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Mr. Jim Blackburn
BLACKBURN CARTER PC
4901 Austin St.
Houston, TX 77004

January 27, 2014

Re: Litigation on the Closure of Rollover Pass – Impacts on Dredging of the GIWW

Dear Mr. Blackburn:

As requested, I have conducted a review of the Corps of Engineers Galveston District's Environmental Assessment (EA) and Statement of Findings regarding a permit application by the Texas General Land Office (GLO) for the closing of Rollover Pass in Galveston County, specifically as it relates to the potential impacts of such on the dredging of the Gulf Intracoastal Waterway (GIWW). The following are my comments and opinions.

SUMMARY OF FINDINGS AND OPINIONS

The Corps' EA and Statement of Findings on the GLO's permit application for closing Rollover Pass states that the additional cost for dredging the GIWW due to the Pass being open is about \$1M per year. This appears to be based on a study by the GLO's consultant, Taylor Engineering, who estimated that the additional amount of sediment that is deposited into the GIWW via the Pass is in the range of 80,000 – 290,000 cubic yards per year (based on a reach length within the GIWW of about 2-10 miles, respectively). This estimate is based on a 1989 study by Bales and Holley who simply assumed that all of the sediment dredged from the GIWW within the reach in the vicinity of Rollover Bay and/or East Bay was due to the Pass, beyond what had been dredged from this area prior to the Pass being opened in the mid-1950s.

However, a subsequent study by the Corps' ERDC (a research center) in 2000 found that only a small portion of this sediment that is dredged from the GIWW (over a reach length of about 0.5 miles) is of a coarser sandy material, indicative of coming from the Gulf of Mexico via the Pass. This study estimated the additional amount of dredging due to the Pass at about 15,000 cubic yards per year, which is much more consistent with most other study estimates. Applying this ERDC study's results of a reach length of about 0.5 miles impacted by the Pass to the 1989 Bales and Holley data of dredging amounts from the GIWW within this smaller reach, an estimate of about 9,000 cubic yards per year is obtained as attributable to the Pass. Applying a unit cost of \$4 per cubic yard for

dredging the GIWW in the vicinity of Rollover Pass, the additional dredging cost attributable to the Pass is no more than \$60,000, far less than the \$1million estimate given in the EA by the Corps of Engineers.

1. Overview of the Corps' EA and Statement of Findings re: permit Application by GLO for the closing of Rollover Pass

The Corps' Environmental Assessment (EA) of the proposed closing of Rollover Pass, based on a permit application by the Texas General Land Office (GLO) and its consultant Taylor Engineering, identifies three main technical issues represented by the Applicant as to the purpose of the project: (1) preventing the additional shoreline erosion along Bolivar Peninsula caused by the diversion of sand into the Pass, (2) preventing the diversion of sand through the Pass and into the Gulf Intracoastal Waterway (GIWW) that results in additional dredging costs of the GIWW by the Corps, and (3) undoing the adverse impact to water quality, especially increased salinity in East Bay, due to the inflow of saltwater through the Pass (pg.3 of the EA – COE001734).

This report will focus on the second of the three technical issues discussed above – additional dredging costs of the GIWW due to the Pass – with the conclusion that the additional costs represented in the EA are grossly over-estimated. The other two technical issues - salinity in East Bay and increased shore erosion along Bolivar Peninsula - are discussed in separate reports, having similar conclusions that the impacts attributable to the Pass are misrepresented in the EA.

2. EA estimates about \$1M of Additional Dredging Costs in the GIWW due to the Pass

The stated purpose of the proposed closing of the Pass by the Applicant (GLO) is “to reduce coastal erosion by eliminating the sediment transport into Rollover Pass” and that by doing so, it will “reduce Corps maintenance costs associated with keeping the GIWW navigable.” [pg. 2 of EA]. The EA states that the Pass has increased the amount and cost of maintenance dredging of the GIWW, and that “the Corps spends over \$1 million dollars yearly to keep the Rollover Pass segment of the GIWW open.” [pg. 2 of EA]. The EA references “GICA and Corps studies” as the source for this cost estimate, but none could be found in the Administrative Record that establishes this cost estimate and/or the basis for such. Nevertheless, by closing the Pass, the USACE found that “reduced maintenance dredging of the GIWW may save taxpayers approximately \$1,000,000 a year in reduced maintenance costs ...” [pg. 37 of EA].

