

Dredging-Related Sediment Impacts on Coral Reefs near the Port of Miami Channel



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As the Panama canal undergoes an expansion, shallow ports along the eastern seaboard race to be ready to accommodate next generation, super-sized shipping vessels.

The Port of Miami was the first on the list.

Construction began November 2013.

The Project: Deep Dredge Background

- May 22, 2012: FDEP issued an Environmental Resource Permit, No. 0305721-001-BI for deepening and widening the Miami Harbor channels and turning basins at the Port of Miami.
- The permit authorizes dredging five to six million cubic yards of material from the Miami Harbor.
- Channel depths will be increased by six feet or more and in the flare area the channel will be widened by as much as 300 feet.
- The permit authorizes up to 600 days of blasting to loosen the rock to accommodate the dredging.
- The COE entered into a contract with Great Lakes Dredge and Dock (“GLDD”) to undertake the permitted work.
- FDEP also granted the COE a variance, allowing degradation of the water quality in and around the Biscayne Bay Aquatic Preserve, an Outstanding Florida Water, for the duration of construction.
- Construction started Nov 2013 after a 4-week “baseline” study period

Shows the reef location near Miami Beach and the location of the Port of Miami shipping channel, within which dredging is occurring offshore.

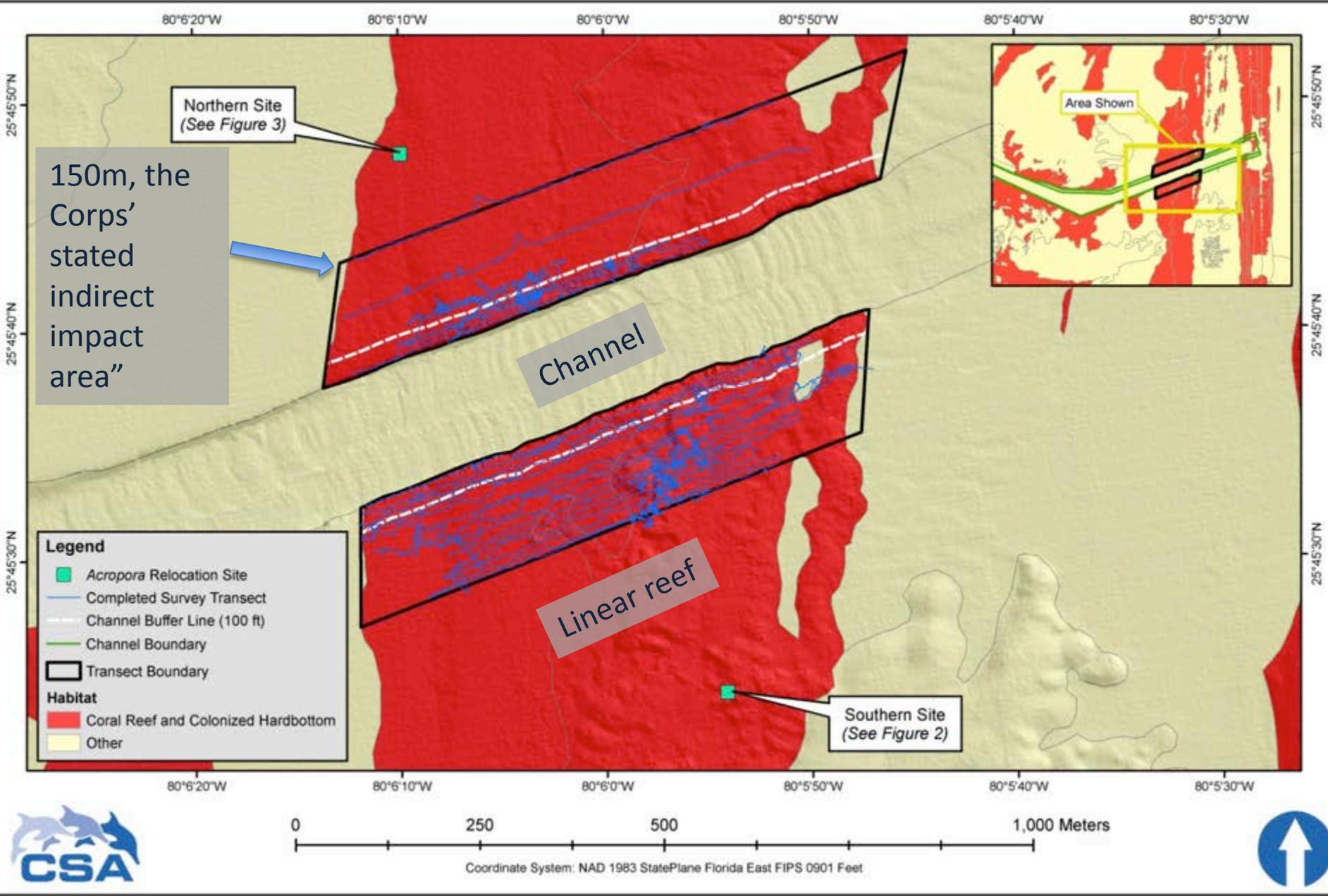


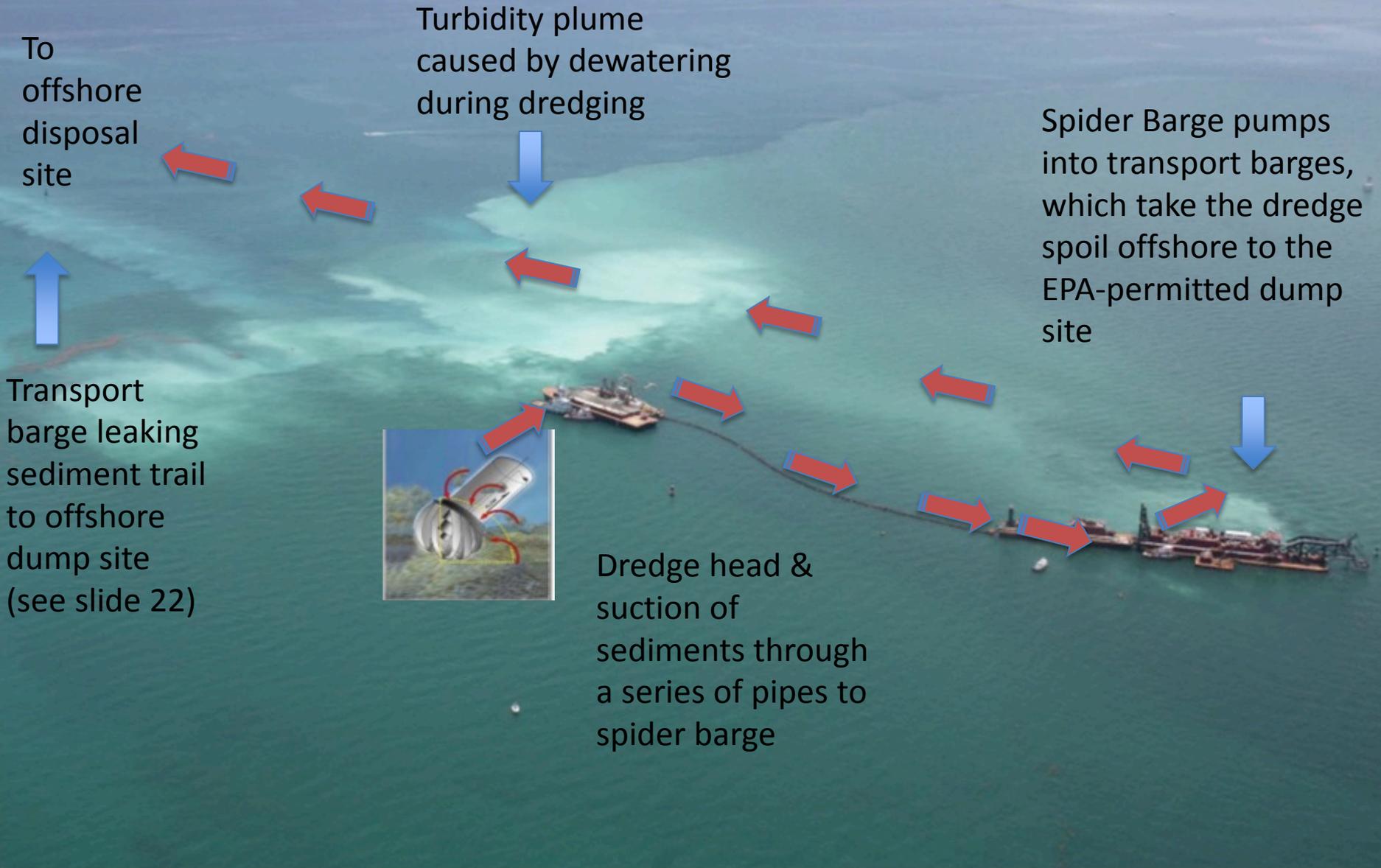
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FIGURE 1
ENTRANCE CHANNEL ACROPORA CERVICORNIS MONITORING PROJECT
LOCATION MAP
AUGUST 2014



The Middle Reef (red area)





 Path of dredge sediments

Dewatering (letting water and fine sediments leak out of transport barges) to reduce load creates massive turbidity (suspended sediments in the water, which fall out of suspension and onto the reef and smother it)

