MONROE COUNTY'S FLORIDA KEYS CANAL RESTORATION PROGRAM
BBECA WATER QUALITY MEETING

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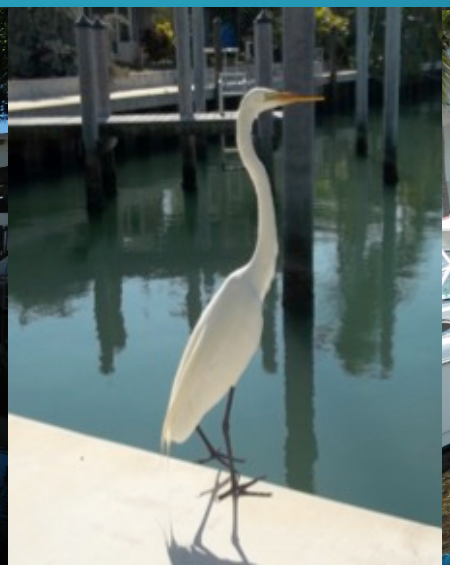
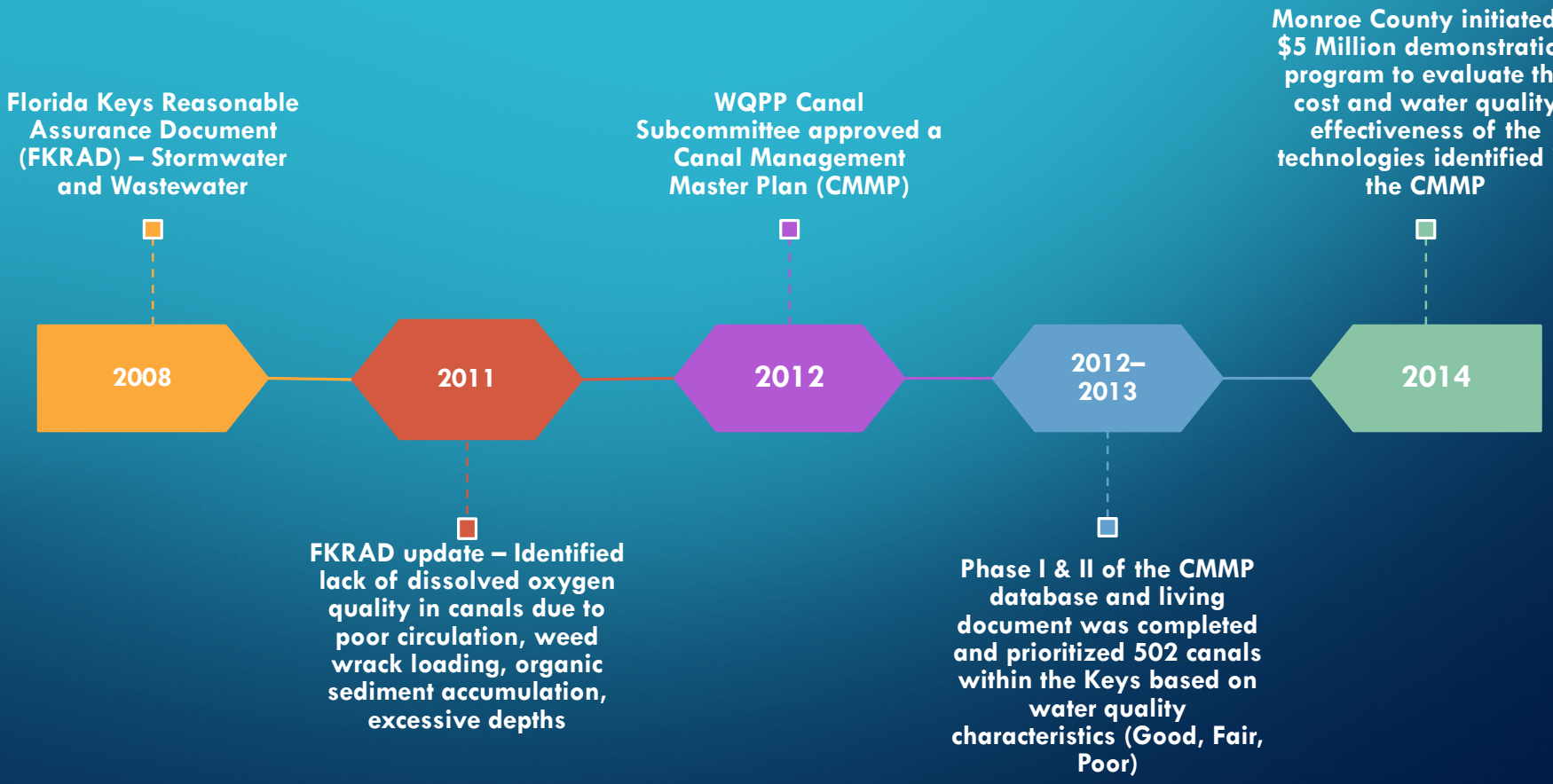
CHIEF RESILIENCE OFFICER
MONROE COUNTY
AUGUST 11, 2021


