More holistic planning for long-term coastal resilience? Port of Providence Demonstration Project

Prof. Austin Becker
Dept. of Marine Affairs -- University of Rhode Island

Green Boats and Ports for Blue Waters III Workshop
URI
April 4, 2016

THINK BIG WE DO

THE UNIVERSITY OF RHODE ISLAND

How can a more holistic approach to planning reduce climate risks within the environmental, social, economic, and political landscape?

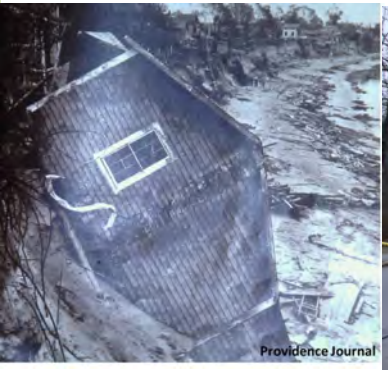
- Framing the problem
- Our team's approach
- Use of three boundary objects
- Discussion/results/next steps

RI DOT

U.S. Department of Transportation
Federal Highway Administration

urit
uri transportation center

Coastal hazard challenges for Rhode Island



Doubling of Cat 4 and 5 tropical storms

1-in-100 year storm event of today

Sea levels to rise 0.[illegible]1.9 meters by 2100

1-in-3 year storm event of 2100

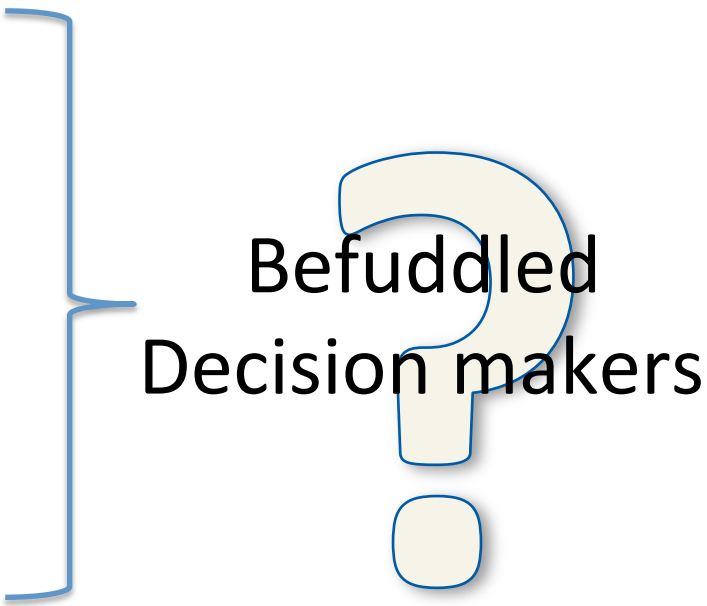
Inland flooding

(Bender et al. 2010; Grinsted et al. 2013; Rahmstorf 2010; Emanuel 2013; IPCC 2012; Tebaldi et al. 2012)

Coastal Hazards - A Wicked Problem

- *Complex issue that defies complete definition*
- *No formal solutions*
- *Any resolution generates further issues*
- *Solutions are neither good nor bad, but the best that can be done at the time.*

Uncertain rates of change
Feedback loops
Misaligned incentives
Unclear funding streams
Complex adaptation options



(Rittel and Webber 1973; Brown et al. 2010)

(Ward 2001; Bryson 2004; Few, Brown, and Tompkins 2007; Chapin et al. 2010; Tompkins, Few, and Brown 2008)

Tools to Stimulate Transformational Thinking

- *Maps, repositories, performances, software tools, etc.*
- *Allow groups with different perspectives, backgrounds, or motivations to work together without prior consensus*
- *Jumpstart dialogue, lead to co-production of strategies, more successful policy and implementation*

- Understand and comment on storm scenario & consequences
- Review long-range transformational resilience concept
- Review possible long-range "resilience goals" for the port and weigh importance of each using multi-criteria decision support tool

(Star 2010; Star and Griesemar 1989)

Port of Providence

1500 Acres

30 businesses

46th port in US

~3000 jobs

Methodology

Guided by steering committee

½ Day workshop

- *15 private sector*
- *12 public sector (local, state, fed)*
- *2 research/academia*

Introduced three boundary objects and discussion

USACE, 2013, 2012; FXM Associates, 2008; 4Ward Planning, 2015


COSCO
DRAKE


MFI


SIMS
METAL

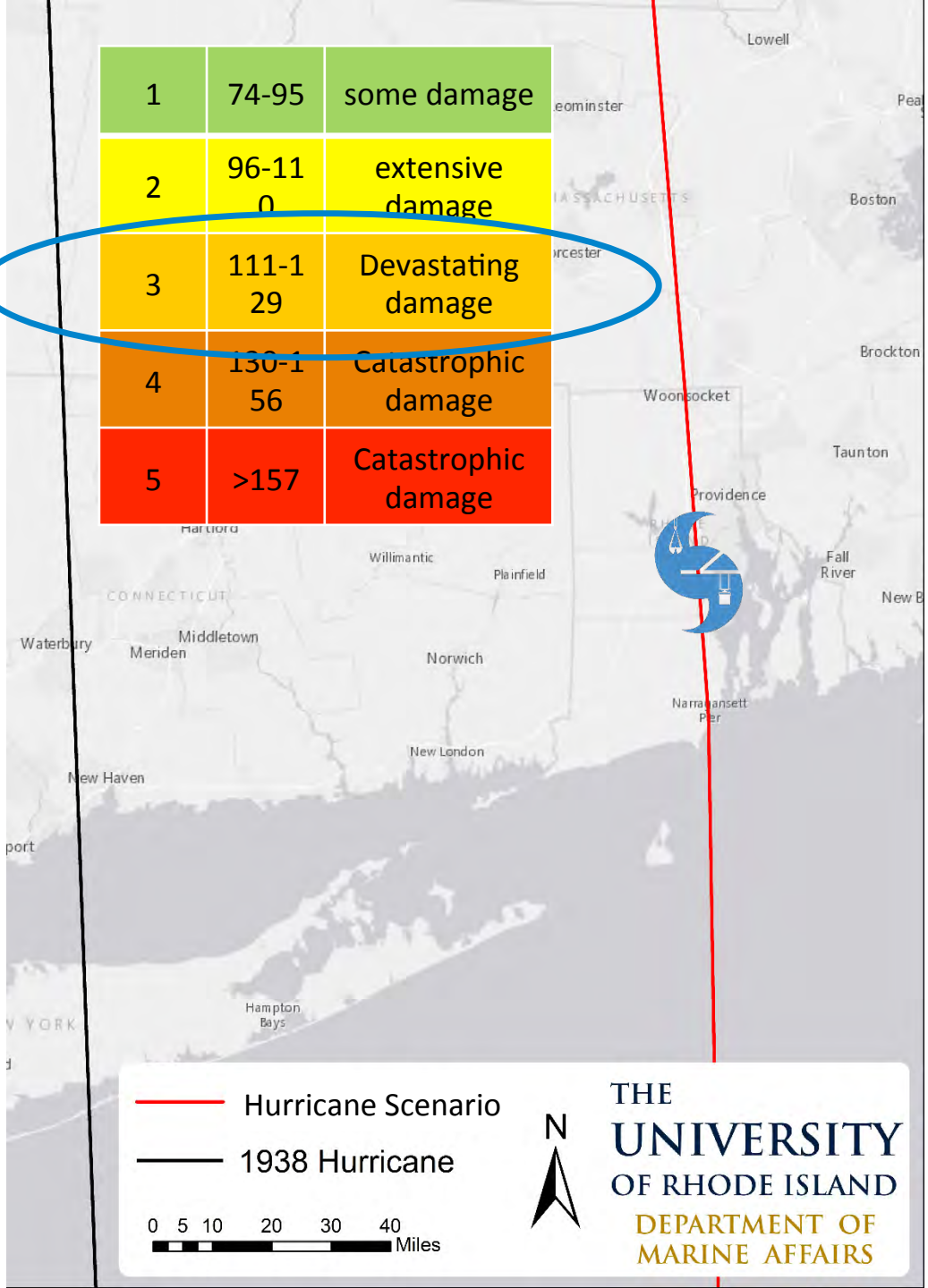
Tool 1

Storm Visualizations

What are the cascading consequences?

