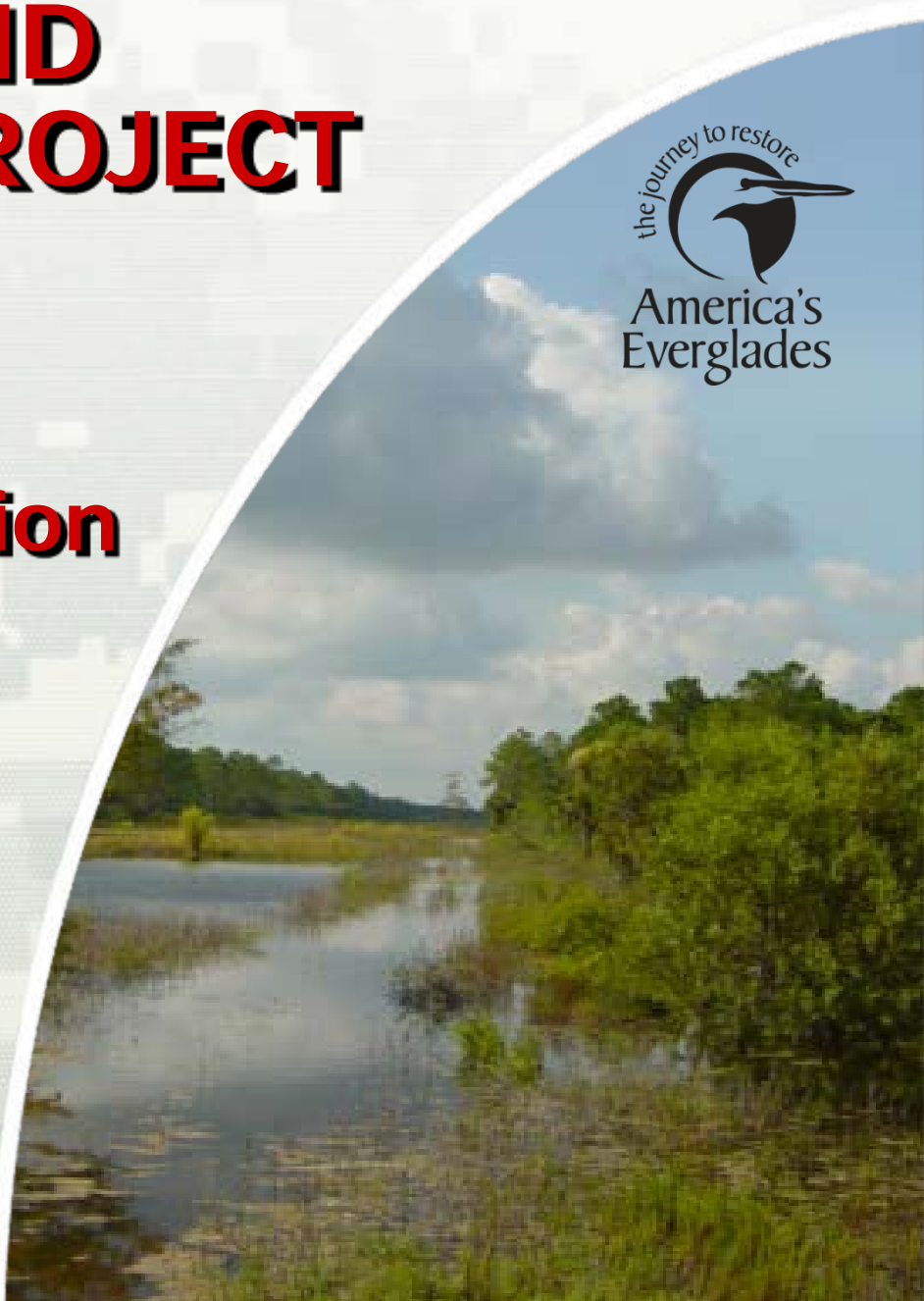


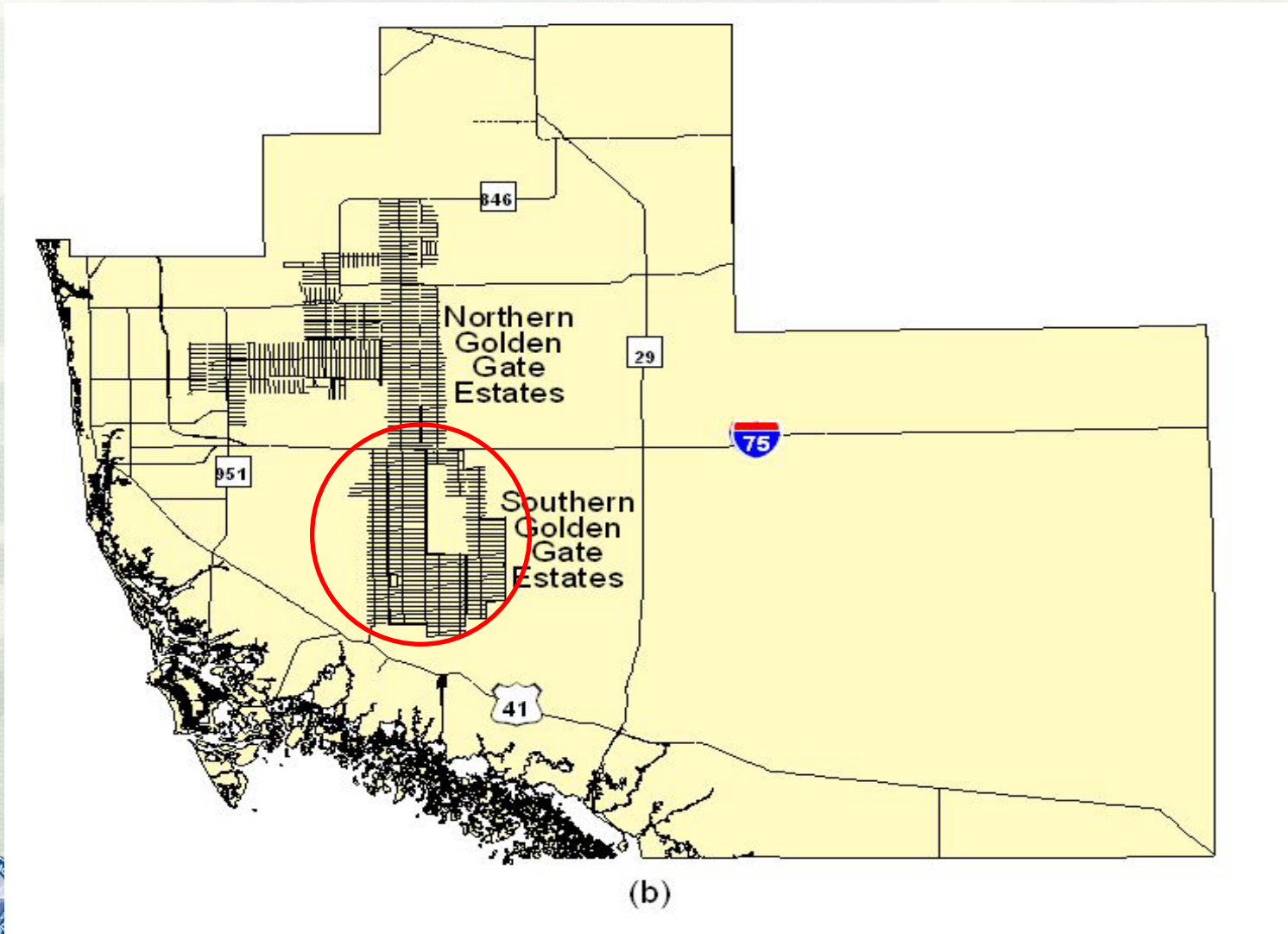
# PICAYUNE STRAND RESTORATION PROJECT

**An accelerated  
design/build restoration  
of the world's largest  
sub-division**



# Golden Gate Estates

Map showing grid of roads and bisection of GAC holdings by I-75 into Northern Golden Gate Estates and Southern Golden Gate Estates





# Chicago Tribune (1967)

## Gulf American Corporation

a growing giant

Advertisement

**Y**OU have read what Gulf American has accomplished to date. You have learned how, starting with a single piece of undeveloped property in 1957, the company has become the largest marketer of land of its kind in the world.

And, now, other dreams are aborning . . . dreams encompassing far wider horizons. Far from having attained full maturity, the Gulf American Corporation is still flexing its corporate sinews, still accelerating its ever increasing diversification to include new fields, and embrace new opportunities. Far from being a giant come of age, Gulf American today is a giant still growing.

Today, Gulf American is constructing homes . . . not only individual residences, but apartments, cooperatives and condominiums, too . . . is providing insurance protection of various kinds and is active in many other businesses, as well.

Obviously, the Gulf American Corporation has much to offer many people. For some . . . residents of its Florida communities . . . the company makes it possible to live and work and raise their families, or to retire in one of America's fastest growing major states. To others . . . those who are investing in properties at River Ranch Acres or Remuda Ranch Grants (see footnotes, page 6) . . . Gulf American represents a chance to own land combining growth potential with the immediate enjoyment of outdoor living at its best. And to still others . . . men and women interested in becoming a part of the Gulf American organization itself . . . the company and its network of subsidiaries offer an opportunity to share in the destiny of a dynamic young corporation, which has already contributed enormously to today's flourishing economy . . . a company dedicated to building new worlds for a better tomorrow.

As of April 1, 1967 . . .

**FACT . . .** The Gulf American Corporation's worldwide land holdings total 575,760 acres (896.5 square miles).

**FACT . . .** The Gulf American Corporation has contributed \$1.1 billion to the economy of the State of Florida.

**FACT . . .** The Gulf American Corporation and its subsidiaries employ a total of 7,070 people.

**FACT . . .** The Gulf American Corporation has completed a total of 291 road miles of streets and boulevards.

**FACT . . .** The Gulf American Corporation has dredged and deepened 168 miles of canals and waterways.

**FACT . . .** The Gulf American Corporation has completed construction of 3,142 buildings of all types . . . with 140 additional under construction.

**FACT . . .** The Gulf American Corporation has sold Florida properties to residents of all 50 states and the District of Columbia, the Canal Zone, Wake Island and the dependencies of the Caroline Islands, Guam, Puerto Rico and the Virgin Islands and 68 foreign nations.

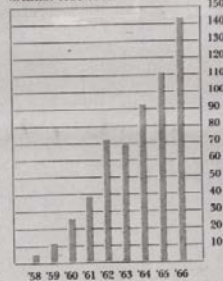
### TOP TEN PUBLICLY OWNED FLORIDA BASED CORPORATIONS - 1966\*

Rank	1966	Name of Company in 1965
1	Southern Bell Telephone	
2	Florida Power & Light Co.	
3	Atlantic Coastline R.R.	
4	GULF AMERICAN CORPORATION	
5	Winn-Dixie Stores, Inc.	
6	Florida Power Corp.	
7	National Airlines, Inc.	
8	Jim Walter Corporation	
9	General Telephone-VL	
10	Tampa Electric Co.	

\*Based on Sales, Net Income and Reported Assets as published by the Florida Business Letter of Research Publishing Corporation, Volume XVI, Number 8, dated April 27, 1967.

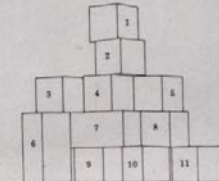
† Tied for fourth position

SALES: 1958-1966



in millions of dollars

- 1: A better world of tomorrow, on the drawing board today at Gulf American
- 2: The Gulf American Corporation Headquarters Building, Miami, Florida
- 3: The newest Land of Gulf American at Remuda Ranch Grants, Florida
- 4: River Ranch Acres, Florida . . . a sportsman's paradise with growth potential
- 5: Modern Air Transport, Inc. offers twenty modern aircraft
- 6: Gulf Life Insurance Company of America . . . a highly computerized operation
- 7: The Cape Coral Yacht and Racquet Club at Cape Coral, Florida
- 8: Golden Gate and Golden Gate Estates . . . for living and investment
- 9: The famous Kennedy hotel at Cape Coral Gardens, Florida
- 10: Gulf Communications, Int. services the Cape Coral community
- 11: Gulf American is building new worlds for a better tomorrow



Advertisement

## Golden Gate

FOR LIVING AND INVESTMENT ON THE GOLDEN GULF COAST



The community of Golden Gate, Florida, is a fine place to visit . . . and live



Golf is more fun at Golden Gate Country Club Golden Gate is Florida living at its fabulous best

tant tournaments. All facilities, locker rooms, pro shop, etc., are, of course, completely up-to-date and the finest of their type available.

Immediately adjacent to the Golden Gate Country Club is the magnificent new Golden Gate Inn. Combining the best and most beautiful elements of Colonial architecture with every conceivable modern comfort and convenience, it is truly one of the handsomest hosteries in the world. Inside, you'll discover all the magnificent touches that do so much to recreate the warmth and charm of a more leisurely age. A perfectly appointed dining room, the Country Squire, offers exquisite cuisine and superb service, and the more intimate Beau Brummel Room is available for cocktails. The Empire Ball Room, on the second level, features a special innovation in the form of a movable parquet dance floor, and can accommodate hundreds of guests for special functions.

**T**HE community of Golden Gate began with a master plan. It provided for much that is best about the Florida way of life. It included wide, palm-bordered boulevards and sparkling waterways, areas set aside for residential and commercial uses, homes offering virtually every modern convenience at prices everyone can afford.

Land was chosen to best meet the requirements of people who choose Florida . . . as a place to live and work and raise their families, to retire or to invest. Land so situated that it can fill the needs of Floridians today . . . and tomorrow, too.

The plan was implemented. All the know-how and experience gained at Cape Coral were put to work. Model homes were built, and facilities installed to provide for the wonderful life that Florida has made famous.

Nor did Gulf American stop there. The community had to top anything available anywhere and affordable by families of average means. A country club was established . . . one of the finest in the entire country!

### FACILITIES ARE SUPERB

People who play here for the first time are delighted to discover that the nine-hole Golden Gate Course is unparalleled in terms of enjoyment and challenge . . . and will be pleased to learn that a second "nine" will soon be ready for play. This highly professional course has already been the scene of impor-

tant tournaments. All facilities, locker rooms, pro shop, etc., are, of course, completely up-to-date and the finest of their type available.

