Collier County

# Watershed Management Plan

January 20, 2011

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# Agenda

- Background
- Model Development
- Existing Conditions Evaluation
  - Water Quantity
  - Water Quality

  Break
- Natural Systems Evaluation
- Fertilizer Ordinance

# Watershed Planning

- Pre 1960 – Major Roads with canals adjacent
- 1960s – Golden Gate Drainage canals
- 1970s – Reactions to flooding and over drainage
- 1980s – Stormwater basin planning
- 1990s – GMP Policy; Stormwater Master Plan
- 2000 – BCB Watershed Plan
- 2006 – GMP EAR Amendment commitment

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# Project Objectives

- Develop watershed management plans that will help protect estuaries and wetland systems to
  - Restore historical water quantity and estuarine discharges
  - Improve water quality within the watersheds and estuaries
  - Address flood control and water supply issues
- Project will be completed in December 2010.

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# Project Specific Tasks

- Update the BCB hydrologic/hydraulic computer model
- Evaluate watershed and estuarine existing conditions
  - Water quantity
  - Water quality
  - Natural resources
- Define performance measures
- Evaluate alternatives and identify recommended improvement projects
- Prepare Watershed Management Plans

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# Project Team Organization

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Principal-in-charge

QA/QC

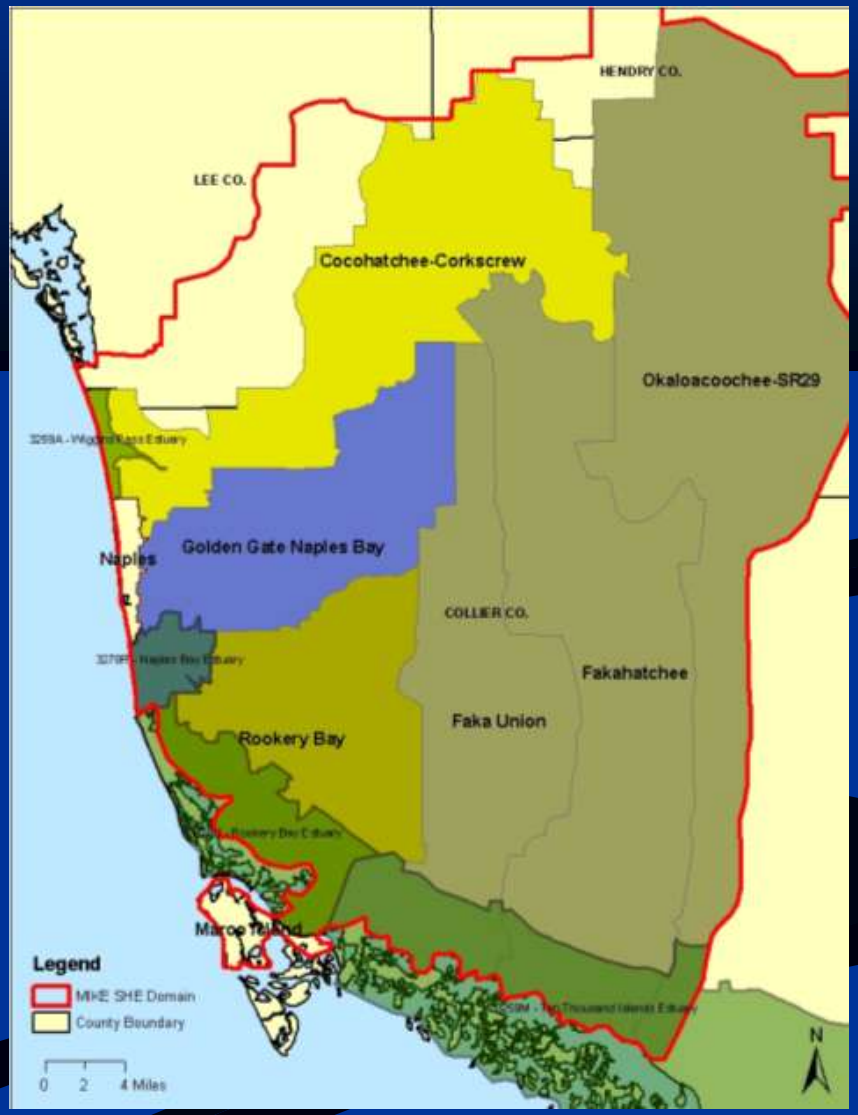
**Project Manager – Moris Cabezas, Ph.D., P.E. – PBS&J**

| Watershed Modeling | Water Resource Evaluation | Natural Systems Evaluation |
|---|---|---|
| Tim Hazlitt, P.G. - DHI | Dave Tomasko, Ph.D. – PBS&J | Ed Cronyn – PBS&J |
| Preston Manning – DHI | Peter deGolian – PBS&J | Dave Tomasko, Ph.D. – PBS&J |
| Peter deGolian – PBS&J | Eric Fontenot, P.E. - DHI | |

Other Support Services

# Watersheds

- Top Priority Watersheds
  - Cocohatchee Corkscrew
  - Golden Gate
  - Rookery Bay
- Additional Watersheds
  - Faka Union
  - Fakahatchee
  - Okaloacoochee SR 29
- Estuaries

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# Water Body IDs (WBIDs)

- FDEP Run 40
- Coastal WBIDs clipped to match model extent
- WBID 3259M subdivided by watershed


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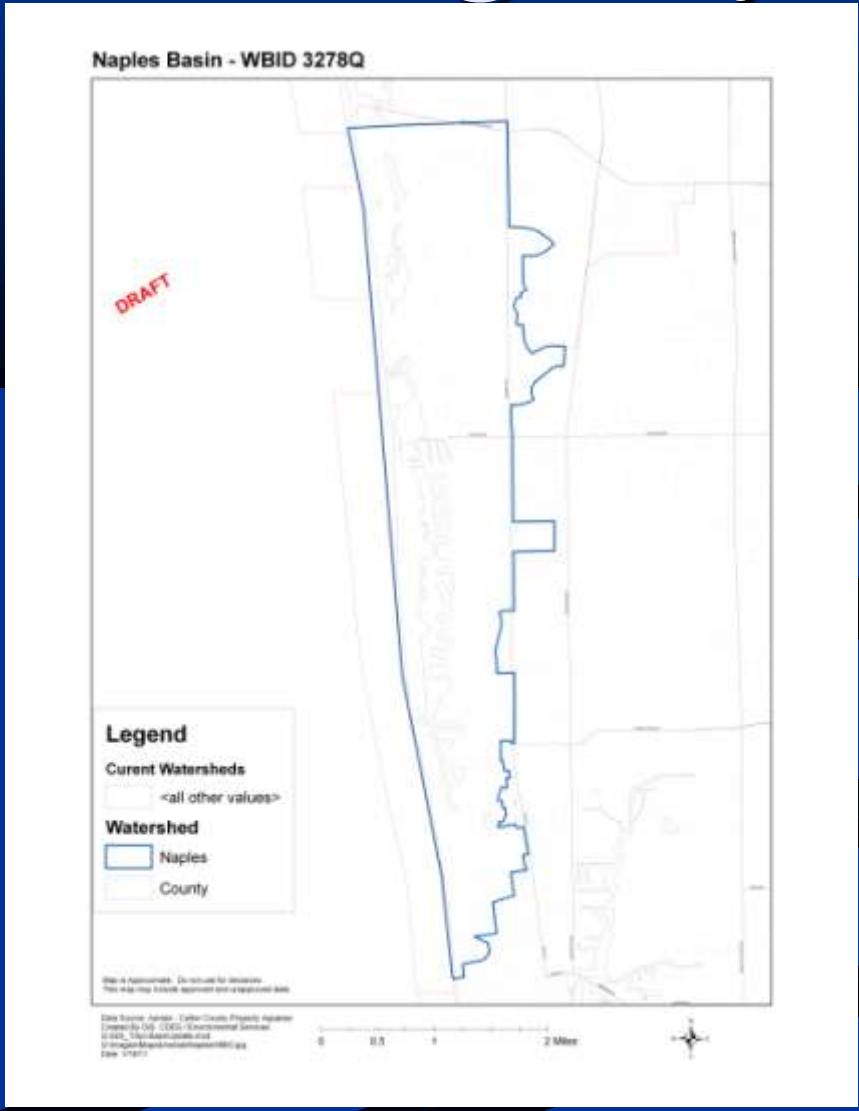
# Clam Bay / Moorings Bay

- Naples WIBID
- 3278 Q
- Estuary
- Class 2

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# Water Quantity Analysis

- Objective
  - Assess the deficit or surplus of freshwater discharges to each estuarine system from the contributing watersheds

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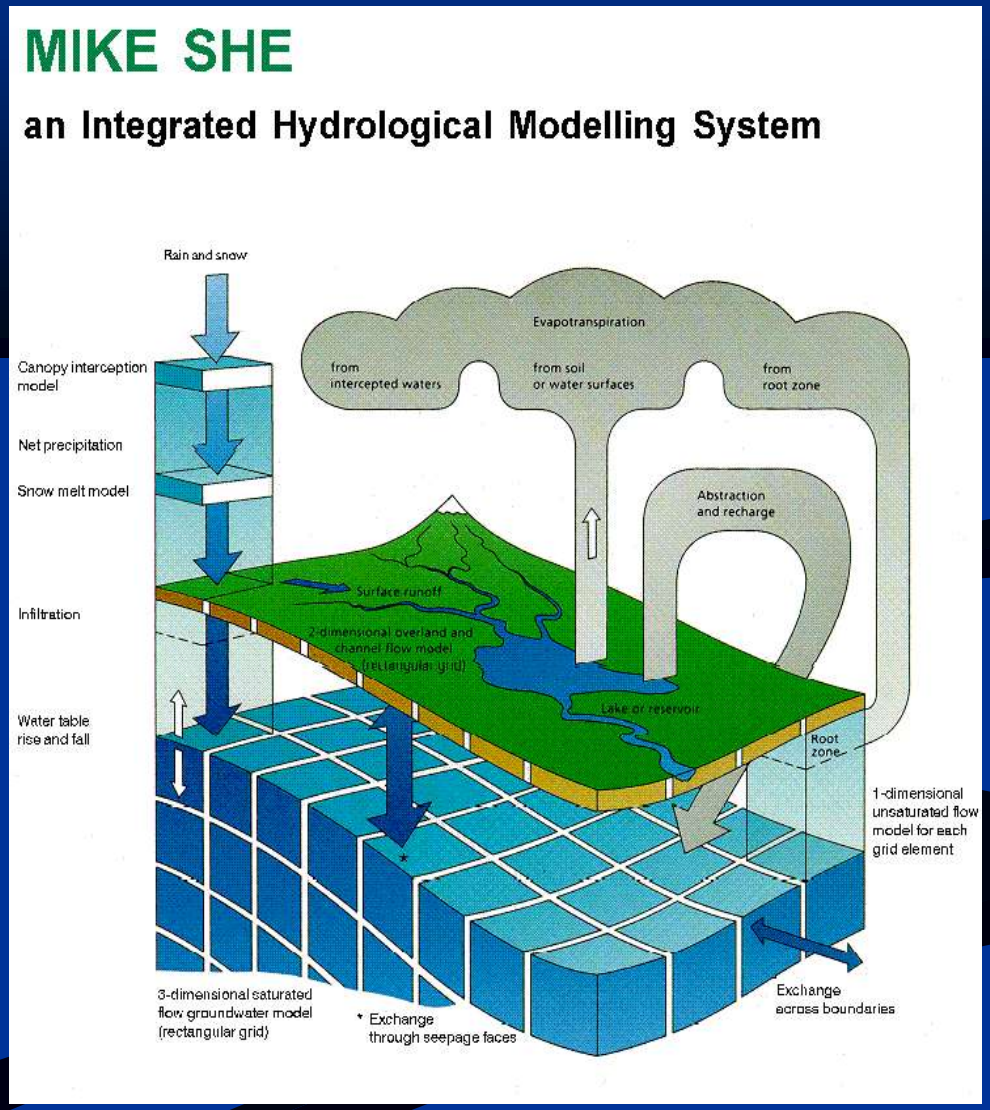
# Existing Conditions Model

- Integrated surface water and groundwater model
- Simulation period is 2002 – 2007

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# Computer Model Grid

- Consistent with previous Big Cypress Basin models
- Model area is 1400 square miles
- Grid size is 1500 feet

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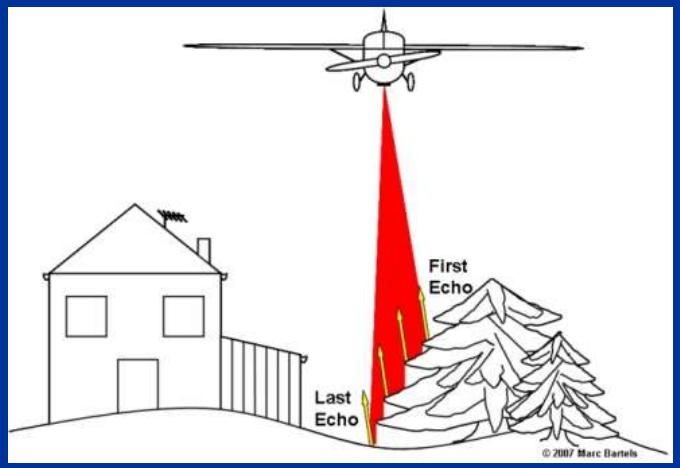
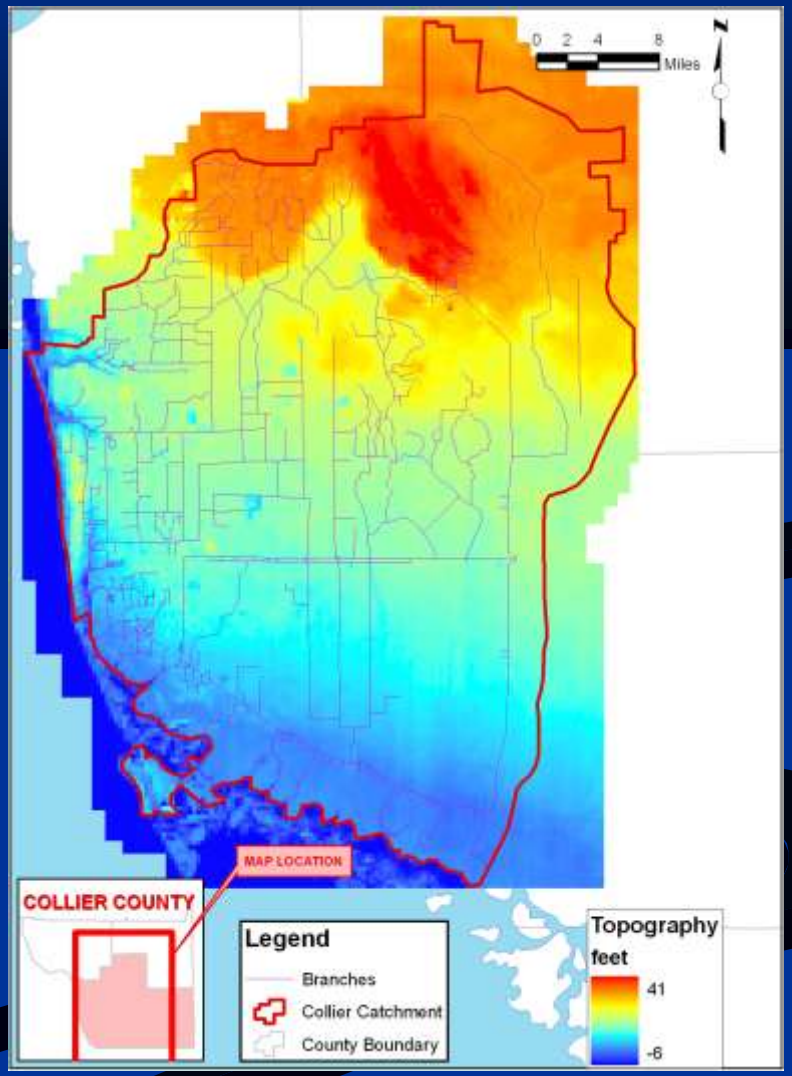
# Topography

