IN THE

# Supreme Court of the United States

OCTOBER TERM, 1962

---

No. 14 Original

---

STATE OF LOUISIANA, *Plaintiff*,

v.

STATE OF MISSISSIPPI, ET AL., *Defendants*.

---

## REPORT OF SPECIAL MASTER

---

MARVIN JONES, *Senior Judge*
*Special Master*

PRESS OF BYRON S. ADAMS, WASHINGTON, D. C.

# INDEX

## Subject Index



## Table of Cases Cited



## Statutes Cited

IN THE

# Supreme Court of the United States

OCTOBER TERM, 1962

---

No. 14 Original

---

STATE OF LOUISIANA, *Plaintiff*,

v.

STATE OF MISSISSIPPI, ET AL., *Defendants*.

---

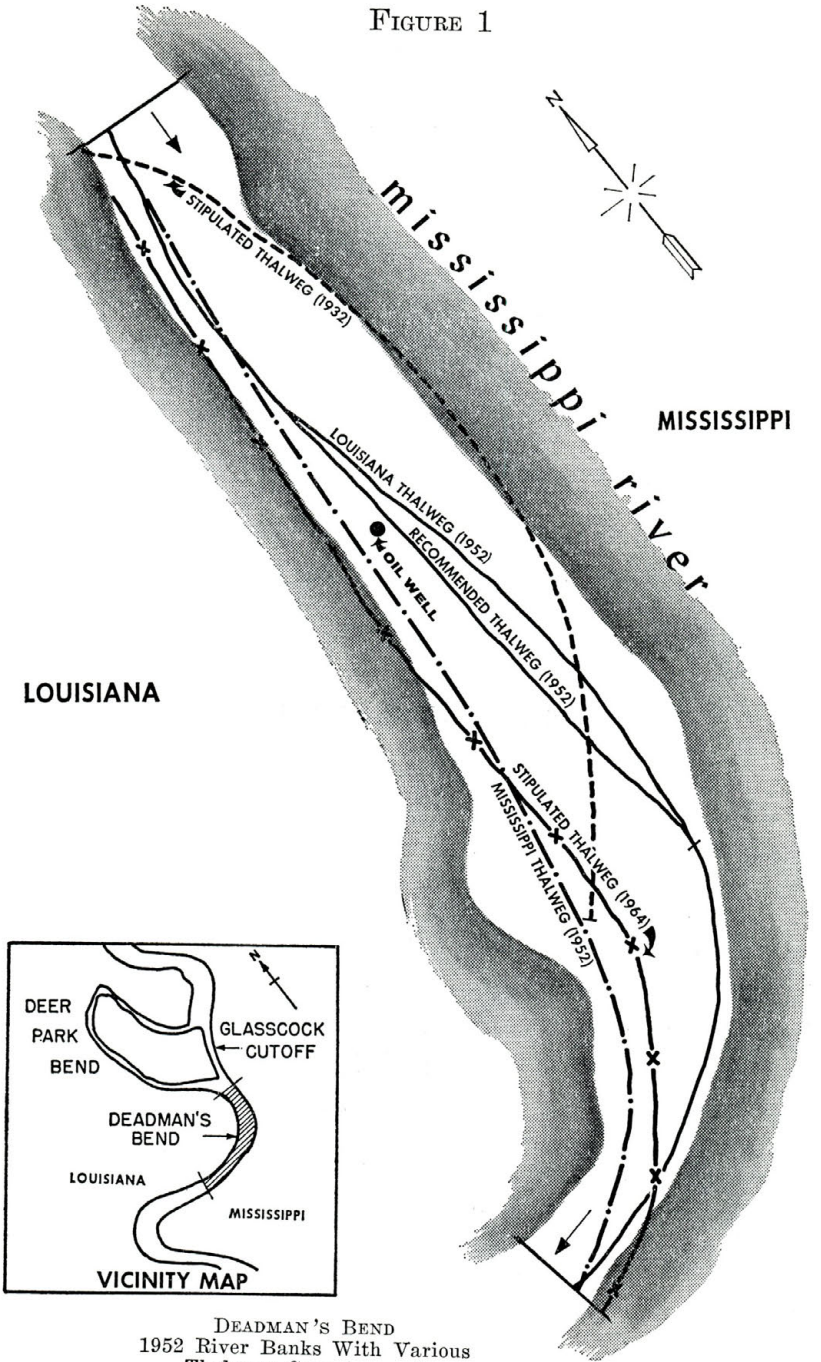
## REPORT OF SPECIAL MASTER

---

### I. PRELIMINARY STATEMENT

The primary issue in this proceeding is the location of the boundary between Louisiana and Mississippi in an area of the Mississippi River about 3 to 4 miles in length immediately below the foot of what is known as the Glasscock Cutoff, which is located about 25 miles below Natchez, Mississippi. See Figure 1. The Glasscock Cutoff was constructed between the years 1933 and 1939 with additional dredging operations in 1942 by the Mississippi River Commission, composed of United States Army and civilian engineers, as one of a series of flood control measures.

FIGURE 1




DEADMAN'S BEND
1952 River Banks With Various
Thalwegs Superimposed

On February 24, 1954, pursuant to an oil, gas and mineral lease theretofore granted, the State of Louisiana through its Department of Conservation issued a permit to the Carter Oil Company to drill a well from a site on the Louisiana side of the river directionally or in a slanting fashion to a point under the bed of the stream. The well, known as Louisiana State Well No. 1, was completed as a producer on April 27, 1954, and has been producing oil since that date. The company paid royalties, severance and other taxes to Louisiana from that date until February 1, 1963.

The State of Louisiana retained title to the land in the bed of the stream to the boundary between the two States, at least in the problem area. The State of Mississippi, on the other hand, sold to the riparian owners title to its part of the riverbed in that area.

It is the claim of the State of Mississippi and the riparian owners that the bottom of the well, the source of the oil production, is on the Mississippi side of the bed of the stream, and has been at all times since the completion of the well. Louisiana and the Humble Oil & Refining Company, with which the Carter Oil Company was merged on December 1, 1959, assert that at the time of the drilling of the well and at all times since, the bottom of the well (hereafter referred to as the well) has been on the Louisiana side of the boundary.

## How the Issues Arise

On the 27th day of November 1962 a suit was filed in the United States District Court at Vicksburg, Mississippi; *Joseph S. Zuccaro, et al.* v. *Humble Oil & Refining Company,* No. 1011 on the docket of that

court. The plaintiffs in that case allege, *inter alia,* that they are the riparian owners on the Mississippi side of the boundary in this particular area. They further allege that at the time of the initial production and at all times since, the well has been and is on the Mississippi side of the boundary between the two States. The Zuccaros ask for judgment against Humble for damages measured by the full value of all the oil that had been produced from the well since its original completion date.

## JURISDICTION

The State of Louisiana, on May 13, 1963, filed a motion in the Supreme Court for permission to file complaint and application for stay order and brief in support of such motion. It was docketed as No. 14 Original, *State of Louisiana* v. *State of Mississippi, et al.*

The State of Mississippi in June 1963 filed opposition to the motion of the State of Louisiana, asserting that the "State of Louisiana has herein no present justiciable controversy with the State of Mississippi", and that the Zuccaro suit against Humble is between private parties.

Process was issued to each and all who were parties to either proceeding. The Humble Oil Company filed an answer adopting the Louisiana motion and brief and, in addition, filed a supplemental brief.

The Zuccaros joined in Mississippi's opposition to Louisiana's original motion. Zuccaro also joined with Mississippi in a supplemental brief opposing Louisiana's original motion, citing additional cases.

On April 20, 1964, the Supreme Court entered the following order:

> IT IS ORDERED that Honorable Marvin Jones, Chief Judge of the United States Court of Claims, be, and he is hereby, appointed Special Master in this case, with authority to summon witnesses, issue subpoenas, and take such evidence as may be introduced and such as he may deem it necessary to call for. The master is directed to submit such reports as he may deem appropriate.
>
> The master shall be allowed his actual expenses. The allowances to him, the compensation paid to his technical, stenographic, and clerical assistants, the cost of printing his report, and all other proper expenses shall be charged against and be borne by the parties in such proportion as the Court hereafter may direct.
>
> The request of the State of Mississippi for admissions is referred to the Special Master for consideration and determination.

Louisiana asks that (1) the boundary in the disputed area be determined, and (2) "that the claim of right and title asserted by the Zuccaros * * * in the said well and in the proceeds thereof be cancelled and forever held for naught." As authority for these two propositions it cites Art. III, sec. 2, cl. 2 of the Constitution and 62 Stat. 927 (1948), 28 U.S.C. § 1251 (a)(1).

Art. III, sec. 2, cl. 2 of the Constitution reads in part as follows:

> In all Cases * * * in which a State shall be Party, the supreme Court shall have original Jurisdiction.

Section 1251 of Title 28 U.S.C. provides in part as follows:

> (a) The Supreme Court shall have original and exclusive jurisdiction of:
>
> (1) All controversies between two or more States; * * *.

Mississippi and the Zuccaros take the position that the Supreme Court should not take jurisdiction in a suit between private parties; and that in no event should it go beyond determining the boundary between the two States in the problem area.

In view of the fact that the determination of the boundary issue in the problem area vitally affects the right of each State to levy severance and other taxes, to issue regulations, and other rights including Louisiana's claim to 1/8th royalty, it is concluded that the Supreme Court has jurisdiction to fix the boundary in the problem area. It is so recommended. *Mississippi* v. *Louisiana,* 350 U.S. 5.

Whether the Special Master should recommend that the Supreme Court go further and determine the right to the proceeds from the oil that has been produced from Louisiana State Well No. 1 will be discussed in the Second Division of this report.

## II. Brief Resume of Facts

The Mississippi winds like a serpent between Cairo, Illinois, and the Gulf of Mexico, with large bends extending alternately to the east and west in a continuous counterbalancing effect for its entire run to New Orleans. At flood-time these bends grow even larger by the accelerated river action, eroding away the out-

side banks on the bight (apex or fartherest reach) of the bends and accreting alluvion deposits to the inside banks either directly across or farther downstream. These ever enlarging bends increase the over-all length of the river, with a corresponding decrease in the speed of the flow. This is due to the fact that the decline in the elevation around a bend is no greater than in the shorter distance across the neck. A greater slope, therefore, can be obtained by a cutoff across the neck, thus increasing the rapidity of the flow of the river. The slowing down of the flow is a direct cause of flooding and so attempts have been made to alleviate this by constructing cutoffs to bypass these bends.

