REQUEST FOR PROJECT/PROGRAMME FUNDING FROM THE ADAPTATION FUND

The annexed form should be completed and transmitted to the Adaptation Fund Board Secretariat by email or fax.

Please type in the responses using the template provided. The instructions attached to the form provide guidance to filling out the template.

Please note that a project/programme must be fully prepared (i.e., fully appraised for feasibility) when the request is submitted. The final project/programme document resulting from the appraisal process should be attached to this request for funding.

Complete documentation should be sent to:

The Adaptation Fund Board Secretariat
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ADAPTATION FUND

PROJECT/PROGRAMME PROPOSAL TO THE ADAPTATION FUND

PART I: PROJECT INFORMATION

Project/Programme Category:	Project
Country/ies:	Trinidad and Tobago
Title of Project/Programme:	Multisectoral Adaptation Measures to Climate Change in the South Oropouche Basin for River Flood Relief
Type of Implementing Entity:	Regional Implementing Entity (RIE)
Implementing Entity:	CAF, Development Bank of Latin America
Executing Entity/ies:	The University of the West Indies (UWI)
Amount of Financing Requested:	USD 10,000,000 (4 years)

Project / Programme Background and Context:

Summary Overview

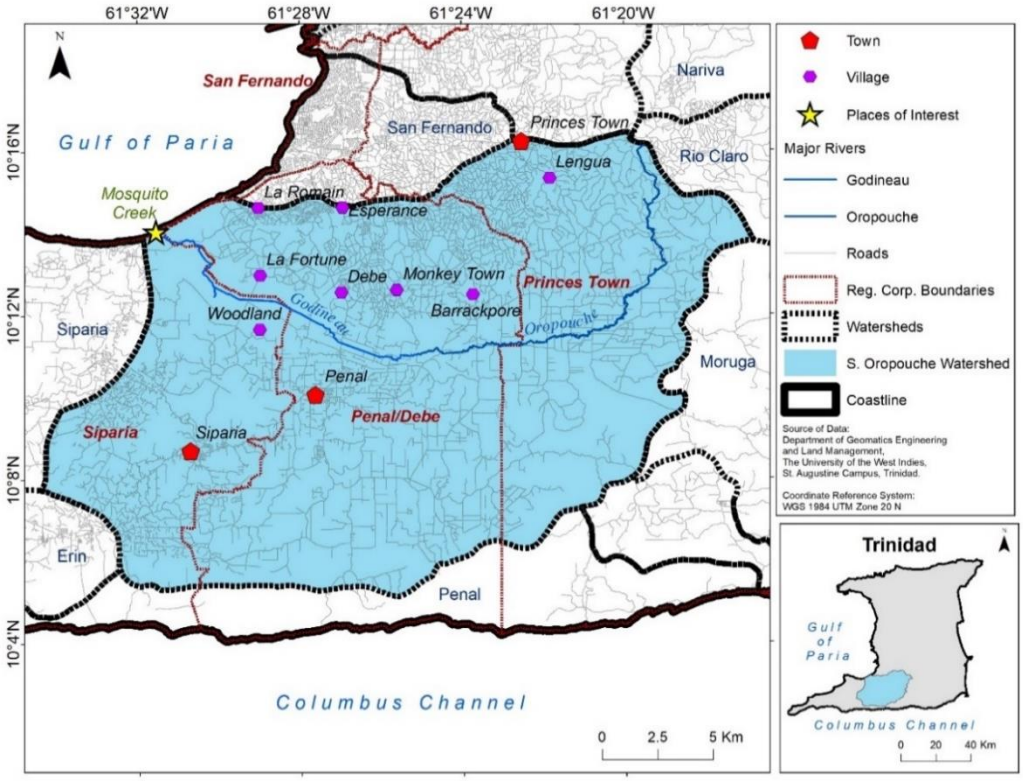
1. Traditionally, flooding in the South Oropouche River Basin (SORB) from high intensity, short duration storms occur about ten times each year. However, in the last five years, basin-wide floods with high water depths, taking several days to subside, have been occurring almost annually. These floods l cause major disruption to the productive sector and the populated centres, and frequently result in loss of personal property. Losses are estimated at between USD 19 - 36 million per year at the country level, depending on the climate scenario. According to the models, climate change is expected to increase the frequency and intensity of floods but will also cause sea level rise and augment the occurrence of drier periods.
2. Climate change will exacerbate the problems that currently exist in the basin, with the confluence of various economic activities in the same territory (agriculture, fishing, commercial, oil and gas production), the poor condition of the drainage systems, and the pressures of major urban growth in the area in recent years. The riverine system is especially susceptible to the effects of climate change, including the threats of saline intrusion which affects both flora and fauna. Economic impacts are evident on people's livelihoods.
3. The path of the South Oropouche River within the South Oropouche watershed takes it from the generally flat and gently undulating arable lands in Barrackpore to the Godineau Swamp, an estuarine wetland of 3,171 ha, and out to the Gulf of Paria. The swamp receives the drainage from a catchment basin of 42,473ha which includes the nearby urban communities. This swamp, which acts as a buffer against flooding and sea level effects, is also under pressure by human activities and the environmental change caused by climate change and needs to be reinforced and protected to in turn protect the population of the basin.
4. The SORB has been prioritized by the country because of the chronic flooding issues that occur even in periods of moderate rainfall, it is a region of high population density and agricultural and commercial activity and thus disruption and economic losses are significant; the most recent studies have identified this region as vulnerable to climate change; the local communities have shown evidence of sea water intrusion; and climate change scenarios show that projected impacts are likely to exacerbate the existing situation unless adaptation measures are taken.

5. The Project implemented by the Development Bank of Latin America (CAF) aims to increase the resilience of the South Oropouche River Basin's population and ecosystems to flooding, sea level rise and expected increasing water deficit events. The proposed activities will strengthen territorial planning and risk management, will promote investments for enhancing water infrastructure, EbA measures in vulnerable and coastal ecosystems, increase the adaptive capacity of vulnerable livelihoods, and raise awareness, build capacities, and mobilize the stakeholders of the SORB towards climate change resilient actions that account for gender justice.

The South Oropouche River Basin (SORB)

6. The South Oropouche River Basin (SORB) is situated on the southwestern coast of Trinidad (Figure 1). Its catchment area of about 450 km^2 is drained westward by a dense network of tributaries that drain into the Godineau/South Oropouche Swamp. A sand dune on the coast extends across the interface with the Gulf of Paria that controls free flow into the sea. Drainage is through two openings in the dune, the Godineau River to the south and Mosquito Creek to the north. The catchment is relatively flat with the highest point being about 175 m MSL. The average slope of the catchment along Godineau River, the main westward flowing watercourse, is about 0.30%. The longest flow path is about thirty (30) km and the travel time to the coast is about one (1) day. The average annual flow from the basin is 3.6 m^3/s, but it varies appreciably. In some years, streamflow stations have recorded almost no flow along the main channel.

7. ***Figure 1. The South Oropouche River Basin (SORB)***



8. In its natural form, about 15% of the catchment was occupied by a lagoon and surrounding swamp lands, with the majority of it being in the lower segment and continuous with the coast. Some pockets of marsh lands extended to Barrackpore, which is about 15 kilometres inland from the coast. About 80% of the soils in the basin have clay textures but there are some pockets of sand toward the southwestern

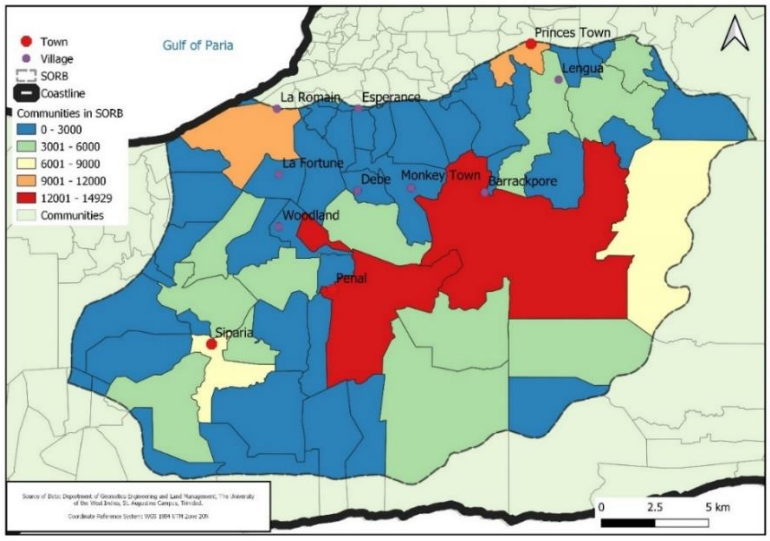
segment. A land capability assessment of the catchment has described the soils as having imperfect drainage with very low infiltration rates[1].

A. Social, Economic, and Environmental Context

a) Demographic data in the project area

9. Portions of three Regional Corporations comprise SORB, namely Siparia, Penal/Debe and Princes Town. Overall, the population of the SORB accounted for 143,855 people in 2000, equivalent to 11.35% of the total population of Trinidad and Tobago at that time. In 2011, date of the last census, the population had grown to 197,540 people.

Figure 2. Population distribution in the SORB (2011)



Source: University of the West Indies, 2021

10. Siparia is just over 51,000 hectares, roughly 10% of the total land area, and features a variety of settlements of various sizes, on and offshore oil production bases, ports, industrial areas, fishing centers, forest, swamps, agriculture, and numerous beaches stretching along the 100 kilometers coastline of southwest Trinidad from Godineau River to Quinam Bay. Oropouche East and West fall under the Penal/Debe Regional Corporation. Princes Town municipality, which is next to the Penal/Debe region, is one of the largest municipalities at 62,000 hectares. It is made up of fifty-six communities and extends to the coast in the South, abutting the City of San Fernando in the North.

11. *Population*: According to the last census (2011) 86,949 people reside in the region of Siparia living in 22,393 private households. The recorded population of Penal/Debe is 89,392 persons, living in the 26,067 recorded private households in the region. In Princes Town, the total recorded population is 102,957 with a population density of 148 per km2 in the last census. The population of the three regional corporations is relatively young, with more than half of the population under 35 years of age. The age/gender comparison shows an almost even distribution of the population by gender.

12. *Education Level:* Examination of the highest qualification attained in Siparia and Penal/Debe approximately 49% of those 15 years or older had no qualifications. However, 30% of those who had qualifications in Siparia and Penal Debe population had attained primary-level education. Tertiary non-university level educational attainment stood at 5.7% and 5.4% for those who attained tertiary university-level education in Siparia; and at 6.1% and 7.9% in Penal Debe. The National Human Development Index ranks Princes Town as having the fourth lowest "secondary and higher education" attainment rate. Princes Town had the lowest rate of female participation in the workforce.

1 Brown, C. and Bally, G., 1968. Land Capability Survey of Trinidad and Tobago No. 5 Soils of South Trinidad. Orbit Press, Port-of-Spain.

13. *Gender Equality*: Siparia and Penal/Debe were among the regions that scored the lowest in the gender inequality index compared to other regions in the country. This trend also applies to Princes Town, with the municipality recording the lowest rate of female participation in the workforce in its last available Economic Profile. Siparia has a higher-than-average female labor force participation rate – 50.3%, while Penal/Debe had the second lowest female labor force participation rate in the country (43.7%). In the case of Princes Town, the municipality has the lowest rate of female participation in the workforce.
14. *Health and Life Expectancy*: In the case of Trinidad and Tobago, in 2016 the total life expectancy was 63.3 years with 4.9% of adult population considered undernourished (2015–2017, 3-year average); 19.7% of adult population considered obese (2016); 12.5% prevalence of diabetes in the adult population (2014) and 23.6% of iron deficiency anemia in women of reproductive age (2016). In the case of the South Oropouche region, Siparia recorded a slightly higher life expectancy of 74.65 for both sexes; 73 for males and 76.6 for females. However, Siparia has a slightly lower incidence of chronic diseases of 21.8 percent compared to the national average. Penal/Debe's life expectancy is higher than the national average; 70.2 years for males; and 76.5 years for females. Penal/Debe also has a relatively low incidence of chronic diseases of 20.7% and recorded the second lowest population percentage without adequate sanitation facilities, with 3.9% of its households. Princes Town reflects a similar life expectancy of 74.20 years, while the municipality has the second highest incidence of chronic diseases and the fourth lowest level of participation in secondary and higher education.
15. *Informal settlements*: In 2011, within the SORB area, there were 187 informal settlements registered in Trinidad. However, these figures do not account for the many squatter communities which remain unregistered. According to ODPM 2014, there were around 23 settlements in Siparia, 12 in Penal Debe, 10 in Princes Town.
16. *Disabilities*: People with disabilities are the most vulnerable to climate risks and they require specific attention in emergencies. According to the 2011 census, the percentage of people with disabilities at the Regional Corporations were: Penal Debe 3,3%, Princes Town 4,5% and Siparia 4,8% from total of population.

b) Access to public services

17. According to the 2011 census[2], households of the SORB face challenges related to unmet basic needs (UBN). As presented in Table 1, the percentage of households in the region with one or more UBN ranges from 18.06% and 22.32%, and with two or more the range varies from 2.85% to 4.67%. The higher percentages of UBN are those related to housing, which varies from 5.76% to 7.53%.
18. The Penal Debe Regional Corporation presents the lowest percentage of population among the three municipalities with two or more UBN (2.85%), while the municipality of Princes Town shows the highest percentage of the population with one or more UBN (22.32%). Siparia has the lowest percentage of households with one or more UBN but has the highest value for two or more UBN (4.67%).

Table 1. Access to Public Services in the South Oropouche watershed

Indicators	Penal-Debe	Princes Town	Siparia
Households with one or more UBN, 2011 (%)	19.24	22.32	18.06
Households with two or more UBN, 2011 (%)	2.85	3.90	4.67
Households with housing UBN, 2011 (%)	5.76	7.53	6.99
Households with water UBN, 2011 (%)	2.28	2.36	1.73
Households with sanitation UBN, 2011 (%)	4.45	5.10	4.69
Households with light UBN, 2011 (%)	1.23	1.97	3.21
Households with refuse collection UBN, 2011 (%)	6.44	6.97	2.20

Source: Trinidad & Tobago 2011 Population and Housing Census

19. The productive and social infrastructure in the project area presents different level of progress among municipalities and sectors. In general, there are needs in the region related to road infrastructure, storm

2 Source: https://cso.gov.tt/census/2011-census-data/.

water management and coastal protection, solid waste management, housing quality and disaster management.

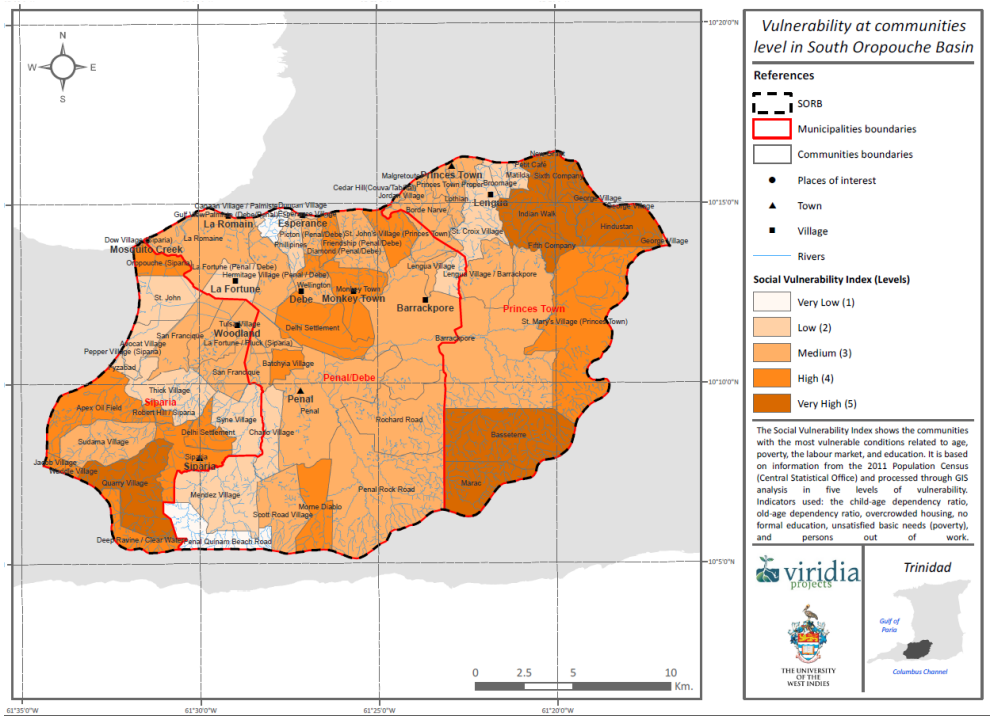
20. The three municipalities are reasonably well supplied with school places at the primary and secondary levels allowing relatively ease of access to the relevant cohorts. However, there may yet be some shortfall in facilities for early childhood care. There has been developing some level of expansion for post-secondary education, and tertiary education with UWI University Centre in San Fernando and UWI Distance Education facilities.
21. Primary health care facilities are relatively well distributed through Health Centers in the Municipality. Secondary care services are available only at some distance to most communities. However, these might be more than one hour away for many communities. This means that many residents are at risk in the case of medical emergencies that require immediate treatment and intervention. A new hospital has been constructed for the area, which has led to major improvement in access. Moreover, the extension of the Highway from San Fernando to Point Fortin is expected to reduce time in access to secondary and emergency care services.
22. **Penal-Debe (PDRC)** features poor quality roads impose high transport costs on the movement of goods and in the provision of some services, as well as risk to female travelers in particular who risk sexual violence. Much of the region lies in the Oropouche Basin and is subject to serious flooding during heavy rainfall events. These impacts on roads and the agricultural traces in the region. The roll-out of telecommunications services offer possibilities to the remote communities in the municipality. Residents in many areas have gained access to cable television and internet access including broadband.
23. **Princes Town (PTRC)**: The roads present many kinds of challenges. Mainly in rural areas, there is inadequate road network and extensively damaged and in a state of disrepair in many areas.
24. **Siparia (SRC)**: There is a substantial arterial road infrastructure in the municipality, but in many parts, it is of low quality and/or not well-maintained thus rendering transport costs relatively expensive in some communities. Having several industrial towns, the telecommunications infrastructure is excellent in many communities. Residents in many areas have access to telephone services – fixed and mobile, cable television and internet access but some rural and remote locations may suffer unreliable access. In the urban centers, however, access is good.

c) Main Economic Activities (livelihoods)

25. According to the World Bank income group classification in 2020, "Trinidad and Tobago is a high-income country, with an open economy in which trade plays a very important role (70% of GDP in 2014). The energy sector dominates the economy and trade: Agriculture contributes only 0.5% to GDP, and agri-food's share of total exports is only 2.6%. Agriculture's share of total employment is relatively higher (3.4%). Trinidad and Tobago imports 85% of its food supply. Although agriculture is not a major contributor to GDP in the country, the diversification of the economy and the reduction of the food import bill are among the country's development goals. Developing agriculture is therefore included in the country's policy priorities."
26. Siparia has a lower-than-average household income per capita per annum, reporting figures of TT$27,217 or US$5,904 in 2012. Incomes fell in the municipality due to the shrinkage of the land-based oil industry in the area. Meanwhile Penal/Debe had the fourth highest household income per capita per annum at TT29,358 or US$6,368 in 2016. The per capita household income for the Princes Town Region in 2008-2009 was US$6,105 or TT$25,258, the fourth lowest in the country.
27. Princes Town has the second highest incidence and highest intensity of Multidimensional Poverty among the municipal corporations with thousands of households receiving public assistance, with a poverty index of 29.3%. Penal/Debe have a similar Multidimensional Poverty Index (MPI) with 28.1% of the total population. In the case of Siparia, the poverty index accounts for 26.5% of the population.
28. According to the information provided in May 2021 by the Ministry of Agriculture, Land and Fisheries, the Victoria County, composed of the districts of Moruga, Barrackpore, Tableland, Piparo, Princes Town, Bonne Aventure, and Debe, comprise a total approximate land area of 600 km^2 and there are approximately 9,900 farmers, of which 3377 are actively registered and 80% are men.
29. In total, 992 hectares are cultivated, in which the most important cultivations are vegetables (161 ha), root crops (161 ha), cocoa (145 ha), and pigeon peas (102 ha). In addition to crops, poultry (280 pens), bees (339 hives), and cattle (3614 heads) are also important.

