



US Army Corps
of Engineers
Kansas City District

Engineering Division
Hydrologic Engineering Branch
Water Management Section

Annual Report of Reservoir Regulation Activities

Summary for 2010 - 2011

November 2011

**NORTHWESTERN DIVISION, KANSAS CITY DISTRICT
SUMMARY OF LAKE REGULATION ACTIVITIES
AUGUST 1, 2010 TO JULY 31, 2011**

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PURPOSE AND SCOPE.

This report summarizes the past year's regulation activities at storage projects within the boundaries of the Kansas City District (District) that are operated for flood control by the Water Management Section staff. It also summarizes major work items affecting the projects, and it outlines briefly the programs ongoing or proposed for the year ahead. Topics discussed in the report include recent weather patterns, project accomplishments, current project operations; major regulation problems and proposed solutions; lake regulation manuals; data collection programs and procedures; ongoing studies, and personnel of the Water Management Section. The reporting period for Water Management Section activities covers the operating year from August 1, 2010, through July 31, 2011, with additional discussion on proposed operations and studies programmed through calendar year 2012. Preparation of this report is in conformance with paragraph 13b of ER 1110-2-240, dated October 8, 1982.

LAKES IN THE KANSAS CITY DISTRICT.

The Kansas City District includes the watershed of the Missouri River from Rulo, Nebraska, (river mile 498.1 above the mouth) to the junction of the Missouri and Mississippi Rivers near St. Louis, Missouri. During the period covered by this report, 29 storage projects, at which the Corps of Engineers (Corps) has either complete or partial water control responsibilities, were in operation within the District. There are 18 Corps of Engineers lakes and 11 Bureau of Reclamation lakes. The location of each lake and reservoir in the District is shown on *Plate 1*, and a summary of engineering data outlining the physical characteristics of each project is included as *Plates 2A through 2E*.

PROJECT FUNCTIONS AND GENERAL PLAN.

Functions served by storage facilities in the Kansas City District include: flood control, irrigation, water supply, low flow and navigation supplementation, water quality, hydropower, recreation, and fish and wildlife. Most functions except flood control are normally provided through the regulation of storage contained in the multipurpose pool. Releases from multipurpose storage are controlled by the manipulation of gates or other means in accordance with plans, schedules, and ratings prepared in advance to meet various conditions of inflow and demand. The general plan for regulation of flood control storage is to evacuate all accumulations in the flood control space as rapidly as downstream channel capacities and flow conditions permit. Should the top of the flood pool be exceeded, criteria have been developed for each project that schedule releases with an aim toward safeguarding the structure. Downstream interests are warned of the possibility of flooding should a surcharge operation appear likely. Although the storage space in the flood control pool is normally evacuated as quickly as downstream conditions allow, release schedules may be modified at times to serve beneficial purposes such as fish and wildlife enhancement.

CLIMATOLOGIC AND HYDROLOGIC CONDITIONS.

August 1, 2010 through July 31, 2011

August 2010

Northern and western parts of the District experienced numerous thunderstorms during the month of August with total monthly accumulations of 2-4 inches in western Kansas. Eastern and southern parts of the District, including the Ozarks were hot and dry. Up to 5 inches of precipitation was recorded in the Blue basin in Nebraska from the 23rd to 25th of the month. Minor flooding was reported in the Blue basin. In Missouri monthly rainfall totals were 1-5 inches.

September 2010

September was 2-3 degrees warmer than usual for most of the District. Rainfall was sparse in eastern Colorado, western Kansas, and western Nebraska. Central parts of Kansas received 2-5 inches of precipitation for the month. On the 9th and 10th remnants of Tropical Storm Hermine brought locally heavy rainfall over eastern Kansas and most of Missouri. Rainfall totals ranged from 4 inches in southeast Nebraska to 12 inches in the Missouri Ozarks. Minor flooding was reported in southeast Nebraska, eastern Kansas, and central Missouri.

October 2010

It was abnormally dry across the entire District during the month of October. Rainfall was less than half of normal and temperatures averaged 2-4 degrees above normal. No flooding was reported.

November 2010

Precipitation across the basin was slightly below normal during the month of November. There was little thunderstorm activity and temperatures were 1-2 degrees above normal. The one exception was a stalled cold front on the 12th which dumped 1-2 inches of rain along the I-44 corridor in Missouri. A few flash flood statements were issued, but no flooding was reported.

December 2010

December was exceptionally dry over the entire District. Rolla, MO recorded the most, with 1.56 inches of liquid precipitation. Temperatures were average for December. An outbreak of tornadoes occurred in central Missouri during the overnight hours of December 30th and into the morning hours of New Years Eve. Little precipitation came with the tornadoes.

January 2010

Precipitation ranged from slightly below normal in eastern Colorado to slightly above normal in eastern Kansas and western Missouri. Eastern Missouri and the Ozarks were abnormally dry. Temperatures were as much as 20 degrees below normal, and nearly all the precipitation came as snow. Ice jams were a problem along the Platte River in Nebraska.

February 2011

February was exceptionally cold and snowy over the Kansas City District. Strong winter storms dumped 18 inches of snow in central Missouri, and up to 34 inches in central and western Kansas. Temperatures averaged 3 degrees to 10 degrees below normal for the month. Ice jamming continued to be a problem in Nebraska. No river flooding was reported elsewhere.

March 2011

Early spring showers varied greatly across the District. Western parts of the basin received about 25% of normal precipitation. Rainfall in eastern parts of the basin was near-normal. Temperatures were also normal. Minor low-land flooding was reported at isolated locations across Missouri.

April 2011

Temperatures were 2-4 degrees above normal throughout the District. The first three weeks of the month saw normal precipitation patterns. Streamflow was near-normal for most of the District. A cold front stalled out across the southeast third of the basin from the 22nd to the 27th producing large amounts of precipitation. Rainfall amounts of 7-10 inches were not uncommon across south-central Missouri. Rivers rose above flood stage at many locations in central and south-central Missouri.

May 2011

May was a cool month, averaging about 2 degrees below normal. Rainfall amounts varied widely. Parts of central Kansas received up to 300% of normal rainfall while eastern Kansas and western Missouri only got 50% of normal. The Ozarks region had several severe weather episodes which resulted in numerous flood warnings. Flooding was light in Missouri. The Chariton River basin, in Iowa, received heavy rains during the last week of the month.

June 2011

More heavy rains were reported over the Chariton River basin in Iowa. Rainfall was also above-normal in western parts of the Kansas City District, although no flooding was reported. Rainfall was sparse across eastern sections of the District. Temperatures averaged 1-2 degrees above normal across the District.

July 2011

July will be remembered for the Excessive Heat Warnings. Many parts of the District recorded their hottest July on record, with multiple days above 100 degrees. Rainfall was average in eastern Colorado, and below average in the rest of the District. No flood warnings were issued.

PROJECT ACCOMPLISHMENTS.

Operating purposes at storage projects in the Kansas City District include flood control, irrigation, water supply, low flow and navigation supplementation, water quality, hydropower, recreation, and fish and wildlife. Project accomplishments in each of these functional areas, for the period covered by this report, are described briefly in the following subparagraphs.

Flood Control.

Stream flow regulation by storage projects in the Kansas City District began with the closure of Kanopolis Lake in February 1948. By July of that year, Kanopolis also provided the first flood control storage, benefiting downstream damage centers. Since then, stream flow regulation by District projects has produced flood reduction benefits estimated in the millions of dollars annually. In

addition to the Corps of Engineers lake projects, local protection projects in the form of levees,

**Table 1: Flood Reduction Benefits
(Thousand Dollars)**

Project	Fiscal Year 2011	Cumulative
Clinton Lake, KS	\$2.3	\$1,209,539.7
Harlan County Lake, NE	\$10,447.2	\$228,574.7
Harry S Truman Resv., MO	\$466.3	\$1,870,150.9
Hillsdale Lake, KS	\$75.6	\$33,409.5
Kanopolis Lake, KS	\$375.7	\$1,647,012.8
Little Blue River Lakes, MO	\$0	\$50,813.0
Long Branch Lake, MO	\$144.6	\$50,229.0
Melvorn Lake, KS	\$328.3	\$220,441.6
Milford Lake, KS	\$39,786.3	\$1,316,824.9
Perry Lake, KS	\$12,665.4	\$5,438,812.2
Pomme De Terre Lake, MO	\$90.5	\$69,169.6
Pomona Lake, KS	\$95.4	\$210,026.4
Rathbun Lake, IA	\$855.0	\$158,985.8
Smithville Lake, MO	\$3,358.8	\$970,223.6
Stockton Lake, MO	\$143.8	\$206,831.2
Tuttle Creek Lake, KS	\$133,886.2	\$6,553,329.5
Wilson Lake, KS	\$2,270.8	\$1,573,237.9
TOTALS	\$204,992.2	\$21,807,612.3

floodwalls, and channel improvements also have provided flood reduction benefits amounting to millions of dollars. Federal and private agricultural levees along with temporary storage of flood flows in the main stem reservoir system above Sioux City provide additional benefits within the District. During the reporting period, all of the District lakes stored water in the flood control pools. Flood reduction benefits during Fiscal Year (FY) 2011 credited to all Corps lake projects in the District were \$204,992,200. During the same period, benefits credited to Section 7 Bureau of Reclamation projects within the District totaled \$40,254,000. The accumulated total of flood control benefits for Bureau projects within the District totaled \$1,837,831,400. The upstream main-stem projects are responsible for additional flood damage reductions along the Missouri River within the Kansas City District reach. A compilation of flood reduction benefits at Corps Lakes in the District is shown in **Table 1** above. The majority of the period flood reduction benefits were incurred in the Kansas River basin during May and June, 2011.

Irrigation.

The 2010 crop yields on lands receiving project water in the Nebraska-Kansas Projects were lower than 2009. The average corn yield, the principal crop of all reporting districts, was 163 bushels per acre. This was approximately 35 bushels per acre less than in 2009. The start of irrigation releases from project reservoirs varied considerably but was generally later than normal due to abundant rainfall in June. Below normal rainfall was experienced during much of the growing season with a few exceptions. Temperatures were near normal during the season. Crop maturity progressed near normal during the growing season. Most irrigation districts had finished making irrigation releases by early September and all irrigation districts had finished delivering water by the end of September. Corn harvest generally commenced in late October and concluded in November. Only two canals did not divert water in 2010 as a result of short water supplies.

The State of Colorado makes Bonny Reservoir storage water available to Hale Ditch and other natural flow appropriators under short-term water service contracts. Most of the 700 acres served by Hale Ditch are now owned and operated by the Division of Wildlife. During the reporting period, the Colorado Water Commissioner did not direct that reservoir inflows from the South Fork of the Republican River and Landsman Creek be passed through Bonny Reservoir into Hale Ditch. Likewise, the Colorado Department of Natural Resources did not request storage releases for irrigation purposes into Hale Ditch. A total of 2,422 AF was released into Hale Ditch during 2010.

Municipal and Industrial Water Supply and Water Quality Control.

Three municipalities and one rural water district have executed water service contracts for full or supplemental water supplies from three Reclamation reservoirs. A contract with the city of Norton, Kansas, provides for a maximum annual usage of 1,600 AF from Keith Sebelius Lake (Norton Dam). A contract with Beloit, Kansas, provides for a maximum annual usage of 2,000 AF from Waconda Lake. Waconda Lake also provides up to 1,009 AF of water for a contract with the Mitchell County Rural Water District No. 2. Based on the current State of Kansas Certificate of Appropriation, water usage is not to exceed 737 AF per calendar year. A

contract with the City of Russell, Kansas, provides for a maximum annual usage of 2,000 AF from Cedar Bluff Reservoir.

During calendar year 2010, the City of Norton used 347 AF of storage from Keith Sebelius Lake for municipal purposes. Storage releases made from Waconda Lake for the city of Beloit totaled 0 AF, with 0 AF bypassed for downstream water quality control as directed by the State Water Commissioner. Releases of 714 AF were made to the Mitchell County Rural Water District No. 2 from Waconda Lake. No water was released from Cedar Bluff Reservoir during 2009 for the City of Russell. The State of Kansas took 20 AF of water for the fish hatchery downstream of Cedar Bluff Dam.

Twenty three water supply contracts exist between the Corps of Engineers and the State Agencies at 14 lakes, for lake storage space, annual withdrawals, or surplus water. Contracts exist with eleven other municipalities and rural water districts within Kansas, Missouri, and Iowa. The State of Kansas in turn contracts with a large number of municipalities and industrial sites to supply water from the State's contracted storage space through the water assurance and water marketing programs. To date, assurance districts have been formed for users along the lower Smoky Hill River, lower Kansas River and the State of Kansas portion of the Marais des Cygnes River.

Water is supplied within the limits of each contract through designated lake releases or from intakes located on the lake at the following projects: Kanopolis, Milford, Tuttle Creek, Perry, Clinton, Melvern, Pomona, Hillsdale, Smithville, Longview, Rathbun, Long Branch, Stockton, and Harry S Truman.

Recommendations for minimum stream flows to benefit stream sanitation and for the maintenance of desirable water quality standards were originally established by the U.S. Public Health Service for many river reaches below proposed dams in the District. These recommendations were then utilized to establish minimum release requirements for many of the District lake projects. The minimum release standards set by the Corps water control plans are usually less than the minimum desirable stream flows set by state water authorities. The latter are intended to satisfy water right holders and fish and wildlife flow standards. In some cases, specific water quality storage allocations were included in the project planning to increase the reliability of the minimum flow releases. Depending on the project, the minimum release quantities may be constant through the year, or they may vary seasonally or vary depending on the amount of current lake storage. Minimum releases for the purposes of downstream quality control and stream sanitation range from 3 cfs during the winter months at Hillsdale Lake to 100 cfs at Tuttle Creek Lake. Seepage is generally considered sufficient to meet minimum flow requirements downstream of the Reclamation dams. Additional releases are made from Tuttle Creek, Milford, and Perry Lakes for water quality and water supply purposes during periods of low flow on the Kansas River. Releases from any lake may be reduced below minimum requirements for brief periods due to construction, periodic inspections, or emergencies.

Navigation.

Releases from the Missouri River main stem reservoir system are designed to provide equitable service to navigation and other project purposes, while at the same time recognizing the important flood control functions of the system. Navigation on the Missouri is limited to the ice-free season, with a full season normally extending from April 1 to December 1 at the mouth. Operating experience plus numerous studies have indicated that flows of 35,000 cfs at Kansas City are the minimum that will permit navigation. Groundings can occur with flows of that magnitude, and dredging may be needed to alleviate local problems. Therefore, an additional flow of 6,000 cfs above the minimum service target has been set as the "full service" level for the navigation function. Thus, a full-service target flow of 41,000 cfs at Kansas City is considered adequate to maintain the designed 9-foot by 300-foot channel with little or no dredging. Milford, Tuttle Creek and Perry lakes are at times called upon to supplement Missouri River flows below Kansas City in order to meet the navigation requirement and to conserve water in the main stem lakes.

The Reservoir Control Center did not request supplemental releases for navigation support during this reporting period. The navigation season ended at the Kansas City reach on December 15, 2010.

Hydropower.

Hydropower is generated at two Kansas City District projects. Stockton Dam has one unit with a nameplate rated capacity of 45 megawatts (MW), and an overload generation rate of 52 MW. Harry S Truman Dam has six units with a total nameplate rated capacity of 160 MW, and an overload generation rate of 180 MW. The Southwestern Power Administration markets power from Stockton and Harry S Truman projects.

On February 5, 2009, the Stockton turbine experienced a catastrophic failure in the form of a broken blade. In September 2010, temporary repairs were completed and the unit was returned to service. Under a contract funded by ARRA, the Stockton power plant is receiving a total rehabilitation. Stockton's power operation continues to be restricted by downstream channel capacities that limit tailwater elevations to 777.0 feet above mean sea level (msl) and Highway "J" stages to a maximum reading of 17.5 feet. Generation by the Stockton plant during this report period totaled 53,389 megawatt hours (MWH).

Generation by the Harry S Truman plant totaled 256,732 MWH during the period of this report. Power generation releases at Harry S Truman are restricted to four units during the week and three units on weekends between Memorial Day and Labor Day by the Consensus Plan. During the period December 1 to March 1, five units may be operated during the weekdays (total time limited to 600 hours per year) and three units on weekends. The tailwater elevation measured at the Highway 7 Bridge in Warsaw is limited to 662.5 feet msl, Union Electric datum, during five-unit releases from the power pool. Flood control releases are made through the generation units as much as possible. When Truman pool level is above 710.0 feet msl, a minimum of one unit is operated continuously. The Consensus Plan for Truman was negotiated

and approved between the Corps, the State, and the Southwestern Power Administration, and became effective March 1990.

Fish and Wildlife.

Water level management plans, which include the fluctuation of pool levels at various times of the year for the enhancement of fish and migrating waterfowl, were in effect during the report period at the following Kansas City District lakes: Smithville, Clinton, Hillsdale, Kanopolis, Melvern, Wilson, Pomme de Terre, Perry, Pomona, Milford, Tuttle Creek, Rathbun, Stockton, and Long Branch. Truman Lake makes releases for the downstream spring fish spawn when water is available, in accordance with an agreement with Southwest Power Administration and the State of Missouri.

Recreation.

Recreational use of the Corps lakes is a highly visible and important function. Recreational use is enhanced when the lakes are operated close to their normal or multipurpose pool levels. During flood years when large quantities of water are stored in the flood pools and during drought years when the lake levels drop, then access to the lakes and the shoreline facilities, as well as the quality of the experience, is reduced. Park managers at the projects are also concerned about related factors such as facility maintenance and water quality. The fish and wildlife function is closely related to the recreation experience, and coordination with state and county park officials for park management is important. A list by projects of the visitation totals at Corps lakes is shown in **Table 2**. Park visitation was down 7% over the previous year. Project park facilities at Blue Springs, Hillsdale, Long Branch, Longview, and Smithville are leased to county or state agencies.

Table 2: Visitation Hours
August 1, 2010 through July 31, 2011

Project	Visitation (Visitor Hours)
Clinton Lake, KS	8,061,375
Harlan County Lake, NE	8,253,419
Harry S Truman Resv., MO	18,234,018
Hillsdale Lake, KS	1,192,382
Kanopolis Lake, KS	920,595
Long Branch Lake, MO	1,830,772
Longview/Blue Springs MO	3,873,221
Melvorn Lake, KS	5,729,331
Milford Lake, KS	8,973,330
Perry Lake, KS	5,966,230
Pomme de Terre Lake, MO	13,256,982
Pomona Lake, KS	3,818,932
Rathbun Lake, IA	5,286,294
Smithville Lake, MO	7,022,258
Stockton Lake, MO	7,874,721
Tuttle Creek Lake, KS	1,817,853
Wilson Lake, KS	2,430,874
TOTALS	104,542,587

PROJECT OPERATIONS.

Corps of Engineer Lakes - August 1, 2010 through July 31, 2011.

Pomme de Terre. In the autumn of 2010 Kansas City District lowered the Pomme De Terre pool to elevation 833.99 in preparation for replacement of the badly worn stilling basin. A temporary bulkhead was installed over the end of the outlet conduit and a 30-inch by-pass tube was hung from steel hangers. The pipe was placed into service on 25 October 2010 and a flow rate of 110 c.f.s. was established. No releases, other than the flow through the tube, were made until



Pomme De Terre – temporary bulkhead and by-pass pipe.

7 April 2011. On that date a maximum pool elevation of 855.94 was reached. The concrete was allowed to cure for one week, and a Phase II release of 3,500 c.f.s. was established on 11 April 2011. The Phase II release remained in effect until 31 May 2011. The multipurpose elevation of 839.0 feet was reached on 13 June 2011. A plot of the historic pool elevation is shown in Appendix A.

Missouri River. During the winter and spring of 2011 snowpack in the upper Missouri River basin accumulated to levels well above normal. The outlook was for higher than normal releases from upstream reservoirs including Gavins Point Dam. Intense rainfalls then fell over the upper basin in Montana and Wyoming causing extreme volumes of inflow into the mainstem reservoirs. Releases from the mainstem dams reached record levels during the summer of 2011. Gavins Point Dam reached a maximum release of 160,000 cubic feet per second (cfs) on 23 June

2011. This record rate of release was sustained through 29 July. Gavins Point releases were above 150,000 cfs for 65 days from 15 June 2011 to 18 August 2011.

These record releases from Gavins Point Dam led to high stages downstream on the lower Missouri River. The Missouri River at St. Joseph reached flood stage (17 ft.) on 12 May 2011 and reached a peak stage of 29.97 ft. on 28 June 2011. Provisional data from the USGS indicate that this stage corresponds to a flow of 277,000 cfs. Reservoir releases in the Kansas basin remained at low-flow from 19 June through 1 September 2011.

Flood Pool Storage. During the last 12-month period, prolonged flood-fighting lake regulation activities were required at Rathbun lake. A short-duration event occurred at Truman Lake in May and June. All of the District's 18 lakes stored at least a little water in their flood control pools. The maximum encroachment into exclusive flood control space was 13.73 feet above multipurpose level (13% of FCP) at Tuttle Creek Lake on 31 July 2011. All Corps lakes within the Kansas City District were regulated in accordance with normal procedures during the period covered by this report. Details regarding the regulation of all projects are included, along with pool elevation hydrographs, in Appendix A of this report.

Deviations.

In August 2010, a deviation from the Rathbun Reservoir water control manual was approved by Northwestern Division (NWD) to increase flood control releases to 3,000 cfs for the remainder of calendar year 2010. This was due to an exceptionally high pool level in the reservoir.

On March 24, 2011 a deviation from the Pomme de Terre lake water control manual was approved by NWD to continue limiting releases to allow for stilling basin construction until April 7, 2011 or until the pool elevation entered the Phase III zone (862.7 feet).

In April 2011, a deviation from the Truman Master Manual was approved by NWD to hold water at Truman Reservoir to assist with reducing Mississippi River stages. HST releases were restricted to a maximum of firm power from May 3rd to May 10th.

In early May 2011, a deviation from the Kansas River Basin Master Manual was requested from NWD to increase the Phase I criteria to 130,000 cfs at the Waverly control point on the Missouri River. The request was to maintain Tuttle Creek and Milford releases, and was requested due to anticipated high Gavins Point releases. The deviation was not used and rescinded at the end of the month due to even higher anticipated Gavins Point releases. On May 29th a deviation was approved through email to remove any Missouri River restrictions from any KCD projects. The deviation was necessary due to sustained high Gavins Point releases. The deviation was approved to allow releasing onto the leading edge of the Missouri River hydrograph without increasing any peak stages from the event.

On June 6, 2011 a deviation from the Waconda lake water control manual was approved by NWD to release 1,500 cfs so that major maintenance and repair of the spillway could be performed, while avoiding a potential spillway release.

In July 2011, a deviation from the Rathbun Reservoir water control manual was approved by NWD to increase the permitted seasonal release from 1,200 cfs to 1,500 cfs due to high pool

levels. The deviation also removed any restriction due to the Boonville gage on the Missouri River.

Bureau of Reclamation Projects – August 1, 2010 through July 31, 2011.

1. Conservation Operations. The 2010 inflow was above the dry-year forecast at all 11 of the project reservoirs. Enders and Lovewell Reservoirs had inflows between the dry- and normal-year forecasts. Bonny, Webster, and Cedar Bluff Reservoirs along with Swanson, Harry Strunk, Keith Sebelius, Waconda, and Harlan County Lakes had inflows between the normal- and wet-year forecasts. Kirwin Reservoir along with Hugh Butler Lake had inflows above the wet-year forecast. Half of the project reservoirs had below average carryover storage from the 2009 water year. Reservoir releases were made from Medicine Creek, Harlan County, Kirwin, Webster, and Glen Elder Dams to maintain or reduce reservoir levels prior to the 2010 irrigation season. Just prior to the irrigation season, Enders, Keith Sebelius, Swanson, and Hugh Butler Lakes, did not have sufficient storage to provide water users with a full water supply. Harry Strunk, Harlan County, and Waconda Lakes and Lovewell, Kirwin, and Webster Reservoirs had some flood storage occupied prior to the irrigation season. The irrigation demand months of July and August did little to reduce storage in those project reservoirs that had storage available for full irrigation as inflows maintained reservoir pools. Precipitation during June also helped in reducing the demands on project reservoirs. Reservoir storage was below normal at nine project reservoirs at the end of 2010.

2. Flood Control Operations. Harry Strunk, Harlan County, Waconda Lakes, Lovewell, Kirwin, and Webster Reservoirs utilized flood pool storage and made flood releases in 2010. The water year 2010 flood damages prevented by the operation of Reclamation's Nebraska-Kansas Projects facilities was \$42,127,300 as determined by the Corps of Engineers. An additional benefit of \$27,035,400 was credited to Harlan County Lake.

The regulation of flood control storage in Reclamation reservoirs in the Kansas River basin is the responsibility of the Kansas City District Water Management Section. When project inflows are sufficient to produce an encroachment into the flood pool, coordination is immediate between the two Federal agencies, and decisions are made regarding the regulation desired. Water Management staff issues regulation orders to the Reclamation's Water Operations Group at the McCook Field Office in Nebraska. The McCook Field Office is responsible for issuing orders for both flood control and conservation releases to the Reservoir Superintendent.

Operations – August 1, 2011.

Corps and Reclamation storage lakes in the District contained a total of 6,408,803 AF of storage on August 1, 2011. Of the total volume in storage, 754,655 AF (12 percent) were contained in the Reclamation lakes and 5,654,148 AF (88 percent) were contained in the Corps projects.

Nine of eighteen Corps lakes and two of the eleven Reclamation lakes in the District contained storage in their flood control pools on August 1, 2011. The occupied flood control storage amounted to 638,501 AF. This volume compares to 1,331,449 AF of flood control storage space occupied on August 1, 2010.

New record low pool levels were established for Pomme de Terre and Hugh Butler Lakes.

MAJOR REGULATION PROBLEMS AND PROPOSED SOLUTIONS.

Water Level Management Plans

Paragraph 8-5 of the Osage River Basin Master Manual, Volume 1, December 1968, reads as follows: “Fish and Wildlife. Control and manipulation of water levels, both in the multipurpose pool and in the lower 2 or 3 feet of the flood pool, can be very beneficial to fish and wildlife when properly timed and executed. The level of the reservoir, degree of fluctuation, and timing of these conditions will have an extremely important effect on fish spawning. The possibility of achieving some control of production of rough fish species is also a factor favoring close control and manipulation of water levels.”

In February 2008 this paragraph was reviewed by Kansas City District counsel and the Reservoir Control Center. A consensus was reached with the following conclusions:

- a. Paragraph 8-5 applies to each Corps of Engineers reservoir in the Osage basin, and
- b. Paragraph 8-5 gives the Kansas City District Hydraulic Engineering Branch the authority to approve Water Level Management Plans.

District Council has determined that it is no longer necessary to seek deviations for Water Level Management Plans at Kanopolis, Long Branch, Perry, Pomona, Stockton, Tuttle Creek, Wilson, or Truman reservoirs. The Chief of the Hydraulic Engineering Branch now has the authority to approve Water Level Management Plans at these lakes. Public hearings are now planned to change the language in the Reservoir Regulation Manuals for Clinton, Hillsdale, Melvern, Milford, Pomme de Terre, Rathbun, Smithville, Keith Sebelius, Kirwin, Lovewell, Waconda, and Webster reservoirs.

Endangered Species Act.

Releases at Milford and Tuttle Creek Lakes are typically affected each summer by special operations required by the Endangered Species Act (ESA). Two listed bird species, the Piping Plover and the Least Tern, were first reported nesting on sandbars in the Kansas River during the mid-1990's. These birds have also affected operations along the Missouri River upstream of Omaha since they were first listed under ESA in 1985. The Terns and Plovers nesting season typically lasts from May through August. During that period, the Corps monitors the bird nests and when possible restricts releases from upstream lakes to protect them to the extent practical

from local uncontrolled runoff. The lakes can only control a portion of the basin runoff from spring and summer storms, and many times the runoff from storms closer to the nests are sufficient to destroy them. Since the major nesting areas to date have been in the Manhattan to Topeka reach of the river, these operations have mainly affected Milford and Tuttle Creek Lakes. In previous years, as much as 17 percent of the flood pool at Tuttle Creek Lake has been forced into storage by ESA concerns.

In accordance with a U.S. Fish and Wildlife Service Missouri River Biological Opinion, the District has developed a plan of operation to monitor the nesting areas and coordinate lake releases. However, in 2011, least tern and piping plover surveys were not conducted in late May and early June due to high river stages. All four reaches of the Kansas River were surveyed during late June and early July. No least terns or piping plovers were observed during any of the nest surveys. There was no requirement for deviation from the reservoir regulation manuals to satisfy ESA considerations.

WATER CONTROL MANUALS.

Manual Status.

This section serves to provide the information requested in paragraph 13c of ER 1110-2-240, dated October 8, 1982, regarding the status of water control manuals.

Water control plans prepared for specific projects and basins within the Kansas City District have been documented in appropriate manuals as directed by paragraph 6c of the above referenced ER. Paragraph 6c also directs that water control plans be revised as necessary to conform with changing requirements resulting from developments in the basin, improvements in technology, new legislation, or other relevant factors, provided such revisions comply with existing Federal regulations and established Corps of Engineers policy.

No water control manuals were submitted to Division for approval during the current reporting period. The schedule and status of manuals for all projects is shown on **Table 3**.

Table 3: Project Manual Status and Revision Schedule

Reservoir/Lake	Stream/River	Owner	Report Status	Submission Schedule
Nebraska				
Master Manual	Republican	CE	Updated final submitted to NWD for review July 28, 1977	
Harlan County	Republican	CE	Revision approved by NWD May 10, 2001	
Harry Strunk	Medicine Creek	BR	Approved by NWD July 12, 1974	
Enders	Frenchman Creek	BR	Approved by NWD March 26, 1973	
Swanson	Republican	BR	Flood Control Plan approved by HQUSACE October 6, 1969	
Hugh Butler	Red Willow Creek	BR	Flood Control Plan approved by HQUSACE November 21, 1969	
Colorado				
Bonny	S. Fork Republican	BR	Approved by HQUSACE October 6, 1969	
Kansas				
Lovewell	White Rock Creek	BR	Approved by HQUSACE April 9, 1969 subject to comments	
Milford	Republican	CE	Approved December 1984. Minor revision approved Jan 1995	
Norton	Prairie Dog Creek	BR	Approved August 28, 1974	
Master Manual	Smoky Hill	CE	Approved March 28, 1975	
Kanopolis	Smoky Hill	CE	Revision submitted to NWD October 30, 1984	
Cedar Bluff	Smoky Hill	BR	Approved by NWD September 25, 1975	
Kirwin	N. Fork Solomon	BR	Approved by NWD February 6, 1974	
Webster	S. Fork Solomon	BR	Approved by NWD July 16, 1975	
Wilson	Saline	CE	Revision submitted to NWD June 13, 1997	
Waconda	Solomon River	BR	Approved by NWD July 12, 1972	
Master Manual	Kansas	CE	Approved by HQUSACE March 22, 1967 subject to comments	
Tuttle Creek	Big Blue	CE	Approved April 16, 1974. Minor revision approved January 1995	
Perry	Delaware	CE	Approved July 1973. Minor revision approved January 1995	
Clinton	Wakarusa	CE	Approved February 12, 1980	
Master Manual	Osage River	CE	Approved by HQUSACE Sep 21, 1970 subject to comments	
Pomona	110 Mile Creek	CE	Approved February 1973	
Melvern	Marais Des Cygnes	CE	Approved June 27, 1985	
Hillsdale	Big Bull Creek	CE	Submitted to CENWD-PDM for approval on May 20, 2005.	
Missouri				
Pomme De Terre	Pomme De Terre	CE	Submitted to CENWD-PDM for final approval on Sep 11, 2006.	
Harry S Truman	Osage	CE	Interim manual approved by NWD May 12, 1981. Minor revision approved April 1996	
Hillsdale	Big Bull Creek	CE	Submitted to CENWD-PDM for final approval on Sep 11, 2006.	
Stockton	Sac	CE	Approved August 21, 1975	
Smithville	Little Platte	CE	Approved August 12, 1979	
Long Branch	E. Fk Lt. Chariton	CE	Interim manual approved November 21, 1978	
Longview	Little Blue	CE	Approved February 15, 1994	
Blue Springs	E. Fork Little Blue	CE	Approved January 27, 1994, minor revisions submitted Dec 1994	
Iowa				
Rathbun	Chariton	CE	Submitted to CENWD-PDM for final approval on Apr 20, 2006	

Other Reports

Plates 2A-E list project data showing the date impoundment of storage began, the date the multipurpose pool (the active conservation pool in USBR projects) first filled, and the current status of Standing Instructions for Regulation of Storage in Corps of Engineers Lakes.

As indicated in Engineering Manual 1110-2-3600, it is essential that project operators (dam tenders, operations managers, power plant superintendents) at the various flood control and multiple-purpose reservoirs be supplied with regulation schedules to be followed in case of communication failure. These regulation schedules should be followed in case of communication failure with the headquarters from which instructions are normally issued during flood situations. Standing Instructions have not yet been issued for Harry S Truman Reservoir, Clinton, Hillsdale, Long Branch, Smithville, Longview, and Blue Springs Lakes.

HYDROLOGIC DATA COLLECTION.

The primary objectives of Kansas City District's hydrologic data program is to provide information on precipitation and stream flow characteristics occurring over and within a particular area for a given period of time. These data are used for many purposes, including the design, construction, and maintenance of a wide variety of structures in and along streams; the management of lake releases during floods; the production of hydropower; the design and maintenance of navigation facilities; the control of pollution; the management of flood plains; the development of recreational facilities; the design of highway bridges and culverts; the establishing and administering of water rights and compacts; and the resolving of political, social, and legal water problems. As with any program, however, the restraint on funds and manpower, and the usefulness of the data obtained will determine to what extent the program will, or should, be pursued at any particular point in time. The overall program of observing, monitoring, and collecting hydrologic and meteorological data in the District is quite extensive yet flexible to meet operational and economic needs. Brief descriptions of the various types of data collection now being utilized are presented in the following paragraphs.

Collection and Processing of Water Control Data.

Hydrologic data such as precipitation, stream flow, and lake information are collected in the Kansas City District by: individual observers, Corps project offices, the National Weather Service, the Geological Survey, the Bureau of Reclamation, and certain state agencies. Several different methods of communication are used in the Kansas City District to receive this data including: electronic transfer, e-mail, and telephone. The electronic transfer of data includes both FTP and SFTP between agency computers and data transmitted through a satellite downlink and a Local Readout Ground Station (LRGS). Data received by the District is entered onto the Water Management Section's Corps Water Management System (CWMS) by both automated and manual methods, depending on the data source. CWMS and Software developed by Water Management Section staff provides a means to view, screen, and process the data for graphical and reporting purposes. The data is then uploaded to the MSC CWMS in Omaha. Daily data and project reports are also available to the public at the Section's web site, <http://www.nwk.usace.army.mil/watermanagement/>.

The Water Management Section is using a Unix/Linux system. Hardware is available in Omaha for a backup server if needed.

Automatic Remote Sensors.

Data Collection Platforms (DCP's) are the primary means by which Kansas City District obtains remote sensing data on stream stages and lake elevations. The DCP is a sophisticated device that collects the information from a stage/elevation sensor and transmits the data to a GOES satellite for subsequent retrieval by the National Environmental Satellite, Data, and Information Service (NESDIS) at Wallops Island, Virginia. NESDIS then rebroadcasts all data over a single high-speed channel on a Domestic Communications Satellite (DOMSAT). The Water Management Section receives DCP data from NESDIS or directly from the DCP's with a DOMSAT receiver station. Maintenance of the DCP's is performed by the USGS under contract with the Corps of Engineers. For Fiscal Year 2012, the District will support 86 permanent DCP's, a 9% cut from the previous year. A breakdown of the total number of DCP's, by states, shows 39 units in Missouri, 33 in Kansas, 8 in Nebraska, and 6 in Iowa.

Cooperative Streamgaging Programs.

Constraints on funds and manpower do not allow the Corps to administer an independent data collection program that satisfies all of its needs. Therefore, assistance is sought from other cooperating agencies. A nationwide program of data collection at selected stream gauging stations has been administered for a number of years by the U.S. Geological Survey (USGS). A similar network of reporting stations has been operated by the National Weather Service (NWS) for their river forecasting services. Arrangements have also been made with the USGS through which they supplement their network of reporting stations, or increase the frequency of reports, to better satisfy Corps needs. The program, designated the "Cooperative Hydrologic Reporting Network," is administered by the USGS and supported by funds transferred from the Corps and by National Streamflow Information Program (NSIP) funds. Arrangements for the services provided are made with USGS data chiefs in each state and submitted annually to the Chief of Engineers, through the Division Commander and the Hydraulic Engineering Center, for review and approval. A summary of funds expended for data collection purposes during the report period is included in the Personnel and Funding section at the end of this report.

Water Quality Investigations and Monitoring Activities.

Lake Projects - All 18 District reservoirs were sampled from April through September for nutrients, pesticides, metals, chlorophyll a and in-situ water column profiles. Sampling season had little influence from flood and runoff events. Environmental staff and Lake Project personnel worked to complete all monthly sampling with one missed sample month at Rathbun Lake. Record floods in the Dakotas and northern states in the Missouri River watershed produced record Missouri River releases from Gavins Point Dam through the most of the summer of 2011. A hot dry summer resulted in minimal inflow in most lakes and downstream releases were reduced or negligible to minimize downstream flooding in the Missouri River. These environmental variables and reduced flow through the lakes resulted in stagnant conditions and reduced water quality compared to typical years. Swim beaches and blue green algae blooms are sampled by district staff, state health departments, and/or contract labs for E. coli bacteria, and harmful algae populations/toxins for public safety alerts/closures. Significant bluegreen algal blooms occurred at Perry and Milford Lakes resulting in a public health warning

with some or all beaches closed and full body contact with water prohibited. Moderate algal blooms occurred at Hillsdale and Clinton Lakes resulting in public health advisories discouraging contact with lake water for people and pets. District swim beaches at Rathbun Lake were closed for a short duration due to high bacteria counts. Beaches at Truman, Rathbun, and Milford were closed due to high water levels and public safety concerns. Zebra mussel surveys were completed at nine un-infested NWK lakes. Three seasons of samples at Pomme de Terre Lake failed to produce zebra mussel veligers analyzed by two independent labs. As a result, Pomme de Terre was removed from the infested list. Smithville Lake had adult zebra mussels discovered in a marina cove and a treatment was attempted in 2010. Recent samples have not indicated reproducing populations in Smithville. New populations were discovered at Melvern Lake by Kansas Division of Wildlife and Parks. This population will eventually flow downstream to Truman Lake in Missouri via the Osage River. District lakes with documented populations of zebra mussels include Perry, Wilson, Milford, Rathbun, and Melvern Lakes. The WQ Program continues to participate with watershed groups for the following lakes: Kanopolis (Smoky Hill), Clinton (Upper Wakarusa), Tuttle Creek, Perry (Delaware River), Pomona, Melvern, Milford, Hillsdale, and Rathbun (Chariton).

Missouri River - NWK staff sampled 7 Missouri River mainstem sites and 11 Missouri River tributary sites in support of the Missouri River Recovery Program (MRRP) in 2011. In conjunction with samples collected by NWO staff, this data will be used to facilitate the application of a CEQUAL-W2 hydrodynamic and water quality model on the lower Missouri River. This sampling was completed on a monthly basis. High water and flooding conditions provided challenges to the sampling in 2011. Many boat ramps were unusable so crews were forced to launch from unique places. Additionally, given the out-of-bank flows some of the data collected in 2011 will not be used for the model, but will provide a unique opportunity to better understand water quality parameters during a flood of this type. Samples collected in the past have been taken from flood waters that were the result of high flows from tributaries. Conversely, the origin of the floodwaters in 2011 was derived from releases from mainstem reservoirs. This provided the unique opportunity to compare and contrast the differences in water quality parameters during two different types of high water events. In addition to sampling mainstem and tributary sites in 2011, the high water event provided opportunities to better understand the chemical and biological responses that take place on the floodplain during these types of events. Samples (water quality, zooplankton, phytoplankton, etc.) were collected from Dalbey Bottoms (Corps mitigation site), Overton Bottoms (Corps mitigation site), and Baltimore Bend (US Fish and Wildlife Service – Big Muddy Refuge System) twice a month while the river was at flood stage (June through September). These sites were also sampled by Habitat Assessment and Monitoring Program (HAMP) and Pallid Sturgeon Population Assessment Program (PSPAP) crews as well. Information gained from these efforts will ultimately help the Corps design, build, and adaptively manage USACE projects as we better understand the physical, chemical, and biological responses to floodplain inundation and lateral connectivity. In 2011, Corps staff continued to monitor for estrogen compounds in the Missouri River. Again, the flooding added challenges to this sampling but it should provide insight as to the presence of these compounds in the system during these types of events.

