The Civil Law Littoral Boundary In "Non-Tidal" Areas of the Texas Coastal Waters:

Mean Daily Higher High Water Level (MDHHWL)

An Analysis for Texas Land Surveyors

http://texascoastgeology.com/papers/Lothrop.pdf

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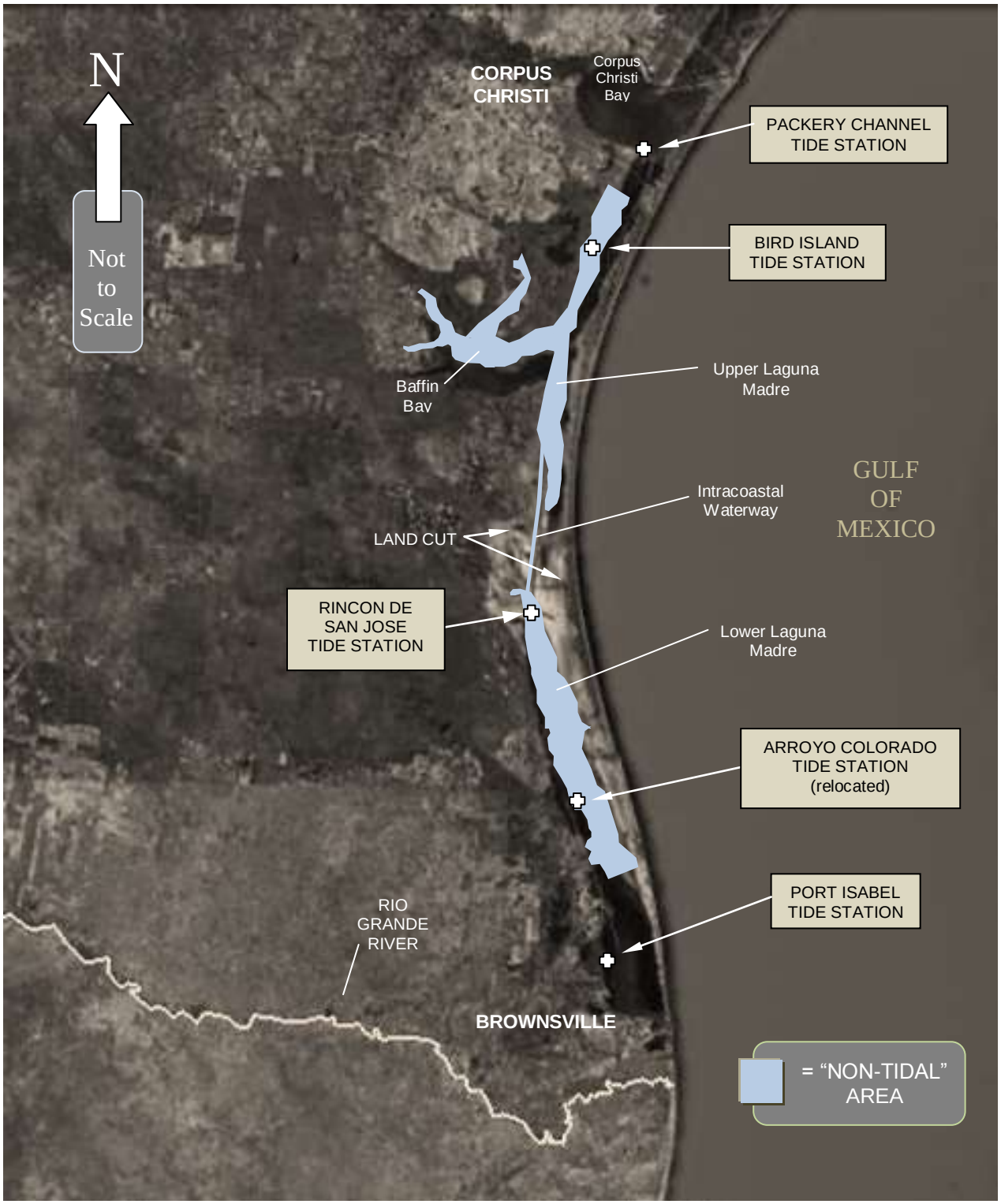

