Paramaribo Strategic Flood Risk Assessment - innovative modelling approach

Climate and Disaster Resilience in Small Island Developing States (SIDS): Practical Solutions

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• JBA Consultants
Flood risk - in and around the city of Paramaribo
Flood Hazard Analysis – data and approach (CHARIM)

RAINFALL RECORD
LENGTH: 1916-01-01 to 1999-11-30 with gaps (~75 years)
MAX. RF: 182.2 mm/day
### Flood Hazard Mapping

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Area of inundation &gt; 0.15m (Km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 Year</td>
</tr>
<tr>
<td>Baseline pluvial design event</td>
<td>421</td>
</tr>
<tr>
<td>Baseline tidal design event</td>
<td>97</td>
</tr>
<tr>
<td>Future pluvial design event (2050)</td>
<td>432</td>
</tr>
<tr>
<td>Future Tidal design event (2050)</td>
<td>151</td>
</tr>
</tbody>
</table>
### Exposure

- **Land Registry Data**
- **Open StreetMap**

### Vulnerability

- **Vulnerability - Depth damage curves**
- **Exposure database – GIS grid containing information on building type, usage, value and density**

### Cost estimates

<table>
<thead>
<tr>
<th>Building Category</th>
<th>Construction Material</th>
<th>Building Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial/Industrial</td>
<td>Steel frame and concrete</td>
<td>$700</td>
</tr>
<tr>
<td></td>
<td>Full concrete</td>
<td>$500</td>
</tr>
<tr>
<td></td>
<td>Concrete block and concrete</td>
<td>$500</td>
</tr>
</tbody>
</table>

### Risk

- **Vulnerability curve**
- **Damage/Probability Chart**

Calculate the area under the curve = AAD (US$m)

<table>
<thead>
<tr>
<th>Return Period</th>
<th>Probability</th>
<th>Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0.02</td>
<td>372</td>
</tr>
<tr>
<td>30</td>
<td>0.005</td>
<td>271</td>
</tr>
<tr>
<td>200</td>
<td>0.005</td>
<td>424</td>
</tr>
</tbody>
</table>

### Total Event Flood Damages and AAD

<table>
<thead>
<tr>
<th>Scenario Description</th>
<th>10 Year</th>
<th>50 Year</th>
<th>300 Year</th>
<th>Total AAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline pluvial design events</td>
<td>171</td>
<td>297</td>
<td>360</td>
<td>424</td>
</tr>
<tr>
<td>Future pluvial design events (2050)</td>
<td>218</td>
<td>277</td>
<td>451</td>
<td>530</td>
</tr>
<tr>
<td>Baseline tidal design events</td>
<td>1,060</td>
<td>1,486</td>
<td>1,684</td>
<td>1,886</td>
</tr>
<tr>
<td>Future tidal design events (2050)</td>
<td>2,185</td>
<td>2,747</td>
<td>3,001</td>
<td>3,256</td>
</tr>
</tbody>
</table>
Options Appraisal

Get the “right” balance between structural and non-structural measures

Keep the water away from the people

- Hard engineered: Increased preparedness
  - Awareness campaigns
  - Urban management
- Flood avoidance: Emergency planning & management
  - Early warning systems and evacuation
  - Critical infrastructure

Keeping the people away from the water

- Eco-system management: Speeding up recovery
  - Building back safer
  - Risk insurance

Option 12: Flood forecasting and early warning – assume flooding still occurs, but vulnerability can be reduced i.e. reflected through contents depth damage curves

Cost Benefit Ratio: 116:1
Estimated Capital Investment: US$ 0.5m

Option 13: Increased mangrove forests – reduced coastal inundation as defined by Coastal study

Cost Benefit Ratio: 2,035:1
Estimated Capital Investment: US$ 1.4m

Option 7: Saramacca Canal improvements – widen and increase conveyance along the canal through dredging and removal of vegetation.

Cost Benefit Ratio: 6:1
Estimated Capital Investment: US$ 25m
Key outcomes – support tools for:

- Risk reduction decision making, with knowledge of the levels of risk faced
- Investment planning, with improved understanding of costs through knowledge annual average damage (AAD)
- Policy development through better understanding of key risk factors
- Climate change impact assessment, with ability to test different future scenarios
- Capacity building – a key objective of the project, through training and a legacy of data and tools that can be used in the future for a wide range of detailed as well as strategic studies.

Hazard maps for spatial planning

Risk maps for investment planning