Observations regarding Draft Implementation of the Turbidity Criterion for the Protection of Coral Reef and Hardbottom Communities (FDEP, September 2019 – draft)

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1. The document proposes that construction related turbidity at the edge of a mixing zone, in marine environments featuring coral reef & hardbottom, may not exceed the concurrently measured background turbidity by an amount greater than the site's natural turbidity variability during a normal tide cycle (versus the traditional value of 29 NTU outside of an OFW). This approach is similar to that currently used to establish the allowable increased turbidity inside an OFW. The document expands this approach to areas outside of OFW. And, the document proposes very specific means by which the site's natural turbidity variation shall be measured and established by data collection and statistical analysis. The change would effect marine construction (dredging and beach nourishment) everywhere within the Florida Reef Tract; i.e., from immediately south of St. Lucie Inlet (Martin County) through Palm Beach, Broward, Dade and Monroe Counties, to the Dry Tortugas "or other areas of the state where coral reef or hardbottom communities are currently found."

2. As such, the proposed change would affect a great many beach nourishment projects beyond the reef tract – it could be applied to any project near hardbottom (e.g., Flagler through Martin Counties, and parts of Collier through Manatee Counties et al.)

3. The proposed approach is similar to that already employed to establish the compliance turbidity levels in an OFW (the measured maximum difference in turbidity during a tide cycle); but it greatly expands the area and number of projects to which this tighter requirement would apply, and it prescribes very strict limits on how the levels shall be established. The proposed change would establish turbidity compliance levels that are very much lower than the existing 29 NTU levels (or less within OFW) at very many project locations.

4. Construction shut-downs and schedule delays would increase significantly because of practical difficulty in operating below potentially impractical turbidity compliance levels, as demonstrated by existing data (described below).

5. As such, the proposed changes would significantly increase project costs, temporary shut-downs, and the time required to complete a project. The delays would cascade to subsequent projects (forcing their delay or cancellation) and/or result in increased need to construct within marine turtle nesting season.

6. The prescribed means to actually establish the compliance levels are additionally costly and not necessarily practical to accomplish. (Specific details are presented below.) It proposes that natural turbidity levels must be measured during at least three (or five) 12.4+ hour tide cycles – not necessarily concurrent – during fairly ideal conditions to establish levels "not more than 3 months before beginning the project". Turbidity levels at multiple locations may, or will be required; and seasonal variations are to be considered for projects lasting over 3 months. This will require repeating the data measurements and establishing the compliance values repeatedly – for each project – through costly field work and analysis. Some projects are conducted annually or biennially. Some are conducted year-round (e.g., in the case of some inlet sand bypassing projects).

7. The following presents several examples of the anticipated delays and associated costs that would be likely caused by the proposed rule, based upon recent actual project data.

8. The costs to establish the "baseline condition" prior to each construction event may be on the order of at least:

Pre-coordination with FDEP (engineer + biologist):	$ 2,000
3 to 5, 14-hour field days (plus weather, since conditions must be ideal):	$27,500
Data analysis, report, submittal, coordination with FDEP, permit mod:	<u>$ 7,500</u>
<u>Total per event</u> (assuming a maximum of 3 baseline locations per project):	$37,000

"If multiple community types are present within the project area, multiple baseline stations may be needed to address the different background conditions". This may require twice as many field days, since the maximum likely number of stations that can be measured in a given field day is three. For projects requiring more than 3 stations:

<u>Total cost per event</u> would thus be closer to:	$67,000

9. There are probably fifteen (15) counties potentially affected by this change: Flagler through Manatee Counties. It is reasonable to assume that there are at least 1 to 4 inlet/dredging/ beach nourishment projects occurring each year, near hardbottom, within at least 12 of these counties: say, a minimum of 2 projects x 12 counties = 24 projects per year. If one-third of these require more than 3 baseline stations to be established ($67,000) and two-thirds of these require 3 or less baseline stations ($37,000), then the total cost of measuring and establishing the baseline turbidity data for each of these, say, 24 projects per year is (8 x $67K + 16 x $37K) = $1,128,000 per year.

