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Strategic Environmental Assessment (SEA) of the Implementation of the National Sugar Adaptation Strategy for Trinidad & Tobago
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Draft Strategic Environmental Assessment

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PINSISI Consortium Partners

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ACRONYMS:

ADB	Agricultural Development Bank
CEC	Certificate of Environmental Clearance
EMA	Environmental Management Authority
EMBD	Estate Management and Business Development Company Limited
E-Teck	Evolving Tecknologies and Enterprise Development Company Limited
FAO	Food and Agriculture Organization (of the UN)
GORTT	Government of the Republic of Trinidad and Tobago
IPCC	International Panel on Climate Change
MALMR	Ministry of Agriculture, Land and Marine Resources
MPHE	Ministry of Planning, Housing, and Environment
MOTI	Ministry of Trade and Industry
MSE	Medium and Small Enterprise
NAMDEVCO	National Agricultural Marketing Development Company
NAS	National Adaptation Strategy
NEC	National Energy Corporation of Trinidad and Tobago Limited
NEP	National Environmental Policy
RDC	Rural Development Company Limited
SILWC	Sugar Industry Labor Welfare Committee
TTABA	Trinidad and Tobago Agri Business Association
TTEC	Trinidad and Tobago Electricity Commission
UTT	University of Trinidad and Tobago
UWI	University of the West Indies
VSEP	Voluntary Separation Package
WASA	Water and Sewerage Authority

1 Executive Summary

Executive Summary

The Strategic Environmental Assessment (SEA) of the National Adaptation Strategy (NAS) focuses on the properties formerly under the management of Caroni (1975) Ltd. Caroni (1975) Ltd. is the former state owned sugar industry for Trinidad and Tobago which was nationalized from the Tate and Lyle Sugar Company, and other state and corporate properties. Caroni (1975) Ltd. operated two sugar mills/refineries, a distillery, coordinated transportation, provided support to private farmers, and diversified into an array of agricultural activities including citrus orchards, rice cultivation, cattle breeding, and aquaculture. Despite substantial property holdings, Caroni (1975) Ltd. was not independently profitable and the sugar industry required substantial subsidies from the state. The Government of Trinidad and Tobago decided to close Caroni (1975) Ltd. in 2003, and developed a National Sugar Adaptation Strategy (NAS) that provided support to displaced workers, allotted lands for agricultural, residential and industrial development. The NAS has evolved since its inception and continues to build upon the inputs of the involved institutions to meet the needs of the citizens of Trinidad and Tobago.

The objective of the SEA is to examine the net environmental, social and economic negative impacts and positive effects of the planned activities in the development of these properties, and the related areas. The SEA was undertaken between January and May of 2009, and focuses on the planned use of the 76,000 acres formerly in cane production and related activities. The SEA seeks to situate the recommendations within the existing planning, policy and programmatic objectives of the Government of Trinidad and Tobago (GoRTT), specifically the country-wide strategic initiative Vision 2020, which seeks to enable Trinidad and Tobago to reach developed nation status by the year 2020. The European Commission (EC) has provided the support for the SEA as part of the Sectoral Support Program, and this SEA is conducted under the guidance of the EC SEA Directive 2001/42.

The subject of the SEA is the series of alternative use plans for the Caroni (1975) Ltd. currently under development. These include development of agricultural uses on 13 mega farms, and 14,000 acres of “2 Acre plot” cooperatives; residential uses via the construction of 30 residential estates; and, industrial development via 6 light industrial estates and one large heavy industry/mixed use estate.

The SEA examines the baseline pre-NAS Caroni (1975) Ltd. properties, the current conditions, and the expected impacts and effects, which are analyzed within the context of water quality and quantity issues, soil health, air quality, climate change, biodiversity, public health, social inclusiveness, cultural heritage and landscapes, economic access, and infrastructure and material assets. For the planned alternatives for use of the Caroni (1975) Ltd. properties, the severity of impacts, micro level mitigation and enhancement efforts and responsible and involved parties are proposed. The intention of these micro level mitigation and enhancement recommendations are to enable those implementing the various activities to take cost effective, environmentally and economically beneficial

steps to create conditions which will enhance the environment and improve ecosystem functions within the planned developments.

The micro-mitigation can serve as the foundation for enhancement recommendations made at the sectoral level that are intended to support the effective management and implementation of the agricultural, residential and industrial alternatives. The agricultural sector recommendations include:

- development of a concerted soil remediation and water retention management scheme;
- development a sustainable agriculture and environmental education programme at all levels, mitigating socio-economic impacts through farmers cooperatives;
- and, a social marketing campaign to encourage consumption of local produce.

The residential sector recommendations include:

- increased mixed-use, high occupancy dwellings with enhanced green space surroundings, enhanced social infrastructure and long term responsibility assigned for maintenance;
- develop a new home owners' guide book for environmental stewardship and savings;
- and, institutionalize access to Green Fund for local/individual kitchen, community gardens, and park developments.

For industrial development the recommendations are:

- encourage enhanced use of Best Available Technologies (BATs), including citing of industry for all new industries;
- develop state-of-the-art mixed-use industrial estates with significant green buffer zones to all waterways;
- and, consult with local stakeholders to enhance the social support for projects early on and incorporate their suggestions into project design including social infrastructure.

The recommended application, reasons for taking the suggested measures, benefits of taking them and potential costs of not taking the measures are outlined, and the potential responsible bodies are proposed for each sectoral level recommendation.

There are three macro level, across the board recommendations that will enable Trinidad and Tobago to most effectively and efficiently develop the planned alternatives for the former Caroni (1975) Ltd. over all. These recommendations are:

- to develop an Integrated Water Resource Management Plan with all impacting and affected sectors that builds on the current WASA Water and Waste Water Management Strategy;
- design a Climate Change Adaptation Strategy with realistic and realizable objectives to minimize impacts and improve responses to potential threats;
- and, conduct a Socio-economic Assessment, focusing on Labor Availability and Capacity Needs Assessment specific to each sector involved in the current NAS.

Each of these recommendations is made with the means of application and reasons for taking the suggested measures. Benefits of implementing these measures and potential

costs of not taking them are outlined, as well as the potentially responsible and involved bodies. A brief review of capacity and suggested indicators are provided in order to facilitate future development of the main recommendations.

There is great potential at this juncture to implement cost efficient measures that will set Trinidad on the path towards being a model of sustainable development into the 21st Century. The recommendation and options proposed here build on the existing strategies and trajectory and are intended to complement the development trends currently underway. Adoption of these measures will have short, medium and long term benefits and reduce costs for citizens, implementing sectors and the government overall.

2 Scope

Caroni (1975) Limited has been the largest agricultural industry in Trinidad and Tobago. Until 2004 the company was producing over 30,000 acres of sugarcane. Private farmers were producing 35,000 acres, primarily on leased lands from Caroni (1975) Limited. The total acreage under the control of Caroni (1975) Ltd. was 76,000 acres. Diversification of Caroni (1975) Ltd. interests included a cattle breeding facility, orchards, rice fields, aquaculture, two refineries, and a distillery. Despite high levels of state subsidies, sugar continued to show constant decline in its contribution to the economy of Trinidad and Tobago, which led to the implementation of a policy decision by the Government to discontinue public sector ownership of the industry in 2003. Even though the initial intention was the possibility to continue operation of the industry under private ownership. This has not been reaslized, as cane production was not economically viable. Alternatives to cane production on the Caroni (1975) Ltd. have been considered, including agriculture to meet food security demands, residential developments and industrial estates. These are the subject of this SEA.

In addition to the agricultural sector and the diversion from cane production to addressing food security through other agriculture development agendas, the property that was formerly under the auspices of Caroni (1975) Ltd. has been divided to meet the needs of the growing demand for residential housing, and for increased economic diversification for industrial development. Lands that were formerly under cane production are now assigned to an array of government agencies and parastatal bodies that will develop these properties for residential, commercial, light and heavy industry uses.

The SEA addresses the agricultural diversification from cane production to alternate agricultural uses. The former Caroni (1975) Ltd. lands which are being converted to residential, industrial and commercial uses are also impacted by the NAS. The economic diversification strategies outlined in Vision 2020 – the national strategy that is intended to guide Trinidad and Tobago to developed nation status by the year 2020 - serves as the impetus to this developmental shift. The SEA will also address the shifts that resulted from a significant portion of these lands being converted for alternate uses, and the environmental, social and economic implications of these actions. The “downstream” impacts will also be addressed where they are directly related to the shift in land use strategies as a result of the NAS.

3 Background

3.1 Sector Programme justification and purpose

In 2006, the EC provided support under its Accompanying Measures for Sugar Protocol (AMSP) countries to Trinidad and Tobago for drafting the National Adaptation Strategy (NAS) for sugar. Although the NAS was adapted specifically to address the adjustments to the sugar industry of Trinidad and Tobago it was premised under the Vision 2020 agenda of the country. The NAS was to speak to future operating framework following the withdrawal of public interest, the implications of the EU sugar reform and the economic trends in Trinidad and Tobago.

The European Commission requires a ***Strategic Environmental Assessment*** (SEA) to be carried out for the implementation of the "National Sugar Adaptation Strategy" and the EC response strategy to the NAS, with special emphasis on the ongoing restructuring process of the sugar industry.

Given the impact on the environment from the sugar sector reform process, it is essential from the onset, for stakeholders and decision-makers to have an environmental baseline as well as relevant recommendations which will be used to mitigate the possible adverse impacts of the implementation of the NAS and to optimise the possible positive impacts.

The T&T NAS is a sector policy document which is incorporated in a wider national development policy (Vision 2020) which, with its main thrust focused on sugar, is based on the Government's policy to divest from sugar and its decision to end subsidies to the sugar industry in Trinidad and Tobago at the end of 2007.

The EC strategy supports two of the NAS Strategic Objectives:

1. Strategic Objective - promoting economic diversification of sugar dependent areas:
   a. Exit strategies for sugar farmers and sugar-cane workers who choose to leave the industry
   b. Improving the enabling environment for economic diversification

2. Strategic Objective - addressing broader impacts related to social, environmental, community and area-based issues
   a. Maintaining environmental stability
   b. Providing sustainable social and economic support related to the socio-economic effects of transitioning out of the industry

The General objective of EC Sugar related assistance is to mitigate the adverse effects for the sugar growing areas of the EC Council of Ministers' decision to exit the Sugar Protocol, while supporting the GORTT in the realization of the priorities established in Vision 2020, the country's National Development Plan to become a developed nation by the year 2020.

3.2 Planned Alternatives

As noted above there are three main alternatives for the Caroni (1975) Ltd. properties: agricultural, residential and industrial development. The development of agricultural lands are either as mega-farms which are commercial entities, or as 2 acre plots provided to 7000 former Caroni (1975) Ltd. workers, which are currently underutilized and are being considered for development as cooperatives in which the title holder would be able to lease his land to a cooperative in return for a portion of the profits. The cooperative plans for the 2 acre plots are still under development and the assessment described here is based on initial discussions. Finalization of these plans will occur in the coming months.

The residential estates under development receive oversight from the Estate Management and Business Development Board, and will provide approximately 30 residential estates for the general public and former Caroni (1975) Ltd. workers on former cane lands.

The industrial development is divided in to light and heavy industry. The 6 light industry estates are managed by E-Teck under the Ministry of Trade and Industry. The heavy industrial estate to border Point Lisa industrial estate is under the management of the National Energy Company of Trinidad and Tobago (NEC), under the Ministry of Energy.

There remain approximately 16,700 acres of Caroni (1975) Ltd. properties that are not yet assigned. The department of Town and Country Planning, in the Ministry of Planning, Housing and Environment is currently surveying these lands. The division of the Caroni (1975) Ltd. is provided in Table 3.2 Caroni (1975) Ltd. Land Allocation. The details of these alternative plans are outlined below.

Table 3.2: Allocation of Caroni (1975) Limited Lands – April 2009

Type of Use	Amount (Acre)	Percent of Total
Agriculture: 2-acre plots	20,319	27
-Mega farms	2,263	3
-Non-cane farming	11,109	15
-Agricultural Squatters	4,222	6
Residential	4,053	5
Industrial	4,078	5
Existing Tenants	11,861	16
Unassigned	16,703	24
Total	76,608	100

Source: Caroni (1975) Ltd.

3.2.1 Agricultural Development Plans

Agriculture continues to be a principal development alternative proposed for the former sugarcane lands at Caroni (1975) Limited. In attempting to deal with the issue of low

productivity from sugarcane the company diversified portions of it sugarcane lands. It had engaged in semi-commercial production of rice, citrus, livestock, aquaculture and other tropical fruit crops. However, the focus remained on sugarcane, hence the true potential of the other enterprises were not fairly developed.

Of the 76,608 acres of available lands, 27% (20,319 acres) are allocated for sub-division into of two acre lots for former sugar workers as a part of their Voluntary Separation, Employment Packages (VSEP). While estimated at approximately 7000 farmers, Caroni workers will be recipients of these two-acre plots, and the precise number of beneficiaries remains to be finalized. However it is not clear as to whether there are 7000, 9000 or what the actual number beneficiaries in the two acre category. Approximately 2,263 acres of land are allocated for the development of 13 commercial (mega) farms. The lot sizes for this category of farms currently range between 100 acres and 267 acres. There are plans to formalise the occupancy of several informal agricultural land settlers (squatters), who are currently occupying 6% (4,222 acres), into legal land holders. It is not clear as to what arrangements are in place to deal with some 11,109 acres (15%) that collectively grow citrus/tree crops, rice, livestock, pasture and aquaculture under the former Caroni 1975 management structure. The future arrangements of existing tenants, currently occupying 16 % (11,861 acres) need to be ratified as well. A total of 16,703 acres (24 %) of the Caroni land are identified as residual lands since the closure of the sugar industry and could be earmarked for meaningful alternative developmental activities. This is detailed in Table 3.2.

Currently, much emphasis is placed on development of the two acre plots and recipients are contractually obligated to engage the lands in agriculture by six months of receipt. The Estate Management and Business Development Board (EMBD) that has the charge to administer the developmental process of the Caroni property reported in March 2009 that Caroni Agricultural Lands Project (CALP) had completed infrastructural work on twenty-seven (27) sub-divisions. This prepared 7,053 two-acre agricultural lots. The remaining two sub-divisions were slated to complete by March 31, 2009 and would prepare an additional 254 two-acre agricultural plots.

The legal framework regarding land tenure for the two-acre agricultural plots is in progress and the consortium of Government agencies responsible has implemented strategies to expedite the process. To date, 3,628 offers have been made for leases. Of this amount 2,286 individuals responded to the offers, 1,925 proceeded to the stage of the lease, 748 leases were executed and 544 leases have been registered. Approximately 3,372 offers are outstanding to date.

Several factors have been cited as impediments to mobilizing the two-acre agricultural plots into production. These include the long distance of the plots from tenant's residences, unavailability of access to water, the high level of legal restrictions imposed on the use of the land and a lack of interest of land holders in agriculture and concerns about praedial larceny. Another major constraint is the inability of tenants to gain free access to their holdings due to limited road infrastructure. Some beneficiaries are discouraged after learning that the ownership arrangement with the two acre plots is

leasehold rather than freehold as they originally thought when they were signing the VSEP. To address the situation an Inter-Agency Working Group consisting of MALMR, Caroni (1975) Limited, EMBD, PCS Nitrogen, ECIAF and TTABA was commissioned by the Ministerial Committee to design an appropriate strategy that would mobilize the farmers and put these lands into active production within the short term.

Of the 2,129 acres of land proposed for the establishment of 13 mega farms the EMBD has received two confirmations to date for a collective plot size of 275 acres. These two plots are being established for training, commercial demonstration and production purposes. Investors for four additional plots, with total land size of 563 acres have been identified. The development of infrastructure for those plots is complete and the process of security status to operate is near completion. These lots are slated to be in operation by September 2009. Invitations for proposals to invest in the remaining seven lots, occupying a total of 1,425 acres are currently active and slated to be closed in June 2009. Investors of the mega farms are allowed a significant degree of flexibility in the choices of agricultural enterprises they would like to establish on those sites.

3.2.2 Residential Development Plans

The second alternative that the GoRTT has developed for the lands that were formerly under sugar cultivation or other property of Caroni (1975) Ltd. is to address national housing scarcity. The Estate Management and Business Development Company Limited (EMBD), the parastatal organization under the Ministry of Finance oversees the development of the properties and distribution of these residential lots is part of the Voluntary Separation Package (VSEP) and other tenants. The intention is to improve the living conditions of displaced workers and to provide much needed housing for the central areas of Trinidad around Chiguanas and Couva.

The EMBD is charged with the management of state lands and development including the housing for the former Caroni workers who have accepted a lot for residential housing as part of the terms of the VSEP. Approximately 7000 former Caroni (1975) Ltd. workers have accepted these residential lots, and will receive an assigned lot in a newly developed subdivision/estate that has water, electricity, roads and other infrastructure. These estates will offer housing to other non-Caroni (1975) Ltd. workers as well, in mixed-use communities. The properties are not constructed beyond basic infrastructure, and the new owners who were Caroni (1975) Ltd. workers must fund the building of the homes themselves, though they are eligible for mortgage rates at favorable terms as part of the VSEP.

To date there are plans for 30 residential estates on 4,053 acres of former Caroni (1975) Ltd. lands, which are undergoing a technical audit. The Phase 1 audit 3,693 residential service lots are to be available by September 30 2009 and of that amount, 880 would be made available to the former employees of Caroni; 374 offers had already been made; 3,033 residential service lots would be made available by December 31 2009 and of that amount, 889 would be made available to the former employees of Caroni; and171 residential service lots had been made available by Sugar Industry Labor Welfare

Committee (SILWC) of which 76 offers had been made to former employees of Caroni. The Phase II audit of residual estates is under review and EMBD, which is part of the new Chairman's decision to determine the status of all of the residential properties, in preparation for certificates and clearances required for building and to assess the condition of the existing properties.

The population in central Trinidad is expanding, and as additional industrial and economic opportunities emerge in this region, the population of the area is expected to increase. The severance package offered to former Caroni (1975) Ltd. workers, combined with the favourable lending terms provides an opportunity for these displaced workers to build homes near industrial centres where they may find replacement employment opportunities. Earlier phase housing was planned to more standard single house lots, but more recent estate plans include mixed-use plans, such as apartments, single house lots, social infrastructure including parks, day care centres, small shops, schools and green spaces.

3.2.3 Industrial Development Plans

The GoRTT seeks to diversify the economy as it grows towards obtaining developed nation status. Blessed with abundant natural resources, a high technical capacity, and geopolitically advantageous location, Trinidad and Tobago has strong industrial growth potential. It is already the most industrialized country in the Caribbean, with the hub of industrial activity centered in Point Lisas next to the former Caroni (1975) Ltd. properties, and operational headquarters. The industrial estates to be developed on former Caroni (1975) Ltd. properties are under the management of the Ministry of Trade and Industry (MOTI) for light industry and the Ministry of Energy for heavy industry. A total of 4178 acres is allotted for industrial development on former Caroni (1975) Ltd. lands.

The Ministry of Trade and Industry has been charged with the development of six light industrial estate properties at Endeavor, Factory Road, Reform, Debe, Presal and Dow Village. Evolving Tecknologies and Enterprise Development Company Limited (E-Teck), a parastatal organization functioning under MOTI, commiserate with EMBD, manages the development and operation of these light industrial parks.

The E-Teck estates are to cover approximately 578 acres of former Caroni (1975) Ltd. lands, with an estimated 500 single acre industrial lots per estate. These estates will be used for light industrial purposes, such as welding, manufacture of parts for auto bodies, food processing, product assembly, and even small-scale recycling. All activities are to take place under coverage, and all lots are leased for 30 years. The tenants will be responsible for obtaining all permits for building from the relevant authorities. E-Teck will maintain responsibility for commonly used infrastructure, water and drainage, with twenty percent of the acreage of the total estate reserved for natural state and watercourse buffering.

These estates are being constructed in order to move light industry away from residential lands, and to provide central hubs for light industrial development which is expected to grow in Trinidad in the next five to ten years with increasing economic diversification.

The Ministry of Energy has been charged with development of heavy industry utilizing the abundant natural energy resources of Trinidad. They have been allotted 3500 acres in Couva on the former Caroni (1975) Ltd. property adjoining the existing Point Lisas industrial complex for construction of heavy industry. Incoming industries include a planned steel mill, a sodium chloride plant, a polyethelyne manufacturing facility, an additional desalinization plant, and construction of a finger port into Claxton Bay on the property next to the former Caroni (1975) Ltd. lands. The management of these properties is under the authority of the National Energy Corporation of Trinidad and Tobago Limited (NEC), a subsidiary of the National Gas Company of Trinidad and Tobago Ltd., a wholly owned subsidiary of the Ministry of Energy.

The current plans for the NEC properties will be to construct the heavy industry near the port and close to the existing industrial facilities. Other property under the management of NEC will be used for complementary light industry, mixed commercial use and some residential use. Additionally, historic properties on the former Caroni (1975) Ltd. estate such as the Estate House are planned for developing a museum under the auspices of University of Trinidad and Tobago (UTT), which currently has a campus on the NEC properties.

The expansion of the Point Lisas industrial complex under the authority of NEC is planned in order to increase the use of the natural gas and oil resources of Trinidad, to further diversify the economy and to create additional employment opportunities for the country.

3.3 Environmental and sectoral policy, legislative and planning framework

Vision 2020 Development Strategy

The National Adaptation Strategy, as outlined above, sets the objectives of divesting from all sugar land holdings and properties of the Caroni (1975) Ltd. Within the NAS, guidance for the SEA is couched firmly within the defined parameters. There are also other policies, both institutional and legislative, which will provide support for the development of the SEA, and which are expected to be largely complementary to the objectives of the SEA in improving social, environmental and economic benefits to the country resulting from the NAS.

The main driver of the GORTT development policy is Vision 2020, a set of goals and objectives intended to bring Trinidad and Tobago to “developed nation” status by the year 2020. With a focus on agricultural development, diversification of the economy, social infrastructure improvements, education, sound environmental management and sustainable development, Vision 2020 has a wide range of direct applications to the SEA,

especially as it pertains to the shift away from the sugar sector to other uses of the natural resources of Trinidad and Tobago.

The Vision 2020 Development Pillar for "Investing in Sound Infrastructure and Environment" has a goal that the "environment will be valued as a national asset and conserved for the benefit of future generations and the wider international community". This goal is complemented by objectives for 2010 to:

- Prevent, reduce or where possible recycle all forms of waste
- Treat wastewater in accordance with world standards
- Conserve and enrich the vitality and diversity of our natural environment
- Create environmental infrastructure that enhances the quality of life of all citizens
- Promote judicious national physical development and the sustainable use and management of environmental resources
- Instill an attitude of care and respect for environment among all citizens
- Empower stakeholders, including communities, to care for their own environments
- Integrate the principles of sustainable development into national policies and programs

In Vision 2020 there is also a Development Pillar for Enabling Competitive Business that includes the objective of reversing the decline in agriculture through increasing the profitability of the agricultural sector and improving food security. This is to be done through increasing production of food crops, increasing commodification marketing and agricultural extension efforts, create linkages with other sectors including manufacturing and government for agro-processing and marketing, revitalize the cocoa sub-sector, and increase cultivation of root crops, small ruminants, aquaculture, and dairy.

These goals and objectives set a fairly high standard to be realized, however the attention to these issues suggests a robust appreciation for the role, both socially and economically, of healthy ecosystems as an integral part of development planning. Within this context the SEA is well situated to move forward and should find support within the government planning processes.

Environmental Policies and Institutional Framework

The institutional support that is specific to environmental protection and sustainable development stems from a wide range of advanced measures pertaining to policy, institutional and legislative frameworks. Within the Ministry of Planning, Housing, and Environment there is also an Environmental Policy and Planning Division responsible for making directives on policy implementation from the Minister to the EMA, and bringing recommendations from the EMA on needed legislation to the Minister. This body provides support to the EMA, as well as the full Ministry, by overseeing compliance with regional and international environmental agreements, environmental policy development, and liaising with other government bodies.

The National Environmental Policy (NEP), developed and updated under the National Environmental Management Act of 2000 provides a rational, practical and

comprehensive framework for environmental management in Trinidad and Tobago. The policy ensures that the natural resources of the country are used for social and economic development, while protecting human health and supporting sustainable development.

The Environmental Act of 2000 empowers the Environmental Management Authority (EMA) within the Ministry of Planning, Housing and Environment. The EMA has authority to conduct SEAs and is required to provide Certification of Environmental Clearance (CECs) for agricultural activities on areas above 2 hectares, housing, building, infrastructure, industry and development efforts in the country. They also require regular follow up and monitoring on compliance with the CECs. These provide basic Environmental Impact Assessment (EIA) characteristics at the project level and must be obtained prior to all works undertaken. Additionally, the CEC is required for decommissioning of sites, including the Brechin Mill Castle Sugar Refinery. The specific activities covered by this are outlined in The Certificate of Environmental Clearance Order 2001- Legal Notice No.103, and the procedures are outlined in The Certificate of Environmental Clearance Rules 2001 - Legal Notice No. 104. All developments, including those by EMBD, MALMR, Caroni (1975) Ltd., E-Teck, and NEC are held to these standards and require EIAs in the event that it is determined by the EMA that such is needed for the issuance of a CEC.

In addition to the CEC and SEA functions supported by the GoRTT, there are significant environmental laws in place pertaining to aspects of environmental damages, use of natural resources, and development measures, these include a series of acts specific to issues of water, forestry, and agricultural products, as well as use of pesticides and toxic chemicals. A unique and very advanced component of the GoRTT Environmental Protection Measures is the formation of the Environmental Commission. The Environmental Commission is the court of record, established to resolve issues of environmental justice. The Court is an impartial body, separate from the EMA and Ministry of Planning Housing and Environment and the bench includes experts in environmental law, environmental and public health, and environmental engineering. The presence of such a court reflects the GoRTT advanced dedication to environmental management issues, as most developed countries have yet to establish such bodies.

The environmental legislation of Trinidad and Tobago is based on a set of national laws, which applies to the NAS and SEA in a wide range of areas and sectors being addressed. These laws are:

- The Water Pollution (Fees) (Amendment) Regulations, 2007
- The Water Pollution (Fees) Regulations, 2001
- The Water Pollution (Amendment) Rules, 2006
- The Water Pollution Rules, 2001
- Environmental Management Act 2000
- Environmentally Sensitive Areas Rules 2001 - Legal Notice No. 37
- Environmentally Sensitive Species Rules 2001 - Legal Notice No. 6 The Certificate of Environmental Clearance Fees Charges Regulations 2001 - Legal Notice No. 91
- The Certificate of Environmental Clearance Order 2001- Legal Notice No.103

- The Certificate of Environmental Clearance Rules 2001 - Legal Notice No. 104
- Noise Pollution Control Rules 2001- Legal Notice No. 60
- The Noise Pollution Control (Fees) Regulations 2001- Legal Notice No. 51
- The Environmental Commission Rules of Practice and Procedure 2001

The Environmental Commission is also reviewing all laws of Trinidad and Tobago to determine where codes are to be updated and it is possible that drafts of these updated codes will be available during the timeframe of the SEA.

Recently there has been a restructuring of the government that (since 2007) has segmented some aspects of environmental management. For example, water quality and water quantity are now handled as water resources within the Water and Sewage Authority (WASA) under Ministry of Public Utilities. The Forestry Division was formerly under the purview of the Ministry of Public Utilities and Environment, and is now under Ministry of Agriculture, Lands, and Marine Resources. Additionally, Town and Country Planning within the Ministry of Local Government works in tandem with EMA, for granting permits for any land use changes, and also provides authorization for any development.

There is also a Town and Country Planning Act from 1969 which is intended "to make provision for the orderly and progressive development of land in both urban and rural areas and to preserve and improve the amenities thereof . . ." (35:01). This gives authority to the Government to provide oversight for all planning, control of development of land, and acquisition and disposal of land for planning purposes. This authority provides the Government with rights to develop the Caroni (1975) Ltd. lands as officials see fit.

3.3.1 Agricultural Policy and Institutional Framework

Based on the Vision 2020 report (2005) agriculture in Trinidad and Tobago is essentially a rural-based activity, which provides a livelihood for a large percentage of rural households, particularly farmers and agricultural labourers. The agricultural sector is segmented into the domestic and export-oriented sectors, with the domestic sector primarily involved in the production of root crops, fruits, vegetables, condiments, rice, pulses, poultry and livestock products. The export sector is involved with cocoa, coffee, sugar, fruits, vegetables, agro-processed products and fish.

During that period of 1996 to 2002 agriculture's contribution to GDP averaged 3.3% per annum, with domestic agriculture contribution averaging 50% per annum and sugar and other export agriculture accounting for 47% and 3% respectively. In 2001 agricultural employment accounted for 7.3% of total national employment. Data shows that the sector has been in an almost perpetual state of stagnation or in some cases absolute decline during the 1980s and 1990s. The food import bill stood at $1.7 billion in 2003, increasing from $1.0 billion in 1994, an overall increase of 70%, with fish and fish products (64%), vegetables and fruits (11%) and coffee, cocoa and spices (84%) showing the largest

overall increase. The share of the food import bill as a percentage of the country's total imports averaged 8.5% per annum over the period 1998-2002.

Some reasons cited for the unimpressive performance of the agricultural sector and the escalating food import bill include inadequate marketing facilities and marketing opportunities for the production of commodities; inadequate mechanisms for providing farmers and other stakeholders with the necessary market intelligence to make informed decisions on productions, grades, standards, food safety and health; the tendency for research to be production-driven rather than market-driven; inability of the sector to compete with other booming sectors of the economy in terms of ability to pay higher wages for labour and for acquiring land, and stagnated local prices of agricultural commodities when compared with other consumer goods and services.

Statistics show that in Trinidad and Tobago approximately 30% of the arable and most productive lands (Classes I, II and most of III) best suited to intensive cropping have been converted irreversibly for non-agricultural uses. Trinidad and Tobago therefore have limited remaining productive land – predominantly capability Classes IV and V – for productive agriculture (mainly tree and food crops). Intensive cultivation may be possible only under special management practices and with proper irrigation infrastructure. As a consequence, the food security situation can be compromised by any further alienation of arable lands.

