



MARSEILLE  
DU 27 MAI  
AU 3 JUIN  
2022

2022 CIGB ICOLD MARSEILLE

ICOLD  
27<sup>TH</sup> CONGRESS  
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MEETING

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ICOLD Technical Committee on Levees

**The world of levees and its significance for the work of ICOLD**  
**Overview of two bulletins prepared by ICOLD Technical Committee LE**

TC Workshop - 28 June 2022



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ICOLD Technical Committee on Levees (TC LE) – TC Workshop - 28 May 2022


## Workshop agenda

10h30-10h40	Welcome - Objectives of the workshop – Practicalities - Appointment of a session secretary <b>Rémy Tourment (chairman) and Elena Sossenkina (vice-chair)</b>
10h40-11h50	Bulletin on "Levees and flood defences across the world - Characteristics, Risks and Governance" Presentation of the bulletin Feedback from the participants <b>Marcel Bottema and Robert Slomp</b>
11h50-12h20	Bulletin on "Comparison of dams and levees - Similarities, differences and recommendations" Presentation <b>Jonathan Simm and Rémy Tourment</b>
12h20-12h30	General comments from the audience (if enough time) Conclusion and messages <b>Rémy Tourment and Elena Sossenkina</b>



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## Workshop introduction (Rémy Tourment, chairman, and Elena Sossenkina, vice-chair, 10 min)

- Welcome
- Practicalities
- Appointment of a session secretary
- Checking attendance

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ICOLD Technical Committee on Levees (TC LE) – TC Workshop - 28 May 2022

## Introduction

- The ICOLD TC on Levees has worked these past years on two bulletins that aim to become the foundation of all future work on levees in ICOLD:
  - Levees and flood defences across the world - Characteristics, Risks and Governance (submitted in 2022)
  - Comparison of dams and levees - Similarities, differences and recommendations (submitted in 2023)
- In 2023 we also aim to publish a position paper and update our terms of reference
- We aim to present today both of these bulletins and get feedback from the audience

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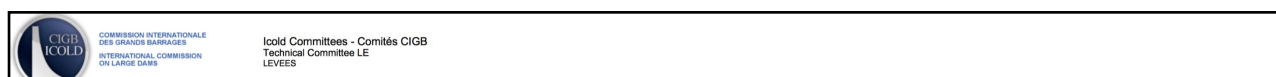
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## Levee Committee Workshop – Dissemination Workshop Draft Bulletin « Levees around the World »

**Marcel BOTTEMA**  
Rijkswaterstaat WVL, NL



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## Levees around the world – presentation topics

1. Link with Terms of reference
2. How we developed the Bulletin
3. Overview of contents and findings
4. Review process and resulting actions
5. Questions and discussion

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## Links with terms of reference


Terms of reference of Levee Committee

1. Collect information on levees in different countries: characteristics, policies and best practices for design, construction, operation, maintenance & management  
→ **Draft Bulletin “Levees around the World – Characteristics, Risks and Governance”**
2. Explore similarities and differences between dams and levees
3. Collaborate with other ICOLD Technical Committees on levee-related topics, ...
4. Explore the potential for combining dam and levee safety approaches in various regulatory, and physical environments
5. Work towards best practices on levee systems and combined dam/levee systems
6. Present levee related issues in a position paper
7. Develop opportunities for capacity building and research on levees

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## Aim of Bulletin “Levees around the world”

- Demonstrate the relevance of levees through a **factual** report
  - in terms of numbers (kilometers)
  - In terms of flood risk (both avoided and remaining risk)
- In line with the 1<sup>st</sup> term of reference of the TCLE
  - Collect information on levees for different countries, such as:
  - characteristics, policies and best practices for design, construction, operation, maintenance and ongoing management
- Providing input related to the other 6 terms of reference, notably to the Position Paper to be prepared for 2022.