- LiDAR generated
- 5-ft digital elevation model (DEM)
- Elevation averaged over grid cell

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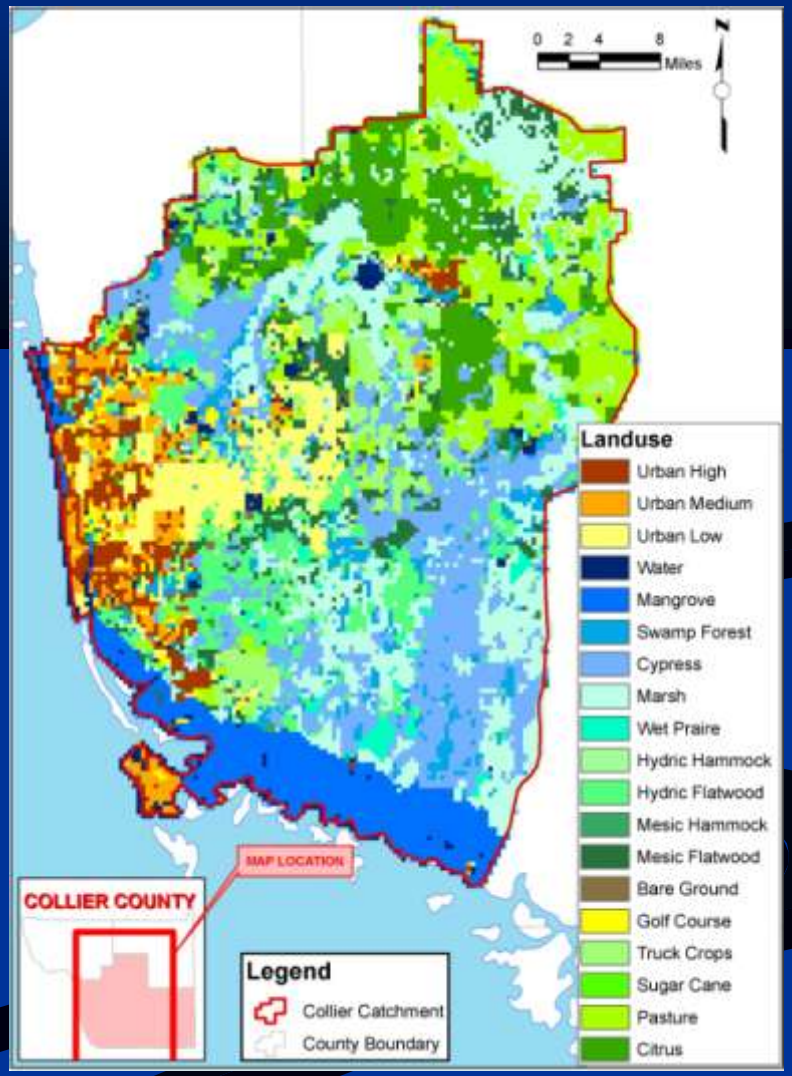
# Land Use

- Land use categories developed from FLUCCS classifications
- Hydrologic parameters are assigned based on land use categories

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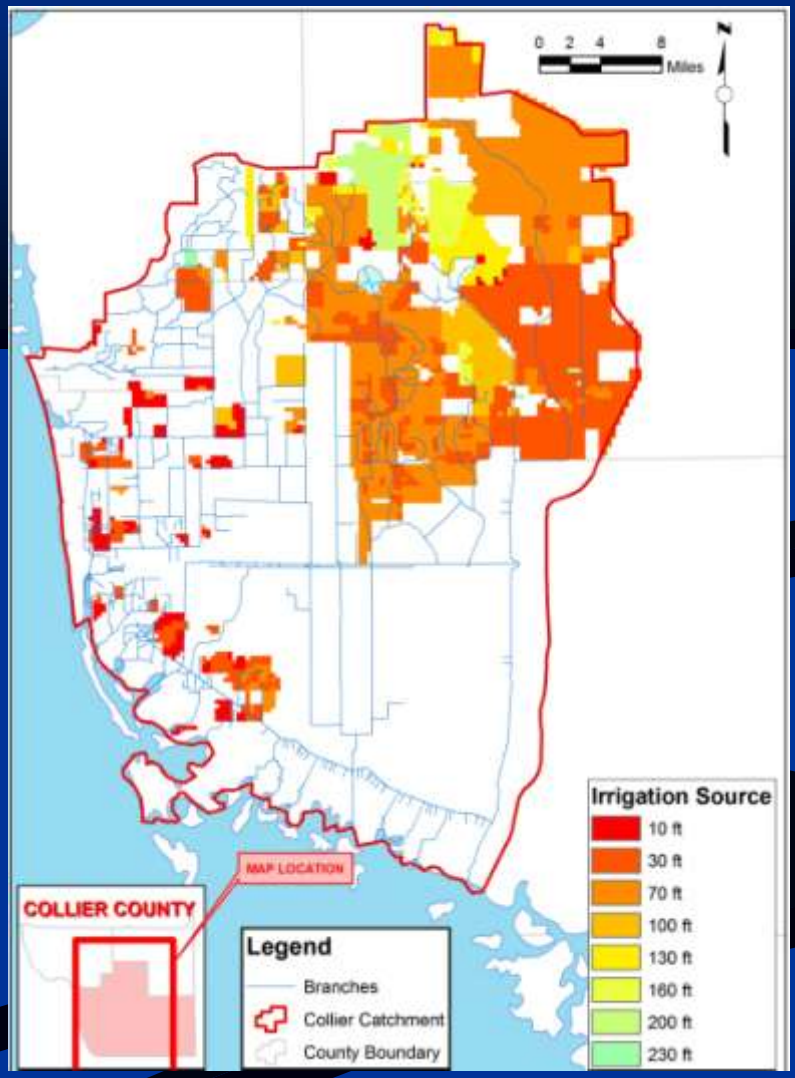
# Irrigation

- Irrigation volume is determined by soil moisture
- Application rate and source defined by water use permits

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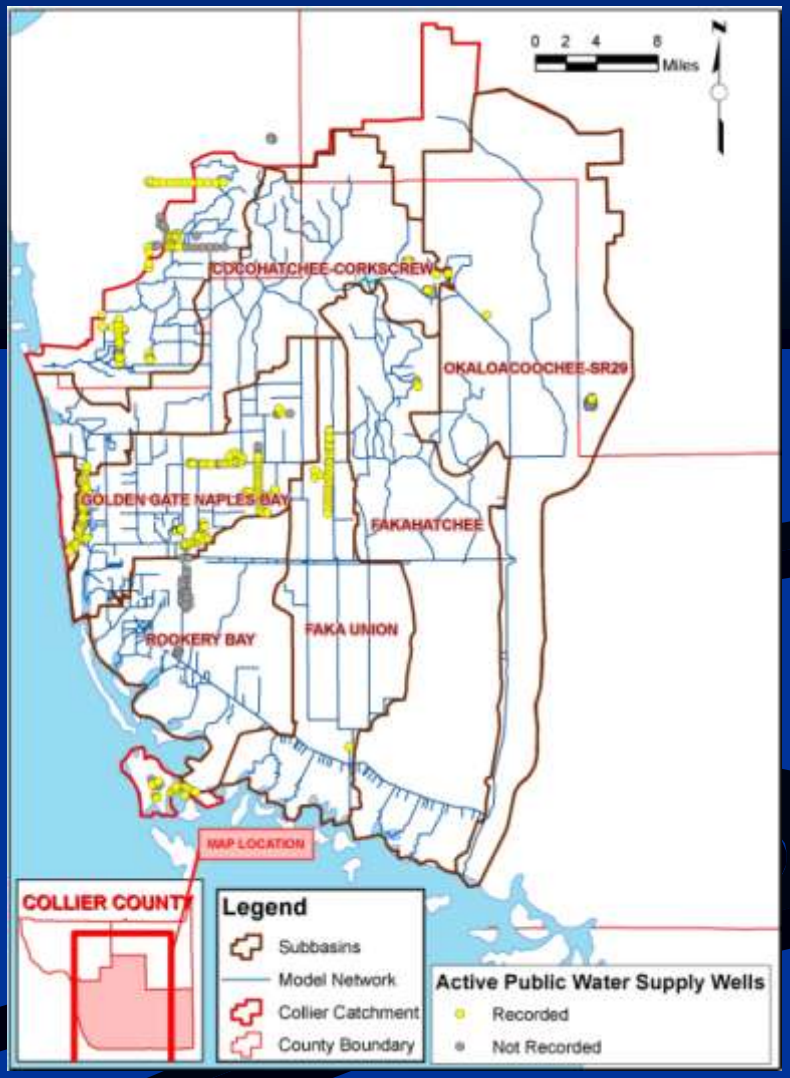
# Water Supply Wells

- Primary users
  - City of Naples
  - Collier County
  - Marco Island
- Timing and volume is determined by withdrawal information provided by SFWMD

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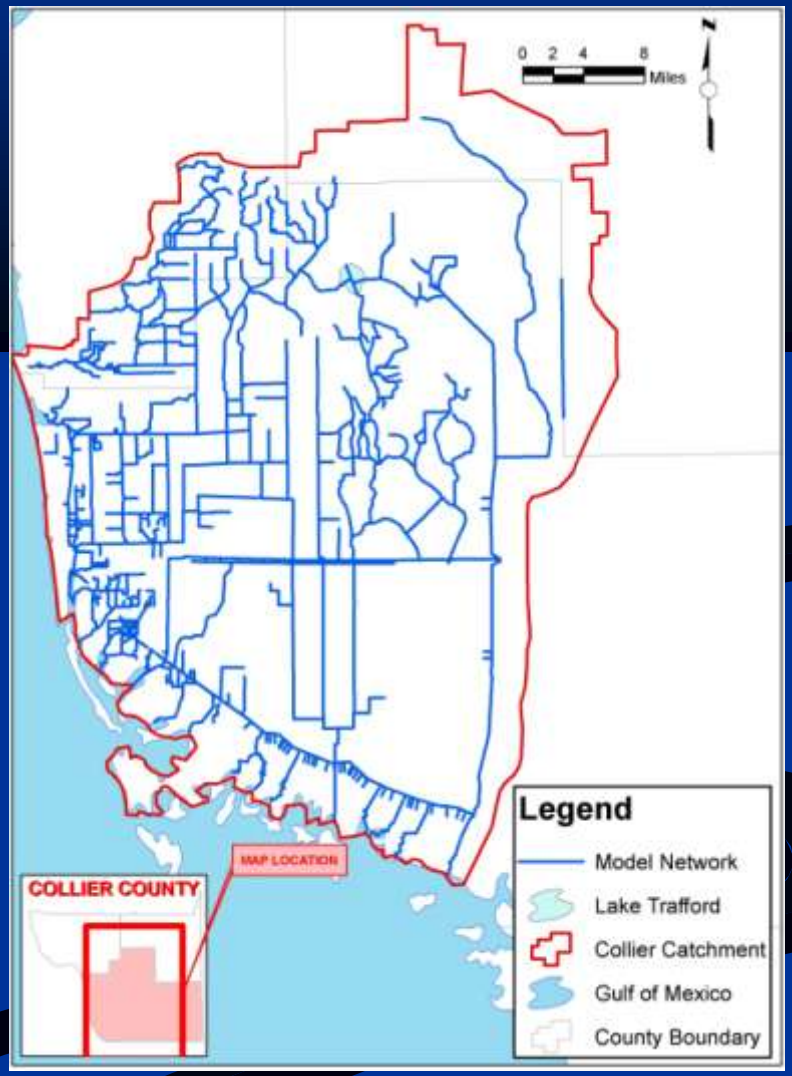
# Canal and Stream Network

- 825 miles of rivers, streams and canals
- Primary drainage network managed by BCB
- Collier County secondary canals
- Imperial River drainage

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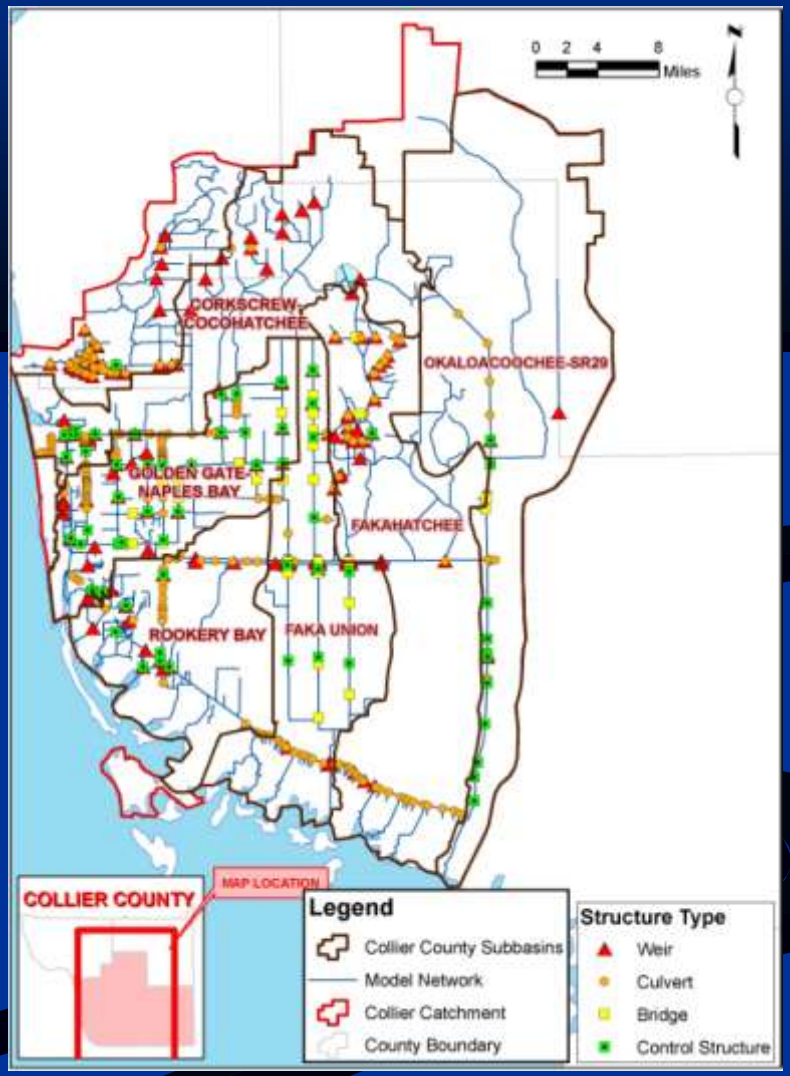
# Control Structures

- Flow and water levels are controlled to maintain desired in-stream conditions
- Structures include weirs, culverts, bridges and gates

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# Control Structures Operations

