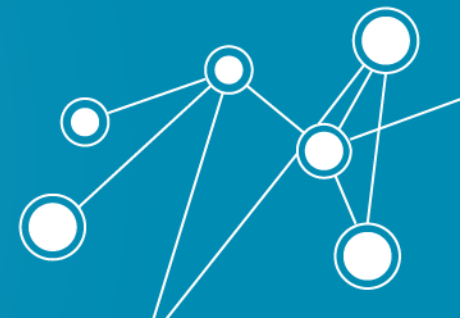


# TRAIN-THE-TRAINER ADAPTATION EXERCISES



MARIN COUNTY COMMUNITY DEVELOPMENT AGENCY  
AECOM

# Training Toolkit – Purpose and Concept



- Mainstreaming climate change preparedness and resilience into planning and engineering activities
- Develop better understanding of climate change vulnerability and risk assessments so that city staff can conduct or assist in completion of these assessments



# THE GAME OF FLOODS

Your Island

START



- Evacuation Route
- Meirina
- Storm Shelter
- Gas Station
- Sewage Lift Station
- Electrical Sub Station
- Mammal Habitat
- Seabird Colony
- Aquaculture
- Ranch
- Agriculture
- Sheep
- Home
- Grocery
- Public Well
- Water
- Roadway
- Beach
- School Site
- Restaurant
- Boat Launch
- Parking
- Library
- Historic Church
- Hospital
- Fire Station
- Post Office

## LEGEND



© SMART Program  
May 2015

Sea levels are rising worldwide as warming oceans expand and melt glaciers and ice sheets. Stronger storms coupled with rising seas can significantly damage—even destroy—property, infrastructure, public facilities, natural habitats, and other resources we depend on. We need to plan now for the future. Adaptation planning is the process of developing a sea level rise adaptation plan using the strategies (game pieces).

1. To begin, each player needs the sea level rise scenario about their island. 2. Players must enroll. Players take turns in clockwise order.

3. In turn, each player selects an asset to accommodate, defend, or retreat from. No need to duplicate assets. Use the worksheet provided to record your choice, costs, and pros and cons.

4. Next, in turn, each player places and states aloud their preferred adaptation strategies or around the island. Conflicting strategies are allowed.

5. Consider the following factors to inform the proposal: (1) cost/benefit, (2) Private property impacts, (3) Environmental impacts, (4) Equity/social justice/economic, (5) Others. Use your worksheet to take notes.

Sea Level Rise 2050 Scenario Key

RED AREA = Permanent Sea Level Rise Flooding

YELLOW AREA = Temporary Sea Level Rise Flooding

GREEN AREA = Temporary 100-Year Storm Flooding

## GAME PIECES

**Managed Retreat**

- Retreat
- Post-storm prohibitions
- Move here
- Stricter land use zoning

**Accommodate Water**

- Elevate Buildings
- Floodable Buildings
- Elevate/New Road

**Hard Engineering**

- Revetment/Seawall
- Traditional Levee
- Tide Gate
- Wall & Pump Station

**Soft Engineering**

- Horizontal Levee
- Wetland/shoreline vegetation
- Offshore Structure
- Beach Maintenance

# AGENDA

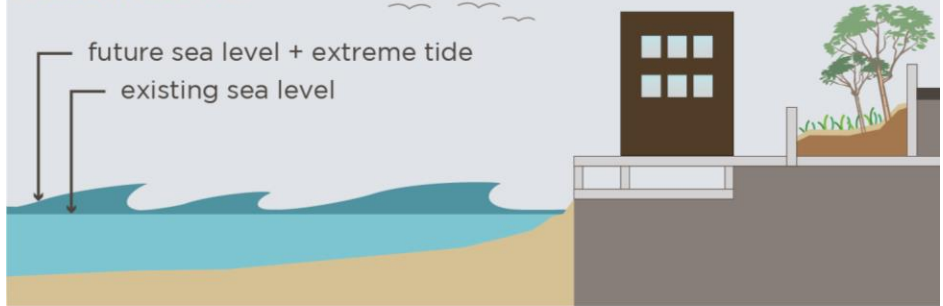
- 2:30** Welcome/Presentation (Large Group)
- 3:00** Play Game (Small Groups)
- 4:05** Report Back (Large Groups)



# HIGH SCHOOLS



### ACCOMMODATE



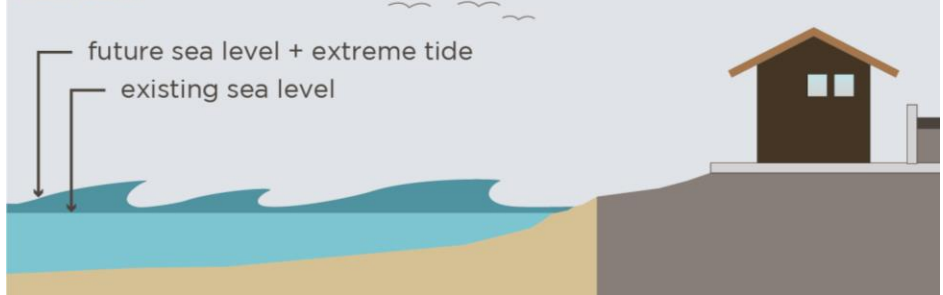
### PROTECT | ENGINEERED



### PROTECT | NATURAL



### RETREAT



# Elevate Buildings (Accommodate)



Costs: Medium

Environmental Impacts: Neutral to Positive

Effectiveness: Medium Term





# Floodproof Buildings

(Accommodate)