Sediment Observations.

Hydrographic surveys of all 18 District lakes have been completed. Area-Capacity tables will be available in 2012.

Three outlet channels were inspected during the report period:

Tuttle Creek Lake - Periodic General Inspection #10A was conducted 6-7 October 2010. The outlet channel was walked and visually inspected from the outlet works to the rocky Ford Recreation Area. The riprap is generally in good repair. In the unprotected portion of the outlet channel, bank sloughing and erosion is still a concern after the high release in 1993. Surveyed records of this area show the bank eroded from approximately 4 to 20 feet during the 1993 event. The bank loss has continued adjacent to the public parking fence. Head cutting in the Wolf Creek channel and deposition of this material in the outlet channel continues to occur. At the confluence of the outlet channel to the natural channel, minor bank cutting and erosion is visible along the left bank. At Range A, the bed has degraded approximately 14 feet since 1961, but appears to have stabilized. At Range B the bank has widened 2 feet, but also appears to have stabilized. Likewise, Ranges C-G appear to be stable. The outlet channel is hydrologically adequate and is operating as designed.



Rocky Ford Dam.

Rathbun Lake - Periodic General Inspection #13A was conducted 21-23 March 2011. The outlet channel was walked and visually inspected from the stilling basin to the confluence with the Rural Water District Intake Structure. During the 2010 high water event, a maximum release of

3,000 c.f.s. was released for 64 consecutive days. After the event, the grouted riprap nearest the stilling basin walls was replaced with a concrete apron. During to the 2010 event, most of the surveyed cross sections experienced a widening and lateral movement. At Range D, the left bank has widened 25 feet since 2006. Other Ranges have less dramatic widening. The 2010 event did not result in any bed degradation. In general, there has been minimal change to the thalweg and channel bed since 1972. Hydraulic adequacy may be impacted, to a small degree, due to several trees and root balls in the channel. The outlet and river channels should continue to function as designed.

Milford Lake – Periodic General Inspection #13 was conducted on 4-5 May 2011. There have been no Phase II releases (greater than 15,000 cfs) since the last periodic inspection, and the outlet channel and river appear to be in excellent condition. No significant streambed changes have occurred since the 2005 survey.



Milford Outlet Channel.

Through an interagency cooperative agreement with the USGS, the District collects point, depth integrated, and bed sediment samples at five Missouri River stations and two inflow points to Truman Lake. The Missouri River data at St. Joseph, Kansas City, and Boonville include point velocities. Laboratory analyses are performed at the USGS facility at Rolla, Missouri, and the results are stored in their database. The USGS publishes the suspended sediment load data for the Schell City and Clinton stations.

RESEARCH AND STUDIES.

Kanopolis Release Rates - Kanopolis Lake provides minimum releases to support the downstream water quality requirements for sanitary purposes at Salina, Kansas, based on a 1949 U.S. Public Health Service study. The State of Kansas believes that the lake's beneficial purposes would be better served by reducing the monthly releases from the Kanopolis project. The Kansas Water Office proposed a reduced table of Kanopolis release rates, and the Water Management section created a Kanopolis operation model to evaluate the affect of the reduced releases on the pool elevation.

The report was complete on January 28, 2011 with the conclusion that a reduced release would improve the Kanopolis Lake beneficial purposes during periods of drought. The report further concluded that flood control benefits would not be adversely affected. The State of Kansas needs to perform additional analysis to insure that downstream water quality does not become a concern with the reduced Kanopolis Lake releases.

Lake Bathymetry Reports - In 2009 and 2010, the District contracted with Eisenbraun and Associates to complete total lake bathymetric surveys of 11 District lake projects. The surveys were conducted with single side band sonar using GPS horizontal control. Eisenbraun then used a CADD methodology to evaluate areas and capacities for the multipurpose pools at eight of the lakes in Missouri, Iowa, and Nebraska. Kansas Biological Survey used a similar field methodology in 2007-09 to complete bathymetric surveys of six additional lake projects in Kansas. Their data files were submitted to NWK as part of the State's contribution to the Kansas River PAS studies. For the nine Kansas lakes within NWK, the District contracted with Surdex Corporation to combine the bathymetric data from KBS and Eisenbraun with LiDAR and DEM data to develop complete area and capacity tables to the top of the dam using GIS methods. Water Management has compiled the Surdex results into tables and background reports, and the review of those reports should be finalized in FY 12. Water Management will then begin using the revised area and capacity tables for the nine Kansas lakes operationally. Only Long Branch Lake was not included in the recent bathymetric surveys.

One of the primary purposes for the bathymetric surveys was to evaluate sedimentation trends. Most lakes have not had a sediment survey since the early 1990's, and in some cases even earlier. For the Kansas lakes, the results indicate that sedimentation trends are in line with previous projections. Sedimentation is not a near term concern at any lake with water supply contracts. The results for the Missouri, Iowa, and Nebraska lakes have not yet been compiled.

TRAINING AND METHODS.

Training of Water Management Section staff progresses as time and scheduling permit. Technical abilities are enhanced as individuals continue to pursue courses on their own initiative. During the period of this report, Section employees participated in the training courses listed in **Table 4**. All staff members attended in-house training of Personally Identifiable Information, Combat Trafficking in Persons (CTIP), ACE-IT IA, Violence in the Workplace, Suicide Prevention for DA Civilians, TARP, SAEDA & OPSEC Training, Sexual Harassment Sexual Response and Prevention (SHARP), and Individual Development Plan Status.

Table 4: Staff Training

Employee	Course or Training
#1	None
#2	None
#3	ResSim
#4	CWMS Modeling for Water Mgmt
#5	None
#6	None
#7	None
#8	Water and Watershed
#9	CWMS Modeling for Water Mgmt

PERSONNEL AND FUNDING.

Personnel.

Authorized positions of the Water Management Section at the close of the fiscal year (September 30, 2011) consisted of one Supervisory Hydraulic Engineer, four Hydraulic Engineers, and four Hydrologic Technicians. At the end of this reporting period, the Section had no vacant positions. A listing of personnel in the Section at the end of the report period by name and title is shown in **Table 5**.

Table 5: Water Management Section Personnel

Employee	Grade
(1)	GS-13
(2)	GS-12
(4)	GS-11
(4)	GS-8
(4)	GS-11
(4)	GS-11
(2)	GS-12
(2)	GS-12
(2)	GS-12
Job Title	
(1)	Supervisory Hydraulic Engineer
(2)	Hydraulic Engineer
(3)	Hydrologist
(4)	Hydrologic Technician

Funding.

Activities of the Water Management Section are funded from the following sources:

Planning

Part of the funds appropriated for survey reports, flood plain information studies, and project planning studies are assigned to the Water Management Section for special studies if water control is included in connection with the planning and design.

Operations and Maintenance

Operation of the existing lakes and reservoirs in the Kansas City District requires stream flow forecasting, water control planning, stream gauging, and other related activities for each authorized function at Corps of Engineers projects, and for the flood control function at Bureau of Reclamation projects. Operation and maintenance funds are used for these purposes.

Technical Services and Flood Emergency

Technical services provided to non-Federal interests, flood emergency operations, post flood reports, and the annual flood report are tasks assigned to the Water Management Section. These activities vary from year to year. Special accounts are provided for these services. Individuals in the Section may also receive special funding from other sources when they participate as a technical resource on Project Development Teams.

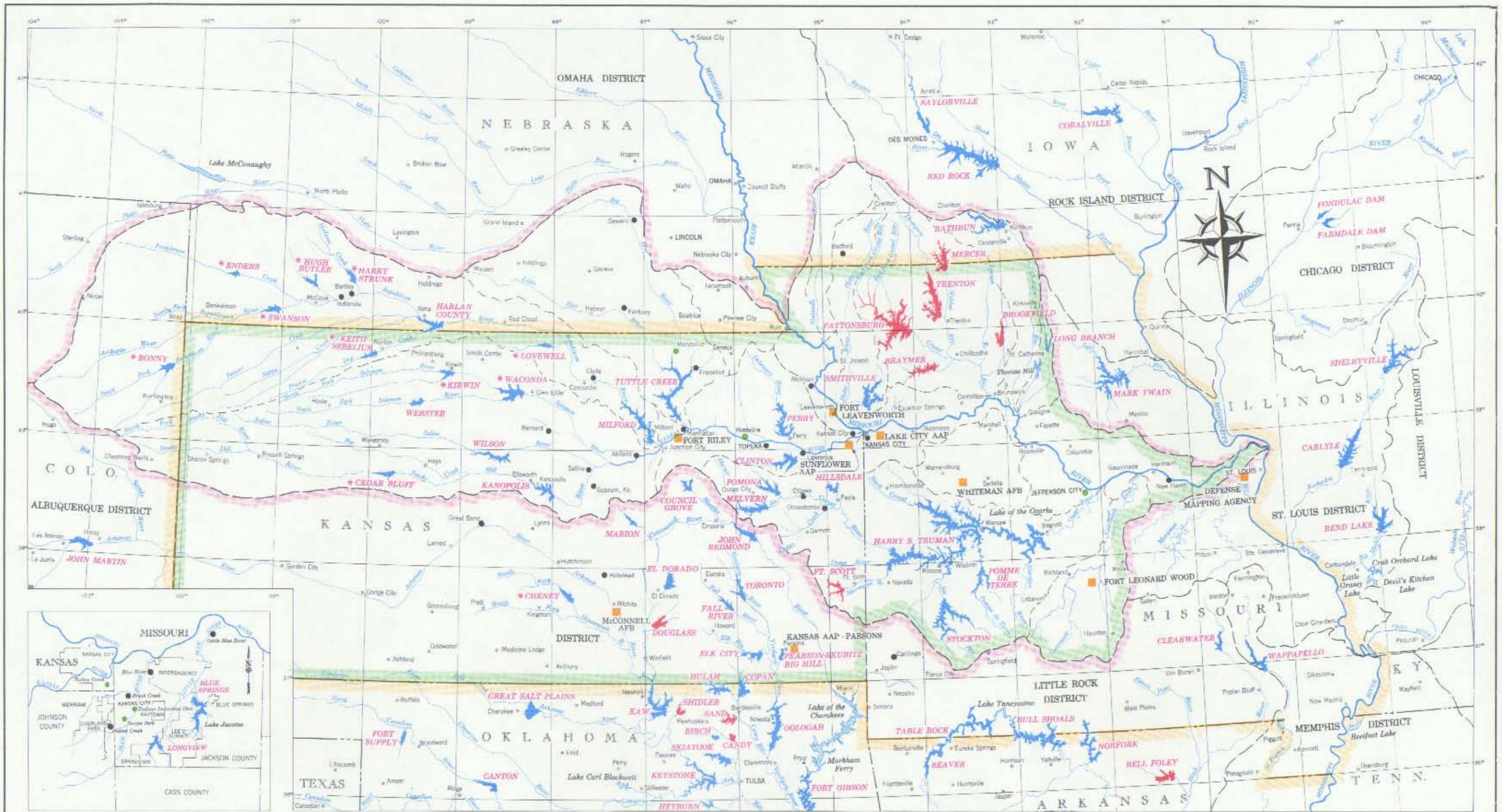
Data Collection Programs

The Cooperative Stream Gauging Program with the four U.S. Geological Survey districts (Kansas, Nebraska, Iowa, and Missouri) includes 86 stations. Kansas City District funding for this program during FY 2012 is \$1,096,138, an 11% drop from the FY 2011 program.

Fiscal year expenses for data collected in FY 2010 and FY 2011, and the programmed expenses for FY 2012 are shown in *Table 6* below.

Table 6: Data Collection Expenditures

Program	FY 2010	FY 2011	FY 2012
U.S.G.S	\$1,227,720	\$1,229,235	\$1,096,138
Independent Stations	\$0	\$0	\$0
TOTAL	\$1,227,720	\$1,229,235	\$1,096,138



SCALE IN MILES

LEGEND

LAKES	LOCAL PROTECTION
COMPLETED	COMPLETED OR UNDER CONSTRUCTION
UNDER CONSTRUCTION	AUTHORIZED
PLANNING	PLANNING
AUTHORIZED	MILITARY BASE
RECOMMENDED	
BUREAU OF RECLAMATION PROJECTS	
OTHERS OF NOTE	

SCALE IN MILES

BOUNDARIES

KANSAS CITY DISTRICT (CIVIL)	
KANSAS CITY DISTRICT (MILITARY)	
KANSAS CITY DISTRICT (REGULATORY)	
OTHER DISTRICTS	

DEPARTMENT OF THE ARMY
 KANSAS CITY DISTRICT
 CORPS OF ENGINEERS
 FEBRUARY 1994
 FILE NO. K-1-734
 PLATE 1

SUBJECT	MELVERN LAKE	POMONA LAKE	HILLSDALE LAKE	STOCKTON LAKE	POMME DE TERRE LAKE	HARRY S. TRUMAN RESERVOIR	REMARKS
GENERAL Location of Dam Stream / River Miles above Mouth Contributing Drainage Area, square miles Approximate Length of Full Reservoir, miles Shoreline, miles (1) Maximum Discharge of Record nr Dam Site Date of Closure Date Storage Began Date Multipurpose Level Reached Operating Agency	Near Melvern, KS Marais des Cygnes River 175.4 349 22 101 68,500 cfs (July 11, 1951) October 2, 1970 August 1, 1972 April 4, 1975 Corps of Engineers	Near Pomona, KS 110 Mile Creek 8.3 322 12 52 38,600 cfs (July 11, 1951) July 19, 1962 October 18, 1963 June 5, 1965 Corps of Engineers	Near Paola, KS Big Bull Creek 18.2 144 15 51 45,200 cfs (July 11, 1951) June 15, 1980 September 19, 1981 February 23, 1985 Corps of Engineers	Near Stockton, MO Sac River 51.4 1,160 24 298 120,000 cfs (May 19, 1943) September 23, 1968 December 12, 1969 December 18, 1971 Corps of Engineers	Near Hermitage MO Pomme de Terre River 45.6 611 28 113 70,000 cfs (Aug 8, 1927) June 28, 1960 October 29, 1961 June 15, 1963 Corps of Engineers	Near Warsaw, MO Osage River 175.1 8,914 (4) 122 958 259,000 cfs (May 17, 1943) July 21, 1977 February 7, 1979 November 29, 1979 Corps of Engineers	(1) With pool at multipurpose level. (2) Damming height is from the original riverbed to the top of the flood control pool. (3) Based on latest available storage data. The revision dates of the current area - capacity tables are indicated below with the effective dates in parentheses: Melvern, February 1986 (effective March 1, 1986) Pomona, March 1990 (effective April 1, 1990) Hillsdale, 1969 (initial) Stockton, February 1988 (effective May 1, 1988) Pomme de Terre, February 1985 (effective Mar 85) Harry S. Truman, April 1993 (effective Mar 94) (4) The total drainage area above Truman Dam is 11,500 square miles. The indicated total is the local drainage area below the upstream dams. (5) In 1994, 1000 AF of flood control storage at Truman Reservoir was reallocated to water supply. The top of the multipurpose pool was adjusted from 706.0 to 706.018
DAM AND EMBANKMENT Top of Dam Elevation, feet msl Length of Dam, feet (net) Damming Height, feet (2) Type of Fill Fill Quantity, cubic yards	1,078.0 9,650 105 Earth 9,100,000	1,031.0 7,750 83 Earth 5,200,000	952.2 8,700 plus 3,300 dike 79 Earth 6,964,000	911.0 for concrete section 912.0 for embankment 5,100 plus 5,600 dike 132 Rock Shell 7,100,000	906.0 4,630 plus 2,790 dike 124 Earth 5,800,000	756.0 5,000 plus 7,500 dike 105 Earth 8,500,000	
SPILLWAY Location Crest Elevation, feet msl Width, Feet Number, Size, and Type of Gates Discharge Capacity, Top of Surge Pool	Left Abutment 1,057.0 200 None 36,000 cfs	Right Abutment 1,006.0 200 None 50,300 cfs	Right Abutment 935.0 50 None 4,750 cfs	Left Abutment 861.5 160 4 - 40'x30.5' Tainter 182,500 cfs	Right Abutment 874.0 170 None 73,000 cfs	Center of Dam 692.3 160 4 - 40'x47.3' Tainter 284,000 cfs	
RESERVOIR (3) Surcharge Pool Elevation and Area Flood Control Pool Elevation and Area Multipurpose Pool Elevation and Area Surcharge Storage, AF Flood Control Storage, AF Multipurpose Storage, AF Gross Storage, AF Design Sediment Reserve Storage Measured Sediment Inflow	1,073.0 ft msl 22,673 ac 1,057.0 ft msl 13,935 ac 1,036.0 ft msl 6,912 ac 1,073.0 - 1,057.0 289,410 1,057.0 - 1,036.0 208,207 1,036.0 - 965.0 152,051 1,057.0 - 965.0 360,258 26,000 AF for 100 years 4,064 AF (1972 to 1985)	1,025.4 ft msl 14,584 ac 1,003.0 ft msl 8,522 ac 974.0 ft msl 3,865 ac 1,025.4 - 1,003.0 255,327 1,003.0 - 974.0 176,123 974.0 - 930.0 64,208 1,003.0 - 930.0 240,331 28,000 AF for 100 years 7,045 AF (1963 to 1989)	948.0 ft msl 10,983 ac 931.0 ft msl 7,413 ac 917.0 ft msl 4,575 ac 948.0 - 931.0 155,799 931.0 - 917.0 83,570 917.0 - 852.5 76,270 931.0 - 852.5 159,840 11,000 AF for 100 years 1,928 AF (1981 to 1993)	906.2 ft msl 48,053 ac 892.0 ft msl 38,281 ac 867.0 ft msl 24,632 ac 906.2 - 892.0 608,708 892.0 - 867.0 776,066 867.0 - 765.0 874,887 892.0 - 765.0 1,650,953 25,000 AF for 100 years 8,953 AF (1969 to 1987)	900.2 ft msl 25,456 ac 874.0 ft msl 15,999 ac 839.0 ft msl 7,790 ac 900.2 - 874.0 535,724 874.0 - 839.0 406,821 839.0 - 750.0 237,356 874.0 - 750.0 644,177 13,000 AF for 50 years 4,358 AF (1961 to 1974)	751.1 ft msl 295,870 ac 739.6 ft msl 209,048 ac 706.02 ft msl (5) 55,406 ac 751.1 - 739.6 2,910,768 739.6 - 706.02 4,005,392 706.02 - 631.0 1,181,640 739.6 - 631.0 5,187,032 244,000 AF for 100 years 22,321 AF (1979 to 1992)	TOTALS 417,619 ac 293,198 ac 103,180 ac 4,755,736 AF 5,656,179 AF 2,586,412 AF 8,242,591 AF
OUTLET WORKS Location River Outlet Type Number and Size of Conduit Length of Conduit, feet Entrance Invert Elevation Discharge Capacity, Top of Surge Pool Discharge Cap, Top of Flood Control Pool Discharge Cap, Top of Multipurpose Pool Service Gates, Number and Size Emergency Gates, Number and Size Low Flow Gates, Number and Size Provision for Power	Right Abutment Gated Horseshoe Conduit 1 - 11.5' 754 962.0 ft msl 6,700 cfs 6,235 cfs 5,520 cfs 2 - 6'x12' 2 - 6'x12' 2 - 2'x2' None	Right Abutment Gated Horseshoe Conduit 1 - 13.5' 720.5 925.0 ft msl 9,200 cfs 8,170 cfs 6,400 cfs 2 - 6.5'x14' 2 - 6.5'x14' 2 - 2'x2' None	Left Abutment Gated Oblong Conduit 1 - 15.92'x11.67' 685 868.0 ft msl 8,200 cfs 7,400 cfs 6,150 cfs 2 - 5.33'x15.92' 1 - 5.33'x15.92' 2 - 2'x2' None	None 2 - 24" dia 3 - 20'x40'	Right Abutment Gated Tunnel 1 - 14' 560 750.0 ft msl 12,750 cfs 11,500 cfs 9,650 cfs 2 - 6.5'x14' 1 - 6.5'x14' 1 - 24" Butterfly	None 12 - 17'x26.5'	ac = acres AF = acre-feet ft = feet msl = elevation above mean sea level cfs = cubic feet per second kw = kilowatts hp = horsepower
POWER FACILITIES Generator Turbine Units, Number Generator Name Plate Capacity, kw Turbine Rating, hp Turbine Type Maximum (Full Pool) Head and Discharge Avg (Power & MP Pool) Head, Discharge Minimum Head and Discharge Reversible Pump Turbines Total Dynamic Head, feet Discharge with 5 Units at Max Head, cfs Maximum Power Required, hp Maximum Drawdown, feet msl				1 45,200 75,600 (56 ft head) Kaplan (Vertical Shaft) 112 ft (6,300 cfs) 85 ft (7,900 cfs) 62 ft (11,000 cfs) None 845		6 160,000 254,400 Kaplan (Inclined Shaft) 79.2 ft (31,800 cfs) 42.5 ft (65,000 cfs) 41 ft (68,000 cfs) 6 50 27,500 197,000 704	SUMMARY OF ENGINEERING DATA OSAGE RIVER BASIN PROJECTS U.S. Army Corps of Engineers Kansas City District December 2004

SUBJECT	SMITHVILLE LAKE	LONGVIEW LAKE	BLUE SPRINGS LAKE	RATHBUN LAKE	LONG BRANCH LAKE	REMARKS
GENERAL Location of Dam Stream / River Miles above Mouth Contributing Drainage Area, square miles Approximate Length of Full Reservoir, miles Shoreline, miles (1) Maximum Discharge of Record near Dam Site Date of Closure Date Storage Began Date Multipurpose Level Reached Operating Agency	Near Smithville, MO Little Platte River 13.6 213 18 175 76,600 cfs (July 20, 1965) July 13, 1976 October 19, 1979 June 11, 1982 Corps of Engineers	Kansas City, MO Little Blue River 42.9 50.3 3.5 24 18,700 cfs (August 13, 1982) June 16, 1983 September 16, 1985 September 23, 1986 Corps of Engineers	Kansas City, MO East Fork Little Blue River 28.8 32.8 2.5 12 11,000 cfs (August 13, 1982) August 12, 1986 September 27, 1988 March 18, 1990 Corps of Engineers	Near Rathbun, IA Chariton River 142.3 549 14 155 21,800 cfs (March 31, 1960) September 29, 1967 November 21, 1969 October 10, 1970 Corps of Engineers	Near Macon, MO East Fork Little Chariton River 78 109 9 24.2 30,000 cfs (April 21, 1973) September 3, 1976 August 2, 1978 May 19, 1981 Corps of Engineers	(1) With pool at multipurpose level. (2) Damming height is from original riverbed to top of flood pool. (3) Based on latest available storage data. The revision dates of the current area capacity tables are indicated below with the effective dates in parentheses: Smithville Lake, February 1990 (effective March 1, 1990) Longview Lake, May 1970 (initial) Blue Springs Lake, September 1974 (initial) Rathbun Lake, January 2000 (effective December 1, 2000) Long Branch Lake, January 1989 (effective October 1, 1989) (4) Spillway flood routing at Long Branch Lake revised for Emergency Action Plan, dated 1981. (5) Flows above 1,800 cfs result in overtopping of the outlet stilling basin walls
DAM AND EMBANKMENT Top of Dam Elevation, feet msl Length of Dam, feet (net) Damming Height, feet (2) Type of Fill Fill Quantity, cubic yards	895.0 4,000 80.2 Rolled Earth 3,200,000	926.6 1,900 110 Earth 2,500,000	840.0 2,500 70 Earth and Rock 1,200,000	946.0 10,600 82 Rolled Earth 4,700,000	826.0 3,550 71 Rolled Earth 1,855,000	
SPILLWAY Location Crest Elevation, feet msl Width, feet Number, Size, and Type of Gates Discharge Capacity, Top of Surcharge Pool	Right Abutment 880.2 50 None 4,800 cfs	Left Abutment 911.3 200 None 22,970 cfs	Left Abutment 823.6 300 None 37,800 cfs	Right Abutment 926.0 500 None 45,600 cfs	Right Abutment 809.0 50 None 9,860 cfs (4)	
RESERVOIR (3) Surcharge Pool Elevation and Area Flood Control Pool Elevation and Area Multipurpose Pool Elevation and Area Recreation Pool Elevation and Area Surcharge Storage Flood Control Storage Multipurpose Storage Recreation Storage Gross Storage Design Sediment Reserve Storage Measured Sediment Inflow	891.1 ft msl 14,611 ac 876.2 ft msl 9,990 ac 864.2 ft msl 7,115 ac 891.1 - 876.2 182,198 AF 876.2 - 864.2 101,777 AF 864.2 - 810.0 141,666 AF 876.2 - 810.0 243,443 AF 52,300 AF for 100 years 4,987 AF (1979 to 1993)	922.9 ft msl 3,207 ac 909.0 ft msl 1,964 ac 891.0 ft msl 927 ac 870.0 ft msl 432 ac 922.9 - 909.0 35,370 AF 909.0 - 891.0 24,810 AF 891.0 - 870.0 13,579 AF 870.0 - 810.0 8,555 AF 909.0 - 810.0 46,944 AF 2,000 AF for 100 years 20 AF/year (estimated)	837.7 ft msl 1,200 ac 820.3 ft msl 982 ac 802.0 ft msl 722 ac 837.7 - 820.3 19,039 AF 820.3 - 802.0 15,715 AF 802.0 - 760.0 10,842 AF 820.3 - 760.0 26,557 AF 300 AF for 100 years 3 AF/year (estimated)	940.0 ft msl 31,135 ac 926.0 ft msl 22,452 ac 904.0 ft msl 10,329 ac 940.0 - 926.0 368,859 AF 926.0 - 904.0 349,173 AF 904.0 - 857.0 221,360 AF 926.0 - 857.0 570,533 AF 24,000 AF for 100 years 240 AF/year (estimated)	821.2 ft msl 6,608 ac (4) 801.0 ft msl 3,663 ac 791.0 ft msl 2,429 ac 821.2 - 801.0 101,880 AF (4) 801.0 - 791.0 30,327 AF 791.0 - 750.0 34,189 AF 801.0 - 750.0 64,516 AF 4,000 AF for 100 years 483 AF (1978 to 1988)	TOTALS 56,761 ac 39,051 ac 21,522 ac 432 ac 707,346 AF 521,802 AF 421,636 AF 8,555 AF 951,993 AF
OUTLET WORKS Location River Outlet Type Number and Size of Conduit Length of Conduit, feet Entrance Invert Elevation Drop Inlet Crest Elevation Low Flow Gate Intake Elevation Discharge Cap, Top Flood Control Pool Discharge Cap, Top of Multipurpose Pool Service Gates, Number and Size Emergency Gates, Number and Size Low Flow Gates, Number, Size, Type Low Flow Gates, Number and Size Provision for Power Provision for Water Supply	Right Abutment Rectangular Conduit 1 - 8'x9' 696 805.0 ft msl 3,150 cfs 2,940 cfs 2 - 4.25'x9.25' Slide 2 - 4.25'x9.25' Slide 1 - 2'x2' None 1 - 5.75' Pipe A portion of MP storage pumped from pool	Left Abutment Concrete Arch 1 - 5.5'x5' 916 816.0 ft msl 891 875 - 861 1,200 cfs 0 (except low flow outlets) 1 - 6'x7' 2 - 24" Knife Valves 2 - 24" Knife Valves None None	Right Abutment Arch Conduit 1 - 3.5'x4.75' 485 768.5 ft msl 802.0 ft msl 791.5 570 cfs 0 (except low flow outlets) 1-4.5'x5' 1-2' Knife Valve 1-2' Knife Valve None None	Right Abutment Horseshoe Conduit 1 - 11' 539 855.0 ft msl 5,160 cfs (5) 4,220 cfs (5) 2 - 6'x12' Slide 2 - 6'x12' Slide 2 - 2' x2' Slide None No pipe outlets, water supply released to river	Right Abutment Concrete Arch 1 - 6'x5.5' 450 760.0 ft msl 910 cfs 495 cfs 2 - 24" Slide 1 - 6'x6' 1 - 18" Slide None No pipe outlets, water supply pumped from pool.	ac = acres AF = acre-feet ft = feet msl = elevation above mean sea level cfs = cubic feet per second

**SUMMARY OF ENGINEERING DATA
LOWER MISSOURI RIVER BASIN PROJECTS**

U.S. Army Corps of Engineers
Kansas City District
December 2004

Plate 2B

SUBJECT	MILFORD LAKE	TUTTLE CREEK LAKE	PERRY LAKE	CLINTON LAKE	REMARKS
GENERAL Location of Dam Stream / River Miles above Mouth Contributing Drainage Area, square miles Approximate Length of Full Reservoir, miles Shoreline, miles (1) Maximum Discharge of Record near Dam Site Date of Closure Date Storage Began Date Multipurpose Level Reached Operating Agency	Near Junction City, KS Republican River 7.7 17,388 (4) 30 163 171,000 cfs (June 3, 1935) August 24, 1964 January 16, 1967 July 14, 1967 Corps of Engineers	Near Manhattan, KS Big Blue River 10 9,628 50 112 98,000 cfs (June 1951) July 20, 1959 March 7, 1962 April 29, 1963 Corps of Engineers	Near Perry, KS Delaware River 5.3 1,117 20 160 94,600 cfs (June 1951) August 2, 1966 January 15, 1969 June 3, 1970 Corps of Engineers	Near Lawrence, KS Wakanusa River 22.2 367 17 82 24,200 cfs (July 1951) August 23, 1975 November 30, 1977 April 3, 1980 Corps of Engineers	(1) With pool at multipurpose level. (2) Damming height is from the original riverbed to the top of the flood control pool. (3) Based on latest available storage data. The revision dates of the current area - capacity tables are indicated below with the effective dates in parentheses: Milford Lake, March 1982 (effective March 10, 1982) Tuttle Creek Lake, October 2000 (effective February 1, 2001) Perry Lake, May 1990 (effective June 1, 1990) Clinton Lake, December 1991 (effective March 1, 1994) (4) Total drainage area above Milford is 38,621 square miles. The indicated total is the local drainage area below Harlan County Dam.
DAM AND EMBANKMENT Top of Dam Elevation, feet msl Length of Dam, feet (net) Damming Height, feet (2) Type of Fill Fill Quantity, cubic yards	1,213.0 6,300 110.2 Earth 15,000,000	1,159.0 7,487 134 Earth, Rock 21,000,000	946.0 7,750 95 Earth 8,000,000	928.0 9,250 114 Earth 10,423,000	ac = acres AF = acre-feet ft = feet msl = elevation above mean sea level cfs = cubic feet per second
SPILLWAY Location Crest Elevation, feet msl Width, feet Number, Size, and Type of Gates Discharge Capacity, Top of Surge Pool	Right Abutment 1,176.2 1,250 None 560,000 cfs	Left Abutment 1,116.0 1,059 18 - 40'x20' Tainter 579,000 cfs	Left Abutment 922.0 300 None 65,000 cfs	Left Abutment 907.4 500 None 44,200 cfs	
RESERVOIR (3) Surcharge Pool Elevation and Area Flood Control Pool Elevation and Area Multipurpose Pool Elevation and Area Surcharge Storage Flood Control Storage Multipurpose Storage Gross Storage Design Sediment Reserve Storage Measured Sediment Inflow	1,208.2 ft msl 59,886 ac 1,176.2 ft msl 32,979 ac 1,144.4 ft msl 15,709 ac 1,208.2 - 1,176.2 1,442,049 AF 1,176.2 - 1,144.4 756,669 AF 1,144.4 - 1,080.0 388,816 AF 1,176.2 - 1,080.0 1,145,485 AF 160,000 AF for 100 years 47,935 AF (1967 to 1994)	1,151.4 ft msl 70,030 ac 1,136.0 ft msl 53,050 ac 1,075.0 ft msl 12,617 ac 1,151.4 - 1,136.0 939,272 AF 1,136.0 - 1,075.0 1,870,735 AF 1,075.0 - 1,020.0 280,137 AF 1,136.0 - 1,020.0 2,150,872 AF 240,312 AF for 50 years 216,145 AF (1962 to 2000)	941.2 ft msl 42,656 ac 920.6 ft msl 25,363 ac 891.5 ft msl 11,146 ac 941.2 - 920.6 692,375 AF 920.6 - 891.5 515,795 AF 891.5 - 835.0 209,513 AF 920.6 - 835.0 725,308 AF 140,000 AF for 100 years 49,057 AF (1969 to 1993)	921.4 ft msl 18,336 ac 903.4 ft msl 12,890 ac 875.5 ft msl 7,120 ac 921.4 - 903.4 285,809 AF 903.4 - 875.5 268,783 AF 875.5 - 828.0 125,334 AF 903.4 - 828.0 394,117 AF 28,500 AF for 100 years 3,421 AF (1977 to 1991)	TOTALS 190,908 ac 124,282 ac 46,592 ac 3,359,505 AF 3,411,982 AF 1,003,800 AF 4,415,782 AF
OUTLET WORKS Location River Outlet Type Number and Size of Conduit Length of Conduit, feet Entrance Invert Elevation Gated Sluice, Number and Size Discharge Cap, Top of Flood Control Pool Discharge Cap, Top of Multipurpose Pool Service Gates, Number and Size Emergency Gates, Number and Size Low Flow Gates, Number and Size Water Supply Gate, Number and Size Provision for Irrigation Provision for Power Provision for Water Supply	Right Abutment Gated Conduit 1 - 21' 615.5 1,080.0 ft msl None 23,100 cfs 18,600 cfs 2 - 10.5'x21' 2 - 10.5'x21' 2 - 2'x2' None None None No pipe outlets, water supply released to river	Right Abutment Gated Conduit 2 - 20' 860 1,003.0 ft msl None 45,900 cfs 31,300 cfs 4 - 10'x20' 1 - 10'x20' 2 - 24" Butterfly Valve None None None No pipe outlets, water supply released to river	Near Center of Dam Gated Conduit 1 - 23.5' 592 833.0 ft msl None 27,500 cfs 21,200 cfs 2 - 11.75'x23.5' 2 - 11.75'x23.5' 2 - 2'x2' None None None No pipe outlets, water supply released to river	Left Abutment Gated Conduit 1 - 12.5'x13' Arch 710 828.0 ft msl None 7,570 cfs 5,900 cfs 2 - 6.33'x12.67' 1 - 6.33'x12.67' 1 - 24" Knife Gate Valve 1 - 54"x54" Slide Gate None None 36" Steel Pipe	

