

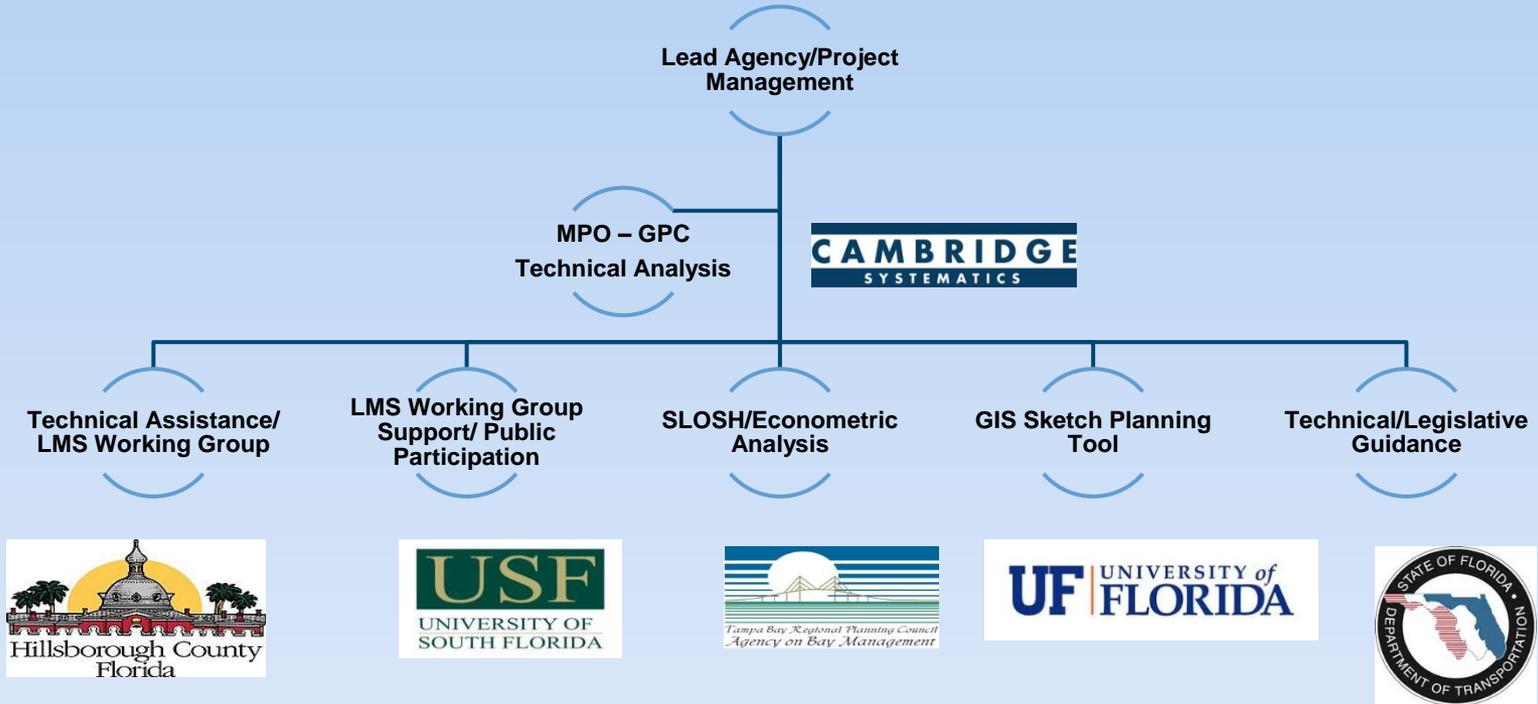
# Hillsborough County MPO Adaptation Pilot Project & LRTP Update

Presented to:

One Bay - Resilient Communities Working  
Group  
October 3, 2014



# Project Partners



# Project background

- **FHWA Pilot:** Climate change vulnerability assessment and adaptation analysis, focused on the transportation sector.
  - » *Sponsored by the Federal Highway Administration (competitive grant)*
- **LRTP update:** Reduce Crashes & Vulnerability investment program
- Both led by HC MPO/Planning Commission, with partners
- Expected completion: September 2014 (on schedule)
  - » *Started in August 2013*

# ***Pilot Scope/Assessment Process***

- ④ *Collect data, identify potential extreme weather vulnerabilities*
- ④ *Identify critical, vulnerable infrastructure (5-10 high-risk assets) for adaptation*
- ④ *Develop adaptation (risk mitigation) strategies for a selection of high-risk assets*
- ④ **Phase 4: Document findings, recommendations, feedback to FHWA [currently underway]**