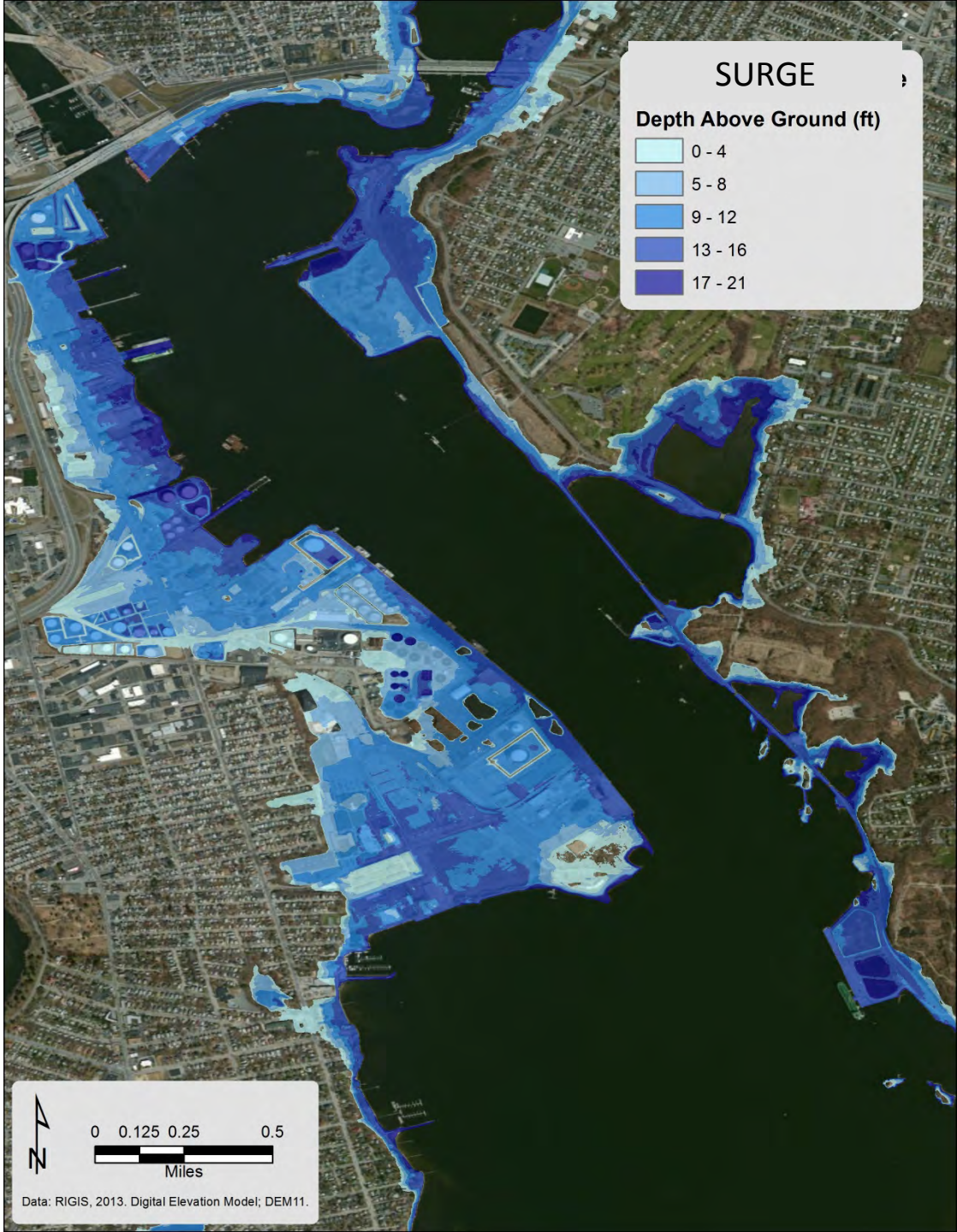
Cat 3 Scenario

- ‘Direct hit’
- 1938 hurricane, but shifted ~ 80 mi East
- Superstorm Sandy without the ‘left hook’

