

Watershed Management Plan

November 19, 2010





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 April 2011.





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





Agenda

- Study Area and H&H Model Description
- Discussion of Individual Watersheds Existing
 Conditions and Issues
 - Water Quantity
 - Water Quality
 - Natural Resources/Functional Assessment
- Initial Identification of Potential Projects
- Performance Measures
- Regulatory Review





Watersheds

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





Water Body IDs (WBIDs)

- FDEP Run 40
- Coastal WBIDsclipped to matchmodel extent
- WBID 3259M subdivided by watershed



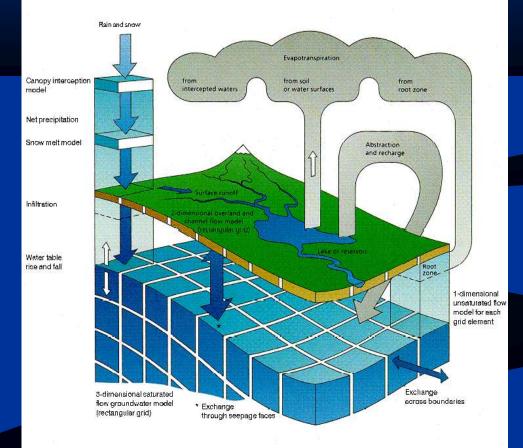


Existing Conditions Model

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

MIKE SHE

an Integrated Hydrological Modelling System









Cocohatchee Corkscrew Watershed

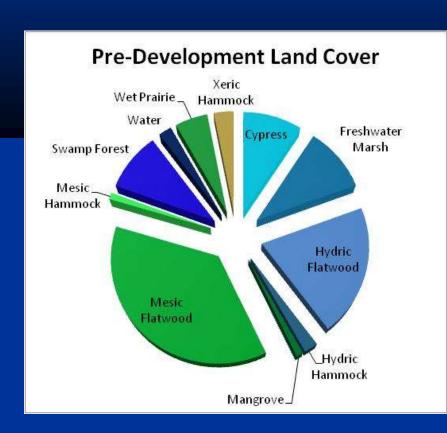
- Area: \sim 200 sq. miles
- FDEP subdivided into 9 "WBIDs"
- Development centered in Immokalee and near I-75 at Immokalee Rd.
- Primarily wetlands in the central portion of the basin

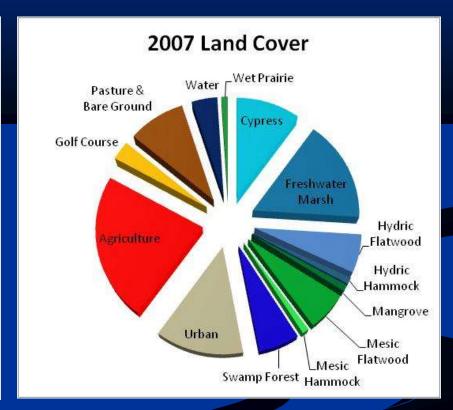






Cocohatchee Corkscrew Land Use Comparison



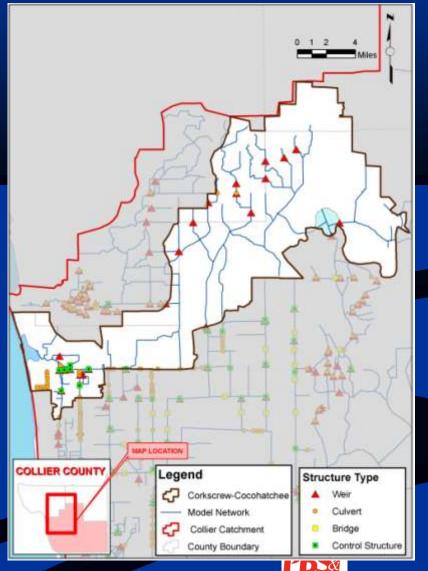






Cocohatchee Corkscrew

- Primary drainage is Cocohatchee Canal
- Wet season water
 transfers with Golden
 Gate, Fakahatchee, and
 Imperial River
 watersheds







Control Structures Operation

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.

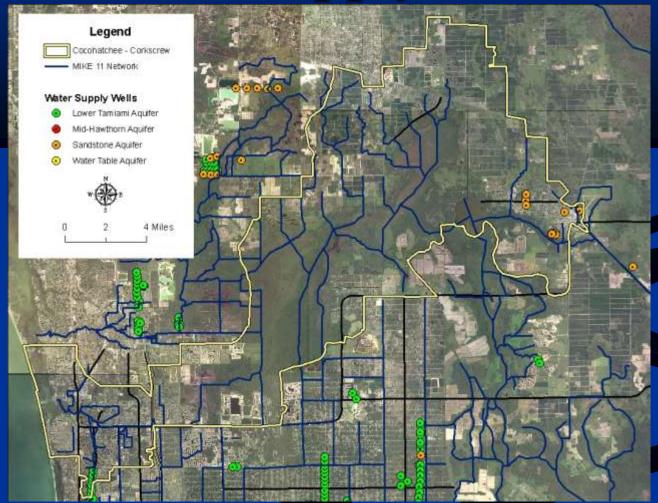
Wet season- Head water elevation desired at ≈ 4.3 feet NAVD.

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





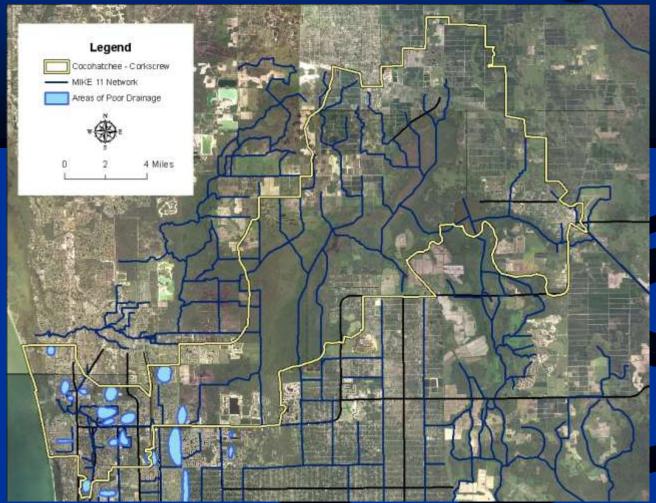
Cocohatchee Corkscrew Watershed Water Supply Wells







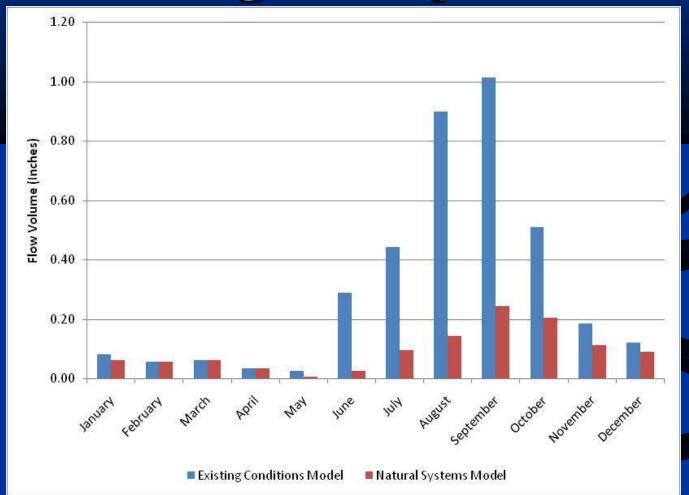
Cocohatchee Corkscrew Areas of Poor Drainage







Cocohatchee Corkscrew Discharge Comparison

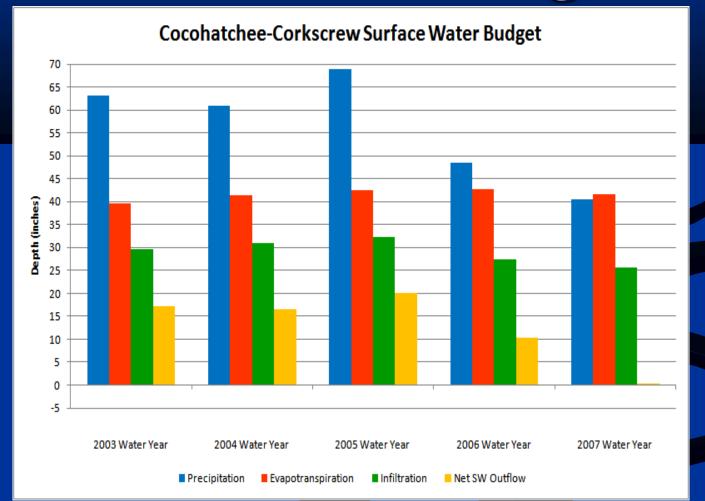








Cocohatchee Corkscrew Surface Water Budget

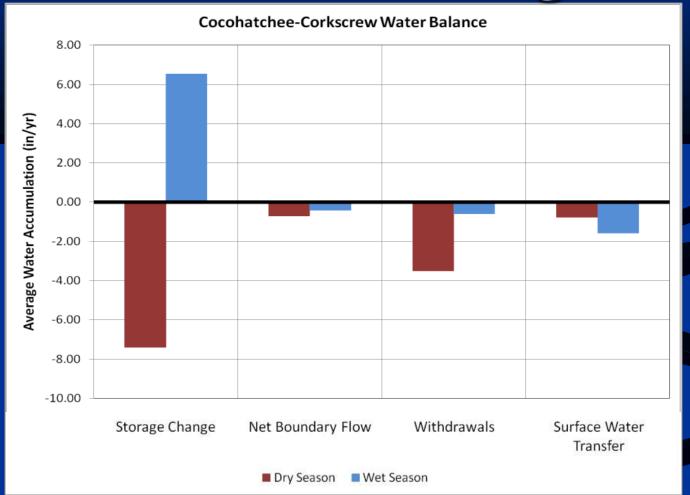








Cocohatchee Corkscrew Groundwater Budget



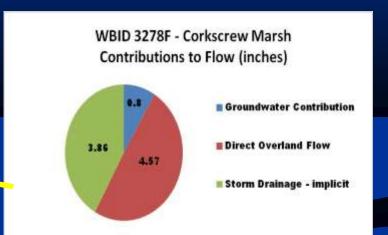




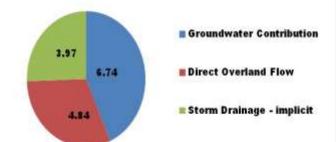


Cocohatchee Corkscrew WBID Contributions to Canal





WBID 3278D - Cocohatchee (Inland Segment)
Contributions to Canal Flow (inches)







Cocohatchee Corkscrew Summary of Water Quantity Issues

- Watershed area has not changed significantly
 - Land Use has changed significantly (50% urban/ag)
- Hydrology of remaining wetlands has changed
 - Shorter hydro-period and less water stored
- Greater discharge to the estuary
 - Approximately two inches (2") in the wet season
- High groundwater contribution to canals
 - Approximately 6.5" to the Cocohatchee Canal WBID

