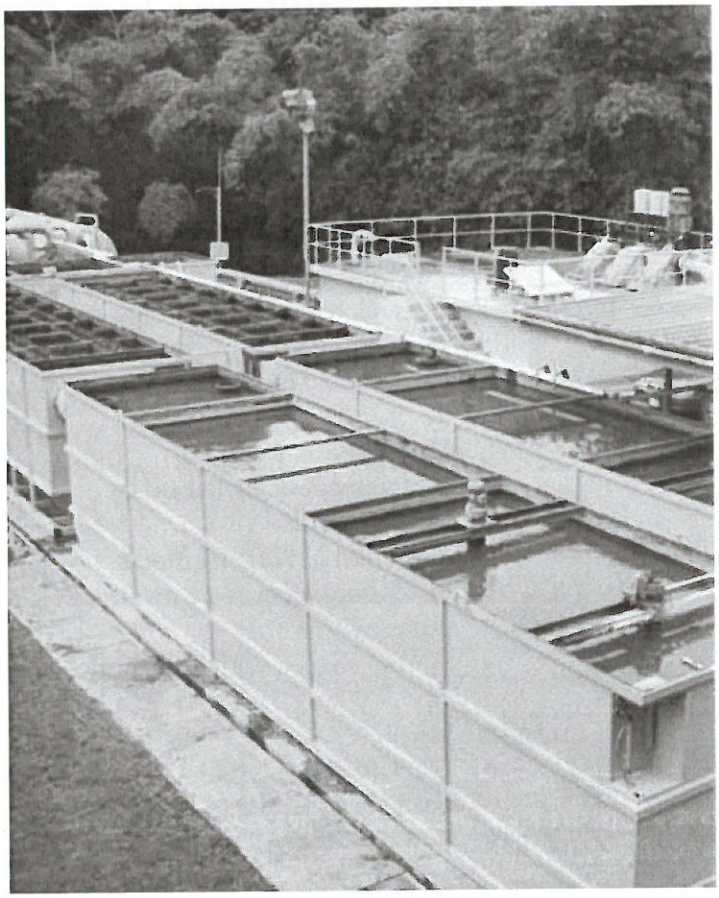
The way WASA is governed, not in terms of its policy structure, but rather in terms of its tone, interpersonal relationships, delegation of authority, and the like, can have a profound impact its ability to achieve the goals set out in the plan. There is a need for a kinder gentler WASA that encourages a greater nurturing spirit, a set of familial relationships that will have employees looking out for each other. To that end, we will pursue the correct balance between the firmness that drives accountability and the softness that drives cooperation and engagement.

Measures/Indicators

- Percentage improvement on the Governance Maturity score
- % of employees satisfied with the tone and attitude of those in authority
- % of employees rating WASA as a kind and caring organization

Initiatives

- Implement framework for the delegation of authority articulating a philosophy of executive management stewardship that reflects a spiritual ethos and kindness
- Adopt and implement NACD governance assessment maturity model to rate organizational governance
- Conduct governance assessment and identify recommendations for improvement
- Champion initiatives to strengthen corporate governance in the organization
- Develop an internal service charter that articulates the desired relationships between employees
- Develop a strategy for creating a values culture at WASA

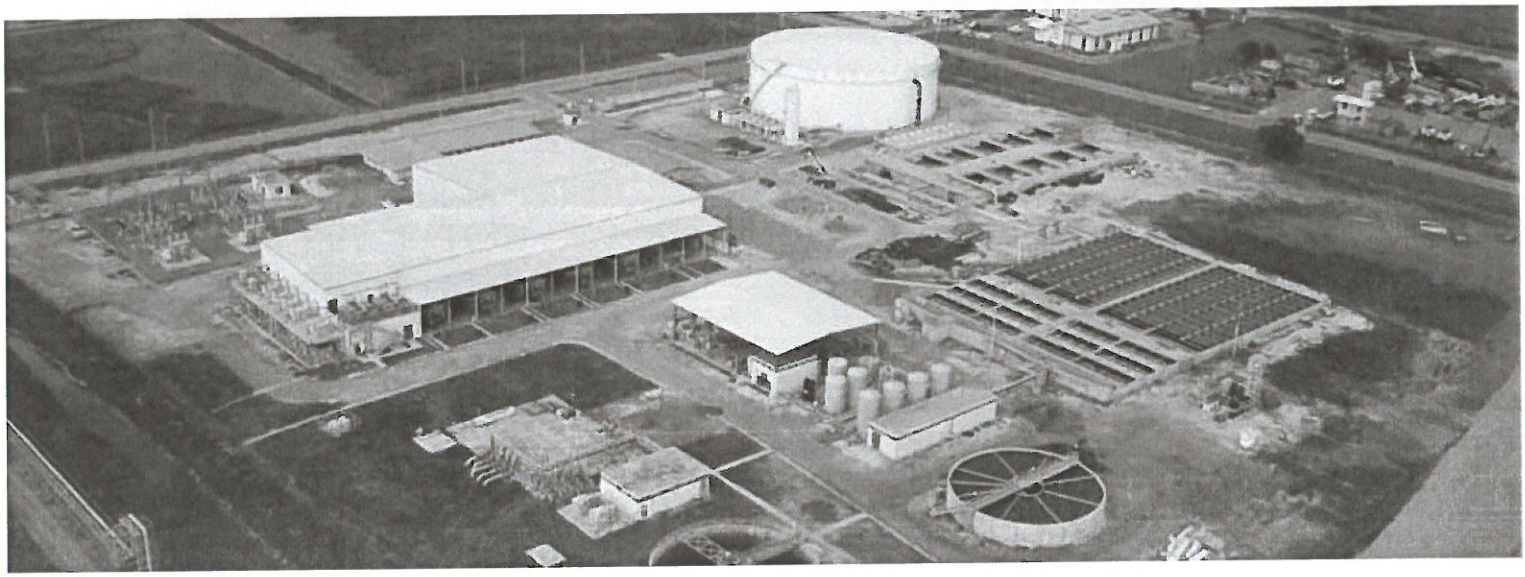


Risks to the Strategic Plan

All strategic plans inherently involve both science and art and are typically based upon several assumptions about the cause and effect relationships, the availability of financial resources, leadership capacity and competence, support from stakeholders, etc. As such, there is a real likelihood that some of the desired outcomes may not be achieved. Maximizing the chances of success for the plan requires an identification of some of the risks and developing where possible contingency strategies. The table below summarizes some of the keys risks to our strategic plan.

Risk	Possible Mitigation Strategies
A lack of leadership will among Board and senior management to implement the entire plan can result in partial, suboptimal execution. Such an approach creates missed opportunities for harnessing synergy between priorities, and missed opportunities for collaboration and partnership with national and international organizations.	Senior leaders and the Board of Commissioners should review and vet the plan to ensure that the plan can be implemented and that the strategy map has integrity. Senior management offers its views to the Board for consideration. The Board after deliberation formally approves the plan an establishes an oversight framework for the plan to hold senior leadership of WASA accountable for its implementation.
Inadequacy of the legislative instruments (The ACT of 1965)	Conduct a review of the ACT and determine the extent to which the ACT is a constraint on the plan. Prepare amendments to the ACT for consideration by Parliament.
Failure to align the structure of WASA with the needs of the plan resulting in a lack of appropriate accountability centres for the inherent priorities	Ensure that every strategic priority has an accountability centre. Review the structure of the WASA and where necessary, make recommendations for structural changes that will lead to greater efficiency and accountability. Consolidate job functions as well as consider consolidation of internal units to bring about improved alignment between the plan and the organizational structure.
Inadequate capacity, capability, and resources at WASA	Conduct a capacity and capability audit of the various accountability centres implicated by the strategic plan. Develop a capacity building strategy (training, reassignment of staff, consolidation of units/departments, etc.) to create the internal capacity needed to drive the plan
Ineffective stakeholder engagement and buy-in. Failure to communicate the plan to critical stakeholders will result is disengagement which can negatively impact areas where partnerships with stakeholders are crucial to success	Develop a stakeholder engagement strategy that focuses on both communication for information purposes as well as their involvement as partners in execution. Stakeholder partnership networks (SPNs) can be established with different market segments. These networks can be setup informally, but should have an operating charter that defines their role in supporting WASA.

Risk	Possible Mitigation Strategies
Inexistent or ineffective monitoring and evaluation of the strategic plan	The absence of a performance monitoring and evaluation system will create a form of "blindness" where both the Board and the senior leadership will have no information on the effectiveness of the plan, its accomplishments, and the return on strategic investments. This situation makes it impossible to undertake course correction activities when particular strategies are being ineffective. The lack of information makes it easy for both the senior management team (SMT) and the Board to abandon the plan. Further, without the M&E framework, it becomes near impossible for the Board to hold the SMT accountable for results. To avert this disaster, WASA will ensure that it adopts a best practice model referred to as "Managing for Results" which has an inherent monitoring and evaluation framework. This model lays out a cycle of activities for managing execution as well as a requirement for annual reporting on the strategic plan.
Failure to develop a formal execution strategy within WASA – a strategy that establishes an appropriate execution process, alignment of the organizational structure, creates an execution culture, and provides a system of incentives to drive execution.	Establish a formal process for execution with a clearly defined annual timetable of activities in support of execution - activities such as: communicating with stakeholders; developing the annual performance plan; developing the program budget; data collection and analysis; annual performance reporting; reviewing and updating the plan; communicating the changes to the plan; and lobbying the political directorate for support. Ensure the execution strategy is fully and extensively communicated to all critical partners in the execution process. There is a need for transparency with respect to implementation so that there is a shared understanding of the rollout of the plan. Review and align the structure, culture, and incentives in order to support the plan.



The Way Forward

There is an adage that stipulates, "*if we fail to plan, we* plan *to fail*". This document reflects the outcome from a planning process that attempted to leverage the collective wisdom of the Board, senior management team, and the employees of WASA. The ideas and recommendations are influenced by our current state of knowledge, our sense of the current state of our operating environment, and our sense of the future that lies ahead. While we have put our best thoughts forward, we understand that the strategic plan is a living document: one that must be challenged on an ongoing basis (for while strategy can be planned, it can also be emergent), and one that must be updated as our various assumptions are validated or invalidated. Also, as new information becomes available, we must be prepared to re-evaluate our decisions and make the necessary changes that will allow the strategic plan to stay on course. In all we do, we will remain steadfastly committed to our mission, vision, value propositions, and values principles.

We will continue to strive to be in the company of "*best-in-class*" water utilities regionally and internationally. To that end we will benchmark our performance against universally accepted water and wastewater standards. As we forge ahead, we will do so as a massive multi-dimensional organization working towards a common purpose supported by our customers, partners, stakeholders and our communities.

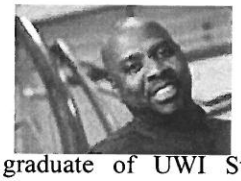
Board of Commissioners of WASA

					
Romney Thomas	Richard Jones	Gayle Daniel-Worrell	Ramaysh Kalipersad	**William McKay**	Wayne Mohan

Participants

Name	Position	Name	Position	Name	Position
Romney Thomas	Chairman	**Richard Jones**	Deputy Chairman	**Gayle Daniel-Worrell**	Commissioner
Wayne Mohan	Commissioner	**Alan Poon King**	Chief Executive Officer (Ag.)	**May Ann Diaz**	Director, Human Resources (Ag.)
Leon Elliott	Director, Corporate Services (Ag.)	**Denise Lee Sing Pereira**	Director, Programmes and Change Management (Ag.)	**Dion Abdool**	General Counsel & Corporate Secretary
Keith Meade	Head, Water Resources Agency (Ag.)	**Daren Gazee**	Head Water Projects (Ag.)	**Paula Maria Fortune**	Head, Legal Services
Peter Hackett	Head, Tobago Region (Ag.)	**Eric Lewis**	Head, Technical Services	**Glason Gurusaransingh**	Head, North Region (Ag.)
Donna Friday-Cole	Senior Manager, Corporate Secretariat and Governance (Ag.)	**Roger Karim**	Senior Manager, HSE	**David Nero**	Senior Manager, Engineering & Design
Ramaysh Kalipersad	Commissioner	**William McKay**	Commissioner	**Anand Jaggernath**	Head, South Region
Sherland Sheppard	Director, Operations (Ag.)	**Rachelle Wilkie**	Director, Finance (Ag.)	**Aldwin Browne**	Head, Logistics (Ag.)
Penelope Williams	Head, Internal Audit & Compliance	**David Benny**	Head, Research and Development	**Giselle Spence**	Senior Manager, Payments, Treasury, Financial and Capital Reporting (Ag)
Ronnie Spencer	Head, Workforce Planning and Organizational Development (Ag.)	**Dial Ramkissoon**	Head, ICM & Transport	**Anthony Chadee**	Senior Manager, Disaster Preparedness

The Consultant



Dr Harvi H. Millar Ph.D., P.Eng., is a son of the Caribbean (St. Lucian and Barbadian heritage) currently residing in Canada. He is a graduate of UWI St. Augustine (Hons.) and is currently a full-professor in the Sobey School of Business at Saint Mary's University in Nova Scotia. An industrial engineer by training, Dr. Millar's 25+ years of experience both as a consultant and an academic has made him a sought-after consultant for organizations looking to take their operations to the next level of performance. He specializes in strategic planning and formulation and implementation, performance management, organizational design, productivity and process improvement, governance improvement, and human resource development (training). He wrote a strategic planning handbook for CARICAD to be used by public sector managers throughout the entire Caribbean. He also developed a performance management model for Service Nova Scotia, a major Division of the Government of Nova Scotia. Dr. Millar has also facilitated and authored strategic plans for several organizations in the Caribbean including: St. Lucia Electricity Services limited (LUCELEC); St. Lucia Air and Seaports Authority (SLASPA), Sir Arthur Lewis Community College (SALCC), The National Insurance Company (NIC), Courts (St. Lucia) Limited, St. Jude Hospital (SJH), the St. Lucia Water and Sewerage Company (WASCO), Massy ST. Lucia, Government of the BVI, Government of St. Vincent and the Grenadines among others. Recently, Dr. Millar facilitated and authored the Education Sector Strategy for Saint Lucia. He has also provided governance evaluation services to organizations such as St. Lucia Electricity Services Ltd., First Citizens Bank of Trinidad and Tobago, St. Jude Hospital (St. Lucia), East Caribbean Financial Holdings (ECFH), and the Council on African Canadian Education in Halifax, Nova Scotia.

APPENDIX V

SUBMISSION FROM MINISTRY OF RURAL DEVELOPMENT AND LOCAL GOVERNMENT DATED FEBRUARY 12, 2020

The Government of the Republic of Trinidad and Tobago

MINISTRY OF RURAL DEVELOPMENT & LOCAL GOVERNMENT

MRDLG Ref.: 7/17/4

February 12, 2020

The Secretary
Joint Select Committee on Land and Physical Infrastructure
Parliament of the Republic of Trinidad and Tobago
Office of the Parliament
Parliamentary Complex
Cabildo Building
St. Vincent Street
Port of Spain

Attention: Ms. Angelique Massiah

Dear Madam

Re: Inquiry into measures for ensuring water security in Trinidad and Tobago

Reference is made to the matter at caption and to your correspondence: ***Parl: 14/3/46-13 Vol. I,*** dated January 30, 2020.

This is to inform you that soft copy of the information sought by the Joint Select Committee on Land and Physical Infrastructure is hereby submitted to you via as requested via email. The twelve (12) hard copies of this document will be delivered by hand to your office shortly.

Thank you.

Permanent Secretary
Ministry of Rural Development & Local Government

Permanent Secretary
Ministry of Rural Development
and Local Government

Office of the Permanent Secretary
Kent House, Long Circular Road, Maraval, Trinidad W.I.
Tel/Fax (868) 622-7410 / 622-1979 Ext 3202/3207 E-mail: localgovps@gov.tt
Like and Follow us on Facebook: https://www.facebook.com/MOLGTT

MINISTRY OF RURAL GOVERNMENT AND LOCAL GOVERNMENT

A RESPONSE TO THE JOINT SELECT COMMITTEE ON LAND AND PHYSICAL INFRASTRUCTURE

Inquiry into measures for ensuring water security in Trinidad and Tobago

Current Measures for ensuring Water Security

i. Describe the Ministry of Rural Development and Local Government's (MoRLDG) role in water security.

Response

The National Integrated Water Resources Management Policy Draft (2017) defines water security as:

> *"The capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability."*

According to the Food and Agriculture Organization of the United Nations, this definition implies that water is managed sustainably throughout the water cycle and is done so through an inter-disciplinary focus, so that it contributes to socio-economic development and reinforces societal resilience to environmental impacts and water-borne diseases without compromising the present and future health of populations and ecosystems.

The Ministry of Rural Development and Local Government (MoRDLG) is fully cognizant that the inability of burgesses to access potable water for daily life can severely impact human well-being. Local governance in Trinidad is facilitated through the fourteen (14) Municipal Corporations. These bodies, however, are legislatively governed by the Municipal Corporations Act which makes provision (under Section 232 (a)) for the distribution of truck borne water subject to the provisions of the Water and Sewerage Act.

Truck borne water distribution is carried out by virtually all Municipal Corporations where policies are formulated to supply water to the most vulnerable organizations and burgesses. These include educational institutions, health centres, police stations and other service organizations with high sanitation requirements. This type of service would typically engage water tenders belonging to the Corporations accessing water at hydrants and pumping stations under the jurisdiction of the Water and Sewerage Authority. However, some Corporations are afforded funding under an annual recurrent water trucking line item primarily because of the extent of rural communities which are devoid of a pipe-borne supply. Based on the magnitude of this exercise, particularly during the dry season, the services of contractors are procured. The trucks used in these operations are subjected to mechanical inspections while the water tanks are closely examined by public health officers to ensure that the water being distributed is not contaminated.

Another element of water security lies in the ability to cope with uncertainties and risks of water-related hazards, such as floods, droughts and pollution, among others. To this end, the MoRDLG operates in alignment with the Disaster Measures Act 1978 where Disaster Management Units are established at the fourteen (14) Municipal Corporations to serve as first responders to hydrometeoriological and other disastrous events. Moreover, within recent times a Disaster Management Coordinating Unit/ Emergency Operations Centre has been instituted at the MRDLG's Head Office at Kent House, Maraval, to improve the efficiency and effectiveness of the response and recovery mechanism in collaboration with other state and non-state agencies.

The MRDLG through the Municipal Corporations indirectly contributes to the improvement of water quality by reducing pollution, eliminating indiscriminate dumping, and minimizing the release of faecal and other hazardous waste into water courses. The implementation of such measures is addressed by the Corporations' Public Health Departments as well as their Building Inspectorates during the building application process.

ii. What are the arrangements in place between the Regional Corporations and the Water and Sewerage Authority (WASA) to provide truck-borne water to communities in time of crisis?

Response

There is close collaboration between WASA and Municipal Corporations to facilitate/augment the needs of burgesses in time of crisis where WASA permits the Corporations' water tenders and approved contracted water tenders to access water from its hydrants/pumping stations.

An example of such a collaborative effort occurred between the Penal/Debe Regional Corporation and WASA over the period October 07 – 15, 2019, during the shutdown of the Point Lisas Desalination Plant. This resulted in two hundred and seventy four (274) households located in high point areas in both the environs of Penal and Debe being distributed with seventy two hundred (7,200) gallons per day during that period.

iii. **Will the Regional Corporations charge citizens for truck-borne water supply in the time of a crisis?**

Response

Being service-oriented organizations, it has never been the policy of the Regional Corporations to charge burgesses for truck-borne water in times of crisis, or any other time for that matter. It is not anticipated that such a policy will change in the future.

iv. Has the MoRDLG received applications for approval for developments containing construction for rain/storm water harvesting systems such as cisterns? If so, please provide the Committee with the approximate number of approvals.

Response

All Municipal Corporations have indicated that no such applications were received for the construction for rain/storm water harvesting systems.

Measures Required For Improving Water Security

v. Describe the measures required for ensuring water security

Response

Encouraging and educating all sectors to include water security in their policies and strategies is critical to sustainable management of water and climate variability. For example:

1. Public health: Mandated to address safe water, environmental sanitation and human hygiene;
2. Economic growth: Income generation heavily rely on water availability for agriculture, energy production, and other livelihood activities;
3. Environmental sustainability: Natural ecosystems rely on water and rapidly deteriorate when deprived of natural flows;
4. Disaster risk reduction: Floods and landslides can be catastrophic events affecting lives and local economies.

Specific interventions which can be adopted to facilitate water security include:

- Construction and management of water-course diversion (weirs & barrages), storage (retention and detention ponds, dams), conveyance (canals, pipes, gates and valves);
- Improved organisation and management of water structures and systems (asset management leak detection, metering);
- Climate-proofing of infrastructure;
- Agroforestry;
- Afforestation and forest conservation;
- Restoration and conservation of wetlands and/or costal ecosystems;
- Vegetation/ bio-structural engineering for river bank or slope stabilisation, erosion control, fisheries and biodiversity;
- Storm water management (reduction of runoff and sedimentation) and river and floodplain management (riparian buffers, controlled flooding, levee set-back/removal);
- Awareness raising and social marketing campaigns (regarding water security risks, improved water use behaviours and practises);
- Capacity building of water users (soil and water management for farmers);
- Livelihoods diversification;
- Collective action, community mobilisation (riverbank or pond clean-ups, waste and wastewater recycling and reuse);
- Education and curriculum development on water security;
- Organisational change management.

vi. Does the country have enough reservoirs to supply the nation in a time of crisis?

Response

The MoRDLG is not in a position to provide an informed response to this question.

vii. What institution agreements are necessary to prevent a water crisis?

Response

Some institutional measures necessary to prevent a water crisis include:

1. Enforcement of water and related laws, by-laws, policies;
2. Preparation and implementation of water security action plans
3. Monitoring and regulation of water services (e.g. data collection, storage analysis);
4. Timely collection of water rates;
5. Engagement of local leaders, farmers and business managers to understand their needs and priorities;
6. Inclusion of community based organizations, electronic and print media, social media, and schools to streamline water utilization methodology.

viii. What are the implications to encourage the use of underground cisterns to retain water from rainfall for consumption?

Response

Cisterns are primarily used for storing water for domestic and other purposes. A system of gutters and downspouts directs the rainwater collected by the roof to these receptacles which are typically located underground. They may be constructed using cinderblock, reinforced concrete, precast concrete, fibreglass or steel. The cistern supplies water to the household through a standard pressurized plumbing system.

The immediate implication is that the cost factor in the installation of cisterns domestically. Additionally, cisterns must be designed appropriately to allow entry for inspection, maintenance and sanitizing. Site suitability/feasibility analysis, soil testing and catchment analysis are also major considerations prior to design and construction. It is to be noted that the maintenance of underground cisterns may be most challenging while the treatment of water (for human consumption) will require careful monitoring and vigilance. Notwithstanding the above, the use of underground cisterns is encouraged in areas devoid of pipe-borne water and where agricultural activities take place on a relatively large scale.

Challenges

ix. Describe the challenges associated with ensuring water security in Trinidad and Tobago.

Response

Securing water is a multi-faceted issue which depends on several elements which require long-term coordinating efforts and integration among stakeholders. Challenges associated with ensuring water security in Trinidad and Tobago include:

1. Lack of a proper institutional framework to address water resources management;
2. Degradation of watersheds, soil erosion, landslides and flooding due to indiscreet quarrying operations, deforestation, planned and unplanned developments, indiscriminate hillside clearing for agriculture, and poor solid waste disposal practices;
3. A growing population, increase in housing developments and increased industrial activities;
4. Degradation of wetlands, coastal ecosystems and habitats;
5. Pollution of watercourses due to malfunctioning wastewater treatment plants, pesticides, herbicides and industrial waste;
6. Ageing and deteriorating water infrastructure;
7. Impacts of climate change in relation to temperature increases, changes in precipitation and sea level rise;
8. Water management regulations for agriculture (cultivation and livestock) during periods of water scarcity.

x. What is being done to address these challenges?

Response

The MoRDLG is not in a position to provide an informed response to this question.

xi. Describe the consequences associated with the withdrawal of water from natural sources, river widening, installing storm water management infrastructure?

Response

The impact of water withdrawals becomes a concern when the rate of withdrawal exceeds the replacement of water. This can lead to both water quantity (shortages) and negative environmental impacts.

Withdrawal from a river can reduce the water level and flow of a stream at the withdrawal point, impact its natural condition, and affect the water-fed ecology and environment. The impacts will be different based on the size, depth, and flow of the stream. Additionally, withdrawal of water from natural sources disrupts the natural water cycle.

River widening increases the catchment area thus increasing the volume of water in the river. River widening also lowers flood water levels hence lowering flood probabilities. The rate of

flow of the river is also reduced when a river is widened. However, it should be noted that one major limitation to river widening by Municipal Corporations is the existence of squatting communities along river banks/reserves which prevents the action of dredging and widening in key areas.

xii. Describe the challenges with ensuring the availability, accessibility, quality and safety of water during a crisis.

Response

The dry season in Trinidad and Tobago on an annual basis contributes to what may be deemed to be a water crisis for many citizens. Many Municipalities are severely affected by a drastic reduction in the water supply from WASA during this period. Limited or no rainfall also affects sectors of the population which are reliant on roof storm water that are collected in tanks. The consequences of the above include loss of productive time, adverse effects on those involved in the education system and public health concerns (including health challenges arising from the use of water from unsafe sources). As was hitherto mentioned, some Municipal Corporations are allocated funding to facilitate truck borne water distribution to burgesses in areas devoid of a pipe-borne supply. However, there is always the complaint from these bodies that such funding is hardly ever adequate to satisfy the great demands.

The non-diversified access to water can also lead to sole reliance on pipe-borne water in many homes and businesses. This has the potential to be disastrous during water distribution system interruption, particularly for extensive periods.

APPENDIX VI

SUBMISSION FROM MINISTRY OF PLANNING AND DEVELOPMENT DATED MARCH 6, 2020

MINISTRY OF PLANNING AND DEVELOPMENT
OFFICE OF THE PERMANENT SECRETARY

Level 14, Eric Williams Financial Building, Independence Square, Port-of-Spain, Trinidad and Tobago, WI
Tel: 612 3000 ext. 2016/1329 Fax: 623 8123

PL&D: 6/12/3 Vol. VI Temp.

March 6th, 2020

Ms. Angelique Massiah
Secretary
Joint Select Committee on Land and Physical Infrastructure
Office of the Parliament
Parliamentary Complex
Cabildo Building
St. Vincent Street
Port of Spain

Dear Ms. Massiah,

Response to the Joint Select Committee on Land and Physical Infrastructure – Inquiry into Measures for Ensuring Water Security in Trinidad and Tobago.

Reference is made to your letter dated January 30, 2020 on the captioned subject.

In this regard, please find attached twelve (12) copies of the Ministry of Planning and Development's responses to the requested information.

I apologize for the delay in responding to your information request and regret any inconvenience caused by the delay.

Sincerely,

Joann Deoraj

Permanent Secretary
Ministry of Planning and Development

Enc.

PL&D: 6/12/3 Vol. VI Temp.

Responses to the Joint Select Committee on Land and Physical Infrastructure – *Inquiry into Measures for Ensuring Water Security in Trinidad and Tobago.*

SECTION: ISSUES, QUESTIONS AND RESPONSES

ISSUE:

1. **To examine the current strategies for ensuring water security and the effectiveness of these strategies;**

Current Measures for ensuring Water Security

(i) Question:

Describe the MoPD's role in ensuring water security.

Response:

The Ministry of Planning and Development and by extension the Town and Country Planning Division (TCPD) recognizes that whilst Trinidad and Tobago is reasonably well endowed with water resources, a number of water related challenges resulting from issues such as increased industrial activity, climate change and variability, and changing demand for water must be addressed.

The TCPD recognizes that these issues are intrinsically linked to land use planning and they are clearly articulated in the National Spatial Development Strategy (NSDS). The NSDS advocates for development that contributes to conservation and optimizing water resources. Hence, policies of the TCPD include:

- preservation of significant water recharge areas under vegetative cover;
- requirements for the recycling and reuse of waste water for non-potable water demands such as watering of lawns and plants; and
- maximizing of the land space in proposed developments that must be retained under vegetation.

Therefore, conditions attached to proposed development applications include requirements for water recycling and reuse, provision of detention and retention ponds, and the minimizing of building coverage while maximizing provision of open space and landscaping.

The TCPD also works collaboratively with other Government Agencies and stakeholders to help safeguard the natural environment and ensure water security. Among them are the Water and Sewerage Authority (WASA), Environmental Management Authority (EMA) and the Water Resources Management Unit of the Ministry of Public Utilities. This collaboration includes obtaining advice where necessary, referral of development applicants to the Agencies and the coordinated development of policy and procedures related to planning in respect of water supply, waste treatment and water quality issues.

The Ministry of Planning and Development (MPD) is also responsible for the overall management of the projects/programmes that comprise the Public Sector Investment Programme (PSIP). More specifically, the role of the Project Planning and Reconstruction Division (PPRD), of the MPD, is to monitor and evaluate the implementation of the PSIP to ensure that resources are efficiently and effectively allocated based on policy objectives.

In Fiscal 2020, under the strategic leadership of the Ministry of Public Utilities, the Water and Sewerage Authority's (WASA) three (3) strategic focal areas for ensuring water security are as follows:

(i) Augment Water Supply (Well Development/Rehabilitation, Treatment Plants, Booster Stations)
(ii) Reduce Non-Revenue Water (Leak repair and replacement of high leakage mains)
(iii) Expand Transmission and Distribution Systems (Pipeline and Storage)

The objective of these strategic areas is to provide a reliable and consistent supply of water for the citizens of Trinidad and Tobago by increasing water production through the Well Development Programme, the rehabilitation of dams, the refurbishment of Water Treatment Plants, the construction of reservoirs and booster stations, the refurbishment and upgrade of pipeline infrastructure to bring about a reduction of non-revenue water and increased water storage capacity with an effective and efficient water distribution. For Water Security Projects the total expenditure for 2019 was TT$71.1 million with the total allocation for 2020 being TT$70.5 Million.

Details of the projects aimed at water security are highlighted in the Table attached as an Appendix.

It is instructive to note that the Ministry of Rural Development and Local Government, through its Municipal Corporations, also distributes potable water to its burgesses.

(ii) Question:

Does the MoPD have spatial data that can be used to establish sustainable groundwater development?

Response:

The Ministry of Planning and Development does not have spatial data that can be used to establish sustainable groundwater development. However, the Town and Country Planning Division is in possession of shapefiles that delineates the watersheds in Trinidad and Tobago. The source of this information is received from WASA.

(iii) Question:

Does the MoPD have spatial data on the water reserves in Trinidad and Tobago that are impacted by rainfall and those that are not impacted by rainfall?

Response:

The Town and Country Planning Division of the Ministry of Planning and Development is not in possession of spatial data other than "hard maps" which point to the location of reservoirs.

(iv) Question:

Does the MoPD have spatial data on the Water and Sewerage Authority's (WASA) pipe infrastructure?

Response:

The Town and Country Planning Division (TCPD) of the Ministry of Planning and Development is only in receipt of "hard" drawings of any new pipeline infrastructure that WASA seeks to implement. These would be on files within the Regional Offices of the TCPD.

(v) Question:

Does the MoPD share spatial data with WASA?

Response:

The TCPD of the MoPD responds to requests from the WASA for the provision of spatial data. This includes requests for land use maps and land use policies for specific areas within the country.

(vi) Question:

Have any studies been done to specifically assess the impact of climate change on water security in Trinidad and Tobago

Response:

A Vulnerability and Capacity Assessment (2019) was conducted by the Government of Trinidad and Tobago through support received from the European Union (EU) under the "Technical Assistance to the Environment Programme in Trinidad and Tobago". The environment programme aimed to address the challenges of pursuing a low-carbon climate resilient development path and contribute to the achievement of the Government of Trinidad and Tobago's goals to improve the management of natural resources in the country. As part of the larger Environment Programme, technical assistance was provided to support the Ministry of Planning and Development in undertaking climate change vulnerability and risk assessments that:

(a) provided a comprehensive picture of the impacts of climate change, climate variability and projected climate change impacts; and

(b) facilitated decision-making on climate change risk management by key Agencies. The support for this vulnerability assessment was over the period of 2 years from September 2016 to 2018.

As the basis for the vulnerability and capacity assessments, the project examined potential and current physical, economic, social and ecological trends and conditions in selected sectors related to climate change over specific timescales. The seven (7) priority sectors were:

1. Agriculture and food security
2. Water resources
3. Human health
4. Coastal resources and fisheries
5. Human settlements and infrastructure
6. Biodiversity
7. Finance Sector (including insurance)

At the request of the stakeholders in Tobago, an Integrated Island Management approach was used for Tobago. Integrated Island Management (IIM) responds to the unique circumstances of small island ecosystems through development of holistic integrated management systems that operate at the scale of ecological, social or physical processes within Islands.

The following summarizes the findings Under the Water Resources Sector:

- The quality of the surface water is deteriorating in many locations as evidenced by high levels of biological oxygen demand, bacterial content, turbidity and the presence of chemical pollutants in rivers. The main threats are uncontrolled point waste discharges, in particular from Industries and domestic sources, as well as the high level of erosion in the upper reaches of watercourses. Given the climate risk factors on water resources, the increasingly warmer climate, frequency of intensifying cyclones, droughts and floods are of major concern and present varying degrees of challenges to development of adaptation strategies. It was determined that the highest risks from climate change are from variations in precipitation (localised) resulting in more instances of water contamination as pollution control systems are not designed to deal with variations resulting in increased instance of pollution and sedimentation of water resources. The communities within the Caroni River Basin (15 watersheds) and South West Tobago were identified as the most vulnerable. The recommended adaptation measures primarily focus on conducting risk assessments and integrating risk management into legislation, policy and practice.

ISSUE:

2. To determine the measures required for improving water security;

Measures Required for Improving Water Security

(vii) Question:

What institutional arrangements are necessary to prevent a water crisis?

Response:

The Ministry of Public Utilities will be the lead agency in coordinating institutional arrangements necessary to prevent a water crisis.

(viii) Question:

Does the MoPD, Town and Country Planning Division (TCPD) receive applications for the construction of buildings for rain/storm water harvesting systems such as cisterns?

Response:

Searches of the databases of the TCPD did not reveal any applications for such construction.

(ix) Question:

If so, are these types of structures recommended by the MoPD, TCPD?

Response:

Although checks did not reveal applications for the above-mentioned construction, the TCPD welcomes these types of structures. This has been a feature of older homes in parts of Trinidad and Tobago. Therefore the TCPD would recommend these types of structures.

(x) Question:

From a building perspective, what are the implications to encouraging the use of underground cisterns to retain water from rainfall for consumption?

Response:

The use of underground cisterns to retain rainwater for consumption, agricultural use, or other purposes would help with water conservation. The availability of the stored rain water would minimize the need for potable water supplied by WASA, and aid with the sustainability of the water supply in Trinidad and Tobago.

However, care must be taken to ensues the cisterns are properly and safely constructed and placed in the most appropriate location. Underground cisterns may be constructed as part of or located close to the building which will use the stored water. There would also be a role for the Ministry of Health to give guidance regarding such structures and the control of certain insect vectors as well as possibly WASA to issue permits re same.

(xi) Question:

Are you aware of the percentage of households in Trinidad and Tobago with underground cisterns that retain water from rainfall?

Response:

The TCPD does not have the data to be able to answer this question. Such data would not usually be collected by the Division during its daily activities.

(xii) Question:

Does groundwater extraction impact on infrastructural developments? If so, please explain.

Response:

Groundwater extraction can cause land subsidence. As groundwater levels fall due to extraction, some aquifers compress significantly causing land subsidence with corresponding damage to infrastructure.

(xiii) Question:

Describe the implications to groundwater extraction on the environment.

Response:

The major implications are related to over extraction which can cause, falling water levels leading to dry wells and reduction in spring and river baseflows, vegetation stress, saline intrusion, loss of aquifer capacity and land subsidence.

ISSUE:

3. To determine the challenges with ensuring water security in Trinidad and Tobago

Challenges with ensuring water security

(xiv) Question:

Describe the challenges associated with ensuring water security in Trinidad and Tobago.

Response:

The Vulnerability and Capacity Assessment has identified the following challenges with respect to Climate Change Impacts on Water Resources:

- Studies have shown cases where the permeable soil which would have allowed water to infiltrate was replaced with compacted earth fill, covered in concrete and asphalt, causing overland flow. The mitigation implemented in the form of box drains which empty into undersized drainage channels proved to be insufficient to carry the volume of water. Unplanned and unmitigated hillside developments contributed to slope instability which was only exacerbated by the intense rainfall and resultant flooding.

- Reduced freshwater supply has also been reported due to decreased rainfall and subsequent reduction in stream flow. Water resource managers in Trinidad and Tobago would need to consider present and future demand in light of declining rainfall, more frequent and longer dry spells, higher evaporation rates and salinity intrusion. The quality of the surface water is deteriorating in many locations as evidenced by high levels of biological oxygen demand, bacterial content, turbidity and the presence of chemical pollutants in rivers. Given the climate risk factors on water resources, the increasingly warmer climate, frequency of intensifying cyclones, droughts and floods are of major concern and present varying degrees of challenges to development of adaptation strategies.

- Projections suggest an increase in intense rainfall events over shorter periods that will result in lower surface water quality, a reduction in the recharge of ground water as run off would be at a maximum; while increases in longer dry spells and drought events coupled with warmer temperatures would increase agricultural irrigation demands, affect crop scheduling, increase health impacts, coral bleaching and saline intrusion.

Based on the MPD's strategic position as the manager of the PSIP, it receives feedback and information from all Ministries and Agencies. To this end, some of the other challenges to water security are as follows:

- Aged pipeline infrastructure;
- High Unaccounted For Water (UFW);
- Dependence on Central Government for funding infrastructure development projects;
- Increased water demand from expanding Housing and Energy sectors;
- Contamination of surface/groundwater sources;
- Seasonal variation in surface water sources;
- Achieving effective coordination among relevant Government Agencies and Units;
- Obtaining buy-in from the general public who would be expected to contribute towards conserving water; and
- Government's commitment towards providing the necessary resources to achieve the goal of water security.

(xv) Question:

What is being done to address these challenges?

Response:

An appropriate response can be sought from the Ministry of Public Utilities.

APPENDIX

Table: Water Security Projects

Strategic Focus	Projects	2019 Expenditure	2020 Allocation	Effectiveness of these Strategies
Augment Water Supply *2019 Expenditure: $56.9 Mn* *2020 Allocation: $56.5 Mn*	Upgrade of Carlsen Field Water Treatment Plant (WTP)	$2.0 Mn	$0 Mn	1. Increased water supply availability and reliability to 7,423 persons in Carlsen Field, Orange Field, Chase Village, Carapichaima, Palmiste and environs 2. Improved class of supply during the Dry Season from 24/3.5 to 24/5.
	Construction of Calvary Hill Booster Station	$1.1 Mn	$0 Mn	1. Increased reliability of water supply to 2,300 persons in Calvary, Mt Pleasant and Alenore Gardens Phases 2 and 3 2. Improved class of supply to 2,300 persons in Calvary, Mt Pleasant and Alenore Gardens Phase 2 and 3 in the dry season from 24/3 to 24/5.
	Arouca Well Development	$1.0 Mn	$0Mn	1. Increased production by 1.0 mgd. 2. Increased reliability of water supply to 11, 250 residents of Bon Air North Development 3. Improved class of supply in the dry season from 24/3 to 24/4 to 11, 250 of Arouca.
	Well Development Programme	$18.9 Mn	$12.0 Mn	Improved reliability of service to 72,011 persons and increased Total Production of 40,399 m3/d
	Desilting and Rehabilitation of Hillsborough Dam Tobago	$6.4 Mn	$10.0 Mn	Improved water supply to approximately 15,000 persons in Bamboo Hill, Cinnamon Hill, Concordia, Ebo Gully, Les Coteaux, Mary's Hill, Mt. Grace, Orange Hill Rd, Parts of Mason Hall, Summer Hill, Table Piece, Union and Whim Development.
	Upgrade of Maloney Water Treatment Plant	$0.2 Mn	$0 Mn	1. Improved reliability of water supply to approximately 12,200 residents of Guayaguayare Mayaro

Strategic Focus	Projects	2019 Expenditure	2020 Allocation	Effectiveness of these Strategies
				Road between Hingwan Drive and Frontin Road. 2. Improved class of supply in the Dry Season from 24/2 - 24/3.5 and 24/4
	Integrated Water Improvement Programme North West Trinidad	$0 Mn	$1.0 Mn	1. The refurbishment of Booster Pumping Stations at, Richplain, School Street, Tucker Valley, Seaview Hill, Lower Convigne and laying of transmission pipeline at Four Roads, Cascade Road, Coco Road and Leone 2. Increased water supply to 114,000 persons.
	Refurbishment Works at Caroni WTP	$0 Mn	$5.0 Mn	Increased water supply to 450,000 customers in North and South Trinidad.
	Upgrade of Petrotrin Guayaguayare WTP	$0 Mn	$1.0 Mn	Increased water supply for approximately additional 2,200 customers in Guayaguayare
	Water Supply to Labidco and Union Industrial Estate	$16.4 Mn	$10.0 Mn	Improved reliability and security of water supply to 25,000 persons from Union Industrial Estate, San Fernando, Debe, Siparia to Erin and Claxton Bay.
	Upgrade of Charlotteville Intake	$2.8 Mn	$0 Mn	1. Improved operations and final water quality benefitting 1,700 persons in the Charlotteville catchment area. 2. Improved level of service. 3. Reduction in downtime
	Community Water Improvement Programme (CWIP)	$6.7 Mn	$10.0 Mn	Improved water supply to at least Class III (72 hrs per week) to benefit a total of 789 households (3,192 persons).
	Moruga Well Development	$0.4 Mn	$1.5 Mn	Improved reliable pipe borne water supply to residents of Moruga.
	Special Skills Training for	$0 Mn	$5.0 Mn	This project involves the development of an Apprenticeship Programme for

Strategic Focus	Projects	2019 Expenditure	2020 Allocation	Effectiveness of these Strategies
	Water Conservation			the Youth of Trinidad and Tobago for the development of Skills and implementation of activities to reduce water loss and promote water conservation and is expected to: 1. Reduce water loss 2.Reduce unemployment rate
	Tobago Well Development	$1.0 Mn	$1.0 Mn	1. 40,000 persons of Les Coteaux, Carnbee, Signal Hill, Calder Hall Scarborough, Mary's Hill and Roxborough. 2. Improve supply in the dry season from 24/2 - 24/3.5 to 24/5 and during the wet season from 24/5 - 24/7. 3. Two (2) million Imperial gallons of water would be gained upon completion of each well.
Reduce Non-Revenue Water *2019 Expenditure: $8.2 Mn* *2020 Allocation: $4.0 Mn*	Non-Revenue Water Reduction Programme	$8.2 Mn	$4.0 Mn	1. Reduced water loss from leaking pipelines 2. Improved response time to leak repairs 3. To improve security of water supply
Expand Transmission and Distribution Systems *2019 Expenditure: $6.0 Mn* *2020 Allocation: $10.0 Mn*	Construction of Avocat Wells	$0.9 Mn	$3.0 Mn	Improved and expanded water delivery to approximately 240 households in Oropouche, St Mary's and Avocate Village.
	Design and Installation of Guanapo Service Reservoir	$0.1 Mn	$0 Mn	1. Increased reliability of water supply to 3,000 persons from Arima and Environs. 2. Improved class of supply to 3,000 persons from Arima and Environs in the Dry Season from 24/3.5 to 24/5

Strategic Focus	Projects	2019 Expenditure	2020 Allocation	Effectiveness of these Strategies
	Quare Service Reservoir	$0 Mn	$0 Mn	Improved reliability of water supply to approximately 4,200 persons in Valencia, Quare and Environs.
	Upgrade of Distribution System– Tobago	$2.7 Mn	$0 Mn	Improved reliability of service to 1,120 residents in Bon Accord, Belle Garden, Mason Hall, Boxborough, Bacolet and Lowlands Tobago.
	Pipeline Replacement for Ministry of Works and Transport Bridges Reconstruction Programme	$2.3 Mn	$1.0 Mn	1. Avoidance of damages and interference to water supply during execution of works by PURE and 2. Positive impact on public health and the environment
	Upgrade of Transmission Network Tobago	$0 Mn	$1.0 Mn	Provision of localised transmission capacity and reduced distribution leakage benefitting 5,300 persons in Northside Road, Connector Road, Mt Pelier, Sandy River, Darrel Spring, Road Reserve, Bethel #3, Bloody Bay Ph 2, Buccoo to Four Roads, Buccoo to Montgomery, Hillsborough to Belmont, Hope Village, Ms. Mills to Mt St George.
	Calvary Tank and Transmission Pipeline	$0 Mn	$5.0 Mn	Improved and expanded level of supply to 3,000 customers in the catchment area including: Calvary, Mt Pleasant and Alenore Gardens Phase 2 and Phase 3 from three (3) days to five (5) days per week.
TOTAL		**$71.1 Mn**	**$70.5 Mn**	

APPENDIX VII

ADDITIONAL SUBMISSION FROM MINISTRY OF PUBLIC UTILITIES DATED MARCH 25, 2020

Government of the Republic of Trinidad and Tobago
Ministry of Public Utilities
Office of the Permanent Secretary

MPU: 2/2/35 Vol.VI

25th March, 2020

Mr. Julien Ogilvie
Secretary
Joint Select Committee on Land and Physical Infrastructure
Office of the Parliament
Parliamentary Complex
Cabildo Building
St Vincent Street
PORT OF SPAIN

Dear Sir,

RE: ***Inquiry into measures for ensuring water security in Trinidad and Tobago- Request for Information***

Reference is made to your letter Parl:14/3/46-13 Vol I dated 16th March, 2020.

In accordance with your request, the Ministry of Public Utilities is submitting the enclosed Twelve (12) copies of its response together with the appendences for your consideration. The aforementioned was also submitted via electronic copy to jsclpi@ttparliament.org on the 26th February 2020.

Should you require further information and /or clarification on the subject matter, please contact Ms. Arlene Collis, Director, Economic, Research and Planning Division at 628-9500 Ext. 4218 or acollis@mpu.gov.tt

Yours faithfully,

Permanent Secretary (Ag.)
Ministry of Public Utilities

Enc.

Ministry of Public Utilities

Responses to the Additional Request for Information from the Joint Select Committee on Land and Physical Infrastructure

"Inquiry into measures for ensuring water security in Trinidad and Tobago"

Request 1: A status update on the Integrated Water Resources Management (IWRM) Policy that has been submitted and remains outstanding

The draft IWRM Policy 2018 was submitted to Cabinet by the MPU in early 2019 and no official feedback on a decision has been provided. This policy document, as previously submitted to the JSCLPI, was prepared by a Cabinet-appointed Technical Steering Committee comprising of various governmental and non-governmental stakeholders and chaired by the MPU. The 2018 IWRM Policy proceeds a 2005 Cabinet-approved IWRM Policy and has been updated to treat with new and emerging issues such as drought, climate change, rainwater harvesting and storm-water management.

Request 2: The model framework for the IWRM agency and the legislative findings referred to

Institutionalising the IWRM process requires a functional separation between policy-maker, economic regulator of water and wastewater services, water resource regulator and service provider for water and wastewater. The defined IWRM process calls for these institutional arrangements to be mandated through water management legislation that defines roles, responsibilities and interrelationships, and facilitates autonomy of the regulators.

Institutional

In 1999, the GoTT approved a Water Resources Management Strategy Study (WRMSS) which made recommendations for institutional strengthening in water resources management (report attached as Appendix I). One of the approved recommendations was the creation of a Water Resources Management Authority (WRMA) as "a new and separate statutory organisation" with "a clear mandate and well-defined responsibilities". Once established the WRMA would allow for independent regulation of water resources, streamlined water resources functions, coordination and cooperation between organisations, and facilitation of a strong and financially autonomous water resources sector. The specific functions of the WRMA were proposed to include (i) water resources policy and strategy development; (ii) water resources assessment, (iii) master planning and allocation, and (iv) water abstraction licensing and enforcement.

In updating the recommendations on the institutionalisation of IWRM, the MPU completed an evaluation of options of various institutional arrangements detailing the advantages and disadvantages of each. This report is also appended as Appendix II.

Legal

The WRMSS 1999 also made recommendations on the legal framework for water resources management, specifying that an act of Parliament must be generated to grant the relevant powers to the proposed WRMA. In 2009, a draft bill and legislative scheme was generated (Appendix III) following the approval of the 2005 National IWRM Policy. The draft WRMA bill 2009 requires updating to incorporate the revised policy prescriptions of the draft National IWRM Policy 2018, and inclusion of modernised legal instruments for water resources regulation such as a financing structure that allows for protection and rehabilitation of watersheds.

Request 3: The location of watersheds in Trinidad and Tobago (illustrated by way of map)

The WRA has divided the land area in Trinidad into 60 watersheds (Appendix IV) and 15 watersheds in Tobago (Appendix V).

A watershed is the *land area* that water (from rainfall) flows over and eventually drains into a river/watercourse/stream. All land area is classified as a watershed. A watershed collects (through vegetation, ponds/lakes), stores (in vegetation, soil and aquifers) and releases water through rivers and wetlands. Watersheds also provide important habitats for flora and fauna, and therefore maintain biodiversity. The term watershed is used interchangeably with catchment, hydrologic/drainage basin.

Request 4: Information on the success achieved in preserving and ensuring longevity as it pertains to management and conservation of watersheds

Robust watershed management relies on land use practices that optimally balances physical development with protection of critical zones such as groundwater recharge areas, flood plains, wetlands, ecologically undisturbed, primary forested areas (with native trees), etc. Watershed management is most effective when the quantity and quality of water (and other natural resources) remains close to the baseline, i.e. prior to development. In effect, a healthy watershed is able to do the following:

1. Collect and store flood waters with minimal damage to infrastructure.
2. Maintain minimum flows in rivers and streams enabling preservation of the natural ecosystem (flora and fauna).
3. Filter sediment and chemicals in rainfall resulting in pristine or near-pristine water quality.

Over the past 20 years but primarily in the past decade, the majority of Trinidad's watershed areas have been showing significant degradation (see Figure 1 below based on water quality analysis). For example, in north-east Trinidad - where water resources are most prolific because it records the highest, most intense rainfall - the Toco and Madamas watersheds drastically deteriorated from good to bad/moderate across the 17-year timeframe (1998 to 2015). This rapid watershed degradation is principally due to convoluted regulation and weak governance arrangements which

involves multiple regulators overseeing various land uses such as quarrying, agriculture, housing, environmental issues, etc. This weakens responsibility and accountability for proper land use planning and regulation and is resulting in increased deforestation in watersheds, and increased runoff and pollution in rivers.

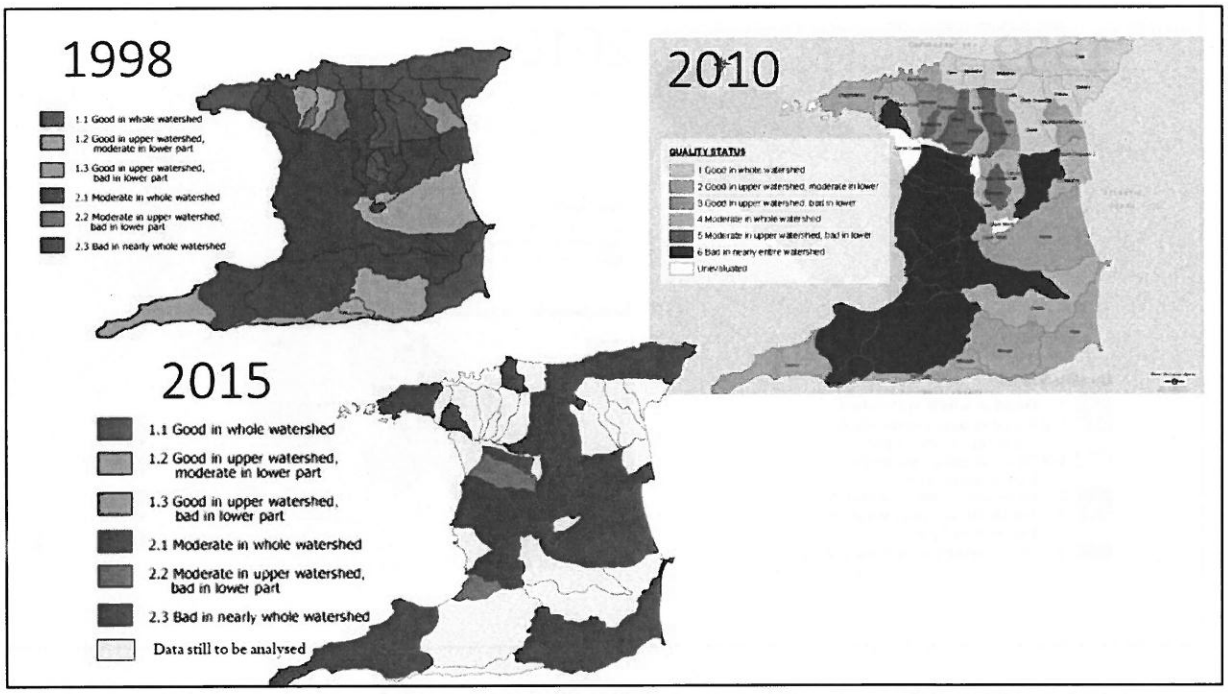


Figure 1: State of Trinidad's Watersheds from 1998 to 2015 (Source WRA – Adopt a River Programme)

Similarly, over a decade of development in Tobago has resulted in degradation of the Courland and Sandy River watersheds from good to bad in the lower watershed (see Figure 2 below). Tobago West, Tobago South, Goldsborough and Louis D'Or watersheds have also declined from good to moderate in the lower watersheds. The lower watersheds are more significantly depleted because it is mostly where development (housing, agriculture, quarrying, other infrastructure) has occurred.

The Tobago and Trinidad watershed assessments are based on water quality sampling of various chemical parameters such as turbidity (sedimentation), nitrates (pesticides/fertilisers), sulphates (sewage), etc. in the upper and lower parts of the major rivers that drain these watersheds.

The Adopt a River Programme (AARP) is one of the key national interventions for safeguarding and rehabilitating watersheds in the last 5 years. The objective of the Programme is to *implement approved watershed rehabilitation and conservation projects, identified by stakeholders at national and community levels, for water supply and/or water management improvement.* The AARP is funded by the Green Fund, executed by a project implementation unit within WRA, WASA and is overseen by a steering committee of multiple governmental and non-governmental stakeholders. While the AARP has tangible objectives such as clean-ups, reforestation exercises, public education activities, etc. the overarching goal is empower citizens with the knowledge and

competencies to become custodians of their watersheds and implement community-based projects to achieve robust watershed management. Additional details on the AARP are attached as Appendix VI.

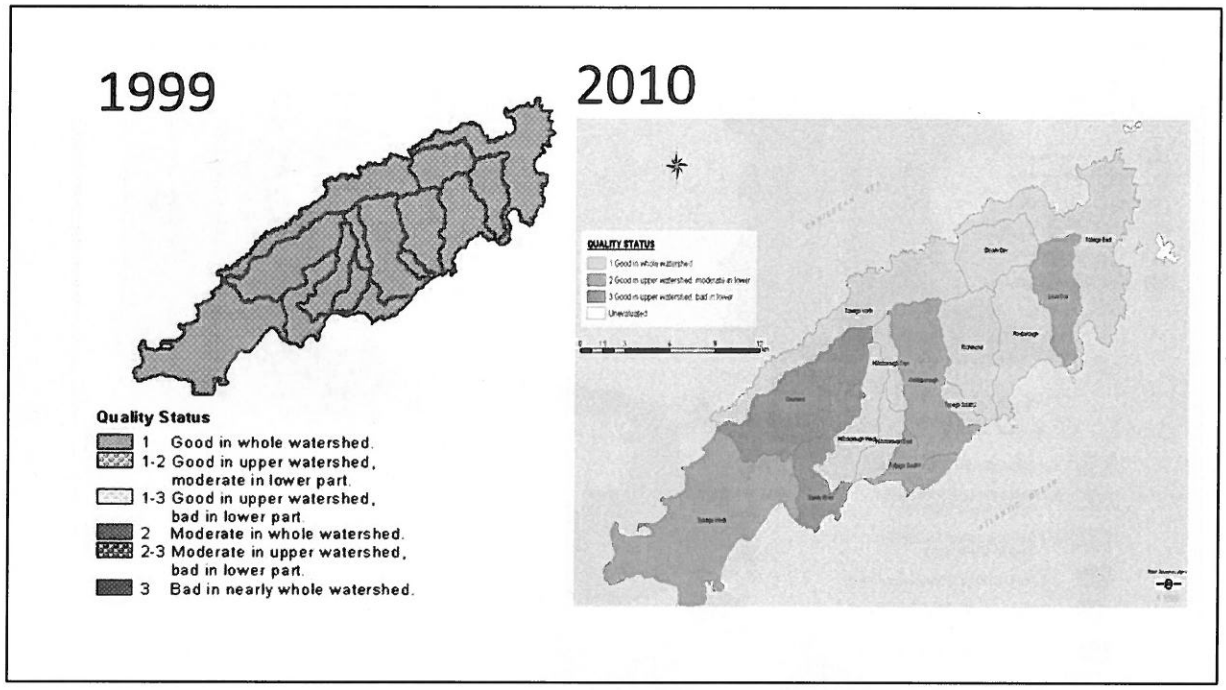


Figure 2: State of Tobago's Watersheds from 1999 to 2010 (Source WRA – Adopt a River Programme)

APPENDICES

Appendix I – WRMSS Annex 11 – Institutional Strengthening

Appendix II – WRMSS Annex 12 – Legal Framework

Appendix III – Draft Bill and Legislative Scheme

Appendix IV – Watershed Map of Trinidad

Appendix V – Watershed Map of Tobago

Appendix VI – Profile of the Adopt a River Programme

The Government of Trinidad and Tobago

Ministry of Planning and Development

Water Resources Management Strategy for Trinidad and Tobago

Final Report

Annex 11

Institutional Strengthening

December 1999

DHV Consultants BV

in association with

Delft Hydraulics **Lee Young & Partners**

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List of Abbreviations

CMI	Caribbean Meteorological Institute (Barbados)
DEP	Department of Environmental Protection (Florida)
EIA	Environmental Impact Assessment
EIS	Environmental Impact Study
EMA	Environmental Management Authority
EMC	Environmental Management Commission
FAO	Food and Agriculture Organisation
FMIS	Financial Management Information System
GIS	Geographical Information Systems
HRM	Human Resources Management
HRMIS	Human Resources Management Information System
IMA	Institute of Marine Affairs
LIS	Land Information Systems
MALM	Ministry of Agriculture, Lands and Marine Resources
MOH	Ministry of Health
MOHS	Ministry of Housing and Settlements
MOPD	Ministry of Planning and Development
MOPU	Ministry of Public Utilities
MOU	Memorandum of Understanding
MOWT	Ministry of Works and Transport
NEMA	National Emergency Management Agency
NRCA	Natural Resources Conservation Authority (Jamaica)
PMO	Prime Minister's Office
PSP	Private Sector Participation
PUC	Public Utilities Commission
RIC	Regulated Industries Commission
ToR	Terms of Reference
TIDCO	Tourism and Industrial Development Corporation
T&TEC	Trinidad and Tobago Electricity Company
T&TSWMCOL	Trinidad an Tobago Solid Waste Management Company Ltd.
UWI	University of the West Indies
WASA	Water And Sewerage Authority
WRA	Water Resources Agency
WRM	Water Resources Management
WRMA	Water Resources Management Authority
WRMIS	Water Resources Management Information System
WRMS	Water Resources Management Strategy
WUA	Water Users Association

Executive Summary

This report is part of the integrated water resources management (WRM) strategy report which has been prepared for the Government of Trinidad and Tobago. It was written to comply with a specific requirement of the Terms of Reference governing the project, viz. that one of its outputs of the consulting services should be a report outlining a comprehensive set of recommendations on institutional strengthening, including recommendations on legislative reform and human resources development.

It is the view of the Consultants that the implementation of these recommendations in their totality would facilitate the effective and efficient management of the country's water resources, ultimately leading to a sustainable and financially autonomous sector.

The approach of the Consultants has been a five-tiered one: (1) an inventory and analysis, which consisted of an assessment of the existing situation; (2) identification of options, which involved an analysis of strengths, weaknesses, opportunities and threats; (3) consultation, consisting of a process of seeking and receiving feedback from the government prior to the selection of a preferred option; (4) elaboration, which entailed the detailing and amplification of the selected option; and (5) the formulation of implementation and short-term action plans. Included in them would be recommendations for such technical assistance as might be considered necessary for their implementation. The Consultants have not yet embarked on this last aspect. This will be addressed in a forthcoming report (Appendix 17).

An examination of the range of WRM functions together with the organisations involved in them, which occurred during the inventory and analysis stage of the project, revealed the following: the need to redesign and streamline the formal allocation of WRM functions; the need to enhance and improve performance; the need to ensure co-ordination and co-operation between organisations; the need to enhance the capabilities of the human resources; the need to reduce dependence on government financing; and the need to increase public awareness of the value of water resources and to enlist public support in its management.

Emerging from this stage of the project was the general conclusion that there was a need for one central and autonomous WRM entity, with a clear mandate and well defined responsibilities, even as it was acknowledged that some functions would have to remain with the various stakeholders. However, it was recognised that in the interest of proper co-ordination, appropriate inter-institutional linkages would have to be secured through clearly defined mechanisms.

The Water Resources Agency (WRA), a division of the Water and Sewerage Authority (WASA), is currently responsible for the management and control of the Nation's water resources. As a consequence of its status, it plays a supporting role to WASA in its task of supplying water and providing sewerage services to the population. This dual and ambivalent role makes its position untenable, especially in the light of the government's intention to embark on a long term Private Sector Participation (PSP) for WASA. A single recommendation therefore, one upon which all others turn, is that the planning and regulatory functions of WRA should be taken out of WASA.

In redesigning the institutional framework for WRM, both functional and structural considerations have to be taken into account. What will be the functions of this organisation, and where will it be best positioned?

As regards WRM functions, it is recommended that the new organisation be granted exclusive responsibility for: (1) water resources policy and strategy development; (2) water resources

assessment, (3) master planning and allocation, and (4) water abstraction licensing and enforcement.

Where other organisations are responsible for certain WRM functions in their respective sub-sectors, the new organisation should be assigned a co-ordinating role. A well structured inter institutional co-operation is essential, reconfirming the different mandates of various organisations and underscoring the integrated character and links between waste, land use and water quality. This co-ordinating role would apply to: (1) water demand analysis, (2) conservation through treatment and reuse of wastewater, (3) water demand management, (4) development and distribution of domestic, industrial and agricultural water, (5) development and management of drainage and flood-control, sewerage and water conveyance mechanisms, (6) development and management of multi-purpose dams and reservoirs and (7) development and management of water treatment facilities. Moreover, and in view of the private sector participation in WASA and the opening up of the WR sector to other private abstractors and distributors, and as water is becoming more and more a scarce resource, these WRM co-ordinating roles are warranted.

And finally, in matters where other organisations have exclusive responsibilities, the new organisation should co-operate or at least be consulted in matters relating to: (1) watershed management, (2) pricing of water to end-users, (3) issuance of water effluent discharge licenses, and (4) issuance of building and land-use permits.

As regards the position of the new organisation within the WRM institutional framework, it is recommended that a new and separate statutory organisation be established under the Ministry of Planning and Development. The justifications for this recommendation is multi-faceted. They relate to the need for the proposed new organisation to be an independent planning and regulatory organisation separated from WASA (see above), the need to be under the political guidance of a super-ministry that has no direct interest in the allocation of water and as such is not a water-user, and the need to be close to other planning and regulatory bodies affecting the water resources sector, for example, the Environmental Management Authority (EMA) and, until recently, the Town and Country Planning Division.

The Consultants considered the advantages and disadvantages of incorporating or merging the new organisation with the EMA. This option was not considered feasible, at least for the short to medium term, mainly due to the differences in character of the two organisations. In the medium term, the government may consider another type of integrated approach and establish a Ministry of Sustainable Development made up of organisations such as EMA, the new WRA organisation, the Institute of Marine Affairs (IMA), the Watershed Management Unit, etc.

Different instruments are available, and should be used in a careful mix in order to formalise and secure the above mentioned institutional arrangements.

- It will be necessary to draft and enact a WRM Act, and simultaneously, amend or repeal relevant existing laws. The Consultants have identified those sections of the WASA Act, the Waterworks and Water Conservation Act, the Acts administered by the Forestry Division, the Town and Country Planning Act, the Environmental Management Act, the Freedom of Information Bill and the Regulated Industries Commission Bill, which would have to be amended or repealed;
- Each of the main stakeholders should be required to issue regulations to fulfil the obligations as stipulated in the new or amended laws. This would serve to avoid the problem of having an overly complex and unwieldy body of law;
- A Memorandum of Understanding (MOU) should be agreed between the key stakeholders, not including the water abstractors or water users, to ensure inter-institutional co-operation. It is the view of the Consultants that the best guarantee of full co-operation between the signatories

would be a truly mutually beneficial agreement, which would include clear 'carrot and stick' principles, and which would be sanctioned and enforced by the highest authorities. The Government is ultimately responsible for all these organisations. They should establish clear standards of behaviour for these organisations and then enforce them;

- A licensing system should be at the centre of the relationship between the new organisation and abstractors. It would be necessary to conclude separate contracts with WASA in respect of the development and management of dams and reservoirs, and with the Planning Advisory Body, being the successor of the Town and Country Planning Division, and the EMA in respect of land-use and waste effluent discharge respectively. This inter-institutional co-operation is absolutely essential for a proper WRM, underscoring the integrate character and links between water (WRMA) and land-use (T&CP) and water quality (EMA).

One of the functions recommended for the new WRM Authority (WRMA) is that of facilitating a strong and financially autonomous WRM sector. The technical and financial capacity building efforts required would include the sharing of WRM related data and information, and the establishment, management and replenishment of special funds for training, and research and development (R&D). Through this mechanism, the key stakeholders, being the managers of the country's water resources, would be allowed to seek jointly financed training and R&D. Thus, water abstractors and water users would be excluded from the use of these facilities, as their prime objectives are significantly different.

The Consultants also recommend that public awareness and education be a function of the new organisation. This function would mainly entail the co-ordination and streamlining of all water resources related awareness activities, not only of the WRMA, but also of all organisations in the sector. Furthermore, direct public awareness activities should be aimed at policy makers and WRMA's potential and actual customers, i.e. the water abstractors.

The WRMA is to be established as a Body corporate to be governed by a Board of Directors, and its proposed structure reflects its functions. This structure would consist of four line units and two support units, under the supervision of a Managing Director. The four line units are Water Resources Management, Water Resources Planning, Compliance, and Communications. Finance and Accounts, and Administration and Human Resources would make up the two support units. The Administration and Human Resources Unit would itself supervise the work of four separate sections: Human Resources and Training Fund, Information and Communication Technology, Administration, and Maintenance and Stores.

The new organisation will need to recruit and retain highly qualified and motivated employees, totalling around 80. The WRMA would need to recruit a significant number of professionals both in its 'traditional' field of water resources (hydrologists) and in other disciplines such as law, communications, computer and data management, human resources, and finance and accounts. In order to attract and retain these staff, the Consultants recommend that the WRMA should offer competitive employment packages, and establish state-of-the-art performance assessment and human resources development systems.

Though the WRMA may not formally be the successor organisation of the WRA, the Consultants recognise the need to put in place some transitional arrangements as regards WRMA's human resources. These arrangements should address the needs of all the employees of the WRA. In this regard, number of recommendations are made in the report.

More or less similar arrangements will have to be made as regards the equipment requirements of the WRMA. It is not correct to assume that the ownership of all existing equipment of the WRA will be transferred to the WRMA, also since WASA is currently considering how best to split up the WRA, one part to remain within WASA, and the other to form the new WRMA. Nevertheless,

the Consultants have identified and tentatively calculated the cost of equipment requirements for the WRMA.

The capital cost of establishing the WRMA will amount to TT$ 3.6 million, with investment costs for the following years calculated at TT$ 1 million per year. A separation package for redundant WRA staff, if any, is not foreseen as they are employed by WASA. The annual operational expenses are estimated at TT$ 17.0 million against an annual income of TT$ 17.3 million. The main cost items include the training and R&D funds consisting of TT$ 1 million and TT$ 4 million respectively, and salaries and related costs for human resources amounting to TT$ 8.9 million. The collection of royalties for water abstraction constitute the bulk of WRMA's projected annual income (TT$ 16.6 million). In view of past experiences with the collection of license fees, it is suggested that the surplus in the operational budget be reserved as a contingency provision. Otherwise, it could be decided to add this surplus to either of the two funds, training and R&D.

Systems and procedures will be the lubricant of the WRMA. The proposed new WRM Act and the amendments to existing laws will contain the rules governing some of the main systems and procedures. A greater level of detail will be found in the proposed regulations, Memoranda of Understanding (MOU) and contracts. However, the systems and procedures will have to be described in full detail in WRMA's Operation Manuals. In order to secure 'ownership', these manuals should be drafted by the senior management of the new organisation. However, the main outlines of these systems and procedures are presented in this report.

Data and Information Management is one of the most important new systems of the WRMA. The Consultants recommend that separate data and information systems be designed, developed and maintained for the management of water resources, human resources, and financial resources, and that supporting systems be set-up for GIS and data communication.

Water resources management and planning are two of the principal processes of the WRMA. Recommended systems and procedures for field monitoring, master planning and allocation and other related activities are described in detail in this report. Similar detailed descriptions are given for water abstraction licensing and related pricing, for the management of the training and R&D funds, and for the management of WRMA's human resources.

The Consultants do not recommend that a separate commission be established with jurisdiction over the issues arising from the WRM Act. Instead, the Environmental Management Commission (EMC) created pursuant to the EMA Act should have the authority to hear all disputes arising out of the enforcement of WRMA's policies, with the exception of the pricing of water abstraction licenses, which should be heard by the Regulated Industries Commission (RIC), being the successor of the Public Utilities Commission (PUC). Any abstractor, not satisfied with the decision of the EMC or the RIC will have the right to appeal to the Court of Appeal.

1 Introduction

1.1 General

The Government of Trinidad and Tobago has sought the services of Consultants to draw up a comprehensive strategy as well as a supporting management system for medium and long-term water resources management. Specifically, the Consultants have been requested to design and develop a comprehensive and integrated water resources management plan. This plan should include appropriate strategies and policy measures for water resources management, an effective institutional framework, an adequate supporting legislative and regulatory framework, recommendations for the upgrading of institutional capacity, technical systems and training, development of efficient information systems, and an implementation plan for selected priority areas for action.

The objectives of the Water Resources Management Strategy (WRMS) as stated in the Inception Report, are:

1. To develop a national strategy for sustainable Water Resources Management
2. To delineate and assess an effective and financially autonomous institutional setting that guarantees optimum Water Resources Management

This report describes the status of the institutional arrangements in the water resources sector of Trinidad and Tobago, and makes comprehensive recommendations for its improvement. A wide range of issues have been considered within the institutional field, including legal and regulatory aspects, the inter-institutional arrangements, organisational structures, human resources management, finance and accounting, information systems and public awareness.

Selected topics and issues discussed in this report are amplified in a number of separate annexures: the legal framework report (Annexure 12), the finance report (Annexure 13), the data and information management report (Annexure 14), the public awareness report (Annexure 15), and the Geographical Information Systems report (Annexure 16). Taken together, they provide a full and comprehensive coverage of the consultants' institutional analysis and recommendations for capacity building in the WRM sector.

In this chapter the various sections of the Terms of Reference (ToR) relevant to the institutional aspects of the project are described. It provides the reader with a clear overview of the contractual obligations which directed the work of the Consultants.

The institutional framework for water resources management is presented in Chapter 2, and consists of a description of the status quo, options and recommendations for the future organisation of the sector, and the implications of these recommendations.

Chapter 3, 4 and 5 elaborate on the proposed Water Resources Management Authority (WRMA) as the custodian of the nation's water resources. Chapter 3 outlines a number of detailed recommendations on its functions, its linkages with other water related organisations and its internal organisational structure. The proposed operating systems and procedures for the WRMA are described in Chapter 4, also including the organisation's staff requirements. Chapter 5 presents the consultants' findings and recommendations on the financial resources and the office equipment necessary for the effective functioning of a financially autonomous WRMA.

The recommendations regarding the legal framework for WRM are outlined in the concluding chapter, Chapter 6. Detailed suggestions are made on the different instruments available to formalise the WRMS recommendations. Specific emphasis is given to the inter-institutional linkages, the establishment of the WRMA and the (non-)establishment of a separate Water Resources Management Commission, to become the WRM arbitrator.

1.2 Relevant sections of the Terms of Reference

The Terms of Reference refer to a number of weaknesses and persistent problems in the management of the water resources in Trinidad and Tobago. These weaknesses and problems can be technical or institutional or a combination of both.

The most explicitly stated institutional problem is "the inadequate institutional and legislative framework to manage the water resources effectively for sustainable use and development" (ToR page 2, a). Management problems which clearly have both technical and institutional elements include e.g. the inefficient water allocation and use patterns (ToR page 3, h) and the poor mechanisms for data and information exchange (ToR page 4, k).

In fact, most of the deficiencies, which at first seem to be purely technical, are often manifestations of deficiencies in the institutional and legal framework, the result of poor inter-institutional or organisational arrangements and mechanisms, the result of insufficient funding or lack of skilled staff, or the result of insufficient awareness of the policy makers and the public at large.

The Terms of Reference also describe the detailing of a clearly articulated water resource management strategy for Trinidad and Tobago to meet the medium and long-term water needs of the country on a sustainable basis as the main output required of the Consultants (ToR, page 4).