10. At *minimum*, there would be at least 20 such projects occurring each year within these counties (simply based upon the number of inlets and beach projects along the affected shoreline within the reef tract or near hardbottom); and say, up to ¼ would require more than 3 baseline stations to be established. In this overly conservative (low) estimate, the total minimum cost of measuring and establishing the baseline turbidity data for these 20 projects per year is (5 x $67K + 15 x $37K) = $890,000 per year.

11. Thus, it is reasonably expected that the minimum probable cost of establishing the baseline turbidity criterion for the affected projects would be between $890,000 and $1,128,000 per year.

12. Typical bid and/or contract costs for a dredge contractor to shut down (or "standby") are listed below. These values are taken directly from four recent federal beach nourishment & sand bypassing projects. These all include ocean-certified dredges for typical-scale beach/dredging projects on Florida's east cost (3 are for hopper dredges, 1 is for a cutterhead dredge (Canaveral)). The average cost is $4,692 per hour – or, about $5,000 per hour when adjusted to summer 2020 valuation.

Dredge Stand-By Time for Federal Projects (by Bid / Contract)		
Canaveral Sand Bypass V	Sept 2018	1,340,000 cy
Contractor 1	$ 3,000	/hr
Contractor 2	$ 5,500	/hr
Duval 2018 Renourishment	July 2018	809,000 cy
Contractor 1	$ 7,600	/hr
Contractor 2	$ 4,250	/hr
Contractor 3	$ 5,000	/hr
Brevard 2017-18 Renour	Oct 2017	1,100,000 cy
Awarded Contractor	$ 4,500	/hr
Brevard 2019-20 Renour	Aug 2019	1,285,000 cy
Awarded Contractor	$ 3,000	/hr
AVERAGE	**$ 4,693**	/hr

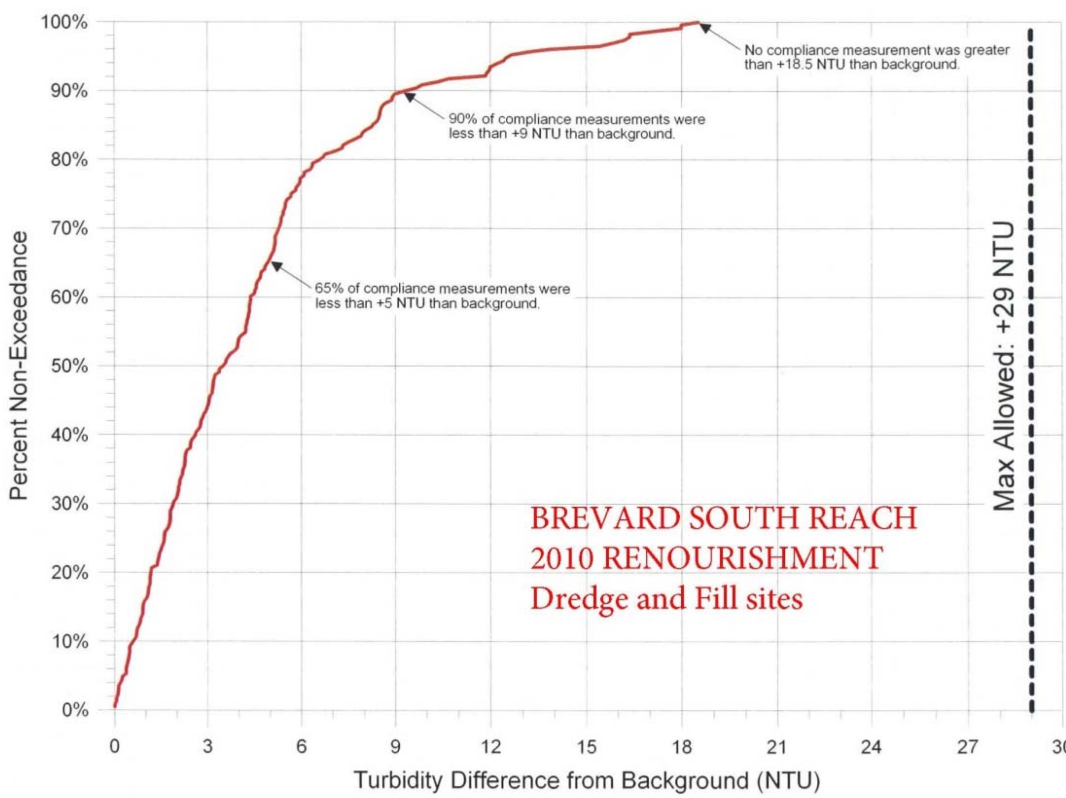
13. These contract line item valuations for dredge "standby" are lower than actual, because payment is infrequently made for shut-down time required by the government (such as, say, may be infrequently required for the presence of a manatee or turtle that is observed near the dredge, or for ordnance recovery, safety, missile launches at Cape Canaveral, etc). So, since payment is infrequently made on this contract line item, there is no benefit in indicating a larger actual value that would otherwise inflate the bottom-line bid value, when payment for this line item is unlikely to ever be paid. Actual costs to the contractor are likely 15% to 25% greater than $4693/hr – specifically, probably about $5,400/hr to $5,900/hr (which when valued per a 24-hour day, equates to about $130K to $142K per day for a beach nourishment project, with dredge/beach/survey/administration crews). On average, that's about 1.2 x $4693 = $5,631/hr. And, adjusted to summer 2020 levels, that equates to at least $5,800/hr.

