

Monroe County Canal Management Master Plan (CMMP) and Canal Restoration Public Outreach Seminar



Funding provided by U.S. Environmental Protection Agency

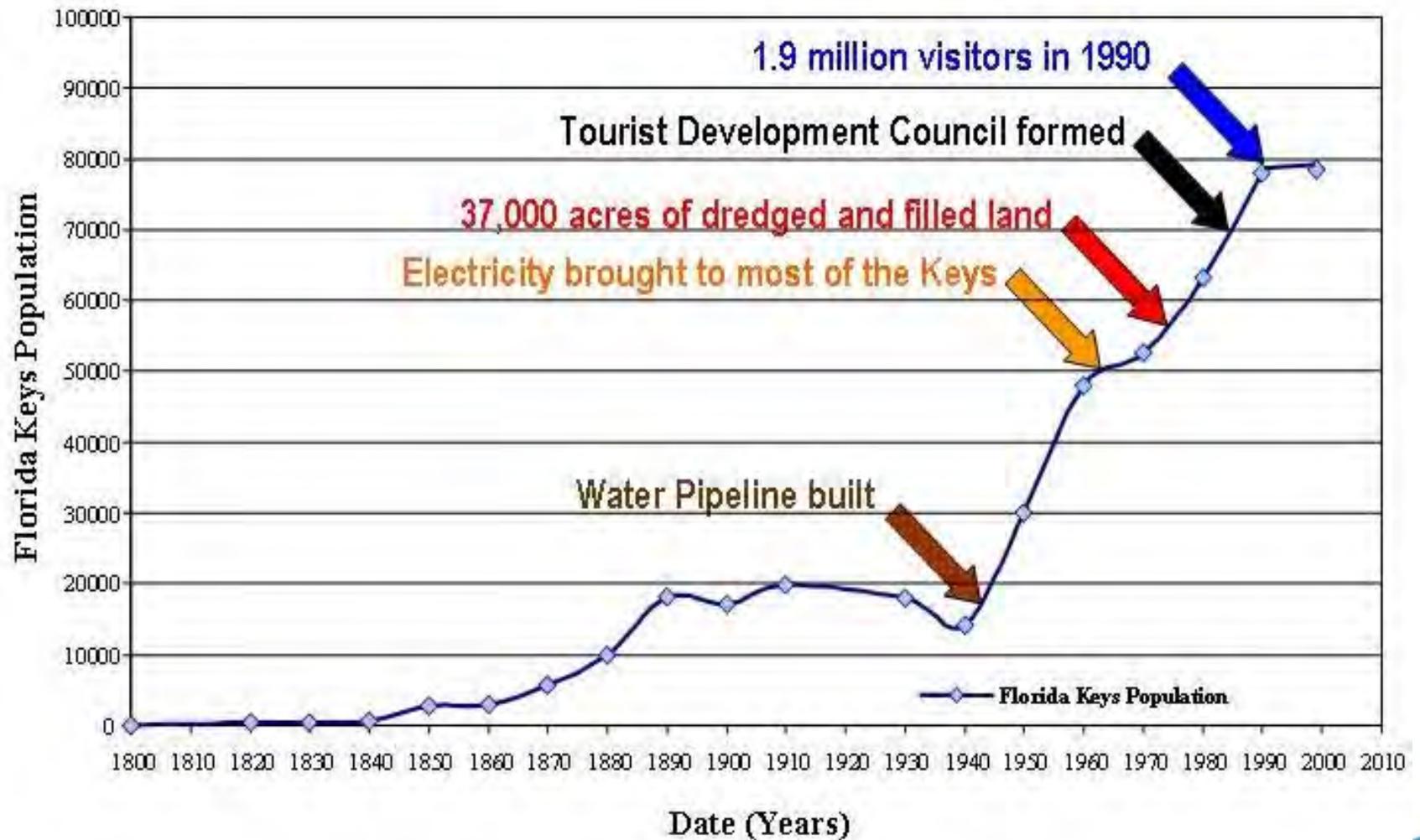


Canal Management Master Plan Stakeholders

- **FEDERAL, STATE, AND LOCAL GOVERNMENTS:** USEPA, NPS, USACE, NOAA, FKNMS, FDEP, SFWMD, FWC, FCAA, FDH, Monroe County, Village of Islamorada, City of Marathon, City of Key Colony Beach, City of Layton, and City of Key West.
- **NOT FOR PROFIT ORGANIZATIONS:** The Nature Conservancy
- **INFORMED CITIZENS:** Today's participants, HOA's, and long term residents.



Development of the Florida Keys



Canal Construction in the Florida Keys

- Dredge and fill activities created 170 miles of canals, with 312 miles of waterfront property
- Many canals dug 10 - 20 feet to maximize fill material
- Most canals are long dead-end networks with little or no tidal flushing
- Canal development initiated before ecologists and resource managers were aware of the implications



Impacts of Canal Development

- Increased population growth in a sensitive area without storm water and waste water systems
- Added excessive nutrients, turbidity and sediment to canal waters causing long-term water quality degradation
- Destroyed shoreline habitat especially mangroves
- The canals discharge directly to near shore **Outstanding Florida Waters** in the FKNMS which may not receive direct or indirect discharges that would significantly degrade these waters



Why is Canal Restoration Needed?



Key Colony Beach

**“Good”
Water
Quality
Canals**



Duck Key



Key Haven



Conch Key



Sugar Loaf

This is Why Restoration is Needed



Upper Keys – accumulated seaweed

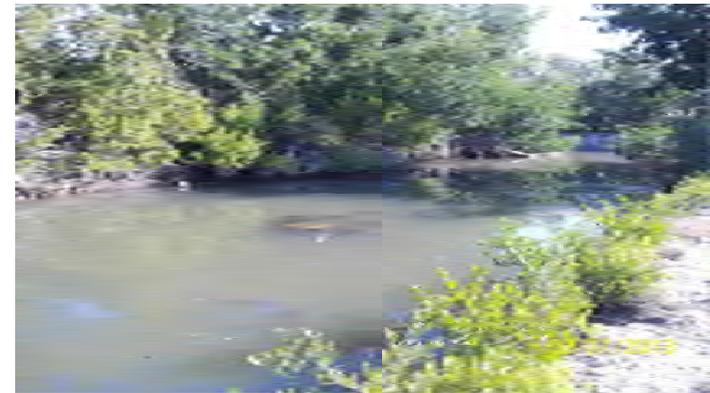
**“Poor”
Water
Quality
Canals**



Middle Keys – trapped seaweed



Summerland – trapped seaweed



Lack of flushing

Regulatory Drivers and Will the New Sewer System be Enough to Improve Water Quality?

1. Many of the Keys canals exhibit poor water quality

- Do not meet the Class III marine surface water quality standards for nutrients and dissolved oxygen in DEP Chapter 62-302, F.A.C.
- Recreational use and propagation and maintenance of healthy fish populations



2. Florida Keys Reasonable Assurance Document (FKRAD)

- Developed in 2008 by DEP in cooperation with local governments to address water bodies that do not meet the State's water quality standards
- Outlined extensive waste water and storm water restoration activities to address the nutrient impairments as an alternative to the establishment of Total Maximum Daily Loads
- The FKRAD 2011 Update recognized that additional canal restorations would be needed, in addition to *the* wastewater and stormwater pollutant reductions, to achieve the Class III Dissolved Oxygen Standard



3. Ramifications of continued impairment

- State and Federal mandated management practices

Photos courtesy of cudjoewastewater.com

Impact of the New Sewers

What they Addressed

- Dependence of Key's residents on old leaky septic systems.
- Reduction in nutrient pollution from septic systems (cause of algal blooms and green tinted water) to coastal and near shore waters.
- Improved water clarity
- Reduction in fecal coliform (bacteria from humans) concentrations in coastal water ways.



What they Did Not Address

- Persistence of low oxygen water in residential canals that does not meet State of Florida water quality standards
- Structural deficiencies of residential canal:
 - Poor flushing, long multi-segmented canals, deep pockets of stagnant water.
 - Accumulation of oxygen consuming materials (i.e. seaweed, yard clips, dead fish) and production of hydrogen sulfide (rotten egg smell).



Clean Water is Critical to the Economy of the Florida Keys

1. The **coral reef tract** in the Florida Keys is the third largest barrier reef in the world, and the only living barrier reef adjacent to continental US
2. More than **two million individuals per year** visit the Florida Keys to enjoy water related activities, including snorkeling, diving, and fishing
3. These water related activities support **70 percent of tourism** in the Florida Keys
4. The Florida Keys reef environment generates more than **70,000 jobs** and **\$6 billion dollars** in economic activity annually



Clean Water is Critical to the Economy of the Florida Keys (continued)

1. The Keys are considered the “fishing capital of the world,” generating hundreds of world records and billions of dollars of economic impact
2. Coral reef areas and seagrass beds provide **critical nursery and feeding habitat** for many commercially and recreationally valuable fish and shellfish species, such as grouper, snapper, stone crab, and spiny lobster
3. **Coral reef and seagrass health is directly linked to near shore marine water quality.** Both corals and seagrasses thrive in areas where water is clear, low in nutrients, and high in dissolved oxygen



Water Quality Protection Program (WQPP)

- In 1992 Congress directed USEPA and the State of Florida to develop a WQPP for the Florida Keys National Marine Sanctuary
- The purpose of the WQPP is to **recommend corrective actions to protect water quality** and compliance schedules to address point and nonpoint sources of pollution to restore and maintain the chemical, physical and biological integrity of the Sanctuary
- Canal water quality restoration is a priority of the WQPP Steering Committee which recently passed a motion to **develop a plan to prioritize canal restoration projects and to identify funding sources** for these projects