FIGURE NO. 1
"NON-TIDAL" AREAS
OF THE
UPPER AND LOWER LAGUNA MADRE

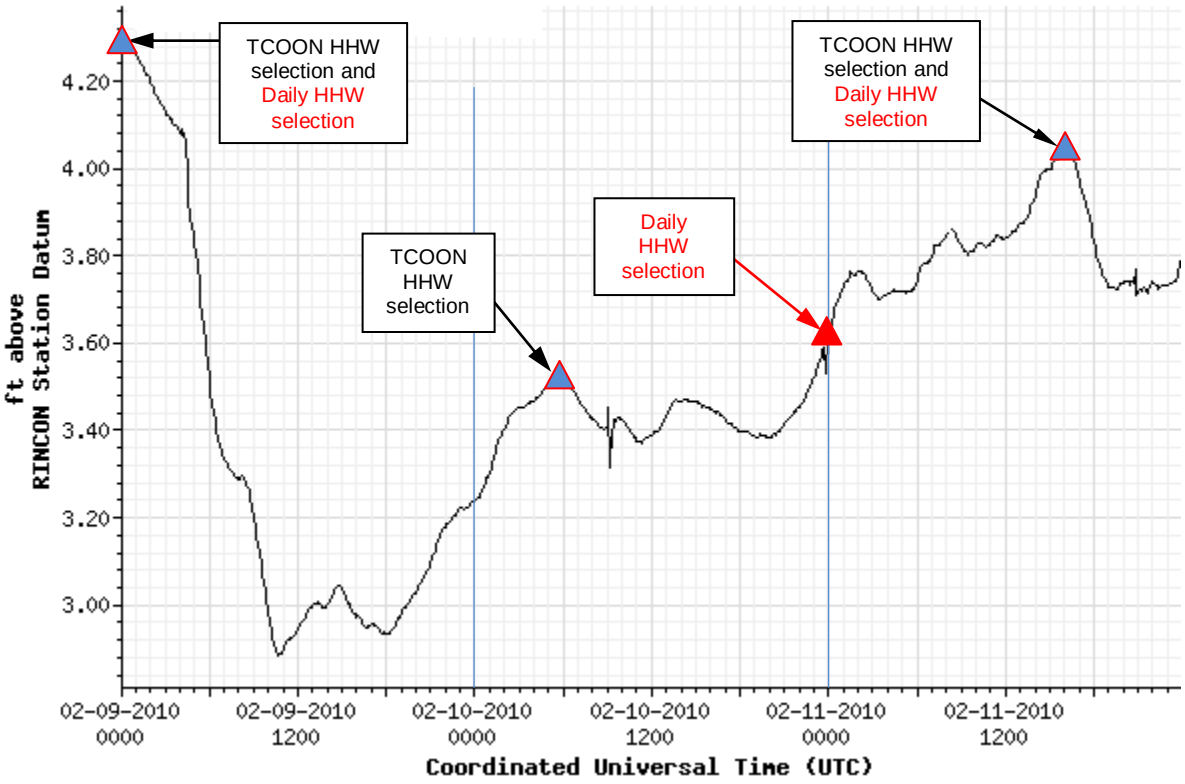

FIGURE NO. 2

Comparison of Higher High Water Selections (or picks)
From TCOON, with Daily Higher High Water Selections (or Picks)
Per *KMF v. Dewhurst*
At Rincon de San Jose Tide Station, Kenedy County, Texas

Base graphics and Primary water
Level data from TCOON data query.

TEXAS GENERAL LAND OFFICE

JERRY PATTERSON, COMMISSIONER

March 9, 2011

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RE: Littoral Boundary on Laguna Madre

Dear Mr. Lothrop:

Thank you for your letter of February 2, 2011. In your letter you pose the very interesting question: "What does the Texas General Land Office recognize as the definition of the boundary between the upland owners of civil law grants and the State of Texas in those areas [of] Laguna Madre that have been designated as 'non-tidal for datum computation purposes' by the National Ocean Service?"

