No. 65, Original

In the
Supreme Court of the United States

OCTOBER TERM, 1975

STATE OF TEXAS, *Plaintiff*

v.

STATE OF NEW MEXICO, *Defendant*
UNITED STATES OF AMERICA, *Intervenor*

REPORT OF SPECIAL MASTER ON OBLIGATION OF NEW MEXICO TO TEXAS UNDER THE PECOS RIVER COMPACT

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INDEX (Continued)

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SUBMISSION OF REPORT

The order appointing the Special Master, 423 U.S. 942, directs him "to submit such reports as he may deem appropriate." This Report covers the Master's rulings on the water delivery obligation of New Mexico to Texas under the Pecos River Compact. A final resolution of this controlling legal issue, before protracted and costly river studies are undertaken, will promote judicial economy by substantial savings in both time and cost. The Master believes that the submission of the Report at this time is appropriate.

SUMMARY STATEMENT

The question is the meaning of the term "1947 condition" as used in the Compact.

Art. III(a) says that New Mexico shall not deplete the state line Pecos flow below that which "will give to

Texas a quantity of water equivalent to that available to Texas under the 1947 condition."

Art. II(g) defines "1947 condition" to mean that situation in the Pecos River Basin as "described and defined in the Report of the Engineering Advisory Committee."

Texas contends that the 1947 condition is immutably defined in a river routing study entitled "Summary of Operations 1947." A copy of that study is attached as Appendix A. The Master rejects the Texas contention. He believes that the word "situation" as used in Art. II(g) refers to a fact, or group of facts, having physical existence. The routing study is an assembly of numbers derived from recreated records to which are applied assumptions and algebraic equations to arrive at figures purportedly showing stream flow at various points and times. The study is artificial and contains errors. It does not define or describe any actuality.

New Mexico asserts that the 1947 condition means the uses which were then made of water in New Mexico. Reliance is placed on the Compact objective stated in Art. I "to protect the development within the States." The Master disagrees. The Compact apportionment is a prohibition against depletion. The New Mexico contention, if carried to its ultimate, would mean that in time of drought New Mexico could use all the water if that were needed to service New Mexico uses. New Mexico supports its position with the Review of Basic Data, "RBD," which was submitted to the Commission which administers the Compact. An RBD table, comparable to the 1947 routing study on which Texas relies, is appended as Appendix B.

An examination of Appendices A and B shows the complexity of the problem. The Compact requires, Art. VI(c), the use of the inflow-outflow method in making required determinations, including state line flow. That method contemplates the establishment of a standard relationship between inflow indices and outflow quantities. An-

nual relationships are compared to the standard to determine departures in deliveries. The engineer advisors to the Compact negotiators presented a document titled "Inflow-Outflow Manual" purportedly containing directions for Compact operation under the inflow-outflow method. The Master held that the Inflow-Outflow Manual had to be modified and corrected. Neither State objected to that conclusion. The result is that a new manual must be prepared and then new routing studies, comparable to Appendices A and B, will have to be made. The directions contained in the new manual will have to reflect the correct definition of the 1947 condition.

The Master defined the 1947 condition thus:

> "The 1947 condition is that situation in the Pecos River Basin which produced in New Mexico the man-made depletions resulting from the stage of development existing at the beginning of the year 1947 and from the augmented Fort Sumner and Carlsbad acreage."

Each State has objected to the Master's definition.

I – INTRODUCTION

In this original jurisdiction suit, Texas sues New Mexico to secure performance of the Pecos River Compact and incidental relief. The right to performance depends upon the Compact obligation of New Mexico. Whatever the obligation may be, determination of compliance requires complex river studies performed under explicit directions. Without an authoritative decision on the obligation, conflicting directions and river studies are to be expected. The time required for their completion is variously estimated at 7 to 24 months, the cost at $70,000 to $200,000. The Master anticipates that these estimates are optimistic. After the validity of a study is determined, the extent and amount of any annual departure from the New Mexico obligation must be determined. The probability

of disputes over highly technical engineering problems, many of which are difficult, if not impossible, of judicial solution, suggests that lengthy hearings will be required.

The United States has been permitted to intervene. 423 U.S. 1085. The Compact, dated December 3, 1948 was ratified by each State and became effective with the consent of Congress. 63 Stat. 159. The Compact is set out as Exhibit "A" to the Texas complaint.

New Mexico denied any breach of the Compact and asserted affirmative defenses which were rejected by the Master in a Report which the Court received and ordered filed. 434 U.S. 809. The October 31, 1977 Pre-Trial Order, ¶ 4(a), (b), and (c), required the Master to first hear and determine three groups of issues: ¶ 4(a), the obligation of New Mexico to Texas under the Compact; ¶ 4(b), the modification or correction of 11 specified items in a river routing study; and ¶ 4(c), the modification or correction of a document entitled "Inflow-Outflow Manual."

This Report covers the ¶ 4(a) issues. On the ¶ 4(b) issues the Master made some rulings and on others held that the record was insufficient to sustain any conclusion. A separate Report will be made on the ¶ 4(b) issues. With regard to the ¶ 4(c) issues, the Master held that a new inflow-outflow manual is needed. Neither State objected to the Master's ¶ 4(c) rulings.

Although the Master believes that the determination of the New Mexico obligation presents a legal question, the factual background of the controversy is helpful to an understanding of the problem.

This Report contains the material presented in pp. 2-56 of the Master's February 2, 1979 Report with the deletion of portions which are irrelevant to the ¶ 4(a) issue. Following that material is the Master's Report covering his rulings on the objections and exceptions of the States to his ruling on the ¶ 4(a) issues.

The Compact was made on the framework of complex engineering reports which are contained in Senate Document 109, 81st Cong. 1st Sess. This report, hereafter S.D. 109, was made to the United States Senate by the Chairman of the Senate Interior and Insular Affairs Committee when the bill for grant of consent was before Congress. The parties have presented a mass of engineering testimony and exhibits. Analysis of the reports in S.D. 109, and of the evidence presented, is peculiarly and characteristically within the field of engineering, not of law. The Master, acting under the authority given him by the order of appointment, has employed and used a technical assistant. The Master relied on the analysis of many hydrologic and engineering problems by the technical assistant in arriving at his conclusions on the ¶ 4(b) and (c) issues. He did not rely on the work of the technical assistant in reaching his conclusions on the legal problem of the determination of the New Mexico obligation.

II – PHYSICAL DESCRIPTION OF PECOS RIVER BASIN

The Pecos River is an interstate stream which rises in north-central New Mexico and flows about 900 miles in a southerly direction through New Mexico and Texas to join the Rio Grande near Langtry, Texas. For most of its course, the stream flows through semi-arid regions where the demand for water exceeds the supply. Upstream depletion must be limited if downstream users are to be assured a fair share of the resource.

A comprehensive description of the physical characteristics of the Pecos River Basin is contained in Stip. Ex. 11(b), pp. 1-24. Precipitation in the valleys averages 11-14 inches annually. The stream flow is extremely variable and "in the absence of flood inflows, the normal base flow is entirely lost and re-established many times in the length of the stream." Id. at 12. Frequent floods occur causing reser-

voir sedimentation and channel deterioration. S.D. 109 at 2. Salt Cedar areas consume unusually large volumes of water. Id. Because of erratic flow, major reservoir development is required and some reservoirs leak badly. Id. at 3. Ground water, both artesian and shallow, is of special significance. Stip. Ex. 11(b), p. 14.

Three divisions of the basin should be noted.

1 — The Upper Reach is that portion of the Pecos River drainage above Alamogordo Dam and Reservoir. Irrigation was practiced in this area by the Indians at the time of the Spanish conquest. S.D. 109, p. 2. Expansion of irrigation in this reach coincided with Spanish colonization. Id. With the exception of the development of the Storrie project about 1918, development in this reach has remained about the same as it was under the early Spanish occupation. Id. An agency of the United States is now constructing in this area the Los Esteros Reservoir for flood control, storage, and recreational purposes.

2 — The Middle Reach is that portion of the drainage between Alamogordo and the New Mexico-Texas state line. The controversy centers around the situation in this reach, which may be divided into subreaches, the most important of which are:

(a) Alamogordo to Acme
(b) Acme to Artesia
(c) Artesia to Carlsbad
(d) Carlsbad to state line (Red Bluff)

3 — The Lower Reach is that portion of the drainage below the New Mexico-Texas state line.

On the following page is a schematic presentation of the Middle Reach showing the relative locations of various points. It is taken from Stip. Ex. 10, Figure 2, p. 11. The second page following presents a Chronology of Development.

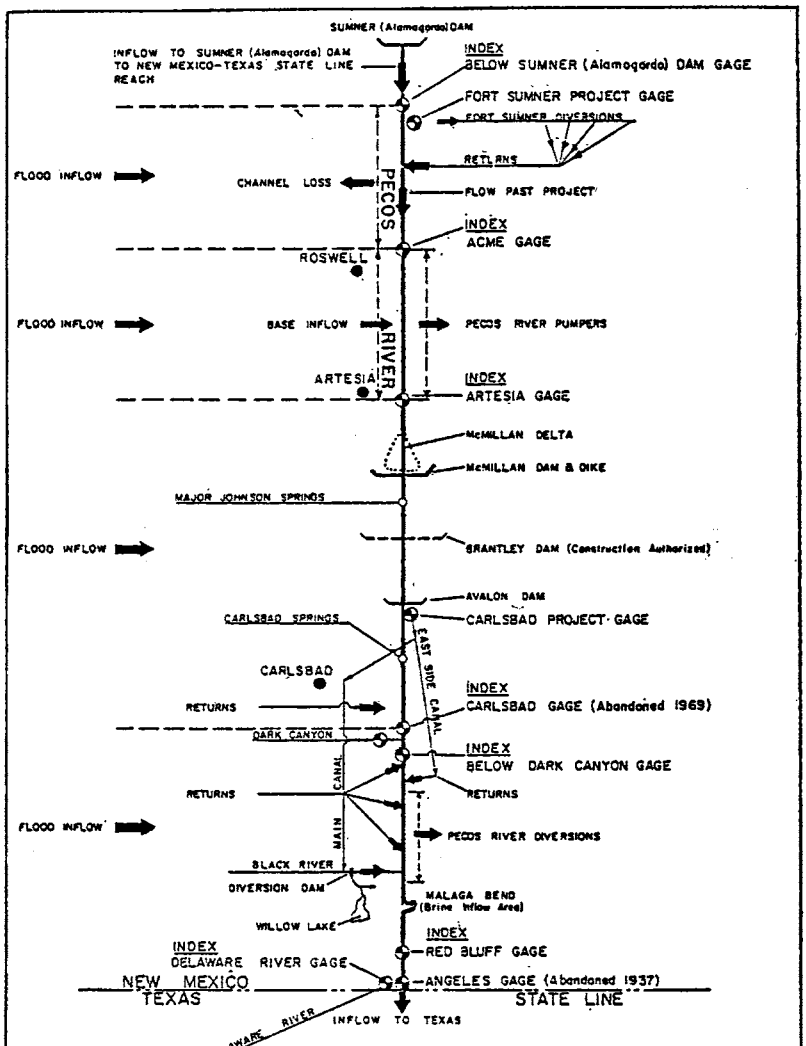

FIGURE 2

Diagram of Sumner (Alamogordo) Dam to New Mexico-Texas State Line Reach

February 1976

CHRONOLOGY OF DEVELOPMENT

1.	1894	McMillan Reservoir completed.
2.	1900-1915	Artesian well development period.
3.	1906	McMillan Reservoir rehabilitated.
4.	1915	First Salt Cedars observed.
5.	1918	Development of Storrie Project.
6.	1921-1923	Hagerman Canal started winter irrigation.
7.	1927	Beginning of shallow pumping.
8.	1931	First New Mexico underground water basin established — required permits.
9.	1935	Alamogordo Agreement.
10.	1935-1938	Rapid development of shallow pumping.
11.	1936	Red Bluff Reservoir completed.
12.	1937	Alamogordo Reservoir completed.
13.	1940-1966	Salt Cedars developed from 2,500 to 21,500 acres.
14.	1941-1942	McMillan Reservoir leakage relationship changed.
15.	1942	Pecos River Joint Investigation.
16.	1948-1953	Kaiser Channel construction.
17.	1951-1952	Fort Sumner rehabilitation.
18.	1967-1969	21,000 acres of Salt Cedar cleared.

The three principal communities in the Middle Reach and their 1970 populations are:

Roswell	—	33,908
Artesia	—	10,315
Carlsbad	—	21,297

The only significant industrial use of water is at a potash plant near Carlsbad.

With relation to irrigation, the engineers in their January 14, 1948 report, S.D. 109, p. 2, said:

> "At the present time up to 210,000 acres of land are irrigated in the basin, of which 156,000 acres are located in New Mexico and up to 54,000 acres in Texas. Of the 156,000 acres in New Mexico, 43,600 acres are irrigated by diversions from the main stream. The remainder is irrigated by ground water or by tributaries. In Texas up to 33,000 acres are irrigated by waters of the main stream."