30. The calculated losses by flooding from June 2017 to November 2020 indicate that losses reached 231 farmers (51% of which are concentrated in 2017) and totaled US$ 433,458. The two-mayor affected by flooding districts at Victoria County are Debe and Barrackpore. It is estimated that 20% of Debe's 6,460 hectares and 40% of Barrackpore´s 11,800 hectares are land area prone to and affected by flooding. The two districts account for 32% of the county farmers.
31. The St. Patrick East area covers an area of approximately 320 km^2 and has 3,266 registered farmers. The estimated production value of crops is US$ 1,363,380. The most widespread crops are banana/plantain (101 ha), citrus (80.8 ha), cocoa (65 ha), coconut (30 ha), and watermelon (21 ha). Although there is no headcount for livestock, the estimated monetary value amounts to US$ 2,292,899.
32. The districts which are directly impacted by flooding and are in the South Oropouche Riverine Basin include the districts of Penal, Clarke Road, San Francique, and Pluck Road. From 2014 to the present there have been 783 claims because of economic losses which implied compensations provided to the farmers for US$ 518,079. It is calculated that the compensation represents approximately 75% of the actual loss.
33. Commercial retail activities are concentrated in Princes Town central business district. Fishing is concentrated in the Moruga area. The fish brought ashore in the area, however, is sold without any value-added processes. All the catch is sold fresh to middlemen who wholesale and retail in other population centers. The PTRC has a high tourism potential.
34. Businesses currently operating in the municipality of Siparia account for 3.85% of the total formally registered in the country. The local economy in Siparia is predominantly comprised of businesses involved in Retail and Distribution (59.67%), the provision of Personal Services (16.37%), and Construction (7.95%). There exists a very well-established industrial sector. Siparia is also home to a substantial energy industry cluster.
35. The Social Vulnerability Index map (Figure 3) is based on the information from the 2011 Population Census and processed through GIS analysis at five levels of vulnerability. It shows the communities with the most socially vulnerable conditions related to the age dependency ratio of children, the old-age dependency ratio, overcrowded housing, lack of formal education, unsatisfied basic needs - UBN (poverty), and unemployed people. The high level of social vulnerability shows that these indicators concentrate the highest numbers of each one. As an advance to the risk analysis that will be presented in the Full Proposal, this map allows to understand the different vulnerabilities within each municipality.

Figure 3. Social Vulnerability Index map



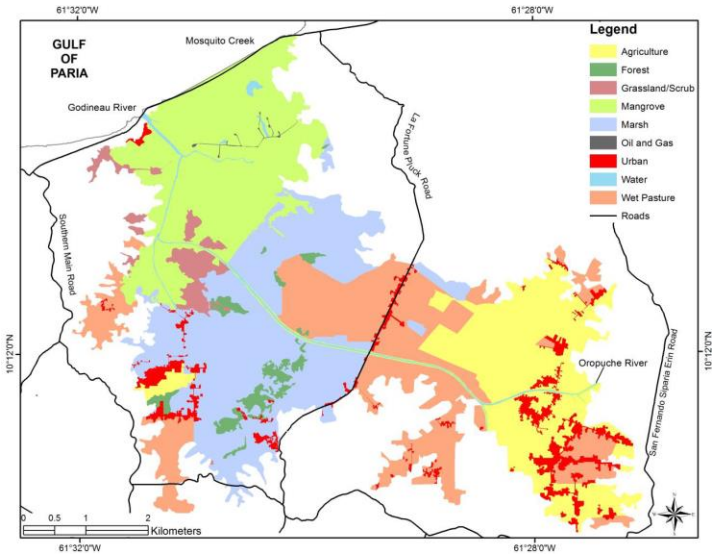
d) Key ecosystems in the SORB

36. The path of the South Oropouche River within the South Oropouche watershed takes it from the generally flat and gently undulating arable lands in Barrackpore to the Godineau Swamp and out to the Gulf of Paria. The Godineau Swamp, also known as the South Oropouche Swamp, is an estuarine wetland of an area of only 3,171ha, yet it receives the drainage from a catchment basin of 42,473ha which includes the nearby urban communities of Penal/Debe, Siparia and Fyzabad. In a historical context, the swamp has been important to the economy of the region as a source of fish and shellfish. However, the conversion of land for agriculture, livestock farming, and housing threatens the ecological functioning of the swamp[3].
37. Changes in salinities along channels in the swamp have shown that there are increasing zonation of mangrove species. Higher penetration of saline water further upstream limits the growth of some species of mangrove, with only one species (Red mangrove - *Rhizophora mangle*) showing increased tolerance to higher water salinities and conductivities. The changes in the biota of the swamp must be taken into consideration as mangrove replacement can be an important effort in protecting inland areas from flooding and thereby safeguarding the ecosystem goods and services that surrounding the communities depend on[4].
38. The main plant communities within this wetland are the tidal marshes, wet pastures, and the mangrove swamp. Land cover is shown in Figure 4. Tidal marsh communities represent the major plant community of the swamp, and at 1,746ha, they account for more than half the total area of the swamp[5]. The Godineau mangrove forest includes the most common mangrove species locally and is approximately 740ha in size. The mangrove oyster (*Crassostrea rhizophorae*) is one of the species that is commercially harvested from the swamp. Though the extent of the Godineau mangrove forest has been generally unchanged since 1969, pollution, oil spills and hydrological alterations have severely impacted the forest. Mangroves have been cleared for roads and oil-drilling activities, interrupting the swamp's hydrological flow. Occasional dredging activities have created embankments within the channels. These three activities have affected tidal flushing capacity of the swamp[6]. This reduces the overall dissolved oxygen content of the water upstream and fosters bacterial growth leading to a decline in water quality and the ability of the biota to withstand the rising anoxic conditions. In addition, it has been observed that the presence of the hairy crab in the South Oropouche mangrove is almost nil. At present, it is being decimated by overfishing by crab fishermen and it is likely that changing conditions in the climate will further harm this and other wildlife. To rehabilitate the ecosystem, in addition to restoration activities, it is necessary to raise public awareness and promote protective measures.
39. With rice cultivation commencing in the 1890s, this activity led to the clearing of 190ha of mangrove forest to develop rice paddies within a system of embankments and sluice gates. The failure of water control mechanisms to prevent saltwater intrusion led to the abandonment of rice farming and the emergent brackish marsh communities is now used by foraging bird species[7].
40. Along the course of the South Oropouche River, are communities that depend on it as a source of freshwater and for small scale fishing. Traditional practices such fishing, recreation, eco-tourism, housing, and religious activities are important to the communities are prevalent within the watershed. These practices are predominantly unregulated[8] and have had an increasingly negative impact on water quality. The ultimate impact of wetland depletion will be the livelihoods of the surrounding communities.
41. With the backdrop of the South Oropouche watershed consisting of significant forest reserves and forest resources, unsustainable logging, unplanned development, land conversion and slash and burn

3 Juman, Rahanna A. 2010. Wetlands of Trinidad and Tobago. Institute of Marine Affairs, Trinidad and Tobago.
4 Atwell, Melissa & Wuddivira, Mark & Gobin, Judith. 2016. Abiotic water quality control on mangrove distribution in estuarine river channels assessed by a novel boat-mounted electromagnetic-induction technique. 42. 399-407. 10.4314/wsa.v42i3.04.
5 Juman, Rahanna A. 2010. Wetlands of Trinidad and Tobago. Institute of Marine Affairs, Trinidad and Tobago.
6 Juman, Rahanna, A. & Hassanali, Khalil. 2013. Mangrove Conservation in Trinidad and Tobago. In G. Gleason & T. R. Victor (Eds.), Mangrove Ecosystems: Biography, Genetic Diversity and Conservation strategies (pp. 35-64). New York: Nova Publisher.
7 Juman, Rahanna, A. & Hassanali, Khalil. 2013. Ibíd.
8 Juman, Rahanna, A. & Hassanali, Khalil. 2013. Ibíd.

agriculture add to the fragility of forests. Controlling these would assist in grappling with the issues related to climate change. It is anticipated that future changes in temperature and rainfall will create conditions that will increase the prevalence of forest and bush fires leading to the loss of significant portions of the forest reserve.

42. ***Figure 4. Land cover in the Godineau Swamp in 2007***



Source: IMA

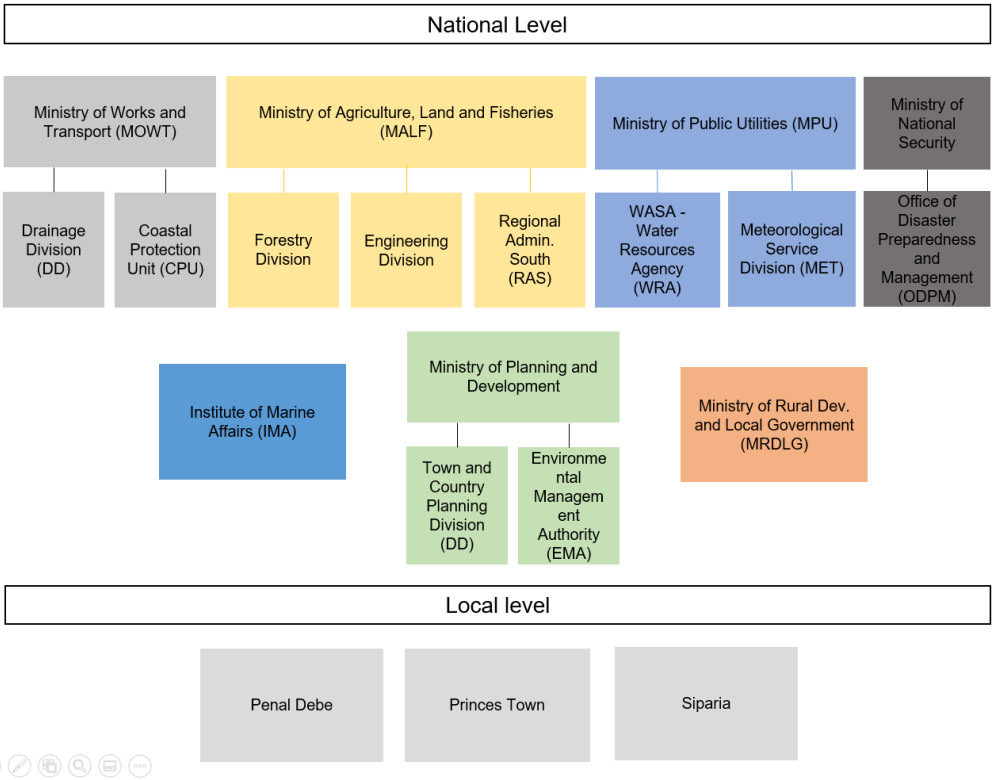
43. In the Penal/Debe municipality, forest reserves, steep slopes, gas line corridors, lands zoned for agriculture, areas of ecological importance, and land less than 1m in elevation present a peculiar set of planning challenges[9]. Siparia has a significant number of natural resources inclusive of oil, timber and fisheries[10], while Princes Town has extensive forest reserves and fishing activities which are concentrated along the southern coast of the municipality. Many of the fishermen from the area use the nearby facilities in Moruga. With issues such as coastal erosion, loss of arable lands to non-agricultural activities, land slippage, squatting and unregulated urban sprawl, the environmental integrity and livelihoods within the Princes Town municipality are threatened[11].

e) Flood governance in the SORB

44. This section describes the governmental and civil society stakeholders considered key for the project and offers a preliminary identification of agencies and tools to be considered for enhancing flood governance[12]. There are several civil society organizations linked to the watershed. Some of them are the South Oropouche Riverine Flood Action Group (SORFAG), the Puzzle Island Farmers Association, and the Woodland Fisherfolk Association. Key governmental stakeholders are shown in Figure 5 and described in Annex 1.

9 GENIVAR (Trinidad and Tobago) Limited. 2010a. Final Draft Municipal Development Plan. Penal/Debe Regional Corporation. Ministry of Local Government, Trinidad and Tobago.
10 All-Inclusive Project Development Services Limited. 2010. Siparia Final Draft Municipal Development Plan. Report Volume 1. Palo Seco Agricultural Enterprises Limited. Siparia Regional Corporation, Ministry of Local Government, Trinidad and Tobago.
11 GENIVAR (Trinidad and Tobago) Limited. 2010b. Final Draft Municipal Development Plan. Princes Town Regional Corporation. Ministry of Local Government, Trinidad and Tobago.
[12] Note: With the partial proclamation of the Planning and Facilitation Act, the Town and Country Planning Division (TCPD) will be subsumed into the National Planning Authority. Therefore, in the next stages of the project formulation, a follow-up of the creation of the proposed Authority will be made.

Figure 5. Key governmental stakeholders



45. Local governments in Trinidad and Tobago function largely as extensions of the central government, with significant limits on local autonomy and resource allocation. Municipal corporations have no independent revenue base and are totally dependent on the central government for national budget allocations. Planning in Trinidad and Tobago is almost exclusively at the national level, although there has been an effort to develop municipal land use plans. Also, some disaster risk management plans have been developed in several corporations.
46. The Municipal Disaster Management Units are linked to the Office of Disaster Preparedness and Management (ODPM), the national organization in charge of disaster preparedness for the nation. The susceptibility to severe flooding makes it imperative that each municipality has an effective disaster management unit.
47. The achievement of flood resilience within SORB requires the pursuit of approaches that can best be placed into five classes: flood risk prevention, flood defense, flood risk mitigation, flood preparation, and flood recovery. Such should be included in considering flood governance on a national scale. Such pursuits fall outside the scope of this project, but it is worth considering from among the existing governance structure in the country the agencies that might be involved and the tools required for being effective in the required roles. This is shown in summary in the table below, where the tools that will be addressed by the project are marked in bold type:

Table 2. Preliminary identification of agencies and tools to be considered for enhancing flood governance.

Approach	Lead agency	Supporting Agency(ies)	Tools/techniques	Comment
Flood prevention	Town and Country Planning Division	Regional Corporations; EMA, ODPM	**Flood hazard map**; necessary enforcement instruments;	Control of investment in high-risk areas

Flood defense	Drainage Division	WRA; TTMS; Ministry Local Government; Ministry of Agriculture; Ministry of Finance	**Comprehensive Hydrologic database**; drainage manual; **soft and hard computer facilities**	Development of structural measures, like levees, Drainage manual would inform options. Use of computer models will improve effectiveness
Flood mitigation	Town and Country Planning Division	Regional Corporations; Ministry of Works and Transport; EMA	Drainage manual; **flood hazard map**	Will control development on floodplains and minimize losses from floods
Flood preparation	ODPM; Regional Corporations	Ministry of Works; WRA; TTMS; Ministry Social Development	**Community Flood Early warning system; flood hazard map; vulnerable persons mapping; floodproof manual**	ODPM, in conjunction with these agencies, will be able to issue early flood warning and do pre-planning for identifying evacuation routes.
Flood recovery	Ministry of Planning	Ministry of Works; Ministry of Agriculture; Ministry Social Development; EMA; APETT	Round table Post-mortem exercises to shed light on reason for floods; Revision of flood hazard map; revision of flood manual	A system is needed for post mortems so that lessons from a flood event can be used for improving future responses and inform methods for rebuilding.

f) Climate context in the SORB

48. The southwestern part of the island receives relatively low annual rainfall (1100 to 1700 mm/year) . Most of the rain (about 75%) falls within the wet season that is from around May to December. The prevailing factors for rainfall[13] are the Intertropical Convergent Zone (ITCZ), the major rainfall/cloud forming system largely responsible for the wet season; the mid-Atlantic Trough of low pressure responsible for rainfall in the latter part of the wet season; daytime convection, orography, and land size; and tropical cyclones, including depressions, storms, and hurricanes. Because of its southerly position, the island of Trinidad generally is not hit frequently by tropical cyclones, although in the last five years at least three storms made landfall.
49. Since 2015, there has been significant flooding within the catchment from large volume rainfall lasting about two to three days. The most recent catastrophic events were in 2017 when more than 200 mm of rainfall fell over three (3) days (Photo 1) and in December 2019.
50. The tidal range at the coast is in the order of about one (1) metre. Drainage of the catchment is partly controlled by the tides which exert effects as far as about ten (10) kilometres inland and cause elevated salinity levels in the watercourses. As a result, mangrove forest proliferated in the lower basin and provided an important area for many birds, including migrating birds, ducks, and the rearing of young scarlet ibis (Bron et al., 2016)[14].

g) Climate Historical Trends and Projections

51. Rainfall data from 1969-1990 indicated an **overall decline in rainfall** over the period. There have been **increases in the incidence of short, intense rainfall** during the dry season in Trinidad, and a comparative **10% increase in dryness** during the dry season (Clarke et al. 2018). **Average temperatures have also recorded an increasing trend** by 0.27^{o}C for Trinidad and 0.17^{o}C for Tobago per decade (Clarke et al. 2018).
52. A 15-model ensemble General Circulation Model (GCM) projection (A2 scenario) indicates Trinidad and Tobago can expect to warm by 0.7˚C to 2.2˚C by the 2050s and 1.0 to 3.7 degrees Celsius by the

13 Royal Haskoning/DHV, 2003. Drainage & Flood control study for the South Oropouche basin.
14 Bron, J, 2016. Problem Identification and Analysis Report for the project: Feasibility Studies and Detailed Design Consultancy Services for South Oropouche River Basin, Flood Mitigation and Integrated Watershed Management Project. Client: National Infrastructure Development Company Limited (NIDCO), GoRTT.

2080s, compared to the 1970-1999 mean (Clarke et al. 2018). Compared to the A2 scenario of GCM ensemble median projections, Regional Climate Models (RCMs) show similar or higher **increases in temperatures**, with changes in annual average temperatures from 3.6˚C and 2.4˚C by 2080, up to **30% decline in annual rainfall**, an **increase of up to 3.1ºC in Sea Surface Temperature, and sea level rise (SLR) of up to 126 cm** (Clarke et al. 2018) The Representative Concentration Pathways (RCP 8.5) indicate a mean annual temperature of 1.40°C (1.00°C to 2.11°C) and **annual precipitation is estimated to decrease** by -59.95mm (-357.10mm to 218.04mm) in 2040-2059 (World Bank, 2018). Already, a rate of SLR of up to 3mm has been observed at tidal gauging stations around the Caribbean (Clarke et al. 2018). Most model projections indicate an **increase in the proportion of total rainfall in heavy events** in all seasons, changing by - 16% to +8% annually by the 2080s (Clarke et al. 2018). Additionally, **more frequent tropical storms** are projected to affect the island within the coming decades, further threatening coastal zones, agriculture and human settlements (Alleng 2014).

53. McShrine et al (2019) analysed the impact of sea surface temperature anomalies (SSTAs) on Trinidad & Tobago and found a weak (r2 < 0.5) but statistically significant influence on the islands' early and late season rainfall pattern. Both the El Nino Southern Oscillation (**ENSO**) and the Northern Atlantic Oscillation (**NAO**) are **key drivers of climate variability** in Trinidad & Tobago (Clarke et al. 2019). For example, inter-annual variability and extremes associated with the 1997-1998 and 2009-2010 drought events which affected Trinidad (and the wider Caribbean) were associated with the ENSO phenomenon. The intensity of cyclone activity during the hurricane season is also sensitive the ENSO, with intensities generally decreasing during the El Niño phase and decreasing during the La Niña phase (Clarke et al. 2019).

h) Present and Projected Climate Risks and Impacts

54. Numerous socio-ecological impacts of the climate extremes have already been documented in a number of studies. The report from the Second National Communication of the Republic of Trinidad and Tobago Under the UNFCCC indicated that Trinidad's agriculture, water resources (including coastal habitats) and biodiversity sectors are among the most vulnerable to climate impacts (UNFCCC 2013). Among the multiple hazards to which the twin island republic has been exposed, flooding has been highlighted as the most frequent hazard affecting Trinidad and Tobago in recent years, according to a preliminary report by the Office of Disaster Preparedness and Management (ODPM 2014).

55. Trinidad's coastal ecosystems have been found to be especially fragile (Clarke et al. 2018). A climate change impact assessment was carried out by Ramnarine-Ramsawak, Suite, and Chinchamee (n.d.) on the Oropouche Hydrometric Areas in South-West Trinidad. Of all the natural resources, Trinidad's **riverine systems were found to be especially susceptible to the effects of climate change, including the threats of saline intrusion** which would affect both flora and fauna. The spill-off of the impacts of climate extremes also have economic ramifications, including on local farming and tourism livelihoods. In quantifying the projected macroeconomic impacts of climate projections, Alleng (2014) suggested that mean damage in Trinidad and Tobago may range between USD$19.5953-36.8614 Million per year, depending on the climate scenario.

56. Despite its limited land size, studies have suggested that climate impacts are not experienced at the same severity spatially across Trinidad. These differences in impacts are moderated by several factors, including biogeography (vegetative cover), site geology and community preparation. A study of potential climate scenarios done by the Providing Regional Climates for Impact Studies (PRECIS-CARIBE), found that **agriculture in the South and Central Trinidad had heightened levels of vulnerability**, compared with the North of the island (UNFCCC 2013, Clarke et al. 2018, GoRTT 2011).