The Glasscock Cutoff is a man-made trench about 4 miles in length which bypasses the 19-mile-long Deer Park Bend in a stretch of the Mississippi about 25 miles south of Natchez, Mississippi. See Figure 1. It was one of a series of 15 cutoffs completed in recent years which have shortened the river by about 175 miles and increased the rapidity of its flow. Other measures have also been taken and other cutoffs developed, both natural and artificial, which have had the effect of shortening the river an additional 200 miles. All these measures have resulted in lessening the destructive effects of floods resulting from the immense waters that pour into the Mississippi from innumerable tributary streams on their voyage to the Gulf.

Deer Park Bend sweeps to the west into Louisiana and is counter-balanced directly downstream by a smaller sweep to the east called Deadman's Bend. Since the time of our first recorded survey of this area —1765—these two bends had been gradually moving in opposite directions and thereby extending them-

selves into the two bordering States. In the area of Deadman's Bend, the river had meandered approximately 5,000 to 7,000 feet eastward into the State of Mississippi since 1817 when that State entered the Union. According to the long-established rule of the thalweg, the boundary between these two States had also been moving eastward in the problem area and Louisiana had been gaining territory continually. There is every reason to believe that were it not for the cutting of Glasscock Cutoff in 1933-1939, Deadman's Bend would still be gradually creeping into Mississippi.

If the construction of Glasscock Cutoff had proceeded according to plan in 1933, the flow through it would have entered Deadman's Bend in a southerly direction. Unforeseen conditions altered the results of this plan and, whereas before 1933 the flow into Deadman's Bend from Deer Park Bend was in a southeasterly direction which naturally flowed against the outside or Mississippi bank and eroded it, now the flow is directed against the Louisiana bank in a slightly southwesterly direction causing erosion of that shore and a natural movement back into Louisiana. It is agreed that the cutoff of Deer Park Bend was an avulsion. Hence the old streambed around that bend remains the boundary and Mississippi retains the land between the 4-mile cutoff and the old streambed. The area immediately below the foot of the Glasscock Cutoff, known as Deadman's Bend, is the problem area. This area just below the foot of the cutoff is now being eroded on the Louisiana side and will probably tend to form a new bend to the west. If what is happening below the cutoff is not found to be an avulsion, then Louisiana will continue to lose land in the foreseeable

future in an area where that State was once gaining territory.

All of the parties are agreed on the location of the navigable channel or thalweg in 1932 for the 3½- to 4-mile stretch of Deadman's Bend. It is shown on the hydrographic survey for that year, Stipulation A, as being near the Mississippi bank. See Figure 1. They are also agreed on the channel location for 1964; shown on Stipulation C. It is near the opposite or Louisiana shoreline in the upper part of the problem area, but crosses over toward the Mississippi side in the lower part of Deadman's Bend. Approximately 2,950 feet separate these two channels within the bed of the stream at the latitude of the well. Located between the two agreed channels is (Carter) Louisiana State Well No. 1 which became a producer on April 27, 1954.

On December 1, 1959, the Carter Oil Company merged with the Humble Oil & Refining Company, the latter succeeding to the lease rights and obligations of Carter with special reference to Louisiana State Well No. 1.

The primary issue is:

Where was the boundary between the two States in April 1954, and where has it been in the succeeding years down to 1964?

Mississippi and the Zuccaros claim that no later than the time drilling was begun, in fact as early as October 1952, by a gradual process of erosion and accretion, the center of the main navigable channel or thalweg had moved west to a point some distance beyond the bottom hole location on the west or Louisiana side of the river and that the oil that has been produced since completion of the well belongs to the Zuccaros.

Louisiana asserts (1) that the change in the main channel was a distinct avulsion that was brought about wholly as a result of the Glasscock Cutoff, and therefore the boundary should be fixed as of 1932; (2) that in any event it was so closely and intimately related to the Glasscock Cutoff as to be a part of that avulsion; and (3) that if it should be held that there was no avulsion then in any event the well was on the Louisiana side of the boundary in 1954 and that the middle of the navigable channel did not cross that point until some time later.

Since there were no hydrographic surveys by the engineers from October 1952 until April 1964, both sides have drawn on the October 1952 survey their proposed thalweg for that date. Louisiana Exhibit No. 14 and Mississippi Exhibit No. 14. Assuming no avulsion is found, it is necessary for the Court to determine the October 1952 boundary, and then with the stipulated 1964 thalweg and the evidence and circumstance of record, determine the boundary for April 1954 and succeeding dates. Using Louisiana's figures, the boundary would have been 335 feet to the east of the well in April 1954; using Mississippi's, more than 500 feet to the west. See Figure 1.

In its complaint in this proceeding, Louisiana has joined the private parties along with Mississippi as defendants.

The Humble Oil Company has adopted the pleadings and evidence of Louisiana with some additions.

The Zuccaros have adopted the pleadings and evidence of Mississippi, which include an assertion that this Court has no jurisdiction to determine at first hand the rights of individual litigants.

Louisiana takes the position that in order to avoid a multiplicity of suits all the rights of all parties should be decided in one package, that the taxing power of both States is involved in any litigation that grows out of the entire series of transactions, and that the Supreme Court has jurisdiction to determine all matters in issue.

A pretrial conference was held in Washington in June 1964, at which time the parties stipulated certain facts and issues, including an agreement that the parties would exchange the substance of what would be the testimony of their respective expert witnesses. The exchanges were made and copies were furnished the Special Master. It was further agreed that Chief District Judge William Harold Cox be requested to enter an order staying proceedings in the case of *Joseph S. Zuccaro* v. *Humble Oil & Refining Company,* No. 1011, pending in the U. S. District Court at Jackson, Mississippi, until the final action by the Supreme Court in the pending case. The order of stay was issued soon thereafter.

After some correspondence, the parties agreed on the geographical location of the bottom of the well that precipitated this action. Many hydrographic maps made by the United States Army engineers under the supervision of the Mississippi River Commission were submitted by the respective parties. These were discussed at a second conference held at Natchez, Mississippi, on November 18, 1964. The next day the Special Master and representatives of all parties took a boat trip over the disputed area.

A 2 weeks' hearing was conducted at Jackson, Mississippi, beginning January 18, 1965, at which maps

and documents, many having been previously exchanged, were introduced into evidence and marked as exhibits and the oral testimony of each of several witnesses was heard. The recorded transcript of this hearing fills five volumes, over 900 pages, and the multitudinous exhibits fill additional folders.

## III. The Applicable Law

1. When a navigable river forms the boundary between two states, the *live thalweg* or middle of the main navigable channel, with certain exceptions, is the true boundary line. This general rule is well established by a long line of decisions in this Court. To cite a few:

> *Iowa* v. *Illinois,* 147 U.S. 1
> *Louisiana* v. *Mississippi,* 202 U.S. 1
> *Arkansas* v. *Tennessee,* 246 U.S. 158
> *New Jersey* v. *Delaware,* 291 U.S. 361.

The basis for this rule is the common interest of affected states in the navigation conducted on any stream forming the boundaries between such states.

> If the dividing line were to be placed in the centre of the stream rather than in the centre of the channel, the whole track of navigation might be thrown within the territory of one state to the exclusion of the other. [Justice Cardozo in *New Jersey* v. *Delaware, supra,* at 380.]

Even though today the mineral rights under our rivers seemingly cast a shadow over rights to navigation, the latter still remain the principal factor in determining boundaries. *Iowa* v. *Illinois, supra.*

2. The *thalweg* is the middle of the main navigable channel. This is normally the principal course taken by boats and is not necessarily the deepest channel.

*Iowa* v. *Illinois,* 147 U.S. 1
*Louisiana* v. *Mississippi,* 202 U.S. 1
*Arkansas* v. *Mississippi,* 250 U.S. 39
*Minnesota* v. *Wisconsin,* 252 U.S. 273
*Arkansas* v. *Tennessee,* 269 U.S. 152
*New Jersey* v. *Delaware,* 291 U.S. 361

The landmark decision establishing this definition of *thalweg* is *Iowa* v. *Illinois, supra,* wherein Justice Field traced the history of boundary and thalweg through the many treatises on International Law, using such definitions as the middle of: the channel, the main channel, the navigable channel, the main navigable channel, the deepest channel, the principal channel, and the channel usually followed. All subsequent decisions have followed *Iowa* v. *Illinois* in using the "track taken by the boats" as the live thalweg or boundary between states bordering on navigable rivers.

Since the optimum course for vessels is one requiring a minimum of rudder and speed changes, their track will not always coincide with a line directly connecting the deepest portions of the stream. This is especially true in river crossings where no distinct deep water channel exists. On occasion there may even be several possible routes or channels. When this occurs, the solution of boundary is as set forth in *Iowa* v. *Illinois, supra,* at 13:

> Thus the jurisdiction of each State extends to the thread of the stream, that is, to the "mid-chan-

> nel," and, if there be several channels, to the middle of the principal one, or, rather, the one usually followed.

The Court followed this rule in *Minnesota* v. *Wisconsin* when the deep channel was along the shore and the boats used a shorter and more preferable course down the middle of the river. When determining the thalweg

> [a]bsolute accuracy is not [always] attainable. A degree of certainty that is reasonable as a practical matter, having regard to the circumstances, is all that is required. [*Arkansas* v. *Tennessee,* 269 U.S. 152, 157, in a thalweg case.]

3. When by natural, gradual and more or less imperceptible processes of erosion and accretion the *thalweg* changes, the boundary follows the stream and remains along this varying center of the channel.