WHY? CANAL RESTORATION PROGRAM



WHY? CANAL RESTORATION PROGRAM

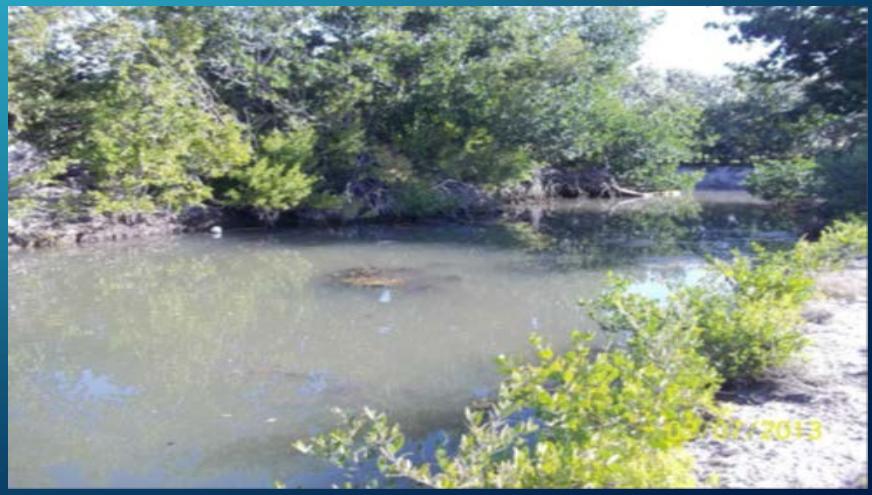
THIS IS WHY RESTORATION IS NEEDED

Upper Keys – accumulated seaweed

“Poor” Water Quality Canals

Middle Keys – trapped seaweed

Summerland– trapped seaweed



Lack of flushing

BEAUTIFUL CANALS CAN BE MISLEADING

Canal 29 in Key Largo Prior to Restoration

Diver in Deadly Hydrogen Sulfide Gas at bottom of Canal

Low Light Conditions at bottom of 40 foot depth prior to Restoration

After Restoration – Still beautiful but now teeming with marine life.

IDENTIFIED CANAL MANAGEMENT ISSUES AND GOALS

1. **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
2. **Water Quality – Organic Material (e.g. Weed Wrack)**
   - Reduce the entry and accumulation of seagrass leaves and other 'weed wrack' in affected canals
3. **Sediment Quality**
   - Reduce the incidence of anoxia (lack of oxygen) and problematic sulfide levels and sediment toxicity in affected canals
4. **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
5. **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