The principal irrigation developments in the Middle Reach are in the Fort Sumner, Roswell, and Carlsbad areas. S.D. 109, p. 2.

The Fort Sumner project began about 1863 and was rehabilitated by the Bureau of Reclamation in 1906. Id.

Irrigation in the Roswell area by surface diversions began in the period 1889-1904 and was augmented by use of artesian water starting in 1891 and by pumping of shallow water after 1927. Id.

The Carlsbad area irrigation began about simultaneously with that in the Roswell area and was served by the McMillan and Avalon reservoirs which were completed about 1893. Id. at 3. Deterioration of these reservoirs resulted in the construction of Alamogordo reservoir in 1937 and the takeover by the Bureau of Reclamation of the Carlsbad project.

Surface inflow to the Middle Reach is designated as the Alamogordo flow which means the river flow of the Pecos immediately below the Alamogordo Dam. In the evidence reference is sometimes made to the Guadalupe Gage which was submerged by the filling of Alamogordo Reservoir. The name Alamogordo has been changed to Sumner. To avoid confusion the Master has used Alamogordo throughout this Report.

Middle Reach outflow is measured at Red Bluff reservoir located near the state line. It was constructed in 1936 as a Public Works Administration project to store water for use in Texas. Id. at 5. The Delaware River originates in Texas and flows into Red Bluff reservoir above the state line. For operational purposes, the Delaware flow plus the Pecos flow into the reservoir equate to the flow at Red Bluff. At times reference is made to the Angeles Gage which is now submerged by Red Bluff reservoir.

III – THE CONTROVERSY

Interstate controversies over the Pecos have existed for more than 60 years. The desire of Texas for a state line reservoir to regulate water for Texas use resulted in a 1914 report by the United States Reclamation Service. Because of interstate problems, a Compact Commission was created in 1923 by enabling acts of New Mexico and Texas legislatures. In 1925 the Commission signed a Compact which was ratified by Texas. The New Mexico legislature also ratified, but the governor vetoed. Texas then repealed its ratification.

In 1931 the Texas legislature authorized a suit against New Mexico over the division of Pecos River water. The suit was never filed. Problems over the river, involving not only the two States but also the United States, became increasingly acute and culminated in a cooperative investigation under the leadership of the National Resources Planning Board. A report styled "The Pecos River Joint Investigation," PRJI, was presented in October, 1942 and plays an important part in subsequent studies and reviews of Pecos River problems. The report is found in the record as Stip. Ex. 11 (b).

Pursuant to authorizing legislation of each State, the Pecos River Compact Commission was created in 1942. That Commission drafted the Pecos River Compact which

was ratified by the New Mexico legislature on February 9, 1949, Laws of N. Mex. 1949, p. 31, and by the Texas legislature on March 4, 1949, Gen. L. 1949, p. 51. The Congress of the United States gave its consent, as required by the United States Constitution, Art. I, § 10, Cl. 3, on June 9, 1949, 63 Stat. 159.

IV – COMPACT NEGOTIATIONS

A – Preliminary.

The Pecos River Compact Commission held its first meeting on February 9, 1943. The Commission was composed of one voting representative each of the United States, New Mexico and Texas. The minutes of the negotiators are contained in Stip. Ex. 4(a). Unproductive meetings were held for several years. An engineering advisory committee was created under the chairmanship of Royce J. Tipton, the engineering advisor to the federal representative. The engineers prepared a report dated January 14, 1948 which was submitted to the negotiators at meetings held in March and November, 1948, and which was supplemented by a report presented to the December 3, 1948 meeting. Also presented by the engineers to the December meeting was a document styled "Manual of Inflow-Outflow Methods of Measuring Changes in Stream-Flow Depletion."

In its search for a method of apportioning the water of this inconstant stream, the engineers explored many possibilities. They reported, S.D. 109, p. XXXIII, that: "A compact based on an allocation of water on a straight-line percentage basis is not feasible or practical." The report also says, Id. at XXXIV:

> "A compact in any basin, based on irrigated acreage, might be unfair to any or all parties to the compact. Depletion at a given point on a stream is not related in direct proportion to the irrigated area above that point."

The engineers recommended, and the negotiating commission adopted, the inflow-outflow method of apportionment, which is described thus in S.D. 109, p. 149:

> "The inflow-outflow method involves the determination of the correlation between an index of the inflow to a basin as measured at certain gaging stations and the outflow from the basin."

B — Reports of the Engineers.

The engineers recommended apportionment "based upon relations between certain water supply indexes and the state line flows." S.D. 109, p. XXXIV. This is the inflow-outflow method which is discussed in the Inflow-Outflow Manual prepared by the engineers and found in S.D. 109, pp. 145-172. The negotiators adopted the inflow-outflow method of apportionment. See Compact Art. VI(c) and S.D. 109, pp. 124 and 126-127.

The engineers made a comprehensive analysis of the river under various assumed conditions. Their work was summarized in a number of routing studies. A routing study is a mathematical model of the river which numerically presents the flow of the river at given points and times under assumed conditions. The presented flows came in large part from records of the United States Geological Survey, U.S.G.S., and are recreated and used for computations on the basis of assumptions. The routing studies do not reflect actual conditions.

The computations are made under various hydrologic and mathematic procedures. One, known as water budget, analyzes a particular reach of the river between two gaging stations. The upstream station measures the main stream inflow and the downstream station measures the outflow.

The gain to the river from additions less depletions is considered as flood inflow.

Two procedures are often used to establish channel loss. Both depend on a relationship of stream flow at a given point and channel loss downstream from that point. The first procedure requires the drawing of a curve that envelopes most of the data points. Generally, this procedure overestimates the channel loss. The second procedure draws a best fit curve through all data points to establish an average relationship which best represents channel loss over a long period of time.

Another procedure is the scalping of hydrographs. A graph is drawn to show stream flow as a function of time. By use of judgment, a hydrologist separates base flow from flood flow for an upstream and downstream point. The flood flow between the two points is computed by subtracting the flood flow for the downstream point from that determined for the upstream point.

Texas witness Bell read, from a text on Applied Hydrology, a statement that, Tr. 713:

> " * * * the difference between the various routing procedures arises to a considerable extent from minor variations in algebraic manipulation or graphical presentation or from refinements in the basic assumptions. A choice of a procedure depends on many factors, including the nature of available data and personal preference."

The engineers initially prepared and presented to the negotiators six routing studies which appear in S.D. 109 as Table 1 on p. XXVI and Table 2 on p. XXVII. Later the engineers made four additional studies. See table appearing on p. 141 of S.D. 109. The negotiators accepted and acted on the routing study which is entitled "Summary of Operations 1947." This study assumed, S.D. 109, p. XXV, "All conditions as of the present."

The 1947 routing study appears in the record as No. 5, face p. 72, S.D. 109 and as Table 6, Tex. Ex. 2. The importance of this study is such that a copy is attached as Appendix A.

The study is presented as a 43 line, 41 column table containing 1,763 figures, all of which are derived from computations. New Mexico contests the validity of many of the figures. The study does not present any physical state, attribute, or circumstance, e.g., irrigation, domestic application of water, the source of the water diverted, or the consumption of water. The table covers the period 1905-1946 inclusive. The columns begin with "Inflow Guadalupe" as column 1 and end with "Inflow to Red Bluff" as column 41. The intermediate columns cover such items as reservoir storage, release, evaporation, spill, and leakage; irrigation diversions and return flows; artesian flow; depletion by pumps and salt cedars; and flood inflows.

A routing study estimates the availability of water under various assumptions. The water is mathematically passed downstream. Depletions result from such items as reservoir evaporation, channel losses, irrigation diversions and domestic and industrial applications. The study includes both depletions from natural phenomena and from the activities of man but makes no definitive determination between the two. For example, pumping is sometimes included in channel loss. Accretions come from tributary inflow, ground water contributions, and return flow from various applications of water. The routing study can be used to develop an inflow-outflow relationship. The Inflow-Outflow Manual says, S.D. 109, p. 152:

> "The inflow is made up of the routed flow past Alamogordo Dam under the 1947 condition and the estimated flood inflow. The outflow consists of the routed flow past the State line under the

1947 condition and includes the estimated flow of the Delaware River."

Administration under the inflow-outflow method requires accurate inflow indices and outflow quantities. Over 50 percent of the inflow index comes from flood inflows. These are shown in the 1947 routing study, columns 13, 25, and 35. The figures used are all computed. The computations in turn depend on other computations of unmeasured values, e.g. evaporation loss, return flows, and channel losses. The methodology for arriving at some of the figures differs from river section to river section. New Mexico witness Erickson testified without contradiction that the engineers who advised the negotiators threw all errors into flood inflows. Tr. 966. In the circumstances, the 1947 routing study does not provide either a reliable inflow index, or a usable method of arriving at that index.

Another problem arises from the use of flood inflows as a substantial part of the inflow index. The effect of the floods varies in accordance with the point of occurrence. Flood inflow above Alamogordo has less effect on the year's state line outflow than does flood inflow below Carlsbad. The first produces water which may be stored in a reservoir and later put to beneficial use. Also that flood inflow is subject to natural channel losses as the water travels a couple of hundred miles downstream to the state line. The second is not capable of storage and suffers from greatly reduced channel loss. The routing study does not weight the impact of a flood inflow on the basis of point of occurrence.

The outflow determination also poses problems. The table on S.D. 109, p. 155 appears to be taken from column 41 of the 1947 routing study. The trouble with the use of the column 41 figures is that the 1947 routing study does not disclose how the figures there appearing were reached. Superficially it would seem that the column 41 result could

be obtained by either adding, subtracting, or ignoring the figures appearing in columns 2 through 40. Witness Bell for Texas testified that column 41 could not be so derived because the 41-column table does not show changes in reservoir storage. Tr. 747. To ascertain these changes, reference must be made to complicated work sheets.

The problems with the 1947 routing study and the Inflow-Outflow Manual were such that efforts to administer the Compact were stymied at the outset.

Another uncertainty should be mentioned. The engineers said, S.D. 109, p. 10, "The 1947 condition is intended to represent the present situation on the river [with stated reservoir capacities]." The doubt is whether the situation is that existing in 1947 or at the beginning of the year 1947. The 1947 routing study is contained in a January, 1948 engineering report and covers the years 1905-1946. It contains no 1947 figures and probably could not because it is unreasonable to believe that those figures could have been available for inclusion in the complicated study presented. After referring to PRJI, Stip. Ex. 11 (b), the engineers said, S.D. 109, p. 34: "No further development has taken place since 1940." On the record presented, some doubt exists whether the reference is to the Upper Reach, the Middle Reach, or both. No evidence was presented on the development, or any change in development, after 1940. In the circumstances, the engineers' intent must have been to relate the 1947 condition to that existing at the beginning, not the end, of 1947. The condition is that of development, not the water supply then occurring. See S.D. 109, p. 113-114.

C — Proposals and Counter-proposals of the Compact Negotiators.

The minutes of the November 8, 1947 meeting of the compact negotiators contain the following statement of the Texas suggestion for a compact basis. S.D. 109, p. 79:

> "It is recommended that the amount of water to be requested as a basis of a compact with New Mexico be 292,400 acre-feet per annum, as shown by operation Proposed-A, as indicated in the Pecos River Basin Report of January 1948."

The mentioned report contains the following note, following Table 2, S.D. 109, p. XXVII:

> "The values given for condition Proposed-A in table 1 represent the amounts of water that would be received by the State of Texas if that State received all of the benefits resulting from the bypassing of the salt cedar, except those benefits that would automatically be received by the Carlsbad project in the absence of any regulation providing otherwise. The benefits received by the Carlsbad project under this condition as indicated in table 2 would be the elimination of all shortages."

New Mexico countered the Texas suggestion with a proposal, S.D. 109, p. 79, that:

> "The suggestions herein contained are based on the premise that allocations of Pecos River water between the States of New Mexico and Texas will be in perpetuity and that in so doing, the Commission must protect all existing beneficial uses insofar as possible on the basis of conditions as we find them today. By today's conditions, New Mexico does not mean the '1947' condition shown in table I of the engineers' report, inasmuch as it is evident that the 1947 water supply will be decreased, other things being equal, by current depletions in the Roswell ground-water basin, the effect of which will not be reflected in the base flow of the river for years to come. Accordingly, it is suggested that the proper basis for

> allocating the water is to provide for deliveries by New Mexico based upon the available supply in accordance with present-day conditions as above defined, providing that all future changes in flow not caused by changed beneficial use shall be charged or credited to the two States on an equitable basis to be worked out."