57. Another study by Ramnarine-Ramsawak, Suite, and Chinchamee (n.d.) on various sections of the Oropouche river region, again found that the South Oropouche region faces higher climate risks than the North, due to higher population pressure in the South. The months of February and July were projected to be the coolest and wettest months for the 2035, 2050 and 2075 reference points (Clarke et al. 2018). **Increases in temperature coupled with lower rainfall or less effective rainfall could result in increased soil aridity and considerable decreases in agricultural yields** (Clarke et al. 2018).

58. Increased rainfall intensity and sea level rise would have significant adverse effects on **flooding at the basin and local scales, impacting residential, commercial buildings and critical infrastructure**; on the **agriculture sector, due to increased levels of salinity** of soils and the **contamination of**

freshwater by saltwater intrusion; and on **fisheries**, due to the damage caused to the accesses to fishing sites. Flooding also impacts on **human health**, through impacts on psychological health, the spread of diseases such as leptospirosis and other waterborne diseases, the disruption to the potable water supply, and the interruption of electricity supply during extreme events.

59. The increasing droughts predicted for Trinidad will have serious **impacts on the water security** of the population, which today lacks sufficient water in quantity and quality.

60. Each of these impacts is described in more detail in the following sections, following the description of the social, economic, and environmental aspects of the basin.

i) Flooding and sea level rise impacting on communities and ecosystems.

61. The increased frequency and intensity of floods, sea level rise, and the increase in drier conditions due to climate change heavily impact livelihood options, water security, health services and infrastructure of human settlements of vulnerable people in the SORB area. The sections below describe the impacts of floods events and sea level rise as the most devastating impact, and the actual situation of lack of access to water for the population that urgently needs to be addressed considering future climate trends.

62. Vulnerability to hydro-meteorological events, such as flooding, has been exacerbated by land-use changes for agriculture, livestock, and urbanization expansion patterns. These processes have led to the degradation of forests, soil erosion and increased sediment yields in rivers and canals and have altered total basin's runoff, peak flows and baseflows. These land alterations are linked to the social and economic changes in the country from the "oil boom" in the 1970s

63. Over the 15-year period (2000-2014), Trinidad and Tobago was impacted by several climate related hazards. Since that time, several major floods have occurred within South Oropouche River Basin (SORB), including a countrywide flood in October 2018, and devastating basin wide floods in 2017 and 2019 during which flood waters remained for several days within many communities.

Photo 1. Flooding in the SORB

Sources: left: flooding in Penal in 2017 (shared in social networks)[15]; right: photo by the South Ororopouche Riverine Action Group (SORFAG).

64. The Office of Disaster Preparedness and Management (ODPM) in its analysis of hazard impact for 2006-2011 (V&Ca, 2019) showed that the most prevalent hazard in Princes Town, Siparia and Penal-Debe based on occurrence was flooding. Each of these districts has different climate hazards distribution and impacts, with Penal-Debe being most impacted both in terms of extent and cost of damages.

65. ***6***Flooding in the SORB is triggered by one of two rainfall phenomena, namely short-duration, high intensity rainfall with limited spatial extent, and long-duration, medium intensity rainfall over wide spatial extents. The majority of the flood events in the SORB is at the urban centre scale and is caused by **short-duration, extreme rainfall, over localized areas**. Records show that they occur on average ten times each year in these regional corporations. These floods last for a few hours, cause **major**

15 /www.facebook.com/yuhdottishawa/photos/

disruption to the productive sector, and frequently result in damage to property. Flooding also occurs at the basin level and it is caused by **long-duration rainfall, spatially distributed over the entire basin**. These floods last for several days and have dire **consequences to households, and the productive sector**. The impact of such flooding is exacerbated by the high tides as the rivers are tidal. The floods of 2017 and 2019 were caused by long-duration rainfall.

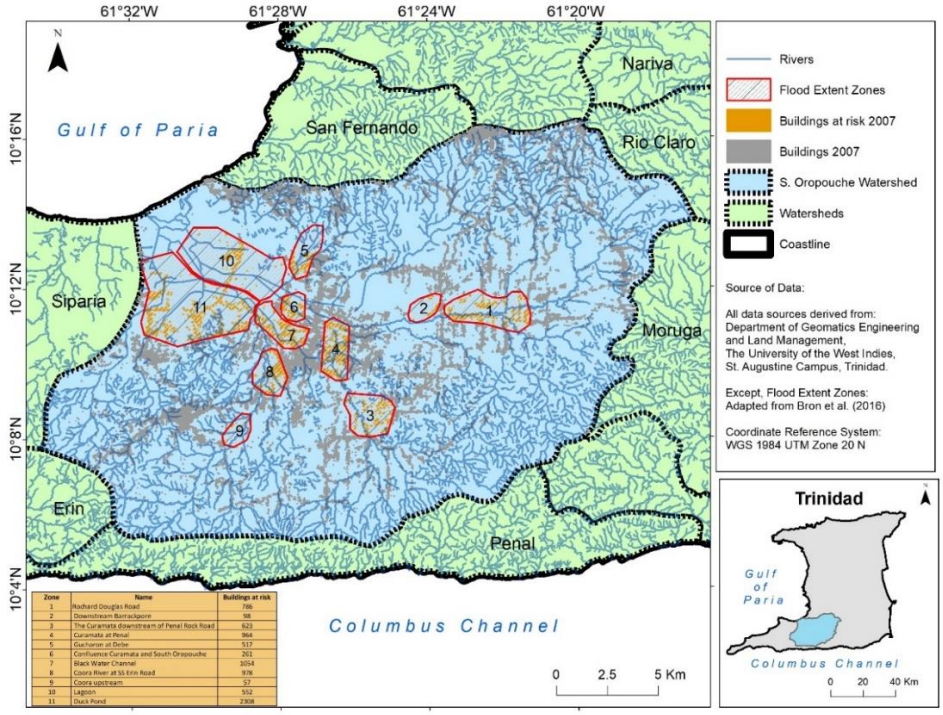
66. The climate change predictions by the IPCC for the Caribbean region are for increased rainfall intensity and sea level rise at an annual rate of between 4 and 7.5 mm. The areas subject to the most severe flooding and the households within that may be affected are listed in Table 4. Their locations as per affected buildings in 2007[16] are shown in Figure 7. The flood susceptibility map of the SORB is shown in Figure 8.

Table 3. Areas subject to flooding in the SORB

Map #[!!]	Name of settlement	Potential no of households affected**	Map #	Name of settlement	Potential no of households affected**
1	Rochard Douglas Road	786	6	Confluence Curamata and South Oropouche	261
2	Downstream Barrackpore	98	7	Black Water Channel	1054
3	Curamata downstream of Penal Rock Road	623	8	Coora River at SS Erin Road	978
4	Curamata at Penal	964	9	Coora upstream	57
5	Gucharon at Debe	517	10	Lagoon	552
				Duck Pond	2308

***. Determined from the Haskoning study (2016) based on the 50-year flood event.*

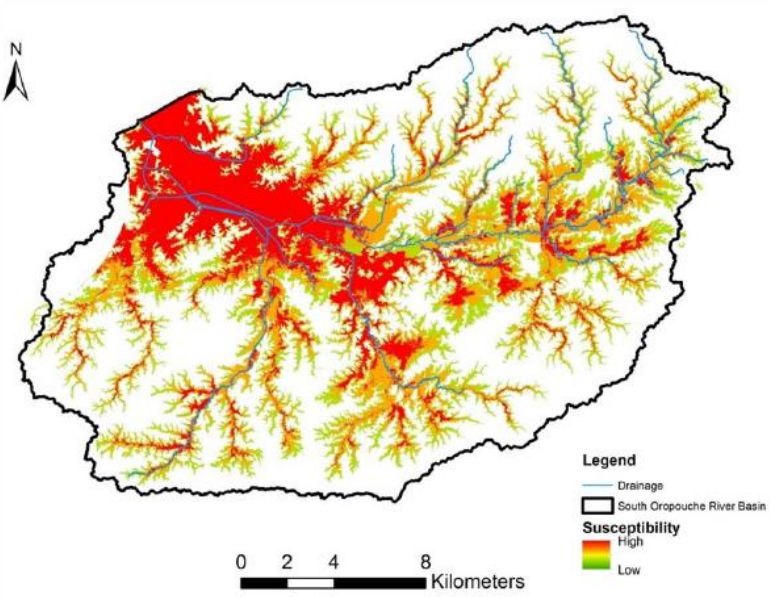
Figure 7. Human settlements prone to flooding in the SORB.



Source: University of the West Indies, 2021

[16] It is assumed that these areas are still the most vulnerable to flooding since the situation has not changed.

Figure 8. Flood Susceptibility Map for the SORB



Source: Drainage Division, 2016.

67. The additional negative effect of climate change on the agricultural sector is through the **increased levels of salinity of soils and the contamination of freshwater by saltwater intrusion**.
68. In the SORB, flooding and sea level rise cause and will continue to cause **damage to infrastructure**: bridges, roads, residential and commercial properties, utilities, access, services, critical infrastructure, historic cultural buildings, and recreational structures, and impacts on wastewater and solid waste management and their infrastructure. In the multi-criteria evaluation system used in the Vulnerability and Capacities Assessment[17], the impact of this risk was rated "high" to "very high" rating. Within the SORB, the specific areas that were ranked as most vulnerable to this damage were the ones shown in the table 4.
69. The reduction of flooding at a basin-wide level requires major infrastructural work including river works, ancillary hydraulic structures and retention and detention facilities. Studies for their sizing would be performed under a recently started project to develop a national drainage plan. Opportunities might exist for utilization of any stored water for irrigation and potable use. Only when these works have been completed would flooding caused by the long duration rainfall be mitigated. One of the major hindrances, however, for developing engineering designs is the lack of a reliable hydrometeorological network to accurately describe the hydrology of the river basin.
70. One major reason for the scale of damage experienced from these floods at the household level is the absence of an effective early flood warning system that can alert them of pending high water levels for them to act to secure property or evacuate as might be required.
71. The Water Resources Agency (WRA), which is responsible for managing the water resources in the country, is collaborating with the Ministry of Rural Development and Local Government to establish a **community flood early warning system (CFEWS)** in the Regional Corporations. The system that is now being implemented consists of one stage recorder on one of the tributaries and the rain gauges existing within SORB. It will provide flood warnings that are based on existing knowledge of the relation between water levels at the stage recorder and flooding downstream. The scope of this system, however, will provide only limited coverage of flooding in the basin and needs to be expanded by gauging other tributaries and deploying other rain gauges over the entire basin. The WRA has identified such a network of instruments that has the potential for providing timely warning for any location within the basin. WRA has received funding for improving its data transmission system and to upgrade its

17 Vulnerability and Capacities Assessment (V&CA), 2019

computer facilities and so the major outstanding components for having a comprehensive warning system in SORB are the hydrometeorological instruments. Should such a system be developed then it would address the concern of households and farmers that warning times will be too short to permit substantial reaction for reducing flood damage costs. The expanded system would most probably have to improve on the methods of forecasting by having means of estimating flood levels based on the information received by the Meteorological Service Division. ***9***

72. The capital works for mitigating basin-wide flooding would not directly address the flooding from localized rainfall Without any intervention, flooding within the built-up areas and agricultural lands would continue and the extent of damage is likely to increase with the predicted increase in rainfall intensity from climate change.
73. The country vulnerability and capacity assessment report (2019) highlighted that the country will face direct **health impacts** caused by different climate risks such as heatwaves, droughts, floods, and storms. This study as well as the first round of stakeholder's consultation conducted for the development of the Concept Note, also discussed indirect impacts, such as changes in infectious disease patterns, pollution, and conflicts.
74. Direct effects from flooding being already experienced by affected population increased in psychological effects such as anxiety, violence, and depression due to the loss of property, livestock, crop, and physical assets during flooding. Sometimes stakeholders mentioned consequences being observed for even longer periods, such as increased stress and trauma from permanent loss of homes from inundation through increased seasonal flooding or landslides. Indirect effects include increase in water-borne diseases such as dengue and leptospirosis, which are categorized as high risk (EU, 2019). This study also underlines that the highest risks come from extreme weather events, increase in flash flooding leading to power supply interruption, injury, interruption of routine health service delivery and response. Among the identified most vulnerable communities to the above-mentioned risks are Penal Debe; and Siparia, both part of the SORB area.

j) Drought exacerbating water scarcity.

75. Currently, localized potable water sources for the region are presently insufficient with only about 3 MIGD (million Imperial Gallon per Day) of the 16 MIGD demand being supplied from sources within the basin. This daily shortfall is provided externally from the Caroni Water Treatment Plant in the north of the island and the Navet Water Treatment Plant to the northeast of the basin. Studies have shown that local supplies can be augmented from the South Oropouche River network and from aquifers. However, neither of these sources are likely to meet the water demand and so dependence on these external sources are likely to continue[18], In the case of run-of-river water systems, the problem will be in the dry season because the flows become so low to prevent any abstraction in order to meet the stipulated environmental flow requirements.
76. There is another side to meeting water needs of customers within the basin and it deals with addressing the water demand. It is a common assumption that at the heart of the problem with securing improved reliability of water to the population is reducing the high fraction of water that leaks from the distribution network. The annual cost country-wide of water leaking from the network has been estimated at about USD $60M[19] and this is mainly due to deficient infrastructure, coupled with lack of capacity to identify leaks and to repair them. The problem with the distribution system to customers within the SORB is likely to be no different than at the national scale. The prediction on rainfall patterns to the end of the century is one of diminishing supply and so it becomes very important to ensure that the water resource is properly used. Inasmuch as the problem of shortfall in demand can be partially solved by bringing into production newly identified water sources, such as from aquifers and surface water intakes and reservoirs, the high fraction of wastage from leakage cannot be overlooked, for the current situation is unsustainable. The impact of not prioritizing fixing this shortfall would likely lead to dire consequences

18 Formulation and Analysis of Alternatives Report: South Oropouche River Basin Study - Flood Management and Water Supply (Royal Haskoning DHV, December 2016).
19 Royal HaskoningDHV, 2016. Solution Identification and Impact Assessment Report (DRAFT). For NIDCO, Government of the Republic of Trinidad and Tobago

in the near future due to climate change. It, however, needs a well-metered distribution network capable of identifying the quantity of water being supplied matched against its usage by its customers. It is to be noted that domestic metering is not practised in Trinidad and Tobago, and this has been cited as a main reason for the high daily per capita water consumption. Attitudes of households toward water consumption need to be changed as they may be unsustainable in the face of climate change. Metering offers an opportunity to trigger change.

k) Land use change in the SORB as a driver for floods

77. ***10111213***There have been major changes in land use within the SORB to facilitate both agriculture and oil exploration. The required infrastructure for accessing drilling sites as well as for controlling saltwater intrusion for agriculture has made major alterations to the natural drainage of the catchments into the Godineau Swamp Later, improved economic opportunities within the SORB diverted interest from agriculture and lead to the subsequent deterioration of the infrastructure. Towns expanded rapidly without a proportional upgrade in the drainage infrastructure, thus making the towns very susceptible to flooding caused by any change in runoff peaks.
78. The limited drainage capacity was further exacerbated by deficiencies in the administration for land use enforcement and the maintenance of the infrastructure. Additionally, the absence of any drainage code for the country that could guide development allowed for arbitrary infrastructure. Many land developers filled the swampy areas to elevations above assumed flood level thus reducing the attenuating capability of these wetlands.
79. The discharge from the towns flows into natural watercourses that are administered by Central Government, but timely maintenance before the onset of the wet season is not always achieved mainly because of deficiencies in the organizational structure for administering to the drainage infrastructure.

l) Barriers to adaptation

80. The main barriers to achieving changes towards a resilient watershed are related to lack of priority in allocating funding for developing the required infrastructure, shortcomings in regulations and institutions, lack of solid data and information systems, lack of technical capacities and knowledge, cultural barriers, and lack of awareness.
81. There is a marked lack of funding to intervene in effective measures in the basin, not only in terms of structural and non-structural investments, but also in terms of human resources available in the responsible public administrations. Lack of funding has prevented the implementation of water infrastructure works such as drainage system improvement or improved access to water, significant interventions for ecosystem restoration, support to the small-scale agriculture and fisheries sector, or support to inhabitants of small towns to improve their flood preparedness. The bilateral meetings carried out and the results of the survey performed in December 2020 – January 2021 indicated that key stakeholders' opinion is that the lack of funding is the major barrier to adaptation in the watershed.
82. There is a lack of key regulations and a lack of incorporation of the climate change perspective in the existing policies and planning. For example, there is no national drainage code now, although there are plans to formulate one in the national drainage plan mentioned above. Key planning instruments that would help ecosystem resilience are not operational, such as the Godineau Swamp Management Plan, which was never adopted. There is a clear need to take up this work that has already begun and incorporate a climate change perspective into the process. There is a clear lack of capacity, highlighted by both authorities and studies in the area, to improve water governance and implement risk reduction and management, response, and recovery plans.
83. Maintenance seems to be a central problem in the drainage system of the SORB, and it stems from two issues. The first is the lack of resources available for doing the necessary works by the agencies responsible for the infrastructure; the other issue is the ambiguity regarding which agency is responsible for doing the maintenance. This issue reflects deficiencies in the governance structure to deal with flooding, and there perhaps cannot be sustained improvements in flood mitigation without properly addressing maintenance. Within the SORB, as is the case all over the country, it is not only the Drainage Division who administers to drains, but also the Highways Division, the Regional Corporations, and the Ministry of Agriculture, to a lesser extent. Initiatives are being made at the country

level for enhancing the drainage network governance; however, some progress could be made at the basin scale to address some of the specific local maintenance problems.

84. There is a significant lack of meteorological, hydrological, and tidal data. If, however, the network of instruments proposed by the present proposal is realised, then its information will provide hydrologic descriptors over the entire basin, be sufficient to address the observation of the highly spatially varied rainfall within the basin and so aid in hydrologic analyses for conducting flood studies and feed the national water resource information management system that is currently being developed. But for such to be realised, the data generated by such a network must be complemented by sound technical capabilities within the agencies to model floods, predict and analyze droughts, manage, and analyze data, and promote cost-effective prevention measures. These capacities are currently insufficient.
85. With regards to ecosystems, the relevant institutions with competencies in the coastal and wetlands ecosystems management know the necessities for their rehabilitation; however, activities are not being promoted because of the lack of funding. Also, there is limited knowledge within the population about the importance of these ecosystems in water regulation and other ecosystem services. The knowledge of ecosystem restoration techniques is not spread at the level of having people being able to work in these duties.
86. Vulnerable groups of the agriculture and fisheries sectors are exposed to high risks and have low adaptive capacities to effectively respond to climate risks. The increase in flooding events and probably the increase of sea surface water temperature compromises the population and potential capture of native fishing species. The farmers and fishers lack of technical capacity and access to funding to diversify their activity and find alternative livelihoods.
87. There seems to be a lack of clarity as to how to incorporate knowledge about climate change and water management and care on the part of the different stakeholders in the basin. Issues such as the causes of flooding, the threats of sea level rise and droughts, the protection of ecosystems, the impacts of discharges into canals by residents and productive sectors, or maintenance of pipeline crossings by the oil and gas sector are just a few examples. This lack of clarity extends to only ad-hoc treatment on the part of national and local authorities to effectively address the management of climate change impacts.
88. There is a lack of a comprehensive approach to climate change in the educational system of Trinidad & Tobago; limited capacity of institutional stakeholders, CSOs, community groups, to address flooding; and lack of accessible and understandable information about climate change for fostering a change of behavior.

Project / Programme Objectives:

General objective:

89. The project aims to increase the resilience of the South Oropouche River Basin's population and ecosystems to flooding, sea level rise and expected increasing water deficit events. The impacts of the mentioned events are already being experienced in the region, but its effects will increasingly impact the infrastructure, health, water security, gender, and livelihoods of the population, as well as the integrity of the basin's ecosystems.

Specific objectives:

90. Strengthen territorial planning and risk management.
91. Strengthen grey and green infrastructure to increase resilience of vulnerable population to floods, sea level rise, and droughts.
92. Enhance vulnerable coastal and wetland ecosystem of the SORB with EbA measures to restore key habitats such as the mangrove areas in the coast and the wetlands in the Godineau swamp.
93. Increase adaptive capacity of vulnerable fisherfolk and farmers to respond to increased climate risks such as flooding, saltwater intrusion, and drought.
94. Raise awareness and build capacities of the stakeholders of the SORB (government institutions, community members, vulnerable groups, private sector), in sustainable climate change resilient actions.