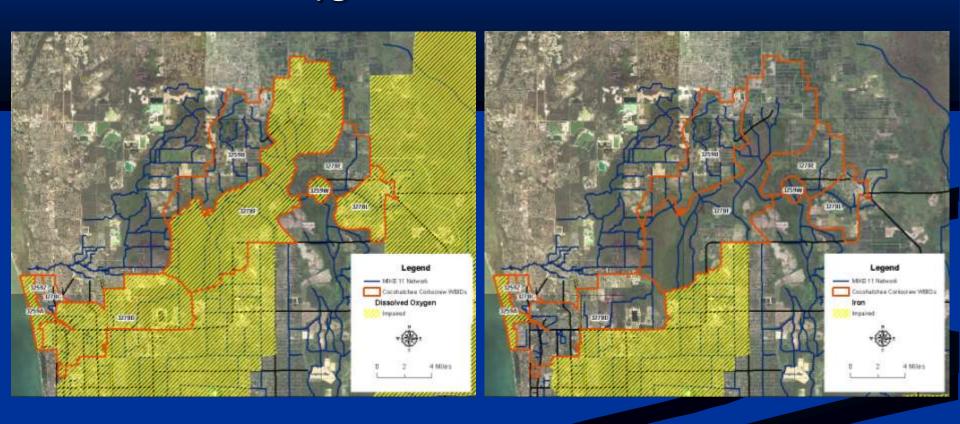




Cocohatchee Corkscrew FDEP Identified Impairments

Dissolved Oxygen

Iron



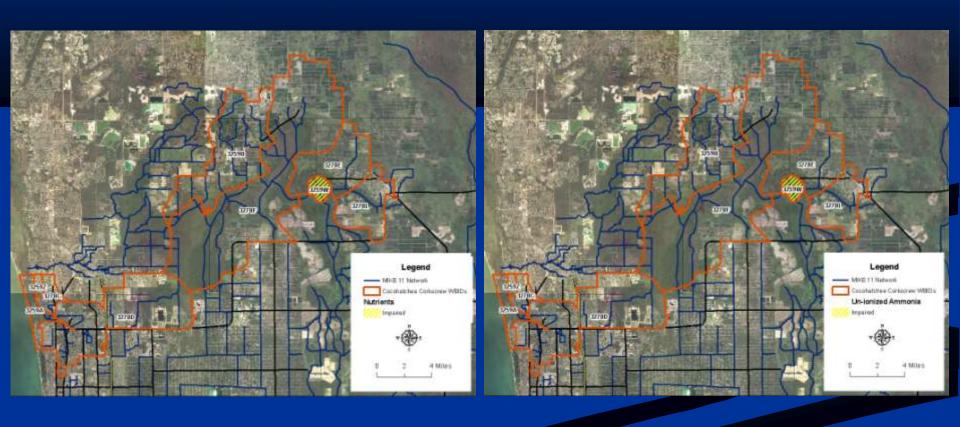




Cocohatchee Corkscrew FDEP Identified Impairments

Nutrients (Chlorophyll a)

Un-ionized Ammonia



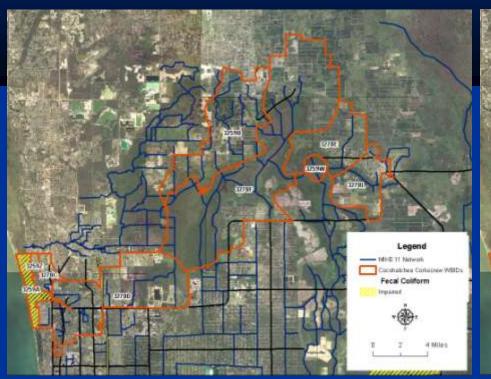


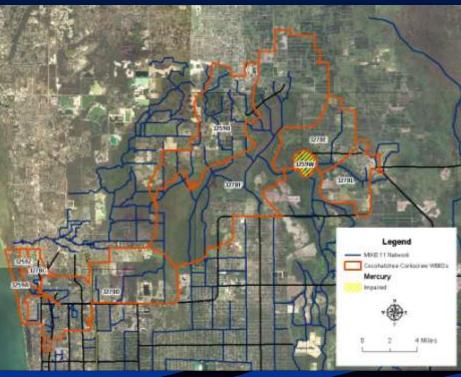


Cocohatchee Corkscrew FDEP Identified Impairments

Fecal Coliform

Mercury









Cocohatchee Corkscrew Summary of Water Quality Issues

- Lake Trafford is impaired for five parameters
 - Impairments based on data collected prior to dredging project
- Wiggins Pass Estuary is identified as impaired for three parameters
- Five WBIDs impaired for Dissolved Oxygen
 - Is the cause nutrient concentrations, groundwater inflow, wetland discharges, or all of the above?





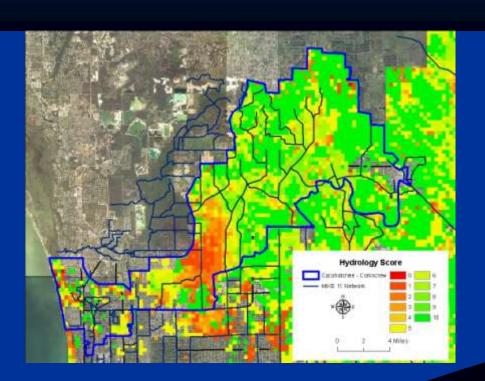
Cocohatchee Corkscrew Natural Resources

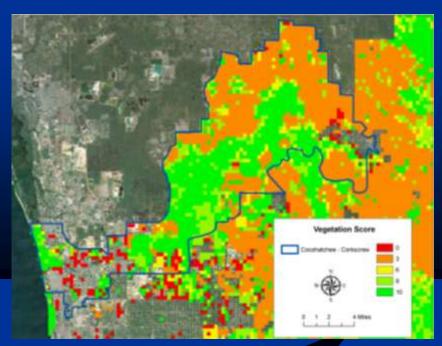
- Three components
 - Hydrology
 - Hydro-period
 - Depth of water
 - Vegetation
 - Score assigned based on current vegetation compared to NSM vegetation
 - Location Suitability Index (LSI)
 - Considers surrounding vegetation

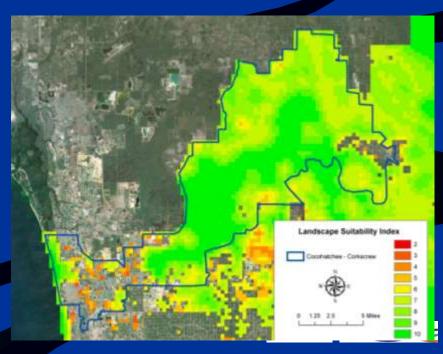




Cocohatchee Corkscrew Natural Resources









Cocohatchee Corkscrew Summary of Natural Resources

- Hydrology of remaining wetlands has changed
 - Shorter hydro-period and less water stored
- Habitat quality remains high in the Corkscrew
 Swamp
- Habitat is degraded in agricultural and urgan areas





Golden Gate – Naples Bay Watershed

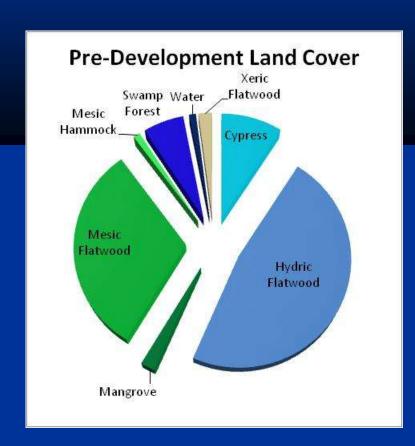
- Area: \sim 135 sq. miles
- Mainly Urban LandUses
- Most lots platted in 1960's; wetland connectivity was lost
- FDEP subdivided into 3 "WBIDs"

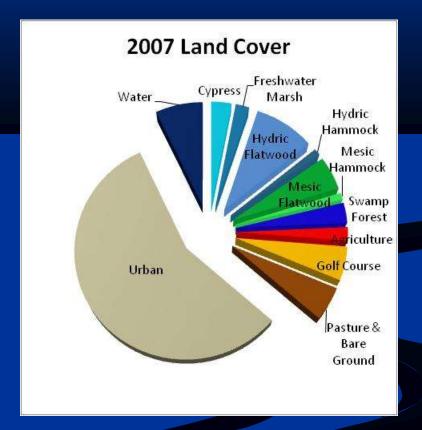






Golden Gate – Naples Bay Land Use Comparison



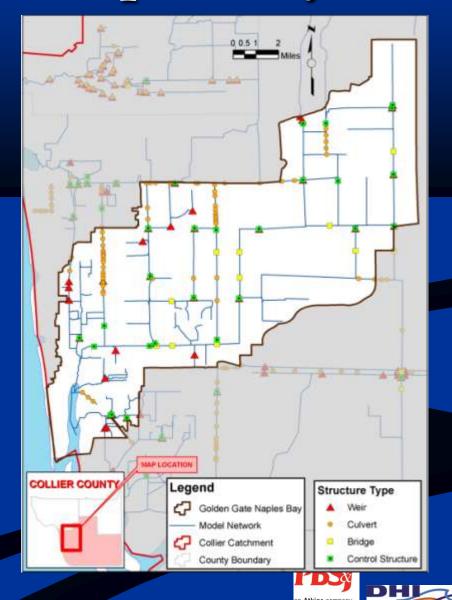






Golden Gate – Naples Bay

- Primary drainage is
 Golden Gate Main
 Canal that discharges
 to Naples Bay
- Drainage pattern changed due to development
- Watershed almost 3X larger than predevelopment





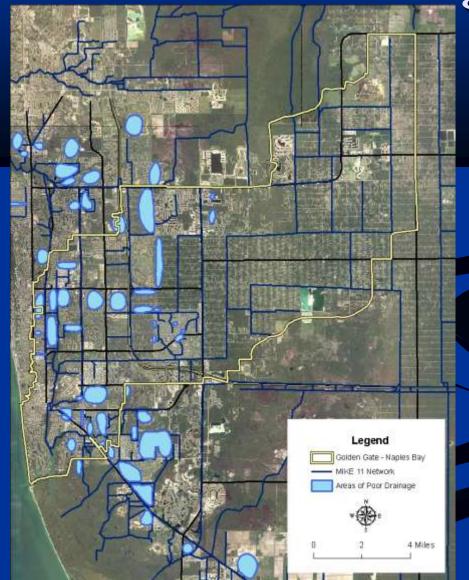
Golden Gate – Naples Bay Water Supply Wells







