

**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

**Tampa Bay Disaster Resiliency Study**

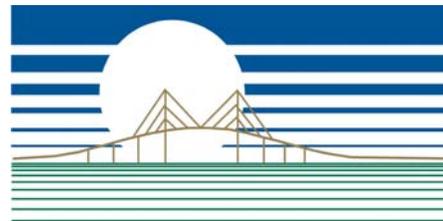
**Part III - Analysis**



**1921 Hurricane – “Safe N Sane” Run Aground at Rail Line in Tampa**

**Table of Contents**

<b>Introduction</b>	<b>III -</b>	<b>2</b>
<b>Hurricane Phoenix Scenario</b>	<b>III -</b>	<b>3</b>
<b>Damage Estimates</b>	<b>III -</b>	<b>16</b>
<b>REMI</b>	<b>III -</b>	<b>18</b>
<b>Input Assumptions</b>	<b>III -</b>	<b>19</b>
<b>Employment Losses Estimates</b>	<b>III -</b>	<b>22</b>
<b>Investment and Spending Estimates</b>	<b>III -</b>	<b>33</b>
<b>Net Results</b>	<b>III -</b>	<b>36</b>
<b>Summary</b>	<b>III -</b>	<b>47</b>



*Tampa Bay Regional Planning Council*

**Introduction**

The study was confined to the four county region of the Tampa Bay Area, including the counties of Hillsborough, Manatee, Pasco, and Pinellas. The hurricane modeled was from Project Phoenix. Project Phoenix is a catastrophic Category 5 Hurricane created to assess the catastrophic planning abilities in the region.

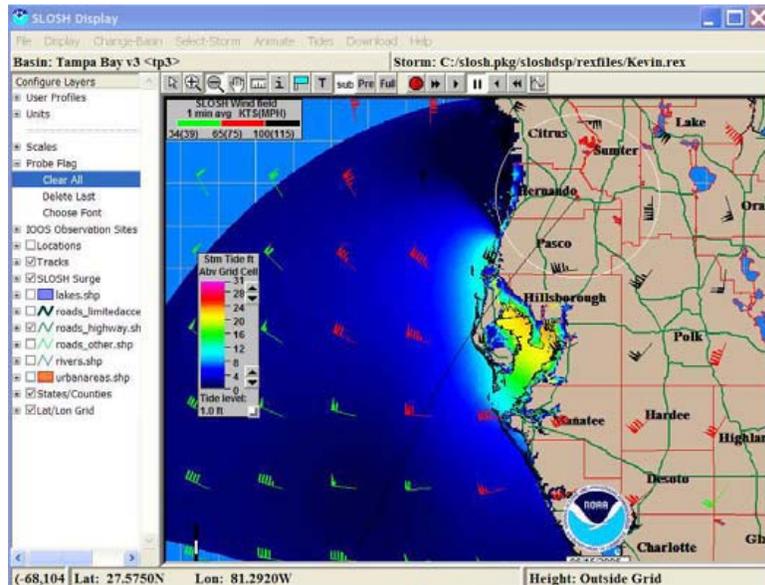
Project Phoenix was created as a product of The Tampa Bay Catastrophic Plan, which addressed the challenges of response and recovery during a catastrophic event in the Tampa Bay area. A catastrophic incident is defined as “*any natural or manmade incident including terrorism that results in extraordinary levels of mass casualties, damage, or disruption severely affecting the population, infrastructure, environment, economy, national morale and/or government functions.*” It requires fully integrated inter and intra governmental actions, combined capacities, communication, coordination and synchronization.

A large catastrophic incident could result in sustained widespread impacts over a prolonged period of time; almost immediately exceeding state, local and private sector resources in the impacted area. It will significantly interrupt governmental operations including emergency services and threaten public safety and national security. These factors drive the urgency for coordinated planning to ensure accelerated federal and state assistance.

The Tampa Bay Catastrophic Plan focused on the procedures, communication channels and coordination strategies necessary to rapidly request and receive critical resources post event. The Disaster Resiliency Study focuses on the economic and long term impacts after the incident has occurred.

### The Hurricane Phoenix Scenario

Hurricane Phoenix is a fictitious storm created to simulate the effects of a worst case scenario. With input from Tampa Bay area emergency management agencies and the local office of the National Weather Service (NWS), a simulated storm was developed with a track and intensity that would devastate the entire Tampa Bay region. The NWS generated National Hurricane Center advisories, local hurricane statements, and data files that simulate the hurricane's location and intensity from its formation in the Caribbean Sea, through landfall in Pinellas County, to the hurricane's exit from the east coast of Florida into the Atlantic Ocean. The maps, assumptions, and information used to estimate damage and recovery rates are based upon this simulated storm.



The simulated parameters of Hurricane Phoenix were input into HAZUS MH, the risk assessment tool that uses the Federal Emergency Management Agency (FEMA) standard methodology to measure the effects of real and simulated hazard events like hurricane winds and flooding. As one might expect, a storm of the size and strength of Hurricane Phoenix would create almost unthinkable damage to the area's homes, businesses, infrastructure, overall economy, and social systems that are currently in place. The goal of this study is to identify the extent of the indirect and induced damage and develop strategies that will help the Tampa Bay region to recover and rebuild after such a devastating catastrophe. The Project Phoenix scenario includes vulnerability maps and damage estimates.

Project Phoenix studied at an 8 county region which make up the Regional Domestic Security Task Force (RDSTF) and Florida Division of Emergency Management Area 4 plus Manatee County which lies within the TBRPC boundaries. Therefore, the study region of Project Phoenix included the following counties:

## Part III – Analysis

### Tampa Bay Disaster Resiliency Study

**Citrus**

**Hardee**

**Hernando**

**Hillsborough**

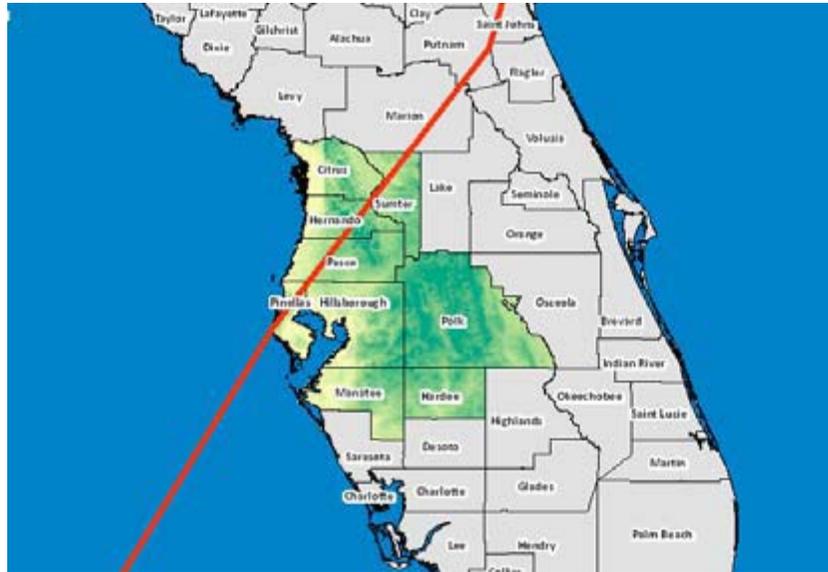
**Manatee**

**Pasco**

**Pinellas**

**Polk**

**Sumter**



Citrus, Sumter, Hernando, Pasco, Pinellas, Hillsborough, Manatee, Polk and Hardee Counties represent an area of 7,249 square miles with 749 Census Tracts and a population (2000) of more than 3,342,291. The Disaster Resiliency Study parceled out the four counties in the study where possible.

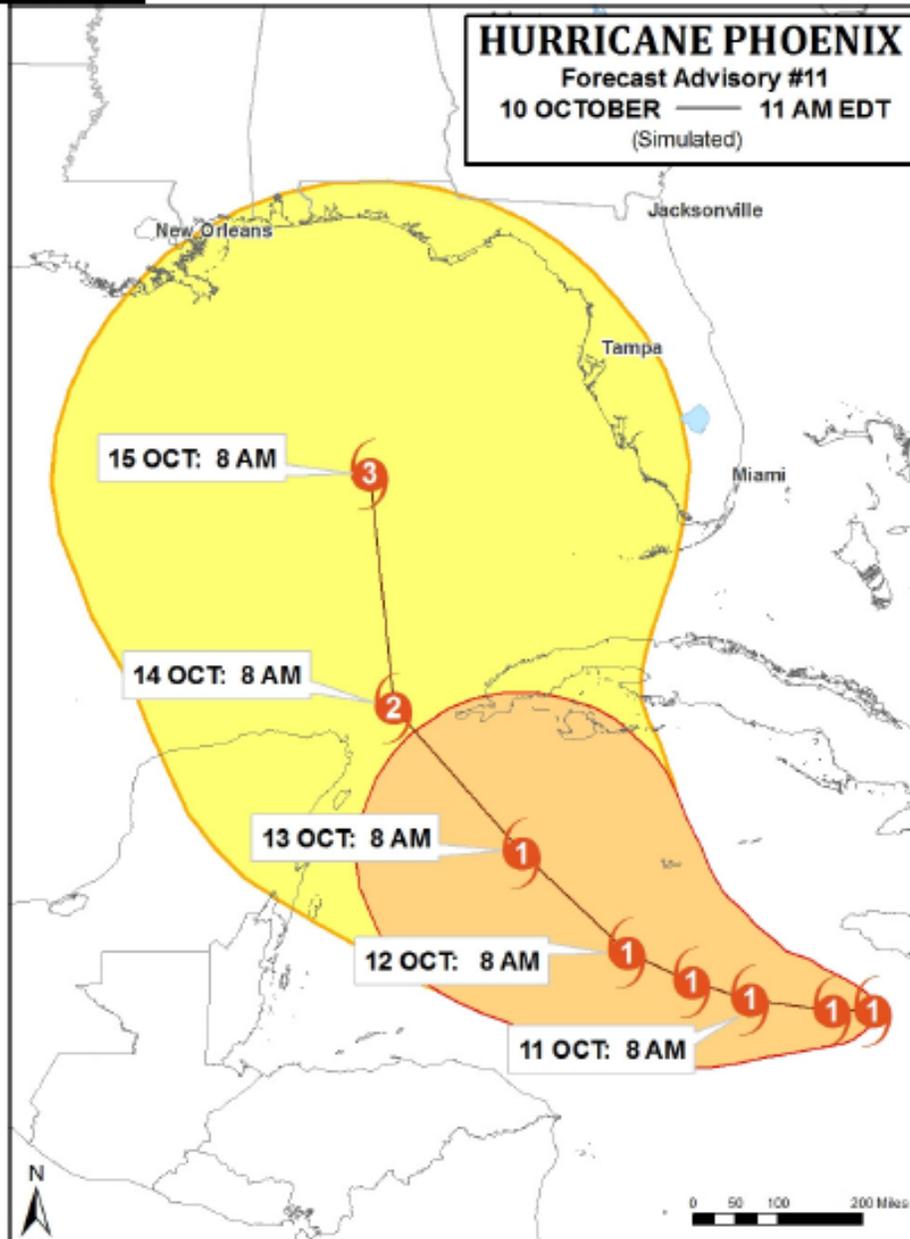
**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

**Project Phoenix Path**

Hurricane Phoenix was created as a simulation, including forecasts, warnings, and responses. The maps below show the forecast path on the days leading up to impact.

This hurricane map is approximately 5 days before impact. It shows the hurricane following the common hurricane path up through the Gulf of Mexico.

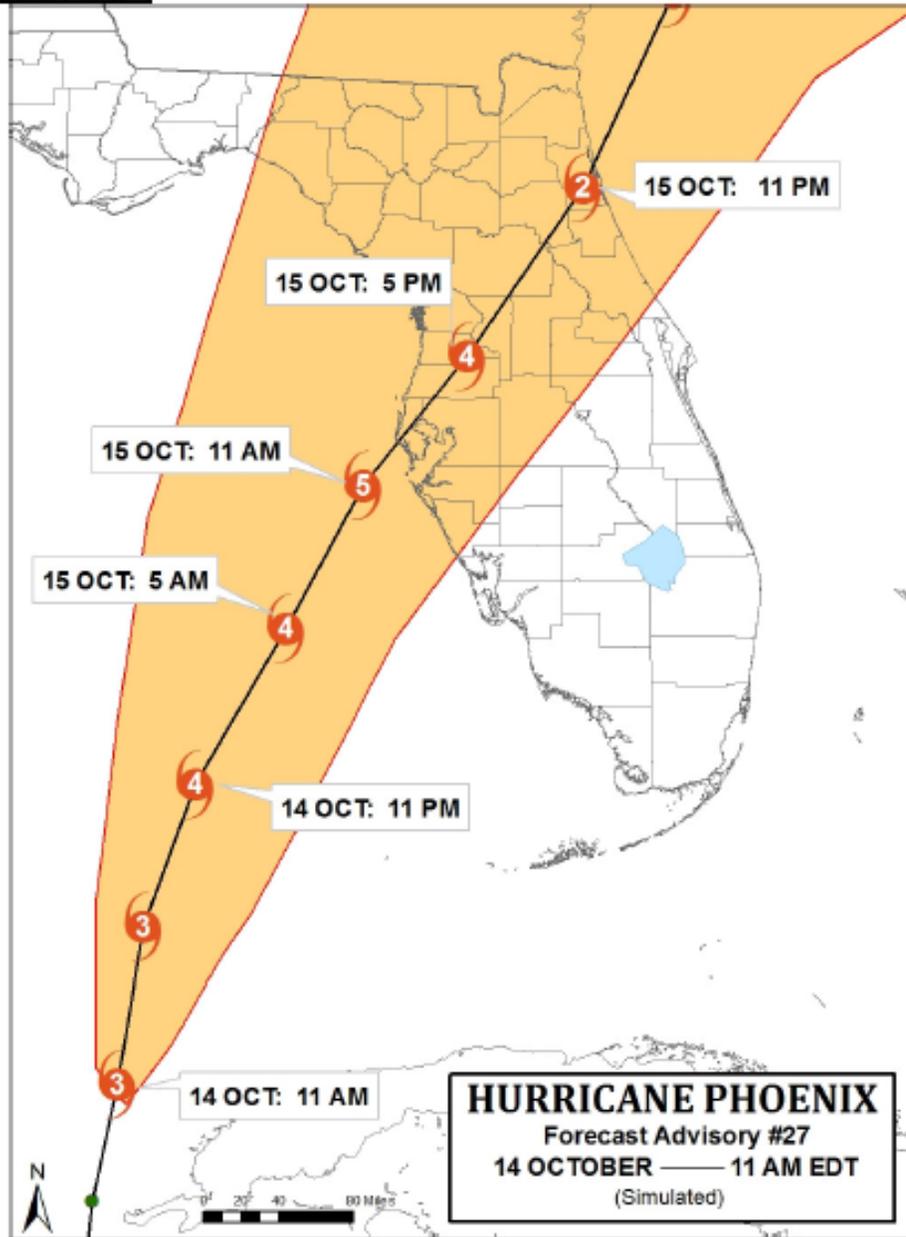
**FORECAST MAP 1**



**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

This hurricane path is approximately 1 day from impact and shows the hurricane has increased speed and altered course. It is now heading for a direct impact at a Category 5 for the Tampa Bay Area.

**FORECAST MAP 3**

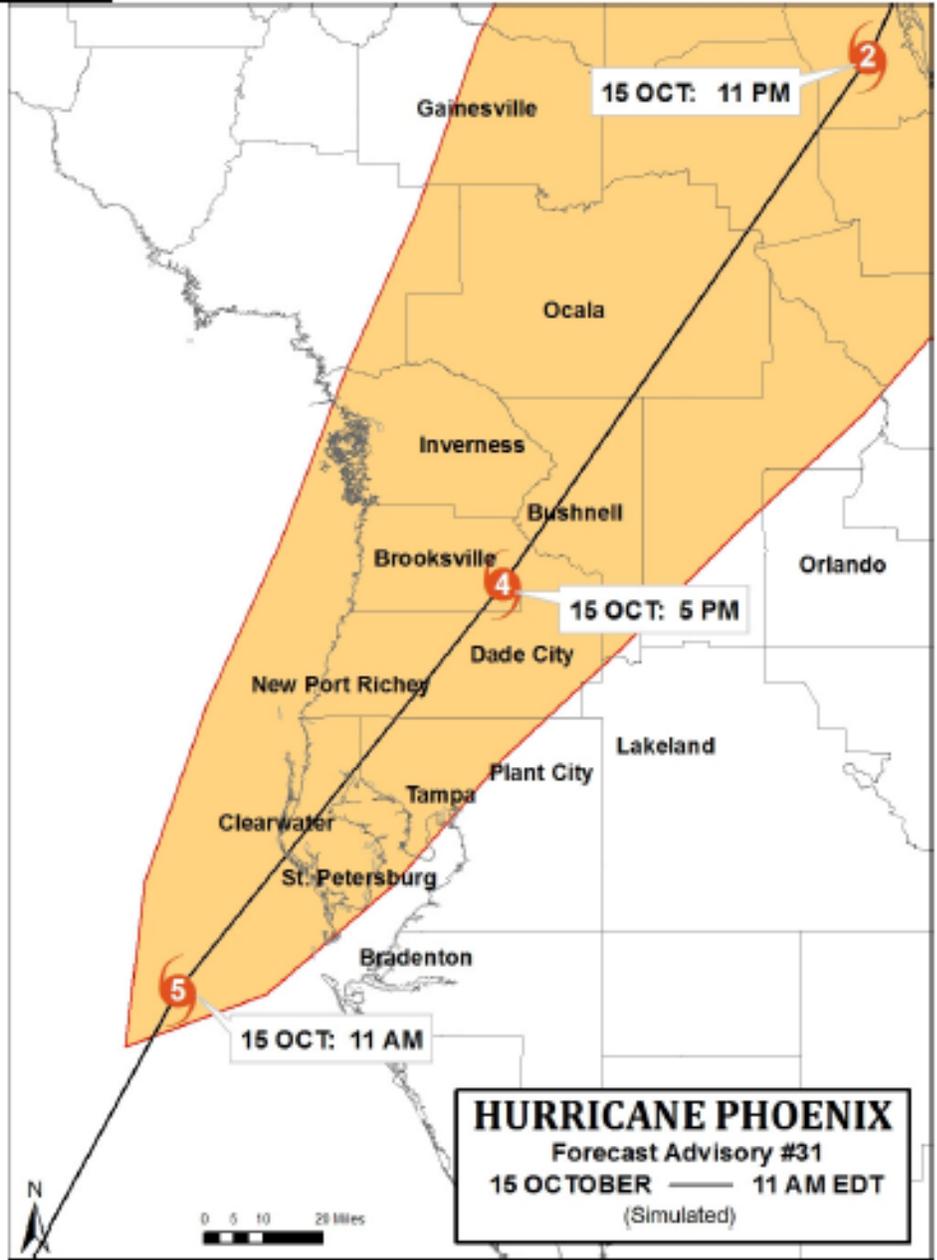


**Part III – Analysis**

**Tampa Bay Disaster Resiliency Study**

This hurricane map is on the eve of impact. The cone of certainty is painting a dim picture for the region. The current path would cause the greatest impact to the region and the hurricane is expected to hit at a full Category 5.