In an attempt to determine the reasonableness of this estimated \$1million cost savings from reduced dredging of the GIWW if the Pass were to be closed, I reviewed previous studies that investigated the amount of coastal sediment that is diverted into the Pass and transported into the GIWW that results in increased dredging. All of these studies indicate that the Pass is considered to be a source of material that is deposited into the GIWW, as sediment is brought in from the Gulf of Mexico (GOM) through the Pass and into Rollover Bay before settling out in the deeper channel of the GIWW.

The Corps' EA states that "we agree that evidence indicates that Rollover Pass is indeed the source of material deposited in the GIWW. The ERDC report, performed in September 2000, as well as other studies, has indicated that the Rollover Pass section of the GIWW receives more than twice the sediment of other GIWW sections. The grain size of the sediment, a coarser grained sandier material, could only have been transported by higher velocities, such as the current entering the pass. Furthermore, the grain size is consistent with the coarser sands of the beaches along the Gulf of Mexico." [pg. 32 of EA]. However, the EA fails to mention the amount of sediment in the GIWW that this ERDC study found as having this coarser sandy material, and thus attributable to the Pass (about 15,000 cubic yards per year), nor does the EA mention the extent of the reach within the GIWW where this coarser sand was found (covering about 3,000 feet).

3. Corps' ERDC study estimates that Additional Dredging from the GIWW due to the Pass is Significantly Less than stated in the EA and provided by the GLO

The GLO (the applicant) had its consultant Taylor Engineering perform a study, including a sediment analysis, dated January 2010, to determine the amount of additional sediment that is deposited into the GIWW due to the Pass, that is subsequently dredged out of the GIWW periodically by the Corps of Engineers [COE000035]. This study was cited in the EA, where the EA states that "according to a sediment analysis performed by the applicant, estimates for increases in sediment vary between 80,000 and 290,000 cubic yards of sediment per year." [pg. 2-3 of EA]. While these estimates do appear in the Taylor Engineering report that was prepared for the applicant (GLO), they are significantly higher than the estimate provided by the ERDC study, as well as estimates provided in other studies referenced in the Taylor Engineering report. It appears that the Corps relied on this significantly higher estimate by Taylor Engineering to derive the \$1 million of additional dredging cost that the EA attributes to the Pass, while ignoring and failing to discuss its own study by the ERDC in which a significantly lower estimate of about 15,000 cubic yards per year (cy/yr) was determined.

ERDC is the Corps of Engineers' Engineer Research and Development Center located in Vicksburg, Mississippi. The Coastal and Hydraulics Laboratory of the ERDC conducted a numerical model study in 1999 of the possible design of a sediment trap for Rollover Pass at the request of the Galveston District Corps of Engineers. A report was prepared dated September 2000 by the lead researcher, Mr. Parchure, summarizing this work and presenting information about the amount of coastal sediment found to be deposited in the GIWW via the Pass. [COE000634]. This is the September 2000 study that the EA (as well as Taylor Engineering) references as providing direct evidence that the Pass transports sand from the GOM into the GIWW, as discussed above.

This ERDC study conducted an analysis of the sediment along a stretch of the GIWW in the vicinity of the Pass. This analysis found coarser sands in some of the sediment that indicated the source of such sediment as being from the Gulf of Mexico. The study determined that there was about 15,000 cubic yards per year (cy/yr) of sediment over a 3,000-foot reach of the GIWW that was attributable to sediment transported through the

Pass from the GOM and into the GIWW. [Table 5 of ERDC study – COE000669]. Table 5 from this ERDC study shows the excess siltation in this reach of the GIWW where the coarser sand was found for the two dredging periods analyzed (1997 and 1999). This 15,000 cy/yr estimate is consistent with the estimate provided by Taylor Engineering in its study regarding the results of the ERDC study (i.e. 15,400 cy/yr); however, Taylor Engineering did not present any discussion in its report to the GLO regarding this ERDC study and how its estimate of excess siltation was derived, nor did it present any of the ERDC study findings as to the extent of the reach where sediment was found within the GIWW that was attributable to the Pass. **Exhibit A** herein is a copy of Figure 17 from the ERDC study showing the various stations designated along the GIWW by the Corps of Engineers. The 3,000-foot reach, determined by the ERDC as being where sediment with coarser sand was found, covered stations 2136+00 through 2166+00, a distance of 0.57 miles. **Exhibit B** herein is a copy of Figure 18 from the ERDC study showing the volume of sediment accumulation in the various reaches of the GIWW through Rollover Bay and East Bay. I have shown on this exhibit where the 3,000-foot reach is located (between Stations 2136 and 2166), in which the increased sediment accumulation as compared to other portions of the GIWW is clearly evident.