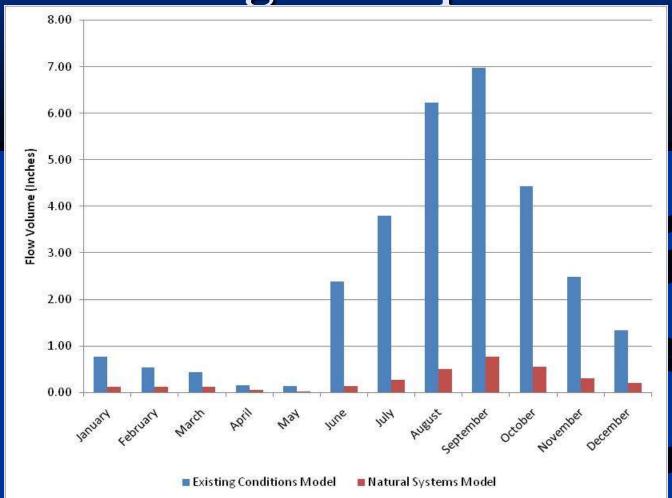
Golden Gate – Naples Bay Areas of Poor Drainage







Golden Gate – Naples Bay Discharge Comparison

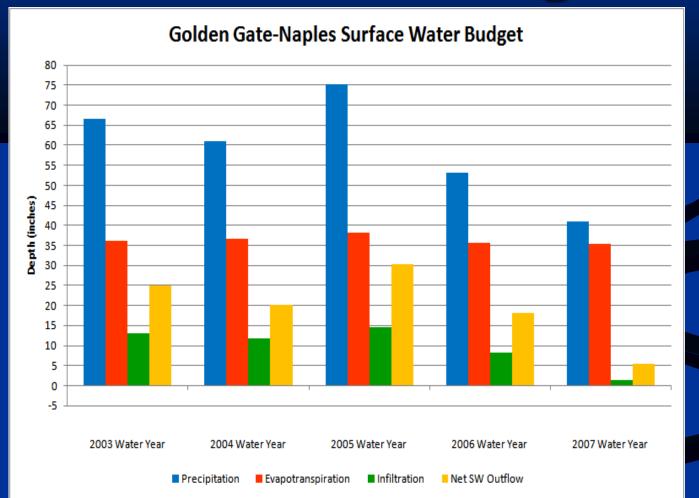








Golden Gate – Naples bay Surface Water Budget

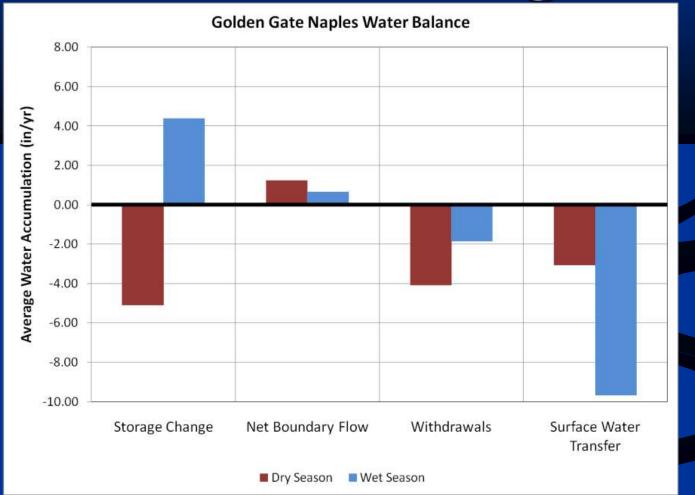








Golden Gate – Naples Bay Groundwater Budget

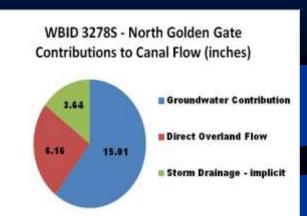






Golden Gate – Naples Bay WBID Contributions to Canal









Golden Gate – Naples Bay Summary of Water Quantity Issues

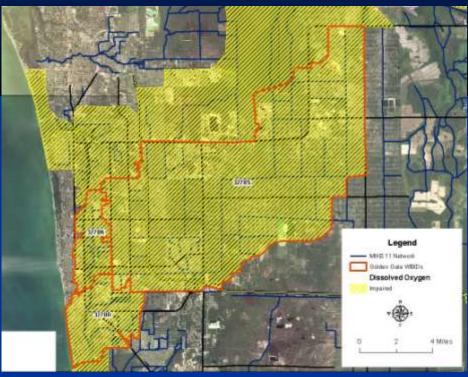
- Watershed area has tripled due to construction of drainage canal
- Hydrology of remaining wetlands has changed
 - Shorter hydro-period and less water stored
 - Wetland connectivity has been broken
- Greater discharge to the estuary
 - Approximately 19" in the wet season
- High groundwater contribution to canals
 - Approximately 15" to the canal network

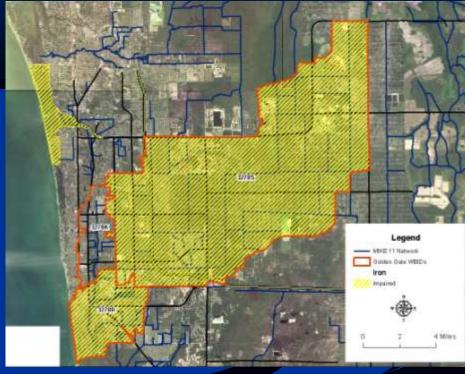


Golden Gate – Naples Bay FDEP Identified Impairments

Dissolved Oxygen

Iron





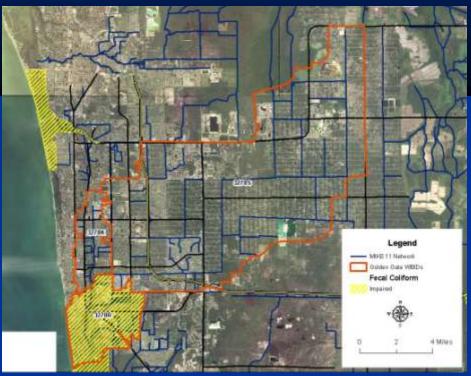


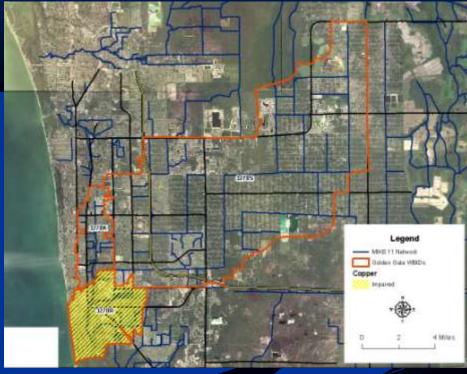


Golden Gate – Naples Bay FDEP Identified Impairments

Fecal Coliform

Copper







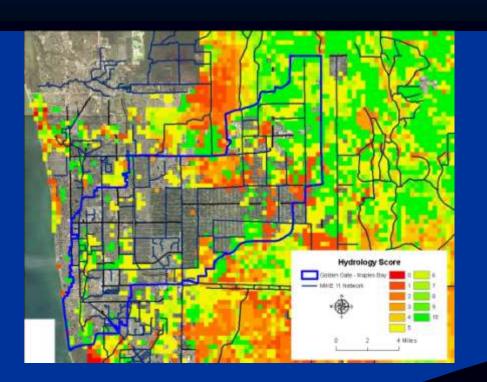


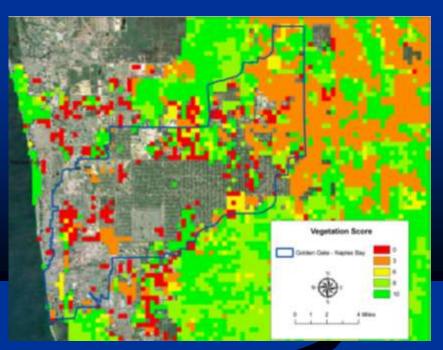
Golden Gate – Naples Bay Summary of Water Quality Issues

- All WBIDs identified as impaired for DO
- Cause of DO impairment not well defined
- Naples Bay WBID is impaired for three (3) parameters
 - Are D.O. and Iron impairments associated with groundwater flow to canals?
- Naples Bay WBID also identified as impaired for copper
 - May be related to use of copper sulfate



Golden Gate Naples Bay Natural Resources









Golden Gate – Naples Bay Summary of Natural Resources

- Hydrology of remaining wetlands has changed
- Habitat quality is degraded in most of the watershed





Golden Gate – Naples Bay Other Issues

- Residential lot owners are able to dredge or fill up to 4,000 square feet of wetlands; plus additional clearing up to 6,000 square feet
- Canal system has limited capacity; full build out could overwhelm the system





Rookery Bay Watershed

■ Area: \sim 145 sq. miles

FDEP subdivided into 3 "WBIDs"

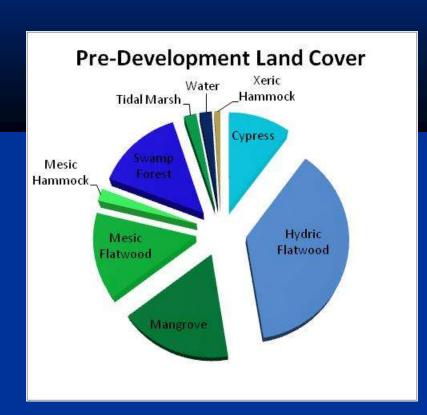
- Includes natural areas,
 agricultural lands, and urban development
- Mostly urbanized west of Collier Boulevard

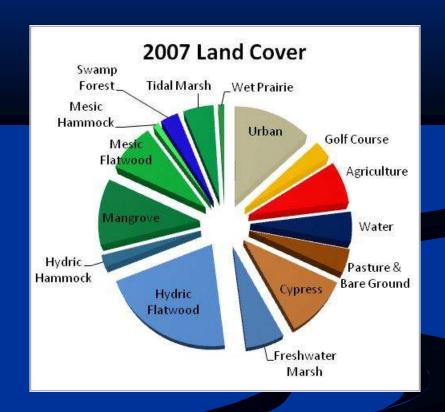






Rookery Bay Watershed Land Use Comparison









Rookery Bay Watershed

- Almost 100 sq. miles smaller than predevelopment
- Overland flow and channel flow

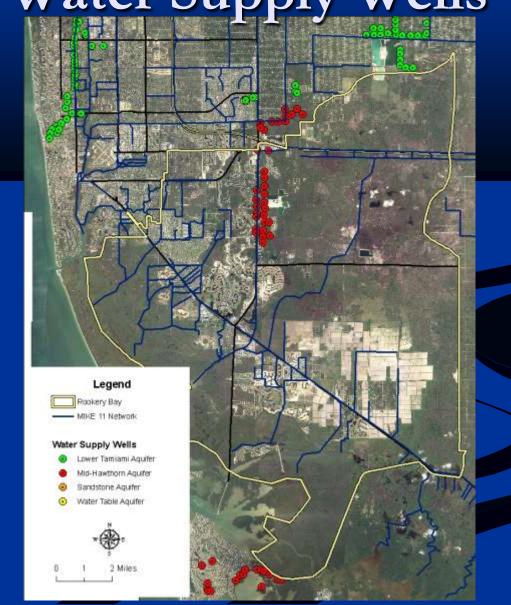








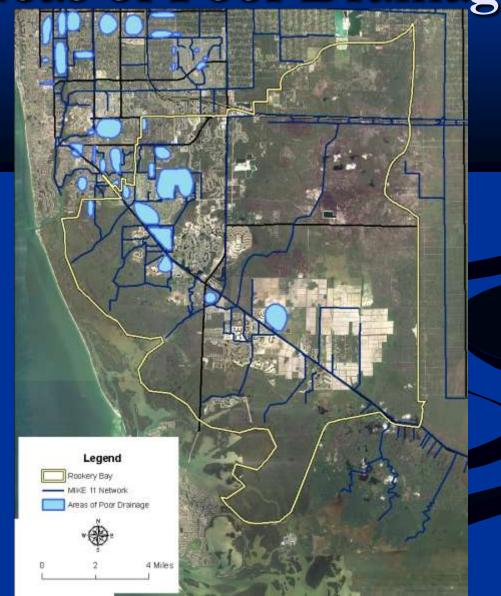
Rookery Bay Watershed Water Supply Wells