Notwithstanding the integrated nature of the problem areas mentioned above, and of the different types of solutions resulting from that, the strategy should include the following specific institutional elements (ToR, pages 4-6):

A. WRM functions, inter-institutional linkages and organisational structure of WRM Authority

- recommendations for an appropriate institutional framework and organisational structure to facilitate an effective and co-ordinated approach to water resources management (l)
- specific legislative changes required to ensure that appropriate enabling legislation is in place (m)

B. Human resources, information systems and equipment

- formulation of recommendations for human resource development to ensure the viability of adequate institutional capacity to implement and manage the recommended changes effectively (n);
- assessment and recommendations of the adequacy and reliability of the existing information platform, methodologies and technical systems is use, compatible with existing GIS and LIS, to serve water resources management (i);
- assessment of and recommendations regarding the adequacy of computer hardware, software, human resources, skills and training to meet the long term requirements for effective integrated water resources management (j); and
- specifications of hardware, software and training, detailed together with an implementation plan for a computerised water resources database using a Geographic Information System (GIS) for data collection, data analysis, evaluation and integrated management (k)

C. Other WRM instruments

- recommend water resources allocation patterns for each hydrometric area, and methodologies for dealing with conflicting demands (f);
- recommend water quality targets and specific monitoring, control and enforcement measures to facilitate achievement of those targets, and ensure compliance with established recommended international standards (g); and
- development of an education and awareness programme for sensitising the public and decision makers on the need to adopt and practice the principles of sound land use and water use (v).

D. Financially autonomous institutional framework for WRM

One additional project objective, though not mentioned in the ToR, was introduced by the World Bank during the inception phase of the project. The Bank requested that the Consultants would make recommendations for the development of an effective and financially autonomous institutional framework for managing the water resources of Trinidad and Tobago.

2 Institutional Framework

2.1 Introduction to WRM and WRM Functions

2.1.1 Water Resources Management

The concept of integrated water resources management has emerged as the dominant model in the water sector in recent years. It entails a comprehensive and strategic approach to the medium term and long term management of water as an economic and social resource consistent with the broader national goals and policies (Crichlow and Mendez-Charles, 1997). In this regard an international consensus seems to be developing in the following areas (Ubels and Wevers 1996):

1. a movement away from 'water master planning', which focuses on water availability and development, towards 'comprehensive water policy planning' which addresses the interaction and possible competition between different sub-sectors, seeks to establish priorities, considers institutional requirements, and deals with the building of capacity;
2. the view that a clear demarcation should be made between the policy, regulatory, and operational functions of water management, and that an institutional separation must be established between the three;
3. the conviction that operational water management functions related to irrigation and drinking water should be decentralised where possible, as this arrangement is likely to increase the possibility of water management decisions matching actual user needs; and
4. the idea that the institutions responsible for water management should be less dependent on financial support from central governments, that greater contributions should be made by users, and that the linkage between payments made and services provided should be more direct.

2.1.2 WRM Functions

There are specific functions which are derived from the general concept of integrated water resources management. These are policy and strategy formulation, water resources assessment, water demand analysis, conservation, allocation of water, pricing of water, legislation and enforcement, demand management, and water resources development:

1. *Policy and strategy formulation*: a policy is a course or principle of action adopted or proposed by an organisation or individual, while strategy refers to general methods and plans of action by which objectives might be achieved;
2. *Water Resources Assessment*: this refers to the continuous study of water availability. This is done through programmes and activities both in on-going survey and monitoring and in research and development
3. *Water Demand Analysis*: demand analysis is the activity involved in determining the requirements of the various sub-sectors and stakeholders in the water sector (for example, agriculture, industry, and households);
4. *Conservation*: in this context, conservation refers to the prudent use of and the preservation of water resources, most notably through the treatment and re-use of water and through the proper management of watersheds and the 12 mile territorial zone.
5. *Master Planning and Allocation of Water*: this involves the determination of how much water is to be provided to each sector or stakeholder;
6. *Pricing of Water*: this is the process of arriving at an economic valuation of water, which is not to ignore or be oblivious to its social and ecological value. A distinction should be made

between prices that are charged to water abstractors and to prices being charged by the abstractors to the end-users of the water;

7. *Legislation and Enforcement:* this is the process to ensure that proper regulations are in place through a licensing and permit system, and that these are complied with as regards the abstraction of water, the prevention of water pollution and the use of the land;
8. *Demand Management*: this is the process of controlling the quantity of water abstracted by the various sectors and stakeholders and ensuring that this water is used in the most efficient way possible; and
9. *Water Resources Development and Distribution*: this covers the gamut of activities involved in making water available for use by its various consumers through the process of abstraction, storage, transmission and distribution. This would also include the proper sewerage and treatment of used water.

Institutional arrangements for water resources management must be built around these functions, and should include a framework for inter-institutional or trans-organisational relationships in the sector, a structure for the organisation with the primary responsibility for water resources management, the systems and procedures to be employed by this organisation in carrying out its functions, its general human resources profile, its equipment requirements, and finally, arrangements for its public relations, marketing, and public education activities.

2.2 Existing allocation of WRM Functions

The Water Resources Agency (WRA), which has the primary responsibility for water resources management, is part of the Water and Sewerage Authority (WASA), a statutory body under the Ministry of Public Utilities (MOPU). WASA is as a service deliverer of water supply and sewerage, largely involved in abstraction and distribution.

At this time the Private Sector Participation (PSP) within WASA appears to be moving apace, and if WRA remains within WASA, the regulatory function will reside with a profit oriented abstractor and distributor. This arrangement would not be in the national interest for obvious reasons. There is therefore a strong case for the separation of the planning and regulatory functions of the WRA from WASA. However some functions of WRA related to WASA operations may be retained by WASA, notably as the service deliverer of water supply and sewerage.

Another feature of the current situation is the number of government organisations which are at present involved in one way or the other with water resources, and this poses the challenge of determining an appropriate inter-institutional framework. The following organisations are the key stakeholders in the water resources sector.

- Drainage Division, Ministry of Works and Transport (MOWT), responsible for the construction and maintenance of storm water and flood control structures in the catchments of all the major river basins, and in charge of the Drainage and Flood Control Project (World Bank)

- Land and Water Division, Ministry of Agriculture, Land and Marine Resources MALM), responsible for irrigation water and efficient use of the water on farms, and in charge of the Agricultural Sector Investment Project (Inter-American Development Bank) and a project funded by the Food and Agriculture Organisation (FAO) to define a WRM policy framework for (irrigated) agriculture.

- Forestry Division, Ministry of Agriculture, Land and Marine Resources (MALM), responsible for forest management in order to promote watershed conservation, for wetland management to promote swamp conservation and in charge of the National Parks and Watershed Management Project (World Bank)

- Extension Division, Ministry of Agriculture, Land and Marine Resources (MALM), responsible for public awareness and extension activities in all spheres of the Ministry's mandate and including irrigation, watershed management and wetland management.

- Town and Country Planning Division, Ministry of Housing and Settlements (MOHS) (recently transferred from the Ministry of Planning and Development), responsible for land-use planning and regulating land development.

- Environmental Management Authority, a statutory body reporting to the Ministry of Planning and Development (MOPD), responsible for management of water pollution, water effluent discharge license and prohibition of water pollution, and in charge of the Environmental Management Agency Project (World Bank).

- Chemistry, Food and Drugs Division, Ministry of Health, responsible for monitoring agro-chemical residues and toxic chemicals.

- Ministry of Local Government and Municipal Authorities, responsible for public and municipal services like street cleaning and fire fighting - Central Government Ministry of National Security

- Public Utilities Commission (PUC), and its successor, the Regulated Industries Commission (RIC), responsible for setting rates the water-supplier may charge to the end-users of water. The RIC may also set standards with service providers and secure compliance in co-operation with the WRMA on water abstraction limits and the EMA on water effluent discharge

In addition there are a number of other organisations involved in the water sector though not as directly as the organisations mentioned above, including the Institute of Marine Affairs (IMA), the Central Statistical Office (CSO), the University of West Indies (UWI), the Meteorological Services, the Tourism and Industrial Development Corporation (TIDCO), the Regional and Municipal Corporations T&T SWMCOL, NEMA, private water abstractors and NGOs.

It must be noted that the number of persons in Trinidad and Tobago who are trained in the area of water resources management, in particular in the field of hydrology and hydro-geology is limited

These factors taken together, i.e. the position of WRA within WASA, the large number of organisations in the sector, and the lack of skilled staff, all constitute the main characteristics of the current situation and any proposal for institutional strengthening must therefore address them all.

It is also important to pay attention to the experience of public administration in post independence Trinidad and Tobago, and to the changes in public sector management practices taking place throughout the world, and particularly, in the British Commonwealth. More specifically, the following issues should be addressed:

1. the ineffectiveness of regulatory organisations: a lack of expertise and therefore a lack of credibility, inadequate legal frameworks, and inter-organisational conflict;
2. the flight of professional staff: inferior compensation packages, poor working conditions, and bureaucratic red-tape contribute to this flight;
3. reform strategies: the most widely used reform strategies are aimed at improving policy development and co-ordination, reorienting organisational cultures, commercialising and developing partnerships, and harnessing information technology;

Table 2.1 Existing allocation of WRM functions

No.	WRM Function	WASA incl.WRA	Approval	Appeal	MOWT Drain.Div	MALNR LW Div.	MALNR For.Div.	MOHS T&C Plan	MOPD EMA	MoHealth	PMO IMA	Met.Serv	Municipal Reg.Corp.	Private Sector	PUC/RIC
1	WR Policy and Strategy Development		Cabinet												
2	Water Resources Assessment														
	Survey and monitoring	Resp			Resp.							Resp.		Coop	
	Research and development	Resp			Resp.						Resp.	Resp.		Coop	
3	Water Demand Analysis	Resp				Coop.		Coop.					Coop	Coop	
4	Conservation (WR sustainability)														
	Treatment/re-use of (waste-)water	Resp							Consult	Consult			Resp.	Resp.	
	Watershed Management						Excl.Resp		Consult						
	12 mile Territorial Area	Excl.Resp									Coop				
5	Master Planning and Allocation	Excl.Resp	MOPU	MOPU											
6	Pricing of Water														
	Water Abstraction	Excl.Resp	WASA	PUC										Consult	
	Water Delivery		PUC	PUC										Excl.Resp	
7	Legislation and Enforcement														
	Water Abstraction Licensing	Excl.Resp	MoPU	MoPU											
	Water Effluent Discharge License		MOPD	MOPD					Excl.Resp						
	Land-use Permits		MOHS	MOHS				Excl.Resp							
	Building Permits		MOHS	MOHS				Resp.					Resp.		
8	Demand Management (efficient use)	Resp.				Resp.		Resp.	Resp.	Resp.			Resp.		
9	WR Development and Distribution														
	Domestic water	Resp.						Consult						Resp.	
	Industrial water	Resp.						Consult						Resp.	
	Agricultural water	Resp.			Resp.	Resp.		Consult						Resp.	
	Multi-purpose dams/reservoirs	Resp.						Consult							
	Drainage/flood-control	Consult			Resp.	Consult	Consult	Consult							
	Sewerage/conveyance	Resp.				Resp.		Consult	Resp.	Consult			Resp.	Resp.	
	Water treatment	Resp.						Consult		Consult			Resp.	Resp.	

Excl.Resp	Exclusive responsibility: Only one organisation is fully responsible for (part of) any WRM function
Resp.	Responsible: Different organisations may have a certain and separate responsibility for (part of) any WRM function
Co-ordinate	One organisation is charged with the co-ordination of (part of) any WRM function. This entails efforts to streamline the different responsibilities of individual organisations
Co-operate	An organisation is expected to work with any other organisation to carry out (part of) any WRM function (Work together)
Consult	An organisation is expected to be heard and its opinion considered by the organisation who bears responsibility for (part of) any WRM function

4. extended start-up periods for new institutions: as a result of a prolonged start-up period, the issues in society which an organisation is established to address might mutate, or new issues might arise; in both instances the fledgling organisation is always unprepared to cope.

2.3 Recommended allocation of WRM Functions

Two kinds of considerations have to be taken into account when determining the future institutional setting of WRM. These considerations may be characterised as functional (Section 2.3.1) and structural (Section 2.3.2). .

2.3.1 Functional Considerations

With respect to the functional considerations, one can place the various organisations operating in the sector into categories and examine their relationships against the background of these categories. Or, one might clarify their relationships and demarcate roles by considering these in relation to each function of water resources management. Taking the former approach first, the organisations in the sector may be placed in the following categories.

Potential Collaborators

These are the organisations which participate in the planning and conservation of water resources, and as well, those that contribute to the improvement of water quality in Trinidad and Tobago; the main organisations belonging to this group are:

- Ministry of Agriculture, Lands and Marine Resources (MALM) - Land and Water Division and the Watershed Management Unit of the Forestry Division;
- Environmental Management Authority (EMA);
- Ministry of Housing and Settlements (MOHS) - Town and Country Planning Division and the Land and Surveys Divisions
- Ministry of Works and Transport (MOWT) - Drainage Division
- Institute of Marine Affairs (IMA)
- Tobago House of Representatives

Abstractors and Distributors

These are organisations which extract and/or distribute water. WASA is the main organisation involved in this activity; private organisations, state institutions other than WASA, and even private organisations and citizens may fall into this category.

Users

This category includes the general public, industrial enterprises, agricultural enterprises, small farmers, and large public sector users such as the Fire Service.

Concerned Observers

The Tourism and Industrial Development Company (TIDCO), the Ministry of Health and the University of the West Indies (UWI) are the three main organisations in this group; they all have a certain interest in the quality and availability of water: for the Ministry of Health, there is a public health concern; for TIDCO, it is a concern for the economic value of water in industry and tourism; and for the UWI, the main interest is from a scientific and capacity building (R&D and training and education) point of view.

The relationship between the WRMA on the one hand, and collaborators and the concerned observers on the other, would be markedly different from WRMA's relationship with the abstractors / distributors and the users. The latter relationship will be considered in the first instance.

Table 2.2 Recommended allocation of WRM functions

No.	WRM Functions	WRMA	Approval	Appeal	WASA	MOWT Drain.Div	MALNR L&W Div	MALNR For.Div.	MOHS T&C Plan	MOPD EMA	MoHealth	PMO IMA	Met.Serv	Municipal Reg.Corp	Private Sector	PUC/RIC
1	WR Policy and Strategy Development	Excl.Resp	Cabinet			Consult	Consult	Consult	Consult	Consult	Consult	Consult			Consult	
2	Water Resources Assessment															
	Survey and monitoring	Excl.Resp			Coop	Coop				Coop			Coop		Coop	
	Research and development	Excl.Resp			Coop	Coop				Coop		Coop	Coop		Coop	
3	Water Demand Analysis	Co-ordinate			Coop	Coop	Coop	Coop	Coop					Coop	Coop	
4	Conservation (WR sustainability)															
	Treatment/re-use of (waste-)water	Co-ordinate			Resp.		Resp.			Resp.	Consult			Resp.	Resp.	
	Watershed Management	Co-operate						Excl.Resp		Consult						
	12 mile Territorial Area	Excl.Resp										Coop.				
5	Master Planning and Allocation	Excl.Resp	MOPD	MOPD	Consult	Consult	Consult	Consult	Consult	Consult				Consult	Consult	
6	Pricing of Water															
	Water Abstraction	Excl.Resp	WRMA	RIC												Consult
	Water Delivery	Consult	RIC	RIC.												Excl.Resp
7	Legislation and Enforcement															
	Water Abstraction Licensing	Excl.Resp	MOPD	EMC/RIC					Coop	Coop						
	Water Effluent Discharge License	Consult	MOPD	EMC		Consult				Excl.Resp	Consult					
	Land-use Permits	Consult	MOHS	LUC		Consult	Consult		Excl.Resp							
	Building Permits	Consult	MOHS	LUC					Resp.					Resp.		
8	Demand Management (efficient use)	Co-ordinate			Resp.		Resp.		Resp	Resp.	Resp.			Resp.		
9	WR Development and Distribution															
	Domestic water	Co-ordinate			Resp.				Consult						Resp.	
	Industrial water	Co-ordinate			Resp.				Consult						Resp.	
	Agricultural water	Co-ordinate			Resp.	Resp.	Resp.		Consult						Resp.	
	Multi-purpose dams/reservoirs	Co-ordinate			Resp.				Consult							
	Drainage/flood-control	Co-ordinate			Consult	Resp.	Consult	Consult	Consult							
	Sewerage/conveyance	Co-ordinate			Resp.		Resp.		Consult	Resp.	Consult			Resp.	Resp.	
	Water treatment	Co-ordinate			Resp.				Consult	Resp.	Consult			Resp.	Resp.	

Excl.Resp	Exclusive responsibility: Only one organisation is fully responsible for (part of) any WRM function
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Co-ordinate	One organisation is charged with the co-ordination of (part of) any WRM function. This entails efforts to streamline the different responsibilities of individual organisations
Co-operate	An organisation is expected to work with any other organisation to carry out (part of) any WRM function (Work together)
Consult	An organisation is expected to be heard and have its opinion considered by the organisation who bears responsibility for (part of) any WRM function

The second suggested approach to clarifying the relationships and demarcating the roles of the various organisations in the sector, is to consider these roles and relationships in relation to each water resource management function separately. Using this approach, Table 2.2 was developed. It contains a detailed description of the recommended relationships.

It is recommended that the WRMA have exclusive responsibility for developing its policies and strategies, however in doing so it would be required to consult with the Drainage Division of the MOWT, the Watershed Management Unit and Forestry Division of the MALM, the Town and Country Planning Division of the MOHS, the EMA, the Ministry of Health, TIDCO, and the IMA.

The WRMA should also have exclusive responsibility for water resources assessment, master planning and allocation, pricing of abstraction of water, and water abstraction licensing. In all cases, however, there will be need to consult with outside agencies, in some cases outside approval will have to be sought (e.g. Cabinet).

The WRMA should work with the main abstractor and distributor WASA, and other agencies in the public and private sectors in analysing the demand for water. In view of private sector participation in WASA and opening up of the water resources sector to other private abstractors and distributors, and as water is becoming more and more a scarce resource, a strong co-ordinating role for the WRMA is absolutely essential. This also relates to the treatment and use of waste water, the management of water demand, and the development of water resources. The WRMA should assist the various responsible organisations in achieving synergy amongst themselves with respect to policy formulation and operations.

Legislation and enforcement: WRMA's relations with EMA and Town and Country Planning Division

WRMA's relations with these two collaborators, though of a different nature when compared to WRMA's relations with WASA, are of equal and crucial importance to achieve optimum WRM. A strong commitment for streamlining and inter-institutional co-operation are called for where different regulators' roles are impinging on each other. As water and water use are closely related to land and land use and to water quality issues, special agreements should be prepared and implemented between these three organisations.

Regulatory policies and supporting legislation, the issuance of licenses and permits, their monitoring and enforcement, and data-exchange are necessary fields of co-operation and co-ordination between WRMA, EMA and the Town and Country Planning Division.

As regards the application for licenses, it is recommended that applications to one organisation be accompanied by a permit/license or a 'letter of no objection' from the two other organisations, wherever relevant. More specifically, the WRMA will consider water abstraction applications only if the applicant attaches a supporting document from EMA, either a water effluent discharge licence or a letter of no-objection if no adverse effects on water quality are envisaged. Similar arrangements should be put in place between WRMA and the Town and Country Planning Division.

As regards the license enforcement, abstraction licenses and the water effluent discharge licenses are also functionally linked, though falling under the responsibility of two different organisations. Because of this, further integration between EMA and the WRMA through a separate agreement should be considered.. This may include special arrangements regarding the monitoring of the water quality, not only of the water discharged by abstractors and distributors both also regarding the regular monitoring of the nation's water resources. Specific matters to be agreed between the WRMA and EMA would include:

1. who will physically collect water effluent samples?
2. who will do the water effluent analysis of these samples?
3. who will take follow-up steps in case of non-compliance with water effluent standards by water abstractors?
4. how will the information collected by one be communicated to the other?
5. what kind of cost-sharing mechanisms will be put in place to finance these activities?

Development and management of multi-purpose dams and reservoirs: WRMA relations with WASA

Of particular importance would be the relation between the WRMA and WASA, since WASA is to be WRMA's main abstractor of water, and since WASA will continue to own and run the country's main dams and reservoirs.

An extra dimension to this is that the Private Sector Participation (PSP) within WASA is about to enter a new stage. The current Interim Operating Agreement with the private operator is coming to an end in April 1999, and a Long-term Operating Agreement is being prepared.

It is expected that this new agreement is likely to be a concession agreement with a duration of 15-20 years. Water production, transmission, distribution, sewerage and waste water treatment functions would be part of the functions of the private operator. In addition, the operation and maintenance of existing dams and reservoirs, and the responsibility for financing (at least partially), the development, operation and maintenance of future dams and reservoirs will be placed with the private operator. These are activities of a complex nature which requires special expertise. It is anticipated that the ownership of all facilities will remain with WASA.

The WRMA will not itself engage directly in the development and management of dams and reservoirs; but instead, it will co-ordinate development work in the context of its concern for the needs of all abstractors. At the same time, WASA and WRMA will have to agree, by means of a special contract, on the technical and financial modalities (including cost sharing mechanisms) of dam and reservoir management in order to accommodate the requirements of the users.

Development and distribution of irrigation water: WRMA relations with WASA, the Drainage Division and the Land and Water Division, Extension Division and the Regional Offices (MALM)

Though farmers requiring water for irrigation purposes can apply to the WRMA for an abstraction license, a large majority of these agricultural enterprises may be too small in size and too short on capital to become a viable private abstractor. The situation might be quite different for capitalised farmers, who can afford an abstraction license, and for farmers who, through the presence of ponds, do not have shortages of water.

To accommodate the water needs of small farmers, a three-staged approach is suggested. For the first few years of the new regime, it is recommended that water be provided in bulk by WASA to these farmers through the Land and Water Division of the MALM. During this period, the MALM will start to establish Water Users Associations (WUA) on a pilot-basis. The following procedure may be considered to allow the supply of irrigation water during the first 3-5 years:

1. The Extension Division and/or the Regional Offices of the MALM, in close co-operation with the Land and Water Division, identify the target-group of farmers and determine their total water demand against the farmers' affordability and willingness to pay;
2. The Land and Water Division enters into an agreement with WASA for a metered bulk supply, if required, in co-operation with the Drainage Division (MOWT) for transmission of the water through its primary irrigation canals;
3. WASA applies to the WRMA to obtain the necessary abstraction licenses to supply the

requested supply of water to the Land and Water Division.
4. WASA supplies the water to the Land and Water Division in bulk for which its receives payment as per the tariffs set by the PUC or its expected successor the RIC;
5. The Land and Water Division develops and manages the supply of water to the farmers through its secondary and tertiary irrigation canals;
6. The Extension Division and/or the Regional Offices collect the contributions from the farmers as predetermined from the farmers' willingness to pay and transfer this to the Land and Water Division.

Shortfalls are expected between the fees collected from the farmers (see 6 above) and the payments due to WASA (see 4 above). A political decision is required from the MALM on how to bridge this gap, e.g. through co-funding or the payment of subsidies.

During a second stage of another 3-5 years, and once the Water Users Associations (WUA) are properly organised and fully established and operational, these groups would be able to take over part of the responsibilities which formerly rested with the Land and Water Division. Among other things, they would assume responsibility for the operation and maintenance of the tertiary system network, the analysis of their combined water demand, the collection of bills and payment to the Land and Water Division.
During a third stage, the WUA concept as tested in the pilot areas may be expanded and introduced in the entire country.

In case the water is being supplied through groundwater or if surface water is directly available in the area, it may even be considered that the WUA directly applies to the WRMA for a water abstraction license, thereby effectively bypassing the need for WASA to supply the water.

2.3.2 Structural aspects

Structural aspects relate to the location of the proposed WRMA within the Government Departmental sector. The main considerations in determining the position of the WRMA within the WRM institutional framework are:

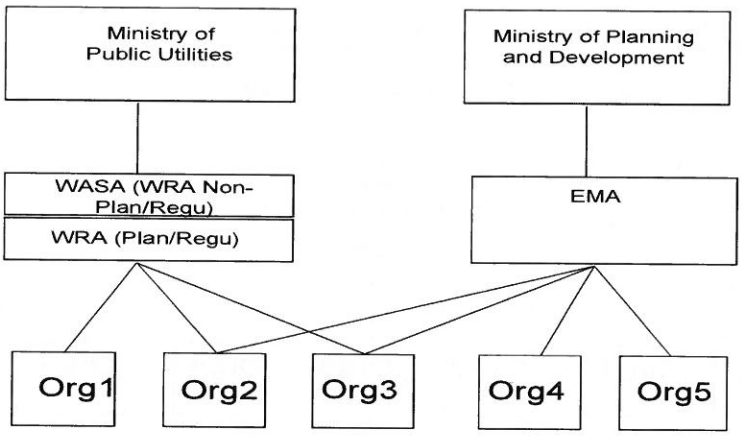
- the relation with WASA;
- the relation with the EMA, the Town and Country Planning Division and other collaborators;
- the parent Ministry of the WRMA.

In this regard, the following four options may be considered:

1. Continuation of existing system
2. Transfer of WRM functions to EMA
3. Establishment of new WRM organisation under one of the ministries, i.e. Ministry of Planning and Development or the Ministry of the Environment
4. Establishment of new WRM organisation under PMO

Consideration is given in detail to these four options on the following pages. For each option, a short description is given, followed by a listing of envisaged advantages and disadvantages.

Option 1. Continuation of existing system



Short description:

WRA continues to carry out its existing WRM functions, as an integral part and division of WASA under the Ministry of Public Utilities (MOPU). Even if the *status quo* is maintained, some minor improvements could be made by giving WRA the responsibility for WR policy and strategy development. Inter-institutional co-operation may be improved through the exchange of data and plans as per Memorandum of Understanding (MOU).

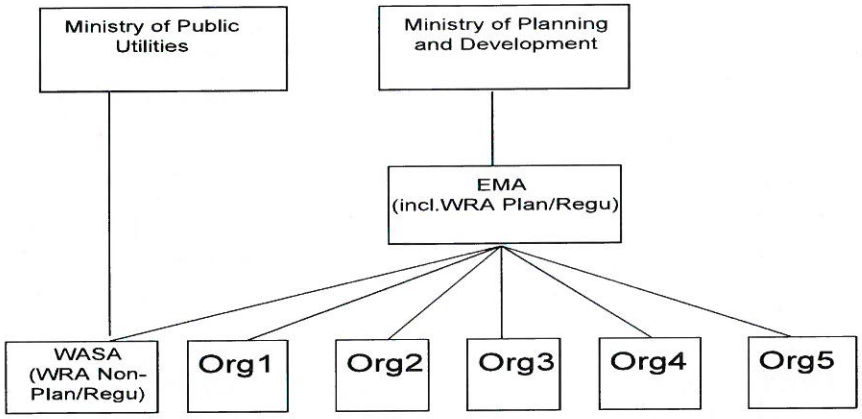
Advantages:

1. The only possible advantage of this option is that the expense of establishing a new organisation would not be incurred.

Disadvantages:

1. In this scenario, the planning and the regulatory functions, and the distribution and the service functions would not be separated, an arrangement which would be self-serving for a privatised WASA;
2. The abstraction license fees and royalties would be retained by WASA;
3. More than likely, water clients would not receive fair and equal treatment in the allocation process;
4. The streamlining of Water Resources Management and Environmental policies, plans and procedures is likely to be difficult;
5. Similarly, it would be difficult to streamline land- and water use policies;
6. Since the EMA and Town and Country Planning, the two other regulatory organisations are in the MOPD and MOHS respectively, stakeholders subject to regulation would have to deal with three Ministries;
7. Finally, if the WRMA is within the MOPU, it would more likely be subject to sectoral influences than if it were placed in the MOPD.

Option 2. Transfer of WRM functions to EMA



Short description:

The second option is to transfer the WRM functions of the WRA to the EMA. EMA would also be given the responsibility for WR policy and strategy development. Inter-institutional co-ordination and co-operation may be improved through the exchange of data and plans as per Memorandum of Understanding (MOU).

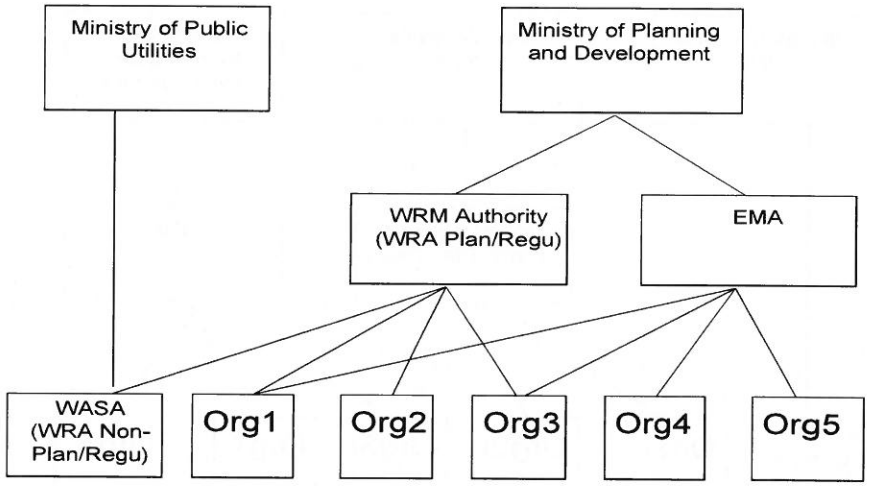
Advantages:

1. The Water Resources Management planning and regulatory functions would be separated from the distribution and service functions;
2. The abstraction fees and royalties would be available for Water Resources Management exclusively;
3. The likelihood of all clients being treated equitably in the allocation process would increase;
4. The streamlining of Water Resources and Environmental policies would be more easily accomplished;
5. It would facilitate the optimum use of scarce human and financial resources;
6. In addition, land use and water use matters would be streamlined under one ministry, the MOPD;
7. There would be no need to establish a new organisation, only an expansion of the already existing EMA;
8. Organisations subject to regulation would have to deal with only one Ministry;
9. It is likely that, under the MOPD, the Water Resources Management function would be less subject to sectoral biases.

Disadvantages:

1. The EMA's character would change substantially should it absorb the Water Resources Management function. The adjustment could be too great for an organisation that is not yet fully off the ground. In the long run, neither function might be managed effectively.

Option 3. Establishment of new WRM organisation under MOPD



Short description:

The third option is to establish a separate Water Resources Management Authority (WRMA) in the MOPD. The new WRMA would also be given the responsibility for WR policy and strategy development. Inter-institutional co-ordination and co-operation may be improved through the exchange of data and plans as per Memorandum of Understanding (MOU).

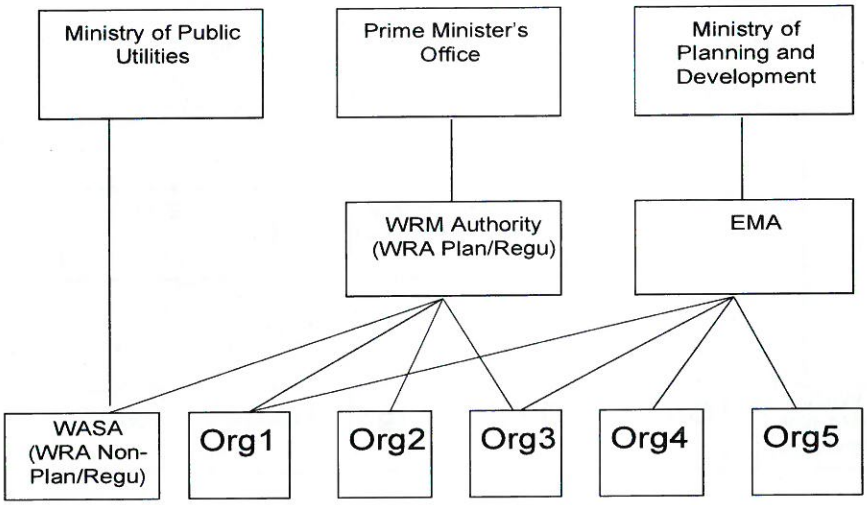
Advantages:

1. The planning and regulatory functions would be separated from the distribution and service functions;
2. Fees and royalties would be fully available for water resources managment;
3. The streamlining of water resources management and environmental policies would be easily achieved;
4. Clients are likely to receive equitable treatment in the allocation process;
5. Land use and water use policies could be easily streamlined;
6. Decisions are less likely to be biased towards one or other sectoral interest.

Disadvantages:

1. There would be the need to establish a new organisation and to alter an existing one;
2. It may result in a less than optimum use of human and financial resources;
3. Regulated organisations would have to deal with separate organisations even if they both belong to the same ministry.

Option 4. Establishment of new WRM organisation under PMO



Short description:

The fourth option is to establish a new Water Resources Management Authority (WRMA) in the Prime Minister's Office (PMO). The new WRMA would also be given the responsibility for WR policy and strategy development. Inter-institutional co-ordination and co-operation may be improved through the exchange of data and plans in accordance with a MOU.

Advantages:

1. The planning and regulatory functions would be separate from the distribution and service functions;
2. Fees and royalties would be available to water resources management;
3. Clients would more likely be treated fairly and equitably in the allocation process;
4. Water resources management decisions would less likely be subject to sectoral biases.

Disadvantages:

1. There would be the need to establish a new organisation and alter an existing one;
2. It would be difficult to streamline water resources management and environmental policies;
3. Similarly, it would be difficult to streamline land-use and water use policies;
4. It may result in less than optimum use of human and financial resources;
5. Regulated organisations would be required to deal with two ministries.

Keeping the WRA as a division in WASA was considered as a first option. However, if water planning and water management are located in an institution with a vested interest in being financially viable, these functions may not be performed objectively. Because of the financial interest, the entity might tend to support projects or allocations to benefit its own interests. To avoid these problems, it is best to locate the water planning and management functions in a non-user agency. Even if WASA were not to enter into a Private Sector Participation arrangement, it does not make sense to have the WRMA located within WASA. As WASA is the largest abstractor in Trinidad and Tobago, it would be very difficult to develop a functional structure that would allow the WRMA, as an entity located within WASA, to regulate its host's abstractions. For this reason, it is strongly recommended that the WRA be removed from WASA.

The merging of the WRMA with the EMA was also carefully considered. This option was rejected for two reasons. First, because the EMA is designed to be an enabling co-ordinating and enforcement organisation, its effectiveness will be compromised if it is burdened by planning functions. Specifically, the EMA currently has approximately 32 employees, and the WRA is anticipated to have approximately 80 employees. Second, since the EMA is designed to regulate air pollution, water pollution, hazardous substances, waste and environmentally sensitive areas and species, significantly broadening its duties in the water resources field would create an unbalanced institutional structure in relation to these other areas of responsibility.

Establishing the WRMA as a new entity under of the PMO, and more specifically under the Junior Minister of the Environment was also considered. However, it is noted that one of the most important goals of the new legal structure is to integrate water resources management and create an effective flow of information and co-ordination of responsibilities between key stakeholders. Since most of the key stakeholders are located within the MOPD, this effort will be hampered if the WRMA is located within the PMO. The recent move of the Minister of Environment from the PMO to the MOPD created an extra argument against the placement of the WRMA under the PMO. Thus, this option was also rejected.

In the light of the above, it is first and foremost recommended that the Water Resources Management Authority (WRMA) be established separate and apart from WASA and the ownership of all water resources in Trinidad and Tobago should be vested in this authority. WASA will retain the ownership and responsibility for the development and running of its reservoirs and abstraction facilities, the water will continue to be owned by the Government with the WRMA as her custodian. The newly established WRMA should be at the centre of the water management system, which at present consists of a number of organisations involved in the sector in one way or the other. All things considered, the option of placing the WRMA within the Ministry of Planning and Development is recommended.

The alternatives presented in this document do not depart radically from the present arrangements in the current organisation of the Government of Trinidad and Tobago. A more substantial departure would be the establishment of a separate Ministry for Sustainable Development, which at its administrative centre might focus on integrated policy development. This recommendation would not out of step with developments in other countries. For reference purposes only, and not intended as concrete recommendations for Trinidad and Tobago at this time, the State of Florida and Jamaica can be mentioned here.

Florida's Department of Environmental Protection (DEP) is a case in point. It is Florida's principal environmental and natural resources agency, and was created in 1993 with a merger of the Departments of Natural Resources and Environmental Regulation. DEP balances research, regulation, resource management, enforcement, and education, and contains divisions and offices that deal with a wide variety of environmental and resource management issues, including water resources.

Jamaica has a similar body, the Natural Resources Conservation Authority (NRCA) which is responsible for the management, conservation and protection of the natural resources of Jamaica. Although water resources management does not fall within this authority, the trend towards integration is clear. At present, NRCA has responsibility for coastal zone management, pollution control and waste management, national parks, protected areas and wildlife management, and watershed protection and management.

It must be noted, however, that even though there is integration at one level, the various units (particularly in the case of Florida's DEP) enjoy considerable autonomy. In states where such integration has not occurred, such as California, inefficiency and lack of inter-agency co-operation are a serious problem.

Trinidad and Tobago might usefully consider such an integrated approach in the medium term, and establish a Ministry for Sustainable Development made up of organisations such as the EMA, the new WRMA, the IMA, the Watershed Management Unit, the National Parks Authority etc.

2.4 Financial autonomy of WRM

Although world-wide a lot has been said and written on the economic value and pricing of water, the actual implementation and application of economic principles for the water sector is not widespread. In many countries, governments still have a central role as provider of water, recognising the basic role of water in sustaining human life and providing it free of charge or at a nominal fee. There is, on the one hand, still a tendency to look at water as a basic public commodity, where the emphasis lies on the social value of water, its importance for public health, food supply and the environmental aspects, all of which are deemed to be overriding factors in the discussions on valuation of water resources.

On the other hand, many governments are faced with increasing public expenditure, which grows faster than their generated income. This dilemma forces governments world-wide to have a serious look at their cost-management and to make decisions on how to manage their costs more efficiently. One of the measures to achieve this is to decrease subsidies and support to state run organisations, or in other words, to strive towards financial autonomy of these individual organisations and eventually financial autonomy for the whole sector in which they operate.

Though not specifically mentioned in the Terms of Reference, the World Bank suggested during the early stages of project implementation that the issue of financial autonomy be addressed by the Consultants. More specifically, the Consultants were requested to formulate recommendations for the development of an effective and financially autonomous institutional framework for managing the water resources of Trinidad and Tobago, thus for the sector at large and beyond the WRMA as one of the WRM organisations.

The process of achieving financial autonomy is one which might take years to implement and which has to be managed very carefully, in order to find a good balance between continuity of activities and speed of implementation. In a predominantly government financed operation, financial autonomy, i.e. the withdrawal of government financial support and subsidies cannot be reached overnight, and is in essence a long term process. This process should start with a thorough review of the organisation and/or sector to determine its strengths and weaknesses, the problems it faces and the possibilities for improvements. This process should culminate in the establishment of a transparent, and cost-effective framework, that can function without financial support from the Government.

From a financial point of view the most important part of the strategy for WRM should be: to

ensure that the sector as a whole and the individual organisations operating in it are able to cover their operating and capital costs. This coverage should come from income generated through economic pricing of water abstraction and use. It is important, however, to take all relevant factors into account when looking at exploitation of water resources. A balance should be struck between the satisfaction of the basic need of water supply and the imperative to mobilise funds necessary to ensure sustainable development of the resource to make it available as, and when and where needed.

From an economic cost/benefit approach, this would be a simple scenario: both capital and operational expenses need to be recovered by the generated income from product or service that is sold to the users of the water, and the price needs to be adjusted accordingly. This, however, would mean that the price of water would be totally dependent on the level of WRM-expenditure and could rise sharply when WASA or other abstractors and distributors need to make major investments, for example to develop new water reservoirs or when implementing major renovation or maintenance programmes. This could create social problems and an unsustainable situation in the longer run.

As stated above, the strive towards financial autonomy as a long-term objective is in principle the right strategy to establish and sustain an effective and efficient structure for the water sector, but this will be a time-consuming process that needs to be managed very carefully, taking into account not only financial, but also socio-economic, environmental and public health considerations. One of the key items in the process will be an extensive public awareness campaign, to make the concept of water as a commodity with economic value understood and accepted.

In Trinidad and Tobago, a substantial part of WRM is still financed by the government as it is in the majority of developing countries. The Government needs to adopt a well managed approach to decrease their financial support step-by-step and to shift from being a provider of water services, through WASA, to being the creator and regulator of an environment allowing involvement of communities, private sector and non-governmental organisations.

First, it should be established what degree of financial autonomy is feasible and desirable and over what period of time this could be achieved. A good starting point in the process towards financial autonomy of the sector is the establishment of a financially independent WRMA, which will be the cornerstone of a new WRM framework. Within a period of five years, the WRMA and the key stakeholders should be able to cover all their operational WRM related expenditures. At the end of this period the new structure should be fully operational, with the WRMA receiving royalties from its licence-holders, including WASA, and making contributions to the collaborators and concerned observers through its training and R&D funds and exchanging data, free of charge.

For the second period, which may take up to 10 years, the aim should be to reach a situation where both operational and capital WRM expenses of the key stakeholders are in principle fully covered by revenues. Government will have a monitoring role to safeguard public interests and will only render financial support where it feels public interest is being compromised. A vital assumption for the feasibility of this concept is that over these fifteen years WASA will develop itself as a (partly) privatised organisation and will be able to cover its own operational and capital expenses.

The recommended financial structure of the new WRMA is detailed, however the total of WRM expenditures and revenues would need further investigation to determine with a certain degree of accuracy the requirements for financial autonomy of WRM. The following matters should be clarified:

1. It should be clearly defined which functions and activities are included in WRM and how the tasks and responsibilities are divided with the WRM-partners. The proposed WRM functions

and responsible organisations as outlined in the next chapters will provide a good basis.

2. Each organisation should provide a cost-estimate of their part of the WRM-activities. Here the main bottleneck will be encountered. To provide a realistic estimate, organisations will have to break down their expenditure into function and unit related costs, which would require a different mode of their administrative organisation and an increase in cost awareness and accountability.
3. It should be clear what degree of financial autonomy is considered desirable. In the first few years, the Government may well continue to play a major role in financing WRM expenditures, mainly in capital expenses for development of infra-structural works and maintenance of existing ones.

The role of the Government should gradually be diminished to at least a 50-50 division of capital expenditure between the Government and the WRM-partners in a period of ten years and a further decrease in financial support over the next five years to reach the desired degree of financial autonomy for the sector.

While the cost side could be determined with some effort and time, the revenues or benefits would be much harder to determine, since there are benefits generated through a proper implementation of WRM, that simply cannot be expressed in financial figures, such as sustainable development of the environment, improvement in water supply, improvement in public health, etc.

The issue of cost sharing is closely related to the above issues. Some ways of sharing expenses have been identified through the establishment of two funds for the WR sector at large. First, a training fund should be set up for the whole sector, managed by the WRMA and to be utilised by all collaborators and concerned observers involved in WRM, to ensure continuity in capacity building in the water sector. An annual amount of TT$ 1 million is proposed. Second, it is recommended that a WRM fund for Research and Development be set up, managed by the WRMA and to be utilised by the same group of organisations, to jointly finance research and development activities in the water sector. An annual budget of at least TT$ 4 million is proposed. The establishment of these funds could be a first step in the direction of financial autonomy of the water sector, since organisations could call on these funds to finance their WRM activities, thus reducing the need for subsidies, grants, external loans, etc.

It is furthermore recommended to set up a communication network for the WRM-partners. Each WRM-partner will be assigned a certain amount to maintain and update their part of the system in order to ensure a continuous exchange of information, free of charge, effectively contributing to a cost-sharing exercise.

3 WRM Authority: functions and structure

3.1 WRM Functions

In this chapter a detailed description is given of the main functions recommended to be carried out by the proposed WRMA as compared to the existing functions of the WRA. Also the recommended degree of responsibility given to the WRMA is discussed. An outline is given of the inter-institutional linkages governing each of the functions and the ways how these links be best formalised. Reference is made to tables with full details of existing and recommended WRM functions presented in Sections 2.2. and 2.3.

In order to carry out the functions as described below, the existing capabilities of the WRA, if transferred to the new WRMA, would need to be substantially enhanced and its human, financial and other resources significantly increased. These factors are further elaborated on later in this chapter.

Water Resources Policy and Strategy Development *Exclusive Responsibility*

This function was not previously vested in the WRA, or with any other organisation. Collaborators and concerned observers will be consulted by the WRMA by way of Memorandum of Understanding (MOU). The Cabinet will review and approve proposals forwarded by the WRMA as described in the new WRM Act.

Water Resources Assessment - Survey and monitoring *Exclusive Responsibility*

This function was previously vested in the WRA. Water abstractors by way of the respective license agreements, and the Drainage Division, the Meteorological Services, EMA and others, through MOU, will co-operate with the WRMA in this respect. The information obtained will be used for planning purposes among other things.

Water Resources Assessment - Research and development *Exclusive Responsibility*

This function was not previously vested in WRA, but was carried out separately by individual collaborators, abstractors and concerned observers. Collaborators and concerned observers will co-operate with the WRMA by means of MOU with joint funding through WRMA's Research and Development Fund as described in the new WRM Act.

Water Demand Analysis *Co-ordinate*

This function was previously vested in WRA, but was not carried out. Individual abstractors and distributors, and collaborators were and will continue to be separately responsible for analysis of water demand in their relevant sub-sectors. Collaborators and distributors will continue to co-operate with the WRMA by means of MOU, and abstractors will continue to co-operate through their license applications. This will be used for planning purposes among other things.

Conservation - Treatment/re-use of (waste-)water *Co-ordinate*

This function was not previously vested in WRA, but rested and will continue to rest with abstractors as per license agreement. The EMA continues to be separately responsible through contract with the WRMA and through water effluent discharge licenses with the abstractors and

distributors. There is a justification for the WRMA to monitor and co-ordinate this function in accordance with the WRM Act.

Conservation - Watershed Management *Co-operate*

This function was not previously vested in WRA, and exclusive responsibility rested and will continue to rest with the Forestry Division. The EMA will continue to be consulted as a collaborator. There is a clear justification for the WRMA to co-operate by means of MOU

Conservation - 12 mile Territorial Area *Co-operate*

This function was previously vested in WRA, but not carried out. Exclusive responsibility will continue to rest with the new WRMA. Improved co-operation will be sought with the IMA as per MOU.

Master Planning and Allocation *Exclusive Responsibility*

This function was previously vested in WRA, but not carried out. Improved national and regional WR demand analysis and careful allocation of water will result from consultation with collaborators and distributors by way of MOU, and abstractors through license applications. The MOPD will review and approve master plans and allocations, and will hear and arbitrate appeals as described in the new WRM Act

Pricing of Water - Water Abstraction *Exclusive Responsibility*

This function was previously vested in the PUC, who would review and approve proposals submitted by WASA. Based on its objective to secure financial autonomy, the WRMA will determine rates chargeable to water abstractors, as described in the new WRM Act. The WRMA will be mindful of the national interest and the possible impact a price change may have on the tariffs that abstractors and distributors charge to their customers, and may liaise with the RIC, being the successor of the PUC. Appeal cases will be heard and decided by the RIC.

Pricing of Water - Water Delivery *Consult*

This function was previously vested in and will stay with the PUC, or its successor the RIC, who will continue to review and approve proposals submitted by WASA. In this process, the RIC may liaise with the WRMA to ensure that the price of water is fair in relation to the cost of abstraction.

Legislation and Enforcement - Water Abstraction Licensing *Exclusive Responsibility*

This function was previously vested in WRA and will continue to be carried out by the WRMA as described in the new WRM Act. Co-operation with the EMA and the Town and Country Planning Division will take place as per MOU, through issue of water effluent discharge licenses and statement of 'no objection' respectively, both as part of the approval procedure of abstraction applications. The MOPD will review and approve proposals for legislation as per the new WRM Act. Appeal cases will be heard and decided by the EMC, in accordance with the new WRM Act. The RIC will arbitrate on price-related appeal cases as per the new WRM Act.

Legislation and Enforcement - Water Effluent Discharge Licensing *Consult*

This function was not previously vested in WRA, and the main responsibility continues to rest with the EMA. The WRMA will be consulted by EMA on water resources related issues as per MOU. Further integration between the EMA and the WRMA through a separate contract may be

considered on enforcement of water quality issues as regards discharge of effluent by abstractors and distributors.

Legislation and Enforcement - Building/Land-use Permits *Consult*

This function was not previously vested in WRA, and the main responsibility for land use permits. continues to rest with the Town and Country Planning Division. Similarly, it is recommended that the responsibility for building permits continues to rest with the Town and Country Planning Division and the Municipal and Regional Corporations. The WRMA will be consulted on water resources related issues as per MOU

Demand Management (efficient use) *Co-ordinate*

This function was not previously vested in WRA. Individual abstractors and distributors, and collaborators will continue to be separately responsible for analysis of water demand in their relevant sub-sectors. Collaborators and distributors will continue to co-operate with the WRMA by way of MOU. Abstractors will continue to co-operate through their license applications with the WRMA.

WR Development and Distribution - Domestic and Industrial water *Co-ordinate*

This function was not previously vested in WRA. WASA and private abstractors will remain responsible for this function through their abstraction license. There is a clear justification for the WRMA to monitor and co-ordinate this function due to the new WRM Act.

WR Development and Distribution - Agricultural water *Co-ordinate*

This function was not previously vested in WRA. WASA, private abstractors, the Drainage Division, and the Land and Water Division will remain responsible for this function through their abstraction licenses and their legal mandates to provide water to users (See also Section 2.3.1). There is a clear justification for the WRMA to monitor and co-ordinate this function due to the new WRM Act.

WR Development and Distribution - Multi-purpose dams/reservoirs *Co-ordinate*

This function was not previously vested in WRA. WASA will remain responsible for the development and operation and maintenance of the dams and reservoirs. The WRMA and WASA will agree on dam development and operation through license agreements and/or contracts, securing the water rights of all abstractors and water needs of non-consumptive users (e.g. wetlands). There is a clear justification for the WRMA to monitor and co-ordinate this function due to the new WRM Act.

WR Development and Distribution - Drainage/flood-control *Co-ordinate*

This function was not previously vested in WRA. The Drainage Division will remain responsible for this function. There is a clear justification for the WRMA to monitor and co-ordinate this function in accordance with the new WRM Act.

WR Development and Distribution - Sewerage *Co-ordinate*

This function was not previously vested in WRA. Abstractors, through license agreements, and Regional Corporations and distributors, by way of MOU (both for all used water) and the Land and Water Division (for used irrigation water) will remain responsible for this function. There is a

clear justification for the WRMA to monitor and co-ordinate this function due to the new WRM Act.

WR Development and Distribution - Water treatment *Co-ordinate*

This function was not previously vested in WRA. Abstractors, through license agreements, and Regional Corporations and distributors, by way of MOU, will remain responsible for this function. There is a clear justification for the WRMA to monitor and co-ordinate this function in accordance with the new WRM Act.

The Consultants strongly suggest that the WRM Authority be given the responsibility to co-ordinate and strengthen the capacity of the water resources management sector at large. It is suggested that special funds be established from the Authority's revenues for training and research and development through the new WRM Act. Collaborators and concerned observers would be allowed to forward annual applications to draw from these two funds in accordance with MOU.

3.2 Organisational structure

3.2.1 WRM Authority structure

The main outline for the organisational structure of the new WRM Authority can be designed relatively straightforward. The organisation, being proposed as a body corporate, will be governed by a Board of Directors and, on a daily basis, managed by a Managing Director.

The organisation's primary process is to manage, as a planning and regulatory body, the country's water resources. As the WRM Authority is also mandated to enhance the capacity of the water resources sector at large, the organisation is entrusted to administer two separate funds, one for training and one for research and development. These specific functions justify the creation of two technical units, one for monitoring and one for planning and research. It is recommended that the responsibility for the management of the training fund is allocated to the human resources section.

The authority's responsibility to review and issue water abstraction licenses and the need to secure compliance of these license agreements, as well as the consideration of the large amounts of money involved and the history of bad payments, justify the establishment of a third and strong line department.

There is also a strong need for public awareness and education. Water resources management is multi-sectoral in nature as it deals with a large number of different users (consumptive and non-consumptive, commercial and non-commercial), and consequently a large number of planning and regulatory organisations. It is recommended to create a fourth line unit, combining regular customer and public relations functions with a public awareness co-ordinating function for the sector at large.

Regular staff or support functions, as in any organisation, would include the need for a finance and accounts unit and an administration and human resources unit. The specific nature and mandate of the organisation further determines which other support functions are required. In the case of the WRM Authority, these would include separate sections for administration and for information and communication technology. More typical sections related to the specific character of the WRM Authority, would require separate sections for human resources, and the above mentioned training fund and for maintenance and stores.

This outline has resulted in the formulation of two alternatives for the organisational structure of

the WRM Authority. These two options are presented in Figures 3.1 and 3.2.
The only structural difference between the two options is the position of a Technical Director in option 2. The main considerations choosing for one or the other option lie in the possible role of the Board of Directors and in the size of the WRM Authority.

First, if the Board of Directors demands a large involvement in the day-to-day operations of the organisation, and there is ample evidence of this being the case in Trinidad and Tobago, the Managing Director would be more upward-looking, having to spend a major part of his time communicating with Board members. As a direct consequence, he would have less time to manage his organisation, hence the need for a Technical Director to supervise the work of the line-units (Option 2). If however, the Board remains more distant from the daily management affairs, the Managing Director would be more downward looking, and thus reducing the need for a Technical Director (Option 1).

Second, as also practised in large public service organisations, the sheer number of departments and staff would create a span of control too large for one person. Consequently, such a situation would warrant a division of responsibilities and tasks between the Managing Director or Permanent Secretary, and the Technical Director or Chief Technical Officer (Option 2).

Figure 3.1 Proposed organisational structure for the WRM Authority (Option 1)

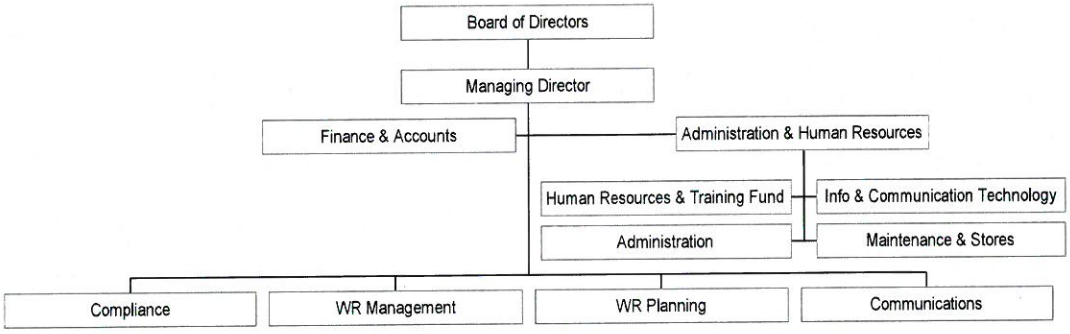
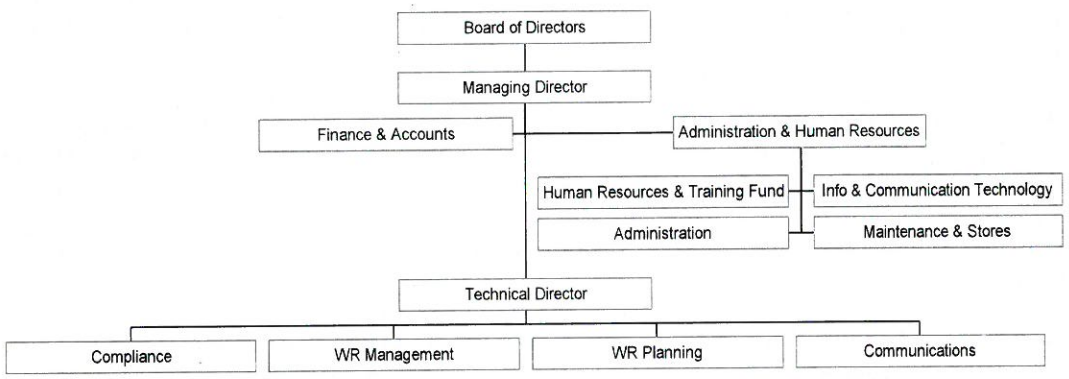


Figure 3.2 Proposed organisational structure for the WRM Authority (Option 2)



The Consultants recommend Option 1 for the WRM Authority for the following reasons:
1. The Board of Directors should minimise their involvement in the day-to-day operations;
2. The proposed span of control for the Managing Director is manageable (1:6);
3. The proposed size of the organisation with 80 staff does not require a Technical Director;
4. A set-up with a Managing Director and a Technical Director is prone to interpersonal conflicts;
5. Line units (Compliance, Water Resources Management, Water Resources Planning and Communications) will be headed by highly qualified managers

Figure 3.3. WRM Authority units and functions

Insert excel worksheet filename WRMAStructure still to be corrected

3.2.2 Board of Directors

The Board of Directors, governing the WRM Authority, will have as its main functions (1) the appointment of a Managing Director, who will also be an *ex officio* member of the Board; (2) the review and approval of policies, annual plans and budgets as prepared by the Managing Director; (3) the reporting to the Minister of Planning and Development; and (4) the regular review and approval of proposals on employment conditions for all WRMA staff.

As mentioned above, the Consultants strongly recommend that the Board remains distant from the day-to-day management of the WRMA, leaving this to the Managing Director. However, it is expected that the Board will give extra support to the Managing Director on policy and strategic issues in the establishment phase of the new organisation.

Board members will serve a term not exceeding five years and shall be appointed by the President. The recommended composition of the Board includes one Chairman, one Deputy Chairman and six to ten board members. Additional *ex-officio members* may also be selected from among the key stakeholders. The Board will have four to six regular meetings per year and any number of special meetings as and when required. Stipends for members of the Board have been budgeted in line with current rates for State-owned Enterprises.

3.2.3 Managing Director's Unit

The Managing Director, also being the Chief Executive Officer of the WRMA, will be responsible for: (1) the overall management, guidance and supervision of the work of the organisation and its staff; (2) reporting to the Board of Directors and attending the Board's meetings as an *ex officio* member; (3) the formulation and updating, together with his senior management, of WRM policies and strategies, annual plans and budgets; (4) the formulation and updating, together with the Head of the Administration and Human Resources Unit, of the WRMA employment conditions, and (5) the establishment and maintenance of formal contacts with (inter-)national organisations in the water sector.

3.2.4 Finance and Accounts Unit

In the new set-up, the WRMA will have to give a full-fledged financial account of its activities, comprising statements, such as: cash flow statement, statements of income and expenditures, monthly/quarterly financial overview, profit/loss accounts and balance sheets, including liaison with the external auditors. Specific financial statements include lists of technical equipment with prices, inventory of stores with pricing and in general lists per unit of all activities with a financial impact.

For the Finance and Accounts unit, there would also be some important additional functions, including: (1) treasury function, with responsibilities for actual payments and receipts for all WRMA activities and control of the cash flow, both internally and to and from external sources; (2) financial management function of the WRMA and of its funds for training and Research and Development, dealing with the actual planning and implementation of commitments and disbursements; (3) pricing of water (see section 3.3); and (4) pricing of consultancy services and sale of data by the WRMA to third parties.

3.2.5 Administration and Human Resources Unit

The unit is designed to play a vital role in the WRMA. It is to manage the human resources, manage the information systems, maintain the organisation's equipment and buildings, manage the stores, maintain a library, and administer and internally audit both management and office systems and procedures. In order to perform these functions, the unit is divided into four distinct sections.

Administration Section

This section will be responsible for ensuring that the organisation is supplied with office equipment and materials, that offices are kept clean, that mail is managed efficiently, that proper records are kept, and that all contact with clients is handled professionally. The section will also have responsibility for the WRMA's library and filing system, particularly with respect to maps and other technical documents.

Maintenance and Stores Section

This section will have the major functions of maintaining the organisation's technical equipment, and the management of its stores. It aims would be essentially to ensure that WRMA's equipment is always functioning at optimal efficiency and to ensure that inventories of required supplies are kept at practical and cost-efficient levels.

Information and Communication Technology Section

This section would be responsible for maintaining and developing the digital information systems of the WRMA. It will essentially provide a service to all units and sections of the organisation, while maintaining an holistic perspective. The services would involve advising the organisation on its hardware and software needs, maintaining and developing software where necessary, technical design and maintenance of Internet and Intranet sites, ensuring the proper functioning of the information systems, assisting in the training of staff and producing relevant reports.

Human Resources and Training Fund Section

This section will be responsible for all activities falling under human resources: vacancy announcements, preparation of job descriptions, recruitment, determination of function group and salary levels, salary administration, co-ordination and administration of training activities, performance appraisal and possible consequences, administration of allowances and insurance, implementation and administration of a pension scheme. Financial data regarding human resources should be compiled in an automated system, also accessible to staff from the Finance and Accounts Unit, who will make the actual payments based on this information.

The section will also be responsible for the administrative management of the training fund: receipt of proposals for training requests related to WRM, from other organisations and from the WRMA itself; initial screening and evaluation and submission of a list with recommendations for the decision takers; implementation of these decisions and co-ordination of administrative arrangements; passing requests for payments to the Finance and Accounts Unit

3.2.6 Compliance Unit

The compliance unit will be responsible for: (1) designing, issuing and processing of abstraction applications, in co-operation with the WRP Unit (for technical scrutiny); (2) fulfilling water resources related data and consultancy requests from third parties, also carefully considering confidentiality issues; (3) contracting arrangement with WASA, EMA, Town and Country Planning Division, and with service organisations in the context of WRMA's outsourcing activities, such as publishing companies, security services, etc.; (4) monitoring of license agreements, whereas assuming overall responsibility within WRMA, activities should be closely co-ordinated with the Finance and Accounts Unit (for financial monitoring) and with the WRM Unit (for technical monitoring); (5) other legal affairs, including tasks such as representing the WRMA in appeal cases for the EMC, the RIC or the courts, in legal platform discussions with other Government and relevant organisations, etc.

3.2.7 Water Resources Management Unit

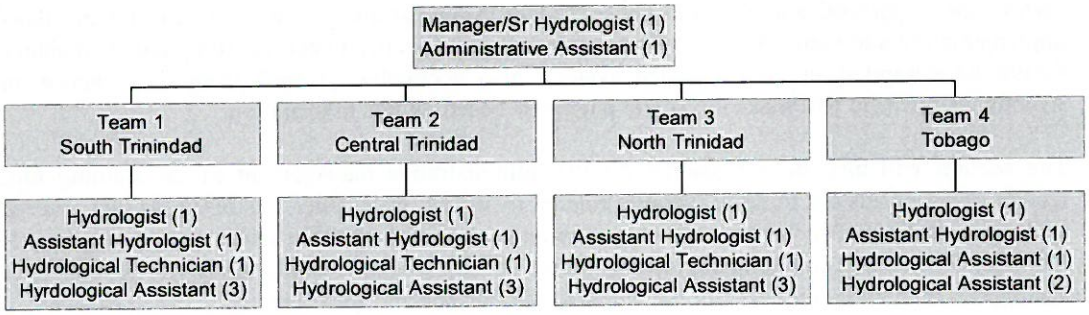
It is proposed that the Water Resources Management Unit be primarily responsible for satisfying the following functions of the WRMA:

- Monitoring of, and reporting on, the status of the water resources of Trinidad and Tobago, in terms of both quantity and quality;
- Monitoring of, and reporting on, the compliance of licensees with the terms and conditions of their licenses, including well drilling and abstraction; and
- Satisfaction of internal and external demands for water resources data, including consultation and co-operation in special studies.

Activities to be carried out as part of these functions include the field collection of data, its subsequent office based processing, analysis and interpretation, and the release of the resulting conclusions and recommendations in timely reports. The Water Resources Management Unit may also be involved in the preparation of annual data sets and water resources status reports, for publication and sale by the Communications Unit.

It is suggested that the work of the WRM Unit be organised and implemented through four technical teams under the supervision and guidance of the Unit Manager/Senior Hydrologist. Each team would be led by a Hydrologist and would be responsible for implementation of all activities in a convenient grouping of hydrological areas. The four teams will work in selected geographical zones, which are approximately the same in size and based on a more or less equal grouping of existing basins : Team 1 (South) comprises the basins 5, 6 and 7, Team 2 (Central) will carry out its activities in the basins 2, 3, 4 and 8, and Team 3 (North) will work in the basins 1 and 9. Tobago will be fully covered by Team 4. These work arrangements are graphically presented in Figure 3.4. More detailed staffing requirements are described in Section 3.4 and Appendix A.

Figure 3.4 Set-up of integrated teams for Water Resources Management Unit



3.2.8 Water Resources Planning Unit

It is recommended that the Water Resources Planning Unit be assigned responsibility for satisfying the following functions of the WRMA:

- Preparation and periodic revision of a water resources management plan, including inventories of water resources availability and water demands, and a preferred allocation to guide the issue of abstraction licenses;
- Design and implementation of basin and special studies, including research projects and the evaluation of new technologies, to improve the definition of elements of the water resources management plan to the level required for the most appropriate water resources development and management decisions;
- Management of the WRMA research and development fund, established to enhance and co-

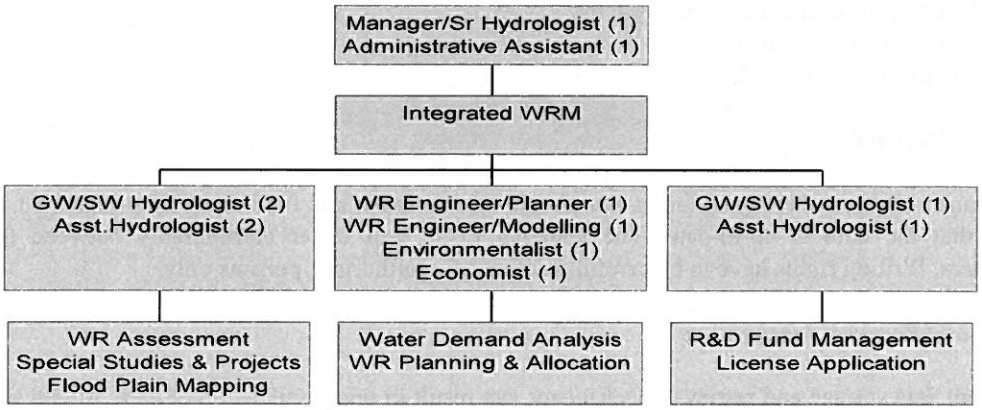
ordinate the research and development activities in the sector;

- Review of abstraction applications for surface water and groundwater, including a technical scrutiny and approval of the application itself and its concurrence with the national water resources management plan;
- Preparation and periodic revision of flood plain maps of Trinidad and Tobago; and
- Co-ordination of the integrated management of the water resources of Trinidad and Tobago, including identification of the data and/or service needs of the WRMA to be satisfied by external agencies, and those of external agencies to be satisfied by the WRMA.

It is envisaged that the satisfaction of these functions will require implementation of a range of activities including: scientific literature surveys, desk studies, field experiments, analysis and interpretation, and the presentation of resulting conclusions and recommendations in technical reports. The integrated WRM would be given effect through MOUs negotiated between the several agencies involved.

It is suggested that the work of the WRP Unit be organised and implemented through three technical teams, under the supervision and guidance of the Unit Manager/Senior Hydrologist. The respective areas of responsibility and the associated professional skills required of each team, are set out in Figure 3.5. More detailed staffing requirements are described in Section 3.4 and Appendix A.

Figure 3.5 Set-up of functional teams for Water Resources Planning Unit



3.2.9 Communications Unit

The Communications Unit will first and foremost be responsible for all of WRMA's public awareness and education, and public relations activities. This would include: (1) co-ordinating and streamlining all water resources related public awareness and education activities of relevant organisations in the sector, like WASA, the MALM, EMA and the Ministry of Health; (2) planning and programming public awareness and education activities for policy makers and WRMA's potential and actual customers, i.e. the water abstractors; (3) regular public relations and press releases targeted towards the general public at large; (4) publication of annual reports and special study reports produced by the WRMA; (5) organisation of the WRMA annual conferences, seminars and workshops; (6) support to individual WRMA representatives for presentations at (inter-)national conferences, seminars, etc.

It is suggested that audio-visual support facilities within the unit would be limited to regular desk-top publishing equipment and software. For studio-, printing- and media-campaign services, it is suggested that these be out-sourced to commercial organisations, as and when required.

4 WMR Authority: systems and procedures

4.1 Data and Information Management System

The Consultants recommend the development of a number of data and information management systems, viz.:

- Water Resource Management Information System (WRMIS)
- Human Resources Management Information System (HRMIS)
- Finance Management Information System (FMIS)
- Geographical Information System (GIS)
- Computer Network and Data Communication System

Each of these systems should be properly maintained and well managed, not only because of the high cost of its acquisition, but also to ensure that it provides adequate and accurate information for water resources management. Therefore the data management requirements entail developing mechanisms, strategies and procedures for the following information management activities:

- Updating mechanism
- Storage and retrieval mechanisms
- Data definition and dictionary systems
- Data integration strategy
- Data evaluation procedure

Updating Mechanism

A mechanism for periodically updating data should be developed and funding options identified, to ensure that the data is up-to-date. The updating cycle will differ considerably between the parameters. Writing rights have to be carefully defined for authorised persons only.

Storage and Retrieval Mechanisms

Inefficient data storage and retrieval mechanisms can result in under utilisation of data. A data and information management system must provide for efficient data storage and retrieval mechanisms so as to accommodate access by the wide community of users, at the same time carefully defining reading and writing rights, thus ensuring security against any un-authorised users.

Data Definition and Dictionary Systems

Developing databases to support various developmental activities is an enormous programme. The wide variety of data, especially with the intended WRM information system, which will be collected and managed require that each data item be properly identified and defined. The agency officially designated to collect and manage specific data items should also be known to all potential users. The mode of collection, format of storage, accuracy and resolution of each data item must be properly documented in a data dictionary. Such a dictionary is the first "port of call" to users of a WRM Information System, for it gives a synopsis of each data item being managed. The existence of a data dictionary for the entire system would reduce duplication in data collection and facilitate access to data.

Data Integration Strategy

The task of developing information systems, and in particular a WRM information system, does not imply that data will be acquired using a simple data acquisition system and at a fixed or uniform resolution. Multiple acquisition systems and resolutions can be adopted, as long as its adoption can be justified and "paid for" by the users. The resolution of widely used data would rarely be uniform. An information system must therefore provide strategies for the integration of data from different sources, different resolutions, and different projections and datums. By displaying such flexibility, the system will be able to attract a larger community of users.

Data Evaluation Procedure

One major virtue required of a corporate database is data integrity. The users of the system must have confidence that the data accurately depicts reality. A certain level of trust in the accuracy of the data must be evident. It is the task of every data collecting agency, to ensure that each item of data is adequately evaluated and its correctness guaranteed before it is entered into the database. Such quality control will lead to increased utilisation of the database. Error reporting procedures, as well as strategies for adding and deleting data items, should be designed and implemented throughout the life-cycle of the database.

Developing a corporate WRM database is a major task which requires close intra- and inter-institutional collaboration. In the former case, the Water Resources Management and Planning Units have different functions, and consequently different information requirements. Tables 4.1 and 4.2 outline the different data systems required by these two units. In the latter case, Figure 4.1 presents the proposed system for water resources data and information management, considering the relations between the different types of organisations. The diagram also shows the suggested range of support measures for each of the identified stages, as well as the steps in formalising these suggested arrangements (MOU, Operations Manual and License agreement).

Figure 4.1 Water Resources Data and Information Cycle

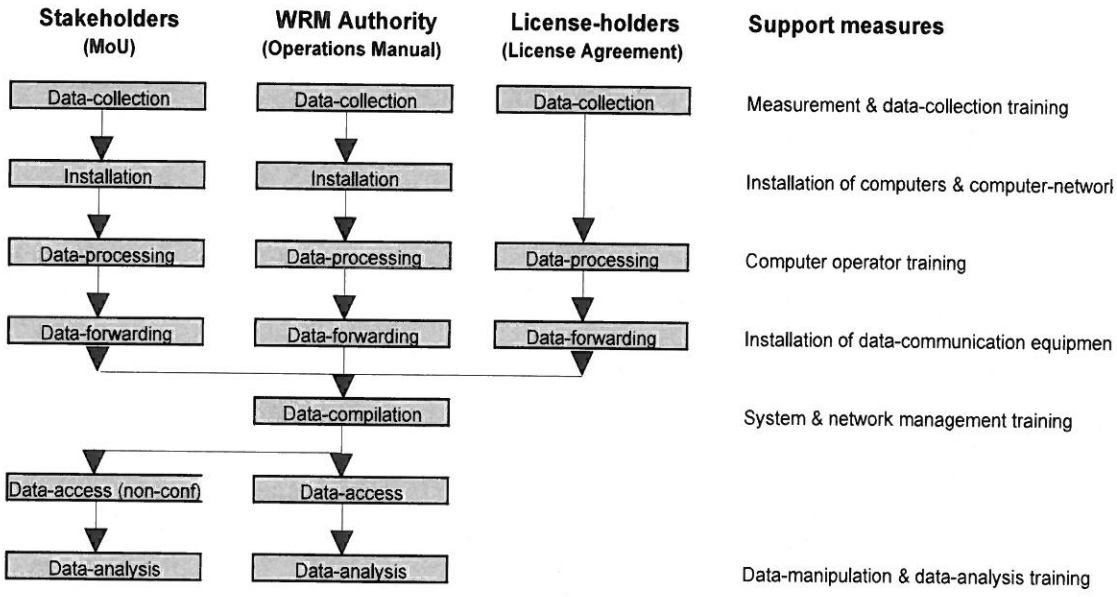


Table 4.1 Data and Information System for the Water Resources Management Unit

Table 4.2 Data and Information System for the Water Resources Planning System

The role of the Geographical Information System for the WRMA is quite important. Because most of the data is geo-referenced, the GIS could provide powerful tools for WRMA's decision support system. It is the strength of GIS to present the results of complex procedures and/or calculations, in a readily understandable form chiefly through maps and tables. Since the data for the GIS come from different sources it is important that all data are collected and processed into compatible formats.

The Consultants also recommend the design and development of separate data and information systems for the management of WRMA's human and financial resources. These structure of these systems can be built on clearly defined input and output formats, allowing for easy input, handling and output. A large number of possible input and output formats are described in the table on the next page (See Table 4.3).

4.2 Water Resources Management System

The activities of the Water Resources Management Unit should be guided towards satisfaction of the WRA functions that have been assigned to it, through the use of systems set out below.

