

Florida Keys National Marine Sanctuary Steering Committee
December 6, 2017

**WATER QUALITY MONITORING PROJECT FOR
DEMONSTRATION OF CANAL REMEDIATION METHODS
FLORIDA KEYS
Report of activities**

Funded by: Environmental Protection Agency

Dr. Henry O. Briceño

Technical crew:

Michael Absten, Breege Boyer, Sandro Stumpf, Eduardo Mollinedo

WATER QUALITY MONITORING PROJECT FOR DEMONSTRATION OF CANAL REMEDIATION METHODS FLORIDA KEYS

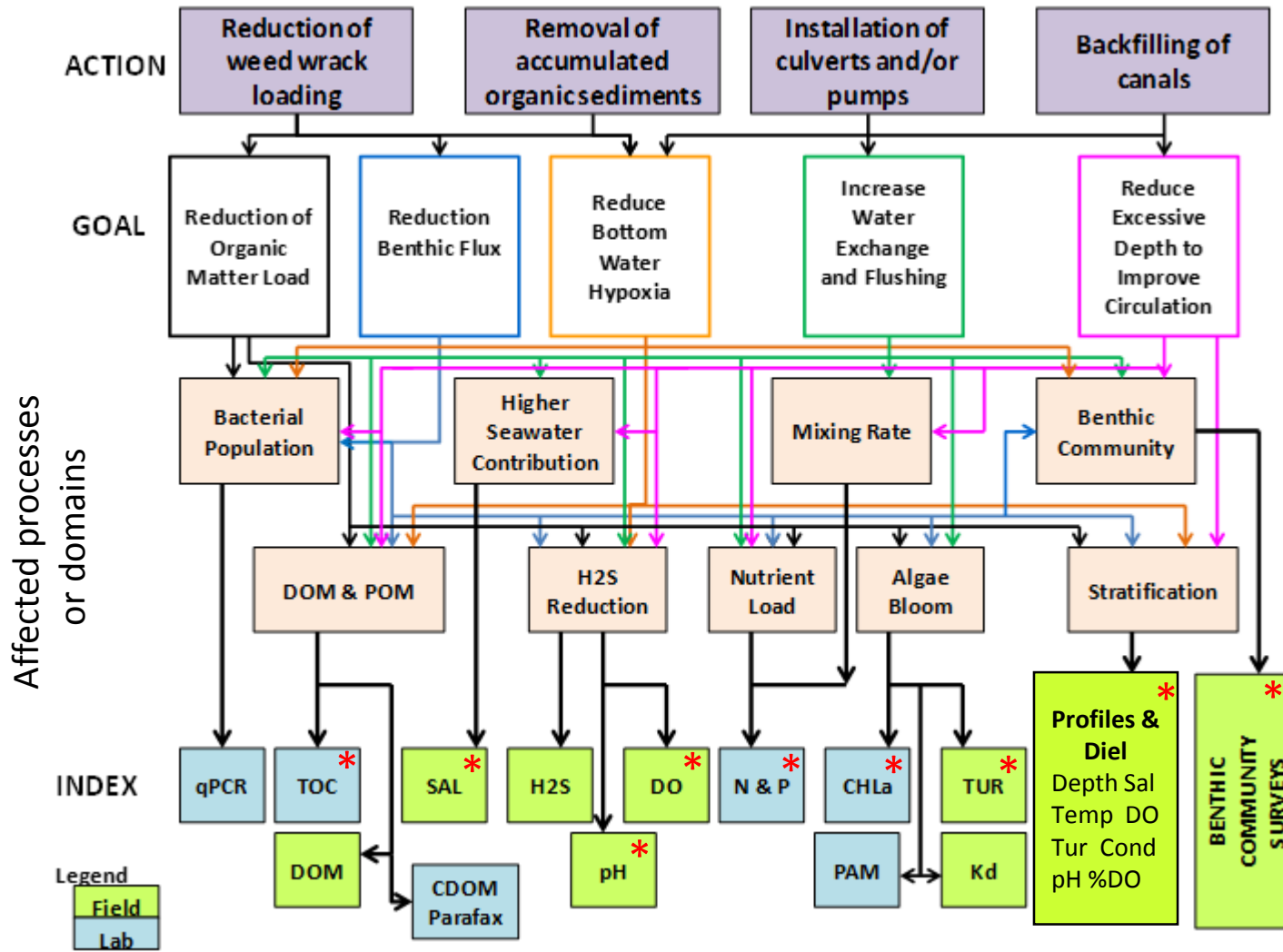
Objective

To provide data needed to make unbiased, statistically rigorous statements about the status and temporal trends of water quality parameters in the remediated canals

WATER QUALITY MONITORING PROJECT FOR DEMONSTRATION OF CANAL REMEDIATION METHODS FLORIDA KEYS

CONTENT OF TODAY'S PRESENTATION

- Conceptual Model**
- Project Components**
- Adaptive Monitoring**
- Summary of Results**
- Individual Projects**
- Preliminary Assessment**



* Currently measured

Conceptual Model

Project Components

Sub-projects:

- Water Quality Monitoring
- Benthic community monitoring

Project Duration

Initial : 2 years

Final: 4 years

Project Initial budget

Water Quality \$171,000

Benthic \$129,000

Total \$300,000 + \$75,000 later granted

BEFORE-AND-AFTER-CONTROL-IMPACT PROJECT

“Sui-generis” Non-conventional Monitoring

- Complex interplay of drivers and pressures
- Non-regular calendar
- Sampling calendar dictated by individual canal construction calendar
- Experience indicates that impacts of remediation on water composition (nutrients) affected by considerable lag (years)

WHAT WE HAVE DONE SO FAR INCLUDES.....