# L RTP Scope/Assessment Process

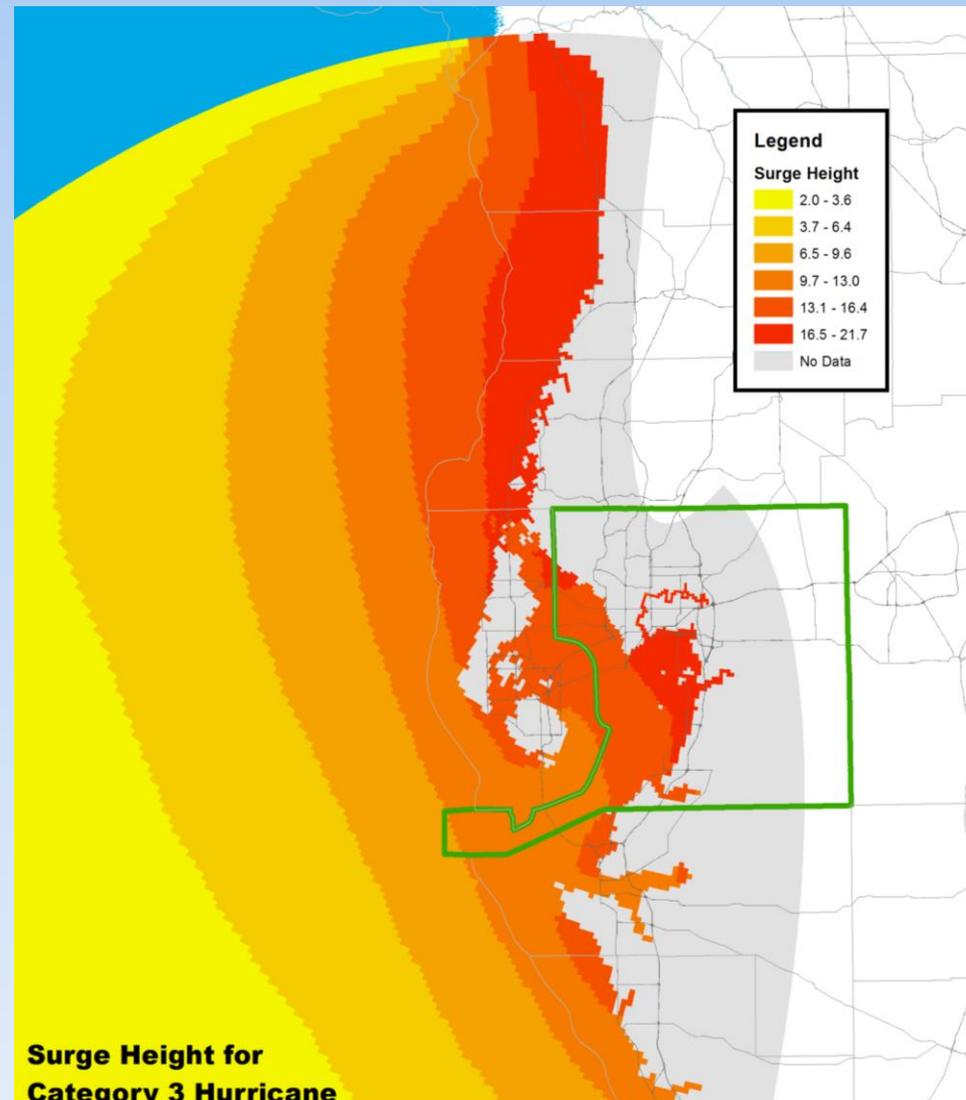
- ① *Develop risk scenario (storm surge)*
- ② *Assess potential disruption impacts*
- ③ *Develop adaptation (risk mitigation) scenarios*

The screenshot displays the 'Investment Programs' step (3) of the L RTP software interface. A pop-up window is overlaid on the main content, providing instructions: 'Now that you've selected growth strategies, it's time to set priorities for infrastructure. You have a limited budget to spend on four transportation programs:'. The pop-up lists four programs with corresponding icons: 'Preserve the System' (blue car icon), 'Reduce Crashes & Vulnerability' (orange triangle icon, highlighted with a blue border), 'Minimize Traffic for Drivers & Shippers' (green bus icon), and 'Real Choices When Not Driving' (purple person icon). Below the list, the pop-up says 'Save some money for the Projects page!' and 'For simplicity, the cost estimates and budget are shown in millions of present-day dollars, for a 20-year period of spending. In each program the low investment level is based on current'. The background interface shows a navigation bar with 'WELCOME', 'PLANS', 'PROGRAMS', 'PROJECTS', and 'STAY INVOLVED'. The 'PROGRAMS' section is active, showing four program cards: 'Preserve the System', 'Reduce Crashes and Vulnerability', 'Minimize Traffic for Drivers and Shippers', and 'Real Choices When Not Driving'. A 'Comment' button is visible in the top right of the 'PROGRAMS' section.