**FORECAST MAP 4**

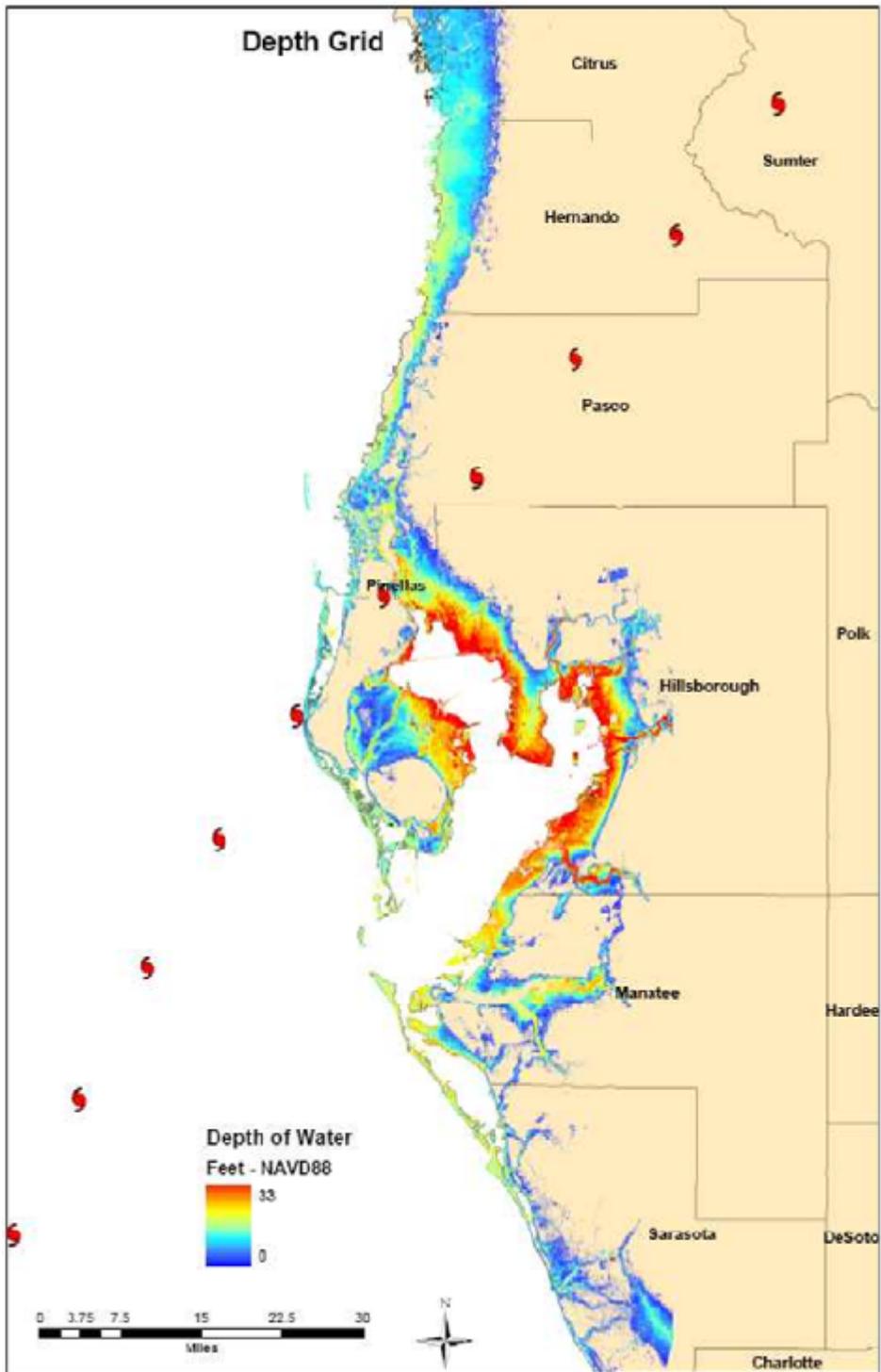


**Part III – Analysis**

**Tampa Bay Disaster Resiliency Study**

This map shows the storm surge flood depths that will occur at each county from Hurricane Phoenix. Tampa Bay (the actual bay of water, not the region) causes significant damage to the adjacent areas.

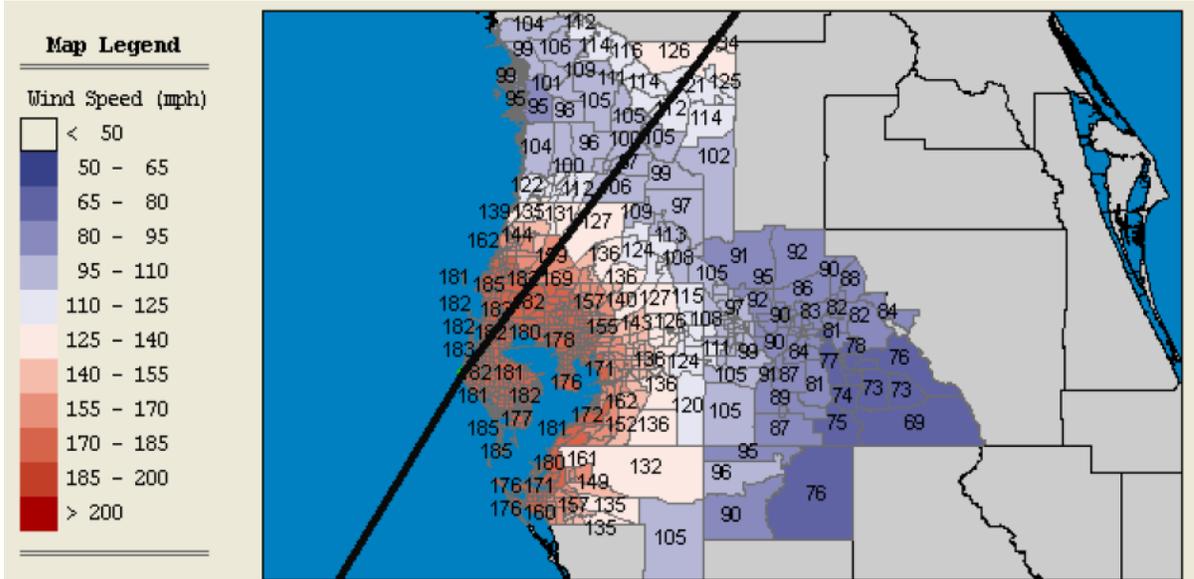
**REGION MAP WITH STORM SURGE FLOOD DEPTHS**



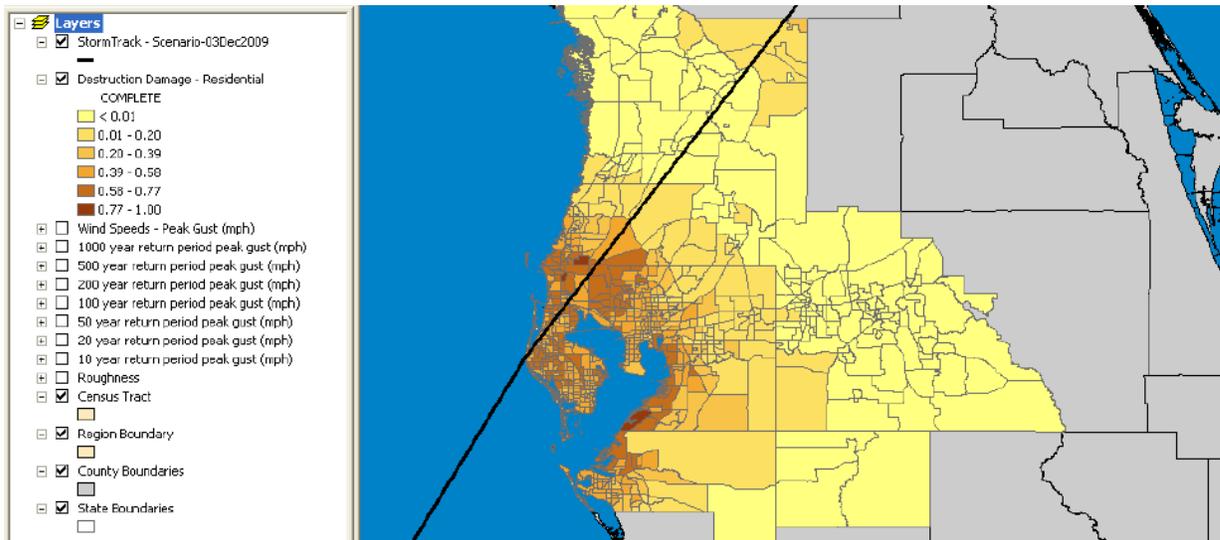
**Part III – Analysis**

**Tampa Bay Disaster Resiliency Study**

The picture below demonstrates the wind speed experienced in the area from the hurricane. While the thin line dictating the path of the hurricane does not touch Manatee County, Hurricane Phoenix wrecks havoc upon the county. Wind speeds surpassing 180 miles per hour are experienced in every county in the 4 county Tampa Bay Region.



As expected, the region experiences significant capital stock damage. The map below shows the severity of the impact.



Infrastructure remaining after the event is questionable.

## **CRITICAL INFRASTRUCTURE**

### **Transportation Facilities**

Interstate 75 (I-75), Interstate 275 (I-275), and Interstate 4 (I-4) are expected to be the primary routes used to transport goods and people into and out of the affected zone during a response and recovery effort within the nine-county West Central Florida area. Interstates and major highways generally have a wide right-of way and trees about 50–100 feet away from the shoulders, so most of the debris on these roads would consist of poles, signs, and small vegetative debris.

According to Florida Department of Transportation (FDOT) engineers, noninterstate/turnpike evacuation routes in the nine-county area are generally at-grade with the surrounding ground. As such, routes shown on maps depicting flooding due to storm surge can generally be assumed to be flooded if the adjacent land is inundated.

Interstates are the Florida Department of Transportation's top priority for debris clearance; FDOT plans to reopen major roads within 8–24 hours after the hurricane has passed, provided all bridges are operating at full or near capacity. Significant impacts on the region's bridges - especially the approaches - are expected on all causeways including the Courtney Campbell Causeway, Howard Frankland Bridge, Gandy Bridge and the Skyway Bridge. Bridges and roads subject to additional flooding due to the storm will have to be inspected before reopening. This is of particular concern on the three causeways connecting Hillsborough and Pinellas County, the bridges connecting the barrier island communities as well as those connecting downtown with Harbor Island, Davis Island and the 22nd St. Bridge providing access to the Port of Tampa. Bridges over the Manatee River in Manatee and the Pithlachascotee River in Pasco will also require engineering survey.

FDOT could impose a vehicle weight restriction or use a temporary bridge if the bridges are damaged. FDOT typically has 10,000 linear feet of such bridges available in nonemergency times.

Runaway barges and other large debris could be a threat to bridges during the storm, Intracoastal Waterway were damaged in this way during Hurricane Wilma. As a result, these bridges had to be closed to motor-vehicle traffic.

Train services in Tampa Bay, East Central Florida and Northeast Florida may not be available because of debris on the railways.

The Florida Department of Transportation's goal is to open (with at least one lane available for emergency vehicles) all State roads to traffic one day after the hurricane has passed.

Hurricane Phoenix will destroy traffic control devices (lights, signs), resulting in dangerous uncontrolled intersections post-landfall.

Many of the buses and other public transit vehicles left in the storm's path will be destroyed and unavailable post-landfall.

**Ports**

Florida's sea- and airports are essential resources for providing goods and services to residents and critical economic engines that generate millions of dollars and thousands of jobs for local communities. The state contains two of the top twenty importing and four of the top twenty exporting seaports in the United States, and Tampa International Airport is one of the busiest in the world. As a result, ports will likely be vital to response and recovery efforts following a catastrophic hurricane in Tampa Bay.

The Tampa International Airport serves 21 passenger air carriers and nine cargo-only airlines. It manages over 18 million passengers per year and 108,000 tons of cargo, including 12,000 tons of mail per year. The estimated replacement cost of the airport's land and facilities is \$2.3 billion.<sup>41</sup> The St. Petersburg-Clearwater International Airport is located 10 miles east of Tampa International and serves as a charter destination for several air carriers, including a few from Canada. The airport provides over 3,000 jobs and contributes an economic benefit of \$400 million annually to the Tampa Bay area.

The Port of Tampa is the largest of the Florida ports, as measured by tonnage, and handles approximately 50 million tons of cargo per year. The Tampa Bay region is the largest metropolitan market in Florida, and it is the 10th largest consumer market in the U.S., with nearly 7 million people within 100 miles of the port. The port contributes to the creation of 96,000 jobs in the region and generates a regional annual economic impact of nearly \$8 billion. Tampa is also the closest full service U.S. port to the Panama Canal. Port Manatee is among Florida's largest deepwater seaports. The port oversees over 9.3 million tons of shipping, and is Fresh Del Monte Produce's second largest U.S. port facility, used for importing Central American fruit and exporting fruit from Florida. It is also the southeast's leading forestry product import facility.

## Part III – Analysis

### Tampa Bay Disaster Resiliency Study

#### Electricity Infrastructure

##### Generation Capacity

The local power plants in the nine-county areas are located along the coast in areas vulnerable to storm surge. All facilities would have been impacted by the sustained 160-180 mph winds. Therefore; it is assumed all local generation operations would be suspended until the damage is assessed and repairs could be made. Once the distribution systems start coming back online, most generation would be purchased from outside of the affected region.

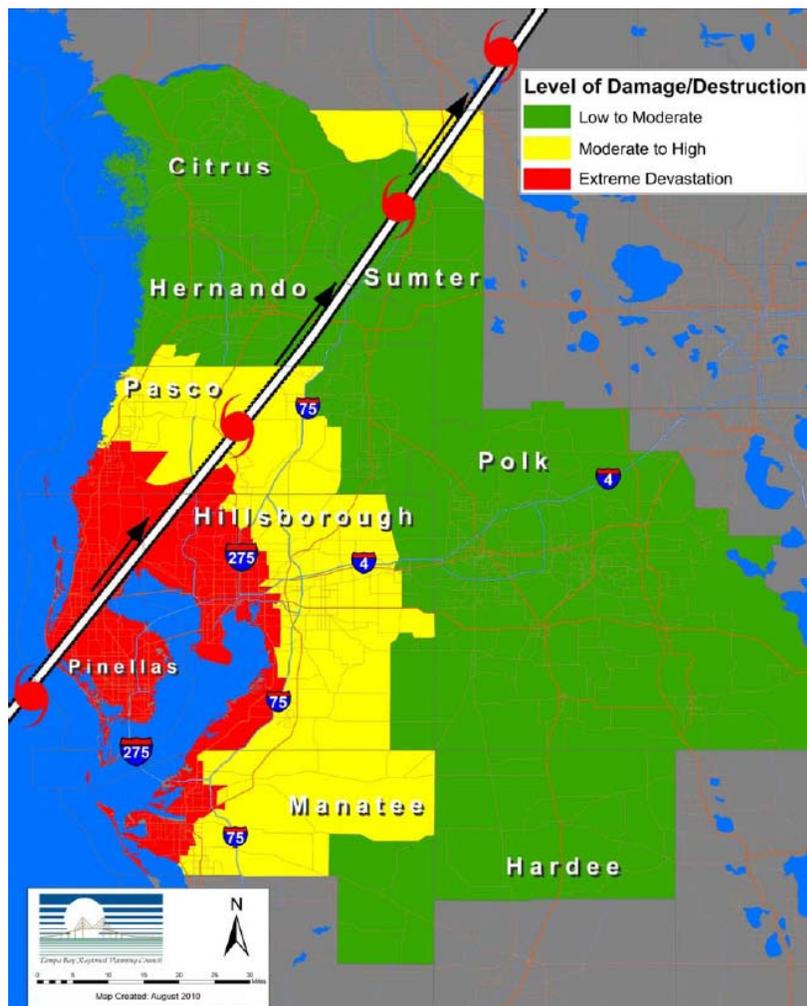
##### Residential Impacts

Weatherheads, which connect homes to the electrical lines, are often damaged and need to be repaired by an electrician.