Canal Restoration Advisory Subcommittee

- Created to address water quality specifically in the Keys canals

- Canal Restoration Advisory Subcommittee Members

Federal: EPA, NOAA

State: DEP, FWC

County: George Neugent

Cities: All 5 represented

Other: Florida Keys Environmental Fund

Advisory: Rhonda Haag - County

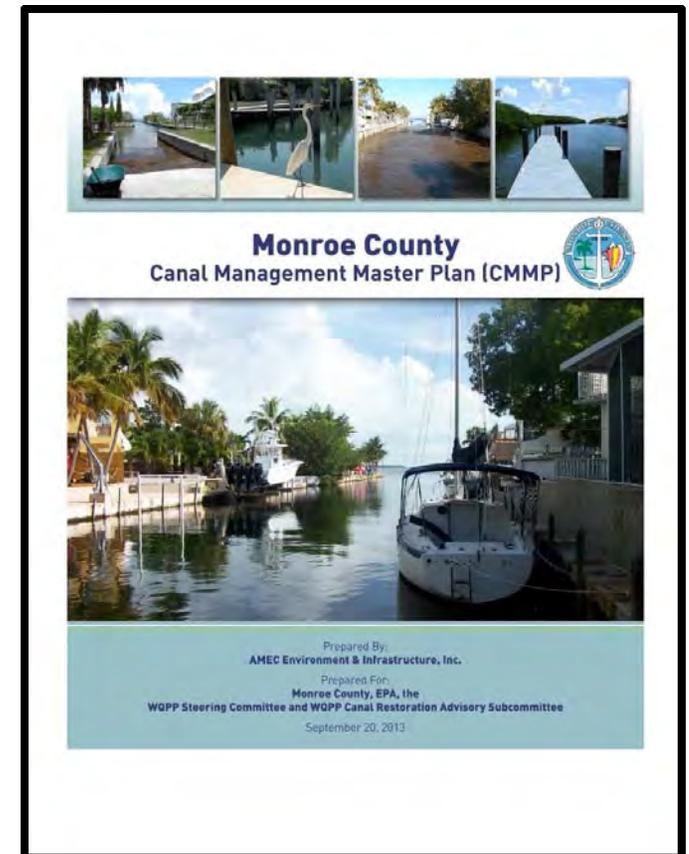
Advisory: Wendy Blondin - Amec Foster Wheeler



- Preparation of a *Canal Management Master Plan* was the first recommendation of the Subcommittee

Monroe County Canal Management Master Plan (CMMP)

- Simply defined, a *Master Plan* is a plan giving comprehensive guidance or instruction
- Objectives of the Monroe County CMMP:
 - Define goals agreed upon by all stakeholders
 - Develop a basic conceptual framework for canal restoration and management including prioritization
 - Propose potential corrective actions and management practices that will improve water quality in residential canals.
 - Identify funding sources to complete the tasks



Identified Canal Management Issues and Goals

Water Quality – Nutrient and Dissolved Oxygen Related Issues

- Restore and maintain water quality conditions in canal systems to levels that are consistent with the State water quality criteria for Class III waters

Water Quality – Organic Material (e.g. Weed Wrack)

- Reduce the entry and accumulation of seagrass leaves and other 'weed wrack' in affected canals

Sediment Quality

- Reduce the incidence of anoxia (lack of oxygen) and problematic sulfide levels and sediment toxicity in affected canals

Habitat Quality

- Protect aquatic and benthic canal habitats that currently support native flora and fauna, and improve water and sediment quality in other canals to levels that are capable of supporting them

Public involvement

- Create and maintain a constituency of citizens involved in the canal management process



Canal Management Master Plan - Two Step Process

1. Engineering and Science based Assessment and Evaluation

- A. Comprehensive County-wide **mapping** of residential canals
- B. County-wide **field study of water quality** in residential canals
- C. Develop a **ranking system** for categorizing canals based on observed characteristics
- D. **Prioritize** canals based on need for water quality improvement

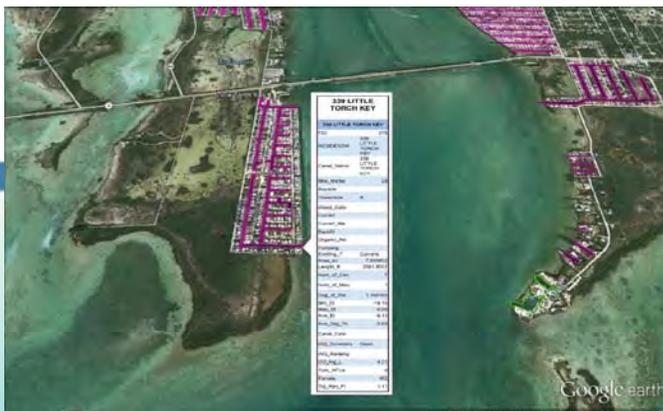
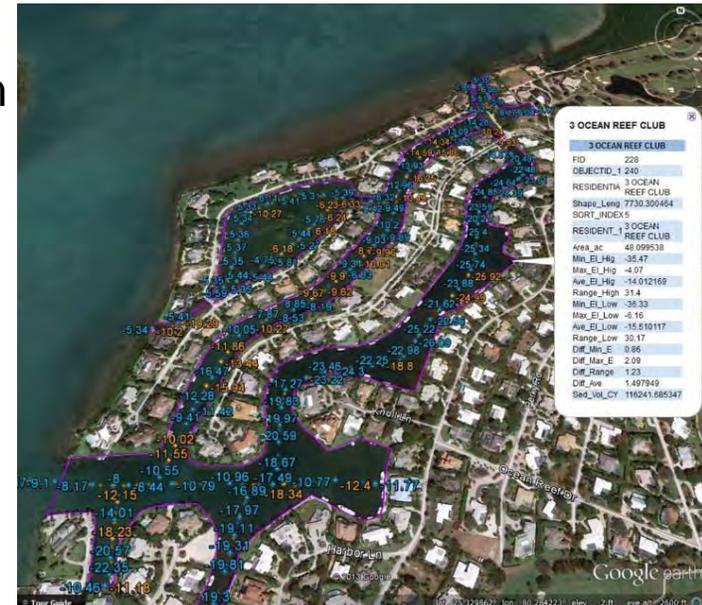
2. Outreach, Management and Program Development

- A. Homeowner **questionnaire**
- B. Prescribe a list of **best management practices** that can be implemented by the homeowners
- C. Identify **funding sources** for implementing canal water quality restoration



1.A. CMMP: Mapping of Residential Canals

- Creation of a canal specific nomenclature that numerically **identifies each canal** within the County
- Bathymetric survey of over **500 residential canals** in Monroe County
- Development of a user-friendly free downloadable **Google Earth database** containing canal specific information
- Availability of **canal specific information**



1.B. Water Quality Assessment

Site visits and assessment of canal conditions

- Visually assess **physical characteristics** of the canals from every neighborhood within Monroe County
 - Length, depth, tidal flushing, seaweed loading
- Collect **water quality data** (dissolved oxygen, turbidity, salinity, pH)
- Observe **biological characteristics**
 - Positive - presence of stony corals, seagrasses or abundance of fish
 - Negative - blue green algae (diatoms), pungent odors, murky water



1.C. CMMP Water Quality Classification

Water Quality Summary Classifications

Total # Canal Systems	502
Good	171
Fair	180
Poor	131
Not Classified	20

1.D. Prioritization of Poor Water Quality Canals for Need for Restoration

- Utilize a **scoring sheet** to rank canals with a Poor Water Quality Classification to assist in **prioritization for restoration**
- **Criteria** (Approved by Canal Restoration Advisory Subcommittee)
 - **Severity of the Problem** - Water Quality, Seaweed Loading, Organic Matter Accumulation
 - **Habitat Quality**
 - Potential for a restoration to provide improvement **within a canal**
 - Potential for a restoration to provide improvement **to near shore zone**
 - Project **constraints** for restoration
 - Homeowner and public **benefit**



2.A. CMMP: An Interactive Process

■ Homeowner Questionnaire

- A three page questionnaire designed to **standardize the collection** of anecdotal data by private homeowners
- The questionnaires are for **planning purposes only** and not provided to any enforcement or regulatory agency
- Encourages residents to take a **greater interest** in their canal as well as develop a **greater understanding** of canal water quality

Residential Canal Homeowner Questionnaire 

1. Homeowner Information:

Name (Optional): _____

Email address: _____

Canal Location/Home Address: _____

Telephone #: _____

2. What issues or concerns do you have with the water quality of your canal?

Seaweed/flotsam _____

Unclear water _____

Bad odor _____

Fish kills _____

Do you swim in your canal: Yes _____ No _____

List other _____

3. Are there certain conditions or times of the year when the water quality in your canal is worse (such as a certain wind direction or a seasonal influence)? Please specify:

4. Is there, or has there been, any treatment systems associated with your canal?

Yes _____

No _____

5. If yes to #4, please indicate the type of canal treatment system:

Aerators _____

Weed gates or bubble curtains _____

Culverts _____

List other _____

CMMP: Inspiring Greater Participation

Helpful Strategies

- Learning the names of your neighbors
- Ask everyone if they are interested in joining a group
- Identify a small project you can work on together as a neighborhood
- The most successful grassroots organizations out there are recognizable by their brand (including their logo, their message, and their spokespeople)
- **Leadership** in the community





How to Access the CMMP Database

Best Management Practices (BMPs)

- All homeowners, waterfront or not, have an important role to play in the achievement of water quality restoration goals for the Keys canals
- **Best Management Practices:** activities, prohibition of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the United States



Best Management Practices – Homeowner Initiated Actions

■ Fish Waste Management

- Dispose of unwanted bait and fish guts offshore or in proper receptacles
- Use fish cleaning stations with trash receptacles and waste water hookups
- Implement fish composting



■ Control What Enters Your Canal

- Prevent yard debris from entering canals, including lawn care company practices
- Maintain appropriate application set backs for yard chemicals
- Limit use of fertilizers
- Limit hosing of docks directly into canals



Best Management Practices – Homeowner Initiated Actions

■ Control of Stormwater Runoff

- Direct rain gutter down spouts to planted areas, not driveways
- Install rain barrels or cisterns
- Use porous pavement or rocks
- Create vegetated buffers



■ Boat Waste Management

- Prevent discharge of oily boat bilge water
- Use biodegradable boat cleaning products
- Properly dispose of oil and old fuel
- Properly maintain your engines
- Painting and other major repairs should be done away from the water



Best Management Practices – Homeowner Initiated Actions (continued)

■ Stop Discharge of Untreated Sewage from Boats

- It is the law
- Spreads disease
 - gastroenteritis, hepatitis, dysentery and cholera.
- Contaminates shellfish beds
- Lowers oxygen levels



■ Tips to Reduce Sewage Discharge

- Use onshore public restrooms whenever possible
- Know where your waste goes and make sure it does not go directly into the water
- Use a holding tank and pump out facilities
- Use enzyme-base products in your holding tank instead of deodorizers and disinfectants which contain chemicals harmful to aquatic life.