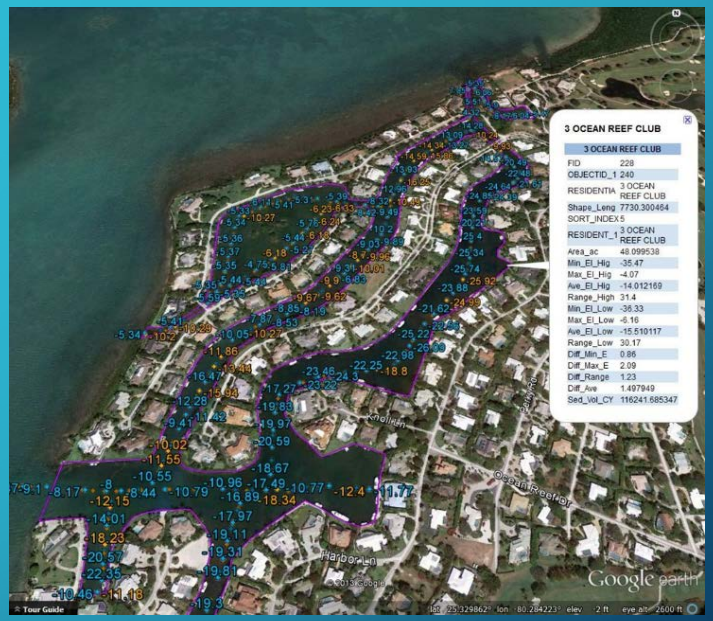
A. Homeowner questionnaire

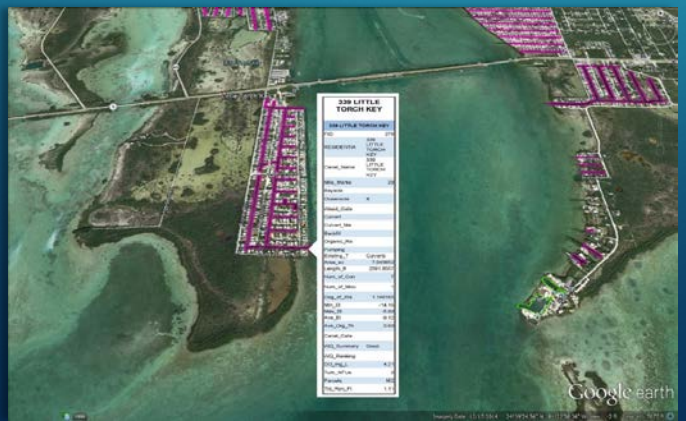
B. Prescribe a list of best management practices that can be implemented by the homeowners

C. Identify funding sources for implementing canal water quality restoration

MAPPING OF RESIDENTIAL CANALS

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





WATER QUALITY ASSESSMENT

Site visits and assessment of canal conditions

A. Visually assess physical characteristics of the canals from every neighborhood within Monroe County
   - Length, depth, tidal flushing, seaweed loading

B. Collect water quality data (dissolved oxygen, turbidity, salinity, pH)

C. Observe biological characteristics
   - Positive - presence of stony corals, seagrasses or abundance of fish
   - Negative - blue green algae (diatoms), pungent odors, murky water

WATER QUALITY CLASSIFICATION

Water Quality Summary Classification - Original

Classification	# Canals (502 Total)
Good	171
Fair	180
Poor	131
Not Classified	20

Water Quality Summary Classification – Current Revised*

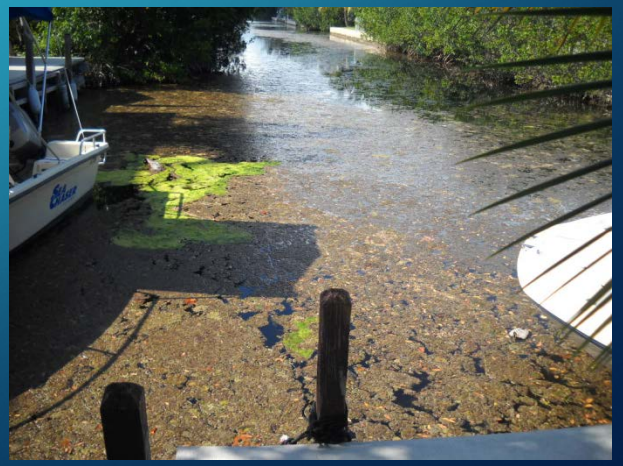
Classification	# Canals (502 Total)
Good	215
Fair	233
Poor	34
Not Classified	20

*In 2013 DEP modified the location/Depth of the sampling, and the DO parameter from a mg/L to % of DO.