Approximately 5,000 weatherheads were damaged following Hurricane Wilma. This figure could easily exceed 50,000 for a storm like Phoenix. Electricians would be required from outside of the state to handle the demand after this type of emergency. Electrical repairs normally need county inspection before reconnection, but this requirement is sometimes waived.

##### Transmission Infrastructure

Distribution facility damage throughout the nine counties would be extensive. Customers are approximately 88% residential, 11% commercial, and 1% industrial. The transmission infrastructure disruption could cause an effect on casualties. Residents could be electrocuted by downed power lines. Residents could also potentially suffer asphyxiation due to improper use of portable generators



## **Part III – Analysis**

### **Tampa Bay Disaster Resiliency Study**

The analysis conducted to determine shelter requirements estimates that 840,000 households will be displaced due to the modeled storm. (Displacement includes households evacuated from within or very near to the impacted area and may not be a direct reflection of residential building damage within a particular census block.) Assuming a regional average of 2.32 persons per household, more than 58% of the individual persons within the region would be impacted (out of a total population of 3.3 million people). Approximately 220,000 of those would seek temporary shelter in public shelter facilities.

**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

**Medical**

**Casualties**

The number of casualties was estimated based on the following assumptions:

Non-evacuation of certain portions of the population-at-risk in storm surge vulnerable evacuation zones and mobile homes. Based on the 2006 behavioral surveys, up to 30% of the vulnerable population would not evacuate even with the threat of a catastrophic hurricane. Approximately 10% of the population on the barrier islands has indicated that they feel safe in a major storm.

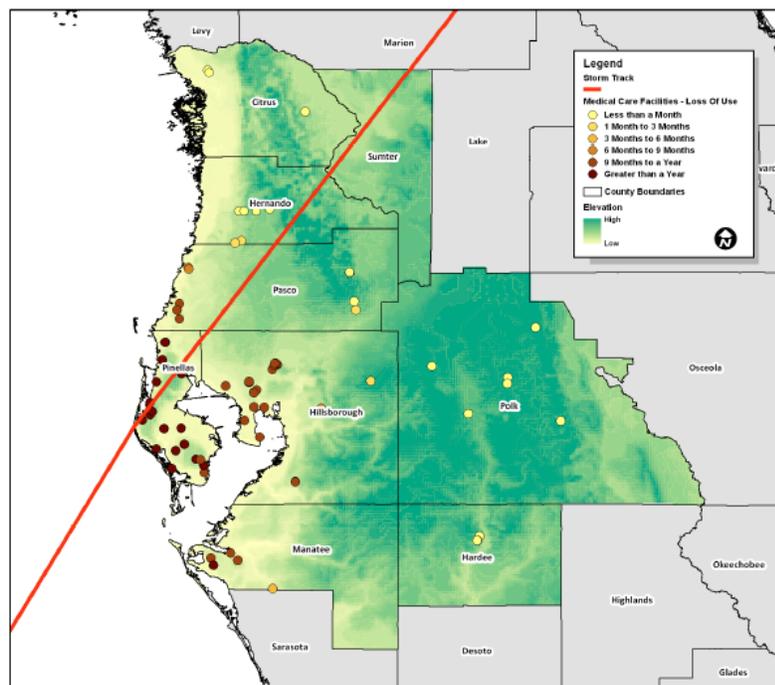
A number of post-hurricane related deaths are known to occur, examples include drowning, electrocution, crushing, head trauma, and natural causes exacerbated by the storm (storm stress-induced heart attack). Improper use of portable generators has led to excess morbidity and mortality following hurricanes. During the period of power outages related to the four major Florida hurricanes in 2004, 167 persons were treated for accidental carbon monoxide poisoning as a result of improper use of portable generators. Six deaths were reported.

Approximately 1,957,000 people will be affected by this catastrophic storm scenario. Of these residents, approximately 1,957 (.001) could lose their lives as a direct result of the storm (primarily due to non-evacuation of storm surge vulnerable areas and mobile homes). An additional 200 additional people (.0001) could lose their lives following the storm.

**Injuries**

Injuries and illnesses observed in previous Florida hurricane events include blunt trauma, lacerations, muscle strains and pulls, insect and animal bites, puncture wounds, burns, infections, gastrointestinal illnesses, sunburns, exposure, psychosocial distress, and carbon monoxide exposure.

Medical Facilities Impacted - Loss of Use



### **Environmental Health**

Storm surge can inundate extant water systems, including wells and water mains, causing breakage and contamination. Loss of electricity will prevent water and sewage pumping in much of Tampa Bay. All water for human and pet use will require boiling. Public health authorities will have to coordinate public notification of boil water notices. Excess gastrointestinal illnesses may be observed if contaminated water is consumed.

While stressful and disturbing, the presence of corpses in floodwaters or in storm debris does not create a risk of infectious disease epidemics in flood- or storm-affected areas.

However, according to the World Health Organization, should dead bodies enter the water supply there is a small risk of contamination that could lead to gastrointestinal infections. Health officials must work with the media to educate the public on these issues.

Loss of medical records resulting in patient treatment challenges is likely as a result of hurricane events. To facilitate patient treatment, Health Insurance Portability and Accountability Act elements will be suspended or modified as provided for within the act's policy. There may be confusion about what elements of the act must be maintained in an emergency.

Although access to traditional prescription drug outlets will be disrupted, access to prescription drugs will be provided by emergency response teams, mobile medical units, and private/voluntary organizations such as AmeriCares and others that focus on distributing prescription drugs and medical equipment following disasters.

Drugs may have been lost in the event or left behind while evacuating. People will have difficulty refilling prescriptions and collecting the cost of replacing them from their insurance companies. Special needs patients on multiple medications may have difficulty recalling specific medications and doses. Lack of accessible medical records will make it difficult to look up medication information for patients. Medical intervention will be required to determine patients' prescription needs.

Following all hurricane events, members of the affected population will experience some level of distress. While most people return to normal levels of psychological functioning, some will exhibit symptoms of Post Traumatic Stress Disorder, depression, or other illnesses. Psychosocial support will be one of the most lasting needs.

Planned and spontaneous medical volunteers, including doctors and nurses, will require reciprocal licensing. This will be an urgent need.

## Part III – Analysis

### Tampa Bay Disaster Resiliency Study

#### Damage Estimates

Hurricane Phoenix is a Category 5 Hurricane with peak wind gusts of 191 mph which makes landfall at Indian Rocks Beach producing storm surge of 11-16 feet along the Gulf Coast and 23-26 feet in Tampa Bay. The following tables show the destruction.

#### General Building Stock Exposure (2000)

Occupancy	Building Count	Dollar Exposure (\$M)
Residential	1,438,227	\$182,816
Commercial	85,481	\$43,372
Other	42,218	19,628
<b>Total</b>	<b>1,565,927</b>	<b>245,816</b>

#### Number of Buildings Damaged

Damage State	Residential	Commercial	Other	Total
Minor	120,000	4,900	2,800	130,000
Moderate	170,000	9,400	4,300	180,000
Severe	320,000	44,000	22,000	390,000
Destroyed	470,000	10,000	3,600	480,000
<b>Total</b>	<b>1,100,000</b>	<b>68,000</b>	<b>32,000</b>	<b>1,200,000</b>

#### Damage Severity by County

	Total Structures	Minor Damage	Moderate Damage	Severe or Destroyed
Hillsborough	405,461	67	42,678	38,252
Manatee	132,349	19	19,470	9,271
Pasco	183,387	7	11,653	6,626
Pinellas	425,113	70	85,265	36,979
<b>TBRPC Total</b>	<b>1,146,310</b>	<b>163</b>	<b>159,066</b>	<b>91,128</b>

#### Damage by County (Part 1)

	Pre-Storm Building Stock Value (\$M)	Total Structural Damage from Winds (\$M)	Percent of Pre-storm Building Stock Value Loss from Wind	Total Structural Damage from Storm Surge (\$M)
Hillsborough	78,949	48,276	61.10%	10,893
Manatee	20,681	12,900	62.40%	2,620
Pasco	23,006	10,715	46.60%	1,789
Pinellas	70,489	54,287	77.00%	12,824
<b>TBRPC Total</b>	<b>193,125</b>	<b>126,178</b>		<b>28,126</b>

**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

**Damage by County (Part 2)**

	<b>Percent of Pre-Storm Building Stock Value Loss from Storm Surge</b>	<b>Total Combined Structural Damage (\$M)</b>	<b>Total Combined Percent of Pre-Storm Building Stock Value Loss</b>
<b>Hillsborough</b>	13.80%	52,508	66.50%
<b>Manatee</b>	12.70%	13,886	67.10%
<b>Pasco</b>	7.80%	11,671	50.70%
<b>Pinellas</b>	18.20%	57,235	81.20%
<b>TBRPC Total</b>		135,300	

**Tons of Debris, by type**

	<b>Brick, Wood and Other</b>	<b>Reinforced Concrete and Steel</b>	<b>Eligible Tree Debris</b>	<b>Total</b>
<b>Hillsborough</b>	11,271,935	1,399,417	894,284	13,565,636
<b>Manatee</b>	3,785,148	568,359	190,620	4,544,127
<b>Pasco</b>	3,272,094	472,985	298,409	4,043,488
<b>Pinellas</b>	15,529,750	2,161,617	737,575	18,428,942
<b>TBRPC Total</b>	33,858,927	4,602,378	2,120,888	40,582,193

**Transmission and power issues, by county**

	<b>Number of Customers (Res and Comm)</b>	<b>Total Structures Affected</b>	<b>Initial Power Outage</b>	<b>W/O Power 3-7 Days</b>	<b>W/O Power 7-15 Days</b>	<b>W/O Power 15-30 Days</b>	<b>W/O Power 30-60 Days</b>
Hillsborough	405,461	388,798	90%	388,798	356,095	287,859	151,185
Manatee	132,349	129,637	20%	129,637	121,930	99,887	54,459
Pasco	183,387	150,589	98%	150,589	126,109	93,305	50,738
Pinellas	425,113	424,291	100%	424,291	418,725	382,165	224,994
<b>TBRPC Total</b>	1,146,310	1,093,315		1,093,315	1,022,859	863,216	481,376

### **REMI Model –**

All modeling was done using the REMI PI+ Model. TBRPC has maintained its agreement to use REMI in the region and state for almost 15 consecutive years. The custom calibrated model includes 23 industry sectors for every county in the state of Florida. REMI PI+ 1.2.6 build 2335 was utilized for all of the runs.

REMI Policy Insight<sup>®</sup> is a structural economic forecasting and policy analysis model. It integrates input-output, computable general equilibrium, econometric and economic geography methodologies. The model is dynamic, with forecasts and simulations generated on an annual basis and behavioral responses to wage, price, and other economic factors. It consists of thousands of simultaneous equations within a structure that is relatively straightforward. The exact number of equations used varies depending on the extent of industry, demographic, and regional detail in the specific model being used. The overall structure of the model can be summarized in five major blocks: (1) Output, (2) Labor and Capital Demand, (3) Population and Labor Supply, (4) Wages, Prices, and Costs, and (5) Market Shares.

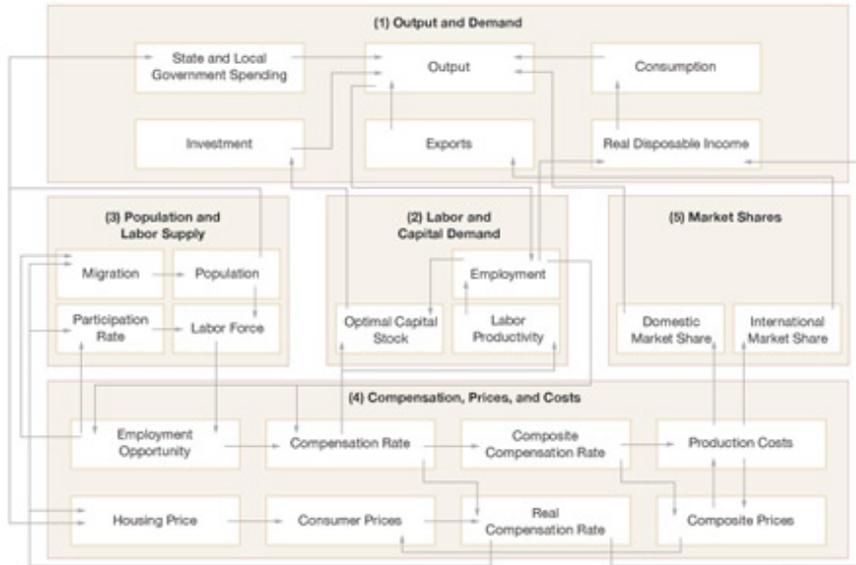
Policy Insight's unique power is to generate realistic year-by-year estimates of the total regional effects of any specific policy initiative. A wide range of policy variables allows the user to represent the policy being evaluated, while the explicit structure in the model helps the user to interpret the predicted economic and demographic effects. The model is calibrated to many sub-national areas for policy analysis and forecasting and is available in single- and multi-area configurations. Each calibrated area (or region) has both economic and demographic variables so that any policy that affects a local economy can be tested. Users can also see the total economic impacts of each region using Policy Insight.

Policy Insight is used by government agencies (including local, state, and Federal), consulting firms, nonprofit institutions, universities, and public utilities. The model's simulations estimate comprehensive economic and demographic effects in wide-ranging initiatives such as economic impact analysis; policies and programs for economic development, transportation, infrastructure, environment, energy and natural resources; and state and local tax changes. Articles about the model equations and research findings have been published in professional journals such as the *American Economic Review*, *The Review of Economic Statistics*, the *Journal of Regional Science*, and the *International Regional Science Review*.

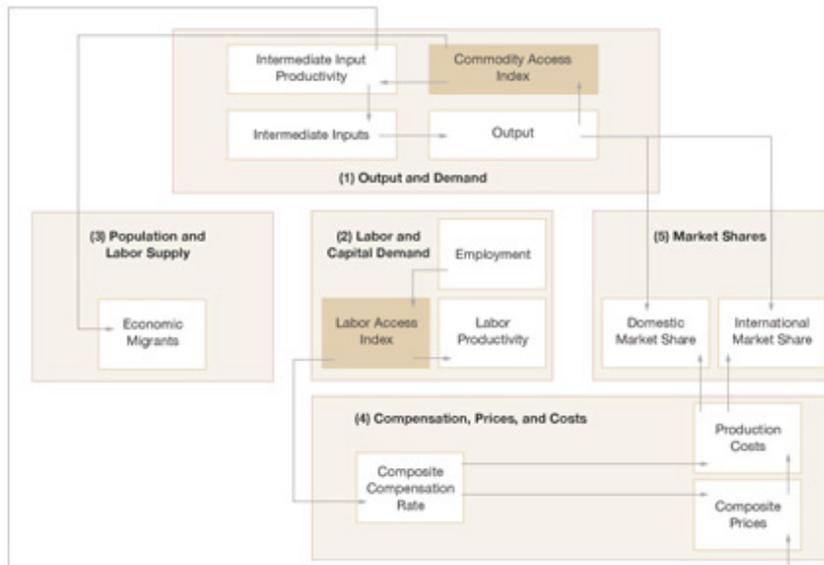
# Part III – Analysis

## Tampa Bay Disaster Resiliency Study

REMI Model Linkages (Excluding Economic Geography Linkages)



Economic Geography Linkages



### **Detailed Assumptions and Inputs**

The employment numbers between the the QCEW and the REMI model were significant enough that they could not be merged. The REMI model allows further customization of employment levels, however, due to the extended forecast timeline, TBRPC opted against that modification and decided to only use the REMI estimates for the purpose of modeling. TBRPC has every intention of getting the figures as precise as possible, but in reality the chances of being 100% accurate are not high. The intent of this study is to provide estimates that guide progress. The ultimate question is: Are the county, region, state, and/or federal governments doing enough to circumvent the potential consequences of the disaster?

When modeling the effects of an event, it is important to think about the impacts the model will return. Ensuring that direct impacts are only counted once is vital to the integrity of the report. For instance, when modeling a new business coming to town, new sales and new employment are often modeled together. If modeled together improperly as two separate events, the two impacts would look like two new business coming to town creating twice the impact that should be estimated. The two events need to be put against each other to assure the model that the new sales are directly caused by the new employment.

When calculating the inputs, it is essential to only model the direct impacts. In the same scenario as above - an employment gain - the new direct employees will create indirect new employment, who in turn create induced new employment. These new direct employees will relocate from other areas and some will bring families, some will buy houses, and other ripple effects. If we modeled everything (population gain, consumer spending, residential capital stock increase, etc.) then the indirect and induced would be counted twice and the impact would be inaccurate.

These points are critical to convey when discussing modeling a huge event with an unquantifiable number of events happening simultaneously. This event was simplified to modeling the drivers of the anticipated loss of employment against the reconstruction and repair of area capital stock. Most of the indirect/induced or double counting activities occur within these two phenomena. Other activities are likely offset by substitute activities. Below is a list of most assumptions and the associated use.

**Modeling Assumptions Regarding Substitute Effects and Double Counting**

Decrease in Tourism (Accommodations and Food and Beverages) – Offset by Increase in Temporary workers.

Decrease in Property Tax Collections – Offset by Increase in Sales Receipts Collections

Decrease in Consumer Discretionary Income (To pay deductibles or minor repairs, increased insurance costs, higher temporary retail prices) – Offset by property repairs, thus delaying future purchases to replace or update items, government assistance, and delayed purchase activity for luxury or nonessential items.

Decrease in Population – Offset by Employment Losses

Decrease in Business Production/Sales – Offset by Employment Losses

Increase in Cost of Doing Business (Gas prices, road closures, etc) - Offset by a decrease in Business Activity.

Decrease in Residential and Commercial stock – Population decrease is Offset by Employment Losses. Actual home equity is accounted for by Private and Public Insurance, Government Assistance, and existing land values.