Encourage local marina owners to get a pump out station



Best Management Practices (Marinas, and Mechanics)

■ Marinas: Maintenance and Storage of Boats

- FDEP's Clean Marina Program
 - Voluntary program that provides assistance to marinas that implement environmental BMPs
 - 23 Clean Marinas in Monroe County

- Mechanics: Encourage them to use BMPs



Example BMPs

Maintaining Marinas and Boat Basins

- Sweep or vacuum around hull maintenance areas, roads, and driveways frequently
- Sweep parking lots regularly
- Plant turf or other vegetative cover between impervious areas and manmade basins or canals
- Use porous pavement where feasible
- Install oil/grit separators and/or vertical media filters to capture pollutants in runoff
- Add filters to storm drains that are located near work areas
- Place absorbents in drain inlets
- Use chemical and filtration treatment systems only where necessary
- Install fish cleaning stations that include adequate disposal of fish parts



Questions?

Followed by a break

CMMP: Restoration Technologies

- CMMP restoration techniques focused on improving the canal water quality conditions related to **reduced dissolved oxygen** and associated lack of flushing



Examples of Technologies

- **Removal of accumulated organics** from within canals
- **Weed gates, air curtains or other physical barriers** to minimize additional organic accumulation in the canals
- **Culvert connections** to facilitate flushing
- **Backfilling** to prevent occurrence of deep stagnant zones
- **Pumping systems** to facilitate flushing

Recommended Restoration Technologies: Removal of Accumulated Organics

Cause of Impairment: Buildup of organic materials

Prescribed Technology: **Organic Removal**

- Removal of decomposed weed wrack material present at the bottom of a canal depleting the dissolved oxygen and adding nutrients
- Logistical limitations
 - Large volume of suspended sediment and extracted water that requires stabilization
 - Space requirements for dewatering
 - High cost associated with technology
- 2015 modifications to the Monroe County Comprehensive Plan allow for organic material removal below -6 feet MLW on a trial basis for two demonstration projects



Geo Tube Dewatering system

Recommended Restoration Technologies: Weed Gates, Air Curtains or Other Physical Barriers

Cause of Impairment: Influx of seaweed
Prescribed Technology: **Air Curtain**

- Designed to prevent floating, wind-driven seaweed from entering into man-made canals
- The gates are placed at a canal mouth
- Can be comprised of physical barriers or air curtains
- Benefits:
 - Ease of permitting
 - Versatility
 - Low Cost of Implementation

Homeowner Constructed



Homeowner Constructed



Engineered Air Curtain

Recommended Restoration Technologies: Culvert Connections

Cause of Impairment: Lack of tidal flushing / stagnant water

Prescribed Technology: **Culverts**

- Installed between canals or between canals and thin strips of land separating bodies of water
- Improve natural tidal flushing
- Success based on canal specific hydrology and location relative to adjacent canal
- Considerations:
 - Low maintenance costs
 - Proven success



Recommended Restoration Technologies: Backfilling Deep Canals to Shallower Depths

Cause of Impairment: Extremely deep (>20 feet deep) stagnant pockets

Prescribed Technology: **Backfilling**

- Placement of clean backfill material up to an elevation of 6 to 8 feet below mean sea level
- Promotes flushing, reduces/eliminates stratification and create a conducive habitat for marine life
- **Logistical limitations**
 - Turbidity caused by placement of backfill material
 - Canal access for staging and emplacement of backfill
 - High cost associated with technology

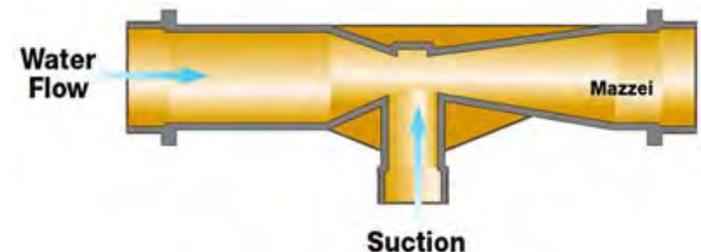


Recommended Restoration Technologies: Pumping Systems

Cause of Impairment: Lack of Flushing due to canal configuration

Prescribed Technology: **Pumping**

- Pumps installed to promote water circulation within a canal and enhance tidal flushing
- Water can be pumped from clean near shore areas to the back end of stagnant canals
- Careful design required to prevent adverse secondary effects such as re-suspension of sediments or bottom scouring
- Tidal studies and hydraulic modeling required to design systems



Where Do We Start?

- The Canal Restoration Advisory Subcommittee recommended that the first step to implement the CMMP was a **Canal Restoration Demonstration Program**
- The purpose is to:
 - Implement CMMP technologies
 - Evaluate the effectiveness of the technologies
 - Obtain realistic permitting, scheduling, and cost information
- Monroe County funded **\$5 Million** for canal demonstration projects in Unincorporated Monroe County
- The Village of Islamorada funded \$100,000 to join in the demonstration program



Canal Restoration Demonstration Selection Process

- Only canals identified by the CMMP with *Poor Water Quality* were selected
- CMMP Ranking Number utilized to prioritize canals
- Needed broad *homeowner support*
- Construction *costs* within budget
- Demonstration Project Ranking Sheets developed based upon:
 - Ease of Permitting
 - Ease in Implementation



Canal Restoration Demonstration Selection Process (continued)

- Ranking performed for each applicable restoration technology
- Process approved by the *Canal Restoration Advisory Subcommittee*, the County and the Village
- Stakeholder meetings held and over 700 homeowner approval letters sent canal property owners
- Unincorporated Monroe County and the Village each selected their demonstration projects
 - Monroe County – 7 projects
 - Village – 1 project



Monroe County Demonstration Projects

Weed Barriers	Organic Removal	Culvert Installation	Backfilling	Pumping
<p>#266 Big Pine Doctor's Arm between Witters & Bailey Lanes</p> <p><i>Same Canal – 2 categories</i></p> <p>#1</p>		<p>#459 Geiger Key Boca Chica Ocean Shores between Boca Chica Rd & Jay Lane</p> <p>#2</p>	<p>#29 Key Largo Sexton Cove between Bunting & Pigeon Drives</p> <p>#3</p>	<p>#278 Big Pine Eden Pines Colony Pine Ave</p> <p>Not Included in current permitting scope – access issue caused delay, evaluating redesigns</p> <p>#7</p>
<p>#287 Big Pine Atlantic Estates between Hollerich and Atlantis Drs</p> <p>#4</p>	<p>#290 Big Pine between Ave I and J</p> <p>Canal already has an existing effective weed gate</p> <p>#5</p>	<p>#277 Big Pine Tropical Bay between Watson Blvd and Sunrise Drive</p> <p>#6</p>		
		<p>#472 Geiger Key Geiger Mobile Homes</p> <p>DEP Grant Project</p>		

Islamorada Village of Islands Top 10 Canals and Approved Canals for Demonstration Funding

	Weed Barriers	Organic Removal	Culvert Installation	Pumping	Backfilling
1	#137 Plantation Key Treasure Harbor	#148 Lower Matecumbe Key Mate-Lido Beach	#157 Lower Matecumbe Beach	#120 Plantation Key Indian Key Waterways	#116 Plantation Key Tropical Atlantic Shores
2	#148 Lower Matecumbe Key Mate-Lido Beach	#147 Lower Matecumbe Key Mar Celeste Am.	#120 Plantation Key Indian Waterways		#137 Plantation Key Treasure Harbor
3	#116 Plantation Key Tropical Atlantic Shores	#145 Lower Matecumbe Matecumbe Ocean View			#143 Upper Matecumbe Key Palm Harbor
4	#132 Plantation Key Plantation Lake Estates	#157 Lower Matecumbe Beach			#145 Lower Mat Matecumbe Ocean View
5	#145 Lower Mat Matecumbe Ocean View				#120 Plantation Key Indian Waterways
6	#147 Lower Matecumbe Key Mar Celeste				#110 Plantation Key Plantation Tropical Park

Update on Canal #29 Backfilling Demonstration Project Sexton Cove, Key Largo between Pigeon and Bunting Drives

1. Restoration consists of placing 25,000 cubic yards of clean fill to raise canal bottom elevation to -7.7 ft MLW from -35 ft

2. Update on Permitting Process

- a) SFWMD ERP submitted 9-24-14 obtained 10-29-14
- b) FKNMS Permit submitted 10-14-14 obtained 11-11-14
- c) USACE Permit submitted 9-24-14 obtained 12-31-14 (with Federal Consultation)
- d) Special Use Permit for Temporary Construction Staging and Monroe County Building Permits obtained 2-25-15



3. Update on Contractor Selection

- a) Proposal opening held January 6, 2015
- b) Adventure Environmental Inc. selected
- c) NTP issued 3-2-15
- d) Construction Cost \$1,360,000



Canal #29 Backfilling Demonstration Project - Sexton Cove, Key Largo (con't)

4. Construction Process

- a) Clean backfill transported by trucks from Florida City
- b) 10-20 trucks per day estimated
- c) Vacant lot at 11 Pigeon Drive used for staging backfill
- d) Excavator or bobcat will load fill onto a conveyor belt
- e) Fill moved onto a 60'x24' barge for uniform emplacement throughout the canal
- f) Turbidity curtains required at canal mouth to isolate construction disturbance from Outstanding Florida Waters
- g) Canal will be closed to boat traffic during construction
- h) REMEMBER – these are demonstration projects, meant to test time, techniques, and costs.



