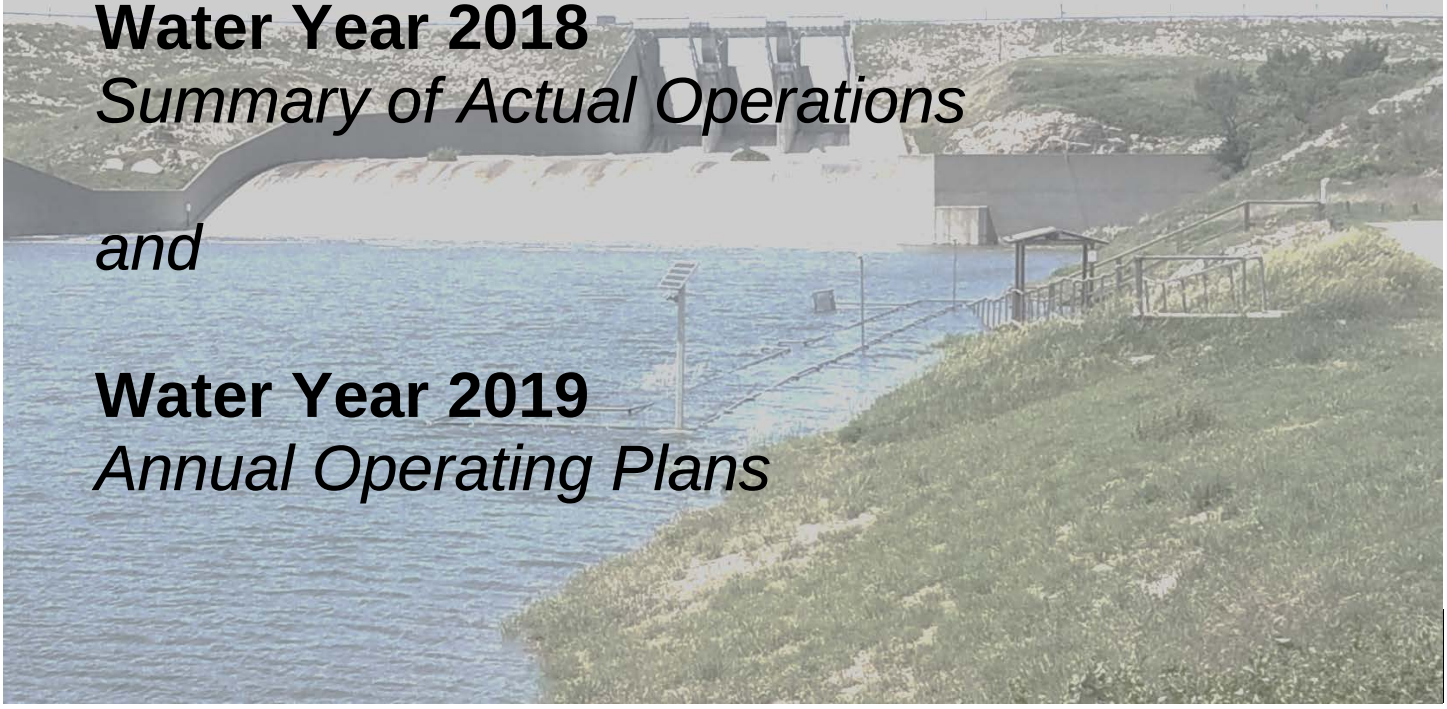
RECLAMATION

Managing Water in the West

Annual Operating Plans

Niobrara, Lower Platte, and Kansas River Basins



Water Year 2018
Summary of Actual Operations

and

Water Year 2019
Annual Operating Plans

U.S. Department of the Interior
Bureau of Reclamation
Great Plains Region

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Overview

General

This year is the 66 consecutive year that an Annual Operating Plan (AOP) has been prepared for the Federally-owned dams and reservoirs in the Niobrara, Lower Platte, and Kansas River Basins. The plan has been developed by the Water Operations Group in McCook, Nebraska for the 16 dams and reservoirs that are located in Colorado, Nebraska, and Kansas. These reservoirs, together with nine diversion dams, nine pumping plants, and 20 canal systems, serve approximately 270,078 acres of project lands in Nebraska and Kansas. In addition to irrigation and municipal water, these features serve flood control, recreation, and fish and wildlife purposes. A map at the end of this report shows the location of these features.

The reservoirs in the Niobrara and Lower Platte River Basins are operated by either irrigation or Reclamation districts. The reservoirs in the Kansas River Basin are operated by either Reclamation or the Army Corps of Engineers. Kirwin Irrigation District provides operational and maintenance assistance for Kirwin Dam. The diversion dams, pumping plants, and canal systems are operated by either irrigation or Reclamation districts.

A Supervisory Control and Data Acquisition System (SCADA) located at McCook, Nebraska is used to assist in operational management of all 11 dams under Reclamation's jurisdiction that are located in the Kansas River Basin. A Hydromet system collects and stores near real-time data at selected stations in the Nebraska-Kansas Projects. The data includes water levels in streams, canals, and reservoirs and also gate openings. This data is transmitted to a satellite and downloaded to a Reclamation receiver in Boise, Idaho. The data can then be accessed by anyone interested in monitoring water levels or water usage in an irrigation system. The Nebraska-Kansas projects currently have 60 Hydromet stations that can be accessed. The Nebraska-Kansas Area Office (NKAO) has installed and maintains 41 of these Hydromet stations. These stations can be found on the Internet by accessing Reclamation’s Great Plains Region Hydromet station codes page at https://www.usbr.gov/gp/hydromet/stationcodes.html.

On page seven “The Headlines 2018”, which follows this overview is indicative of the awareness that the local residents have of the natural resource development and conservation in the Niobrara, Lower Platte, and Kansas River Basins.

2018 Summary

Climatic Conditions

Precipitation at the project dams during 2018 ranged from 99 percent of normal at Glen Elder Dam to 157 percent of normal at Webster Dam. Annual precipitation was above normal for 15 of the 16 project dams.

Temperatures in January were generally below normal, while temperatures in February were typically much above normal throughout the project area. Precipitation in January varied from 237 percent of average to 38 percent of average. February precipitation was well below the normal average throughout the project area. March temperature and precipitation was well above normal at most of the dams with twelve of the project dams above 111 percent of the average precipitation.