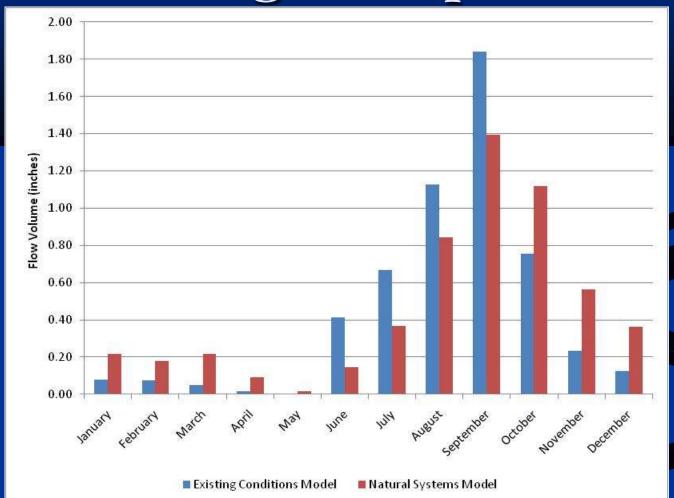
Rookery Bay Watershed Areas of Poor Drainage







Rookery Bay Watershed Discharge Comparison

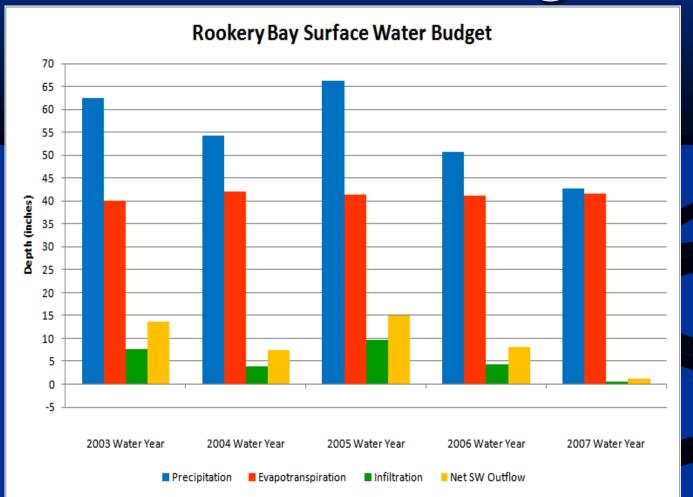








Rookery Bay Watershed Surface Water Budget

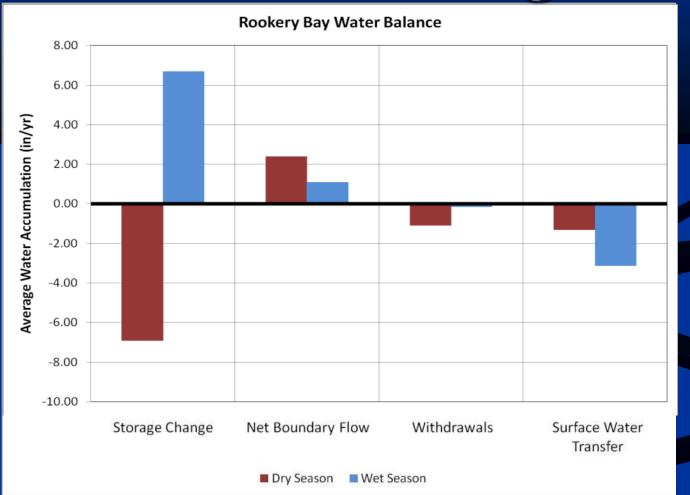








Rookery Bay Watershed Groundwater Budget

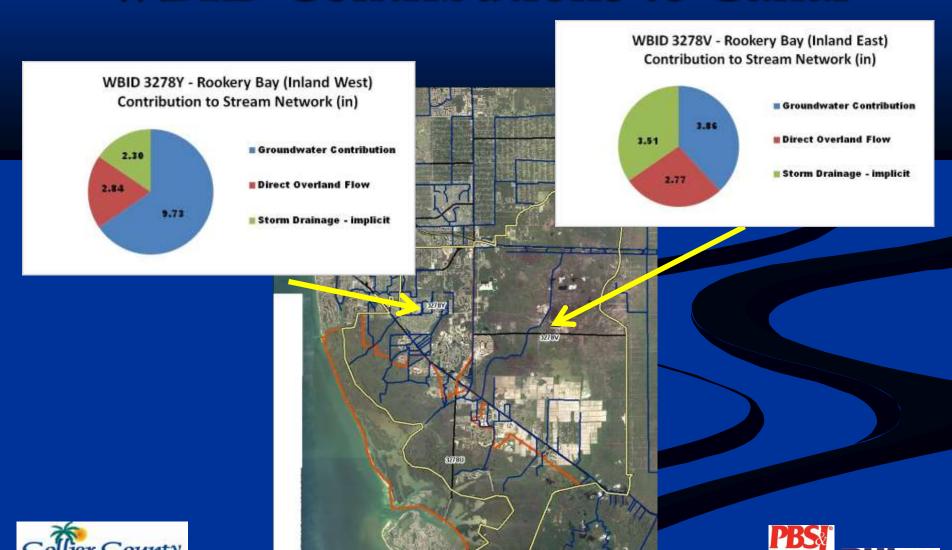








Rookery Bay Watershed WBID Contributions to Canal



Rookery Bay Watershed Summary of Water Quantity Issues

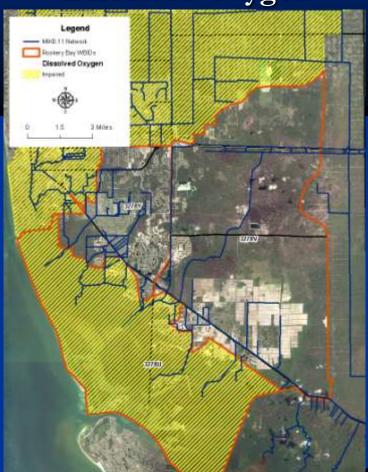
- Watershed area has decreased by about 100 square miles due to construction of canals.
- Hydrology of remaining wetlands has changed
 - Shorter hydro-period and less water stored
- Pattern of discharge to the estuary has changed
 - Dry season deficit and wet season surplus



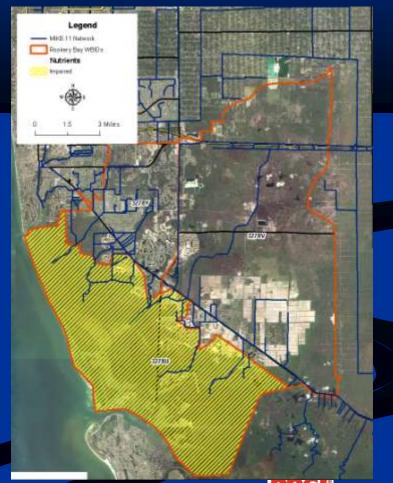


Rookery Bay Watershed FDEP Identified Impairments

Dissolved Oxygen



Nutrients

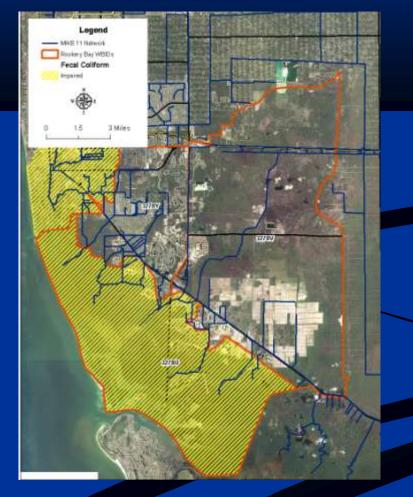






Rookery Bay Watershed FDEP Identified Impairments

Fecal Coliform







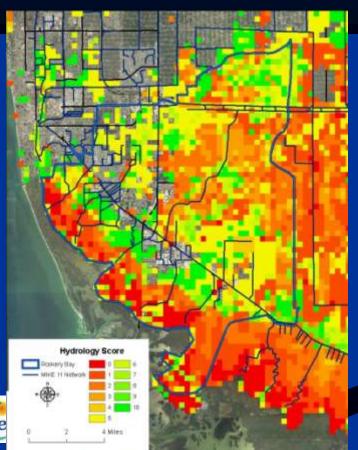
Rookery Bay Watershed Summary of Water Quality Issues

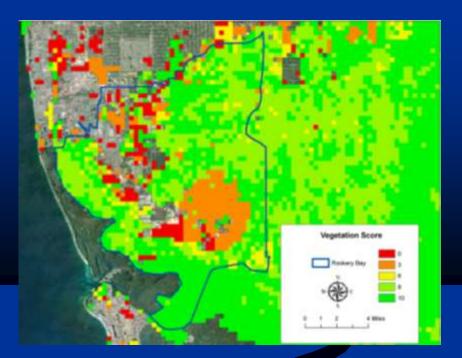
- Rookery Bay Estuary is only WBID identified as impaired
 - Nutrient impairment may be related to change in sampling location. Results should be verified.