**SUMMARY OF ENGINEERING DATA
LOWER KANSAS RIVER BASIN PROJECTS**

U.S. Army Corps of Engineers
Kansas City District
December 2004

SUBJECT	BONNY RESERVOIR	SWANSON LAKE	ENDERS RESERVOIR	HUGH BUTLER LAKE	HARRY STRUNK LAKE	KEITH SEBELIUS LAKE (Norton Dam)	HARLAN COUNTY LAKE	LOVEWELL RESERVOIR	REMARKS
GENERAL Location of Dam Stream / River Miles above Mouth Contributing Drainage Area, sq mi Approx Length of Full Resv, miles Shoreline, miles (1) Max. Disch. of Record nr Dam Site Date of Closure Date Storage Began Date Multipurpose Level Reached Operating Agency	Near Hale, CO S. Fk Republican River 60.4 1,435 5.5 15.0 103,000 (May 31, 1935) July 6, 1950 July 6, 1950 March 19, 1954 Bureau of Reclamation	Near Trenten, NE Republican River 359 2,506 below Bonny 9.0 30 200,000 (May 31, 1935) May 4, 1953 May 4, 1953 May 15, 1957 Bureau of Reclamation	Near Enders, NE Frenchman Creek 81.7 786 6.0 26 Insufficient Data October 23, 1950 October 23, 1950 January 29, 1952 Bureau of Reclamation	Near McCook, NE Red Willow Creek 18.7 310 7.5 35 30,000 (June 22, 1947) September 5, 1961 September 5, 1961 May 21, 1967 Bureau of Reclamation	Near Cambridge, NE Medicine Creek 11.9 642 8.5 29 120,000 (June 1947) August 8, 1949 August 8, 1949 April 2, 1951 Bureau of Reclamation	Near Norton, KS Prairie Dog Creek 74.9 688 9.5 32 37,500 (May 28, 1953) January 28, 1964 October 5, 1964 June 21, 1967 Bureau of Reclamation	Nr Republican City, NE Republican River 232.3 7,169 below u/s dams (5) 17 54 260,000 (June 1, 1935) July 22, 1951 November 14, 1952 June 14, 1957 Corps of Engineers	Near Lovewell, KS White Rock Creek 19.3 358 11 44 23,300 (July 10, 1950) May 29, 1957 October 2, 1957 May 20, 1958 Bureau of Reclamation	(1) With pool at MP level. (2) Damming height is from original riverbed to top of flood control pool. (3) Based on latest storage data. Date of current area capacity tables given below with effective date in (.). Bonny, Mar 51 (initial) Swanson, Feb 84 (Jan 84) Enders, May 97 (Jan 1, 99) Butler, May 97 (Jan 1, 99) Strunk, Oct 82 (Feb 1, 83) Sebelius, Sep 00 (Jan 02) Harlan, Jan 01 (Jan 1, 01) Lovewell, Jun 95 (Jan 97) (4) Bartley Div Dam, Rep R. below Red Willow Ck,
DAM AND EMBANKMENT Top of Dam Elevation, feet msl Length of Dam, feet (Less Spillway) Damming Height, feet (2) Type of Fill Fill Quantity, cubic yards	3,742.0 9,141.5 93.0 Earth 8,853,000	2,793.0 8,600 80.0 Earth 8,130,000	3,137.5 2,242 93.0 Earth 1,950,000	2,634.0 3,159 About 85 Earth 3,122,000	2,415.0 5,665 86 Earth 2,730,000	2,347.0 6,344 85.5 Earth 3,740,000	1,982.0 11,830 98.5 Earth 13,400,000	1,616.0 8,392 70.3 Earth 3,000,000	conc ogee weir w/2-10x16 gates to rivr, 2-10'x3' gates to canal, max cap 130 cfs. Franklin pumps on Rep R. blw Harlan Cty, cap 40 cfs. Courtland Div Dam, Rep R
SPILLWAY Location Crest Elevation, feet msl Width, feet Number, Size, and Type of Gates Disch. Cap. Top of Surge Pool	Left Abutment 3,710.0 121.5 None (see notes below) 73,300 cfs (with sluice)	Left Abutment 2,743.0 142 3 - 42' x 30' Radial 126,000 cfs	Right Abutment 3,097.0 361 6 - 50' x 30' Radial 202,000 cfs (with notch)	Right Abutment 2,604.9 31.5 (circ morning glory) None 4,910 cfs	Left Abutment 2,386.2 (see also below) 229 None 99,000 cfs (with notch)	Right Abutment 2,296.0 106 3 - 30'x36.35' Radial 96,000 cfs	Center of Dam 1,943.5 856 18 - 40'x30' Radial 480,000 cfs	Right Abutment 1,575.3 53 2 - 25'x20' Radial 35,000 cfs	
RESERVOIR (3) Surcharge Pool Elev (ft msl), Area Flood Cntrl Pool Elev (ft msl), Area MP, or Top Cons Pool Elev, Area Inactive Pool Elev (ft msl), Area Dead Stor Pool Elev (ft msl), Area Surcharge Storage, AF Flood Control Storage, AF MP, or Active Conserv Storage, AF Inactive Storage, AF Dead Storage, AF Gross Storage, AF Design Sediment Reserve Storage Measured Sediment Inflow	3,736.2 8,579 ac 3,710.0 5,036 ac 3,672.0 2,042 ac 3,638.0 331 ac 3,635.5 242 ac 3,736.2 - 3,710 178,230 3,710.0 - 3,672 128,820 3,672.0 - 3,638 39,206 3,638.0 - 3,635.5 716 3,635.5 - 3,617 1,418 3,710.0 - 3,617 170,160 8,000 AF for 50 years 160 AF/year (estimated)	2,785.0 10,035 ac 2,773.0 7,940 ac 2,752.0 4,922 ac 2,720.0 1,411 ac 2,710.0 488 ac 2,785 - 2,773 107,610 2,773 - 2,752 134,077 2,752 - 2,720 99,784 2,720 - 2,710 10,312 2,710 - 2,701 2,118 2,773 - 2,701 246,291 51,000 AF for 50 years 7,659 AF (1953 to 1982)	3,129.5 ft msl 2,557 ac 3,127.0 ft msl 2,405 ac 3,112.3 ft msl 1,707 ac 3,082.4 ft msl 627 ac 3,080.0 ft msl 567 ac 3,129.5 - 3,127 6,203 3,127.0 - 3,112.3 30,048 3,112.3 - 3,082.4 33,962 3,082.4 - 3,080 1,432 3,080.0 - 3,050 7,516 3,127.0 - 3,050 72,958 4,000 AF for 100 years 1,572 AF (1950 to 1997)	2,628.0 ft msl 4,079 ac 2,604.9 ft msl 2,681 ac 2,581.8 ft msl 1,621 ac 2,558.0 ft msl 715 ac 2,552.0 ft msl 536 ac 2,628.0 - 2,604.9 76,829 2,604.9 - 2,581.8 48,846 2,581.8 - 2,558 27,303 2,558.0 - 2,552 3,736 2,552.0 - 2,527 5,185 2,604.9 - 2,527 85,070 10,000 AF for 50 years 1,616AF (1961 to 1997)	2,408.9 ft msl 5,784 ac 2,386.2 ft msl 3,483 ac 2,366.1 ft msl 1,840 ac 2,343.0 ft msl 701 ac 2,335.0 ft msl 481 ac 2,408.9 - 2,386.2 105,660 2,386.2-2,366.1 52,715 2,366.1 - 2,343 26,846 2,343.0 - 2,335 4,699 2,335.0 - 2,318.5 4,160 2,386.2 - 2,318.5 88,420 15,000 AF for 50 years 4,397 AF (1949 to 1981)	2,341.0 ft msl 6,713 ac 2,331.4 ft msl 5,316 ac 2,304.3 ft msl 2,181 ac 2,280.4 ft msl 575 ac 2,275.0 ft msl 317 ac 2,341.0 - 2,331.4 58,287 2,331.4 - 2,304.3 99,230 2,304.3 - 2,280.4 30,517 2,280.4 - 2,275 2,357 2,275.0 - 2,262 1,636 2,331.4 - 2,262 133,740 6,000 AF for 50 years 1,617 AF (1964 to 2000)	1,975.5 ft msl 24,339 ac 1,973.5 ft msl 23,431 ac 1,945.73 msl 13,305 ac 1,932.5 ft msl 9,282 ac 1,885.0 ft msl 0 ac 1,975.5 - 1,973.5 47,767 1,973.5 - 45.73 500,000 1,945.73 - 32.5 150,000 1,932.5 - 1,890 164,111 Sluice crest at 1,885 0 1,973.5 - 1,890 814,111 200,000 AF for 100 yrs 38,548 AF (1952 - 00)	1,610.3 ft msl 7,635 ac 1,595.3 ft msl 5,024 ac 1,582.6 ft msl 2,987 ac 1,571.7 ft msl 1,495 ac 1,562.07 ft msl 494 ac 1,610.3 - 1,595.3 94,145 1,595.3 - 1,582.6 50,465 1,582.6 - 1,571.7 24,022 1,571.7 - 1,562.07 9,985 1,562.07 - 1,550.0 1,659 1,595.3 - 1,550.0 86,131 8,000 AF for 50 years 6,021 AF (1957 to 1995)	TOTALS 69,721 ac 55,316 ac 30,605 ac 15,137 ac 3,125 ac 674,731 AF 1,044,201 AF 431,640 AF 197,348 AF 23,692 AF 1,696,881 AF
OUTLET WORKS Location River Outlet Type Number and Size of Conduit Length of Conduit, feet Entrance Crest Elevation Disch Cap, Top of Flood Cntrl Pool Disch Cap, Top of MP (Consv) Pool Service Gates, Number, Size, Type Provision for Irrigation Provision for Power Provision for Municipal Supply Other Outlet	Left Abutment Gated Conduit 1 - 56" Cond to 26" Pipe 831.5 3,635.5 ft msl 140 cfs (approx) 103 cfs 1 - 24" Hollow Jet Valve 1 - 32" Pipe to 24" Valve None None 1 - 40" Capped Conduit	Left Abutment Gated Conduit 2 - 6' x 7.5' 86.74 2,710.0 ft msl 4,300 cfs 3,500 cfs 2 - 6' x 7.5' Slide Gates 1 - 56" Pipe to 4' Gate None None None	Right Abutment Gated Conduit 1 - 84" Cond to 84" Pipe 516 3,080.0 ft msl 1,430 cfs 1,300 cfs 2-60" Hollow Jet Valves None None None None	Right Abutment Gated Conduit 1 - 82" 553.5 2,552.0 ft msl 1,170 cfs 990 cfs 2 - 42" Slide Gates None None None None	Right Abutment Gated Conduit 1 - 84" Cond to 44" Pipe 553 2,335.0 ft msl 398 cfs (max elev 2,379) 361 cfs 1 - 39" Slide Gate None None None None	Left Abutment Gated Conduit 1 - 48" Cond to 38" Pipe 495 to Gate, 145 to Basin 2,275.0 ft msl 312 cfs 257 cfs 1 - 33" Slide Gate None None 1 - 16" Pipe to 16" Gate None	Center of Dam Gated Sluices 9 - 5'x8' thru Spillway 1,885.0 ft msl 20,700 cfs 17,370 cfs 9 - 5' x 8' Slide Gates 1-5.5'; 1-2.83' Conduits 12'x12' Plug for 9' Cond None 1-18" outlet for low flow regulation in mono 20. Franklin Canal conduit to 2-36" gates, cap 520 cfs. Naponee Canal conduit to 1-24" valve, cap 40 cfs. See also note (4)	Right Abutment Spillway gates used for river releases. Gated wasteway with 1-10'x9' radial gate from outlet canal to stilling basin. Wasteway is not used. None None None None Note: Inflow to lake also provided from gated Courtland Canal outlet.	at Guide Rock, conc ogee w/2-20'x12' gates to river 5-10'x6' gates to Courtland canal (cap 751 cfs), 1-10x6 gate to Superior (cap 139). Other private diversion weirs exist on some creeks like Riverside blw Enders but div capacity minimal. (5) 13,536 sq mi total contributing with u/s dams. ac = acres ft = feet cfs = cubic feet per sec msl = elev abv mean sea lvl
SUMMARY OF ENGINEERING DATA REPUBLICAN RIVER BASIN PROJECTS									
U.S. Army Corps of Engineers Kansas City District December 2004									
Plate 2D									

SUBJECT	WACONDA LAKE	KIRWIN RESERVOIR	WEBSTER RESERVOIR	WILSON LAKE	KANOPOLIS LAKE	CEDAR BLUFF RESERVOIR	REMARKS
GENERAL Location of Dam Stream / River Miles above Mouth Contributing Drainage Area, sq miles Approx Length of Full Reservoir, miles (1) Shoreline, miles (1) Maximum Discharge of Record nr Dam Site Date of Closure Date Storage Began Date Multipurpose Level Reached Operating Agency	Near Glen Elder, KS Solomon River 172.4 2,559 below u/s dams (4) 24 100 125,000 cfs (July 1951) October 18, 1967 July 24, 1968 May 16, 1973 Bureau of Reclamation	Near Kirwin, KS North Fork Solomon River 67.8 1,367 9 37 24,000 cfs (Sep 1919) March 7, 1955 October 5, 1955 July 2, 1957 Bureau of Reclamation	Near Stockton, KS South Fork Solomon River 92.4 1,150 7 27 55,200 cfs (July 1951) May 3, 1956 May 3, 1956 June 18, 1957 Bureau of Reclamation	Near Wilson, KS Saline River 153.9 1,917 24 100 25,700 cfs (Jul-Aug 1928) September 3, 1963 December 29, 1964 March 12, 1973 Corps of Engineers	Near Ellsworth, KS Smoky Hill River 183.7 2,330 blw Cedar Bluff (6) 12 41 61,000 cfs (June 1938) July 26, 1946 February 17, 1948 July 19, 1948 Corps of Engineers	Near Ellis, KS Smoky Hill River 333.4 5,365 9 50 98,000 cfs (May 1938) November 13, 1950 November 13, 1950 June 21, 1951 Bureau of Reclamation	(1) With pool at multipurpose or full conservation level. (2) Damming height is height from original river bed to top of flood control pool. (3) Based on latest available storage data. The dates of the current area - capacity tables are indicated below along with the effective dates in parenthesis: Waconda, July 2001 (effective January 1, 2003) Kirwin, May 1996 (effective January 1, 1998) Webster, May 1996 (effective January 1, 1998) Wilson, December 1984 (effective January 1, 1985) Kanopolis, February 1983 (effective March 1, 1983) Cedar Bluff, March 2001 (effective January 1, 2002)
DAM AND EMBANKMENT Top of Dam Elevation, feet msl Length of Dam, feet (Less Spillway) Damming Height, feet (2) Type of Fill Fill Quantity, cubic yards	1,500.0 14,631 107.9 Earth 8,050,000	1,779.0 12,246 95 Earth 9,537,000	1,944.0 10,604 84.7 Earth 8,145,000	1,592.0 5,600 114 Earth 8,500,000	1,537.0 15,360 102 Earth 15,200,000	2,198.0 12,409.5 102 Earth 8,490,000	(4) Total DA with Kirwin and Webster = 5,076 sq miles (5) 7' conduit from intake tower to gate chamber. 4'x5' emergency gate to 60" pipe. Entrance to stilling well controlled by 4'x5' slide gate. From stilling well, 42" river outlet pipe controlled by 36" gate. River outlet capacity at top of MP pool and flood control pool about 220 cfs. Length of combined pipes from intake to stilling well about 500'. About 200' more to stilling basin. Canal releases from two openings at top of stilling well. Canal capacity is about 175 cfs, but combined capacity with river outlet about 395 cfs. (6) Total contrib. DA with Cedar Bluff = 7,695 sq miles
SPILLWAY Location Crest Elevation, feet msl Width, feet Number, Size, and Type of Gates Discharge Capacity at Top of Surchage Pool	Right Abutment 1,467.4 644 12 - 50'x21.76' Radial 278,000 cfs	Right Abutment 1,757.3 400 (uncontrolled) None, but see note below 96,000 cfs (sluices closed)	Left Abutment 1,884.6 116 3 - 33.33'x39.51' Radial 138,000 cfs	Right Abutment 1,582.0 450 (uncontrolled) None 15,700 cfs	Right Abutment 1,507.0 500 (uncontrolled) None 172,000 cfs	Right Abutment 2,166.0 150.5 (uncontrolled length) Gated orifice, see note blw 84,000 cfs (with orifice)	
RESERVOIR (3) Surcharge Pool Elevation (ft msl), Area Flood Control Pool Elevation (ft msl), Area Multipurpose, or Top Cons Pool Elev, Area Inactive Pool Elevation (ft msl), Area Dead Storage Pool Elevation (ft msl), Area Surcharge Storage, AF Flood Control Storage, AF MP, or Active Conservation Storage, AF Inactive Storage, AF Dead Storage, AF Gross Storage, AF Design Sediment Reserve Storage Measured Sediment Inflow	1,492.9 ft msl 38,178 ac 1,488.3 ft msl 33,682 ac 1,455.6 ft msl 12,602 ac 1,428.0 ft msl 3,020 ac 1,407.8 ft msl 248 ac 1,492.9 - 1,488.3 203,798 1,488.3 - 1,455.6 722,988 1,455.6 - 1,428.0 193,183 1,428.0 - 1,407.8 25,989 1,407.8 - 1,395.0 248 1,488.3 - 1,395.0 942,408 23,750 AF for 50 years 22,597 AF (1968 to 2001)	1,773.0 ft msl 14,660 ac 1,757.3 ft msl 10,639 ac 1,729.25 ft msl 5,071 ac 1,697.0 ft msl 1,006 ac 1,693.0 ft msl 765 ac 1,773.0 - 1,757.3 198,467 1,757.3 - 1,729.25 215,136 1,729.25 - 1,697.0 89,639 1,697.0 - 1,693.0 3,546 1,693.0 - 1,680.0 4,969 1,757.3 - 1,680.0 313,290 14,950 AF for 100 years 1,278 AF (1955 to 1996)	1,938.0 ft msl 11,270 ac 1,923.7 ft msl 8,478 ac 1,892.45 ft msl 3,767 ac 1,860.0 ft msl 904 ac 1,855.5 ft msl 440 ac 1,938.0 - 1,923.7 140,912 1,923.7 - 1,892.45 183,353 1,892.45-1,860.0 71,926 1,860.0 - 1,855.5 2,975 1,855.5 - 1,849.0 1,256 1,923.7 - 1,849.0 259,510 18,600 AF for 100 years 1,267 AF (1956 to 1996)	1,587.5 ft msl 33,882 ac 1,554.0 ft msl 20,027 ac 1,516.0 ft msl 9,045 ac 1,587.5 - 1,554.0 894,263 1,554.0 - 1,516.0 530,204 1,516.0 - 1,435.0 242,528 1,554.0 - 1,435.0 772,732 40,000 AF for 100 years 15,066 AF (1964 to 1995)	1,531.8 ft msl 23,408 ac 1,508.0 ft msl 13,958 ac 1,463.0 ft msl 3,406 ac 1,531.8 - 1,508.0 438,655 1,508.0 - 1,463.0 369,278 1,463.0 - 1,430.0 49,474 1,508.0 - 1,430.0 418,752 51,500 AF for 50 years 28,704 AF (1948 to 1993)	2,192.0 ft msl 16,510 ac 2,166.0 ft msl 10,790 ac 2,144.0 ft msl 6,869 ac 2,107.8 ft msl 1,907 ac 2,090.0 ft msl 755 ac 2,192.0 - 2,166.0 353,250 2,166.0 - 2,144.0 191,890 2,144.0 - 2,107.8 143,878 2,107.8 - 2,090.0 24,172 2,090.0 - 2,078.0 4,402 2,166.0 - 2,078.0 364,342 26,000 AF for 100 years 13,044 AF (1950 to 2000)	TOTALS 137,908 ac 97,574 ac 40,760 ac 2,229,345 AF 2,212,849 AF 790,628 AF 56,682 AF 10,875 AF 3,071,034 AF (7) In addition to the gated conduit, Kanopolis has an uncontrolled port opening 3.5'x13.75' in the 10' pier separating the two service gate openings. Crest elevation of the port is 1,463 ft msl. The max discharges given for the outlet is the combined total of the port and gates. (8) River outlet crest elev is 2,090 ft msl. Crest elev of sluices under spillway is 2,134.82 ft msl. River outlet capacity at MP is 804 cfs, at top of flood pool is 909 cfs. Cedar Bluff also has an irrig canal outlet on Y junction from river outlet, 5.5' pipe to control house, canal flow controlled by 4'x5' gate (not used since 1978, irrigation district disbanded in 1994). Also a hatchery supply line from 18" valve on canal outlet, capacity 10 cfs. Lake storage owned by KS, for benefit of recreation and F&W. All releases coordinated with Kansas KDWP. (9) 2,000 AF annual storage supply contract for Russell.
OUTLET WORKS Location River Outlet Type Number and Size of Conduit Length of Conduit, feet Entrance Crest Elevation Gated Sluice, Number and Size Discharge Cap, Top of Flood Control Pool Disch Cap, Top of MP (Conservation) Pool Service Gates, Number, Size, Type Emergency Gates, Number and Size Low Flow Gates, Number and Size Provision for Irrigation Provision for Power Provision for Municipal Supply	Left Abutment Gated Conduit 1 - 12.5' 575 1,407.8 ft msl None 5,200 cfs 4,000 cfs 2 - 6.5'x8' Slide Gates 1 - 9'x12' Slide Gates None None None No pipe outlets, water supply released to river	Center of Dam Gated Conduit 7' Cond to 60" pipe (5) (5) 1,693 ft msl See note below 220 cfs (5) 220 cfs (5) 1 - 4'x5' to stilling well (5) 1 - 4'x5' (5) None 2 - 5.5'x8' openings (5) None None None Note: 15 - 5' x 5' gated sluices located in concrete ogee section below spillway crest. Crest elevation at sluice entrance = 1,720.0. Discharge capacity at top of conserv pool = 4,800 cfs, top, flood pool = 15,350 cfs.	Right Abutment Gated Conduit 4.5' Conduit to 48" pipe 538 1,855.5 ft msl None 480 cfs 385 cfs 1 - 3.5'x3.5' Slide Gate 1 - 3.5'x3.5' Slide Gate None None None None Note: When reservoir elevation is below 1,860, the outlet gate openings must be reduced to prevent air entrainment in conduit.	Right Abutment Gated Conduit 1 - 12' 1,097 1,450.0 ft msl None 6,500 cfs 5,300 cfs 2 - 6'x12' Service Gates 2 - 6'x12' Slide Gates 2 - 2'x2' Slide Gates None None None Note: Low flow gates are mounted in the service gates	Right Abutment Gated Conduit (7) 1 - 14' 2,443 1,415.0 ft msl None 6,400 cfs (7) 4,500 cfs (7) 2 - 6'x12' 1 - 6'x12' None None Provision future penstock Pump outlet near tower	Left Abutment Gated Conduit to River 1 - 5.5' 863.5 2,090.0 ft msl 8 - 5'x5', gated (8) 3,520 cfs (outlet, sluices) (8) 7,949 cfs (outlet, sluices) (8) 1 - 4'x5' 1 - 4'x5' None 1 - 4'x5' (8) None See (9), supplied by release to river, pump to Big Ck. Note: Spillway also has a gated orifice section at center with 1 - 14.5' x 9.58' radial gate, crest elev 2,144. Spillway cap includes ogee and orifice. Sluices located in ogee section below crest.	SUMMARY OF ENGINEERING DATA SMOKY HILL RIVER BASIN PROJECTS U.S. Army Corps of Engineers Kansas City District December 2004 Plate 2E
Abbreviations ac = acres AF = acre-feet ft = feet msl = elevation above mean sea level cfs = cubic feet per second MP = multipurpose pool elevation							

APPENDIX A
CORPS OF ENGINEERS PROJECTS

BLUE SPRINGS LAKE

CLINTON LAKE

HARLAN COUNTY LAKE

HARRY S TRUMAN RESERVOIR

HILLSDALE LAKE

KANOPOLIS LAKE

LONG BRANCH LAKE

LONGVIEW LAKE

MELVERN LAKE

MILFORD LAKE

PERRY LAKE

POMME DE TERRE LAKE

POMONA LAKE

RATHBUN LAKE

SMITHVILLE LAKE

STOCKTON LAKE

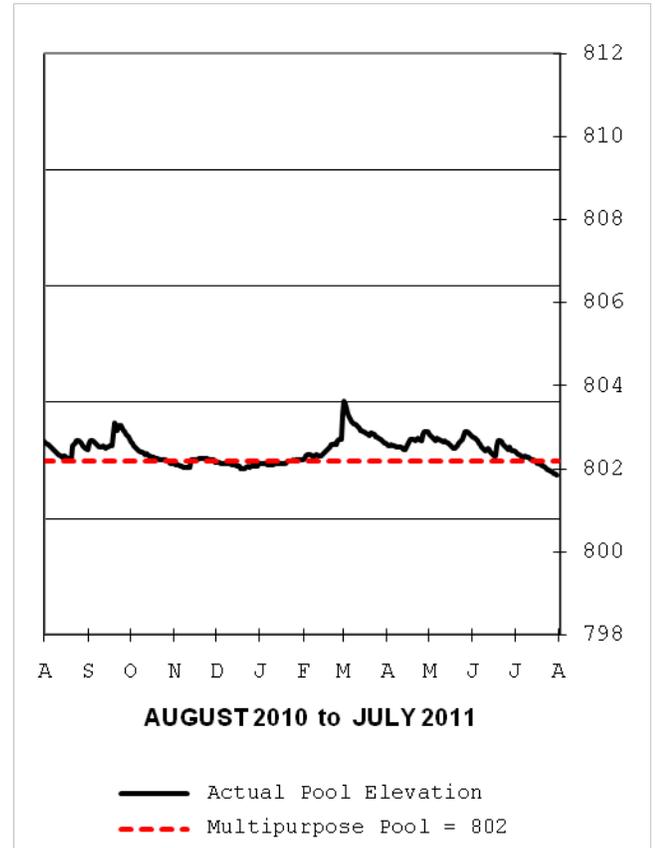
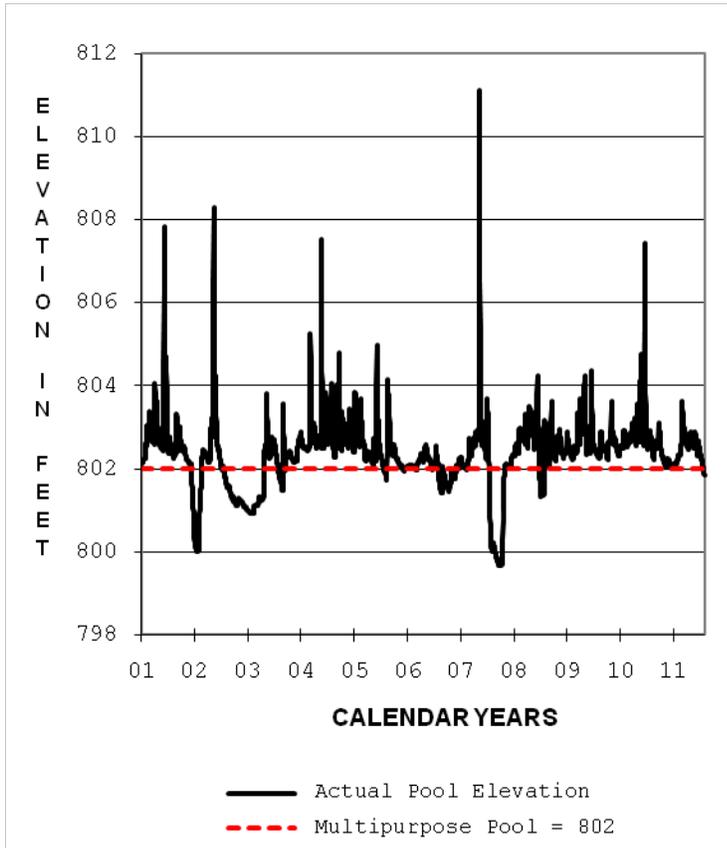
TUTTLE CREEK LAKE

WILSON LAKE

BLUE SPRINGS LAKE

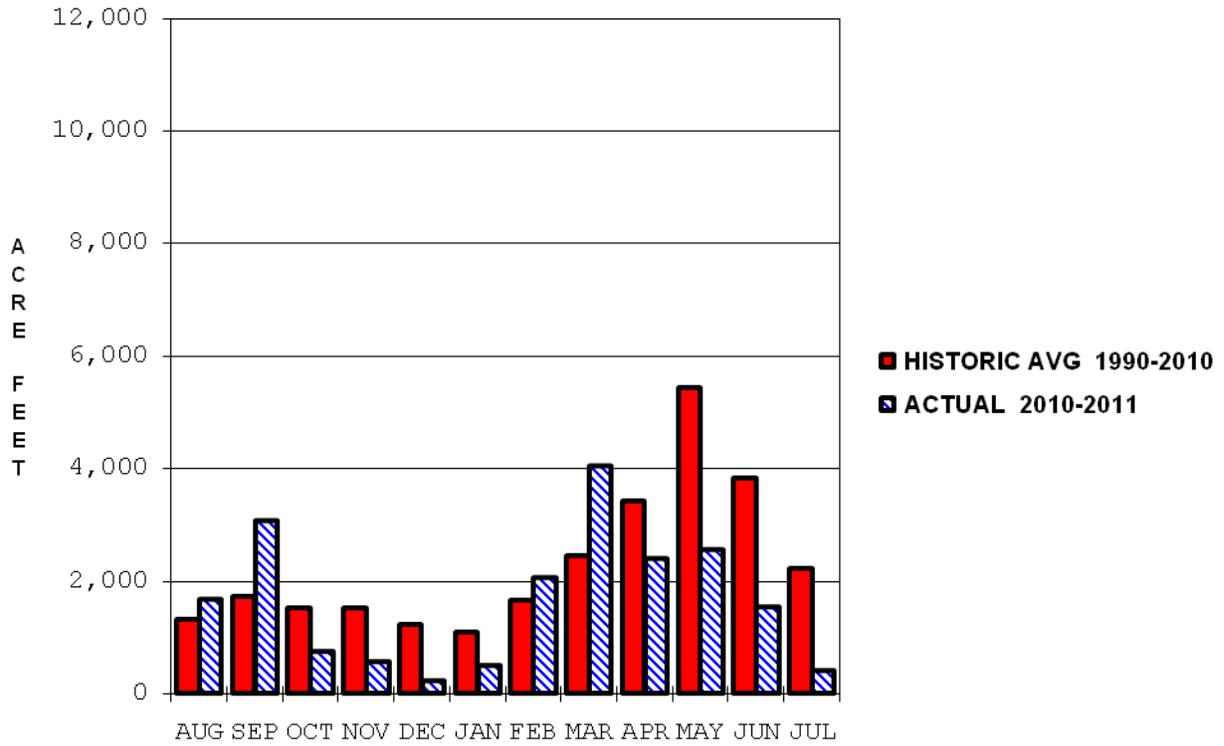
2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

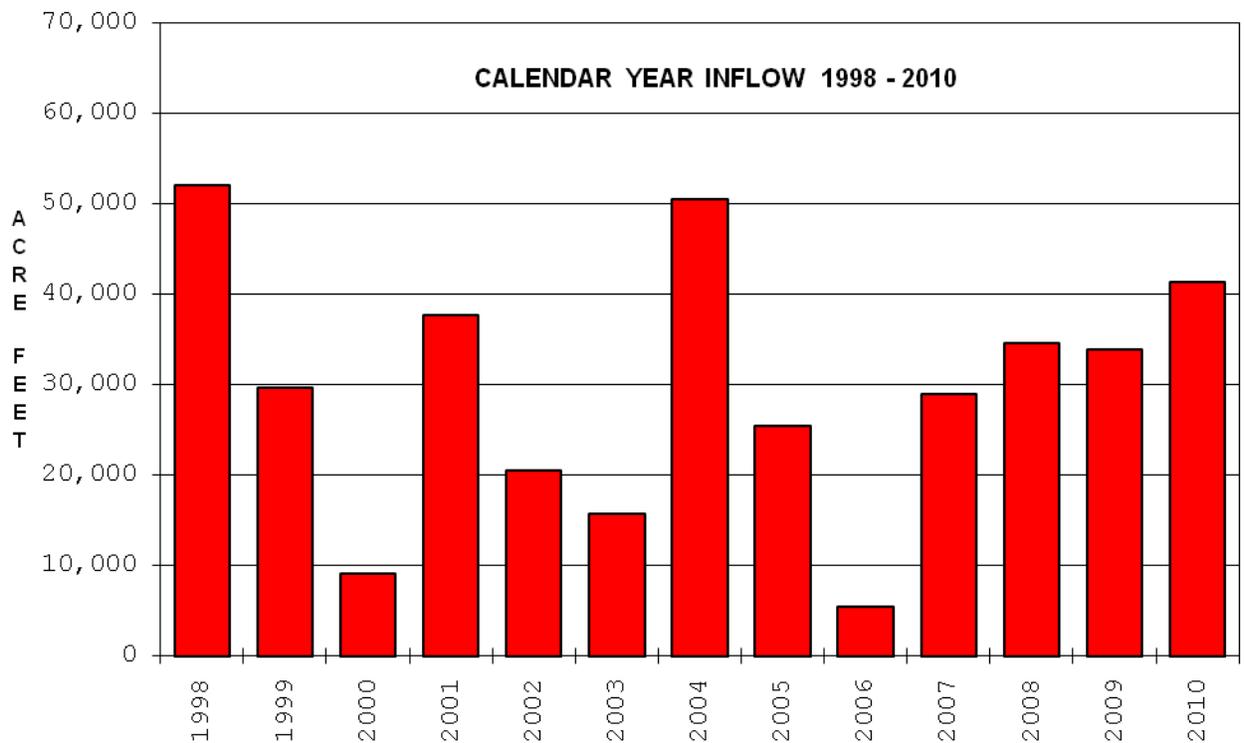


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
802.65 1 Aug 10	801.86 31 Jul 11	803.64 1 Mar 11	801.86 31 Jul 11	816.37 16-17 May 90	799.69 7 Oct 07
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
300 28 Feb 11	19,586	166 2 Mar 11	0 Many days		
All releases are to the river. No minimum release requirement. No release when lake below notch elevation 802.0					

BLUE SPRINGS LAKE MONTHLY INFLOW



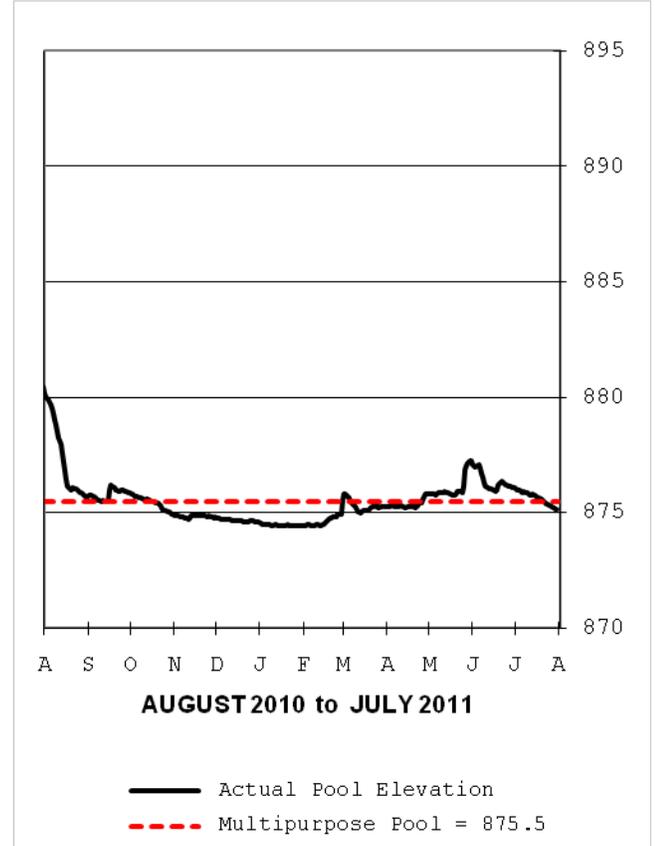
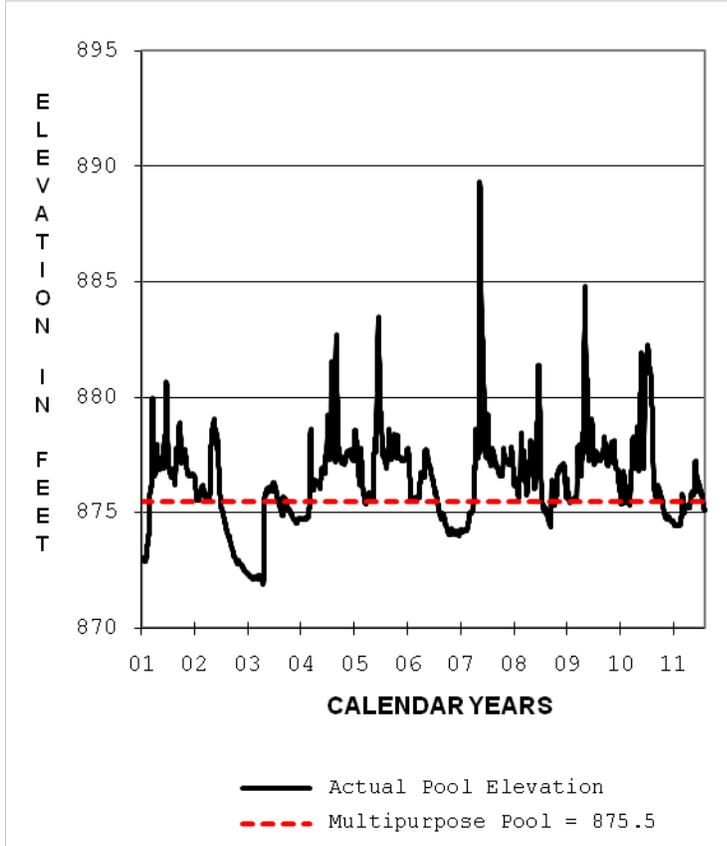
BLUE SPRINGS LAKE ANNUAL INFLOW



CLINTON LAKE

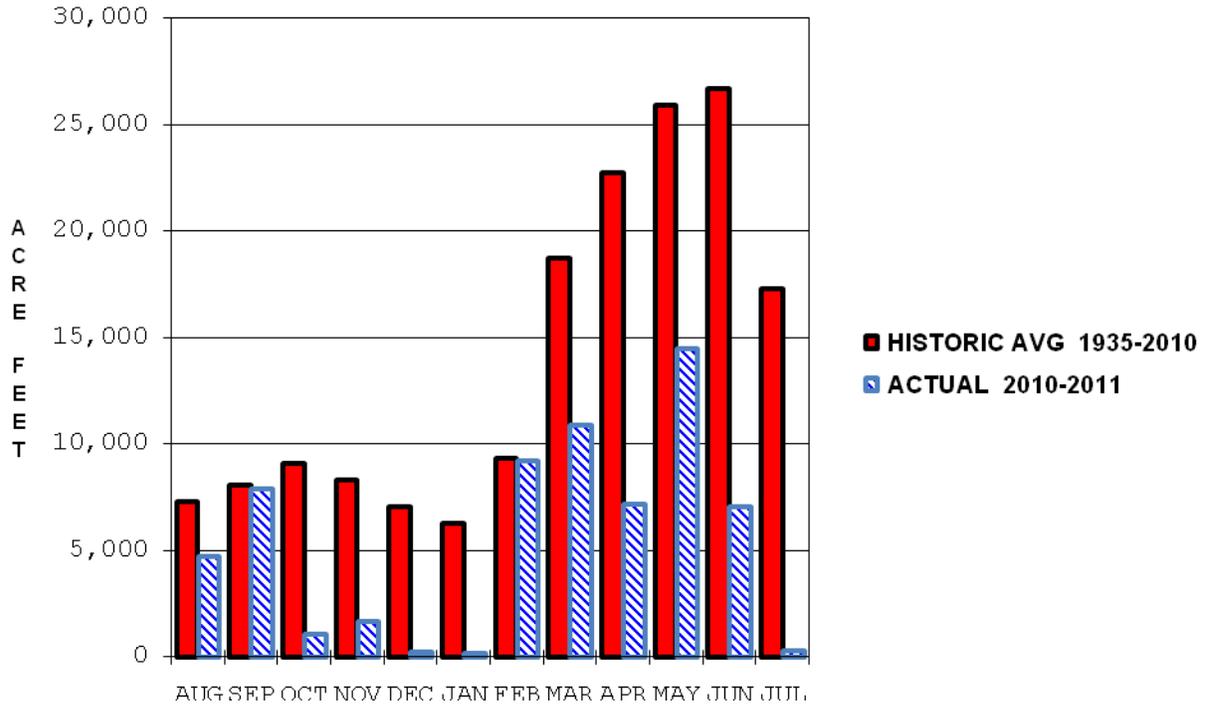
2010 - 2011 REGULATION

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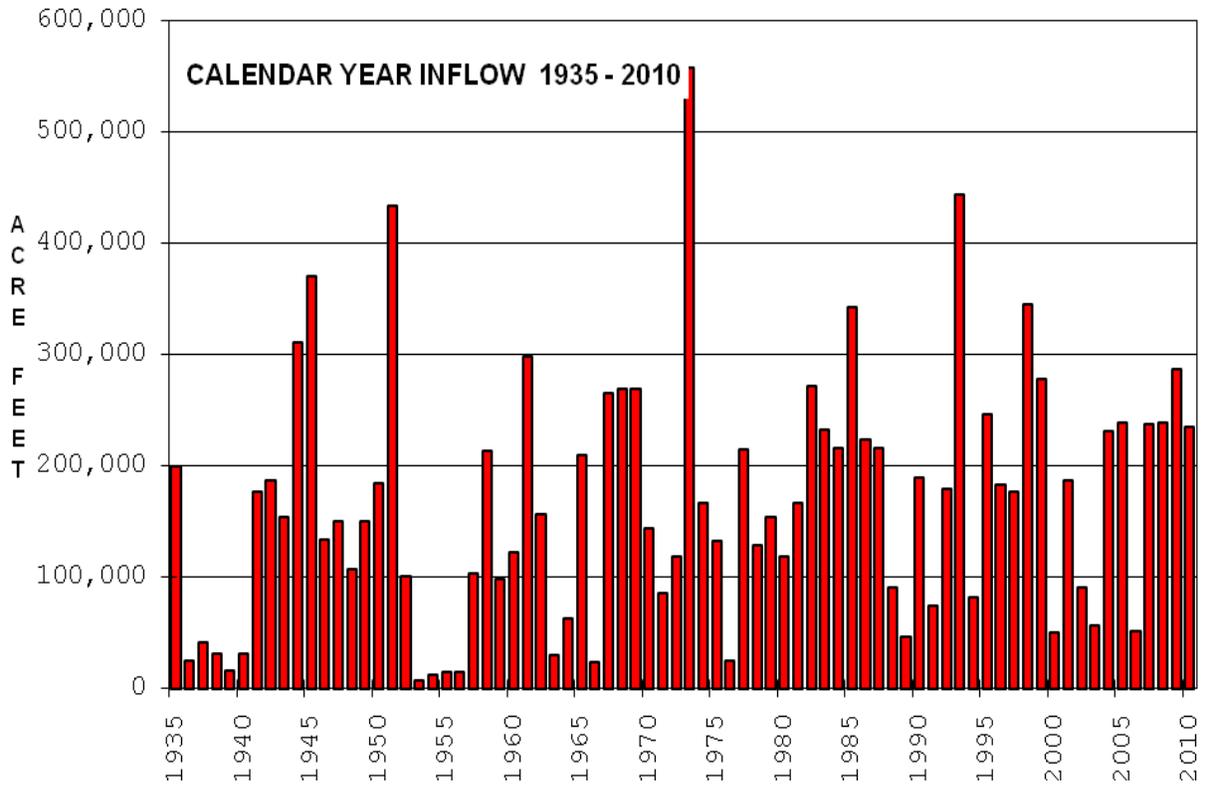


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
880.18 1 Aug 10	875.11 31 Jul 11	880.18 1 Aug 10	874.41 19 Jan 11	892.48 29 May 95	871.60 18-19 Aug 89
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
2,500 26 May 11	64,506	1,520 14 Aug 10	12 27 Dec 10		
Outflows are those to river only. Minimum release is 7 to 21 cfs. Releases cut to 0 for maintenance, inspections.					