While Taylor Engineering did identify and cite to other studies that attempted to estimate the amount of additional dredging of the GIWW that was attributable to the Pass (and suggested that a reasonable estimate of this amount is 80,000 – 290,000 cy/yr), no other study that I found in the Administrative Record provided sampling results of the sediment in the GIWW in order to determine a reasonable estimate of the amount of deposition in the GIWW of sediment attributable to coastal sand being transported through the Pass, and the extent of the GIWW where such coarser sand material was found. I did find a Taylor Engineering letter to the Corps dated January 2011, in which a study by Morang (2006) was cited, that stated “based on sediment sampling and modeling, Morang estimated annual inputs of 15,434 cy of sediment from Rollover Pass. [COE001166-67]. This only further supports the Corps’ ERDC study result, also based on sediment sampling, showing that the amount of additional sediment being dredged from the GIWW due to the Pass is about 15,000 cy/yr.

It is unclear why the Corps’ EA does not acknowledge nor mention its own research center’s estimate of about 15,000 cy/yr as the amount of increased sediment in the GIWW due to the Pass, while referring to this same study as the source of information confirming that some of the sediment found in the GIWW in the vicinity of the Pass is from the GOM. Furthermore, a closer review of the statements made in the EA, and the information referenced in support thereof, reveal that these statements regarding the amount and cost of the additional dredging due to the Pass are misleading and fail to include pertinent information from the ERDC and other studies mentioned in the Taylor Engineering report and in the Administrative Record. This missing information in the EA shows that the increased amount of sediment due to the Pass is estimated to be on the order of about 10,000 – 20,000 cy per year (far below the high of 290,000 cy/yr mentioned in the EA) which would make the additional cost of dredging due to the Pass being far less than the \$1 million per year estimate referenced by the Corps in its EA.

4. Applicant and EA Over-Estimated the Additional Dredging of the GIWW due to the Pass while ignoring critical information from the Corps’ ERDC study

Taylor Engineering identified a number of studies in its 2010 report to the GLO (the applicant), which attempted to estimate the sediment transport rates into Rollover Pass and the resulting deposition into the GIWW that results in increased dredging of that channel for navigation purposes [COE000040]. The studies were identified in a table and were classified on the basis of the methodology used to arrive at the estimates, as primarily either based on an analysis of “beach erosion” rates along the Bolivar Peninsula or on an analysis of “dredging records” of the GIWW from the USACE. (The only other study listed by Taylor Engineering was by PIE (2002), whose results were based on a different method and were acknowledged as being significantly influenced by T.S. Allison and a newly constructed sediment trap in Rollover Bay).

The following are the three (3) studies identified in Table 1 of the Taylor Engineering report, along with their estimates of the amount of sediment deposited into the GIWW due to the Pass:

“Beach-erosion” based studies

- | | | | |
|---------------------|--------|--------------------|---------------------------------|
| 1. USACE | (1958) | 18,000 cy/yr | |
| 2. Bales and Holley | (1989) | 9,000-26,000 cy/yr | |
| 3. Bales and Holley | (1989) | 3,800-29,000 cy/yr | (% of longshore transport rate) |

“Dredging-records” based studies

- | | | | |
|---------------------|--------|-----------------------|------------------------------|
| 1. Bales and Holley | (1989) | 240,000-290,000 cy/yr | (based on a 10.4 mile reach) |
| 2. Bales and Holley | (1989) | 80,000 cy/yr | (based on a 1.7 mile reach) |
| 3. ERDC/Parchure | (2000) | 15,400 cy/yr | (based on a 0.57 mile reach) |

(Note: the reach length shown above was not provided in the Taylor Engineering table, but was determined from my review of the two studies identified to help put these estimates into perspective with one another).