> *New Orleans* v. *United States,* 12 U.S. (10 Pet.) 292
> *County of St. Clair* v. *Lovingston,* 90 U.S. (23 Wall.) 46
> *Nebraska* v. *Iowa,* 143 U.S. 359
> *Missouri* v. *Nebraska,* 196 U.S. 23
> *Arkansas* v. *Tennessee,* 246 U.S. 158
> *Kansas* v. *Missouri,* 322 U.S. 213

There are several sound reasons supporting this retention of the varying or "live thalweg" as the boundary line. First, states bordering on rivers originally adopted boundaries running along the streams for ease of identification of territorial limits. If these rivers later underwent gradual changes, it was still thought best to retain them as the "varying" boundary, thereby obviating the possibility of one state

possessing a narrow strip of territory on the opposite shore. Second, bordering states were desirous of retaining rights to the traffic proceeding up and down the river. Third, by adopting the "live thalweg" rule, states would be susceptible to the same possibility of gradual addition or loss of land over the years. *Nebraska* v. *Iowa, supra.*

As was stated in *County of St. Clair* v. *Lovingston, supra,* at 68:

> In the light of the authorities alluvion may be defined as an addition to riparian land, gradually and imperceptibly made by the water to which the land is contiguous.

4. There is a noted exception to this general rule of the "live thalweg" and that is when there is an *avulsion.* An avulsion is a drastic change in the channel of a river caused either naturally or artificially and occurring suddenly and perceptibly. On such a happening the center of the old channel remains the boundary, regardless of continued changes in the newly formed channel.

*County of St. Clair* v. *Lovingston,* 90 U.S. (23 Wall.) 46
*Jefferis* v. *East Omaha Land Co.,* 134 U.S. 178
*Nebraska* v. *Iowa,* 143 U.S. 359
*Missouri* v. *Nebraska,* 196 U.S. 23
*Arkansas* v. *Tennessee,* 246 U.S. 158
*Louisiana* v. *Mississippi,* 282 U.S. 458
*Kansas* v. *Missouri,* 322 U.S. 213

The reason supporting this exception to the general rule is equally sound. Gradual additions and losses of land seemed fair to both states, but sudden changes involving large pieces of territory were inequitable.

As was quoted from 8 Ops. Att'y Gen. 175, 177 by the Court in *Nebraska* v. *Iowa, supra,* at 362:

> But, on the other hand, if, deserting its original bed, the river forces for itself a new channel in another direction, then the nation, through whose territory the river thus breaks its way, suffers injury by the loss of territory greater than the benefit of retaining the natural river boundary, and that boundary remains in the middle of the deserted river bed.

The test for determining whether a change was gradual and imperceptible and so not an avulsion, was laid down with clarity in *County of St. Clair* v. *Lovingston, supra,* at 68:

> The test as to what is gradual and imperceptible in the sense of the rule is, that though the witnesses may see from time to time that progress has been made, they could not perceive it while the process was going on.

It is therefore sudden and perceptible if an eyewitness could perceive it. The Court further clarified this test of "avulsion" in *Nebraska* v. *Iowa, supra,* at 369, in ruling that, notwithstanding the rapidity with which the Missouri River cuts huge chunks of land off from the bank in a manner perceptible to an onlooker, there is still no avulsion. We quote the following:

> There is, no matter how rapid the process of subtraction and addition, no detachment of earth from the one side and deposit of the same upon the other. The only thing which distinguishes this river from other streams, in the matter of accretion, is in the rapidity of the change caused by the velocity of the current; and this in itself, in

> the very nature of things, works no change in the principle underlying the rule of law in respect thereto.

"Whether it [the change] is the effect of natural or artificial causes makes no difference." *County of St. Clair,* at 68. The test is always the suddenness and perceptibility of the change—not its cause.

In practically all past decisions of this Court where an avulsion was found, the river had suddenly left its old bed and formed an entirely new one through the adjoining land. A large visible piece of surface land was thereby always cut off between the two channels. Suddenness and perceptibility were easily met.

*Query One.* Can there be an avulsion where the entire change in the channel takes place in the same river bed, leaving no surface land between the two channels?

*Query Two.* If it should be held that there was no avulsion, as such, below the foot of the Glasscock Cutoff may the exception to the general rule be extended so as to properly treat the changes below the foot as a part of the Glasscock Cutoff itself?

5. When the abandoned channel is retained as the boundary because of an avulsion, this boundary is still subject to gradual change as long as the abandoned channel remains a running stream. Once the water becomes stagnant, the process is at an end and the middle of the channel becomes fixed as the boundary.

> *Arkansas* v. *Tennessee,* 246 U.S. 158
> *Louisiana* v. *Mississippi,* 282 U.S. 458
> *Mississippi* v. *Louisiana,* 350 U.S. 5

## Was There An Avulsion?

Louisiana and Humble make a rather plausible argument that there was an avulsion in the 3- to 4-mile stretch of Deadman's Bend immediately south of the foot of Glasscock Cutoff. They base their contention upon several grounds. One, it is undisputed that the natural and historic movement of the Bend into Mississippi in the disputed area has been completely reversed by the manmade cutoff; that whereas previously Louisiana had been gradually gaining in that area, it will now, due solely to the works of man, be constantly losing territory. It is contended that this was a drastic and unnatural process.

Two, that since 1932, and for the most part since 1942, this loss of land has amounted to 2950 feet in the area of Louisiana State Well No. 1, and that this is a drastic boundary change.

Three, that the reversal of the main channel south of the cutoff did not take place gradually from 1933 to 1952, but rather occurred suddenly in the short period of 1950-1952. Although water first ran through the cutoff 19 years before 1952, unforeseen events delayed a full development of the cutoff many years. A full development was finally reached during the 1950 flood and 1951-1952 high water. During those 2 years vast amounts of water flowed through the cutoff and eroded away the soft western bank at the foot. This rapid widening to the west at the foot of the cutoff directed the flow out of the cutoff toward the Louisiana bank in an area over 1000 feet removed from the preexisting channel. It could be likened to the turning of a water hose onto a bank of sand. Therefore, the channel in Deadman's Bend in October 1952 did not

gradually move westward from its 1932 position, but was created entirely separate from the old channel and in an avulsive fashion.

Mississippi replies that all the witnesses agree that the reversed trend began at the foot of the cutoff soon after 1936, and that it had moved several hundred feet—as shown by the maps and reports—even by 1940, 10 years prior to the 1950 flood; that it had continued the gradual movement west since the last survey in 1940; that while a large part of the change occurred during the 1950-1952 flood and high water period even that portion of the change was not sudden or perceptible, and that at no time according to the testimony, nor according to any of the maps and documents, did the channel leave the bank and form a new bed.

The Special Master's study of the applicable case law leads to the conclusion that there are but two rules—or rather one long-standing general rule and its exception—which can be applied to river boundary changes. The general rule is that the boundary follows the changes in the main navigable channel. The exception is that when there is a cutoff, natural or artificial, the old bend that has been cut off remains the boundary in that particular area. Louisiana contends that since the cutting of the new deep-water channel was not altogether a gradual process of erosion and accretion, it must be an avulsion.

This contention is untenable. All case law and all reasoning behind these rules point to the opposite conclusion—that the general rule of the "live thalweg" is preferable and will be applied *in all cases,* unless there has been a clear and convincing avulsion. This avulsion must be sudden and perceptible. It is con-

ceivable that the term "sudden" should be applied in a more flexible sense than its use in ordinary conversation. But even conceding the strength of this argument, we have been unable to find any case, with facts similar to the instant case, in which an avulsion has been found by the Court where the river remains in the same bed of the stream. In all such cases the new channel was formed when the river "suddenly leaves its old bed and forms a new one * * *." *Arkansas* v. *Tennessee,* 246 U.S. 158, 173. Unless suddenness and perceptibility are not thus clearly established, the general rule must be applied.

In the instant case there was a gradual reversal of the trend of erosion and accretion from one side of the river to the other. This reversed trend began not later than 1940 in the area directly below the foot of the cutoff and has continued at all times during the period from that date until 1964. It is true that a great portion of this reversed process occurred during the flood which began in 1950 and the prolonged high-water that continued through 1951 and a part of 1952. This is natural, for greater river action always occurs in periods of high water. However, a close study of the Hydrographic Surveys for these years, 1932-1964, points out the "over-all" gradualness of the change in the thalweg south of Glasscock Cutoff.

There are page references to the Record in the Additional Findings of Fact. It is sufficient here to say that by 1940—3 years after the opening of the cutoff to vessels and 10 years before the alleged "drastic change in 1950-1952"—the thalweg just below the foot of the cutoff as agreed by both sides had already progressed westward 400 feet. While there were no surveys between 1940 and 1951, it seems certain this

trend continued and must have moved the thalweg several hundred feet more during that time. This seems all the more plausible since the evidence shows that from 1941 the water from the cutoff dominated the flow into Deadman's Bend.

The Special Master does not find any clear and convincing reason *in the facts and circumstances of this case*, for recommending an extension of a long-established doctrine of avulsion, which heretofore has been limited to the area of the bend of the river that has been cut off and also to instances in which the stream left its old banks and formed a new bed. In the instant case the problem area is entirely below the foot of the cutoff and no new stream bed has been formed. The vagaries of this river or any river, especially in times of high water, are such that it appears many problems and controversies would be created or would inevitably follow from such an extension of the rule of avulsion. Changes in the navigable channel of a river, especially the lower Mississippi, are such that a definite pattern for court determination would be difficult to establish.

### The Extent of an Avulsion

The plaintiff apparently further contends that the changes in the channel of the river immediately below the foot of the Glasscock Cutoff are so intimately related to the cutoff itself as to be tied to and become a part of the cutoff and its legal results. When asked how far downstream the effects should be considered a part of the cutoff, Louisiana stated "as far down the river as the effects are substantially measurable."

Again it must be stated that there is no case law bearing directly on this question. But as was stated

previously in discussing the applicable law, the true import of related cases appears to be that suddenness and perceptibility are essential elements of an avulsion. Whether the direct cause is natural or artificial, or whether the related event is an avulsion is immaterial. Each change must on its own merits stand the test.

Here again, an extension of the prevailing rule would appear to raise many questions as to the thalweg below the foot of all cutoffs. It would be very difficult for the Court to establish a pattern for these "thin-line" decisions. In any event the Special Master does not consider it wise to recommend the Court's establishing this additional exception to a rule which has been in use for so long in the Supreme Court and the various Federal Circuit and District courts.

## IV. The Boundary in 1954

In the absence of an avulsion, or a holding that the disputed area is a part and parcel of the Glasscock Cutoff, we must determine the location of the boundary as of April 27, 1954, when the oil well was completed. It must be drawn from the foot of Glasscock Cutoff for a distance of between 3½ and 4 miles to a point beyond the present bight in Deadman's Bend below Black Hills Light. The parties have stipulated the location of the 1964 thalweg. It is necessary to locate it for each intervening year, beginning in 1954. Since there were no surveys after 1952, it is necessary to locate the thalweg of 1952 as a starting point.

