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SBOE

*Survey*

REPRODUCED FROM THE  
HOLDINGS OF THE  
TEXAS STATE ARCHIVES

HARRIS  
Harris  
Early Determination of Mean High Tide of  
Goose Creek  
June 18  
By Douglas Howard  
GARRY MAURO, Com'r  
Sketch FILE 97  
County  
19 90

Austin, Texas, July 10, 1917.

RECEIVED  
JUN 12 1974  
Central Records  
Texas Water Development Board

Hon. B. F. Looney,  
Attorney General,  
Austin, Texas.

Dear Sir:

With the sanction of the Governor, you requested me to make a careful instrumental survey to establish the levels of the tide in the Goose Creek oil field of Harris County. The survey has been made, and I have the honor to report the results as follows:

**PURPOSE.** The purpose of the survey was to definitely determine the elevation of certain lands in the vicinity of Goose Creek oil field with relation to the level of "ordinary high tide".

**ORDINARY HIGH TIDE.** This expression is assumed to signify the "mean" or average high tide, or a height of the tide that might reasonably be expected to occur in the neighborhood during ordinary, normal conditions of the weather, the same being a tide height not the result of storms or unusual winds.

**THE TIDE ACTUALLY MEASURED.** The tide has not been measured in the Goose Creek oil field; but two independent series of measurements were made by the Corps of Engineers of the Army on the opposite side of the bay, about two miles to the southward, at Morgan's Point. The first of these series was made by an automatic tide gauge, the available record of which practically covers the period from May 1887 to December 1889. In the second series the tide gauges were read daily by an assistant from 6 A.M. to 6 P.M. from January 1902 to June 1910. These two series of readings constitute the only precise tidal information that can be had for this locality. Another automatic tide gauge was installed at Morgan's Point in 1915, but the storm in August of that year destroyed the gauge, and apparently the record, but as the instrument was in operation for only a few months the record would be of little practical value even if available.

During the two periods mentioned, the tide gauge readings are



not altogether complete for the whole time. Breaks occurred in the record of the automatic gauge. In the second series frequently the hourly reading of the gauge seems to have been neglected, and a small portion of this record was lost altogether in the storm of 1915. However, as will be seen, the final results of the two series agree very closely, and for practical purposes appear to be excellent.

The gauge readings of the first series (1887 to 1889) are not available, and are not needed, as the final results of the readings have been worked out and are published on page 1883, Appendix U, Annual Report, Chief of Engineers, United States Army, 1891. Table 4 of this publication gives: Mean high tide, 1.21 feet; mean low tide, 0.61 foot; mean fluctuation of the tide, 0.60 foot. The figures represent the distance in feet above the plane of reference, which is the zero on the tide gauge.

The daily and hourly readings of the second series (1902 to 1910) have not been officially reduced or officially published by the Corps of Engineers, but are available for inspection in the form of original note books kept by the District Engineer Officer at Galveston. Mr J. P. Murray, Civil Engineer of this department, visited the office at Galveston and made a careful examination of these gauge readings. Time did not permit of making a complete copy of all the record, as it is voluminous, filling nearly a dozen field note books; but each book was examined, and portions of the record, indicative of normal conditions, were copied and reduced, with the following results:

	Mean High Tide (feet)	Mean Low Tide (feet)	Mean Fluctuation (feet)
Jan. 1-Dec. 24, 1902 . . .	1.14	0.67	0.47
Dec. 1, 1905-Mch. 22, 1906	0.83	0.12	0.71
Dec. 17, 1906-May 31, 1907	1.52	0.83	0.69
Mch. 23-June 5, 1906 . . .	1.37	0.78	0.59
June 1-25, 1907 . . . . .	1.83	1.01	0.82
June 2-July 7, 1908 . . .	1.32	0.48	0.84
Mch. 28-June 10, 1910 . .	0.99	0.41	0.58



The first of these readings (January-December 1902) being the longest unbroken gauge record of the series, is considered singly; average was taken of all the remaining shorter readings; this average was then averaged with the first readings of this series, which gave the following figures: Mean high tide, 1.22 feet; mean low tide, 0.64 foot; mean fluctuation, 0.58 foot; thus furnishing an excellent practical check upon the final results of the first series of tidal measurements published in Appendix U and mentioned above.

Serial 43 (Atlantic Coast Tables) for the year 1917, page 342, published by that well known and most accurate bureau, the United States Coast and Geodetic Survey, gives the mean fluctuation of the tide at Morgan's Point as 0.70 foot. Though the detailed source of the information is not explained, this figure practically checks the other work. However, in view of the apparently more elaborate investigations of the Corps of Engineers, the results of their work have been adopted.