PRIORITIZATION OF POOR WATER QUALITY CANALS FOR NEED FOR RESTORATION

1. Utilize a **scoring sheet** to rank canals with a Poor Water Quality Classification to assist in **prioritization for restoration**

2. **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**



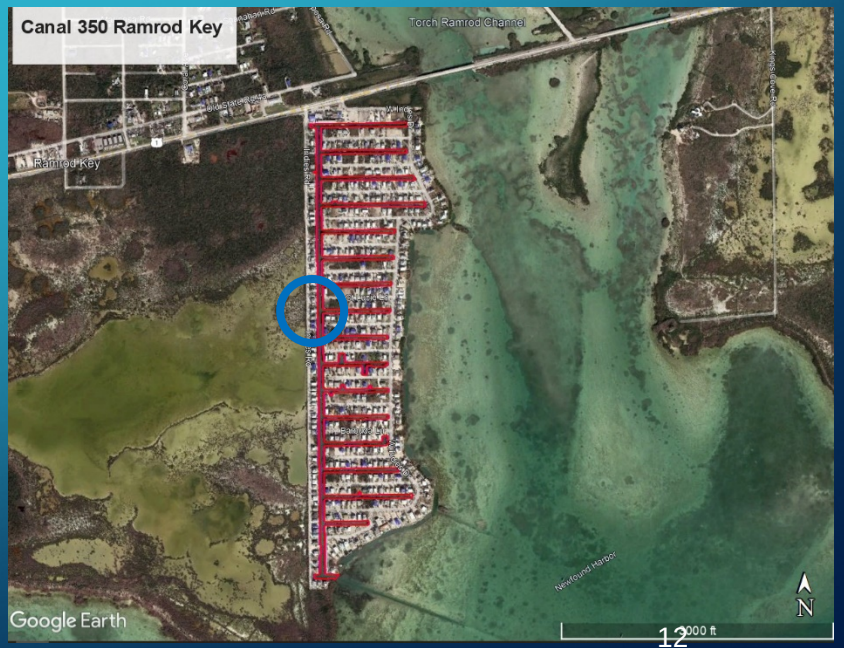
RAMROD KEY, CANAL #350

1. Large canal system with multiple fingers. Rated “Good”. However, do not have a specific water quality reading for each finger yet.

2. The reading was taken in the central portion of the canal system so it may not be reflective of the entire canal system, especially the dead-end portions.

3. County will be obtaining additional Dissolved Oxygen readings in September 2021. Will gather the information for the dead-end portions of the fingers to give a complete picture of the canal system.
   a) Could be added to the project Restoration list.

Average Elevation	**-8.43 feet**
Average Organic Thickness	0.79 feet
Water Quality Summary	Good
Parcels	461
Existing Treatment	Culvert



RECOMMENDED RESTORATION TECHNOLOGIES

Cause of Impairment: *Buildup of organic materials*

Prescribed Technology: **Organic Removal**

1. Removal of decomposed weed wrack material present at the bottom of a canal depleting the dissolved oxygen and adding nutrients

2. Logistical limitations
   - Large volume of suspended sediment and extracted water that requires stabilization
   - Space requirements for dewatering
   - High cost associated with technology

3. 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

Cause of Impairment: *Influx of seaweed*

Prescribed Technology: **Air Curtain**

1. Designed to prevent floating, wind-driven seaweed from entering into man-made canals
2. The gates are placed at a canal mouth
3. Can be comprised of physical barriers or air curtains
4. Logistics:
   - Ease of permitting
   - Versatility
   - Low Cost of Implementation
   - Requires Operations and Maintenc