# Step 1: Develop Risk Scenario

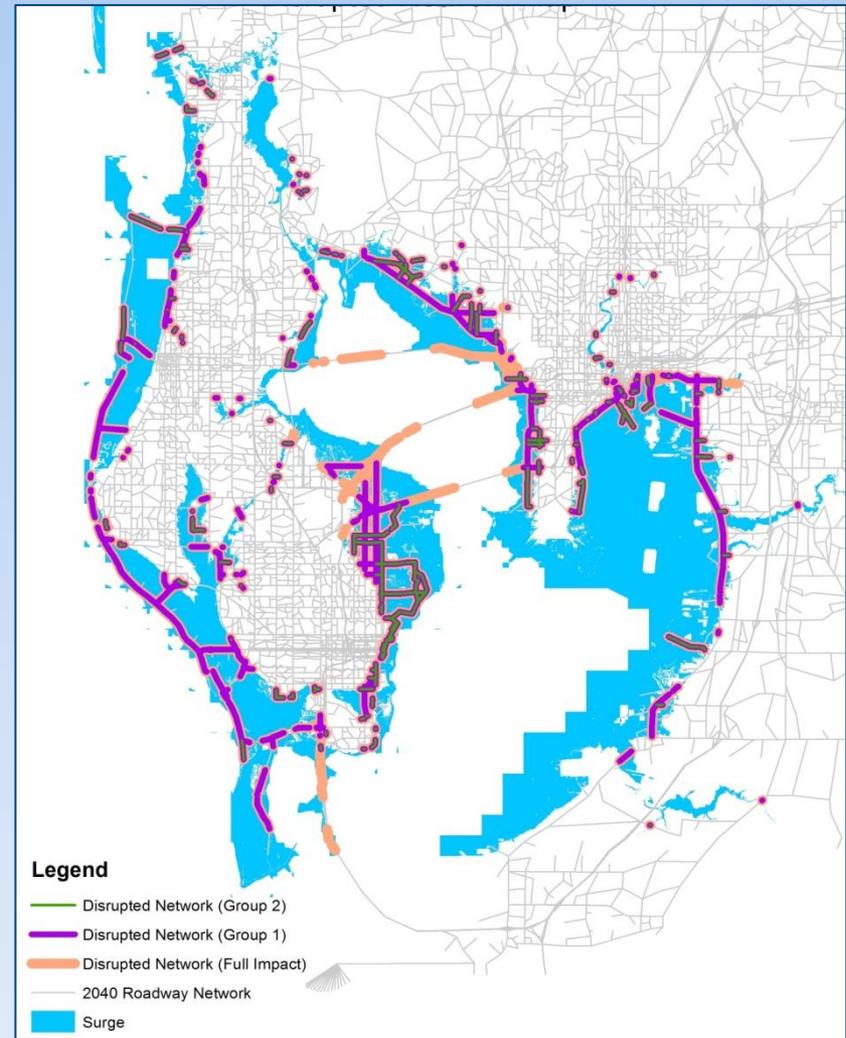
## » Simulated Category 3 storm surge

- Same category, trajectory as 1921 Tarpon Springs
- High tide
- Addition of sea level rise



# Step 2: Assess Potential Disruption Impacts

- » Simulation of phased recovery (post-storm surge)
- » Simulate travel disruption using TBRPM
- » Derive daily change in
  - Hours of delay
  - Miles travelled
  - Trips (lost)
- » Estimate range of potential disruption



# Step 2: Assess Potential Disruption Costs

- **Model economic costs of disruption**

- » Using REMI  
econometric model

- **Impacts are measured in terms of WEEKLY:**

- » Work hours
- » Income;
- » Gross Regional Product.

- **Results of full disruption (one week)**

- » \$109 million lost GRP
- » \$66 million lost income
- » 2+ million lost work hours

# Step 3: Risk Mitigation Investment Scenarios

	<b>Illustrative Mitigation Measures</b>		
Strategy Type	Baseline	Tier 1 (Interstates)	Tier 2 (Interstates & Arterials)
Limit <b>Exposure</b>	Maintain/manage as usual	Raise roadway profile <ul style="list-style-type: none"> <li>• Elevate profile, enhance crown</li> </ul>	
Mitigate <b>Sensitivity</b>		Shoreline protection <ul style="list-style-type: none"> <li>• Wave attenuating devices</li> </ul> Enhance roadway base	
Enhance <b>Adaptive Capacity</b> (recovery)		Increase drainage capacity <ul style="list-style-type: none"> <li>• Upgrade to flanking inlets, increase conveyance capacity</li> </ul>	

