



# Annual Seismic Resilience Update

Engineering and Operations Committee

Item 6d

January 10, 2022

# Metropolitan's Seismic Resilience Strategy

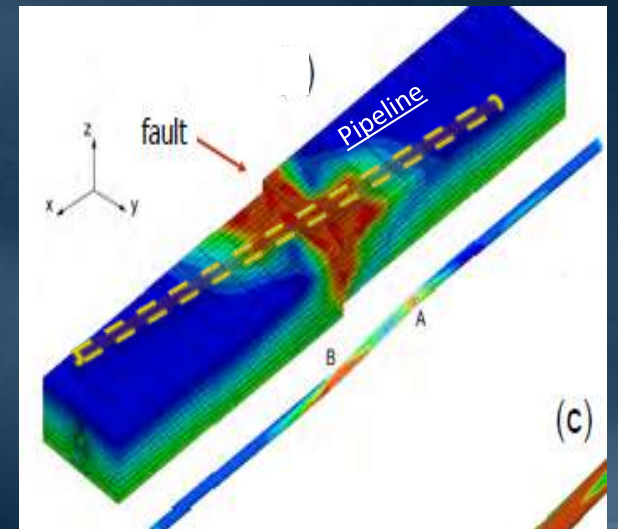


# 1. Comprehensive Assessment

- Primary seismic hazards to Metropolitan's infrastructure
  - Intense ground shaking (IGS)
  - Permanent ground displacement (PGD)
- Components of Infrastructure
  - Dams & reservoirs – IGS
  - Aboveground facilities – IGS & PGD
  - Underground structures - PGD
  - Lifelines (CRA & C&D) - PGD