- Cocohatchee Canal Structure 1

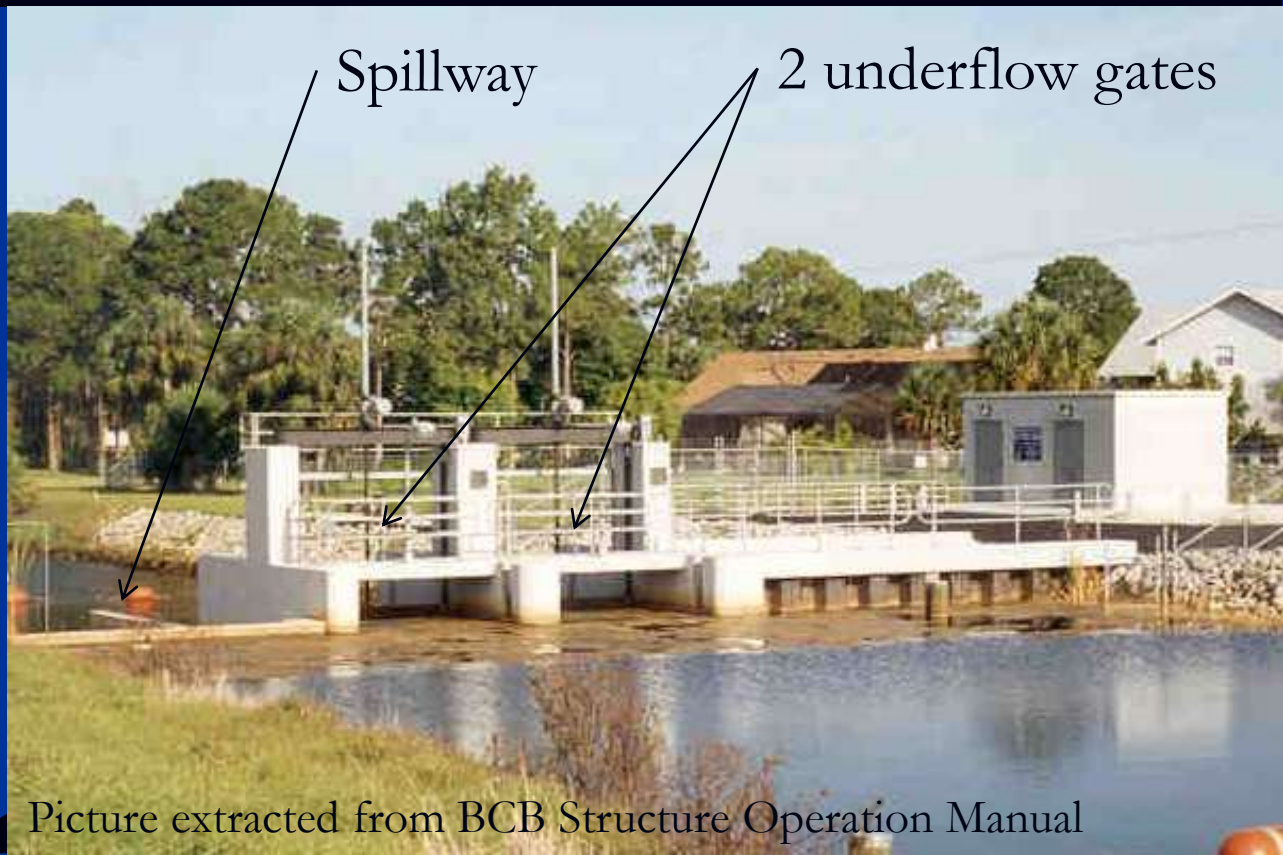
Rules:

**Dry season-** Head water elevation desired at ≈ 4.8 feet NAVD.

Above 5.5 feet, gates open.
Below 4.0 feet, gates close.

**Wet season-** Head water elevation desired at ≈ 4.3 feet NAVD.

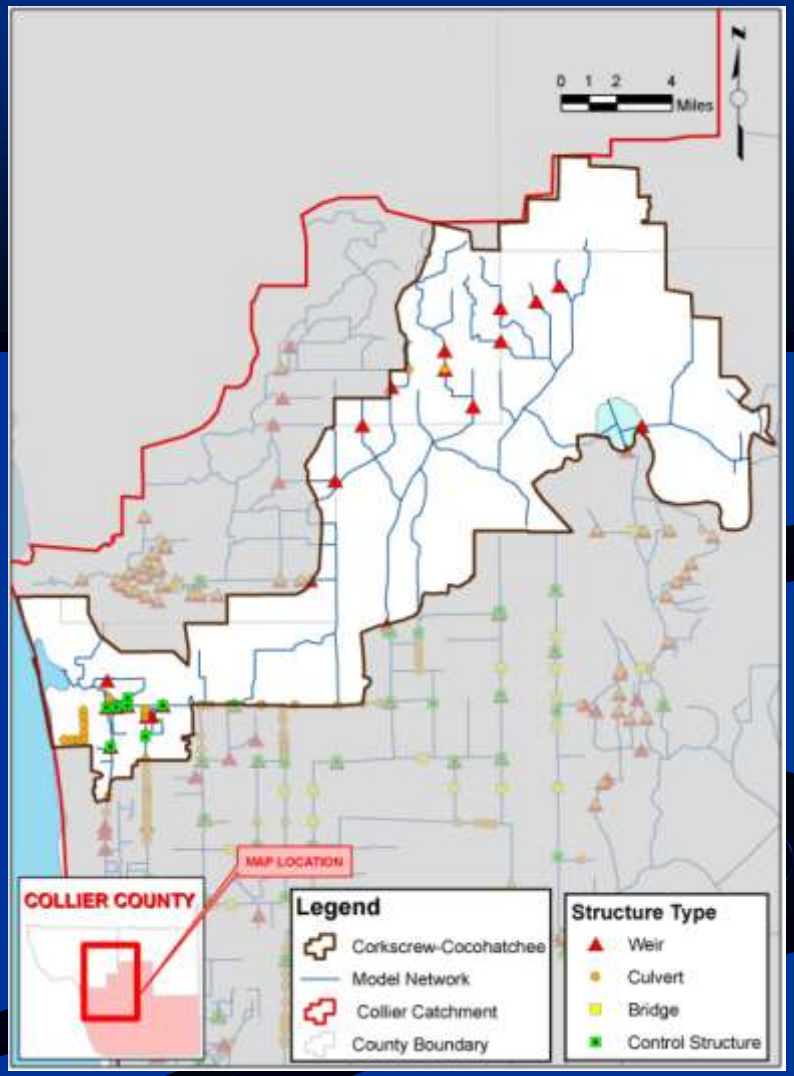
Above 5.5 feet, gates open.
Below 2.8 feet, gates close.




Picture extracted from BCB Structure Operation Manual

# Cocohatchee Corkscrew

- Primarily natural areas in the upper basin
- Water transfers with Golden Gate and Imperial River watersheds

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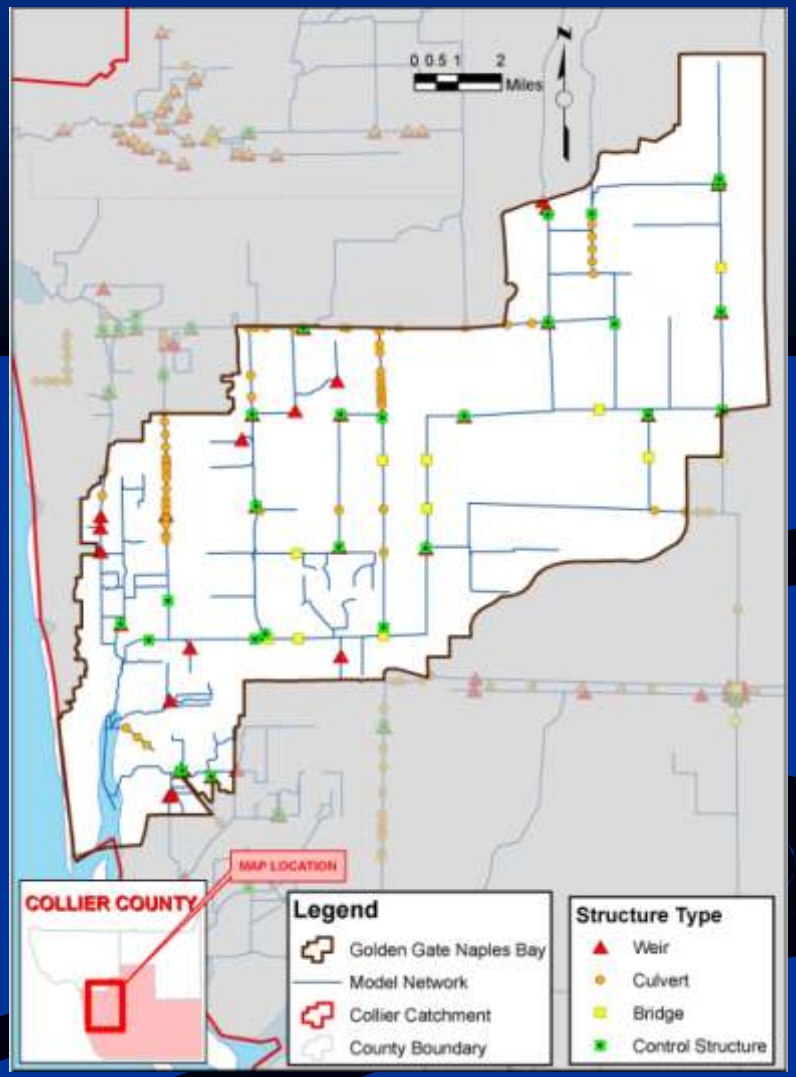
# Golden Gate

- Mainly Urban Land Uses
- Discharges to Naples Bay
- Drainage pattern changed due to development

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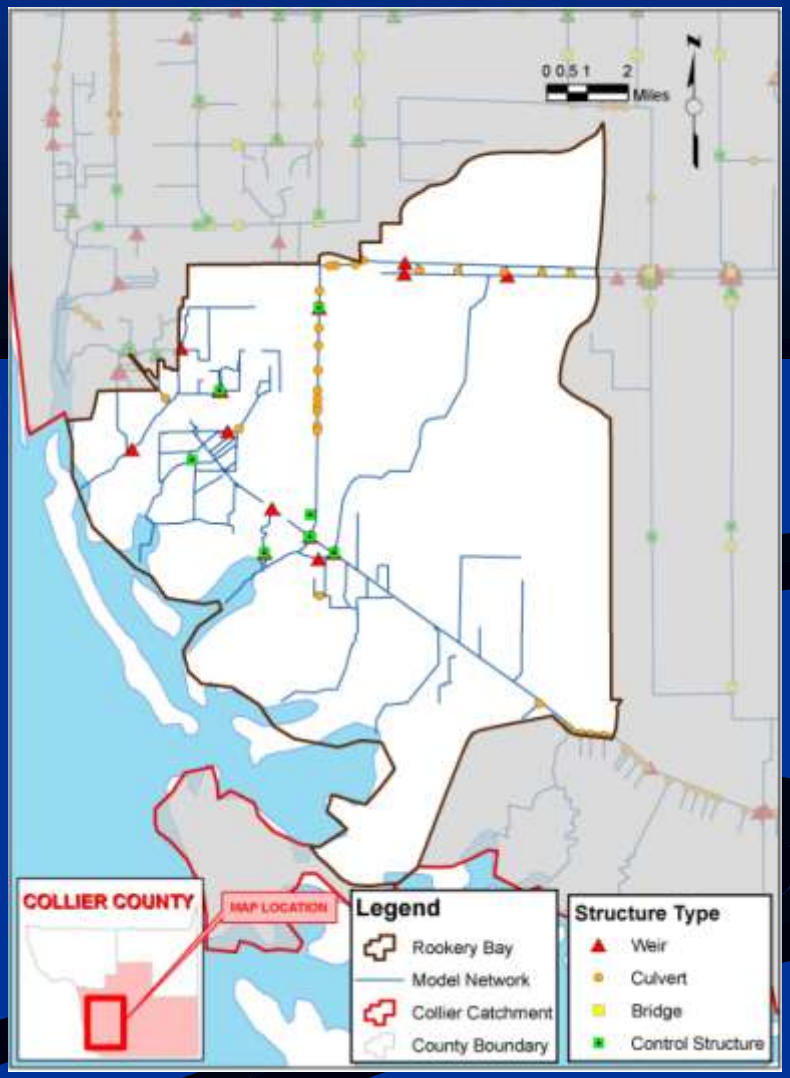
# Rookery Bay

- Includes natural areas, agricultural lands, and urban development
- Overland flow and channel flow

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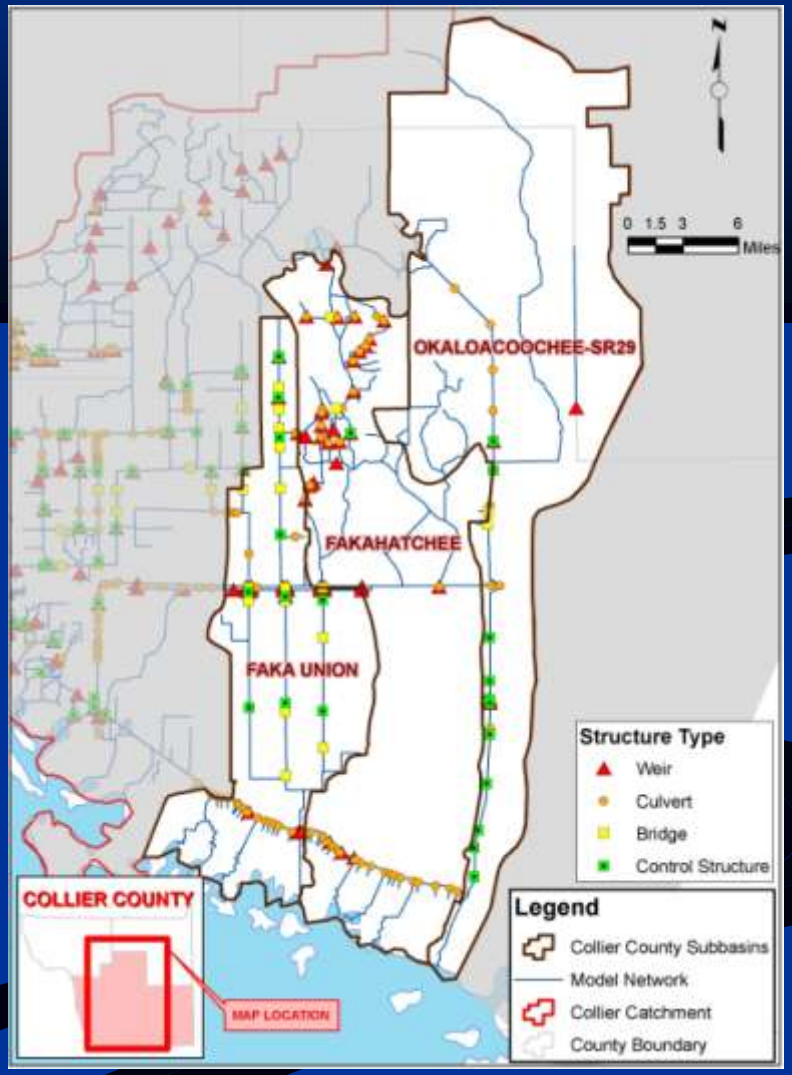
# Faka Union, Fakahatchee, Okaloacoochee – SR29

- Primary drainage features:
  - Miller Canal
  - Faka Union Canal
  - Merritt Canal
  - SR 29 Canal
- Picayune Strand Restoration Project