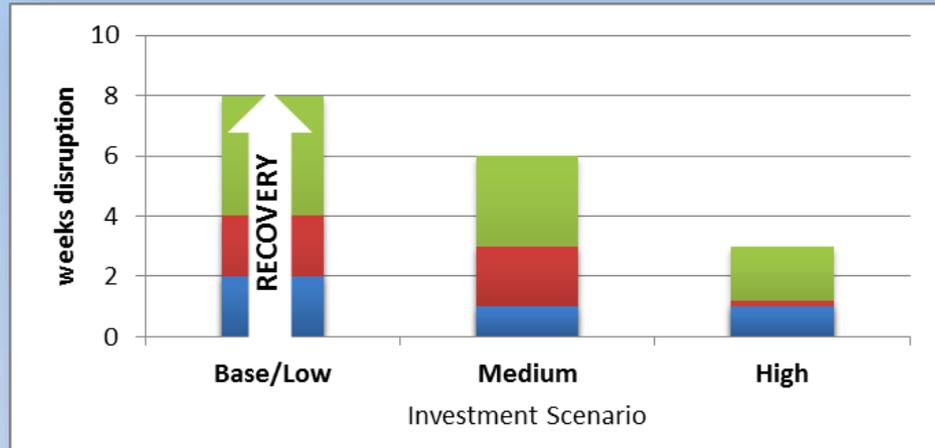
# Sample Strategy

## Wave Attenuating Devices (WADs)



# Estimated Risk Mitigation Benefits

**Illustrative result:**  
\$35 - \$82 million net benefit



Moderate Scenario	Base/Low Investment Level	Medium Investment Level	High Investment Level
Economic Loss	\$ 266,094,000	\$ 153,141,000	\$ 119,203,200
Avoided Loss	\$ -	\$ 112,953,000	\$ 146,890,800
Strategy Cost		\$ 31,000,866	\$ 111,932,281
<b>Net</b>	<b>\$ -</b>	<b>\$ 81,952,123</b>	<b>\$ 34,958,508</b>

Not NPV

# **Critical Assets for Pilot Assessment**

# Assets Studied

- Memorial Highway (Segment)
- South 20<sup>th</sup>/22<sup>nd</sup> (Segment)
- Selmon Expressway (Ramps)
- Gandy Boulevard (Segment)
- Courtney Campbell Causeway (Segment)
- I-75 over Alafia River (Bridge)\*

