CESAM-EN-YD 26 Oct. 1987

MEMORANDUM FOR RECORD

SUBJECT: Impact of the proposed Mobile Bay ship channel deepening on the littoral drift system in the Mobile Bay pass.

1. The following people met in EN-Y on 26 Oct., 1987 to discuss Mr. Francis Escoffier's concerns regarding the impact of the deeper channel on the littoral drift system at the Mobile Bay pass.

Francis Escoffier Retired
Hugh Mclellan PD-EC
Matt Laws PD-FC
S. McClure PD-E
M. James EN-YD

Mr. Escoffier supplied a paper which he had written on the littoral drift system at an inlet. He also gave a brief history of the island system and harbors which had originally existed south of Dauphin Island (DI). This system was referred to as the Spanish Islands (Pelican Is.) which has now been reduced to a single island called Sand Island. He had concluded that the dredging of the Mobile Ship Channel had created a "sand trap" and thus interrupted the littoral movement of sands across the pass. In his opinion this had contributed to the erosion of the east end of Dauphin Island and therefore he also felt that the additional dredging for the deeper channel would further aggravate the problem.

2. Mr. Escoffier was then given a general overview of the submerged berm concept which the District was now testing to solve the problem which he had pointed out. The District had already constructed a "feeder berm" south of Sand Island near the lighthouse and was closely monitoring its movement. Mr. Escoffier was invited to attend a District briefing on the berm program next week and he indicated he would like to hear it. It was pointed out that the basic premise behind the feeder berm concept was to resupply the area with the materials which were being blocked by the channel. Also the District intended to construct a "stable berm" in deeper waters south of the Island to provide storm surge protection. This berm would be constructed in 40 feet of water to an elevation of 20 feet NGVD and would be approximately one mile long and 1000 feet wide.

3. Mr. Escoffier was pleased to learn that the District had become aware of the problem and had initiated actions to address the problem.

Maurice James

Maurice James

EN-YD

1 Encl.

December 1, 1976

THE MECHANICS OF NATURAL BYPASSING AT INLETS

Francis Escoffier

The purpose of this memorandum is to formulate a theory as to how the tidal currents and waves effect the transfer of the littoral drift from one side of an inlet to the other. Some thought is also given to the application of the theory to the improvement of inlets.

In Fig. 1 there is shown an inlet with the littoral drift approaching from the left side. The direction of movement of the waves which cause the transport of the littoral drift is also indicated.

An important consideration in regard to the sand transporting capacity of the currents flowing through an inlet is the fact that a converging current has a greater transporting capacity than a diverging current. This is so because the bottom currents are stronger. It follows that if the alignment of the inlet banks, bayward to the gorge, is such as to cause the ebb current to converge as it approaches the gorge, that current will be able to carry seaward whatever sand was brought into the inlet by the flood current. As a consequence an inner shoal will not be formed.

Returning to Fig. 1 we see that the littoral drift that enters the inlet while the flood current is flowing is carried bayward along with whatever sand that current has picked up from the outer channel and the outer bar. Because of the divergence of the current bayward of the gorge, the sand comes to rest on the bottom of the channel. The following ebb current, because it is a converging current, readily picks up this sand and carries it back seaward.

The action of the ebb current seaward of the gorge is somewhat more complex. Some of the sand carried out by the ebb current is deposited on the bed of the outer channel, some on the seaward portion of the outer bar, and some on the two finger shoals that lie on either side of the outer channel.

As the two finger shoals play an important part in the theory that follows, it will be interesting to examine an illustration of how these fingers develop. The two attached photographs are pictures taken at Western Lake which is about 20 miles east of Destin, Florida. Some hard rains had fallen and the water in the lake had broken out to the gulf. The strong outflow had built two finger shoals, the larger being on the west or downdrift side. The waves at the time of the snapshots were pushing the sand on the shoals landward, but with a larger angle of incidence from the east they would probably push the sand on each shoal to the west side of that shoal.