Rookery Bay Watershed Natural Resources









Rookery Bay Watershed Summary of Natural Resources

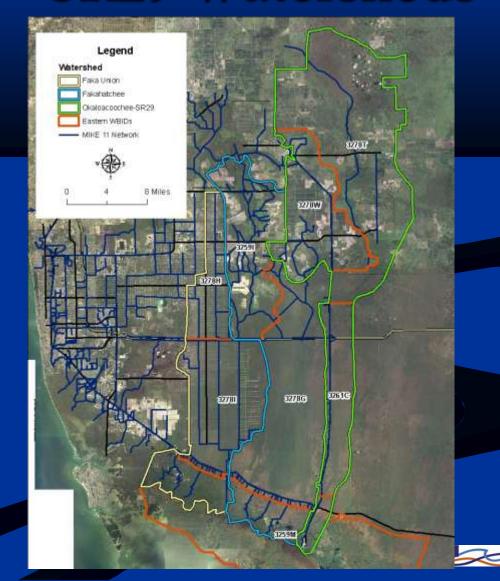
- Hydrology of remaining wetlands has changed
 - Shorter hydro-period and less water stored
- Habitat quality generally remains high in the Picayune Strand Forest portion of the watershed
- Habitat is degraded in the urban and agricultural areas





Faka Union, Fakahatchee, and Okaloacoochee – SR29 Watersheds

- The three watersheds encompass 770 sq.mi.
- Three watersheds divided into 8 "WBIDs"
- Faka Union is most modified:
 - Miller Canal
 - Faka Union Canal
 - Merritt Canal

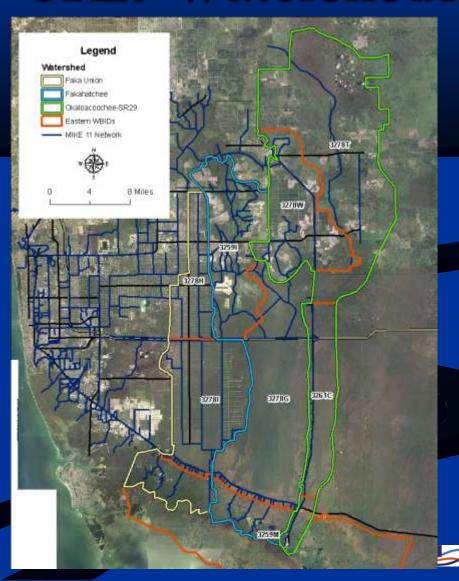




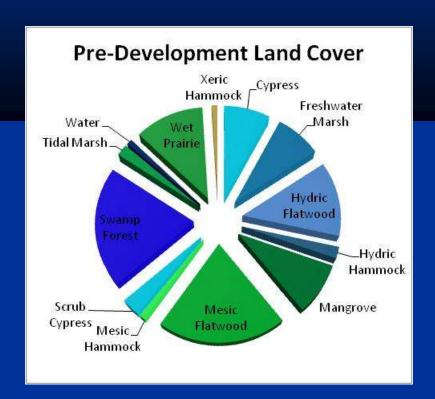
Faka Union, Fakahatchee, and Okaloacoochee – SR29 Watersheds

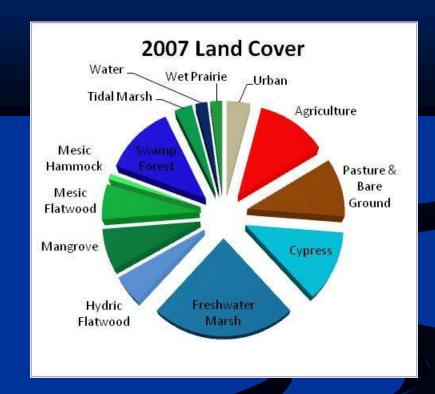
- Fakahatchee watershed is often used as a reference station and remains mostly natural
 - Agriculture in headwaters
- Okalocoochee partially developed
 - Ave Maria
 - Agricultural lands
 - SR 29 Canal to south





Eastern Watersheds Land Use Comparison



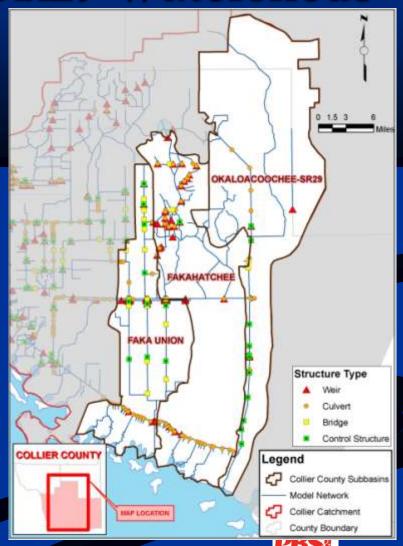






Faka Union, Fakahatchee, and Okaloacoochee – SR29 Watersheds

- Primary drainage features:
 - Miller Canal
 - Faka Union Canal
 - Merritt Canal
 - SR 29 Canal
- Area of the Faka
 Union watershed has increased by ~35 sq.mi.







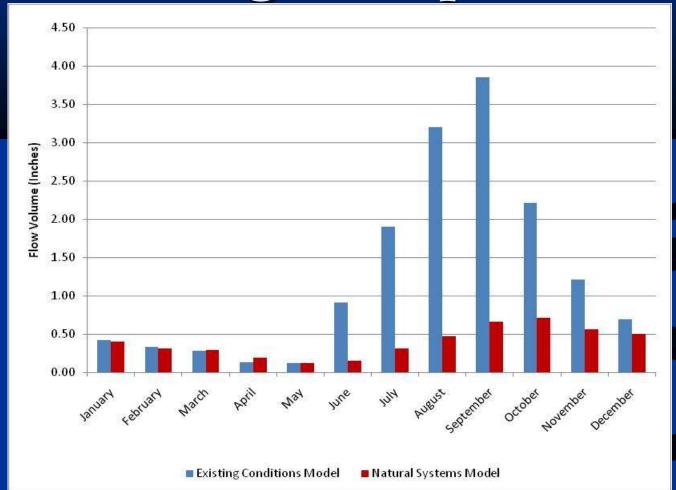
Eastern Watersheds Water Supply Wells







Eastern Watersheds Discharge Comparison



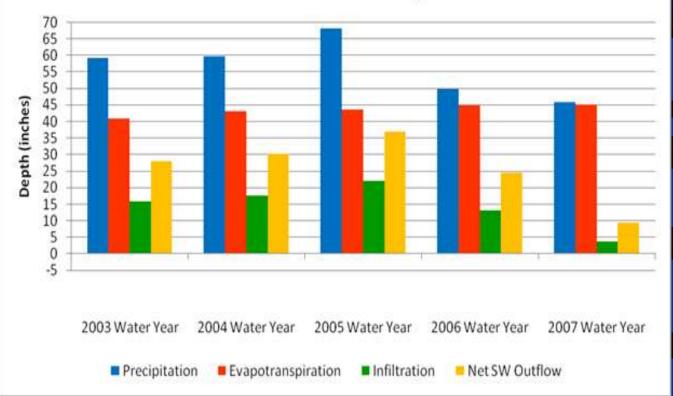






Eastern Watersheds Surface Water Budget

Faka Union + Fakahatchee + Okaloacoochee-SR29 Surface Water Budget

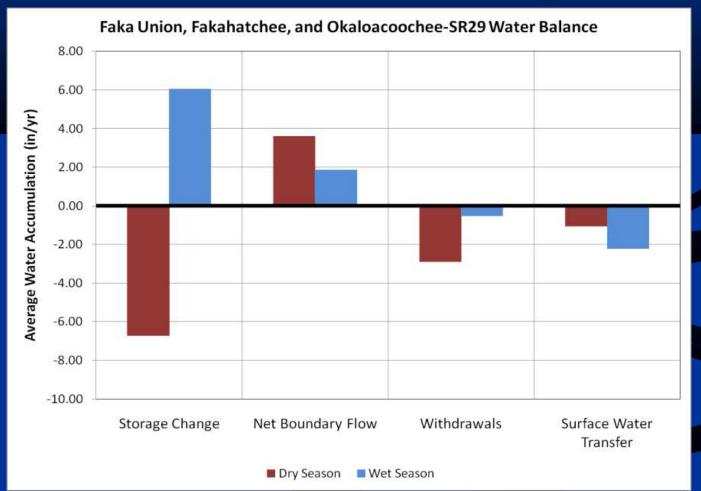








Eastern Watersheds Groundwater Budget

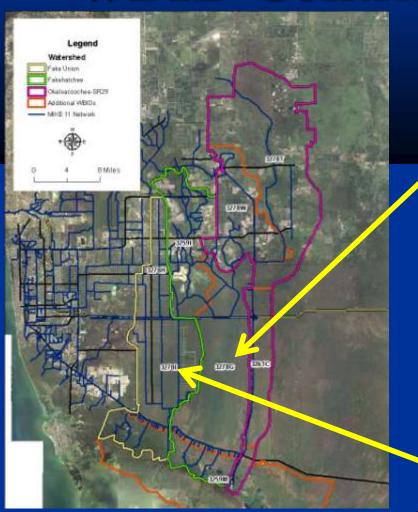


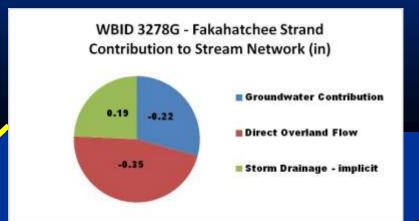


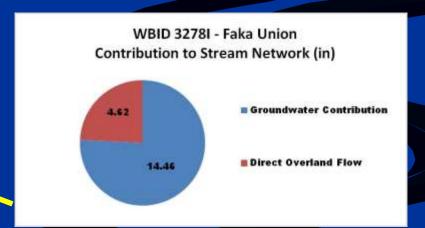




Eastern Watersheds WBID Contributions to Canal











Eastern Watershed Summary of Water Quantity Issues

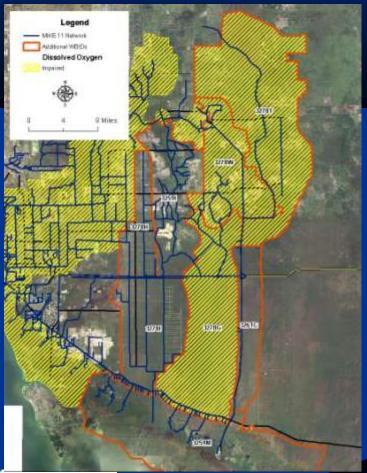
- Watershed area is increased in headwaters of Faka Union watershed
 - Dredging of canals in GGE changed hydrology
- Hydrology of remaining wetlands has changed
 - Shorter hydro-period and less water stored
- Large increase in wet season flow to estuary
 - Approximately 9" increase during wet season
 - Existing dry season flows are very similar to NSM



