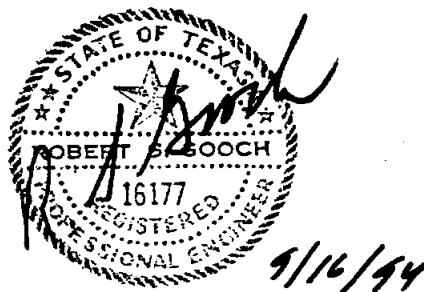


LOWER NECHES VALLEY AUTHORITY
HYDROLOGIC STUDIES OF THE NECHES RIVER BASIN

SEPTEMBER 1994



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LNV94060

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LOWER NECHES VALLEY AUTHORITY

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1. INTRODUCTION

The Lower Neches Valley Authority was granted the water rights associated with Sam Rayburn Reservoir and Lake B. A. Steinhagen in 1963. It is now more than 30 years since those rights were approved. In many ways, conditions in the Neches River Basin today are materially different from the conditions of the early 1960's, and a number of changes and events that were foreseen then have not developed as anticipated. Major new reservoirs that were proposed at the Rockland, Ponta and Weches sites have still not been built, and there is little prospect that they will be developed in the foreseeable future. Increases in municipal and industrial water requirements have been slower than predicted, and water use for irrigation has actually decreased in recent years. Temporary barrier structures, which have been the customary method for coping with salt water intrusion in the lower reaches of the river since the 1940's, are no longer readily accepted as the proper solution to that problem.

As one after another of the basic conditions changed, it has become more and more difficult for the Lower Neches Valley Authority to know whether its existing sources of supply could be counted on to provide the yields that they had originally been indicated to have. By early 1994, it was clear that the former hydrologic

studies on which the Authority has based its long range planning should be reviewed and brought up to date. In March of this year, the LNVA authorized Freese and Nichols to carry out a new series of analyses, which would provide the basic facts needed for water supply planning and policy decisions under present conditions in the Neches Basin. The studies were intended to give answers to the following questions:

- How much dependable yield does the Rayburn/Steinhagen reservoir system have under existing conditions?
- How much dependable yield would this system have if the proposed Eastex Reservoir is built?
- How much dependable yield would it have if both the Eastex and Rockland Reservoirs are built and operated on a priority basis upstream?
- How much additional yield can be gained through coordinated use of runoff originating downstream from Lake Steinhagen?
- How much yield would be lost due to requirements for control of salt water intrusion?

These questions were to be answered for each of several possible scenarios: (a) with a permanent salt water barrier in operation, both with and without the flow bypass limitations that were adopted for the Phase I studies of the proposed Trans-Texas Water Program, (b) using temporary salt water barrier structures, both with and without major permit restrictions and (c) for the extreme case in which permission to build temporary barriers might be denied altogether.

In addition to the yield analyses needed to obtain the information listed above, the scope of work also included the following three supplemental studies:

- Derivation of flow probability statistics for the Neches River at the Evadale gaging station without major man-made impacts (i.e., under essentially state-of-nature conditions), based on the 50 years of hydrologic records from 1941 through 1990.
- A check on whether the current seasonal pattern of hydroelectric generation at Sam Rayburn Dam would cause significantly greater spills from Lake Steinhagen (and thus loss of usable yield) during a critical drought under existing watershed conditions and, if so, how much the loss of yield might be.
- Simulated operation of the surface water supply systems of the lower Neches Basin under hydrologic conditions similar to those experienced from 1941 through 1990.

The remaining sections of this report describe the methods and results of those studies.

2. THE NECHES RIVER BASIN

Figure 2.1 is a map of the Neches River Basin, which covers an area of approximately 10,000 square miles and includes all or part of 21 counties in East Texas. The basin is roughly 200 miles long and is between 30 and 70 miles wide throughout most of its length. The overall drainage flow is from north-northwest to south-southeast, from the headwaters in Van Zandt, Henderson and Smith Counties to the Sabine-Neches estuary in Jefferson and Orange Counties. The two main streams are the Neches and Angelina Rivers, which come together at Lake B. A. Steinhagen, near Woodville.

Storage Reservoirs

There are ten surface water reservoirs with 5,000 or more acre-feet of storage capacity in the Neches Basin. All were designed to provide water supply, although some of them serve other purposes as well. Table 2.1 gives some basic information relating to these existing lakes.

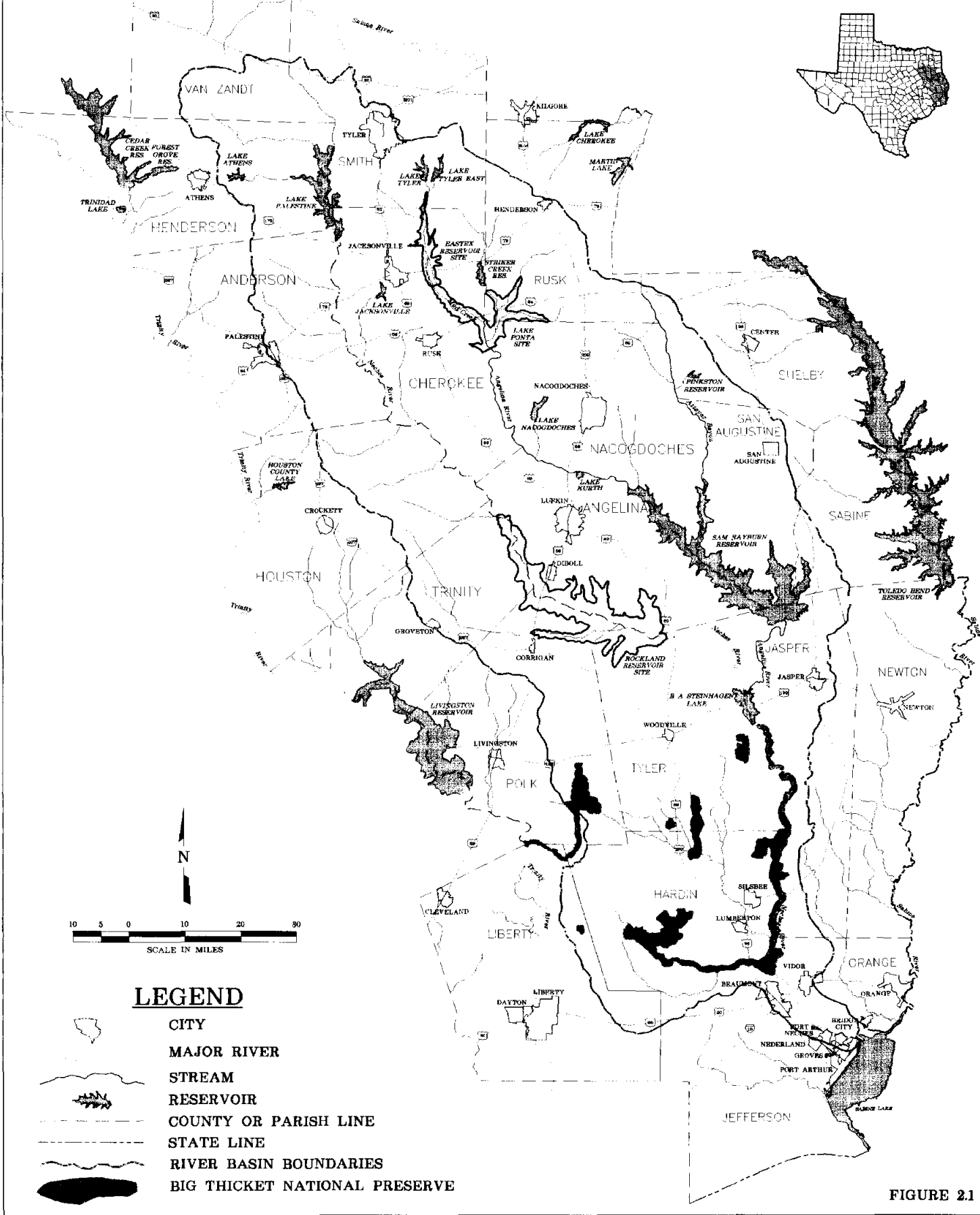
Hydrologic Data

The U. S. Geological Survey has measured and published daily stream flows at key points in the basin for many years (1). The gaging station with the longest period of continuous records is located on the Neches River near Rockland and has





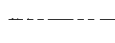



(1) Numbers in parentheses match references listed in Appendix A.

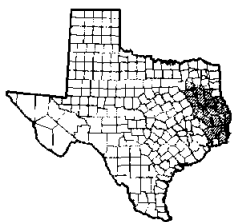
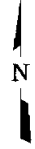
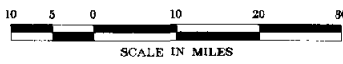
NECHES RIVER BASIN

FREESE AND NICHOLS, INC.
1994



LEGEND

-  CITY
-  MAJOR RIVER
-  STREAM
-  RESERVOIR
-  COUNTY OR PARISH LINE
-  STATE LINE
-  RIVER BASIN BOUNDARIES
-  BIG THICKET NATIONAL PRESERVE



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FIGURE 2.1

Table 2.1

MAJOR STORAGE RESERVOIRS IN THE NECHES RIVER BASIN						
RESERVOIR	OWNER	DATE BUILT	CAPACITY IN ACRE-FEET	SURFACE AREA IN ACRES	DRAINAGE AREA IN SQUARE MILES	
					TOTAL	NET
Sam Rayburn Reservoir	Corps of Engineers	March 1965	2,898,200	114,500	3,449	3,060
Lake Palestine	Upper Neches River MWA	May 1962	412,000	25,560	839	817
Lake B. A. Steinhagen	Corps of Engineers	April 1951	89,400	13,600	7,573	3,251
Lake Tyler	City of Tyler	January 1949	42,300	2,400	45	45
Lake Tyler East	City of Tyler	November 1966	44,000	2,560	62	62
Flat Creek Reservoir	City of Athens	November 1962	32,690	1,520	22	22
Striker Creek Reservoir	Angelina-Nacogdoches MWD	May 1957	21,500	1,910	183	183
Lake Jacksonville	City of Jacksonville	June 1957	30,500	1,320	34	34
Lake Nacogoches	City of Nacogdoches	July 1976	40,250	2,370	89	89
Southland Reservoir	Champion-International Paper Company	July 1957	16,200	800	4	4

been in service since 1903. The station with the next longest span of records (since 1922) is on the Neches at Evadale. Two other gages, one on the Neches River near Neches and the other on Village Creek near Kountze, have been in continuous service since 1939. Appendix B (Table B-17) contains a summary of the USGS stations that are now operating in the Neches Basin and the stations that have been maintained in the past but are no longer active.

The National Weather Service and the Texas A&M Agricultural Experiment Station system have collected daily records of rainfall and evaporation in the Neches Basin for roughly the same period of time as is covered by the stream flow records of the USGS (2), (3). Thus, there is a substantial body of hydrologic data, extending back 50 years and more, from which can be derived the basic information for reservoir operation simulations and other studies such as are the subject of this report.

Critical Drought Period

The drought of the 1950's was the worst so far recorded in the Neches Basin. For some of the reservoirs in the upper reaches of the watershed, the critical period of record began in the summer of 1950 and extended through the early months of 1957. If Sam Rayburn Reservoir had been in operation, it would have spilled in the early 1950's, and the critical period for that impoundment would not have begun until the summer of 1953. In all cases, however, the limiting drought would have

been within the years from mid-1950 through early 1957.

Based on the long-term records from the Rockland gaging station, the dry period from 1950 to 1957 was the worst in more than 90 years of historical observations. The average annual runoff at the Rockland gage has been approximately 1.7 million acre-feet per year over the total period of observed records but averaged only about half that much from 1951 through 1956. The driest single year experienced to date was 1956, when there was only approximately 1/7 of the normal average flow. In contrast, the wettest year to date was 1946, when the flow at Rockland was nearly 2-1/2 times the average amount.

3. SALT WATER INTRUSION

The fresh water diversion points of the City of Beaumont and the Lower Neches Valley Authority are on the Neches River and Pine Island Bayou at places where the stream bed is below sea level. Figure 3.1 is a map showing the locations of these installations. The pump intakes themselves are also below sea level, and it is critically important that salt water from the Gulf of Mexico not be allowed to flow upstream as far as the pump stations. If that should happen, the pumps would have to be turned off to keep from pulling salt water into the supply systems. The entire area served by Beaumont and the LNVA would then lose nearly all of its municipal, industrial and irrigation water supply. Within a few hours, more than 200,000 people would be without drinking water. One of the nation's most important petrochemical complexes would have to shut down. And farmers would face crop failures on tens of thousands of irrigated acres.

Because the salt water is heavier than fresh water, it tends to move into the portion of the channel that is below sea level and to force its way upstream. The downstream flow of fresh water opposes the upstream movement of the salt water. In normal times, there is enough flow in the river to keep the salt water away from the diversion facilities. The LNVA maintains a careful watch on the location and movement of the salt water wedge. Releases from Lake Steinhagen are coordinated with local needs and the natural inflows from the uncontrolled portion of the watershed downstream from Lake Steinhagen, so that the salt water is not allowed

to get too close to the intakes. Based on recent observations by the Authority, it takes a flow in the river of about 2,500 cubic feet per second to counteract the tendency of the salt wedge to move upstream when it is a short distance below the mouth of Pine Island Bayou (4). The flow needed to hold back the salt wedge must be allowed to go on into Sabine Lake and is not available for beneficial use. Thus, any water released for this purpose during a critical drought period will represent a loss of usable yield.

If the salt water barriers are not constructed, and if hydrologic conditions remain dry for a long enough period of time, the continuing releases necessary for salt water control could exhaust the reservoirs' conservation storage. During severe drought conditions, there would not be enough conservation capacity in Lake Sam Rayburn and Lake Steinhagen to maintain releases at the rate needed. Under conditions comparable to those of the 1950's, the conservation storage in Sam Rayburn and Steinhagen would be depleted part-way through the drought, and there would be no dependable yield to meet the area's water requirements.

Temporary Salt Water Barriers

In the past, the LNVA has built temporary barrier structures of steel sheet piling on both the Neches River and Pine Island Bayou to hold back the salt water when necessary. The Authority's records show that such barriers have been used since as least as far back as 1944 (5). The temporary structures are relatively

economical, and in the past they have provided effective protection for the area's water supply operations.

The Permitting Process

In 1945, the U. S. Army Corps of Engineers issued a continuing permit to the LNVA, authorizing the installation of temporary barriers when required (6). Over the years, steel sheet piling barriers have been constructed 36 times on Pine Island Bayou and 32 times on the Neches River (7).

In 1991, the Corps withdrew the standing permit and indicated that the Authority would be expected to apply for a new permit before installing the barriers again in the future. At about the same time, overall requirements for irrigation water declined, and for several years there has been enough runoff to allow control of the salt water by means of extra releases from Lake Steinhagen.

Under the operating guidelines of the Corps of Engineers, the conservation storage space in Sam Rayburn Reservoir is divided into four zones, and the high releases for salt water control are considered to be available as long as the water surface remains within Zone 1 or Zone 2. Figure 3.2 is a diagram of the zones, which vary throughout the year on a seasonal basis. The Corps' customary procedure has been to notify the LNVA whenever the lake dropped into Zone 3 and then to allow a reasonable interval for placement of the temporary barriers before discontinuing the extra releases.

STORAGE ZONES IN SAM RAYBURN RESERVOIR

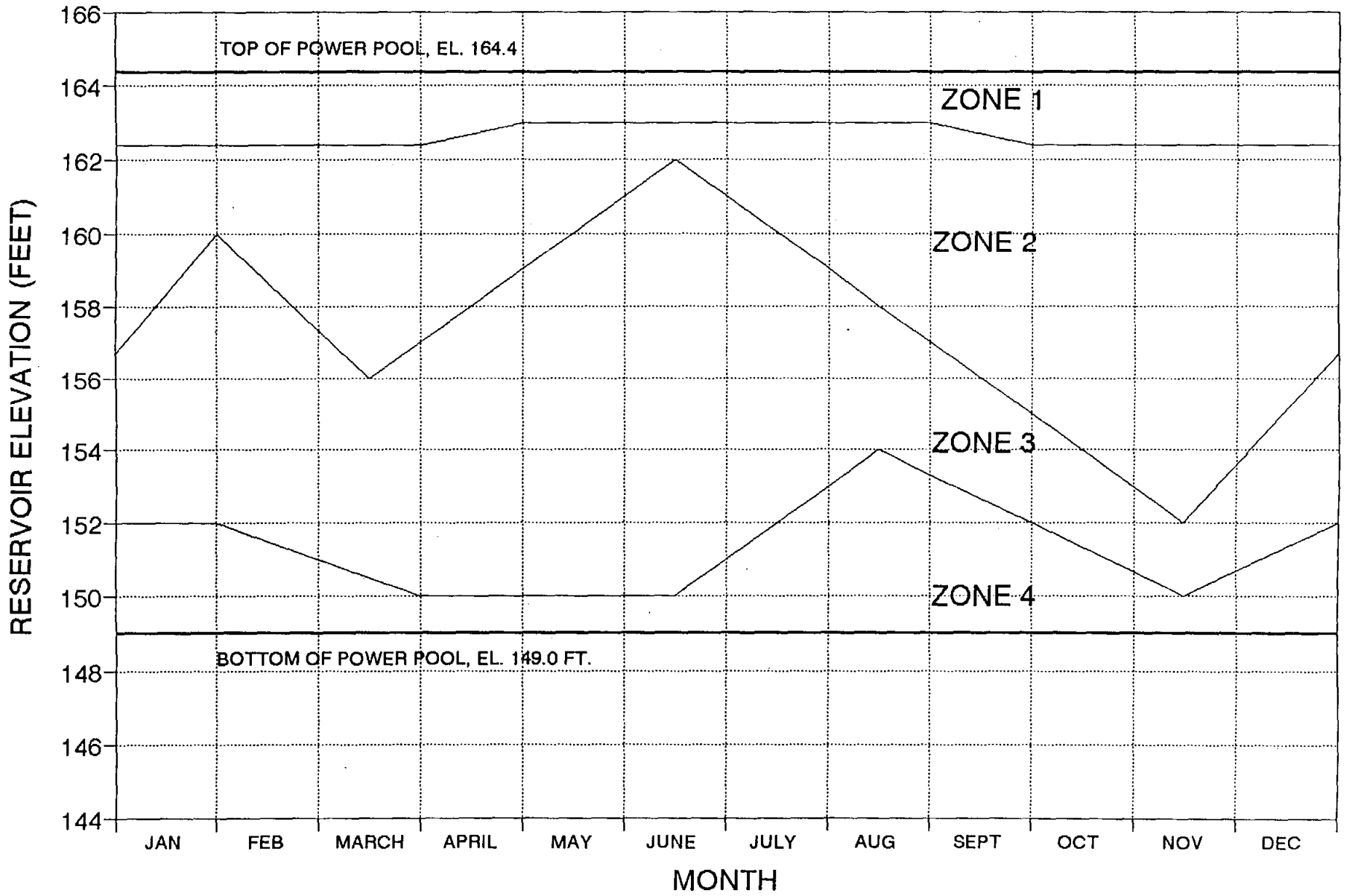


FIGURE 3.2

In the spring of 1992, the LNVA realized that the barriers might be needed later that year or sometime in the following year, and a permit application was filed with the Corps, seeking approval to put the barriers in place if necessary. The review process proved to be quite thorough, and it was approximately two years later, in March of 1994, when the requested permit was granted. Appendix C contains the wording of eight key permit conditions that are listed in the concluding section of the Corps' statement of findings (6). From the standpoint of usable system yield, the following two conditions are particularly important because they influence the times when the releases for salt water control are to be discontinued and the times when they will be resumed:

- Construction of temporary barriers is not to begin until Sam Rayburn Reservoir has been in Zone 3 for at least 30 days.
- The temporary barrier structures are to be removed if Sam Rayburn Reservoir returns to Zone 2 and remains there for 60 days or more.

Permanent Salt Water Barrier

In the course of the recent barrier application review, several issues were raised by parties that objected to the temporary structures. Some of their principal concerns were the following:

- The steel sheet piling blocks the stream channels to boat traffic, and no suitable way has been developed for navigation passage through or around the temporary structures while they are in place.

- The feasible temporary barrier sites are in the Big Thicket National Preserve. They interfere with the natural conditions of the Big Thicket. In the past, there has been erosion damage where barriers have been washed out during rises on the streams.
- In some areas farther upstream along Pine Island Bayou there has been flood damage to homes in recent years. There is uneasiness that the temporary barriers may cause an increase in flood hazard.
- The Texas Parks and Wildlife Department has an active project aimed at revitalizing the paddlefish population in the lower reaches of the Neches Basin. The barriers help to protect most of the paddlefish habitat against salt water encroachment, but there is concern that fish might be trapped on the wrong side of the structures when the temporary barriers are closed.

A common theme expressed in most of the opposing comments was that a permanent barrier structure could be designed to avoid the problems attributed to the temporary barriers. Navigation facilities are proposed as part of the permanent structure. It would be downstream from the Big Thicket National Preserve. It could provide for passage of floods without significant backwater effects. The need for freshwater fish to get from below the barrier to above it in times of very low flows could be met by providing fish passages that would remain open until the salt water wedge reached the downstream side of the barrier.

Although the Corps granted the requested temporary barrier approval, the overall result of the review process was to create considerable pressure to move toward development of a permanent structure in the foreseeable future. The final comments from the Fish and Wildlife Service, the Big Thicket National Preserve,

the National Park Service and the Environmental Protection Agency all speak of the temporary barriers as an interim solution, to be used only until a permanent barrier can be provided (6). The final paragraph of the statement of findings specifies that the permit "will not be valid after the completion of the Federal Saltwater Barrier at Beaumont Project" (i. e., the permanent barrier). In the same paragraph is the condition that "if the Federal project is not deemed feasible, this permit will only be valid for 5 years and any extension of time request may be denied should the applicant not pursue an alternate design."

4. RAYBURN/STEINHAGEN SYSTEM STAND-ALONE YIELDS

Using the monthly hydrologic data derived as described in Appendix B, a computer model (see Appendix D) was developed to simulate the potential performance of Sam Rayburn and B. A. Steinhagen Reservoirs when operating together for water supply under low-flow conditions comparable to those of the 1950's. These simulations treat the Rayburn/Steinhagen system as if it were standing alone, without consideration of the added yield that might be gained through coordinated use of the uncontrolled runoff originating below Lake Steinhagen and without allowance for extra releases to control salt water intrusion. This is the simplest way to get a first approximation of the potential yield of the two reservoirs that make up the LNVA's main source of supply. The inflow data did not include any increases in return flows from upstream users over and above what was reflected by the stream flow records of the 1950's, and in that sense these studies are somewhat conservative.

Computer simulations were run for three separate scenarios: (a) with present-day conditions of upstream development, (b) with the addition of the proposed Eastex Reservoir on Mud Creek near Jacksonville and (c) with the Eastex Reservoir in place and the proposed Rockland Reservoir project also operating on the Neches River near Rockland. For the first case, the Lake Steinhagen conservation storage capacity was taken as estimated for the year 1994. For the second case (with Eastex in operation), the Steinhagen capacity was as estimated for ten years from now, in

2004. And for the final case (with both Eastex and Rockland added upstream), the capacity was as projected for the year 2024. Details of the capacity estimates are contained in Appendix B. It was assumed that siltation in Sam Rayburn Reservoir would occur mostly in the power head pool, below elevation 149.0, and would not significantly affect the conservation storage.

The studies covered the years 1953 through 1957, which were found to include the historical critical drought period in all three scenarios. It was determined that other major reservoirs in the basin could capture and hold all their inflows during the critical months for Rayburn and Steinhagen, so the analysis assumed that there would be no flow passing the Eastex or Rockland Dams in the studies which included those projects. A local demand of 10,000 acre-feet per year was counted as being withdrawn directly from Sam Rayburn Reservoir, and all remaining use from the system was assumed to take the form of releases from Lake Steinhagen to meet demands farther downstream.

Releases were made from Sam Rayburn as needed to keep Lake Steinhagen partly filled, so that it would have water readily available to meet downstream requirements but would also have storage space available to capture runoff coming from areas upstream from Steinhagen and not controlled by Sam Rayburn. Sam Rayburn Reservoir was not drawn down below the bottom of the power pool (elevation 149.0), and a minimum storage content of 10,000 acre-feet was maintained in Lake Steinhagen. Operating in that manner, the critical drawdown

period for Sam Rayburn Reservoir was found to be from June of 1953 through February of 1957.

It was determined that, without the Rockland Reservoir in operation, there would be enough inflow from the Neches River to cause unavoidable spills at Lake Steinhagen in February and April of 1955. The operating rules of the system were adjusted to minimize those losses, but it was not possible to eliminate them entirely in either of the two cases that did not include the Rockland Reservoir. In the third scenario, with the Rockland Reservoir assumed to be built and intercepting all its runoff, there were no spills at Lake Steinhagen in 1955.

Table 4.1 is a summary of the results of these three studies, showing stand-alone yields ranging from 1,323,900 acre-feet per year under present conditions to 1,269,900 acre-feet per year with Lake Eastex developed and 989,100 acre-feet per year with both Eastex and Rockland upstream. Detailed printouts of the studies are reproduced in Appendix E.

Table 4.1

FIRM WATER SUPPLY YIELDS FROM SAM RAYBURN RESERVOIR AND B.A. STEINHAGEN RESERVOIR SYSTEM STANDING ALONE	
Present Conditions (1994)	1,323,900 Acre-Feet Per Year
With Eastex Reservoir Built (2004)	1,259,900 Acre-Feet Per Year
With Eastex and Rockland Built (2024)	989,100 Acre-Feet Per Year
<u>Note:</u> The yield amounts are rounded downward to the nearest 100 acre-feet per year.	

The simulations show that, even without considering the possible additional supply that might be derived from coordinated use of flows originating below Steinhagen, the Rayburn/Steinhagen system could provide more yield during a drought comparable to the critical period of record than the amount covered by the LNVA's existing 820,000 acre-feet per year of water rights associated with those two projects. This would be true regardless of whether or not the Eastex and Rockland projects were intercepting flows upstream.

At this time, it is not clear whether either of those reservoirs will be built in the foreseeable future. The Angelina and Neches River Authority, which is sponsoring the Eastex Reservoir, has been granted a Texas water right permit for that project but has not yet succeeded in providing the necessary financing. There are no existing water rights associated with the Rockland project, and there are no current indications of active plans to build the Rockland Reservoir, although it is the project most frequently mentioned in connection with additional water resource development on the main stem of the Neches River.

If the Eastex Lake is placed in operation, it presumably would not be required to allow runoff to flow downstream to Sam Rayburn Reservoir during a critical drought (except for whatever instream flows might be required to pass through the dam), since the LNVA's rights at Sam Rayburn and Steinhagen are subordinate to subsequent development in the portion of the basin where the Eastex Reservoir would be located. On the other hand, the Rayburn/Steinhagen water rights are not

subordinate to future development at the Rockland site. Thus, the indicated decrease in the Rayburn/Steinhagen system yield caused by assuming that no flow passes the Rockland site during the critical period is basically different in nature from the estimated impact of the Eastex project. The amount associated with Rockland does not represent a possible loss in LNVA yield, because the LNVA rights are superior to whatever rights might be developed later at Rockland. It is instead a measure of the degree to which the potential benefit of the Rockland project overlaps the yield already available from the Rayburn/Steinhagen system. Any estimate of Rockland's contribution of additional dependable water supply should allow for the amount of that overlap.

It should be noted that the stand-alone values are not the definitive yields for the Rayburn/Steinhagen system from the standpoint of the LNVA. They should be considered as guideline results only, subject to further refinement through more detailed analysis. The more exact studies must include daily computations of (a) the water available from the run-of-the-river flow originating below Lake Steinhagen and (b) the amounts of flow that must remain in the river to keep salt water away from the intakes when the salt water barriers are not in place. The first of these represents a gain in yield, while the other causes a loss. Together, they may in some cases result in greater overall yields than indicated by the stand-alone studies, and in other cases the net yields may be less.

5. COORDINATED SYSTEM OPERATION WITH SALT WATER CONTROL

A more advanced version of the computer model was used to simulate operation of Sam Rayburn and B. A. Steinhagen Reservoirs with (a) coordinated use of the uncontrolled downstream runoff and (b) various alternatives for control of salt water intrusion. This more sophisticated model is described in Appendix D.

The system was analyzed for the following eight different cases:

- Case 1:** With coordinated use of the uncontrolled runoff originating below Lake Steinhagen but without use of salt water barriers.
- Case 2:** With coordinated use of the uncontrolled runoff originating below Lake Steinhagen, using temporary salt water barriers under the terms of the present Corps of Engineers permit.
- Case 3:** The same conditions as in Case 2 except that there is no requirement to remove the temporary barriers when the water level in Sam Rayburn Reservoir has been in Zone 3 and then has moved back into Zone 2 for a period of 60 days or more.
- Case 4:** The same conditions as in Case 2 except that the temporary barriers are assumed to be closed 30 days after Sam Rayburn Reservoir drops into Zone 3.
- Case 5:** The same conditions as in Case 2 except that the temporary barriers are assumed to be closed 30 days after Sam Rayburn Reservoir enters Zone 3 and there is no requirement to remove the barriers if Sam Rayburn moves back into Zone 2 for 60 days.
- Case 6:** With temporary barriers operated for maximum water supply yield, (i. e., with the barriers allowed to be installed whenever they will save salt water control releases at Lake Steinhagen, regardless of what zone Sam Rayburn Reservoir is in).
- Case 7:** With a permanent salt water barrier and the proposed Trans-Texas bypass requirements.

Case 8: With a permanent salt water barrier operated for maximum water supply yield (i.e., without bypass requirements).

These alternative sets of conditions were selected to show the potential water supply contributions of the systems (a) with no salt water barriers at all, (b) with the present barrier approach and existing rules, (c) with the present barrier approach and several forms of less restrictive rules, (d) with a permanent barrier and proposed bypass requirements and (e) with a permanent barrier and no bypass requirements. By comparing the yields for the various cases, it is possible to determine approximately the amounts of dependable supply that are lost due to the various requirements of the barrier permit or would be lost due to flow bypass provisions that might be imposed if the permanent barrier is constructed.

As with the stand-alone yields described in Chapter 4, these eight cases were evaluated (a) for present conditions of watershed development, (b) for present conditions plus the addition of the Eastex Reservoir, and (c) with both the Eastex Reservoir and the Rockland Reservoir withholding inflows upstream.

Table 5.1 shows the yields obtained from the Rayburn/Steinhagen/barrier system in the simulation studies. Printouts or summaries of the more significant cases are included in Appendix F.

Operation Without Salt Water Barriers

Case 1, where it was assumed that no salt water barriers are permitted and

Table 5.1

YIELDS OF THE RAYBURN/STEINHAGEN/BARRIER SYSTEM (Acre-Feet Per Year)				
		PRESENT CONDITIONS	WITH EASTEX	WITH EASTEX AND ROCKLAND
Case 1	No salt water barriers	0	0	0
Case 2	Temporary barriers with the current permit	799,700	765,700	539,800
Case 3	Same as Case 2, except no 60-day removal rule after return to Zone 2	888,200	840,000	660,500
Case 4	Same as Case 2, except barriers closed 30 days after entering Zone 3	914,500	869,500	647,900
Case 5	Same as Case 2, except no 60-day removal rule after return to Zone 2 and barriers closed 30 days after entering Zone 3	1,013,700	975,000	825,500
Case 6	Temporary barriers operated for maximum water supply yield	1,391,900	1,336,500	1,112,800
Case 7	Permanent barrier with TTWP bypass rules	1,505,600	1,449,700	1,221,300
Case 8	Permanent barrier operated for maximum water supply yield	1,574,800	1,515,500	1,326,700

that the uncontrolled runoff below Lake Steinhagen would be used to the maximum extent possible, had no dependable yield at all. The studies showed clearly that the extra releases required from the upstream reservoirs to hold the salt water wedge downstream from the LNVA and Beaumont intakes would have exhausted the available storage in Lakes Rayburn and Steinhagen some time in 1955 or 1956 (depending on the status of basin development), without even considering the water supply needs of the service area. The system simply would not be able to function during a severe drought period without salt water barriers of some type.

Yield Under Existing Conditions

Case 2, with present conditions, shows the performance of the existing reservoirs, using temporary salt water barriers in accordance with the recently issued Corps permit. The usable yield of the system as indicated by the computer simulation for this case is 799,700 acre-feet per year. Construction of the Eastex project would lower the yield to an estimated 765,700 acre-feet per year. The Rockland project, if operated on a priority basis, would lower the yield further to approximately 539,800 acre-feet per year.

The simulation for present conditions shows that, after allowing for the restrictions included in the recent Corps permit decision, the total Rayburn/Steinhagen/barrier system yield today is less than the 820,000 acre-feet per year originally granted by the State for the Rayburn/Steinhagen system standing alone. In effect, the computed yield of 799,700 acre-feet per year represents the aggregate firm yield that is available to the LNVA and the City of Beaumont combined under their existing water rights.

Impact of Rules Relating to Sam Rayburn Zones

Table 5.2 shows the approximate amounts of firm yield lost due to the various limitations found in the existing temporary barrier permit. The studies indicate that the duration of the waiting period before starting to install the temporary barriers and the requirement to remove the barriers after Sam Rayburn has been back in

Table 5.2

YIELD LOSSES ATTRIBUTABLE TO VARIOUS PERMIT REQUIREMENTS (Acre-Feet Per Year)			
	PRESENT CONDITIONS	WITH EASTEX	WITH EASTEX AND ROCKLAND
Requirement to remove barriers if Sam Rayburn returns to Zone 2 for 60 days	88,500	74,300	120,700
Required 30-day waiting period before starting to build barriers	114,800	103,800	108,200
Requirement to wait until Sam Rayburn enters Zone 3 before building barriers	378,200	361,300	287,400
All three of the above requirements combined	592,200	570,800	573,000

Zone 2 for as much as 60 days both will have a significant effect on the usable yield. Based on the studies for present-day conditions, the 60-day removal rule would result in a yield loss of about 88,500 acre-feet per year. Eliminating the requirement to wait 30 days before starting barrier construction when Sam Rayburn drops into Zone 3 would gain approximately 114,800 acre-feet per year of usable yield.

The yield of the system was found to be relatively sensitive to changes in details of operation. With regard to the information shown in Tables 5.1 and 5.2, the results will depend on the order in which the restrictions are assumed to come into play. Specifically, in examining the impact of the various factors it is assumed that the 60-day barrier removal rule after return to Zone 2 would be relaxed first and that shortening the length of the waiting period after the reservoir drops into Zone 3 would be the next change made. The requirement to wait until Sam Rayburn Reservoir falls into Zone 3 before installing the temporary barriers was

assumed to be the most basic of the restrictions, and it was the final one removed in the series of studies.

Under existing conditions, the total yield impact of these restrictions is approximately 592,200 acre-feet per year. Of that amount, 378,200 acre-feet per year are associated with the requirement to wait until Sam Rayburn Reservoir is in Zone 3 to install the salt water barriers. Additional losses of 114,800 acre-feet per year relate to the relatively long waiting period after Sam Rayburn enters Zone 3 before starting construction of the barriers. And some 88,500 acre-feet per year are associated with the requirement to remove the barriers if Sam Rayburn returns to Zone 2 for a period of 60 days. The individual amounts of these factors were found to vary somewhat if the Eastex and Rockland projects are assumed to be intercepting runoff upstream, but their collective impact would be almost the same regardless of whether those additional projects are considered.

Potential Yield Impact of a Permanent Barrier

The most dramatic impact on usable yield would be due to the proposed change from use of temporary barriers to a permanent structure. Most of the potential gain in yield would come from elimination of the requirement for a continuous flow of 2,500 cubic feet per second during the early years of drought periods (i.e., before Sam Rayburn Reservoir drops to Zone 3). Comparison of Case 2 and Case 8 shows that this change could approximately double the available

supply.

Operation for Maximum Water Supply

Case 6 and Case 8 show the yields that could be provided if the systems were operated for maximum water supply benefit. Case 6 shows performance with temporary barriers, and Case 8 is based on a permanent barrier structure. Under existing conditions, the yields of these two alternatives are indicated to be approximately 1.39 and 1.57 million acre-feet per year, respectively. Construction of the Eastex project would reduce these quantities to about 1.34 and 1.52 million acre-feet per year, respectively. Development of both Eastex and Rockland would further reduce them to around 1.11 and 1.33 million acre-feet per year.

6. LONG TERM OPERATION

Included in the scope of work is a 50-year simulation of the Rayburn/Steinhagen/barrier system to show the resulting range and distribution of water flowing into Sabine Lake under conditions of maximum use. This study was based on the scenario designated as Case 8 in the previous chapter, where it is assumed that a permanent salt water barrier is built and the system is operated for maximum water supply yield (i.e., with no requirement for minimum flows to pass the barrier) under present conditions of basin development. The monthly hydrologic events of the years 1941 through 1990 were used for the runoff and net evaporation data. The monthly printout of the analysis is in Appendix G.

Under those assumed conditions, the firm yield of the system is indicated to be approximately 1,574,800 acre-feet per year. Table 6.1 is a yearly summary of the basic parameters from the 50-year performance simulation, showing annual amounts of available runoff, net evaporative losses, water use, changes in storage and flows going downstream to Sabine Lake. The average available runoff was approximately 5,325,700 acre-feet per year. Of that quantity, net evaporative losses would account for some 107,000 acre-feet per year, or about two percent of the available runoff. The water use of 1,574,800 acre-feet per year would represent 30 percent of the basic flows. The water flowing downstream into Sabine Lake would average 3,646,600 acre-feet per year, or 68% of the runoff.

TABLE 6.1
SUMMARY OF 50 YEAR OPERATION RUN
 (Values in Acre-Feet)

Year	Inflow to Reservoirs	Total Inflow to System	Net Reservoir Evaporation	Supply from Uncontrolled Flow	Supply from Steinhagen Releases	Total Supply	Change in Reservoir Storage	Downstream Flow to Sabine Lake
1941	6,696,759	9,268,269	(77,944)	1,424,172	150,628	1,574,800	0	7,771,413
1942	3,771,233	5,658,787	101,237	1,369,741	205,059	1,574,800	0	3,982,750
1943	1,241,198	2,369,950	205,441	845,032	729,768	1,574,800	(408,827)	998,536
1944	7,093,597	8,877,009	(52,171)	1,074,213	500,587	1,574,800	408,827	6,945,553
1945	7,139,534	9,379,609	(11,938)	1,260,619	314,181	1,574,800	0	7,816,747
1946	8,404,185	11,677,230	(89,280)	1,412,650	162,150	1,574,800	0	10,191,710
1947	4,880,567	6,662,383	75,818	1,075,154	499,646	1,574,800	(247,385)	5,259,150
1948	2,583,375	3,321,233	98,406	769,718	805,082	1,574,800	(439,471)	2,087,498
1949	3,216,714	5,906,638	(69,706)	1,055,174	519,626	1,574,800	686,856	3,714,688
1950	5,366,768	8,534,708	(73,432)	1,100,957	473,843	1,574,800	(276,370)	7,309,710
1951	999,909	1,530,467	125,059	607,014	967,786	1,574,800	(526,296)	356,904
1952	1,921,065	2,862,047	101,589	806,746	768,054	1,574,800	142,432	1,043,226
1953	5,364,700	7,474,400	(61,178)	1,136,094	438,706	1,574,800	521,708	5,439,070
1954	1,110,300	1,624,629	249,991	688,099	886,701	1,574,800	(700,568)	500,406
1955	1,659,800	2,431,564	137,199	520,193	1,054,607	1,574,800	2,656	716,909
1956	802,000	1,292,236	160,206	345,496	1,229,304	1,574,800	(661,511)	218,741
1957	4,579,900	6,048,306	(61,326)	1,024,673	550,127	1,574,800	1,497,949	3,036,883
1958	4,257,470	5,588,438	37,374	1,038,343	536,457	1,574,800	0	3,976,264
1959	3,059,497	4,109,080	40,443	1,169,956	404,844	1,574,800	0	2,493,837
1960	4,093,941	5,405,957	9,421	791,015	783,785	1,574,800	0	3,821,736
1961	5,926,305	8,763,832	1,853	1,282,063	292,737	1,574,800	0	7,187,179
1962	3,028,101	3,832,039	113,590	1,042,260	532,540	1,574,800	(245,524)	2,389,173
1963	1,005,002	1,685,845	124,857	658,278	916,522	1,574,800	(545,401)	531,589
1964	1,243,269	2,149,876	139,697	777,477	797,323	1,574,800	(318,424)	753,803
1965	1,758,587	2,240,539	41,910	518,624	1,056,176	1,574,800	375,927	247,902
1966	3,413,633	4,774,368	120,591	852,510	722,290	1,574,800	343,169	2,735,808
1967	949,896	1,355,191	151,483	365,690	1,209,110	1,574,800	(446,684)	75,592
1968	5,263,763	6,408,785	54,301	1,392,438	182,362	1,574,800	836,937	3,942,747
1969	6,324,216	7,750,124	226,505	1,006,426	568,374	1,574,800	(483,087)	6,431,906
1970	1,827,757	2,474,967	115,784	867,264	707,536	1,574,800	(75,223)	859,606
1971	800,588	1,500,123	171,455	403,128	1,171,672	1,574,800	(675,442)	429,310
1972	1,790,715	3,211,433	97,525	829,130	745,670	1,574,800	322,903	1,216,205
1973	7,740,427	11,924,788	94,724	1,574,800	0	1,574,800	910,849	9,344,415
1974	5,048,048	7,770,709	137,669	1,111,028	463,772	1,574,800	0	6,058,240
1975	4,617,436	7,478,034	172,201	1,524,953	49,847	1,574,800	0	5,731,033
1976	2,744,247	4,211,657	173,864	1,301,647	273,153	1,574,800	0	2,462,993
1977	2,952,978	4,153,734	215,392	922,844	651,956	1,574,800	(531,014)	2,894,556
1978	1,590,855	2,902,835	208,884	526,287	1,048,513	1,574,800	(152,052)	1,171,203
1979	6,833,787	10,849,713	122,009	1,444,656	130,144	1,574,800	683,066	8,469,838
1980	3,743,821	5,432,311	242,623	851,770	723,030	1,574,800	(766,629)	4,381,517
1981	1,444,471	2,790,417	156,467	852,883	721,917	1,574,800	309,837	749,313
1982	3,504,875	4,858,689	143,409	918,100	656,700	1,574,800	456,792	2,683,688
1983	4,887,588	7,453,305	149,658	1,370,284	204,516	1,574,800	0	5,728,847
1984	3,169,682	5,020,013	186,691	1,010,282	564,518	1,574,800	(81,241)	3,339,763
1985	3,697,637	5,325,872	219,695	932,722	642,078	1,574,800	81,241	3,450,136
1986	4,241,514	6,580,007	149,699	1,275,167	299,633	1,574,800	0	4,855,508
1987	3,681,705	5,719,055	180,737	1,243,215	331,585	1,574,800	0	3,963,518
1988	2,045,802	2,978,091	236,963	603,369	971,431	1,574,800	(718,776)	1,885,104
1989	5,528,305	8,095,110	105,637	1,396,298	178,502	1,574,800	718,776	5,695,897
1990	5,091,813	6,672,673	250,251	1,060,507	514,293	1,574,800	(132,533)	4,980,155
Average	3,682,797	5,325,742	107,027	988,623	586,177	1,574,800	(2,651)	3,646,566
Minimum	800,588	1,292,236	(89,280)	345,496	0	1,574,800	(766,629)	75,592
Median	3,504,875	5,325,872	122,009	1,010,282	550,127	1,574,800	0	3,339,763
Maximum	8,404,185	11,924,788	250,251	1,574,800	1,229,304	1,574,800	1,497,949	10,191,710
Std. Dev.	2,046,163	2,837,932	95,498	317,308	317,308	0	470,640	2,690,641

7. NATURAL FLOW CHARACTERISTICS

Table 7.1 is a summary of the flow frequency characteristics of the Neches River at the Evadale gaging station under essentially natural conditions, without the influence of major man-made changes. The historical daily flows observed at Evadale during the 50 years from 1941 through 1990 were analyzed as described in Appendix B to remove the impacts of significant upstream regulation. The resulting values were then processed statistically to arrive at flows of various frequencies for each month of the year and also to determine the natural average, minimum and maximum flow rates.

The median rates, which are frequently used as the basis for instream flow rules and similar requirements, were indicated to range from a low of 614 cfs in September to a maximum of 7,619 cfs in March.

The Evadale station is the key hydrologic observation point in the lower Neches River Basin. It reflects runoff from approximately 80 percent of the total basin drainage area and has been in continuous operation for a long period of time. For computations intended to take into consideration the natural behavior of the river, the characteristics shown in Table 7.1 will be more appropriate than the actual flow records because of the degree of regulation introduced by large reservoir projects in the basin. In particular, actual flows recorded since the mid-1960's have been influenced by operation of Sam Rayburn Reservoir and are therefore in some respects materially different from the natural flow patterns of the river.

Table 7.1

ESTIMATED NATURAL FLOW STATISTICS AT THE EVADALE GAUGE 1941 - 1990 (Daily Values in cfs)												
	January	February	March	April	May	June	July	August	September	October	November	December
Minimum	128	87	790	318	590	200	24	10	30	1	73	122
10%	1311	2139	2295	1998	1504	807	379	252	187	205	268	869
25%	2390	3874	4020	3562	2896	1418	683	420	365	366	562	1320
50%	5945	7534	7619	6522	6867	3565	1276	690	614	667	1380	3057
75%	11307	13470	12825	12200	14100	8811	3289	1300	1258	1580	3482	8820
90%	21918	20688	18600	20778	23930	17000	6540	2651	2801	4448	9428	14535
Maximum	51151	56000	42817	126787	92100	47376	49683	13800	26068	25937	47100	38036
Average	8551	9796	9283	9386	10941	6730	2771	1230	1267	1740	3449	6014

8. HYDROELECTRIC POWER GENERATION

Even before Sam Rayburn Reservoir was completed, the LNVA recognized that a reasonable degree of agreement between the patterns of power generation and water supply needs would be necessary in order for the new federal reservoir to provide its expected yield benefits. The turbines at Sam Rayburn have a combined rated capacity of 52 megawatts. In 1989, turbines were also placed in service at Lake Steinhagen, with a total rated capacity of 6 megawatts. The peak flow rate through the turbines at Sam Rayburn is substantially more than the amount currently needed to meet the peak diversion requirements of the LNVA and Beaumont, plus the instream flow needed to keep salt water away from the intakes when salt water barriers are not in place. Only if the hydroelectric generation is matched to the water supply diversion schedule, with due allowance for runoff coming in downstream, can the yield of the system be used to full advantage.

In October of 1963, Freese, Nichols and Endress submitted a report to the Authority, entitled *Water Supply Rule Curves for McGee Bend Reservoir* (8). (McGee Bend was the original name of the Sam Rayburn project.) That study pointed out the need for the power releases to be consistent with the water supply needs during drought years. It proposed a set of rule curves, defining the monthly reservoir levels at Sam Rayburn below which the power releases should not be more than the

downstream requirements. It was noted that different rule curves would be associated with various levels of annual water demand, and curves were derived for the future demands projected at five-year intervals from 1965 through 1980. The essential guideline was that the power generation releases should not cause Lake Steinhagen to spill excessively in times of critical drought, since such spills could represent losses of water which might be needed later to meet downstream needs.

The Corps' operating records for Sam Rayburn Reservoir over the last ten years (1984 through 1993) show that the water level has been in Zone 2 for an entire month during eight of the ten years but has dropped into Zones 3 and 4 on only one occasion during that period (9). Table 8.1 is a summary of conditions during months when Sam Rayburn was continually in Zone 2 or lower during those years. The most serious depletion of the Sam Rayburn power pool storage was in 1988-1989, when it reached a minimum level of elevation 151.15, or 2.15 feet above the bottom of the power pool. Figure 8.1 is a graph of the lake level at Sam Rayburn during the latter part of 1988 and early 1989, showing the greatest degree of drawdown experienced since 1984. Table 8.2 is a more detailed listing of conditions at the reservoirs during the complete drought period of 1988-1989.

Examination of the Corps' records, as reflected in Table 8.1, suggests that releases from Lake Steinhagen generally have not tended to be more than the required flows to hold the salt wedge downstream from the mouth of Pine Island

Table 8.1

Summary of Conditions at Sam Rayburn Reservoir and Lake B.A. Steinhagen
 During Months when Sam Rayburn Was Continuously in Zone 2 or Lower: 1984-1993

Month/Year	Sam Rayburn Levels		Sam Rayburn Reservoir Releases (Ac-Ft)	Lowest Zone Reached at Sam Rayburn Reservoir	Maximum Lake Elev. at Lake B.A. Steinhagen	Lake Steinhagen Releases (Ac-Ft)
	Maximum Elev.	Minimum Elev.				
Aug 1984	161.01	159.40	148,344	Zone 2	83.23	160,980
Sep 1984	159.32	157.91	116,934	Zone 2	82.48	143,722
Oct 1984	158.69	157.00	93,336	Zone 2	83.30	221,714
Nov 1984	160.08	158.80	5,062	Zone 2	83.65	183,336
Dec 1984	161.34	160.05	0	Zone 2	82.29	111,219
Jun 1985	164.45	162.87	150,889	Zone 2	82.77	162,034
Jul 1985	162.76	161.34	156,698	Zone 2	83.09	175,811
Aug 1985	161.22	159.19	171,665	Zone 2	83.08	164,830
Sep 1985	159.11	157.44	140,751	Zone 2	83.43	141,439
Oct 1985	157.90	156.78	118,961	Zone 2	83.52	184,812
Nov 1985	160.27	157.95	37,240	Zone 2	83.32	195,600
Sep 1987	161.55	160.41	138,534	Zone 2	83.36	178,766
Oct 1987	160.31	158.40	163,970	Zone 2	82.65	172,598
Nov 1987	159.76	157.48	79,002	Zone 2	83.05	225,812
Jul 1988	161.13	159.33	163,696	Zone 2	82.71	207,427
Aug 1988	159.44	157.62	170,580	Zone 2	82.89	198,649
Sep 1988	157.54	155.46	158,059	Zone 2	82.52	185,986
Oct 1988	155.42	153.50	144,547	Zone 2	82.55	169,390
Nov 1988	153.43	151.72	130,328	Zone 3	82.13	161,209
Dec 1988	151.66	151.25	103,866	Zone 4	82.47	169,632
Jan 1989	155.17	151.15	46,352	Zone 4	83.12	223,464
Feb 1989	159.21	155.42	0	Zone 3	82.77	273,521
Mar 1989	161.58	159.26	35,564	Zone 2	82.96	262,350
Nov 1989	161.67	160.41	127,222	Zone 2	82.51	171,761
Dec 1989	160.35	158.76	149,383	Zone 2	83.04	203,928

Continued on the next page....

Table 8.1, Continued

Month/Year	Sam Rayburn Levels		Sam Rayburn Reservoir Releases (Ac-Ft)	Lowest Zone Reached at Sam Rayburn Reservoir	Maximum Lake Elev. at Lake B.A. Steinhagen	Lake Steinhagen Releases (Ac-Ft)
	Maximum Elev.	Minimum Elev.				
Sep 1990	161.29	159.64	150,411	Zone 2	82.40	176,348
Oct 1990	159.60	158.58	104,672	Zone 2	82.57	151,317
Nov 1990	159.22	158.54	45,630	Zone 2	82.66	141,780
Dec 1990	160.08	159.18	35,939	Zone 2	82.59	182,215
Aug 1992	161.82	160.15	157,793	Zone 2	82.33	191,395
Sep 1992	160.05	158.72	122,741	Zone 2	82.65	172,147
Oct 1992	158.62	156.78	162,758	Zone 2	82.76	176,519
Nov 1992	156.88	156.02	102,329	Zone 2	82.40	168,887
Dec 1992	159.16	156.00	42,478	Zone 2	82.97	299,812
Sep 1993	161.90	159.96	164,396	Zone 2	82.66	196,570
Oct 1993	159.90	159.14	112,456	Zone 2	82.64	179,902
Nov 1993	159.06	158.54	91,190	Zone 2	82.88	159,637
Dec 1993	159.92	158.70	44,019	Zone 2	83.08	154,732

Notes:

- a. There were no releases from Say Rayburn Reservoir other than through the turbines in the months shown.
- b. Turbines went on line at Lake Steinhagen in October of 1989. After that date, the releases from Steinhagen were predominantly through the turbines.
- c. The top of conservation storage in Lake Steinhagen is at elevation 83.0
- d. The top of conservation storage in Sam Rayburn Reservoir is at elevation 164.4.

SAM RAYBURN WATER SURFACE ELEVATION FROM MAY 1988 - APRIL 1989

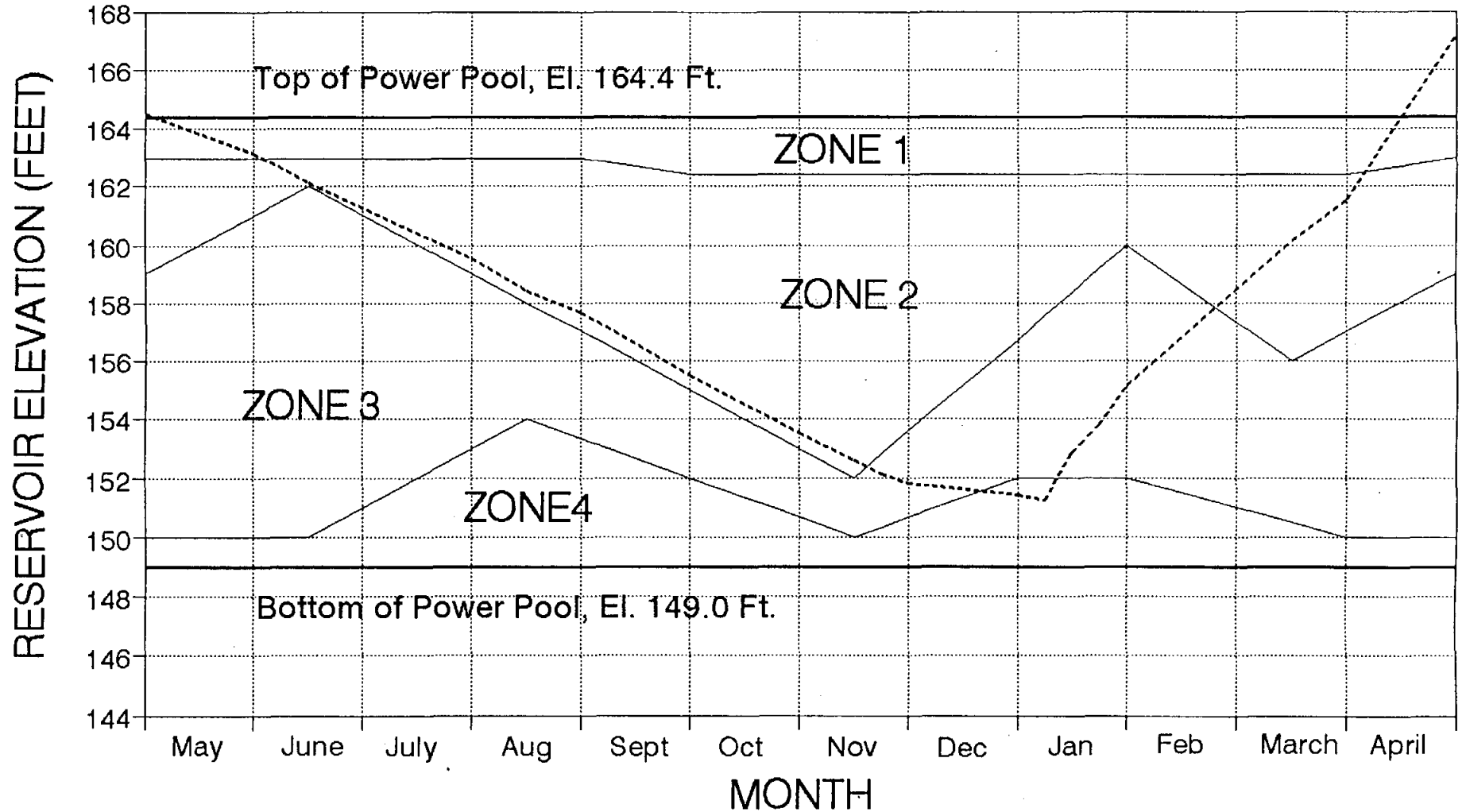


FIGURE 8.1

----- Water Surf. Elev.

Table 8.2

Comparison of Releases from Sam Rayburn Reservoir and Lake Steinhagen

With the Potential Flow Requirements for Salt Water Control and Diversions Under Terms of the

Current Corps Permit: Drought of May 1988 - January 1989

(Acre-Feet)

Month/Year	Salt Water Control Requirements	Diversion Requirements	Total Requirements	Town Bluff Gage Flow	Usable Flow from Below Steinhagen	Releases Plus Natural Flow	Releases Lost
May 7-31,1988	136,400	87,900	224,300	146,678	22,916	169,594	0
June 1988	163,600	115,300	278,900	200,000	21,721	221,721	0
July 1988	169,100	112,100	281,200	204,000	21,775	225,775	0
August 1988	169,100	68,700	237,800	195,000	18,030	213,030	0
Sept. 1988	163,600	53,700	217,300	186,500	11,690	198,190	0
October 1988	169,100	45,800	214,900	175,300	10,754	180,482	0
Nov. 1988	163,600	37,200	200,800	169,300	11,182	180,482	0
Dec. 1988	169,100	34,700	203,800	177,200	38,119	215,319	11,519
Jan. 1-11,1989	60,000	12,600	72,600	61,686	15,769	77,455	4,855

Notes:

- a. Requirements for salt water control are based on a flow rate of 2,750 cfs.
- b. Diversion requirements are based of Case 2, as described in Chapter 5.
- c. Sufficient regulation capability is assumed available for adjustments to match the historical Town Bluff flows to the total potential diversion requirements plus the salt water control flows as necessary.