\* Not vulnerable under any studied flooding scenario

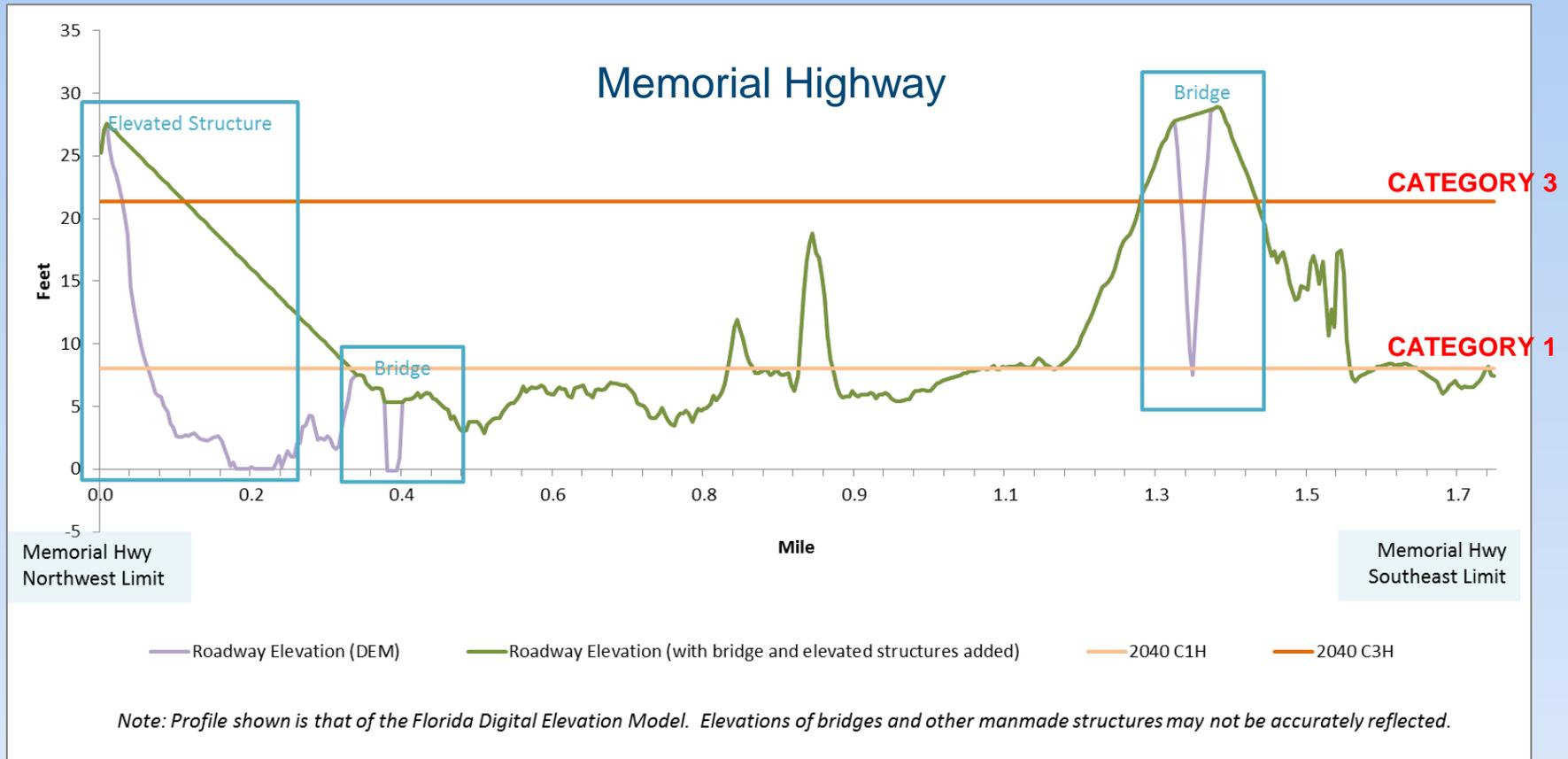
# Memorial Highway



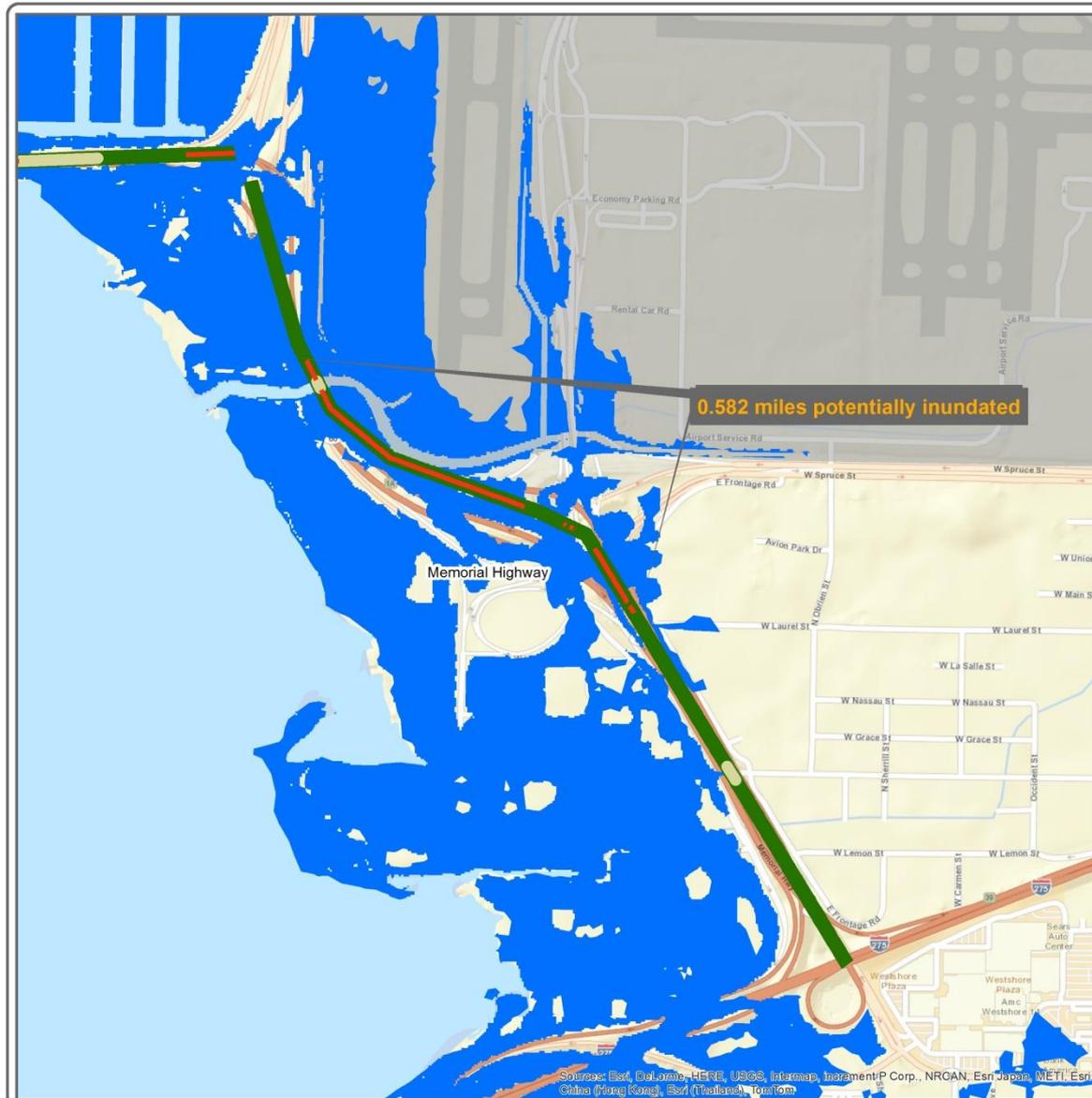
<b>Current Condition</b>	Multi-modal corridor between Pinellas and Hillsborough Counties
<b>Estimated Age (Lifespan)</b>	1964, 2005, 2010
<b>Use / Ridership</b>	158,000 AADT
<b>Estimated Replacement Cost</b>	Approx. \$164M*