Water Quality Monitoring

- Continuous 24- to 72-hour recording (Diel) of physical-chemical data
- Vertical profiles (casts) of physical-chemical properties of water column
- Water sampling and analysis

1-3-day Diel Measurements

Frequency= every 10 min

Total of 51,645 readings

	2014		2015		2016			2017	
Canal	FKC01	FKC02	FKC03	FKC04	FKC05	FKC06	FKC07	FKC08	FKC09
28	Mar-14	Sep-14			Feb-16	Apr-16 May-16	Jul-16 Aug-16	Jun-17	Oct-17
29	Mar-14	Sep-14			Feb-16	Apr-16 May-16	Jul-16 Aug-16	Jun-17	Oct-17
132	Apr-14	Sep-14	Jul-15		Jan-16		Jul-16 Sep-16	Jun-17	Oct-17
137	Apr-14		Jul-15		Jan-16		Jul-16 Sep-16	Jun-17	Oct-17
147	Apr-14	Sep-14			Jan-16		Aug-16	Jun-17	Oct-17
148	Mar-14	Sep-14			Jan-16		Aug-16	Jun-17	Oct-17
266		Jun-14 Sep-14				Jun-16	Sep-16	Jun-17	Oct-17
277		Jun-14 Sep-14		Aug-15	Feb-16	Jun-16	Jul-16 Aug-16 Sep-16	Jun-17	Oct-17
278		Jun-14 Sep-14			Feb-16		Jul-16		
282		Jun-14 Sep-14		Aug-15	Feb-16		Jul-16 Sep-16	Jun-17	Oct-17
287		Jun-14 Sep-14			Feb-16		Jul-16 Sep-16	Jun-17	Oct-17
290		Jun-14 Sep-14		Aug-15			Jul-16 Sep-16	Jun-17	Oct-17
293		Jun-14 Sep-14		Aug-15	Feb-16		Jul-16 Aug-16 Sep-16	Jun-17	Oct-17
458		Sep-14	May-15	Aug-15		May-16	Jul-16 Aug-16	Jun-17	Oct-17
459	May-14	Sep-14		Aug-15	Feb-16				
460				Aug-15	Feb-16				
470				Aug-15		May-16	Aug-16	Jun-17	Oct-17
472	May-14	Sep-14	May-15	Aug-15		May-16	Aug-16	Jun-17	Oct-17

Profile Measurements:

- 5,920 readings along water column

Profile Measurements										
Canal	FKC00	FKC01	FKC02	FKC03		FKC05	FKC07	FKC08	FKC09	
28	Nov-13		Oct-14			Feb-16	Nov-16	Jun-17	Oct-17	
29	Nov-13		Oct-14			Feb-16	Nov-16	Jun-17	Oct-17	
132	Nov-13	Apr-14			Jun-15	Feb-16	Nov-16	Jun-17	Oct-17	
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266		May-14	Oct-14				Dec-16	Jun-17	Oct-17	
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287		May-14			Jun-15	Feb-16		Jun-17	Oct-17	
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458		May-14	Oct-14	Apr-15	Jun-15	Jul-15	Feb-16	Dec-16	Jun-17	Oct-17
459			Oct-14	Apr-15	Jun-15		Feb-16			
460						Feb-16				
470					Jun-15		Dec-16	Jun-17	Oct-17	
472			Oct-14	Apr-15	Jun-15		Dec-16	Jun-17	Oct-17	

Water Sampling and Analysis

- Samples = 220

- Analytical determinations = 2,074

CANAL	2014		2015		2016		2017	
28	Mar-14	Oct-14			Feb-16	Nov-16	Jun-17	Oct-17
29	Mar-14	Oct-14			Feb-16	Nov-16	Jun-17	Oct-17
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472	May-14	Oct-14	Apr-15	Jun-15		Dec-16		Oct-17



Backfilling

Sexton Cove, Key Largo

Canal 29

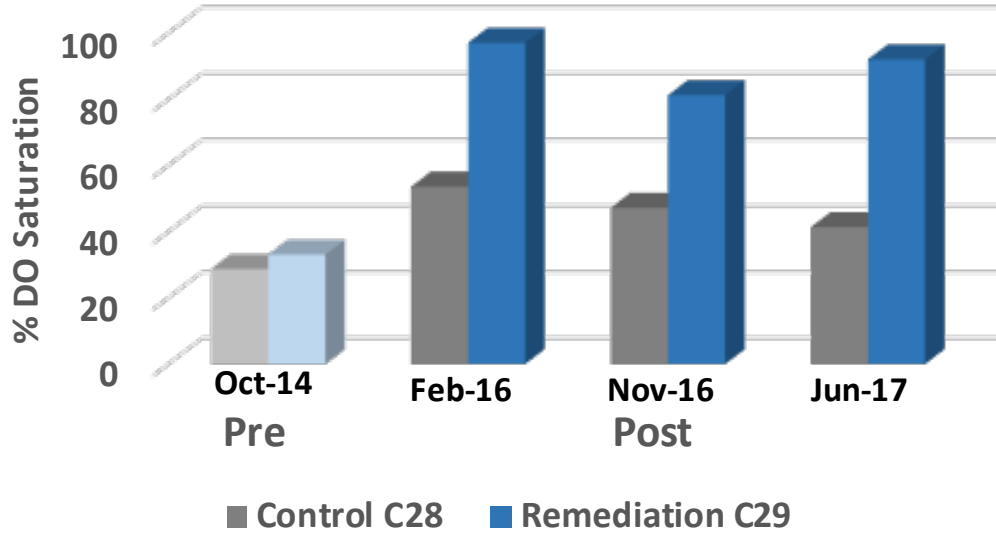
**26,000 cy of fill to raise
canal bottom**