In the case of the inlet in Fig. 1, the sand deposited on the updrift finger shoal by the ebb current is pushed back into the channel by the waves but that deposited on the downdrift shoal is pushed toward the downdrift beach where it again becomes part of the littoral drift. This mechanism explains how the littoral drift bypasses the inlet. It also explains why the updrift finger

shoal is usually quite slender while the downdrift finger shoal is quite wide. This mechanism together with the refraction of the waves on the downdrift or wide shoal also explains the hump that is so frequently found on the downdrift side of an inlet.

One of the conclusions that can be drawn from the foregoing theory is that a deep inlet channel does not act as an obstruction to the movement of the littoral drift across an inlet. The littoral drift that enters the inlet does not cross the channel directly but is drawn in by the flood current, is deposited in the bayward part of the inlet channel and is then carried out by the ebb current. A given grain of sand may repeat this trip many times before it is deposited on the downdrift shoal but it does not in this process move directly across the inlet channel.

A conclusion that I have drawn is that jetties as ordinarily constructed interfere with the process of natural bypassing. I believe that it would be advantageous in many cases to use, instead of jetties, a pair of training walls to give the inlet banks the desired alignment. These would not extend seaward far enough to interfere with the bypassing of the littoral drift. A suggested arrangement is shown in Fig. 2.

To obtain as great a depth as practicable in the inlet channel and across the outer bar, it would be desirable to place the training walls close together. Also, the inlet channel should be made as short as practicable.

The bypassing capacity of an inlet can probably be increased by giving a downdrift inclination to the seaward parts of the training walls. This is illustrated in Fig. 3. With this alignment it is reasonable to expect a greater effectiveness of the waves in driving the sand toward the downdrift shore.

A good illustration of an inlet in which the littoral drift is bypassed by natural forces is Boca Grande on the west coast of Florida. A comparison of a very early survey with a recent one (an interval of about 104 years) indicates that the inlet is quite stationary. I suspect that it is held in place by coquina or some other resistant material. There is no inner shoal. There is a slender finger shoal on the north or updrift side and a much wider one on the south or downdrift side. The sand is apparently driven to the downdrift shore by the waves in an intermittent way in the forms of small shoals and islands.

About eleven miles south of Boca Grande is Redfish Pass, an inlet that has been studied by Professors Dean and Walton. This inlet migrates in a direction opposite to the littoral transport which suggests th t the inlet bypasses more sand than is carried to it by the littoral transport. There is no inner shoal and the downdrift finger shoal is wider than the updrift one. I believe that the observations made by Professors Dean and Walton are consistent with the theory that I have outlined.