Immediately adjacent to the Golden Gate Country Club is the magnificent new Golden Gate Inn. Combining the best and most beautiful elements of Colonial architecture with every conceivable modern comfort and convenience, it is truly one of the handsomest hosteries in the world. Inside, you'll discover all the magnificent touches that do so much to recreate the warmth and charm of a more leisurely age. A perfectly appointed dining room, the Country Squire, offers exquisite cuisine and superb service, and the more intimate Beau Brummel Room is available for cocktails. The Empire Ball Room, on the second level, features a special innovation in the form of a movable parquet dance floor, and can accommodate hundreds of guests for special functions.

A wide variety of clubs assures Golden Gate residents of being able to pursue their hobbies with others whose special interests are similar to their own. And a constant round of social events scheduled throughout the year make an active social life possible for people of all ages. Truly, to live is to enjoy life . . . at lovely Golden Gate.

### PRACTICALLY EVERY NEED WAS PROVIDED FOR

Plans were made for the most practical aspects of life in one of America's fastest growing major states. Provision was made for a central water system, a sewerage treatment plant, telephone and power lines.

Then . . . and only then . . . the property was offered for sale.

All these things the Gulf American Corporation has done at Golden Gate, just eleven road miles northeast of lovely Naples and one mile north of the intersection of State Highway 858 and the new Everglades Parkway, scheduled for completion late in the summer of 1967.





# Chicago Tribune (1967)



*Forget your weather worries in the year 'round Florida sunshine*

## Golden Gate Estates

IMPROVED ACREAGE . . .  
WITH GROWTH  
POTENTIAL

**A**ND Gulf American has made provision for additional land investment in adjoining Golden Gate Estates. Here, on improved acreage only thirteen road miles from Naples, the company has made available some 164 square miles of land specifically to investors who recognize the potential inherent in Florida land investment and are anxious to share in that potential. At Golden Gate Estates, in-

vestors enjoy the opportunity to purchase larger units of land improved with access roads and drainage facilities only . . . at a cost commensurately lower than that of fully developed properties. Gulf American is convinced that the combination of the dynamic growth of the lower Gulf Coast, the excellent location of the property (Golden Gate Estates is bisected by the Everglades Parkway) and the development activities of the company itself make Golden Gate Estates a most attractive investment possibility at this time.

*Properties at Golden Gate and Golden Gate Estates are not offered for sale in the State of New York at this time.*

**“Forget your weather worries in the year ‘round Florida sunshine”**



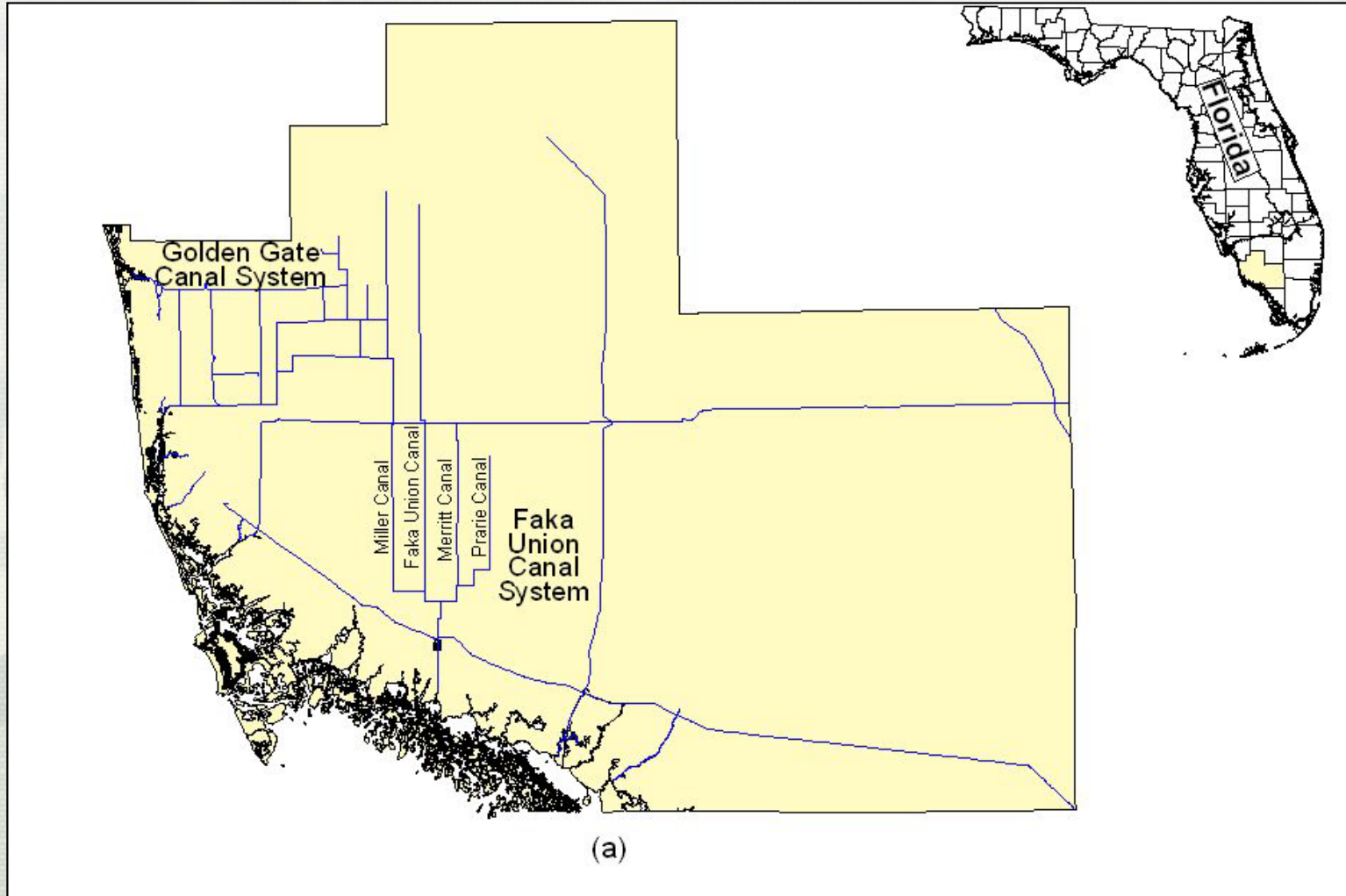


# Free flight/free ride...





# Golden Gate Estates Canal Systems





# Wet Season: Miller Blvd.



[www.floridadot.com](http://www.floridadot.com)





# Undoing Ecological Errors -- Long Way to Road's End

By BILL WHITING  
Naples Bureau Chief

Collier County began taking a first, small, tentative step toward undoing 15 years of ecological mistakes in the development of 160 square miles known as Golden Gate estates this week.

It's still a long way to the end of the road.

An ad hoc committee, established recently to investigate the county's options in attacking the draining and environmental destruction wreaked by the 190 miles of canals through the area, began to assess the enormous problems confronting it.

THEY ARE complex almost beyond comprehension:

- Of 102,000 acres owned by GAC, 90,000 acres have been platted and laid out in straight grids of deteriorating limerock roads and canals.
- More than 40,000 people have contracted for deeds for lots ranging in size from 1/4 to 10 acres. Some 29,000 people all over the world own their land free and clear.
- Estimates of daily fresh water



NEWS  
ANALYSIS

supply from the area into the gulf through canals are equivalent to approximately 44 times the daily pumpage of the city of Naples, leaving most of Western Collier to desert-like conditions and the ravages of wildfires.

● Minimum standards were applied to Golden Gate development chiefly to make the land saleable. Little thought was ever given to making the land truly developable.

With the exception of Golden Gate City, however, fewer than 80 houses have been built through the estates. County officials, relying on GAC estimates that major development of the land won't take place for at least another three years, are trying to undo past errors before it is too late.

Whether or not it is too late is

GAC OFFICIALS, while indicating a willingness to cooperate with the committee's efforts, have drawn the line on making any concessions themselves.

"I can't visualize a plan that would be adoptable unless it is economically feasible," said Robert Weintraub, GAC general counsel.

"Money on both sides of the scales is almost beyond comprehension," Bacon concedes.

But the costs of proceeding with planned development in terms of the hundreds of millions of dollars in roads, canals, and municipal services must be weighed against the potential expense incurred by the immense effort to be made in starting everything over from scratch, he says.

"Not only," says critical Naples land planner William Vines, "is Golden Gate Estates entirely unworkable and hopeless with regard to a rational urban development outlook, it also violates all known natural-resource management principles and practices."

THE INITIAL blunders made by county officials who accepted the plats in the 1960s, Vines said, could be charitably excused because they didn't know any better.

"To do nothing at this time to head off predictable problems of truly monstrous proportions will constitute a mistake much less justifiable than the initial one," Vines concludes.

"The only reason for doing little or nothing to alter the future course of development in Golden Gates Estates is that to make meaningful changes at this time would be too difficult legally, financially, or politically. That reason isn't good enough."

still a question for debate.

The committee has called in one of the major architects of Florida's 1972 Water Resources Act, Frank Maloney, dean emeritus of the University of Florida Law School, to help unravel the snarl of legal entanglements.

Maloney, regarded as an expert in water law, said he plans to turn the legal research loose on an army of law students.

THE PRIMARY question he faces is how to divest a property owner of his title to the land and move him to another area.

Norman Bacon, chairman of the committee and the county's Coastal Area Planning Commission, insists the job can be done without endangering the rights of the property owners.

He envisions a replatted estates area to conform with modern, accepted and ecologically safe land-planning methods with property owners being convinced it would be in their interest to exchange parcels.

If some property owners couldn't be fit into new plans, their land could be bought, he reasons — again, respecting their rights.

The solution, of course, sounds easier than it will be to implement.

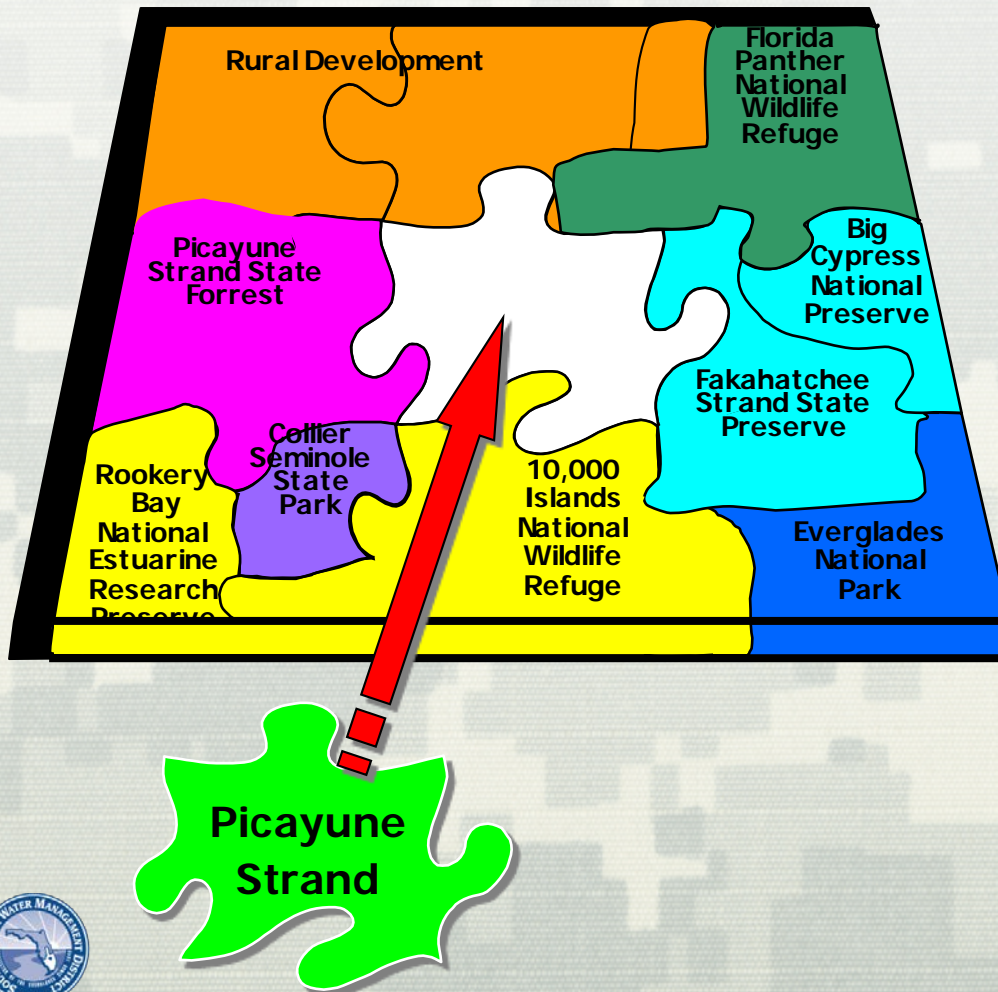
# 30+ yrs later...