*\*Estimated cost is based on 2010 project, which was larger in scope than the 1.76 miles studied here.*

# Inundation Profile



# Inundation with Cat 1 Surge



Jurisdiction (Unincorporated Hillsborough County, Tampa, Plant City, Temple Terrace)

## HILLSBOROUGH COUNTY VULNERABLE ASSETS SENSITIVITY ANALYSIS

### Legend

- 2040 SLR with Cat 1 Surge Exposure
- Bridges
- Asset Extent
- Potential Area of Inundation (Cat 1)

### Location Diagram and Reference Information



DATA SOURCES: Hillsborough County MPO, Cambridge Systematics, Hillsborough County GIS and Florida Geographic Data Library

MAJOR ROADS: See Adopted MPO Long Range Transportation Plan for specific improvements.

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This map is for illustrative purposes only for the cities of Tampa, Temple Terrace and Plant City.

Author: Hillsborough County Metropolitan Planning Organization

Date: 5/28/2014



For more information about our organization visit website: [www.theplanningcommission.org](http://www.theplanningcommission.org)

Sources: Esri, DeLorme, HERE, USGS, Intermap, iPlanet, P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), Swisstopo

# Inundation with Cat 3 Surge



Jurisdiction (Unincorporated Hillsborough County, Tampa, Plant City, Temple Terrace)

## HILLSBOROUGH COUNTY VULNERABLE ASSETS SENSITIVITY ANALYSIS

### Legend

- 2040 SLR with Cat3 Surge Exposure
- Bridges
- Asset Extent
- Potential Area of Inundation (Cat 3)

### Location Diagram and Reference Information



DATA SOURCES: Hillsborough County MPO, Cambridge Systematics, Hillsborough County GIS and Florida Geographic Data Library

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# Inundation with FEMA 1% Chance Flood



Jurisdiction (Unincorporated Hillsborough County, Tampa, Plant City, Temple Terrace)

## HILLSBOROUGH COUNTY VULNERABLE ASSETS SENSITIVITY ANALYSIS

### Legend

 Flooding Exposure (FEMA 1% Chance Flood)

 Bridges

 Asset Extent

### Potential Area of Inundation (FEMA 1%)

#### Flood Zone

 A

 AE

 VE

### Location Diagram and Reference Information



DATA SOURCES: Hillsborough County MPO, Cambridge Systematics, Hillsborough County GIS and Florida Geographic Data Library

MAJOR ROADS: See Adopted MPO Long Range Transportation Plan for specific improvements.

