BEST PRACTICES ON DROUGHT AND FLOOD MANAGEMENT: ENGINEER’S CONTRIBUTION

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1. Introduction

• The Working Group on Water (WGoW) of the World Federation of Engineering Organizations (WFEO) covers water engineering initiatives and its relations with United Nations’ bodies and agencies, primarily with UN-Water and UNESCO, showing the contribution of engineering to the accomplishment of United Nations’ Sustainable Development Goals (SDG).

• WFEO’s WGoW was created by its Executive Council at the meeting held in October 2018 in London on the occasion of the Global Engineering Congress.

• Such Working Group on Water has committed to deliver three monographs during its 2019-2021 three-year mandate regarding the following topics: Best practices on Drought and flood management: Engineer’s contribution, 2019; Achieving SDG 6 on Water: Engineer’s contribution, 2020 and Adaptation to climate change - Water: Engineer’s contribution, 2021.
Learn the ABCs of disaster risk reduction
http://www.unisdr.org/we/inform/terminology
2 Objectives

- Main goal: to describe the best practices for the risk management of droughts and floods, highlighting the engineer’s contribution to such practices taking into account:
  - Economic impacts caused by extreme hydrological events
  - Climate change
  - Evolution from crisis-based approach to risk management or adaptive management approach

2001: Crisis-based approach

2016: Risk management approach
3. General framework (1/2)

• Number of people living at risk-flooding areas will increase from 1.2 to 1.6 billion people by 2050 (OECD)

• The greatest number of weather-related disasters is due to flooding, followed closely by storms (UNDRR)
3. General framework (2/2)

- The total elimination of the risk of flooding is not possible, no matter how many population protection measures are implemented.
- Therefore, it is necessary to promote awareness of self-protection in citizens.
- Unlike floods, droughts are an extreme hydrological phenomenon of low water availability, which take place slowly and imperceptibly and that sometimes when detected, is too late and can cause very high social, economic and environmental impacts.
- Extreme hydrological events - droughts and floods - have become current global topics regarding water issues, as reflected in the United Nations’ 2030 Agenda (UN). (SDG 6 & SDG 11)
4. Floods and droughts in the World

- The economic impacts caused by extreme hydrological events - floods and droughts - have been increasing around the world causing high social, economic and environmental impacts.

![Evolution of water Surface in the Lake Chad](image)

![Type of damages due to floods](image)
5. Effects of climate change

“Climate change is part of other global changes of greater scope, which causes negative effects on the availability of resources and the frequency of presentation of extreme hydrological events, such as droughts and floods”

(Intergovernmental Panel on Climate Change, 2014).
1. Traditional approaches: reactive. Measures and actions that are only triggered after the extreme event has occurred.
2. Approaches based on risk reduction:

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<thead>
<tr>
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<th>Prospective</th>
<th>Corrective</th>
<th>Compensation</th>
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<tbody>
<tr>
<td>Disaster risk</td>
<td>Avoid the risk</td>
<td>Reduce/mitigate risk</td>
<td>Enhance resilience to disaster (economic and social)</td>
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<td>management</td>
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<tr>
<td>Climate change</td>
<td>Climate change mitigation</td>
<td>Climate change adaptation</td>
<td>Enhance resilience to extreme events associated to climate change.</td>
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<td>Sustainable Development</td>
<td>Contribute to future sustainable development</td>
<td>Enhance the sustainability of the current development framework</td>
<td>Enhance resilience to all common risks.</td>
</tr>
</tbody>
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Table 1. Relationships between disaster risk management, climate change and sustainable development. Source: UNDDF, 2019
6. Evolution of water policies to manage extreme hydrological events (2/2)

3. Governance in the management of extreme hydrological events:
   stakeholders, mechanisms, regulatory and legal frameworks
   - coordination between different levels of government
   - administrative, hydrological and political boundaries
   - Stakeholders engagement
   - Public and private insurance systems

7. Knowledge, technology and innovation

1. Hydrological and hydraulic models.
2. Hazard and flood risk maps.
3. Actions: technology and innovation
4. Advances in warning systems
8. Cases and experiences - Box in the Report

Box 1.- Lake Chad Crisis
Box 2.- European SUFRI Project
Box 3.- Managing Droughts in Portugal
Box 4.- Principles of EU Flood Directive
Box 5.- State of art on Flood Damage Assessment
Box 6.- Flood Mapping Project for key areas China
Box 7.- Drought Risk Management through AQUATOOL DSS
Box 8.- Cooperation in Drought Planning and Management in Iberian Peninsula
Box 9.- Drought Management Plans in Spain
Box 10.- La Paz (Bolivia) Drought Management Plan

Box 11.- Flood Risk Management and Ecosystem Restoration in Arlington, Texas, USA
Box 12.- Flood Risk Protection through Reservoirs Management – Ebro River Basin, Spain
Box 13.- Nature Based Solutions to prevent Urban Flooding (USDS)
Box 14.- International experiences in the protection of buildings and constructions
Box 15.- Flood Warning Systems in Spain
Box 16.- China’s Flood Forecast and Warning System
Box 17.- USA National Flood Insurance Program
Box 18.- Measures in Cyprus during 1996-2000 Drought Period
Box 19.- Reuse of Urban Water for Wetland Conservation in Dry Periods, Apuria, Italy.
9. Experiences and Best Practices (1/5)

1. Risk management plans: floods and droughts.
9. Experiences and Best Practices (1/5)

2. Structural Protection Measures.

1. Flood control reservoirs
2. Diversion channels
3. Embankments and dykes
4. Channel modification
5. Drainage of linear infrastructures
6. Green infrastructure and natural water retention measures
7. Hydrological restoration and flood zone measures
8. Non-structural or management measures: prevention, alert and response (next slide)
RESERVOIRS MANAGEMENT FOR FLOOD CONTROL

Since 1936 the Corps has completed over 400 major lake and reservoir projects, emplaced over 8,500 miles of levees and dikes, and implemented hundreds of smaller local flood damage reduction projects.
9. Experiences and Best Practices (4/5)

3. Non-structural or management measures: prevention, alert and response:

1. Adaptation measures for potentially affected assets, for damage mitigation
2. Prevention measures: land management and urban planning
3. Warning measures: flood warning systems
4. Response measures: civil protection
5. Response measures: flood insurance
9. Experiences and Best Practices (5/5)

4. Measures to deal with drought risks.

1. Integrated Water Resources Management
2. Management and control measures: resource allocation, water savings and temporary transfer of rights
3. Environmental measures
4. Drought warning and monitoring system
5. Agricultural insurance
10. Lessons learned

1. Importance of planning.
2. Adaptative management.
3. Technology and improvement of results
4. Combination of measures
11. Challenges for engineers

1. The current role.
2. Professional practice indicators.
3. Innovation and technology
4. Social responsibility
5. Emerging and future areas
6. New roles and challenges
Thank you

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