**Michelle Mycoo**
The University of the West Indies, St Augustine

Chapter 16

# Environmental policy for water resources development: A case study of Trinidad

## Introduction

The Water Resources Management Policy for Trinidad and Tobago states the commitment of the government to transform the country into a developed nation by 2020. The objective of the policy is to improve water quality and equity in access to water and sanitation, promote water conservation, and ensure the optimal use and management of the nation's water resources. This chapter examines the developmental and environmental policies for the small and island state of Trinidad to determine if they conflict or complement each other.

## Background

Trinidad, the most southerly of the Caribbean archipelago of islands, is an oil-rich country with a land mass of 4,828 square kilometres, which supports a population of approximately 1.3 million. Unlike some other Caribbean islands, Trinidad has an abundance of rainfall arising from orographic rainfall and its location in the Inter-tropical Convergence Zone. The Water Resources Management Unit (WRMU) estimated that water demand in 2002 was 368 million cubic metres (mcm) in contrast to water supply of 346 mcm. Countries are considered to be facing a serious water crisis if available water is less than 1,000 cubic metres per person per annum. Trinidad is not a water-scarce country as the data shows that the per capita annual water availability is approximately 2,500 cubic metres (WRA, 2002).

Approximately 76 per cent of the country's water supply is derived from surface water sources while the remainder is obtained from groundwater sources. Eighty per cent of the country's surface water resources originate in its Northern Range and 58 per cent of the groundwater is located in this same geographical area (Water Resources Authority, 2002). The available surface water is an estimated 3,600 mcm per year, which is 10 times the island's present water demand.

Domestic consumers are the largest single users of water accounting for 36 per cent of demand; total industrial demand accounts for 18%; and irrigated agriculture accounts for 3 per cent of demand. A challenge to water resources management is that 43 per cent of water is lost during transmission and is classified as unaccounted-for-water (WRMU I, 2001). Although difficult to quantify, ecological demand represents an important user of water and water itself is needed to maintain the productive ecology of the island's rivers and wetlands (Government of Trinidad and Tobago, 2003).

Despite rapid economic growth linked to spiralling oil prices in recent years, the disparity in income distribution is increasing. The poverty rate was estimated at 22 per cent in 2005 (Kedir and Sookram, 2005). In 2004 the country's Environmental Management Authority (EMA), highlighted that income disparities and poverty are driving many persons, households and communities to seek affordable living space, homesteads and livelihood opportunities on hillsides, in peri-urban areas, and along access routes into the valleys. This pattern of settlement is associated with deforestation which degrades the country's watersheds and pollutes its main water sources. The population of a country at risk to economic inequalities also places the environment at risk.

While the country's population growth rate has been decreasing over the past twenty years, and while the estimated average annual rate of increase in the urban population between 2000 and 2005 was 0.9 per cent (United Nations, 2005), the alarming aspect of Trinidad's demographic pattern is that 76 per cent of the population lives in urban centres. Moreover, a substantial portion of the urban population is generating a demand for land for housing and construction materials such as forests products and aggregate obtained from quarries near watershed areas, which is leading to degradation of these areas.

Overall challenges in water resources management in Trinidad include population increase, the growth of industrial activity which has high levels of water consumption, threats from seasonality and climate change, general misuse and the lack of a water resources management framework that includes sound policy formulation and effective implementation.

## Framework for water resources management

Over the last decade, the government has been undertaking several measures to improve the framework for water resources management. In 1999, a Water Resources Management Strategy was developed; in 2003, the National Water Resources Management Policy was prepared; Water Pollution Rules were passed in 2007; and a Water and Wastewater Master Plan and Policy was completed in 2008.

The main focus of the National Water Resources Management Policy (NWRMP), adopted in 2003, is to effectively manage the country's water resources in an integrated and sustainable manner, and to resolve water resources management conflicts that arise from discordant policies and development practices. The policy embraces the four main Dublin Principles.

**Box 16.1. The Dublin Principles**

1. Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.
2. Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.
3. Women play a central role in the provision, management and safeguarding of water.
4. Water has an economic value in all its competing uses and should be recognised as an economic good.

Integrated water resources management (IWRM), as defined in Box 16.2, is crucial to small island developing states where there is increasing competition for scarce land and water resources. Furthermore, given the small size of islands, damage inflicted in the watershed areas because of poor land-use practices pollute the coastal water sources including aquifers. The close proximity between the land in the watershed areas and the coastal plains necessitate an approach to water management that considers the integration of these two areas. The basis of IWRM is that there are a variety of uses of water resources which are interdependent. This interdependency coupled with unregulated use can lead to negative consequences of water resource wastage, and, in the long term, unsustainability of water resources.