Bayou when Sam Rayburn Reservoir has been in Zone 2 or lower but that there are occasional months when the releases substantially exceed the needed salt water control flows. These records also indicate that the matching of the power releases with flows originating below Lake Steinhagen probably has not been given very close attention in the last ten years.

More detailed examination of flow records from the drought of 1988-1989 (Table 8.2) shows that there were only minimal releases in excess of the potential firm yield at that time, with due allowance given to the instream flows needed for salt water control. Overall, the records seem to show some room for more careful coordination of hydroelectric releases and diversion requirements but do not reflect any serious problem in this regard.

This issue will merit further review if and when serious consideration is given to construction of a permanent barrier. Because one of the permanent barrier's primary benefits would be elimination of the need for high releases from Lake Steinhagen to keep salt water away from the intakes, the level of Sam Rayburn power generation that could cause unwanted spills at Steinhagen would at times be lower with a permanent barrier than it is under existing conditions. The gain in yield due to building a permanent barrier would depend in part on the pattern of power releases from Sam Rayburn Reservoir and Lake Steinhagen during dry periods. There is no present indication that effective coordination of the power

generation releases and the water supply requirements could not be maintained, but the matter should receive further attention if the permanent barrier becomes a serious prospect.

Economic evaluations during planning for the Sam Rayburn hydroelectric units indicated that the value of those generating facilities is predominantly in their firm capacity for peaking purposes, as opposed to the value per KWH of energy generated (10). Thus, there is a shared benefit to both the power function and the water supply function in protecting the firm yield of the system, and the interests of the power users agree with the interests of the water users in that regard.

In reviewing the power releases and other records, a couple of points were noted which should be mentioned here. First, the behavior of Sam Rayburn Reservoir in the 1988-89 drawdown period was such as to allow virtually no benefit from the temporary salt water barriers under the existing rules. The lake level went down rapidly, beginning with a full power pool on May 6 and reaching a minimum point 13.25 feet lower some eight months and five days later. The trace of the lake elevation versus time (see Figure 8.1) remained barely above the bottom limit of Zone 2 throughout most of that period, finally entering Zone 3 on or about November 18, 1989. (In the actual event, the barrier on Pine Island Bayou was closed on January 15, 1989, and was washed out five days later, before the barrier on the Neches River could be completed.) In this particular case, the set rules of

the barrier permit would have left no option except to use most of the available storage for holding the salt water wedge downstream from the diversion intakes. Fortunately, the drought was relatively short and ended in January of 1989. A second year of low flows on top of the initial period could have posed a very severe problem if such conditions had occurred.

Second, the installation of turbines at Lake Steinhagen in 1989 set up a duality of purpose for that reservoir which makes it more difficult to achieve its original purpose of flow regulation for support of downstream use. The records show that Lake Steinhagen is now seldom less than a foot below the top of conservation storage when Sam Rayburn is in Zone 2 or lower. This is consistent with keeping a high power head and maximizing power output at Steinhagen, but it leaves little available storage capacity for temporarily holding the releases from Sam Rayburn when they cannot be used immediately to meet downstream requirements. This is not a difficult problem as long as the water supply requirements are significantly less than the firm yield, but it will become more noticeable as the diversion needs increase.

9. **SUMMARY OF FINDINGS**

- a. Considered as a stand-alone water supply system, without allowance for the flow needed for salt water control, Sam Rayburn Reservoir and Lake B. A. Steinhagen are indicated to have a firm yield of approximately 1.32 million acre-feet per year under present conditions. Construction of the proposed Eastex Reservoir upstream would reduce that amount to approximately 1.26 million acre-feet per year. If both the Eastex project and the proposed Rockland Reservoir were built and operated on a priority basis, the Rayburn/Steinhagen system yield is indicated to be approximately .99 million acre-feet per year. The above values are slightly conservative because they do not reflect the moderate increases in return flow that have taken place since the critical drought of the 1950's.
- b. In actual operation, the usable yield produced by the Rayburn/Steinhagen system can be increased significantly by diversions of uncontrolled runoff originating below Lake Steinhagen. On the other hand, part of the usable yield is lost due to the need to maintain enough flow in the river to keep salt water away from the water supply intakes.
- c. For the water supply of the lower Neches River area (i.e., the water furnished by the LNVA and the City of Beaumont) to be reliable, some type of salt water barrier(s) must be installed in times of severe drought. Without such

barriers, the extra releases required to hold the salt water away from the intakes would be more than the system could provide, and the reservoir storage would be emptied part way through the drought. There would be no firm yield available at all under those conditions.

- d. Depending on the type of salt water barriers used and on the nature of restrictions imposed on their installation and operation, the net available yield of the system when all factors are considered may be more or less than the stand-alone yields listed above. Table 5.1 (page 5.3) shows the yields over a full range of possible conditions. The key yields under current conditions are also shown in Table 9.1.

Table 9.1

SUMMARY OF KEY YIELD ESTIMATES FOR THE RAYBURN/STEINHAGEN/BARRIER SYSTEM (Acre-Foot Per Year)			
		PRESENT CONDITIONS	WITH EASTEX
Case 2	Temporary salt water barriers with the existing Corps permit	799,700	765,700
Case 6	Temporary barriers operated for maximum water supply yield	1,391,900	1,336,500
Case 7	Permanent salt water barrier with proposed TTWP instream flow rules	1,505,600	1,449,700
Case 8	Permanent barrier operated for maximum water supply yield	1,574,800	1,515,500

- e. Using temporary salt water barriers under terms of the current Corps of Engineers permit, the present firm usable yield is estimated to be approximately 799,700 acre-feet per year. This would be reduced to 765,700 acre-feet per year if Eastex Reservoir is built.
- f. The yield with temporary barriers could be materially greater if the restrictions of the Corps permit were less stringent. The usable yield of the system based on temporary barriers under current conditions, if operated for maximum water supply benefit, is estimated at approximately 1.39 million acre-feet per year.
- g. Table 5.2 (page 5.5) summarizes the yield impacts of the principal limitations built into the existing Corps permit. The key values are reflected in Table 9.2.
- h. The usable yield with a permanent salt water barrier structure, operated for maximum water supply benefit, is estimated to be approximately 1.57 million acre-feet per year under existing conditions of basin development. Construction of the Eastex project would reduce that amount to 1.52 million acre-feet per year.
- i. Table 6.1 (page 6.2) summarizes the simulated operation of the system with a permanent barrier, based on the sequence of hydrologic events experienced during the years 1941-1990.

Table 9.2

SUMMARY OF ESTIMATED LOSSES OF FIRM YIELD ATTRIBUTABLE TO VARIOUS PERMIT REQUIREMENTS UNDER PRESENT CONDITIONS (Acre-Feet Per Year)	
Requirement to remove the temporary salt water barriers if Sam Rayburn Reservoir returns to Zone 2 for 60 days.	88,500
Requirement to wait 30 days after Sam Rayburn Reservoir enters Zone 3 before starting to install the temporary salt water barriers.	114,800
Requirement to wait until Sam Rayburn Reservoir enters Zone 3 before installing the temporary salt water barriers.	378,200
All three of the above requirements combined.	592,200

- j. Table 7.1 (page 7.2) is a summary of the natural flow frequency characteristics of the Neches River at the Evadale gaging station after adjustments to remove the effects of man-made projects upstream.
- k. Hydroelectric releases from Sam Rayburn Reservoir have tended generally to be consistent with downstream conditions and with the water supply requirements during the last ten years of operation. There is no indication from the records that there would be any material loss of firm yield due to excessive power generation. This item should be re-examined in further detail if the proposed permanent salt water barrier is found to be economically feasible and placed under consideration for definite development, since the

regime of downstream requirements would be altered by elimination of the need for the present relatively high salt water control flows if a permanent barrier is built. It will be important to re-examine this factor if a permanent barrier structure is determined to be a serious prospect.

APPENDIX A

LIST OF REFERENCES

APPENDIX A

LIST OF REFERENCES

- (1) U. S. Geological Survey: *Water Resource Data, Texas*, published annually at Austin, Texas. Prior to 1960, these records were published as *USGS Water-Supply Papers*.
- (2) U. S. National Weather Service: *Climatological Data, Texas*, published monthly at Asheville, North Carolina.
- (3) Texas A&M University and Texas Agricultural Experiment Station: *Meteorological Data/Texas*, published monthly at College Station, Texas.
- (4) Freese and Nichols, Inc.: *Report on the Impact of the Proposed Permanent Salt Water Barrier on Water Supply Yield*, prepared for the Lower Neches Valley Authority, 1987.
- (5) Lower Neches Valley Authority: "Statement of Lower Neches Valley Authority with Reference to Salt Water Barrier on Neches River below Mouth of Pine Island Bayou," submitted at a public hearing called by the District Engineer, Galveston District, Corps of Engineers, Beaumont, Texas, November 14, 1961.
- (6) U.S. Army Corps of Engineers, Galveston District, "Permit Application 19611 Environmental Assessment and Statement of Findings," Galveston, Texas, March 16, 1994.
- (7) Lower Neches Valley Authority: "Statement of the Lower Neches Valley Authority with Reference to the Application for a Permit to Install Temporary Salt Water Barriers on the Neches River and Pine Island Bayou," submitted at a public hearing called by the District Engineer, Galveston District, U.S. Army Corps of Engineers, Lumberton, Texas, January 21, 1993.
- (8) Freese, Nichols and Endress: *Water Supply Rule Curves for McGee Bend Reservoir*, prepared for the Lower Neches Valley Authority, October 1963.
- (9) U.S. Army Corps of Engineers, Fort Worth District: daily operating records for Sam Rayburn Reservoir and Lake B.A. Steinhagen.
- (10) U.S. Army Corps of Engineers, Fort Worth District: *McGee Bend Reservoir Design Memorandum Number 8, "Hydroelectric Power,"* July 1959.

APPENDIX B
HYDROLOGIC DATA

APPENDIX B

HYDROLOGIC DATA

This appendix summarizes the runoff, evaporation, and area/capacity data which were derived for use in the reservoir operation studies. U. S. Geological Survey stream gage information was used as the main source of data. The U.S.G.S. records were supplemented by computed estimates of historical spills and evaporative losses at existing reservoirs. Reservoir operation calculations were made for the critical period (a) for the present conditions, (b) for conditions with Eastex Reservoir in place upstream, and (c) for Eastex and Rockland Reservoirs in place and capturing all inflows during the critical period. The data was organized so that the flows with and without the proposed upstream reservoirs could be calculated by the reservoir operation computer program. For existing conditions of basin development, the data were also extended to cover the 50-year period from 1941 through 1990.

Intervening Flow Into Lake B. A. Steinhagen - Critical Drought Years 1953-1957

The intervening flows into Lake B. A. Steinhagen during the critical period (i.e., flows originating below the proposed Rockland Reservoir site and Sam Rayburn Reservoir) were calculated using the total historical flows minus the estimated flows coming from above the Rockland and Rayburn dam sites. The historical inflow for the drought years was calculated from a mass balance determination, using the change in reservoir contents, the calculated evaporation, and releases and/or spills

as determined from flows at the Town Bluff gage.

The intervening flow into Steinhagen was then calculated based on drainage area ratios, as follows:

- a. The drainage area between Lake Steinhagen, Sam Rayburn Reservoir and the Rockland gage is 488 square miles. The area between Lake Steinhagen, the Zavalla gage and the Rockland gage is 1,045 square miles. The runoff contributed by the area below Sam Rayburn and below the Rockland gage was calculated as the difference between the historical inflows at Steinhagen and the sum of the observed flows at the Zavalla and Rockland gages, all multiplied by the ratio of $488/1,045 = 0.467$.
- b. To this was added the estimated contribution of the area (79 square miles) between the Rockland gage and the Rockland dam site. That amount was calculated as the difference between the observed flows at the Rockland and Diboll gages multiplied by the ratio $79/912 = .087$. (The drainage area between the Rockland and Diboll gages is 912 square miles.)

The results are summarized in Table B-1.

Flow Into Rockland Reservoir - Critical Drought Years 1953-1957

The inflow to Rockland Reservoir during the critical period was calculated as follows:

- a. The total runoff above the Rockland Dam site was based on the observed flows at the Rockland gage (drainage area = 3,636 square miles) minus the estimated contribution from the area between the Rockland gage and the Rockland dam site (79 square miles). Using a drainage area ratio, the adjustment for the area below the dam site was calculated as the difference between the flows observed at the Rockland and Diboll gages multiplied by $79/912 = .087$ (The drainage area between the Rockland and Diboll gages is 912 square miles.)
- b. It was determined that Lake Palestine could have impounded all its inflows during the critical period, so the historical Rockland Reservoir runoff was

reduced by the estimated Lake Palestine flows. Lake Palestine has a drainage area of 839 square miles, and the gaging station on the Neches River near Neches has a drainage area of 1,145 square miles. The historical runoff from the drainage area above Lake Palestine was calculated as the recorded flows at the Neches gage multiplied by $839/1,145 = .733$.

- c. Similarly, the historical flows at the Rockland site were reduced by the estimated amounts that could be captured by Lake Jacksonville, which were calculated as the difference between recorded flows at the Alto and Neches gages multiplied by $34/800 = .043$. (The drainage area above Lake Jacksonville is 34 square miles, and the area between the Alto and Neches gages is 800 square miles.)
- d. When these operations are combined and expressed in their simplest form, the overall computation is equivalent to

.913 x Rockland gage records -
.690 x Neches gage records +
.087 x Diboll gage records -
.043 x Alto gage records.

The results are summarized in Table B-2

Flow Into Lake Steinhagen - 1941-1990

- a. Net runoff into Lake Steinhagen under current basin development conditions and based on the period 1941-1990 was calculated in the following manner:

1/1941-4/1951: Observed flows at the Rockland gage were multiplied by the drainage area ratio $3,251/3,636 = .894$. (The area above Lake Steinhagen but below the Sam Rayburn, Lake Palestine, and Lake Jacksonville projects is 3,251 square miles, and the area above the Rockland gage is 3,636 square miles).

5/1951-12/1952: The historical inflows to Lake Steinhagen as estimated by the Corps of Engineers were adjusted by subtracting the effective rainfall on the lake surface, and the adjusted flows were then multiplied by the drainage

area ratio $3,251/7,573 = .429$. (The gross drainage area above Lake Steinhagen is 7,573 square miles.)

- 1/1953-12/1957: The monthly runoff quantities in Tables B-1 and B-2 were combined.
- 1/1958-4/1962: The same procedure was used as for the period 5/1951-12/1952 except that the factor was changed to $3,251/7,539 = .431$, to reflect the presence of Lake Jacksonville upstream.
- 5/1962-2/1965: The same procedure was retained, but the factor was changed to reflect the historical presence of Lake Palestine upstream. During months when Lake Palestine was less than full, the factor used was $3,251/6,700 = .485$. When Lake Palestine (and Lake Jacksonville) were full, the factor used was .429.
- 3/1965-12/1990: The same procedure was followed, with an added adjustment to remove any releases coming from above Lake Sam Rayburn. For these computations, the drainage area ratio was unity when Lake Palestine was less than full. If Lake Palestine was full, the factor was $3,251/4,124 = .788$.

- b. To all of the above monthly values were added the computed spills from Lake Palestine when operating at a demand equal to its firm yield.

The resulting monthly runoff quantities are summarized in Table B-3.

Flow Into Sam Rayburn Reservoir - Drought Years 1953-1957

The inflow to Sam Rayburn Reservoir during the critical period was calculated as follows:

- a. The historical flow at the Sam Rayburn site was based on the observed flow at the gaging station near Zavalla plus the estimated intervening runoff between the Zavalla gage and the damsite. The intervening inflow between

the gage and the damsite was based on the estimated total flow from the area between the Rockland gage, the Zavalla gage and Lake Steinhagen (see above) multiplied by the drainage area ratio $557/1,045 = .533$. (The area between Sam Rayburn Reservoir and the Zavalla gage is 557 square miles. The area between the Rockland gage, the Zavalla gage and Lake Steinhagen is 1,045 square miles.)

- b. When those operations are reduced to their simplest form, the computation is equivalent to

.467 x Zavalla gage records -
.533 x Rockland gage records +
.533 x historical Lake Steinhagen inflows.

- c. The inflows were then adjusted to reflect the impacts (inflows less spills) of upstream lakes built after 1957 - Lake Tyler East, Striker Creek Reservoir, Lake Nacogdoches and Lake Pinkston.
- d. The inflows were then further reduced to reflect diversions of 1,592 acre-feet per month into Lake Kurth. The resulting values are included in Table B-4.
- e. The monthly runoff was then adjusted to remove the Eastex Reservoir inflows.

The results are in Table B-5.

Flow Into Sam Rayburn Reservoir - 1941-1952 and 1958-1990

The inflow to Sam Rayburn Reservoir under existing conditions for the remainder of the 50-year period 1941-1990 was calculated as follows:

- a. The flows from the 3,060 square miles of now uncontrolled drainage above Sam Rayburn were calculated as follows:

1/1941-3/1951: Observed flows at the gage near Horger (3,485 square miles) were multiplied by the drainage area factor $3,060/3,485 = .878$.

- 4/1951-12/1952: Observed flows at the Lufkin gage (1,600 square miles) were multiplied by the factor $3,060/1,600 = 1.913$.
- 1/1958-1/1965: Observed flows at the Zavalla gage (2,892 square miles) were multiplied by $3,060/2,892 = 1.058$.
- 2/1965-12/1990: Inflow to Sam Rayburn as calculated by the Corps of Engineers was adjusted to remove the effective rainfall on the lake surface.

- b. The calculated values were adjusted by adding the estimated spills from major upstream lakes when operating at maximum yield rates.
- c. The monthly values through 1952 were then reduced by subtracting 1,592 acre-feet per month to allow for diversions to Lake Kurth where not already reflected by the historical records.

The final results are summarized in Table B-4.

Flow Into Lake Palestine

The inflow into Lake Palestine was calculated to be:

- 1/1941-4/1962: The Neches River flow at the Neches gage times 0.714.
- 5/1962-12/1978: The Neches River flow at the Alto gage minus the Neches River flow at the Neches gage all times 1.067.
- 1/1979-9/1985: The Neches River flow at the Diboll gage minus the Neches River flow at the Neches gage all times 0.529.
- 10/1985-12/1990: The Neches River flow at the Rockland gage minus Neches River flow at the Neches gage all times 0.333.

The inflows for the reservoir for the 1941-1990 time period are presented in Table B-6.

Flow Into Striker Creek Reservoir

The inflow data calculated in a 1986 Striker Creek Reservoir study was used through 1985. The data were extended through 1990. The calculations were performed by using the following:

- 1/1941-9/1949: The Striker Creek flow at the Summerfield gage times 1.203.
- 10/1949-11/1966: Mud Creek flow at the Jacksonville gage times 0.634 when Lake Tyler was full and times 0.721 when less than full.
- 12/1966-9/1979: Mud Creek flow at the Jacksonville gage times 0.634 when Lake Tyler and Lake Tyler east were full and times 0.867 when less than full.
- 10/1979-9/1989: The East Fork of the Angelina at the Cushing gage times 1.464.
- 10/1989-12/1990: Lake Palestine inflow times 0.416.

The inflows for Striker Creek Reservoir for 1941-1990 are shown in Table B-7.

Reservoir Evaporation

Net reservoir evaporation data used in the reservoir operation calculations were calculated from Texas Water Development Board Report 64, "Monthly Evaporation Data for Texas, 1940 through 1965," and from data in the Texas Water Oriented Data Bank. The same net evaporation rates were used for B. A.

Steinhagen Reservoir and Sam Rayburn Reservoir. These are shown in Table B-8.

Net evaporation as calculated for Lake Palestine and Striker Creek Reservoir is shown in Tables B-9 and B-10.

Reservoir Area - Capacity - Elevation

The areas, capacities, and elevations for B. A. Steinhagen Reservoir, Sam Rayburn Reservoir, Lake Palestine, and Striker Creek Reservoir are listed in Tables B-11 through B-16.

Daily Flow at Evadale

The recorded daily flows at the USGS gaging station on the Neches River at Evadale during the 50-year period from 1941 through 1990 were adjusted to remove the impacts of man-made impoundments upstream. Until early in 1951, when Lake Steinhagen first went into operation, man-made influences were relatively minor, and the observed Evadale flows were taken as recorded. Beginning with April of 1951, the USGS records at the Town Bluff gage were modified by use of records from existing gaging stations on the Neches and Angelina Rivers (see Table B-17 for a summary of the gaging stations) to estimate what would have been the flows at Town Bluff without significant upstream development. Separate estimates were made of the contributions from (a) the Neches River and its tributaries and (b) the Angelina River and its tributaries, and those two amounts were combined to arrive

at the adjusted flows for Town Bluff. The recorded intervening flows between Town Bluff and Evadale were then added to the modified Town Bluff flows to arrive at the estimated state-of-nature flows at Evadale, allowing for a travel time of 2 days.

The calculation methodology for the Neches River portion of the basin (approximately 3,913 square miles) was as follows:

- 4/1951-1/1962: Observed flows at the Neches River gage near Rockland were multiplied by the drainage area ratio $3,913/3,636 = 1.076$, with allowance for a travel time of 1 day from the Rockland gage to Town Bluff.
- 2/1962-12/1990: Observed flows at the Neches River near Rockland were multiplied by the drainage area ratio $3,913/3,636 = 1.076$ when Lake Palestine (and Lake Jacksonville) were full and by the drainage area ratio $3,913/2,763 = 1.416$ when Lake Palestine (and Lake Jacksonville) were less than full. Lake Palestine travel time is 6 days to the Rockland gage. Travel time from the Rockland gage is 1 day to Town Bluff.

The calculation methodology for the Angelina river portion of the basin (approximately 3,660 square miles) was as follows:

- 4/1951-9/1951: Observed flows at the Angelina River gage near Lufkin were multiplied by the drainage area ratio $3,660/1,600 = 2.288$, with a travel time allowance of 4 days to Town Bluff.
- 10/1951-5/1957: Observed flows at the Angelina River gage near Zavalla were multiplied by the drainage area ratio $3,660/2,892 = 1.266$, with a travel time allowance of 2 days to Town Bluff.
- 6/1957-1/1965: Observed flows at the Angelina River gage near Zavalla were multiplied by the drainage area ratio

$3,660/2,892 = 1.266$ when Lake Striker and Lake Tyler were full and by the drainage area ratio $3,660/2,665 = 1.373$ when Lake Striker and Lake Tyler were less than full, with a travel time allowance of 2 days to Town Bluff.

2/1965-10/1966: Observed flows at the Angelina River gage near Lufkin were multiplied by the drainage area ratio $3,660/1,600 = 2.288$ when Lake Striker and Lake Tyler were full and by the drainage area ratio $3,660/1,373 = 2.666$ when Lake Striker and Lake Tyler were less than full, with a travel time allowance of 4 days to Town Bluff.

11/1966-6/1976: Observed flows at the Angelina River gage near Lufkin were multiplied by the drainage area ratio $3,660/1,600 = 2.288$ when Lake Striker, Lake Tyler and Lake Tyler East were full and by the drainage area ratio $3,660/1,311 = 2.792$ when Lake Striker, Lake Tyler and Lake Tyler East) were less than full, with a travel time allowance of 4 days to Town Bluff.

7/1976-9/1979: Observed flows at the Angelina River gage near Lufkin were multiplied by the drainage area ratio $3,660/1,600 = 2.288$ when Lake Striker, Lake Tyler, Lake Tyler East and Lake Nacogdoches were full and by the drainage area ratio $3,660/1,222 = 2.995$ when Lake Striker, Lake Tyler, Lake Tyler East, and Lake Nacogdoches were less than full with a travel time allowance of 4 days to Town Bluff.

10/1979-12/1990: Observed flows at the Angelina River gage near Alto were multiplied by the drainage area ratio $3,660/1,276 = 2.868$ when Lake Striker, Lake Tyler, and Lake Tyler East were full and by the drainage area ratio $3,660/987 = 3.708$ when Lake Striker, Lake Tyler, and Lake Tyler East were less than full, with a travel time allowance of 5 days to Town Bluff.

Table B-1

BAS_TAB2.WQ1

INTERVENING FLOW INTO B. A. STEINHAGEN RESERVOIR

Below Rockland and Rayburn Reservoirs

Units: ac-ft

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1953	47,000	66,000	56,200	80,500	354,600	91,600	26,900	18,200	6,800	4,100	5,900	16,900	774,700
1954	26,400	7,400	4,000	34,100	56,000	15,900	900	2,600	3,400	3,900	4,600	3,800	163,000
1955	16,200	44,900	6,700	67,500	5,900	10,100	6,200	8,300	2,300	900	1,500	4,900	175,400
1956	8,500	37,200	11,600	14,300	0	1,400	2,000	1,200	2,600	2,200	2,700	5,900	89,600
1957	5,300	5,600	36,000	13,400	157,300	12,200	8,700	4,300	8,200	0	33,700	110,300	395,000

Table B-2

ROC_TAB1.WQ1

FLOW INTO PROPOSED ROCKLAND RESERVOIR

Units: ac-ft

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1953	50,100	94,900	188,400	156,900	873,100	177,800	32,800	10,300	7,600	1,900	3,500	40,200	1,637,500
1954	54,900	34,900	23,300	35,900	97,700	54,600	2,900	1,300	400	0	0	21,700	327,600
1955	36,700	129,500	55,500	241,400	66,800	54,600	6,200	8,900	1,700	5,400	1,000	3,900	611,600
1956	6,300	52,300	26,300	62,800	33,100	13,200	2,300	500	100	0	500	1,700	199,100
1957	3,000	5,900	46,100	0	654,800	125,700	34,300	16,400	5,200	119,100	357,800	249,400	1,617,700

Table B-3

B. A. STEINHAGEN RESERVOIR INFLOW - PRESENT CONDITIONS

Units: ac-ft

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1941	518,492	305,894	483,459	218,645	265,857	373,841	197,808	20,855	39,787	98,766	446,072	187,341	3,156,817
1942	152,320	150,457	190,250	473,066	372,979	233,853	73,897	75,682	47,888	16,862	28,879	37,452	1,853,585
1943	180,461	67,231	59,784	66,150	82,451	148,749	35,908	15,239	3,057	14,640	30,927	35,197	739,794
1944	212,609	386,400	481,934	285,387	1,533,175	275,972	20,794	7,265	34,349	7,661	36,030	244,723	3,526,299
1945	648,625	396,818	564,692	1,268,160	198,058	62,975	133,621	59,378	14,971	103,806	74,712	133,289	3,659,105
1946	504,013	781,994	568,694	342,510	492,812	510,613	104,689	23,066	75,948	53,206	656,929	367,647	4,482,121
1947	650,473	225,190	537,667	307,104	357,267	189,859	42,225	8,978	7,636	7,611	22,850	82,056	2,438,916
1948	95,364	325,702	300,863	190,339	166,145	69,703	15,987	3,673	3,181	2,066	14,572	20,566	1,208,161
1949	102,714	177,039	292,316	232,115	125,301	43,566	12,006	14,783	11,498	125,785	80,373	186,000	1,403,496
1950	456,499	619,369	299,997	121,313	371,238	464,678	35,253	12,400	10,050	10,267	10,463	16,885	2,428,412
1951	26,589	41,660	84,572	88,108	56,021	23,656	11,972	7,584	11,888	8,758	10,884	31,923	403,615
1952	35,299	108,225	193,101	192,905	259,354	86,109	14,837	1,376	5,378	3,254	8,580	38,210	946,628
1953	97,100	160,900	244,600	237,400	1,227,700	269,400	59,700	28,500	14,400	6,000	9,400	57,100	2,412,200
1954	81,300	42,300	27,300	70,000	153,700	70,500	3,800	3,900	3,800	3,900	4,600	25,500	490,600
1955	52,900	174,400	62,200	308,900	72,700	64,700	12,400	17,200	4,000	6,300	2,500	8,800	787,000
1956	14,800	89,500	37,900	77,100	33,100	14,600	4,300	1,700	2,700	2,200	3,200	7,600	288,700
1957	8,300	11,500	82,100	13,400	812,100	137,900	43,000	20,700	13,400	119,100	391,500	359,700	2,012,700
1958	434,361	270,467	193,595	140,165	539,114	51,633	43,687	17,644	159,177	172,003	45,634	46,673	2,114,153
1959	45,033	166,832	129,528	331,271	388,860	157,738	83,150	56,658	17,029	30,492	49,558	143,560	1,599,709
1960	314,867	303,050	371,935	88,683	69,246	53,240	45,226	24,002	16,843	53,068	106,565	593,513	2,040,238
1961	811,675	482,154	542,991	361,253	89,180	70,199	131,020	20,789	92,554	27,151	48,686	288,326	2,965,978
1962	211,258	201,533	197,273	129,705	409,013	121,294	40,017	20,424	24,665	17,712	26,864	80,866	1,480,624
1963	101,475	94,163	102,527	87,675	36,655	27,214	14,576	5,780	13,155	3,504	14,429	30,737	531,890
1964	47,944	49,400	184,776	201,607	154,466	32,194	7,434	6,191	5,243	6,700	8,251	22,251	726,457
1965	20,114	55,758	66,064	140,618	136,617	194,385	19,366	8,494	25,883	9,332	16,776	182,472	875,879
1966	144,708	426,108	92,453	87,527	770,873	104,394	20,543	28,048	28,488	33,430	13,377	30,789	1,780,738
1967	41,656	45,943	34,814	120,183	98,591	71,527	26,175	7,692	4,039	6,054	9,674	36,226	502,574
1968	170,088	118,179	196,124	635,187	418,174	424,208	287,670	55,468	60,759	36,049	65,286	272,372	2,739,564
1969	173,253	269,963	775,865	839,790	1,089,201	194,324	46,939	20,467	14,830	6,046	37,599	89,015	3,557,292
1970	112,402	102,865	200,893	180,560	167,307	37,974	24,584	6,989	21,382	50,325	67,332	49,179	1,021,792

Table B-9

PAL3.WQ1

PALESTINE RESERVOIR EVAPORATION

Units - feet

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1941	0.02	-0.06	0.01	-0.05	0.17	-0.15	0.29	0.37	0.22	0.01	0.08	-0.04	0.87
1942	0.08	0.10	0.13	-0.33	0.16	0.09	0.45	0.23	0.19	0.20	0.12	-0.12	1.30
1943	0.08	0.21	0.02	0.19	-0.17	0.20	0.45	0.60	0.22	0.00	0.17	-0.08	1.89
1944	-0.12	-0.18	-0.08	0.04	-0.38	0.34	0.47	0.29	0.35	0.36	-0.15	-0.27	0.67
1945	-0.03	-0.11	-0.62	0.05	0.23	0.04	0.06	0.31	0.34	-0.02	0.16	0.06	0.47
1946	-0.26	-0.05	-0.05	0.05	-0.33	0.23	0.50	0.08	0.29	0.23	-0.38	0.05	0.36
1947	-0.08	0.09	-0.08	-0.08	0.07	0.24	0.53	0.38	0.29	0.29	-0.01	-0.16	1.48
1948	-0.12	-0.11	0.02	0.12	-0.05	0.43	0.56	0.60	0.57	0.29	0.07	-0.02	2.36
1949	-0.41	-0.13	0.00	-0.14	0.16	0.30	0.22	0.30	0.30	-0.42	0.26	-0.09	0.35
1950	-0.18	-0.29	0.15	-0.12	-0.17	0.28	0.20	0.42	0.01	0.26	0.24	0.20	1.00
1951	0.01	-0.13	0.11	0.17	0.22	0.13	0.38	0.69	-0.08	0.22	0.11	-0.08	1.75
1952	0.05	-0.08	-0.01	-0.18	0.01	0.36	0.41	0.77	0.65	0.55	-0.18	-0.20	2.15
1953	0.07	0.01	-0.11	-0.10	-0.15	0.43	0.08	0.31	0.30	0.27	0.02	-0.14	0.99
1954	-0.11	0.14	0.16	0.03	-0.14	0.46	0.76	0.82	0.63	-0.16	0.07	0.07	2.73
1955	-0.01	-0.15	-0.05	0.00	0.01	0.32	0.32	-0.05	0.10	0.42	0.32	0.12	1.35
1956	0.00	-0.13	0.22	0.14	0.07	0.35	0.71	0.60	0.59	0.32	0.11	0.13	3.11
1957	0.02	-0.07	-0.09	-0.70	-0.15	0.04	0.47	0.30	0.16	-0.18	-0.21	0.10	-0.31
1958	-0.02	0.05	0.03	-0.24	0.07	0.12	0.28	0.29	-0.17	0.16	0.11	0.15	0.83
1959	0.18	-0.09	0.10	-0.07	-0.25	-0.04	0.08	0.30	0.23	0.08	0.23	-0.17	0.58
1960	-0.10	-0.03	0.05	0.14	0.25	0.01	0.23	0.29	0.22	0.08	0.09	-0.43	0.80
1961	-0.16	-0.08	-0.08	0.23	0.17	-0.18	0.24	0.36	0.17	0.25	-0.11	-0.08	0.73
1962	-0.08	-0.08	0.08	-0.10	0.22	-0.08	0.23	0.45	-0.03	0.00	-0.04	0.07	0.64
1963	0.08	0.11	0.06	-0.15	0.08	0.27	0.39	0.57	0.35	0.54	0.19	0.04	2.53
1964	0.09	-0.03	-0.03	-0.01	-0.08	0.29	0.57	0.39	0.09	0.35	0.04	0.06	1.73
1965	-0.02	-0.23	-0.03	0.17	-0.50	0.21	0.48	0.44	0.06	0.25	0.09	-0.04	0.88
1966	-0.06	-0.06	0.04	-0.23	-0.07	0.21	0.26	0.18	0.08	0.19	0.15	0.10	0.79
1967	0.08	0.04	0.06	-0.28	-0.20	0.33	0.24	0.24	0.05	0.08	0.14	0.06	0.84
1968	0.09	0.08	0.00	-0.04	-0.07	0.24	0.14	0.55	0.21	0.27	0.25	0.09	1.81
1969	-0.06	-0.05	0.01	-0.20	-0.41	0.32	0.54	0.53	0.32	0.37	0.13	0.00	1.50
1970	0.03	-0.08	-0.08	-0.18	0.01	0.20	0.53	0.57	0.32	0.14	0.13	-0.09	1.50

Table B-9

PAL3.WQ1

PALESTINE RESERVOIR EVAPORATION (continued)

Units - feet

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1971	0.20	0.02	0.19	0.22	0.23	0.50	0.39	0.27	0.32	0.11	0.09	-0.09	2.45
1972	-0.04	0.17	0.15	0.17	0.32	0.25	0.39	0.47	0.24	0.17	-0.01	0.02	2.30
1973	-0.07	-0.01	0.03	-0.04	0.21	0.14	0.31	0.54	0.11	0.06	0.04	0.09	1.41
1974	-0.13	0.11	0.16	0.17	0.17	0.26	0.57	0.24	-0.01	0.13	-0.01	-0.02	1.64
1975	0.02	-0.05	0.03	0.06	0.10	0.23	0.46	0.52	0.45	0.30	0.20	0.06	2.38
1976	0.10	0.15	0.05	0.07	0.10	0.23	0.22	0.47	0.11	0.08	0.15	0.00	1.73
1977	-0.08	0.01	0.07	0.10	0.32	0.37	0.61	0.37	0.35	0.36	0.03	0.13	2.64
1978	-0.08	-0.06	0.11	0.24	0.20	0.43	0.66	0.54	0.32	0.41	-0.04	0.02	2.75
1979	-0.11	-0.02	0.07	0.15	0.20	0.39	0.38	0.44	0.31	0.39	0.17	0.00	2.37
1980	-0.09	0.05	0.11	0.12	0.16	0.41	0.74	0.67	0.37	0.27	0.10	0.10	3.01
1981	0.08	0.05	0.10	0.21	0.12	0.20	0.46	0.56	0.36	0.10	0.11	0.21	2.56
1982	0.02	-0.01	0.10	0.08	0.13	0.18	0.46	0.57	0.51	0.18	0.01	-0.07	2.16
1983	0.10	-0.07	0.06	0.28	0.15	0.19	0.48	0.39	0.46	0.26	0.07	0.01	2.38
1984	0.04	0.03	0.05	0.30	0.33	0.42	0.58	0.57	0.47	0.15	0.08	0.00	3.02
1985	0.02	0.02	0.10	0.20	0.30	0.36	0.51	0.72	0.38	0.17	0.11	0.10	2.99
1986	0.19	0.00	0.29	-0.01	0.13	0.16	0.63	0.51	0.26	0.10	-0.05	-0.07	2.14
1987	0.04	-0.08	0.08	0.39	0.14	0.18	0.42	0.64	0.30	0.29	0.00	-0.13	2.27
1988	0.13	-0.01	0.08	0.21	0.43	0.44	0.44	0.59	0.38	0.20	0.05	0.01	2.95
1989	-0.03	-0.07	0.05	0.20	0.09	0.14	0.33	0.51	0.42	0.30	0.25	0.17	2.36
1990	0.08	0.06	0.05	0.11	0.27	0.45	0.38	0.53	0.26	0.28	0.17	0.10	2.74

Table B-10

STR3.WQ1

7/21/84 TRS

STRIKER CREEK RESERVOIR EVAPORATION

Units - feet

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1941	-0.04	-0.10	-0.04	0.01	-0.04	-0.05	0.21	0.35	0.14	-0.14	0.03	-0.04	0.29
1942	0.09	0.10	0.11	-0.21	-0.01	0.06	0.35	0.13	0.16	0.16	0.16	-0.08	1.02
1943	-0.03	0.19	0.05	0.20	0.01	0.28	0.30	0.50	0.17	0.18	0.11	-0.13	1.83
1944	-0.31	-0.25	-0.14	-0.06	-0.45	0.28	0.47	0.29	0.32	0.37	-0.22	-0.40	-0.10
1945	-0.11	-0.10	-0.34	-0.07	0.17	0.08	0.08	0.28	0.38	-0.10	0.15	-0.01	0.41
1946	-0.33	-0.13	-0.12	0.05	-0.27	0.13	0.41	0.26	0.31	0.20	-0.46	0.02	0.07
1947	-0.16	0.06	-0.16	0.03	-0.18	0.25	0.46	0.46	0.35	0.33	-0.03	-0.16	1.25
1948	-0.19	-0.20	0.01	0.09	-0.02	0.34	0.48	0.56	0.49	0.30	-0.10	0.00	1.76
1949	-0.35	-0.08	-0.05	-0.11	0.16	0.17	0.08	0.23	0.23	-0.37	0.25	-0.10	0.06
1950	-0.24	-0.19	0.12	-0.06	-0.15	0.19	0.20	0.33	-0.05	0.25	0.20	0.15	0.75
1951	-0.07	-0.13	-0.02	0.19	0.20	0.16	0.41	0.63	-0.15	0.30	0.05	-0.03	1.54
1952	-0.06	-0.15	-0.05	-0.19	-0.07	0.32	0.31	0.66	0.58	0.51	-0.15	-0.13	1.58
1953	0.02	-0.10	-0.14	-0.17	-0.37	0.37	0.10	0.33	0.29	0.25	0.02	-0.20	0.40
1954	-0.10	0.14	0.16	0.02	-0.25	0.41	0.65	0.74	0.64	-0.10	0.01	0.03	2.35
1955	-0.06	-0.25	0.04	-0.11	0.01	0.33	0.35	0.06	0.19	0.42	0.31	0.10	1.39
1956	-0.03	-0.22	0.12	0.04	-0.02	0.29	0.56	0.49	0.47	0.28	0.10	0.06	2.14
1957	0.01	-0.13	-0.17	-0.63	0.05	-0.06	0.36	0.21	0.19	-0.40	-0.23	0.04	-0.76
1958	-0.11	-0.01	0.04	-0.14	0.05	0.07	0.35	0.15	-0.30	0.16	0.09	0.11	0.46
1959	0.14	-0.10	0.13	-0.15	-0.24	0.05	-0.02	0.24	0.21	0.12	0.11	-0.17	0.32
1960	-0.09	-0.08	0.06	0.14	0.29	0.01	0.36	0.19	0.18	0.02	-0.07	-0.38	0.63
1961	-0.18	-0.10	-0.09	0.20	0.23	-0.20	0.08	0.37	0.08	0.23	-0.02	-0.14	0.46
1962	-0.20	0.00	0.09	-0.16	0.19	-0.06	0.41	0.49	0.05	0.14	-0.05	-0.01	0.89
1963	0.02	0.01	0.08	-0.11	0.16	0.14	0.34	0.47	0.24	0.43	0.05	-0.08	1.75
1964	0.08	0.00	-0.05	-0.10	0.10	0.36	0.56	0.30	0.21	0.35	0.07	-0.03	1.85
1965	-0.06	-0.21	-0.07	0.20	-0.28	0.20	0.53	0.41	0.16	0.28	0.08	-0.17	1.07
1966	-0.05	0.04	0.11	0.00	-0.07	0.38	0.39	0.30	0.07	0.27	0.16	0.12	1.72
1967	-0.01	0.09	0.14	0.02	0.00	0.25	0.41	0.51	0.14	0.23	0.06	0.06	1.90
1968	0.01	-0.02	-0.01	-0.07	0.10	0.20	0.37	0.29	0.06	0.05	0.08	0.09	1.15
1969	0.04	-0.07	-0.01	-0.20	-0.05	0.46	0.56	0.46	0.24	0.26	0.19	0.06	1.94
1970	-0.03	-0.05	0.10	-0.30	0.14	0.46	0.53	0.51	0.25	0.21	0.21	-0.03	2.00

Table B-10

STR3.WQ1

7/21/94 TRS

STRIKER CREEK RESERVOIR EVAPORATION (continued)

Units - feet

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1971	0.17	0.03	0.20	0.21	0.14	0.37	0.37	0.26	0.24	0.13	0.09	-0.06	2.15
1972	-0.05	0.15	0.09	0.11	0.22	0.19	0.26	0.38	0.21	0.13	-0.03	-0.02	1.64
1973	-0.08	0.01	0.02	-0.02	0.20	0.12	0.25	0.38	0.10	0.04	0.06	0.01	1.09
1974	-0.16	0.09	0.11	0.17	0.16	0.29	0.46	0.21	0.04	0.13	-0.01	-0.02	1.47
1975	0.01	-0.06	0.02	0.05	0.08	0.21	0.42	0.41	0.35	0.18	0.11	0.05	1.83
1976	0.08	0.09	0.03	0.07	0.08	0.22	0.21	0.46	0.14	0.06	0.06	-0.05	1.45
1977	-0.07	0.02	0.06	0.09	0.31	0.31	0.54	0.31	0.28	0.35	0.04	0.07	2.31
1978	-0.11	-0.04	0.14	0.23	0.25	0.40	0.58	0.53	0.21	0.35	-0.04	-0.02	2.48
1979	-0.11	-0.03	0.06	0.08	0.16	0.33	0.30	0.42	0.26	0.34	0.06	-0.01	1.86
1980	-0.08	0.04	0.04	0.10	0.10	0.43	0.66	0.64	0.35	0.28	0.04	0.12	2.72
1981	0.06	0.01	0.08	0.17	0.11	0.17	0.35	0.47	0.26	0.05	0.09	0.16	1.98
1982	0.02	-0.01	0.07	0.02	0.11	0.19	0.43	0.50	0.43	0.16	0.00	-0.07	1.85
1983	0.04	-0.09	0.03	0.26	0.17	0.19	0.40	0.32	0.36	0.25	0.05	-0.04	1.94
1984	0.02	0.00	0.06	0.32	0.30	0.34	0.44	0.44	0.36	-0.08	0.03	0.00	2.23
1985	0.05	0.02	0.10	0.20	0.28	0.32	0.44	0.64	0.33	0.09	0.12	0.10	2.69
1986	0.16	0.04	0.28	0.09	0.11	0.09	0.59	0.44	0.20	0.06	-0.09	-0.11	1.86
1987	0.01	-0.12	0.12	0.34	0.13	0.18	0.33	0.47	0.22	0.31	-0.04	-0.15	1.80
1988	0.10	0.00	0.09	0.19	0.43	0.40	0.43	0.41	0.39	0.19	0.04	-0.03	2.64
1989	-0.09	-0.06	-0.05	0.19	0.13	0.04	0.26	0.46	0.39	0.25	0.16	0.08	1.76
1990	0.05	0.06	0.05	0.09	0.22	0.45	0.32	0.49	0.26	0.23	0.11	0.07	2.40

Table B-11

B. A. STEINHAGEN RESERVOIR AREA/CAPACITY/ELEVATION

1994

AREA acres	CAPACITY acre-feet	ELEVATION feet
0	0	58
6	3	59
40	26	60
78	85	61
139	193	62
186	355	63
252	574	64
333	866	65
527	1,296	66
571	1,845	67
615	2,438	68
979	3,234	69
1,271	4,359	70
1,721	5,855	71
2,211	7,821	72
3,321	10,587	73
4,051	14,272	74
5,171	18,883	75
5,791	24,364	76
6,851	30,685	77
7,531	37,876	78
8,631	45,956	79
9,471	55,007	80
10,891	65,188	81
11,951	76,609	82
13,631	89,400	83
14,910	103,670	84
16,713	119,481	85
18,251	136,963	86
19,731	155,954	87
21,221	176,430	88
22,621	198,350	89
24,041	221,681	90
25,441	264,422	91
26,471	272,378	92
28,291	299,759	93

Table B-12

B. A. STEINHAGEN RESERVOIR AREA/CAPACITY/ELEVATION

2004

AREA acres	CAPACITY acre-feet	ELEVATION feet
0	0	59
6	3	60
44	28	61
105	103	62
152	231	63
218	416	64
299	675	65
493	1,071	66
537	1,586	67
581	2,145	68
945	2,908	69
1,237	3,999	70
1,687	5,461	71
2,177	7,393	72
3,287	10,125	73
4,017	13,777	74
5,137	18,354	75
5,757	23,801	76
6,817	30,088	77
7,497	37,245	78
8,597	45,292	79
9,437	54,309	80
10,857	64,456	81
11,917	75,843	82
13,597	88,600	83
14,876	102,836	84
16,679	118,614	85
18,217	136,062	86
19,697	155,019	87
21,187	175,461	88
22,587	197,348	89
24,007	220,645	90
25,407	245,352	91
26,437	271,274	92
28,257	298,621	93

Table B-13

B. A. STEINHAGEN RESERVOIR AREA/CAPACITY/ELEVATION
2024

AREA acres	CAPACITY acre-feet	ELEVATION feet
0	0	61
31	16	62
78	70	63
144	181	64
225	366	65
419	688	66
463	1,129	67
507	1,614	68
871	2,303	69
1,163	3,320	70
1,613	4,708	71
2,103	6,566	72
3,213	9,224	73
3,943	12,802	74
5,063	17,305	75
5,683	22,679	76
6,743	28,892	77
7,423	35,975	78
8,523	43,948	79
9,363	52,891	80
10,783	62,964	81
11,843	74,277	82
13,523	86,960	83
14,802	101,123	84
16,605	116,826	85
18,143	134,200	86
19,623	153,083	87
21,113	173,451	88
22,513	195,265	89
23,933	218,488	90
25,333	243,121	91
26,363	268,969	92
28,183	296,242	93

Table B-14SAM RAYBURN RESERVOIR AREA/CAPACITY/ELEVATION

AREA acres	CAPACITY acre-feet	ELEVATION feet
0	0	80.0
4,500	21,940	105.0
8,300	53,940	110.0
13,000	107,190	115.0
18,900	160,000	120.0
25,500	280,000	125.0
34,000	440,000	130.0
43,000	650,000	135.0
54,000	900,000	140.0
65,000	1,170,000	145.0
74,040	1,452,000	149.0
78,000	1,500,000	150.0
90,000	1,830,000	155.0
103,000	2,290,000	160.0
114,500	2,898,200	164.4
129,000	3,550,000	170.0
142,700	3,997,600	173.0
153,800	4,442,400	176.0
170,000	5,000,000	180.0
180,000	5,610,000	183.0

Table B-15PALESTINE RESERVOIR AREA/CAPACITY/ELEVATION

AREA acres	CAPACITY acre-feet	ELEVATION feet
0	0	290.0
400	550	298.0
1,700	10,600	309.5
2,500	20,000	315.0
5,250	43,000	320.0
8,700	80,000	325.0
12,300	133,000	330.0
16,300	206,000	335.0
20,750	297,000	340.0
23,500	362,600	343.0
24,500	386,700	344.0
25,560	412,000	345.0
26,400	437,900	346.0

Table B-16

STR4.WQ1

STRIKER CREEK RESERVOIR AREA/CAPACITY/ELEVATION

AREA acres	CAPACITY acre-feet	ELEVATION feet
0	0	268
13	7	269
26	26	270
60	69	271
100	149	272
140	269	273
190	434	274
230	644	275
320	919	276
430	1,294	277
520	1,769	278
630	2,344	279
745	3,032	280
860	3,834	281
990	4,759	282
1,110	5,809	283
1,220	6,974	284
1,335	8,252	285
1,430	9,634	286
1,510	11,104	287
1,590	12,654	288
1,670	14,284	289
1,744	15,991	290
1,800	17,763	291
1,860	19,593	292
1,910	21,478	293
2,300	23,583	294
2,650	26,058	295
2,980	28,873	296
3,200	31,963	297
3,460	35,293	298
3,710	38,878	299
3,973	42,720	300

Table B-17

NECHES RIVER BASIN GAGES

Station	Drainage Area (square miles)	Continous Records
Neches River near Neches	1,145	Feb 1939-Sep 1993
Neches River near Alto	1,945	Jan 1943-Dec 1978
Neches River near Diboll	2,724	Oct 1939-Sep 1985
Neches River near Rockland	3,636	Jul 1903-Sep 1993
Neches River near Town Bluff	7,573	Apr 1951-Sep 1993
Neches River at Evadale	7,951	Apr 1921-Sep 1993
Angelina River near Alto	1,276	Mar 1959-Sep 1993
Angelina River near Lufkin	1,600	Oct 1940-Sep 1979
Angelina River near Zavalla	2,892	Oct 1951-Jan 1965
Angelina River at Horger	3,486	Oct 1939-Apr 1950

APPENDIX C

**TEMPORARY SALT WATER BARRIER
PERMIT CONDITIONS**

APPENDIX C

TEMPORARY SALT WATER BARRIER PERMIT CONDITIONS

The statement of findings by the Corps of Engineers relating to the permit application for installation of temporary salt water barriers (6) concludes with the following special requirements and conditions:

- "a. The LNVA will construct the temporary saltwater barrier and attendant structures as outlined in the project plans. As built drawings of site specific waterway and barrier dimensions will be submitted to the Galveston District within 30 days of each barrier installation.
- "b. Barrier installation will commence only after the applicant receives notification from the COE Fort Worth District (copy furnished to the Galveston District COE) stating that the conservation pool within Sam Rayburn Reservoir has remained within Zone 3 for a 30 day period; after 60 days, releases of water for the prevention of saltwater intrusion will be curtailed.
- "c. The applicant will provide a written notice to mariners in the form of a public warning announcement, to be published in local newspapers covering the project area, approximately 15 days prior to the date on which the LNVA plans to install a saltwater barrier. Daily announcements will appear in local newspapers one week prior to the initiation of work. Copies of publishers affidavits and a notification of the commencement of work will be submitted to the COE Galveston District.
- "d. For all barrier installation and removal operations occurring within the BTNP, the applicant will adhere to a Plan of Operations previously approved by Preserve officials.
- "e. Warning lights and markers will be installed on each barrier and each associated structure and maintained as per U.S. Coast Guard requirements.

- "f. All saltwater barrier structures and construction materials within each waterway and adjacent property will be removed within 60 days after Sam Rayburn Reservoir returns to and remains within Pool Zone 2. Requests to extend this deadline must be submitted to the Galveston District within this time frame and will be reviewed on a case by case basis. Written and photographic documentation will be submitted to the COE Galveston District within 30 days of the removal of each barrier.

- "g. The applicant will participate with the TPWD in several studies that will provide much needed information regarding barriers impacts on paddlefish as well as other aquatic species. Specific study parameters will be submitted to the COE Galveston District within on year of permit issuance.

- "h. The subject permit will not be valid after the completion of the Federal Saltwater Barrier at Beaumont Project. If the Federal project is not deemed feasible, this permit will only be valid for 5 years and any extension of time request may be denied should the applicant not pursue an alternate design."

APPENDIX D

RESERVOIR SYSTEM SIMULATION MODEL

APPENDIX D

RESERVOIR SYSTEM SIMULATION MODEL

Two versions of the Rayburn/Steinhagen computer model were used in this study: (a) a stand-alone version that simulates only the two reservoirs and (b) a more detailed version that includes the uncontrolled downstream runoff below Lake B.A. Steinhagen and control of salt water intrusion. The model was written in Microsoft FORTRAN 5.1 and is based on OPERATE, a general purpose reservoir modeling program previously developed by Freese and Nichols.

Stand-Alone Operation

The stand-alone version uses releases from Sam Rayburn to maintain Steinhagen at a partially full 'target content'. The Steinhagen target content is decreased at the end of the year to allow capture of spring inflows. If Sam Rayburn drops to the bottom of the power pool (elevation 149.0 feet), the releases to Steinhagen are discontinued. If Rayburn drops below the bottom of the power pool and Steinhagen drops below a minimum storage of 10,000 acre-feet, the system experiences a shortage.

The stand-alone version uses a constant annual demand, and each month's demand is a percentage of the annual demand, based on historical use patterns derived in previous studies. For each inflow condition (current conditions or with the Eastex and/or Rockland Reservoirs), the demand was adjusted to the maximum

value that would not cause a shortage. In all cases, 10,000 acre-feet per year were assumed to be used locally at Sam Rayburn and the rest from Lake Steinhagen.

Coordinated Operation

The coordinated operation version first uses the uncontrolled runoff below Lake Steinhagen plus spills from Steinhagen. If this source is insufficient, releases are made from Steinhagen as long as 10,000 acre-feet or more remain in the reservoir. In addition, this version accounts for control of salt water intrusion and assumed flow bypass requirements. These subjects are discussed in more detail below. The operating rules for releases from Sam Rayburn to Steinhagen are the same as in the stand-alone version.

Although the model computes in monthly time increments, the daily flows below Steinhagen are used to calculate total monthly releases from Steinhagen. The daily flow below Steinhagen is defined as 2.675 times the flow observed at the Village Creek gaging station near Kountze. If a spill from Steinhagen occurs, it is divided by the number of days in the current month. If possible, demand and instream flow requirements are met by the daily flows and Steinhagen spills. If those flows are insufficient to meet the diversion demands and control salt water intrusion, the remaining supply comes from the Steinhagen/Rayburn system.

There are four categories of water in this version of the model: (a) required flows to prevent salt water intrusion, (b) use under existing water rights of the

LNVA and Beaumont below Steinhagen, (c) bypass flow requirements and (d) extra supply available after satisfying (a),(b) and (c). Table D-1 is a summary of the demands and bypass flow requirements. The water rights of LNVA and Beaumont and the additional supply are distributed on a monthly basis as a percentage of the annual demand, with the percentage varying each month based on historical patterns of seasonal use.

Table D-1

DEMANDS AND INSTREAM FLOW REQUIREMENTS IN COORDINATED OPERATION (Listed in order of priority)		
TYPE	AMOUNT	POSSIBLE SOURCES
Salt water intrusion control.	5,453 acre-feet per day (2,750 cfs)	Daily flows below Steinhagen. Steinhagen spills. Steinhagen releases.
Existing water rights of LNVA and Beaumont, other than the LNVA's 820,000 acre-feet per year at Rayburn/Steinhagen.	438,343 acre-feet per year	Daily flows below Steinhagen. Steinhagen spills. Steinhagen releases.
Trans-Texas Water Program bypass requirements for new reservoirs.	Varies by month.	Daily flows below Steinhagen.
Additional available supply.	Varies with operating conditions.	Daily flows below Steinhagen. Steinhagen spills. Steinhagen releases.

Flow bypass requirements for a permanent barrier (Case 7) are based on the proposed Phase I Trans-Texas Water Program (TTWP) environmental criteria for new reservoirs. Those criteria require new impoundments to pass through inflows up to certain levels. They are intended to be conservatively high and may be

adjusted as additional information becomes available. The Phase I TTWP criteria do not apply to water covered by existing prior rights.

For the Case 7 simulations, the TTWP environmental rules were applied to the inflows originating downstream from Lake Steinhagen. It was assumed that these uncontrolled inflows would be available under a new appropriation only to the extent that they exceed the bypass criteria. Table D-2 shows the flows to be passed through each month based on historic uncontrolled flows. (Note that diversions by the LNVA and the City of Beaumont under their existing run-of-the-river rights would not be subject to the bypass criteria.) In many months, most of the uncontrolled inflow that is not usable under the older water rights would be earmarked for bypass.

The same water may be used to meet both the flow pass-through requirement and minimum flow needs for salt water control. Except in April and May, the flow required for salt water control is greater than the instream requirement. Therefore, unless a barrier is in place, the flow for salt water control is normally more than adequate to meet the bypass requirements.

Temporary Salt Water Barriers

Rules governing the installation of temporary barriers are based on (a) the current storage zone condition at Sam Rayburn and/or (b) the daily flow below Steinhagen. A summary of the rules is shown in Table D-3. In all instances, it was

assumed that the uncontrolled flow must be less than 3,183 acre-feet per day for the barrier to be completed, and the barrier was assumed to wash out when the net flow exceeded 6,365 acre-feet per day.