Immediately the question arises: Are the several stages of the tide at Goose Creek the same as at Morgan's Point? From a mere practical view of the situation, they are; the tidal connection between the two places being quite direct, unaffected and short. Also, from a more precise view of the case, they are. This is definitely indicated by the records of other tide gauges. Prior to 1891 and in connection with the tidal observations at Morgan's Point and elsewhere in Galveston Bay, the United States Engineer Corps maintained two tide gauges on Red Fish Bar. One was called Red Fish North; the other, Red Fish South (see Appendix U, Annual Report, Chief of Engineers, 1891, page 1863, Table 4). Red Fish North was located about 13.5 miles down the bay (southward) from the gauge at Morgan's Point, and a direct, unrestricted portion of the bay connected it with the gauge at Morgan's Point. The observations at both gauges in part cover the same period (July 1889-December 1890, less five months). The stages of the tide at Red Fish North were: Mean high tide, 1.38 feet; mean low tide, 0.78 foot; mean fluctuation, 0.60 foot. On the other hand, the gauge at Red Fish South, located a very short distance south from Red



Fish North, but partially separated from it by Red Fish Bar, during the same period gave: Mean high tide, 1.51 feet; mean low tide, 0.70 foot; mean fluctuation, 0.81 foot.

For the purpose of this report it is therefore assumed that the several stages of the tide are the same in the Goose Creek oil field as at Morgan's Point, and they are finally adopted as follows: Mean high tide, 1.21 feet; mean low tide, 0.61 foot; mean fluctuation, 0.60 foot.

**THE PLANE OF REFERENCE MARKED.** The plane of reference, or the zero of the tide gauges used in all of the tidal measurements made by the Corps of Engineers, was marked on the ground by certain permanent bench marks. Two of these original bench marks were identified as follows:

(a) Known as "M. P.", located on the west bank of the channel, about 1560 feet to the north of the Engineer's Office at Morgan's Point. The top of a 2" iron pipe surrounded by concrete, projecting several inches above the ground. This pipe marks the station center of the old Morgan's Point triangulation point, but the signal framework has been destroyed, and another triangulation station has since been established on a high point of land about half a mile to the westward, near the Rice property. Bench mark "M. P." was set November 10, 1890, and is described in Appendix U, Annual Report, Chief of Engineers, 1891, page 1882. The published elevation above the plane of reference or the zero of the tide gauge is 14.857 feet. The elevation above mean ("ordinary") high tide is  $14.857 - 1.2$ , or 13.657 feet.

(b) In the United States Reservation fence line, about 50 feet southwest of the United States Engineer Office at Morgan's Point. The top of a 2" iron pipe set in concrete about two feet below the surface of the ground, and marked by a 4" iron pipe standing over the 2" pipe and projecting about a foot above the ground surface. (Note. The level rod should be lowered into the 4" pipe until it rests on the top of the 2" pipe.) The elevation of this bench mark was furnished by the present engineer officer in charge at Morgan's Point as 6.367 feet above the plane of reference. From this elevation the zero of the present tide gauge nearby was found



to be 0.033 foot. But a series of careful level circuits were run by the State Reclamation Department from bench mark "M. P.", using the published elevation (14.857), and the resulting elevation of bench mark (b) was found to be 6.448 feet instead of 6.367 feet; the elevation of zero on the tide gauge, 0.114 foot instead of 0.033 foot. The elevation above mean ("ordinary") high tide was found to be  $6.448 - 1.2$ , or 5.248 feet.

As bench mark (b) was established in after years from the original bench mark "M. P.", the published elevation of "M. P." (14.857 feet) is adopted as the basis for all the work covered by this report, it being assumed that the more recent elevation of bench mark (b) (6.367) and the corresponding elevation of the zero on the present tide gauge (0.033) are, for some reason, in error to the small extent above indicated.