Project / Programme Components and Financing:

Project Components	Expected Concrete Outputs	Expected Outcomes	Amount (US$)
1. Strengthening of Territorial Planning and Risk Management	1.1. Strengthened institutional and regulatory systems for climate responsive planning and development.	Improved policies, regulations and plans to reduce risk to climate change impacts.	200,000
	1.2. Strengthened information, monitoring, and climate information management systems	Reduced exposure to climate-related hazards and threats.	2,350,000
	1.3. Community Early Warning and Decision-making system strengthened and expanded to assess and manage climate risks.		250,000
2. Green and grey infrastructure enhanced to increase resilience to floods and droughts	2.1. Impact of flooding in selected most vulnerable flood-prone neighbourhoods minimized.	Increased resilience of infrastructure at risk in the SORB area.	3,000,000
	2.2. Housing and commercial buildings reinforced against floods.	Reduced exposure of vulnerable population to climate-related hazards and threats.	400,000
3. Vulnerable coastal and wetland ecosystems of the SORB enhanced.	3.1. Key coastal and wetland ecosystems restored.	Increased resilience of coastal and wetland ecosystems	1,300,000
4. Increase adaptation capacity of vulnerable farmers and fishers to address climate change and climate variability	4.1 Resilient farming technologies promoted to increase adaptation to climate change impacts.	Diversified and strengthened livelihoods for vulnerable people in the SORB area	400,000
	4.2 Fishers' resilient livelihood options promoted to increase adaptation to climate change impacts.		450,000
5. Stakeholders of the SORB have built their capacities and are aware of climate risks.	5.1. Capacities of stakeholders have been built to cope with climate change impacts in the SORB	Government officials and staff's strengthened capacities for decision-making to reduce risk to climate change impacts.	100,000
	5.2. Communication and dissemination strategies have been implemented towards reducing vulnerability.	Community members and vulnerable groups strengthened capacities to respond to climate change impacts.	150,000

		Increased awareness of CSOs, community members, associations, and the private sector on CC.	
6. Project/Programme Execution cost			750,000
7. Total Project/Programme Cost			9,300,000
8. Project/Programme Cycle Management Fee charged by the Implementing Entity (if applicable)			700,000
Amount of Financing Requested			10,000,000

Projected Calendar:

Milestones	Expected Dates
Start of Project/Programme Implementation	September 2022
Mid-term Review (if planned)	September 2024
Project/Programme Closing	August 2026
Terminal Evaluation	June 2026

PART II: PROJECT JUSTIFICATION

A. Describe the project / programme components

Project Components

Component 1. Strengthening of Territorial Planning and Risk Management

95. This component includes the outputs aimed at strengthening institutional and regulatory systems for climate responsive planning and development; strengthening information, monitoring, and climate information management systems; and strengthening and expanding the existing Community Early Warning and Decision-making system to assess and manage climate risks.

Output 1.1. Strengthened institutional and regulatory systems for climate responsive planning and development.

96. The project has identified important tools and techniques needed to support the flood governance structure and will provide them as outputs for use now. These tools would be even more effective when an improved governance system has been established. The project proposes the following activities:
    i. Building the capacity of residents living within flood prone areas with knowledge, via a floodproofing manual, that would allow them to take timely and effective actions toward minimizing the potential damage from floods.
    ii. The formulation of a development plan for Godineau Swamp, a sensitive eco-system that is essential for the livelihood of a substantial number of households and whose character is largely determined by the flooding regime within the lower SORB.
    iii. The development of a flood hazard map that can form the basis for land zoning policies.

Activity 1.1.1 Manual about floodproofing infrastructure and buildings, specific to the reality of the SORB.

97. Even if structural measures are implemented for the improvement of the drainage infrastructure within SORB, flooding may still occur because of the uncertainties of rainfall and sea levels due to climate change. Additionally, the implementation of such works would most probably occur in phases so that there may be regions that remain unattended to for some period of time. Under these circumstances, the reduction of losses from flooding might be left up to households but their required effort must be supported for it to be effective. For this reason, the project proposes to develop a floodproofing manual containing the following:
    - A description of the flood prone areas within SORB and an indication of expected depths.
    - A description of the causes of flooding within SORB, illustrated using specific flood events. The consequences of various actions on flooding would be explained.
    - A description on what can happen in the near future due to climate change, in terms of the increased frequency of extreme events and rising sea level.
    - Information on the role and function of each agency involved in flood protection, their assistance each can provide, and how it can be accessed.
    - Information on the community flood early warning system, a description of the meaning of the bulletins, and how households should respond to them.
    - Practical information on a range of floodproofing measures for different house types, including how and where to access resources for implementing the most appropriate measures.
    - A description of the grant facility for floodproofing homes, on how it works, how it can be accessed and the technical support for implementation of the measures (see Section 2.2.1).
98. It is expected that the manual will be continually updated as more information becomes available. It is aimed to have the first edition produced in Year 1 so that it can contribute toward flood damage reduction in the shortest possible time. Subsequent versions of the manual will benefit from improvements in the flood hazard map and the community flood early warning system that would reflect the effects of any modifications to the drainage infrastructure and on improved understanding of the

hydrology of SORB from the expanded hydrometeorological network. Other types of communication materials such as short videos or other graphic formats will be produced so the information is easily understood by community members without tertiary or secondary school experience for it to be beneficial to the wider community.

99. Location: Basin-wide.
100. Beneficiaries: Households in flood prone areas in SORB (will also benefit citizens in other parts of the country).
101. Institutions responsible/stakeholders involved: ODPM, Drainage Division, National Planning Authority, Regional Corporations, Water Resources Agency (WRA), TCPD.

Activity 1.1.2. Support to the governance on the drainage system's maintenance in the SORB

102. To address the lack of clarity of responsibility to maintenance of the different segments of the drainage network described in the Background section, the project proposes to provide technical support to help the key institutions involved - Drainage Division, Highways Division, Regional Corporations, Ministry of Agriculture, Land and Fisheries - to distinguish responsibilities for administering to various watercourses. This could be done by the accompaniment of specialized consultants that could facilitate the informed decision process that would lead to an agreement and an institutional decision. As a result, the project would provide a clear decision tree/guiding document for responsibilities for waterways and drains in the SORB.
103. Also, recognizing that once this clarity has been reached, maintenance will only be effective if the corresponding institutions count with a mechanism for the funding and the sustainability of the necessary actions. The project will support the design and establishment of a sustainability mechanism to ensure that maintenance will be financed over time, regardless of the type of management (private or public). The project will seek the commitment of the governmental institutions for ensuring that this mechanism will be sustained and that there will be enough human resources assigned to this duty.
104. Location: SORB.
105. Beneficiaries: All agencies involved in flooding
106. Institutions responsible/stakeholders involved: Drainage Division; Water Resources Agency, Town, and Country Planning Division, ODPM, Ministry of Rural Development and Local Government, EMA Regional Corporations.

Activity 1.1.3 Update and undertake participatory processes to approve and implement the Management Plan for the Godineau swamp

107. The objective of this activity is to update the Management Plan for the Godineau swamp, with a participatory approach. This would include:
    - Updating the wetland baseline information, as much has changed in the wetland since the last comprehensive assessment in 2002-2004.
    - Incorporate the climate change aspects in the management plan.
    - Undertake consultations and workshops with key stakeholders-surrounding communities, resource users, private sector (energy companies) and government entities (Ministry of Agriculture, Land and Fisheries, Drainage Division, among others); and
    - Provide resources for the implementation of the prioritized actions.
108. A National Wetland Policy was developed in 2001 and a National Wetland Committee was appointed in 2004. The IMA's ecological assessment of the Godineau Swamp in 2002-2004, included a study of the hydrology, vegetation, fauna, and socio-economic aspects of the wetland. At that time, the possibility of listing the Godineau Swamp as a Ramsar site was being considered. It is one of the largest wetlands in the country and is a habitat for several species, including birds. The preparation of the Management Plan had started, including participatory processes, but unfortunately it was not completed.
109. That first attempt gave no consideration to the impact of climate change on the Swamp. The wetland does play a key role in the water regulation of the basin and, therefore, it is key to strengthen it to provide ecosystem services that minimize the impact of floods and serve as a barrier against saltwater intrusion and erosion – that is expected to be exacerbated by climate change. It is key to develop a management plan for the Godineau Swamp using new information considering all the alterations that have occurred in the last two decades and including the impact of climate change in the diagnosis, working with the major stakeholders, and developing a priority listing for all the actions identified.

110. IMA's work and research experience in the Godineau Swamp, coupled with the fact that it participates in the inter-ministerial committee responsible for developing an integrated coastal zone policy, makes it the most suited institution for leading the process re p and implementing the Godineau Swamp Management Plan. The Project would provide resources for updating the studies, organizing consultations, and implementing prioritized actions. This activity will be implemented closely with activities in Component 3 – ecosystem restoration – and in Component 5 – awareness-raising and capacity building on Ecosystem-based adaptation actions.
111. The participatory approach is key since the experience of the consulted key stakeholders shows that implementation of management plans without the involvement of the communities have not borne fruit in Trinidad.
112. Location: Godineau Swamp.
113. Beneficiaries: inhabitants of the swamp and the community in general. The population of the basin will experience reduced seawater intrusion and flooding through the improved management of the ecosystem.
114. Institutions / stakeholders involved: Institute of Marine Affairs (IMA); Coastal Protection Unit of the Ministry of Work and Transport (CPU); Forestry Division of the Ministry of Agriculture, Land and Fisheries; Drainage Division of the Ministry of Works and Transport, Environmental Management Authority (EMA); Siparia, Penal-Debe and Princes Town Regional Corporations, community, and groups within the SORB, CSOs, private sector.

Output 1.2. Strengthened information, monitoring, and climate information management systems.

115. The limitations in the existing hydrometeorological database in the SORB have been identified as the major hindrance to developing robust flood defense systems. The deficiencies in this database would not allow for (i) the creation of accurate flood hazard maps; (ii) the development of effective early flood warning systems; (iii) certainty of advice given to households for floodproofing; (iv) reduction of risks taken by farmers; (v) the prediction of the water resources available within the basin. Such shortcomings would also not allow for the quantification of changes in climate and the ability to respond accordingly. The development of a comprehensive hydrometeorological network is therefore critical to the reduction of flood risk within SORB and the development of sound resilient strategies in the face of climate change.

Activity 1.2.1 Expand and upgrade weather, tidal, and hydrological monitoring systems in the SORB.

116. Prudent decision-making approaches suggest building flexibility in strategies so that modification can be made as climate conditions change. Correct modifications can only be made with a continuous and complete dataset, for such will allow trends to be more easily observed and would also permit more reliable model predictions for any contemplated interventions.
117. A sound hydrometeorological network is therefore very critical for reducing the adverse impacts of flooding in the basin. If such is implemented, it will have a very significant impact that extends beyond flood reduction to include:
    - ✓ Any future investment for utilization of the physical resources within the basin.
    - ✓ Design of facilities for agriculture.
    - ✓ All future infrastructure development.
    - ✓ Effective land use zoning.
118. The agencies administering the instruments for the proposed network are as follows:
    - Institute of Marine Affairs, responsible for the tidal gauges.
    - Meteorological Service Division, responsible for weather stations, including rain gauges.
    - WRA, responsible for stage recording stations, rainfall stations, weather stations.
119. In consultation with these agencies, it was able to determine the instrument requirement for developing this network. It is essentially the hydrometeorological network proposed by the WRA for a comprehensive early flood warning system, along with the inclusion of a tidal gauge and additional weather stations. The agencies have accounted for the resources required for the installation of the instruments and expect to have continued budgetary allocations to operate and maintain the instruments. The following table shows the type of each instrument, the number, and their estimated costs for the optimal network suggested by these agencies.

Table 4. Components of the hydrometeorological network

Agency in charge	Instrument	Optimal Number	Number Existing	Required Number	Installed Cost (USD $K)
IMA	Tidal gauge	1	0	1	10
WRA	Stage recorder	5	1	4	100
WRA	High flow equipment	2	0	2	10
WRA	Rain gauge	20	6	14	350
TTMS	Weather station	7	1	6	210
WRA	Crest gauge	6	0	6	5
WRA	Observation wells**	22	9	13	355
WRA	Water Quality	5	0	5	70

** The project proposes to fund two of the 13 required observation wells identified by WRA.

120. Other resources normally required for proper functioning of the network for telemetry transmission, data storage and retrieval and subsequent dissemination of the information are available in varying degrees within the agencies and would be sufficient to satisfy data from the proposed network.
121. Location: Basin-wide.
122. Beneficiaries: Direct benefit to the Drainage Division, Regional Corporations, ODPM, Town and Country Planning Division for construction, operation, and maintenance of physical infrastructure, for developing early flood warning systems, for creating flood hazard maps to support land zoning, and for enhancing water capture for water supply.
123. Institutions responsible/stakeholders involved: Water Resources Agency, Meteorological Service, Institute of Marine Affairs/Regional Corporations, Ministry of Rural Development and Local Government, NGOs

Activity 1.2.2 Foster a water supply and demand management

124. Traditionally, the southwestern region of Trinidad has relatively limited freshwater and the consequence has been an unreliable potable water system. The Water and Sewerage Authority (WASA) is very aware of the current water situation and knows of the importance to reduce the very high fraction of water lost to leakage in its distribution system. . However, limitations in resources have posed challenges in their ability to identify where the leakages might be and then to carry out the necessary repairs. A major component in improving reliability is the ability to account for water produced by the water treatment plant.
125. The project proposes to assist in increasing the reliability of the water supply by contributing to WASA's capability to reduce leaks through the provision of bulk and domestic meters and computational facilities (hardware and software) for data storage and analysis. The project will supply meters for each of WASA's seven district meter areas (DMA) within SORB and from among these, all households within three DMAs are to be metered. The gathered information will be used to identify leaks that would be repaired by WASA. Additionally, the information gathered on household water consumption would be used to formulate programmes for more efficient use of water within the households. ***14***
126. Location: Three DMAs called Scott Road, Barrackpore and Oropouche.
127. Beneficiaries: Direct benefit to SORB households fed by the water supply system that will be enhanced.
128. Institutions responsible/stakeholders involved: Water and Sewerage Authority (WASA).

Output 1.3. Community Early Warning and Decision-making system strengthened and expanded to assess and manage climate risks.

129. It is not likely that any of the major engineering works required for mitigating basin-wide flooding would be done soon. Until such happens, flooding would continue within the basin. In the meantime, it is important that an effective flood early warning system be developed to warn households of impending floods so that they can take measures to save life, limb, and property. The project proposes to support existing efforts to develop such a system.

Activity 1.3.1. Expand the Community Flood Early Warning System in the SORB

130. In response to the recent flooding over the country, the Red Cross has partnered with the agencies involved in flood control to implement a basic flood early warning system in each of the regional corporations, including Penal-Debe Regional Corporation, Siparia Regional Corporation and Princes Town Regional Corporation. This basic system will be in place during the 2021 wet season, and it is being monitored by the WRA.
131. The project proposes to assess the effectiveness of this warning system, expand its coverage by providing additional instruments and then to use their signal to input into hydrologic and hydraulic models to obtain improved predictions and to issue more accurate bulletins. A substantial amount of information already exists within the regional corporations and their Disaster Management Units (DMU) have protocols for assisting households in flood prone areas. The project proposes to work with the DMUs to develop a flood early warning system that would have the following features:
    - Establishment/improvement of flood response and recovery plans for flood-prone areas.
    - Creation/improvement of a community database for vulnerable persons for first responders during rising flood waters.
    - Improvement of flow information to farmers on impending floods, including the promotion of the existing tools such as the mobile apps designed by the Trinidad and Tobago Meteorological Service.
    - A database on critical equipment, their owners, locations and how to access them when needed for better assisting persons living in flooded areas.
    - The flood early warning system will benefit from the development of the flood-proofing manual for buildings developed under activity 1.1.1, which will include explanation of the meaning of the warnings to households and advise them on the measures they should take to minimize damage from impending floods.
132. Location: Basin-wide.
133. Beneficiaries: Direct benefit to households in SORB.
134. Institutions responsible/stakeholders involved: Water Resources Agency, Trinidad and Tobago Meteorological Service (TTMS), Drainage Division, ODPM, Ministry of Agriculture /Regional Corporations, NGOs.

Component 2. Green and grey infrastructure enhanced to increase resilience to floods and droughts.

135. This component includes actions focused on infrastructure enhancement or development, in urban and rural areas. The activities proposed are aimed at reducing the impact of flooding, improving urban drainage in selected most vulnerable flood-prone neighborhoods; promoting the flood-proofing of housing and commercial buildings; and improving water access for urban and rural population. Activities under this component will need accompanying cultural shifts through social and behavior change education. This will be covered by activities in Component 5.

Output 2.1. Impact of flooding in selected most vulnerable flood-prone neighborhoods minimized.

136. Many of the drainage problems in the basin require large infrastructure works currently being considered by the Drainage Division. Such works address flooding from the long-duration rainfall that may last several days. The scale of these works is beyond the scope of this project in terms of budget. However, some small-scale interventions could significantly help to alleviate severe flooding in specific locations in some vulnerable neighborhoods. The proposed activities will minimize the impact of floods and will provide support to Regional Corporations to carry out small drainage and rainwater harvesting works that will have the dual benefit of water retention to mitigate the impact of flooding and to increase the availability of water, the supply of which is currently insufficient for the population.

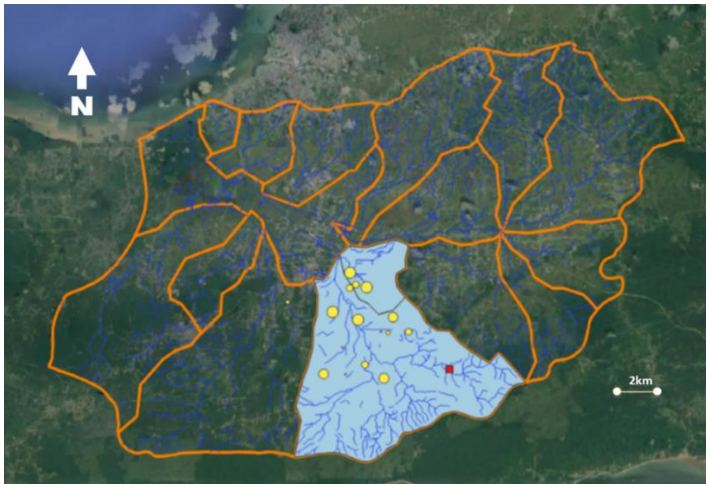
Activity 2.1.1 Reduce flooding within the Penal Debe Regional Corporation by using detention basins.

137. Much attention has been given to reducing flooding within PDRC by using detention basins. The main area of interest is in the lower reach of Curamata River (see Figure 9). A potential site in the upper part of this catchment, in the vicinity of Haggard Trace, has been identified for a detention basin (see Figure 11). The effectiveness of retention basins to positively impact flooding within Curamata River Catchment was reported in a study done in 2016 by Haskoning DHV consultants for the Drainage Division. Along with the traditional retention basin, the study also found that the lower-cost permeable

weir solution could also be effective. Permeable weirs are constructed of gabion baskets, no more than two meters high, arranged in a cascading formation within the river. (See Figure 10). The project prefers the less obstructive permeable weir solution and proposes that they be used within the Curamata River system.

138. Location: Within upper reaches of the Curamata River network.
139. Beneficiaries: Built-up areas around the central PDRC, which is in the lower reach of Curamata River Catchment.
140. Institutions responsible/stakeholders involved: Regional Corporations, Drainage Division.

Figure 15. The Curamata River Catchment



The Curamata River Catchment (blue shade) among the other sub-catchments (orange outline). The yellow circles are locations of flooding. The red square is the potential detention basin at Haggard Trace.

Figure 10. Concept of a cascade to permeable weirs (left) and an example of a permeable weir made of gabion baskets.