CLINTON LAKE MONTHLY INFLOW

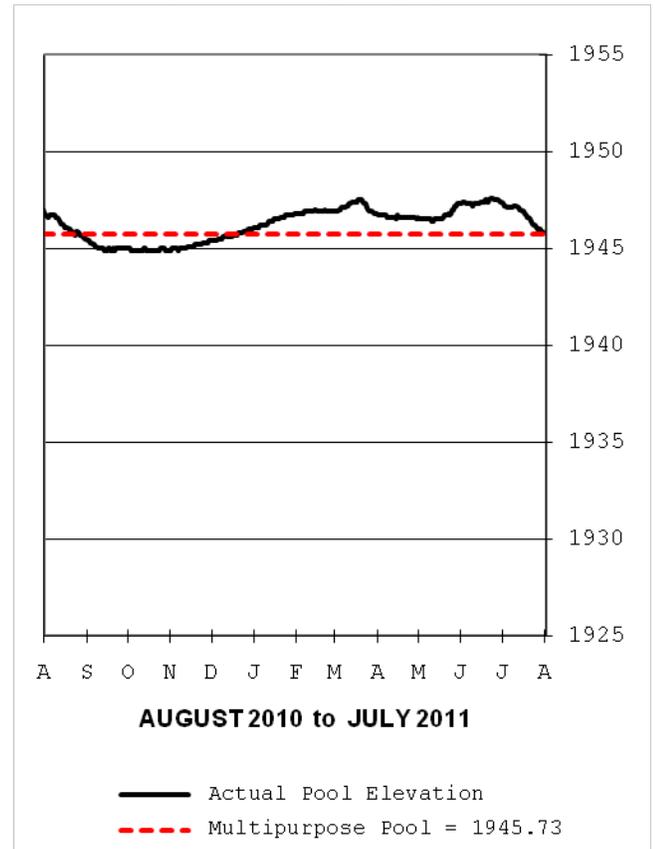
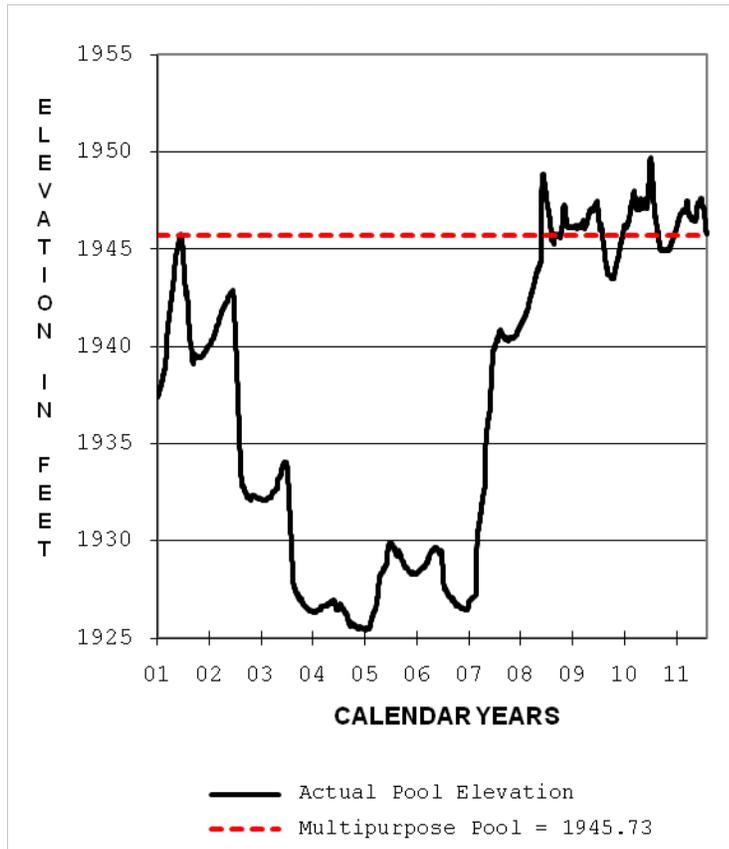


CLINTON LAKE ANNUAL INFLOW



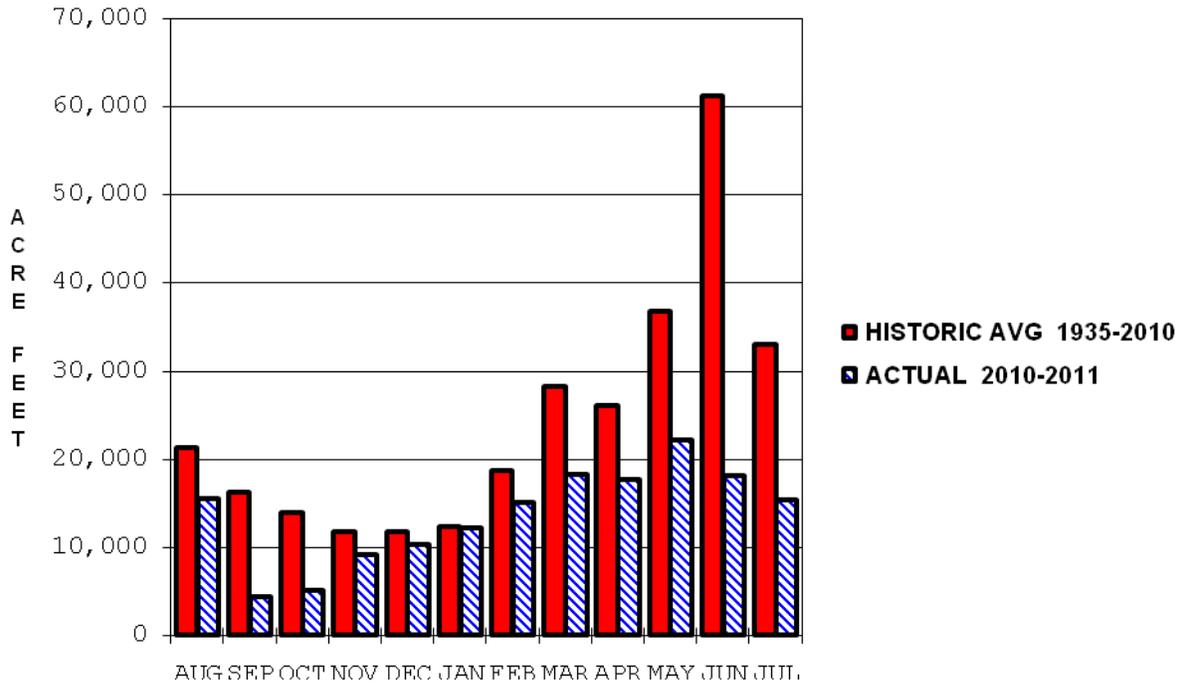
HARLAN COUNTY LAKE 2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW
WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

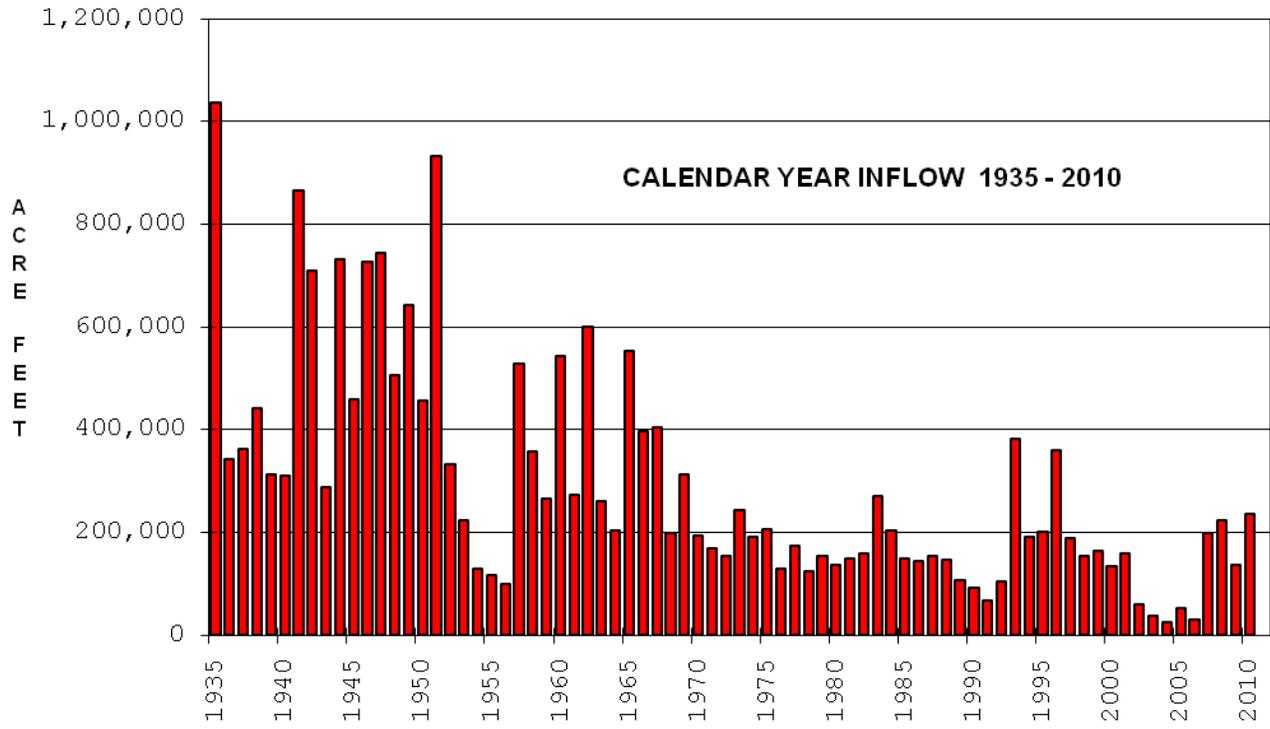


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1946.8 1 Aug 10	1945.8 31 Jul 11	1947.6 23 Jun 11	1944.9 13 Sept 10	1955.66 5 Apr 60	1925.38 31 Dec 04
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
1,700 24 Aug 10	164,347	1000 23 Mar 11	0 Many Days		
Max daily outflow to river normally occurs as part of normal releases for irrigation. No minimum release requirement.					

HARLAN COUNTY LAKE MONTHLY INFLOW



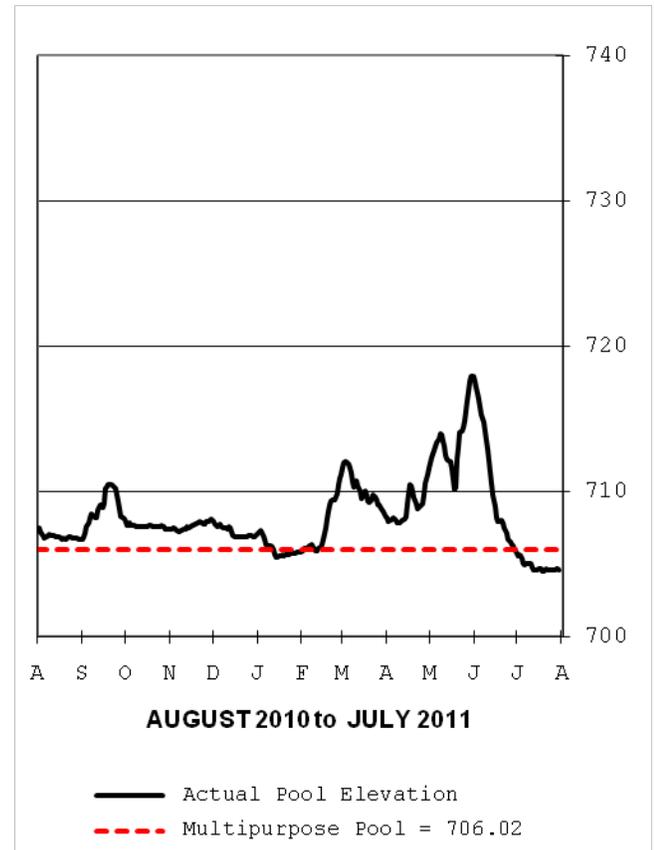
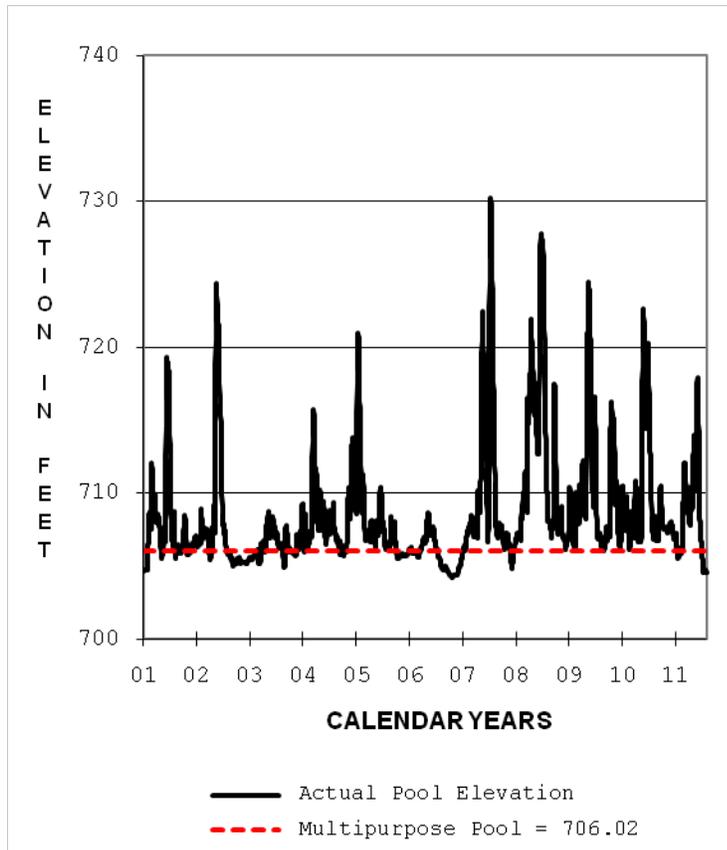
HARLAN COUNTY LAKE ANNUAL INFLOW



HARRY S TRUMAN RESERVOIR

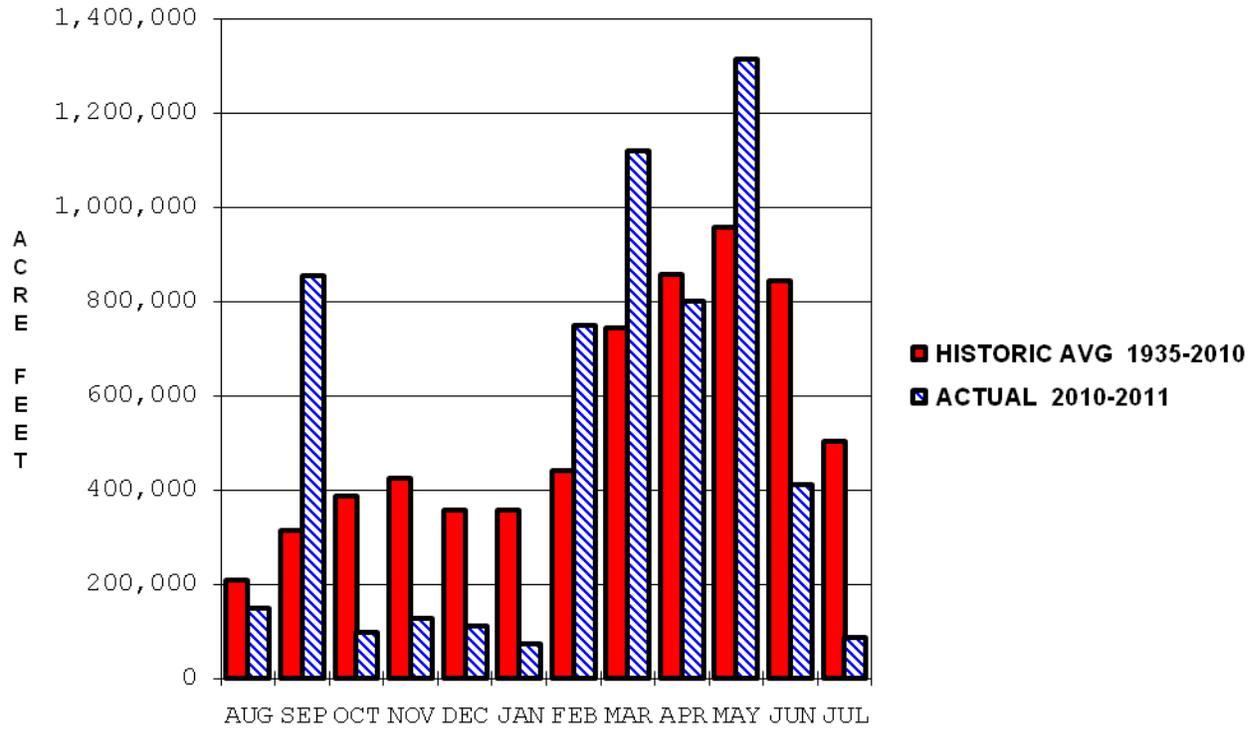
2010 - 2011 REGULATION

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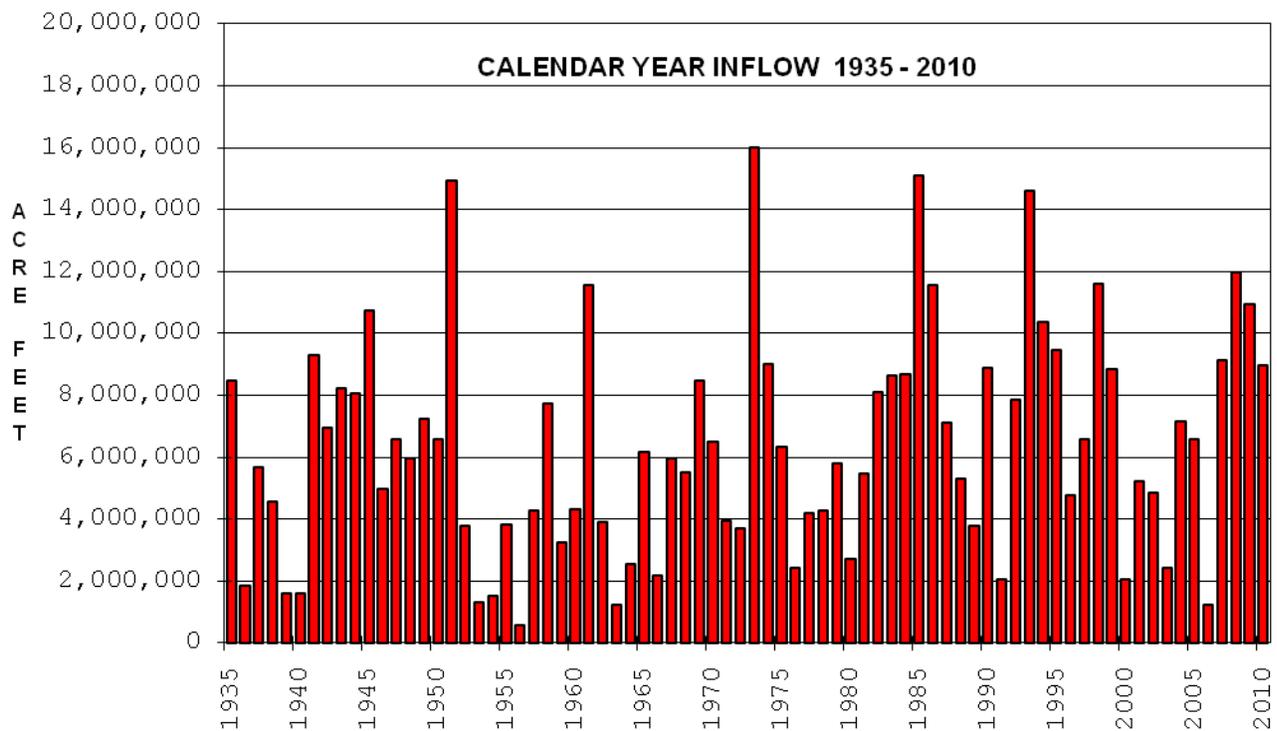


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
707.47 1 Aug 10	704.61 31 Jul 11	717.89 20 May 11	704.52 18 Jul 11	738.72 12 Oct 86	703.42 10 Apr 81
Report Period Inflow and Outflow					
Max Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
69,500 21 May 11	5,892,559	33,350 9 Jun 11	0 Many days		
No minimum release requirement.					

HARRY S. TRUMAN RESERVOIR MONTHLY INFLOW



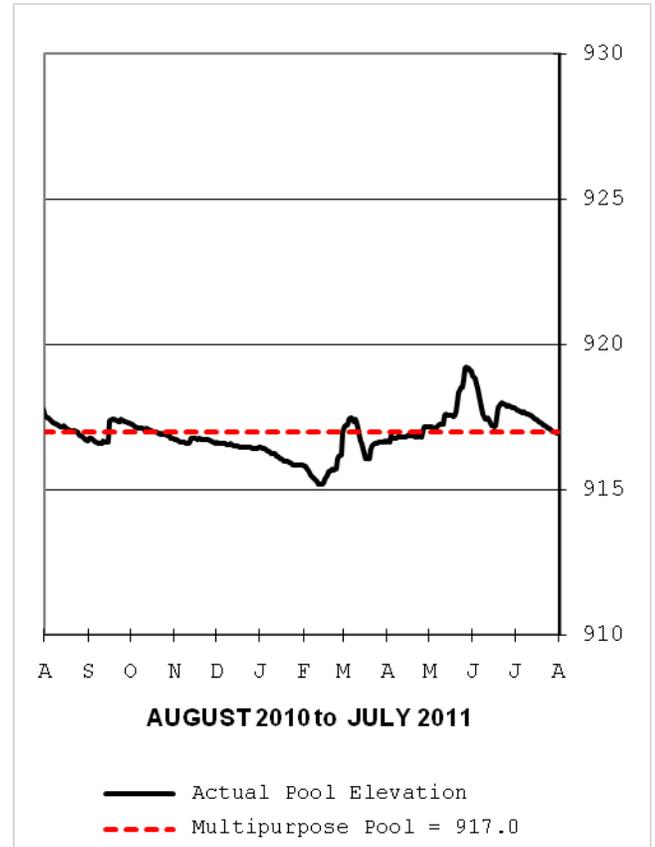
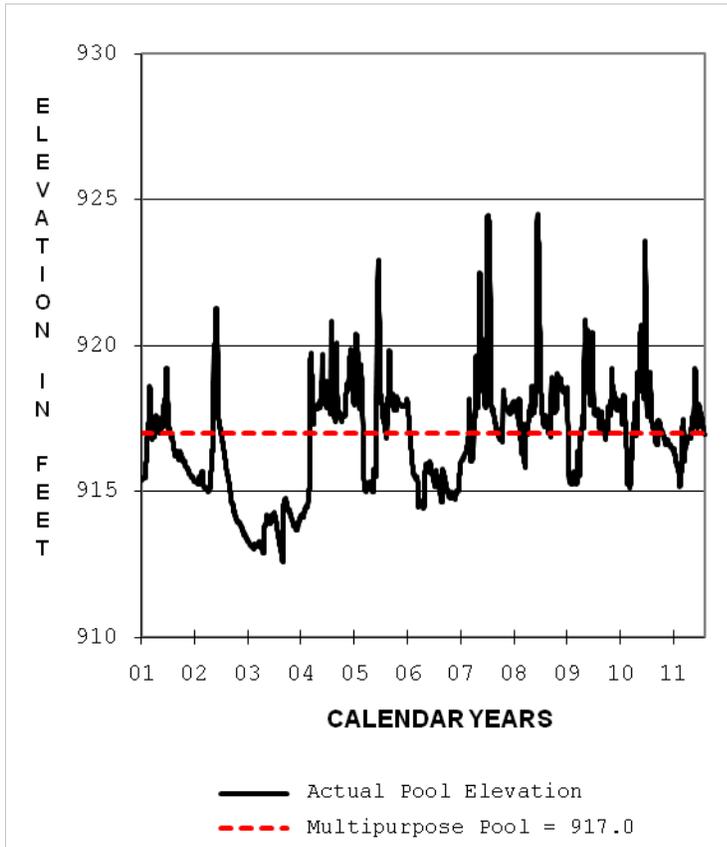
HARRY S. TRUMAN RESERVOIR ANNUAL INFLOW



HILLSDALE LAKE

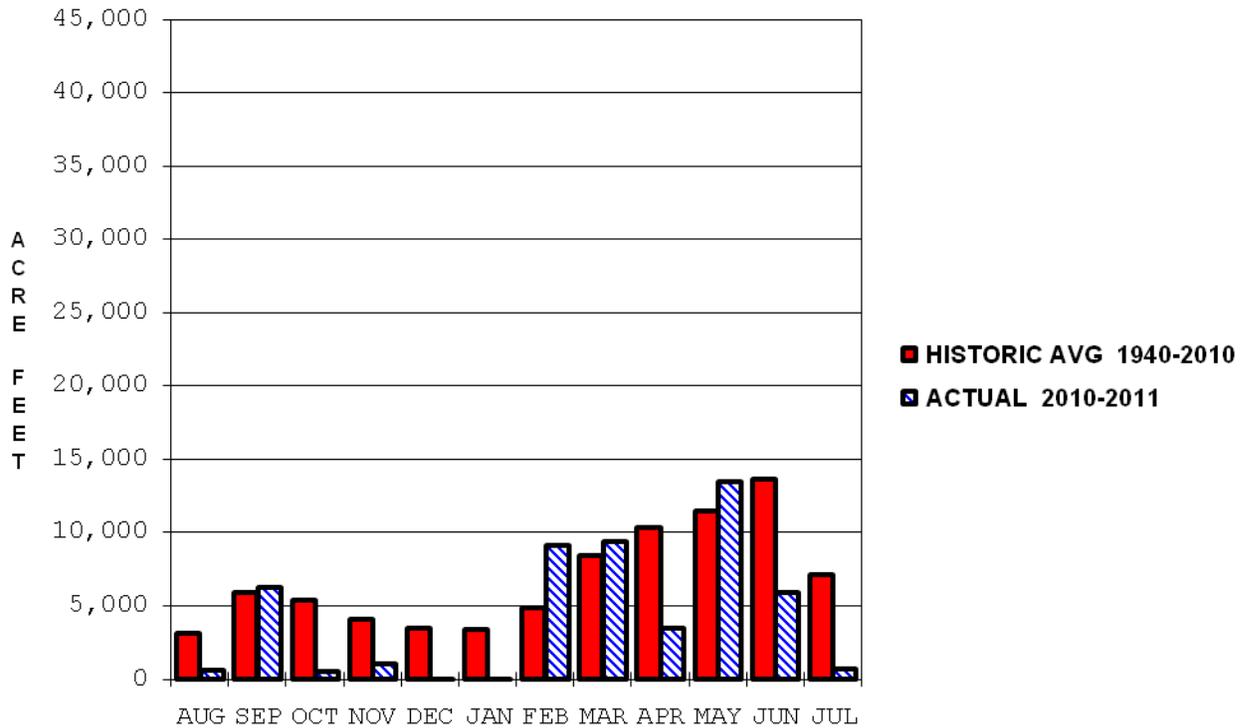
2010 - 2011 REGULATION

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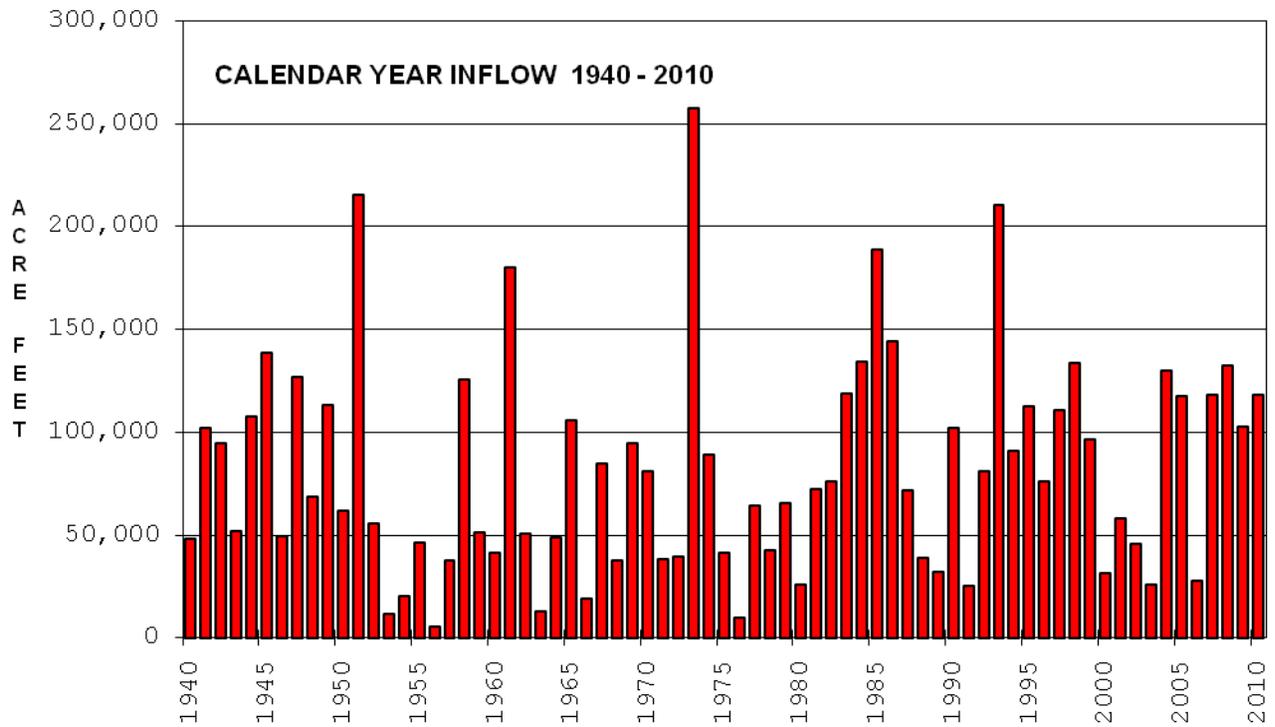


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
917.62 1 Aug 10	916.94 31 Jul 11	919.21 27 May 11	915.17 12 Feb 11	928.51 21 Oct 86	904.97 14-15 Nov 87
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
1,700 28 Feb 11	50,539	500 Many days	3 Many days		
Minimum required release varies seasonally 3 to 24 cfs. Releases cut to 0 for maintenance and inspections.					

HILLSDALE LAKE MONTHLY INFLOW



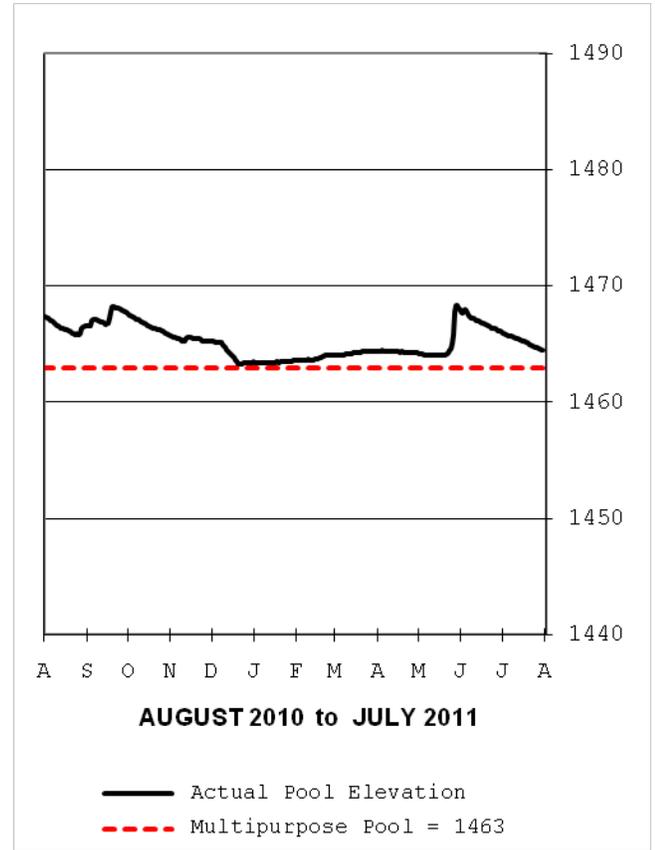
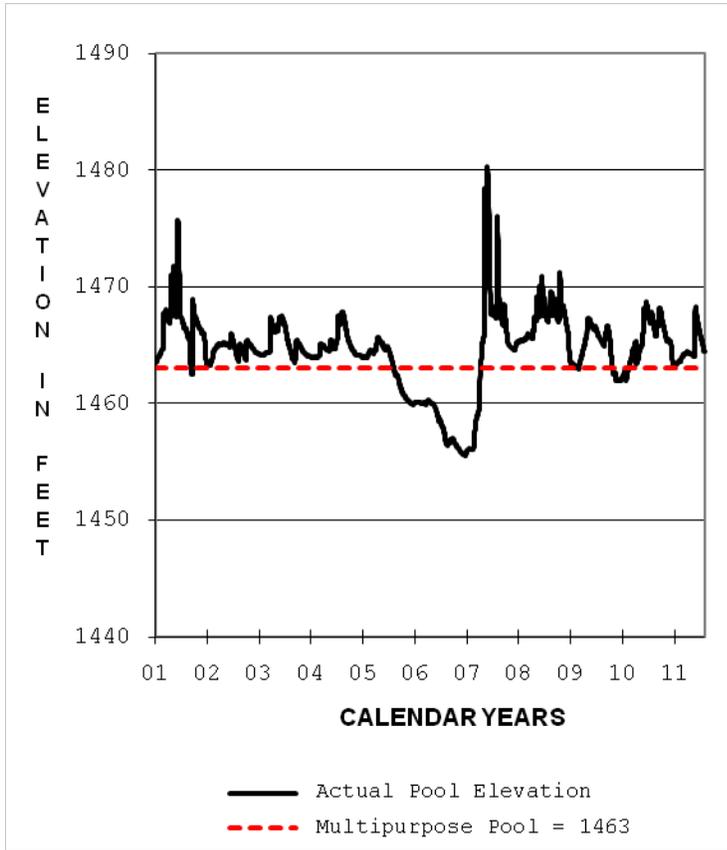
HILLSDALE LAKE ANNUAL INFLOW



KANOPOLIS LAKE

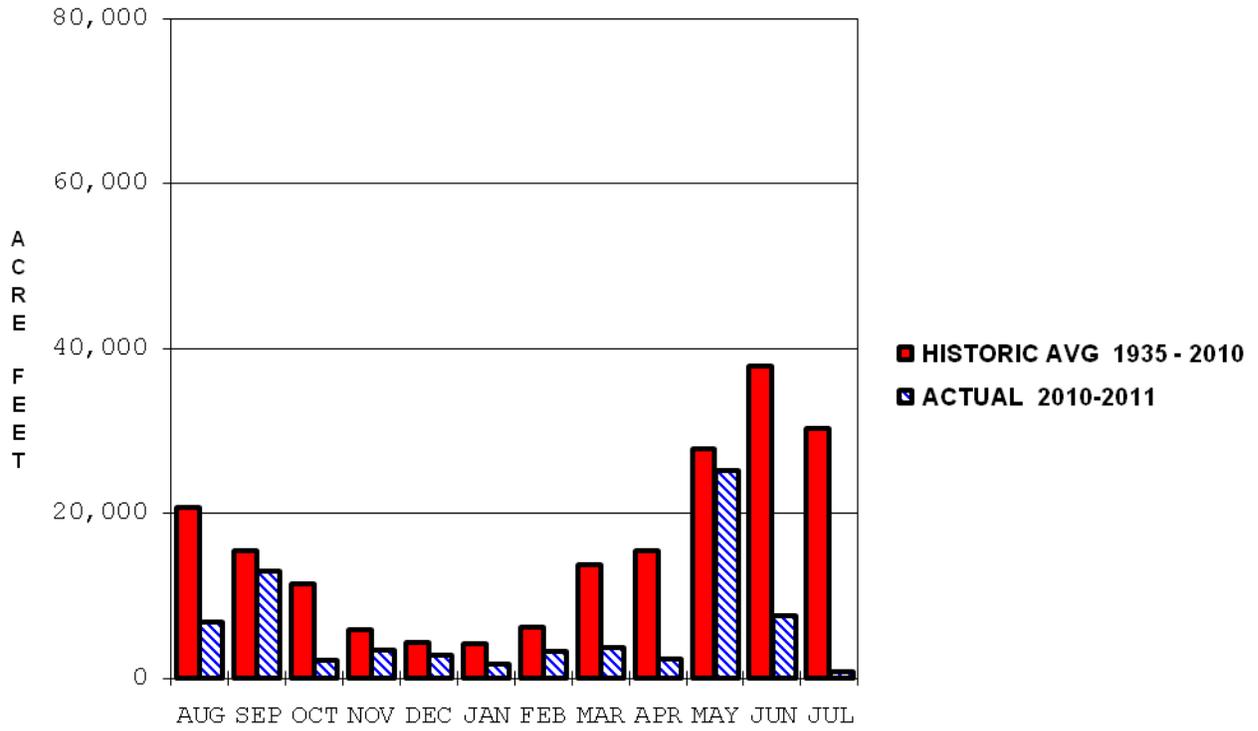
2010 - 2011 REGULATION

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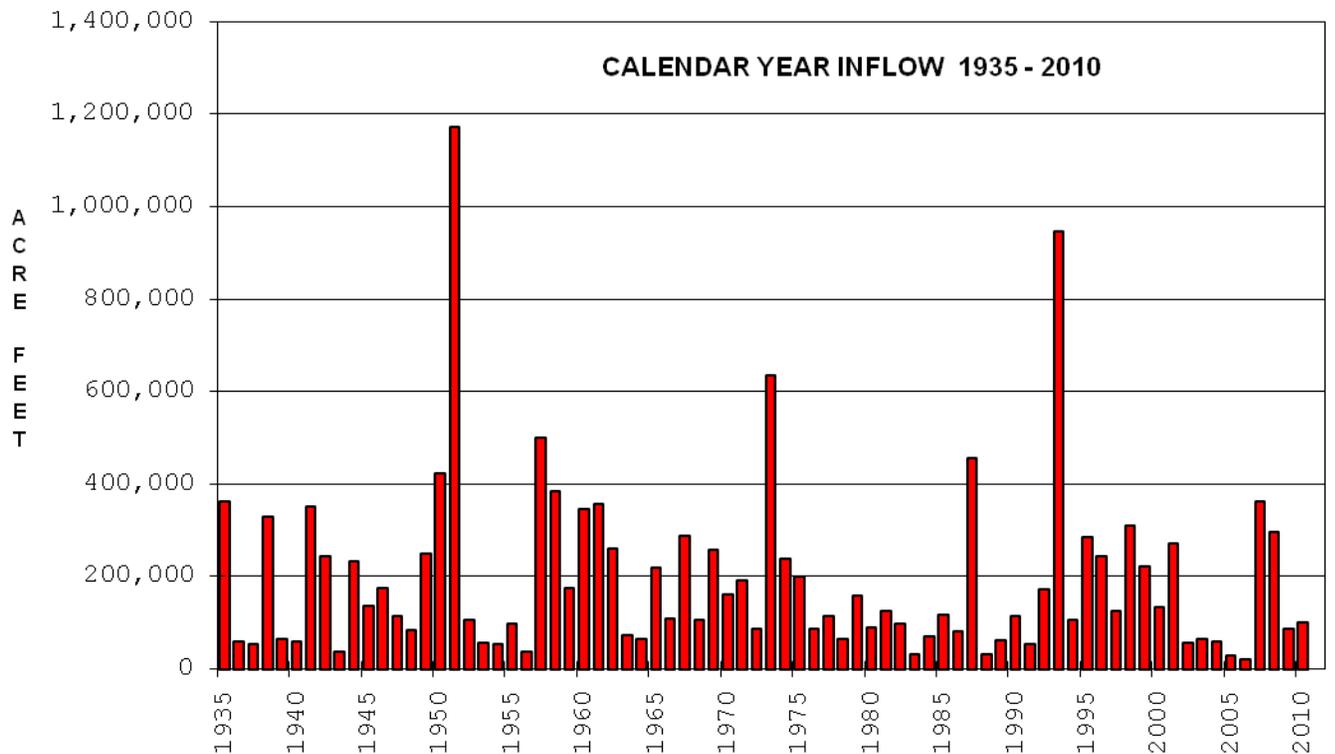


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1467.3 1 Aug 10	1464.5 31 Jul 11	1468.3 28 May 11	1463.3 20 Dec 10	1506.98 14 Jul 51	1452.55 11 Dec 88
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
4,000 27 May 11	76,635	677 29 May 11	0 Many days		
Outflows are total from the gates and the uncontrolled notch. Minimum release varies seasonally 10 to 50 cfs.					