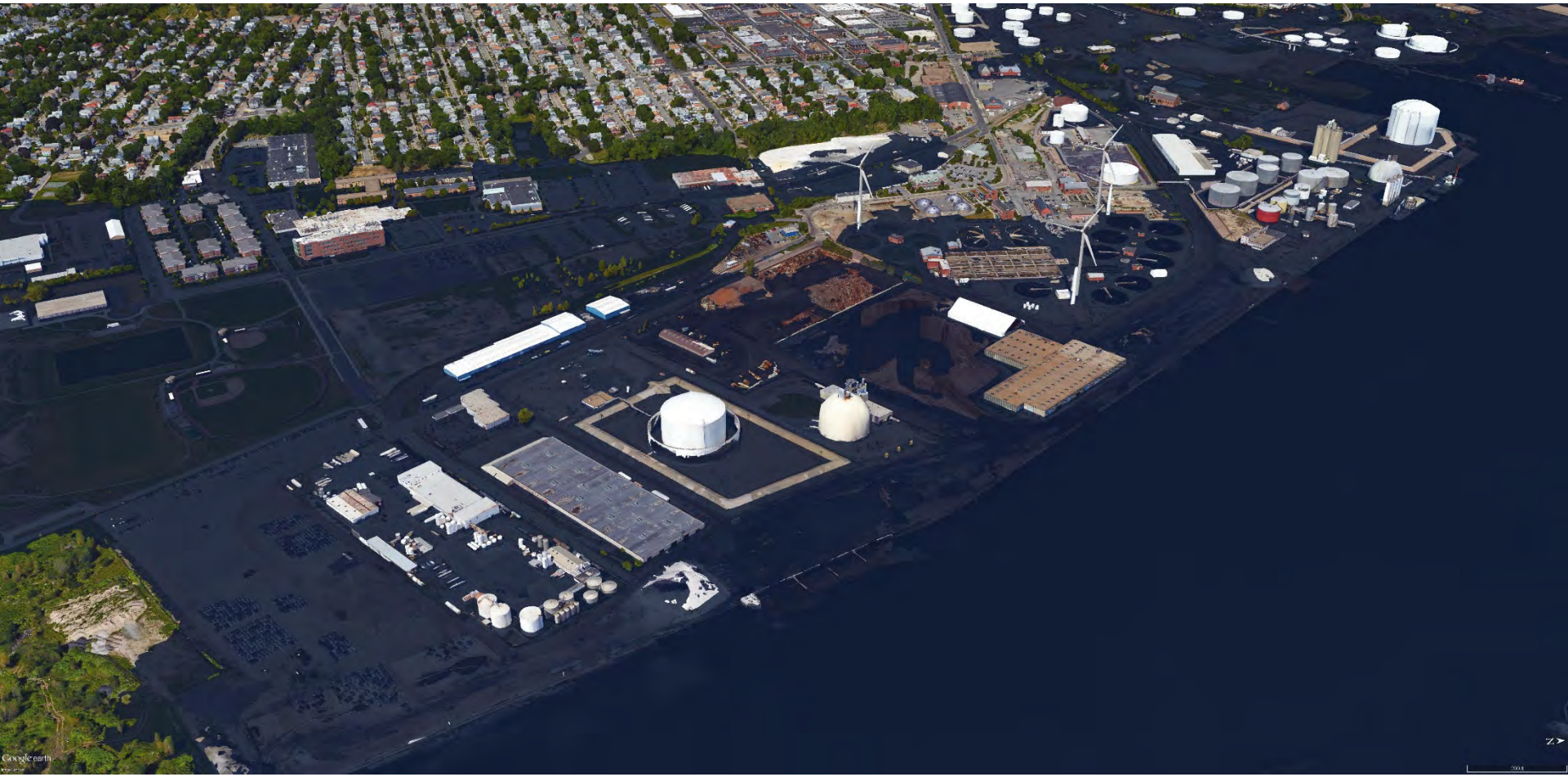


- GIS Visualization of 21 ft “bathtub” inundation
- Assumes Fox Point Barrier not overtopped
- Only shows passive level of surge
- Does not show expected 6-10’ wave action

Based on RIGIS, 2013 DEM derived from a 1-meter resolution digital elevation model originally produced as part of the Northeast LiDAR Project in 2011.



Example Visualization: ProvPort



Example Visualization: Metals Recycling, Inc.

Example Visualization: Motiva Enterprises

Example Visualization: Sprague Energy

Example Visualization:
Wilkes-Barre Pier (Capital Terminals, E. Providence)

Key Impacts of Hurricane

Weeks	Loss of critical facilities cripples business Energy supply compromised (hospitals, institutions, etc.) Raw wastewater discharge Debris cleanup, debris obstructions, debris as battering ram
Months	Damaged roads and rail disrupt commerce Debris/sedimentation require surveying, restrict navigation Bulkhead/pier damage result in permitting delays & repair Erosion of riverbank leads to sediment loading of deep channel
Years	Long-term environmental impacts to Narragansett Bay Economic impacts, but little clarity over their nature Risks to competiveness of port if perceived as vulnerable to storms Increase in insurance rates could force business to leave

Tool 2 –
Long-term resilience planning concepts

Introduce and discuss three "transformational concepts"

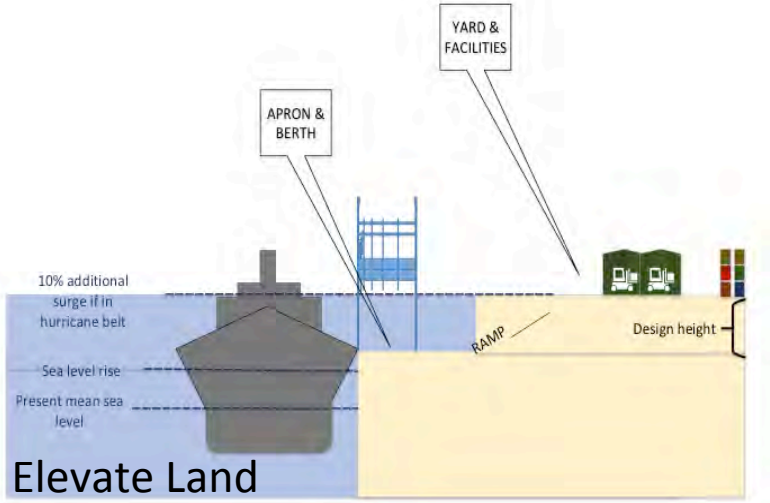
"…Those that are adopted at a much larger scale or intensity, those that are truly new to a particular region or resource system, and those that transform places and shift locations."

(Kates, Travis, and Wilbanks 2012, p. 7156; Cheong 2011; J. Dronkers, J. Campbell, and Spradley 19