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# Estimated Impacts of Disruption

## Memorial Highway (Segment)

Trip Type	Attribute	Daily Change
Leisure Travel Data	Auto - VMT	68,409
	Auto - VHT	274,029
	Auto - Delay	266,660
	Auto - Lost Trips	0
Commute Auto Travel Data	Auto - VMT	51,313
	Auto - VHT	104,898
	Auto - Delay	99,977
	Auto - Lost Trips	0
Business/On-the-clock	Auto - VMT	100,049
	Auto - VHT	111,230
	Auto - Delay	106,929
	Auto - Lost Trips	0
Truck	Truck - VMT	7,495
	Truck - VHT	38,641
	Truck - Delay/Idling	37,626
	Truck - Lost Trips	0

## Estimated weekly losses

Gross Regional Product:

**\$15.8 MM**

Income:

**\$8.0 MM**

Work Hours:

**223,000**

# Potential Impacts and Mitigation Strategies

Scenario	Extent (miles)	Potential Impacts	Potential Mitigation Strategies
SLR	0.0	<ul style="list-style-type: none"> <li>n/a (unlikely)</li> </ul>	<ul style="list-style-type: none"> <li>n/a</li> </ul>
Cat 1	0.58		<ul style="list-style-type: none"> <li>Drainage improvements</li> <li>Raise profile/crown</li> <li>Force attenuation (WADs)</li> </ul>
Cat 3	1.09	<ul style="list-style-type: none"> <li>Disruption (overtopping, ponding)</li> <li>Washouts, erosion</li> </ul>	<ul style="list-style-type: none"> <li>Existing condition: established shoreline vegetation (<u>stabilizing/attenuating</u>)</li> </ul>
DFIRM (A /AE)	0.98		<b>\$4.2 MM (marginal illustrative cost)</b>
DFIRM (V /VE)	0.0	<ul style="list-style-type: none"> <li>n/a (unlikely)</li> </ul>	<ul style="list-style-type: none"> <li>n/a</li> </ul>

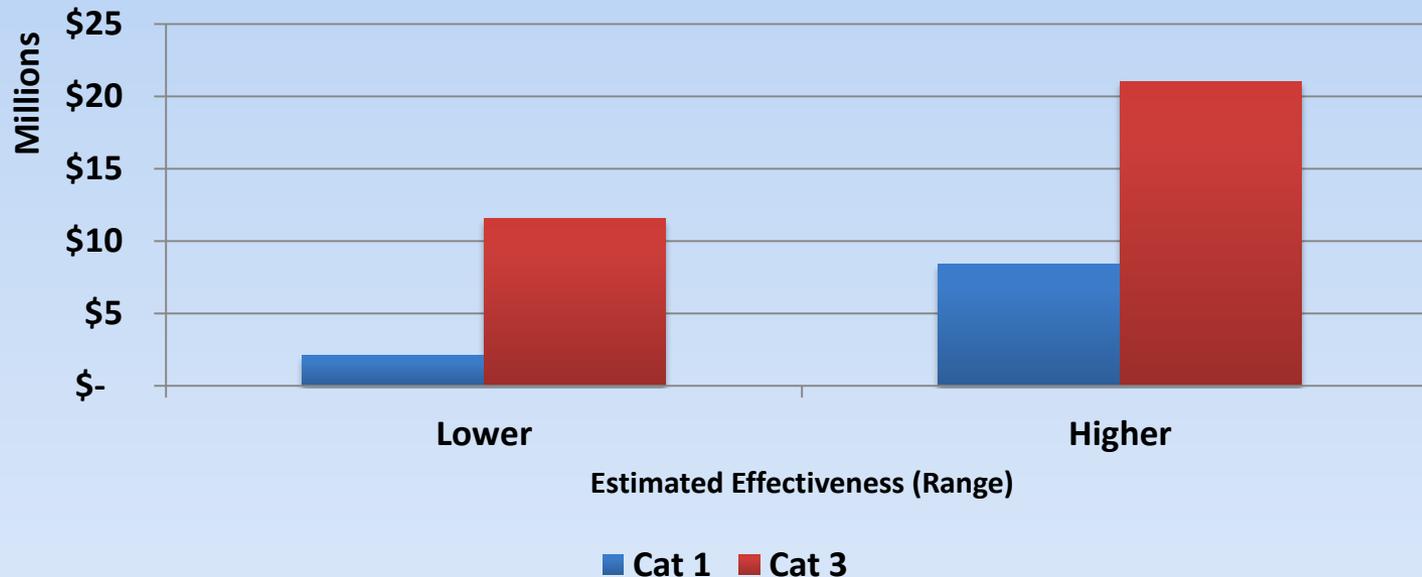
# Memorial Highway Preliminary Results

## Estimated Avoided Net Losses

Category 1: \$2.1 – \$8.4 MM

Category 3: \$11.6 – \$21.0 MM

Tipping Point: 1.3 days avoided disruption\*



\* Point after which strategy “pays for itself” (not time-value adjusted)

# Thank you

 Questions?