Case 1:14-cv-23632-FAM Document 23-5 Entered on FLSD Docket 10/22/2014 Page 4 of 5



Massive, widespread sedimentation on top of coral has occurred, as documented by Corps contractors, DEP, NOAA, DERM, and BBWK



BBWK,
middle
reef,
1/14/15

July 2014: Miami-Dade County DERM reports widespread sedimentation and coral mortality

Site A: This site is a shallow-colonized pavement reef located approximately 150ft north of the 'elbow' of Government Cut channel. This site is in 23 ft of water. This low relief hard bottom is inhabited by numerous octocoral species, scleractinians, and sponges. Wide view photographs were not possible due to poor visible from sediment plume. Turf algae was partially visible and ~ 1cm layer of fine sediment was seen on hardbottom. Heavy sedimentation was observed on scleractinians, octocorals, and sponges. Sediment accumulation was observed along the base of many scleractinians. Wafting accumulated sediment from the colonies revealed recent mortality (~4-6cm of coral skeleton from colony edge) on many scleractinians (Figure 7A, B). The holdfasts of a few octocorals were buried and the branch tips were rubbing against the sediment layer on the hard bottom (Figure 7C). Some octocorals were observed with heavy mucus production (Figure 7D).

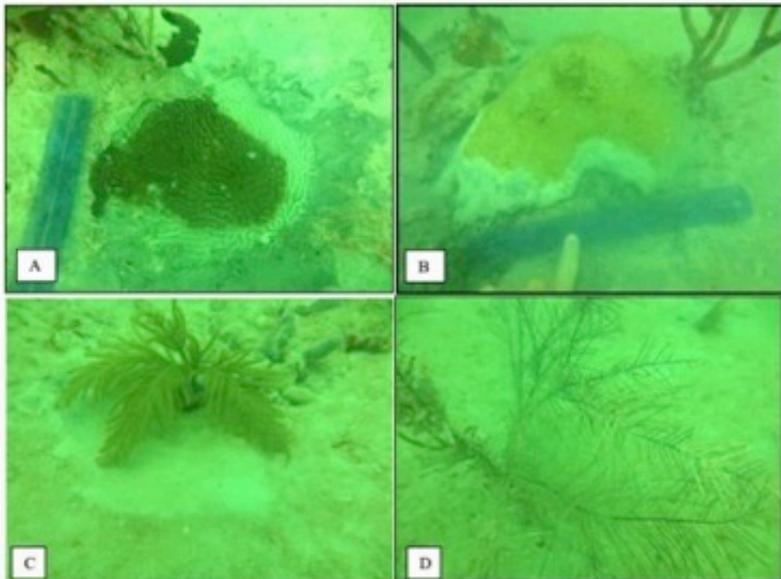


Figure 7. Benthic habitat and coral stress at Site A. A) *Meandrina jacksoni* colony with exposed recent mortality from sediment accumulation; B) *Solenastrea bournoni* colony with exposed recent mortality from sediment accumulation; C) Octocoral with buried holdfast and branch tips braising the sediment covered hard bottom; D) Octocoral with heavy mucus production.

Site E: This site is a shallow-colonized pavement reef located approximately 230ft south of the 'elbow'