There is substantial conflict in the testimony of the expert witnesses as to the location of the main navigable channel in April 1954—and even as to its location on the October 1952 survey.

The absence of accurate information as to the varying depths of the water throughout Deadman's Bend during these years has added greatly to the task of establishing *after-the-fact* the main navigation channel for this period. Also adding to the problem, the area of concern was a river crossing where the deep water leaves its pronounced trench on one side and crosses to a similar deep water area on the other side. Added to this is the fact that in 1950-1952 this crossing was in the process of more rapid than normal change. In these circumstances it is easy to understand how these four river experts could disagree on the location of the thalweg in their interpretations of the October 1952 survey.

All four of these witnesses were experienced men. They were earnest men who gave every evidence of giving their honest opinions based upon the facts as they interpreted them. But somehow experts seem to have a tendency to form widely differing opinions when looking at the same basic facts. I sometimes wonder why.

The two experts for Louisiana drew a thalweg on the survey of October 1952, which was 500 feet to the east of the well, whereas the experts for Mississippi in their testimony placed it nearer to the Louisiana shore about 500 feet west of the well. The agreed main navigational channel for 1964 runs about 850 feet to the west of the well. Therefore, according to Louisiana, the thalweg moved 1,350 feet in 11½ years from October 1952 to April 1964; a rate of 117 feet per annum. Mississippi's thalweg would have only 350 feet to move, or a rate of 30 feet per annum.

We regard both of these suggested rates of movement incorrect since the rate of change for this area

in the long period prior to 1932 was 70 feet per annum. We have found the 1952 main navigable channel somewhat in between the two that were suggested by the respective parties. A constant rate of change for the intervening years from 1952 to 1964 must be assumed in the absence of surveys for those years. Our recommended rate of more than 70 feet seems justified since the evidence shows that the Mississippi bank was much more resistant to erosion in the problem area than the Louisiana bank.

Up to and including the survey of March 1951, the thalweg was definitely east of the bottom hole location. It had been east thereof since sometime after 1900. Prior to 1936 it had been shaped in a slightly curved line on the Mississippi side in the upper part of Deadman's Bend, growing more pronounced in the sharper turn in the lower part of that bend. By 1951 the flow from the cutoff had forced the segment of it above the well over toward the Louisiana side. Although by 1951 this gradual change in the arced thalweg was evident, the channel was still fairly pronounced, and both sides agree basically on its location. Mississippi places the 1951 crossing closer to the well and makes it a sharper curve—still leaving the well to the west of the thalweg.

The gradual process of erosion whereby the channel was being forced to the west—initially at the foot of the cutoff and increasing gradually downstream—was accelerated in the 1950-1952 flood and high water period. This resulted in a deepening of the water on the Louisiana side in an area below the well. By the time of the October 1952 survey this accelerated process had ceased and while there were some rises there was no unusual high water for several years thereafter.

Channel change was therefore gradual after October 1952, and it is reasonable to assume a constant rate of change between that date and 1964.

The basic question is: Where was the true channel or thalweg in October 1952 after the intensified river action of the previous 2 years had ceased?

On the October 1952 survey [see Special Master Exhibit 1] the pronounced deep water pools were still on opposite sides of the bend. The deep water, at least a long finger of it, had extended below the well to a point on the Louisiana side almost directly across from the beginning of the deep water on the Mississippi side. Crossing from one to the other had become a problem. For a short period the water was extremely low in the usual crossing area, or in fact in certain parts of any crossing that might be chosen. The minimum for safety is set at 9 feet by the Mississippi River Commission. Prior to the October 3, 1952 survey, river traffic was following the buoy-marked crossing [appearing on Louisiana's and Mississippi's Exhibits 14] which began north and east of the well from the deep water on one side to the deep water on the other. This was an easy course to follow requiring no sharp rudder movements for boats crossing from the one side to the other.

For a short period after October 2, 1952, it was not possible for a vessel to proceed in any manner in Deadman's Bend and avoid all the bad water. In times other than extreme low water—and the latter is very seldom —there would be no problem here for navigation and a boat could safely go several ways.

After the results of the October 2, 1952 survey were known, it became necessary for the River Commission

to take steps to assure vessels of a 9-foot channel. The engineers chose to dredge out the low spot in a sharper, more direct crossing farther down the bend. This temporary course had the disadvantage of not utilizing the first mile of deep water on the Mississippi side south of the latitude of the well. However, in the circumstances it was simpler than dredging a shallow spot on the longer and more slanting crossing. This dredging occurred on October 10-12, 1952. Soon thereafter the navigation lights and buoys were moved accordingly to guide the vessels along this new route. Before the end of November the water level had risen and safe navigation in Deadman's Bend no longer posed a problem. Many vessels went back to a more gradual crossing near the one that had been used theretofore. Others probably continued to use the route that the engineers had temporarily established near the Louisiana side. This latter course required a sharp turn by the boats at the bight of the bend nearer to the Black Hills Light in order to get to the deep water on the Mississippi side.

From a study of what has preceded, it is evident that (1) the deepest water was along opposite banks separated by a stretch of water at various depths—and that either crossing encountered a spot during the brief October 1952 period of extremely low water; (2) the established course used by river traffic prior to October 2, was along these two deep water pools and the gradual crossing between; (3) many vessels returned to a somewhat similar course after the low water period in October; (4) a course was available near the Louisiana side which took little advantage of the deep water on the Mississippi side. This was not as gradual a course, but at least for the time being

seemed more feasible; (5) the engineers chose this second course as the one to be dredged during the October low water and the one the vessels were to use during periods of extremely low water; (6) some vessels continued to use this new course after the return of normal water in December 1952; (7) the navigational bulletins continued to mark this new course for some time after 1952. However, there is no evidence that there was another period of extremely low water between October 1952 and 1964, such as to create a crossing problem.

It is agreed that the main navigation channel in April 1964 was near the Louisiana side, but farther east in the lower part of the channel than Mississippi had claimed it was even in October 1952. Mississippi contends that the October 1952 course established by the engineers to combat the low water was the true thalweg at that time and has been moving west ever since. Louisiana feels the gradual crossing north and east of the well to the deep water on the Mississippi side was the true thalweg in October 1952 and agrees that it has continually been moving westward since 1952. It, therefore, according to Louisiana, would have passed over the bottom of the well sometime after the well was drilled.

Since the accelerated process of change in the river bed subsided after October 1952, it is unlikely that the new medium-water area near the Louisiana side became the deep channel that is present in 1964, in any short space of time after 1952. If it did, then there was little movement west between then and 1964, and in fact in the lower part of the disputed area it actually moved back to the east. This all seems unlikely. Also, in 1952 the truly deep water was still on the

Mississippi side at the bend and so a substantial portion of the flow was across to that pool after 1952. This flow across the river would have been in the area of the well, slightly north and east of it. The upper part of the deep water channel on the Mississippi side had filled up with alluvium by 1964. The lower part still had deep water on the Mississippi side. That was a gradual process of erosion and accretion.

If the high water of 1950-1952 had continued for another year or two and completely dug out a new deep channel near the Louisiana side, then that would likely have been the new thalweg. However, the high water had receded by the early summer of 1952. The October 1952 survey clearly shows a new deep channel had not been completed at that time. The location of the 1964 deep channel bears this out, for if the new channel had been completed shortly after 1952 it would be much farther west in the lower part of Deadman's Bend than the stipulated location in 1964.

I conclude that in October 1952 the true thalweg or main navigation channel was one gradually moving from the deep water on the Louisiana side toward the deep water on the Mississippi side. I find that on October 3, 1952, such channel was 230 feet east of the well. In the light of all the evidence—expert testimony, surveys, navigation bulletins, past river history, optimum navigational course—I feel that the recommended result is reasonable and well grounded. I have had an engineer draw my thalweg line on the survey of Deadman's Bend for October 3, 1952, which is included here as Exhibit 1 and as Figure 1. Also present on the survey are the proposed 1952 thalwegs by Louisiana and Mississippi, and the 1932 and 1964 stipulated thalwegs. I have found my recom-

mended thalweg is between the two proposed by the parties; nearer to the one drawn by Louisiana than that by Mississippi. The reasons for this have been set down previously.

The foregoing reasons also support the use of a constant in determining the location of the thalweg for any intervening period between October 3, 1952 and April 10, 1964. The distance between my 1952 thalweg—230 feet east of the well—and the 1964 thalweg is 1,080 feet. The interval in time between October 3, 1952 and April 10, 1964, is 11 years 6 months 7 days. Dividing 1,080 feet gives approximately 94 feet as the constant annual rate of movement of the thalweg in the area of the well. This is slightly less than 8 feet per month. The time interval between October 3, 1952 and April 27, 1954, is 18 months and 24 days. In those months the boundary moved approximately 150 feet. This movement subtracted from the 230 feet which separated the thalweg from the well in October 1952, leaves the thalweg still 80 feet to the east of the well on April 27, 1954.

At the same rate of movement toward the west the thalweg was directly above the bottom hole location on February 27, 1955. Therefore, on February 28, 1955, the boundary was on the western side of the well and the well became located in Mississippi on that date—February 28, 1955. I treat the boundary as having moved west at this constant rate ever since, and in April 1964 it is shown as reaching the stipulated survey. The oil well was inside the boundary of Louisiana when drilled and was there for the next 10 months.

To determine the location of the thalweg at points along the 3½- to 4-mile stretch other than at the well

it is a simple matter to measure on the map herein the distance between the 1952 and 1964 thalwegs and, through a process similar to ours, calculate the precise location. These distances between the two thalwegs vary but there are range marks approximately every 1,000 feet for ease of measuring and calculation.