Temperatures in April were generally above normal while in May they were generally below normal. Precipitation during April was generally below average with only two project dams above average. May precipitation was above normal at nine of the dams ranging from Norton Dam at 66 percent to Cedar Bluff Dam at 155 percent of average.

Temperatures in July and August were generally below normal, while temperatures in June were typically well above normal throughout the project area. Total precipitation for June was above average at all but three project dams. July was typically well above average at all the project dams with thirteen dams recording above four inches of rain as well as five over six inches. August precipitation varied from 26 percent of average to 233 percent of average.

Precipitation recorded in September ranged from 37 percent to 237 percent of normal. September, October, and November temperatures were generally above normal. October precipitation was generally well above average with 10 of the dams above 200 percent of average. November precipitation ranged from 23 percent to 180 percent of normal with 11 project dams recording below normal precipitation. In December, precipitation was generally well above average for the project dams in the Kansas River Basins with 12 of the project dams above 300 percent of average.

Storage Reservoirs

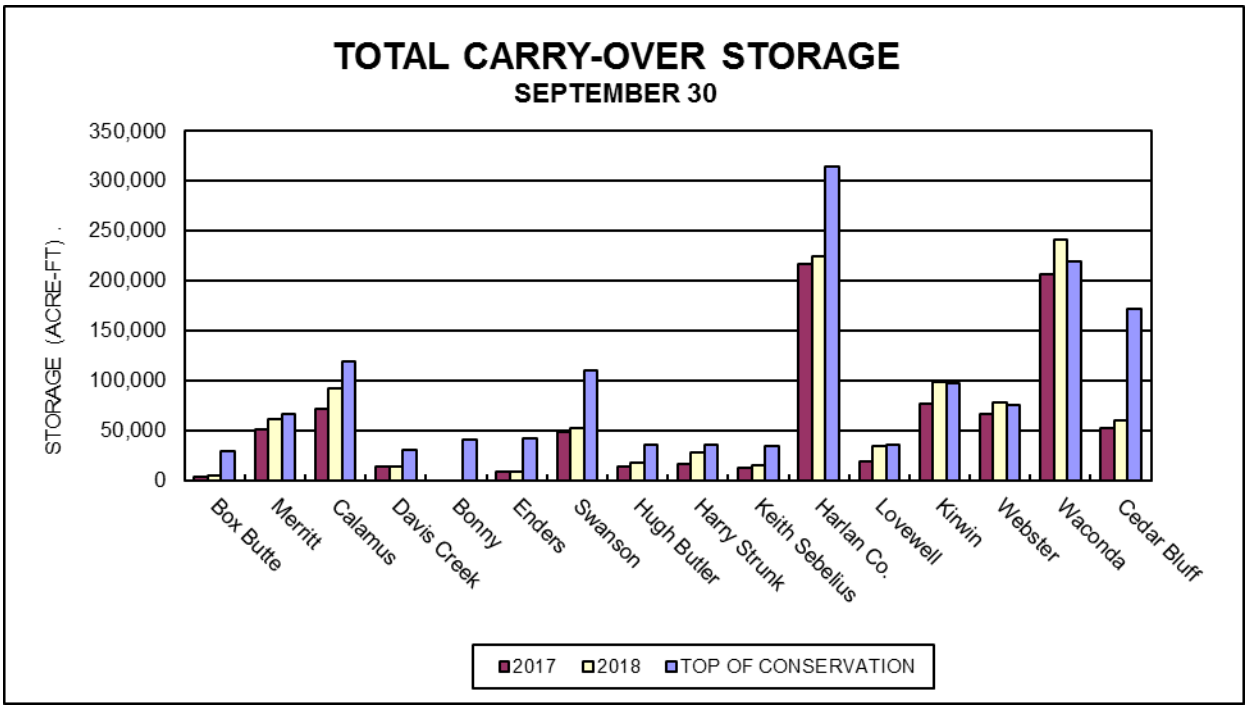
Conservation Operations: The 2018 inflows at Hugh Butler Lake, Bonny Reservoir, Harry Strunk Lake, and Enders Reservoir were between the dry-year and normal-year forecasts. The inflow for Box Butte Reservoir, Merritt Reservoir, and Webster Reservoir was above the wet-year forecast. The remaining reservoirs had inflows between the normal-year and wet-year forecasts.

Eleven of the sixteen reservoirs had below average carryover storage from the 2017 water year. Box Butte and Enders Reservoirs, along with Swanson, Hugh Butler, Keith Sebelius, and Harlan County Lakes did not have sufficient storage to provide water users with a full water supply. Webster, Kirwin, and Lovewell Reservoirs, Harry Strunk and Waconda Lake utilized some flood pool storage during the year. Irrigation demands greatly reduced the storage in several project reservoirs throughout the summer. Reservoir storage was below average at seven of the sixteen reservoirs at the end of the 2018 water year.

On September 20, 2011, the State of Colorado ordered that Bonny Reservoir be drained for Republican River Compact compliance. All of the water in Bonny Reservoir was evacuated by the end of May 2012 and no storage has been recorded since. The State of Colorado order remains in effect and inflows continue to be bypassed.

On December 31, 2017 the State of Nebraska, Department of Natural Resources (NDNR) determined a “Compact Call Year” (Compact Call) to be in effect on the Republican River Basin for the sixth consecutive year. The Compact Call resulted in the NDNR issuing closing notices on all natural flow in the basin until such time that the NDNR determines that yearly administration is no longer needed to ensure Republican River Compact compliance. Also on December 31, 2017 the NDNR notified Reclamation that it was not requiring curtailment of storage water rights held by Reclamation in the Republican River Basin but a future notice could be provided to Reclamation to ensure Nebraska's Compact obligations would be accomplished. No natural flow was bypassed through Enders Reservoir, Swanson Lake, Hugh Butler Lake, Harry Strunk Lake and Harlan County Lake as a result of the Compact Call. On December 28, 2018 the NDNR determined that 2019 would also be a “Compact Call Year”.