KANOPOLIS LAKE MONTHLY INFLOW

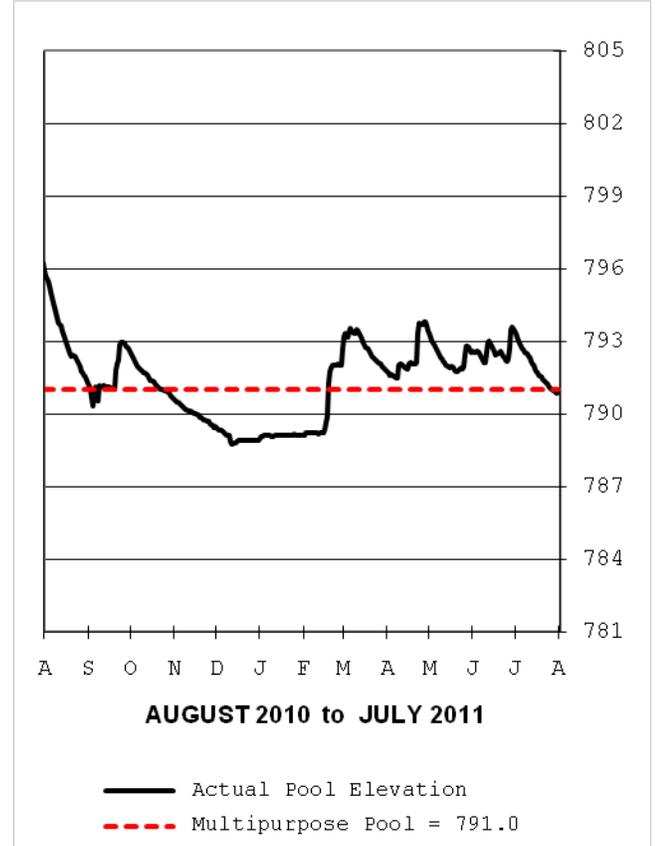
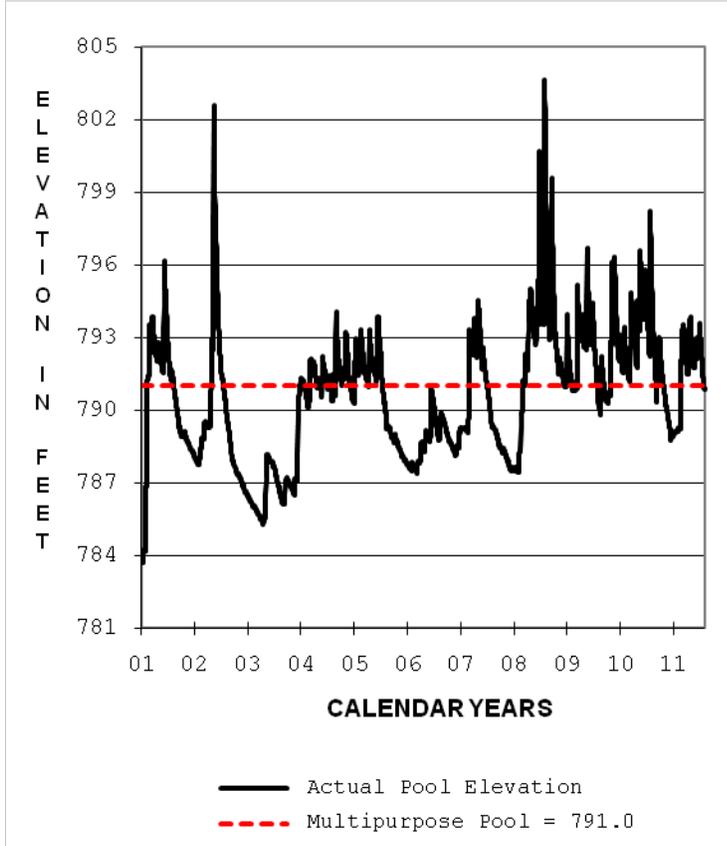


KANOPOLIS LAKE ANNUAL INFLOW



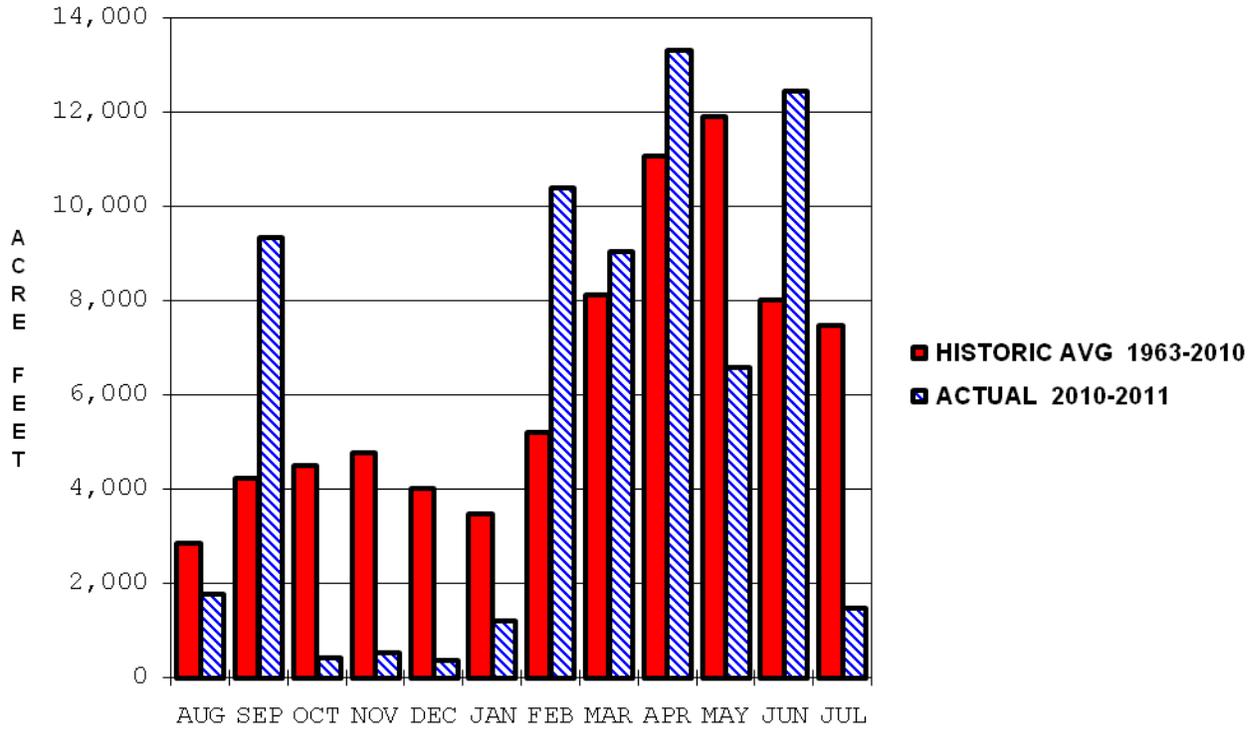
LONG BRANCH LAKE 2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW
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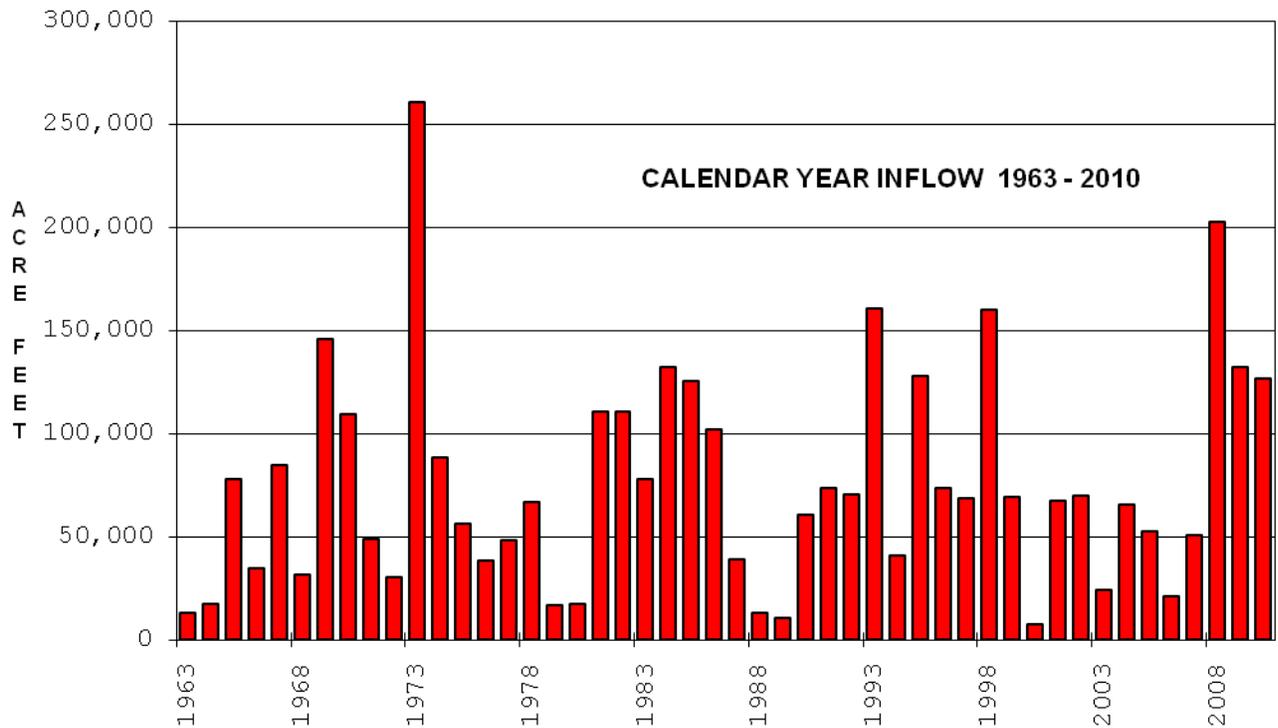


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
795.93 1 Aug 10	790.9 31 Jul 11	795.93 1 Aug 10	782.53 15 Dec 10	803.64 30 Jul 08	783.70 12 Jan 01
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
1,800 23 Apr 11	66,869	480 1 Aug 10	10 25 Dec 10		
Listed outflows are total to the river from the gates and the uncontrolled notch. Min req release is normally 7 cfs.					

LONG BRANCH LAKE MONTHLY INFLOW



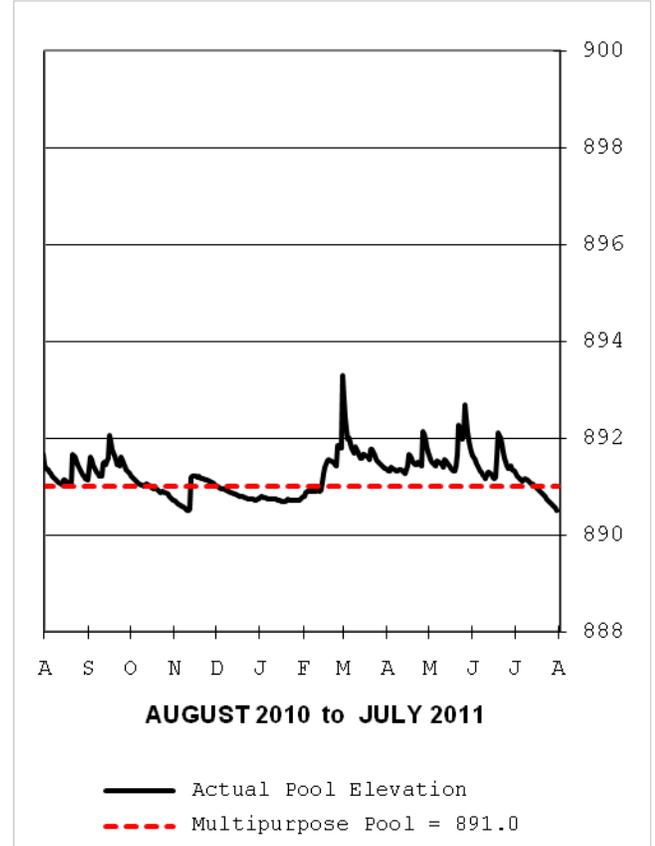
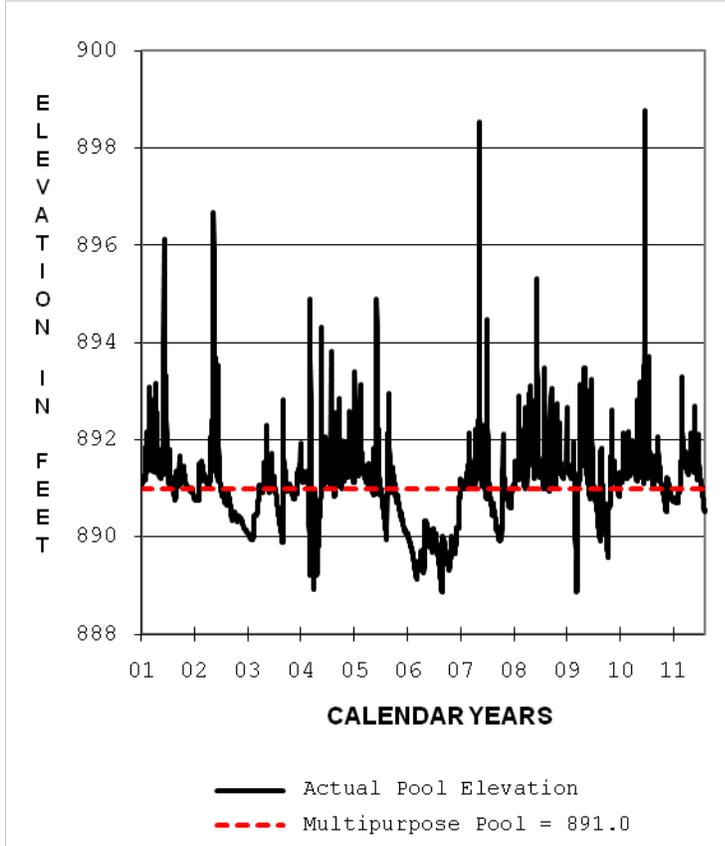
LONG BRANCH LAKE ANNUAL INFLOW



LONGVIEW LAKE

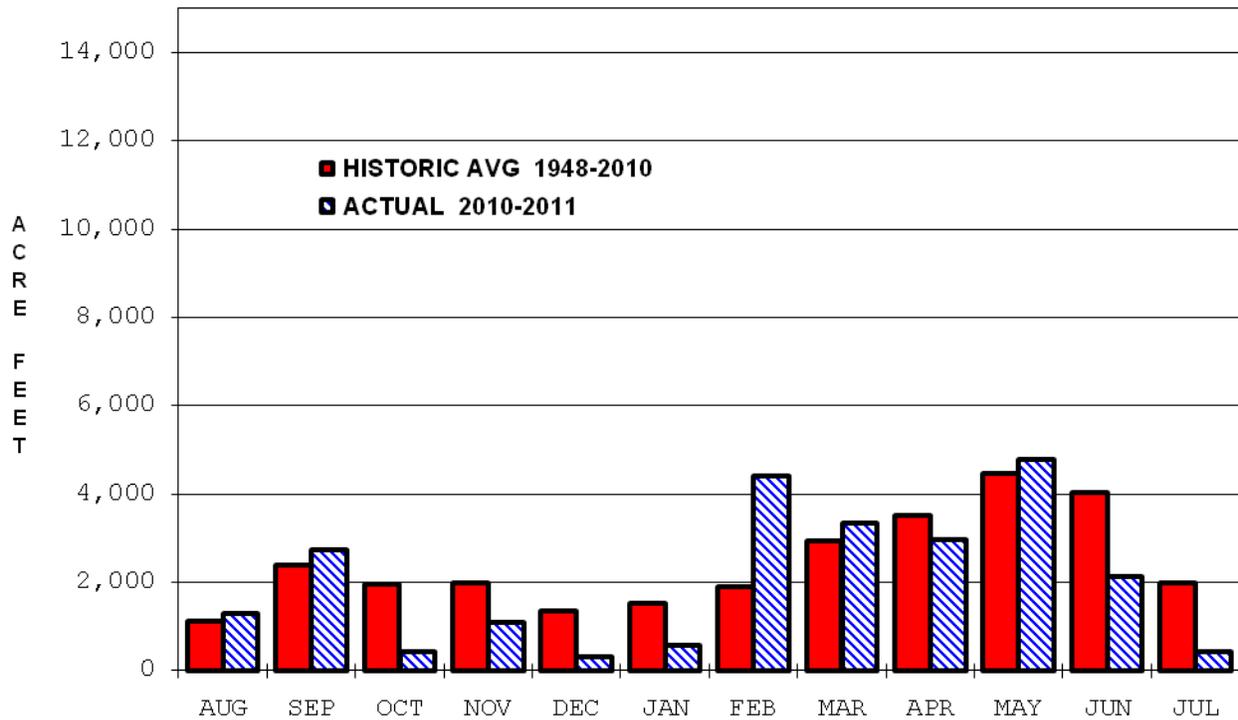
2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW
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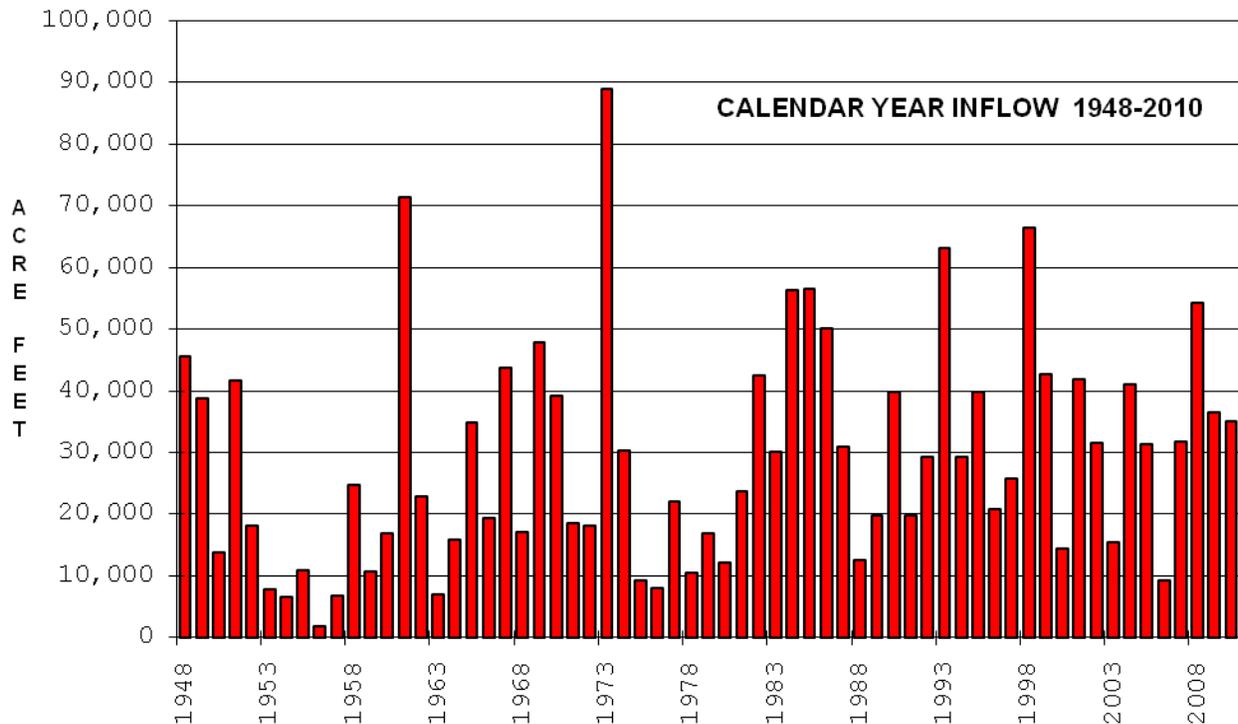


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
891.47 1 Aug 10	890.58 31 Jul 11	893.3 28 Feb 11	890.51 11 Nov 10	903.37 16 May 90	888.08 14 Sep 88
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
1,075 28 Feb 11	24,569	415 1 Mar 11	8 Many Days		
Listed outflows are total to the river from the gate and the uncontrolled notch. Minimum required release is 8 cfs.					

LONGVIEW LAKE MONTHLY INFLOW



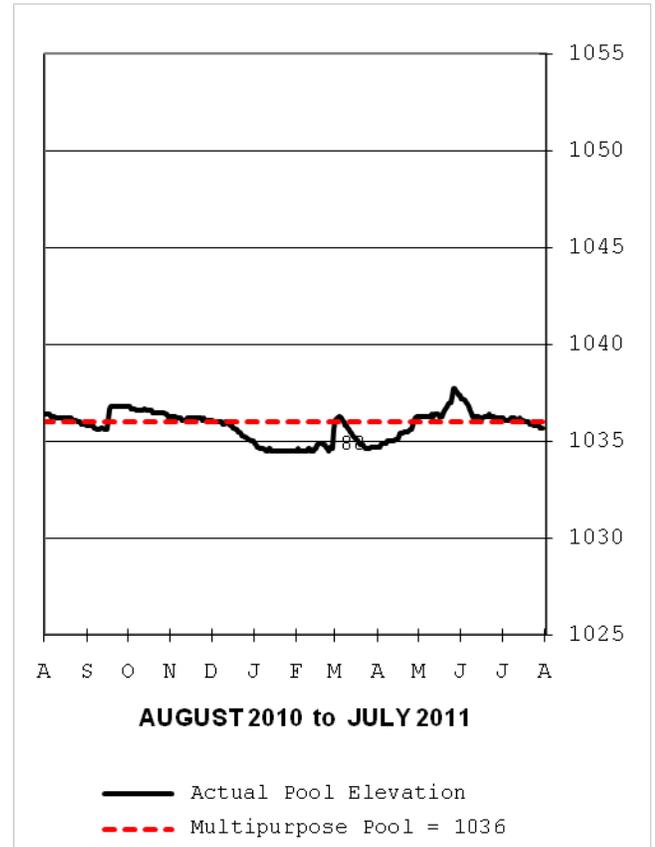
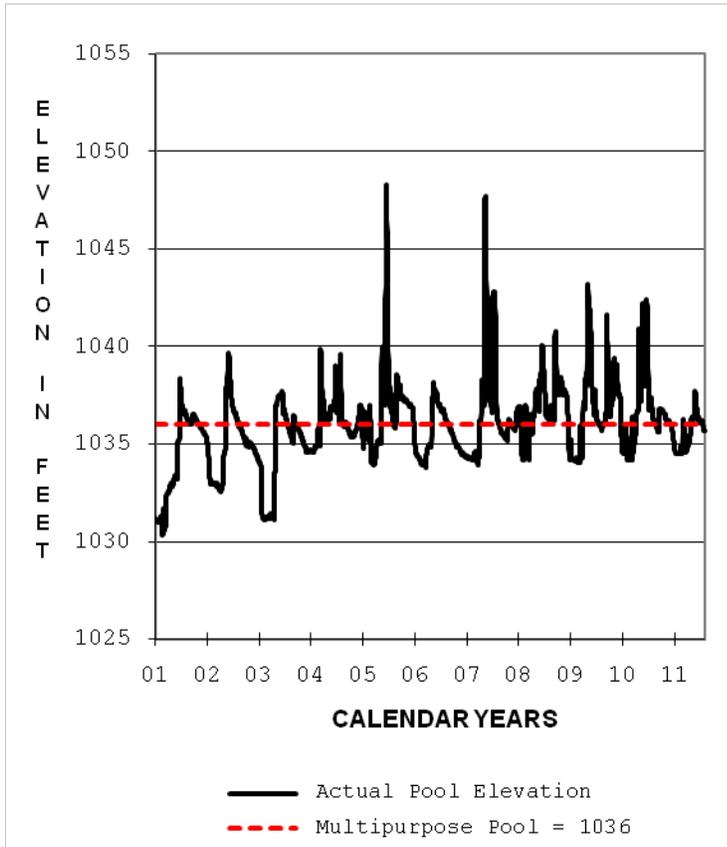
LONGVIEW LAKE ANNUAL INFLOW



MELVERN LAKE

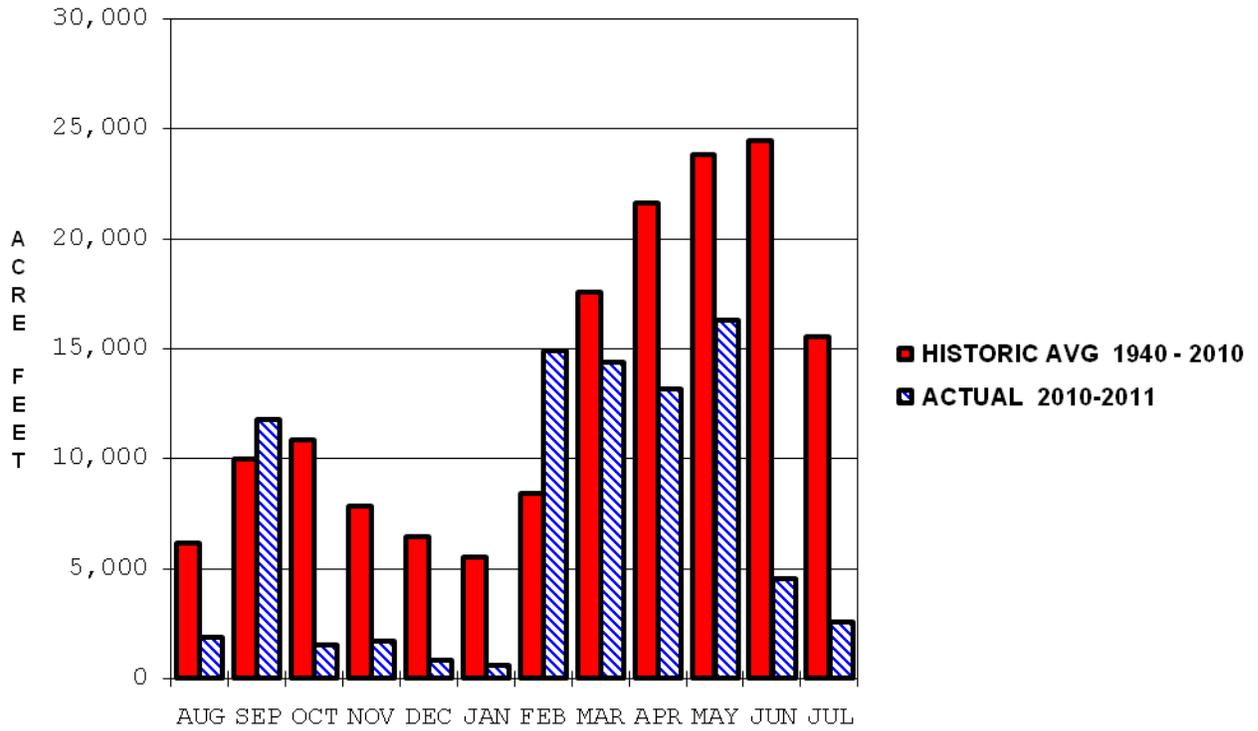
2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

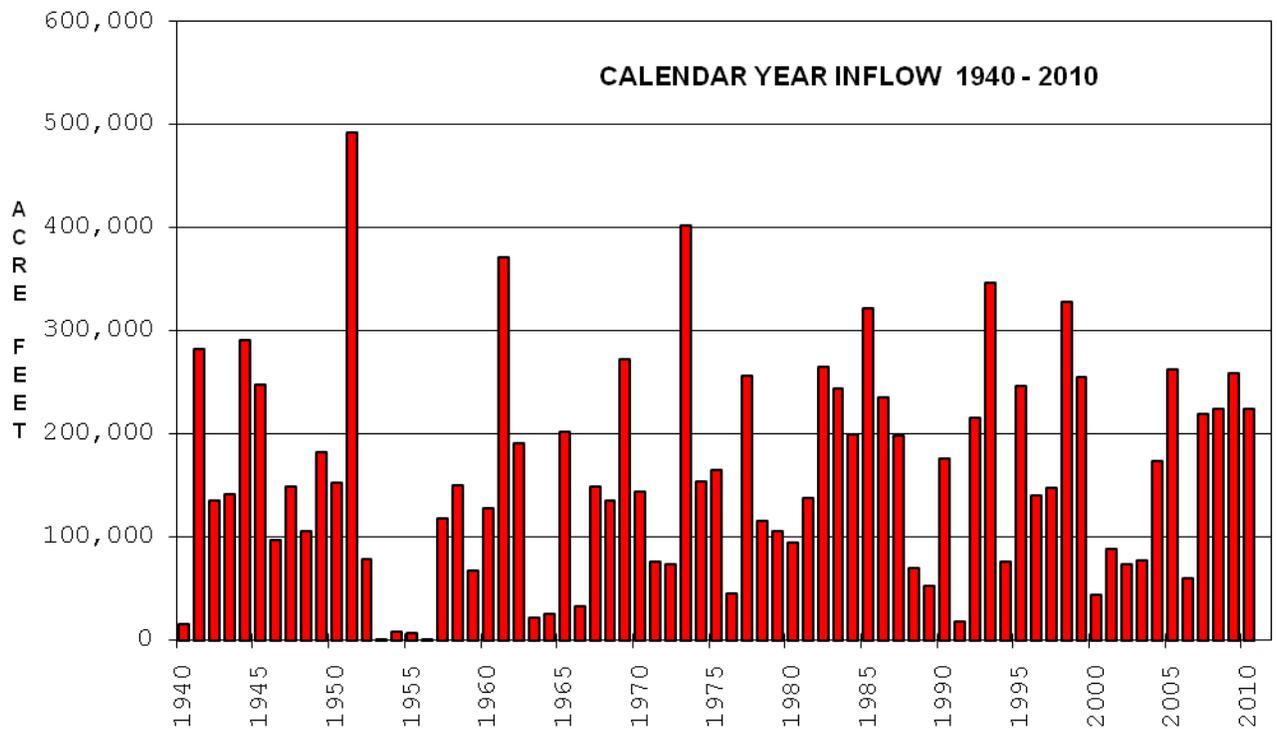


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1036.4 1 Aug 10	1035.7 31 Jul 11	1037.7 26 May 11	1034.5 9 Jan 11	1053.45 13 Jun 95	1029.87 11 Feb 92
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
2,000 28 Feb 11	83,600	500 Many days	20 Many days		
Minimum required release is 20 cfs. Releases reduced to 0 for maintenance and inspection periods.					

MELVERN LAKE MONTHLY INFLOW



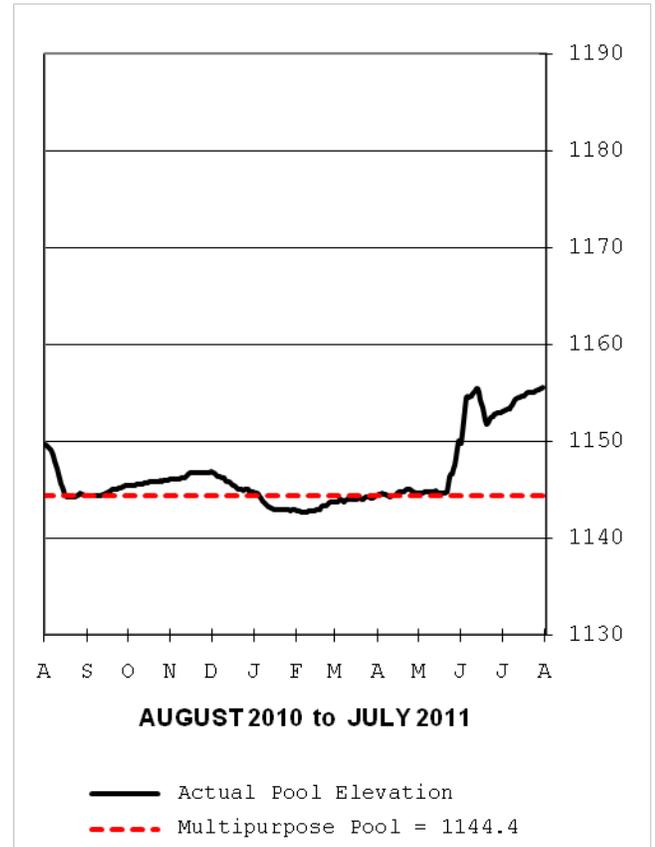
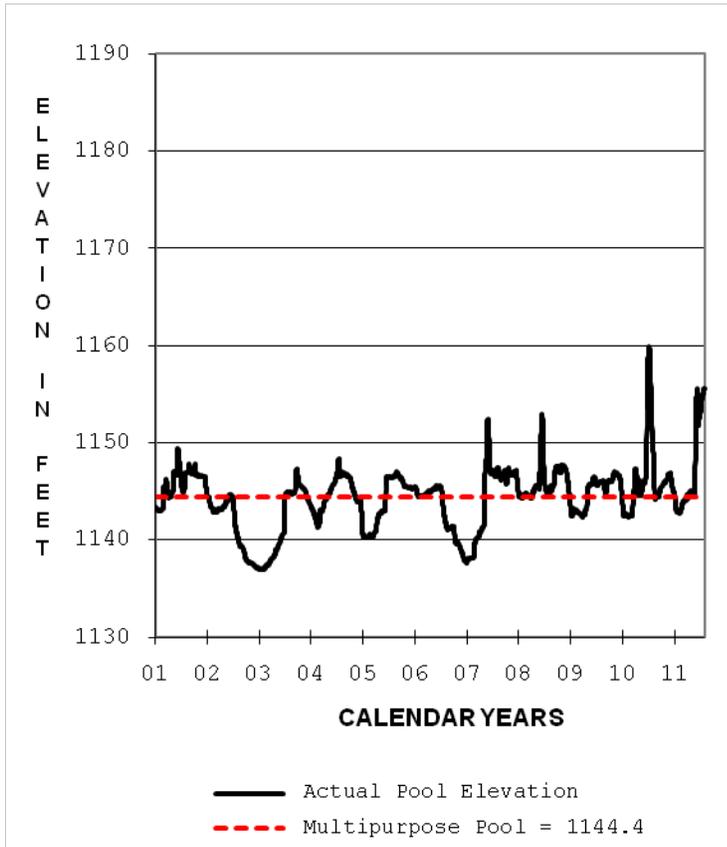
MELVERN LAKE ANNUAL INFLOW



MILFORD LAKE

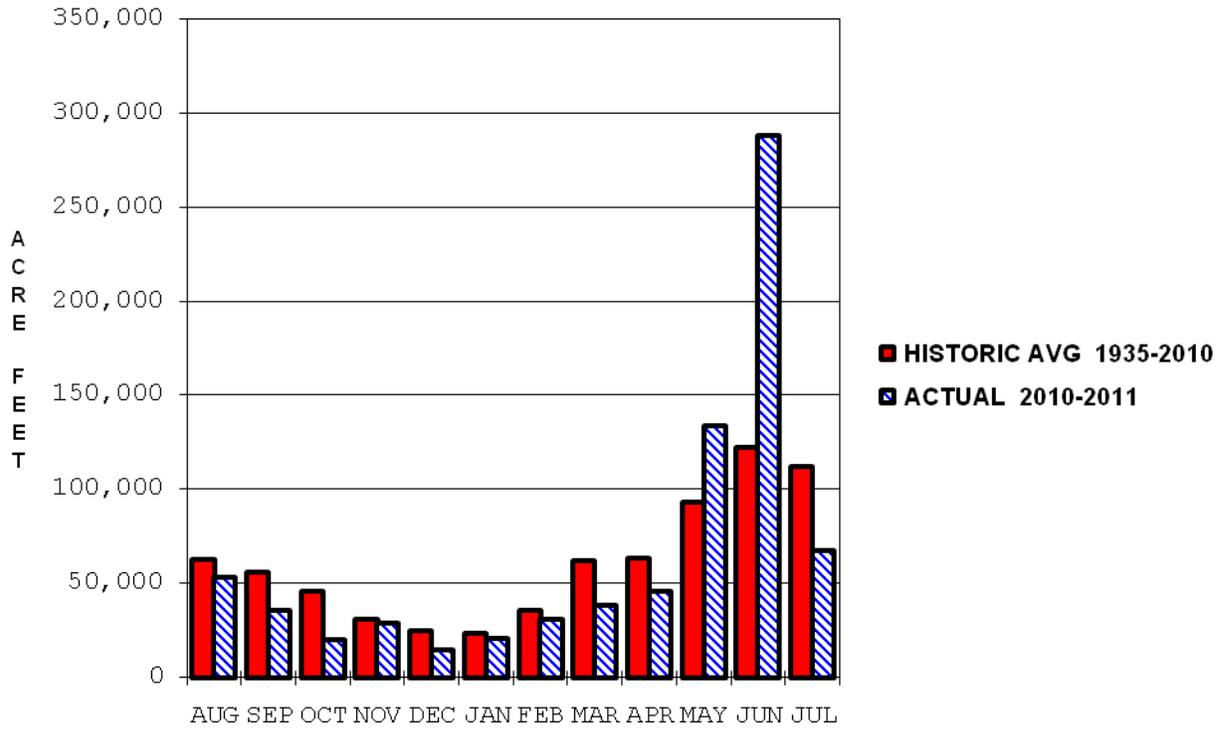
2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

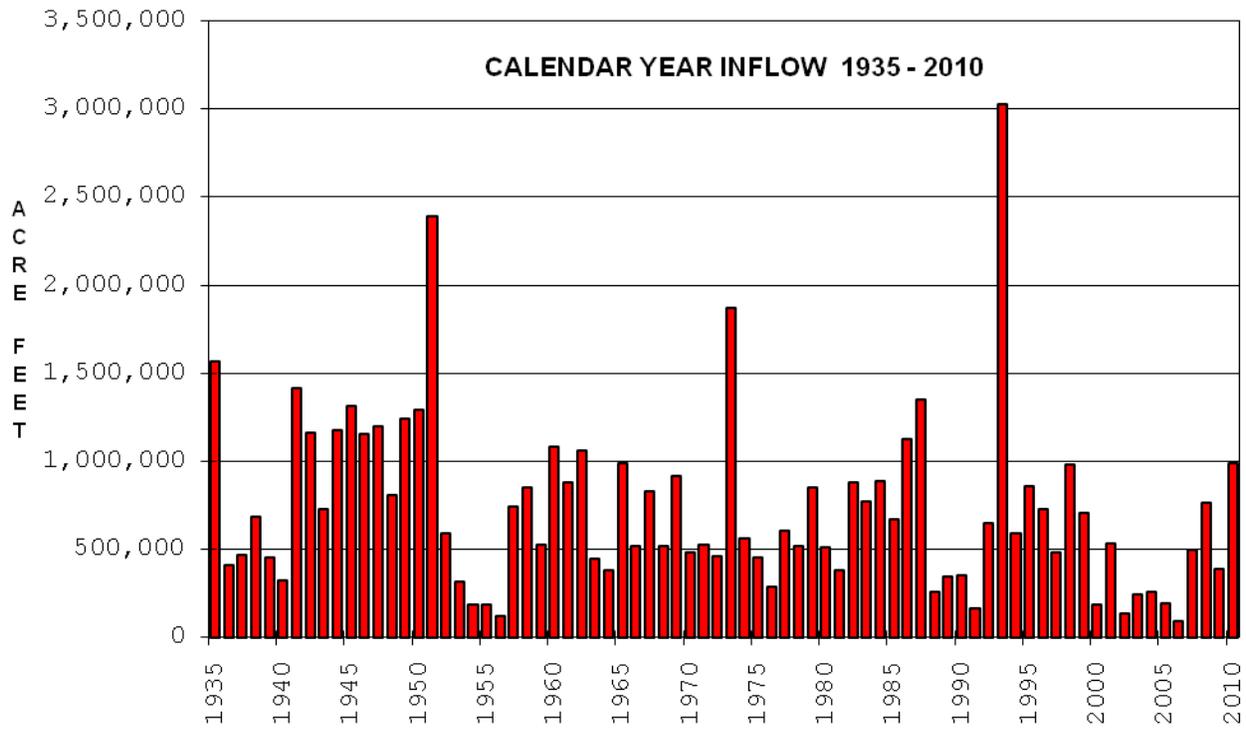


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1149.7 1 Aug 10	1155.6 31 Jul 11	1155.6 31 Jul 11	1142.7 4 Feb 11	1181.94 25 Jul 93	1136.89 12-13 Jan 03
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
32,800 3 Jun 11	778,186	9,000 3 Jun 11	25 Many days		
Minimum required release is 25 cfs.					