- Field Data Network: Points within a hydrological area where the data on which the desired water resources outputs are to be based, are collected. The network should include climate, surface water, groundwater and water quality data points, geographically distributed to allow characterisation of the hydrologic parameters of interest, in both time and space. Each data point has to be designed, equipped and maintained to consistently provide accurate data, within the time intervals necessary for the analysis to be of relevance. Telemetry may be used to provide real-time data as is required in a flood warning system, or from remote data points.
- Data Collection Programme: The collection of data from the Field Data Network (and its maintenance), according to a pre-determined schedule, by the WRM Field Crew and Field Observers.

  The Programme is to be designed to provide the data needed as input into the set of hydrological analyses that are to be used to satisfy the objectives of the Unit. The field data is to be entered directly on to purpose designed forms to facilitate digitising, except for recorder charts that are already in a form suitable for digitising.
- Data Digitisation and Processing system: The respective data is received in the office by the WRM Office Crew and digitised using a computer system of adequate capacity and appropriate software. The data is then processed into its final form using suitable computer software, is checked for accuracy and then placed in the necessary computer files for storage/retrieval, by the Team Supervisor/Hydrologist..
- Data Storage and Retrieval System: The respective data in their final form are to be stored in computer files, programmed with a security system that allows only the Supervisor/ Hydrologist to input/amend them. Each Supervisor/Hydrologist will be assigned responsibility for the data files for their respective hydrological area. However, copying/retrieval from the data files would be available to all authorised users of the WRA computer system. The system would be updated monthly.
- Analytical Systems: A computer directory with files containing a number of programmes useful for routine analysis, such as pumping test analysis, preparation and analysis of streamflow and ground-water hydrographs, preparation of groundwater and water quality contour maps, etc.
- Reporting Format and Standards: A computer file that details the reporting format and standards to be adopted in the preparation of the various types of communication used by the WRA, i.e. internal and external technical reports, inter-office memoranda, minutes of meetings, record of consultations, etc.

Table 4.3 Outline for Human Resources and Financial Management Information Systems

Human Resources Management Information System	
Input	**Output**
- Employment application forms - Leave forms - Performance appraisal forms - Training attendance - Attendance for seminars, etc - Insurance - Salaries	- Demographics (age, gender distribution, marital status, parental status, education and training levels) - Individual employees (age, gender, marital status, address, parental status, employment history, education, salary, performance appraisal, special achievements and contributions, skills and unique skills) - Training (training programmes offered, evaluation of those programmes, employees trained, planned training, development activities, cost of training.) - Career and succession (skills, accomplishments, "personality" profiles) - HR-Planning (current in-house HR resources, future availability of in-house resources, national demographics, turnover rates, productivity and resource utilisation, costs and budgets.) - Costs of HR (salary and wage structures, salary and wage bills, benefit packages, benefits used and accumulated, cost of training, cost of HR processes) - Health and Safety (accidents, individuals involved in accidents, cost of accidents, data required for government, insurance reports.) - Labour relations ((changes in) collective agreements, cost of each item in the collective agreement and grievances, company morale, employee feedback on management initiatives) - Business environment (other companies, institutes and organisations, economic trends , national educational statistics)

Financial Management Information System	
Input	**Output**
- All units within the WRMA (annual activity forecasts and financial requirements and expected revenues; major changes in planned activities and financial consequences; financial commitments: contracts and agreements; information concerning procurements) - Administrative and Human Resources unit (information of staff salaries payments, allowances, pensions, etc.; training fund activities and payments; invoices for building maintenance and management) - Compliance unit (licence holders and payment arrangements; overview of imposed fines; information on data sale) - Managing Directors Office (policy decisions and financial consequences; feedback on budget proposals and financial statements) - External (bank statements; progress reports from WRMA partners on activities financed through training and R&D funds; tax forms; approved funding proposals from training and R&D fund screening committees)	- Internal (budget proposals to the management; balance sheet; profit and loss accounts; cash flow statements; budgets (per unit and for the whole organisation); monthly/quarterly statements of actual income and expenditure; management overview; price structure for water abstraction). - Payments (salaries, allowances, etc; invoices; disbursements to WRMA partners; tax declarations) - External (published financial statements: balance, profit and loss account, specifications).

- Computer System: All of the office processes/procedures are to be computer based. The Unit will be served by a computer network, in which each professional/hydrology technician will have a workstation and be able to access those directories/programmes that are required for their respective work assignments.

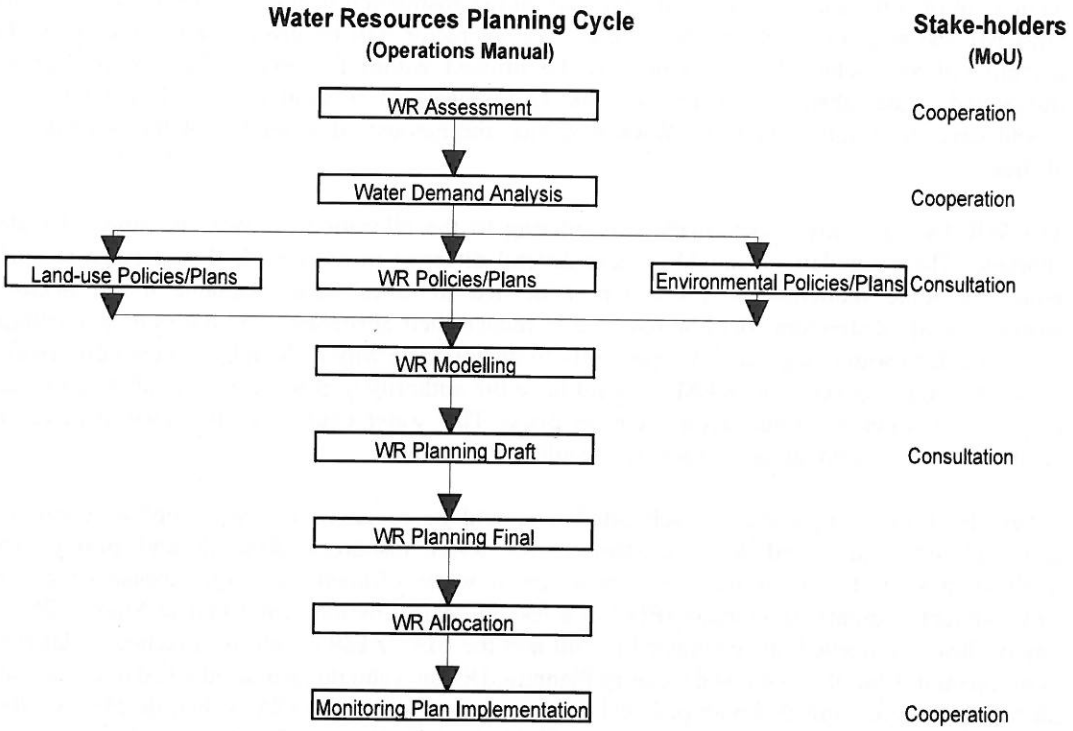
These systems assume that each team is divided into a field crew and an office crew. The field crew will be primarily involved in the field collection of data and the routine servicing of the data network, whereas the office crew will be primarily engaged in data processing and storage. Both crews will be involved in the routine analyses and report preparation.

4.3 Water Resources Planning System

The implementation of the work activities of the Water Resources Planning Unit is to be guided towards attainment of its objectives by the use of the several systems described below.

- Reference Library: A collection of the hard and/or digital copies of water resources information on/or of direct relevance to Trinidad and Tobago. These should include (a) technical reports and professional papers on previous water resources and water supply studies/projects; (b) laws and regulations; (c) guidelines and standards; (d) hydrological and hydro-geological text books and journals; (e) data series published by the WRA; etc.
- Internet Access: Computer access to international and other national water resources information systems, to obtain relevant science and technology information.
- Computer/Mathematical Models: A directory of analytical and simulation models of relevance to the understanding of the hydrology of Trinidad and Tobago e.g. aquifer, water quality, water balance, rainfall/runoff models.
- GIS System: Digital topographic maps of Trinidad and Tobago to serve as base maps, for the analysis of hydrological (and other) data and the graphical presentation of the results obtained.
- Memoranda of Understanding: Legally non-binding agreements negotiated between the WRA and other government and private sector organisations, governing the provision and/or exchange of information of relevance to the integrated water resources management of Trinidad and Tobago.
- Reporting Format and Standards: A computer file that details the reporting format and standards to be adopted in the preparation of the various types of communication used by the WRA i.e. internal and external technical reports, inter-office memoranda, minutes of meetings, record of consultations, etc.
- Computer System: All of the office processes/procedures are to be computer based. The Unit will be served by a computer network, in which each professional will have a workstation and be able to access those programmes that are required for their respective assignments.

Figure 4.2 Water Resources Planning Cycle



4.4 Water Abstraction Licensing System

As part of its mandate in controlling the water resources of Trinidad and Tobago for the benefit of the public, the WRMA must have the power to charge royalties and license fees for the abtraction and use of surface water or ground water. All current and potential abstractors will be required to submit an application covering the quantity and method of abstraction to the WRMA for approval. WASA must do so as soon as the WRMA is established. All other current abstractors should do so upon renewal of their abstraction licenses. The WRMA will respect the licenses of existing abstractors. However, the WRMA would need information concerning the licences of all existing abstractors so that it can build a database on water use abstraction. All future licenses will also contain regulations on the discharge of effluent and related reporting requirements.

Furthermore, the WRMA will have the authority to condition the issue of licenses on factors including, but not limited to operation of abstraction facilities, measurements of abstraction and maintenance of minimum stream flows, in addition to billing and collection procedures. The WRMA will have the authority to establish regulations for these and other relevant factors, and should promptly establish regulations regarding efficiency of use and compliance with

The WRMA will also check whether the applicant has obtained, or is in the process of obtaining a water effluent discharge licence as required by the EMA, that is if there is an effluent discharge associated with the abstraction. All licensees will be required to periodically report relevant data to the WRMA, and the WRMA will have the right of entry and authority to monitor the licensed abstractors' compliance with the conditions contained in the license.

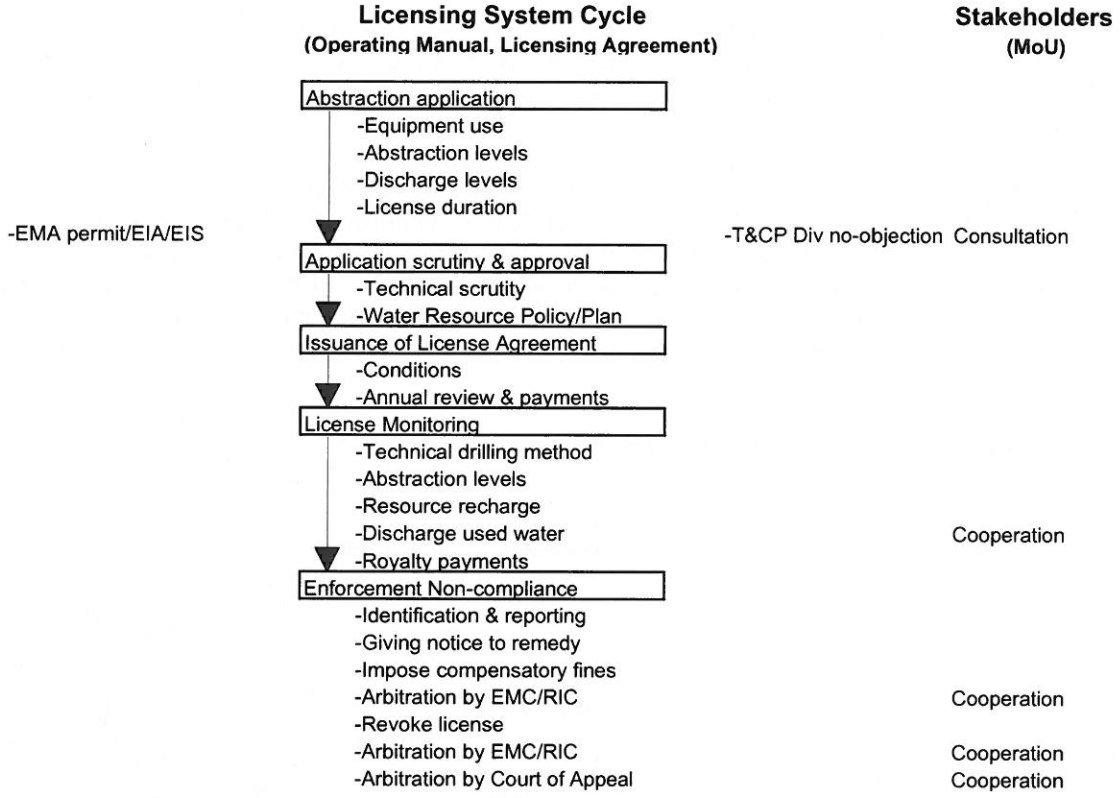
The price of an abstraction license should be a fixed price based on the amount of water the abstractor applies to abstract. If the abstractor abstracts an amount of water in excess of that amount, the abstractor must pay for the additional water plus a penalty. If the abstractor abstracts an amount of water that is less than the amount on the abstraction license, the abstractor must still must pay the amount stated on the license. The abstractor will be given a water credit for the amount not abstracted. This amount must be utilised within five years. This credit may be transferred. Water abstraction volumes would be reviewed on an annual basis and the abstractor would have the right to have the WRMA reduce the amount of water that it has a license to abstract.

The WRMA also must enact regulations relating to the allocation of water in times of water shortage. These regulations should contain several different provisions. If the shortage is fairly mild, but some reduction in abstraction is needed to make water available to all licensed abstractors, all abstractors could be required to reduce their abstractions by the same percentage. An abstractor should be given the opportunity to demonstrate why it should be treated differently. If the shortage is severe, the WRMA should have the authority to prioritise water abstraction and to purchase water from abstractors at a set price. This water could then be make available to abstractors who cannot abstract water as a result of the draught.

When the license application is submitted it should be reviewed by the compliance unit for technical sufficiency and for consistency with water resources planning and policy. The application should state if there is a need for a water effluent discharge license or for an Environmental Impact Assessment (EIA) or a less in-depth Environmental Impact Study (EIS). If any of these are needed, the completed permit and the EIA or EIS should be attached. A letter of non-objection from the Town and Country Planning Division should also be attached to ensure non obstruction and compliance with physical plans and purposes. The WRMA then decides whether to issue the license and determines any conditions in the license. The license should contain provisions relating to the technical issues regarding the method of abstraction, the quantity of abstraction, water discharges and water pollution if any, fees for abstraction and other provisions deemed necessary by the WRMA. Once a license is issued it may be modified through an application of the abstractor to the WRMA and the process used for issuing the initial license. The quantity of the abstraction license may be modified on an annual basis. The license must contain a provision that the WRMA has the authority to enforce non-compliance through fines, or revocation or modification of the license. Appeals of permit decisions or modifications will be heard by the EMC.

The procedures for water abstraction license application and the actual license enforcement are presented in Figure 4.3.

Figure 4.3 Water Abstraction Licensing System



4.5 Training and R&D Fund Management System

In order to strengthen the WRM sector at large, the WRM Authority will manage two separate funds, one for training and one for research and development. A second objective of these funds is to facilitate cost-sharing between the different organisations engaged in water resources management. A third objective is to seek alignment with international aims and objectives in the water resources sector.

Funds will be made available to support and facilitate activities of collaborators and concerned observers in WRM, being the custodians and managers of the country's water resources. Only those organisations who have signed the MOU as described above may apply for and benefit from these funds. Thus, water abstractors and water users would be excluded from the use of these facilities, as their prime objectives are significantly different.

Activities that may be considered for co-financing under the Training Fund include e.g. training courses, seminars, conferences, overseas fellowships, participation in international programs and twinning arrangements. R&D activities which could be considered for co-financing include, for example pre-feasibility studies, environmental studies, and water demand analysis.

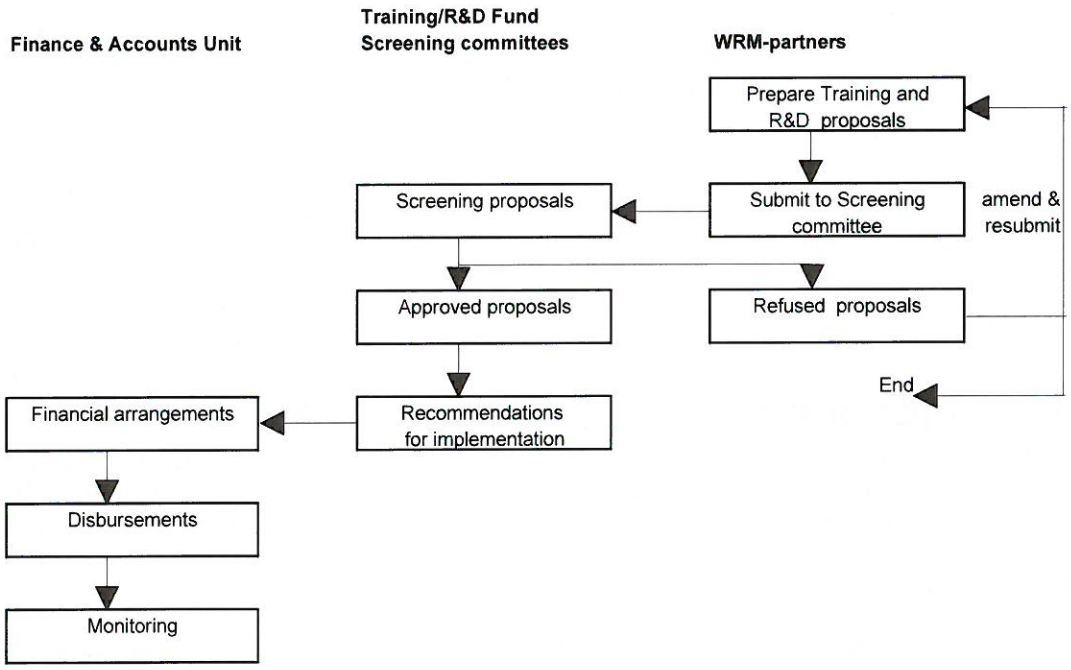
To ensure continuity of activities and a steady flow of financial resources, a part of WRMA revenues will be reserved for this fund. The annual budgets for the two funds are tentatively set a TT$ 1 million for training, and TT$ 4 million for research and development. Other external sources of income may also be considered, such as for example international support, grants and

loans. It might even be an option to set up an annual contribution for WRM-partners, allocated according to a scheme of pre-determined quota.

Once a year, proposals and applications for co-financing can be submitted to the WRMA, which will serve as fund manager and secretariat. The WRMA senior management, or alternatively, a screening committee, comprising representatives of the various WRM-partners, will be responsible for review and approval.

Once approved, the WRMA will be responsible for making the necessary financial arrangements, actual disbursements, and financial and technical monitoring. The WRM Planning Unit is responsible for technical monitoring of the R&D activities. The Human Resources and Training Fund Section will be responsible for the technical monitoring of the training activities. The Finance and Accounts Unit will be in charge of all financial matters related to the management of these funds. The tentative procedures for the two funds are presented in the figure below. (See Figure 4.4)

Figure 4.4 Training and Research and Development System



4.6 Water Abstraction Pricing System

The determination of the price-level is one of the critical issues where the financial autonomy of the WRMA is at stake, since this will decide the level of their main source of income, the royalties. There are two possibilities :

1. The WRMA determines the price, in which case it will be set at such a level as to cover expenditures and perhaps provide for creation of some reserves (WRM R&D Fund, Training Fund and contingency provision) and thus ensure financial viability; or
2. The price is determined outside the WRMA (i.e. by RIC/PUC).

It is recommended that the WRMA itself determines a reasonable price for all parties, taking into consideration both the financial need to cover their own expenses, and the influence their price will have on the financial position of the licence holder, i.e. how will this influence the rate that WASA will eventually charge its customers. In order to do so, and ensure objective and fair pricing, the WRMA may consult with the RIC, being the successor of the PUC.

The impact of the amount of royalties to be levied from WASA could be estimated, *ceteris paribus*, as an increase of the operational costs of around 4% thereof. This figure has been derived from the cost figures obtained from WASA's audited accounts for the financial year ending 31 March, 1997.

The WRMA may hold consultations with WASA and the MOPD on its proposed price level and publish a royalty price which will apply over a five year period. All abstractors are notified of any price changes three months in advance and in case of disagreement, they can appeal. For practical reasons, it would be difficult to consult with all abstractors. Since WASA is responsible for around 90% of WRMA's expected revenues, it makes good business sense to consult with WASA regarding the price of abstraction although there is no formal obligation to do so.

An annual increase of 3-5% could be added to the price in the following years to compensate for inflation, increase in expenditure and financing of additional activities under the R&D Fund. It is well known and accepted practice to include e.g. the effect on inflation in the pricing of goods and services. Review of the price level will have to be done every five years. A price increase will have to be announced to the licence holders at least three months before the end of the fixed period. In the case of any disagreement or complaint, the matter can be submitted to the RIC.

The initial consideration for the WRMA in determining a reasonable price level for water abstraction is to maintain its financial viability to execute its co-ordinating and regulating role in the management of the water resources of Trinidad and Tobago. To come to a realistic price-level, reflecting the present situation and agreeable to all parties involved, the following information is important :

* total amount of water to be abstracted under the licence agreements: estimated at 300 million m3 annually, WASA 280 million (93.3%), other licence holders 20 million (6.7%), these are estimated figures for 1998;
* annual WRMA expenses to be covered : estimated at approximately TT$ 16,5 million increasing by approximately 3-5% a year; and
* the percentage of licence fees that will actually be collected is conservatively estimated at 75% for all license holders, considering possible delays in payment, partial payments, disputes and liquidity problems. From 1998 until 2003, this percentage should increase to 95%

Taking this information into account, it would be practical to establish a two-tiered rate structure with a sliding scale for WASA on the one hand and the other licensees on the other hand. The main reason for this two tiered rate structure is that it is unrealistic to assume that WASA could pay the same as other domestic abstractors unless other abstractors are charged the same low rate as WASA, who does not pay any license fee as yet, would then have to significantly increase the price they charge to their customers. A sliding scale is proposed in order to improve the allocation of resources and to promote the efficient use of the water.

Table 4.4 Proposed price structure for WASA

water abstraction million m3/month	price per m3(in TT$)
0-5	0.04
5-10	0.05
10-15	0.06
15-20	0.07
20-25	0.08
25 and higher	0.10

Following Table 4.4, this would, at an average monthly volume of abstracted water of 23 million m3, amount to an average monthly royalty charge of TT$ 1 million, or annually TT$ 12.06 million (at a fee collection rate of 75%). Alternatively, since the demand elasticity of WASA is not very high at present, i.e. the overall demand is not likely to vary significantly in the short term and under the present conditions, a flat rate of TT$ 0.06/m3 would also be an option, which would give a slightly higher amount (TT$ 12.42 million/year).

These calculations, however, are based on an estimated total water abstraction of 300 million m3 annually and under present conditions, of which WASA is abstracting 280 million m3. Major repairs to the distribution network and the installation of meters for the end-users now and in the coming years, are expected to reduce the overall annual water demand and thus the amounts of water abstracted. This should be taken into account when calculating abstraction fees for a longer period of time. It would be a feasible option to set a price of TT$ 0.065/m3, with an annual increase of at least 3-5% to reflect increasing costs, thus creating some financial reserves for the years in which the water demand is expected to decline. Since the latter is the most likely scenario, an amount of TT$ 0.065 is used in the budget calculations for the first year of WRMA activities.

To enable longer term planning for the financial activities of the sector, it would be advisable to develop a clear pricing policy. A costing model for the WRM-activities needs to be developed, estimating expenditures over a longer period of time. Based on this, and taking into account the estimated water demand, an estimate can be made of the price structure.

Considering the proposed rate for WASA and the principle of cost-recovery, it would be feasible to lower the rates for the other licence holders. This would better reflect the principle of fair and equal treatment of customers, but at the same time still value the difference between WASA, as an 'intermediate' service provider and the other licence holders as direct consumers of the water.

Table 4.5 Proposed price structure for other licensees

water abstraction 1,000 m3/month	price per m3(in TT$)
0-50	0.15
50-100	0.18
100-200	0.20
200-400	0.25
400 and higher	0.30

A progressive price structure generally decreases the demand for water. However, the impact here will be very limited in view of the small amount, and therefore an alternative would be to maintain the current method of using a flat rate. This rate would then be set at a lower level of TT$ 0.20/m3, which is used in the budget calculations.

Another possibility would be to create a more differentiated price structure, to distinguish between

industrial and agricultural licence holders. To stimulate growth in the agricultural sector, an even lower tariff could be set, for example, at the same level as the rate for WASA, although lower prices might lead to an excess use of water. The rate for industrial licensees could remain at the level of TT$ 0.20/m3, or could be increased slightly to compensate for the lower tariffs.

4.7 Public awareness system

The Trinidad and Tobago water resources sector can only be managed effectively if it is accompanied with an effective system of public awareness. Public awareness in this context should be geared towards key decision takers at policy level and at the level of the end users of water. As water is multi-sectoral and its uses multi-purpose, it goes beyond saying that the public awareness strategies, programs, plans, projects and activities have to be multi-faceted.

The underlying principle for public awareness in the water sector is that of subsidiarity. In other words, although the WRMA is the custodian of all water in the country, the public awareness activities should be carried out where they are most effective: at the lowest level. This means that the different organisations have different roles to play, together contributing to the common cause of public awareness in the water sector.

The MALM should continue to be responsible and step-up its efforts on public awareness towards its target groups regarding irrigation and watersheds, the MOH should continue to be responsible for water related public health activities on e.g. waterborne diseases, WASA should continue to target its customers on the efficient use of water in households, EMA has to bring across its environmental messages to its different target groups, primary and secondary schools should teach children on the importance and value of water and its use, and TIDCO should make tourists aware on their responsible use and behaviour regarding water for drinking and recreation purposes.

The WRMA also has its own direct target groups both in terms of key decision takers and in terms of its direct customers, being the water abstractors. On top of this direct responsibility, the WRMA should also be responsible for the co-ordination of all public awareness activities in the water sector.

The envisaged MOU between the WRMA and the collaborators and concerned observers provides a good opportunity to agree on streamlining strategies, programs, plans and activities and on joint venturing wherever and whenever appropriate. Annual meetings should be initiated by the WRMA and organised for all key stakeholders to exchange ideas and inform each other on the intentions for that year.

More often than not, public awareness activities are carried out as one-off activities, not being embedded within a well defined strategy, and not making best use of and not carefully selecting the optimum mix from the wide variety of communication tools. Once properly staffed and equipped, the WRMA could also inform and enhance the knowledge and skills of public awareness staff from relevant key-stakeholders in these aspects.

Similarly, the WRMA should organise annual conferences for key stakeholders, industry, NGOs and the public at large on a specially selected theme within the water resources sector. These conferences should not only target a national audience, but should also aim to attract an international audience, seeking the participation from similar organisations in the region and from international donor organisations.

The relation between the WRMA and the actual and potential water abstractors is significantly different and requires a different but equally tailor-made approach. Water abstraction license holders and organisations considering to apply for an abstraction license need to be fully aware of

the rules, regulations and practical modalities related to water abstraction.

Technical standards for design, construction, operation and maintenance can also prove to be of valuable assistance to license holders to abstract water in the most effective and efficient manner. Also, standards for the efficient use of water could be of enormous assistance to water abstractors. And information regarding the proper discharge of used water could be provided as a joint effort between the WRMA and EMA. The WRMA should organise regular workshops and seminars for (potential) water abstractors for this purpose, complementing elaborate written materials (brochures, leaflets) and unambiguous and comprehensive license application forms.

In view of the seasonal water scarcities in Trinidad and Tobago, public awareness activities for policy makers seems to be an easy goal to achieve. Nevertheless, it is important to provide policy makers with timely and accurate information regarding the actual situation and trends in the water resource sector. The WRMA should also be able to point policy makers to similar problems and solutions found in other similar countries.

The WRMA also has an internal task when it comes to public awareness. Its employees, and most importantly the 'front-desk' employees should be capable to deal with the 'outside world'. A clear orientation towards its customers, customers in the widest sense, is essential for a proper information and communication to achieve public awareness. This can be achieved through training and coaching of WRMA employees in customer relations, in appearing in television commercials and programmes, and in participating and making presentations during conferences and seminars.

4.8 Human resources system

Traditional Human Resource Management (HRM) has been undergoing fundamental changes over the course of the past two decades. Perhaps the most fundamental change that has taken place is the movement away from a perspective which considers the employee a cost, to one which views him as an asset. This new perspective has revolutionised HRM practices in the organisations in which it has been adopted.

A second, and very significant change, has been the emergence of *strategic* human resource management, which has replaced the ad hoc and tactical approaches practised by many organisations in the past. This change has impacted directly on the status of HRM practitioners, for accompanying the change to strategic HRM, has been the elevation of HRM from a clerical/administrative activity to one that is essentially managerial/professional. Indeed, human resource managers are now considered to be strategic partners with top management in many organisations.

As the proposed new WRMA is brought into being, perhaps significantly at the turn of the millennium, it should be provided with the capacity to stay in step with contemporary practices and developments. Accordingly, careful attention must be paid to the selection of the human resource specialists who would have the responsibility of advising top management on HRM matters, and guiding the implementation of HRM programmes.

The proposals for the establishment of the WRMA, discussed in other parts of this document, clearly chart a new strategic direction for the organisation. As has already been pointed out, a recommendation has been made to remove the WRMA from within WASA and make it into an independent organisation. In addition, it is proposed that this new organisation should be made financially autonomous.

These changes would be revolutionary, if implemented. It would involve transforming a placid

division of a bureaucratic public sector organisation into an independent financially autonomous body. This frame-breaking change would pose major challenges for human resource management in the WRMA, not only with respect to policy development, but also with respect to the change in management. It would perhaps be the one most important issue with which the organisation would have to grapple in its infant years.

The national environment, and the sector, in which the organisation is to perform, will provide the organisation with its other major challenge, that is, the matter of the reported severe shortage of qualified professionals in the area of hydrology and hydro-geology. Persons with university training in natural science and engineering, who have the potential to be trained in hydrology, or indeed those who have already been so trained, are likely to be attracted to organisations, such as those in the energy sector, which offer luring compensation packages and working conditions. At present, compensation at the WRA is pegged at the Public Service level, which is significantly lower than that of the energy sector.

It is most likely, therefore, that these two issues would have the greatest impact on the HRM choices which the WRMA would have to make. As the WRMA is brought on stream, there are four areas in which key HRM choices will have to be made, most notably: (1) staffing, (2) performance management, (3) human resource development, and (4) rewards and compensation.

4.8.1 Staffing requirements

The recommended structure and functions of the WRMA are described earlier in this chapter. In addition, general recommendations have been made regarding the required staffing. The resulting staffing requirements for each of the units are summarised in Figure 4.5.

In view of the requirements outlined above, the challenge facing the WRMA would be to determine where to source its staff, whether internally from the WRA or externally. The WRMA must decide its long term as well as its short term policy in this regard.

The advantage of promoting from within is that current employees tend be motivated by the prospect of promotion. However, the disadvantage is that this policy can contribute in the long term to organisational staleness. For this reason, it is advisable to bring new staff into an organisation from time to time with the aim of introducing fresh perspectives. Of course, choices in this area are also dependent on the availability and the level or type of staff in question.

At start-up, the WRMA would have three options in this regard. It can return all the existing WRA staff to WASA and then recruit an entirely new one. Or it can fill all its posts with its present staff. Neither option is wholly feasible as Appendix A, which contains a detailed description of WRMA's staff requirements, demonstrates. It shows that the WRA does not have personnel who can fill many of the new positions. Hence, the WRMA might wish to pursue a mixed strategy in the short term. It may also wish to adopt a similar approach in the medium term so as to enjoy the best of both worlds, that is the combined benefits of internal and external recruitment.

A critical issue would be the need to fill the eight posts of hydrologist. In view of the reported shortage of such personnels in Trinidad and Tobago, the WRMA should advertise locally first, clearly mentioning the improved employment conditions, to determine the true state of the local market and, if necessary, advertise regionally, and internationally.

The start-up cohort may be hired on a contractual basis, especially in the case of the non-nationals in the group. Simultaneously, a group of local understudies with first degrees in either the natural sciences or engineering could be hired, put to work with their seniors for a year, and on the basis of positive evaluations, be sent to pursue postgraduate study abroad.

Figure 4.5 WRM Authority units and proposed staffing

Insert Excel worksheet filename WRMAstaff.xls

The WRMA should develop clear guidelines and conditions, which are fair to all parties, regarding the grant of scholarships of this kind. There appears to be no particular difficulty in filling the other new posts from the local market.

While the matter of sourcing staff will perhaps constitute the major staffing challenge for the WRMA, there are others. These are discussed below:.

1. *At what level should the minimum entry qualifications for each job be placed?*
   It is recommended that the organisation place its entry qualifications towards the higher end of the scale. For example, administrative assistants should be required to possess at least 5 O'Level/ CXC passes, together with computer literacy (which should include a high level of keyboard skills); and the work of these administrative assistants should embrace both clerical and secretarial activities. It is to be noted that in the Public Service, from where WASA adopted most of its personnel policies, clerical and secretarial work are separated.
2. *Should there be limited or extensive socialisation of staff upon entry to the organisation?*
   Because of the revolutionary change in organisational culture that is envisaged for the WRMA, it is advisable that extensive socialisation be done for the new, accompanied by similar doses of reorientation for present staff.
3. *Should the organisation explicitly and publicly state the criteria and standards which guide its recruitment and selection processes?*
   As a public sector agency, the WRMA seems to have no choice but to be explicit and be seen to be an equal opportunity employer. In addition to the ethical aspects of this issue, the public relations aspect cannot be ignored. Such a policy will contribute significantly to the WRMA's credibility and standing in the wider society.
4. *Should there be high security of tenure, or should there be low security of tenure?*
   The existing system, built on Public Service norms, provides a high security of tenure. This is coupled with a non-contributory pension scheme. These two factors are among the reasons public service salaries have been kept at much lower levels than the energy sector, and indeed other parts of the private sector. However as the WRMA moves to being a financially autonomous, results driven organisation, needing to compete for staff with the upper end of the private sector, the typical public service terms and conditions of employment would become dysfunctional. It would be necessary to equate compensation with the energy sector and at the same time remove the high security of tenure now existing. In the new WRMA, employees should secure their positions on the basis of the results they deliver, which should be determined on objective standards. This issue can be expected to be controversial.

4.8.2 Human Resources Development

The second major area in which choices will have to be made is in the area of Human Resource Development, which includes activities such as training, coaching and mentoring, counselling, career planning and development, management development, and organisational development. In all of the areas listed, the organisation has the choice of either functioning in a spontaneous ad hoc manner, or in a planned and systematic way.

There are times when it is necessary to be spontaneous and ad hoc. This kind of response is necessary when unexpected situations and issues arise, and in a complex and dynamic environment such unpredictable occurrences are to be expected. However, it is advisable that in view of the difficulty the WRMA is likely to have in obtaining staff trained in the various aspects of hydrological sciences, it should very systematically prepare human resource development plans.

As it is at the heart of the work of the WRMA, hydrology has been specifically mentioned. However, in the interest of continuous improvement and of creating a functionally efficient organisation, the WRMA should also plan the development of all its staff. An organisation that only pays attention to one part of its cadre of human resources cannot be effective, as all of its

parts (except in the case of superfluous parts) contribute to goal achievement.
It seems necessary for the WRMA to take the following human resource development initiatives at start-up:

1. As was stated above, the WRMA should hire eight experienced hydrologists at start-up. These persons should be hired on contract (especially if they are non-nationals) and among their duties would be the responsibility of training young local recruits. The training of these recruits should include postgraduate courses abroad. The number of trainees would depend on the age and nationality of each of the senior hydrologists.
2. The WRMA should organise training courses for the paraprofessional staff in conjunction with the Faculty of Engineering of the UWI. These courses could be conducted in a modular format so as to cause as little disruption as possible to work flow. Upon completion, participants should attain standards of proficiency that would equate with international norms, and they should be awarded appropriate certification by the University. It may be useful to conduct this programme with the collaboration of the Caribbean Meteorological Institute (CMI) in Barbados which conducts this kind of training for Caribbean nationals. The WRMA would have to enter into contract with these institutions and perhaps meet the full cost of the training. The need for this training emerges from an examination of the qualifications of the paraprofessionals, that is, the Assistant Hydrologists, Hydrology Technicians, and Hydrology Assistants now employed by the WRA. At present, these posts are classified Hydrological Assistants III, II, and I respectively. It is advised that the training be conducted in Trinidad and Tobago so that all staff might be trained in the quickest possible time, and with the least disruption to the organisation.
3. The WRMA should develop and manage a special fund for the training of nationals in water resources management, and related areas, such as watershed and environmental management. It should seek to obtain the agreement of other organisations in the sector, for example, the MALM, and the EMA, to participate by contributing to the building and maintenance of the fund. This might be considered an insurance policy aimed at securing, in the long term, a steady stream of suitable employees at both the professional and paraprofessional levels. Considering the existing situation, it is imperative that such a scheme be started as early as possible.
4. The organisation could consider organisational development interventions to enable it to deal effectively with the challenge of managing change. Organisational development is an approach to organisational improvement that uses an integrated framework of theories and practices capable of solving, or helping to solve, most of the important problems confronting the human side of organisations. The management of change, much of which the WRMA would be involved in during its infancy, consists in large part of treating with the human side, hence the relevance of organisational development.

4.8.3 Performance management

Performance management is the third area in which choices would have to be made. It is to be noted that the proposed WRMA is to have a team-based structure in the operating core of the organisation, that is, in the Water Resources Management Unit. In other sections, a more traditional structure is envisaged. These facts should influence performance management choices. The major decisions to be made are outlined below:

1. *Should appraisal systems be developed to assess individual or group performance?*
   This question would be most pertinent for the staff of the Water Resources Management Unit. An approach that has been used in some organisations which have adopted team based structures, is to assess teams as units on the basis of their results, and simultaneously have team members assess each others' contributions to the achievement of those results. This method can lead to considerable conflict if extensive preparatory team building and training in appraisal methodology are not done. Just as important as putting in place a fair mechanism for staff assessment is the establishment of a demonstrable link between the achievement of desired results and the apportionment of rewards which are valued by staff. While this is an important

issue for all organisations, it is particularly important for organisations that are financially autonomous. The WRMA would therefore have to design or obtain from outside sources, appropriate performance management instruments.

2. *Should the staff assessment focus on determining staff development needs, or should it focus on seeking out reasons for taking punitive action?*
   Given the strategic direction proposed for the WRMA, there should be a focus on staff development linked to a focus on rewards. While poor performance or breaches of discipline should lead either to a denial of rewards or punishment of some kind, the organisation might wish to put its emphasis on the positive. A focus on development and rewards is in keeping with the WRMA's strategic goals.
3. *Should there be low or high employee participation in the appraisal process?*
   High participation consists of the involvement of staff in the setting and clarification of objectives, and in performance discussions during, and at the end of, the appraisal period. Participation tends to ensure commitment to goal achievement, and performance management systems which include periodic performance discussions during the appraisal period may be more successful in reducing disagreements at end-of-period assessments than others. A high participation system is therefore recommended.
4. *Should appraisal be based on behavioural criteria or should it be based on results?*
   The WRMA might consider certain behaviour as necessary and important in determining quality of performance in some jobs, for example, telephone and counter behaviour. If this is the case, behavioural criteria might be used in the assessment process. However, a greater focus on results appears to be in keeping with the WRMA's new strategic direction, especially for the technical jobs.

4.8.4 Rewards and compensation

Rewards and compensation is the final major area in which the WRMA would have choices to make. Decisions would have to be made on the following issues:

1. *Should compensation policy be focused on external or internal equity?*
   Internal equity refers to the relativities existing between jobs within an organisation. External equity refers to the relationships between the level of compensation in one organisation and the levels in the marketplace. Given the shortages of key professionals, and the nature of the competition for the few potential ones, it seems that the WRMA has no choice but to focus on marketplace levels and to place its compensation packages at the upper end of the national scale, that is, comparable with medium and large manufacturing business and conglomerates. Be that as it may, it is obvious that internal equity cannot be ignored, and equitable relativities must be established internally. A proposal for a WRMA salary structure has been formulated by the Consultants.
2. *Should the WRMA develop compensation packages with many or few incentive payments?*
   Unless properly conceived and managed, incentive payments can become ineffective and costly. However, given its proposed focus, incentive schemes related to team performance and staff development may be considered. It should be noted as well, that the proposed organisational structure does not provide for many promotional opportunities. In view of the fact that the possibility of promotion is itself an incentive, substitute rewards may have to be identified. Hence, the WRMA might consider instituting a system of incentives which would serve to encourage team work and staff development, and would as well make up for the limited promotional opportunities.
3. At present, the WRA is unionised. When the new WRMA comes into being, the issues discussed above may lead to changes which might become the subject of collective bargaining. The WRMA management should prepare itself for that. The law protects collective agreements when organisations change hands and a public sector company should not be seen to ignore the law.

4.8.5 Transitional arrangements

In transforming the WRA to the WRMA, the existing terms and conditions under which staff are employed would have to be changed. Changes of this type typically encounter strong resistance.

The existing situation is that WRA employees are employees of WASA. Their terms and conditions of employment have been largely determined through a collective bargaining process recognised by the laws of Trinidad and Tobago. They should therefore be changed by the same means.

On the face of it, the proposal that salaries at the WRMA should be made comparable with those of the energy sector should meet with little resistance. However, the difficulty would most likely arise over the issues of terminal benefits, and security of tenure.

With respect to terminal benefits, the WRMA, as a financially autonomous organisation is not likely to be allowed to participate in the Public Service pension arrangements. Indeed, in the 1998 budget address, the Minister of Finance signalled Government's intention to change that scheme into a contributory one, even for the central public service. It appears then that the WRMA would have to establish its own scheme, which would more than likely be contributory. With respect to the second matter, given its strategic focus, the WRMA would not be in a position to guarantee security of tenure. These matters would cause concern for existing WRA staff.

There are a number of options which the WRMA might wish to explore with the representative Union/Association.

1. Those employees who wish not to work in the new organisation under any circumstances (1) may prefer to be absorbed into WASA, if that is possible given WASA's recent move to reduce staff; or (2) may accept a reasonable separation package.
2. Those employees who wish to work in the new organisation but are worried about losing the terminal benefits which would have accrued to them: (1) may be allowed to be seconded to the new WRMA; (The act setting up the WRMA should provide for secondment The WRMA would have to contribute 25% of the salaries of these employees to the treasury to preserve their pensions; the 25% should be calculated on the basis of their WRA salaries; they should be provided an allowance to bring them to the new salary level; they should be given the opportunity to join the new pension scheme); or (2) if over fifty, may wish to retire early from WASA and take up employment in the WRMA.
3. Those employees for whom there are no positions in the new WRMA: (1) may seek absorption into WASA; (2) if over fifty, may retire early and obtain their benefits; or (3) may accept a reasonable separation package.

The WRMA should make its decision on which existing employees to offer employment on the basis of explicit, published criteria.

The detailed programmes which may be developed on the basis of the recommendations discussed, if accepted, would have to be developed by the management of the new WRMA. It is advised that careful consideration be given to the principles and reasoning upon which the recommendations were based.

5 WRM Authority: equipment and finance

5.1 Equipment requirements

The equipment used in WRA at the moment is not sufficient for the execution of functions as required under the new organisation. Some equipment is already quite old and in need of replacement, either because it does not function properly, or it is not up to the latest technological standards.

The WRA has already taken action to replace some of their equipment. Two projects are in the last phases of implementation The first one has equipment supply as its main objective, the second one has an important equipment component:

- Project WTC 6/96 : supply and installation of state of the art equipment for management of the water resources, including telemetry (hydrological) equipment;
- Project P5102 : implementation of a comprehensive monitoring system to protect ground water resources, including supply and installation of equipment for aquifer monitoring and database development

One can not assume that ownership of all currently used and recently acquired equipment of the WRA will be transferred to the new WRM Authority. WASA is currently looking into splitting the WRA into two parts: one part related to WRA's support functions to WASA as a service provider and the other part related to WRA's functions as national water resources planner and regulator. Consequently, it is expected that part of the existing equipment will be retained by WASA.

In general, the Consultants recommend that the procurement of any equipment be delayed, unless urgently required, until the question of transfer of ownership has been resolved.

Apart from the equipment acquired through the above mentioned projects, the new WRMA will need to replace outdated equipment over the coming years, and particularly their computer hardware and software in all sections. A provision of TT$ 600,000 is included in the investment costs of the WRMA for the first year to finance the replacement of existing equipment and to finance the purchase of new equipment. The provision is meant to cover expenses for technical equipment, including hardware and software use in the Water Resources Management and the Water Resources Planning and Research Units and the Information and Communications Technology Section. The purchase of hardware and software for the other units and sections will be financed from the provision made for office equipment and furniture.

To strengthen the links between the key stakeholders in the water resources sector a provision of TT$ 540,000 is made to set up a comprehensive data-network, integrating all WRM collaborators and concerned observers, and ensuring a continuous flow and exchange of information. This will include the purchase and installation of required hardware and software, including on-the-job training for the users. This should only be initiated once an agreement between these key stakeholders has been signed and only the signatories should be included in the network.

For optimal use of equipment and various new technologies involved, it is important that the users of this equipment are properly trained. Some training is already included in the two projects mentioned above. Activities ranging from basic computer training courses to technical training abroad and on-the-job training could be financed through the training fund, established under the new WRMA structure.

6 A legal framework for WRM

6.1 Formalising inter-institutional linkages

The challenge that is posed by the wide distribution of roles in the sector is the problem of ensuring co-operation and co-ordination of effort in the long term. In traditional bureaucracies, co-ordination is accomplished primarily through a hierarchy of power and authority. To the traditionalist, co-ordination without hierarchy is difficult to conceptualise; but this is precisely the challenge faced when consistent and continuous co-ordination between two or more organisations is required.

A major objective of collaborators and concerned observers in the water management sector is that of ensuring synergy in their policies, plans, and functioning. Synergy, it is presumed, is most likely to lead to the optimum use of resources; is most likely to ensure the accomplishment of objectives which are accepted and desired by a wide cross-section of stakeholders; and therefore, is likely to bring most benefit to the national community.

It is recommended that these organisations maintain autonomy, because of the high risk of bureaucratic dysfunctions taking root and frustrating performance. In addition, while the risk of suffering bureaucratic dysfunctioning is high, there is no guarantee that a common administrative structure will ensure synergy. It is imperative therefore that other means be found to achieve the objective.

The challenge therefore is that recommendations are made not only to authorise the creation of a new entity, the WRMA, but also to develop, through amendments to existing legislation, the issuing of regulations by the WRMA, Memorandums of Understanding (MOU) and contractual arrangements, a clear delineation of the responsibilities of key stakeholders and processes and inter-institutional linkages for co-operative and productive relationships between stakeholders.

6.1.1 New legislation and amendments to existing law

It is recommended that the WRMA be created by statute and be a body corporate. Creating the WRMA will require an act of Parliament. First of all, the provisions of the new WRM Act must ensure that effective inter-institutional linkages are developed between stakeholders that have been assigned any (or part) of the identified WRM functions.

Similarly, a large number of existing laws will need to be amended to create suitable and effective inter-institutional linkages. These include the WASA Act (1965), the Waterworks and Water Conservation Act (1944), the Forestry Division Law (1916), the Town and Country Planning Act (1960), the Environmental Management Act (1995), the Freedom of Information Bill and the Regulated Industries Commission Bill.

The proposed legislation and amendments to existing law should make clear the responsibilities of each stakeholder in relation to a comprehensive integrated water resources management plan. The Consultants have formulated a large number of recommendations for the creation of new legislation and the amendments to existing law.

However, the law will be too complex and unwieldy if it attempts to describe how the required co-operation, consultation and co-ordination should take place between the stakeholders. Furthermore, the process to fulfil those responsibilities should be specific to the expertise and resources of each stakeholder.

For these reasons, each stakeholder that has the responsibility to co-operate, consult or co-ordinate under the WRM Act or the proposed amendments should be required to issue regulations within a specific time-frame to fulfil those obligations. The WRMA should promptly issue regulations relating to efficiency of uses. These regulations should set standards to secure sustainable development of water resources and avoid the waste of water.

6.1.2 Memorandum of Understanding

A typical mechanism used to achieve co-operation is the Memorandum of Understanding (MOU). Experience with this method has not always been positive. It seems that this mechanism only works when it is sanctioned and enforced by the highest authorities. With this proviso, the Memorandum of Understanding as a means of securing co-operation and co-ordination is recommended.

Signatories should include all the institutions involved in Water Resources Management at the planning and regulatory levels (the collaborators). The organisations in this category at this time are:

1. the Environmental Management Authority
2. the Town and Country Division of the MOHS,
3. the Land and Water Development Division and the Forestry Division of the MALM,
4. the Institute of Marine Affairs,
5. the Drainage Division of the MOWT.

Concerned observers that may also be invited to participate include:
1. the Ministry of Health,
2. Tourism and Industrial Development Corporation (TIDCO)
3. the University of West Indies (UWI)

The proposed MOU should follow the usual legal format and should contain provisions for the following issues:

1. agencies should be allowed to forward (annual) applications to the WRMA requesting (co-) funding of water resources related training and research and development activities, administered by the WRMA through special funds established for this purpose;
2. agencies should co-operate in the regular collection and exchange, free of charge, of water resources data relevant to the individual agencies, with 'firewalls' as required. To facilitate this process, the WRMA will obtain necessary computers, printers and data-communication equipment and related training;
3. agencies should participate in periodic (annual) review conferences with the objective of ensuring synergy with respect to policies, strategies, plans, and operations;
4. agencies should participate in the preparation of water resources plans, bringing together sub-sectoral water demand plans and proposals to manage the demand for water technically, financially or otherwise;
5. agencies should co-ordinate and, where relevant, collaborate on the development and implementation of public education programmes;
6. agencies should define and estimate and justify respective costs for their contribution to effective and efficient WRM with the objective of transparency and cost-sharing, and ultimately to achieve financial autonomy of the WRM sector;
7. agencies should demonstrate to the public and to the Government that their policies and plans are in line with those pursued by other participating agencies;
8. agencies should share services without instituting red tape; for example, the Environmental Management Commission (EMC) could serve other agencies;

9. agencies should share expenses when collaborating on the use of services; contracts should be drawn up in this regard;
10. the penalty for not observing the agreement should be the denial by the government, or by lending agencies, of financial support to the offending agencies;
11. in the case of financially autonomous organisations in the public sector, the Cabinet must be given the authority to advise His Excellency the President of the breach (where the President appoints the Board, and where the occurrence of a breach is confirmed) and to ask for the removal of the Board; in cases where the Cabinet has direct responsibility, an investigation is to be carried out, and the Board removed if found wanting
12. Cabinet, through the responsible ministers, should be informed of any memorandum of understanding; ministers (or Cabinet) should agree on the principles which should guide the preparation of a memorandum of understanding.

6.1.3 Contracts

The WRMA's relationship with abstractors and distributors would be more straight forward. It would be primarily contractual; the WRMA, for a fee, would grant licenses which would permit abstractors to extract prescribed amounts of water.

Of particular importance will be a contract between WRMA and WASA. This contract should specify the criteria for the operations of certain waterworks. Although the operations of some waterworks may be governed by license conditions, where the operational criteria are detailed the license conditions could be general and the operational criteria could be detailed in a contract. Operations that could be governed by contracts include releases for minimum stream flows and the timing of discharges.

Separate contracts may have to be concluded between the WRMA and two collaborators, most notably the EMA and the Town and Country Planning Division. The WRMA should also enter into a contract with the EMA regarding their respective permit processing procedures, the sharing of relevant data and for water quality monitoring and enforcement. The WRMA should also enter into a contract with the Town and Country Planning Department regarding procedures for land use and land development.

With respect to the end-users, the WRMA would have little contact except through its public education programmes.

6.2 Formalising the WRM Authority

The formation of the WRMA as a separate entity is appropriate from a policy perspective, because, as noted in the Terms of Reference, the Government of Trinidad and Tobago is well advanced in the search for a suitable private sector partner to undertake the management of the operations of the water utility, WASA. In establishing the WRMA, the proposed legislation in the WRM Act should clearly contain:

1. The WRMA's primary objectives and its relationship with other government entities;
2. Its main functions and duties;
3. Its means of funding, so as to provide for its financial autonomy; and
4. Its powers for regulation, monitoring, compliance and enforcement, including remedies for aggrieved persons.

The WRMA should be given the authority to control, for the good of the public, the use and the way in which water is to be regulated, used and developed.

Several options for the legal structure of the WRMA were considered. These included the WRMA becoming:

1. a statutory authority;
2. a government division established administratively; or
3. an advisory body.

The Consultants recommend that the WRMA be created by statute and be a body corporate authorised to receive policy direction from the MOPD. The option of a governmental division was rejected because it is vulnerable to politicisation and it could loose its funding if it takes action that is politically unpopular. Also, since the WRMA is to be financially autonomous, it would not function as a division. An advisory body not created by statute and consisting of representatives of key stakeholders would lack sufficient authority and might be ineffective because of internal conflicts between stakeholder representatives (Herbert, p 1215)

A statutory authority is likely to produce the most effective legal results for several reasons. First, the WRMA, as a separate entity with the single purpose of comprehensive water resources management, will be able to devote all of its resources to water management issues. Second, because it has enforcement powers, the WRMA will be able to utilise these as it determines appropriate for water resources management. It will not be limited, as it might be if it were located in another agency that also had other responsibilities. Third, the EMA, which will interact extensively with the WRMA, already receives policy direction from the MOPD. Fourth, all major stakeholders already interact with the MOPD for the use of land and development, and the WRMA's presence in MOPD will facilitate its consultation with stakeholders on issues related to water resources master planning and allocation, and watershed management. Fifth, locating the WRMA within the MOPD should make it easier to arrange a MOU between the WRMA and other stakeholders with authority impacting on water resources, such as the EMA, since it is authorised to receive policy direction from it. Finally, it is important that the WRMA is legally independent since the WRMA will be exercising enforcement authority against abstractors, including WASA.

The creation of this new entity, the WRMA, will require an Act of Parliament. To achieve the goals contained in the Terms of Reference, the WRMA must have a number of powers and must be a corporate body. First and foremost, the WRMA must be granted the power to control all surface water and ground water in Trinidad and Tobago, as well as water located within the 12 mile territorial limit. The WRMA must also be given the power to prevent all persons from interfering with the quantity and timing of stream flow. The WRMA also must have the power to establish minimum stream flows for aquifer recharge, environmental needs and other water management purposes. The WRMA should also be given the power to prevent all persons from negatively impacting water quality, but should only be able to utilise this power if the EMA is failing to exercise these powers.

For the WRMA to be effective, it must have a well-trained staff with the power to collect and review needed data. This staff must have access to surface water and ground water abstraction works and discharge points. Thus, the WRMA inspectors also must be empowered to enter private lands and businesses to collect any needed information relating to water quantity, water quality, license applications, compliance or any other aspect of the WRMA's responsibilities.

It is essential for the WRMA to be a financially autonomous and fully self-sufficient entity. To meet that goal, the WRMA must be given the full power to set rates for all water abstraction and use in Trinidad and Tobago. The WRMA should have the authority to set different rates for different types of use, and the quantity of abstraction and discharge. The PUC, or its probable successor, the RIC, should not control the value of rates for abstraction of water. This is because, for the WRMA to be financially autonomous, it must also be able to adjust prices. The WRMA

should liaise with, but not be dependent on the PUC, or its probable successor the RIC, in setting abstraction rates. It is important for the WRMA to be aware of the rates approved by the PUC or RIC for water deliveries by abstractors to its water users. The RIC shall resolve appeals from price disputes between the WRMA and it license holders that cannot be resolved within the WRMA.

Although the WRMA will have broad powers for water resources management and planning, the impact of pollution on water resources, land use planning and other factors not within the direct control of the WRMA should not be overlooked. Since other agencies have authority over matters impacting these issues, effective inter-institutional linkages are essential for comprehensive water resources management. To enhance the opportunities for co-ordination with other key stakeholders, the WRMA should be subject to the policy direction of the MOPD. It will not be a division of the MOPD, but will be a corporate body like the EMA.

The establishment of the WRMA calls not only for new legislation, but would also need amendments to existing laws to provide for an effective and integrated WRM strategy for Trinidad and Tobago. These necessary changes include amendments to the WASA Act (1965), the Waterworks and Water Conservation Act (1944), the Environmental Management Act (1995) and the Town and Country Planning Act (1960).

Though not necessary for the creation of the WRMA as such, the Consultants have identified Regulations, Memorandums of Understanding and Contracts as possible means to secure inter-institutional co-operation between the WRMA and the other WR related organisations.

Similarly, the WRMA will need its own internal set of operating systems and procedures. These would need to be developed and maintained in an Operations Manual. Preparatory arrangements to develop such a manual can already be made by the existing WRA management, and if this recommendation is adopted, it is also suggested that the WRA management be given the opportunity to review and discuss existing operation manuals of similar organisations in other countries in the region. During the WRMS project implementation, the Consultants have already put forward proposals to the Project Co-ordinator for a study tour for this purpose to Jamaica and Puerto Rico with possible funding from the current World Bank Loan

6.3 Water Resources Management Commission

The Consultants do not recommend that a separate commission be established with jurisdiction over the issues arising from the WRM Act. Instead, the Environmental Management Commission (EMC), created pursuant to the EMA Act will have the jurisdiction to hear all matters appealed from WRMA enforcement, except for the pricing of water abstraction licenses, which will be heard by the RIC.

The option of creating a separate commission was considered, but for several reasons it was rejected.

1. Since there are limited human resources available, it seems imprudent to dilute the expertise of the Environmental Management Commission.
2. Creating a new commission would increase the environmental bureaucracy and might hinder integrated water resources management.
3. The Environmental Commission will already be developing an expertise on the types of permitting and water resources issues that will be brought before it from the WRMA. It is logical to take advantage of this expertise.
4. Creating a new commission would require defining the jurisdictional boundaries of each commission, which could prove difficult because of the overlapping nature of the issues to be brought before them.

The option of involving the EMC and the RIC, or any new Commission for that matter, was preferred over involving the courts to hear disputes from aggrieved water abstractors, mainly due to the heavy case load and the lack of relevant expertise available in the existing court system. Offering the two options as alternatives for abstractors to hear matters appealed from WRMA enforcement was rejected for reasons of clarity and uniformity.

Nevertheless, any abstractor, not satisfied with the decision of the EMC or the RIC has the right to appeal to the Court of Appeal.

As a result of these recommendations, necessary provisions should be made in the new WRM Act. Similarly, amendments will be required to the Environmental Management Act (1995) and the Regulated Industries Commission Act (proposed).

Appendix A. WRMA Human resources requirements

Job Title	Nos. Required	Qualifications	Nos. Available	Deficit/ Surplus	Remarks
Managing Director	1	First degree preferably in the Natural Sciences or Engineering; Five years managerial experience; Post-graduate training in Hydrology an asset; Management training as evidenced by an academic qualification or a combination of management development courses an asset.	1	0	
Unit Manager	6	First degree in relevant field (Finance & Accounts, Human Resources, Law, Natural Sciences/Engineering, Communications) Relevant post-graduate training an asset Five years professional experience	0	6	
Hydrologist	9	Bachelors degree in Engineering or Natural Science; Post-graduate Degree in Water Resources Management or Hydrological Techniques; Computer Literacy.	0	-9	Advertise locally and internationally; offer 3 yr. contract initially; offer salaries comparable to energy sector; hire 8 young understudies and send them for post graduate training after evaluating them over a 1 year period.
Civil Engineer - Maintenance	1	Bachelors Degree in Civil Engineering; Five years experience.	0	-1	Advertise and hire locally.
Water Resources Engineer	2	Bachelors Degree in Engineering; Post-graduate training in hydrology.	1	-1	Advertise and hire locally.
Economist	1	Bachelors Degree in Economics; Training in urban planning an asset; Five years experience in a planning environment.	0	-1	Advertise and hire locally

Job Title	Nos. Required	Qualifications	Nos. Available	Deficit/ Surplus	Remarks
Environmentalist	1	Bachelors Degree in relevant area; five year experience in the field.	0	-1	Advertise and hire locally
Hydrological Assistants (entry level) Hydrological Technicians (second level) Assistant Hydrologists (highest Level)	11 4 8	*Basic:*5 CXC or Ordinary level passes including English Language and Mathematics and Physics or Chemistry Lower Technicians Diploma or equivalent. *Further Training for Advancement* - Advanced Level passes in Natural Science, Higher Technicians Diploma; advanced hydrological technicians courses	42 (WASA, 1977)	19	Return excess to WASA
Instrument Technician	2	*Basic:* Five GCE or CXC 'O'Level passes including English Language, Mathematics and Physics or Chemistry; Instrument Technicians Diploma; Computer Literacy. *For Further Advancement:* Technicians Diploma in Telecommunications, Mechatronics and Telecon.	1	-1	Advertise locally; hire at basic level; and train.
Engineering Assistant	1	*Basic:* Five GCE/CXC passes including English Language, Mathematics and Physics or Chemistry; Computer Literacy. *For Further Advancement:* Technical Training in Civil or Mechanical Engineering or Certificate in Surveying, Architectural/Mechanical Drawing, Equipment Maintenance and Repair.	1	0	Train current employee.
Electronic Technician	1	*Basic:* Five GCE/CXC passes including Mathematics, English Language and Physics or Chemistry; Electronic Engineering Diploma.	0	-1	Advertise locally and hire.
Information and Communication Technology Manager; Programmer/ Analyst;	1 2	*Basic:* Associate or Bachelors Degree in Computer Science. *For Further Advancement:* five years experience or post-graduate training in Management Information Systems, Computer Science or Information Technology	0	-4	One Hydrological Assistant III possesses an Associate Degree in Computer Science, and is managing WRA IS matters; Other

Job Title	Nos. Required	Qualifications	Nos. Available	Deficit/ Surplus	Remarks
Systems Administrator.	1				positions: Advertise locally and hire
GIS/CAD Specialist	1	Associate or Bachelors Degree in Computer Science or Information Technology, Diploma in Geographic Information Systems or equivalent	**0**	**-1**	Advertise locally and hire.
Human Resource Specialists: Senior HR Specialist; HR Specialist	1 2	*Basic:* Bachelors Degree in the Social Sciences preferably in Management Studies with an emphasis on Human Resource Management. *For Further Advancement:* Experience in the field; Post Graduate Training in Human Resource Management	0	-3	Advertise locally and hire.
Marketing and Communications Specialists: Manager Communications Specialist	1 2	*Basic:* Bachelors Degree in Management Studies with emphasis on Marketing; Training in Mass Communications an asset. *For Further Advancement:* experience in the field; post graduate training asset.	0	-3	Advertise locally and hire.
Attorney: Senior Company Lawyer; Junior Company Lawyer	**1** **1**	*Basic:* Qualified to practice law in T and T; A minimum of five years experience in Corporate Law for senior post	0	-2	Advertise locally and hire.
Paralegal Assistant	1	Five GCE/CXC O'Level and two 'A'Level; passes in English and Math at 'O' level; computer literacy; experience with work in a legal environment an asset	0	-1	Advertise locally and hire.
Senior Administrative Assistant; Administrative Assistant.	1 12	*Basic:* Five GCE/CXC O'Level passes including English Language and Mathematics; Two 'A'Level passes; Computer Literacy; keyboard competence *For Further Advancement:* Diploma or Certificate in Management.	WRA employs a cadre of secretarial and clerical staff who could be trained for these functions		Train existing clerical and secretarial staff; recruit others as required.
Secretary to the Board	1	*Basic:* Five GCE/CXC passes including English Language and Mathematics; Corporate Secretary-ship; Computer Literacy; five	0	-1	Promote from within; train as corporate

Job Title	Nos. Required	Qualifications	Nos. Available	Deficit/ Surplus	Remarks
		years experience as an executive secretary			secretary if required.
Manager Administration	1	Bachelor's Degree in the Social Sciences; five years experience in administration or as an Executive Secretary.	0	-1	Determine whether suitable candidates are available within before advertising externally
Librarian	1	Bachelor's Degree in Library Studies.	0	-1	Advertise locally and hire.
Archivist	1	5 GCE/CXC O'Level passes; computer literacy.	0	-1	Select from among existing clerical and secretarial staff.
Manager Finance and Accounts	1	ACCA or Equivalent; 10 years experience.	0	-1	Advertise locally and hire.
Accountant	1	ACCA or equivalent.	0	-1	Advertise locally and hire.
Accounting Assistant	3	Level One of the ACCA.	0	-3	Advertise locally and hire.
Storekeeper	1	Five GCE/CXC O'Level passes; five years experience in clerical/ administrative work.	1	0	Select from existing clerical and secretarial staff.
Storekeeper Assistant	1	Five GCE/CXC O'Level passes.	1	0	Select from existing clerical and secretarial staff.
Maid	1	Primary School			Select internally.

Appendix B Indications of WRMA salary scales and amounts

Description	Price m/m (in TT$)	Units required	Total annual expenses(in TT$)	Salary scale
Managing Director's office:				
Managing Director	22.500	12	270.000	A1
Secretary to the Board	7.500	12	90.000	B4
Administrative assistant (2)	5.500	24	132.000	C
Finance and Accounts unit:				
Manager F and A	14.000	12	168.000	A3
Accountant	9.500	12	114.000	B2
Accounting assistant (3)	6.500	36	234.000	B5
Administrative assistant	5.500	12	66.000	C
Administration and HR unit:				
Manager Admin. And HR	14.000	12	168.000	A3
Administrative assistant	5.500	12	66.000	C
ICT Section:				
Manager I&C Technology	12.000	12	144.000	B1
Programmer/Analyst	8.500	24	204.000	B3
System Administrator	8.500	12	102.000	B3
GIS/LIS Specialist	8.500	12	102.000	B3
Administrative assistant	5.500	12	66.000	C
Administration section:				
Senior Administrative assistant	8.500	12	102.000	B3
Administrative assistant (2)	5.500	24	132.000	C
Librarian	5.500	12	66.000	C
Archivist	5.500	12	66.000	C
Maintenance and Stores section:				
Maintenance engineer	9.500	12	114.000	B2
Instrument technician (2)	6.500	24	156.000	B5
Electronic technician	6.500	12	78.000	B5
Engineer assistant	5.500	12	66.000	C
Store keeper and assistant	5.500	24	132.000	C
Administrative assistant	5.500	12	66.000	C
HR and Training Fund section:				
Senior HR Specialist	9.500	12	114.000	B2
HR specialist (2)	7.500	24	180.000	B4
Administrative assistant	5.500	12	66.000	C
Compliance unit:				
Sr. Company Lawyer	14.000	12	168.000	A3
Jr. Company Lawyer	8.500	12	102.000	B3
Paralegal assistant	7.500	12	90.000	B4

Description	Price m/m (in TT$)	Units required	Total annual expenses(in TT$)	Salary scale
Compliance unit: (continued)				
Assistant hydrologist	7.500	12	90.000	B4
Administrative assistant	5.500	12	66.000	C
Water Resources Management unit:				
WRM Manager	14.000	12	168.000	A3
Hydrologist (4)	9.500	48	456.000	B2
Assistant hydrologist (4)	7.500	48	360.000	B4
Hydrology technician (4)	6.500	48	312.000	B5
Hydrology assistant (11)	5.500	132	726.000	C
Administrative assistant	5.500	12	66.000	C
WR Planning and Research unit:				
Manager WR Planning	14.000	12	168.000	A3
Hydro-geologist (2)	9.500	24	228.000	B2
Hydrologist	9.500	12	114.000	B2
WR Engineer Planning	8.500	12	102.000	B3
WR Engineer Modelling	8.500	12	102.000	B3
Environmentalist	8.500	12	102.000	B3
Urban planner	8.500	12	102.000	B3
Assistant hydrologist (3)	7.500	36	270.000	B4
Administrative assistant	5.500	12	66.000	C
Communications unit:				
Manager Comm. and Marketing	12.000	12	144.000	B1
Marketing assistant (2)	6.500	24	156.000	B5
Administrative assistant	5.500	12	66.000	C
Sub total		936	7.488.000	
Pension fund contributions 12% of basic salary			899.000	
Support staff provision (10)	3.000	120	360.000	D
Board of directors stipends	3.500	12	170.000	
	1.750	12		
	1.000	108		
Provision medical insurance			13.000	
TOTAL			**8.930.000**	

Appendix C. Tentative list of computer and other electronic equipment

FINAL

A BILL

Establishment of the Water Resources Authority

An Authority is hereby established as a body corporate, to be known as the Water Resources Authority and is a body corporate, which shall be governed by a Board of Commissioners, comprising of the persons appointed in accordance with this section hereunder: And to effectively manage and control the use of the countries water resources and to promote conservation, development and protection of these resources in a cost effective manner for sustainable socioeconomic growth.

An Act to provide for the management, protection, conservation and sustainable use of the water resources of Trinidad and Tobago; and for the establishment of functions of a Water Resources Authority to administer the several purposes aforesaid and matters connected therewith

Enactment

ENACTED by the Parliament of Trinidad and Tobago as follows:

Preamble

Whereas it is enacted *inter alia* by section 13(1) of the Constitution that an Act of Parliament to which this section applies may expressly declare that it shall have effect even though inconsistent with sections 4 and 5 of the Constitution and, if any such Act does so declare, it shall have effect accordingly:

And whereas it is provided by section 13(2) of the Constitution that an Act of Parliament to which this section applies is one the Bill for which has been passed by both Houses of Parliament and at the final vote thereon in each House has been supported by the votes of not less than three-fifths of all members of that House:

And whereas it is necessary and expedient that the provisions of this Act shall have effect even though inconsistent with sections 4 and 5 of the Constitution:

PART I

Preliminary

Short Title

1. This Act may be cited as the Water Resources Management Authority Act, 2009.

Commencement

2. This Act comes into operation on such day as is fixed by the President by Proclamation.

Act inconsistent With sections 4 And 5 of the Constitution Chap. 1:01

3. This Act shall have effect even though inconsistent with sections 4 and 5 of the Constitution.

Interpretation

4. In this Act –

"Authority" means the Water Resources Management Authority established under section 4;

"Minister" means the minister to who water resources is assigned.

PART II

Establishment of the Water Resources Authority

An Authority is hereby established as a body corporate, to be known as the Water Resources Authority and is a body corporate, which shall be governed by a Board of Commissioners, comprising of the persons appointed in accordance with this section hereunder:

FUNCTIONS OF AUTHORITY

The functions of the Authority are as follows:

a. Undertake water resources planning, development and management
b. license all water abstractors/users
c. monitor licence compliance
d. assess water resources quality and quantity
e. maintain a national water resources database
f. enforcing the Act and develop subsidiary legislation
g. planning and research in respect of water resources management
h. promoting education and public awareness of water resources
i. resolve conflict among competing uses and users
j. required to ascertain whether pursuant to the Oil and Water Board Ordinance there are:
   (i) Any surface water rights being exercised; or
   (ii) Any ground water rights being exercised that were exempt.

Comments: Further research is required. All these referred to has been repealed by the Water and Sewerage Act.

Page 15 Part 1 Subsection 11 & Part 111 what was vested in the WAS Act should also be included in this WR Act.

Page 23 Section 20.1 of the EMA Act This statement should also be included

POWERS

The powers of the Authority are as follows:

i. To charge fees for water abstraction;
ii. To borrow and invest funds;
iii. To control all surface, ground and coastal waters;
iv. To enter through inspection private lands of businesses to collect data in relation to water quantity ,licence applications or complaint with the consent of the owner/occupier;
v. To enter into contracts and Memoranda of understanding with stakeholders;
vi. To exert legal authority over pre existing water users and to provide compensation for such users where regulation violates constitutional property rights;
vii. To set charges for all water abstraction and use;
viii. To set charges for different types of use and quantity of abstraction;
ix. To make regulations where there is a water shortage;
x. To acquire hold and dispose of real and personal property;
xi. To accept gifts, devices and bequest made to the Authority whether Trust or otherwise.

Comments:
Concerns: If the Authority has the powers to enter private lands why should there be a need for consent?

Arguments: The owner has a constitutional right to privacy of property .If in the opinion that actions of the owner have been deemed inimical to the sustainable use of the water resources then what can be put in place without violating the constitutional rights of citizens?

Concerns: Set charges in lieu of set rates as setting rates refer to the financial instruments used to provide a service while setting charges relate to the economical instrument used for management of the resource in this context.

When you refer to contracts does that include MoUs and MoAs

Is there a need to use the word competent or is that implicit.

The fees for discharges are already included in the 'Water Pollution Rules'

From the WAS Act Part 1 Subsection 9:2 could be included in this Act

Composition of Authority

The Authority shall comprise of-

a. A Board of Directors with power to appoint a Managing Director/Chief Executive Office

b. A Water Planning and Investigation Unit responsible for water resources investigation research and development ,projects, policy development and implementation

c. A Water Resources and Environmental Unit responsible for water resource allocation water use efficiency management, licensing and compliance

d. A Water Resources Management Unit responsible for flood and drought management, river basin management, groundwater management, water resources assessment coastal zone management

e. A Water Resources Monitoring and Data Collection Unit responsible for instrumentation, monitoring, data collection, quality control, instrumentation, maintenance

f. A Data and Information Management Unit responsible for management of a library and website, Geographic Information Systems and Computer Aided Designs, Public Education and Awareness, data and information reporting, establishing a National Water Resources Database

g. An Administrative Unit responsible for Human resources and industrial relations, finance asset management, procurement, secretariat, health and safety security

Custody and use of Seal

The seal of the Authority shall be kept in the custody either of the Chairman or the Deputy Chairman or the Secretary as the Authority may determine, and may be affixed to instruments pursuant to Standing Orders or to a resolution of the Authority and in the presence of the Chairman or Deputy Chairman, and of one other member and the Secretary.

The seal of the Authority shall be attested by the signature of the Chairman or Deputy Chairman and the Secretary.

All documents other than those required by law to be under seal, made by and all decisions of the Authority may be signified under the hand of the Chairman or Deputy Chairman or the Secretary.
Service upon the Authority of any notice, order or other document shall be executed by delivering the same or by sending it by registered post addressed to the Secretary at the office of the Authority

Procedure

Procedure and meetings

(1) The Authority shall meet at least once a month and at such other times as may be necessary or expedient for the transaction of business, and such meetings shall be held at such place and time and on such days as the Authority determine.

(2) The Chairman may at any time call a special meeting of the Authority and shall call a special meeting within seven (7) days of the receipt of a requisition for that purpose addressed to him by any three Commissioners.

(3) The Chairman, or in his absence the Deputy Chairman, and two other Commissioners shall form a quorum.