The following graph shows a comparison of 2017 and 2018 carry-over storage conditions as compared to the top of conservation storage for all reservoirs in the Niobrara, Lower Platte, and Kansas River Basins as of September 30, 2018.



Flood Control Operations: Lovewell Reservoir, Kirwin Reservoir, Webster Reservoir, Waconda Lake, and Harry Strunk Lake utilized flood pool storage in 2018. Flood releases from Lovewell Reservoir totaled approximately 8,200 AF from mid-October through the beginning of November and 6,200 AF in December. Flood releases from Webster Reservoir totaled around 55,300 AF from late-May through mid-August and nearly 23,400 AF from mid-October through the end of the year. Waconda Lake totaled nearly 57,700 AF from early-June through late-July and nearly 129,300 AF from early September though the end of the year. Flood releases from Kirwin Reservoir totaled almost 10,000 AF for the year. Approximately 2,900 AF was evacuated from the flood pool at Medicine Creek Dam from mid-May through mid-June.

Rains throughout the upper Solomon River Basin from May 21 through May 31, 2018 increased the reservoir levels of Kirwin and Webster Reservoirs. Kirwin Dam recorded 5.58 inches of precipitation with runoff increasing the reservoir to a peak elevation of 1,731.16 feet on May 30, 2018. This is 1.9 feet above the top of conservation with 10,000 AF stored in the flood pool. Releases of 300 cfs were made though the river outlet from May 30 through June 11, 2018. Webster Dam recorded 6.67 inches of precipitation with runoff increasing the reservoir to a peak elevation of 1,899.26 feet on May 31, 2018. This is 6.8 feet above the top of conservation with 28,300 AF stored in the flood pool. River releases from Webster Dam were staged up to 745 cfs through the spillway beginning on May 29, 2018. The releases were staged down throughout the month of June as the pool was evacuated. Heavy rains in the South Fork Solomon River Basin above Webster Reservoir over the weekend of June 30, 2018 increased the reservoir level to a peak elevation of 1,896.91 feet on July 3, 2018. This is 4.5 feet above the top of conservation with 18,000 AF stored in the flood pool. River releases were again staged to 745 cfs through the spillway. The flood pool was evacuated by mid-August.

River releases from Glen Elder Dam were staged up to 700 cfs beginning June 1, 2018 as flood releases from Kirwin and Webster Reservoirs began to reach Waconda Lake. Releases were staged down throughout July as the flood pool was evacuated. Runoff from early September rains increased the reservoir level of Waconda Lake to a peak elevation of 1,457.69 feet on September 7, 2018. This level is 2.1 feet above the top of conservation with 27,300 AF stored in the flood pool. A river release of 300 cfs began on September 7, 2018 to decrease the pool level. As this release was being staged down in early October, Glen Elder dam reported 2.45 inches of precipitation and the reservoir quickly gained two feet to an elevation to 1,459.54 feet (3.9 feet above top of conservation) with almost 30,000 AF stored in the flood pool. Releases were again staged to 1,500 cfs and continued through the end of the year.

The water year 2018 flood damages prevented by the operation of Reclamation's Nebraska-Kansas Projects facilities was $1,847,100 as determined by the Corps of Engineers. An additional benefit of $364,500 was credited to Harlan County Lake. The accumulative total of flood control benefits for the years 1951 through 2018 by facilities in this report total $2,204,165,900 (see Table 5). Box Butte, Merritt, Calamus, and Davis Creek Reservoirs do not have a designated flood pool and have not accrued any flood benefits to date.

A summary of precipitation, reservoir storage and inflows at the facilities of the Nebraska-Kansas Projects during 2018 can be found in Table 7.

Water Service

There was 279,571 AF of water diverted to irrigate approximately 198,507 acres of project lands in the 12 irrigation districts (see tables 3 and 6). The project water supply was either inadequate or limited for 149,257 acres of the total project lands. This includes lands in Mirage Flats, Frenchman Valley, H&RW, Frenchman-Cambridge, Almena, Bostwick in Nebraska, and Kansas Bostwick Irrigation Districts. The project water supplies for the other units mentioned in this report were adequate in 2018.

The water requirements of three municipalities, one rural water district, and two fish hatchery facilities were met in 2018. Both storage releases and natural flows are utilized in meeting these demands.

Fish and Wildlife and Recreation Benefits

The National Recreational Fisheries Policy declares that the Government's vested stewardship responsibilities must work in concert with the state managing agency's recreational fisheries constituency and the general public to conserve, restore, and enhance recreational fisheries and their habitats. The NKAO is available for meetings if requested with Nebraska, Colorado, and Kansas state management agencies to discuss the AOP. Information is solicited from the agencies to enhance fisheries resources within the flexibility allowed while still meeting contractual obligations with the various irrigation districts.

Reservoir operations were favorable for recreation and fish and wildlife uses in 2018 at those project reservoirs with full or nearly full conservation pools prior to the irrigation season. The higher water levels experienced early in the year submerged existing shoreline vegetation. Normal irrigation demands and the lack of precipitation during the summer greatly reduced the pool levels at several reservoirs allowing for late summer shoreline revegetation. The draining of Bonny Reservoir and the State administration of storage rights in southwest Nebraska reservoirs in previous years diminished recreation benefits at these facilities.

2019 Outlook

Three forecast conditions have been developed for each of the reservoirs in the Niobrara, Lower Platte, and Kansas River Basins conforming to established operating criteria under various reservoir inflow conditions. These operation studies are included in Table 4, sheets 1 through 16. The municipal and rural water district water supply requirements will be met under all three inflow forecast conditions for all units.

Under reasonable minimum inflow forecast conditions, irrigation districts receiving storage water from the following lakes and reservoirs are expected to receive less than a full supply: Box Butte, Enders, Swanson, Hugh Butler, Harry Strunk, Keith Sebelius, Harlan County, and Lovewell. The irrigation districts affected are Mirage Flats; Frenchman Valley and H&RW; Frenchman- Cambridge; Almena; Bostwick in Nebraska; and Kansas Bostwick; respectively. If 2019 is a dry year, 149,257 acres of the total 269,745 acres with service available to be irrigated (55 percent) will have an inadequate water supply.