**Before = -35 feet MLW
After = -7.7 feet MLW**

Remediated : July, 2015



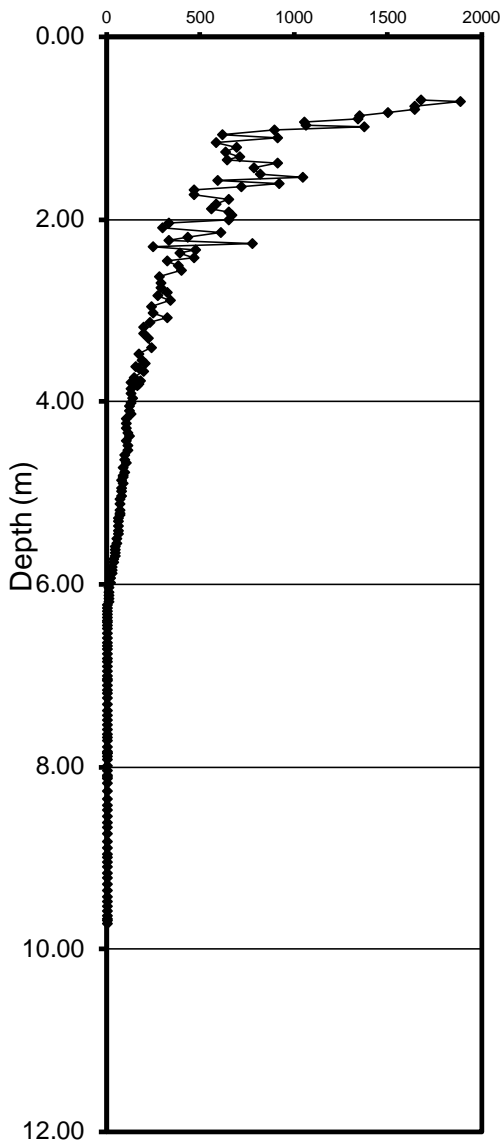
Sexton Cove, Key Largo



Sexton Cove, Key Largo
Canal 29



Surface Irradiance



Before



After



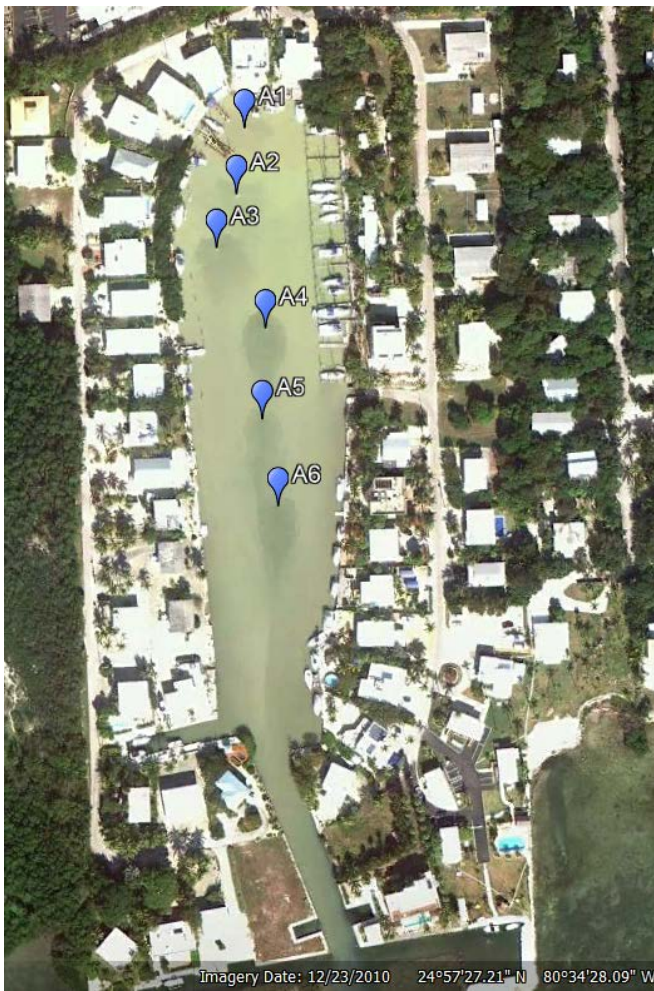
Weed barrier & Aerators

Treasure Harbor, Plantation Key

Canal 137

Before
(Dec 2010)

After
(Dec 2014)