(4) Minutes in proper form of each meeting shall be kept by the Secretary and shall be confirmed by the Chairman or the Deputy Chairman at a subsequent meeting. Certified copies of such minutes when so confirmed shall be forwarded to the Minister.

(5) The Authority may co-opt any one or more persons to attend any particular meeting of the Authority for the purpose of assisting or advising the Authority, but no such co-opted person shall have any right to vote.

(6) Where a Managing Director is not a Commissioner, he shall nevertheless attend all meetings of the Authority unless the Minister otherwise directs, but he shall not have any right to vote.

(7) Subject to this section, the Authority may by Standing Orders regulate its own proceedings.

Appointment of Committee

(1) The Authority may appoint committees to examine and report to it on any matter whatsoever arising out of or connected with any of its powers and duties under this Act.

(2) A committee appointed by the Authority shall consist of at least one member of the Authority together with such other persons, whether members of the Authority or not, whose assistance or advice the Authority may desire.

(3) Where persons, not being members of the Authority, are members of a committee appointed under this section, the Authority may with the approval of the Minister, by resolution, declare the remuneration and allowances of such person, and such sums shall be so payable out of the funds and resources of the Authority.

(4) The Authority may by resolution reject the report of any such committee or adopt it either wholly or with such modifications, additions or adaptations as the Authority may think fit.

Establishment of Advisory Committee

There is to be established a body advisory committee who shall advise the Minister

(a) On matters of general policy relating to the management, development, conservation and use of the Water Resources of Trinidad and Tobago;

(b) On the Master Plan, Water Quality Control Plan and State of the Water Resources, including any amendments which may be proposed from time to time in relation to any of those Plans; and

(c) On such other matters related to the Water Resources of Trinidad and Tobago as the Minister may refer to it.

Unless otherwise specified in this Act, the Minister is not bound to seek or act in accordance with the advice of the Advisory Committee.

(1) For the purpose of advising the Authority on such matters concerning the exercise of its powers and functions and the performance of its duties as are referred to in subsection (4), the Authority shall establish Standing Advisory Committees (in this section referred

to as an "Advisory Committee") for the Port-of-Spain Corporation, the San Fernando Corporation and the Borough of Arima, respectively.

(2) An Advisory Committee shall consist of a Commissioner, who shall be chairman and two other persons representing the respective local authorities, each of whom shall be appointed by the Authority acting in accordance with the advice of the local authority concerned, for such period as is provided, in the discretion of the Authority, in the terms of the appointment.

(3) The appointment and termination of office of the chairman and every such member of the Advisory Committee whether by death, resignation, revocation or effluxion of time or otherwise shall be notified in the *Gazette*.

(4) The matters, concerning which an Advisory Committee is by virtue of this section established and authorised to advise the Authority are as follows:

(a) The demand for water supplies in its district, and the employment of the water resources in or available for that district in order to meet the future water supply requirements of the district;

(b) Subject to any other written law, the fixing of a water rate or the making of any charge in respect of the supply of water for domestic purposes within its district;

(c) Such other matters as are referred to an Advisory Committee by the Authority for advice.

(5) The Authority may by resolution reject the advice of any Advisory Committee or adopt it either wholly or with such modifications, additions or adaptations as the Authority may think fit.

(6) In this section "district" means the area in respect of which a local authority was, before the commencement of this Act, authorised by or under any written law relating to local authorities to perform any duties and exercise any powers in relation to the provision of water supplies in such area.

(7) Subject to this Act and to the prior approval of the Minister, the Authority may delegate to a Commissioner or a committee, power and authority to carry out on its behalf such duties and functions and to exercise such powers as the Authority may determine; but any such delegation shall be revocable at will and shall not preclude the Authority from acting from time to time as occasion requires.

Board of the Authority

The Board of the Authority shall consist of not less than five nor no more than seven persons to be designate Commissioners, who shall be appointed by the

Minister/President., from among persons who shall have special qualifications in and have had experience of matters relating to Water Resources Management, Environmental and Natural Resources Management, Water Resources Engineering, Environmental Law and Policy, Environmental Economics ,Economics , Business Management, Human Resource Management and Finance.

The Minister/President shall appoint a Chairman and a Deputy Chairman from among the Commissioners.

Appointment to the office of Commissioner shall be for a period of not more than five years or as the Minister /President shall specify at the time of the appointment.

A Commissioner may at any time resign his or her office by instrument in writing addressed to the Chairman, who shall forthwith cause it to be forwarded to the Minister.

The appointment of any person as a Commissioner and the termination of office of any person as a Commissioner whether by death, resignation, revocation, effluxion of time or otherwise shall be notified in the Gazette and at least on two of the daily newspapers circulating in Trinidad and Tobago .

If a Commissioner is unable to perform the functions of his or her office owing to absence from Trinidad and Tobago or to inability for any reason, the Minister may appoint some other person to act as a temporary Commissioner during the time such absence or inability continues.

Functions and powers of the Board

The Board of Directors shall be responsible for

i. Policy and Strategy formulation
ii. The review and approval of policy
iii. The approval of annual plans and budgets prepared by the Managing Director/Chief Executive Director
iv. The preparation of reports to the Minister
v. The regular review and proposals on employment conditions for staff at the WRMA

TRANSITIONAL PROVISIONS

(1) Upon the commencement of this Act the functions conferred on and exercisable by WASA within the meaning of the Water and Sewerage Act, as from the appointed day transferred to and are exercisable by the Authority.

(2) All rights and obligations that before the appointed day were vested in WRMA relating to the functions to be performed by the Authority are as from that day transferred to and vested in the Authority.

(3) (a) All land and other property of every kind, including things in action, vested or deemed to be vested immediately before the commencement of this Part in—

(i) The State (under the Waterworks and Water Conservation Act or by any other right or title) and relating to waterworks and sewerage works;

(ii) The Central Water Distribution Authority established under the Central Water Distribution Authority Ordinance (repealed by this Act);

(iii) The Port-of-Spain Corporation under the Municipal Corporations Act or by any other right or title and relating to waterworks (within the meaning of section 40) or the existing sewerage system;

(iv) Any local authority, other than the Port-of-Spain Corporation, under any written law or by any other right or title and relating to waterworks (within the meaning of section 40); and

(v) Statutory authorities under or by virtue of any written law or by any other right or title and relating to waterworks;

is hereby vested in the Authority;

(b) all public pumps, wells, cisterns, reservoirs, conduits and other works used for the gratuitous or other supply of water to the inhabitants of any part of the district of a local authority [within the meaning of section 58(3)] and not otherwise in this subsection contemplated, are hereby vested in the Authority;

(c) all the rights, privileges and advantages, and all the liabilities and obligations that, immediately before the commencement of this Part, the Government or the Central Water Distribution Authority or the local authority or the statutory authority, in relation to the matters respectively referred to in paragraph *(a)*, were entitled or subject to, as the case may be, are hereby transferred to, and conferred or imposed upon, the Authority for the purposes of this Act.

(2) A reference in any deed, contract, bond or security or other document to—

(a) The Government, in relation to its rights, titles and obligations concerning waterworks referred to in subsection (1)*(a)*(i) and the sewer system or any sewerage works;

(b) The Central Water Distribution Authority;

(c) The Port-of-Spain Corporation, in relation to the waterworks, referred to in subsection (1)*(a)*(iii) and the existing sewerage system;

(d) a local authority, other than the Port-of-Spain Corporation, in relation to waterworks referred to in subsection (1)*(a)*(iv); or

(e) Any other statutory authority, in relation to the existing sewerage system,

shall, upon the commencement of this Act, be construed as a reference to the Authority.

(3) (1) Subject to subsection (2), the Authority has the same rights, powers and remedies (including particular rights and powers as to the taking and resisting of legal proceedings) for ascertaining, perfecting or enforcing any rights or liabilities vested in or attaching to the Authority as if they had at all times been rights and liabilities of the Authority.

(4) All civil proceedings instituted by or against WRMA in respect of any of the functions to be transferred to and exercised by the Authority that are pending immediately before the appointed day may be continued by or against the Authority with such amendments as are necessary to give effect to this section.

(5) In subsection (1)*(a)*(i), "waterworks" means all works, constructions and developments relating to waterworks as defined in section 2, as well as such works, constructions and developments as were before the commencement of this Act.

(6) (a) All books, records, accounts and other documents and;

(b) All furniture, equipment or other chattels;

That is in the possession of WRMA immediately before the appointed day relating to any of the functions is to be transferred to the Authority.

(7) All or any part of the operational undertakings necessary for the Authority to undertake the maintenance and development of a water supply shall be transferred to or vested in the Authority.

(8) All contracts entered into before the appointed day by or on behalf of WRMA in relation to any function to be transferred to the Authority are as from that day deemed to have been entered into or executed by the Authority and any such contract shall be construed

accordingly with such modifications and adaptations as are necessary to give effect to this section.

MISCELLANEOUS

Remuneration of Commissioners

The Authority shall, subject to the approval of the Minister, pay to each Commissioner in respect of his office such remuneration and allowances, if any, as the Authority thinks fit, and, subject to the like approval, to the Chairman and Deputy Chairman in respect of his office, such remuneration and allowances, if any, in addition to any remuneration or allowances to which he may be entitled in respect of his office as Commissioner, as, subject to the like approval, may be so determined.

Declaration of Interest

A Commissioner who is in any way, whether directly or indirectly, interested in a contract or proposed contract with the Authority, or any other matter whatsoever in which the Authority is concerned, shall declare the nature of his interest at the first meeting of the Authority at which it is practicable for him to do so.

(2) A Commissioner shall not take part in any deliberation or decision of the Authority with respect to any contract or proposed contract with the Authority or any other matter whatsoever with which the Authority is concerned, in which he has any pecuniary interest, whether directly or indirectly.

(3) This section shall not apply to—

(a) An interest in a contract or other matter which a Commissioner may have—

(i) As a consumer of water for domestic purposes provided by the Authority; or

(ii) As a ratepayer in respect of sewerage facilities provided by it; or

(b) To an interest in any matter relating to the terms on which the right to participate in any service provided by the Authority, is offered to the public.

(4) For the purposes of this section, a person—

(a) Who, or any nominee of whom, is a shareholder or partner in a company or other body of persons (other than a statutory authority); or

(b) Who is an employee thereof, shall be treated as having indirectly a pecuniary interest in a contract or other matter, if such company or such other body of persons is a party to the contract or proposed contract or has a pecuniary interest in such other matter under consideration.

(5) Nothing in subsection (4) shall apply to any person who, but for the said subsection (4), would not fall to be treated as having indirectly a pecuniary interest in a contract or other matter, if the total value of his shareholding or other interest does not exceed such amount of the total nominal value of the issued share capital of the company or body as the Standing Orders of the Authority provides.

(6) Any person who fails to comply with the provisions of this section is liable on summary conviction to a fine of seven hundred and fifty dollars, unless he proves that he did not know that a contract, proposed contract or other matter in which he had a pecuniary interest was the subject of consideration at the meeting.

Execution of Documents

(1) Any document requiring to be executed by the Authority shall be deemed to be duly executed—

(a) If signed by the Chairman or the Deputy Chairman and the Executive Director or the Secretary; or

(b) if signed, whether within or without Trinidad and Tobago by a person or persons authorised by resolution of the Authority so to sign, but in such case an extract of the resolution certified by the Chairman or Deputy Chairman and the Secretary shall be attached to and form part of the document.

(2) Any cheque, bill of exchange or order for the payment of money required to be executed by the Authority shall be deemed to be duly executed if signed by a person or persons authorised by this Act or by resolution of the Authority.

Annual Report of Authority

The Authority shall make an annual report of its proceedings to the Minister which shall be laid before Parliament.

PART III

ADMINISTRATION

General

Subject to this Act, the Authority may do all such things as are necessary or convenient for the purpose of exercising the powers and performing the duties and functions conferred or imposed on it by this Act as respects its responsibility for Water and Sewerage in as full and effectual a manner as if such responsibility was but one undertaking only.

Personnel

(1) The Authority may, subject to the approval of the Minister, appoint on such terms and conditions as it thinks fit, an Executive Director, a Deputy Executive Director, a Secretary, a Treasurer and a Chief Accountant and such other officers and employees as may be necessary and proper for the due and efficient performance by the Authority of its duties under this Act.

(2) An annual salary in a sum that is equivalent to or exceeds the annual salary of ten thousand dollars or such greater amount as the Minister may prescribe shall not be assigned to any post under this section without the prior approval of the Minister.

(3) The Executive Director is the chief executive officer and is responsible for carrying out the decisions of the Authority, and in the performance of his duties the Executive Director is subject to the control of the Authority.

(4) A person shall not be disqualified from being appointed to the office of Executive Director or Deputy Executive Director by reason of being a Commissioner, and if any person is so appointed he may continue to hold office as a Commissioner in addition to the office of Executive Director or Deputy Executive Director.

Subject to section 23, on the coming into operation of this Act, the Authority shall give first consideration for appointment by the Authority of its officers and employees to those public officers and other employees -

(a) Who were before the commencement of this Act carrying out functions and duties under -

(i) The Waterworks and Water Conservation Act in connection with waterworks within the meaning of section 11(6);

(ii) The Central Water Distribution Authority Ordinance (repealed by this Act);

(b) In the service of the local authorities in connection with the waterworks (within the meaning of section 40), and the existing sewerage system; or

(c) In the service of a statutory authority in connection with the existing sewerage system, who qualify for posts with the Authority.

(1) An officer in the public service may, with the approval of the Minister, be transferred to the service of the Authority, and upon such transfer shall become a member of the Pension Scheme and, if such officer's transfer becomes effective before the establishment of that Scheme, he shall become a member within one year of its establishment; and an officer in the service of the Authority may be transferred to the public service.

(2) A transfer described in subsection (1) shall be on such terms as may be acceptable to the Minister, the Authority and the officer concerned and the pension or superannuation rights accruing to the officer at the time of his transfer shall be preserved.

(3) Subject to subsection (2), any officer in the public service may, with the approval of the Minister, be transferred on secondment to the service of the Authority or from the service of the Authority to the public service.

(4) Where a transfer on secondment contemplated by subsection (1) is effected, the Minister or the Authority, as the case may require, shall make such arrangements as may be necessary to preserve the rights of the officer so transferred to any pension, gratuity or other allowance for which he would have been eligible had he remained in the service of the Government or of the Authority, as the case may be.

(5) A period of transfer on secondment shall not in any case exceed six years.

The Authority shall within a period of three years of its establishment, by Rules confirmed by the Minister, provide for the establishment and maintenance of a Pension Scheme for the benefit of the officers and employees of the Authority and officers transferred to it on secondment.

Without prejudice to the generality of the Pension Scheme may enable the Authority to—

(a) Grant gratuities, pensions or superannuation allowances to, or to the widows, families or dependants of, their employees;

(b) Establish contributory superannuation schemes, and establish and contribute t superannuation funds for the benefit of their employees;

(c) Enter into and carry into effect agreements with any insurance company or other association or company for securing to any such employee, widow, family or dependant such gratuities, pensions or allowances as are by this section authorised to be granted;
(d) Give donations or subscriptions to charitable institutions, sick funds, benevolent funds and other objects calculated to benefit their employees.

(1) Prescribed Public Officers and prescribed members of the staff employed by the Central Water Distribution Authority and by a local authority in relation to the waterworks transferred to the Authority under section 11 and the existing sewerage system, and by a statutory authority in relation to the existing sewerage system, shall be given the option of retiring on abolition of office, pension or provident fund terms as appropriate, or of continuing under the Authority, in accordance with Regulations made by the Minister.

(2) Public officers and members of the staff so employed by the Central Water Distribution Authority and by a local authority and a statutory authority who, on or after the commencement of this Act, elect to continue their services under the Authority shall—

(a) Be regarded as transferred to the service of the Authority; and

(b) Have preserved to them the superannuation rights accruing at the time of their transfer to the Authority; and

(c) Within a year of the establishment of the Pension Scheme become members of that scheme,

but all such rights shall be forfeited on dismissal by the Authority, in such circumstances as they would have been forfeited on dismissal from the public service or from the service of the Central Water Distribution Authority or a local authority or a statutory authority.

(3) In the case of a person who has elected to continue his service under the Authority and who retires from or dies in that service before the establishment of the Pension Scheme under section 21, any superannuation rights occurring at the time of his retirement or death may be paid to such person in accordance with Regulations made by the Minister.

(4) In this section, "prescribed" means prescribed by the Minister by Order made by virtue of this subsection.

(5) Public officers and members of the staff and prescribed employees of the persons or authorities referred to in section 23 shall, where such officers or staff members or employees are not eligible for an increase of pension under regulation 12 of the Pensions Regulations, 1938, be paid by the Authority such compensation for loss of office or employment, as may be prescribed, if—

(a) Such staff members and employees are not employed by the Authority or another statutory authority within three months of the commencement of this section; or

(b) In the case of public officers,

(i) Do not continue to be public officers; and

(ii) Are not given the option referred to in section 23.

(6) In this section, "prescribed" means prescribed by the Minister by Order made by virtue of this subsection.

(7) All officers charged with the receipt, accounting for, or disbursement of moneys or with the custody or delivery of stores, or other property belonging to the Authority shall be individually responsible for the due and efficient discharge of their respective duties, and for the exercise of proper supervision of the accounts kept or controlled by them and of all property entrusted to their care, and for the due observance of all rules and regulations, and of all orders and instructions prescribed for their guidance.

(8) The Authority may require any officer or servant in its service to give security to its satisfaction for the due performance of his duties.

Financial Provisions

(1) The Authority shall so exercise and perform its functions as to ensure that its revenues are not less than sufficient to—

(a) Pay instalments of compensation required by section 39;

(b) Cover operating expenses, including taxes, if any, and to provide adequate maintenance and depreciation, and interest payments on borrowings;

(c) Meet periodic repayment on long-term indebtedness to the extent that any such repayment exceeds the provisions for depreciation;

(d) Create reserves for the purpose of future expansion,

And the sums required for any of the purposes of the Authority shall be met out of the funds and resources of the Authority.

(2) Subject to subsection (1), the Authority may, in such manner as is considered appropriate, but subject to the approval of the Minister of Finance, borrow sums required by it for meeting any of its obligations and discharging any of its functions.

The funds and resources of the Authority shall consist of—

(a) Such amounts as may be appropriated therefore by Parliament;

(b) All sums from time to time received by or falling due to the Authority in respect of its operations;

(c) Sums borrowed by the Authority for the purpose of meeting any of its obligations or discharging any of its functions; and

(d) all other sums or property that may in any manner become payable to or vested in the Authority in respect or any matter incidental to its powers and duties.

(1) The Treasury may guarantee in such manner and on such conditions as it thinks fit the payment of the principal and interest in respect of any borrowing of the Authority under section 26(2).

(2) Where the Minister of Finance is satisfied that there has been default in the repayment of any principal moneys or interest guaranteed under the provisions of this section, he shall direct the repayment out of the general assets and public funds of Trinidad and Tobago of the amount in respect of which there has been such default.

(3) The Authority shall make to the Treasury, at such times and in such manner as the Minister of Finance may direct, payments of such amounts as may be so directed in or towards repayment of any sums issued in fulfilment of any guarantee given under this section, and payments of interest on what is outstanding for the time being in respect of any sums so issued at such rates as the Minister of Finance may direct, and different rates of interest may be directed as regards different sums and as regards interest for different periods.

(4) The revenue of the Authority for any financial year shall be applied in defraying the following charges:

(a) The remuneration, fees and allowances of the Commissioners or of any committee of the Authority;

(b) The salaries, fees, remuneration and gratuities, (including payments for the maintenance of the Pension Scheme authorised by this Act) of the officers, agents and servants, and technical and other advisers, of the Authority;

(c) instalments of compensation required by section 39, and working operations and establishment expenses and expenditure on, or provision for, the maintenance of any of the works or installations of the Authority, and the insurance of the same and the discharge of the functions of the Authority properly chargeable to revenue account;

(d) Interest on any debenture and debenture stock or other security issued, and on any loan raised, by the Authority;

(e) Sums required be transferring to a sinking fund or otherwise setting aside for the purpose of making provision for the redemption of debentures or debenture stock or other security or the repayment of other borrowed money;

(f) Such sums as it may be deemed appropriate to set aside in respect of depreciation on the property of the Authority having regard to the amount set aside out of the revenue under paragraph *(e);*

(g) Any other expenditure authorised by the Authority and properly chargeable to revenue account.

(5) Notwithstanding anything to the contrary in section 11(3), references to interest on loans raised by the Authority and the repayment of other borrowed money in subsection (1)*(d)* and *(e)*, respectively, shall be deemed to include a reference to interest and repayment of the loan the subject of the agreement referred to in the said section 11(3), in such proportion and in such manner as the Minister may direct.

(6) The balance of the revenue of the Authority shall be applied to the creation of reserve funds to finance future expansion or, where there is already a sufficient reserve fund, on the direction of the Minister shall be paid into public funds.

Funds of the Authority not immediately required to be expended in the meeting of any obligations or the discharge of any functions of the Authority may be invested from time to time in securities approved by the Minister for investment by the Authority.

(1) The rates and charges to be charged by the Authority for the supply of water, sewerage facilities and other services and facilities shall be in accordance with such rates and charges as may, from time to time, be fixed by or under this Act or any other written law.

(2) Subsection (1) does not prevent the Authority from charging other rates and charges by special agreement under the provisions of this Act.

(3) Where the Authority is by this Act empowered to fix rates and charges for the supply of water, sewerage facilities and other services and facilities, the Authority shall not—

(a) Show undue preference as between consumers or rate payers similarly situated;

(b) exercise undue discrimination as between persons similarly situated, having regard to the place and time of supply, the quantity of water supplied, the regularity of supply, and the purposes for which the supply is taken; and

(c) Supplement its revenues in respect of its operations under Part III or Part IV by undue preference as between ratepayers under Part IV and consumers under Part III.

(1) All decisions, orders, rules and regulations relating to the financial operations of the Authority and authorised by this Act shall be made by resolution of the Authority at a meeting thereof and shall be recorded in the minutes of the Authority.

(2) Subject to this Part, the Authority shall keep separate and proper accounts and other records in respect of its operations under Parts III and IV, and shall cause to be prepared separate statements in respect of both for each financial year.

(3) The accounts of the Authority shall be audited by auditors to be appointed annually by the Authority or under the supervision of the Auditor General in accordance with the Exchequer and Audit Act, if so directed by resolution of Parliament.

(4) After the end of each financial year of the Authority, the Authority shall, as soon as the accounts of the Authority have been audited, cause a copy of the statement of account to be transmitted to the Minister, together with a copy of any report made by the auditors on that statement or on the accounts of the Authority.

(5) The Minister shall cause a copy of every such statement and report to be laid before Parliament.

(6) All moneys of the Authority accruing from its operations under this Act shall be paid into the prescribed bank in separate accounts with respect to its operations under Parts III and IV, and such moneys shall, as far as practicable, be paid into the bank from day to day, except such sums as the Chief Accountant of the Authority may be authorised by regulations of the Authority to retain in his hands to meet petty disbursements for immediate payments.

(7) All payments out of the funds of the Authority except petty disbursements not exceeding such sums to be fixed by the rules, shall be made by the Chief Accountant, or on his behalf by any other officer appointed by the Authority, in accordance with the rules.

(8) Cheques against any banking account required to be kept or withdrawals from any savings bank account and bills of exchange or orders for payment of money shall be signed by the Chief Accountant or on his behalf by an officer appointed by the Authority and countersigned by the Chairman of the Authority or any member of the Authority or any officer of the Authority appointed by resolution of the Authority for the purpose; and a copy of any such resolution shall be certified by the Chairman and forwarded to the bank or banks concerned.

For the purpose of regulating and controlling its financial operations, the Authority may make Rules in respect of the following matters:

(a) The manner in which and the officers by whom payments are to be approved;

(b) The bank or banks into which the moneys of the Authority are to be paid, the title of any account with any such bank, and the transfer of one fund from one account to another;

(c) The appointment of a Commissioner or an officer of the Authority to countersign cheques on behalf of the Chairman or in the absence of the Chairman;

(d) The sum to be retained by the Chief Accountant to meet petty disbursements and immediate payments and the maximum sum that may be so disbursed for any one payment;

(e) The method to be adopted in making payments out of the funds of the Authority; and

(f) Generally as to all matters necessary for the proper keeping and control of the finances of the Authority.

PART IV

STAFF OF THE AUTHORITY

The Authority shall employ such members of staff as are required for the performance of its functions, including –

WATER RESOURCES ADMINISTRATION UNIT

General Manager
Management Assistant II
Secretary Executive Services

Manager Human Resources and Administration

Human Resources/ Industrial Relations
(1) Human Resources Officer
(1) Office Assistant/Driver
(1) Hospitality Assistant

Secretarial
(2) Senior Secretaries
(2) Assistant Secretaries

Finance
(1) Accounting Technician
(1) Staff Assistant

Building & Maintenance
(1) Engineering Technician (Building & Grounds)
(2) Female Attendants
(1) Handyman

Security
(1) Estate Corporal
(2) Estate Constables
(2) Security Officers

Procurement/Stores
(1) Procurement Officer
(1) Stores Attendant

WATER RESOURCES PLANNING AND INVESTIGATION UNIT

Manager

Water Resources Planning, Policy Development and Implementation

(1) Assistant Hydrologist
(1) Paralegal Assistant
(1) Hydrological Technician I/II

Projects/Research & Development

(1) Hydrologist
(1) Economist
(1) Water Resources Engineer
(1) Assistant Hydrologist
(1) Hydrological Technician III
(1) Hydrological Technician I/II

Water Resources Investigation

(1) Hydrogeologist
(1) Geologist
(2) Assistant Hydrologist
(1) Hydrological Technician I/II

WATER RESOURCES AND ENVIRONMENTAL REGULATION UNIT

Allocations, Licensing & Regulations

(1) Natural Resource/Environmental Specialist/Scientist
(1) Assistant Hydrologist
(1) Senior Hydrological Technician
(1) Hydrological Technician III
(1) Hydrological Technician I/II

Water Use Efficiency

(1) Assistant Hydrologist
(1) Hydrological Technician I/II

WATER RESOURCES DATA AND INFORMATION UNIT

Information Systems

(1) Systems Administrator
(1) Hydrological Systems Analyst
(1) Network Administrator
(1) IT Technician
(1) Hydrological Technician III

Geographic Information Systems

(1) GIS/CAD Specialist
(1) GIS/CAD Modeller
(1) GIS/CAD Technician

Communication

(1) Communication Officer
(1) Library Technician
(1) Hydrological Technician III

WATER RESOURCES DATA COLLECTION AND MONITORING UNIT

Manager
Administrative Assistant

Maintenance Field & Instrumentation

(1) Senior Instrument Planner
(1) Senior Instrumentation Technician
(2) Instrumentation Technician
(5) Craftsmen
(3) Attendants

Surface Water and Water Quality

(1) Assistant Hydrologist
(1) Senior Hydrological Technician
(1) Hydrological Technician III
(5) Hydrological Technician I/II

Tobago

(1) Senior Hydrological Technician
(1) Hydrological Technician III
(1) Hydrological Technician I/II
(1) Craftsman

Groundwater & Climatic

(1) Assistant Hydrologist
(1) Senior Hydrological Technician
(1) Hydrological Technician III
(5) Hydrological Technician I/II

WATER RESOURCES MANAGEMENT UNIT

Manager

(1) Technical Assistant

Flood & Drought Management

(1) Senior Hydrologist
(1) Assistant Hydrologist
(1) Hydrological Technician III
(1) Hydrological Technician I/II

River Basin Management

(1) Hydrogeologist
(1) Environmental Specialist/Scientist
(1) Water Quality Specialist
(2) Assistant Hydrologists
(1) Senior Technician
(2) Hydrological Technicians III
(3) Hydrological Technician I/II

PART V

WATER RESOURCES PLANNING AND DEVELOPMENT

Abstraction and Use of Water

The abstraction and use of water in Trinidad and Tobago and the construction of any works for such abstraction and use must be governed by the provision of the Water Resources Act, and nothing in other existing enactment (an enactment which is in force on an appointed day), shall be construed as derogating from any provision made by or pursuant to this Act.

the National Integrated Water Resources Management Policy (2005) provides guidance for addressing the following aspects of IWRM as set out in Section 5 of the Policy: land use planning and management, water resources assessments, water resources planning, licensing of abstractions, designated uses of water, ambient water quality, public water supply, public water quality, agricultural water management, seasonal variation of rainfall, watershed management, water-related ecology and wetlands.

Abstract and use water

The requirement, through the Water Resources Act, for persons desirous of abstracting water from any source, to have a licence. This includes abstraction of any surface, ground, or coastal waters and will require an abstraction license. Such license will include a volume-based fee for abstraction.

The award of abstraction licenses will consider the rights of multiple users of the water resource, the protection and sustainable management of the water resource, and allocation priorities.

Types of abstraction requiring a license will include:

1. The diversion or impoundment of water from precipitation, runoff, or a water body.
2. The abstraction of water from subterranean and surface water sources.
3. The abstraction of water from coastal sources
4. The abstraction of water for the generation of any form of energy.
5. The abstraction of water for cooling or purposes ancillary to a manufacturing process or industrial activity.
6. Any other uses that affect the flow, quantity, or quality of any water body.

Abstraction of groundwater and surface water will be managed on a sustained yield basis. However, during periods of emergency, increased abstraction may be permitted on the optimal yield basis, provided that an impact assessment identifies that an acceptable level of risk is

involved and that system recovery is reasonably guaranteed through the adoption of appropriate mitigation measures.

Fees and Charges

The fees collected through abstraction licensing will be sufficient to cover the reasonable costs of operating an integrated water resources management programme, including, but not limited to, the costs of research, planning, monitoring, watershed management, water resources assessment, coastal zone management, administrative costs, overheads costs and incident remediation

Fees will be charged on the basis of the allocation, not actual consumption. However, to encourage conservation, systems for credits or rebates and the trading allocation licenses may be established. Credits may also be established for water that is used and returned to its source with no significant alteration in quality.

Subject to assessment, fees for abstraction may be varied on the basis of the quality, quantity, variability, and sensitivity of the source of water, the amount of water to be abstracted, and the nature of demand to be met.

Purveying

The Act must have provision for water purveying

Easement

Special Power relating to the abstraction and use of water

1. Where the ground and surface waters are interconnected
2. Where certain areas are designated "special"
3. In cases of emergency
4. Natural disasters
5. Severe meteorological conditions
6. Sources reserved for public purposes

Control and protection of water resources which includes:

- Surface water
- Groundwater
- Coastal Water

Control of Water Quality

Water Quality control areas
Water quality control plan

PART VI

GENERAL

Penalties

To be able to imposed penalties for contravention of licence requirements or obligations

Appeals
The Act must provide redress for those aggrieved by penalties or notices
Suspension of License
Fees and Charges
Offences by Corporations
Agencies to consult authority prior to giving decisions
Inter-Agency coordination as proposed

SCHEDULES

1st Schedule

Constitution and Procedures of the Water Resources Management Authority

- Appointment of members
- Temporary Appointments
- Chairman
- Tenure
- Resignation
- Publications of Members
- Authentication of Seal

- Procedure and Meetings
- Remuneration of Officer
- Appointment of Officers
- Protection of Members of the authority

2nd Schedule

Constitution and Procedure of the Water Resources Management Advisory Committee

3rd Schedule

AMENDMENT OF ENACTMENTS

Water and Sewerage Act (1965)
This Act needs to be amended to require WASA to work with the WRMA on water resources assessment issues and water demand analysis.

Waterworks and Water Conservation Act (1944)
This Act needs to be amended to require the Drainage Division to cooperate with the WRMA on water resource assessment issues, water demand analysis and to co-ordinate with the WRMA the development of agricultural water and drainage and flood control facilities.

Forestry Division Law (1916)
This law needs to be amended to require the Forestry Division to cooperate with WRMA on water demand analysis issues and to consult with the WRMA on watershed management issues.

Town and Country Planning Act (1960)
This Act needs to be amended to require that the Town and Country Planning Division obtain a letter of no objection from the WRMA in the land use permitting process and to cooperate with WRMA on water demand analysis.

Environmental Management Act (1965)
Section 81(5) of the EMA Act should be amended to clearly define that the Environmental Commission, created pursuant to the EMA Act, has the authority to hear WRMA matters not related to disputes over abstraction fees. The EMA Act should be amended to require the EMA to obtain a letter of no-objection

from the WRMA in the water pollution permitting process and to co-ordinate with the WRMA on the development of sewerage and conveyance issues and demand management.

Freedom of Information Bill

Part III: Provides for information that is exempt from the provisions of the Bill. This part should be amended to provide that water resources information gathered pursuant to the provisions of the WRMA Act is exempt, unless a fee set by the WRMA is paid for it.

Section 29: Provides for limits on fees that can be charged for information. This section should be amended to provide that the WRMA may set its own fees for water resources information gathered pursuant to the provisions of the WRMA Act.

Regulated Industries Commission Bill

Section 34: Provides that any entity providing services must have a license under the provisions set forth in the RIC Bill. This section should be amended to provide that the WRMA does not need a license to set fees for the abstraction of water.

Section 61: Provides that entities lawfully operating under the WASA Act can continue charging current rates until provisions are made under the RIC bill. This section should be amended to provide that it does not apply to the setting of fees for abstraction by the WRMA, which is done pursuant to the WRMA Act.

Second Schedule: Provides a list of services that are regulated by the RIC. This schedule should be amended to provide that the licensing of abstractions by the WRMA is not a service within the meaning of the second schedule, and thus that the WRMA is not a service provider within the meaning of the first schedule.

New Section: A section needs to be added providing that the RIC is required to consult with the WRMA regarding the fees set for abstraction before it sets rates for water service providers that have abstraction licenses issued by the WRMA.

4th Schedule

License to Abstract and Use Water

The following images are proposed application forms to be used for abstraction and use of water from surface and ground water sources

WELL COMPLETION REPORT

WELL MAKE AND NUMBER: _____

CONTRACTOR'S NAME: _____

DATE WELL COMPLETED: _____

TOTAL DEPTH DRILLED: _____ DIAM. FOR OF WELL _____

TYPE OF CASING: _____ DIAM. FOR OF CASING _____

SCREEN TYPE _____ SLOT SIZE _____

SCREEN INTERVAL (S): _____

FORMATION STRATA

FROM - TO INTERVALS DESCRIPTION / SOIL TYPES

_____

_____

_____

_____

GEOPHYSICAL LOGS INCLUDED? YES [ ] NO [ ]

STATIC WATER LEVEL _____

FLOW RATE: _____

PUMPING LEVEL _____

DATE _____

AUTHORISED SIGNATURE _____

This Completion Report must be accompanied by the Application for Licence to Abstract Water (as form provided) Inclusive with these must be the results of a Chemical and Bacteriological Analysis, conducted on a water sample from the well done by WASA's Water Quality Department

(Tel No 674-8555)

APPLICATION FOR PERMISSION TO DRILL AND CONSTRUCT ONE (1) PRIVATE WATER WELL

I/We ______________________________ hereby apply for permission to drill and construct one (1) Private Water Well in Trinidad and Tobago, details of which follow hereunder.

APPLICANT ______________________________

INDIVIDUAL [ ]   COMPANY [ ]

ADDRESS ______________________________

____

CONTRACTOR'S NAME ______________________________

ADDRESS OF CONTRACTOR ______________________________

____

WATER USER(S) ______________________________

ADDRESS ______________________________

____

TOTAL DAILY REQUIREMENTS ______________________________

PURPOSE FOR WHICH WATER WILL BE USED ______________________________

IS WASA WATER AVAILABLE?   YES [ ]   NO [ ]
HAS REQUEST BEEN MADE FOR A SUPPLY FROM WASA?   YES [ ]   NO [ ]

[illegible] ______________________________

[illegible] ______________________________

[illegible] ______________________________

IS WATER TO BE PUMPED TO STORAGE?   YES [ ]   NO [ ]

TOTAL STORAGE CAPACITY OF WATER TANKS ______________________________

ABSTRACTION RATE DESIRED PER DAY   MINIMUM ______________

MAXIMUM ______________

LOCATION OF WELL ______________________________
(Site plan / Location to accompany Application)

DATE ______________   CONTACT NUMBER ______________

APPLICANT'S SIGNATURE / COMPANY STAMP
and AUTHORISED SIGNATURE

FOR OFFICIAL USE ONLY

DATE APPLICATION RECEIVED ______________________________

DATE RECEIPT FOR PAYMENT RECEIVED ______________________________

APPLICATION APPROVED   YES [ ]   NO [ ]   DATE ______________

INDEX FILE NUMBER ______________ WELL NAME & NUMBER ______________

SUGGESTED DEPTH TO BE DRILLED ______________

REMARKS ______________________________

____

OFFICER'S SIGNATURE ______________

APPLICATION TO RENEW LICENCE TO ABSTRACT WATER

NAME OF APPLICANT: .....

ADDRESS OF APPLICANT: .....

NAME OF COMPANY: .....

ADDRESS OF COMPANY: .....

.....

CONTACT TEL. NO. .....

I / WE, the above, hereby request renewal of the licence (s) indicated below for the year .....

LICENCE NO.	SOURCE	LOCATION	RENEWAL REQUESTED (Please indicate Yes or No)
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....

Interest of Licensee in property: owner, lease, tenant, etc .....

Method of measuring or assessing quantities abstracted: .....

Specify Purpose of abstraction .....

.....

Desired rate of abstraction (m³/anth.) .....

.....

Signature of Applicant

.....

Date of Application

Please fill out and return this form with the appropriate answer (s) to the above address.

APPLICATION FOR LICENSE TO ABSTRACT WATER FROM A SURFACE WATER SOURCE

MR. / MRS. _____

INDIVIDUAL [ ] COMPANY [ ]

ADDRESS: _____

_____

_____

NAME OF COMPANY _____

_____

_____

MAJOR ACTIVITY _____

PURPOSE FOR WHICH WATER WILL BE USED: _____

HAS A REQUEST BEEN MADE FOR A SUPPLY FROM WASA? YES [ ] NO [ ]

IS A WASA SUPPLY AVAILABLE? YES [ ] NO [ ]

IF NOT, WHEN WASA SUPPLY WILL BE AVAILABLE? _____

APPROXIMATE REQUIREMENT FROM WASA: _____

TYPE OF STORAGE SOURCE TO BE EXCLUDED: SPRING [ ]
RIVER / DAM ON RIVER [ ]
RAIN WATER RESERVOIR [ ]

LOCATION OF SOURCE: _____
(To be shown on sketch accompanying application)

IS WATER TO BE DIVERTED TO STORAGE? YES [ ] NO [ ]

IF YES, STORAGE CAPACITY AVAILABLE: _____

PERIOD OF YEAR DURING WHICH ABSTRACTION IS REQUIRED: _____

DESIRED ABSTRACTION RATE: _____ m^3/day

TOTAL VOLUME TO BE ABSTRACTED _____ m^3/day

APPLICATION FOR LICENSE TO ABSTRACT WATER FROM ~~WELL~~

I/We..... of .....
..... hereby apply for permission abstract water from well indicated below.

WELL NAME / NO. _____

LOCATION OF WELL: _____

DRILLING CONTRACTOR. _____

DESIRED ABSTRACTION RATE _____ CUBIC METRES PER DAY

DATE _____ APPLICANT'S SIGNATURE AND COMPANY STAMP
APPLICANT'S SIGNATURE

Please note the results of a water quality analysis must be submitted before a license to abstract can be issued.

OFFICIAL USE

GROUND ELEVATION _____ METRES

YIELD AVAILABLE FROM WELL _____

STATIC WATER LEVEL: _____

YIELD GRANTED _____

RECOMMENDATIONS BASED ON WATER QUALITY RESULTS _____

REMARKS _____

_____

_____

_____

_____

_____

DATE _____

OFFICER'S SIGNATURE _____

Groundwater/Surface Water

Application and Permission to drill and construct water well

- Matters to be considered by the Authority
- Authority may grant or refuse licence
- Provisions as to certain conditions in licence
- Licence not transferrable
- Renewal of licence
- Revocation of licence
- Revocation ,suspension of licence for breach of Act
- Revocation of licence granted for use of excess water
- Revocation ,variation of licence for non-use

Miscellaneous Powers of the Authority

- Power to require information on measuring devices installed
- Power of entry, inspection, taking of samples

General

- Procedure on receipt of application for licences
- Registration or recording of easement
- Information as to underground water
- Provisions relating to appeal
- Licence based on long use
- Licence of right
- Application of certain provisions
- Reason for varying use of water to be in writing

5/29/2009

WATER RESOURCES MANAGEMENT AUTHORITY BILL, 2009

LEGISLATIVE SCHEME

1. Establishment of Authority
2. Functions of Authority
3. Powers
4. Composition of Authority
5. Seal of the Authority

6. Establishment of Board of the Authority and appointment of members
7. Functions and powers of the Board
8. Acting appointment
9. Revocation of appointment
10. Resignation
11. Remuneration
12. Location and meetings
13. Disclosure of interest

14. Staff of Authority
15. Compliance Unit
16. Water Resources Management Unit
17. Water Resources and Planning Unit
18. Communications Unit
19. Finance and Account Unit

20. Pension Scheme
21. Funds
22. Accounts and Audit
23. Annual reports and estimates
24. Liability of members

Part I

Preliminary

Section

Part II

Establishment and Organisation of the WRMA

Establishment, incorporation and constitution of the WRMA

Part III

Functions and Powers of the Authority

General functions

Powers

General Powers of the Authority

Part IV

Rules

Rule making process

Public comment procedure

Jurisdiction and standard for appeal

Part V

Water Resources Management Authority Bill 2009

Suggested Legislative Scheme –No 2

SCHEDULES

The Water Resources Management Authority Bill 2009

JAMAICA

Suggested Legislative Scheme –No 3

Part I

Preliminary

Short title and commencement

Interpretaion

Part II

Administration of Water Resources

Water Resources Management Authority

Establishment of Authority

Functions of Authority

Ministerial directions

Funds and resources of the Authority

Application of revenues

Water Resources Advisory Committees

National Water Resources Plan

Abstraction and use of Water

Easement

Special Powers Relating to the Abstraction and use of Water

Part IV. Control and Protection of Underground water

Control of well drilling

Special Power of Authority in relation to Aquifer

Part V

Control of Water Quality

Water quality Control plan

Part VI

Supplementary powers of Authority

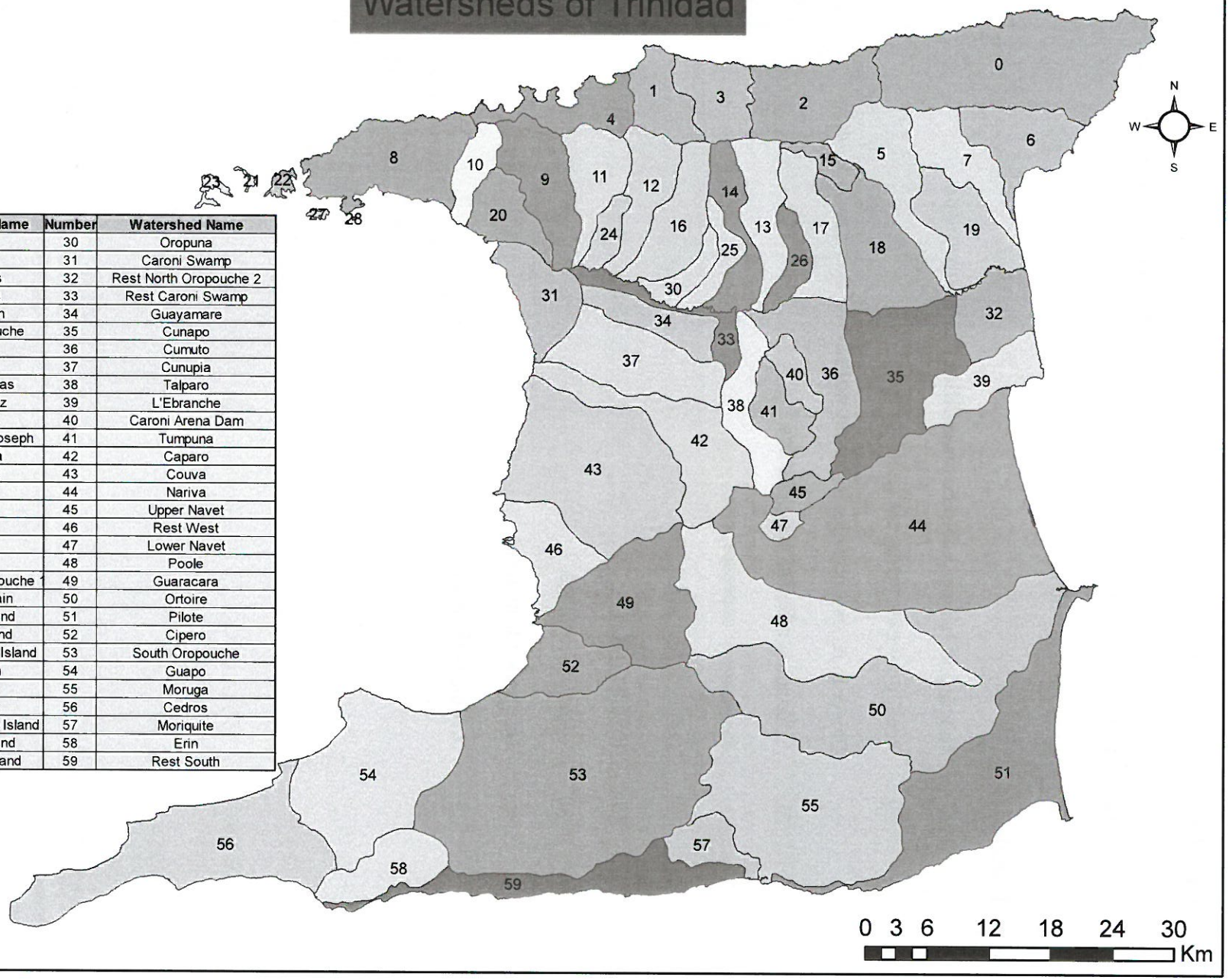
Part VI. General

Part VIII

Schedules

ARRANGEMENT OF SECTIONS

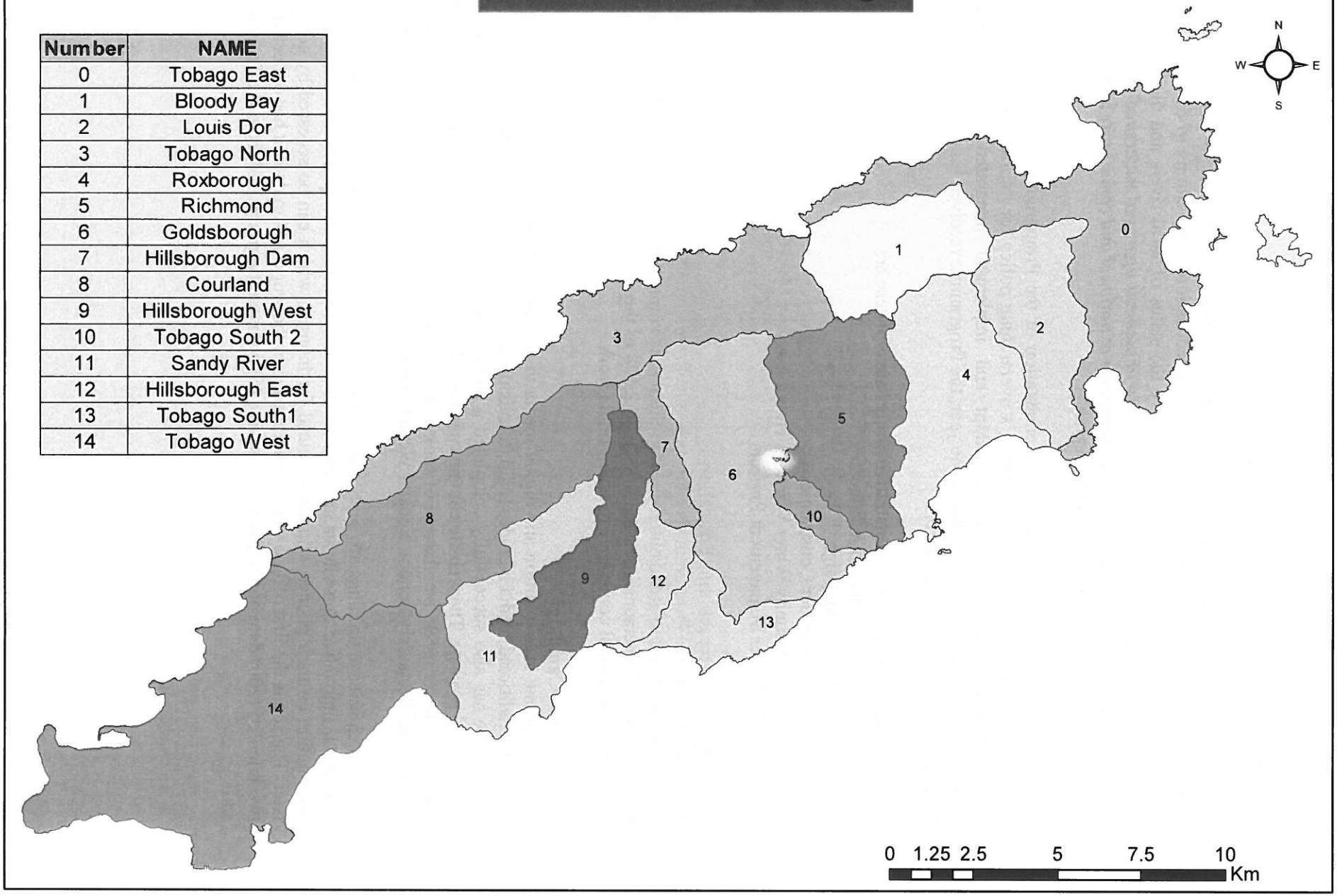
Watersheds of Trinidad



Number	Watershed Name	Number	Watershed Name
0	Toco	30	Oropuna
1	Yarra	31	Caroni Swamp
2	Madamas	32	Rest North Oropouche 2
3	Marianne	33	Rest Caroni Swamp
4	Rest North	34	Guayamare
5	North Oropouche	35	Cunapo
6	Salybia	36	Cumuto
7	Matura	37	Cunupia
8	Chaguaramas	38	Talparo
9	Santa Cruz	39	L'Ebranche
10	Maraval	40	Caroni Arena Dam
11	Maracas/ St Joseph	41	Tumpuna
12	Tacarigua	42	Caparo
13	Guanapo	43	Couva
14	Arima	44	Nariva
15	Hollis	45	Upper Navet
16	Arouca	46	Rest West
17	Aripo	47	Lower Navet
18	Quare	48	Poole
19	Rest North Oropouche 1	49	Guaracara
20	Port Of Spain	50	Ortoire
21	Huevos Island	51	Pilote
22	Monos Island	52	Cipero
23	Chacachacare Island	53	South Oropouche
24	Tunapuna	54	Guapo
25	Mausica	55	Moruga
26	El Mamo	56	Cedros
27	Gaspar Grande Island	57	Moriquite
28	Carerra Island	58	Erin
29	Cronstadt Island	59	Rest South

Watersheds of Tobago

Number	NAME
0	Tobago East
1	Bloody Bay
2	Louis Dor
3	Tobago North
4	Roxborough
5	Richmond
6	Goldsborough
7	Hillsborough Dam
8	Courland
9	Hillsborough West
10	Tobago South 2
11	Sandy River
12	Hillsborough East
13	Tobago South1
14	Tobago West



Profile of the Adopt A River Programme

The Adopt A River Programme is an initiative of the Water and Sewerage Authority to bring together corporate entities, community groups and educational institutions to develop holistic, coordinated and sustainable projects to improve the status of local rivers and their supporting watersheds. The objective of the Programme is ***to implement approved watershed rehabilitation and conservation projects, identified by stakeholders at national and community levels, for water supply and/or water management improvement.***

The Water Resources Agency began implementation of the Programme in 2012. In 2015, the Programme is aligned with the Government's overarching policy for improvement of the water sector, including its commitment to adopt and implement Integrated Water Resources Management (IWRM) locally. In that same year, the Programme received funding from the Green Fund in the amount of $34.2Million.

The Programme has 5 non-administrative project areas. These are:

1. Public Outreach & Education
2. Media Campaign
3. Stakeholder Consultations
4. Community Water Warriors Training
5. Water Management Projects

1. Public Outreach and Education

The foundation of the Programme is education. The Programme participates in one-off educational events such as exhibitions and outreaches to schools and communities. Since 2016, the Programme has engaged 5,123 persons in its activities with 2,108 of these being children. It is also mandated to complete an annual conference to report on its work.

2. Media Campaign

The Programme uses tradition and digital media to educate and update the country on ongoing projects. Traditional media includes radio, television and electronic billboard advertisements. The Programme has also successfully completed a website, which it uses to inform on community partners and projects. The website contains a list of all our publications, which include conference papers and RiverSpeak, a collection of spoken word pieces, which were submitted as part of the RiverSpeak, Secondary School, Spoken Word Competition.

Our citizen science trainings are supported by the development of a water quality sampling app. This bold, innovative app allows any user to store site location, site quality and water quality information on their phones, without the need for internet, which can be accessed by computer later. The app is the first offline water-sampling app in the world and to date, it has collected over two hundred (200) data points from at least five (5) community groups and from the Programme staff.

3. Stakeholder Consultations

Community engagement is an important part of the Programme and hence, it is important to involve and encourage participation of NGOs as well as important business stakeholders. A list of meetings is summarised in the Appendix 2. The stakeholder consultations were held in the following areas (details in Appendix 3):

i. St. Joseph
ii. Santa Cruz Scouts
iii. Cunupia
iv. Tobago Scouts
v. Recycling Stakeholder Consultations – held in partnership with Caribbean Bottlers Limited.

4. Community Water Warriors Training

The Programme also train communities in water management and water quality testing and gifts them testing kits to monitor their rivers, under our Community Water Warriors Training. This training empowers communities and provide avenues for citizen science, which is an important aspect of integrated water resources management. In-house, the Programme's staff also monitors rivers to provide background information on project progress as part of our river monitoring exercises. To date, twenty-five (25) groups from fourteen (14) communities with a total of two hundred and seven people (207) were trained.

5. Water Management Projects

After educating communities through river quality testing, we then assist them in developing projects to improve the status of rivers and their water supply. This is the main thrust of the Programme. These projects include the:

- Installation of rainwater harvesters – three (3) harvesters installed in Tobago and ten (10) to be installed across the country;
- Installation of irrigation ponds;
- Development of springs;
- Installation of rural intakes – three (3) intakes in process;
- Reforestation exercises – three (3) exercises completed in Brasso Seco, Lopinot and Arima (see Appendix 5);
- Recycling projects – Fifty six (56) recycling projects in twenty (20) watersheds were implemented (see Appendix 6), and
- Clean-up exercises – Thirty-five (35) clean-ups completed in twenty-four (24) watersheds with a total participation of nine hundred and eighty-six persons (986) (see Appendix 7).

The Programme has partnered with Government Ministries and other Programmes, like ICARE, in order to successfully complete these projects, thus illustrating our commitment to an integrated approach to water management.

APPENDIX VIII

ADDITIONAL SUBMISSION RECEIVED FROM WASA DATED MAY 15, 2020

TRINIDAD AND TOBAGO
WATER AND SEWERAGE AUTHORITY
HEAD OFFICE: VALSAYN, ST. JOSEPH, TRINIDAD W.I.

Phone: 662-2302/7
Website: www.wasa.gov.tt
WASA Trinidad & Tobago
@wasatnt

May 15, 2020

Mr. Julian Ogilvie
Secretary
Office of Parliament
Parliamentary Complex
Cabildo Building
St. Vincent Street
PORT- OF- SPAIN

Dear Mr. Ogilivie

Re: Inquiry into measures for ensuring water security in Trinidad and Tobago
Request for Additional Information

Reference is made to correspondence dated March 16, 2020 on the above captioned matter.

As requested, please find attached the Authority's electronic copy of responses regarding the "Inquiry into measures for ensuring water security in Trinidad and Tobago - Request for Additional Information".

Please note that hard copy of the Authority's written submission will be forwarded hereafter.

Forwarded for your attention.

For and on behalf of the
Water and Sewerage Authority

Alan Poon-King
Chief Executive Officer (Ag.)

c.c. *Permanent Secretary, Ministry of Public Utilities*
Chairman, Board of Commissioners, WASA

WATER AND SEWERAGE AUTHORITY

JOINT SELECT COMMITTEE

LAND AND PHYSICAL INFRASTRUCTURE

INQUIRY INTO MEASURES FOR ENSURING WATER SECURITY IN TRINIDAD AND TOBAGO

ADDITIONAL INFORMATION REQUESTED

DATED MARCH 16, 2020

Table of Contents

The Joint Select Committee on Land and Physical Infrastructure requested additional information from the Water and Sewerage Authority at its last session on March 9, 2020. The following questions were posed and below each is the Authority's response.

1. The Priority List of leaking mains across Trinidad and Tobago.

Response

243.2 kilometres of high leakage pipelines have been identified for replacement at an estimated cost of Nine Hundred and Forty-Six Million, Four Hundred and Twenty Eight Thousand, Five Hundred and Seventy Five Dollars and Twenty Six Cents ($946,428,575.26) over a period of ten (10) years. This has been prioritized as detailed in Appendix 1.

2. The Public Education Initiatives in place for the conservation of watershed.

Response

The Adopt A River Programme is an initiative of the Water and Sewerage Authority to bring together corporate entities, community groups and educational institutions to develop holistic, coordinated and sustainable projects to improve the status of local rivers and their supporting watersheds. The objective of the Programme is ***to implement approved watershed rehabilitation and conservation projects, identified by stakeholders at national and community levels, for water supply and/or water management improvement.***

The Water Resources Agency began implementation of the Programme in 2012. In 2015, the Programme was aligned with the Government's overarching policy for improvement of the water sector, including its commitment to adopt and implement Integrated Water Resources Management (IWRM) locally. In that same year, the Programme received funding from the Green Fund in the amount of $34.2Million for over a five year period ending June 2020.

The Programme has 5 non-administrative project areas. These are:

1. Public Outreach & Education
2. Media Campaign
3. Stakeholder Consultations
4. Community Water Warriors Training
5. Water Management Projects

1. Public Outreach and Education

The foundation of the Programme is education. The Programme participates in one-off educational events such as exhibitions and outreaches to schools and communities. Since 2016, the Programme has engaged 5,123 persons in its activities with 2,108 of these being children. It is also mandated to complete an annual conference to report on its work.

2. Media Campaign

The Programme uses traditional and digital media to educate and update the country on ongoing projects. Traditional media includes radio, television and electronic billboard advertisements. The Programme has also successfully completed a website, which it uses to

inform on community partners and projects. The website contains a list of all publications including conference papers and RiverSpeak (a collection of spoken word pieces, submitted as part of the RiverSpeak Secondary School Spoken Word Competition).

Our citizen science trainings are supported by the development of a water quality sampling app. This app allows any user to store site location, site quality and water quality information on their phones, without the need for internet, which can be accessed by computer later. The app is the first offline water-sampling app in the world and to date, it has collected over two hundred (200) data points from five (5) community groups and from the Programme staff.

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After educating communities through river quality testing, assistance was provided in developing projects to improve the status of rivers and their water supply. This is the main thrust of the Programme. These projects include the:

- Installation of rainwater harvesters – three (3) harvesters installed in Tobago and ten (10) approved for Trinidad;
- Installation of irrigation ponds;
- Development of springs;
- Installation of rural intakes – three (3) intakes in process;
- Reforestation exercises – three (3) exercises completed in Brasso Seco, Lopinot and Arima;
- Recycling projects – Fifty six (56) recycling projects in twenty (20) watersheds were implemented, and
- Clean-up exercises – Thirty-five (35) clean-ups completed in twenty-four (24) watersheds with a total participation of nine hundred and eighty-six persons (986).

The Programme has partnered with Government Ministries and other Programmes, like ICARE, in order to successfully complete these projects, illustrating the commitment to an integrated approach to water management.

3. The number of loans the WASA has expected with the IDB including:

a. The purpose of these loans;

b. The loan amount; and

c. The terms of these loans

Response

The Water and Sewerage Authority (WASA) is the "Executing Agency" (EA) of two (2) Inter-American Development Bank (IDB) Loans signed between the Government of the Republic of Trinidad and Tobago (GORTT) and the IDB. The Loans 2600/OC-TT and 2890/OC-TT both have terms of twenty-five (25) years.

i. **Loan 2600/OC-TT** was entered into on November 30, 2011 for execution of a program for the WASA's Modernization and Wastewater Infrastructure Rehabilitation.

Project Number: TT-L1018

The general objective of the Program is to improve the environmental conditions in Trinidad and Tobago by increasing the amount of wastewater treated, and to improve WASA's efficiency by supporting the reorganization of its personnel structure and reduction in personnel costs.

The specific objectives of the Program are:

a. The takeover, refurbishment, upgrade, integration or decommissioning of Malfunctioning Wastewater Treatment Facilities.

b. The rationalization of WASA's personnel.

c. The improvement of WASA's Wastewater Management operational and maintenance performance.

Pursuant to Section 3.05 of the Loan Contract, the IDB approved on May 05, 2017 an extension of the Disbursement Period to April 03, 2020. This extension will allow execution of activities which includes construction of a Wastewater Treatment Plant at Trincity and construction designs of the proposed Maloney Wastewater Treatment Plant.

Loan 2600/OC-TT has a loan amount of USD50.0Mn. detailed below:

Original Table of loan amount (expressed in United States dollars)

	Component	Total US$
1.0	**Project Administration**	
	1.1 Project Management	200,000
2.0	**Direct Costs**	
	2.1 Improvement of T&T's Wastewater System	28,935,000
	2.2 Re-organization of WASA	20,000,000
	2.3 Institutional Strengthening of WASA	625,000
3.0	**Concurrent Costs**	
	3.1 Program Auditing	150,000
	3.2 Program Monitoring	15,000
	3.3 Program Evaluation	75,000
	Total	**50,000,000**

Revised Investment Program

In May 2017, the Program was realigned such that the undisbursed funds from the Original Program of US$29.8Mn. was redirected to support the following projects:

a. South West Tobago Wastewater Upgrade Project – upgrade of the existing Samaan Grove and Bon Accord Waste Stabilization Ponds ('WSP') at an estimated cost of US$16.4Mn;

b. Provision of Consultancy Services for the Detailed Designs and Bid Documents of the Maloney Wastewater Treatment Plant and Phase 2 Collection System at an estimated cost of US$2.1Mn;

c. Design/Construct Trincity Wastewater Treatment Plant to expand and upgrade at an estimated cost of US$8.8Mn;

d. Continuation of Existing Contracts under Loan 2600 relating to Program Evaluation and Auditing of US$2.5Mn.

ii. **Loan 2890/OC-TT** was entered into on January 19, 2013.

Project Number: TT-L1026

The main objective of this project is to contribute to the GORTT's efforts to improve the environmental conditions of Trinidad and Tobago by decreasing the uncontrolled discharge of untreated wastewater into the environment. In order to achieve this objective, the Loan (2890/OC-TT) will finance the following components:

a. Component 1 – Construction of San Fernando and Malabar Wastewater Treatment Plants

The construction of two (2) Wastewater Treatment Plants (WWTPs) and Collection Systems for the San Fernando and the Malabar catchment areas, which will require infrastructure works together with trunk sewers connecting to collection systems from existing connections. Detailed designs for construction including bill of quantities, drawings and specifications of the works are fully developed. Works are in progress at the San Fernando Wastewater Treatment Plant and collection system. Construction of the Malabar WWTP and Collection System have been completed and handed over to WASA.

b. Component 2 – Institutional strengthening for the Authority

Finance activities related to the initiation of policy and institutional reforms at the Authority, as well as to institutional restructuring and capacity building. The specific activities comprised in this component include:

i. implementation of key actions to improve corporate governance (such as development of comprehensive corporate governance policies, improvement of the current information management policies and disclosure practices, training on risk management and controls systems, and establishment of a permanent financial statements team to strengthen auditing and internal control practices);
ii. implementation of key actions to improve commercial management services (including the purchase, installation, integration and implementation of a new billing system); and
iii. training activities on contract management of outsourced operations, operation and maintenance, and environmental management.

Loan 2890/OC-TT has a loan amount of US$246.5Mn. See details below. This represents the first of a three-phase rehabilitation program valued at US$546.5Mn.

No	Category	Original Budget	Revised Budget
		US$	US$
1	**Project administration**		
	1.1 Project management and supervision	1,000,000	600,000
	1.2 Works supervision	5,445,000	6,695,000
2	**Direct costs**		
	2.1 Construction of San Fernando and Malabar Wastewater Treatment Plants	210,942,000	220,634,000
	2.2 Works cost escalation allocation	23,438,000	6,006,000
	2.3 Institutional strengthening for WASA	4,255,000	9,095,000
3	**Concurrent costs**		
	3.1 Auditing	200,000	300,000
	3.2 Monitoring and evaluation	100,000	100,000
4	**Unallocated**		
	4.1 Contingencies	1,120,000	670,000
	Total	**246,500,000**	**246,500,000**

4. **In relation to the recovery of receivables from residential customers, please provide:**
   a. **The top 100 most indebted residential customers;**
   b. **The amount owed in each instance; and**
   c. **The area of these residents.**

Response

Top One Hundred (100) Residential Customers

As at 17 April 2020

Summary

Regions	No of Accounts	Arrears (Balance before April 2020 billing)	Current Balance as at 17 April 2020
North West			
Blanchiseuse	1	$ 27,372.40	$ 27,575.40
Carenage/Diego Martin	9	$ 267,457.75	$ 269,518.14
Dibe/Maraval	3	$ 98,535.57	$ 100,124.57
Port of Spain	15	$ 492,535.39	$ 496,591.92
San Juan/Laventille	16	$ 506,810.29	$ 510,986.42
Santa Cruz	2	$ 53,232.66	$ 53,877.77
North West Total	**46**	**$ 1,445,944.06**	**$ 1,458,674.22**
Central			
Central North	8	$ 353,133.55	$ 354,753.41
Central South	9	$ 231,271.81	$ 236,636.86
Central Total	**17**	**$ 584,405.36**	**$ 591,390.27**
South West			
Debe/Penal	1	$ 26,288.00	$ 26,355.50
La Brea/Point Fortin	2	$ 62,032.58	$ 62,640.58
Naparima	4	$ 146,141.32	$ 147,138.82
San Fernando	12	$ 341,632.47	$ 345,355.14
South West Total	**19**	**$ 576,094.37**	**$ 581,490.04**
North East			
Arima	8	$ 223,940.45	$ 226,357.35
Dabadie/Tacarigua	1	$ 36,355.66	$ 36,421.29
Omera/Malabar	4	$ 119,769.94	$ 121,479.84
Sangre Grande	2	$ 47,805.01	$ 48,107.32
North East Total	**15**	**$ 427,871.06**	**$ 432,365.80**
South East			
Princes Town	2	$ 76,590.41	$ 76,626.95
South East Total	**2**	**$ 76,590.41**	**$ 76,626.95**
Tobago			
Tobago	1	$ 23,979.22	$ 24,011.20
Tobago Total	**1**	**$ 23,979.22**	**$ 24,011.20**
Grand Total	**100**	**$ 3,134,884.48**	**$ 3,164,558.48**

Details

No.	REGION	BILL AREA	ACCT ID	ARREARS	CURRENT BALANCE
1	Central	Central North	0397120000	$ 95,896.37	$ 96,263.87
2	Central	Central North	3962330000	$ 71,482.51	$ 71,718.76
3	North West	San Juan/Laventille	7294440000	$ 70,404.55	$ 70,449.55
4	North West	Port of Spain	4594220000	$ 64,601.13	$ 64,998.38
5	South West	Naparima	0980430000	$ 59,120.14	$ 59,424.14
6	North West	Carenage/Diego Martin	2024200000	$ 53,461.88	$ 53,685.01
7	South East	Princes Town	0681800000	$ 52,759.12	$ 52,789.12
8	Central	Central North	0885230000	$ 52,588.82	$ 52,621.13
9	North West	Port of Spain	6776210000	$ 47,141.84	$ 47,186.84
10	North West	San Juan/Laventille	6633630000	$ 39,836.06	$ 40,140.06
11	North West	Dibe/Maraval	5555030000	$ 38,853.07	$ 39,250.32
12	South West	La Brea/Point Fortin	0081510000	$ 38,251.91	$ 38,555.91
13	North West	Port of Spain	1833140000	$ 37,847.02	$ 38,143.27
14	North East	Omera/Malabar	4889430000	$ 36,417.50	$ 36,713.75
15	North East	Dabadie/Tacarigua	4971100000	$ 36,355.66	$ 36,421.29
16	North West	Port of Spain	7349420000	$ 36,272.25	$ 36,568.50
17	South West	San Fernando	5368400000	$ 35,836.59	$ 36,233.84
18	North East	Arima	2470020000	$ 34,966.94	$ 35,364.19
19	North West	San Juan/Laventille	6893710000	$ 34,844.98	$ 35,148.98
20	North West	Port of Spain	8521820000	$ 34,692.38	$ 34,941.76
21	South West	San Fernando	4106410000	$ 34,637.57	$ 35,000.82
22	North West	Dibe/Maraval	7827240000	$ 34,560.75	$ 34,958.00
23	South West	San Fernando	8647810000	$ 33,551.12	$ 33,948.37
24	North East	Arima	7235520000	$ 33,452.50	$ 33,788.75
25	North West	San Juan/Laventille	5444320000	$ 33,201.53	$ 33,446.53
26	North West	San Juan/Laventille	3144730000	$ 32,696.02	$ 32,992.27
27	South West	Naparima	2038930664	$ 32,605.28	$ 32,769.78
28	Central	Central North	1701320000	$ 32,529.32	$ 32,833.32
29	North West	Port of Spain	7202830000	$ 31,744.54	$ 32,096.99
30	North West	Carenage/Diego Martin	5695830000	$ 31,269.08	$ 31,565.33
31	South West	San Fernando	9536942562	$ 30,793.50	$ 31,089.75

No.	REGION	BILL AREA	ACCT ID	ARREARS	CURRENT BALANCE
32	Central	Central South	6411210000	$ 30,716.02	$ 34,037.52
33	South West	Naparima	4188930000	$ 30,408.44	$ 30,633.44
34	North West	Port of Spain	9563130000	$ 30,288.75	$ 30,625.00
35	North East	Omera/Malabar	2494230000	$ 29,965.75	$ 30,329.00
36	North West	Port of Spain	9018240000	$ 29,921.25	$ 30,217.50
37	South West	San Fernando	3211610000	$ 29,913.41	$ 30,209.66
38	North West	Carenage/Diego Martin	7169300000	$ 29,346.73	$ 29,592.33
39	North West	San Juan/Laventille	4264310000	$ 29,313.00	$ 29,617.00
40	North West	San Juan/Laventille	0723540000	$ 29,246.66	$ 29,516.66
41	North East	Arima	8997630000	$ 28,909.75	$ 29,307.00
42	North East	Omera/Malabar	4389210000	$ 28,866.60	$ 29,101.50
43	North West	San Juan/Laventille	5808600000	$ 28,733.92	$ 28,778.92
44	North East	Arima	1080240000	$ 28,622.50	$ 28,918.75
45	North West	Port of Spain	5633210000	$ 28,459.90	$ 28,729.80
46	Central	Central North	2588220000	$ 28,164.20	$ 28,370.00
47	North West	San Juan/Laventille	2273030000	$ 27,894.09	$ 28,291.34
48	North West	Carenage/Diego Martin	3360710000	$ 27,559.61	$ 27,762.61
49	North West	San Juan/Laventille	0741240000	$ 27,440.03	$ 27,710.03
50	North West	Blanchiseuse	9436210000	$ 27,372.40	$ 27,575.40
51	North West	San Juan/Laventille	4380820000	$ 27,312.56	$ 27,531.56
52	North West	Santa Cruz	1953610000	$ 26,636.08	$ 26,883.94
53	North West	Port of Spain	2749530000	$ 26,615.75	$ 27,013.00
54	North West	Santa Cruz	2130930000	$ 26,596.58	$ 26,993.83
55	South West	Debe/Penal	5797130000	$ 26,288.00	$ 26,355.50
56	South West	San Fernando	4755610000	$ 26,218.50	$ 26,615.75
57	North East	Arima	9669420000	$ 25,968.33	$ 26,171.33
58	Central	Central South	9213620000	$ 25,891.00	$ 26,128.00
59	North West	San Juan/Laventille	9742210000	$ 25,819.53	$ 26,022.53
60	North West	Carenage/Diego Martin	2290500000	$ 25,786.89	$ 25,944.98
61	South West	San Fernando	6322300000	$ 25,771.25	$ 26,168.50
62	North West	Port of Spain	5799820000	$ 25,759.50	$ 26,017.25
63	North West	San Juan/Laventille	9892400000	$ 25,736.33	$ 26,240.33

No.	REGION	BILL AREA	ACCT ID	ARREARS	CURRENT BALANCE
64	North West	Port of Spain	9302400000	$ 25,604.00	$ 25,924.05
65	North West	Carenage/Diego Martin	8596400000	$ 25,591.67	$ 25,879.31
66	Central	Central South	3831510000	$ 25,538.54	$ 25,834.79
67	North West	Carenage/Diego Martin	8151220000	$ 25,505.25	$ 25,765.43
68	South West	San Fernando	6750040000	$ 25,465.16	$ 25,507.16
69	South West	San Fernando	7924040000	$ 25,424.00	$ 25,821.25
70	North West	Dibe/Maraval	0862485767	$ 25,121.75	$ 25,916.25
71	Central	Central South	6168910000	$ 25,075.04	$ 25,294.04
72	Central	Central South	2543440000	$ 25,075.04	$ 25,294.04
73	Central	Central South	7238410000	$ 25,075.04	$ 25,294.04
74	North West	Port of Spain	0975100000	$ 25,056.00	$ 25,360.00
75	South West	San Fernando	8553800000	$ 25,026.75	$ 25,424.00
76	Central	Central South	4238110000	$ 24,901.59	$ 25,221.64
77	North West	San Juan/Laventille	5034710000	$ 24,861.00	$ 25,157.25
78	North West	Carenage/Diego Martin	3070320000	$ 24,855.33	$ 25,058.33
79	North West	San Juan/Laventille	4942320000	$ 24,742.83	$ 24,988.43
80	North West	San Juan/Laventille	8636140000	$ 24,727.20	$ 24,954.98
81	North West	Port of Spain	8966540000	$ 24,660.30	$ 24,853.80
82	South West	San Fernando	9679500000	$ 24,606.70	$ 24,902.95
83	Central	Central South	2569040000	$ 24,538.54	$ 24,834.79
84	Central	Central North	3196710000	$ 24,525.00	$ 24,750.00
85	North East	Omera/Malabar	0222110000	$ 24,520.09	$ 25,335.59
86	Central	Central South	3152000000	$ 24,461.00	$ 24,698.00
87	South West	San Fernando	6734910000	$ 24,387.92	$ 24,433.09
88	North East	Arima	3203110000	$ 24,153.60	$ 24,348.00
89	North East	Arima	3695600000	$ 24,111.58	$ 24,407.83
90	North West	Carenage/Diego Martin	0600500000	$ 24,081.31	$ 24,264.81
91	North East	Sangre Grande	1687140000	$ 24,030.00	$ 24,300.00
92	South West	Naparima	7485310000	$ 24,007.46	$ 24,311.46
93	Tobago	Tobago	4310800000	$ 23,979.22	$ 24,011.20
94	Central	Central North	1593120000	$ 23,975.04	$ 24,194.04
95	Central	Central North	6269300000	$ 23,972.29	$ 24,002.29

No.	REGION	BILL AREA	ACCT ID	ARREARS	CURRENT BALANCE
96	North West	Port of Spain	8408010000	$ 23,870.78	$ 23,915.78
97	South East	Princes Town	1771100000	$ 23,831.29	$ 23,837.83
98	South West	La Brea/Point Fortin	7536000000	$ 23,780.67	$ 24,084.67
99	North East	Sangre Grande	5701030000	$ 23,775.01	$ 23,807.32
100	North East	Arima	5397500000	$ 23,755.25	$ 24,051.50

5. The quantity of wastewater effluent generated from both and private sector wastewater treatment plants.

Response

The quantity of wastewater generated from WASA facilities is estimated at 24.3 million gallons daily (mgd). The quantity from the private sector is estimated at 12.1 mgd.