1. Accommodate –

Site-specific improvements to increase resilience

Elevate Utilities and Generator



Elevate Land

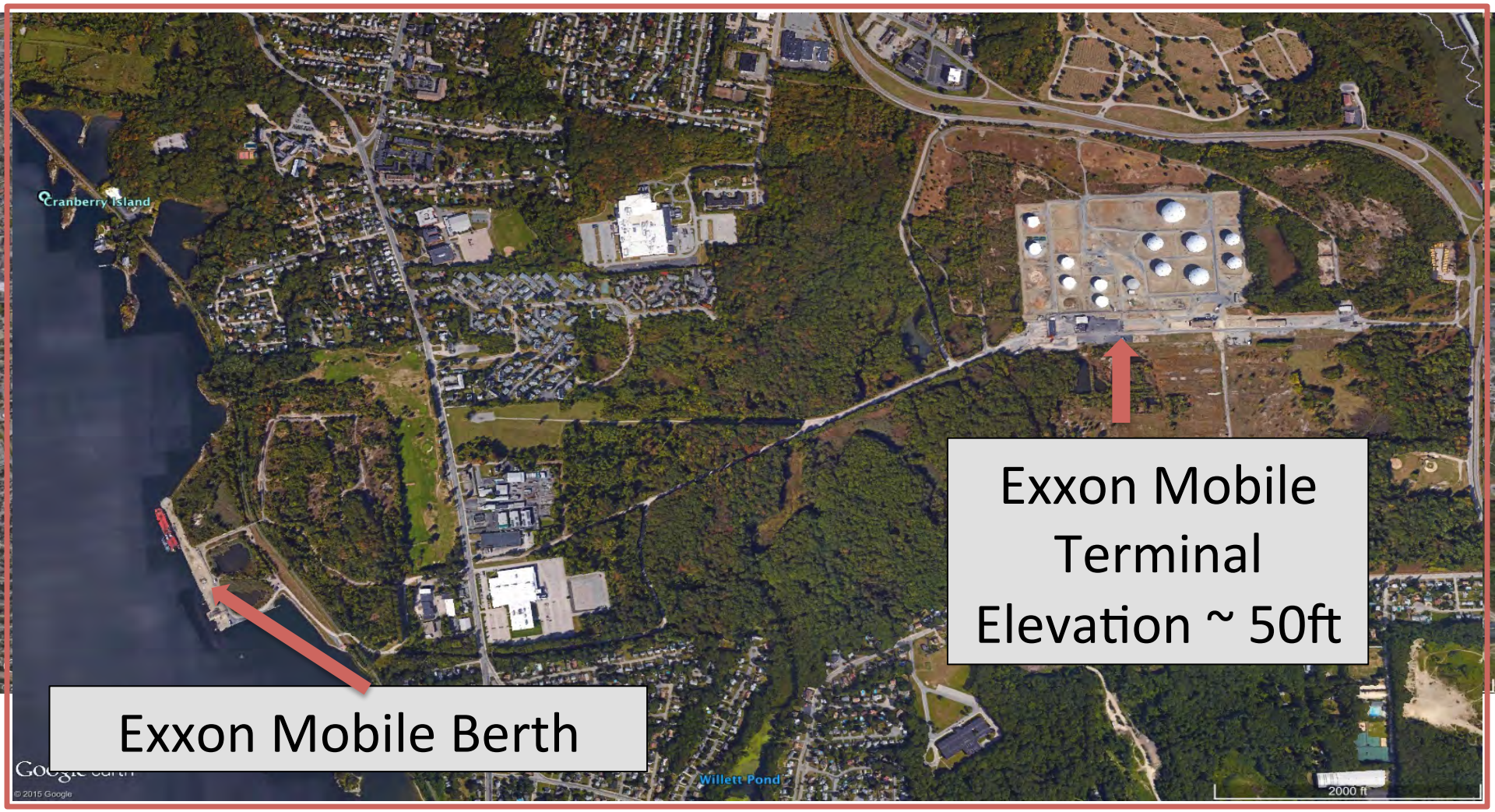
Flood berms

https://www.walthers.com/prodimage/0933/09330000003168.gif

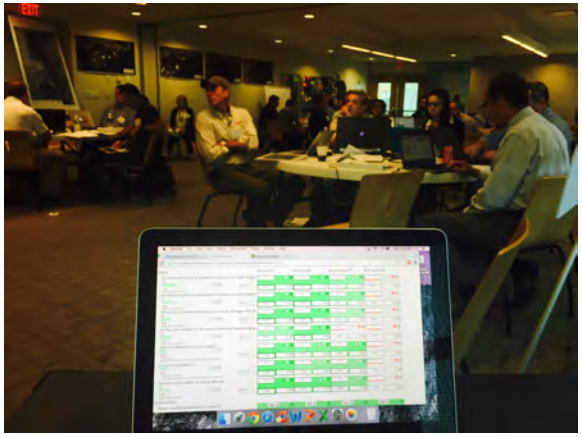
Flood proof

2. Relocate –

Move port uses to less vulnerable location.



3. Protect –
New storm barrier for Providence Harbor.



Tool 3

Wecision

http://www.wecision.com/

1) How well does each concept meet each "resilience goal"?
2) How important is each goal to you?

- Ensure post-hurricane **business continuity** for waterfront business
- **Minimize hurricane damage** for infrastructure and waterfront business
- Minimize hurricane-related **environmental damage** from port uses.
- Build **public support** for port resilience
- Minimize **hazard insurance** rates
- Foster **port growth**
- Protect **human safety & critical lifelines**

Protect

18.71

- Ensure post-hurricane business continuity for water front business — 4 1-5
- Minimize huricane to damages to infrastructure and waterfront businesses — 4 1-5
- Minimize hurricane-related environmental damage from port uses — 4 1-5
- Build public support for hurricane resilience measures &
- Minimize hazard insurance rates
- Foster port growth — 4 1-5
- Protect human safety & critical lifelines — 5 1-5

Relocate

13.41

- Ensure post-hurricane business continuity for water front business — 4 1-5
- Minimize huricane to damages to infrastructure and waterfront businesses
- Minimize hurricane-related environmental damage from port uses — 4 1-5
- Minimize hazard
- Foster port growth — 3 1-5
- Protect human safety & critical lifelines — 4 1-5

Accomodate

8.79

- Ensure post-hurricane business continuity for water front
- Minimize huricane to damages to
- Minimize hurricane-related environmental
- Build public support for hurricane
- Minimize hazard
- Foster port growth — 3 1-5
- Protect human safety & critical lifelines — 3 1-5

Do Nothing

1.16

- Build public support for hurricane

20

10

0

Preliminary findings

- **No long-term plan** for major hurricane events
- Difficult to entice private business to participate when **next steps are not clear**
- **No clear champion** (gov't or private) to take the lead on long-term planning
- Stakeholders found it difficult to engage, as **costs were not addressed**
- **Boundary objects effective,** percolating through system, need some improvements

Research Team

Leads

Evan Matthews, Port of Davisville, Chair of Steering Committee
Dr. Austin Becker, URI, Project co-lead
Dr. Rick Burroughs, URI, Project co-lead
Dr. John Haymaker, Area Research, Wecision lead
Mark Amaral, Lighthouse Consulting, Workshop Facilitator

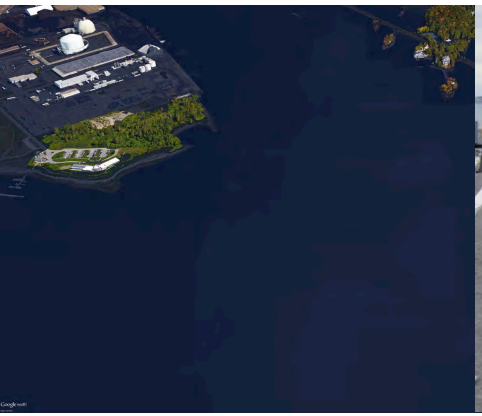
Steering Committee

Dan Goulet, CRMC
Corey Bobba, FHWA
Dr. Julie Rosatti, USACE
Katherine Touzinsky, USACE
Pam Rubinoff, CRC/RI Sea Grant
Kevin Blount, USCG
Bill McDonald, MARAD
Meredith Brady, RIDOT
John Riendeau, CommerceRI
David Everett, City of Providence Dept. of Planning
Chris Witt, RI Statewide Planning

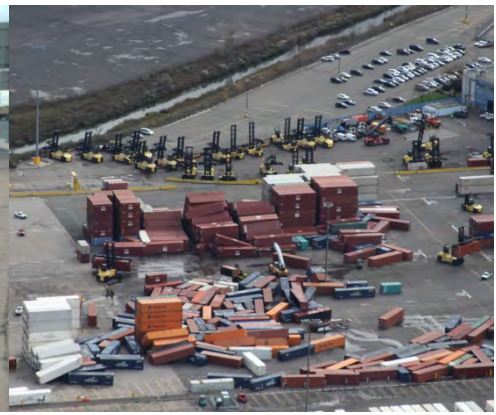
Students

Eric Kretsch, Julia Miller, Duncan McIntosh, Emily Humphries, Peter Stempel, Emily Tradd, Nicole Andrescavage, Zaire Garrett, Brian Laverriere, LAR 444 Class

Questions?







Hurricane Sandy photos courtesy Mary Lee Clanton, Port of NYNJ

Austin Becker, PhD
e: abecker@uri.edu | p: 401-874-4192 | w: web.uri.edu/abecker

www.portofprovidenceresilience.org

RI DOT | U.S. Department of Transportation Federal Highway Administration | urit uri transportation center