**THE PLANE OF REFERENCE TRANSFERRED.** The plane of reference, or the zero of the Morgan's Point tide gauge, was carried from Morgan's Point to the Goose Creek oil field by means of a very carefully run line of primary levels, forming a series of closed circuits. The line began at bench mark "M. P.", elevation 14.857, crossed Morgan's Channel to Atkinson's Island, crossed Cedar Bayou Channel to the nearest spoil bank at the southern continuation of Hog Island, extended along the line of spoil banks, and Hog Island, crossed a subsidiary channel of Goose Creek to the mainland, thence through Goose Creek oil field to a point on the bay shore near the old residence of Dr. Ashbel Smith, and returned over the same route to the point of beginning. The total length of the line is about nine miles. The line followed a land route, and firm foundation was found for each instrument set-up. The methods of work employed, and the precautions taken to guard against instrumental and other errors, particularly errors due to unfavorable weather conditions, were identical with those prescribed by the United States Geological Survey in primary leveling. All level circuits closed within the prescribed limit of allowable error expressed by the formula  $.05 \times$  the square root of the length of the circuit in miles. The total actual error in the entire line, as indicated upon returning to the point of beginning, was



+0.005 foot, various negligible errors in the several small circuits having compensated. The only sight distance of unusual length was from Atkinson's Island across Cedar Bayou Channel to the nearest spoil bank. This sight was 800 feet long. The difference of elevation at this point, however, was obtained by reciprocal leveling, and four independent sets of observations were made during excellent conditions of the weather. All indicated errors were altogether negligible, and the results of the work at this place were exceptionally accurate and satisfactory.

**BENCH MARKS.** The level line was permanently marked by means of the bench marks given in the attached list, marked Exhibit C. In this list two elevations are given for each bench mark. The first signifies the difference of level between the bench mark and the plane of reference, as determined from the published elevation (14.857 feet) of the bench mark "M. P."; the second signifies the difference of level between the bench mark and mean ("ordinary") high tide in the vicinity of Morgan's Point and the Goose Creek oil field. To mark upon the ground the level of ordinary high tide, adopt the second elevation given for any bench mark, and run the level down hill until the elevation of the ground surface is found to be zero.

**TOPOGRAPHIC MAP MADE IN MAY 1912.** In May 1912, at the request of the State Levee and Drainage Board, the State Levee and Drainage Commissioner (now the State Reclamation Engineer) made a careful topographic map of a portion of the Goose Creek oil field. A blueprint copy of the map accompanies and is made part of this report.

The map was made in the field by means of the plane table instrument. Differences of elevation were read direct upon a 12-foot rod. Vertical angle methods were not used. Distances were read with the stadia. All the work was done in the form of closed circuits, and all errors of closure in elevation and position were negligible. The elevations of the ground surface as it then existed were shown, in part by elevation figures written in black on the map, and in a more general manner by contour lines of one foot interval.

There being no established level datum in the section at the



time the map was made, a datum was assumed about the middle of the area, and all elevations on the map are based upon this assumed datum, which was indicated upon the ground by means of a number of bench marks.

*Extra today*  
*John A. Steele*  
MAP DATUM AND TIDE DATUM CONNECTED. Upon extending the level line from the tide gauge at Morgan's Point into the Goose Creek oil field, a sufficient number of the bench marks of the topographic map (1912) were recovered and joined to the level line to accurately connect the assumed datum or zero of the topographic map with the plane of reference or zero of the tide gauge at Morgan's Point. The zero of the map was found to be 1.9 feet lower than the zero of the tide gauge; consequently, to express the level of ordinary high tide in terms of the assumed datum of the map this difference (1.9) in datum must be added to the level of ordinary high tide (1.2) on the Morgan's Point tide gauge. Thus, the level of ordinary high tide on the map is 3.1 feet.

CONCLUSION. Careful reference to the topographic map shows that there is no place where the ground surface has an elevation as low as 3.1 feet, except in one place close to the edge of the water on the south side of the so called Gailliard Peninsula, and marked by a red circle on the topographic map. From this fact the conclusion is reached that no appreciable portion of the property in question, shown upon the topographic map, is below ordinary high tide.

Another blueprint map, marked Exhibit B, made by J. W. Gillespie, surveyor, also accompanies and is made part of this report. The property shown on the southern portion of this blueprint is not shown upon the topographic map, but a number of general surface elevations were determined for this area. These elevations are shown in approximately true position on the blueprint by means of small figures and small circles, drawn in red ink. The figures signify the number of feet that the average ground surface is above ordinary high tide, from which it will be seen that the lowest places found on the blueprint are 1.1 feet above ordinary high tide; and the same conclusion is reached regarding the areas on



both maps; to wit, that all of the property in question is above  
the ordinary high tide of the bay.