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## Development of Bulletin “Levees Around the World”

1. 2016-2018 Preparation of EURCOLD Levee Report
  - 2016: Questionnaire
  - 2017-2018: Preparing report, with 11 chapters/country appendices: B, CZ, UK, FI, FR, DE, IT, NL, ES, CH, USA
2. 2018-2021 Extension of report to Draft Bulletin
  - Some updates to report structure and existing content
  - Scope nearly doubled in terms of countries across all continents, thanks to: ARG, AUS, CN, DK, IR, HU, JP, MOZ, NO, PL
3. 2022: Reviews and finishing touches

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## Levees around the World - Bulletin Structure


Standard items including preface and French/English summaries:

- **4 General Chapters:**
  - **1 – Introduction**
  - **2 – Main Results**
  - **3 – Data gaps, Research Needs, Recommendations**
  - **4 – References for General Chapters**
- **21 Country Annexes** with detailed information (10-20 pages each, resulting in a fairly long Bulletin)
- **An additional Annex** on Risk-Informed Decision Making in some countries

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## General Chapter 1 - Introduction

Includes some information on:


- **Definition of levees**
- **History of levees**
  - Levees are nearly as ancient as dams
- **Global flood risk**
  - Order 1 billion people at risk from either river or coastal flooding
- **Role of dams and levees in reducing flood risk**
  - Levees provide flood risk reduction for order 10% of world's population
  - and help to protect trillions of US\$ in economic value

**→ These numbers indicate the need/value for a Bulletin on Levees Around the World**

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## General Chapter 2 – Main Results


Includes:

- **Brief description of general key findings with focus on:**
  - Levee portfolio (> 500000 km, a few levees > 10m in height)
  - Protected value (order 10% worlds population and trillions of US\$)
  - Legislation and governance (national/varying, sometimes using dam legislation)
  - Levee failures and flood events (still highly significant)
  - Current practices (often somewhat comparable to small dams)
- **For each country: bullet list with key facts & figures**
- **3 summarizing tables (levee portfolio, major flood events, legislation + governance)**

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## Chapter 3 – §3.1: Data gaps and Research Needs


**Approach:**

- Gather, classify and analyze the research needs given in the Country Appendices (note: this is based on a shortlist given by each country, i.e. just the most urgent ones).


**Results:**

- Data needs are often mentioned, especially in countries with many orphan levees; sometimes also the need for capacity building
- Levee monitoring is often mentioned as a research need.
- Research needs on Transitions, Geotechnical Issues, Revetments and Climate Change were broadly shared as well.
  - Wave Loads, Degradation, Complex Failure Mechanisms, Systems Approaches, and Failure Consequences are also mentioned.
- Most research needs are linked to creating Practical Guidance (for levee management).

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## §3.2: Further countries with significant levee portfolios

**Approach:** Limited data and literature research


**Results**

- At least 7 countries with > 3000 km of levee portfolio
  - Bangladesh, India, Moldova, Pakistan, former Yugoslavia, Vietnam
- And several more with hundreds or at least dozens of km of levee...
- **More information is welcome, especially on levees in Africa, Latin America and SE- and other parts of Asia !**

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## Chapter 3 – §3.3: Recommendations (1/2)


**Approach:** Consider a maturity-level context where a country first wants to explore its levee portfolio, then considers the start-up of levee management, and finally the research needs that result from issues arising during levee management.

1. Invite non-Levee-Committee countries to share information on their (often significant) levee portfolios.
2. Define/share good practices on gathering data on (unknown) levee portfolios
3. Establish links with the ICOLD Small Dams groups (similarities between orphan levees and several small dams).
4. Defining/sharing good practices on levee portfolio data management
5. Map the levee portfolio, its state and contribution to flood risk reduction.

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## Chapter 3 – §3.3: Recommendations (2/2)

**Approach:** Gather, classify and analyze the research needs given in the Country Appendices (note: this is based on a shortlist given by each country, i.e. just the most urgent ones).