MILFORD LAKE MONTHLY INFLOW



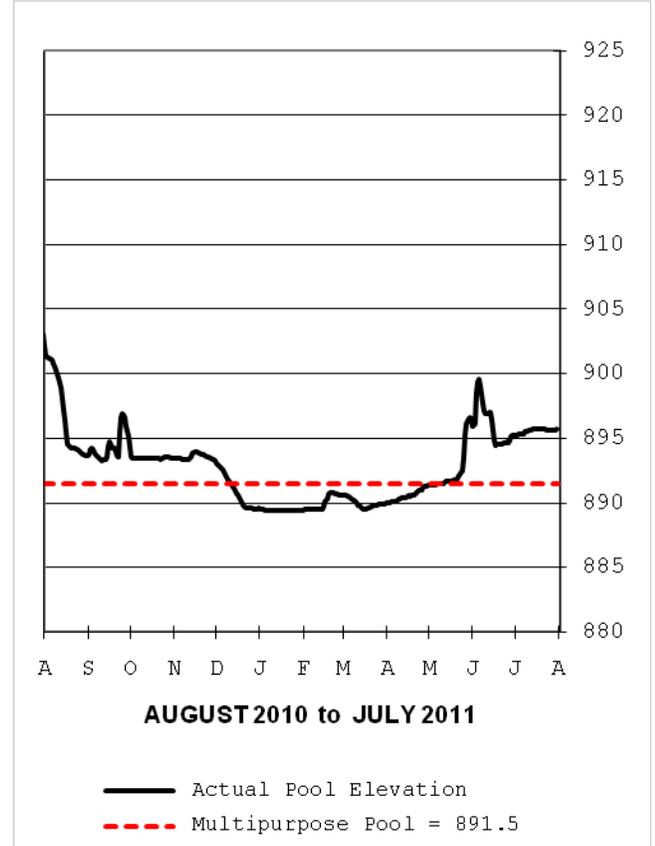
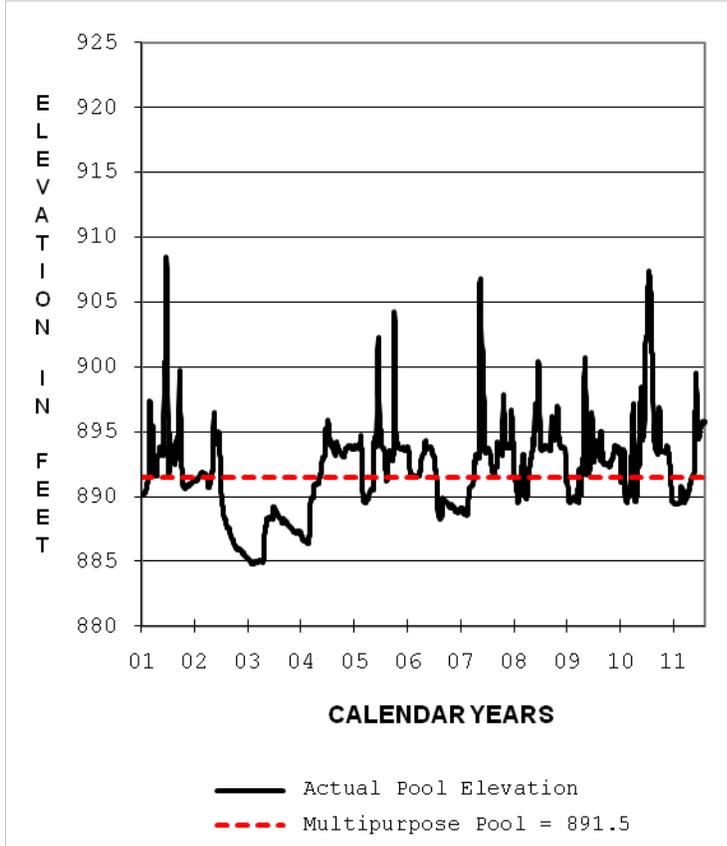
MILFORD LAKE ANNUAL INFLOW



PERRY LAKE

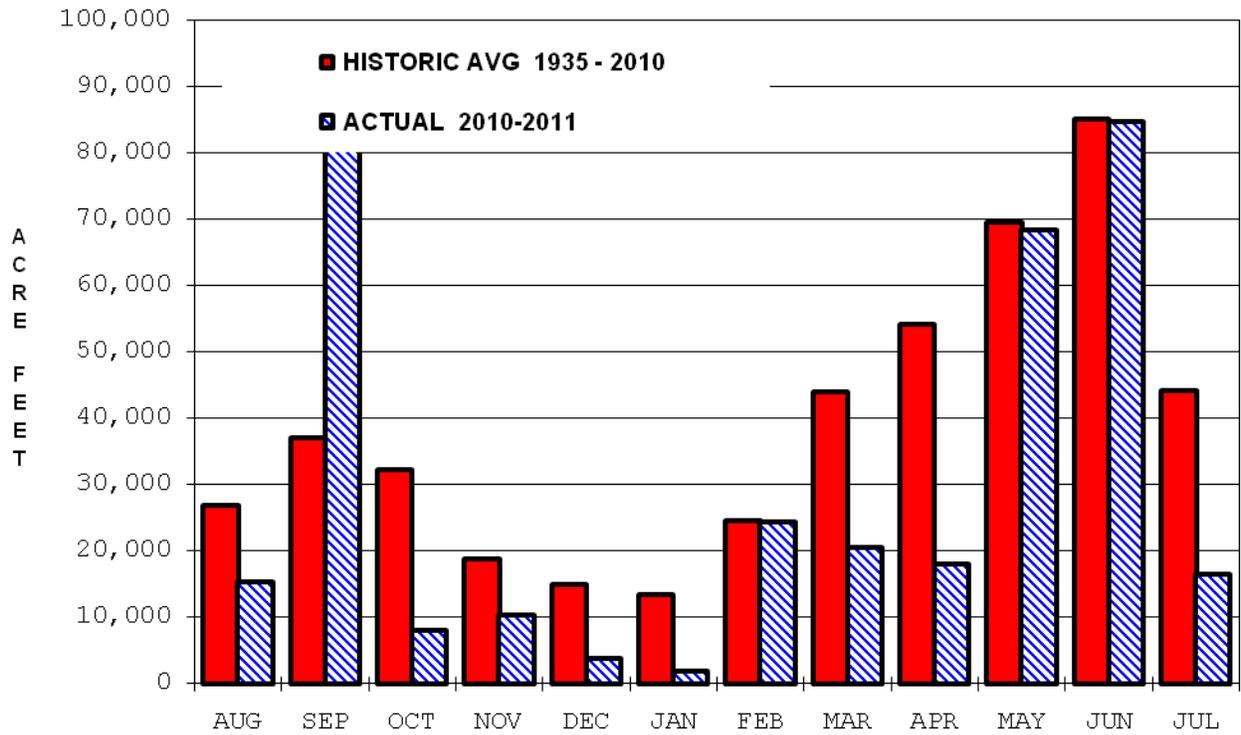
2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW
WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

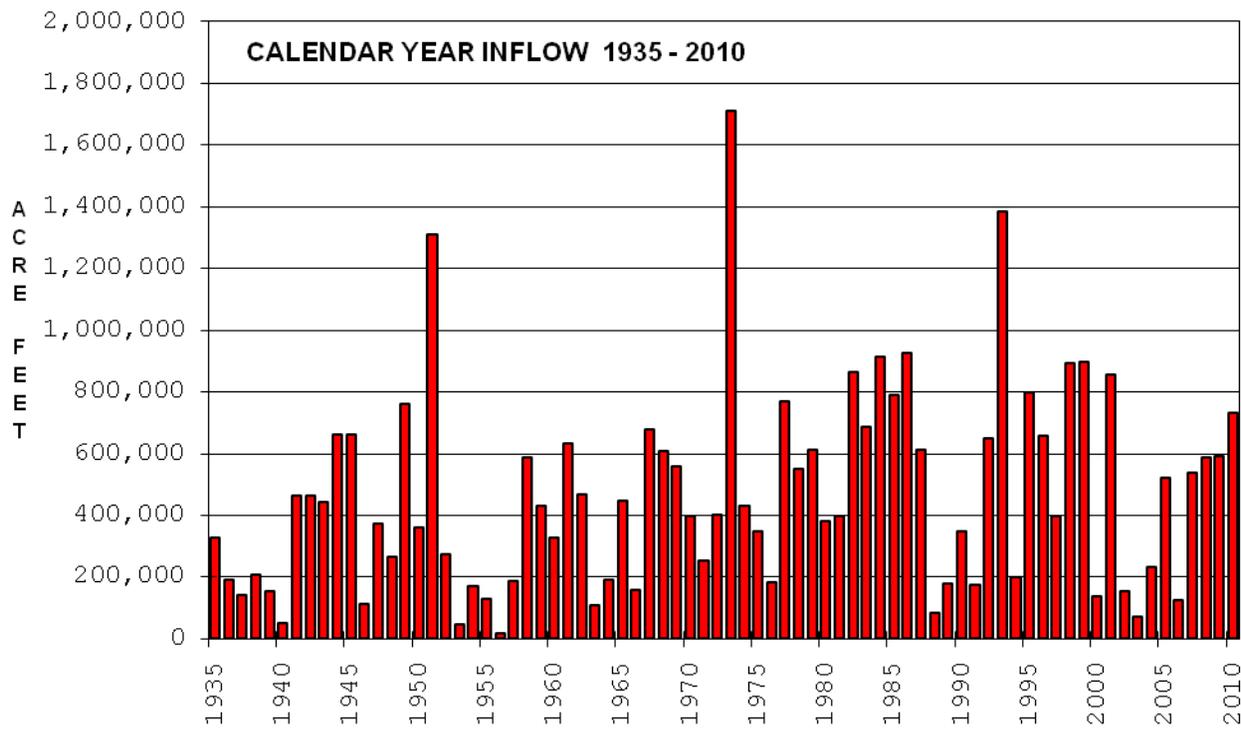


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
902.13 1 Aug 10	895.8 31 Jul 11	902.13 1 Aug 10	889.38 17 Jan 11	920.85 25 Jul 93	884.77 30 Jan 03
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
16,400 3 Jun 11	363,360	8,000 1 Aug 10	25 Many days		
Minimum required release is 25 cfs. Releases reduced to 0 for maintenance and inspection periods.					

PERRY LAKE MONTHLY INFLOW



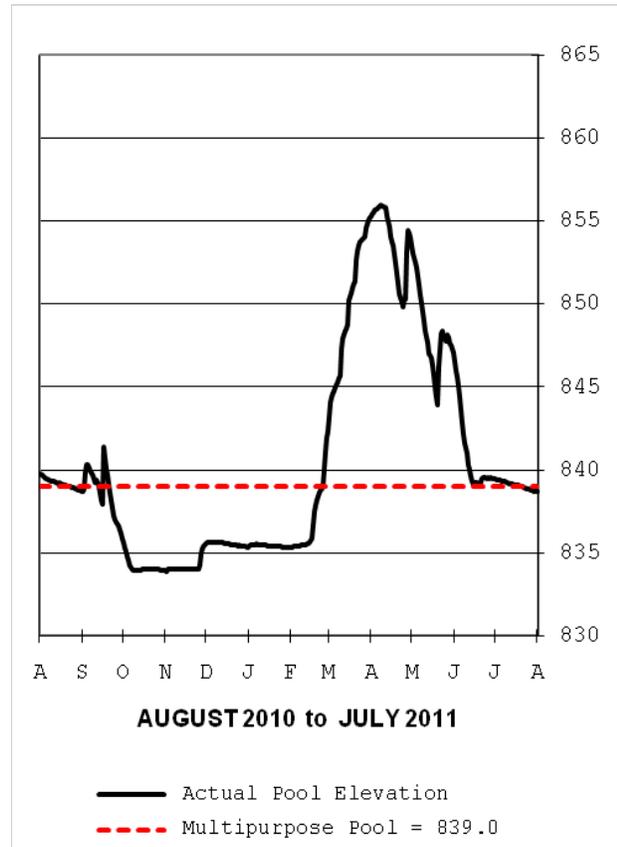
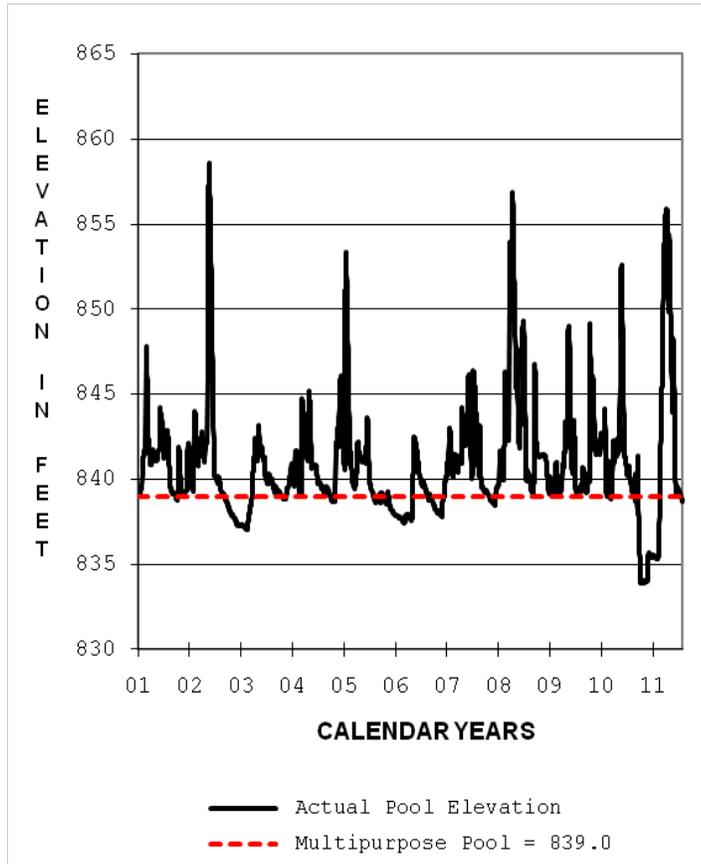
PERRY LAKE ANNUAL INFLOW



POMME DE TERRE LAKE

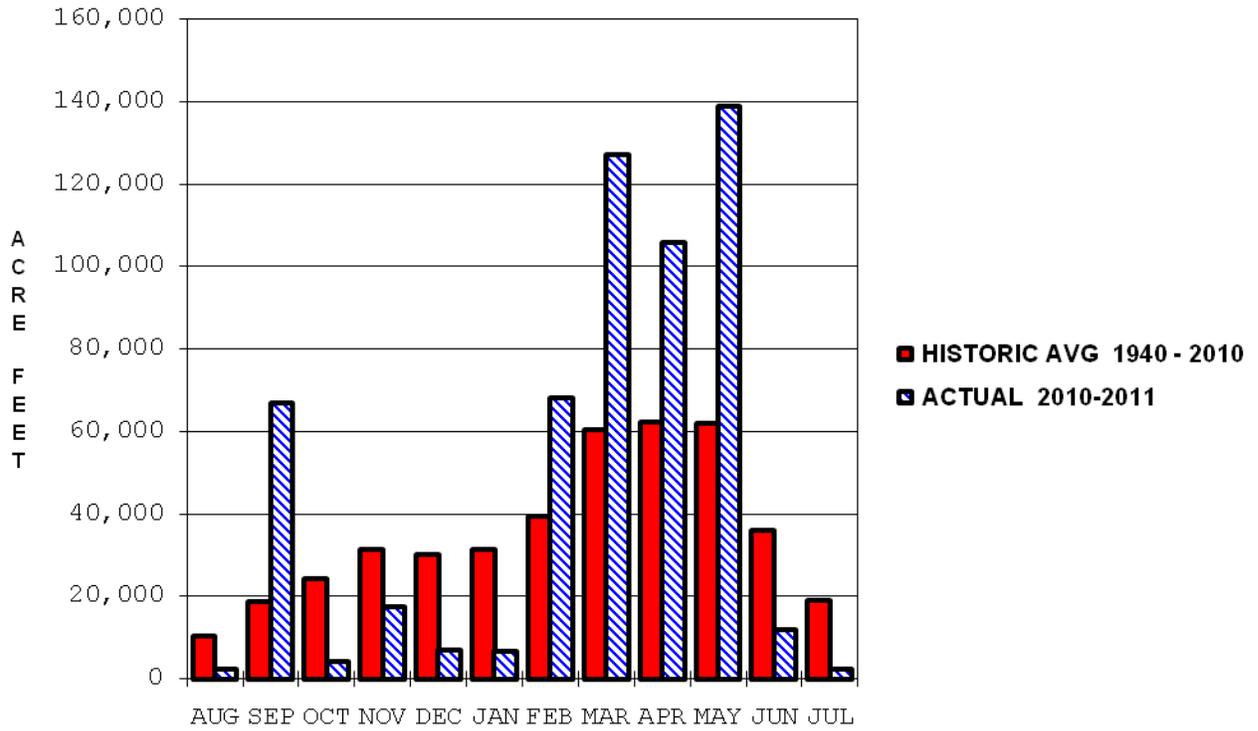
2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

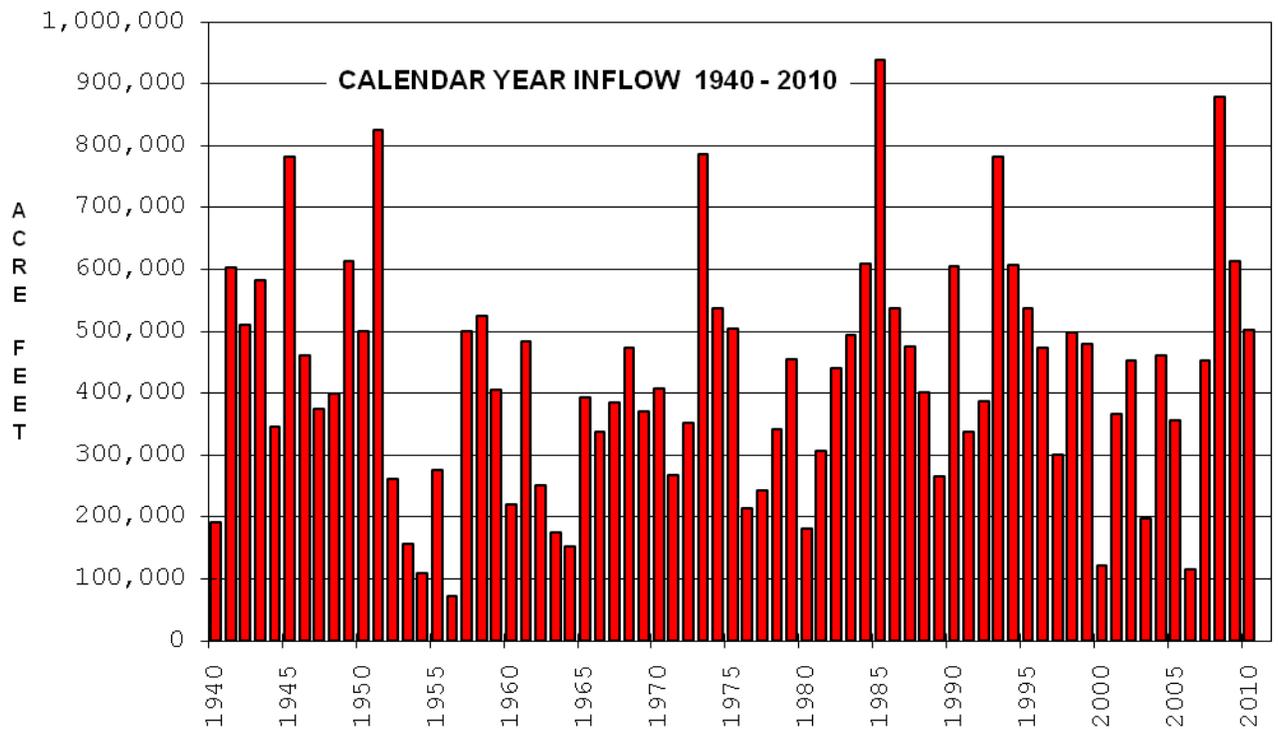


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
839.69 1 Aug 10	838.69 31 Jul 11	855.93 7 Apr 11	833.89 1 Nov 10	864.58 27 Sep 93	833.89 1 Nov 10
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
12,000 26 Apr 11	559,229	3,500 Many days	0 Many days		
Minimum required release is 50 to 100 cfs, varying by season and pool level.					

POMME DE TERRE LAKE MONTHLY INFLOW



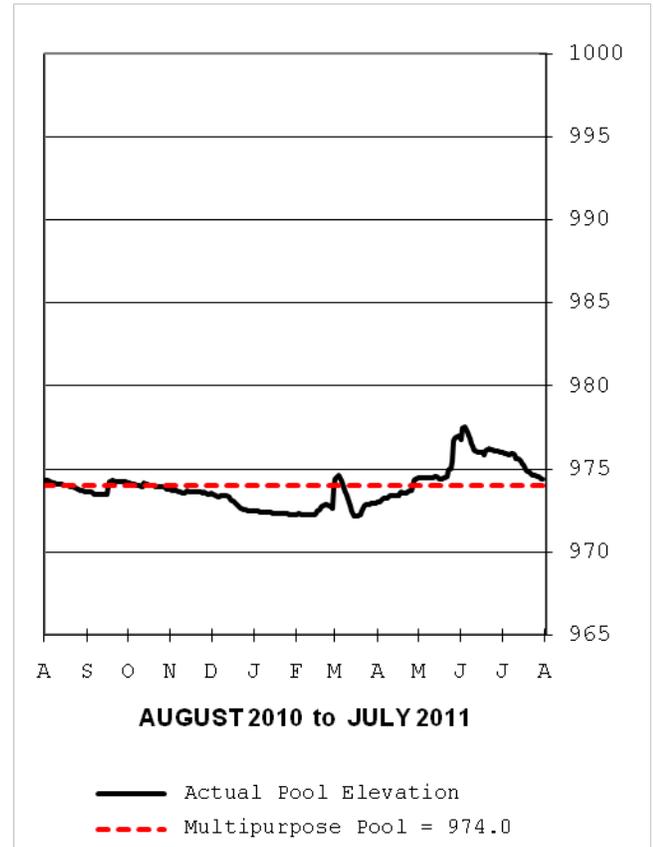
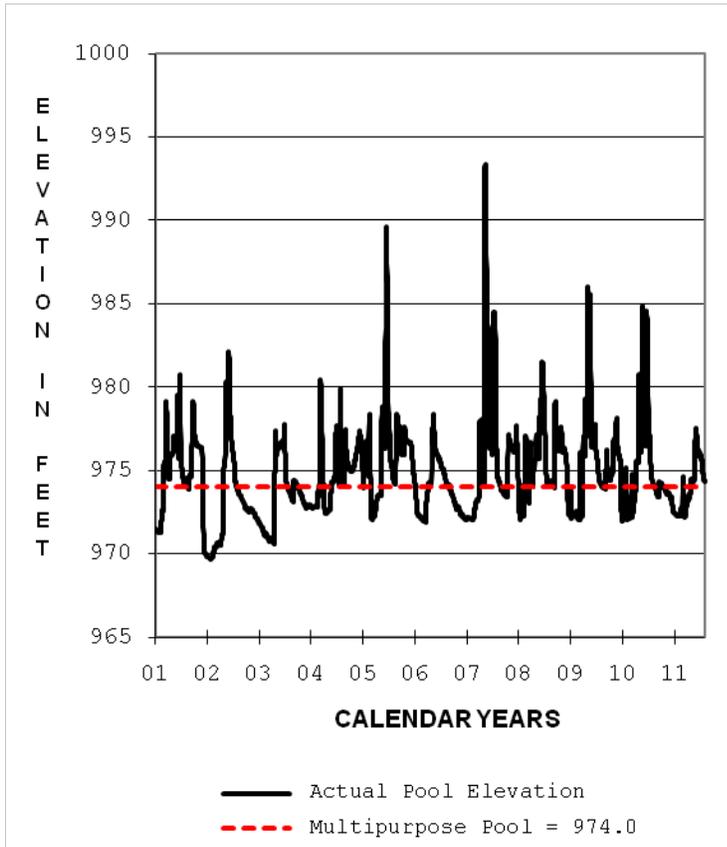
POMME DE TERRE LAKE ANNUAL INFLOW



POMONA LAKE

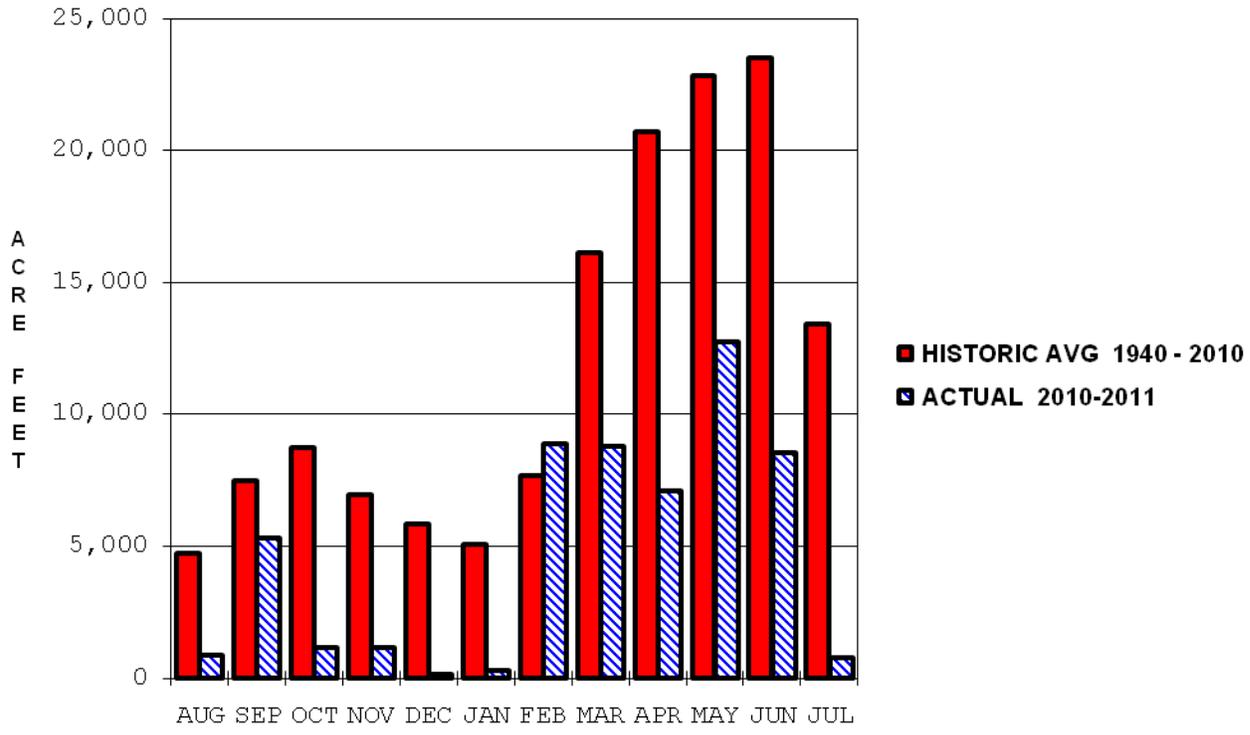
2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW

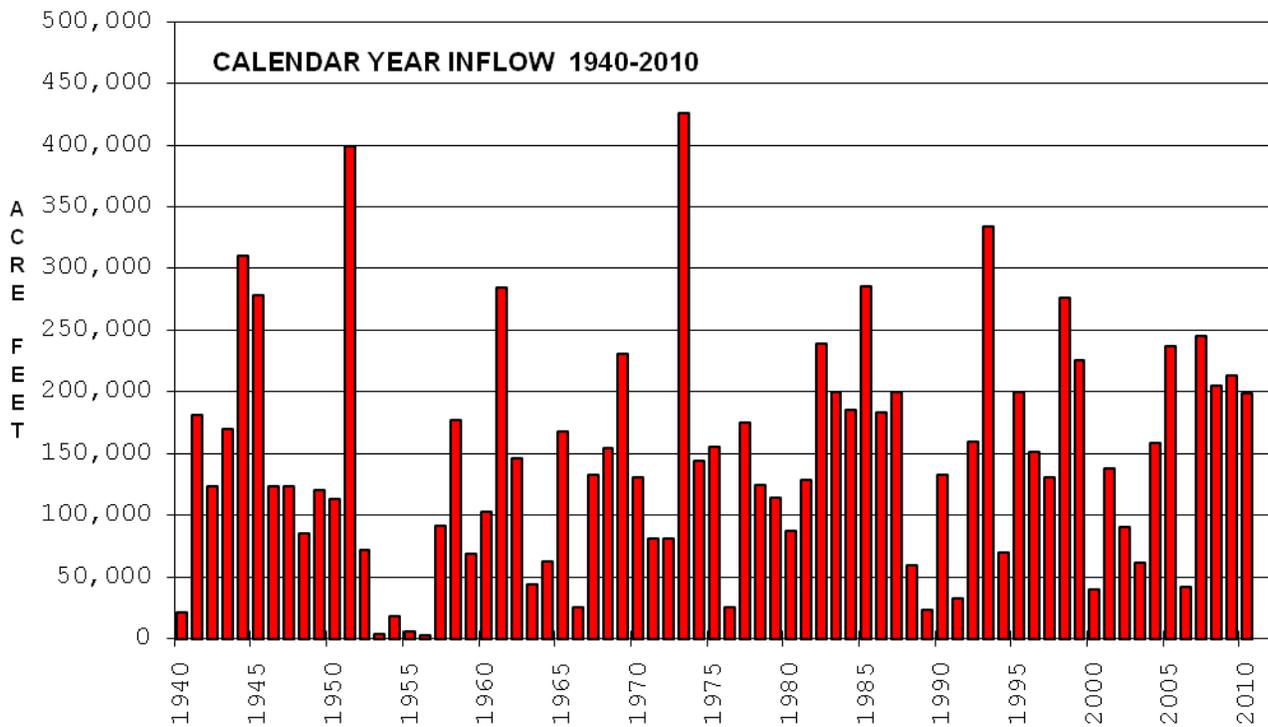


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
974.35 1 Aug 10	974.35 31 Jul 11	977.51 3 Jun 11	972.19 15 Mar 11	998.40 12-13 Jun 95	969.62 30 Mar 67
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
2,100 28 Feb 11	55,535	500 5 Mar 11	15 Many Days		
Minimum required release is 15 cfs.					

POMONA LAKE MONTHLY INFLOW



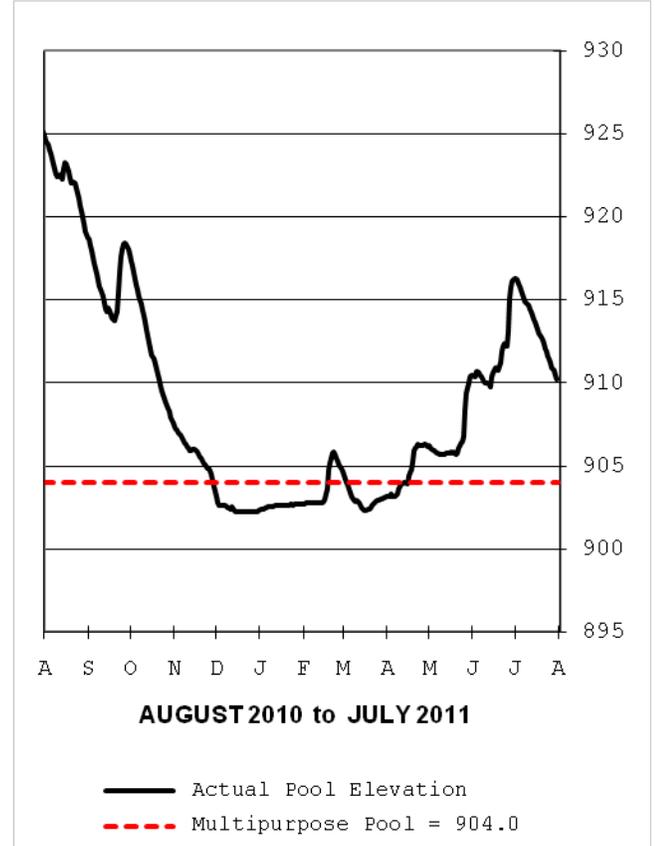
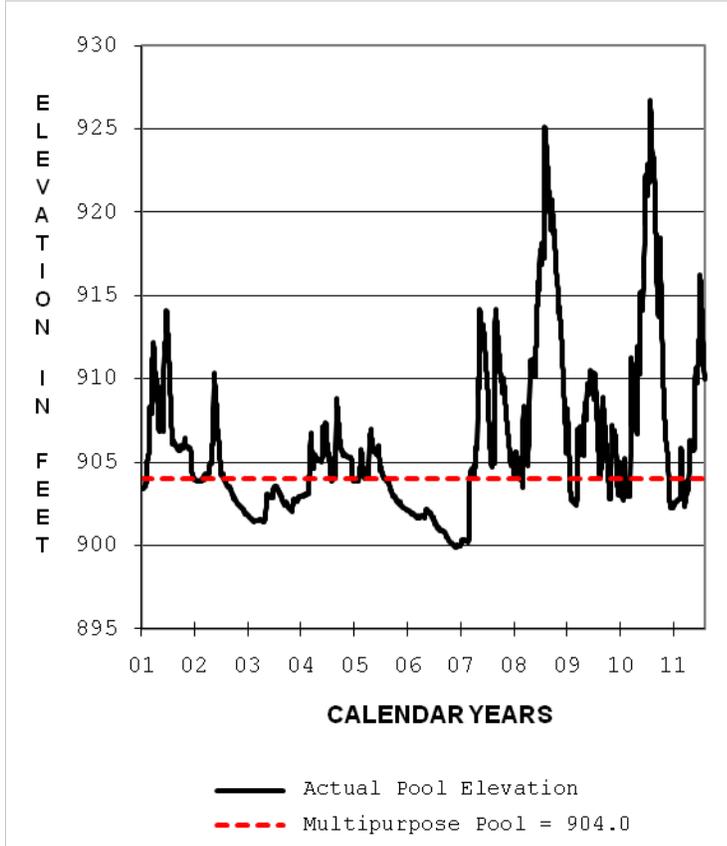
POMOMA LAKE ANNUAL INFLOW



RATHBUN LAKE

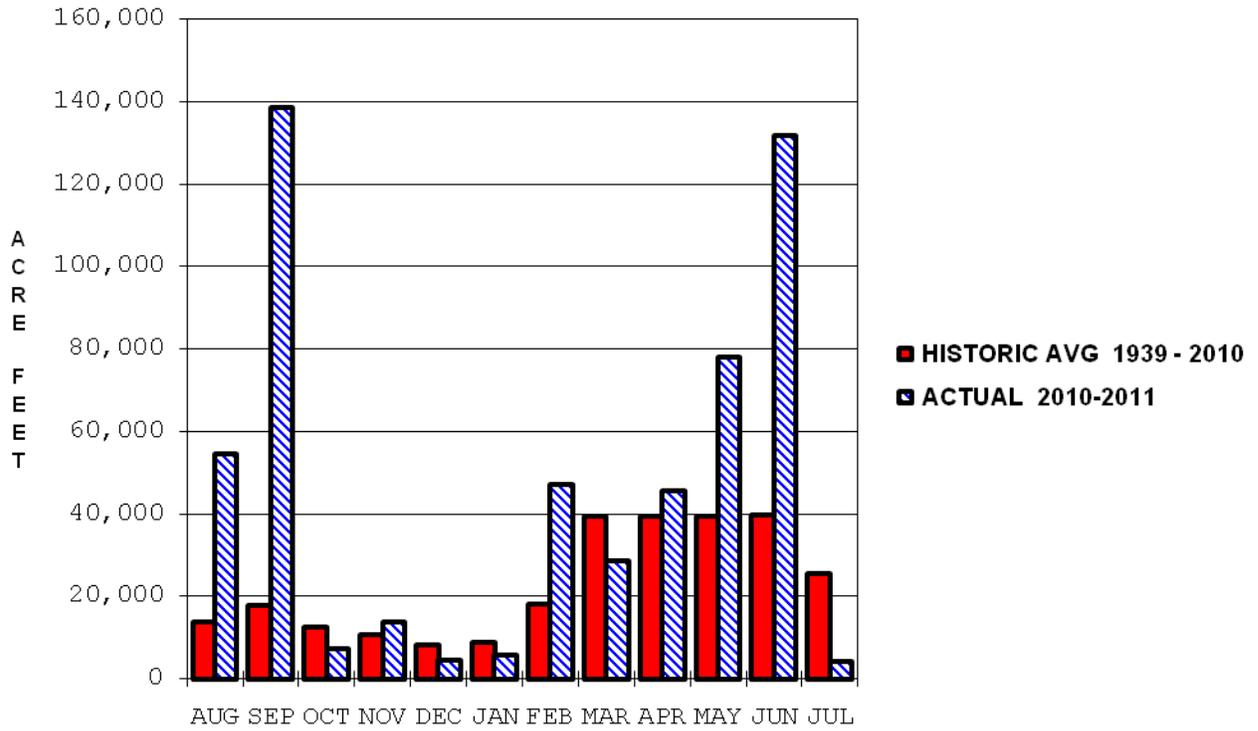
2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW
WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

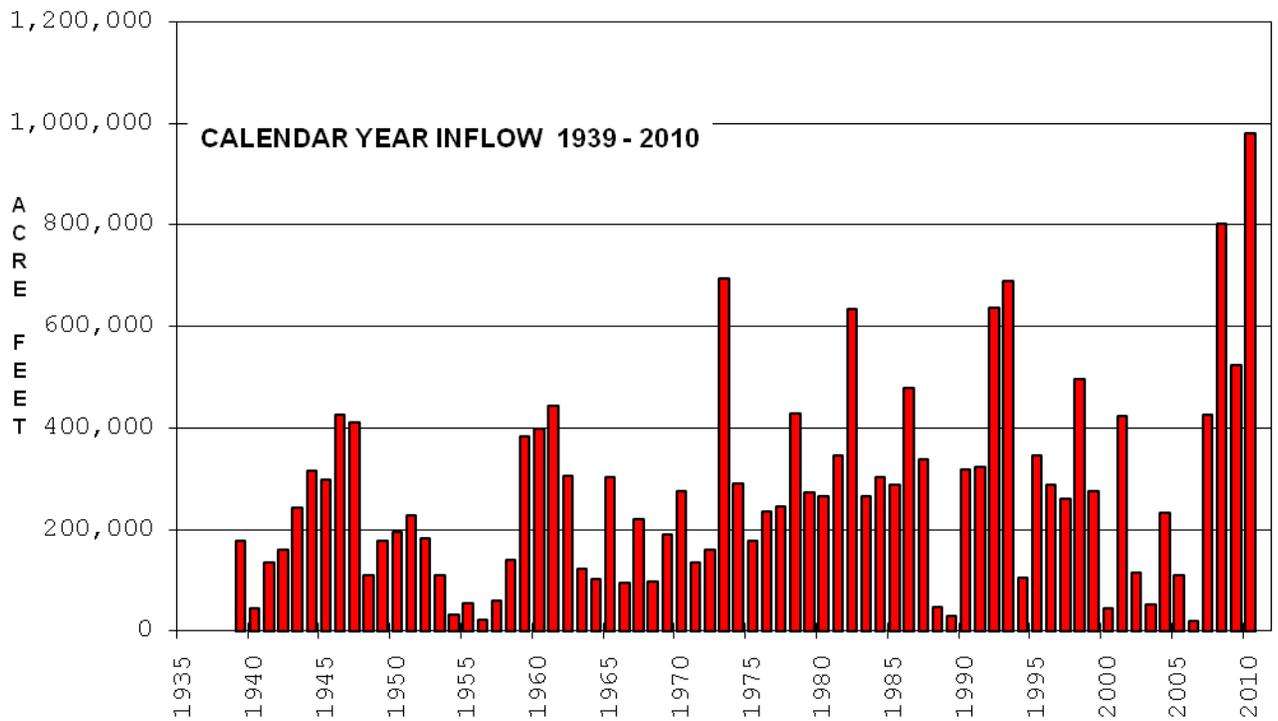


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
924.85 1 Aug 10	909.95 31 Jul 11	924.85 1 Aug 10	902.22 19 Dec 10	927.16 28 Jul 93	898.38 26-27 Jan 95
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
11,430 23 Sep 10	559,850	3006 Many Days	6 22 Mar 11		
Outlets include a fish hatchery pipe and service gate. Minimum required release varies with downstream needs.					