*"Not only is Golden Glades Estates entirely unworkable and hopeless with regard to urban development outlook, it also violates all known natural-resource management principles and practices" – William Vines; former Naples Land Planner*





# Building the puzzle

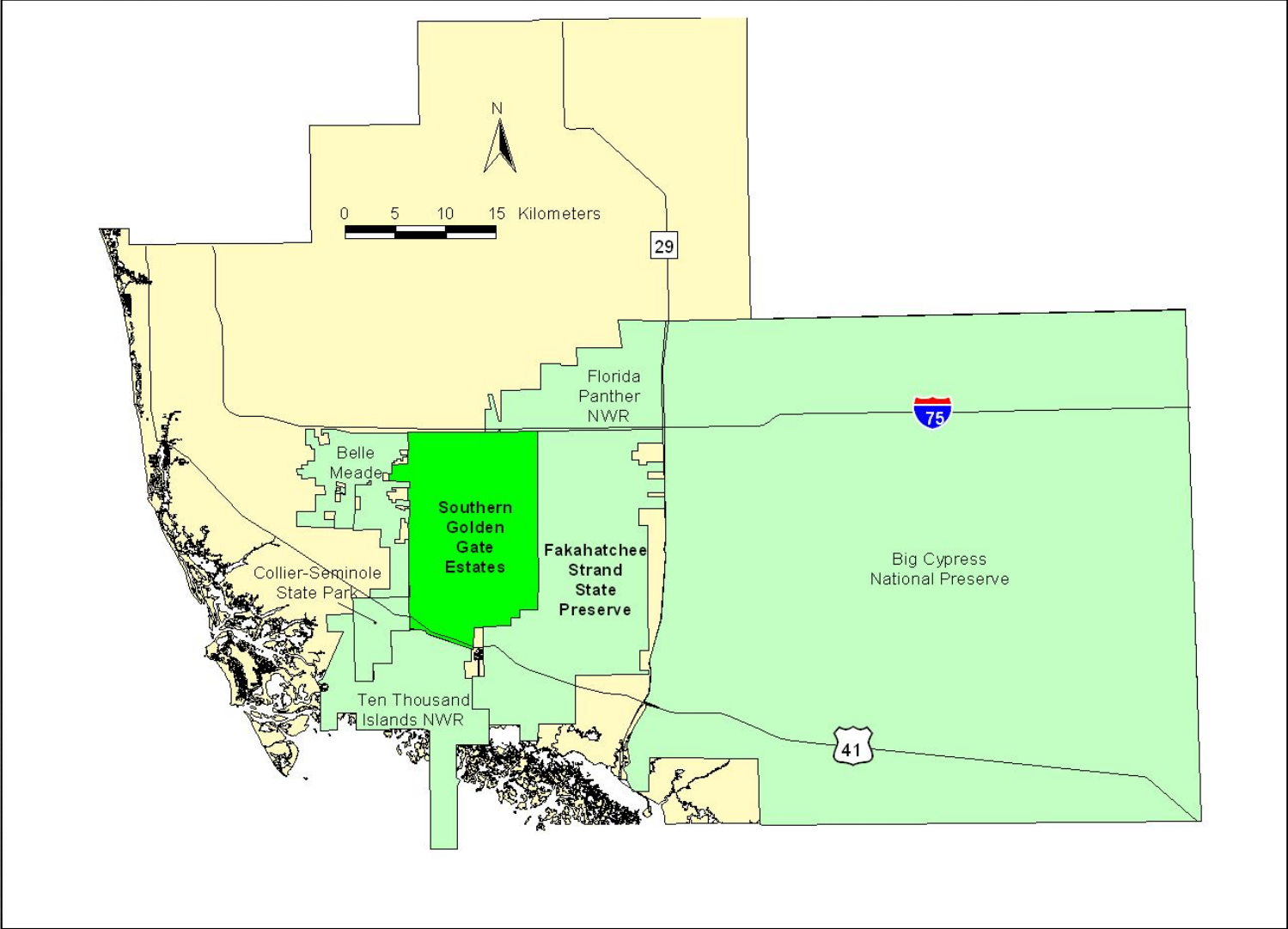


*Restores ecological connectivity between publicly owned lands*





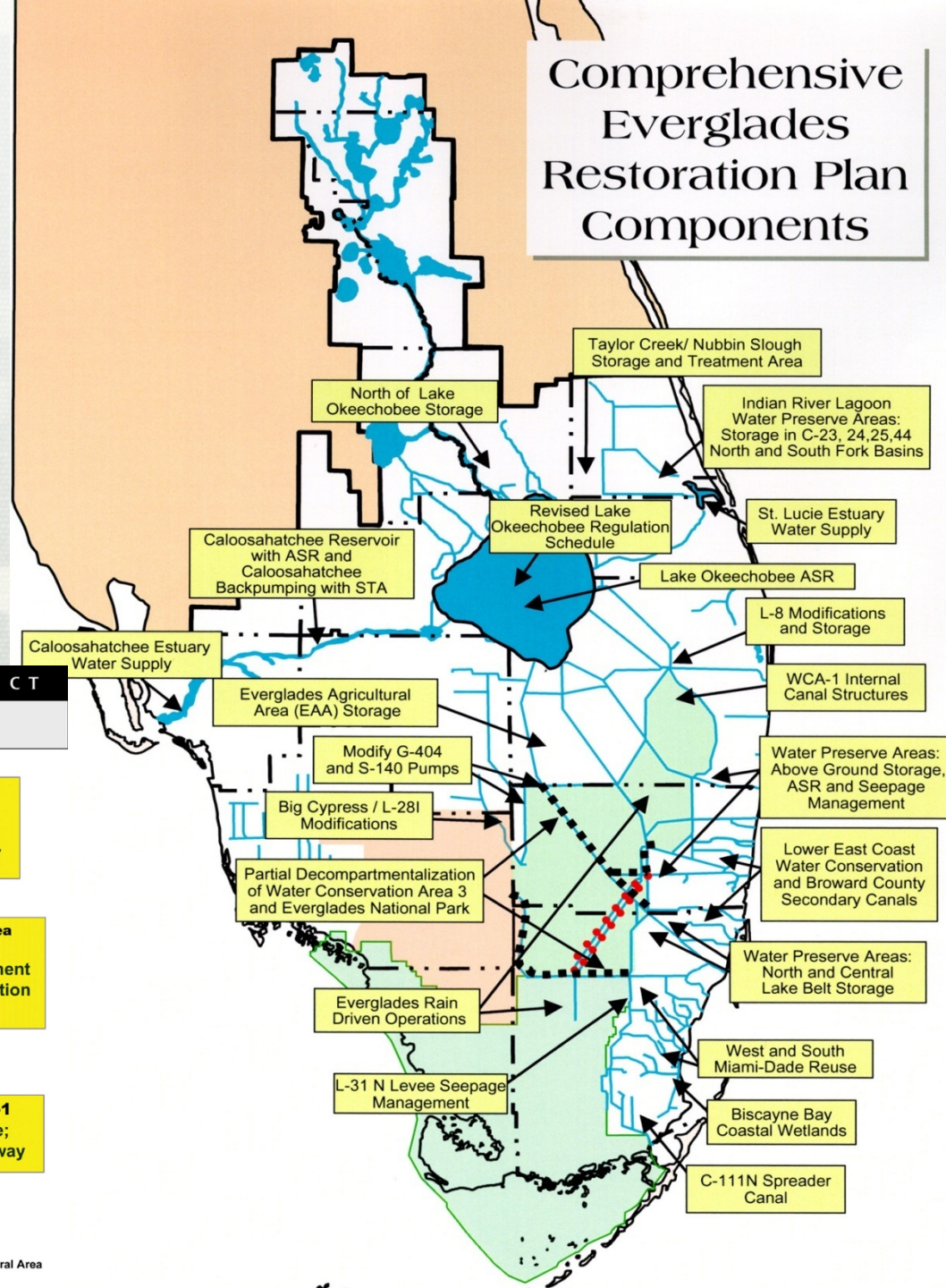
# Conservation areas surrounding Picayune Strand Restoration Project



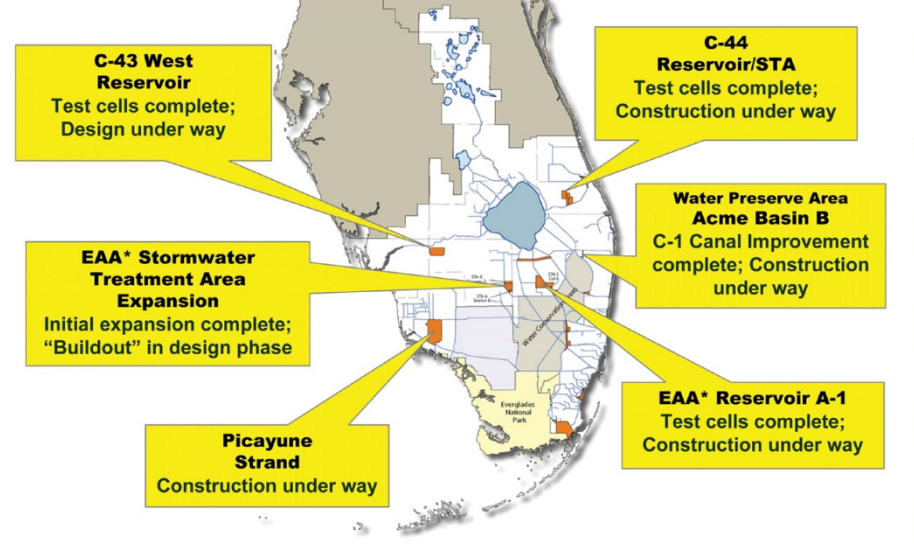


# 1998 – Southern Golden Gate Estates was identified as an essential part of the effort to restore the Western Everglades

## Comprehensive Everglades Restoration Plan Components



**SOUTH FLORIDA WATER MANAGEMENT DISTRICT**  
**Everglades Restoration – Construction Status**



\*Everglades Agricultural Area



# Authorization

## WRDA (2007)

### ■ CERP

- PICAYUNE STRAND RESTORATION PROJECT, COLLIER COUNTY, FLORIDA
- USACE Chief of Engineers Report (September 15, 2005)
  - \$375,330,000 (Federal \$187,665,000; Non-Federal \$187,665,000).



[sfwmd.gov](http://sfwmd.gov)



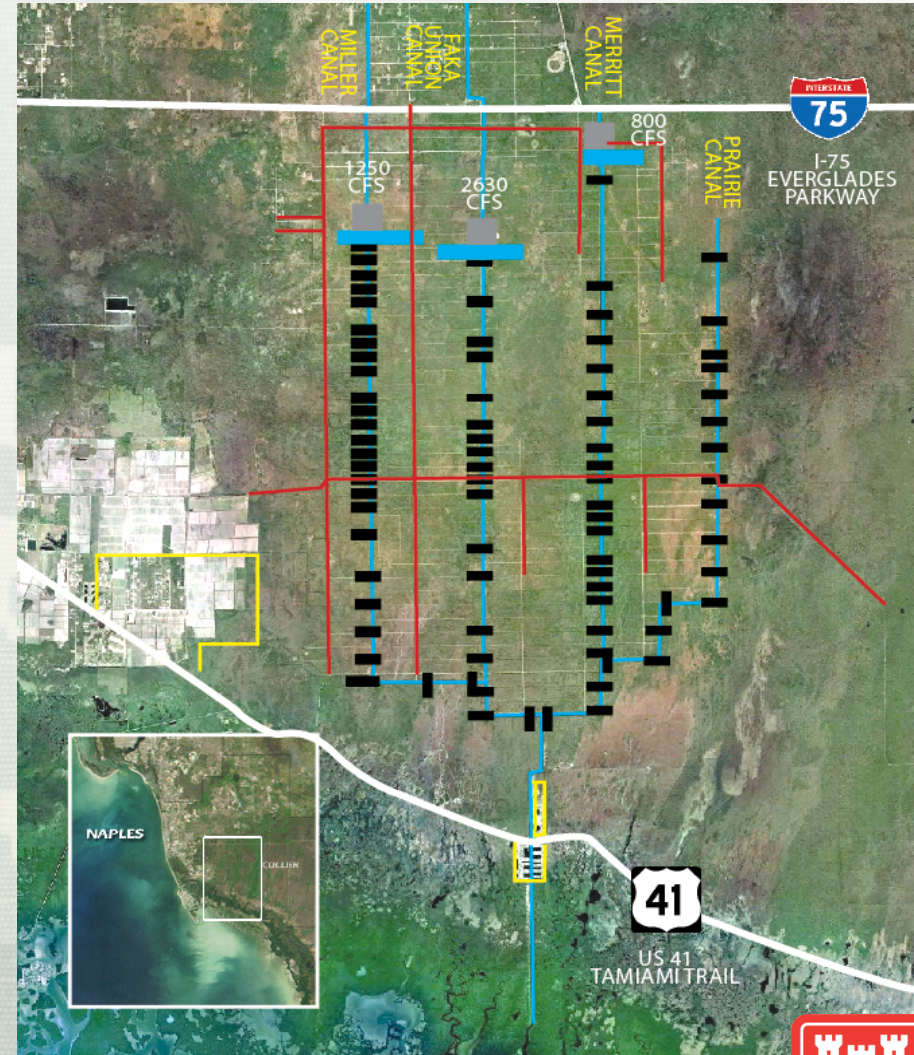


# The Restoration Project

Restore 55,000 acres of native Florida wetlands and uplands

## Project Features

- 3 spreader canals
- 3 pump stations: Merritt, Faka Union, and Miller
- Plugging 48 miles of canals (with more than 100 plugs)
- Removing and degrading 260 miles of roads





# Purpose and Benefits

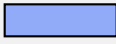





- Improve aquifer recharge to protect water supply and prevent saltwater intrusion.
- Restore/enhance habitat for fish and wildlife resources.
- **Maintain existing level of flood protection for Northern Golden Gate Estates and adjacent private properties.**
- Reduce Drainage of Fakahatchee Strand State Preserve.
- Reduce or eliminate over-drainage of adjacent sensitive ecosystems.
- Reduce freshwater releases (point discharges) to improve the health and productivity of downstream estuaries.
- Preserve upland habitat.
- Control invasive exotic plants.
- Improve water quality of stormwater runoff.
- Provide resource-based recreational opportunities.
- Provide comprehensive habitat conservation for the greater Everglades ecosystem, including:
  - Florida Panther National Wildlife Refuge
  - Fakahatchee Strand State Preserve
  - Ten Thousand Islands National Wildlife Refuge
  - Collier Seminole State Park
  - Belle Meade Conservation and Recreation Lands.