The short answer to that question is the line of mean higher high water (MHHW).

The Laguna Madre is a unique body of water. It is connected to the Gulf of Mexico and is therefore considered to be tidal. Accordingly, per our body of common law, the littoral, tidal boundary of a civil law grant is MHHW; the littoral, tidal boundary of a common law grant is mean high water (MHW).

We know from experience and from the NOS published report, "Tidal Characteristics and Datums of Laguna Madre, Texas" dated July 1995, that a good portion of Laguna Madre is classified as non-tidal for the purposes of determining NOS tidal datums. According to the NOS report, Port Mansfield appears to be near the tidal/non-tidal transition to the south and somewhere between Yarborough Pass and Packery Channel appears to be the transition zone to the north. As a result of the lack of tidal signal in this area of the Laguna Madre, it is impossible to locate MHHW along its shoreline using the science we have available today.

Much of the Laguna Madre side of Padre Island in the land cut area is flat, barren and vast. Depending on which way the wind is blowing, much of it is covered by water or it is dry. The practical reality is we need to rely on other natural, biological indicators to tell us how high the water gets and how much of the land mass on the Laguna side of the island is regularly covered by the water. These indicators combined with water level data could provide a functional mean water level to use for boundary determination in this area.

In Luttes v. State, 324 S.W. 2d 167, p. 192 (Tex. 1958), the Supreme Court of Texas gives us some guidance in stating: "Whatever may be the case as to that part of our shores governed by the Anglo-American rule of mean high tide, we do think it correct to say that the Spanish (Mexican) law concept of the shore is the area in which land is regularly covered and uncovered by the sea over a long period. If it be shown in a given case that the upper level of the shore, as actually covered and uncovered by the sea, is higher (or lower) than the level of mean higher high tide as determined by tide gauges, and if it also appears that an upper mean line of the shore, as actually so regularly covered and uncovered, can be determined with reasonable accuracy otherwise than by exclusive resort to tide gauges, we do not by our opinion intend to foreclose such a case."

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At this point in time though, there is no legal precedent in Texas which guides us as surveyors to rely on such indicators for the purpose of determining a littoral, tidal boundary between the privately owned upland and the state owned submerged land.

Sincerely,

Bill O'Hara

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Introduction

In the years since the final judgment (2002) rendered in *Kenedy Memorial Foundation v. Dewhurst,* 90 S. W. 3d 268 (referred to hereafter as *KMF*), I have become concerned over what I have perceived as a general lack of knowledge (and even confusion) among Texas land surveyors as to the significance of this case. *KMF* further illuminates for the surveyor that guide line or principle first established by *Luttes v. State* (324 S. W. 2d 167 [Texas 1958] and referred to hereafter as *Luttes*) that defines the shoreline boundary between upland owners and the State in civil law grants. In doing so, *KMF* defines the vertical component of this boundary as mean daily higher high water level (MDHHWL), a legal datum that can be readily computed by the surveyor. The horizontal or locative component of this boundary is the descriptive call for a particular body of water: the waters of the Laguna Madre, the shoreline of Baffin Bay, the margin of Cayo Del Grullo, and so forth. What the surveyor places on the ground for the boundary is a meander and not the boundary itself. I understand the ruling of *KMF* to apply particularly to those areas of the Texas coastal waters that have been defined as "non-tidal for purposes of datum determination" by the National Oceanic and Atmospheric Administration (NOAA) - see Appendix V of *Tidal Characteristics and Datums of Laguna Madre, Texas,* NOAA Technical Memorandum NOS OES 008, Silver Springs Maryland, 1995. The *KMF* ruling may also apply to civil law shoreline grants fronting on tidal areas of the Texas coast.