Under most probable inflow conditions, it is expected that Mirage Flats, Frenchman Valley, H&RW, and Almena Irrigation Districts would experience some shortages to irrigation demands from Box Butte Reservoir, Enders Reservoir, and Keith Sebelius Lake. Most irrigators in these districts plan to use water from private wells to supplement the project water supply.

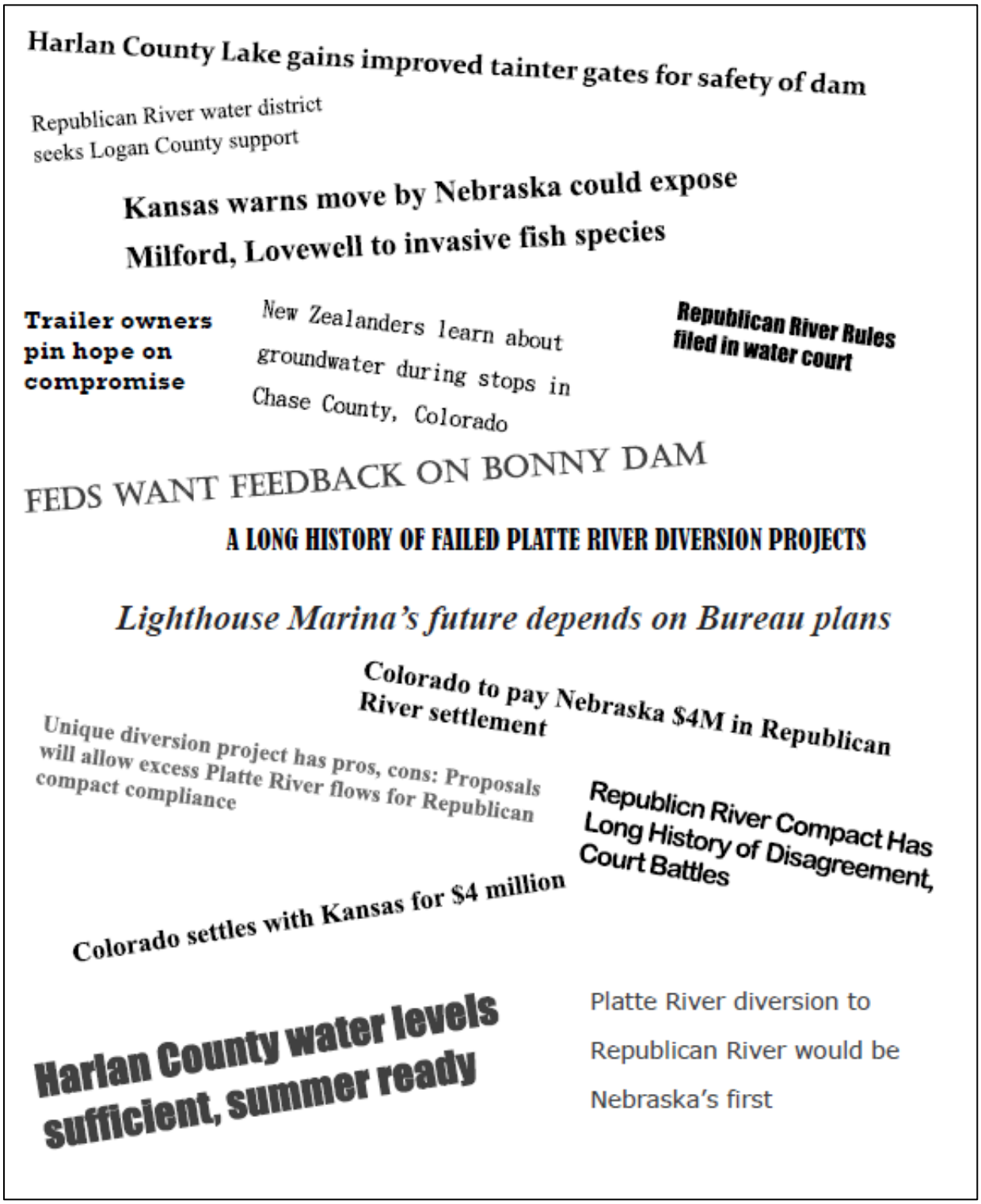
Even under reasonable maximum inflow conditions Frenchman Valley, and H&RW Irrigation Districts are expected to experience irrigation demand shortages from Enders Reservoir.

Under reasonable minimum inflow conditions, the conservation pools at Merritt, Calamus, Davis Creek, Kirwin, Webster, and Lovewell Reservoirs, and Waconda and Harry Strunk Lake are expected to fill during 2019.

Even with low reservoir levels and inadequate water supplies for some project lands, the recommendations of various state agencies will be considered. As in the past, irrigation and Reclamation Districts will advise state agencies regarding aquatic weed control and canal operations. Reclamation will continue to operate the reservoirs and other facilities under its jurisdiction in the best interests of all project functions and for the optimum public benefit.

Water is not expected to be stored in Bonny Reservoir during 2019 as the State of Colorado's order to bypass all inflows remains in effect. Bonny Reservoir was drained in 2012 by order of the State of Colorado to assist in meeting Republican River Compact compliance.

2018 Headlines



A collection of media headlines related to Niobrara, Lower Platte, and Kansas River Basins

Chapter I – Introduction

Purpose of This Report

This AOP advises water users, cooperating agencies, and other interested groups or persons of the actual operations during 2018 and serves as a guideline for the 2019 operations. This report also describes the responsibilities of Reclamation, Corps of Engineers, and the irrigation and Reclamation districts in the Niobrara, Lower Platte, and Kansas River Basins.

Operational Responsibilities

Reclamation is responsible for irrigation operations at all federal reservoirs in the Nebraska-Kansas Projects. Reclamation is also responsible for the operation and maintenance (O&M), safety of the structure, and reservoir operations not specifically associated with regulation of the flood control storage at the reservoirs constructed by Reclamation. Regulation of the flood control storage is the responsibility of the Corps of Engineers. In addition to irrigation and flood control, these reservoirs provide recreation, fish and wildlife, and municipal water supply benefits.