Taylor Engineering noted in its study that the “dredging-records” based studies were considered more reliable than the “beach-erosion” based studies as providing a more reasonable estimate of the deposition of sediment into the GIWW due to the Pass. [COE000040]. However, of the three estimates shown above that were based on “dredging records” of the Corps (USACE), Taylor Engineering (and the EA) ignore the 15,400 cy/yr estimate provided by the Corps’ ERDC in its 2000 study, and instead only rely on the estimates made by the 1989 Bales and Holley study of 80,000 cy/yr – 290,000 cy/yr. This is surprising since it was specifically acknowledged in the EA and by Taylor Engineering that it was the ERDC study that was able to identify that the GIWW had coarser sandy sediment attributable to the GOM (but only over a 0.57 mile reach), while the 1989 Bales and Holley study acknowledged that it didn’t know the source of the sediment, and thus simply assumed that all of the additional sediment in the GIWW

covering a reach length of over 10 miles came from the GOM via the Pass in arriving at its estimates.

A close reading of the 1989 Bales and Holley study confirmed that the authors did not know how much of the material being dredged from the GIWW was attributable to the Pass. For example, they state that “the source of the sediments in the higher dredging rates in the vicinity of Rollover Bay cannot be clearly identified from the dredging data.” [pg. 440]. They go on to state that “the reach of the GIWW affected by the presence of ROP is somewhat difficult to ascertain, but it was estimated that effects of ROP are observable between GIWW stations 1900+00 and 2450+00”; and that “it is not known if other sources are contributing sediment to the GIWW east of Rollover Bay ...” [pg. 437]. The attached **Exhibit C** is a copy of Figure 1 from the Taylor Engineering report citing as its source this 1989 Bales and Holley report showing the extent of the GIWW and its associated annual dredging amounts per linear foot of the GIWW [COE000040]. Bales and Holley, as well as Taylor Engineering and the Corps, assumed that all of the sedimentation along that 10.4 mile reach of the GIWW, beyond the amounts that had been historically dredged from that reach prior to the opening of the Pass, was attributable to the Pass. This 1989 study, however, did not sample any of the sediment that was dredged from the GIWW to identify if any or all of the sediment was coarser sands that would indicate it came from the GOM; it was simply assumed to be such. The 80,000 cy/yr estimate by Bales and Holley simply came from another assumption that the relevant reach of the GIWW associated with sediment coming from the Pass was solely across Rollover Bay (between Stations 2080 and 2170), a distance of 1.7 miles, rather than the 10.4 mile reach.

By using the 3,000-foot (0.57 mile) reach of the GIWW found by the Corps’ ERDC study, and applying it to the 1989 Bales and Holley study data covering about 20 years of dredging records since the Pass was opened, the resulting estimate of increased dredging due to the Pass for this 0.57 mile-reach is about 9,000 cy/yr. (See attached Exhibit C for the Bales and Holley figure showing the amount of dredging along the GIWW that is associated with the Pass, being between Stations 2136 and 2166, or about the western one-third of the reach shown for Rollover Bay). This estimate is based on the increase in dredging amounts shown in the 1989 Bales and Holley study for this reach (Stations 2136 – 2166 which cover 3,000 feet) over and above the dredging amounts in the rest of Rollover Bay, which amounts to about 3 cy per linear foot along the GIWW of additional sediment deposition, as compared to the 80,000 cy/yr estimate based on the entire reach of the GIWW within Rollover Bay (Stations 2080 – 2170 which cover 9,000 feet).

5. Most of the Sediment deposited into the GIWW in the vicinity of the Pass is not sand from the GOM

The vast majority of the sediment that is deposited into the GIWW along Bolivar Peninsula, and routinely dredged by the USACE, has more silt in it than sand, and thus is most likely associated with sediment-laden streamflows and runoff entering the GIWW, along with erosion along the edges of the GIWW and from adjacent wetland areas. [pg. 3-61 of the Tx A&M Sept. 2000 report to TxDOT]. The significant increase in dredging

amounts shown in the attached Exhibit C (Figure 1 of the 1989 Bales and Holley study) within the GIWW as compared to pre-Pass conditions is evident within Rollover Bay (Stations 2170+00 – 2080+00) and east thereof, and to a lesser extent east of East Bay (east of Station 1900+00). This increase in sedimentation along this reach of the GIWW is expected since the velocities in the GIWW are going to decrease as flows coming from the east enter the reach where East Bay begins (Station 1900), since there is more area for these flows to pass through, thereby lowering their velocities. Lower velocities allow sediments suspended in the water to settle out into the bottom of the GIWW channel. As this water travels further west, it enters Rollover Bay (Station 2080), where there is even more area for the flows to pass through, thereby producing even lower velocities in the GIWW, thereby allowing even more sediment to settle out and deposit into the GIWW channel.