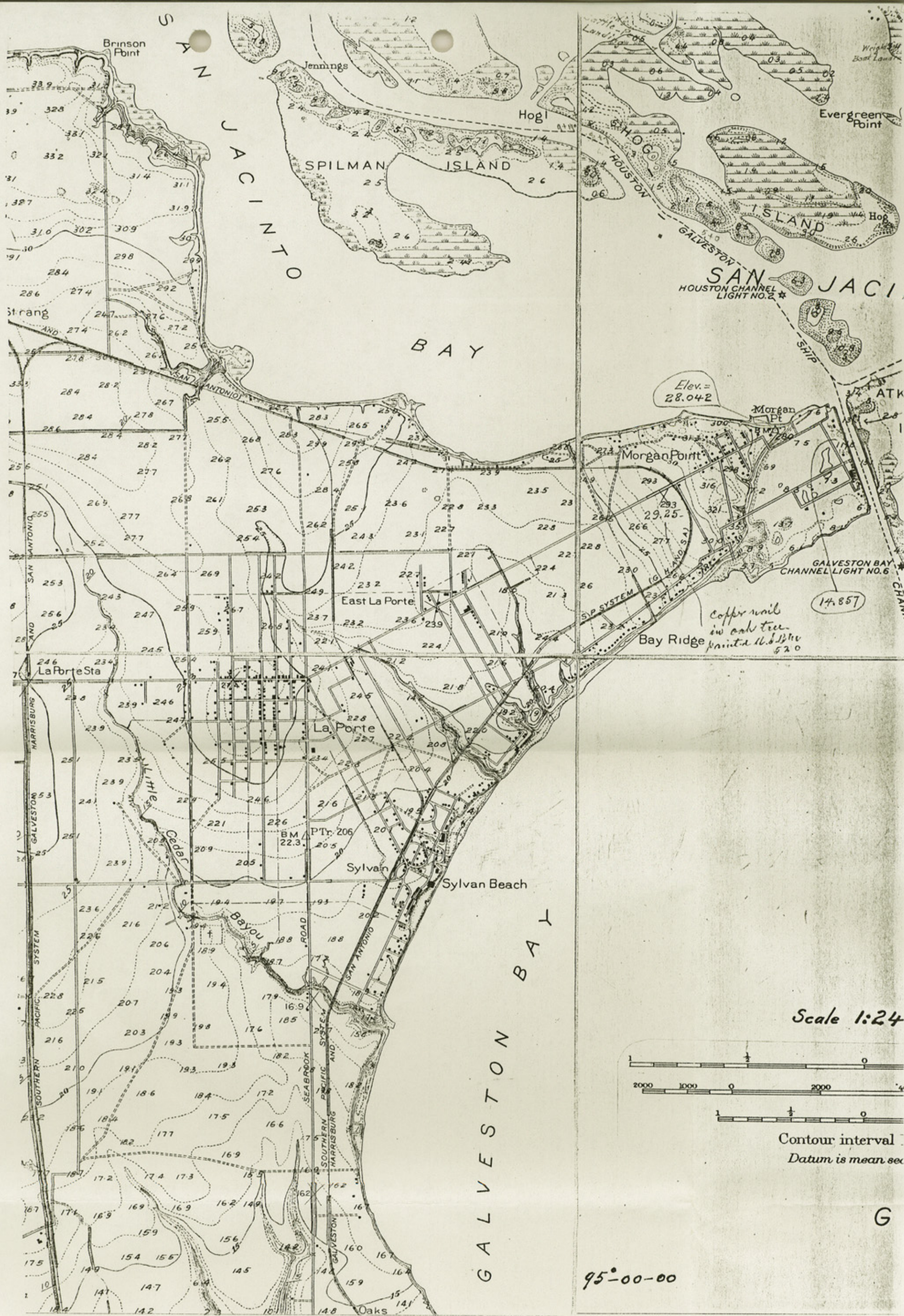
Respectfully,

*Arthur A. Stiles*

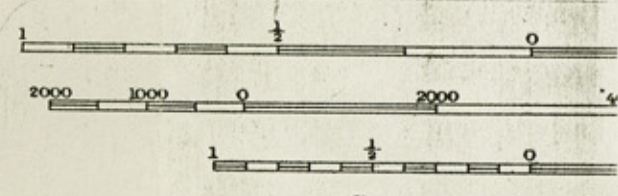
State Reclamation Engineer.