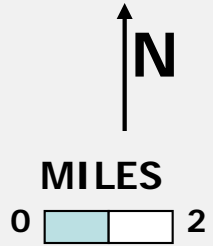




# Picayune Strand Restoration Project

## Features with Cost

-  Spreaders
-  Pump Stations
-  Canal Plugs
-  Primary/Secondary All Weather Roads
-  Tie-back Levee
-  Flood Protection Levees (footprints shown from PIR)



MILLER PS  
\$77M

FAKA UNION PS  
\$89M

MERRITT PS  
\$70M

PRAIRIE CANNAL  
\$9M

I-75

Private Lands  
\$6M

1250 cfs

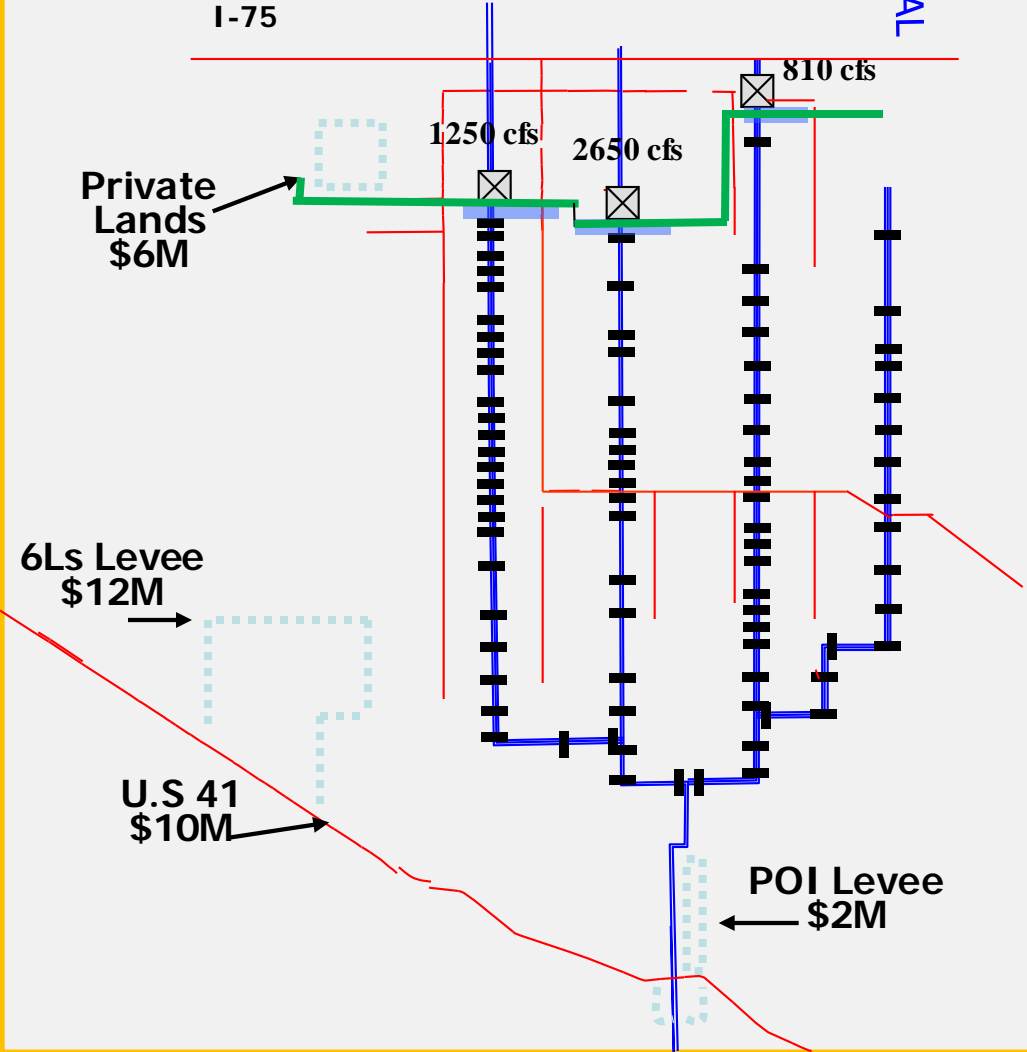
2650 cfs

810 cfs

6Ls Levee  
\$12M

U.S 41  
\$10M

POI Levee  
\$2M





# Flood Protection Features

- To maintain existing (no project condition) levels of flood protection for adjacent lands
  - Private Lands
  - Port of the Islands
  - 6Ls Farm







**Private Lands**



**6Ls Farm**



**Port of the Islands**

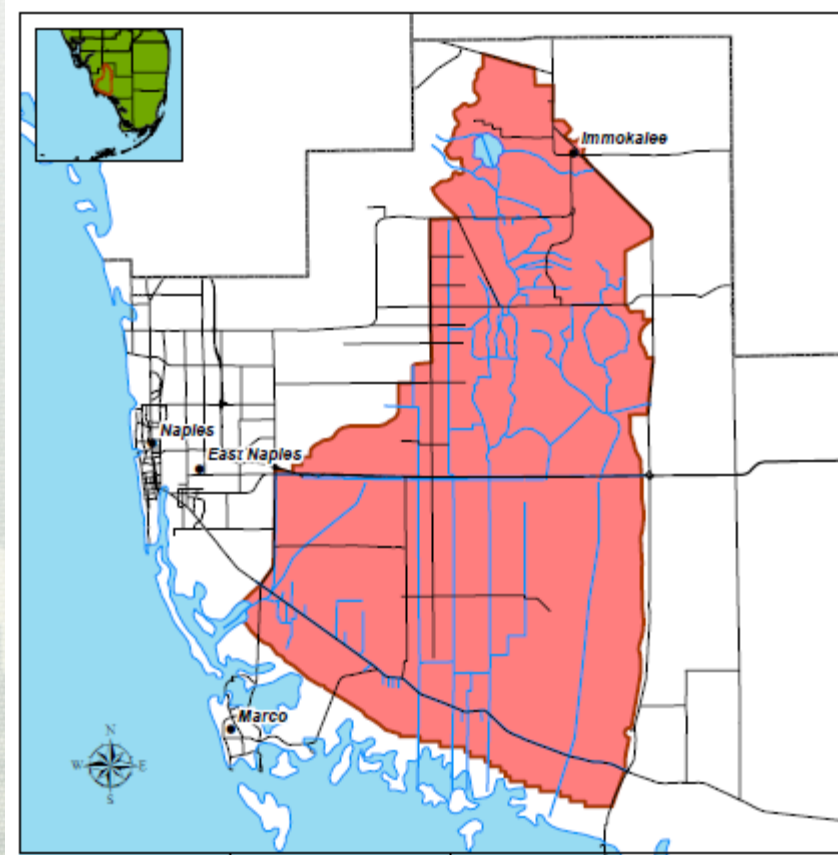


Image © 2015 TerraMetrics

Google



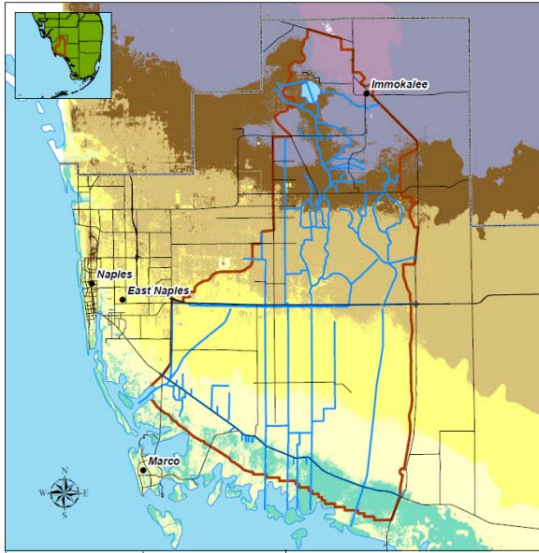
# H&H Modeling



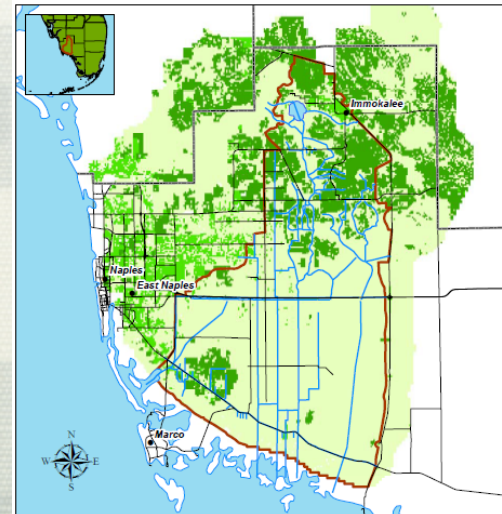
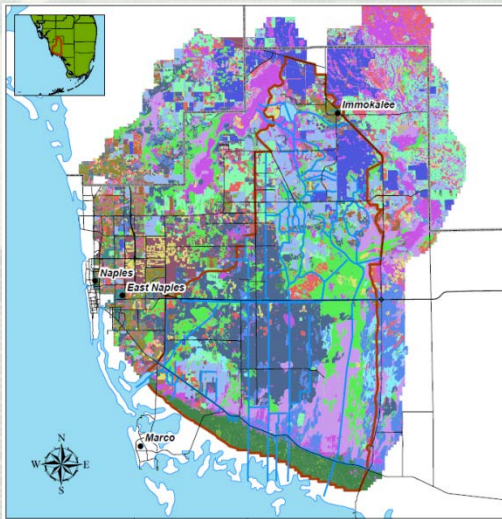
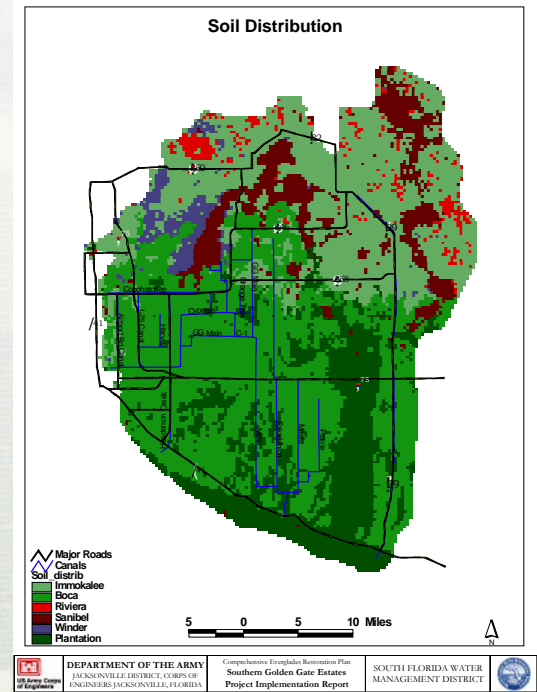
- Acceler8 model
  - Hydraulic Design Tool (HDT) to design proposed project structures
  - Integrated surface/groundwater MShe/M11







# Model Data sets





# Do we need to “re-do” this again?

## H&H Design Objective

- To comply with current USACE guidelines and regulations for levee/dam safety
- Assess residual risk by examining consequences of design capacity exceedence events





# Some of the ER's, EM's, ETL's

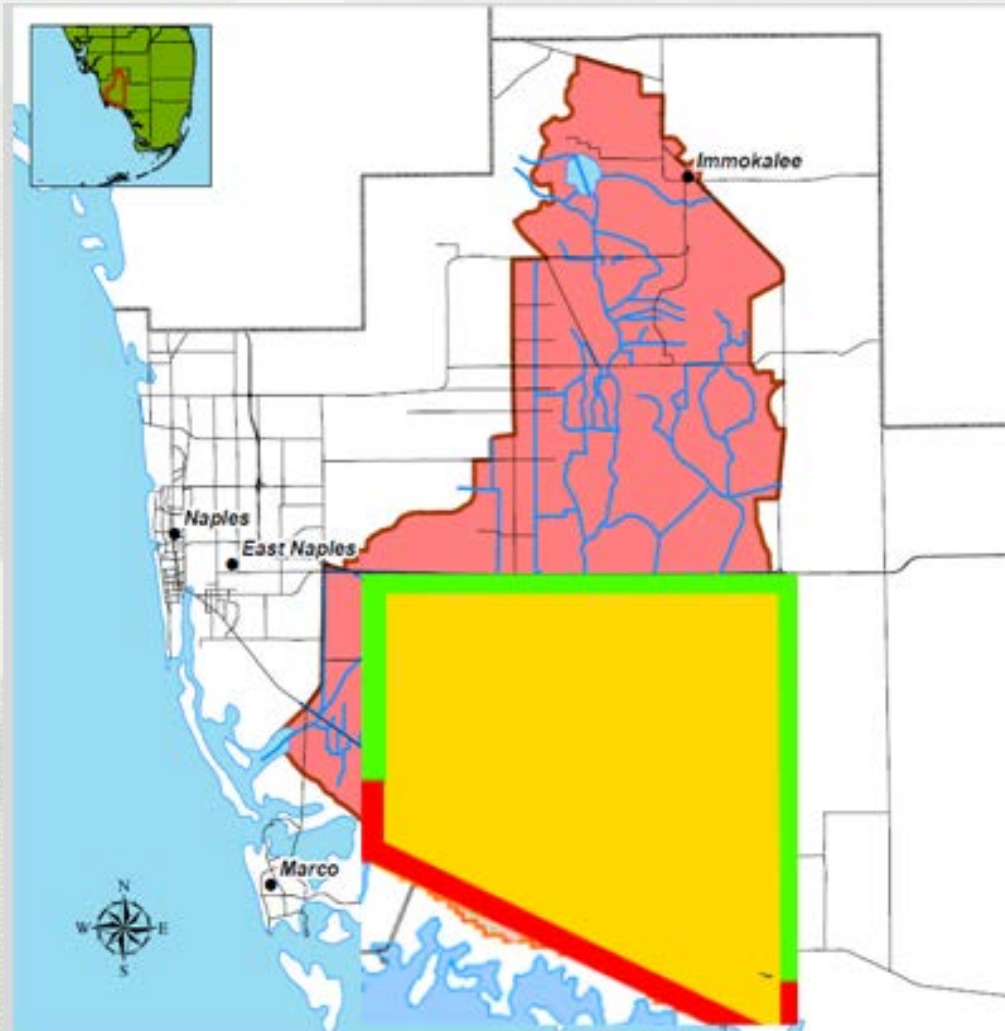
- EM 1110-2-1619 (Engineering and Design - RISK-BASED ANALYSIS FOR FLOOD DAMAGE REDUCTION STUDIES)
- EM 1110-2-1913 (Engineering and Design - DESIGN AND CONSTRUCTION OF LEVEES)
- EM 1110-2-1415 (Hydrologic Frequency Analysis)
- EM 1110-2-1417 (Engineering and Design - FLOOD-RUNOFF ANALYSIS)
- EM 1110-2-1908 (Engineering and Design - INSTRUMENTATION OF EMBANKMENT DAMS AND LEVEES)
- ER 1105-2-100 – (Planning - PLANNING GUIDANCE NOTEBOOK)
- ER 1105-2-101 – (Planning – RISK ANALYSIS FOR FLOOD DAMAGE REDUCTION STUDIES)
- ETL 1110-2-571 - Engineering and Design - GUIDELINES FOR LANDSCAPE PLANTING AND VEGETATION MANAGEMENT AT LEVEES, FLOODWALLS, EMBANKMENT DAMS, AND APPURTENANT STRUCTURES)
- ETL 1110-2-569 - (Engineering and Design - INSTRUMENTATION OF EMBANKMENT DAMS AND LEVEES)
- ETL 1110-2-299 – (Engineering and Design - OVERTOPPING OF FLOOD CONTROL LEVEES AND FLOODWALLS) (Restricted Use)
- EC 1110-2-6067 – (Engineering and Design - USACE PROCESS FOR THE NATIONAL FLOOD INSURANCE PROGRAM (NFIP) LEVEE SYSTEM EVALUATION)