This explains the differing amounts of dredged material shown in Exhibits B and C along the various reaches of the GIWW, and why assigning all of the sediment found in the GIWW to sediment transported through the Pass is an invalid assumption not supported by the data collected by the Corps' ERDC. Instead, based on the proper understanding of the data presented, the sediment transported through the Pass and being deposited into the GIWW has been on the order of about 10,000 - 15,000 cy/yr.

This lower estimate, than the one referenced in the EA, is further supported by a more recent study that also relied on sediment sampling to establish the amount of sediment in the GIWW attributable to the Pass, rather than simply assuming all of it is due to the Pass. Taylor Engineering, in its January 2011 letter to the Corps, cited to a more recent study by Morang (2006) and stated that "based on sediment sampling and modeling, Morang estimated annual inputs of 15,434 cy of sediment from Rollover Pass". [COE001166-67]. The EA, however, failed to disclose any of these lower estimates, which are based on sampling results to distinguish between silt and fine sand versus the coarser sand that would be coming from the Gulf of Mexico via the Pass; instead, the Corps relied on the estimates of 80,000 – 290,000 cy/yr in its EA, which are based on the unsupported assumption that all of the sediment in the GIWW, beyond that which was observed prior to the Pass being opened, is from the Gulf of Mexico via the Pass.

6. Corps's ERDC Study shows the Alleged Cost of \$1 Million per Year for the Additional Dredging of the GIWW due to the Pass is a Gross Over-estimate

The Corps' 2000 ERDC report determined that the additional dredging of the GIWW associated with the Pass is attributable to a 3,000-foot reach in the immediate vicinity of the Pass. It was also determined in that report that the additional amount of sediment deposited into the GIWW due to the Pass is about 15,000 cy/yr, which is an estimate that is consistent with most other studies. The 9,000 cy/yr estimate that I determined, based on the 1989 Bales and Holley data for this same 3,000-foot reach, compares very well with this 15,000 cy/yr estimate from the ERDC study, and is consistent with the "beach-erosion" based estimates referenced above that were identified in the Taylor Engineering study, as well as the estimate by Morang (2006). Thus, virtually all of the studies, when properly interpreted, including the Corps's own study, show the additional amount of

sediment dredged from the GIWW due to the Pass is on the order of 10,000 – 15,000 cy/yr.

To determine the cost associated with this additional amount of sediment that is dredged from the GIWW due to the Pass, I found a 2010 Corps' cost estimate contained in the Administrative Record showing that the cost of additional dredging of the GIWW was \$4 per cubic yard of dredged material. [COE000755]. Applying the range of 10,000 – 15,000 cy/yr estimate discussed above as the amount of increased dredging of the GIWW due to the Pass, the additional cost associated with such would range from \$40,000 - \$60,000, assuming that the cost of dredging the additional amount of sediment due to the Pass is \$4 per cubic yard. Previous dredging costs for the GIWW in the vicinity of the Pass, including beach nourishment, showed around \$1 per cubic yard for the cost of dredging.

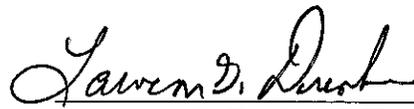
Thus, the EA's estimated cost of \$1 million for increased dredging is grossly over-estimated. It appears from the Corps' own estimate of Pass-related dredged material that the vast majority of the average annual costs for the dredging of the GIWW that the Corps incurs (estimated by the Corps to be approx. \$1 million) is to remove the sediments (primarily silt) in the channel that come from other sources, e.g. from land-surface runoff and/or erosion from the banks of the GIWW.

