RE:CODE LA X WATER

CREATING A WATER RESILIENCE CITY

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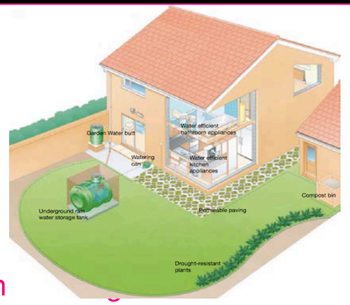
Summary

- Updating zoning code for the 21st century:



1. Respond to **severe drought** and risks from **sea level rise** and **extreme precipitation**
2. Shape the built environment in **sustainable** and **equitable** future.

- It could

1. Generate and manage more **local sources of water** (Residential + Commercial Area)
   - Rainwater harvesting system
   - Porous or permeable paving
2. **Protect buildings against flooding** (Coastal Area)
   - Elevated ground floor level
   - Setback of houses
3. **Prioritize** water access and climate

WHY SO SERIOUS ON WATER?

Drought (Status: EXTREME Drought)

WHAT CAN WE DO?

- **Zoning Principle + Water Management**

Sets restrictions of the land usage and building standards, in different zones like floor area ratio and height

Enables special design in the right places and can help
1. **Decentralize** water storage and capturing system
2. **Protect** coastal residents and infrastructures

- **RE:CODE LA**

Process to review the Zoning Code in LA
Not updated for issues in 21st century (69 years ago)
- Demographic changes (doubled)
- Climate changes (variability)

TAKE THIS CHANCE!!!!

COMBAT FLOOD

1. GROUND FLOOR LEVEL

- **Principle:**

Many coastal structures, particularly residential and small commercial buildings, could be elevated on pilings for protection from floods

The pilling level is usually higher than the predicted tides or waves level so as to prevent directly facing and resist waves' force

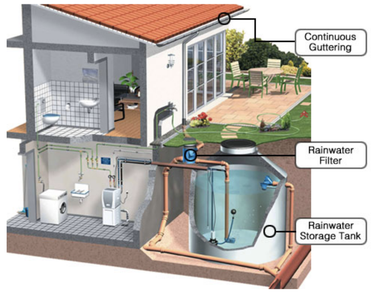
COMBAT DROUGHT

1. RAINWATER HARVESTING SYSTEM (RwH)

- **Principle:**

Collects rain that would normally infiltrate into the soil, evaporate or be directed to the receiving watercourse

Can be used for draining surface water from roofs, or run-off from roads and other surfaces and then used for irrigation or other purposes



- **Benefits:**

a) Additional water supply for portable and non-portable uses that benefits water metering households
b) Reduce pressure on sewer system and official supply

- **Considerations:**

a) Water contamination from surrounding environment
b) Cost effectiveness depends on the local water price

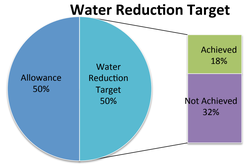
- **Cases:**

a) Mandate RwH in Australia
b) Utilized in many places include Germany, United Kingdom and Singapore for alternative water sources

2. POROUS or PERMEABLE PAVEMENT

1.**MUCH** Water Consumption:

- Average 131 gallons per capita per day (2014)
- TWICE average EU city consumption



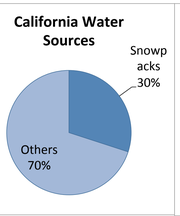
2. **LESS** Water Supply:

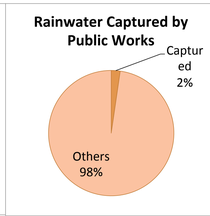
a) Less Water Available for Imported Water Project
- California's mountain snowpack shrinks to 1/3 in mid century