**The National Levee Safety Act of 2007, Title IX of WRDA 2007 Flood Risk Management Executive Order (EO 11988)**





# Model Migration from ACCELER8 – Parsons AE Model to GSSHA



**Key**

- Approximate extent of previous models
- Approximate extent of planned Tier 1 model/s



[www.flwmd.com](http://www.flwmd.com)





# Model Purpose

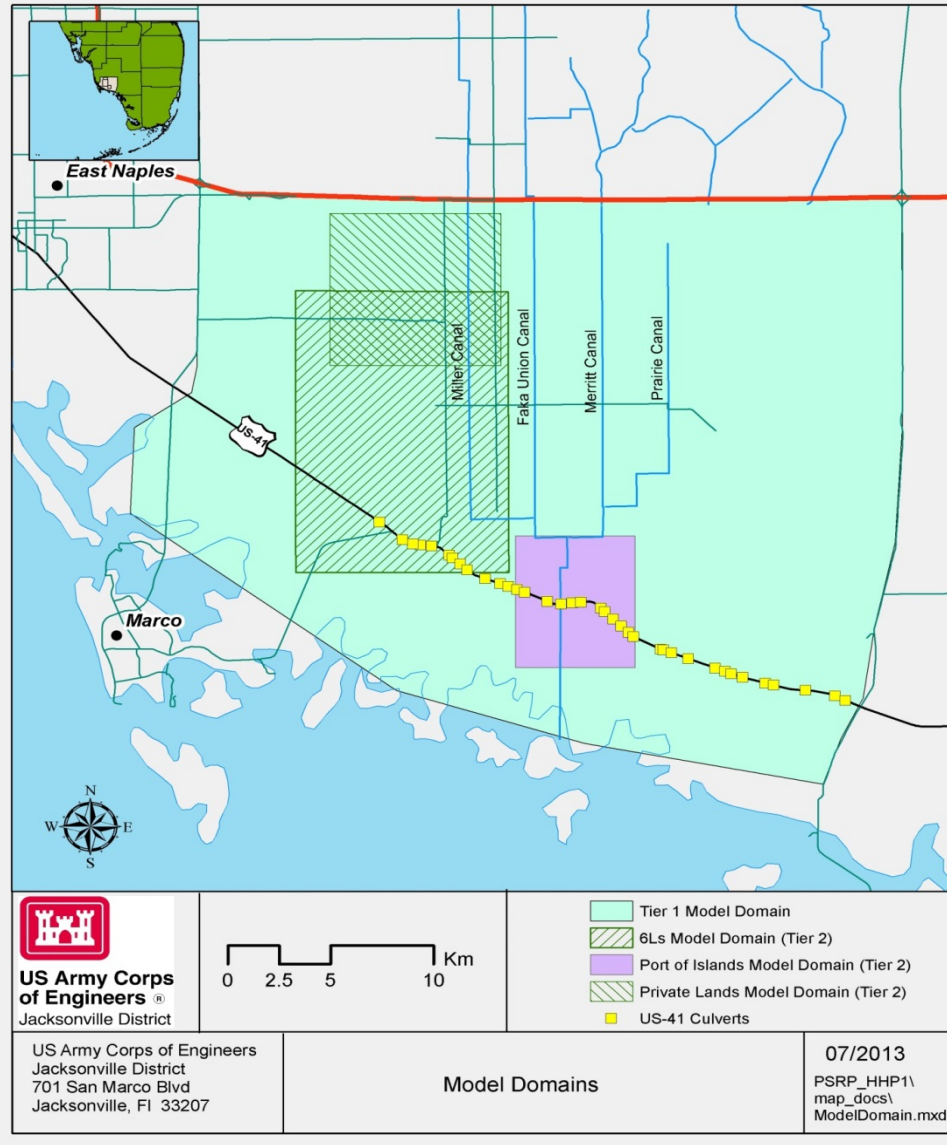
Determine hydraulic design criteria for the protective features per the new ER's-EM's-ETL's

- Port of the Islands
- Private Lands
- 6L's





# Tiered Modeling Scales





# Modeling Approach

## 1. Model Migration

- Existing Mike She/Mike 11 Models (PIR Models)
- Gridded Surface Subsurface Hydrologic Analysis (GSSHA)

## 2. Develop Tier 1 Models

- Low resolution, large domain
- Calibration: 1995 Storm Event (Tropical Storm Jerry)
- Develop existing and “with” project conditions

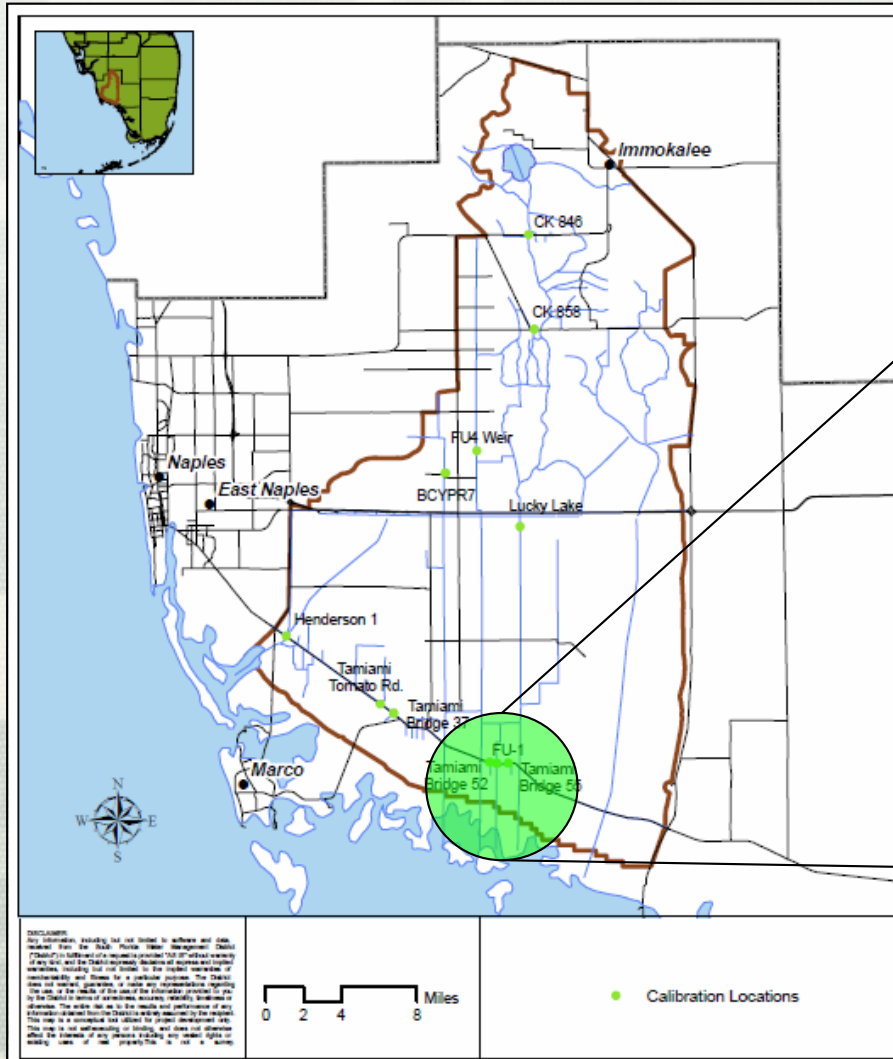
## 3. Develop Tier 2 Models

- High resolution, reduced domain
- High level of detail wrt Tier 1 models
- Design criteria

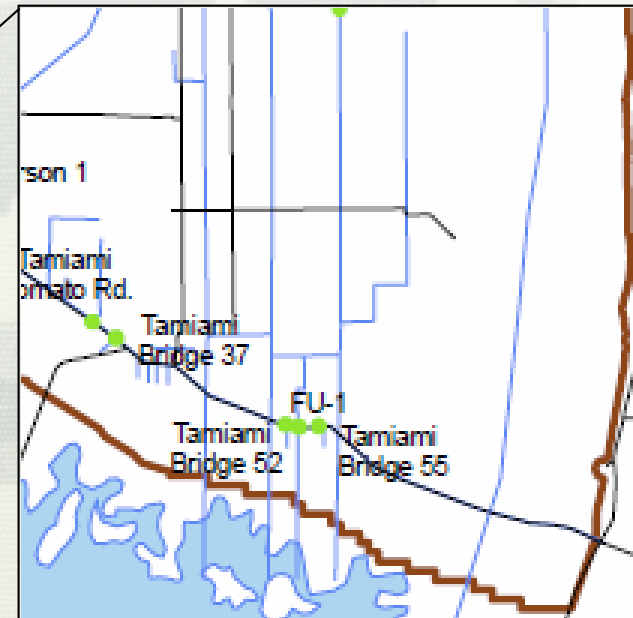




# Tier 1 Model Calibration

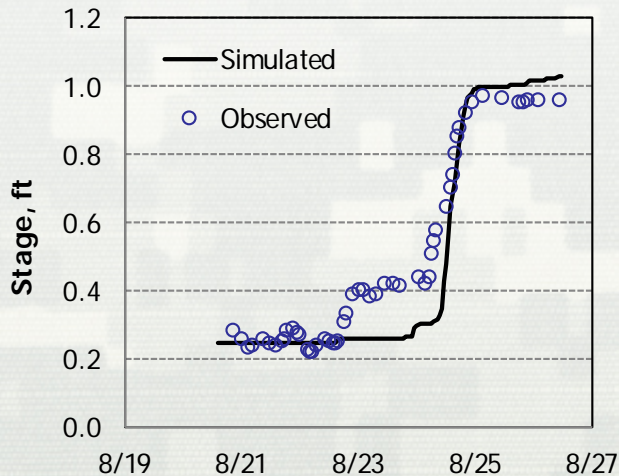


## Calibration Gauges

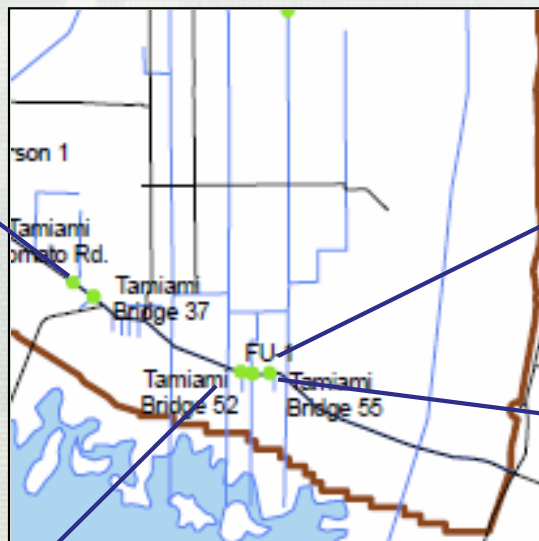
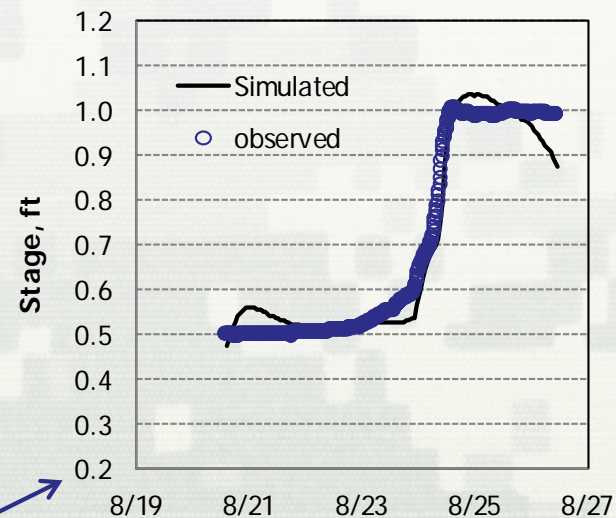




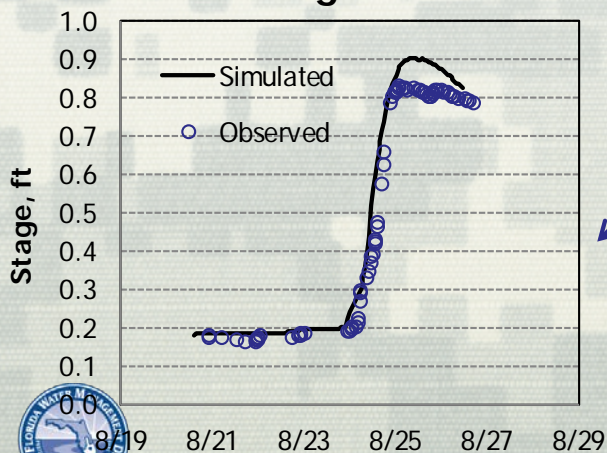
### Bridge 36-Tomato Rd



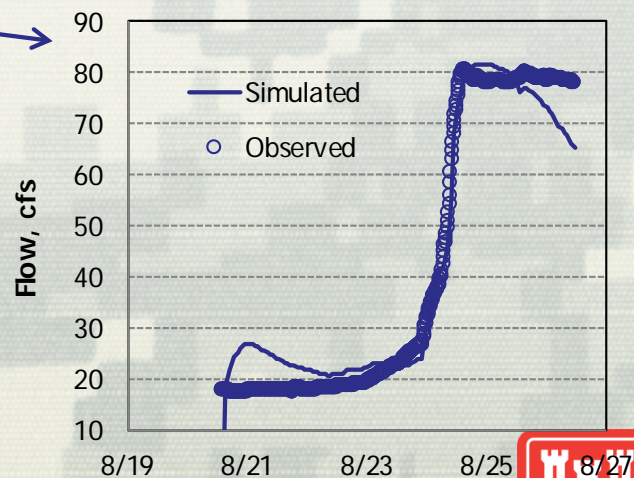
### FU - 1



### Bridge 52

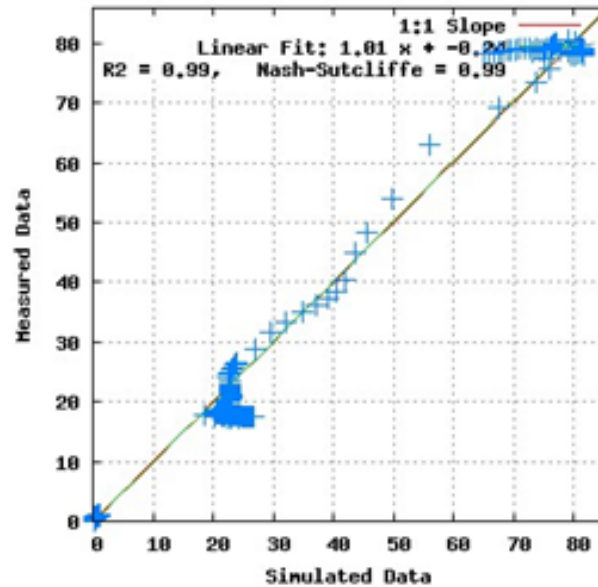


### FU-1





Comparison of Measured Data with Simulated Data



Plot comparing all of the simulated and observed data (FU-1 flow and stage, stage values at ditch locations numbered 36, 37, 52, and 55) that was used to calibrate the GSSHA PSRP Tier 1 event model.