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Extra Slides Below

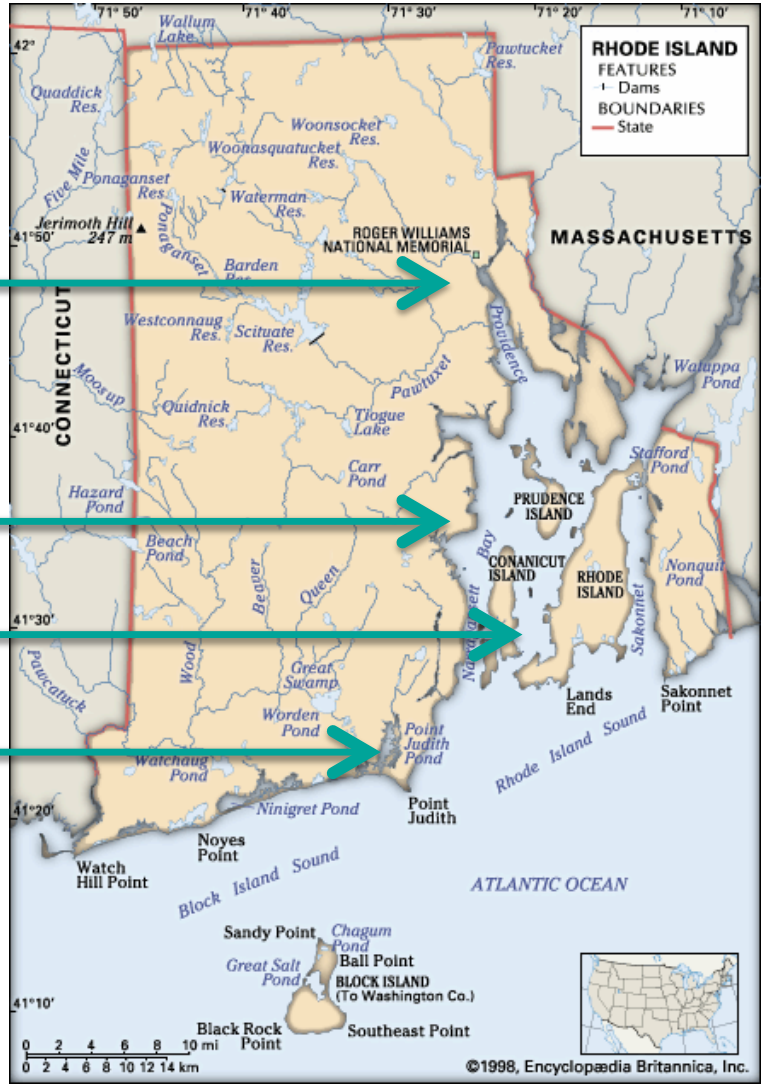
The Ports of Rhode Island

Providence

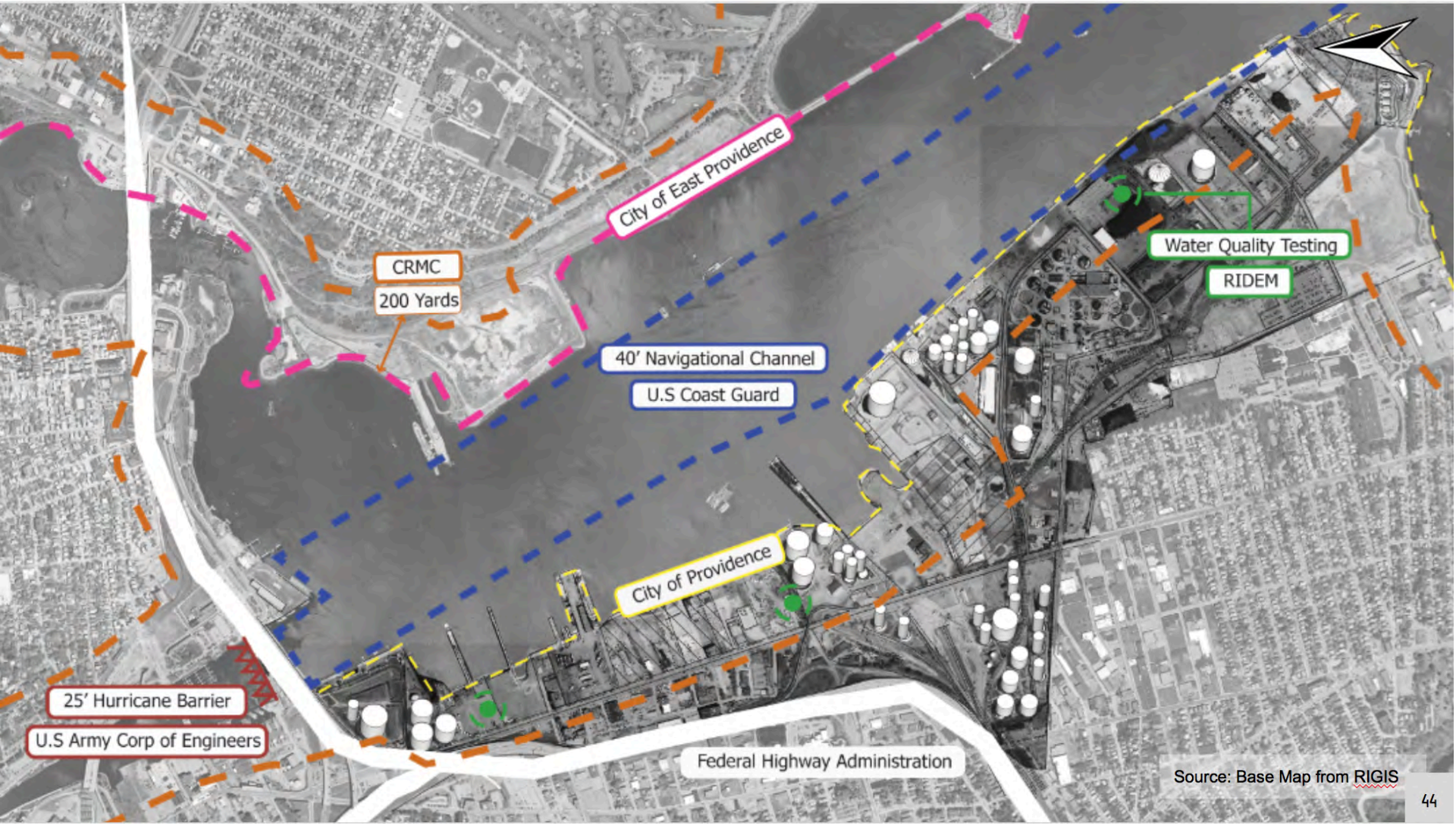
Quonset/Davisville

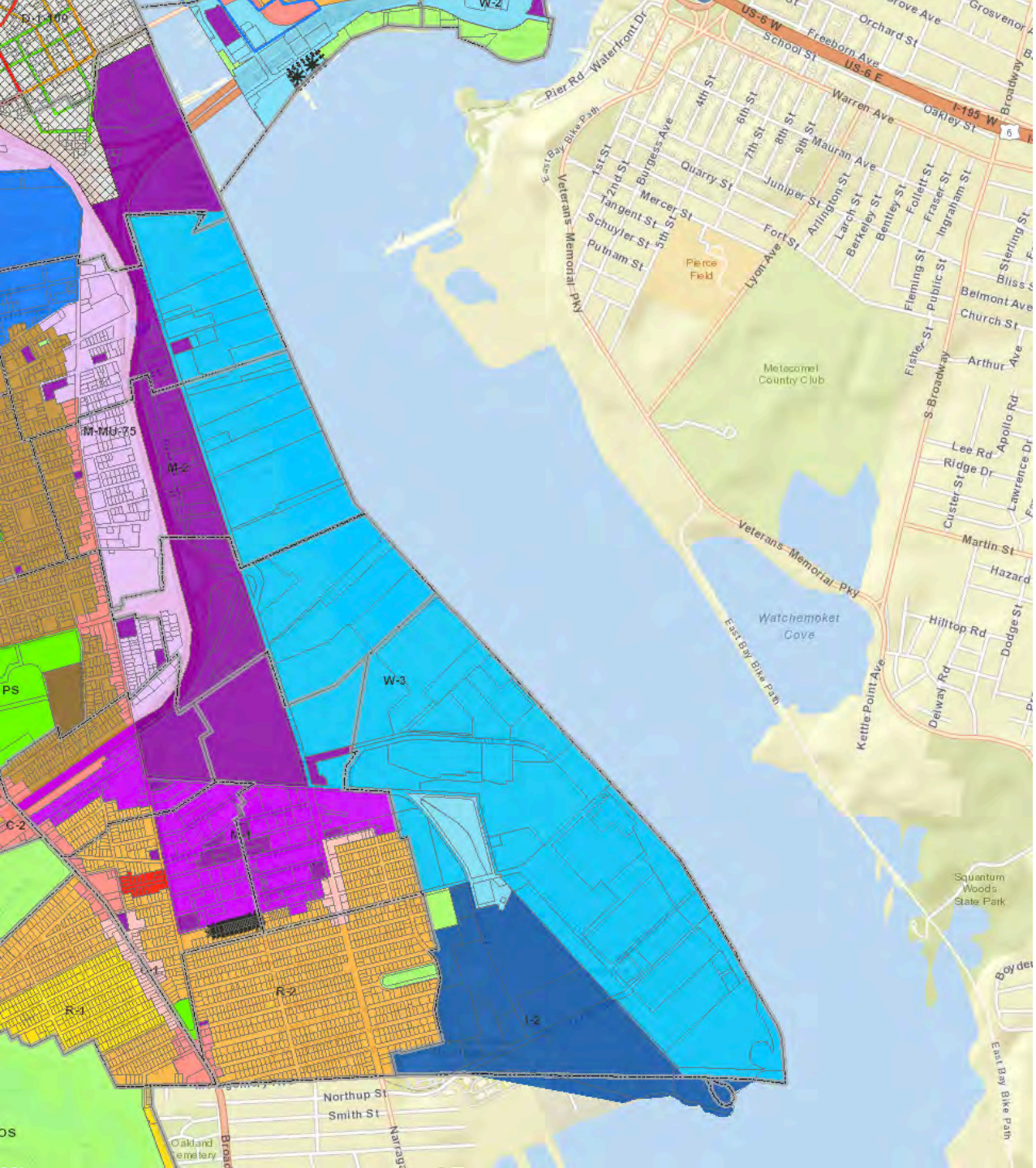
Newport

Point Judith




Save the Bay
Vacant Lot
EUKOR Auto
UNIVAR
Enterprise Terminal
Lehigh Terminal
Schnitzer Northeast
Washington Mills
Wastewater Facility
Hudson Liquid Cement
International Salt
New England Petroleum
National Grid
Vacant Lot
Providence & Worcester Rail
Motiva Enterprises
R.I Recycled Metals
Miscellaneous
Sims Metal Management
Gansett Improvement
Conley
Active Terminal
Sprague Energy
Collier Park
Providence Steam Boat
Hurricane Barrier
Johnson & Wales University