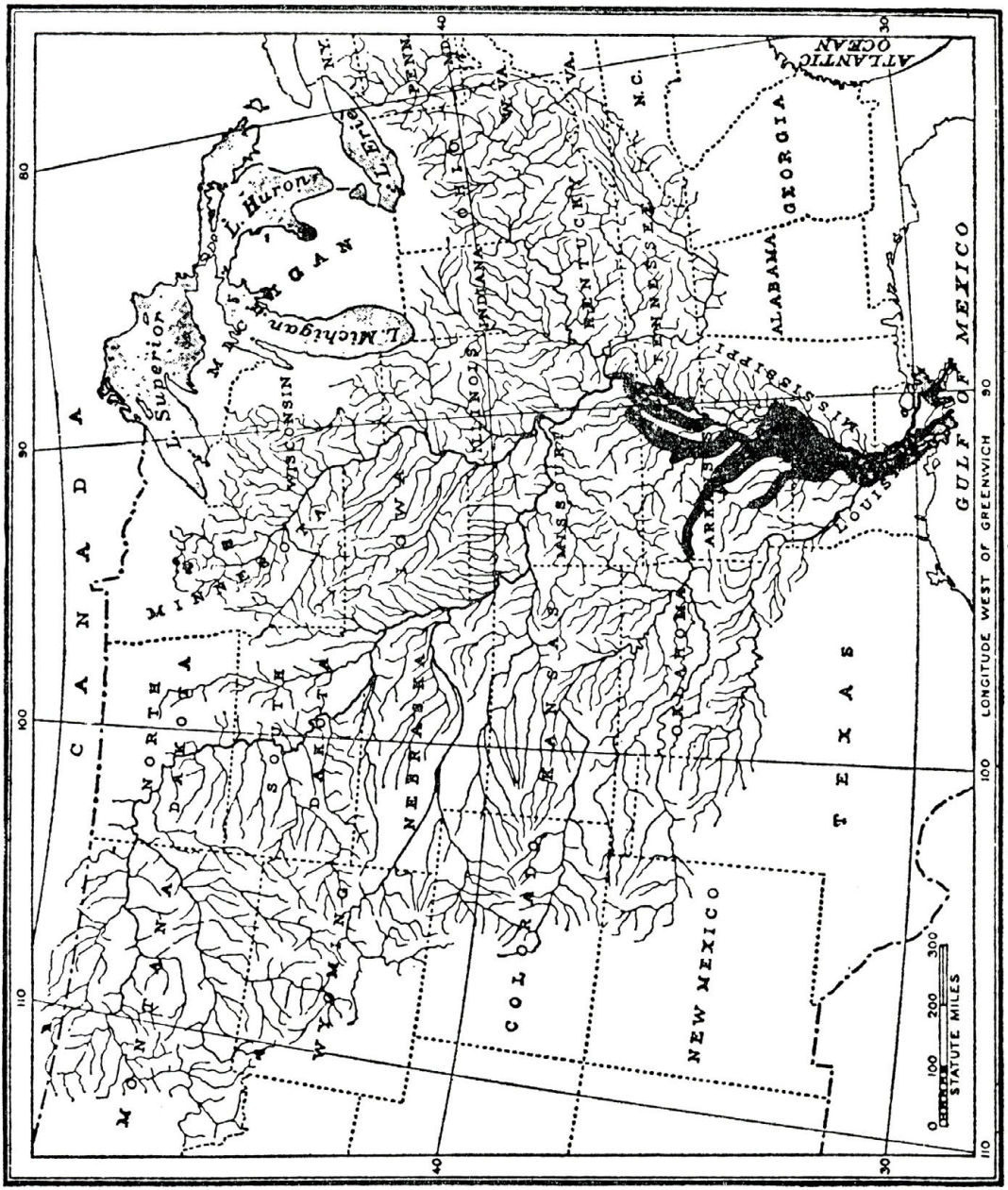
It is so recommended.

There were no other wells drilled in the problem area except for a well drilled by the Humble Oil & Refining Company on the Zuccaro property immediately across from the original (Carter) Louisiana State Well No. 1. Humble has had an oil, gas and mineral lease on this Zuccaro property since before 1950, keeping it alive by renewal, bonus and annual rental payments. In 1955, after Carter had hit oil, Humble drilled its well on the Zuccaro land but it resulted in a "dry hole," that is, it produced neither oil nor gas. It is probable that it may not be considered feasible to drill any further well on either side in the problem area until the boundary question is settled.

## COMMENT

The Mississippi River system is one of the greatest in the world. According to the Army Engineers' reports, the system with its several major tributaries includes 2,000 miles of navigable waters. Its thousands of tributaries stretch all the way from the Alleghany mountains to the Rocky mountains and drain parts of some 31 States and portions of Canada. All these waters finally flow together and eventually reach the Gulf through one major channel.[1]

[1] Attached is a drawing of the Mississippi River system, published in a document by the Bureau of Agricultural Economics under the title "Flood Control in the Mississippi Alluvial Valley."




The shaded portion is the area of alluvial land overflowed in 1927.

It is little wonder that at flood time the lower Mississippi becomes a restless river, incredible in its energy and terrible in its destructive power.

Had the country never been settled, had nature's policies never been interfered with, the Mississippi River system would probably have never been a serious problem. There is no evidence that the Indians had any trouble with it. But since the ax first rang in the wilderness of America man has undertaken to harness the wild forces of nature and bend them to his own use. Watersheds in many instances have been stripped of trees, land has been plowed and erosion has taken place. Soil conservation practices, contouring, furrowing, chisseling, and the construction of small ponds and check dams on tributary streams and other practices have had a part in the ever-changing picture. The Mississippi River valley, covering all of its tributaries, has become one of the great bread baskets of the world.

Industrial developments and plants have etched the skylines of great cities. Great dams have been built, electrical energy has been produced, and industrial development on a large scale has resulted. Docks, revetments, and other improvements have been built out into the tributary streams. All these things have contributed to the problem of the lower Mississippi. Drainage areas of the Missouri, Ohio, and scores of other great tributaries have caused millions of tons of fertile soil to be swept away into the Gulf. Much of it was deposited along the way and this building up the level of the bed of the streams has produced and complicated many troublesome results.

During the high flood stages of 1927, the waters flowed out of the banks of the lower Mississippi. The

bed of that part of the stream had been raised by the deposit of soil and other debris until in some instances the bed of the stream was above the surrounding areas. The water flowed over the levees that had been built by great effort and expense. The swirling waters inundated portions of eight States and caused a destruction of property in that area of an estimated value of $200,000,000, not to mention the loss of valuable soil and many plants that had been built along the banks of the various tributaries, large and small.

All these works of man have contributed to the changes in the flow of the river. When at flood time damages are occasioned to so much property and so many people, private property becomes to some degree affected with a public interest.

In an effort to help in the solution of these problems, the Mississippi River Commission was established many years ago. It has done valuable work in many lines including repeated surveys of the river, its customs, its habits, its increasing problems.

SECOND DIVISION

Plaintiffs urge that the Special Master recommend a finding as to the ownership of the oil produced from Louisiana State Well No. 1 since completion in April 1954. They contend that any determination in a United States District Court in either Louisiana or Mississippi as to the rights of the Zuccaros or The Humble Oil & Refining Company would necessarily involve the property rights of Louisiana and the taxable interests of both States.

Mississippi and the Zuccaros contend that the only issue involved is the boundary question; that it is the only question over which the Supreme Court has ex-

clusive jurisdiction; that there are regular judicial facilities available for determining ownership and that the Supreme Court should not extend its original but nonexclusive jurisdiction to cover these private party matters.

As Special Master, it is my recommendation that the Supreme Court not accept jurisdiction over the nonboundary questions in this proceeding. This will avoid the possible establishment of a burdensome and perhaps an undesirable precedent for other State-private party litigants. Rather, it is recommended that the Court confine its determination to the boundary between the two States in the disputed area and leave the related issues of oil ownership to be decided by the appropriate judicial tribunals.

For this Court to go beyond a determination of the boundary dispute will require an involvement in several questions which are not within its exclusive jurisdiction. Some of these issues are as follows: The Zuccaros claim the value of all the oil that has been produced since April 1954. Humble pleads that it has had a continuing lease from the Zuccaros since 1950 and that its terms allowed Humble to drill for, remove and market any oil and gas found on the Zuccaro property; that this lease allowed Humble to market the oil subject only to the payment of one-eighth royalties to the lessors (therefore limiting the recovery in any event to the one-eighth royalty paid to Louisiana from 1954 to 1963); that the lease from the Zuccaros did not require the well to be drilled from a site on the Zuccaro property. It was also pleaded that the Zuccaros delayed too long in making their claim, i. e., 1954 until 1962, and Humble therefore pleads waiver, estoppel, laches, and the Mississippi 6-year statute of

limitations. The State of Louisiana is also directly involved in these ownership questions since it is the lessor of the oil rights on the west side of the bed of the river. From 1954 until 1963 Humble had apparently paid Louisiana over $89,000 in royalties and over $64,000 in severance taxes. The record also shows that, subsequent to the successful drilling of the Carter well in 1954, Humble drilled a similar well on the Zuccaro property on the Mississippi side of the river. It resulted in a dry well. The Carter well—Louisiana State Well No. 1—is to date the only producer in the disputed area.

The Court, of course, recognizes that the exercise of such ancillary jurisdiction is a matter wholly within the discretion of the Court, since it does not fall within its exclusive jurisdiction. In the past these permissive powers have been used sparingly. There is one case where the Court exercised such wider ancillary jurisdiction. *Oklahoma* v. *Texas,* 258 U.S. 574. In that case the facts are unusual and readily distinguishable from the present controversy. Armed conflict was eminent over oil rights under the Red River, and the Supreme Court had appointed a receiver to take possession and operate existing wells, drill new ones, market the oil and retain the proceeds pending the outcome of the Court proceedings. The Court explained its acceptance of original jurisdiction over the various private claims as follows:

> The other claims [of the private parties], being for particular tracts and funds in the receiver's possession and exclusively under our control, are brought before us because no other court lawfully can interfere with or disturb that possession or control. It long has been settled that claims to property or funds of which a court has taken

> possession and control through a receiver or like officer may be dealt with as ancillary to the suit wherein the possession is taken and the control exercised,—and this although independent suits to enforce the claims could not be entertained in that court. [At p. 581.]

If the Court decides to assume jurisdiction over the nonboundary questions, it is recommended that the boundary issue be settled first and the parties then given 60 to 90 days in which to attempt a settlement between themselves on the ownership of the oil and related matters. It was indicated to the Special Master during the Hearing that, once the boundary was settled, pooling arrangements and division of proceeds could probably be agreed upon.