By contractual arrangements with Reclamation, the irrigation or Reclamation districts in the Niobrara, Lower Platte, and Kansas River Basins are responsible for the O&M of the canals and irrigation distribution facilities constructed or rehabilitated by Reclamation. In addition, the appropriate irrigation or Reclamation districts are responsible for operating and maintaining Box Butte, Merritt, Virginia Smith and Davis Creek Dams. The Corps of Engineers operates and maintains Harlan County Dam and Lake. The State of Colorado provides operational guidelines for Bonny Reservoir. Operational guidelines for Cedar Bluff Reservoir are provided by the State of Kansas. Reclamation operates and maintains eleven dams and reservoirs in the Republican, Solomon, and Smoky Hill River Basins. Under a contract with Reclamation, Kirwin Irrigation District performs certain operational and maintenance functions at Kirwin Dam.

An updated Field Working Agreement was executed on July 17, 2001 between the Corps of Engineers and Reclamation regarding operation of Harlan County Dam and Lake. The agreement provides for a sharing of the decreasing water supply into Harlan County Lake. Storage capacity allocations were redefined based on the 2000 sediment survey and a procedure was established for sharing the reduced inflow and summer evaporation among the various lake uses.

The States of Nebraska, Colorado, and Kansas are responsible for the administration and enforcement of their state laws pertaining to the water rights and priorities of all parties concerned with the use of water. As provided by the lease agreement between Reclamation and the states, the states are responsible for administering the water surface activities and the federal lands around the reservoirs. The U.S. Fish and Wildlife Service administer the water surface activities and most of the federal lands at Kirwin Reservoir.

Reclamation cooperates with all state agencies and compact commissions to ensure that all operations are in compliance with state laws and compact requirements.

Tables and Exhibits

Records for the facilities reported in the AOP are included as tables and exhibits and are located following page 34.

Water Supply

For forecasting purposes, values of annual inflows that will be statistically equaled or exceeded 10, 50, and 90 percent of the time were selected from the probability data to be reasonable maximum (wet-year), most probable (normal-year), and reasonable minimum (dry-year) inflow conditions, respectively.

Inflow records from 1999 through 2018 were used for the analysis of reservoirs in the Niobrara, Lower Platte and Kansas River Basins.

Reservoir Operations

All operations are scheduled for optimum benefits of the authorized project functions. Monthly, or as often as runoff and weather conditions dictate, Reclamation evaluates the carry-over storage and estimated inflow at each reservoir to determine whether excess water is anticipated. If excess inflow is apparent, controlled releases will be made to maximize the downstream benefits.

Major Features

The Mirage Flats Project was constructed under the Water Conservation and Utilization Act and includes an irrigation storage reservoir, diversion dam, and canal system. The other features discussed in this report are all a part of the Pick-Sloan Missouri Basin Program and include single and multipurpose reservoirs, diversion dams, pump stations and canal systems. The sixteen storage facilities now in operation are listed below.

Constructed by Reclamation

Operated by irrigation or Reclamation districts--Box Butte and Merritt Dams in the Niobrara River Basin and Virginia Smith and Davis Creek Dams in the Lower Platte River Basin.

Operated by Reclamation--Bonny, Trenton, Enders, Red Willow, Medicine Creek, Norton, Lovewell, Kirwin, Webster, Glen Elder, and Cedar Bluff Dams in the Kansas River Basin. A contract provides for Kirwin Irrigation District to perform certain operational and maintenance functions at Kirwin Dam.

Constructed and Operated by the Corps of Engineers

Harlan County Dam in the Kansas River Basin.

Irrigation and Reclamation Districts

Twelve irrigation districts and one Reclamation district in the Niobrara, Lower Platte, and Kansas River Basins have contracted with Reclamation for water supply and irrigation facilities. The Twin Loups Irrigation District has contracted their O&M responsibilities to the Twin Loups Reclamation District. Bostwick Irrigation District in Nebraska has contracted their O&M responsibilities for Superior-Courtland Diversion Dam and the Courtland Canal between the head gates and the Nebraska-Kansas state line to Kansas Bostwick Irrigation District.

The contracted irrigation season for Mirage Flats Irrigation District is April through September. The contracted irrigation season for Frenchman-Cambridge Irrigation District is April 15 through October 15 or such additional period from April 1 to April 15 of each year as may be agreed upon between the District and Reclamation. The contracted irrigation season for Frenchman Valley and H&RW Irrigation Districts is from May 1 through October 15 or such additional period from April 1 through May 1 of each year as determined between the district and Reclamation. The contracted irrigation season for Twin Loups Reclamation District and Almena, Bostwick in Nebraska and Kansas Bostwick Irrigation Districts is May 1 through September 30 or such additional period from April 1 through November 15 of each year as determined between the district and Reclamation. For Ainsworth, Kirwin and Webster Irrigation Districts, the contracted irrigation season is from May 1 through September 30.

Municipal Water

Three municipalities in Kansas (Norton, Russell, and Beloit) and one rural water district in Kansas (Mitchell County Rural Water District No. 2) have executed water service contracts or repayment contracts for full or supplemental water supplies.

Fish and Wildlife

The Calamus Fish Hatchery is located below Virginia Smith Dam and Calamus Reservoir. The hatchery is operated and maintained by the Nebraska Game and Parks Commission (Commission). The water supply is provided by natural flows passed through Virginia Smith Dam and from Calamus Reservoir storage through an agreement dated July 28, 1988, between the Commission and the Twin Loups Reclamation District.

The State of Kansas operates and maintains the fish hatchery facility below Cedar Bluff Reservoir.

State of Colorado Division of Wildlife

The State of Colorado provides operational guidelines for Bonny Reservoir. The entire conservation pool storage was purchased by the State of Colorado on June 24, 1982.

State of Kansas Department of Wildlife, Parks and Tourism (KDWPT)

The State of Kansas acquired the use and control of portions of the conservation capacity at Cedar Bluff Reservoir following the reformulation of the Cedar Bluff Unit in October of 1992. The City of Russell's existing water storage right and contract with the United States remained unchanged.

Power Interference Considerations

A Power Interference Agreement exists between Reclamation, the Twin Loups Reclamation District, and the Loup River Public Power District. Subordination Agreements also exist between Reclamation, the Ainsworth Irrigation District, and the Nebraska Public Power District and between Reclamation, the Mirage Flats Irrigation District and the Nebraska Public Power District. Provisions of these agreements will be incorporated into the 2019 operations.

