



**National Secondary Schools'  
Quiz Competition 2012  
on Wastewater & Re-use  
SUMMARY STUDY GUIDE**

**For use during Qualification Phase ONLY**



**WATER AND SEWERAGE AUTHORITY**  
*"Water Security for Every Sector.  
Deliver it. Sustain it"*

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*Wastewater is understood as any water that has been adversely affected in quality due to anthropogenic influence. It comprises liquid waste discharged by domestic residences, commercial properties, industry and agricultural fields.*

## Section 1

### Wastewater Sector Development

WASA is responsible for the collection, transmission, treatment and disposal of wastewater in Trinidad & Tobago and achieves this mainly through its Public Sewerage Systems in Port of Spain, San Fernando, Arima, Point Fortin and Scarborough Tobago.

The table below offers a synopsis of the Wastewater Sector Milestones:

YEAR	MILESTONES
1861	1 <sup>st</sup> underground sewer system constructed in Port-of-Spain
1902	1 <sup>st</sup> major sewerage works built along Wrightson Road
1962	Construction of Treatment Systems in San Fernando, Port of Spain & Arima
1965	WASA was established as a consolidated entity
1966	Island wide Sewerage Extension Project undertaken by the Lock Joint Ltd
1980	WASA completed the construction of the Piarco Wastewater Treatment Plant
1994	Completion of the Scarborough Wastewater Treatment Plant
2001	Construction of the new Beetham Wastewater Treatment Plant commenced
2004	Beetham Plant was completed

In Trinidad and Tobago the development of the wastewater sector was influenced by several interventions over its history. With the construction of the first wastewater system in Port of Spain in 1861, Trinidad and Tobago had embarked on the development path for this sector, particularly in its urban centers. In Tobago, planned integrated wastewater initiatives are of very recent vintage and date back to the recent 1990's with the completion of works on the Scarborough wastewater treatment plant in 1994.

Projects undertaken through this development path included:

- San Fernando, Arima and Port of Spain wastewater systems
- The New Beetham Wastewater Treatment Plant
- The New Scarborough Wastewater Treatment Plant

From the late 1990's to the present time several studies were conducted and recommendations made as it related to private wastewater treatment plants. All studies point to the fact that private developers do not operate the wastewater treatment plant and associated infrastructure in a manner which will result in the wastewater being properly treated and safely discharged into the environment.

Governmental intervention has taken place mandating WASA to take over, upgrade and operate these facilities. The process of adoption includes the transfer of ownership, the upgrade of the facility and the implementation of an operations and maintenance programme. Challenges faced in the implementation of the adoption process mainly surround the issue of ownership and its transfer to WASA.

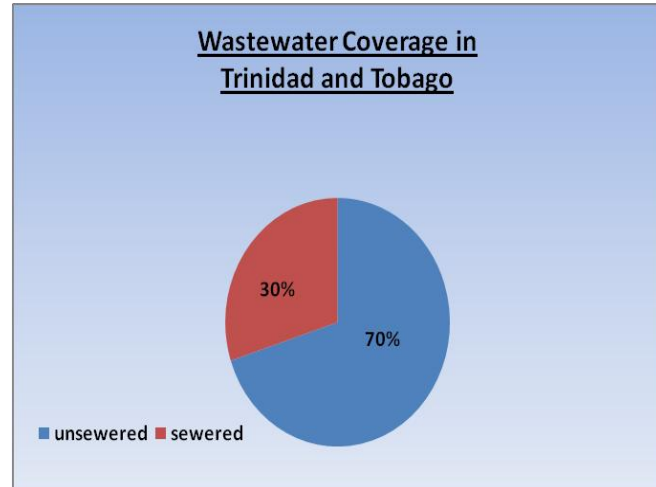
## Section 2

### National Wastewater System

*In Trinidad and Tobago approximately 30% of the population is sewered and serviced directly by WASA.*

*The remaining 70% of the populations is serviced by septic tanks, soakaways and pit latrines.*

WASA has constructed twelve (12) wastewater systems nationwide. Additionally, there are a significant number of small wastewater treatment facilities that are poorly maintained or abandoned, resulting in



improperly treated sewerage being discharged into the environment.