The potential for agriculturae in Trinidad and Tobago appears largely untapped when compared with its' Caribbean counterparts. There is an abundance of agricultural land located on vast expanses of flat and gently sloped terrain, offering the advantage of size economies of scale for cultivation. Such a layout of land is ideal for extensive mechanization, efficient development of farm roads and water infrastructures, appropriate farm buildings and the productive use of other essential farm resources. To date, there remains room for improvement in the current social attitude and approach towards the agriculture sector in Trinidad and Tobago. Amongst its Caribbean counterparts agricultural activities are carried out predominantly on very steep and rugged terrains. Such a situation militates against efficiency in the use of farm resources. Yet, many of these Islands are close to being self-sufficient in a wide range of their domestic agricultural requirements and are able to export to Trinidad and Tobago, which are currently importing most food resources for domestic food consumption.

Thus, Trinidad and Tobago currently has an opportunity to exploit its' agricultural resources more efficiently. Any design and implementation of agricultural activities should adapt a conscientious approach towards maintaining the integrity of the environment. Agriculture is capable of contributing to the enhancement of the livelihood of the participants and to the country as a whole, by providing gainful, permanent and sufficiently rewarding opportunities for employment and entrepreneurial activities. It also encompasses activities in the rural sector associated with sustainable environmental use of renewable natural resources such as agro and eco-tourism, wildlife farming, and preservation of bio-diversity.

In light of the perceived potential for agricultural development in Trinidad and Tobago the SEA has considered some important parameters, including soil quality and conditioning, water availability and use, erosion, alternative land use, good agricultural practices, entrepreneurship, climate change, organic farming and integrated pest management. These were chosen on the basis of the importance of agriculture to sustainable development and addressing important food security issues. There are concerns about the readiness of the over 50,000 acres of land that recently became available for non-sugarcane agriculture under the Caroni (1975) Limited land distribution program, to achieve a level of balance between good agricultural practices and the social and physical environment.

The natural resource base for capacity building is critical for agricultural development, and in many cases is threatened by urban sprawl and squatting, water pollution, lack of access to water and 'slash and burn' practices. Effective policy interventions with enforcement are required to influence environmentally related behaviour of all types of farming across the national economic landscape.

Historically, the policy formulation process for agriculture in Trinidad and Tobago has been adapting more narrowly focused approaches, which have rendered it vulnerable to increased pressure from various interest groups. Such approaches triggered responses that resulted in an unsystematic assortment of ad hoc policies, failing to optimise the potential of the sector in the long run. An appropriate support for an agricultural policy direction is the Vision 2020 report. The report has highlighted sector performance analysis supports in the conclusion that policy and institutional reforms need to be revisited and be strengthened in the context of the emerging challenges for agriculture.

The broad agricultural policy agenda and objectives proposed by Vision 2020 include the improvement of efficiency and competitiveness of the agricultural sector in Trinidad and Tobago on a sustained basis through strategic interventions on policy framework, physical and institutional infrastructure and support services; to achieve an acceptable level of food and nutritional security through the production, processing and distribution of strategic commodities and to reduce the country's dependence on external sources of supplies; to achieve and sustain the quality of life for rural communities in Trinidad and Tobago envisioned in Vision 2020 and commensurate with their social, cultural, and political aspirations.

According to Vision 2020 Agricultural Sector Objectives, the sector should adapt: the ability to contribute to the conservation and enhancement of the natural environment and rural landscape and to promote and maintain their integrity, to enhance the multifunctional contribution of agriculture to societal well-being; to attain balanced development between rural and urban communities throughout Trinidad and Tobago in terms of social and physical amenities; to contribute to the socioeconomic development of rural communities through training and skill development, harnessing of indigenous knowledge and establishment of a facilitative environment for nurturing investment and

entrepreneurship, and to facilitate growth and expansion of the sector to meet food and income opportunities for a growing population.

Regarding a framework for action in the agricultural sector, the Ministry of Agriculture Land and Marine Resources (MALMR) was cited as the principal stakeholder that should be given the responsibility to enforce laws against slash and burn, logging and to streamline associated approval requirements; re-focus and strengthen the forestry department; and to formulate policy for hillside development that would limit the disturbance to the land.

Other organizations that form the current network that is actively engaged in the restructuring of the sugar industry and are pertinent to the development of an agricultural component include Water and Sewage Authority, National Agricultural Marketing Development Company (NAMDEVCO0), Agricultural Development Bank (ADB), EMBD, Rural Development Company Limited (RDC), Trinidad and Tobago Agribusiness Association (TTABA), the University of the West Indies (UWI) and the University of Trinidad and Tobago (UTT). Several other stakeholders bear heavily on the success of the sector, some of which are listed below, with their related responsibilities or possible contributions.

Water and Sewage Authority (WASA) The WASA manages all water resources of Trinidad and Tobago, including surface water and the aquifer. During consultations with the organization they reported that the water authority was not currently prepared to provide water for agricultural activities since it was not economical to treat water for such a purpose. While desalinization was claimed to be feasible for industrial purposes it was deemed uneconomical for agriculture. It is believed that consideration could be given to the use of waste water for agriculture. Mention was made of WASA's two waste water plants with a total capacity of six (6) million gallons per day, as possibilities for agriculture. The main challenge however would be to treat the water for such a purpose. Suggestion was also made to construct water collection sites to provide water for agricultural pursuits. This is a significant challenge that is addressed in section 8.4 of this report, and through the recommendations in section 7.

3.3.2 Residential Policy and Institutional Frameworks

The GoRTT National Housing Plans, Policy and Institutions will have significant impacts on the use of the former Caroni (1975) Ltd. properties as noted in section 3.2 with five percent of the lands being dedicated to residential estate development under the authority of EMBD. This is largely directed by the Vision 2020 focus on increasing housing for all citizens and expanding the current home ownership rates nationwide. As this development directly involves former Caroni (1975) Ltd. workers, the properties and the overall environment, including social and economic development plans, it must be included into the SEA. The Vision 2020 strategies, combined with the National Housing Policy of 2008, and the National Environmental Policy, set the institutional framework pertaining to the rise in housing on former sugar properties.

Throughout Trinidad there is an increasing demand for housing and as part of Vision 2020 the Government seeks that by the year 2020 every citizen in Trinidad and Tobago will have access to adequate quality housing. The goals for this include: supporting housing development in the country through an effective legal, regulatory, and financial framework; ensuring the availability of all required resources for housing design and construction; fulfilling the country's housing needs through adequate land management; and ensuring active participation of all stakeholders in the housing development process.

It is estimated that in order to achieve the Housing Vision, the country must build ninety thousand (90,000) housing units with related facilities and utilities within the said community structure by 2020. Additionally, 100% of houses should be supplied with basic utilities and amenities. It is anticipated that these new communities will feature strong social bonds as a measure of success will be stakeholder participation that can be accomplished determined by the percentage of new communities that embrace the community management concept.

While a significant portion of the housing will be in urban and semi-urban areas, some of the Caroni (1975) Ltd. properties will be part of the national rural improvement strategy that utilizes existing agencies, such as the Sugar Industry Labour Welfare Committee along with strengthened local government to drive the rural improvement strategy, and will be home to some of the former Caroni (1975) Ltd. workers.

The National Housing Policy defined how properties are to be distributed with larger households who are first time buyers being given precedence in the assignment of homes. Additionally, favorable lending terms are being developed which will enable citizens to take out mortgages for properties with minimal down payments. The properties on the 30 estates under development by EMBD will serve as a significant source of these residences.

Within the National Housing Policy and Vision 2020, there is a drive toward improved community development to provide increased capacity for planners, architects and social infrastructure development. This includes dedication of scholarships for these fields and an increased use alternative planning methods that encourage community cohesion. Strategies such as high density housing surrounded by natural areas are under formal consideration in order to minimize the infrastructure span while reducing impacts on the natural environment. The emphasis on community involvement and self-governance is also high, with a focus on community stakeholder involvement in the planning and management process.

In recognition of the rapid industrialization of Trinidad and Tobago, including major development in the housing sector and significant expansion and upgrading of the infrastructure, the Government updated the National Environmental Policy to reflect the demands that these developments will place on the health of the environment.

3.3.3 Industrial Policies and Institutional Frameworks

The Industrial Development Policies pertaining to the Caroni (1975) Ltd. properties, includes the mandates for E-Teck to manage the light industrial estates and NEC to oversee the development of heavy industry near Point Lisas on former Caroni (1975) Ltd. properties. The guiding principles of the Vision 2020 Policy emphasize increased global competitiveness and increased economic development, as well as the use of the energy sector and abundant energy resources to broaden the scope of value added products, diversify economic development and spur growth into the 21st Century. There is a specific vision for industry and entrepreneurship focusing on technology and diversification of the products from the country, and a vision specific to energy which plans for sustainable use of resources and in part, protection of natural resources and the environment.

The vision for industry and entrepreneurship projects a dynamic and globally competitive sector contributing significantly to GNP, providing sustainable employment, and driven by a culture of innovation and entrepreneurship in a free market global economy. The established goals to accomplish this include: having a stable, facilitative and efficient business environment; strengthening the institutional and regulatory functions of state and quasi-state agencies; encouraging and developing a vibrant MSE sector; attracting and facilitating increased levels of Foreign and Domestic Investment; developing human resources; promoting a country culture that values and rewards innovation, creativity, entrepreneurship and productivity; improving access to financial resources and facilitating investment; enhancing access to and promoting the efficient and appropriate use of technology.

These goals emphasize the need to move away from dependence on their status as an extractive economy and increase the productive capacity based on value added development. There is already a strong tradition of industrial manufacturing, and Trinidad is the most developed of all of the Caribbean islands in this respect. The economic development rates, high level of technical capacity among the population and abundant resources favour a continuation of this through government support for entrepreneurial activities. A concerted effort is being made to divert revenues from the petroleum sector into diversification including light industrial manufacturing, development of food processing facilities and transportation infrastructure. The government is sensitive to the need to foster this growth. They feel that there is tremendous growth potential in this sub-sector and as such are devoting resources, including lands such as the E-Teck industrial sites, training, and investment incentives, for domestic and international entities. Additionally, they are actively planning to expand the port infrastructure to facilitate export of manufactured goods and processed foods.

The basis for government planning to accomplish this focuses on creating conditions for profitable investments. They plan to: create an enabling environment that encourages and increases levels of business investment; to actively promote investment opportunities; review and strengthen the institutional and governance frameworks; provide widespread training to develop the country's human resources; improve access to finance; develop a

strong technological base aligned to an infrastructure that facilitates timely and efficient movement of goods and services; and to create a culture of innovation.

As it pertains to the environment, the government has set the objective within the development of conditions favorable for enterprise development to ensure that the environment is safe and that projects do not negatively impact the overall quality of life and freedom of individuals, based on training, law enforcement and prevention of accidents. Within the E-Teck mandate, twenty percent of lands must be left undeveloped in order to allow for run-off, aquifer recharge, and buffering of the industrial areas from surrounding communities.

The vision for the use of energy resources is the emergence of an integrated and fully developed energy sector that is a key driver of a sustainable and flourishing local and regional economy while attaining global competitiveness in all of its sub-sectors by 2020. The intention is to: encourage local players within the energy sector; ensure the transparent governance of energy-related Private and Public Sector institutions; contribute to the enhanced development of human capital; support the development of the energy sector through physical and systemic structures; and, contribute to the protection and enhancement of the natural environment.

This is based on the anticipated continued demand for oil and gas. Natural gas consumption remains high despite overall downturns in the oil markets, and as the US increases consumption of natural gas in response to driving down carbon emissions, this will remain a strong economic source for government revenues. The plan is to use this income to increase economic diversification, while also building a strong heavy industrial sector into the economy through use of energy resources to fuel manufacturing within Trinidad for export to global markets, with the intention of supporting sustainable economic development.

Within the energy sector development and diversification, Vision 2020 has established the goal to contribute to the protection and enhancement of the natural environment. This is to be accomplished through: the development of an effective management and regulatory framework that will inform local health, safety and environmental practices; review and definition of the role and responsibility of the EMA as it pertains to the special needs of the energy industry; the establish a comprehensive environmental management system; ensuring that all operators comply with and exceed local and international standards; establishing a zero tolerance policy on all accidents/injuries to personnel and a zero tolerance policy on all spills, discharges and net emissions to the natural environment.; development of monitoring programmes to enable regular environmental monitoring and research; creating a mechanism to assess the use of new technologies for pollution potential and social risks. Within the monitoring for environmental issues the official intention is to develop a holistic monitoring programme which will: track and model cumulative environmental impacts; and to determine environmental carrying capacities, by undertaking a baseline assessment of the west coast and the Gulf of Paria as well as a detailed vulnerability assessment of the entire coastal area.

4 Approach and methodology

4.1 General approach

The methodological approach employed in the collection of information of this SEA was based on numerous individual interviews with a wide array of stakeholders, review of policy and project documents, four multi-stakeholder group workshops, many extensive meetings with the staff of Caroni (1975) Ltd., presentation of all project materials, documents and presentations on the web via an internet web log (blog), and attendance and participation in meetings on agricultural development alternatives.

The Stakeholder Engagement Plan was based on a desk study of existing documents pertaining to the NAS, review of comparable Stakeholder Engagement Plans and Strategies and internet information gathering pertaining to the structure of the government organizations in Trinidad and Tobago.

The Scoping Study was conducted through close review of all press information about the NAS, and pertaining to the Caroni (1975) Ltd. closings, followed by interviews with primary stakeholders, scheduled with the assistance of the National Authorizing Office, and through Delegation contacts. These meetings involved an initial briefing about the project, including the reason for the EC Sectoral Support Programme, and the disbursement mechanism for the funds. This was followed by informational interviews that involved asking the views and concerns of the various stakeholders regarding the ecological, social, and economic conditions pertaining to the closing of Caroni (1975) Ltd. The various interviews also included a discussion of how the various institutions were involved in or impacted by the Caroni (1975) Ltd. closing. These opinions and concerns were assembled into the initial Scoping Study with the initial legislative and institutional overview, description of the key environmental, social and economic issues to be addressed in the SEA, with an outline of the anticipated methodology to be employed for the full SEA.

The SEA followed a similar interview pattern. An Agricultural Economist with experience in a wider array of tropical agricultural development strategies replaced the Sugar Sector Expert from the Scoping Study. His experience in the country and familiarity with the agricultural sector in Trinidad enabled him to very quickly adapt to the project. A workshop was held in the first days of the SEA phase of the project to present the Scoping Study findings and to present the methodology for the SEA. Participants in the workshop were drawn from those with whom initial interviews had been conducted, and others who had not been available previously. The presentation from the meeting is Appendix 11.

Following the Scoping Study workshop another round of interviews began to obtain available baseline data and sectoral planning reports. Due to institutional restrictions it was not always possible to obtain the actual copies of the reports, though many interview participants were quite forthcoming with information. This trend continued and as a

result the SEA team prepared specific questions based on information required for the SEA, and made a point of discussing these with stakeholders. The SEA Team met with the key stakeholders for the agricultural, residential and industrial sectors. The full listing of interview subjects is in Appendix 11.

As a rule many of the interview participants were quite open about the challenges and opportunities that needed to be addressed in the SEA, and were quite willing to share their perspectives. As a result a great deal of the information that is in this report is drawn from these interviews, rather than specific published sources. We gratefully acknowledge the support of those who contributed to this report.

For collection of baseline data, the SEA team shared 38 questions with the administrative staff of Caroni (1975) Ltd., who very generously provided a significant amount of time collecting data and meeting with the SEA team to answer all of the questions about the environmental, social and economic conditions prior to the 2003 closing of Caroni (1975) Ltd. Concurrently, the staff of Caroni (1975) Ltd. were charged with developing the strategy for implementing cooperatives for the 2 Acre Plots, and the SEA Team provided some support and possible guidance to assist in the conceptualization of this undertaking.

A large meeting/workshop was held with private cane farmers who have been concerned about the social and economic impacts of the closing of Caroni (1975) Ltd. and who are eager to participate in the decision making process regarding the distribution of the EC Sectoral Support funding. During the meeting they were briefed on the status of the NAS and asked to develop proposals for consideration by the delegation. They have agreed to do this, and the Delegation is currently awaiting these proposals.

The final SEA Workshop was held at the end of the mission to present the initial findings of the SEA to stakeholders. The attendees were drawn from the organizations that had played a key role in the SEA process. The workshop enabled the attendees to see the full picture that the SEA attempts to represent, and to hear about what the potential recommendations stemming from the SEA, and to provide initial input into the SEA.

All project documents and presentations are located at the SEA Blog at
http://seaforttnas.blogspot.com/ and linked to
http://www.ecosocialsolutions.com/MTI_Web_page/Project_Documents.html

These web pages with all documents will remain active until at least June 2010.

4.2 Geographical or environmental mapping units

The Caroni (1975) Ltd. properties covered almost 77,000 acres of the island of Trinidad. This property was highly segmented and a digital single map of the territories is not yet available.

The areas under the attention of the SEA are in the range from Chagaramas in the extreme north west to Arima in the north, south to Navat Dam and Poole and West to Debe and St. Mary's. This includes the entire area between these points and along the western coast of Trinidad The cane processing centers were at St. Madelines in San Fernando, and the Brechin Castle in Couva due east of Point Lisas. The area within this block of territory constitutes the main holdings of Caroni (1975) Ltd.

source: National Energy Corporation of Trinidad and Tobago Ltd.

The areas west along the coast, including the Caroni Swamp, which is a Ramsar Convention International Protected Wetland, and within all the river basins flowing into the Gulf of Paria is included in this assessment.

4.3 Assumptions, uncertainties and constraints

This SEA is based on a number of assumptions, uncertainties and constraints.

The assumptions include that the information gathered is correct, factually and theoretically and that the project plans and strategies will come to be realized in the near future. Plans and strategies are subject to change, and therefore this assessment is based on the best available information as of May 2009. There are a number of shifting

strategies and competing demands within the various government structures of Trinidad and Tobago, and this SEA has attempted to capture those as they are relevant to the NAS. The complete information is imperfect at best, and as a result, it is only appropriate to assume that efforts will continue to move along the current trajectory.

The uncertainties faced in this assessment include a lack of comprehensive historical environmental information to inform the full baseline study. The information gathered represents a valiant effort on behalf of the Caroni (1975) Ltd. staff to accommodate questions and to piece together a comprehensive picture of conditions prior to the decision to close the sugar industry in Trinidad. It is also impossible within any research effort to be completely certain that every source was found. It has been a task to conduct an SEA on three different sectors, and as such, there may be information sources untapped. The team had sought to make the best of available information and takes full responsibility for any gaps in information.

Other uncertainties are a product of institutional constraints that prohibited access to some strategy and development documents. Within these constraints, many stakeholders have been very gracious with the information they have confided in us and we have done our best to represent this information in a useful and impartial manner. The SEA Team takes full responsibility for any misrepresentation that may have inadvertently occurred. The SEA Team welcomes any differing and supplemental views, for inclusion in any subsequent drafts of this assessment in order to make this a more useful and meaningful document for the implementation of the NAS.

5 Environmental baseline study prior to closure of Caroni (1975) Ltd.

The baseline information outlines the condition of the environment, as well as social and economic areas of concern prior to the intervention. This information features conditions prior to the closing of the Caroni (1975) Limited and divestment from the sugar sector. The baseline information is categorized in accordance with the EC SEA Directive and addresses: water, soil, biodiversity, air, climate change, public health, social inclusiveness, cultural heritage and landscape, economics, material assets and infrastructure.

The study adapted an approach that includes the use of structured questionnaires as an instrument in the conduct of a series of consultation exercises that included major stakeholders. This was supported by information from the scoping study, the use of key sectoral reports such as the vision 2020 report, annual reports from the Caroni (1975) research station and other pertinent documents.

WATER RESOURCES

Water Experience at Caroni (1975) Limited

From consultations with current members of Staff at Caroni (1975) Ltd., it was found that major water testing exercises were conducted at several water ports. The type of testing done conformed to the WHO standards and was used to test for chemical contamination and E-coli bacteria. No testing is done for any downstream impacts. Testing was also done on volume of water and trend of availability since these were major concern. There were no formal data sources in-house, but based on the discussions the technicians were able to generate some detail regarding water availability and use, both before and after the closure of Caroni (1975) Ltd.

Water Availability and Use at the Sugar Estate

It was reported that the Caroni (1975) Ltd. used three types of water during it operations. These include (1) Water as steam used for power (2) water for cooling and (3) water for potable use.

Water for Power (Steam): – According the company, sugarcane contains 10-11 % sugar, 15-17% fibre and about 72-75% water. The water evaporated from sugar is produced through a four stage water cycle, with the quantity increasing progressively as it moves to stage four. A considerable amount of water is produced at this stage, and remained the primary source throughout the processing of sugar in the factory. For instance, during the period 1995-2003, it was reported that an annual average of 1.4 million tonnes of sugarcane was processed by the two factories of Caroni (1975) Limited. As such, this yielded an average of 1 million tonnes of water per year through the steaming process.

Water for Cooling – This involved the use of specially constructed ponds situated in close proximity to each factory to collect rain water. During the dry season these ponds were replenished by river water. Besides a percentage that was evaporated, these ponds collectively produced 300,000 tons of water per year in 1995-2003.

Water from WASA – The Company received two types of water from WASA. One type was raw water which had significant hardness, enhancing the potential to damage the processing system with oxidized minerals. As a result such water was used as a back-up source after treatment for the removal of temporary and permanent hardness and amounted to about 150,000 tonnes per year. The other type constituted 50,000 tonnes of potable water, which was used to serve an office complex and 334 houses on location at the properties. By means of all the ponds and rivers, the Company obtained a total of 350,000 tonnes of water per year to operate its distillery and 10,000 tonnes for drinking purposes. The above may be summarized to average 1,575,000 tonnes per year for the period 1995-2003.

Table 5.1.1 Average Annual Water Usage of Caroni (1975) Ltd. - Pre and Post Closure

Water Source	**Pre Closure (1995-2003)**	**Post Closure (2003-2005)**	**2005 – Current**
Refinery/Distillery	1,000,000 tonnes	395,000 tonnes	-
Rivers & Ponds	350,000 tonnes	150,000 tonnes	18,000 tonnes
WASA: Raw Potable	150,000 tonnes 60,000 tonnes	50,000 tonnes 20,000 tonnes	 20,000 tonnes
Other	15,000 tonnes	-	-
TOTAL	**1,575,000 tonnes**	**615,000 tonnes**	**38,000 tonnes**

Source: Caroni (1975) Ltd.

Using a conversion factor of 10 pounds per gallon and 2000 pounds to a tonne it follows that Caroni (1975) Limited average annual usage of water was 315,000,000 gallons before the closure of the factory, 123,000,000 gallons after closure but with minimum operations and 7,600,000 gallons after all processing of sugarcane stops.

Water Quality Assessment at Caroni (1975) Ltd.
With respect to water quality, Caroni (1975) Limited conducted routine tests of water for sweetness since any escape of sugar in the water could cause corrosion and damage to the system. Tests were also done to ensure that tolerable levels of pH and sediments were maintained in all water sources. Water would also be treated for the removal of hardness. The testing of the water for cooling involved the use of a series of ponds, wet scrubs and a boiler trap system. The water passed progressively through a six-pond filtering return system, where water is retained for six days in the ponds before being reintroduced to the system. Here, testing was done on Bio-Oxygen and Carbon-Oxygen levels to control odour before excess water was allowed to flow back into the river.

Drainage and Flooding

Flooding was kept at a minimum at Caroni (1975) Limited since there was a permanent crew of workers, actively engaged with the cleaning drains, especially after harvesting of the sugarcane. Each worker had to patrol sugarcane fields looking for pollutants. With the closure of the sugar industry the routine patrols have stopped and some areas have become a dumping ground, which has contributed to an increase in the incidence of flooding as drainage channels are blocked.

Effluents and Sewage Management

Caroni (1975) Limited had properly maintained septic tanks to deal with all sewages. Effluent discharge was collected by established plants and wet scrubbers used overflow ponds which captured ash and mud. Such sediments were use as fertilizer.

SOIL QUALITY

The soil of the Caroni (1975) Limited holdings was reported to have been contaminated for 30 – 50 years. This resulted from the high use of chemicals and urea based fertilizers, which contributed to increase soil acidity. Yet, there is evidence that structured soil testing was maintained prior to the management of Caroni (1975) Limited. It was reported that since Company took over in 1975, no structured and periodic soil testing was done to investigate the status of the soil. A single broad based fertilizer regime was adopted every year for the entire crop.

However, various annual reports showed that some amount of soil testing was done in an ad hoc manner. This activity was completed mostly for pedagogical purposes and not to establish any particular pattern regarding changes in soil fertility and acidity with operations over time. Such a situation has constrained the effectiveness of a baseline study on soil conditioning. Attempts were made to utilize the available data from those reports to generate a pattern that may show some progress on the situation of the soil in some sugarcane growing areas before and after the closure of Caroni (1975) Limited. The soil series or sections presented in Table 5.1.2 were chosen based on availability of information and the fact that a semblance of trend may have appeared.

Table 5.1.2: Average Acidity Levels of Selected Soils in Caroni 1975 Limited

Soil Series/Section	1995 -2002 (Pre Closure)	2003 – 2006 (Post Closure)
Caroni	-	4.55
Jerningham	-	5.06
Edinburgh	5.35	4.70
Exchange	4.92	4.37
Felicity	5.75	5.36
Waterloo	5.19	4.73
Montserrat	5.27	4.62
La Fortune/Picton	-	4.63

Source: Caroni (1975) Ltd.

Air Quality
The air quality in and around the Caroni (1975) Ltd. was not regularly monitored. The aerial application of pesticides on a regular basis would have had a net negative, though short-term, impact. More pervasive was the burning of cane fields that contributed to ash, particulate matter and smoke in the air. Strong winds carried soot from the fields across significant distances and created a short-term public nuisance.

Prior to the introduction of scrubbers at the cane processing plants there were problems with fly ash being released and impacting local communities downwind from the stacks. However, scrubbers were introduced, and fly ash was captured and used as fertilizer for local gardens.

Biodiversity
During the operation of Caroni (1975) Ltd. there were no studies conducted of the biodiversity of the area. It is expected that as a result of heavy pesticide usage, and monoculture biodiversity would be relatively low. Caroni (1975) Ltd. employees have reported significant increases in biodiversity since the cessation of pesticide application in 2003.

Human Health
Caroni (1975) Limited maintained a health system which required all workers, especially those who were frequently exposed to chemicals, to visit the clinic at least once per year for blood tests.

Cultural Heritage Landscape
Some efforts are made to sustain some aspects of the cultural heritage landscape of the Caroni properties. The unused factories and distillery (?) and plans are in place for the one at St. Madelines to remain as a museum. A cemetery is being retained and will be a source of historical evidence. The University of Trinidad and Tobago has demonstrated interest in the Sevilla Sports Club and wishes to convert it into a museum as well. There are evidences of sporting and entertainment facilities which community members continue to enjoy.

Social Inclusiveness
The communities at or bordering the properties of Caroni (1975) Limited were built around the sugar plantation and were traditionally supported by the sugar industry. Many socio-economic activities such as direct and indirect employment, training, sports, entertainment and healthcare were supported by the Company. Many structural facilities such as housing, road and drain construction, maintenance of infrastructure, water, recreation ground, and electricity were also provided. There was a sugar welfare loan that was use as a measure to bind the workers to the estate, which discontinued when Caroni 1975 started.

Since the closure of Caroni (1975) Limited some aspects of social breakdown are evident. There has been a social and cultural shift, breakdown of community network, deterioration in neighbourly trust and degradation of community infrastructure due to

lack of maintenance and increased flooding. Many of the former sugar workers found alternative employment at the neighbouring Point Lisas Industrial Estate, a trend that continued for years.

Economic Access

In a Price Waterhouse report (1992) it was stated that the Caroni (1975) Limited Company was perceived by many to be a social responsibility of Government rather than an economic entity from which a profit was intended. It was reported that workers were aware that the industry has been subsidized by Government for years and many of them started making personal preparation for any closure, which they knew was imminent. The regular employment arrangement at the estate was always ideal for a worker to engage in employment elsewhere. Many of them set up their own businesses and some were able to do two to three other jobs. About 6-7% of the workers had major private farms. An opportunity came in 2002 when the Government announced the closure on the basis of low productivity. The company learned of about the closure in September 2002 and the first package was approved in January 2003.

Caroni (1975) Limited had about 40% female cane cutters and field workers, which kept declining through the years to about 15% during the 1990s. However, the population of female workers with office jobs or working in administration remains between 40% and 50%.

Caroni maintained a significant training program for years. The company ran a five year apprenticeship program for most of its entry level positions. This provided an opportunity for workers to advance up to management positions. Unfortunately, it could not retain its workers after training since they were getting very attractive offers at the Point Lisas' plant and the Caroni (1957) Limited could not compete with its pay structure.

Private Cane Farmers – There has always been a cadre of private sugarcane farmers that supply a significant amount of cane to the factories over the years. These farmers were averaging 15% returns to their investments. Prior to 2003 there were approximately 4,500 private farmers supplying 550,000 tonnes of sugarcane to the factories (average 15 t/farmer). The number of farmers dropped to 3,400 and produced 350,000 tonnes in 2008.

The private farmers collectively produced slightly more sugar than Caroni (55:45%). The production of Caroni began declining from the onset in 1975. From that time the private farmers started seeing themselves as the engine of Caroni. The private farmers received major subsidies from Caroni, primarily in the form of fertilizers and chemicals.

Material Assets and Infrastructure

Roads, residences and other infrastructure occupy less than 5% of the Caroni land to date. Bridges and gravel roads occupied about 1000 acres, ponds and water 566 acres, traces and derricks 3000 acres. There was always a well defined and maintained drain network throughout the property. With the closure of Caroni (1975) Limited, these facilities became the responsibilities of other Government agencies but there is no evidence of

their involvement since there are major overgrowths of flora and major problems with drainage and illicit dumping.

Caroni (1975) Limited used two sources of power throughout its operations. The major source of power was generated from the steam evaporated from the sugarcane and fuel bagasse. The steam is converted to mechanical energy via steam turbines. This energy was used to drive the mills and generate electrical power. The other source of power was commercial, provided by Trinidad and Tobago Electricity Commission (TTEC). This was used mainly for other commercial and residential purposes. Table 5.1.3 provides a comparison of power usage between the pre and post closure periods of Caroni (1975) Limited. It was discovered that with the closure of the organization, power consumption was reduced by 45%.