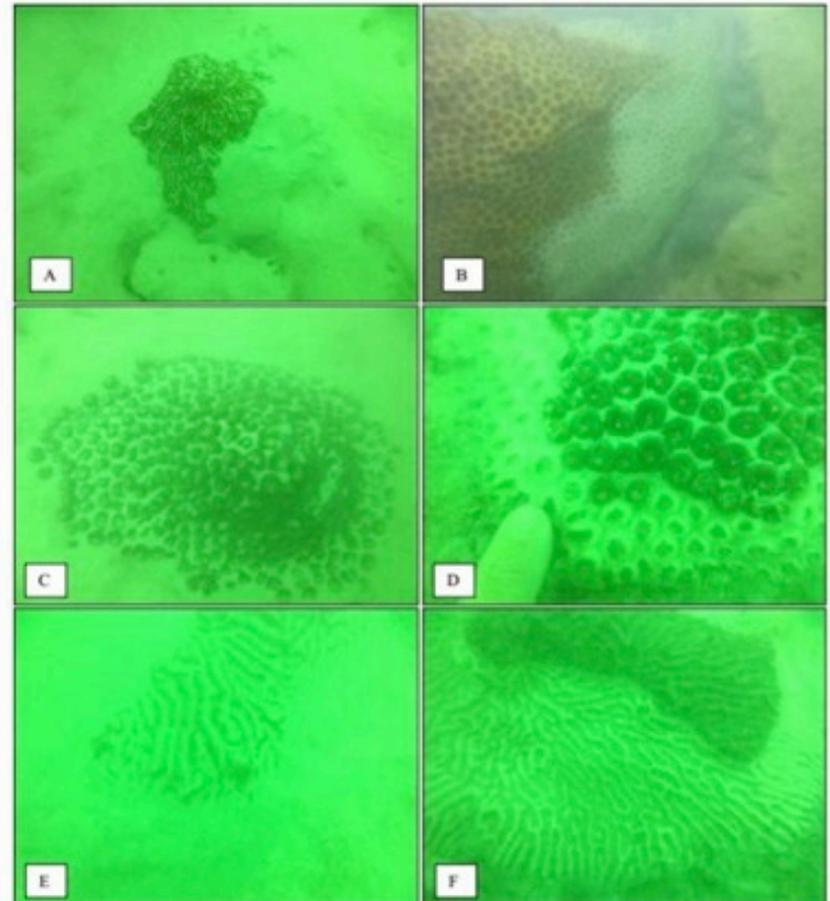


Figure 6. Benthic habitat and coral stress at Site B. A) *Solenastrea bournoni* with heavy sedimentation; B) Same *S. Solenastrea* colony in Figure 6A with exposed recent mortality from sediment accumulation; C) *Montastraea cavernosa* with heavy sedimentation; D) Same *M. cavernosa* colony in Figure 6C with exposed recent mortality from sediment accumulation; E) *Meandrina jacksoni* with heavy

July 2014: FDEP divers come to Miami and report widespread sedimentation and coral mortality >200m



Figure 11. The same colony of *Colpophyllia natans* after sediments were removed from the base of the colony. Considerable part of the colony is dead due to the accumulation of sediments at its base.

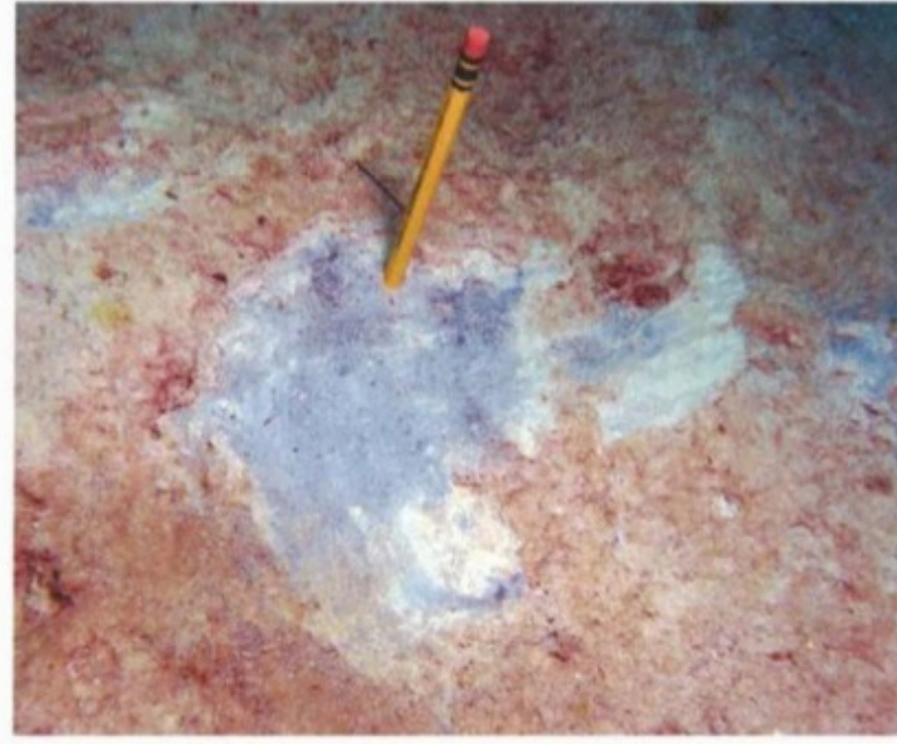


Figure 9. Sediments that covered practically entire area more than 100 m from the channel and southward from monitoring sites HBS3 and HBS4 become anoxic in less than 1 cm below the surface. Notice that almost all surface of recently accumulated fine sediments was covered with cyanobacterial mat.

Oct 2014 survey (Feb 2015 final report), NOAA reports widespread sedimentation and coral mortality beyond 200m from channel



Figure 6: Accumulation of sediment on corals (and resultant partial mortality of basal portions of the colonies) in areas adjacent to the dredging. The colony of *Montastraea cavernosa* on the top left has its tentacles out and is actively producing mucus to remove the sediment. This sediment then accumulates on the lower section of the colonies causing mortality.

Feb 2015
NOAA reports
sedimentation
and coral
mortality
>200m from
channel

Photos taken the
same month that
Corps contractors
declare the sediment
has disappeared