CONCLUSION

The Corps' ERDC study (2000) established that only a portion of the sediment in the GIWW comes from the Gulf of Mexico via Rollover Pass, estimated at about 15,000 cubic yards per year. The EA failed to discuss this study result, and instead relied on the applicant's representation of the amount of additional sediment deposited into the GIWW of 80,000-290,000 cubic yards per year to support the Corps' estimate of about \$1 million per year as the additional dredging cost associated with the Pass. Based on the Corps' ERDC study results, which are consistent with most other estimates, a range of 10,000 – 15,000 cubic yards per year of additional sediment is dredged from the GIWW, at a cost far less than the EA's \$1 million (between \$40,000 and \$60,000), due to the Pass.

If there is any additional information that I am able to review on this matter, I may need to amend or supplement this report as appropriate.

Respectfully Submitted,


Lawrence G. Dunbar, P.E. 54506 (TX)

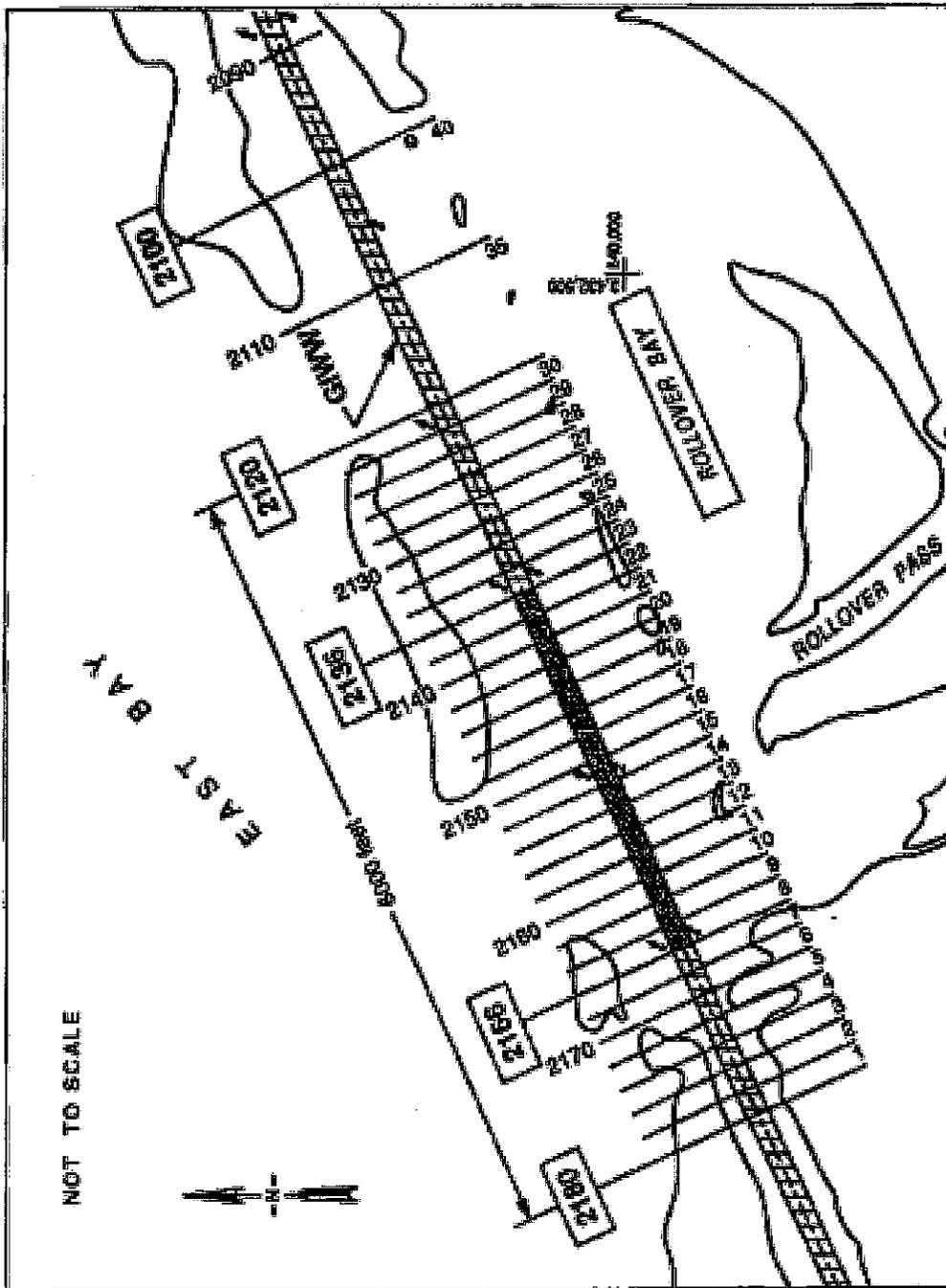


Figure 17. Location of transects for lead profile measurements (To convert feet to meters, multiply by 0.3048)