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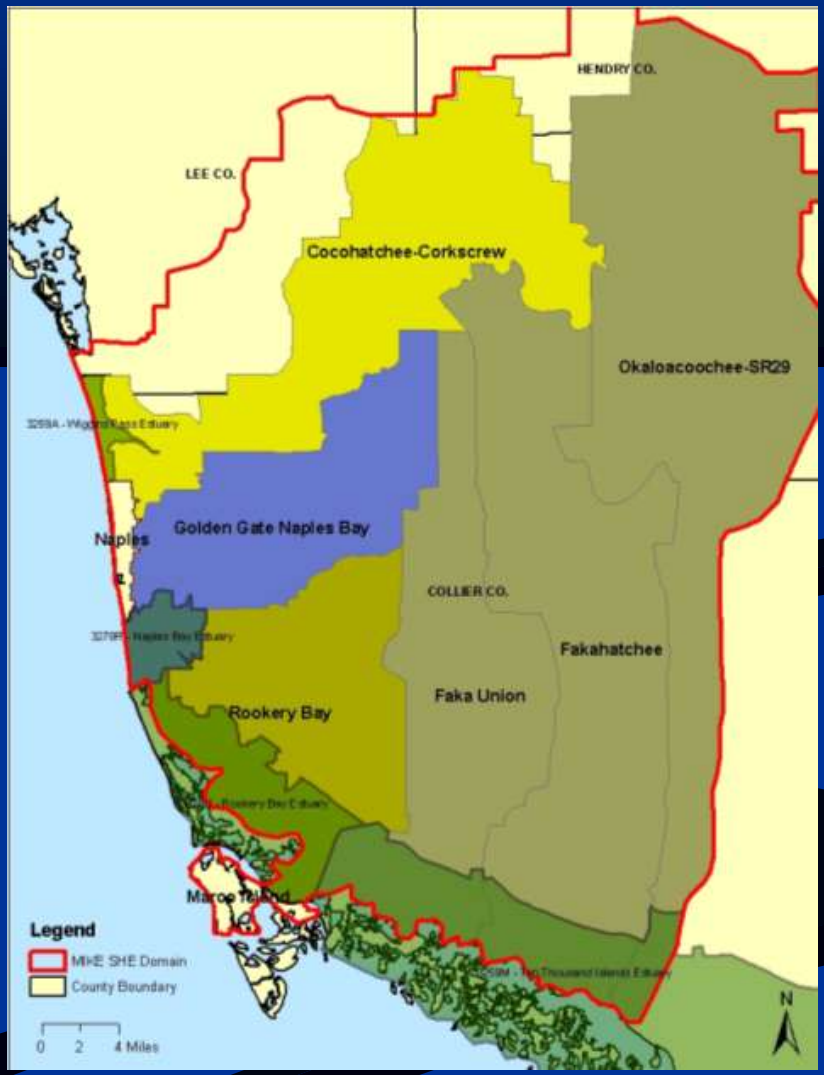
# Surface Water Budget

- Prepared for each watershed
- Budget Components
  - Precipitation/ET
  - Infiltration
  - Surface Runoff
- Prepared for water year and wet and dry seasons

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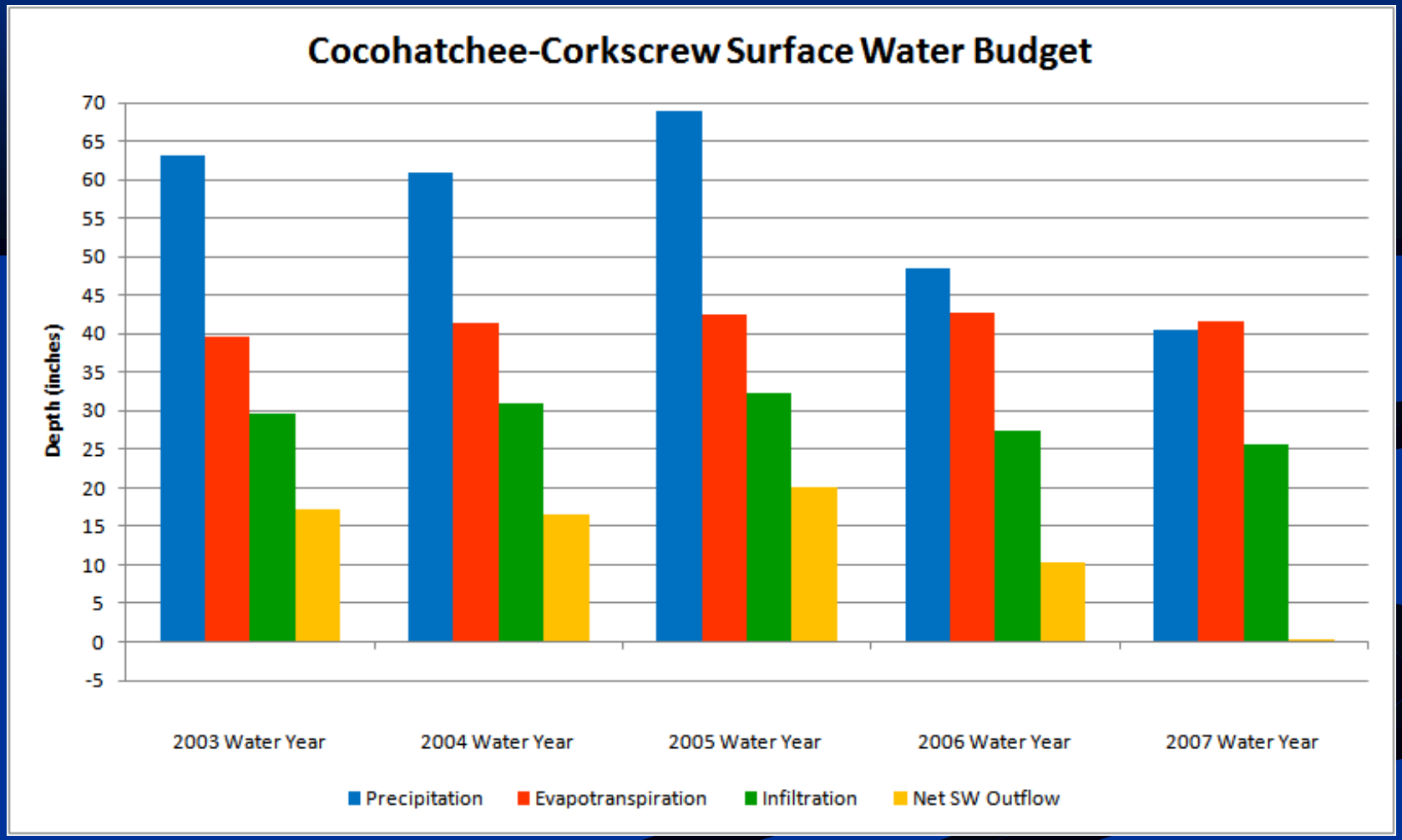
# Surface Water Budget

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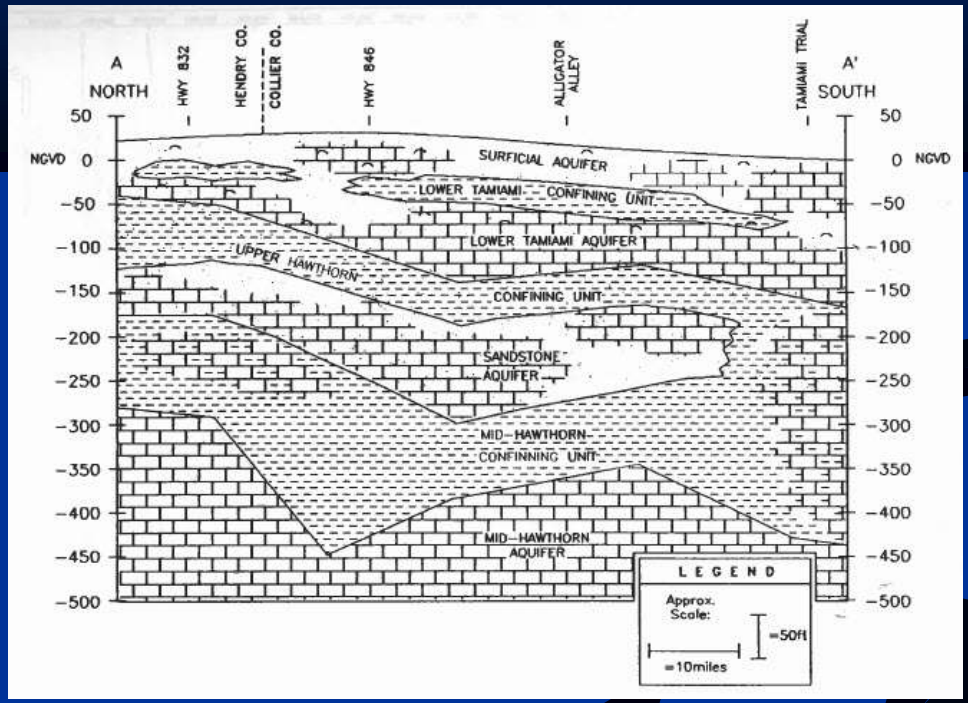
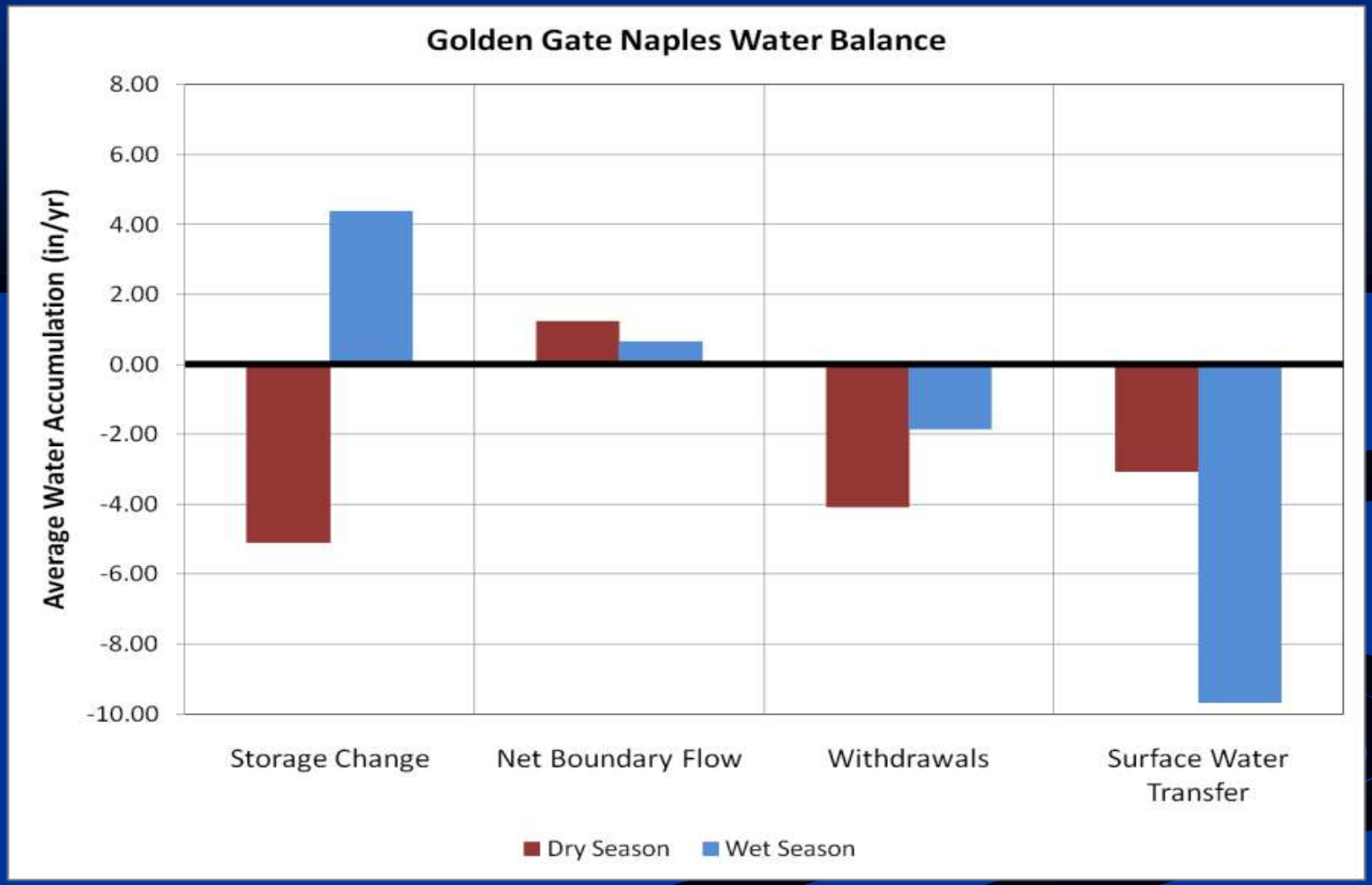
# Groundwater Budget

- Budget Components
  - Flows across watershed boundaries
  - Withdrawals
  - Change in storage
  - Surface water interaction
- Average for wet and dry seasons



# Groundwater Budget

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# Water Quality

- WBIDs, TMDL Process
- Watersheds, Impairments, DO, Nutrients
- Estuaries


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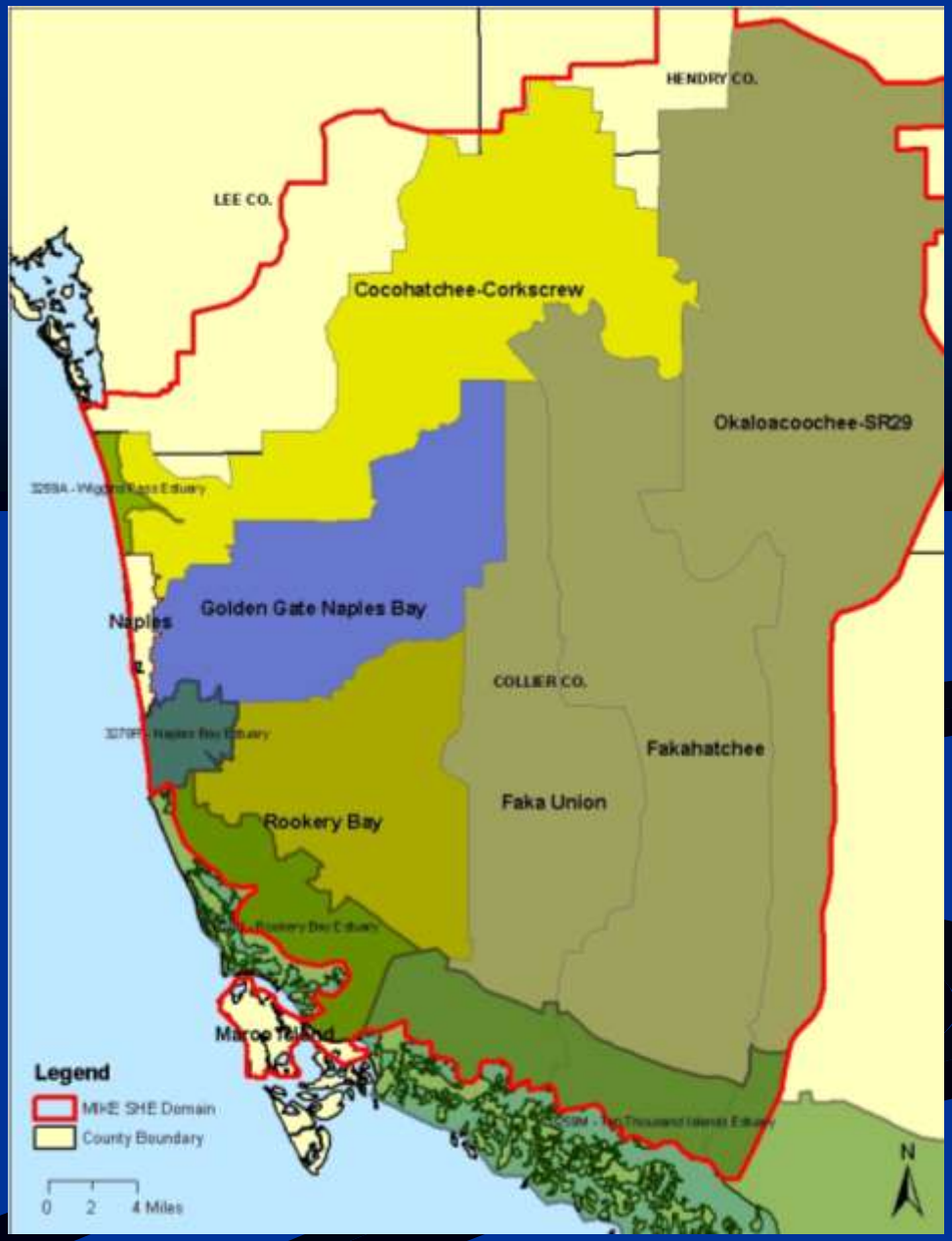
Efforts focused on six main watersheds, and the estuaries influenced by them