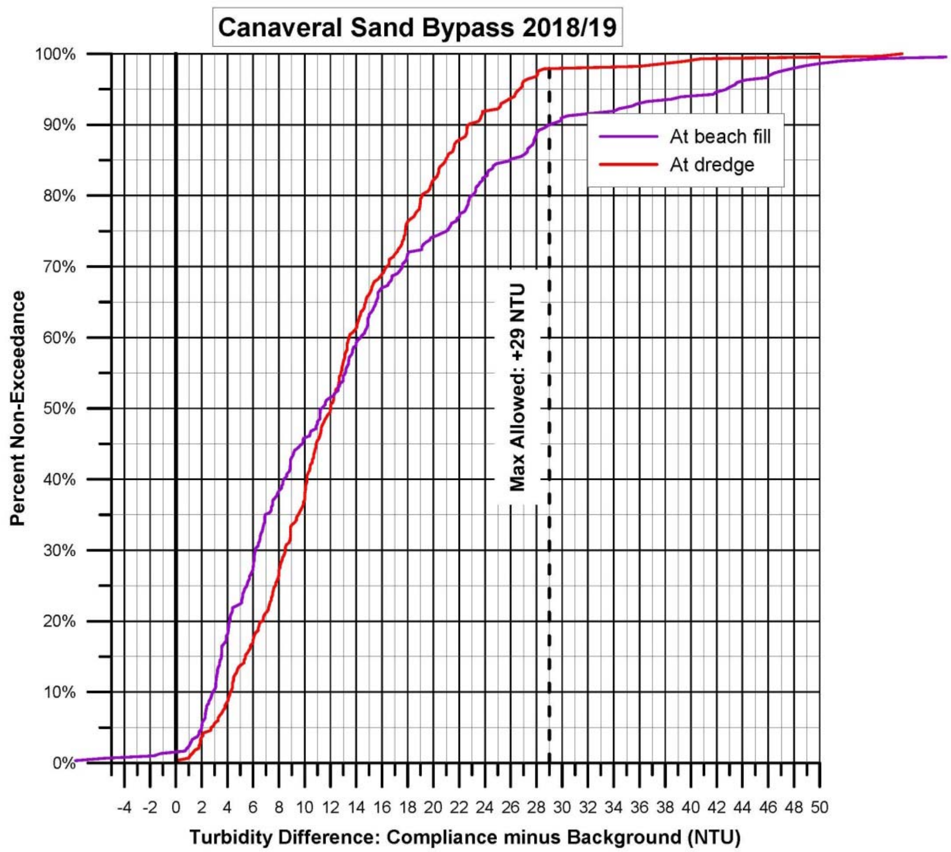
14. Per standard contract specifications, the Corps (and most non-federal projects) does not typically pay "standby" time for turbidity exceedances. Instead, the burden is left upon the contractor to avoid turbidity exceedances (through dredge, diking and best management practices, etc). The probable occurrences, risk and costs of dredge shut-down from turbidity exceedances must be anticipated by the contractor in his bid – based upon the project details, contract requirements, and maximum turbidity thresholds allowed by the permit. The contractor's actual cost of anticipated shut-downs & delays from turbidity exceedance is folded within the fixed and/or unit costs of the contract bid. So, even though the cost of "standby (shut-down) hours" for turbidity exceedance may not be directly paid by the Corps or Owner, such cost is very real – and this cost is reflected within the contractor's overall bid. Per the above contract data, this cost is not less than $5000 per hour at year-2020 levels – or more realistically it is on the order of at least $5,800 per hour, which is the probable actual minimum cost to the contractor (and the construction contract) in 2020, as described above.