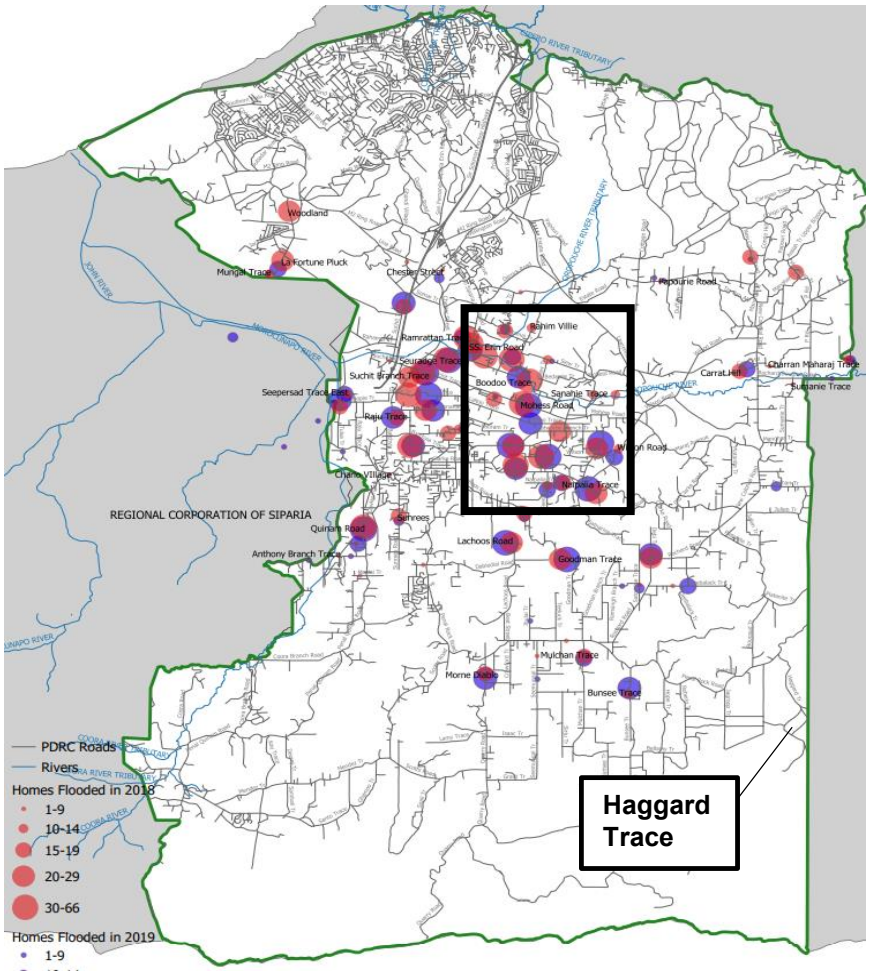
Activity 2.1.2 Improve urban drainage within the PDRC, especially in the lower Curamata river.

141. Urban areas are particularly vulnerable to the predicted increases in short duration rainfall intensities due to climate change. These rainstorms exacerbate current problems with the urban drainage system, which are: i) blockages from utility lines and from siltation; ii) the failure to expand the drainage system to account for increased impervious areas and hence increased peak runoff flowing into the drains; iii) the main watercourses receiving runoff from these areas frequently are not well maintained resulting in reduced carrying capacity to convey urban runoff; iv) malfunctioning pumps in places that rely on them for urban drainage.
142. The PDRC has identified a built-up area in the lower Curamata River catchment that is subject to frequent flooding caused by localized rainfall (see Figure 11). Various river works have been identified by the corporation, mainly within the small tributaries to the Curamata River to reduce the frequency at which they spill their banks. The needed works are consistent with the finding in the Haskoning study that looked at all the main urban centers in the basin. The consultant concluded that the flooding in

these centers was largely because the outlet drains were not well-connected to the main water channels and so runoff was not being conveyed quickly enough. The required works are about 2.5 km long.

143. Location: Within PDRC, around the lower reach of Curamata River.
144. Beneficiaries: Households affected by flooding because of the identified deficient infrastructure.
145. Institutions responsible/stakeholders involved: Regional Corporations, Drainage Division, Environmental Management Agency (EMA).

Figure 11. Flood-prone area within Penal Debe Regional Corporation in the lower reach of Curamata River.



Flooding in 2018 and 2019 are colored pink and blue, respectively. The number of households affected are distinguished by the size of the circle. The proposed drainage works target improving the areas within the black rectangle.

Activity 2.1.3 Increase access to water while minimizing the impact of flooding with rainwater harvesting systems in urban and rural areas.

146. As mentioned in other sections, there are deficiencies in the water supply system within SORB and this has ultimately limited the amount of fresh water available to households, as well as water for agricultural uses. The problem is particularly acute during the dry season, both in urban and rural areas, and also during the extreme rainfall events since the water supply service is affected and sometimes are interrupted during those. In rural areas, many families are solely dependent on agriculture as a means of earning an income, and water scarcity also affects their food security. Expected impacts of climate change will exacerbate this situation. On the other hand, during the wet season, excess rainfall causes floods, the severity of which is directly related to the increased coverage of impervious surfaces, including rooftops. In at least one regional corporation, consideration has been given to collecting in

tanks water from these rooftops before it flows into the urban drains so as to reduce floods caused by short duration events within the urban areas. The water collected from the rooftops can then be used to augment the water supply. The idea is interesting because it helps to solve these two problems.

147. The project will promote the installation of rainwater harvesting systems as a means of flood reduction and increasing reliability of the water supply. It will aim at providing technical assistance and funds to assess water demand, design and build rainwater harvesting systems for vulnerable groups in the rural areas of the watershed; and to promote strategies for efficient irrigation practices.
148. The project will promote two main water harvesting systems:

i. **Rainwater harvesting system** consists of a catchment surface, a conveyance system, and water storage tanks. This system is directed towards individual households as well as the construction in community building or specially constructed catchment surface for households or communities with no available surface. The activities will entail the building of sloped roofs, when needed, to avoid ponding and non-toxic roof coating. The conveyance system consists of gutters or pipes that deliver rainwater falling on the rooftop to cisterns or tanks. The tanks or cisterns can also be built with different materials, such as reinforced concrete, fiberglass, or stainless steel. For water pumping, the project will encourage the use of solar pumps thus promoting renewable energy use.

   Special attention will be given to provide information and capacity building for the maintenance and the water treatment when it is expected to be used for human consumption. To this end, rainwater harvesting systems include a pre-filtering and a filtering system. Further sanitization is needed for human consumption.

   An effective rainwater harvesting system to serve the two needs (mitigating the effect of floods and reducing water scarcity) requires knowledge of several components, such as the expected water quality depending on its purpose; desired level of reliability; cost of the system; efficiency of communal systems versus household systems; and the overall impact on flood mitigation.

   For acquiring this information, the Project will perform a small study undertaken by a research institution considering the existing system developed by GWP and NIHERST[20] for water supply improvement, with possible adaptation to maximize its flood reduction capability.

   The project will work with the community to minimize any risk to public health using the stored water. For the unlikely purpose for potable use, the project will ensure that the design is robust and minimizes the risk to public health. It is more than likely that the purpose will be for non-potable use, such as for flushing toilets, washing cars and for gardening, but still consideration will be given to providing proper training for using and maintaining the rainwater harvesting system.

ii. **Small retention ponds for farmers or communities.** Designed with additional storage capacity, retention ponds can serve the dual purpose of attenuating surface runoff during rainfall events; and water harvesting, which can be channelled to the surrounding areas for irrigation purposes. The project will support retention ponds to be created by using an existing natural depression, by excavating a new depression, or by constructing embankments; and the conveyance system to channel the water to the communities' farms. When required, ponds might also include windmills and associated tanks for water use. The project will work with the community to develop a management and maintenance plan, with clear responsibilities agreed among all users.

149. Location: Specific urban and rural areas identified by the Regional Corporations, suffering from water scarcity and floods.
150. Beneficiaries: Urban and rural vulnerable households and farmers affected by flooding and unreliable water supply in the chosen areas.
151. Institutions responsible/stakeholders involved: Regional Corporations, Drainage Division, ODPM, WRA-WASA.

Output 2.2. Housing and commercial buildings reinforced against floods.

152. Given that floods will likely continue to occur due to climate change despite planned infrastructure improvement works in the country - the timing of which is uncertain - there is a need to help flood-

20 NIHERST, National Institute for Higher Education, Research, Science and Technology

affected communities prepare for and recover from the impacts. It is possible to improve their resilience by retrofitting residential and commercial buildings.

Activity 2.2.1 Reinforcing houses and commercial buildings against floods.

153. This activity proposes to create a grant facility or revolving fund targeted to inhabitants of the most vulnerable flood-prone neighborhoods in Penal, Debe, Barrackpore, Woodland and La Fortune, to reinforce their housing and commercial buildings. Housing in adjacent rural areas would also be eligible.
154. According to Regional Corporations' records, around 1,000 households are affected by floods periodically, which cause severe adverse economic, psychological, and social impacts. While commercial buildings affected by floods result in loss of livelihoods, one of the situations reported to be most worrying is that sometimes families do not want to leave their homes because they want to protect their assets and because of emotional reasons. The problem becomes more serious in the case of households with elderly people, young children, and people with disabilities. These issues will be addressed in part by the project through the improvement of the Community Early Warning System (Component 1) and the strengthening of the awareness-raising and capacity building initiatives being developed by the ODPM (Component 5). This activity will enhance these actions by facilitating means to adapt and improve households and commercial buildings that are currently vulnerable to flooding.
155. Some of the eligible investments could be: door flood locks or gates, waterproofing walls, internal sanitary installations to minimize risks, including non-return valves; adaptation of electrical installations, construction of upper floors as a contingency measure for floods, accessibility measures for people with disabilities or reduced mobility, to remove barriers that prevent them from moving to safer places within their home (e.g., moving to upper floors), or if necessary, evacuating their homes; mechanisms to elevate furniture and other valuable objects to upper floors, refurbishing and/or repairing the house/commercial building after the event.
156. The first step for implementing this activity will be to develop an operations manual that states how the grant will function, including eligibility conditions for obtaining a grant, and the monitoring method. The manual will be produced with the participation of the community, including persons with different vulnerabilities. The outcome from this process would be a list of criteria that defines what qualifies for funding, and the mechanism by which persons can apply.
157. The grants facility could be managed by an agency with experience in granting social or emergency assistance. Another possibility lies within the local governments. During the preparation of the Full Proposal, these possibilities and also means of capitalizing the grant facility will be explored in more detail. Ceilings to how much a household can access will be determined. At this stage, an estimation of 2,500 per household is considered.
158. Location: flood-prone neighborhoods in Penal, Debe, Barrackpore, Woodland and La Fortune.
159. Beneficiaries: 160 households (800 people) in the selected areas which meets the grant requirements. Direct beneficiaries will be the owners of the houses and commercial buildings. However, since this is a pilot that can be upscaled in this and other flood-prone areas, the quantity of indirect beneficiaries would be much higher. During the formulation of the Full Proposal, consideration will be given to homeowners who do not have a Deed to show ownership but have a Certificate of Comfort from the Land Settlement Agency (LSA) which demonstrates that the LSA is in the process of regularizing the settlement. This would improve the equity of access to the fund.
160. Institutions responsible/stakeholders involved: Siparia and Penal Debe Regional Corporations, Drainage Division, Ministry of Planning, Agency managing the grant facility / revolving funds to be determined.

Component 3. Vulnerable coastal and wetland ecosystems of the SORB enhanced.

161. This component brings together activities to strengthen key ecosystems for the regulation of water resources in the SORB: the coastal ecosystem and the wetlands, following the Nature-based solutions approach. Capacity building of key stakeholders on conservation, restoration and management of coastal and wetlands ecosystems is needed to ensure the sustainability of the project's actions and to promote employment opportunities.

Output 3.1. Key coastal and wetland ecosystems restored.

Activity 3.1.1 Restoration of key coastal and wetland ecosystems

162. This activity proposes the rehabilitation of the two ecosystems key for the water regulation of the watershed, in the face of flooding effects and sea level rise, including saline intrusion: the coastal ecosystem, consisting mainly of mangrove forest, dunes and beaches; and the inland wetland ecosystem, the Godineau Swamp. The activity also includes investments in monitoring equipment to enhance the knowledge of the ecosystem evolution.
163. **Wetlands**: the history and importance of the Godineau Swamp have been described in the Background section and in Activity 1.1.5 aimed at developing its Management Plan. One of the outcomes of this Plan will be the methods and the priority areas for the restoration. Restoration of the wetlands would contribute to mitigate the impact of floods, saltwater intrusion that has led to mangrove colonization, and would also benefit fishermen: the wetland is important in terms of supporting the fisheries in the adjacent Gulf of Paria by providing organic material, food and nursery support for the fish. Through this activity, the project would fund the restoration of priority areas within the wetland defined by the studies and the Plan. The activity will include the hydrological restoration to some of freshwater and brackish marsh areas of at least 50-75 ha. Vegetation found in the brackish marsh that can withstand saltwater intrusion include sedges Eleocharis mutate and *Cyperus articulatus*. These were dominant species recorded back in 2004. Other brackish marsh species include *Fimbristylis cymosa*, *F. miliacea*, *Cyperus surinamensis*, *Torulinium odaratum* and *Rhynchospora corymbosa*.
164. On the other hand, the **coastal ecosystem** is subject to different pressures due to changes in the water regime and suffers from severe erosion. As described previously, mangroves are expanding into freshwater areas. Through this activity, the project would fund the restoration of priority areas in the coastal area. A portion of the mangrove forest can be restored/ enhanced by removing levee / raised embankments so there is increasing flushing / flow within the system (hydrological restoration) and by removing old oil infrastructure (derricks) that cause oil pollution. The current estimate of mangrove coverage is approximately 691 ha, and the project will improve approximately 100 ha.
165. The Institute of Marine Affaires (IMA) analyses the change in land cover patterns in the Godineau Swamp through aerial photography and satellite imagery. This kind of analysis can help monitor the evolution of the vegetation with climate change, and the effect of the restoration measures that would be applied with the project. For this reason, this activity will include the purchase of drones that allow mapping of mangrove dieback using photogrammetric techniques, and training for their use. Digital elevation models can be obtained from drone images and videos. These can be incorporated into the regular monitoring programmes of the IMA.
166. Location: Godineau Swamp and coastal area: between 50-75 ha of marshes and 100 ha of coastal ecosystem.
167. Beneficiaries: Inhabitants of the swamp and the coastal area, fishers, and the community in general. The population of the basin will reduce their risk of flooding through the improved management of the ecosystem.
168. Institutions / stakeholders involved: Institute of Marine Affairs (IMA); Coastal Protection Unit (CPU) and the Drainage Division (DD) of the Ministry of Work and Transport; Forestry Division of the Ministry of Agriculture, Land and Fisheries; Environmental Management Authority; Ministry of Energy and Energy Industries, Siparia, Penal Debe and Princes Town Regional Corporations, CSOs, private sector.

Activity 3.1.2 Capacity building for CSOs, community groups and government, on conservation, restoration, and management of wetland coastal ecosystems.

169. This activity aims to strengthen the institutional capacity of Civil Society Organizations (CSOs), community groups, and government agencies to effectively participate in critical management functions to conserve, restore, and manage wetland and coastal ecosystems. To accomplish this, a rapid institutional assessment of targeted entities will be conducted to identify key capacity needs; an action plan will be developed to outline and support the recommended areas for capacity improvement and medium-term conservation priorities; training will be delivered to improve skills and contribute to capacity building; and where possible certain operational resources will be purchased to improve operations.
170. These activities could be organized with EMA and IMA, which have done community outreach programmes. Additionally, environmental NGOs can often develop beneficial programmes for communities with the absence of top-down academic approach allowing the communities to have greater buy-in and build trust and strong working relationships with the NGOs and governing bodies.
171. Location: SORB.

172. Beneficiaries: CSOs, community groups, and government agencies in the SORB.
173. Key stakeholders involved: Institute of Marine Affairs (IMA), Environmental Management Agency (EMA), Regional Corporations, environmental NGOs, Academia, Education-related governmental institutions.

Component 4. Increase adaptation capacity of vulnerable farmers and fishers to address climate change and climate variability.

174. This component targets the most vulnerable population living in the rural areas in the watershed. Communities living in the SORB are greatly dependent on climate-sensitive practices, such as fishing, agriculture, forestry, and animal husbandry. The proposed activities aim at enhancing the adaptive capacities of the targeted groups, by providing technical assistance and affordable finance to promote the efficient use of water, promote alternative livelihoods for income and food security, and climate-resilient practices in the agriculture, aquaculture, and animal husbandry sector.

Output 4.1 Resilient farming practices promoted to increase adaptation to climate change impacts.

Activity 4.1.1 Pilot project of small-scale hydroponics systems to respond to climate-related risks.

175. Dry spells, increased sea water intrusion and increased flooding have a great negative impact in the agriculture sector, especially on vulnerable groups with low adaptive capacities to effectively respond to these emerging climate-risks. According to estimations of the Ministry of Agriculture 60% of all farmers' land in the SORB are flood-prone areas. Through this activity the project aims at developing a pilot small scale hydroponics project and provide support with technical assistance as well as affordable finance to around 120 vulnerable smallholders to test and implement the technology in their fields, including a commercial scheme to sell the hydroponic production in the market. Hydroponics is a suitable adaptation technology, which allows farmers to grow plants without soil, hence overcoming the problems of salinity, floods, and the accumulation of pests and diseases. Furthermore, it saves water (savings of 60-80%), contributing to address the problem of projected droughts and it is nutrient efficient, reducing the use of pesticides. At the same time, it offers good yields and quality of products and can be grown all year long.
176. There are different potential technological designs, which could be feasible to promote with the pilot project. During the preparation of the full proposal, the most suitable design will be further assessed and refined, including necessary modifications to ensure the promoted system can withstand floods.
177. The UWI has already been testing the following technologies in the region, among others:
    Table-Top and Double Table-Top Hydroponic System: uses Deep Flow Technique (DFT), which assist with areas of high intense heat and minimizes losses due to electrical cut-off. It is easy to maneuver, saves on water, preassembled, modular design for expansion, incorporates vertical farming (planting from 2.5ft above ground level).
    A-frame Hydroponic System, which Uses DFT technology, saves on space, saves water, easy to maneuver, preassembled, incorporates vertical farming (planting from 1.5ft above ground level).
    Deep Water Culture: Plants are usually placed to float on a raft structure on top of the nutrient tank, with their roots hanging in the water. This system is commonly used for aquaponics in Trinidad. It is ideal for crops with complex root systems that are not top heavy.
    Under current system: employs a negative pressure technology to re-circulate nutrient water solution that is highly concentrated with oxygen. Ideal for top heavy plants, fruiting plants.
178. The main advantage of the proposed pilot are:
    - **Adaptability**: the design can be adapted to different conditions and areas, it is allowed for high savings and water efficiency, and nutrient's efficiency, reducing pesticide and herbicide use.
    - **Scalability** potential: its modular designs facilitate scalability since farmers can test and learn about the hydroponic systems and easily expand and replicate the modules.
179. The proposed pilot will also include the necessary linkages to promote market access of the hydroponics production. According to the consulted stakeholders, there is a growing market in the country for hydroponic crops. Furthermore, the promotion of a Participatory Guarantee System (PGS) will be fostered with the project since there have already been previous successful experiences of farmers adoption of this labels in the country.

180. Location: Vulnerable areas to dry spells and flooding in Siparia, Penal-Debe and Princes Town. Flooding areas include the low-lying area of the watershed, being Woodland and Barrackpore the most affected areas.
181. Beneficiaries: Rural vulnerable population with no year-round access to water in the SORB area during the dry season and suffering frequent flooding during the wet season. it is proposed that land ownership should not be a requirement as hydroponics structures could be relocated if farmers were to change the location of their activity.
182. Key stakeholders involved for management and support: Ministry of Agriculture, Siparia, Penal-Debe and Princes Town Regional Corporations, UWI, NAMDEVCO.

Output 4.2 Fishers resilient livelihood options promoted.

Activity 4.2.1 Promotion of fishers' livelihoods diversification to reduce exposure to climate-related risks.

183. Floods expel large quantities of objects and pollution into the sea in a very short time, causing fish populations to move away. The fisherfolk have reported that, every time there is a flood event on the mainland, their catches are drastically reduced. They have also reported a sustained decline in catches over time, which may be due to rising sea surface temperatures, coupled with overfishing. Within this framework, the promotion of alternative livelihoods for fisher folks such as aquaculture and ecotourism provide an effective option for diversification.
184. This activity will provide training as well as funding to fisher folks in the SORB area to adapt to the increasing risks of flooding and saltwater intrusion and diversify their livelihoods income.
185. As part of the potential livelihoods alternatives suitable for fisher folks, this activity will promote investments and the strengthening of capacities to create small-scale community-based ecotourism; or aquaculture. Further assessments will be conducted in the feasibility study to determine the best suited solution for the identified most vulnerable population, either the development of an ecotourism enterprise or the potential aquaculture model (oyster farming, freshwater, or brackish water species). Additionally, the most adequate financing instruments to be used for this activity will be further explored during the design of the Full Proposal and further discussed with the Ministry of Agriculture, Land and Fisheries.
186. Location: SORB.
187. Beneficiaries: Fisher folks (with special focus on low-income women-led households, youth-led households, mono parental households with fishing as the only income generating activity), in the SORB area.
188. Key stakeholders involved: Ministry of Agriculture, Land and Fisheries, Siparia, Penal-Debe and Princes Town Regional Corporations.

Component 5. Stakeholders of the SORB have built their capacities and are aware of climate risks.

189. Some of the barriers identified in the watershed are related to the lack of a comprehensive approach to climate change in the educational system of Trinidad & Tobago; limited capacity of institutional stakeholders, CSOs, community groups, to address flooding; and lack of accessible and understandable information about climate change for fostering a change of behavior. The activities included in this component have the objective of raising awareness and building capacities of the stakeholders of the SORB in sustainable climate change resilient actions and decision-making to reduce their risk to climate change impacts. Activities related to learning and dissemination from the implementation of the Project will contribute to support the adoption of best practices.