RATHBUN LAKE MONTHLY INFLOW



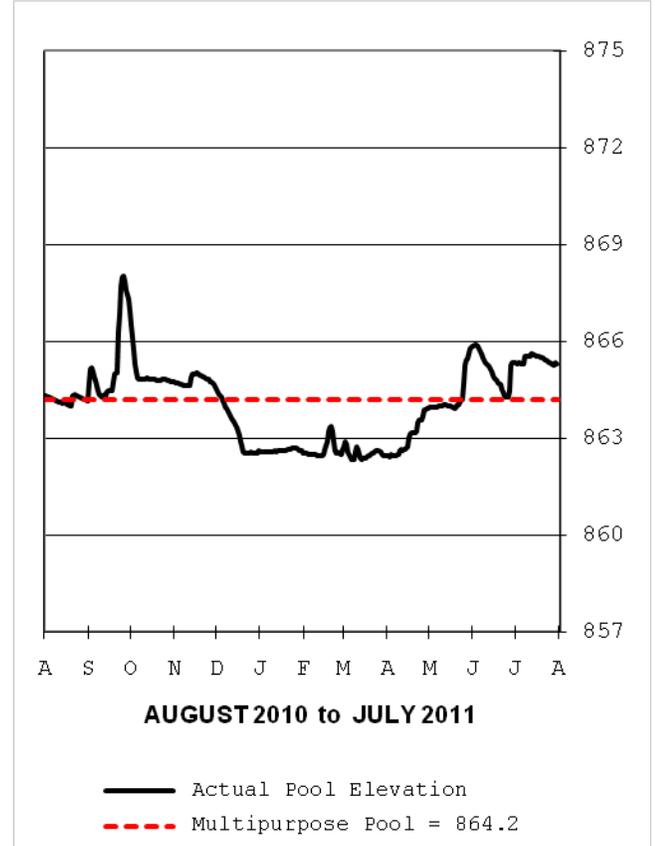
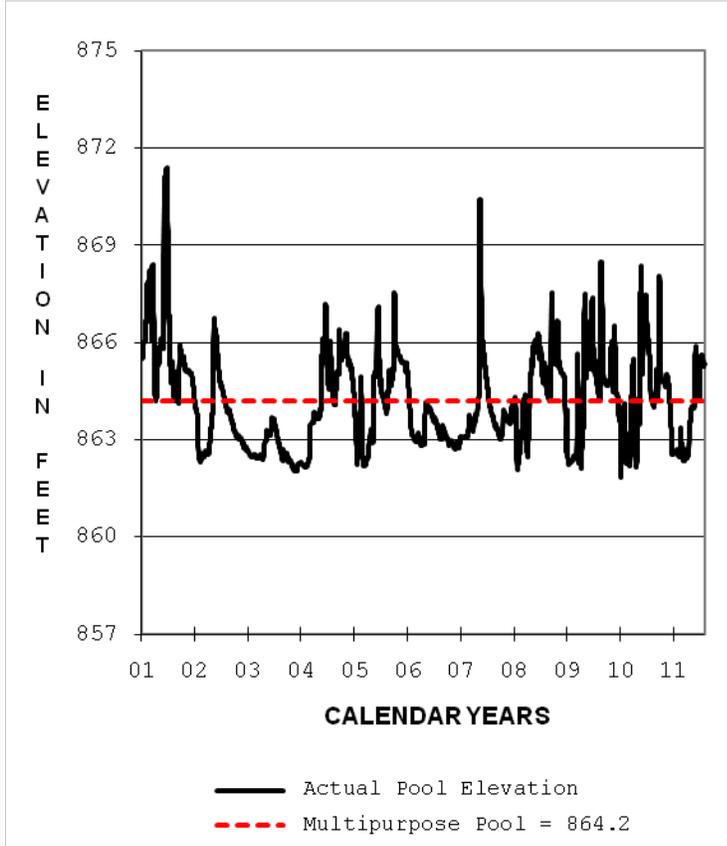
RATHBUN LAKE ANNUAL INFLOW



SMITHVILLE LAKE

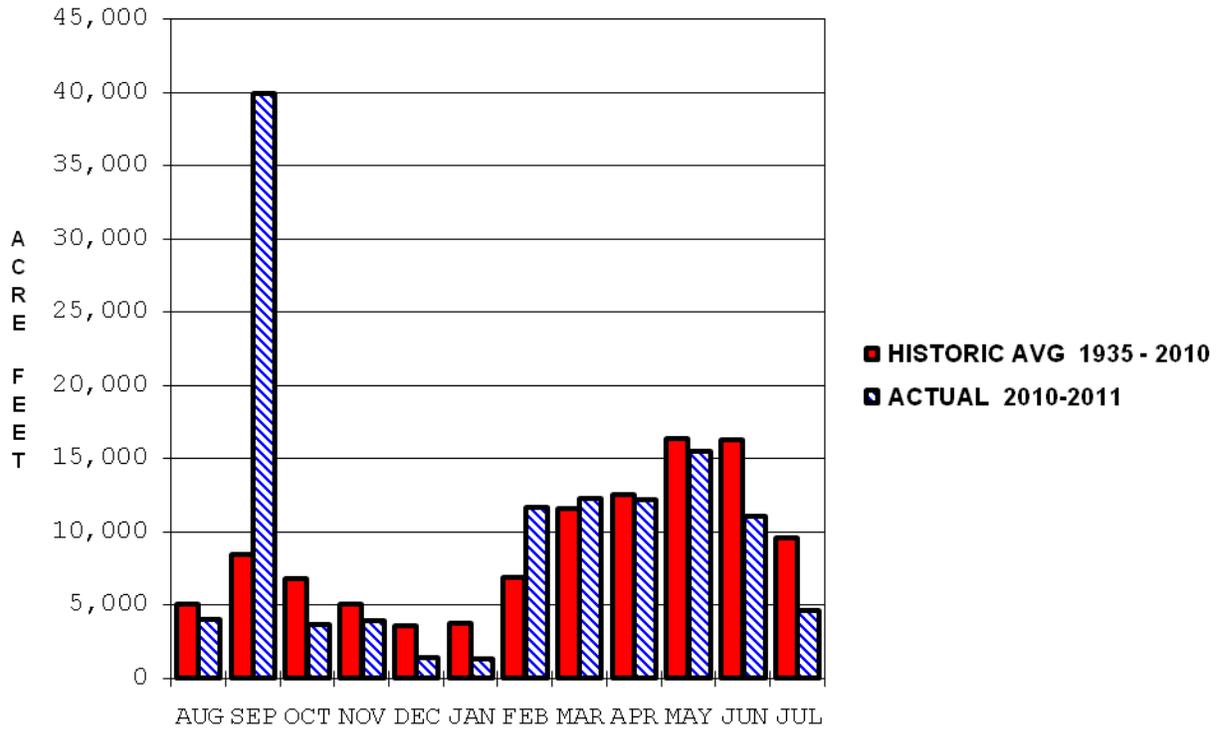
2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW
WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

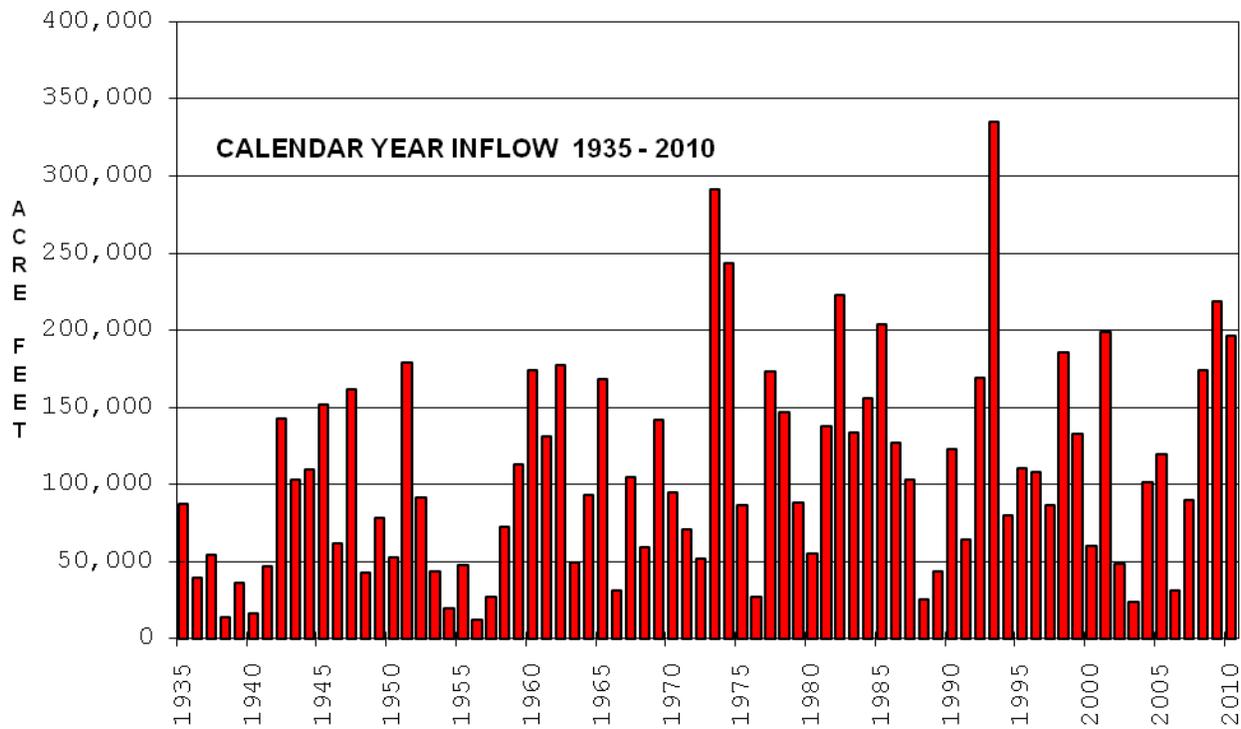


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
864.32 1 Aug 10	865.35 31 Jul 11	868.03 26 Sep 10	862.36 7 Mar 11	874.31 27-28 Jul 93	858.86 19 Jan 93
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
4,900 22 Sep 10	121,008	1,600 1 Oct 10	8 Many Days		
Minimum required release is 8 cfs. Releases cut to 0 during flooding and for maintenance and inspections.					

SMITHVILLE LAKE MONTHLY INFLOW



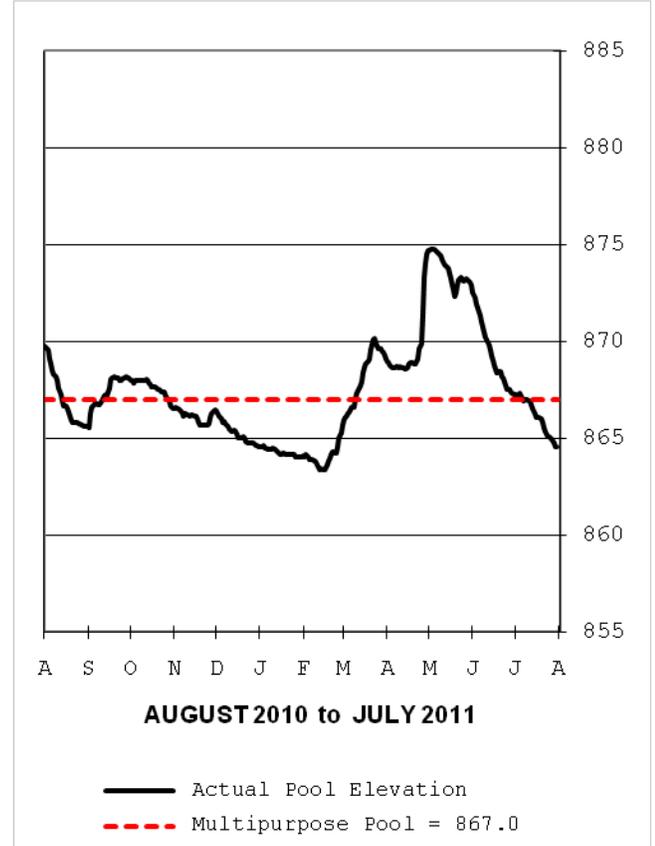
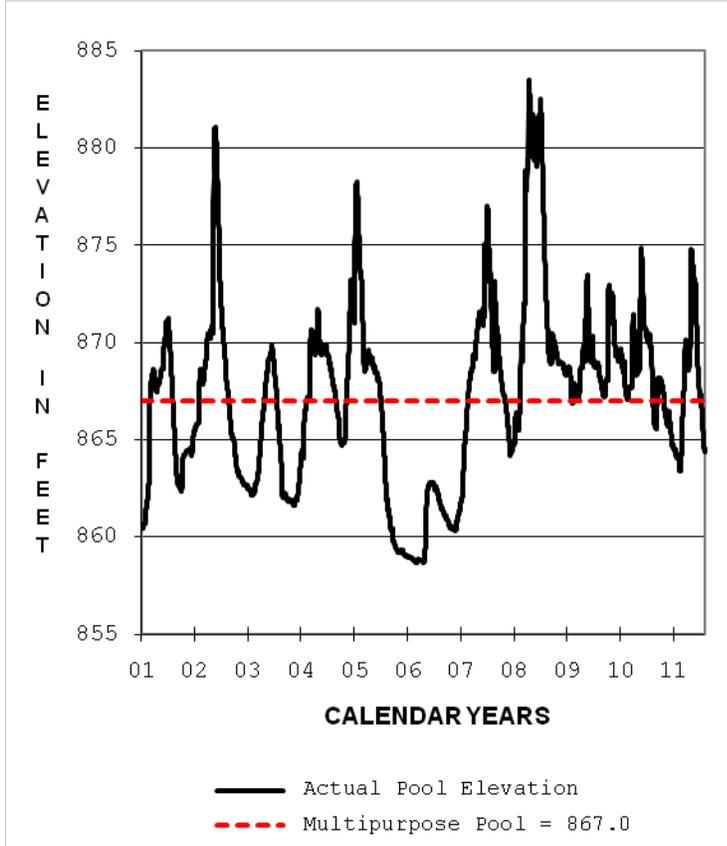
SMITHVILLE LAKE ANNUAL INFLOW



STOCKTON LAKE

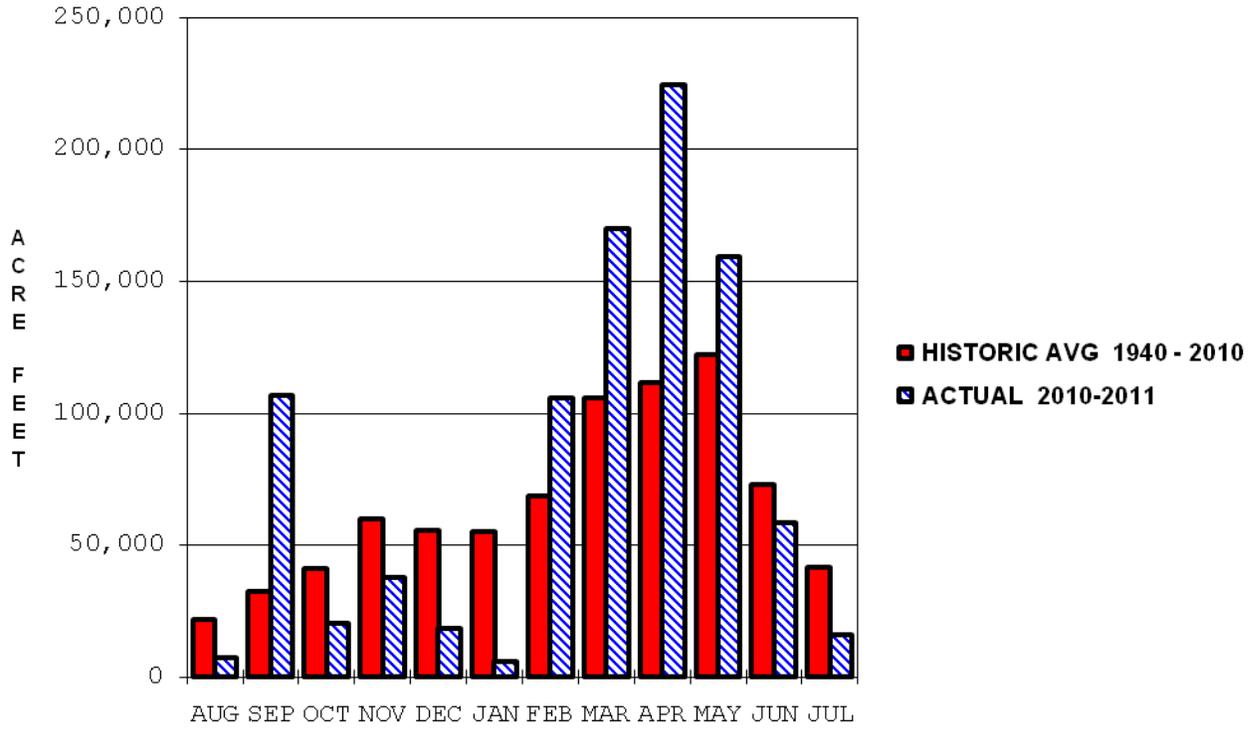
2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

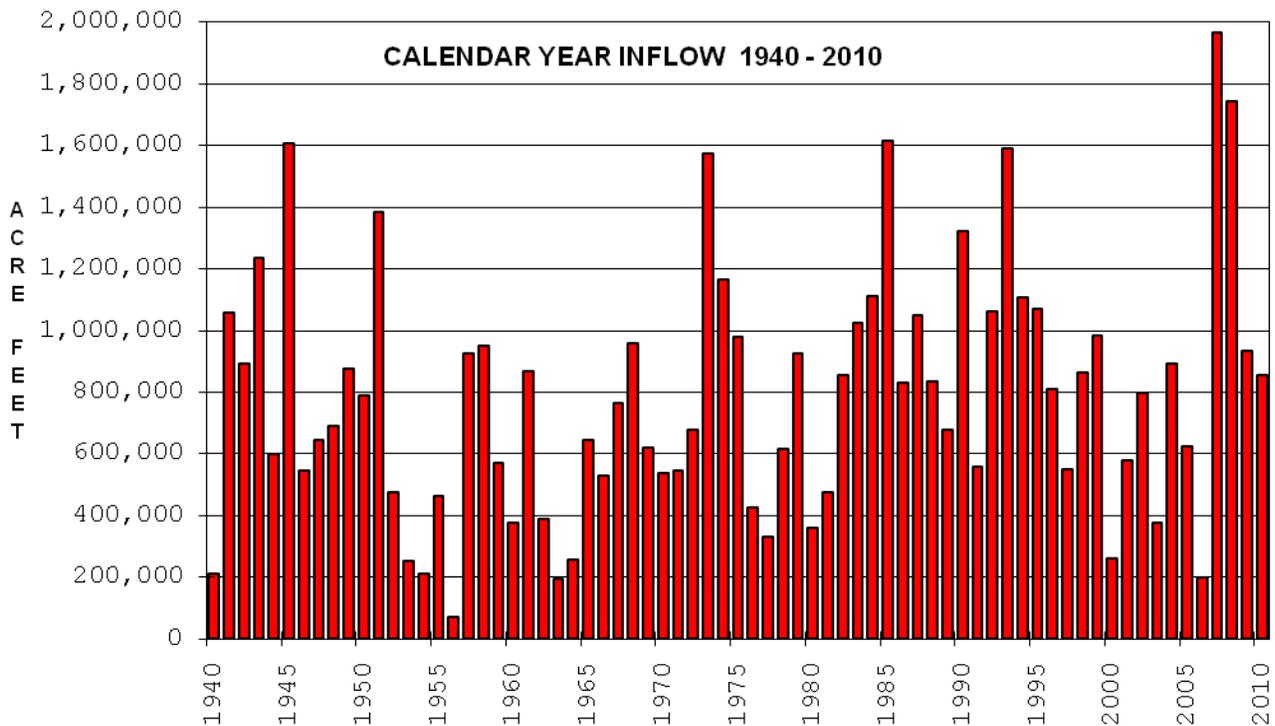


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
869.71 1 Aug 10	864.26 31 Jul 11	874.78 3 May 11	863.40 12 Feb 11	885.94 28 Apr 73	851.86 2 Feb 77
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
23,000 27 Apr 11	927,212	5,378 19 May 11	0 Many Days		
Listed outflows include turbine releases and spill to the river. Minimum required release is 40 cfs.					

STOCKTON LAKE MONTHLY INFLOW

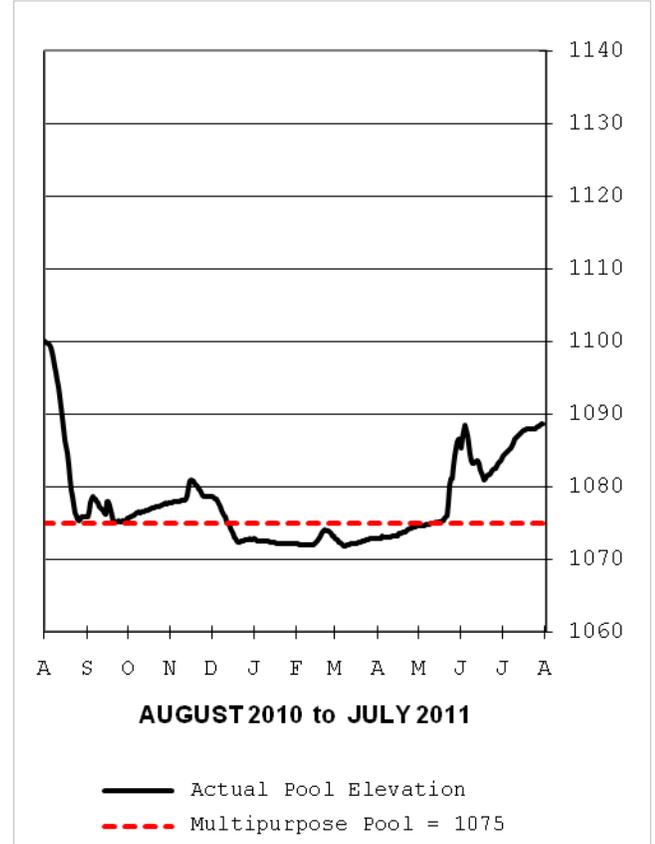
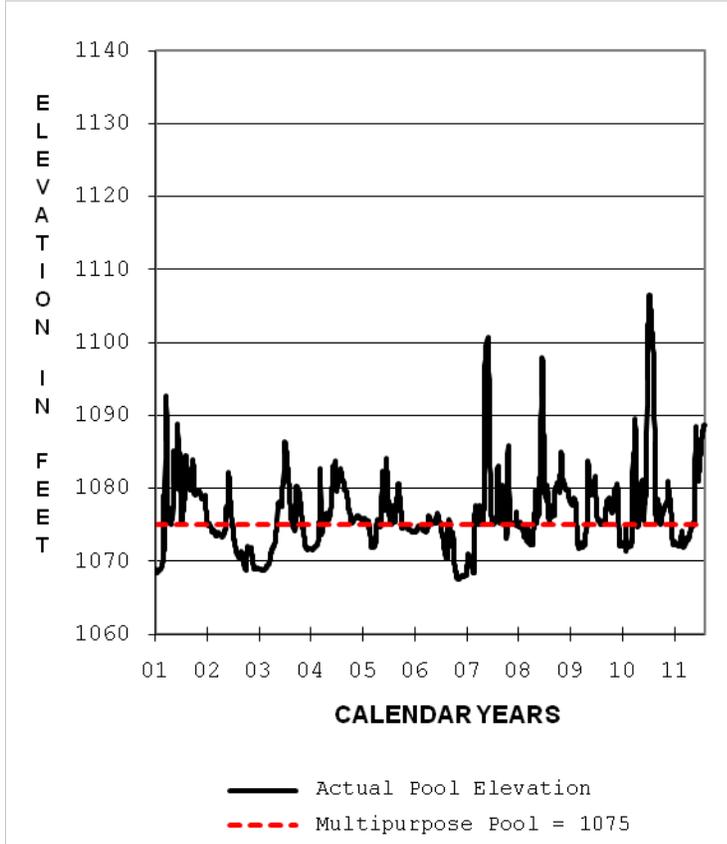


STOCKTON LAKE ANNUAL INFLOW



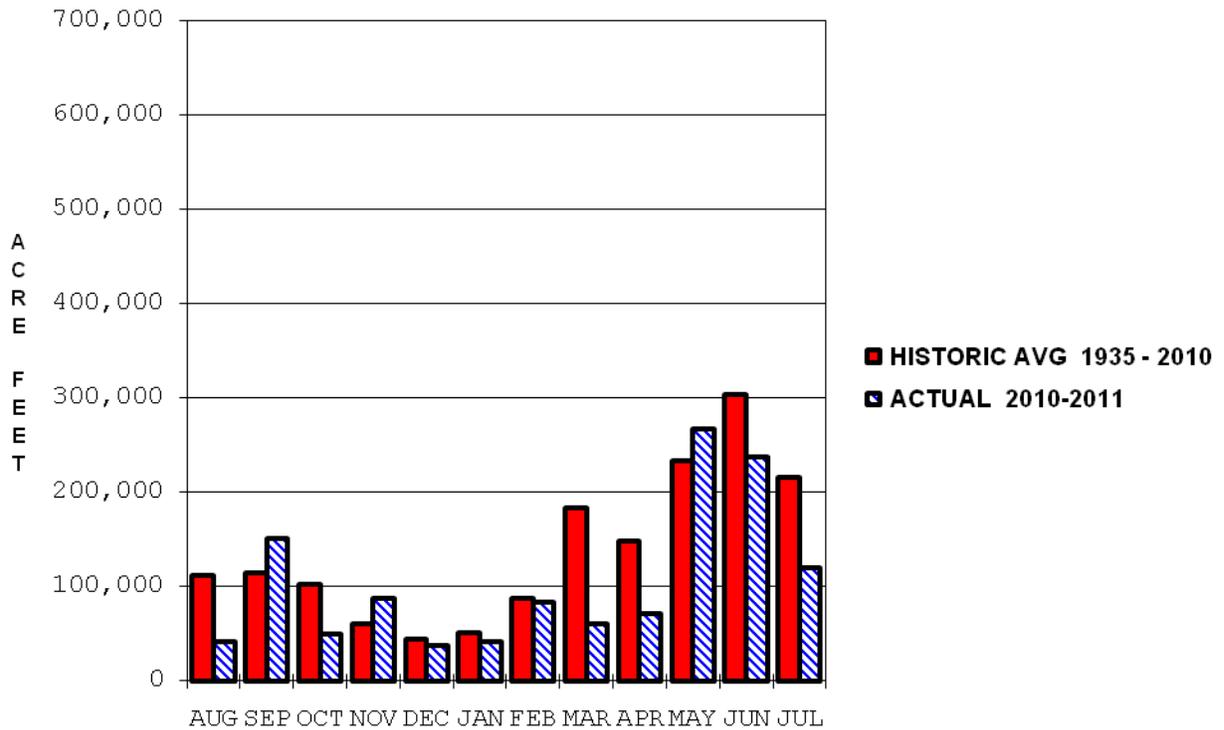
TUTTLE CREEK LAKE 2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW
WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

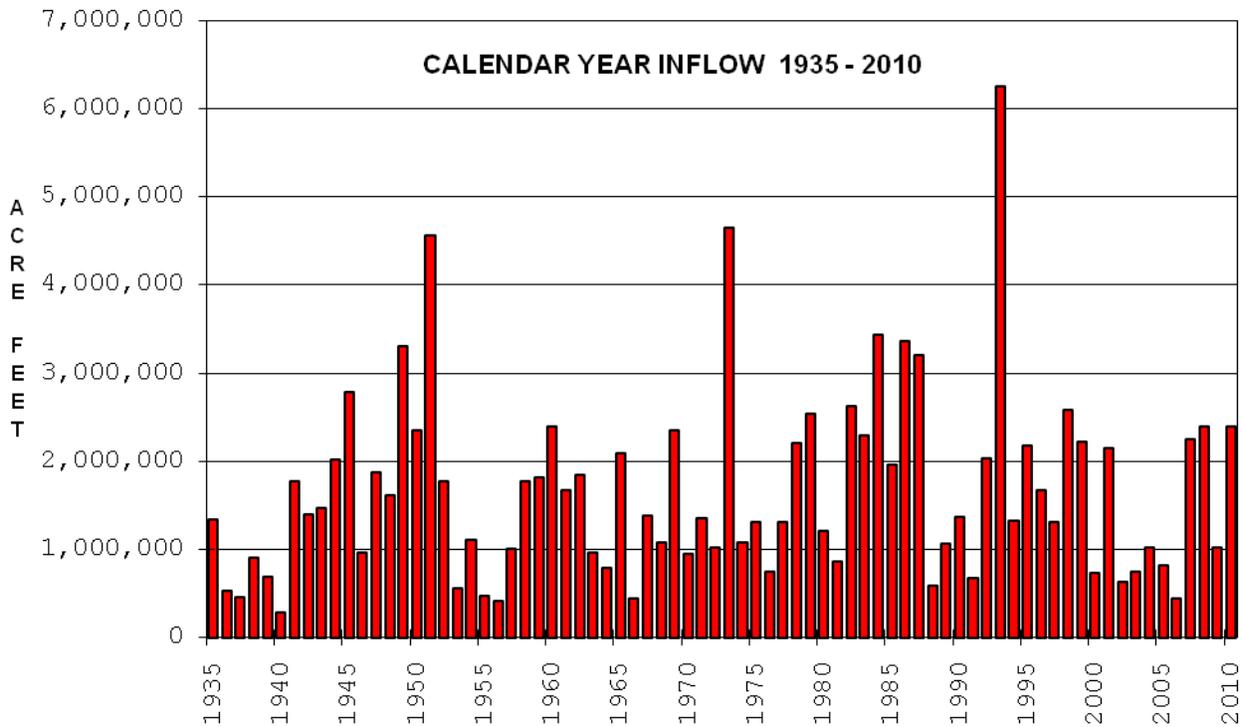


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1099.97 1 Aug 10	1088.71 31 Jul 11	1099.97 1 Aug 10	1071.87 7 Mar 11	1137.77 22 Jul 93	1060.82 4 Jan 67
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
28,000 2 Jun 11	1,249,230	16,000 13 Aug 10	0 30 Sep 10		
Minimum required release is 50 to 100 cfs. Releases may be cut to 0 for maintenance and inspection periods.					

TUTTLECREEK LAKE MONTHLY INFLOW



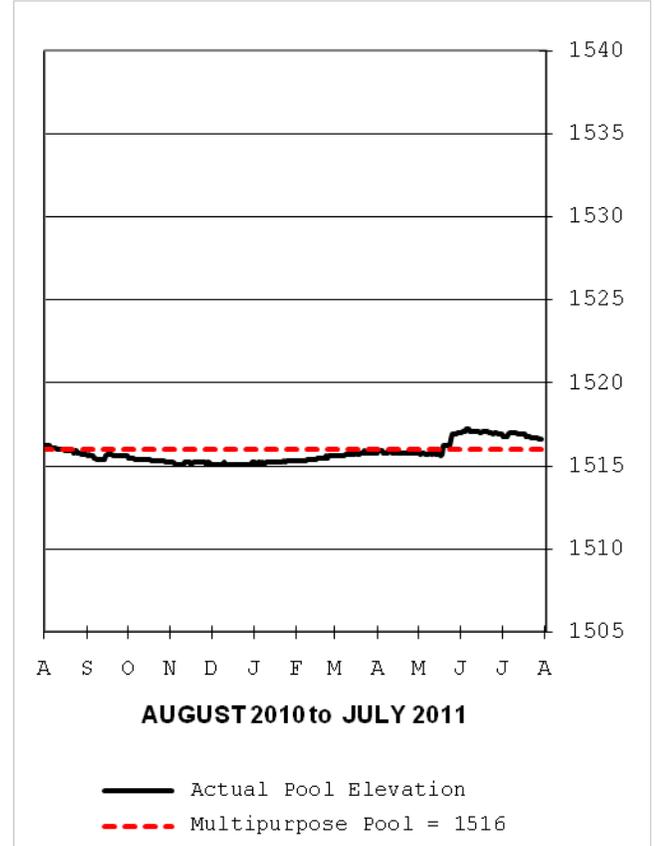
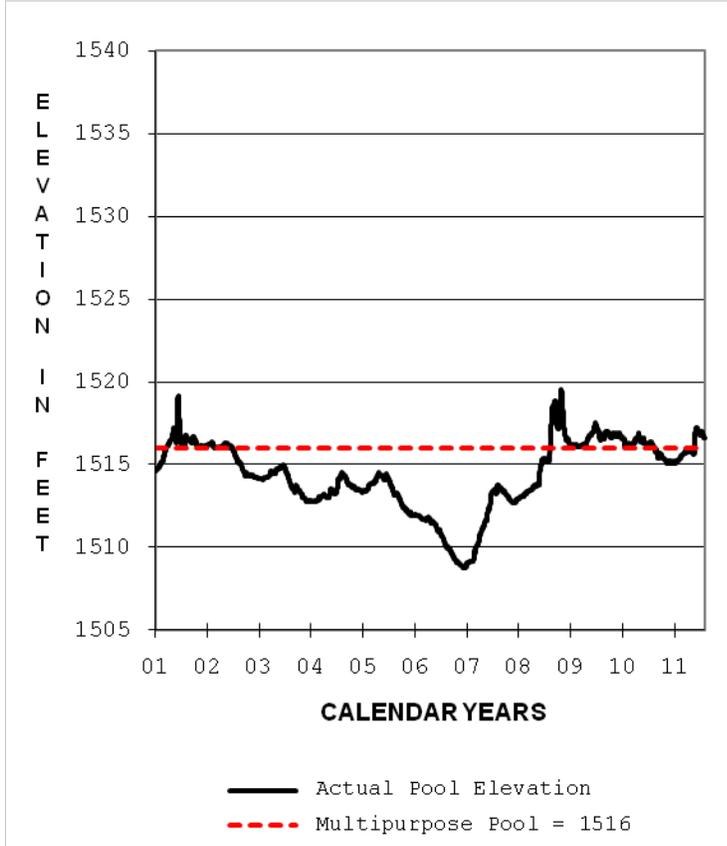
TUTTLECREEK LAKE ANNUAL INFLOW



WILSON LAKE

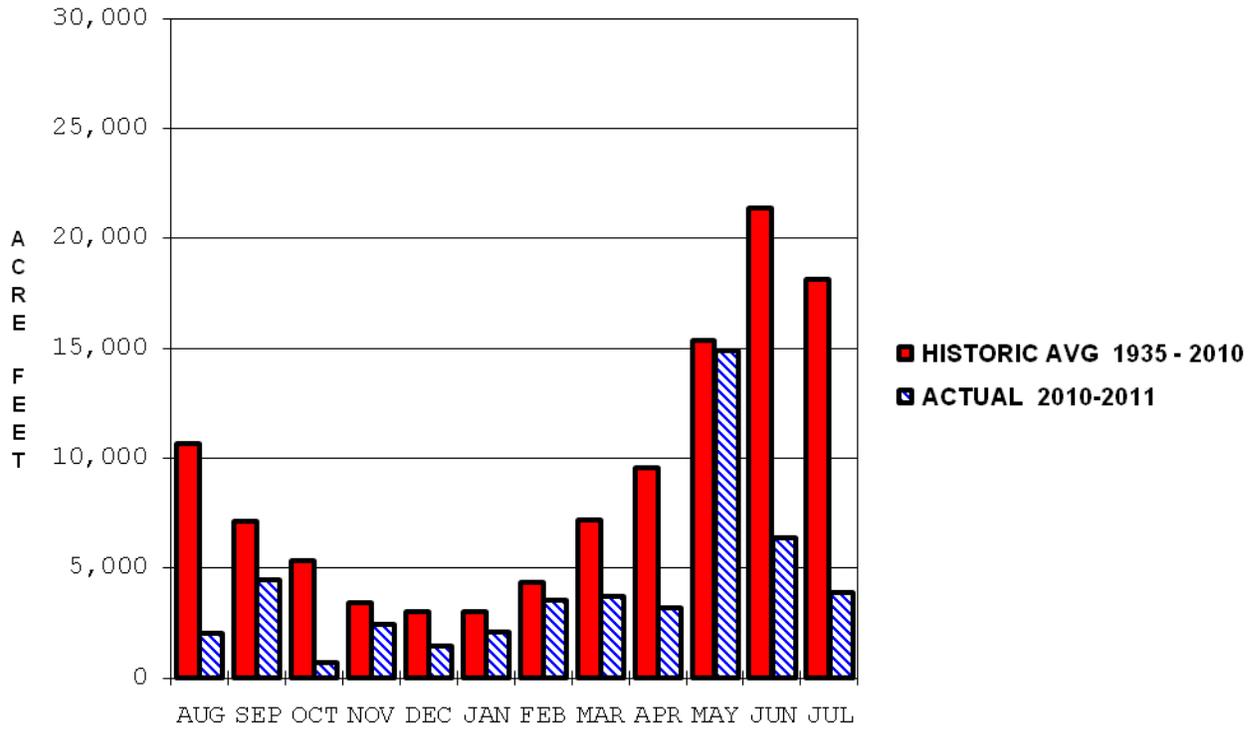
2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW
WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

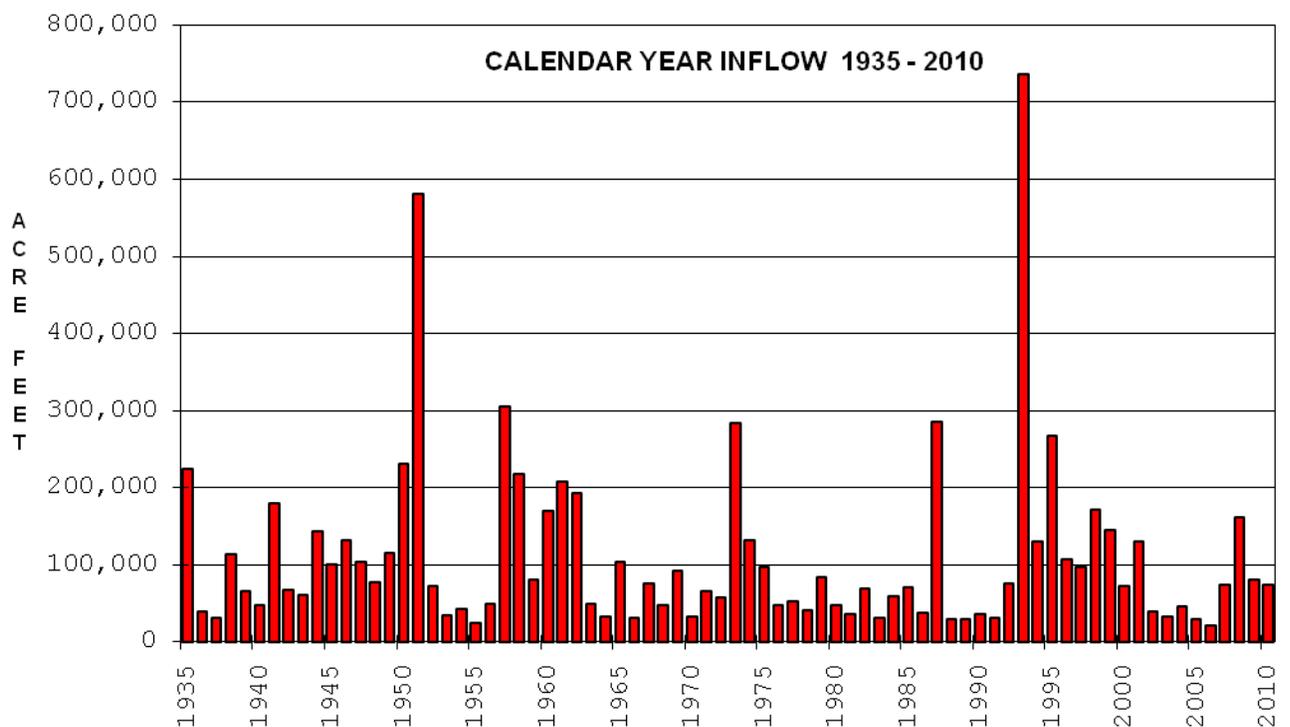


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1516.2 1 Aug 10	1516.6 31 Jul 11	1517.2 5 Jun 11	1515.1 5 Nov 10	1548.27 13 Aug 93	1508.73 19 Dec 06
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
2,100 20 May 11	49,342	889 2 Jun 11	0 15 May 11		
Minimum required release of 5-15 cfs varies seasonally. Releases cut to 0 for maintenance and inspections.					