## Policy in action

Although the NWRMP was formulated to embrace IWRM and the key Dublin Principles, operationalising these principles is challenging and, as the following sections of this chapter will demonstrate, there have been inconsistencies in policy implementation arising from the weak monitoring and enforcement capacity of the various regulatory agencies that have an input into water resources management in Trinidad and Tobago.

**Box 16.2. Definition of IWRM**

IWRM may be defined as a systematic process for the sustainable development, allocation and monitoring of water resource use in the context of social, economic and environmental objectives (Global Water Partnership, 2000). It is cross-sectoral and therefore in stark contrast to the traditional sectoral approach that has been adopted by many countries. It has been further broadened to incorporate participatory decision-making of all stakeholders.

### Land-use planning and management

The nexus between land-use planning and management and water resources management is strong because land use inevitably impacts on water quality and quantity. The NWRM policy states that where practicable, land-use planning will be conducted on a watershed basis, meaning that planning approval for new land development will consider the mitigation of potential negative impacts on watersheds, the supply of adequate water and sewerage services, and the protection of surface and groundwater resources.

The Capital Region Plan (1975), the Northern Range Hillside Development Policy (NRHDP) (1976), and the National Physical Development Plan of Trinidad and Tobago (1988) prohibit development above the 300-foot mean sea-level contour line and on slopes steeper than 1 in 6, to ensure watershed protection through the containment of settlement expansion in the Northern Range where the country's major watersheds are concentrated. Both plans also recommended reafforestation of hillsides above the 700-foot contour line in some valleys. The NRHDP guidelines indicate that forested areas are to remain intact, developments on steep slopes are to be controlled, and residential settlements are to be regulated.

The NRHDP policy has been ineffective as privately owned, forested areas are sold to developers (EMA, 2004). The previous paragraph states what are the NRHDP guidelines on the use of private lands. Hillside slopes are very attractive sites for high-income households that place a premium value on the scenic views of the valleys of the Northern Range, although the engineering costs are quite exorbitant. Moreover, the increasing pressure of limited land space, which is common in small and island states, has pushed built development onto the hillsides of the Northern Range.

However, this type of residential development is often in conflict with other uses such as catchment areas for freshwater resources (EMA, 2004). This fact prompted a review of the NRHDP – which was submitted to the Minister of Planning and Development in 2007 with the main recommendation that development in areas in excess of 1 in 3 degree slopes should be discouraged to facilitate watershed management. Additionally, since the enactment of the EMA Act 2000, all developers undertaking sub-division of land and other types of development in these areas are now required to apply for a Certificate of Environmental Clearance.

Increasing socio-economic inequalities have pushed poor households out of the formal land market and into squatting. Estimates of squatting range from 20 per cent in 1985, (Glen et al. 1991; Kairi 1999b) to 25 per cent in 1989. Driver (2002) estimated that 47 per cent of households in Trinidad and Tobago have improper title and 55 per cent of farmers have no proof of land ownership. Faizool (2002) noted that increasing socio-economic pressures have been accompanied by an increase in squatting especially on the upper slopes of the western half of the Northern Range, both on private and state-owned lands.

Squatting in hillside and forested areas arises from the dysfunctionality of Trinidad's land market and this has alienated the poor from the land. One reason for the malfunctioning of the market is the failure of land-use planning to release land for development in the right place and at the right time, thus creating artificial land shortages that drive land values up and beyond the reach of the poor to purchase land. State failure to embark on land assembly/land banking has also encouraged a shortage of land in areas deemed appropriate for housing and livelihood practices especially agriculture. The unaffordability of low-income housing and the inefficient and expensive land registration system has also contributed to squatting by marginal groups in areas that are highly sensitive from a water resources management perspective. Moreover, the policy on the link between land tenure and integrated water resources management is still weak.

The landless poor are not the only threat to water resources degradation. The EMA (2004), concluded that 'The Northern Range is affected by authorised high-income housing as much as by unauthorised settlements. There is need to highlight high-income housing and land developers, as often the attention falls on the poorer squatters who have more limited options. The associated road construction and the houses decrease the surface area for ground-water infiltration while increasing the pollution load on the surface and ground-water resources'.

Agricultural squatting on the upper slopes of the valleys of the Northern Range where the country's main rivers originate has also had a deleterious impact on available water

resources. There has been a reduction in groundwater recharge resulting from soil loss associated with slash and burn cultivation, which is common among subsistence, landless and therefore transient farmers, who are, paradoxically, both the victims and agents of environmental degradation.