Data Comparisons	R <sup>2</sup>	Nash-Sutcliffe Efficiency Scores
All data	0.99	0.99
All FU-1 data	0.99	0.99
FU-1 discharge data	0.98	0.97
FU-1 stage data	0.97	0.97
All ditch stage data	0.90	0.87
Ditch numbered 36 stages	0.86	0.77
Ditch numbered 37 stages	0.86	0.77
Ditch numbered 52 stages	0.98	0.97
Ditch numbered 55 stages	0.99	0.99

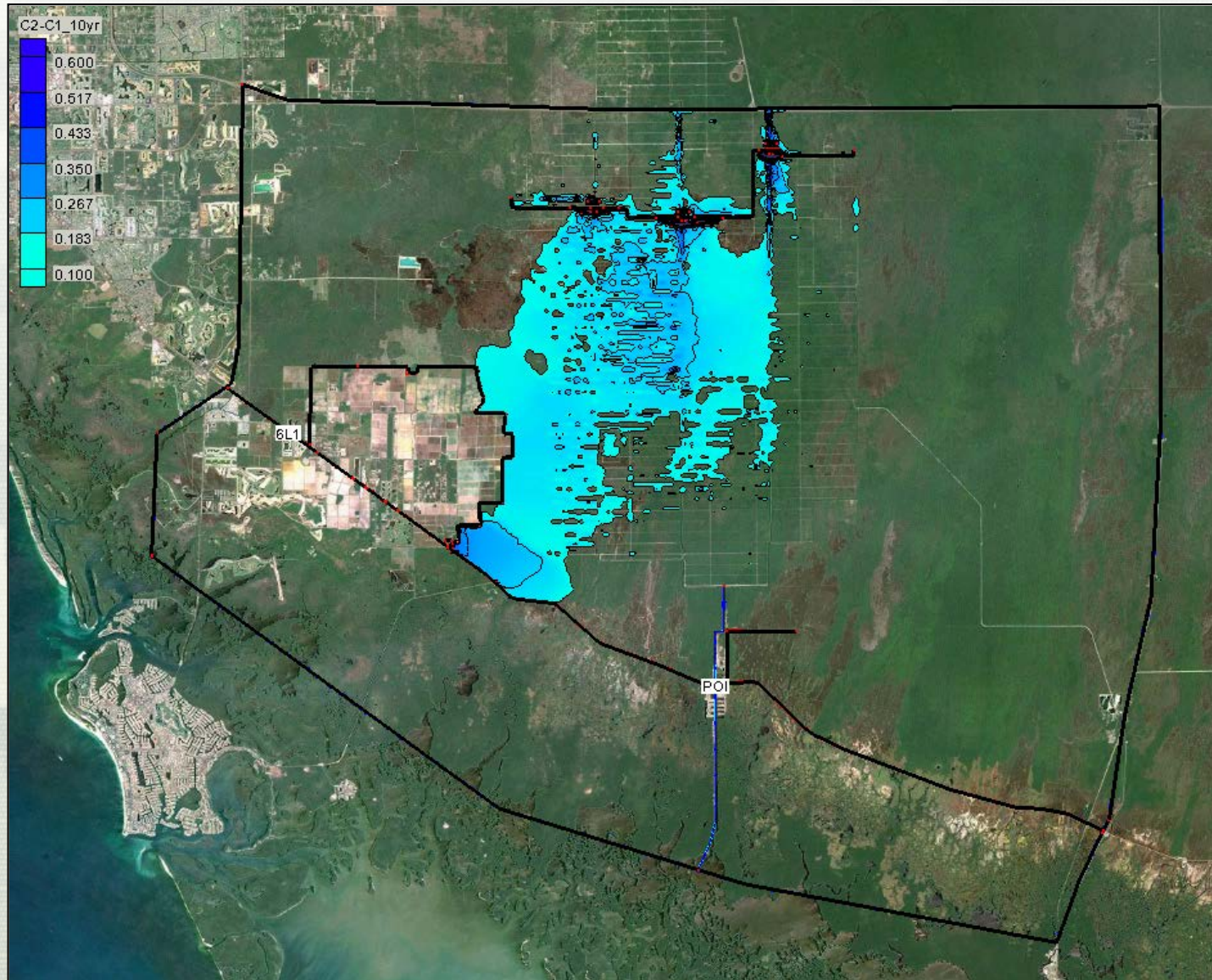
Table summarizing R<sup>2</sup> and Nash-Sutcliffe scores for all and subsets of the data that was used to calibrate the GSSHA Tier 1 PSRP model.

Please take note of the high R<sup>2</sup> and Nash-Sutcliffe scores.



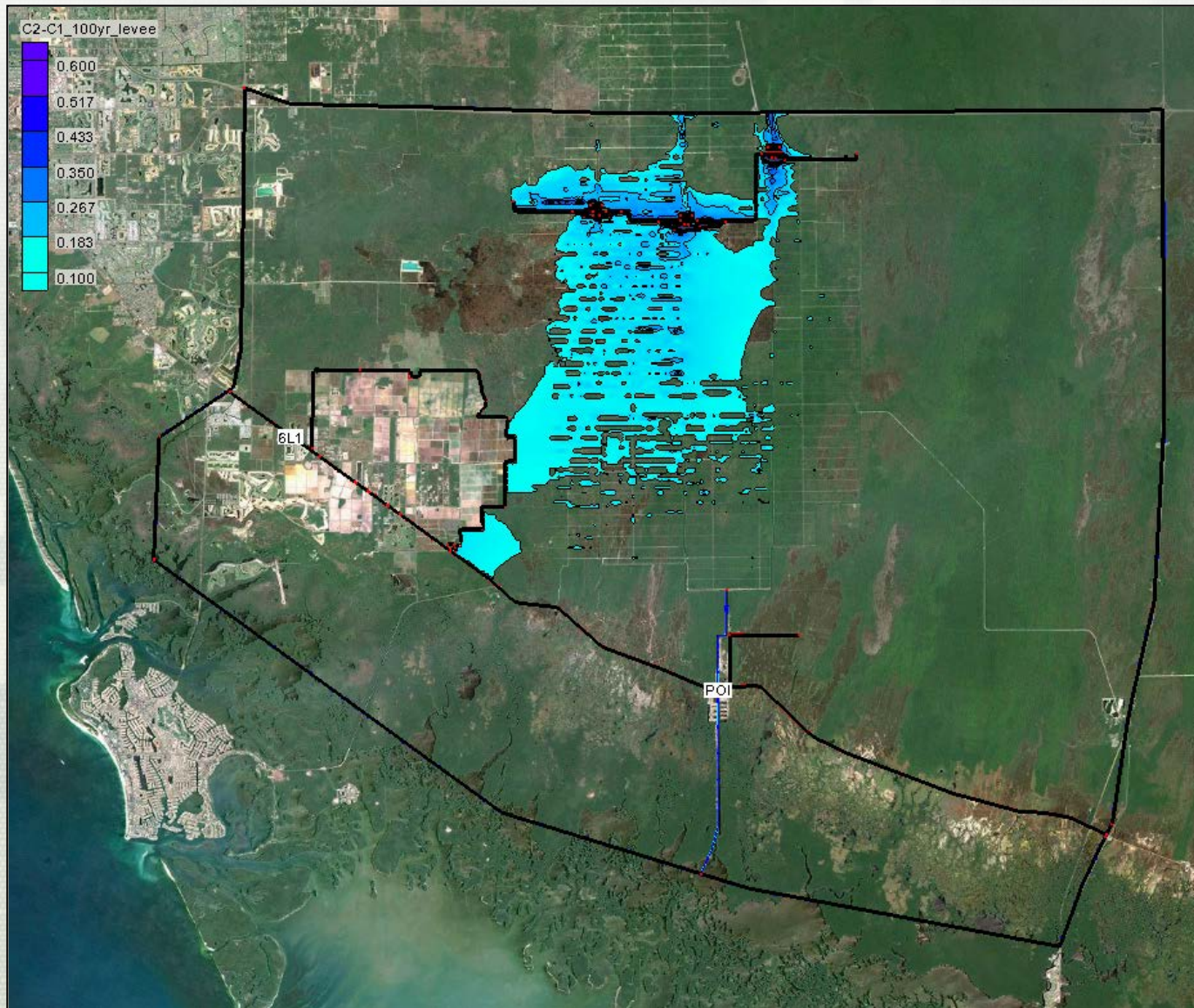


# Depth Difference Map: 10-yr Storm Frequency



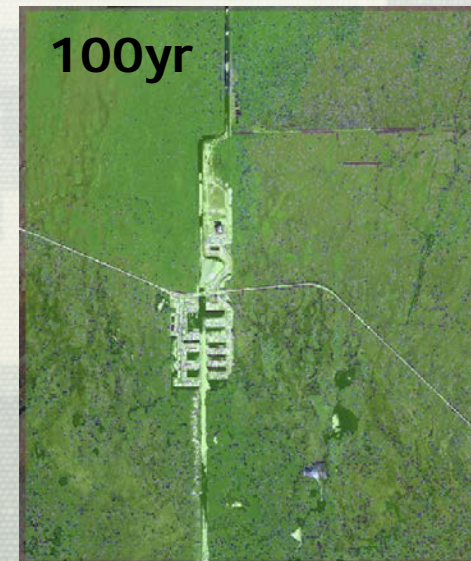
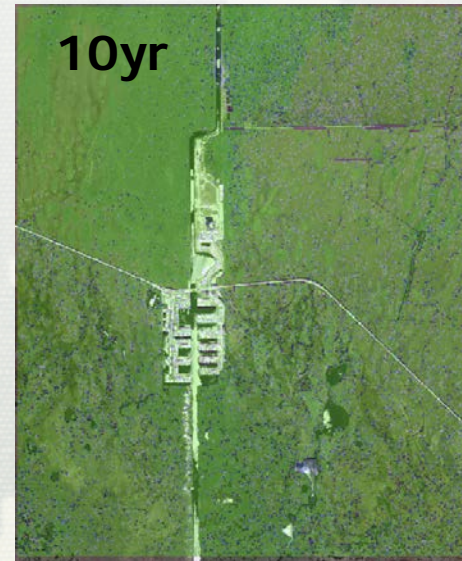
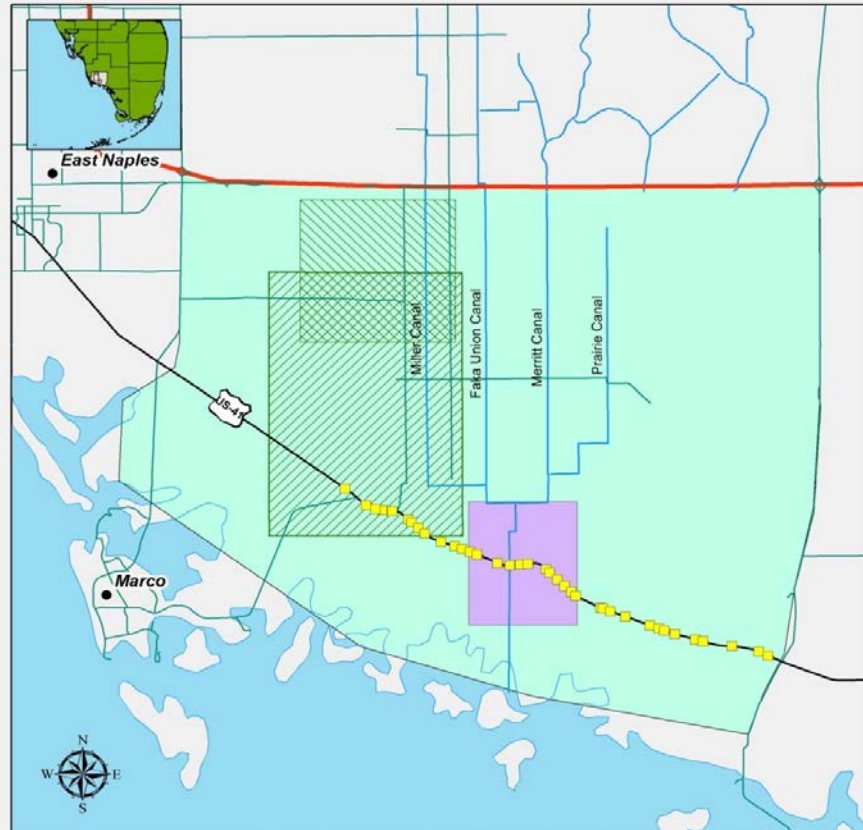