Table 5.1.3 Average Annual Consumption of Power by Caroni (1975) Limited

Source of Power	1995-2003	2003-2005
Factories and Refinery: -120,000 hp mechanical power converted to electricity -48,000 hp mechanical power converted to electricity	 89,500,000 kw -	 - 35,800,000 kw
-Electrical power generated	54,000,000 kw	34,600,000 kw
Commercial Consumption: -TTEC	 48,600,000 kw	 36,000,000 kw

Source: Caroni (1975) Ltd.

6 Impacts on Selected Environmental and Socio Economic Concerns

To date, approximately 70 percent of the total Caroni (1975) Limited land is slated for agricultural activities, rendering this sector the principal area for development. Consistent with the European Union SEA Directive water, soil, air quality, climate change and biodiversity are selected environmental concerns on which the agricultural impacts were considered for the demised lands of Caroni (1975) Limited. The selected socio-economic concerns include human health, social inclusiveness, cultural heritage landscape, economics and material assets. The development of the residential and industrial estates has not transitioned as quickly as anticipated and as a result most land is left fallow with some agricultural development. The conditions of these lands as they are now are discussed here as the current impacts, five years since the closing and prior to implementation of the alternatives for development currently being planned.

Environmental Concerns

Water

Water is a very important resource for agriculture, without which it is impossible to conduct any meaningful agricultural activity. Livestock operations usually require an abundance of potable water, whereas a combination of gray, untreated and potable water may be used for crop production, mainly for irrigation purposes.

With agriculture being the major activity proposed for the Caroni (1975) Limited lands there is a significant demand for efficient water resources. It is likely that such a demand will increase the pressure on the existing local water facilities such as the public potable water system, rivers, streams, aquifers and other sources. With the closure of Caroni (1975) Limited regular maintenance of drains and close monitoring of garbage disposal was discontinued. These factors, along with increase agricultural activities, result in increased flooding in low lying areas and siltation of water ways due to erosion. There is also the possibility of contaminating the water table due to seepage of harmful chemicals and effluents.

Soils

The soils reported for the lands of Caroni (1975) Limited are of low quality, with marginal suitability for agriculture. They are predominantly clay with low acidity. By discontinuing the production of sugarcane, a mono-crop that is adaptable to acidic conditions, an opportunity is created for multiple cropping and the growing of varieties that are less adaptable to those lands. The current development strategies afoot for those lands include the growing of short term crops on two-acre plots and flexible farming options for mega farms. However, most of the lands remain fallow as the planning process continues. In some areas, the existing natural vegetation provides good ground cover, thereby lowering the incidence of soil erosion. It also helps with the natural amelioration and restoration of soil fertility in those areas. In other areas lands are used to establish vegetables and other short term crops, subjecting the soil to frequent tillage operations. The implications of such practices include the loss of useful soil organisms, and an increase in wind and water erosion. There are also heavy usage chemicals and

fertilizers which may further lower the pH of the soil and contaminate the water table due to seepage and water runoffs.

Air Quality
The air quality within the area has improved due to the lack of sugarcane burning and the discontinuation of soot and emission of gases from the sugar factories and distillery. However, there are concerns about the potential for air pollution through the current usage of chemical sprays to control pest and diseases on crop production.

Climate Change
Based on the current status of Caroni (1975) Limited properties, the climate change implications include the loss of a carbon sink with no sugarcane production. However, the natural vegetation consists of many plant species from the grass family and other species which are good carbon sinks. Some of the crops currently grown also allow for carbon sequestration.

Bio Diversity
The bio diversity status of the Caroni (1975) Limited lands is rebounding with the closure of the sugar industry. There has been the re-emergence of beneficial insects and a wide variety of plant species due to the discontinuation of aerial spray and the low use of pesticides and herbicides most areas. There is a noticeable increase in the bee population, which is necessary for pollination and for the production of honey.

Socio Economic Concerns:

Human Health
Due to the current low level of agricultural activities on the Caroni (1975) Limited lands, the human health implication is at a lower level when compared to the period of growing sugarcane. Exposure to harmful chemicals is more directed toward those who are using chemicals to control pests and diseases on crops as against the wider community when aerial spray was used for sugarcane. There is somewhat improved access to affordable foods and ultimately nutrition has been enhanced within the described area due to increased production of a variety of ground provisions and vegetables.

Social Inclusiveness
The current engagement in agricultural activities on the Caroni (1975) Lands has the potential to improve cohesiveness within the community by including other segments of society such as schools and community groups, along with the establishment of farmers' cooperatives, among other fostered activities in the farming process. This should serve to establish strong linkages between the farmer and various market segments such as supermarkets, restaurants, hospitality industry, wholesalers and retailers. It has a positive impact on food security through import substitution.

There are instances where VSEP recipients invest portions of their money to develop existing privately owned agricultural operations, thereby strengthening family and community networks through the provision of labour and family support. There are

implications with the issue of praedial larceny, which stands to increase if adequate security measures are not implemented.

Cultural Heritage Landscape

The private engagement of individuals in agriculture offers an opportunity to showcase strong cultural heritage. Besides being driven by regular market demand, farmers tend to choose crops based on ethnicity and other perceived cultural biases. This is evidenced by the current choice of crops and the ethnic background of the farming communities. A strong cultural landscape is also demonstrated in the farming methods and approaches adapted by those currently involved in agricultural production.

Economics

The closure of Caroni (1975) Limited has realized mixed economic impacts on agriculture. There is currently no income from sugarcane and the oil boom that cushioned many displaced workers and private farmers has stopped. There is a decline in business opportunities and many of those who found alternative employments since the closure have lost their jobs. This has brought a renewed emphasis on food security and has diverted the interest of more individuals towards farming the lands. To date approximately 15 percent of the displaced workers who received two-acre plots are engaged in some level of farming on their plots. Many others do not farm their lands, mainly because they are not interested in agriculture, are having difficulties gaining access due to location or simply do not have the economic base to do so. Meanwhile, there is a sense of strong agricultural influences that are emerging within communities, evidenced by market support for farm produce and employment generation.

Material Assets

Many material assets remain intact since the closure of Caroni (1975) Limited. Those that may be of importance to agriculture include road networks, bridges, drains and ponds. These infrastructures are not being maintained and have far reaching implications on ensuing increased demand for water and other infrastructure for proposed agricultural activities. Illicit dumping and major overgrowth of weeds cause silting of ponds, blockage of drains, bridges and road ways.

7 Analysis of planned alternatives, impacts and micro level mitigation

The current alternatives for the use of the former Caroni (1975) Ltd. properties are divided into agricultural, residential and industrial sectors. Each of these alternatives are described in section 3.2 of this report and are based on plans put forward by the Inter-Ministerial Planning Committee.

This section will address the analysis of anticipated environmental and socio-economic impacts and effects to delineate where challenges may exist. Each section will address the context of the concerns specified in the EC SEA Directive and will provide a brief description of the impact including the severity of these anticipated impacts. Options for *mitigation* of negative impacts and *enhancement* of positive effects specific to each challenge are presented with every issue. *Responsible and involved parties* are recommended to facilitate addressing these impacts and effects. For each sub-section, summary tables are presented with color coded severity of impacts and positive effects. Details are in the following text. For the issues that will have high negative impacts mitigation efforts are more fully developed with regard to responsible parties and timing as appropriate. Meso – sectoral and macro level enhancement and mitigation recommendations are presented in Section 8 of this report.

7.1 Analysis of Agricultural Plans

The options of the agricultural alternatives include the mega farms and the two-acre farm lots. These are the broad areas under which the Government's major development strategies for agriculture are cited. Approximately 30 percent of the total Caroni (1975) Limited lands are allocated to these segments of agriculture. 20,319 acres of lands are assigned for two-acre lots and 2,263 acres for mega farms in lots ranging between 100 acres and 267 acres apiece. The major elements of environmental concern relating to agricultural development include water, soil, air quality, climate change and biodiversity. Those relating specifically to socio-economic concern are human health, social inclusiveness, cultural heritage landscape, economics and material assets. Several major environmental impact assessments relevant these concern are summarized in Table 7.1.1.

Table 7.1.1: Summary of Agricultural Development Environmental Impacts

CONCERNS	Impact Severity	ENVIRONMENTAL IMPACTS – Mega farm and 2-acre plots
Water		a. Significant increase in demand for water resources
		b. Pressure on aquifers and existing water resources
		c. Silting of water ways due to erosion
		d. Contamination from agrochemicals
Soil		e. Frequent tillage affect soil structure, texture and erosion
		f. Displacements of topsoil from clearing and construction
		g. Significant land clearing
		h. Compaction due to development of infrastructure
Air Quality		i. Pollution from agro chemical sprays
		j. Emission of fumes from livestock operations
		k. Soot and particulate from burning and tillage
Climate Change		l. Choice of farm enterprise and approach to development
		m. Increase energy consumption for livestock operations and other farming activities
		n. Carbon sink/sequestration implications
Bio Diversity		o. Increase some beneficial insect
		p. Loss of some plant and animal species
		q. Introduction of invasive species
		r. Segmentation of species and habitats

Impact Severity color key	Red = High	Orange = Moderate	Yellow = Low	Green = Positive

Elements of Environmental Concerns Relating to Agriculture

WATER

a. Significant increase in demand for water resources - Severity Extremely High

Most short crop agricultural activities require an abundance and a continuous supply of water in order to be viable. During the sugarcane operations, the cane crops were rain fed and did not rely on irrigation. Caroni (1975) Limited generated approximately 64% of its annual water requirement from pressed cane for its factory refinery and distillation processes, obtained 22% from rivers and ponds for other uses and acquired 14% from the national water resource system (WASA) for residential water. It is unlikely that any alternative agricultural operations will be able to generate more than 60% of its annual water requirements. Even if an agricultural system seeks to adapt stringent water

recycling measures it may not reduce its dependence on external water resources to such a magnitude. Therefore, both the mega farm and the two-acre properties are expected to have high levels of dependencies on reliable water supplies.

At the same time the WASA reported that the water authority was not currently prepared provide water for agricultural activities since this was not economically viable, and the level of demand outstripped the level of available resources. The company also claimed that has been experiencing shortfall and is currently exploring additional desalination to mitigate the shortfall.

The current land tenure arrangement with the two acre lots constrained farmers to produce only short term crops. There are 7000 lots occupying approximately 14,000 acres that are currently earmarked for such operations. These farms will require a reliable supply of good quality water, which is not currently available. Future development plans with regard to the two acre plot cooperatives will also face this dilemma. Notwithstanding the greater flexibility given to the land holders of the mega farm to establish a wider variety of farm enterprises on their properties, they are also constrained by the current lack of water availability.

Mitigations: Establish ponds at strategic locations to harvest rain water. This should be properly engineered and calibrated to provide a timely supply of water that matches required demand and will minimize flooding during the rainy seasons. Allowance should be made to address the issue of climate change during construction. While each mega farm could have its own water storage facility, ponds may be constructed to serve the two-acre cooperative properties by clusters.

Work with WASA as possible and appropriate to enable incorporation of future water demands for untreated water for irrigation, specifying amounts of water needed at specific locations which can not be met by irrigation ponds.

Responsible and involved bodies: Caroni (1975) Ltd. and Megafarms, WASA, EMBD, MALMR, Extension Services, UTT/UWI, Cane Feed Center

b. Pressure on aquifers and existing water resources - Severity High

Both the two-acre properties and the mega farms have demands for water that may cause pressure on aquifers and existing water resources. In order to meet the water requirement there will be interest in constructing wells, extracting water from rivers and utilizing potable and other water resources for agricultural activities. Meanwhile, these facilities are being heavily exploited to supply current national daily water requirements. If excessive withdrawals are made on groundwater resources there is a high probability that the result could be salt water inundation of aquifers, rendering them unusable for all consumers. The fragility of the aquifer systems must be seriously considered prior to any wells or additional water withdrawals.

Mitigation: Invest in infrastructures that will optimise the collection water runoff during the rainy season, including irrigation ponds and storage facilities. Streamline collection

and processing of grey water to be used appropriately in agriculture. In any infrastructure paved areas construct swales to support aquifer recharge. Establish treatment facilities to extract good quality water from alternative sources for agricultural purposes.

Caroni (1975) Ltd. and EMBD to work with WASA ground water specialists, MALMR, and UTT/UWI to ensure that groundwater withdrawals to meet needs for irrigation are compensated as possible through ground water recharge. This should be planned into the development of the 2 Acre Cooperatives as early as possible to ensure that excessive withdrawals on ground water resources are avoided.

Responsible and involved bodies: Caroni (1975) Ltd. and Megafarms, EMBD, MALMR, Extension Services, UTT/UWI, Cane Feed Center,

c. Silting of water ways due to erosion - Severity High

Frequent tillage is an issue especially with the production of short term crops. It is usually unavoidable when carefully considerations are not given to environmental concerns. Due to its varying terrains and heavy clay soils, tillage operations in the Caroni area create the conditions that favor water erosion of soils. Such water runoff usually carries an abundance of soil particles and other debris which are subsequently deposited into drains, rivers and streams, causing major siltation problems, blocking the flow of water and increasing the severity of flooding. .

Mitigation: Select crops that will provide good ground cover. Consider mixed cropping, using varieties that will mature at different periods. Practice crop rotation that will include a fallow system, where portions of the land remain uncultivated for some time. With regard to the mega farms, production practices may be streamlined to include the establishment of medium term and permanent crops. Farmers may also establish pastures for small ruminants and cattle production. Use adequate soil conservation methods such as edge rows and terracing to lower water velocity and encourage slow percolations.

Caroni (1975) Ltd. in the preparation of the 2 Acre Cooperatives should work closely with MALMR, UTT/UWI and Cane Feed Center to identify good ground cover crops and rotation schedules specific to soil and terrain types. This should be initiated early in the 2 Acre cooperative development processes and should be monitored and evaluated at regular cycles to develop best practices.

Responsible Parties: Caroni (1975) Ltd. and Megafarms, Department of Drainage – Ministry of Public Works, MALMR, Extension Services, UTT/UWI, Cane Feed Center,

d. Contamination from agrochemicals - Severity High

The use of chemical sprays and fertilizers result in the contamination of ground and surface water sources. This was an issue with the cultivation of sugarcane and is likely to continue with the proposed agricultural activities as agrochemicals are used. The effects stand to be more significant with new farming activities in the area due to potential increase in frequency of chemical and fertilizer usage to enhance productivity.

Mitigation: Use biodegradable substances to control pests and disease. Employ cropping systems that encourage low fertilizer usage. Use natural fertilizers to complement the use of organic manure. Provide training on water management, quality and conservation awareness.

In the selection of crops and development of agricultural practices, Caroni (1975) Ltd. to coordinate with MALMR, UTT/UWI faculty focusing on low impact agricultural practices, and regional and international certifying bodies.

Responsible and involved bodies: Caroni (1975) Ltd. and Megafarms, MALMR, Extension Services, UTT/UWI, Cane Feed Center

Soils:

e. Frequent tillage affects soil structure, texture and erosion - Severity High
Frequent tillage operations are likely to take place on both the two-acre and mega farms, especially where vegetable and root crop production occur. The natural condition of the soils in the Caroni area is not conducive for such practices. Frequent tillage of clay soils perpetrates the perpetuation of poor soil structure and texture. It predisposes beneficial plants and animals to undesirable conditions, resulting in their demise. It also encourages wind and water erosion. Tillage operations may cause depletion of soil nutrients due to leaching from water runoff.

Mitigation: Employ minimum tillage practices and 'spot planting'. Ameliorate the soil using compost and organic manure to improve soil structure, texture and soil nutrition. Engage in vermiculture/composting exercises. Establish permanent and medium term crops as possible. Apply mulching to enhance soil cover and periodically plough into the soil to improve soil conditioning. Plant legumes and other nitrogen fixing crops, and use a regular crop rotation cycle best suited for local soils. Establish pasture for grazing animals during times when land is left fallow to increase nutrients recharge into soils and to control weeds.

Caroni (1975) Ltd. to work with Cane Feed Center on soil remediation techniques to be employed early in the planning process.

Responsible and involved bodies: MALMR, Extension Services, UTT/UWI, Cane Feed Center, Caroni (1975) Ltd. and Megafarms

f. Displacements of topsoil from clearing and construction - Severity High
The first three inches of top soil is where most plants obtain their nutrients. Therefore any displacement of topsoil may result in stunted plant growth and low productivity. Most beneficial soil organisms also dwell within the first 3-6 inches of topsoil. During land clearing exercises care should be taken to protect the topsoil.

Mitigation: During construction, secure topsoil for future use. Select land clearing and preparation methods that will cause minimum disturbance to the topsoil. Add compost where major disturbance to topsoil occurs for amelioration purposes.

Caroni (1975) Ltd., EMBD and MegaFarmers to provide close attention to top soil replacement in all land clearing activities.

Responsible Parties: EMBD, Caroni (1975) Ltd. and Megafarms

g. Significant land clearing - Severity High

Agricultural activities usually entail extensive land preparation. Engaging both the two-acre plots and the mega farms result in far more land clearing activities on the Caroni (1975) Limited lands when compared to the growing of sugarcane. In the case of the mega farms, hundreds of acres will be denuded simultaneously using heavy equipment. This will result in massive loss of natural habitat to the construction of buildings, restored farmlands, and the introduction of new, possibly invasive, species.

Mitigation: Create a proper farm layout plan with appropriate zoning of the land according to farm enterprises. Clear land in blocks based on priority. For the establishment of tree crops, use spot clearing method, where existing flora will be removed from only the immediate area for planting. Adapt a maintenance program that will encourage rapid growth of the crop to the point where tree crops cause natural suppression of weed growth. Some level of manual or mechanical weed control may be employed at this stage since the natural greenery would have been retained by the newly established crop. Select crop species with rapid growth rates and provide good ground cover at establishment.

Caroni (1975) Ltd., and Mega Farmers to use agricultural best practices for companion planting, soil retention and enhancement. Support from MALMR, Extension Services, UTT/UWI, Cane Feed Center

Responsible and involved bodies: Caroni (1975) Ltd. and Megafarms, MALMR, Extension Services, UTT/UWI, Cane Feed Center

h. Compaction due to development of infrastructure - Severity Moderate

The soil of the Caroni plains are predominantly clays and are derived from acidic parent materials. It is believed that within any narrow radius there are different types of clays, exhibiting different properties. These soils are very soft, slippery when wet and very compact when dry. With the closure of Caroni (1975) Limited major infrastructural developments are needed to accommodate both the two acre and mega farms.

While the lease arrangement restricts infrastructural development of the two acre farm to a road network to the entrance of each property, it offers flexibility for additional road construction, buildings and other infrastructure on the mega farms. Such infrastructural development may lead to soil compaction, ultimately increasing water runoff and the risk

of flooding. The replacement of soil with concrete also compromises development of green space and the opportunity for other environmentally friendly practices.

Mitigation: Acquire proper education and develop appropriate management skill for soils. Adapt developmental techniques that will minimise negative impacts on the environment such as the use of decorated block interspersed with green spaces for drive ways and entrances to buildings; employ compensatory practices such as planting trees along road ways and the establishment of buffer zones around construction areas.

Responsible and involved bodies: EMBD, MALMR, Extension Services, UTT/UWI, Cane Feed Center, Caroni (1975) Ltd. and Megafarms

Air Quality

i. Pollution from chemical* sprays - *Severity Moderate

In Trinidad and Tobago chemical sprays are widely used by farmers to control weeds, pests and diseases. They are usually applied using mist blowers or spraying cans. On observation, most farmers use protective gear, both to protect themselves and to prevent the chemicals from blowing onto neighbouring crops. Although the level of protection might be inadequate, in many cases such measures demonstrate some level of consciousness and awareness about the safe use of chemicals.

It is anticipated that many of the farmers of both the two-acre plots and the mega farms will use chemicals in a similar fashion for pests and disease control. Although they may not resort to aerial sprays causing widespread contamination, as was the case with Caroni (1975) Limited, some level of air pollution may occur, especially when applications are made during windy periods. This will become hazardous to the farmers themselves or to neighbouring communities.

Mitigation/Enhancement: Reinforce the use of proper protective gear. Select substances that are biodegradable for the control of pest and disease. Use biological control measures and integrated pest management practices. Adapt integrated farming systems that are designed to control pests and diseases.

Responsible and involved bodies: MALMR, Extension Services, Caroni (1975) Ltd. and Megafarms

j. Emission of fumes from livestock operations - Severity Low

There are existing livestock farms such as chicken, pigs and cattle in and around the Caroni area. In most instances knowledge of such farms is acquired first by smelling and then by sight. This is because of the strong and obnoxious exudates from those farms that are polluting the atmosphere. Some recipients of mega farms have already included livestock operations within their farm plans. It is likely that many of those farmers will adapt aspects of existing practice within the areas which may contribute to such pollution.

Mitigation: Establish properly ventilated livestock houses equipped with scrubbers to trap odour. Adapt integrated farming system that will recycle exudates and refuse to produce energy for the farm, feed for livestock and manure for crops.

Responsible and involved bodies: MALMR, Extension Services, UTT/UWI, Cane Feed Center, Caroni (1975) Ltd. and Megafarms

k. Soot and particulate from burning and tillage - Severity Low

In Trinidad and Tobago, burning is used as a part of the land preparation mechanism. This emits soot and particulates into the atmosphere, creating respiratory hazards for neighbouring communities. Burning also releases CO_2 into the atmosphere, hence contributing to the issue of climate change. It is anticipated that the farmers who will be operating on the Caroni (1975) Limited lands will resort to some level of burning to control weeds. Although such burning will be at much lower levels when compared to former sugarcane operations it should be discouraged, and composting of weeds to increase soil qualities encouraged in its place.

Mitigation: Adapt manual and appropriate mechanical means of weed control. Employ "spot" weeding measures where possible. Use farming methods that will suppress weed growth.

Responsible and involved bodies: MALMR, Extension Services, UTT/UWI, Cane Feed Center, Caroni (1975) Ltd. and Megafarms

Climate Change

The baseline data shows that prior to the closure of Caroni (1975) Limited the Company was using an average of approximately 192 million kw of energy per annum for its entire operation. With the closure in 2003 this amount reduced by 45 percent, to an average of 106 kw per year, up to 2005 when all operations in the refinery and distillery lowered significantly. Further analysis of the data suggests that the Company generated 75 percent (l44 million kw) of its total energy requirement annually during normal operation, which reduced slightly to 66 percent (70 million kw) with the closure in 2003. Twenty five percent (25%) and thirty four percent (34%) of requirement were acquired for TTEC respectively before and after closure. The growth of cane is one of the highest carbon sequestration activities, and therefore the loss of cane agriculture reduces the sink capacity for carbon. Replacement agricultural activities will not result in the same levels of sequestration because they require more labor intensive, mechanized approaches and the crops will likely not have the same degree of carbon absorption capacity.

l. Choice of farm enterprise and approach to development - Severity Moderate

The poor quality of the lands available within the Caroni area remains an issue for agriculture. Besides being acidic and with heavy clays, many areas are prone to flooding. Many technicians have predicted that with climate change, Trinidad and Tobago will experience frequent rainfall with strong intensities. This will lead to more flooding in low

lying areas and in new areas without a history of flooding. These are important considerations that should influence the farmers' decisions as they make their farm development plans.

During the subdivision of the Caroni (1975) Ltd properties, several agricultural lots are located in close proximity to rivers, streams and areas that are prone to flooding. There are instances where some areas are affected by the seepage of salt water and may be categorised as wetlands. Care should be taken in selecting farm enterprises that will withstand flooding or are adaptable to the existing conditions.

Mitigation: Farmers could consider establishing wetland farms which could serve as a source of income and for agro tourism. They will select ornamental species such as water cress, ginger lilies and a variety of other species that are adaptable. Commercial growth of bamboo for export in these areas may be a viable alternative. Aquaculture may be a viable option if properly engineered within wetland areas. There are some fish species that do well in brackish water and may be considered for aquaculture. These efforts are environmentally friendly, in that they are adaptable and will be a minimal disturbance to the land. They will raise the productivity of the farmers' property. They are not labour intensive and the fish will address major food security and import substitution issues. By product from the fish farms may serve as a source of animal feed and fertilizer.

Responsible and involved bodies: MALMR, EMBD, Caroni (1975) Ltd., IMA for aquaculture

m. Increase energy consumption for livestock operations and other farming activities – Severity Low

The proposed agricultural alternatives (mega farms and two acre plots) for the use of the Caroni (1975) Limited lands are poised to increase energy consumption during operations. Such increased usage may be more intense with mega farms since they are likely to engage in more energy intensive operations than their two acre counterparts, primarily because of the restrictions imposed on the two acre lots to engage in infrastructural development. Thus the mega farms, especially those with livestock operations, will need energy to operate housing and processing facilities. Another major energy requirement will be needed for mechanical purposes. Such energy needs will be largely dependent on commercial sources and will impact negatively on climate change.

Mitigation/enhancement: Adapt an integrated farming system approach that will not only be environmentally friendly but will maximize returns from resource use. Such a system will reduce wastage through rigid recycling processes. By means of direct linkages between different farm enterprises, refuse may be used to generate bio energy to run on-farm operations, thereby minimising dependence on external sources. This will reduce illicit dumping and excessive waste disposal and discourage low yield per individual farm enterprise.

Responsible and involved bodies: Caroni (1975) Ltd. and Megafarms

n. Carbon sink/sequestration implications – Severity Low

During former agricultural operations on the Caroni (1975) Ltd lands, sugarcane was a good carbon sink. Farmers of both the two acre properties and the mega farms will engage in mixed farming practices. There is no guarantee that the individual farmer will make an effort to ensure that their decisions are based on reducing CO_2 emission. Farmers are likely to choose their options based on perceived profitability and market availability. However, some of the crops chosen such as pasture grasses, rice, corn and some vegetables will be good carbon sinks.

Mitigation/Enhancement: Educate farmers on climate change issues and how they can make positive influences in this regard. Encourage the inclusion of crop species with good Carbon sink potential in cropping systems. With any proposed alternatives for Carbon sequestration, make connections to increase profitability.

Responsible and involved bodies: MALMR Extension, Feed Cane Center, UWI/UTT, Caroni (1975) Ltd. and Megafarms

Bio Diversity

Several consultations suggests that there has been little done with regard to the management of biodiversity on the Caroni (1975) Limited properties over the years. As such there has not been any record history of biodiversity within the area. It is felt that prolonged cultivation of sugarcane, which is a mono-crop, would have resulted in extensive loss of the biodiversity within the area, combined with the aerial spraying of malathion as a pesticide, which killed most insects and those dependent upon them in the food web. There are many reports of the re-appearance of many animals and plant species in to the area since the closure. The renewed agricultural activities brought about by the two acre plots and the mega farms should impact positively on the re-emergence of biodiversity, if a sustainable approach to agriculture is employed..

o. Increase some beneficial insects - Positive

The currently proposed agricultural alternatives to sugarcane farming include multiple cropping systems. This has the potential to sustain a resurgence of several beneficial insects within the area. The bee offers multiple benefits, with honey production and service as a pollinator being two of the most important benefits. With the introduction of large acreages of multiple crops within the Caroni lands there will be a need for pollinators. To date no importation of honey is allowed in Trinidad and Tobago, which creates a great economic potential for apiculture.

Enhancement: Establish apiculture, which will cater to the need for more pollinators. Bees will also help to replenish the biodiversity of the area. Another major benefit to be derived from bees is the production of honey. Adapt an integrated pest management system that will discourage the use of chemical pest and disease control. Use biological control in an attempt to maintain a balance population of flora and fauna.

Responsible and involved bodies: MALMR, Extension Services, UTT/UWI, Caroni (1975) Ltd. and Megafarms

p. Loss of some plant and animal species - Severity Low

Any new intervention that interferes with the natural habitat will result in the loss of some plant and animal species. Close monitoring of the species will help to create checks and balances within the area. There will be many privately owned sites within the Caroni area which affect proper monitoring of biodiversity.

Mitigation: Institute policies and management plan to monitor environmentally sensitive areas. Engage farmers in education programs to build awareness about the importance of supporting beneficial insects, and natural pest reduction strategies, especially within sensitive areas.

Responsible and involved bodies: Caroni (1975) Ltd., Mega Farms, MALMR Extension Services, EMA, UWI/UTT

q. Introduction of invasive species – Severity Low

Farmers will enter into operations with a desire to make profits. They will adapt those practices that guarantee optimum returns. It is with this notion that they will seek improved varieties that are high yielding. This may lead to the introduction of new species to a given ecological zone. Some of such species may (unknowingly) be invasive and difficult to control.

Mitigation: Adapt best agricultural practice. Seek to use varieties that are certified with good adaptability. Avoid genetically modified seed and plant strains that may impact natural biodiversity.

Responsible and involved bodies: MALMR, Extension Services, UTT/UWI, Cane Feed Center, Caroni (1975) Ltd. and Megafarms

r. Segmentation of species and habitats - Severity Low

Trinidad's fishing is done mainly in territorial water. Estuaries for fishery are located in local wetlands. The Caroni swamp is a major nursery for some species. There are threats to such delicate areas from newly proposed farm interventions. Farmers in close proximity may attempt to extract water from these areas for irrigation and other farm activities. They may allow the seepage of chemical and fertilizers into these areas from their operations. Such actions may create imbalance within natural habitats of endemic species, leading to their notable decline. The loss of fishes within the fishing spaces of Trinidad and Tobago as a result may cause major food security implications.

Mitigation: Create buffer zones in delicate areas. The intention is to ensure that any functional development is not greater than the functional natural loss to the environment as a result of the development. Build strong capacities to the environment. Institute a proper management plan for the support of the biodiversity within the Caroni area.