Output 5.1 Capacities of stakeholders have been built to cope with climate change impacts in the SORB.

Activity 5.1.1 Institutional strengthening on flood, drought, sea level rise and saltwater intrusion management.

190. This activity is focused on strengthening the government institutional capacity of key entities operating in the SORB to manage risks associated with flood, drought, sea-level rise, and saltwater intrusion. The first step will be to conduct a rapid institutional capacity assessment to identify specific areas for strengthening. Priority will be given to measures focused on improving coordination and communication, access to environmental information, and building capacity to support livelihood alternatives among local institutions operating in the SORB. It is envisaged that strengthening the

institutional capacity of a diverse group of institutions engaged in climate resilience building in the SORB will enable the upscaling of the range of solutions introduced by the project. This activity is related to the actions for flood governance (Component 1): it is expected that the capacities strengthened in this activity will contribute to the achievement of better results in the aforementioned initiative.

191. Location: SORB.
192. Beneficiaries: National and local institutions with competencies in managing flood, drought, sea level rise and saltwater intrusion management.
193. Key stakeholders involved: Academia, and national and local governmental institutions.

Activity 5.1.2 Promotion of peer-to-peer learning and capacity building on approaches to solving flooding for key government institutions.

194. Despite the increased attention to the impacts of flooding in Trinidad, the requisite expertise to develop local solutions is a major constraint to the long-term alleviation of the problem. The MoWT, MoRDLG, and the MoPD have extensive expertise and experience in addressing flooding challenges; however, knowledge-sharing and peer-to-peer learning are limited. Additionally, there is often discordance between conceptual understandings of flooding and the implementation of measures on the ground. Thus, the Project proposes to develop a short-term training programme on flooding preparedness and management that will be accessible in person for the duration of the project and additionally through online modality, which will ensure sustainability of the programme after the Project ends. Additionally, as adult-centered learning principles highlight the importance of peer-to-peer learning, the Project proposes to organize from Year 2 onwards of the implementation of the project annual exchange sessions among government professionals and university experts on approaches to solving flooding to meet the learning needs of experts and practitioners. On an annual basis, the Project will ensure at least 10 exchange sessions with a balanced participation of staff involved in the implementation of flooding solutions from different institutions.
195. The main objective of both modalities of learning would be to build professional capacities in flood risk management at the institutional and individual levels.
196. There are several universities which have the requisite resources to support the design of such training and knowledge sharing programmes. For example, the UWI has a strong record of implementing similar programmes, and the required infrastructure to support the sharing of course content and teaching material via blended, online, and face-to-face learning modalities.
197. Location: Trinidad & Tobago.
198. Beneficiaries: Professionals who are involved with the implementation of solutions to flooding.
199. Key stakeholders involved: Academia, Ministry of Education, government institutions at the national and basin level.

Activity 5.1.3 Incorporation of climate change and disaster risk reduction in the curriculum.

200. Embedding climate change and disaster risk management in national teaching curricula provides multiple co-benefits to building resilience. Climate change and disaster risk management are not consistently addressed in the school curriculum in Trinidad & Tobago. This activity will focus on developing core modules targeting youth that may have limited knowledge of climate change and disaster risk management concepts. The training will target primary and secondary schools as well as youth skills training programmes. The curriculum design will provide maximum flexibility and will include teacher training - covering content related to climate change, disaster preapredness, response and rehabilitation, climate hazards and vulnerabilities relating to gender relations and family life. It is anticipated that the training will equip younger generations with the ability to respond to natural disasters and significantly reduce losses of lives and property.
201. The strategy for the implementation of the specialized modules will rely both in the Environmental Policy and Planning Division (EPPD) that will provide the trainings based on the modules designed with the Project and the mainstreaming of these modules in the curriculum of primary and secondary schools in alliance with the Ministry of Education.
202. Location: Trinidad & Tobago.
203. Beneficiaries: Primary and secondary school, and youth skills training programmes.
204. Key stakeholders involved: Academia, Education-related governmental institutions.

Output 5.2. Communication and dissemination strategies have been implemented towards reducing vulnerability.

Activity 5.2.1 Awareness raising campaigns on climate change risk reduction management and adaptation strategies.

Sub-activity 5.2.1.1 Community level awareness raising campaigns.

205. Awareness raising is key to address knowledge gaps targeting different stakeholders. Campaigns will comprise topics related to: climate change expected impacts and risks, efficient water management, linkages between human-made obstruction to channels through dumping of debris and flooding consequences, maintenance work in channels that could be taken up by community members; importance of recycling to avoid dumping of debris, impact of the use of chemical for cleaning dumping, waste and run off in water courses. Additionally, information on the characteristics of the ecosystems in each community and the climate related risks will be part of the awareness raising campaigns to support activities of Component 3. People have lived in the Godineau Swamp for years. During the socio-economic assessment conducted in 2002/2003, it was evident that many people did not even realize they lived in a wetland and thought the wetland was the mangrove swamp. So, many of the inhabitants may not be aware of their vulnerability because of where they live.
206. To support activities and behavior change of component 2, specifically, the reinforcement of houses to withstand floods, awareness raising campaigns will target cultural practices and norms, to support the technical recommendations. Additionally, since many families are reluctant to be evacuated when floods come, a focus will be given to the emotional and cultural reasons about invasion of privacy, protection of property and inheritance, how people living in the SORB act in crisis to promote understanding of emergency and safety concerns.
207. Different communication strategies for the awareness raising campaigns will target different actors, since the incentives to promote behavior change vary among the target stakeholders. The following strategies have been identified during the consultation process as to be more effective in targeting the following actors: a) Public information campaigns in schools, or public places, or radio; b) Community involvement activities, such as contents through partnerships with key NGOs working at the local level; c) Joint presentations and campaigns with government officials aligning the discourse at the national, and local level, including public and key local leaders.

Sub-activity 5.2.1.2 Awareness raising campaigns for business such as Oil and Gas companies, and developers.

208. This activity is focused on building awareness of real estate developers of the risks of climate change. For real estate investors, climate change is causing risks to rise exponentially, and incorporating sustainability into the real estate sector has become an absolute imperative for long-term investment prospects. The SORB has experienced rapid real estate development in the last decade or so, resulting in increased infrastructure and livelihood exposure to climate risks. One of the greatest challenges faced by developers is the lack of awareness of climate risks and the benefits and opportunities of green infrastructure. In addition to information on the climate risks, this activity will equip developers with material related to green building construction and operation to preserve natural resources and protect the environment for generations to come.
209. Targeted meetings with the CEOs, board of directors, managers and key decision-makers in the companies will be organized to raise awareness on climate change impacts and the industry-related exacerbation of risks in the area. A focus on improved practices to reduce the impact of the industries on flooding will be promoted along with the alignment of such action with corporate responsibility principles.

Sub-activity 5.2.1.3: Design of communication material

210. The communication material includes including short films highlighting activities that contribute to flooding, on impacts of flooding and the development of promotional material and campaigns that can be shared through social media will also be developed.
211. Location: Siparia, Penal-Debe and Princes Town Regional Corporations.
212. Beneficiaries: Communities within the SORB area in Siparia, Penal-Debe and Princes Town.
213. Key stakeholders involved: Penal-Debe and Princes Town Regional Corporations, National government, CSOs, private sector, Chambers of Commerce, Trinidad and Tobago Society of Planners,

Trinidad and Tobago Association of Planners, APETT, Association of Real Estate Agents, Trinidad and Tobago Institute of Architects, and the Trinidad and Tobago Green Building Council.

Activity 5.2.2 Identification of best practices and lessons learned, and dissemination activities.

214. Communication and dissemination activities arising from the implementation of the Project will contribute to support the adoption of best practices and the wider reflection at the Project level and dissemination to a wide variety of stakeholders of lessons learned.
215. To this end, the Project will promote a series of case studies, and proper identification throughout of a learning agenda and learning plan. After the definition of the learning plan, the identified and prioritized learning questions will be supported. Supported sub-activities will potentially include:
    - Case studies of promoted strategies: From year 3 onwards, the identification of best practices on the proposed strategies and technologies will be identified and further assessment through case studies will analyze them.
    - Lessons learned: identification of problems or challenging situations during implementation and distilled lessons will also be identified and documented through systematization of experiences, which will enable a reflection process with the involved stakeholders and the lessons that can be shared and disseminated.
216. The Project will hold annual Reflection workshops with a wide variety of stakeholders, including public officials, NGOs working in the area, and beneficiaries, to assess the progress of the Project and get feedback on improvements that could be made, and potential partnerships for the upcoming activities.
217. Lessons learned, case studies and good practices identified during project implementation will be developed in different communicational formats, such as videos, short-interviews films, and one-pagers with key highlights to be widely disseminated among stakeholders working in flooding adaptation strategies, and climate change adaptation to dry spells and sea water intrusion.
218. Location: Siparia, Penal-Debe and Princes Town Regional Corporations.
219. Beneficiaries: Communities within the SORB area in Siparia, Penal-Debe and Princes Town.
220. Key stakeholders involved: Ministry of Planning, Penal-Debe and Princes Town Regional Corporations, NGOs, other Regional Corporations of the country, donors and funding institutions working in adaptation strategies, CAF.

B. Describe how the project / programme provides economic, social, and environmental benefits.

Economic benefits of the Project

221. The economic benefits of the project overall include increased and more stable income, protected assets, job creation, higher productivity, and money savings as a result of the improved adaptive capacities and reduced exposure to flooding, drought and saltwater intrusion of vulnerable population in the SORB area.
222. Component 1, through the institutional and regulatory improvements (outcome 1.1), the climate information management system (outcome 1.2), and the EWS (outcome 1.3), will allow better prevention, mitigation, planning, and response to climate risks, and therefore, the reduced exposure and economic costs associated to its impacts.
223. Component 2 will enhance water drainage infrastructure in selected most vulnerable flood-prone neighborhoods (outcome 2.1), which will result in indirect economic benefits by avoiding cost from emergency response regarding extreme events. The housing and commercial building improvement against floods (outcome 2.2), will benefit vulnerable population by protecting their assets and reducing exposure and economic costs due to property loss as well. The improved water access for the urban and rural population (outcome 2.1) due to the installation of rainwater harvesting systems, retention ponds at the household and community level will result in economic benefit by reducing flooding costs and water supply costs for household owners, and in rural areas where the water is carried, it will also reduce the time spent in carrying water, a task usually performed by women.
224. Component 3, restoring key coastal and wetland ecosystems (outcome 3.1) will increase income and productivity in the area by reducing losses in agriculture, fishing, and trade due to climate hazards and threads decline. In agriculture, the avoidance of flooding, saltwater intrusion, and soil erosion, will result

in economic benefit due to productivity gains. The fisheries will benefit from reduced pollution and wetland degradation, which are important nurseries and providing organic material for fish.

225. Component 4 through the implementation of hydroponic systems (outcome 4.1) will increase productivity and income. Technical and commercial assistance, and affordable finance will be provided as well.
226. For fishers, diversification of livelihoods with ecotourism or aquaculture (outcome 4.2) will result in income growth, at the same time that will reduce the likelihood of the need for social assistance from the government.
227. Component 5 will build capacities among stakeholders (outcome 5.1) and develop communication and dissemination strategies (outcome 5.2) which will reduce economic impact by educating on how to prevent flooding and act during emergencies , reducing the cost of climate change hazards on livelihoods, infrastructure, and population.
228. A cross-cutting benefit to all the outcomes of components 2 to 5, is the creation of indirect jobs because of the implementation of the planned works and capacity building activities.

Environmental Benefits of the Project

229. Structural interventions discussed in Components 1 and 2 focus on providing both long- and short-term positive impacts. Activity 1.1.3 which revolves around governance support gives direct environmental benefits of flood alleviation through basic structural maintenance works, while Activity 1.1.2 will provide individuals with the type of information needed to better implement options for flood proofing their homes and businesses, which will be more effective and environmentally sustainable than the short-term usage of options such as sandbagging. Activities 2.1.1 and 2.1.2 under the remit of Component 2 which addresses infrastructure to increase resilience is directly connected to reducing flood impacts.
230. The development of a Management Plan for the Godineau Swamp under Component 1 will provide both direct and indirect environmental benefits in the short- and long-term. It will ensure that the Swamp's resources are used sustainably, the ecological integrity of the Swamp is protected, biodiversity is conserved, activities that have a negative impact on the Swamp are precluded, and the Swamp's hydrology is properly maintained. The development of a Management Plan through a participatory approach lends for the possibility of the successful sustainable management of the Swamp's resources, as top-down legislative approaches are challenging to enforce and manage in developing countries. Nonetheless, the development of a Management Plan could also provide a possible pathway for the legal recognition of the Swamp as a protected area allowing for prosecutions in the event of environmental violations.
231. Component 2 prescribes activities related to rainwater harvesting that can effectively reduce the impacts associated with stormwater runoff and reduce potential impacts associated with increasing pressures placed on freshwater systems to meet growing demands.
232. The implementation of an initial study prior to the implementation of water harvesting will allow for the filling of knowledge gaps so that any provision of information to the residents of SORB will be relevant. Residents will be educated on the appropriate measures for the management of the systems to reduce any health or environmental risks. Any impacts will be addressed through the Certificate of Environmental Clearance process whereby the Environmental Management Authority (EMA) would require each impact be determined and mitigated prior to the grant of approval.
233. In the case of Component 3, the restoration of mangroves can improve the carbon sequestration capability of the Godineau Swamp, and increase the availability of habitats, nurseries and spawning grounds for both crustaceans and fish which are intrinsically linked to the livelihoods of the residents of the SORB. Additionally, mangrove restoration will ultimately reduce the risks of storm surges, improve coastal protection, and reduce erosion, maintain the biodiversity of the Swamp, and improve water quality. Reduction of negative impacts associated with mangrove restoration programmes as outlined in Component 3 will be avoided through the involvement of the Institute of Marine Affairs (IMA) and the Coastal Protection Unit of Ministry of Works and Transport. This would address some of the reasons why some restoration programmes fail including a lack of knowledge of the site hydrology, poor site and species selection and the absence of long-term monitoring and management.
234. Actions related to more sustainable practices in Component 4 provide several environmental benefits. For example, hydroponics systems will reduce the amount of water used by farmers, which will contribute to reduce droughts. As it is nutrient efficient, it will also minimize the use of pesticides.

Social Benefits of the Project

235. Components 1 and 5, through regulatory and institutional improvements combined with awareness and communicational campaigns, will allow the population not only to have more information and capabilities, but also a greater degree of involvement and empowerment in relation to floods and the decisions made in relation to them.
236. The infrastructure works of Component 2 will significantly contribute to enhance the population's quality of life by improving the living environment. The rainwater harvesting systems will also increase hours-availability for productive or domestic tasks, by reducing the time spent in carrying water, a task usually performed by women.
237. In component 3, restoration of mangroves will imply the improvement of the ecosystem services. The hydroponic systems in component 4 will benefit population with a better health, by reducing the use of pesticides and the possibilities of water run off pollution.
238. Regarding gender considerations, data will be discriminated in all consultative and participatory instances. Likewise, the gender responsive approach will be mainstreamed in the entire project activities, including the design of trainings, the implementation of technical assistance to ensure women participation and care for the children so they can attend, appropriate language and gender considerations in the communication, dissemination, and awareness activities, among others.
239. Overall it is expected that the reduced impact of flooding will also benefit SORB population's spread of diseases such as leptospirosis and other waterborne diseases, the disruption to the potable water supply, and the interruption of electricity supply during extreme events.

C. Describe or provide an analysis of the cost-effectiveness of the proposed project / programme.

240. The project proposes a combination of investments in different technologies, including hard adaptation measures, such as grey and green infrastructure and soft adaptation (e.g capacity building, awareness raising, and flood governance strengthening) that are combined to address in an integral manner the impacts of flooding, droughts and increased sea level rise providing benefits for the most vulnerable population in the area. The Project has included the following consideration to ensure cost-effectiveness:

Prioritization of no-regret and low regret options[21] and cost-effective technologies for adaptation assessed in the study conducted by the Inter-American Development Bank (IDB) in Trinidad and Tobago "Understanding the economics of climate adaptation in Trinidad and Tobago" (2014) [22].

- Support for the strengthening of flooding governance, which includes the meteorological alert system under component 1 and mangrove restoration (component 3) fall into the category of "high impact" and "no regret".
- Capacity building activities are generally no regret options since they entail low-investment with proven long-term effectiveness and sustainability of actions as well as benefits that would be justified under all future scenarios, since it addresses key issues already being experienced in the SORB. Furthermore, social awareness and institutional training as well as the introduction of retention ponds obtained the highest score in terms of cost-effectiveness assessment under the multi-criteria analysis in the above-mentioned study.
- Activities as rainwater harvesting systems, infrastructure and building reinforcement, and sustainable drainage systems, are also included in the analysis of the IDB study and obtained a high score as cost-effective actions to prioritize in the country.

[21] Low regrets options deliver benefits now and across a wide range of future scenarios of climate change and may incur in an additional cost to offset climate change risks but costs are small in comparison to the benefits of avoiding future costs. No regret options are investments that would be justified under all plausible future scenarios, including the absence of human-induced climate change

[22] This study assesses the existing climate hazards calculates their economic effects, proposes actions to address the identified risks, and analyses their economic costs and benefits of each adaptation measure, reaching to a weighted result for each of them. Link available at https://publications.iadb.org/en/publication/16851/understanding-economics-climate-adaptation-trinidad-and-tobago.

Proactive and preventive approach to address flooding, drought and increased sea level rise: The proposed measures contribute to avoid associated increasing losses and economic costs compared to the current approach of reactive measures such as evacuation, subsidies to farmers and people affected by flooding, among others.

Reduced costs of investments, low maintenance costs and increased associated co-benefits:

- Activities such as the improvement of the early warning systems (Component 1) builds on previous work done by a partnership of non-government and government institutions and complement the required investment to expand and enhance the EWS. This kind of systems do not only contribute to disaster risk management but also contribute to social-capital and community network development and has a low associated operation and maintenance cost.
- Component 2 will address identified drainage issues by investing in small detention basins, and small drainage works in specific identified location, which entail a relatively small investment and can maximize the benefits to avoid flooding in the identified areas. Through this component, the strengthening of housing and commercial buildings to withstand floods also represents a low investment adaptation solution that entails high benefits of avoided asset losses and the losses related to the stop of an income-generating activity for the flooded households. The development of rainwater harvesting systems that will also be promoted through component 2 will build upon the experience of other institutions with a proven design and improve the technology to make it also effective for flooding. Community involvement and training will contribute to maintenance and long-term sustainability avoiding the high costs associated to the procurement of water by the government, long distances, or payment to commercial providers.
- Component 3 includes ecosystem-based adaptation solutions that have been proven to require not only a low initial investment but also low maintenance costs, making them efficient and effective. This measure not only contributes to avoiding costs but also supports key ecosystem services, and associated benefits of environmental health such as increased biodiversity.
- Activities such as capacity building and awareness raising (component 5) require a minimum investment and entail associated benefits to not only address climate-related impacts, but also, to improve health and water-borne diseases, contribute to improve chemical pollution derived from pesticides use and water run-off, contribute to address social and cultural behaviors that tend to neglect vulnerable groups such as women and youth, and contribute to understand the importance of emergency responses that can prevent loss of lives, among others.
- Component 4 will avoid high costs for farmers and the government due to losses in the agriculture production by promoting innovative solutions that are proven to save high quantities of water, reduce pollution and high return on investment (ROI). Without the proposed adaptation solutions to vulnerable groups of agriculture and the promotion income-diversifying solutions among fisher-folks, they would continue to depend on government subsidies due to climate-related events.

The project sought to leverage local resources and previous experiences by:

- Leveraging human and technical resources from the public sector: for the implementation of activities, the project will rely on existing structures while strengthening them and ensuring the mainstreaming of climate change and adaptation solutions. This contributes to the sustainability while ensuring consideration of climate change aspects in future interventions.
- Considering additional infrastructure and activities required, complimentary to current and planned investments and projects aimed at improving water management in the country
- Ensuring complementarity with other projects and programmes run by public institutions

Promoting community involvement, trainings and communication strategies based on local practices, culture and social norms to effectively promote behavior change.

D. Describe how the project / programme is consistent with national or sub-national sustainable development strategies.

241. Trinidad and Tobago's National Development Strategy 2016-2030 was built on significant consultations within all spheres of Trinidad and Tobago to determine the challenges faced by the

country and establish the thematic areas that require national attention as the country move along a pre-determined developmental pathway. Theme V – Placing the Environment at the Centre of Social and Economic Development allowed for the articulation of goals that align with the outcomes of components of this project including the strengthening of environmental governance and management systems, climate change vulnerability assessment, and improvement of natural resource management. This Strategy explicitly mentions DRM and Climate Change Adaptation among the highest priorities[23].