Costs: Medium

Environmental Impacts: Neutral

Effectiveness: Medium Term



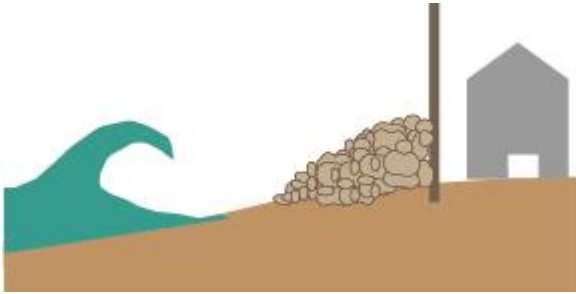
# Elevate/New Road

(Accommodate /Retreat)

Costs: High  
Environmental Impacts: High  
Effectiveness: Long Term



# Coastal Armoring (Protect-Engineered)

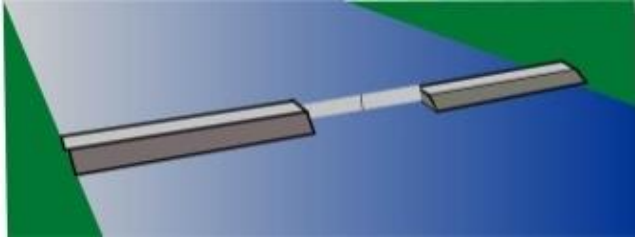


Costs: High  
Environmental Impacts: High  
Effectiveness: Medium to Long Term



# Tidal gate

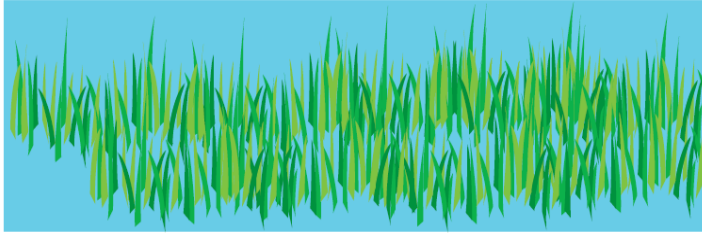
(Protect/Engineered)



Costs: Extreme  
Environmental Impacts: High  
Effectiveness: Long Term



# Wetland/Living Shorelines



Costs: Medium  
Environmental Impacts: Positive  
Effectiveness: Medium Term



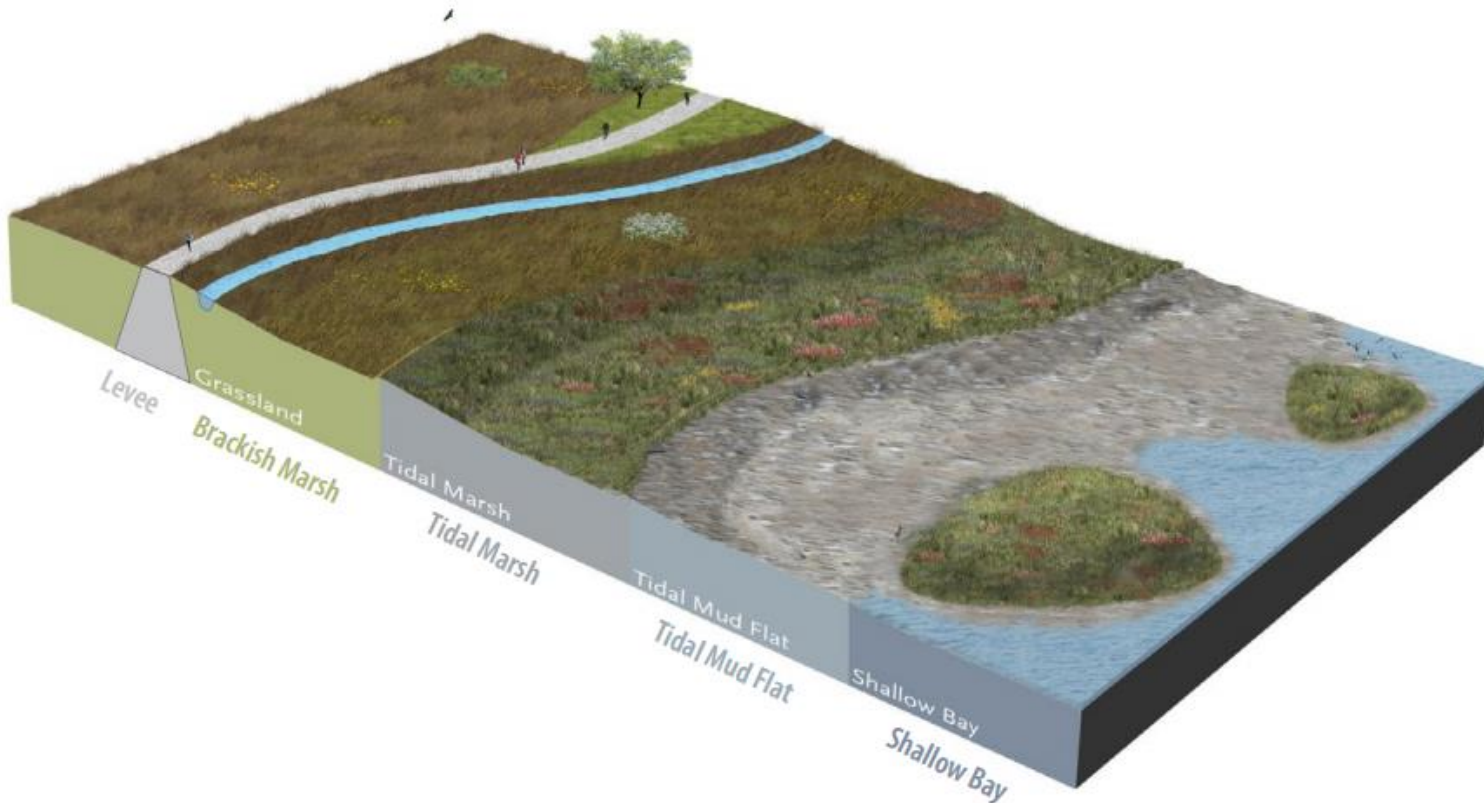
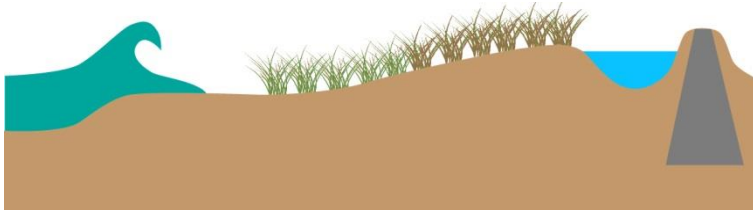
# Horizontal levee