Increase in Cleanup, Repairs and Construction are accounted for by an increase to the Government Spending and an Increase to the Residential, Commercial, and Infrastructure Capital.

Loss of Employment was factored by dissecting each employment industry and factoring a return to work rate in which the employees would be able to start working again.

**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

**Modeled Inputs by County**

Impacts were modeled regionally and were input by county. Estimates are reported by county and region.

Each scenario and data set was looked at from three perspectives – employment impacts, spending impacts, and net impacts. The results are very sensitive to the government spending amounts and the employment production. One should consider the situation if more or less federal aid were available. A benefit of this modeling effort is that it provides a benchmark for how much federal and state assistance would be needed to bring about a full recovery to anticipated pre-event levels.

For each scenario and data variable analyzed, the baseline forecast is shown. Also, the current level for that data set (for example employment) is shown. The data variables analyzed for each scenario is employment, gross regional product, output, population, and fiscal (revenues).

It is important to remember that we are measuring our impacts and recovery rates against where we would have been in five years or so, not where we were when the event occurred.

The following chart shows the return to rate factor of the local employment under the conservative approach. Due to the impacts proximity to employment centers, each county was treated identically, percentage-wise.

<b>Year</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
<b>Percent</b>	33%	24%	18%	13%	10%	5%	3%	1.5%	1%	0.5%

**Hillsborough County – Employment Losses**

The table below provides the baseline forecast for employment by industry for the future of Hillsborough County. The amount of aid provided should attempt to catch up to where the area should be 5-7 years down the road, as opposed to where the region was at the time of the event.

**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

Hillsborough Employment by Industry Baseline Forecast (In Thousands)

Industry	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Forestry, Fishing, Related Activities, and Other	3.011	3.046	3.063	3.068	3.063	3.046	3.025	3.005	3.086	3.155
Mining	0.465	0.480	0.484	0.484	0.483	0.480	0.476	0.472	0.475	0.482
Utilities	2.736	2.747	2.747	2.736	2.719	2.690	2.654	2.615	2.575	2.523
Construction	44.68	50.35	52.47	54.36	56.11	57.64	58.98	60.31	61.35	62.49
Manufacturing	28.39	29.03	29.19	29.2	29.11	28.92	28.68	28.45	28.35	28.19
Wholesale Trade	33.39	34.28	34.61	34.79	34.90	34.90	34.84	34.8	34.89	35.03
Retail Trade	75.93	77.47	78.30	78.82	79.19	79.32	79.28	79.33	79.60	80.32
Transportation and Warehousing	22.37	23.15	23.59	23.93	24.22	24.42	24.57	24.72	24.98	25.22
Information	20.33	20.51	20.84	21.18	21.52	21.85	22.19	22.62	22.78	22.81
Finance and Insurance	61.66	62.53	63.58	64.33	64.91	65.27	65.45	65.65	66.18	66.68
Real Estate and Rental and Leasing	31.99	33.28	34.20	34.97	35.66	36.21	36.65	37.10	37.53	37.84
Professional and Technical Services	68.30	71.71	74.84	77.71	80.46	82.98	85.36	87.79	89.22	90.45
Management of Companies and Enterprises	7.069	7.225	7.308	7.357	7.381	7.383	7.375	7.364	7.348	7.381
Administrative and Waste Services	78.84	80.99	83.10	84.88	86.46	87.77	88.88	90.02	91.25	92.33
Educational Services	13.74	14.31	14.85	15.30	15.71	16.06	16.34	16.62	16.99	17.14
Health Care and Social Assistance	75.00	76.70	80.14	83.29	86.32	89.11	91.67	94.32	96.69	98.80
Arts, Entertainment, and Recreation	17.78	18.17	18.54	18.82	19.05	19.21	19.31	19.40	19.54	19.70
Accommodation and Food Services	52.90	54.20	55.27	56.06	56.67	57.02	57.18	57.31	57.64	58.40
Other Services, except Public Administration	44.06	45.34	46.51	47.44	48.26	48.89	49.37	49.87	50.45	50.94
State and Local	62.93	62.81	64.27	65.66	67.02	68.34	69.54	70.72	71.88	72.91
Federal Civilian	14.67	14.63	14.56	14.47	14.38	14.28	14.17	14.06	14.05	14.01
Federal Military	8.413	8.109	8.264	8.416	8.564	8.712	8.852	8.990	9.017	8.932
Farm	9.570	9.526	9.454	9.380	9.296	9.211	9.125	9.039	8.949	8.833
Total	778.2	800.6	820.2	836.6	851.4	863.7	874.0	884.6	894.9	904.6

Actual employment losses by industry for Hillsborough County are shown below.

Hillsborough Employment Losses by Industry (In Thousands)

Industry	Year									
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**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

	1	2	3	4	5	6	7	8	9	10
Forestry, Fishing, Related Activities, and Other	-0.99	-0.72	-0.54	-0.39	-0.30	-0.15	-0.09	-0.05	-0.03	-0.02
Mining	-0.15	-0.11	-0.08	-0.06	-0.05	-0.02	-0.01	-0.01	0.00	0.00
Utilities	-0.90	-0.66	-0.49	-0.36	-0.27	-0.14	-0.08	-0.04	-0.03	-0.01
Construction	-14.7	-10.7	-8.04	-5.81	-4.47	-2.23	-1.34	-0.67	-0.45	-0.22
Manufacturing	-9.37	-6.81	-5.11	-3.69	-2.84	-1.42	-0.85	-0.43	-0.28	-0.14
Wholesale Trade	-11.0	-8.01	-6.01	-4.34	-3.34	-1.67	-1.00	-0.50	-0.33	-0.17
Retail Trade	-25.1	-18.2	-13.7	-9.87	-7.59	-3.80	-2.28	-1.14	-0.76	-0.38
Transportation and Warehousing	-7.38	-5.37	-4.03	-2.91	-2.24	-1.12	-0.67	-0.34	-0.22	-0.11
Information	-6.71	-4.88	-3.66	-2.64	-2.03	-1.02	-0.61	-0.30	-0.20	-0.10
Finance and Insurance	-20.4	-14.8	-11.1	-8.02	-6.17	-3.08	-1.85	-0.92	-0.62	-0.31
Real Estate and Rental and Leasing	-10.6	-7.68	-5.76	-4.16	-3.20	-1.60	-0.96	-0.48	-0.32	-0.16
Professional and Technical Services	-22.5	-16.4	-12.3	-8.88	-6.83	-3.42	-2.05	-1.02	-0.68	-0.34
Management of Companies and Enterprises	-2.33	-1.70	-1.27	-0.92	-0.71	-0.35	-0.21	-0.11	-0.07	-0.04
Administrative and Waste Services	-26.0	-18.9	-14.2	-10.3	-7.88	-3.94	-2.37	-1.18	-0.79	-0.39
Educational Services	-4.53	-3.30	-2.47	-1.79	-1.37	-0.69	-0.41	-0.21	-0.14	-0.07
Health Care and Social Assistance	-24.8	-18.0	-13.5	-9.75	-7.50	-3.75	-2.25	-1.13	-0.75	-0.38
Arts, Entertainment, and Recreation	-5.87	-4.27	-3.20	-2.31	-1.78	-0.89	-0.53	-0.27	-0.18	-0.09
Accommodation and Food Services	-17.5	-12.7	-9.52	-6.88	-5.29	-2.65	-1.59	-0.79	-0.53	-0.26
Other Services, except Public Administration	-14.5	-10.6	-7.93	-5.73	-4.41	-2.20	-1.32	-0.66	-0.44	-0.22
State and Local	-20.8	-15.1	-11.3	-8.18	-6.29	-3.15	-1.89	-0.94	-0.63	-0.31
Federal Civilian	-4.84	-3.52	-2.64	-1.91	-1.47	-0.73	-0.44	-0.22	-0.15	-0.07
Federal Military	-2.78	-2.02	-1.51	-1.09	-0.84	-0.42	-0.25	-0.13	-0.08	-0.04
Farm	-3.16	-2.30	-1.72	-1.24	-0.96	-0.48	-0.29	-0.14	-0.10	-0.05
Total	-257	-187	-140	-101	-77.8	-38.9	-23.4	-11.7	-7.78	-3.89

**Manatee County – Employment Losses**

The table below provides the baseline forecast for employment by industry for the future of Manatee County. The amount of aid provided should attempt to catch up to where the area should be 5-7 years down the road, as opposed to where the region was at the time of the event.

**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

Manatee Employment by Industry Baseline Forecast (In Thousands)

Industry	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Forestry, Fishing, Related Activities, and Other	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Mining	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Utilities	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Construction	10.3	12.0	12.7	13.2	13.7	14.1	14.5	14.8	15.1	10.3
Manufacturing	9.5	9.7	9.7	9.7	9.6	9.6	9.5	9.4	9.4	9.5
Wholesale Trade	4.3	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.3
Retail Trade	17.3	17.7	17.9	18.0	18.1	18.1	18.1	18.1	18.1	17.3
Transportation and Warehousing	2.5	2.6	2.7	2.7	2.7	2.7	2.8	2.8	2.8	2.5
Information	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Finance and Insurance	7.2	7.3	7.5	7.6	7.8	7.8	7.9	8.0	8.0	7.2
Real Estate and Rental and Leasing	12.8	13.3	13.7	13.9	14.2	14.4	14.5	14.6	14.8	12.8
Professional and Technical Services	9.8	10.3	10.8	11.2	11.6	12.0	12.3	12.7	12.9	9.8
Management of Companies and Enterprises	3.1	3.1	3.2	3.2	3.2	3.2	3.1	3.1	3.1	3.1
Administrative and Waste Services	18.8	19.2	19.6	19.8	20.0	20.2	20.3	20.4	20.5	18.8
Educational Services	1.9	2.0	2.1	2.1	2.2	2.2	2.2	2.3	2.3	1.9
Health Care and Social Assistance	16.4	16.8	17.6	18.3	18.9	19.5	20.1	20.7	21.1	16.4
Arts, Entertainment, and Recreation	5.1	5.2	5.3	5.4	5.5	5.5	5.6	5.6	5.6	5.1
Accommodation and Food Services	10.7	10.9	11.1	11.2	11.3	11.3	11.3	11.3	11.4	10.7
Other Services, except Public Administration	10.6	11.0	11.3	11.6	11.8	12.0	12.1	12.3	12.4	10.6
State and Local	11.2	11.2	11.4	11.6	11.8	12.0	12.2	12.3	12.5	11.2
Federal Civilian	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0
Federal Military	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Farm	4.4	4.4	4.3	4.3	4.3	4.2	4.2	4.1	4.1	4.4
Total	161	167	171	174	177	179	181	183	184	161

Actual employment losses by industry for Manatee County are shown below.

**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

Manatee Employment Losses by Industry (In Thousands)

Industry	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Forestry, Fishing, Related Activities, and Other	-0.73	-0.53	-0.40	-0.29	-0.22	-0.11	-0.07	-0.03	-0.02	-0.01
Mining	-0.03	-0.02	-0.02	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00
Utilities	-0.08	-0.06	-0.04	-0.03	-0.02	-0.01	-0.01	0.00	0.00	0.00
Construction	-3.41	-2.48	-1.86	-1.34	-1.03	-0.52	-0.31	-0.16	-0.10	-0.05
Manufacturing	-3.13	-2.28	-1.71	-1.23	-0.95	-0.47	-0.28	-0.14	-0.09	-0.05
Wholesale Trade	-1.43	-1.04	-0.78	-0.56	-0.43	-0.22	-0.13	-0.06	-0.04	-0.02
Retail Trade	-5.70	-4.14	-3.11	-2.24	-1.73	-0.86	-0.52	-0.26	-0.17	-0.09
Transportation and Warehousing	-0.83	-0.60	-0.45	-0.33	-0.25	-0.13	-0.08	-0.04	-0.03	-0.01
Information	-0.47	-0.34	-0.26	-0.19	-0.14	-0.07	-0.04	-0.02	-0.01	-0.01
Finance and Insurance	-2.37	-1.73	-1.29	-0.93	-0.72	-0.36	-0.22	-0.11	-0.07	-0.04
Real Estate and Rental and Leasing	-4.22	-3.07	-2.30	-1.66	-1.28	-0.64	-0.38	-0.19	-0.13	-0.06
Professional and Technical Services	-3.22	-2.34	-1.76	-1.27	-0.98	-0.49	-0.29	-0.15	-0.10	-0.05
Management of Companies and Enterprises	-1.01	-0.74	-0.55	-0.40	-0.31	-0.15	-0.09	-0.05	-0.03	-0.02
Administrative and Waste Services	-6.22	-4.52	-3.39	-2.45	-1.88	-0.94	-0.57	-0.28	-0.19	-0.09
Educational Services	-0.63	-0.46	-0.34	-0.25	-0.19	-0.10	-0.06	-0.03	-0.02	-0.01
Health Care and Social Assistance	-5.40	-3.93	-2.95	-2.13	-1.64	-0.82	-0.49	-0.25	-0.16	-0.08
Arts, Entertainment, and Recreation	-1.70	-1.23	-0.92	-0.67	-0.51	-0.26	-0.15	-0.08	-0.05	-0.03
Accommodation and Food Services	-3.52	-2.56	-1.92	-1.39	-1.07	-0.53	-0.32	-0.16	-0.11	-0.05
Other Services, except Public Administration	-3.49	-2.54	-1.90	-1.37	-1.06	-0.53	-0.32	-0.16	-0.11	-0.05
State and Local	-3.69	-2.68	-2.01	-1.45	-1.12	-0.56	-0.34	-0.17	-0.11	-0.06
Federal Civilian	-0.33	-0.24	-0.18	-0.13	-0.10	-0.05	-0.03	-0.01	-0.01	0.00
Federal Military	-0.22	-0.16	-0.12	-0.09	-0.07	-0.03	-0.02	-0.01	-0.01	0.00
Farm	-1.45	-1.05	-0.79	-0.57	-0.44	-0.22	-0.13	-0.07	-0.04	-0.02
Total	-53.3	-38.8	-29.1	-21.0	-16.1	-8.1	-4.8	-2.4	-1.6	-0.8

**Part III – Analysis**

**Tampa Bay Disaster Resiliency Study**

**Pasco County – Employment Losses**

The table below provides the baseline forecast for employment by industry for the future of Pasco County. The amount of aid provided should attempt to catch up to where the area should be 5-7 years down the road, as opposed to where the region was at the time of the event.

Pasco Employment by Industry Baseline Forecast (In Thousands)

<b>Industry</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>	<b>Year 6</b>	<b>Year 7</b>	<b>Year 8</b>	<b>Year 9</b>	<b>Year 10</b>
Forestry, Fishing, Related Activities, and Other	0.77	0.78	0.79	0.80	0.80	0.80	0.79	0.79	0.81	0.83
Mining	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Utilities	0.78	0.80	0.82	0.83	0.84	0.84	0.84	0.85	0.85	0.85
Construction	10.7	12.3	12.9	13.4	13.8	14.3	14.6	15.0	15.3	15.7
Manufacturing	3.63	3.78	3.84	3.89	3.93	3.94	3.95	3.95	3.97	3.97
Wholesale Trade	2.47	2.53	2.55	2.57	2.58	2.58	2.58	2.58	2.60	2.61
Retail Trade	20.2	20.6	20.9	21.1	21.2	21.3	21.4	21.5	21.6	21.8
Transportation and Warehousing	2.51	2.60	2.66	2.70	2.73	2.76	2.78	2.80	2.83	2.86
Information	1.01	1.00	1.01	1.02	1.03	1.03	1.04	1.06	1.05	1.05
Finance and Insurance	5.35	5.44	5.55	5.64	5.72	5.77	5.82	5.87	5.92	5.96
Real Estate and Rental and Leasing	7.63	7.92	8.15	8.33	8.50	8.64	8.74	8.85	8.99	9.08
Professional and Technical Services	6.80	7.15	7.47	7.77	8.07	8.34	8.61	8.88	9.08	9.23
Management of Companies and Enterprises	0.41	0.41	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.43
Administrative and Waste Services	9.4	9.6	9.8	9.9	10.0	10.1	10.2	10.3	10.4	10.5
Educational Services	2.33	2.44	2.53	2.62	2.69	2.76	2.82	2.87	2.94	2.97
Health Care and Social Assistance	17.7	18.1	18.9	19.7	20.5	21.2	21.8	22.5	23.2	23.7
Arts, Entertainment, and Recreation	2.77	2.82	2.89	2.94	2.99	3.02	3.04	3.07	3.10	3.14
Accommodation and Food Services	11.5	11.8	12.1	12.4	12.6	12.7	12.8	12.9	13.0	13.3
Other Services, except Public Administration	10.4	10.7	11.0	11.3	11.5	11.7	11.8	12.0	12.2	12.3
State and Local	16.0	16.0	16.4	16.8	17.2	17.6	17.9	18.3	18.6	19.0
Federal Civilian	0.90	0.90	0.90	0.89	0.89	0.88	0.87	0.87	0.87	0.86
Federal Military	0.95	0.92	0.94	0.95	0.97	0.99	1.00	1.02	1.02	1.01
Farm	1.39	1.38	1.37	1.36	1.35	1.34	1.33	1.31	1.30	1.28
<b>Total</b>	<b>136</b>	<b>140</b>	<b>144</b>	<b>147</b>	<b>151</b>	<b>153</b>	<b>155</b>	<b>158</b>	<b>160</b>	<b>163</b>

**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

Actual employment losses by industry for Hillsborough County are shown below.