## Watershed management

The legal and policy framework for watershed management in Trinidad and Tobago is inadequate. Toppin-Allahar (2001) noted in relation to several Caribbean SIDS like Trinidad and Tobago that specific legislation governing soil and water conservation is scarce and generally out-dated and that sound land management practices are being abandoned. A particularly interesting anomaly that is drawn from Toppin-Allahar's (2001) research is that '... old laws, such as measures which accelerate the acquisition of title to public lands by adverse possession where the land is "improved" by squatters, offer indirect incentives to environmentally unsound practices, such as the deforestation of marginal lands and the draining of wetlands for cultivation'. The issue was brought before the courts of Trinidad and Tobago in a case relating to the illegal occupation by rice farmers of land in the Nariva Swamp, which is protected under the Ramsar Convention. The court ruled that: the investments made by the squatters in the Nariva Swamp were destroying a protected area; that they were not property improvements and therefore could not give rise to an equitable interest in the land.

The legal and policy framework for forestry, national parks and protected areas is equally fundamental to watershed management. The Main Ridge Forest Reserve in Tobago has the distinction of being the oldest forest reserve in the western hemisphere, having been declared in 1764. The reserve was established expressly for watershed management purposes (Toppin-Allahar, 2001). However, the forestry legislation, as noted by Toppin-Allahar (2001), is directed at the regulation of production forestry on publicly owned lands and weak on the issue of deforestation on private lands and watershed management, including the control of forest fires.

Weak enforcement of laws and policy over the last 30 years has resulted in a decrease of forest cover from nearly 60 per cent to less than 50 per cent. The last official forest inventory for Trinidad and Tobago dates back to 1980 and is still used in official statements. This estimated that there was 50 per cent forest coverage, but the University of Maryland Global Land Cover Facility using MODIS satellite coverage, which mapped forested areas with crown cover greater than 75 per cent, estimated it as 46 per cent (Agard and Gowrie, 2003). The most recent estimate, using aerial photography suggests that the forested area is 33 per cent inclusive of natural and re-growth vegetation. The rate of loss of vegetative cover was approximately 4 per cent between 1998 and 2003 (Agard, 2006).

The Forestry Division (2003) estimated that between 1980 and 1988 forestry accounted for 2.5 per cent of the country's gross domestic product. However, this is a gross underestimation of the role and value of forests in providing environmental services such as water cycling and replenishment, soil preservation and flood mitigation. The Forestry Division's current policy is that licences for timber harvesting in the Northern Range will not be issued (Faizool, 2002), but trucks with logs are often seen traversing parts of the

East–West Corridor, the most urbanised zone in the country. Assumptions have been made by public officials that such activity may be originating from private lands in the Northern Range. Much of this activity appears to be taking place on weekends which also suggests that it may be illicit logging.

The failure to enforce the regulations and policy in respect of deforestation is partly related to the inability to place a monetary and environmental value on forests and has had negative consequences for water resources management (Government of Trinidad and Tobago, 2007a).

## Quarrying

The oil boom has caused a surge of construction activity that has generated a high demand for aggregate. Trinidad's main watersheds are located in areas where the major sources of blue limestone and other non-hydrocarbon construction materials are located (Faizool, 2002). However, quarrying activity has had a deleterious impact on water quality. In 1993, two engineering companies reported that the quarrying operations in one of the main valleys of Trinidad were dictated by profit maximisation to the detriment of the environment. Subsequent studies conducted by the EMA concluded that several main rivers suffered from reduced water quality because of poor quarrying methods and inadequate mitigation of quarry-floor runoff and effluent discharge that led to changes in sediment dynamics and river ecosystems (Alkin-Koo et al. 2004). Many quarry operators were granted licences prior to the EMA Act 2000 and therefore did not have a Certificate of Environmental Clearance (CEC) based on an Environmental Impact Assessment. All new operators now require CECs and must rehabilitate the vegetation and terrain where they are quarrying. However, enforcement of conditions drawn up in the issuing of the licences remains difficult to enforce. Furthermore, the Quarry Policy White Paper (Government of Trinidad, 2007b) makes no reference to the potential impact of increased quarry activity on forest resources and, by extension, water resources.

## Water quality and pollution

The country has historically enjoyed good potable water quality, but this is being threatened by increasing pollution from sewage, industrial effluents, and accelerated soil erosion triggered by authorised and unauthorised land clearance and building activity. All of these sources of water pollution make treatment costs higher and have implications for public health and natural ecosystems.