5. Project Schedule

- a) **Construction started March 4, 2015**
- b) 90+ days estimated completion time



Update on Organic Removal Projects

Canal #266 Drs. Arm & #290 Avenue J, Big Pine Key

1. Restoration consists of removal of decayed seaweed and muck from the canal bottoms

- a) Canal #266 8,300 cubic yards from -3.4 to -8.4 feet MLW
 - a) Removing 5 ft of muck
- b) Canal #290 4,700 cubic yards from -3.9 to -8.9 feet MLW
 - a) Removing 5 ft of muck



2. Update on permitting status

- a) SFWMD ERP submitted 11-13-14 obtained 12-04-14
- b) FKNMS Permit submitted 11-18-14 obtained 12-22-14
- c) USACE Permit submitted 11-13-14 obtained 1-02-15 (with Federal Consultation)
- d) Special Use Permit for *Temporary Construction Staging* approved at Feb 18, 2015 BOCC meeting
- e) Comp Plan Amendment final approval received Feb 27, 2015



Construction and Schedule for Organic Removal – Canal #266 Drs. Arm & #290 Avenue J (con't)

3. Update on Contractor Selection and Schedule

- a) Proposal opening held January 14, 2015
- b) Lowest cost for both canals was \$1,839,905
(Canal #266 only \$1,202,163 and Canal #290 only \$849,840)
- c) Negotiating a contract with JND Thomas
- d) Anticipate contract award in April 2015
- e) Project initiation expected in May 2015



4. Construction Methodology

- a) Hydraulic vacuum dredge removes sediment
- b) Dredge spoils piped to land side staging areas
- c) Spoils dewatered using a mix tank, hydro-cyclone, clarifier, and belt press
- d) Reuse of dredge spoils at a local facility being evaluated



Update on Demonstration Projects for Culvert Installation in Canals #459 Geiger Key and #277 Big Pine

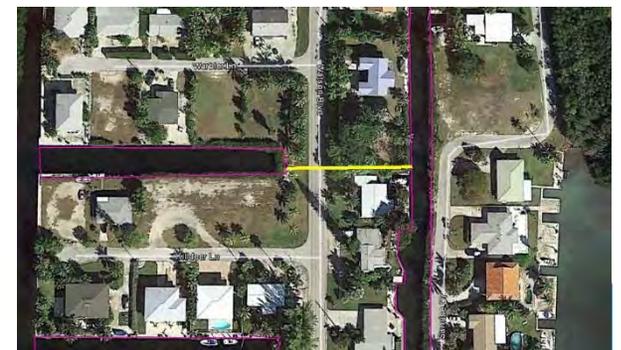
1. Canal #459 Boca Chica Ocean Shores between Boca Chica Rd & Jay Lane, Geiger Key – 1st ranked canal

- a) Access approval for the culvert slowing down design



2. Canal #277 Tropical Bay, between Watson Blvd and Sunrise Drive, Big Pine Key – 2nd ranked canal

- a) Design is more complex due to multi-finger construction of canal and homeowner concern of entry of seaweed
- b) Original culvert design connected main canal to open bay but seaweed entry required a redesign
- c) Hydraulic modeling completed connecting main canal to a small dead end finger canal
- d) Final design/permitting to be completed in March 2015
- e) Request for Proposals scheduled for April 2015
- f) Construction start date estimated for June/July 2015



Geiger Key #472 Culvert Installation Project

DEP Funded - Boca Chica Rd btw Venus and Mars Lanes

1. Project consists of installation of a concrete culvert underneath Boca Chica Road to create tidal connection between two dead end canals (#472 and #470)

2. Deign and Permitting

- a) Completed in June 2014 under a separate DEP \$100,000 Design Grant

3. Update on Contractor Selection and Schedule

- a) Project went out for bid September 2014
- b) Monroe County approved a contract with Charley Toppino & Sons, Inc., the lowest bidder, at the December 2014 BOCC meeting
- c) Monroe County approved funding \$121,350 of the total cost
- d) DEP Grant is funding \$78,291
- e) Remaining Grant funds are for Construction Engineering Services



Geiger Key #472 Culvert Installation (con't)

4. Construction Methodology

- a) Install a 112 foot 24-inch by 38-inch submerged elliptical concrete culvert at a depth of approximately 4.5 feet below ground surface
- b) Placement is above existing sewer pipe
- c) One lane of Boca Chica Road will always remain open and traffic will be directed by flagmen and signage
- d) Remove and replace a portion of the concrete seawalls
- e) Cofferdams, dewatering pumps, and turbidity barriers will be installed around the in-water work areas to prevent sediment transfer and wildlife impacts
- f) All impacted areas will be restored to pre-construction conditions.

5. Update on Project Schedule

- a) **Start of installation March 9, 2015**
- b) Anticipate project construction completion March 27, 2015



Update on Canal #278 Pumping Demonstration Project - Eden Pines, Big Pine Key

1. Restoration consists of pumping clean bay water to the farthest ends of the Eden Pines canal system to increase natural tidal flushing

2. Design requires access from USFWS

- a) Discussed two alternative conceptual designs with USFWS at a Sept 2014 meeting
- b) A revised conceptual design was prepared after the meeting
- c) Design distributed to homeowners for review in Feb 2015
- d) Conceptual design to be presented at next Canal Restoration Subcommittee meeting

3. Overview of Conceptual Design

- a) Pump intakes south side of Watson Boulevard culverts
- b) Two pumps installed in a wet well – est. capacity 1200 gpm
- c) Water pumped to northern and eastern fingers of the canal
- d) Likely pump only during the outgoing tide
- e) Venturi aeration pump located at the Watson Blvd Bridge crossing to assist with water quality treatment at initial startup until adequate flushing has occurred



Update on Demonstration Projects for Air Curtains Canals #266 & #287 Big Pine Key & #137 Plantation Key

1. Three demonstration projects for air curtains

- a) **Air Curtain Alone** – Canal #287 Atlantic Estates between Hollerich and Atlantis Drives, Big Pine Key
- b) **Air Curtain Combined with Organic Removal** – Canal #266 Doctors Arm between Wiitters and Baileys Lanes, Big Pine Key
- c) **Air Curtain Combined with Aerators** - #137 Treasure Harbor, Plantation Key, Islamorada



2. Effectiveness Monitoring will Compare Results

3. Canals #287 and #266 in Big Pine

- a) Final design and permitting underway
- b) **Construction start date estimated for June/July 2015**

4. Canal #137 Treasure Harbor - System Installed Nov 2014



Islamorada Village of Islands Demonstration Project Construction - Canal #137 Treasure Harbor

■ Pre-Construction Meeting

- Held October 15, 2014 on-site
- Reviewed plans, schedules and permit requirements

■ Phase 1 – Land Side Work

- Compressor Installation and Electric Hookup
- 8 high flow (21 cfm) compressors placed inside two compressor cabinets for the air curtain
- 1 large Lake compressor in a separate cabinet for basin aerator upgrade
- Installation completed on October 30, 2014



Islamorada Village of Islands Demonstration Project Construction - Canal #137 Treasure Harbor

■ Phase 2 In-Water Work – Air Curtain

- Diffuser installation and pipe laying
- 20 Teflon coated membrane air diffuser disks mounted on 10 emitter assemblies set in an arc at canal mouth
- Self weighted tubing installed from air curtain to HOA park – location of compressors
- Air Curtain installation completed November 3-4, 2014



■ Phase 3 In-Water Work – Basin Aerators

- 6 Airstations, each comprised of 5 diffusers, installed throughout basin
- Elevated 18 inch base
- Basin Aerator installation completed November 4, 2014