15. The following graphs depict the occurrence of actual measured turbidity levels (compliance value minus background value) during the construction of four different types of beach nourishment projects along the central-southeast Florida coast. Each project includes "high-quality" beach fill sand that exhibit minimal amounts of fine sediment (<2% at most). These projects include:
    - Brevard South Reach – 2010, dredged from Canaveral Shoals II offshore borrow area.
    - Canaveral Sand Bypass V – 2018/19, dredged from the natural beach north of Port Canaveral.
    - Duval Beach Nourishment -- 2018/19, dredged from a high-quality offshore sand source.
    - Broward Truck Haul, Segment II – 2016, placed from commercial Ortona upland mine.

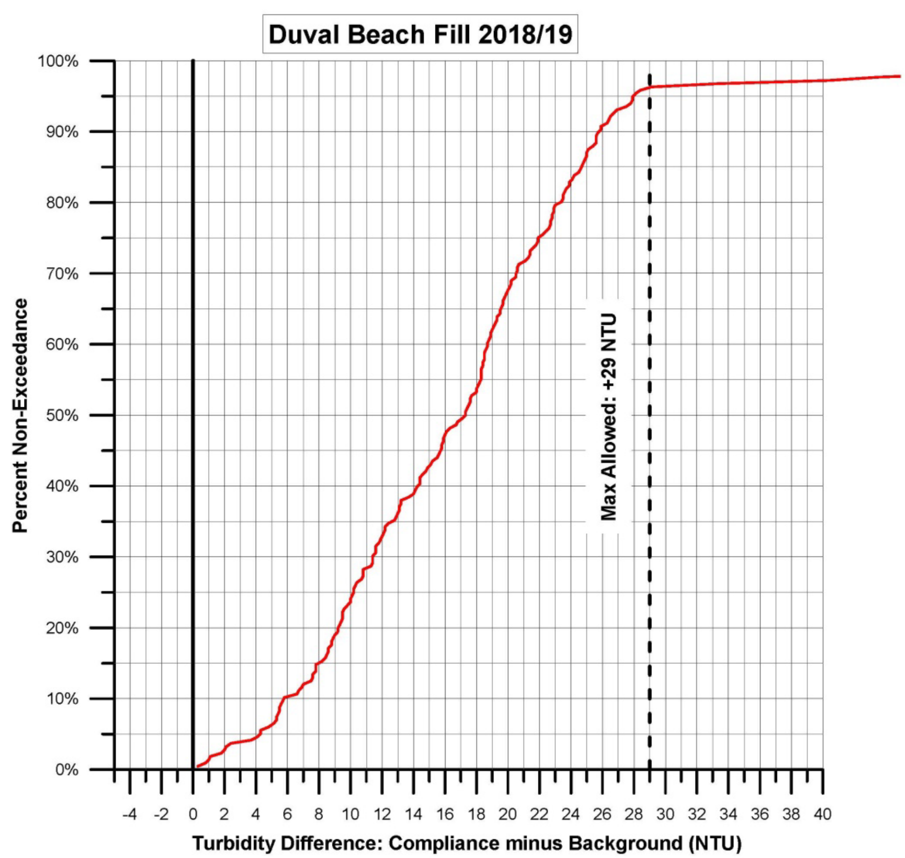
16. Each graph depicts the cumulative occurrence (non-exceedance) of turbidity compliance levels for all data collected during each project. For example, from the first graph, below, 90% of all turbidity measurements collected at both the dredge and beach fill sites for the Brevard County South Reach renourishment in 2010 exhibited compliance values that were less than 9 NTU above background. Conversely, 10% presented values that were greater than 9 NTU above background.