Alkins-Koo et al. (2004) argued that Trinidad's rivers and other natural waters are used as solid waste and liquid effluent disposal sites especially in areas that are poorly serviced by waste collection and treatment facilities. According Alkins-Koo et al. (2004), the lack of adequate regulations and alternatives for waste disposal make rivers function as informal, low-cost, liquid-receiving, and transportation systems.

Of particular concern is the pollution of surface water from high levels of biological oxygen demand (BOD), bacterial content, turbidity and chemical pollutants in rivers. The main sources of pollution are unregulated, point-waste discharges from industries and

settlements and high erosion levels in the upper catchment of rivers. Only 23 per cent of the population is served by a central sewage treatment system and these are located in the main urban centres of Port-of-Spain, San Fernando and Arima (EMA, 2004). The majority of the burgeoning urban centres where more than half the population resides are serviced by private package treatment plants, many of which are malfunctioning and contributing to BOD, faecal coliforms, and low dissolved oxygen values for several key rivers. Concerns about the risks to the water quality of the aquifers, due to the prevalence of septic tank sewerage disposal systems in urbanised areas, influenced the Water and Sewerage Authority in the 1970s to make it a policy that developments of 25 lots or more should build package sewerage treatment plants. However, a study done in 1990 found that many developers went into receivership, abandoned their projects or had their electricity supply to the plant disconnected because of arrears to the electricity company (Toppin-Allahar, 1992).

Mandatory effluent standards for wastewater treatment have been issued in the new water pollution rules passed in 2007. However, enforcement of these standards remains ineffective because of limited field inspection capability especially of the burgeoning small enterprises and factories that can cumulatively do as much or more damage to water resources than large industries. The other exception is the household that is allowed to discharge a wide range of toxic household chemicals. In the absence of a national wastewater system households are polluting water resources. The Water Pollution Rules of the EMA are supposed to protect freshwater resources via the use of standards, permits and fines, but while sources of industrial pollution are tackled, neither the Water Pollution Rules nor the NWRMP addresses ambient water quality, which would be more relevant to the diffused sources of pollution from agricultural and housing activity.

Excessive and continuous discharge of untreated agricultural and livestock wastes feed directly into two of the country's rivers – the Tacarigua and Aripo Rivers – at a rate that sometimes exceeds their capacity for biodegradation (EMA, 2004). This results in increased BOD and a subsequent overall decrease in water quality as in the case of the Arima River (EMA, 1998). Surface water pollution not only depletes potable water sources but degrades the ability of rivers to host productive habitats for both terrestrial and aquatic species.

Apart from surface water pollution, over-extraction of water from groundwater sources led to saltwater intrusion of two main wells in the 1980s. Although there have been no major occurrences of groundwater contamination in recent times, intermittent high levels of nitrates were detected in three sub-aquifers of the Northern Gravel System. Additionally, recent preliminary surveys detected trigalmethanes, lead and methyl tertiary butyl ether in the groundwater of the East–West Corridor, which is the most urbanised zone in Trinidad. These pollutants can be traced to hazardous waste dumps, underground fuel storage tanks, untreated sewage and industrial effluents.

## Conclusion

Trinidad has several policies and plans which articulate the need for effective water resources management but these are not being implemented. The *State of the Environment*

*Report*, (EMA, 2004), cites several reasons for weak environmental policy implementation, which are applicable to the water resources management policy. One explanation is that the enforcement of policy stipulation is not rigorous enough. Another is the highly sectoral organisation of the public administration system, in which water resources management responsibilities are scattered amongst a plethora of government departments and statutory authorities that restricts the systematic application of these official policies. The dichotomisation of policies and fragmentation of responsibility is clear. The EMA (2004) also noted that there is no co-ordinating mechanism to ensure that all relevant agencies are operating consistently with these policies, or to make use of synergies or manage trade-offs among their objectives. Finally, the discordance in policy and action arises from the non-existence of practice in the public sector to monitor and evaluate outcomes and impacts of activities on water resources management. After a decade of policies that deal directly with water resources management, much still needs to be done in developing the institutional capacity to monitor and enforce these policies, and ensure consistency in other policies that indirectly impinge on water resources management.

## References


Agard, J.B.R., and M. Gowrie (2003). 'Environmental Vulnerability Index (EVI): Provisional indices and profiles for Trinidad and Tobago'. *State of the Environment Report 2001 & 2002.* Environmental Management Authority, Trinidad and Tobago. 53 pp.

Agard, J. (2006). Lecture on the Millennium Development Goals and Environmental Issues in Trinidad & Tobago hosted by the United Nations Association of Trinidad and Tobago, March 23 2006.