Homeowner Constructed – Not Permitted

Engineered Air Curtain - Permitted

Homeowner Constructed – Not Permitted

RECOMMENDED RESTORATION TECHNOLOGIES

Cause of Impairment: *Lack of tidal flushing / stagnant water*

Prescribed Technology: **Culverts**

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

RECOMMENDED RESTORATION TECHNOLOGIES

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

Prescribed Technology: **Backfilling to Shallower Depth**

1. Placement of clean backfill material up to an elevation of 6 to 8 feet below mean sea level

2. Promotes flushing, reduces/eliminates stratification and create a conducive habitat for marine life

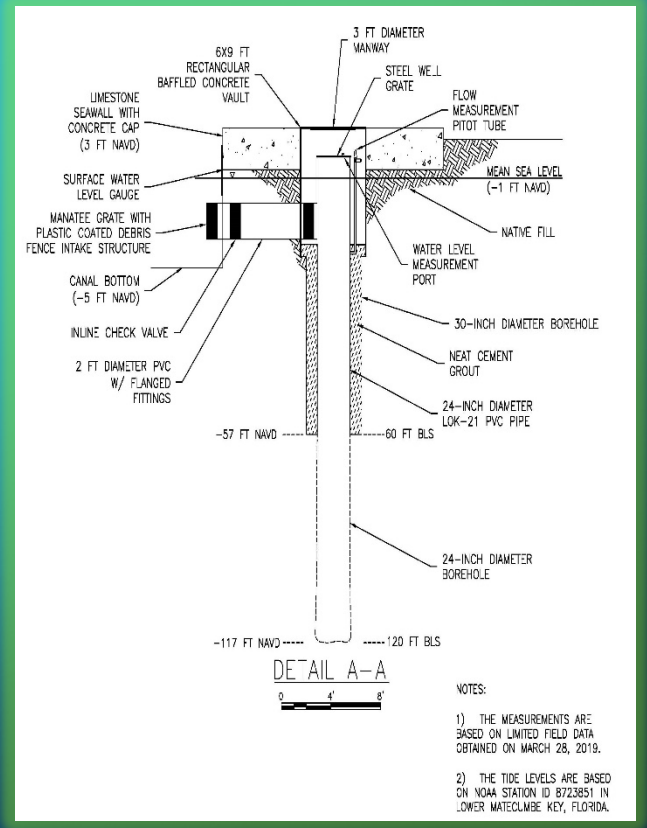
3. **Logistical**
   - Turbidity caused by placement of backfill material
   - Canal access for staging and emplacement of backfill
   - High cost associated with technology
   - No operations and maintenance costs!

RECOMMENDED RESTORATION TECHNOLOGIES

Cause of Impairment: ***Lack of Flushing due to canal configuration***

Prescribed Technology: Injection Well

1. Injection Wells installed to promote water circulation within a canal and enhance tidal flushing
2. Water can be slowly injected into the ground from the back end of stagnant canals to increase circulation fro the front end
3. Careful design required to prevent adverse secondary effects such as re-suspension of sediments or bottom scouring
4. Tidal studies and hydraulic modeling required to design systems



SARGASSUM MASTER PLAN

Monroe County Sargassum Management Master Plan – Phase 1. EPA grant awarded to Monroe County

- A review of existing management strategies from across the region
- Development of a hydrodynamic model that helps explain how sargassum moves into and around the Florida Keys.
- A proposed framework that will encourage regional partners to work together on management strategies and disposal options
- Evaluate existing and proposed strategies for the management of sargassum
- Feasibility of Onshore vs. Offshore disposal options
- Preliminary economic analysis of proposed *management strategies.*

CANAL RESTORATION

Monroe County and Municipalities Canal Program

- Canal Water Quality Improvement projects to increase dissolved oxygen and habitat quality:
  - Air Curtain at mouth of canal to prevent the sargassum from migrating into dead end canals
  - Culvert connections to improve flushing
  - Backfilling deep stagnant canals to increase flushing
  - Organic removal to remove the oxygen depleting decomposing sargassum that has fallen to the bottom of the canals
- Sargassum Skimming Program
  - Evaluated the use of a vessel to remove sargassum within the canals located in Key Largo

CANAL RESTORATION WORK PLAN 2021

The Governor & Cabinet, sitting as the Administration Commission, adopted a new rule (Rule 28-20.140) amending the County Comprehensive Plan to include a 10-year Canal Restoration Implementation work program.

Rule 28-20.140 – Monroe County Comprehensive Plan

(d) Canal Restoration Implementation

- By December 30, 2020, Monroe County and its partners shall update the 2013 Canal Management Master Plan (CCMP) to include any updated water quality assessment of canals, a methodology to prioritize need for water quality improvement, appropriate restoration options and revised canal rankings based on new information.
- By December 30, 2020, Monroe County shall develop and adopt guidelines to select canals for restoration, including a process to evaluate the feasibility of the project, the proposed restoration design (evaluate long-term cost-effective solutions) and associated funding needs.
- By December 30, 2020, and each year thereafter until 2030, the Department of Economic Opportunity shall work with each stakeholder, including but not limited to each local government, Environmental Protection Agency (EPA), United States Army Corps of Engineers (ACOE), Florida Department of Environmental Protection (DEP), National Oceanic and Atmospheric Administration (NOAA), Florida Keys National Marine Sanctuary (FKNMS), and the South Florida Water Management District (SFWMD) to facilitate intergovernmental coordination and expedite review of canal restoration projects within the Florida Keys.