Damage caused by ground shaking



Simulated pipe displacement caused by fault rupture

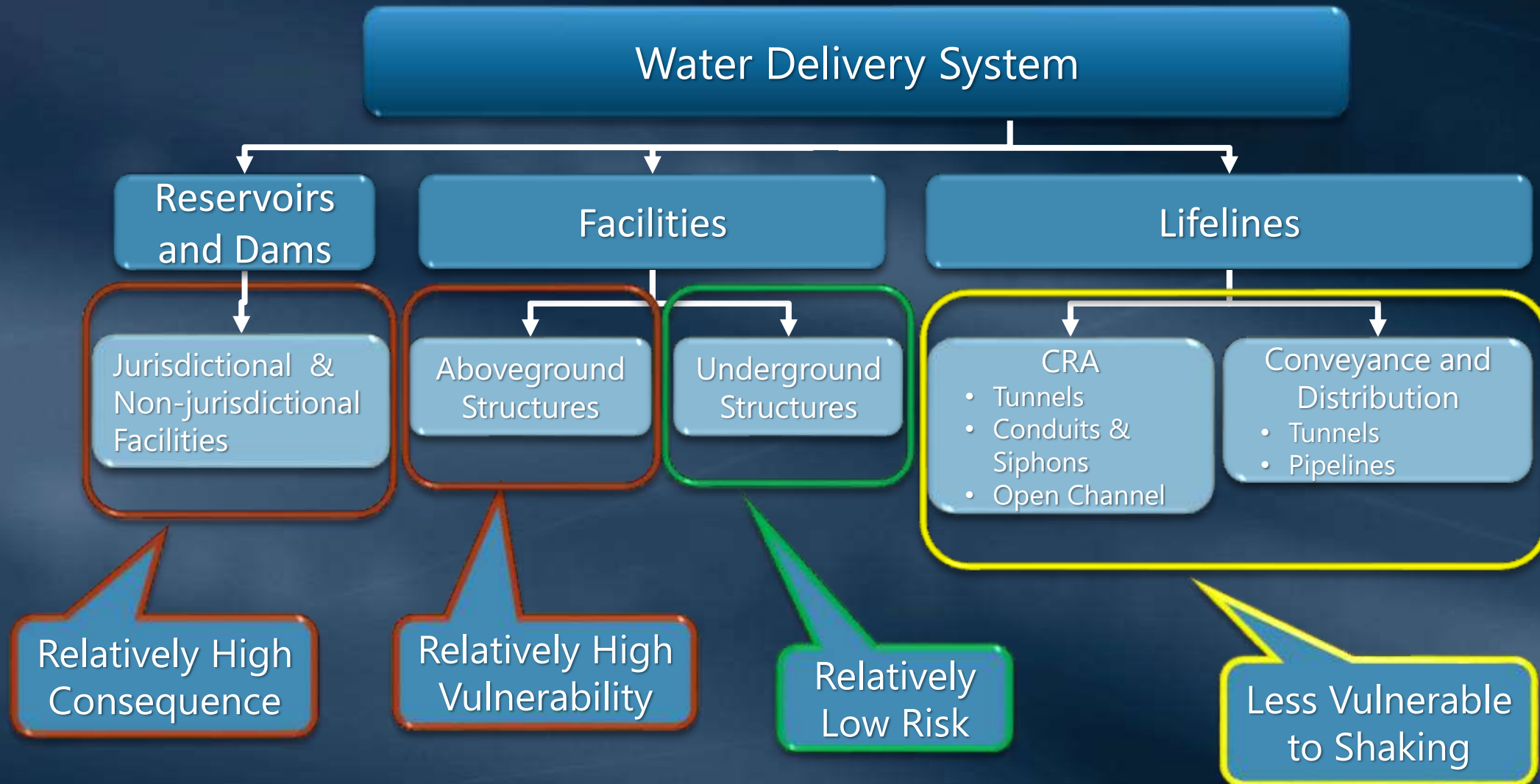
## 2. Risk-Based Prioritization

- Risk is the combination of likelihood of damage and its consequences
- Prioritization by risk level of each component

Component	Likelihood of Damage	Consequences
<b>Aboveground facilities</b>	Relatively high	Medium/high
<b>Underground structures</b>	Relatively low	Relatively low
<b>Lifelines</b>	Relatively low except under PGD	Medium/high
<b>Dams &amp; reservoirs</b>	Relatively low	Relatively high



# Main Components of Water Delivery System



### 3. Effective Mitigation

- Develop component-specific mitigation strategies/measures
- Apply resilient tools including flexibility & redundancy
- Improve cost/benefit with multi-purpose projects
- Continue refining mitigation measures to take advantage of latest technologies



Earthquake-Resistant Ductile Iron Pipe

# Example of Effective Mitigation

## Devil Canyon Facility

- Crossed by San Andreas Fault
- Mitigation measures
  - Structures were designed to meet state-of-the-practice seismic design standards
  - “Fuses” in the system were installed to isolate affected areas, protect crucial components and facilitate restoration
  - Continue preparing for post-event repair and restoration
  - Plan for alternative supplies to further mitigate the risk