WATER QUALITY AND BENTHIC MONITORING FOR CANAL RESTORATIONS



Florida International University

Henry O. Briceño
Southeast Environmental Research Center

Jason Howard and James Fourqurean
Seagrass Ecosystems Research Lab



Seagrass Ecosystems
Research Lab
Florida International University

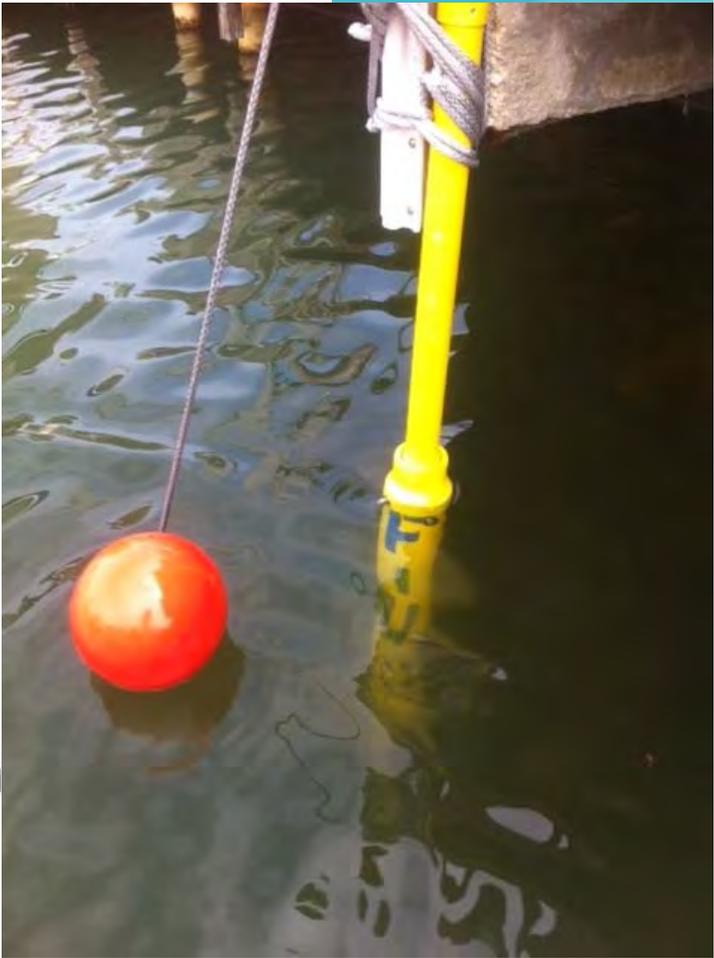
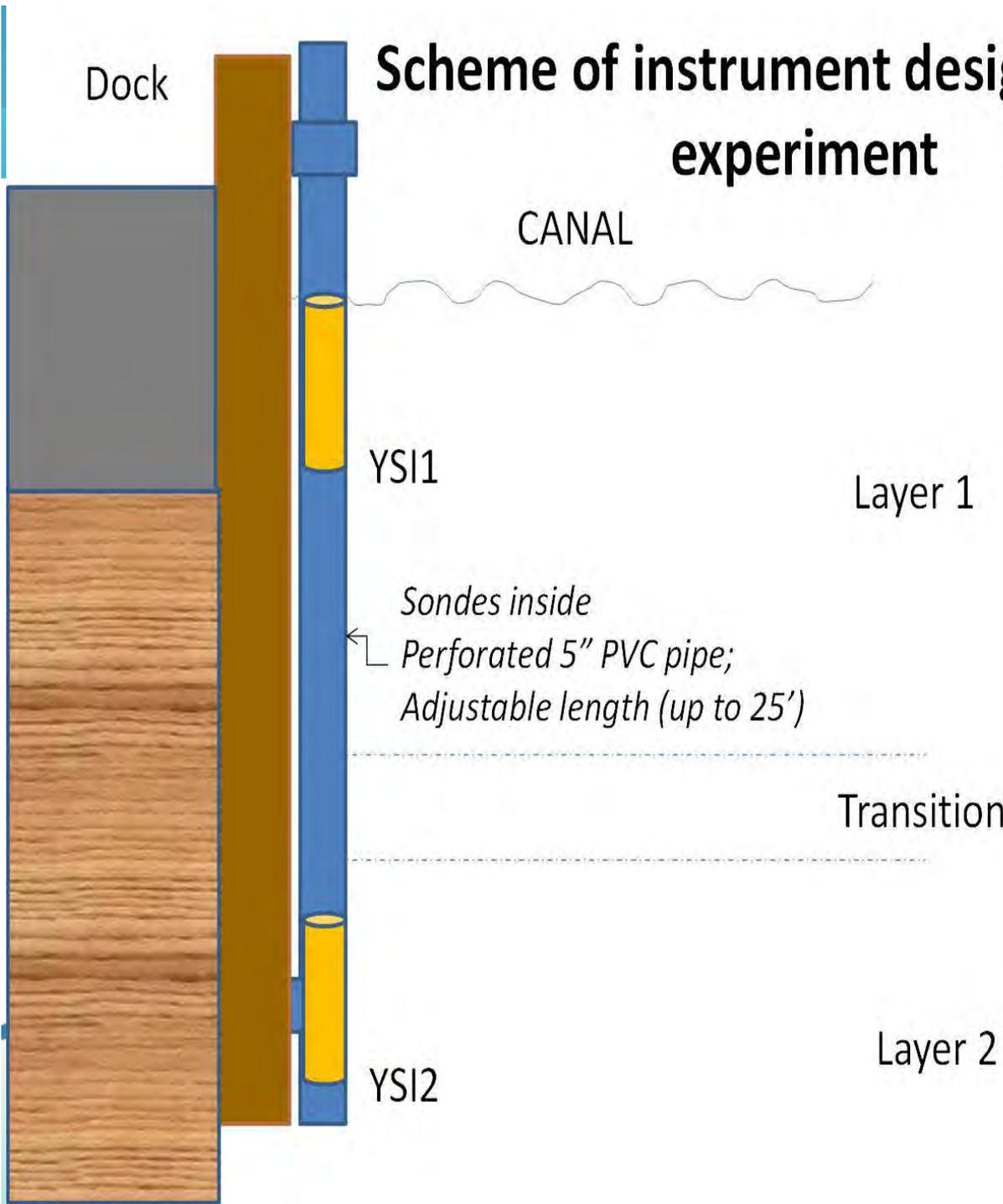


Water Quality Monitoring Toolkit

- **Profile measurements** (YSI and Seabird)
 - Temperature, DO, Depth, Conductivity, Salinity, pH, Turbidity, Photosynthetically Active Radiation, Colored Dissolved Organic Matter
- **Diel cycles** (24 h @ 10 min sampling rate)
 - DO, Turbidity, Conductivity, Salinity, Temperature, pH
- **Water Quality analysis**
 - Nutrients - Total Nitrogen, Total Phosphorous, Dissolved Inorganic Nitrogen
- **Enterococci bacteria** analysis (Enterolert)
- **Pre-restoration and post-restoration monitoring**



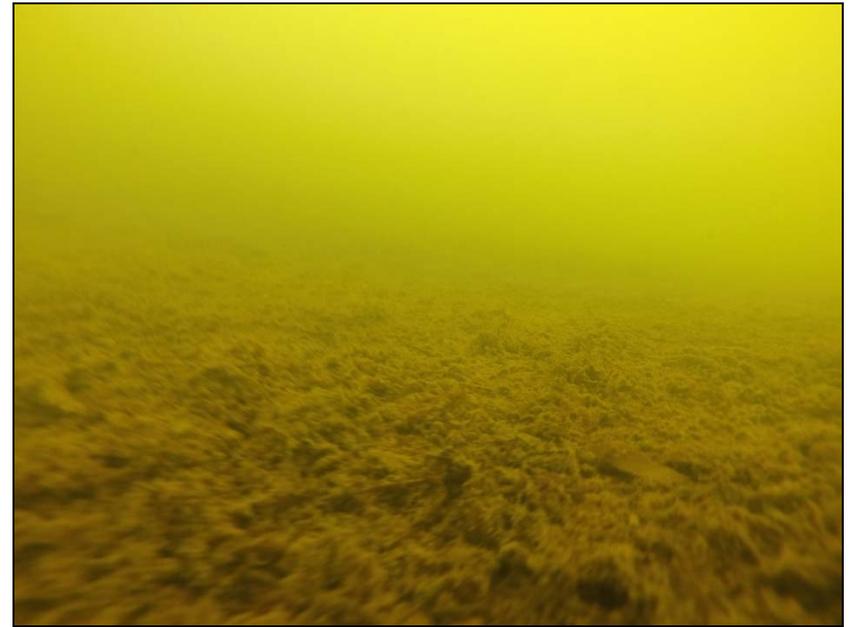
Scheme of instrument design for diel experiment



Benthic Communities in Canals



50 meters outside canal



25 meters inside canal

Presentation Roadmap

What we sample

- Seagrass and algae
- Fish and other marine life
- Organisms on sea wall
- Sediment characteristics

Where and when we sample

- Experimental Design
- Sampling Schedule

Baseline and Post Restoration

- Seagrass/algae
- Animals
- Sea wall
- Sediment



Florida Keys Water Watch

- Shelly Krueger
- Florida Sea Grant/Monroe County Extension
- 1100 Simonton Street, Suite 2-260
- Key West, FL

