

Barbados Town & Country Planning Society

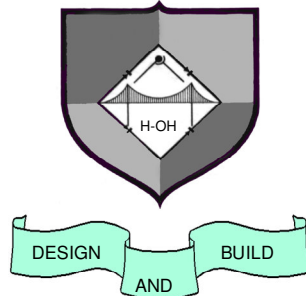
Reflections on Planning Practice

Ruby Anniversary Symposium

Barbados Association of
Professional Engineers

Barbados Association of Professional Engineers

B . A . P . E .



- The motif of the insignia is “The Bridge” to represent four branches of engineering. It is composed of:
- (1) The electrical and electronic “bridge” with its four diodes.
- (2) The “ball and socket” which designates the mechanical “bridge”.
- (3) The “suspension bridge” of Civil Engineering.
- (4) The Chemical “bridge” H-OH which, as someone said, is “the water under the bridge”.

Barbados Association of
Professional Engineers

Barbados Association of Professional Engineers

Founded in November 1964

Incorporated in 1970

303 members including 136 Civil Engineers

Barbados Association of
Professional Engineers

List of Past Presidents

- Blackman, R.
- Boyce, J.
- Browne, T. T.
- Clarke, T.
- Crawford, C.G.
- Elcock, A.
- Franklin, C. L.
- Gaskin, A.
- Gibbs, T.
- Gittens, A. S.
- Griffith, G.M.
- Hazzard, G.F.H.
- Hutchinson, A. E.
- Hutchinson, A. P.
- Hutson, F.
- Johnson, K. M.
- Johnson, W. A.
- Jordan, C. G. L.
- McConney, F. O.
- Nelson, J. H.
- Phillips II, G. W.
- Sealy, H. A.
- Sobers, P. T.
- Wason, A. T.
- Weekes, R.
- Went, R.
- Williams, P.
- Yearwood, W.

Barbados Association of
Professional Engineers

National Awardees

- **Alwyn Wason OBE** - 1970 in recognition of service in the field of Public Works
- **Keith Johnson OBE** –1970 in recognition of service in the field of Water Supply
- **Arthur Archer SCM** (deceased) – 1984 for outstanding work in environmental matters, especially in marine pollution control
- **Sir Francis Challenor Hutson CBE, KB** – 1961 & 1963 in recognition of his long and distinguished voluntary services to his native land and fellow citizens
- **Dr. Colin Hudson MBE** (Honorary Member 1985) – 1975; Guinness Award for Scientific Achievement in 1982, VOB Community Award in 1983 and National Industrial Award in 1987

Barbados Association of
Professional Engineers

Responsible Action

- BAPE, in collaboration with agencies such as Barbados Town & Country Planning Society, has an important role to play in advising Government on matters of engineering relevance

Barbados Association of
Professional Engineers

“When the Rains Come: Problems, Solutions and Public Policy”

Gregory Hazzard, Past President, BAPE

Barbados Association of
Professional Engineers

Solving Drainage Problems Requires:

- Engineering Expertise
- + Local Knowledge
- + Government Policy and Funding
- Barbados Town & Country Planning Society has role in framing Government policy – Physical Development Plans, Legislation (Acts, Orders, Regulations)!

Barbados Association of
Professional Engineers

The Rains

Barbados Association of
Professional Engineers

Characteristics of Precipitation on Barbados

- Wet season from June to November (coincides with the hurricane season)
- Dry season from December to May
- Transition months May and December
- Heaviest precipitation during the months of August to November
- October and November are the wettest periods (with October taking precedence)

Barbados Association of
Professional Engineers

Characteristics of Precipitation on Barbados

- The wet season accounts for approximately 71% of the yearly rainfall total, with the wettest four-month period of August to November recording about 73% of this amount.

Barbados Association of
Professional Engineers

Characteristics of Precipitation on Barbados

- On 3rd August 1995, the highest one-day totals were recorded across the island, ranging from 165.2mm at the Airport to 228.7 at Haggatts.
- November 1991 recorded the highest total rainfall for any month, with amounts ranging from 426.2mm to 565.1mm across the island.

Barbados Association of
Professional Engineers

Characteristics of Precipitation on Barbados

- Recent rainfall events have produced the following totals:

18th September 2008:

- Sanford, St. Phillip - 115mm in 4 hours (6am – 10am)
- Foster Lodge, St. George – 90mm in 2.5 hours (6am – 8:30am)

9th October 2008

- Wildey, St. Michael – 120.7mm in 2.5 hours (9:30am – 12:00pm)
- Foster Lodge, St. George – 92.2mm in 2.5 hours (10:00am – 12:30pm)

Barbados Association of
Professional Engineers

Characteristics of Precipitation on Barbados

- As recently as 2003, rainfall totals ranging from 205.5 at the Airport to 452.8mm in St. Andrew, were recorded during the month of October.