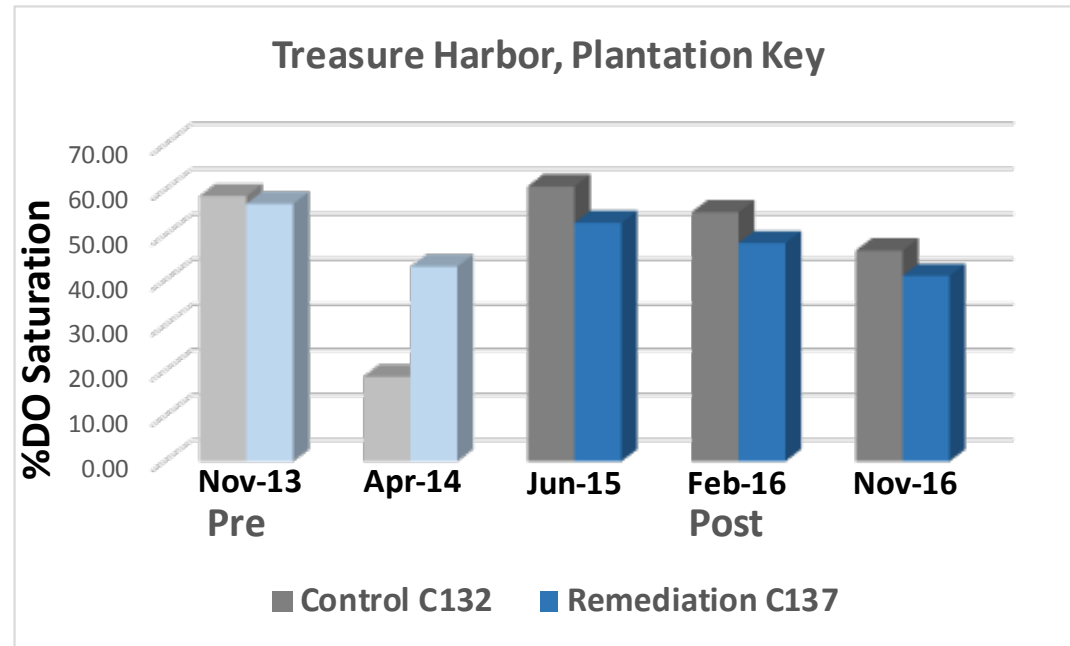


Remediated:
Nov, 2014

Profiles

Treasure Harbor, Plantation Key Canal 137

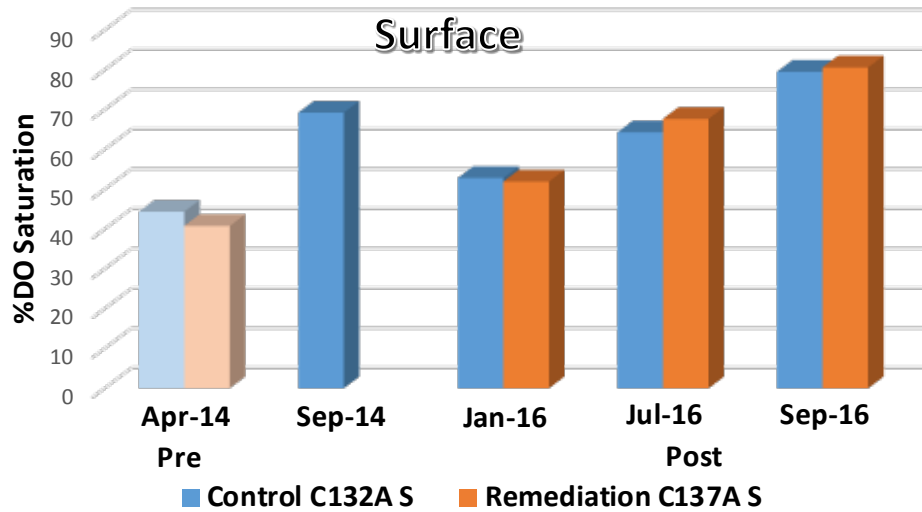
Treasure Harbor, Plantation Key



- No significant improvement wrt control
- Close coupling to Control canal in profiles

Treasure Harbor. Plantation Key

Surface

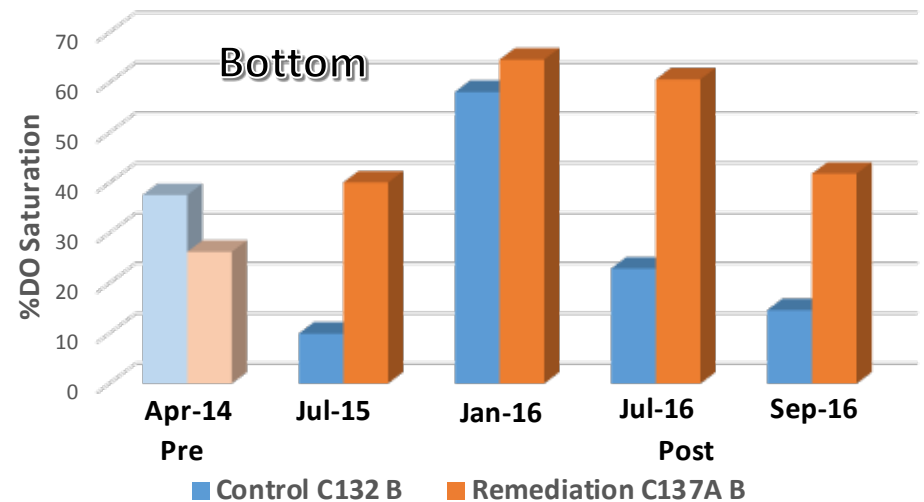


Diels

- Some improvement wrt control in Diels
- Close coupling to Control canal in surface but bottom improves