WASA is currently adopting and refurbishing a number of wastewater facilities from various government authorities which include the former National Housing Authority (NHA), now the Housing Development Corporation (HDC) and the Urban Development Company of Trinidad and Tobago (UDeCOTT). WASA plans to adopt and refurbish over one hundred and fifty (150) sewerage treatment plants within private land developments with the intention to integrate these smaller systems into larger regional sewerage treatment facilities.

With the exception of the Beetham and the Scarborough Wastewater Treatment Plants, the wastewater infrastructure in the urban centers is over twenty five (25) years old. The Arima and San Fernando Wastewater Treatment Plants and collection systems, as well as the collection systems in Port of Spain and environs, are over forty five (45)

years old. As such, most of the infrastructure has come to the end of their useful life and are in need of replacement.

## **Trinidad**

Here, the main wastewater treatment plants spread across the North, South and East of the island. The Beetham Wastewater Treatment Facility serves the Greater Port of Spain region. In addition to the Beetham WWTP, there are several other sewage treatment installations existing in Port of Spain namely Dundonald Hill, Valley View Hotel, Diego Martin etc. Wastewater from the Diego Martin and Carenage areas is transferred to the Beetham WWTP via the Diego Martin Pumping Station.

In the Chaguaramas area there are approximately five (5) sewage lift stations. There are also some wastewater treatment plants, namely the Point Gourde Treatment Plant, the Granwood WWTP, the Power Boat WWTP, Coast Guard WWTP and the Teteron WWTP.

The Eastern Main Road area (between Curepe and Sangre Grande along the East-West corridor) is served mainly by activated sludge package treatment plants, which serve small and medium size housing developments. Most of them are owned by private housing developers while some of the others are owned by HDC.

The Borough of Arima is mainly served by the Arima WWTP which has a trickling filter design; a WASA owned and operated treatment plant. The effluent from this plant is discharged to the Mausica River, a tributary of the Caroni River. Discharge from this plant can affect raw water quality of Caroni water treatment plant, the largest water treatment plant in Trinidad, as the intake is located downstream of the Wastewater Treatment Plant.

The City of San Fernando is served mainly by a WWTP owned and operated by WASA. The San Fernando WWTP has a trickling filter design and discharges into the Cipero River. The plant provides co-treatment of septage and wastewater.

There are several wastewater treatment plants in the Borough of Chaguana. Two of them serve housing estates and another three of them serve shopping centers in the area. The rest of the population use septic tanks and pit latrines.

A lift station located in Strikers Village pumps waste from Striker's Village in Point Fortin to the nearby Southern Gardens Wastewater Treatment plant which is owned and operated by the Housing Development Cooperation (HDC). In addition, there are other treatment installations located in the Point Fortin region. The majority of the area depends on on-site treatment systems like septic tanks and pit latrines.

There are several wastewater package treatment plants located within Sangre Grande, Couva, Fyzabad, Siparia and Princes Town. The majorities of these communities depend on septic tanks and pit latrines. Mayaro is a rural community consisting mainly of a fishing village with slow commercial developmental growth. Wastewater treatment is generally achieved by the use of on-lot systems (pit latrines and septic tanks).

## **Tobago**

The Scarborough WWTP, serving the Scarborough town area is an extended aeration plant. With few exceptions, wastewater treatment plants in Tobago fall into five broad categories:

- Septic tank and tile drain or soak away systems
- Septic tanks followed by secondary treatment systems
- Lagoons
- Trickling filters
- Activated sludge package plants.

The majority of the private properties in Tobago are currently served by onsite systems such as pit latrines, septic tanks and soakaway systems and package plants. There are two housing developments, Milford Court at Bon Accord and Coral Gardens at Buccoo that have their own sewer collection system and package sewage treatment plants.

## **Private Wastewater Systems**

Private wastewater treatment plants, as the name suggests, are considered to be all wastewater plants that are not owned and operated by WASA, and include plants owned by governmental ministries and departments, state and private residential developments and those within the industrial and commercial sectors.