6. What potential is there to convert effluent water for reuse for agricultural, industrial or potable water use?

Response

Once the wastewater is properly treated, it can be recycled for agricultural, industrial or even potable water use. The end use will dictate the level of treatment required.

Treated effluent can be reused for irrigation in agriculture; the nutrient (nitrogen and phosphorus) content of the treated wastewater has the benefit of acting as a fertilizer. The type of crop to be irrigated will dictate the level of treatment. The food crop types are listed below:

i. Food crops to be eaten raw: crops which are intended for human consumption to be eaten raw or unprocessed
ii. Processed food crops: crops which are intended for human consumption not to be eaten raw but after treatment process (i.e. cooked, industrially processed).
iii. Non-food crops: crops which are not intended for human consumption (e.g. pastures, forage, fiber, ornamental, seed, forest and turf crops)

Treated effluent can also be used in industries as part of the industrial water usage. The industry type will dictate the effluent quality parameters. Treated effluent can be used for processing water; cooling water, recirculating cooling towers, wash down water; washing aggregate; making concrete, soil compaction, dust control.

The use of recycled water for drinking is less common, as many people do not accept the use of water that has been in our toilets going to our taps. A few countries like Singapore, Australia and Namibia, and states such as California, Virginia and New Mexico are drinking recycled water. In these countries, water is very scarce and the recycled water that ends up as drinking water undergoes extensive purification to achieve potable water quality.

A cost-benefit analysis will have to be conducted if the Authority proposes to pursue wastewater reuse as one of the main avenues of New Water, this is a key element that will have to be conducted

in assessing re-use potential, the analysis will have to include the social and environmental components in the analysis.

7. The status of the Beetham reuse program and the plans to get water from that project into the mainstream supply.

Response

WASA and the National Gas Company of Trinidad and Tobago Limited (NGC) entered into a Memorandum of Understanding (MOU) in 2013 which stated inter alia, " to explore and consider the feasibility and suitability of constructing infrastructure as part of their mutual cooperation for:

a) Water Recycling through the treatment of effluent from the Beetham Wastewater Treatment Plant;
b) Storage and Transmission of water from the Beetham Wastewater Treatment Plant to the Point Lisas Industrial Estate; and
c) Distribution of Industrial quality Water within the Point Lisas Industrial Estate."

This was subject to required approvals and the conclusion and execution of a legally binding agreement between NGC and WASA. That legally binding agreement was not entered upon.

Notwithstanding, NGC initiated the Beetham the Beetham Reuse Project including:

i. Beetham Water Re-use Plant with a capacity of 50,000 cubic metres daily including a Feedwater Storage Facility (18,000 cubic metres) and a Product Water Storage Facility (8,200 cubic metres).
ii. 1.0 metre diameter Product Water Pipeline with a total length of approximately 40 kilometres of pipe between the proposed Beetham Water Re-use Plant and the Point Lisas Industrial Estate.
iii. Product Water Storage Facilities at Point Lisas with a total capacity of 32,500 cubic metres with a pumping station

In 2014 under a Design & Build arrangement, NGC procured the services of a contractor to execute the works of design and construction of the BWRP including the operation of the plant for 5 years. The contract was terminated by NGC in 2015 with a significant quantity of incomplete works, including incomplete process units at the plant site, segments of incomplete product water pipeline and incomplete product water storage facilities at Point Lisas. Equipment procurement as well as engineering designs however were reportedly deemed generally completed.

The foundation for the Re-use plant was constructed. Equipment for reuse plant was received and is in NGC's possession

Approximately 16.2 kilometres of pipe was installed from Point. Lisas to Guayamare.

The storage tanks at Point Lisas are approximately 75% completed.

8. Provide details on the plans to manage water consumption through the Bulk Metering Programme

Response

Management of water consumption is to be done through **Bulk Metering** complemented by **Universal Domestic Metering.** The Authority plans to establish one hundred and twenty (120) District Metered Areas (DMA's) which is estimated for full DMA coverage of Trinidad and Tobago. Each functional DMA, with specific set boundaries, will consist of a **bulk meter** which will facilitate the calculation of Non-Revenue Water (NRW) by subtracting the customer metered consumption when installed from the bulk meter reading for the same period (Water Balance). This will aid in efficient leak detection and repair which will in turn reduce NRW. In addition, customer consumption would decrease after being converted from an unmetered (A3) to a metered customer (A4) as they will now be paying based on usage.

The establishment of a monitoring system via SCADA will make the information real time and would allow for a faster response to leakage management

The scope of works for each DMA using **bulk meters** are as follows:

i. Procurement of temporary measuring devices
ii. Detailed site investigations, updating of distribution network drawings, complete with all trial holes that might be required to verify pipe connections (and the consequent re-instatement of road, sidewalk or any other surface)
iii. Population Count and Demand Survey in order to generate District Metered Area reports for each zone containing length of mains, population, street names, storage etc.
iv. Verification of system input values
v. DMA Design inclusive of hydraulic models for each DMA, Hydraulic modeling reports and Network Alternative Reports
vi. Verification of suggested DMA boundaries; locating of existing boundary valves, functioning and tightness checks of existing boundary valves, identification of location for additional boundary valves to be installed via zero pressure testing
vii. Procurement of bulk and domestic meters
viii. Installation of bulk meters
ix. Installation of domestic meters on all customers within a DMA
x. Commissioning of DMA
xi. Water balance for each DMA
xii. Leak detection surveys (using listening sticks, leak noise correlators and leak noise loggers)
xiii. Pressure management: stabilizing, managing and reducing average DMA pressure using Pressure Reduction Valves (PRVs)/ Pressure Sustaining Valves (PSVs).
xiv. Leak repair on mains
xv. Replacement of leaking service connections

xvi. Leak detection surveys, repairs and pressure fine-tuning shall be repeated and/or shall continue until an acceptable level of leakage is achieved.
xvii. Development of a monitoring system via SCADA

The outputs of the Programme are as follows:

i. Reduction in leak repair time
ii. Reduction in water losses
iii. Decrease in customer consumption
iv. Improvement in assets efficiency
v. Reduction in operating cost
vi. Calibrated hydraulic models and subsequent hydraulic recommendation report
vii. Establishment of One Hundred Fifteen (120) DMAs
viii. Updated customer and infrastructure database
ix. Development of water consumption data and monitoring system

9. Copies of reports regarding the Water Sector Improvement Programme particularly the IDB's contribution and proposals; and

Response

A copy of the IDB's Guidance Brief dated January 2020 is attached in Appendix II.

10. Information on WASA's outstanding bills to the Desalination Company of Trinidad and Tobago (DESALCOTT) and the arrangements made to settle such outstanding bills.

Response

As at April 21st 2020, WASA was up to date with payments to the DESALCOTT, with the exception of one disputed invoice (Desal-533) in the amount of US$22,907.25 for the provision of excess water over the period July 01, 2019 to August 02, 2019.

The Authority secured loan funding in the amount of US$100.0Mn. which was approved by the Ministry of Finance on January 13, 2020 and subsequently executed on February 19, 2020 with the key terms and conditions as listed below:

i. Tenor – Fourteen (14) years.
ii. Interest Rate – Fixed at 5.6% per annum.
iii. Interest Payment – Payable Semi-Annually.
iv. Principal Repayment – Bullet at maturity.
v. Security – Letter of Guarantee, pending finalization of the Deed of Guarantee.

The purpose of the US$100.0Mn Loan was to pay:

i. The Authority's US$60.0Mn. Desalcott Revolving Facility held at Republic Bank Limited.
ii. A US$5.0Mn. Short-Term Loan held at Republic Bank Limited utilized for payment of desalinated water purchases from DESALCOTT
iii. Outstanding arrears owed to Desalcott totaling US$35.0Mn

Invoice and payment details of the utilization of the US$5.0Mn Loan, part proceeds from the US$100.0Mn Loan totaling $35.7Mn. and subsequent utilization of the repaid US$60.0Mn Desalcott Facility totaling $38.3Mn. are detailed as follows:

Invoice Period	Invoice Number	Payments US$	Date Paid	Details
January 02 to February 01, 2019	Desal-527	3,000,000.00	19.12.2019	US$5.0Mn. loan proceeds
February 01 to March 01, 2019	Desal-528	2,000,000.00	19.12.2019	US$5.0Mn. loan proceeds
February 01 to March 01, 2019	Desal-528	2,494,090.50	20.02.2020	Part proceeds of US$100.0Mn. loan
March 01 to April 01, 2019	Desal-529	6,302,795.63		
April 01 to May 01, 2019	Desal-530	6,086,928.38		
May 01 to June 03, 2019	Desal-531	6,562,229.63		
June 03 to July 01, 2019	Desal-532	5,575,216.50		
July 01 to August 02, 2019	Desal-533	6,545,412.00		
August 02 to September 02, 2019	Desal-534	2,134,306.98		
August 02 to September 02, 2019	Desal-534	3,899,261.52	06.03.2020	US$60.0Mn. Desalcott Revolving Facility at RBL
September 02 to October 01, 2019	Desal-535	5,946,565.50		
October 01 to November 01, 2019	Desal-536	4,481,312.63		
November 01 to December 02, 2019	Desal-537	5,875,701.75		
December 02, 2019 to January 02, 2020	Desal-538	6,119,548.88		
January 02 to February 03, 2020	Desal-539	6,518,876.63	12.03.2020	US$60.0Mn Desalcott Revolving Facility at RBL
February 03 to March 02, 2020	Desal-540	5,503,884.75	02.04.2020	US$60.0Mn Desalcott Revolving Facility at RBL
TOTAL		**79,046,131.28**		

TRINIDAD AND TOBAGO

Guidance Brief

on the scope and implementation of an Action Plan for
the Water and Sewerage Authority (WASA)
of the Republic of Trinidad and Tobago

prepared for

The Hon. Minister of Public Utilities

by the Water and Sanitation Division
of the Inter-American Development Bank

JANUARY 2020

Contents

ACRONYMS AND ABBREVIATIONS

AMI	Advanced Metering Infrastructure
AMR	Automated Meter Reading
CEO	Chief Executive Officer
DMA	District Metered Area
EMA	Environmental Management Authority
GIS	Geographic Information System
GoRTT	Government of The Republic of Trinidad and Tobago
IDB	Inter-American Development Bank
IFC	International Finance Corporation
IWA	International Water Association
JMP	Joint Monitoring Program of the United Nations
KPI	Key Performance Indicator
LAC	Latin America and the Caribbean
LPD	Liters per Person per Day
LCD	Liters per Connection per Day
MIG	Million Imperial Gallons
MIGD	Million Imperial Gallons per Day
MOF	Ministry of Finance
Mm^3	Million Cubic Meters
MPU	Ministry of Public Utilities
NRW	Non-Revenue Water
OPEX	Operating Expenses
PMA	Pressure Managed Area
PPP	Public Private Partnership
RIC	Regulated Industries Commission
ROI	Return on Investment
SCADA	Supervisory Control and Data Acquisition
SDG	Sustainable Development Goal
SWIT	Smart Water Infrastructure Technologies
T&TEC	Trinidad and Tobago Electricity Commission
TSTT	Telecommunications Services of Trinidad and Tobago Company Ltd.
TT	Trinidad and Tobago
UARL	Unavoidable Annual Real Losses
UN	United Nations
USD	United States Dollar
WASA	Water and Sewerage Authority
WHO	World Health Organization
WRA	Water Resources Authority
WTP	Water Treatment Plant

EXECUTIVE SUMMARY

I. Overview of Challenges

Trinidad and Tobago has made significant strides in the provision of water supply to its population as well as in the collection and treatment of wastewater. WASA's service coverage is almost universal for improved water supply services, covering 97 percent of the population. However, **only an estimated 53% of consumers receive 24/7 water supply during the rainy season and 31% during the dry season**[1]. This is explained mainly by **high levels of Non-Revenue Water** that are estimated to be 40% to 50% of water supplied into the network. This results in socioeconomic and environmental impacts as water unavailability and reduced access have deleterious effects on all kinds of life, the social fabric and the economy of the country. Going forward, it is expected that Climate Change will adversely impact the water availability in Trinidad and Tobago, a country that lacks storage capacity and is heavily reliant on surface water sources.

The availability of **annual renewable water resources in Trinidad and Tobago is estimated as 2,330 cubic meters per capita, greater than the international standard**[2] **of 1,000 cubic meter per capita threshold**, below which a country is considered as water scarce. In 2018 WASA produced 232 Million Imperial Gallons Day (MIGD) from all sources or an excessive 178 imperial gallons per capita per day (gpcd). In comparison, Jamaica (NWC) produced 65 gpcd; Barbados (BWA) 66 gpcd; Belize (BWSL) 31 gpcd, and the Bahamas (WSC) 38 gpcd.

Based on the above one can conclude that **water resources availability is high and production of 232 MIGD (which includes 45 MIGD of desalinated water) is more than sufficient to meet the extremely high peak demand of 163 MIGD (83** gpcd**).** Furthermore, Trinidad and Tobago's consumption of 83 gpcd exceeds the 44 gpcd recommended by the WHO and also exceeds Jamaica's consumption of 35 gpcd and Barbados' 60 gpcd and Belize's 24 gpcd. Therefore, **WASA's inability to provide 24/7 water supply service is not caused by a lack of production capacity nor can it be solved by pumping more water into a porous network**.

One of the root causes of the issues and challenges inhibiting WASA's performance to provide reasonable water supply service is **poor governance and implementation arrangements: there has not been a consistent focus on WASA's accountability for the resources allocated and WASA's management structure**, that would ensure efficiency, productivity, and financial sustainability of the utility.

Another contributing factor is the fact that **water tariffs** charged on domestic customers, average US$0.23 per cubic meter, is the lowest in the Caribbean and have not been adjusted since 1993. This has only aggravated the situation, as revenues are insufficient to meet operating costs. Additionally, the lack of **efficient tariffs** creates a situation where the proper signal is not sent to consumers to curb **excessive consumption** and in conjunction with **lack of universal metering**, impedes **demand management.**

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[1] Farrar T., Updated Definition of an Action Plan for Water Supply Improvement Programme (2019)

[2] https://en.wikipedia.org/wiki/Water_scarcity

The high NRW of 99 MIGD, results in a financial leakage of an estimated TT$329 million per annum due to physical losses and commercial losses. Another issue is the inability to take advantage of abundant water resources to meet dry season demand due to WASA's **lack of storage capacity**, estimated at 0.01 MIGD/person compared to international standards of 0.40 MIGD/person. This is exacerbated by aging infrastructure and **bottlenecks in the network** that inhibits the transmission of water from water rich areas to water scarce areas.

Finally, WASA has become dependent on **subventions from GoRTT of TT$1.8 billion to TT$2 billion** without defined performance targets to account for its use of the resources and in the absence of these subventions, WASA would effectively become insolvent.

Based on the above, the delivery of 24/7 water supply service, adequate governance arrangements and the transformation of WASA into a well performing utility are no regrets activities that the GoRTT needs to prioritize as a matter of urgency. Additionally, for the annual subsidy WASA receives from the Government, the population of Trinidad and Tobago must be able to receive a higher level of service.

II. Proposed Solution—a holistic Action Plan

This Guidance Brief aims to assist the GoRTT by recommending a holistic Action Plan to turnaround WASA, improve the enabling environment and its management and stabilize its operations so that it can **provide 24/7 water supply service to 90% of the population by 2024**. The Action Plan is underpinned by a financial justification that evaluated business as usual without and with tariff increases. For information purposes, Annex 2 contains a scenario of the potential savings from reducing the purchase of desal water. This reduction can only occur when the network has been stabilised (Phase 1) and most consumers are getting 24/7 water due to the NRW recovery savings retained in the network (see Section VI. Below). The Bank can assist the GoRTT with preparing a technical and legal analysis of desal replacement under the Institutional Strengthening Component.

It is proposed that this be done through a loan operation that will attend to the governance and management, oversight and accountability issues on the one hand, and optimize, rehabilitate, upgrade and modernize the water supply infrastructure on the other. In regard to climate change, the Multi-Purpose Flood Mitigation and Water Supply Reservoir at the Ravine Sable Sand Pit, Caparo will be constructed to alleviate the perennial problem of flooding, increase water storage and production using the impounded floodwater that could be easily treated and converted to potable water standard.

The Action Plan has three (3) phases:

(i) **Phase 0 (present – 2020):**

(a) **Phase 0-A Dry Season Emergency Actions [present – mid 2020]**, including: (i) Provide the necessary hydraulic tools to guide the rehabilitation of wells, water treatment works and storage, in order to increase production from existing sources and provide water to localized water scarce areas; (ii) Implementation by WASA of focused and aggressive leak detection and repairs in those areas where it is intended to provide water into supply; (iii) Provide technical assistance to WASA regarding the Hillsborough Reservoir desilting project; (iv) Implement conservation education campaign.

The civil works such as well rehabilitation, putting back equipment and facilities into operation and conducting leak detection and repair in those areas where it is intended to provide water into supply should be done through Public Sector Investment Programme (PSIP) funds by WASA's crews or contracted out.

Expected Outcomes at the end of Phase 0-A are: (i) hydraulic model; (ii) increased production and supply of water to localised water scarce areas coupled with a concomitant reduction in the back log of leaks in those areas; (iii) mobilization by WASA of Hillsborough desilting works.

(b) **Phase 0-B Detailed preparation of the Programme. [present – end of 2020]** activities will be conducted that will support the execution of Phase 1. These activities are expected to be funded through the TC and in the case of the baseline assessment, funding would continue through the loan operation: (i) Universal metering – preparation of tender documents and complete tendering process; (ii) NRW Reduction and network optimization – prepare request for proposals and performance-based contract (PBC) to achieve 24/7 water supply; (iii) Conduct field work for baseline assessment, prepare hydraulic model and water balance; (iv) Review and update studies, designs, and tender package for the Multi-Purpose Flood Mitigation and Water Supply Reservoir at RSSP, Caparo; (v) Strengthening the institutional capacity of the MPU by creating the Project Execution Unit.

i) **Expected Outcomes** at the end of Phase 0-B are: i) Successful bidder for Universal Metering; ii) Detailed Baseline Data and Hydraulic Model; and iii) Tender Package for NRW Reduction PBC; iv) Updated studies and designs and tender package for the construction of the Multi-Purpose Flood Mitigation and Water Supply Reservoir at RSSP.

(ii) **Phase I (2020 – 2024)** is the substance of the Programme for which the entire loan package will be utilized, detailed in the following sections.

(iii) **Phase II** is a follow-up phase after 2025 and is proposed to be funded through a different arrangement to be defined at the end of 2024 or performed by WASA.

III. Components of the Programme – Phase I (2020-2024)

On the **policy, governance and institutional** arrangements side, the Action Plan recommends: (i) Creating an effective enabling environment to allow WASA to successfully function; (ii) Institutional strengthening of the WRA and MPU's technical oversight capacity; (iii) A Turnaround Roadmap with a clear and measurable performance management scorecard of operational, financial and institutional targets with timelines that will guide the transformation; and (iv) Ensuring the Board has the appropriate skills and targets for WASA to transform.

Improvements in Sector Governance after Phase I:

(i) Improved oversight, accountability, transparency, management structure, service provision and culture of WASA to sustain the Programme gains;

(ii) Improved overall sector governance, coordination, sustainability and environmental protection of watersheds and water recharge areas;
(iii) WASA's Revised Business Plan to MPU for submission to the RIC;
(iv) Performance Scorecard implemented for WASA's Board and Management;
(v) Draft new Water Sector Act and revision of relevant legislation (RIC, etc.);
(vi) Project Executing Unit established in the MPU;
(vii) Improved water security, increased climate resilience, and improved access to good-quality, reliable water supply to vulnerable communities, agriculture and the commercial sectors.

On the **infrastructure side**, the Action Plan proposes to achieve pressurized 24/7 water supply by reducing water shortages and inefficiencies through:

(i) Development of analytical and management tools;
(ii) Execution of the NRW Reduction Performance Based Contract; network optimization, transmission bottlenecks.
(iii) Implementation of Universal Metering;
(iv) Existing Wellfield Assessment, Rehabilitation and Automation;
(v) Based on hydraulic modelling, increase impounding storage capacity, particularly in NE Trinidad (funding through the PSIP);
(vi) Procurement and construction of the Multi-Purpose Flood Mitigation and Water Supply Reservoir at the Ravine Sable Sand Pit, Caparo.

Technical indicators - Expected Outcomes and Benefits of the Programme

Indicator	**Baseline**	**Year 5**	**Year 10**
Capital Investment Plan	-	1	-
Smart Water Balance, Analytics and Management Information System for real time monitoring	-	1	-
NRW (%)	42%	26%	14%
NRW (MIGD)	99.2	53	31
Physical Losses (MIGD)	48.1	29	24
Commercial Losses (MIGD)	51.1*	23.4	7.4
Production (MIGD)	232	215.3**	208
24/7 Supply (% of population)	53%	90%	>98%
Total water consumption (MIGD)	135	161	177
Domestic water consumption (lpcd)	377	281	241
Overall metered customers (%)	4.5%	100%	100%
Industrial	100%	100%	100%
Commercial	63%	100%	100%
Domestic	3.1%	100%	100%
Storage (gallons/capita)	11,330	12,416	14,900

Note: the baseline is 2019, Year 5 is the end of Phase I and Year 10 is end of Phase II.
*Includes 2.0 MIGD of unbilled unmetered consumption; ** Includes 2.3 MIGD from the RSSP Multi-Purpose Reservoir.

IV. Cost and Institutional Arrangements of the Programme - Phase I (2020-2024)

The total cost of Phase I is estimated at US$315 million (TT$2.14 billion). It is proposed that the entire cost of its implementation be financed by an IDB loan and supported by an estimated US$1.0 million non-reimbursable Technical Cooperation (TC)[3] to fund activities that support loan preparation, commencement of baseline studies and studies to support the execution (Phase 0-A activities). These terms are negotiable. The following is the proposed loan structure (to be discussed during the loan preparation):

(i) Borrower: The Government of the Republic of Trinidad and Tobago
(ii) Executing structure:
   a. MPU, on behalf of the GoRTT will be responsible for implementing the institutional changes (transformation) and governance strengthening components for WASA and for the sector;
   b. WASA will be responsible for implementing the infrastructure, technical and commercial operations; and
   c. Independent water operator. It is recommended—based on successful examples like the one implemented in the Bahamas—to contract the services of an independent water operator, working under a robust performance-based contract to achieve the targets of the Action Plan. This operator will bring the experience, know-how and expertise to guide, train and mentor WASA's personnel to fix and sustain a high-quality and reliable service.
(iii) Terms: interest rate 3.0%[4], 25 years, grace period 5 years
(iv) Timeline: Letter of request for TC and Loan, January 2020; eligibility for retroactive financing at publication of Project Profile, February/March 2020; target date for Loan approval July 2020.

Programme Components and Budget - Phase I

Preliminary Budget for IDB Proposed Action Plan 2020-2024	Estimated Cost (US$ million)
Infrastructure Rehabilitation	**263**
Multi-Purpose Flood Mitigation and Water Supply Reservoir at Ravine Sable Sand Pit (RSSP), Caparo	**42**
Institutional Strengthening	**10**
TOTAL	**315**

V. Financial Justification of the Programme– Phase I[5]

The Programme demonstrates high financial benefits, with an IRR of 17% (considering 25 years, equivalent to the IDB loan repayment period) or 5% (considering only the first ten years), which is considered attractive as a result of comparison with the GoRTT's cost of capital. The payback period

[3] Up to 20% of the loan funds will be available for retroactive financing after the publication of the Project Profile.
[4] As of the fourth quarter of 2019, the Libor based lending rate of the IDB is 2.93 percent. See: http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=EZSHARE-1436601171-374
[5] See ANNEX 1 FINANCIAL JUSTIFICATION OF THE PROGRAMME, PHASE I – STABILIZATION for more details

is 9 years. This was calculated by contrasting (i) Programme's total cost executed in five years, against (ii) Programme's financial benefits: (a) increased sales from apparent[6] commercial loss recovery, estimated at TT$1,249 million (b) cost saving from physical[7] loss reduction, estimated at TT$559 million and (c) reduction in bad debt expenses to due improvements in the collection rate, estimated at TT$739 million.

Impact on WASA's financials. With the Programme, WASA's earnings Before Interest Taxes Depreciation and amortization (EBITDA) improves from negative TT$1,663 million (or operating cost recovery ratio (OCRR) of only 30 percent) in the baseline year to negative TT$1,300 million (or OCRR of 41 percent) in year 10. In the absence of tariff adjustments, EBITDA will remain negative. It is also noted that the Programme does not contemplates reduction in the number of employees per thousand connections. An earlier study[8] proposed an efficient level of employees as 8 per thousand connections. The difference between this level and the current level (12 per thousand connections) has a cost implication on the annual OPEX by TT$418 million.

Impact on GORTT's subventions. IDB loan (principal and interest) repayment can be made from the Programmes financial benefits. Even if IDB loan repayments are included, sizable reduction of government subventions can be achieved, from TT$2,056 million[9] in the baseline year to TT$1,924 million or TT$1,768 net of the IDB loan repayment in year 10.

Financial indicators <u>without tariff adjustments</u> (in TT$ million)

Indicator	Baseline	Year 5	Year 10
Average water tariff per cubic meter (US$)	US$0.43	US$0.43	US$0.43
Collection rate (%)	85%	97%	97%
Programme benefit	-	289	393
Increased sales from apparent/commercial loss recovery	-	*124*	*202*
Cost saving from physical loss reduction	-	*64*	*81*
Reduction in bad debt expenses to due improvements in the collection rate	-	*101*	*110*
Revenue	717	841	919
OPEX excl. depreciation and amortisation	2,380	2,234	2,219
EBITDA	-1,663	-1,392	-1,300
Operating cost recovery ratio (%)	30%	38%	41%
Subventions	2,056	1,929	1,924
Of which amount for IDB repayment	-	*59*	*156*
Subsidy for WASA	2,056	1,870	1,768

[6] **Apparent Losses** result from unauthorized consumption and all types of inaccuracies associated with metering

[7] **Real Losses** result from losses at mains, service reservoirs, and service connections (up to the point of customer metering).

[8] CASTALIA, Business Plan and Price Control Proposal for WASA: 2019-2024 (July 2019)

[9] In calculating this baseline figure for the government subventions, it is assumed that WASA will stop its heavy reliance on accounts payable growth. In recent years, WASA heavily depended on accounts payable growth to finance its cash shortfall. Between 2015 to 2018, accounts payable grew from $1,869 to $3,714 million (almost double) due to i) annual subventions to WASA being lower than the actual accrued need, and ii) unverified payables.

Note: the baseline is constructed based on historical analysis of financial statements for 2016-2018. Year 5 is the end of Phase I and Year 10 is end of Phase II.

Illustrative tariff-adjustment scenario. To illustrate a scenario in which WASA achieves self-sustainability, an alternative scenario with tariff increases is generated. This scenario enables the EBITDA to become positive in year 5 and the phasing out of government subventions by year 7. When the Programme benefits are considered, WASA's average water tariff needs to reach **US$1.36** [TT$9.22] per cubic meter in the medium to long term. This can be positively evaluated and compared with a scenario without the Programme, under which the required tariff level would be significantly higher at **US$1.93** [TT$13.08] per cubic meter. The resulting tariff level of US$1.36 per cubic meter favourably compares with the **'comparator utilities' US$2.34** [TT$13.08] per cubic meter[10]. It should be noted that service level improvements need to accompany tariff adjustments otherwise, the public acceptability may not be forthcoming.

Financial indicators with tariff adjustments (in TT$ million)

Indicator	Baseline	Year 5	Year 10
Average water tariff per cubic meter (US$)	US$0.43	US$1.18	US$1.36
Collection rate (%)	85%	97%	97%
Programme benefit	-	682	1,067
Increased sales from apparent/commercial loss recovery	-	*341*	*638*
Cost saving from physical loss reduction	-	*64*	*81*
Reduction in bad debt expenses to due improvements in the collection rate	-	*277*	*348*
Revenue	717	2,309	2,900
OPEX excl. depreciation and amortisation	2,380	2,278	2,278
EBITDA	-1,663	31	622
Operating cost recovery ratio (%)	30%	101%	127%
Subventions	2,056	506	-
Of which amount for IDB repayment	-	*59*	-
Subsidy for WASA	2,056	447	-

VI. Financial Scenario of the Programme with potential reduction in Purchase of Desalinated Water and without tariff increases – Phase 2[11]

The gradual NRW savings of 24 MIGD (232 to 208 MIGD) at the end of Phase 2 (Year 10) could be an opportunity to evaluate purchasing less desalinated water. Reducing desalination purchase[12] has the potential to save US$1.7 Million per year per MIGD. However, until the 24/7 gap is substantially

[10] CASTALIA, Benchmarking study prepared for the Business Plan and Price Control Proposal for WASA: 2019-2024 (July 2019).

[11] See ANNEX 2 FINANCIAL SCENARIO OF THE PROGRAMME, PHASE 2 for more details

[12] The financial, legal and contractual implications under the Desalination Contract are not considered and need to be analyzed by the GoRTT

eliminated, there is unlikely to be a demand-based justification to reduce desalination purchase. If desalination purchase is reduced during Phase 2 as per the annual physical losses savings, the Programme's IRR could improve to 29% over 25 years and 19% over 10 years. This purchase reduction achieves a cumulative undiscounted cash saving of TT$2.0 billion by the end of Phase 2.

Impact on WASA's financials. With the Programme and reduction in the purchase of desalinated water (no tariff increases), WASA's EBITDA improves from negative TT$1,663 million (or operating cost recovery ratio (OCRR) of only 30 percent) in the baseline year to negative TT$1,083 million (or OCRR of 46 percent) in year 10. In the absence of tariff adjustments, EBITDA will remain negative. Over the 10-year period, the total potential savings from the reduction in the purchase of desalinated water of 24 MIGD is estimated at TT$2,051 million. In terms of annual savings this increases from TT$235 million in Year 5 to TT$297 million in Year 10.

Impact on government subventions. IDB loan (principal and interest) repayment can be made from the Programmes financial benefits. As can be seen in the Figure below, even if IDB loan repayments are included, sizable reduction of government subventions can be achieved, from TT$2,056 million[13] in the baseline year to TT$1,708 million or TT$1,551 net of the IDB loan repayment in year 10.

[13] In calculating this baseline figure for the government subventions, it is assumed that WASA will stop its heavy reliance on accounts payable growth. In recent years, WASA heavily depended on accounts payable growth to finance its cash shortfall. Between 2015 to 2018, accounts payable grew from $1,869 to $3,714 million (almost double) due to i) annual subventions to WASA being lower than the actual accrued need, and ii) unverified payables.

1. BACKGROUND AND CONTEXT

1.1. Purpose and Strategic Objectives of IDB's Guidance Engagement

The Hon. Robert Le Hunte, Minister of Public Utilities of the Government of The Republic of Trinidad and Tobago (GoRTT, or The Government) has set the goal of transforming the Water and Sewerage Authority (WASA) into a well-performing utility that delivers reliable, high-quality services and operates as a financially sound, self-sustainable organization. WASA has been plagued by a range of operational inefficiencies, weak governance structures, poor management, public mistrust and a culture of underperformance. Of particular concern to WASA is its significant financial obligations under the DESALCOTT agreement which cannot be renegotiated at this time as well as the accumulated debt from previous years that continues to negatively affect its efforts toward achieving the desired financial viability.

Given the irreplaceable role of water in socio-economic development and to human life, there is a need to take urgent action to turnaround the utility. In this regard, the Minister requested the assistance of the IDB to chart a path for an intervention to improve the water supply situation in Trinidad and Tobago and the performance of WASA. The Minister advised that the submission would assist the Ministry of Public Utilities (MPU) to make the case for an IDB loan operation for this purpose.

The IDB, in taking up this assignment, deployed its Water and Sanitation Specialists in the Caribbean along with a Water Expert and the Water and Sanitation Division's support to prepare an Action Plan to guide an intervention to achieve 24/7 water supply to the population of Trinidad and Tobago and improve WASA's governance arrangements.

The achievement of 24/7 water supply service is dependent on the access to and availability of water resources, whether surface or ground water. In this regard, the approval and subsequent implementation of T&T's Draft Integrated Water Resources Management Policy is urgently needed, supported by long term integrated national planning that recognizes critical risks related to climate change, pollution and deforestation of watersheds, flooding and other natural disasters. In its preparation of the Action Plan, the risks posed by the impacts of climate change to water resources and water supply infrastructure are taken into account.

The methodology used for this assignment comprised of desk-top study of the literature on WASA, discussions with the MPU, and observation of a sample of WASA's water supply systems by the assigned Bank Team. The IDB has been engaged in the water sector of Trinidad and Tobago since 2011, largely in the wastewater side, and discussions with the MPU on the water supply side since 2015, which intensified in 2017 to present. In addition to assistance with studies of WASA and workshops in the past, most recently, the IDB has assisted with piloting the use of leak detection using satellite imagery by *Utilis*, a specialized company, and sponsored a visit by Trinidad and Tobago delegation led by Minister of the MPU to the Bahamas and Jamaica to observe the NRW reduction programme and works execution and the results thus far achieved.

This initiative, to prepare a roadmap for improvement in water supply in Trinidad and Tobago is in line with the IDB's Water and Sanitation Sector Framework Document that mandates the Bank to support its member countries in achieving universal access to sustainable, high-quality WSA services

and to prioritize the following principles which shall govern the Bank's actions: (i) achieve universal access to the services, improving opportunities for the low-income and most vulnerable population (women, indigenous and afro-descendant people), and increasing the quality of the services; (ii) promote comprehensive solutions, where in addition to providing infrastructure, actions for the institutional strengthening are implemented for the utilities and as well as a sector governance framework, and promote financing schemes for the proper operation and maintenance of the services; (iii) promote multisector interventions, deepening the articulation with other sectors seeking more social and economic impacts; and (iv) reinforce the concept of water security in the WSA sector, to have resources of adequate quality and quantity for all uses and reduce the risk of disasters, taking into consideration climate change effects.

This Guidance Brief document therefore is the IDB's response to the Minister's request for an action plan to address the deficiencies in Trinidad and Tobago's water sector, particularly with respect to water supply service and governance of WASA within the context of a possible immediate dry season crisis and climate change and variability. It is meant to be the start of a process of dialogue among the Cabinet of Trinidad and Tobago and to be improved upon as the dialogue with other stakeholders progresses. This Guidance Brief contains four sections: Section 1 describes the purpose of the Guidance Brief and gives an overview of the importance of water and sanitation services in general and the situation of Trinidad and Tobago; Section 2 deals with key challenges of WASA's performance with respect to water supply; Section 3 provides the proposed Action Plan; and Section 4 outlines the implementation arrangements for the proposed Action Plan.

1.2. Overview of the Water and Sanitation Sector

a) Benefits of Water Supply and Sanitation Services

The IDB's Water and Sanitation Sector Framework Document highlights the importance of access to quality Water and Sanitation (WSA) service because of its positive impacts on health, education and economic growth. The avoided costs in health interventions, the improvements in children academic performance, the increase in work productivity and the growth of industries that depend on water (agriculture, livestock, recreational, fishing, tourism, etc.) are some of the socio-economic benefits of investments in water and sanitation resulting from improved access and quality. According to a study from the World Health Organization (WHO),[14] it is estimated that for each dollar invested in water in the Latin America and Caribbean (LAC) region, the economic return is US$2.40. Similarly, investments in sanitation produce a return of US$7.30. For Trinidad and Tobago, the return in investments in water and sanitation were estimated at US$8.60 and US$20.23, respectively.

The positive impact of water and sanitation services is particularly significant for poor and vulnerable groups including women. Goal 6 of the United Nations (UN) Sustainable Development Goals (SDGs) urges countries to "Ensure availability and sustainable management of water and sanitation for all." Furthermore, the UN and other agencies recognize the human right to water and sanitation. In addition to its human health benefits, water underpins sustainable social and economic development and plays a central role in the preservation of ecosystems and the environment in general.

[14] Hutton, G. Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage. WHO, 2012

Equally important, adequate sanitation services protect human health by preventing human contact with pathogens in excreta and other harmful substances reducing the incidence of water-borne diseases. For Trinidad and Tobago, the GoRTT and development agencies have reported that the discharge of effluents from industries, the improper disposal of sewage and farm wastes, non-functional sewage treatment plants and the disposal solid waste are degrading the nation's rivers and streams thus negatively impacting the environment. Management of the freshwater resources is critical to the sustainable development of Trinidad and Tobago especially in the light of current and future changes in precipitation patterns, flooding and droughts due to climate change and climate variability.

Given the impacts on social development and the strong economies of scale related to the investments in water and sanitation, it is recommended that the GoRTT intervene decisively on the following: (i) improvement of the access and quality of the services; (ii) strengthening of sector governance and regulation; (iii) financial sustainability and increase in efficiency to improve WASA's performance; and (iv) the consideration of disaster risk management and water security and availability caused by climate change and other causes. Each of the associated social considerations must be addressed to consider the sustainability of the interventions.

b) Water Availability and Climate Change and Sanitation Services in Trinidad and Tobago

WASA is a state-owned utility mandated by the Water and Sewerage Authority Act of 1965 to manage the water and sewerage sector of Trinidad and Tobago. Current availability of surface water in Trinidad and Tobago is estimated at 638,570 Million Imperial Gallons/Year (MIG) and groundwater at 58,512 MIG/Year, totalling 697,082 MIG/Year (IFC, World Bank, Adaptive Planning Workshop, Norton M. 2018). Actual consumption averages 84,248 MIG/Year and therefore Trinidad and Tobago uses only 12% of its existing water resources.

Based on the 2018 midyear population estimate of 1,359,193 by the Central Statistics Office, this converts to annual renewable water resources of 2,330 cubic meters per capita, greater than the 1,000 cubic meter per capita threshold, below which a country is considered as water scarce. Therefore, under normal circumstances it would be said that Trinidad and Tobago has abundant water resources for the foreseeable future and as such would not be considered a water scarce country. However, in the light of the new normal of climate change and climate variability, inadequate long term planning, insufficient storage and pollution of water resources, it is unsafe to assume that WASA can continue to utilize surface and groundwater resources at the same rate and with the existing infrastructure to provide for future needs, especially given that future hydrology and precipitation patterns will be uncertain, and storage is seriously inadequate. Consequently, these risks need to be taken into account in the preparation of the Action Plan. In 2018 WASA produced 232 MIGD from all sources. Surface water is the largest source utilized by WASA, 58% followed by ground water at 20% and desalination at 20%.

Enhanced planning and governance, improving the operational efficiency of WASA, reducing excessive consumption of the consumers through demand management, reducing physical and commercial losses, augmenting storage and new water development schemes in water scarce areas where necessary, are some of the measures the GoRTT must take to increase water security.

As with most of the Caribbean countries, WASA has high water supply coverage, but a considerable percentage of WASA's customers struggle with intermittent and unreliable supply. As documented by multiple studies, WASA is afflicted by pervasive performance deficiencies, which at the root are linked to governance, management and organizational shortcomings. These weaknesses hinder in particular the continuity of supply of drinking water and overall customer satisfaction. Other contributing factors are: the state of the assets, absence of a proactive asset management approach, high backlog of unfixed leaks, poor commercial performance, as well as ineffective control and enforcement processes. The company's inefficiency is evidenced by a volume of water produced which has steadily grown over time, but which is inconsistently high compared with the population served.

Overall, it is estimated that WASA receives no revenue for 99 MIGD of its 232 MIGD produced. The combined annual cost of 48 MIGD of real losses and 51 MIGD of apparent or commercial losses (includes 2.0 MIGD of unbilled unmetered consumption that is not in the estimate) is estimated at $313 million TTD [$46 million USD].

Moreover, the high levels of subsidies that WASA receives year on year from the Government of the Republic of Trinidad and Tobago (GoRTT) to cover the utility's operational and capital expenditures are also well documented[15] and are not tied to performance targets or any structure capital investment programme. This lack of accountability contributes to WASA lacklustre performance.

With respect to sanitation, according to the WHO/UNICEF JMP, centralized sewerage service coverage in the region is low (6 to 19%) and wastewater treatment even lower (around 10%). In the Caribbean, while centralized wastewater collection and treatment has become critical for densely populated areas, most wastewater is discharged via septic tanks. In comparison to other countries in the Caribbean, Trinidad and Tobago, however, is making progress in centralized sewerage service coverage by adding two new wastewater treatment plants (WWTP) with a total capacity of 85 million liters per day. The Malabar WWTP is already operational and is equipped with facilities to receive and treat septage since vacuum trucks are used to remove septage from the septic tanks for disposal.

c) Water Sector Governance

A well-performing water utility is characterized by servicing a high proportion of the population with water and wastewater services that are reliable, continuous and responsive while operating in a cost-efficient manner. To be a well-performing utility, whether public or private, the utility needs to function within robust and transparent governance, legal/regulatory and institutional framework that provides the enabling environment for it to efficiently provide affordable quality water supply and wastewater services. At the same time, the utility should also be subjected to an accountability framework between the Board, Management, the parent and resource providing Ministries, customers and other key stakeholders.

At present, governance within and around WASA is weak as evidenced by Safege's recently completed governance assessment of the Trinidad and Tobago water sector. According to the below figure from the World Bank, WASA is currently in a "Spiral of Decline", Figure 1 that began with low tariffs and low collections ultimately resulting in WASA's current position of degraded assets. It

[15] Farrar, T., Updated Definition of an Action Plan for Water Supply Improvement Programme (2019)

is recommended that to begin the turnaround of WASA will require improved governance at three levels – across the sector, at the Board level and at the organisational level. This will involve: (i) creating an effective enabling environment (legislation and regulation) to allow WASA to successfully function; (ii) ensuring the Board has the appropriate skills and targets as set by the Cabinet for WASA to transform; and (iii) equip the Executive team with a robust performance management system to invoke change in WASA's operations.

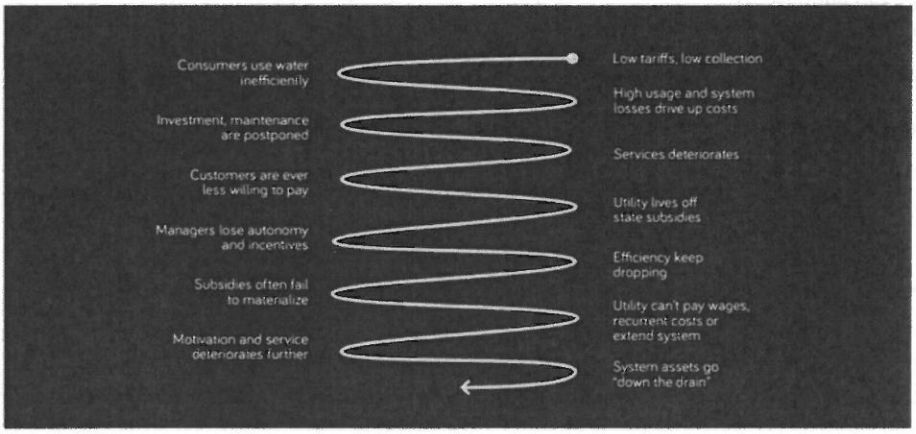

Figure 1 Spiral of decline

In Trinidad and Tobago, the foundation for improved governance is there to be built upon as institutions such as the Regulated Industries Commission (RIC), Environmental Management Authority (EMA), and the Water Resources Agency (WRA), Office of the Procurement Regulator and the Occupational Safety and Health Authority already exist[16]. The Government therefore needs to strengthen the legislative and regulatory tools of these regulators to provide proper oversight of WASA's performance.

Of major concern is that there is very limited measurement of the water moving within and around WASA's network which makes it difficult to estimate the volumes of water that is received by customers and that WASA receives no revenue for. In addition, data and information management is considerably lacking in WASA, inhibiting proper planning and performance monitoring to inform decision-making. Democratizing access to water data using social media and other platforms would be useful to get information into the hands of civil society and bring about accountability.

d) Current performance indicators for Water Services in the Caribbean

WASA's performance benchmarked against some of the IDB countries of the Caribbean is shown in Table 1 below. In 2018 WASA produced about 232 MIGD which is the highest in the Caribbean. The data indicates that WASA produces the highest amount of water per capita, T&T has the highest consumption in the region but still WASA has the lowest operational and financial performance.

[16] Final Report on the Transformation Process Roadmap, SAFEGE, 2017

Table 1. Benchmarking WASA Against Regional Utilities

Key Performance Indicator	WASA T&T	NWC Jamaica	WSC The Bahamas	GBUC Grand Bahamas	BWSL Belize	Target
Metered Customers	5%			100%	100%	100%
Consumption (l/capita-day)	377	162	101	80	110	<200
Affordability (% of Average Expenditure by Households in the bottom quintile)	0.6%	0.10%				
Production/Distribution						
Production (MIGD)	232	190	9.6	6.2	8.1	
Production (imperial gallons/person day)	178	65	38		31	
Production (m^3/Day)	1,054,693	863,757	43,642	28,186	36,672	
Groundwater	20%	38%		100%		
Surface Water	58%	62%		0%	60%	
Desalination	20%		>90%	0%		
Services Indicators						
Coverage Water	97%	93%	98%	99%	97%	100%
% with 24/7 Water Supply	53%			100%		100%
Avg ***Domestic*** Water Tariff (US$ /m^3)	$0.23	$1.95	$2.78	$1.51	$1.89	
% Connected to Sewer Network	30%	19%	12%	6%	8%	>75%
Efficiency Indicators						
Non-Revenue Water	50%	73%**	23%	40%	24%	<26%
Operating Cost Ratio	0.30	1.11	0.68		1.55	>1.00
EBITDA Margin	-232%	17%	-46%		35%	
Accounts Receivables Days	188*	76	41		29	
Staff/1000 Connections	12.0	3.9	7.3	3.8	4.8	<5

Sources: Castalia Final Report on the Transformation Process Roadmap, Safege, 2017; Presentation TECHNICAL EXCHANGE National Water Commission, Jamaica 2019; Presentation by Mario Tavera, Project Manager, Miya Bahamas, 2019; WHO/UNICEF Joint Monitoring Program, 2017; Smart Water Analytics, Master Plan for Grand Bahama Utility Company, 2018; CASTALIA (2019); Belize Water Services Ltd., Annual Report (2019).

*Revised to 56 days in CASTALIA 2019; ** 40% in the KSA.

e) Current indicators of Wastewater Service provision

As stated above, most countries of the Caribbean have limited centralized wastewater collection and treatment facilities and households dispose of wastewater via septic tanks. Utilities, therefore, provide more of their population with water supply service and limited connection to centralized sewerage systems, relying heavily on individual solutions such as septic tanks and latrines; which, if not properly managed, have been shown to contribute to adverse environmental and unsanitary conditions. Table 2 shows the types of sanitation systems in use in the regions' countries.

Table 2. Types of Sanitation Systems in use (Expressed as % of Population)

Country	Centralized Sewerage System	Septic Tanks	Latrines and Other
Trinidad y Tobago	30%*	54%	7%
Jamaica	19%	21%	45%
The Bahamas	12%	79%	1%
Guyana	2%	58%	26%
Suriname	1%	65%	13%

Source: WHO/UNICEF JMP (2017); *CASTALIA (2019)

The GoRTT is making significant investments (almost US$300M from IDB loan operations) in wastewater infrastructure, including the construction of two new regional wastewater collection and treatment facilities; taking over several derelict and abandoned wastewater treatment plants; and tie-ins of old plants converted to lift stations. Once the new plants, collection systems, and property connections are commissioned, about 45% of the population will have access to a centralized sewer network. In the future, additional investments will be necessary to increase the percentage of raw sewerage that is collected and treated before discharge to receiving water bodies or reused. It is estimated that some US$750 million in investments will be required to improve wastewater collection and secondary treatment to about 80% coverage of the population.

2. KEY CHALLENGES FACING WASA

WASA faces a myriad of issues and challenges that contribute to its low operating efficiency, low quality of water service and low wastewater coverage and treatment. Some of these include high levels of NRW, low labor productivity, and low collection rates. WASA also displays poor financial performance due to its high and rising operating expenses and relatively flat revenues. WASA's water tariffs are among the lowest in the region. Additionally, WASA suffers from poor business planning and relies on Government transfers to meet its operational and capital expenses. These problems contribute to WASA's customers not receiving continuous water service despite the high subsidies and a water production level that should suffice to provide adequate supply per capita.

The cause and effect diagram Figure 2, while not exhaustive, depicts some of the major causes contributing to WASA's inability to provide 24/7 continuous water supply to its customers. Other causes not listed include: inadequate strategic planning, lack of land use planning, pollution of water courses, impacts of natural disasters and extreme events resulting from climate change and other causes.

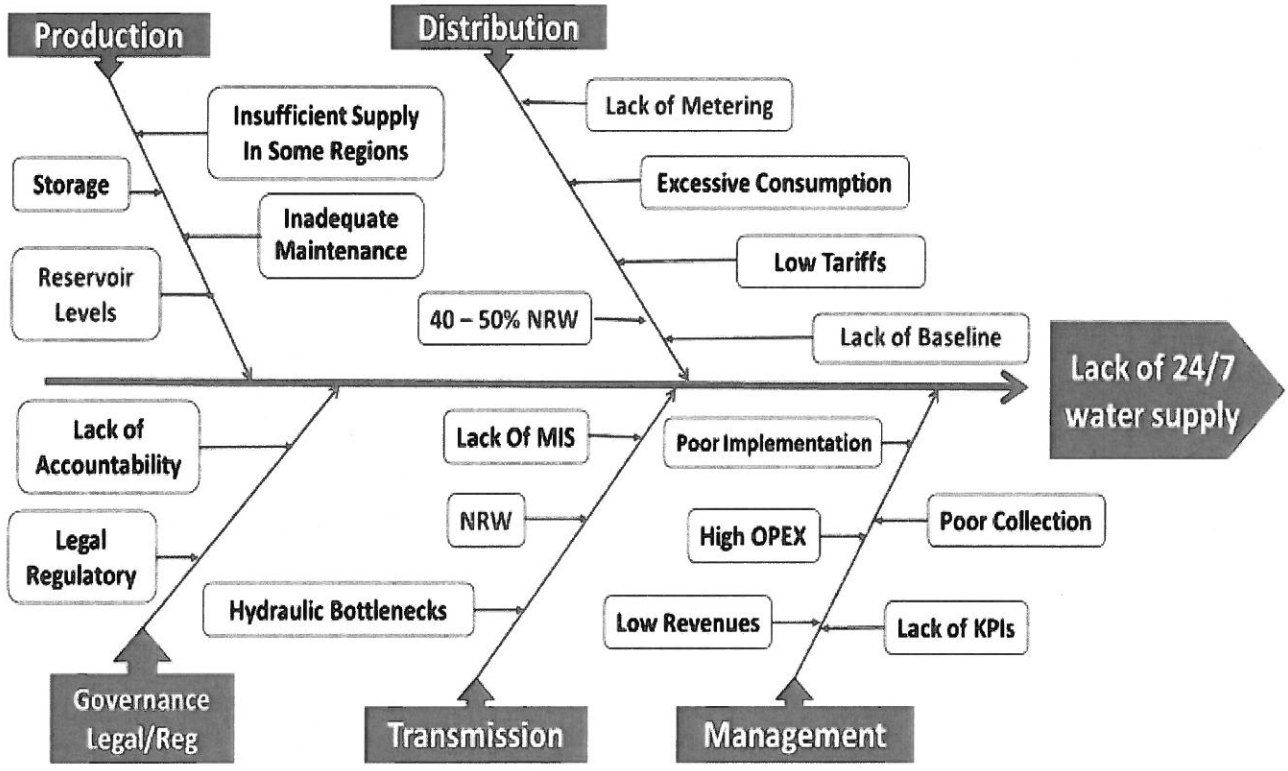

Figure 2 Cause and Effect diagram, WASA

The challenges that WASA need to overcome concern all the main organisation's functions and governance including: technical and commercial operations, financial management, organization and strategic management, human resources management, and sector governance. Concurrently, WASA must also plan and provide for the effects of current and future climate change and climate variability on its water resources, water supply services and infrastructure.

2.1. Harsh Dry Seasons and Climate Change and Climate Variability

The majority of mainstream scientists agree that the earth's climate is changing due to human activity. These changes are manifesting in: temperature rise; changes in rainfall patterns, intensity and duration; sea level rise; more intense storms and hurricanes; flooding and drought. Water resources, water supply and quality and infrastructure are particularly at risk. Across the region, most water utilities are vulnerable and ill prepared to confront the complex challenges posed by climate change and climate variability. This vulnerability is further exacerbated by poor financial, commercial and technical operations, high levels of NRW and aged infrastructure. The effects of climate change on water resources, water supply and quality and infrastructure are summarized in the following table[17].

[17] Adapted from: AECOM International Development, "CLIMATE-RESILIENT WATER INFRASTRUCTURE: GUIDELINES AND LESSONS FROM THE USAID BE SECURE PROJECT" (March 2017)

Table 3: Effects of climate change on Water Resources, supply and Infrastructure

EVENT	IMPACTS/EFFECTS
Increased Mean Annual and/or Intensity of Precipitation	
Higher intensity rainfall and flooding during storms	**River water resources**
Extreme precipitation events are location specific and can cause flooding and landslides when downpours exceed the capacity of river or urban drainage systems.	• Increased water turbidity after heavy storm events • Need for dredging to remove sediment, rocks and debris deposited after storm events.
	Water impoundments
	Additional storage facilities needed to capture water during shorter, higher intensity storms • Higher turbidity of stored water requires more treatment chemicals and time for clarification; temporary suspension of treatment of stored water may also occur in cases of extreme turbidity • Decrease in storage capacity of impounding reservoirs due to high sediment deposition.
	Wells and Spring Sources
	• Well contamination from flooding • Physical damage to structures from flooding • Higher maintenance costs to keep water intake structures clear of debris
	Storage Tanks
	• Contamination due to flooding for cisterns • Physical damage due to landslides.
	Pipelines
	Corrosion of metal pipes weaken structures over time • Physical damage to pipes from flooding and landslides • Contamination from pipes damaged by flooding or landslides.
	Treatment Facilities
	Physical damage to structures from flooding • Water damage to chemical supplies due to flooding • Lower treatment effectiveness due to higher than normal turbidity or disrupted/shorter treatment operation.
	Auxiliary Services
	Loss of power supply • Loss of telecommunication facilities • Loss of data
Drought and Decreased Mean Annual Precipitation	
More frequent drought conditions; increased evaporation and/or reduced soil moisture	**River water resources**

Increased Mean Annual and/or Intensity of Precipitation

EVENT	IMPACTS/EFFECTS
A prolonged dry period in a natural climate cycle which results in a shortage of water. Likely increase in drought conditions in some areas through a warming of air temperature and decrease in precipitation.	Decreased availability of surface water resources • Lower river levels affect water intake • Water systems designed using historical precipitation data are likely to be unsustainable for future projections of reduced precipitation • Competing demands for water from industrial, agricultural and urban sectors.
	Water impoundments
	Increased evaporation decreases availability of surface water • Need for increased inter-annual storage capacity.
	Wells and Spring Sources
	Decreased availability of groundwater resources • Deeper groundwater tables • Decreased availability of surface water resources requires increased need for additional groundwater sources or deeper wells • Increased pumping costs to reach deeper groundwater tables.
	Storage tanks
	Lack of inflow to storage tanks • Frequently emptied due to higher demand.
	Pipelines
	Decreased supply and intermittent or low pressure • Increased risk of contamination from wastewater intrusion • Increased demand for increasingly scarce water resources.
	Treatment Facilities
	Declining raw water quality due to drought-prone algal blooms or diminished runoff and flows that cause concentration of chemical pollutants • Increased treatment costs as pollutants become more concentrated.

Increased Mean Annual Temperature/Extreme Heat/Heat Waves

Extreme Heat	Water impoundments
Extreme temperatures are location- specific. Heat waves are prolonged periods of excessively hot weather. Likely increase in extreme air temperature and heat waves.	Reduced holding capacity of reservoirs due to increased evaporation and/or aquatic vegetation growth. Reduced water quality associated with increased algal blooms triggered by heat waves.
	Pipelines
	Decreased, intermittent supply or low-pressure delivery, with increased risk of contamination from wastewater intrusion.

As we speak, the effects of climate change and climate variability are being felt across the region as can be attested to by flooding, hurricanes and particularly prolonged periods of droughts. Jamaica, Belize, Trinidad and Tobago and other islands as recently as last year were affected by harsh dry seasons. Average annual rainfall in Trinidad is estimated at 2,255 mm and 1,882 mm in Tobago. The WRA and Meteorological Office projects that during a dry year, rainfall can decrease by as much as 30% below the long-term average. Coupled with higher evaporation rates, this dry weather event can result in a greater than 30% reduction in water resource availability during an extremely dry event. Due to the longer-term impacts of climate change, it is projected that rainfall will reduce by 14% and potential evaporation will increase by 5% in 2050. By 2100 rainfall is expected to reduce by 21% and potential evaporation will increase by 8%. These predictions coupled with rising sea levels pose a direct threat to the availability of water resources and saline intrusion into coastal aquifers.

Trinidad and Tobago is particularly vulnerable to the impacts of pollution and climate change on its water resources, water supply and quality and infrastructure, as its major source of supply is from surface water. This water resource vulnerability is as a result of inadequate land use planning and environmental regulation which results in degradation of ecosystems that buffer water contamination and major pollution events in the country's major rivers (for example oil spills in the Caroni River).

Surface water sources account for about 58%, ground water 20% and desalination 20% of water produced. The average daily production[18] in Trinidad is estimated as 208 million gallons of water in the dry season and 219 million gallons of water per day in the wet season. In Tobago the average daily production is 9.35 million gallons of water in the dry season and 12.3 million gallons of water per day in the wet season. However, WASA has a rainy season production capacity of about 245 million gallons of water per day from its various groundwater and surface water sources. This includes 40 million gallons of water purchased daily from the Desalination Company of Trinidad and Tobago (Desalcott) in Point Lisas Industrial Estate and 5.58 million gallons of water per day from Seven Seas Water in Point Fortin.

There are three surface water reservoirs in Trinidad: Caroni-Arena [capacity 46.6 million cubic meters[19]]; Navet [19.1 million cubic meters]; and Hollis [4.75 million cubic meters] and one in Tobago - Hillsborough [1.02 million cubic meters]. Total impoundment capacity is estimated at 72 million cubic meters, however this still cannot meet network or customer needs. An assessment is needed to determine the impact of siltation on the capacity of the reservoirs and recommendations made for necessary remedial actions. The largest of these reservoirs is the Caroni-Arena dam in the Caroni River and supplies water to areas of central Trinidad. The Navet reservoir was designed to supply San Fernando and other outlying districts including Rio Claro, Princes Town, Moruga, and Gasparillo. The Hollis reservoir on the Quare River supplies Arima, Port of Spain and other areas of northern Trinidad. The Hillsborough reservoir supplies South West Tobago and surroundings.

[18] PARTICIP, prepared for the EU Delegation to Trinidad and Tobago, "Vulnerability and Capacity Analysis Report" (January 2019)

[19] PARTICIP, prepared for the EU Delegation to Trinidad and Tobago, "Vulnerability and Capacity Analysis Report" (January 2019)

During the 2019 dry season the water supply deficit was estimated at 45 million gallons of water per day and WASA had to resort to rationing water via published scheduled supply and outages, use of water tanker trucks, replenishing storage and implementing a communication strategy and plan. In 2019 WASA also planned to implement a series of short- and long-term initiatives to achieve the following:

1. Reduce the reliance on surface water sources;
2. Seek indigenous sources of water;
3. Replacement/Upgrade of the distribution network;
4. Refurbishment of major wastewater facilities in Trinidad and Tobago.

According to data from the WRA, as a result of below normal rainfall during the 2019 wet season, as of September 9, 2019, the levels of the reservoirs were considerably below the respective long-term averages as follows: Hollis at 23.0% versus 69.5%; Caroni - Arena 46.4% versus 70.8%; Navet at 33.6% versus 71.8% and Tobago's Hillsborough at 52.7% versus 73.5%. However, media reports on September 27, 2019 reported that there were improvements in the measured dam levels, notably the Hillsborough dam was recorded at 100% after the passage of Tropical Storm Karen. Based on the projections, come December 2019, all indications are that the reservoirs may not be at the required levels for the 2020 dry season.

The low levels of the reservoirs to start the 2020 dry season, coupled with the probability of near average rainfall during the dry season itself, paints a grim picture for the availability and provisioning of water supply to the population of Trinidad. There will be a significant deficit in water supply from surface water sources, if the forecast from the TTMS holds true. The situation is further exacerbated by the high levels of losses from physical leaks.

From the foregoing, it is evident that Trinidad and Tobago's water resources, water supply and infrastructure are vulnerable to recurring annual harsh dry season conditions. This can only get worse if comprehensive measures are not put in place, not only to attend to the upcoming 2020 dry season but to also implement climate resilient measures to reduce reliance on surface water sources and/or balance surface and ground water usage, protect watersheds, control land use and development in watersheds; rehabilitate and develop new ground water sources as needed in water scarce areas, reduce non-revenue water, increase network connectivity and storage, rehabilitate infrastructure, improve operations and maintenance as proposed in the Action Plan (Section 3). Within these measures, Tobago should be subjected to its own analysis and solutions tailored to its unique needs as the hydrometeorological situation there is different from Trinidad.

2.2. Technical Operations

The IDB Water Sector Strategic Plan (2008) noted that since its inception, WASA has been unable to deliver an acceptable level of service to its customers. Despite several attempts at a 'turn around', including two management contracts, there had been little improvement in the level of service. IDB studies carried out in 2012 for preparation of the project TT-L1026, *'Multi-Phase Wastewater Rehabilitation Programme'* and in 2017 in for the preparation of *'Trinidad and Tobago Draft Case Study of the Water and Sanitation Sector'* show that the situation has not improved. Similarly, the

RIC (2018[20]) acknowledges that since the 1970s, customers of WASA have received an unreliable supply of water.

While Trinidad and Tobago has achieved almost universal coverage of potable water, according to the Ministry of Public Utilities about 53% of consumers enjoy a continuous supply (24hr x 7 days per week) during the wet season. MPU figures put WASA's potable water production for 2018 at 232 MIGD (1,054,693 m^3/day) to serve a population of around 1.36 million. The WHO estimates that 100-120 liters/person/day (**22 – 26.4 IGs/person/day**) is an adequate water supply. Therefore, with an estimated NRW of about 50%, WASA supplies around 100 MIGD (454,609 m^3/day) of water to the population, which is equivalent to a supply of approximately 80 gallons (364 liters) per person per day. Notwithstanding the volume of water supplied by WASA, the reality is that a significant portion of the population do not receive continuous water supply.

WASA's water supply systems operate under constant challenges, mostly related to aging infrastructure, insufficient investments and inadequate maintenance of critical assets, due to the lack of strategic use of the resources provide by GoRTT and inadequate oversight of the use of such funds. The low quality of the water supply service could be attributed to an inadequate transmission and distribution system; highly insufficient storage; excessive customer consumption and lack of demand management; and unbalanced pressures. These deficiencies are manifested in a high level of NRW, a high per capita demand and a low level of continuous service to customers. In the *Updated Definition of an Action Plan for Water Supply Improvement Programme* (2018), it is estimated that NRW volumes represent between 40% to 50% of the total volume produced. An accurate determination of NRW, however, is not possible due to the lack of bulk and universal metering.

2.3. Commercial Operations

WASA's customer database and collection efficiency needs to be improved. According to a recent study,[21] the collection rate is 85% for 2017. As part of the same study, collection efficiency was assessed using the ratio of accounts receivable net of provisions for doubtful accounts to revenue, and the conclusion was that for the benchmarked utilities, it takes an average of about 80 days to collect amounts billed to customers, with several taking well over 100 days. Of the utilities that were the focus of the study, WASA was of particular concern, as WASA was assessed to take 188 days to collect amounts billed to customers. A possible factor contributing to this result could be that there is not a clear suspension of service policy due to no payment, which may be linked to the unmetered water supply. In addition, WASA does not have an accurate customer cadastre as the specifics of its customers are often unknown or require updating.

The management of water demand is recognized as a major challenge given the high per capita consumption levels in the country. Less than 2.9% of WASA's residential customers are metered. In addition, WASA's tariffs are low and have not been updated in over 25 years despite significant growth in WASA's pipeline network and other assets to service the country with water and wastewater for the last 25 years of its development. Tariffs should serve as a proper signal to water users on the value of water. The combination of low metering, low collection and low tariff results in

[20] Outline for Universal Metering

[21] CASTALIA (2017); CASTALIA, Benchmarking study prepared for the Business Plan and Price Control Proposal for WASA: 2019-2024 (July 2019) - estimates the accounts receivables days at 56

consumers having little or no incentive to limit consumption. The development and implementation of "economic efficient" pricing through a tariff adjustment and accurate consumption metering through a universal metering programme constitute critical challenges for WASA.

WASA has flagged the following as critical issues that need to be addressed to improve service delivery:

- The inability to increase revenue that is primarily tied to an outdated (1993) tariff; review and updating of the WASA Act (1965);
- Replacing aging infrastructure will require heavy capital investment to improve service levels;
- The current rates for commercial abstraction need revision;
- There is no 'quick fix; the issues that impact performance are systemic and must be addressed concurrently;
- The rapid expansion of the wastewater sector means that there will be increased costs to the Authority to treat effluent and a revision of the wastewater rates are needed; and,
- The continued contraction of the industrial sector (especially in the Point Lisas Industrial Estate) has negatively impacted WASA's largest revenue-generation customer base.

2.4. Financial Management

As mentioned before, WASA's water tariffs are among the lowest in the region (about US$0.23 per cubic meter average residential tariff). Hence, revenues resulting from the tariffs do not allow the company to recover its operating expenses. As previously shown in Table 1, typical tariffs in other Caribbean countries range from US$1.51 to US$2.78 per cubic meter, which is at least 480% higher than WASA's base tariff.

According to the WASA's Management Accounts, revenues from WASA's customers over the last years are, on average, only TT$800 million (US$118 million), while total expenses are around TT$2.7 billion (approx. US$397 million) per annum, due in part to its outdated Tariff Structure and also its low operational efficiency where staffing expenditure is close to half of WASA's operating budget in spite of TT having one of the lowest electricity rates in the world. WASA posits that possible factors contributing to this higher operating recovery ratio is the absence of a clear suspension of service policy due to non-payment, which may be linked to the unmetered water supply and the lack of an accurate customer cadastre as the specifics of its customers are often unknown or require updating. Currently, WASA employs a labour intensive, costly option of excavation using heavy equipment because it has been unable to secure funding for curb values which is a less labour-intensive mechanism of suspending water services.

Notwithstanding, WASA has not been able to recover its Operational and Maintenance (O&M) costs for more than the last decade. Consequently, WASA relies on Government transfers to cover its annual operational deficit of approximately 70% of the total cost. WASA suggests that this is as a result of the significant increase in the cost of potable water production over the years and the absence of tariff increases which is necessary to achieving operating cost recovery. Network expansion to increase the existing number of customers has also been severely impacted due to its lack of funding.

In addition to Government subsidies, WASA also has outstanding long-term debt with financial institutions. Currently, according to MPU, WASA has outstanding verified payables of TT$1.0

billion (US$147 million) and receivables of around TT$650 million (US$96 million). WASA's debt is around TT$4.0 billion (US$588 million). It is recommended that a mechanism needs to be developed to address the old 'debt' of the Water and Sewerage Authority to permit engagement of encumbered resources.

2.5. Organization and Strategic Management

Under the Corporate Governance Services for the Multi-Phase Wastewater Rehabilitation Programme (Phase 1), SAFEGE analysed the medium- to long term planning carried out by WASA. SAFEGE found that WASA has been engaged to a limited extent in planning to achieve certain corporate objectives as identified in the Authority's medium-term strategic plans. Regarding coordination between strategic plans and GoRTT policies, SAFEGE has found that WASA's long-term planning is guided by the GoRTT's vision of water security but apparently not by any other need (such as financial self-sufficiency or greater accountability to the public) to transform the water sector. They noted that the Authority's planning documents do not make reference to the Authority's Master Plan for the sector, which usually covers a period of 30 years; and that the Authority's long-term planning seems to be done in a vacuum without any reference to past plans which have impacted the development strategy.

There is a national outcry for social and cultural transformation of WASA, which must be acknowledged is not just internal to WASA but also requires transformation of the water sector in its entirety (regulators, legislation, policymakers) and the Board. In evaluating the lessons learnt of previous attempts at WASA's transformation, the missing link was the handing over of a clear policy mandate by the responsible Ministry that are aligned to specific targets for the Board that are then filtered down to WASA's executive. This policy mandate can take the form of this Action Plan (Section 3). The targets handed over from the Board to the Management must also permeate through a performance management framework that monitors and evaluates progress on the strategic and operational targets of WASA's turnaround.

Moving forward from entrusting of a policy mandate to WASA, it must be recognised that allocating resources to WASA to achieve this Action Plan will not on its own suffice. WASA needs the focus, technology, systems, skills and incentive to comprehensively address the country's water supply shortages and sustain the 24/7 (continuous) supply of water. As recommended by the Action Plan, this requires the services of an independent water operator, working under a robust performance-based contract to achieve the targets of the Action Plan. This operator will bring the experience and expertise to guide and impact the competencies to WASA to fix and sustain a high-quality and reliable service.

2.6. Human Resources Management

Based on benchmarks of similar agencies in the Caribbean[22], WASA's staff productivity is characterized as low, with about 12.0 employees per 1,000 water connections (equivalent to 10.61

[22] CASTALIA, Benchmarking study prepared for the Business Plan and Price Control Proposal for WASA: 2019-2024 (July 2019)

employees per 1,000 **water and wastewater connections combined**) while efficient utilities will typically have between 3 to 5 employees per 1,000 water connections[23]. The Authority operates a labour-intensive organization. Factors such as, the inadequate planning for urban expansion and the Authority's provision of services to all customers regardless of geographic dispersion, has led to the provision of services to parts of the country where it is not economically feasible to so do.

WASA is of the view that those utilities that are "efficient" are also characterized by the following:

- Low levels of Government intervention in day-to-day operations;
- Ability to request tariff reviews from the Regulator that keep pace with the increasing cost of delivering service to customers; WASA still charges a 1993 tariff rate;
- Almost all services are outsourced; only minimal staff is retained to manage contractors;
- High levels of technology in the delivery and maintenance of service levels.

The MPU estimates that WASA is overstaffed by approximately 2,000 employees, reflecting years of unstructured recruitment. WASA recruits top management from the pool of internal candidates who have in-depth institutional knowledge of the functional areas for which they have been selected to manage. The appointment of the CEO requires Cabinet's approval. The benchmark study reported that, as of September 2010, staff costs accounted for about 49 percent of WASA's operating expenses (up from 46 percent in 2005); a more recent study[24] puts this figure at 54%.

This situation of high dependence by WASA on subsidies results in a lack of accountability for subsidies received. Because the subsidies are not tied to any performance targets the GoRTT can instruct WASA on how the funds should be spent, or WASA can decide how it spends the funds. Resulting in a situation whereby no one is held accountable for not delivering. Needed investments and maintenance are therefore misplaced or postponed causing the efficiency of operations to drop. WASA acknowledges that this state of affairs continues as it is the only utility, local and regionally, that still provides its citizens with water and wastewater services at a 1993 water tariff; while the cost of all other factors of production have increased.

In this situation, as per Figure 1 'Spiral of Decline', subsidies fail to materialize impacting the ability of the utility to pay wages and recurrent costs and motivation and services deteriorate leading to continued dependency on subsidies. WASA recognizes that also contributing to the "Spiral of Decline" is customers apathy regarding the real cost of producing the high quality of water currently enjoyed throughout Trinidad and Tobago. This is evident by customers unwillingness to pay for the current supply received which is lower than the cost of bottled water, which is consumed at an alarming rate, and at a higher cost based on the volume of water in each bottle. The redirection of the monies paid to purchase bottle water, to instead pay for the actual supply of water received will assist WASA towards its goal of financial sustainability. This situation is further exacerbated in a unionized environment, which looks more after the interest of workers' wages and benefits and not necessarily in the interest of the quality of service being provided by the utility.

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[23] Leading utilities in the region have 1 employee per 1,000 connection and sub-contract a large number of their activities. Levels of 2 to 3 employees per 1,000 connections are considered reasonable levels.