17. These graphs provide an indication of actual prototype levels of compliance turbidity (occurrence of construction-minus-background turbidity) that have been observed at four recent, typical projects that include hopper-dredge placement from offshore sources, cutter-head bypass from a natural beach, and truck-haul placement from a high-quality upland source. These are four more or less randomly selected projects, spanning a variety of very "clean" beach fill sources, for which data was readily available for plotting.

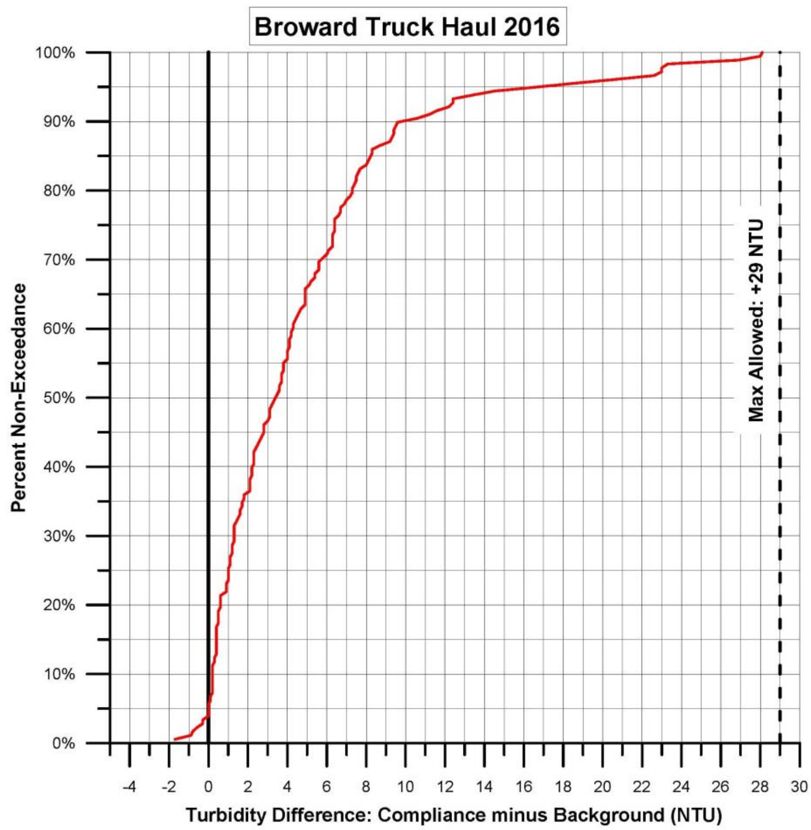




Canaveral Sand Bypass 2018/19
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Percent Non-Exceedance
At beach fill
At dredge
Max Allowed: +29 NTU
-4 -2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50
Turbidity Difference: Compliance minus Background (NTU)



Duval Beach Fill 2018/19
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Percent Non-Exceedance
Max Allowed: +29 NTU
-4 -2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40
Turbidity Difference: Compliance minus Background (NTU)



18. Among these four projects, the total number of turbidity exceedances (beyond 29 NTU allowable), and the total number of days of beach fill construction activity, were approximately as follows:

- Brevard South Reach, 2010: 0 exceedances 43 days construction
- Canaveral Sand Bypass V, 2018/19: ~10 exceedances 130 days construction
- Duval Beach Nourishment, 2018/19 7 exceedances 90 days construction
- Broward II Truck Haul, 2016 ~4 exceedances 111 days construction

Totaled among the four projects, that equates to 21 exceedance events over 374 days of construction activity, or 0.056 exceedance events per construction days. Alternately, by individual project, that equates to an average of 0.048 exceedance events per construction days.