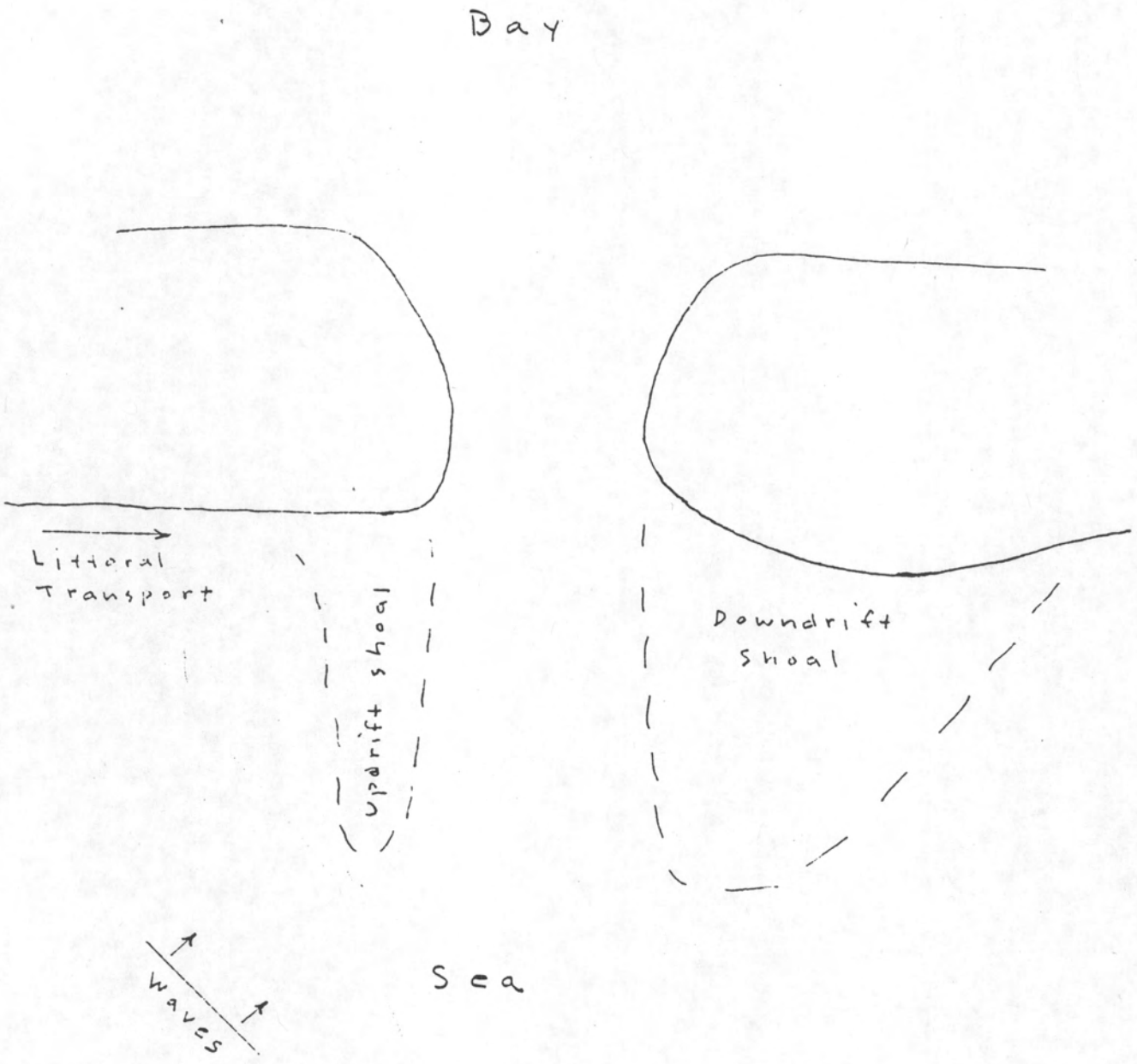
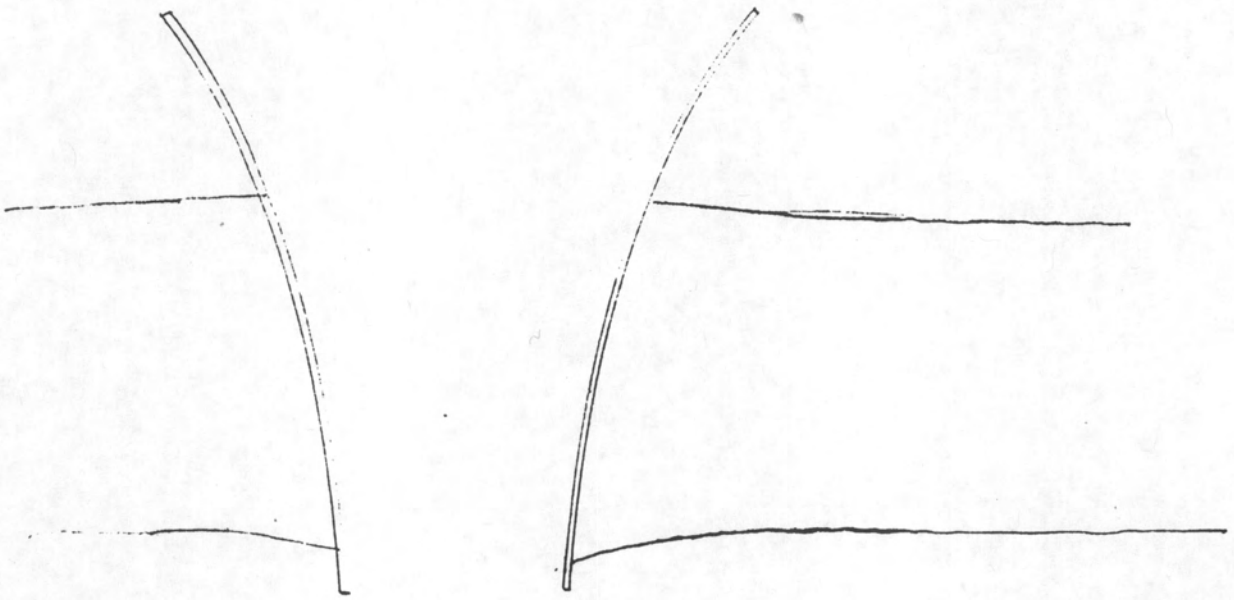