In 2009 an assessment of the wastewater sector was conducted. The data derived indicated the existence of more than one hundred of fifty (150) private wastewater systems in Trinidad and Tobago. Private wastewater plants in Trinidad and Tobago are generally in a poor working condition and pose a risk to public health and the environment. The sector distribution of private wastewater treatment plants is generally as follows:

- Private residential developments
- State residential developments (HDC, UDeCOTT), etc)
- State agencies (SWMCOL, TDC, etc)
- Government Ministries (Health, Education, THA, etc)
- Industrial
- Commercial (Malls, Shopping Centers, etc)

In a bid to meet the demands of the national community for sewage services, WASA, has provided permission to private developers, to construct and operate their own wastewater treatment plants and associated collection systems. This practice still continues today with much closer scrutiny being placed on the developers to ensure compliance with designs and operations guidelines.

*The Integrated Wastewater Management Forum (IWWMF) is one mechanism being used to effectively implement Wastewater Management with the utilization of stakeholder involvement and participation.*

## Section 3

### **Integrated Wastewater Management**

Wastewater Management Goals include:

- To provide suitable wastewater treatment facilities using appropriate technology and methodology
- To ensure wastewater does not harm the marine /soil environment and public health
- To have treatment and disposal systems that supports the economic success of the industry
- To achieve compliance with appropriate Acts, Plans and standards

The Integrated Wastewater Management Forum focuses on:

- Actions at the local level, which target improved Wastewater Services Delivery, meeting Sanitation requirements and Environmental Enhancement,
- An integrated approach which targets the development of a level of greater understanding of the significance of wastewater management to health, sanitation and the environment in Trinidad and Tobago.

This forum aims to impact on Service Levels and Environmental Enhancement by:

- Targeting Communities, assessing the issues affecting them and undertaking relevant actions geared towards the main objective,
- Involving local groups and bodies in actions which would improve the level of service in the short, medium and long term incorporating formal stakeholder interactions and social learning activities,
- Increasing awareness of effective Wastewater Management with respect to Services and Environmental Protection and Enhancement (health, sanitation and the environment).

Benefits include:

- Improved customer service
- Knowledge and understanding of the significance of Wastewater Management and its relevance to Health, Sanitation and the Environment
- An integrated approach involving local communities and stakeholders
- Capacity Building and Social Learning Opportunities
- Relevant linkages, associations and relationships

Successes include:

- Repairs and aesthetic works were carried out on package plants in the areas such as Homestead, Santa Cruz and Pleasantville, San Fernando.
- Georeference information of wastewater infrastructure and types of systems existing in impact areas were collected and are being entered into a database that will be utilized to map the area.
- Water quality information of effluent from plants in the area was collected to assess the water quality situation in the area.
- The school outreach programme incorporated primary schools in the area to spread the message of proper wastewater practices.



To effectively operate and maintain our sewer systems, public awareness on the part of the citizens and users of the systems can contribute significantly to the prevention of expensive sewer repairs and the protection of the environment.

### **Wastewater, Public Health & the Environment**

The degradation of the marine environment, as well as the irresponsible discharge of untreated water has become a serious and critical concern globally, regionally and nationally. Wastewater can have very serious potential impacts on not just the environment, but also our health and well being. Treatment of sewage is essential to ensure that the water returning into the environment meets the accepted regulatory standards.

Untreated or improperly treated wastewater contains biological contaminants known to cause diseases. These contaminants are known as germs or pathogens.

The following table offers further insight into the potential impacts of wastewater use:

Impact Areas	Potential Impacts of Wastewater Use
<b>Public Health &amp; Other living organism</b>	Use of untreated sewage water pose a high risk to human health and other living organisms in all groups as it contain pathogenic microorganisms which have the potential to cause diseases.
<b>Crops</b>	Wastewater (treated and untreated) is extensively used in agriculture because it is a rich source of nutrients and provides all the moisture necessary for crop growth. Most crops give higher than potential yields with wastewater irrigation; reduce the need for chemical fertilizers, resulting in net cost savings to farmers.
<b>Soil Resources</b>	Impact from wastewater on agricultural soil, is mainly due to the presence of high nutrient contents (Nitrogen and Phosphorus), high total dissolved solids and other constituents such as heavy metals, which are added to the soil over time. Wastewater can also contain salts that may accumulate in the root zone with possible harmful impacts on soil health and crop yields.
<b>Groundwater Resources</b>	Wastewater application has the potential to affect the quality of groundwater resources in the long run through excess nutrients and salts found in wastewater leaching below the plant root zone. Groundwater constitutes a major source of potable water hence the potential of groundwater contamination needs to be evaluated before embarking on a major wastewater irrigation program.
<b>Ecological</b>	When drainage water from wastewater facilities drains particularly into small confined water bodies and surface water, and if phosphates in the orthophosphate form are present, the remains of nutrients may cause eutrophication, resulting in decreases in dissolved oxygen which may lead to changes in the composition of aquatic life, such as fish deaths and reduced fishery.
<b>Social</b>	Social concerns such as food safety, health and welfare, impaired quality of life loss of property values and sustainability of land use, can be impacted by wastewater use.