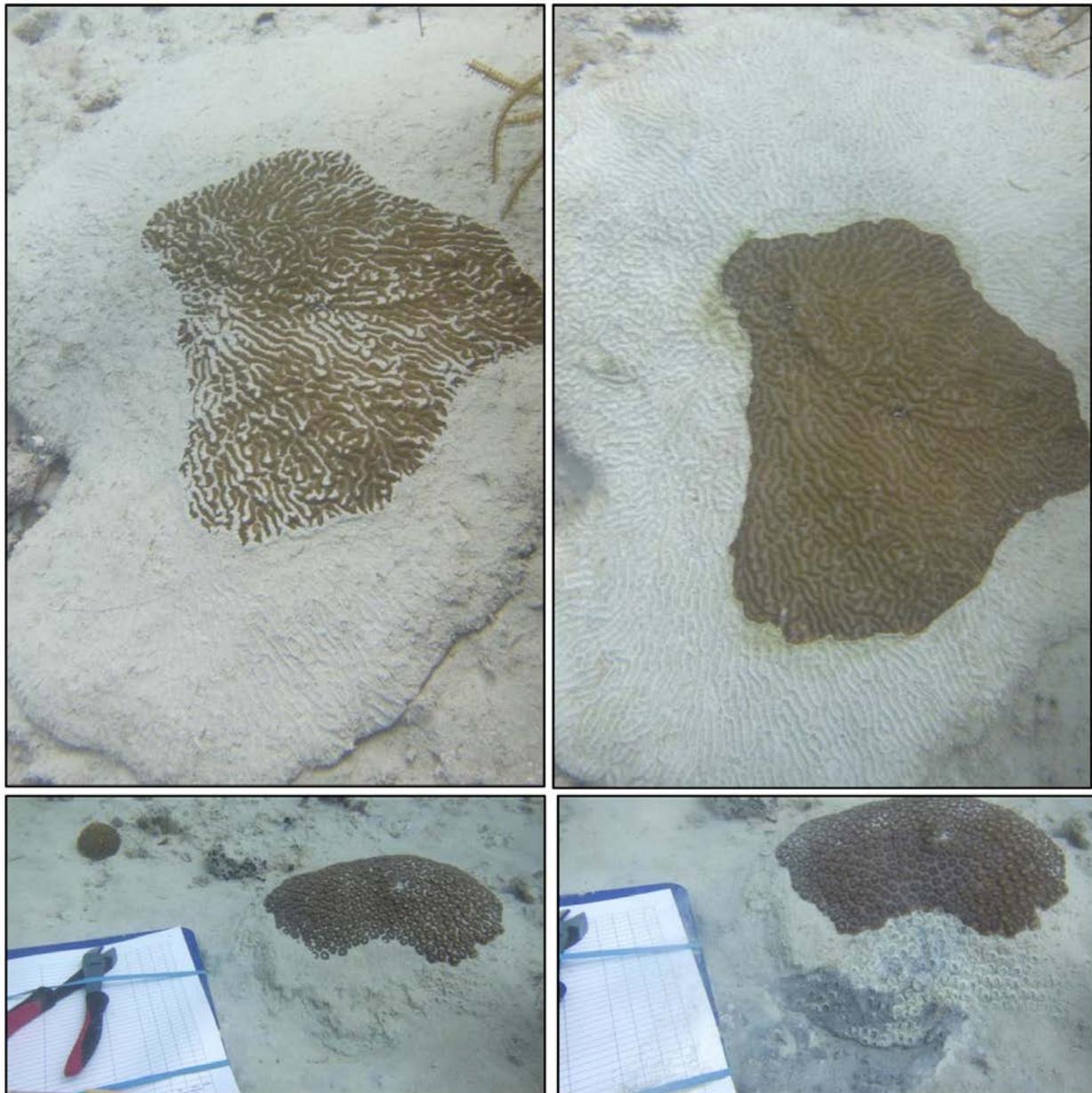
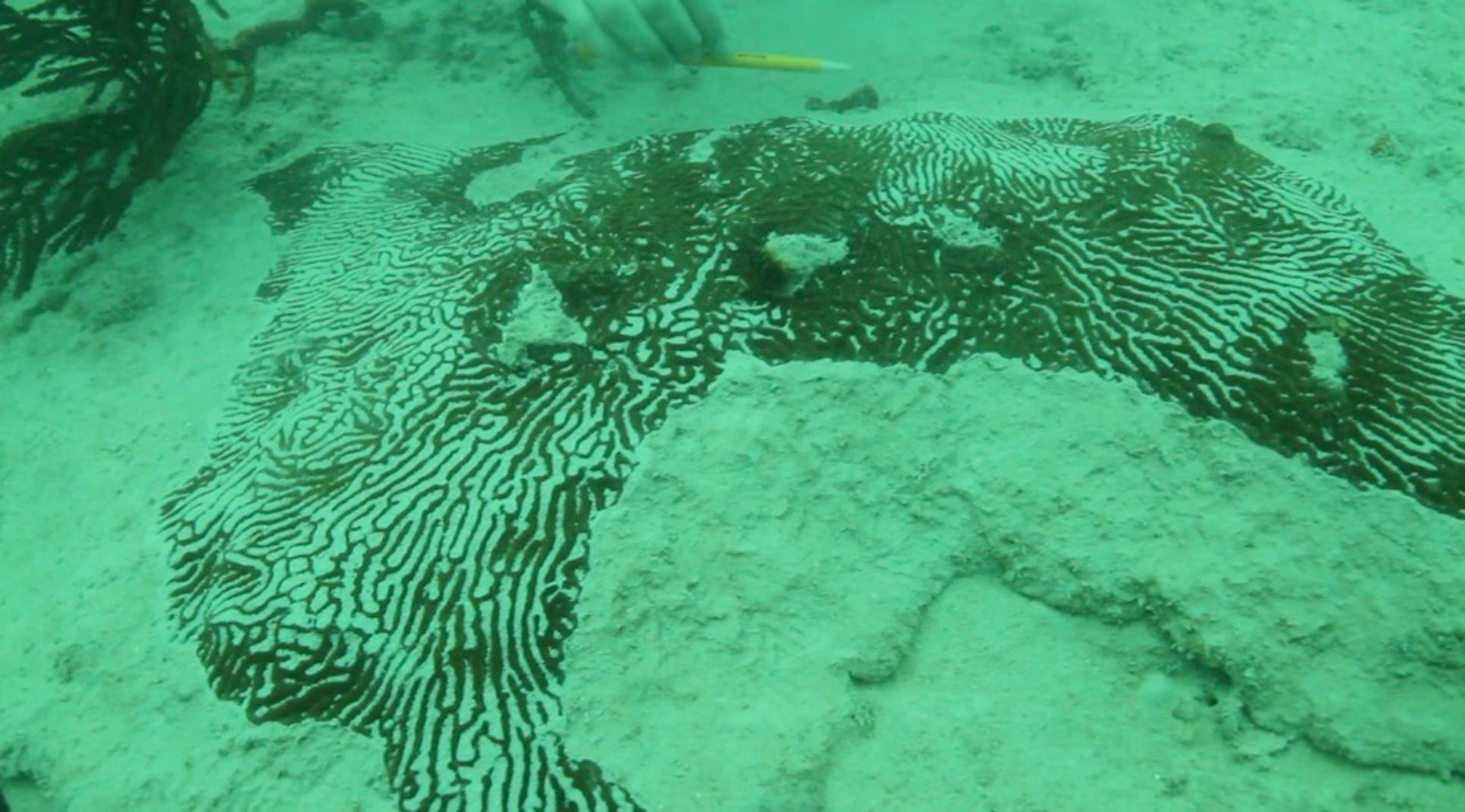


Figure 7: Coral colonies before (left photos) and after (right photos) divers cleared sediment from the corals showing accumulation and recent mortality (exposed white skeleton) along the lower portions of the colonies as a result of accumulation of fine and clay-like material (sedimentation)



BBWK photo, middle reef,
1/14/15



BBWK photo, middle reef relocation area, 1/14/15
Dead staghorn coral



Dead staghorn coral
buried in sediment



BBWK photo, middle reef, 1/30/15
Dead and buried staghorn coral



BBWK photo, middle reef, 1/30/15
Dead staghorn coral



BBWK photo, middle reef, 1/30/15
Buried *Montastraea cavernosa* coral



BBWK Photo 1/30/15

Deep sediments still cover the reef 7.5cm deep. Only the tops of gorgonians (sea whips) are exposed. A layer of natural sand covers the clay-like, fine, anoxic sediment below



BBWK Photo 1/30/15

Deep sediments still cover the reef. They are clay-like and are not natural on the reef.

Recent (October) Dial Cordy report states that these sediments have dissipated. We found that this is not the case.

How did this happen?