Environmental Considerations

A "Statement of Operational Objectives" for Harlan County Lake sets forth the general operational objectives and the specific reservoir uses that are desirable. The operational objectives indicate that fish and wildlife interests are best served by high reservoir levels with minimum fluctuations, and regulation of the outflow in excess of the minimum desired flows. Although the statement recognizes flood control and irrigation as primary purposes, it indicates that comprehensive operational plans should be developed for maximum integration of the secondary uses.

These operational objectives are also considered in the operation of all Reclamation reservoirs in the Kansas River Basin, Niobrara River Basin, and the Lower Platte River Basin. The regulated outflow can also benefit farmers, ranchers, cities, and other interests below the reservoirs.

Republican River Compact – Kansas v. Nebraska

On May 26, 1998, Kansas filed a petition with the U. S. Supreme Court stating that Nebraska had violated the Republican River Compact by using more than its share of the Republican River water supply. The three original parties to the Compact; Kansas, Nebraska and Colorado, became parties to the case. Because the major water development structures in the Republican River Basin were constructed by the Bureau of Reclamation and the Corps of Engineers, the United States was allowed to participate as *amicus curiae.* After seventeen months of negotiations, the Final Settlement Stipulation (Stipulation) was signed by each respective governor and attorney general and was filed with the Special Master on December 16, 2002. The United States Supreme Court approved the settlement and dismissed the case on May 19, 2003.

The settlement provides for a moratorium on new groundwater wells, special rules for administration of water during water-short years, protection of storage releases, minimized flood flow effects on the accounting, recognition by Nebraska of a 1948 priority date for the Kansas Bostwick Irrigation District, inclusion of the impacts of groundwater pumping from tableland wells in the accounting, and accounting for all reservoirs 15 AF and larger within the river basin.

The Stipulation also required that Colorado, Kansas and Nebraska, in cooperation with the United States, form a Conservation Committee to develop a proposed study plan to determine the quantitative effects of non-federal reservoirs and land terracing practices on water supplies in the Republican River Basin above Hardy, Nebraska. The study plan supported by Colorado, Kansas and Nebraska, the Natural Resources Conservation Service, and Reclamation was completed and signed on April 28, 2004. Cooperative agreements for completing the five year study were developed between Reclamation, the University of Nebraska-Lincoln (UNL), and Kansas State University. Installation of data loggers on 35 reservoirs throughout the basin was completed in 2004. Advanced monitoring equipment for terraces and additional reservoirs was installed by UNL in 2006. Data collection and model development continued through 2009. The Conservation Committee presented a Summary Report of Preliminary Findings for the study at the 2011 Republican River Compact annual meeting held in Burlington, Colorado on August 31, 2011. The Republican River Compact Administration (RRCA) reviewed the report and determined a formal study report was needed. The final report was released in June of 2014.

After more than two years of negotiations among the States, the RRCA approved two resolutions on August 24, 2016 establishing long-term agreements among Kansas, Colorado and Nebraska related to Colorado's and Nebraska's compliance activities in the Republican River basin.

Water-Short Year Administration will be in effect in those years in which the projected or actual irrigation supply is less than 119,000 AF of storage available for use from Harlan County Lake as determined by Reclamation. It was determined that Water Short Year Administration would be in effect in 2018.

Republican River Basin Study

In early 2016, the Republican River Basin Study (Basin Study) was completed. The Basin Study represented an extensive collaborative effort among the states of Colorado, Kansas, and Nebraska to identify adaptation strategies that address current and future water management challenges in the basin.

The Basin Study found that climate change may have a pronounced impact on future supplies and demands across the basin. The modeling tools developed under the study were used to evaluate alternatives to improve the supply reliability at the Frenchman-Cambridge Irrigation District in Nebraska, as well as the Bostwick Irrigation Districts in Nebraska and Kansas.

Nebraska focused on augmenting the supply of Swanson Lake and creating new surface water storage on Thompson Creek, a tributary of the Republican River. Kansas evaluated alternatives that increase the storage volume at Lovewell Reservoir.

The newly developed ground and surface water modeling tools will help inform future water management decisions that help build resiliency against future climate change, while also maintaining compliance with the Republican River Compact.

The Basin Study is a part of Reclamation's WaterSMART Program. The report is available online at www.usbr.gov/watersmart/bsp.

Emergency Management

The NKAO continues to coordinate with local jurisdictions that could potentially be impacted by flooding from large operational releases and/or dam failure. Three Tabletop Exercises of the Emergency Action Plan (EAP) were held for Cedar Bluff, Enders, Davis Creek, and Virginia Smith Dams in 2018. Functional Exercises will be held for Box Butte, Kirwin, Lovewell, and Merritt Dams in 2019. Communications Directories for all of the EAPs are reviewed annually.

Emergency radios have been installed at all dams. These radios will be used as a backup means of communication when notifying the local emergency management officials in the event of an emergency at the dam. The NKAO has one satellite phone that can be used in an emergency. Management and dam operators have been trained on the use of these phones.

Public Safety Reviews

The Annual Safety Training for field personnel was held in McCook, Nebraska in the spring of 2018. This training provided personnel the opportunity to update their training in Hazard Communication, Fall Protection and Walking-Working Surface Safety, NFPA 70E Electrical Safety, Job Hazard Analysis, Identifying and Selecting Appropriate Personal Protective Equipment, Confined Space Safety, Ergonomics, Hearing Conservation, Respiratory Protection, and Pest Control. In addition, Security Awareness and an Active Shooter Protection were provided.

The ongoing safety reviews of project facilities continue to identify potential safety hazards to the public and operating personnel. NKAO combines elements of the Annual Safety Inspections of the major facilities with the Dam Safety Facility Reviews when possible, and conducts follow up inspections when deficiencies are not on-the-spot correctible. This format provides for enhanced communication and coordination between both the Area Safety Specialist and Staff, and teams of Dam Safety Specialists.

NKAO continues to involve Great Plains Region Safety and Occupational Health located in Billings, Montana when maintenance and operational items, such as replacing AED batteries and pads, and reprogramming CPR protocol, is required.