The availability and supply of clean, safe potable water is essentially related to the level of sanitation. The management of wastewater disposal has become a fundamental factor in both the social and economic development of the country. In efforts to effectively operate and maintain our sewer systems, public awareness can contribute significantly to the prevention of expensive sewer repairs and the protection of the environment. It must be noted that changes in our wastewater behavior will aid in the sustainability of the water resource.

**Don't**

- Make unauthorized connections to the existing system.
- Pour substances that are poisonous or flammable down the drain.
- Pour liquids that are highly acidic or alkaline and paints or solvents down the plumbing fixture at your home.
- Flush sanitary pads, diapers or condoms down the toilet.
- Pour used cooking oil down the sink.



## Do's

- Connect to the Public sewer system if one exists in your area.
- Ensure that your internal plumbing is not clogged and that water can flow freely at all times.
- Report broken sewer mains or overflowing manholes to the relevant authorities.
- Use Baking Soda instead of harsh chemicals like Bleach or Lye to clean sinks and toilet bowls.
- Use a strainer in the sink to catch food scraps and other solids.



*A well managed wastewater system provides protection against diseases while a poorly functioning system adversely impacts on the health, sanitation and well being of a community.*

## Section 4

### **Wastewater: Collection, Treatment and Disposal**

To effectively operate and maintain our sewer systems, public awareness on the part of the citizens and users of the systems can contribute significantly to the prevention of expensive sewer repairs and the protection of the environment.

A poorly functioning wastewater system results in the following:

- Disease causing bacteria/viruses
- Discomfort from foul odors
- Infestation by rodents
- Damage to marine life
- Reduction in recreational activities
- General damage to the environment and waterways

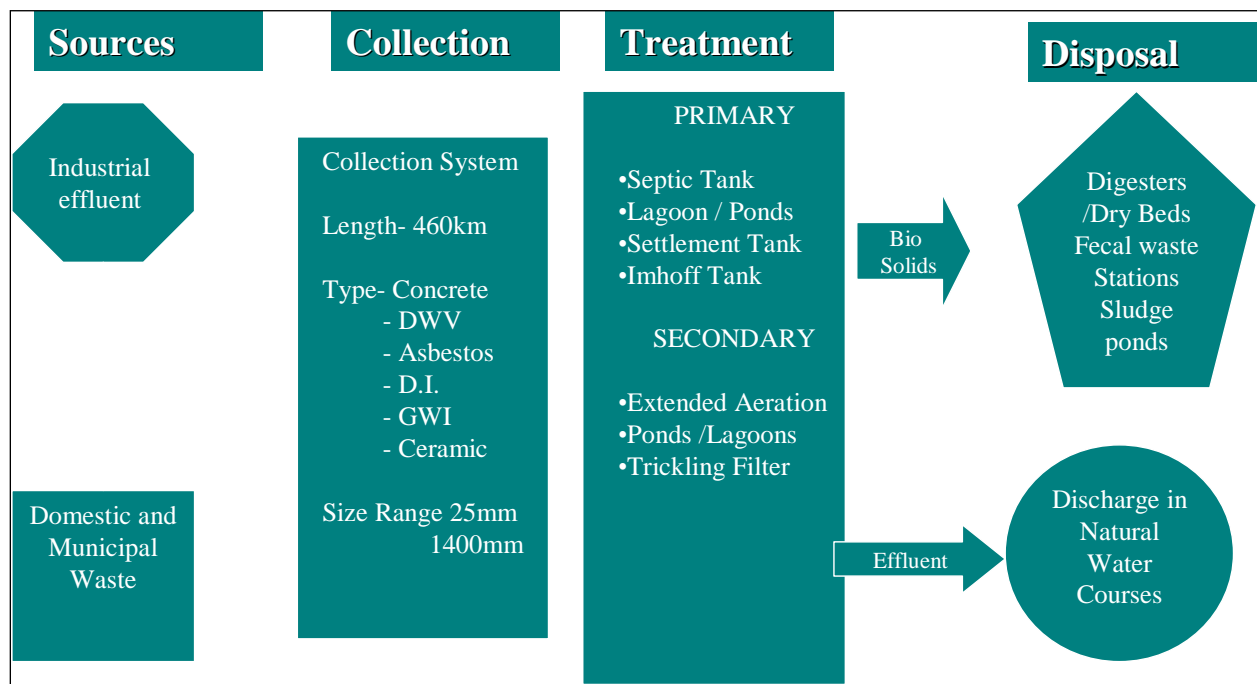
The first step in understanding wastewater is to first understand what it is and how it works. Wastewater collection systems are the network or pipelines, manholes and pump stations designed to effectively collect and transmit the wastewater from households and businesses to a wastewater treatment plant.