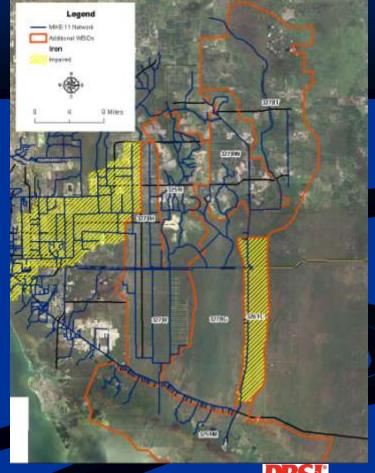


Eastern Watersheds FDEP Identified Impairments

Dissolved Oxygen



Iron

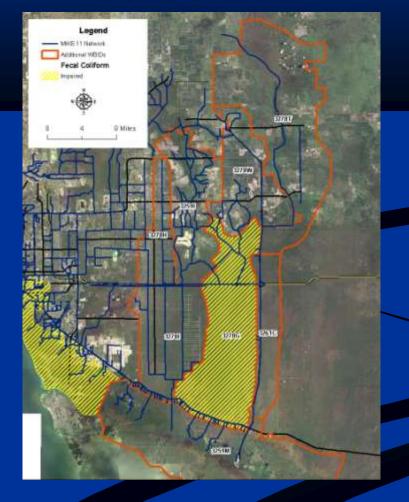






Eastern Watersheds FDEP Identified Impairments

Fecal Coliform







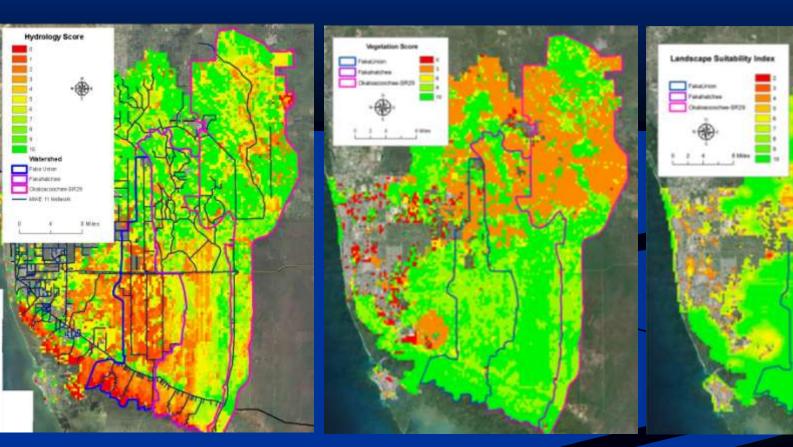
Eastern Watersheds Summary of Water Quality Issues

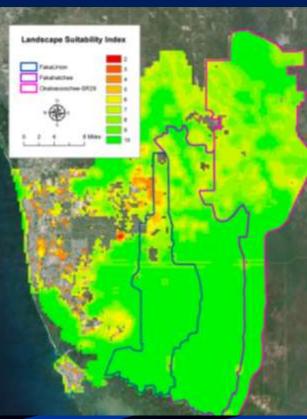
- Camp Keais Strand, Okaloacoochee Strand, and Fakahatchee Strand identified as impaired for Dissolved Oxygen
 - Fakahatchee Strand is considered a reference station
 - What is role of wetland activity on low D.O. level?
- SR29 Canal identified as impaired for Iron
 - Is there a groundwater contribution?





Eastern Watersheds Natural Resources









Eastern Watersheds Summary of Natural Resources

- Hydrology of remaining wetlands has changed
 - Shorter hydro-period and less water stored
- Habitat quality generally remains high in Fakahatchee Strand and Okaloacoochee Slough
- Habitat quality is moderate in the southern parts of the Faka Union watershed and near the SR 29 Canal
- Habitat is degraded in the urban and agricultural areas





Identification of Potential Projects

- Methodology
 - Identify previously considered projects or projects that are scheduled for implementation
 - Better define previously identified projects
 - Identify new project opportunities based on:
 - Estuary freshwater surplus/deficit
 - Changes in hydrology
 - Future roadway improvements
 - Current property ownership
 - Existing conservation easements
 - Location within Sending/Receiving areas





Identification of Potential Projects

- Methodology
 - Previously considered projects or projects that are scheduled for implementation
 - Picayune Strand Restoration Project
 - Southwest Florida Feasibility Study
 - Belle Meade Area Master Plan
 - Northern Golden Gate Estates Flowway Restoration Plan (Horsepen Strand Restoration)
 - Lely Area Stormwater Improvement Project
 - Immokalee Stormwater Master Plan
 - Master Plan for Regional Irrigation Distribution System (RIDS)





Previously Proposed Projects

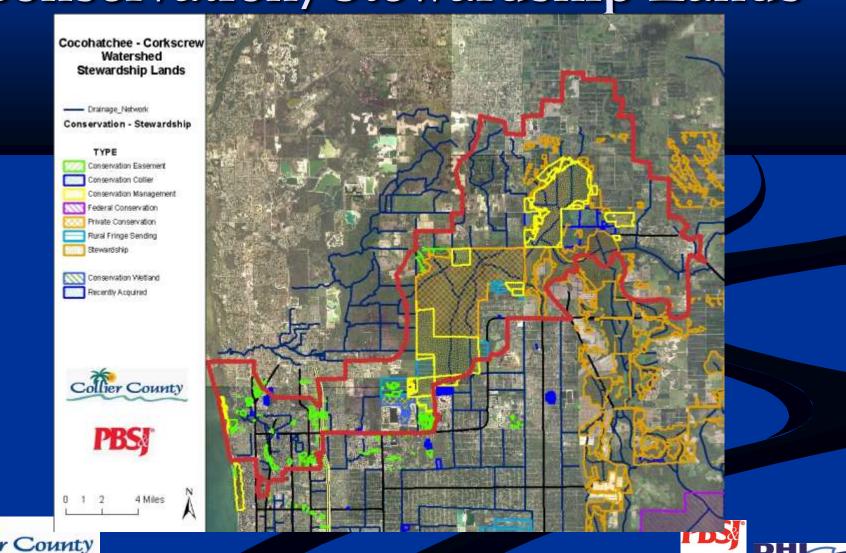




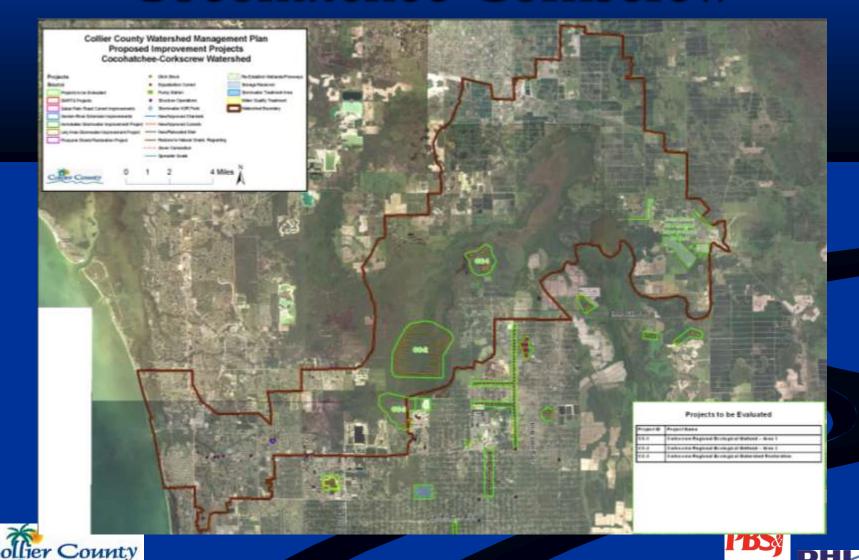




Cocohatchee-Corkscrew Conservation/Stewardship Lands



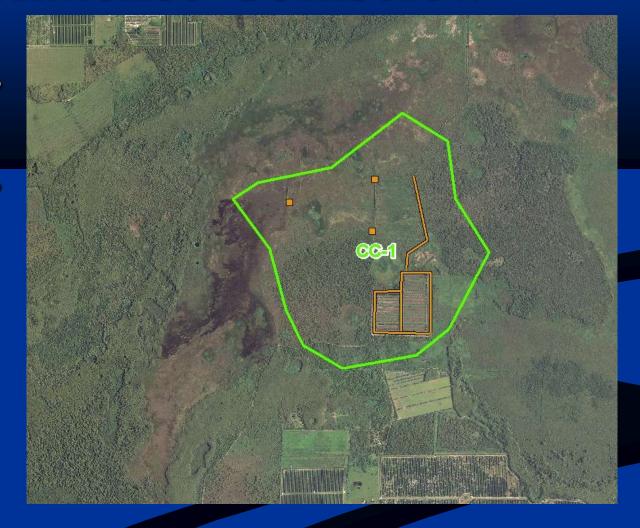
Potential Projects: Cocohatchee-Corkscrew



an Atkins company

Potential Projects: Cocohatchee-Corkscrew

- CC-1
 - Ditch blocks to force overland flow
 - Regrade area to remove berms

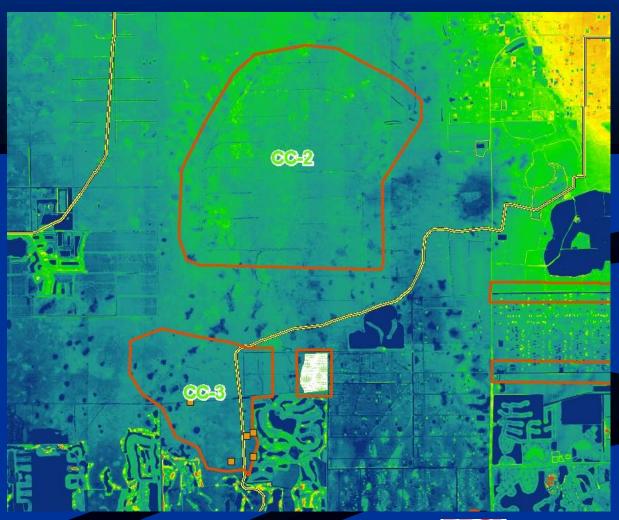






Potential Projects: Cocohatchee-Corkscrew Watershed

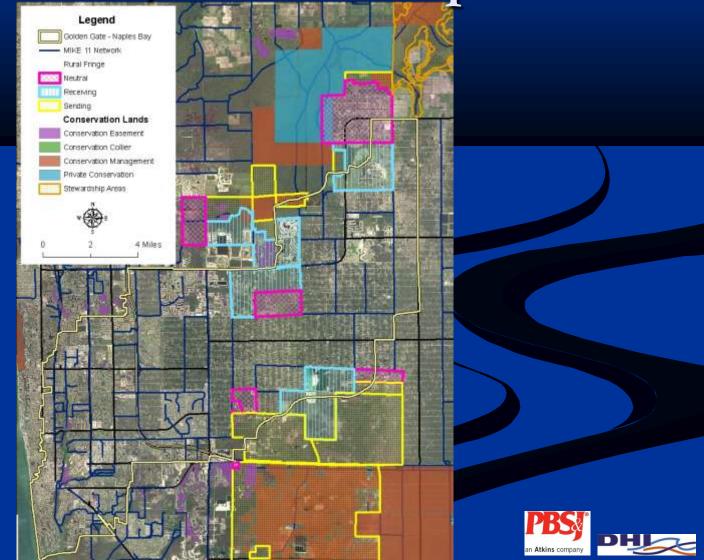
- **CC-2**
 - Regrade tonatural elevation
- **■** CC-3
 - Ditch blocks to encourage overland flow







Golden Gate – Naples Bay Conservation/Stewardship Lands









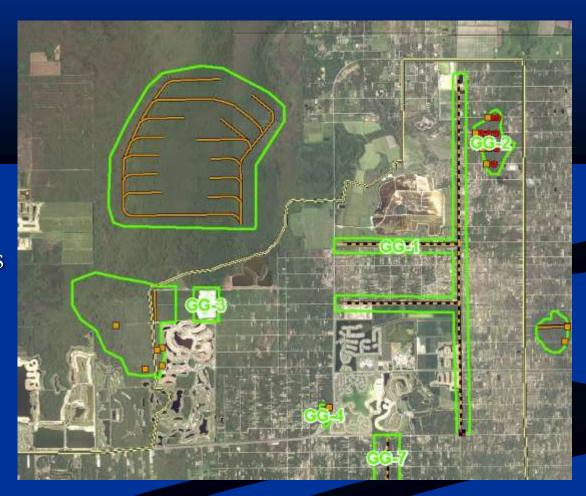
Potential Projects: NGGE Flowway Restoration