REVISED CANAL RESTORATION RANKING CRITERIA UNDER THE WORK PLAN 2021

Scoring Criteria for Potential Canal Restoration Sites		Canal Name:			
		Score	Weighting Factor	Total Score	Maximum Score
Canal Water Quality Ranking					
1) Water Quality (scored from 0 to + 5) Scoring is based on observed water quality degradation and monitoring conducted by the County.	If no monitoring data is available, or greater than 50 percent of the monitoring data exhibits DO saturation greater than 70 percent; the score is 0.	0	10	0	50
	If 1 to 10 monitoring events have been completed, and greater than 50 percent of the monitoring data exhibits a DO saturation between 42 - 70 %; the score is 1.				
	If 1 to 10 monitoring events have been completed, and less than 50 percent of the monitoring data exhibits a DO saturation below 42 percent; the score is 2.				
	If between 1 and 10 monitoring events have been completed, and greater than 50 percent of the monitoring data exhibits a DO saturation below 42 percent; the score is 3.				
	If greater than 10 monitoring events have been completed, and greater than or equal to 3 monitoring events (or the allowable number pursuant to Table 1 of 62-303) exhibit a DO saturation less than 42 percent; the score is 5.				
	If greater than 10 monitoring events have been completed, and less than 3 monitoring events (or the allowable number pursuant to Table 1 of 62-303) exhibit a DO saturation greater than 42 percent; the score is 0.				
2) Evidence of Nutrient Accumulation (scored from 0 to +5) Scoring is based on the potential discharge of nutrient rich waters from the canals.	For canals that do not receive seaweed loads or do not exhibit elevated nutrient concentrations (evident through slime growth and reduced water clarity); the score is 0.	0	3	0	15
	For canals with moderate seaweed loading, moderate slime growth, moderate water clarity, or moderate reduction in fish habitat; the score is 3.				
	For canals with heavy seaweed loading, significant visual degradation, and lack of fish habitat; the score is 5.				
3) Likelihood of toxicity (scored from 0 to +5) Scoring is based on the likelihood of hydrogen sulfide production based on canal bathymetry.	For canals with an average depth less than 10 feet; the score is 0.	0	3	0	15
	For canals with an average depth between 10 feet and 20 feet; the score is 3.				
	For canals with an average depth greater then 20 feet; the score is 5.				
4) Connectivity to Nearshore Waters (scored from 0 to +5) Scoring is based on the potential of the canal to degrade the water quality in nearshore waters.	For canals that are connected to semi-enclosed waters such as harbors and inlets; the score is 0.	0	2	0	10
	For canals that are connected to open water, but are a sufficient distance away from high flow areas such as tidal channels; the score is 3.				
	For canals that are connected to open water, and are close to high flow areas such as tidal channels; the score is 5.				
5) Potential Nearshore Impact (scored from 0 to +5) The public benefit criterion is related to the number of users affected by the proposed project. A value of 0 means 0-9 users (parcels) would be positively affected by the project, a value of 1 means 10-44 users would be positively affected by the project, a value of 3 means 45-79 users would be positively affected by the project, +5 indicates that 80 or more users would be positively affected.		0	2	0	10