Table D-2

TTWP PHASE I FLOW BYPASS CRITERIA FOR FLOW ORIGINATING DOWNSTREAM FROM LAKE B. A. STEINHAGEN					
MONTH	KOUNTZE GAGE FLOW		BASIS FOR BYPASS FLOW	BYPASS FLOW	
	Average cfs	Median cfs		cfs	Ac-Ft/Day
January	-	766	Median	2,048	4,063
February	-	900	Median	2,407	4,775
March	-	722	Median	1,930	3,829
April	1,086	-	Average	2,904	5,761
May	1,254	-	Average	3,353	6,651
June	897	-	Average	2,398	4,757
July	-	175	Median	468	928
August	259	-	Average	693	1,374
September	319	-	Average	853	1,691
October	329	-	Average	867	1,719
November	-	228	Median	610	1,210
December	-	531	Median	1,420	2,816

Table D-3

RULES GOVERNING THE INSTALLATION OF TEMPORARY BARRIERS	
CONDITION	RESULTS
Sam Rayburn in Zone 3 for n consecutive days.	Temporary barriers are installed.
Total flow below Steinhagen greater than 3,183 acre-feet per day (1,605 cfs).	Installation of temporary barrier is delayed until flow is below 3,183 acre-feet per day.
Sam Rayburn in Zone 1 or 2 for m consecutive days after previously being in Zone 3 long enough to install barriers.	Temporary barriers are removed.
Total flow below Steinhagen greater than 6,365 acre-feet per day (3,210 cfs).	Temporary barriers wash out.
Sam Rayburn in Zones 3 or 4 and barrier has washed out.	Temporary barriers are assumed to be re-installed as soon as possible.

Permanent Salt Water Barrier

To simulate permanent barriers, the installation time for a barrier is set to zero days, and the flow that washes out the barriers and the number of days before removal are set to very large numbers, effectively making the barriers permanent. The salt water control requirement is set to zero, and the barrier does not interfere with meeting instream flow requirements.

Step-by-Step Operation Calculation

The model uses the following steps in its calculations. Steps "c" through "m" are skipped in the stand-alone version of the model.

Table B-3

B. A. STEINHAGEN RESERVOIR INFLOW - PRESENT CONDITIONS (continued)

Units: ac-ft

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1971	47,533	35,772	55,331	33,664	40,414	8,297	4,421	12,819	6,296	16,695	12,781	125,757	399,780
1972	133,499	99,376	123,361	79,272	114,346	16,444	13,612	6,396	11,132	15,333	66,280	121,597	800,648
1973	294,114	184,458	330,908	593,361	433,036	708,144	217,973	92,004	142,991	280,286	341,494	473,266	4,092,035
1974	683,158	410,242	202,154	175,550	98,416	77,223	43,196	40,831	79,532	83,647	285,385	315,116	2,494,450
1975	322,641	410,818	222,539	214,243	426,990	215,839	119,675	68,696	42,501	77,525	73,730	89,202	2,284,399
1976	103,973	77,632	115,671	101,588	251,786	143,521	188,640	30,295	30,814	44,498	39,125	151,321	1,278,864
1977	153,132	175,116	265,795	290,807	179,931	37,922	25,803	17,825	16,748	11,145	39,095	57,594	1,270,913
1978	178,512	160,441	88,265	58,443	22,557	23,624	1,023	10,609	15,639	5,591	33,816	62,298	660,818
1979	307,903	271,403	359,938	618,285	433,047	446,758	92,511	128,598	174,507	95,922	136,552	215,853	3,281,277
1980	262,940	359,232	263,665	291,641	451,660	87,492	27,363	9,515	6,610	5,057	8,413	12,560	1,786,148
1981	17,250	35,024	35,406	21,829	27,534	212,828	90,768	21,867	37,923	69,121	61,290	31,841	662,681
1982	52,031	69,789	71,354	267,409	315,594	62,116	65,837	20,186	2,915	16,071	106,512	320,006	1,369,820
1983	227,990	346,324	401,594	192,233	377,092	310,026	84,512	101,709	52,369	26,002	63,837	209,126	2,392,814
1984	164,113	238,945	324,821	117,941	107,447	38,311	23,579	15,512	13,758	139,931	167,751	117,826	1,469,935
1985	198,372	271,932	353,976	129,755	70,183	15,975	10,715	(1,174)	2,322	72,210	124,309	344,300	1,592,875
1986	109,015	153,721	71,464	79,050	242,621	537,369	72,368	12,042	25,592	28,742	291,739	355,423	1,979,146
1987	202,320	221,274	500,223	137,301	53,983	108,411	67,369	35,316	37,879	16,155	143,402	227,281	1,750,914
1988	242,058	112,958	219,444	150,858	57,948	36,668	47,301	35,125	32,741	23,200	24,510	62,036	1,044,847
1989	193,926	211,700	172,801	235,782	334,698	522,102	421,248	113,964	51,356	58,741	52,889	64,131	2,433,338
1990	300,419	229,136	257,695	471,170	297,011	627,159	54,605	27,239	29,012	54,908	78,365	93,422	2,520,141

Table B-4

SR_TAB1.WQ1

SAM RAYBURN RESERVOIR INFLOW - PRESENT CONDITIONS

Units: ac-ft

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1941	591,689	327,621	520,383	199,489	317,606	288,461	118,510	35,869	42,667	133,453	648,441	315,753	3,539,942
1942	235,886	181,747	258,618	381,734	265,658	204,878	64,029	128,165	85,227	23,997	36,895	50,814	1,917,648
1943	151,905	86,375	76,678	61,214	31,838	23,651	13,064	5,895	3,413	5,769	14,186	27,416	501,404
1944	240,585	336,866	394,217	362,696	1,431,820	358,588	18,869	9,888	38,353	9,590	49,402	316,424	3,567,298
1945	808,506	482,771	457,333	750,784	199,578	82,644	203,540	58,176	15,499	176,977	78,328	166,293	3,480,429
1946	637,840	812,383	524,336	310,739	368,220	371,137	81,682	35,288	52,776	41,383	380,898	305,382	3,922,064
1947	665,820	253,692	498,074	306,711	293,882	176,434	31,944	10,403	7,605	8,472	42,447	146,167	2,441,651
1948	137,719	434,002	287,241	244,631	143,486	38,603	14,276	3,586	3,779	3,150	27,249	37,492	1,375,214
1949	190,428	260,010	314,487	285,413	137,690	70,287	29,348	23,535	13,991	155,650	87,791	244,588	1,813,218
1950	696,320	601,743	333,882	128,122	434,281	567,319	62,070	19,656	22,937	18,230	22,369	31,427	2,938,356
1951	66,620	100,944	148,441	149,467	47,255	26,351	6,726	922	2,617	3,347	8,243	35,361	596,294
1952	37,854	192,596	290,867	235,682	130,672	46,134	7,082	1,100	0	0	2,810	29,640	974,437
1953	96,400	184,000	529,500	211,500	1,506,500	196,900	74,800	41,600	20,000	8,300	14,500	68,500	2,952,500
1954	100,200	76,600	49,400	83,200	209,400	46,600	4,000	2,600	3,600	3,700	19,100	21,300	619,700
1955	57,100	183,200	102,800	260,100	100,100	81,200	19,900	34,800	7,600	6,700	4,400	14,900	872,800
1956	24,100	128,000	54,500	99,900	168,600	13,500	3,800	1,500	3,600	2,500	4,500	8,800	513,300
1957	10,800	18,200	93,300	173,600	880,500	211,000	46,500	18,300	16,600	132,100	559,300	407,000	2,567,200
1958	333,774	250,930	180,960	122,312	467,227	78,479	43,874	18,551	270,475	256,971	58,708	61,056	2,143,317
1959	56,315	185,967	134,910	272,817	342,343	96,160	59,211	41,024	14,522	25,451	60,156	170,912	1,459,788
1960	263,843	255,876	369,696	104,262	72,105	45,111	37,843	21,165	20,943	50,254	122,302	690,303	2,053,703
1961	688,338	383,904	512,605	404,865	104,445	73,541	121,021	25,881	88,524	34,678	55,936	466,589	2,960,327
1962	274,283	281,897	197,197	136,948	362,742	83,568	41,283	24,782	25,514	21,235	30,060	67,968	1,547,477
1963	90,748	80,915	101,874	93,083	26,676	20,557	12,280	7,899	6,625	6,033	8,230	18,192	473,112
1964	34,061	38,124	134,405	158,285	89,216	24,231	5,356	5,538	4,118	4,751	5,194	13,533	516,812
1965	20,601	117,312	120,028	179,035	118,754	130,708	9,003	13,339	23,892	1,547	17,382	131,107	882,708
1966	129,405	410,515	78,126	169,026	653,410	62,114	1,868	26,501	37,425	20,019	14,093	30,393	1,632,895
1967	23,583	50,654	43,651	94,032	77,815	120,074	954	0	0	0	0	36,559	447,322
1968	198,734	77,677	206,057	754,420	340,834	246,020	122,554	22,595	97,819	4,088	101,785	351,616	2,524,199
1969	148,931	469,576	738,035	598,913	601,601	92,286	17,369	0	0	0	24,227	75,986	2,766,924
1970	80,009	93,543	275,197	140,864	126,065	5,322	2,189	0	116	43,214	17,060	22,386	805,965

Table B-4

SR_TAB1.WQ1

SAM RAYBURN RESERVOIR INFLOW - PRESENT CONDITIONS (continued)

Units: ac-ft

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1971	31,799	36,354	38,410	25,572	70,709	225	0	11,510	0	22,877	7,787	155,565	400,808
1972	205,482	100,904	145,871	82,676	71,426	1,805	14,837	12,054	10,714	14,086	109,769	220,443	990,067
1973	430,373	218,420	462,989	521,973	210,848	437,942	111,513	20,945	91,433	287,824	256,808	597,324	3,648,392
1974	850,323	298,998	168,553	149,719	88,740	13,730	8,623	3,785	72,877	84,564	415,179	398,507	2,553,598
1975	341,804	676,068	233,424	219,547	472,228	172,292	63,780	12,867	0	30,291	54,898	55,838	2,333,037
1976	95,854	127,168	226,555	140,576	269,032	199,697	205,485	10,004	0	0	25,961	165,051	1,465,383
1977	153,164	231,574	260,141	221,575	708,041	7,181	8,961	22,767	0	0	28,196	40,465	1,682,065
1978	232,215	225,049	100,628	74,190	41,134	12,228	0	633	73,918	1,378	31,962	136,702	930,037
1979	568,104	536,006	518,422	545,976	346,576	502,042	29,321	35,589	84,653	42,672	125,493	217,656	3,552,510
1980	289,059	345,474	290,313	458,657	533,925	27,373	0	0	0	0	0	12,872	1,957,673
1981	21,722	45,704	77,318	29,150	87,865	214,059	40,339	0	140,826	52,485	54,570	17,752	781,790
1982	54,040	109,393	129,809	610,350	321,297	75,546	42,684	1,042	0	35,621	127,776	627,497	2,135,055
1983	229,247	572,167	353,037	129,879	496,985	211,149	52,936	62,976	26,491	0	50,103	309,804	2,494,774
1984	190,698	385,271	417,109	101,271	100,517	32,964	0	8,889	0	170,212	138,233	154,583	1,699,747
1985	201,794	373,916	326,597	116,560	137,103	0	24,656	5,385	27,629	142,753	295,744	452,625	2,104,762
1986	87,590	220,390	56,119	82,726	254,532	571,228	55,660	31,591	34,710	38,811	422,520	406,491	2,262,368
1987	224,135	411,779	362,428	74,763	81,205	122,938	38,721	16,737	34,587	0	211,600	351,898	1,930,791
1988	310,978	134,825	267,949	139,285	16,214	3,715	40,092	13,057	0	0	6,103	68,737	1,000,955
1989	373,491	372,850	282,122	495,622	493,687	575,414	389,196	35,944	5,892	11,352	6,200	53,197	3,094,967
1990	431,870	413,737	255,582	225,892	573,751	380,539	4,806	2,119	5,904	27,114	110,967	139,391	2,571,672

Table B-5

SR_TAB2.WQ1

SAM RAYBURN RESERVOIR INFLOW - WITH EASTEX

Units: ac-ft

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1953	92,600	180,400	494,000	199,700	1,425,400	196,200	73,100	42,800	19,500	8,100	15,900	61,700	2,809,400
1954	94,300	69,700	44,400	78,800	174,500	46,000	4,800	4,000	3,800	2,800	16,000	16,500	555,600
1955	49,400	164,800	81,600	237,700	93,200	78,800	18,800	35,900	7,700	6,200	3,900	14,500	792,500
1956	24,300	121,100	53,400	99,900	127,800	14,000	5,200	2,300	3,600	2,500	4,900	10,200	469,200
1957	10,900	19,200	92,500	138,900	846,500	182,900	45,700	18,000	16,400	121,600	511,500	396,700	2,400,800

Table B-6

PAL2.WQ1

PALESTINE RESERVOIR INFLOW - PRESENT CONDITIONS

Units - ac-ft

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1941	78,410	40,700	69,650	45,010	29,560	99,220	26,800	3,300	3,460	14,980	18,580	40,740	470,410
1942	28,980	34,650	31,270	142,490	70,480	57,750	6,130	5,780	17,430	5,530	10,820	16,510	427,820
1943	51,870	16,310	22,590	30,440	51,490	70,840	5,820	750	980	27,660	6,960	17,310	303,020
1944	78,160	97,870	116,130	37,200	224,170	34,710	3,370	1,570	3,050	1,690	8,440	46,100	652,460
1945	106,740	59,630	179,040	307,980	24,010	24,530	54,220	5,280	4,400	43,460	21,390	39,290	869,970
1946	117,720	97,050	108,010	58,760	124,060	122,360	14,160	19,370	39,070	18,890	161,450	76,890	957,790
1947	84,650	42,100	90,100	104,490	39,700	21,250	5,740	1,810	3,490	2,750	9,750	44,270	450,100
1948	38,910	88,750	80,520	27,610	68,990	7,840	4,710	790	660	1,010	4,630	7,140	331,560
1949	25,100	40,040	57,350	65,390	15,690	8,880	3,180	2,810	2,270	22,140	21,220	14,560	278,630
1950	74,200	147,520	33,840	39,930	77,310	43,320	6,910	3,170	4,290	2,950	5,990	6,700	446,130
1951	11,020	25,850	30,670	21,730	16,420	12,620	3,220	640	1,220	1,250	4,190	9,220	138,050
1952	12,820	30,380	36,260	67,990	35,680	17,160	1,670	460	250	310	2,930	18,730	224,640
1953	28,440	15,620	68,540	18,190	154,930	5,500	5,050	1,860	1,820	1,060	4,990	23,340	329,340
1954	19,480	15,570	15,390	17,270	65,850	3,800	490	160	50	6,280	41,880	25,330	211,550
1955	27,020	45,520	61,420	59,490	25,590	10,240	3,900	1,630	4,000	2,770	1,630	4,910	248,120
1956	8,770	24,050	9,020	5,350	57,500	1,330	500	140	160	220	1,160	1,800	110,000
1957	3,270	12,530	17,200	159,350	159,740	108,140	3,430	2,330	2,140	30,640	87,560	41,550	627,880
1958	57,280	40,740	34,400	38,170	186,690	12,020	28,820	2,500	9,650	9,770	11,040	15,020	446,100
1959	15,040	39,070	38,580	68,670	149,970	36,010	17,170	8,150	3,660	9,490	11,960	44,820	442,590
1960	96,670	53,830	73,910	22,470	13,180	8,920	14,630	3,440	3,500	12,200	21,120	160,980	484,850
1961	144,100	105,790	102,140	46,260	15,690	21,690	13,950	4,110	5,230	4,840	11,550	36,710	512,060
1962	31,550	40,010	58,250	29,340	77,080	41,400	17,790	620	8,520	4,920	5,850	11,890	327,220
1963	16,630	16,610	15,820	19,310	0	0	5,980	1,260	970	1,250	2,240	3,840	83,910
1964	5,840	6,570	14,370	11,860	13,400	10,400	750	690	1,220	1,270	1,330	3,000	70,700
1965	1,680	5,050	23,710	48,150	147,520	40,690	4,940	4,020	4,050	4,100	6,380	23,690	313,980
1966	25,110	36,550	27,480	0	252,290	25,870	4,740	8,530	6,200	4,650	3,310	3,330	398,060
1967	9,470	6,770	7,150	13,240	13,130	6,410	4,760	1,390	2,470	1,060	840	0	66,690
1968	36,720	16,640	39,280	95,020	17,140	63,640	36,540	5,750	17,400	8,110	20,480	79,830	436,550
1969	37,720	44,990	150,110	178,660	139,450	11,890	5,980	200	1,890	2,370	7,780	19,390	600,430
1970	26,390	21,510	53,400	57,940	20,600	3,590	1,200	120	2,470	0	0	2,490	189,710

Table B-6

PAL2.WQ1

PALESTINE RESERVOIR INFLOW - PRESENT CONDITIONS (continued)

Units - ac-ft

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1971	4,360	5,190	11,470	7,870	22,370	2,110	0	1,590	1,200	1,620	2,100	14,860	74,740
1972	26,860	15,530	12,460	7,250	3,210	2,720	4,570	930	0	2,440	15,540	16,220	107,730
1973	31,900	26,340	21,080	41,290	89,620	0	6,980	3,540	3,590	84,450	16,060	87,320	412,170
1974	115,450	79,470	45,880	19,440	15,810	7,030	2,650	2,350	11,830	2,550	18,810	41,540	362,810
1975	40,910	74,850	32,060	34,490	69,350	34,620	25,260	4,600	1,780	3,910	6,970	7,890	336,690
1976	10,610	7,480	37,460	27,110	70,630	31,140	64,670	9,110	0	4,650	10,970	27,290	301,120
1977	29,290	31,350	42,050	49,350	40,600	5,420	4,010	1,290	3,120	1,740	2,350	9,240	219,810
1978	17,630	23,040	1,050	20,130	7,350	4,040	0	0	0	0	4,650	7,490	85,380
1979	59,870	79,260	85,630	152,530	75,170	79,020	16,090	28,140	26,700	22,040	32,800	45,070	702,320
1980	65,010	71,790	59,900	52,100	103,860	16,080	2,040	1,090	680	1,010	2,050	3,160	378,770
1981	3,490	5,920	10,380	5,950	5,860	5,590	27,060	1,430	5,780	28,220	19,690	7,140	126,510
1982	9,470	18,630	16,250	83,000	88,320	18,450	14,500	1,410	200	1,340	17,490	61,710	330,770
1983	47,320	99,460	84,570	41,490	64,330	69,180	17,560	18,790	3,730	1,120	3,510	46,010	497,070
1984	18,970	27,570	77,950	26,860	7,730	2,920	3,650	1,090	710	40,820	45,840	33,460	287,570
1985	56,630	65,420	77,770	33,140	18,170	5,410	3,060	880	290	12,920	25,870	88,970	388,530
1986	33,750	23,460	19,650	0	35,270	136,200	25,650	1,250	7,000	5,640	77,180	82,230	447,280
1987	52,310	44,410	88,760	31,090	7,390	12,790	8,970	900	4,110	260	21,260	27,490	299,740
1988	48,380	16,540	39,510	29,250	7,650	1,730	3,580	1,400	120	0	1,100	7,250	156,510
1989	43,850	60,720	35,330	81,220	40,950	131,370	225,900	6,690	2,000	1,400	2,080	7,460	638,970
1990	59,280	71,530	34,810	102,900	49,130	164,510	6,290	1,990	1,950	5,610	9,060	11,940	519,000

Table B-7

STRIKER CREEK RESERVOIR INFLOW - PRESENT CONDITIONS
Units - ac-ft

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1941	21,310	18,230	18,630	17,200	11,210	6,580	6,830	2,320	11,250	24,470	31,860	18,750	188,640
1942	9,560	11,570	10,590	26,130	8,760	20,870	3,060	12,540	12,490	3,580	6,420	12,290	137,860
1943	10,770	5,830	6,080	6,570	2,350	2,170	1,610	220	240	3,100	3,330	7,580	49,850
1944	27,950	38,630	27,970	14,710	76,630	8,190	900	790	3,320	1,100	11,580	31,010	242,780
1945	38,420	17,640	40,950	35,430	10,210	18,840	42,920	1,710	2,440	35,270	6,000	11,870	261,700
1946	35,090	36,600	26,470	9,200	45,920	29,640	3,990	10,250	5,230	4,170	39,690	16,520	262,770
1947	26,720	13,100	26,950	26,780	29,240	4,980	1,900	770	2,350	1,320	4,900	16,570	155,580
1948	17,420	27,890	16,400	11,330	15,700	1,850	1,490	250	320	580	4,140	4,390	101,760
1949	15,690	11,870	9,380	14,880	6,800	3,450	3,800	3,310	2,260	6,380	2,680	4,820	85,320
1950	30,840	32,420	8,760	9,560	25,640	19,710	2,060	690	1,010	770	1,410	1,660	134,530
1951	3,880	8,770	9,670	7,150	4,720	3,120	760	50	200	190	910	2,790	42,210
1952	4,700	29,470	16,650	22,530	6,250	3,640	530	40	0	0	750	2,990	87,550
1953	5,200	5,120	29,250	8,620	56,090	1,030	2,610	680	890	140	1,680	7,840	119,150
1954	6,600	4,760	4,370	3,780	25,150	1,170	10	0	0	1,470	4,410	6,510	58,230
1955	8,350	17,560	19,420	16,950	7,220	2,000	1,080	530	670	350	330	970	75,430
1956	1,810	830	3,090	1,650	33,370	550	50	0	0	0	60	210	41,620
1957	600	2,030	3,600	50,630	35,060	36,090	1,080	410	320	12,800	50,280	11,250	204,150
1958	19,950	14,370	10,370	20,600	44,430	6,370	3,300	1,110	8,170	5,230	3,610	5,030	142,540
1959	5,370	13,550	8,560	16,990	68,830	8,900	4,510	2,150	1,090	1,610	3,480	18,420	153,460
1960	25,960	29,150	29,270	6,890	2,500	3,050	2,100	1,040	3,800	3,760	8,870	59,440	175,830
1961	50,370	32,300	39,560	16,830	7,320	10,500	5,000	1,310	4,900	2,060	7,310	17,770	195,230
1962	23,200	16,460	13,860	16,520	15,050	11,050	8,550	1,170	2,080	3,360	3,710	6,220	121,230
1963	6,850	6,140	7,830	3,460	1,980	850	500	250	150	60	330	1,460	29,860
1964	1,850	2,480	5,630	2,830	1,590	790	20	50	180	210	690	1,750	18,070
1965	5,230	13,460	9,480	8,520	22,480	5,560	400	90	270	190	330	1,110	67,120
1966	1,950	3,930	3,450	83,270	34,110	1,930	460	1,710	2,060	1,100	2,010	2,630	138,610
1967	2,990	2,410	2,450	7,430	2,550	4,020	420	40	320	80	420	1,590	24,720
1968	9,680	10,180	12,080	17,520	60,220	8,560	5,250	750	2,210	1,150	4,930	15,630	148,160
1969	6,370	14,760	44,690	37,750	23,160	2,080	250	90	210	420	9,900	10,590	150,270
1970	11,130	11,360	26,300	12,310	2,540	1,020	270	120	690	3,180	3,450	4,630	77,000

Table B-7

STRIKER CREEK RESERVOIR INFLOW - PRESENT CONDITIONS (continued)

Units - ac-ft

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1971	3,850	6,520	4,090	2,860	6,340	260	90	180	260	270	720	5,600	31,040
1972	16,050	6,870	4,630	1,520	810	650	160	140	710	2,980	7,350	8,460	50,330
1973	13,060	12,940	24,650	48,310	8,530	48,580	12,880	6,030	17,000	25,620	17,060	28,020	262,680
1974	34,790	22,230	14,720	7,600	8,480	5,400	880	500	19,030	10,870	35,950	18,880	179,330
1975	16,930	41,570	15,380	12,980	19,390	13,620	4,210	1,410	780	1,320	2,000	3,280	132,870
1976	5,820	5,180	21,910	10,150	16,560	27,300	18,380	1,300	3,280	3,830	4,370	14,310	132,390
1977	12,530	28,360	21,670	25,760	5,540	2,400	740	740	900	850	1,380	3,030	103,900
1978	6,170	7,630	13,510	4,140	4,700	750	400	400	530	500	1,640	1,980	42,350
1979	17,640	14,640	33,150	39,270	20,200	21,400	9,330	3,590	13,830	3,880	16,400	16,470	209,800
1980	26,480	22,940	11,580	59,260	34,370	4,900	1,830	1,170	1,300	1,630	2,850	3,240	171,550
1981	3,510	4,610	7,820	3,480	5,360	7,280	1,520	750	7,770	15,580	8,540	4,070	70,290
1982	7,130	10,560	7,280	35,650	20,330	8,780	8,480	1,870	1,050	2,620	9,910	42,250	155,910
1983	15,420	55,560	20,420	9,060	38,210	15,310	4,130	6,380	2,560	2,370	4,580	16,320	190,320
1984	9,050	27,260	35,550	8,420	3,530	2,060	1,310	1,160	1,030	13,670	12,030	11,860	126,930
1985	13,400	26,940	17,190	17,380	11,890	2,180	1,480	790	650	6,760	37,430	22,840	158,930
1986	10,930	8,450	4,270	5,070	14,230	40,100	3,250	1,970	2,370	5,140	18,760	30,890	145,430
1987	14,450	36,410	18,390	6,160	5,660	6,480	3,120	1,240	3,060	2,260	10,780	24,250	132,260
1988	13,930	8,650	11,940	6,310	2,400	1,210	1,030	32,430	1,600	2,400	4,790	6,850	93,540
1989	24,000	20,510	47,190	11,410	37,850	13,760	18,500	2,880	2,610	580	870	3,100	183,260
1990	24,660	29,760	14,480	42,810	20,430	68,430	2,620	830	810	2,330	3,770	4,970	215,900

Table B-8

EVP41_90.WQ1

6/30/94 TRS

EVAPORATION DATA FOR SAM RAYBURN AND B A STEINHAGEN

Units: feet

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1941	-0.02	-0.14	-0.03	0.00	-0.14	-0.12	-0.04	0.30	-0.05	-0.36	0.01	-0.02	-0.61
1942	0.05	-0.01	0.02	-0.14	-0.02	-0.02	0.25	0.11	0.25	0.27	0.10	-0.06	0.80
1943	-0.05	0.14	0.04	0.20	0.11	0.20	0.20	0.42	0.20	0.24	0.05	-0.07	1.68
1944	-0.31	-0.09	-0.09	-0.05	-0.63	0.20	0.38	0.24	0.23	0.31	-0.24	-0.34	-0.39
1945	-0.16	-0.15	-0.05	-0.11	-0.02	0.13	0.07	0.13	0.18	-0.13	0.09	-0.07	-0.09
1946	-0.39	-0.26	-0.11	0.05	-0.20	0.00	0.19	0.15	0.16	0.11	-0.34	-0.05	-0.69
1947	-0.30	0.04	-0.14	0.05	-0.20	0.15	0.29	0.38	0.43	0.25	-0.12	-0.18	0.65
1948	-0.11	-0.20	0.05	-0.01	-0.01	0.31	0.23	0.38	0.25	0.24	-0.23	-0.07	0.83
1949	-0.33	-0.12	-0.12	-0.10	0.08	0.02	0.14	0.22	0.24	-0.47	0.19	-0.32	-0.57
1950	-0.33	-0.32	0.06	-0.10	-0.29	-0.14	0.15	0.30	-0.11	0.20	0.06	-0.03	-0.55
1951	-0.05	-0.17	-0.10	0.15	0.16	0.15	0.24	0.50	-0.04	0.29	0.06	-0.11	1.08
1952	-0.04	-0.14	-0.05	-0.21	-0.12	0.25	0.04	0.43	0.43	0.45	-0.15	-0.02	0.87
1953	-0.05	-0.18	-0.22	-0.38	-0.49	0.12	-0.01	0.23	0.27	0.23	0.07	-0.06	-0.47
1954	-0.10	0.21	0.15	0.00	-0.12	0.34	0.40	0.51	0.47	0.09	0.05	0.13	2.13
1955	-0.08	-0.20	0.13	-0.10	0.06	0.31	0.22	0.14	0.19	0.29	0.18	0.05	1.19
1956	-0.07	-0.20	0.07	-0.02	0.10	0.12	0.42	0.38	0.43	0.23	0.12	0.04	1.62
1957	-0.07	-0.09	-0.14	-0.41	0.03	-0.08	0.23	0.29	0.00	-0.05	-0.39	0.00	-0.68
1958	-0.18	-0.03	0.04	0.00	0.08	0.10	0.33	0.10	-0.42	0.19	0.02	0.07	0.30
1959	0.09	-0.14	0.11	-0.14	0.14	0.10	-0.06	0.19	0.21	-0.03	0.06	-0.21	0.32
1960	-0.10	-0.14	0.08	0.07	0.26	-0.05	0.22	-0.05	0.20	0.00	-0.12	-0.28	0.09
1961	-0.27	-0.07	-0.16	0.18	0.19	-0.02	-0.01	0.28	-0.05	0.22	-0.04	-0.23	0.02
1962	-0.12	0.06	0.12	-0.14	0.17	0.04	0.39	0.36	0.07	0.19	-0.08	-0.14	0.92
1963	0.00	-0.08	0.13	-0.01	0.18	-0.02	0.12	0.42	0.14	0.32	-0.05	-0.07	1.08
1964	-0.07	0.02	-0.08	-0.24	0.09	0.31	0.47	0.31	0.19	0.30	0.06	-0.09	1.27
1965	0.01	-0.20	-0.10	0.16	-0.28	0.14	0.34	0.29	0.04	0.24	0.01	-0.30	0.35
1966	0.02	0.01	0.13	-0.10	0.00	0.12	0.14	0.11	0.19	0.12	0.19	0.08	1.01
1967	0.00	-0.01	0.05	-0.02	-0.17	0.17	0.15	0.27	0.35	0.36	0.13	0.06	1.34
1968	0.00	0.02	-0.03	-0.06	-0.12	0.01	0.15	0.29	-0.01	0.04	0.13	0.01	0.43
1969	0.11	-0.04	-0.06	0.02	-0.16	0.31	0.48	0.40	0.32	0.27	0.21	0.03	1.89
1970	-0.10	-0.10	0.01	-0.06	0.00	0.20	0.33	0.23	0.23	0.05	0.16	0.04	0.99

Table B-8

EVP41_90.WQ1

6/30/94 TRS

EVAPORATION DATA FOR SAM RAYBURN AND B A STEINHAGEN (continued)

Units: feet

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1971	0.12	0.04	0.14	0.22	0.08	0.21	0.31	0.25	0.15	0.12	0.06	-0.06	1.64
1972	-0.04	0.09	0.05	0.08	0.12	0.16	0.13	0.19	0.13	0.11	-0.02	-0.07	0.93
1973	-0.09	0.01	-0.01	-0.01	0.16	0.09	0.23	0.22	0.06	0.05	0.04	-0.02	0.73
1974	-0.23	0.07	0.06	0.15	0.10	0.30	0.37	0.19	0.03	0.11	0.00	-0.03	1.12
1975	-0.01	-0.05	0.01	0.03	0.05	0.16	0.31	0.34	0.28	0.14	0.05	0.04	1.35
1976	0.07	0.06	0.01	0.13	0.09	0.21	0.16	0.38	0.15	0.12	0.04	-0.04	1.38
1977	-0.06	0.05	0.03	0.10	0.25	0.23	0.41	0.15	0.23	0.31	0.04	0.05	1.79
1978	-0.10	0.00	0.13	0.20	0.18	0.30	0.40	0.36	0.05	0.30	0.00	-0.02	1.80
1979	-0.15	-0.09	0.03	0.02	0.11	0.24	0.17	0.31	0.14	0.18	0.03	-0.04	0.95
1980	-0.07	0.02	0.00	0.05	0.06	0.41	0.46	0.51	0.30	0.21	0.00	0.10	2.05
1981	0.02	-0.03	0.05	0.17	0.10	0.12	0.24	0.36	0.14	0.07	0.04	0.09	1.37
1982	-0.01	0.00	0.00	-0.08	0.11	0.13	0.30	0.42	0.30	0.09	0.02	-0.09	1.19
1983	0.01	-0.08	0.02	0.20	0.05	0.10	0.33	0.18	0.21	0.23	0.00	-0.07	1.18
1984	-0.02	-0.03	0.03	0.21	0.21	0.26	0.37	0.34	0.23	-0.08	0.01	0.00	1.53
1985	0.02	-0.01	0.01	0.12	0.18	0.27	0.33	0.51	0.24	0.05	0.04	0.07	1.83
1986	0.11	0.02	0.23	0.06	0.05	0.09	0.41	0.31	0.14	0.02	-0.16	-0.09	1.19
1987	0.03	-0.10	0.08	0.28	0.09	0.14	0.23	0.41	0.16	0.26	-0.07	-0.07	1.44
1988	0.05	0.00	0.03	0.15	0.36	0.37	0.29	0.28	0.30	0.15	0.07	-0.05	2.00
1989	-0.15	-0.03	-0.02	0.20	0.10	-0.09	0.15	0.30	0.16	0.17	0.06	-0.03	0.82
1990	0.02	0.04	0.05	0.09	0.13	0.36	0.26	0.44	0.27	0.20	0.07	0.10	2.03

- a. Operate Rayburn with local demand (10,000 acre-feet per year) and no release.
- b. Operate Steinhagen with no demand. Spills from Rayburn are added to the natural inflow to Steinhagen.
- c. Divide the LNVA and Beaumont water rights and additional demand by the number of days in the month. Daily demand is assumed to be constant throughout the month.
- d. Divide the Steinhagen spill by the number of days in the month. Spills are assumed to be constant each day of the month.
- e. Read in the daily flow values at the Kountze gage and multiply the result by 2.675 to estimate the uncontrolled daily flow below Steinhagen.
- f. Add the daily spill from Steinhagen (Step "d") to the daily flow below Steinhagen (Step "e") to calculate the total daily flow.
- g. Determine the bypass flow requirement for that day. The bypass requirement is limited to the flow below Steinhagen less the older water rights for LNVA and Beaumont. It is defined as:

$$V_{\text{bypass}} = \text{MIN}(V_{\text{daily}} - D_{\text{permit}}, D_{\text{ttwp}})$$

where

- V_{bypass} = bypass flow volume for that day
- V_{daily} = daily flow volume below Steinhagen
- D_{permit} = run-of-the-river water rights of LNVA and Beaumont
- D_{ttwp} = Trans-Texas Water Program bypass requirements

The bypass flow requirement does not cover spills from Steinhagen. If the daily flow is less than that day's water rights demand (D_{permit}), the bypass requirement is set to zero.

- h. If a temporary barrier is in place, determine if the net remaining flow will wash out the barrier. The remaining flow is defined as the total flow less the total demand; in other words any flow left after the LNVA and Beaumont water rights and additional supply needs are satisfied.

- i. If the temporary barrier is not in place or has been washed out, determine the downstream flow requirement. The downstream flow requirement is set to the flow to control the salt water wedge or the fresh water bypass requirement, whichever is greater.
- j. Distribute the supply to meet the demands and the bypass flow requirements. The demands are met in the following order: run-of-the-river rights of LNVA and Beaumont, downstream flow requirement (salt wedge control and/or bypass requirements), and additional demand. A record of this calculation is saved in a file.
- k. If there is not enough total flow to meet LNVA and Beaumont water rights, salt water wedge control, or extra demands, add the amount needed to the cumulative deficiency for the month. If there is excess supply for the current day, subtract the daily Steinhagen spill from the cumulative deficiency. It is assumed that there is sufficient control over small spills and releases from Steinhagen to allow coordination of the Steinhagen supply with the supply below Steinhagen. If there is excess supply of the flow below Steinhagen, that excess flow is lost.
- l. Return to Step "f" until all of the days in the month have been processed.
- m. If the deficiency is greater than zero, recalculate the Steinhagen end-of-month content with a release equal to the deficiency plus the previous spill.
- n. If Steinhagen is below its target content for the month, determine the release from Rayburn. The release from Rayburn is calculated by the following formula:

$$R_{\text{ray}} = C_{\text{target}} + E_{\text{est}} - (C_{\text{com}} + E_{\text{com}}) + S_{\text{com}}$$

where

R_{ray}	= Release request from Rayburn
C_{target}	= Target content for Steinhagen
E_{est}	= Evaporation estimate for target content
C_{com}	= Current end-of-month content for Steinhagen
E_{com}	= Current evaporation at Steinhagen
S_{com}	= Current shortage at Steinhagen

The evaporation estimate for the target content is defined as:

$$E_{est} = \frac{1}{2}(A_{target} + A_{bom}) * E_{rate}$$

where

A_{target}	= Area at Steinhagen target content
A_{bom}	= Beginning-of-month area for Steinhagen
E_{rate}	= Evaporation rate

- o. Estimate the available supply from Rayburn with the following formula:

$$V_{available} = C_{com} + E_{com} - (C_{min} + E_{est})$$

where

$V_{available}$	= Available supply volume from Rayburn
C_{com}	= Current end-of-month content at Rayburn
E_{com}	= Current evaporation at Rayburn
C_{min}	= Minimum content for Rayburn
E_{est}	= Evaporation estimate for minimum content

The evaporation estimate for the minimum content is defined as:

$$E_{est} = \frac{1}{2}(A_{min} + A_{bom}) * E_{rate}$$

where

A_{min}	= Area at Rayburn minimum content
A_{bom}	= Beginning-of-month area for Rayburn
E_{rate}	= Evaporation rate

If the release request from Rayburn is greater than the supply estimate, the release request is set to the supply estimate.

- p. If there is to be an additional release from Rayburn recalculate the Rayburn and Steinhagen end-of-month contents with the new release from Rayburn.
- q. If the end-of-month elevation puts Rayburn in Zone 3, calculate the number of consecutive days that Rayburn has been in Zone 3. If Rayburn has been in Zone 3 for longer than the installation period, then re-execute the daily calculation (Steps "d" through "l") with a barrier installed on the appropriate day. The current Steinhagen spill, if any, is used for the calculation. The

waiting period for installation varies depending on the total number of days that Rayburn has been in Zone 3. This allows rapid installation of the barrier when the barrier has washed out and Rayburn has been in Zone 3 for an extended period. This situation occurs in both 1956 and 1957. If the flow on the installation day is greater than 3,183 acre-feet, installation is delayed until the flow has been reduced. Then re-execute Steps "m" through "p".

- r. If a temporary barrier is in place and the end-of-month elevation puts Rayburn above Zone 3, calculate the number of days that Rayburn has been above Zone 3. If the number of days is greater than the specified removal period, then re-execute the daily flow calculation (Steps "d" through "l") with the barriers removed on the appropriate day. Then re-execute Steps "m" through "p".

APPENDIX E

STAND-ALONE OPERATION STUDIES

APPENDIX E

STAND-ALONE OPERATION STUDIES

This appendix contains monthly summary printouts for three preliminary operation studies of the Sam Rayburn Reservoir/Lake B. A. Steinhagen system. These analyses treat the Rayburn/Steinhagen system as standing alone, without consideration of the flows originating below Steinhagen or instream flows needed to prevent salt water intrusion when salt water barriers are not in place. The following scenarios are included:

- Present conditions; yield of 1,323,900 acre-feet per year.
- Conditions with Lake Eastex; yield of 1,269,900 acre-feet per year.
- Conditions with Lake Eastex and Rockland Reservoir; yield of 989,100 acre-feet per year.

After each operation study, there is a figure showing the variation of lake surface levels with time during the critical period for the two impoundments.

V2:SA1_PRES.DAT 1953 to 1957 Rayburn/Steinhagen Stand Alone with Present Conditions
Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
10,000 demand at Rayburn; 1,313,900 demand at Steinhagen; 1,323,900 total

page: 1
08/19/94 09:24:59

SAM RAYBURN RESERVOIR SUMMARY

Maximum Capacity = 2898200 acre-feet
Starting Content = 2898200 acre-feet
Minimum Content = 1452000 acre-feet

Critical period is from 6/1954 through 2/1957

Titles from input database file

Sam Rayburn Reservoir	4/5/94 data	08/19/94	09:23
Present Conditions	1974 ACE		

LAKE B.A. STEINHAGEN SUMMARY

Maximum Capacity = 89400 acre-feet
Starting Content = 89400 acre-feet
Minimum Content = 10052 acre-feet

Critical period is from 5/1955 through 2/1957

Titles from input database file

Lake B.A. Steinhagen	4/5/94 data	05/04/94	08:51
Rockland inflow plus intervening inflow	1994 ACE		

Date	SAM RAYBURN RESERVOIR									LAKE B.A. STEINHAGEN								
	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	End-of-Month Elev. (Ft)	Evap. Loss (Ac-Ft)	Demand (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	End-of-Month Elev. (Ft)
1953																		
1	-.05	-5725	450	96400	0	0	101675	2898200	164.40	-682	59126	97100	101675	0	0	140331	89400	83.00
2	-.18	-20610	410	184000	0	0	204200	2898200	164.40	-2454	53870	160900	204200	0	0	313684	89400	83.00
3	-.22	-25190	710	529500	0	0	553980	2898200	164.40	-2999	93287	244600	553980	0	0	708292	89400	83.00
4	-.38	-43510	1130	211500	0	0	253880	2898200	164.40	-5180	148471	237400	253880	0	0	347989	89400	83.00
5	-.49	-56105	1380	1506500	0	0	1561225	2898200	164.40	-6679	181318	1227700	1561225	0	0	2614286	89400	83.00
6	.12	13740	1460	196900	0	0	181700	2898200	164.40	1636	191829	269400	181700	0	0	257635	89400	83.00
7	-.01	-1143	1420	74800	0	97356	0	2875367	164.23	-118	186574	59700	97356	0	0	0	60000	80.49
8	.23	26076	870	41600	0	88148	0	2801873	163.70	2339	114309	28500	88148	0	0	0	60000	80.49
9	.27	30197	680	20000	0	77690	0	2713306	163.06	2745	89345	14400	77690	0	0	0	60000	80.49
10	.23	25357	580	8300	0	62384	0	2633285	162.48	2178	76206	6000	62384	0	0	0	50000	79.45
11	.07	7640	470	14500	0	42948	0	2596727	162.22	595	61753	9400	42948	0	0	0	40000	78.26
12	-.06	-6570	440	68500	0	0	0	2671357	162.76	-468	57812	57100	0	0	0	0	39756	78.23
SUM	-.47	-55843	10000	2952500	0	368526	2856660			-9087	1313900	2412200	3225186	0	0	4382217		
1954																		
1	-.10	-11126	450	100200	0	0	0	2782233	163.56	-913	59126	81300	0	0	0	0	62843	80.77
2	.21	23689	410	76600	0	0	0	2834734	163.94	2019	53870	42300	0	0	0	0	49254	79.36
3	.15	16958	710	49400	0	58001	0	2808465	163.75	1268	93287	27300	58001	0	0	0	40000	78.26
4	.00	0	1130	83200	0	78471	0	2812064	163.78	0	148471	70000	78471	0	0	0	40000	78.26
5	-.12	-13642	1380	209400	0	0	135526	2898200	164.40	-1299	181318	153700	135526	0	0	59807	89400	83.00
6	.34	38643	1460	46600	0	95932	0	2808765	163.75	4003	191829	70500	95932	0	0	0	60000	80.49
7	.40	44259	1420	4000	0	186841	0	2580245	162.10	4067	186574	3800	186841	0	0	0	60000	80.49
8	.51	54517	870	2600	0	115594	0	2411864	160.88	5185	114309	3900	115594	0	0	0	60000	80.49
9	.47	48887	680	3600	0	90324	0	2275573	159.84	4779	89345	3800	90324	0	0	0	60000	80.49
10	.09	9145	580	3700	0	63158	0	2206390	159.09	852	76206	3900	63158	0	0	0	50000	79.45
11	.05	5008	470	19100	0	47578	0	2172434	158.72	425	61753	4600	47578	0	0	0	40000	78.26
12	.13	12930	440	21300	0	23256	0	2157108	158.56	944	57812	25500	23256	0	0	0	30000	76.89
SUM	2.13	229268	10000	619700	0	759155	135526			21330	1313900	490600	894681	0	0	59807		
1955																		
1	-.08	-8012	450	57100	0	721	0	2221049	159.25	-505	59126	52900	721	0	0	0	25000	76.10
2	-.20	-20724	410	183200	0	0	0	2424563	160.97	-1955	53870	174400	0	0	0	58085	89400	83.00
3	.13	13829	710	102800	0	0	0	2512824	161.61	1511	93287	62200	0	0	0	0	56802	80.18
4	-.10	-10977	1130	260100	0	0	0	2782771	163.56	-1163	148471	308900	0	0	0	128994	89400	83.00
5	.06	6752	1380	100100	0	69897	0	2804842	163.72	679	181318	72700	69897	0	0	0	50000	79.45
6	.31	34669	1460	81200	0	140065	0	2709848	163.04	2936	191829	64700	140065	0	0	0	60000	80.49
7	.22	24028	1420	19900	0	176411	0	2527889	161.72	2237	186574	12400	176411	0	0	0	60000	80.49
8	.14	14944	870	34800	0	98532	0	2448343	161.15	1423	114309	17200	98532	0	0	0	60000	80.49
9	.19	19959	680	7600	0	87277	0	2348027	160.42	1932	89345	4000	87277	0	0	0	60000	80.49
10	.29	29951	580	6700	0	62652	0	2261544	159.69	2746	76206	6300	62652	0	0	0	50000	79.45
11	.18	18230	470	4400	0	50783	0	2196461	158.98	1530	61753	2500	50783	0	0	0	40000	78.26
12	.05	4997	440	14900	0	39375	0	2166549	158.66	363	57812	8800	39375	0	0	0	30000	76.89
SUM	1.19	127646	10000	872800	0	725713	0			11734	1313900	787000	725713	0	0	187079		

V2:SA1 PRES.DAT 1953 to 1957 Rayburn/Steinhagen Stand Alone with Present Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,313,900 demand at Steinhagen; 1,323,900 total

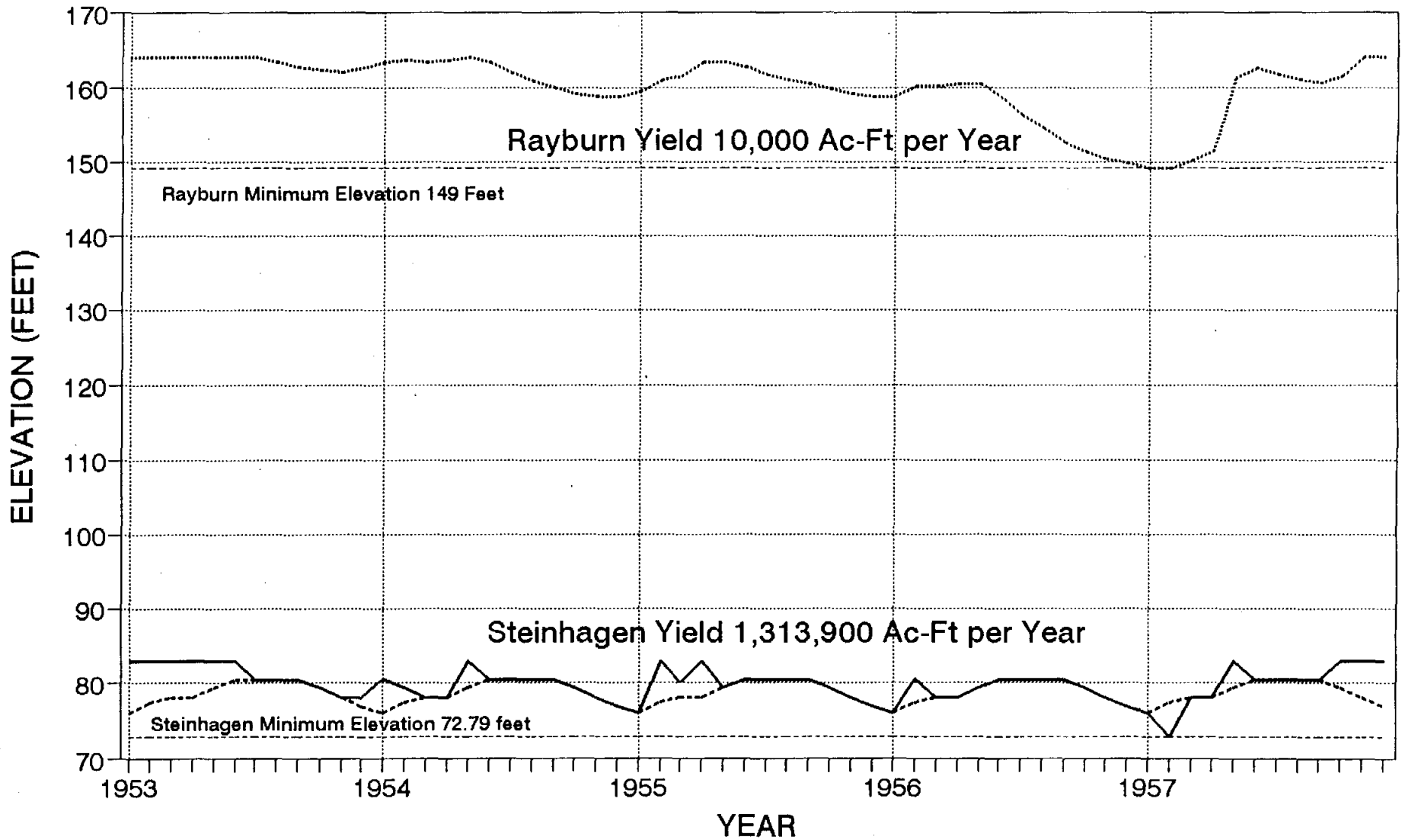
SAM RAYBURN RESERVOIR

LAKE B.A. STEINHAGEN

Date	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Demand (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	
1956																			
1	-.07	-6958	450	24100	0	38884	0	2158273	158.57	-442	59126	14800	38884	0	0	0	25000	76.10	
2	-.20	-20273	410	128000	0	0	0	2306136	160.12	-1663	53870	89500	0	0	0	0	62293	80.72	
3	.07	7240	710	54500	0	33732	0	2318954	160.21	638	93287	37900	33732	0	0	0	40000	78.26	
4	-.02	-2077	1130	99900	0	71215	0	2348586	160.42	-156	148471	77100	71215	0	0	0	40000	78.26	
5	.10	10409	1380	168600	0	159068	0	2346329	160.41	850	181318	33100	159068	0	0	0	50000	79.45	
6	.12	12231	1460	13500	0	188365	0	2157773	158.56	1136	191829	14600	188365	0	0	0	60000	80.49	
7	.42	40358	1420	3800	0	186544	0	1933251	156.12	4270	186574	4300	186544	0	0	0	60000	80.49	
8	.38	34502	870	1500	0	116473	0	1782906	154.29	3864	114309	1700	116473	0	0	0	60000	80.49	
9	.43	36986	680	3600	0	91017	0	1657823	152.39	4372	89345	2700	91017	0	0	0	60000	80.49	
10	.23	18912	580	2500	0	66184	0	1574647	151.13	2178	76206	2200	66184	0	0	0	50000	79.45	
11	.12	9565	470	4500	0	49573	0	1519539	150.30	1020	61753	3200	49573	0	0	0	40000	78.26	
12	.04	3123	440	8800	0	40502	0	1484274	149.67	290	57812	7600	40502	0	0	0	30000	76.89	
SUM	1.62	144018	10000	513300	0	1041557	0			16357	1313900	288700	1041557	0	0	0			
1957																			
1	-.07	-5283	450	10800	0	45384	0	1454523	149.05	-442	59126	8300	45384	0	0	0	25000	76.10	
2	-.09	-6673	410	18200	0	26986	0	1452000	149.00	-436	53870	11500	26986	0	0	0	10052	72.81	
3	-.14	-10729	710	93300	0	40309	0	1515010	150.23	-826	93287	82100	40309	0	0	0	40000	78.26	
4	-.41	-32751	1130	173600	0	131865	0	1588366	151.34	-3206	148471	13400	131865	0	0	0	40000	78.26	
5	.03	2867	1380	880500	0	0	0	2464619	161.26	325	181318	812100	0	0	0	581057	89400	83.00	
6	-.08	-8651	1460	211000	0	23587	0	2659223	162.67	-942	191829	137900	23587	0	0	0	60000	80.49	
7	.23	25022	1420	46500	0	145913	0	2533368	161.76	2339	186574	43000	145913	0	0	0	60000	80.49	
8	.29	30903	870	18300	0	96558	0	2423337	160.96	2949	114309	20700	96558	0	0	0	60000	80.49	
9	.00	0	680	16600	0	75945	0	2363312	160.53	0	89345	13400	75945	0	0	0	60000	80.49	
10	-.05	-5284	580	132100	0	0	0	2500116	161.52	-589	76206	119100	0	0	0	14083	89400	83.00	
11	-.39	-43187	470	559300	0	0	203933	2898200	164.40	-5316	61753	391500	203933	0	0	538996	89400	83.00	
12	.00	0	440	407000	0	0	406560	2898200	164.40	0	57812	359700	406560	0	0	708448	89400	83.00	
SUM	-.68	-53766	10000	2567200	0	586547	610493			-6144	1313900	2012700	1197040	0	0	1842584			
RUN SUM	3.79	391323	50000	7525500	0	3481498	3602679			34190	6569500	5991200	7084177	0	0	6471687			
ANN AVG	.76	78265	10000	1505100	0	696300	720536			6838	1313900	1198240	1416835	0	0	1294337			

RAYBURN AND STEINHAGEN STAND-ALONE

Yield with Present Conditions



..... Rayburn — Steinhagen Steinhagen Target

V2:SA2_ETX.DAT 1953 to 1957 Rayburn/Steinhagen Stand Alone with Eastex Reservoir
Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 2004 Area/Capacity/Elev. at Steinhagen
10,000 demand at Rayburn; 1,259,900 demand at Steinhagen; 1,269,900 total

page: 1
08/19/94 09:10:50

SAM RAYBURN RESERVOIR SUMMARY

Maximum Capacity = 2898200 acre-feet
Starting Content = 2898200 acre-feet
Minimum Content = 1452000 acre-feet

Critical period is from 6/1954 through 1/1957

Titles from input database file

Sam Rayburn Reservoir 4/5/94 data 08/19/94 08:54
Present Conditions with Eastex 1974 ACE

LAKE B.A. STEINHAGEN SUMMARY

Maximum Capacity = 88600 acre-feet
Starting Content = 88600 acre-feet
Minimum Content = 10012 acre-feet

Critical period is from 5/1955 through 2/1957

Titles from input database file

Lake B.A. Steinhagen 4/5/94 data 05/04/94 08:51
Rockland inflow plus intervening inflow 2004 ACE

V2:SA2_ETX.DAT 1953 to 1957 Rayburn/Steinhagen Stand Alone with Eastex Reservoir
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 2004 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,259,900 demand at Steinhagen; 1,269,900 total