The Treatment Plant is designed to receive wastewater from the collection system and treat it. This treatment process removes undesirable substances, which can cause pollution of rivers and streams and ultimately cause water-borne diseases in humans and other animal life. The

Treatment Plant uses living organisms (mainly bacteria) together with mechanical equipment to reduce pollution in wastewater. The treated wastewater, called effluent, is then discharged into the environment.

The Wastewater treatment process begins once used water is flushed into the system. The wastewater proceeds from the premises by way of a lateral line (the property of the owner) to the collector line where it becomes the responsibility of the Authority. Wastewater arrives at the Treatment Plant through a piping system, which collects all sewage from communities. Primary treatment involves physically removing debris and large particles from the wastewater to prepare it for the biological treatment process that occurs during Secondary Treatment.

The diagram illustrates the various stages associated with the management of wastewater namely, collection, treatment and disposal.



## **Collection, Treatment & Disposal**

Wastewater collection systems are the network of pipelines, manholes and pump stations designed to effectively collect and transmit the wastewater from households and businesses to a wastewater treatment plant nearest to you.

The treatment of this wastewater is necessary to protect the environment and public health. Wastewater treatment is a combination of physical and biological processes designed to remove inorganic and organic matter from solution. Wastewater treatment can be broken –down into the following steps: preliminary treatment, primary treatment, secondary treatment and tertiary treatment.

Subsequent to treatment, the liquid effluent stream is reintroduced into the environment or reused, while the solid waste remains. Sludge is defined as coarse primary solids and secondary biosolids accumulated in a wastewater treatment process. It must be treated, dewatered and disposed of in a safe and effective manner. This material may be inadvertently contaminated with toxic organic and inorganic compounds.

When a liquid sludge is produced, further treatment may be required to make it suitable for final disposal. Typically, sludges are thickened (dewatered) to reduce the volumes transported off-site for disposal. Processes for reducing water content include lagooning and centrifugation. Lagooning in drying beds produces a cake that can be applied to land or incinerated, where the sludge is mechanically filtered, often through cloth screens to produce a firm cake. In centrifugation, the sludge is thickened by centrifugally separating the solid and liquid. Sludge can be disposed of by liquid injection to land or by disposal in a landfill. There are concerns about sludge incinerations because of air pollutants in the emissions, along with the high cost of supplemental fuel, making this a less attractive and less commonly used means of sludge treatment and disposal. There is no process which completely eliminates the requirements for disposal of biosolids.

In Trinidad and Tobago, waste products produced by the treatment process (sludge) is usually dried on the treatment plant compound then trucked to a landfill site.

*Reclaimed water, or recycled water, is (former) wastewater which includes sewerage that has been treated to remove solids and certain impurities, and then used for servicing water demands in various areas.*

## Section 5

### Reclamation and Reuse

Global water issues and needs will make water reuse one of the crucial components and the New Frontier of water resources management. It is believed that it is essential for wastewater and water supply professionals to evaluate water reuse to a strategic level in their planning process so that this limited resource can be efficiently managed and properly preserved.

Water reuse and reclamation is a new paradigm in water resources management that incorporates the principles of sustainable development, environmental ethics and public participation in project development. Although the immediate drivers behind water reuse may differ in each case, the overall goal is to close the hydrological cycle on a much smaller, local scale. In this way, the used water, subsequent to proper treatment, becomes a valuable resource.