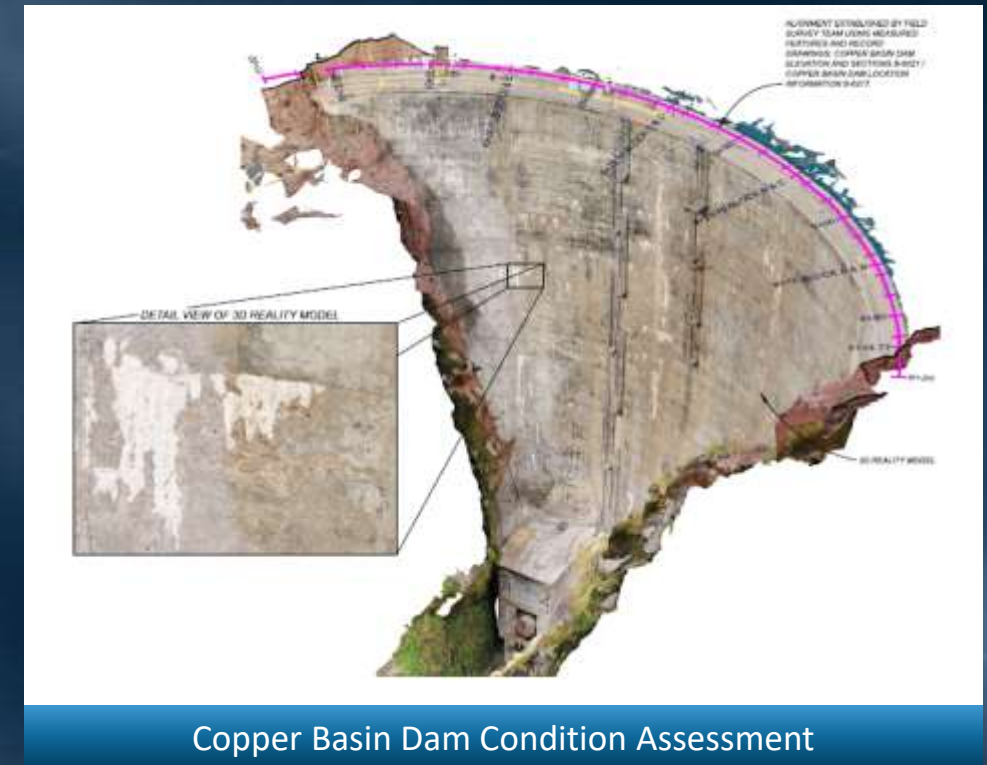




# Status Update

## 1. Dams & Reservoirs

- Mitigation measures
  - Continuous monitoring by instrumentation
  - Regular inspections
  - Periodical review & assessment
  - As-needed upgrade
- Examples of ongoing projects
  - DVL monitoring system upgrade
  - Copper Basin Dam assessment
- Planned improvements
  - Real-time monitoring
  - Scenario-based risk assessment





# Status Update

## 2. Aboveground Facilities

- Current status

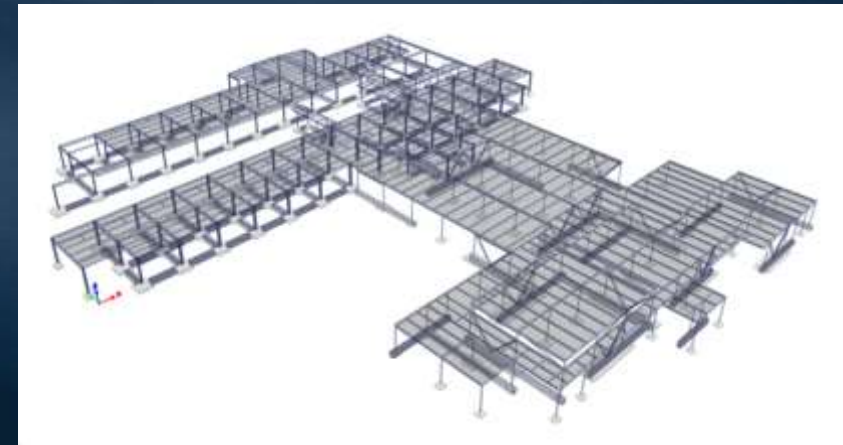
- 311 pre-1990 aboveground structures:
  - 195 are seismically sufficient
  - 75 have been upgraded
  - 41 under evaluation, design, or construction
- 28 post-1990 aboveground structures
  - 10 have been evaluated and confirmed to be adequate
  - 1 has been upgraded
  - 5 under evaluation or design
  - 12 to be evaluated

- Examples of recent projects

- Construction: Diemer W. Basins & Filter Bldg.
- Design: La Verne WQL, Weymouth Headhouse Bldg., Foothill PCS, etc.



Diemer West Basins and Filter Building  
Rehabilitation Project



La Verne WQL 3-D Structural Model

# Status Update

## 3. Lifelines

- Mitigation strategies
  - Identify high-risk segments with large potential PGD
  - Incorporate seismic improvement into rehabilitation projects
  - Improve flexibility to enhance resilience
- Examples of ongoing projects
  - Casa Loma Siphon No. 1
  - PCCP Rehabilitation
  - DVL to Rialto Flexibility Improvement
- Planned tasks
  - Update tunnel risk assessment
  - Update pipeline vulnerability assessment



Casa Loma Siphon Improvement



PCCP Rehabilitation

# Status Update

## 4. Underground structures

- Current status
  - Created a comprehensive inventory (more than 6300 underground structures)
  - Categorizing based on functions and seismic risk
- Examples of high-risk structures
  - Bifurcation structures
  - Vault structures in liquefaction zone
- Planned tasks
  - Conduct initial screening of high-risk structures
  - Develop mitigation measures for high-risk structures identified as seismically deficient



Bifurcation Structure



Vault Structure



# Status Update

## Agency Partnerships

- Seismic Resilience Water Supply Task Force
  - Improve regional resilience through collaboration between three main imported-water agencies
- Conducted Task Force meeting in June 2021
  - Exchanged knowledge by sharing recent seismic resilience efforts
  - Collaborated on emergency response exercises
  - Supported studies to improve connectivity between systems
  - Continued to explore other collaborative efforts to improve regional resilience



Colorado River Aqueduct



California Aqueduct



Los Angeles Aqueduct

# Summary

- Conduct comprehensive assessment to include all major assets
- Prioritize mitigation based on risk level
- Develop mitigation strategies tailored to each component of infrastructure
- Continue implementation of mitigation measures
- Report progress regularly
  - Periodic written reports
  - Annual oral updates

