



# BARBADOS TOWN PLANNING SOCIETY

## Ridge to Reef – Development and Climate Change

### A Report of the Barbados Town Planning Society's Annual Symposium held on World Town Planning Day – 8 November 2017

The BTPS Vice President, **Raymond Lorde**, welcomed participants to the BTPS World Town Planning Day event and set the context for discussion. He said the **“Ridge to Reef”** concept was central to the way the 2017 Physical Development Plan (PDP) Revision was dealing with environmental issues. He said Barbados was unique in the Caribbean in having an island-wide comprehensive physical development plan. He said review at this time was needed but he did not agree that a full review every 5 years (as required by statute) was either necessary or practicable. He remarked that sustainable development issues had come into the 1991 and 2003 PDP Revisions but that these issues were even more critical now given the New Urban Agenda and the commitments arising from the COP21 Paris Agreement. The PDP Revision is an opportunity to strengthen the policy and investment framework and deliver a resilient and prosperous future for the island.

Mr Lorde listed the new PDP's five strategic policies – promoting sustainable development, protecting core assets, greening the economy, advancing mobility and accessibility, and planning for national infrastructure. He said the Ridge to Reef concept was central to protecting core assets. He said it tackled issues at the drainage basin or watershed management level and includes the management of agricultural land (including land no longer under cultivation) and the maintenance of soil cover. As a trained geographer and planner, Mr Lorde supported the concept but suggested that flooding exacerbated by dumping and debris showed that as a nation we do not care enough.

**Dr Vernese Inniss** of Ecoisle Inc spoke on **The Global Climate Change Agenda: Implications for Small Island States like Barbados**. She quoted the 2°F (1.1°C) global average temperature increase since the nineteenth century and the IPCC (International Panel on Climate Change) view that the 95% probability is that human action is the main cause. Most warming has taken place in the last 35 years and 2016 was the warmest year on record with the expectation that 2017 will prove warmer still. On current trends and without major intervention, IPCC expects a rise of between 2.6°C and 4.8°C by the end of the century. This year there were three hurricanes in quick succession in the region with two reaching Category 5 strength.

Dr Inniss described the United Nations process from the original Rio agreement in 1992, through the more detailed actions set out in the 1997 Kyoto Protocol, and the Paris Agreement of 2015. Dr Inniss explained that the Alliance of Small Island States (AOSIS) is the voice of SIDS, representing 40 islands and low-lying coastal states worldwide with the majority in the tropical cyclone belt. The global policy response started with the Rio objective of stabilizing emissions, putting responsibility for this with the developed countries which had historically contributed most emissions, maintaining developing countries' right to development and recognizing the vulnerabilities of SIDS. She quoted India's argument that there is a difference between "luxury" emissions and "survival" emissions. At Kyoto it was accepted that emissions should be reduced to 5.2% below 1990 levels by 2012 with different targets for each country and a range of methods including emissions trading. Kyoto was legally binding and had a compliance mechanism. However, AOSIS had called for a greater reduction and emissions continued to rise anyway. Progress after Kyoto was weak and it was generally accepted that deeper cuts were needed, that there should be more emphasis on adaptations as well as mitigation, and there should be funding for technological development and technological transfer. AOSIS adopted the slogan "1.5 to stay alive" which meant reducing CO<sub>2</sub> emissions by 40% of 1990 levels by 2020 and 95% by 2050. AOSIS also called for help with loss and damage from slow onset impacts and from catastrophic events as well as managing financial risks. Highlighting the urgency for AOSIS members, Dr Inniss gave examples of where climate changing is already giving rise to refugee issues. The COP23 Paris Agreement response was an intention to hold the global temperature increase to "well below" 2°C and to aim for 1.5°C above pre-industrial levels and to reach peak emissions as soon as possible. However, it does not set targets for individual countries and they are to work out their own "nationally determined contributions" with global reviews of progress every 5 years. The Paris Agreement did not move forward on compensation or insurance, with the 2013 Warsaw International Mechanism on Loss and Damage continuing in place and further discussion planned for COP 25 in Bonn.