Barbados Association of
Professional Engineers

Monthly Total Rainfall for September 2008

<u>STATION</u>	<u>PARISH</u>	<u>YEAR</u>	<u>MONTH</u>	<u>DAY TOTAL</u>	<u>NIGHT TOTAL</u>	<u>TOTDLY</u>
BANATYNE GARDENS	CHRIST CHURCH	2008	9	49.2	28.6	77.8
BAWDEN	ST ANDREW	2008	9	347.0	0.0	347.0
BELLEVILLE	ST MICHAEL	2008	9	109.5	38.4	147.8
BELLEVILLE	ST MICHAEL	2008	9	109.5	38.4	147.8
BWA BOWMANSTON	ST JOHN	2008	9	62.4	205.8	268.2
C.M.H.I	ST JAMES	2008	9	216.6	0.0	216.6
CAMBRIDGE	ST JOSEPH	2008	9	399.2	0.0	399.2
CARTERS ROAD	ST JOHN	2008	9	216.9	142.6	359.5
DRAXHALL PLANTATION	ST GEORGE	2008	9	236.2	77.9	314.1
FOSTER LODGE	ST GEORGE	2008	9	207.6	72.0	279.6

Barbados Association of
Professional Engineers

Monthly Total Rainfall for September 2008

<u>STATION</u>	<u>PARISH</u>	<u>YEAR</u>	<u>MONTH</u>	<u>DAY TOTAL</u>	<u>NIGHT TOTAL</u>	<u>TOTDLY</u>
FOSTER LODGE	ST GEORGE	2008	9	207.6	72.0	279.6
GOLDENRIDGE (AWS)	ST GEORGE	2008	9	116.5	34.3	150.8
GRANTLEY ADAMS AIRPORT	CHRIST CHURCH	2008	9	118.5	65.8	184.3
GREENLAND	ST ANDREW	2008	9	292.5	0.0	292.5
HAGGATTS	ST ANDREW	2008	9	338.5	0.0	338.5
JOES RIVER	ST JOSEPH	2008	9	309.3	0.0	309.3
LEARS PLANTATION	ST MICHAEL	2008	9	269.2	81.3	350.5
MOUNT ALL	ST ANDREW	2008	9	267.1	0.0	267.1
RAWINSONDE STATION	CHRIST CHURCH	2008	9	99.6	64.9	164.5
RETREAT	ST LUCY	2008	9	110.6	35.6	146.2
SANFORD	ST PHILIP	2008	9	196.4	53.2	249.6

Barbados Association of
Professional Engineers

Monthly Total Rainfall for September 2008

<u>STATION</u>	<u>PARISH</u>	<u>YEAR</u>	<u>MONTH</u>	<u>DAY TOTAL</u>	<u>NIGHT TOTAL</u>	<u>TOTDLY</u>
SANFORD	ST PHILIP	2008	9	196.4	53.2	249.6
SEDEPOND PLANTATION	ST ANDREW	2008	9	327.6	0.0	327.6
SPRINGVALE	ST ANDREW	2008	9	335.9	0.0	335.9
ST NICHOLAS PLANTATION	ST PETER	2008	9	205.4	0.0	205.4
UNION HALL	ST PHILIP	2008	9	187.1	65.7	252.8
WALKERS TERRACE	ST GEORGE	2008	9	269.8	34.8	304.6
BANATYNE GARDENS	CHRIST CHURCH	2008	10	134.5	110.8	245.3
BAWDEN	ST ANDREW	2008	10	375.9	0.0	375.9
BELLEVILLE	ST MICHAEL	2008	10	302.0	92.4	394.4
BRIGHTON PLTN	ST. GEORGE	2008	10	197.6	151.2	348.8
C.M.H.I	ST JAMES	2008	10	373.6	0.0	373.6

Barbados Association of
Professional Engineers

Monthly Total Rainfall for October 2008

<u>STATION</u>	<u>PARISH</u>	<u>YEAR</u>	<u>MONTH</u>	<u>DAY TOTAL</u>	<u>NIGHT TOTAL</u>	<u>TOTDLY</u>
CAMBRIDGE	ST JOSEPH	2008	10	333.4	0.0	333.4
FOSTER LODGE	ST GEORGE	2008	10	290.4	136.7	427.1
GOLDENRIDGE (AWS)	ST GEORGE	2008	10	226.4	120.7	347.1
GRANTLEY ADAMS AIRPORT	CHRIST CHURCH	2008	10	155.5	175.3	330.8
GREENLAND	ST ANDREW	2008	10	362.9	0.0	362.9
HAGGATTS	ST ANDREW	2008	10	309.6	0.0	309.6
JOES RIVER	ST JOSEPH	2008	10	270.3	0.0	270.3
LEARS PLANTATION	ST MICHAEL	2008	10	284.5	204.5	489.0
MOUNT ALL	ST ANDREW	2008	10	362.2	0.0	362.2
RAWINSONDE STATION	CHRIST CHURCH	2008	10	124.3	211.7	336.0