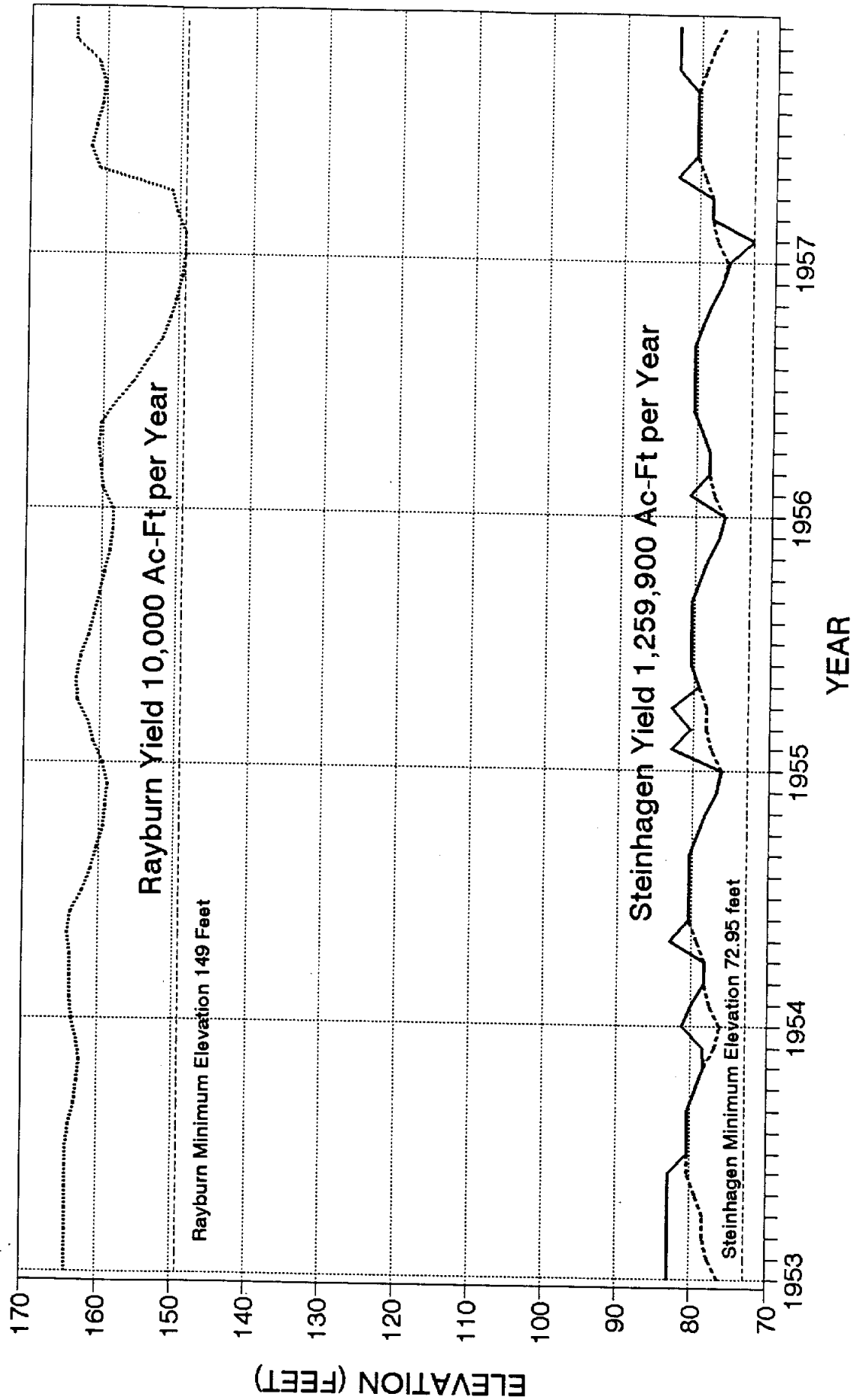
SAM RAYBURN RESERVOIR										LAKE B.A. STEINHAGEN								
Date	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	End-of-Month Elev. (Ft)	Evap. Loss (Ac-Ft)	Demand (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	End-of-Month Elev. (Ft)
1953																		
1	-.05	-5725	450	92600	0	0	97875	2898200	164.40	-680	56696	97100	97875	0	0	138959	88600	83.00
2	-.18	-20610	410	180400	0	0	200600	2898200	164.40	-2447	51656	160900	200600	0	0	312291	88600	83.00
3	-.22	-25190	710	494000	0	0	518480	2898200	164.40	-2991	89453	244600	518480	0	0	676618	88600	83.00
4	-.38	-43510	1130	199700	0	0	242080	2898200	164.40	-5167	142369	237400	242080	0	0	342278	88600	83.00
5	-.49	-56105	1380	1425400	0	0	1480125	2898200	164.40	-6663	173866	1227700	1480125	0	0	2540622	88600	83.00
6	.12	13740	1460	196200	0	0	181000	2898200	164.40	1632	183945	269400	181000	0	0	264823	88600	83.00
7	-.01	-1143	1420	73100	0	90488	0	2880535	164.27	-118	178906	59700	90488	0	0	0	60000	80.56
8	.23	26111	870	42800	0	83465	0	2812889	163.78	2354	109611	28500	83465	0	0	0	60000	80.56
9	.27	30261	680	19500	0	74036	0	2727412	163.16	2763	85673	14400	74036	0	0	0	60000	80.56
10	.23	25424	580	8100	0	59267	0	2650241	162.61	2193	73074	6000	59267	0	0	0	50000	79.52
11	.07	7665	470	15900	0	40414	0	2617592	162.37	599	59215	9400	40414	0	0	0	40000	78.34
12	-.06	-6590	440	61700	0	0	0	2685442	162.86	-481	55436	57100	0	0	0	0	42145	78.61
SUM	-.47	-55672	10000	2809400	0	347670	2720160			-9006	1259900	2412200	3067830	0	0	4275591		
1954																		
1	-.10	-11147	450	94300	0	0	0	2790439	163.62	-952	56696	81300	0	0	0	0	67701	81.28
2	.21	23708	410	69700	0	0	0	2836021	163.95	2205	51656	42300	0	0	0	0	56140	80.18
3	.15	16969	710	44400	0	47341	0	2815401	163.80	1328	89453	27300	47341	0	0	0	40000	78.34
4	.00	0	1130	78800	0	72369	0	2820702	163.84	0	142369	70000	72369	0	0	0	40000	78.34
5	-.12	-13652	1380	174500	0	0	109274	2898200	164.40	-1300	173866	153700	109274	0	0	41808	88600	83.00
6	.34	38663	1460	46000	0	88848	0	2815229	163.80	4003	183945	70500	88848	0	0	0	60000	80.56
7	.40	44340	1420	4800	0	179199	0	2595070	162.21	4093	178906	3800	179199	0	0	0	60000	80.56
8	.51	54688	870	4000	0	110930	0	2432582	161.03	5219	109611	3900	110930	0	0	0	60000	80.56
9	.47	49088	680	3800	0	86683	0	2299931	160.07	4810	85673	3800	86683	0	0	0	60000	80.56
10	.09	9210	580	2800	0	60032	0	2232909	159.38	858	73074	3900	60032	0	0	0	50000	79.52
11	.05	5045	470	16000	0	45043	0	2198351	159.00	428	59215	4600	45043	0	0	0	40000	78.34
12	.13	13021	440	16500	0	20883	0	2180507	158.81	947	55436	25500	20883	0	0	0	30000	76.99
SUM	2.13	229933	10000	555600	0	711328	109274			21639	1259900	490600	820602	0	0	41808		
1955																		
1	-.08	-8057	450	49400	0	0	0	2237514	159.43	-522	56696	52900	0	0	0	0	26726	76.47
2	-.20	-20752	410	164800	0	0	0	2422656	160.96	-1981	51656	174400	0	0	0	62851	88600	83.00
3	.13	13799	710	81600	0	0	0	2489747	161.45	1529	89453	62200	0	0	0	0	59818	80.54
4	-.10	-10912	1130	237700	0	0	0	2737229	163.24	-1176	142369	308900	0	0	0	138925	88600	83.00
5	.06	6700	1380	93200	0	63244	0	2759105	163.39	678	173866	72700	63244	0	0	0	50000	79.52
6	.31	34418	1460	78800	0	132200	0	2669827	162.75	2955	183945	64700	132200	0	0	0	60000	80.56
7	.22	23875	1420	18800	0	168757	0	2494575	161.48	2251	178906	12400	168757	0	0	0	60000	80.56
8	.14	14864	870	35900	0	93844	0	2420897	160.95	1433	109611	17200	93844	0	0	0	60000	80.56
9	.19	19867	680	7700	0	83617	0	2324433	160.25	1944	85673	4000	83617	0	0	0	60000	80.56
10	.29	29809	580	6200	0	59539	0	2240705	159.46	2765	73074	6300	59539	0	0	0	50000	79.52
11	.18	18129	470	3900	0	48255	0	2177751	158.78	1540	59215	2500	48255	0	0	0	40000	78.34
12	.05	4972	440	14500	0	37000	0	2149839	158.48	364	55436	8800	37000	0	0	0	30000	76.99
SUM	1.19	126712	10000	792500	0	686456	0			11780	1259900	787000	686456	0	0	201776		

V2:SA2_ETX.DAT 1953 to 1957 Rayburn/Steinhagen Stand Alone with Eastex Reservoir
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 2004 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,259,900 demand at Steinhagen; 1,269,900 total

Date	SAM RAYBURN RESERVOIR									LAKE B.A. STEINHAGEN									
	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Demand (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	
1956																			
1	-.07	-6927	450	24300	0	36449	0	2144167	158.41	-447	56696	14800	36449	0	0	0	25000	76.19	
2	-.20	-20174	410	121100	0	0	0	2285031	159.95	-1705	51656	89500	0	0	0	0	64549	81.01	
3	.07	7215	710	53400	0	27651	0	2302855	160.09	647	89453	37900	27651	0	0	0	40000	78.34	
4	-.02	-2072	1130	99900	0	65112	0	2338585	160.35	-157	142369	77100	65112	0	0	0	40000	78.34	
5	.10	10358	1380	127800	0	151622	0	2303025	160.09	856	173866	33100	151622	0	0	0	50000	79.52	
6	.12	12099	1460	14000	0	180489	0	2122977	158.18	1144	183945	14600	180489	0	0	0	60000	80.56	
7	.42	40001	1420	5200	0	178904	0	1907852	155.85	4298	178906	4300	178904	0	0	0	60000	80.56	
8	.38	34259	870	2300	0	111800	0	1763223	153.99	3889	109611	1700	111800	0	0	0	60000	80.56	
9	.43	36709	680	3600	0	87373	0	1642061	152.15	4400	85673	2700	87373	0	0	0	60000	80.56	
10	.23	18794	580	2500	0	63067	0	1562120	150.94	2193	73074	2200	63067	0	0	0	50000	79.52	
11	.12	9517	470	4900	0	47042	0	1509991	150.15	1027	59215	3200	47042	0	0	0	40000	78.34	
12	.04	3101	440	10200	0	38127	0	1478523	149.55	291	55436	7600	38127	0	0	0	30000	76.99	
SUM	1.62	142880	10000	469200	0	987636	0			16436	1259900	288700	987636	0	0	0			
1957																			
1	-.07	-5259	450	10900	0	42232	0	1452000	149.00	-442	56696	8300	42232	0	0	0	24278	76.08	
2	-.09	-6664	410	19200	0	25454	0	1452000	149.00	-436	51656	11500	25454	0	0	0	10012	72.96	
3	-.14	-10747	710	92500	0	36507	0	1518030	150.27	-834	89453	82100	36507	0	0	0	40000	78.34	
4	-.41	-32581	1130	138900	0	125741	0	1562640	150.95	-3228	142369	13400	125741	0	0	0	40000	78.34	
5	.03	2830	1380	846500	0	0	0	2404930	160.83	325	173866	812100	0	0	0	589309	88600	83.00	
6	-.08	-8545	1460	182900	0	16503	0	2578412	162.09	-942	183945	137900	16503	0	0	0	60000	80.56	
7	.23	24686	1420	45700	0	138260	0	2459746	161.23	2354	178906	43000	138260	0	0	0	60000	80.56	
8	.29	30512	870	18000	0	91879	0	2354485	160.47	2968	109611	20700	91879	0	0	0	60000	80.56	
9	.00	0	680	16400	0	72273	0	2297932	160.06	0	85673	13400	72273	0	0	0	60000	80.56	
10	-.05	-5217	580	121600	0	0	0	2424169	160.97	-589	73074	119100	0	0	0	18015	88600	83.00	
11	-.39	-42907	470	511500	0	0	79906	2898200	164.40	-5303	59215	391500	79906	0	0	417494	88600	83.00	
12	.00	0	440	396700	0	0	396260	2898200	164.40	0	55436	359700	396260	0	0	700524	88600	83.00	
SUM	-.68	-53892	10000	2400800	0	548849	476166			-6127	1259900	2012700	1025015	0	0	1725342			
RUN SUM	3.79	389961	50000	7027500	0	3281939	3305600			34722	6299500	5991200	6587539	0	0	6244517			
ANN AVG	.76	77992	10000	1405500	0	656388	661120			6944	1259900	1198240	1317508	0	0	1248903			

RAYBURN AND STEINHAGEN STAND-ALONE

Yield with Eastex Reservoir



..... Rayburn — Steinhagen Steinhagen Target

V2:SA3_ROCK.DAT 1953 to 1957 Rayburn/Steinhagen Stand-Alone with Eastex and Rockland Reservoirs
Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 2024 Area/Capacity/Elev. at Steinhagen
10,000 demand at Rayburn; 979,100 demand at Steinhagen; 989,100 total

page: 1
08/19/94 08:58:24

SAM RAYBURN RESERVOIR SUMMARY

Maximum Capacity = 2898200 acre-feet
Starting Content = 2898200 acre-feet
Minimum Content = 1452000 acre-feet

Critical period is from 7/1953 through 1/1957

Titles from input database file

Sam Rayburn Reservoir 4/5/94 data 08/19/94 08:54
Present Conditions with Eastex 1974 ACE

LAKE B.A. STEINHAGEN SUMMARY

Maximum Capacity = 86960 acre-feet
Starting Content = 86960 acre-feet
Minimum Content = 10058 acre-feet

Critical period is from 7/1953 through 2/1957

Titles from input database file

Lake B.A. Steinhagen 4/5/94 data 05/04/94 08:51
Intervening Inflow only 2024 ACE

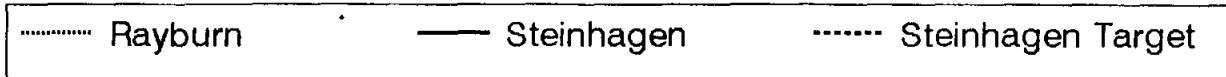
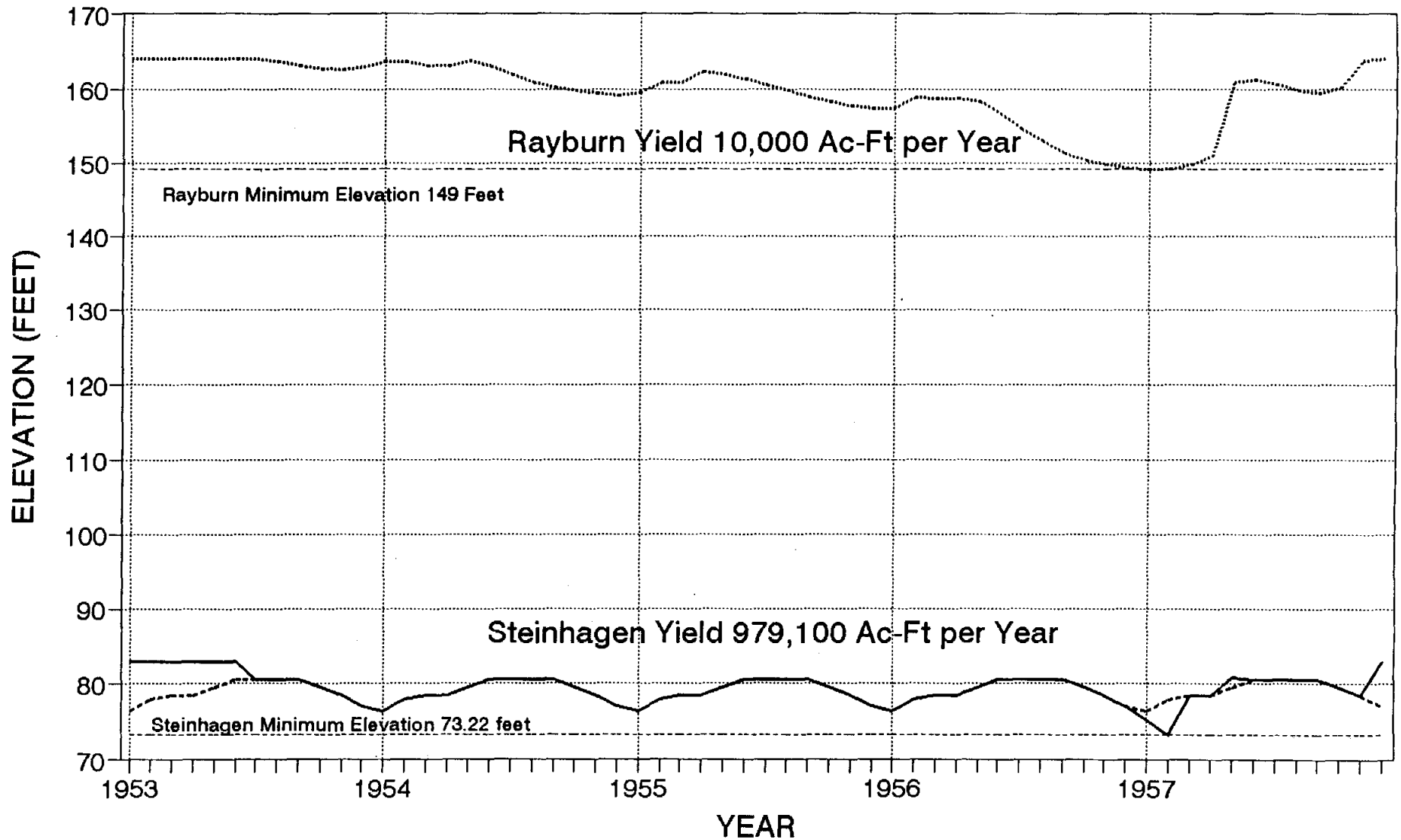
SAM RAYBURN RESERVOIR										LAKE B.A. STEINHAGEN								
Date	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Demand (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)
1953																		
1	-.05	-5725	450	92600	0	0	97875	2898200	164.40	-676	44060	47000	97875	0	0	101491	86960	83.00
2	-.18	-20610	410	180400	0	0	200600	2898200	164.40	-2434	40143	66000	200600	0	0	228891	86960	83.00
3	-.22	-25190	710	494000	0	0	518480	2898200	164.40	-2975	69516	56200	518480	0	0	508139	86960	83.00
4	-.38	-43510	1130	199700	0	0	242080	2898200	164.40	-5139	110638	80500	242080	0	0	217081	86960	83.00
5	-.49	-56105	1380	1425400	0	0	1480125	2898200	164.40	-6626	135116	354600	1480125	0	0	1706235	86960	83.00
6	-.12	13740	1460	196200	0	0	181000	2898200	164.40	1623	142949	91600	181000	0	0	128028	86960	83.00
7	-.01	-1144	1420	73100	0	85054	0	2885970	164.31	-118	139032	26900	85054	0	0	0	60000	80.71
8	.23	26165	870	42800	0	69366	0	2832369	163.92	2384	85182	18200	69366	0	0	0	60000	80.71
9	.27	30390	680	19500	0	62578	0	2758221	163.39	2799	66579	6800	62578	0	0	0	60000	80.71
10	.23	25589	580	8100	0	44910	0	2695242	162.93	2222	56788	4100	44910	0	0	0	50000	79.68
11	.07	7731	470	15900	0	30722	0	2672219	162.77	604	46018	5900	30722	0	0	0	40000	78.50
12	-.06	-6643	440	61700	0	15739	0	2724383	163.14	-440	43079	16900	15739	0	0	0	30000	77.16
SUM	-.47	-55312	10000	2809400	0	308369	2720160			-8776	979100	774700	3028529	0	0	2889865		
1954																		
1	-.10	-11209	450	94300	0	12009	0	2817433	163.82	-651	44060	26400	12009	0	0	0	25000	76.37
2	.21	23727	410	69700	0	44181	0	2818815	163.83	1438	40143	7400	44181	0	0	0	35000	77.86
3	.15	16886	710	44400	0	71661	0	2773958	163.50	1145	69516	4000	71661	0	0	0	40000	78.50
4	.00	0	1130	78800	0	76538	0	2775090	163.51	0	110638	34100	76538	0	0	0	40000	78.50
5	-.12	-13573	1380	174500	0	88081	0	2873702	164.22	-1035	135116	56000	88081	0	0	0	50000	79.68
6	.34	38341	1460	46000	0	140334	0	2739567	163.25	3285	142949	15900	140334	0	0	0	60000	80.71
7	.40	43909	1420	4800	0	142278	0	2556760	161.93	4146	139032	900	142278	0	0	0	60000	80.71
8	.51	54431	870	4000	0	87868	0	2417591	160.92	5286	85182	2600	87868	0	0	0	60000	80.71
9	.47	49037	680	3800	0	68051	0	2303623	160.10	4872	66579	3400	68051	0	0	0	60000	80.71
10	.09	9240	580	2800	0	43757	0	2252846	159.60	869	56788	3900	43757	0	0	0	50000	79.68
11	.05	5082	470	16000	0	31849	0	2231445	159.36	431	46018	4600	31849	0	0	0	40000	78.50
12	.13	13125	440	16500	0	30232	0	2204148	159.07	953	43079	3800	30232	0	0	0	30000	77.16
SUM	2.13	228996	10000	555600	0	836839	0			20739	979100	163000	836839	0	0	0		
1955																		
1	-.08	-8085	450	49400	0	22340	0	2238843	159.44	-520	44060	16200	22340	0	0	0	25000	76.37
2	-.20	-20749	410	164800	0	3873	0	2420109	160.94	-1370	40143	44900	3873	0	0	0	35000	77.86
3	.13	13708	710	81600	0	68808	0	2418483	160.93	992	69516	6700	68808	0	0	0	40000	78.50
4	-.10	-10737	1130	237700	0	42340	0	2623450	162.41	-798	110638	67500	42340	0	0	0	40000	78.50
5	.06	6527	1380	93200	0	139733	0	2569010	162.02	517	135116	5900	139733	0	0	0	50000	79.68
6	.31	33267	1460	78800	0	145844	0	2467239	161.28	2995	142949	10100	145844	0	0	0	60000	80.71
7	.22	23104	1420	18800	0	135112	0	2326403	160.26	2280	139032	6200	135112	0	0	0	60000	80.71
8	.14	14440	870	35900	0	78333	0	2268660	159.77	1451	85182	8300	78333	0	0	0	60000	80.71
9	.19	19245	680	7700	0	66248	0	2190187	158.92	1969	66579	2300	66248	0	0	0	60000	80.71
10	.29	28758	580	6200	0	48689	0	2118360	158.13	2801	56788	900	48689	0	0	0	50000	79.68
11	.18	17539	470	3900	0	36070	0	2068181	157.59	1552	46018	1500	36070	0	0	0	40000	78.50
12	.05	4823	440	14500	0	28545	0	2048873	157.38	366	43079	4900	28545	0	0	0	30000	77.16
SUM	1.19	121840	10000	792500	0	815935	0			12235	979100	175400	815935	0	0	0		

SAM RAYBURN RESERVOIR

LAKE B.A. STEINHAGEN

Date	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Demand (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	
1956																			
1	-.07	-6733	450	24300	0	30105	0	2049351	157.38	-455	44060	8500	30105	0	0	0	25000	76.37	
2	-.20	-19604	410	121100	0	11573	0	2178072	158.78	-1370	40143	37200	11573	0	0	0	35000	77.86	
3	.07	6971	710	53400	0	63450	0	2160341	158.59	534	69516	11600	63450	0	0	0	40000	78.50	
4	-.02	-1988	1130	99900	0	96178	0	2164921	158.64	-160	110638	14300	96178	0	0	0	40000	78.50	
5	.10	9905	1380	127800	0	145978	0	2135458	158.32	862	135116	0	145978	0	0	0	50000	79.68	
6	.12	11579	1460	14000	0	152708	0	1983711	156.67	1159	142949	1400	152708	0	0	0	60000	80.71	
7	.42	38579	1420	5200	0	141385	0	1807527	154.66	4353	139032	2000	141385	0	0	0	60000	80.71	
8	.38	33063	870	2300	0	87921	0	1687973	152.85	3939	85182	1200	87921	0	0	0	60000	80.71	
9	.43	35688	680	3600	0	68436	0	1586769	151.31	4457	66579	2600	68436	0	0	0	60000	80.71	
10	.23	18401	580	2500	0	46810	0	1523478	150.36	2222	56788	2200	46810	0	0	0	50000	79.68	
11	.12	9377	470	4900	0	34353	0	1484178	149.67	1035	46018	2700	34353	0	0	0	40000	78.50	
12	.04	3034	440	10200	0	27472	0	1463432	149.24	293	43079	5900	27472	0	0	0	30000	77.16	
SUM	1.62	138272	10000	469200	0	906369	0			16869	979100	89600	906369	0	0	0			
1957																			
1	-.07	-5216	450	10900	0	27098	0	1452000	149.00	-418	44060	5300	27098	0	0	0	18756	75.27	
2	-.09	-6664	410	19200	0	25454	0	1452000	149.00	-391	40143	5600	25454	0	0	0	10058	73.23	
3	-.14	-10595	710	92500	0	62606	0	1491779	149.83	-852	69516	36000	62606	0	0	0	40000	78.50	
4	-.41	-32426	1130	138900	0	93967	0	1568008	151.03	-3271	110638	13400	93967	0	0	0	40000	78.50	
5	.03	2835	1380	846500	0	0	0	2410293	160.87	275	135116	157300	0	0	0	0	61909	80.90	
6	-.08	-8469	1460	182900	0	128000	0	2472202	161.32	-840	142949	12200	128000	0	0	0	60000	80.71	
7	.23	24237	1420	45700	0	132716	0	2359529	160.50	2384	139032	8700	132716	0	0	0	60000	80.71	
8	.29	29986	870	18000	0	83888	0	2262785	159.70	3006	85182	4300	83888	0	0	0	60000	80.71	
9	.00	0	680	16400	0	58379	0	2220126	159.24	0	66579	8200	58379	0	0	0	60000	80.71	
10	-.05	-5108	580	121600	0	46305	0	2299949	160.07	-483	56788	0	46305	0	0	0	50000	79.68	
11	-.39	-42283	470	511500	0	0	0	2853262	164.07	-3382	46018	33700	0	0	0	0	41064	78.64	
12	.00	0	440	396700	0	0	351322	2898200	164.40	0	43079	110300	351322	0	0	372647	86960	83.00	
SUM	-.68	-53703	10000	2400800	0	658413	351322			-3972	979100	395000	1009735	0	0	372647			
RUN SUM	3.79	380093	50000	7027500	0	3525925	3071482			37095	4895500	1597700	6597407	0	0	3262512			
ANN AVG	.76	76019	10000	1405500	0	705185	614296			7419	979100	319540	1319481	0	0	652502			

RAYBURN AND STEINHAGEN STAND-ALONE Yield with Eastex and Rockland



APPENDIX F

RAYBURN/STEINHAGEN/BARRIER SYSTEM OPERATION STUDIES

APPENDIX F

RAYBURN/STEINHAGEN/BARRIER SYSTEM OPERATION STUDIES

Table F-1 summarizes the results of operation studies for the coordinated Rayburn/Steinhagen/barrier system. Detailed monthly summaries and graphs of the following studies are included:

- Case 1 Present conditions, no barriers
- Case 2 Present conditions, temporary barriers and current permit
- Case 6 Present conditions, temporary barriers operated for maximum yield
- Case 8 Present conditions, permanent barrier operated for maximum yield

Table F-1

Summary of Rayburn/Steinhagen/Barrier System Operation Studies

Case	Description	Conditions	Water Supply Yield (Ac-Ft/Yr)	Critical Period	Comments
1	No barriers	Present	0	----	No firm yield - insufficient supply for salt water
		With Eastex	0	----	
		With Eastex & Rockland	0	----	
2	Temporary barriers and current permit	Present	799,700	7/53 - 12/56	Limit of firm yield under present conditions
		With Eastex	765,700	7/53 - 12/56	
		With Eastex & Rockland	539,800	7/53 - 1/57	
3	Temporary barriers w/o 60 day removal rule	Present	888,200	7/53 - 12/56	Yields without the 60-day removal rule
		With Eastex	840,000	7/53 - 12/56	
		With Eastex & Rockland	660,500	7/53 - 12/56	
4	Temporary barriers - no wait to start installing barriers after entering Zone 3	Present	914,500	7/53 - 12/56	Yields if construction of barriers can start when Sam Rayburn enters Zone 3
		With Eastex	869,500	7/53 - 12/56	
		With Eastex & Rockland	647,900	7/53 - 12/56	
5	Temporary barriers - no 60-day removal rule and no wait to start installing barriers after entering Zone 3	Present	1,013,700	7/53 - 1/57	Yields if both 60-day removal and 30-day Zone 3 waiting period are deleted
		With Eastex	975,000	7/53 - 1/57	
		With Eastex & Rockland	825,500	7/53 - 12/56	

Continued on the next page....

Table F-1, Continued

Case	Description	Conditions	Water Supply Yield (Ac-Ft/Yr)	Critical Period	Comments
6	Temporary barriers operated for maximum water supply yield	Present	1,391,900	7/53 - 1/57	Yields if barriers can be installed as soon as low flow conditions begin
		With Eastex	1,336,500	7/53 - 1/57	
		With Eastex & Rockland	1,112,800	7/53 - 1/57	
7	Permanent barrier with TTWP bypass criteria	Present	1,505,600	8/53 - 2/57	
		With Eastex	1,449,700	8/53 - 2/57	
		With Eastex & Rockland	1,221,300	8/53 - 2/57	
8	Permanent barrier operated for maximum water supply yield	Present	1,574,800	7/53 - 1/57	
		With Eastex	1,515,500	8/53 - 1/57	
		With Eastex & Rockland	1,326,700	8/53 - 1/57	

CASE 1 V3:NO1_PRES.DAT 1953 to 1957 No Barriers, Present Conditions
Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
0 demand at Rayburn; 0 demand at Steinhagen; 0 total

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SAM RAYBURN RESERVOIR SUMMARY

Maximum Capacity = 2898200 acre-feet
Starting Content = 2898200 acre-feet
Minimum Content = 1405472 acre-feet

Critical period is from 8/1953 through 11/1956

Titles from input database file

Sam Rayburn Reservoir 4/5/94 data 08/19/94 09:23
Present Conditions 1974 ACE

DAILY FLOW BELOW STEINHAGEN

Titles from input database file

Critical period information for Kountze gauge
VILLAGE CREEK NR KOUNTZE, TEX.

LAKE B.A. STEINHAGEN SUMMARY

Maximum Capacity = 89400 acre-feet
Starting Content = 89400 acre-feet
Minimum Content = -970196 acre-feet

Critical period is from 5/1955 through 2/1957

note: minimum content is the greatest shortage encountered during the run

Titles from input database file

Lake B.A. Steinhagen 4/5/94 data 05/04/94 08:51
Rockland inflow plus intervening inflow 1994 ACE

Date	SAM RAYBURN RESERVOIR									LAKE B.A. STEINHAGEN								
	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	End-of-Month Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	End-of-Month Elev. (Ft)	Below Steinhagen (Ac-Ft)
1953																		
1	-.05	-5725	0	96400	0	0	102125	2898200	164.40	-682	0	97100	102125	0	199907	89400	83.00	122380
2	-.18	-20610	0	184000	0	0	204610	2898200	164.40	-2454	0	160900	204610	0	367964	89400	83.00	211770
3	-.22	-25190	0	529500	0	0	554690	2898200	164.40	-2999	0	244600	554690	0	802289	89400	83.00	165865
4	-.38	-43510	0	211500	0	0	255010	2898200	164.40	-5180	0	237400	255010	0	497590	89400	83.00	128495
5	-.49	-56105	0	1506500	0	0	1562605	2898200	164.40	-6679	0	1227700	1562605	0	2796984	89400	83.00	1139960
6	.12	13740	0	196900	0	0	183160	2898200	164.40	1636	0	269400	183160	0	450924	89400	83.00	52568
7	-.01	-1145	0	74800	0	0	75945	2898200	164.40	-136	0	59700	75945	0	135781	89400	83.00	82553
8	.23	26200	0	41600	0	77444	0	2836156	163.95	2708	132636	28500	77444	0	0	60000	80.49	36407
9	.27	30265	0	20000	0	120165	0	2705726	163.01	2745	131820	14400	120165	0	0	60000	80.49	31770
10	.23	25157	0	8300	0	139963	0	2548906	161.87	2178	153785	6000	139963	0	0	50000	79.45	15258
11	.07	7478	0	14500	0	120429	0	2435499	161.05	595	139234	9400	120429	0	0	40000	78.26	24356
12	-.06	-6385	0	68500	0	5206	0	2505178	161.56	-436	72742	57100	5206	0	0	30000	76.89	98318
SUM	-.47	-55830	0	2952500	0	463207	2938145			-8704	630217	2412200	3401352	0	5251439			2109700
1954																		
1	-.10	-10812	0	100200	0	0	0	2616190	162.36	-831	54925	81300	0	0	0	57206	80.22	115105
2	.21	22963	0	76600	0	34549	0	2635278	162.50	1815	97240	42300	34549	0	0	35000	77.60	55444
3	.15	16327	0	49400	0	105460	0	2562891	161.97	1124	126636	27300	105460	0	0	40000	78.26	42407
4	.00	0	0	83200	0	24851	0	2621240	162.40	0	94851	70000	24851	0	0	40000	78.26	87303
5	-.12	-13364	0	209400	0	0	0	2844004	164.01	-1299	0	153700	0	0	105599	89400	83.00	105715
6	.34	38445	0	46600	0	50606	0	2801553	163.70	4003	146503	70500	50606	0	0	60000	80.49	17087
7	.40	44316	0	4000	0	158926	0	2602311	162.26	4067	158659	3800	158926	0	0	60000	80.49	10384
8	.51	54561	0	2600	0	151397	0	2398953	160.79	5185	150112	3900	151397	0	0	60000	80.49	18931
9	.47	48481	0	3600	0	157132	0	2196940	158.99	4779	156153	3800	157132	0	0	60000	80.49	7437
10	.09	8846	0	3700	0	142416	0	2049378	157.38	852	155464	3900	142416	0	0	50000	79.45	13579
11	.05	4730	0	19100	0	127442	0	1936306	156.16	425	141617	4600	127442	0	0	40000	78.26	21973
12	.13	11896	0	21300	0	115523	0	1830187	155.00	944	150079	25500	115523	0	0	30000	76.89	18964
SUM	2.13	226389	0	619700	0	1068302	0			21064	1432239	490600	1068302	0	105599			514329
1955																		
1	-.08	-7218	0	57100	0	49091	0	1845414	155.17	-505	107496	52900	49091	0	0	25000	76.10	61547
2	-.20	-18658	0	183200	0	0	0	2047272	157.36	-1955	0	174400	0	0	111955	89400	83.00	226241
3	.13	12636	0	102800	0	15422	0	2122014	158.17	1407	125615	62200	15422	0	0	40000	78.26	43428
4	-.10	-10207	0	260100	0	0	0	2392321	160.74	-1082	0	308900	0	0	260582	89400	83.00	266478
5	.06	6335	0	100100	0	25083	0	2461003	161.24	679	136504	72700	25083	0	0	50000	79.45	32539
6	.31	32788	0	81200	0	97500	0	2411915	160.88	2936	149264	64700	97500	0	0	60000	80.49	14326
7	.22	22886	0	19900	0	132383	0	2276546	159.85	2237	142546	12400	132383	0	0	60000	80.49	26497
8	.14	14165	0	34800	0	122673	0	2174508	158.74	1423	138450	17200	122673	0	0	60000	80.49	30593
9	.19	18546	0	7600	0	139589	0	2023973	157.11	1932	141657	4000	139589	0	0	60000	80.49	21933
10	.29	27027	0	6700	0	141370	0	1862276	155.35	2746	154924	6300	141370	0	0	50000	79.45	14119
11	.18	15911	0	4400	0	141371	0	1709394	153.17	1530	152341	2500	141371	0	0	40000	78.26	11249
12	.05	4174	0	14900	0	127792	0	1592328	151.40	363	146229	8800	127792	0	0	30000	76.89	22814
SUM	1.19	118385	0	872800	0	992274	0			11711	1395026	787000	992274	0	372537			771764

CASE 1 V3:NO1_PRES.DAT 1953 to 1957 No Barriers, Present Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 0 demand at Rayburn; 0 demand at Steinhagen; 0 total

Date	SAM RAYBURN RESERVOIR									LAKE B.A. STEINHAGEN								
	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1956																		
1	-.07	-5607	0	24100	0	98968	0	1523067	150.35	-442	119210	14800	98968	0	0	25000	76.10	55127
2	-.20	-16292	0	128000	0	0	0	1667359	152.54	-1874	33561	89500	0	0	0	82813	82.49	196951
3	.07	5948	0	54500	0	0	0	1715911	153.27	777	67941	37900	0	0	0	51995	79.67	109792
4	-.02	-1744	0	99900	0	28311	0	1789244	154.38	-173	117579	77100	28311	0	0	40000	78.26	46011
5	.10	8908	0	168600	0	128832	0	1820104	154.85	850	151082	33100	128832	0	0	50000	79.45	17961
6	.12	10438	0	13500	0	149072	0	1674094	152.64	1136	152536	14600	149072	0	0	60000	80.49	11054
7	.42	33946	0	3800	0	162699	0	1481249	149.61	4270	162729	4300	162699	0	0	60000	80.49	6314
8	.38	28594	0	1500	0	2155	0	1452000	149.00	2758	164301	1700	2155	113204	0	10000	72.79	4742
9	.43	31644	0	3600	0	0	0	1423956	148.60	1327	159368	2700	0	157995	0	10000	72.79	4222
10	.23	16770	0	2500	0	0	0	1409686	148.40	710	164724	2200	0	163234	0	10000	72.79	4319
11	.12	8714	0	4500	0	0	0	1405472	148.34	370	153826	3200	0	150996	0	10000	72.79	9764
12	.04	2906	0	8800	0	0	0	1411366	148.42	123	145064	7600	0	137587	0	10000	72.79	23979
SUM	1.62	124225	0	513300	0	570037	0			9832	1591921	288700	570037	723016	0			490236
1957																		
1	-.07	-5109	0	10800	0	0	0	1427275	148.65	-216	150478	8300	0	141962	0	10000	72.79	18565
2	-.09	-6628	0	18200	0	103	0	1452000	149.00	-278	117099	11500	103	105218	0	10000	72.79	35585
3	-.14	-10902	0	93300	0	11311	0	1544891	150.68	-826	64237	82100	11311	0	0	40000	78.26	131381
4	-.41	-33970	0	173600	0	30408	0	1722053	153.36	-3206	47014	13400	30408	0	0	40000	78.26	147725
5	.03	2980	0	880500	0	0	0	2599573	162.24	325	0	812100	0	0	762375	89400	83.00	305585
6	-.08	-8875	0	211000	0	0	0	2819448	163.83	-1090	0	137900	0	0	138990	89400	83.00	100850
7	.23	25897	0	46500	0	64608	0	2775443	163.51	2708	134300	43000	64608	0	0	60000	80.49	35443
8	.29	32120	0	18300	0	136570	0	2625053	162.42	2949	154321	20700	136570	0	0	60000	80.49	14722
9	.00	0	0	16600	0	109091	0	2532562	161.75	0	122491	13400	109091	0	0	60000	80.49	59294
10	-.05	-5444	0	132100	0	0	0	2670106	162.75	-589	0	119100	0	0	90289	89400	83.00	105453
11	-.39	-43814	0	559300	0	0	375020	2898200	164.40	-5316	0	391500	375020	0	771836	89400	83.00	329654
12	.00	0	0	407000	0	0	407000	2898200	164.40	0	0	359700	407000	0	766700	89400	83.00	184149
SUM	-.68	-53745	0	2567200	0	352091	782020			-5539	789940	2012700	1134111	247180	2530190			1468406
RUN SUM	3.79	359424	0	7525500	0	3445911	3720165			28364	5839343	5991200	7166076	970196	8259765			5354435
ANN AVG	.76	71885	0	1505100	0	689182	744033			5673	1167869	1198240	1433215	194039	1651953			1070887

CASE 1 V3:N01_PRES.DAT 1953 to 1957 No Barriers, Present Conditions
Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
0 demand at Rayburn; 0 demand at Steinhagen; 0 total

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DAILY FLOW BELOW STEINHAGEN

Titles from input database file

Critical period information for Kountze gauge
VILLAGE CREEK NR KOUNTZE, TEX.

CASE 1 V3:NO1_PRES.DAT 1953 to 1957 No Barriers, Present Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 0 demand at Rayburn; 0 demand at Steinhagen; 0 total

FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1953									
1	199907	122380	322287	169043	0	0	0	153244	0
2	367964	211770	579734	152684	0	0	0	427050	0
3	802289	165865	968154	169043	0	0	0	799111	0
4	497590	128495	626085	163590	0	0	0	462495	0
5	2796984	1139960	3936944	169043	0	0	0	3767901	0
6	450924	52568	503492	163590	0	0	0	339902	0
7	135781	82553	218334	169043	0	0	0	49291	0
8	132636	36407	169043	169043	0	0	0	0	0
9	131820	31770	163590	163590	0	0	0	0	0
10	153785	15258	169043	169043	0	0	0	0	0
11	139234	24356	163590	163590	0	0	0	0	0
12	72742	98318	171060	169043	0	0	0	2017	0
SUM	5881656	2109700	7991356	1990345	0	0	0	6001011	0
1954									
1	54925	115105	170030	169043	0	0	0	987	0
2	97240	55444	152684	152684	0	0	0	0	0
3	126636	42407	169043	169043	0	0	0	0	0
4	94851	87303	182154	163590	0	0	0	18564	0
5	105599	105715	211314	169043	0	0	0	42271	0
6	146503	17087	163590	163590	0	0	0	0	0
7	158659	10384	169043	169043	0	0	0	0	0
8	150112	18931	169043	169043	0	0	0	0	0
9	156153	7437	163590	163590	0	0	0	0	0
10	155464	13579	169043	169043	0	0	0	0	0
11	141617	21973	163590	163590	0	0	0	0	0
12	150079	18964	169043	169043	0	0	0	0	0
SUM	1537838	514329	2052167	1990345	0	0	0	61822	0
1955									
1	107496	61547	169043	169043	0	0	0	0	0
2	111955	226241	338196	152684	0	0	0	185512	0
3	125615	43428	169043	169043	0	0	0	0	0
4	260582	266478	527060	163590	0	0	0	363470	0
5	136504	32539	169043	169043	0	0	0	0	0
6	149264	14326	163590	163590	0	0	0	0	0
7	142546	26497	169043	169043	0	0	0	0	0
8	138450	30593	169043	169043	0	0	0	0	0
9	141657	21933	163590	163590	0	0	0	0	0
10	154924	14119	169043	169043	0	0	0	0	0
11	152341	11249	163590	163590	0	0	0	0	0
12	146229	22814	169043	169043	0	0	0	0	0
SUM	1767563	771764	2539327	1990345	0	0	0	548982	0

CASE 1 V3:NO1_PRES.DAT 1953 to 1957 No Barriers, Present Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 0 demand at Rayburn; 0 demand at Steinhagen; 0 total

FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1956									
1	119210	55127	174337	169043	0	0	0	5294	0
2	33561	196951	230512	158137	0	0	0	72375	0
3	67941	109792	177733	169043	0	0	0	8690	0
4	117579	46011	163590	163590	0	0	0	0	0
5	151082	17961	169043	169043	0	0	0	0	0
6	152536	11054	163590	163590	0	0	0	0	0
7	162729	6314	169043	169043	0	0	0	0	0
8	51097	4742	55839	55839	0	0	0	0	113204
9	1373	4222	5595	5595	0	0	0	0	157995
10	1490	4319	5809	5809	0	0	0	0	163234
11	2830	9764	12594	12594	0	0	0	0	150996
12	7477	23979	31456	31456	0	0	0	0	137587
SUM	868905	490236	1359141	1272782	0	0	0	86359	723016
1957									
1	8516	18565	27081	27081	0	0	0	0	141962
2	11881	35585	47466	47466	0	0	0	0	105218
3	64237	131381	195618	169043	0	0	0	26575	0
4	47014	147725	194739	163590	0	0	0	31149	0
5	762375	305585	1067960	169043	0	0	0	898917	0
6	138990	100850	239840	163590	0	0	0	76250	0
7	134300	35443	169743	169043	0	0	0	700	0
8	154321	14722	169043	169043	0	0	0	0	0
9	122491	59294	181785	163590	0	0	0	18195	0
10	90289	105453	195742	169043	0	0	0	26699	0
11	771836	329654	1101490	163590	0	0	0	937900	0
12	766700	184149	950849	169043	0	0	0	781806	0
SUM	3072950	1468406	4541356	1743165	0	0	0	2798191	247180
RUN SUM	13128912	5354435	18483347	8986982	0	0	0	9496365	970196
ANN AVG	2625782	1070887	3696669	1797396	0	0	0	1899273	194039

CASE 2 V3:TB1_PRES.DAT 1953 to 1957 Temporary Barriers; Current Conditions; Current Permit
Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
10,000 demand at Rayburn; 789,700 demand at Steinhagen; 799,700 total

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SAM RAYBURN RESERVOIR SUMMARY

Maximum Capacity = 2898200 acre-feet
Starting Content = 2898200 acre-feet
Minimum Content = -470 acre-feet

Critical period is from 7/1953 through 11/1956

note: minimum content is the greatest shortage encountered during the run

Titles from input database file

Sam Rayburn Reservoir 4/5/94 data 08/19/94 09:23
Present Conditions 1974 ACE

DAILY FLOW BELOW STEINHAGEN

Titles from input database file

Critical period information for Kountze gauge
VILLAGE CREEK NR KOUNTZE, TEX.

LAKE B.A. STEINHAGEN SUMMARY

Maximum Capacity = 89400 acre-feet
Starting Content = 89400 acre-feet
Minimum Content = 15724 acre-feet

Critical period is from 3/1956 through 12/1956

Titles from input database file

Lake B.A. Steinhagen 4/5/94 data 05/04/94 08:51
Rockland inflow plus intervening inflow 1994 ACE

Date	SAM RAYBURN RESERVOIR									LAKE B.A. STEINHAGEN								
	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1953																		
1	-.05	-5725	450	96400	0	0	101675	2898200	164.40	-682	0	97100	101675	0	199457	89400	83.00	122380
2	-.18	-20610	410	184000	0	0	204200	2898200	164.40	-2454	0	160900	204200	0	367554	89400	83.00	211770
3	-.22	-25190	710	529500	0	0	553980	2898200	164.40	-2999	0	244600	553980	0	801579	89400	83.00	165865
4	-.38	-43510	1130	211500	0	0	253880	2898200	164.40	-5180	0	237400	253880	0	496460	89400	83.00	128495
5	-.49	-56105	1380	1506500	0	0	1561225	2898200	164.40	-6679	0	1227700	1561225	0	2795604	89400	83.00	1139960
6	.12	13740	1460	196900	0	0	181700	2898200	164.40	1636	0	269400	181700	0	449464	89400	83.00	52568
7	-.01	-1142	1420	74800	0	109409	0	2863313	164.15	-118	198627	59700	109409	0	0	60000	80.49	82553
8	.23	25835	870	41600	0	175179	0	2703029	162.99	2339	201340	28500	175179	0	0	60000	80.49	36407
9	.27	29449	680	20000	0	173865	0	2519035	161.66	2745	185520	14400	173865	0	0	60000	80.49	31770
10	.23	24246	580	8300	0	185766	0	2316743	160.19	2178	199588	6000	185766	0	0	50000	79.45	15258
11	.07	7114	470	14500	0	157545	0	2166114	158.65	595	176350	9400	157545	0	0	40000	78.26	24356
12	-.06	-6001	440	68500	0	37938	0	2202237	159.05	-436	105474	57100	37938	0	0	30000	76.89	98318
SUM	-.47	-57899	10000	2952500	0	839702	2856660			-9055	1066899	2412200	3696362	0	5110118			2109700
1954																		
1	-.10	-10204	450	100200	0	2543	0	2309648	160.14	-632	89475	81300	2543	0	0	25000	76.10	115105
2	.21	21616	410	76600	0	98733	0	2265489	159.73	1415	129618	42300	98733	0	0	35000	77.60	55444
3	.15	15075	710	49400	0	161529	0	2137575	158.34	1124	182705	27300	161529	0	0	40000	78.26	42407
4	.00	0	1130	83200	0	100057	0	2119588	158.15	0	170057	70000	100057	0	0	40000	78.26	87303
5	-.12	-12098	1380	209400	0	33994	0	2305712	160.11	-1020	178714	153700	33994	0	0	50000	79.45	105715
6	.34	34867	1460	46600	0	73647	0	2242338	159.48	3220	130927	70500	73647	0	0	60000	80.49	17087
7	.40	39874	1420	4000	0	102020	0	2103024	157.97	4067	101753	3800	102020	0	0	60000	80.49	10384
8	.51	49123	870	2600	0	51389	0	2004242	156.89	5185	50104	3900	51389	0	0	60000	80.49	18931
9	.47	44028	680	3600	0	47242	0	1915892	155.93	4779	46263	3800	47242	0	0	60000	80.49	7437
10	.09	8287	580	3700	0	19353	0	1891372	155.67	852	32401	3900	19353	0	0	50000	79.45	13579
11	.05	4480	470	19100	0	159105	0	1746417	153.73	425	173280	4600	159105	0	0	40000	78.26	21973
12	.13	10973	440	21300	0	150268	0	1606036	151.61	944	184824	25500	150268	0	0	30000	76.89	18964
SUM	2.13	206021	10000	619700	0	999880	0			20359	1470121	490600	999880	0	0			514329
1955																		
1	-.08	-6594	450	57100	0	31983	0	1637297	152.08	-505	90388	52900	31983	0	0	25000	76.10	61547
2	-.20	-17326	410	183200	0	0	0	1837413	155.08	-1955	0	174400	0	0	111955	89400	83.00	226241
3	.13	11893	710	102800	0	0	0	1927610	156.06	1772	15592	62200	0	0	44836	89400	83.00	43428
4	-.10	-9655	1130	260100	0	0	0	2196235	158.98	-1363	0	308900	0	0	310263	89400	83.00	266478
5	.06	6100	1380	100100	0	0	0	2288855	159.99	800	76440	72700	0	0	0	84860	82.65	32539
6	.31	32019	1460	81200	0	14995	0	2321581	160.23	3585	100970	64700	14995	0	0	60000	80.49	14326
7	.22	22609	1420	19900	0	75477	0	2241975	159.48	2237	85640	12400	75477	0	0	60000	80.49	26497
8	.14	14221	870	34800	0	24051	0	2237633	159.43	1423	39828	17200	24051	0	0	60000	80.49	30593
9	.19	18956	680	7600	0	112038	0	2113559	158.08	1932	114106	4000	112038	0	0	60000	80.49	21933
10	.29	27569	580	6700	0	187173	0	1904937	155.81	2746	200727	6300	187173	0	0	50000	79.45	14119
11	.18	16067	470	4400	0	178487	0	1714313	153.25	1530	189457	2500	178487	0	0	40000	78.26	11249
12	.05	4151	440	14900	0	162537	0	1562085	150.94	363	180974	8800	162537	0	0	30000	76.89	22814
SUM	1.19	120010	10000	872800	0	786741	0			12565	1094122	787000	786741	0	467054			771764

SAM RAYBURN RESERVOIR

LAKE B.A. STEINHAGEN

Date	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1956																		
1	-.07	-5553	450	24100	0	80138	0	1511150	150.17	-442	100380	14800	80138	0	0	25000	76.10	55127
2	-.20	-16204	410	128000	0	0	0	1654944	152.35	-1955	25692	89500	0	0	1363	89400	83.00	196951
3	.07	5910	710	54500	0	4475	0	1698349	153.01	758	91017	37900	4475	0	0	40000	78.26	109792
4	-.02	-1741	1130	99900	0	0	0	1798860	154.53	-189	47464	77100	0	0	0	69825	81.41	46011
5	.10	9080	1380	168600	0	39109	0	1917891	155.96	1016	91018	33100	39109	0	0	50000	79.45	17961
6	.12	10929	1460	13500	0	100778	0	1818224	154.82	1136	104242	14600	100778	0	0	60000	80.49	11054
7	.42	36551	1420	3800	0	105793	0	1678260	152.70	4270	105823	4300	105793	0	0	60000	80.49	6314
8	.38	31434	870	1500	0	66126	0	1581330	151.23	3864	63962	1700	66126	0	0	60000	80.49	4742
9	.43	34168	680	3600	0	51150	0	1498932	149.98	4372	49478	2700	51150	0	0	60000	80.49	4222
10	.23	17474	580	2500	0	31378	0	1452000	149.00	2177	41484	2200	31378	0	0	49917	79.44	4319
11	.12	8876	470	4500	470	0	0	1447624	148.94	898	27352	3200	0	0	0	24867	76.08	9764
12	.04	2959	440	8800	0	1025	0	1452000	149.00	213	17555	7600	1025	0	0	15724	74.31	23979
SUM	1.62	133883	10000	513300	470	479972	0			16118	765467	288700	479972	0	1363			490236
1957																		
1	-.07	-5183	450	10800	0	15533	0	1452000	149.00	-366	16972	8300	15533	0	0	22951	75.74	18565
2	-.09	-6735	410	18200	0	5242	0	1471283	149.40	-591	5284	11500	5242	0	0	35000	77.60	35585
3	-.14	-11038	710	93300	0	0	0	1574911	151.14	-1466	0	82100	0	0	29166	89400	83.00	131381
4	-.41	-34641	1130	173600	0	0	0	1782022	154.27	-5054	38321	13400	0	0	0	69533	81.38	147725
5	.03	3031	1380	880500	0	0	0	2658111	162.66	370	0	812100	0	0	791863	89400	83.00	305585
6	-.08	-8952	1460	211000	0	13109	0	2863494	164.15	-942	181351	137900	13109	0	0	60000	80.49	100850
7	.23	25780	1420	46500	0	205076	0	2677718	162.80	2339	245737	43000	205076	0	0	60000	80.49	35443
8	.29	31395	870	18300	0	205274	0	2458479	161.22	2949	223025	20700	205274	0	0	60000	80.49	14722
9	.00	0	680	16600	0	155543	0	2318856	160.21	0	168943	13400	155543	0	0	60000	80.49	59294
10	-.05	-5242	580	132100	0	0	0	2455618	161.20	-507	119866	119100	0	0	0	59741	80.46	105453
11	-.39	-43023	470	559300	0	0	159271	2898200	164.40	-4587	0	391500	159271	0	525699	89400	83.00	329654
12	.00	0	440	407000	0	0	406560	2898200	164.40	0	0	359700	406560	0	766260	89400	83.00	184149
SUM	-.68	-54608	10000	2567200	0	599777	565831			-7855	999499	2012700	1165608	0	2112988			1468406
RUN SUM	3.79	347407	50000	7525500	470	3706072	3422491			32132	5396108	5991200	7128563	0	7691523			5354435
ANN AVG	.76	69481	10000	1505100	94	741214	684498			6426	1079222	1198240	1425713	0	1538305			1070887

CASE 2 V3:TB1_PRES.DAT 1953 to 1957 Temporary Barriers; Current Conditions; Current Permit
Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
10,000 demand at Rayburn; 789,700 demand at Steinhagen; 799,700 total

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DAILY FLOW BELOW STEINHAGEN

Titles from input database file

Critical period information for Kountze gauge
VILLAGE CREEK NR KOUNTZE, TEX.

FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1953									
1	199457	122380	321837	169043	9118	0	26419	117257	0
2	367554	211770	579324	152684	8372	0	24006	394262	0
3	801579	165865	967444	169043	26081	0	29988	742332	0
4	496460	128495	624955	163590	54092	0	35144	372129	0
5	2795604	1139960	3935564	169043	72151	0	36828	3657542	0
6	449464	52568	502032	163590	82978	0	32318	223146	0
7	198627	82553	281180	169043	78420	0	33717	0	0
8	201340	36407	237747	169043	41686	0	27018	0	0
9	185520	31770	217290	163590	26607	0	27093	0	0
10	199588	15258	214846	169043	19901	0	25902	0	0
11	176350	24356	200706	163590	9819	0	27297	0	0
12	105474	98318	203792	169043	9118	0	25627	4	0
SUM	6177017	2109700	8286717	1990345	438343	0	351357	5506672	0
1954									
1	89475	115105	204580	169043	9118	0	26419	0	0
2	129618	55444	185062	152684	8372	0	24006	0	0
3	182705	42407	225112	169043	26081	0	29988	0	0
4	170057	87303	257360	163590	54092	0	35144	4534	0
5	178714	105715	284429	169043	72151	0	36828	6407	0
6	130927	17087	148014	32718	82978	0	32318	0	0
7	101753	10384	112137	0	78420	0	33717	0	0
8	50104	18931	69035	0	41686	0	27018	331	0
9	46263	7437	53700	0	26607	0	27093	0	0
10	32401	13579	45980	0	19901	0	25902	177	0
11	173280	21973	195253	158137	9819	0	27297	0	0
12	184824	18964	203788	169043	9118	0	25627	0	0
SUM	1470121	514329	1984450	1183301	438343	0	351357	11449	0
1955									
1	90388	61547	151935	98154	9118	0	26419	18244	0
2	111955	226241	338196	152684	8372	0	24006	153134	0
3	60428	43428	103856	0	26081	0	29988	47787	0
4	310263	266478	576741	163590	54092	0	35144	323915	0
5	76440	32539	108979	0	72151	0	36828	0	0
6	100970	14326	115296	0	82978	0	32318	0	0
7	85640	26497	112137	0	78420	0	33717	0	0
8	39828	30593	70421	0	41686	0	27018	1717	0
9	114106	21933	136039	81795	26607	0	27093	544	0
10	200727	14119	214846	169043	19901	0	25902	0	0
11	189457	11249	200706	163590	9819	0	27297	0	0
12	180974	22814	203788	169043	9118	0	25627	0	0
SUM	1561176	771764	2332940	997899	438343	0	351357	545341	0

CASE 2 V3:TB1_PRES.DAT 1953 to 1957 Temporary Barriers; Current Conditions; Current Permit
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 789,700 demand at Steinhagen; 799,700 total

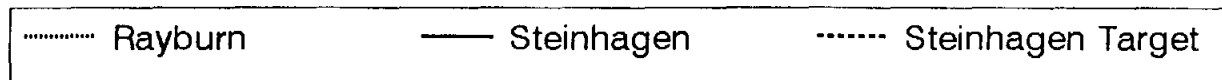
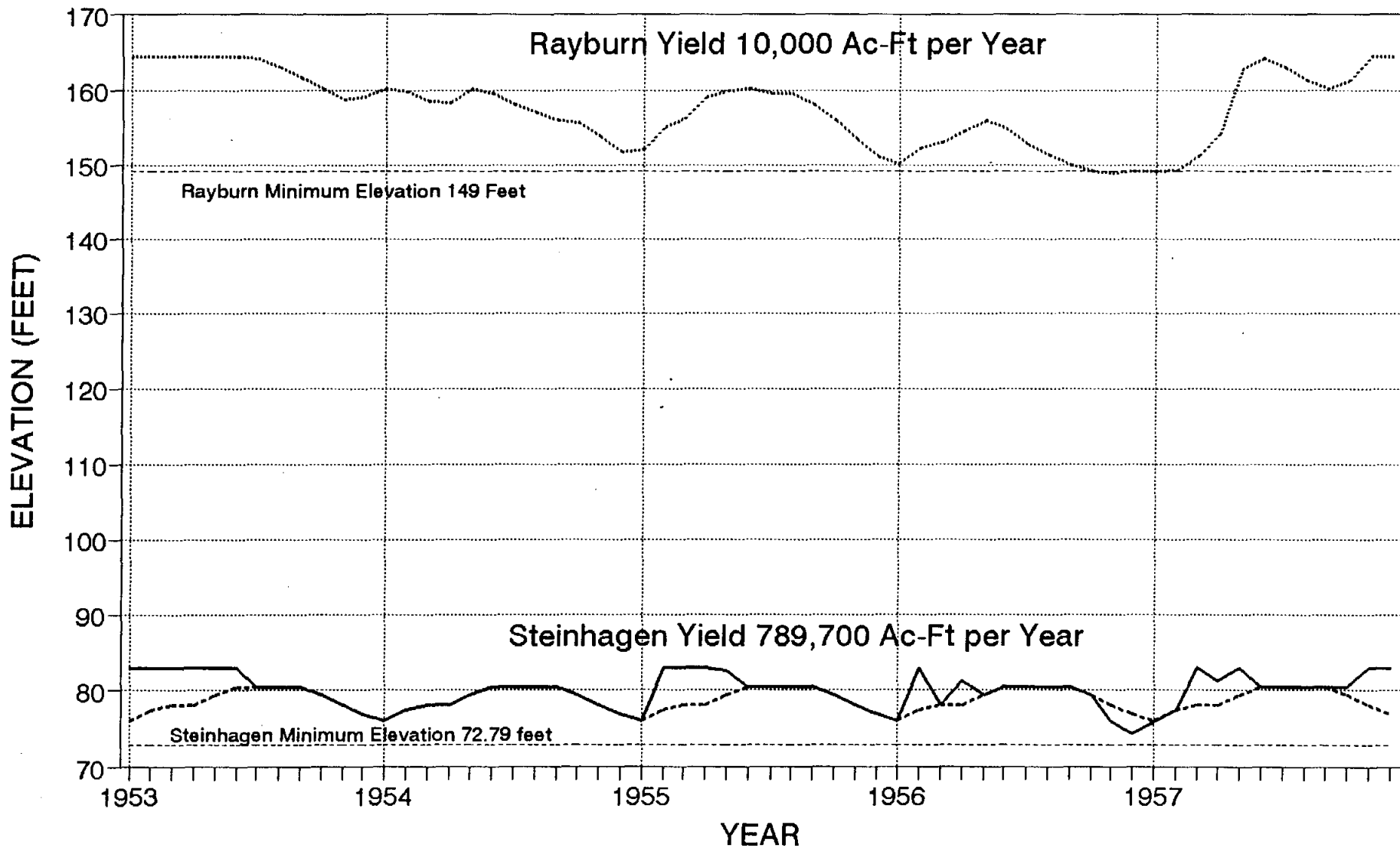
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FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1956									
1	100380	55127	155507	87248	9118	0	26419	32722	0
2	27055	196951	224006	130872	8372	0	24006	60756	0
3	91017	109792	200809	141778	26081	0	29988	2962	0
4	47464	46011	93475	0	54092	0	35144	4239	0
5	91018	17961	108979	0	72151	0	36828	0	0
6	104242	11054	115296	0	82978	0	32318	0	0
7	105823	6314	112137	0	78420	0	33717	0	0
8	63962	4742	68704	0	41686	0	27018	0	0
9	49478	4222	53700	0	26607	0	27093	0	0
10	41484	4319	45803	0	19901	0	25902	0	0
11	27352	9764	37116	0	9819	0	27297	0	0
12	17555	23979	41534	0	9118	0	25627	6789	0
SUM	766830	490236	1257066	359898	438343	0	351357	107468	0
1957									
1	16972	18565	35537	0	9118	0	26419	0	0
2	5284	35585	40869	0	8372	0	24006	8491	0
3	29166	131381	160547	59983	26081	0	29988	44495	0
4	38321	147725	186046	65436	54092	0	35144	31374	0
5	791863	305585	1097448	169043	72151	0	36828	819426	0
6	181351	100850	282201	163590	82978	0	32318	3315	0
7	245737	35443	281180	169043	78420	0	33717	0	0
8	223025	14722	237747	169043	41686	0	27018	0	0
9	168943	59294	228237	163590	26607	0	27093	10947	0
10	119866	105453	225319	169043	19901	0	25902	10473	0
11	525699	329654	855353	163590	9819	0	27297	654647	0
12	766260	184149	950409	169043	9118	0	25627	746621	0
SUM	3112487	1468406	4580893	1461404	438343	0	351357	2329789	0
RUN SUM	13087631	5354435	18442066	5992847	2191715	0	1756785	8500719	0
ANN AVG	2617526	1070887	3688413	1198569	438343	0	351357	1700144	0

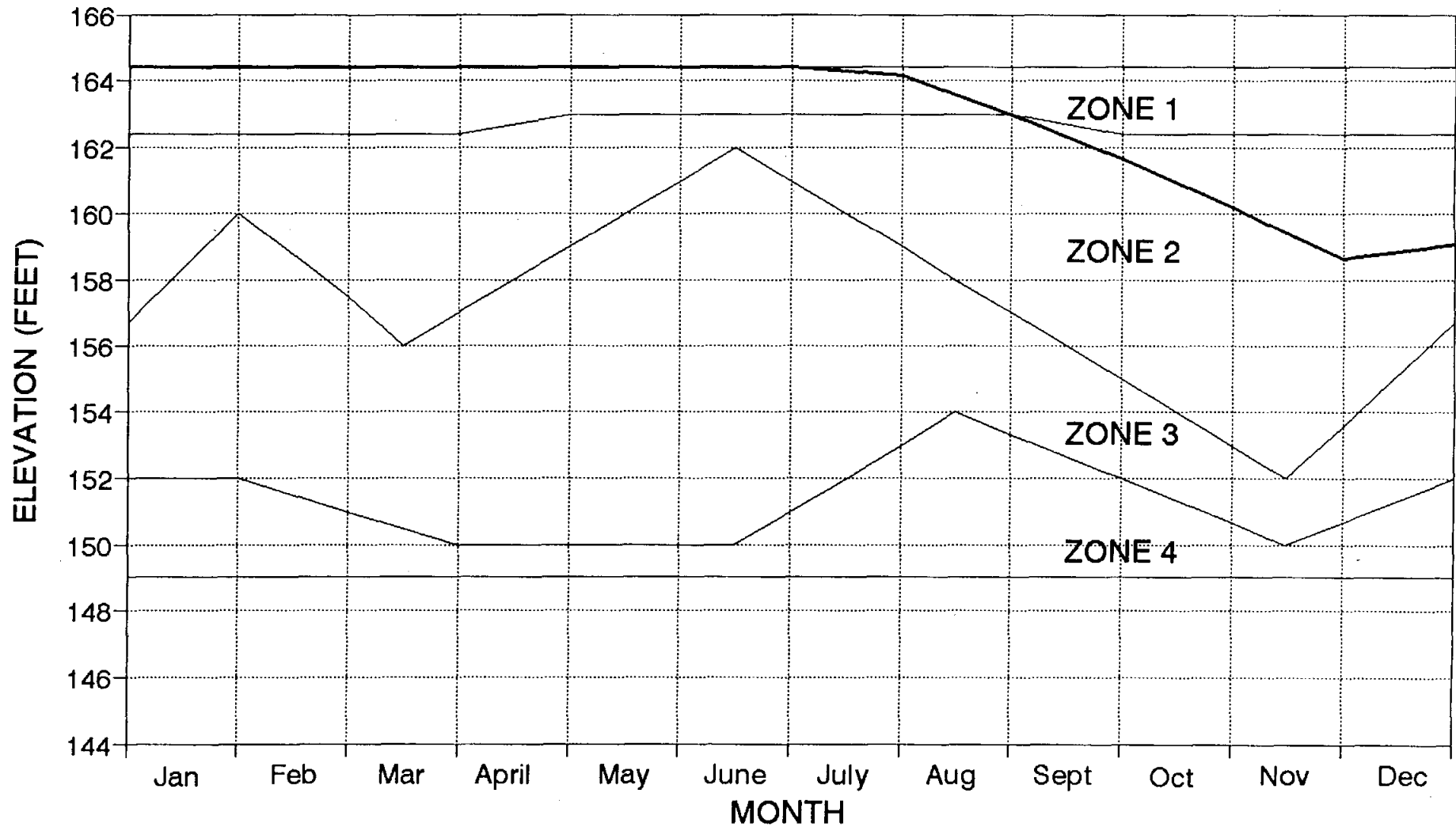
CASE 2: PRESENT CONDITIONS

Temporary Barriers with Current Permit



CASE 2: PRESENT CONDITIONS 1953

Temporary Barriers with Current Permit

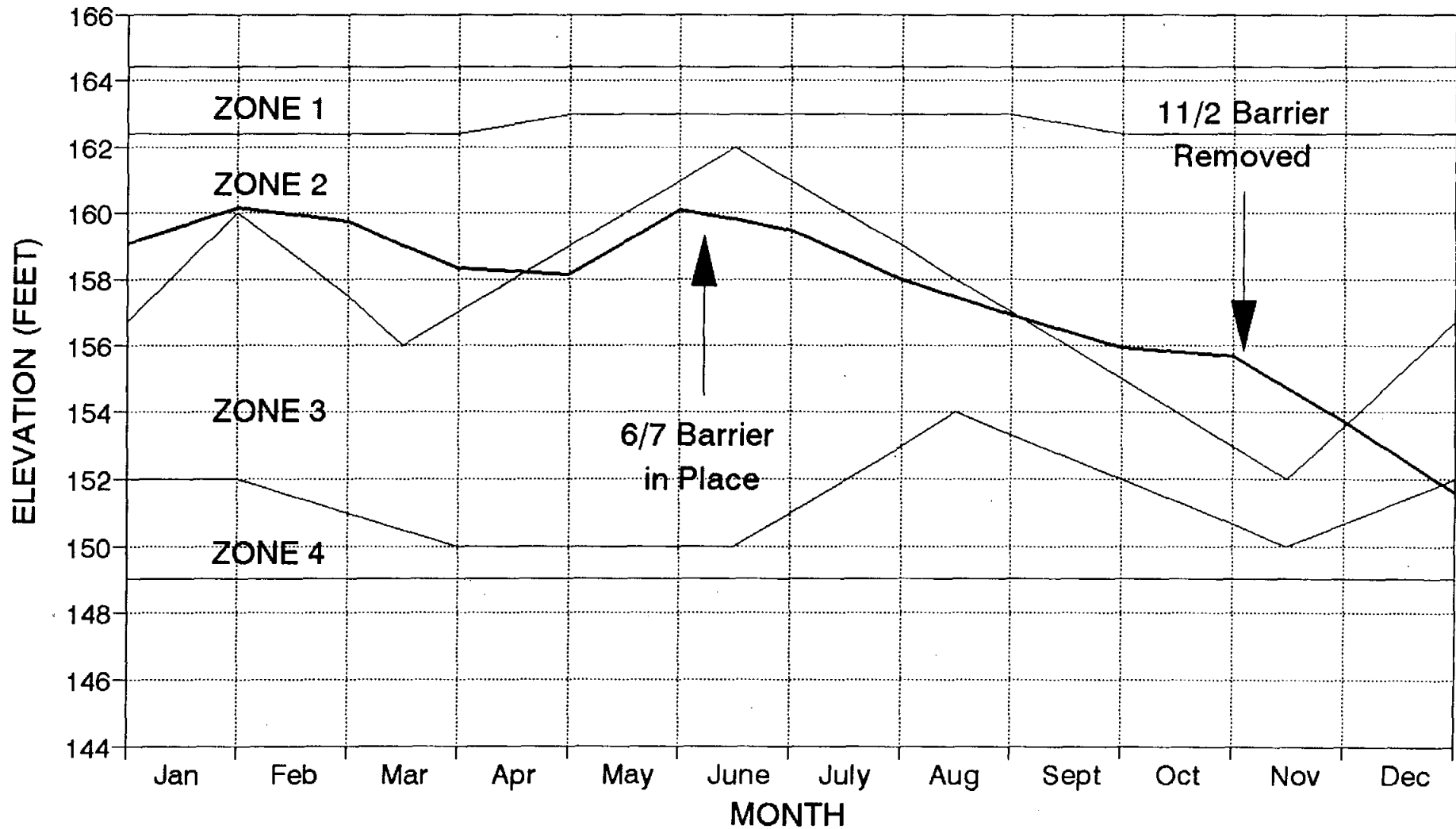


— Rayburn Elevation

TB1_PRES
7/11/94

CASE 2: PRESENT CONDITIONS 1954

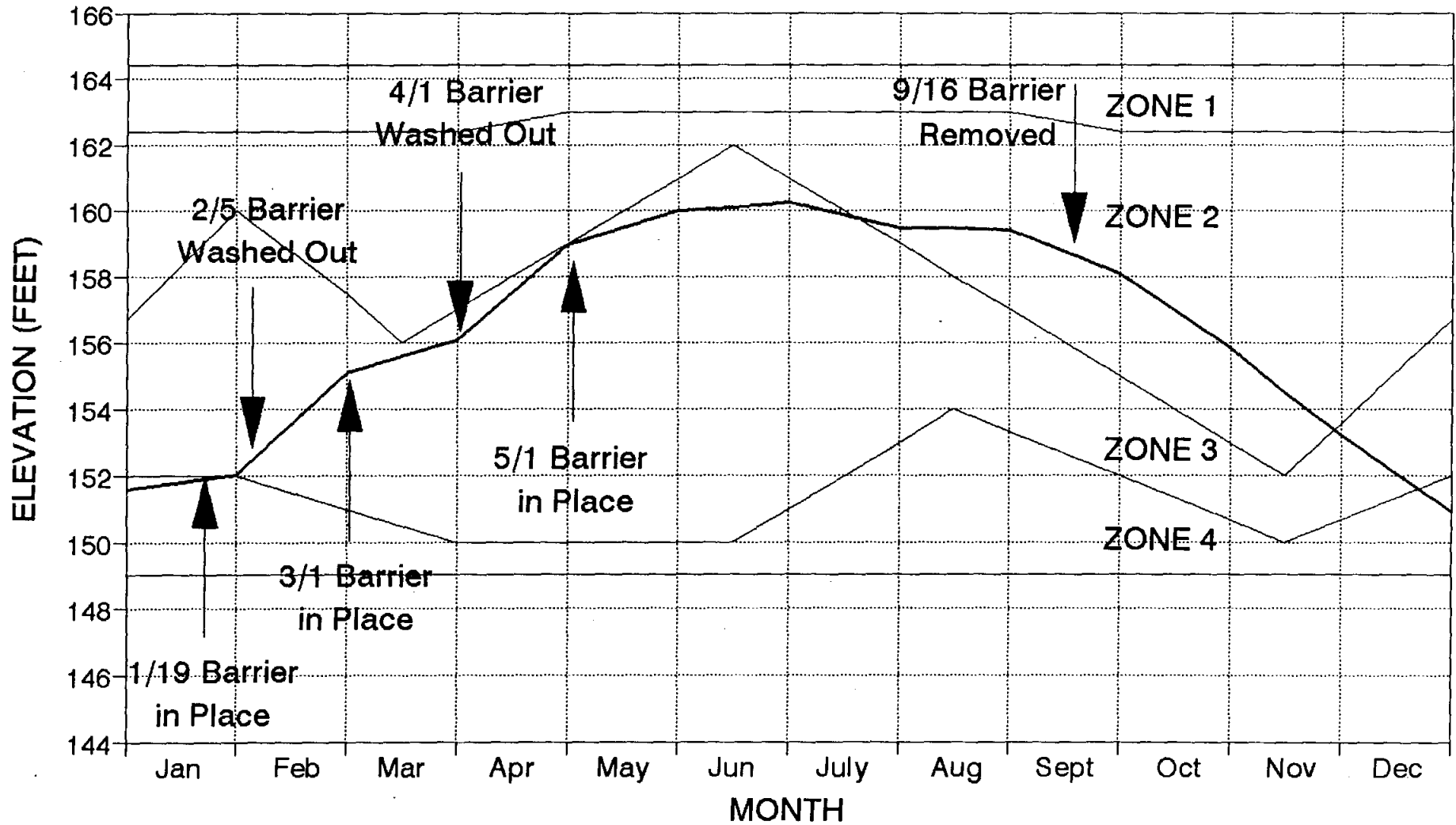
Temporary Barriers with Current Permit



— Rayburn Elevation

CASE 2: PRESENT CONDITIONS 1955

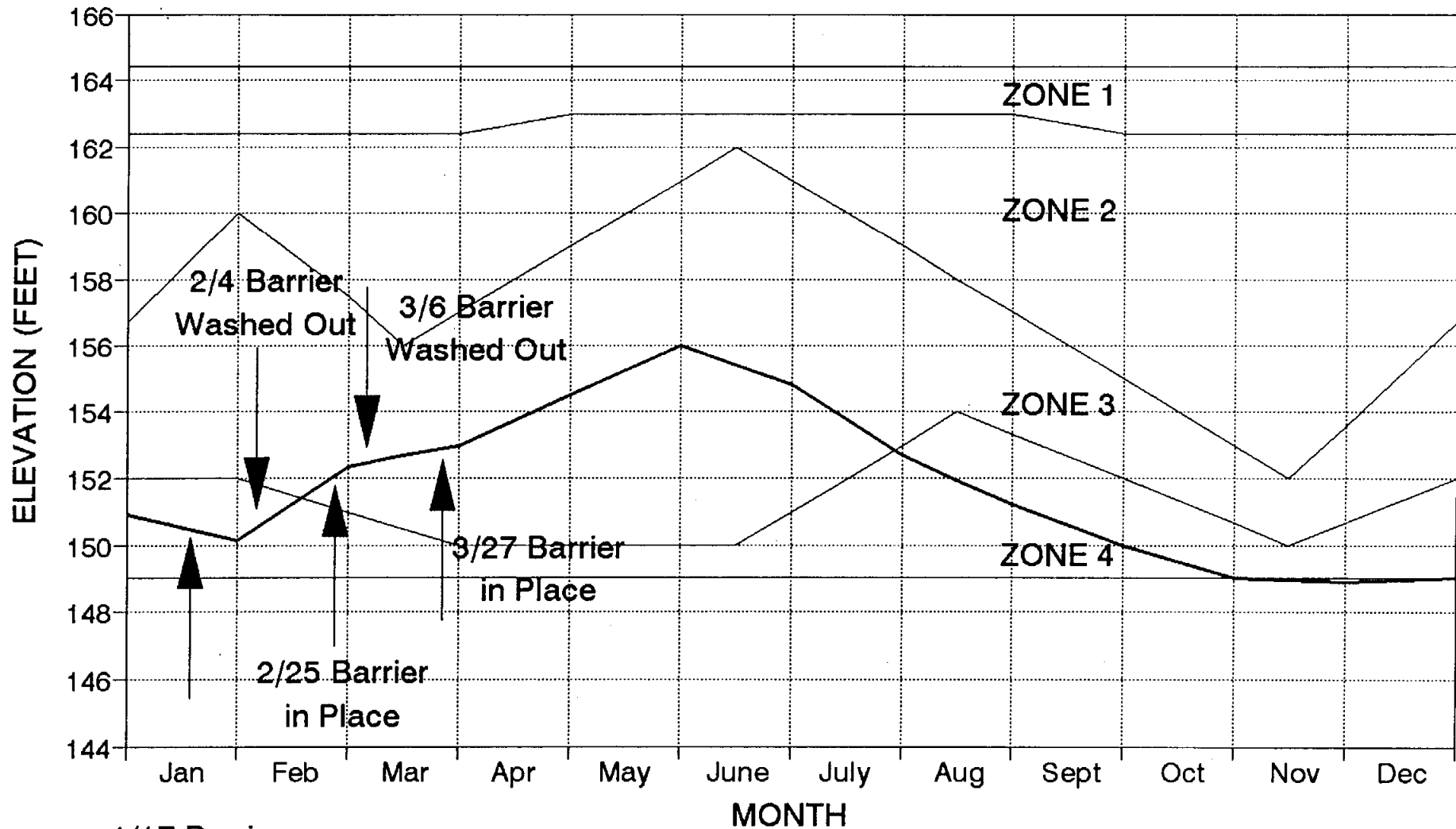
Temporary Barriers with Current Permit



— Rayburn Elevation

CASE 2: PRESENT CONDITIONS 1956

Temporary Barriers with Current Permit

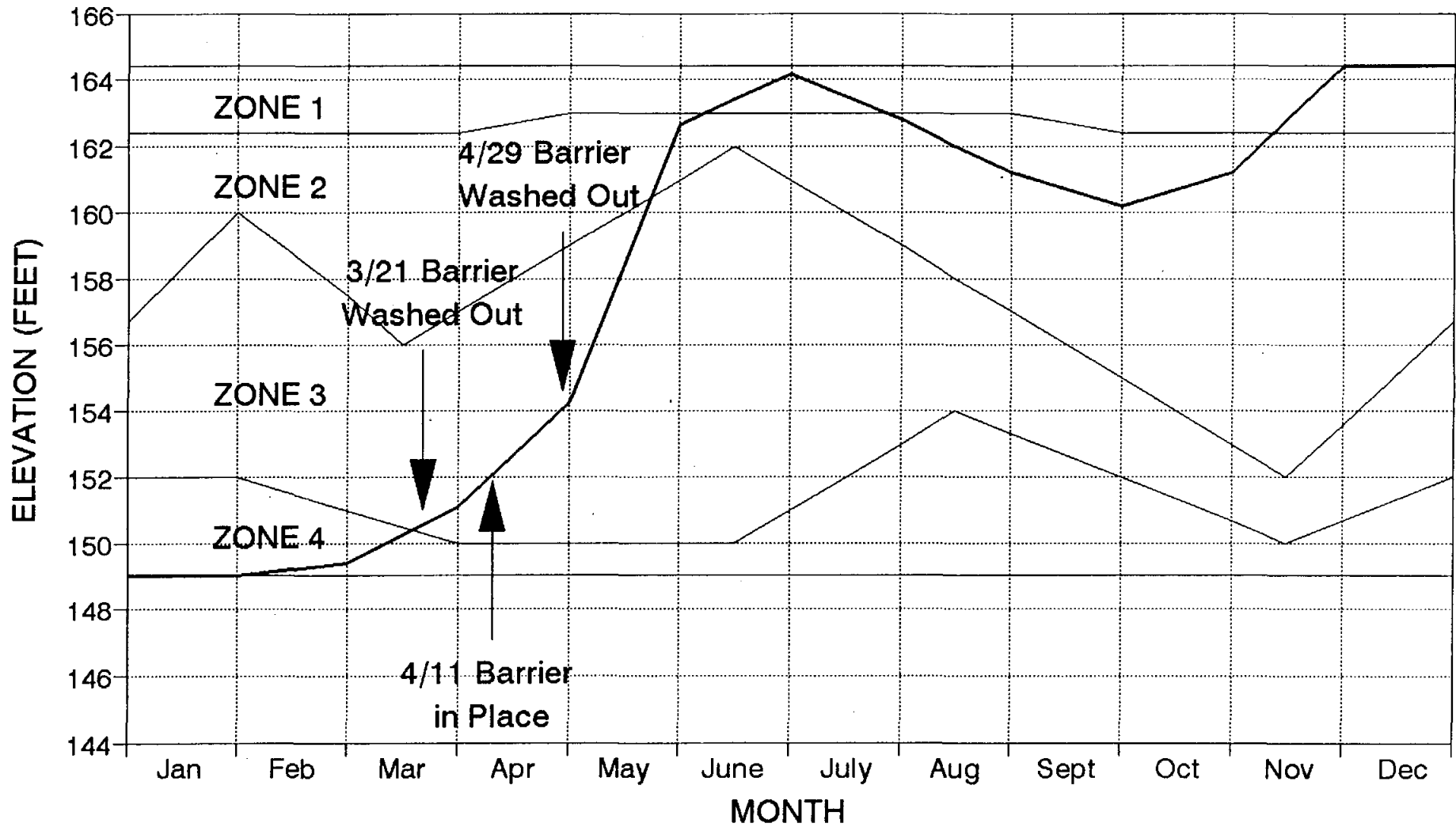


1/17 Barrier
in Place

— Rayburn Elevation

CASE 2: PRESENT CONDITIONS 1957

Temporary Barriers with Current Permit



— Rayburn Elevation

CASE 6 V4:MX1_PRES.DAT 1953 to 1957 Temporary barriers; Current Conditions; Maximum yield
Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
10,000 demand at Rayburn; 1,381,900 demand at Steinhagen; 1,391,900 total

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SAM RAYBURN RESERVOIR SUMMARY

Maximum Capacity = 2898200 acre-feet
Starting Content = 2898200 acre-feet
Minimum Content = 1452000 acre-feet

Critical period is from 6/1954 through 12/1956

Titles from input database file

Sam Rayburn Reservoir 4/5/94 data 08/19/94 09:23
Present Conditions 1974 ACE

DAILY FLOW BELOW STEINHAGEN

Titles from input database file

Critical period information for Kountze gauge
VILLAGE CREEK NR KOUNTZE, TEX.

LAKE B.A. STEINHAGEN SUMMARY

Maximum Capacity = 89400 acre-feet
Starting Content = 89400 acre-feet
Minimum Content = 10096 acre-feet

Critical period is from 5/1955 through 1/1957

Titles from input database file

Lake B.A. Steinhagen 4/5/94 data 05/04/94 08:51
Rockland inflow plus intervening inflow 1994 ACE

CASE 6 V4:MX1_PRES.DAT 1953 to 1957 Temporary barriers; Current Conditions; Maximum yield
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,381,900 demand at Steinhagen; 1,391,900 total

Date	SAM RAYBURN RESERVOIR									LAKE B.A. STEINHAGEN								
	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1953																		
1	-.05	-5725	450	96400	0	0	101675	2898200	164.40	-682	0	97100	101675	0	199457	89400	83.00	122380
2	-.18	-20610	410	184000	0	0	204200	2898200	164.40	-2454	0	160900	204200	0	367554	89400	83.00	211770
3	-.22	-25190	710	529500	0	0	553980	2898200	164.40	-2999	0	244600	553980	0	801579	89400	83.00	165865
4	-.38	-43510	1130	211500	0	0	253880	2898200	164.40	-5180	0	237400	253880	0	496460	89400	83.00	128495
5	-.49	-56105	1380	1506500	0	0	1561225	2898200	164.40	-6679	0	1227700	1561225	0	2795604	89400	83.00	1139960
6	.12	13740	1460	196900	0	0	181700	2898200	164.40	1636	0	269400	181700	0	449464	89400	83.00	52568
7	-.01	-1137	1420	74800	0	155331	0	2817386	163.82	-118	244549	59700	155331	0	0	60000	80.49	82553
8	.23	25890	870	41600	0	57657	0	2774569	163.51	2339	83818	28500	57657	0	0	60000	80.49	36407
9	.27	30127	680	20000	0	50544	0	2713218	163.06	2745	62199	14400	50544	0	0	60000	80.49	31770
10	.23	25381	580	8300	0	51070	0	2644487	162.56	2178	64892	6000	51070	0	0	50000	79.45	15258
11	.07	7669	470	14500	0	21788	0	2629060	162.45	595	40593	9400	21788	0	0	40000	78.26	24356
12	-.06	-6607	440	68500	0	0	0	2703727	162.99	-649	0	57100	0	0	8349	89400	83.00	98318
SUM	-.47	-56077	10000	2952500	0	336390	2856660			-9268	496051	2412200	3193050	0	5118467			2109700
1954																		
1	-.10	-11187	450	100200	0	0	0	2814664	163.80	-1158	116124	81300	0	0	55734	80.07	115105	
2	.21	23705	410	76600	0	56540	0	2810609	163.77	1796	117778	42300	56540	0	0	35000	77.60	55444
3	.15	16923	710	49400	0	34532	0	2807844	163.75	1124	55708	27300	34532	0	0	40000	78.26	42407
4	.00	0	1130	83200	0	18655	0	2871259	164.21	0	88655	70000	18655	0	0	40000	78.26	87303
5	-.12	-13709	1380	209400	0	0	194788	2898200	164.40	-1299	0	153700	194788	0	300387	89400	83.00	105715
6	.34	38299	1460	46600	0	203286	0	2701755	162.98	4003	299183	70500	203286	0	0	60000	80.49	17087
7	.40	43456	1420	4000	0	186113	0	2474766	161.34	4067	185846	3800	186113	0	0	60000	80.49	10384
8	.51	53567	870	2600	0	102579	0	2320350	160.22	5185	101294	3900	102579	0	0	60000	80.49	18931
9	.47	47933	680	3600	0	87511	0	2187826	158.89	4779	86532	3800	87511	0	0	60000	80.49	7437
10	.09	8935	580	3700	0	53523	0	2128488	158.24	852	66571	3900	53523	0	0	50000	79.45	13579
11	.05	4911	470	19100	0	28801	0	2113406	158.08	425	42976	4600	28801	0	0	40000	78.26	21973
12	.13	12743	440	21300	0	7284	0	2114239	158.09	944	41840	25500	7284	0	0	30000	76.89	18964
SUM	2.13	225576	10000	619700	0	778824	194788			20718	1202507	490600	973612	0	300387			514329
1955																		
1	-.08	-7916	450	57100	0	0	0	2178805	158.79	-721	13591	52900	0	0	70030	81.42	61547	
2	-.20	-20546	410	183200	0	0	0	2382141	160.67	-2472	0	174400	0	0	157502	89400	83.00	226241
3	.13	13653	710	102800	0	59007	0	2411571	160.88	1407	169200	62200	59007	0	0	40000	78.26	43428
4	-.10	-10785	1130	260100	0	0	0	2681326	162.83	-1082	0	308900	0	0	260582	89400	83.00	266478
5	.06	6585	1380	100100	0	161255	0	2612206	162.33	679	272676	72700	161255	0	0	50000	79.45	32539
6	.31	33556	1460	81200	0	135667	0	2522723	161.68	2936	187431	64700	135667	0	0	60000	80.49	14326
7	.22	23286	1420	19900	0	159570	0	2358347	160.49	2237	169733	12400	159570	0	0	60000	80.49	26497
8	.14	14529	870	34800	0	73855	0	2303893	160.10	1423	89632	17200	73855	0	0	60000	80.49	30593
9	.19	19423	680	7600	0	69968	0	2221422	159.25	1932	72036	4000	69968	0	0	60000	80.49	21933
10	.29	28999	580	6700	0	52477	0	2146066	158.44	2746	66031	6300	52477	0	0	50000	79.45	14119
11	.18	17664	470	4400	0	42730	0	2089602	157.82	1530	53700	2500	42730	0	0	40000	78.26	11249
12	.05	4860	440	14900	0	19553	0	2079649	157.71	363	37990	8800	19553	0	0	30000	76.89	22814
SUM	1.19	123308	10000	872800	0	774082	0			10978	1132020	787000	774082	0	418084			771764

Date	SAM RAYBURN RESERVOIR									LAKE B.A. STEINHAGEN								
	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1956																		
1	-.07	-6813	450	24100	0	10834	0	2099278	157.93	-442	31076	14800	10834	0	0	25000	76.10	55127
2	-.20	-19939	410	128000	0	0	0	2246807	159.53	-1750	46824	89500	0	0	0	69426	81.37	196951
3	.07	7092	710	54500	0	79983	0	2213522	159.17	661	146648	37900	79983	0	0	40000	78.26	109792
4	-.02	-2036	1130	99900	0	32888	0	2281440	159.91	-156	110144	77100	32888	0	0	40000	78.26	46011
5	.10	10285	1380	168600	0	150491	0	2287884	159.98	850	172741	33100	150491	0	0	50000	79.45	17961
6	.12	12035	1460	13500	0	187239	0	2100650	157.94	1136	190703	14600	187239	0	0	60000	80.49	11054
7	.42	39664	1420	3800	0	189886	0	1873480	155.47	4270	189916	4300	189886	0	0	60000	80.49	6314
8	.38	33759	870	1500	0	117647	0	1722704	153.37	3864	115483	1700	117647	0	0	60000	80.49	4742
9	.43	36049	680	3600	0	91419	0	1598156	151.49	4372	89747	2700	91419	0	0	60000	80.49	4222
10	.23	18417	580	2500	0	65809	0	1515850	150.24	2178	75831	2200	65809	0	0	50000	79.45	4319
11	.12	9278	470	4500	0	43005	0	1467597	149.32	1020	55185	3200	43005	0	0	40000	78.26	9764
12	.04	2987	440	8800	0	20970	0	1452000	149.00	289	38766	7600	20970	0	0	29515	76.81	23979
SUM	1.62	140778	10000	513300	0	990171	0			16292	1263064	-288700	990171	0	0			490236
1957																		
1	-.07	-5183	450	10800	0	15533	0	1452000	149.00	-369	43621	8300	15533	0	0	10096	72.82	18565
2	-.09	-6664	410	18200	0	24454	0	1452000	149.00	-411	23803	11500	24454	0	0	22658	75.69	35585
3	-.14	-10939	710	93300	0	0	0	1555529	150.84	-1188	38835	82100	0	0	0	67111	81.17	131381
4	-.41	-33703	1130	173600	0	86102	0	1675600	152.66	-3828	130441	13400	86102	0	0	40000	78.26	147725
5	.03	2941	1380	880500	0	0	0	2551779	161.89	325	0	812100	0	0	762375	89400	83.00	305585
6	-.08	-8728	1460	211000	0	96255	0	2673792	162.78	-942	264497	137900	96255	0	0	60000	80.49	100850
7	.23	24893	1420	46500	0	234639	0	2459340	161.23	2339	275300	43000	234639	0	0	60000	80.49	35443
8	.29	30522	870	18300	0	87752	0	2358496	160.50	2949	105503	20700	87752	0	0	60000	80.49	14722
9	.00	0	680	16600	0	54081	0	2320335	160.22	0	67481	13400	54081	0	0	60000	80.49	59294
10	-.05	-5234	580	132100	0	19410	0	2437679	161.07	-474	148984	119100	19410	0	0	50000	79.45	105453
11	-.39	-42957	470	559300	0	0	141266	2898200	164.40	-4411	0	391500	141266	0	497777	89400	83.00	329654
12	.00	0	440	407000	0	0	406560	2898200	164.40	0	0	359700	406560	0	766260	89400	83.00	184149
SUM	-.68	-55052	10000	2567200	0	618226	547826			-6010	1098465	2012700	1166052	0	2026412			1468406
RUN SUM	3.79	378533	50000	7525500	0	3497693	3599274			32710	5192107	5991200	7096967	0	7863350			5354435
ANN AVG	.76	75707	10000	1505100	0	699539	719855			6542	1038421	1198240	1419393	0	1572670			1070887

CASE 6 V4:MX1_PRES.DAT 1953 to 1957 Temporary barriers; Current Conditions; Maximum yield
Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
10,000 demand at Rayburn; 1,381,900 demand at Steinhagen; 1,391,900 total

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DAILY FLOW BELOW STEINHAGEN

Titles from input database file

Critical period information for Kountze gauge
VILLAGE CREEK NR KOUNTZE, TEX.

CASE 6 V4:MX1_PRES.DAT 1953 to 1957 Temporary barriers; Current Conditions; Maximum yield
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,381,900 demand at Steinhagen; 1,391,900 total

FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1953									
1	199457	122380	321837	169043	9118	0	53068	90608	0
2	367554	211770	579324	152684	8372	0	48286	369982	0
3	801579	165865	967444	169043	26081	0	72034	700286	0
4	496460	128495	624955	163590	54092	0	102063	305210	0
5	2795604	1139960	3935564	169043	72151	0	118551	3575819	0
6	449464	52568	502032	163590	82978	0	118779	136685	0
7	244549	82553	327102	130872	78420	0	117810	0	0
8	83818	36407	120225	0	41686	0	78539	0	0
9	62199	31770	93969	0	26607	0	67362	0	0
10	64892	15258	80150	0	19901	0	60249	0	0
11	40593	24356	64949	0	9819	0	55130	0	0
12	8349	98318	106667	0	9118	0	51686	45863	0
SUM	5614518	2109700	7724218	1117865	438343	0	943557	5224453	0
1954									
1	116124	115105	231229	169043	9118	0	53068	0	0
2	117778	55444	173222	114513	8372	0	48286	2051	0
3	55708	42407	98115	0	26081	0	72034	0	0
4	88655	87303	175958	0	54092	0	102063	19803	0
5	300387	105715	406102	169043	72151	0	118551	46357	0
6	299183	17087	316270	114513	82978	0	118779	0	0
7	185846	10384	196230	0	78420	0	117810	0	0
8	101294	18931	120225	0	41686	0	78539	0	0
9	86532	7437	93969	0	26607	0	67362	0	0
10	66571	13579	80150	0	19901	0	60249	0	0
11	42976	21973	64949	0	9819	0	55130	0	0
12	41840	18964	60804	0	9118	0	51686	0	0
SUM	1502894	514329	2017223	567112	438343	0	943557	68211	0
1955									
1	13591	61547	75138	0	9118	0	53068	12952	0
2	157502	226241	383743	130872	8372	0	48286	196213	0
3	169200	43428	212628	114513	26081	0	72034	0	0
4	260582	266478	527060	114513	54092	0	102063	256392	0
5	272676	32539	305215	114513	72151	0	118551	0	0
6	187431	14326	201757	0	82978	0	118779	0	0
7	169733	26497	196230	0	78420	0	117810	0	0
8	89632	30593	120225	0	41686	0	78539	0	0
9	72036	21933	93969	0	26607	0	67362	0	0
10	66031	14119	80150	0	19901	0	60249	0	0
11	53700	11249	64949	0	9819	0	55130	0	0
12	37990	22814	60804	0	9118	0	51686	0	0
SUM	1550104	771764	2321868	474411	438343	0	943557	465557	0

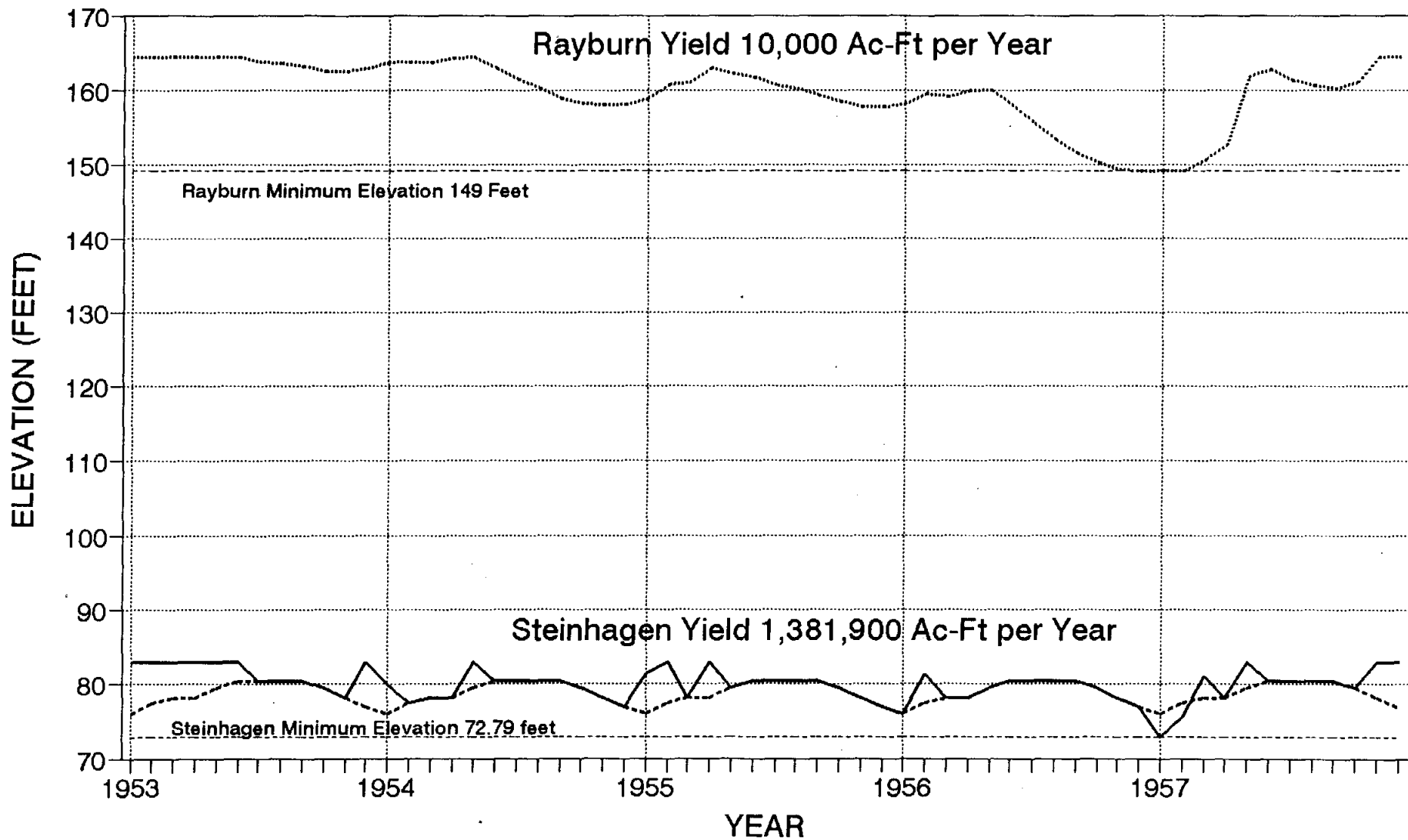
CASE 6 V4:MX1_PRES.DAT 1953 to 1957 Temporary barriers; Current Conditions; Maximum yield
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,381,900 demand at Steinhagen; 1,391,900 total

FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1956									
1	31076	55127	86203	0	9118	0	53068	24017	0
2	46824	196951	243775	141778	8372	0	48286	45339	0
3	146648	109792	256440	158137	26081	0	72034	188	0
4	110144	46011	156155	0	54092	0	102063	0	0
5	172741	17961	190702	0	72151	0	118551	0	0
6	190703	11054	201757	0	82978	0	118779	0	0
7	189916	6314	196230	0	78420	0	117810	0	0
8	115483	4742	120225	0	41686	0	78539	0	0
9	89747	4222	93969	0	26607	0	67362	0	0
10	75831	4319	80150	0	19901	0	60249	0	0
11	55185	9764	64949	0	9819	0	55130	0	0
12	38766	23979	62745	0	9118	0	51686	1941	0
SUM	1263064	490236	1753300	299915	438343	0	943557	71485	0
1957									
1	43621	18565	62186	0	9118	0	53068	0	0
2	23803	35585	59388	0	8372	0	48286	2730	0
3	38835	131381	170216	54530	26081	0	72034	17571	0
4	130441	147725	278166	109060	54092	0	102063	12951	0
5	762375	305585	1067960	169043	72151	0	118551	708215	0
6	264497	100850	365347	163590	82978	0	118779	0	0
7	275300	35443	310743	114513	78420	0	117810	0	0
8	105503	14722	120225	0	41686	0	78539	0	0
9	67481	59294	126775	21812	26607	0	67362	10994	0
10	148984	105453	254437	169043	19901	0	60249	5244	0
11	497777	329654	827431	163590	9819	0	55130	598892	0
12	766260	184149	950409	169043	9118	0	51686	720562	0
SUM	3124877	1468406	4593283	1134224	438343	0	943557	2077159	0
RUN SUM	13055457	5354435	18409892	3593527	2191715	0	4717785	7906865	0
ANN AVG	2611091	1070887	3681978	718705	438343	0	943557	1581373	0

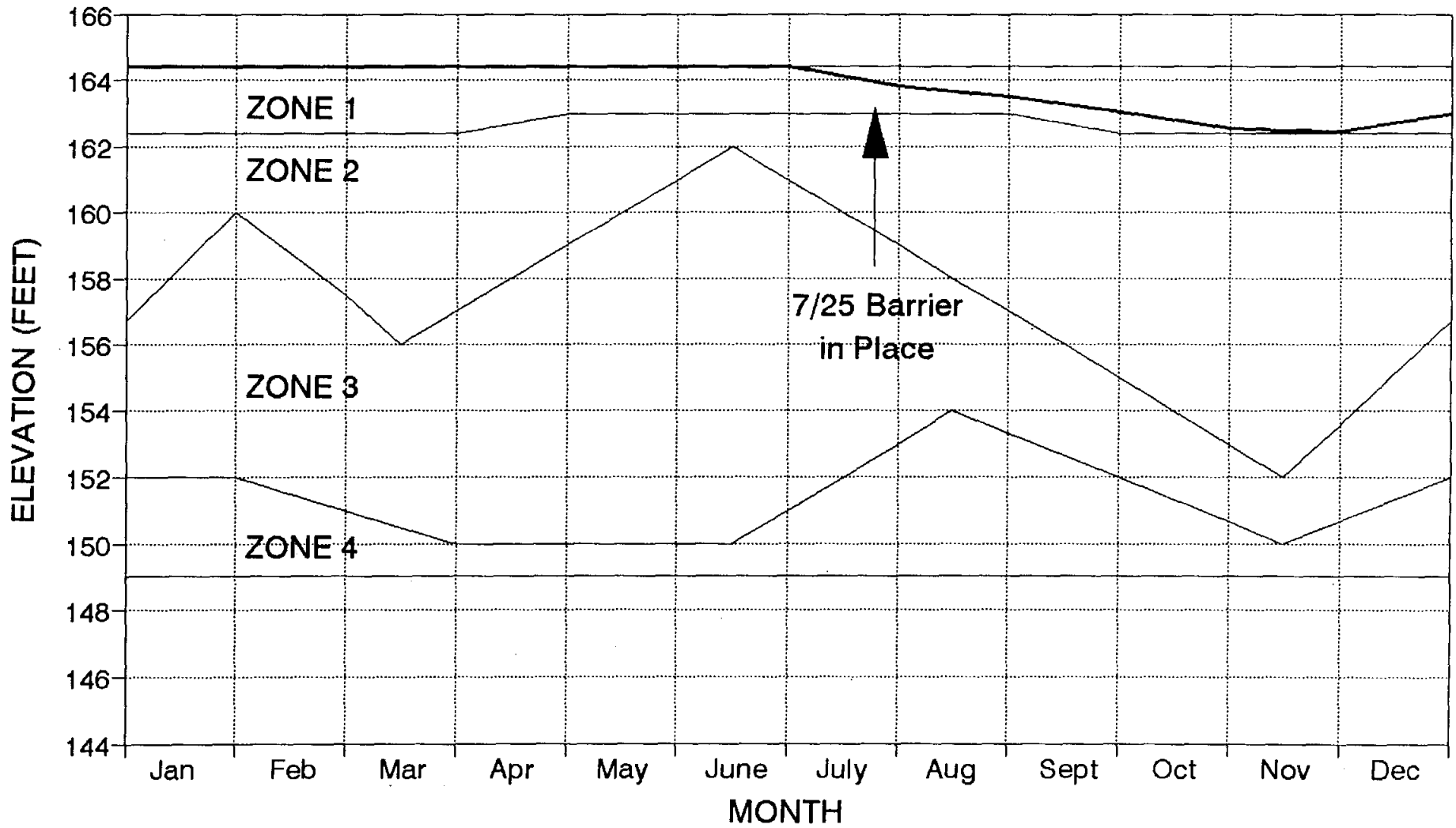
CASE 6: PRESENT CONDITIONS

Temporary barriers, maximum yield



CASE 6: PRESENT CONDITIONS 1953

Temporary barriers, maximum yield

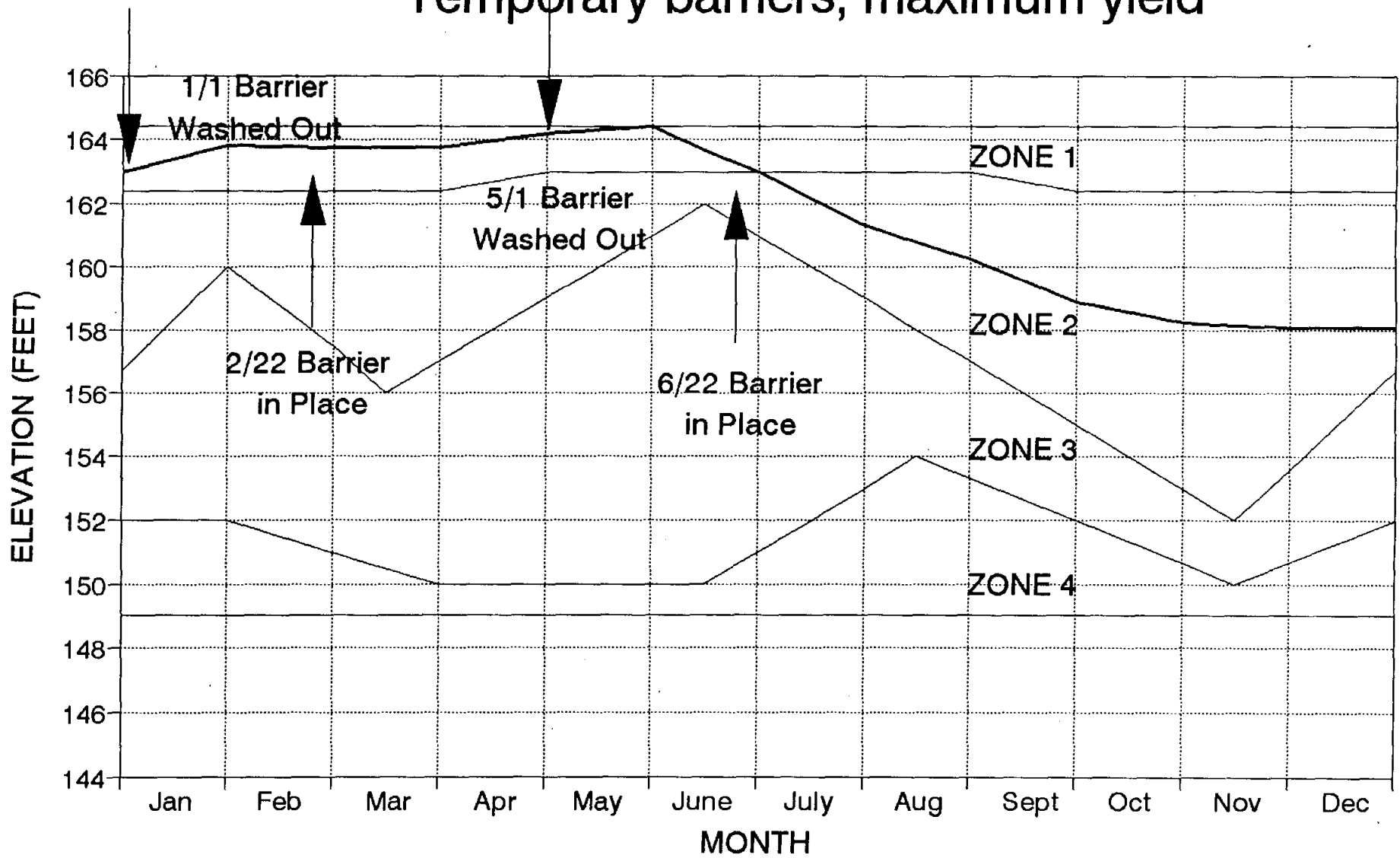


— Rayburn Elevation

MX1_PRES
8/1/94

CASE 6: PRESENT CONDITIONS 1954

Temporary barriers, maximum yield

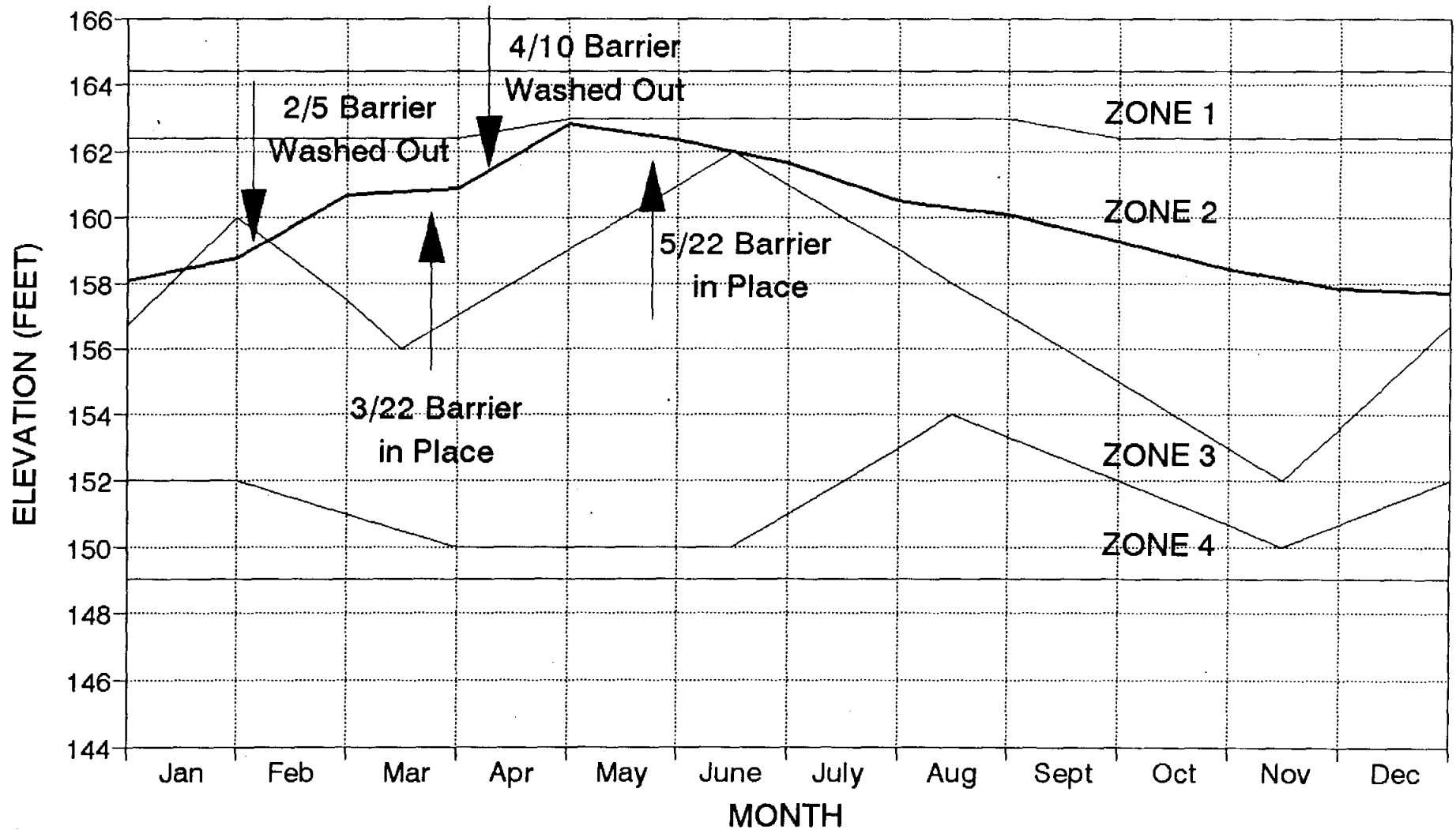


— Rayburn Elevation

MX1_PRES
8/1/94

CASE 6: PRESENT CONDITIONS 1955

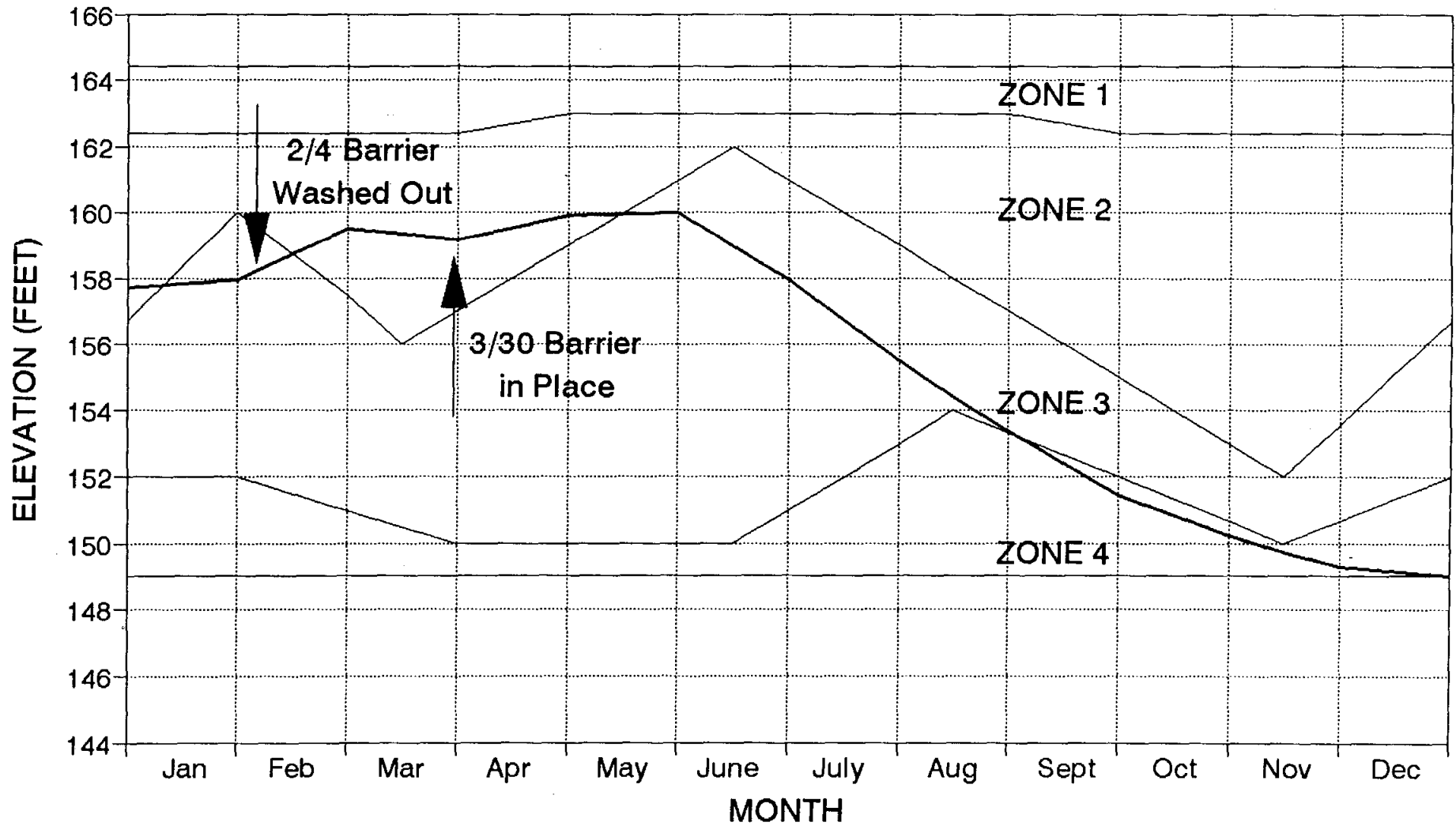
Temporary barriers, maximum yield



— Rayburn Elevation

CASE 6: PRESENT CONDITIONS 1956

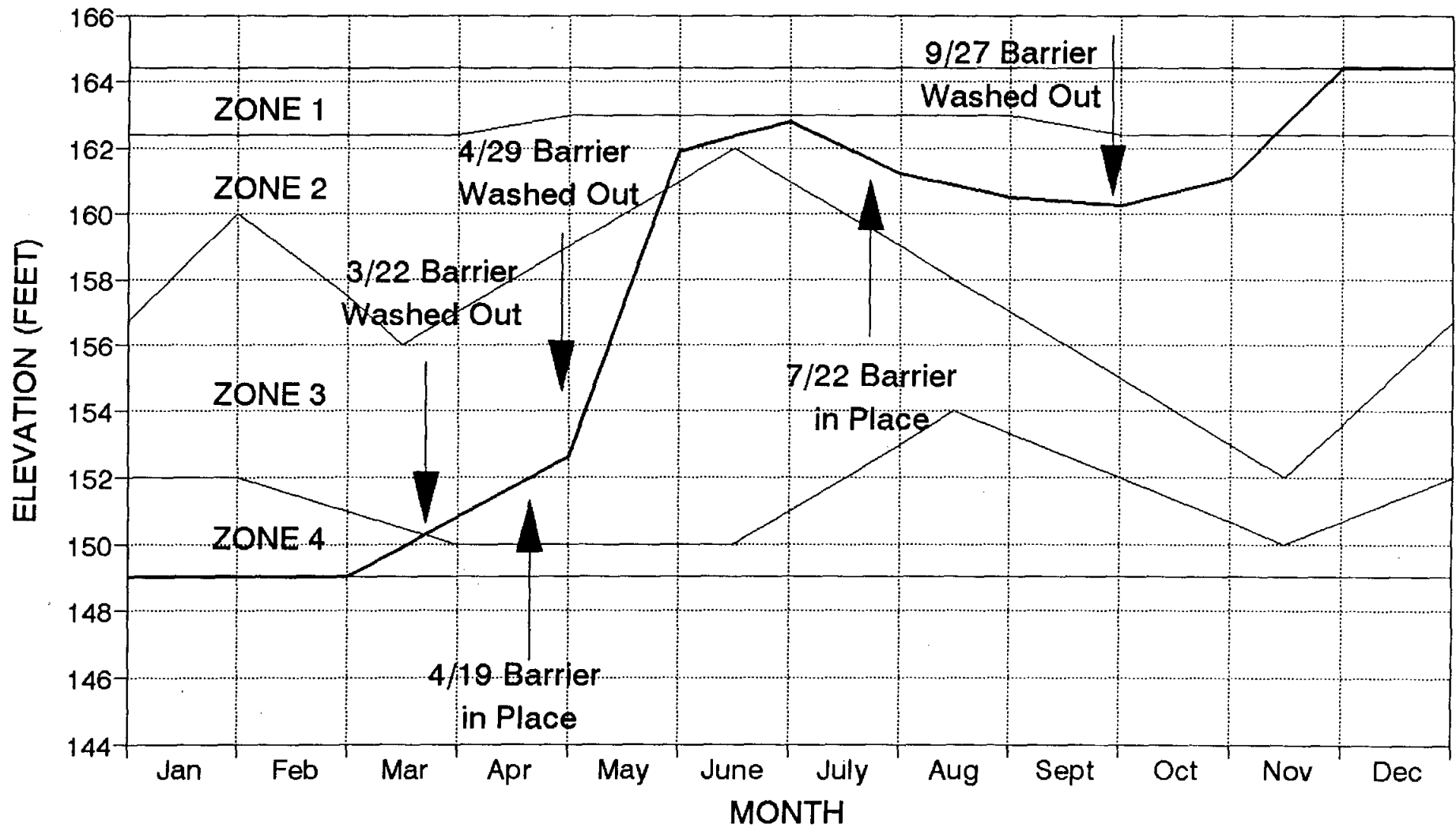
Temporary barriers, maximum yield



— Rayburn Elevation

CASE 6: PRESENT CONDITIONS 1957

Temporary barriers, maximum yield



— Rayburn Elevation

CASE 8 V3:PB1_PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

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SAM RAYBURN RESERVOIR SUMMARY

Maximum Capacity = 2898200 acre-feet
Starting Content = 2898200 acre-feet
Minimum Content = 1452000 acre-feet

Critical period is from 6/1954 through 1/1957

Titles from input database file

Sam Rayburn Reservoir 4/5/94 data 08/19/94 09:23
Present Conditions 1974 ACE

DAILY FLOW BELOW STEINHAGEN

Titles from input database file

Critical period information for Kountze gauge
VILLAGE CREEK NR KOUNTZE, TEX.