The Engineering Advisory Committee was directed to make further studies. Id. at 79-80. It reported, Id. at 80:

> "From the record of the proceedings of the compact commission at its last session, the committee interpreted the New Mexico proposal to mean that New Mexico would agree to a delivery of a sufficient amount of water to result in a safe yield of 165,000 acre-feet from Red Bluff Reservoir subject, however, to any diminution in that supply which might result from increased depletion by the shallow ground water pumping between Roswell and Artesia in New Mexico, and subject further to augmentation by an equitable apportionment of any water that might be salvaged by the bypassing of the salt cedars at the head of Lake McMillan and/or by other means.
>
> The proposal also was interpreted to mean that the deliveries to Texas might be decreased because of additional taking of water by nature, if such taking was not corrected."

The engineers also said, Id. at 82:

> "The studies indicate it would be entirely impossible for the State of New Mexico under present conditions to deliver to the State of Texas an amount of water sufficient to result in a yield from Red Bluff of 198,700 acre-feet which was essentially the Texas proposal. There is not that

> much water in the river under present conditions. That is on account of the changed conditions, because among other things of the area of salt cedars that is taking a large toll of water.
>
> Going to the New Mexico proposal, the committee concluded that if a compact were written around that it would start out by New Mexico supplying Texas sufficient water to provide a safe yield of 165,000 acre-feet under present conditions."

After some discussion, the meeting adjourned and reconvened on November 11. The Texas Commissioner stated, Id. 96:

> "The proposal of * * * New Mexico * * * as a basis for a compact is entirely too vague and indefinite for Texas to consider as a compact basis.
>
> Texas cannot agree to protect the junior rights in New Mexico. Texas is not asking for the same protection in Texas.
>
> New Mexico must be responsible for and assume the burden for the taking of underground water that affects the base flow of the stream in question."

New Mexico asked for a recess. The meeting reconvened on November 13. The New Mexico Commissioner stated, Id. at 97:

> "I do not believe it will be necessary at this time to go back and answer specifically the comments as made by Texas commissioner because I believe they are all answered and embodied in the current New Mexico proposal. There may be some questions as to how the current proposal might work in actual practice. It seems to me that those are matters which can be worked out as

> administrative features of the compact. If the principles set forth are agreeable to both States, those details can be worked out."

The New Mexico proposal contained nine items or principles, of which the following are pertinent, Id. at 97:

> "New Mexico shall agree not to deplete by man's activities, the flow of the Pecos River at the New Mexico-Texas State line below an amount which would give to Texas the quantity of water equivalent of the 1947 condition as reported by the engineering advisory committee in its report of January 1948 and supplements thereto, adopted November 11, 1948, except as modified by paragraph 3 hereof.
>
> Water salvaged by reducing the present-day consumption of water by nature shall be apportioned 38 percent to Texas and 62 percent to New Mexico, the Texas share to be delivered and measured at the New Mexico-Texas State line."

Texas agreed with the principles except for the apportionment of salvage water. Id. at 97-98. The division was changed to 43% for Texas and 57% for New Mexico, Id. at 100, and apparently everyone was satisfied. A drafting committee was created. Id. at 101-102.

The records of the next meeting are not satisfactory. S.D. 109 at p. 105 shows that the meeting was held on December 3. On the next page the date is given as December 4. The compact purports to be signed on December 3. The Commission records contain minutes dated December 4, see Stip. Ex. 4(a), which do not check with the minutes appearing in S.D. 109. The original minutes were probably edited and those contained in S.D. 109 are the results of editing. The record shows no approval of the minutes, either as originally appearing or as edited. With some trepidation, the Master accepts the minutes as appearing in S.D. 109.

The compact draft was reviewed by Mr. Tipton. In explaining Art. II(g), he said, Id. at 113:

> " '1947 condition' relates to a condition on the stream and does not relate to the water supply that occurred in the year 1947 * * * There were certain conditions that existed on the river, such as the diversion requirements of the Carlsbad project, which the engineering advisory committee assumed; the salt cedar consumption; the reservoir capacities that existed in 1947; the operation of the Fort Sumner project up to 6,500 acres; and the operation of all other projects on the stream as they actually existed in 1947. It must be understood that the term '1947 condition' relates to the condition described in the report and does not relate to the water supply that occurred in the year 1947."

With reference to Art. III, the apportionment article, he said, Id. at 115:

> "There are three types of water that are apportioned. One is the water which is equivalent to that which was being received by Texas under the '1947 condition.' And on the other side of the picture, by implication, there is apportioned to New Mexico that which she was using under the '1947 condition' [N.B. the word "using" presents problems. The compact refers to depletions, not uses.] There is apportioned salvaged water and there is apportioned unappropriated floodwater.
>
> * * *
>
> The amount that Texas will receive will vary from year to year in accordance with the inflow to the basin. Another series of years with the same length as the 1905 to 1946 period will occur and it would be only happenstance if the average

> received by Texas will be 250,900 acre-feet. The amount received depends upon the inflow to the basin. What it means is that of a given inflow Texas will receive each year essentially the same proportion which she received under the '1947 condition.'
>
> * * *
>
> The only way that Texas would receive less water than she would be receiving under the '1947 condition' would be by the action of nature, in other words an increase of nonbeneficial consumption by nature with no salvage. That would be something that would be outside of the ability of the State of New Mexico to take care of."

The Compact was a compromise. New Mexico accepted a limitation on its depletions. Art. III(a). Texas agreed that the phrase "activities of man" did not include, Art. II (e), "the diminution of such [Pecos River] flow by encroachment of salt cedars or other like growth, or by deterioration of the channel of the stream." Salvage water and unappropriated flood waters were divided on a percentage basis. Art. III(c), (d), (e) and (f). A difficulty arises over ground water depletions.

V — GROUND WATER DEPLETION

This brings us to the problem of base flow. That term is used indiscriminately by the engineers who advised the negotiators and by the witnesses who have testified. To the Master base flow means that portion of the flow at any given point which arises from natural contributions of water either from surface run-off or ground water accretions to stream flow.

The ground water contribution to base flow has two sources, artesian and shallow. Because of the permeability of some of the separating strata, water disperses both to and from each source. Water from the shallow strata may

enter the stream and some of the stream flow may enter the shallow source. Pumping complicates the problem. Wells in the shallow reduce the contribution of water from the shallow to the stream and possibly to the artesian source. Wells in the artesian may pull water from the shallow. New Mexico selectively measures the quantity of water pumped. Surface flows are measured at selected points. The movement of water to and from shallow and artesian is not capable of measurement.

The engineers reported that before development the artesian contribution to the stream was 325 cubic feet per second (cfs). By 1925 the flow had been depleted to 90 cfs. The engineers believed that statutory and regulatory controls imposed by New Mexico would probably result in restoration of some of the artesian contribution to stream flow. S.D. 109, pp. 3-4.

Shallow pumping has significantly affected the base flow and, according to estimates, has decreased the base flow about 30 cfs since 1927. Both artesian and shallow pumping are now under the control of the New Mexico state engineer. Quoting the USGS the engineers told the negotiators that, Id. at 4:

> "the full effect of the pumping as now controlled will not be felt for many years, and * * * in spite of such control and the probable restoration of some of the flow to the river from the artesian area, there will be an additional depletion of inflow to the river."

The engineers further reported:

1 — The shallow pumping is exceeding the safe yield. Id. at 83.

2 — The shallow pumping depletion has already reached 20,000 acre-feet per year. Id. at 81.

3 — The total area irrigated by the pumped water is 50,000 acres. Id.

4 — If the shallow pumping proceeds at the present rate "ultimately practically all of the accretion to the base flow of the river between Roswell and Artesia will be depleted." Id.

5 — In the future some of the shallow pumping depletion may be curtailed because of (a) economics such as increase in lift and (b) overdraft. Id.

6 — Depletion will be at a slow rate with the ultimate effect in fifty or more years. Id.

Texas argues that New Mexico traded the ground water depletion for water to be salvaged by elimination of the salt cedars. The engineers reported, Id. at 83:

> "The amount of water that it appears can be salvaged by bypassing the present growth of salt cedars at the head of Lake McMillan and by bypassing that reservoir will not be much more than enough to compensate for the loss of base inflow to the river which will result from continuing the present shallow ground-water pumping in the Roswell-Artesia area."

Texas places much stress on a letter from the Acting Secretary of the Interior to the Chairman of the Senate Committee on Interior and Insular Affairs which then had under consideration the bill authorizing congressional consent to the Compact. Among other things the letter said, S.D. 109, XIV-XV:

> "The compact reflects a compromise on some points of difference. On the one hand, New Mexico has agreed to settlement on the basis of '1947 conditions' although the depletion effects of present groundwater pumping in the Roswell area, because of the slow movement of percolating underground waters, will not be reflected in the stream flow until some future date. This is offset by the agreement of Texas that nonbeneficial con-

> sumptive use of water due to non-man-made activities, would not be chargeable against New Mexico in determining her obligation to deliver water at the New Mexico-Texas State line. * * * The non-man-made depletions, to which reference is made, are primarily uses by native vegetation principally salt cedars. The validity of the compact will not be adversely affected, even though the estimate of the quantity of water it may be possible to salvage by constructing a bypass canal around the salt cedar area at the head of McMillan reservoir may not be fully realized."

The suggestion that New Mexico traded whatever rights it may have had to deplete the base flow for the salvage water hopefully to be secured by elimination or reduction of the salt cedar loss is difficult to reconcile with the compact provisions. Art. III(c) reads:

> "The beneficial consumptive use of water salvaged in New Mexico through the construction and operation of a project or projects by the United States or by joint undertakings of Texas and New Mexico, is hereby apportioned forty-three percent (43%) to Texas and fifty-seven percent (57%) to New Mexico."

Art. II (h) reads:

> "The term 'water salvaged' means that quantity of water which may be recovered and made available for beneficial use and which quantity of water under the 1947 condition was non-beneficially consumed by natural processes."

The engineers compared salvage water with base flow in total amounts, but the Compact apportions to New Mexico only 57 percent of the salvage water. Art. III (c). In the light of the discrepancy between the engineers' treatment

of salvage water and the Compact's apportionment, the Master puts little weight on Texas' trade-off argument. Likewise, the Master places little weight on the letter of the Acting Secretary of the Interior expressing his view as an outsider, probably most concerned with the Compact's effect on Bureau of Reclamation projects. Of more significance is the fact that the negotiators rejected the engineers' operation study 1947-A, which considered: "All conditions as of present, except base flow fully depleted." S.D. 109, p. 141. The 1947 routing study, Appendix A, did not consider the base flow fully depleted. Instead it was based on present conditions. The question is the depletion of the base flow at the beginning of 1947.

VI – ADMINISTRATION OF THE COMPACT

Art. V (a) creates the "Pecos River Commission" composed of one representative each of the United States, Texas, and New Mexico, with the representative of the United States having no vote. The potential of a one-man veto of any administrative action is built into the Compact. The summary which follows contains those Commission actions which the Master deems significant to the problems under consideration. The sources used are:

Stip. Ex. 4 (b)	—	Pecos River Commission minutes.
Stip. Ex. 2	—	Minutes, reports and memoranda of Engineering Advisory Committee to the Pecos River Commission.
Stip. Ex. 6	—	Minutes and reports of the Inflow-Outflow subcommittee of the Engineering Advisory Committee to the Pecos River Commission.

Pagination of these exhibits is incomplete, unreliable, and, at times, non-existent.

[N.B. The Master's February 2, 1979 Report summarizes and quotes excerpts from the minutes of 27 Commission meetings held between December 9-10, 1949 and February 20, 1975. Herein, the Master includes references to those meetings which have some possible pertinence to the ¶ 4 (a) issues.]

Second Meeting, December 9-10, 1949.

Proposed program and budget adopted. The program included:

"Determine more accurately the 1947 Condition as defined in the compact" and "Study and investigate the items recommended in the Inflow-Outflow Manual directed toward a more accurate determination of inflow-outflow relationships." A rule was adopted which provides that "The Commissioners of the signatory States must concur in any action taken by the Commission." Certain standing committees, including an Engineering Advisory Committee and a Legal Committee, were created. Royce J. Tipton was employed as an engineering advisor and made chairman of the Engineering Advisory Committee.

Minutes of a January 16-17, 1951 meeting of the engineers, Stip. Ex. 2, note:

> "The fact that the inflow-outflow relationship for the three year period 1946-1948 for the reach of the river, Alamagordo Dam to the New Mexico-Texas state line shown on Plate No. 2, page 154, Senate Document No. 109, falls below the limit of the relationship as defined by previously existing data."

Twenty-second Meeting, July 29, 1957.

Tipton reported that the engineers "could not reach a conclusion [on restudy of the 1947 condition] and needed legal advice. The Legal Committee reported, Stip. Ex. 4 (b), that it

> "is of the opinion that the Commission has the authority to correct any mistakes in the inflow-outflow computations and criteria. The Committee observed, however, that the inflow-outflow curves, graphs and plates in Senate Document 109 * * * are more or less sacred, and suggested that the Commission should be slow to make any changes in the curves, graphs and plates, and then only after careful consideration with clear and convincing evidence to support the changes."