Responsible and involved bodies: EMA, IMA, MALMR, Extension Services, Caroni (1975) Ltd. and Megafarms

ASSESSMENT OF AGRICULTURE IMPACTS ON SOCIO ECONOMIC CONCERNS

CONCERNS	Impact Severity	SOCIO ECONOMIC IMPACT – Mega Farm and Two acre
Human Health		a. Exposure to harmful chemicals, soot and fumes
		b. Increase access to affordable food/food security
Social Inclusiveness		c. Strengthening farming communities
		d. Improved cohesiveness through farmers' cooperative
		e. Improved inclusion of segments of society in agriculture (credit facilities, schools, labour, etc.)
Cultural Heritage Landscape		f. Showcase traditional farming methods
		g. Increase potential for agro-tourism
		h. Potential vacant lot syndromes increase potential for squatting and dumping
		i. Potential vacant lot syndromes, dumping
Economics		j. Increase rural income and employment
		k. Market research and intelligence influence demand
		l. Increase supply chain linkages
		m. Increase in personal capital investment
		n. Strengthened agricultural enterprises
Material Assets		o. Potential demand on water infrastructure
		p. Increase demand on existing infrastructural systems (road, water, electricity)

Impact Severity color key	Red = High	Orange = Moderate	Yellow = Low	Green = Positive

Human Health

The issue of human health received a fair amount of attention when Caroni (1975) Ltd was in operation. Workers were provided with protective gear, the use of which was reinforced by management when necessary. A concerted effort was made to ensure that all levels of workers who were exposed to the use of chemicals received a medical check up at least once per year. The company also invested in health insurance for all workers.

a. Exposure to harmful chemicals, soot and fumes - Severity Low

The current proposed agricultural arrangements for the Caroni (1975) Limited property will involve approximately 7000 private farmers operating two acre plots and several other farmers privately operating commercial farms at about 13 different locations. These individual farmers will make their own decisions with regard to levels of farming operations, including the use of chemicals. There are concerns as to whether the current extension services provided by the Ministry of Agriculture Land and Marine Resources will be adequate to serve the new induction of farmers. Such perceived deficiency is exacerbated by the inexperience of the new farmers in agriculture. It is anticipated that these farmers will engage the use of chemicals in their farming operations and will not be forced to take adequate precautions during application. Not only will the farmers themselves be exposed to the chemicals, it is likely that there will be increased exposure of neighbouring communities as well as the surrounding natural habitat.

Mitigation: Train farmers in integrated pest management strategies. Provide practical alternatives to the use of chemicals. Ensure that biological control methods are available, accessible and affordable to farmers. Encourage farmers to form cooperatives so as to gain better access to developmental support. Strengthen and make relevant service providers available.

Responsible and involved bodies: MALMR, Extension Services, Caroni (1975) Ltd. and Megafarms, TTABA UTT/UWI

b. Increase access to affordable food/food – Positive

There will be positive influence on the issue of food security with the engagement of more than 7000 new farmers in agriculture, cultivating more than 20,000 acres of land. These farmers will be producing and supplying a wide range of fresh agricultural produce on the local market. It is anticipated that large volumes of a variety of commodities will be consistently available and will likely adjust prices downward. Consumers will benefit from healthier commodities at lower prices.

Mitigation/Enhancement: Conduct careful market studies to include supply chain analysis. Include measures to avoid glut or disincentive to farmers. Streamline production against the principle of supply and demand analysis. Make allowance to add value to commodities, such as agro processing. Ensure that farmers are equipped with proper storage and post harvest facilities.

Responsible and involved bodies: TTABA, Caroni (1975) Ltd.

Social Inclusiveness

c. Strengthening farming communities - Positive

During the years of producing sugarcane, Caroni (1975) Limited was able to sustain a strong spirit of community, evidenced by its support in providing employment, training, sports, entertainment and health care. The company also provided housing, roads, drains, water and other infrastructure to the community. The closure of the company resulted in

major social fallouts. Many benefits were withdrawn. Government entities mandated to fill the gap in service faltered, causing significant dissatisfaction and frustration among community members. There has been major deterioration of community infrastructure due to lack of maintenance. It is felt that the people have now lost trust in the Government and even among themselves. They believe that the Government did not engage in adequate public relations to carefully explain all aspect of the transition process to them.

Mitigation: For any new intervention to be successful is has to first regain the trust of the people. It is especially crucial to take care to prevent further distrust among the two acre farmers since many more people will be affected. The current administrative component of Caroni (1975) Limited that presides over the transformation process of the existing properties has been in the process of developing a model to aid the transition of the two acre lots into agriculture. The model has adapted a production cooperative approach, and shows promise. The Trinidad and Tobago Agribusiness Association (TTABA) has proposed a similar model which is more focudes on a marketing cooperative type and will include the mega farm component. All mitigation efforts suggested here can be adopted by the two acre cooperatives as well as individuals engaged in farming.

Responsible and involved bodies: Caroni (1975) Ltd., and TTABA

d. Strengthening farming communities – Positive

Considering the large number of private individuals who will be occupying agricultural lots, some coordinated approach is needed to ensure strong community support. Such an approach should note that the cohort group of farmers have already been aggravated and feel disenfranchised by the previous system, and attempt to dispel any built up tension among them. The proposed farm development models include measures to capture community trust. There is an element of social cohesion, which it is hoped will capitalize on the collective societal memories of inclusiveness. Further, newly proposed models have created room to periodically include the private cane farmers. It is anticipated that praedial larceny will increase with greater involvement in agriculture.

Mitigation/Enhancement – Secure the voice of the farmers at the initial stage of any planning and maintain their effectiveness at all stages during the process. The process should be fully transparent and demonstrate clear incentives that are sustainable to the farmers. Institute a functional farm security system to control praedial larceny. Adapting proper crop rotational systems where crops mature at different periods may help to manage the issue of praedial larceny.

Responsible and involved bodies: Caroni (1975) Ltd., and TTABA

e. Improved cohesiveness through farmers' cooperative – Positive

The idea of establishing farmers' cooperatives is encouraging. It may be impractical to deal with over 7000 farmers individually and realize any meaningful benefit. With cooperative groups, there are incentives for farmers to acquire cheaper inputs, market their products and acquire market intelligence. Available resources through the MALMR

and other supporting agencies may be utilized more efficiently through cooperatives. The concerns of the farmers have a greater impact when voiced collectively through cooperatives.

*Mitigation/Enhancemen*t: Conduct extensive research to dispel any negative perception of cooperatives. Establish the most suitable types of cooperatives. Train farmers extensively on the operation of cooperatives.

Responsible and involved bodies: Caroni (1975) Ltd., and TTABA

f. Improved inclusion of segments of society in agriculture – Positive

Greater agricultural involvement within the community will create linkages with other segments of the society. Farmers will need credit, which they may seek to secure through the financial sector. Direct employment will be generated on the farms, marketing of farm produce and/or through agro processing. However, there are major problems in Trinidad and Tobago in finding direct labour for agriculture. There will be an increase in the number of service providers such as farm stores, agro-processing, traders and manufacturers. Schools and other training institutions may be included pedagogically.

Mitigation/Enhancement – Agricultural credit banks and other financial institutions should create flexible portfolios to facilitate the farmers' access to credit. Provide strong incentives to labour by offering shares in the case of cooperatives. Effort should be made to create strong linkages between farmers and existing apprenticeship and un-employment resource programs as a means to appease current labour issues. Engaging in agro processing could influence a business approach to agriculture, address the issue of possible glut and may add value to products. Farms may be used as demonstration sites for students as they learn about agriculture.

Responsible and involved bodies: Caroni (1975) Ltd., Megafarms, ADB, MALMR, Ministry of Eductation, TTABA, NAMDEVCO,

Cultural Heritage Landscape

There is the feeling that Caroni (1975) Limited did not place much emphasis on securing the cultural heritage landscape of its properties. Many argue for the establishment of a herbarium to secure the genome of the sugarcane and to preserve the history of the industry for future generation.

f. Showcase traditional farming methods – Positive

There will be a natural tendency to showcase traditional farming methods among farmers. This will be based on their individual ethnic origin and cultural background. Even with improved technology, farmers tend to stick to the traditional way of engaging in agriculture and are often criticised for doing so.

Mitigation/Enhancement – Conduct research to understand the cultural heritage landscape of each farming community. Incorporate the traditions of the community within developmental strategies to achieve greater reception from members.

Responsible and involved bodies: UTT/UWI

g. Increase potential for agro-tourism – Positive

Both the two acre and the mega farm offer great potentials for agro tourism. Large acreages of well structured, well designed acreage will be brought into agriculture. Since those lots are new, farmers should take the advantage of including elements of agro tourism in their farm development plans. This will include engagement in activities that are sustainable and aesthetically designed.

Mitigation/Enhancement: Add variety to the farm plans. Carefully zone farm enterprises based on suitability and adaptability to locations. Include green spaces and buffer zones. Design each farm unit to showcase different stages of operation. Maintain proper waste management strategies through recycling and the use of appropriate receptacles. Maintain good farm maintenance policies.

Responsible and involved bodies: Caroni (1975) Ltd., Megafarms and TTABA

h. Potential vacant lot syndromes increase potential for squatting and dumping – Severity Moderate

Squatting and illicit dumping are commonplace in Trinidad and Tobago. Squatting is a situation involving individuals informally taking possession of unoccupied land for their personal use. Squatters use land predominantly for agriculture and residential purposes. Similarly, unused or uncontrolled vacant lots are used for dumping purposes. Caroni (1975) Limited has a history of dealing with the issue of squatting for many years and illegal dumping has increased since the closure of the company. Under the new program disinterested, disgruntled and disenfranchised farmers may not be willing to engage in agriculture, leaving vast expanses of unoccupied lands exposed to illegal uses.

Mitigation – Institute laws with punitive actions against squatting. Engage all lands in productive activities or demonstrate effective methods of occupancy. Install fences and strategically post no dumping and no squatting signs. Consider regulation of existing squatters on state lands. Zone garbage disposal sites and land fill areas.

Responsible and involved bodies: Caroni (1975) Ltd.

j. Increase Rural Income and Employment – Positive

The current downturn in global economies begins to negatively impact the economy of Trinidad and Tobago. According to the recent Central Bank report, Trinidad and Tobago have moved from virtual full employment (4.5% unemployment) to a current unemployment rate of 7.5 percent in less than a one-year period. The impact of such a downturn has been greatest in rural communities, which include approximately 10,000

displaced workers and private sugarcane farmers from the Caroni (1975) Limited sugar industry. The establishment of the two acre plots and the mega farms are very timely since they will be creating direct employment for community members. They will also influence the establishment of other agricultural support industries and private enterprises, which may also be sources of indirect employment. The wages for labour and the returns on investments in agriculture will raise rural income and ultimately improve living conditions in rural communities.

Mitigation/enhancement: The GoRTT needs to send a strong signal that it intends to provide a stable and predictable fiscal, trade and regulatory policy environment for agricultural and livestock production in the short and medium term. This will attract capital and labour back to agriculture, and the current holders of the two acre lots and mega farms will be motivated. This should also include the lifting of a series of current institutional and legal constraints that will benefit existing farmers and encourage agricultural production on both the two acre and mega farm lots. The current agricultural market intelligence network needs to be expanded to accommodate new farmers, providing them with reliable market information and market development strategies.

Responsible and involved bodies: Caroni (1975) Ltd., MegaFarms, Trade Unions, TTABA, ABD, NAMDEVCO

Economics

Low productivity and low profitability are economic reasons that strongly influenced the closure of Caroni (1957) Limited. The proposed arrangement to use the property for agriculture should influence positive economic returns. Large numbers of private owners will be engaged in agriculture for profit making purposes. Hence the overall returns from such intervention should be positive, to be evidenced by increased rural income and the provision of employment. All mitigation and enhancement efforts suggested here can be adopted by these two acre cooperatives as well as individual farmers.

k. Market research and intelligence influence demand – Positive

The magnitude of the proposed agricultural intervention will demand extensive market research and intelligence for it to be viable. It is likely that supply will exceed demand if production is not demand driven. This would result in major gluts on the market. For farmers to continue production they have to be guaranteed the incentive to do so, which will be provided through effective market research. Such a study will inform that farmer about what to produce with the best timing. With such information, farmers will be able to streamline production in a way that will realize positive returns. Market research must include existing farmers to prevent any major negative repercussions. Current levels of production and associated shortfalls have to be factored into the analysis.

Market research should extend beyond the local market of fresh produce since the magnitude of farming that is proposed for the Caroni (1975) Limited properties has the potential to exceed local demand. This will impact the export market potentials and local agro industries.

Responsible and involved bodies: Caroni (1975) Ltd, TTABA, Mega Farms, NAMDEVCO, UTT/UWI

Mitigation/Enhancement - Engage the local Universities (UWI and UTT), MALMR, international organization with interest in local agriculture (IICA, CARDI, FAO/UN) and other relevant stakeholders in market research exercises. Train farmers in appropriate marketing techniques. Provide timely market information for all farmers. Promote social marketing and national branding.

l. Increase in Supply Chain Linkages - Positive

It is anticipated that the recipients of agricultural lands on the Caroni property who decide to engage in agriculture will be fairly receptive to developmental information. They may be willing to establish strong linkages with the players along the value chain that they perceive to positively impact the quality and profitability of their farm operations. Similarly, the users of the farm produce are likely to be motivated if they are brought to understand the situation in which commodities are produced and handled. Such linkage should be encouraged and promoted among farmers of the two acre and mega farm lots.

Mitigation/enhancement: Prepare a sound agricultural and agro-industrial development policy that enhances linkage to the domestic agricultural resource base and traditional skills and cottage industries. This should be implemented within a clear, coherent and efficient legal, regulatory and institutional framework that draws on the analysis of the national and regional resource base for direction. The focus should be on an assessment of opportunities and constraints in the sector, and reconciliation of national and regional interests at all stages of the value chain from farm to processor to the final consumer.

Responsible and involved bodies: Caroni (1975) Ltd., MALMR Planning, TTABA, NAMDEVCO, ADB

m. Increase in personal capital investment – Positive

By investing in agriculture farmers will increase their personal capital. They will benefit from a variety of training in agriculture and will have acquired technical capabilities through active engagement. The agricultural sector will in turn benefit from greater farming intelligence, thereby strengthening its capacity to handle local food security issues.

Mitigation/Enhancement – Engage farmers in on-farm adaptive research programmes. Encourage farmers to adapt a business approach to farming through farm registration, and appropriate farm administrative systems. Provide training in post harvest handling of produce. Introduce strategies that will strengthen the farmers' connections and networks as they move along the value chain.

Responsible and involved bodies: Caroni (1975) Ltd.

n. Strengthened agricultural enterprises – Positive

In a bid to remain competitive farmers may need to find productive niches. Organic farming may be a viable option in areas of the Caroni property. During the operations of Caroni (1975) Limited the type of farming practiced enhanced soil acidity. This may be corrected over time with improved practices. Studies show that it requires about seven years for most land to be organically certified if it remains uncultivated or if organic methods of farming are adapted. It has been over five years since most of the Caroni (1975) Ltd properties have been left in follow, suggesting that very soon the land could become organically certified. Organic farming practices are good soil amelioration strategies. The demand for organic produce is increasing both locally in internationally. It may be difficult for Trinidad and Tobago to compete normally in global and regional markets with vegetable and root crops. The country will be more competitive abroad by creating a niche market for organically grown produce.

Engaging in organic farming creates a demand for organic manure. Such a demand coupled with the need for organic manure for soil amelioration may warrant commercial production of organic manure. This could include the use of vermiculture where earthworms are used to convert organic waste into a state that may be used as fertilizer. The abundance of potential waste from increased levels of farming could help to make such an entity viable. These opportunities broaden the scope for the inclusion of the private cane farmers who may seek to continue in agriculture.

Mitigation/Enhancement – Examine the profitability of organic farming in the Caroni area and the establishment of a commercial organic farming enterprise. Conduct research on local earthworms and compare the rate of breakdown with imported species. The intention is to minimise the possibility of introducing invasive and/or destructive species to the ecosystem. Train farmers in organic farming and encourage the use of organic manure. Engage local organic farming initiatives and stakeholders in the process.

Responsible and involved bodies: Caroni (1975) Ltd., TTABA, UTT/UWI

Material Assets

o. Potential Demand on Water Infrastructure – Severity Extremely High

At Caroni (1975) Limited, water remains one of the most critical resource needs for the transition from sugar production to the establishment of two acre and mega farms. To date, there is still no clear measure in place to ensure that water will be available for any level of farming on the Caroni properties. Any decision to begin cultivation will increase pressure on existing water resource facilities. Farmer may be inclined to divert water from rivers and streams or may resort to the use of contaminated water sources for food production.

Mitigation: Consider using grey water to irrigate non-vegetable crops. Practice intense water conservation strategies such as the use of drip irrigation. Select crops that are

adaptable to different weather conditions and streamline planting accordingly. Enable the immediate relevant public water authorities to accommodate farmers in their water programs.

Caroni (1975) Ltd. and WASA to coordinate as per suggested in water section above. Careful coordination of anticipated demands, water storage and ground water withdrawals should be closely observed within the development plans.

Responsible and involved bodies: Caroni (1975) Ltd., WASA

p. Increase demand on existing infrastructural systems (road, water, electricity) – ***Severity Low***

It is felt that there is an inadequate road network in areas where farm lots are established. Some areas are remote and do not have access to electricity to operate irrigation pumps.

Mitigation/Enhancement: Consider generating bio energy using wastage from the farm. Enable relevant authorities to improve road network and to provide alternative energy sources.

Responsible and involved bodies: Caroni (1975) Ltd, EMBD, Mega Farms

7.2 Residential Developments

7.2.1 Environmental Impacts of Residential Developments

The development of 30 new housing estates on 4,054 of former Caroni (1975) Ltd. property will be sited in areas where sugar cultivation predominantly took place in the higher elevations of the central Caroni flood plain. The lands are gently sloped and have been selected based on the likelihood that the estates will be less prone to severe flooding. The environmental impacts of converting this property from cane fields to residential estates involves clearing, grading, installation of infrastructure, including water, sewage, roads, electricity and gas during the construction phase, followed by the active use phase, which is signified by human settlement and habitation of residential estates. For the NEC Brechin Castle mixed use properties, where residential and commercial land use plans are implemented, the same impacts and recommended actions apply.

The environmental impacts are outlined in Table 7.2.1 and each is summarized below.

Table 7.2.1 Environmental Impacts – Residential Development

CONCERNS	Impact Severity	ENVIRONMENTAL IMPACT – Residential
Water		a. Increase in flooding due to paving of lands
		b. Increased flooding and silting of waterways as a result of heavy rain fall events and improper waste disposal (high)
		c. Increased water consumption for domestic use
		d. Potential sewerage overflows during storms and demands on water for sewerage systems
		e. Potential contamination of groundwater from sewerage leakages
		f. Potential contamination of groundwater from chemicals during construction processes
		g. Increased pollution to surface water due to run off from municipal sources (roads, etc.)
Soil		h. Displacements of topsoil from clearing and construction
		i. Erosion (wind and rain) of soils during land clearing
		j. Lack of recharge/flooding due paving
		k. Contamination runoff from construction, residential chemicals and automobile leakages etc
Air Quality		l. Increased dust during clearing and construction
		m. Fumes from building, painting, operation
		n. Increased air pollution from transportation/private cars
Climate Change		p. Loss of carbon sinks
		q. Increased energy consumption for domestic use
		r. Increased use of cars
		s. Increased surface temperatures due to paved surfaces
Bio Diversity		t. Loss of indigenous flora and fauna
		u. Segmentation of species and loss habitats

Impact Severity color key	Red = High	Orange = Moderate	Yellow = Low	Green = Positive

Residential Development Environmental Impacts:

WATER:
The impacts on water quantity and quality of the conversion of cane lands to residential estates are common to development on agricultural lands. The impacts are both on water quantity and water quality.

The impacts on water quantity issues are:

a. Increase in flooding due to paving of lands – Severity High
The paving of lands reduces the ability of the soils to absorb water and increases storm water runoff. Paving of driveways, patios, sidewalks, road ways and house foundations significantly diminishes the absorptive capacity of the land. When significant amounts of rainfall occur in a short time frame, as is common in Trinidad, especially during the rainy season, the lack of the natural sponge which exists in unpaved land will result in increased runoff, which is compounded by large contiguous areas of mostly paved land.

Mitigation: require a percentage of lands on each lot to be left unpaved, and provide incentives for swales[1] down hill from paved areas to serve as aquifer recharge and green spaces.
EMBD, Ministry of Planning, Housing and Environment – Town and Country Planning Division, and Ministry of Works, Drainage Department, in combination with WASA should consider how to strategically construct swales for all lots. Drainage systems should be within green spaces that can act as sponges to absorb water and minimize flooding severity. Early incorporation of this should be included into planning for future developments and current developments as possible.

Responsible and involved bodies: EMBD

b. Increase flooding and silting of waterways as a result of heavy rainfall events and improper waste disposal – Severity High
The increase in flooding due to paving will also result in the flooding and silting of waterways, including streams, tributaries and rivers, as erosion occurs due to the increased velocity and volume of water washing into water ways during heavy rains. This problem is exacerbated by potential problems of improper waste disposal, especially of plastic bags, plastic bottles, construction material wastes and household wastes. Water ways that are clogged by plant growth formerly cut back under Caroni (1975) Ltd. protocols should be considered for green spaces and kept clean of debris.

Mitigation: provide proper waste disposal sites in each estate, including recycling for plastic bags and bottles, metals and paper, and provide low fencing around water ways to serve as barriers to these washing into main water ways. Allow stream, tributary and

[1] swales are capture surface run off and send it into the aquifers, both nourishing soils and reducing erosion – see http://seaforttnas.blogspot.com/search?updated-max=2009-04-07T11%3A33%3A00-04%3A00&max-results=7

river banks to grow so that soil will be held by plant roots. – designate green spaces around tributaries.

EMBD in the current development plans is working in this direction and should be encouraged to do so, including funding for recycling centers at all estates.

Responsible and involved bodies: EMBD

c. Increase potable water consumption for domestic use – Severity Medium
The increased number of households over all (90,000 for Trinidad) will increase the potable water consumption for domestic use, as people purchase additional home appliances, including washing machines, create sewage, use water for cleaning around homes, and for washing down cars and driveways. Though rainfall is quite high, the availability of potable water is quite limited and no additional water sources are currently available, according to WASA (Water and Sewerage Authority).

Mitigation: water conservation measures, incentives for low flow appliances, cisterns and rain barrels for grey water use.

Responsible and involved bodies: WASA, EMBD

d. Potential sewerage overflows during storms and demands on water for sewerage systems - Severity High

Climate change predictions for Trinidad indicate increasing frequency and severity of flooding events. Sewerage systems for residential estates will be vulnerable, especially if maintenance responsibility is not clearly defined and systems are allowed deteriorate. During flooding events the overflow from sewerage systems, especially those in need of repair, can result in contamination of surface waters resulting in public health problems and nutrient loading into rivers and estuaries.

Mitigation: For all residential estates and sewerage systems, site accordingly to minimize impacts for overflow and follow best available technologies in structural designs. Assign oversight responsibility and authority to appropriate bodies to carry out all regular maintenance according to contracted schedule.

For all EMBD Estates, clear lines of responsibility for upkeep and maintenance of sewerage facilities should be outlined and contracted to avoid deterioration of lines and systems.

Responsible and involved bodies: WASA, Town and Country Planning, EMBD

e. Potential contamination of groundwater from sewerage leakages – Severity Medium
As discussed above, the increase in flooding events, and the precedent for deterioration of some residential sewerage facilities, creates a potential threat to public health from

contamination from sewerage systems. Use of soaker hoses, pit latrines, and septic tanks, installed as a back up in areas where there is a dense population, can result in contamination of ground waters as well as surface waters.

Mitigation: Provide appropriate maintenance authority and responsibility for sewerage and disallow use of soaker hoses, pit latrines and septic tanks in high density residential estates.

Responsible and involved bodies: WASA, Town and Country Planning, EMBD

f. ***Potential contamination of surface and groundwater from chemicals during construction processes – Severity Medium***
Construction of roads, infrastructure and residential buildings can result in unintentional dumping of excess paints, solvents, oils, fuels, building materials and other contaminants at residential sites. These can leach into groundwater and contaminate surface waters, especially during heavy rainfall events. The impact is an increase in harmful chemicals in the water system, which increases the cost of improving the water quality for potable water, and can impact the health of river and marine ecosystem functions.

Mitigation: At all building sites/residential estates have waste disposal/storage facilities and storage to be hauled to appropriate recycling or disposal facilities sited to minimize contamination of soils and water resources.

Responsible and involved bodies: EMBD

g. Increase pollution to surface water due to run off from municipal sources (roads, etc.) – Severity Medium
Residential and transportation effluents, including radiator fluids, fuel and oil leakages from cars, pollution from household chemicals, paints, detergents, solvents, oils, and other harmful substances can negatively impact surface waters, especially during heavy rain events.

Mitigation: in flood prone areas, and in green spaces, plant non-invasive species that can absorb heavy metals and other contaminants, such as some grasses and other hydrophilic species.

Responsible and involved bodies: EMBD.

SOIL:
h. Displacements of topsoil from clearing and construction – Severity Medium
During construction, removal of topsoil for grading and leveling of lots and land for roadways can cause displacement of fertile soils. Loss of this soil can result in the increase of weedy and opportunistic species more suited to poor soil conditions, which in turn reduces the ability of new residents to successfully grow kitchen gardens and ornamental plants.

Mitigation: When clearing and grading lands, avoid unnecessary displacement of top soils whenever possible. Also provide topsoil storage for application to green spaces, gardens, and yards by residents following construction.

Responsible and involved bodies: EMBD

i. Erosion (wind and rain) of soils during land clearing – Severity High
The exposure of soils to wind and rain during land clearing can lead to high rates of erosion. The loss of soils diminishes fertility and increases silting in rivers, streams and tributaries, as well as contributing to the clogging of drainage ditches, which can increase severity of flooding.

Mitigation: Implement erosion control measures during initial clearing and construction phases, including cloth screens, straw/hay bales, or planting of grasses on exposed areas.

EMBD and contractors should clearly delineate erosion control measures to be used and EMBD should monitor this regularly throughout the construction processes.

Responsible and involved bodies: EMBD

j. Lack of recharge/flooding due paving – Severity Medium
The loss of soil surface area from agricultural to residential land use results in a lack of absorption of water and the failure of aquifers to recharge during rain and flooding events. The soils that remain will therefore be more exposed to chemicals and high density flooding events.

Mitigation: For remaining soils, plant non-invasive native species that will support the soil structure, increase roots to hold soils and provide backfilled swales to improve aquifer recharge.

Responsible and involved bodies: EMBD

k. Contamination runoff from construction, residential chemicals and automobile leakages etc – Severity High
As with water quality contamination above, soil will also risk contamination due to runoff and household effluents. Soils, especially in green spaces and near waterways, are especially vulnerable and will often hold toxins that bind to soil molecules. As a result, this contamination can be compounded over time.

Mitigation: Sample soils, especially in green spaces, to determine exposure to harmful chemicals. Plant a variety of non-invasive species that will absorb heavy metals, etc. to reduce soil contamination.

The EMA and EMBD should set up a monitoring protocol to be used to ensure that soil contamination is minimized, and where it does occur fines or sanctions should be levies.

For all construction EMBD should require contractors/developers to closely observe best practices to minimize impacts.

Responsible and involved bodies: EMA, EMBD

AIR QUALITY:

l. Increased dust during clearing and construction – Severity Low

The disturbance of soil during clearing and construction can result in increased dust and particulate matter. This can create a public nuisance and has the potential to impact nearby neighborhoods.

Mitigation: during the dry season, if dust becomes problematic, spray areas being graded with water to minimize dust.

Responsible and involved bodies: EMBD

m. Fumes from building, painting, operation - Severity Low

The fumes released during building and painting can have some negative human health impacts.

Mitigation: Provide workers with masks, etc. as needed, and work in areas that are as well ventilated as possible. Use non-toxic substances, including paints and solvents, when possible.

Responsible and involved bodies: Contractors building houses

n. Increased air pollution from transportation/private cars - Severity Low

There will be a net increase in air pollution as a result of increased driving in private cars and energy consumption by new homes, compared to the land being used for cane production.

Increased emissions from consumption of energy to meet domestic demands will result in an overall decline in air quality.

Mitigation: Plant trees, and plan green spaces to absorb emissions and improve ambient air quality where possible. Encourage property owners to plant non-invasive native trees and provide incentives for planting kitchen gardens and ornamental gardens.

Responsible and involved bodies: EMBD

CLIMATE CHANGE:

p. Loss of carbon sinks – Severity Moderate

Cane serves as an excellent sink for carbon sequestration, and the non-agricultural use of land for other purposes decreases the over all carbon absorption for the country. The loss of the cane acreage to residential use indicates a net loss of carbon absorption capacity for the country.

Mitigation: In areas in and around residential estates plant non-invasive native trees and other flora species with high carbon absorption rates, to offset some of the losses from cane. In green spaces, where possible use both grass and tree crops.

Responsible and involved bodies: EMBD, UWI/UTT to advise on species

q. Increased energy consumption for domestic use - Severity Moderate
The residential use of these lands will also increase carbon emissions through increased net energy consumption for home appliances such as air conditioners, water heaters, entertainment media, washing machines, refrigerators, stoves and ovens.

Mitigation: Provide information on and incentives for use of low impact housing that makes use of passive cooling, solar water heaters, solar power panels, and energy efficient appliances.

Responsible and involved bodies: EMBD

r. Increased use of cars – Severity Low
The rise in residential estates will increase the use of private cars for transportation that in turn will increase the emissions of green house gases.

Mitigation: Provide sidewalks, bicycle lanes and bus stops around and within residential estates to encourage the use of personal locomotion and mass transportation.

Responsible and involved bodies: EMBD

s. Increased surface temperatures due to paved surfaces - Severity Low
The loss of surface areas to soil and plant life can result in an increase in surface temperatures, which in turn can have a small but cumulative impact on the local temperatures and may result in microclimate variations. This can result in increased energy demand, amplifying carbon emissions through the use of air conditioning as well as reducing adaptability to severe weather events.

Mitigation: increase the use of native, non-invasive vegetation in and around residences, and in and around other social infrastructure, including trees and high grasses, where possible and appropriate. Use lighter colored building materials to reduce heat absorption and need for cooling.

Responsible and involved bodies: EMBD, Private builders, home owners

BIODIVERSITY
t. Loss of indigenous flora and fauna - Severity Low
The construction of residential estates on former cane lands should not significantly impact indigenous flora and fauna with the exception of those species which have

established themselves within these areas since the closing of the Caroni (1975) Ltd. activities. As a result, it can be expected that if there are such indigenous species that have established themselves within 3-5 years, they are substantially robust and in that they would be able to establish themselves elsewhere are not part of threatened populations.