Bay
Littoral Transport
Updrift shoal
Downdrift Shoal
Waves
Sea

Fig. 1.

Bay



Sea

Fig 2

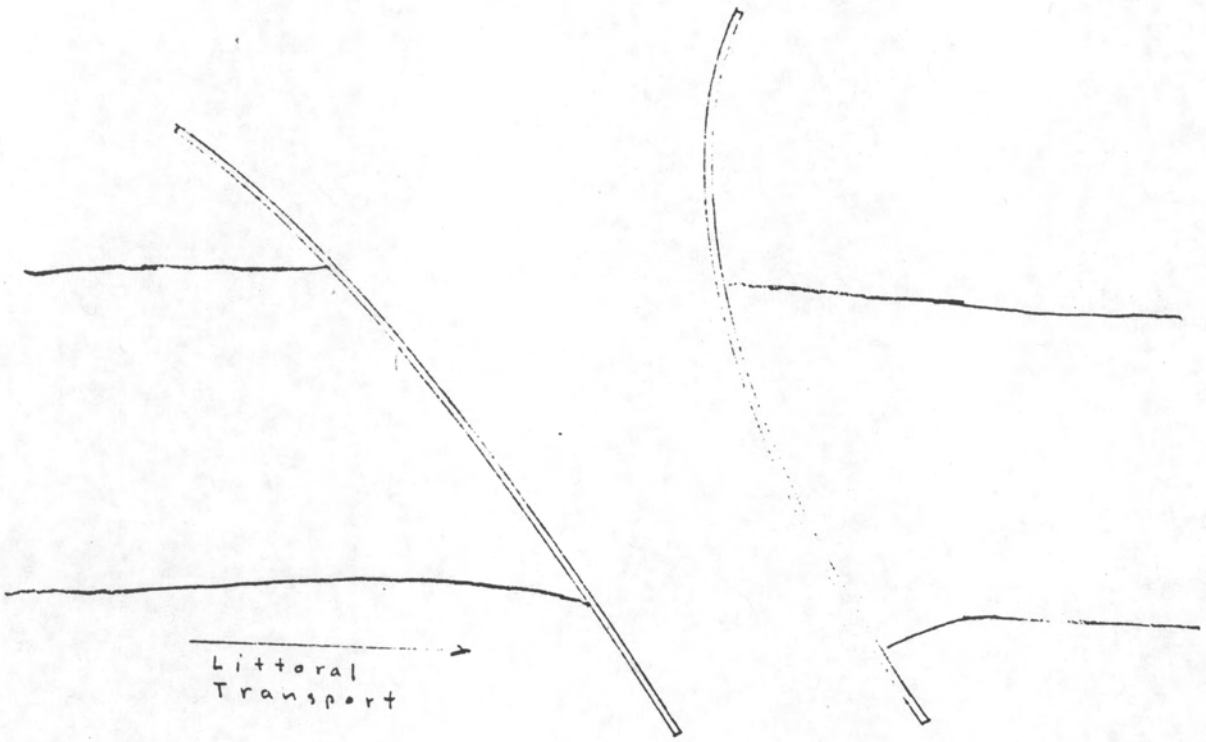


Fig. 3

WESTERN LAKE

Shoal on east side
(on far side of channel)

Shoal on west side