On finance, Dr Inniss said AOSIS had argued that the developed world should provide new and additional money (rather than just use existing development aid budgets) and that funding should be in the form of grants rather than loans. However, the Paris Agreement did not distinguish climate change funding from aid money. A \$US100 Bn Green Climate Fund was agreed up to 2025 for adaptations (building resilience) and mitigation (emissions reduction). So far, \$US10 Bn has been pledged by developed countries with equal allocations for adaptations and mitigation. Dr Inniss said this was not a huge amount and much more is needed. Caribbean countries are accessing these funds and have schemes in the pipeline but it emerged in discussion that the process is slow with the level of preparatory work to justify projects so high that it was suggested 5 years is a realistic time from bid to approval.

**Tony Gibbs**, engineer with special interest in designing for hurricane and earthquake risks, spoke on **The Effects of Climate Change on Wind Speeds for Structural Design**. He gave examples of changing hurricane activity: in 2004 the first hurricane identified in the South Atlantic hit the Brazilian coast; also in 2004, Ivan was the most intense hurricane recorded so close to the Equator; Gustave in 2008 set the record wind speed of 340 km/hr before the

measuring equipment broke. Mr Gibbs examined whether the Caribbean can expect more hurricanes in the future. He said the evidence showed sea temperatures were rising and the number of North Atlantic hurricanes was rising with them. Activity also increased in years when there is a La Nina and this cycle suggests a relatively high period of hurricane activity from 1995 through to 2025. He also said the incidence of major storms had been increasing with an increasing proportion of storms being in Category 4 or Category 5. Mr Gibbs said that globally the number of cyclones has not changed much but the picture is different in the North Atlantic because, while it was previously the coolest ocean, it is warming up fastest. On the basis of these trends he anticipates unprecedented tropical cyclone activity in the region in coming years with 15 – 20 storms per annum of which 3 – 4 would be Category 4 or 5.

Mr Gibbs pointed out that there was evidence from actual wind measurements to suggest that the US National Hurricane Centre overstated wind speeds when compared with the levels actually experienced. He said that, while Hurricane Irma generated Category 5 wind speeds in Barbuda, sustained wind speeds from Hurricane Maria in Puerto Rico did not reach this level. Nevertheless, both storms caused catastrophic damage.

On the question of whether man-made climate change is real or not, Mr Gibbs said the safest bet even for sceptics was to accept that it is and amend lifestyles accordingly. He said US building standards were the basic reference point for engineers but said even these should be upgraded. For Category II buildings (homes, offices, hotels, etc) he said climate change requires a 13% uplift in the winds they can withstand. He similarly recommended a 10% increase for Category I buildings such as hospitals. Mr Gibbs showed examples of structural damage to buildings and also to critical transportation and telecommunications infrastructure. He said it was possible to build structures that would withstand Category 5 wind speeds and gave the example of thin shell concrete roofs that provide resistance through their shape rather than from material strength. He also recommended windows should be to Miami Dade standard which is based on tests for wind pressure, impact of wind-blown debris and ingress of wind-driven rain. Mr Gibbs emphasized that window design is critical as “water is the main destroyer”. With regard to existing buildings, he said strengthening against wind is possible and cited a UK DFID project which is aiming to strengthen 50 health facilities in 7 Caribbean countries. He finished by saying we should not ignore earthquake risks as Barbados is located immediately above a major plate junction.

**Dr Leo Brewster**, Director of the Coastal Zone Management Unit (CZMU), spoke on **Protecting our Coasts and Marine Environment**. Dr Brewster stressed the uniqueness of the island with eight different coastal segments exhibiting different characteristics in a small space. But pollution is a major problem bringing nutrients, bacteria and sediment into the marine environment. Major sources include sewage (exacerbated by urban expansion and extra waste water), golf courses, industry (including construction) and agriculture. Current agricultural practices (including furrowing that encourages rapid run-off and blocking of drains with sediment) worsen the situation. Sub-terranean groundwater movement also brings pollutants to the coast, as does storm water run-off. Illegal dumping of garbage in gulleys prevents them fulfilling their natural function. Marine litter is a growing problem and the main sources are beach and near-shore recreational activities. In addition there are periodic sargassum incidents.

The CZMU has existed since 1982 as a science-based multi-disciplinary organization directed at protection of the coastal and marine environment. As well as responsibility for the Coastal Zone Management Plan and proposed marine management areas, CZMU is responsible for delivering its own coastal infrastructure projects and for advising the Town & Country Development Office on planning applications affecting the coast and marine environment. In this context, Dr Brewster said that, while the Environmental Impact Assessment (EIA) process works well for large projects, it needs to be adjusted for smaller schemes. Climate change figured in the CZMU's work from the outset and Dr Brewster said that the Ridge to Reef concept was "mandatory" in its work so he welcomes the new PDP approach.