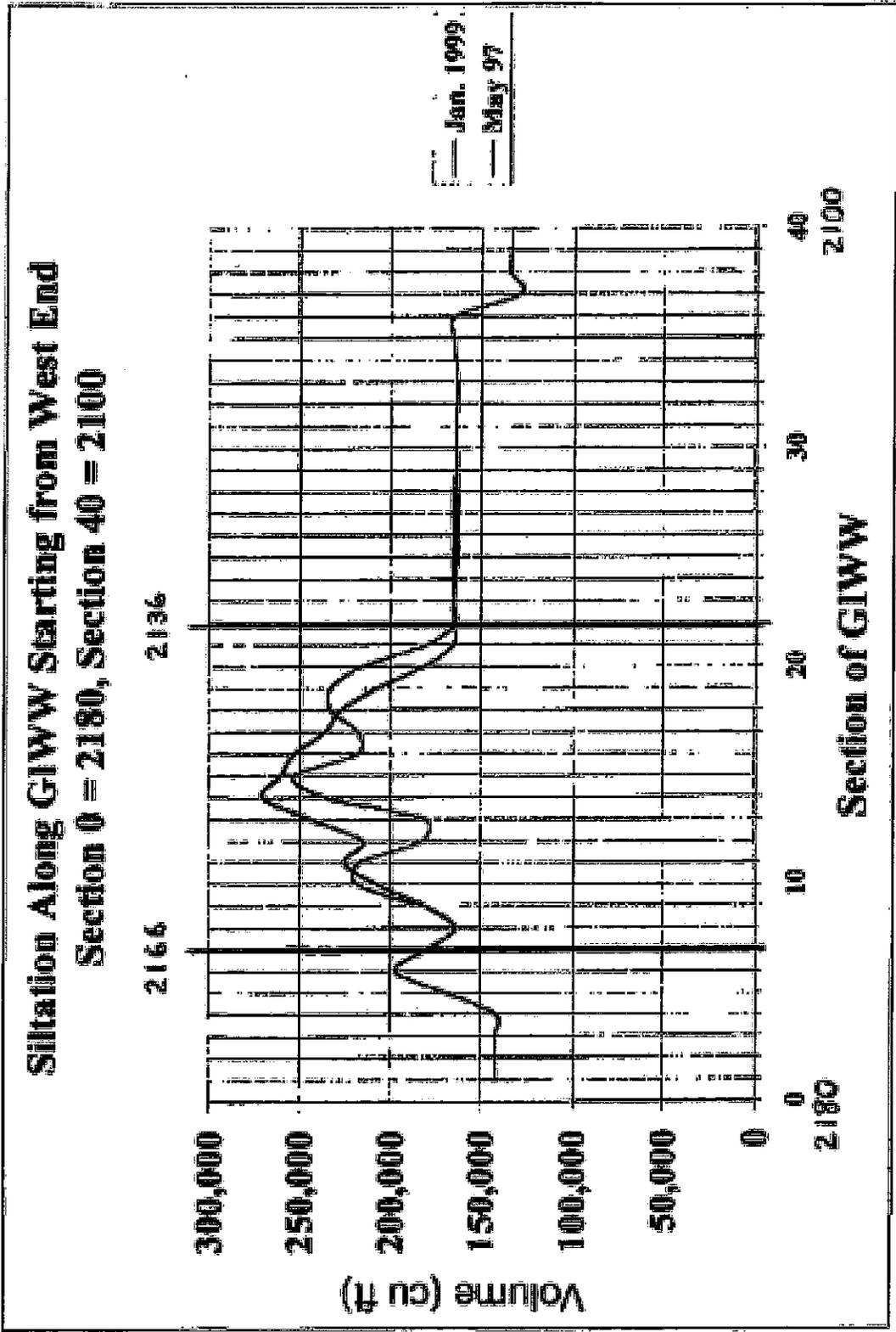


Figure 1B. Computed volumes of sediment accumulation in GIWW (Volume is in cubic feet). To convert to cubic meters, multiply cubic feet by 0.30483