Alkins-Koo, M., F. Lucas, L. Maharaj, P. Phillip, W. Rostant and S. Surujdeo-Maharaj (2004). *Water resources and aquatic biodiversity conservation: a role for ecological assessment of rivers in Trinidad and Tobago.* Caribbean Environmental Forum-2, Port of Spain, Trinidad and Tobago, May 31–June 04, 2004. 13pp.

Driver, T. (2002). 'Comparative study of land administration systems', Trinidad and Tobago, Case-study, unpublished; referenced in Johnson, S.G. (2003). 'Building the cadastral framework; achievements and challenges in the English speaking Caribbean', http://www.gsdi.org/gsdiconf/gsdi10/papers/TS42.2paper.pdf

Environmental Management Authority (EMA) (1998). *State of the Environment Report 1998*. Ministry of Public Utilities and the Environment, GoTT. 98 pp.

Environmental Management Authority (EMA) (2004). *State of the Environment Report 2004.* Ministry of the Environment, GoTT. 28 pp.

Faizool, S. (2002). *Watershed Management of the Northern Range in Trinidad and Tobago*. Forestry Division, Ministry of Public Utilities and the Environment, GoTT. Paper presented at a regional dialogue hosted by the Natural Resources Management Unit of the Organization of Eastern Caribbean States at St. Lucia on February, 25–27 2002. 47 pp.

Forestry Division (2003). *Annual Report 2002*. Ministry of Public Utilities and the Environment, GoTT. 68 pp.

Glenn, J., R. Labossiere, and J. Wolfe (1991). *Squatter regularisation problems from Trinidad.* Urbanization and Development Project. School of Urban Planning, Mc Gill Univ., Montreal, Canada. Mimeo.

Global Water Partnership (2000). TAC Background Paper No. 4. *Integrated Water Resources Management*. GWP, Stockholm, Sweden.

Government of Trinidad and Tobago (2003). *National Water Resources Management Policy*. Revised Version, Water Resources Management Unit.

Government of Trinidad and Tobago (2007a). *Draft and Protected Area Policies for Trinidad and Tobago.*

Government of Trinidad and Tobago (2007b). *Quarry Policy White Paper.*

Kairi Consultants Limited (Kairi) (1999). *Environmental Data and Information Project: Socio-economics.* Final Report submitted to the Environmental Management Authority. Trinidad and Tobago. 99 pp.

Kedir, A.M., and S. Sookram (2005). *Poverty and household welfare in Trinidad and Tobago: Evidence from the Survey of Living Conditions*. Unpublished.

Lucas, F. (2003). *A Watershed Approach to the Assessment of Human Impacts on Northern Range Rivers, Trinidad*. Dept. of Life Sciences, the University of the West Indies, Trinidad and Tobago. Paper presented at UWI–EMA Symposium, Ecological Assessment of Rivers of Trinidad and Tobago, April 3, 2003.

Lucas, F., and M. Alkins-Koo (2004). *A case study in pollution in a major river catchment, Trinidad.* Second Caribbean Environmental Forum, Port-of-Spain, Trinidad and Tobago. May 31–June 4, 2004. 11 pp.

Mahabir, S. (2003). *Integrated Water Resource Management in Trinidad and Tobago*. Interim Rep. IR-04-008. Intl. Inst. for Appl. Syst. Anal. 26 pp.

Surujdeo-Maharaj, S., M. Alkins-Koo, W. Rostant, L. Maharaj, F. Lucas, and I. Chang Yen (2004). *Metal pollution considerations in integrated water management for Trinidad and Tobago, West Indies*. Second Caribbean Environmental Forum, Port-of-Spain, May 31–June 4, 2004. 11 pp.

Toppin-Allahar, C. (1992). *Institutional Strengthening and Legal Infrastructure*. Technical Report submitted to the Government of Trinidad and Tobago.

Toppin-Allahar, C. (2001). *Legislative Environment and Policy*, Chapter 12 in Course on Coastal Zone/Island Systems Management, The Faculty of Engineering, the University of the West Indies, St. Augustine, Trinidad.

Water Resources Agency (WRA) (2002). *State of the Water Resources Report*. Ministry of Public Utilities and the Environment. GoTT. 96 pp.

Water Resources Management Unit I (WRMU I) (2001). *Millennium Report – State of the Water Resources 1988–98*. Water Resources Agency. Water and Sewerage Authority, Ministry of Public Utilities and the Environment, GoTT. 89 pp.

## Websites

United Nations 2005 http://unstats.un.org/unsd/de