Water reuse is the use of wastewater for a beneficial purpose, such as agricultural irrigation or industrial cooling. Whereas water reclamation is the collection, treatment and processing of wastewater to make it reusable with definable treatment reliability and meeting appropriate water quality criteria.

Treated municipal wastewater provides a more reliable and significant source for reclaimed water as compared to wastewater coming from agricultural return flows, storm water runoff, and industrial discharges. Because of its genesis from municipal wastewater, acceptance of reclaimed water as an alternative water source has to overcome hurdles such as treatment to strict water quality standards to ensure it is non toxic

and free from disease causing microorganisms as well as social acceptance.

The table below offers some insight into water reuse categories and typical application.

CATEGORY	TYPICAL APPLICATION
Agricultural irrigation	Crop irrigation, Commercial nurseries
Landuse irrigation	Parks, School yards, Freeways medians, Golf courses, Ceneteries, Greenbelts, Residential
Industrial recycling and reuse	Cooling water, Broiler feed, Process water, Heavy construction
Groundwater recharge	Groundwater replenishment, Salt water intrusion control, Subsidence control
Recreational/environmental uses	Lakes and ponds, Marsh enhancement, Streamflow augmentation, Fisheries, Snowmaking
Nonpotable urban uses	Fire protection, Air conditioning, Toilet flushing
Potable reuse	Blending in water supply reservoirs, Blending in groundwater, Direct pipe to pipe water supply

Direct potable reuse refers to the introduction of highly treated reclaimed water either directly into the potable water supply distribution system downstream of a water treatment plant or into the raw water supply immediately upstream of a water treatment plant. This introduction can be either into a service reservoir or directly into a water pipeline. This practice implies a confidence in and reliance on the applied technology to always produce water that is safe and acceptable to consume, without the opportunity for any natural processes to further improve the water quality.

In indirect potable reuse, highly treated reclaimed water is introduced to a surface water or groundwater system that ultimately uses the water as a potable water supply. Here, reclaimed water is blended with water in a natural system where more treatment takes place between the points where reclaimed water is

discharged and where water is withdrawn into the potable water treatment facility. Reclaimed water is significantly diluted by natural water.

Indirect potable reuse refers to the planned introduction of reclaimed water into a raw water supply, such as a potable water storage reservoir or a groundwater aquifer, resulting in the mixing and assimilation, thus providing an environmental buffer. This practice is motivated by the need to develop additional sustainable water supplies, as well as by recent advances in water reclamation technologies. Indirect potable reuse through surface water augmentation; a planned activity, can occur when treated reclaimed water is introduced into an intervening stream, followed by withdrawal for municipal water supply or direct discharge to a raw water storage reservoir.

It is essential that the public is educated about drinking water quality issues and the principles and capabilities of water reclamation and reuse technologies and applications. An educated and well-informed public will recognize the need for integrated water resources management in the region and increase the likelihood of full confidence in the integrity of operating and regulatory agencies. Public outreach and education efforts are thus, essential to successfully achieve acceptance for these reuse projects.

### Singapore – A World Leader



Singapore has clearly recognized the critical nature of interventions such as its NEWater program, focused on Water Reclamation and Reuse, which have allowed the country to become today one of the leaders in the water and sanitation sector. In fact, in 2007 the Singapore Public Utilities Board (PUB) received the Stockholm Industry Water Award for its holistic approach to water resources management.

As Trinidad and Tobago seeks to develop its own capabilities in relation to wastewater reclamation and reuse, it is not difficult to foresee an overlay of the Singapore model onto our own local setting, with both having similar climate, geographic setting, and historical beginning in the water and sanitation sector. By implementing sound watershed management, effective water treatment processes and continued investments in Research and Development, Singaporeans have been enjoying good quality water for the last four decades.



### Reclamation and Reuse in Trinidad & Tobago

Trinidad and Tobago is not a water scarce country however; the challenge arises in the management of the water resources in the face of competing demands. The water demand is continuously increasing because of population growth and major industrial expansion particularly in the Point Lisas Industrial Estate.