## Recommended Decree

As Special Master in the dispute between the States of Louisiana and Mississippi (Original No. 14), I recommend the following decree:

1. The true boundary between the States of Louisiana and Mississippi in the area of the Mississippi River known as Deadman's Bend on the several dates mentioned is determined to be as follows:

At all times the live thalweg has been the true boundary.

On October 3, 1952, the live thalweg was a gradually curving line running southward from the foot of Glasscock Cutoff, and east of the future location of Louisiana State Well No. 1 by 230 feet, to the end of Deadman's Bend at range 334.5 AHP. This line is described below by latitude and longitude and is drawn on Special Master Exhibit No. 1.

On April 10, 1964, the live thalweg was a gradually curving line running southward from the foot of Glasscock Cutoff, and west of Louisiana State Well No. 1 by 850 feet, to the end of Deadman's Bend at range 334.5 AHP. This line is described below by latitude and longitude and is drawn on Special Master Exhibit No. 1.

At all times between October 3, 1952 and April 10, 1964, the live thalweg has moved at a constant rate. The boundary location for any intervening period at any point in Deadman's Bend (from the foot of Glasscock Cutoff to range 334.5 AHP) is to be determined mathematically by calculating the constant rate of change for that particular place in Deadman's Bend, using the 1952 and 1964 thalwegs described heretofore and the appropriate time differentials.

At the latitude of Louisiana State Well No. 1 the location of the boundary was as follows from October 3, 1952 to April 10, 1964:

October 3, 1952—230 feet east of well
April 27, 1954—80 feet east of well
February 27, 1955—Directly above the well
April 10, 1956—102 feet west of well
April 10, 1957—195 feet west of well
April 10, 1958—289 feet west of well
April 10, 1959—382 feet west of well
April 10, 1960—476 feet west of well
April 10, 1961—569 feet west of well
April 10, 1962—663 feet west of well
April 10, 1963—756 feet west of well
April 10, 1964—850 feet west of well

The Louisiana State Well No. 1 became located inside the boundary of Mississippi on February 28, 1955.

The description of the October 3, 1952 live thalweg by geodetic positions (North American Datum) is as follows:

Beginning at the foot of Glasscock Cutoff at a point on range 338.3 AHP, which is Lat. 31°19′ 07.0″—Long. 91°30′33.5″.

Thence running southward through the following points:

| Latitude | Longitude |
|---|---|
| 31°18′57.5″ | 91°30′37.0″ |
| 31°18′47.5″ | 91°30′39.0″ |
| 31°18′37.0″ | 91°30′40.0″ |
| 31°18′27.0″ | 91°30′39.5″ |
| 31°18′17.0″ | 91°30′39.0″ |
| 31°18′07.0″ | 91°30′38.0″ |
| 31°17′57.5″ | 91°30′38.0″ |
| 31°17′47.0″ | 91°30′38.0″ |
| 31°17′37.0″ | 91°30′37.0″ |
| 31°17′27.0″ | 91°30′36.5″ |
| 31°17′17.0″ | 91°30′36.0″ |
| 31°17′07.0″ | 91°30′35.0″ |
| 31°16′57.5″ | 91°30′33.5″ |
| 31°16′47.0″ | 91°30′32.5″ |
| 31°16′42.5″ | 91°30′34.0″ |
| 31°16′38.0″ | 91°30′37.0″ |
| 31°16′30.0″ | 91°30′43.0″ |
| 31°16′22.5″ | 91°30′51.0″ |
| 31°16′17.0″ | 91°31′00.0″ |
| 31°16′12.0″ | 91°31′10.0″ |
| 31°16′08.0″ | 91°31′21.0″ |
| 31°16′05.5″ | 91°31′32.0″ |
| 31°16′03.5″ | 91°31′42.0″ |

The description of the April 10, 1964 live thalweg by geodetic positions (North American Datum) is as follows:

Beginning at the foot of Glasscock Cutoff at a point on range 338.3 AHP, which is Lat. 31°19′ 07.0″—Long. 91°30′38.5″.

Thence running southward through the following points:

| Latitude | Longitude |
|---|---|
| 31°18′57.5″ | 91°30′40.5″ |
| 31°18′48.0″ | 91°30′42.5″ |
| 31°18′38.0″ | 91°30′44.0″ |
| 31°18′28.0″ | 91°30′46.0″ |
| 31°18′18.5″ | 91°30′47.0″ |
| 31°18′08.5″ | 91°30′48.5″ |
| 31°17′59.0″ | 91°30′50.0″ |
| 31°17′49.0″ | 91°30′52.0″ |
| 31°17′39.0″ | 91°30′52.5″ |
| 31°17′29.5″ | 91°30′52.5″ |
| 31°17′20.0″ | 91°30′52.5″ |
| 31°17′10.0″ | 91°30′52.0″ |
| 31°17′00.5″ | 91°30′52.0″ |
| 31°16′51.0″ | 91°30′52.5″ |
| 31°16′41.0″ | 91°30′53.0″ |
| 31°16′36.0″ | 91°30′55.0″ |
| 31°16′32.0″ | 91°30′58.0″ |
| 31°16′24.0″ | 91°31′04.5″ |
| 31°16′16.0″ | 91°31′11.5″ |
| 31°16′09.0″ | 91°31′18.5″ |
| 31°16′03.0″ | 91°31′28.0″ |
| 31°15′59.0″ | 91°31′38.0″ |

2. The costs of this suit are to be equally divided between the two States.

Respectfully submitted,

MARVIN JONES, *Senior Judge*
*Special Master*

MAY 28 1965

## Additional Findings of Fact
## and
## Page References to the Record

1. On December 16, 1963, the Supreme Court of the United States permitted Louisiana to file its Complaint (No. 14, Original) against Mississippi and certain other parties, which other parties at that time were involved in a private litigation in a United States District Court in Mississippi. In Louisiana's complaint, the Supreme Court was requested to ascertain the boundary between the two States in a 3½- to 4-mile stretch of the Mississippi River south of Natchez, Mississippi, known as Deadman's Bend. A producing oil well is located under the river bed in the bend; the ownership of which had precipitated the private suit in the District Court. Louisiana also requested the Court to stay the District Court proceeding since certain rights of the two States to royalties, severance and other taxes would inevitably be affected by the decision in that lower court.

2. The Supreme Court in April 1964 issued an order appointing the undersigned, Judge Marvin Jones of the United States Court of Claims, as Special Master in this dispute.

3. Upon call of the Special Master, a prehearing conference was held in Washington, D. C., on June 25, 1964. There, the parties agreed to certain "statements-of-fact" and "suggested issues" in an effort to shorten the time required to be spent in future hearings. Both sides were also urged to prepare and exchange, insofar as practicable, copies of exhibits and of the expected testimony of expert witnesses. In this way, it was felt that surprises and resultant delays would be avoided at the formal Hearing. The June conference was followed

by an inter-party meeting in August. Several important stipulations were agreed upon at this August meeting: the location of the well; the location of the 1932 thalweg in the problem area; and, similarly, the location of the 1964 thalweg. The Special Master held another prehearing conference in Natchez, Mississippi, in November, at which time he made a firsthand inspection of the disputed area by boat. The formal Hearing was held in Jackson, Mississippi, from January 18 to 28, 1965. The short duration of the Hearing was largely the result of the fine cooperation of all parties in the various preparations leading up to it.

4. Mr. Alex Osanik was the first witness called by Louisiana and The Humble Oil & Refining Co. at the January Hearing. He received his B.S. degree in geology from Oregon State College in 1939 and his M.S. in the same field from Louisiana State University in 1942. From 1942 to 1946 he served as an officer in the United States Navy and then returned to Louisiana to work with Dr. Fisk on the Mississippi River Commission under the United States Army Engineers.

In his 2-year association with Dr. Fisk, Mr. Osanik assisted in various studies concerning the Mississippi River. In 1948 he began his career with The Humble Oil & Refining Co. Here he conducted research in various areas in Texas and Louisiana to determine the location of possible oil deposits. Aerial photographs and on-site investigations were utilized.

Mr. Osanik is presently a Senior Geologist, Esso Production Research Co. in Houston, Texas. He is a member of various professional and honorary societies. Over 2 years ago Louisiana requested Dr. Fisk and Mr. Osanik to conduct geological studies of the contested area in preparation for the future pro-

ceedings. This study involved the activity of the river both before and after the construction of the Glasscock Cutoff. Dr. Fisk, a recognized authority on the Mississippi, had to withdraw from the study prior to its completion due to illness and Mr. Osanik saw it to completion for the January Hearing.

5. Mr. R. A. Latimer was the second witness for Louisiana. He received his B.S. in civil engineering from Mississippi State University in 1914 and then went to work for the United States Corps of Engineers at Memphis, Tennessee. There he rose in position from inspector through associate engineer while working on the construction of levees on the caving banks of the Mississippi. In 1930 he was transferred to Vicksburg, Mississippi, where he was responsible for all levee construction in the Lower Mississippi Valley. (This includes the area in controversy.) In 1937, he assisted the Chief Engineer of the Commission in the drawing of plans for many flood control devices in the Lower Valley. Mr. Latimer continued to advance until he attained the top civilian position in the Commission in 1950—Chief Engineering Assistant to the Mississippi River Commission. Throughout this long career he has continually been associated with the various flood-control programs on the river. In 1953, Mr. Latimer received the highest civilian award of the Department of the Army—the decoration for exceptional civilian service. In 1961, upon retirement, he received the second highest award—the award for meritorious civilian service. It was Mr. Latimer's responsibility during the last 20 years of his employment with the Commission to oversee and direct all construction and improvements by the Engineer Districts of the Commission. During this time he accompanied the Commis-

sion on semiannual trips for the entire course of the river from Cairo to New Orleans. He had 51 years' experience on the Mississippi River and demonstrated an unusual grasp of the subject.

6. Mr. Austin B. Smith was the first witness for Mississippi. He received his B.S. degree in civil engineering from the University of Arkansas in 1930 and has been working with the Mississippi River Commission since 1935—a total of 30 years. Initially, he assisted in the planning of cutoffs and navigation in the Lower Mississippi Valley. He was with this division until 1942 and was familiar with the construction of the cutoffs. He has since been assigned to the maintenance branch of the Commission where he has worked on navigation and dredging. For 7 years he was assigned to the Vicksburg District. Mr. Smith is presently the Chief of the Maintenance Branch. During World War II he was an officer in the U. S. Army Corps of Engineers. In addition to his work in the maintenance branch, he has also conducted studies on the history of accretion, erosion, and related subjects concerning the Mississippi. Mr. Smith has served as an expert witness in numerous boundary disputes. He is a member of several engineering societies, is listed in "Who is Who in Engineering", and has made a detailed study of the area in controversy.