Pasco Employment Losses by Industry (In Thousands)

<b>Industry</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>	<b>Year 6</b>	<b>Year 7</b>	<b>Year 8</b>	<b>Year 9</b>	<b>Year 10</b>
Forestry, Fishing, Related Activities, and Other	-0.25	-0.19	-0.14	-0.10	-0.08	-0.04	-0.02	-0.01	-0.01	0.00
Mining	-0.07	-0.05	-0.04	-0.03	-0.02	-0.01	-0.01	0.00	0.00	0.00
Utilities	-0.26	-0.19	-0.14	-0.10	-0.08	-0.04	-0.02	-0.01	-0.01	0.00
Construction	-3.52	-2.56	-1.92	-1.38	-1.07	-0.53	-0.32	-0.16	-0.11	-0.05
Manufacturing	-1.20	-0.87	-0.65	-0.47	-0.36	-0.18	-0.11	-0.05	-0.04	-0.02
Wholesale Trade	-0.81	-0.59	-0.44	-0.32	-0.25	-0.12	-0.07	-0.04	-0.02	-0.01
Retail Trade	-6.66	-4.85	-3.64	-2.63	-2.02	-1.01	-0.61	-0.30	-0.20	-0.10
Transportation and Warehousing	-0.83	-0.60	-0.45	-0.33	-0.25	-0.13	-0.08	-0.04	-0.03	-0.01
Information	-0.33	-0.24	-0.18	-0.13	-0.10	-0.05	-0.03	-0.02	-0.01	-0.01
Finance and Insurance	-1.77	-1.28	-0.96	-0.70	-0.54	-0.27	-0.16	-0.08	-0.05	-0.03
Real Estate and Rental and Leasing	-2.52	-1.83	-1.37	-0.99	-0.76	-0.38	-0.23	-0.11	-0.08	-0.04
Professional and Technical Services	-2.24	-1.63	-1.22	-0.88	-0.68	-0.34	-0.20	-0.10	-0.07	-0.03
Management of Companies and Enterprises	-0.13	-0.10	-0.07	-0.05	-0.04	-0.02	-0.01	-0.01	0.00	0.00
Administrative and Waste Services	-3.11	-2.26	-1.69	-1.22	-0.94	-0.47	-0.28	-0.14	-0.09	-0.05
Educational Services	-0.77	-0.56	-0.42	-0.30	-0.23	-0.12	-0.07	-0.04	-0.02	-0.01
Health Care and Social Assistance	-5.84	-4.25	-3.19	-2.30	-1.77	-0.89	-0.53	-0.27	-0.18	-0.09
Arts, Entertainment, and Recreation	-0.91	-0.67	-0.50	-0.36	-0.28	-0.14	-0.08	-0.04	-0.03	-0.01
Accommodation and Food Services	-3.78	-2.75	-2.06	-1.49	-1.15	-0.57	-0.34	-0.17	-0.11	-0.06
Other Services, except Public Administration	-3.45	-2.51	-1.88	-1.36	-1.04	-0.52	-0.31	-0.16	-0.10	-0.05
State and Local	-5.27	-3.83	-2.88	-2.08	-1.60	-0.80	-0.48	-0.24	-0.16	-0.08
Federal Civilian	-0.30	-0.22	-0.16	-0.12	-0.09	-0.05	-0.03	-0.01	-0.01	0.00
Federal Military	-0.31	-0.23	-0.17	-0.12	-0.10	-0.05	-0.03	-0.01	-0.01	0.00
Farm	-0.46	-0.33	-0.25	-0.18	-0.14	-0.07	-0.04	-0.02	-0.01	-0.01
<b>Total</b>	<b>-44.8</b>	<b>-32.6</b>	<b>-24.4</b>	<b>-17.6</b>	<b>-13.6</b>	<b>-6.8</b>	<b>-4.1</b>	<b>-2.0</b>	<b>-1.4</b>	<b>-0.7</b>

**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

**Pinellas County – Employment Losses**

The table below provides the baseline forecast for employment by industry for the future of Pinellas County.

Pinellas Employment by Industry Baseline Forecast (In Thousands)

<b>Industry</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>	<b>Year 6</b>	<b>Year 7</b>	<b>Year 8</b>	<b>Year 9</b>	<b>Year 10</b>
Forestry, Fishing, Related Activities, and Other	0.63	0.64	0.64	0.64	0.64	0.64	0.64	0.63	0.64	0.65
Mining	0.54	0.53	0.53	0.53	0.52	0.51	0.49	0.48	0.47	0.46
Utilities	0.56	0.56	0.56	0.55	0.54	0.54	0.53	0.52	0.51	0.50
Construction	29.8	33.8	35.2	36.4	37.5	38.6	39.6	40.6	41.3	42.0
Manufacturing	35.5	36.1	36.4	36.6	36.7	36.9	37.4	37.9	37.7	37.5
Wholesale Trade	17.5	18.0	18.2	18.3	18.3	18.4	18.5	18.6	18.7	18.8
Retail Trade	59.8	60.7	61.1	61.1	61.1	61.0	60.8	60.6	60.5	60.8
Transportation and Warehousing	8.94	9.23	9.39	9.52	9.62	9.70	9.75	9.81	9.90	10.00
Information	9.32	9.39	9.53	9.66	9.80	9.95	10.12	10.32	10.34	10.32
Finance and Insurance	34.2	34.7	35.3	35.8	36.2	36.5	36.7	36.9	37.1	37.5
Real Estate and Rental and Leasing	33.4	34.5	35.3	35.9	36.5	37.0	37.3	37.7	38.0	38.2
Professional and Technical Services	45.3	47.3	49.2	50.8	52.4	53.8	55.3	56.8	57.6	58.4
Management of Companies and Enterprises	11.3	11.5	11.6	11.6	11.7	11.7	11.6	11.6	11.6	11.6
Administrative and Waste Services	56.8	58.1	59.4	60.4	61.3	62.0	62.6	63.3	63.9	64.4
Educational Services	9.5	9.9	10.2	10.5	10.7	10.9	11.0	11.2	11.4	11.4
Health Care and Social Assistance	73.3	74.8	77.8	80.5	83.0	85.4	87.7	90.0	91.8	93.4
Arts, Entertainment, and Recreation	12.4	12.6	12.8	12.9	13.0	13.1	13.1	13.1	13.1	13.2
Accommodation and Food Services	41.2	41.8	42.3	42.6	42.7	42.7	42.6	42.5	42.5	42.8
Other Services, except Public Administration	36.1	37.2	38.2	38.9	39.5	40.0	40.4	40.9	41.2	41.6
State and Local	38.6	38.5	39.3	40.0	40.8	41.6	42.4	43.2	43.9	44.4
Federal Civilian	7.23	7.21	7.17	7.13	7.09	7.04	6.98	6.93	6.92	6.90
Federal Military	3.03	2.92	2.98	3.03	3.09	3.14	3.19	3.24	3.25	3.22
Farm	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14
<b>Total</b>	<b>565</b>	<b>580</b>	<b>593</b>	<b>603</b>	<b>613</b>	<b>621</b>	<b>629</b>	<b>637</b>	<b>643</b>	<b>648</b>

**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

Actual employment losses by industry for Pinellas County are shown below.

Pinellas Employment Losses by Industry (In Thousands)

Industry	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Forestry, Fishing, Related Activities, and Other	-0.21	-0.15	-0.11	-0.08	-0.06	-0.03	-0.02	-0.01	-0.01	0.00
Mining	-0.18	-0.13	-0.10	-0.07	-0.05	-0.03	-0.02	-0.01	-0.01	0.00
Utilities	-0.19	-0.13	-0.10	-0.07	-0.06	-0.03	-0.02	-0.01	-0.01	0.00
Construction	-9.82	-7.14	-5.36	-3.87	-2.98	-1.49	-0.89	-0.45	-0.30	-0.15
Manufacturing	-11.7	-8.51	-6.39	-4.61	-3.55	-1.77	-1.06	-0.53	-0.35	-0.18
Wholesale Trade	-5.79	-4.21	-3.16	-2.28	-1.75	-0.88	-0.53	-0.26	-0.18	-0.09
Retail Trade	-19.7	-14.3	-10.8	-7.77	-5.98	-2.99	-1.79	-0.90	-0.60	-0.30
Transportation and Warehousing	-2.95	-2.15	-1.61	-1.16	-0.89	-0.45	-0.27	-0.13	-0.09	-0.04
Information	-3.07	-2.24	-1.68	-1.21	-0.93	-0.47	-0.28	-0.14	-0.09	-0.05
Finance and Insurance	-11.3	-8.21	-6.16	-4.45	-3.42	-1.71	-1.03	-0.51	-0.34	-0.17
Real Estate and Rental and Leasing	-11.0	-8.01	-6.00	-4.34	-3.34	-1.67	-1.00	-0.50	-0.33	-0.17
Professional and Technical Services	-14.9	-10.9	-8.15	-5.89	-4.53	-2.26	-1.36	-0.68	-0.45	-0.23
Management of Companies and Enterprises	-3.72	-2.70	-2.03	-1.46	-1.13	-0.56	-0.34	-0.17	-0.11	-0.06
Administrative and Waste Services	-18.8	-13.6	-10.2	-7.39	-5.68	-2.84	-1.70	-0.85	-0.57	-0.28
Educational Services	-3.15	-2.29	-1.72	-1.24	-0.95	-0.48	-0.29	-0.14	-0.10	-0.05
Health Care and Social Assistance	-24.2	-17.9	-13.2	-9.53	-7.33	-3.67	-2.20	-1.10	-0.73	-0.37
Arts, Entertainment, and Recreation	-4.08	-2.97	-2.23	-1.61	-1.24	-0.62	-0.37	-0.19	-0.12	-0.06
Accommodation and Food Services	-13.6	-9.88	-7.41	-5.35	-4.12	-2.06	-1.23	-0.62	-0.41	-0.21
Other Services, except Public Administration	-11.9	-8.66	-6.50	-4.69	-3.61	-1.80	-1.08	-0.54	-0.36	-0.18
State and Local	-12.8	-9.28	-6.96	-5.02	-3.86	-1.93	-1.16	-0.58	-0.39	-0.19
Federal Civilian	-2.38	-1.73	-1.30	-0.94	-0.72	-0.36	-0.22	-0.11	-0.07	-0.04
Federal Military	-1.00	-0.73	-0.55	-0.39	-0.30	-0.15	-0.09	-0.05	-0.03	-0.02
Farm	-0.05	-0.04	-0.03	-0.02	-0.02	-0.01	0.00	0.00	0.00	0.00
Total	-186	-136	-102	-73.4	-56.5	-28.2	-16.9	-8.47	-5.65	-2.82

**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

**Tampa Bay – Employment Losses**

The table below provides the baseline forecast for employment by industry for the future of the Tampa Bay Area. The amount of aid provided should attempt to catch up to where the area should be 5-7 years down the road, as opposed to where the region was at the time of the event.

Tampa Bay Employment by Industry Baseline Forecast (In Thousands)

Industry	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Forestry, Fishing, Related Activities, and Other	6.6	6.7	6.7	6.7	6.7	6.7	6.7	6.6	6.8	6.9
Mining	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2
Utilities	4.3	4.3	4.4	4.4	4.3	4.3	4.3	4.2	4.2	4.1
Construction	95	108	113	117	121	125	128	131	133	136
Manufacturing	77.0	78.6	79.1	79.4	79.4	79.4	79.5	79.7	79.4	79.0
Wholesale Trade	57.7	59.3	59.8	60.1	60.3	60.4	60.4	60.4	60.7	60.9
Retail Trade	173	176	178	179	180	180	180	180	180	181
Transportation and Warehousing	36.3	37.6	38.3	38.8	39.3	39.6	39.9	40.1	40.5	40.9
Information	32.1	32.3	32.8	33.3	33.8	34.3	34.8	35.4	35.6	35.6
Finance and Insurance	108	110	112	113	115	115	116	116	117	118
Real Estate and Rental and Leasing	85.8	89.1	91.4	93.2	94.9	96.2	97.2	98.3	99.3	100.0
Professional and Technical Services	130	137	142	148	153	157	162	166	169	171
Management of Companies and Enterprises	21.8	22.3	22.5	22.6	22.6	22.6	22.6	22.6	22.5	22.6
Administrative and Waste Services	164	168	172	175	178	180	182	184	186	188
Educational Services	27.5	28.6	29.7	30.5	31.3	31.9	32.4	33.0	33.6	33.9
Health Care and Social Assistance	182	186	194	202	209	215	221	227	233	237
Arts, Entertainment, and Recreation	38.1	38.8	39.6	40.1	40.5	40.8	41.0	41.1	41.4	41.7
Accommodation and Food Services	116	119	121	122	123	124	124	124	125	126
Other Services, except Public Administration	101	104	107	109	111	113	114	115	116	117
State and Local	129	128	131	134	137	140	142	145	147	149
Federal Civilian	23.8	23.7	23.6	23.5	23.3	23.2	23.0	22.8	22.8	22.7
Federal Military	13.1	12.6	12.8	13.1	13.3	13.5	13.8	14.0	14.0	13.9
Farm	15.5	15.4	15.3	15.2	15.1	14.9	14.8	14.6	14.5	14.3
Total	1,640	1,688	1,728	1,762	1,792	1,817	1,839	1,862	1,882	1,901

**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

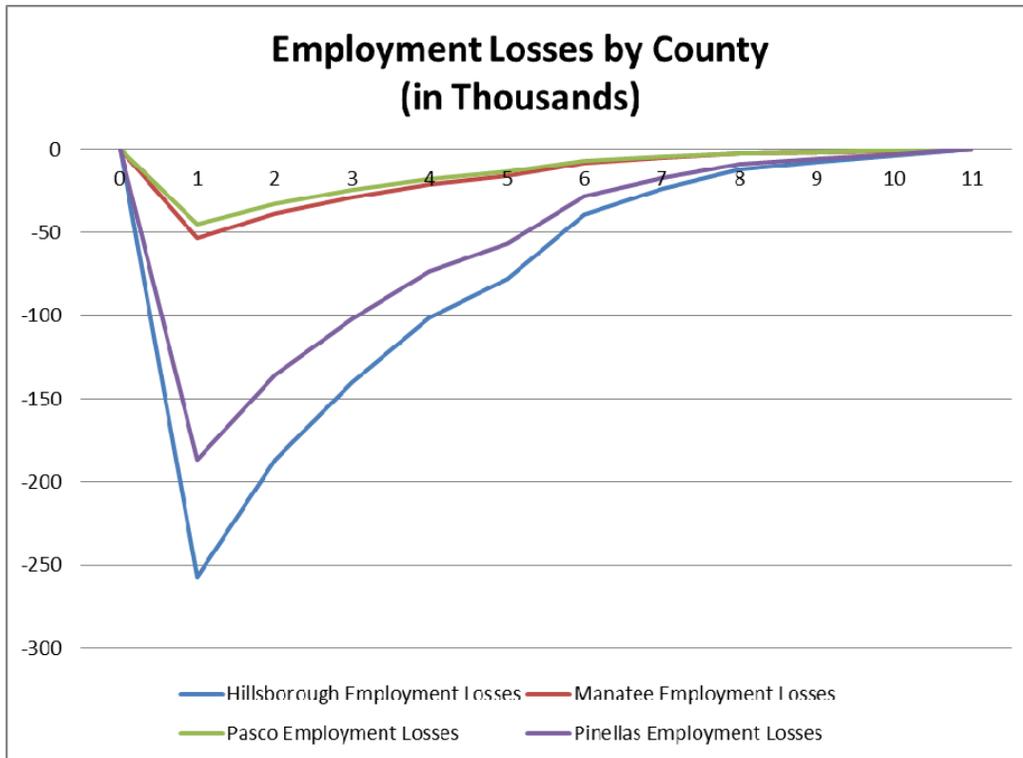
Actual employment losses by industry for the Tampa Bay Region are shown below.

Tampa Bay Employment Losses by Industry (In Thousands)

**Chart 1 - Employment Losses by County**

<b>Industry</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>	<b>Year 6</b>	<b>Year 7</b>	<b>Year 8</b>	<b>Year 9</b>	<b>Year 10</b>
Forestry, Fishing, Related Activities, and Other	-2	-2	-1	-1	-0.7	-0.3	-0.2	-0.10	-0.07	-0.03
Mining	-0.4	-0.3	-0.2	-0.2	-0.1	-0.1	0.0	-0.02	-0.01	-0.01
Utilities	-1	-1	-1	-1	-0.4	-0.2	-0.1	-0.06	-0.04	-0.02
Construction	-31	-23	-17	-12	-9.5	-4.8	-2.9	-1.43	-0.95	-0.48
Manufacturing	-25	-18	-14	-10	-7.7	-3.9	-2.3	-1.16	-0.77	-0.39
Wholesale Trade	-19	-14	-10	-8	-5.8	-2.9	-1.7	-0.87	-0.58	-0.29
Retail Trade	-57	-42	-31	-23	-17.3	-8.7	-5.2	-2.60	-1.73	-0.87
Transportation and Warehousing	-12	-9	-7	-5	-3.6	-1.8	-1.1	-0.54	-0.36	-0.18
Information	-11	-8	-6	-4	-3.2	-1.6	-1.0	-0.48	-0.32	-0.16
Finance and Insurance	-36	-26	-20	-14	-10.8	-5.4	-3.3	-1.63	-1.08	-0.54
Real Estate and Rental and Leasing	-28	-21	-15	-11	-8.6	-4.3	-2.6	-1.29	-0.86	-0.43
Professional and Technical Services	-43	-31	-23	-17	-13.0	-6.5	-3.9	-1.95	-1.30	-0.65
Management of Companies and Enterprises	-7	-5	-4	-3	-2.2	-1.1	-0.7	-0.33	-0.22	-0.11
Administrative and Waste Services	-54	-39	-30	-21	-16.4	-8.2	-4.9	-2.46	-1.64	-0.82
Educational Services	-9	-7	-5	-4	-2.8	-1.4	-0.8	-0.41	-0.28	-0.14
Health Care and Social Assistance	-60	-44	-33	-24	-18.2	-9.1	-5.5	-2.74	-1.82	-0.91
Arts, Entertainment, and Recreation	-13	-9	-7	-5	-3.8	-1.9	-1.1	-0.57	-0.38	-0.19
Accommodation and Food Services	-38	-28	-21	-15	-11.6	-5.8	-3.5	-1.74	-1.16	-0.58
Other Services, except Public Administration	-33	-24	-18	-13	-10.1	-5.1	-3.0	-1.52	-1.01	-0.51
State and Local	-42	-31	-23	-17	-12.9	-6.4	-3.9	-1.93	-1.29	-0.64
Federal Civilian	-8	-6	-4	-3	-2.4	-1.2	-0.7	-0.36	-0.24	-0.12
Federal Military	-4	-3	-2	-2	-1.3	-0.7	-0.4	-0.20	-0.13	-0.07
Farm	-5	-4	-3	-2	-1.6	-0.8	-0.5	-0.23	-0.16	-0.08
<b>Total</b>	<b>-541</b>	<b>-394</b>	<b>-295</b>	<b>-213</b>	<b>-164</b>	<b>-82</b>	<b>-49</b>	<b>-25</b>	<b>-16</b>	<b>-8</b>

**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**



The Construction and Clean up Gains were estimated on rebuilding the residential and non residential capital stock and the Federal Assistance provided to New Orleans in Hurricane Katrina. Federal Assistance was dispersed using a per capita approach to each county. The capital stock figures used were from the Project Phoenix scenario.