Treasure Harbor. Plantation Key

Bottom



Removal of Organic Sediments/ Installation sand cap

Dr Arm, Big Pine Key
Canal 266



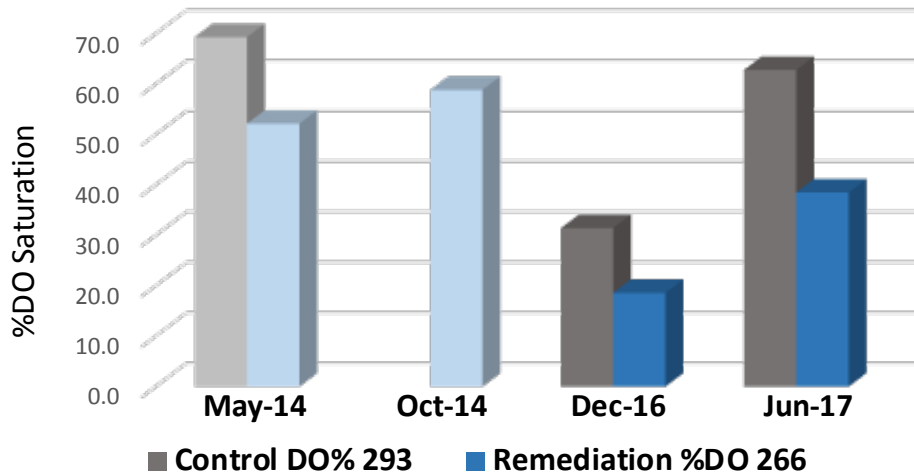
Remediated: May, 2016



Photo by AMEC



Dr Arm Subdivision. Big Pine

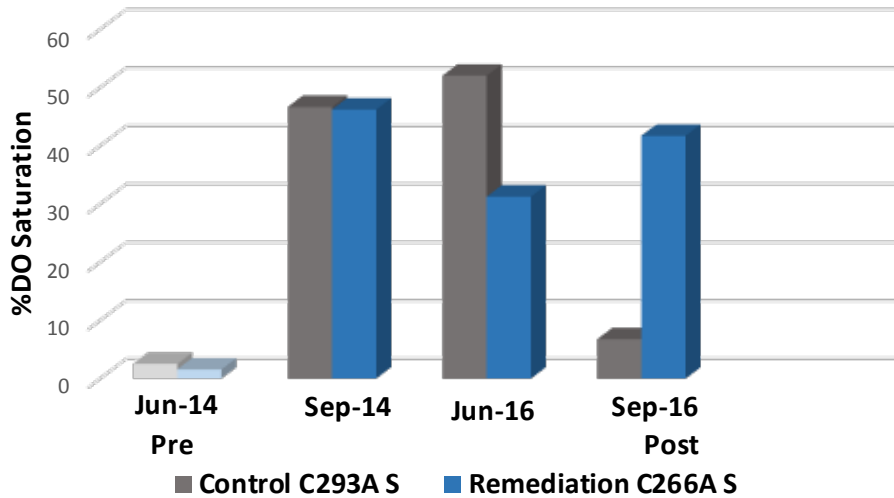


- No significant improvement wrt control or remediation
- Slight coupling to Control canal



Photo by AMEC

Dr Arm. Big Pine Key

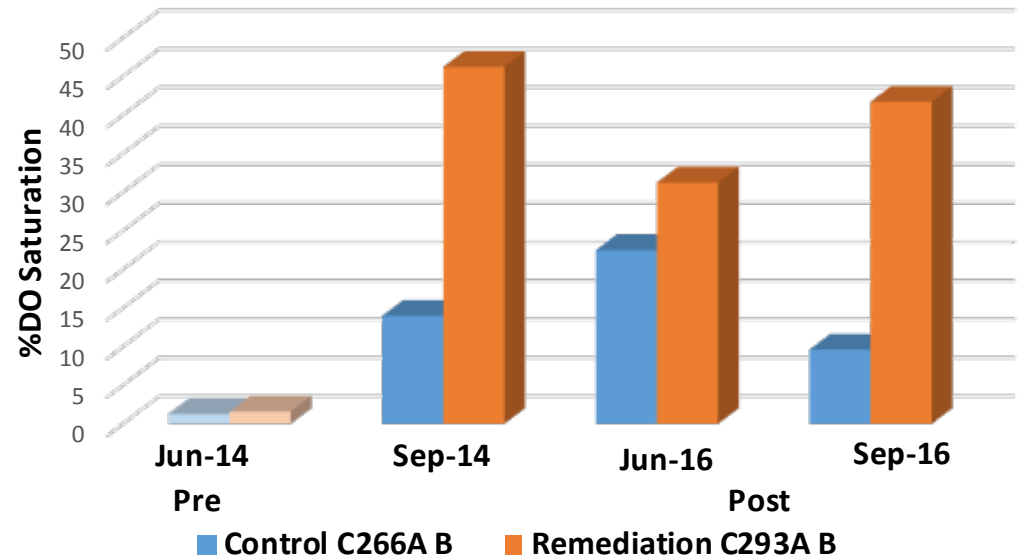


- Slight improvement in surface waters but still with many readings <42% DO Sat

- Significant improvement wrt remediation. Values higher than control and approaching compliance.