Protect/Natural

Costs: High

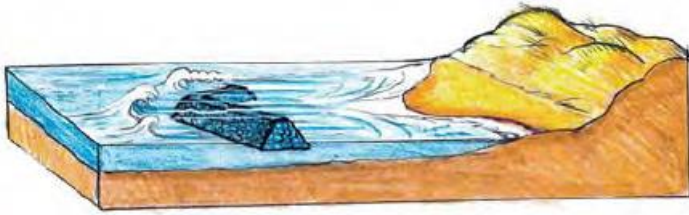
Environmental Impacts: Positive

Effectiveness: Long Term



# Offshore structures

## Protect/Natural



Costs: Medium to High  
Environmental Impacts: Positive  
Effectiveness: Medium Term



*San Clemente artificial reef experiment*



*Concrete*



*Quarry rock*

# Managed Retreat

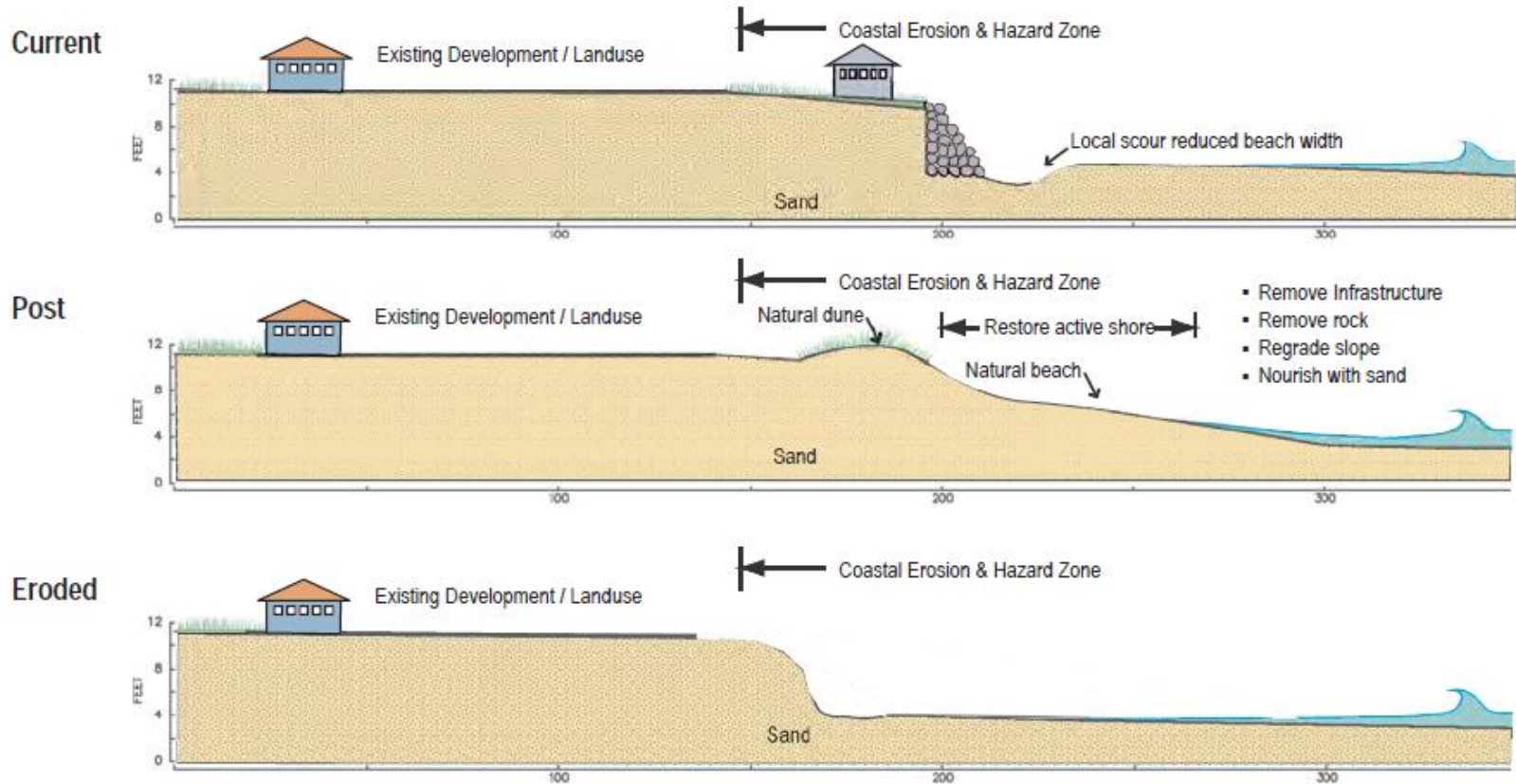


Retreat



Rebuild here

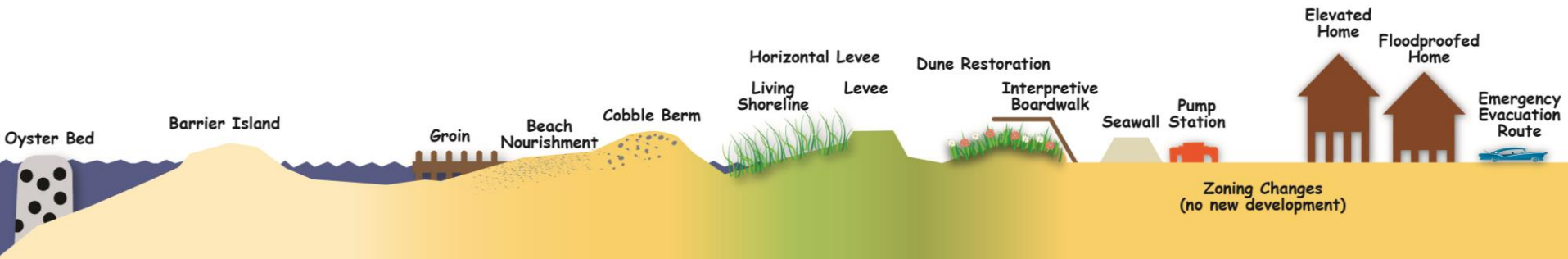
Costs: High  
Environmental Impacts: Low to Medium  
Effectiveness: Long Term





**BLANK**

# Hybrid Strategies



# THE GAME OF FLOODS

## Your Island

START

Sea levels are rising worldwide as warming oceans expand and melt glaciers and ice sheets. Stronger storms coupled with rising seas can significantly damage—even destroy—property, infrastructure, public facilities, natural habitats, and other resources we depend on. Adaptation planning is essential to help communities and individuals develop a sea level rise plan using the strategies in game pieces.

1. To begin, each player needs the sea level rise scenario sheet. The highest roll goes first. If tie occur, the tied players must re-roll. Players take turns in clockwise order.

2. In turn, each player selects an asset to accommodate, defend, or retreat from. No need to duplicate assets. Use the worksheet provided to record your choice, costs, and pros and cons. Next, in turn, each player places and states aloud their preferred adaptation strategies or around the island. Conflicting strategies are allowed.

3. Consider the following factors to inform the proposal: (1) Costs/benefits, (2) Private property impacts, (3) Environmental impacts, (4) Equity/social justice/economic, (5) Others. Use your worksheet to take notes.