Dr Brewster said CZMU recognizes that sea level rise is inevitable and that coral reefs will be drowned. Increasing water temperatures are linked to coral bleaching and CZMU is monitoring recovery rates. There is increased wave activity in swell events and this can lead to narrowing of beaches.

The coastal infrastructure programme has adopted the approach of always using physical modelling as well as computer simulation. This has been applied to the boardwalks, shoreline stabilization and the creation of new beaches. The success of this approach is evidenced by the fact that it has never been necessary to "nourish" these projects with imported sand after completion. Positive outcomes for projects like the boardwalks include (in addition to increased resilience) public access and recreation, beach stabilization and new beach habitats for turtles and other species. Dr Brewster reported that the CZMU is now working on baseline studies (including geotechnical surveys and laser imagery) to create a National Coastal Risk Information Planning Platform. Future potential areas for action include the Crane area, a Rockley to St Lawrence section of boardwalk, the coast from Retreat to Mullins, Oistins and drainage issues in the Holetown area. CZMU is also working on coral reef restoration.

The main source of funding for CZMU coastal infrastructure projects is the Inter-American Development Bank (IDB). Dr Brewster pointed out, however, that the initial impetus for the Holetown – Heron Bay boardwalk came from the private sector and the project was subsequently implemented by Government because of the complexities involved. In contrast, he warned that some private property owners are not maintaining or reviewing older infrastructure. Dr Brewster also warned that lack of awareness and understanding in the population at large was a problem that needed to be addressed.

**Kevin MacIntosh**, CEO of Baird (coastal engineering), spoke on **The Impact of Drainage on the Island's Environmental Sustainability**. Mr MacIntosh said in his view the data showed that climate change was an absolute certainty. Temperatures are rising, sea levels are rising (and different agencies suggest future increases between 0.2 metres and 2.2 metres), storm intensity is increasing in the Caribbean, and (although rainfall totals are diminishing) there is increased rainfall intensity too. He said these changes presented major challenges for urban design and maintenance.

Mr MacIntosh described the typical features of flooding from land in Barbados:

- Rapid run-off down gulleys is held up behind the coast road and causes floods in low-lying areas.
- The situation is worsened because development has occurred across natural water courses.
- Much of the drainage infrastructure is under-sized and sometimes gets narrower towards the coast, especially at the point where it crosses the coast road.
- Flow into the sea is often held back by a natural beach berm which also exacerbates flooding.

In addition to flooding from the land, climate change is increasing the likelihood of flooding from the sea. Key parameters influencing an increase in storm surge are sea level rise and pressure, wind, and wave set up. In a hurricane situation, land and sea flooding often occur at the same time.

The main actions that can contribute to flood alleviation are:

- Storage and retention measures upstream including measures to increase absorption.
- Flow diversion.
- Infrastructure improvements, eg proper sizing of culverts and drainage canals.
- Debris management – keeping gulleys, drains and canals clear.

Mr MacIntosh explained how new technology can assist in understanding the details associated with modelling of hydrological processes and how improved modelling at a very detailed scale can assist in reaching the right design solutions. LIDAR data (light detection and ranging – remote sensing by pulsed laser) is available for the whole island and is the basis for detailed hydrological modelling. The extent and impact of storm surge flooding can now also be modelled far more accurately than in the past.

Mr MacIntosh said this enhanced understanding made it possible to use innovative design solutions. For instance the problem of beach sand berms preventing the release of flood water can be solved by using a fluidizer to minimize the height of the natural sand berm which allows rainfall generated flood waters to breach the shoreline more effectively thereby minimizing flood impacts. Mr MacIntosh also described the design concept of the Barbados boardwalks which look very simple on the surface but has a complex structure underneath. One key feature is the way the boardwalks filter surface water from the deck and landward development through to the beach. Mr MacIntosh stressed that the use of high quality materials was essential if infrastructure improvements like this are to last and not become a maintenance burden.

The final element of the Symposium was a showing of a short version of the award winning “**Plastic Oceans**” film which describes the impact of plastic waste on the marine environment. The film had been made available by the Barbados Plastic Oceans Trust who also collaborated with BTPS in arranging a showing of the full length feature version of the film to secondary school students later in the week.