*Extra Copy*





Scale 1:24



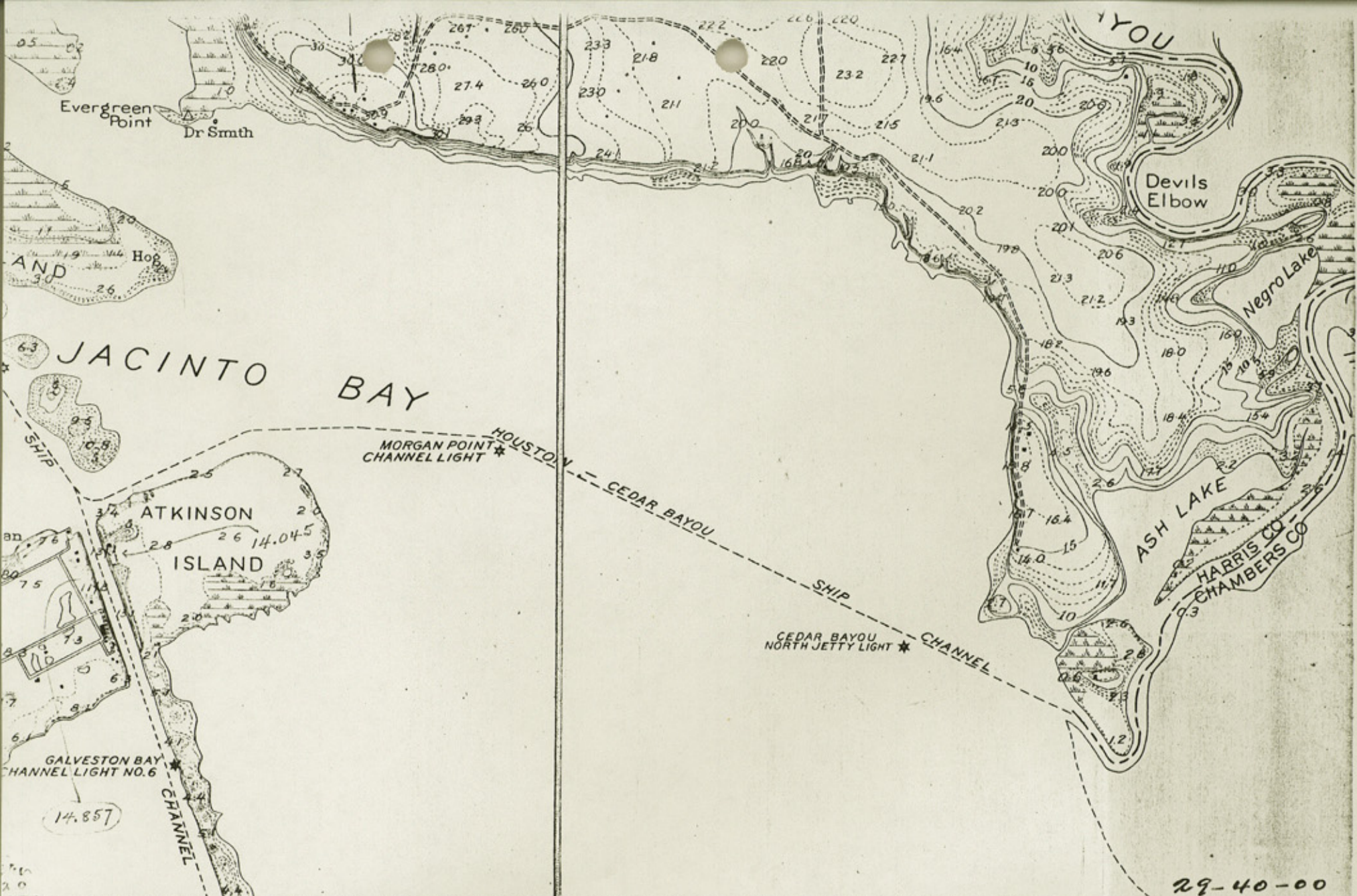
Contour interval 1  
Datum is mean sea level

G

95-00-00

counter 25649

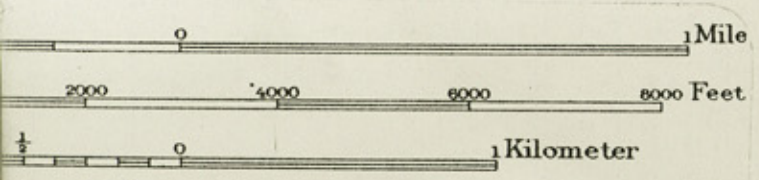




29-40-00

△ Mesquite Knoll

Scale 1:24000



Contour interval 1 foot  
Datum is mean sea level

G A L V E S T O N

95°-57'-30"

29°-37'-30"

*4/5/1917*  
*5 miles*  
*of distance*

REPRODUCED FROM THE  
HOLDINGS OF THE  
TEXAS STATE ARCHIVES

County 25650





29-45-00"

June 5<sup>th</sup> 1917

29-42-30

29-40-00

counter 25651

△ Mesquite Knoll