**SEA LEVEL RISE 2050 SCENARIO KEY**

**RED AREA** = Permanent Sea Level Rise Flooding  
**ORANGE AREA** = Temporary Sea Level Rise Flooding  
**YELLOW AREA** = Temporary 100-Year Storm Flooding



- Evacuation Route
- Storm Shelter
- Gas Station
- Sanitary Lift Station
- Marina
- Mammal Habitat
- Seabird Colony
- Aquaculture
- Ranch
- Agriculture
- Sheriff
- Grocery
- Public Well
- Home
- Water
- Roadway
- Beach
- School Site
- Restaurant
- Boat Launch
- Parking
- Library
- Historic Church
- Hospital
- Fire Station
- Post Office

### LEGEND

**Managed Retreat**

- Retreat
- Post-storm prohibitions
- Move here
- Stricter land use zoning

**Accommodate Water**

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- Floodable Buildings
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**Hard Engineering**

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- Wall & Pump Station

**Soft Engineering**

- Horizontal Levee
- Wetland/shoreline vegetation
- Offshore Structure
- Beach Maintenance

### GAME PIECES

# Downtown Zappa

- Commercial hub of the island
- Protected by undersize levees and vulnerable to both riverine and tidal flooding



# Eroding Cliff Heights

- Residential community threatened by cliff erosion
- Zoning and shoreline protection challenges



# Mudflat Manor

- Large residential community threatened by SLR
- Vocal community of property owners demanding protection



# Desolation Court

- Small poor isolated community threatened by SLR
- In danger of being cut-off from services



# Shoreline Marina

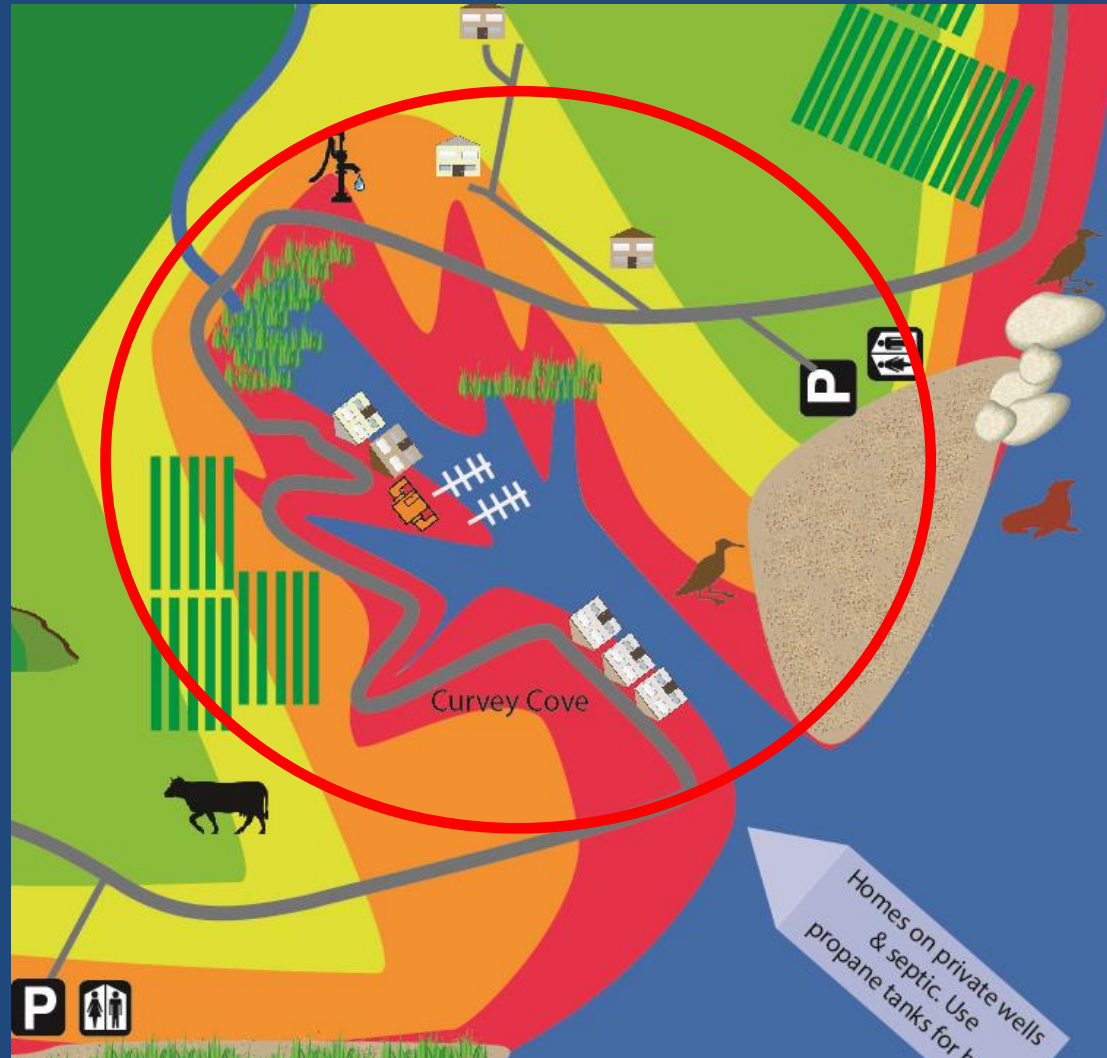
- Water-based commercial business and associated businesses threatened by SLR
- In danger of being cut-off from road access at high tides