The Commission then adopted a recommendation of the engineers that a special subcommittee be created to restudy under 1947 conditions "the Alamogordo-State line reach." The purpose of the restudy was stated to be "to determine whether the relationship depicted by the curves appearing in pages 153 and 154 of Senate Document 109 * * * should be modified."

Twenty-third Meeting, February 14, 1958.

Tipton reported verbally for the engineers. The minutes show:

> "Mr. Tipton then discussed the subcommittee's report on reconsideration of the relationship between base flow in the Acme-Artesia section of the river and rainfall, to include the recent years of low rainfall in the study. He stated that three factors which affect base flow in this river section are rain, pumping from the shallow ground water basin, and the growth of salt cedars. He reported that the committee felt that each of the three factors could be evaluated, if the Legal Committee feels this procedure proper, and these data used in evaluation of the 1947 condition restudy."

The minutes show no Legal Committee action on the mentioned subject.

Twenty-sixth Meeting, October 27, 1960.

Prior to this meeting the subcommittee had presented its report to the engineers. That report is Stip. Ex. 8 and is entitled "Report on Review of Basic Data to Engineering Advisory Committee Pecos River Commission," hereafter RBD. RBD is of special importance. See particularly minutes of October 27, 1960, January 31, 1961, November 9, 1962, and January 29, 1970 meetings. It is essentially another river operation study using a different period, revised USGS records, different assumptions, and different hydrologic and mathematic procedures than those used in the 1947 routing study. Attached as Appendix B is a copy of the RBD routing study comparable to the 1947 routing study.

Twenty-eighth Meeting, November 9, 1962.

The Commission directed the engineers to proceed with a draft of a new Inflow-Outflow Manual.

Forty-second Meeting, January 28, 1971.

Mr. John Russell reports for the Legal Committee stating that the members have corresponded, and also met, and came to the conclusion that an agreement on a report could not be made, therefore, no report was submitted.

Texas advisors and New Mexico advisors separately report on their inflow-outflow calculations. New Mexico says it has called meetings which Texas has not attended and that it is up to Texas to call the next meeting. Commission gives no further instructions to the engineers.

Forty-sixth Meeting, February 21, 1974.

Texas and New Mexico engineer advisors submit separate reports.

Forty-seventh Meeting, February 20, 1975.

[N.B. The Texas suit against New Mexico was filed in the United States Supreme Court on June 27, 1974.]

New Mexico Commissioner believed that meaningful work could be done by the engineers. The Texas Commissioner disagreed and said "that attempts had been made for several years to resolve differences in the Engineering Advisory Committee and that it had now become obvious it could not be accomplished, and that the only proper tribunal was a court of proper jurisdiction."

The administrative history indicates that the States harmoniously cooperated in Compact administration from the organization of the Pecos River Commission until some time after 1962. The disagreements then surfaced and became increasingly severe.

VII – PERTINENT COMPACT PROVISIONS

A. Purpose of the Compact.

The major purposes of the Compact, as stated in Art. I, include two pertinent objectives:

(1) "to provide for the equitable division and apportionment of the use of the waters of the Pecos River," and (2) "to make secure and protect present development within the States."

The negotiators knew that the dependable supply was insufficient "adequately to serve present development." S.D. 109, p. 2. The problem was, and is, the equitable apportionment of a deficient supply. Just as the benefits of a more than adequate supply must be shared equitably, so also the burdens of an inadequate supply must be borne equitably.

The Art. I provision for security and protection of development applies to each State, not to New Mexico alone.

Because New Mexico is the upstream state, the apportionment must take the form of some inhibition of actions occurring in New Mexico.

B. **Apportionment of Water.**

Four articles of the Compact are pertinent to water apportionment.

Art. III(a) provides that with immaterial exceptions:

> "New Mexico shall not deplete by man's activities the flow of the Pecos River at the New Mexico-Texas state line below an amount which will give to Texas a quantity of water equivalent to that available to Texas under the 1947 condition."

Art. II(e) says that the term "deplete by man's activities" means "to diminish the stream flow of the Pecos River at any given point as the result of beneficial consumptive uses of water within the Pecos River Basin above such point." The same article says that diminution of flow by encroachment of salt cedars or by deterioration of the channel of the stream is excluded from the term.

Art. II(g) says that the term "1947 condition" means "that situation in the Pecos River Basin as described and defined in the Report of the Engineering Advisory Committee." It also provides that questions of fact arising as to such situation shall be determined with reference to and decisions shall be based on such report.

Art. II(f) defines "Report of the Engineering Advisory Committee" to mean the Committee's January, 1948 report with the basic data, processes, and analyses used in preparing that report, all of which were approved and adopted by the negotiating commissioners at their December 3, 1948 meeting and included within the minutes of that meeting.

The term "1947 condition" is said to be the "situation" as "defined and described" in the engineering reports which

are assimilated into the Compact by reference. Neither party makes any point of the validity of such assimilation. The Master notes the confusion in the record with regard to the minutes of the December 3, 1948 meeting of the negotiators. Because neither State makes any point of that confusion, the Master accepts those minutes as they appear in S.D. 109, p. 105, et seq. The complex, complicated and intricate engineering reports with their appendices and supplements must be searched for a definition and description of the "situation" mentioned in Art. II(g).

C. **Provisions for Administration.**

(1) Interstate Agency.

Art. V(a) creates "an interstate administrative agency to be known as the 'Pecos River Commission' " with powers listed in Art. V(d). The agency is composed of one representative of each State and of the United States. The representative of the United States "shall not have the right to vote in any of the deliberations of the Commission."

Commission action requires the approval of the representative of each State. There may be no unilateral action by the representative of one State. The Commission was promptly organized after the 1949 consent of the United States to the Compact and acted with apparent harmony and mutual cooperation through 1962. Thereafter, differences arose to prevent action on the points now in controversy. Diplomatic relations were severed in 1974 when Texas presented its complaint in this case to the Supreme Court of the United States.

(2) Use of Engineering Reports.

Art. VI(a) provides:

> "The Report of the Engineering Advisory Committee, supplemented by additional data hereafter accumulated, shall be used by the Commission in making administrative determinations."

This provision becomes important in considering the RBD approved by the Commission in 1962 for determination of state line departures during the 1950-1961 period.

The use of supplemental data does not permit any change in the obligation imposed on New Mexico by Art. III(a).

(3) Inflow-Outflow Method.

Art. VI(c) provides:

> "Unless and until a more feasible method is devised and adopted by the Commission the inflow-outflow method, as described in the Report of the Engineering Advisory Committee, shall be used [to make specified determinations and measurements]."

The Commission has not adopted any other method. The engineers said, S.D. 109, p. 149:

> "The inflow-outflow method involves the determination of the correlation between an index of the inflow to a basin as measured at certain gaging stations and the outflow from the basin."

The use of this method in the administration of the Compact requires for each year the determination of the relationship of the inflow indices to the state line flow and the comparison of that relationship to an established base. The comparison for each year shows departures, either positive or negative, from the base. The operation of the method requires reliable indices and state line quantities. Successful use of the method demands consistency and uniformity in the procedures applied in arriving at the numbers used in establishing the base and in determining the annual flows. Without such consistency no worthwhile comparison can be made. Much of the difficulty which occurred in the administration of the Compact arose from uncertainty of the procedures employed by the engineering advisors in obtaining and applying the necessary values.

VIII

COMPACT CONSTRUCTION

The Compact is not self executing. It requires continuing administration of an inconstant stream. The hydrology and geology of the Pecos basin is complex and the precipitation falling within the basin has extreme annual variations.

The Compact is neither a law of the Union nor a statute of the United States. See Hinderlider v. La Plata, 304 U.S. 92, 109; and Delaware River Joint Toll Commission v. Colburn, 310 U.S. 419, 427.

From a practical standpoint, an interstate compact imposes a contractual obligation on each of the compacting states. See Dyer v. Sims, 341 U.S. 22, 28. Questions of obligation and breach are for determination by the Supreme Court. Id., and see Kentucky v. Indiana, 281 U.S. 163, 176. Neither State may decide these questions unilaterally. See Hinderlider v. La Plata, 304 U.S. at 110.

Contemporaneous construction by the agency charged with the responsibility of administration is entitled to great weight unless compelling indications of error are present. E.I. Du Pont de Nemours & Co. v. Collins, 432 U.S. 46, 55, and cases there cited. The extension of that rule to this interstate compact is not helpful because there was no contemporaneous construction. Within less than a year after the Compact became effective, the Commission charged by Art. V with the administration of the Compact found itself unable to make the determinations necessary under the Compact provisions. See Stip. Ex. 4(b), Minutes of Meetings of Pecos River Commission dated December 9-10, 1949, and January 16-17, 1950. For at least 12 years, 1950-1961, the States, acting in apparent harmony, were unable to make the stream flow determinations and from them the departures, if any, from Compact requirements. The Compact administrators did not interpret the Compact other than to recognize that something was wrong.

New Mexico relies heavily on Younger v. Tahoe Regional Planning Agency, 9 Cir., 516 F.2d 215. In that case the court upheld a regulation adopted by the administrative agency pursuant to a compact mandate. In the case at bar we have failure to act, rather than action.

The positions of the States will be considered in the light of the background which has been presented.

IX – THE MEANING OF "1947 CONDITION"

A. Provisions of Pre-Trial Order.

Par. 4(a) of the pre-trial order says:

> "Is the 1947 Condition, as that term is used in the Pecos River Compact, an artificial condition defined by the Engineering Reports contained in S.D. 109, or is it a condition or situattion of physical circumstances existing in the river basin in 1947, except for any increases due to development of the Carlsbad Project to 25,055 acres and development of the Fort Sumner Project to 6,500 acres and except for the use of flood water unappropriated in 1947."

B. Texas Position.

(1) Artificiality of Routing Study.

Texas says that the 1947 condition is artificial. Consideration of this contention leads into a maze of semantics. The 1947 routing study is artificial. That study is not, and does not purport to be, based on any physical condition. It is a conglomeration of computed values arising from the application of many hypotheses, some of which are hidden in obscurity. The engineers unequivocally say that they used assumed figures for the irrigated acreage in the Fort Sumner and Carlsbad projects. See S.D. 109, p. 70.

The artificiality of the routing study does not eliminate from the Compact the phrase "1947 condition" as used in Art. III (a) and defined in Art. II (g). The latter Article

says that the "1947 condition" is the "situation" as "described and defined" in the engineering reports. The effect of the Texas position is to insert "artificial" as a modifier of "situation." With full realization that "the objective meaning of a word cannot be considered, ordinarily, separate and apart from the context of its actual subjective use," Northern Natural Gas Company v. Grounds, 10 Cir., 441 F. 2d 704, 712, cert. denied 404 U.S. 951, the Master is convinced that "situation" as used in the Compact refers to tangible reality, not synthetic imagery. The artificiality of the routing study does not change the Compact meaning.

(2) Routing Study Immutable.

Texas contends that the 1947 condition is immutably expressed in the routing study. The Master disagrees. That routing study is no more than a model of how the river would operate under various assumptions. It does not describe or define any situation. The Compact recognizes supplementation "by additional data hereafter accumulated." Art. VI (a). The engineers recognized the need for corrections and refinements. S.D. 109, pp. 150-151. Texas agreed with New Mexico that the RBD be used to determine departures for the 1950-1961 period. A pattern which contains the mistakes and omissions that are found in that routing study is of little if any practical use. The routing study fails to understandably delineate the hydrologic and mathematic procedures used to obtain many of the computed values. Uncertainties as to procedure caused much of the difficulty which the administrators and their engineers had in applying the Compact and the engineering reports.

(3) New Mexico Bound By Routing Study Mistakes.

Texas argues that by its ratification of the Compact New Mexico accepted and agreed to the Appendix A routing study with all of its errors. Again, the Master disagrees.

The Texas argument relates to mistakes of fact and for support relies on the decision in Rhode Island v. Massa-

chusetts, 45 U.S. 591, and Virginia v. Tennessee, 148 U.S. 503. Each was a boundary case in which, by agreement, commissioners had run a line which had long been accepted. The Court rejected the claim of mistake. In the Rhode Island case the Court, 45 U.S. at 635, said:

> "It may be a matter of doubt, whether a mistake of recent occurrence, committed by so high an agency in so responsible a duty, could be corrected by a court of chancery. Except on the clearest proof of the mistake, it is certain there could be no relief. No treaty has been held void, on the ground of misapprehension of the facts, by either or both of the parties."

See also Virginia v. Tennessee, 148 U.S. at 527.

It is undisputed that the engineering reports to the negotiators contained mistakes, inconsistencies, and omissions which were promptly recognized by the agency charged with the administration of the Compact. Neither State acquiesced in the errors. Instead the States, acting in apparent cooperation, struggled for at least 12 years to make the Compact workable. They failed, and controversy replaced harmony. Even now, after many years of controversy, the States each say that the Compact contains no vitiating infirmity. See Hinderlider v. La Plata, 304 U.S. 92, 108-109. Each State asserts that if the "conceptual" differences over Compact meaning are resolved, the Compact can be made workable.