# Depth Difference Map: 100-yr Storm Frequency





# Port of the Islands Tier 2 Model



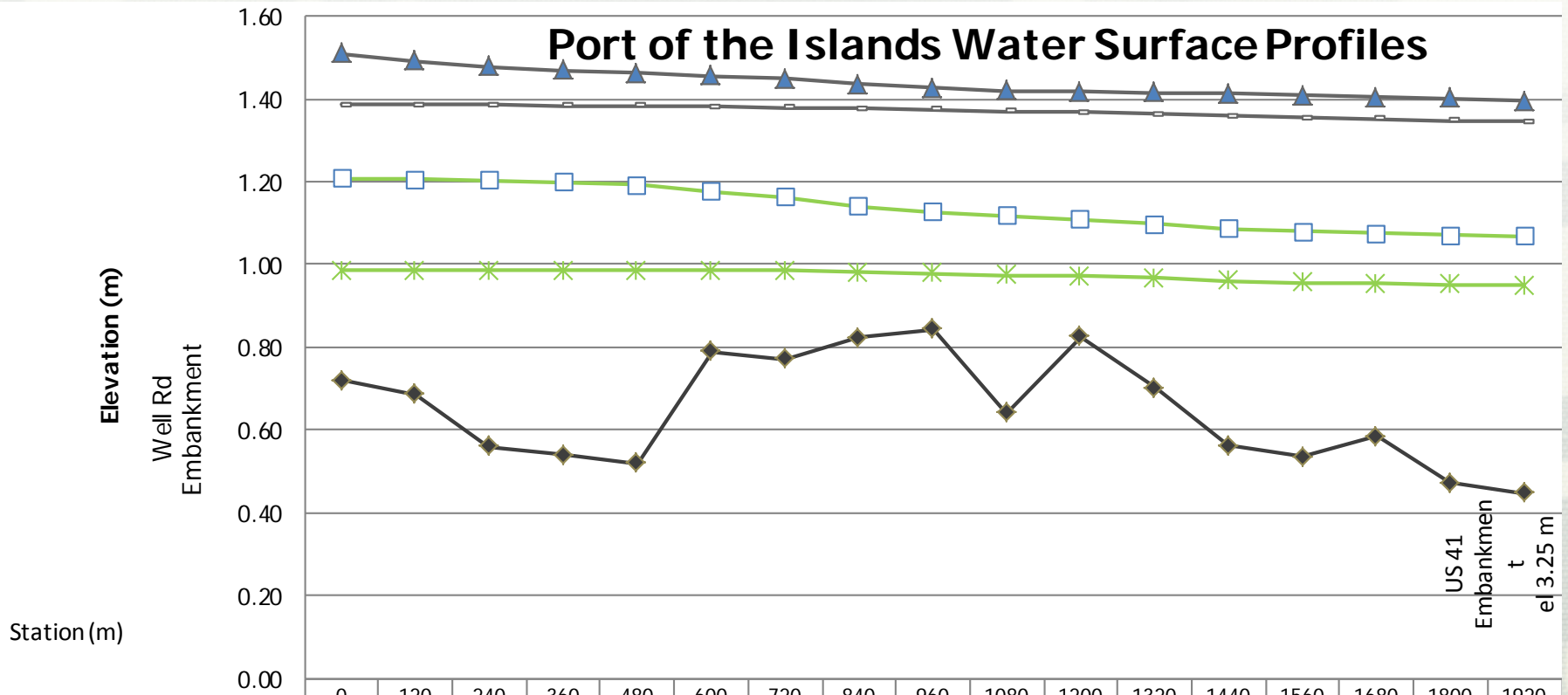
Differences  $< 0$   
i.e., "with"  $<$  "without"





# Profile along north-south direction of proposed levee alignment

## Port of the Islands Water Surface Profiles



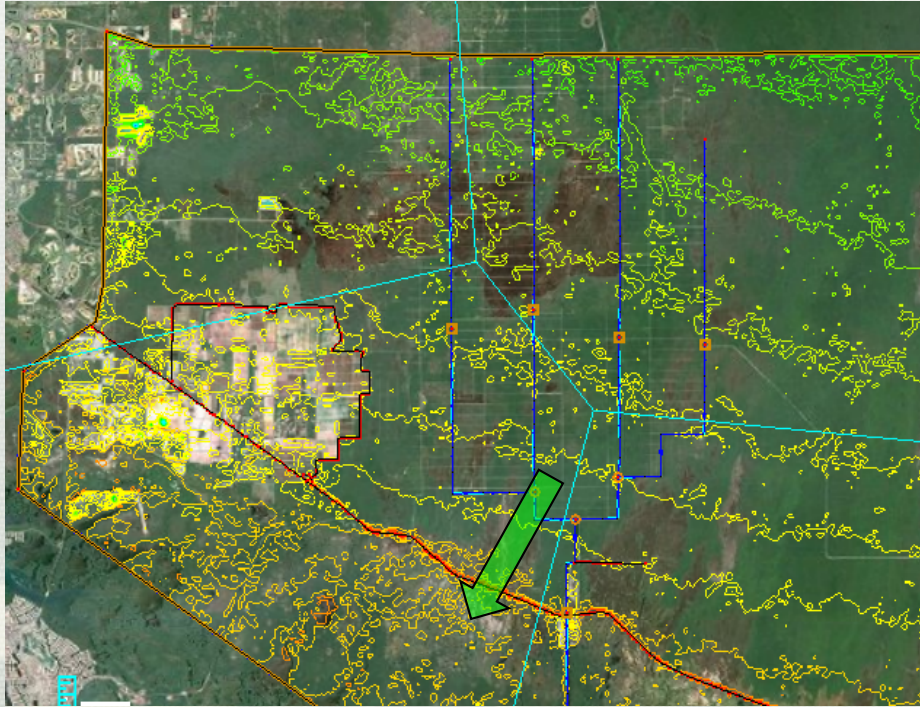
	0	120	240	360	480	600	720	840	960	1080	1200	1320	1440	1560	1680	1800	1920
◆ Ground El.	0.721	0.687	0.561	0.541	0.521	0.79	0.771	0.824	0.843	0.641	0.825	0.703	0.563	0.536	0.586	0.473	0.447
□ 10 Yr WS Condition 1	1.2069	1.2062	1.2028	1.19905	1.19302	1.17638	1.16199	1.14083	1.12598	1.1173	1.10816	1.09856	1.08691	1.08068	1.07531	1.07115	1.06888
▲ 100 YR WS Condition 1	1.50871	1.49097	1.47719	1.46853	1.46121	1.45559	1.44749	1.43436	1.42568	1.41961	1.41685	1.41515	1.41161	1.40707	1.40344	1.40015	1.39472
* 10 Yr WS Condition 2	0.98584	0.98583	0.98581	0.98575	0.98547	0.98496	0.98438	0.98121	0.97822	0.97466	0.97158	0.96681	0.96056	0.95722	0.95385	0.9507	0.9489
● 100 Yr WS Condition 2	1.38529	1.38521	1.38488	1.38429	1.38332	1.38177	1.37988	1.37716	1.37401	1.3707	1.36735	1.36364	1.35862	1.35424	1.35082	1.34732	1.34398

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# Do we need POI Levee?

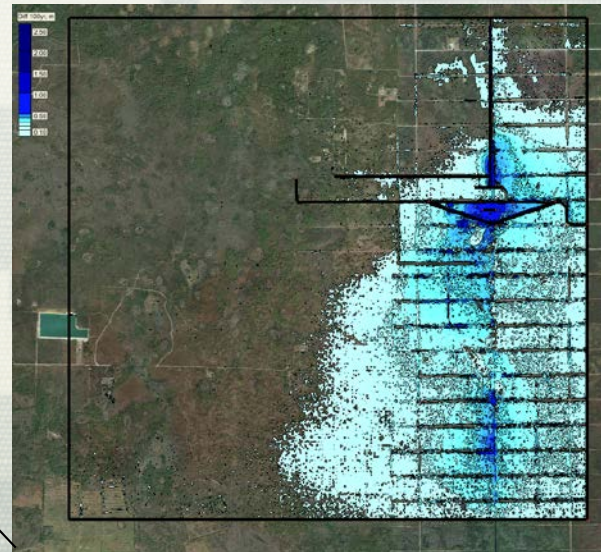
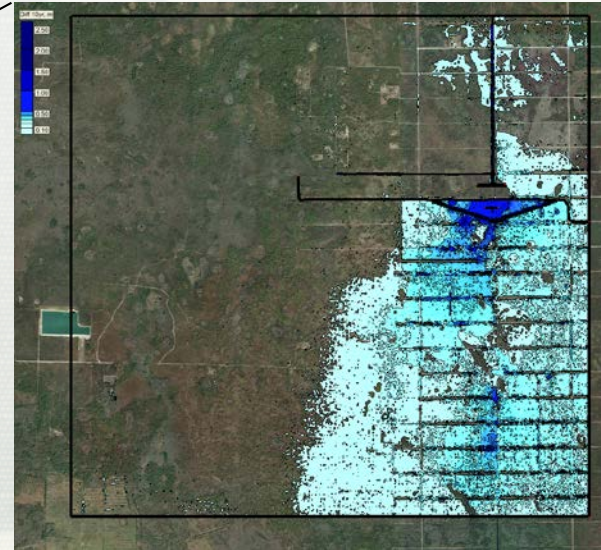
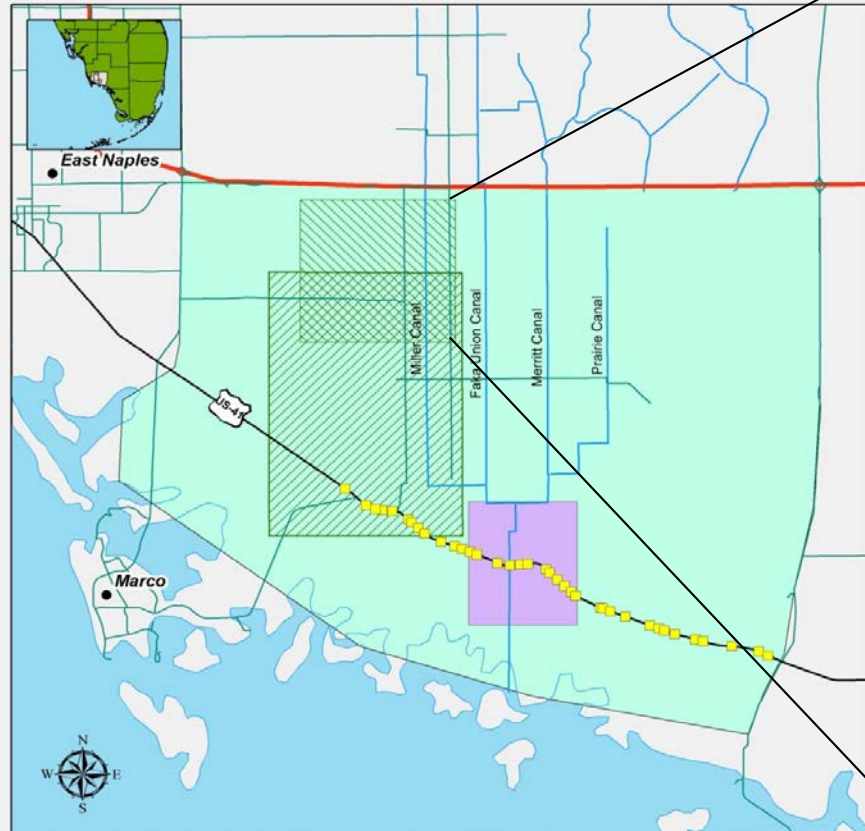


Improvements in Topo DEM wrt  
data source in PIR model  
(\$ Savings)



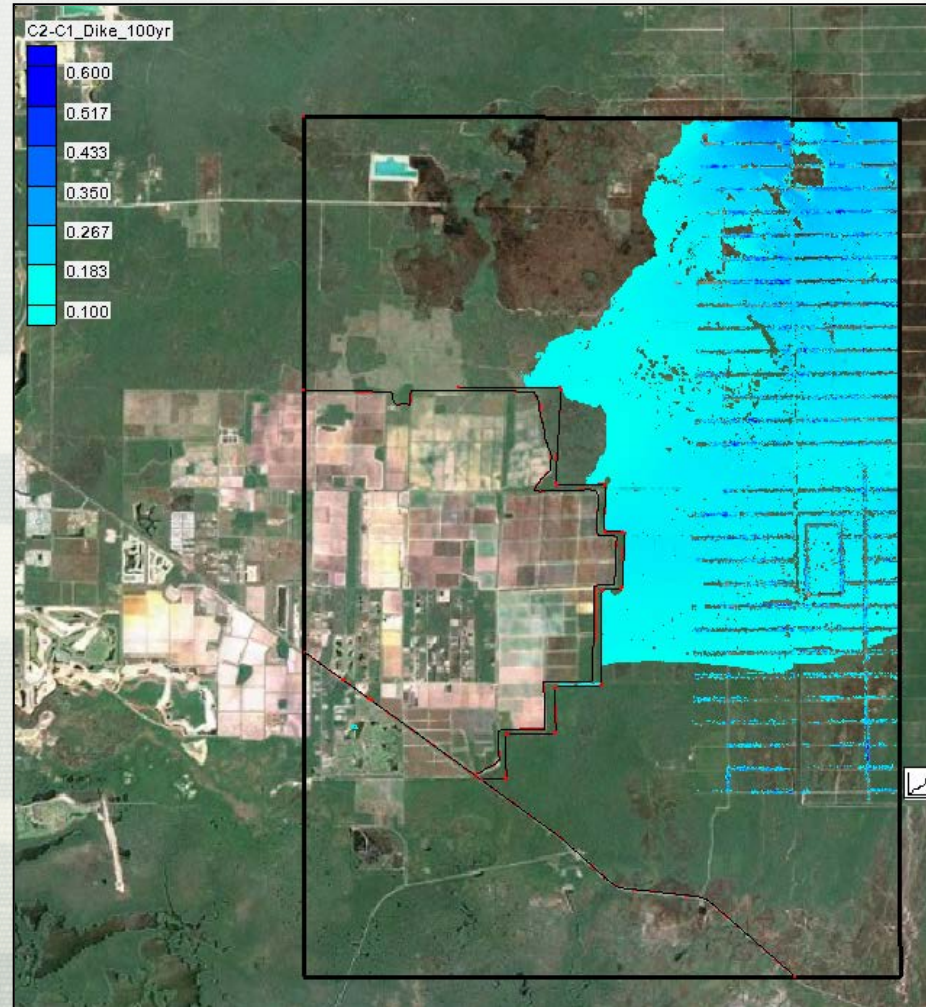
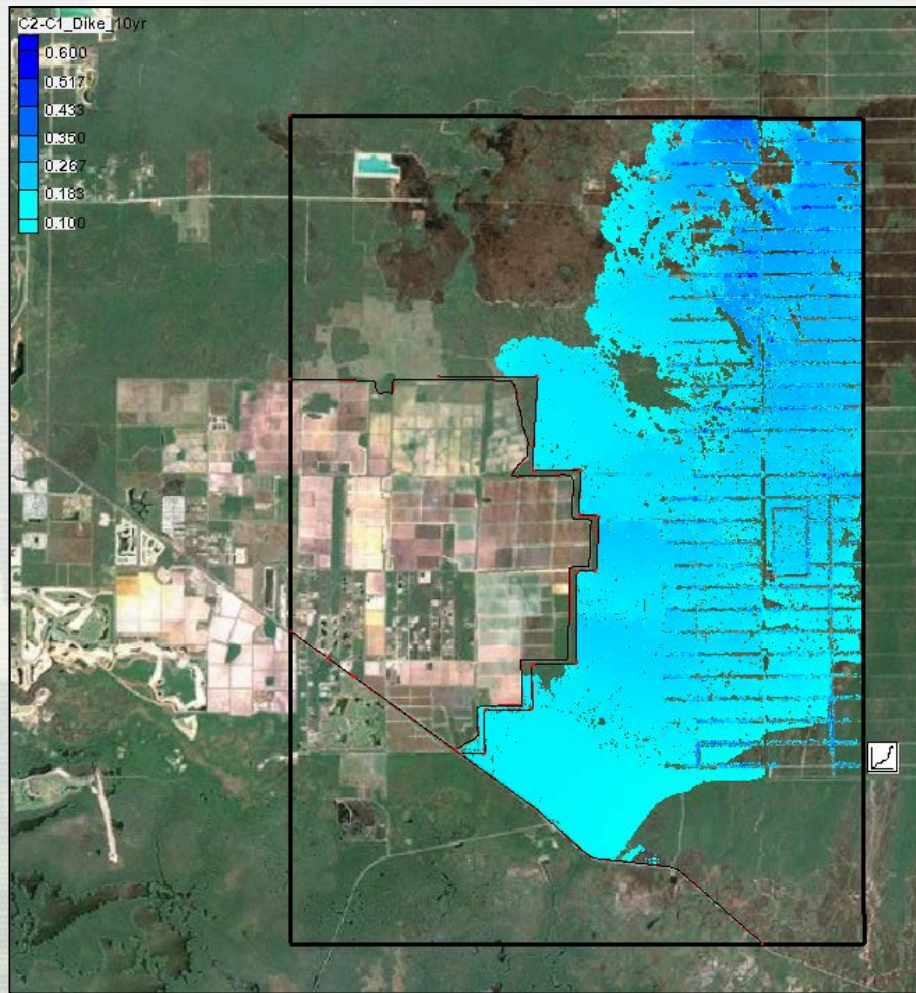