# Sample Menu of Risk Management Strategies

Storm Surge Vulnerability	INVESTMENT LEVEL		
	Low	Medium	High
<b>Exposure: Reduce exposure to storm surge</b>			
<b>Elevate</b>	-	RAISE PROFILE (low lying interstates)	→ Increase deployment
<b>Protect</b>	-	SEA WALLS/BULKHEADS (low lying interstates)	→ Increase deployment
<b>Shield</b>	-	-	+ STORM GATE
<b>Sensitivity: Reduce the impacts of storm surge</b>			
<b>Maintain</b>	DRAINAGE (culverts, grates, catch basins)	→ Increase deployment	▲ Same as MEDIUM
	ROADWAY (base, shoulder, pavements)	→ Increase deployment	▲ Same as MEDIUM
<b>Strengthen</b>	ROADWAY BASE (upon reconstruction)	BRIDGE APPROACHES/RAMPS (approach plates)	SECURE BRIDGE DECKS (anti-buoyancy measures)
	-	SCOUR COUNTERMEASURES	→ Increase deployment
	-	RENO MATS	→ Increase deployment
<b>Attenuate</b>	FENCING (low lying interstates/major arterials)	BARRIERS/WAVE ATTENUATORS	→ Increase deployment
	RIP RAP	DUNES (selective deployment)	→ Increase deployment
	SALT RESISTANT VEGETATION	CONSTRUCTED WETLANDS (selective deployment)	→ Increase deployment
<b>Adaptive Capacity: Increase the capacity of the network to recover functionality</b>			
<b>Recover</b>	PLAN (increase post disaster response planning/response budgets)	DRAINAGE (upsized during replacement cycle to)	→ Increase deployment
	-	STAGING (establish new recovery/supply areas/lifelines)	→ Increase deployment
	PERMIT (blanket debris permits)	SUPPLIES/MATERIALS (stockpile)	→ Increase deployment
<b>Reroute</b>	ESTABLISH EMERGENCY DETOURS	DYNAMIC REROUTING (ITS)	→ Increase deployment
	-	-	BUILD REDUNDANT CRITICAL CONNECTORS

# Preliminary Results (detail)

## Memorial Highway

<b>Cat 1</b>		<b>Estimated Effectiveness</b>		
<b>Scenario</b>	<b>Base (No Adapt)</b>	<b>Lower</b>	<b>Higher</b>	
Disruption (weeks)	1	0.6	0.2	
<b>Economic Loss</b>	<b>\$ 15,781,000</b>	<b>\$ 9,468,600</b>	<b>\$ 3,156,200</b>	
<b>Avoided Loss</b>	<b>\$ -</b>	<b>\$ 6,312,400</b>	<b>\$ 12,624,800</b>	
<b>Strategy Cost</b>		<b>\$ 4,219,594</b>	<b>\$ 4,219,594</b>	
<b>Net</b>	<b>\$ -</b>	<b>\$ 2,092,806</b>	<b>\$ 8,405,206</b>	
<b>Cat 3</b>		<b>Estimated Effectiveness</b>		
<b>Scenario</b>	<b>Base (No Adapt)</b>	<b>Less</b>	<b>More</b>	
Disruption (weeks)	2	1	0.4	
<b>Economic Loss</b>	<b>\$ 31,562,000</b>	<b>\$ 15,781,000</b>	<b>\$ 6,312,400</b>	
<b>Avoided Loss</b>	<b>\$ -</b>	<b>\$ 15,781,000</b>	<b>\$ 25,249,600</b>	
<b>Strategy Cost</b>		<b>\$ 4,219,594</b>	<b>\$ 4,219,594</b>	
<b>Net</b>	<b>\$ -</b>	<b>\$ 11,561,406</b>	<b>\$ 21,030,006</b>	
<b>Tipping Point</b>		<b>Mitigation Range</b>		
<b>Scenario</b>	<b>Weeks</b>	<b>Days</b>	<b>Hours</b>	
Disruption (weeks)	0.27	1.34	32.09	
<b>Economic Loss</b>	<b>\$ 15,781,000</b>			
<b>Avoided Loss</b>				
<b>Strategy Cost</b>	<b>\$ 4,219,594</b>			
<b>Net</b>	<b>\$ 11,561,406</b>			

# 2040 & 2060 SLR Scenarios

2040 Sea Level Rise		2060 Sea Level Rise	
Scenarios	Depth (in)	Scenarios	Depth (in)
MHHW	30	MHHW	42
MLW	2	MLW	15

# Simulated Storm Parameters

Parameter	Value
Simpson-Saffir Hurricane Category	3 (111-129 mph winds, up to 21 foot surge depths)
Trajectory	Tarpon Springs Hurricane (1921), observed track
Sea Level Rise	High, 2040 (current Mean Sea Level + 14’)
Tidal Datum	Mean Higher High Water (projected MSL + 16’)