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# TMDL process

- FDEP-led process with 5 basic phases
  - Assess the quality of surface waters--are they meeting water quality standards?
  - Determine which waters are impaired--which ones are not meeting water quality standards
  - Establish and adopt, by rule, a TMDL for each impaired water for the pollutants of concern
  - Develop a Basin Management Action Plan (BMAP)
  - Implement the strategies and actions in the BMAP

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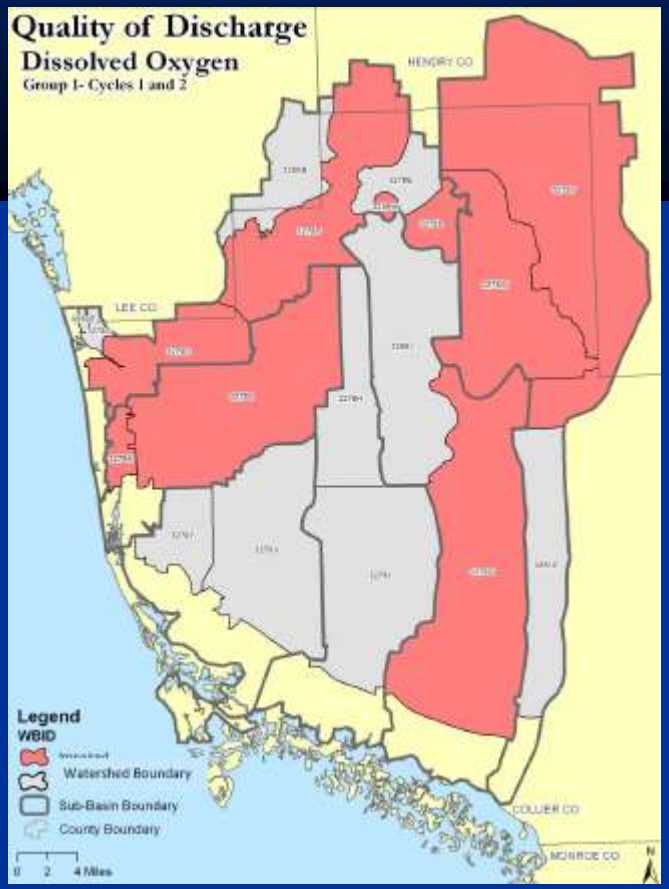
# Within the watersheds themselves, 15 WBID-impairment combinations

| WBID# | WBID Name | Impaired Parameter | Watershed |
|---|---|---|---|
| 3259W | Lake Trafford | Dissolved Oxygen | Cocohatchee-Corkscrew |
| 3259W | Lake Trafford | Mercury | Cocohatchee-Corkscrew |
| 3259W | Lake Trafford | Nutrients | Cocohatchee-Corkscrew |
| 3259W | Lake Trafford | Un-ionized Ammonia | Cocohatchee-Corkscrew |
| 3278D | Cocohatchee Inland | Dissolved Oxygen | Cocohatchee-Corkscrew |
| 3278F | Corkscrew Marsh | Dissolved Oxygen | Cocohatchee-Corkscrew |
| 3278L | Immokalee Basin | Dissolved Oxygen | Cocohatchee-Corkscrew |
| 3278K | Gordon River Extension | Dissolved Oxygen | Golden Gate - Naples Bay |
| 3278S | North Golden Gate | Dissolved Oxygen | Golden Gate - Naples Bay |
| 3278S | North Golden Gate | Iron | Golden Gate - Naples Bay |
| 3278G | Fakahatchee Strand | Dissolved Oxygen | Fakahatchee |
| 3278G | Fakahatchee Strand | Fecal Coliform | Fakahatchee |
| 3261C | Barron River Canal | Iron | Okaloacochee-SR29 |
| 3278T | Okaloacoochee | Dissolved Oxygen | Okaloacochee-SR29 |
| 3278W | Silver Strand | Dissolved Oxygen | Okaloacochee-SR29 |

# Watersheds
# Spatial extent of impairments

## Dissolved Oxygen




## Nutrients (Chl-a)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# Watersheds
# Spatial extent of impairments

## Fecal Coliform Bacteria


## Un-ionized Ammonia


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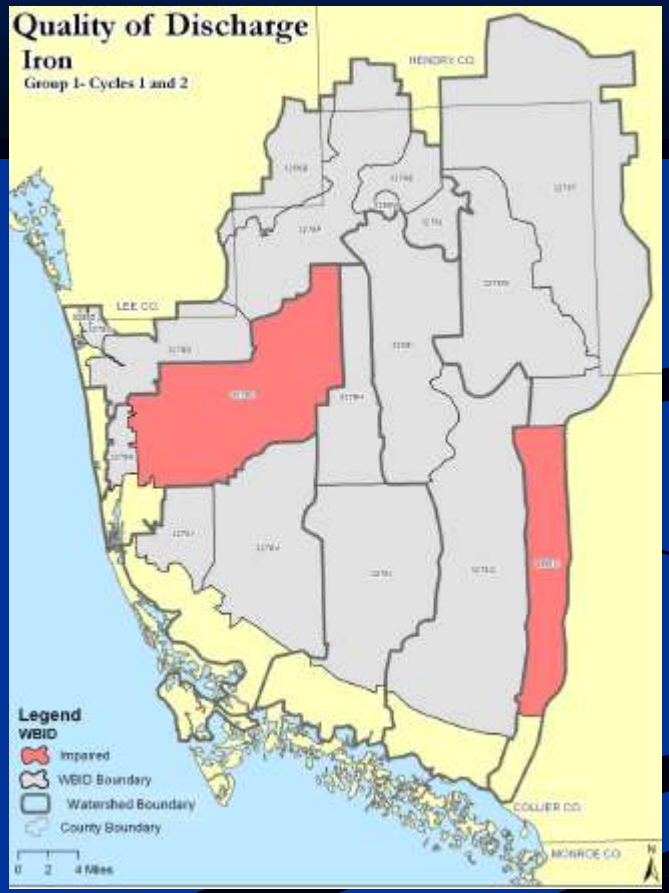
# Watersheds
# Spatial extent of impairments

## Iron

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# General findings - watersheds

- Lake Trafford had most impairments
  - DO, nutrients (Chl-a), un-ionized ammonia
- North Golden Gate and Fakahatchee Strand were second highest impairments
- Most common impairment was for dissolved oxygen (DO)
  - 9 of 15 impairments were for low DO
- Iron was second most common impairment
  - North Golden Gate and Barron River Canal

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# Impairments listed by FDEP also assessed for the estuarine receiving water bodies

| WBID# | WBID Name | Receiving Water |
|---|---|---|
| 3259A | Cocohatchee River | Wiggins Pass |
| 3278R | Naples Bay (Coastal Segment) | Naples Bay |
| 3278U | Rookery Bay (Coastal Segment) | Rookery Bay |
| 3259M | Ten Thousand Islands | Ten Thousand Islands |

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# Estuaries
# Spatial extent of impairments

## Dissolved Oxygen


## Nutrients (Chl-a)


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# Estuaries
# Spatial extent of impairments

## Fecal Coliform Bacteria


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# Estuaries
# Spatial extent of impairments

## Iron


## Copper


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# General findings - estuaries

- Naples Bay had most impairments
  - DO, fecal coliform bacteria, iron, copper
- Rookery Bay had second highest impairments
  - DO, nutrients (Chl-a), fecal coliform bacteria
- Most common impairments were DO and fecal coliform bacteria
- Iron as second most common impairment
  - Naples Bay and Wiggins Pass

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# Issues for Collier County

- Are standards appropriate?
  - Does existing DO standard make sense in SW Florida?
  - Class II standards for bacteria in marine waters
- Are locations sampled representative of system being assessed?
- Are portions of Collier County truly problematic, or is TMDL process flawed?

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# Appropriateness of standards Dissolved Oxygen

- Florida's Surface Water Quality Standard (Rule 62-302, F.A.C.) states that, for Class III freshwater –
  - *Shall not be less than 5.0 (mg/L). Normal daily and seasonal fluctuations above these levels shall be maintained.*
- For Class II and III marine water -
  - *Shall not average less than 5.0 in a 24-hour period and shall never be less than 4.0. Normal daily and seasonal fluctuations above these levels shall be maintained.*
- Problems
  - DO often fails standard in "undeveloped" locations
  - DO shows strong evidence of influence from wetlands, rather than human-induced

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# Developing Nutrient Criteria

- No state standards for nutrients
  - FDEP proposed, but not adopted
  - EPA's Numeric Nutrient Criteria – due late 2011
- Default FDEP approach is to develop screening levels per waterbody type as 70$^{th}$ percentile value state-wide
- Alternative approach – use TN and TP targets from Gordon River TMDL
  - Based on DO due to nutrients (not necessarily the case)
  - Gordon River reference sites also fail standard
  - Developed as 75$^{th}$ percentile of Everglades reference sites

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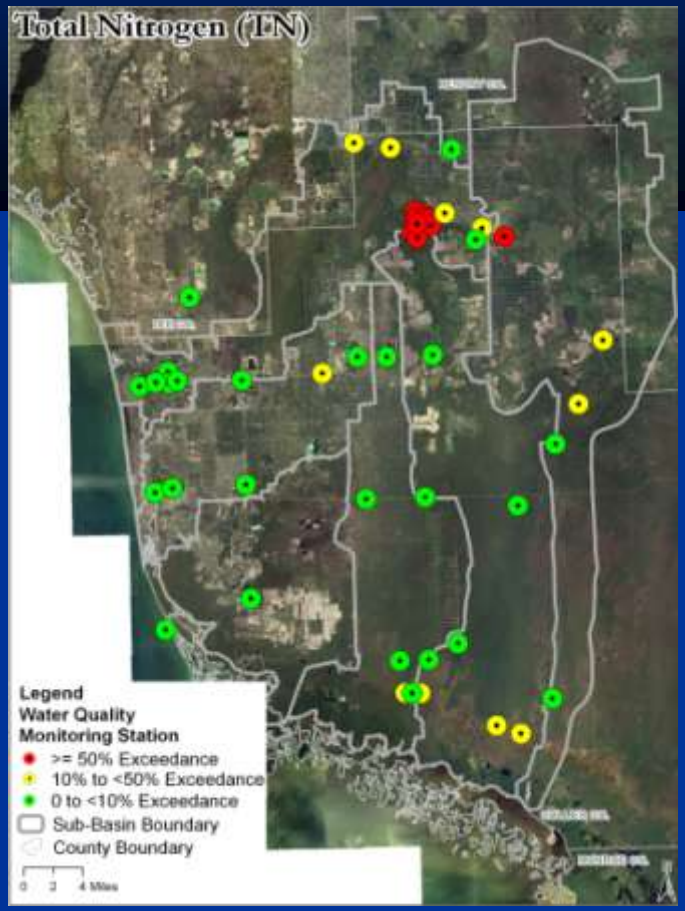
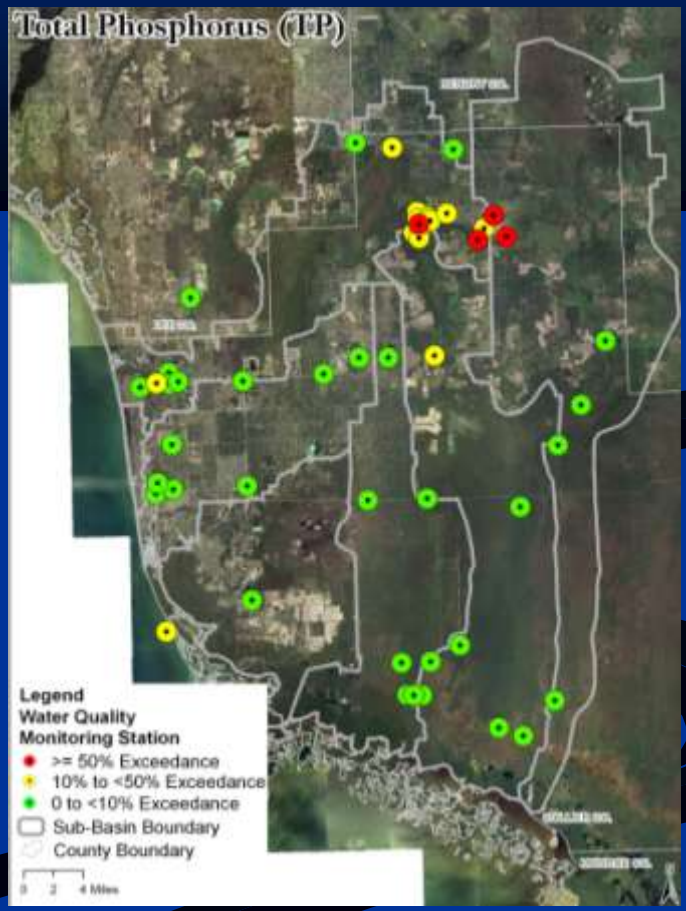
# Frequency of exceeding 70th percentile values statewide for lakes and/or stream within watershed