- Decoupling with Control canal

Dr Arm. Big Pine Key

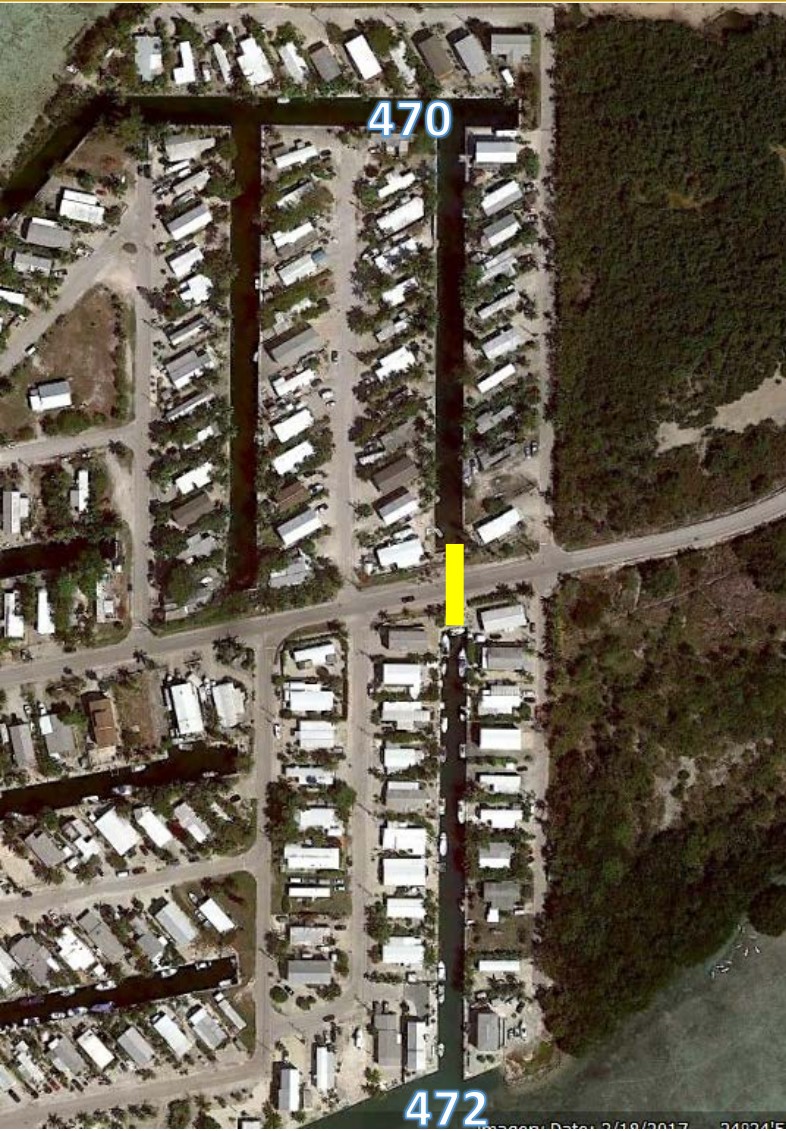


Culvert Installation

Geiger Key

Canal 472

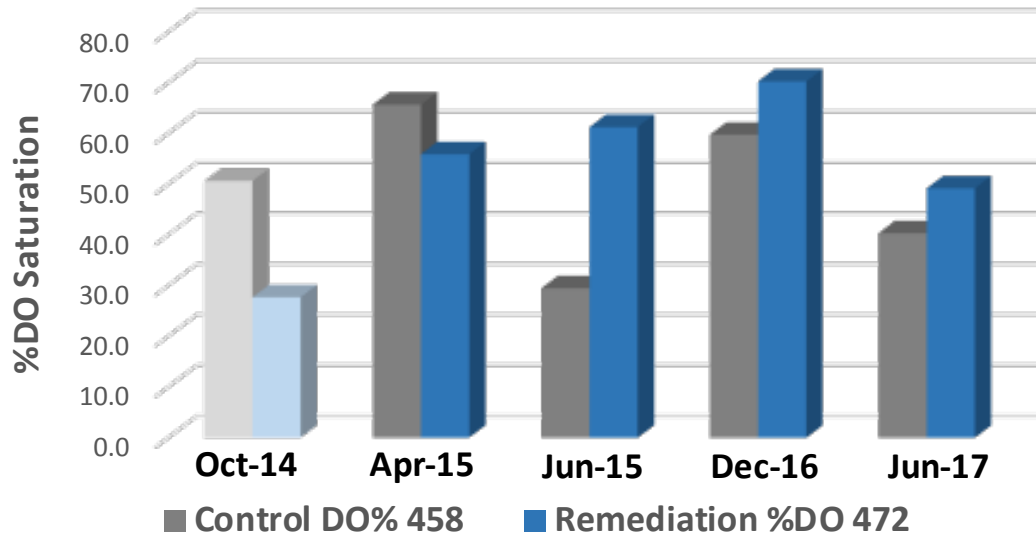
Installation of 112 foot 24" by 38" concrete culvert