- Compliance issues with State (Florida Department of Environmental Protection, FDEP) Permit
- Compliance issues with Endangered Species Act (*Acropora cervicornis* staghorn coral “take”)

Sediment blocks were placed to measure sediment accumulation on the reef

2.2.2 Sedimentation Blocks

A net sediment accumulation block was placed at each site at the 10 m mark on Transect 2 (Figure 4). This block serves as the center point of the monitoring site for underwater navigational purposes. The sediment accumulation block consists of an 8 in. x 8 in. x 8 in. concrete block attached to the bottom with hydraulic cement. The block has one side coated with antifouling paint, which is oriented as the upper surface. The antifouling paint minimizes the bioaccumulation on the upper surface of the block which could interfere with sediment accumulation. Blocks were attached to exposed rock surfaces devoid of benthic fauna and no closer than 30 cm to any coral colony to assure no impact to living marine resources from the antifouling paint.

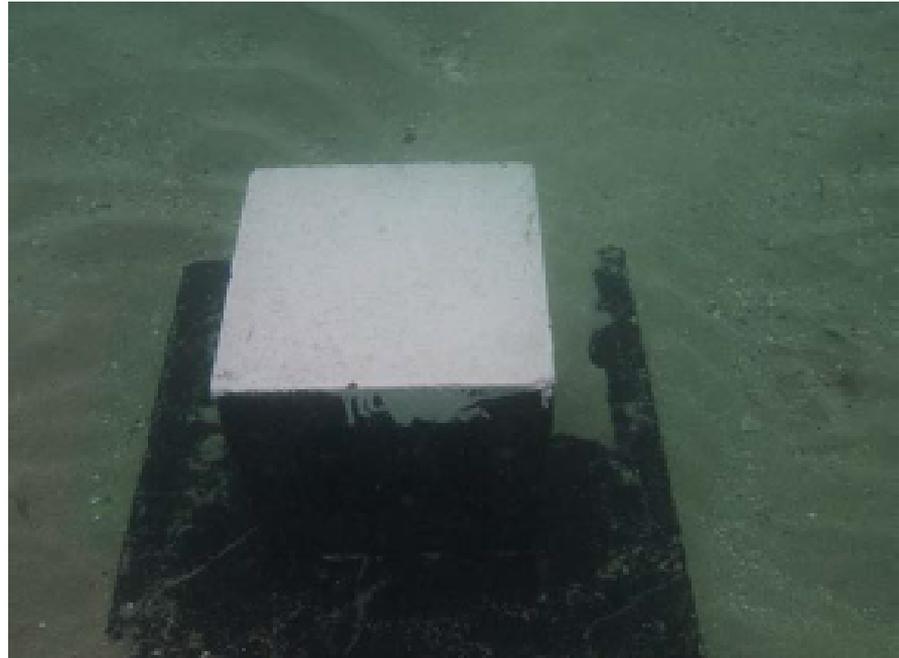


Figure 4 Sediment block used to monitor sediment accumulation at hardbottom and reef resources at hardbottom sites.

The Corps recognized that the sediment blocks didn't trap sediment before construction began

Miami Harbor Monthly Inter-Agency Coordination Meeting Minutes February 6, 2014

Page 3

Sedimentation blocks do not appear to hold sediment falling from the water column, although that same sediment does settle on the habitat and benthos-below the block. The blocks sit 16-18 inches off the bottom, and it appears that this height is sufficient for them to be cleaned of material by water movement.

Instead of switching to a method that effectively measure sediment, the contractors simply reported “0”s in every report. They say only “We are in compliance with our permit,” when we ask them about this.

Sediment Block Survey

No sediment was found accumulating on sediment blocks at any compliance monitoring sites in Week 22.

Table 3: Sediment accumulation data collected from sediment blocks during compliance monitoring Week 22. All measurements are in mm.

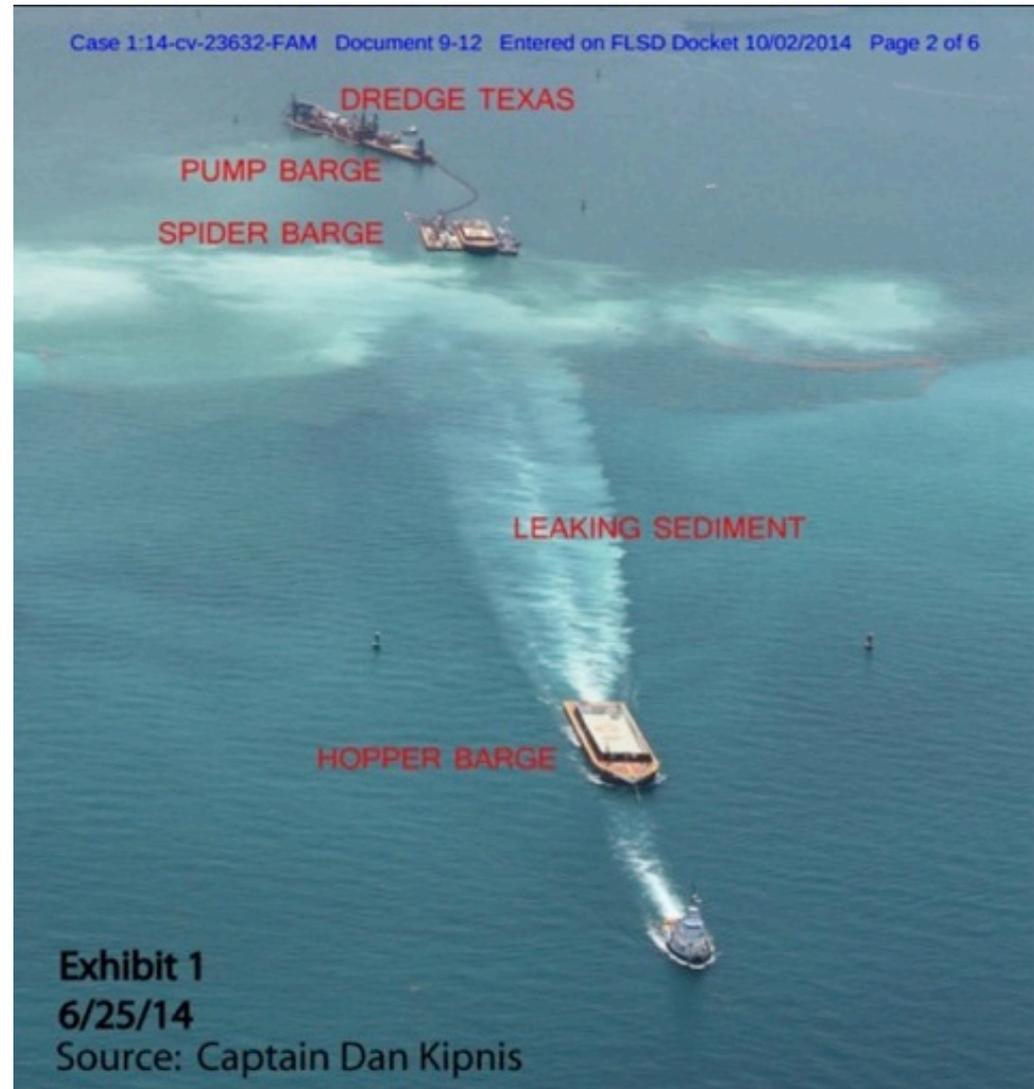
Area	Site	Sediment Accumulation (mm)	N
Southern Hardbottom	HMSC1	0	1
	HBS1	0	1
	HBS2	0	1
	HBS3	0	1
	HBS4	0	1
Northern Hardbottom	HBNC1	0	1
	HBN1	SITE BURIED IN WEEK 3 OF BASELINE SURVEYS DUE TO NATURAL SAND TRANSPORT. NOT DREDGE RELATED.	
	HBN2	0	1
	HBN3	0	1

NA: No data were collected.