6. Make or optimise arrangements for governance and management of levees, verify whether dam practices/guidelines are suitable for levees..
7. Include levees in Integrated Flood Risk Management Plans.
8. Specify levee-related research questions (risk issues, monitoring & maintenance, climate, ...); address them in a position paper; answer them while co-operating with ICOLD committees etc.
9. Keep exchanging knowledge and good practices.

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## Template/Structure of country appendices – section 1/9


### X.1: Facts and figures on levees and flood defenses

- *An important section since it demonstrates the relevance of levees in terms of numbers*
- *This section is meant to answer questions like:*
  - *Number of levees and other flood defenses (km's / nr's)*
    - *other flood defenses may be moveable flood walls, storm-surge-barriers and also ordinary gates and sluices (the latter may be so numerous it may be too difficult to quantify them)*
  - *typical dimensions and other properties (materials, layering, revetment, ..) for (different types of) levee in your country*
  - *geographical context in terms of typical environments / flood types (for example: % urban/rural levees, % river, estuary or coastal levees)*

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## Template/Structure of country appendices – section 2/9


### X.2: Protected value, safety standards, flood risk

- *This section is meant to give an indication of the following:*
  - *The protected value that could flood without levees and flood defenses.*
    - *Both in terms of life and economic value (preferably the assets, otherwise a fraction of the Gross Domestic Product)*
  - *Safety standards used, with definition (what does it refer to) and value*
  - *The actual protection level of your levees etc. (or what % does or does not satisfy the safety standards)*
  - *What is the residual risk (related to flooding despite the levees etc.), and how large is it compared to protected value (the ratio is in fact a measure of the actual protection level)*

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## Template/Structure of country appendices – section 3/9


### X.3: Recent (near-) failures of levees

- *This is one of the key sections of each chapter as it demonstrates the relevance of levees*
- *Give a brief description of (near-) failures of levees/structures, and their causes and failure modes. Detailed/exhaustive information is not required; rather this section should serve as a portal to this detailed information.*

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## Template/Structure of country appendices – section 4/9


### X.4: Legislation and governance

- *Please include the following subsections*
  - *X.4.1: about implementation of any international regulations*
  - *X.4.2: national legislation that applies*
  - *X.4.3: Governance, including roles and responsibilities*
- *Please also indicate whether*
  - *(i) this legislation is similar or even identical to the legislation used for dams and whether*
  - *(ii) this legislation is a translation of the EU Floods Directive and/or other international regulations.*
  - *This allows to get an indication to what extent international regulations have resulted in common legal frameworks, especially throughout Europe in relation to the EU Floods Directive.*
- *Please also describe the key players with respect to Levees and Flood Risk Management and how they interact*
  - *i.e. the governance with respect to all life cycle phases of Levees and Flood Defenses.*
  - *This also helps to make clear how easy/difficult it is to get relevant information*

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## Template/Structure of country appendices – section 5/9


### X.5: Guidelines and good practices

- *What guidelines and good practice documents are used in your country for design, safety assessment and maintenance of levees/flood defenses*
  - *please give references/web links to some key documents.*
- *Please also mention what parts of ICOLD-Bulletins and/or the International Levee handbook ILH are used in your country for the above.*

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## Template/Structure of country appendices – section 6/9


### X.6: Common practices during levee life cycle

- *This section is meant to briefly share some common practices related to various life cycle phases of Levees & structures:*
  - *Design practice and cost of heightening/strengthening a levee of other type of flood defense (per km or per object)*
  - *Inspection of levees*
  - *Maintenance and safety assessment*
  - *Flood event management*
- *...*

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## Template/Structure of country appendices – section 7/9


### X.7: Critical knowledge and data gaps; critical research needs

- *Please mention critical knowledge and data gaps*
  - *this may also include information about the levees, their subsoil, and their flood risk, or even lack of knowledge about their owners*
- *Please mention critical research needs as well*
  - *what research must be done to assure the flood protection role of levees*