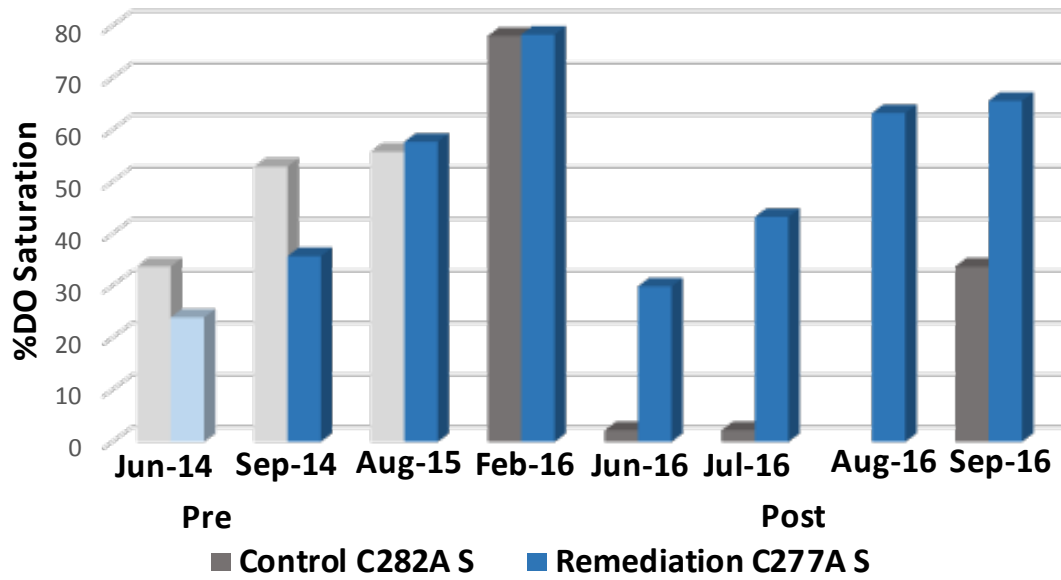
Remediation: March 22, 2015

Photo by AMEC

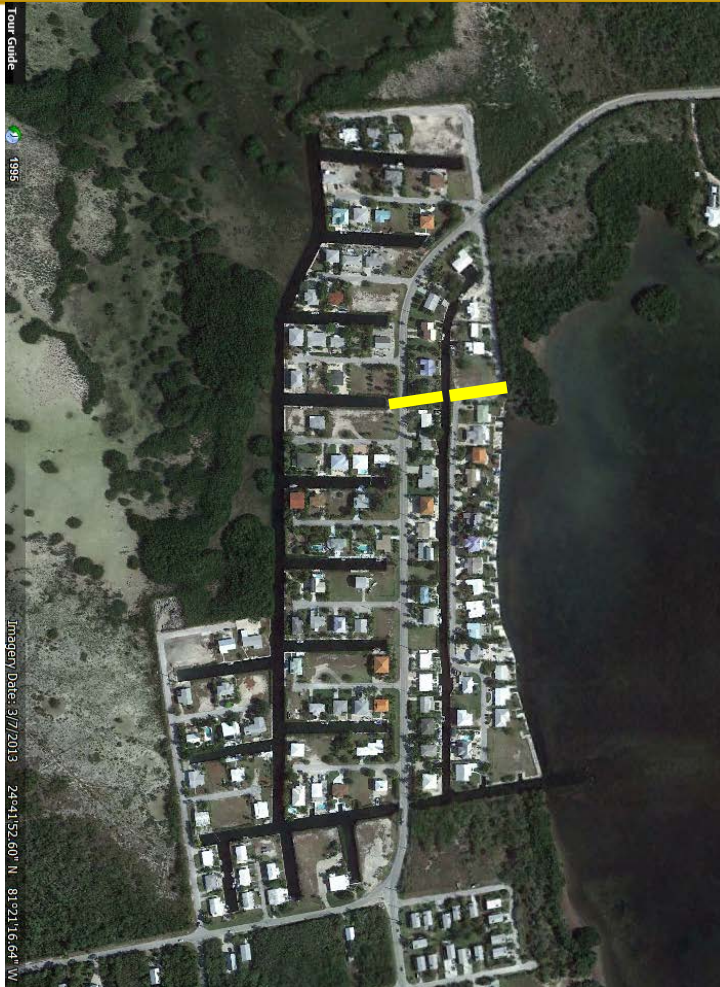
Geiger Mobile Home Subdivision, Geiger Key