LAKE B.A. STEINHAGEN SUMMARY

Maximum Capacity = 89400 acre-feet
Starting Content = 89400 acre-feet
Minimum Content = 10026 acre-feet

Critical period is from 4/1956 through 1/1957

Titles from input database file

Lake B.A. Steinhagen 4/5/94 data 05/04/94 08:51
Rockland inflow plus intervening inflow 1994 ACE

CASE 8 V3:PB1 PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

SAM RAYBURN RESERVOIR

LAKE B.A. STEINHAGEN

Date	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1953																		
1	-.05	-5725	450	96400	0	0	101675	2898200	164.40	-682	0	97100	101675	0	199457	89400	83.00	122380
2	-.18	-20610	410	184000	0	0	204200	2898200	164.40	-2454	0	160900	204200	0	367554	89400	83.00	211770
3	-.22	-25190	710	529500	0	0	553980	2898200	164.40	-2999	0	244600	553980	0	801579	89400	83.00	165865
4	-.38	-43510	1130	211500	0	0	253880	2898200	164.40	-5180	0	237400	253880	0	496460	89400	83.00	128495
5	-.49	-56105	1380	1506500	0	0	1561225	2898200	164.40	-6679	0	1227700	1561225	0	2795604	89400	83.00	1139960
6	-.12	13740	1460	196900	0	0	181700	2898200	164.40	1636	0	269400	181700	0	449464	89400	83.00	52568
7	-.01	-1145	1420	74800	0	0	74525	2898200	164.40	-133	139649	59700	74525	0	0	84109	82.59	82553
8	.23	26258	870	41600	0	49774	0	2862898	164.14	2652	99731	28500	49774	0	0	60000	80.49	36407
9	.27	30545	680	20000	0	62981	0	2788692	163.61	2745	74636	14400	62981	0	0	60000	80.49	31770
10	.23	25686	580	8300	0	61678	0	2709048	163.03	2178	75500	6000	61678	0	0	50000	79.45	15258
11	.07	7749	470	14500	0	30385	0	2684944	162.86	595	49190	9400	30385	0	0	40000	78.26	24356
12	-.06	-6670	440	68500	0	0	0	2759674	163.40	-649	0	57100	0	0	8349	89400	83.00	98318
SUM	-.47	-54977	10000	2952500	0	204818	2931185			-8970	438706	2412200	3136003	0	5118467			2109700
1954																		
1	-.10	-11293	450	100200	0	0	0	2870717	164.20	-1363	0	81300	0	0	82663	89400	83.00	115105
2	.21	23990	410	76600	0	0	24717	2898200	164.40	2863	0	42300	24717	0	64154	89400	83.00	55444
3	.15	17175	710	49400	0	0	31515	2898200	164.40	1928	68694	27300	31515	0	0	77593	82.08	42407
4	.00	0	1130	83200	0	0	82070	2898200	164.40	0	0	70000	82070	0	140263	89400	83.00	87303
5	-.12	-13740	1380	209400	0	0	221760	2898200	164.40	-1636	0	153700	221760	0	377096	89400	83.00	105715
6	.34	38580	1460	46600	0	115477	0	2789283	163.61	4003	211374	70500	115477	0	0	60000	80.49	17087
7	.40	44017	1420	4000	0	212085	0	2535761	161.78	4067	211818	3800	212085	0	0	60000	80.49	10384
8	.51	54076	870	2600	0	118492	0	2364923	160.54	5185	117207	3900	118492	0	0	60000	80.49	18931
9	.47	48429	680	3600	0	99948	0	2219466	159.23	4779	98969	3800	99948	0	0	60000	80.49	7437
10	.09	9002	580	3700	0	64131	0	2149453	158.47	852	77179	3900	64131	0	0	50000	79.45	13579
11	.05	4935	470	19100	0	37398	0	2125750	158.21	425	51573	4600	37398	0	0	40000	78.26	21973
12	.13	12773	440	21300	0	15331	0	2118506	158.14	944	49887	25500	15331	0	0	30000	76.89	18964
SUM	2.13	227944	10000	619700	0	662862	360062			22047	886701	490600	1022924	0	664176			514329
1955																		
1	-.08	-7925	450	57100	0	0	0	2183081	158.84	-702	18700	52900	0	0	0	64902	80.97	61547
2	-.20	-20570	410	183200	0	0	0	2386441	160.70	-2404	0	174400	0	0	152306	89400	83.00	226241
3	.13	13736	710	102800	0	0	0	2474795	161.34	1711	67673	62200	0	0	0	82216	82.44	43428
4	-.10	-10905	1130	260100	0	0	0	2744670	163.29	-1316	0	308900	0	0	303032	89400	83.00	266478
5	.06	6707	1380	100100	0	71982	0	2764701	163.43	679	183403	72700	71982	0	0	50000	79.45	32539
6	.31	34370	1460	81200	0	162371	0	2647700	162.59	2936	214135	64700	162371	0	0	60000	80.49	14326
7	.22	23751	1420	19900	0	185542	0	2456887	161.21	2237	195705	12400	185542	0	0	60000	80.49	26497
8	.14	14768	870	34800	0	89768	0	2386281	160.70	1423	105545	17200	89768	0	0	60000	80.49	30593
9	.19	19745	680	7600	0	82405	0	2291051	160.01	1932	84473	4000	82405	0	0	60000	80.49	21933
10	.29	29524	580	6700	0	63085	0	2204562	159.07	2746	76639	6300	63085	0	0	50000	79.45	14119
11	.18	17939	470	4400	0	51327	0	2139226	158.36	1530	62297	2500	51327	0	0	40000	78.26	11249
12	.05	4924	440	14900	0	27600	0	2121162	158.16	363	46037	8800	27600	0	0	30000	76.89	22814
SUM	1.19	126064	10000	872800	0	734080	0			11135	1054607	787000	734080	0	455338			771764

SAM RAYBURN RESERVOIR

LAKE B.A. STEINHAGEN

Date	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1956																		
1	-.07	-6889	450	24100	0	17111	0	2134590	158.31	-442	37353	14800	17111	0	0	25000	76.10	55127
2	-.20	-20139	410	128000	0	0	0	2282319	159.92	-1955	0	89500	0	0	27055	89400	83.00	196951
3	.07	7231	710	54500	0	0	0	2328878	160.28	954	0	37900	0	0	36946	89400	83.00	109792
4	-.02	-2093	1130	99900	0	4095	0	2425646	160.98	-216	130811	77100	4095	0	0	40000	78.26	46011
5	.10	10538	1380	168600	0	175731	0	2406597	160.84	850	197981	33100	175731	0	0	50000	79.45	17961
6	.12	12381	1460	13500	0	213943	0	2192313	158.94	1136	217407	14600	213943	0	0	60000	80.49	11054
7	.42	40593	1420	3800	0	215858	0	1938242	156.18	4270	215888	4300	215858	0	0	60000	80.49	6314
8	.38	34464	870	1500	0	133560	0	1770848	154.10	3864	131396	1700	133560	0	0	60000	80.49	4742
9	.43	36699	680	3600	0	103856	0	1633213	152.02	4372	102184	2700	103856	0	0	60000	80.49	4222
10	.23	18665	580	2500	0	76417	0	1540051	150.61	2178	86439	2200	76417	0	0	50000	79.45	4319
11	.12	9410	470	4500	0	51602	0	1483069	149.65	1020	63782	3200	51602	0	0	40000	78.26	9764
12	.04	3025	440	8800	0	28753	0	1459651	149.16	290	46063	7600	28753	0	0	30000	76.89	23979
SUM	1.62	143885	10000	513300	0	1020926	0			16321	1229304	288700	1020926	0	64001			490236
1957																		
1	-.07	-5205	450	10800	0	23206	0	1452000	149.00	-371	51851	8300	23206	0	0	10026	72.80	18565
2	-.09	-6664	410	18200	0	24454	0	1452000	149.00	-341	30498	11500	24454	0	0	15823	74.34	35585
3	-.14	-10939	710	93300	0	0	0	1555529	150.84	-1158	28293	82100	0	0	0	70788	81.49	131381
4	-.41	-34287	1130	173600	0	8379	0	1753907	153.85	-3905	56472	13400	8379	0	0	40000	78.26	147725
5	.03	3007	1380	880500	0	0	0	2630020	162.46	325	0	812100	0	0	762375	89400	83.00	305585
6	-.08	-8920	1460	211000	0	0	0	2848480	164.04	-1090	0	137900	0	0	138990	89400	83.00	100850
7	.23	25906	1420	46500	0	117067	0	2750587	163.33	2708	186759	43000	117067	0	0	60000	80.49	35443
8	.29	32071	870	18300	0	103665	0	2632281	162.48	2949	121416	20700	103665	0	0	60000	80.49	14722
9	.00	0	680	16600	0	61438	0	2586763	162.15	0	74838	13400	61438	0	0	60000	80.49	59294
10	-.05	-5495	580	132100	0	0	0	2723778	163.14	-589	0	119100	0	0	90289	89400	83.00	105453
11	-.39	-44012	470	559300	0	0	428420	2898200	164.40	-5316	0	391500	428420	0	825236	89400	83.00	329654
12	.00	0	440	407000	0	0	406560	2898200	164.40	0	0	359700	406560	0	766260	89400	83.00	184149
SUM	-.68	-54538	10000	2567200	0	338209	834980			-6788	550127	2012700	1173189	0	2583150			1468406
RUN SUM	3.79	388378	50000	7525500	0	2960895	4126227			33745	4159445	5991200	7087122	0	8885132			5354435
ANN AVG	.76	77676	10000	1505100	0	592179	825245			6749	831889	1198240	1417424	0	1777026			1070887

CASE 8 V3:PB1_PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

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DAILY FLOW BELOW STEINHAGEN

Titles from input database file

Critical period information for Kountze gauge
VILLAGE CREEK NR KOUNTZE, TEX.

CASE 8 V3:PB1_PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1953									
1	199457	122380	321837	0	9118	0	61298	251421	0
2	367554	211770	579324	0	8372	0	55785	515167	0
3	801579	165865	967444	0	26081	0	85020	856343	0
4	496460	128495	624955	0	54092	0	122730	448133	0
5	2795604	1139960	3935564	0	72151	0	143791	3719622	0
6	449464	52568	502032	0	82978	0	145483	273571	0
7	139649	82553	222202	0	78420	0	143782	0	0
8	99731	36407	136138	0	41686	0	94452	0	0
9	74636	31770	106406	0	26607	0	79799	0	0
10	75500	15258	90758	0	19901	0	70857	0	0
11	49190	24356	73546	0	9819	0	63727	0	0
12	8349	98318	106667	0	9118	0	59733	37816	0
SUM	5557173	2109700	7666873	0	438343	0	1126457	6102073	0
1954									
1	82663	115105	197768	0	9118	0	61298	127352	0
2	64154	55444	119598	0	8372	0	55785	55441	0
3	68694	42407	111101	0	26081	0	85020	0	0
4	140263	87303	227566	0	54092	0	122730	50744	0
5	377096	105715	482811	0	72151	0	143791	266869	0
6	211374	17087	228461	0	82978	0	145483	0	0
7	211818	10384	222202	0	78420	0	143782	0	0
8	117207	18931	136138	0	41686	0	94452	0	0
9	98969	7437	106406	0	26607	0	79799	0	0
10	77179	13579	90758	0	19901	0	70857	0	0
11	51573	21973	73546	0	9819	0	63727	0	0
12	49887	18964	68851	0	9118	0	59733	0	0
SUM	1550877	514329	2065206	0	438343	0	1126457	500406	0
1955									
1	18700	61547	80247	0	9118	0	61298	9831	0
2	152306	226241	378547	0	8372	0	55785	314390	0
3	67673	43428	111101	0	26081	0	85020	0	0
4	303032	266478	569510	0	54092	0	122730	392688	0
5	183403	32539	215942	0	72151	0	143791	0	0
6	214135	14326	228461	0	82978	0	145483	0	0
7	195705	26497	222202	0	78420	0	143782	0	0
8	105545	30593	136138	0	41686	0	94452	0	0
9	84473	21933	106406	0	26607	0	79799	0	0
10	76639	14119	90758	0	19901	0	70857	0	0
11	62297	11249	73546	0	9819	0	63727	0	0
12	46037	22814	68851	0	9118	0	59733	0	0
SUM	1509945	771764	2281709	0	438343	0	1126457	716909	0

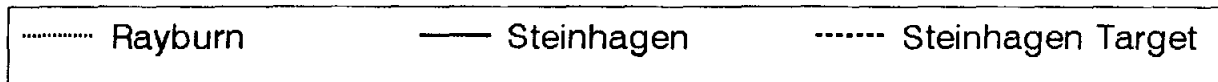
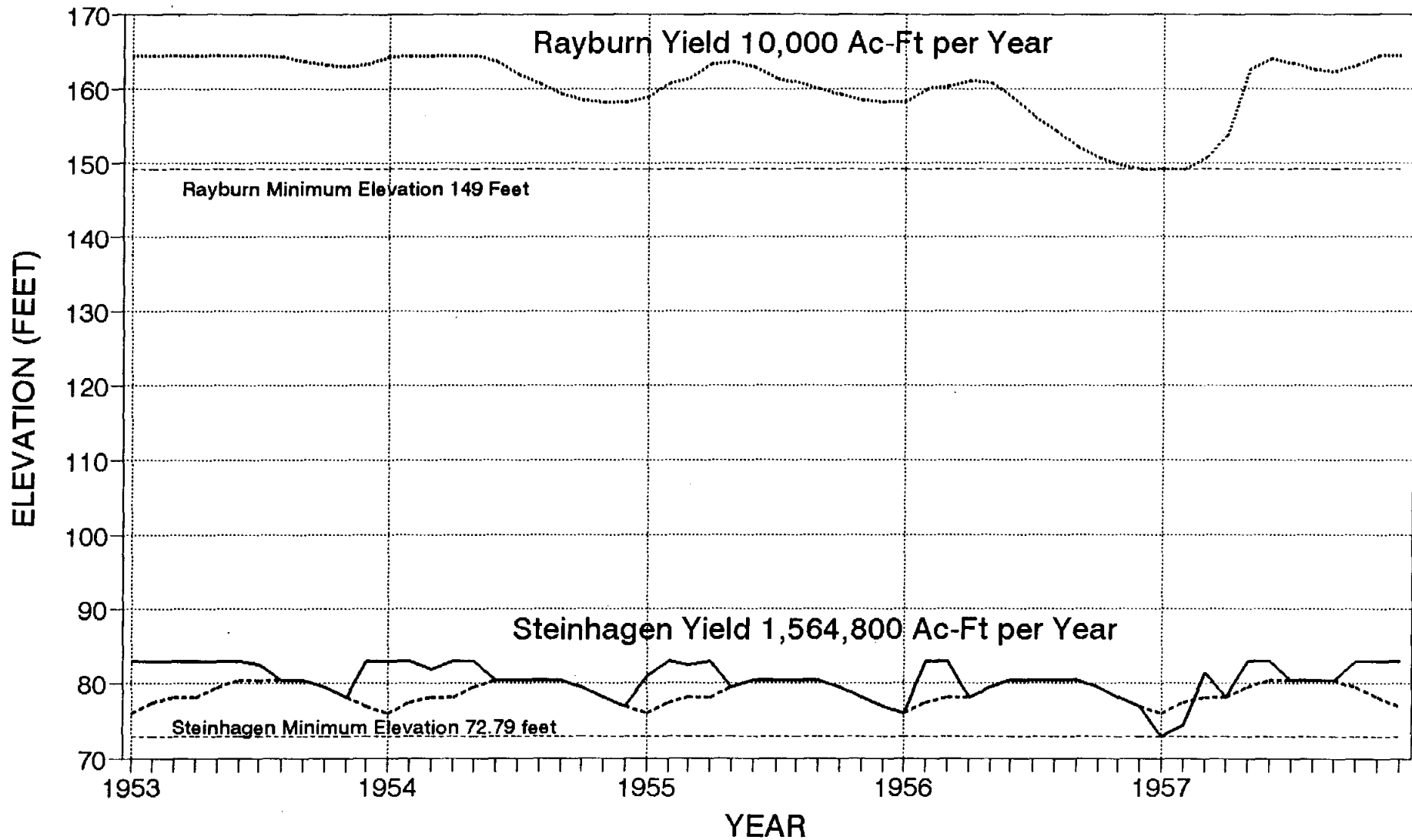
CASE 8 V3:P81_PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1956									
1	37353	55127	92480	0	9118	0	61298	22064	0
2	27055	196951	224006	0	8372	0	55785	159849	0
3	36946	109792	146738	0	26081	0	85020	35637	0
4	130811	46011	176822	0	54092	0	122730	0	0
5	197981	17961	215942	0	72151	0	143791	0	0
6	217407	11054	228461	0	82978	0	145483	0	0
7	215888	6314	222202	0	78420	0	143782	0	0
8	131396	4742	136138	0	41686	0	94452	0	0
9	102184	4222	106406	0	26607	0	79799	0	0
10	86439	4319	90758	0	19901	0	70857	0	0
11	63782	9764	73546	0	9819	0	63727	0	0
12	46063	23979	70042	0	9118	0	59733	1191	0
SUM	1293305	490236	1783541	0	438343	0	1126457	218741	0
1957									
1	51851	18565	70416	0	9118	0	61298	0	0
2	30498	35585	66083	0	8372	0	55785	1926	0
3	28293	131381	159674	0	26081	0	85020	48573	0
4	56472	147725	204197	0	54092	0	122730	27375	0
5	762375	305585	1067960	0	72151	0	143791	852018	0
6	138990	100850	239840	0	82978	0	145483	11379	0
7	186759	35443	222202	0	78420	0	143782	0	0
8	121416	14722	136138	0	41686	0	94452	0	0
9	74838	59294	134132	0	26607	0	79799	27726	0
10	90289	105453	195742	0	19901	0	70857	104984	0
11	825236	329654	1154890	0	9819	0	63727	1081344	0
12	766260	184149	950409	0	9118	0	59733	881558	0
SUM	3133277	1468406	4601683	0	438343	0	1126457	3036883	0
RUN SUM	13044577	5354435	18399012	0	2191715	0	5632285	10575012	0
ANN AVG	2608915	1070887	3679802	0	438343	0	1126457	2115002	0

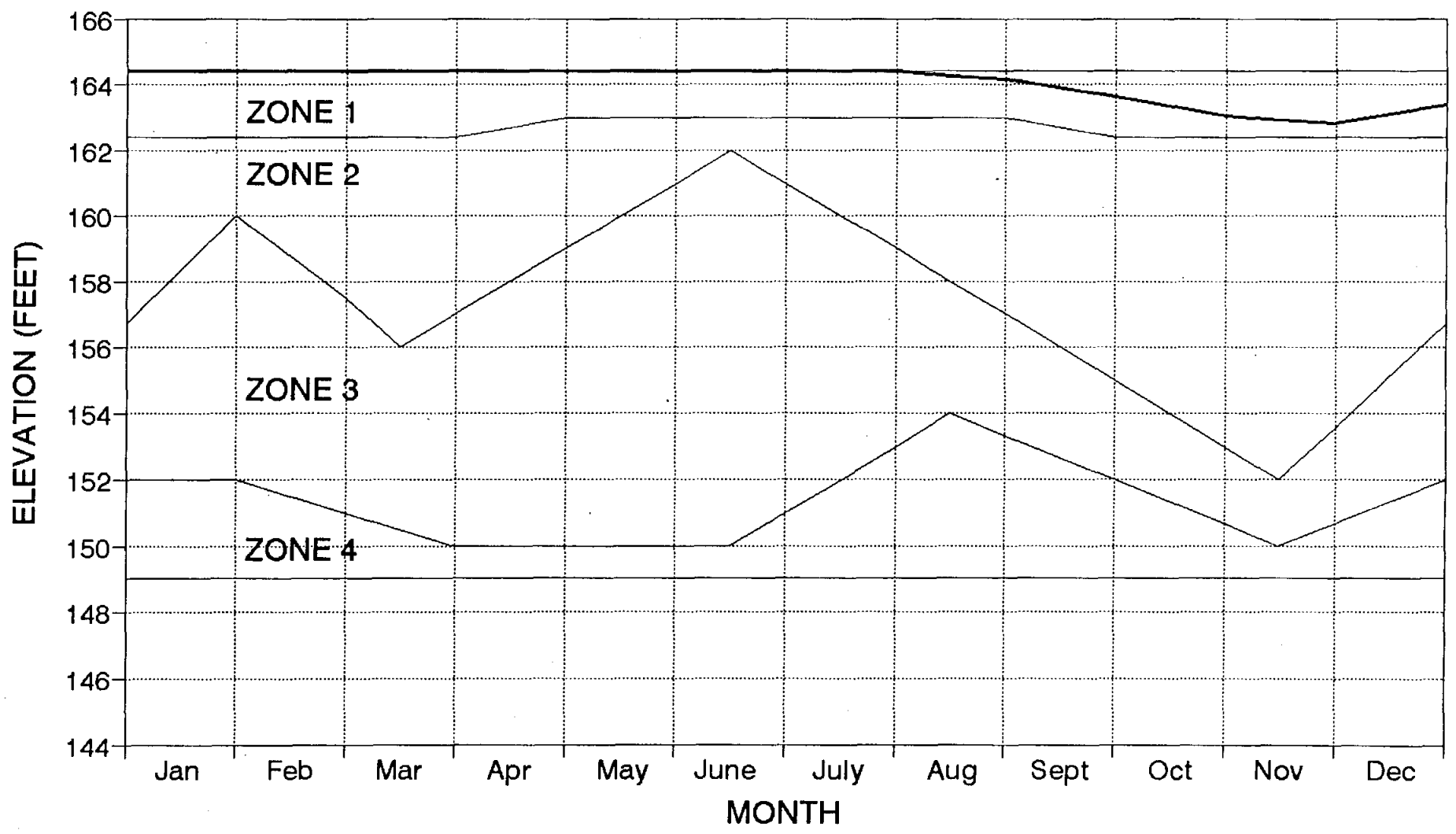
CASE 8: PRESENT CONDITIONS

Permanent Barrier



CASE 8: PRESENT CONDITIONS 1953

Permanent Barrier

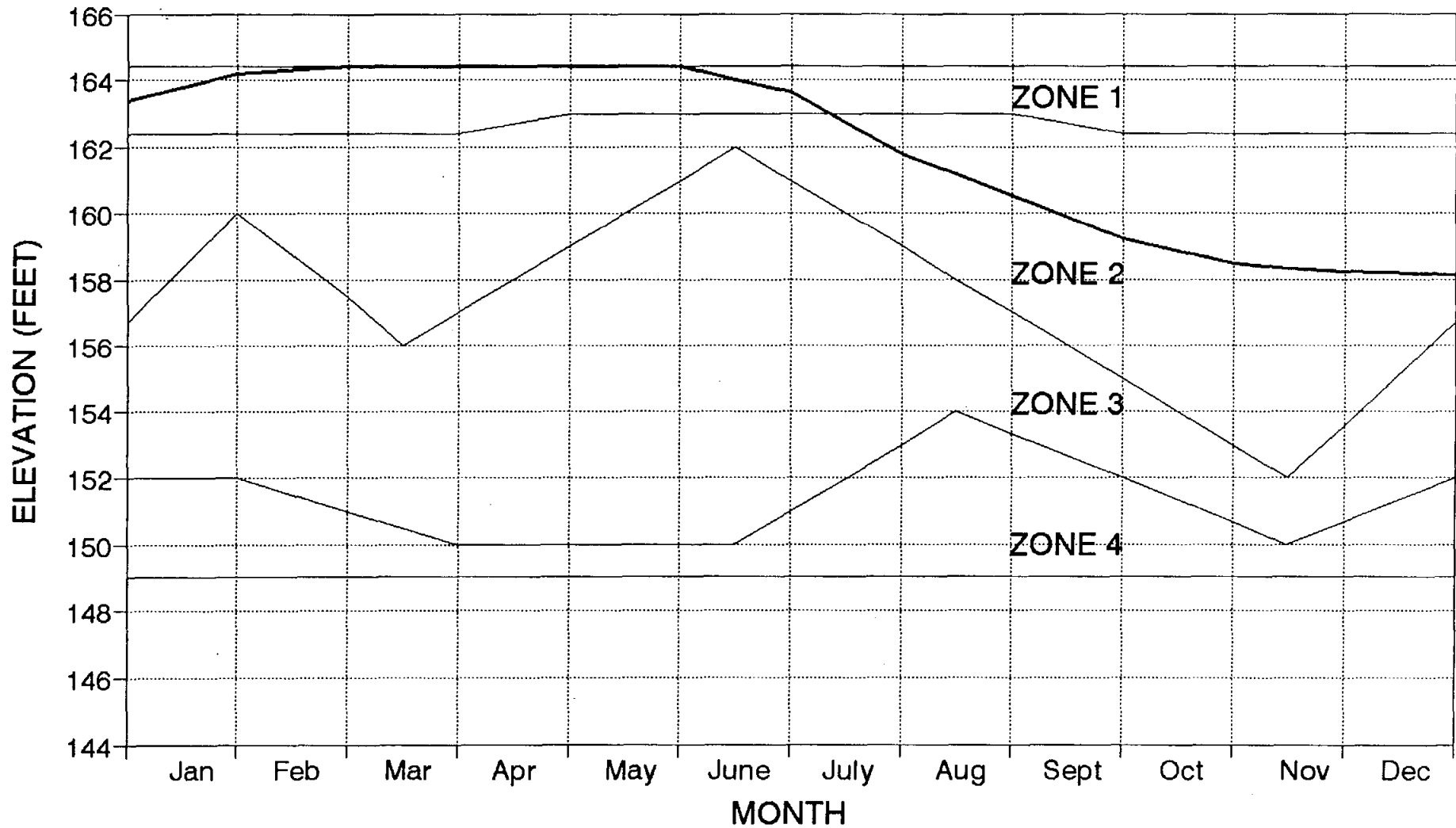


— Rayburn Elevation

PB1_PRES
8/2/94

CASE 8: PRESENT CONDITIONS 1954

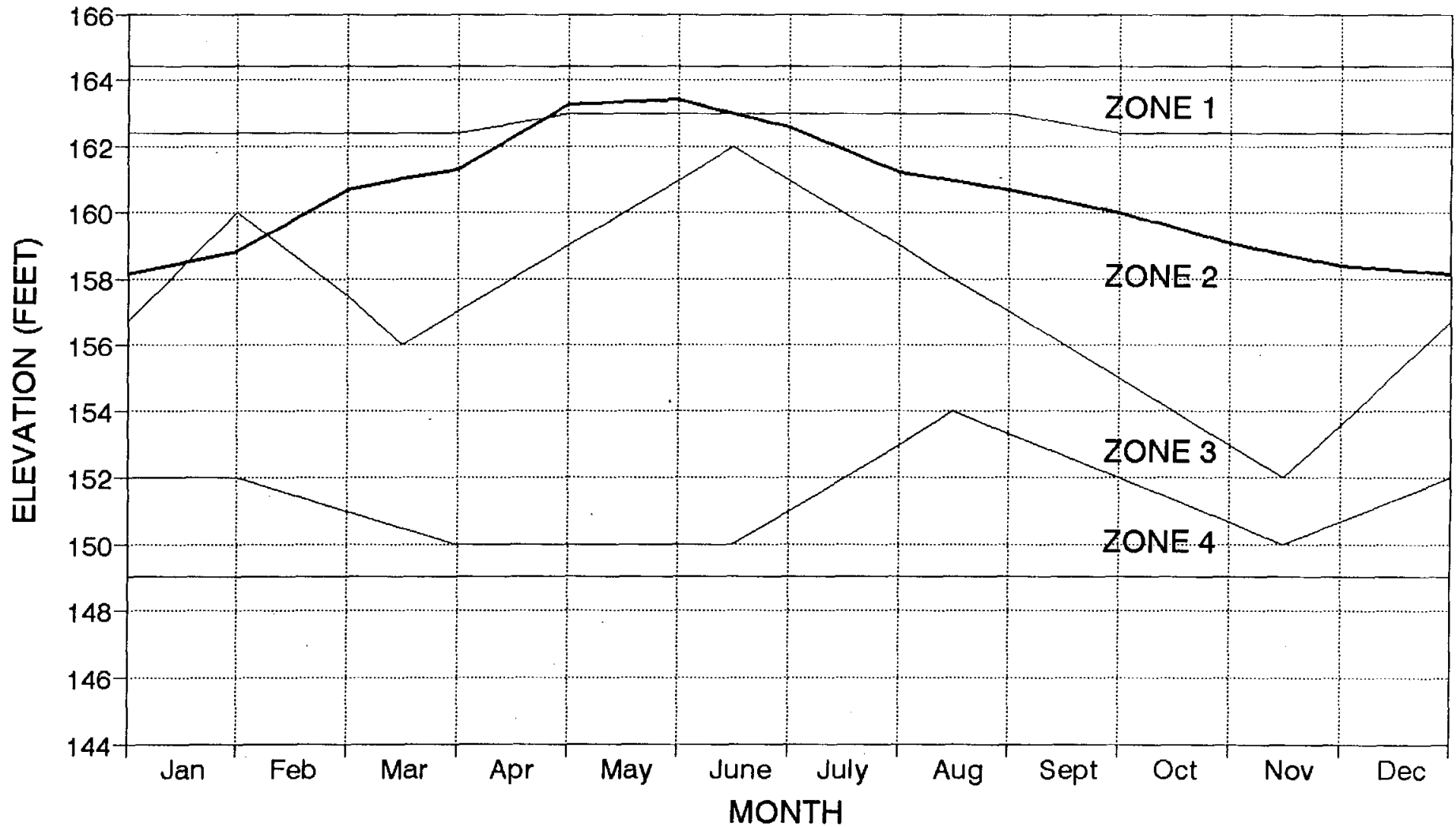
Permanent Barrier



— Rayburn Elevation

CASE 8: PRESENT CONDITIONS 1955

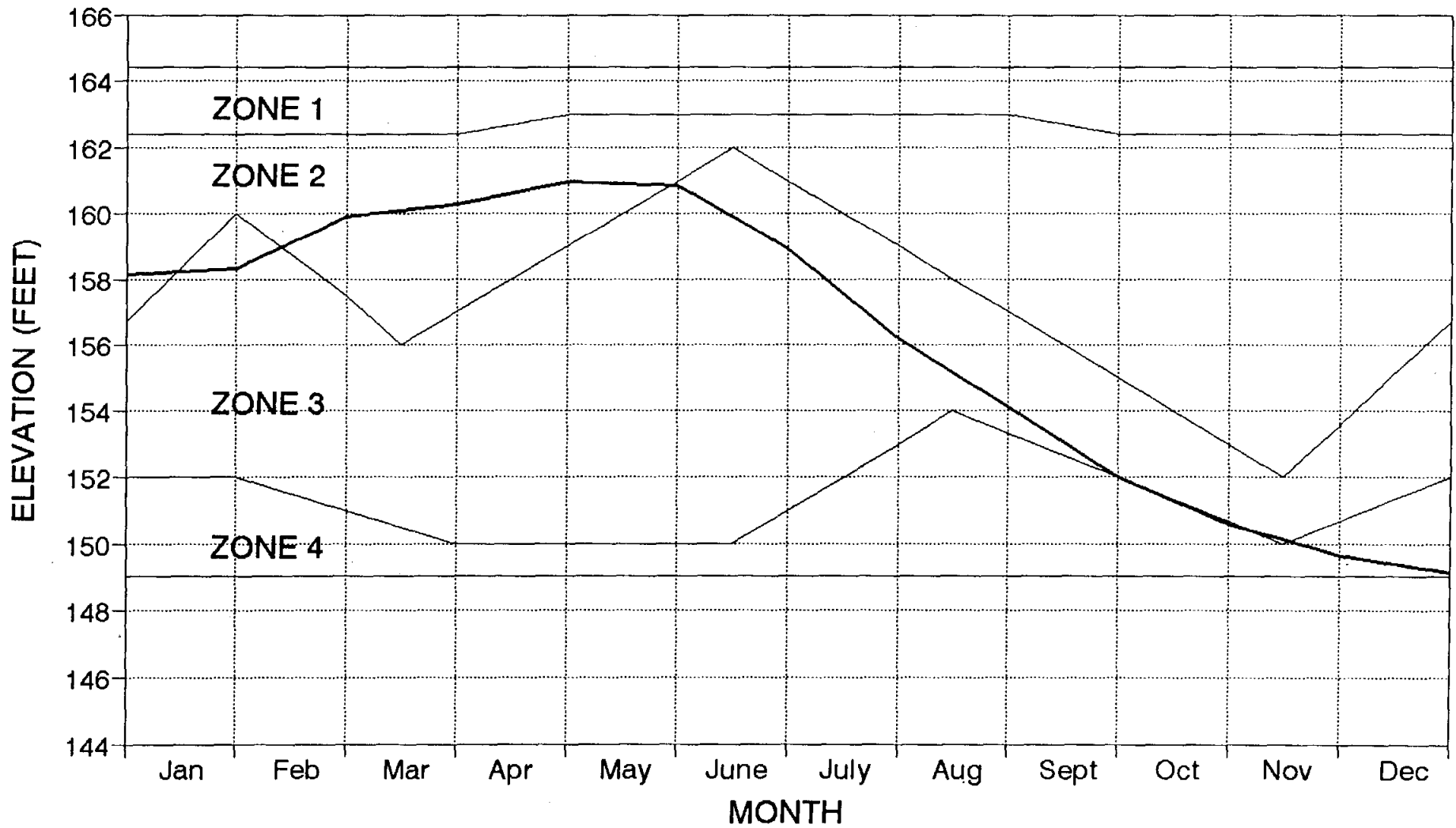
Permanent Barrier



— Rayburn Elevation

CASE 8: PRESENT CONDITIONS 1956

Permanent Barrier

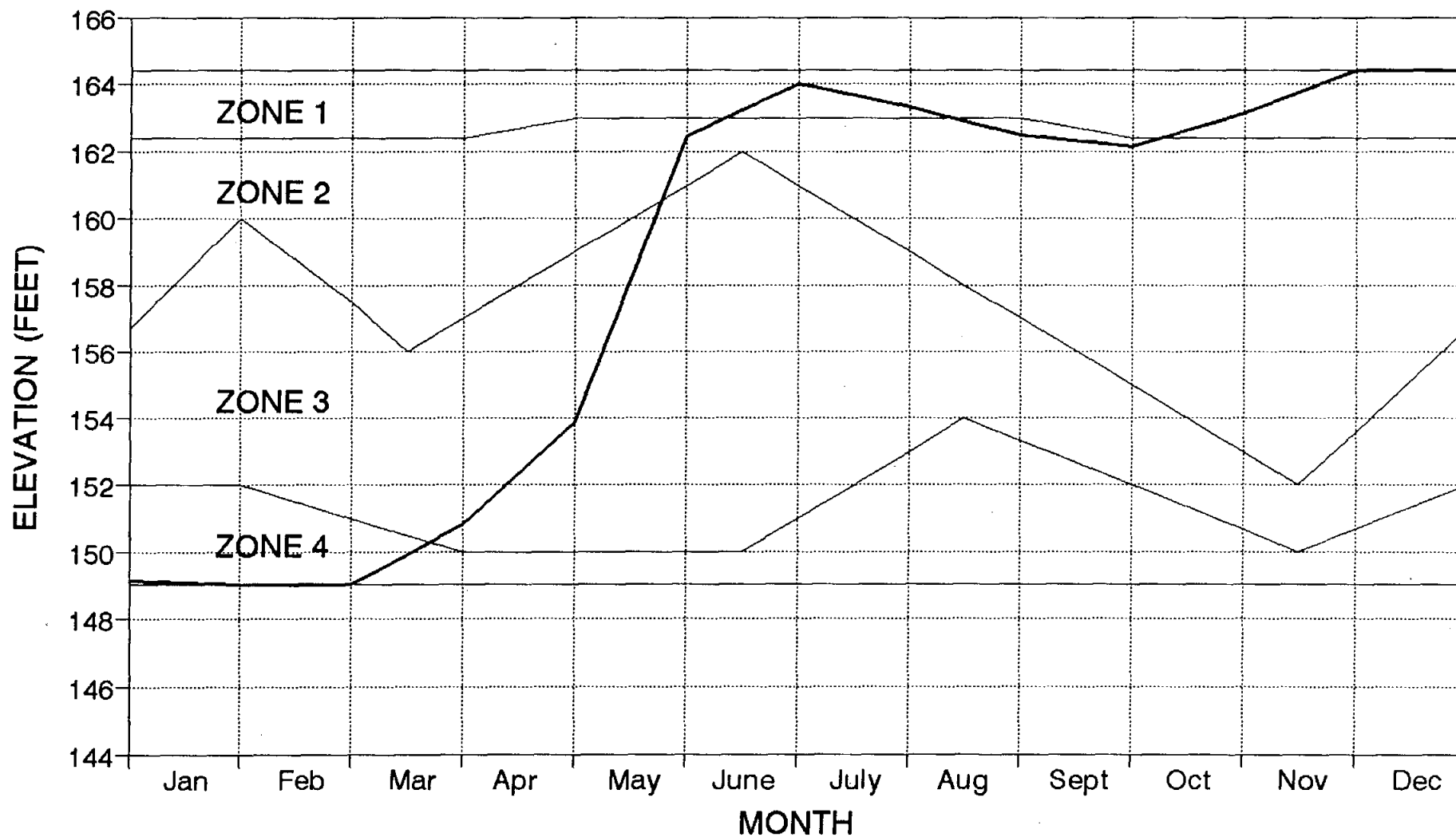


— Rayburn Elevation

PB1_PRES
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CASE 8: PRESENT CONDITIONS 1957

Permanent Barrier



— Rayburn Elevation

APPENDIX G

50-YEAR OPERATION STUDY

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

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SAM RAYBURN RESERVOIR SUMMARY

Maximum Capacity = 2898200 acre-feet
Starting Content = 2898200 acre-feet
Minimum Content = 1452000 acre-feet

Critical period is from 6/1954 through 1/1957

Titles from input database file

Sam Rayburn Reservoir SR_41_90 08/19/94 13:36
50 years Present Conditions 1974 ACE

DAILY FLOW BELOW STEINHAGEN

Titles from input database file

1941 to 1990 for Kountze gauge
VILLAGE CREEK NR KOUNTZE, TEX.

LAKE B.A. STEINHAGEN SUMMARY

Maximum Capacity = 89400 acre-feet
Starting Content = 89400 acre-feet
Minimum Content = 10026 acre-feet

Critical period is from 4/1956 through 1/1957

Titles from input database file

Lake B.A. Steinhagen BAS41_90.DAT 06/07/94 14:27
50 years present conditions 1994 ACE

Date	SAM RAYBURN RESERVOIR									LAKE B.A. STEINHAGEN								
	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1941																		
1	-.02	-2290	450	591689	0	0	593529	2898200	164.40	-273	0	518492	593529	0	1112294	89400	83.00	264430
2	-.14	-16030	410	327621	0	0	343241	2898200	164.40	-1908	0	305894	343241	0	651043	89400	83.00	218928
3	-.03	-3435	710	520383	0	0	523108	2898200	164.40	-409	0	483459	523108	0	1006976	89400	83.00	316626
4	.00	0	1130	199489	0	0	198359	2898200	164.40	0	0	218645	198359	0	417004	89400	83.00	125551
5	-.14	-16030	1380	317606	0	0	332256	2898200	164.40	-1908	0	265857	332256	0	600021	89400	83.00	278631
6	-.12	-13740	1460	288461	0	0	300741	2898200	164.40	-1636	0	373841	300741	0	676218	89400	83.00	405984
7	-.04	-4580	1420	118510	0	0	121670	2898200	164.40	-545	0	197808	121670	0	320023	89400	83.00	144215
8	.30	34198	870	35869	0	54540	0	2844461	164.01	3532	101263	20855	54540	0	0	60000	80.49	34875
9	-.05	-5692	680	42667	0	9070	0	2883070	164.29	-508	49365	39787	9070	0	0	60000	80.49	91232
10	-.36	-41169	580	133453	0	0	158912	2898200	164.40	-4239	0	98766	158912	0	232517	89400	83.00	123693
11	.01	1145	470	648441	0	0	646826	2898200	164.40	136	0	446072	646826	0	1092762	89400	83.00	455141
12	-.02	-2290	440	315753	0	0	317603	2898200	164.40	-273	0	187341	317603	0	505217	89400	83.00	112204
SUM	-.61	-69913	10000	3539942	0	63610	3536245			-8031	150628	3156817	3599855	0	6614075			2571510
1942																		
1	.05	5725	450	235886	0	0	229711	2898200	164.40	682	0	152320	229711	0	381349	89400	83.00	157843
2	-.01	-1145	410	181747	0	0	182482	2898200	164.40	-136	0	150457	182482	0	333075	89400	83.00	150076
3	.02	2290	710	258618	0	0	255618	2898200	164.40	273	0	190250	255618	0	445595	89400	83.00	197128
4	-.14	-16030	1130	381734	0	0	396634	2898200	164.40	-1908	0	473066	396634	0	871608	89400	83.00	477848
5	-.02	-2290	1380	265658	0	0	266568	2898200	164.40	-273	0	372979	266568	0	639820	89400	83.00	150878
6	-.02	-2290	1460	204878	0	0	205708	2898200	164.40	-273	0	233853	205708	0	439834	89400	83.00	122216
7	.25	28625	1420	64029	0	0	33984	2898200	164.40	3202	117234	73897	33984	0	0	76845	82.02	115795
8	.11	12595	870	128165	0	0	114700	2898200	164.40	1409	0	75682	114700	0	176418	89400	83.00	218505
9	.25	28625	680	85227	0	0	55922	2898200	164.40	3408	0	47888	55922	0	100402	89400	83.00	138927
10	.27	30882	580	23997	0	5495	0	2885240	164.31	3054	58703	16862	5495	0	0	50000	79.45	32055
11	.10	11438	470	36895	0	0	12027	2898200	164.40	953	29122	28879	12027	0	0	60831	80.57	45821
12	-.06	-6870	440	50814	0	0	57244	2898200	164.40	-709	0	37452	57244	0	66836	89400	83.00	80462
SUM	.80	91555	10000	1917648	0	5495	1810598			9682	205059	1853585	1816093	0	3454937			1887554
1943																		
1	-.05	-5725	450	151905	0	0	157180	2898200	164.40	-682	0	180461	157180	0	338323	89400	83.00	226416
2	.14	16030	410	86375	0	0	69935	2898200	164.40	1908	0	67231	69935	0	135258	89400	83.00	74857
3	.04	4580	710	76678	0	0	71388	2898200	164.40	545	0	59784	71388	0	130627	89400	83.00	108251
4	.20	22900	1130	61214	0	0	37184	2898200	164.40	2726	0	66150	37184	0	100608	89400	83.00	95397
5	.11	12595	1380	31838	0	0	17863	2898200	164.40	1292	129123	82451	17863	0	0	59299	80.42	132602
6	.20	22849	1460	23651	0	26143	0	2871399	164.21	2024	172167	148749	26143	0	0	60000	80.49	56294
7	.20	22532	1420	13064	0	130184	0	2730327	163.19	2033	164059	35908	130184	0	0	60000	80.49	129151
8	.42	46305	870	5895	0	72559	0	2616488	162.36	4270	83528	15239	72559	0	0	60000	80.49	102607
9	.20	21670	680	3413	0	67951	0	2529600	161.73	2033	68975	3057	67951	0	0	60000	80.49	40989
10	.24	25669	580	5769	0	40418	0	2468702	161.29	2273	62785	14640	40418	0	0	50000	79.45	28058
11	.05	5323	470	14186	0	0	0	2477095	161.35	432	38380	30927	0	0	0	42115	78.52	35186
12	-.07	-7480	440	27416	0	0	0	2511551	161.60	-661	10751	35197	0	0	0	67222	81.18	98944
SUM	1.68	187248	10000	501404	0	337255	353550			18193	729768	739794	690805	0	704816			1128752

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

Date	SAM RAYBURN RESERVOIR									LAKE B.A. STEINHAGEN								
	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1944																		
1	-.31	-34032	450	240585	0	0	0	2785718	163.59	-3774	0	212609	0	0	194205	89400	83.00	333920
2	-.09	-10209	410	336866	0	0	234183	2898200	164.40	-1227	0	386400	234183	0	621810	89400	83.00	227271
3	-.09	-10305	710	394217	0	0	403812	2898200	164.40	-1227	0	481934	403812	0	886973	89400	83.00	192170
4	-.05	-5725	1130	362696	0	0	367291	2898200	164.40	-682	0	285387	367291	0	653360	89400	83.00	74847
5	-.63	-72135	1380	1431820	0	0	1502575	2898200	164.40	-8588	0	1533175	1502575	0	3044338	89400	83.00	522809
6	.20	22900	1460	358588	0	0	334228	2898200	164.40	2726	0	275972	334228	0	607474	89400	83.00	74385
7	.38	42865	1420	18869	0	154159	.0	2718625	163.10	4474	199879	20794	154159	0	0	60000	80.49	22323
8	.24	26371	870	9888	0	112227	0	2589045	162.16	2440	117052	7265	112227	0	0	60000	80.49	19086
9	.23	24932	680	38353	0	39868	0	2561918	161.97	2339	71878	34349	39868	0	0	60000	80.49	40997
10	.31	33286	580	9590	0	56887	0	2480755	161.38	2936	71612	7661	56887	0	0	50000	79.45	19146
11	-.24	-25755	470	49402	0	0	0	2555442	161.92	-2139	40166	36030	0	0	48003	79.23	48837	
12	-.34	-37828	440	316424	0	0	11054	2898200	164.40	-3814	0	244723	11054	0	218194	89400	83.00	207621
SUM	-.39	-45635	10000	3567298	0	363141	2853143			-6536	500587	3526299	3216284	0	6226354			1783412
1945																		
1	-.16	-18320	450	808506	0	0	826376	2898200	164.40	-2181	0	648625	826376	0	1477182	89400	83.00	439892
2	-.15	-17175	410	482771	0	0	499536	2898200	164.40	-2045	0	396818	499536	0	898399	89400	83.00	286162
3	-.05	-5725	710	457333	0	0	462348	2898200	164.40	-682	0	564692	462348	0	1027722	89400	83.00	193786
4	-.11	-12595	1130	750784	0	0	762249	2898200	164.40	-1499	0	1268160	762249	0	2031908	89400	83.00	510768
5	-.02	-2290	1380	199578	0	0	200488	2898200	164.40	-273	0	198058	200488	0	398819	89400	83.00	139618
6	.13	14885	1460	82644	0	0	66299	2898200	164.40	1587	149383	62975	66299	0	0	67704	81.22	85354
7	.07	8015	1420	203540	0	0	194105	2898200	164.40	854	0	133621	194105	0	305176	89400	83.00	66184
8	.13	14885	870	58176	0	0	42421	2898200	164.40	1765	100885	59378	42421	0	0	88549	82.93	48584
9	.18	20562	680	15499	0	22505	0	2869952	164.20	2112	63913	14971	22505	0	0	60000	80.49	59292
10	-.13	-14850	580	176977	0	0	162999	2898200	164.40	-1531	0	103806	162999	0	238936	89400	83.00	86395
11	.09	10305	470	78328	0	0	67553	2898200	164.40	1227	0	74712	67553	0	141038	89400	83.00	46856
12	-.07	-8015	440	166293	0	0	173868	2898200	164.40	-954	0	133289	173868	0	308111	89400	83.00	277184
SUM	-.09	-10318	10000	3480429	0	22505	3458242			-1620	314181	3659105	3480747	0	6827291			2240075
1946																		
1	-.39	-44655	450	637840	0	0	682045	2898200	164.40	-5316	0	504013	682045	0	1191374	89400	83.00	534132
2	-.26	-29770	410	812383	0	0	841743	2898200	164.40	-3544	0	781994	841743	0	1627281	89400	83.00	533213
3	-.11	-12595	710	524336	0	0	536221	2898200	164.40	-1499	0	568694	536221	0	1106414	89400	83.00	310645
4	.05	5725	1130	310739	0	0	303884	2898200	164.40	682	0	342510	303884	0	645712	89400	83.00	129303
5	-.20	-22900	1380	368220	0	0	389740	2898200	164.40	-2726	0	492812	389740	0	885278	89400	83.00	276174
6	.00	0	1460	371137	0	0	369677	2898200	164.40	0	0	510613	369677	0	880290	89400	83.00	325096
7	.19	21755	1420	81682	0	0	58507	2898200	164.40	2590	0	104689	58507	0	160606	89400	83.00	210205
8	.15	17143	870	35288	0	40048	0	2875427	164.24	1766	90748	23066	40048	0	0	60000	80.49	45390
9	.16	18286	680	52776	0	0	11037	2898200	164.40	1768	71402	75948	11037	0	0	73815	81.76	35004
10	.11	12595	580	41383	0	0	28208	2898200	164.40	1387	0	53206	28208	0	64442	89400	83.00	76710
11	-.34	-38930	470	380898	0	0	419358	2898200	164.40	-4635	0	656929	419358	0	1080922	89400	83.00	580153
12	-.05	-5725	440	305382	0	0	310667	2898200	164.40	-682	0	367647	310667	0	678996	89400	83.00	217020
SUM	-.69	-79071	10000	3922064	0	40048	3951087			-10209	162150	4482121	3991135	0	8321315			3273045

SAM RAYBURN RESERVOIR

LAKE B.A. STEINHAGEN

Date	Evap- Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short- age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short- age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1947																		
1	-.30	-34350	450	665820	0	0	699720	2898200	164.40	-4089	0	650473	699720	0	1354282	89400	83.00	605618
2	.04	4580	410	253692	0	0	248702	2898200	164.40	545	0	225190	248702	0	473347	89400	83.00	146140
3	-.14	-16030	710	498074	0	0	513394	2898200	164.40	-1908	0	537667	513394	0	1052969	89400	83.00	399464
4	.05	5725	1130	306711	0	0	299856	2898200	164.40	682	0	307104	299856	0	606278	89400	83.00	88569
5	-.20	-22900	1380	293882	0	0	315402	2898200	164.40	-2726	0	357267	315402	0	675395	89400	83.00	188568
6	.15	17175	1460	176434	0	0	157799	2898200	164.40	2045	0	189859	157799	0	345613	89400	83.00	86692
7	.29	32875	1420	31944	0	118107	0	2777742	163.53	3414	186318	42225	118107	0	0	60000	80.49	35884
8	.38	42143	870	10403	0	107080	0	2638052	162.52	3864	112194	8978	107080	0	0	60000	80.49	23944
9	.43	46614	680	7605	0	84744	0	2513619	161.62	4372	88008	7636	84744	0	0	60000	80.49	18398
10	.25	26619	580	8472	0	60965	0	2433927	161.04	2368	76208	7611	60965	0	0	50000	79.45	14550
11	-.12	-12745	470	42447	0	3048	0	2485601	161.42	-1020	36918	22850	3048	0	0	40000	78.26	37094
12	-.18	-19487	440	146167	0	0	0	2650815	162.61	-1948	0	82056	0	0	34604	89400	83.00	136895
SUM	.65	70219	10000	2441651	0	373944	2234873			5599	499646	2438916	2608817	0	4542488			1781816
1948																		
1	-.11	-12236	450	137719	0	0	0	2800320	163.69	-1499	0	95364	0	0	96863	89400	83.00	122662
2	-.20	-22715	410	434002	0	0	358427	2898200	164.40	-2726	0	325702	358427	0	686855	89400	83.00	222628
3	.05	5725	710	287241	0	0	280806	2898200	164.40	682	0	300863	280806	0	580987	89400	83.00	143155
4	-.01	-1145	1130	244631	0	0	244646	2898200	164.40	-136	0	190339	244646	0	435121	89400	83.00	82611
5	-.01	-1145	1380	143486	0	0	143251	2898200	164.40	-136	0	166145	143251	0	309532	89400	83.00	45072
6	.31	35168	1460	38603	0	113657	0	2786518	163.59	3650	209110	69703	113657	0	0	60000	80.49	19351
7	.23	25426	1420	14276	0	182281	0	2591667	162.18	2339	195929	15987	182281	0	0	60000	80.49	26273
8	.38	40717	870	3586	0	126312	0	2427354	160.99	3864	126121	3673	126312	0	0	60000	80.49	10017
9	.25	26119	680	3779	0	95714	0	2308620	160.13	2542	96353	3181	95714	0	0	60000	80.49	10053
10	.24	24525	580	3150	0	72786	0	2213879	159.17	2273	82579	2066	72786	0	0	50000	79.45	8179
11	-.23	-23281	470	27249	0	23752	0	2240187	159.46	-1955	50279	14572	23752	0	0	40000	78.26	23717
12	-.07	-7142	440	37492	0	13637	0	2270744	159.79	-508	44711	20566	13637	0	0	30000	76.89	24140
SUM	.83	90016	10000	1375214	0	628139	1027130			8390	805082	1208161	1655269	0	2109358			737858
1949																		
1	-.33	-34570	450	190428	0	0	0	2495292	161.49	-3341	0	102714	0	0	46655	89400	83.00	136183
2	-.12	-13135	410	260010	0	0	0	2768027	163.46	-1636	0	177039	0	0	178675	89400	83.00	234195
3	-.12	-13592	710	314487	0	0	197196	2898200	164.40	-1636	0	292316	197196	0	491148	89400	83.00	421783
4	-.10	-11450	1130	285413	0	0	295733	2898200	164.40	-1363	0	232115	295733	0	529211	89400	83.00	383073
5	.08	9160	1380	137690	0	0	127150	2898200	164.40	1090	0	125301	127150	0	251361	89400	83.00	84209
6	.02	2287	1460	70287	0	82132	0	2882608	164.29	235	154863	43566	82132	0	0	60000	80.49	73598
7	.14	15781	1420	29348	0	169084	0	2725671	163.15	1423	179667	12006	169084	0	0	60000	80.49	42535
8	.22	24268	870	23535	0	96852	0	2627216	162.44	2237	109398	14783	96852	0	0	60000	80.49	26740
9	.24	26070	680	13991	0	66640	0	2547817	161.87	2440	75698	11498	66640	0	0	60000	80.49	30708
10	-.47	-51620	580	155650	0	0	0	2754507	163.36	-5534	0	125785	0	0	101919	89400	83.00	680706
11	-.19	-21357	470	87791	0	0	0	2820471	163.84	2590	0	80373	0	0	77783	89400	83.00	64050
12	-.32	-36405	440	244588	0	0	202824	2898200	164.40	-4362	0	186000	202824	0	393186	89400	83.00	512144
SUM	-.57	-61849	10000	1813218	0	414708	822903			-7857	519626	1403496	1237611	0	2069938			2689924