Mitigation: Avoid disturbing areas with natural growth, trees and near waterways as much as possible during construction and development of residential estates.

Responsible and involved bodies: EMBD

u. Segmentation of species and loss habitats - Severity Low

The increase in human settlements in formerly agricultural areas has the potential to divide populations of some species, resulting in a decrease in genetic diversity. This can lead to a reduction in the long term survival of the species. Additionally, the loss of habitats can have negative impacts on some species that have recently resettled the former cane lands. However, as noted, these species are expected to be relatively robust if they are already re-established in an area that was under monoculture and routinely sprayed with a large amount of pesticide.

Mitigation: When possible, leave natural corridors between and within the residential estates, especially around water ways and where old growth trees are established.

Responsible and involved bodies: EMBD

SOCIAL AND ECONOMIC IMPACTS OF RESIDENTIAL DEVELOPMENTS

The social and economic impacts of the planned residential developments on the Caroni (1975) Ltd. properties are largely positive and are part of the effort to meet the objectives of Vision 2020 to provide housing for 90,000 households by the year 2020. These impacts are outlined in Table 7.2.2 Social and Economic Impacts of Residential Development, and expanded below.

7.2.2 Social and Economic Impacts – Residential Development

CONCERNS	Impact Severity	SOCIO ECONOMIC IMPACT – Residential
Human Health		a. Exposure to harmful chemicals
		b. Improved living conditions
Social Inclusiveness		c. Neighborhood "adjustment period"
		d. Improved social networking and opportunities for community cohesiveness
		e. Improved access to social services (schools, daycare, clinics, etc.)
Cultural Heritage Landscape		f. Potential for community oriented landscaping (parks, green spaces etc.)
		g. Loss of "natural" landscapes
		h. Potential vacant lot syndromes, dumping
Economics		i. Construction sector employment
		j. Increase in infrastructural maintentacne employment
		k. Increase in personal capital investment
Material Assets		l. Improved infrastructure development
		m. Increased demand on existing infrastructural systems (road, water, electricity)
		n. Increased traffic and traffic congestion

Impact Severity color key	Red = High	Orange = Moderate	Yellow = Low	Green = Positive

HUMAN HEALTH:

a. Exposure to harmful chemicals - Low Severity

As noted in #2 for the Air Quality section above, during the construction process and the habitation of homes, when toxic chemicals are used in the building and finishing process, there can be issues of lingering outgassing, which can negatively impact human health in the short and long term.

Mitigation: When possible advise use of non-toxic chemicals in the construction process, and provide information to homeowners on the dangers of outgassing of chemicals.

Responsible and involved bodies: EMBD and EMA

b. Improved living conditions - Positive

The current housing crisis in Trinidad will be partially alleviated by the construction and settlement of residential estates going into the former Caroni (1975) Ltd. properties. As a result, the improved living conditions will contribute to an over allsense of wellbeing, reduction of crowding and improved household environments.

Enhancement: Provide residents of all new homes information on environmental stewardship for residents, including information on health through improved access to locally grown produce (including kitchen gardens), exercise, and access to healthcare facilities.

Responsible and involved bodies: EMBD

SOCIAL INCLUSIVENESS:

c. Neighborhood "adjustments period" - Severity Low

The new settlement of residential estates will entail establishment of new communities which can have some adjustment periods as neighbors become familiar with each other's daily routines and rituals. These adjustment periods can result in some degree of social tension, especially as communities are becoming established.

Mitigation: Provide support in establishing neighborhood councils to facilitate positive neighbor to neighbor relationships, and to assist community members to address common concerns and interests.

Responsible and involved bodies: EMBD, Local Police Authorities

d. Improved social networking and opportunities for community cohesiveness - Positive

As community members build and settle into new homes, there will be opportunities for increased social networking and opportunities for community cohesiveness that can strengthen the sense of belonging and ownership, and build social capital. This can lead to increased economic, social and cultural development opportunities and enhance quality of life for community residents. Though not guaranteed by any means, this potential can emerge especially if supported by local and national authorities, and providing mechanisms for mutually beneficial developments.

Enhancement: Provide areas for community members to interact, such as community centers, parks, playgrounds and play fields, green spaces, side walks, and common areas. Potentially provide support for community gardens and information on funding for community groups to access for specific projects, such as the Green Fund.

Responsible and involved bodies: EMBD

e. Improved access to social services (schools, daycare, clinics, etc.) - Positive

The Phase II Estates under the development of EMBD have included plans for social services for residents, including schools, daycare, clinics, shops, and other small commercial useage. The resulting access to social services, especially if developed

concurrently with the residential development, has the potential to increase the sense of community cohesion and strengthen the sense of social inclusiveness.

Enhancement: Actively recruit social service providers to establish businesses/clinics/schools in residential development sites during the construction phase, including possible incentives for early leases and construction. Make information about these services available to new and prospective residents.

Responsible and involved bodies: EMBD with Ministry of Health, Ministry of Education, and religious outreach organizations, and others.

CULTURAL HERITAGE AND LANDSCAPES:

f. Potential for community oriented landscaping (parks, green spaces etc.) - Positive

There is potential for communities to be strengthened through collaboration to establish and enjoy community oriented landscapes such as parks, green spaces, play fields, community centers, etc. Though historic landscapes are not generally protected the Trinidadian culture, there is a strong appreciation of the social infrastructure, and this can be a focus for new developments.

Enhancements: Access Green Fund and other means for funding that supports the development of landscaping for community use. Potentially collaborate with national, regional and international University's public planning programmes to develop projects for University students to populate, including landscape architecture.

Responsible and involved bodies: EMBD, Town and Country Planning, EMA, UTT, UWI

g. Loss of "natural" landscapes - Severity Low

Much of the land to be dedicated to EMBD Residential estates are former cane fields and are therefore not "natural" landscapes. However, when located near waterways or other natural structures, attention should be paid to minimize the loss of these sites, including small woodlands/forests, large trees and wetland areas.

Mitigation: When surveying areas to be developed for residential use and planning estates, actively work to incorporate natural landscape attributes into planning and implementation of the development schemes.

Responsible and involved bodies: EMBD, Town and Country Planning, EMA

h. Potential vacant lot syndromes, dumping - Severity High

There is a strong potential that vacant lots can become dumping grounds for waste from construction and other domestic wastes. This lowers property values, increases animosity within neighborhoods and lowers the sense of pride in neighbors, especially in newly established communities.

Mitigation: Provide waste disposal sites and recycling for each residential estate, monitor conditions for trash dumping, penalize offenders. Provide a 24 hour anonymous hotline for reporting of illegal dumping.

EMBD should include responsibility for lots, including dumping sites in planning, and in leases there should be clearly defined outlines to minimize wherever possible. Waste disposal facilities should be provided in every estate with clear lines of responsibility delineated for pick up and proper disposal.

Responsible and involved bodies: EMBD

ECONOMICS

i. Construction sector employment - Positive

The construction of 30 residential estates increases the demand for construction sector employment at a time when other areas of construction employment are expected to decline due to economic downturn and lower global oil prices. This includes all household construction, finishing and maintenance.

Enhancement: Consider use of environmentally beneficial building practices, and make information available to both building firms and to new home owners.

Responsible and involved bodies: EMBD

j. Increase in infrastructural maintenance employment - Positive

In addition to the rise in domestic construction employment, there will also be an expected increase in infrastructure maintenance employment for roadways, energy, water, sewerage, and gas. This employment will be long term and sustainable for skilled and semi-skilled workers.

Enhancement: Provide information and training on energy savings, water saving and environmental stewardship through employers.

Responsible and involved bodies: EMBD, Developers

k. Increase in personal capital investment - Positive

The increase in home ownership will increase the total national investment in personal capital, ideally increasing the long term economic stability of the country.

Enhancement: Provide investment incentives for households purchasing environmentally friendly, energy saving appliances.

Responsible and involved bodies: EMBD

MATERIAL ASSETS:

l. Improved infrastructure development - Positive

The material assets of the residential estates will improve as newer infrastructure is put into place. It is hoped that infrastructure problems which exist in older communities- such as outdated sewerage systems, leaking pipes, etc will not be an issue for these newer developments.

Enhancement: Take every possible opportunity to use best practices technologies.

Responsible and involved bodies: EMBD

m. Increase demand on existing infrastructural systems (road, water, electricity) - Severity Moderate

Though the new infrastructure can be expected to be an improvement on older more worn systems, many of the residential estates will be tied into the existing infrastructure which will increase the strain on already overloaded systems, such as the water and sewerage
Mitigation: provide routine updates on existing infrastructure to minimize losses where possible. Provide a 24 hour hotline for reporting of problems. EMBD, Ministry of Public Utilities

n. Increased traffic and traffic congestion - Severity Low

As new residential estates are populated, it will be important to work with traffic engineers to ensure public safety and to reduce traffic congestion.

Mitigation: Provide public transportation hubs for residential estates.

Responsible and involved bodies: EMBD, Town and Country Planning.

7.3 Analysis of Industrial Plans

The industrial activities that are planned for the Caroni (1975) Ltd. properties are under the authority of the NEC and E-Teck. The NEC Heavy Industrial and Mixed Use estates are on 3,500 acres near Brechin Castle, and the E-Teck Light Industrial Estates are on a total of 578 acres on six different estates on former Caroni (1975) Ltd. properties. The impacts and micro-level mitigation measures here are intended for both of these types of projects, unless otherwise specified.

Table 7.3.1 Environmental Impacts Industrial Development

CONCERNS	Impact Severity	ENVIRONMENTAL IMPACT – Industrial
Water		a. Increased flooding due to paving
		b. Contaminated surface & ground water
		c. Increase demand on water resources
Soil		d. Soil contamination due to spills
		e. Soil erosion in construction
		f. Decline in soil quality, increase silting due to construction
Air Quality		g. Increased emissions
		h. Increase particulate matter during construction
		i. Potential release of extremely hazardous noxious emissions
Climate Change		j. Loss of carbon sinks
		k. Increase use of energy and carbon emissions
Bio Diversity		l. Loss of indigenous flora and fauna and potential impacts on sensitive coastal estuaries
		m. Segmentation of species and loss habitats

Impact Severity color key	Red = High	Orange = Moderate	Yellow = Low	Green = Positive

WATER

a. Increased flooding due to paving - Severity High

The increase in paving of industrial sites will reduce the absorptive capacity of the land, and in heavy rainfall events there will be an increase in flooding. Many of the industrial sites are located in flood plain areas and as a result the increased severity of flooding events will be prone to impact these areas. E-Teck has a 20% unpaved policy and early plans for the NEC estates suggest that similar policies will apply. However, flooding of these areas, especially if the 20% of unpaved property is not located at lower grades, will contribute to the overall damage and stress on drainage structures.

Mitigation: Where possible, use swales[2] around paved sites to allow for aquifer recharge, and allow more than 20% to remain unpaved. Add buffers around all waterways with non-invasive indigenous plants on banks to reduce flooding. As possible and appropriate,

[2] swales are capture surface run off and send it into the aquifers, both nourishing soils and reducing erosion – see http://seaforttnas.blogspot.com/search?updated-max=2009-04-07T11%3A33%3A00-04%3A00&max-results=7

capture and channel waste water runoff to storage ponds to share with nearby agricultural users during dry seasons.

NEC and E-Teck should work closely with the Ministry of Public Works Drainage Department to identify best placement for swales and drainage sponges/green spaces. This should be done as early in the planning process as possible, and should include use of run off water for storage for agricultural sites if possible.

Responsible and involved bodies: NEC and E-Teck with Ministry of Public Works Drainage Department

b. Contaminated surface & ground water - Severity High

The increased likelihood of flooding accompanies the increased tendency that ground and surface waters will be contaminated by industrial effluents and as a result of aquifer contamination. This is similar to the challenges of surface and ground water contamination for residential developments, however in both the construction and operation phases in industrial development and operations the propensity toward use of more harmful effluents and toxic chemicals increases the risk of contaminants.

Mitigation: Use international best practices at all times. With EMA guidance develop accidental effluent discharge response protocols for all industrial sites. Identify highest risk areas for runoff and aquifer contamination and limit storage of harmful chemicals in these areas. Register all toxic chemicals used in all industrial processes with EMA. Provide safe disposal measures, and require these plans for all new incoming industries. For any chemicals always provide covered storage facilities that are secure from strong winds.

NEC and E-Teck in coordination with EMA should commission study to identify international best practices to be applied on all estates and should include compliance and guidance in all contracts for development on sites. Sensitive materials and hazardous material disposal methods and sites should be identified for all developers and users of the NEC and E-Teck sites.

Responsible and involved bodies: NEC and E-Teck with EMA

c. Increase demand on water resources - Severity High

The increase in industrial activities intended to diversify the economy of Trinidad will require additional fresh water resources. There may be plans for the installation of another desalinisation plant near Point Lisas by NEC, or expansion of the existing Point Lisas desalinisation plant to meet water demands. Use of water from WASA is anticipated to meet the immediate needs of industrial development in the region. The environmental impacts of this include increased salinity of the discharges, energy use for desalinisation, and withdrawals on an already overtaxed system for potable water.

Mitigation: For industrial use avoid discharges and excessive use by recycling/ reclaiming water whenever possible. Use international best practices. For cooling water, reuse/recycle water and minimize evaporation losses.

NEC and E-Teck should use best practices and water conservation measures for all future developments. Use of additional desalinization plants should only be used as a last resort due to the energy intensity of desalinization.

Responsible and involved bodies: NEC and E-Teck

SOIL:

d. Soil contamination due to spills - Severity High

As with any industrial activities there is a high potential for soil contamination through leaching and accidental spills of chemicals, including solvents, oils, paints, and other toxic industrial materials. This can create lasting hazardous wastes that have long-term impacts on soils and ability to use these brown fields after sites have been abandoned.

As with water quality contamination above, soil will also risk becoming contaminated due to runoff and industrial effluents. Soils, especially in green spaces and near water ways are especially vulnerable and will often hold toxins that bind to soil molecules. As a result, this contamination can become compounded over time.

Mitigation: Sample soils, especially in green spaces, to determine exposure to harmful chemicals. Plant a variety of non-invasive species that will absorb heavy metals, etc. to reduce soil contamination.

NEC, E-Teck and EMA should coordinate soil sampling prior to construction and as part of the best practices for enterprises. This soil sampling should be done in a manner that provides assurances to the people in surrounding areas that contamination is being minimized wherever possible.

Responsible and involved bodies: NEC, E-Teck, with support of EMA

e. Soil Erosion in construction - Severity High

The exposure of soils to wind and rain during land clearing can lead to high rates of erosion. The loss of the soils diminishes fertility and increases silting in rivers, streams and tributaries, as well as contributing to the clogging of drainage ditches that can increase severity of flooding.

Mitigation: Implement erosion control measures during initial clearing and construction phases, including cloth screens, straw/hay bales, or planting of grasses on exposed areas.

NEC and E-Teck should develop standards to mitigate erosion of soils during construction including outlines for all prevention measures and all types of erosion (wind, rain, wear), and require adherence to these by all developers in the construction process.

Responsible and involved bodies: E-Teck and NEC

f. Decline in soil quality, increase silting due to construction – Severity Moderate
The loss of soil surface area from agricultural to industrial land use results in a lack of absorption of water and aquifer recharge during rain and flooding events. The soils that remain will therefore be more exposed to chemicals and high density flooding events, which leads to a decline in the overall soil quality and increased silting due to erosion.

Mitigation: For remaining soils, plant species that will support the soil structure, increase roots to hold soils and provide backfilled swales to improve aquifer recharge.

Responsible and involved bodies: E-Teck and NEC, Department of Drainage, Ministry of Public Works and Utilities

AIR QUALITY:
g. Increased emissions - Severity High
The increased development of the industrial sector will inevitably result in an increase in emissions. While steps may be taken to reduce noxious emissions, the air quality over all will decline. In the Point Lisas, area air quality is already under threat due to the strong concentration of heavy industry. The addition of new heavy industry, including a steel mill, polyethylene plant, and other chemical plants will add to this concentration and is currently under review by the EMA to determine if this will be exceed the legal limits for air pollution.

The emissions from light industry will also have a cumulative impact on the air quality, depending on the type of light industry being developed. For the manufacture of automotive paints, pressing of aluminum, and other such manufacturing, emissions can be expected to be high and will require careful regulation for human and public health. If sites are used for product assembly, food processing, or recycling, the emissions will be significantly lower.

Mitigation: For heavy industry, follow international best practices to reduce emissions for all aspects of manufacturing, and follow citing regulations established by the Ministry of Housing, Planning and the Environment. For light industries, carefully monitor air quality in all industrial sites and when possible segregate industries with higher emissions from those which are more labor intensive and/or producing food products. In all cases, efforts should be made to minimize emissions using scrubbers and best available technologies whenever possible.

Monitoring should be coordinated through EMA and support by NEC and E-Teck. Any violation of standards should be strictly and quickly dealt with and emissions rates should be clearly spelled out for all CECs and leases.

Responsible and involved bodies: NEC, E-Teck, MPHE, EMA

h. Increase particulate matter during construction - Severity Moderate
The disturbances of soil during clearing and construction can result in increased dust and particulate matter. This can create a public nuisance and potentially impact nearby neighborhoods.

Mitigation: During the dry season, if dust becomes problematic, spray areas being graded with grey water to minimize dust.

Responsible and involved bodies: NEC, E-Teck

i. Potential release of extremely hazardous noxious emissions - Severity High
The use of extremely toxic chemicals in the manufacturing process has a high level of potential for severe impacts on the environment. Accidental discharges of these chemicals can have very severe impacts on the health of the local populations, and the ecosystem as a whole. Though it is not anticipated that this will be an issue, it is critical that emergency measures are put into place, including notification of authorities, local populations, and emergency response to reduce the short, medium and long term impacts of such an accident.

Mitigation: Develop emergency preparedness and response measures, including informing local communities and authorities of potential emissions events and emergency response measures.

EMA, with clear and continued support from NEC and E-Teck should provide monitoring of all emissions for all industrial site leasees in accordance with CECs and EIA compliance. In the event that extremely hazardous emissions may be released, the EMA should be notified by NEC and/or E-Teck and all measures recommended by EMA should be enforced by NEC and E-Teck as property leasors.

Responsible and involved bodies: NEC, E-Teck, EMA, All industrial site leasees

CLIMATE CHANGE:
j. Loss of carbon sinks – Severity Moderate
Cane serves as an excellent sink for carbon sequestration, and the non-agricultural use of land for other purposes decreases the over all carbon absorption for the country. The loss of the cane acreage to industrial use indicates a net loss of carbon absorption capacity for the country.

Mitigation: In areas in and around industrial estates plant native, non-invasive trees and other native, non-invasive flora species with high carbon absorption rate to offset some of the losses from cane. In green spaces, where possible use both grass and tree crops.

Responsible and involved bodies: NEC, E-teck, UWI/UTT to advise on species

k. Increase use of energy and increased carbon emissions - Severity High

The industrial use of these lands also will increase carbon emissions through increased net energy consumption for industrial purposes. The high level of energy consumption, though using natural gas supplies is less impactful than using oil or coal, will still result in a higher carbon emission rate for the country. The outcome is a notable increase in carbon emissions over all, especially as land use patterns that formerly absorbed carbon are replaced.

Mitigation: For all new industrial sites, provide significant incentives for using energy saving/carbon reducing measures and international best practices. Where ever possible capture carbon emissions emitted by energy generation or from industrial purposes. For non-industrial needs at industrial sites use alternate sources of energy, including solar and wind. For industrial sites under cover, use translucent roofing to minimize the need to lighting during daylight hours.

NEC and E-Teck should include guidelines for this in their best practices guidelines for all leasers and should strongly encourage compliance. Incentives for lower carbon emissions should be provided to leasors and highly publicized by NEC and E-Teck.

Responsible and involved bodies: NEC, E-Teck

BIODIVERSITY

l. Loss of indigenous flora and fauna and potential impacts on sensitive coastal estuaries - Severity High

The construction of industrial estates on former cane lands should not significantly impact indigenous flora and fauna with the exception of those species that have established themselves within these areas since the closing of the Caroni (1975) Ltd. activities. As a result, it can be expected that if there are such indigenous species that have established themselves within 3-5 years, they are substantially robust and as they would be able to establish themselves elsewhere are not a part of threatened populations.

The construction of the NEC properties adjacent to Point Lisas includes plans for construction of a finger port facility in Claxton Bay. This is not directly on the Caroni (1975) Ltd. properties, but it is contiguous and the construction on the former Caroni (1975) Ltd. lands necessitates the construction of the port. NEC currently plans to build the port so that it extends out into the bay to minimize impacts on the coastal ecology, including sensitive mangroves. These mangroves and neighboring estuaries are critical for the development of crustaceans that are responsible for the bright coloring of the Scarlet Ibis. If these mangroves are not protected, there may be a loss of the brilliant colors of this bird, which is a source of significant pride to Trinidad and Tobago.

This construction will result in a 50m corridor being built through mangroves and NEC states that they will make mitigation efforts to replant mangroves and avoid disturbances as much as possible. The ecological, habitat and biodiversity ramifications of construction are under consideration by the EMA, and are being closely monitored by local communities dependent on fishing in Claxton Bay, as well as by the Institute for

Marine Affairs. One issue that should be considered for the port is that it may act as an artificial reef that could increase habitat for some species in the bay.

Mitigation: Avoid disturbing areas with natural growth, trees and near waterways as much as possible during construction and development of residential estates. For the Claxton Bay Port, mitigation efforts should minimize disruption to sensitive areas during construction, and work with coastal habitat experts to improve the coastal ecosystems after construction, through increased mangrove planting, possibly using mangroves or other coastal flora along the bridgeway to the port facility, and designing port facilities to mimic coastal and reef structures to increase habitats for marine species.

Responsible and involved bodies: E-Teck, NEC, EMA, IMA

m. Segmentation of species and loss habitats - Severity Low
The increase in human settlements in formerly agricultural areas has the potential to divide populations of some species resulting in a decrease in the genetic diversity. This can lead to a reduction in the long term survival of species. Additionally, the loss of habitat can have negative impacts on some that have recently resettled the former cane lands. However as noted these species are expected to be relatively robust if they are already reestablished in an area that was under monoculture and routinely sprayed with a high amount of pesticide.

Mitigation: When possible, leave natural corridors between and within the industrial estates, especially around water ways, and where old growth trees are established.

Responsible and involved bodies: NEC, E-Teck EMA to advise.

Table 7.3.2 Social and Economic Impacts of Industrial Development

CONCERNS	Impact Severity	SOCIAL AND ECONOMIC IMPACT – Industrial
Human Health		a. Exposure to harmful chemicals
		b. Noise pollution during construction and operation
Social Inclusiveness		c. Increased workforce opportunities
Cultural Heritage Landscape		d. Potential damage to coastal landscapes
Economics		e. Improved GDP Stability and employment opportunities
		f. Strengthened industrial enterprises
		g. Loss of income from fisheries
Material Assets		h. Increase demands of existing and new infrastructure - roads, water, power

Impact Severity color key	Red = High	Orange = Moderate	Yellow = Low	Green = Positive

HUMAN HEALTH

a. Exposure to harmful chemicals- Severity High

The increased industrial sector has the potential to increase human exposure to toxic substances through regular contact and accidental releases. The human health impacts over prolonged exposure or through brief, intense doses of toxins will require that all safely measures are taken and that the neighboring communities are protected as much as possible.

Mitigation: Establishment of clear toxin management strategies to minimize human health impacts, development of community warning systems, including evacuation plans for implementation in the event of a significant accident. See above outlined recommendations for mitigation above in Noxious and Harmful Emmissions.

Responsible and involved bodies: NEC, E-Teck, local Authorities, EMA, Toxins Management Board

b. Noise pollution during construction and operation- Severity Moderate

The noise pollution problems for incoming industrial development will impact local neighborhoods and communities. The construction and operation phases are expected to have some level of noise disturbance that will be addressed in the CEC/EIA phase of project evaluation and permitting. Whenever possible efforts should be made to reduce excess noise, and work should take place only during daylight hours to avoid disturbing households.

Mitigation: Only work during daylight hours, in the event that long term operational noise is a problem, establish buffers and siting that minimizes disturbances to communities and households.

Responsible and involved bodies: NEC, E-Teck, EMA

SOCIAL INCLUSIVENESS

c. Increased workforce opportunities - Positive

The increase in workforce opportunities resulting from industrial development has the benefit of establishing mechanisms for people to come together and to work together, increasing the sense of social belonging and self identification. Orchestrated shift work and workplace teaming can result in increasing social bonds among workers.

Enhancement: Provide opportunities for workers to develop group activities through the placement of social infrastructure within or around the industrial sites.

Responsible and involved bodies: NEC, E-Teck

CULTURAL HERITAGE AND LANDSCAPES

d. Potential damage to coastal landscapes – Severity High

As noted above in the Biodiversity section, the potential construction of a finger port into Claxton Bay has the potential to significantly disrupt the local landscape, including a fishing village next to the bay. The construction of the port, while not on former Caroni (1975) Ltd. properties is dependent on approval of additional industries planned for the NEC properties next to Point Lisas. As a result, if the development on these properties goes forward, there will be significant alteration to the coastal zone of Claxton Bay, including impacts on the fisheries and residential neighborhoods there.

Mitigation: Work closely with community and IMA to minimize negative impacts and work to improve the conditions for fishermen in the Claxton Bay communities, including mangrove restoration, wetland enhancement, and possibly NEC purchases of private properties within the Caroni Swamp Ramsar Wetlands with conservation easements to stop any potential development in this protected area. The net result could be the improvement to the over all health of the west coast marine and coastal ecosystem. This is in line with Vision 2020 Industrial Development Strategy for minimizing impacts of industrial development on the local ecosystems referenced in the policy and institutional framework of this document. This would also contribute to the support of food sources for the Scarlet Ibis.

Responsible and involved bodies: NEC, IMA, EMA

ECONOMICS

e. Improved GDP stability and employment opportunities - Positive

In keeping with the objective of Vision 2020 there is a noted increase in employment opportunities with the expansion of the light and heavy industrial sectors. This calls for increases in skilled and semi-skilled labor, increasing the overall capacity for the country's workforce. Unemployment rates have been quite low in 2008, measuring 4.2% nationally and theer is an overall shortage in labor. The global economic decline in 2009 and drop in oil prices has driven unemployment up and estimates are as high as 10% for 2009. As a result of the diversification of the economy from the oil sector, and an increase in use of natural resources for added value products, the potential for economic development of the industrial sector and the improvement of employment opportunities are quite promising.

Enhancement: Within the selection and training of new employees, select workers who have experience in similar jobs, and provide training in environmentally sound industrial practices focusing on international best practices.

Responsible and involved bodies: NEC, E-Teck

f. Strengthened industrial enterprises - Positive

The emphasis on industrial enterprises and allotment of state lands to industrial estates enables the strengthening of a wide array of industrial activities and incentives for development of entrepreneurship within the country. This is a clear objective of Vision 2020. While there are environmental concerns from this level of development, the social and economic benefits are quite tangible.

Enhancement: Apply international best practice to industrial development. Provide incentives for environmentally friendly, sustainable industries that will enhance the natural ecosystem of Trinidad and Tobago.

Responsible and involved bodies: NEC, E-Teck

g. Loss of income from fisheries – Severity Low

The potential loss of fisheries in Claxton Bay as a result of the pending port construction could have a concentrated economic impact on local populations who fish these waters. The community has significant reservations about the building of the port and the accompanying industries. The long-term impact on fisheries could be reduced by environmentally sound port construction and management practices.

Mitigation: Work with IMA and local communities to minimize the impacts on fisheries, including mangrove offsetting and economic compensation for short term losses until fisheries are reestablished. Possibly provide support for community aquaculture project in impacted coastal communities.

Responsible and involved bodies: NEC, IMA, EMA

MATERIAL ASSETS:

h. Increase demands of existing and new infrastructure - roads, water, power - Severity Low

The construction of industrial estates will increase demands on existing infrastructure, including roadways, power, and water resources. This can lead to an increase in the cost of materials and goods as demand rises, concurrently with other infrastructure expansion for residential and other industrial estates.

Mitigation: Through conscientious planning efforts and coordination it will be possible to mitigate resource demands and to provide improvements and strengthening of infrastructure for long term resource use, and to minimize losses of limited resources.

Responsible and involved bodies: NEC, ETeck, WASA

8 Mitigation or optimising measures

The environmental and socioeconomic impacts and effects of the development of alternative agricultural, residential and industrial uses of the former Caroni (1975) Ltd. properties are outlined in the previous section with specific mitigation and enhancement measures recommended in response to each impact and effect. Suggested responsible bodies are also included within that analysis of the alternatives.

The larger sectoral issues that also will provide support to these measures and macro level recommendations are presented here. These are intended to be complementary to the measures recommended in previous sections, but may also stand alone to strengthen the further strengthen the environmental stability of the former Caroni (1975) Ltd. properties.

For each mitigation and optimizing measure here, a summary of the option is presented and summarized. The reason for taking the measure is outlined as an optimizing or mitigation effort. The benefits of implementing the measure as well as the potential costs of not taking these steps is outlined to inform decision makers. Recommendations for potential responsible parties with organizations to involve are also provided.

8.1 Agriculture Development

The challenges encountered during the development of two acre and mega farms on the properties of Caroni (1975) Limited should be perceived as opportunities to develop creative ways of amending the fledgling agricultural sector of Trinidad and Tobago. In attempting to capture the extent to which the agricultural component impacts the environmental and socio-economic elements of the SEA in dealing with the transformation from sugarcane production to two acre plots and mega farms, a three pronged approach was adapted, which categorizes the impact into micro, intermediary and macro levels. The mitigation and optimization measures at the micro level are adressed for each issue identified during the analysis of the individual alternatives. These measures may be implemented at the farm level and are presented in section 6.1. The intermediate and macro levels address mitigation and optimization measures that are broad based, and may require interventions at the private institutional and public sector levels respectively. This section focuses on providing the relevant adjustment measures at both the intermediary and macro levels. In all recommendations, local, regional and international study tours would be extremely beneficial in examining how this has been done successfully in other cases so that the knowledge can be cumulative and expanding rather than requiring investment in time for initial conceptualization.