## TN of 1.6 mg / L




## TP of 0.22 mg / L

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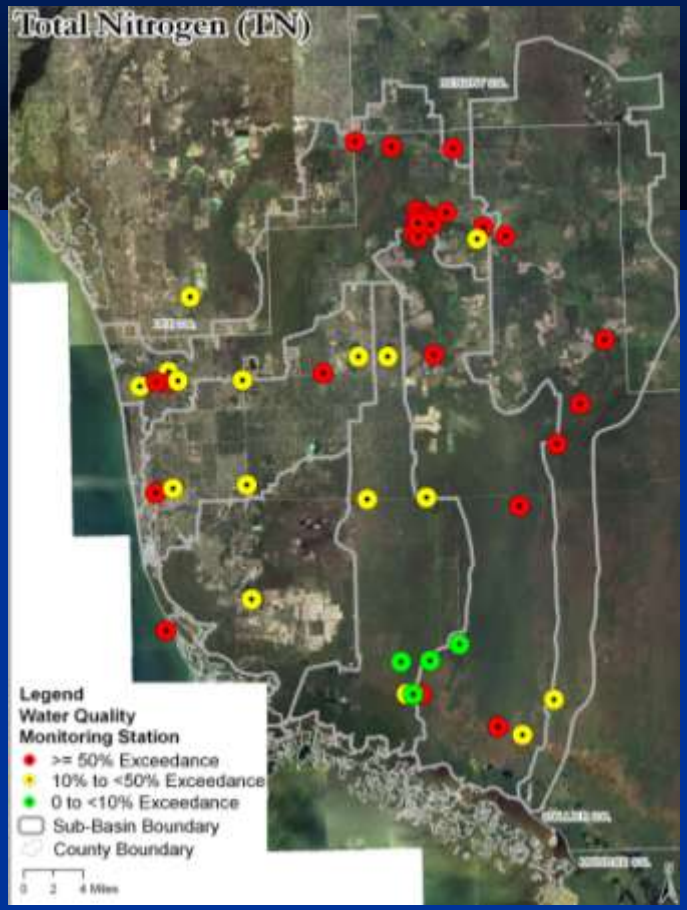
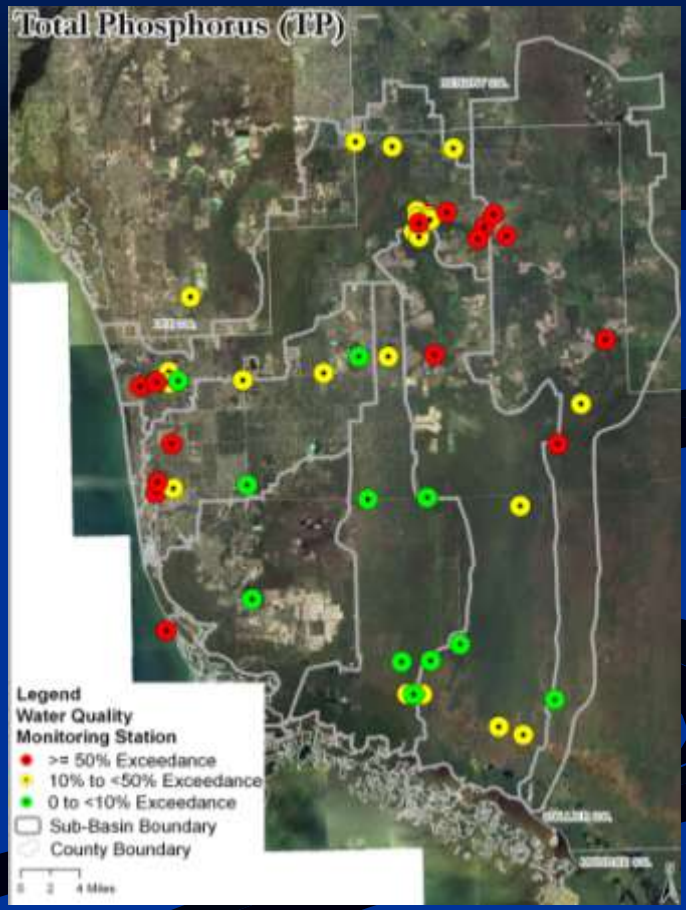
# Frequency of exceeding 75th percentile values for Gordon River TMDL reference sites for streams

## TN of 0.74 mg / L




## TP of 0.04 mg / L

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# Nutrient issues within Collier County

- Lake Trafford obviously impaired
  - But also improving water quality with dredging project
- For most of Collier County "impairment" for nutrients really means Chl-a higher than standards
  - Rookery Bay "impairment" likely due to 2006 sample sites
- Based on TN and TP screening using 70$^{th}$ percentile values statewide, nutrients not much of a concern in Collier County
- Based on TN and TP screening using 75$^{th}$ percentile values from Gordon River TMDL reference sites, nutrients elevated throughout much of County
  - But nutrient thresholds based on DO "impairment" caused by nutrients

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# Water Quality
# General Conclusions

- Dissolved oxygen
  - Lots of impairments, most likely due to large ground water contribution and color
  - Value to creating locally-relevant standard
- Fecal coliform bacteria
  - Lots of impairments, often due to Class II standards
  - Is shellfish harvesting – rather than recreational use / bodily contact the most appropriate classification?
  - Appropriate to have source identification efforts

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# Water Quality
# General Conclusions

- Nutrients (chlorophyll-a)
  - Impairment in Rookery Bay likely not realistic
    - Nutrient levels not very high in watershed
  - Level of concern over nutrients depends on screening criteria used
    - State-wide approach – not much of a problem
    - Reference sites in Everglades approach – more of a problem
- Various metals
  - Copper could be herbicide use
  - Iron likely from groundwater

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# Functional Assessment

- Existing condition evaluated for:
  - Vegetation
  - Hydrology
  - Landscape Suitability Index (landscape position)

# Vegetation Score Methodology

- Concept – assume that pre-development vegetation communities provide optimal functional value
- For watershed-level application
  - 2007 FLUCCS compared to PDVM

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# Vegetation Score by Category

| Model Land Use Type | MIKE SHE Model Code | FLUCCS Code | Vegetation Score |
|---|---|---|---|
| Citrus | 1 | 221, 222, 223 | 4 |
| Pasture | 2 | 211, 212, 213, 251, 260, 261, 832 | 6 |
| Pasture | 2 | 190,192, 193 (urban abandoned) | 1 |
| Sugar Cane & Sod | 3 | 2156, 242 | 4 |
| Truck (Row) Crops | 5 | 214, 215, 216 | 4 |
| Golf Course | 6 | 180, 182 | 1 |
| Bare Ground | 7 | 161, 162, 163, 164, 181, 231, 740, 743, 744, 8113, 8115, 835 | 0 |
| Urban Low Density | 41 | 110, 111, 112, 113, 119, 148, 185, 240, 241, 243, 250 | 1 |
| Rural Residential Low Density | 41 | 118 | 3 |
| Urban Medium Density | 42 | 120, 121, 122, 123, 129, 176, 834 | 1 |
| Urban High Density | 43 | 130, 131, 132, 133, 134, 135, 139, 140, 1411, 1423, 146, 149, 154, 155, 156, 170, 171, 183, 184, 187, 252, 810, 811, 814, 820, 831, 833 | 0 |

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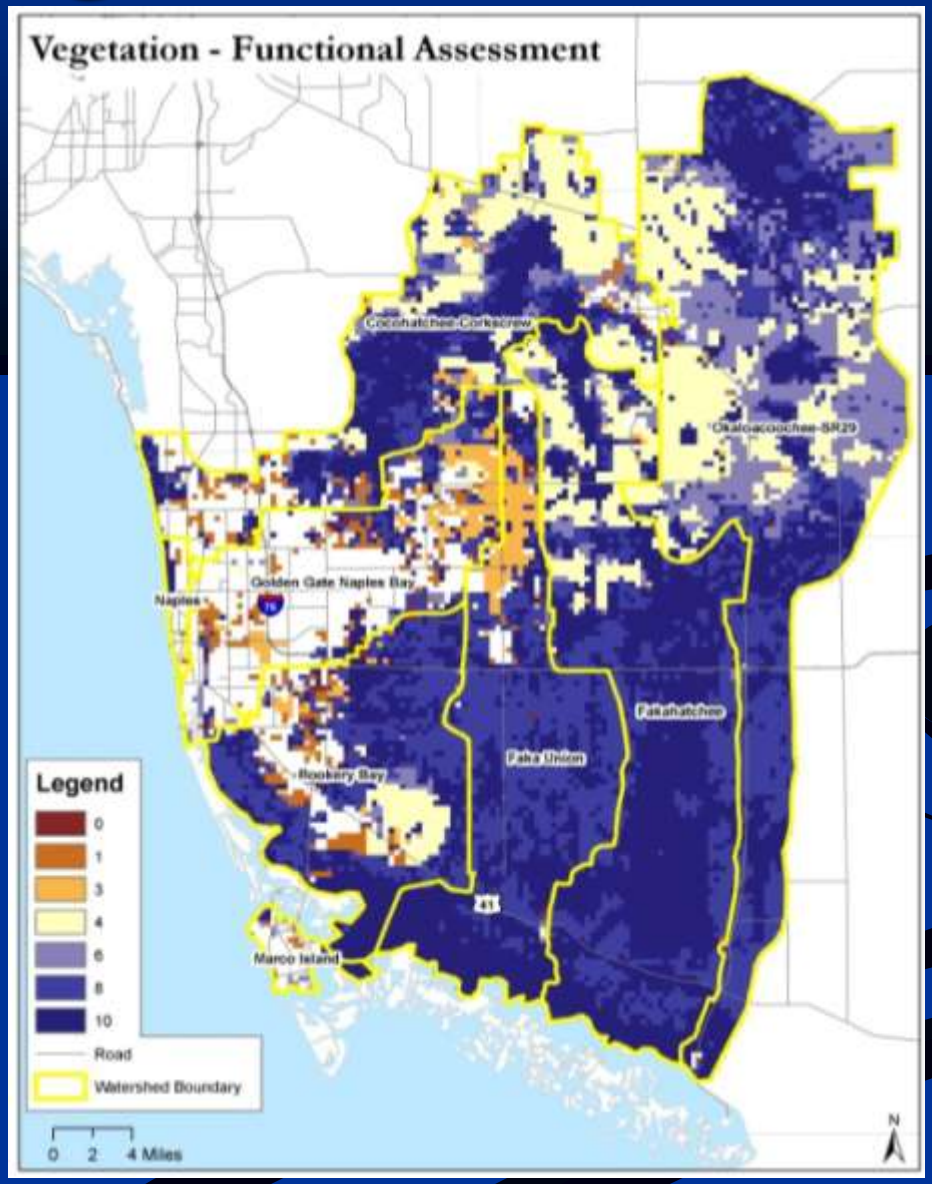
# Vegetation Score Results

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# Hydrology Score Methodology

- Concept – locations with similar water depths and hydroperiods over time provide optimal functional value
- Process: Compare existing conditions model hydrology against hydrology of PDVM vegetation
- Scoring computer based on:
  - Hydro-period
  - Seasonal Water Level

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# PDVM Hydrology (Duever, 2004)

| SW Florida Plant Communities | Hydroperiod (months) | Seasonal Water Level (inches) | |
|---|---|---|---|
| | | Wet | Dry (1,10)* |
| Xeric Flatwood<br>Xeric Hammock | 0 | ≤-24 | -60, -90 |
| Mesic Flatwood<br>Mesic Hammock | ≤1 | ≤2 | -46, -76 |
| Hydric Flatwood<br>Hydric Hammock | 1 - 2 | 2 - 6 | -30, -60 |
| Wet Prairie<br>Dwarf Cypress | 2 - 6 | 6 - 12 | -24, -54 |
| Freshwater Marsh | 6 - 10 | 12 - 24 | -6, -46 |
| Cypress | 6 - 8 | 12 - 18 | -16, -46 |
| Swamp Forest | 8 - 10 | 18 - 24 | -6, -36 |
| Open Water | >10 | ≥24 | < 24, -6 |
| Tidal Marsh<br>Mangrove<br>Beach | Tidal | Tidal | Tidal |
| | | | |
| * 1 = average year low water | | | |
| 10 = 1 in 10 year drought | | | July 2002 |

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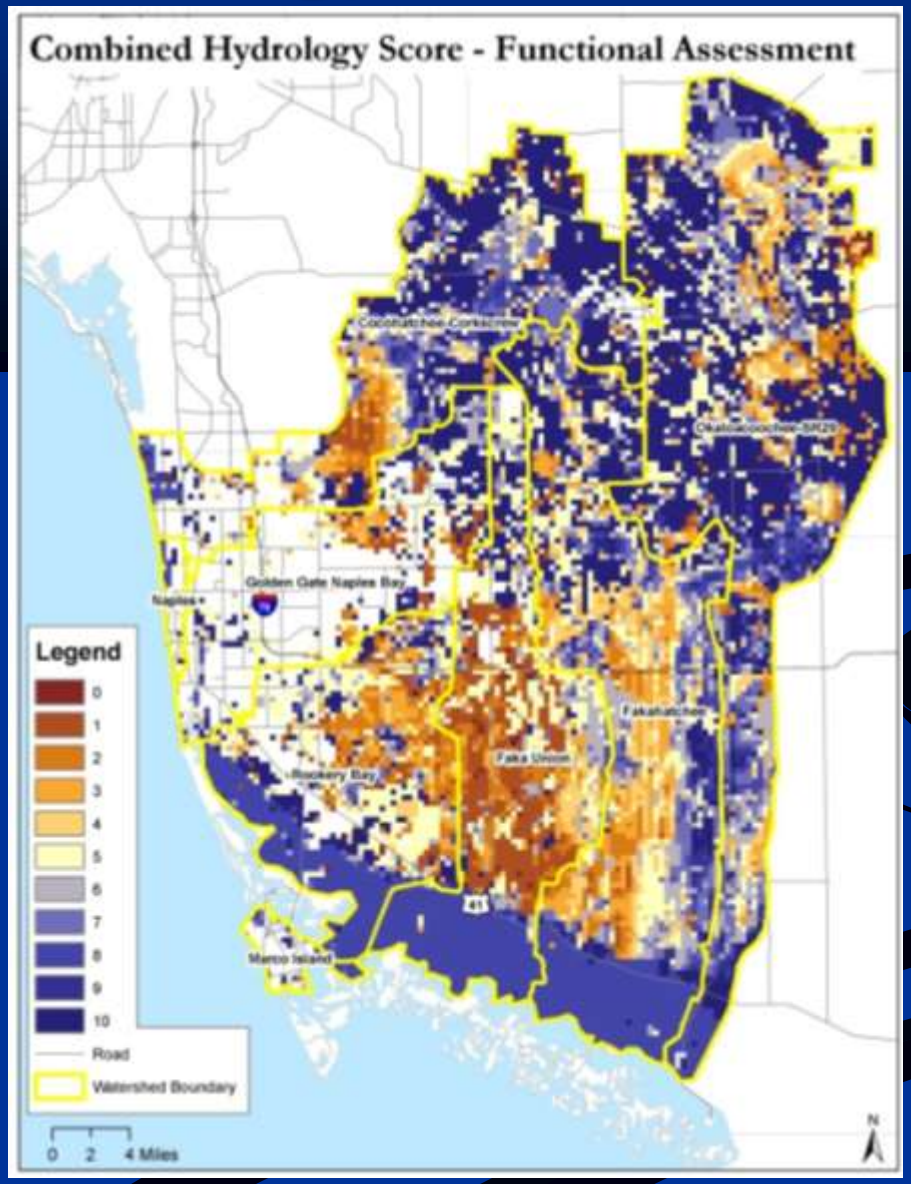
# Hydrology Score Results

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# Landscape Suitability Index Methodology

- Concept – evaluate habitat based on surrounding landuse
- Developed by Center for Wetlands (UF)
- For watershed-level application
  - 2007 FLUCCS into 1500 x 1500 foot cells
  - LSI for each cell calculated based on scores of adjacent cells
  - Scores reported by WBID and watershed