# Curvey Cove

- Historic Ag based community with access and crops threatened by SLR
- In danger of being cut-off from road access at high tides



# Seaspray Estates

- Large vacation and second home community with access and homes threatened by SLR
- In danger of being cut-off from road access at high tides













# Costs \$\$\$

*Real World* – costs are messy and depend on many factors

- + planning & engineering
- + permitting
- + mitigation
- + maintenance & repair

*Game World* – costs are simpler one-time costs and given to you per unit (i.e. mile or # of buildings)

| Name                         | Piece   | Piece Unit  | Cost (\$)  | Environmental Impacts<br>Red (neg.)<br>Yellow (neutral/caution)<br>Green (pos.) | Flood Protection | Protects Against |             |                |              |         | Feasibility     |            |
|------------------------------|---|-------------|------------|---|------------------|------------------|-------------|----------------|--------------|---------|-----------------|------------|
|                              |   |             |            |   |                  | Temp. Flooding   | Storm Surge | Sea Level Rise | Wave Impacts | Erosion | Sheltered Areas | Open Coast |
| <b>Protect - Engineered</b>  |   |             |            |   |                  |                  |             |                |              |         |                 |            |
| Coastal Armoring             |    | 1 Mile      | \$\$\$     | EEE   | med              | x                | x           | X              | x            |         | X               | x          |
| Tidal Gate                   |    | Creek width | \$\$\$\$\$ | EEE   | long             | x                | x           | x              | x            |         | x               |            |
| <b>Protect - Natural</b>     |   |             |            |   |                  |                  |             |                |              |         |                 |            |
| Horizontal Levee             |    | 1 Mile      | \$\$\$\$   | E   | long             | x                | x           | x              | x            |         | x               |            |
| Wetland/shoreline vegetation |  | 1 Acre      | \$\$\$     | E   | med              | x                | x           |                | x            |         | x               |            |
| Offshore structure           |  | 1 Mile      | \$\$       | E   | med              | x                | x           |                | x            |         | x               | x          |
| <b>Accommodate</b>           |   |             |            |   |                  |                  |             |                |              |         |                 |            |
| Elevate Buildings            |  | 4 Buildings | \$\$\$     | EE  | med              | x                | x           |                | x            |         | x               | x          |
| Floodproof Buildings         |  | 4 Buildings | \$\$       | EE  | med              | x                | x           |                |              |         | x               | x          |
| New/Elevate Road             |  | 1 Mile      | \$\$\$\$\$ | EEE   | long             | x                | x           | x              | x            |         | x               | x          |
| <b>Retreat</b>               |   |             |            |   |                  |                  |             |                |              |         |                 |            |
| Retreat                      |  | 4 Buildings | \$\$       | E   | long             | x                | x           | x              | x            | x       | x               | x          |
| Move Here                    |  | 4 Buildings | \$\$       | EEE   | long             | x                | x           | x              | x            | x       | x               | x          |

THANK YOU!