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## Template/Structure of country appendices – sections 8-9/9

### X.8: Summary of key facts


### X.9: References

- X.8 Summary of key facts
  - *Aim of section: summarize some key facts and figures in just a few words, for easy comparison amongst countries*
  - *Km of levees, number of structures*
  - *% along river, estuary, sea, lake*
  - *Protected value, safety standard, actual protection level or flood risk*
  - *Recent (near-)failures*
  - *Key facts governance (which key players) and legislation*
  - *Types of guidelines used*
- X.9 References
  - *Enough references and web links to assure the information is traceable*

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## Review process so far

1. 2018 – internal review of EURCOLD Levee Report
2. 2019-2020 – internal review by Committee Members
  - Language & clarity of general and country chapters improved
3. 2021 – review by National Committees linked to the Levee Committee
  - Only minor comments
4. March/April 2022 – review by all National Committees
  - ICOLD CL 1995 (5Mar2022) – no feedback/concerns
5. 28 May 2022 – today's dissemination workshop

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## Subsequent actions

1. 31 May 2022 – discussion (and hopefully approval) of Draft Bulletin in General Assembly
2. Final touches to Draft Bulletin:
  - Using inputs from the current workshop
  - Using inputs from the ICOLD General Assembly
3. French translation
  - Of at least the main Chapters
4. Publication process
  - while making arrangements for the length of the Bulletin

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# Levees around the World - Questions and discussion

## See the next slides

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# Questions and discussion

## Are there any clarifying questions?

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## Questions and discussion – general feedback


Whom of you have read the Draft Bulletin “Levees around the World”?

- What findings were most striking/inspiring for you?
- Do you have specific feedback on the Bulletin (content, size/detail, clarity, ..)


For those who have not read the Bulletin:

- Did the presentation make you decide to download & read the Bulletin ([see https://www.icold-cigb.org/userfiles/files/CIRCULAR/CL1995-Bulletin.pdf](https://www.icold-cigb.org/userfiles/files/CIRCULAR/CL1995-Bulletin.pdf))
- After hearing the presentation, is there any important feedback you want to give?

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## Questions and discussion - recommendations


Do you have specific feedback on the recommendations in the Bulletin?

Are there any essential things we overlooked in the recommendations?

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## Questions and discussion – uptake and further actions


Uptake of the Bulletin – what is in it for you

- How would you benefit from the information in our Bulletin?
- Who else would benefit?
- With whom should it be shared?

What further actions should our Committee and ICOLD consider?

- How can they benefit from the information in this Bulletin?
- What would be the best actions to encourage (additional) countries to identify their levees and improve their management?

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## Additional countries with significant levee portfolios

Thousands of km of levees

- Vietnam, Bangladesh, India, Pakistan, Serbia, Moldova

Probably at least hundreds of km of levees

- Canada, Ireland, wider Danube basin (Austria, Bulgaria, Croatia, Slovenia, Ukraine), Russia, Surinam/Guyana's

Smaller or uncertain portfolios


- Europe: Portugal
- Asia: Korea, Myanmar, Cambodia, Thailand, Indonesia, Malaysia, Singapore, Philippines
- Africa: most Nile basin countries, Cameroon (Logone), ..
- Latin America: Mexico? Venezuela? Columbia?

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## Questions and discussion – future TCLE activities

Using this Bulletin for future Committee activities


Considering the knowledge and research gaps in this Bulletin:

- Are they suitable to identify topics for future Bulletins and activities
- What would be the key topics for such future Bulletins/activities?
- What are the main opportunities for co-operation with other ICOLD Committees

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## Questions and discussion – future updates

Updating this Bulletin

What is your view on future updates of this Bulletin, considering:

- Typical updating cycles for ICOLD Bulletins
- Availability of new country chapters
- Needs/wishes regarding updates of current contents
- The effort involved in producing such updates

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TC LE Workshop – 28th May 2022