242. The project will support five out of the six national environmental priorities set by the National Environmental Policy (2018) for Trinidad and Tobago: Priority 1 – Protecting Environmental and Human Health through Pollution Control; Priority 2 – Sustainably Managing Assets; Priority 3 – Improving the Local Environment; Priority 5 – Fostering an Environmentally Responsible Society; and Priority 6 – Addressing Climate Change and Environmental and Natural Disasters.
243. The project also allows Trinidad and Tobago to address some of their national goals and key thematic sectors that require consideration under various policies in addition to the National Environmental Policy (2018). These policies including the National Policy and Programmes on Wetland Conservation for Trinidad and Tobago (2002), National Protected Areas Policy (2011), National Forest Policy (2011), National Climate Change Policy (2011), National Wildlife Policy (2013), National Tourism Policy (2010), and National Integrated Water Resources Management Policy (2005). Policy documents not yet approved by the Cabinet of the Government of Trinidad and Tobago but still represent valuable guides in determining priority areas for Ministerial interest also cover some of the components of this project. These draft policies include the Draft Ecotourism Policy, Draft Integrated Coastal Zone Management Policy, Draft Comprehensive Disaster Management Policy, and Draft Hazard Mitigation Management Policy.
244. Regarding the abovementioned National Climate Change Policy (2011),the present proposal is aligned with the objectives of conserving and building resilience of human and natural systems to adapt to the adverse impacts of climate change, including through capacity building; protection of the natural environment and human health; enhanced agricultural production and food security; educating the wider public on the potential impacts of climate change and the recommended adaptation strategies; and conserving and guaranteeing a sustainable supply of potable water.
245. Trinidad and Tobago's nationally implemented plans also have matching components with the project. These are the National Biodiversity and Strategy Action Plan (2017), Draft National Flood Response Plan, National Response Framework (2014), National Protected Areas Systems Plan for Trinidad and Tobago (2018), National Hazard Mitigation Plan (2014) and the National Action Plan Programme to Combat Land Degradation in T&T: 2006-2020.
246. This proposal is also aligned to the efforts that the country through the ODPM is undertaking for updating its governance framework for Disaster Risk Management. Nowadays, the country lacks from a comprehensive disaster risk management legislation, since the Disasters Measures Act (Ch. 16:50, Act 47 of 1978) – the only regulation governing disaster related issues at national level – is focused on disaster response; and there is a general absence of DRM responsibilities explicitly defined on sectorial and territorial regulations[24]. To give a solution to this, the ODPM is working on the revision of past draft legislation documents to obtain a new comprehensive bill that incorporates, among others, some of the elements gathered by the present proposal at the watershed level: building capacity of disaster management stakeholders, information sharing, early warning systems, public awareness, and resilience[25].

E. Describe how the project / programme meets relevant national technical standards.

[23] Government of the Republic of Trinidad and Tobago, 2016. "Vision 2030- The National Development Strategy of Trinidad and Tobago 2016-2030".
[24] IDB, 2020. "Index of Governance and Public Policy in Disaster Risk Management (IGOPP): National Report for Trinidad and Tobago". Technical Note Nº IDB-TN-02002.
[25] ODPM website, section "Policies, Plans and Legislation": www.odpm.gov.tt

247. The project will be executed by the University of the West Indies through its St. Augustine Centre for Innovation and Entrepreneurship (STACIE), who will ensure adherence to that all laws, policies and regulations of the Government of Trinidad and Tobago.
248. The Project will comply with all the applicable national regulations regarding management of the environment, the industrial relations, health and safety, public health and protection of rivers and waterways. It will comply with all relevant government policies such as its water resources management policy and adhere to all standards for construction and building. It will also comply with CAF' safeguards and AF Environmental and Social Policies.
249. The relevant national legislation and regulations are as follows:
    - National Climate Change Policy (2011)
    - Environmental Management Act (2000) and subsidiary legislation: Certificate of Environmental Clearance Rules (2001), Certificate of Environmental Clearance (Designated Activities) Order, 2001 (As amended), Air Pollution Rules (2014), Noise Pollution Control Rules (2001), and Water Pollution Rules, 2019.
    - Environmentally Sensitive Areas Rules (2001)
    - National Protected Areas Policy.
    - Trinidad and Tobago ratified the Convention of Biological Diversity in 1996 and developed the National Biodiversity Strategy and Action.
    - Waterworks and Water Conservation Act Chapter 54:41.
    - Water and Sewerage Act Chapter 54:40
    - Town and Country Planning Act and Planning and Facilitation Act.
    - Plant Protection Act Chapter 63:56
    - Fisheries Act Chapter 67:51
    - Forests Act Chapter 66:01
    - Occupational Safety and Health Act Chapter 88:08.
    - Industrial Relations Act Chapter 88:01.
    - Public Health Ordinance Chapter 12:04.
    - National Policy on Gender and Development of the Republic of Trinidad and Tobago (2009).
    - Trinidad and Tobago's labour legislation will govern any project that would require the use of local labour inclusive of the provisions set forth in the Occupational Health and Safety Act, 2004 (As Amended), Workmen's Compensation Act, 1960 (As Amended), Minimum Wages Act, 1976 (As Amended), Maternity Protection Act, 1998 (As Amended), and the Children Act, 2012 which seeks to prevent child labour.

F. Describe if there is duplication of project with other funding sources. If any.

250. The SORB is of high priority for the country and thus several studies are being developed and various investments are being envisaged at present by the government. Therefore, the development of this concept note has aimed to carefully identify the existing or planned initiatives by always coordinating with the Ministry of Planning and Development and CAF, and by addressing the topic throughout the bilateral meetings with the various stakeholders (see section H below).
251. The continuous effort made by the governmental institutions in the region has been described in the Background section: from the hydrometeorological network developments made by the MET to the ecosystem monitoring actions sustained by the IMA with the limited resources available, to mention a few. This project builds on these efforts in order to boost action to increase community resilience as a matter of urgency.
252. If we refer to specific projects, the unfinished Godineau management plan initiative will be resumed by this project. Also, several studies have been carried out in coordination with the main governmental entities related to flooding, such as the Drainage Division, to find the best solutions for flooding problems in different basins of the country, including the SORB.

253. Particularly in the SORB, an important work was made in 2003 to characterize[26] the needs and the possibilities for enhancing Drainage and Flood control in the watershed. This study has been taken as a knowledge basis in this proposal (see Background section). Also, it should be noted that very recently, in 2019, CAF commissioned a "Rapid assessment for the rehabilitation and improvement of drainage infrastructure in Trinidad"[27]. The objective of this study was to assess the no-regret and short-term measures for a rapid rehabilitation of the drainage infrastructure on Trinidad after the October 2018 flood event. In addition to this, the mid- and long-term measures were assessed in order to further improve the drainage infrastructure and flood management on the island. The recommendations for the case of the SORB were: 1) in the long term, to increase the capacity of the New Cut Channel and of the upstream tributaries and to construct a bypass near the river mouth; 2) in the short term, to build embankments. These are grey infrastructure investments whose budget exceeds the possibilities of this project. In addition, these large investments are being considered by the government for loan applications with multilateral agencies.
254. Based on this knowledge, the preparation of the concept note has prioritized the focus on smaller-scale complementary interventions and sought to promote ecosystem-based adaptation interventions.
255. Regarding the enhancement of the agriculture, farming and fishing sectors and ecosystems management, the project will seek synergies with at least the following projects:
    - The Caribbean Agrometeorological Initiative (CAMI) reunited the meteorological and agricultural agencies of 10 Caribbean nations to deliver climate services to farmers. European Union (EU) African, Caribbean, and Pacific Group of States' Science and Technology Programme (ACP-ST)-funded initiative operated by the Caribbean Institute for Meteorology and Hydrology (CIMH).
    - CDKN (Climate & Development Knowledge Network) project "Climate impacts and resilience in Caribbean agriculture"[28]: Using innovative technology, the University of the West Indies (UWI), has connected with farmers to "climate proof" the agriculture sector.
    - FAO's Climate Change Adaptation of the Eastern Caribbean Fisheries Sector Project (CC4FISH)[29] objective is to increase resilience and reduce vulnerability to climate change impacts in the Eastern Caribbean fisheries sector, through introduction of adaptation measures such as capacity building of fisherfolk and aquaculturists and mainstreaming of climate change into fisheries governance. In Trinidad and Tobago, this project undertook a Vulnerable Capacity Assessment, different activities to reinforce resilience of the fishery sector, and provided support to the Trinidad Fisheries Division.
    - FAO's project "Improving Forest and protected area management in Trinidad and Tobago", included activities such as improvements to the legal and institutional arrangements for PA management, improvements to infrastructure for biodiversity conservation and forest restoration[30].
256. In terms of strengthening capacities in climate change in the country, lessons learned can be taken from the "Climate ACTT: Action by Civil society in Trinidad and Tobago to build resilience to climate change"[31].

G. Describe the learning and knowledge management component to capture and disseminate lessons learned.

257. The Project will develop a knowledge management strategy at the start of the intervention to ensure effective use and dissemination of the information and data generated by the Monitoring and Evaluation System and the best practices and lessons learned captured under component 5. The Project includes among its activities in Component 5 the development of communication material as well as identification of best practices and lessons learned to guarantee knowledge generation.

[26] Royal Haskoning/DHV, 2003. Drainage & Flood control study for the South Oropouche basin.
[27] Witteveen+Bos International Projects B.V., 2019. Rapid assessment for the rehabilitation and improvement of drainage infrastructure in Trinidad – Final Report.
[28] CDKN website: https://cdkn.org/project/climate-impacts-and-resilience-in-caribbean-agriculture-assessing-the-consequences-of-climate-change/?loclang=en_gb
[29] FAO's website: http://www.fao.org/in-action/climate-change-adaptation-eastern-caribbean-fisheries/project-overview/en/
[30] FAO website: http://www.fao.org/sids/resources/projects/detail/en/c/281935/
[31] CANARI (Caribbean Natural Resources Institute): https://canari.org/climateactt/

258. An initial mapping of all key stakeholders has already been performed during the formulation stage (see Annex 1). The knowledge management strategy will update the stakeholders map at the inception stage to ensure all relevant stakeholders, including new ones that might not have been identified during formulation are targeted and engaged with the project learning activities. Different audiences require different knowledge products to capture their attention. Thus, the KM strategy will identify the most adequate communication material to reach the different targeted stakeholders. To this end, a list of potential knowledge material might include short videos, leaflets, one-pagers, infographic, and multimedia resources to ensure knowledge is disseminated adequately targeting different learning needs.
259. The KM strategy will also ensure to identify additional dissemination strategies. Some activities already included under component 5 and the M&E component of the project include peer to peer learning between key government staff supported by specialists from the university, development of training material, embedding climate change and risk reduction planning to address flooding in the school curricula or through extra-curriculum activities targeting initial and middle school students, learning workshops to critically examine evidence from the implementation and the M&E data system for adaptive management and further planification of activities. Sharing of best practices will be promoted through these activities and at the community level through participatory approaches and discussion of the implementation of Project activities. All activities targeting vulnerable population such as farmers, fisher folks, women and youth, vulnerable urban neighbourhoods for the development or redesign of resilient infrastructure or the climate-proofing of assets have a strong technical assistance component associated to ensure knowledge dissemination and appropriation of the adaptation measures at the community level. Ecosystem restoration activities will also be developed with a community-level approach, where community members will be trained to support rehabilitation efforts, which will in turn contribute to the longer-term sustainability of the Project. Knowledge products will be developed featuring the successful strategies used at the community level to disseminate knowledge and reinforce a virtuous cycle of learning.
260. All knowledge generated will be discussed among different stakeholders at annual learning workshops, which will gather the information generated by the Project, including mid-term evaluation results, case studies and final evaluation findings and lessons learned. Additional targeted presentation to key government stakeholders will also be considered in case not everyone is willing to participate in the larger dissemination activities to promote evidence-based decision making and a learning culture of adaptation strategies in the SORB area.

H. Describe the consultative process

261. The formulation of this project has been led by the Ministry of Planning and Development - the Designated Authority to the Adaptation Fund -, and CAF, Development Bank of Latin America.
262. A Kick-off workshop in November 2020 was attended by 72 participants (44% women), from governmental and non-governmental organizations. Following this event, bilateral interviews with key stakeholders were organized and prioritized in conjunction with CAF and the Ministry of Planning, NDA of the Adaptation Fund in Trinidad and Tobago. These are listed in the table below.

Table 5. First round of bilateral interviews with key stakeholders (Dec 2020-Jun 2021)

Environmental Management Authority (EMA)	Water and Sewerage Authority/ WRA
Penal Debe Regional Corporation	Regional Administration South (MALF)
Office of Disaster Preparedness and Management	Siparia Regional Corporation
Coastal Protection Unit (MoWT)	Institute of Marine Affairs (IMA)
T&T Meteorological Service	Puzzle Island Farmers Association
Drainage Division (MoWT)	Woodland Fisherfolk Association
Princes Town Regional Corporation	Global Water Partnership (GWP) and NIHERST
The Penal Debe Foundation	Ministry of Rural Development and Local Government
Engineering Division (MALF)	Extension, Training, and Information Services Division (MALF)
Estate Management and Business Development Company Ltd (EMDB)	Faculty of Agriculture - University of the West Indies (UWI)
Forestry division (Ministry of Agriculture, Land and Fisheries – MALF)	

263. After this first round of bilateral interviews, further meetings were held with these same stakeholders to allow definitions on the different adaptation measures.
264. On 22 April 2021, a Validation Workshop was held to validate with all relevant stakeholders the identified climate risks, the baseline conditions, main barriers to alleviate flooding in the watershed; additional climate threats and impacts experienced by the affected population; and to validate the proposed draft activities and interventions, as well as the prioritization of areas to implement the Project and the institutional arrangements foreseen. There were 58 attendees (43% women)[32].

Table 6. Organizations attending the Concept Note Validation Workshop

Type	Ministry/Division/Agency/Organization
CSO	Adopt a River
	South Oropouche Riverine Flood Action Group
	The Penal Debe Foundation
	Woodland Fisherfolk Association
Private Sector	Penal Debe Chamber of Commerce
	Witteveen+Bos (engineering firm)
Local Govt	Penal Debe Regional Corporation
	Siparia Regional Corporation
	Penal Debe Regional Disaster Management Unit
	Princes Town Regional Corporation
National Govt	Ministry of Works and Transport - Drainage Division
	Ministry of Agriculture, Land and Fisheries
	Ministry of Agriculture, Land and Fisheries - Engineering Division
	Ministry of Agriculture, Land and Fisheries - Regional Administration South
	Ministry of Agriculture, Land and Fisheries - Forestry Division
	Ministry of Energy and Energy Industries
	Ministry of Finance
	Ministry of Rural Development and Local Government
	Ministry of National Security - Office of Disaster Preparedness and Management (ODPM)
	Ministry of Planning and Development
	Ministry of Planning and Development - Environmental Management Authority (EMA)
	Ministry of Sport and Community Development/Community Development Division
	Ministry of Works & Transport - Coastal Protection Unit
	Ministry of Public Utilities - Water Resources Agency (WRA) - Water and Sewerage Authority (WASA)
	Ministry of Public Utilities - Trinidad and Tobago Meteorological Service
	NAMDEVCO (National Agricultural Marketing and Development Corporation)
	NIDCO (National Infrastructure Development Company)

265. The main issues addressed by the participants revolved around the need to work with developers; concrete proposals for short-term flood intervention; the complexity related to the fact that the problems occur in several jurisdictions; the need for enforcement of the law; the importance of community empowerment; the possibility of building detention ponds upstream; the suggestion to adapt existing manuals and codes to the reality of the SORB. Regarding investments in water infrastructure, comments were made on the availability of data on flooded houses; the suitability of rainwater harvesting systems and the need for training for their proper operation; problems with oil extraction infrastructure; problems of saline intrusion; possible mechanisms to manage grants for housing reinforcement. In discussing livelihoods and ecosystems, participants were interested in promoting restoration, aquaculture, and ecotourism activities. They mentioned concern about the mangroves

[32] This figure does not include the participants from the Consortium supporting the development of the Concept Note, integrated by Viridia Projects and the University of the West Indies (UWI).

growing upstream and the decimated crabs population. All the applicable comments from the stakeholders were taken into account in the development of the proposal.

266. At the time of preparation of this concept note, the COVID-19 pandemic situation in Trinidad and Tobago has been very serious. The country has entered a new lockdown due to the large number of cases. The state of emergency, which began on Sunday, May 16 - for a 15-day duration - is being extended for a period of three months[33]. Therefore, the planned field trip to the SORB has been suspended for the time being. So far, due to the pandemic, all project exchanges have been virtual. However, the high level of participation of different types of actors, despite the situation, is remarkable.

I. Justification for funding requested.

267. As described in section F when explaining the non-duplication and complementarity of the project with other funding sources, the formulation of this proposal has taken into account the planned investments in the SORB and has carefully identified the activities that are complementary to the country's efforts and planning and has ensured that the project activities can deliver adaptation results by themselves. None of the proposed activities depend on any other investments to be made by other sources or stakeholders. The proposed activities focus on targeted groups and areas to ensure that the adaptation results are verified. When addressing issues with the national institutions, the proposed activities have a precise and stringent scope so that the objectives of the project are clear, and their outputs and outcomes can be monitored.

268. To increase the resilience of the SORB population and ecosystems to flooding the project activities are organized in five distinct components.

Component 1. Strengthening of Territorial Planning and Risk Management.

269. *Baseline*: There is a lack of incorporation of the climate change perspective in the existing policy and planning. Also, key planning instruments that would help ecosystem resilience, such as the Godineau Swamp management plan are not operational. Also, maintenance is a central problem in the drainage system of the SORB, due to the ambiguity in terms of roles and responsible institutions. Today, warning times are too short to permit substantial reaction for reducing flood damage cost. There is a significant lack of meteorological, hydrological, and tidal data The community flood early warning system (CFEWS) being implemented in the Regional Corporations will provide only limited coverage of flooding in the basin and would need to be expanded. Also, the MET has reported that existing tools to alert the population are not being spread in all their potential.

270. *With AF funds*: The project will strengthen territorial planning and risk management, by developing technical documents that will help to better face the increasing flood events, will facilitate governance in the maintenance of drainage infrastructure; will facilitate local planning processes to increase resilience of key ecosystems and vulnerable people depending on them, will strengthen information, monitoring and climate information management systems, and will help strengthening and expanding the existing Community Flood Early Warning and Decision-making system, by improving the forecast and the uptake of the alert tools by the population.

Component 2. Green and grey infrastructure enhanced to increase resilience to floods and droughts.

271. Baseline: There is a marked lack of funding to intervene in effective measures in the basin.

272. *With AF funds*: The project will help to enhance infrastructure in increase resilience to both floods and droughts, via flood reduction structures in a particular catchment; will improve urban drainage in localized neighborhoods; will increase access to water while minimizing the impact of flooding with rainwater harvesting systems; will promote the adaptation to floods of residential and commercial buildings; and will fund the redesigning high-risk zones of the city to avoid settlements of vulnerable people and therefore avoid their exposure to flooding.

Component 3. Vulnerable coastal and wetland ecosystems of the SORB enhanced.

273. Baseline: There is a marked lack of funding to intervene in effective measures to reinforce key ecosystems. There is room to further promote the Ecosystem-based adaptation approach, which is well

[33] Trinidad Express, 19 May, 2021: "3-month extension for SoE": https://trinidadexpress.com/news/local/3-month-extension-for-soe/article_f0db0e1a-b905-11eb-a5fd-d7f724cfec04.html

known by the relevant institutions with competencies in the coastal and wetlands ecosystems management. There is limited knowledge within the population about the importance of these ecosystems in water regulation and other ecosystem services. The knowledge of ecosystem restoration techniques is not spread at the level of having people being able to work in these duties.

274. *With AF funds*: The project will fund the rehabilitation of vulnerable areas of ecosystems that are key for the water regulation of the watershed, in the face of increasing flooding effects and sea level rise, including saline intrusion, and will provide capacity building to increase technical knowledge.

Component 4. Increase adaptation capacity of vulnerable fishers and farmers to address climate change and climate variability.

275. *Baseline*: Vulnerable groups of the agriculture and forestry sector are exposed to high risks and have low adaptive capacities to effectively respond to climate risks such as dry spells, increased sea water intrusion and increased flooding. The increase in flooding events and probably the increase of sea surface water temperature compromises the population and potential capture of native fishing species. The fisherfolk lack of technical capacity and access to funding to diversify their activity and find alternative livelihoods.

276. *With AF funds*: The project will help to increase the adaptation capacity of vulnerable fishers and farmers to address climate change and climate variability, by providing technical assistance and funds to promote the efficient use of water, promote alternative livelihoods for income and food security, and climate-resilient practices in the agriculture, aquaculture, and animal husbandry sector. These activities aim to address adaptation to the increasing droughts (e.g., efficient irrigation), increasing flooding events (e.g., animal shelters) and increasing changes in the marine environment due to climate change (e.g., diversification to fish farming and aquaculture).