# Private Lands Tier 2 Model





# 6Ls Tier 2 Model



FLORIDA WATER MANAGEMENT DISTRICT

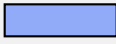







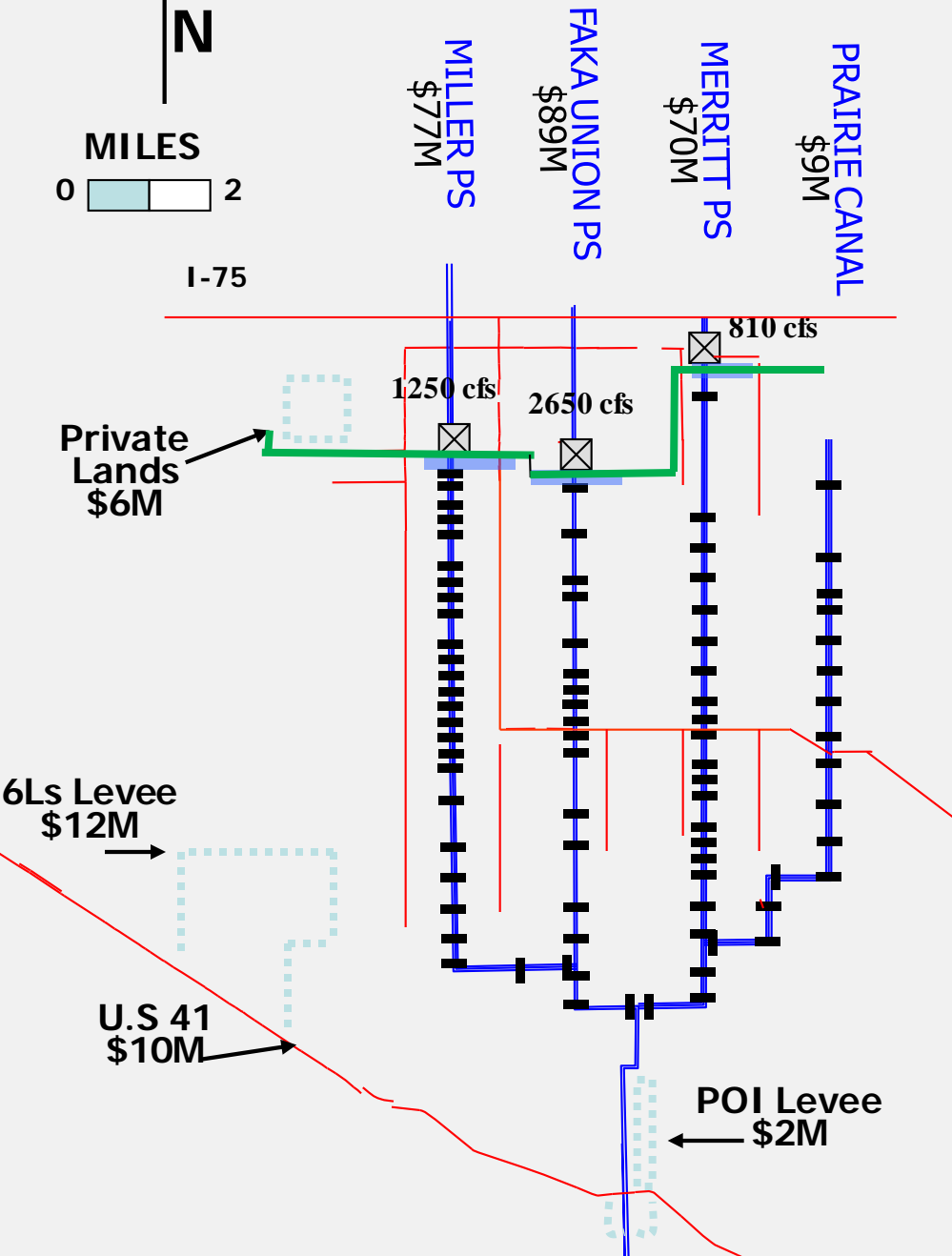
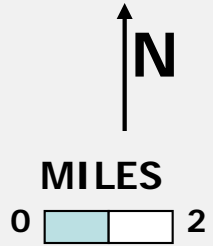
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# Picayune Strand Restoration Project

## Features with Cost

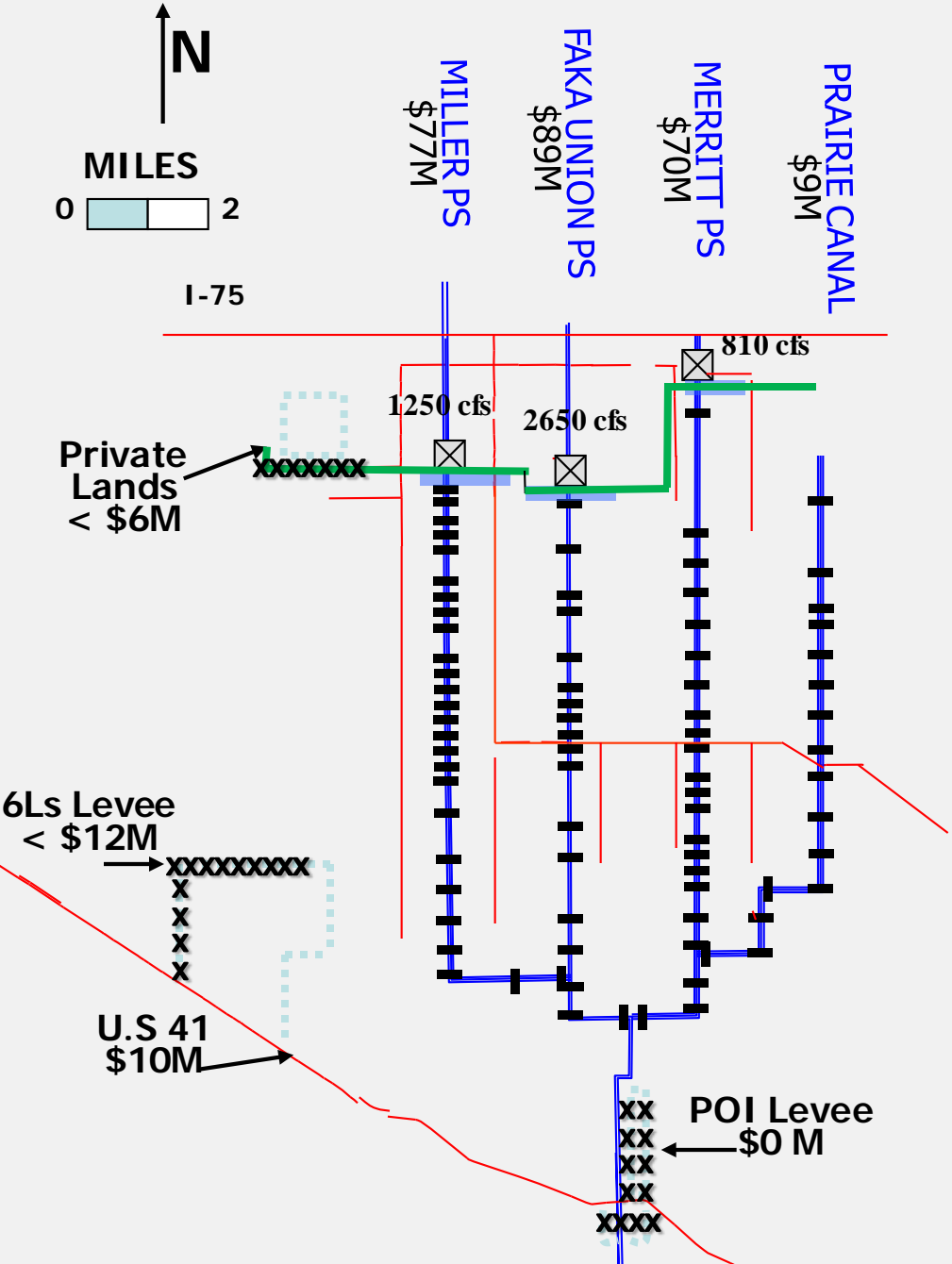
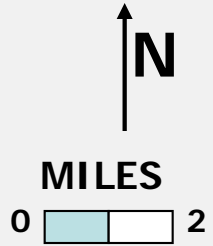
-  Spreaders
-  Pump Stations
-  Canal Plugs
-  Primary/Secondary All Weather Roads
-  Tie-back Levee
-  Flood Protection Levees (footprints shown from PIR)

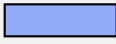



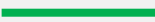






# Picayune Strand Restoration Project

## Features with Cost



-  Spreaders
-  Pump Stations
-  Canal Plugs
-  Primary/Secondary All Weather Roads
-  Tie-back Levee
-  Flood Protection Levees (footprints shown from PIR)
-  Eliminated based on GSSHA Modeling



# Design Criteria

- **Superiority Analysis**
  - Levee crest at least 2ft > than 95% CI for 100yr storm
- **Pump stations Tieback system**
  - Crest elevation @ 15ft (NAVD88)
- **6L's farm levee**
  - TBD





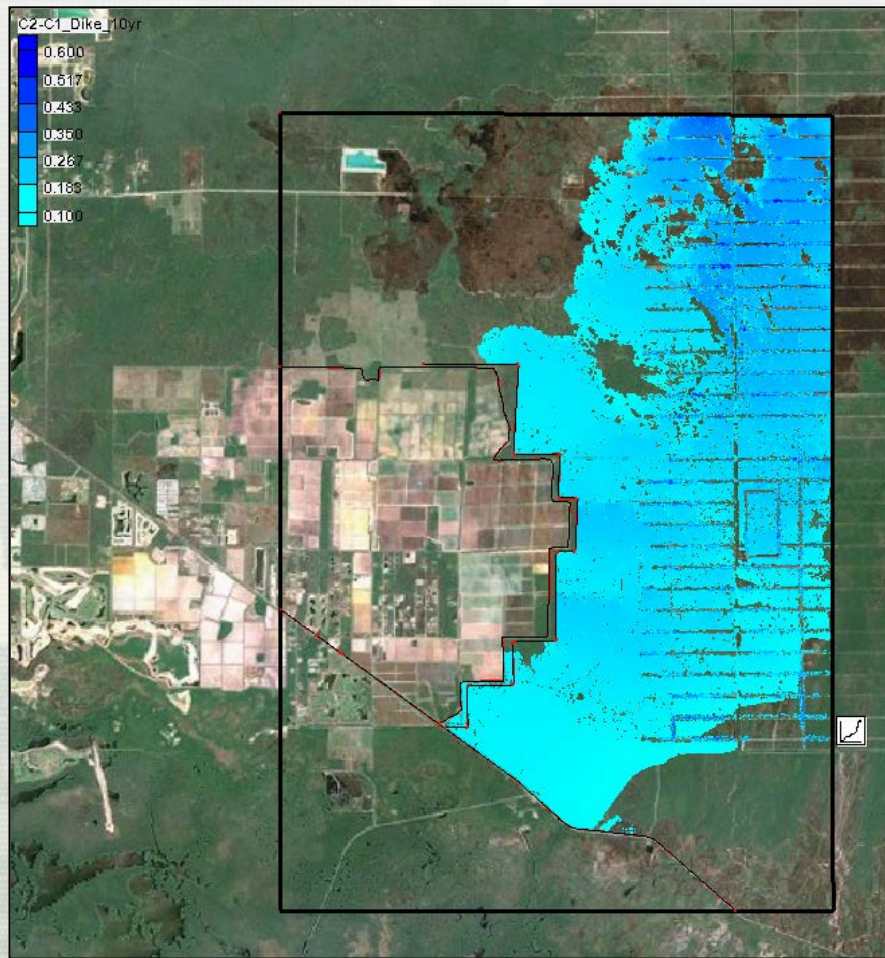
# Summing up...

- SGGE unsuccessful urban development attempt turned into successful restoration project
- Benefits identified in restoring PSRP
- H&H modeling to help with design and refinement of PSRP flood control protective features per current USACE guidelines
- Other issues identified





# Never ending H&H modeling...



- GW impacts to 6L farms
  - > seepage rates = mitigation measures
  - < seepage = > pump irrigation costs
- US41 Road bed impacts
- Drainage issues to TTINWR
- Red-cockaded woodpecker habitat impacts





# PSRP Success!





An aerial photograph showing a wide, rocky riverbed with several small, irregular pools of greenish water. The surrounding landscape is covered in dense, green trees and shrubs, with some areas appearing to be a mix of green and brown, possibly indicating a fire or a specific type of vegetation. The text is overlaid in yellow on the upper and lower portions of the image.

**PM: "Is the H&H analysis complete?"**

**Drainage H&H eng.: "We just found another basin we need to include..."**