TOP 11 PROJECTS OF CANAL RESTORATION WORK PLAN
MONROE COUNTY BOARD OF COUNTY COMMISSIONERS
JULY 21, 2021

Air Curtain across the mouth of canal

Compressor cabinets and control panel on concrete pad

Rhonda Haag
Monroe County

Ricardo Fraxedas
Greg Corning
Stephen Hanks

CANAL RESTORATION PROJECT RANKING LIST 2021

Canal Restoration Ranking List 4/21/2021

Sort ID	Canal Name	Community Area	2020 - WQ Ranking Score	2020 - Technology Ranking Score	2020 - Total Score	2020 - Technology Recommendation	Restoration Cost	2020 Water Quality Summary
1	105 TAVERNIER	TAVERNIER	36	80	116	Backfill and Culvert and Weedgate	668,871	Fair
2	28 KEY LARGO	KEY LARGO	88	24	112	Backfill Only	2,128,927	Poor
3	255 BIG PINE KEY	BIG PINE KEY	45	65	110	Injection Well and Weedgate	300,000	Fair
4	315 BIG PINE KEY	BIG PINE KEY	64	45	109	Organic Removal, Capping and Weedgate	2,373,982	Poor
5	402 SUGARLOAF KEY	SUGARLOAF KEY	28	80	108	Backfill and Weedgate	210,523	Fair
6	300 BIG PINE KEY	BIG PINE KEY	37	70	107	Organic Removal, Capping and Weedgate	1,490,926	Limited Data - Fair
7	295 BIG PINE KEY	BIG PINE KEY				anic Removal, Capping and Weedgate	1,040,727	Limited Data - Fair
8	474 GEIGER KEY	GEIGER KEY				ckfill and Weedgate	222,651	Limited Data - Fair
9	297 BIG PINE KEY	BIG PINE KEY	47	55	102	Organic Removal, Capping and Weedgate	1,352,390	Fair
10	403 SUGARLOAF KEY	SUGARLOAF KEY	30	70	100	Backfill and Weedgate	804,157	Fair
11	90 TAVERNIER	TAVERNIER	33	65	98	Backfill Only	729,512	Fair
12	287 BIG PINE KEY	BIG PINE KEY	37	60	97	Organic Removal, Capping and Weedgate	2,942,881	Limited Data - Fair
13	299 BIG PINE KEY	BIG PINE KEY	37	60	97	Organic Removal, Capping and Weedgate	2,151,972	Fair
14	472 GEIGER KEY	GEIGER KEY	42	55	97	Organic Removal and Backfill	1,461,708	Fair
15	293 BIG PINE KEY	BIG PINE KEY	80	15	95	Organic Removal, Capping and Weedgate	2,145,335	Poor
16	41 KEY LARGO	KEY LARGO	45	50	95	Organic Removal, Capping and Weedgate	855,900	Fair
17	77 ROCK HARBOR	ROCK HARBOR	26	65	91	Maintenance to Culvert	71,301	Fair

$21 Million #1 - 17

CANAL RESTORATION RANKING LIST – CONT.

Sort ID	Canal Name	Community Area	2020 - WQ Ranking Score	2020 - Technology Ranking Score	2020 - Total Score	2020 - Technology Recommendation	Restoration Cost	2020 Water Quality Summary
84	31 KEY LARGO	KEY LARGO	56	-75	-19	Organic Removal, Capping, Culvert and Weedgate	8,033,255	Fair
85	229 BIG PINE KEY	BIG PINE KEY	45	-65	-20	Organic Removal, Capping, Culvert and Weedgate	13,708,914	Fair
86	384 SUGARLOAF KEY	SUGARLOAF KEY	37	-60	-23	Organic Removal, backfilling, Culvert Maintenance, and Weedgate	7,159,702	Poor
87	277 BIG PINE KEY	BIG PINE KEY	64			e	25,070,057	Fair
88	164 CONCH KEY ADDED	CONCH KEY	33				5,645,651	Fair
89	70 ROCK HARBOR	ROCK HARBOR	42			ert	8,897,468	Fair
90	51 KEY LARGO	KEY LARGO	60	-60	-30	Capping, Culvert and Weedgate	18,286,087	Fair
91	261 No Name Key	No Name Key	52	-75	-33	Organic Removal, Capping, Culvert and Weedgate	23,569,737	Poor
92	42 KEY LARGO	KEY LARGO	46	-100	-54	Organic Removal, Capping and Weedgate	19,671,052	Fair
93	4 OCEAN REEF CLUB	OCEAN REEF CLUB	44	-100	-56	Backfill Only	19,981,889	Fair
94	63 ROCK HARBOR	ROCK HARBOR	44	-107	-63	Organic Removal, Backfill and Weedgate	30,069,854	Fair
95	13 KEY LARGO	KEY LARGO	50	-115	-65	Organic Removal, Capping and Weedgate	49,375,510	Fair
96	278 BIG PINE KEY	BIG PINE KEY	35	-135	-100	Organic Removal, Capping and Weedgate	48,535,740	Fair