SAM RAYBURN RESERVOIR

LAKE B.A. STEINHAGEN

Date	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1950																		
1	-.33	-37785	450	696320	0	0	733655	2898200	164.40	-4498	0	456499	733655	0	1194652	89400	83.00	585620
2	-.32	-36640	410	601743	0	0	637973	2898200	164.40	-4362	0	619369	637973	0	1261704	89400	83.00	442588
3	.06	6870	710	333882	0	0	326302	2898200	164.40	818	0	299997	326302	0	625481	89400	83.00	361557
4	-.10	-11450	1130	128122	0	0	138442	2898200	164.40	-1363	0	121313	138442	0	261118	89400	83.00	143332
5	-.29	-33205	1380	434281	0	0	466106	2898200	164.40	-3953	0	371238	466106	0	841297	89400	83.00	341091
6	-.14	-16030	1460	567319	0	0	581889	2898200	164.40	-1908	0	464678	581889	0	1048475	89400	83.00	1061068
7	.15	17132	1420	62070	0	73566	0	2868152	164.18	1766	136453	35253	73566	0	0	60000	80.49	94375
8	.30	33869	870	19656	0	94391	0	2758678	163.39	3050	103741	12400	94391	0	0	60000	80.49	32397
9	-.11	-12276	680	22937	0	62528	0	2730683	163.19	-1118	73696	10050	62528	0	0	60000	80.49	32710
10	.20	22162	580	18230	0	50910	0	2675261	162.79	1894	69283	10267	50910	0	0	50000	79.45	21475
11	.06	6609	470	22369	0	29588	0	2660963	162.68	510	49541	10463	29588	0	0	40000	78.26	24005
12	-.03	-3306	440	31427	0	14026	0	2681230	162.83	-218	41129	16885	14026	0	0	30000	76.89	27722
SUM	-.55	-64050	10000	2938356	0	325009	2884367			-9382	473843	2428412	3209376	0	5232727			3167940
1951																		
1	-.05	-5554	450	66620	0	0	0	2752954	163.35	-363	16899	26589	0	0	0	40053	78.27	64313
2	-.17	-19191	410	100944	0	0	0	2872679	164.22	-1682	7343	41660	0	0	0	76052	81.95	59430
3	-.10	-11426	710	148441	0	0	133636	2898200	164.40	-1275	0	84572	133636	0	206135	89400	83.00	72723
4	.15	17175	1130	149467	0	0	131162	2898200	164.40	2045	0	88108	131162	0	217225	89400	83.00	102670
5	.16	18229	1380	47255	0	87740	0	2838106	163.97	1810	181351	56021	87740	0	0	50000	79.45	34591
6	.15	16735	1460	26351	0	198176	0	2648086	162.59	1421	210411	23656	198176	0	0	60000	80.49	18050
7	.24	25847	1420	6726	0	198761	0	2428784	161.00	2440	208293	11972	198761	0	0	60000	80.49	13909
8	.50	51978	870	922	0	124547	0	2252311	159.59	5084	127047	7584	124547	0	0	60000	80.49	9091
9	-.04	-4050	680	2617	0	54399	0	2203899	159.06	-407	66694	11888	54399	0	0	60000	80.49	65629
10	.29	28832	580	3347	0	55019	0	2122815	158.18	2746	71031	8758	55019	0	0	50000	79.45	19727
11	.06	5868	470	8243	0	35563	0	2089157	157.82	510	55937	10884	35563	0	0	40000	78.26	17609
12	-.11	-10777	440	35361	0	0	0	2134855	158.31	-936	22780	31923	0	0	0	50079	79.46	52816
SUM	1.08	113666	10000	596294	0	754205	264798			11393	967786	403615	1019003	0	423360			530558
1952																		
1	-.04	-3968	450	37854	0	0	0	2176227	158.76	-354	38987	35299	0	0	0	46745	79.09	31429
2	-.14	-14378	410	192596	0	0	0	2382791	160.67	-1562	0	108225	0	0	67132	89400	83.00	67948
3	-.05	-5377	710	290867	0	0	0	2678325	162.81	-682	0	193101	0	0	193783	89400	83.00	70064
4	-.21	-23608	1130	235682	0	0	38285	2898200	164.40	-2863	0	192905	38285	0	234053	89400	83.00	267502
5	-.12	-13740	1380	130672	0	0	143032	2898200	164.40	-1636	0	259354	143032	0	404022	89400	83.00	294820
6	.25	28517	1460	46134	0	61734	0	2852623	164.07	2943	174300	86109	61734	0	0	60000	80.49	54238
7	.04	4488	1420	7082	0	154557	0	2699240	162.96	407	168987	14837	154557	0	0	60000	80.49	56961
8	.43	46918	870	1100	0	125326	0	2527226	161.72	4372	122330	1376	125326	0	0	60000	80.49	13808
9	.43	45632	680	0	0	98063	0	2382851	160.67	4372	99069	5378	98063	0	0	60000	80.49	7337
10	.45	46617	580	0	0	75678	0	2259976	159.67	4262	84670	3254	75678	0	0	50000	79.45	6088
11	-.15	-15278	470	2810	0	38733	0	2238861	159.44	-1275	58588	8580	38733	0	0	40000	78.26	14958
12	-.02	-2040	440	29640	0	0	0	2270101	159.78	-178	21123	38210	0	0	0	57265	80.22	55829
SUM	.87	93783	10000	974437	0	554091	181317			7806	768054	946628	735408	0	898990			940982

Date	SAM RAYBURN RESERVOIR									LAKE B.A. STEINHAGEN								
	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1953																		
1	-.05	-5179	450	96400	0	0	0	2371230	160.59	-582	0	97100	0	0	65547	89400	83.00	122380
2	-.18	-19161	410	184000	0	0	0	2573981	162.05	-2454	0	160900	0	0	163354	89400	83.00	211770
3	-.22	-24516	710	529500	0	0	229087	2898200	164.40	-2999	0	244600	229087	0	476686	89400	83.00	165865
4	-.38	-43510	1130	211500	0	0	253880	2898200	164.40	-5180	0	237400	253880	0	496460	89400	83.00	128495
5	-.49	-56105	1380	1506500	0	0	1561225	2898200	164.40	-6679	0	1227700	1561225	0	2795604	89400	83.00	1139960
6	.12	13740	1460	196900	0	0	181700	2898200	164.40	1636	0	269400	181700	0	449464	89400	83.00	52568
7	-.01	-1145	1420	74800	0	0	74525	2898200	164.40	-133	139649	59700	74525	0	0	84109	82.59	82553
8	.23	26258	870	41600	0	49774	0	2862898	164.14	2652	99731	28500	49774	0	0	60000	80.49	36407
9	.27	30545	680	20000	0	62981	0	2788692	163.61	2745	74636	14400	62981	0	0	60000	80.49	31770
10	.23	25686	580	8300	0	61678	0	2709048	163.03	2178	75500	6000	61678	0	0	50000	79.45	15258
11	.07	7749	470	14500	0	30385	0	2684944	162.86	595	49190	9400	30385	0	0	40000	78.26	24356
12	-.06	-6670	440	68500	0	0	0	2759674	163.40	-649	0	57100	0	0	8349	89400	83.00	98318
SUM	-.47	-52308	10000	2952500	0	204818	2300417			-8870	438706	2412200	2505235	0	4455464			2109700
1954																		
1	-.10	-11293	450	100200	0	0	0	2870717	164.20	-1363	0	81300	0	0	82663	89400	83.00	115105
2	.21	23990	410	76600	0	0	24717	2898200	164.40	2863	0	42300	24717	0	64154	89400	83.00	55444
3	.15	17175	710	49400	0	0	31515	2898200	164.40	1928	68694	27300	31515	0	0	77593	82.08	42407
4	.00	0	1130	83200	0	0	82070	2898200	164.40	0	0	70000	82070	0	140263	89400	83.00	87303
5	-.12	-13740	1380	209400	0	0	221760	2898200	164.40	-1636	0	153700	221760	0	377096	89400	83.00	105715
6	.34	38580	1460	46600	0	115477	0	2789283	163.61	4003	211374	70500	115477	0	0	60000	80.49	17087
7	.40	44017	1420	4000	0	212085	0	2535761	161.78	4067	211818	3800	212085	0	0	60000	80.49	10384
8	.51	54076	870	2600	0	118492	0	2364923	160.54	5185	117207	3900	118492	0	0	60000	80.49	18931
9	.47	48429	680	3600	0	99948	0	2219466	159.23	4779	98969	3800	99948	0	0	60000	80.49	7437
10	.09	9002	580	3700	0	64131	0	2149453	158.47	852	77179	3900	64131	0	0	50000	79.45	13579
11	.05	4935	470	19100	0	37398	0	2125750	158.21	425	51573	4600	37398	0	0	40000	78.26	21973
12	.13	12773	440	21300	0	15331	0	2118506	158.14	944	49887	25500	15331	0	0	30000	76.89	18964
SUM	2.13	227944	10000	619700	0	662862	360062			22047	886701	490600	1022924	0	664176			514329
1955																		
1	-.08	-7925	450	57100	0	0	0	2183081	158.84	-702	18700	52900	0	0	0	64902	80.97	61547
2	-.20	-20570	410	183200	0	0	0	2386441	160.70	-2404	0	174400	0	0	152306	89400	83.00	226241
3	.13	13736	710	102800	0	0	0	2474795	161.34	1711	67673	62200	0	0	0	82216	82.44	43428
4	-.10	-10905	1130	260100	0	0	0	2744670	163.29	-1316	0	308900	0	0	303032	89400	83.00	266478
5	.06	6707	1380	100100	0	71982	0	2764701	163.43	679	183403	72700	71982	0	0	50000	79.45	32539
6	.31	34370	1460	81200	0	162371	0	2647700	162.59	2936	214135	64700	162371	0	0	60000	80.49	14326
7	.22	23751	1420	19900	0	185542	0	2456887	161.21	2237	195705	12400	185542	0	0	60000	80.49	26497
8	.14	14768	870	34800	0	89768	0	2386281	160.70	1423	105545	17200	89768	0	0	60000	80.49	30593
9	.19	19745	680	7600	0	82405	0	2291051	160.01	1932	84473	4000	82405	0	0	60000	80.49	21933
10	.29	29524	580	6700	0	63085	0	2204562	159.07	2746	76639	6300	63085	0	0	50000	79.45	14119
11	.18	17939	470	4400	0	51327	0	2139226	158.36	1530	62297	2500	51327	0	0	40000	78.26	11249
12	.05	4924	440	14900	0	27600	0	2121162	158.16	363	46037	8800	27600	0	0	30000	76.89	22814
SUM	1.19	126064	10000	872800	0	734080	0			11135	1054607	787000	734080	0	455338			771764

Date	SAM RAYBURN RESERVOIR									LAKE B.A. STEINHAGEN								
	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1956																		
1	-.07	-6889	450	24100	0	17111	0	2134590	158.31	-442	37353	14800	17111	0	0	25000	76.10	55127
2	-.20	-20139	410	128000	0	0	0	2282319	159.92	-1955	0	89500	0	0	27055	89400	83.00	196951
3	.07	7231	710	54500	0	0	0	2328878	160.28	954	0	37900	0	0	36946	89400	83.00	109792
4	-.02	-2093	1130	99900	0	4095	0	2425646	160.98	-216	130811	77100	4095	0	0	40000	78.26	46011
5	.10	10538	1380	168600	0	175731	0	2406597	160.84	850	197981	33100	175731	0	0	50000	79.45	17961
6	.12	12381	1460	13500	0	213943	0	2192313	158.94	1136	217407	14600	213943	0	0	60000	80.49	11054
7	.42	40593	1420	3800	0	215858	0	1938242	156.18	4270	215888	4300	215858	0	0	60000	80.49	6314
8	.38	34464	870	1500	0	133560	0	1770848	154.10	3864	131396	1700	133560	0	0	60000	80.49	4742
9	.43	36699	680	3600	0	103856	0	1633213	152.02	4372	102184	2700	103856	0	0	60000	80.49	4222
10	.23	18665	580	2500	0	76417	0	1540051	150.61	2178	86439	2200	76417	0	0	50000	79.45	4319
11	.12	9410	470	4500	0	51602	0	1483069	149.65	1020	63782	3200	51602	0	0	40000	78.26	9764
12	.04	3025	440	8800	0	28753	0	1459651	149.16	290	46063	7600	28753	0	0	30000	76.89	23979
SUM	1.62	143885	10000	513300	0	1020926	0			16321	1229304	288700	1020926	0	64001			490236
1957																		
1	-.07	-5205	450	10800	0	23206	0	1452000	149.00	-371	51851	8300	23206	0	0	10026	72.80	18565
2	-.09	-6664	410	18200	0	24454	0	1452000	149.00	-341	30498	11500	24454	0	0	15823	74.34	35585
3	-.14	-10939	710	93300	0	0	0	1555529	150.84	-1158	28293	82100	0	0	0	70788	81.49	131381
4	-.41	-34287	1130	173600	0	8379	0	1753907	153.85	-3905	56472	13400	8379	0	0	40000	78.26	147725
5	.03	3007	1380	880500	0	0	0	2630020	162.46	325	0	812100	0	0	762375	89400	83.00	305585
6	-.08	-8920	1460	211000	0	0	0	2848480	164.04	-1090	0	137900	0	0	138990	89400	83.00	100850
7	.23	25906	1420	46500	0	117067	0	2750587	163.33	2708	186759	43000	117067	0	0	60000	80.49	35443
8	.29	32071	870	18300	0	103665	0	2632281	162.48	2949	121416	20700	103665	0	0	60000	80.49	14722
9	.00	0	680	16600	0	61438	0	2586763	162.15	0	74838	13400	61438	0	0	60000	80.49	59294
10	-.05	-5495	580	132100	0	0	0	2723778	163.14	-589	0	119100	0	0	90289	89400	83.00	105453
11	-.39	-44012	470	559300	0	0	428420	2898200	164.40	-5316	0	391500	428420	0	825236	89400	83.00	329654
12	.00	0	440	407000	0	0	406560	2898200	164.40	0	0	359700	406560	0	766260	89400	83.00	184149
SUM	-.68	-54538	10000	2567200	0	338209	834980			-6788	550127	2012700	1173189	0	2583150			1468406
1958																		
1	-.18	-20610	450	333774	0	0	353934	2898200	164.40	-2454	0	434361	353934	0	790749	89400	83.00	545656
2	-.03	-3435	410	250930	0	0	253955	2898200	164.40	-409	0	270467	253955	0	524831	89400	83.00	288089
3	.04	4580	710	180960	0	0	175670	2898200	164.40	545	0	193595	175670	0	368720	89400	83.00	162251
4	.00	0	1130	122312	0	0	121182	2898200	164.40	0	0	140165	121182	0	261347	89400	83.00	93493
5	.08	9160	1380	467227	0	0	456687	2898200	164.40	1090	0	539114	456687	0	994711	89400	83.00	53177
6	.10	11390	1460	78479	0	128820	0	2835009	163.94	1177	208676	51633	128820	0	0	60000	80.49	19785
7	.33	36900	1420	43874	0	162924	0	2677639	162.80	3355	203256	43687	162924	0	0	60000	80.49	18946
8	.10	10937	870	18551	0	107898	0	2576485	162.07	1017	124525	17644	107898	0	0	60000	80.49	11613
9	-.42	-46792	680	270475	0	0	0	2893072	164.36	-4945	0	159177	0	0	134722	89400	83.00	60155
10	.19	21746	580	256971	0	0	229517	2898200	164.40	2590	0	172003	229517	0	398930	89400	83.00	32784
11	.02	2290	470	58708	0	0	55948	2898200	164.40	273	0	45634	55948	0	101309	89400	83.00	23491
12	.07	8015	440	61056	0	0	52601	2898200	164.40	954	0	46673	52601	0	98320	89400	83.00	21528
SUM	.30	34181	10000	2143317	0	399642	1699494			3193	536457	2114153	2099136	0	3673639			1330968

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

SAM RAYBURN RESERVOIR

LAKE B.A. STEINHAGEN

Date	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1959																		
1	.09	10305	450	56315	0	0	45560	2898200	164.40	1227	0	45033	45560	0	89366	89400	83.00	26193
2	-.14	-16030	410	185967	0	0	201587	2898200	164.40	-1908	0	166832	201587	0	370327	89400	83.00	180191
3	.11	12595	710	134910	0	0	121605	2898200	164.40	1499	0	129528	121605	0	249634	89400	83.00	75539
4	-.14	-16030	1130	272817	0	0	287717	2898200	164.40	-1908	0	331271	287717	0	620896	89400	83.00	227969
5	.14	16030	1380	342343	0	0	324933	2898200	164.40	1908	0	388860	324933	0	711885	89400	83.00	63065
6	-.10	-11450	1460	96160	0	0	83250	2898200	164.40	1363	0	157738	83250	0	239625	89400	83.00	27014
7	-.06	-6870	1420	59211	0	0	64661	2898200	164.40	-788	156153	83150	64661	0	0	81846	82.41	90462
8	.19	21755	870	41024	0	0	18399	2898200	164.40	2404	72452	56658	18399	0	0	82047	82.43	76654
9	.21	23926	680	14522	0	49904	0	2838212	163.97	2401	86579	17029	49904	0	0	60000	80.49	19827
10	-.03	-3406	580	25451	0	11713	0	2854776	164.09	-284	52489	30492	11713	0	0	50000	79.45	48251
11	.06	6845	470	60156	0	0	9417	2898200	164.40	615	37171	49558	9417	0	0	71189	81.53	43342
12	-.21	-24045	440	170912	0	0	194517	2898200	164.40	-2611	0	143560	194517	0	322477	89400	83.00	171076
SUM	.32	36525	10000	1459788	0	61617	1351646			3918	404844	1599709	1413263	0	2604210			1049583
1960																		
1	-.10	-11450	450	263843	0	0	274843	2898200	164.40	-1363	0	314867	274843	0	591073	89400	83.00	178330
2	-.14	-16030	410	255876	0	0	271496	2898200	164.40	-1908	0	303050	271496	0	576454	89400	83.00	217772
3	.08	9160	710	369696	0	0	359826	2898200	164.40	1090	0	371935	359826	0	730671	89400	83.00	117194
4	.07	8015	1130	104262	0	0	95117	2898200	164.40	954	0	88683	95117	0	182846	89400	83.00	34202
5	.26	29707	1380	72105	0	66679	0	2872539	164.21	2941	172384	69246	66679	0	0	50000	79.45	43558
6	-.05	-5660	1460	45111	0	136320	0	2785530	163.58	-474	180034	53240	136320	0	0	60000	80.49	65070
7	.22	24475	1420	37843	0	130600	0	2666878	162.73	2237	173589	45226	130600	0	0	60000	80.49	61437
8	-.05	-5475	870	21165	0	91472	0	2601176	162.25	-508	115982	24002	91472	0	0	60000	80.49	20156
9	.20	21632	680	20943	0	75270	0	2524537	161.70	2033	90080	16843	75270	0	0	60000	80.49	16326
10	-.00	0	580	50254	0	0	0	2574211	162.06	0	51716	53068	0	0	61352	80.62	59276	
11	-.12	-13158	470	122302	0	0	0	2709201	163.03	-1420	0	106565	0	0	79937	89400	83.00	253768
12	-.28	-31560	440	690303	0	0	532424	2898200	164.40	-3817	0	593513	532424	0	1129754	89400	83.00	244927
SUM	.09	9656	10000	2053703	0	500341	1533706			-235	783785	2040238	2034047	0	3290735			1312016
1961																		
1	-.27	-30915	450	688338	0	0	718803	2898200	164.40	-3680	0	811675	718803	0	1534158	89400	83.00	792070
2	-.07	-8015	410	383904	0	0	391509	2898200	164.40	-954	0	482154	391509	0	874617	89400	83.00	381617
3	-.16	-18320	710	512605	0	0	530215	2898200	164.40	-2181	0	542991	530215	0	1075387	89400	83.00	248847
4	.18	20610	1130	404865	0	0	383125	2898200	164.40	2454	0	361253	383125	0	741924	89400	83.00	98296
5	.19	21755	1380	104445	0	0	81310	2898200	164.40	2584	168347	89180	81310	0	0	88959	82.97	47595
6	-.02	-2290	1460	73541	0	0	74371	2898200	164.40	-272	0	70199	74371	0	144401	89400	83.00	173499
7	-.01	-1145	1420	121021	0	0	120746	2898200	164.40	-136	0	131020	120746	0	251902	89400	83.00	323947
8	.28	31971	870	25881	0	26815	0	2864425	164.16	3297	73707	20789	26815	0	0	60000	80.49	62431
9	-.05	-5709	680	88524	0	0	59778	2898200	164.40	-589	0	92554	59778	0	123521	89400	83.00	335974
10	.22	25190	580	34678	0	0	8908	2898200	164.40	2748	50683	27151	8908	0	0	72028	81.60	40075
11	-.04	-4580	470	55936	0	0	60046	2898200	164.40	-500	0	48686	60046	0	91860	89400	83.00	131155
12	-.23	-26335	440	466589	0	0	492484	2898200	164.40	-3135	0	288326	492484	0	783945	89400	83.00	202021
SUM	.02	2217	10000	2960327	0	26815	2921295			-364	292737	2965978	2948110	0	5621715			2837527

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

Date	SAM RAYBURN RESERVOIR									LAKE B.A. STEINHAGEN								
	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1962																		
1	-.12	-13740	450	274283	0	0	287573	2898200	164.40	-1636	0	211258	287573	0	500467	89400	83.00	157235
2	.06	6870	410	281897	0	0	274617	2898200	164.40	818	0	201533	274617	0	475332	89400	83.00	100701
3	.12	13740	710	197197	0	0	182747	2898200	164.40	1636	0	197273	182747	0	378384	89400	83.00	82211
4	-.14	-16030	1130	136948	0	0	151848	2898200	164.40	-1908	0	129705	151848	0	283461	89400	83.00	66397
5	.17	19465	1380	362742	0	0	341897	2898200	164.40	2317	0	409013	341897	0	748593	89400	83.00	135901
6	.04	4580	1460	83568	0	0	77528	2898200	164.40	545	0	121294	77528	0	198277	89400	83.00	55793
7	.39	44169	1420	41283	0	127492	0	2766402	163.45	4592	192317	40017	127492	0	0	60000	80.49	29885
8	.36	39899	870	24782	0	108448	0	2641967	162.55	3660	125212	20424	108448	0	0	60000	80.49	10926
9	.07	7643	680	25514	0	67123	0	2592035	162.19	712	91076	24665	67123	0	0	60000	80.49	15330
10	.19	20567	580	21235	0	49276	0	2542847	161.83	1799	75189	17712	49276	0	0	50000	79.45	15569
11	-.08	-8643	470	30060	0	11202	0	2569878	162.02	-680	48746	26864	11202	0	0	40000	78.26	28637
12	-.14	-15270	440	67968	0	0	0	2652676	162.62	-1515	0	80866	0	0	32981	89400	83.00	105353
SUM	.92	103250	10000	1547477	0	363541	1316210			10340	532540	1480624	1679751	0	2617495			803938
1963																		
1	.00	0	450	90748	0	0	0	2742974	163.28	0	0	101475	0	0	101475	89400	83.00	114696
2	-.08	-8993	410	80915	0	0	0	2832472	163.92	-1090	0	94163	0	0	95253	89400	83.00	109177
3	.13	14804	710	101874	0	0	20632	2898200	164.40	1772	0	102527	20632	0	121387	89400	83.00	74432
4	-.01	-1145	1130	93083	0	0	93098	2898200	164.40	-136	0	87675	93098	0	180909	89400	83.00	38041
5	.18	20402	1380	26676	0	127209	0	2775885	163.52	2036	201228	36655	127209	0	0	50000	79.45	14714
6	-.02	-2212	1460	20557	0	191272	0	2605922	162.29	-189	208675	27214	191272	0	0	60000	80.49	19786
7	.12	12873	1420	12280	0	177455	0	2426454	160.99	1220	190811	14576	177455	0	0	60000	80.49	31391
8	.42	43708	870	7899	0	123423	0	2266352	159.74	4270	124933	5780	123423	0	0	60000	80.49	11205
9	.14	14195	680	6625	0	58110	0	2199992	159.02	1423	69842	13155	58110	0	0	60000	80.49	94208
10	.32	31722	580	6033	0	67464	0	2106259	158.00	3031	77937	3504	67464	0	0	50000	79.45	12821
11	-.05	-4893	470	8230	0	9055	0	2109857	158.04	-425	33909	14429	9055	0	0	40000	78.26	40378
12	-.07	-6878	440	18192	0	0	0	2134487	158.31	-638	9187	30737	0	0	0	62188	80.71	119994
SUM	1.08	113583	10000	473112	0	753988	113730			11274	916522	531890	867718	0	499024			680843
1964																		
1	-.07	-6942	450	34061	0	0	0	2175040	158.75	-831	0	47944	0	0	21563	89400	83.00	135540
2	.02	2005	410	38124	0	0	0	2210749	159.14	273	0	49400	0	0	49127	89400	83.00	146389
3	-.08	-8221	710	134405	0	0	0	2352665	160.45	-1090	0	184776	0	0	185866	89400	83.00	278727
4	-.24	-25419	1130	158285	0	0	0	2535239	161.77	-3271	0	201607	0	0	204878	89400	83.00	129782
5	.09	9754	1380	89216	0	0	0	2613321	162.34	1227	0	154466	0	0	153239	89400	83.00	71499
6	.31	33396	1460	24231	0	135736	0	2466960	161.28	3650	193680	32194	135736	0	0	60000	80.49	34781
7	.47	48852	1420	5356	0	209547	0	2212497	159.16	4779	212202	7434	209547	0	0	60000	80.49	10000
8	.31	30619	870	5538	0	118242	0	2068304	157.59	3152	121281	6191	118242	0	0	60000	80.49	14857
9	.19	18093	680	4118	0	92102	0	1961547	156.43	1932	95413	5243	92102	0	0	60000	80.49	10993
10	.30	27729	580	4751	0	67551	0	1870438	155.44	2841	81410	6700	67551	0	0	50000	79.45	9348
11	.06	5433	470	5194	0	41764	0	1827965	154.97	510	59505	8251	41764	0	0	40000	78.26	14041
12	-.09	-8121	440	13533	0	928	0	1848251	155.20	-653	33832	22251	928	0	0	30000	76.89	50650
SUM	1.27	127178	10000	516812	0	665870	0			12519	797323	726457	665870	0	614673			906607

SAM RAYBURN RESERVOIR

LAKE B.A. STEINHAGEN

Date	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1965																		
1	.01	906	450	20601	0	12895	0	1854601	155.27	63	37946	20114	12895	0	0	25000	76.10	32553
2	-.20	-18522	410	117312	0	0	0	1990025	156.74	-1710	16710	55758	0	0	0	65758	81.05	65743
3	-.10	-9634	710	120028	0	0	0	2118977	158.14	-1207	43813	66064	0	0	0	89216	82.99	77869
4	.16	16073	1130	179035	0	0	0	2280809	159.90	2179	0	140618	0	0	138255	89400	83.00	89049
5	-.28	-29173	1380	118754	0	2246	0	2425110	160.98	-3167	181430	136617	2246	0	0	50000	79.45	34512
6	.14	14900	1460	130708	0	22139	0	2517319	161.64	1326	205198	194385	22139	0	0	60000	80.49	23263
7	.34	35759	1420	9003	0	196606	0	2292537	160.02	3457	212515	19366	196606	0	0	60000	80.49	9687
8	.29	29321	870	13339	0	122080	0	2153605	158.52	2949	127625	8494	122080	0	0	60000	80.49	8513
9	.04	3937	680	23892	0	70871	0	2102009	157.96	407	96347	25883	70871	0	0	60000	80.49	10059
10	.24	23145	580	1547	0	66372	0	2013459	156.99	2273	83431	9332	66372	0	0	50000	79.45	7327
11	.01	951	470	17382	0	24470	0	2004950	156.90	85	51161	16776	24470	0	0	40000	78.26	22410
12	-.30	-29161	440	131107	0	0	0	2164778	158.64	-3247	0	182472	0	0	136319	89400	83.00	100967
SUM	.35	38502	10000	882708	0	517679	0			3408	1056176	875879	517679	0	274574			481952
1966																		
1	.02	2025	450	129405	0	0	0	2291708	160.01	273	0	144708	0	0	144435	89400	83.00	139552
2	.01	1069	410	410515	0	0	0	2700744	162.97	136	0	426108	0	0	425972	89400	83.00	656419
3	.13	14477	710	78126	0	0	0	2763683	163.43	1772	0	92453	0	0	90681	89400	83.00	102935
4	-.10	-11323	1130	169026	0	0	44702	2898200	164.40	-1363	0	87527	44702	0	133592	89400	83.00	103600
5	.00	0	1380	653410	0	0	652030	2898200	164.40	0	0	770873	652030	0	1422903	89400	83.00	142982
6	.12	13722	1460	62114	0	62949	0	2882183	164.28	1413	195330	104394	62949	0	0	60000	80.49	33131
7	.14	15718	1420	1868	0	188057	0	2678856	162.81	1423	207177	20543	188057	0	0	60000	80.49	15025
8	.11	12068	870	26501	0	81189	0	2611230	162.32	1118	108119	28048	81189	0	0	60000	80.49	28019
9	.19	20643	680	37425	0	61346	0	2565986	162.00	1932	87902	28488	61346	0	0	60000	80.49	18504
10	.12	12978	580	20019	0	13718	0	2558729	161.94	1136	56012	33430	13718	0	0	50000	79.45	35776
11	.19	20485	470	14093	0	21033	0	2530834	161.74	1615	42795	13377	21033	0	0	40000	78.26	39723
12	.08	8620	440	30393	0	0	0	2552167	161.90	654	24955	30789	0	0	0	45180	78.90	45069
SUM	1.01	110482	10000	1632895	0	428292	696732			10109	722290	1780738	1125024	0	2217583			1360735
1967																		
1	.00	0	450	23583	0	0	0	2575300	162.06	0	17515	41656	0	0	0	69321	81.36	62777
2	-.01	-1089	410	50654	0	0	0	2626633	162.44	-123	0	45943	0	0	25987	89400	83.00	61723
3	.05	5486	710	43651	0	0	0	2664088	162.71	610	55917	34814	0	0	0	67687	81.22	55377
4	-.02	-2219	1130	94032	0	0	0	2759209	163.39	-241	101322	120183	0	0	0	86789	82.80	117470
5	-.17	-19098	1380	77815	0	46051	0	2808691	163.75	-1902	183333	98591	46051	0	0	50000	79.45	32609
6	.17	19102	1460	120074	0	146176	0	2762027	163.41	1610	206093	71527	146176	0	0	60000	80.49	22368
7	.15	16501	1420	954	0	185875	0	2559185	161.95	1525	210525	26175	185875	0	0	60000	80.49	11677
8	.27	28788	870	0	0	125393	0	2404134	160.83	2745	130340	7692	125393	0	0	60000	80.49	5798
9	.35	36351	680	0	0	100311	0	2266792	159.75	3559	100791	4039	100311	0	0	60000	80.49	5615
10	.36	36278	580	0	0	74362	0	2155572	158.54	3409	87007	6054	74362	0	0	50000	79.45	3751
11	.13	12781	470	0	0	49417	0	2092904	157.86	1105	67986	9674	49417	0	0	40000	78.26	5560
12	.06	5869	440	36559	0	2491	0	2120663	158.16	436	48281	36226	2491	0	0	30000	76.89	20570
SUM	1.34	138750	10000	447322	0	730076	0			12733	1209110	502574	730076	0	25987			405295

Date	SAM RAYBURN RESERVOIR									LAKE B.A. STEINHAGEN								
	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1968																		
1	.00	0	450	198734	0	0	0	2318947	160.21	0	0	170088	0	0	110688	89400	83.00	44899
2	.02	2085	410	77677	0	0	0	2394129	160.75	273	0	118179	0	0	117906	89400	83.00	26020
3	-.03	-3208	710	206057	0	0	0	2602684	162.26	-409	0	196124	0	0	196533	89400	83.00	64619
4	-.06	-6702	1130	754420	0	0	464476	2898200	164.40	-818	0	635187	464476	0	1100481	89400	83.00	165957
5	-.12	-13740	1380	340834	0	0	353194	2898200	164.40	-1636	0	418174	353194	0	773004	89400	83.00	203589
6	.01	1145	1460	246020	0	0	243415	2898200	164.40	136	0	424208	243415	0	667487	89400	83.00	306849
7	.15	17175	1420	122554	0	0	103959	2898200	164.40	2045	0	287670	103959	0	389584	89400	83.00	108330
8	.29	33087	870	22595	0	31671	0	2855167	164.09	3414	113125	55468	31671	0	0	60000	80.49	23013
9	-.01	-1141	680	97819	0	0	55247	2898200	164.40	-118	0	60759	55247	0	86724	89400	83.00	31402
10	.04	4580	580	4088	0	0	0	2897128	164.39	463	69237	36049	0	0	55749	80.07	21521	
11	.13	14884	470	101785	0	0	85359	2898200	164.40	1505	0	65286	85359	0	115489	89400	83.00	38496
12	.01	1145	440	351616	0	0	350031	2898200	164.40	136	0	272372	350031	0	622267	89400	83.00	110327
SUM	.43	49310	10000	2524199	0	31671	1655681			4991	182362	2739564	1687352	0	4180163			1145022
1969																		
1	.11	12595	450	148931	0	0	135886	2898200	164.40	1499	0	173253	135886	0	307640	89400	83.00	61719
2	-.04	-4580	410	469576	0	0	473746	2898200	164.40	-545	0	269963	473746	0	744254	89400	83.00	203486
3	-.06	-6870	710	738035	0	0	744195	2898200	164.40	-818	0	775865	744195	0	1520878	89400	83.00	258637
4	.02	2290	1130	598913	0	0	595493	2898200	164.40	273	0	839790	595493	0	1435010	89400	83.00	132375
5	-.16	-18320	1380	601601	0	0	618541	2898200	164.40	-2181	0	1089201	618541	0	1709923	89400	83.00	591197
6	.31	35495	1460	92286	0	0	55331	2898200	164.40	4226	0	194324	55331	0	245429	89400	83.00	69521
7	.48	54185	1420	17369	0	132453	0	2727511	163.17	5651	203141	46939	132453	0	0	60000	80.49	19061
8	.40	43923	870	0	0	110070	0	2572648	162.04	4067	126470	20467	110070	0	0	60000	80.49	9668
9	.32	34306	680	0	0	85388	0	2452274	161.17	3254	96964	14830	85388	0	0	60000	80.49	9442
10	.27	28387	580	0	0	69703	0	2353604	160.46	2557	83192	6046	69703	0	0	50000	79.45	7566
11	.21	21861	470	24227	0	12793	0	2342707	160.38	1785	58607	37599	12793	0	0	40000	78.26	14939
12	.03	3140	440	75986	0	0	0	2415113	160.91	325	0	89015	0	0	39290	89400	83.00	48297
SUM	1.89	206412	10000	2766924	0	410407	2623192			20093	568374	3557292	3033599	0	6002424			1425908
1970																		
1	-.10	-10622	450	80009	0	0	0	2505294	161.56	-1363	0	112402	0	0	113765	89400	83.00	55325
2	-.10	-10805	410	93543	0	0	0	2609232	162.31	-1363	0	102865	0	0	104228	89400	83.00	51108
3	.01	1116	710	275197	0	0	0	2882603	164.29	136	0	200893	0	0	200757	89400	83.00	77404
4	-.06	-6861	1130	140864	0	0	130998	2898200	164.40	-818	0	180560	130998	0	312376	89400	83.00	79286
5	.00	0	1380	126065	0	0	124685	2898200	164.40	0	0	167307	124685	0	291992	89400	83.00	174330
6	.20	22647	1460	5322	0	115151	0	2764264	163.43	2355	180170	37974	115151	0	0	60000	80.49	48291
7	.33	36242	1420	2189	0	191200	0	2537591	161.79	3355	212429	24584	191200	0	0	60000	80.49	9773
8	.23	24440	870	0	0	125096	0	2387185	160.70	2339	129746	6989	125096	0	0	60000	80.49	6392
9	.23	23890	680	116	0	78120	0	2284611	159.94	2339	97163	21382	78120	0	0	60000	80.49	9243
10	.05	5163	580	43214	0	0	0	2322082	160.23	492	54508	50325	0	0	55325	80.03	67662	
11	.16	16577	470	17060	0	0	0	2322095	160.23	1834	33520	67332	0	0	87303	82.84	42433	
12	.04	4151	440	22386	0	0	0	2339890	160.36	540	0	49179	0	0	46542	89400	83.00	25963
SUM	.99	105938	10000	805965	0	509567	255683			9846	707536	1021792	765250	0	1069660			647210

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

Date	SAM RAYBURN RESERVOIR									LAKE B.A. STEINHAGEN								
	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1971																		
1	.12	12495	450	31799	0	0	0	2358744	160.50	1636	0	47533	0	0	45897	89400	83.00	41046
2	.04	4184	410	36354	0	0	0	2390504	160.73	536	38797	35772	0	0	0	85839	82.72	25986
3	.14	14716	710	38410	0	0	0	2413488	160.89	1760	62566	55331	0	0	0	76844	82.02	48809
4	.22	22985	1130	25572	0	91948	0	2322997	160.24	2188	160268	33664	91948	0	0	40000	78.26	16554
5	.08	8227	1380	70709	0	138553	0	2245546	159.52	680	168287	40414	138553	0	0	50000	79.45	47655
6	.21	20646	1460	225	0	220690	0	2002975	156.88	1989	216998	8297	220690	0	0	60000	80.49	11463
7	.31	28340	1420	0	0	215813	0	1757402	153.90	3152	217082	4421	215813	0	0	60000	80.49	5120
8	.25	21313	870	11510	0	105244	0	1641485	152.14	2542	115521	12819	105244	0	0	60000	80.49	20617
9	.15	12198	680	0	0	87366	0	1541241	150.62	1525	92137	6296	87366	0	0	60000	80.49	14269
10	.12	9500	580	22877	0	31088	0	1522950	150.35	1136	56647	16695	31088	0	0	50000	79.45	34599
11	.06	4710	470	7787	0	21098	0	1504459	150.07	510	43369	12781	21098	0	0	40000	78.26	30632
12	-.06	-4864	440	155565	0	0	0	1664448	152.49	-649	0	125757	0	0	77006	89400	83.00	402785
SUM	1.64	154450	10000	400808	0	911800	0			17005	1171672	399780	911800	0	122903			699535
1972																		
1	-.04	-3511	450	205482	0	0	0	1872991	155.47	-545	0	133499	0	0	134044	89400	83.00	244692
2	.09	8327	410	100904	0	0	0	1965158	156.47	1227	0	99376	0	0	98149	89400	83.00	139493
3	.05	4790	710	145871	0	0	0	2105529	157.99	682	0	123361	0	0	122679	89400	83.00	182550
4	.08	7906	1130	82676	0	0	0	2179169	158.80	1077	80838	79272	0	0	0	86757	82.79	111384
5	.12	12082	1380	71426	0	0	0	2237133	159.43	1615	0	114346	0	0	110088	89400	83.00	378310
6	.16	15843	1460	1805	0	160462	0	2061173	157.51	1884	204422	16444	160462	0	0	60000	80.49	24039
7	.13	12236	1420	14837	0	171556	0	1890798	155.66	1322	183846	13612	171556	0	0	60000	80.49	38356
8	.19	17100	870	12054	0	115528	0	1769354	154.08	1932	119992	6396	115528	0	0	60000	80.49	16146
9	.13	11217	680	10714	0	81762	0	1686409	152.82	1322	91572	11132	81762	0	0	60000	80.49	14834
10	.11	9253	580	14086	0	40709	0	1649953	152.27	1042	65000	15333	40709	0	0	50000	79.45	25758
11	-.02	-1709	470	109769	0	0	0	1760961	153.95	-226	0	66280	0	0	27106	89400	83.00	92568
12	-.07	-6387	440	220443	0	0	0	1987351	156.71	-954	0	121597	0	0	122551	89400	83.00	152588
SUM	.93	87147	10000	990067	0	570017	0			10378	745670	800648	570017	0	614617			1420718
1973																		
1	-.09	-9058	450	430373	0	0	0	2426332	160.99	-1227	0	294114	0	0	295341	89400	83.00	286222
2	.01	1076	410	218420	0	0	0	2643266	162.56	136	0	184458	0	0	184322	89400	83.00	448263
3	-.01	-1121	710	462989	0	0	208466	2898200	164.40	-136	0	330908	208466	0	539510	89400	83.00	398698
4	-.01	-1145	1130	521973	0	0	521988	2898200	164.40	-136	0	593361	521988	0	1115485	89400	83.00	661075
5	.16	18320	1380	210848	0	0	191148	2898200	164.40	2181	0	433036	191148	0	622003	89400	83.00	376943
6	.09	10305	1460	437942	0	0	426177	2898200	164.40	1227	0	708144	426177	0	1133094	89400	83.00	425406
7	.23	26335	1420	111513	0	0	83758	2898200	164.40	3135	0	217973	83758	0	298596	89400	83.00	205684
8	.22	25179	870	20945	0	0	0	2893096	164.36	2999	0	92004	0	0	89005	89400	83.00	163741
9	.06	6867	680	91433	0	0	78782	2898200	164.40	818	0	142991	78782	0	220955	89400	83.00	228373
10	.05	5725	580	287824	0	0	281519	2898200	164.40	682	0	280286	281519	0	561123	89400	83.00	285481
11	.04	4580	470	256808	0	0	251758	2898200	164.40	545	0	341494	251758	0	592707	89400	83.00	280022
12	-.02	-2290	440	597324	0	0	599174	2898200	164.40	-273	0	473266	599174	0	1072713	89400	83.00	424453
SUM	.73	84773	10000	3648392	0	0	2642770			9951	0	4092035	2642770	0	6724854			4184361

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with varible target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

SAM RAYBURN RESERVOIR

LAKE B.A. STEINHAGEN

Date	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1974																		
1	-.23	-26335	450	850323	0	0	876208	2898200	164.40	-3135	0	683158	876208	0	1562501	89400	83.00	936198
2	.07	8015	410	298998	0	0	290573	2898200	164.40	954	0	410242	290573	0	699861	89400	83.00	265025
3	.06	6870	710	168553	0	0	160973	2898200	164.40	818	0	202154	160973	0	362309	89400	83.00	172446
4	.15	17175	1130	149719	0	0	131414	2898200	164.40	2045	0	175550	131414	0	304919	89400	83.00	299866
5	.10	11450	1380	88740	0	0	75910	2898200	164.40	1363	0	98416	75910	0	172963	89400	83.00	95311
6	.30	34121	1460	13730	0	58875	0	2817474	163.82	3532	161966	77223	58875	0	0	60000	80.49	66495
7	.37	41138	1420	8623	0	155505	0	2628034	162.45	3762	194939	43196	155505	0	0	60000	80.49	27263
8	.19	20630	870	3785	0	67968	0	2542351	161.83	1932	106867	40831	67968	0	0	60000	80.49	29271
9	.03	3253	680	72877	0	0	0	2611295	162.32	353	0	79532	0	0	49779	89400	83.00	78522
10	.11	12073	580	84564	0	0	0	2683206	162.84	1499	0	83647	0	0	82148	89400	83.00	39517
11	.00	0	470	415179	0	0	199715	2898200	164.40	0	0	285385	199715	0	485100	89400	83.00	304004
12	-.03	-3435	440	398507	0	0	401502	2898200	164.40	-409	0	315116	401502	0	717027	89400	83.00	408743
SUM	1.12	124955	10000	2553598	0	282348	2136295			12714	463772	2494450	2418643	0	4436607			2722661
1975																		
1	-.01	-1145	450	341804	0	0	342499	2898200	164.40	-136	0	322641	342499	0	665276	89400	83.00	480059
2	-.05	-5725	410	676068	0	0	681383	2898200	164.40	-682	0	410818	681383	0	1092883	89400	83.00	334476
3	.01	1145	710	233424	0	0	231569	2898200	164.40	136	0	222539	231569	0	453972	89400	83.00	269689
4	.03	3435	1130	219547	0	0	214982	2898200	164.40	409	0	214243	214982	0	428816	89400	83.00	217913
5	.05	5725	1380	472228	0	0	465123	2898200	164.40	682	0	426990	465123	0	891431	89400	83.00	373042
6	.16	18320	1460	172292	0	0	152512	2898200	164.40	2181	0	215839	152512	0	366170	89400	83.00	337433
7	.31	35495	1420	63780	0	0	26865	2898200	164.40	4226	0	119675	26865	0	142314	89400	83.00	180522
8	.34	38844	870	12867	0	0	0	2871353	164.21	4635	0	68696	0	0	64061	89400	83.00	259761
9	.28	31832	680	0	0	0	0	2838841	163.97	3615	49847	42501	0	0	0	78439	82.14	56810
10	.14	15891	580	30291	0	0	0	2852661	164.07	1808	0	77525	0	0	64756	89400	83.00	106520
11	.05	5703	470	54898	0	0	3186	2898200	164.40	682	0	73730	3186	0	76234	89400	83.00	124765
12	.04	4580	440	55838	0	0	50818	2898200	164.40	545	0	89202	50818	0	139475	89400	83.00	119608
SUM	1.35	154100	10000	2333037	0	0	2168937			18101	49847	2284399	2168937	0	4385388			2860598
1976																		
1	.07	8015	450	95854	0	0	87389	2898200	164.40	954	0	103973	87389	0	190408	89400	83.00	178294
2	.06	6870	410	127168	0	0	119888	2898200	164.40	818	0	77632	119888	0	196702	89400	83.00	83770
3	.01	1145	710	226555	0	0	224700	2898200	164.40	136	0	115671	224700	0	340235	89400	83.00	140684
4	.13	14885	1130	140576	0	0	124561	2898200	164.40	1772	0	101588	124561	0	224377	89400	83.00	113996
5	.09	10305	1380	269032	0	0	257347	2898200	164.40	1227	0	251786	257347	0	507906	89400	83.00	258847
6	.21	24045	1460	199697	0	0	174192	2898200	164.40	2863	0	143521	174192	0	314850	89400	83.00	207779
7	.16	18320	1420	205485	0	0	185745	2898200	164.40	2181	0	188640	185745	0	372204	89400	83.00	117618
8	.38	43184	870	10004	0	56686	0	2807464	163.74	4474	111907	30295	56686	0	0	60000	80.49	24231
9	.15	16813	680	0	0	55973	0	2733998	163.21	1525	85262	30814	55973	0	0	60000	80.49	21144
10	.12	13351	580	0	0	736	0	2719331	163.11	1136	54098	44498	736	0	0	50000	79.45	36660
11	.04	4453	470	25961	0	0	0	2740369	163.26	398	21886	39125	0	0	0	66841	81.14	53373
12	-.04	-4520	440	165051	0	0	11300	2898200	164.40	-486	0	151321	11300	0	140548	89400	83.00	231014
SUM	1.38	156866	10000	1465383	0	113395	1185122			16998	273153	1278864	1298517	0	2287230			1467410

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

SAM RAYBURN RESERVOIR

LAKE B.A. STEINHAGEN

Date	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1977																		
1	-.06	-6870	450	153164	0	0	159584	2898200	164.40	-818	0	153132	159584	0	313534	89400	83.00	191086
2	.05	5725	410	231574	0	0	225439	2898200	164.40	682	0	175116	225439	0	399873	89400	83.00	147401
3	.03	3435	710	260141	0	0	255996	2898200	164.40	409	0	265795	255996	0	521382	89400	83.00	185611
4	.10	11450	1130	221575	0	0	208995	2898200	164.40	1363	0	290807	208995	0	498439	89400	83.00	219751
5	.25	28625	1380	708041	0	0	678036	2898200	164.40	3408	0	179931	678036	0	854559	89400	83.00	95027
6	.23	26080	1460	7181	0	97085	0	2780756	163.55	2708	161699	37922	97085	0	0	60000	80.49	77835
7	.41	45201	1420	8961	0	177330	0	2565766	162.00	4169	198964	25803	177330	0	0	60000	80.49	23238
8	.15	16112	870	22767	0	90488	0	2481063	161.38	1525	106788	17825	90488	0	0	60000	80.49	29350
9	.23	24336	680	0	0	60030	0	2396017	160.77	2339	74439	16748	60030	0	0	60000	80.49	31967
10	.31	32296	580	0	0	54356	0	2308785	160.14	2936	72565	11145	54356	0	0	50000	79.45	18193
11	.04	4143	470	28196	0	0	0	2332368	160.31	363	37501	39095	0	0	0	51231	79.58	39909
12	.05	5207	440	40465	0	0	0	2367186	160.56	568	0	57594	0	0	18857	89400	83.00	141388
SUM	1.79	195740	10000	1682065	0	479289	1528050			19652	651956	1270913	2007339	0	2606644			1200756
1978																		
1	-.10	-10675	450	232215	0	0	0	2609626	162.31	-1363	0	178512	0	0	179875	89400	83.00	297710
2	.00	0	410	225049	0	0	0	2834265	163.94	0	0	160441	0	0	160441	89400	83.00	309906
3	.13	14806	710	100628	0	0	21177	2898200	164.40	1772	0	88265	21177	0	107670	89400	83.00	101205
4	.20	22900	1130	74190	0	0	50160	2898200	164.40	2320	139461	58443	50160	0	0	56222	80.12	37361
5	.18	20356	1380	41134	0	168455	0	2749143	163.32	1673	195561	22557	168455	0	0	50000	79.45	20381
6	.30	32898	1460	12228	0	191598	0	2535415	161.78	2841	202381	23624	191598	0	0	60000	80.49	26080
7	.40	42098	1420	0	0	209914	0	2281983	159.91	4067	206870	1023	209914	0	0	60000	80.49	15332
8	.36	36230	870	633	0	114629	0	2130887	158.27	3660	121578	10609	114629	0	0	60000	80.49	14560
9	.05	4932	680	73918	0	58847	0	2140346	158.37	508	73978	15639	58847	0	0	60000	80.49	32428
10	.30	29229	580	1378	0	66514	0	2045401	157.34	2841	79264	5591	66514	0	0	50000	79.45	11494
11	.00	0	470	31962	0	0	0	2076893	157.68	0	29420	33816	0	0	0	54396	79.93	133659
12	-.02	-1979	440	136702	0	0	0	2215134	159.19	-230	0	62298	0	0	27524	89400	83.00	211864
SUM	1.80	190795	10000	930037	0	809957	71337			18089	1048513	660818	881294	0	475510			1211980
1979																		
1	-.15	-16065	450	568104	0	0	0	2798853	163.68	-2045	0	307903	0	0	309948	89400	83.00	610551
2	-.09	-10220	410	536006	0	0	446469	2898200	164.40	-1227	0	271403	446469	0	719099	89400	83.00	474649
3	.03	3435	710	518422	0	0	514277	2898200	164.40	409	0	359938	514277	0	873806	89400	83.00	399698
4	.02	2290	1130	545976	0	0	542556	2898200	164.40	273	0	618285	542556	0	1160568	89400	83.00	1071421
5	.11	12595	1380	346576	0	0	332601	2898200	164.40	1499	0	433047	332601	0	764149	89400	83.00	162995
6	.24	27480	1460	502042	0	0	473102	2898200	164.40	3271	0	446758	473102	0	916589	89400	83.00	227577
7	.17	19462	1420	29321	0	10235	0	2896404	164.39	2002	130144	92511	10235	0	0	60000	80.49	212537
8	.31	35482	870	35589	0	0	0	2895641	164.38	3650	0	128598	0	0	95548	89400	83.00	94701
9	.14	16027	680	84653	0	0	65387	2898200	164.40	1908	0	174507	65387	0	237986	89400	83.00	285455
10	.18	20610	580	42672	0	0	21482	2898200	164.40	2454	0	95922	21482	0	114950	89400	83.00	63517
11	.03	3435	470	125493	0	0	121588	2898200	164.40	409	0	136552	121588	0	257731	89400	83.00	230440
12	-.04	-4580	440	217656	0	0	221796	2898200	164.40	-545	0	215853	221796	0	438194	89400	83.00	182385
SUM	.95	109951	10000	3552510	0	10235	2739258			12058	130144	3281277	2749493	0	5888568			4015926

SAM RAYBURN RESERVOIR										LAKE B.A. STEINHAGEN								
Date	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1980																		
1	-.07	-8015	450	289059	0	0	296624	2898200	164.40	-954	0	262940	296624	0	560518	89400	83.00	284238
2	.02	2290	410	345474	0	0	342774	2898200	164.40	273	0	359232	342774	0	701733	89400	83.00	291192
3	.00	0	710	290313	0	0	289603	2898200	164.40	0	0	263665	289603	0	553268	89400	83.00	262003
4	.05	5725	1130	458657	0	0	451802	2898200	164.40	682	0	291641	451802	0	742761	89400	83.00	334129
5	.06	6870	1380	533925	0	0	525675	2898200	164.40	818	0	451660	525675	0	976517	89400	83.00	313578
6	.41	46590	1460	27373	0	70798	0	2806725	163.74	4827	182863	87492	70798	0	0	60000	80.49	45598
7	.46	50859	1420	0	0	181167	0	2573279	162.05	4677	203853	27363	181167	0	0	60000	80.49	18349
8	.51	54423	870	0	0	118681	0	2399305	160.79	5185	123011	9515	118681	0	0	60000	80.49	13127
9	.30	31195	680	0	0	82749	0	2284681	159.94	3050	86309	6610	82749	0	0	60000	80.49	20097
10	.21	21391	580	0	0	48061	0	2214649	159.18	1989	61129	5057	48061	0	0	50000	79.45	29629
11	.00	0	470	0	0	21874	0	2192305	158.94	0	40287	8413	21874	0	0	40000	78.26	33259
12	.10	10022	440	12872	0	3744	0	2190971	158.92	726	25578	12560	3744	0	0	30000	76.89	43291
SUM	2.05	221350	10000	1957673	0	527074	1906478			21273	723030	1786148	2433552	0	3534797			1688490
1981																		
1	.02	2008	450	21722	0	4675	0	2205560	159.08	126	26799	17250	4675	0	0	25000	76.10	45009
2	-.03	-3039	410	45704	0	0	0	2253893	159.61	-219	14700	35024	0	0	0	45543	78.95	51877
3	.05	5146	710	77318	0	4989	0	2320366	160.22	410	45528	35406	4989	0	0	40000	78.26	86937
4	.17	17405	1130	29150	0	114992	0	2215989	159.20	1329	135492	21829	114992	0	0	40000	78.26	41330
5	.10	9986	1380	87865	0	150468	0	2142020	158.39	850	167152	27534	150468	0	0	50000	79.45	48790
6	.12	12198	1460	214059	0	0	0	2342421	160.38	1357	0	212828	0	0	172071	89400	83.00	691977
7	.24	24989	1420	40339	0	0	0	2356351	160.48	3212	91343	90768	0	0	0	85613	82.70	199790
8	.36	37154	870	0	0	72805	0	2245522	159.52	4175	116110	21867	72805	0	0	60000	80.49	20028
9	.14	14426	680	140826	0	32115	0	2339127	160.36	1423	68615	37923	32115	0	0	60000	80.49	40591
10	.07	7305	580	52485	0	0	0	2383727	160.68	768	56178	69121	0	0	0	72175	81.61	34580
11	.04	4210	470	54570	0	0	0	2433617	161.04	500	0	61290	0	0	43565	89400	83.00	37057
12	.09	9521	440	17752	0	0	0	2441408	161.10	1227	0	31841	0	0	30614	89400	83.00	47980
SUM	1.37	141309	10000	781790	0	380044	0			15158	721917	662681	380044	0	246250			1345946
1982																		
1	-.01	-1064	450	54040	0	0	0	2496062	161.49	-136	0	52031	0	0	52167	89400	83.00	55882
2	.00	0	410	109393	0	0	0	2605045	162.28	0	0	69789	0	0	69789	89400	83.00	98081
3	.00	0	710	129809	0	0	0	2734144	163.21	0	0	71354	0	0	71354	89400	83.00	81673
4	-.08	-9036	1130	610350	0	0	454200	2898200	164.40	-1090	0	267409	454200	0	722699	89400	83.00	200649
5	.11	12595	1380	321297	0	0	307322	2898200	164.40	1499	0	315594	307322	0	621417	89400	83.00	223567
6	.13	14831	1460	75546	0	103178	0	2854277	164.08	1531	193163	62116	103178	0	0	60000	80.49	35298
7	.30	33782	1420	42684	0	120040	0	2741719	163.27	3050	182827	65837	120040	0	0	60000	80.49	39375
8	.42	46294	870	1042	0	93192	0	2602405	162.26	4270	109108	20186	93192	0	0	60000	80.49	27030
9	.30	32306	680	0	0	95942	0	2473477	161.33	3050	95807	2915	95942	0	0	60000	80.49	10599
10	.09	9561	580	35621	0	50576	0	2448381	161.15	852	75795	16071	50576	0	0	50000	79.45	14963
11	.02	2144	470	127776	0	0	0	2573543	162.05	226	0	106512	0	0	66886	89400	83.00	52405
12	-.09	-10029	440	627497	0	0	312429	2898200	164.40	-1227	0	320006	312429	0	633662	89400	83.00	514292
SUM	1.19	131384	10000	2135055	0	462928	1073951			12025	656700	1369820	1536879	0	2237974			1353814