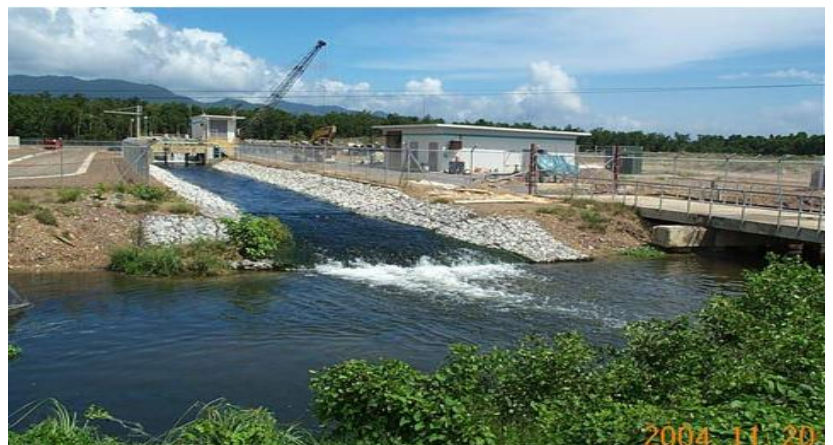
The challenges are more acute as the water resources are not evenly distributed geographically, with greater abundance in the North East and scarcity in South Trinidad. Additionally, potential climate change, weather variability and seasonality of rainfall increase the challenges now and projected into the future. There is also the challenge of increasing pollution of the available water resources and decrease in its availability due to watershed degradation, particularly from hillside development along the foothills of the Northern Range. In fact, trends have indicated a depletion of both ground and surface water resources over the years. Together, these sources account for 63% of the potable water supply for the country.

According to the Water Resources Management Strategy Study published in the year 2000, the total surface water availability can be considered as remaining relatively constant over the years. The major

challenges to this component of the water resources are in the areas of water quality and watershed degradation, particularly with reference to the major water sources which are located along the East-West corridor, which make up the Caroni River Basin system. It is pointed out in the study, that major changes took place in land use over three decades leading up to the year in which the assessment was undertaken, 1997. In fact, it was reported that forest cover decreased from nearly sixty percent (60%) to fifty percent (50%) over this period. The Study also indicates that ground water availability is about three percent (3%) of the surface water availability and based on withdrawals at the time of assessment, the groundwater resources utilized were already close to the full potential availability. This situation is compounded by an ever increasing demand, particularly from the industrial sector. It is therefore very obvious that there is a need to expand the portfolio of water sources locally, and within the short term include emerging areas such as desalination, groundwater recharge, rain-water harvesting and wastewater reclamation for the provision of both potable and non-potable water supplies.

The use of treated wastewater effluent is a new paradigm within Trinidad and Tobago. The Water and Sewerage Authority, on behalf of the Government is seeking to incorporate treated wastewater effluent, as part of the Integrated Water Resources Management (IWRM) concept in providing a sustainable source of water. This concept has greater relevance due to increased urbanization, population density; increased industrialization and the lack of fresh water resources, particularly within the Central and Southern Western parts of the country. This is further compounded by inadequate maintenance practices for the network and distribution system, leading to transmission and distribution losses.

More recently, there has been an increasing interest in the use of highly treated reclaimed water to augment potable water resources. With the construction of the Beetham Wastewater Treatment Plant with reuse potential several other projects are being planned to make the use of reclaimed water a reality in Trinidad and Tobago. In cases where, water resources are limited, when



compared the potential benefits of recycling reclaimed water outweighs the disadvantages. However,

important questions remain about the levels of treatment, monitoring and testing needed to ensure the safety of recycling ‘reclaimed water’.

The operations at the Beetham Wastewater Treatment facility represents the signature initiative in Trinidad and Tobago and the wider English speaking Caribbean, focusing on water reclamation for intended water reuse by other demand sectors. The WWTP employs some of the leading technologies such as reverse osmosis followed by ultra violet disinfection which has been proven to be an effective and an environmentally friendly treatment having higher virus inaction, with no toxic by-products, in meeting the effluent quality standards. This plant is designed to meet effluent quality standards established by the Environmental Management Authority (EMA).