Concerted Soil Remediation and Water Retention Management Scheme

Due to the history of low fertility and high level of acidity widespread soil testing is required at Caroni (1975) Ltd properties in order to determine appropriate remedial measures and to select the crop best suited to the soil types. These soils are predominantly heavy clays that hold excessive moisture when wet and get very hard when dry. Maintaining adequate moisture retention, conducive for optimal crop growth is

usually a challenge when working with these soils. The use of lime to improve soil fertility is commonplace in the Caroni area but this can prove to be very costly as the soils continue to show high acidity levels.

Since more than 60% of the Caroni (1975) Ltd's lands are allocated for agricultural activities composting and commercial production of organic manure may be a viable option for soil remediation within the Caroni area. It is anticipated that the two acre and mega farms will generate a large volume of waste, which may be utilized for large scale production of organic manure. Commercial production of organic manure will provide a consistent and abundant supply of alternative fertilizers for the 2,263 acres of mega farms and the over 20,000 acres of small farms proposed for the Caroni (1975) Limited property. This could help promote sustainable agriculture throughout Trinidad and Tobago since other farmers may also benefit from such a facility.

Application: The production process of the organic manure will include the use of vermiculture. This involves the use of earthworms to process biodegradable materials into organic manure. Consideration should be given to the utilization of local earthworms in process in order to minimise the risk of introducing invasive species to the local ecosystem. Study tours to farms in other tropical countries doing similar soil remediation efforts would be useful, as would visits to local farms in Trinidad which are doing this on a smaller scale.

Benefits: Using organic manure to remediate the soils will improve soil pH and increase fertility while improving the structure and texture of the soils. It is a sustainable and environmentally friendly practice that forms the basis for organic farming.

Costs if not done: The cost for not engaging in commercial production of organic manure includes continued widespread deterioration of soils, cost to import material for soil amelioration and increased use of chemical fertiliser. The GoRTT may have to bear the cost of investments to restore soil fertility to a reasonable level.

Responsible and involved parties: Commercial production of organic manure may be a private venture, where a potion of the Caroni (1975) Limited land is leased to a private investor for such a purpose. Institutions such as the local universities (UWI and UTT), the Caribbean Agriculture Research and Development Institute (CARDI) and the Inter-American Institute for Cooperation on Agriculture (IICA) are relevant stakeholders to inform the process through research and the sharing of useful experiences.

Sustainable Agriculture and Environment Education Programme at all Levels

The challenges that exist with the development of the agriculture on the properties of Caroni (1975) Limited offer many opportunities for teaching and learning sustainable agriculture at all levels. Students may be exposed to science and business approaches to agriculture through active engagement. One way to engage students at the junior and primary levels of education in agriculture is through the concept of establishing edible

school yards. In principle, the student with the guidance of staff and local farmers will establish school gardens where they are engaged at all stages. The garden will be adapted to instructional strategies for a variety of subject matter. Students will be allowed to harvest the produce as well and prepare it for their own consumption. They will be involved in the marketing process where necessary.

The establishment of a Sustainable Agribusiness Faculty at the university level is proposed as a mitigating strategy to the lack of motivation of youth towards agriculture and the need to enhance the level of engagement in environmental development activities. The intention is to rebrand agriculture by replacing the perpetual negative image with more positive and profitable ventures. Thus establishing a Sustainable Agribusiness programme at the University level should be a relatively low cost positive step.

The philosophy of such a programme is premised on the need to establish a strong entrepreneurial spirit, social and environmental awareness, and technical and scientific knowledge. Adapting an inclusive and diversified pedagogical approach will provide a sound education while inculcating critical thinking among professionals who are creative, thoughtful and innovative in the pursuit of their quest for strategic development, particularly in cocoa production.

Application: Elements of the proposed University Model include allocation of 2100 acres of the remaining unassigned Caroni land to the programme for establishment of enterprises, housing and facilities for training; 2000 acres will be used to establish the farm lab (variety of commodities); 100 acres will be dedicated for building and infrastructure; Government and other stakeholders will assist the University in creating relevant infrastructure, initial land preparation and crop and livestock establishment; matriculate 100 eligible students per batch (recruitment will be based on a demonstrable interest in agribusiness, with a particular interest in managing a farm enterprise); each student will be assigned full responsibility for a specific lot over the 4 years of the degree programme (they will be assigned technical assistance which will reduce progressively as they advance in their training); each batch of students will collectively assume the functional role of a cooperative during the operation of their two acre plot (to include sharing labour, acquisition of resources and marketing); could consider different types of cooperatives within the structure for pedagogical purposes; students' engagement will span the entire supply chain of a choice production in Trinidad and Tobago, which will include land preparation, planting and establishment, crop maintenance, harvesting, post harvest handling, processing, value added (manufacturing of product) and marketing; success in the program will be binding to the efficient operation of an enterprise and students will need to make a profit in order to graduate with a degree; the operation will adopt an organic type of farming. No inorganic approach will be accommodated since the intention is to establish 2000 acres of sustainable agricultural enterprise at the training institution in the long run; within the teaching model students will also be assigned a school with an "edible schoolyard" program to mentor and over see, and will be required study agricultural education as a part of their curriculum. Coordination with other universities throughout the region and internationally which already have these types of

programmes could encourage cross fertilization of ideas and study opportunities for students and faculty.

Benefits: Increased long term interest in agriculture, revitalization of agricultural sector in current and future generations, increased knowledge sharing at local and regional levels, increased use of land and resources for short and long term food security, increased entrepreneurial opportunities for citizens, increased agricultural self sufficiency.

Costs if not done: continued low interest in agricultural sector in Trinidad, and decline in farming population, lack of farm labor and decline in agricultural management, loss of current capacity for self sufficiency, increased vulnerability to food scarcity.

Responsible and involved bodies: Establishment of a central body with responsibility for agricultural research and training at the intermediate level, under UWI or UTT; MALMR, Ministry of Education, Ministry of Youth and Sports; 4-H organizations; civic organizations, TTABA, CARDI

Mitigating Socio Economic Impact - Farmers cooperatives

The establishment of farmers' cooperatives or community associations represents an important socio-economic measure to support strong social inclusiveness among the small and commercial farmers that will be occupying the Caroni (1975) Ltd property. By dealing with collective groups of farmers, more efficient methods may be employed to train a large number of farmers with limited knowledge and expertise in agriculture. Farmers' cooperatives offer an opportunity to benefit from economies of scale and will promote entrepreneurship. It also creates an environment that is conducive for farmers to add value to certain commodities. Such a farming entity lends itself to mechanization, thereby reducing the need for manual labour.

Application: Current efforts by Caroni (1975) Limited and TTABA to establish cooperatives are encouraging. Caroni could focus on the establishment of a production-based cooperative while the TTABA continues to focus on establishing a marketing cooperative. To be successful the two organizations need to operate synergistically towards a common goal. Examination of other similar case studies, both successes and challenges would be beneficial and could enable serious pitfalls to be avoided. Organization of study tours would enable the implementing organizations to build on the cumulative experience of similar endeavours.

Benefits: Increased short term food production, increased use of land resources, increased income within 5 years for former Caroni (1975) Ltd. workers who are current lease holders on the properties, ability to serve as a catalyst to revive agricultural sectors, ability to use sustainable agricultural activities from the start of the effort, ability to grow produce with minimal agro chemical application, ability to make infrastructural adjustments (such as retention and irrigation ponds) to lots without costs to farmers, over all increase in food security.

Costs if not done: Continued low interest in the agricultural sector in Trinidad, and aging of farming population, lack of farm labor and decline in agricultural management, unproductive lands, increased dumping, social unrest due to restrictions on properties, continued importation of large quantities of produce, loss of entrepreneurial opportunities, loss of current capacity for national self sufficiency, increased vulnerability to food scarcity.

Responsible and Involved Parties: Caroni (1975) Ltd., Such processes may attract resources from important stakeholders such as MALMR, Inter-American Institute for cooperation on agriculture, Caribbean Agricultural Research & Development Institute and various agricultural societies, extension services of the MALMR should collaborate with UWI, CARDI, etc. to keep abreast of new technologies; empower farmers to be sources for information and support among themselves.

Social Marketing Campaign for Local Produce

The overall sense among consumers in Trinidad seems to be that the local produce is often laden with agrochemicals and may not be safe to eat, based on informal polling. The importation of large amounts of food, including produce, increases food costs and decreases the affordability of produce in the country. For locally grown produce there is a significant image problem in terms of commercial viability. Therefore in conjunction with the above-mentioned strategies, there should be a concerted social marketing campaign that increases the awareness of new healthier crops, emphasizes the benefits of eating local produce and showcases sustainable agriculture practices used for these crops.

Application: Relying on local and regional marketing firms, work to design a multi-pronged approach to advocating the multiple benefits of consuming local produce, including personal health benefits, benefits to environment, benefits to the national economy, nutritious fresh produce for young minds and bodies, fresh local produce and weight loss benefits, etc.

Benefits: Improved consumption and demand for local produce, increased status of agricultural sector, decreased carbon footprint for imported foods, increased environmental sustainability with demand for organic foods, increased public health, increased economic diversification.

Costs if not done: Potential lack of consumer enthusiasm for local produce, including continued competition with imported foods, potential market congestion, frustration and lack of profits among producers, lack of continued interest in agriculture in Trinidad among domestic and international investors.

Responsible and involved parties: MALMR, Caroni (1975) Ltd. Cooperatives, Mega Farms, advertising firms, private farmers associations, TTABA, CARDI, UWI/UTT

8.2 Residential Development

Increased mixed use, high occupancy dwellings with enhanced green space surroundings, enhanced social infrastructure and long term responsibility assigned for maintenance

Phase I of the EMBD residential estates are single house lots with minimal social infrastructure and green space allotment. The impacts of this type of development on both environmental and social structures are outlined in Section 7.2. The Phase II EMBD Residential Estates have a higher rate of mixed use spaces, including some green spaces, parks, some high density housing units, schools, and day care centers. This planning scheme will enhance both the social and environmental benefits of new neighborhoods and serve to improve community cohesiveness. In subsequent phases of estate planning, increased green spaces, including spaces for large community gatherings, community centers, more play/sports fields and recycling centers may be considered. The development of higher density housing options opens spaces up in the estates for additional social infrastructure and green spaces.

Planners are working to realize these ideals and study tours of regional and international planned communities may enable them to more fully realize the challenges and benefits, as well as implementation of these planning schemes. Examination of how managed living spaces can improve community cohesiveness, reduce crime and benefit the environment should be explored for study tour targets.

Within the study tours and planning schemes, efforts should be made to clearly determine long term responsibility for upkeep and maintenance of the infrastructure of communities, including the greenspace, play fields and other shared spaces. Ideally a Community Management Organization/Home Owners Association could be commissioned for each estate that would take on this responsibility, though this will require support from either the estate residents or the state.

Reasons: Improved neighborhood amenities will increase a communal sense of pride, ownership and belonging. Environmental measures will improve the long term health of communities, and can reduce costly damage to infrastructure from flooding events and reduce impacts of droughts. Current developments in community design and planning provide excellent opportunities to develop state of the art developments that focus on sustainable homes and neighborhoods in a concerted, conscientious manner. There is the potential to set the new standard for sustainable communities across the country and the Caribbean region.

Potential Benefits: stronger community investments, healthier residents, minimized costs of infrastructure repairs, increased social capital, and increased sense of belonging among residents.

Potential Costs if not done: potential problems for communities without social infrastructure, lack of a sense of ownership, increased turnover in residents, increased

potential for damage to infrastructure, decline in neighborhood quality, increase in need for policing.

Potential Responsible Parties: EMBD and eventually give responsibility to Community Management Organization.

Organizations to be involved: EMBD, Town and Country Planning, Environmental Planning, WASA, Public Works and Utilities, EMA, Waste management authority, Ministry of Youth and Sports, residential groups, Estate Homeowners Association

Develop a new home owners' guide book for environmental stewardship and savings
New homeowners of the lots on the residential estates are required to submit building plans to the division of Town and Country Planning, to ensure that they are in compliance with local zoning rules. There are also requirements for building specifications outlined in the lease agreements from EMBD that provide stipulations for building. Local builders, new home owners and those subsidizing mortgages may not be focusing on how to build in ways that optimize the environmental sustainability of these new structures and homes. A new homeowner's guidebook should be produced that addresses how to build in an environmentally friendly manner that can reduce costs in the long and short terms. The topics covered include the costs of energy saving measures using natural lighting, and cooling; how to build to reduce heat, improve air flow, reduce energy demand, improve internal air quality: guides for high efficiency appliances and lighting including dealers in Trinidad; steps for conserving potable water, and benefits of rain barrels/cisterns; how to reduce exposure to toxic chemicals; how to reuse, reduce and recycle materials ; how to reduce greenhouse gases; gardening and landscaping for long term health and beauty; and sources of additional information including local and regional organizations, web pages and a bibliography. This guidebook could also provide information on local community development resources, emergency phone numbers and information sources for builders, appliance dealers, retailers, recycling centers, etc. Potentially offer low cost energy efficient appliances, or incentives for purchase through reduced import taxes.

Reason: Current information on environmentally friendly building and sustainable housing has not been developed or made widely accessible to residents of Trinidad. Providing simple, cost effective measures to reduce environmental impacts, save energy and water and increase long term sustainability that can be adopted in the building and settlement phases of homes are more likely to be adopted and sustained over the long term as residents adapt to new surroundings and routines.

*Benefi*t: Provide information to all new homeowners at relatively low cost that can reduce human impacts on environment, will improve public health, and increase the sense of responsibility for environment, while empowering people to take small steps with large benefits.

Potential costs if not done: Continuation of building practices and household management that does not efficiently use limited energy and water resources and are

more susceptible to natural disasters, faster depletion of natural resources, increased obsolescent utilities, increased landfill/dump use, lower household incomes, decreased economic growth in the long term.

Potential Responsible Party: EMBD

Organizations to be involved: EMBD, Town and Country Planning, Environmental Planning, WASA, Public Works and Utilities, EMA, Waste management authority, UTT/UWI Planning, design and technology departments, Ministry of Trade and Industry (import taxes)

Institutionalized access to Green Fund for local/individual kitchen, community gardens, and park developments

The recent food crisis left many in Trinidad and Tobago concerned about access to food in the event of future shortages. The EMBD lots are not large enough for a full scale household garden, however there is room for smaller and very productive kitchen gardens. Additionally, if unclaimed lots exist in the estates, it is possible that these could be used for community gardens or additional park spaces. The newly institutionalized Green Fund under the management of the Ministry of Planning, Housing, and the Environment could provide a funding source for these activities, including information on how to organize a community garden, how to protect from preadial larceny, how to establish kitchen gardens in communities, how to preserve foods, and how to access additional funding.

Reason: Often a small amount of seed money is needed to initiate community organization and cooperation. By providing information on how to set up kitchen gardens and community gardens in shared spaces, the MPHE can be supporting the economic sustainability of communities through providing healthy locally produced foods.

Benefits: Access to the Green Fund increases exposure of the fund, and demonstrates government commitment to improving the local environment of Trinidad in a very tangible way for residents and local communities. Improved health of residents, and improved environmental conditions are additional benefits.

Costs if not done: Green Fund remains less known, kitchen and community gardens may not be developed, lower food security.

Potential Responsible Bodies: EMBD and MPHE Green Fund

Organizations Involved: EMBD, MPHE Green Fund, Community organizations, extension services, 4H, MALMR outreach, schools, civic organizations

8.3 Industrial Development

Enhanced use of Best Available Technologies (BATs), including citing of industry for all new industries

Advancements in industrial technology feature state of the art engineering that reduces waste, increases safety and uses energy more efficiently. Older generation industry does not share these benefits and can result in excessive wastes, less safe operations, and higher energy costs. Though Trinidad is blessed with an abundant supply of energy resources, the petroleum-based energy is nonetheless limited. Therefore to be more energy efficient and prolong the life of new plants, using the best available technologies should be advocated strongly. Additionally, newer plant designs reduce wastes because of the increased costs of "disposable materials" (which are excess "wastes") and increase the requirements for cleaner technologies. Newer plant designs also have the most up to date technologies to prevent accidents and have redundancy systems engineered into the operations system, thereby protecting the local population and ecosystems by implementing steps to avoid accidental discharge of hazardous substances.

The new industrial sites for both E-Teck and NEC have the advantageous attribute of being owned by the state. The government, in the effort to reach developed nation status has the authority to provide incentives to any new industries for the use of proven BATs, and to reward these companies for using these. Wherever possible apply incentives in leasing agreements, import subsidies and other benefits to encourage the use of BATs throughout the country and specifically on the Caroni (1975) Ltd. properties. While this will not mitigate all damage done to the environment in the switch from cane to other uses, it sets a precedent for stronger environmental management and may attract a more committed, advanced sort of investor to the country.

Reasons: To improve industrial processes in Trinidad, to improve energy efficiency of industries and extend duration of energy supplies in the long term, to reduce wastes, to improve public health, to attract new business to Trinidad and encourage local innovation.

Benefits: Improved ecosystem health, extended life of energy supplies and increased energy efficiency, less wastes to deal with either on the island or for export, improved opportunities for public health, improved reputation of Trinidad and Tobago as a leader in BATs for industrial development for light and heavy industries.

Costs of not implementing: Potential for increased use of petroleum resources for decreased numbers of units produced, increased costs for repairs, increased costs due to pollutants, increased costs for waste storage, transportation, and storage. Much higher costs for mitigation and remediation in the event of an accident. Increased externalities from industrial production.

Potential Responsible Parties: Ministry of Trade and Industry/E-Teck, and Ministry of Energy/ NEC

Organizations involved: MOTI/E-Teck, Min. of Energy/NEC, UTT, UWI, EMA, International Industrial Environmental Engineering organizations

Develop state-of-the-art mixed-use industrial estates with significant green buffer zones to all water ways

The development of industrial estates has the potential to showcase the state of the art planning that highlights local environment with industrial development. The use of green spaces, buffer zones, natural areas and strategic protection of waterways can be practical as well as attractive for these new industrial estates under development. The use of ponds for water retention and to reduce flooding severity can also provide micro habitats for wildlife. The use of green spaces to buffer communities from the noise and bustle of an industrial site can serve to reduce wind erosion, to protect industrial sites from storms, and can improve the over all ambiance of the area. Within the drawings for both the NEC and E-Teck Estates there are plans for mixed uses, including a small restaurant complex in the E-Teck Estates to reduce traffic, and for workers to be able to have amenities close by. These also include walking trails, and potentially sport fields for workers for off hours recreation. The NEC plans for the area around Brechin Castle are significant, and include large industry, light supplemental industry, residential, recreational, commercial and potential university uses. This integrated use plan shows forethought for ambiance and industrial use. There is room for additional environmental amenities, including additional linked ponds which could be used as irrigation ponds for neighboring agricultural sites and reduce impact of flooding. Broader buffers for rivers and streams would minimize impacts of flooding on industrial and residential areas allowing for higher absorption and aquifer recharge. These areas could be used for trails and parks, which would improve the over all social infrastructure as well, by providing local workers and residents places to enjoy the natural beauty of the area. The effort to do this may include study tours of areas where this sort of mixed use, environmentally friendly industrial estates are being developed currently in Europe and Latin America for planners and those implementing the plans to see what ideas could be transferred to these areas.

Reason: To reduce severity of the impact of flooding, to improve the over all ambiance of the area, to provide local agriculture with water from retention ponds in the dry season, to showcase state of the art industrial parts and planning, to improve social infrastructure.

Benefits: Enables E-Teck and NEC to showcase themselves as nation, regional and international leaders in industrial estate planning, improved water management, improved relations with neighboring communities, improved health of workers.

Potential Costs if not done: Increased flooding and increased severity of flooding, increased damage to environment and surrounding environments including sensitive wetlands, lack of good will and potential noise, traffic and pollution disturbances with neighboring communities, loss of opportunity to showcase environmentally proactive industrial development in Caribbean.

Potential Responsible Bodies: Ministry of Energy/NEC and Ministry of Trade and Industry/E-Teck, Ministry of Planning, Housing and Environment to advise.

Organizations Involved: Ministry of Energy/NEC and Ministry of Trade and Industry/E-Teck, Ministry of Planning, Housing and Environment to advise, UTT/UWI, Local Communities.

Consult with local stakeholders to enhance the social support for projects early on and incorporate their suggestions into project design (social infrastructure)
Changing a local land use pattern can result in significant resistance from neighboring communities, especially when the Not In My Back Yard (NIMBY) mentality sets in and becomes pervasive. The placement of industrial estates on former cane lands is viewed as especially disruptive and can result in strong anti-development sentiments. These attitudes are difficult to reverse once established and can create long term challenges to the development as animosity between parties becomes more pronounced. Though many plans are already well developed, and some communities have already been very vocal in their displeasure regarding developments, there are still opportunities to reverse course and to improve relationships with local stakeholders to enhance social support for projects. The most critical aspect of this is listening to their concerns, addressing these respectfully and including them in the process to resolve problems they see as insurmountable. While it may not be possible to appease all groups, it would be advantageous to take steps to work with local communities to get their inputs. Holding individual and group meetings, providing transparency, and using a neutral party to mediate when conflicts become heated can provide support to the community inputs.

Finding areas where the community can have meaningful inputs, including inputs into development plans, can be empowering to them and can help them feel a sense of ownership about the project. Often local communities can provide ideas and inputs which external bodies would not be aware of, that can be implemented at a relatively low cost, but can build significant social capital. Providing local community members with a sense of importance in the process, through incorporating their ideas into project designs, demonstrates a willingness to work with them and to be respectful of how new developments can impact their lives. Possible social infrastructure projects, like play/sport fields, community centers, natural areas, support to local schools, scholarship funds, open house days that allow local residents to see what is being done and how within industrial sites, and support for maintenance of community resources can go a long way towards building positive relations with local communities. For each new industrial site, the establishment of a stakeholder advisory committee, made up of local community representatives, industrial estate developers, local authorities, community based organizations, civic organizations, and others, can provide a source of guidance to build community relations and to improve stakeholder support for project implementation. Openness to the concerns of the local stakeholders and efforts to address their concerns can be orchestrated through this stakeholder advisory committee with the long term benefit of improved stakeholder support and innovations for community and industrial estates. The earlier in the planning and development process this can occur the higher the level of community and local stakeholder support there will be for the project, though efforts made at any stage can be beneficial.

Reason: Improved community level buy-in for projects, innovative ideas for improved relations between developers and local stakeholders, innovative ideas for development in multi-use sites building on local knowledge of the area, reduced tensions and potential for problems with development due to community resistance.

Benefits: Stronger community relations for industrial sites, more harmonious existence between communities and industrial site development, improved atmosphere to attract investors, improved worker relations.

Potential Costs if not done: Increased tensions between communities and developers, loss of investment due to low community receptivity to new industry, costs of legal actions in response to community grievances, increased problems of traffic and pollution disturbances with neighboring communities and community backlash, loss of opportunity to showcase socially proactive industrial development in Caribbean.

Potential Responsible Bodies: Ministry of Energy/NEC and Ministry of Trade and Industry/E-Teck

Organizations Involved: Ministry of Energy/NEC and Ministry of Trade and Industry/E-Teck, Local community organizations, local community leaders, civil society organizations, churches, mosques and temple officials, municipal leaders, local business owners, mediators as needed.

8.4 Macro-level Mitigation and Optimizing Measures

There are three macro level across the board concerns that will have significant impacts on the ability of the NAS, and that the success of the accompanying development plans in agricultural, residential, and industrial sectors will depend upon. These are access to water and water distribution mechanisms, the potential impacts of climate change and adaptation to those shifts, and access to a reliable labour pool that will remain in the sectors throughout larger economic fluctuations. These issues cannot be addressed on a sector by sector basis, given that they are closely interlinked, and the degree of impact on one sector will influence the degree to with another sector is impacted.

Therefore, there are three recommendations that should be pursued at a macro institutional level, incorporating an intersectoral approach to addressing the issues at the highest possible levels. Each of these recommendations is presented within the context of the sectoral and pervasive concern it is intended to address, an outline of how the recommendation should be applied, the benefit of applying it, the costs of not addressing these issues, and the suggested responsible and involved bodies.

Integrated Water Resource Management Plan with all impacting and affected sectors

The current status of existing fresh water sources, including surface waters and aquifers are extended to or just beyond the existing capacity to meet demand. The Water and Sewerage Authority (WASA) has been in the process of developing a water and waste water management strategy over the past year that examines forecasted demand and

availability. This strategy focuses on meeting the anticipated needs in the development of residential and industrial real estate, but does not incorporate plans for accessing water for agricultural needs. Additionally, WASA acknowledges that there are significant leakages in the existing water infrastructure that are not being addressed. Estimates suggest that between 40 and 60 percent of potable water is lost due to leakages within the existing system.

To meet rising demands, future water management plans include construction of three additional desalinisation plants in Trinidad and one in Tobago. The use of desalinised water, given the high costs, energy intensive process, and exceedingly high quality of water suggests that this option may not be sustainable in the long term. Construction of additional desalinization plants will have cumulative negative environmental impacts to coastal and marine ecosystems threatening fisheries and protected species and habitats. Use of desalinised water will more quickly deplete the finite energy resources of Trinidad and may result in more extensive losses of high priced water if the existing infrastructure is not repaired. A lack of metering, low pricing for use, and lack of resource use monitoring has resulted in excessive losses, and a cultural attitude that does not value fresh potable water endangers existing and future water supplies.

The WASA Strategy, to the best of our knowledge, addresses the currently expected demands for planned residential and industrial needs, but does not address the need to make water available to the agricultural sector. Cane production did not require irrigation because it was entirely rain fed, and adaptable to the wet and dry season variations. In comparison, the food crops that are planned to address food security concerns on the mega farms and two acre cooperatives will require irrigation during the dry season, and the soils will require protection from erosion during the rainy season. The specific issues of managing these have been addressed in Section 7, however, these are stop gap measures, and may not ensure a regular food supply, which will be critical in the event of another or more severe food crisis. If water is withdrawn from the system to provide irrigation it will not be available for residential or industrial use. If demand for either industrial or residential water increases it will not be available for agriculture or other sectors. Despite an abundance of rainfall in Trinidad, rainwater is generally not captured and due extensive paving aquifer recharge is declining, decreasing the available supplies in an already limited system.

It is anticipated that increased rainfall events and severity will occur due to climate change, however this water will not be potable, or suitable for domestic or industrial use without treatment through the system that is currently highly inefficient at delivering water due to leakages and being strained beyond capacity currently. Further, climate change scenarios with higher rainfall and severity of downpours will contribute to severity of flooding events, loss of property and potentially loss of lives of those who are impacted by flash flooding events. The cost of these damages may potentially be catastrophic.

Application: Therefore the recommendation for the development of an Integrated Water Resource Management Strategy (IWRM) will build upon the WASA Strategy and will

incorporate a wider range of impacting and effected stakeholders. Further, the IWRM Strategy will make a comprehensive assessment of current, future and potential water resource needs and availability. Issues addressed in an IWRM Strategy can include (among others): strategies for improved water governance and water conservation measures; strengthening water management strategies; household use rates and introduction of metering; groundwater flow rate analysis; threats of contamination of aquifers from salt water inundation; the cost effectiveness of desalinisation and potential alternatives; integrated flooding management and response strategies; potential salinisation of soils; and preservation of coastal, marine and river ecology to protect vulnerable species. The IWRM Strategy will address these in a comprehensive manner that will enable Trinidad and Tobago to sustainably develop its existing resources, while taking steps to protect the future generations from the challenges of depleted or contaminated water resources. It is recommended that the IWRM Strategy be developed by local and international experts with a strong history of IWRM Strategy Development in a wide range of countries so that there is a cross fertilization of ideas, international best practices, social and economic considerations, and a familiarity with domestic institutions, structures and cultural issues.

Benefits: Increased water use efficiency, ability to use state of the art international best practices for water management, minimize losses and costs to infrastructure due to damage caused by leakages, improved ecosystem health, extended viability of energy resources, improved public health, water resources allocated to agriculture and able to meet expanding demands in all sectors.

Costs if not done: Continued water wastage, loss of infrastructure stability, possible saltwater inundation to aquifers due to overuse, lack of water for irrigation and lack of agricultural production resulting in continued significant vulnerability to food scarcity, possible salinisation of soils, loss of biodiversity and health of river, coastal and marine ecosystems, competing demands on water resources between sectors and potential health impacts of low water availability for residential use, possible public health problems resulting in low fresh water availability, continued and increased damages to property and humans due to flooding severity.

Institutional Aspects: The institutional remedies for development and implementation of an integrated water resource management plan would require a high level of support from the highest possible level of government, with a clear mandate for intersectoral cooperation, open sharing of data on all aspects of water management and use, and a clear goal towards enhanced natural resource protection and use. As the WASA strategy was not available for review at the time of the SEA, it is difficult to identify the full range of needs, though it was understood that the agricultural sector water needs had not been factored into the planning.

For a successful IWRM strategy to be developed for all sectors, it would need to be based on the current WASA strategy and then build from there. Development of such a strategy would require a working group consisting of representatives from Ministry of Public Utilities and WASA, MPHE – Town and Country Planning, Environmental Planning,

EMA, Ministry of Health, MALMR – Planning Division, 2 Acre Farm Cooperatives and Mega Farm agencies, TTABA, IMA, Forestry Division, EMBD, NEC, E-Teck, UTT/UWI faculty, the ADB, fishermen, NGOs, civil society organizations. Support from international organizations that focus on water management and related issues should be sought for guidance and support as well. This would include UN, World Meteorological Organization, FAO, UNDP, World Bank, European Union, Global Water Partnership, and IPCC.

All users and their interests should be give consideration and weight in the discussion and division of sub groups can address water quality issues, water quantity issues, issues where there are conflicting demands, flooding issues, biodiversity and ecological flows issues, aquifer management, integrated coastal zone management, and others as warranted by stakeholders. These groups would develop a clear set of priorities, means for addressing these and work with other groups to identify common and conflicting needs and strategies for building an enhanced strategy for all water related aspects of human development in Trinidad. The enhanced strategy would also tie into the Climate Change Adaptation Strategy and enable final planning and implementation of both strategies concurrently.