## Update on Dams and Levees Intercomparison Bulletin

**Jonathan Simm**  
HR Wallingford, UK/British Dam Society



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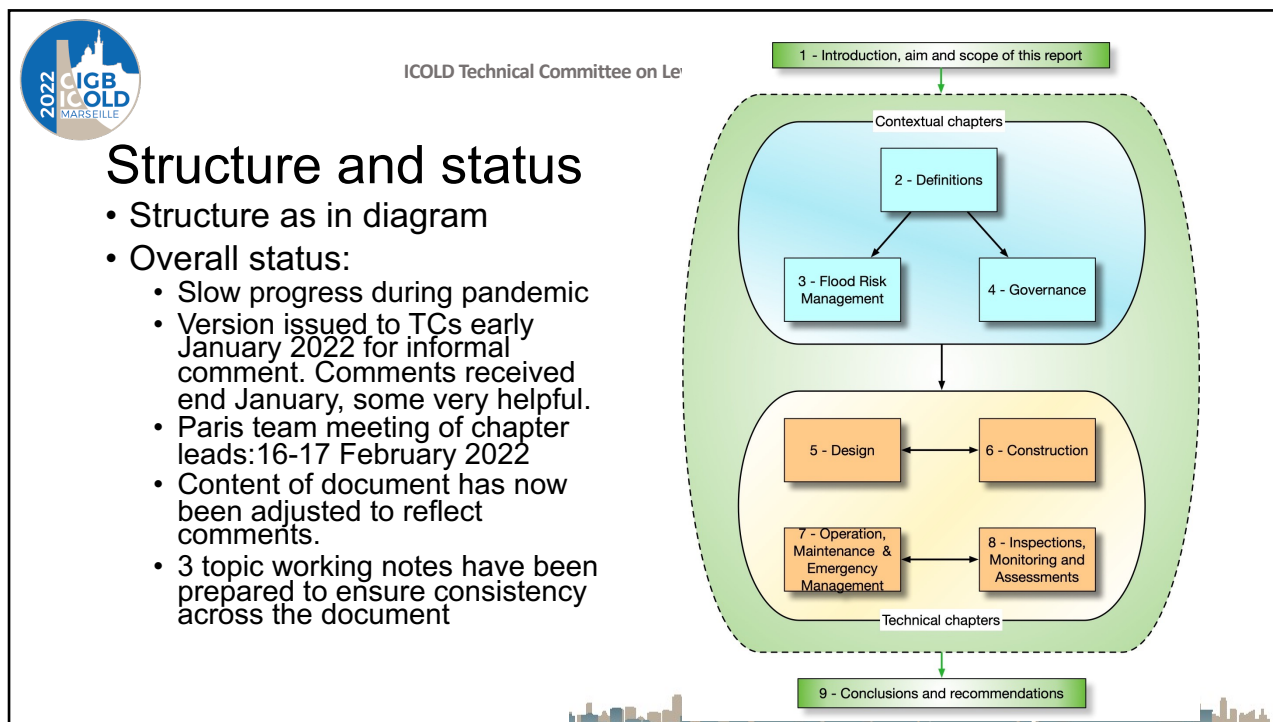
## Introduction – Objective of the report

- This report is one of our main deliverables to present to ICOLD
- It identifies many possible interaction between the topics of other ICOLD TCs (past, present and future) and levees
- This report will support the now-accepted importance of the topic of levees within ICOLD and facilitate exchange of information and production of best practice for issues related to both dams and levees
- It will also help to identify more focused topics to work on in the later phases of our TC activity, including with other ICOLD TCs