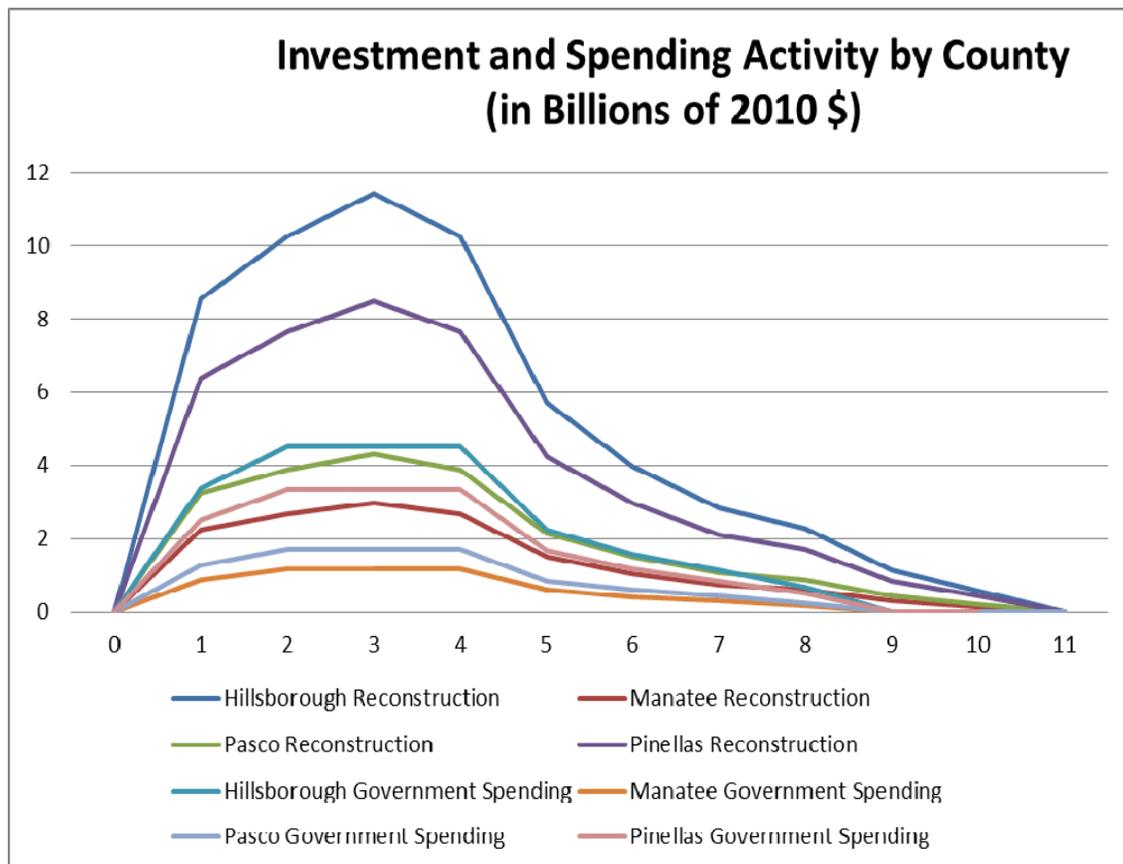
Residential and Nonresidential estimates were similar and the amounts were split evenly in the rebuilding phases. A total of almost \$136 Billion would be spent over 10 years, creating a significant economic driver. Additionally, the Federal Government would contribute over \$53 Billion in government spending. Total activity would equal almost \$190 Billion into the local economy over 10 years. The tables below show the investment amount and type in the four county region. Numbers are in Billions of \$2010

Type	TOTAL	1	2	3	4	5
<b>Residential Construction</b>	\$67.9	\$10.2	\$12.2	\$13.6	\$12.2	\$6.8
<b>NonResidential Construction</b>	\$67.9	\$10.2	\$12.2	\$13.6	\$12.2	\$6.8
<b>Government Spending</b>	\$53.6	\$8.0	\$10.7	\$10.7	\$10.7	\$5.4
<b>TOTAL SPENDING</b>	<b>\$189.5</b>	<b>\$28.4</b>	<b>\$35.2</b>	<b>\$37.9</b>	<b>\$35.2</b>	<b>\$19.0</b>

**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

Type	TOTAL	6	7	8	9	10
<b>Residential Construction</b>	\$67.9	\$4.8	\$3.4	\$2.7	\$1.4	\$0.7
<b>NonResidential Construction</b>	\$67.9	\$4.8	\$3.4	\$2.7	\$1.4	\$0.7
<b>Government Spending</b>	\$53.6	\$3.8	\$2.7	\$1.6	\$0	\$0
<b>TOTAL SPENDING</b>	<b>\$189.5</b>	<b>\$13.3</b>	<b>\$9.5</b>	<b>\$7.0</b>	<b>\$2.7</b>	<b>\$1.4</b>

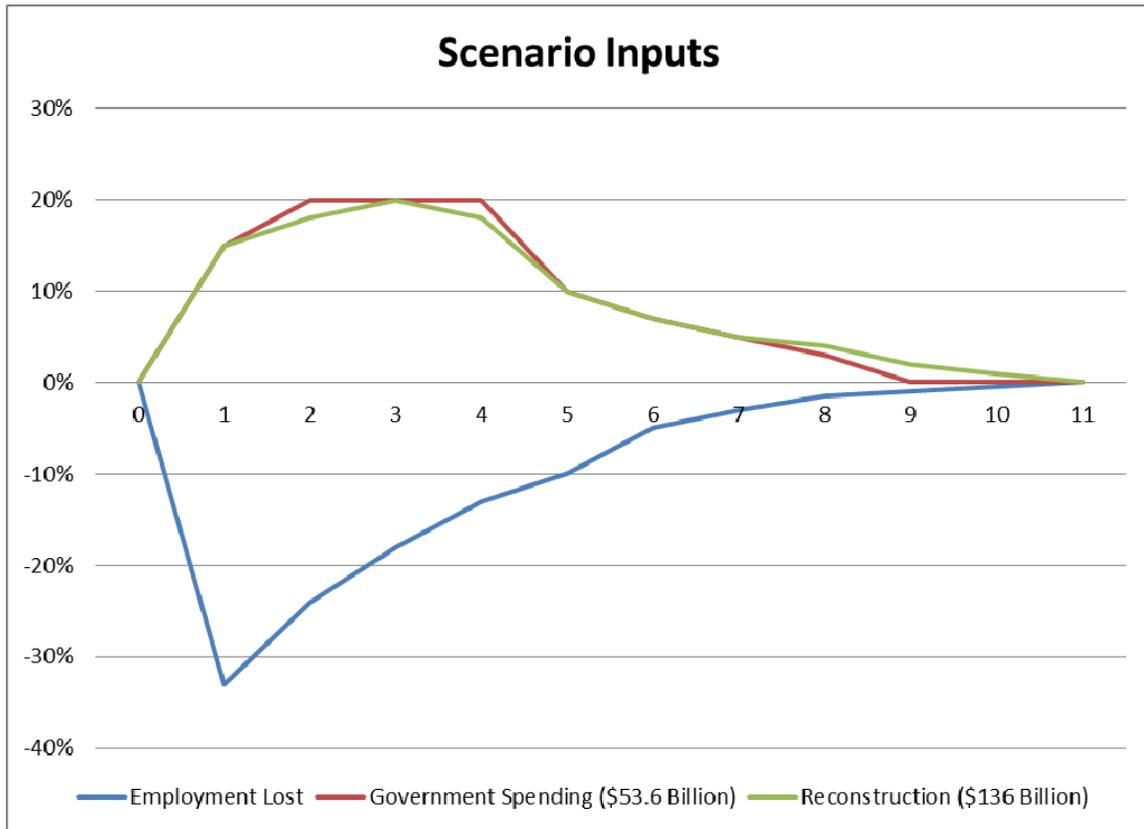
The information provided in the previous table is shown graphically below.



**Chart 2 - Investment and Spending Activity by County**

**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

**Scenario Inputs**



**Chart 3 - Disaster Resiliency Scenario Inputs**

The inputs of the scenario are shown above in a percentage graphic to demonstrate the timing of the impacts. The negative impacts, the direct loss of employment, peaks at 30% of the regional workforce being unable to work. The positive impacts, the reconstruction and government spending, are spread over 8 and 10 years, the respective percent of the total spending is graphed.

**Results**

The results presented in this section are predominately in chart format. The goal is understand the concept and see if enough federal governmental assistance is being provided. These results are intended to be looked at from a bird’s eye view, not to the n<sup>th</sup> decimal place. Ensuring that the proper amount of government aid and assistance is administered to get back to the forecast pattern is more crucial than the actual number of jobs. The ultimate goal should be to be targeted in the correct direction and judged on a pass/fail grade. These estimates are provided to ballpark a local scenario.

A hypothetical scenario could include a controlled burn going awry and turning into a devastating inferno in the Westchase Traffic Evacuation Areas (TEAs) of Tampa in Hillsborough County. Local Hillsborough County staff would be able to pull out a map of the damage and identify the affected Traffic Evacuation Areas (TEAs). The staff would then find the corresponding TEAs in Section 2 of this document and be able to see how employment exists and in which industries. After examining the building damage, an average of 3 months is the likely estimate until the workers can return to work. Staff would be able to compare Westchase’s employment to all of Hillsborough County to see how many Hillsborough employees would be displaced for 3 months. Utilizing the data in the appendix, staff would then determine the factor between the wildfire displaced employees versus the Project Phoenix displaced employees would allow the staff to quickly divide the Hillsborough County Impact to see the negative impacts from the loss of employment. Knowing the negative side of the equation will help the local area determine how much governmental aid and assistance is needed by using the same factor.

After compensating government assistance with the reconstruction of the destroyed areas, the net result eventually turns positive. Most indicators turn positive towards the fifth year, but considering how far they drop, a number of successful years are needed in order to accrue some productivity. When talking about the status of an area in future years, it is important to remember that the area is constantly progressing. Florida has a stronger growth rate than most states and it would be unfair to assume it would stay at the levels when the incident occurs. To demonstrate the point, the next two charts (Charts 4 and 5) show the same employment changes from the scenario. Chart 4 compares employment change to the current level, showing the forecast. Chart 5 shows the new scenario compared to the forecast. In Chart 4, the region has a significant increase compared to the current level, even when comparing only the negative impacts. Chart 5 shows how important knowing your projected levels is in order to gauge how well the area responded.

The forecasts utilized are provided in the appendix. It is not essential for the forecasts to be precisely accurate, what we are measuring is the difference from the forecast based upon the assumed change in the new scenario.

The damage from the Negative Loss of Employment (Lime Green Line) demonstrates how critical the employment is to the entire region. The Positive Impact of Government Spending, Cleaning, and Reconstruction (Purple Line) show how much government

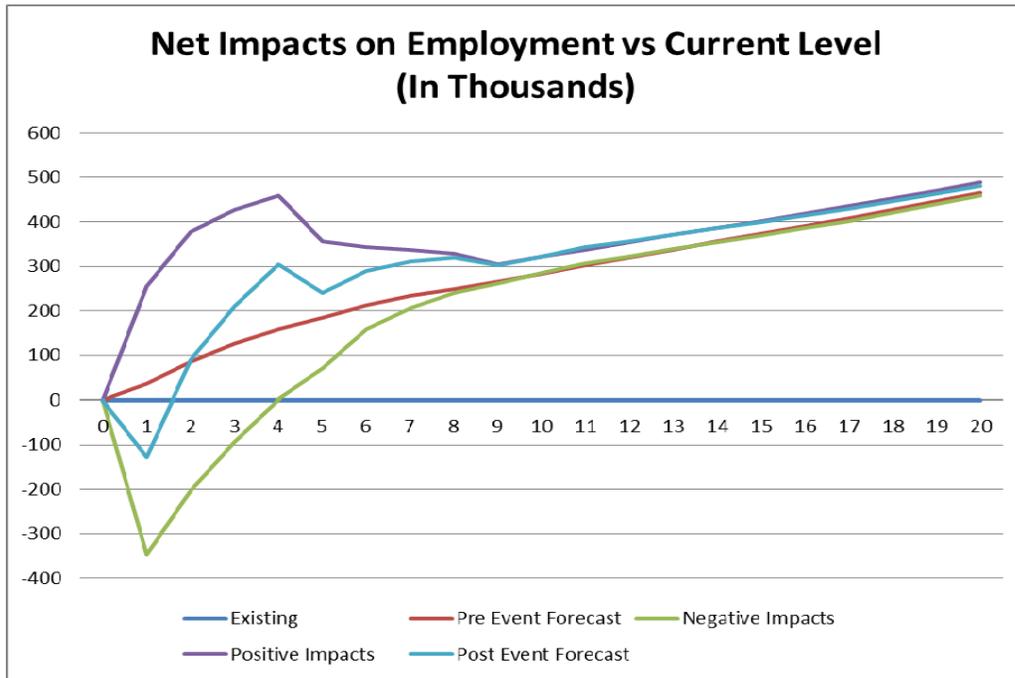
## **Part III – Analysis**

### **Tampa Bay Disaster Resiliency Study**

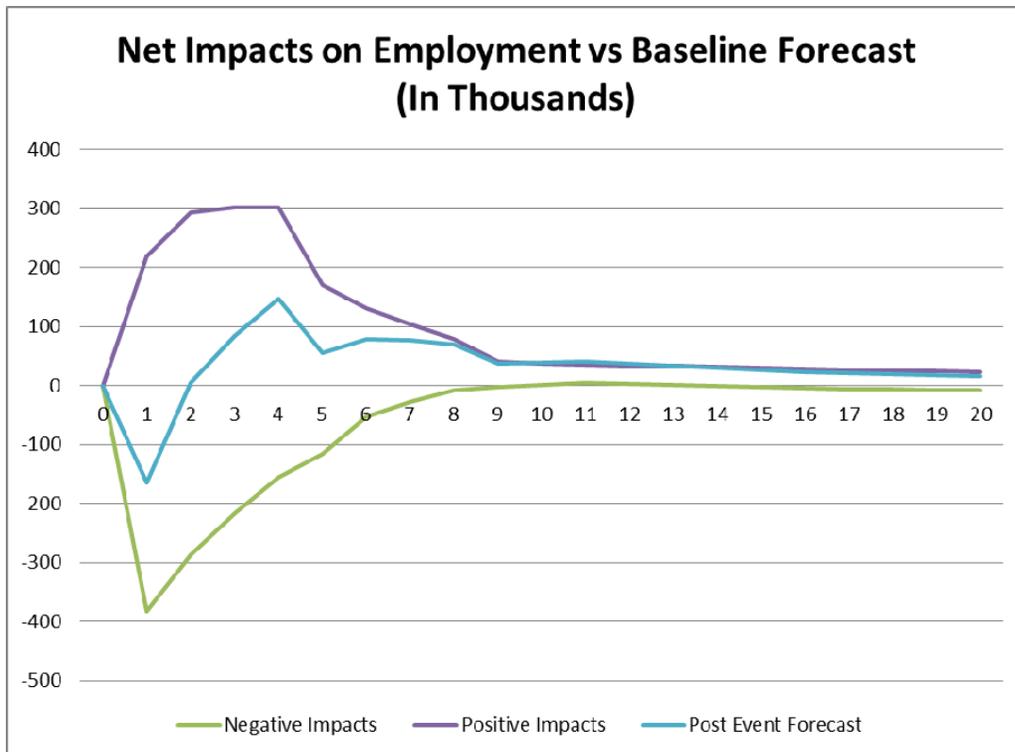
assistance can aid a community in need. The Net Impact from both events (Blue Line) is a gauge to see if the federal and local assistance meets the needs.