So, overall, this represents about 0.05 exceedance events per construction days, based upon the projects' contract allowance (i.e., expectation) of ≤ 29 NTU compliance turbidity level; that is, about 1 day out of 20 resulted in a turbidity exceedance during construction, on average. These 4 projects averaged about 93.5 days of dredge & fill construction activity.

19. Hence, during an average construction period of 93.5 days (not atypical for a beach fill project), these four projects indicated about 0.05 turbidity exceedance events per construction day – or 0.05 x 93.5 = 4.7 events per project. From practical experience, each exceedance event (at 29 NTU compliance) requires about 1 hour of stand-down time for turbidity measurements and levels to allow resumption of construction.

20. At a probable contractor cost of at least $5800/hr (2020 value), and a 1-hr stand-down time for each exceedance event (at 29 NTU), a total of 4.7 exceedance events per average project would equate to $5800/hr x 4.7 hrs = $27,260 per average project.

21. My recent experience in establishing turbidity compliance levels within OFW's, through measurement of turbidity fluctuations during a single tide cycle per existing policy, includes two projects: St Lucie Inlet – 7.2 NTU, and Clearwater Pass – 11.2 NTU. Both of these were within a semi-confined inlet throat setting, where natural turbidity levels can vary significantly during the tide cycle. In an open ocean environment – such as over a nearshore or offshore reef – such turbidity variation will be likely less. That is, it is reasonable to assume that the proposed establishment of a turbidity criterion level, in open water, averaged over 3 to 5 tide cycles, will be less than 7.2 to 11.2 NTU.

22. Say, for example, the established "baseline" turbidity variation per the proposed rule is 8.0 NTU, which is a wholly reasonable assumption based upon the prior observation, and probably high. According to the actual measured turbidity compliance values from the four open-ocean projects that are featured above, the compliance turbidity values (construction-minus-background) that exceed 8.0 NTU threshold value were observed to occur as follows:
    - Brevard South Reach, 2010: 16% exceedances x43 days constr= 7 events
    - Canaveral Sand Bypass V, 2018/19: 61-73% exceedance x130 days constr= 79-95 events
    - Duval Beach Nourishment, 2018/19: 85% exceedances x90 days constr= 76 events
    - Broward II Truck Haul, 2016: 16% exceedances x111 days constr= 18 events

23. Totaled among the four projects, that equates to 180 to 196 days – over 374 days of construction – at which an exceedance event (over 8 NTU) would have occurred. That's 0.48 to 0.52 exceedance events per construction days – or basically 1 every other day.

24. During the same average construction period of 93.5 days described above, that would equate to about 0.50 x 93.5 = 47 exceedance events per project (on average). The time required to return to a threshold turbidity level of 8 NTU is inherently longer than that required to return to a level of 29 NTU – say, minimum of 2 hours versus 1 hour.

25. Hence, for an average 93.5-day long project, with 47 exceedance events (at 8 NTU) each requiring a shut-down time of at least 2 hours, and at a contractor cost of $5800/hr, the cost of the turbidity shut-downs would be 47 x 2 x $5800 = $545,200 for an average project.

26. Compared to the "existing" expected shut-down cost of $27,260 for turbidity exceedances at 29 NTU (described above), compliance at, say, 8 NTU represents an additional project cost of $545,200 - $27,260 = *$517,940.*

27. That is a real cost that the contractor must have to anticipate – and include within the contract bid – to reflect the very real risk posed by a turbidity compliance level of 8 NTU versus 29 NTU, based upon known prior project experience. It is not a simply speculative cost; it is a real and demonstrable risk & cost that must be reflected in the contractor's bid to rightly protect the fiscal interest of the contractor given the historical probability that the project will exceed low threshold turbidity compliance values of, say, 8 NTU, as a realistic example.

28. If applied across, say, a minimum of 20 projects per year along the potentially affected counties (paragraphs 9-11, described above), this equates to an added potential contract cost of 20 x $517,940 = $10,358,800. That is in addition to the approximate $1M cost of establishing the baseline permit criterion to which the contractor must abide. All this totals to an added cost of about $11,350,000 per year. Depending upon the specific nature and federal/non-federal funding of these projects, the State of Florida may typically bear between as much as ¼ to ½ of these additional costs.