$278 Million #84-#96

Cumulative $538 Million

TOP 11 - CANAL WORKPLAN RESTORATION PROJECTS $11.3 MILLION

Canal Restoration Ranking List 7/21/2021

Sort ID	Canal Name	Community Area	2020 - WQ Ranking Score	2020 - Technology Ranking Score	2020 - Total Score	2020 - Technology Recommendation	Restoration Cost	2020 Water Quality Summary
1	105 TAVERNIER	TAVERNIER	36			Backfill and Culvert and Weedgate	668,871	Fair
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9 of top 11 projects require a Weedgate

CANAL RESTORATION OPERATION & MAINTENANCE (O&M)

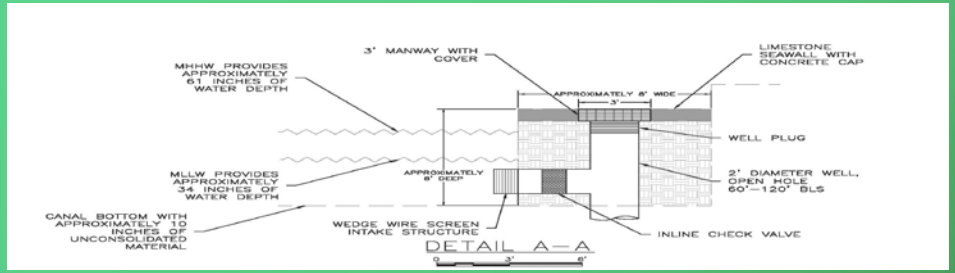
1. The County pays for the capital costs associated with the canal restoration project: design, permits, and construction
2. The O&M to be provided by residents surrounding the canal restoration project through a Municipal Services Benefit Unit (MSBU) and covers:
    a) Electrical
    b) Repairs
    c) Quarterly Maintenance Visits
    d) Replacement of Equipment when it wears out
    e) Replacement of Equipment after a storm
3. The MSBU assessment needed for all projects that require a culvert, weedgate, and injection well.
4. The annual MSBU financial assessment will be dependent on final design and cost of installation of the culverts and physical weed gate
    a) Tied to replacement cost built into MSBU

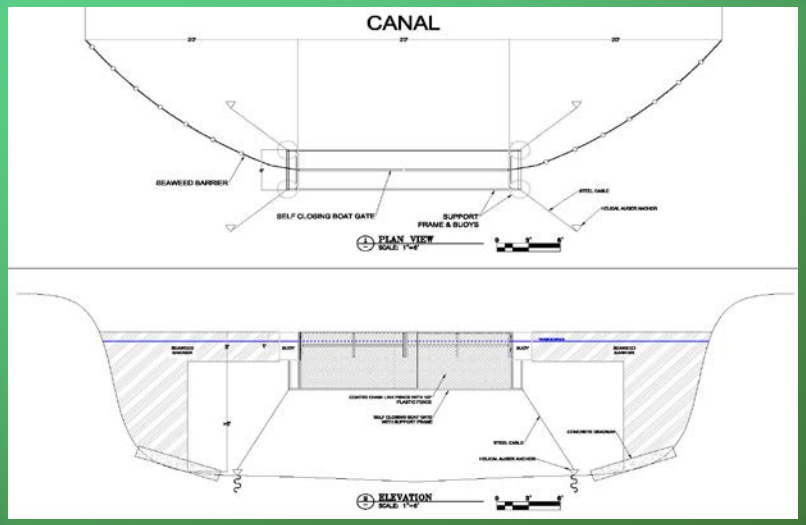
CANAL RESTORATION PROJECTS
CANAL #266 AIR CURTAIN – BIG PINE KEY

1. Air curtain destroyed in Hurricane Irma
2. County replaced with FEMA funds
3. Homeowners are contributing $100 / month / parcel to pay for operations and maintenance

ALTERNATIVE TECHNOLOGY(S) FOR WEED GATES

- **Physical Weed gate**
  - **Alternative to air curtain system to reduce O&M**
  - **Swing gate with buoys to allow for ease of operation**





WHAT'S NEXT?
CANAL RESTORATION PROJECTS

- Coordination with DEO on the Canal Restoration Work Plans
- Continue to pursue state and federal funding for canal restoration implementation
- Hold public outreach meetings (pending EPA Grant application)
- Improving canal water quality throughout the Florida Keys


Questions?
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Rhonda Haag (305) 453-8774