Tropical Bay. Big Pine Key

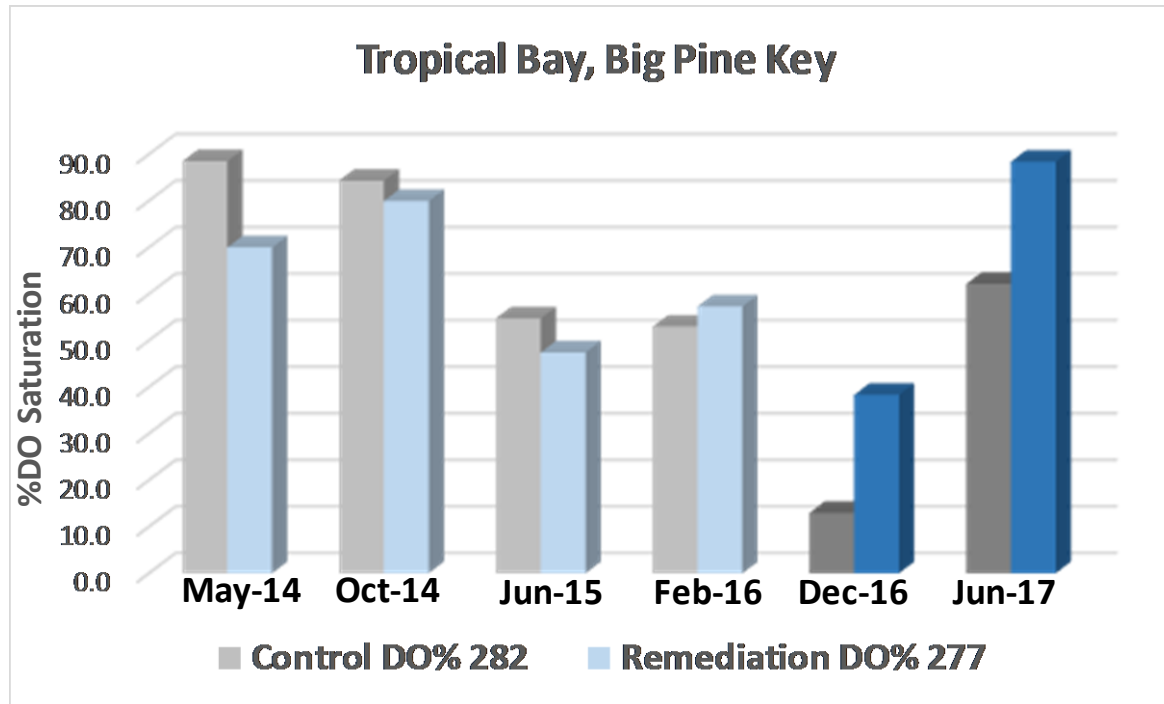


Culvert Installation Tropical Bay, Big Pine Key Canal 277



Installation of a 200 foot 60" concrete culvert

Remediated: Apr, 2016





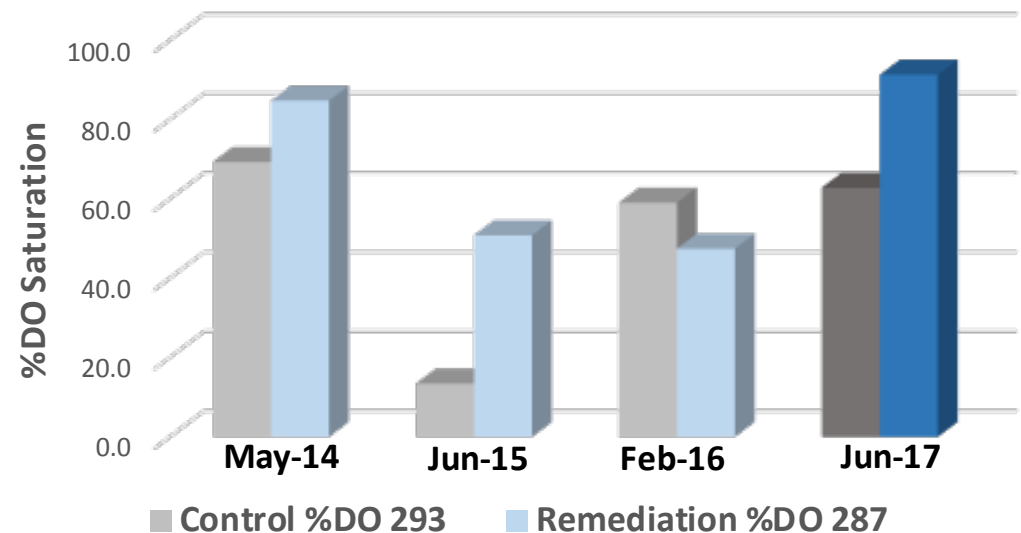
Air Curtain

Hollerich Subdivision, Big Pine Key Canal 287

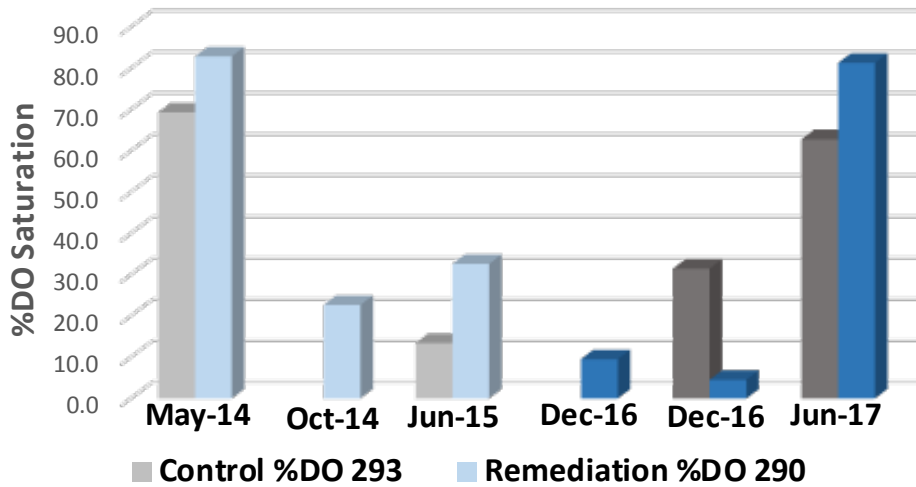
**Installation of Air
Curtain at Canal
Mouth**

Remediated: Jun, 2016

Hollerich Subdivision, Big Pine Key



The Avenues. Big Pine



Removal of Organic Sediments

The Avenues, Big Pine

Key

Canal 290

Removal of 5' of organic sediments, rotten seaweed and muck. Capping with 6" sand layer

Air curtain re-installed

Remediation: March 2, 2016