Attention continues with regards to issues concerning contractor safety, defensive driving, National Fire Protection Association 70E Electrical Safety/Arc Flash, construction equipment safety, lock out/tag out, personal protective equipment, welding, cutting, coating safety procedures, confined space, pesticide and herbicide use, fall protection/slips, trips, and falls, working alone, near-miss accident reporting, and completing job hazard analyses, with emphasis from managers, supervisors, employees, and the NKAO Safety Committee. Guidance contained in the Reclamation Safety and Occupational Health Plan is incorporated. Employees were provided safety and health training and given information related to these and several other issues throughout the year.

Chapter II - Niobrara and Lower Platte River Basins

Mirage Flats Project in Nebraska

General

Flows in the Niobrara River along with Box Butte Reservoir storage provide a water supply for the 11,662 acre Mirage Flats Project. From 2008 to 2017, the project water supply averaged 11,297 AF, which is about 0.97 AF per irrigable acre. Many irrigators supplement their water supply with private wells.

The Mirage Flats Irrigation District cooperates with the Commission by operating the Box Butte Dam outlet works gate and the Dunlap Diversion Dam gates in a manner to avoid sudden large changes in the flows of the Niobrara River. A 30-year agreement was made in 1990 between the district and the Commission whereby the district would not draw the reservoir water level below elevation 3978.00 feet (2,026 AF). In return the district received an up-front payment which was used to improve the efficiency of the project's delivery system. On March 17, 2000, the district agreed to increase the minimum reservoir level by one additional foot to elevation 3979.00 feet (2,392 AF). In return the district received an additional payment from the Commission for the 20 years left on the original agreement.

A data collection platform was installed in May of 1992 to monitor the reservoir elevation and outflow at Box Butte Dam. A telephone (primary communication system) and a radio (backup communication system) have been installed at the outlet works for contacting the Region 23 Emergency Management Agency.

2018 Summary

The flows of the Niobrara River plus the carry-over storage in Box Butte Reservoir were not adequate to provide a full water supply for the project lands. Precipitation in the Mirage Flats Irrigation District totaled 21.60 inches, which is 127 percent of normal. The 2018 total inflow of 21,920 AF was above the wet-year forecast.

The reservoir level began the year at elevation 3,984.80 feet (22.2 feet below the top of conservation). The pool level was maintained between elevations 3,979.00 and 3,985.00 feet throughout the year due to construction work on the toe drain. Irrigation releases began on May 2, 2018 and ended on August 16, 2018. Diversions of 5,891 AF to the Mirage Flats Canal provided irrigation water for approximately 4,500 acres, 39 percent of the service available acreage. The farm deliveries from the project water supply totaled 2,309 AF (0.51 acre-foot per irrigated acre), which is a delivery efficiency of 39 percent. Total reservoir storage was 4,504 AF at the end of the irrigation season. Privately owned irrigation wells supplemented the project water supply. The reservoir level at the end of the year was 3,990.96 feet (16.0 feet below the top of conservation).

Higher reservoir levels experienced in 2011, not experienced since June 1959, resulted in increased toe drain seepage and observed wet areas below the dam. Engineers with Reclamation's Technical Service Center (TSC) out of Denver, Colorado followed up with a special inspection that summer. Irrigation releases decreased the reservoir level throughout the summer, seepage returned to near normal levels, and observed wet areas dried up. Three SOD recommendations were completed in 2012 as a result of this event including performing an Issue Evaluation on changed seepage conditions at higher reservoir levels, stockpiling of filter sand and drain gravel at the dam, and daily monitoring of instrumentation when the reservoir level exceeds 4,004.00 feet. A Corrective Action/Value Planning Study was initiated and Appraisal Level Design Alternatives and Costs were completed in 2013.

The preferred design alternative, to replace the toe drains, was selected in 2015 and documented in the Corrective Action Study transmitted in early 2016. In 2016 contract specifications were completed, NEPA documentation was prepared and the Mirage Flats Irrigation District repayment contract was signed. In 2017 the contract for dam modifications was awarded to Paul Reed Construction out of Gering, Nebraska for 3.6 million dollars. The construction was completed in November 2018.

The district continued to implement water conservation measures as outlined in their Water Management Plan and their Long Range Plan. Assistance to project irrigators provided by the district include delivery system improvements that provide on-farm efficiency improvements, such as relocation of turnouts, burying pipe for better access, and on-farm efficiency incentives.

2019 Outlook

The project water supply is expected to be inadequate in 2019 as it has been since the early 1960's. In the spring, the district will inform their water users of the amount of water that will be available from storage in Box Butte Reservoir. It is anticipated that district irrigators will continue to use their privately-owned irrigation wells as a supplemental supply.

Ainsworth Unit, Sandhills Division in Nebraska

General

Within the Ainsworth Irrigation District, there are approximately 35,000 acres with available service. The project water supply is provided by Snake River flows and Merritt Reservoir storage. The reservoir is filled to elevation 2,944.0 feet each fall after the irrigation season. This level is approximately two feet below the top of conservation capacity and within the repaired area of soil cement on the upstream face of the dam. The reservoir is regulated to maintain this level until the ice clears each spring. Maintaining the reservoir at this elevation during the winter will help avoid ice damage to the older existing soil cement at lower elevations. Upon ice-out the outlet pipe is drained, inspected, and repaired as necessary. The reservoir is then rapidly filled to elevation 2,946.0 feet to reduce shoreline erosion around the reservoir and minimize sand accumulations on the face of the dam. This filling process generally takes place in April. The reservoir level is maintained until irrigation releases begin to draw on the pool around mid-May. Seepage, pickup

and toe drain flow normally result in flows of up to 15 cubic feet per second (cfs) below Merritt Dam.

Reclamation has executed a Memorandum of Agreement (MOA) between Reclamation, the Commission and the Ainsworth Irrigation District for Snake River releases below Merritt Dam. The purpose of this MOA is to establish the protocol that will be used to make future releases of water from Merritt Dam to the lower Snake River. The development of the MOA was an environmental commitment outlined in the Ainsworth Irrigation District Final Environmental Assessment for the conversion of a Long-Term Water Service Contract to a Repayment Contract (December 2006). Release criteria will be based on the best available scientific data to determine when local conditions warrant releases to the Snake River. When it becomes necessary to release water from Merritt Reservoir, Reclamation will direct the Ainsworth Irrigation District to make the necessary releases to the river. Changes to the river will be staged to allow fish and other aquatic organisms time to acclimate to the changing environment.