- Goal is to restore wetland connectivity
- Currently defined area falls
 within three (3) watersheds
- Key issues
 - Interaction with primary canal network
 - Influence on septic systems





- **GG-1**
 - New weirs to stage water in canals
- GG-2
 - Ditch blocks and equalization culverts to allow more storage
- GG-3
 - Ditch blocks to force overland flow





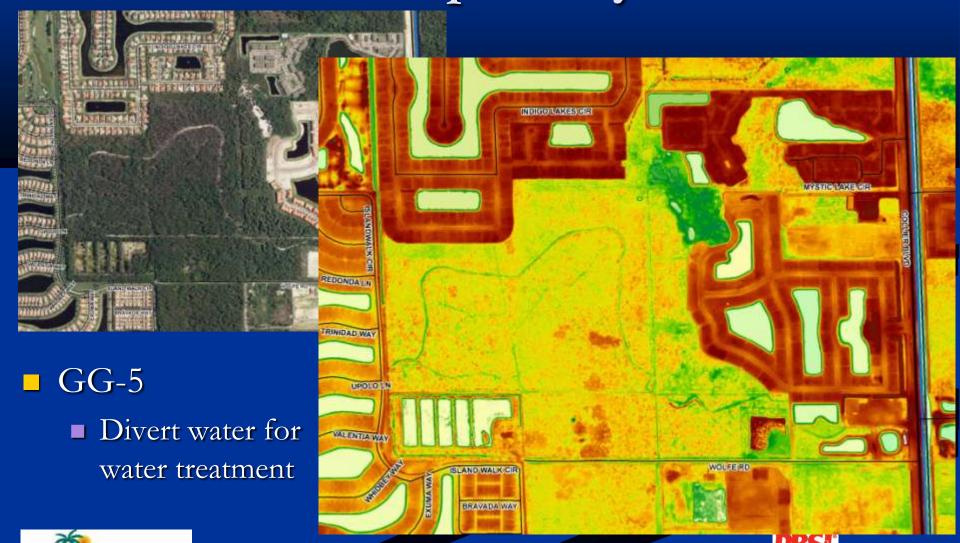


- **GG**-4
 - Ditch blocks to force overland flow
- GG-5
 - Divert water for water treatment
- **GG**-6
 - Off-line stormwater reservoir
- **GG**-7
 - New weirs in canal









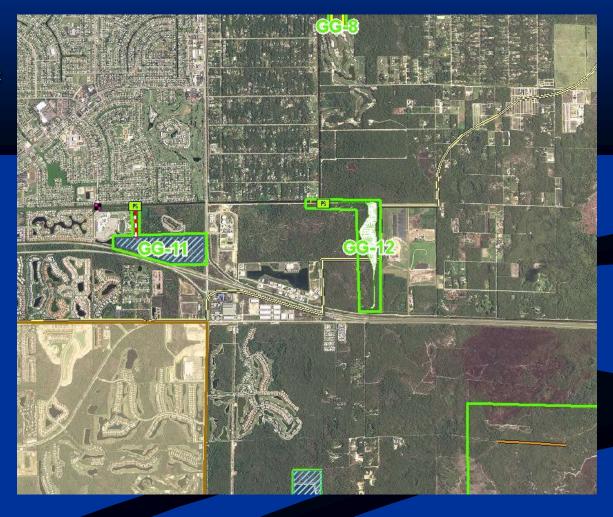
- **GG**-8
 - Wetland flow
- **GG**-9
 - New weirs to stage water
- **GG-10**
 - Off-line storage reservoir







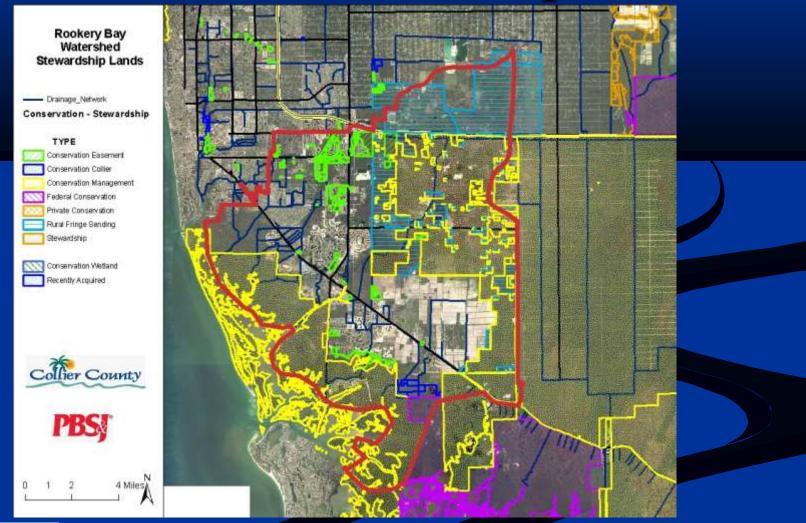
- **GG-11**
 - Off-line storage reservoir
- GG-12
 - Diversion to Rookery Bay watershed







Rookery Bay Watershed Conservation/Stewardship Lands







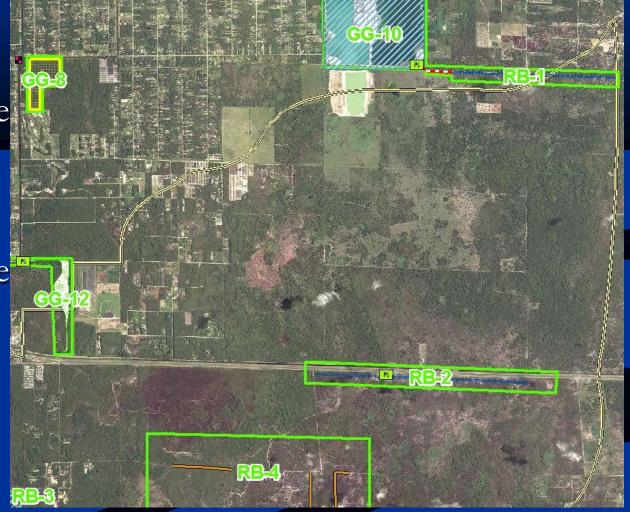
Potential Projects: Rookery Bay Watershed





Potential Projects Rookery Bay Watershed

- RB-1
 - Spreader swale in RFS lands
- RB-2
 - Spreader swale south of I-75

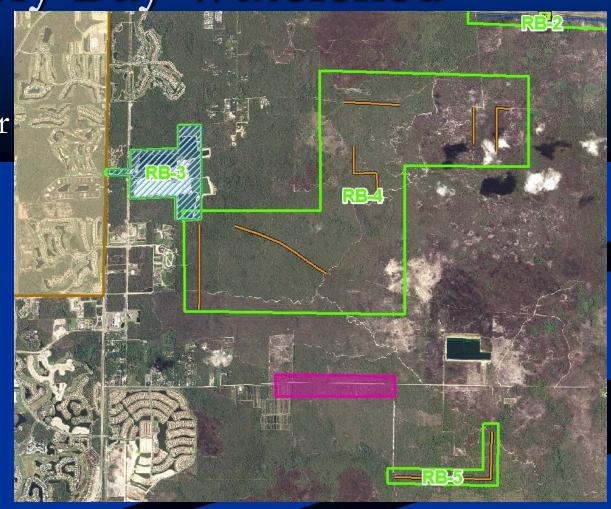






Potential Projects Rookery Bay Watershed

- RB-3
 - Storage reservoir (SWFFS)
- RB-4 and RB-5
 - Regrading of roads and horse trails in PSSF







Potential Projects Rookery Bay Watershed

- RB-6 and RB-7
 - Drainageupgrades andspreader swale
- RB-8
 - Stormwatertreatment area
- RB-9
 - Spreader swale







Eastern Watersheds Conservation/ Stewardship Lands

Faka Union, Fakahatchee, Okaloacoochee/SR29 Watersheds Stewardship Lands

Drainage_Network

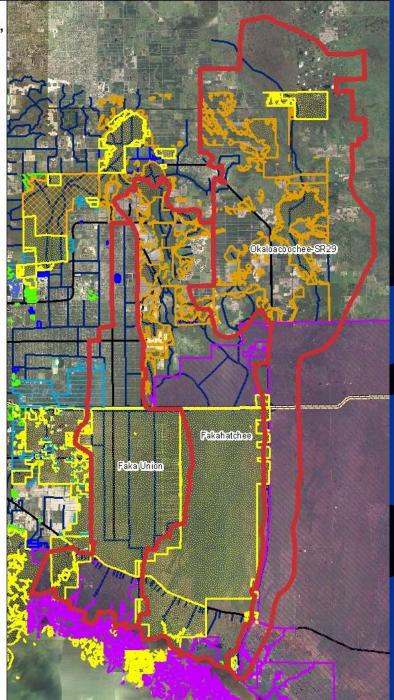
Conservation - Stewardship

TYPE

- Conservation Easement
- Conservation Collier
- Conservation Management
- Federal Conservation
- Private Conservation
- Rural Fringe Sending
- Stewardship
- erson encuto
- Conservation Wetland
 Recently Acquired





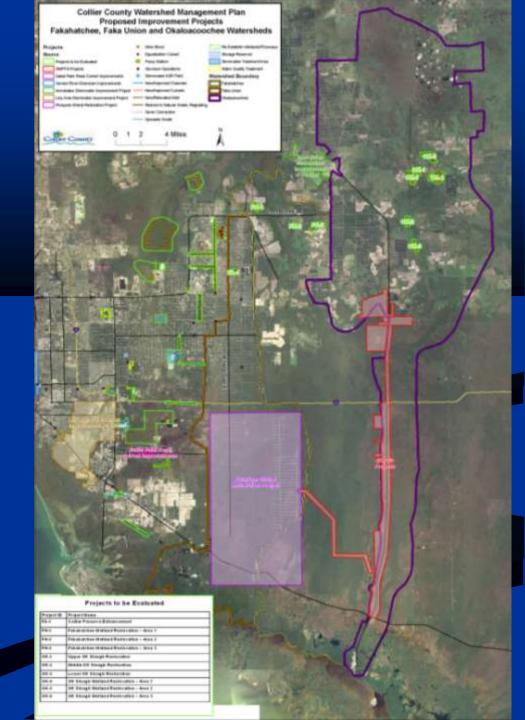




0 1.5 3 6 Miles



Potential Projects: Eastern Watersheds





Potential Projects Eastern Watersheds

FA-1

- Winchester Head in the Northern Golden GateEstates FlowwayRestoration Plan
- Ditch blocks and equalization culverts for more storage