The planning being under taken represents one of the key elements in embracing the concept of water reclamation and reuse for water supply dev within the country. Other major studies in this direction include:

- San Fernando Wastewater Integrated System
- South West Tobago Wastewater Development
- Malabar/Maloney Wastewater Integrated System
- Chaguanas Wastewater system

It is envisaged that with the development of these centralized Wastewater Systems, wastewater reclamation and reuse can be expanded to present a viable alternative for the development of water supplies nationally and present significant business opportunities for WASA. There is also the opportunity for new business development for the Authority through commercial transfers of reclaimed water to the industrial, agricultural and commercial sectors.

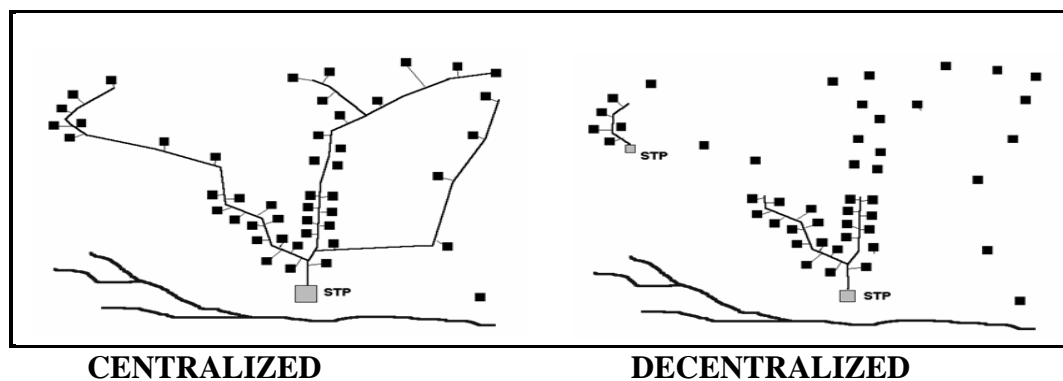
### Centralized Systems

A Centralized system is one where all the wastewater is collected and conveyed to a central location for treatment or disposal. Centralized systems are also called conventional systems.

### *Typical Characteristics of Centralized systems*

- Conventional gravity sewers (deeply placed with manholes & lift stations)
- One treatment facility (normally activated sludge variation)
- High capital cost
- Transfers water away from source basin
- Long, disruptive construction
- Highly trained operator needed
- Potential for catastrophic failure

The diagram below represents a schematic of both a centralized and a decentralized system:



The wastewater collection systems in Trinidad collect wastewater produced by residential, commercial, institutional and industrial service areas. Wastewater is collected within relatively localized areas of Trinidad and is directed to the wastewater treatment plants. Since the 1960s, Trinidad's wastewater collection systems have continued to expand. However, much of the expansion has been completed by private developers. The wastewater collection system pipe length in Trinidad is estimated to be in the order of 500 km, whilst in Tobago it is estimated to be 200km.

Due to many factors, WASA has been unable to execute any large scale consolidation of wastewater collection systems in tandem with the growth of developments. Developers therefore, have been required to construct their own wastewater disposal facilities sized for their immediate needs. The collection systems within these areas did not typically take into consideration future growth, or adjacent properties.

Recent Master Planning assessments have divided the island of Trinidad and Tobago into thirty (30) sewersheds, twenty five (25) and five (5) respectively, for the purpose of planning and development to the provision of centralized wastewater systems to the year 2035. The rationale for developing these sewage catchment areas considers present development locations and probable development locations and intensities. The process in going forward will require consideration inter-alia of the following:-

- **Integration of existing systems**

Where small independent collection and treatment areas would be integrated into regional systems, largely as a result of the failure of the small treatment plants to be operated and maintained effectively. Regional or centralized systems are certainly the conventional and proven method of handling sewage in urban settlements in developed nations.

- **Integration of new developments**

New developments will no longer be required to construct independent treatment and disposal works once regional facilities are available. In lieu of being made responsible for treatment plant construction course, developers could be asked to spend the equivalent amount or make contributions towards the regional trunk sewer or treatment works.

- **Integration of un-sewered areas**

Un-sewered areas of Trinidad are typically mixed throughout the community, with the private systems and new developments, and can therefore be easily integrated with proposed collection systems. Costs of work in these areas will be high due to the need to construct local sewers on every street and connections to every residential, commercial and industrial property.