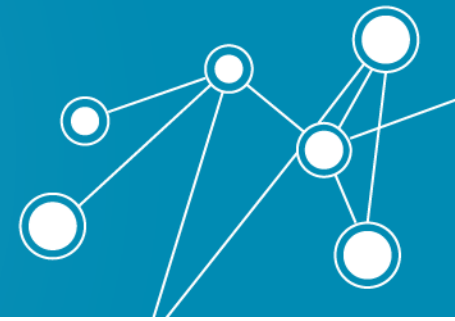


# USDN Climate Preparedness Training

## Game 2: Engaging Internal Government Stakeholders

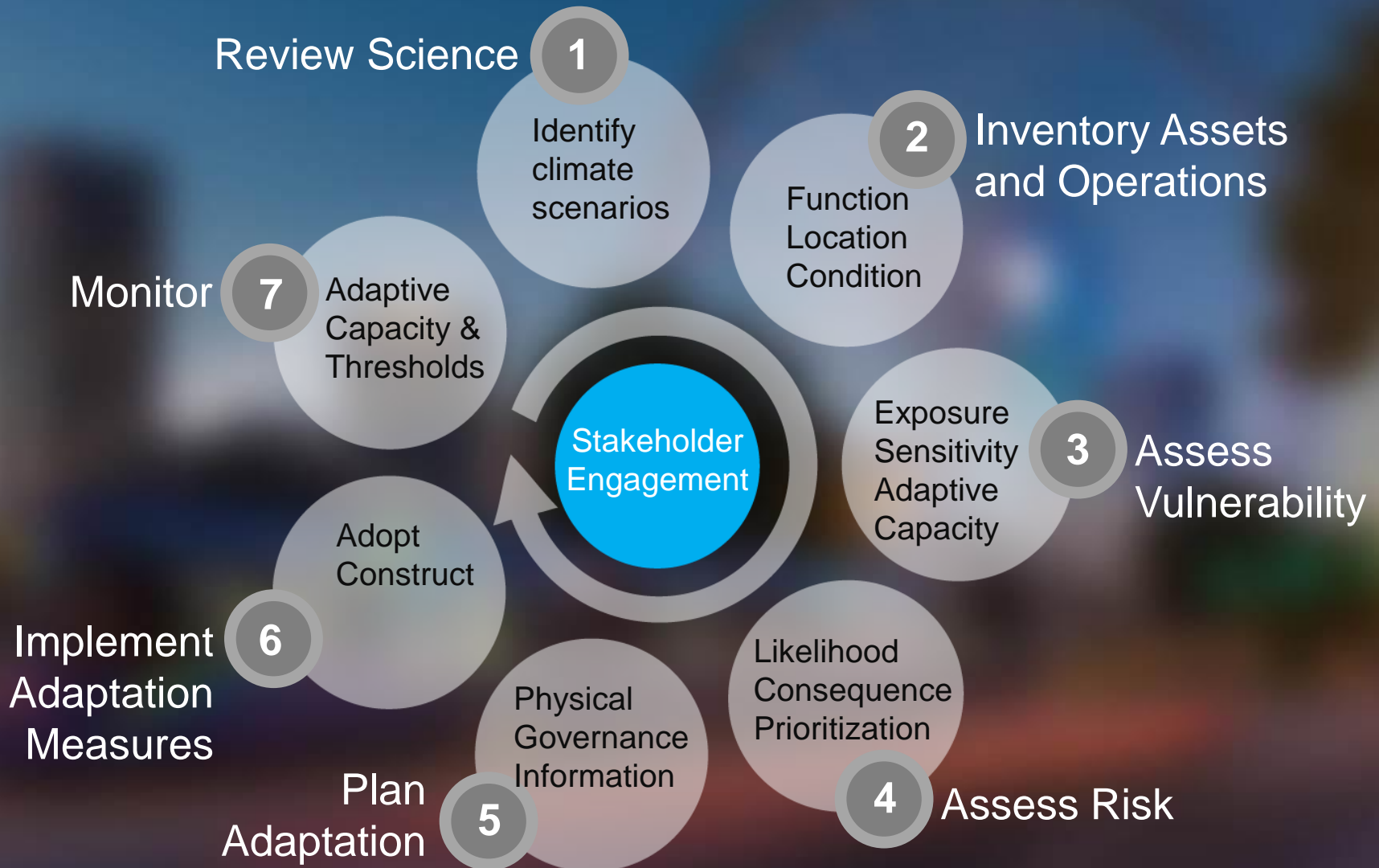
National Adaptation Forum  
May 10, 2017

# Pilot Cities, Input, and Feedback

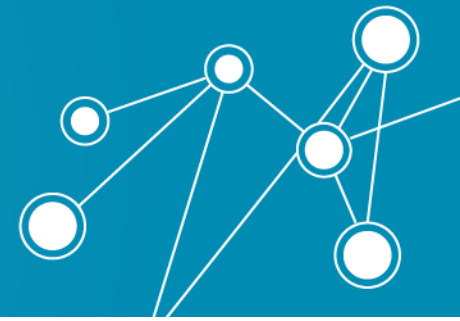


- Participating Cities:
  - Baltimore
  - Seattle
  - Ft. Lauderdale
  - Vancouver
  - Toronto
  - Providence
- Design convening/workshop
  - Review and provide existing training materials
  - Brainstorm training topics
  - Identify level of detail
  - Test games and exercises
- Pilot training and provide feedback

# Process for Incorporating Climate Change into Project Planning



# Format of Training Toolkit



- Focus on flooding and sea level rise
- Customizable training template (required!)
  - Placeholders for trainers to provide local:
    - Climate hazards
    - Climate impacts
    - Climate preparedness activities
    - Asset examples
  - Overview and detailed slides for less vs. more detail
  - Modular topics can be added or removed
- Interactive – switch between presentations and exercises or game activities



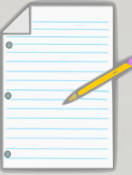
# Format of Training Toolkit (Not just a game!)