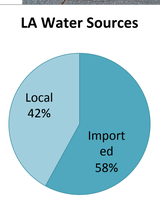
b) Too Dependent on Imported Water

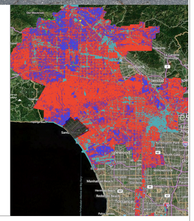
c) Changing Precipitation
- Same Quantity, Change in rainfall pattern:
  - Winter: higher flooding risk
  - Summer: less rainfall

a) Little Infiltration (around 20%)









<u>**Flood** (Coastal Area: Catalina Island and Long Beach etc.)</u>

1. **LACK** of coastal protection

- Example: Ike 2008 in Texas (15 - 20 ft above normal tides level)
- Threat to lives: 22 killed, 34 missing
- Threat to properties: $24.9 billion loss (more densely populated, economies, infrastructures, tourism etc.)

2. **HIGHER** risks (storm surges and storm tides)

a) More severe
- Sea level rise 0.4 – 1.7m from 2000 to 2100

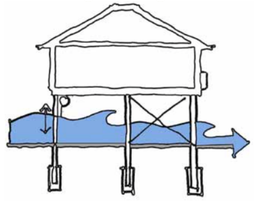
b) More frequent (IPCC)

- **Benefits:**

a) Add value of the house
b) Increase space for parking and storage

- **Considerations:**

a) Storm tide water level survey
b) Concrete construction materials and flow through design



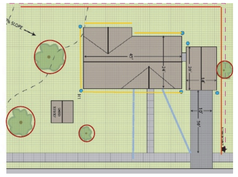
- **Cases:**

Queensland (Australia) strongly recommends elevating building for preparing once in 500 year storm tide event in storm tide prone area

2. <u>SETBACK</u>

- **Principle:**

Provide a buffering zone for flood before entering residential area. Allows development to take place around flood prone areas but buildings are mandated to follow a setback from 50 to 100 ft



- **Benefits:**

a) Prevent relocation of residence with the natural buffer
b) Relatively low cost

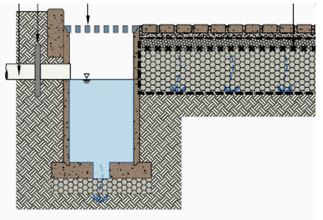
- **Considerations:**

a) Setback distance considering soil erosion and potential sea level rise
b) Stability of the slope

- **Cases:**

India, Sri Lanka, Tonga, Fiji, Mauritius and Australia have already required setback in coastal area

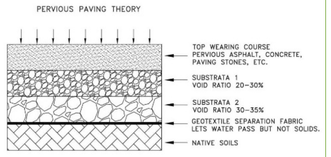
<u>SYSTEM (PPS)</u>



- **Principle:**

Allow infiltration of storm water for further storage in groundwater supplies

Consist of concrete blocks, porous tarmac or loose gravel

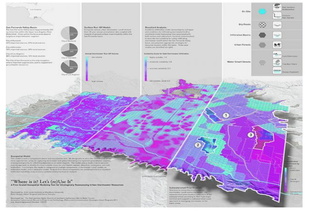


- **Benefits:**

a) Lower initial and whole-of-life project costs with high durability
b) Surface water runoff pollution control by biodegradation and screening inside geotextile layer

- **Considerations:**

a) Soil infiltration ability
b) Surface slope in case of PPS failures or extreme rainstorm



- **Cases:**

a) UK encourages PPS by allowing PPS in garden without planning permission
b) Included in numerous countries' best practical mean as an effective way of flood prevention and water retention

METHODOLOGY

- Conducted literature reviews on LA zoning information and water strategies around the world

a) Drought

Grey water system, Unlined open conveyance and storage features, Hosepipe restriction, Weather based irrigation controller, drip irrigation system, Rainwater harvesting system, Porous or permeable pavement

b) Flood

Land use restriction, Land acquisition, Change in land use, Floating house, Floodwater diversion, Setback, Ground floor level

- Selected strategies among 16 options according to the below criteria:

1) Appropriateness for Zoning 2) Flexibility
3) Cost Effectiveness 4) Equity