The Position of the Texas General Land Office in Regard to the Boundary Being Considered

In preparation for this article I submitted a request to the Texas General Land Office (GLO) for an official response to this question: "What does the Texas General Land Office recognize as the definition of the boundary between the upland owners of civil law grants and the State of Texas in those areas [of the] Laguna Madre that have been designated as 'non-tidal for datum computation purposes' by the National Ocean Service?" I also noted that I hoped to include their response in an article I was preparing for publication (a copy of their answer is included herein). Their answer appears to me to be consistent with the State's position since the ruling in *KMF*.

In the third paragraph of the GLO letter of response it is stated, "…the littoral, *tidal* [my italics] boundary of a civil law grant is MHHW [mean higher high water]…" The fourth paragraph states, in part:

> "We know from experience and from the NOS published report … that a good portion of the Laguna Madre is classified as non-tidal for the purposes of determining NOS tidal datums. According to the NOS report, Port Mansfield appears to be near the tidal/non-tidal transition to

> the south and somewhere between Yarborough Pass and Packery Channel appears to be the transition zone to the north. As a result of the lack of tidal signal in this area of the Laguna Madre, it is impossible to locate MHHW along its shoreline using the science we have available today."

This is a neat piece of reasoning, if it is accepted that a tidal datum (MHHW) from NOAA or NOS defines this boundary – which it does not. The Texas Supreme Court has defined this boundary as mean daily higher high water level (MDHHWL), not mean higher high water (MHHW).

The NOS report that the GLO's response is referring to is *Tidal Characteristics and Datums of Laguna Madre, Texas,* NOAA Technical Memorandum NOS OES 008, Silver Spring, Maryland, 1995. Since the publication of that report, the Texas Coastal Ocean Observation Network (TCOON) of the Division of Nearshore Research of the Conrad Blucher Institute for Surveying and Science (CBI) has established a tide station (Arroyo Colorado – now inactive) south of the Port Mansfield tide station mentioned as near the tidal/non-tidal transition in the southern portion of the Laguna Madre. Using the TCOON website and by accessing the Datums tab for the Arroyo Colorado tide station, we find that the only datum "published" for the station is Mean Water Level (MWL). MWL is the only datum recognized by NOAA or NOS when a station is considered to be in a non-tidal area. Normally, when a station's vicinity is considered non-tidal, this note is found on the datum page: "This station is in an area that the National Ocean Service has designated as **non-tidal** for datum computation purposes." This note is not found on the Arroyo Colorado Datum page. The Arroyo Colorado tide station is considered, for this article, to be non-tidal. Please refer to Figure No. 1 for a general map of the non-tidal areas of the upper and lower Laguna Madre.

The fifth paragraph of the GLO's response says:

> "Much of the Laguna Madre side of Padre Island in the land cut area is flat, barren, and vast. Depending on which way the wind is blowing, much of it is covered by water or it is dry. The practical reality is we need to rely on other natural, biological indicators to tell us how high the water gets and how much of the land mass on the Laguna side of the Island is regularly covered by the water. These indicators combined with water level data *could* provide a functional mean water level to use for boundary determination in this area." [My italics].

This whole paragraph ignores the fact that this boundary has *already* been determined by *Luttes*, as elucidated by *KMF:* mean daily higher high water level, which surveyors are able to place on the ground, even on the Laguna side of Padre Island, without resorting to a "mean water level" or "natural, biological indicators". All the surveyor need do in these "non-tidal" areas of the coast is to compute a current value for MDHHWL (adjusted to the current 19 year epoch, and possibly applying a factor for sea level rise in his project area) and meander the contour of his

computed elevation. If the shoreline boundary is of sufficient length, the surveyor may want to apply an average of MDHHWL's computed at the extremities of his project to the total shoreline boundary, or to apply a gradient between the extremities.

The last paragraph on the first page of the GLO's response restates what has been called the *Luttes* loop-hole which apparently allows for this boundary to be located by an "upper mean line of the shore", if it corresponds with the same line as determined by using tide gauges. The last paragraph of the letter concludes that there are no legal precedents that furnish guide lines for surveyors that would enable them to do so. I agree.