- Main components:
  - Trainer “How-to” guide
  - PPT and speaker notes
  - PPT case studies
  - List of resources
  - Exercises and games
  - Pre-training questionnaire
- Game track: Asset inventory and sensitivity, vulnerability and risk assessment, adaptation planning
- Exercise track: Cascading impacts, climate scenario selection, asset sensitivity, risk assessment, resilience project review



# Exercise Track (Optional)



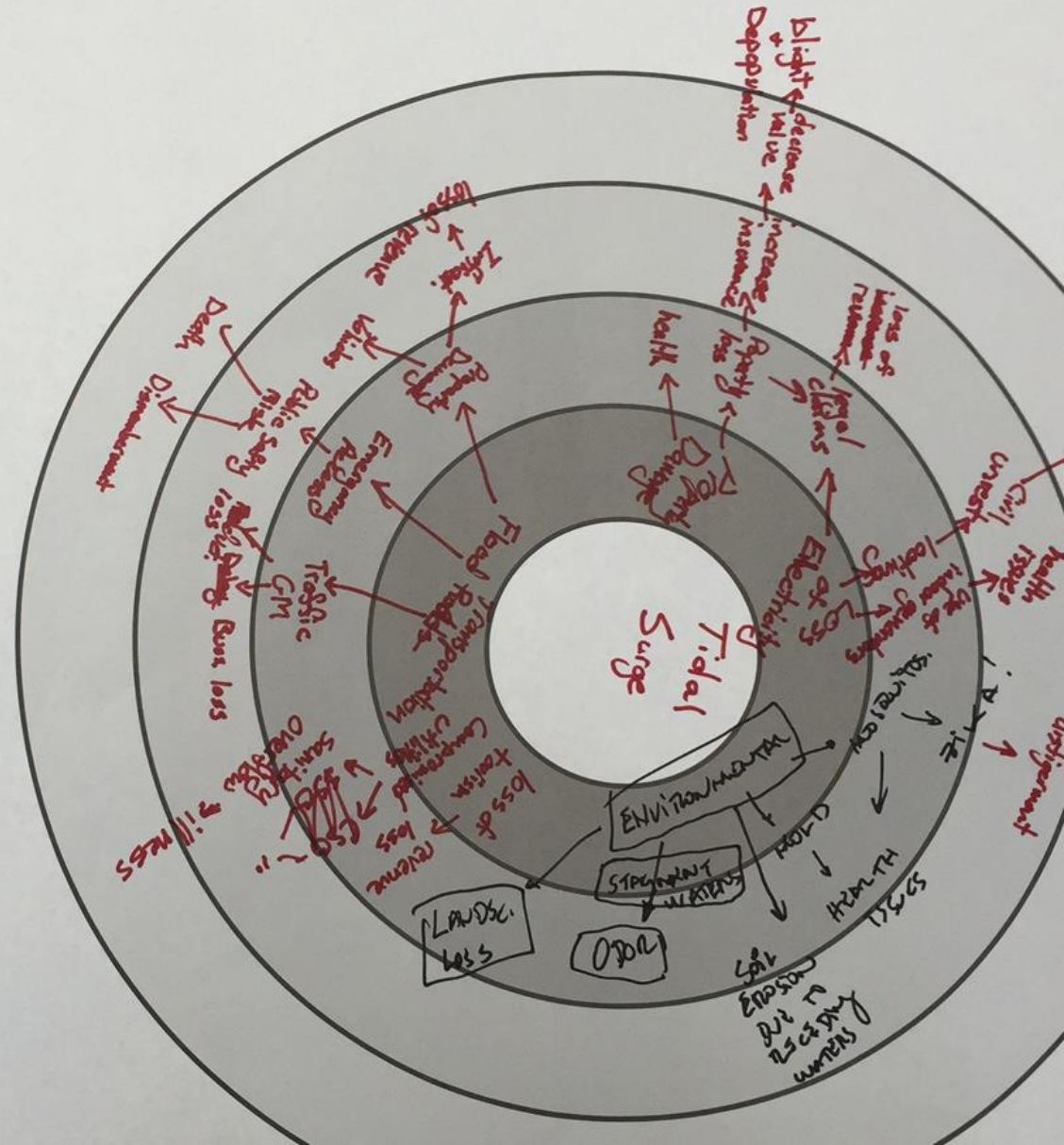
## Cascading Impacts Exercise

Principal Stakeholders that need to collaborate:

- 1) Property owners & Public
- 2) Government Agencies (Public works, DOT)
- 3) Tourists

Areas already affected by climate stressor:

- 1) Eroded coastlines
- 2)
- 3)





# Training Toolkit Template Example Presentation Slides

# Overview of Flooding Processes



## Coastal



Large waves, high tides, storm surge



## Riverine



Large river flow caused by heavy precipitation



## Urban



Heavy precipitation causing an overflow of the drainage system

# Miami Beach Example: Regional and Local Impacts



Extreme tide events today



Image: National Weather Service



Image: Marsha Halper (Miami Herald)



Image: Noor (New Republic)

# Climate Impacts: *ADD YOUR* Regional and Local Impacts



Add image of existing impacts from climate  
stressor

Add image of existing  
impacts from climate  
stressor

Add image of existing  
impacts from climate  
stressor

# Vulnerability Assessment

## Assess Vulnerability

3

Exposure  
Sensitivity  
Adaptive  
Capacity

Three step process to help  
PRIORITIZE assets for  
adaptation

**Is asset  
flooded?**  
(exposed)

yes

**Is asset  
sensitive?**

yes

**Does the  
asset have  
adaptive  
capability?**

yes  
no

4

Likelihood  
Consequence  
Prioritization

no

Asset no longer part of analysis

no

yes

Consider how this can help  
with adaptation strategies

## Assess Risk



# Asset and Operations Inventory Considerations for Sensitivity



Flood-proofed generator door

Source: FEMA (2013)



Flood barrier, Fargo, ND

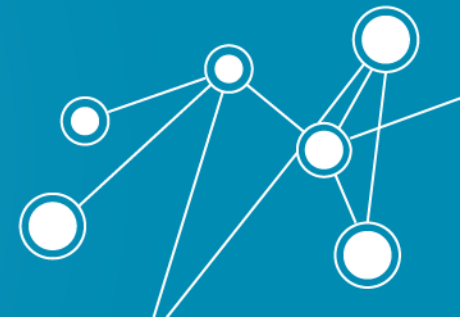
Source: Flood Control America, LLC; FEMA (2013)

What makes an asset sensitive to flooding?