The most troublesome errors do not arise out of the particular numbers used in the routing study but out of uncertainties and inconsistencies in the procedures used to obtain those numbers. These uncertainties and inconsistencies come to light only after careful analyses of the complex and intricate engineering reports. The engineers recognized the need for further study and continuing refinement. See e.g. S.D. 109, pp. 150-151. The Compact recognizes the pos-

sibility of supplementation "by additional data hereafter accumulated." See Art. VI (a). The Master concludes that neither State is bound by the mistakes, uncertainties, and omissions in the reports made by the engineers to the negotiators.

One other matter should be mentioned in passing. The Compact requires the administrative agency to use the inflow-outflow method in making various determinations unless the agency adopts a different method. Art. VI (c). The agency has adopted no other method. For the method to function, some means or procedure must be available for comparing an annual relationship against a known base. If the comparison shows a negative departure, the problem is whether that departure results from man's activities. If the base contains errors which affect the departure, the question is whether the departure is the result of an error in the base or of man's activities. Although man's activities are not of present concern, the Master believes that acceptance of an error does not convert that error into an activity of man.

C. **New Mexico Position.**

(1) Compact Protects New Mexico Uses

New Mexico views the Compact as protecting the New Mexico uses existing when the Compact was made. The Master disagrees.

Art. I expresses a general objective to "secure and protect present development." The provision applies to each State. The negotiators knew that the water supply was inadequate "to serve present development." S.D. 109, p. 2. Protection for Texas, the downstream State, can come only from some restriction on New Mexico, the upstreem State. The apportionment was made by the Art. IIIa) limitation on depletion by New Mexico.

Use by beneficial consumption does not equate with depletion. If use were to be the criterion, the limitation on

New Mexico could have been expressed in terms of irrigated acreage. It was not. The engineers told the negotiators that use of irrigated acreage might be unfair and pointed out that "[d]epletion at a given point on a stream is not related in direct proportion to the irrigated area above that point." S.D. 109, at XXXIV. Consumption may depend on irrigation and cropping practices. All water diverted is not consumed. Some gets back to the stream as return flow.

Acceptance of the New Mexico position protects New Mexico rights but destroys Texas rights. If all New Mexico uses are protected, all of the inadequate supply of the inconstant stream in times of drought could be consumed in New Mexico in complete disregard of Texas rights. Texas is entitled to its equitable share. It does not have to bear all the burden, nor is New Mexico entitled to all the benefit.

One ancillary matter must be mentioned. Texas presented much evidence on depletions resulting from the pumping of ground water in New Mexico. The Master deems evidence of depletions after January 1, 1947 to be of no pertinence to the determination of the 1947 condition. This evidence may be pertinent in consideration of whether New Mexico has impermissibly increased stream depletions by the activities of man. The Master is now concerned with determination of the 1947 condition, not with the question of whether man's actions have depleted the stream flow.

During Compact discussions much was said about pumping in New Mexico. Various statements related to the extent of depletion by pumping. See, e.g., S.D. 109, pp. 55, 81-83 and 141. By prohibiting New Mexico from increasing depletions beyond a certain point, Art. III (a) impliedly recognizes the depletions below that point resulting from pumping.

The 1947 routing study has only one column, No. 14, which relates to pumps. Texas says that the reference is to river pumping rather than to subsurface pumping. Tr. 2954-2955. If this is true the Appendix A routing study does not identify any pumping of ground water. That column, which appears in the treatment of the Artesia-McMillan reach, is headed "Depletion by Pumps" and contains the same figure, 8.8 thousand acre-feet for each year of the entire 1905-1946 period. The idea that the same amount of depletion occurred in each of the 42 years is unreasonable. In the reach McMillan to Red Bluff, pumping occurs but is identified in no column. The pumping statistics are hidden in some other columns, probably those identified as spring inflow and channel loss. It is impossible to determine from either routing study the total depletion from pumping at any given time.

(2) Texas May Not Repudiate Review of Basic Data.

New Mexico also asserts that the RBD was adopted by the Pecos River Commission for administrative purposes and that Texas may not unilaterally repudiate the RBD. It is undisputed that the RBD makes changes in the routing study. Compare Appendix A with Appendix B.

As has been noted, the administering commission was unable to determine departures from the material contained in the Compact and in the various engineering reports. After about 12 years of work the engineers produced the RBD. See Stip. Exs. 5 and 8. Appendix B is essentially a new routing study proposed to replace that appearing as Appendix A. In many instances the RBD uses different records, assumptions, and procedures.

The Pecos River Commission accepted and adopted the RBD for the determination of state line departures during the period 1950-1961. See Stip. Ex. 4(b), Minutes of Meetings of Pecos River Commission held on January 3, 1961 and November 9, 1962. The Commission did not

adopt the RBD for the determination of departures after 1961. Instead it directed the engineers to continue with preparation of a revised Inflow-Outflow Manual. Id., and see minutes of many meetings after 1962. The engineers did not complete this task. No good purpose would be served by any attempt to fix the blame for the failure.

Texas says that the RBD is an impermissible change or amendment of the Art. III(a) obligation. The Master does not agree. The RBD recognizes, rather than detracts from, the obligation. It endeavors to supply a workable means of determining whether there has been a departure from the required deliveries to Texas.

New Mexico says that Texas may not unilaterally reject the RBD. See Hinderlider v. La Plata, 304 U.S. 92, 110. Again, the Master does not agree. We have not reached the point in the case where the effect of the Texas approval of the RBD for the determination of 1950-1961 departures is significant. The immediate concern is with the New Mexico obligation.

X — CONCLUSIONS OF SPECIAL MASTER ON 1947 CONDITION

(1) The 1947 condition is that situation in the Pecos River Basin which produced in New Mexico the man-made depletions resulting from the stage of development existing at the beginning of the year 1947 and from the augmented Fort Sumner and Carlsbad acreage.

(2) Determination of a change in that situation is to be made by the inflow-outflow method.

(3) Neither the 1947 routing study, nor any other portion of the various engineering reports, appendices, and supplements, supplies adequate information or direction to permit the use of the inflow-outflow method in determination of stream depletion by New Mexico.

XI – OBJECTIONS OF TEXAS TO MASTER'S RULING ON NEW MEXICO OBLIGATION

Texas objects to the Master's conclusion that the 1947 condition "is something other than the condition defined by the Report of the Engineering Advisory Committee contained in S.D. 109." The definition is said to be contained in the Appendix A 1947 routing study. That study is no more than a compilation of numbers which are derived from computations based on assumptions and which purport to show quantities appearing at various points and times. It does not describe or define anything having actual existence at any time. The Master believes that the word "situation" as used in Art. II(g) refers to reality, not to a contrived barrage of numbers. The failure of the routing study as a definition or description is emphasized by the 30 years of controversy which have produced no more than this litigation.

Texas specifically asks that the Master's definition of the 1947 condition be amplified by the addition to the definition of the phrase underlined below:

> "The 1947 Condition is that situation in the Pecos River Basin which produced in New Mexico the man-made depletions resulting from the stage of development existing at the beginning of the year 1947 and from the augmented Fort Sumner and Carlsbad acreage, *with the groundwater contribution to the Pecos River depleted to the extent existing at the beginning of 1947.*"

The Compact says nothing about contributions to the stream from any source. It prohibits increased depletions but does not require contributions. The determining factor is the quantity of the flow at the state line. The source of the flow is immaterial.

Other objections and contentions of Texas have been noted but merit no discussion beyond that contained in the

Master's February 2 Report. The Master overrules all Texas objections to his rulings on the ¶ 4(a) issue.

XII – OBJECTIONS OF NEW MEXICO TO MASTER'S RULING ON THE NEW MEXICO OBLIGATION

New Mexico contends that the 1947 condition stage of development is that existing at the end of 1947, not the beginning of 1947, as held by the Master. By way of support it offered the testimony of witness Erickson in question and answer form. See Tr. 3008-3014. The Master rejected the offer. Acceptance of the offered testimony would not change the Master's conclusion. The engineers presented to the negotiators ten routing studies which are reproduced in S.D. 109 opposite face pp. 72 and 144. Each of those studies ends with the year 1946. The negotiators accepted the study entitled "Summary of Operations 1947." That study ends with 1946. Loose references cannot take the place of the studies. The Master finds nothing in the record which justifies any date other than the beginning of the year 1947.

New Mexico construes the Master's definition as entitling it "to continue the diversions and uses and the depletions associated with the diversions and uses being made with the stage of development and the works existing under the 1947 condition." N.Mex. Objections, p. 4. Diversions, uses, and depletions are three different things. A diversion is the taking of water from a source. A use is the application of the water for a particular purpose. A depletion is the withdrawal of water at a faster rate than it is being replenished. See Clark, Waters and Water Rights, Vol. 7, pp. 283, 285, and 321. The Art. III(a) obligation on New Mexico is "shall not deplete." The New Mexico diversions and uses, taken as a whole, may not deplete the state line flow below what it was at the beginning of 1947. The Master must take the Compact as written, ratified by the States, and consented to by Congress.

New Mexico objects to the Master's conclusion that the actions of the Commission "between 1950 and 1961 do not constitute a construction of the Compact within the decision in E.I. Du Pont de Nemours & Co. v. Collins, 432 U.S. 46, and similar cases." N.Mex. Objections pp. 8-9. New Mexico argues that inaction is significant under Federal Trade Commission v. Bunte, 312 U.S. 349, 352. See Tr. 2961-2962. That case had to do with failure to exercise power. In the instant case action to determine state line flows occurred from 1949 to 1961 but failed to produce a result. Twelve years of action without a result is not contemporaneous construction which aids in the construction of a legal obligation. The most that can be said is that during the period the Commission recognized that something was wrong. After 1961-1962 the Commission continued to struggle with the inflow-outflow method and never reached a conclusion.

Other objections of New Mexico have been noted but justify no discussion beyond that contained in the Master's Report of February 2. The Master overrules all New Mexico objections to his rulings on the ¶ 4(a) issue.

XIII – GROUND WATER

Although hidden in a mass of semantics and mathematics, the heart of this controversy is the pumping of ground water in New Mexico. Texas says that pumping reduces the base flow. New Mexico says that it may continue the pumping practices of 1947.

The Compact says nothing about base flow. The efforts of the Master to obtain agreement on the meaning of that term failed completely. See Tr. 2936-2944 and 2980-2981. The Compact reference is "the flow of the Pecos River at the New Mexico-Texas State line." That flow may come from base flow, flood inflow, or some other sources.

The New Mexico position is no more than a reiteration of the "use" theory which the Master has consistently rejected.

The pumping, whatever it may be and whatever may be its effect, has no bearing on the meaning of the 1947 condition. The engineers hid the extent and effect of pumping in the confusion of numbers appearing in the 1947 routing studies and RBD. Perhaps that is the reason that administration of the Compact has failed. Pumping may be of importance in a determination of whether negative departures from the required state line flows result from man's activities.

The Master notes the contentions of the parties with regard to ground water, and rejects them as having no bearing on the meaning of the term "1947 condition."

XIV – OTHER MATTERS

The Master doubts whether the Compact will ever be workable because it permits a one-state veto of any proposed Commission action. The requirement of the use of the inflow-outflow method presents complications. The application of that method in the operation of the Compact requires the exercise of engineering judgment and skill. As recognized by Texas witness Bell, Tr. 713:

> "A choice of procedure depends on many factors, including the nature of available data and personal preference."

The States cannot agree on the basic data. The selection and acceptance of the facts necessary to a determination of the basic data present engineering problems on which many good-faith differences of opinion may arise. Without determination of the basic data no new routing study may be made. When and if a determination of the basic data is made, the use of that data requires assumptions and appli-

cation of diverse hydrologic procedures. Again, good-faith differences may arise. The Compact provides no means of resolving these differences. They present no legal problems and, at the most, require arbitration.

The Master directed the States to give their positions on whether the Compact contained any vitiating infirmity. See Hinderlider v. La Plata, 304 U.S. 92, 108.

At the July, 1979 hearing, attorney Caroom, representing Texas, said, Tr. 3247, that the Texas position was that "there is no vitiating infirmity in the Compact." He went on to say, Id., that:

> "On the off chance it were totally impossible to develop a routing study or to determine departures or ascertain whether or not they were due to man's activities, if this later in the proceeding turned out to be totally impossible, that would be a vitiating infirmity, but we frankly do not anticipate that to be the case."

New Mexico recognized that the point is arguable, Tr. 3250-3254, and said that it could not take a definite position without consultation with the New Mexico Interstate Streams Commission. Tr. 3254.

The Master also requested that the States give their views on whether Supreme Court review should be sought of the Master's ruling on the ¶ 4 issues. In its Objections and Exceptions to the Master's February 2 Report, p. 8, Texas said:

> "We would suggest that the report be written in a form which would not encourage review by the United States Supreme Court at this time."