WILSON LAKE MONTHLY INFLOW



WILSON LAKE ANNUAL INFLOW



APPENDIX B
BUREAU OF RECLAMATION PROJECTS

BONNY RESERVOIR

CEDAR BLUFF RESERVOIR

ENDERS RESERVOIR

HARRY STRUNK LAKE
(Medicine Creek Dam)

HUGH BUTLER LAKE
(Red Willow Dam)

KEITH SEBELIUS LAKE
(Norton Dam)

KIRWIN RESERVOIR

LOVEWELL RESERVOIR

SWANSON LAKE
(Trenton Dam)

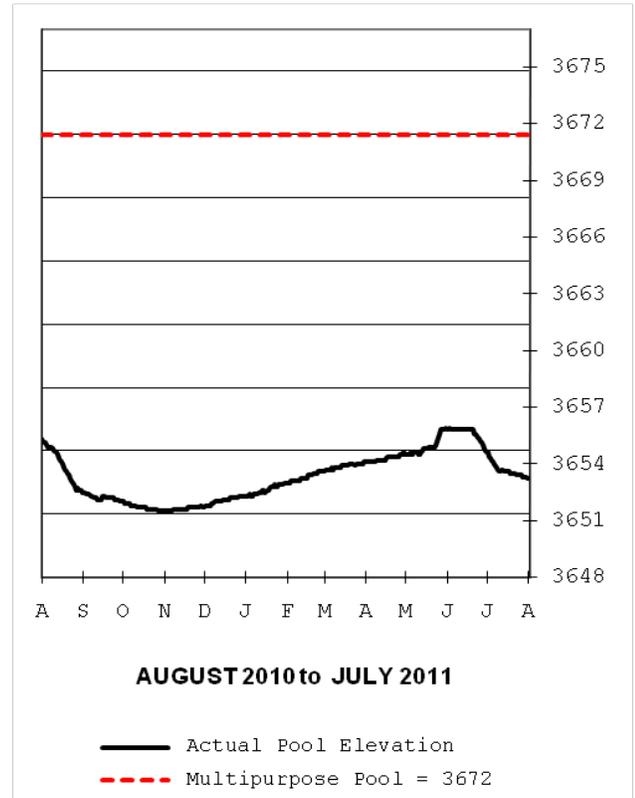
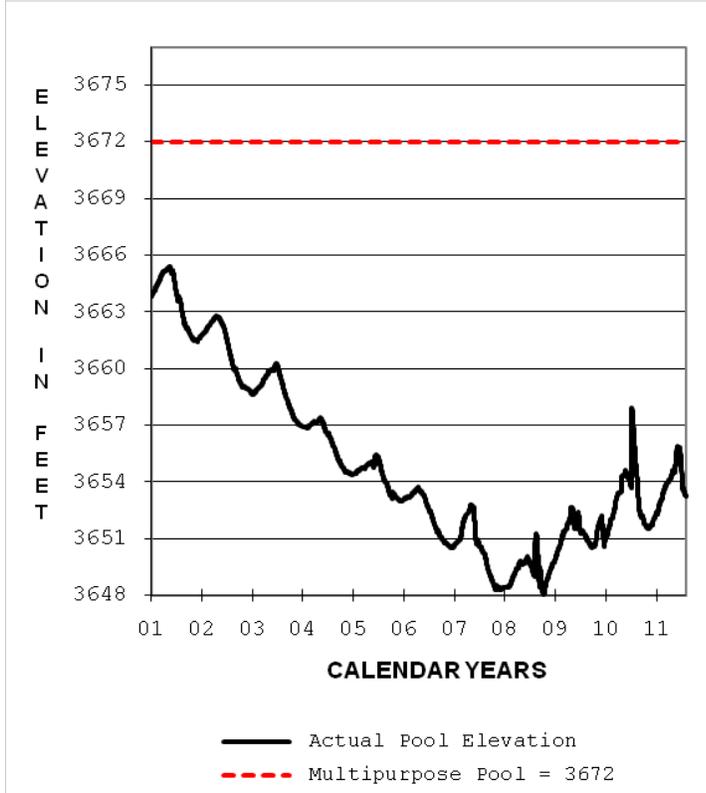
WACONDA LAKE
(Glen Elder Dam)

WEBSTER RESERVOIR

BONNY RESERVOIR

2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

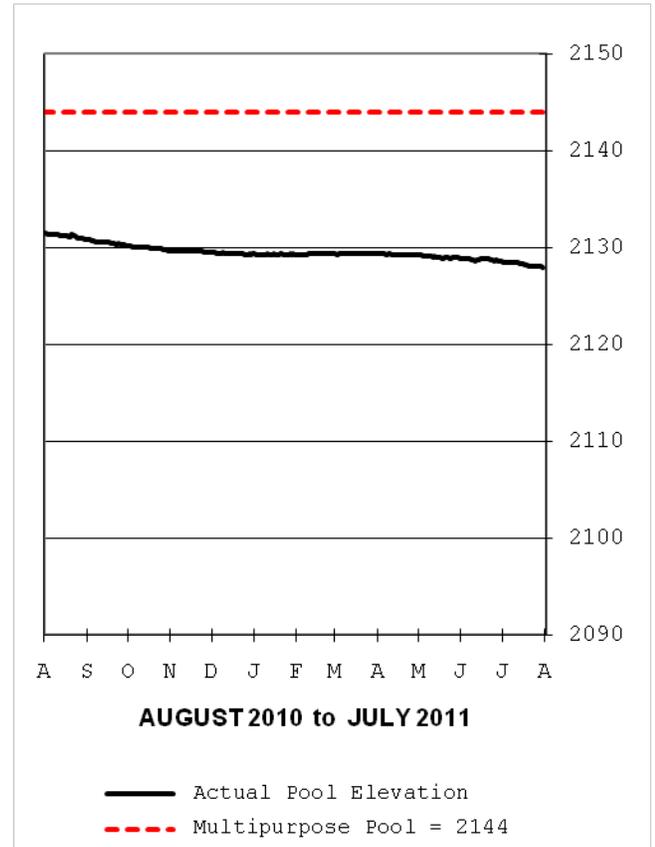
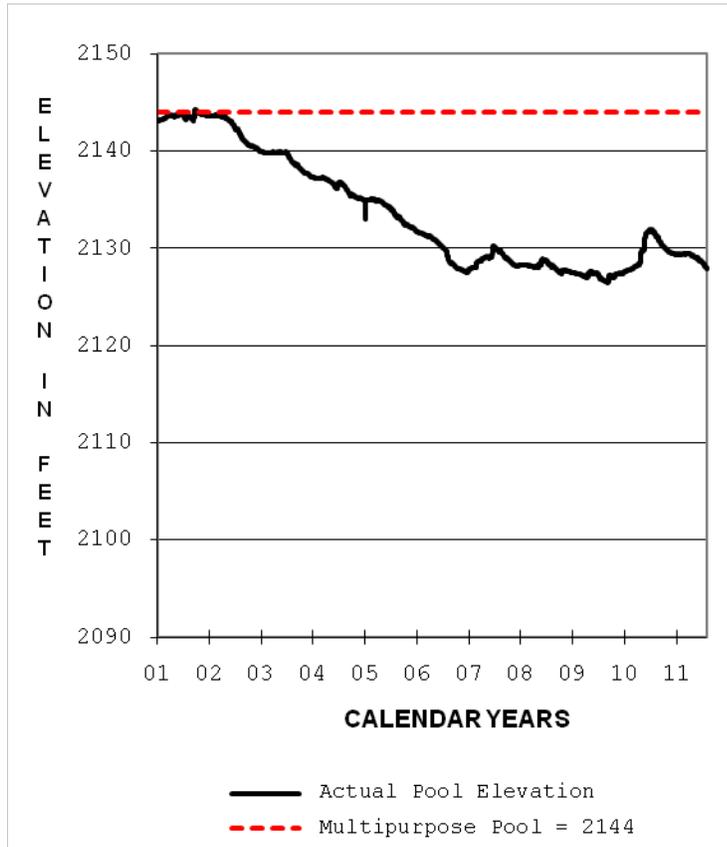


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
3655.20 1 Aug 10	3653.24 31 Jul 11	3655.89 2 Jun 11	3651.51 28 Oct 10	3678.10 17 May 57	3648.05 9 Oct 08
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
110 25 May 11	10,994	65 1 Aug 10	3 Many days		
Maximum daily outflow is river release only. Minimum required release is 5 cfs.					

CEDAR BLUFF RESERVOIR

2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW
WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

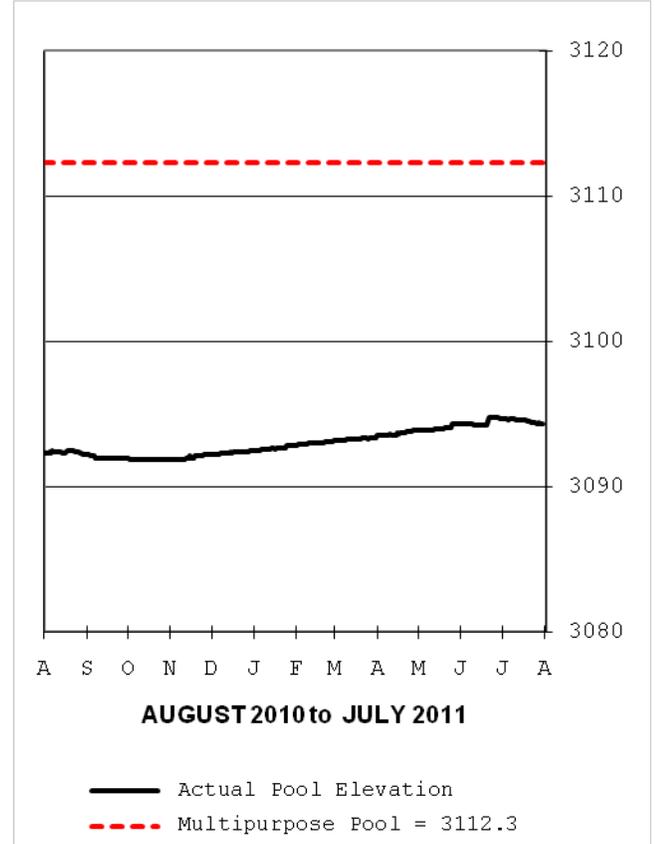
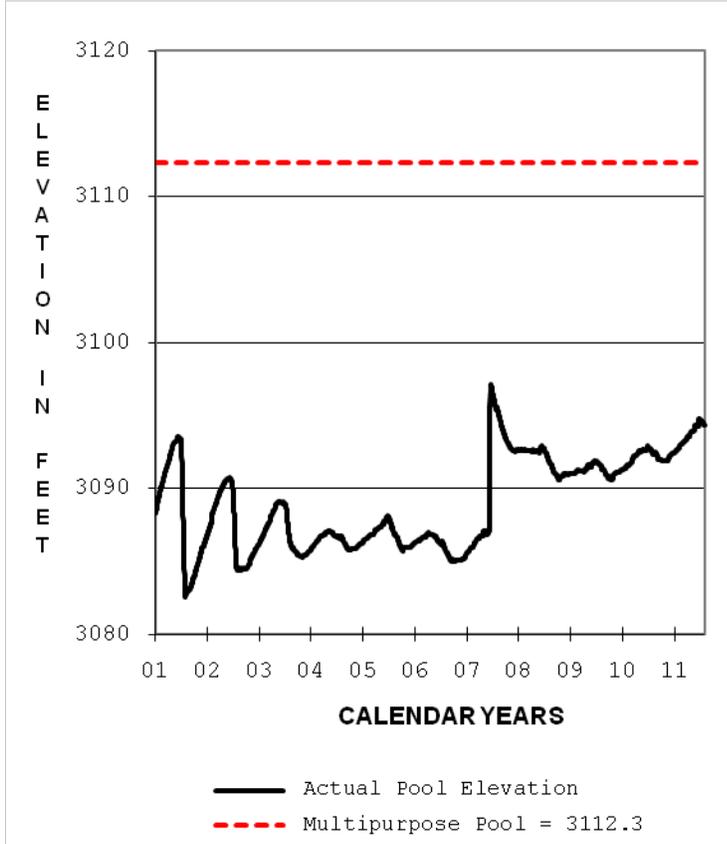


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
2131.50 1 Aug 10	2127.90 31 Jul 11	2131.50 1 Aug 10	2127.90 31 Jul 11	2154.90, 2 Jul 51 4-5 Jul 57	2091.78 9-19 Nov 92
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
370 7 Jun 11	9,277	0 All Year	0 All Year		
No minimum required release. Minor releases to the fish hatchery are not reported on a daily basis.					

ENDERS RESERVOIR

2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

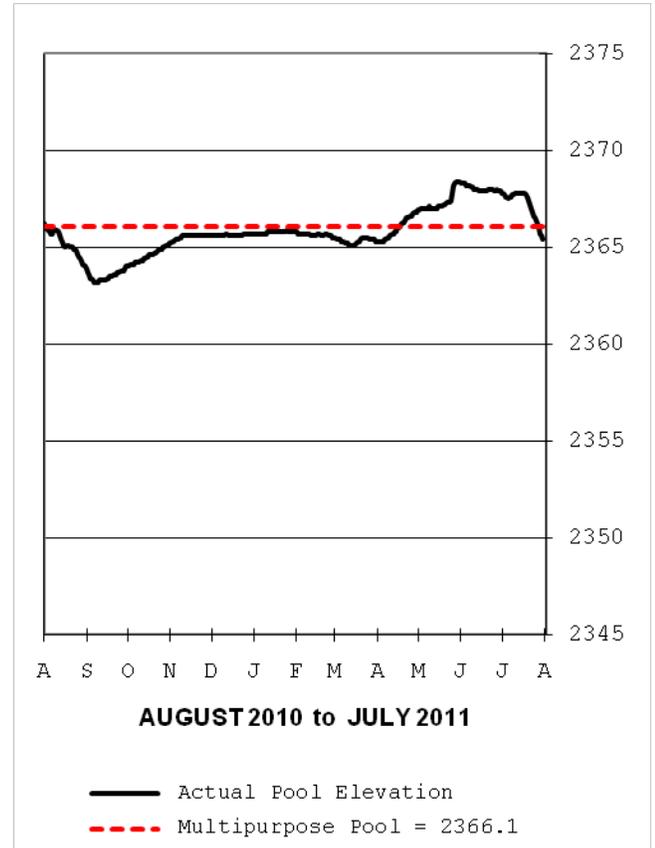
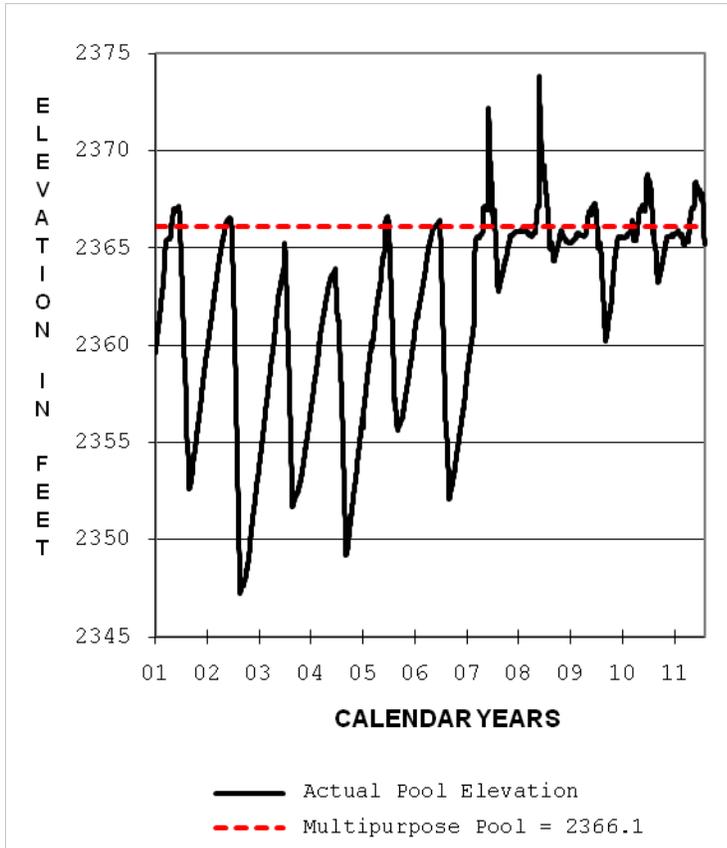


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
3092.30 1 Aug 10	3094.30 31 Jul 11	3094.80 21 Jun 11	3091.90 2 Oct 10	3118.20 25 Mar 60	3080.67 28 Aug 78
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
165 21 Jun 11	8,884	5 All year	5 All year		
No minimum required release. The outflow is mostly seepage.					

HARRY STRUNK LAKE

2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

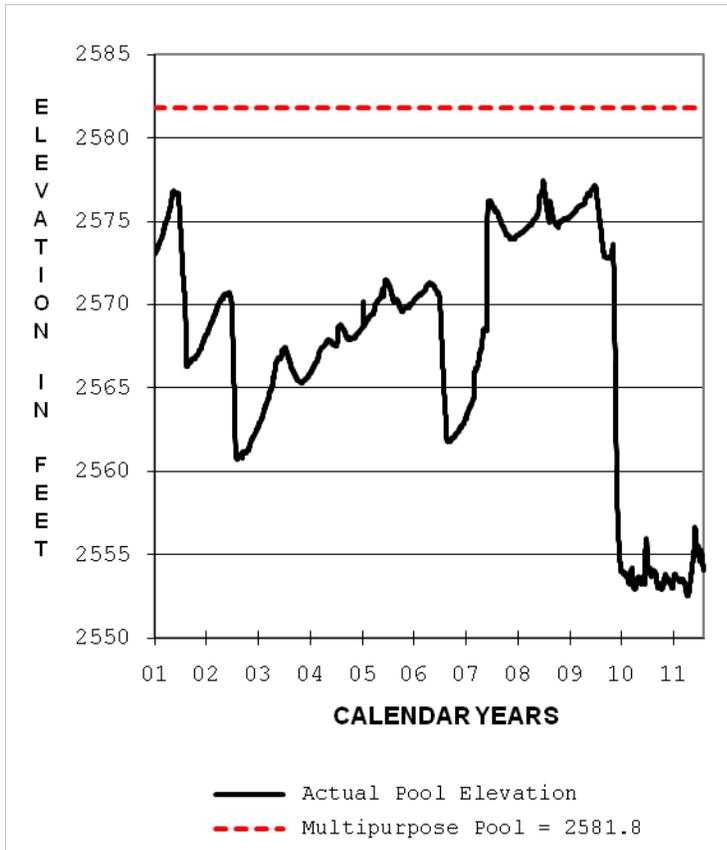


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
2366.2 1 Aug 10	2365.2 31 Jul 11	2368.4 28 May 11	2363.2 6 Sep 10	2374.10 23 Mar 60	2340.42 8 Sep 78
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
525 25 May 11	43,944	257 26 Jul 11	1 Many Days		
Max daily outflow occurred as part of normal irrigation releases. All releases to the river. No min required release.					

HUGH BUTLER LAKE

2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

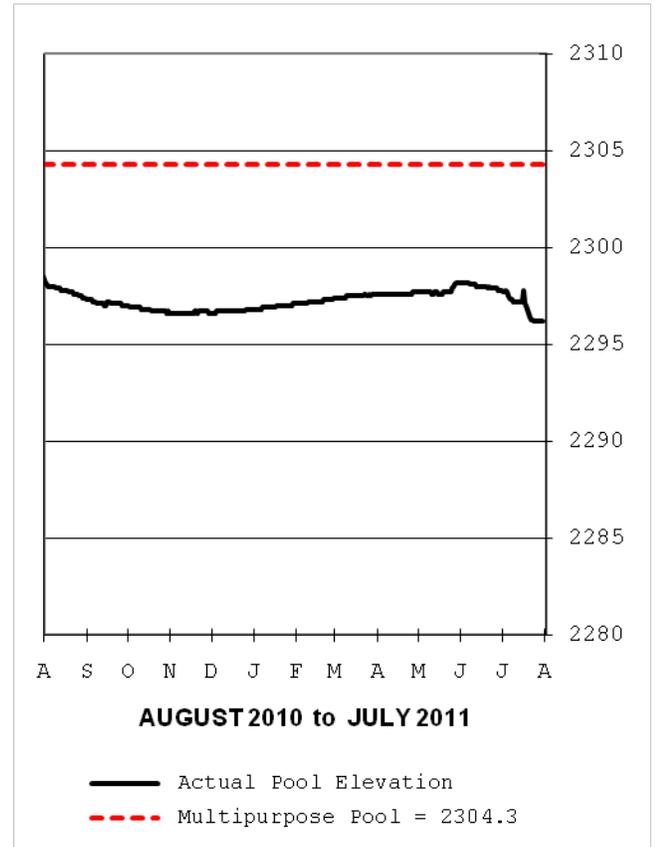
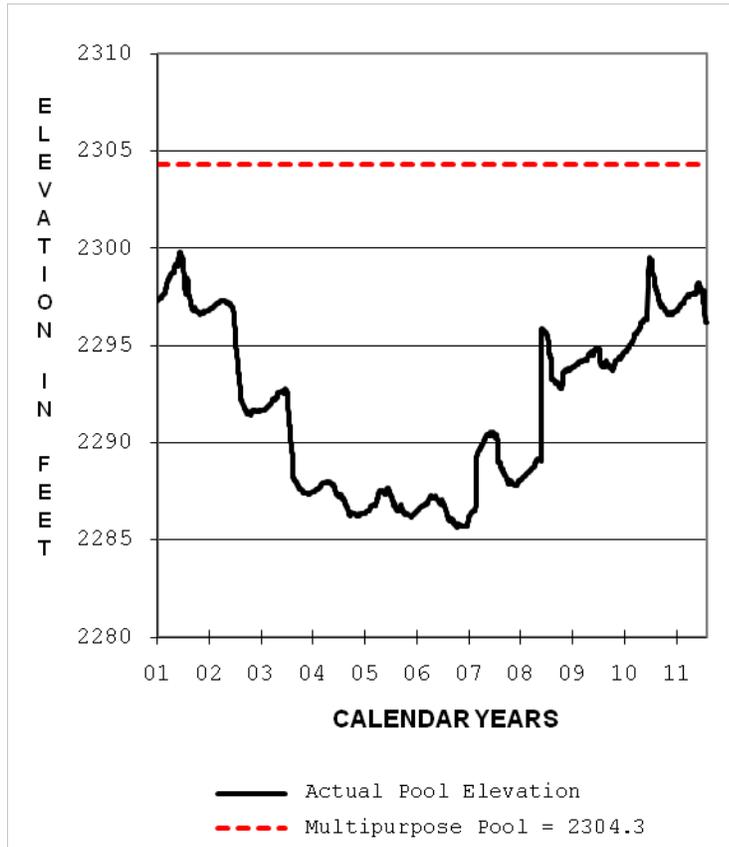


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
2553.8 1 Aug 10	2551.4 31 Jul 11	2556.7 29 May 11	2552.5 7 Apr 11	2584.11 16 Jul 67	2552.5 7 Apr 11
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
150 21 Jun 11	14,907	125 23 Jun 11	4 Many Days		
No minimum required release. The outflow is mostly seepage.					

KEITH SEBELIUS LAKE

2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

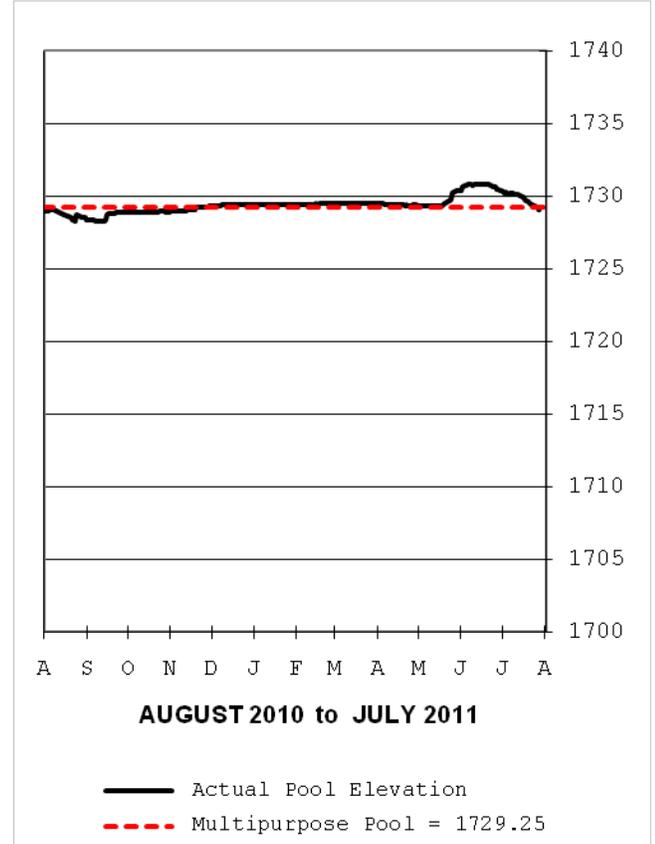
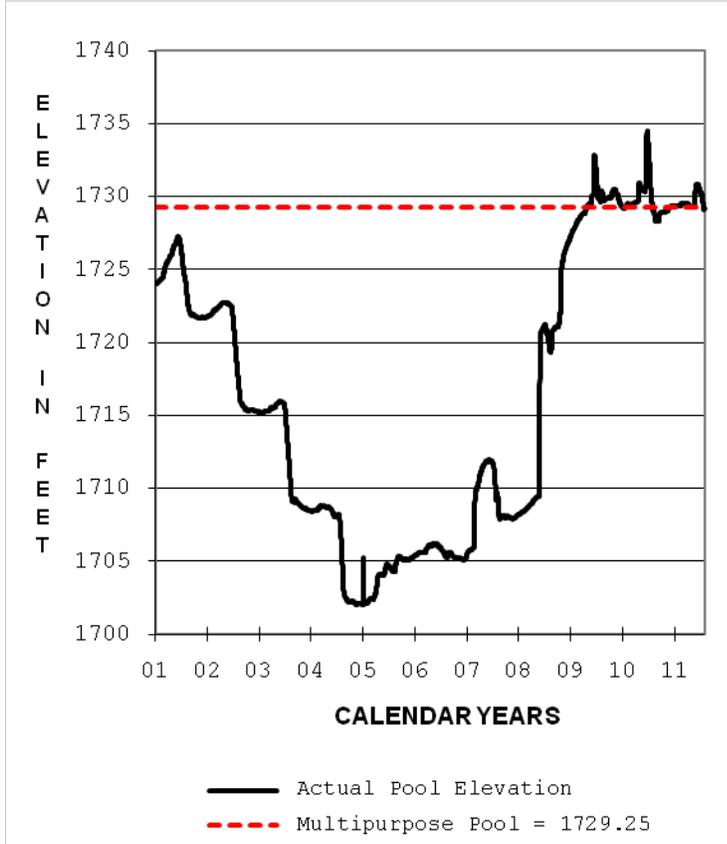


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
2298.3 1 Aug 10	2296.2 31 Jul 11	2298.3 1 Aug 10	2296.2 31 Jul 11	2306.47 15 Feb to 4 Mar 97	2275.82 1 Feb 82
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
150 25 May 11	6,997	121 5 Jul 11	1 26 May 10		
No minimum required release. The normal outflow is mostly seepage. Historic Minimum Pool Elevation of 2275.82 occurred on many days 28-29 Nov 81 and 20 Jan to 1 Feb 82.					

KIRWIN RESERVOIR

2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW
WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

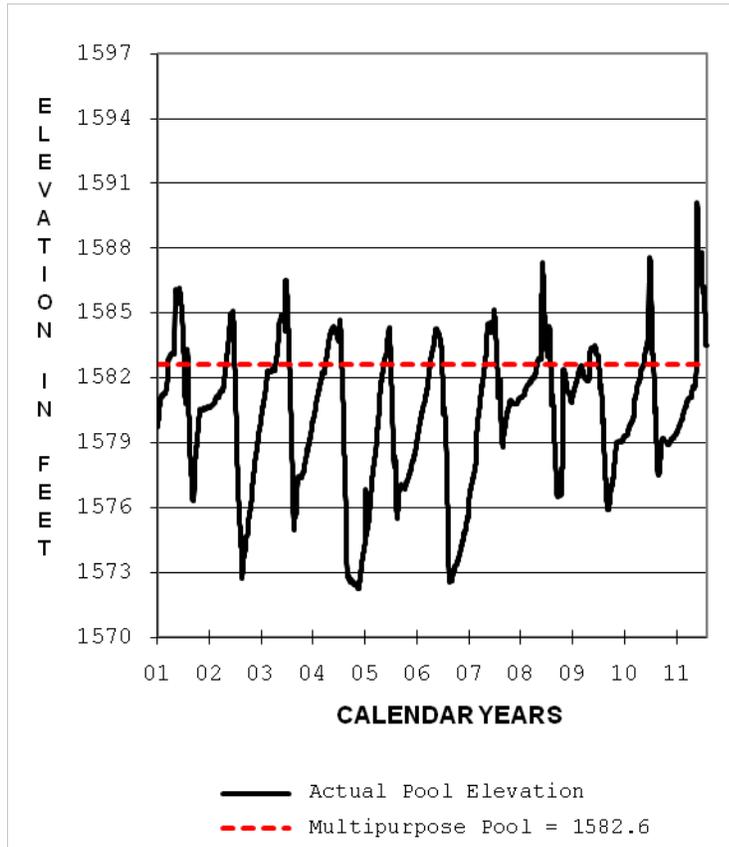


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1729.1 1 Aug 10	1729.2 31 Jul 11	1730.8 5 Jun 11	1728.3 23 Aug 10	1737.07 2 Jun 95	1695.45 11 Feb 81
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
1000 25 May 11	51,533	182 1 Aug 10	0 Many Days		
Max daily outflow is river release only. Max release to canal was 150 cfs on 7 Aug 04. No min required release.					

LOVEWELL RESERVOIR

2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

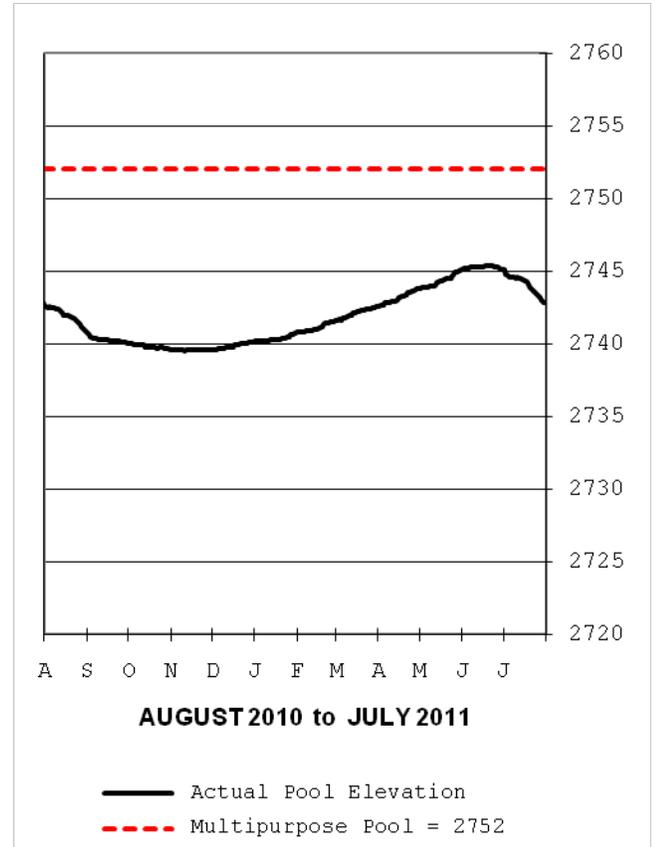
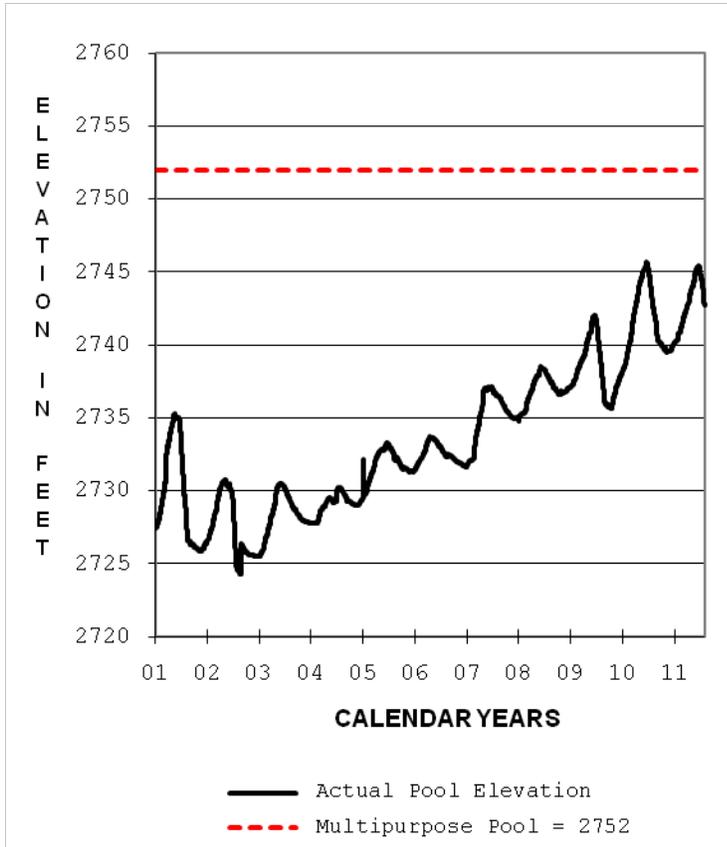


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1580.9 1 Aug 10	1583.5 31 Jul 11	1590.1 27 May 11	1577.5 24 Aug 10	1595.34 22 Jul 93	1570.20 22 Aug 91
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
4,000 26 May 11	71,505	1250 28 May 11	0 Many Days		
Max daily outflow is river release only. Max release to canal was 425 cfs on 6 Aug 04. No min required release.					

SWANSON LAKE

2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW
WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

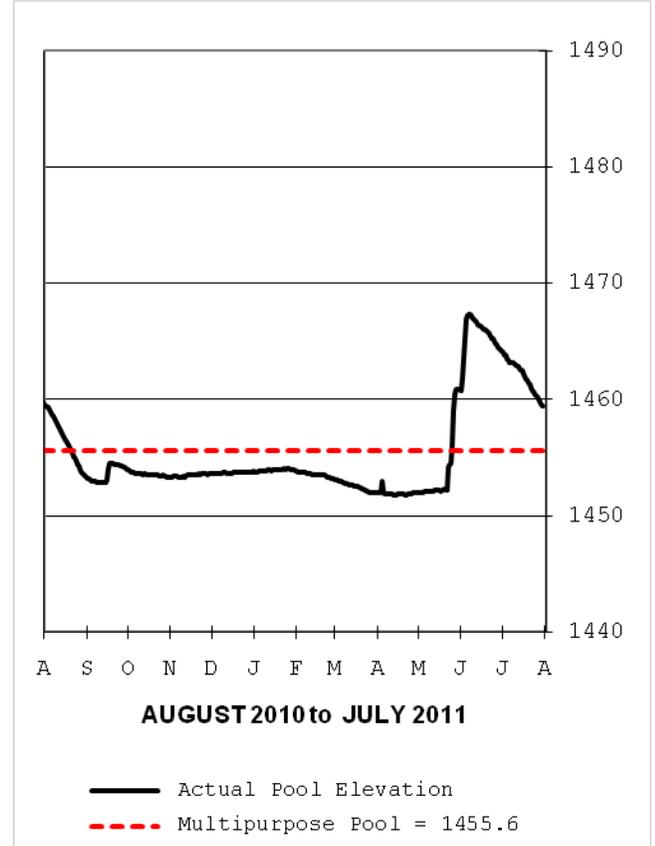
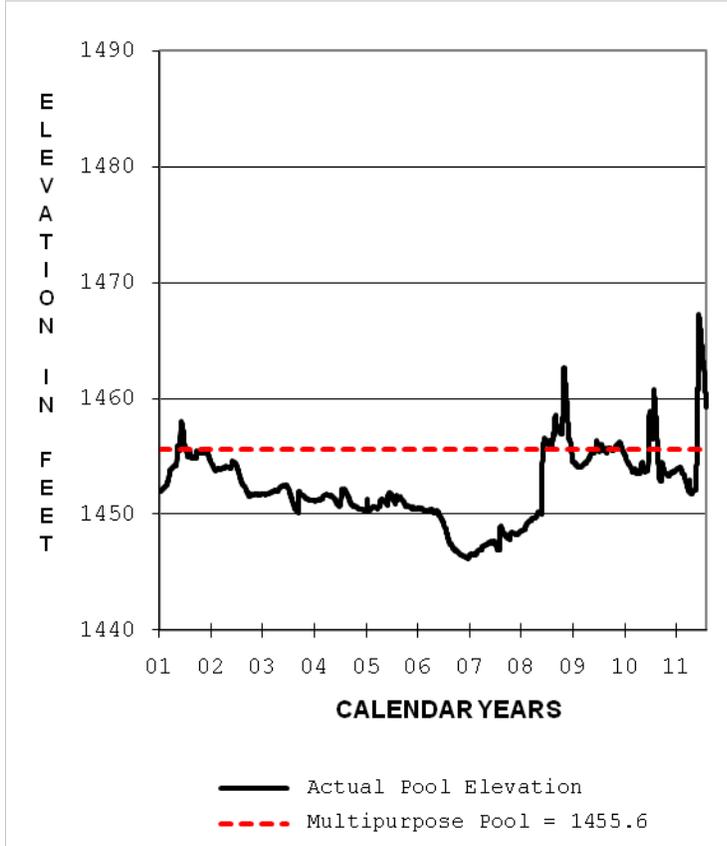


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
2742.7 1 Aug 10	2742.7 31 Jul 11	2745.4 17 Jun 11	2739.5 11 Nov 10	2757.40 3-4 Aug 62	2724.30 26 Aug 02
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
500 24 May 11	34,959	193 1 Aug 10	1 Many days		
Maximum daily outflow is river release only (mostly seepage). No releases from canal. No min required release.					

WACONDA LAKE

2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW
WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

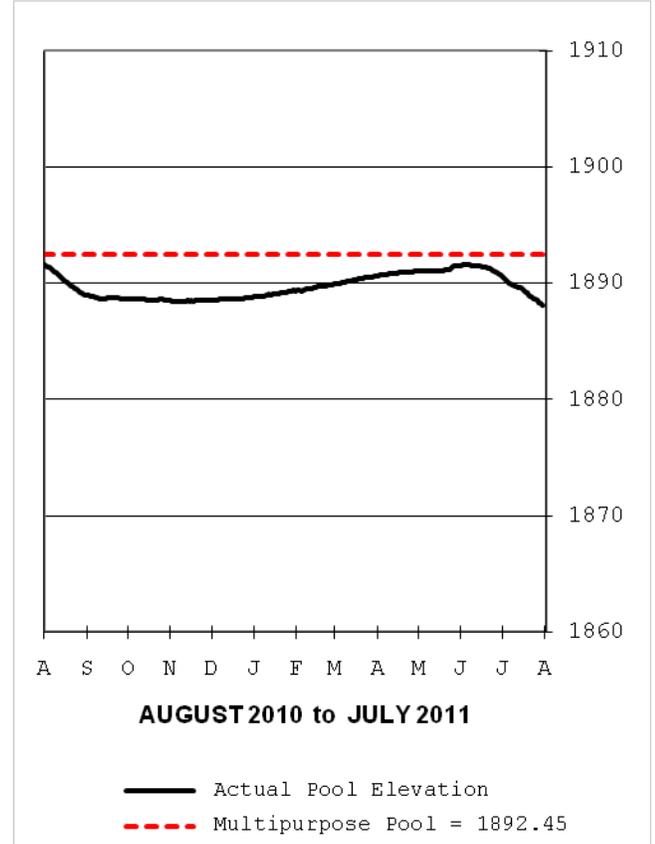
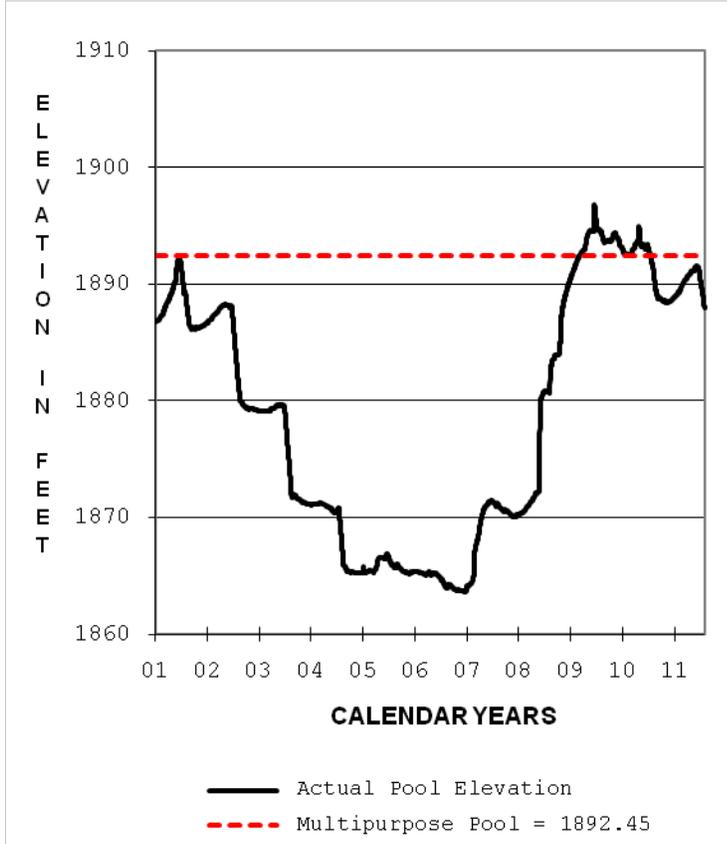


Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1459.6 1 Aug 10	1459.2 31 Jul 11	1467.3 7 Jun 11	1451.8 12 Apr 11	1487.02 29 Jul 93	1446.18 19 Dec 06
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
30,000 3 Jun 11	457,594	1,701 1 Aug 10	1 4 Jun 11		
Max daily outflow is river release only. No min required release, but min mean monthly flow of 24 cfs is desirable.					

WEBSTER RESERVOIR

2010 - 2011 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.



Pool Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1891.57 1 Aug 10	1888.03 31 Jul 11	1891.57 1 Aug 10	1888.03 31 Jul 11	1907.04 5 Jun 95	1857.35 22-29 Oct 71
Report Period Inflow and Outflow					
Maximum Daily Inflow Day Second Feet	Period Total Inflow Acre Feet	Maximum Daily Outflow Day Second Feet	Minimum Daily Outflow Day Second Feet		
180 25 May 11	20,202	140 10 Aug 10	0 Many Days		
All releases to river. Max daily outflow occurred as part of normal irrigation releases. No minimum required release.					