- Asset sensitivity is difficult to quantify
- Studies typically adopt “indicators” of sensitivity, such as:
  - Asset condition (age, materials, etc)
  - Level of use (average daily traffic, discharge, capacity, etc)
  - Prior climate impacts (flooding, extreme heat, etc.)
  - Susceptibility to flood impacts (flood-proofed, corrosion resistant, backflow prevention)
  - Socio-economic factors (asset serves vulnerable or disadvantaged populations)



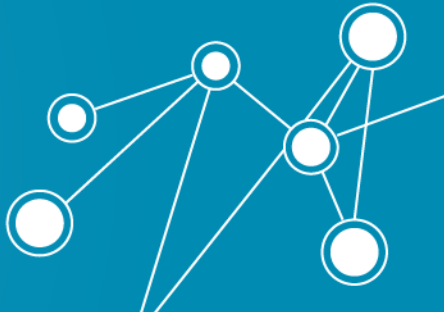
# Game of Floods – Resilience Harbor



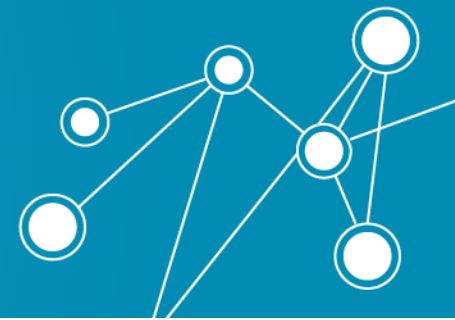
- Adaptation-based game originally developed by Marin County, California
- Updated for USDN training toolkit
  - Asset inventory, vulnerability assessment, and consequence exercises incorporated
  - Revised game board to reflect urban edge (instead of island); added new assets, riverine floodplain, and non-structural adaptation strategies



# Game of Floods – Resilience Harbor



# Game of Floods – Resilience Harbor



## Team Scenario 1



**Planning Horizon: 2050**  
**Sea Level Rise: Mid range (12" by 2050)**  
**Precipitation: 20% increase in precipitation intensity**

### Town History:

Originally settled by longline fisherman in the 1890s, the area became heavily farmed in the 1930s, and transitioned to a resort community during the economic boom of the 1980s. The town's economy is now based on a mix of technology-related industry, tourism, fishing, and agriculture.

## City Planning and Sustainability



### Role: City Planner and Sustainability Director

You represent the interests of the Resilience Harbor Planning Department. It is your role to ensure the recommendations and decisions made ensure a safe, healthy, and sustainable path for Resilience Harbor to continue to grow and function in the face of future climate change.

## Asset Condition Cards



### Historic Courthouse

The Historic Courthouse is a registered landmark beloved by the community and frequently used for weddings. Because it is a historic structure, the



## Asset Condition Cards



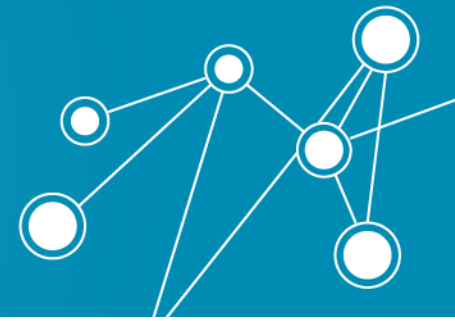
### Riverfront Estates

Originally settled in the 1890s by fishermen, the Estates neighborhood has tripled over the last two decades and now comprises 300 homes. Housing styles range from original Craftsmen to sprawling 1950s ranch homes to new, luxury vacation estates. This neighborhood is home to many wealthy residents. The Abundance River has overflowed its banks twice in the last decade, causing millions of dollars worth of damage.



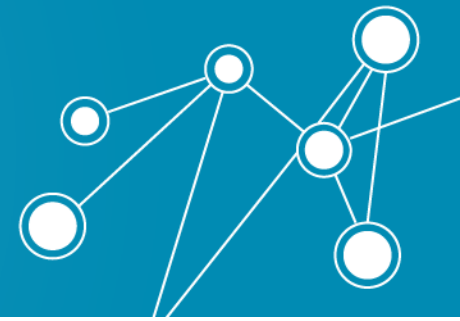
Built gradually, 1890s-present.

# Game of Floods – Resilience Harbor



- Assign a role card to each team member; advocate for your assets!
- Review your climate change scenario
  - Sea level rise (12”, 24”, or 36” SLR)
  - Increased precipitation
- Review your planning horizon (2050 or 2100)
- Review game board and prioritize assets that you (in your role) want to consider (choose 6-8)
- Review asset condition cards for info about each asset
- Identify climate impacts to those assets & their vulnerability
- Develop near-term and long-term adaptation plan and costs
- Each team has \$50M budget

# Game of Floods – Resilience Harbor



## Group A – Kristin

**Planning Horizon: 2050**

**Climate Scenario: 12” SLR and  
20% increase in precipitation**

**Budget: \$50 M**

## Group B – Lisa

**Planning Horizon: 2050**

**Climate Scenario: 12” SLR and  
20% increase in precipitation**

**Budget: \$50 M**

## Group C – Claire

**Planning Horizon: 2050**

**Climate Scenario: 24” SLR and  
20% increase in precipitation**

**Budget: \$50 M**

## Group D – Tracy

**Planning Horizon: 2100**

**Climate Scenario: 36” SLR**

**Budget: \$50 M**

# Acknowledgements

- Training was developed through a generous grant from the USDN Innovation Fund. The project was conceived and managed by Kristin Baja, City of Baltimore, and Tracy Morgenstern, City of Seattle, and developed and produced by AECOM.
- Thanks to staff from the cities of Baltimore, Fort Lauderdale, Providence, Seattle, Toronto, and Vancouver for helping to develop and pilot the training.

