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## Observations on the Topography and Conditions at Spillman's Island, Houston Ship Channel

M. Justin Wilkinson, Ph.D.  
Consulting Geomorphologist

Spillman's Island (also spelled Spilman) is a triangular island located at the north end of Galveston Bay in Harris County, southeast Texas. The island is bounded on the northeast by the Houston Ship Channel, Barbour's Cut Channel and the community of Morgan's Point on the south side, and Texas highway 146 on the west side (*Figure 1*). The Fred Hartmann Bridge leads Hwy 146 over the Ship Channel between La Porte and Baytown: the bridge abutments on the south side lie on the north end of Spillman's Island. In recent years this island has been used as a dredge spoil disposal area for material dredged from the ship channel.

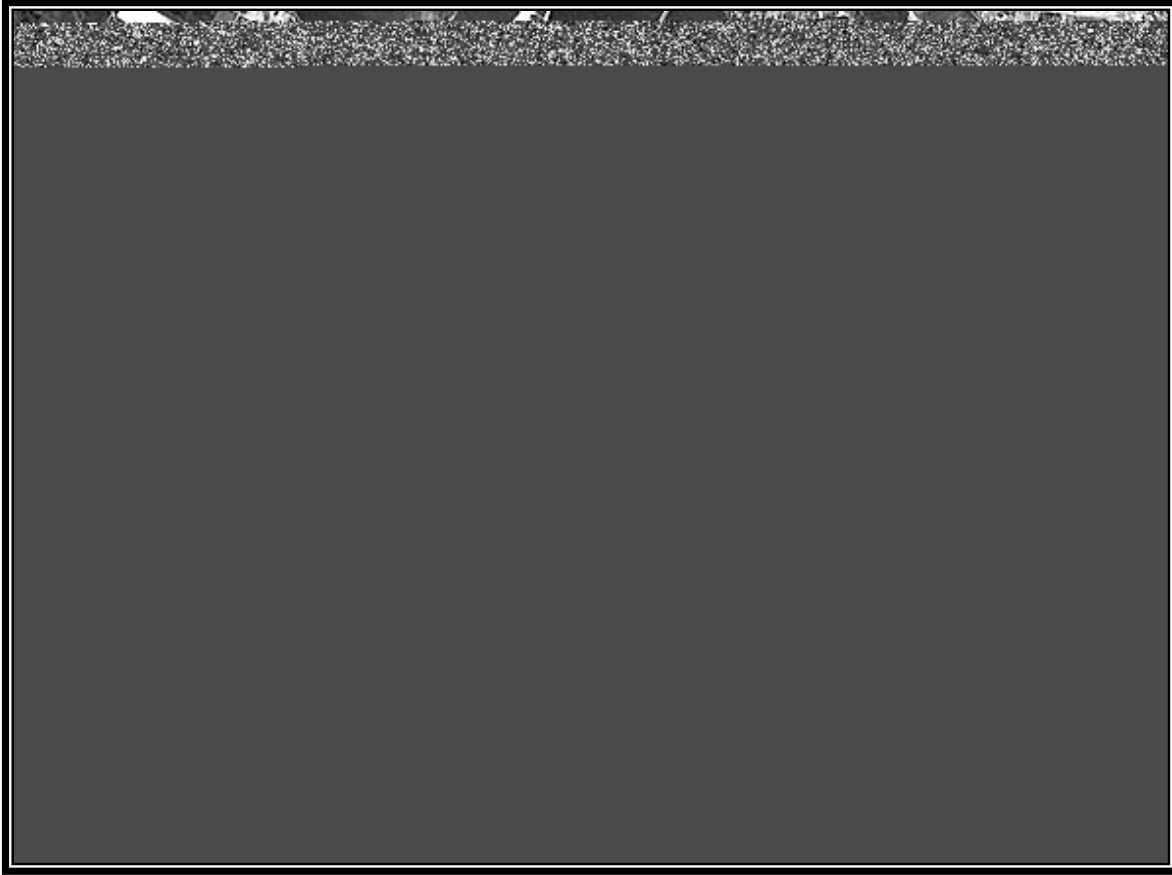
The observations below are based on (i) comparison of remotely sensed photographs taken in 1970 and 2000 (aerial photo and Space Station photo respectively, attached) and on viewing the island in 2003 from publicly accessible locations; and (ii) by comparing the surface of Spillman's with nearby islands with similar geological histories.

The comments below are based on interpretation of remotely sensed data. Ground-truthing of interpretations based on remotely sensed data is a necessary follow-up step in all remote sensing experimental design.