29. *Even if these valuations are 50% over-estimated* – which is altogether unlikely based upon the data presented above – then one is still left with an added cost of ½ x $11.35M = $5,675,000 per year added cost associated with compliance with the proposed criterion of the new turbidity requirements.

30. Beyond these direct costs, the shut-downs – projected above at about 47 events x 2 hrs/event = 94 hours – result in an additional 4-day schedule delay to each 93-day long project. At a time when the allowable dredging and beach fill construction calendar is already very busy and limited by environmental constraints, the additional delays (even at only 4 days) impedes the Corps of Engineers' and contractors' ability to complete all of the requisite, funded projects within the allowable construction windows. This, in turn, results in year-long delays in project implementation and/or increased mobilization fees (on the order of $4M) for the contractor to have to depart a site and return the following season.

31. Specific comments regarding the particulars of the proposed background turbidity measurement criterion are presented as follows:

32. Page 9: The pre-project baseline conditions are to be established no more than 3 months before beginning a project. For purposes of bidding and awarding a project – this is impossible. The construction contract must include the allowable limits of turbidity, and the contract must be solicited for bid more than three months before construction is to begin; and, the work to prepare the construction contract (and cost estimates, etcetera) must begin several month before the solicitation. In all, the key particulars of a project – such as the turbidity allowances – must be known at least 9 months in advance of the beginning of construction, at minimum.

33. The requirement to establish the pre-project baseline conditions no more than 3 months before beginning a project requires that the entire process be repeated essentially every year – or at least, before every time a project is to be built. There is no physical rationale for this. What would change? Moreover, is the "3 month" requirement intended to ensure that the baseline data are conducted less than 3 months prior to construction? That would be wholly impossible. The field data have to be collected (not a simple task), analyzed, coordinated with FDEP, and the permit modified. That total process alone could entail 5 months.

34. Page 10: The requirement to consider "season specific" values for projects lasting more than 3 months becomes further onerous, and further confusing to enforce. As noted from the examples cited above, the average length of a typical ocean dredge / beach fill construction project is 93.5 days. So, this 3 month "season specific" requirement will affect many projects.

35. For such project lasting more than 3 months, when is the "second season" turbidity allowance to be determined: less than three months before beginning the "second season"? If so, that would be after the contract has already begun construction, and so a change order would have to be issued to the contractor to present them with a "new" turbidity requirement half-way through construction. That does not work.

36. Page 10: Requires baseline turbidity measurements to be repeated within 10 m horizontal accuracy. That is less than one boat length; that is, it less than the length of the boat that would be taking the measurements. This is impractical, particularly if the boat is moving between sites during the course of the tidal-day measurements. This observation raises further question as to whether the practicality of the scheme has been fully considered.

37. Page 10: There are strict limits on data quality, including requiring data collection in "relatively uniform weather conditions". While the intent is understood, the physical reality of complying with this requirement – particularly when multiple days of measurements are required – is far from practical. Particularly in south Florida, it can be difficult to find three or more days of suitable seas and weather conditions (suitable for data collection during 12.4+ straight hours) that do not feature some notable and unavoidable meteorologic disturbance, such as a thunderstorm or wind shift.

38. With different turbidity allowance values at multiple baseline conditions locations, and at different depths, the overall scheme is very over-complicated relative to actual, practical field operations. This is particularly true when the background and compliance measurements (typically 500 meters apart) span different areas. What does one do when the requisite upcurrent background reading is in one "baseline zone" while the dredge is working in another zone, and while the downcurrent compliance reading is in yet another zone? What values of allowable turbidity apply?

39. Page 11-12: Why are equations only given for 3 and 5 baseline tidal cycles? Why not 4? Why not more than 5?

40. While I concur with the need to protect corals and hardbottom from harmful sedimentation and/or turbidity associated with construction activities, it is my opinion that the proposed criterion for establishing allowable turbidity is impractical and would result in very significant increases in costs and/or impossibilities in actually completing a dredging, bypassing, and/or beach nourishment project.