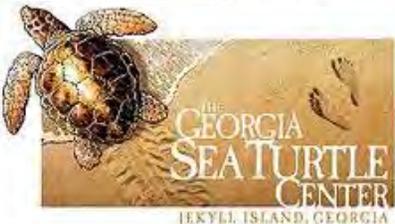
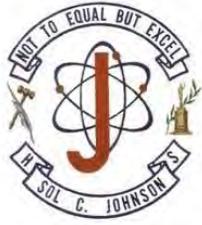
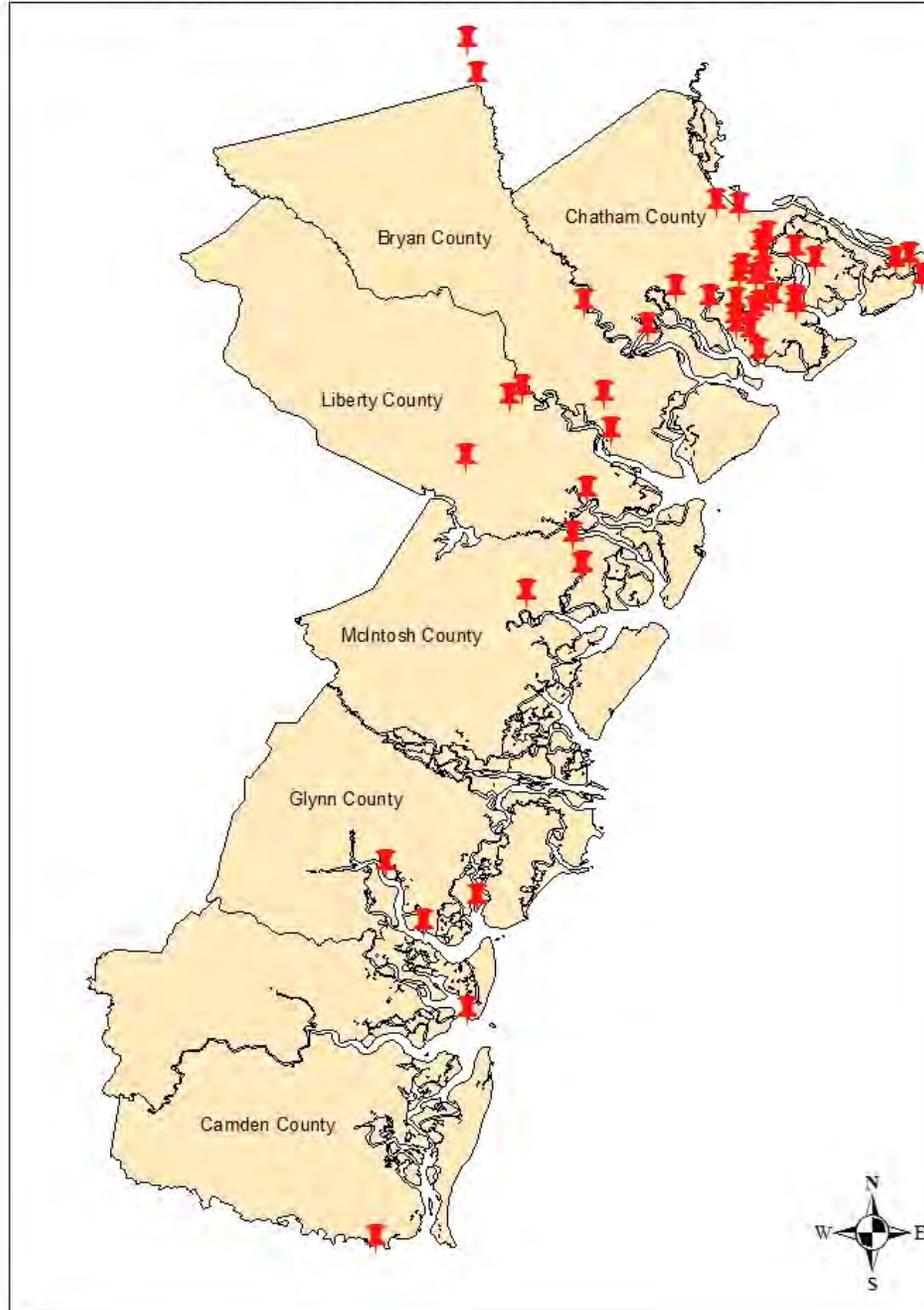


Florida Keys Water Watch Program Goals

- **A:** AWARENESS – Importance of water quality
- **D:** DATA – Collect water quality data
- **A:** ADOPT – BMPs to prevent pollution
- **P:** PARTNERSHIPS – Citizens & agencies
- **T:** TOOLS & TRAINING – To evaluate local waterways & encourage stewardship



Coastal GA Adopt-A-Wetland Sites



A HOME & SCHOOL FOR BOYS SINCE 1740



Citizen Science

- GA Adopt A Stream QAPP
- GA DNR EPD Water Quality Database
- EPA-approved chemical monitoring program

USE	State Government	Federal Government	Local Government	University Scientists
Education	202	84	242	156
Establish baseline condition	231	84	185	100
Problem Screening	205	44	201	55
Research	175	87	107	184
Advocacy	88	32	106	37
Nonpoint Source Assessment	169	58	153	48
Restoration project planning	102	53	128	29
Land use decisions	69	31	150	18
Enforcement	103	31	84	7
Legislation	67	18	40	7
305(b) Report	96	24	14	6
Swimming advisories	26	3	26	4
Shellfish bed closures	28	1	11	1

Table 1. Environmental Protection Agency Survey of Volunteer Data Uses and Users (USEPA, 2011)

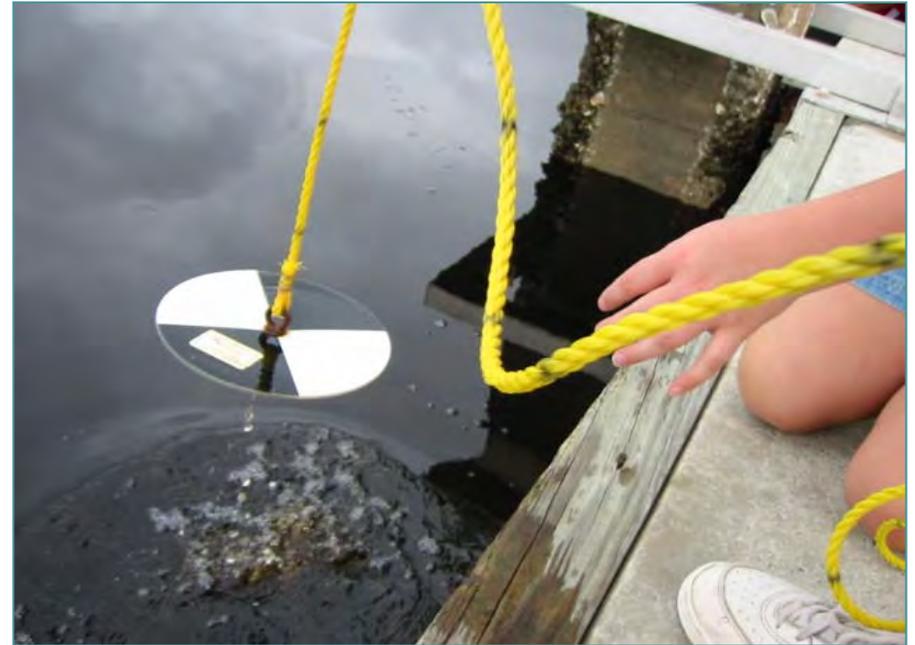
Florida Keys Water Watch 4-Hour Workshop

- Chemical Monitoring PPT
- Demonstrate chemical tests in the field:
 - ✓ Two samples
 - ✓ These samples must be **within 10%** of each other
- DNR-EPD WQ DB
- Written test >80%



Chemical Water Quality Data

- Lamotte Kits
 - Dissolved oxygen (DO), pH, Nitrate, Orthophosphate, Alkalinity
- Temperature
- Salinity
- Turbidity



Volunteer Responsibilities

- Monitor site at least monthly
- Legal Access
- Enter data into GA-DNR EPD DB
www.georgiaadoptastream.org
- Create a “Who to Call List”
- Consistency: Same location, same tidal stage

GA-DNR EPD Water Quality Database

www.georgiaadoptastream.org

Click on a program below to visit each website

 Georgia Project WET Water Education for Teachers	 Georgia River of Words Environmental Poetry & Art Project	 Georgia Adopt-A-Stream Volunteer Water Monitoring Program	 Georgia Rivers Alive Volunteer Waterway Cleanups
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Georgia Environmental Protection Division
Watershed Protection Branch