[24] CASTALIA, Benchmarking study prepared for the Business Plan and Price Control Proposal for WASA: 2019-2024 (July 2019)

2.7. Sector Governance Framework

The Trinidad and Tobago water sector is comprised of: (i) WASA, the service provider; (ii) the MPU, which is the ministry responsible for policy direction; (iii) the RIC, which is the economic regulator; and (iv) the Environmental Management Authority (EMA), responsible for environmental regulation. The resource regulator, the Water Resources Agency, is an agency within WASA. WASA is headed by a Board comprised of eight (8) Commissioners, which is responsible for matters of general policy. WASA's management is responsible for the day to day running of the Authority. While several reports (PES, CASTALIA, IDB docs) reference the Government's objective for the water sector, and there is the Manifesto of the Political Administration, there has not been a water sector policy document since 2015.

The corporatization of WASA, requires renewed consideration and approval by the GORTT and could be a target after WASA is stabilized. The aim being to capture the advantages of a private sector company, including efficiency, productivity, and financial sustainability while retaining accountability to owners.

2.8. WASA's Institutional Capacity Assessment

As per IDB 2012 Institutional Capacity Assessment, WASA displays significant procurement-related challenges such as delays in procurement execution and timely payments to contractors due to weak intra-institutional communication and response-time framework. This negatively impacts the delivery of timely solutions to burning problems.

SAFEGE, in their Final Report *(WASA) Transformation Process Roadmap*, under the Corporate Governance assignment, describes a 'WASA Ecosystem' that suggests an explanation of the WASA conundrum. The WASA Ecosystem contains four (4) critical relationships and their inherent dynamics. These relationships are (i) WASA to Cabinet and resources-providing Ministries; (ii) Regulators[25], WASA and Government; (iii) Energy Sector, Government and Society; and (iv) Consumers, WASA and Ministries. Further details can be found in the SAFEGE Final Report.

The core problem of WASA is recognized as a governance problem. Indeed, there has not been a consistent focus on accountability for resources allocated that would ensure efficiency, productivity, and financial sustainability of the utility. Improvements that have been demonstrated in electricity and the telecommunication utilities (T&TEC and TSTT) have eluded WASA.

[25] There are three regulators: RIC (tariffs), EMA (Environment) and WRA (water resources).

3. ACTION PLAN - BUDGET AND SCHEDULE

The Action Plan

The Action Plan is proposed to be implemented in three (3) phases: **Phase 0** consist of **Phase 0-A**, Dry Season Emergency Actions and **Phase 0-B** Detailed preparation of the Programme and Baseline Assessment to more precisely define the loan operation, commence tender document preparation, among other things; **Phase I** is the substance of the Programme for which the entire loan package will be utilized; and **Phase II** is a natural continuation of Phase I, proposed to be funded through a different arrangement to be defined at the end of 2024 or performed by WASA.

The phases are:

(i) Phase 0-A Dry Season Emergency Actions;
(ii) Phase 0-B Detailed preparation of the Programme and Baseline Assessment;
(iii) **The Programme**, Phase I - Stabilization:
- Governance, Policy and Institutional Reformulation; and
- Infrastructure Rehabilitation;
- Multi-Purpose Flood Mitigation and Water Supply Reservoir at Ravine Sable Sand Pit (RSSP) Caparo;

(iv) Phase II – Optimization and Maintenance.

3.1. Proposed Actions for Implementation

The proposed actions are designed to comprehensively and sustainably improve water supply and security in Trinidad and Tobago, including the effects of climate change and climate variability by addressing the governance, policy, institutional and legal/regulatory framework and infrastructure rehabilitation needs. The achievement of pressurized 24/7 water supply service continuity is based on the reduction of the apparent/commercial losses that are caused by excessive consumption from unmetered customers and real losses caused by physical leaks in water mains and customer service connections. Additionally, the implementation of universal metering as a demand management measure, will serve to reduce apparent/commercial losses and curb demand, most dramatically in conjunction with appropriate price signals.

The Action Plan aims to achieve >90% of customers receiving 24/7 water supply by 2024, the end of the Programme, Phase I – Stabilization, as well as reduce total NRW from 224 to 120 imperial gallons per connection per day as well as increase water storage and reduce the impact of extreme flooding in central Trinidad. Notwithstanding the emphasis on water savings from NRW, the Action Plan recognizes that for various reasons, there are water scarce areas both in Trinidad and in Tobago and as such, attention will also be given to rehabilitate, develop and provide water supply and the necessary storage to such areas based on the results of hydraulic modelling and water availability.

The Action Plan is cognizant that WASA on its own does not have the necessary resources (human and technology) and systems to undertake the work required to provide continuous water supply to Trinidad and Tobago within a reasonable timeframe. Consequently, the Action Plan recommends that

the GoRTT procures international expertise through a performance-based contract to guide, mentor and support WASA with delivering on the work packages under the Programme.

a) Phase 0-A Dry Season Emergency Actions [present – mid 2020]

Phase 0-A Dry Season Emergency Actions seeks to:

(i) Provide the necessary hydraulic tools to guide the rehabilitation of wells, water treatment works and storage, in order to increase production from existing sources and provide water to localized water scarce areas;
(ii) Implementation by WASA of focused and aggressive leak detection and repairs in those areas where it is intended to provide water into supply;
(iii) Provide technical assistance to WASA regarding the Hillsborough Reservoir desilting project;
(iv) Implement conservation education campaign.

The civil works, such as well rehabilitation and reinstating equipment and facilities and conducting leak detection and repair in those areas where it is intended to provide water into supply should be done through PSIP funds. In the interest of expedience, the National Infrastructure Development Company Limited (NIDCO) can be considered for the procurement for Phase 0-A. It is recommended that these works be synchronized with focused and aggressive leak detection and repairs by WASA's personnel or a specialized contractor. WASA's personnel can be deployed and benefit from implementing these initiatives, which will prepare them to actively participate in the prospective NRW programme.

General Scope Services

Task 1 - Skeletonized Hydraulic Model Development for 5 Regions

The objective of having a skeletonized hydraulic model is to be able to perform a water balance and match demand to supply in order to determine the extent of any deficit. A skeletonized model usually lacks the level of detail that a full pipe model has. Typically, it includes larger pipes, such as 12 inches in diameter and larger to assess the big picture of the supply and demand of water. Therefore, as part of this task a hydraulic model will be set up using the existing WASA GIS and production volumes and demand available for each region.

Task 2 - Focused Regional Assessment of Intermittent Supply

This initiative is also a fast-track activity and it is focused on investigating intermittent supply areas that have historically had water deficits during the dry season and in some cases the wet season as well. The emphasis will be on analyzing historic drought events, performing the preliminary water balance using the hydraulic model generated in Task 1, identifying wells and putting back wells into service, and evaluating areas where new wells could be installed. This task could also include geophysical survey to assist in the fast-track design of well production rates and groundwater ability and yield. Due to the common features, Task 1 and 2 could be done together.

Task 3 - Focused Water Loss Reduction and Leak Detection and Repairs

This task consists of hiring a turnkey contractor that can perform surveys and conduct leak repairs or, better yet, this can be performed by WASA crews. The survey and leak repairs should be focused on areas that have historically had water scarcity that could be targeted for an expedited water loss reduction initiative or areas where it is intended to supply additional water through wells. It is anticipated that the selected contractor, if one is used, will have state-of-the-art equipment including acoustic leak detection systems.

Task 4- Water Conservation Educational Campaign

The programme should be focused on educating the public that there is an emergency and conservation is not a personal choice but a requirement.

	Emergency Activity	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20
Task 1	**Skeletonized Hydraulic Model Development for 5 Regions**						
1.1	Model Setup and load allocation						
1.2	Preliminary calibration with historical data and limited monitoring						
1.3	Technical Memorandum						
Task 2	**Focused Regional Assessment of Inermittent Supply**						
2.1	Focused Wellfield Assessment						
2.2	Analysis of historic drought events						
2.3	Preliminary Water Balance with Historic Data						
2.4	Identification of wells that can be repaired						
2.5	Fast- Track Geophysics Survey (Electromagnetic) in Targetd Areas						
2.5	Simplified modeling of water augmentation scenarios						
2.6	Technical Memorandusm						
2.7	Fast-Track Well Restoration						
2.8	Provide Emergency Water Service						
Task 3	**Focused Water Loss Reduction and Leak Detection and Repairs**						
3.1	Selection of target areas that are historically impacted by dry season						
3.2	Perform selective leak detection						
3.3	Repair Leaks						
Task 4	**Water Conservation Educational Campaign**						

Figure 3 Proposed schedule for the actions under this phase

The estimated cost of Phase 0-A is approximately US$500,000. Figure 4 presents preliminary budget of these fast-track activities proposed as emergency actions in preparation for the 2020 dry season.

	Emergency Activity	Person/ Days	Average Daily Rate, USD	Total Labor, USD	Expenses and Direct Costs, USD	Total Costs, USD
Task 1	**Skeletonized Hydraulic Model Development for 5 Regions**	**40.0**		**50,800.0**	**$ 9,200.00**	**$ 60,000**
1.1	Model Setup and load allocation	20.0	$ 1,360	$ 27,200	$ 9,200.00	$ 36,400
1.2	Preliminary calibration with historical data and limited monitoring	15.0	$ 1,120	$ 16,800		$ 16,800
1.3	Technical Memorandum	5.0	$ 1,360	$ 6,800		$ 6,800
Task 2	**Focused Regional Assessment of Inermittent Supply**	**124.0**		**$ 153,730**	**$ 18,270**	**$ 172,000**
2.1	Focused Wellfield Assessment	12.0	$ 1,360	$ 16,320	$ 18,270	$ 34,590
2.2	Analysis of historic drought events	10.0	$ 1,360	$ 13,600		$ 13,600
2.3	Preliminary Water Balance with Historic Data	15.0	$ 1,360	$ 20,400		$ 20,400
2.4	Identification of wells that can be repaired	4.0	$ 1,120	$ 4,480		$ 4,480
2.5	Fast- Track Geophysics Survey (Electromagnetic) in Targetd Areas	25.0	$ 1,450	$ 36,250		$ 36,250
2.5	Simplified modeling of water augmentation scenarios	10.0	$ 1,360	$ 13,600		$ 13,600
2.6	Technical Memorandusm	3.0	$ 1,360	$ 4,080		$ 4,080
2.7	Fast-Track Well Restoration	40.0	$ 1,000	$ 40,000		$ 40,000
2.8	Provide Emergency Water Service	5.0	$ 1,000	$ 5,000		$ 5,000
Task 3	**Focused Water Loss Reduction and Leak Detection and Repairs**	**98.5**		**$ 183,000**	**$ 20,000**	**$ 203,000**
3.1	Selection of target areas that are historically impacted by dry season	8.5	$ 1,200	$ 10,200	$ 20,000	$ 30,200
3.2	Perform selective leak detection	90.0	$ 1,920	$ 172,800		$ 172,800
Task 4	**Water Conservation Educational Campaign**	**100.0**	**$ 500**	**$ 50,000**	**$ 15,000**	**$ 65,000**
	Total	**362.5**	**$ 500**	**437,530**	**62,470**	**500,000**

Figure 4 Estimated cost

Expected outcomes:

Expected Outcomes at the end of Phase 0-A are: (i) hydraulic model; (ii) rehabilitated wells; (iii) increased production and supply of water to localised water scarce areas coupled with a concomitant reduction in the back log of leaks in those areas; (iv) mobilization by WASA of Hillsborough desilting works.

b) Phase 0-B Detailed preparation of the Programme and Baseline Assessment [present to – end of 2020]

Under Phase 0-B, preparatory activities will be conducted that will support the execution of the Programme, Phase 1 – Stabilization. These activities are expected to be funded through the TC and in the case of the baseline assessment, funding would continue through the loan operation:

(i) Universal metering – prepare tender documents and complete tendering process, assuming competitive procurement of a performance-based supply/install contractor;
(ii) NRW Reduction and network optimization – prepare request for proposals and Performance-Based Contract (PBC) to achieve 24/7 water supply;
(iii) Review and update studies, designs and tender package for the Multi-Purpose Flood Mitigation and Water Supply Reservoir at RSSP, Caparo;
(iv) Conduct field work for baseline assessment, prepare hydraulic model and water balance;
(v) Strengthening the institutional capacity of the MPU by creating the Project Execution Unit.

Expected Outcomes are:

ii) Successful bidder for Universal Metering;
iii) Detailed Baseline Data and Hydraulic Model;
iv) Tender Package for NRW Reduction PBC;
v) Updated studies, designs and tender package for the construction of the Multi-Purpose Flood Mitigation and Water Supply Reservoir at RSSP.

c) Components of the Programme - Phase I – Stabilization (2020 to 2024)

The Stabilization Phase of the Programme, seeks to achieve pressurized 24/7 water supply and improve technical and commercial operations by solving the four most pressing issues facing WASA: (i) intermittent service to customers; (ii) water losses caused by leakage and unbilled unmetered consumption; (iii) low tariffs and poor collection of receivables; and (iv) improvement and automation of information. The Plan proposes to supply the current deficit with water recovered from reducing water losses and thus deferring the investment cost of new supplies. Notwithstanding, the plan will also assess the need for storage; network bottlenecks; the rehabilitation and development of wells; and the rehabilitation of existing production sources.

1. Governance, Policy and Institutional Reformulation

On the policy, governance and institutional arrangements side, the Action Plan recommends that the turnaround of WASA will require improved governance at three levels – across the sector, at the Board level and at the organisational level. The focus under this component will be on systemwide change management informed by an institutional and operational audit, and reestablishment of oversight and reporting protocols to address gaps in accountability:

(i) Creating an effective enabling environment (policy, legislation and regulation) to allow WASA to successfully function;
(ii) Institutional strengthening of the WRA and MPU's technical oversight capacity by creating and funding the PEU; redefinition of the duties of all related water sector stakeholders (MPU, WRA, RIC, etc.); communicating a clear mandate from the GoRTT to WASA's Board and Management;
(iii) Prepare and implement a Turnaround Roadmap with a clear and measurable performance management scorecard of operational, financial and institutional targets with timelines that will guide the transformation;
(iv) Ensure that the Board has the appropriate skills and targets for WASA to transform;
(v) Prepare and implement a Communication Strategy and Plan.

Mechanisms will be built into the prospective loan operation to monitor the achievement and progress of the governance, policy and institutional reformulation.

At the end of the Programme – Phase I, these are the expected improvements in Sector Governance:

(i) Improved sector governance, oversight, accountability, transparency, management structure, service provision and culture of WASA to sustain the Programme gains;
(ii) Improved coordination, sustainability and environmental protection of watersheds and water recharge areas;
(iii) WASA's Revised Business Plan submitted to MPU for submission to the RIC;
(iv) Performance Management Scorecard implemented for WASA's Board and Management;
(v) Draft new Water Sector Act and revision of relevant legislation (WASA, RIC, etc.);
(vi) Project Executing Unit established in the MPU;
(vii) Improved water security, increased climate resilience, and improved access to good-quality, reliable water supply to vulnerable communities, agriculture and the commercial sectors.

2. Infrastructure Rehabilitation

On the **infrastructure side**, the Action Plan proposes to achieve pressurized 24/7 water supply by reducing water shortages and inefficiencies through:

(i) Development of Analytical, Management and Smart Tools;
(ii) Water Distribution Network Optimization and Rehabilitation - Execution of the NRW Reduction Performance Based Contract; bottlenecks;

(iii) Implementation of Universal Metering;
(iv) Existing Wellfield Assessment, Rehabilitation and Automation;
(v) Commercial Strengthening; and
(vi) Based on hydraulic modelling, increase impounding storage capacity, particularly in NE Trinidad (funding through the PSIP);
(vii) Procurement and construction of the Multi-Purpose Flood Mitigation and Water Supply Reservoir at the Ravine Sable Sand Pit, Caparo to alleviate the perennial problem of flooding, increase water storage and production using the impounded water that could be easily treated and converted to potable water standard.

Figure 5 shows the application of the Smart Business Model to WASA's situation and defines six work packages for the proposed Action Plan of the Programme. One package under Governance, Policy and Institutional Reformulation and five under Infrastructure Rehabilitation. These packages address the main components of the Smart Business Model, including planning the integration of Smart Water Infrastructure Technology (SWIT) to improve systemwide efficiency, change management, capacity building, technical support, and fact-based operational policies and decisions.

Figure 5 - Main Work Packages of the Proposed Action Plan

The Work Packages are structured in such a manner that there can be a phased or concurrent implementation based on the preference of the GoRTT. However, they all form part of the holistic Action Plan and are inter-related and interdependent. The MPU has indicated that they would like to commence with the **Universal Metering Package**. This involves **Customer Metering Assessment** and Procurement and installation of non-domestic and domestic meters. However, this should be concurrent or followed closely by the Water Distribution Network Optimization and Rehabilitation package.

WASA has commented that its internal cost of domestic meter installation is estimated to be US$440 including materials and labour of a 5-man crew plus US$145 for a meter box. The estimated cost of installation of a meter in the region are as follows: Jamaica US$60; the Bahamas US$50 and Guyana US$96. Given international bidding experiences that validate the unit cost used for the estimates in this Brief, we suggest we maintain the estimated cost of US$80 for meter installation as it is. (It is

assumed that a competitively procured contractor for meter installation would work in the form of two-person teams.) During the detailed preparation of the loan, we will analyze how to possibly take advantage of WASA's internal human resources that may be made available for this activity to further reduce its cost. For now, going on the assumption of a competitive tendering for a performance-based supply/install contractor, tender packages for Universal Metering and NRW Reduction and network optimization and rehabilitation would have been completed in Phase 0-B, for implementation in Phase I.

The "**Baseline Study and Development of Smart Tools**" package involves the development of analytical and data management tools, such as hydraulic models, updating the existing geographical information system (GIS), and Asset Management. Buttressed by an institutional and operational audit of WASA, these tools are essential to WASA for evaluating and finding solutions to the intermittent water supply situation, network bottlenecks, storage and for optimizing the DMAs and overall distribution system.

The "**Assessment of Intermittent Water Supply**" initiative will evaluate historic water supply deficits and develop hydrological water balances to determine whether the recoverable volumes attributed to reduction of leakage and universal metering can supply all customers systemwide or if new water supply schemes need to be developed as well as increase impounding storage capacity, particularly in NE Trinidad which offers great potential of sustainable water supply (funding through the PSIP).

The hydraulic model developed will be used to properly size and site storage requirements. Figure 6 below illustrates the cost of adding additional storage to the system, e.g. if 25% additional storage capacity is needed then the estimated cost is about US$52 million for an additional capacity of 34.5 MIG based on the current demand of 138 MIGD.

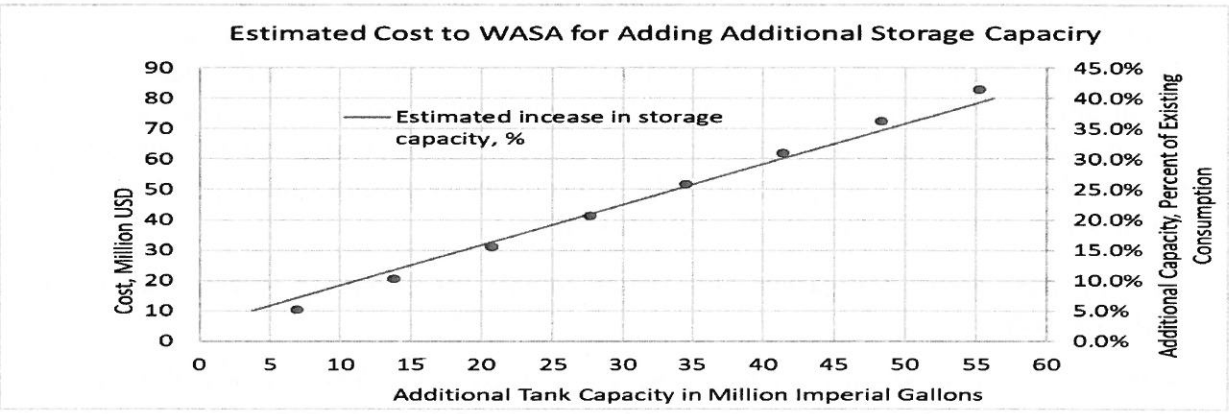


Figure 6 cost of adding additional; storage

Execution of the **Non-Revenue Water Reduction Performance Based Contract**.

The **Commercial Strengthening** package will include a review and update of WASA's business plan prepared by CASTALIA, to support the case for tariff review. The plan recommend additional capital expenditure to increase storage.

Develop a **Capital Investment Plan** to build national and zonal climate resilience by addressing storage and other network deficiencies not funded by the IDB loan. These projects are expected to be funded by the Government and through other modalities (including PPPs).

The **Asset Management** tool will also help in the installation of customer meters, georeferencing meter locations and associating meters with customers, undertaking of a customer cadastre survey to update customer data and management of the horizontal and buried infrastructure. This package also includes the development of the **Smart Water Balance** and the **seven-management information system (MIS)** modules that will provide WASA's managers and operators with up-to-date information and the ability to make proactive decisions. The seven modules are:

- Module 1 Management Information System - Production Data from SCADA
- Module 2 - Management Information System - DMAs/PMAs
- Module 3 - Commercial and Industrial Customers
- Module 4 -Domestic Customers
- Module 5 -Billing System
- Module 6 - Customer Service
- Module 7 - Buried/Horizontal Infrastructure Asset Management and Condition Assessment

The first two MIS modules will be developed in parallel with the production metering initiative and the establishment of the DMAs/PMAs. This will allow WASA's management and operators to have, on a daily basis, the production in the entire system, supply to each DMA, and an estimate of NRW at each DMA using night flow analysis. **Annex 4** contains a detailed description of all the activities organized by Action Package.

Responding to Climate Change

Given the present and future impacts of climate change and climate variability on water resources, supply, quality and infrastructure, and also given the reliance of WASA on surface water sources, a climate change vulnerability assessment will be conducted in Phase I. The assessment will identify and quantify risks and recommend mitigation or remedial measures for vulnerable water supply infrastructure such as reservoirs, other storage facilities, pumping stations, water treatment works and exposed pipelines. The list of projects can be pooled together under a climate proofing and resilient infrastructure portfolio and funded through the PSIP.

Multi-Purpose Flood Mitigation and Water Supply Reservoir at Ravine Sable Sands Pit (RSSP), Caparo

In January of 2014, studies conducted by Royal Haskoning DHV on behalf of the National Infrastructure Development Company (NIDCO) and the Drainage Division of the Ministry of Works and Transport, recommended that constructing a multi-purpose reservoir and water treatment facility at the site of the Ravine Sable Sands Pit (RSSP) offered the greatest economic and environmental returns to alleviating the perennial problem of flooding and water scarcity in the Caparo River Basin. The RSSP is a large depression in the middle of the Caparo River Basin formed after a major flood event in May 2010 and it presently acts as a natural flood retention system. The construction of the RSSP Multi-Purpose Reservoir will both alleviate the Caparo River Basin's flood challenges and improve access to reliable water supply.

The communities within the Caparo River Basin - including the Borough of Chaguanas have been impacted by significant flooding from both natural and anthropogenic causes. This has resulted in financial losses incurred by residents, businesses and agriculture. At the macro level the country has distributed $150 million in payouts in 2018 for flood damages, most of which occurred in central Trinidad. It was recommended that the RSSP Reservoir be designed to protect the Basin against a 1 in 25-year flood event, as a greater return period would be cost prohibitive. The Multi-Purpose Reservoir at RSSP will increase water storage and increase water production using flood waters that could be easily treated and converted to potable water standard.

According to WASA, the current water demand in the Caparo River Basin is estimated at 2 million imperial gallons per day (MIGD). Presently, the Caroni Water Treatment Plant supplies to the area 1 MIGD and local groundwater sources supply 0.7 MIGD, resulting in a water supply deficit of 0.3 MIGD. The RSSP Multi-Purpose Reservoir and Water Treatment Plant is expected to produce 2.3 MIGD of water benefiting approximately 14,000+ persons in the Basin and would simultaneously create less dependency on the Caroni WTP, freeing up 1 MIGD of water.

The Table below summarizes the **expected outcomes** and benefits of the programme at the end of Phase I, Year 5 and it also shows those for Year 10 at the end of Phase II.

Table 4. Technical indicators - Expected Outcomes and Benefits of the Programme

Indicator	Baseline	Year 5	Year 10
Capital Investment Plan	-	1	-
Smart Water Balance, Analytics and Management Information System for real time monitoring	-	1	-
NRW (%)	42%	26%	14%
NRW (MIGD)	99.2	53	31
Physical Losses (MIGD)	48.1	29	24
Commercial Losses (MIGD)	51.1*	23.4	7.4
Production (MIGD)	232	215.3**	208
24/7 Supply (% of population)	53%	90%	>98%
Total water consumption (MIGD)	135	161	177
Domestic water consumption (lpcd)	377	281	241
Overall metered customers (%)***	4.5%	100%	100%
Industrial	100%	100%	100%
Commercial	63%	100%	100%
Domestic	3.1%	100%	100%
Storage (gallons/capita)	11,330	12,416	14,900

Note: the baseline is 2019, Year 5 is the end of Phase I and Year 10 is end of Phase II.
*Includes 2.0 MIGD of unbilled unmetered consumption; ** Includes 2.3 MIGD from the RSSP Multi-Purpose Reservoir.
***WASA should keep additional meter inventory of domestic and most commonly used non-domestic meters to connect new accounts to the system.

Additionally, all the DMAs/PMAs (about 120) will be in place and the Smart Water Balance (SWB) and Management Information Systems are fully operational and providing daily water balances of all water supplied to the DMAs/PMAs. It will also allow WASA to be proactive in NRW monitoring,

mitigating real losses, and tracking irregularities associated with apparent (or commercial) losses, such as meter tampering, meter by-pass, illegal connections, etc.

d) Phase II - Optimization and Maintenance 2025 - 2029

Phase II is not funded under the current IDB loan proposal. It seeks to sustaining and optimising the Programme's efficiency gains in NRW Reduction, 24/7 supply, smart water infrastructure technology, improved operations, revenue growth, among others. It involves strategic infrastructure upgrades based on the Capital Investment Plan, specifically increased storage potentially using different modalities including PPPs, along with a greater turnaround in WASA's commercial operations to address its revenue shortfall. It is proposed that Phase II be funded through another loan arrangement with the Bank and will be formulated in 2024, nearer to the end of Phase I. Alternatively, it can be implemented by WASA, which by this time, would have gained the necessary experience, expertise and know-how through its training and mentoring by the international water operator.

The **Expected outcomes** at the end of Phase II are summarized in Table 4 under Year 10.

3.2. Assumptions for Effective Implementation.

To succeed, the Action Plan needs to be enabled and supported by decisions, approvals, and commitments that are the responsibility of public sector stakeholders. Without the endorsement and appropriation, throughout all its phases, of the Action Plan by the Cabinet and the highest-ranking officers from the concerned ministries and institutions, the initiative is likely to become another failed attempt at transforming WASA.

The plan is based on the following set of assumptions and pre-conditions:

- Key stakeholders, namely MPU, WASA, Ministry of Finance and the Ministry of Planning and Development, formally endorse the Action Plan and commit to working together as a team, thus approving dedication of human resources, funding, and executing policy needed to realize true change management and sustainability. These agreements should be structured into the prospective loan operation.

- The Cabinet is expected to approve the Budget for the low hanging fruits of the Action Plan (Phase 0-A) and will arrange for the financing to be available for disbursement as per the schedule proposed.

- All government stakeholders respect and enforce the institutional and regulatory arrangements set for the implementation of the Action Plan. Allowing for review mechanisms to adjust and improve the plan and creating enhanced conditions for it to achieve its targets.

The stakeholders, led by MPU and supported by IDB, will prepare and implement a robust Communication Strategy and Plan using the most engaging, efficient and cost-effective channels including social media to reach and engage all consumers as the community level. The Strategy

and Plan will be duly funded and implemented by professional communication specialists. The Communication Strategy and Plan will include innovative educational and public relations campaigns aiming to inform the staff of WASA and the Trinidad and Tobago public and solicit their involvement in the improvements planned for the water supply system and hence the quality of service. This action is necessary to engender staff as well as the customer's cooperation and support for the Action Plan.

3.3. Costs and Institutional Arrangements of the Programme, Phase I - Stabilization

Start of a turnaround of WASA. The Programme aims to assist the GoRTT by recommending a holistic five-year Action Plan to turnaround WASA, improve the enabling environment and stabilize its operations so that it can provide 24/7 water supply service to over 90 percent of the population by 2024. It is proposed that this be done through a loan operation that will attend to the governance, oversight and accountability issues on the one hand, and optimize, rehabilitate, upgrade and modernize the water supply infrastructure and respond to climate change on the other.

The total cost of Phase I is estimated at US$315 million (TT$2.14 billion). It is proposed that entire cost of its implementation be financed by an IDB loan and supported by an estimated US$1.0 million non-reimbursable Technical Cooperation (TC) to fund activities that support loan preparation, commencement of baseline studies and studies to support the execution (Phase 0-A activities). These terms are negotiable. The following is the proposed loan structure (to be discussed during the loan preparation):

(i) Borrower: The Government of the Republic of Trinidad and Tobago

(ii) Executing structure:

a. MPU, on behalf of the GoRTT will be responsible for implementing the institutional changes (transformation) and governance strengthening components for WASA and for the sector;
b. WASA will be responsible for implementing the infrastructure, technical and commercial operations; and
c. Independent water operator. It is recommended—based on successful examples like the one implemented in the Bahamas—to contract the services of an independent water operator, working under a robust performance-based contract to achieve the targets of the Action Plan. This operator will bring the experience, know-how and expertise to guide, train and mentor WASA's personnel to fix and sustain a high-quality and reliable service.

(v) Terms: interest rate 3.0%[26], 25 years, grace period 5 years;

(iii) Timeline: Letter of request for TC and Loan, January 2020; eligibility for retroactive financing at publication of Project Profile, February/March 2020; target date for Loan approval July 2020.

[26] As of the fourth quarter of 2019, the Libor based lending rate of the IDB is 2.93 percent. See: http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=EZSHARE-1436601171-374

Table 5 below shows the proposed cost estimates of the Infrastructure Rehabilitation and Institutional components of the Programme. See Annex 4 for a description of Actions under each component.

Table 5. Programme Components and Budget - Phase I

Preliminary Budget for IDB Proposed Action Plan 2020-2024	Estimated Cost (US$ million)
Infrastructure Rehabilitation: Baseline Studies and Smart Tools, Water Distribution Network Optimization [NRW Reduction] and Rehabilitation, Universal Metering, Commercial Management Strengthening, Wellfield Assessment, Rehabilitation and Automation	**263**
Multi-Purpose Flood Mitigation and Water Supply Reservoir at Ravine Sable Sand Pit, Caparo	**42**
Institutional Strengthening: Governance, Institutional Reformulation and Systemwide Change Management and Project Execution unit; Technical and Legal Review of Desal replacement	**10**
TOTAL	**315**

3.4. Financial Justification of the Programme Phase I – Stabilization[27]

As part of this Action Plan, the early stabilization of WASA would come from improving efficiency in all areas of operations, particularly in NRW volume recovery. Other initiatives, like universal metering, will also contribute significantly to water supply volume recovery and to achieving 24/7 service. As part of the Smart Business Model, the efficiencies derived from NRW reduction and system optimization should be considered part of funding because a dollar saved is equivalent to a dollar earned and has the same value in the bottom line and cash flow analysis. WASA can also improve the bottom line by improving energy efficiency, chemical optimization, personnel retraining and attrition, commercial auditing, promoting competitive bidding of chemicals and materials.

Financial analysis of the Programme (without tariff adjustments). **The Programme demonstrates high financial benefits, with an IRR of 17% (considering 25 years, equivalent to the IDB loan repayment period) or 5% (considering only the first ten years), which is considered attractive as a result of comparison with the GoRTT's cost of capital. The payback period is 9 years.** This was calculated by contrasting (i) Programme's total cost executed in five years, against (ii) Programme's financial benefits: (a) increased sales from apparent[1]/commercial loss recovery, estimated at TT$1,249 million (b) cost saving from physical[2] loss reduction, estimated at TT$559 million and (c) reduction in bad debt expenses to due improvements in the collection rate estimated at TT$739 million. As stated above, it is proposed that entire cost of the Programme be covered by an IDB loan (see Table 6 for these calculations. Also see Table 7 for the calculation of the benefits).

Table 6 compares the calculation of the IRR with the IDB loan and without the IDB loan (GoRTT using its own resources to implement the Programme).

[27] See more details in ANNEX 1 ANNEX 1 - FINANCIAL JUSTIFICATION OF THE PROGRAMME, PHASE I – STABILIZATION

Table 6. IRR calculations

	Notes	1	2	3	4	5	6	7	8	9	10
Programme cost (million TT$)	**A**	**415**	**439**	**444**	**435**	**402**	**-**	**-**	**-**	**-**	**-**
Summary of Programme financial bentifts											
Apparent loss recovery (million TT$)		3	33	63	94	124	155	179	194	202	202
Real loss reduction (million TT$)		3	11	34	53	64	74	78	80	81	81
Reduction in bad debt expenses (million TT$)		-	-	31	65	101	105	107	109	110	110
Total benefits (million TT$)	**B**	**6**	**44**	**128**	**212**	**289**	**334**	**364**	**383**	**393**	**393**
Cash flow (without IDB loan)	**C=B-A**	**(409)**	**(395)**	**(316)**	**(223)**	**(113)**	**334**	**364**	**383**	**393**	**393**
IRR (year 1 through 25)	**17%**										
IRR (year 1 through 10)	**5%**										
IDB loan disbursement (million TT$)	**D**	**415**	**439**	**444**	**435**	**402**	**-**	**-**	**-**	**-**	**-**
Debt service (million TT$)	**E**	**16**	**27**	**38**	**49**	**59**	**169**	**166**	**163**	**160**	**156**
Net cash flow (with IDB loan)	**F=C+D-E**	**(10)**	**18**	**91**	**163**	**230**	**164**	**198**	**220**	**234**	**237**

Table 7 shows the Programme's benefits in terms of the dollar amounts and volumes of apparent/commercial loss and physical loss recovery in cubic meters based on an average water tariff (across all customer types) of US$0.43 or TT$2.92 per cubic meter. The reduction in bad debt is also shown due to improvements in the collection rate.

Table 7. Programme benefits calculation

	Notes	1	2	3	4	5	6	7	8	9	10
Apparent loss recovery (million TT$)	**A=B*C**	**3**	**33**	**63**	**94**	**124**	**155**	**179**	**194**	**202**	**202**
Average water tariff (TT$/m3)	B	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92
Cumulative apparent loss reduction (million m3/year)	C	1	11	22	32	43	53	61	66	69	69
Apparent loss reduction from previous year (million m3/year)		1	10	10	10	11	11	8	5	3	-
Real loss reduction (million TT$)	**D=E*F**	**3**	**11**	**34**	**53**	**64**	**74**	**78**	**80**	**81**	**81**
Historical variable operational cost (TT$/m3)	E	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03
Cumulative real loss reduction (million m3/year)	F	2	5	17	26	31	36	38	39	40	40
Real loss reduction from previous year (million m3/year)		2	4	11	9	5	5	2	1	1	-
Reduction in bad debt expenses (million TT$)	**G=H*I**	**-**	**-**	**31**	**65**	**101**	**105**	**107**	**109**	**110**	**110**
Total revenue (million TT$)	H	720	750	780	811	841	872	896	911	919	919
Improved collection compared to baseline level (%)	I	0%	0%	4%	8%	12%	12%	12%	12%	12%	12%
Estimated collection rate	Baseline	85%	85%	89%	93%	97%	97%	97%	97%	97%	97%

Figure 7 shows that the sum of the benefits (apparent loss recovery, real loss recovery and reduction in bad debts) more than adequately cover the debt service for the repayment of the loan.

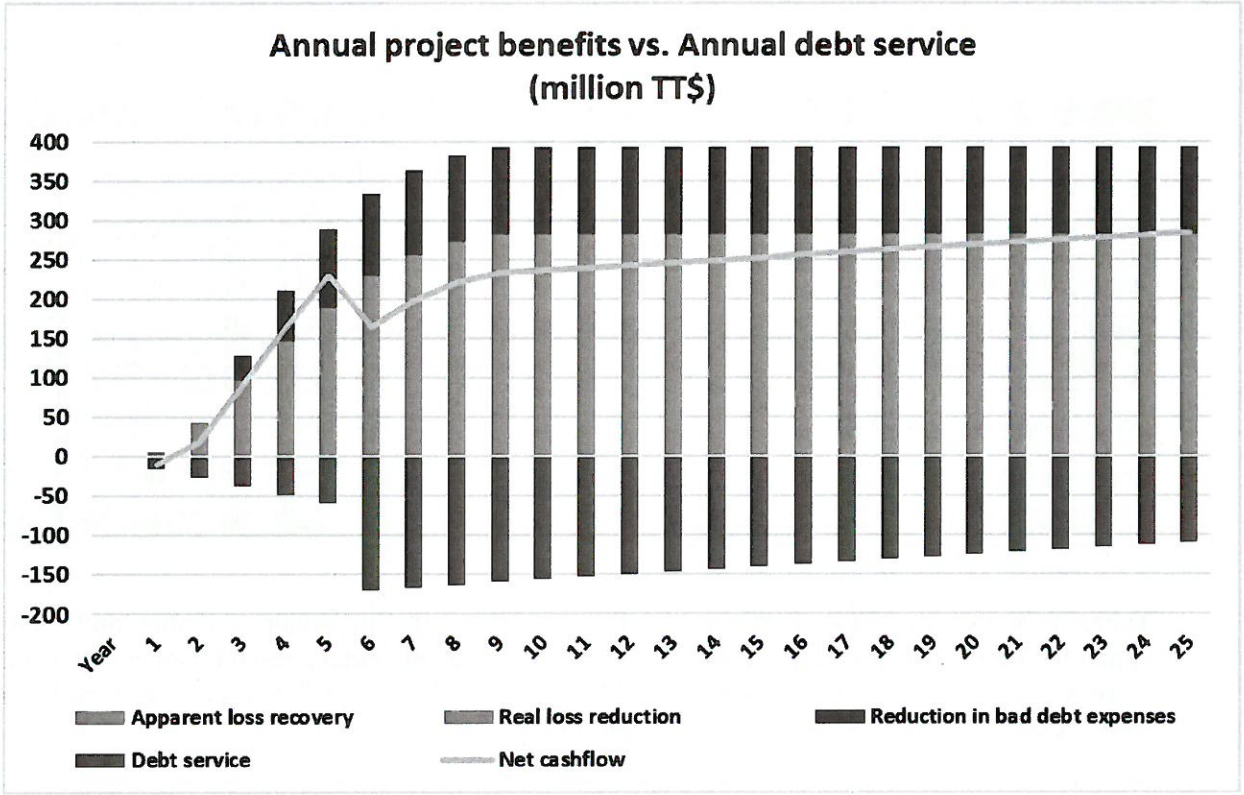


Figure 7 Annual Programme Benefits vs Annual debt Service for the Loan

- ***Programme's impact on WASA's financials.*** With the Programme, WASA's EBITDA improves from negative TT$1,663 million (or Operating Cost Recovery Ratio (OCRR) of only 30 percent) in the baseline year to negative TT$1,300 million (or OCRR of 41 percent) in year 10 (see Table 8 for WASA projected income statement and Table 9 for the projected cash flow statement). In the absence of tariff adjustments, EBITDA will remain negative. It is also noted that the Programme does not contemplates reduction in the number of employees per thousand connections. An earlier study [28] proposed an efficient level of employees as 8 per thousand connections. The difference between this level and the current level (12 per thousand connections) has a cost implication on the annual OPEX by TT$418 million.

Table 8. WASA projected income statement (without tariff adjustments)

	Baseline	1	2	3	4	5	6	7	8	9	10
Income Statement (million TT$)											
Total revenue	724	717	720	750	780	811	841	872	896	911	919	919
Expenditure before dep&amrt	2,339	2,380	2,377	2,374	2,324	2,276	2,234	2,225	2,221	2,220	2,219	2,219
EBITDA	(1,615)	(1,663)	(1,657)	(1,624)	(1,544)	(1,465)	(1,392)	(1,352)	(1,325)	(1,309)	(1,300)	(1,300)
Margin (in %)	*-223%*	*-232%*	*-230%*	*-216%*	*-198%*	*-181%*	*-165%*	*-155%*	*-148%*	*-144%*	*-141%*	*-141%*
Other items incl. financial expenses	(458)	(393)	(405)	(438)	(472)	(505)	(537)	(559)	(548)	(538)	(528)	(518)
Surplus/(def) bef GORTT related items	(2,073)	(2,056)	(2,062)	(2,062)	(2,016)	(1,970)	(1,929)	(1,912)	(1,873)	(1,846)	(1,827)	(1,817)
Government subventions	1,858	2,056	2,062	2,062	2,016	1,970	1,929	2,018	1,980	1,953	1,934	1,924
Net surplus/(def)	(215)	-	-	-	-	-	-	107	107	107	107	107

[28] CASTALIA, Benchmarking study prepared for the Business Plan and Price Control Proposal for WASA: 2019-2024 (July 2019)

Table 9. WASA projected cash flow statement (without tariff adjustments)

Statement of Cash Flows (million TT$)		Baseline	1	2	3	4	5	6	7	8	9	10
Net surplus/(deficit)	A	(2,056)	(2,062)	(2,062)	(2,016)	(1,970)	(1,929)	(1,912)	(1,873)	(1,846)	(1,827)	(1,817)
Dep&amort, and other adjustments	B	234	230	252	275	298	319	338	329	322	316	309
Before subventions & WC changes	**C=A+B**	**(1,822)**	**(1,832)**	**(1,809)**	**(1,741)**	**(1,673)**	**(1,610)**	**(1,574)**	**(1,544)**	**(1,524)**	**(1,512)**	**(1,508)**
Government subventions	D	2,056	2,062	2,062	2,016	1,970	1,929	2,018	1,980	1,953	1,934	1,924
Working capital (WC) changes	E	17	4	(23)	(23)	(23)	(21)	(19)	8	7	7	7
Net cash from operation	**F=C+D+E**	**251**	**234**	**230**	**252**	**275**	**298**	**426**	**445**	**436**	**429**	**422**
Net cash outflow from investment	**G**	**(251)**	**(649)**	**(669)**	**(697)**	**(710)**	**(700)**	**(319)**	**(338)**	**(329)**	**(322)**	**(316)**
Net cash inflow from financing	**H**	**-**	**415**	**439**	**444**	**435**	**402**	**(107)**	**(107)**	**(107)**	**(107)**	**(107)**
Increase/(decrease) in cash	**I=F+G+H**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

- ***Impact on government subventions.*** IDB loan (principal and interest) repayment made from the Programmes financial benefits. Even if IDB loan repayment are included, sizable reduction of government subventions can be achieved, from TT$2,056 million[29] in the baseline year to TT$1,924 million in year 10. If the IDB loan repayment is subtracted, the amount of GoRTT subventions to WASA would be smaller, TT$1,768 million (see Table 9 for WASA projected cashflow statement, and Table 10 for evolution of government subventions).

Table 10. Government subventions breakdown (without tariff adjustments)

	Baseline	1	2	3	4	5	6	7	8	9	10
Government subventions	2,056	2,062	2,062	2,016	1,970	1,929	2,018	1,980	1,953	1,934	1,924
For operational cash shortfall	1,663	1,657	1,624	1,544	1,465	1,392	1,352	1,325	1,309	1,300	1,300
For IDB loan repayment	-	16	27	38	49	59	169	166	163	160	156
For financial expenses on existing debts	159	159	159	159	159	159	159	159	159	159	159
For asset replacement/rehabilitation need	234	230	252	275	298	319	338	329	322	316	309
Difference (other financing)	(0)	0	0	-	-	-	-	-	-	-	-

Table 11 summarizes the financial benefits of the Programme **without tariff adjustments**. Year 5 corresponds to the end of Phase I and Year 10 corresponds to the end of Phase II.

[29] In calculating this baseline figure for the government subventions, it is assumed that WASA will stop its heavy reliance on accounts payable growth. In recent years, WASA heavily depended on accounts payable growth to finance its cash shortfall, Between 2015 to 2018, accounts payable grew from $1,869 to $3,714 million (almost double) due to i) annual subventions to WASA being lower than the actual accrued need, and ii) unverified payables. .

Table 11. Financial indicators without tariff adjustments (in TT$ million)

Indicator	Baseline	Year 5	Year 10
Average water tariff per cubic meter (US$)	US$0.43	US$0.43	US$0.43
Collection rate (%)	85%	97%	97%
Programme benefit	-	289	393
Increased sales from apparent/commercial loss recovery	-	*124*	*202*
Cost saving from physical loss reduction	-	*64*	*81*
Reduction in bad debt expenses to due improvements in the collection rate	-	*101*	*110*
Revenue	717	841	919
OPEX excl. depreciation and amortisation	2,380	2,234	2,219
EBITDA	-1,663	-1,392	-1,300
Operating cost recovery ratio (%)	30%	38%	41%
Subventions	2,056	1,929	1,924
Of which amount for IDB repayment	-	*59*	*156*
Subsidy for WASA	2,056	1,870	1,768

Note: the baseline is constructed based on historical analysis of financial statements for 2016-2018. Year 5 is the end of Phase I and Year 10 is end of Phase II.

- ***Illustrative tariff-adjustment scenario.*** To illustrate a scenario in which WASA achieves self-sustainability, an alternative scenario with tariff adjustments (increases) is generated. This scenario enables the EBITDA to become positive in year 5 and the phasing out of government subventions by year 7 (see Table 12 for WASA projected income statement under this scenario). When the Programme benefits are considered, WASA's average water tariff needs to reach US$1.36 [TT$9.22] per cubic meter in the medium to long term (see Table 13 for illustrative tariff adjustments required for WASA self-sustainability). This can be positively evaluated, compared with a scenario without the Programme, under which required tariff level would be significantly higher at US$1.93 [TT$13.08] per cubic meter. The resulting tariff level of US$1.36 per cubic meter favourably compares with the "comparator utilities' US$2.34 [TT$15.87] per cubic meter[30]. It should be noted that service level improvements need to accompany tariff adjustments: otherwise, the public acceptability may not be forthcoming.

[30] CASTALIA, Benchmarking study prepared for the Business Plan and Price Control Proposal for WASA: 2019-2024 (July 2019). See Figure 15 of the Financial Annex 1.

Table 12. WASA projected income statement (with tariff adjustments)

	Notes	Baseline	1	2	3	4	5	6	7	8	9	10
Income Statement (million TT$)												
Total revenue	A	717	720	750	1,092	1,589	2,309	2,753	2,826	2,876	2,900	2,900
Expenditure before dep&amrt	B	2,380	2,377	2,374	2,359	2,330	2,278	2,281	2,279	2,279	2,278	2,278
EBITDA	C=A-B	(1,663)	(1,657)	(1,624)	(1,266)	(741)	31	472	547	597	622	622
Margin (in %)	*D=C/A*	*-232%*	*-230%*	*-216%*	*-116%*	*-47%*	*1%*	*17%*	*19%*	*21%*	*21%*	*21%*
Other items incl. financial expenses	E	(393)	(405)	(438)	(472)	(505)	(537)	(559)	(548)	(538)	(528)	(518)
Surplus/(def) bef GORTT related ite	F=C+E	(2,056)	(2,062)	(2,062)	(1,738)	(1,247)	(506)	(88)	(0)	59	95	105
Government subventions	G	2,056	2,062	2,062	1,738	1,247	506	88	0	-	-	-
Net surplus/(def)	H=F+G	-	-	-	-	-	-	-	-	59	95	105

Table 13. Illustrative tariff adjustments required for WASA self-sustainability

	Baseline	1	2	3	4	5	6	7	8	9	10
Average water tariff (TT$/m3)	2.92	2.92	2.92	4.09	5.73	8.02	9.22	9.22	9.22	9.22	9.22
Average water tariff (US$/m3)	*0.43*	*0.43*	*0.43*	*0.60*	*0.84*	*1.18*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*
Tariff increase		0%	0%	40%	40%	40%	15%	0%	0%	0%	0%

Table 14 summarizes the financial benefits of the Programme **with tariff adjustments**. Year 5 corresponds to the end of Phase I and Year 10 corresponds to the end of Phase II.

Table 14. Financial indicators with tariff adjustments (in TT$ million)

Indicator	**Baseline**	**Year 5**	**Year 10**
Average water tariff per cubic meter (US$)	US$0.43	US$1.18	US$1.36
Collection rate (%)	85%	97%	97%
Programme benefit	-	682	1,067
Increased sales from apparent/commercial loss recovery	-	*341*	*638*
Cost saving from physical loss reduction	-	*64*	*81*
Reduction in bad debt expenses to due improvements in the collection rate	-	*277*	*348*
Revenue	717	2,309	2,900
OPEX excl. depreciation and amortisation	2,380	2,278	2,278
EBITDA	-1,663	31	622
Operating cost recovery ratio (%)	30%	101%	127%
Subventions	2,056	506	-
Of which amount for IDB repayment	-	*59*	*156*
Subsidy for WASA	2,056	447	-

Note: the baseline is constructed based on historical analysis of financial statements for 2016-2018. Year 5 is the end of Phase I and Year 10 is end of Phase II.

3.5. Preliminary Schedule of the Programme, Phase I - Stabilization

Table 28 shows the preliminary schedule for the Programme, Phase I – Stabilization and summarized below:

1) **Baseline Studies and Development of Smart Tools** commences in Q2 of 2020 and is completed in Q4 2024;
2) **Water Distribution Network Optimization and Rehabilitation** from Q2/3 of 2020 to Q2 of 2024; leak survey and repair fast tracked to commence in Q1/2 of 2020. WASA can start with its own resources.
3) **Universal Metering** from Q2/3 of 2020 to Q4 of 2024; based on GoRTT's priority, preparatory studies and preparation of tender documents for this package can start in Q1 of 2020 supported by a Technical Cooperation. It is estimated that Universal Metering will take 5 years to implement.
4) **Commercial Strengthening** from Q2/3 of 2020 to Q3 of 2024;
5) **Existing Wellfield Assessment, Rehabilitation and Automation** from Q2/3 of 2020 to Q4 of 2023; this component is planned to be fast tracked to support Phase 0-A Dry Season Emergency Actions.
6) **Multi-Purpose Flood Mitigation and Water Supply Reservoir at Ravine Sable Sand Pit, Caparo** from Q2/3 of 2020 to Q4 of 2024.
7) **Governance, Policy and Institutional Reformulation and Systemwide Change Management** from Q2/3 of 2020 to Q4 of 2023.

It is important to ensure during the 2020 Dry Season Emergency Actions, that any water into supply by means of well development and/or rehabilitation of water works in localized areas of water scarcity is accompanied by hydraulic modelling and focused and aggressive leak detection and repair. The followed actions can be fast tracked and commenced in Q1/2 of 2020:

- Development of Analytical and Management tools – Hydraulic Models and GIS/Asset Management GIS;
- Regional Assessment of Intermittent Supply;
- Smart Water Balance, Analytics and Information Management;
- Leak Survey and Repair by WASA; and
- Existing Wellfield Assessment, Rehabilitation and Automation.

Table 28 Preliminary schedule for the Investment Programme under Phase I – Stabilization

Proposed Action	Duration, Days	Start Date	Finish Date	2020				2021				2022				2023				2024			
				Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Baseline Studies and Development of Smart Tools																							
Development of Analytical and Management tools – Hydraulic Models and GIS/Asset Management GIS	182	3-Feb-20	3-Aug-20																				
Customer Consumption Assessment and Metering Pilot Test	182	3-Feb-20	3-Aug-20																				
Regional Assessment of Intermitent Supply	182	3-Feb-20	3-Aug-20																				
Smart Water Balance, Analytics and Information Management	1,232	10-Aug-20	25-Dec-23	Modules 1					Modules 3 to 7														
Water Distribution and Network Optimization and Rehabilitation																							
Production Metering and SCADA Assessment, Procurement and Installation	182	3-Feb-20	3-Aug-20																				
Leak Survey and Repair Contracting	1400	9-Mar-20	8-Jan-24																				
Planning, Implementation and Operation of DMAs/PMAs	1274	22-Jun-20	18-Dec-23																				
Universal Metering																							
Customer Metering Assessment & Procurement	161	3-Feb-20	13-Jul-20																				
Non-Domestic Meter Implementation	728	29-Apr-20	27-Apr-22																				
Universal Domestic Metering Implementation	1554	29-Sep-20	31-Dec-24																				
Commercial Strengthening																							
Universal Metering Business Case Evaluation	60	24-Jun-20	23-Aug-20																				
Assessment and Recommendations of Tariffs	364	26-Feb-22	25-Feb-23																				
Public Relations and Educational Campaigns	1554	29-Sep-20	31-Dec-24																				
PPP Contracting Assessment and Procurement	546	28-Sep-21	28-Mar-23																				
Existing Wellfield Assessment, Rehabilitation and Automation																							
Existing Wellfield Assessment, Rehabilitation and Automation	1274	24-Jun-20	20-Dec-23																				
Multi-Purpose Flood Mitigation and Water Supply Reservoir at Ravine Sable Sand Pit, Caparo	1554	29-Sep-20	31-Dec-24																				
Governance Policy and Institutional Reformulation																							
Institutional Strengthening and Change Management	1204	3-Feb-20	22-May-23																				

Regualr activity of the Actio Plan

3.6. Action Plan and Business Model

IDB recommends applying the Smart Business Model to guide in the achievement of the objectives stated above. The Smart Business Model (SBM) approach, shown below in Figure 12 would transition WASA from existing conditions of poor water accountability to a future that is guided by the implementation of the Smart Water Balance (SWB).

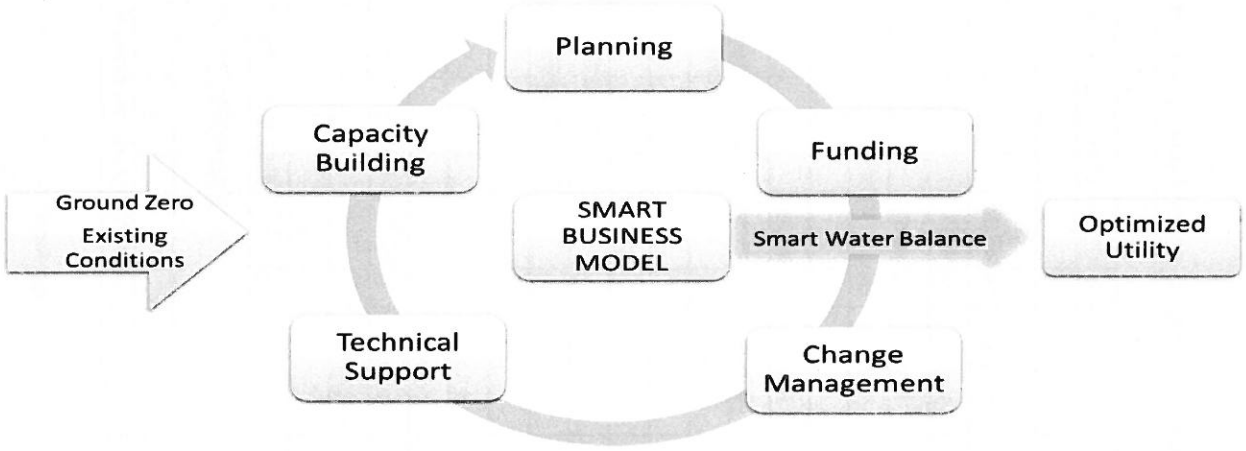


Figure 12 - Conceptualization of the Smart Business Model

The SWB is a process driven by Smart Water Infrastructure Technologies (SWIT) and innovation that is improved incrementally with knowledge acquired through its phased progression, and iterative process of change management, capacity building, technical support, proper funding, and fact-based operational policies. The SWB process generates a common database that can be used, in a timely manner, for planning, pro-active operations, and short and long-term decision making.

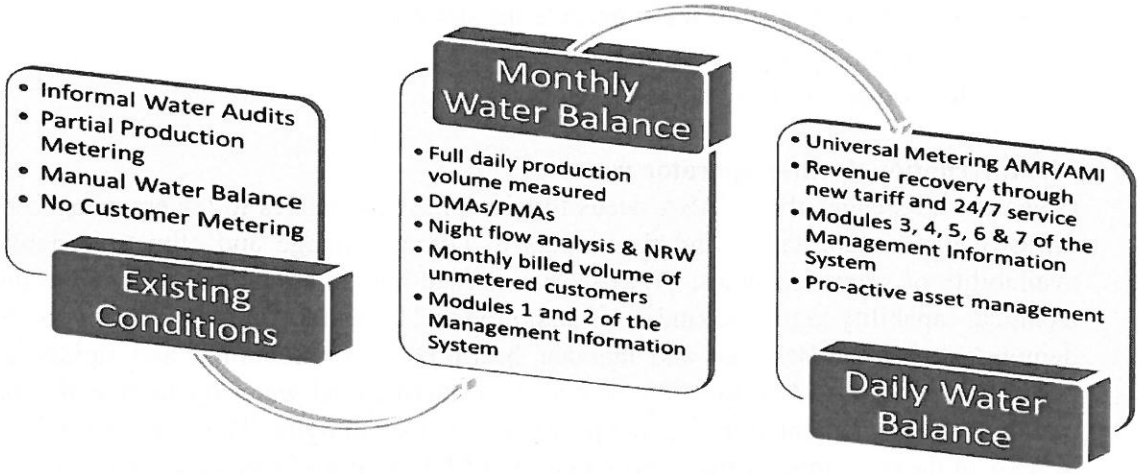


Figure 13 - Conceptualization of the Smart Water Balance

Along with the main interventions previously mentioned, the SBM advances the water balance cycle and the automated management of information. Figure 13 presents a conceptual visualization of the SWB starting from where WASA is now to the future by improving and repairing obsolete and non-functional monitoring devices and creating and integrated management information system (MIS). It will allow WASA to move from the existing status-quo of decentralized management.

Based on the five principles of the SBM a proposed approach to improve WASA's existing conditions is described in the following paragraphs.

Planning the Integration of SWIT and Innovation

It is important to recognize that different types of innovation and SWIT are arriving at different sectors of water utilities and that this trend will continue in the coming decades. Therefore, now is an opportune time to establish a Smart Business Model that provides the step-by-step integration strategy for WASA. The Action Plan proposes that the SBM be implemented within the next 10 years in two phases: Stabilization (2020-2024) and Optimization and Maintenance (2025-2029). Disregarding the planning and integration of SWIT may result in dysfunctional operations and costly do-overs due to deployment of incompatible technologies. A suggested guidance for a Business Model is outlined in the following steps:

- Identification of drivers for changing existing conditions
- Definition of problems or issues that need to be resolved such as management/policies, technical and engineering, and training
- Formulating possible alternative solutions to each problem or issue by category

- Analyzing alternative funding mechanisms for implementing the selected options
- Developing a strategy that integrates solutions
- Assigning responsibilities to execute the strategy
- Implementing the strategy in phases,
- Monitoring progress and adjusting as needed.

The international water operator water

Given the challenges that WASA needs to overcome as it relates to governance, accountability, infrastructure rehabilitation and the threats of climate change and climate variability on the availability of water resources, WASA lacks trained human resources, systems, technology and technical capability to turn around itself and provide 24/7 water supply to consumers. As has been demonstrated in the Bahamas and Jamaica, best practice to modernize and rapidly improve the performance of WASA is to bring on board an international water operator with experience in planning and implementation of water programs and technologies. There are manifold benefits for WASA in these arrangements: rapid reduction of NRW; transfer of expert knowledge and know how; smart water infrastructure technology transfer; flexible and more agile procurement; accountability for results due to performance-based remuneration; formal education or targeted training of staff and guidance in operations and maintenance and strategic management in the water sector. Engaging a highly competent, transparently selected water operator on a performance-based arrangement will also address WASA's operational and implementation weakness and ensure the Plan achieves and sustains its objectives within budget and schedule.

The NRW Reduction projects in New Providence, Bahamas, and Kingston, Jamaica, are good examples of stabilization of the water supply network utilizing a dedicated contractor in line with these steps. In both cases the water utility struggled with keeping NRW at manageable levels and found it necessary to apply effort to define the problem, which was identified as high NRW, and formulating strategies to address this problem. In The Bahamas a performance-based[31] contract was entered into between the Water and Sewerage Corporation (WSC) and a water company to reduce NRW from the established baseline of 57% to the specified target of 30%, and to assist with maintaining low level of NRW. The total project cost was reported as US$83 million and total benefit US$174 million giving a Benefit/Cost ratio of 2.1 and payback period of 9.6 years[32].

In Jamaica, the contract between the National Water Commission (NWC) and the water company is a Co-management Contract with performance-based features. The co-management aspect is NWC's approach to dealing with the need to keep NRW at manageable levels after the project. In both cases, having sound baseline information on the state of the water supply network was critical for contracting to ascertain the before-the-project situation, setting the target, and monitoring of the achievement of the target. Due to the complexity of reducing NRW and giving considerations to the state of the assets and maintenance practices, both utilities found it more cost effective to contract a water company to provide dedicated effort to address the problem of NRW. In addition,

[31] Whereby payment is based on achievement of specified targets over time.

[32] IDB, Water and Sanitation Division, TECHNICAL NOTE Nº IDB-TN-813, Case Study: Performance-based Contract for NRW Reduction and Control, New Providence, Bahamas (January 2018)

the water company brought expertise for use of technology and assist with modernizing the operation of the utility.

"Performance-based contracts can, under conditions delineated in this document, be a very effective, and, ultimately, cost-efficient mechanism for implementing NRW projects. The case of the PBC in New Providence, Bahamas is a very good illustration of the attributes and benefits of a well-designed PBC – 1) baseline study and target/plan adjustment period; 2) a "minimum scope" combined with flexibility for the contractor to adjust specific plans to the evolving situation, to both exceed targets and receive additional performance-based remuneration; 3) rapid NRW reduction, with its technical, financial and political benefits and results; 4) reduced project risk for the utility; 5) a lengthy maintenance phase to promote sustainability of the NRW reductions and 6) overall improvement of technical and financial performance at a competitive price"[33].

Funding

The action plan needs to evaluate and select funding mechanisms for improvements and other capital expenditures that WASA needs during the 10-year planning period. This is a role for MPU and MOF.

Change Management

An aspect of change management is making the best use of the people that will successfully deliver the implementation of WASA's Smart Business Model. This can be accomplished through culture change, leadership, assigning responsibilities and accountability, cross-business integration, change processes and teamwork for project delivery. It is important to develop a "Turnaround Roadmap" for WASA and to include specific policies and responsibilities. This would be done by the MPU in conjunction with WASA's Board.

The key elements of the Turnaround Roadmap are to define the specific roles of the utility personnel and devise an implementable and functional operations plan. This will include a top-down institutional review of key positions of the utility. Given that the Authority operates in a unionized environment, consultation is necessary with the three (3) bargaining unions.

[33] IDB, Water and Sanitation division, TECHNICAL NOTE Nº IDB-TN-813, Case Study: Performance-based Contract for NRW Reduction and Control - New Providence, Bahamas, (January 2018)

4. IMPLEMENTATION ARRANGEMENTS

The MPU as the ministry responsible for the water and wastewater sector, will lead the implementation of the Action Plan and guide WASA's transformation. Given the myriad issues and challenges affecting WASA's ability to provide adequate water supply service to Trinidad and Tobago, as discussed in Section 2. Key Challenges Facing WASA, transforming the Trinidad and Tobago water sector and restructuring WASA is a matter of urgent national priority. The MPU is committed to lead this transformation process and WASA's restructuring.

It is recognized that the root cause of the issues and challenges inhibiting WASA's performance to provide reasonable water supply service is poor governance and management arrangements. That is, there has not been a consistent focus on WASA's accountability for the resources allocated that would ensure efficiency, productivity, and financial sustainability of the utility. Concomitantly, WASA has become dependent on financial allocations without performance targets to account for its use of the resources, which is, to some extent, evident by the backlog of annual audited financial statements and the fact that despite an annual subsidy of more than $2.5 billion for operating and capital expenses, the country still has not been able to receive continuous and reliable service.

The proposed intervention by the IDB to assist the Government to improve the situation of water supply in Trinidad and Tobago, therefore, must be more than fixing the water supply infrastructure and continuing business as usual, and needs to provide for WASA's organizational restructuring and accountable performance management. There is also the need to provide for increasing WASA's revenue stream and improve its customer relationship through increased efficiency and transparency. Given these high-level needs, which are dependent on proper policy guidance, the onus is indeed on the MPU, with the full support of the Cabinet, to lead a process of transformation of the water sector of Trinidad and Tobago and the restructuring of WASA.

On the assumption that the Republic of Trinidad and Tobago will take a loan from the IDB for improvement of its water supply, and given the foregoing justification, it is recommended that the MPU be the lead agency for the loan operation. For discussion purposes, Figures 14a and 14b below illustrate two possible organizational arrangements for the implementation of the operation. To start this process of transformation, it is recommended that the MPU engage WASA, MPD and the Ministry of Finance in a workshop to agree on this transformation process and confirm the role of each one of the key stakeholders in the transformation process. The IDB is willing to broker the working session to arrive at consensus on the execution agreement between the parties.

The MPU's role, based on a Cabinet Directive, should be policy resetting and overall guidance of the transformation process; WASA will have responsibility to adopt operational improvement practices through the transformation process; and the Ministry of Finance will approve and allocate the financial resources. Unless this agreement/ commitment is in place, this initiative is likely to become another failed attempt at transforming WASA. Therefore, such roles and responsibilities with the associated targets, once agreed, can be included in the prospective loan operation. Indeed, unless the transformation of WASA has the full backing of the GORTT, such transformation will be unsuccessful.

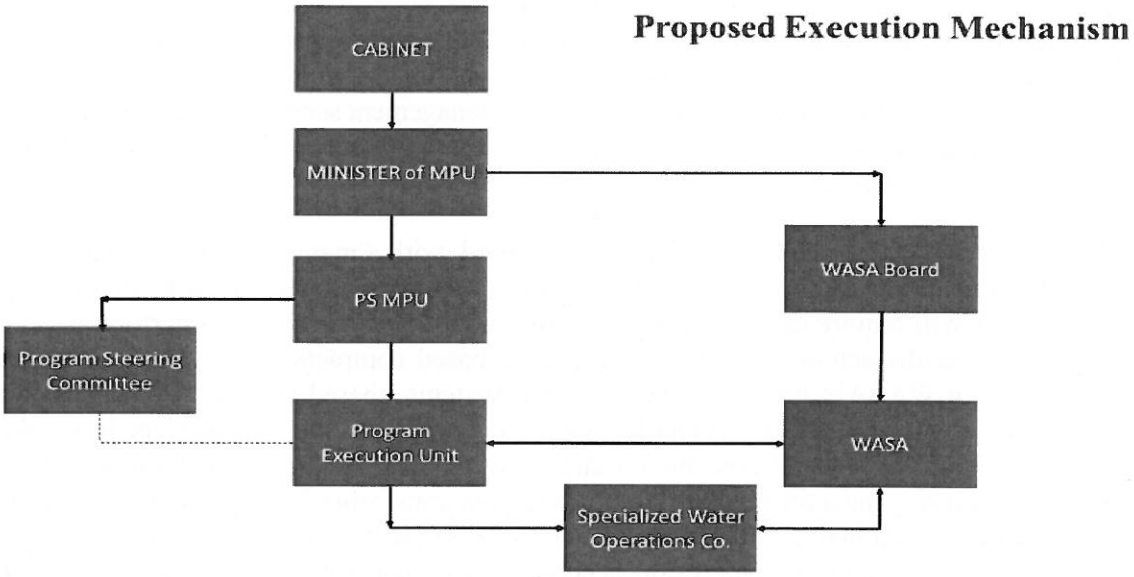


Figure 14a Proposed Execution Mechanism

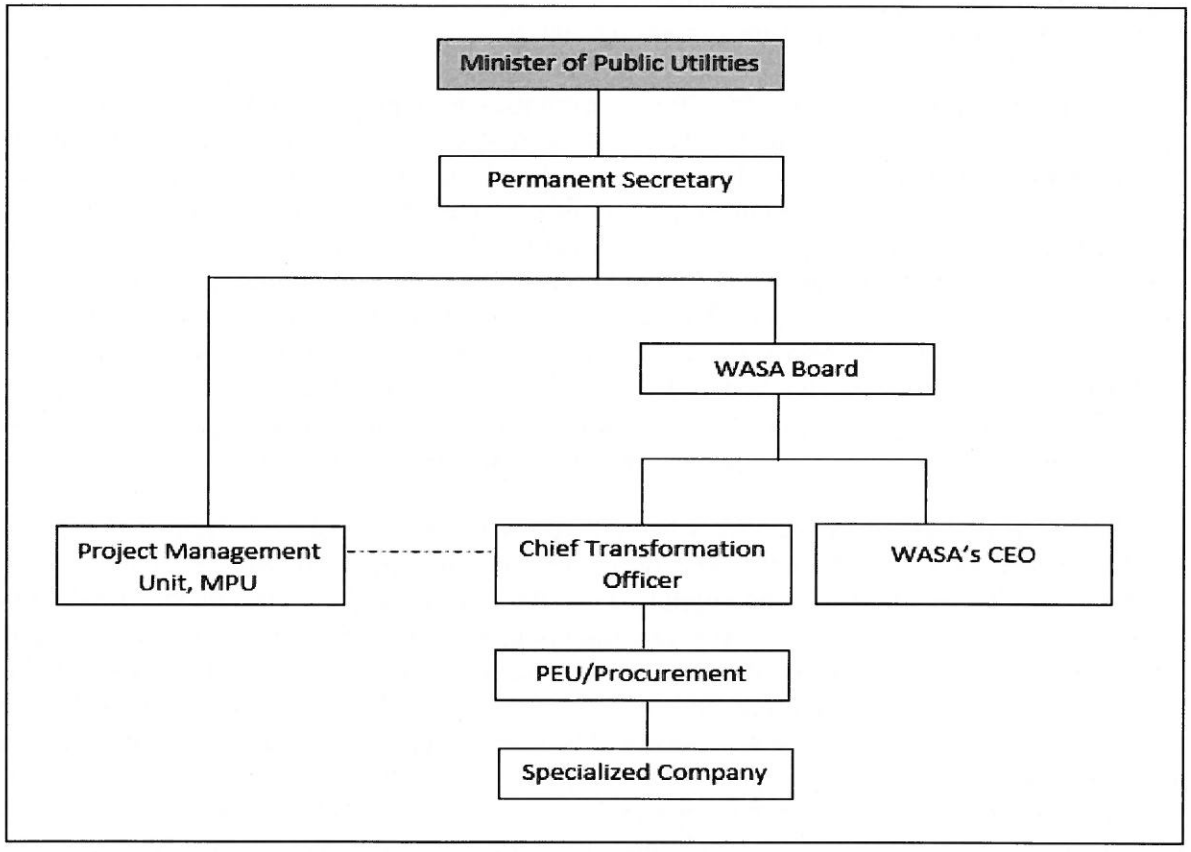


Figure 14b Alternative Execution Mechanism

The MPU will have the responsibility of the transformation of WASA at two of the three levels – the Board and within the enabling institutions that support sector governance. The specific responsibilities of the PEU as an instrument of the MPU, can be further defined in the Turnaround Roadmap. Conceptually, the PEU will support the Minister with setting and monitoring of the policy mandate against a pre-agreed performance management scorecard. In addition, the PEU can support the recommendation to the Minister of the requisite skills on the Board to enhance governance over WASA.

At the other level, it is recommended that the Board, with a mandate from Cabinet, oversees the social and cultural transformation of WASA within the period of the Stabilization Phase (2020 – 2024). This will require creating an organization with the know-how and performance culture to sustain the results achieved via the performance-based contracts, as well as reengineering and reconfiguring WASA's strategy, structure, staff, systems, shared values, etc. It is recommended that the CEO with assistance from an HR Executive or CTO if the stakeholders decide that one is required, should be made responsible for championing WASA's transformation. The Board, CEO and HR Executive must then build a strong executive transformational team to i) ensure alignment of strategic, operational and transformational goals across WASA from the Board through to the most junior level; and ii) deliver results according to a pre-agreed Turnaround Roadmap inclusive of a clear and measurable performance management scorecard requiring accountability related to technical, operating, financial targets (e.g. NRW, 24/7 water, revenue, expenses, etc.) with timelines. The CEO and HR Executive supported by the Management team will have to proactively and constructively, engage with the unions, the employees, the regulators, stakeholders, etc. to minimize disruption during the transformation journey.

Recognizing that the MPU also is resource-constrained and requires the know-how and capacity to provide the necessary oversight of WASA and the transformation process, the IDB recommends that the MPU establish a dedicated Program Executing Unit (PEU), which will be comprised at a minimum of a Programme Manager, a policy/institutional specialist, two engineers, a communications specialist, a procurement specialist, a legal specialist, and financial specialist. This team could be a composite of individual consultants. The PEU, working together with the Board of WASA, will be responsible for implementation of the Governance, Policy and Institutional Reformulation; and working together with WASA's Management and Operations and an international water operator water, the Infrastructure Rehabilitation and improvement of operations. This implies a type of co-executing arrangement with MPU taking the lead. This co-executing arrangement will be agreed upon and included in the loan operation.

The PEU will be headed by the PM, who will report to the Permanent Secretary of MPU for institutionalization of the reforms. The policy/institutional specialist will be responsible for charting the change process to be supported by the loan operation. The engineers will have competency in water infrastructure operation including, pressure management, leak detection and repair, service monitoring, NRW reduction and mechanical equipment and will be responsible for the review of designs, monitoring and site supervision of the works and activities of the programme. The communications specialist will be responsible for preparing key public messages and communications with the public and ensure that the public is kept abreast of WASA's restructuring and the transformation process in general. The procurement specialist will be responsible for procurement. The legal specialist will be responsible for the policy and legal

matters of the programme, and the financial specialist for accounting and financial management functions.

In order to establish the smart water balance and the analytical and management tools, an international water operator water will be contracted on a Performance Based Contract for NRW Reduction, leak detection and repairs, planning and implementation of DMAs and to support and mentor the MPU, PEU, and WASA within the context of the overall transformation process and infrastructure rehabilitation. The MPU has indicated that they want to prioritize Universal Metering as this can be done via a separate performance-based contract.