7. Mr. Francis N. Geddes was the second witness for Mississippi. He received his B.S. in civil engineering from Mississippi State College and his M.S. in geology from Washington University. He has been employed by the Commission since graduation in 1928. Up until 1939 he worked on revetments and surveys in the Natchez area (the area in dispute). From 1939 to 1946 he was stationed in the New Orleans District with some

supervision over the Natchez area, and since 1946 he has been in charge of all flood control work in northeast Louisiana, his office being about 20 miles from the problem area. Mr. Geddes also prepared a study of the area in dispute.

8. The Mississippi River System is one of the largest and mightiest in the world, draining 31 of our States and 2 Canadian provinces. This system, which includes the Missouri and Ohio rivers, converges immense volumes of water into the main stem which runs from Cairo, Illinois, to the Gulf of Mexico. The vast energy of this river has played an important role in the history of our country and has defied for decades the puny efforts of man at restraining its mighty power. The devastating flood in 1927 submerged parts of eight States, drove half a million persons from their homes, caused property damage of an estimated $200,000,000 and almost destroyed New Orleans. [R. 475.]

9. The Mississippi River Commission was formed by the Congress in 1879 to cope with the problems of this vast river system and to assist navigation thereon. The Commission is composed of U. S. Army and civilian engineers. Its efforts from 1879 to 1927 in controlling the river were inadequate and the shock created by the 1927 flood caused the Congress to throw even more resources and skills into the program so as to avoid a repetition of the 1927 disaster. [R. 475.]

10. The plan embarked upon by the Commission under the guiding force of the U. S. Army Engineers called for the construction of 15 cutoffs in the winding stretch of the river running from Memphis, Tennessee, to a point 20 miles south of Natchez, Mississippi, called Deer Park Bend. Other measures were also taken,

such as work on the levees and associated revetments. [R. 478.]

11. To fully understand the reason for the cutoffs, it is necessary to have some background knowledge on the Mississippi. Scientific experiment has proven that this river will naturally meander. [R. 476.] Geologically, it is referred to as a poised stream, i. e., the bed has matured from the last ice age, the meander belt is approximately 20 miles wide, and the location of the river in the meander belt is fairly stable. Generally, between Cairo, Illinois, and Baton Rouge, Louisiana, the river loops and bends in its southward progression. From Baton Rouge to the Gulf the great loops and bends diminish and the river by comparison is almost straight. [R. 227.] The length of the river from Cairo to New Orleans is about 1,000 miles, as compared to a direct distance of about 600 miles. The river valley can be likened to a huge trough, sloping to the sea from a 300-foot elevation in the north with a leveling off below Baton Rouge. [R. 223.]

12. In the area of great loops and bends the river will normally compensate itself by forming natural cutoffs to bends that have progressed too far. [R. 291.] The timing of the cutoffs depends on several items such as the resistivity of the soil in the neck of the bend, i. e., the area between its starting point and where it reenters the main stem of the river. [R. 263-272.] Clay deposits are very resistive to erosion and point bar deposits are very susceptible to erosion.

13. The specific area of the river involved in this dispute is called Deadman's Bend and is located 25 miles south of Natchez, Mississippi. In that area the river, prior to 1932, swung westward in a 19-mile loop called Deer Park Bend and then returned to the center-

line at a point just 4 miles south of where the Bend originally started. On leaving Deer Park Bend, the river flowed into a second and smaller bend to the eastward, called Deadman's Bend. This can be seen on Figure 1. [R. 477.]

14. As one of the 15 cutoffs to aid in flood control, the engineers decided to construct a 4-mile trench across the neck of Deer Park Bend and thus eliminate that 19-mile loop to the west and north. This cutoff would, by shortening the distance travelled by the river, increase its slope and thus speed up the flow. The resultant increase in flow would remove potential flood waters more rapidly. [R. 479.]

15. This bypass of Deer Park Bend was called the Glasscock Cutoff. It was one of the longest bends bypassed and one of the earliest of the 15 cutoffs constructed. Construction continued from 1933 to 1939 with some additional dredging occurring in 1942. [R. 312.]

16. The original plan of the engineers was to excavate a narrow 4-mile pilot channel across the neck and then permit the natural scouring effect of the river to complete the cutoff by moving through the cut in ever increasing amounts. The pilot channel was dug in early 1933 and had a slight curve in the middle so as to direct the flow into Deadman's Bend on a course approximately south. [R. 117 and Louisiana Exhibit 7-AA.] The direction of this course was about 30° to the west of the direction of the outflow of Deer Park Bend, the latter being in a somewhat southeasterly direction. [R. 117 and 479.]

17. If the cutoff, once fully developed by the river, was to maintain its preplanned course it was essential

that there be uniform caving on both banks of the cut. This did not occur. Instead, the highly resistive clay deposit which the engineers encountered in the middle of the cut caused the flow gradually to take a course somewhat west of south and thus it eroded the less resistant bank on the lower western side. This eventually affected the river in a manner detrimental to Louisiana. [R. 119 and 480-1.]

18. Aside from this unexpected development in the construction of Glasscock Cutoff, there was also a considerable delay in its final completion. This delay was caused mainly by the same clay deposit, which continued to settle back into the cut after excavation. [R. 481 and 773.] For this reason, the cutoff did not carry an annual average of more than 50 percent of the flow until about 1941 [R. 482, 784, Geddes Ex. No. 6]; 8 years after commencement of the construction.

19. Mr. Osanik, the first expert called by Louisiana, spent several days describing in great and illuminating detail the geological history of this area of the Mississippi. His comments on the movements of the river from the first recorded map (1765) until 1933 were agreed to substantially by the other three experts. Basically, the river in Deadman's Bend had moved eastward into Mississippi about 9,000 feet between 1765 and 1933. [R. 290.]

20. Sometime after the year 1900 the bend migrated over the present location of the oil well involved herein. Prior to that time the future well was to the east of the river inside the borders of Mississippi. [Smith Report at 28.] By 1932 the future oil well location was on dry land in Louisiana and about 2,000 feet to the west of the boundary. [R. 450.] However, in 1964

the well was 850 feet east of the thalweg. [Stipulation C.]

21. It was conceded by all the experts that Deadman's Bend would have continued to migrate eastward into Mississippi had it not been for the construction of Glasscock Cutoff. [R. 478.] Hence, but for the construction of the cutoff the well would today be well within Louisiana. Deer Park Bend, which was the larger loop north of Deadman's Bend, had conversely been moving progressively westward into Louisiana prior to the cutoff. [R. 477.] Its elimination by the engineers still leaves Mississippi in possession of the land up to the thalweg in the abandoned bendway.

22. Louisiana bases its theory of avulsion on two principal grounds: (1) the cutoff was slow in development and the major change in the channel in Deadman's Bend did not occur until the flood and high water of 1950-1952. At that time the increased flow through the cutoff rapidly eroded the soft western bank at the foot of the cutoff and shot out into the head of Deadman's Bend on an increased angle to the old flow (Latimer likened it to a water hose being turned on a bank of sand). [R. 489.] It was claimed that a distinctly new channel near the Louisiana side in the upper half of Deadman's Bend was thus suddenly forged; and that it was thus completely removed from the then existing channel on the Mississippi side of the Bend, and that this avulsion was caused solely by the manmade cutoff and so the boundary should be permanently fixed as of its position in 1932; (2) if the change in the channel in Deadman's Bend in 1950-1952 was not an avulsion, it was, nonetheless, a drastic change and was thus part and parcel of Glasscock Cutoff itself and should be treated as such.

23. It is conceded that prior to 1932 the "thalweg" or center of the main channel of navigation in the disputed area was the boundary between the two States, and had been since their admission into the Union; Louisiana in 1812 and Mississippi in 1817.

24. It is also generally conceded that the land under the river on the Mississippi side of the thalweg or boundary belongs to the riparian landowner, the Zuccaro family in this case; that Louisiana owns the riverbed on its side and leased the oil, gas and mineral rights therein to the Carter Oil Company in 1948; that on February 27, 1954, Carter obtained a permit from Louisiana and directionally drilled a well from the Louisiana shore to a point under the riverbed in Deadman's Bend about one mile south of the foot of Glasscock Cutoff; that this well (Louisiana State Well No. 1) became a producer on April 27, 1954; that Carter merged with Humble Oil & Refining Co. in 1959; that Louisiana has received royalties, severance and other taxes on the oil produced up until February 1, 1963; and that the ownership of this oil is what precipitated this action and the prior private suit in District Court.

25. The difficulty in making several of the crucial factual determinations herein stems from the lack of river surveys from 1942 to 1951, and from 1952 to 1964. Hydrographic surveys of the riverbed in the disputed area were made in April 1933, September 1936, September 1937, August 1938, November 1939, August 1940, February 1942 (only a partial survey), March 1951, October 1952, and April 1964. These surveys show the elevation of the riverbed above and below sea level at range lines drawn about 1,000 feet apart. The mean low watermark and the actual watermark at the time of each survey are also shown.

To get the depth of water at any particular point on the 1952 survey, one simply adds 12 feet (the mean low watermark) to the minus figures on the range line or, if the range line has a plus sign, one subtracts such range marking from 12 feet. In either event the net result is the depth of the actual water at that point on the range line at mean low water. [R. 646 and 661.]

26. After a thorough study of the conflicting testimony concerning the events leading up to the changes in the channel in the upper half of Deadman's Bend, including a study of the 1951 and 1952 river surveys and the many engineering surveys relating thereto, I find the following: (a) The cutoff developed slowly after 1933, and yet the 1940 survey (the last full survey prior to 1951) reveals a movement to the west of 400 feet in the thalweg just south of the cutoff. [Louisiana Ex. No. 10.] (b) By 1941 the cutoff was carrying an annual average of over 50 percent of the flow into Deadman's Bend. This percent increased continually thereafter. [Geddes Ex. No. 6 and R. 784.] (c) The dominant flow which the cutoff carried after 1941 was a substantial factor in causing the channel changes evident on the March 1951 survey. (d) During the formation of the channel in Deadman's Bend which shows on the 1951 and 1952 surveys, there was never a time when a visible piece of land in the river was cut off between the two channels. [R. 528.] (e) This change in Deadman's Bend from 1932 to 1952, although artifically caused, was not an unusual change for that river [R. 896] and it cannot be considered as sudden and perceptible in the historic and legal pattern heretofore established.