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

Date	SAM RAYBURN RESERVOIR									LAKE B.A. STEINHAGEN								
	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1983																		
1	.01	1145	450	229247	0	0	227652	2898200	164.40	136	0	227990	227652	0	455506	89400	83.00	257106
2	-.08	-9160	410	572167	0	0	580917	2898200	164.40	-1090	0	346324	580917	0	928331	89400	83.00	358233
3	.02	2290	710	353037	0	0	350037	2898200	164.40	273	0	401594	350037	0	751358	89400	83.00	205192
4	.20	22900	1130	129879	0	0	105849	2898200	164.40	2726	0	192233	105849	0	295356	89400	83.00	102124
5	.05	5725	1380	496985	0	0	489880	2898200	164.40	682	0	377092	489880	0	866290	89400	83.00	723143
6	.10	11450	1460	211149	0	0	198239	2898200	164.40	1363	0	310026	198239	0	506902	89400	83.00	93816
7	.33	37683	1420	52936	0	46505	0	2865528	164.16	3885	156532	84512	46505	0	0	60000	80.49	65670
8	.18	20554	870	62976	0	0	8880	2898200	164.40	2119	0	101709	8880	0	79070	89400	83.00	158177
9	.21	24045	680	26491	0	0	1766	2898200	164.40	2863	0	52369	1766	0	51272	89400	83.00	194812
10	.23	26277	580	0	0	0	0	2871343	164.21	2761	47984	26002	0	0	0	64657	80.95	42774
11	.00	0	470	50103	0	0	22776	2898200	164.40	0	0	63837	22776	0	61870	89400	83.00	76116
12	-.07	-8015	440	309804	0	0	317379	2898200	164.40	-954	0	209126	317379	0	527459	89400	83.00	288554
SUM	1.18	134894	10000	2494774	0	46505	2303375			14764	204516	2392814	2349880	0	4523414			2565717
1984																		
1	-.02	-2290	450	190698	0	0	192538	2898200	164.40	-273	0	164113	192538	0	356924	89400	83.00	272322
2	-.03	-3435	410	385271	0	0	388296	2898200	164.40	-409	0	238945	388296	0	627650	89400	83.00	478070
3	.03	3435	710	417109	0	0	412964	2898200	164.40	409	0	324821	412964	0	737376	89400	83.00	291941
4	.21	24045	1130	101271	0	0	76096	2898200	164.40	2863	0	117941	76096	0	191174	89400	83.00	119198
5	.21	24045	1380	100517	0	0	75092	2898200	164.40	2863	0	107447	75092	0	179676	89400	83.00	203833
6	.26	29514	1460	32964	0	106060	0	2794130	163.65	3061	170710	38311	106060	0	0	60000	80.49	57751
7	.37	40876	1420	0	0	175093	0	2576741	162.07	3762	194910	23579	175093	0	0	60000	80.49	27292
8	.34	36450	870	8889	0	100250	0	2448060	161.14	3457	112305	15512	100250	0	0	60000	80.49	23833
9	.23	24160	680	0	0	75174	0	2348046	160.42	2339	86593	13758	75174	0	0	60000	80.49	19813
10	-.08	-8463	580	170212	0	0	0	2526141	161.71	-942	0	139931	0	0	111473	89400	83.00	110299
11	.01	1088	470	138233	0	0	0	2662816	162.70	136	0	167751	0	0	167615	89400	83.00	105178
12	.00	0	440	154583	0	0	0	2816959	163.81	0	0	117826	0	0	117826	89400	83.00	140801
SUM	1.53	169425	10000	1699747	0	456577	1144986			17266	564518	1469935	1601563	0	2489714			1850331
1985																		
1	.02	2275	450	201794	0	0	117828	2898200	164.40	273	0	198372	117828	0	315927	89400	83.00	131510
2	-.01	-1145	410	373916	0	0	374651	2898200	164.40	-136	0	271932	374651	0	646719	89400	83.00	305202
3	.01	1145	710	326597	0	0	324742	2898200	164.40	136	0	353976	324742	0	678582	89400	83.00	357160
4	.12	13740	1130	116560	0	0	101690	2898200	164.40	1636	0	129755	101690	0	229809	89400	83.00	113759
5	.18	20610	1380	137103	0	0	115113	2898200	164.40	2454	0	70183	115113	0	182842	89400	83.00	64306
6	.27	30462	1460	0	0	145457	0	2720821	163.12	3179	187653	15975	145457	0	0	60000	80.49	40808
7	.33	36037	1420	24656	0	192827	0	2515193	161.63	3355	199013	9541	192827	0	0	60000	80.49	23189
8	.51	53867	870	5385	0	123840	0	2342001	160.38	5185	118655	0	123840	0	0	60000	80.49	17483
9	.24	24754	680	27629	0	91427	0	2252769	159.60	2440	91309	2322	91427	0	0	60000	80.49	15097
10	.05	5180	580	142753	0	0	0	2389762	160.72	581	45448	72210	0	0	0	86181	82.75	59242
11	.04	4305	470	295744	0	0	0	2680731	162.83	537	0	124309	0	0	120553	89400	83.00	175984
12	.07	7871	440	452625	0	0	226845	2898200	164.40	954	0	344300	226845	0	570191	89400	83.00	324495
SUM	1.83	199101	10000	2104762	0	553551	1260869			20594	642078	1592875	1814420	0	2744623			1628235

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with varible target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

SAM RAYBURN RESERVOIR

LAKE B.A. STEINHAGEN

Date	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1986																		
1	.11	12595	450	87590	0	0	74545	2898200	164.40	1499	0	109015	74545	0	182061	89400	83.00	79261
2	.02	2290	410	220390	0	0	217690	2898200	164.40	273	0	153721	217690	0	371138	89400	83.00	216522
3	.23	26335	710	56119	0	0	29074	2898200	164.40	3135	0	71464	29074	0	97403	89400	83.00	69117
4	.06	6870	1130	82726	0	0	74726	2898200	164.40	818	0	79050	74726	0	152958	89400	83.00	61417
5	.05	5725	1380	254532	0	0	247427	2898200	164.40	682	0	242621	247427	0	489366	89400	83.00	174744
6	.09	10305	1460	571228	0	0	559463	2898200	164.40	1227	0	537369	559463	0	1095605	89400	83.00	544711
7	.41	46872	1420	55660	0	26203	0	2879365	164.26	4827	123144	72368	26203	0	0	60000	80.49	165200
8	.31	35108	870	31591	0	89940	0	2785038	163.58	3152	98830	12042	89940	0	0	60000	80.49	37308
9	.14	15721	680	34710	0	25709	0	2777638	163.53	1423	49878	25592	25709	0	0	60000	80.49	56528
10	.02	2251	580	38811	0	0	0	2813618	163.79	204	27781	28742	0	0	0	60757	80.56	76147
11	-.16	-18192	470	422520	0	0	355660	2898200	164.40	-1889	0	291739	355660	0	620645	89400	83.00	345052
12	-.09	-10305	440	406491	0	0	416356	2898200	164.40	-1227	0	355423	416356	0	773006	89400	83.00	512486
SUM	1.19	135575	10000	2262368	0	141852	1974941			14124	299633	1979146	2116793	0	3782182			2338493
1987																		
1	.03	3435	450	224135	0	0	220250	2898200	164.40	409	0	202320	220250	0	422161	89400	83.00	290201
2	-.10	-11450	410	411779	0	0	422819	2898200	164.40	-1363	0	221274	422819	0	645456	89400	83.00	214563
3	.08	9160	710	362428	0	0	352558	2898200	164.40	1090	0	500223	352558	0	851691	89400	83.00	283458
4	.28	32060	1130	74763	0	0	41573	2898200	164.40	3817	0	137301	41573	0	175057	89400	83.00	56752
5	.09	10305	1380	81205	0	0	69520	2898200	164.40	1227	0	53983	69520	0	122276	89400	83.00	193538
6	.14	16030	1460	122938	0	0	105448	2898200	164.40	1908	0	108411	105448	0	211951	89400	83.00	336551
7	.23	26335	1420	38721	0	0	10966	2898200	164.40	2957	87163	67369	10966	0	0	77615	82.08	202056
8	.41	46648	870	16737	0	45945	0	2821474	163.84	4603	94273	35316	45945	0	0	60000	80.49	41865
9	.16	18053	680	34587	0	39104	0	2798224	163.68	1627	75356	37879	39104	0	0	60000	80.49	31050
10	.26	29080	580	0	0	51100	0	2717464	163.09	2462	74793	16155	51100	0	0	50000	79.45	15965
11	-.07	-7895	470	211600	0	0	38289	2898200	164.40	-792	0	143402	38289	0	143083	89400	83.00	81191
12	-.07	-8015	440	351898	0	0	359473	2898200	164.40	-954	0	227281	359473	0	587708	89400	83.00	290160
SUM	1.44	163746	10000	1930791	0	136149	1620896			16991	331585	1750914	1757045	0	3159383			2037350
1988																		
1	.05	5725	450	310978	0	0	304803	2898200	164.40	682	0	242058	304803	0	546179	89400	83.00	264686
2	.00	0	410	134825	0	0	134415	2898200	164.40	0	0	112958	134415	0	247373	89400	83.00	154414
3	.03	3435	710	267949	0	0	263804	2898200	164.40	409	0	219444	263804	0	482839	89400	83.00	246836
4	.15	17175	1130	139285	0	0	120980	2898200	164.40	2045	0	150858	120980	0	269793	89400	83.00	94730
5	.36	40845	1380	16214	0	84260	0	2787929	163.60	4072	177536	57948	84260	0	0	50000	79.45	38406
6	.37	40816	1460	3715	0	183587	0	2565781	162.00	3504	206751	36668	183587	0	0	60000	80.49	21710
7	.29	30975	1420	40092	0	156081	0	2417397	160.92	2949	200433	47301	156081	0	0	60000	80.49	21769
8	.28	29242	870	13057	0	85836	0	2314506	160.18	2847	118114	35125	85836	0	0	60000	80.49	18024
9	.30	30699	680	0	0	65034	0	2218093	159.22	3050	94725	15921	65034	0	0	60000	80.49	11681
10	.15	15010	580	0	0	48232	0	2154271	158.52	1421	80011	23200	48232	0	0	50000	79.45	10747
11	.07	6912	470	6103	0	28460	0	2124532	158.20	595	62375	24510	28460	0	0	40000	78.26	11171
12	-.05	-4968	440	68737	0	0	0	2197797	159.00	-477	31486	62036	0	0	71027	81.51	38115	
SUM	2.00	215866	10000	1000955	0	651490	824002			21097	971431	1044847	1475492	0	1546184			932289

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

SAM RAYBURN RESERVOIR

LAKE B.A. STEINHAGEN

Date	Evap. Rate (Ft)	Evap. Loss (Ac-Ft)	Local Demand (Ac-Ft)	Inflow (Ac-Ft)	Short-age (Ac-Ft)	Release (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Evap. Loss (Ac-Ft)	Release (Ac-Ft)	Natural Inflow (Ac-Ft)	Makeup Inflow (Ac-Ft)	Short-age (Ac-Ft)	Spills (Ac-Ft)	End-of-Month Content (Ac-Ft)	Elev. (Ft)	Below Steinhagen (Ac-Ft)
1989																		
1	-.15	-15740	450	373491	0	0	0	2586578	162.15	-1864	0	193926	0	0	177417	89400	83.00	130130
2	-.03	-3347	410	372850	0	0	64165	2898200	164.40	-409	0	211700	64165	0	276274	89400	83.00	126281
3	-.02	-2290	710	282122	0	0	283702	2898200	164.40	-273	0	172801	283702	0	456776	89400	83.00	150863
4	.20	22900	1130	495622	0	0	471592	2898200	164.40	2726	0	235782	471592	0	704648	89400	83.00	137170
5	.10	11450	1380	493687	0	0	480857	2898200	164.40	1363	0	334698	480857	0	814192	89400	83.00	724544
6	-.09	-10305	1460	575414	0	0	584259	2898200	164.40	-1227	0	522102	584259	0	1107588	89400	83.00	317531
7	.15	17175	1420	389196	0	0	370601	2898200	164.40	2045	0	421248	370601	0	789804	89400	83.00	816096
8	.30	34350	870	35944	0	0	724	2898200	164.40	4089	0	113964	724	0	110599	89400	83.00	41795
9	.16	18291	680	5892	0	5784	0	2879337	164.26	1884	84656	51356	5784	0	0	60000	80.49	21750
10	.17	19391	580	11352	0	0	0	2870718	164.20	1730	56897	58741	0	0	0	60114	80.50	35299
11	.06	6838	470	6200	0	0	0	2869610	164.19	668	36949	52889	0	0	0	75386	81.89	36597
12	-.03	-3427	440	53197	0	0	27594	2898200	164.40	-381	0	64131	27594	0	78092	89400	83.00	28749
SUM	.82	95286	10000	3094967	0	5784	2283494			10351	178502	2433338	2289278	0	4515390			2566805
1990																		
1	.02	2290	450	431870	0	0	429130	2898200	164.40	273	0	300419	429130	0	729276	89400	83.00	239520
2	.04	4580	410	413737	0	0	408747	2898200	164.40	545	0	229136	408747	0	637338	89400	83.00	250577
3	.05	5725	710	255582	0	0	249147	2898200	164.40	682	0	257695	249147	0	506160	89400	83.00	262129
4	.09	10305	1130	225892	0	0	214457	2898200	164.40	1227	0	471170	214457	0	684400	89400	83.00	343214
5	.13	14885	1380	573751	0	0	557486	2898200	164.40	1772	0	297011	557486	0	852725	89400	83.00	254936
6	.36	41220	1460	380539	0	0	337859	2898200	164.40	4907	0	627159	337859	0	960111	89400	83.00	71947
7	.26	29447	1420	4806	0	105311	0	2766828	163.45	3061	186255	54605	105311	0	0	60000	80.49	35947
8	.44	48685	870	2119	0	97369	0	2622023	162.40	4474	120134	27239	97369	0	0	60000	80.49	16004
9	.27	29292	680	5904	0	59485	0	2538470	161.80	2745	85752	29012	59485	0	0	60000	80.49	20654
10	.20	21533	580	27114	0	8571	0	2534900	161.77	1894	71585	54908	8571	0	0	50000	79.45	19173
11	.07	7602	470	110967	0	0	0	2637795	162.52	746	50567	78365	0	0	0	77052	82.03	22979
12	.10	11079	440	139391	0	0	0	2765667	163.44	1282	0	93422	0	0	79792	89400	83.00	43780
SUM	2.03	226643	10000	2571672	0	270736	2196826			23608	514293	2520141	2467562	0	4449802			1580860
RUN SUM	45.13	4876038	500000	94398455	0	19052282	70102668			475295	29308841	89740880	89154950	0	114911694			82147740
ANN AVG	.90	97521	10000	1887969	0	381046	1402053			9506	586177	1794818	1783099	0	2982234			1642955

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

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DAILY FLOW BELOW STEINHAGEN

Titles from input database file

1941 to 1990 for Kountze gauge
VILLAGE CREEK NR KOUNTZE, TEX.

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
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FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1941									
1	1112294	264430	1376724	0	9118	0	61298	1306308	0
2	651043	218928	869971	0	8372	0	55785	805814	0
3	1006976	316626	1323602	0	26081	0	85020	1212501	0
4	417004	125551	542555	0	54092	0	122730	365733	0
5	600021	278631	878652	0	72151	0	143791	662710	0
6	676218	405984	1082202	0	82978	0	145483	853741	0
7	320023	144215	464238	0	78420	0	143782	242036	0
8	101263	34875	136138	0	41686	0	94452	0	0
9	49365	91232	140597	0	26607	0	79799	34191	0
10	232517	123693	356210	0	19901	0	70857	265452	0
11	1092762	455141	1547903	0	9819	0	63727	1474357	0
12	505217	112204	617421	0	9118	0	59733	548570	0
SUM	6764703	2571510	9336213	0	438343	0	1126457	7771413	0
1942									
1	381349	157843	539192	0	9118	0	61298	468776	0
2	333075	150076	483151	0	8372	0	55785	418994	0
3	445595	197128	642723	0	26081	0	85020	531622	0
4	871608	477848	1349456	0	54092	0	122730	1172634	0
5	639820	150878	790698	0	72151	0	143791	574756	0
6	439834	122216	562050	0	82978	0	145483	333589	0
7	117234	115795	233029	0	78420	0	143782	10827	0
8	176418	218505	394923	0	41686	0	94452	258785	0
9	100402	138927	239329	0	26607	0	79799	132923	0
10	58703	32055	90758	0	19901	0	70857	0	0
11	29122	45821	74943	0	9819	0	63727	1397	0
12	66836	80462	147298	0	9118	0	59733	78447	0
SUM	3659996	1887554	5547550	0	438343	0	1126457	3982750	0
1943									
1	338323	226416	564739	0	9118	0	61298	494323	0
2	135258	74857	210115	0	8372	0	55785	145958	0
3	130627	108251	238878	0	26081	0	85020	127777	0
4	100608	95397	196005	0	54092	0	122730	19183	0
5	129123	132602	261725	0	72151	0	143791	45783	0
6	172167	56294	228461	0	82978	0	145483	0	0
7	164059	129151	293210	0	78420	0	143782	71008	0
8	83528	102607	186135	0	41686	0	94452	49997	0
9	68975	40989	109964	0	26607	0	79799	3558	0
10	62785	28058	90843	0	19901	0	70857	85	0
11	38380	35186	73566	0	9819	0	63727	20	0
12	10751	98944	109695	0	9118	0	59733	40844	0
SUM	1434584	1128752	2563336	0	438343	0	1126457	998536	0

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
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FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1944									
1	194205	333920	528125	0	9118	0	61298	457709	0
2	621810	227271	849081	0	8372	0	55785	784924	0
3	886973	192170	1079143	0	26081	0	85020	968042	0
4	653360	74847	728207	0	54092	0	122730	551385	0
5	3044338	522809	3567147	0	72151	0	143791	3351205	0
6	607474	74385	681859	0	82978	0	145483	453398	0
7	199879	22323	222202	0	78420	0	143782	0	0
8	117052	19086	136138	0	41686	0	94452	0	0
9	71878	40997	112875	0	26607	0	79799	6469	0
10	71612	19146	90758	0	19901	0	70857	0	0
11	40166	48837	89003	0	9819	0	63727	15457	0
12	218194	207621	425815	0	9118	0	59733	356964	0
SUM	6726941	1783412	8510353	0	438343	0	1126457	6945553	0
1945									
1	1477182	439892	1917074	0	9118	0	61298	1846658	0
2	898399	286162	1184561	0	8372	0	55785	1120404	0
3	1027722	193786	1221508	0	26081	0	85020	1110407	0
4	2031908	510768	2542676	0	54092	0	122730	2365854	0
5	398819	139618	538437	0	72151	0	143791	322495	0
6	149383	85354	234737	0	82978	0	145483	6276	0
7	305176	66184	371360	0	78420	0	143782	149158	0
8	100885	48584	149469	0	41686	0	94452	13331	0
9	63913	59292	123205	0	26607	0	79799	16799	0
10	238936	86395	325331	0	19901	0	70857	234573	0
11	141038	46856	187894	0	9819	0	63727	114348	0
12	308111	277184	585295	0	9118	0	59733	516444	0
SUM	7141472	2240075	9381547	0	438343	0	1126457	7816747	0
1946									
1	1191374	534132	1725506	0	9118	0	61298	1655090	0
2	1627281	533213	2160494	0	8372	0	55785	2096337	0
3	1106414	310645	1417059	0	26081	0	85020	1305958	0
4	645712	129303	775015	0	54092	0	122730	598193	0
5	885278	276174	1161452	0	72151	0	143791	945510	0
6	880290	325096	1205386	0	82978	0	145483	976925	0
7	160606	210205	370811	0	78420	0	143782	148609	0
8	90748	45390	136138	0	41686	0	94452	0	0
9	71402	35004	106406	0	26607	0	79799	0	0
10	64442	76710	141152	0	19901	0	70857	50394	0
11	1080922	580153	1661075	0	9819	0	63727	1587529	0
12	678996	217020	896016	0	9118	0	59733	827165	0
SUM	8483465	3273045	11756510	0	438343	0	1126457	10191710	0

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
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FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1947									
1	1354282	605618	1959900	0	9118	0	61298	1889484	0
2	473347	146140	619487	0	8372	0	55785	555330	0
3	1052969	399464	1452433	0	26081	0	85020	1341332	0
4	606278	88569	694847	0	54092	0	122730	518025	0
5	675395	188568	863963	0	72151	0	143791	648021	0
6	345613	86692	432305	0	82978	0	145483	203844	0
7	186318	35884	222202	0	78420	0	143782	0	0
8	112194	23944	136138	0	41686	0	94452	0	0
9	88008	18398	106406	0	26607	0	79799	0	0
10	76208	14550	90758	0	19901	0	70857	0	0
11	36918	37094	74012	0	9819	0	63727	466	0
12	34604	136895	171499	0	9118	0	59733	102648	0
SUM	5042134	1781816	6823950	0	438343	0	1126457	5259150	0
1948									
1	96863	122662	219525	0	9118	0	61298	149109	0
2	686855	222628	909483	0	8372	0	55785	845326	0
3	580987	143155	724142	0	26081	0	85020	613041	0
4	435121	82611	517732	0	54092	0	122730	340910	0
5	309532	45072	354604	0	72151	0	143791	138662	0
6	209110	19351	228461	0	82978	0	145483	0	0
7	195929	26273	222202	0	78420	0	143782	0	0
8	126121	10017	136138	0	41686	0	94452	0	0
9	96353	10053	106406	0	26607	0	79799	0	0
10	82579	8179	90758	0	19901	0	70857	0	0
11	50279	23717	73996	0	9819	0	63727	450	0
12	44711	24140	68851	0	9118	0	59733	0	0
SUM	2914440	737858	3652298	0	438343	0	1126457	2087498	0
1949									
1	46655	136183	182838	0	9118	0	61298	112422	0
2	178675	234195	412870	0	8372	0	55785	348713	0
3	491148	421783	912931	0	26081	0	85020	801830	0
4	529211	383073	912284	0	54092	0	122730	735462	0
5	251361	84209	335570	0	72151	0	143791	119628	0
6	154863	73598	228461	0	82978	0	145483	0	0
7	179667	42535	222202	0	78420	0	143782	0	0
8	109398	26740	136138	0	41686	0	94452	0	0
9	75698	30708	106406	0	26607	0	79799	0	0
10	101919	680706	782625	0	19901	0	70857	691867	0
11	77783	64050	141833	0	9819	0	63727	68287	0
12	393186	512144	905330	0	9118	0	59733	836479	0
SUM	2589564	2689924	5279488	0	438343	0	1126457	3714688	0

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
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FLOW BELOW STEINHAGEN

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1950									
1	1194652	585620	1780272	0	9118	0	61298	1709856	0
2	1261704	442588	1704292	0	8372	0	55785	1640135	0
3	625481	361557	987038	0	26081	0	85020	875937	0
4	261118	143332	404450	0	54092	0	122730	227628	0
5	841297	341091	1182388	0	72151	0	143791	966446	0
6	1048475	1061068	2109543	0	82978	0	145483	1881082	0
7	136453	94375	230828	0	78420	0	143782	8626	0
8	103741	32397	136138	0	41686	0	94452	0	0
9	73696	32710	106406	0	26607	0	79799	0	0
10	69283	21475	90758	0	19901	0	70857	0	0
11	49541	24005	73546	0	9819	0	63727	0	0
12	41129	27722	68851	0	9118	0	59733	0	0
SUM	5706570	3167940	8874510	0	438343	0	1126457	7309710	0
1951									
1	16899	64313	81212	0	9118	0	61298	10796	0
2	7343	59430	66773	0	8372	0	55785	2616	0
3	206135	72723	278858	0	26081	0	85020	167757	0
4	217225	102670	319895	0	54092	0	122730	143073	0
5	181351	34591	215942	0	72151	0	143791	0	0
6	210411	18050	228461	0	82978	0	145483	0	0
7	208293	13909	222202	0	78420	0	143782	0	0
8	127047	9091	136138	0	41686	0	94452	0	0
9	66694	65629	132323	0	26607	0	79799	25917	0
10	71031	19727	90758	0	19901	0	70857	0	0
11	55937	17609	73546	0	9819	0	63727	0	0
12	22780	52816	75596	0	9118	0	59733	6745	0
SUM	1391146	530558	1921704	0	438343	0	1126457	356904	0
1952									
1	38987	31429	70416	0	9118	0	61298	0	0
2	67132	67948	135080	0	8372	0	55785	70923	0
3	193783	70064	263847	0	26081	0	85020	152746	0
4	234053	267502	501555	0	54092	0	122730	324733	0
5	404022	294820	698842	0	72151	0	143791	482900	0
6	174300	54238	228538	0	82978	0	145483	77	0
7	168987	56961	225948	0	78420	0	143782	3746	0
8	122330	13808	136138	0	41686	0	94452	0	0
9	99069	7337	106406	0	26607	0	79799	0	0
10	84670	6088	90758	0	19901	0	70857	0	0
11	58588	14958	73546	0	9819	0	63727	0	0
12	21123	55829	76952	0	9118	0	59733	8101	0
SUM	1667044	940982	2608026	0	438343	0	1126457	1043226	0

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1953									
1	65547	122380	187927	0	9118	0	61298	117511	0
2	163354	211770	375124	0	8372	0	55785	310967	0
3	476686	165865	642551	0	26081	0	85020	531450	0
4	496460	128495	624955	0	54092	0	122730	448133	0
5	2795604	1139960	3935564	0	72151	0	143791	3719622	0
6	449464	52568	502032	0	82978	0	145483	273571	0
7	139649	82553	222202	0	78420	0	143782	0	0
8	99731	36407	136138	0	41686	0	94452	0	0
9	74636	31770	106406	0	26607	0	79799	0	0
10	75500	15258	90758	0	19901	0	70857	0	0
11	49190	24356	73546	0	9819	0	63727	0	0
12	8349	98318	106667	0	9118	0	59733	37816	0
SUM	4894170	2109700	7003870	0	438343	0	1126457	5439070	0
1954									
1	82663	115105	197768	0	9118	0	61298	127352	0
2	64154	55444	119598	0	8372	0	55785	55441	0
3	68694	42407	111101	0	26081	0	85020	0	0
4	140263	87303	227566	0	54092	0	122730	50744	0
5	377096	105715	482811	0	72151	0	143791	266869	0
6	211374	17087	228461	0	82978	0	145483	0	0
7	211818	10384	222202	0	78420	0	143782	0	0
8	117207	18931	136138	0	41686	0	94452	0	0
9	98969	7437	106406	0	26607	0	79799	0	0
10	77179	13579	90758	0	19901	0	70857	0	0
11	51573	21973	73546	0	9819	0	63727	0	0
12	49887	18964	68851	0	9118	0	59733	0	0
SUM	1550877	514329	2065206	0	438343	0	1126457	500406	0
1955									
1	18700	61547	80247	0	9118	0	61298	9831	0
2	152306	226241	378547	0	8372	0	55785	314390	0
3	67673	43428	111101	0	26081	0	85020	0	0
4	303032	266478	569510	0	54092	0	122730	392688	0
5	183403	32539	215942	0	72151	0	143791	0	0
6	214135	14326	228461	0	82978	0	145483	0	0
7	195705	26497	222202	0	78420	0	143782	0	0
8	105545	30593	136138	0	41686	0	94452	0	0
9	84473	21933	106406	0	26607	0	79799	0	0
10	76639	14119	90758	0	19901	0	70857	0	0
11	62297	11249	73546	0	9819	0	63727	0	0
12	46037	22814	68851	0	9118	0	59733	0	0
SUM	1509945	771764	2281709	0	438343	0	1126457	716909	0

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1956									
1	37353	55127	92480	0	9118	0	61298	22064	0
2	27055	196951	224006	0	8372	0	55785	159849	0
3	36946	109792	146738	0	26081	0	85020	35637	0
4	130811	46011	176822	0	54092	0	122730	0	0
5	197981	17961	215942	0	72151	0	143791	0	0
6	217407	11054	228461	0	82978	0	145483	0	0
7	215888	6314	222202	0	78420	0	143782	0	0
8	131396	4742	136138	0	41686	0	94452	0	0
9	102184	4222	106406	0	26607	0	79799	0	0
10	86439	4319	90758	0	19901	0	70857	0	0
11	63782	9764	73546	0	9819	0	63727	0	0
12	46063	23979	70042	0	9118	0	59733	1191	0
SUM	1293305	490236	1783541	0	438343	0	1126457	218741	0
1957									
1	51851	18565	70416	0	9118	0	61298	0	0
2	30498	35585	66083	0	8372	0	55785	1926	0
3	28293	131381	159674	0	26081	0	85020	48573	0
4	56472	147725	204197	0	54092	0	122730	27375	0
5	762375	305585	1067960	0	72151	0	143791	852018	0
6	138990	100850	239840	0	82978	0	145483	11379	0
7	186759	35443	222202	0	78420	0	143782	0	0
8	121416	14722	136138	0	41686	0	94452	0	0
9	74838	59294	134132	0	26607	0	79799	27726	0
10	90289	105453	195742	0	19901	0	70857	104984	0
11	825236	329654	1154890	0	9819	0	63727	1081344	0
12	766260	184149	950409	0	9118	0	59733	881558	0
SUM	3133277	1468406	4601683	0	438343	0	1126457	3036883	0
1958									
1	790749	545656	1336405	0	9118	0	61298	1265989	0
2	524831	288089	812920	0	8372	0	55785	748763	0
3	368720	162251	530971	0	26081	0	85020	419870	0
4	261347	93493	354840	0	54092	0	122730	178018	0
5	994711	53177	1047888	0	72151	0	143791	831946	0
6	208676	19785	228461	0	82978	0	145483	0	0
7	203256	18946	222202	0	78420	0	143782	0	0
8	124525	11613	136138	0	41686	0	94452	0	0
9	134722	60155	194877	0	26607	0	79799	88471	0
10	398930	32784	431714	0	19901	0	70857	340956	0
11	101309	23491	124800	0	9819	0	63727	51254	0
12	98320	21528	119848	0	9118	0	59733	50997	0
SUM	4210096	1330968	5541064	0	438343	0	1126457	3976264	0

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1959									
1	89366	26193	115559	0	9118	0	61298	45143	0
2	370327	180191	550518	0	8372	0	55785	486361	0
3	249634	75539	325173	0	26081	0	85020	214072	0
4	620896	227969	848865	0	54092	0	122730	672043	0
5	711885	63065	774950	0	72151	0	143791	559008	0
6	239625	27014	266639	0	82978	0	145483	38178	0
7	156153	90462	246615	0	78420	0	143782	24413	0
8	72452	76654	149106	0	41686	0	94452	12968	0
9	86579	19827	106406	0	26607	0	79799	0	0
10	52489	48251	100740	0	19901	0	70857	9982	0
11	37171	43342	80513	0	9819	0	63727	6967	0
12	322477	171076	493553	0	9118	0	59733	424702	0
SUM	3009054	1049583	4058637	0	438343	0	1126457	2493837	0
1960									
1	591073	178330	769403	0	9118	0	61298	698987	0
2	576454	217772	794226	0	8372	0	55785	730069	0
3	730671	117194	847865	0	26081	0	85020	736764	0
4	182846	34202	217048	0	54092	0	122730	40226	0
5	172384	43558	215942	0	72151	0	143791	0	0
6	180034	65070	245104	0	82978	0	145483	16643	0
7	173589	61437	235026	0	78420	0	143782	12824	0
8	115982	20156	136138	0	41686	0	94452	0	0
9	90080	16326	106406	0	26607	0	79799	0	0
10	51716	59276	110992	0	19901	0	70857	20234	0
11	79937	253768	333705	0	9819	0	63727	260159	0
12	1129754	244927	1374681	0	9118	0	59733	1305830	0
SUM	4074520	1312016	5386536	0	438343	0	1126457	3821736	0
1961									
1	1534158	792070	2326228	0	9118	0	61298	2255812	0
2	874617	381617	1256234	0	8372	0	55785	1192077	0
3	1075387	248847	1324234	0	26081	0	85020	1213133	0
4	741924	98296	840220	0	54092	0	122730	663398	0
5	168347	47595	215942	0	72151	0	143791	0	0
6	144401	173499	317900	0	82978	0	145483	89439	0
7	251902	323947	575849	0	78420	0	143782	353647	0
8	73707	62431	136138	0	41686	0	94452	0	0
9	123521	335974	459495	0	26607	0	79799	353089	0
10	50683	40075	90758	0	19901	0	70857	0	0
11	91860	131155	223015	0	9819	0	63727	149469	0
12	783945	202021	985966	0	9118	0	59733	917115	0
SUM	5914452	2837527	8751979	0	438343	0	1126457	7187179	0

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 19% Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1962									
1	500467	157235	657702	0	9118	0	61298	587286	0
2	475332	100701	576033	0	8372	0	55785	511876	0
3	378384	82211	460595	0	26081	0	85020	349494	0
4	283461	66397	349858	0	54092	0	122730	173036	0
5	748593	135901	884494	0	72151	0	143791	668552	0
6	198277	55793	254070	0	82978	0	145483	25609	0
7	192317	29885	222202	0	78420	0	143782	0	0
8	125212	10926	136138	0	41686	0	94452	0	0
9	91076	15330	106406	0	26607	0	79799	0	0
10	75189	15569	90758	0	19901	0	70857	0	0
11	48746	28637	77383	0	9819	0	63727	3837	0
12	32981	105353	138334	0	9118	0	59733	69483	0
SUM	3150035	803938	3953973	0	438343	0	1126457	2389173	0
1963									
1	101475	114696	216171	0	9118	0	61298	145755	0
2	95253	109177	204430	0	8372	0	55785	140273	0
3	121387	74432	195819	0	26081	0	85020	84718	0
4	180909	38041	218950	0	54092	0	122730	42128	0
5	201228	14714	215942	0	72151	0	143791	0	0
6	208675	19786	228461	0	82978	0	145483	0	0
7	190811	31391	222202	0	78420	0	143782	0	0
8	124933	11205	136138	0	41686	0	94452	0	0
9	69842	94208	164050	0	26607	0	79799	57644	0
10	77937	12821	90758	0	19901	0	70857	0	0
11	33909	40378	74287	0	9819	0	63727	741	0
12	9187	119994	129181	0	9118	0	59733	60330	0
SUM	1415546	680843	2096389	0	438343	0	1126457	531589	0
1964									
1	21563	135540	157103	0	9118	0	61298	86687	0
2	49127	146389	195516	0	8372	0	55785	131359	0
3	185866	278727	464593	0	26081	0	85020	353492	0
4	204878	129782	334660	0	54092	0	122730	157838	0
5	153239	71499	224738	0	72151	0	143791	8796	0
6	193680	34781	228461	0	82978	0	145483	0	0
7	212202	10000	222202	0	78420	0	143782	0	0
8	121281	14857	136138	0	41686	0	94452	0	0
9	95413	10993	106406	0	26607	0	79799	0	0
10	81410	9348	90758	0	19901	0	70857	0	0
11	59505	14041	73546	0	9819	0	63727	0	0
12	33832	50650	84482	0	9118	0	59733	15631	0
SUM	1411996	906607	2318603	0	438343	0	1126457	753803	0

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1965									
1	37946	32553	70499	0	9118	0	61298	83	0
2	16710	65743	82453	0	8372	0	55785	18296	0
3	43813	77869	121682	0	26081	0	85020	10581	0
4	138255	89049	227304	0	54092	0	122730	50482	0
5	181430	34512	215942	0	72151	0	143791	0	0
6	205198	23263	228461	0	82978	0	145483	0	0
7	212515	9687	222202	0	78420	0	143782	0	0
8	127625	8513	136138	0	41686	0	94452	0	0
9	96347	10059	106406	0	26607	0	79799	0	0
10	83431	7327	90758	0	19901	0	70857	0	0
11	51161	22410	73571	0	9819	0	63727	25	0
12	136319	100967	237286	0	9118	0	59733	168435	0
SUM	1330750	481952	1812702	0	438343	0	1126457	247902	0
1966									
1	144435	139552	283987	0	9118	0	61298	213571	0
2	425972	656419	1082391	0	8372	0	55785	1018234	0
3	90681	102935	193616	0	26081	0	85020	82515	0
4	133592	103600	237192	0	54092	0	122730	60370	0
5	1422903	142982	1565885	0	72151	0	143791	1349943	0
6	195330	33131	228461	0	82978	0	145483	0	0
7	207177	15025	222202	0	78420	0	143782	0	0
8	108119	28019	136138	0	41686	0	94452	0	0
9	87902	18504	106406	0	26607	0	79799	0	0
10	56012	35776	91788	0	19901	0	70857	1030	0
11	42795	39723	82518	0	9819	0	63727	8972	0
12	24955	45069	70024	0	9118	0	59733	1173	0
SUM	2939873	1360735	4300608	0	438343	0	1126457	2735808	0
1967									
1	17515	62777	80292	0	9118	0	61298	9876	0
2	25987	61723	87710	0	8372	0	55785	23553	0
3	55917	55377	111294	0	26081	0	85020	193	0
4	101322	117470	218792	0	54092	0	122730	41970	0
5	183333	32609	215942	0	72151	0	143791	0	0
6	206093	22368	228461	0	82978	0	145483	0	0
7	210525	11677	222202	0	78420	0	143782	0	0
8	130340	5798	136138	0	41686	0	94452	0	0
9	100791	5615	106406	0	26607	0	79799	0	0
10	87007	3751	90758	0	19901	0	70857	0	0
11	67986	5560	73546	0	9819	0	63727	0	0
12	48281	20570	68851	0	9118	0	59733	0	0
SUM	1235097	405295	1640392	0	438343	0	1126457	75592	0

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1968									
1	110688	44899	155587	0	9118	0	61298	85171	0
2	117906	26020	143926	0	8372	0	55785	79769	0
3	196533	64619	261152	0	26081	0	85020	150051	0
4	1100481	165957	1266438	0	54092	0	122730	1089616	0
5	773004	203589	976593	0	72151	0	143791	760651	0
6	667487	306849	974336	0	82978	0	145483	745875	0
7	389584	108330	497914	0	78420	0	143782	275712	0
8	113125	23013	136138	0	41686	0	94452	0	0
9	86724	31402	118126	0	26607	0	79799	11720	0
10	69237	21521	90758	0	19901	0	70857	0	0
11	115489	38496	153985	0	9819	0	63727	80439	0
12	622267	110327	732594	0	9118	0	59733	663743	0
SUM	4362525	1145022	5507547	0	438343	0	1126457	3942747	0
1969									
1	307640	61719	369359	0	9118	0	61298	298943	0
2	744254	203486	947740	0	8372	0	55785	883583	0
3	1520878	258637	1779515	0	26081	0	85020	1668414	0
4	1435010	132375	1567385	0	54092	0	122730	1390563	0
5	1709923	591197	2301120	0	72151	0	143791	2085178	0
6	245429	69521	314950	0	82978	0	145483	86489	0
7	203141	19061	222202	0	78420	0	143782	0	0
8	126470	9668	136138	0	41686	0	94452	0	0
9	96964	9442	106406	0	26607	0	79799	0	0
10	83192	7566	90758	0	19901	0	70857	0	0
11	58607	14939	73546	0	9819	0	63727	0	0
12	39290	48297	87587	0	9118	0	59733	18736	0
SUM	6570798	1425908	7996706	0	438343	0	1126457	6431906	0
1970									
1	113765	55325	169090	0	9118	0	61298	98674	0
2	104228	51108	155336	0	8372	0	55785	91179	0
3	200757	77404	278161	0	26081	0	85020	167060	0
4	312376	79286	391662	0	54092	0	122730	214840	0
5	291992	174330	466322	0	72151	0	143791	250380	0
6	180170	48291	228461	0	82978	0	145483	0	0
7	212429	9773	222202	0	78420	0	143782	0	0
8	129746	6392	136138	0	41686	0	94452	0	0
9	97163	9243	106406	0	26607	0	79799	0	0
10	54508	67662	122170	0	19901	0	70857	31412	0
11	33520	42433	75953	0	9819	0	63727	2407	0
12	46542	25963	72505	0	9118	0	59733	3654	0
SUM	1777196	647210	2424406	0	438343	0	1126457	859606	0

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1971									
1	45897	41046	86943	0	9118	0	61298	16527	0
2	38797	25986	64783	0	8372	0	55785	626	0
3	62566	48809	111375	0	26081	0	85020	274	0
4	160268	16554	176822	0	54092	0	122730	0	0
5	168287	47655	215942	0	72151	0	143791	0	0
6	216998	11463	228461	0	82978	0	145483	0	0
7	217082	5120	222202	0	78420	0	143782	0	0
8	115521	20617	136138	0	41686	0	94452	0	0
9	92137	14269	106406	0	26607	0	79799	0	0
10	56647	34599	91246	0	19901	0	70857	488	0
11	43369	30632	74001	0	9819	0	63727	455	0
12	77006	402785	479791	0	9118	0	59733	410940	0
SUM	1294575	699535	1994110	0	438343	0	1126457	429310	0
1972									
1	134044	244692	378736	0	9118	0	61298	308320	0
2	98149	139493	237642	0	8372	0	55785	173485	0
3	122679	182550	305229	0	26081	0	85020	194128	0
4	80838	111384	192222	0	54092	0	122730	15400	0
5	110088	378310	488398	0	72151	0	143791	272456	0
6	204422	24039	228461	0	82978	0	145483	0	0
7	183846	38356	222202	0	78420	0	143782	0	0
8	119992	16146	136138	0	41686	0	94452	0	0
9	91572	14834	106406	0	26607	0	79799	0	0
10	65000	25758	90758	0	19901	0	70857	0	0
11	27106	92568	119674	0	9819	0	63727	46128	0
12	122551	152588	275139	0	9118	0	59733	206288	0
SUM	1360287	1420718	2781005	0	438343	0	1126457	1216205	0
1973									
1	295341	286222	581563	0	9118	0	61298	511147	0
2	184322	448263	632585	0	8372	0	55785	568428	0
3	539510	398698	938208	0	26081	0	85020	827107	0
4	1115485	661075	1776560	0	54092	0	122730	1599738	0
5	622003	376943	998946	0	72151	0	143791	783004	0
6	1133094	425406	1558500	0	82978	0	145483	1330039	0
7	298596	205684	504280	0	78420	0	143782	282078	0
8	89005	163741	252746	0	41686	0	94452	116608	0
9	220955	228373	449328	0	26607	0	79799	342922	0
10	561123	285481	846604	0	19901	0	70857	755846	0
11	592707	280022	872729	0	9819	0	63727	799183	0
12	1072713	424453	1497166	0	9118	0	59733	1428315	0
SUM	6724854	4184361	10909215	0	438343	0	1126457	9344415	0

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1974									
1	1562501	936198	2498699	0	9118	0	61298	2428283	0
2	699861	265025	964886	0	8372	0	55785	900729	0
3	362309	172446	534755	0	26081	0	85020	423654	0
4	304919	299866	604785	0	54092	0	122730	427963	0
5	172963	95311	268274	0	72151	0	143791	52332	0
6	161966	66495	228461	0	82978	0	145483	0	0
7	194939	27263	222202	0	78420	0	143782	0	0
8	106867	29271	136138	0	41686	0	94452	0	0
9	49779	78522	128301	0	26607	0	79799	21895	0
10	82148	39517	121665	0	19901	0	70857	30907	0
11	485100	304004	789104	0	9819	0	63727	715558	0
12	717027	408743	1125770	0	9118	0	59733	1056919	0
SUM	4900379	2722661	7623040	0	438343	0	1126457	6058240	0
1975									
1	665276	480059	1145335	0	9118	0	61298	1074919	0
2	1092883	334476	1427359	0	8372	0	55785	1363202	0
3	453972	269689	723661	0	26081	0	85020	612560	0
4	428816	217913	646729	0	54092	0	122730	469907	0
5	891431	373042	1264473	0	72151	0	143791	1048531	0
6	366170	337433	703603	0	82978	0	145483	475142	0
7	142314	180522	322836	0	78420	0	143782	100634	0
8	64061	259761	323822	0	41686	0	94452	187684	0
9	49847	56810	106657	0	26607	0	79799	251	0
10	64756	106520	171276	0	19901	0	70857	80518	0
11	76234	124765	200999	0	9819	0	63727	127453	0
12	139475	119608	259083	0	9118	0	59733	190232	0
SUM	4435235	2860598	7295833	0	438343	0	1126457	5731033	0
1976									
1	190408	178294	368702	0	9118	0	61298	298286	0
2	196702	83770	280472	0	8372	0	55785	216315	0
3	340235	140684	480919	0	26081	0	85020	369818	0
4	224377	113996	338373	0	54092	0	122730	161551	0
5	507906	258847	766753	0	72151	0	143791	550811	0
6	314850	207779	522629	0	82978	0	145483	294168	0
7	372204	117618	489822	0	78420	0	143782	267620	0
8	111907	24231	136138	0	41686	0	94452	0	0
9	85262	21144	106406	0	26607	0	79799	0	0
10	54098	36660	90758	0	19901	0	70857	0	0
11	21886	53373	75259	0	9819	0	63727	1713	0
12	140548	231014	371562	0	9118	0	59733	302711	0
SUM	2560383	1467410	4027793	0	438343	0	1126457	2462993	0

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1977									
1	313534	191086	504620	0	9118	0	61298	434204	0
2	399873	147401	547274	0	8372	0	55785	483117	0
3	521382	185611	706993	0	26081	0	85020	595892	0
4	498439	219751	718190	0	54092	0	122730	541368	0
5	854559	95027	949586	0	72151	0	143791	733644	0
6	161699	77835	239534	0	82978	0	145483	11073	0
7	198964	23238	222202	0	78420	0	143782	0	0
8	106788	29350	136138	0	41686	0	94452	0	0
9	74439	31967	106406	0	26607	0	79799	0	0
10	72565	18193	90758	0	19901	0	70857	0	0
11	37501	39909	77410	0	9819	0	63727	3864	0
12	18857	141388	160245	0	9118	0	59733	91394	0
SUM	3258600	1200756	4459356	0	438343	0	1126457	2894556	0
1978									
1	179875	297710	477585	0	9118	0	61298	407169	0
2	160441	389906	470347	0	8372	0	55785	406190	0
3	107670	101205	208875	0	26081	0	85020	97774	0
4	139461	37361	176822	0	54092	0	122730	0	0
5	195561	20381	215942	0	72151	0	143791	0	0
6	202381	26080	228461	0	82978	0	145483	0	0
7	206870	15332	222202	0	78420	0	143782	0	0
8	121578	14560	136138	0	41686	0	94452	0	0
9	73978	32428	106406	0	26607	0	79799	0	0
10	79264	11494	90758	0	19901	0	70857	0	0
11	29420	133659	163079	0	9819	0	63727	89533	0
12	27524	211864	239388	0	9118	0	59733	170537	0
SUM	1524023	1211980	2736003	0	438343	0	1126457	1171203	0
1979									
1	309948	610551	920499	0	9118	0	61298	850083	0
2	719099	474649	1193748	0	8372	0	55785	1129591	0
3	873806	399698	1273504	0	26081	0	85020	1162403	0
4	1160568	1071421	2231989	0	54092	0	122730	2055167	0
5	764149	162995	927144	0	72151	0	143791	711202	0
6	916589	227577	1144166	0	82978	0	145483	915705	0
7	130144	212537	342681	0	78420	0	143782	120479	0
8	95548	94701	190249	0	41686	0	94452	54111	0
9	237986	285455	523441	0	26607	0	79799	417035	0
10	114950	63517	178467	0	19901	0	70857	87709	0
11	257731	230440	488171	0	9819	0	63727	414625	0
12	438194	182385	620579	0	9118	0	59733	551728	0
SUM	6018712	4015926	10034638	0	438343	0	1126457	8469838	0

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1980									
1	560518	284238	844756	0	9118	0	61298	774340	0
2	701733	291192	992925	0	8372	0	55785	928768	0
3	553268	262003	815271	0	26081	0	85020	704170	0
4	742761	334129	1076890	0	54092	0	122730	900068	0
5	976517	313578	1290095	0	72151	0	143791	1074153	0
6	182863	45598	228461	0	82978	0	145483	0	0
7	203853	18349	222202	0	78420	0	143782	0	0
8	123011	13127	136138	0	41686	0	94452	0	0
9	86309	20097	106406	0	26607	0	79799	0	0
10	61129	29629	90758	0	19901	0	70857	0	0
11	40287	33259	73546	0	9819	0	63727	0	0
12	25578	43291	68869	0	9118	0	59733	18	0
SUM	4257827	1688490	5946317	0	438343	0	1126457	4381517	0
1981									
1	26799	45009	71808	0	9118	0	61298	1392	0
2	14700	51877	66577	0	8372	0	55785	2420	0
3	45528	86937	132465	0	26081	0	85020	21364	0
4	135492	41330	176822	0	54092	0	122730	0	0
5	167152	48790	215942	0	72151	0	143791	0	0
6	172071	691977	864048	0	82978	0	145483	635587	0
7	91343	199790	291133	0	78420	0	143782	68931	0
8	116110	20028	136138	0	41686	0	94452	0	0
9	68615	40591	109206	0	26607	0	79799	2800	0
10	56178	34580	90758	0	19901	0	70857	0	0
11	43565	37057	80622	0	9819	0	63727	7076	0
12	30614	47980	78594	0	9118	0	59733	9743	0
SUM	968167	1345946	2314113	0	438343	0	1126457	749313	0
1982									
1	52167	55882	108049	0	9118	0	61298	37633	0
2	69789	98081	167870	0	8372	0	55785	103713	0
3	71354	81673	153027	0	26081	0	85020	41926	0
4	722699	200649	923348	0	54092	0	122730	746526	0
5	621417	223567	844984	0	72151	0	143791	629042	0
6	193163	35298	228461	0	82978	0	145483	0	0
7	182827	39375	222202	0	78420	0	143782	0	0
8	109108	27030	136138	0	41686	0	94452	0	0
9	95807	10599	106406	0	26607	0	79799	0	0
10	75795	14963	90758	0	19901	0	70857	0	0
11	66886	52405	119291	0	9819	0	63727	45745	0
12	633662	514292	1147954	0	9118	0	59733	1079103	0
SUM	2894674	1353814	4248488	0	438343	0	1126457	2683688	0

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
 Steinhagen min 10,000 with variable target; Rayburn min 149 ft; 1994 Area/Capacity/Elev. at Steinhagen
 10,000 demand at Rayburn; 1,564,800 demand at Steinhagen; 1,574,800 total

FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1983									
1	455506	257106	712612	0	9118	0	61298	642196	0
2	928331	358233	1286564	0	8372	0	55785	1222407	0
3	751358	205192	956550	0	26081	0	85020	845449	0
4	295356	102124	397480	0	54092	0	122730	220658	0
5	866290	723143	1589433	0	72151	0	143791	1373491	0
6	506902	93816	600718	0	82978	0	145483	372257	0
7	156532	65670	222202	0	78420	0	143782	0	0
8	79070	158177	237247	0	41686	0	94452	101109	0
9	51272	194812	246084	0	26607	0	79799	139678	0
10	47984	42774	90758	0	19901	0	70857	0	0
11	61870	76116	137986	0	9819	0	63727	64440	0
12	527459	288554	816013	0	9118	0	59733	747162	0
SUM	4727930	2565717	7293647	0	438343	0	1126457	5728847	0
1984									
1	356924	272322	629246	0	9118	0	61298	558830	0
2	627650	478070	1105720	0	8372	0	55785	1041563	0
3	737376	291941	1029317	0	26081	0	85020	918216	0
4	191174	119198	310372	0	54092	0	122730	133550	0
5	179676	203833	383509	0	72151	0	143791	167567	0
6	170710	57751	228461	0	82978	0	145483	0	0
7	194910	27292	222202	0	78420	0	143782	0	0
8	112305	23833	136138	0	41686	0	94452	0	0
9	86593	19813	106406	0	26607	0	79799	0	0
10	111473	110299	221772	0	19901	0	70857	131014	0
11	167615	105178	272793	0	9819	0	63727	199247	0
12	117826	140801	258627	0	9118	0	59733	189776	0
SUM	3054232	1850331	4904563	0	438343	0	1126457	3339763	0
1985									
1	315927	131510	447437	0	9118	0	61298	377021	0
2	646719	305202	951921	0	8372	0	55785	887764	0
3	678582	357160	1035742	0	26081	0	85020	924641	0
4	229809	113759	343568	0	54092	0	122730	166746	0
5	182842	64306	247148	0	72151	0	143791	31206	0
6	187653	40808	228461	0	82978	0	145483	0	0
7	199013	23189	222202	0	78420	0	143782	0	0
8	118655	17483	136138	0	41686	0	94452	0	0
9	91309	15097	106406	0	26607	0	79799	0	0
10	45448	59242	104690	0	19901	0	70857	13932	0
11	120553	175984	296537	0	9819	0	63727	222991	0
12	570191	324495	894686	0	9118	0	59733	825835	0
SUM	3386701	1628235	5014936	0	438343	0	1126457	3450136	0

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
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FLOW BELOW STEINHAGEN

Date	Steinhagen Releases (Ac-Ft)	Flow Below Steinhagen (Ac-Ft)	Total Flow (Ac-Ft)	Salt Water Control (Ac-Ft)	Existing Rights (Ac-Ft)	Bypass Requirement (Ac-Ft)	Additional Supply (Ac-Ft)	Excess Supply (Ac-Ft)	Total Shortage (Ac-Ft)
1986									
1	182061	79261	261322	0	9118	0	61298	190906	0
2	371138	216522	587660	0	8372	0	55785	523503	0
3	97403	69117	166520	0	26081	0	85020	55419	0
4	152958	61417	214375	0	54092	0	122730	37553	0
5	489366	174744	664110	0	72151	0	143791	448168	0
6	1095605	544711	1640316	0	82978	0	145483	1411855	0
7	123144	165200	288344	0	78420	0	143782	66142	0
8	98830	37308	136138	0	41686	0	94452	0	0
9	49878	56528	106406	0	26607	0	79799	0	0
10	27781	76147	103928	0	19901	0	70857	13170	0
11	620645	345052	965697	0	9819	0	63727	892151	0
12	773006	512486	1285492	0	9118	0	59733	1216641	0
SUM	4081815	2338493	6420308	0	438343	0	1126457	4855508	0
1987									
1	422161	290201	712362	0	9118	0	61298	641946	0
2	645456	214563	860019	0	8372	0	55785	795862	0
3	851691	283458	1135149	0	26081	0	85020	1024048	0
4	175057	56752	231809	0	54092	0	122730	54987	0
5	122276	193538	315814	0	72151	0	143791	99872	0
6	211951	336551	548502	0	82978	0	145483	320041	0
7	87163	202056	289219	0	78420	0	143782	67017	0
8	94273	41865	136138	0	41686	0	94452	0	0
9	75356	31050	106406	0	26607	0	79799	0	0
10	74793	15965	90758	0	19901	0	70857	0	0
11	143083	81191	224274	0	9819	0	63727	150728	0
12	587708	290160	877868	0	9118	0	59733	809017	0
SUM	3490968	2037350	5528318	0	438343	0	1126457	3963518	0
1988									
1	546179	264686	810865	0	9118	0	61298	740449	0
2	247373	154414	401787	0	8372	0	55785	337630	0
3	482839	246836	729675	0	26081	0	85020	618574	0
4	269793	94730	364523	0	54092	0	122730	187701	0
5	177536	38406	215942	0	72151	0	143791	0	0
6	206751	21710	228461	0	82978	0	145483	0	0
7	200433	21769	222202	0	78420	0	143782	0	0
8	118114	18024	136138	0	41686	0	94452	0	0
9	94725	11681	106406	0	26607	0	79799	0	0
10	80011	10747	90758	0	19901	0	70857	0	0
11	62375	11171	73546	0	9819	0	63727	0	0
12	31486	38115	69601	0	9118	0	59733	750	0
SUM	2517615	932289	3449904	0	438343	0	1126457	1885104	0

50 YEARS V3:PB50PRES.DAT 1953 to 1957 Permanent barriers; Current Conditions
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FLOW BELOW STEINHAGEN

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1989									
1	177417	130130	307547	0	9118	0	61298	237131	0
2	276274	126281	402555	0	8372	0	55785	338398	0
3	456776	150863	607639	0	26081	0	85020	496538	0
4	704648	137170	841818	0	54092	0	122730	664996	0
5	814192	724544	1538736	0	72151	0	143791	1322794	0
6	1107588	317531	1425119	0	82978	0	145483	1196658	0
7	789804	816096	1605900	0	78420	0	143782	1383698	0
8	110599	41795	152394	0	41686	0	94452	16256	0
9	84656	21750	106406	0	26607	0	79799	0	0
10	56897	35299	92196	0	19901	0	70857	1438	0
11	36949	36597	73546	0	9819	0	63727	0	0
12	78092	28749	106841	0	9118	0	59733	37990	0
SUM	4693892	2566805	7260697	0	438343	0	1126457	5695897	0
1990									
1	729276	239520	968796	0	9118	0	61298	898380	0
2	637338	250577	887915	0	8372	0	55785	823758	0
3	506160	262129	768289	0	26081	0	85020	657188	0
4	684400	343214	1027614	0	54092	0	122730	850792	0
5	852725	254936	1107661	0	72151	0	143791	891719	0
6	960111	71947	1032058	0	82978	0	145483	803597	0
7	186255	35947	222202	0	78420	0	143782	0	0
8	120134	16004	136138	0	41686	0	94452	0	0
9	85752	20654	106406	0	26607	0	79799	0	0
10	71585	19173	90758	0	19901	0	70857	0	0
11	50567	22979	73546	0	9819	0	63727	0	0
12	79792	43780	123572	0	9118	0	59733	54721	0
SUM	4964095	1580860	6544955	0	438343	0	1126457	4980155	0
RUN SUM	178420535	82147740	260568275	0	21917150	0	56322850	182328275	0
ANN AVG	3568411	1642955	5211366	0	438343	0	1126457	3646566	0