It is recommended that the PEU's specific responsibilities will include: (i) implementation, coordination and support of the preparation of the Pluriannual Execution Plan (PEP) and Annual Operating Plans (AOP) for the overall transformation process; (ii) preparation of budgets, Programme accounting, and preparation of requests of advances of funds from the IDB; (iii) preparation of the Programme's procurement plan, the carrying out of the procurement of goods, works and the contracting of consulting services for the Programme; (iv) coordinating the preparation of technical reports and the preparation of periodic and end-of-year financial reports; (v) monitoring the progress of Programme activities and analyzing variances of actual results against plans; (vi) contracting the external auditor and ensuring that the recommendations are implemented; (vii) contracting the external evaluation consultant and ensuring that the recommendations are implemented and (viii) serving as a liaison for the programme with the Bank.

The Programme will be executed following the AOPs that will include for each programed annual activity: its goals, terms of reference, budget, source of funding, and responsibility for its execution. The PEU will hold monthly meetings to ascertain progress of implementation that will include WASA's Chair and CEO.

Additionally, if deemed necessary, a Programme Steering Committee (PSC) will be established with representatives from WASA, Ministry of Finance, Ministry of Planning, the EMA, the WRA, and the MPU who will chair the PSC. It is recommended that Civil Society also be represented on the PSC to assure public disclosure. The PSC will be responsible for review and approval of the PEP and AOP that will guide the annual implementation plan. The PSC will also be responsible for addressing any bottle-neck issues that arise during project execution.

Procurement: The procurement of works, goods and consulting services will be conducted in accordance with the Bank's procurement policies and procedures. A key procurement will be to contract an international water operator water that can assist the MPU with transformation of Trinidad and Tobago's water sector and restructuring of WASA. Specifically, this international water operator water will: (i) provide advice to MPU and the PEU on water sector policy reform and reorganization of WASA; (ii) conduct baseline studies and develop SMART tools; (iii) implement water distribution network optimization and rehabilitation, NRW Reduction; (iv) conduct wellfield rehabilitation assessment and automation; and (v) train and mentor WASA's staff in technical and commercial operations and adoption of a new business model.

Regarding the distribution network optimization and rehabilitation, the contract with the international water operator water will be a form of co-management with WASA and performance based for NRW reduction. WASA will be responsible to assign personnel to engage in distribution network optimization and rehabilitation activities and training. Along with the procurement specialist and WASA assigned personnel, the international water operator water will be responsible to update and define the procurement needs that will inform the procurement plan. Because of the technical nature of NRW reduction, the international water operator water will have the overriding vote should there be any differences of opinion on technical solutions, equipment needs and schedules for NRW reduction.

Regarding the implementation of Universal Metering, there are two options that can be decided upon: WASA's crews and a competitively procured supply/install meter contractor. While WASA's crews can be used to install the meters, the cost of their 5-man crew is on the high side when compared to the cost of meter installation in the region. Given international bidding experiences that validate the unit cost used for the estimates in this Brief, we suggest we maintain the estimated cost for meter installation as it is. (It is assumed that an external contractor for meter installation would work in the form of two-person teams.) During the detailed preparation of the loan, we will analyze how to possibly take advantage of WASA's internal human resources that may be made available for this activity to further reduce its cost.

Universal Metering is expected to be implemented by Operational Zones or Regions and can be independent of the NRW programme, but ideally, these should be complementary in order to achieve the full benefit of NRW savings. A consultant would be hired to prepare the tender package and provide technical advice during the evaluation and selection process of the Universal Metering contractor. The funding for this consultant can be by way of a Technical Cooperation. This consultant would have to be contracted at least by the end of Quarter 1 of 2020 to begin the assessment and preparation of the tender documents. By Quarter 2/3 of 2020, the Universal Metering contractor would have been identified and possibly contracted. This is all contingent on receiving a letter of request for the TC and Loan from the GoRTT through the MPD.

Monitoring: The PEU will be responsible for monitoring the performance and progress of Programme execution. Monitoring will be against the Programme's result matrix that will establish the baseline and the projected annual targets of the Programme. The PEU will collate monthly status reports on the progress of the Programme. The PEU will submit to the IDB and Cabinet two semi-annual progress reports throughout the life of the Programme execution, within 90 days after the end of the calendar year or half year. Additionally, with Bank's resources, independent evaluators will be hired to conduct a midterm and final evaluation of the Programme.

ANNEX 1 - FINANCIAL JUSTIFICATION OF THE PROGRAMME, WITH AND WITHOUT TARIFF INCREASE, PHASE I – STABILIZATION

I. Historical Analysis

a. Income Statement

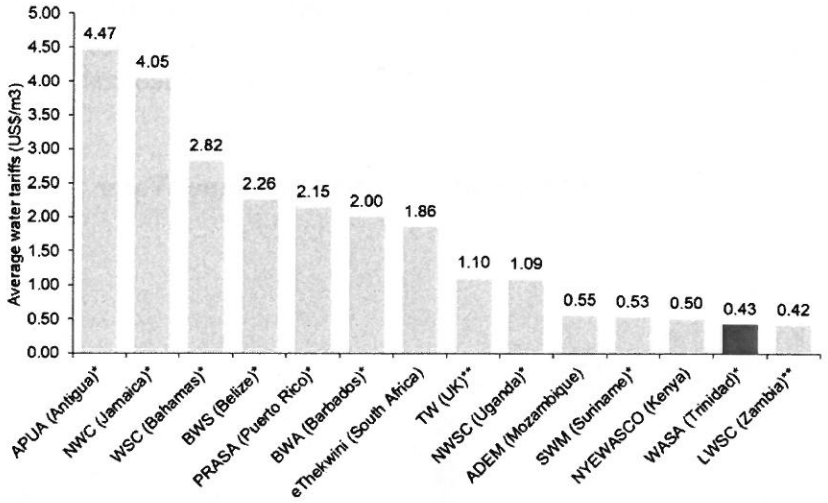
During the period of this historical analysis (2016-2018), the company's operating revenue has been far from sufficient to cover its operational expenditures even before depreciation and amortisation. WASA's Earnings before Interest, Tax and Depreciation and Amortisation (EBITDA) margin averaged negative 211% during this period.

Table 29 WASA's Income statement 2016-2018

	2016	2017	2018
Income Statement (million TT$)			
Revenue			
Water revenue	728	659	653
Sewer and other	64	65	64
Total revenue	**792**	**724**	**717**
Expenditure			
Salaries and wages	(1,201)	(1,243)	(1,251)
Desalinated water purchase	(505)	(530)	(523)
Provision for bad debt	(46)	(49)	(57)
Other	(511)	(517)	(498)
Expenditure before dep&amrt	**(2,263)**	**(2,339)**	**(2,329)**
EBITDA	***(1,471)***	***(1,615)***	***(1,612)***
Margin (in %)	***-186%***	***-223%***	***-225%***
Depreciation & amortisation	(239)	(250)	(251)
Total expenditure	**(2,501)**	**(2,589)**	**(2,580)**
Op. surplus/(deficit)	**(1,709)**	**(1,865)**	**(1,863)**
Financial expenses	(238)	(208)	(193)
Surplus/(def) bef GORTT related items	**(1,947)**	**(2,073)**	**(2,056)**
Margin (in %)	**-246%**	**-286%**	**-287%**
Government subventions	2,151	1,858	1,804
Net surplus/(def) aft GORTT related items	**203**	**(215)**	**(251)**

WASA's total revenue declined from TT$792 million in 2016 to TT$717 million in 2018. While this decline may have been affected by the roll-out of the new billing system in 2017, an important factor that is contributing to the lack of operational revenue is the level of tariff. WASA's tariff is well below comparator utilities, at an average US$0.43 per cubic meter: WASA had the second lowest average water tariff of all the benchmarked utilities, according to a benchmarking analysis conducted by CASTALIA (2019) for the preparation of the Business Plan and Price Control Proposal for WASA (Figure 15). The average tariff for the Caribbean benchmarked utilities is US$2.34 per cubic meter.

Figure 15 Average Water Tariffs US$

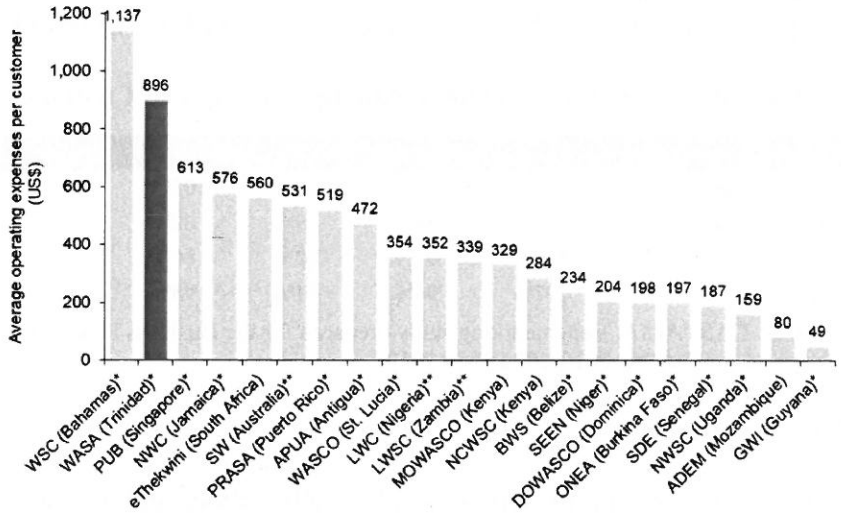


Note: * national utility; ** regional utility; no asterisk local utility. Blue shaded bar indicates WASA.

Source: CASTALIA, Benchmarking study prepared for the Business Plan and Price Control Proposal for WASA: 2019-2024 (July 2019)

During the same period, WASA's operational expenditures before depreciation and amortisation showed a slight 3 percent increase. Salaries and wages and Desalinated water purchasing cost together represent 76 percent of such expenditures. On the operational cost, the same benchmarking analysis reveals that WASA is among the utilities with highest annual operating cost per customer per year (US$896), suggesting that WASA has significant room for improving its efficiency (Figure 16). The average for Caribbean utilities is US$495.

Figure 16 Operating Cost per Customer per Year

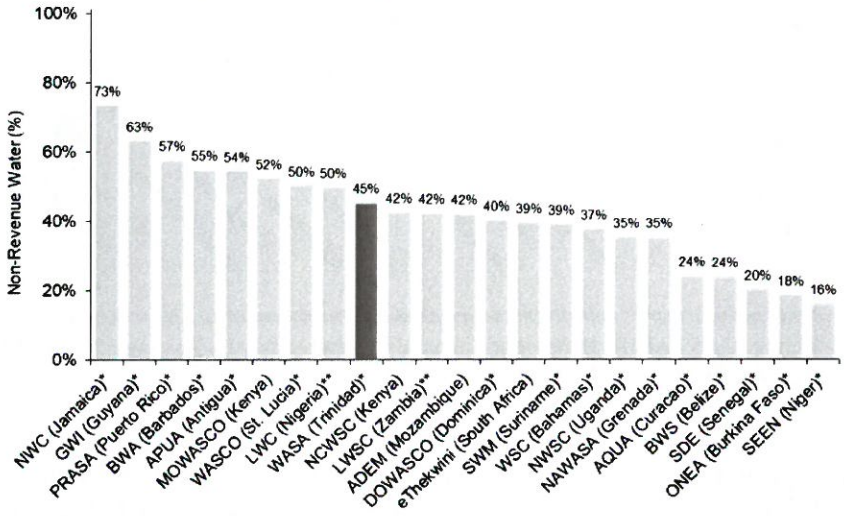


Note: * national utility; ** regional utility; no asterisk local utility. Blue shaded bar indicates WASA.

Source: CASTALIA, Benchmarking study prepared for the Business Plan and Price Control Proposal for WASA: 2019-2024 (July 2019)

WASA's Non-Revenue Water (NRW) level is estimated to be around 40 to 50 percent (the mid-point of this range is used in the figure), and peer utilities such as Belize Water Services have achieved a much lower NRW ratio. Reduction of NRW presents WASA a great opportunity to increase revenue, through commercial loss reduction, and to reduce cost, through physical loss reduction (Figure 17).

Figure 17 Percentage of Non-Revenue Water



Note: * national utility; ** regional utility; no asterisk local utility. Blue shaded bar indicates WASA.

Source: CASTALIA, Benchmarking study prepared for the Business Plan and Price Control Proposal for WASA: 2019-2024 (July 2019)

Another area that requires attention is the collection rate, WASA's collection rate—defined as cash collections divided by billed revenue. The table below indicates that the collection rate fell to 85% in 2017, and it was even lower for customer categories other than industrial metered customers. An efficient level was defined to be 97% in the Business Plan and Price Control Proposal.

Table 30 Percentage Collection Rate by Category of Customer

Customer Category	2013	2014	2015	2016	2017	Average
Industrial, Metered	101%	98%	100%	102%	100%	**100%**
Residential, Unmetered	88%	84%	79%	82%	76%	**82%**
Other	100%	97%	88%	89%	71%	**89%**
Average	**97%**	**94%**	**91%**	**93%**	**85%**	**92%**

Source: CASTALIA, Benchmarking study prepared for the Business Plan and Price Control Proposal for WASA: 2019-2024 (July 2019)

b. Cashflow statement

WASA's net cashflow from operating activities before subventions and working capital changes has been negative TT$1,763 million on average during 2016-2018. This required huge government subvention (annual average TT$1,938 million) and generation of cash from working capital

changes (annual average TT$479 million), for WASA to be able to cover all the cash requirements, from operating, investing and financing activities.

On average during the period of historical analysis, WASA invested TT$384 million. Meanwhile, there was not any significant new debt financing, and the net cashflow from financing activities was negative TT$230 million.

Table 31 Statement of Cash Flows

	2016	2017	2018
Statement of Cash Flows (million TT$)			
Cash flow from operating activities			
Net surplus/(deficit)	(1,947)	(2,073)	(2,056)
Depreciation and amortisation	239	250	251
Before subvention and working capital changes	(1,814)	(1,920)	(1,556)
Government subventions	2,151	1,858	1,804
Working capital changes	251	527	657
Net cash from operating activities	588	465	906
Cash flow from investing activities			
Investment	(238)	(475)	(439)
Net cash outflow from investing activities	(238)	(475)	(439)
Cash flow from financing activities			
Capital funding and loans	(137)	(121)	(432)
Net cash inflow from financing	(137)	(121)	(432)
Increase/(decrease) in cash and cash equivalents	213	(130)	35

c. Statement of financial position

WASA's net current asset is negative in an accelerated manner, owing mainly to accumulation of accounts payable. As explained in the previous section, WASA historically has depended on cash generation from working capital to finance its activities. Due to accumulation of net deficits, the equity is almost non-existent. WASA has some loans contracted. However, as mentioned earlier, WASA is not capable of internally generating resources to repay these loans.

Such dependency could hardly be sustained, as WASA's accounts payable have been exponentially growing in recent years. The accounts payables amounted TT$2,055 million in 2016, which grew to TT$3,714 million in 2018 (81 percent increase). Measured in terms of months of operational expenditures, these amounts translate to 11 months and 19 months respectively.

Table 32 Statement of financial position

	2016	2017	2018
Statement of Finanical Position (million TT$)			
Current assets	725	600	583
Current liabilities	3,387	4,484	5,089
Net current assets	**(2,662)**	**(3,884)**	**(4,507)**
Long term investments	1,144	1,248	1,007
Fixed assets	5,927	6,605	6,790
Non current assets	15	10	6
Net total assets	**4,424**	**3,980**	**3,296**
Financed by:			
Contributions/Capital	3,123	3,173	3,203
Accum oper surp/(deficit) C/F	(2,524)	(2,817)	(3,068)
Equity	**599**	**357**	**135**
Non current liabilities	538	507	507
Loans	3,287	3,116	2,654
Funds employed	**4,424**	**3,980**	**3,296**

II. Financial Projections

BASE CASE ASSUMPTIONS	
Water supply	***Production***: The program proposes water distribution network optimization and rehabilitation to reduce **physical losses**. As a result, the level of production declines from 232 million imperial gallons per day (MIGD) or 385 million cubic meters/year in the baseline year [2019] to 213 MIGD or 353 million cubic meters /year in year 5 and 208 MIGD or 345 million cubic meters/year in year 10. ***Billed consumption***: Billed consumption grows from 135 MIGD or 224 million m3/year in the baseline year to 161 MIGD or 266 million cubic meters/year in year 5 and 177 MIGD or 293 million cubic meters/year in year 10, thanks to **apparent loss reduction** mainly from improved metering of the Programme. ***Real consumption:*** Real consumption (i.e. the sum of billed and unbilled consumption) remains unchanged (181 MIGD or 300 million cubic meters/year). ***Non-Revenue Water (NRW):*** As a result of both physical and apparent loss reduction, NRW ratio will improve from 42%[34] in the baseline year to 25%[35] in year 5.
Customer base	The number of customers remain unchanged, at 423 thousand customers.
Tariff	The existing tariff structure remains unchanged.
Sewer and other revenue	The level of sewer and other revenue remains unchanged.
Operation and maintenance expenses	***Base OPEX with 15% provision:*** Operation and maintenance expenses in the baseline year is used as the base OPEX. This remains practically unchanged (from TT$2,380 million to TT$2,410 million), except for a slight increase in the cost of provisioning, which is calculated as a percentage of the Total revenue. ***Less bad debt provision from improved collection:*** Commercial strengthening of the Programme will enable WASA to improve its collection efficiency from 85 percent between the baseline year and year 2, to 97 percent in year 5.

[34] (Volume produced – Volume billed) / Volume produced = (385 million m3 - 224 million m3) / 385 million m3 = 42%.

[35] (Volume produced – Volume billed) / Volume produced = (353 million m3 – 266 million m3) / 353 million m3 = 25%.

	Saving from physical loss reduction: Physical loss declines from 48 MIGD or 80 million per cubic meter /year in the baseline year to 29 MIGD or 48 million per cubic meter /year in year 5, as a result of the water distribution network optimization and rehabilitation. Financial benefit of real loss reduction is calculated using the historical variable operational cost of WASA's own water resources, which is TT$2.03 per cubic meter (or US$0.30 per cubic meter).
Capital expenditure	***Investment of the Programme:*** Total cost of the Programme is TT$2.14 billion in five years. For the purpose of this financial analysis, this investment is reflected on WASA's financial statements. ***Other investment:*** In addition to the Programme investment, WASA invests on average TT$253 million during years 1-5 to replace or rehabilitate existing assets. For this financial analysis, this amount is estimated based on the level of annual depreciation and amortization expenses.
Financing	***IDB loan:*** IDB loan covers 100 percent of the Programme investment. Standard repayment schedule of IDB's Flexible Financing Facility[36] is assumed (25-year repayment period including 5.5-year grace). For the purpose of this financial analysis, disbursements and repayments of this loan are reflected on WASA's financial statements. ***Other financing:*** It is assumed that net cashflow from other financing is null.
Financial expenses	***IDB loan interests and charges:*** The interest rate used is 3.0 percent[37]. During the execution period, a credit fee of 0.5 percent over the undisbursed balance is charged[38]. ***Other financial expenses:*** Non IDB related financial expenses remains unchanged.
Government subventions	The annual amount of government subventions declines from TT$2,056 million in the baseline year to TT$1,929 million in year 5. This amount is estimated to allow WASA to have neutral net surplus each year. It is noteworthy that repayments of IDB loan are reflected as part of this calculation. If this is separated, the amount of GoRTT subventions to WASA would be smaller (TT$1,870 million in year 5).
Working capital changes	In this financial analysis, it is assumed that working capital changes would not have a significant role in WASA's financing.

[36] https://www.iadb.org/en/idb-finance/flexible-financing-facility

[37] As of the fourth quarter of 2019, the Libor based lending rate of the IDB is 2.93 percent. See: http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=EZSHARE-1436601171-374

[38] http://www.iadb.org/document.cfm?id=EZSHARE-1436601171-396

a. Income Statement

WASA's operating revenue increases from TT$717 million in the baseline year to TT$919 million in year 10. In this projection, water revenue is divided in to two parts: (i) water revenue that doesn't depend on the Programme; and (ii) additional revenue which derives from apparent loss recovery mainly from the Programme's improved metering.

In the same period, operating expenditures before depreciation and amortization decrease from TT$2,380 million to TT$2,219 million, as a result of the collection rate improvement and cost saving from real loss reduction, as stated in the assumptions.

The following table presents key figures relevant for Programme financial benefit estimation.

Table 33 Estimation of Programme's financial benefits

	Notes	1	2	3	4	5	6	7	8	9	10
Apparent loss recovery (million TT$)	**A=B*C**	**3**	**33**	**63**	**94**	**124**	**155**	**179**	**194**	**202**	**202**
Average water tariff (TT$/m3)	B	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92
Cumulative apparent loss reduction (million m3/year)	C	1	11	22	32	43	53	61	66	69	69
Apparent loss reduction from previous year (million m3/year)		1	10	10	10	11	11	8	5	3	-
Real loss reduction (million TT$)	**D=E*F**	**3**	**11**	**34**	**53**	**64**	**74**	**78**	**80**	**81**	**81**
Historical variable operational cost (TT$/m3)	E	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03
Cumulative real loss reduction (million m3/year)	F	2	5	17	26	31	36	38	39	40	40
Real loss reduction from previous year (million m3/year)		2	4	11	9	5	5	2	1	1	-
Reduction in bad debt expenses (million TT$)	**G=H*I**	**-**	**-**	**31**	**65**	**101**	**105**	**107**	**109**	**110**	**110**
Total revenue (million TT$)	H	720	750	780	811	841	872	896	911	919	919
Improved collection compared to baseline level (%)	I	0%	0%	4%	8%	12%	12%	12%	12%	12%	12%
Estimated collection rate	Baseline	85%	85%	89%	93%	97%	97%	97%	97%	97%	97%

With the Programme, WASA's EBITDA improves from negative TT$1,663 million (or operating cost recovery ratio (OCRR) of only 30 percent) in the baseline year to negative TT$1,300 million (or OCRR of 41 percent) in year 10 (see Table 34 for WASA projected income statement). In the absence of tariff adjustments, EBITDA will remain negative. It is also noted that the Programme does not contemplate reduction in the number of employees per thousand connections. An earlier study [39] proposed an efficient level of employees as 8 per thousand connections. The difference between this level and the current level (12 per thousand connections) has a cost implication on the annual OPEX by TT$418 million.

The following table summarises the income statement of WASA for the first ten years of the Programme.

[39] CASTALIA, Benchmarking study prepared for the Business Plan and Price Control Proposal for WASA: 2019-2024 (July 2019).

Table 34 WASA's projected income statement

	Baseline	1	2	3	4	5	6	7	8	9	10
Income Statement (million TT$)											
Revenue											
Water revenue	653	653	653	653	653	653	653	653	653	653	653
+ Apparent loss recovery	-	3	33	63	94	124	155	179	194	202	202
Sewer and other	64	64	64	64	64	64	64	64	64	64	64
Total revenue	**717**	**720**	**750**	**780**	**811**	**841**	**872**	**896**	**911**	**919**	**919**
Expenditure											
Base OPEX with 15% provision	(2,380)	(2,380)	(2,385)	(2,389)	(2,394)	(2,398)	(2,403)	(2,407)	(2,409)	(2,410)	(2,410)
+ Less provision from improved collection	-	-	-	31	65	101	105	107	109	110	110
Provision in % of total revenue	*-15%*	*-15%*	*-15%*	*-11%*	*-7%*	*-3%*	*-3%*	*-3%*	*-3%*	*-3%*	*-3%*
+ Saving from real loss reduction	-	3	11	34	53	64	74	78	80	81	81
Expenditure before dep&amrt	**(2,380)**	**(2,377)**	**(2,374)**	**(2,324)**	**(2,276)**	**(2,234)**	**(2,226)**	**(2,221)**	**(2,220)**	**(2,219)**	**(2,219)**
EBITDA	***(1,663)***	***(1,657)***	***(1,624)***	***(1,544)***	***(1,465)***	***(1,392)***	***(1,352)***	***(1,325)***	***(1,309)***	***(1,300)***	***(1,300)***
Margin (in %)	***-232%***	***-230%***	***-216%***	***-198%***	***-181%***	***-165%***	***-155%***	***-148%***	***-144%***	***-141%***	***-141%***
Depreciation & amortisation	(234)	(230)	(252)	(275)	(298)	(319)	(338)	(329)	(322)	(316)	(309)
Total expenditure	**(2,614)**	**(2,607)**	**(2,626)**	**(2,599)**	**(2,573)**	**(2,552)**	**(2,562)**	**(2,550)**	**(2,542)**	**(2,534)**	**(2,528)**
Op. surplus/(deficit)	**(1,897)**	**(1,887)**	**(1,876)**	**(1,819)**	**(1,763)**	**(1,711)**	**(1,690)**	**(1,655)**	**(1,631)**	**(1,615)**	**(1,608)**
Other financial expenses	(159)	(159)	(159)	(159)	(159)	(159)	(159)	(159)	(159)	(159)	(159)
IDB loan interests and charges	-	(16)	(27)	(38)	(49)	(59)	(62)	(59)	(56)	(53)	(50)
Surplus/(def) bef GORTT related items	**(2,056)**	**(2,062)**	**(2,062)**	**(2,016)**	**(1,970)**	**(1,929)**	**(1,912)**	**(1,873)**	**(1,846)**	**(1,827)**	**(1,817)**
Margin (in %)	**-287%**	**-286%**	**-275%**	**-258%**	**-243%**	**-229%**	**-219%**	**-209%**	**-203%**	**-199%**	**-198%**
Government subventions	2,056	2,062	2,062	2,016	1,970	1,929	2,018	1,980	1,953	1,934	1,924
Net surplus/(def) aft GORTT related items	**-**	**-**	**-**	**-**	**-**	**-**	**107**	**107**	**107**	**107**	**107**

b. Cashflow Statement

WASA's capacity to generate internal cash is improved thanks to the Programme: according to Table 35 cashflow from operating activities before government subvention and working capital changes improves from negative TT$1,822 million in the baseline year to negative TT$1,508 million in year 10, which will allow sizable reduction of government subventions as stated previously.

Table 35 WASA's projected cashflow statement

	Baseline	1	2	3	4	5	6	7	8	9	10
Statement of Cash Flows (million TT$)											
Cash flow from operating activities											
Net surplus/(deficit)	(2,056)	(2,062)	(2,062)	(2,016)	(1,970)	(1,929)	(1,912)	(1,873)	(1,846)	(1,827)	(1,817)
Depreciation and amortisation	234	230	252	275	298	319	338	329	322	316	309
Before subvention and working capital changes	**(1,822)**	**(1,832)**	**(1,809)**	**(1,741)**	**(1,673)**	**(1,610)**	**(1,574)**	**(1,544)**	**(1,524)**	**(1,512)**	**(1,508)**
Government subventions	2,056	2,062	2,062	2,016	1,970	1,929	2,018	1,980	1,953	1,934	1,924
Working capital changes	17	4	(23)	(23)	(23)	(21)	(19)	8	7	7	7
Net cash from operating activities	**251**	**234**	**230**	**252**	**276**	**298**	**426**	**445**	**436**	**429**	**422**
Cash flow from investing activities											
Investment of the programme	-	(415)	(439)	(444)	(435)	(402)	-	-	-	-	-
Other investment	(251)	(234)	(230)	(252)	(275)	(298)	(319)	(338)	(329)	(322)	(316)
Net cash outflow from investing activities	**(251)**	**(649)**	**(669)**	**(697)**	**(710)**	**(700)**	**(319)**	**(338)**	**(329)**	**(322)**	**(316)**
Cash flow from financing activities											
IDB loan for the project	-	415	439	444	435	402	(107)	(107)	(107)	(107)	(107)
Capital funding and loans	-	-	-	-	-	-	-	-	-	-	-
Net cash inflow from financing	**-**	**415**	**439**	**444**	**435**	**402**	**(107)**	**(107)**	**(107)**	**(107)**	**(107)**
Increase/(decrease) in cash and cash equivalents	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

During the five-year execution period, investment of the Programme totals TT$2.14 billion, financed 100% by an IDB loan. In this analysis, the loan amount of TT$2.14 billion, or 100 percent of the investment, is adopted as an assumption. Capital Expenditures of the Programme is summarised in the following table. Its scoping are detailed in the Annex 4 of the document.

Table 36 Preliminary Budget of the Programme

Preliminary Budget for IDB Proposed Action Plan 2020-2024	**Estimated Cost (US$ million)**
Infrastructure Rehabilitation: Baseline Studies and Smart Tools, Water Distribution Network Optimization [NRW Reduction] and Rehabilitation, Universal Metering, Commercial Management Strengthening, Wellfield Assessment, Rehabilitation and Automation	**263**
Multi-Purpose Flood Mitigation and Water Supply Reservoir at Ravine Sable Sand Pit, Caparo	**42**
Institutional Strengthening: Governance, Institutional Reformulation and Systemwide Change Management and Project Execution unit	**10**
TOTAL	**315**

IDB loan (principal and interest) repayment can be made from the Programmes financial benefits. Even when IDB loan repayments are included, sizable reduction of government subventions can be achieved, from TT$2,056 million[40] in the baseline year to TT$1,924 million in year 10 and TT$1,768 million net of the IDB Loan repayment.

The Programme would be an excellent start to improving water supply services, governance and the turnaround of WASA. It should also be highlighted that the proportion of these subsidies required to cover the operational cash shortfall declines from 81 percent to 68 percent in the same period, allowing to allocate more of the subventions for asset replacement and rehabilitation.

Table 37 Government subventions breakdown

	Baseline	1	2	3	4	5	6	7	8	9	10
Government subventions	2,056	2,062	2,062	2,016	1,970	1,929	2,018	1,980	1,953	1,934	1,924
For operational cash shortfall	1,663	1,657	1,624	1,544	1,465	1,392	1,352	1,325	1,309	1,300	1,300
For IDB loan repayment	-	16	27	38	49	59	169	166	163	160	156
For financial expenses on existing debts	159	159	159	159	159	159	159	159	159	159	159
For asset replacement/rehabilitation need	234	230	252	275	298	319	338	329	322	316	309
Difference (other financing)	(0)	0	0	-	-	-	-	-	-	-	-

[40] In calculating this baseline figure for the government subventions, it is assumed that WASA will stop its heavy reliance on accounts payable growth. In recent years, WASA heavily depended on accounts payable growth to finance its cash shortfall. Between 2015 to 2018, accounts payable grew from $1,869 to $3,714 million (almost double) due to i) annual subventions to WASA being lower than the actual accrued need, and ii) unverified payables.

c. Balance sheet

In this projection, it is assumed that WASA's net current asset will practically stabilise, emerging from its historical dependency on ever growing accounts payable. Growth in fixed assets will be financed by the IDB loan.

Table 38 WASA's projected balance sheet

	Baseline	1	2	3	4	5	6	7	8	9	10
Statement of Finanical Position (million TT$)											
Current assets	583	583	583	583	583	583	583	583	583	583	583
Current liabilities	5,106	5,110	5,088	5,065	5,042	5,021	5,002	5,011	5,018	5,024	5,031
Net current assets	**(4,523)**	**(4,528)**	**(4,505)**	**(4,482)**	**(4,460)**	**(4,438)**	**(4,420)**	**(4,428)**	**(4,435)**	**(4,442)**	**(4,449)**
Long term investments	1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007
Fixed assets	6,806	7,226	7,642	8,064	8,476	8,857	8,838	8,847	8,854	8,860	8,867
Non current assets	6	6	6	6	6	6	6	6	6	6	6
Net total assets	**3,296**	**3,711**	**4,150**	**4,595**	**5,030**	**5,432**	**5,432**	**5,432**	**5,432**	**5,432**	**5,432**
Financed by:											
Contributions/Capital	3,203	3,203	3,203	3,203	3,203	3,203	3,203	3,203	3,203	3,203	3,203
Accum oper surp/(deficit) C/F	(3,068)	(3,068)	(3,068)	(3,068)	(3,068)	(3,068)	(2,961)	(2,855)	(2,748)	(2,641)	(2,534)
Equity	**135**	**135**	**135**	**135**	**135**	**135**	**242**	**349**	**455**	**562**	**669**
Non current liabilities	507	507	507	507	507	507	507	507	507	507	507
IDB loan for the project	-	415	854	1,298	1,734	2,136	2,029	1,922	1,815	1,709	1,602
Other loans	2,654	2,654	2,654	2,654	2,654	2,654	2,654	2,654	2,654	2,654	2,654
Funds employed	**3,296**	**3,711**	**4,150**	**4,595**	**5,030**	**5,432**	**5,432**	**5,432**	**5,432**	**5,432**	**5,432**

d. Assessment of the Programme

This base scenario illustrates the financial impact of the IDB Loan Programme for WASA, without any tariff adjustments.

The Programme—without the leverage of the IDB loan, or assuming the GoRTT employs its own financial resources for the implementation—demonstrates high financial benefits, with an IRR of 17% (considering 25 years, equivalent to the IDB loan repayment period) or 5% (considering only the first ten years). The payback period is 9 years. This was calculated by contrasting (i) Programme's total cost executed in five years, against (ii) Programme's financial benefits: (a) increased sales from apparent[41]/commercial loss recovery (b) cost saving from physical[42] loss reduction, and (c) reduction in bad debt expenses to due improvements in the collection rate.

With an IDB loan covering 100% of the Programme cost, the GoRTT is not responsible for any initial cost of investment and can achieve its benefits[43].

[41] Apparent losses are losses due to unauthorized consumption and all types of inaccuracies associated with metering.

[42] Physical losses are water lost through leakages in the piped network.

[43] As there is no initial investment which the GoRTT needs to pay, it is impossible to calculate a meaningful IRR figure.

Table 39 IRR calculation

	Notes	1	2	3	4	5	6	7	8	9	10
Programme cost (million TT$)	**A**	**415**	**439**	**444**	**435**	**402**	-	-	-	-	-
Summary of Programme financial bentifts											
Apparent loss recovery (million TT$)		3	33	63	94	124	155	179	194	202	202
Real loss reduction (million TT$)		3	11	34	53	64	74	78	80	81	81
Reduction in bad debt expenses (million TT$)		-	-	31	65	101	105	107	109	110	110
Total benefits (million TT$)	**B**	**6**	**44**	**128**	**212**	**289**	**334**	**364**	**383**	**393**	**393**
Cash flow (without IDB loan)	**C=B-A**	**(409)**	**(395)**	**(316)**	**(223)**	**(113)**	**334**	**364**	**383**	**393**	**393**
IRR (year 1 through 25)	**17%**										
IRR (year 1 through 10)	**5%**										
IDB loan disbursement (million TT$)	**D**	**415**	**439**	**444**	**435**	**402**	-	-	-	-	-
Debt service (million TT$)	**E**	**16**	**27**	**38**	**49**	**59**	**169**	**166**	**163**	**160**	**156**
Net cash flow (with IDB loan)	**F=C+D-E**	**(10)**	**18**	**91**	**163**	**230**	**164**	**198**	**220**	**234**	**237**

III. Alternative scenario with tariff increase

To illustrate a scenario in which WASA achieves self-sustainability, an alternative scenario with tariff adjustments is generated. In this scenario, assumptions remain the same compared to the base scenario, except that there are tariff adjustments shown in Table 40 below. These adjustments are calculated, for illustrative purpose, so that WASA can achieve operational self-sustainability (or positive EBITDA) by the end of Phase I (years1-5), and full self-sustainability (or positive net earnings) in Phase II (years 6-10). In other words, under this alternative scenario: (i) by the end of the Phase I, WASA will be able to cover its operational cost with its operational revenue; (ii) during Phase II the necessity of government subventions will disappear, and WASA could be fully responsible for repaying the IDB loan required for the Programme from the generated revenue.

Table 40 Illustrative tariff adjustments required for WASA self-sustainability

	Baseline	1	2	3	4	5	6	7	8	9	10
Average water tariff (TT$/m3)	2.92	2.92	2.92	4.09	5.73	8.02	9.22	9.22	9.22	9.22	9.22
Average water tariff (US$/m3)	*0.43*	*0.43*	*0.43*	*0.60*	*0.84*	*1.18*	*1.36*	*1.36*	*1.36*	*1.36*	*1.36*
Tariff increase		0%	0%	40%	40%	40%	15%	0%	0%	0%	0%

When the Programme benefits are considered, WASA's average water tariff needs to reach US$1.36 per cubic meter in the medium to long term. This can be positively evaluated, compared with a scenario without the Programme, under which required tariff level would be significantly higher at US$1.93 per cubic meter. The resulting tariff level of US$1.36 per cubic meter favourably compares with the comparator utilities' US$2.34 per cubic meter[44]. It should be noted that service level improvements need to accompany tariff adjustments: otherwise, public acceptability may not be forthcoming.

[44] CASTALIA, Benchmarking study prepared for the Business Plan and Price Control Proposal for WASA: 2019-2024 (July 2019). See Figure 15 of the Financial Annex 1.

WASA's projected financial statements (income statement, cashflow statement, and balance sheet) for years 1-10 are presented in the following tables. As can be noted with the illustrated tariff adjustments, WASA will obtain positive EBITDA of TT$31 million in year 5, and positive net earnings in year 7.

Table 41 WASA's projected income statement (alternative scenario, years 1-10)

	Baseline	1	2	3	4	5	6	7	8	9	10
Income Statement (million TT$)											
Revenue											
Water revenue	653	653	653	914	1,280	1,792	2,061	2,061	2,061	2,061	2,061
+ Apparent loss recovery	-	3	33	88	184	341	490	564	613	638	638
Sewer and other	64	64	64	89	125	175	202	202	202	202	202
Total revenue	**717**	**720**	**750**	**1,092**	**1,589**	**2,309**	**2,753**	**2,826**	**2,876**	**2,900**	**2,900**
Expenditure											
Base OPEX with 15% provision	(2,380)	(2,380)	(2,385)	(2,436)	(2,511)	(2,619)	(2,685)	(2,696)	(2,704)	(2,707)	(2,707)
+ Less provision from improved collection	-	-	-	44	127	277	330	339	345	348	348
Provision in % of total revenue	*-15%*	*-15%*	*-15%*	*-11%*	*-7%*	*-3%*	*-3%*	*-3%*	*-3%*	*-3%*	*-3%*
+ Saving from real loss reduction	-	3	11	34	53	64	74	78	80	81	81
Expenditure before dep&amrt	**(2,380)**	**(2,377)**	**(2,374)**	**(2,359)**	**(2,330)**	**(2,278)**	**(2,281)**	**(2,279)**	**(2,279)**	**(2,278)**	**(2,278)**
EBITDA	***(1,663)***	***(1,657)***	***(1,624)***	***(1,266)***	***(741)***	***31***	***472***	***547***	***597***	***622***	***622***
Margin (in %)	***-232%***	***-230%***	***-216%***	***-116%***	***-47%***	***1%***	***17%***	***19%***	***21%***	***21%***	***21%***
Depreciation & amortisation	(234)	(230)	(252)	(275)	(298)	(319)	(338)	(329)	(322)	(316)	(309)
Total expenditure	**(2,614)**	**(2,607)**	**(2,626)**	**(2,634)**	**(2,628)**	**(2,597)**	**(2,619)**	**(2,608)**	**(2,601)**	**(2,594)**	**(2,587)**
Op. surplus/(deficit)	**(1,897)**	**(1,887)**	**(1,876)**	**(1,541)**	**(1,039)**	**(288)**	**134**	**218**	**274**	**307**	**313**
Other financial expenses	(159)	(159)	(159)	(159)	(159)	(159)	(159)	(159)	(159)	(159)	(159)
IDB loan interests and charges	-	(16)	(27)	(38)	(49)	(59)	(62)	(59)	(56)	(53)	(50)
Surplus/(def) bef GORTT related items	**(2,056)**	**(2,062)**	**(2,062)**	**(1,738)**	**(1,247)**	**(506)**	**(88)**	**(0)**	**59**	**95**	**105**
Margin (in %)	**-287%**	**-286%**	**-275%**	**-159%**	**-78%**	**-22%**	**-3%**	**0%**	**2%**	**3%**	**4%**
Government subventions	2,056	2,062	2,062	1,738	1,247	506	88	0	-	-	-
Net surplus/(def) aft GORTT related items	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**59**	**95**	**105**

Table 42 WASA's projected cashflow statement (alternative scenario, years 1-10)

	Baseline	1	2	3	4	5	6	7	8	9	10
Statement of Cash Flows (million TT$)											
Cash flow from operating activities											
Net surplus/(deficit)	(2,056)	(2,062)	(2,062)	(1,738)	(1,247)	(506)	(88)	(0)	59	95	105
Depreciation and amortisation	234	230	252	275	298	319	338	329	322	316	309
Before subvention and working capital changes	**(1,822)**	**(1,832)**	**(1,809)**	**(1,463)**	**(949)**	**(187)**	**250**	**329**	**382**	**410**	**413**
Government subventions	2,056	2,062	2,062	1,738	1,247	506	88	0	-	-	-
Working capital changes	17	4	(23)	(23)	(23)	(21)	88	115	55	19	9
Net cash from operating activities	**251**	**234**	**230**	**252**	**275**	**298**	**426**	**445**	**436**	**429**	**422**
Cash flow from investing activities											
Investment of the programme	-	(415)	(439)	(444)	(435)	(402)	-	-	-	-	-
Other investment	(251)	(234)	(230)	(252)	(275)	(298)	(319)	(338)	(329)	(322)	(316)
Net cash outflow from investing activities	**(251)**	**(649)**	**(669)**	**(697)**	**(710)**	**(700)**	**(319)**	**(338)**	**(329)**	**(322)**	**(316)**
Cash flow from financing activities											
IDB loan for the project	-	415	439	444	435	402	(107)	(107)	(107)	(107)	(107)
Capital funding and loans	-	-	-	-	-	-	-	-	-	-	-
Net cash inflow from financing	**-**	**415**	**439**	**444**	**435**	**402**	**(107)**	**(107)**	**(107)**	**(107)**	**(107)**
Increase/(decrease) in cash and cash equivalents	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Table 43 WASA's projected balance sheet (alternative scenario, years 1-10)

	Baseline	1	2	3	4	5	6	7	8	9	10
Statement of Finanical Position (million TT$)											
Current assets	583	583	583	583	583	583	583	583	583	583	583
Current liabilities	5,106	5,110	5,088	5,065	5,042	5,021	5,109	5,224	5,279	5,298	5,307
Net current assets	**(4,523)**	**(4,528)**	**(4,505)**	**(4,482)**	**(4,460)**	**(4,438)**	**(4,526)**	**(4,642)**	**(4,696)**	**(4,715)**	**(4,724)**
Long term investments	1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007
Fixed assets	6,806	7,226	7,642	8,064	8,476	8,857	8,838	8,847	8,854	8,860	8,867
Non current assets	6	6	6	6	6	6	6	6	6	6	6
Net total assets	**3,296**	**3,711**	**4,150**	**4,595**	**5,030**	**5,432**	**5,325**	**5,218**	**5,170**	**5,158**	**5,156**
Financed by:											
Contributions/Capital	3,203	3,203	3,203	3,203	3,203	3,203	3,203	3,203	3,203	3,203	3,203
Accum oper surp/(deficit) C/F	(3,068)	(3,068)	(3,068)	(3,068)	(3,068)	(3,068)	(3,068)	(3,068)	(3,009)	(2,914)	(2,810)
Equity	**135**	**135**	**135**	**135**	**135**	**135**	**135**	**135**	**194**	**289**	**394**
Non current liabilities	507	507	507	507	507	507	507	507	507	507	507
IDB loan for the project	-	415	854	1,298	1,734	2,136	2,029	1,922	1,815	1,709	1,602
Other loans	2,654	2,654	2,654	2,654	2,654	2,654	2,654	2,654	2,654	2,654	2,654
Funds employed	**3,296**	**3,711**	**4,150**	**4,595**	**5,030**	**5,432**	**5,325**	**5,218**	**5,170**	**5,158**	**5,156**

ANNEX 2 - FINANCIAL SCENARIO OF THE PROGRAMME THAT ILLUSTRATES THE IMPACT OF REDUCTION IN THE PURCHASE OF DESAL WATER WITHOUT TARIFF INCREASE

Financial Scenario of the Programme, with potential for reducing the purchase of Desalinated[45] Water

Under this scenario, it is assumed that **there are no tariff adjustments and GoRTT decides to analyze the financial impact of gradually reducing the purchase of desalinated water in Phase 2 as production is decreased due to the recovery of real losses from 232 MIGD to 208 MIGD in Year 10 and WASA has been stabilized during Phase I**. Under these assumptions, the Programme demonstrates high financial benefits, with an IRR of 27% (considering 25 years, equivalent to the IDB loan repayment period) or 19% (considering only the first ten years), which is considered attractive as a result of comparison with the GoRTT's cost of capital. The payback period is 7 years. This was calculated by contrasting (i) Programme's total cost executed in five years, against (ii) Programme's potential financial benefits over the 10-year period: (a) increased sales from apparent/commercial loss recovery estimated at TT$1,249 million (b) potential cost saving from reducing the purchase of desalinated water resulting from physical loss reduction of 24 MIGD, estimated at TT$2,051 million and (c) reduction in bad debt expenses due to improvements in the collection rate estimated at TT$739 million. Table 44 illustrates cash flow projections with the IDB loan and without the IDB loan (GoRTT using its own resources to implement the Programme). Also see Table 45 for the calculation of the benefits).

Table 44 IRR calculations

	Notes	1	2	3	4	5	6	7	8	9	10
Programme cost (million TT$)	**A**	**415**	**439**	**444**	**435**	**402**	**-**	**-**	**-**	**-**	**-**
Summary of Programme financial bentifts											
Apparent loss recovery (million TT$)		3	33	63	94	124	155	179	194	202	202
Savings from Reduction in Purchase of Desal Water [Real loss reduction] (million TT$)		12	41	124	195	235	271	287	292	297	297
Reduction in bad debt expenses (million TT$)		-	-	31	65	101	105	107	109	110	110
Total benefits (million TT$)	**B**	**15**	**74**	**219**	**353**	**460**	**531**	**573**	**596**	**610**	**610**
Cash flow (without IDB loan)	**C=B-A**	**(400)**	**(365)**	**(226)**	**(82)**	**58**	**531**	**573**	**596**	**610**	**610**
IRR (year 1 through 25)	**27%**										
IRR (year 1 through 10)	**19%**										
IDB loan disbursement (million TT$)	**D**	**415**	**439**	**444**	**435**	**402**	**-**	**-**	**-**	**-**	**-**
Debt service (million TT$)	**E**	**16**	**27**	**38**	**49**	**59**	**169**	**166**	**163**	**160**	**156**
Net cash flow (with IDB loan)	**F=C+D-E**	**(1)**	**47**	**181**	**305**	**401**	**361**	**407**	**433**	**450**	**453**

Table 45 illustrates the Programme's benefits in terms of the dollar amounts and volumes of apparent/commercial loss and potential savings due to reduced purchase of desalinated water [physical loss recovery] in cubic meters [also shown in MIGD] based on an average water tariff (across all customer types) of TT$2.92 per cubic meter for commercial losses and TT$7.46 per

[45] The financial, legal and contractual implications under the Desalination Contract are not considered and need to be analyzed by the GoRTT.

cubic meter for desal water. The reduction in bad debt is also shown due to improvements in the collection rate.

Table 45 Programme benefits calculation

	Notes	1	2	3	4	5	6	7	8	9	10
Apparent loss recovery (million TT$)	**A=B*C**	**3**	**33**	**63**	**94**	**124**	**155**	**179**	**194**	**202**	**202**
Average water tariff (TT$/m3)	B	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92
Cumulative apparent loss reduction (million m3/year)	C	1	11	22	32	43	53	61	66	69	69
Apparent loss reduction from previous year (million m3/year)		1	10	10	10	11	11	8	5	3	-
Reduction in Purchase of Desal Water [Real loss reduction] (million TT$)	**D=E*F**	**12**	**41**	**124**	**195**	**235**	**271**	**287**	**292**	**297**	**297**
Historical desalination water purchase price (TT$/m3)	E	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46
Cumulative Reduction in Purchase of Desal Water [Real loss reduction] (million m3/year)	F	2	5	17	26	31	36	38	39	40	40
MIGD		1	3	10	16	19	22	23	24	24	24
Reduction in Purchase of Desal Water [Real loss reduction] from previous year (million m3/year)		2	4	11	9	5	5	2	1	1	-
MIGD		1	2	7	6	3	3	1	0.4	0.4	
Reduction in bad debt expenses (million TT$)	**G=H*I**	**-**	**-**	**31**	**65**	**101**	**105**	**107**	**109**	**110**	**110**
Total revenue (million TT$)	H	720	750	780	811	841	872	896	911	919	919
Improved collection compared to baseline level (%)	I	0%	0%	4%	8%	12%	12%	12%	12%	12%	12%
Estimated collection rate	Baseline 85%	85%	85%	89%	93%	97%	97%	97%	97%	97%	97%

Figure 18 shows that the sum of the benefits (apparent loss recovery, potential savings from reduction in the purchase of desalinated water [real loss recovery] and reduction in bad debts) more than adequately cover the debt service for the repayment of the loan. The total potential savings from the reduction in the purchase of desalinated water of 24 MIGD is estimated at TT$2,051 million, going from TT$235 million in Year 5 to TT$297 in Year 10.

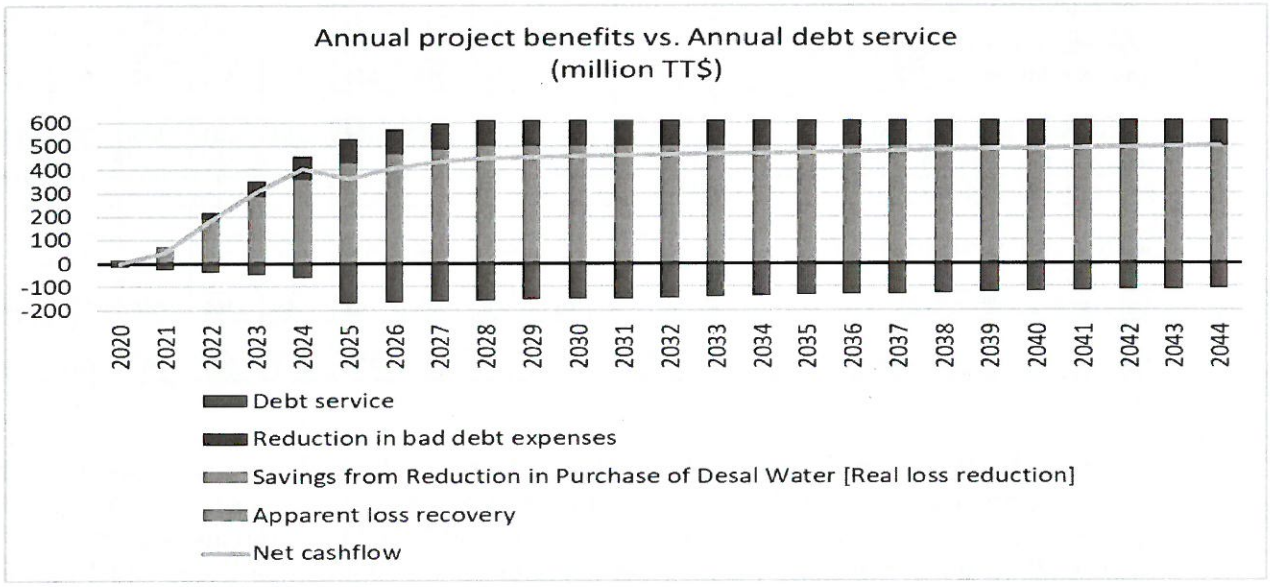


Figure 18 Annual Programme Benefits vs Annual debt Service for the Loan

- ***Programme's impact on WASA's financials.*** With the Programme and the assumptions previously mentioned, WASA's EBITDA improves from negative TT$1,663 million (or

Operating Cost Recovery Ratio (OCRR) of only 30 percent) in the baseline year to negative TT$1,083 million (or OCRR of 46 percent) in year 10 (see Table 46 for WASA projected income statement and Table 18 for the projected cash flow statement). In the absence of tariff adjustments, EBITDA will remain negative. As mentioned before, it is also noted that the Programme does not contemplate reduction in the number of employees per thousand connections.

Table 46 WASA projected income statement (without tariff adjustments)

	Baseline	1	2	3	4	5	6	7	8	9	10
Income Statement (million TT$)											
Total revenue	717	720	750	780	811	841	872	896	911	919	919
Expenditure before dep&amrt	2,380	2,368	2,344	2,234	2,134	2,063	2,028	2,012	2,007	2,002	2,002
EBITDA	(1,663)	(1,648)	(1,594)	(1,454)	(1,324)	(1,221)	(1,155)	(1,117)	(1,096)	(1,083)	(1,083)
Margin (in %)	*-232%*	*-229%*	*-213%*	*-186%*	*-163%*	*-145%*	*-132%*	*-125%*	*-120%*	*-118%*	*-118%*
Other items incl. financial expenses	(393)	(405)	(438)	(472)	(505)	(537)	(559)	(548)	(538)	(528)	(518)
Surplus/(def) bef GORTT related items	(2,056)	(2,053)	(2,032)	(1,925)	(1,829)	(1,758)	(1,715)	(1,664)	(1,634)	(1,611)	(1,601)
Government subventions	2,056	2,053	2,032	1,925	1,829	1,758	1,821	1,771	1,741	1,718	1,708
Net surplus/(def)	-	-	-	-	-	-	107	107	107	107	107

Table 47 WASA projected cash flow statement (without tariff adjustments)

		Baseline	1	2	3	4	5	6	7	8	9	10
Statement of Cash Flows (million TT$)												
Net surplus/(deficit)	A	(2,056)	(2,053)	(2,032)	(1,925)	(1,829)	(1,758)	(1,715)	(1,664)	(1,634)	(1,611)	(1,601)
Dep&amort, and other adjustments	B	234	230	252	275	298	319	338	329	322	316	309
Before subventions & WC changes	**C=A+B**	**(1,822)**	**(1,823)**	**(1,779)**	**(1,650)**	**(1,531)**	**(1,439)**	**(1,377)**	**(1,335)**	**(1,311)**	**(1,295)**	**(1,292)**
Government subventions	D	2,056	2,053	2,032	1,925	1,829	1,758	1,821	1,771	1,741	1,718	1,708
Working capital (WC) changes	E	17	4	(23)	(23)	(23)	(21)	(19)	8	7	7	7
Net cash from operation	**F=C+D+E**	**251**	**234**	**230**	**252**	**275**	**298**	**426**	**445**	**436**	**429**	**422**
Net cash outflow from investment	**G**	**(251)**	**(649)**	**(669)**	**(697)**	**(710)**	**(700)**	**(319)**	**(338)**	**(329)**	**(322)**	**(316)**
Net cash inflow from financing	**H**	**-**	**415**	**439**	**444**	**435**	**402**	**(107)**	**(107)**	**(107)**	**(107)**	**(107)**
Increase/(decrease) in cash	**I=F+G+H**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

- ***Impact on government subventions.*** IDB loan (principal and interest) repayment are made from the Programme's financial benefits. Even if IDB loan repayment are included, sizable reduction of government subventions can be achieved, from TT$2,056 million in the baseline year to TT$1,708 million in year 10. If the IDB loan repayment is subtracted, the amount of GoRTT subventions to WASA would be smaller, TT$1,551 million (see Table 47 above for WASA's projected cashflow statement, and Table 48 and Figure 19 for reductions in government subventions).

Table 48 Government subventions breakdown (without tariff adjustments)

	Baseline	1	2	3	4	5	6	7	8	9	10
Government subventions (million TT$)	2,056	2,053	2,032	1,925	1,829	1,758	1,821	1,771	1,741	1,718	1,708
For operational cash shortfall	1,663	1,648	1,594	1,454	1,324	1,221	1,155	1,117	1,096	1,083	1,083
For IDB loan repayment	-	16	27	38	49	59	169	166	163	160	156
For financial expenses on existing debts	159	159	159	159	159	159	159	159	159	159	159
For asset replacement/rehabilitation needs	234	230	252	275	298	319	338	329	322	316	309
Difference (other financing)	(0)	-	-	-	-	-	-	-	-	-	-

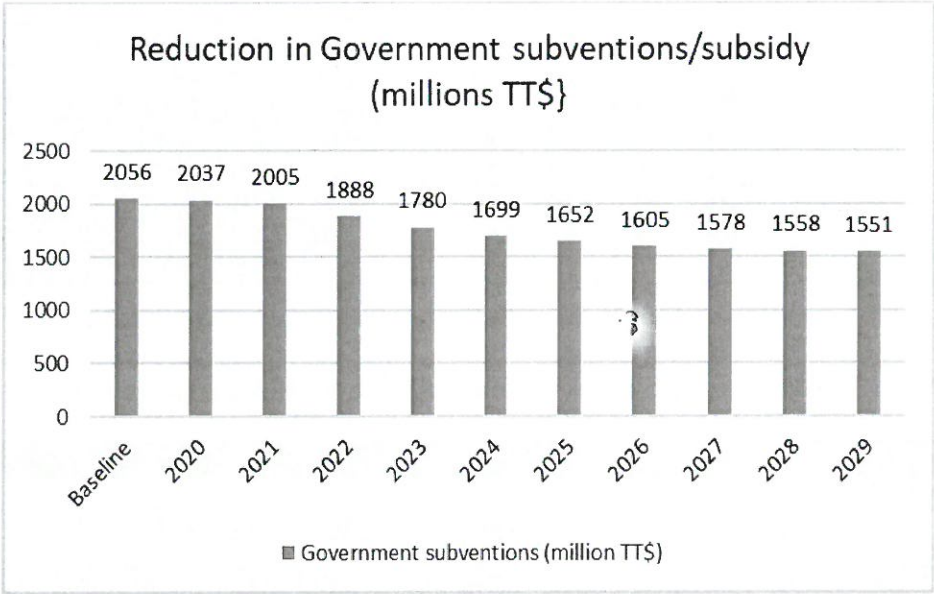


Figure 19 Reduction in GoRTT Subventions over the 10-year period

Table 49 summarizes the financial benefits of the Programme with potential reduction in the purchase of desalinated water and **without tariff adjustments**.

Table 49 Financial indicators with potential reduction in Purchase of Desal Water and without tariff adjustments (in TT$ million)

Indicator	Baseline	Year 5	Year 10
Average water tariff per cubic meter (US$)	US$0.43	US$0.43	US$0.43
Collection rate (%)	85%	97%	97%
Programme benefit	-	460	610
Increased sales from apparent/commercial loss recovery	-	*124*	*202*
Cost saving from reducing desal water purchase (accruing from physical losses reduction)	-	*235*	*297*
Reduction in bad debt expenses to due improvements in the collection rate	-	*101*	*110*
Revenue	717	841	919
OPEX excl. depreciation and amortisation	2,380	2,063	2,002
EBITDA	-1,663	-1,221	-1,083
Operating cost recovery ratio (%)	30%	41%	46%
Subventions	2,056	1,758	1,708
Of which amount for IDB repayment	-	*59*	*156*
Subsidy for WASA	2,056	1,699	1,551

Note: the baseline is constructed based on historical analysis of financial statements for 2016-2018. Year 5 is the end of Phase I and Year 10 is end of Phase II.

ANNEX 3 - ANALYSIS OF CURRENT WATER DISTRIBUTION ISSUES AND POSSIBLE SOLUTIONS

Analysis of Current Water Distribution Issues and Possible Solutions

The following comments are based on observations during a site visit to several WASA facilities and on the analysis of gathered by the IDB consultant.

Current Issues: Production

1) Insufficient supply - there is a significant number of customers that have water rationing during the dry season and some areas are also subject to rationing during the wet season. Some new sources may be required on localized based.

Navet Reservoir shows the effects of the dry season. The reservoir was 26 ft. below full volume.

2) Inadequate maintenance: in general, most of the water treatment facilities and booster stations have been in operation for over 20 years and show significant deterioration. Also, observations during the site visit by the IDB consultant showed certain level of neglect in basic maintenance.

Example of maintenance issue at a water treatment facility. According to local sources, this leak has been on-going for several weeks unrepaired. It is estimated that this leak generates a water loss of about 1 2,800 Imperial gallon per day or 1 MIG per year

Status of Production Meters

The status of production meters from one of the WASA water treatment plants (WTPs) was evaluated by the IDB project team. This assessment included visits to several water treatment plants in Trinidad and collecting data from WASA regarding the status of production meters in the five regions of Trinidad and from Tobago. Table 50 – summarizes status of the production meters from WTPs supply directly to the distribution system and the estimated replacement cost. Based on this information, it is estimated that about 35% of the production meters are defective or not operable. In addition, plant operators captured the information from meter loggers, and treatment records, or SCADA. Therefore, the Action Plan proposes replacements of the defective production meters, establishing new SCADA connections at each WTP, and the development of Module 1 of the management information system to gather the water production information from all WTPs automatically in real-time and displaying such information in a dashboard style on a daily basis. The production meters of wells that pump to the water treatment plant were not included in the table. Production metering cost are based on average international value of electromagnetic flow meters of good quality. Figure 20 includes the graph that shows the international capital costs of electromagnetic flow meters. These values do not include taxes or transport cost that may be applicable in Trinidad and Tobago.

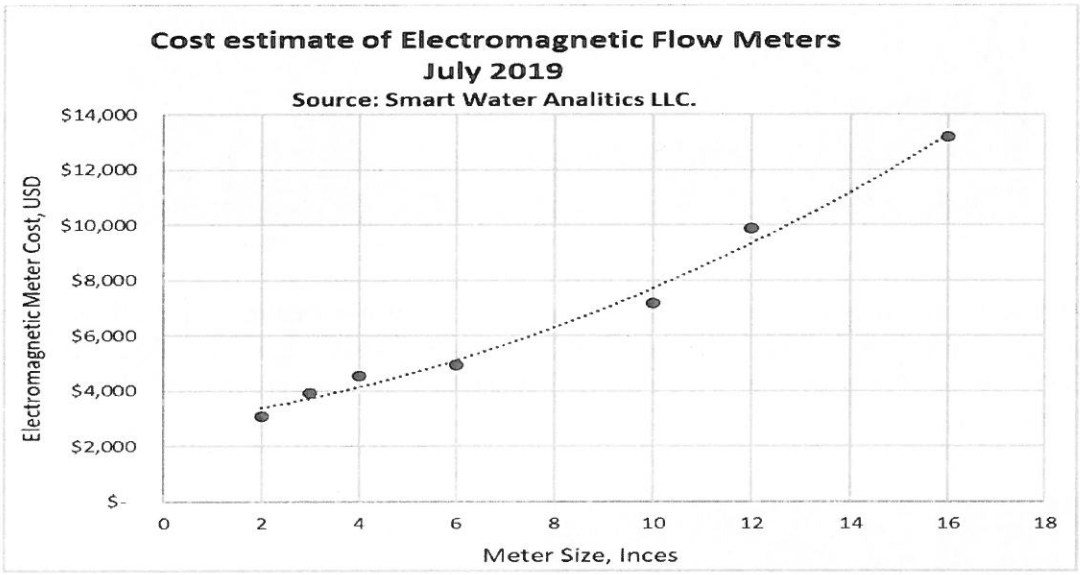


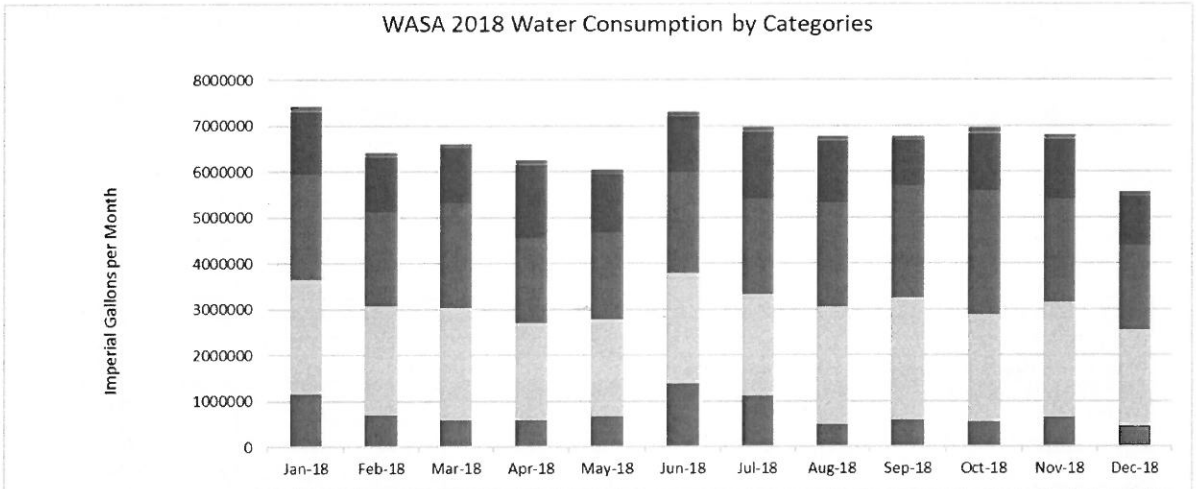
Figure 20 - International Cost of Electromagnetic Flow Meters

Table 50 Cost of Electromagnetic Flow Meters in the International Market

Plants and Wells Flowmeter Status - South West						
Water Facilities	Meter Status	Meter Size, Inches	Meter Type	Replace Meter	Size, Inches	Meter Cost , USD$
Penal WTP	defective	10	Electromagnetic	YES	10	$ 7,300
Fyzabad WTP	defective	6	Electromagnetic	YES	6	$ 4,800
Siparia WTP	defective	10	Electromagnetic	YES	10	$ 7,300
Carapal WTP	defective	8	Electromagnetic	YES	8	$ 6,000
Clarke Rd Package Plant	operational	6	Electromagnetic	NO		
Chatham WTP	operational	12	Electromagnetic	NO		
Techier	defective	6	Electromagnetic	YES	6	$ 4,800
Cap-de-Ville	defective	4	Electromagnetic	YES	4	$ 3,900
Granville WTP	operational	6	Electromagnetic	NO		
Granville WTP	operational	8	Electromagnetic	NO		
Point Fortin	defective	6	Electromagnetic	YES	6	$ 4,800
LA FORTUNE (Packaged)	operational	4	Electromagnetic	NO		
Plants and Wells Flowmeter Status - South Central						
Water Facilities	Meter Status	Meter Size	Meter Type			
Freeport WTP	operational	12	Electromagnetic	NO		
	operational	12	Electromagnetic	NO		
Carlsen Field WTP	operational	12	Electromagnetic	NO		
	defective	6	Electromagnetic	YES	6	$ 4,800
Ravine Sable WTP	operational	4	Electromagnetic	NO		
	defective	4	Electromagnetic	YES	4	$ 3,900
Plants and Wells Flowmeter Status - South East						
Water Facilities	Meter Status	Meter Size	Type & Status	Replace Meter	Size, Inches	Meter Cost , USD$
Maloney WTP	defective	4		YES	4	$ 3,900
Stonebright WTP	defective	4		YES	4	$ 3,900
Mayaro WTP	operational	4	Electromagnetic	NO		
Biche WTP	operational	4	Electromagnetic	NO		
Guayaguayare (Petrotrin)	defective	4	No Meter	YES	4	$ 3,900
Guayaguayare (WASA) WTP	operational	4	Electromagnetic	NO		
Navet WTP	operational	36	Electromagnetic	NO		
TRINITY	operational	3	Electromagnetic	NO		
Plants and Wells Flowmeter Status - North East						
Water Facilities	Meter Status	Meter Size	Meter Type	Replace Meter	Size, Inches	Meter Cost , USD$
Caura W.T.P	Operational	12	Electromagnetic	NO		
L&N WTP	Operational	6	Electromagnetic	NO		
Acono W.T.P	Operational	4	Electromagnetic	NO		
Cumuto WTP	Defective	10	Electromagnetic	YES	10	$ 7,300
Talparo WTP	Operational			NO		
Tacarigua WTP	Operational	12		NO		
Tacarigua WTP	Operational	12		NO		
Arouca WTP	Operational	3	Electromagnetic	NO		
Hollis WTP	operational	24	Electromagnetic	NO		
Quare WTP	defective	8		YES	8	$ 6,000
Guanapo WTP	Operational	12	Electromagnetic	NO		
Tompire WTP	Defective	8		YES	8	$ 6,000
Matura WTP	Operational	6		NO		
Plants and Wells Flowmeter Status -Tobago						
Water Facilities	Meter Status	Meter Size	Meter Type	Replace Meter	Size, Inches	Meter Cost , USD$
Richmond WTP	Operational	8	Electromagnetic	NO		
Richmond WTP	Operational	6	Electromagnetic	NO		
King's Bay WTP	Operational	6	Electromagnetic	NO		
Highlands Rd. WTP	Operational	6	Electromagnetic	NO		
Hillsboro West WTP	Defective	12	Electromagnetic	YES	12	$ 8,900
Hillsborough Dam	Operational	8	Electromagnetic	NO		
Greenhill Intake	defective	6	Electromagnetic	YES		
Courland WTP	Functional	8	Electromagnetic	NO		
Charlotteville Intake	Functional	4	Turbine	YES	4	$ 3,900
					17	$ 91,400

Water Consumption Records

Estimates of water consumption were provided by WASA are summarized in Figure 21.



	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18
Agricaltural - E4	36528	31104	21779	44258	37584	30331	39706	33456	7346	59505	31695	34958.67
Cottage D4	43154.33	47546	42705.34	56598	38369.17	49176.5	49936	46664	32254	57459	47681.83	40321
Commercial - C4	1339775.66	1165605	1184603.33	1580381.33	1242789.17	1202591.17	1432842.17	1324896.17	983864	1226861.17	1278183.28	1043655.5
Water Improvement - B6	2307446	2064121	2275681	1840238	1904075	2185115	2085814	2274807	2442613	2701041	2256671	1839597
Industrial - B4	2506576	2360321	2456968	2114697	2114033	2420355	2213137	2548916	2651876	2329569	2512880	2106239
Charitable Institution - A6	6044	5032	3258	2592	17683	3368	2629	7421	3034	1723	10490	3232
Domestic - Internally Serviced - A4	1151362.9	719875.55	597428	604261	668242.15	1392983	1121157.9	508415.43	606801.94	557585.42	644146.03	461885.44

Figure 21 Water Consumption by Category of Customer

Comments regarding water consumption:

a) The domestic consumption is 48 m^3/connection/month. Based on experience in other places in the Caribbean, the average monthly residential metered customer consumption is in the range of 20.0 to 30.0 m^3/connection/month (4,000 to 6,000 IG per connection per month). Therefore, the TT system has probably an excess consumption by the unmetered customers of 18.0 to 28.0 m^3/connection/month (1,600 to 5,600 IG/c/m). Potentially, this excess represents 66.6 to 102.7 million m^3/year (40.2 to 62.0 MIGD) that are not effectively "billed" to the customers.

b) The current Annual Taxable Value tariff structure does not have the provisions to recover this excess volume. The tariff on an average has not been increased since 1993. In general, it is concluded that if the volume of leakage is recovered, then there should be enough water supply to cover the deficit. However, in some areas the recoverable volume may not be sufficient to supply the deficit during the dry season.

c) Based on the above considerations and findings, the conclusions are:

- The existing fixed tariff structure lends itself to excess consumption that contributes to the generation of a continuous growing deficit. It is recommended to review the tariff structure once customer service has been improved.

- There is a high probability that not having volumetric metering is the cause of excess consumption. Universal metering is a proven solution for reducing excess consumption.

It is estimated that 40 to 62 MIGD can be recovered by an adequately implemented universal customer metering programme. Additionally, the proposed leakage reduction initiative should effectively recover between 38 to 50 MIGD, for a total of 78 to 112 MIGD additional volume that would be available to cover customer demand with 24/7 water supply in most areas of the system. However, it is possible that in some areas of the system the water NRW recovery may not be enough to supply the deficit. Therefore, one of the initiatives recommended by the Action Plan is to conduct an assessment of the water supply deficiencies based on the hydrology of the water resources and the hydraulics of the transmission and distribution system.

Current Issues: Transmission

1) Real and Apparent Losses – 50% NRW
2) Lack of network transmission capacity (bottlenecks)
3) Lack of management information systems and analysis

Comments:

a) The IDB Consultant developed a Preliminary Water Balance and Component analysis (see Annex 3), using available information, to assess the NRW volumes and category of the water loss component.

b) **Network upgrade:** Pipe upgrades and replacement are expensive and should be considered as the last resort. This programme requires proper planning, developing smart tools, conducting surveys, and analyzing data to prioritize new piping and replacement. The following actions are suggested:
   - ✓ Replace defective production flow meters and install an ethernet-based SCADA system to transfer production flow and pressure to a central server in real time. Develop Module 1 of the Management Information System (MIS). Appoint an existing employee as "Production Monitoring and SCADA Superintendent". Retrain personnel (by regions) to assist the Superintendent to trouble-shoot equipment issues as part of daily operations.
   - ✓ Do a pilot study of customer consumption using 4,000 smart meters with data loggers that can measure customer flow in 5 to 15-minute time intervals. Meters should be capable of transmitting data via SMS or with Drive-by AMR readers. This could be done in one or more existing functional DMAs.
   - ✓ Update and validate the GIS of the transmission and distribution system.
   - ✓ Develop an Asset Management tool that can be used for universal meter replacement. In addition, this tool should be able to track leak repairs, develop and trace work orders for the water distribution infrastructure, illegal connections, and customer service cut-off and re-connection. This tool should be compatible with other asset management tools used for maintenance of vertical infrastructure.
   - ✓ Develop all-pipes hydraulic models of the Trinidad and Tobago systems to properly analyze and size/optimize pipe upgrades and replacements and for establishment of Macro-DMAs and DMAs/PMAs.

c) **Storage**: Use the hydraulic model to properly size the storage tanks and the hydraulic grade line of the system improvements and 24/7 supply.