At the July hearing, Texas opposed such review because of the delay which would ensue. Tr. 3247-3248.

In its objections to the Master's February Report, New Mexico said, p. 20:

> "under Supreme Court practice the Master's findings and conclusions respecting the first segment of the trial would not be reviewable unless the Master were to recommend dismissal or other final disposition of the action.

At the July hearing New Mexico raised questions as to the power of the Master to certify a question to the Supreme Court for review and the desirability of such certification. Tr. 3255. New Mexico says that there is no clear controlling question of law, but rather mixed questions of law and fact.

The Master believes that determination of the obligation of New Mexico under the Compact presents a clear and controlling issue of law. Although Texas relies on the 1947 routing study and New Mexico contests its validity, the existence of the study is admitted as is also its presentation to the Compact negotiators, and their use of it. The existence of the routing study does not raise a question of fact. The validity of a routing study depends on the directions which govern its making. The directions for the 1947 routing study were ostensibly given in the Inflow-Outflow Manual. The Master held, and the States have agreed, that the manual must be modified and corrected. Whatever may be the ultimate decision on the New Mexico Art. III(a) obligation, a new manual and a new routing study will have to be prepared.

The States are not in agreement on the procedure to be followed in the preparation of a new manual and routing study. See the exchange of correspondence which is in the record as Master's Exhibits 2-9. The complexity of the problem is analyzed by the Master's technical assistant in an April 23, 1979 letter which has been received in evidence as Master's Exhibit No. 1. He lists eight items of basic data which will be needed and seven determinations which must be made from the basic data. All of these items

and determinations present technical difficulties. He then gives three possibilities for future proceedings and estimates the required time at about 9 to 18 months and the cost at $70,000 to $200,000. The time estimates do not include consideration and resolution of potential controversies.

The intransigent attitude of each State over the many years of this controversy suggests the probability that little agreement may be expected in the preparation of a new manual and routing study. The differences will probably relate to technical hydrologic and engineering matters, susceptible of arbitration but presenting no legal or equitable issues. Because of his lack of training and knowledge in these specialized fields, the Master will have to rely heavily on his technical assistant.

XV – RECOMMENDATION OF SPECIAL MASTER

The Master recommends that the Supreme Court consider and approve his ruling on the "1947 condition" as that term appears in Arts. II(g) and III(a) of the Compact.

DATED at Denver, Colorado, August 13, 1979.

Jean S. Breitenstein
Special Master

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SUPPLEMENTAL REPORT OF SPECIAL MASTER

INTRODUCTION

Texas and New Mexico have each filed objections to the Master's August 13 Report. The Master overrules all objections.

A – OBJECTIONS OF TEXAS

Texas reasserts its position that the 1947 condition is presented in the engineering reports contained in S.D. 109. The Master stands by his conclusion that those reports do not define or describe any physical situation and do not meet the Art. II(g) definition of the 1947 condition. The 30 years of controversy over the operation of the Compact demonstrate the weakness of the Texas position that the 1947 condition is immutably expressed in the 1947 routing study. The Compact commissioners and their engineer advisors tried to apply that study and could not make the Compact work. The logical conclusion from the Texas position is that the Compact is not capable of performance. The Master has attempted to avoid this result by stating a definition of the 1947 condition which comports with the Compact and which may result in its effective administration. Texas concedes that the Inflow-Outflow Manual must be changed. Any change in that Manual requires a change in the routing study.

B – NEW MEXICO OBJECTIONS

New Mexico objects to the Master's conclusion that the actions of the Pecos River Commission do not constitute a construction of the Compact within the meaning of the decision of E. I. Du Pont de Nemours & Co. v. Collins, 432 U.S. 46, and similar cases. The Master adheres to his ruling. He finds nothing in Power Reactor Co. v. Electricians, 367 U.S. 396, or in Udall v. Tallman, 380 U.S. 1, which causes him to change his mind.

New Mexico attacks the Master's conclusion that the 1947 condition is that existing at the beginning, rather

than the end, of 1947. The problem arises from the lack of specificity in the negotiation and writing of the Compact. None of the river routing studies presented to the Compact negotiators covered 1947 data. The use of some 1947 data in the Inflow-Outflow Manual is immaterial. The Manual is not part of the Compact and the States agree that it must be modified and corrected. Further, the Manual is suspect because it was not completed until sometime in January, 1949 and was not submitted to the negotiators until a January 21, 1949 meeting, more than six weeks after the Compact was signed. Tr. pp. 597-599 and 1361. The record contains no minutes of a January 21, 1949 meeting. The Master adheres to his ruling.

The third objection of New Mexico is that the Master in his definition of the 1947 condition did not include the ground water uses developed before 1947. This is a reargument, in new form, of the New Mexico use theory. The Compact does not talk about ground water. It places a limit on New Mexico depletions. New Mexico seeks the right to deplete the ground water to the full extent needed to satisfy all 1947 uses. The Compact negotiators rejected the engineers' routing study 1947-A, which was predicated on "base flow fully depleted," see item 8 in table appearing on p. 95, S.D. 109. Instead, they acted on the 1947 routing study, Appendix A. The Master again rejects the New Mexico use theory.

In its Memorandum supporting its objections, New Mexico discusses the water salvage problem. Water salvage has nothing to do with the 1947 condition.

New Mexico refers to Compact Art. IX which provides:

> "In maintaining the flows at the New Mexico-Texas state line required by this Compact, New Mexico shall in all instances apply the principle of prior appropriation within New Mexico."

The contention is that the impact of the Master's definition of the 1947 condition and of the quoted Compact provision will reduce the irrigated acreage in New Mexico. The record contains no evidence one way or the other on this point. As pointed out in the Master's Report, the States rejected irrigated acreage as a method of apportionment.

New Mexico calls attention to the first sentence on p. 13, reading: "The gain to the river from additions less depletions is considered as flood inflow." New Mexico would have the word "less" changed to "plus." The sentence relates to the determination of flood inflows by the water budget method and is perhaps too general. In his December, 1978 report to the Master, p. 43, the technical assistant, in describing the problem of determining flood inflows by the water budget method, lists 5 plus items and 3 minus items. The method described by the technical assistant can result in negative flood inflows, which do not occur in nature. Tr. 720. To avoid this result, a negative figure is often treated as a zero, Tr. 722, causing a distortion of the balance. The Master's reference to the water budget method was explanatory only, and its use will depend upon the receipt of further evidence.

New Mexico also questions the sentence on p.15 reading: "The routing study does not weight the impact of a flood inflow on the basis of point of occurrence." The routing study gives some weight to the point of occurrence by its columns 13, 25 and 35 entitled "flood inflow." The routing study was used in the preparation of the second table appearing on p. 155, S.D. 109, and that table in turn was used in the preparation of plate 2 appearing on p. 154, S.D. 109. In that table, and in the plate prepared from it, the points of occurrence of flood inflow are not weighted.

All objections of both Texas and New Mexico are overruled. The Master adheres to the recommendation made in his August 13 Report.

Dated at Denver, Colorado, September 7, 1979.

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Special Master

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Source: S.D. 109, No. 5, face p. 72; also
Tex. Ex. 2, Table 6.