**Part III – Analysis**  
**Tampa Bay Disaster Resiliency Study**

**Net Impacts on Employment**

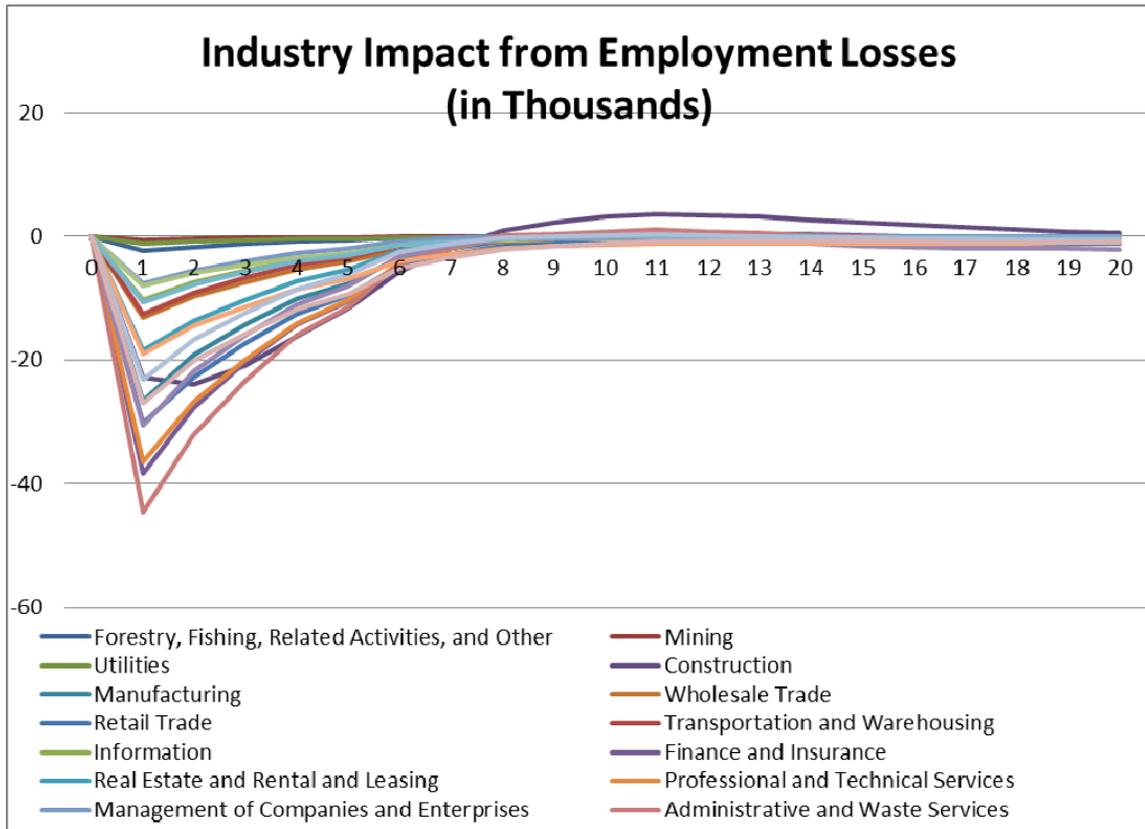


**Chart 4 - Net Impacts on Employment vs Current Level**



**Chart 5 - Net Impacts on Employment vs Baseline**

**Industry Impacts from Employment Losses**

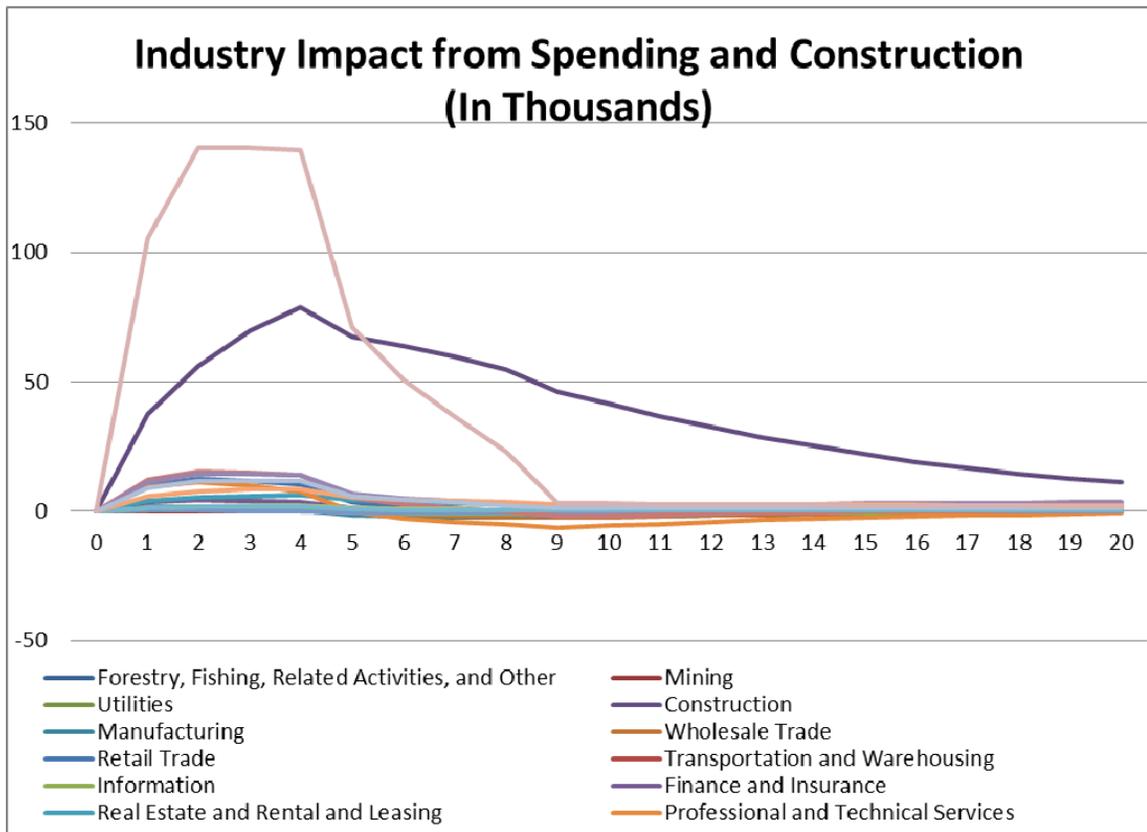


**Chart 6 - Industry Impact from Employment Losses**

The Negative Impacts from the Employment Loss are shown above. The graph shows the losses by industry by year. The construction industry automatically benefits from the employees returning to work, even without the positive impacts modeled. This scenario will only work with a normal workforce recovery rate. Any delays in getting employees to work caused by prolonged power outages, segmented succession plans, business exodus, etc would cause severe negative impacts.

The Administrative and Waste services, which covers a number of occupations including all temporary employment, shows the most employment decrease. This is expected since it is the region’s largest employer.

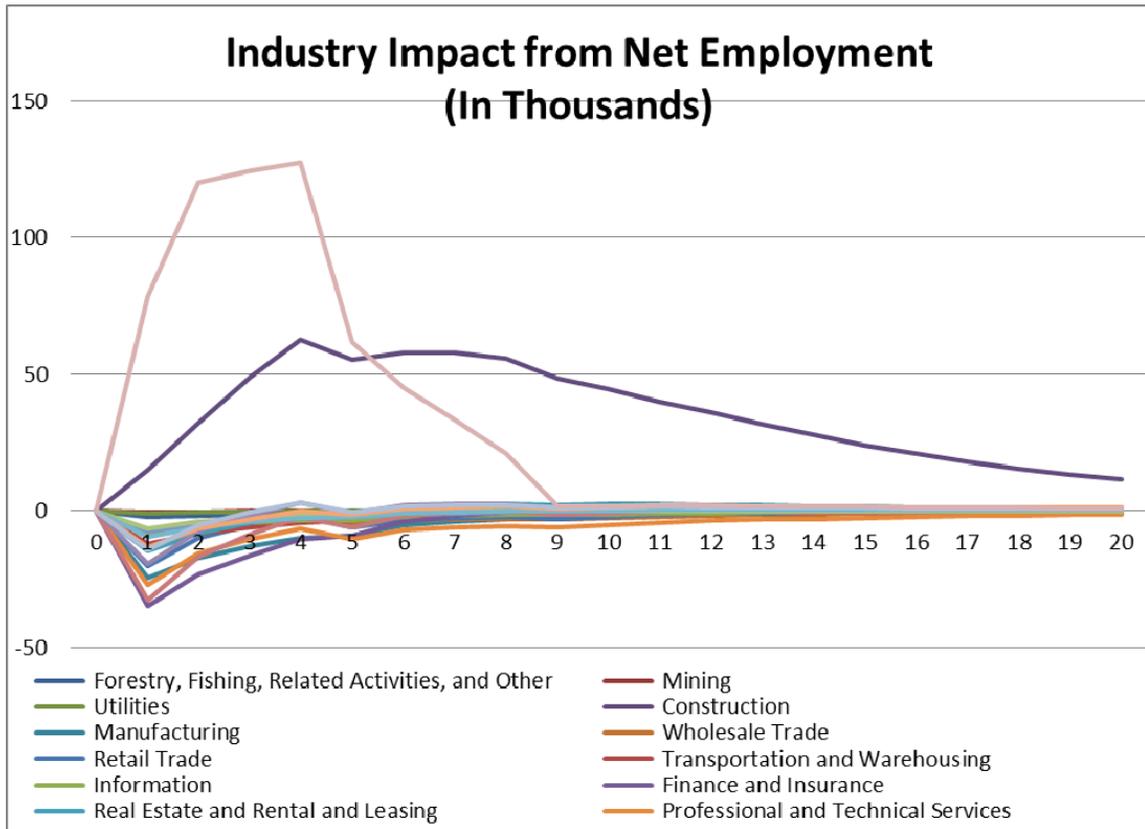
**Industry Impact from Spending and Construction**



**Chart 7 - Industry Impact from Spending and Construction**

Looking at the industry impact from the positive inputs, provided below, an increase is felt in all sectors. The government and construction sectors see the biggest boost, as expected. Once the spending and reconstruction slows down, a dip is experienced in most of the sectors, as businesses start to downsize and become more efficient.

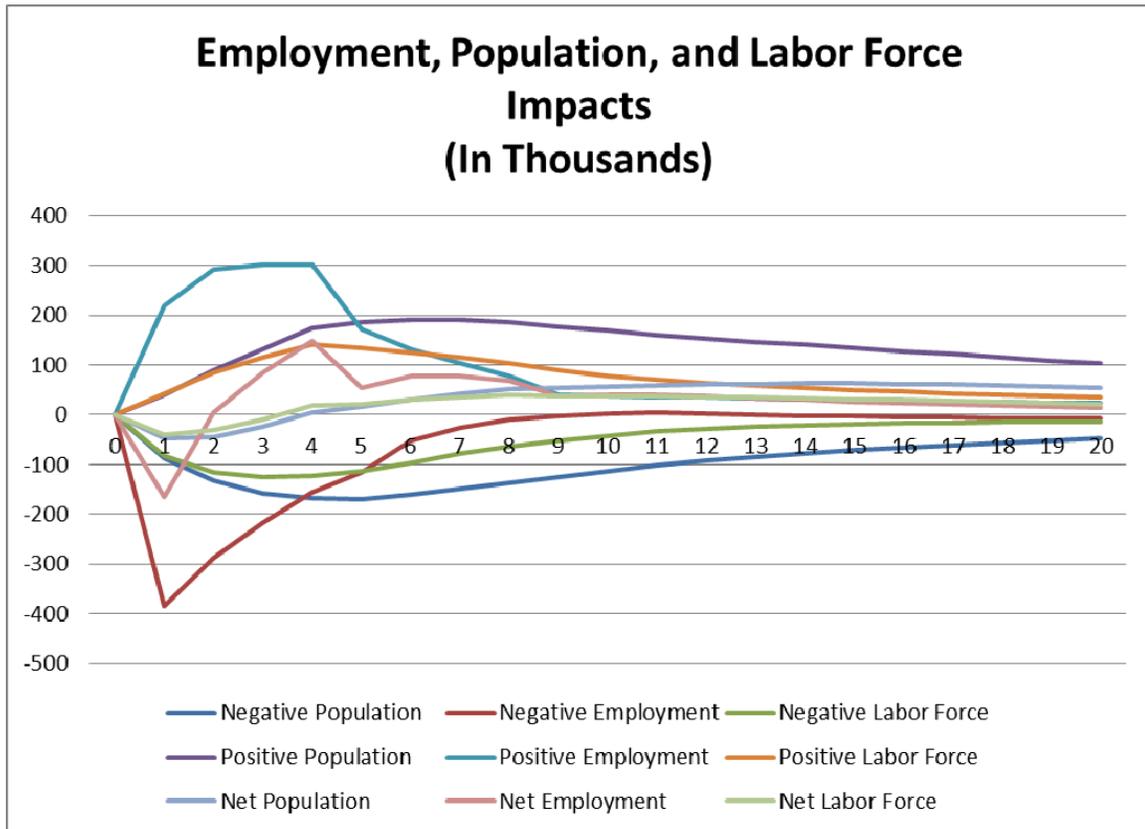
**Industry Impact from Net Employment**



**Chart 8 - Industry Impact from Net Employment**

The net employment impact of the event is shown on the graph below. It incorporates the Positive and Negative impacts. The biggest benefactors are government employment and construction. The surge in employment is enough to bring up the other sectors and offset their losses.

**Employment, Population, and Labor Force Impacts of All Scenarios**



**Chart 9 - Employment, Population, and Labor Force Impacts**

The change in Employment, Population, and Labor Force for the positive, negative, and net scenarios are shown in a graph below. The population and labor force are less elastic than the employment and typically has a slight lag effect, often due to the reluctance of someone to permanently move themselves and their family to a new place. Notice that without government assistance and reconstruction, the region never returns to the pre event forecast in Employment, Population, or Labor Force.

Net Impact to Economic Indicators

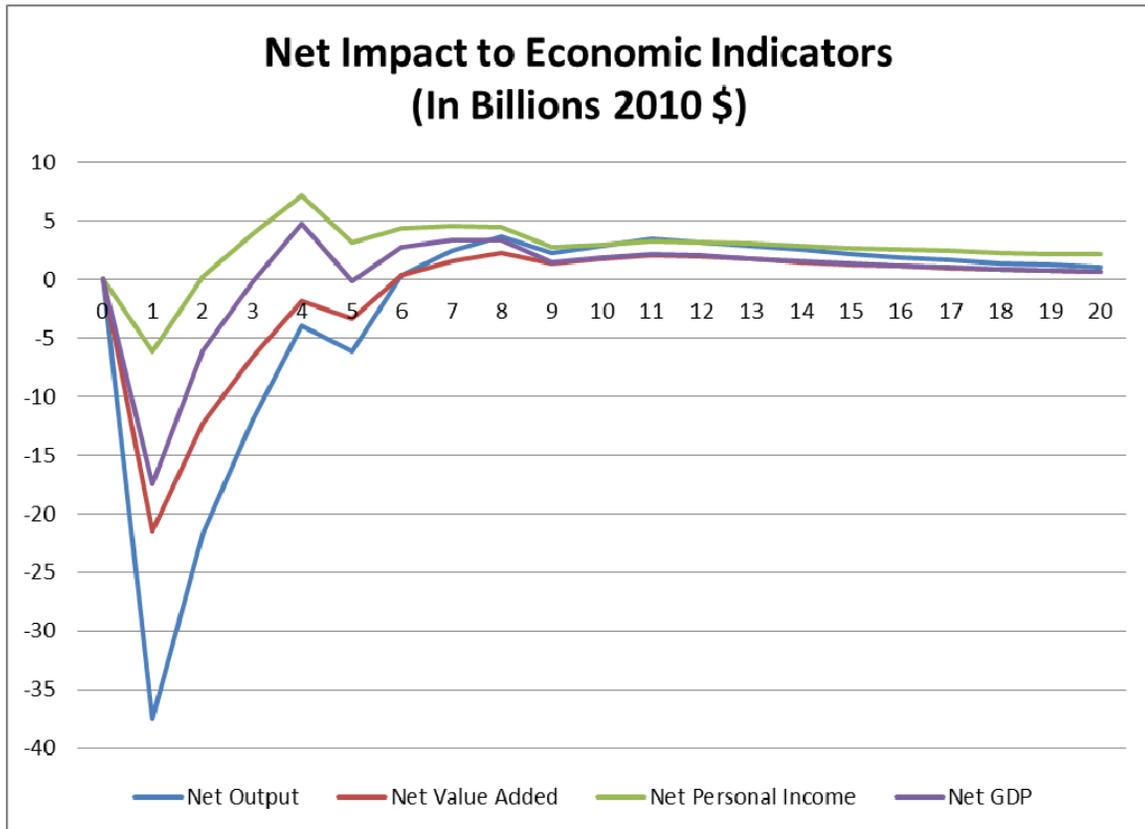


Chart 10 - Net Impact to Economic Indicators

With the swings in employment, it is important to look at how the local economy handles the changes. The Net Impacts are shown in the graph below, demonstrating how long it takes for the economy to rebound even with the surge in activity. The Output never reaches its pre event forecast until year 6, meaning the region lost an enormous amount of Output over the first 6 years of the recovery.