### **Background**

Spillman's Island is one of several in the lower reaches of the San Jacinto River. These islands are composed of fluvial sediments with the characteristic flat surface of estuarine sediment surfaces. Spillman's Island was settled by Captain James Spillman in the early nineteenth century (Wallace L. McKeehan, *Sons of the Dewitt Colony, Old Texian Memoirs*, 1997-2001). Since 1900, as a result of subsurface fluid withdrawal, Galveston Bay has experienced subsidence averaging about 1.5 feet in its open waters and up to 7-9 feet in the bayou reach of the Houston Ship Channel (George H. Ward, *Dredge and Fill Activities in Galveston Bay*, GBNEP, 1994).

The irregular triangle of Spillman's Island is approximately 1.4 miles along the base (west side) and 2 miles long (NW-SE direction) with an area of  $\sim 2$  mi<sup>2</sup>. An island of similar size and undoubted similar geological history lies less than one mile north of Spillman's Island (immediately north of the Fred Hartmann Bridge). This island is taken as an analog of the state of Spillman's Island before the surface changes of the last thirty years.



**Figure 1, Spillman's Island 1970**

**1970 Spillman's Island surface conditions (Fig. 1)**

1. The appearance of most of the island surface is consistent that of neighboring islands, namely flat surfaces near sea level with a dark cover of low trees/prairie, probably similar to the main part of the neighboring island immediately to the north.
2. Levees have apparently been built around the west and northeast sides at least, probably to contain dredge spoil. Two linear features are a possible linear levee crossing the island from the northwest and a possible pipeline from the west which intersect one another near the center of the island.
3. Four small, well defined high albedo\* (white) patches cover less than 5% of the island surface (2% in one calculation), three on the northeast side along the Ship Channel, and a fourth elongated patch along the small west-side channel. The largest patch lies on the southeast tip of the island near the mouth of Barbour's Cut Channel. The patches extend ~800 yards, ~280 yards, ~200 and ~150 yards onto the island behind the levee.

The color and delta/radial shape of each patch are interpreted as indicating dredge spoil deposits in the form alluvial fans, apexed at a few point sources (probably pipes such are seen along the present levees). This interpretation is based on the morphology of existing spoil masses observed from Hartmann Bridge, on Feb 1, 2003 (see below).



**Figure 2,-Spillman's Island 2000**

### **2000 Spillman's Island surface conditions (Fig. 2)**

Changes over 30 years around Spillman's Island are the new Fred Hartmann Bridge and the extensive development of port installations along the south side of Barbour's Cut, with widening of the turning basin at the inner end of the Cut.

Surface conditions of Spillman's Island—

1. Four high-albedo patches of white dredge spoil cover approximately 10% of the island surface.\*\* Three are new (the three 1970 patches which are less visible appear to be overgrown with vegetation).
2. Most of the island appears to be a paler color (higher albedo) than it was in 1970. This is interpreted to be outflow of fine white sediment from the old and new coarser grained spoil deltas, in the form of low-angle tabular sediment deposits typical at the foot of relatively steep alluvial fans.
3. Dark line along the Ship Channel margin is probably undisturbed vegetation on the levee.

### 2003 Spillman's Island surface conditions (Fig. 3)

Observations from the Hartmann Bridge (February 1)—

1. Presently active dredge spoil with the following characteristics: (i) white-pink masses of sediment (ii) on the immediate inshore side of the Ship Channel levee, (iii) relatively steeply sloping, with (iv) deltalike, partial cone morphology. These sediment masses are interpreted as single and multiple alluvial fans.
2. The west-side levee rises approximately 23 feet above mean water level, as estimated by comparison with nearby structures of known height.
3. Irregularly shaped small bodies of water occupy the low points of the island (the largest lie on either side of the levee that crosses the island). The waterbodies are interpreted to result from (i) the enclosing levee preventing rapid drainage, and (ii) probably from dredging operations that apparently involve a slurry, the water component of which collects at low points on the island. These two factors probably explain why Spillman's Island displays water bodies whereas the island immediately north has no waterbodies of this size.