Mean Daily Higher High Water Level

Luttes v. State declared that:

> "We sustain the contention of the petitioners-plaintiffs that the applicable rule of the Mexican (Spanish) law is that of the average of the highest daily water computed over or corrected to the regular tidal cycle of 18.6 years. This means in substance mean high tide (page 187)."

On Motion for Rehearing the judge clarified his statement:

> "It was our intention to hold, and do hold, that the line under the Spanish (Mexican) law is that of mean higher high tide, as distinguished from the mean high tide Of the Anglo-American law (page 191)."

KMF v. Dewhurst elucidates the *Luttes* judgment:

> "In *Luttes v. State,* we determined that the law of those two sovereigns [Spain and Mexico] governing such grants was that a shoreline is to be found where the mean daily higher high water level – that is, the average of daily highest water levels – reaches the mainland. …the civil law as determined in *Luttes* …requires that the shoreline boundary in this case, like all others governed by civil law, be set at measured mean daily higher high water levels (page 270)." (My brackets).

The court uses the expression "higher high water" in its definition of the boundary, but is not using the term in the sense that NOAA uses it. NOAA defines higher high water (HHW) as:

> "The highest of the high waters (or single high water) of any specified tidal day due to the declination A1 effects of the Moon and Sun (page 87, *Tidal Datums and Their Applications,* NOAA Special Publication NOS CO-OPS 1, June 2000).

NOAA defines a high water (HW) as:

> "The maximum height reached by a rising tide. The high water is due to the periodic tidal forces and the effects of meteorological, hydrologic, and/or oceanographic conditions. For tidal datum computational purposes, the maximum height is not considered a high water unless it contains a tidal high water (page 87, same publication)."

In *Luttes,* the judge made it clear how a high water is to be defined:

> "Once we elect for an average, as the practicalities seem to require, and the texts of neither the Roman Civil Law nor the *partidas* appear to forbid, the sounder course is to take the average of *daily* highest water, <u>be it tide or a wind-driven wave</u> (page 182)." (My underlining).

Dr. Reinhard E. Flick, an oceanographer and expert witness for the Kenedy Memorial Foundation in *KMF v. Dewhurst,* computed a "mean higher high water" elevation at the TCOON tide station Rincon de San Jose (at the southern end of the disputed area) for the trial. He simply averaged the highest water levels reported at the station for each day and adjusted the resultant mean to the mean values at a 19 year control station, demonstrating that all the land at issue in the case was above his computed "MHHW" elevation. Mr. Flick also stated (admitted, according to the State) that this was not NOAA's methodology for determining the datum, and that he had never used the method previously. His method *does not* consider whether or not the daily highest water level was generated primarily by astronomic factors or by atmospheric factors. The Supreme Court was entirely satisfied with Mr. Flick's method (see pages 273, 290, and 295 of *KMF*).

Computing the MDHHWL Datum

Luttes and *KMF* both require that a short term series of observations at a particular site be related by simultaneous observations at a nineteen year control station and adjusted to a nineteen year datum at the control station. Given the distance of the sites of *Luttes* and *KMF* to a suitable control station, a year's worth of simultaneous observations were required. With the success of the TCOON project in establishing many more tide stations in our Texas coastal waters, it is presumed that the length of time requirement may be shortened - especially when a boundary determination site is in the immediate vicinity of one of these new stations. A word of caution concerning the adjustment to a nineteen year datum: apples must be compared to apples. A MHHW datum computed from TCOON or NOAA higher high water picks on a tidal or non-tidal control station is *not* (as I hope we have made clear) a MDHHWL datum. That must be computed by the surveyor or other investigator for the particular 19 year epoch he is adjusting his site to - then the adjustment can be made.

If we are computing a MDHHWL datum for application to a shoreline boundary, and since this is not a tidal datum as defined by NOAA, why should we then make a correction to a 19 year tidal epoch?

1. Although the astronomical tide is very small in these "non-tidal" areas of the Laguna Madre it does exist in these areas, even though it is masked by the existing atmospheric factors (as admitted in the depositions of the State's experts in *KMF* – I was present at the depositions). They are considered to be tidally influenced.