Leaking transport barges

EPA has noted over 49 violations of the contractors' offshore disposal practices.

The Corps recently asked for a two year permit to continue dumping offshore, but the EPA only gave them six months because of violation concerns



Mitigation boulders were placed on top of living corals, found by DEP divers



Photo from DEP July Warning Letter field notes reports:
Mitigation boulders for artificial reef habitat were placed on top of living coral.

Inaccurate Turbidity Monitoring



What are the Consequences?

- Massive sedimentation on top of corals
 - DEP measured it at 14cm on top of corals in some areas
- Severe and profound impacts to the hardbottom. DEP, NOAA, & BBWK have reported sediment damage beyond 200m from the channel, Dial Cordy measured it at 400m from the channel
- Staghorn corals “taken” by dredging sediment in violation of ESA

ESA-Listed Corals: Staghorns

2010, pre-construction

Dial Cordy survey finds 31 corals in the indirect impact area (within 150m of the channel)



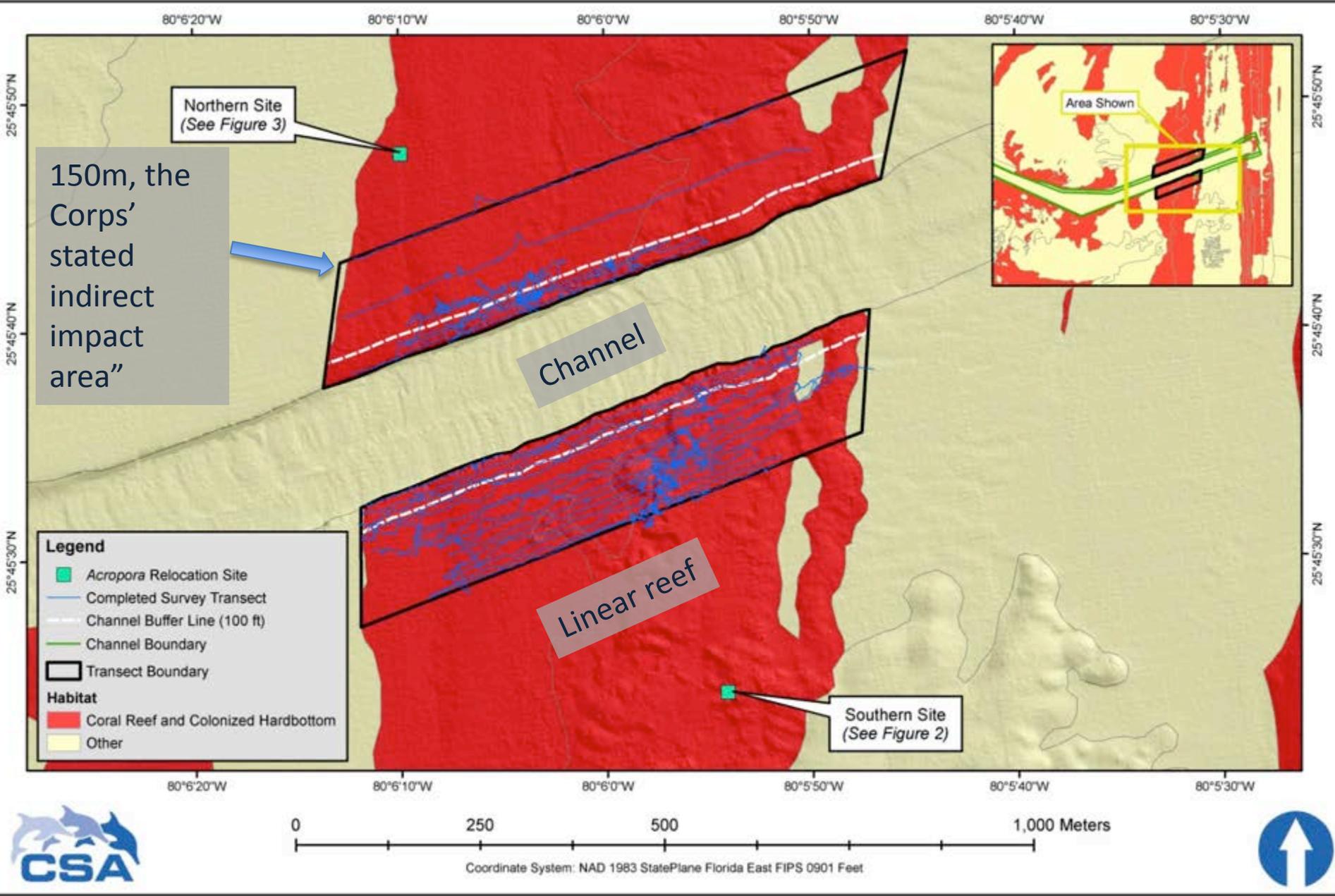
Corps tells NOAA the sedimentation will be minimal, NOAA says to move the 31 colonies and will OK the project in 2011 Biological Opinion

ESA-Listed Corals: Staghorns

October 2013, the month before dredging begins

CSA (USACE contractors) complete a survey to find the 31 staghorn colonies for relocation. *Instead of just 31 colonies, they find 248*, before stopping their survey, leaving it incomplete, to await further instruction from NOAA.

Blue lines are where the survey was completed in 2013



150m, the Corps' stated indirect impact area"

ESA-Listed Corals: Staghorns

October 2013, the month before dredging begins

But, when the additional corals are found, it's the government shutdown. The Corps doesn't want delays in dredging. The Corps asks NOAA for a way forward.

NOAA says to: 1) move staghorn corals within 40-50 ft of the channel, 2) to monitor the rest of the colonies and 3) to reinitiate formal consultation about the newly-discovered colonies

ESA-Listed Corals: Staghorns

October/November 2013

1) The Corps contractor moves 38 colonies within 100ft of the channel to a location ~250m from the channel.