SUMMARY OF OPERATIONS 1947

UNIT - 1000 ACRE FEET 1947

Year	ALAMOGORDO RESERVOIR				STORAGE		CHANNEL GAINS AND LOSSES										McMILLAN RESERVOIR					STORAGE		CHANNEL		AVALON RESERVOIR						CHANNEL GAINS AND LOSSES										
	Inflow Guad.	Irrig. Release	Evap. Loss	Spills	Max.	Min.	FT. SUMNER Div.	FT. SUMNER Return Flow	Vol Past Diversion	Channel Loss	Acme Flow	Artesian Inflow	Flood Inflow to Guad-Artesia	Depletion by Pumps	Artesia Flow	Depletion by Salt Cedars	Inflow to McMillan	Irrig Realease	Evap. Loss	Leakage from Res.	Spills	Max.	Min.	Major Johnson Springs	Flood Inflow	Inflow to Avalon	Irrig Release	Evap. Loss	Seepage from Res.	Spills	Shortages	Seepage from Main Canal	Carlsbad Springs	Flow at Carlsbad	Flood Inflow	Spring Inflow	Return Flow	Potash Plant Use	Irrig. Depletion	Channel Loss	Inflow to Red Bluff
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
1905	224.6	17.8	19.2	187.0	132.0	132.0	17.7	5.6	192.6	28.4	164.2	61.6	392.7	8.8	609.9	56.7	553.2	0	21.1	197.2	334.9	38.6	21.0	215.2	145.7	695.8	114.6	3.6	57.6	520.0	0	10.1	70.8	600.9	8.0	2.0	53.8	4.3	6.6	48.9	604.9
1906	223.6	18.8	24.0	180.8	132.0	132.0	18.9	5.9	188.7	28.0	158.7	66.0	8.8	8.8	224.7	52.5	172.2	23.6	19.1	134.4	17.7	38.6	0	152.4	25.5	219.2	125.5	3.8	31.5	58.4	0	11.1	47.0	116.5	7.6	2.0	59.0	4.3	6.6	14.3	157.9
1907	178.5	78.3	21.2	84.6	132.0	100.2	18.3	5.8	150.4	23.5	126.9	64.5	20.5	8.8	203.2	59.8	143.4	5.0	18.5	131.7	0	17.5	3.2	149.7	38.6	213.3	129.5	4.6	43.0	36.2	0	11.4	56.2	103.8	23.2	2.0	59.7	4.3	6.6	14.7	184.2
1908	139.2	71.4	23.7	38.5	122.0	87.2	21.4	6.9	95.4	20.1	75.3	61.8	68.0	8.8	196.3	49.9	146.4	5.2	15.3	118.1	0	21.2	0	136.1	51.7	193.0	129.3	4.3	34.0	24.2	0	11.4	48.4	85.0	70.3	2.0	59.7	4.3	6.6	12.9	194.2
1909	122.1	171.9	18.1	12.1	132.0	48.8	28.9	9.1	164.2	23.0	141.2	55.4	3.1	8.8	191.9	51.2	140.7	55.6	13.6	79.3	0	20.0	0	95.3	26.5	178.4	137.2	3.5	22.4	15.3	0	12.1	35.6	62.9	35.9	2.0	64.4	4.3	6.6	10.0	124.3
1910	130.8	149.8	6.0	0	69.1	3.0	28.2	9.1	130.7	20.9	109.8	50.5	31.1	8.8	182.6	48.6	134.0	113.8	1.1	19.7	0	4.1	0	37.7	3.3	154.8	142.4	4.4	28.5	7.3	27.8	10.2	41.7	59.2	56.5	2.0	53.8	4.3	6.6	9.9	150.7
1911	181.9	141.2	7.2	0	61.8	3.0	25.6	8.1	128.7	19.4	109.3	49.5	53.5	8.8	203.5	53.8	149.7	63.8	6.9	75.6	0	18.5	0	93.6	38.2	189.6	125.0	2.9	26.1	37.0	1.4	11.0	39.3	87.3	21.3	2.0	58.0	4.3	6.6	13.0	144.7
1912	141.2	176.6	7.5	0	62.9	3.0	26.9	8.7	158.3	23.7	134.6	52.9	17.2	8.8	195.9	55.6	139.3	68.0	8.7	85.5	0	6.8	0	82.8	31.6	152.8	131.6	2.6	16.0	9.4	6.8	10.8	27.2	47.4	69.8	2.0	58.5	4.3	6.6	8.3	158.4
1913	136.4	109.7	5.7	0	67.3	3.0	22.0	7.0	94.6	17.3	77.3	54.6	47.0	8.8	170.1	47.1	123.0	46.0	8.4	67.3	0	10.6	0	85.3	99.2	230.5	127.5	3.2	25.0	84.0	9.2	10.4	38.5	132.9	53.6	2.0	55.6	4.3	6.6	18.1	215.1
1914	289.5	79.8	15.8	114.5	132.0	3.0	23.3	7.5	169.5	22.6	146.9	57.5	46.5	8.8	242.1	54.6	187.5	30.0	16.1	127.3	0	34.4	.1	145.3	24.7	200.0	124.0	3.7	24.7	47.9	.3	10.9	37.9	95.7	95.1	2.0	53.2	4.3	6.6	14.1	227.0
1915	265.1	22.3	20.2	246.6	132.0	132.0	22.4	7.1	253.7	31.4	222.3	60.9	147.9	8.8	423.3	67.3	356.0	17.0	23.3	156.0	164.3	38.6	8.6	174.0	18.7	374.0	127.3	4.5	46.1	195.1	0	11.3	59.3	265.7	143.1	2.0	59.8	4.3	6.6	29.2	431.5
1916	207.8	28.1	29.2	150.5	132.0	130.3	28.1	9.0	159.5	25.9	132.6	61.8	50.8	8.8	235.4	44.0	192.4	0	17.2	161.5	0	38.0	7.0	179.8	201.3	381.1	120.0	4.7	28.0	203.4	0	10.6	61.2	220.2	2.2	2.0	56.4	4.3	6.6	30.1	299.8
1917	87.2	179.9	17.1	6.0	132.0	4.2	25.0	8.0	169.0	26.4	142.6	58.2	30.9	8.8	222.9	68.9	154.0	82.4	13.5	82.3	0	22.5	0	100.5	15.4	198.3	143.1	4.8	27.6	22.8	0	12.5	40.8	78.1	14.1	2.0	67.2	4.3	6.6	11.6	136.9
1918	86.3	82.0	1.7	0	28.8	3.0	27.3	8.7	83.4	19.7	43.7	52.4	62.0	8.8	149.3	37.0	112.3	44.3	5.1	61.9	0	10.5	0	79.9	0	124.2	137.8	2.1	22.9	15.5	54.1	7.3	36.1	55.9	18.3	2.0	39.4	4.3	6.6	9.0	93.7
1919	465.5	12.0	18.6	331.7	132.0	37.7	12.0	3.9	395.6	34.0	301.6	52.5	250.4	8.8	595.7	63.2	532.5	5.0	28.0	176.0	293.7	38.6	1.2	193.0	195.3	687.0	124.8	4.8	48.4	509.0	0	10.9	61.6	581.5	20.0	2.0	58.6	4.3	6.6	45.6	605.6
1920	165.7	40.5	28.1	101.4	132.0	109.5	20.6	6.6	128.0	22.7	105.3	55.0	25.5	8.8	177.0	46.9	130.1	50.4	15.4	100.1	0	32.3	0	118.1	42.0	210.5	130.2	4.5	40.0	35.8	0	11.5	53.2	109.4	42.7	2.0	61.2	4.3	6.6	14.5	189.9
1921	304.7	47.1	24.8	228.5	132.0	101.0	17.0	5.5	264.0	32.2	231.8	55.4	140.6	8.8	419.0	59.5	359.5	25.2	19.8	123.7	181.3	38.6	0	141.7	113.0	461.2	131.4	4.6	44.8	280.4	0	11.5	58.0	349.9	82.6	2.0	61.7	4.3	6.6	34.8	450.5
1922	83.6	131.0	22.5	9.4	132.0	42.8	25.9	8.2	122.6	20.2	102.4	53.9	43.8	8.8	191.3	62.3	129.0	109.5	2.2	27.8	0	6.9	0	45.8	27.7	182.0	131.9	3.8	27.0	19.6	.3	11.6	40.2	71.4	35.2	2.0	61.9	4.3	6.6	11.1	148.5
1923	179.6	118.6	8.3	0	105.4	18.1	28.5	9.2	99.2	21.0	78.2	52.5	97.4	8.8	219.3	60.8	158.5	78.8	3.6	52.7	0	23.4	0	70.8	67.2	216.8	128.9	3.7	34.1	50.3	0	11.4	47.3	109.0	34.9	2.0	60.5	4.3	6.6	15.5	180.0
1924	142.2	103.5	23.7	41.0	132.0	63.6	28.1	7.6	128.6	21.5	107.1	51.8	45.2	8.8	195.2	60.9	134.3	107.6	4.7	42.2	0	16.9	0	60.2	50.3	218.1	142.8	5.1	31.9	38.6	.3	12.5	45.1	96.2	0	2.0	67.0	4.3	6.6	13.9	140.4
1925	124.9	101.7	9.9	0	132.4	14.3	21.7	6.8	80.8	13.8	73.0	49.3	122.0	8.8	235.7	48.5	187.2	10.0	21.8	145.6	.3	53.9	.3	169.3	160.1	275.9	135.0	4.4	40.1	98.4	0	12.7	53.2	161.4	Tr.5	2.0	63.4	4.3	6.6	20.8	213.6
1926	190.8	47.2	19.9	84.1	132.6	70.8	17.2	5.5	119.6	21.2	98.4	50.8	80.4	8.8	220.8	44.4	176.4	0	16.4	148.4	0	35.4	4.4	166.4	162.0	328.4	123.2	4.2	54.8	146.2	0	10.7	68.6	226.9	0	2.0	57.9	4.3	6.6	26.0	247.9
1927	140.7	188.6	17.5	1.1	132.0	54.8	23.6	7.5	173.6	26.6	147.0	52.1	6.0	8.8	196.3	63.2	133.1	91.2	7.3	53.7	0	15.0	0	71.7	66.0	228.9	142.8	4.8	30.3	51.7	0	12.4	43.5	107.6	0	2.0	67.0	4.3	6.6	15.3	150.4
1928	115.9	69.3	12.7	0	99.5	37.1	19.3	6.2	86.2	14.2	42.0	50.6	127.7	8.8	211.5	55.6	155.9	35.7	9.8	84.0	0	30.0	0	112.0	84.6	212.3	127.0	4.6	38.3	41.7	0	11.0	51.5	104.2	24.5	2.0	59.6	4.3	6.6	15.0	164.4
1929	187.0	54.3	23.0	72.2	132.0	85.9	24.4	7.8	85.0	17.4	67.6	52.5	14.8	8.8	126.1	36.1	90.0	50.4	4.2	52.0	0	12.4	0	70.0	86.5	205.9	128.4	4.0	32.5	41.6	0	11.2	49.1	98.9	0	2.0	60.3	4.3	6.6	14.4	135.9
1930	160.9	111.1	21.4	28.4	132.0	103.7	21.1	6.8	125.2	20.9	104.3	52.6	89.9	8.8	238.0	49.2	188.9	53.8	8.7	88.9	17.0	38.6	0	106.9	79.4	257.1	133.3	3.9	35.9	84.1	0	11.6	49.1	144.8	27.3	2.0	62.4	4.3	6.6	19.3	206.3
1931	190.5	20.4	22.5	147.6	132.0	132.0	20.4	6.6	154.2	28.4	125.8	53.4	26.8	8.8	197.2	54.6	142.5	1.7	16.9	134.8	0	17.7	0	161.6	105.8	260.3	131.0	4.9	50.5	73.8	0	11.5	63.8	149.1	43.6	2.0	61.5	4.3	6.6	19.8	225.5
1932	158.4	21.1	24.0	111.3	132.0	132.0	21.2	6.7	118.0	24.5	93.5	57.9	169.8	8.8	312.4	46.0	265.4	3.3	14.9	143.6	93.1	38.6	0	161.6	116.2	374.2	123.2	3.7	45.0	202.3	0	10.7	58.2	271.2	32.8	2.0	57.9	4.3	6.6	29.5	323.5
1933	125.6	109.4	26.4	6.8	132.0	106.2	24.4	7.7	99.5	18.7	80.8	57.9	41.3	8.8	171.4	49.0	122.2	82.7	5.2	59.4	0	22.0	0	77.4	57.4	217.5	137.2	3.8	30.8	45.7	0	12.3	44.0	106.9	16.2	2.0	64.4	4.3	6.6	14.1	159.1
1934	79.2	169.6	11.5	0	120.0	3.0	34.4	11.0	146.2	25.0	121.2	52.8	2.1	8.8	167.3	52.4	114.9	67.5	7.1	38.4	0	8.3	0	56.4	10.2	134.2	140.6	2.4	19.6	6.6	35.0	9.8	32.8	49.2	11.9	2.0	49.6	4.3	6.6	8.6	93.2
1935	152.6	123.1	3.5	0	39.1	3.0	32.6	10.4	100.9	21.8	79.1	50.4	29.6	8.8	150.3	43.6	106.7	81.7	3.1	22.7	0	2.0	0	40.7	37.3	159.7	129.0	3.4	26.4	17.2	16.3	10.0	39.6	65.8	56.0	2.0	52.6	4.3	6.6	10.7	155.8
1936	115.9	120.7	6.5	0	46.2	6.4	20.7	6.6	106.6	16.8	89.8	50.4	88.7	8.8	220.1	52.0	158.1	77.6	7.4	71.1	0	14.0	0	89.1	0	166.7	129.7	2.8	21.3	12.9	0	11.4	34.5	58.8	33.1	2.0	60.9	4.3	6.6	9.5	134.4
1937	328.1	48.8	19.3	157.8	132.0	27.9	26.8	8.6	186.4	23.5	162.9	52.2	243.3	8.8	449.6	64.2	385.4	25.0	22.0	137.1	192.0	38.6	0	155.1	131.5	503.6	132.6	4.8	44.3	321.9	0	11.6	57.5	391.0	33.4	2.0	62.3	4.3	6.6	37.9	440.5
1938	163.2	112.9	25.4	50.9	132.0	84.4	22.9	7.3	148.2	23.6	124.6	55.7	67.4	8.8	239.9	70.6	168.3	52.3	12.7	109.1	0	16.2	0	127.1	36.1	215.5	134.4	4.3	38.0	38.8	0	12.0	53.2	102.0	42.9	2.0	63.1	4.3	6.6	14.7	180.4
1939	147.9	103.4	24.3	35.2	132.0	102.7	23.5	7.4	127.6	22.0	105.6	52.0	67.2	8.8	213.0	60.5	152.5	134.0	1.7	22.9	0	4.7	0	40.9	21.6	196.8	138.2	5.0	42.2	11.2	0	12.3	55.4	78.9	21.3	2.0	64.9	4.3	6.6	12.0	144.2
1940	124.3	170.2	16.0	0	118.5	34.3	30.2	9.7	149.7	22.8	126.9	48.4	22.4	8.8	198.9	61.1	127.8	99.5	3.8	25.9	0	3.2	0	49.3	34.2	177.6	131.6	4.4	33.9	7.5	0	11.6	47.1	65.2	16.2	2.0	61.8	4.3	6.6	10.5	124.8
1941	722.8	6.1	7.2	627.6	132.0	56.1	8.1	2.0	629.6	45.2	583.4	91.7	711.3	8.8	1377.6	38.8	1338.5	32.7	9.0	153.1	1105.4	38.6	7.2	171.1	144.5	1453.8	99.7	1.9	53.2	1259.1	0	8.9	65.4	1374.4	315.1	2.0	46.8	4.3	6.6	77.0	1650.4
1942	356.0	20.1	21.6	314.3	132.0	132.0	20.0	6.4	320.7	33.9	286.8	108.4	83.5	8.8	469.9	63.2	406.7	10.0	24.9	191.5	180.3	38.6	7.2	209.6	41.4	441.8	132.8	4.4	49.7	254.9	0	11.7	62.9	329.5	72.0	2.0	62.4	4.3	6.6	33.4	421.6
1943	135.0	131.2	25.9	20.0	132.0	75.3	31.2	9.9	129.9	20.6	109.3	66.5	21.2	8.8	188.2	54.2	134.0	57.3	15.4	97.7	0	33.7	0	115.7	47.6	220.6	134.3	5.7	41.1	40.0	0	11.6	54.3	105.9	21.7	2.0	63.1	4.3	6.6	15.1	166.7
1944	141.9	159.9	16.4	0	106.0	39.2	24.9	7.9	142.9	21.7	121.2	65.4	8.0	8.8	185.8	47.2	138.6	91.6	6.5	39.3	0	10.0	0	57.3	42.7	191.6	129.9	4.3	38.8	18.6	0	11.5	52.0	82.1	28.6	2.0	61.0	4.3	6.6	12.5	150.3
1945	130.9	161.0	6.8	0	65.8	3.0	30.3	9.7	140.4	24.5	115.6	65.4	1.6	8.8	155.8	48.2	108.6	79.4	3.4	26.4	0	2.6	0	44.4	14.9	138.7	135.7	2.8	23.7	5.0	27.9	9.4	36.9	51.3	15.9	2.0	50.6	4.3	6.6	8.9	100.0
1946	132.1	95.6	3.1	0	50.9	3.0	29.4	9.4	76.6	19.7	56.9	59.0	39.4	8.8	146.5	35.7	110.8	79.4	3.3	44.7	0	8.8	0	62.7	4.8	128.8	127.2	2.2	24.1	17.4	42.7	7.4	37.3	82.1	30.3	2.0	39.7	4.3	6.6	10.4	112.8
AVERAGE	183.6	94.3	17.0	79.2			23.5	7.5	157.5	23.6	133.9	57.3	86.9	8.9	269.3	53.6	215.7	50.7	11.6	93.0	61.5			110.8	62.0	285.2	130.5	3.9	35.6	120.3	5.3	11.0	48.8	179.2	40.4	2.0	58.7	4.3	6.6	15.7	250.9

SUMMARY OF 1947 CONDITION ROUTING STUDY

(1946 - 1952 LEAKAGE RELATIONSHIP McMILLAN RESERVOIR)