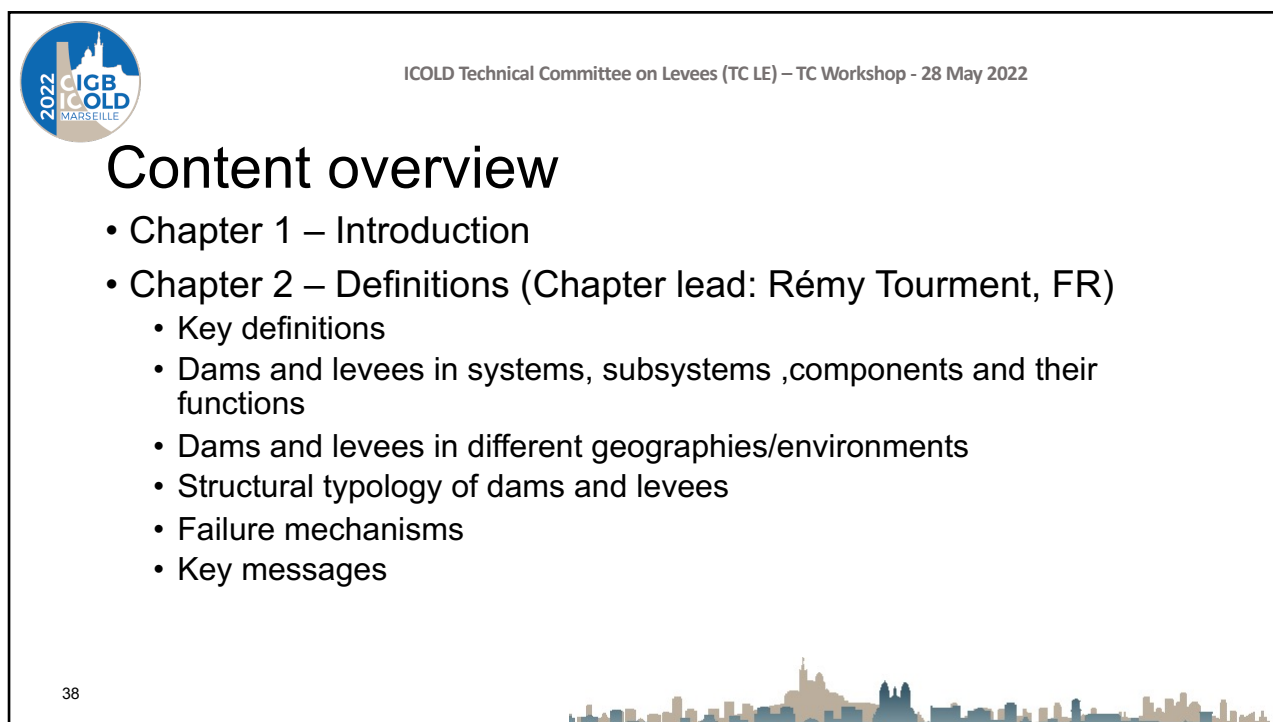
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## Content overview (contd.)

- Chapter 3 – Flood Risk Management (Chapter Lead: Marcel Bottema, NL)
  - Definition of flood risk management (FRM)
  - Role of dams and levees in river basins and FRM
  - FRM-related similarities and differences between dams and levees
  - Dams and levees in a FRM context: lessons and recommendations

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## Content (continued)

- Chapter 4 – Governance (chapter Lead: Adrian Rushworth, UK)
  - Roles and responsibilities
  - Ownership and management
  - Regulation
  - Funding
  - Risk-based decision-making
  - Recommendations

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## Content (continued)

- Chapter 5 – Design (Chapter leads David Bouma, NZ & Meindert Van, NL)
  - Safety philosophy
  - Site characterisation and loads
  - Design analysis procedures
  - Design considerations, given analysis in previous
  - Design guidance references
  - Summary and key messages

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## Content (continued)

- Chapter 6 – Construction (Chapter lead Arnaud le Peillet, FR, replacing Herve Guerpillon who has now retired)
  - Organisation of construction process
  - Allowing for hydro-meteorological conditions
  - Setting up and managing the site
  - Fundamentals of earth construction
  - Methods of construction
  - Lessons and recommendations