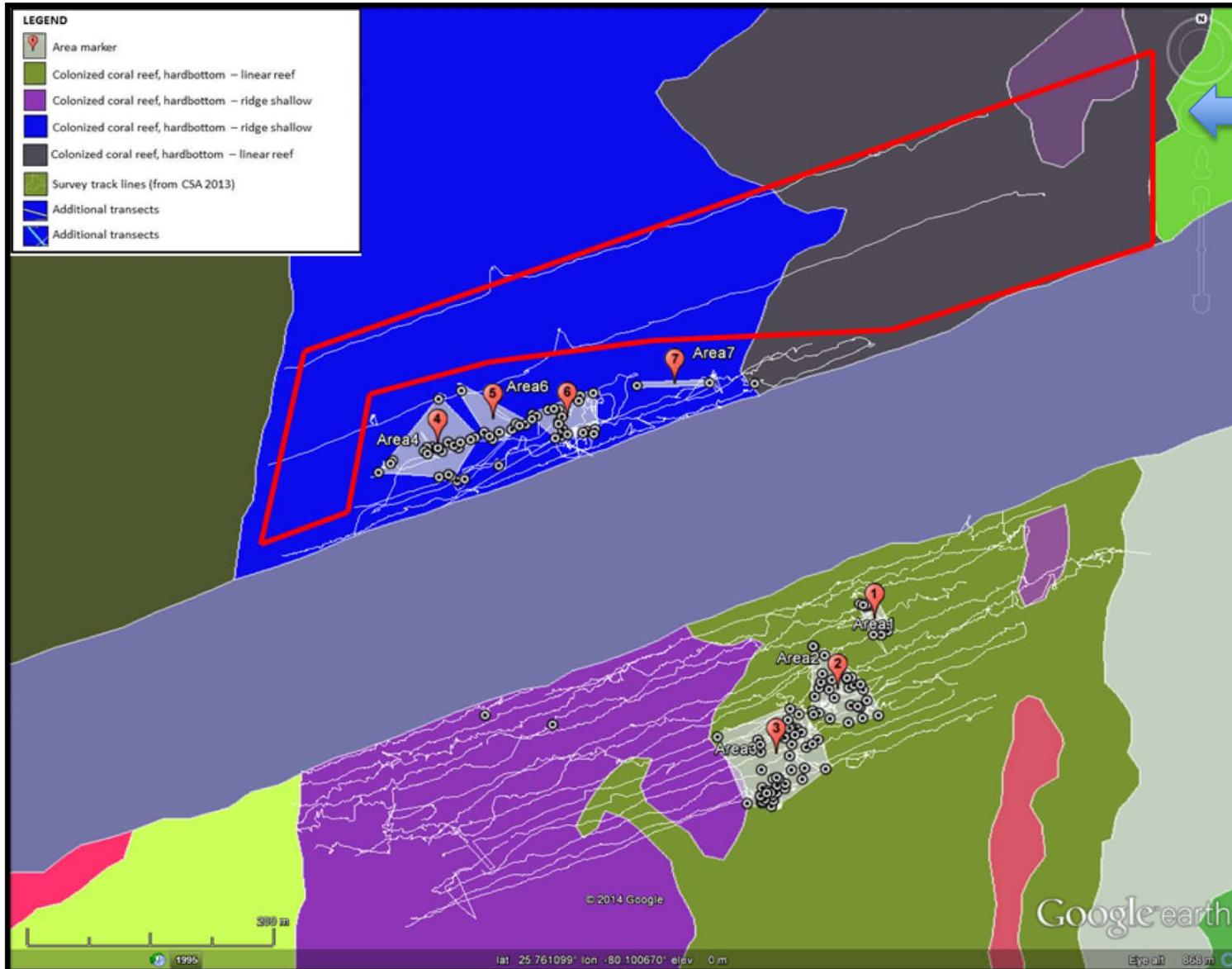
But,

2) The Corps does not monitor the rest of the staghorn corals.

3) The Corps does not reinitiate formal consultation with NOAA.

The survey of the staghorn corals within 150m impact area is never completed, (and remains incomplete today).

NOAA's relocation report Feb 13, 2015



Area still lacking surveys for staghorn corals for sediment-ation impacts

Figure 2: The seven search areas identified by NOAA where *A. cervicornis* had been observed on the north and south sides of the Federal Channel. The orange markers show the center of each area. The red polygon in reef habitat to the north of the channel depicts areas with limited prior survey effort.

ESA-Listed Corals: Staghorns

July 2014, the dredging has been going on for over 8 months

Reports start streaming in about heavy sedimentation on the reefs and massive coral damage. Despite repeated efforts to alert the Corps and NOAA to the issue, there is no change in monitoring behavior or methods.

ESA-Listed Corals: Staghorns

August 2014

NOAA asked the Corps to begin monitoring the staghorn corals that they had failed to monitor nine months before

After the first survey results, NOAA issues emergency recommendations for the Corps to relocate the corals immediately

9-10-2014

Port of Miami Emergency Remediation Recommendations From NMFS PRD

NMFS has determined, based on monitoring reports submitted by the USACE, that there is clearly sediment impact affecting coral colonies, including ESA-listed *Acropora cervicornis* and possibly newly-listed corals, in the project area. There is also evidence of additional background warm temperature stress in the region. Both these factors are contributing to rapid deterioration in colony condition in the project area. Furthermore, accumulation and resuspension of sediments in the project area will continue to affect extant colonies and designated critical habitat as long as the sediments are present. Therefore, emergency relocation of living staghorn colonies should be undertaken immediately and further mitigation (e.g., translocation of additional coral species, CH mitigation) considered. NMFS recommends the following remediation actions to begin immediately:

ESA-Listed Corals: Staghorns

October 17, 2014

The Corps agree to pay NOAA divers over \$400,000 to have NOAA divers fly in to relocate the staghorn corals found in the survey within two weeks

NOAA agrees to allow the Corps to continue dredging during the rescue mission

NOAA Staghorn Coral Relocation/Rescue

Late October, early Nov 2014

NOAA divers fly in for a two week rescue mission, but find the dredge working directly on top of the reef

NOAA repeatedly requests that the Corps move the dredge, even for 2 days, so that they can access the reef. The Corps refuses.

NOAA divers report heavy sedimentation, dense turbidity plumes, severe impacts to corals and other organisms (See Feb 2015 POM Acropora relocation report)

ESA-Listed Corals: Staghorns

After two weeks, NOAA divers must leave

The staghorn coral survey on the North side remains incomplete.