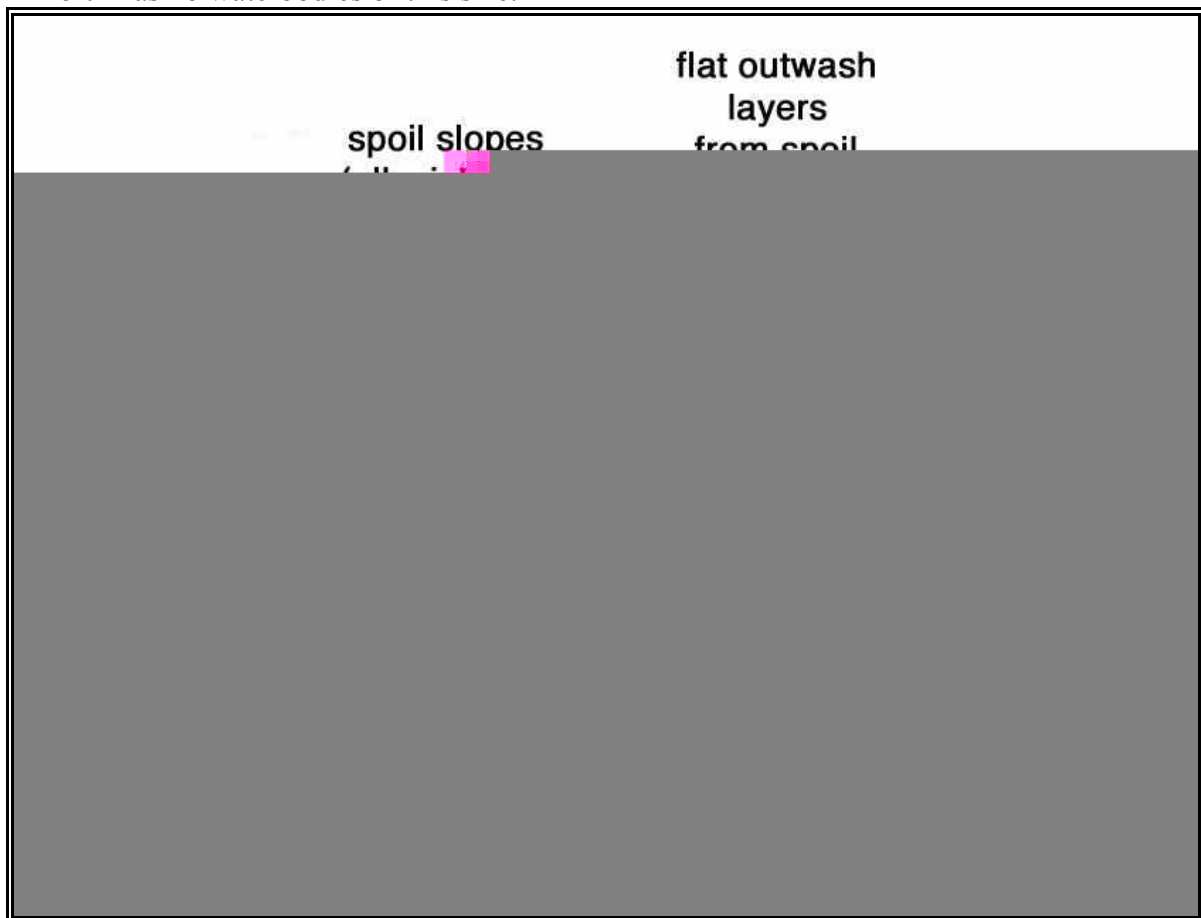


Figure 3, Spillman's Island Diagram

## Conclusions

1. Dredge spoil deltas. The partial cones of sediment represent centers of dredge spoil accumulation. They occupy small parts of the island (less than 10%). The alluvial fan cones are probably less than 20 feet thick at the levee, thinning to much less at the low end, considering that (i) the cones slope steeply, and (ii) the levees are ~23 feet high.
2. The majority of Spillman's Island surface. The outflow of fine material from the spoil deltas appears to occupy much of the island, but is probably a few feet thick at maximum.
3. 1970 surface. Since 90% of the island surface was visible in 1970, we may conclude that the 1970 surface has probably subsided very little (dewatering was halted in the 1980s) Any subsidence has been counteracted by the building of levees and the addition of dredge spoil.
4. Ground truthing. Simple techniques such as surveying, seismic tests (with portable small surface units) and especially auguring or backhoe trenching would immediately indicate the depth of the spoil at different points on Spillman's Island.
5. A simple system of trenches would presumably drain the impounded water areas.

Although it might be assumed that the wet central parts of Spillman's Island would require more stabilization than the higher ground before construction could occur, the *reverse* is likely true: the low central portions of Spillman's Island are those with the thinnest dredge spoil sediments and should need less stabilization. Cost of stabilization would likely vary significantly across the site.

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## References

- McKeehan, Wallace L. Sons of the Dewitt Colony Texas. 1997-2001. Old Texian Memoirs, <http://www.tamu.edu/ccbn/dewitt/kokernotmemoirs.htm>, <http://www.tamu.edu/ccbn/dewitt/miscmemoirs6.htm>, Nov. 23, 2002.
- Ward, G. H. 1994. Dredge and Fill Activities in Galveston Bay. Galveston Bay National Estuary Program Publication GBNEP-28. Webster, Texas.

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\* albedo is a measure of the brightness of surfaces in remotely sensed images

- \*\*• one on the northside of the turning basin, apparently generated by dredging related to the expansion of the turning basin.
- the largest lies near the Fred Hartmann Bridge along the Ship Channel
  - one located between two earlier dredge patches on the Ship Channel side.
  - an elongated patch parallel to the small channel on the west side of Spillman's Island, apparently related to the widening/deepening of this channel.