2. Since this tidal influence (however small or insignificant) is recognized as present in the "non-tidal" areas, and since the influence must vary throughout the entire tidal cycle of 18.6 years (or a 19 year epoch) the adjustment should be made, encapsulating the influence.

3. Water levels in these "non-tidal" areas are seasonally consistent with seasonal water levels in clearly tidal areas (see page 27 of the above mentioned *Tidal Characteristics and Datums of Laguna Madre, Texas*). An adjustment to a 19 year epoch incorporates all these seasonal variations.

4. *Luttes* and *KMF* require the adjustment to be made.

A good general reference for computing a MDHHWL datum for a shoreline boundary is *Computational Techniques for Tidal Datum Handbook*, NOAA Special Publication NOS CO-OPS 2, Silver Springs Maryland, September, 2003. The modified range ratio method of computation is recommended for the Texas coast when adjusting computed datums on a secondary tide station to a primary or control tide station. The surveyor should remember to substitute his selected (picked) daily higher high water levels and computed mean daily higher high water levels at the appropriate places in the formulas. Using the modified range ratio method, the surveyor will also have to select daily lower low water levels and compute mean daily lower low water levels for the formula (mean daily lower low water level is simply the average of the lowest daily water level, whether caused by astronomic or atmospheric factors, being the low water counterpart of daily higher high water level).

The surveyor's primary source for the data on TCOON's tide stations is CBI's Division of Nearshore Research website, which can be found by doing a Google search on the acronym TCOON (http://lighthouse.tamucc.edu/TCOON/HomePage). Almost all of his computations will be performed on his selection of the highest and lowest water level for each day from the website's primary water level data. This data can be imported into spread sheet software. Once imported, a very simple formula for selecting maximum or minimum values for a set of numbers can be employed to determine the daily highest and lowest water levels. Gaps in the primary water level record can be handled as described in the previously mentioned *Tidal Datums and Their Applications.* When selecting daily highest and lowest water levels, the selections should

be checked to confirm that a "spike" has not been selected. I would define a "spike" as a value for a daily highest water level that is four to five hundredths of a foot higher than the immediately surrounding six minute values (the same would be conversely true of the daily lowest water level selection). If such is found, substitute an average of the adjacent six minute water level values. Using the method I have described, it will be found that on several days out of a month, a daily highest water level has been selected that falls at 2354 hours (just before midnight) or at 0000 hours (the beginning of the day) – see Figure No. 2 – rather than a peak in the graph of the primary water level, as would naturally be expected.

Assuming that our highest water level selection for a particular day is at either 0000 hours or at 2354 hours (but not at a peak in the water level data), a naturally occurring water level peak that is lower than that at 0000 hours or at 2354 hours *should not* be selected instead for the day's highest water level. It must be remembered that we are not computing a *tidal* datum which requires the selection of tidally driven high waters which occur independently of the beginning and ending of a 24 hour time period, but rather with computing a water level datum which depends solely on the selection of the highest water level reached in a 24 hour time period. Obviously, if the highest water level for the day occurs at a time other than at 0000 hours or 2354 hours, that water level must be selected.

In a recent datum study (data obtained from the Division of Nearshore Research, Conrad Blucher Institute for Surveying and Science, Texas A & M University-Corpus Christi) I compared the average for the year of 2010 at the Rincon de San Jose tide station (a non-tidal station) of daily mean higher high water levels with the average of TCOON's higher high water picks for the same station. The average of daily higher high water levels was 4.32 feet (station datum) and the average of the higher high water picks was 4.27 feet (station datum), the daily higher high water levels being 0.05 feet higher (a result which favors the State, by the way). This difference is due primarily to the differing selection methods being used. In the previously mentioned *Tidal Characteristics and Datums of Laguna Madre, Texas,* NOAA stated that the algorithm used in their software to pick high and low waters was not especially successful in these areas of minimal tidal signals. I understand that the algorithm used by TCOON is similar, but not identical. TCOON's software failed to pick higher high waters on 99 days out of 365 in 2010 at the Rincon tide station. Both NOAA's and TCOON's algorithms are far more successful in areas with a distinct tidal signal – which is what they are designed to do.