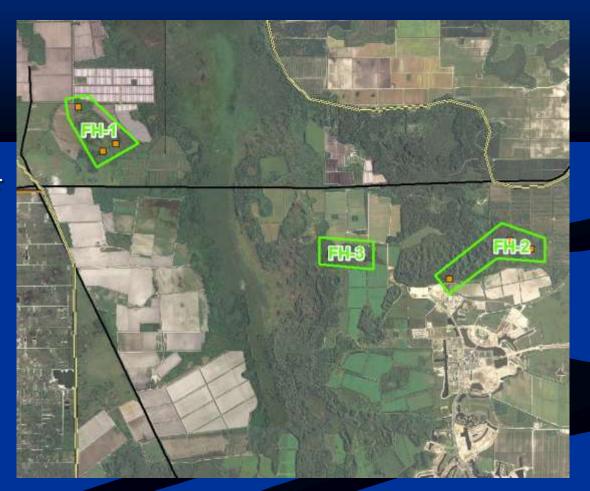






Potential Projects Eastern Watersheds

- FH-1 to FH-3
 - Ditch blocks to reduce drainage of isolated wetlands



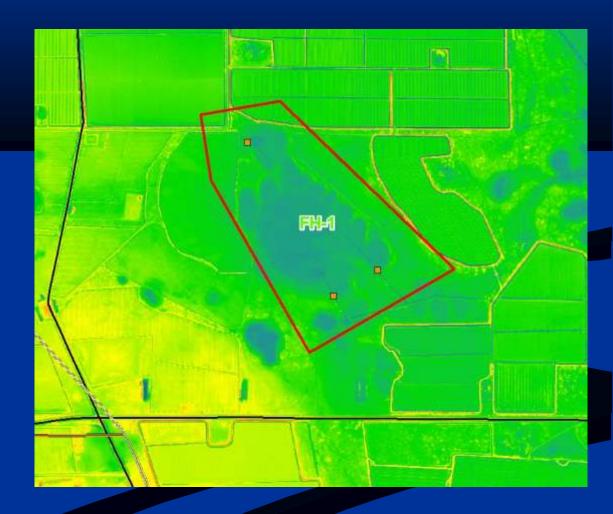




Potential Projects Eastern Watersheds

FH-1

 Ditch blocks to reduce drainage of isolated wetlands

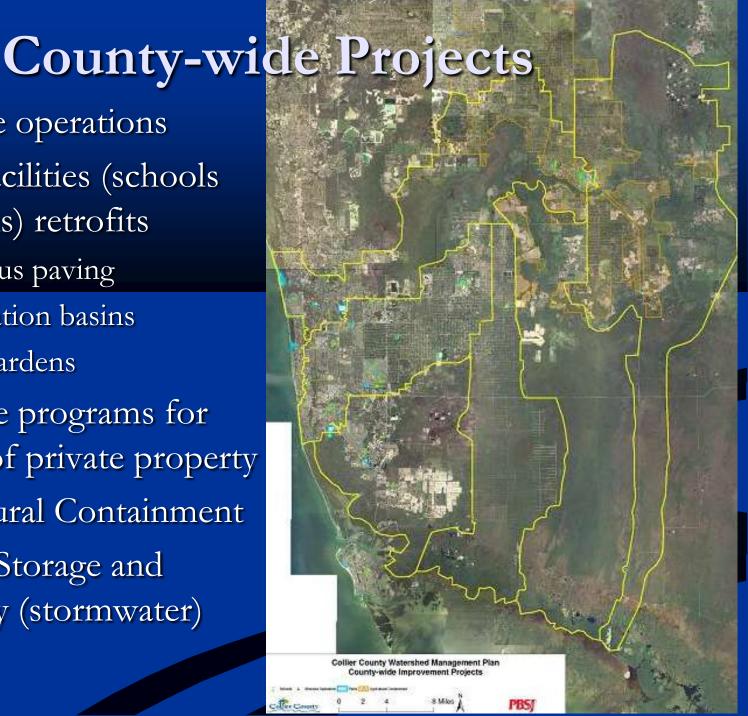






- Structure operations
- Public facilities (schools and parks) retrofits
 - Pervious paving
 - Infiltration basins
 - Rain gardens
- Incentive programs for retrofit of private property
- Agricultural Containment
- Aquifer Storage and Recovery (stormwater)





Public Facilities Potential Retrofits



- Utilize islands as infiltration basins
- Install pervious pavement in low traffic areas
- Install rain gardens to capture roof runoff







Performance Measures

Definition

 A metric used to assess the potential benefit/impact resulting from implementation of a specific program or project





Performance Measures

- Freshwater Discharge to Estuaries
- Pollutant Load
- Flood Risk
- Aquifer Recharge/Yield
- Natural Systems





Regulatory Issues

- Background
- Objectives
- Low Impact Development





Background

- State Water Policy, the TMDL Program, the Current ERP Process, and the Proposed Stormwater Rules
- Current Applicable Regulations from SFWMD and Collier County
- Regulatory Review Categories:
 - Water Quality
 - Water Quantity
 - Land Development
 - Zoning





Objective

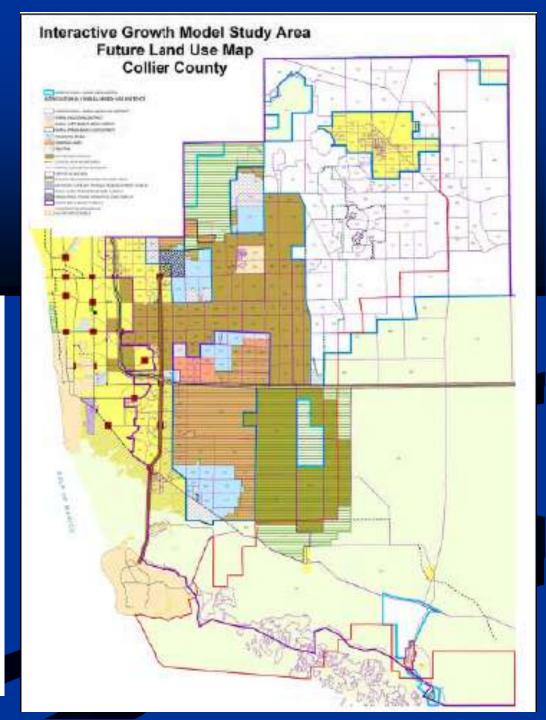
- Help implement a Sustainable Stormwater
 Management Program
- The programs should aim to:
 - Promote more effective site planning to minimize anthropogenic impacts,
 - Promote preservation of the natural system
 - Help reduce development costs
 - Help reduce cost of future drainage system improvements





Future Land Use





Regulatory Review Categories

- Water Quality
- Water Quantity
- Land Development
- Zoning





Current Stormwater Management Approach







Water Quality Regulations Promote Low Impact Development (LID)

- LID promotes management of stormwater by:
 - Encouraging management of stormwater at the site
 - Minimize the extent of directly connected impervious areas.
 - Minimize site disturbance
 - Maintain or restore a site's natural hydrology
 - Maximize the site's assimilative capacity





Low Impact Development (LID)







Water Quality Regulatory Issues

- Main Issue: How to provide water quality credits for development
- Not feasible under current State regulations.
 Feasible under proposed new stormwater rules.
- Recommendation:
 - Modify Ordinance 90-10 requiring 150% of ERP treatment.
 - Develop incentives to retrofit private property





Water Quality Regulations Fertilizer Ordinances

- Main Issue: How best to manage application rates and timing of fertilizer?
- Ordinances have been implemented by Lee
 County, City of Naples and other municipalities
- Recommendation:
 - At a minimum, implement ordinance using FDEP recommended language
 - Consider options appropriate for Collier County





Fertilizer Ordinances

FDEP Model Ordinance

- Nitrogen and Phosphorus application prohibition period
- A minimum of ten (10) feet from water bodies
- Nitrogen, Phosphorus formulation restriction
- Avoid impervious areas
- Agricultural exemptions
- Public education







Fertilizer Ordinances

Additional Options

- Mow-Free zone near water
- Landscaper certification
- Slow-Release formula
- Maximum application rates
- Seasonal ban on sale







Water Quantity and Flood Risk

- Issue: Current regulations for large storms focus on control of peak discharge for the 25-year/24-hour design event.
- Recommendation:
 - Require volume control for the 25-year/24-hour design event.
 - It allows control of peak, volume and timing of stormwater discharges





Water Quantity and Flood Risk

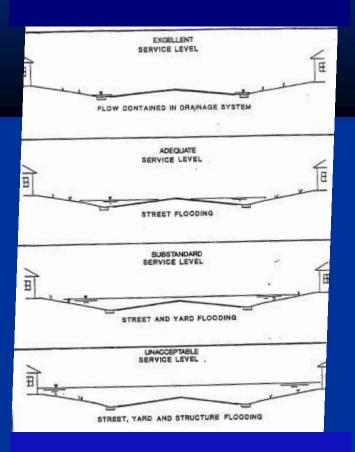
- Issue: Most County watersheds do not meet current flood protection levels of service (FPLOS).
- Recommendation:
 - Modify FPLOS to set realistic goals.





Water Quantity and Flood Risk

Current FPLOS



Proposed FPLOS

	Storm Return Period (years)		
Roadways	10	25	100
A. Evacuation Routes	None	None	None
B. Arterials	None	None	6 inches
C. Collectors	None	6 inches	9 inches
D. Neighborhood	6 inches	9 inches	12 inches

Open Space

Flooding of open space is acceptable if it does not compromise public health and safety





Land Development Regulations

- Recommendations:
 - Promote cluster development
 - Modify road width requirements based on actual ADT
 - Modify required lot setbacks ("zero lot lines")







Other Issues

- Modify zoning to address extent of impervious cover in addition to density
- Examine the TDR program and make recommendations





Summary

- There are opportunities to modify current regulations related to water quality, water quantity, land development, and zoning.
- The objective should be to implement a "sustainable stormwater management program".
- Encourage application of LID concepts
- Examine zoning and TDR program



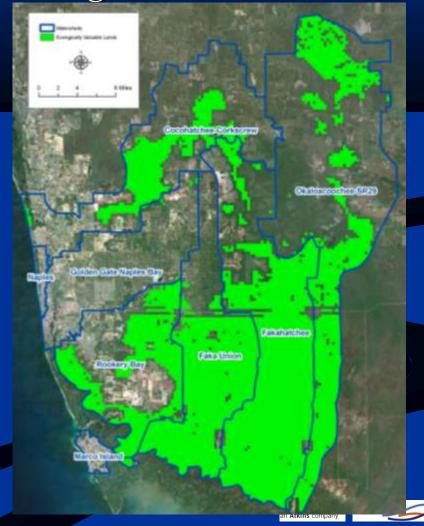


Conservation Areas vs. High Functional Value Areas

Conservation Lands



High Functional Value



Wrap Up

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

machatcher@colliergov.net

- Formal position papers
 - Please mail to Mac Hatcher