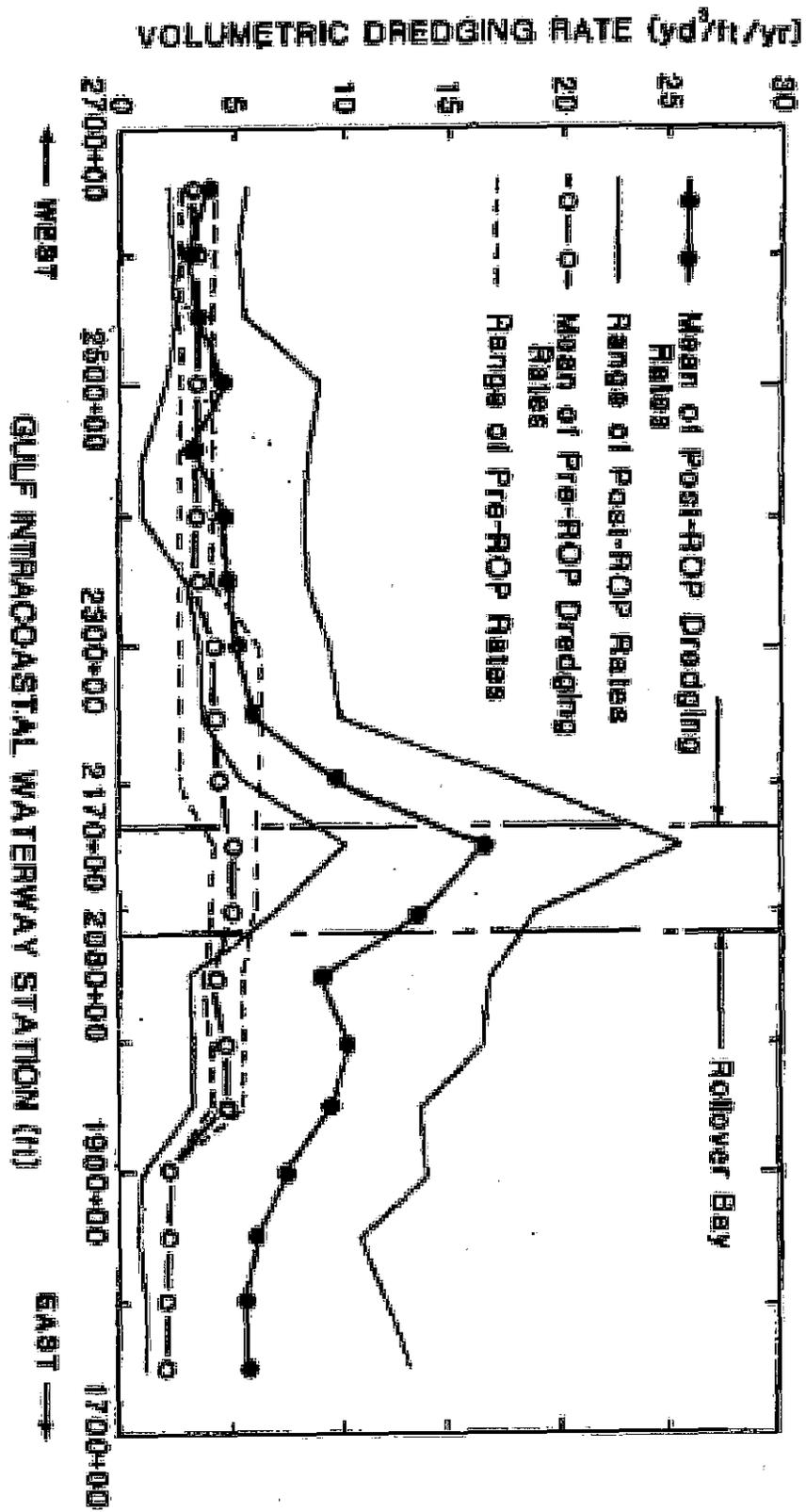


Figure 1 Observed Mean and Extreme Intracoastal Waterway Dredging Rates, Station 1700+00 to Station 2700+00, 1943-1980 (Source: Bales and Holley, 1989)