The Nineteen Year Epoch

The current official NOAA nineteen year epoch is 1983 through 2001. Datums published on tide stations are computed to this epoch (although for navigational purposes NOAA is publishing five year epochs on stations where sea level rise seems to require it). It is my view that, for the purpose of boundary construction, a current nineteen year epoch should be

computed, adopting as the end point the last year the primary water level at the stations has been verified. As of this writing, that would be a 1992 through 2010 epoch. The water level data required to compute a nineteen year MDHHWL datum is available to the surveyor on the above mentioned website. When a shoreline meander is surveyed, it should represent the best estimate of the elevation of the datum used as of the date of the survey. Neither *Luttes* nor *KMF* specifies a particular epoch.

Sea Level Rise

Water level measurements generated from tide stations do not distinguish between an actual sea level rise and subsidence or a combination of the two. This fact is immaterial for the purpose of a shoreline boundary survey. For the purpose of this article, sea level rise means all of those components lumped together, just as they are on actual water level measurements. General literature on the topic of sea level rise indicates that the average rise in the elevation of mean sea level on the Texas coast is about 0.017 feet per year. This rise in mean sea level is not uniform along the Texas coast. Local sea level rise can vary significantly enough to be of concern to the surveyor. For instance, according to NOAA, the mean sea level trend at Port Isabel is rising at about 0.012 feet per year and at Port Mansfield at about 0.006 feet per year (information concerning sea level trends can be accessed by the NOAA Co-ops link from the TCOON website). This being the case, in a span of ten years, it is estimated that mean sea level at Port Isabel would rise 0.12 feet, and at Port Mansfield 0.06 feet. If a surveyor was conducting a shoreline boundary survey on the Laguna side of Padre Island in the early months of 2011, and his control tide station was Port Isabel, and he had adjusted his simultaneous observations to the 1992~2010 epoch at Port Isabel, he would then raise his nineteen year MDHHWL or MHHW computed datum by 0.12 feet (ten years from the middle year of his current epoch). This would be the value for the datum to be applied on the ground at his project site. A more accurate method for estimating the local mean sea level (in this case, mean water level) trend might be to make a plotting of monthly or yearly mean sea level (or MWL) for about ten years in the surveyor's coordinate geometry software and apply its "best fit line" sub-routine to the plot. Others can probably do something similar in spread sheet software. The goal is to generate a value of the datum to be applied to the ground that best represents the current adjusted elevation of the datum. The guide lines established by *Luttes* and *KMF* do not require this sea level rise adjustment to be made, but good practice suggests that it should be.

Conclusion

Luttes and *KMF* establish a datum that defines at what elevation a shoreline boundary is to be surveyed on civil law grants. It is not a tidal datum as defined by NOAA. The datum of *Luttes* as elucidated by *KMF* is based on averaging the daily highest water level (whether caused

by astronomic or atmospheric factors) reached at a project site, adjusted to a tidal epoch. Consistently applied, a shoreline meander will be located that will only change due to those factors which normally change shoreline boundaries (erosion, accretion, sea level rise, and so forth).

I hope that this article will be helpful to Texas surveyors working with shoreline boundaries along the southern Texas coast, particularly along "non-tidal" areas. It is not intended to outline methods of simultaneous observations or of physically locating shoreline boundaries, subjects upon which an abundance of study materials are already available. I hope that the General Land Office, in consultation with Licensed State Land Surveyors, Registered Professional Land Surveyors, The Conrad Blucher Institute for Surveying and Science, and other interested parties will work to promote generally accepted standards and procedures for surveying these boundaries, in accordance with *Luttes* and *KMF,* and that the MDHHWL datum be computed and published on the TCOON tide stations that are considered "non-tidal".

A Suggested Bibliography for the Surveyor

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