27. Today, as shown on the 1964 survey [Stipulation C], the deep channel in Deadman's Bend is near

the Louisiana side for about 1½ to 2 miles south of the cutoff. It then crosses to the deep water on the Mississippi side in the area of Black Hills Light, the latter being located approximately 3½ miles south of the cutoff in the bight of the bend.

28. Deadman's Bend as it existed since prior to 1765 has definitely changed. In fact, a slight curve to the west is now evident in the area immediately below the foot of the cutoff, and in all probability a new bend to the west may be formed gradually in future years and extend from the middle of Glasscock Cutoff into Louisiana in the area of Fairview Light. [R. 291 and 815.]

29. The elimination of historical Deadman's Bend has not only caused an erosion into Louisiana and an accretion of alluvium to Mississippi in the first 3 miles below the cutoff, but has also caused a new impingement of the river against the Mississippi bank below Black Hills Light and a corresponding accretion on the western or Louisiana side in that area. [R. 120.]

30. The following findings relate to the location of the thalweg or main navigation channel on April 27, 1954 when the oil well was completed, and the years following. The lack of river surveys after October 1952 requires us to first determine the true thalweg in October 1952 and then establish a constant rate from then until the next survey in 1964 in order to fix the 1954 thalweg.

31. Both sides drew upon copies of the October 2-3, 1952 survey what they believed to be the proper thalweg on that date. [Louisiana and Mississippi Exhibits Nos. 14.] Since there were no periods of unusual high water for several years after 1952—periods wherein pronounced river changes occur—, both sides agreed

that to do other than establish a constant rate of thalweg change for these 11½ years between October 1952 and April 1964 would involve arbitrary determination without guide lines. [R. 855.]

32. The location of the oil well is shown on the 1964 river survey [Stipulation C]. I have taken a copy of the October 1952 survey and placed thereon the following: (a) the well location; (b) the 1952 thalweg proposed by each side; (c) the stipulated 1932 and 1964 thalwegs; and (d) our recommended thalweg for October 3, 1952. [Figure 1 and Special Master Exhibit 1.] By referring to this drawing, it is possible to see the relation of all these items to one another.

33. The experts for both sides substantially agreed on the locations of the thalweg for the years from 1932 to 1940. By studying the surveys [Louisiana Exs. Nos. 1-10] it can be seen that the deep water extended throughout Deadman's Bend from the foot of the cutoff to beyond Black Hills Light in all of these years. [R. 732.]

34. The navigation channel on the Mississippi River requires a minimum depth of 9 feet and a width of 300 feet. Whenever this minimum is in danger (during periods of excessive low water), the U. S. Engineers are responsible for dredging and doing whatever else is felt necessary at the time to guarantee that the specified limits will be maintained. [R. 491 and 730.]

35. The only official record of the extent of the change in the deep channel in Deadman's Bend after 1940 was the March 1951 river survey. [Louisiana and Mississippi Exs. Nos. 12 and 13.] Evidently, in the intervening years from 1940 to 1951 the flow from the cutoff had gradually forced the part of the channel

directly below the cutoff over toward the Louisiana side of Deadman's Bend. The deep water channel below the latitude of the future well location, however, was still near the eastern or Mississippi side as it was on the 1940 survey. In 1940, river traffic had proceeded near the Mississippi side for almost the entire length of Deadman's Bend. In 1951, however, the boats were using the deep water near the Louisiana side, north of the latitude of the future well location. They then gradually crossed to the east of the well location and continued downstream in the deep water near the Mississippi side. In the crossing the water was deeper than the 9-foot minimum and so the boats proceeded with safety. [R. 642 and 864.]

36. The next river survey, October 2-3, 1952, was conducted as an emergency measure to determine if a 9-foot channel still existed throughout the bend. The prolonged highwater occurring from October 1951 until late spring of 1952 had been followed by an unusually low water and it was anticipated that it might go even lower in the coming weeks. [R. 493 and 648.] The October 1952 survey [Louisiana and Mississippi Exs. Nos. 14] showed that there existed a stretch of shallow water in the crossing and that this area would go below 9 feet if mean low water were exceeded. The crossing used at that time, and marked by lights and buoys on the October 1952 survey, was similar to the March 1951 thalweg as described in Finding 35. It was a gradual crossing from deep water to deep water that took the boats east of the future well location. [R. 493 and 747.]

37. The U. S. Engineers, after studying the October 1952 survey, decided they would need to dredge to ensure a 9-foot channel during the ensuing extremely

low water. Rather than dredging in the existing crossing, they decided to dredge the low spots in an area south of the well. The dredging was somewhat west of the longitude of the future well location. However, at the latitude of the well the water was deep enough for the boats to pass either east or west of its future location. The boats then proceeded over the dredged area and continued in water of about a 10-foot depth around the bend and finally crossed over to the deep water on the Mississippi side. This temporary course did not utilize the first mile of deep water on the Mississipi side south of the latitude of the well. However, it was more convenient to dredge in this area and direct the boats below the well near the Louisiana side in the 10-foot water which was present throughout the crossing on that side except for the small area dredged. [R. 493.]

38. The water level rose shortly after October 1952 and by December 1, most of the river traffic had returned to a course similar to the original and deeper course in Deadman's Bend that gradually crossed east of the latitude of the future well location. [R. 494, 495.] (Note: There was conflicting evidence on this point with the experts taking contrary positions. Several navigation bulletins were also introduced which, as interpreted by one side, showed the channel as remaining west of the well after the water level had risen. [R. 676.] The other side showed that these bulletins were not only inconsistent between themselves but inconsistent when compared to later bulletins. [R. 495 and 745.] In any event it is clear that the water at the latitude of the well was of sufficient depth so that boats could safely pass either east or west of the well and still reach the dredged area in crossing.)

39. The thalweg which I have recommended for October 3, 1952 [see Figure 1 and Special Master Exhibit 1] follows a gradual crossing between the two deep water areas similar to that which boats had all been using prior to the temporary change in October and November 1952. The thalweg I have selected is the course which most boats returned to after the emergency passed. It makes an optimum utilization of the deepest water and passes over no areas possessing a depth of less than 9 feet. This thalweg passes the latitude of the future well location 230 feet to the east, leaving the well location inside Louisiana in October 1952. This thalweg is also consistent with the stipulated 1964 thalweg and the gradual westward trend of the thalweg movement after 1952. [R. 118 and 716.]

40. Louisiana placed the thalweg for October 1952 on a crossing similar to mine but almost 500 feet to the east of the well. Mississippi, conversely, placed it 500 feet on the western side of the well. I find neither of these two proposed thalwegs acceptable, particularly in the light of the movement which the thalweg made to the west between October 1952 and April 10, 1964. [R. 788.]

41. The thalweg moved westward after October 3, 1952 at a constant rate. At the latitude of the well it moved 1,080 feet in 11½ years from October 3, 1952 until April 10, 1964, or nearly 94 feet per year. This is approximately 8 feet per month. The time lapse from October 3, 1952 until the completion of the well on April 27, 1954 was 1 year 6 months 24 days. In that time the thalweg or boundary moved about 150 feet closer to the well, but still left the well 80 feet on the

Louisiana side on April 27, 1954. The boundary did not cross over the well until February 27, 1955, and the well became located inside Mississippi on February 28, 1955. The thalweg has moved constantly west since then and on April 10, 1964 it was as shown on Special Master's Exhibit No. 1.

CORPS OF ENGINEERS

U.S ARMY

SURVEY OF 2-3 OCTOBER 1952

SCALE 1:10,000

1000 0 1000 2000 3000

# MISSISSIPPI

BAYOU WASHOUT

U.S LIGHT 336.4

U.S LIGHT 335.5

C.I.P.C

C.I.P.A

C.I.P.B

LOUISIANA THALWEG (1952)

RECOMMENDED THALWEG (1952)

STIPULATED THALWEG (1964)

MISSISSIPPI THALWEG (1952)

OIL WELL

STIPULATED THALWEG (1932)

W.E. 0 10 20 30 GAGE

30 OCT 1952

2 OCT 1952

M.L.W. 12 / M.L.W. 11

M.L.W. 13 / M.L.W. 12

# LOUISIANA

GAGE DATA

| DATE | W.S ELEVATIONS M.G.L. R-338.3 | GAGE |
|---|---|---|
| 10-2-52 | 16.78 | 3.8 |
| 10-3-52 | 16.62 | 3.7 |

HYDROGRAPH NATCHEZ GAGE

SEPT 1952 OCT.

5 17 19 21 23 25 27 29 1 2 3 4 5 6 7 8 9 10 12 14 16

10 / 5 / 0

DATE OF SURVEY

ZERO OF GAGE 17.28 M.G.L

LEGEND

- W.E. TO 0
- 0 TO 10
- 10 TO 20
- 20 TO 30
- 30 AND UP

SPECIAL MASTER

EXHIBIT NO. 1

MISSISSIPPI RIVER

HYDROGRAPHIC SURVEY

## DEADMAN BEND

338.5 TO 334.5 MILES ABOVE HEAD OF PASSES

IN 1 SHEET SHEET 1

SCALE 1:10,000

1000 0 1000 2000 3000 4000 FEET

CORPS OF ENGINEERS, U. S. ARMY, VICKSBURG DISTRICT, 1952

PREPARED UNDER THE DIRECTION OF

LT. COL. GEORGE F. DIXON, JR., DISTRICT ENGINEER

POLYCONIC PROJECTION M.R.C. DATUM. MILEAGE ABOVE HEAD OF PASSES

ELEVATIONS REFERRED TO MEAN SEA LEVEL. CONTOURS ABOVE AND BELOW MEAN LOW WATER

SURVEY BY: INKED BY FILE NO 11-3-57 SM-11

SURVEY OF 2-3 OCTOBER 1952