Responsible and involved parties: Ministry of Public Utilities and WASA, MPHE – Town and Country Planning, Environmental Planning, EMA, Ministry of Health, MALMR – Planning Division, 2 Acre Farm Cooperatives and Mega Farm agencies, TTABA, IMA, Forestry Division, EMBD, NEC, E-Teck, UTT/UWI faculty, fishermen, NGOs, civil society organizations

Climate Change Adaptation Strategy with realistic and realizable objectives

Predicted climate change patterns will have a significant impact on the ecosystem, as well as the social and economic function of Trinidad and Tobago. As a small island country, in areas that are proximal to severe storms, there is a high potential for the impacts of climate change to be magnified with compounded results. These dire predictions are difficult to believe given that the tropical climate in Trinidad and Tobago has been blessed with a long term benefit of safety from severe storms, regular rainy and dry seasons, and predictable weather patterns. Ideally these will continue, however, given the cumulative warning signs, increased climate variation world wide and locally, it can not be assumed that Trinidad and Tobago will be spared these impacts. It is strongly recommended that Trinidad and Tobago develop and implement a Climate Change Adaptation Strategy that has realistic and realizable objectives. At worse, it will reduce catastrophic impacts, at best it will lead to improved sustainable management of social and economic systems.

The recent years in Trinidad have been marked by an increase in rainfall during the traditionally dry season, and increase in the severity of rainfall events based on the sheer volume of rainfall in short time frames during the rainy season. Many in Trinidad will

claim it is immune from hurricanes crossing the Atlantic because of it's unique geographic location as the most southern of the Caribbean Islands. However, in recent years there have been shifts in the tropical storm paths with wider variation in ranges where they make landfall. For the first time in recorded history, a hurricane struck Brazil in 2005, veering much further to the south than ever before. The potential small shifts in the Westerly Trade Winds due to climate change could significantly impact the trajectory of Atlantic Hurricanes, putting Trinidad clearly in a zone of potential danger.

The population of Trinidad would be protected to a degree because of the high settlement rates on the western coasts of Trinidad, so a direct hit may be less severe. However, these areas are also far more developed, and with the rainfall that accompanies major tropical depressions, tropical storms and hurricanes the impacts of a direct or even indirect strike could be quite severe. The increase in flooding events, accompanied by increased rates of paving of ground surfaces creates a unique constellation that has the potential in a serious storm situation to create very severe impacts on the human population of Trinidad in the event of increasing storm severity and shifting trajectories.

The placement of industrial, residential and agricultural developments in flood plains will have potential ramifications as climate change continues, and steps should be taken to address these with realistic and realizable objectives.

Recently even farmers and beekeepers have commented that they have experienced substantial problems with harvests, growing patterns and pollination due to the shifts in dry and rainy season weather patterns. The implications for food security, especially for new crops could be significant and must be addressed as soon as possible to avoid investment in crops that will not provide expected yields due to climatic variation. Potential storm surges could bring more seawater onto lands, rendering them infertile due to the high salt content, and severely impacting the viability all coastal communities. When combined with extreme flooding events, coastal erosion, and other impacts on coastal infrastructure, including farmlands, factories, industrial centers and residential estates designated for development in flood plains, the impacts could be catastrophic.

Application: Working with national and international experts, implement a vulnerability monitoring strategy, and an immediate emergency response plan. With this same team begin examining what sort of infrastructural, structural and institutional adaptations would be required to protect vulnerable areas, and within a cost/benefit analysis prioritize how and what would need be done where and by whom. Use an intersectoral/ inters ministerial approach that includes all stakeholder groups and addresses potential and future scenarios to develop this strategy and to take mitigation actions wherever possible.

Benefits: Plans and adaptation to potential hazards to reduce impacts, ability to take steps ahead of time to secure vulnerable areas, including industrial centers which could have extremely serious repercussions if hit by natural disasters,

Costs if not done: Potentially significant impacts from catastrophic events and from long term more slowly emerging problems like shifts in weather patterns, loss of seasonal

differentiation and impacts on species including food crops, inability to meet demand for foods, increased vulnerability of farmers and consumers of local produce, potential damage to industry, low lying farm lands loosing fertility, impacts on water supply and purification systems as well as sewerage systems.

Institutional Aspects: A meaningful climate change adaptation strategy will take into account the range of anticipated risks that will impact the country of Trinidad and Tobago. The variation in climate is expected to vary significantly in the short term as well as the long term. Support for a strategy to mitigate the negative impacts must come from the highest levels of government as a sign of the serious commitment to taking steps to protect the population and property of Trinidad and Tobago. From a Ministerial level a mandate should be passed down that would bring together stakeholders, and experts on climate change scenarios. The EU Delegation has taken the initial steps on this to increase awareness; however additional more concrete measures need to be developed and implemented. The Ministry of Planning, Housing and Environment should spearhead this effort with support of the EMA, Town and Country Planning, Ministry of Energy, MALMR, MOTI, EMBD, T&T Meteorological Institute, NEC, E-TECK, Emergency Preparedness and response organizations, and others. The international community, including EU and World Bank/UNDP/GEF have a special interest in adaptation strategies in small island developing countries. Potential inputs, both logistically and financially may be available to support these efforts.

A working group should be established similar to that of the IWRM Strategy, with sub groups that will focus on specific issues of climate change. These will include, interalia: emergency preparations, risk scenarios, economic impacts, impacts on agriculture, social and housing impacts, coastal zone protection strategies, flooding and drought mitigation measures, and macro and micro mitigation efforts. Each of these groups working under the direction of the lead agency, should develop strategies for various scenarios for climate change, and adaptation measures in 2 year, 5 year, 10 year and 20 year intervals. Potential inputs, both logistically and financially may be available to support these efforts.

Responsible and involved bodies: Ministry of Planning, Housing and Environment, EMA, Town and Country Planning, Ministry of Energy, MOTI, MALMR EMBD, T&T Meteorological Institute, NEC, E-TECK, Emergency Preparedness and response organizations, and others.

Socio-economic Assessment, focusing on Labor Availability and Capacity Needs Assessment specific for each sector

A significant cross cutting issue that will severely impact the successful implementation of any of the current development plans is the existing socio-economic conditions. The impacts of displaced workers and the over all impact of the shift in the agricultural sector focus has effected displaced workers and associated farmers who were dependent on

selling cane to Caroni (1975) Ltd. for income and now no longer enjoy that guaranteed market. This shift has resulted in a release of workers into the workplace, a degree of economic displacement and restructuring, and creation of opportunities for new sectoral development in agriculture as well as beyond in other sectors. It is difficult to accurately and empirically gauge what has happened to these workers and their communities in terms of the social and economic development impacts of the closing of Caroni (1975) Ltd..

Recent absorption of labour into the construction sector was fueled by the rapid climb in petroleum prices, but the subsequent and sustained drop in oil revenues is resulting in an economic slow down. The workers who went from cane to construction are now being released again into the national labor pool. There is the potential for these workers and former private farmers are going to experience difficulties they might have initially experienced had the closing of Caroni (1975) Ltd. not coincided with the increased demand for petroleum revenue funded labor.

As these laborers are released into the national labor pool, and the associated construction industries slow down due to the over all global economic down turn, the impacts on communities that were assured relative stability under sugar production may become more pronounced. This should be carefully considered to determine what is happening to labourers, both those who were under Caroni (1975) Ltd., and those who were part of private sector cane production.

The diversification of the economy through new agricultural development in the form of the two acre cooperatives and the mega farms, the residential developments, and the industrial development will all require labor in order to be productive and profitable. The degree of labour intensity will likely fluctuate, throughout the development process from construction to operation and maintenance. It is not clear if the labourers who were formerly under Caroni (1975) Ltd. and private cane production will have the requisite skills needed to fill the needs of these sectors or if it will be necessary to provide some degree of training and capacity building for them.

The amount of available labour in Trinidad is relatively low, but the capacity is quite high with high literacy rates, and high skill sets. High demand for labour has driven up pay rates, and for some skilled labour, rates are comparable to those in the developed countries. As a result, the anticipated variation in labour demand and employment trends will have a higher rate of impact on the over all economy as a balance between gainful employment and skilled labour is sought by the different sectors.

Application: Working with national and international experts, develop a baseline socio-economic conditions measure for household incomes in communities directly impacted by the closing of Caroni (1975) Ltd., track trends in employment sectors for former Caroni (1975) Ltd. workers, and private cane production workers, assess average household income levels prior to the closing of Caroni (1975) Ltd., and compare to current levels. Concurrently, examine where trends in labour are heading, especially with consideration to development plans for the former Caroni (1975) Ltd. properties to

determine if there is sufficient labour to fill the anticipated demand. Identify skills that will be needed, anticipated wage rates, available labour pools, and determine if there is sufficient skilled and unskilled labour to meet the labour needs for these development plans. Based on these findings develop options to improve labour skills, increase labour availability to developing sectors, and identify steps to stabilize employment rates in order to support socio-economic development nationally.

Benefits: Enhanced economic and social stability, identification of needs for labourers, identification of needs for prospective employers, improved understanding of socio-economic development patterns in Trinidad, development of skilled labour force and subsequent employment opportunities.

Costs if not done: Potential lost opportunities for improved labour pool for agricultural, residential and industrial development sectors, potential competition between employers for skilled labour, potential unemployment for unskilled/low skill labour, failure to realize economic opportunities locally and nationally, increased demands on social services, increase in unemployment and socio-economic displacement.

Institutional Aspects: In order to conduct a full Socio-economic Assessment, focusing on Labor Availability and Capacity Needs Assessment specific for each sector, it will be critical that there is support from the highest levels of government possible to insure coordination among Ministries and Sectors. Examination of data collected through the Socio-economic assessment with the CSO should be combined with information from the Ministry of Labor to establish baseline data for current existing labor availabilities and shifts. Based on these findings there should be a concurrent survey done of the anticipated needs and capacities for the incoming NEC and E-Teck business, the EMBD support and Caroni (1975) Ltd. This survey should also examine where the current labor can be retrained as needed, and where emerging capacity can be recruited from, including UTT and UWI. Consultation with Trade Unions should also be incorporated in the demands. Anticipated pay scales, capacity demands, imported labor (if needed), training needs, and worker matching programs should be instituted and made available to those seeking work and/or those seeking to change their professional direction. There should be close attention paid to maximizing the talents of the citizens of Trinidad and Tobago, as well developing the needs for planned and supporting industries emerging from the division of the Caroni (1975) Ltd. properties.

Responsible and involved parties: Central Statistical Office, Ministry of Labour, Ministry of Energy – NEC, Ministry of Trade and Industry – E-TECK, EMBD, UTT/IWU, Trade Unions, Caroni (1975) Ltd.

9 Institutional capacities and recommended indicators

The institutional capacity for the implementation of the recommendations within the SEA is actually quite high. The various sectors have an impressively well trained and eligible staff with a strong commitment to improving conditions in Trinidad and Tobago. The largest barrier to realizing this potential is the standard ubiquitous institutional constraints found in any government bureaucracy. Perhaps the largest threat is the need for lower level staff to provide meaningful assistance and gain experience, sharing the administrative burden with the higher level staff.

A significant challenge is that budgets and personnel are overstretched and there is a need to increase the capacity of organizations. A prime example of this is the EMA, which has the potential and capacity to become a very effective body, but within the EMA there is a low level of enforcement of EIAs and CEC compliance due to low staff rates and low retention rates. Those who are in the EMA are dedicated and enthusiastic and are working diligently to meet the demands of their institutions.

As the economic downturn continues, it may be possible to provide incentives for those who would have gone into the business sector to bring their experience to the public sector through offering attractive benefit packages and possibly signing bonuses. Additionally, offering training courses in environmental stewardship for all sectors could increase innovations, conservation and sustainable entrepreneurship. Trinidad is extremely well situated to become a leader in the green revolution, if the current capacities including high levels of education, awareness and sensitivity to shifting environmental conditions can be nurtured and developed.

In order to successfully implement the recommendation and options presented in this SEA the following indicators may be useful in setting priorities and developing strategies for meeting the objectives of Vision 2020.

Within the SEA, recommended indicators may include:

Macro Recommendation Indicators:

- Completion and implementation of an IWRM Plan to international standards, focusing on international best practices.

- Development of an intersectoral Climate Change Adaptation Strategy to address all of Trinidad and Tobago with prioritization of interventions and activities.

- Socio-economic and labor needs assessment completed with training and employment opportunities for workers delineated and workforce stabilization measures developed.

Capacity building Recommendation for Caroni (1975) Ltd. and former Caroni (1975) Ltd. properties:

- Training for staff in all sectors about environmental and sustainable management practices specific to their sector emphasizing costs and benefits of environmental stewardship activities.

- Establish mentoring of junior staff members by senior, through formalised programmes in MALMR, EMA, MPHE, NEC, E-Teck and EMBD that emphasize decision making and institutional development skills.

- Increase monitoring and enforcement training and staffing of EIAs and CECs for EMA through recruitment of new staff from the business sector and new university graduates.

For Agricultural Development:

- Conduct biodiversity surveys of all Caroni (1975) Ltd. properties for future baseline references.

- Formation of farmers cooperatives with development of management rules, and actively grow produce for sale in national markets.

- Soil remediation and water management schemes implemented in all mega farms and on all two acre cooperatives, with at least 40% under organic cultivation.

- Development of a joint, sustainable agri business degree program at UWI and UTT, recruiting from local faculty and seeking new hires from top agricultural and ecology programs internationally.

- Increased domestic food production and consumption rates with local branding for minimal agro chemical usage through the implementation of a Social Marketing campaign for local produce and impacts measured.

For Residential Development:

- Green guide books for new home owners published and distributed to all new residents upon lease signing.

- Green funds accessed by at least 20 of the 30 Residential estates.

- Increase in play fields, parks and social infrastructure in Phase II and Phase III residential estates to comprise 20% of allotted space.

- Development of a national recycling effort to include separation of plastics, papers, glass and organic wastes for recycling and use for composts and soil remediation.

For Industrial Development on Former Caroni (1975) Ltd. properties:

- Reduced pollutions loads within legal requirements for industrial sites and awarding of incentives to 25% of industries for use and showcasing of BAT/environmentally friendly technologies .

- Implementation of green buffer zones and water reservoirs in all industrial and residential estates.

- Establishment and support for local community and stakeholder advisory groups for all industrial parks.

- Emergency management plans in case of environmental threats due to accidents in industrial sites.

- Purchase of private properties in Caroni Swamp with development easements to protect wetlands, in partial exchange for loss of wetlands in Claxton Bay.

10 Conclusions and recommendations

10.1 General conclusions

The National Adaptation Strategy and this Strategic Environmental Assessment demonstrate the complexity involved shifting from a single economic driver in agriculture to a true diversified economy with multiple sectors. The most significant challenges are organizational and administrative, and the task of comprehensive planning required is a test of logistical prowess. Within that light, the SEA has had the objective of identifying environmental, social, and economic impacts of this planned developmental trajectory, and making recommendations for improvement along this common path.

In the concerted effort to reach developed nation status, Trinidad and Tobago has the opportunity to become developed not only by 20th Century measures of GDP per capita, literacy rates, human development rates, and the like, but also to become the model of development for the 21st Century. The developed countries of the 21st Century take steps that that will reduce wastes and live more harmoniously with the environment, that benefit from a healthier population, and will take steps to buffer itself from larger global challenges of shifting economic and climatic conditions. Trinidad and Tobago stands at the precipice of this type of development and by making conscientious choices now, can reduce negative impacts, improve positive effects and become a global leader for sustainable development.

Other developed countries are plagued with the challenges of a mindset that created waste, polluted air, soils and waters, reduced the health of the ecosystem, destroyed species, and divided their countries. These developed countries now are struggling to remediate these past wrongs with antiquated institutions and practices that are hard pressed to make significant changes. Trinidad benefits from being a small state with a predictable revenue stream, a population with abundant creativity and problem solving abilities, and an environment that is not so spoiled that investment for remediation is overwhelming. Instead investments to avert the need for remediation are far more cost effective and meaningful. Further, on the 76,000 acres of former Caroni (1975) Ltd. land, there is the potential to take steps to improve the environmental conditions, strengthen social foundations and build new economic drivers that can sustain the country well into the future. These steps are not insurmountable or even arduous. They only require vision and foresight, and the openness to learning and new ideas that are the hallmark of Trinidad and Tobago culture.

10.2 Recommendations for EC support to the NAS

The SEA can provide some of the ideas to serve as the catalysts for the realizations of these objectives. Working within the priorities already established by the GoRTT, and specifically in line with Vision 2020, the European Commission has the opportunity to support these development plans. The EC can bring experiences from other developed

countries and other parts of the world to share with the GoRTT and the sectors evolving from the NAS.

The SEA provides recommendations for efforts that are prime opportunities for the EC to share it's experience and knowledge and to provide support to the GoRTT in realizing its goal. These include the development of the IWRM Plan, the Climate Change Adaptation Strategy, and the Socio-Economic and Capacity and Labor Needs Assessments. Additionally, the EC can support the GoRTT and the NAS through support to the various sectors in the development of their environmental management plans as outlined within this report, including support for training, capacity building, identification and development of best practices for agricultural, residential and industrial developments. This could include study tours to regional and international sites where similar challenges are being addressed and to emphasize the exchange of information in agricultural, residential and industrial development, enabling those implementing these efforts to build on lessons learned from counterparts in other countries facing similar challenges and overcoming comparable obstacles.

In support of the NAS the EC SEA Directive 2001/42 requires that the SEA is to be made available to the relevant authorities and to the public upon release to improve the transparency of the process and to enable comments to be taken prior to any adoption of the SEA.

10.3 Recommendations for NAS enhancement

The full SEA is conducted to provide recommendations for the enhancement of the NAS. The micro level recommendations can serve as the immediate foundation with the meso and macro level recommendations, providing options and guidance for enhancing the positive trajectory that the NAS is already taking. The utilization and encouragement of the local expertise, openness to new ideas, and creativity will serve to more fully realize the objectives of the NAS and those ambitious objectives set forth in Vision 2020. Trinidad and Tobago have a great opportunity at this juncture with the NAS to showcase the advancements and potential for sustainable development in the Caribbean and around the world. This is a bold step that, if taken, can place the country well ahead of regional and international counterparts, and ensure a better life for all of its citizens.

11 Technical appendices

a. List of stakeholders consulted/engaged

LIST OF STAKEHOLDERS CONSULTED DURING SEA STUDY

Name	Position and Organization	Contact Information
Mr. Jerry Hospedales	Coordinator, National Strategic Management Group, Office of the Prime Minister	Office of the Prime Minister
Ms. Salisha Ali-Bellamy	Divisional Manager, Estate Management, EMBD	Unit # 2.27S, Valpark Plaza, 1 Morquito Road, Valsayn South, Trinidad W.I. **Tel. 645-7847**
Ms. Sheryl Ann Haynes	Actg. Director, Town & Country Planning Division, Ministry of Planning and Development	Level 17, Eric Williams Finance Building, Independence Square, Port of Spain, Trinidad W.I **Tel. 627-9700 Ext. 2134, 624-4009 (SL)**
Mr. John Jones	Manager, Engineering Design Construction, NEC	Cor. Rivulet & Factory Road, Brechin Castle, Couva, Trinidad W.I., **Tel. 636-8471, Ext. 116, Fax: 636-2905**
Ms Cecilie Clarke-Marshall	Assistant Manager, Environmental Assessment, EMA	8 Elizabeth Street, St. Clair, P.O. Box 5071, Port of Spain, Trinidad W.I. **Tel. 628-8042, Ext. 2298, Fax: 628-9123**
Mr. Allan Poonking	General Manager, Operations, WASA	Farm Road, St. Joseph, Trinidad W.I. **Tel. 662-2302**
Mr. Anthony Arjune	Senior Commercial Analyst, ETECK	The Atrium, Don Miguel Road Extension, El Socorro, Trinidad W.I. **Tel. 675-1989 ext. 2136**
Mr. Vassell Stewart	Chief Executive Director, Trinidad and Tobago Agri-Business Association	Level 2, Auzonville Court Tunapuna, Trinidad, W. I. **Tel. 360-3717**
Mr. Ramgopaul Roop	Agricultural Consultant, Trinidad and Tobago Agri-Business Association	Level 2, Auzonville Court Tunapuna, Trinidad, W. I. **Tel. 365-1130**
Dr. David. Dolly	Lecturer, University of the West Indies	Department of Agricultural Economics and Extensión, University of the West Indies, St. Augustine, Trinidad W.I Farmdavid42@gmail.com **Tel.662-2002 Ext. 3602**
Dr. Joth Singh	CEO/Managing Director,	8 Elizabeth Street, St. Clair, P.O.

	Environmental Mgt Authority	Box 5071, Port of Spain, Trinidad W.I. **Tel. 628-8042, Ext. 2224, Fax: 628-9123**
Ms. Marlene Johnson	National Authorizing Officer, M PHE	☺
Mr. Anthony Bartholomew	Interim Program Coordinator, Commercial Farms, MALMR	St. Clair Circle, St. Clair, Trinidad W.I. **Tel.622-1221/5, Ext. 2140, Fax: 622-8762**
Mr. Willard Phillips	Programme Specialist, Environment, UNDP	UN House, 3A Chancery Lane, P.O. Box 812, Port of Spain, Trinidad W.I. **Tel: 623-7056, Fax: 623-1658**
Mr. Ricardo Ramdin	Manager, Water Planning, Water Resource Agency, WASA	Head Office, Farm Road, St. Joseph, Trinidad W.I. **Tel. 645-5900 (3834), Fax: 662-2810**
Dr. David Persaud	Environmental Manager, Environmental Policy & Planning Division, M PHE	Level 13, Eric Williams Finance Building, Independence Square, Port of Spain, Trinidad W.I. **Tel. 627-9700 ext 2073, fax:623-8123**
Ms. Kelly-Ann Thorpe	Communication Engineer, WASA	179-183 Eastern Main Road, Barataria, Trinidad W.I. **Tel. 674-2186; Fax: 638-5456**
Ms. Sarah McIntosh	Executive Director, Caribbean Natural Resource Institute	Fernandes Industrial Centre, Administration Building, Eastern Main Road, Laventille, Trinidad W.I. **Tel. 626-6026, Fax: 626-1788**
Mr. R. Shah	Chairman, Trinidad Island-wide Cane Farmers Association	14 Abdool Street, Cedar Hill Road, Claxton Bay, Trinidad W.I. **Tel. 657-2263 (o), 659-2775/789-4612**
Ms. M. Fletcher	Director of Corporate Credit, Agricultural Development Bank	Head Office, 87 Henry Street, Port Of Spain, Trinidad W.I, Tel.623-6261 ext. 238
Ms. S. Rambadan	Field Officer, NAMDEVCO	S.S. Erin Road, Debe, San Fernando, Trinidad W.I. **Tel. 647-3218/3866**
Mr. R. Siewnarine	Agricultural Research Officer, Sugarcane Feed Centre	Pakhor Road Londonville, Trinidad W.I., **Tel. 367-8655**
Mr. D. Jagroo	Chief Executive Officer, Caroni (1975) Ltd.	P.O. Box 437, Brechin Castle, Couvca, Trinidad W.I. **Tel. 636-4973/9912, Fax: 636-4035**
Mr. Russel Boland	Caroni (1975) Ltd.	P.O. Box 437, Brechin Castle, Couvca, Trinidad W.I. **Tel. 636-4973/9912, Fax: 636-4035**
Mr. Arjun Singh	Engineer, Caroni (1975) Ltd.	P.O. Box 437, Brechin Castle, Couvca, Trinidad W.I. **Tel. 636-4973/9912, Fax: 636-4035**

Mr. Patric Novaro	Account and Finance Manager, Caroni (1975) Ltd.	P.O. Box 437, Brechin Castle, Couvca, Trinidad W.I. **Tel. 636-4973/9912, Fax: 636-4035**
Ms. Lynett Morris	IT Manager, Caroni (1975) Ltd.	P.O. Box 437, Brechin Castle, Couvca, Trinidad W.I. **Tel. 636-4973/9912, Fax: 636-4035**
Mr. Ansel Castillo	Chief Financial Officer, Caroni (1975) Ltd.	P.O. Box 437, Brechin Castle, Couvca, Trinidad W.I. **Tel. 636-4973/9912, Fax: 636-4035**
Commodore Anthony Franklin HBM	Administrator, Marine and Maritime Programmes, IMA/UTT	University of Trinidad and Tobago, Hilltop Lane, Chaguaramas, Trinidad W.I. **Tel. 634-4291/4 (w), 724-8312 (m); Fax: 634-4433**
Ms Yvonne Davidson	Senior Planning Officer, Planning Division, MALMR	St. Clair Circle, St. Clair, Trinidad W.I. **Tel.622-1221/5, Ext. 2140, Fax: 622-8762**
Mr. Anthony Ramnarine	Conservator of Forest, Forestry Division, MALMR	Long Circular Road, St. James, Port of Spain Trinidad W.I. **Tel. 622-4860 (w), 684-7481 (m), Fax: 628-5503**
Mr. Gregg Rawlins	Representative, Inter-American Institute for Cooperation on Agriculture	P.O. Box 1318, #3 Herbert Street, Newtown, Port of Spain, Trinidad W.I. **Tel.628-4403; 628-4078-9, fax: 628-4562**
Dr. Rahanna A Juman	Wetland Ecologist, Environmental Research Programme, Inst. of Marine Affairs	Hilltop Lane, Chaguaramas, P.O. Box 3160, Carenage, Trinidad W.I. **Tel 634-4291/4**

b. Records of stakeholders' participation

18 January -	Scoping study – Introductory meeting
3 March -	SEA Workshop – Scoping Study Review
31 March -	SEA Private Farmers Stakeholder Meeting – Introduction of SEA and alternatives to Private Cane Farmers and related organizations
Multiple dates -	Information Meetings - Caroni (1975) Ltd. Staff
30 April -	SEA Final Presentation – Presentation of findings
9 June -	SEA Working Group Meeting – Future of SEA for GoRTT with Working Group

All other meetings were individual interviews held in stakeholders offices.

Administrative appendices

c. Study methodology/work plan (2–4 pages) and Consultants' itinerary

***Activity*/Week**	**1**	**2**	**3**	**4**	**5***	**6***	**7***	**8**	**9**	**10**
Scoping Study Workshop	*R									
Meet with Additional Stakeholders 1 on 1 (Private Farmers, etc.)	*									
Evaluation of policy and institutional contexts		R								
Environmental baseline study				R						
Identification and evaluation of environmental opportunities and constraints						R				
Identification and evaluation of impacts							R			
Analysis of performance indicators								R		
Assessment of the capacities to address environmental challenges								R		
Development of conclusions and recommendations									R	
Finalization of Report										R

' 4 day work weeks due to public holidays

Week 1

2 March Consultants travel to/arrive POS
3 March Brief new Ag. Person, Prepare for workshop
4 March Workshop with Government Stakeholders
5 March Revision of Scoping Study
6 March San Fernando to meet with Private Farmers (accompanied by GORTT Representative and EC Delegation – additional meetings may be scheduled)

Collect data for environmental baseline from Stakeholders at Workshop

Week 2

9- 13 March

DELIVERABLE: Policy and Institutional Context Report – 6 pages
Analysis of where the SEA fits within the NAS and identify missing bits. Use SEA Institutional Framework

Meetings to be scheduled with additional stakeholders and finalization evaluation of policy and institutional contexts

- AMI Marine Institute
- NAMDEVCO
- E-teck
- Meteorological Organization
- CIVM if appropriate
- Environmental expert with Caroni (according to Planning guys, also exists)
- Others suggested stakeholder from meetings
- Ministry of Health
- Ministry of Social Development
- WASA Communications – Kelly-Ann Thorpe

Collect data for environmental baseline from Stakeholders at Workshop

Week 3
16 – 20 March

Continue to collect data for environmental baseline from Stakeholders at Workshop
Begin identification and evaluation of environmental opportunities and constraints, for each sector involved (Agriculture, housing, infrastructure, industry)
Field trips begin pending scheduling availability, ideally clustering for common theme and/or geographical area (see below).

Week 4
23 – 27 March

Finalize baseline study – draft baseline study for report and distribution to relevant stakeholders (those who want to be involved, or have an active interest)
Continue identification and evaluation of environmental opportunities and constraints, for each sector involved (agriculture, housing, infrastructure, industry)
Field trips continue pending scheduling availability, ideally clustering for common theme and/or geographical area (see below)

Week 5 (public holiday 30 March Spiritual Baptist Liberation Day)
1 – 3 April
Continue identification and evaluation of environmental opportunities and constraints, for each sector involved (agriculture, housing, infrastructure, industry)
Begin identification and evaluation of impacts of alternatives for each sector
Finishing field trips pending schedule availability

Week 6 (public holiday 10 April Good Friday)
6 – 9 April

Finish identification and evaluation of environmental opportunities and constraints, for each sector involved (agriculture, housing, infrastructure, industry)
Draft corresponding report sections for environmental opportunities and constraints.
Distribute draft to appropriate stakeholders for comments
Continue identification and evaluation of impacts of alternatives for each sector
Prepare agenda, invitees list and send invitations for final SEA workshop to be held 28 or 29 April

Week 7 (public holiday 13 April for Easter Monday)
14-17 April

Finalize identification and evaluation of impacts of alternatives for each sector
Distribute draft to appropriate stakeholders for comments
Begin Analysis of performance indicators
Begin formal assessment of capacities to address environmental challenges

Week 8
20 – 24 April

Finalize analysis of performance indicators and distribute draft to appropriate stakeholders for comments
Finalize formal assessment of capacities to address environmental challenges and distribute draft to appropriate stakeholders for comments
Begin development of conclusions and recommendations, based on comments from stakeholders on earlier drafts and through conversations with stakeholders

Week 9
27 April – 1 May

Continue to develop conclusions and recommendations, based on comments from stakeholders on earlier drafts and through conversations with stakeholders
April 28 or 29 hold final workshop to meet with stakeholders to present SEA findings to date and to discuss conclusions and recommendations (*may want to do this in sectoral sections)
30 April, 1 May working in office with experts, finalize gathering comments for sections to be completed at home base

2/3 May Depart Port of Spain.