Net Impact to Exports

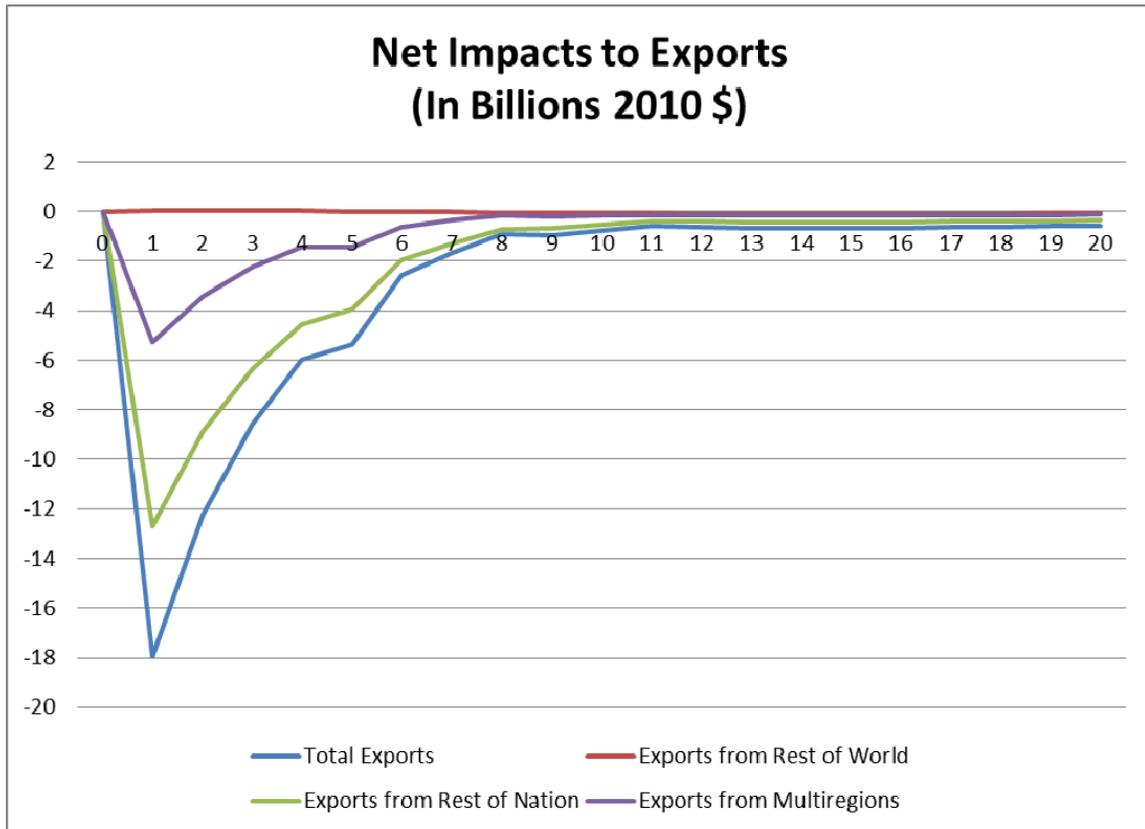


Chart 11 - Net Impact to Exports

When a region is devastated, it must rely upon other regions to import essentials until the business are back up and running. Then when the region is back at full capacity, it will gain steam from all of the activity happening within itself while it rebuilds. This behavior is shown in the charts below.

Chart 11 shows the Net Impacts decrease in Exports associated with the inability to produce materials.

Net Impact to Imports

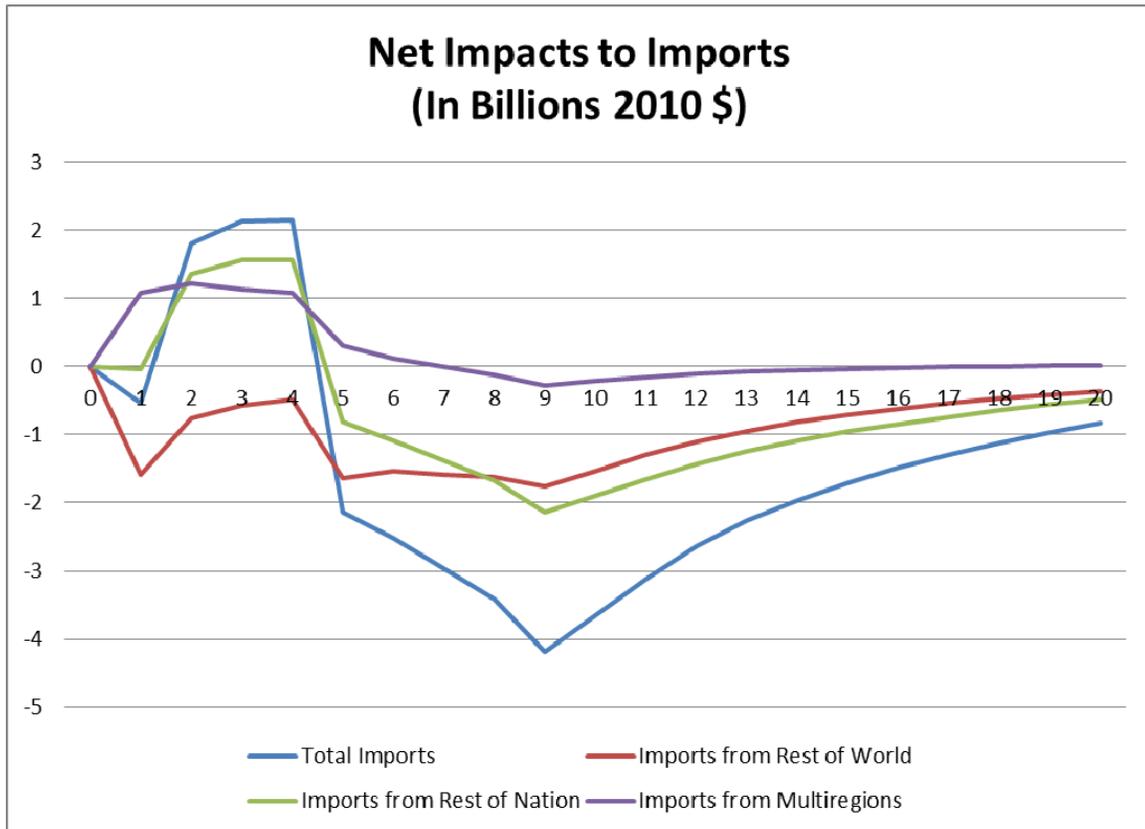
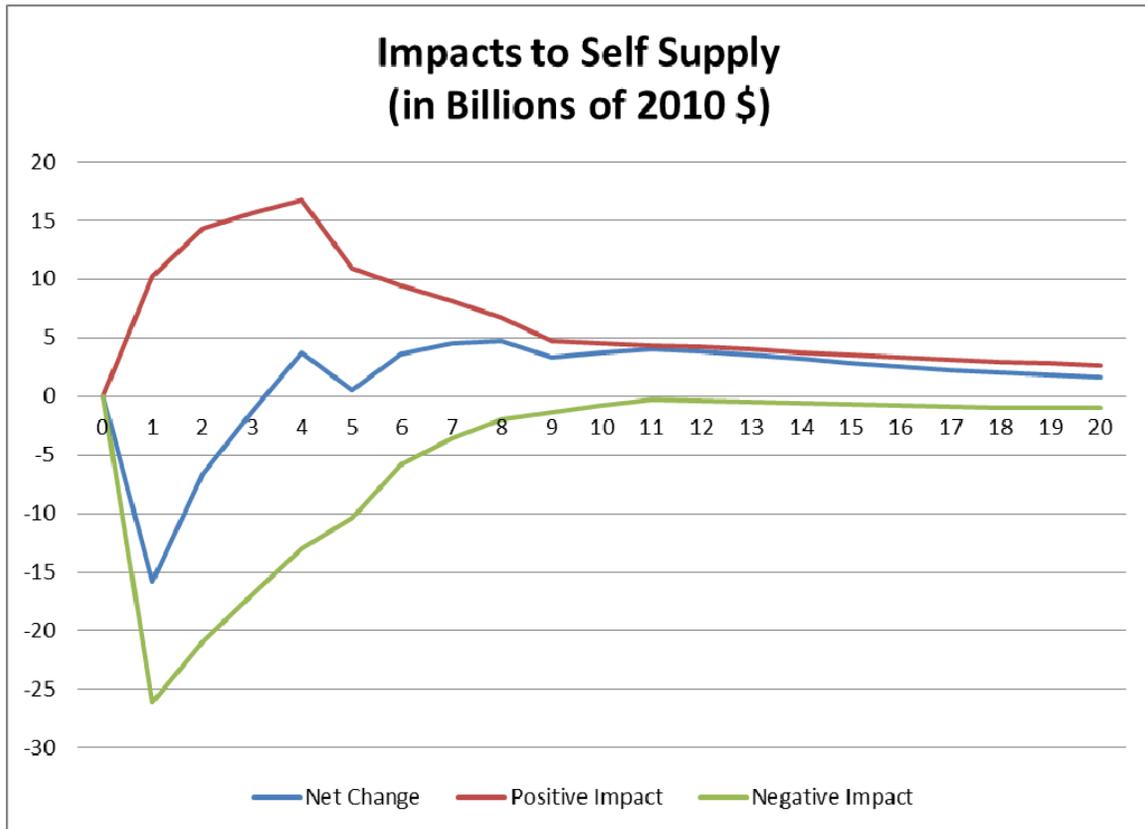


Chart 12 - Net Impact to Imports

Unable to produce the required needs of the community, the region must import goods. Chart 12 shows the increase as well as the location of the import. Producing more things in your region is better than having income from residents leaving the region to support other regions.

**Impacts to Self Supply of All Scenarios**



**Chart 13 - Impacts to Self Supply of All Scenarios**

The Impacts to the Self Supply of the region are shown above. The Red Line indicates the positive economic aspects (Reconstruction, Clean Up, and Government Spending). The Green Line displays the impacts from the negative factors (Employment Losses). The Blue Line shows the Net Impact of both scenarios. It takes approximately 3 years to return to the forecast.

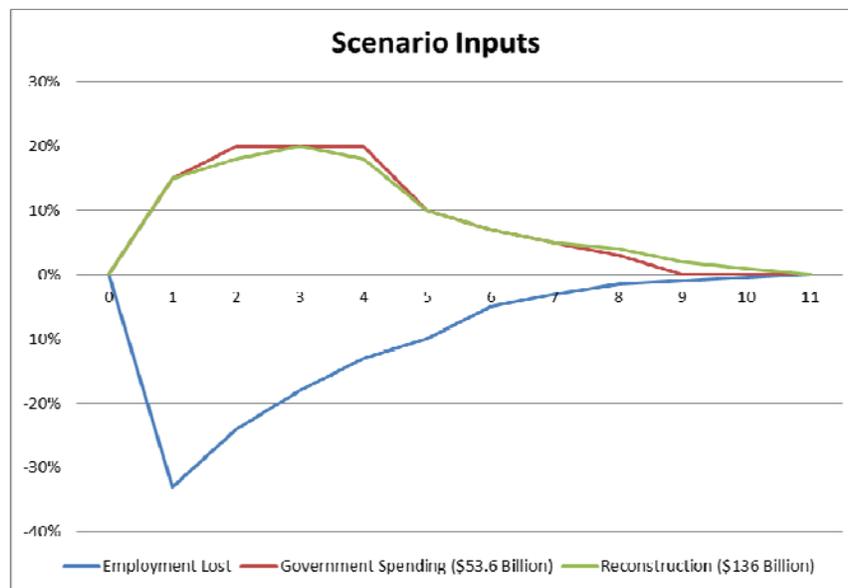
## Part III – Analysis

### Tampa Bay Disaster Resiliency Study

#### Summary

Using the catastrophic scenario of Project Phoenix, we were able to test a worst case scenario to the Tampa Bay Region. This category 5 hurricane would go through Pinellas and Hillsborough Counties and be large enough to provide substantial damage to Pasco and Manatee Counties. The doomsday scenario was modeled as a catastrophic planning exercise in 2010. The probability of the exact scenario occurring is extremely low, however the analysis provides scalability and transferability to any hazard. Like most disaster scenarios, only the direct impacts were reported in the Project Phoenix scenario. Our analysis took the direct impacts and then estimated the indirect and induced impacts.

The assumptions and timing of the event and reactions are what drives the results. The main components are split into two main categories, economic losses associated with losing employment and economic gains associated with reconstruction, cleaning, and government spending. The employment losses drive a loss in production and wages due to the employees being unable to actually get to work. The losses are spread over 7 years. The economic gains drive the economy back to positive results and are spread over 10 years, as some home owners wait a long time to rebuild their houses. The shape and distribution of the inputs are shown below in the chart. The blue line shows the direct employment missing by year. The Green line shows the percentage of \$136 Billion each year. The Red Line shows the percentage of \$53.6 Billion in government spending in each year.

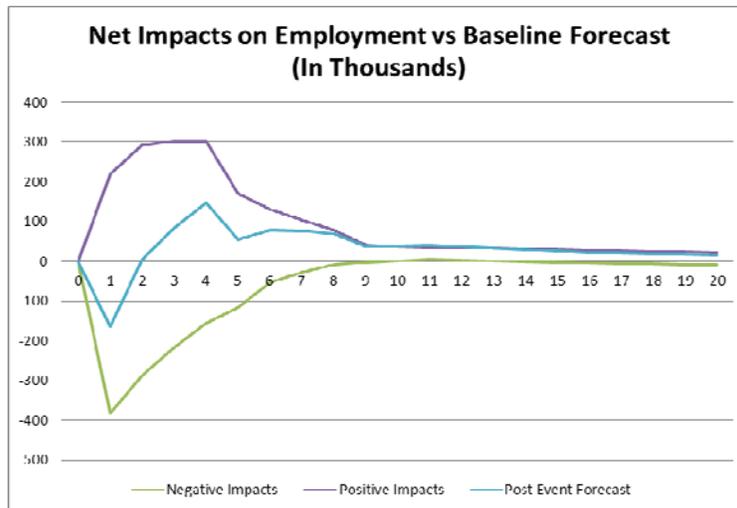


After accounting for the negative losses and positive gains, the results show how significant a loss of employment is to the region. Without government assistance and reconstruction, the region never fully recovers. Additional funds could be input to overcompensate for each year to show what the recovery would be, but the employment that comes along with government spending (contractual, temporary, cleaning, etc)

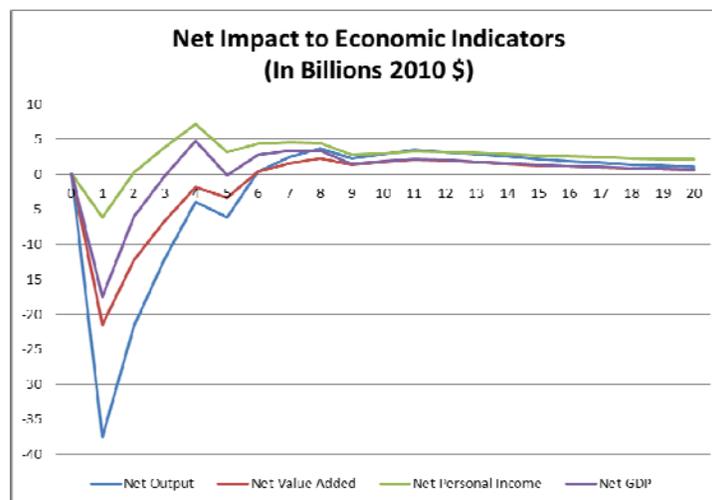
### Part III – Analysis

## Tampa Bay Disaster Resiliency Study

disappears almost as quickly as the funds disappear. These jobs help the region look strong while it recovers, but the longer lasting impact is actual employment. The chart below shows the effects on employment of all three scenarios. The Purple Line shows the change in employment from only the positive economic impacts (reconstruction, cleanup, and government spending). The Green Line shows the change in employment change from only the negative economic impacts. The Blue Line shows the change in employment from the net impact (both the negative and positive economic impacts).



The chart below shows the Net Impact of several Economic Indicators. All comparisons are to the baseline forecast. The Green Line shows the impact to the Personal Income. The Purple Line shows the Gross Domestic Product of the Tampa Bay Region. The Red Line charts the change to the Net Value Added. The Blue Line displays the change to the Output.



When looking at how to recover from a catastrophic event, employment was the largest factor in our analysis. If more effort is spent on the prevention or reduction in damage before the storm hits, the employment should be more resilient. Additionally, if some

disaster funds or initial tax revenues can be invested in the region to create more permanent jobs in the future, the economy could actually be in a better position in the long run.

Investing in infrastructure to harden buildings to build stronger, more disaster resilient buildings will help the economy be in better shape next time a disaster occurs by allowing more employees access to their respective workplaces after the event. Investing in economic development activities before and after the event will help retain and attract employment to strengthen the economy. The PDRP (Post Disaster Redevelopment Plan) is a planning process to identify policies, operational strategies, and roles and responsibilities for implementation that will guide decisions that affect long-term recovery and redevelopment of the community after a disaster. Recovery topics include business resumption and economic redevelopment, housing repair and reconstruction, infrastructure restoration and mitigation, short-term recovery actions that affect long-term redevelopment, sustainable land use, environmental restoration, and financial considerations as well as other long-term recovery issues identified by the community.

Despite the fact that the Project Phoenix impacts and the best assumptions based upon previous hurricanes were used in this analysis, the exact scenario is highly unlikely to occur. Instead each county can look at their own situation and disaster to evaluate what needs to happen to return to sustainability. The scenario can even be a completely different hazard. Estimating the damage, workforce displacement, reconstruction, cleanup, and federal assistance will provide any of the counties with a likely estimate of the indirect and induced impacts. If the county can only estimate the damage, they can then determine what level of activity is needed to offset the losses. The appendices detail the exact impact each category creates through each county the region. This level of detail gives users and decision makers the tools and knowledge they need to respond appropriately.

A hypothetical scenario could include a tornado touching down in the Feather Sound area of St. Petersburg in Pinellas County. Local Pinellas County staff would be able to pull out a map of the damage and identify the affected Traffic Evacuation Areas (TEAs). The staff would then find the corresponding TEAs in Section 2 of this document and be able to see how employment exists and in which industries. After examining the building damage, an average of 6 months is the likely estimate until the workers can return to work. Staff would be able to compare Feather Sound's employment to all of Pinellas County to see how many Pinellas workers would be displaced for 6 months. Determining the factor between the tornado displaced employees versus the Project Phoenix displaced employees would allow the staff to quickly divide the Pinellas County Impact to see the negative impacts from the loss of employment. Knowing the negative side of the equation will help the local area determine how much governmental aid and assistance is needed by using the same factor.