Barbados Association of
Professional Engineers

Monthly Total Rainfall for October 2008

STATION	PARISH	YEAR	MONTH	DAY TOTAL	NIGHT TOTAL	TOTDLY
RETREAT	ST LUCY	2008	10	145.6	90.2	235.8
SANFORD	ST PHILIP	2008	10	61.7	90.2	151.9
SEdgePOND PLANTATION	ST ANDREW	2008	10	354.3	0.0	354.3
SPRINGVALE	ST ANDREW	2008	10	397.9	0.0	397.9
ST NICHOLAS PLANTATION	ST PETER	2008	10	386.6	0.0	386.6
UNION HALL	ST PHILIP	2008	10	89.6	86.1	175.7

Barbados Association of
Professional Engineers

Characteristics of Precipitation on Barbados

- Rainfall from local convection has traditionally made a significant contribution to the annual total especially in central, western and elevated parts of the island.
- This type of activity is characterized by its localized area of genesis, high rainfall rates and daytime development.

Barbados Association of
Professional Engineers

Characteristics of Precipitation on Barbados

- Strong daytime heating of moisture laden air, under the influence of low wind velocity, are the main factors responsible for the generation of torrential tropical downpours. Other factors such as the direction of the wind, favourable ventilation process and convergence of moisture and wind in the lower atmosphere also determine the intensity, duration and location of these significant rainfall events. The complex tropical environment can at times dominate and overwhelm the region, as occurred recently.

Barbados Association of
Professional Engineers

Special Concerns

- Climate Change
 - Effect on hurricanes and precipitation
 - Rise in sea level
 - The influence of climate change on rainfall patterns and distribution in Barbados is yet to be determined?
- “Extreme” Weather – Hurricanes, Tropical Depressions

Barbados Association of
Professional Engineers

Recent Weather Experience

- All indications point to the availability of many of these factors during the past few months. The sustainability of frequent and high intensity rainfall was assured.
- It is noteworthy that many other factors may have contributed to the excessive build-up of run-off and consequential flooding across the island.

Barbados Association of
Professional Engineers

Problems

Barbados Association of
Professional Engineers

Factors Affecting Runoff

- Ground strata – composition, porosity / impermeability of ground, absorption rates, saturation
- Topography
 - Terraced
 - Gully System
 - Flood Plains have significant Watersheds: Constitution River at 13,600 acres (13% of Barbados); Holetown at 3,000 acres (2.8% of Barbados); Speightstown at 2,000 acres (1.8% of Barbados)
- Agricultural Practices
- Development – siting, fields now hard surfaces, routing of runoff, flow times, concentration / accumulation
- Policy & Drainage Design issues
- Maintenance Practices

Barbados Association of
Professional Engineers

Drainage Problems

- Flash flooding
- Remote flooding
- Relatively large flood plains – e.g., Constitution River, New Orleans, Sunset Crest
- Roads as rivers – not enough “interceptors” / vehicular & pedestrian safety / road surface damage
- Localized flooding – blocked culverts & suck wells
- Drain outfalls to sea blocked with sand
- Pollution / Public Health
- National Park / Scotland District – land slippage

Barbados Association of
Professional Engineers

“Wet” Spots

- Constitution River flood plain (watershed is 13,600 acres)
- Wotton
- Sunset Crest / Hometown (watershed is 3,000 acres)
- Speightstown (watershed is 2,000 acres)
- Weston
- New Orleans / Murphy's Pasture
- Charles Rowe Bridge
- “St. Barnabas Bypass Road” / Emancipation Roundabout
- Spring Garden / Brandons
- Halton
- The list goes oncoming soon to a neighbourhood near you

Barbados Association of
Professional Engineers

Case Studies:

- Charles Rowe Bridge
- Spring Garden / Brandons
- Constitution River

Barbados Association of
Professional Engineers

Solutions

Barbados Association of
Professional Engineers

Solutions to Drainage Problems

- Comprehensive consideration of problem on a national level
- Review and implement the recommendations of previous stormwater drainage studies:
 - Wallace Evans Drainage Study 1973
 - Speightstown Study 1986, Island Engineering Group Ltd
 - Cummin Cockburn Drainage Study 1996
 - Water Resources & Water Loss Study of Barbados 1997; Kohn Crippen / Stantec
 - New Orleans Study 1999, CASSE Engineering Ltd
 - Gullies Ecosystem Management Study 2003; Environmental Planning Group, People Dynamics, Stantec, et.al.