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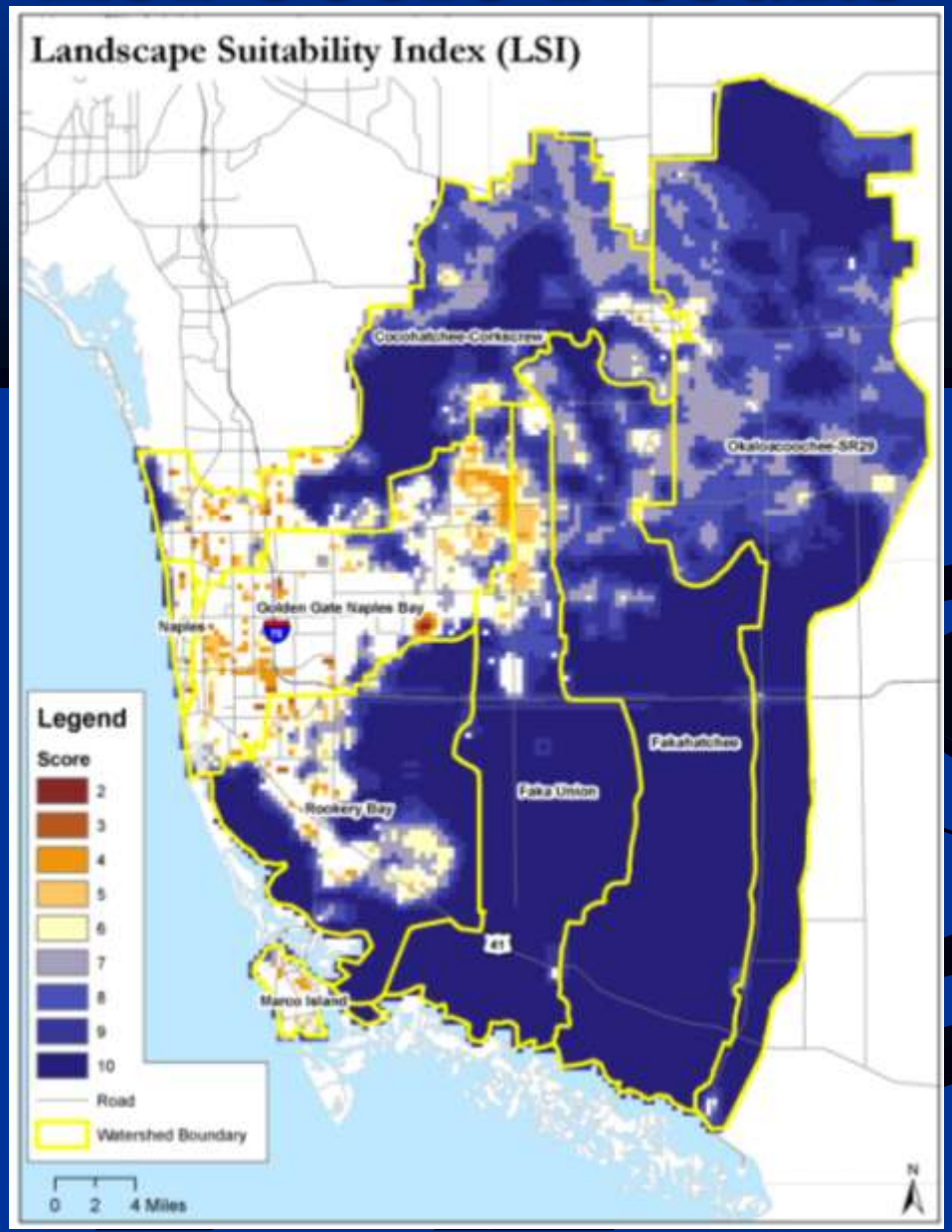
# LSI Coefficients

| Land Use/Land Cover | LSI Coefficients |
|---|---|
| Natural System | 10.00 |
| Natural Open water | 10.00 |
| Pine Plantation | 9.36 |
| Recreational / Open Space (Low-intensity) | 9.08 |
| Woodland Pasture (with livestock) | 8.87 |
| Pasture (without livestock) | 8.03 |
| Low Intensity Pasture (with livestock) | 7.32 |
| Citrus | 7.02 |
| High Intensity Pasture (with livestock) | 6.96 |
| Row crops | 6.07 |
| Single Family Residential (Low-density) | 3.57 |
| Recreational / Open Space (High-intensity) | 3.42 |
| High Intensity Agriculture (Dairy farm) | 3.33 |
| Single Family Residential (Med-density) | 2.81 |
| Single Family Residential (High-density) | 2.72 |
| Mobile Home (Medium density) | 2.56 |
| Highway (2 lane) | 2.43 |
| Low Intensity Commercial | 2.22 |
| Institutional | 2.14 |
| Highway (4 lane) | 1.91 |
| Mobile Home (High density) | 1.90 |
| Industrial | 1.87 |
| Multi-family Residential (Low rise) | 1.49 |
| High Intensity Commercial | 0.91 |
| Multi-family Residential (High rise) | 0.90 |
| Central Business District (Average 2 stories) | 0.64 |
| Central Business District (Average 4 stories) | 0.00 |

# LSI Score Results

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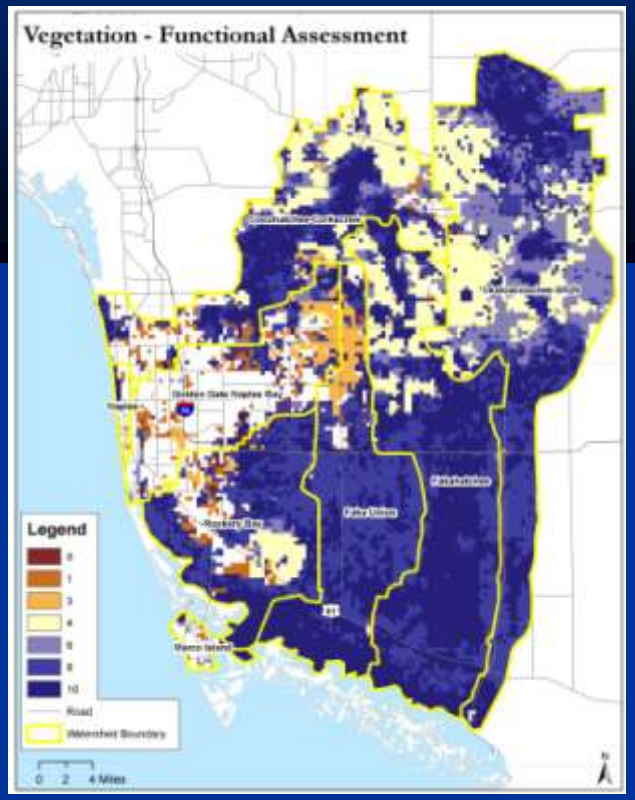
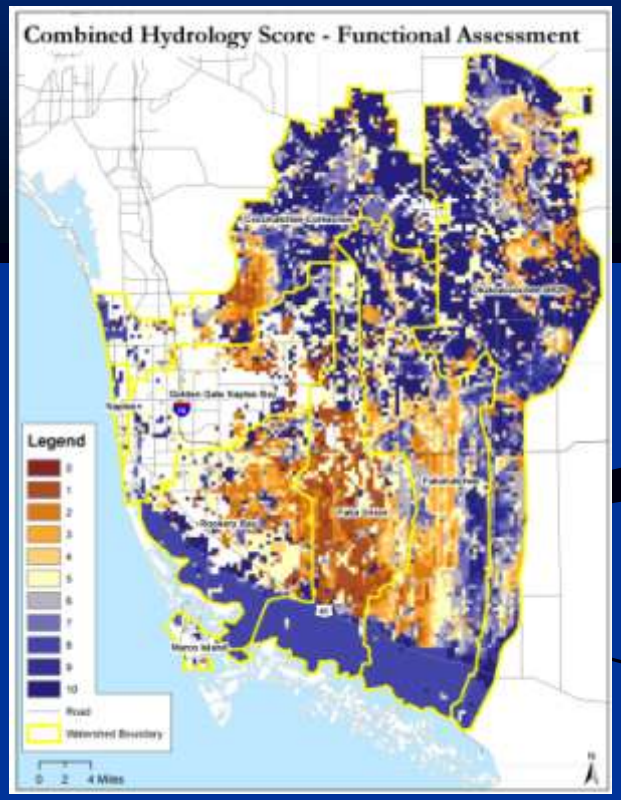
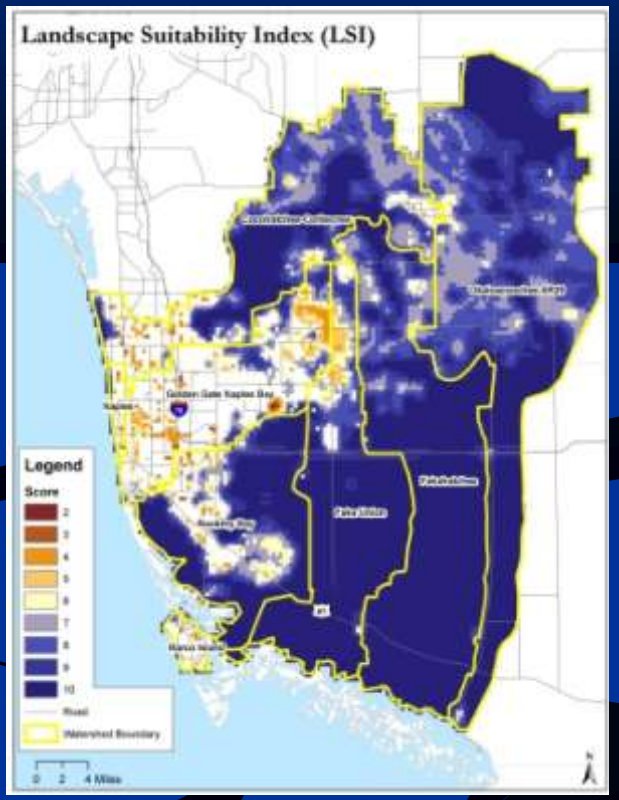
# Functional Assessment Scores




Vegetation




Hydrology




LSI

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# Application of Results

- Evaluation of Ecologically Valuable Lands
- Evaluation of  Project Performance (Performance Measures)

# Evaluation of Ecologically Valuable Lands

- Based on Vegetation and LSI scores
  - Ecologically Valuable Lands:
    - Vegetation Score = 8 – 10
    - LSI Score = 10
  - Ecologically Supportive Lands:
    - Vegetation Score = 6 – 8
    - LSI Score = 8 – 10
  - Agricultural Supportive Lands:
    - Vegetation Score = 4 – 6
    - LSI Score = 6 - 8

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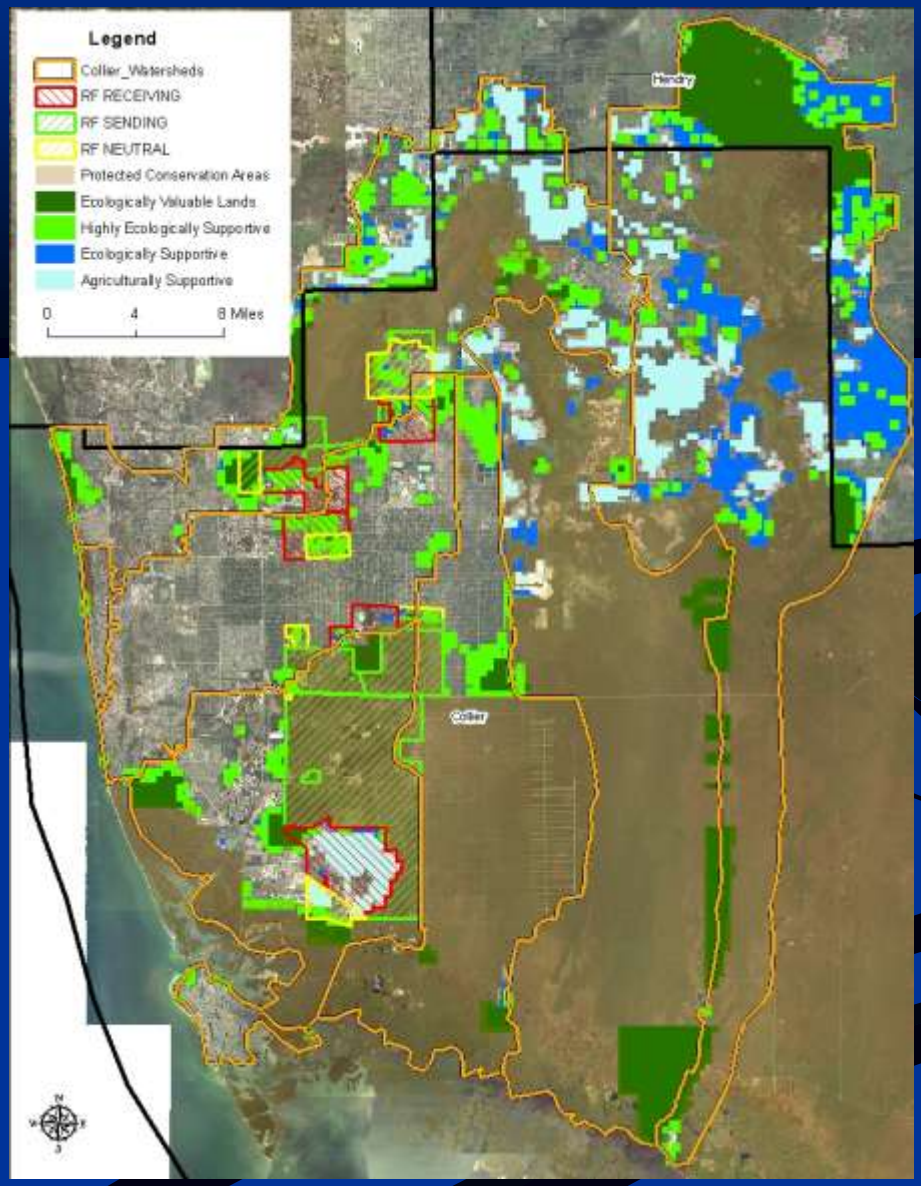
# Ecologically Valuable Lands

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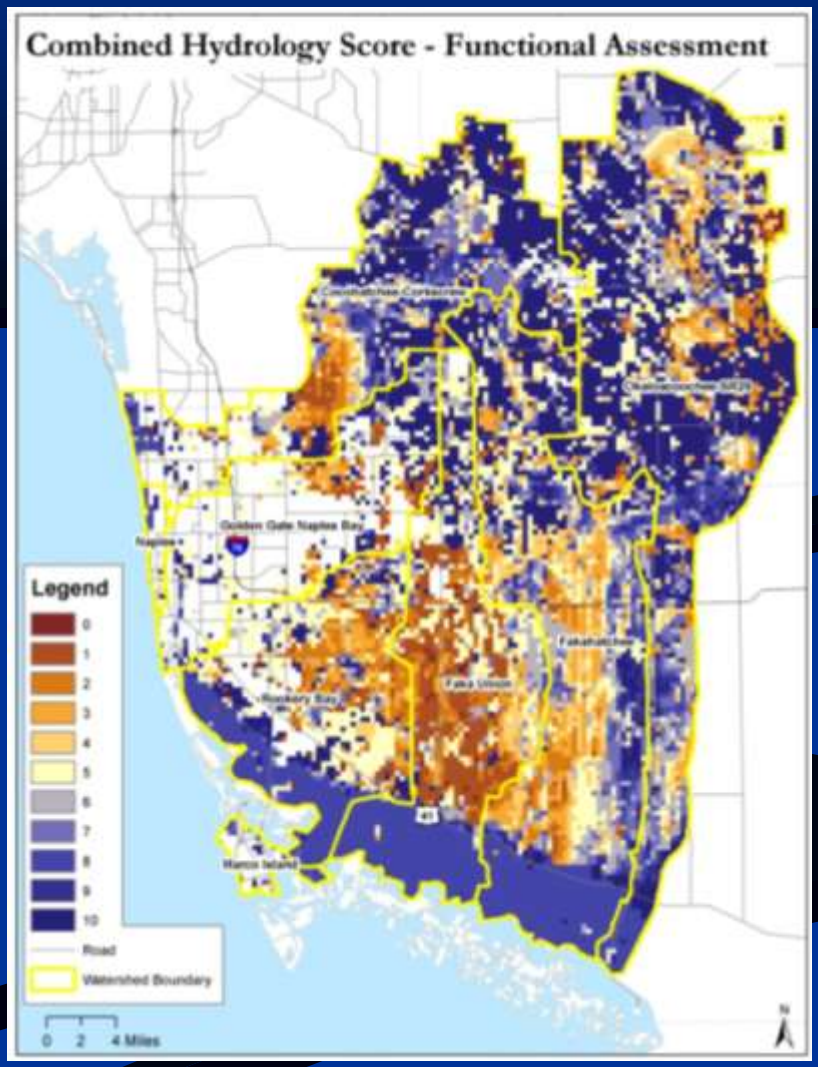
# Natural Systems Performance Measure