SOURCE; Stipulated Exhibit 5, p. 18

UNIT - 1000 ACRE FEET

12-60

Year	ALAMOGORDO RESERVOIR						CHANNEL GAINS AND LOSSES										Year	McMILLAN RESERVOIR						CHANNEL		AVALON RESERVOIR						CHANNEL GAINS AND LOSSES								Year
	Inflow at Guadalupe	Irrigation release	Evap.	Spill	Storage end of year	Routed flow below dam	Ft. Sumner Project diversion	Ft. Sumner Project return flow	Shortage to Ft. Sumner Project	Routed flow past Project	Channel losses	Arian ine	River pump depletion	River pump shortages	Flood inflow Guad Artesia	Routed flow at Artesia	Channel and Delta losses	Flood inflow Artesia to McMillan		Inflow	Irrigation release	Reservoir leakage	Evap.	Spill	Storage end of year	Base flow Major Johnson Springs	Flood inflow McMillan Dam Carlsbad	Inflow	Irrigation release	Reservoir leakage	Evap.	Spill	Storage end of year	Shortage to Carlsbad Project	Seepage from Main Canal	Base flow Carlsbad Spring	Routed flow at Carlsbad	Inflow index at Carlsbad	Depletion Carlsbad to Angeles	Flood inflow Carlsbad to Angeles	Inflow to Red Bluff Res.	
	A																																						
	1	2	3	4	5	6	7	8	9	10	11			14	15	16	17	18		19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
					28.8																				2.7															
1919	447.0	30.8	12.3	300.5	132.2	331.3	30.8	16.3	0	316.8	57.2	6	10.7	0	249.3	558.9	121.8	94.8	1919	531.9	15.0	141.8	19.9	325.8	32.1	17.4	176	676.1	124.8	30.0	4.4	516.9	6.0	0	8.6	16.6	572.1	688.3	87.5	90.9	691.7	1919
1920	164.2	84.2	21.1	78.1	113.0	*162.3	38.3	20.3	0	144.3	38.3	5	11.4	0	50.4	195.5	78.7	9.2	1920	127.0	39.3	102.2	15.5	0	2.1	17.4	15	174.5	130.2	19.0	3.4	24.2	3.7	0	9.0	21.0	73.2	194.4	90.3	8.6	112.7	1920
1921	282.4	79.6	23.8	159.8	132.2	239.4	30.3	16.0	0	225.1	47.3	8	12.9	0	169.2	377.9	85.1	28.6	1921	321.4	18.7	111.0	21.1	168.0	4.7	17.4	54	369.9	131.4	23.5	4.9	207.8	6.0	0	9.3	14.5	255.1	377.2	101.0	48.3	324.5	1921
1922	94.6	192.8	15.6	7.7	10.7	200.5	35.5	18.8	0.7	183.8	39.4	5	21.4	0	39.8	199.4	78.2	7.0	1922	128.2	44.8	72.3	14.0	0	1.8	17.4	13	148.0	123.6	14.5	3.5	11.9	0.5	8.3	8.6	18.8	53.8	168.8	81.5	29.3	116.6	1922
1923	159.3	101.4	1.6	0	67.0	101.4	37.1	19.7	0	84.0	33.5	5	10.7	0	132.4	205.2	84.8	18.6	1923	140.0	23.8	78.6	10.0	0	29.4	17.4	35	155.6	95.5	13.2	1.6	39.8	6.0	33.3	6.7	19.5	79.2	168.0	81.2	31.1	117.9	1923
1924	141.4	179.5	15.9	0	69.9	77.3	38.4	20.3	0	161.4	40.6	4	23.1	1.2	60.4	204.4	77.8	10.3	1924	136.9	56.7	91.7	17.9	0	0	17.4	19	185.2	142.6	12.9	3.7	31.6	0.4	0.2	9.9	21.0	75.4	208.1	94.4	2.4	116.1	1924
1925	138.7	77.3	4.5	0	69.9	77.3	31.7	16.8	1.0	62.4	26.7	3	11.4	0	107.0	167.9	59.9	23.7	1925	131.7	22.7	83.1	10.7	0	15.2	17.4	44	167.7	101.5	13.5	2.1	45.0	6.0	33.5	7.1	22.4	88.0	182.4	86.7	42.6	138.3	1925
1926	196.7	53.5	17.2	63.7	132.2	117.2	32.9	17.4	0	101.7	34.5	2	10.7	0	76.6	184.3	73.7	47.4	1926	158.0	4.1	129.8	16.9	0	22.4	17.4	82	240.8	123.2	27.1	4.2	86.3	6.0	0	8.5	12.3	134.2	248.9	100.9	15.5	163.5	1926
1927	143.2	211.4	18.2	3.9	41.9	215.3	35.4	16.8	0	198.7	45.4	1	23.6	0	22.2	189.3	77.4	16.8	1927	128.7	46.1	88.2	16.8	0	0	17.4	31	183.0	142.8	13.7	4.2	26.1	2	0	10.1	15.9	65.8	198.5	91.5	0.3	107.3	1927
1928	120.5	128.9	4.2	0	29.3	128.9	28.9	15.1	0	115.1	36.3	0	10.7	0	100.9	210.0	90.8	16.6	1928	135.8	27.6	86.3	12.9	0	9.0	17.4	31	162.8	117.8	14.7	3.6	22.9		.2	8.3	19.5	65.4	174.9	84.0	50.1	141.0	1928
1929	157.0	161.6	4.6	0	20.1	161.6	36.7	19.5	0	144.4	39.0	1	13.6	0	19.2	159.7	66.9	24.0	1929	116.8	37.4	75.0	11.1	0	2.3	17.4	15	175.3	125.8	18.2	3.4	27.9		2.6	8.7	20.3	75.1	192.2	89.7	12.4	114.9	1929
1930	160.9	123.5	5.6	0	51.9	123.5	32.3	17.1	0.1	108.3	35.3	1	17.2	0	105.3	200.5	66.1	18.9	1930	153.3	27.8	82.0	11.0	12.6	22.2	17.4	36	175.8	105.6	15.1	2.6	52.5		27.4	7.4	21.7	96.7	194.9	90.5	16.5	120.9	1930
1931	190.5	111.3	14.8	0	116.3	111.3	33.3	17.6	0	95.6	28.5	1	13.6	0	85.8	187.4	77.2	12.8	1931	123.0	34.1	95.1	12.9	0	3.1	17.4	24	170.9	131.0	17.1	3.0	19.8	6.0	0	9.3	17.4	63.6	185.3	87.6	44.3	142.0	1931
1932	163.4	97.1	19.4	37.4	125.8	134.5	34.4	18.2	0	118.3	36.4	4	10.7	0	177.3	313.1	97.0	32.1	1932	248.2	31.1	106.9	10.9	78.5	23.9	17.4	60	294.6	123.2	22.2	3.2	146.0	6.0	0	8.7	23.9	200.8	315.3	102.0	58.3	271.6	1932
1933	125.6	178.5	17.4	1.2	54.3	179.7	32.8	17.4	0	164.3	42.1	1	19.3	0	34.5	180.4	76.0	18.1	1933	122.5	36.4	92.8	15.4	0	1.8	17.4	35	181.7	137.2	14.4	3.0	27.1	6.0	0	9.5	23.2	74.2	201.9	92.6	12.1	121.4	1933
1934	79.2	117.2	6.1	0	10.2	117.2	33.6	17.8	0	101.4	33.9	1	20.5	2.4	34.9	104.3	39.7	5.7	1934	70.3	23.9	37.1	9.5	0	1.6	17.4	11	89.6	79.4	10.9	2.4	1.2	1.7	61.2	5.4	17.3	34.8	108.8	53.3	7.9	63.4	1934
1935	152.6	122.1	5.0	0	35.7	122.1	39.2	20.8	0	103.7	32.4	0	16.4	0	48.8	139.7	52.5	16.8	1935	104.0	36.0	56.8	9.9	0	2.9	17.4	31	142.0	113.1	14.5	3.4	6.7	6.0	15.9	7.9	22.4	51.5	156.7	76.4	40.6	120.9	1935
1936	115.9	129.7	4.4	0	17.5	129.7	35.2	18.7	0	113.2	36.0	2	14.3	0	86.6	183.7	76.0	1.1	1936	108.8	32.9	65.4	11.4	0	2.0	17.4	2	117.9	96.7	13.3	2.2	8.7	3.0	33.0	6.7	23.1	51.8	141.8	69.2	23.7	96.3	1936
1937	328.5	52.3	18.7	142.8	132.2	195.1	29.2	15.5	0	181.4	41.3	1	14.3	0	261.2	442.2	93.5	58.5	1937	407.2	9.9	120.9	25.9	241.6	10.9	17.4	119	509.5	132.6	23.0	5.0	345.9	6.0	0	9.2	25.3	403.4	526.8	96.5	21.8	452.1	1937
1938	192.7	124.4	21.6	46.7	132.2	171.1	35.2	18.7	0	154.6	37.2	1	16.4	0	73.5	228.9	93.8	16.7	1938	151.8	35.4	103.6	15.1	0	8.6	17.4	31	188.3	134.4	18.2	3.5	32.2	6.0	0	9.4	25.3	85.1	210.1	95.0	34.4	149.5	1938
1939	149.3	134.3	24.0	8.1	115.1	142.4	33.4	17.7	0	126.7	37.8	1	17.2	0	70.2	188.0	81.1	14.4	1939	121.3	39.6	75.4	12.7	0	2.2	17.4	27	160.1	138.2	10.8	3.0	12.6	1.5	0	9.7	20.2	53.3	181.8	86.5	14.5	109.8	1939
1940	122.6	167.2	18.4	0	51.5	167.8	37.5	19.9	0	150.2	36.1	1	12.9	0	29.2	176.8	70.5	13.8	1940	120.1	40.8	67.2	12.2	0	2.1	17.4	26	151.4	131.6	14.5	3.3	0	3.5	0	9.3	17.3	41.1	163.4	79.4	19.2	103.2	1940
1941	730.4	21.3	6.9	621.5	132.2	642.8	21.3	13.3	0	632.8	86.7	14	10.7	0	746.9	1383.6	97.7	68.1	1941	1354.0	6.5	135.1	9.6	1166.3	38.6	17.4	127	452.4	99.7	26.7	2.0	1321.5	6.0	0	7.1	34.0	1389.3	1481.9	43.0	225.1	1664.0	1941
1942	367.8	26.5	22.1	319.2	132.2	345.7	26.5	14.1	0	333.3	58.8	1	12.1	0	108.9*	464.6	89.4	13.2	1942	388.4	10.8	160.3	27.6	189.7	38.6	17.4	25	403.8	132.8	27.5	4.8	238.7	6.0	0	9.4	39.1	314.7	438.1	99.0	26.1	365.2	1942
1943	124.0	109.3	25.1	38.0	83.8	147.3	44.2	26.2	0	126.3	37.2		20.0	0	52.0*	169.6	76.7	18.7	1943	111.6	25.7	102.1	19.1	0	3.3	17.4	35	180.9	134.3	16.9	4.2	26.3	5.2	0	9.4	36.9	89.5	214.4	95.9	14.9	133.4	1943
1944	129.2	173.3	12.2	0	27.5	173.3	37.6	18.4	0	154.1	40.5		12.9	0	43.0*	188.8	77.9	15.2	1944	126.1	45.7	71.0	10.2	0	2.5	17.4	28	162.9	129.9	16.9	3.4	11.9	6.0	0	9.2	34.0	72.0	192.7	89.8	6.0	108.9	1944
1945	122.7	130.0	3.7	0	16.5	130.0	45.9	22.9	0	107.0	35.7		25.7	1.5	26.8*	105.8	45.9	5.0	1945	64.9	16.8	40.6	8.1	0	1.9	17.4	9	83.9	73.7	10.1	1.8	2.5	1.8	62.0	5.1	31.8	49.5	118.1	58.0	6.6	66.7	1945
1946	130.9	107.4	3.8	0	36.2	107.4	41.0	19.6	0	86.0	29.5		15.0	0	70.4*	142.5	61.1	3.1	1946	84.5	23.4	51.6	8.2	0	3.1	17.4	5	98.2	71.9	11.9	1.9	8.3	6.0	55.3	5.1	27.5	52.8	119.6	58.8	15.3	76.1	1946
1947	87.2	106.6	5.0	0	11.8	106.6	42.0	20.4	0	85.0	32.0		19.2	3.7	27.1*	90.9	38.6	5.7	1947	58.0	18.8	34.8	6.5	0	1.0	17.4	10	81.8	69.1	9.6	1.8	6.3	1.0	71.0	4.8	24.6	45.3	109.6	53.4	0.8	57.0	1947
Average	190.3	114.9	12.9	63.1	---	178.0	34.9	18.2	0.1	161.3	39.8		15.5	0.2	107.3	260.2	76.1	21.9	Average	206.0	28.7	88.2	13.9	75.3	---	17.4	41	251.2	117.0	17.0	3.2	114.1	---	14.2	8.2	23.0	162.3	271.1	83.3	31.7	219.5	Average

* Includes storage effect