Barbados Association of
Professional Engineers

Solutions to Drainage Problems

- Additional studies as necessary, especially to effect coordination with PDP, BWA & CZMU priorities, etc.
- Establish Flood Hazard Maps for high risk areas so that the population will know where these areas are.
- The Gully Ecosystem Management Study has categorized all Drainage Watersheds and Outlets and provided a Risk Analysis that assigns a rating for each community in the vicinity of each outlet.

Barbados Association of
Professional Engineers

Solutions to Drainage Problems

- **Watershed Management & Remediation**
 - Concentrate on the watersheds of Constitution River, Hometown and Speightstown – the three largest watersheds that impact on settlement / commercial areas
 - Runoff Mitigation Measures within watersheds - Check dams and settlement ponds in gully system to slow down flow of water to low-lying coastal areas
 - Engage the Populations in the Watersheds

Barbados Association of
Professional Engineers

Solutions to Drainage Problems

- Design practices must be improved:
 - no more “drainage design as a poor cousin”
 - consider the impact on neighbours
 - Better drainage structures for the collection, movement and disposal of runoff
 - Inlet conditions to wells and box drains must be appropriately designed
 - Storage (e.g., retention ponds) has to be integral part of a drainage system that depends on suck wells for disposal
 - Larger, deeper wells; injection wells; fluidization projects

Barbados Association of
Professional Engineers

Solutions to Drainage Problems

- Involved Government Agencies must be furnished with:
 - sufficient engineers and professional staff
 - manpower and equipment to do continuous maintenance
- Provide for maintenance of drainage structures in privately developed residential districts
- NO MORE LITTERING
 - public education
 - no tolerance policies; penalties
 - grills in drains to stop garbage going into sea

Barbados Association of
Professional Engineers

Solutions for National Park / Scotland District

- Regard challenges as engineering rather than agricultural
- Soil Conservation Unit only able to address isolated problems and apply “Band Aid” - apply funds towards solving, not patching, the problem
- Commission a comprehensive drainage study for Scotland District and immediately implement recommendations
- Establish a well-funded Barbados National Park Commission to implement and monitor development, and quickly respond to matters

Barbados Association of
Professional Engineers

Public/Government Policy

Barbados Association of
Professional Engineers

Government Policy

- Prime Minister Thompson has announced intention to establish a new statutory body to deal with surface water drainage in Barbados
- Golden opportunity to “Get it Right from the Start”
- Set up a **Commission for the Establishment of a Barbados Drainage Authority**
 - fixed timeline – 6 - 9 months MAX
 - representatives from:
 - Drainage Unit / Ministry Transport, Works and International Transport
 - Barbados Association of Professional Engineers
 - Town Planning Dept / Barbados Town & Country Planning Society
 - Ministry of Agriculture / Soil Conservation Unit
 - Coastal Zone Management Unit
 - Environmental Protection Department
 - Barbados Water Authority (example concern - Aquifer recharge good or bad?)
 - AG's Chambers / Accountant / Etc.

Barbados Association of
Professional Engineers

Government Policy

- Set up a Commission for the Establishment of a Barbados Drainage Authority (cont'd):
 - Mandate to:
 - establish firm objectives and priorities for the Barbados Drainage Authority, including:
 - Review of existing Drainage Studies
 - Supplementary Drainage Studies
 - Drainage Study of the Scotland District Area
 - Barbados Drainage Plan (separate document from the PDP)
 - set timeline for objectives to be met in the first 5 years,
 - design and staff the organization accordingly,
 - facilities & equipment plan,
 - prepare a funding and cash flow plan for first 5 years

Barbados Association of
Professional Engineers

Government Policy – Supporting Action

- Enact the Barbados Building Code
- Establish the Barbados Building Authority
- Ensure that Professional Engineers design and approve drainage systems, using rational methods, not technicians or others by rule of tumbler.
- Monitoring / Enforcement of standards and policies

Barbados Association of
Professional Engineers

Government Policy

- “Too expensive” does not hold water here!
- If we get our drainage, coupled with the rest of our physical development, right on a national level, the multi-faceted returns, measurable in hard GDP, will be more than worth it.

Barbados Association of
Professional Engineers

Discussion



Barbados Association of
Professional Engineers