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## Content (continued)

- Chapter 7 – Operation, Maintenance and Emergency Management (Chapter Leads: Malcolm Barker & Tracey Williamson, AU)
  - Introduction
  - Normal operation
  - Routine maintenance
  - Emergency management
  - Risk informed approaches
  - Key messages

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## Content (continued)

- Chapter 8 – Inspections, Monitoring and Assessments (Chapter Lead: Noah Vroman, US)
  - Introduction
  - Data for assessments (from inspections, monitoring and investigations)
  - Assessments
  - Key findings
- Chapter 9 – Conclusions and recommendations (Chapter Lead: Jonathan Simm)
  - (For themes see following slides)

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## Conclusions – some overall perspectives

<p><b>Dams</b></p> <p>Mostly built across rivers (with the exception of those for off-line reservoirs) Specifically built to store/regulate water, Creating potential new hazards to downstream communities, Typically higher incremental consequences of failure per unit length (depending on local factors)</p> <p>Well-established common practices informed by international standards (such as ICOLD)</p> <p>More design, construction records, drawings, etc</p> <p>Have established safety assurance procedure/standard</p>	<p><b>Levees</b></p> <p>Built along rivers or coasts with quite long defence lines.</p> <p>Often built up over decades/centuries</p> <p>Protecting inland / people for self-defence, Typically lower consequences per unit length compared to dam break (depending on local factors)</p> <p>More diverse design standards / practices, although common practices have been captured in the International Levee Handbook (ILH) Often unclear original design, construction materials/methods More challenging safety assurance with higher uncertainties</p>	Temporary water levels	Flood storage	'Normal' rivers & coasts
		Permanent water levels	Water supply	Canals High level carriers
			Dams	Levees

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## Conclusion themes

- Dams and Levees have common features and operate in a common environment, resulting in interacting performance
- Scope for mutual learning and research, bringing together and comparing:
  - governance approaches for dams and levees
  - design experiences from dams and levees
  - construction experiences from dams and levees
  - operation and maintenance approaches
  - emergency management
  - instrumentation and monitoring

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## Themes of recommendations

- Find ways of integrating between dams and levees
  - risk and safety approaches
  - language / terminology – (to achieve a level of consistency)
- Given scope for mutual learning and research, there are many possibilities for collaborative working with existing TCs, such as
  - C (Hydraulics for dams); E (Embankment dams); F (Engineering activities with the planning process); G (Environment); H (Dam Safety); I (Public safety – specifically in regard to TC plans to draft a Bulletin on Emergency Management for Dams); N (Public awareness and education); S (Flood evaluation and dam safety); P (Cemented materials dams); Q (Dam surveillance); U (Dams and river basin management); Y (Climate change); Z (Capacity building and dams)

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## Additional thoughts

- Common risk and safety issues include:
  - Risk informed decision-making generally
  - Best practices for evaluating dam and levee interactions in a watershed and optimising performance
  - Risk evaluation of cascading failures in a river basin
  - River/coastal morphological change
- Scope for mutual learning issues
  - Base topics on 1-to-1 discussions with individual TCs
- Climate change adds a further motivation to all the above, since existing best practices may need to be modified

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## Next steps – to be confirmed at TC meeting

- Issue draft for formal review by National committees and TCs by end of June 2022.
- Review period July-August 2022. Comments to be received by 15 September 2022 latest.
- October 2022 – February 2023 final editing, including author team workshop in Paris (January 2023)
- 11<sup>th</sup> March 2023 – latest date to send to ICOLD central office
- Gothenburg, SE, meeting 2023. Hoped-for approval of report

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LEVEES

## Questions and discussion - closure

Any final remarks?

**Thank you for your attention and input !**

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## Workshop conclusion

(Rémy Tourment and Elena Sossenkina, 10 min)

- General comments from the audience (if enough time)
- Conclusion and messages
- Thank you for your attention
- See you tomorrow for the annual TC meeting

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