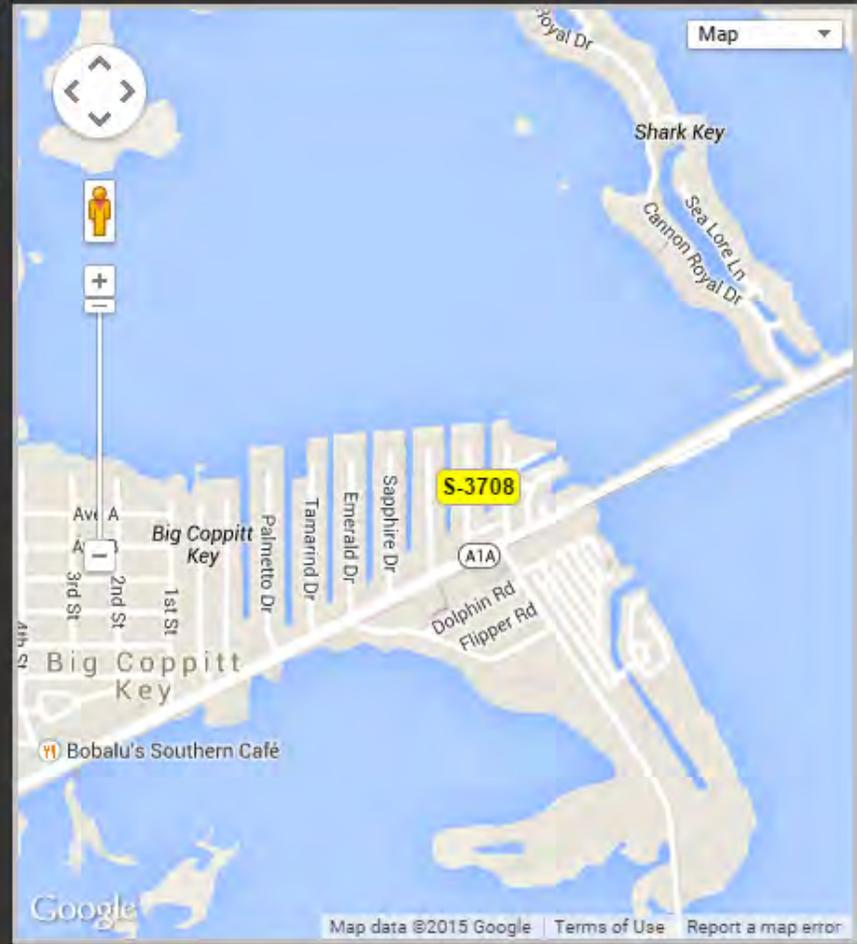
Outreach

Florida Keys Water Watch

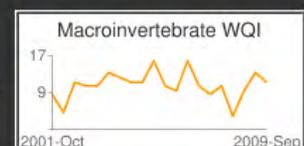
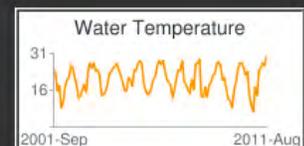
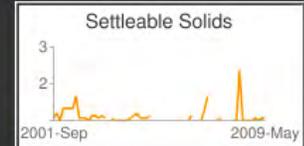
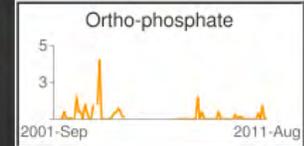
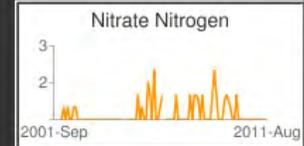
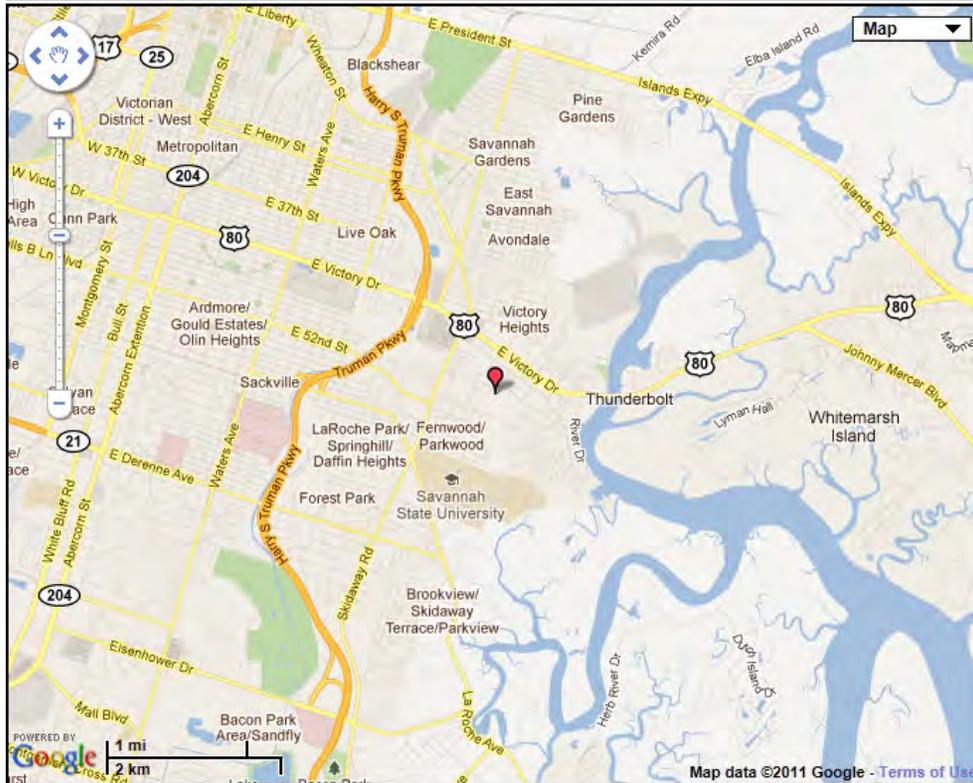
Sites

Members

All sites	Adopt-A-Stream	Rivers Alive	Both programs	No events	
#	Site ID	Waterbody Name	Events	Dates	Excel
1.	S-3708	Waltz Key Basin	1	02/06/2015	
Total Monitoring Events:			1		



Johnson High School Stream Team





Georgia Adopt-A-Stream

GEORGIA'S VOLUNTEER WATER QUALITY MONITORING PROGRAM

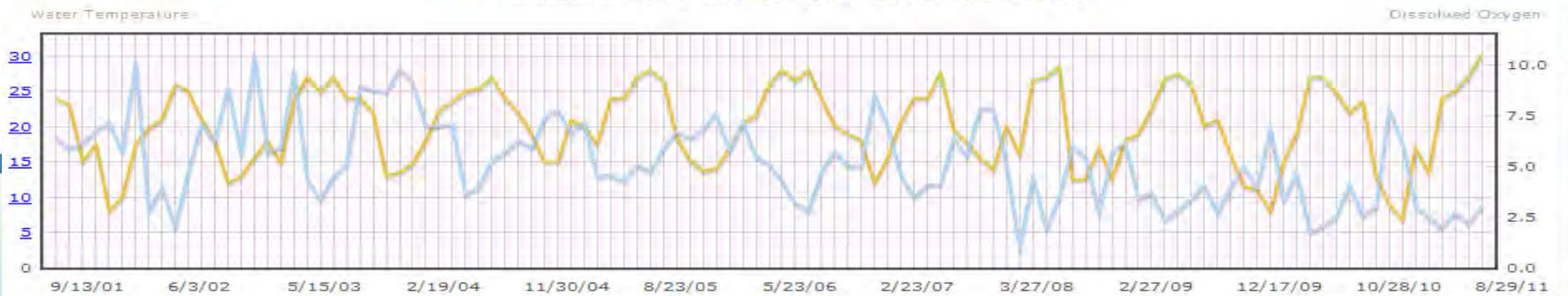


- Adopt-A-Stream
- Get Involved
- Groups
- Sites
- People
- Data Views
- Forms & Reports
- Materials & Resources
- Teacher's Corner
- Contact us
- Sign in

G-516 SCJ Stream Team/Johnson High School S-229 Placentia Canal

Date/Time	09/13/2001 <small>08:30 am</small>	10/04/2001 <small>01:30 pm</small>	11/05/2001 <small>01:00 pm</small>	12/14/2001 <small>01:45 pm</small>	01/08/2002 <small>12:00 pm</small>	01/10/2002 <small>08:30 am</small>	02/05/2002 <small>08:00 am</small>	03/07/2002 <small>01:00 pm</small>	04/30/2002 <small>08:00 am</small>	05/16/2002 <small>08:00 am</small>
Time spent monitoring minutes	-	-	-	-	-	-	-	-	-	-
Rain in past 24 hours	Heavy Rain	None	Intermittent Rain	None	-	None	None	None	None	None
Current conditions	Overcast	Clear/Sunny	Overcast	Overcast	-	Clear/Sunny	Clear/Sunny	Clear/Sunny	-	Clear/Sunny
Water Temperature °C	24	23	15	17.5	-	8	10	17.5	19.75	21
Air Temperature °C	25	29	17	24	-	6.5	0	21	20	24
pH	6.5	7.5	7.5	7	-	7	7	7.5	7	7
Dissolved Oxygen mg/L	6.4	5.9	6.2	6.75	-	7.2	5.7	10.2	2.8	4
Alkalinity mg/L	40	94	125	-	-	-	-	-	-	-
Nitrate-Nitrogen mg/L	<0.5	1.5	<4.4	0	-	0	0.5	0	0.5	0
Ammonia-Nitrogen mg/L	-	-	-	-	-	-	-	-	-	-
Ortho-phosphate mg/L	<1	<1	<1	0	-	0	0.5	0.1	0	0.1
Settleable Solids mg/L	0.1	0.3	-	-	-	0	0.5	0.5	0.5	0.5
Salinity ppt	-	-	-	-	-	-	-	-	-	-
Water Quality Index	-	8	-	-	4	-	-	-	-	-
Event ID	1123	1124	1122	1204	1206	1205	1325	1326	1327	1328

- Water Temperature (range 6.75 - 30, average 20.12)
- Dissolved Oxygen (range 0.9 - 10.5, average 20.12)



<input type="radio"/> intermittent rain	<input type="radio"/> none	<input type="radio"/> overcast	<input type="radio"/> partly cloudy	<input type="radio"/> clear/sunny
Amount of rain, if known? <input type="text"/> inches in last <input type="text"/> <input checked="" type="radio"/> hours / <input type="radio"/> days				
Basic Tests	Sample 1	Sample 2		Result
Air Temperature	<input type="text"/>	<input type="text"/>	(°C)	<input type="text"/>
Water Temperature	<input type="text"/>	<input type="text"/>	(°C)	<input type="text"/>
pH	<input type="text"/>	<input type="text"/>	(0 - 14)	<input type="text"/>
Dissolved Oxygen	5.6	8.2	(mg/L or ppm)	error
Conductivity	<input type="text"/>	<input type="text"/>	(µs/cm)	<input type="text"/>
Advanced Tests	Sample 1	Sample 2		Result
Alkalinity	<input type="text"/>	<input type="text"/>	(mg/L or ppm)	<input type="text"/>
Nitrate-Nitrogen	<input type="text"/>	<input type="text"/>	(mg/L or ppm)	<input type="text"/>
Ammonia-Nitrogen	<input type="text"/>	<input type="text"/>	(mg/L or ppm)	<input type="text"/>
Ortho-phosphate	<input type="text"/>	<input type="text"/>	(mg/L or ppm)	<input type="text"/>
Settleable Solids	<input type="text"/>	<input type="text"/>	(mg/l)	<input type="text"/>
Salinity	<input type="text"/>	<input type="text"/>	(ppt)	<input type="text"/>
Other Tests	Sample 1	Sample 2		Result
Fecal Coliform	<input type="text"/>	<input type="text"/>	(cfu / 100 mL)	<input type="text"/>
<i>Escherichia coli</i>	<input type="text"/>	<input type="text"/>	(cfu / 100 mL)	<input type="text"/>
Chlorophyll A	<input type="text"/>	<input type="text"/>	(mg/L or ppm)	<input type="text"/>
Turbidity	<input type="text"/>	<input type="text"/>	(NTU)	<input type="text"/>
Secchi Disk Depth	<input type="text"/>	<input type="text"/>	(cm)	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>



All chemical tests x2 and within 10%!!