Fueling Station
Utilities
Athletic Fields
Honey Dew Donuts
Hush Night Club
Cheater's
Sources:
Google Maps
ProvPort.com
Dr. Becker
0 500 1,000 2,000 Feet

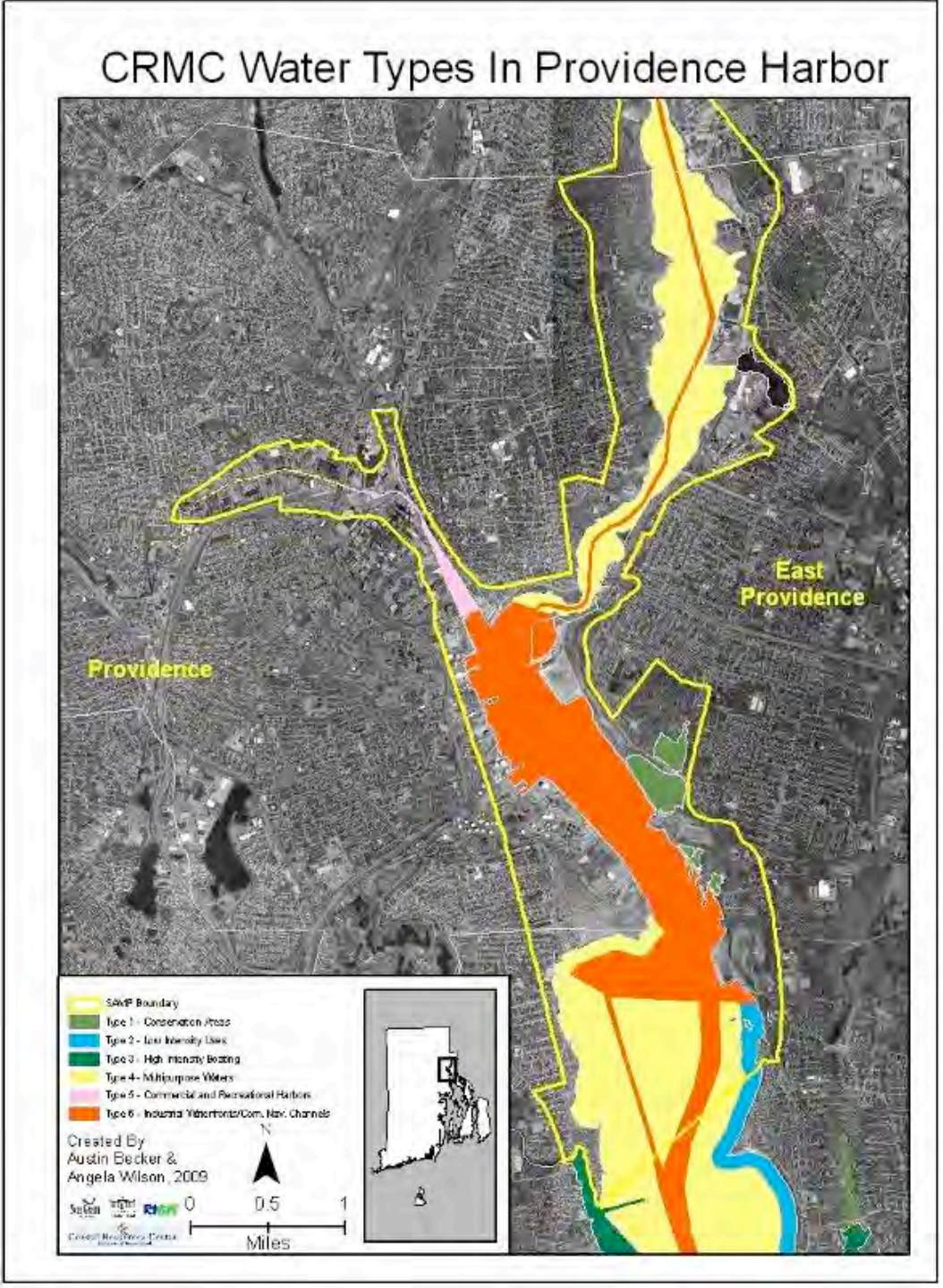

City of East Providence
CRMC
200 Yards
Water Quality Testing
RIDEM
40' Navigational Channel
U.S Coast Guard
City of Providence
25' Hurricane Barrier
U.S Army Corp of Engineers
Federal Highway Administration
Source: Base Map from RIGIS



The W-3 Port/Maritime Industrial Waterfront District is intended to promote maritime industrial and commercial uses within the areas of Providence's waterfront, protect the waterfront as a resource for water-dependent industrial uses, and facilitate the renewed use of a vital waterfront.