NOAA issues Final POM Acropora relocation report Feb 2015

ESA-Listed Corals: Staghorns

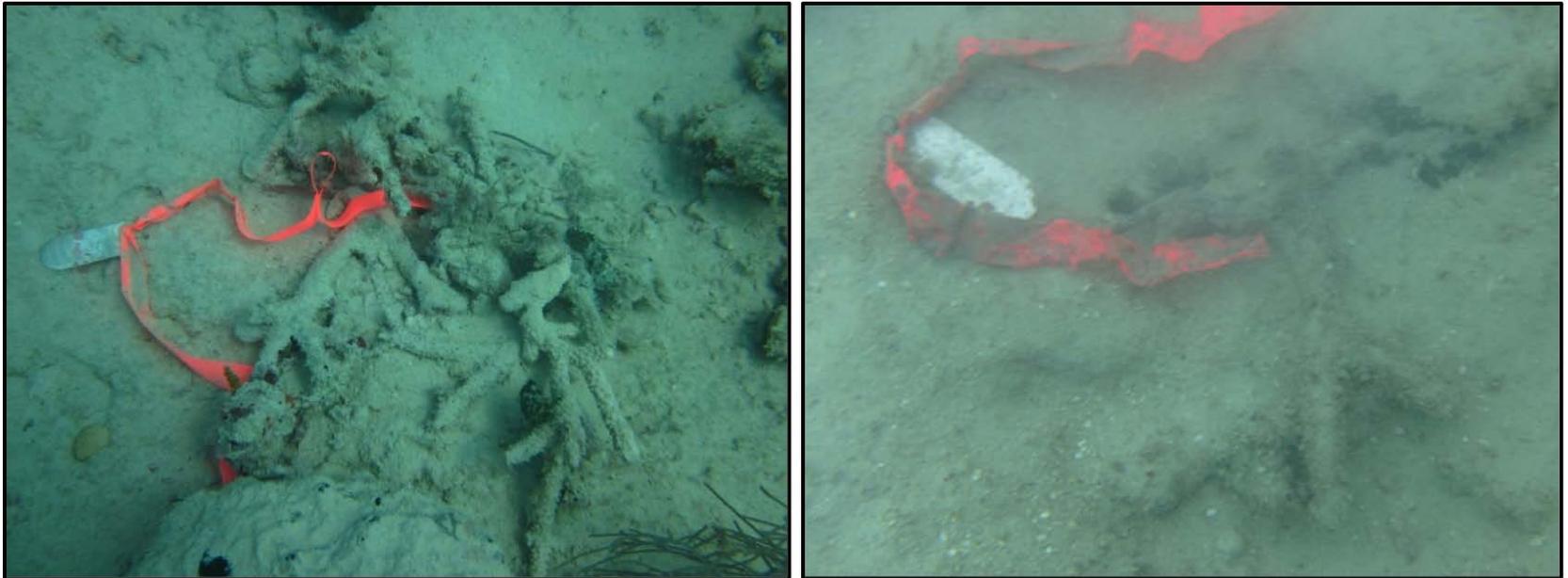


Figure 3: Colonies of *A. cervicornis* that had been tagged for monitoring [tag #22 (left)]. Tag #57 (right)] associated with a missing colony with a nearby dead coral as a result of burial by sediment.

NOAA report on the relocation mission, Feb. 13, 2015

Feb 2015 NOAA Relocation Report

Photos taken the same month that Corps contractors declare the sediment has disappeared



Figure 7: Coral colonies before (left photos) and after (right photos) divers cleared sediment from the corals showing accumulation and recent mortality (exposed white skeleton) along the lower portions of the colonies as a result of accumulation of fine and clay-like material (sedimentation)

ESA-Listed Corals: Staghorns

There are still more staghorn corals on the North side of the channel

Corals that were relocated to 250m north of the channel before construction have heavy and severe mortality

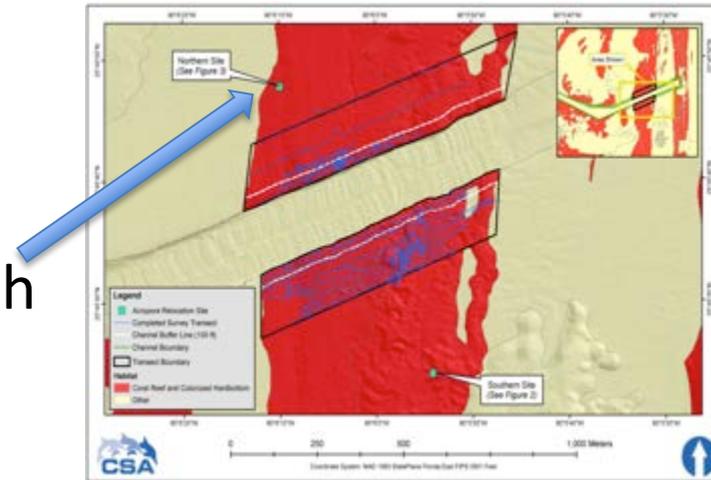


Photo C-24c. *Acropora cervicornis* colony #24 immediately post-reattachment.



BBWK photo 1/30/15

ESA-Listed Corals: Staghorns



Photo C-34d. *Acropora cervicornis* colony #34 30 days post-reattachment. CSA 1/14/14



BBWK photo 1/30/15

Recovery from sedimentation will be almost impossible for reef corals

- What is a “temporary” impact?
- Recovery will be hindered by:
 - the lack of hardbottom substrate for coral larvae to attach to
 - a lack of crustose coralline algae, which is red, encrusting algae that signals good habitat (reef) to juvenile corals



The Corps is delaying surveying the full extent of the sediment impacts for months

- Offshore dredging has been finished near the reefs since December.
- Still, no full accounting of sediment survey has been completed
- The Corps says that they have one day left of dredging to do offshore, so they want to wait until that's complete to conduct the full sediment delineation survey.
- If they wait months, it will become harder and harder to link the damage to sedimentation
- The survey must be done ASAP.

Sediment Delineation Survey is needed immediately

“It will be easier to detect sediment impacts with a high degree of confidence in the immediate short-term. As time goes by, the dead portions of the colony could be colonized by algae and it will become more difficult to determine sediment impacts.”

--NOAA report on the relocation mission, Feb. 13, 2015

Conclusions in Miami



- Dense, fine, clay-like sediments are still present in the area, choking the reef



- **Sediment impacts extend far beyond the anticipated 150m “indirect impact area”**

- **The extent of the sediment damage has still not been fully delineated**



- The staghorn coral survey has not been completed on the North side of the channel. There are staghorns being impacted on the North side of the channel that were not surveyed or relocated. This is an ongoing “take”

Port Everglades

Port Everglades, just 30 miles up the coast from Port of Miami, is the next port on the list getting ready for dredging.

Port Everglades contains even more coral, seagrass, and mangroves than the Port of Miami.

The Corps is getting ready to approve the final Environmental Impact Statement on Feb. 27th. *They are still using 150m as the indirect impact area.*

NOAA's March 2014 Biological Opinion also assumes an 150m indirect impact areas. It also relies on another 2010 Dial Cordy Acropora survey, which underestimated the number of staghorn corals by over 10x in Miami

No one has completed a full survey of impacts in Miami.

Therefore, it is impossible that the impacts observed in Miami were taken into account.



Conclusions in Port Everglades

Port Everglades' **Final EIS is being reviewed Feb 27th** by Army Corps Civil Works Review Board. It still uses 150m as the indirect impact area, like in Miami.

Impacts in Miami have not yet been fully delineated, so there is no way that Port Everglades' plans have incorporated "lessons" from Miami or additional costs for mitigation and monitoring in cost-benefit analysis

Relies on a survey for *Acropora* corals that was proved to be unreliable in Miami

Needs an updated Biological Opinion & Section 7 ESA consultation



Requests for Next Steps

- Complete the staghorn coral survey in Miami
- Fully delineate the extent of the dredging sediment impacts in Miami
- Apply “lessons” in Miami to resource damage estimates and cost-benefit analyses for Port Everglades EIS
- Have your agency conduct monitoring in Miami ASAP

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