Clean Water Act 1972



■ Point Source Pollution

- Pollution you can “Point To”
- Industrial discharge pipe, wastewater treatment pipe
- CWA of 1972
- NPDES permits



■ Non-Point Source Pollution

- Diffuse pollution sources
- Sediment
- Fertilizers
- Pesticides
- Animal wastes
- Runoff
- Impervious surfaces

Importance of Wetlands

Nutrient Cycling

Recreation & tourism

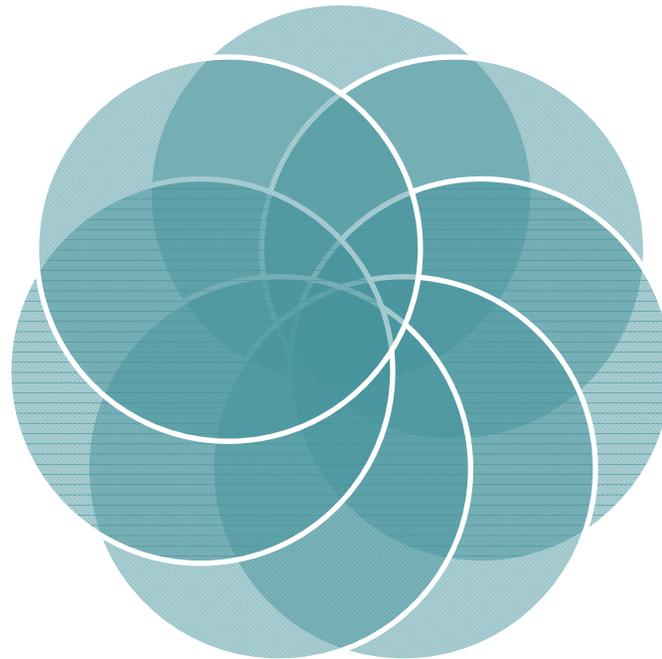
Habitat and forage for marine life and wildlife

Carbon storage

Floodwater, storm surges, pollution, and erosion control

Commercial & recreational fisheries

Water quality



Nutrients & Eutrophication

Sources of Cultural Eutrophication

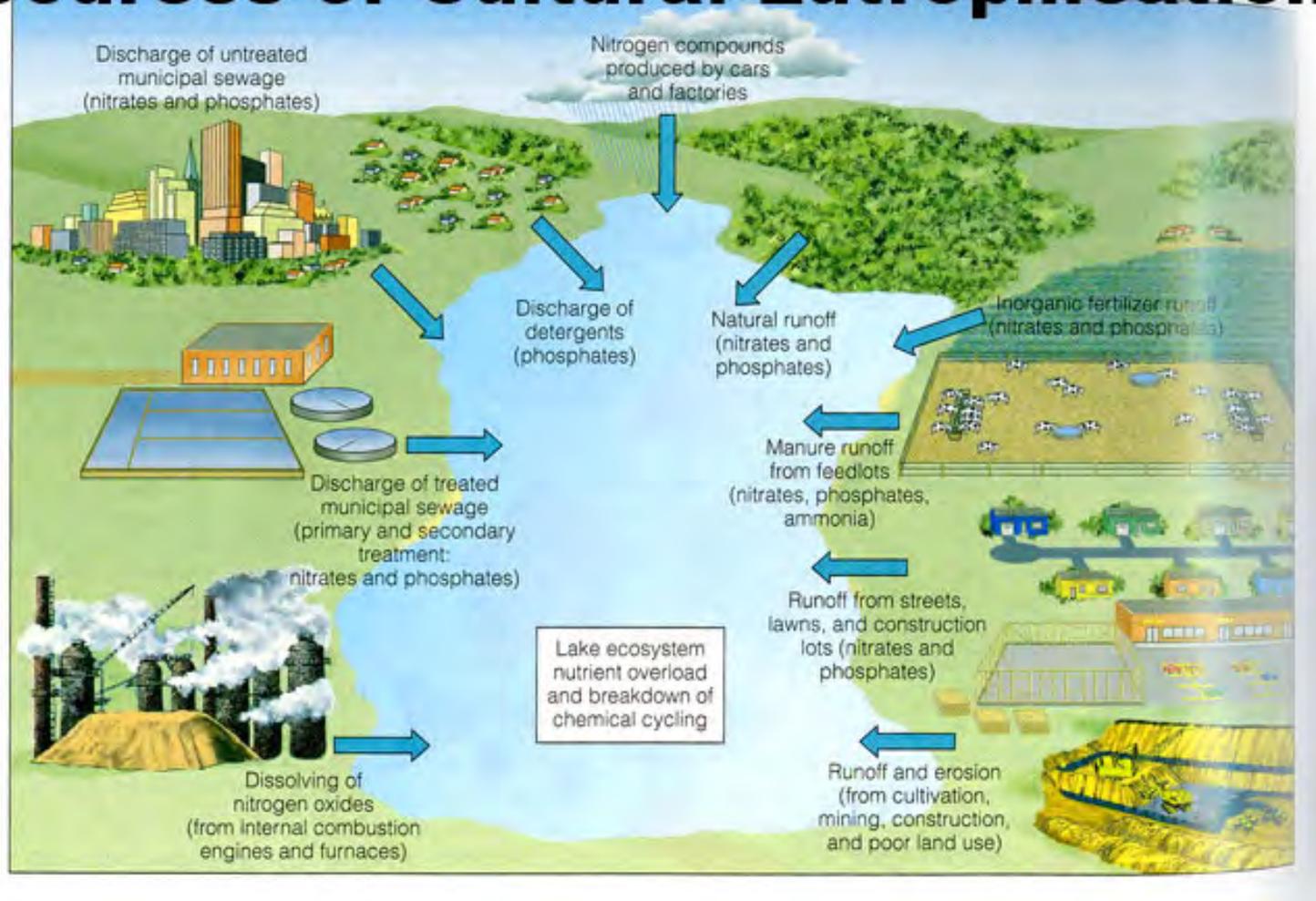
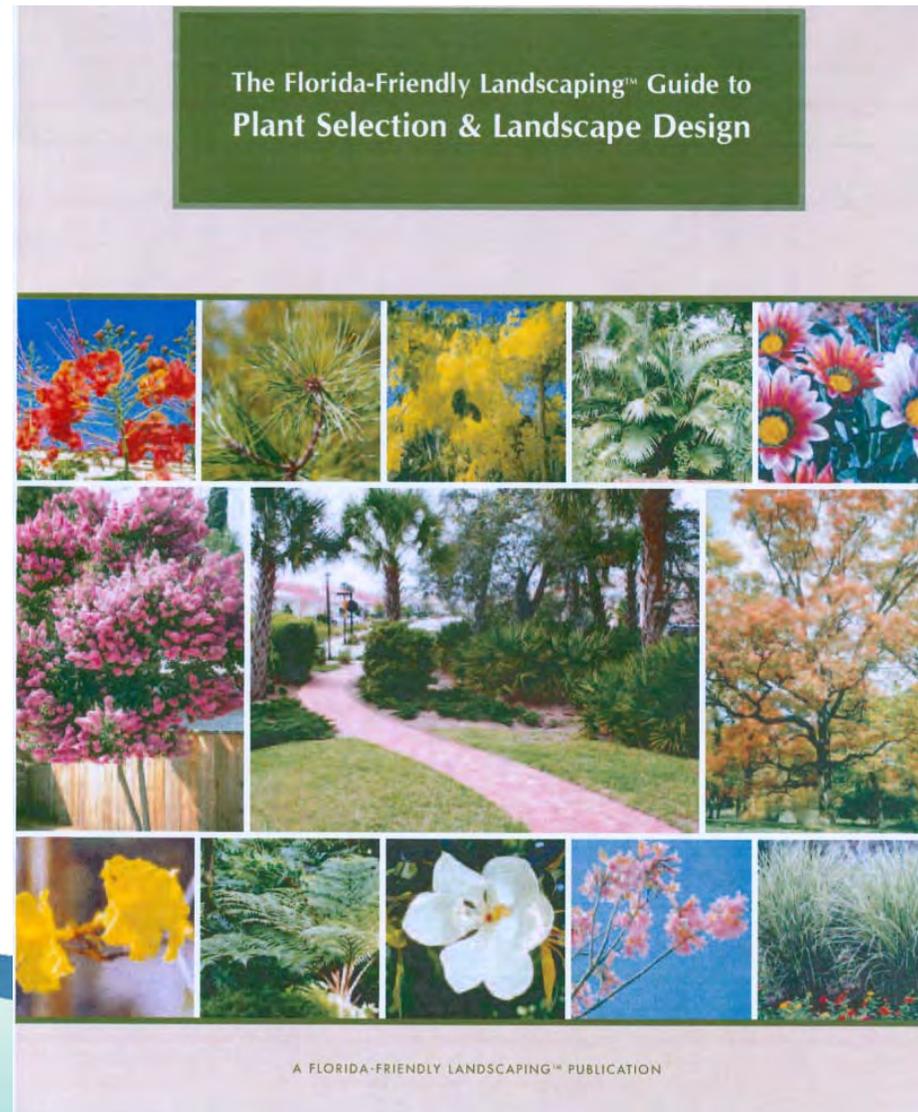


Diagram from British Geographer

Florida Friendly Landscaping



Future



Pilot program

Biscayne Bay Water Watch - HABs

Incorporate biological, bacterial, phytoplankton and microplastics

Questions?

UF | **IFAS Extension**
UNIVERSITY *of* FLORIDA

Next Steps for Canal Restoration

1. Public Outreach and Education

- Video production of demonstration projects
- Other components of EPA Outreach Grant
 - Web-based permitting guidance for homeowners
 - Field trip to a restoration site



2. Complete demonstration projects, evaluate effectiveness, and modify restoration implementation process as needed

3. Identify additional sources of funds to implement more restorations

- Homeowner led restorations
- **RESTORE Act Local Pot funds awarded to Unincorporated Monroe County and Islamorada**





Questions?