- Projects being evaluated based on improved hydrology

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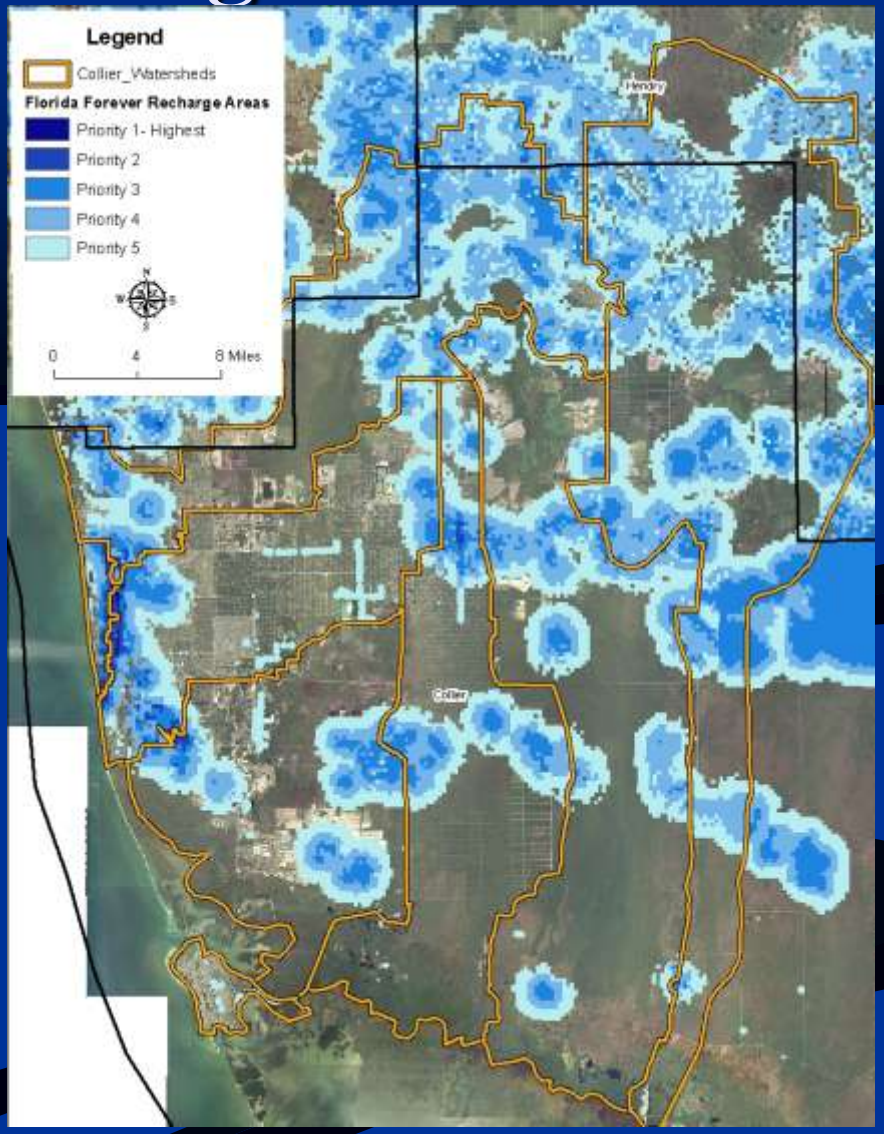
# Groundwater Recharge Areas

- Priority recharge areas defined by Florida Forever
- Consistent with recharge results from NSM model
- Important for future development and aquifer protection

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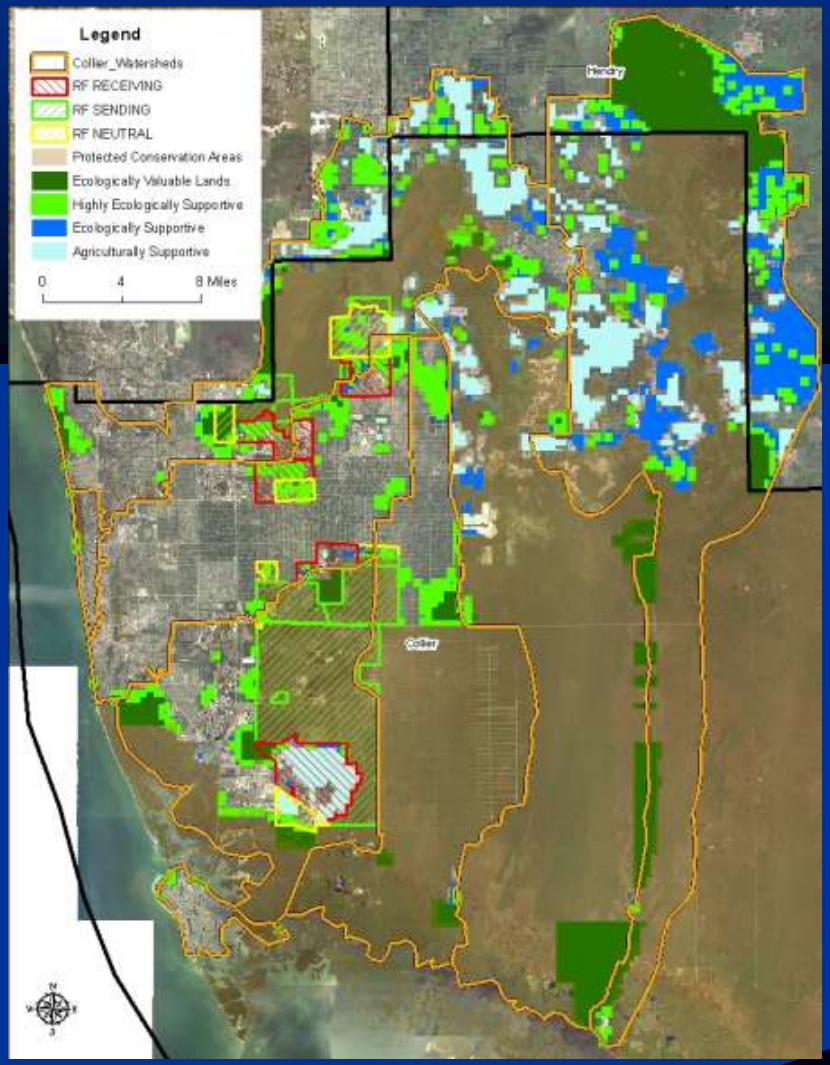
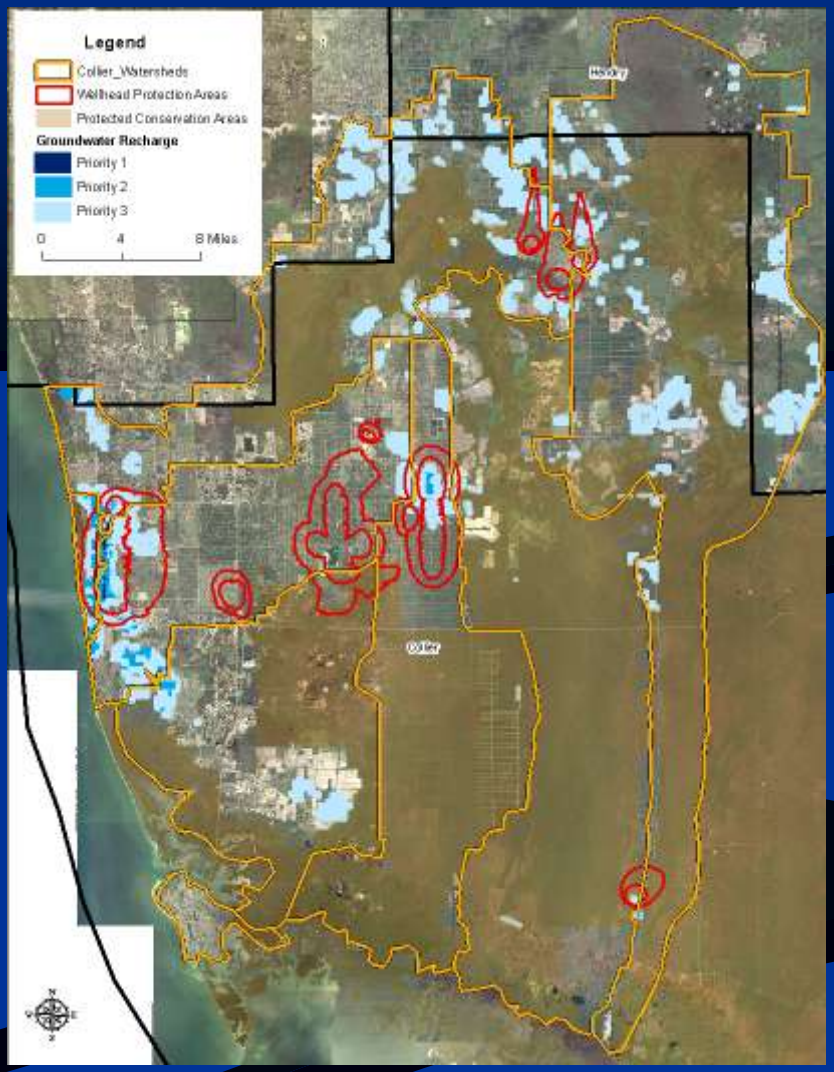
# Groundwater Recharge Areas

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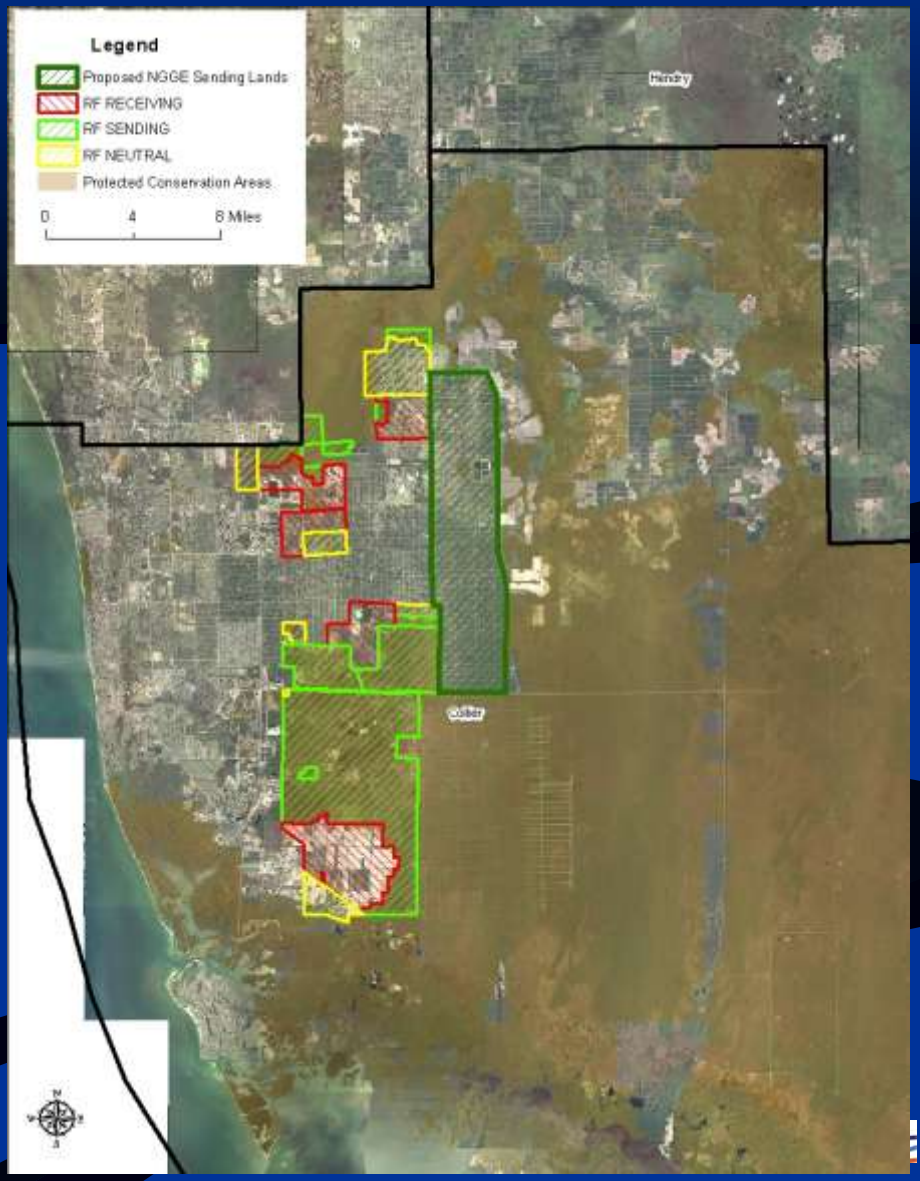
# Recommendations for Additional Protection

- Expand Rural Fringe Sending Lands into NGGE
- Re-evaluate RF Neutral Lands in high value ecological areas
- Utilize LID policies to protect high recharge areas.
- Coordinate with SFWMD for land along SR 29

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# Model Ordinance Requirements

- Training and Licensing
- Prohibited Period – Watches
- Application Rate – Label requirement
- Fertilizer Free Zone – Voluntary 10 feet
- Low Maintenance Area (buffers)
- Exemptions – Agriculture
- Application Practices – No fertilizer on impervious

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# Comparison with Existing Ordinances

| Ordinance | FDEP/DACS/UF | City of Naples | SWFRPC | Lee County | CSWF |
|---|---|---|---|---|---|
| | | | | | |
| Training | Applicators | Applicators | Applicators | Applicators | Applicators |
| License | Applicators | Applicators | Applicators | Applicators | Applicators |
| Prohibited Period | Watches | June-Sept | June-Sept | June-Sept | Watches + June-Sept |
| Application Rate | Label Req: 2-7 lbs N per yr based on species; not > 1 lb N per application; 0.5 lb P per year | 50 % slow N, 4 lbs N per yr, <=2 % P, | <=2 % P, 70 % slow N, no blended fertilizer<= 6 times / year | 50 % Slow N, 0.50 lbs. P per yr, 4 lbs. of N per year | 50 % Slow N, 4 lbs. of N per yr No P, 0.50 lbs. P per yr, |
| Fertilizer Free Zone | 10 ft ( 3ft w deflect) | 10 ft | 25 ft | 10 ft | 10 ft |
| Exceptions | Agriculture, research | Agriculture + vegetables | Agriculture | Agriculture; new plants; vegetables | Agriculture + various others |
| Enforcement | Applicators | Applicators | Applicators | Applicators | Applicators |
| Others | | Sales | | | Sales |

# Development Standards Review

- Help implement a Sustainable Stormwater Management Program
- The programs should aim to:
  - Promote more effective site planning to minimize anthropogenic impacts,
  - Promote preservation of the natural system
  - Help reduce development costs
  - Help reduce cost of future drainage system improvements

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# What's Next

- Alternatives Analysis
- Preparation of Watershed Management Plans

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# Watershed Management Plans

- Separate Watershed Management Plans for each watershed.
  - Cocohatchee-Corkscrew
  - Golden Gate Naples Bay
  - Rookery Bay
  - Additional Watersheds
- Target date for submittal to Collier County is April 2011.

**Long-Term Plan**

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# Wrap Up

- If you didn't sign in, please do so
  - Include your E-mail address and Phone Number

  Comment Cards for Mangrove Action Group
- Comments via E-Mail

  *machatcher@colliergov.net*
- Formal position papers
  - Please mail to Mac Hatcher

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