All permitted and special uses shall be part of a marine enterprise or dependent on access to the water.

There are still some grandfathered uses that do not meet this standard.



Type 6: Industrial Waterfronts and Commercial Navigation Channels

Areas that are used to accommodate commercial and industrial water-dependent and water-enhanced activities

REIMA Flood Mapping Tool

Providence County Effective Flood Zones

- 0.2 Percent Annual Chance Flood Zone
- A
- AE
- Floodway
- AH
- AO
- VE

Zone	Description
0.2%	Areas of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. Also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year floods, shallow flooding areas with average depths of less than one foot, or drainage areas less than 1 square mile.
A	Areas with 1% annual chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths or base flood elevations are shown within these zones.
AE	The base floodplain where base flood elevations are provided.
AH	Areas with 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
AO	River or stream flood hazard areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
VE	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood evaluations derived from detailed analyses are shown at selected intervals within these zones.

The Port of Providence

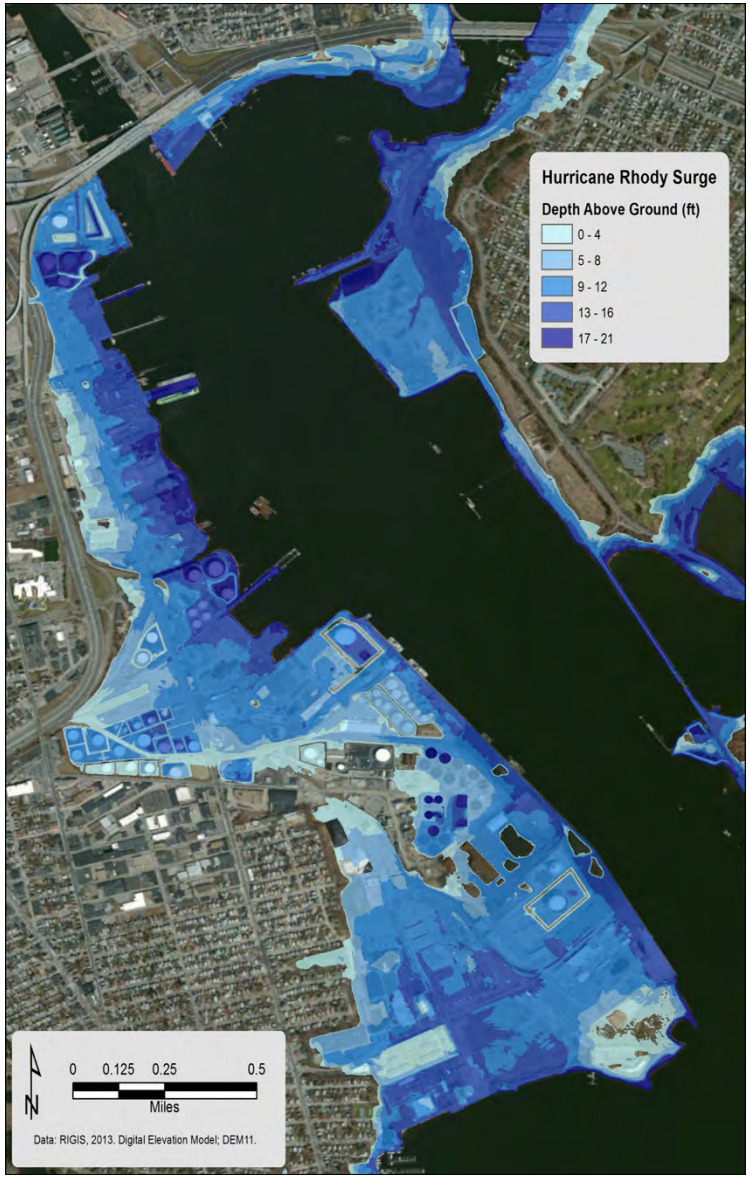
- $340 Million in economic benefits to RI (2008)
- 744 jobs (2008)
- ProvPort: 1,722 Jobs (2015); $211.5 Million output
- Average Salary ~$54,00 year

Long Term Resilience Strategies

1. **Do Nothing** – No change to port resilience.
2. **Accommodate** –Improvements to current port infrastructure to increase resilience.
3. **Relocate** – Moving port uses to less vulnerable location.
4. **Protect** – New storm barrier for Providence Harbor.

Discussion -> goals and preferences

1. Do Nothing –
No change to port resilience



Advantages

- Low/no upfront costs
- No disruption until storm event(s) occur
- Easy
- Allows for investments in other priorities

Disadvantages

- Major catastrophe after each storm event
- Businesses leaving the State
- Major environmental damage to Narragansett Bay
- Channel closing for weeks/months
- Impacts to state's energy supplies

1. Do Nothing – No change to port resilience

2. Accommodate –

Site-specific improvements to increase resilience

Advantages

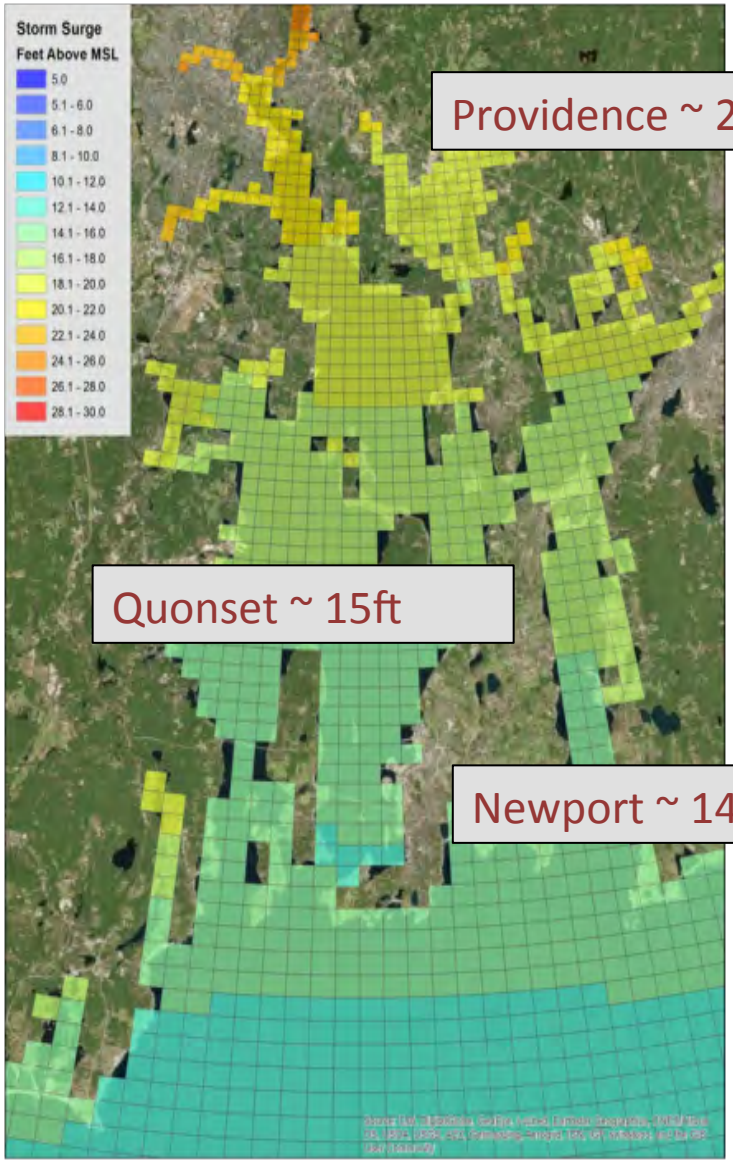
- Costs can be incremental
- Site-specificity
- Low-cost options
- Single business could improve its own resilience
- Could address SLR
- Does not disrupt port system as a whole