The Unavoidable Annual Real Losses (UARL) can be used to predict, with reasonable reliability, the lowest technically achievable annual real losses. The preliminary estimate of the UARL was 4,471,829 m^3/year [985 MIG Year] or 12,252 m^3/day [2.7 MIGD]. The actual real losses are estimated at 218,312 m^3/day [48.1 MIGD] or about 17.8 times higher than the so-called unavoidable losses. Therefore, assuming an economically potential recoverable volume of 50%, or 106,156 m^3/day [23.4 MIGD], the estimated annual savings in operating cost amount to $163.0 Million TTD. Of course, it is not realistic to target such high-volume recovery in a short-term. Some of the initiatives that can be implemented to reduce real losses are:

- ✓ Pressure management and district metering
- ✓ Leak detection using acoustic and satellite surveys and simultaneous contracted leak repairing crews
- ✓ Replacement of leaky service connections
- ✓ Limited replacement of water mains that have exceeded their useful life (based on a systematic analysis and field survey)

d) The apparent losses can be grouped into three main categories:

Unauthorized consumption – theft/fraud/illegal connections. The information reviewed suggests that this could be in the 4% range or higher. Having unmetered customers could be the cause of most of the illegal use incidences.

Metering inaccuracies – this category usually includes commercial losses when meters under-register the through flow. In cases where there is no metering, it can be interpreted as the volume of water consumed that exceeds the billing tariff in terms of $/unit volume (say US$/m^3 or TTD/IG). For example, if a customer has a flat fee of $35.00 TTD/month, then, based on a tariff of $1.75 TTD/$m^3$, the reasonable consumption should be 20 m^3/month [4,000 IG/month], which is very typical as an average domestic consumption in other countries in the region. Anything over 20 m^3/month could be considered apparent losses due to excess consumption or leaks inside the customer's residence due to plumbing wastage.

As part of the water balance and being careful not to overestimate the potential recoverable volume of apparent losses for TT, an average of 30 m^3/month (6,000 IG/month) was used as the possible actual consumption per connection in TT. Therefore, as shown in the water balance calculation, the excess usage/overconsumption that can be attributed to apparent losses of 194,390 m^3/day [42.8 MIGD] of consumption that does not return revenue.

This makes a robust case for considering universal metering of domestic customers with a reasonable tariff that is in line with other water utilities in the region. The use of smart meters

will also help in reducing customer fraud, illegal use, and tampering, and improve the data handling that would reduce billing errors significantly.

Systematic Data Handling Errors: It is difficult to estimate this category without the benefit of a billing system audit. These are errors that can occur due to data transfer or errors in data analysis and auditing. These uncertainties could also include reading errors of metered customers. A smart customer metering system could increase the accuracy and help recover revenue that otherwise would not be billed.

If a more aggressive NRW reduction plan is implemented, some or all the capital planned for new sources and wellfield rehabilitation can be deferred for the future. The bleeding of NRW must be stopped before adding new sources. Otherwise, leaky pipes and customer overuse will continue or become worst. It is important to implement pressure management in parallel to reduce night pressures and overall operation pressures. When pumping is directly to the distribution system, WASA should consider replacing or retrofitting fixed-speed pump motors with motors controlled by variable frequency drives (VFDs). This can help to regulate night pressures and reduce excessive leakage.

The preliminary component analysis shown below indicates that total losses are composed of about 50% real losses and 50% apparent losses. This is based on top-down information from existing data. However, the accuracy of the data is highly questionable since monitoring of production is not consistent and incomplete and the total consumption is not measured.

The estimated recoverable volumes of apparent losses as a result of universal metering using smart meters are summarized in Figure 22. Likewise, the estimated recoverable volume of real loses by type of real loss reduction initiative is summarized in Figure 23.

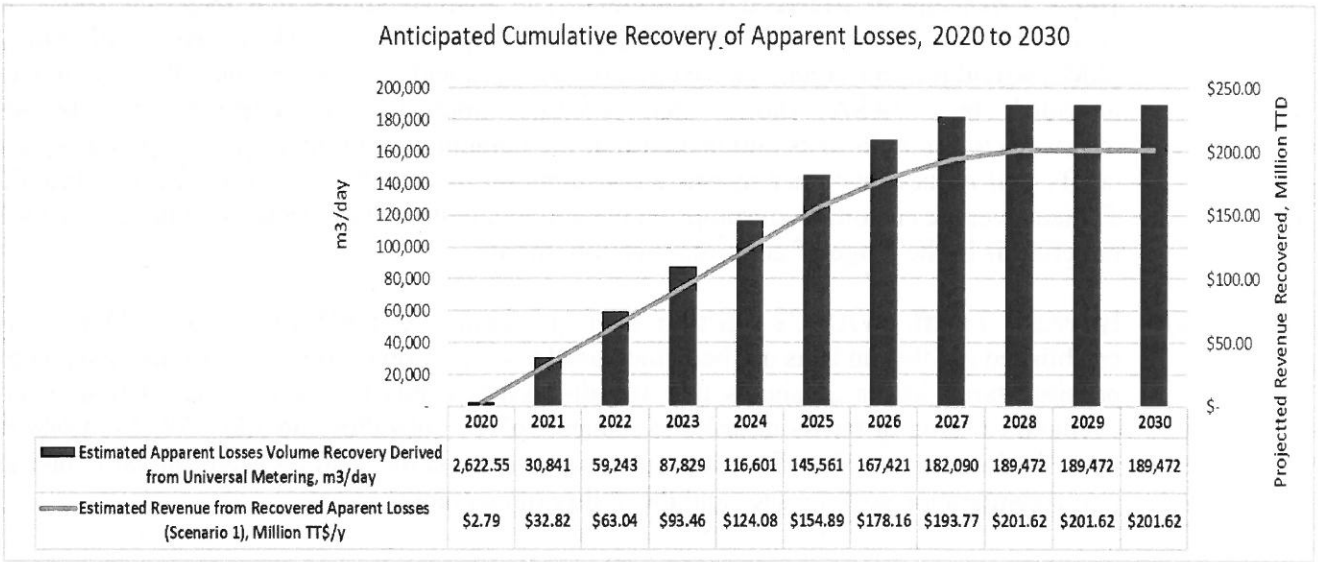
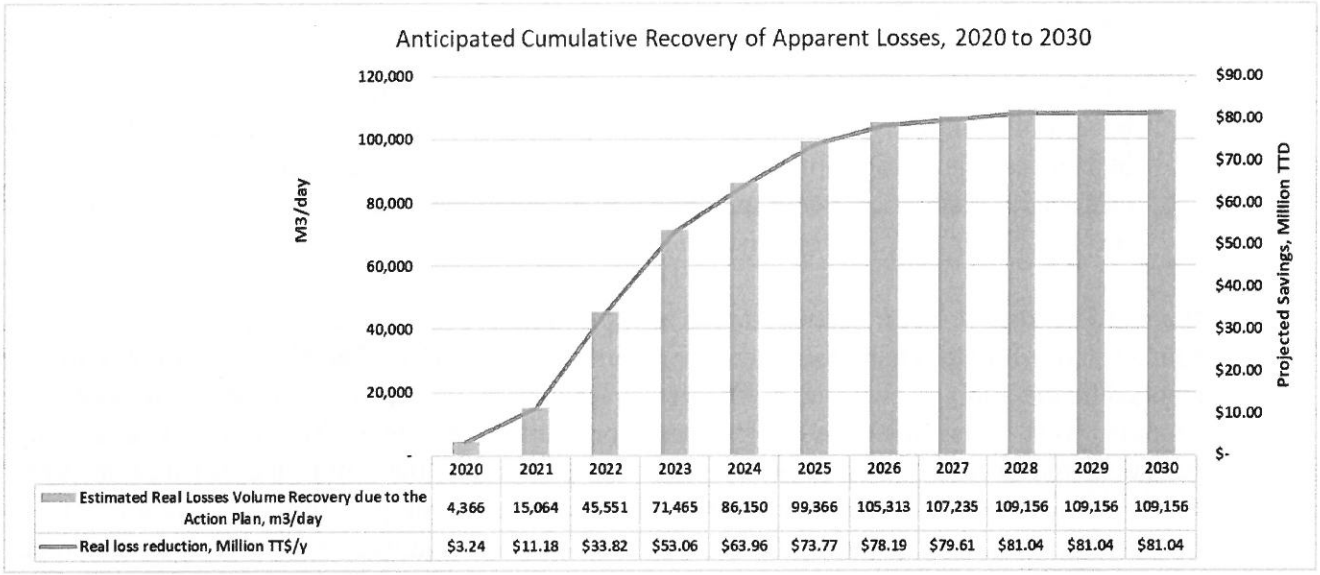


Figure 22 Estimated Apparent Losses Volume Recovery



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Estimated Real Losses Volume Recovery due to the Action Plan, m3/day	4,366	15,064	45,551	71,465	86,150	99,366	105,313	107,235	109,156	109,156	109,156
Real loss reduction, Million TT$/y	$3.24	$11.18	$33.82	$53.06	$63.96	$73.77	$78.19	$79.61	$81.04	$81.04	$81.04

Figure 23 Estimated Real Losses Volume Recovery

Current Issues: Distribution

1) Low Tariffs – Low Collection
2) No Customer Metering
3) Wastage culture
4) Poor Customer Service

Comments:

a) **100% Coverage of Metered Customers.** The analysis shows that metering 100% of customers with Automated Meter Reading (AMR) and/or Advanced Metering Technology (AMI) would recover volume, save operational costs, and increase revenue. Review of data provided by WASA shows that average domestic consumption exceeds 48 m^3/connection/month. It is anticipated that the combination of smart metering and higher tariffs will reduce customer monthly consumption to less than 30 m^3/connection/month. Typical average customer consumption in similar countries in the region that have universal metering is in the range of 20 m^3/connection /month.

b) **Increase Tariff.** WASA's existing average residential tariff of $0.23 USD/$m^3$ was established in 1993 and has not been increased to date. A preliminary sensitivity analysis of possible tariff increases shows that the discussion needs to continue in relation to an eventual revision of tariffs in order to reduce GoRTT subsidies and allow WASA to meet its operational cost. Therefore, it is necessary to restructure and redesign the tariff taking into consideration social issues and the ability of customers to pay.

c) **Conservation Campaign.** It is a considered view that metering all customers will disrupt the cultural behaviour and force conservation once customers must pay for the actual volume of water consumed. Meter replacement paired with customer education and improvement of the levels of service are elements of the proposed conservation campaigns.

Some suggestions for the educational and conservation campaign are:

- ✓ WASA to provide a two to three-month grace period after meter replacement and monitor accurate customer usage but only charge for a fixed volume of water at the established tariff. Those customers that have significant night-time usage can be flagged and notified about having internal leakage that needs to be fixed. Customers with plumbing issues must fix them during the grace period. After the grace period concludes, the customer must pay for the metered volume.

- ✓ WASA should consider offering a "social tariff" that provides incentives (15 to 25% cost reduction) to low-income customers that use less than 20 m^3/month. The proposed monthly volume is a reasonable consumption that is equivalent to less than 208 lcd based on 3.15 people per dwelling. Other possible incentives would include a 5 to 10% reduction of the water bill for those "blue ribbon" customers that pay their bill in less than 15 days.

d) **Improved customer satisfaction**. Customer satisfaction is anticipated to increase as 24/7 service is established. The smart meters also can provide metrics and online real-time information that would be beneficial to customers.

Current Issues: Management

1) Low revenues and high operating costs
2) Weak governance

Comments:

The operating cost is top heavy on salaries.

ANNEX 4 – PRELIMINARY WATER BALANCE FOR TRINIDAD AND TOBAGO

Preliminary Water Balance for Trinidad and Tobago

The principle of water balance involves the quantification of water volumes from the production facility to the end user. The accuracy of the water balance depends on the accuracy of monitoring the volumes of each of the individual components of the system. Table 45 shows the different components of the water balance, as stipulated in the methodology developed by the International Water Association (IWA). This methodology is considered the industry's standard and has been adopted by numerous countries and regulatory agencies throughout the world.

Table 51 Preliminary Water Balance

Volume From Own Sources (corrected for known errors)	System Input Volume	Water Exported (corrected for known errors)		Billed Water Exported		Revenue Water
		Water Supplied	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption Billed Unmetered Consumption	Revenue Water
				Unbilled Authorized Consumption	Unbilled Metered Consumption	Non-revenue Water
					Unbilled Unmetered Consumption	
			Water Losses	Apparent Losses	Customer Metering Inaccuracies Unauthorized Consumption	
					Systematic Data Handling Errors	
				Real Losses	Leakage on Transmission and Distribution Mains	
Water Imported (corrected for known errors)					Leakage and Overflows at Utility's Storage Tanks	
					Leakage on Service Connections up to the Point of Customer Metering	

Water Balance

Source: Standard IWA methodology of balancing consumption and water losses

At present WASA does not have the infrastructure required to do a proper water balance. The water systems lack volumetric production monitoring as well as metering of customer consumption. Furthermore, not having supply continuity also impairs the ability of the utility to develop a proper water balance. As an effort to estimate some of the critical components of a water balance for the Trinidad and Tobago systems, the IDB's Water Expert used existing data (2018) available in several reports to establish an approximation of the production, consumption, and key components of the water balance that are highlighted in Table 45 above. Figure 22 shows the results of the preliminary water balancing attempted.

Water Balance Report for:	WASA TOTAL SYSTEM		
Population served with piped water:	#REF!		
Reporting Period:	JANUARY 1 TO DECEMBER 31, 2018		
WATER SUPPLIED	Based on Data from The Transformation Plan		
Volume from own sources:	186.9	MIGD	
Desal Water Purchased:	45.1	MIGD	
Water exported:	-	MIGD	
WATER SUPPLIED:	**232.0**	**MIGD**	
AUTHORIZED CONSUMPTION: Based on available resources			
Billed Metered	48.0	MIGD	
Billed Unmetered	84.8	MIGD	
		MIGD	
		MIGD	
Unbilled metered:		MIGD	
Unbilled unmetered:	2.0	MIGD	
AUTHORIZED CONSUMPTION:	**134.8**	**MIGD**	
WATER LOSSES (Water Supplied - Authorized Consumption)	**97.2**	MIGD	
Apparent Losses			
Unauthorized consumption:	3.9	MIGD	4.03% Assumed*
Customer over consumption :	42.8	MIGD	31.75% Assumed *
Systematic data handling errors:	2.4	MIGD	2.50% Assumed*
			* See text
Apparent Losses:	**49.1**	MIGD	
Real Losses (Current Annual Real Losses or CARL)			
Real Losses = Water Losses - Apparent Losses:	**48.1**	MIGD	
WATER LOSSES:	**97.2**	MIGD	
NON-REVENUE WATER			
NON-REVENUE WATER:	**99.2**	MIGD	
= Water Losses + Unbilled Metered + Unbilled Unmetered	99.2	MIGD	
SYSTEM DATA			
Length of mains:	6,181.4	kilometers	Source: Miya WB
Number of active AND inactive service connections:	423,629		Source: Miya WB
Service connection density:	68.5	conn./ km main	
Are customer meters typically located at the curbstop or property line?	Yes		
Average length of customer service line:	2.0	m	
Average operating pressure: Estimated	30.0	m H2O	
COST DATA			
Estimated annual cost of operating water system:	$12,761	$TTD/MIG	
Total annual fixed operating cost of the water system:	$ 1,080,563,776	$TTD/Year	
Customer retail unit cost (applied to Apparent Losses):	$7.95	$TTD per 1000 IG	
Variable production cost (applied to Real Losses):	$9.72	$TTD per 1000 IG	

Figure 24 – Estimated Water Balance Report for Trinidad and Tobago

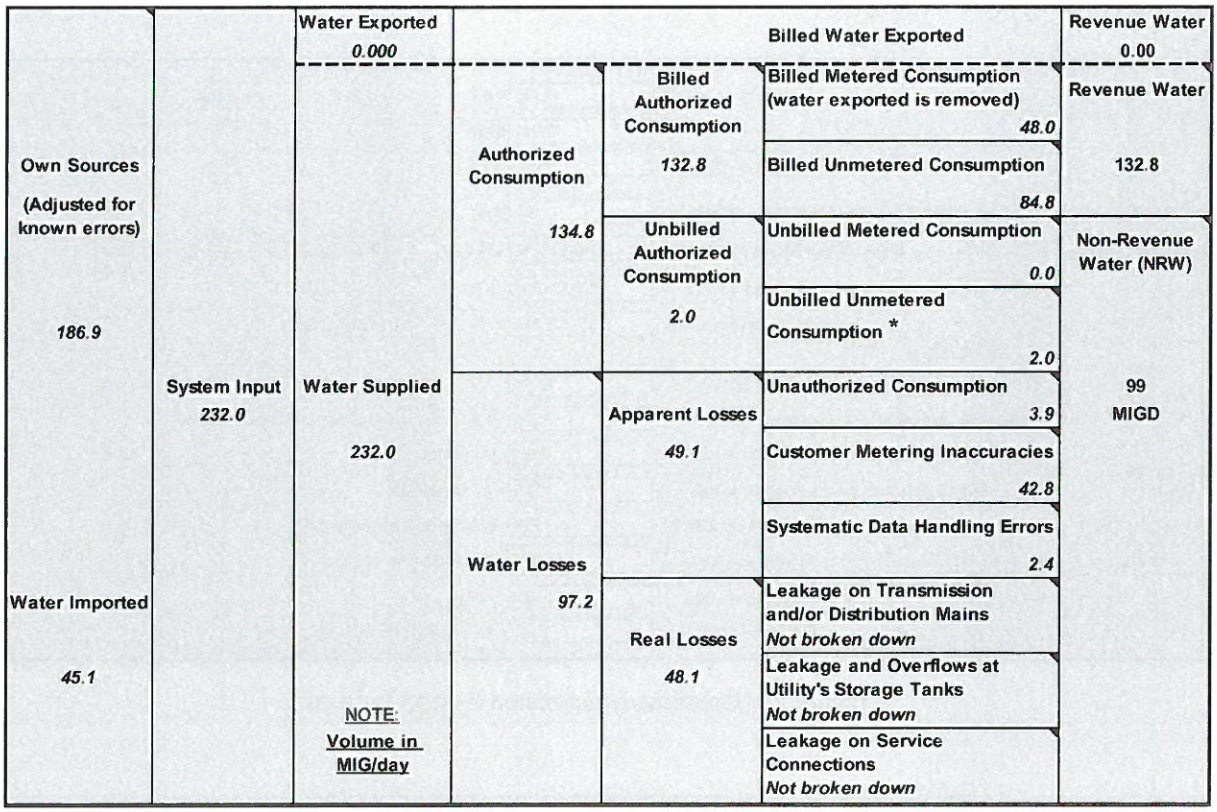
System Indicators:				
Apparent Losses:	17,938 MIGY	USD =	6.78 TTD	
+ Real Losses:	17,544 MIGY			
= **Water Losses:**	35,482 MIGY			
Unavoidable Annual Real Losses (UARL):	985 MIGY			
Annual cost of Apparent Losses:	142,605,754 $TTD	21,033,297 USD		
Annual cost of Real Losses:	170,525,924 $TTD	25,151,316 USD		
Total cost of water losses :	313,131,678 $TTD	46,184,613 USD		
Performance Indicators:				
Non-revenue water as percent by volume of Water Supplied:	41.9%			
Non-revenue water as percent by cost of operating system:	29.0%	Real Losses valued at Variable Production Cost		
Apparent Losses per service connection per day:	116.0 IG/connection/day			
Real Losses per service connection per day:	113.5 IG/connection/day			
Real Losses per length of main per day*:	7,776 IG/kilometer of mains/day			
Real Losses per service connection per day per meter (head) pressure:	1,380.4 IG/connection/day/m H_2O			
From Above, Real Losses = Current Annual Real Losses (CARL):	17,544 m3/year			
Infrastructure Leakage Index (ILI) [CARL/UARL]:	17.82 *Note: this indicator is for reference only and may not be applicable to systems with intermittent service or small systems*			

Figure 24 (Continued) Estimated System Indicators

		Water Exported 0.000			Billed Water Exported	Revenue Water 48,468
Own Sources (Adjusted for known errors) 68,219	System Input 84,680	Water Supplied 84,680	Authorized Consumption 49,198	Billed Authorized Consumption 48,468	Billed Metered Consumption (water exported is removed) 17,520	Revenue Water
					Billed Unmetered Consumption 30,948	48,468
				Unbilled Authorized Consumption 730.0	Unbilled Metered Consumption 0	Non-Revenue Water (NRW)
					Unbilled Unmetered Consumption * 730	
			Water Losses 35,482	Apparent Losses 17,938	Unauthorized Consumption 1,429	36,212 MIGY
					Customer Metering Inaccuracies 15,621	
					Systematic Data Handling Errors 887	
Water Imported 16,462		NOTE: Volume in MIG/year		Real Losses 17,544	Leakage on Transmission and/or Distribution Mains *Not broken down*	
					Leakage and Overflows at Utility's Storage Tanks *Not broken down*	
					Leakage on Service Connections *Not broken down*	

Note: * The estimated excess use (which could also be cosidered unbilled unmetered) was attributed to apparent losses

Figure 24 (Continued) Estimated Water Balance in MIGY



Note: * The estimated excess use (which could also be cosidered unbilled unmetered) was attributed to apparent losses

Figure 24 (Continued) Estimated Water Balance in MIGD

Using the volumetric estimates obtained from the water balance calculations, the key NRW components - Real and Apparent losses, where estimated volumetrically and the cost of the losses was calculated, as shown in Figure 25. The cost of the real losses is based on the variable production cost of the water, and the cost of the apparent losses is based on the retail cost of water to customers. Therefore, a value of $17.20 TTD per 1000 IG (Source: Castalia) was given to the real losses and a value of $12.80 TTD per 1000 IG (Source: Castalia) was applied to the apparent losses.

Overall, as shown in the estimated system indicators chart, the total volume of water losses is estimated at 97.2 MIG per day. The analysis shows that about 48.1 MIG per day of the water losses are attributed to real losses or leakage, approximately 49.1 MIG per day of the losses can be attributed to apparent losses or commercial type losses and unbilled unmetered consumption is 2.0 MIGD, bringing the total NRW to 99.2 MIGD. The overall estimated annual value of the real and apparent losses is $313.1 million TTD [$46.2 million USD].

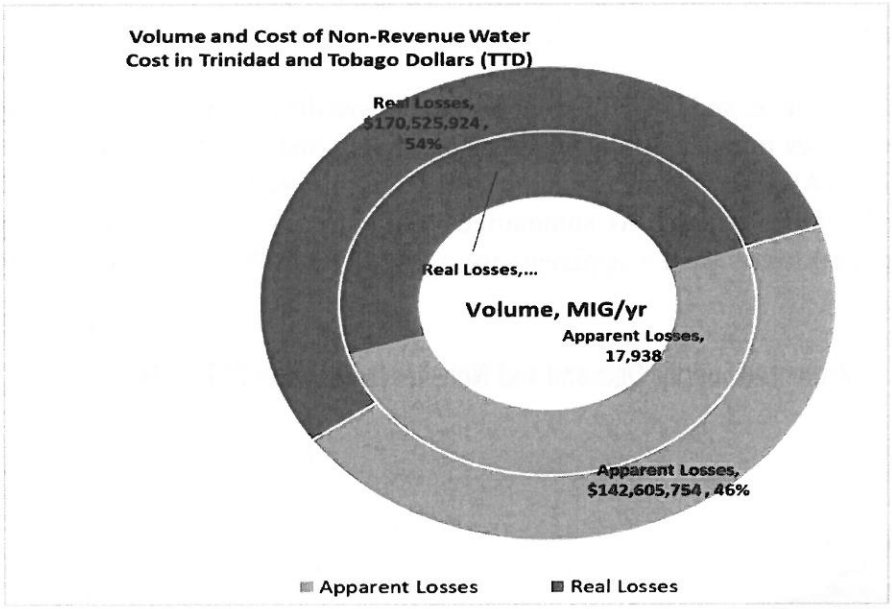


Figure 25 – Estimated Volume and Cost of NRW in Trinidad and Tobago

A preliminary component analysis was also estimated using the water balance calculations as shown in Figure 26. This preliminary estimate shows that customer overconsumption is a very significant component of the water losses and the primary justification for the need for implementing universal metering as soon as possible. The overconsumption can also be considered as part of the unbilled unmetered (UU) component. For this analysis, the UU component was attributed to the apparent losses.

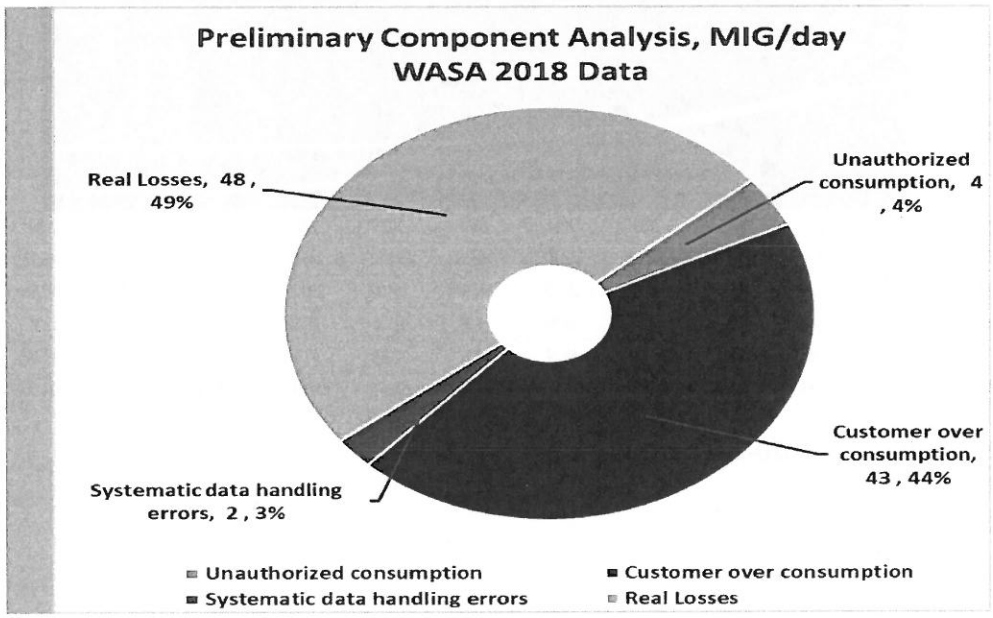
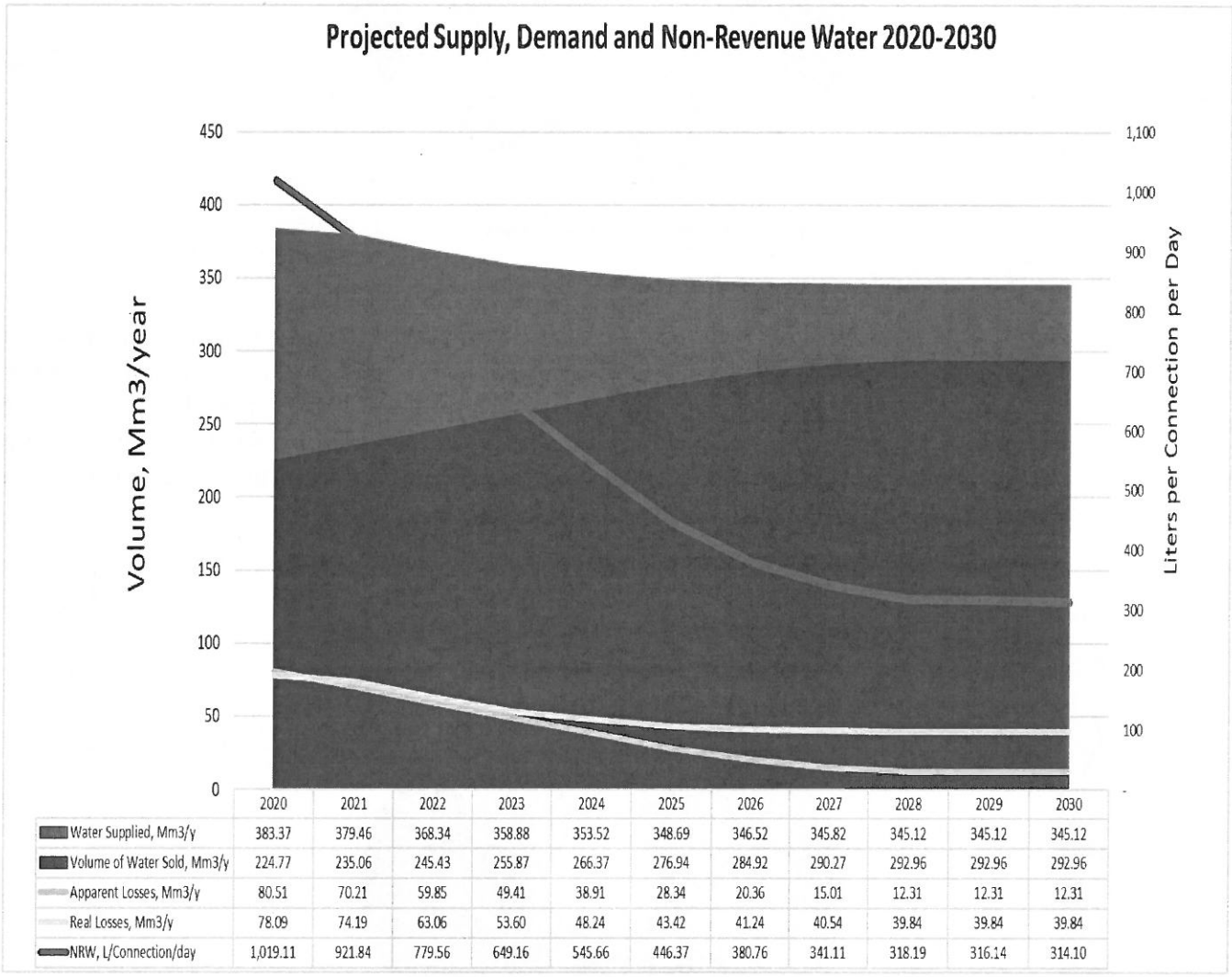


Figure 26 – Preliminary Component Analysis MIG/day, WASA data 2018

NRW Recovery Scenario

Using the preliminary water balance, an NRW Recovery Scenario was developed with a focus on reducing real and apparent losses to make up the water supply deficit and to achieve 24/7 water service in all or most of the WASA service areas without increasing the water supply. Figure 27 shows the water balance for this Scenario. As summarized in Figure 28, the NRW Recovery Scenario aims at reducing total losses [real + apparent] from 99 MIGD in 2020 to 31 MIGD by 2029.



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Water Supplied, Mm3/y	383.37	379.46	368.34	358.88	353.52	348.69	346.52	345.82	345.12	345.12	345.12
Volume of Water Sold, Mm3/y	224.77	235.06	245.43	255.87	266.37	276.94	284.92	290.27	292.96	292.96	292.96
Apparent Losses, Mm3/y	80.51	70.21	59.85	49.41	38.91	28.34	20.36	15.01	12.31	12.31	12.31
Real Losses, Mm3/y	78.09	74.19	63.06	53.60	48.24	43.42	41.24	40.54	39.84	39.84	39.84
NRW, L/Connection/day	1,019.11	921.84	779.56	649.16	545.66	446.37	380.76	341.11	318.19	316.14	314.10

Figure 27- Projected NRW over a 2020-2030 period.

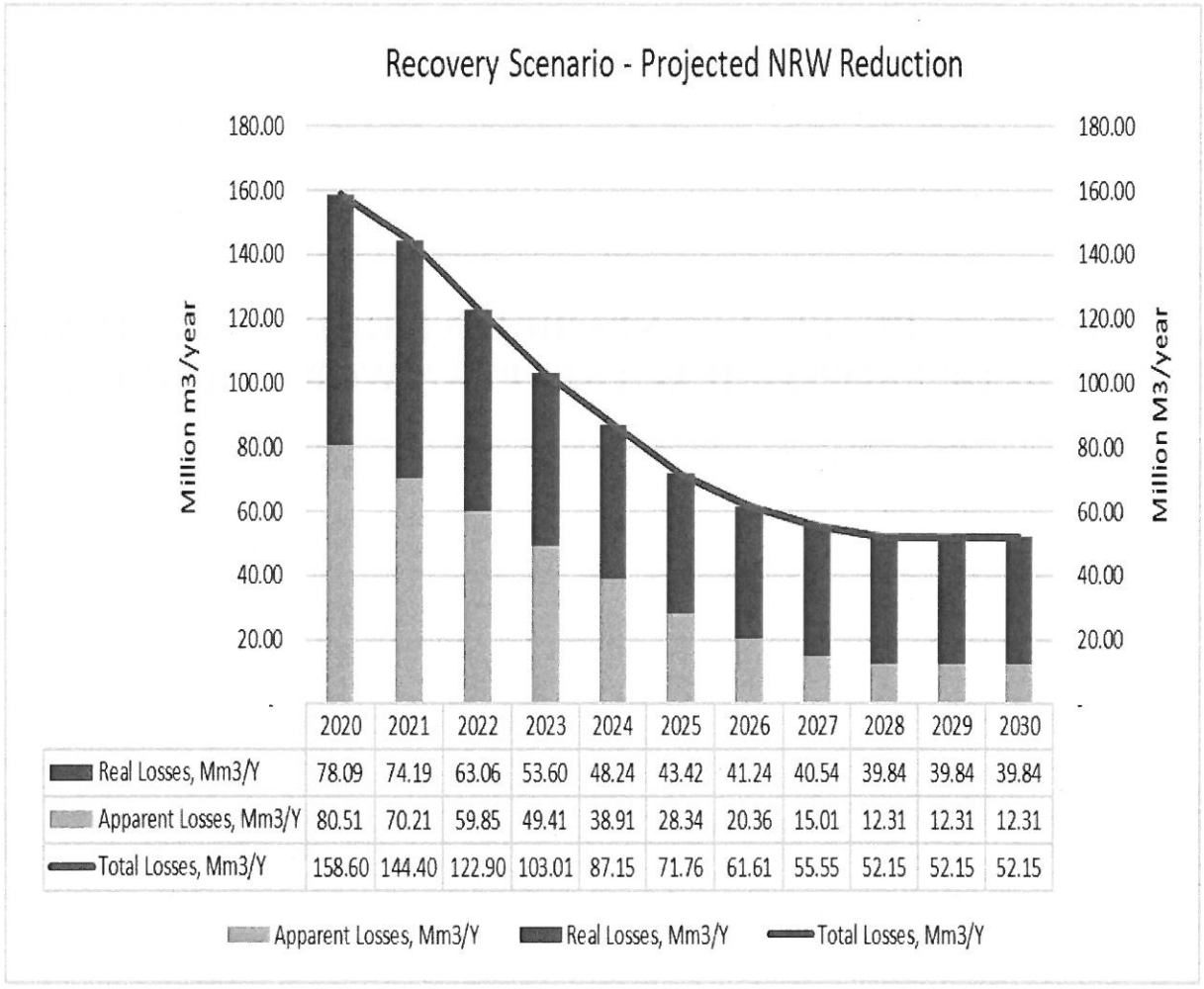


Figure 28 Shows a more detailed projection of the anticipated NRW reduction

ANNEX 5 – PHASE I – STABILIZATION, PRELIMINARY SCOPING OF PROPOSED ACTION PLAN WORK PACKAGES

PHASE I - STABILIZATION

A summary of each of the Action Packages under the Programme, Phase I - Stabilization is presented below. The Infrastructure Rehabilitation prong consists of 5 Action Packages numbered 1 to 5 and the Institutional Strengthening: Governance, Institutional Reformulation and Systemwide Change Management corresponds to Action Package No. 6.

1. BASELINE STUDIES AND DEVELOPMENT OF SMART TOOLS

Development of analytical and management tools – Hydraulic Models, GIS, and Asset Management

The purpose of this activity is to enhance the validity of existing tools such as Geographic Information System (GIS) and to develop new tools, including hydraulic modelling and asset management systems that are needed for proper operation and proactive management of the system. The proposed action would involve surveying each one of the five regions to update and evaluate existing information. It will also include a two-day workshop at each one of the regions with operating personnel who are familiar with the distribution systems to validate the field data as well as fill in data gaps. Once the GIS is updated, it will be used to develop hydraulic models for each one of the five regions that will be calibrated with data obtained from the water balance and customer consumption monitoring projects.

Regional Assessment of Intermittent Supply

Based on the water balance presented in Annex 3 and the realistic quantities of recoverable volumes from NRW, it is anticipated that, in general, current seasonal water deficits can be supplied with the recovered NRW. However, from the geographical standpoint some areas of the distribution system may still require supplemental supply sources or operational changes in water transmission patterns to supply 24/7 water to all customers. As part of this task, historic water supply deficits will be evaluated, and hydrological water balances will be developed to determine if the recoverable volumes attributed to reduction of leakage and universal metering can supply all customers. The hydraulic models will be used to determine if the combination of water transfers, additional storage, more aggressive leakage reduction, and rehabilitation of existing wells can supply the deficits or if additional sources are necessary or cost-effective.

Customer Consumption Assessment

This activity consists of procuring about 4,000 smart meters to be used for recording actual customer consumption. The meters should be capable of registering volume passing through the meter with an accuracy of 0.1 liters and logging consumption data every 15 minutes. The meters should be capable of transferring data to a fixed or drive-by network collector or via radio or cellular communications. A preliminary assessment of meter installation is required to properly select a representative customer population. One possibility is to use one of the existing DMAs that are functional. The testing will be conducted for about 10 consecutive weeks. This activity will be conducted by the contractor who will be responsible for installing the meters in the proper meter box and for managing the data. The contractor will analyze the data and provide a technical memorandum of the customer water consumption activities and analytical results.

Smart Water Balance, Analytics and Information Management

This activity involves an analysis of WASA's current systems and the development of seven management information modules and developing an integrated management information system (MIS) of WASA's operations, as needed. The seven modules are:

- Module 1 Management Information System - Production Data from SCADA
- Module 2 - Management Information System - DMAs/PMAs
- Module 3 - Commercial and Industrial Customers
- Module 4 -Domestic Customers
- Module 5 -Billing System
- Module 6 - Customer Service
- Module 7 - Buried/Horizontal Infrastructure Asset Management and Condition Assessment

The MIS modules will be developed progressively in parallel with the corresponding initiatives.

2. WATER DISTRIBUTION NETWORK OPTIMIZATION AND REHABILITATION

Production Metering and SCADA Assessment, Procurement and Installation

This activity involves an evaluation of existing conditions of all meters and instrumentation at water treatment plants (WTPs) that supply finished water to the water distribution system. As a result, the contractor performing the activity will determine the existing metering and instrumentation functionality and accordingly, determine equipment replacement needs. The flow and pressure monitoring equipment will be connected to a new ethernet-based Supervisory Control and Data Acquisition (SCADA) system that will transmit real-time data to a new MIS server. Module 1 of the MIS will be designed to process the real-time data and provide real-time systemwide water production. This will be done as part of an application that will provide management and operators with periodic statistical analysis of performance indicators and targeted parameters.

Leak Survey and Repair Contracting and Implementation

This is a continuous 48-month activity aimed at plugging the holes in the distribution system. This activity involves hiring a contractor to survey the water distribution system in areas of known or suspected high leakage and repairing leaks as soon as possible. The initiative also includes replacing leaking service connections. The surveys have been budgeted primarily for acoustic-based surveys with the possibility of using satellite-based assessments to locate areas of interest. This could be a regular proactive activity where many of the existing leaks are detected and repaired on a regular basis. All leak repairs will be documented with the asset management system and will be used to generate information needed to assess future pipe replacement needs. It is important to conduct this activity in parallel with pressure management initiatives at the DMAs. Repairing leaks will have the tendency of increasing pressures that would create additional leakage in pipes if pressure is not properly regulated.

Planning and Implementation of DMAs/PMAs

This activity consists of planning and implementation of District Metred Areas (DMAs) and Pressure Managed Areas (PMAs). In the past, WASA implemented several DMAs of which some are still functional. The contractor for this activity will be responsible for evaluating the existing DMAs and determining appropriate changes and upgrades necessary for its functionality. The objective of this initiative is to reduce leakage and to improve the database on the regional systems divided by sectors or DMAs. Whenever possible, the pressure will be controlled at each DMA using Smart Pressure Reducing Valves (PRVs). This will help to reduce leakage, particularly at night-time conditions. It is anticipated that about 120 DMAs/PMAs will be established.

3. UNIVERSAL METERING

Customer Metering Assessment & Procurement

This activity involves selecting a contractor that is knowledgeable in smart meters for both domestic and non-domestic customers. The meter selection criteria should include, but not be limited to:

- cost of meters
- annual operating and maintenance required
- meter precision and accuracy at low, medium and high flows
- the warranty for batteries should be on order for 8 to 10 years
- meter housing and durability of materials
- demonstrated experience in similar climatic conditions
- software and hardware requirements
- integrated or separate data transmission devices
- ease of implementation
- installation costs
- cyber security
- factory and/or customer programmability
- tamperproof
- reverse flow measurements
- two-way communication

Non-Domestic Meter Implementation

This activity will involve hiring one or more contractors to install new meters for all nondomestic customers. New meters should be capable of transmitting data remotely and have batteries with a warranty of five years or better. Using the proposed management information system and SCADA, the nondomestic customer database consumption will be available to management daily. If the testing of existing meters shows that there are salvageable units, these will be taken into consideration for conversion to automated metering.

Universal Domestic Metering Implementation

This activity will involve hiring one or more contractors to install new domestic meters for all customers. It is anticipated that the selected metering equipment will be smart meters with accuracy better than 98.5 percent at all flow ranges. The meters will be 5/8 inches or 16 mm and will be AMR/AMI capable. During the business case evaluation, WASA, and MPU will determine whether meters will be read using the drive-by capabilities or a fixed network.

4. COMMERCIAL STRENGTHENING

Universal Metering Business Case Evaluation

Using the budgetary pricing for nondomestic and universal domestic metering, a water expert will conduct Business Case Evaluation and life cycle cost analysis for providing 100% coverage. The contractor must evaluate and test several metering options and consider as a minimum the meter selection criteria guidance included in the scope of work for the customer consumption pilot study.

Assessment and Recommendations for Restructuring Tariffs

This activity will build on CASTALIA's work and also include evaluating several tariff models that provide the required revenue stream for the long-term sustainability of the utility.

Public Relations Education Campaign

This activity is critical to bringing the general public of Trinidad and Tobago on board with the Transformation effort. As part of a Communication Plan, key messages to inform the public of the water supply situation will be prepared as well as request and suggestions for behavioral change in the use of water and the need for conservation practices. On the other hand, public outreach is also critical for water utilities when they need to raise awareness about water issues, inform consumers about rate changes, and get feedback from stakeholders. This activity will consist of procuring professional and internal resources to develop a comprehensive public outreach programme. The programme must highlight the importance of metering customer consumption and improving levels of service of the entire water and sanitation systems.

PPP Contracting Assessment

This activity will consist of evaluating possible PPP contracting modalities. The planning and procurement will be discussed among IDB, MPU, and WASA.

5. WELLFIELD REHABILITATION ASSESSMENT AND AUTOMATION

Existing Wellfield Rehabilitation Assessment and Automation

This activity consists of assessing the needs of rehabilitating existing wellfields. This will be done by a water expert that will evaluate existing conditions of the wellfields and determine automation needs and operating modalities that will allow for groundwater production redundancy, aquifer recharge and better operability. Security of facilities should be included

6. INSTITUTIONAL STRENGTEHENING: GOVERNANCE, POLICY AND INSTITUTIONAL REFORMULATION AND SYSTEMWIDE CHANGE MANAGEMENT

Institutional and Operations Audit of WASA; Governance, Policy and Institutional Reformulation; Systemwide Change Management and WASA Turnaround Plan; Performance management, Human Resources and staffing and recommendations for changes to the legal/regulatory framework for WRA and WASA; staffing of the Project Execution Unit.

7. PROCUREMENT AND CONSTRUCTION OF THE MULTI-PURPOSE FLOOD MITIGATION AND WATER SUPPLY RESERVOIR AT THE RAVINE SABLE SAND PIT, CAPARO

Construction of Flood Mitigation and Water Supply Reservoir, Construction of WTP and Pipeline Distribution Network and Land Acquisition.

WATER AND SEWERAGE AUTHORITY
HIGH LEAKAGE PIPELINE REPAIR PLAN

Region	Distance/km		Estimated Cost	
	Years 1-5	Years 6-10	Years 1-5	Years 6-10
North	59.3	43	$ 197,568,390.21	$ 156,220,725.00
South	57.4	23.4	$ 257,651,496.05	$ 95,940,000.00
Tobago	25.7	34.4	$ 96,756,424.00	$ 142,291,540.00
Sub-Total	**142.4**	**100.8**	**$ 551,976,310.26**	**$ 394,452,265.00**
Total	**243.2**		**$**	**946,428,575.26**

	PRIORITY 1		PRIORITY 2			PRIORITY 3				
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
North	$ 23,078,200.00	$ 27,470,000.00	$ 40,323,329.00	$ 55,960,975.72	$ 50,735,885.49	$ 40,450,500.00	$ 36,715,225.00	$ 21,809,000.00	$ 33,026,000.00	$ 24,220,000.00
South	$ 18,607,900.00	$ 53,830,326.05	$ 72,108,670.00	$ 68,002,100.00	$ 45,102,500.00	$ 16,400,000.00	$ 16,400,000.00	$ 25,100,000.00	$ 20,000,000.00	$ 18,040,000.00
Tobago	$ 10,088,772.00	$ 22,811,980.00	$ 9,206,672.00	$ 40,249,000.00	$ 14,400,000.00	$ 30,240,000.00	$ 25,367,800.00	$ 40,613,000.00	$ 23,650,740.00	$ 22,420,000.00
Total	**$ 51,774,872.00**	**$ 104,112,306.05**	**$ 121,638,671.00**	**$ 164,212,075.72**	**$ 110,238,385.49**	**$ 87,090,500.00**	**$ 78,483,025.00**	**$ 87,522,000.00**	**$ 76,676,740.00**	**$ 64,680,000.00**

Project	Distance/m	Total Estimated Cost	2018/19	2019/20	2020/21	2021/22	2022/23
			Estimated Cost	Estimated Cost	Estimated Cost	Estimated Cost	Estimated Cost
NORTH							
Replace 700m 4" AC main with 4" PVC on 1st Avenue, Mt. Lambert	700	$ 2,730,000.00	$ 2,730,000.00				
Replace 300m each 4" AC main with 4" PVC on 1st, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th Street, Mt. Lambert	2,400	$ 9,600,000.00		$ 9,600,000.00			
Replace 650m 4" grey PVC main with 4" PVC on Willam St, Mt. Dor Rd, Champs Fleurs	650	$ 1,690,000.00	$ 1,690,000.00				
Replace 700m 4" CI main with 4" PVC on Maloney St, San Juan	700	$ 1,820,000.00	$ 1,820,000.00				
Replace 110m 1 1/2" GWI main with 4" PVC on Dorchester Walk, MayFair Gardens, Lower Santa Cruz	110	$ 286,000.00		$ 286,000.00			
Replace 110m 1 1/2" GWI main with 4" PVC on Park Ave, MayFair Gardens, Lower Santa Cruz	110	$ 286,000.00			$ 286,000.00		
Replace 660m 4" grey PVC main with 4" PVC on Grace Gardens, Lower Santa Cruz	660	$ 1,716,000.00		$ 1,716,000.00			
Replace 500m 2" CI with 4" PVC main on Sinanan Gardens, Lower Santa Cruz	500	$ 1,300,000.00			$ 1,300,000.00		
Replace 320m 4" GWI with 4" PVC main on Sunvalley Dr, La Pastora, Santa Cruz	320	$ 832,000.00		$ 832,000.00			
Replace 1,300m 3" CI and grey PVC main with 8" PVC on La Pastora Rd, Santa Cruz	1300	$ 4,756,700.00			$ 4,756,700.00		
Repace 150m 3/4" long service with 4" PVC main at Jaggernath Tr, El Socorro South	150	$ 390,000.00			$ 390,000.00		
Replace 350m 4" CI main with 4" PVC at Sadoo Tr, El Socorro South	350	$ 910,000.00			$ 910,000.00		
Replace 100m 3/4" long service with 4" PVC main at Sunrise Ave, El Socorro South	100	$ 260,000.00			$ 260,000.00		
Replace 340m 3/4" long service with 4" PVC main at Swami Ave, El Socorro	340	$ 884,000.00			$ 884,000.00		
Replace 300m 3/4" long service with 4" PVC at Ali Dr, El Socorro South	300	$ 780,000.00			$ 780,000.00		
Replace 375m 4" CI main with 4" PVC main on Pitch Rd, Morvant	375	$ 1,372,125.00				$ 1,372,125.00	
Replace 425m 4" main with 4" PVC on Alexis St, Morvant	425	$ 1,105,000.00				$ 1,105,000.00	
Replace 100m 4" main with 4" PVC on Morgan Lane, Laventille	100	$ 260,000.00				$ 260,000.00	
Replace 400m 4" CI main with 4" PVC on Redwood St, Morvant	400	$ 1,040,000.00				$ 1,040,000.00	
Replace 110m 4" CI main with 4" PVC on Cosmos Dr, Morvant	110	$ 286,000.00				$ 286,000.00	
Replace 300m 4" CI main with 4" PVC on Plover St, Movanct from Lady Young Ave to Plover Gardens	300	$ 780,000.00				$ 780,000.00	
Replace 450m 4" CI main with 4" PVC on Furnesswithy Private Rd to Erica St, Laventille	450	$ 1,170,000.00				$ 1,170,000.00	
Caroni 12" Offtake Replacement of 1.2km of 12" DI Pipe	1200	$ 4,920,000.00	$ 4,920,000.00				
Maraj Street, Tunapuna Replacement of 800m of 6" PVC	800	$ 2,640,000.00		$ 2,640,000.00			
Smart Street, St. Augustine Replacement of 700m of 4" PVC	700	$ 1,820,000.00	$ 1,820,000.00				
Riverside Road, St. Augustine Replacement of 2000m of 4" PVC	2000	$ 5,200,000.00		$ 5,200,000.00			
St. John Road, St. Augustine Replacement of 1600m of 4" PVC	1600	$ 4,160,000.00				$ 4,160,000.00	
Flamingo/Cocrico Street, Trincity Replacement of 355m of 4" PVC	355	$ 923,000.00		$ 923,000.00			
Mora Trace, Tacarigua Replacement of 114m of 4" PVC	114	$ 296,400.00			$ 296,400.00		
Morequito Avenue, Valsayn Repalcement of 520m of 6" PVC	520	$ 1,716,000.00	$ 1,716,000.00				
Mayfield Road, Valsayn Replacement of 1100m of 4" PVC	1100	$ 2,860,000.00				$ 2,860,000.00	
Palm Road, Valsayn Replacement of 1200m of 4" PVC	1200	$ 3,120,000.00				$ 3,120,000.00	
Golden Grove Road, Arouca Extension of 500m of 4" PVC	500	$ 1,300,000.00	$ 1,300,000.00				
Parima Road, Valsayn Replacement of 800m of 4" PVC	800	$ 2,080,000.00			$ 2,080,000.00		
Tunapuna Road, Tunapuna Replacement of 1500m of 6" PVC	1500	$ 4,950,000.00				$ 4,950,000.00	
St. John Ext., St. John Road Replacement of 500m of 4" PVC	500	$ 1,300,000.00		$ 1,300,000.00			
Freeman Street, St. Joseph Repalcement of 300m of 4" PVC	300	$ 780,000.00	$ 780,000.00				
Acono Road, Acono Replacement of 1600m of 4" PVC	1600	$ 4,160,000.00					$ 4,160,000.00
Jackson Street, Curepe Replacement of 500m of 4" PVC	500	$ 1,300,000.00				$ 1,300,000.00	
Knowles Street, Curepe Replacement of 600m of 4" PVC	600	$ 1,560,000.00					$ 1,560,000.00
UWI Field Station Road, Mt. Hope Replacement of 1100m of 6" PVC	1100	$ 3,630,000.00					$ 3,630,000.00
Mt. Hope Road, Mt. Hope Replacement of 600m of 6" PVC	600	$ 1,980,000.00		$ 1,980,000.00			
Munroe Road, Tunapuna Replacement of 300m of 4" PVC	300	$ 780,000.00	$ 780,000.00				
Cunapo Southern Main Rd from EMR to Barker Trace, Coal Mine Booster 1800m of 150mm PVC	1800	$ 5,940,000.00					$ 5,940,000.00
EMR from Mausica Rd to Red Hill 950m of 200mm PVC	950	$ 3,476,050.00				$ 3,476,050.00	
Delaney Street Extension Salybia, Toco Rd 231m	231	$ 845,229.00			$ 845,229.00		
EMR from Valencia Juction to Quare Booster 1800m of 300 PVC	1800	$ 7,380,000.00			$ 7,380,000.00		

Project	Distance/m	Total Estimated Cost	2018/19	2019/20	2020/21	2021/22	2022/23
			Estimated Cost	Estimated Cost	Estimated Cost	Estimated Cost	Estimated Cost
Fishing Pond from LP 234 to Lp 121 1825m of 150 PVC 6"	234	$ 772,200.00	$ 772,200.00				
Foster Rd from Graham Tr to La Sieva 1700m of 200 PVC	1700	$ 6,220,300.00				$ 6,220,300.00	
Galera Road from Palm Tree to Lighthouse Phase 1 1750m of 150 PVC	1750	$ 5,775,000.00				$ 5,775,000.00	
Galera Road from Palm Tree to Lighthouse Phase 2 1750m of 150 PVC	1750	$ 5,775,000.00				$ 5,775,000.00	
Mausica Rd between PBR an CR Highway Phase 1 730m of 300mm DI	730	$ 2,993,000.00		$ 2,993,000.00			
Mausica Rd between PBR an CR Highway Phase 2 730m of 300mm DI	730	$ 2,993,000.00			$ 2,993,000.00		
Toco M Rd Matura to Vega De Oropouche Phase 1 (along Toco M Rd from Lp 185 a to 11km mark) 1000m of 150 PVC 6"	1000	$ 3,300,000.00					$ 3,300,000.00
Toco M Rd Matura to Vega De Oropouche Phase 2 (along Toco M Rd from 11km to 10km mark)) 1000m of 151 PVC 6"	1000	$ 3,300,000.00					$ 3,300,000.00
Toco M Rd Matura to Vega De Oropouche Phase 3 (along Toco M Rd from 10km to 9km mark lp 142) 1000m of 152 PVC 6"	1000	$ 3,300,000.00			$ 3,300,000.00		
Tumpuna Rd from CR Highway to Broadway and Prince St up to Columbus Phase 1 1000m of 300 DI	1000	$ 4,100,000.00					$ 4,100,000.00
Tumpuna Rd from CR Highway to Broadway and Prince St up to Columbus Phase 2 1000m of 300 DI	1000	$ 4,100,000.00			$ 4,100,000.00		
Tumpuna Rd from CR Highway to Broadway and Prince St up to Columbus Phase 3 1000m of 300 DI	1000	$ 4,100,000.00				$ 4,100,000.00	
Tumpuna Rd from CR Highway to Broadway and Prince St up to Columbus Phase 4 1000m of 300 DI	1000	$ 4,100,000.00	$ 4,100,000.00				
Valencia Junction Eastern Main Rd to Quare Booster 1600m of 300 DI	1600	$ 6,560,000.00			$ 6,560,000.00		
Valencia Stretch, East of St. Albans heading West 3400 m of 200 PVC 8"	3400	$ 12,440,600.00					$ 12,440,600.00
Quare Road and Valencia Old Road Valencia 1600m	1600	$ 5,711,500.72				$ 5,711,500.72	
Mootee Stree Ojoe Road, Sangre Grande 270m	270	$ 702,000.00			$ 702,000.00		
Mora Avenue Ext 1 and 2 Valencia 660m	660	$ 987,395.11					$ 987,395.11
Corner Boys Lane from E.M.R tp PBR D' Abadie 320m	320	$ 617,890.38					$ 617,890.38
Toco M Road Matura to Vega De Oropouche Phase 4 (Toco M Road from 9km mark lp 142 to lp 131 A)	500	$ 2,500,000.00			$ 2,500,000.00		
Toco M Road Matura to Vega De Oropouche Phase 5 (Toco M Road from lp 121 to 5km)	500	$ 2,500,000.00				$ 2,500,000.00	
Toco M Road Matura to Vega De Oropouche Phase 6 (Toco M Road from lp 169 to 6km)	500	$ 2,500,000.00					$ 2,500,000.00
Valsayn A 30" Transmission Replacement of 50m of the Valsayn A Transmission System	500	$ 650,000.00	$ 650,000.00				
Golden Grove Road, Five Rivers 12" Offtake Replacement of 2km of the North Oropouche Offtake in Five Rivers	2000	$ 8,200,000.00					$ 8,200,000.00
NORTH FIVE YEAR PROJECT COST	**59264**	**$ 197,568,390.21**	**$23,078,200.00**	**$27,470,000.00**	**$40,323,329.00**	**$55,960,975.72**	**$50,735,885.49**
SOUTH							
•Installation of 2.13km of 200mm PVC mains along Pleasantville Circular	2130	$ 7,793,670.00			TT$7,793,670.00		
Installation of 0.8km of 100mm PVC mains Apoo Avenu to Jerry Junction	800	$ 2,640,000.00			TT$2,640,000.00		
Raw Water line Mora Dam Road. Installation of 0.75km of 150mm PVC mains	750	$ 2,475,000.00			TT$2,475,000.00		
•Installation of 1.1km of 100mm PVC mains along Forres Ave, Cocoyea	1100	$ 2,860,000.00		TT$2,860,000.00			
• Installation of 3000m of 200mm PVC main from Corinth Road to Peterloo Junction along Cipero Road	3000	$ 10,977,000.00					TT$10,977,000.00
•Installation of 4.5km of 200mm PVC mains along Naparima Mayaro Rd from Reform Rd to Mon Repos Round-a-bout	4500	$ 16,465,500.00					TT$16,465,500.00
•Installation of 0.57km of 100mm PVC mains along St Andrews Ave, Cocoyea	570	$ 1,482,000.00			TT$1,482,000.00		
•Navet transmission main. Installation of 1.8km of 900mm DI mains along Naparima Mayaro Rd from St Clements to Mon Repos	1800	$ 16,200,000.00				TT$16,200,000.00	
•Installation of 2.6km of 400mm DI mains along San Fernando bypass from Mon Repos Round-a-bout to S.S.Erin Rd	2600	$ 12,656,800.00				TT$12,656,800.00	
•Replacement of 650m of 125mm (5" AC) Main with 150mm PVC in Bel View from Bel View Junction to South Oropuche Government School.	650	$ 2,145,000.00	TT$2,145,000.00				
•Install 2.7km of 150mm PVC main along the Fyzabad Guapo Road (Replace 75mm AC main).	2700	$ 8,910,000.00		TT$8,910,000.00			
• Install 3.1km of 200mm PVC main in Harris Village from Corner Southern Main Road Oropouche to Avocat Junction (Replace 125mm AC main).	3100	$ 11,342,900.00	TT$11,342,900.00				

Project	Distance/m	Total Estimated Cost	2018/19	2019/20	2020/21	2021/22	2022/23
			Estimated Cost	Estimated Cost	Estimated Cost	Estimated Cost	Estimated Cost
• Install 1.4km of 150mm PVC main from Avocat Junction to Avocat Vedic School along the Siparia Old Road (Replace 125mm AC main).	1400	$ 4,620,000.00	TT$4,620,000.00				
•Replacement of 4.0km of 225mm AC main with 200mm PVC from Alutrin Round-A-Bout to Guapo Police Station along the Southern Main Road Point Fortin.	4000	$ 14,636,000.00				TT$14,636,000.00	
•Replacement of 4.7km of 150 & 225mm AC main with 200mm PVC from Guapo Police Station to Dunlop Round-A-Bout along the Southern Main Road Point Fortin.	4700	$ 17,197,300.00				TT$17,197,300.00	
•Replacement of 5.6km of 100mm AC/CI main with 150 PVC from Hilo Round-A-Bout to Cap de Ville Junction along Guapo Cap de Ville Road Point Fortin.	5600	$ 14,560,000.00		TT$14,560,000.00			
•Replacement of 1000m of 3/4" Poly to 4" main at Clifton Hill.	1000	$ 1,268,726.05		TT$1,268,726.05			
Replacement of 950 meters of 100mm AC to 100mm PVC main along Gambal Street.	950	$ 2,470,000.00				TT$2,470,000.00	
Replacment of 1670m of 100mm AC Main with 100mm PVC Main, Jacob Settlement, Santa Flora, Street A, Street B, Street C	1670	$ 4,342,000.00				TT$4,342,000.00	
Replacment at Waddle Village 580m of 75mm CI to 100mm PVC	580	$ 1,508,000.00			TT$1,508,000.00		
Replace leaking pipelines and valves at South East Production Facilities.		$ 1,886,700.00	TT$500,000.00	TT$386,700.00	TT$500,000.00	TT$500,000.00	
1.1km of 200mm PVC at Cedar Hill Road from Macaulay Link Road to Foress Park Junction.	1100	$ 4,024,900.00		$4,024,900.00			
0.7km of 100mm PVC at Ganessingh from Balmain Main Road to end of street	700	$ 1,820,000.00		$1,820,000.00			
Navet WTP to TCO booster	5800	$ 45,460,000.00			$ 45,460,000		
Installation of raw water mains from Siewdass Road to Freeport WTP, along Siewdass Rd, Raphael Rd and Calcutta#1		$ 20,000,000.00		$20,000,000.00			
Installation of 2.5km of 300mm DI mains from St. Joseph Rd to Chacon Reservoir (cross country)	2500	$ 10,250,000.00			$10,250,000.00		
Installation of 1.4km of 600mm DI mains from Mon Repos Round-about to Marryat Reservoir	1400	$ 8,680,000.00					$8,680,000.00
Installation of 2km of 600mm DI mains along Marryat St and Coffee Street	2000	$ 8,200,000.00					$8,200,000.00
Installation of 0.3km of 100mm PVC mains from Hermitage Main Road to end of street	300	$ 780,000.00					$780,000.00
SOUTH FIVE YEAR PROJECT COST	**57400**	**$ 257,651,496.05**	**$18,607,900.00**	**$53,830,326.05**	**$72,108,670.00**	**$68,002,100.00**	**$45,102,500.00**
TOBAGO							
Replacement of 3km of pipeline from Hillsborough Dam to Belmont Branch Rd.	3000	$ 14,400,000.00					14,400,000.00
Replacement of 1.3km DI of pipeline from Rojas Junction to St. Luke Junction.	1300	$ 5,088,772.00	$5,088,772.00				
Replacement of 0.9km of 12" pipeline from Cocoa Watty to Butcher.	900	$ 3,690,000.00		3,690,000.00			
Installation of 0.9km of 8" pipeline from Sandy River Jn to Easterfield Jn.	900	$ 3,293,100.00		3,293,100.00			
Replacement of 2km of pipeline from Riseland Gardens to RC Church, Patience Hill.	2000	$ 7,828,880.00		$7,828,880.00			
Replacement of 1.6km of pipeline from Buccoo Jn to Montgommery Jn.	1600	$ 9,206,672.00			$9,206,672.00		
Installation of 4km of pipeline 8"DI from Speyside to Charlotteville.	4000	$ 14,636,000.00				14,636,000.00	
Installation of 7km of pipeline 8"DI from Runnemede to Castara	7000	$ 25,613,000.00				25,613,000.00	
Installation of pipeline to replace defective mains and long service connections	5000	$ 13,000,000.00	5,000,000	8,000,000			
TOBAGO FIVE YEAR PROJECT COST	**25700**	**$ 96,756,424.00**	**$10,088,772.00**	**$22,811,980.00**	**$9,206,672.00**	**$40,249,000.00**	**$14,400,000.00**

TOTAL FIVE YEAR PROJECT COST	**142364**	**$ 551,976,310.26**	**51,774,872.00**	**104,112,306.05**	**121,638,671.00**	**164,212,075.72**	**110,238,385.49**

Project	Distance/m	Total Estimated Cost	2023/24	2024/25	2025/26	2026/27	2027/28
			Estimated Cost	Estimated Cost	Estimated Cost	Estimated Cost	Estimated Cost
NORTH							
EMR from Sangre Grande Booster to Plum Mitan Junction 10000m of 400mm DI	10000	$ 48,680,000.00	$ 24,000,000.00	$ 24,680,000.00			
Toco Road from Five Tanks to Palm Tree and along Paria Main Rd to Mission Rd and to San Souci 11000m of 200 PVC	11000	$ 40,249,000.00			$ 20,249,000.00	$ 20,000,000.00	
Bye Pass Rd to Broadway, into Columbus, Prince St De Gannes St. and to King St. 2500m of 300mm DI	2500	$ 10,250,000.00					$ 10,250,000.00
Piarco Old Road, D'abadie Replacement of 1900m of 6" PVC	1900	$ 6,270,000.00					$ 6,270,000.00
Piarco Old Road, D'abadie Replacement of 1900m of 6" PVC	1900	$ 6,270,000.00					$ 6,270,000.00
Replace 300m each 4" AC main with 4" PVC on 1st, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th Street, Mt. Lambert	2400	$ 6,240,000.00	$ 6,240,000.00				
Replace 700m 4" AC main with 4" PVC on 1st Avenue, Mt. Lambert	700	$ 1,820,000.00	$ 1,820,000.00				
Caigual Rd from Lp 216 to Lp 157 off EM Road Comparo Village	1400	$ 4,340,000.00		$ 4,340,000.00			
SMR, Curepe from the PBR to East Grove (HDC) Replacment of 1.25km of 8" PVC	1250	$ 4,573,750.00		$ 4,573,750.00			
Replace 25m 8" CI main with 8" PVC at Wrightson Rd, POS in the vicinity of UTT	25	$ 91,475.00		$ 91,475.00			
Replace 600m 3" CI main with 4" PVC at Nelson St - from Duke St to Independence Sq, POS	600	$ 1,560,000.00			$ 1,560,000.00		
Replace 500m 4" CI main with 4" PVC at Prince St - from Picadilly to Frederick St, POS	500	$ 1,300,000.00				$ 1,300,000.00	
Replace 1,500m 4" CI main with 4" PVC at Henry St - from Gordon St to South Quay, POS	1500	$ 3,900,000.00	$ 3,900,000.00				
Replace 550m 3" CI main with 4" PVC at New St - from Charlotte St to Dundonald St, POS	550	$ 1,430,000.00					$ 1,430,000.00
Replace 480m 4" CI main with 4" PVC on Cicada St, Morvant	480	$ 1,248,000.00	$ 1,248,000.00				
Replace 200m each 4" and 6" mains with 4" and 6" PVC on Pashley St, Laventille	200	$ 1,180,000.00	$ 1,180,000.00				
Replace 625m 6" main with 6" PVC on EMR, Laventille from CGA to Morvant Junction	625	$ 2,062,500.00	$ 2,062,500.00				
Replace 75m 4" GWI main with 4" PVC at Rose Hill, Maraval	75	$ 195,000.00		$ 195,000.00			
Replace 250m 3" CI main with 4" PVC at Besson St off Picadilly St, POS	250	$ 650,000.00		$ 650,000.00			
Replace 200m 3" CI main with 4" PVC at John John, POS	200	$ 520,000.00		$ 520,000.00			
Replace 200m 12" CI main with 12" DI at from Beverly Hills to Laventille, POS	200	$ 820,000.00		$ 820,000.00			
Replace 800m 4" CI main with 4" PVC at Bombay St - from Western Main Rd to Dundonald Hill, St. James	800	$ 2,080,000.00				$ 2,080,000.00	
Replace 210m 2" GWI main with 4" PVC at Meerut St - from Bombay St to Long Circular Rd, St. James	210	$ 546,000.00				$ 546,000.00	
Replace 1,900m 4" GWI main with 4" PVC at Dibe Rd, St. James	1900	$ 4,940,000.00				$ 4,940,000.00	
Replace 450m 4" CI main with 4" PVC at Brieves Rd, St. James	450	$ 1,170,000.00				$ 1,170,000.00	
Replace 350m 4" CI main with 4" PVC at Long Circular Rd - from Dibe Rd to Stephens Rd, St. James	350	$ 910,000.00				$ 910,000.00	
Replace 800m 3" CI main with 4" PVC at Long Circular Rd - from Prospect Rd to Flagstaff, St. James	800	$ 2,080,000.00				$ 2,080,000.00	
Replace 100m 4" PVC main with 4" PVC at Morne Renee, Paramin	100	$ 260,000.00		$ 260,000.00			
Replace 100m 1 1/2" main with 4" PVC at Apple Blossom Rd, Petit Valley	100	$ 260,000.00		$ 260,000.00			
Repace 125m 3/4" long service with 4" PVC main at Cameron Rd, Petit Valley	125	$ 325,000.00		$ 325,000.00			
NORTH YEAR 6 to 10 PROJECT	**43090**	**$ 156,220,725.00**	**$ 40,450,500.00**	**$ 36,715,225.00**	**$ 21,809,000.00**	**$ 33,026,000.00**	**$ 24,220,000.00**

Project	Distance/m	Total Estimated Cost	2023/24	2024/25	2025/26	2026/27	2027/28
			Estimated Cost	Estimated Cost	Estimated Cost	Estimated Cost	Estimated Cost
SOUTH							
Replacement of approximartely 11km of 8" to 12" Ductile Iron pipe from Granville Plant to Cedros	11000	$ 45,100,000.00			$ 25,100,000.00	$ 20,000,000.00	
Caroni South Bank Road Las Lomas # 2 from the Police Post to the Plant and from	4000	$ 16,400,000.00		$ 16,400,000.00			
Las Lomas Plant to San Rapheal Junction	4000	$ 16,400,000.00	$ 16,400,000.00				
Replacment of 1900 m of 300mm Steel Main along Coora Road from Siparia to Alexander Road Junction.	1900	$ 7,790,000.00					$ 7,790,000.00
Installation of 2.5km of 400mm DI mains Freeport Plant to TGR	2500	$ 10,250,000.00					$ 10,250,000.00
SOUTH YEAR 6 to 10 PROJECT	**23400**	**$ 95,940,000.00**	**$ 16,400,000.00**	**$16,400,000.00**	**$25,100,000.00**	**$20,000,000.00**	**$18,040,000.00**
TOBAGO							
Replacement of 6.3km of pipeline from Hillsborough Dam to Belmont Branch Rd.	6300	$ 30,240,000.00	$ 30,240,000.00				
Replacement of 1.9km of pipeline from Shirvan Junction to Carnbee Main Road along Buccoo Rd.	1900	$ 9,120,000.00					$ 9,120,000.00
Installation of two 8"DI along Milford Rd - from Cove to Crown Pt. Each 3.5km in length	7000	$ 25,613,000.00			$ 25,613,000.00		
Installation of 4.2km of 8" pipeline from Miss Mills to Caledonia.	4200	$ 15,367,800.00		$ 15,367,800.00			
Replacement of 2km of pipeline from Union Junction to Glen Road.	2000	$ 8,650,740.00				$ 8,650,740.00	
Installation of 13km of pipeline 12"DI from Lanse Fourmi to Charlotteville	13000	$ 53,300,000.00		$ 10,000,000.00	$ 15,000,000.00	$ 15,000,000.00	$ 13,300,000.00
TOBAGO YEAR 6 to 10 PROJECT	34400	**$ 142,291,540.00**	**$ 30,240,000.00**	**$ 25,367,800.00**	**$ 40,613,000.00**	**$ 23,650,740.00**	**$ 22,420,000.00**

TOTAL YEAR 6 to 10 PROJECT	100890	**$ 394,452,265.00**	**$ 87,090,500.00**	**$ 78,483,025.00**	**$ 87,522,000.00**	**$ 76,676,740.00**	**$ 64,680,000.00**

APPENDIX IX

SUBMISSION RECEIVED FROM NGC DATED APRIL 7, 2020

THE NATIONAL GAS COMPANY
OF TRINIDAD AND TOBAGO LIMITED
Orinoco Drive,
Point Lisas Industrial Estate, Point Lisas
P.O. Box 1127, Port of Spain.
Tel: (868) 636-4662, 4680
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AT THE FOREFRONT OF Energy

April 7, 2020

The Secretary
Joint Select Committee on Land and Physical Infrastructure
Office of the Parliament
Parliamentary Complex
Cabildo Building
St. Vincent Street
PORT OF SPAIN

Dear Sirs

An Inquiry into measures for ensuring water security in Trinidad and Tobago given the need to conserve, manage and increase the country's water resources

We write with reference to the above and acknowledge receipt of your letter dated March 16, 2020, duly received by us on April 7, 2020.

In relation to the questions raised in the aforementioned letter, The National Gas Company of Trinidad and Tobago Limited (NGC) wish to hereby respond as follows:

QUESTION 1

The status of the Beetham Wastewater Reuse Project (BWRP)?

ANSWER

NGC duly terminated the contract in relation to the BWRP in and around December 2015 and the Board of NGC subsequently agreed not to continue with the Project. At present, NGC is engaged in arbitration proceedings with the contractor for, inter alia, the recovery of certain sums expended on the BWRP. As you would appreciate, the details of these proceedings are confidential in accordance with the terms and conditions governing same and, as such, we are unable to disclose further details around this process.

In parallel with the arbitration process and having received the advice of our external Attorneys and the approval of our Board, NGC has been in the process of taking the necessary steps to dispose of the assets acquired for the BWRP. During this process, NGC received a request from the Honourable Minister of Public Utilities and the Honourable Minister of Energy and Energy Industries for the transfer of these assets to the Trinidad and

April 7, 2020

The Secretary
Joint Select Committee on Land and Physical Infrastructure
Office of the Parliament

An Inquiry into measures for ensuring water security in Trinidad and Tobago given the need to conserve, manage and increase the country's water resources

Tobago Water and Sewerage Authority (WASA), to be utilized to assist in increasing the Authority's transmission main capacity and better supply the nation.

NGC is amenable to acceding to this request in the best interest of Trinidad and Tobago. As such, NGC has reached out to WASA with a view to engaging in discussions on suitable terms and conditions for the transfer of the assets. These discussions have commenced and are ongoing and any agreed terms and conditions would be subject to the approval of the Boards of both NGC and WASA.

QUESTION 2

Are there any plans to use water from the Beetham Reuse Project for WASA's mainstream supply?

ANSWER

It is not the intention of NGC to continue with the BWRP. However, if agreement on terms and conditions are reached and the assets are transferred to WASA, it would be within the purview of WASA to determine how it will use the water in the best interest of Trinidad and Tobago.

We trust that the above responses are of assistance and remain available to provide any additional clarification that may be required.

Yours faithfully,
FOR: THE NATIONAL GAS COMPANY OF TRINIDAD AND TOBAGO LIMITED

Mark Loquan
President

cc: Senator The Honourable Deoroop Teemal- Chairman of the Committee
Mr. Conrad Enill- Chairman, NGC