Week 10
4 – 8 May

DELIVERABLES: Finalized report

Finalization of text of report with both consultants working from home offices

After Mission
14 May NIRAS submits QA to EC Delegation (electronically) for distribution to GoRTT

3 June EC Delegation returns comments to NIRAS/Team Leader

3-5 June Team Leader addresses all changes/ revisions based on comments

8 June Final Draft with Revisions to NIRAS for QA
10 June NIRAS sends FINAL SEA to EC DELEGATION

Contract Concludes.

d. List of documentation consulted

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Matthews M., NIRAS (Feb 2009), Draft SEA Scoping Study Report, Strategic Environmental Assessment of the Implementation of the National Sugar Adaptation Strategy for Trinidad and Tobago, EU Ref. No. 110860/C/SV/Multi.

Ministry of Agriculture Land and Marine Resources, (Jan. 2009), Investment, Development, Management and Operation of Commercial Agriculture Farm in Trinidad and Tobago

Office of the Prime Minster, (2008), Fifth Meeting of the Ministerial Committee Responsible for the Restructuring of Caroni (1975) Limited.

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Paersad, S. (2004), Paper, Land Use Planning for Agricultural Diversification of Sugar Estates in Trinidad and Tobago,
Persad S. et al, (2007), Paper, Soil and Water Constraints to Food Crop Production in Trinidad and Tobago – Challenges and Opportunity for Small Farms.

Persad S. et al, (2008), Paper, Soil and Water Management Strategies for Two Acre Farms on Caroni (1975) Limited Lands in Trinidad.

Persad S., Rampersad I, (2004), Paper, Soil Acidity in Trinidad and Tobago

Price Waterhouse, Trinidad and Tobago, (1992), Report, Caroni (1975) Limited Diagnostic Review

Republic of Trinidad and Tobago Central Sorting Office, (2004), Agriculture Census.

Riki T. (2008), Strategic Environmental Assessment in Action, Earthscan

Roop, R., (2009), A TTABA Proposal for the Development of Production Farms on Caroni (1975) Ltd "2 acre" Sites.

The Environment Commission of Trinidad and Tobago, (2007), Achieving the Vision, Strategic Plan of the Environmental Commission of Trinidad and Tobago 2007 – 2010

Trinidad and Tobago, (2007), Real Property Ordinance CF.27 NO 11 Memorandum o f State Agricultural lease

TTABA, (2008), Operation Plan 2008 – 2009

Vision 2020 (2005), Draft National Strategic Plan, Trinidad and Tobago

Vision 2020 (2006), Operational Plan 2007 – 2010, Republic of Trinidad and Tobago

e. Curricula vitae of the consultants

CURRICULUM VITAE

1. **Family name:** **Matthews**
2. **First names:** **Mary Martha**
3. **Address:** 445 Brookstone Dr. Athens, GA, 30605 USA
4. **Phone:** +1 706 621 7871
5. **E-mail** Dr.Mary.Matthews@gmail.com
6. **Date of birth:** 12 August 1965
7. **Nationality:** US
8. **Civil status:** Married
9. **Education:**

Institution [Date from - Date to]	Degree(s) or Diploma(s) obtained:
Earlham College, Sept 1983 – June 1987	BA Sociology and Cultural Anthropology
University of Georgia Sept 1993 – May 1995	MA Political Science
University of Georgia Sept 1995 – May 2001	Graduate Certificate – Principles of Conservation and Sustainable Development – UGA Institute of Ecology
University of Georgia Sept 1995 – May 2001	Ph.D. Political Science, International Relations, Comparative Political Economy, Environmental Policy

10. **Language skills:** Indicate competence on a scale of 1 to 5 (1 - excellent; 5 - basic)

Language	Reading	Speaking	Writing
English	1	1	1
Russian	4	1	4

11. **Membership of professional bodies:** International Association for Study of the Commons
International Association for Impact Analysis
International Association for Public Participation
12. **Training and** Alternative Dispute Resolution/ Certified Mediator (2007), full computer skills
other skills: including MS Office Suite, Mac OS, web design, and QuickBooks Pro.
13. **Present position:** Independent Consultant
14. **Years within the firm:** n/a
15. **Key qualifications:**

- 8 years Project Manager and Team Leader experience including Strategic Environmental Assessments, social assessments, and environmental governance projects
- 12 years experience with strategic environmental assessments of complex natural resource use including: establishment of criteria for baseline environmental and socio-economic analysis; legislative and policy analysis and implementation assessment; empirical methodological selection, design and development; mutli-sector socio-economic impact analysis; multistakeholder analysis and public involvement strategy design; and recommendations for further actions/possible

solutions to mitigate adverse impacts for short, medium and long term management

- 16 years applied experience in comparative assessment of environmental policy and institutions for managing shared natural resources focusing on socioeconomic and political development for water resources, agricultural sector transitions, and energy industry impacts
- Sustainable strategy development for Integrated Natural Resource Management, Integrated Water Resource Management, Integrated Coastal Zone Management, and Climate Change Adaptation
- Empirical Stakeholder Analysis, Stakeholder Engagement Strategy, and Public Consultation Plan development and implementation
- Substantial experience with EC environmental policy integration, country strategies, EU Framework Directives and EU environment and development policies
- Extensive inputs into EU, IFC, EBRD, UNDP, UNEP, GEF and US MCC/ US AID
- Able to quickly distil complex, multifaceted social, economic, political and ecosystem based information into easily accessible formats for both specialists and non-specialist audiences
- Experience in Caribbean, Eastern Europe, Former Soviet Union, Southern and Eastern Africa, and Middle East.

CURRICULUM VITAE

1. **Family name:** **Ennis**
2. **First name:** **Glenroy**
3. **Address:** 11 Earls Court, P.O. Box 1308, Kingston 8, Jamaica W.I.
4. **Phone:** 1-876-383-5749
5. **E-mail** genkosi@hotmail.com
6. **Nationality:** Jamaican
7. **Civil status:** Single
8. **Education:**

Institution [Date from - Date to]	Degree(s) or Diploma(s) obtained:
College of Agriculture, 09, 1984 – 06, 1987	ASc. Agricultural Science
University of the West Indies, 09, 1987 – 06, 1989	BSc Agricultural Science
University of the West Indies, 09, 1992 – 06, 1998	MPhil Agricultural Economics, Resource Use Efficiency
York University 08, 2007 – 07- 2008	B.Ed. Diversity in Education

9. **Language skills:** Indicate competence on a scale of 1 to 5 (1 - excellent; 5 - basic)

Language	Reading	Speaking	Writing
English	1	1	1
Spanish	4	3	4

10. **Membership of professional bodies:** Caribbean Agricultural Economics Society
Jamaica Society for Agricultural Scientists

11. **Special Training and other skills** Certificate, Project Formulations Appraisal and Management, Diploma, Conversational Spanish, Venezuelan Institute, Kingston, Jamaica

Efficient User of MS Office Suite

12. **Present position:** Independent Consultant
13. **Key qualifications:**

- Experienced in the tropical agriculture of the English and Spanish speaking Caribbean with regard to crop, livestock, agro forestry and specialist production systems. Knowledge of the micro and macroeconomic economic characteristics of the Caribbean region.
- Strong expertise in conducting Strategic Environmental Assessment, especially within sugar and banana sectors
- More than 15 years applied experience in strategic planning, policy formulation and analysis; proposal writing, project appraisal and management; feasibility studies and financial analyses, focusing primarily on tropical agricultural enterprises and rural development.
- 7 years experience coordinating consultation exercises and moderating focus groups, which led to the development of position/concept papers and business plans.
- More than 8 years experience working with projects that address food security issues throughout the Caribbean and conducting extensive industrial analyses of various fresh agricultural commodities, with particular emphasis on understanding the linkages among the players along the value chains
- 6 years extensive agricultural and sustainable development services as a consultant with various organizations, including the Food and Agricultural Organization of the United

Nations (FAO/UN), European Union (EU) and the Inter-American Institute for Corporation on Agriculture (IICA). Caribbean Agricultural Development Institute (CARDI) and Environmental Foundation of Jamaica (EFJ). Led several agricultural, environmental and rural development project teams.

- 5 years experience administering ex-post evaluation of of several community development and environemntal projects, providing impact assessment on sustainable development; advised organizations on relevant optimization and mitigating strategies; conducted essential environmental impact assessments of projects
- Significant research on production, productivity and marketing analyses of agricultural enterprises
- Worked extensively coaching entrepreneurs, monitoring, evaluating business performances and developing strategies to attract venture capital.
- Designed and analyzed models, explaining and forecast economic behaviour and patterns and devised methods for the collection and analyses of data.
- Outstanding communication, report writing, problem solving and organizational skills. Excellent team player, detail oriented and work well independently.

14. Other Relevant Information:

RESEARCH ACTIVITIES

1998, Thesis, Master of Philosophy, “Efficiency in the use of Resources of Small Banana Farm Holdings, A Case Study in the Rio Grande Valley, Portland, Jamaica”, University of the West Indies

1989, Final Year Project, “Response of Phosphorus on Maize in the Bauxite Soils of Jamaica”, University of the West Indies

TECHNICAL PAPERS

1999, Conducted study on “Institutional Analysis of the Agribusiness Council of Jamaica”

1997, Country paper, “Strategy for National Agricultural Development - Horizon 2010” Jamaica, commissioned by Food and Agricultural Organization of the United Nation

1996, Country paper, “Situation and Outlook Report” on the agricultural sector, Jamaica, commissioned by the Inter-American Institute for Cooperation on Agriculture

ACADEMIC AWARDS

1992, Jamaica Agricultural Research Program/Jamaica Agricultural Development Foundation Scholarship, to pursue the Master of Philosophy degree

1987, United States Agency for International Development scholarship, to pursue Bachelor of Science degree

1987, College of Agriculture Science and Education, graduated in upper 10 percent of class, awarded prize for best agronomy student

f. Terms of Reference for the SEA

EUROPEAID

LOT N° 6: Environment
REQUEST N° 2008/165287

Terms of reference for the Strategic Environmental Assessment (SEA) of the implementation of the National Sugar Adaptation Strategy for Trinidad & Tobago

BACKGROUND

The European Commission requires a ***Strategic Environmental Assessment*** (SEA) to be carried out for the implementation of the "National Sugar Adaptation Strategy" and the EC response strategy to the NAS, with special emphasis on the ongoing restructuring process of the sugar industry.

Given the impact on the environment from the sugar sector reform process, it is essential from the onset, for stakeholders and decision-makers to have an environmental baseline as well as relevant recommendations which will be used to mitigate the possible adverse impacts of the implementation of the NAS and to optimise the possible positive impacts.

Although the NAS contains a general environmental baseline, environmental impact assessment studies will need to be carried out more systematically and comprehensively in order to ensure that the country's environment is not further adversely affected.

1.1 Context

The T&T NAS is a sector policy document which is incorporated in a wider national development policy (Vision 2020) and, which for its main thrust with focus on sugar, is based on the Government's policy to divest from sugar and its decision to end subsidies to the sugar industry in Trinidad and Tobago by the end of 2007.

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The EC strategy supports two of the NAS Strategic Objectives:

3. Strategic Objective 2 - promoting economic diversification of sugar dependent areas:
   a. Exit strategies for sugar farmers and sugar-cane workers who choose to leave the industry
   b. Improving the enabling environment for economic diversification
4. Strategic Objective 3 - addressing broader impacts related to social, environmental, community and area-based issues
   a. Maintaining environmental stability
   b. Providing sustainable social and economic support related to the socio-economic effects of transitioning out of the industry

The General objective of the EC Sugar related assistance is to mitigate the adverse effects for the sugar growing areas of the EC Council of Ministers decision to exist the Sugar Protocol, while supporting the GORTT in the realization of the priorities established in Vision 2020, the country's National Development Plan to become a developed nation by the year 2020.

DESCRIPTION OF THE ASSIGNMENT

2.1 Global objective

The overall objective of undertaking the SEA is to describe, identify and assess the likely significant environmental challenges, considerations and effects of implementing the NAS with regard to the environmental impact of the sugar restructuring outlined in the NAS. The SEA will provide relevant information for the implementation and/or review of the NAS.

2.2 Specific objectives

To complete and strengthen the findings of the NAS pertaining to environmental issues. In addition, the SEA will provide decision-makers in the EC and other donors and the partner country with relevant information to be integrated in the decision-making and implementation processes.

Requested services, including suggested methodology

The SEA is composed of two parts: a ***Scoping Study*** and a ***SEA Study***. The Scoping Study will define the critical issues that need to be addressed in the SEA Study, considering the specific context in which the NAS is being developed and is likely to be implemented. The activities and detailed calendar for the SEA Study will be determined on the basis of the conclusions of the Scoping Study.

2.3.1 Scoping Study

2.3.1.1 Overview of the NAS and its institutional and legislative framework

A general description must be made of the NAS's objectives, institutional and legislative framework, including the institutions responsible for the implementation of the NAS, for the management of its environmental impacts and for the SEA process, as well as the relevant environmental policy and legislation. The specific decisions and process that should be influenced by the SEA must be identified. The major policy documents to be considered include environmental policy documents (National Environment Policy/ Environmental Management Act and its subsidiary legislation, Act 59:01 Town and Country Planning Act, land development programmes, etc). Issues to be analysed should also include: the link between institutions and the regulatory framework; regulations for the development of large scale agro-businesses, GoRTT's reforestation programme and the Regulatory framework for industrial emissions (Subsidiary legislation of the EM Act 2000).

An overview must also be given of the wider policy framework related to the NAS in order to identify other planning or policy documents which will need to be explored in the SEA Study.

2.3.1.2 Description of key stakeholders and their concerns

The involvement of stakeholders in the SEA process is a key success factor. The consultant should identify key stakeholders (key groups and institutions, environmental agencies, NGOs, representatives of the public and others, including those groups potentially affected by the likely environmental impacts of implementing the NAS). An indicative list of key stakeholders is attached as Annex I.

Consultants must review records of any national public consultation processes that may have taken place as part of the attached NAS preparation and finalisation process. Based on this review and on additional consultations, they should identify key stakeholders' concerns and values with respect to the NAS under consideration. The stakeholder engagement strategy to be employed has to be agreed with the Commission and the GoRTT before being implemented in order to avoid unnecessary conflicts or raising of expectations. The strategy should give stakeholders an opportunity to influence decisions. However, it must be remembered that a number of projects as a result of the discontinuance of the Sugar industry have already started. Reports from the Ministerial Committee responsible for the

Restructuring of Caroni (1975) Limited will be key to assess the ongoing restructuring process. The reports can be obtained from the EC Delegation
If the public is not used to being engaged, particularly at the strategic level, and if there are no precedents, it will be important to include an education component in the stakeholder engagement process. Due to broader geographical areas that may be covered by the NAS, stakeholder engagement may focus on key stakeholders, especially targeting directly affected and vulnerable groups as well as key stakeholders that may not have been adequately represented during the NAS formulation.
Records must be kept of all consultations and comments received. Those consultations must be sensitive to the fact that the Government may have already consulted affected and vulnerable groups, as several plans and programmes are already in place.

2.3.1.3 Description of key environmental aspects to be addressed in the SEA Study
On the basis of the policy, institutional and legislative framework analysis, as well as the participation of stakeholders, the consultants must identify the key environmental aspects that should be addressed in the SEA Study. That is, the key NAS – environment interactions that need to be given special consideration and emphasis.

Areas to be appraised should include (but not necessarily be limited to): water management; soil conservation; alternative land uses; biodiversity (marine and inland); institutional capacities; reforestation, previous and current land uses, current development plans and programmes.

Depending on expected impacts on society and the scope of other studies, there is also a need to determine to which extent social impacts should be assessed[3].

2.3.1.4 Description of the scope of the environmental baseline to be prepared in the SEA Study
On the basis of the information obtained above, the consultants shall provide indications on the scope of the environmental baseline needed for the SEA Study.

Trinidad and Tobago is an archipelagic state comprising 23 islands. with a total land area of 5.128 sq km on which land under agricultural use amounts to 84 900 hectares. Ca. 8.000 – 18.000 hectares had been used for sugarcane cultivation in Trinidad until 2003. The consultants should give particular attention to the fact that the state owned sugar company was closed in 2003 and the 2007 crop was the last one subsidised. Since then, some of the former sugar lands have been converted into residential lots, agricultural plots or plans for industrial use has been made.

2.3.1.5 Recommendations on specific impact identification and evaluation methodologies to be used in the SEA Study
Consultants should provide an indication of the impact identification and evaluation methodologies that will be used in the SEA Study. Special attention should be given to identifying those environmental interactions that will merit quantitative analyses and those for which qualitative analyses should be carried out.

The final Scoping Study Report will be presented to stakeholders and the Delegation during a workshop.

2.3.2 SEA Study
The scope of the SEA Study will be agreed with the Commission and the GoRTT on the basis of the results of the Scoping Study. The SEA study will be based on the results of the scoping stage and include an environmental baseline study, an identification of environmental opportunities and constraints, an identification and assessment of the potential environmental

[3] In this case, impacts on people should be disaggregated according to sex, age, or other relevant social criteria.

impacts, an analysis of performance indicators, an assessment of the institutional capacities to address environmental challenges an assessment of the environmental input of plans and programmes already in place as a result of the disbanding of the Sugar Industry and conclusions and recommendations.

2.3.2.1 Environmental baseline study

A description and appraisal must be made of the current state of the environment, focusing on those key environmental components identified by the scoping study. The trends for the various environmental components must be identified and a projection must be made of the state of the environment on the short-, medium- and long-term in the assumption of no further implementation of the NAS. External factors must be taken into account, including the influence of other sectoral policies.

2.3.2.2 Identification and evaluation of environmental opportunities and constraints

The environmental factors and resources that can affect (positively or negatively) the effectiveness, efficiency and sustainability of the NAS and progress done so far should be identified, described and assessed for each project undertaken by GoRTT. These factors may include expected impacts from other sectors or policies. This part of the study should also consider the environmental issues that could potentially be addressed by the assessed Programme. The study should assess if the NAS and the steps taken by GoRTT since then provide an adequate response to these opportunities and constraints.

2.3.2.3. Identification and evaluation of impacts

The potential environmental impacts and risks from implementing the NAS must be identified and described for each project being studied, taking into account the views and concerns of stakeholders. Their significance should be determined according to their characteristics (e.g. duration, probability, magnitude, mitigability, reversibility) and the sensitivity of the environment. Those impacts which are significant should be assessed in detail taking into account:

- the views and concerns of stakeholders,
- the consistency with international commitments,
- the socio-economic consequences (especially on vulnerable groups),
- compliance with environmental regulations and standards,
- consistency with environmental objectives and policies, and
- their implications for sustainable development.

2.3.2.4 Analysis of performance indicators

Draft Performance indicators envisaged under the EC support to the NAS (indicators for 2008 – 2010) should be assessed and revised from an environmental perspective, i.e. their usefulness to identify the environmental effects (positive and negative) of NAS implementation. Proposals should be made for the NAS environmental performance indicators and corresponding monitoring system.

The set of indicators may include:

- "Pressure" indicators[4];
- "State" indicators, for sectors with a direct and major link with key environmental resources (e.g. soil for agriculture, forest resources for forestry, reforestation);
- Indicators of other specific issues, such as key institutional weaknesses identified by the SEA[5].

[4] For example: fertiliser use in a given area; hectares of sugar cane land cleared for alternative uses.

[5] For example: number of annual environmental inspections carried out by local authorities in industrial facilities.

2.3.2.5 Assessment of the capacities to address environmental challenges
The capacity of regulatory institutions to address the environmental issues, especially the impacts identified, should be assessed. In addition, national budget availability and commitment for environmental issues in the NAS should be analysed.

2.3.2.6 Stakeholder engagement
Stakeholders should be engaged throughout the SEA study according to the stakeholder engagement strategy agreed in the scoping stage.

2.3.2.7 Conclusions and recommendations
This chapter of the SEA study will summarise the key environmental issues for the sector(s) involved, including policy and institutional constraints, challenges and main recommendations. Recommendations should be made on how to optimise positive impacts and the opportunities to enhance the environment, as well as on how to mitigate environmental constraints, negative effects and risks. The SEA is expected to complete the environmental measures recommended in the NAS or provide additional recommendation. Those should especially be made to support the overall assessment of the NAS and the potential changes in implementation of the NAS and monitoring modalities (MIP indicators).

The recommendations for NAS enhancement should be addressed to the EC for incorporation in its policy dialogue with the GoRTT.

The SEA study recommendations should also identify the areas where technical assistance or other aid modalities (e.g. projects) are required to address specific weaknesses in the environmental institutional, legal and policy framework. They should also include proposals for indicators.

The limitations of the SEA and its assumptions should be presented. The recommendations should take into account the views presented by the stakeholders and explain how these were integrated. In the case of concerns that were not integrated in the final recommendations, the reasons thereof should be given.

2.4 Required outputs
The ***SEA Scoping Study*** will deliver the following results:

- A brief description of the NAS and projects identified therein ;
- A brief description of the institutional and legislative framework of the sector;
- A brief description of what has already taken place (development plans and programmes) since the ending of the Sugar Industry.
- A brief presentation of the relevant environmental policy, environmental and planning legislation and objectives in the country;
- An identification of the key stakeholders and their main concerns;
- An identification of the key NAS-environment interactions;
- A description of the scope of the environmental baseline to be prepared;
- An identification of the impact identification and evaluation methodologies to be used in the SEA Study;
- A work plan for the SEA Study

The ***SEA Study*** will deliver the following results:

- An environmental assessment of NAS and the measures taken by the GoRTT in its efforts to restructure the sugar industry. It will take into account the potential environmental impacts of its implementation and its consistency with the GoRTT's and the EC's environmental policies and objectives;
- Recommendations for further actions/possible solutions to mitigate adverse impacts of the implementation of the NAS. Elements which should be addressed in particular are:
  - industrial waste management,
  - long-term planning of water resources use,
  - inland soil and agrochemical management,
  - alternative land use (including land use planning)
  - afforestation programme
  - alternative agricultural programmes propose (large scale farms)
- Recommendations for EC support implementation (including performance indicators, use of technical assistance and other aid delivery methods) and for NAS enhancement.

On the basis of this draft proposal and the time schedule outlined in the ToR, the company must provide their detailed work plan.

EXPERTS PROFILE

The consulting company must specify the qualifications and experience of each specialist to be assigned to the SEA study. Moreover, the experts must be sensitive to socio-economic impacts of the implementation of the NAS and take into account that some of the stakeholders are already affected by changes.

3.1 Number of requested experts per category and number of man-days per expert

For this assignment a team of two experts will be required as follows

Indicative Schedule (work Days=	Expert I	Expert II
Engagement plan (in consultant's head office)	5	5
Scoping study (including field phase & possible workshop)	18	10
SEA Study (including field phase)	45	45
Finalising of the report (in consultant's head office)	5	5
Total days	**73**	**65**

3.2 Profile required (education, experience, references and category as appropriate)

<u>Environmental Expert – Category II</u>

Qualifications

- Minimum an MSc in environmental management or an equivalent field
- A recognised certificate for Proficiency in English (written and spoken) for non-native speakers

General Experience

- At least 10 years practical experience in environmental issues, including institutional aspects, socio-economic aspects, international environmental policies and management, and environmental assessment techniques or other related issues.

Specific Experience

- At least 3 years experience in the implementation and follow-up of Strategic Environmental Assessments (SEA)
- At least 6 months experience in the implementation of Environmental Impact Assessments (EIA) as well as related issues (Environmental Management Plans, etc.)

Additional advantages

- Familiarity with co-products/carbon emission credit computation
- Familiarity with EC guidance on programming, country strategies, policy mix and integration of environmental issues into other policy areas;
- An understanding of the EU environment and development policies;
- Previous working experience in the region
- An understanding of the EU Sugar Market Regime;

Sugar Sector Expert – Category III

Qualifications

- Minimum a BSc in agronomy or an equivalent field
- A recognised certificate for Proficiency in English (written and spoken)

General Experience

- At least 5 years practical experience in sugar sector, including agronomic aspects

Specific Experience

- At least 1 year practical experience in land use project management including reforestation, diversification, etc.
- A least 6 months proven experience in biological control of pest and disease in sugar cane

Additional advantages

- An understanding of Trinidad & Tobago environment and development policies;
- Familiarity with the EIA methodology and implementation.
- Water management and environmental-related issues

3.3 Working language(s)

The working language shall be English.

LOCATION AND DURATION

4.1 Starting period

The assignment shall commence on January 5 2009.

4.2 Foreseen finishing period or duration

The assignment is expected to end on June 1 2009.

Planning The planning of the assignment is as follows:

Date*	Planned Assignment	Remarks
January 5 2009 January 9 2009	**Commencement of the assignment** Submission of the stakeholders' engagement plan	Consultants' headquarters The EC Delegation and the representatives of the GoRTT will provide their feedback on the plan prior to the commencement of the scoping study

SCOPING STUDY January 19 2009	Introduction meeting	With the EC Delegation and the representatives of the GoRTT
January 20 2009	**Commencement of Scoping Study**	
February 4 2009	Submission of Draft Scoping Study Report	
February 17 2009	Submission of comments on the draft Scoping Study report by the EC Delegation	Comments submitted will include the comments made by the representatives of the GoRTT
February 18 2009	Presentation of Final Scoping Study Report during a Workshop	The workshop will be organised by the consultants in collaboration with the Ministry of Finance
February 19 2009	**End of first phase of assignment**	
SEA STUDY **March 01 2009**	**Commencement of SEA Study**	
May 04 2009	Submission of Draft SEA Study Report	A meeting will be held with the EC Delegation and the representatives of the GoRTT wherein the consultants will present their findings/recommendations
May 05 2009	**End of assignment**	
June 01 2009	Submission of comments on the draft SEA Study report by the EC Delegation	Comments submitted will include the comments made by the representatives of the GoRTT and other key stakeholders
June 10 2009	Submission of Final SEA report to EC Delegation	

* *Dates are indicative*

4.4 Location of assignment

The assignment shall be undertaken in Trinidad.

REPORTING

5.1 Content

The presentation of the reports is explained in Annex II.

5.2 Language

The report shall be written in English.

5.3 Number of copies for reports

The detailed stakeholder engagement plan to be presented *2* weeks after kick-off shall be submitted to the European Commission for comments in 5 copies and one CD-Rom.

The draft Scoping Study Report shall be submitted to the European Commission in 5 copies and one CD-Rom. The draft SEA Study Report shall be submitted to the European Commission in 5 copies and one CD-Rom. The final report shall be submitted to the European Commission in 5 copies and one CD-Rom.

6. ADMINISTRATIVE INFORMATION

6.1 Other authorized items to foresee under 'Reimbursable'

- plane tickets Europe – POS – Europe (one per expert)

- inter city travel, outside Port of Spain (note that expenses for car hire and fuel, or other transport, are only eligible for mission days outside Port of Spain)

- expenses required for the workshop.

All the above items are expenses reimbursable on submission of relevant supporting documents.

The consultant must provide all other support, communication, intra-city transport and backstopping for the experts..

Annex I - List of Key Stakeholders

List is indicative

Ministries:

Finance

Agriculture, Land and Marine Resources (MALMR)

Public utilities

Trade and Industry

Planning Housing and Environment

Social Development

Government bodies / Parastatal organizations and programmes:

Biodiversity Clearing House

Caribbean Planning for Climate Change

Central Statistical Office (CSO)

Divestment Secretariat

Environmental Commission of Trinidad&Tobago

Environmental Management Authority (EMA)

Farmers Training Centre

Water and Sewerage Authority (WASA)

Sugar Cane Feeds Centre

Institute of Marine Affairs

University of the West Indies (Faculty of Agriculture and Natural Sciences.

Private Sector

All Trinidad Island-wide Cane farmers and general Work Trade Union

Cane Farmers' Co-operative

Cane Producers Association of Trinidad and Tobago

NAMDEVCO

Trinidad Island-wide Cane farmers Association of T&T

T&T Agribusiness Association

South Trinidad Chamber of Industry and Commerce

Annex II – Standard format for reports

SEA Scoping Report

Maximum length of the main report (without appendices): 25 pages.

The following text appears on the inside front cover of the report:
This report is financed by the European Commission and is presented by the [name of consultant] for the Government of the Republic of Trinidad and Tobago and the European Commission. It does not necessarily reflect the opinion of the Government of the Republic of Trinidad and Tobago or the European Commission.

1. Executive summary
2. Description of the NAS
3. Overview of the policy, institutional and legislation framework
4. Description of key stakeholders and their concerns
5. Description of key environmental aspects to be addressed in the SEA Study
6. Description of the scope of the environmental baseline to be prepared in the SEA Study
7. Recommendations on specific impact identification and evaluation methodologies to be used in the SEA Study
8. Proposal of time frames and resources needed for the SEA Study
9. Technical appendices
    - I. Stakeholder engagement methodology
    - II. List of stakeholders engaged or consulted
    - III. Records of stakeholder participation
    - IV. List of documents consulted

SEA report

Maximum length of the main report (without appendices): 100 pages.

The following text appears on the inside front cover of the report:
This report is financed by the European Commission and is presented by the [name of consultant] for the Government of the Republic of Trinidad and Tobago and the European Commission. It does not necessarily reflect the opinion of the Government of the Republic of Trinidad and Tobago or the European Commission.

1. Executive summary
2. Scope
3. Background
    - 3.1 Sector Programme justification and purpose
    - 3.2 Alternatives
    - 3.3 Environmental policy, legislative and planning framework
4. Approach and methodology
    - 4.1 General approach
    - 4.2 Geographical or environmental mapping units
    - 4.3 Assumptions, uncertainties and constraints
5. Environmental baseline study
6. Impact identification and evaluation
7. Analysis of alternatives
8. Mitigation or optimising measures
9. Indicators and institutional capacities
10. Conclusions and recommendations
    - 10.1. General conclusions
    - 10.2. Recommendations for EC support of the NAS
    - 10.3. Recommendations for NAS enhancement
11. Technical appendices
    - Maps and other illustrative information not incorporated into the main report
    - Other technical information and data, as required
    - List of stakeholders consulted/engaged
    - Records of stakeholders' participation
11. Administrative appendices
    - Study methodology/work plan (2–4 pages)
    - Consultants' itinerary (1–2 pages)
    - List of documentation consulted (1–2 pages)
    - *Curricula vitae* of the consultants (1 page per person)

- Terms of Reference for the SEA