Disadvantages

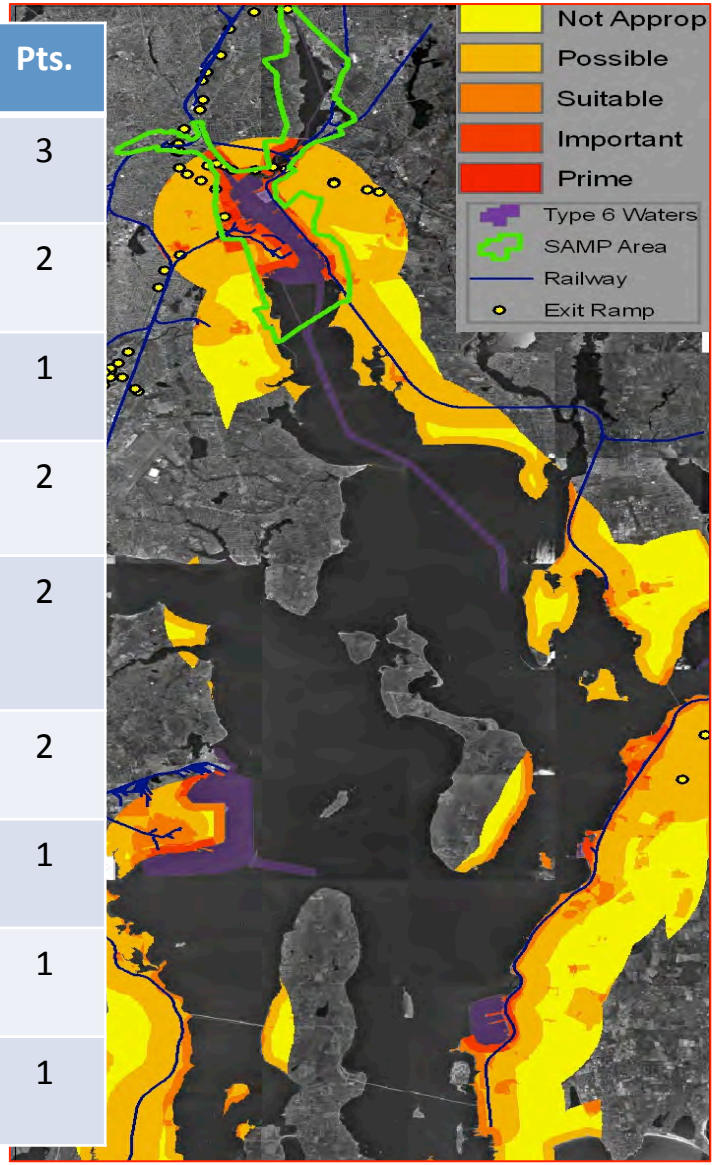
- Limited in ability to protect against major storm
- Does not address interdependent uses
- Storm could result in high levels of environmental damages
- Few tested examples for industrial waterfronts
- Less likely to protect navigation channel from debris

3. Relocate

Move port uses to less vulnerable location.



Characteristic	Pts.
1000’ from >40’ water	3
1000’ from 30-40’ water	2
1000’ from 10-20’ water	1
1000’ from Type 6 waters	2
Current land use industrial	2
Current land use vacant	2
Industrial zoning in place	1
>1 mile from highway exit	1
<1000’ from rail line	1



3. Relocate – Moving port uses to less vulnerable location.

Advantages

- Removes hazardous materials from floodplain
- Tested strategy has been implemented elsewhere
- Opens floodplain as public waterfront space and/or environmental remediation
- Can account for SLR
- Reduces debris in navigation channel after storm
- Improves water quality to Providence Harbor

Disadvantages

- Disrupts port network
- Limited land availability
- High costs
- May impact communities around relocation sites
- Complexities from dependence on utilities (e.g., pipelines, rail, highway)
- May displace environmental damages to other places

4. Protect –
Storm barrier for Providence Harbor.

Advantages

- Protects during all major events
- New public uses can be integrated (e.g., on berm)
- Does not disrupt shipping
- Creates safe harbor for new business
- Tested solution
- Very long term solution
- Frees up land in City through removal of current barrier system

Disadvantages

- Impacts of sea level rise are not addressed
- May impact tidal flows (water quality)
- Impacts sediment flow, water quality, discharge from watershed (sedimentation of navigation channel)
- High upfront costs
- May impact view of Bay
- May require pumping due to increased freshwater flows

RESILIENCE GOALS REVIEW

1. Ensure post-hurricane business continuity for waterfront business
2. Minimize hurricane damage for infrastructure and waterfront business
3. Minimize hurricane-related environmental damage from port uses.
4. Build public support for hurricane resilience measures & port operations
5. Minimize hazard insurance rates
6. Foster port growth
7. Protect human safety & critical lifelines

CONCEPTS	*G1*	*G2*	*G3*	*G4*	*G5*	*G6*	*G7*
Protect							
Relocate							
Accommodate							
Do Nothing							

Aug. 3 Workshop Agenda

Scenarios

a. Super Storm Sandy and the PNYNJ
b. What the science says could happen in Providence
c. Consequences of Cat 3 in weeks/months/years

Long term resilience concept alternatives

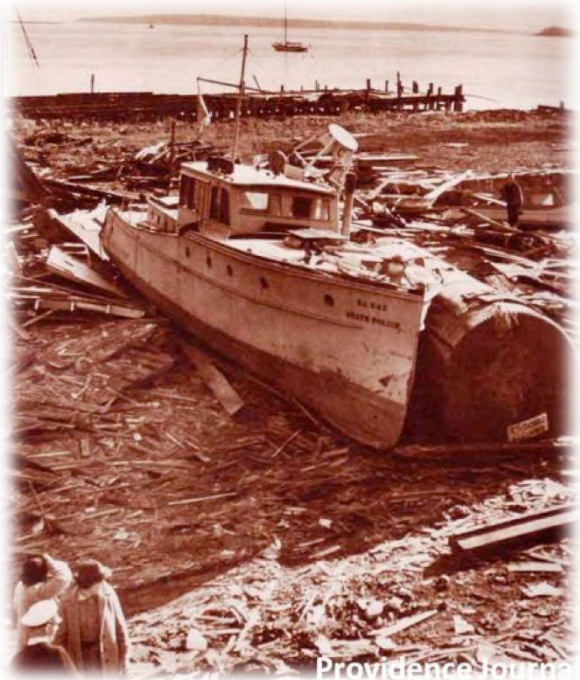
a. Present Wecision tool
b. Three long term resilience concept alternatives
c. Compare proposed long term resilience goals to concept alternatives

Conclusion

Adjourn for cocktails (Sponsor: Providence Working Waterfront Alliance)

Rhode Island Hurricanes: Historical Record

- 37 hurricanes within 50 mi of RI since 1851
- ≈ 4 year return period
- ≈ 22.8% chance of hurricane per year




RELIANCE
MATTHEW McALLISTER

Exxon Mobile (E. Providence)

Save the Bay Center
8-3-15
28 participants

Photos: John Haymaker