Component 5. Stakeholders of the SORB have built their capacities and are aware of climate risks.

277. *Baseline*: There is a lack of a comprehensive approach to climate change in the educational system of Trinidad & Tobago; limited capacity of institutional stakeholders, CSOs, community groups, to address flooding; and lack of accessible and understandable information about climate change for fostering a change of behavior.

278. *With AF funding*: Barriers will be overcome through raising awareness and building capacities of the stakeholders of the SORB in sustainable climate change resilient actions and decision-making to reduce their risk to climate change impacts. Activities related to learning and dissemination from the implementation of the Project will contribute to support the adoption of best practices.

J. Describe how the sustainability of the project outcomes has been taken into account when designing the project.

279. The design of the Project includes several elements to ensure actions and benefits of the intervention continue after it ends. The main sustainability and replicability considerations aim to ensure that the local population, the institutions, and the policy environment are supportive of an effective adaptation to the increasing impacts of flooding, saltwater intrusion, and dry spells in the SORB area. The main elements that will contribute to this include:

- **Capacity building for key government institutions** to strengthen climate change knowledge, the use of hydro-climatic information for decision-making, flood, drought, and saltwater intrusion management with appropriate adaptation strategies, which will enable the local institutions to continue implementing similar actions, after the Project ends.
- **Capacity building** and **awareness raising for the local population**: the project considers different strategies targeting the local population, among which, awareness raising campaigns, capacity building activities for the implementation of the adaptation measures, incorporation of climate change and disaster risk reduction as extracurricular activities targeting children at school age. All these strategies will strengthen capacities in vulnerable populations, enhancing their knowledge about climate change, main impacts, and efficient measures to contribute to prevent and manage flooding, efficient use and harvesting of water, promoting a cultural change.
- **Maintenance of small works**: Rainwater harvesting systems as well as retention ponds at the household and community level will include capacity building for the use and proper maintenance in the long-term. For communal works the Project will require before accessing funds, the commitment to develop a community plan, which regulates rights and responsibilities of the

community that will use the installed system to avoid conflicts and guarantee long-term operation and maintenance.

- **Partnership with key governmental institutions** to ensure resources are allocated for the long-term maintenance and operation of the investments made. Additionally, the implementation of activities involving key government institutions contributes to guarantee ownership and the sustainability once the Project comes to an end.
- **Strengthening of regulations and the flooding management governance**: The Project strongly supports the strengthening of the enabling environment contributing to develop a stronger flood governance structure and improved water management, mainstreaming climate change considerations and its impact in the drainage, and building code. It promotes regulatory changes that will make it possible to support flooding management in the long-term, protecting and restoring key ecosystems exposed to the impacts of climate change in the region.

K. Provide an overview of the environmental and social impacts and risks identified as being relevant to the project.

280. A preliminary analysis of the Project's impacts and risks as per the AF´s Environmental and Social Principles in compliance with the Fund's Environmental and Social Policy (revised in March 2016) is presented below. A detailed impact assessment and mitigation plan will be developed for the Full Proposal. Overall, this project has been classified as a **Category B** project/ program according to the E&SP of the AF, as the potential impacts are few, small in scale and not extremely widespread, reversible, or easily mitigated.

Checklist of environmental and social principles	Further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
Compliance with the Law	Further assessment required	All applicable proposed projects need to comply with the legislation of Trinidad and Tobago. The EMA grants approvals via the Environmental Management Act (2000) under which there are subsidiary legislation which covers the types of approvals and regulatory requirements projects need. These pieces of legislation include the Certificate of Environmental Clearance Rules (2001), Certificate of Environmental Clearance (Designated Activities) Order, 2001 (As amended), Air Pollution Rules (2014), Noise Pollution Control Rules (2001), and Water Pollution Rules, 2019. The recommended projects/ actions which develop from the proposed Activity 1.1.3 which provides for the development of a management plan for Godineau Swamp will be subject to regulatory approval where needed. Additionally, future protective designation of the Godineau Swamp can be achieved under the Environmentally Sensitive Areas Rules (2001) and Environmentally Sensitive Species Rules (2001) via implementation of recommendations made under the management plan. This would legally restrict the types of activities which can be undertaken in the Swamp necessary for compliance. Drainage works will lie with other regulatory agencies including the EMA and TCPD (or the planned National Planning Authority in lieu of TCPD) to provide conditional approvals for. Therefore, there will be some legal requirement to be met for each development with stormwater management engineering works. Future assessment of this criterion is required for the Full Proposal.
Access and Equity	Further assessment required	Beneficiaries were identified during extensive stakeholder engagement. This was imperative in the engagement process as it allowed for groups which may not often have had the opportunity to raise some of their concerns with flooding in the SORB on a national scale.
Marginalized and Vulnerable Groups	Further assessment required	Vulnerable groups have been identified for the project at this stage. There is no specific legislation in Trinidad and Tobago to address any means by which Venezuelan refugees can have a legal redress for ownership of properties. In the provision of grants to homeowners and business-owners, it has not yet been determined at the Concept Note stage whether refugees, renters, and holders of Certificates of Comfort from the Land Settlement Agency will have equivalent

		access to funds. Therefore, there is a potential for such persons to indicate they are being denied the same rights being granted to members of the community that are affected by flooding. This criterion would require further assessment.
Human Rights	No further assessment required	Human rights will be further protected through the implementation of activities that will raise awareness and build capacity of homeowners and business-owners within the basin. Given that there are no proposed projects which will negatively impact human rights, there is no further need for assessment for this criterion.
Gender Equity and Women's Empowerment	Further assessment required	The proposed projects present gender and women's empowerment sensitive activities.
Core Labour Rights	Further assessment required	While the perceived risks may be minimal at this stage since there is governing legislation regarding several different aspects of labour rights, there would be a need for further assessment at a later stage regarding any project that would require any civil work.
Indigenous Peoples	No further assessment required	There are no known Indigenous communities currently residing within the SORB watershed, even though there are artefacts from previous generations. There is no further assessment required for compliance.
Involuntary Resettlement	No further assessment required	There have been no proposed activities that require the resettlement of persons, but rather the redesign of only vacant flood prone land, and thus no further assessment is needed.
Protection of Natural Habitats	Further assessment required	There are no project components which require any unjustified conversion of habitats recognized for their legal protected status or by communities, and high in conservation value. In fact, the components recognize the conservation value of the Godineau Swamp. Further assessment of risks related to economic activities will be required.
Conservation of Biological Diversity	Further assessment required	Some of the proposed project´s interventions will consider nature-based solutions intended to provide for human well-being and positively impact the biodiversity of the Godineau Swamp - an important measure as Trinidad and Tobago ratified the Convention of Biological Diversity in 1996 and developed the National Biodiversity Strategy and Action to specifically plan for the country's sustainable use of biodiversity. Output 3.1 which involves the restoration of coastal and wetland ecosystems, will involve activities that include re-growth of mangroves and restoration of marshes. The potential impacts of the aforementioned activities cannot be fully explored at this Concept Note stage and therefore the extent of the risks cannot be determined, even though the intended result will be of direct benefit to the ecosystem and indirectly, positively impact the surrounding communities.
Climate Change	No further assessment required	There are no provisions for projects within the SORB to target sectors that generate GHG. Where civil works may be required, the movement of vehicles have the potential to increase greenhouse gas emissions, but it is considered as not significant.
Pollution Prevention and Resource Efficiency	Further assessment required	There is a potential risk of measures which will not maximize energy efficiency and reduce resource use to be implemented at some stage. Additionally, the production of waste or even the production of pollution emissions and effluent may also be a plausible project by-product. The potential risks cannot be adequately assessed at this stage and would require future elaboration.
Public Health	Further assessment required	There are interventions which can possibly have a potential public health impact which have not been fully assessed at this stage, and therefore the extent of potential risks has not been fully ascertained.
Physical and Cultural Heritage	Further assessment required	There are no proposed projects that will have an impact on the archaeological sites which have been discussed in the Background section of this Concept Note. However, the proposed Management Plan development for the Godineau Swamp recognizes the important of this cultural find and through the participatory process, this will be incorporated into the management objectives for the Swamp. Any proposals from the Plan will be subject to future compliance requirements where needed to properly ascertain the potential impacts or risks associated with the activity. Further risk evaluation is necessary.
Lands and Soil Conservation	Further assessment required	The promotion of potentially improved valuable ecosystem services are provided by proposed activities. While the proposed projects provide the opportunity for the promotion of soil conservation, improved protection to lands and soils and conservation of valued ecosystem services within the SORB watershed, the

		inherent potential impacts, and risks of each of these projects have not been thoroughly assessed at this stage.

PART III: IMPLEMENTATION ARRANGEMENTS

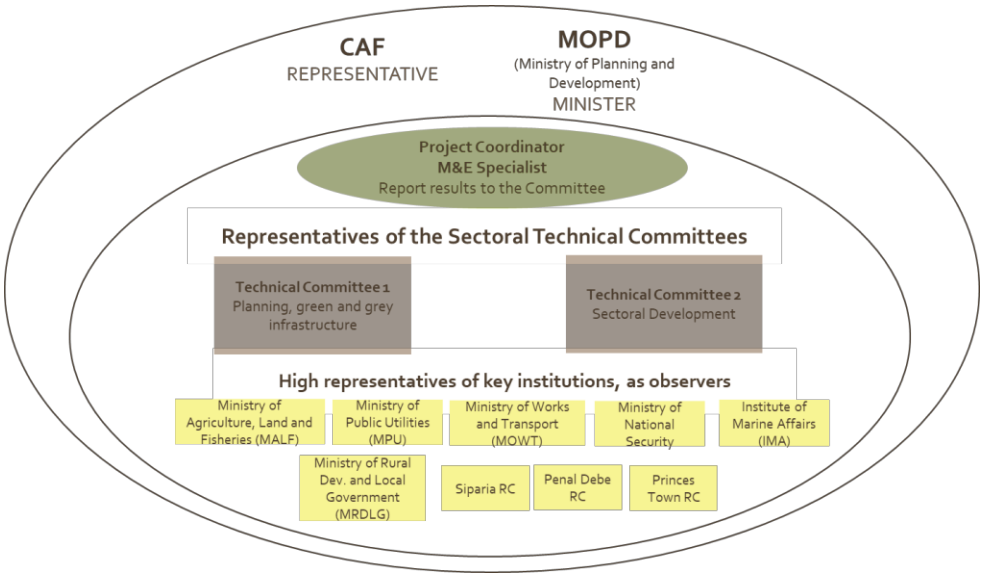
A. Describe the arrangements for project implementation.

281. Upon the request of the Government of Trinidad & Tobago, CAF is the Regional Implementing Entity (RIE) for the project. The Executing Entity is the University of the West Indies (UWI), through its St. Augustine Centre for Innovation and Entrepreneurship (STACIE) as the internal execution unit.
282. Key stakeholders related to climate impacts in the SORB at the national and the local level identified and described in the context/background section will also be involved in the implementation of the project under the scheme depicted below.
283. The project will have two levels of coordination: a level of strategic coordination that will include a Steering Committee and two Technical Committees, and an operational structure to manage the coordination of the accredited entity, the executing entity, and the operational team / project management unit (PMU).

1. Strategic coordination level

Steering Committee

284. Maximum decision-making authority, it will be led by high representatives from CAF and high representatives from the NDA (Ministry of Planning and Development) and will include as observers representatives of the different governmental institutions key for the management of the climate-related issues in the SORB. The Project Coordinator and the M&E Specialist will participate in the meetings with the main objective of reporting results to the Committee.



Technical Committees

285. There will be two Technical Committees responsible for presenting execution results to the Steering Committee: one that will advise and report on the Planning and green and grey infrastructure interventions; and one that will advise and report on the Sectoral development interventions related to the agriculture, farming, and fishing sectors. While the Steering Committee will be composed by high representatives of the institutions (Ministers, secretaries, majors), the Technical Committees will be integrated by technical referents of institutions related to each of the thematic areas.

2. Operational structure

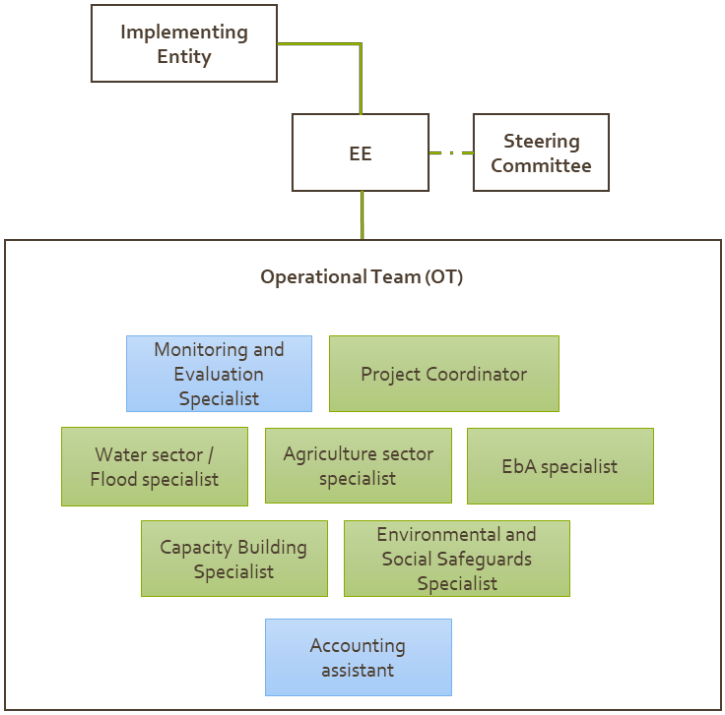
Implementing entity (AE)

286. CAF will hold the role of the Implementing Entity of the Programme, based on its experience of successfully carrying out similar Programme activities in the LAC region. CAF will maintain day-to-day oversight responsibility for project supervision and have direct responsibility for fulfilling the duties and obligations of an AF Implementing Entity. It will be responsible for financial management and accountable for the use of AF resources under the project. It will provide technical and administrative backstopping to the Operational Team (see below) to ensure results-oriented management and proper administration of funds. The IE functions involve the provision of monitoring and evaluation services. CAF will have permanent coordination with project staff and dialogue with project stakeholders.

Executing Entity (EE) and the Operational Team (OT)

287. The University of the West Indies (UWI) will be the EE of the project and will be aligned with CAF's administrative procedures, including procurement methods and audits. The Operational Team (OT) within the EE will have a dedicated team to guarantee all components and activities are carried out according to the project design. It will articulate with the monitoring and evaluation activities (covered by CAF as IE) to ensure that all expected results will be achieved on time and within budget.

288. This OT will have a Project Coordinator, a Monitoring and Evaluation Specialist, a Water Sector/Flood Specialist, an Agriculture, farming and fishing Specialist, an EbA Specialist, a Capacity Building Specialist and an Environmental and Social Safeguards Specialist. The latter will be responsible for overseeing the implementation of the ESMF and the Gender Action Plan in liaison with CAF's Coordination of Environmental and Social Assessment and Monitoring (CESAS) and CAF's Gender Coordination. The OT will work closely with the administrative areas within CAF.



289. The OT will ensure that the Project's implementation proceeds smoothly through well-written work plans, Terms of Reference and carefully designed administrative arrangements that meet CAF and AF requirements.

Subsequent sections of Part III will be developed at the Full proposal stage.

PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. Record of endorsement on behalf of the government[1]

Project: Multisectoral Adaptation Measures to Climate Change in the South Oropouche Basin for River Flood Relief

Name: Joanne Deoraj *Position: Permanent Secretary* *Ministry of Planning and Development* *Trinidad and Tobago*	Date: *20 July, 2021* Joanne Deoraj

[6] Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY

B. Implementing Entity certification

Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project/programme contact person's name, telephone number and email address.

Project: Multisectoral Adaptation Measures to Climate Change in the South Oropouche Basin for River Flood Relief

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.	
DocuSigned by: ELIZONDO, UBALDO 3849551E19244BF... *Ubaldo Elizondo* Climate Change Coordinator CAF, Corporación Andina de Fomento	
Date: *August 06, 2021*	Tel. and email:uelizondo@caf.com
Project Contact Person: Carolina Cortés	
Tel. And Email:acortes@caf.com	

MINISTRY OF PLANNING AND DEVELOPMENT
OFFICE OF THE PERMANENT SECRETARY
Level 14, Eric Williams Financial Building, Independence Square, Port-of-Spain, Trinidad and Tobago, WI
Tel: 612 3000 ext. 2016/1329

July 30th, 2021

To: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: Endorsement for "**Multisectoral Adaptation Measures to Climate Change in the South Oropouche Basin for River Flood Relief**"

In my capacity as designated authority for the Adaptation Fund in Trinidad and Tobago, I confirm that the above national project proposal is in accordance with the Government of the Republic of Trinidad and Tobago's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in Trinidad and Tobago.

Accordingly, I am pleased to endorse the above project proposal with support from the Adaptation Fund. If approved, the project will be implemented by Development of Latin America (CAF) and executed by the Ministry of Planning and Development in collaboration with the University of the West Indies.

Sincerely,

Joann Deoraj

Permanent Secretary
Ministry of Planning and Development

PERMANENT SECRETARY
MINISTRY OF PLANNING
AND DEVELOPMENT

Annex 1 Key governmental stakeholders related to climate change impacts in the SORB.

Key governmental stakeholders at the national level

Name	Role in the Project
Drainage Division (Ministry of Works and Transport)	It is considered a key stakeholder due to its role in the flood risk mitigation in Trinidad &Tobago.
Coastal Protection Unit (Ministry of Works and Transport)	Its role in developing a long-term policy towards preservation, rehabilitation, and management of the coastal zone as a model for sustainable development in Trinidad & Tobago.
Forestry Division (Ministry of Agriculture)	Sustainable management of the Nation's forests to ensure that they are abundant, ecologically healthy, biologically diverse and contribute to the wellbeing of all people and to the national economy in current and future generations.
Engineering Division (Ministry of Agriculture)	For farm road, irrigation and building construction, technical services in design, estimate and supervision of construction works under the Ministry of Agriculture Land & Fisheries.
Regional Administration South (RAS) (Ministry of Agriculture	Its role in providing advisory and technical support services to farming communities. Mission of the Regional Administration South relevant to the project: The RAS mission to provide decentralized services of core divisions of the Ministry of Agriculture, Land and Fisheries.
Water Resources Agency (WRA) of the Water and Sewerage Authority (WASA) (Ministry of Public Utilities)	Role in effectively managing the country's water resources and promote conservation, development, and protection of these resources, for sustainable use, in a cost effective and integrated manner to support socio economic growth.
Meteorological Services Division (MET) (Ministry of Public Utilities)	It is considered a key stakeholder due to its role in providing meteorological information and advice consistent with international standards.
Office of Disaster Preparedness and Management (ODPM) (Ministry of National Security)	Although the mandate for flood alleviation and control does not fall under the ODPM's purview, as the national coordinating agency for Disaster Risk Reduction, the ODPM's principal responsibility relative to flooding situations is to coordinate the response of national agencies and international partners in the event of severe flooding that overwhelms the Municipal Corporations and the national capacity, respectively. The ODPM also plays a critical role regarding the preparation of maps of flood plains and the updating of maps in a timely manner.
Town and country planning Division (Ministry of Planning and Development)	It provides approvals for projects with a drainage component, and their grant of approvals are usually conditional and requires the fulfilment of specific drainage requirements depending on the nature/scale/impact of the proposed development.
Environmental Management Authority (EMA) **(Ministry of Planning and Development)**	Facilitates cooperation among persons and manages the environment in a manner, which fosters participation and promotes consensus, including encouraging the use of appropriate means to avoid or expeditiously resolve disputes through mechanisms for alternative dispute resolution.
Institute of Marine Affairs (IMA) (Ministry of Planning and Development)	Considered a key stakeholder for the project due to its mandate to collect, analyze and disseminate information relating to the economic, technological, environmental, social, and legal developments in marine affairs and to formulate and implement specific projects.
Ministry of Rural Development and Local Government (MRDLG)	Coordinating agency that guides Municipal Corporations and Special Purpose Enterprises in assisting communities by pooling resources in targeted areas which include among others Infrastructure Development, Disaster Management, Public Health and Sanitation. The Ministry's role in organizing, promoting, and implementing rural development policies and strategies are also of interest to the project.

Key governmental stakeholders at the local level

Name	Role in the Project
Penal Debe Regional Corporation	Supporting the Ministry of Rural Development and Local Government with organizing, promoting, and implementing rural development policies and strategies. Knowledge and understanding of flooding within the South Oropouche River Basin
Princes Town Regional Corporation	
Siparia Regional Corporation	