2018 Summary

Precipitation, as recorded near Merritt Dam, totaled 24.99 inches, which was 119 percent of normal. The total yearly inflow of 211,086 AF was above the wet-year forecast and was the greatest annual total since dam construction. The reservoir level at the beginning of the year was at elevation 2944.00 feet. The water supply was more than adequate to meet the project's irrigation requirement. There were 54,456 AF diverted from Merritt Reservoir into Ainsworth Canal, with 20,298 AF delivered to the farm head gates (delivery efficiency of 37 percent). There were 34,626 acres of land irrigated in 2018. The reservoir elevation at the end of 2018 was 2944.23 feet.

The district provided a total of 215 AF of irrigation water from holding ponds located within the district’s service area.

During the 2011 annual site inspection at Merritt Dam, a large seep located near the outlet works stilling basin wing wall was observed to be transporting a sand material. After discussions with personnel in the Regional Office and TSC, it was determined that the seep was an ongoing issue. An Issue Evaluation to address the transportation of sand observed was initiated in 2012 and was completed in 2015. A Risk Analysis was also conducted.

The Corrective Action Study was subsequently started and completed in July 2017. The Corrective Action Study recommended modification of the structure.

In early 2018 the Great Plains Regional Drill crew, the TSC, and the Nebraska-Kansas Area Office completed grouting of the of the spillway and river outlet works underdrain systems. The post grouting monitoring of the facility noted sand emanating from the right drain outfall for the spillway chute drain system. Weir plates were installed on both outfalls to monitor the sand accumulation. Six well points were also installed around the basin to provide additional ground water level monitoring. Subsequently, a Risk Reduction Verification Decision Document was completed and indicated that there is justification for further action to evaluate the migration of material through the right spillway chute drain outfall.

2019 Outlook

During the winter months, the reservoir will be regulated to maintain elevation 2,944.0 feet (2.0 feet below the top of conservation capacity). In order to alleviate erosive action to the lands around the reservoir and to maximize all benefits associated with the reservoir, releases from Merritt Reservoir will be regulated to fill the conservation capacity during the early spring. This filling generally takes place during April. If weather conditions or irrigation demands dictate, it may be necessary to begin filling the reservoir prior to this time. This reservoir level will be maintained until irrigation releases begin dropping the pool level. Following the irrigation season the reservoir will begin to refill to elevation 2,944.0 feet. A release of 50 cfs will be made to the Snake River beginning around the second week of October and will continue until the reservoir reaches the desired winter elevation. The water supply is expected to be adequate in 2019 for the irrigation of 35,000 acres.

In 2019, the Dam Safety Office will send work request to the TSC to begin addressing Safety of Dams recommendations.

North Loup Division in Nebraska

General

The North Loup Division is located in the Loup River drainage basin. Water is diverted from both the Calamus and North Loup Rivers for the irrigation of approximately 55,100 acres of project lands. Operation of the division also provides a sustained groundwater supply for an additional 17,000 acres. Principal features of the division include Virginia Smith Dam and Calamus Reservoir, Calamus Fish Hatchery, Kent Diversion Dam, Davis Creek Dam and Reservoir, five principal canals, one major and one small pumping plant and numerous open ditch and buried pipe laterals.

Calamus Reservoir is normally regulated at three to four feet below the top of conservation capacity during the winter months. Maintaining the reservoir at this elevation during the winter helps avoid ice damage to the soil cement on the upstream face of the dam. After the ice clears in the spring, the reservoir is filled to conservation capacity. The North Loup Division project operation is restricted to zero water diversions from the Calamus and North Loup Rivers during the months of July and August, and also during the month of September whenever sufficient water is available in the storage reservoirs to deliver full water demands. During this time, inflows to Calamus Reservoir are required to be bypassed under the Power Interference Agreement between Reclamation, the Twin Loups Reclamation District, and the Loup River Public Power District and as required in the authorizing legislation.

Davis Creek Reservoir level is typically maintained at an average elevation of 2,048.0 feet from the end of the irrigation season through the winter months. Off season seepage and evaporation has historically resulted in a reservoir drawdown of 2.5 to 3.0 feet requiring an end of September reservoir level of 2050.0 feet or less. This carry-over elevation provides a minimal recreational pool while reducing increases in groundwater storage due to reservoir seepage. The reservoir is filled by the Mirdan Canal starting in April and will generally reach full content by the end of June. A 160-acre recreation area adjoining the reservoir continues to be managed by the Lower Loup

Natural Resources District. The area includes a boat ramp, a handicapped accessible fishing pier, a day-use area, a primitive camping area, shelter and a hiking path. Public lands adjoining Kent Diversion Dam are managed by the Commission and are also open to day-use fishing with handicapped accessibility provided.

2018 Summary

Precipitation at Virginia Smith Dam was 29.07 inches which is 118 percent of normal for the year. The inflow totaled 296,165 AF which was between the normal-year and wet-year forecasts. The reservoir level at the first of the year was elevation 2239.46 feet (4.5 feet below the top of conservation). The conservation pool filled on April 12, 2018. The water supply was more than adequate for the district's needs. There were 76,991 AF of water released into Mirdan Canal for district use and 8,082 AF diverted through Kent Canal from the North Loup River. A total of 27,731 AF was diverted for district use above Davis Creek Reservoir. The farm head gate delivery was 5,908 AF which is a delivery efficiency of 21 percent. Land irrigated in 2018 totaled 34,110 acres above Davis Creek Reservoir. The Calamus Fish Hatchery used bypassed natural flows and storage from the reservoir totaling 3,675 AF. Calamus Reservoir inflows were bypassed during July, August, and September as required. The elevation at the end of the year was 2,239.81 feet.

The precipitation total of 35.43 inches near Davis Creek Dam was 140 percent of normal. Inflow to Davis Creek Reservoir totaled 48,098 AF during 2018. The reservoir elevation at the first of the year was 2,054.69 feet, 21.3 feet below the top of conservation. Beginning in mid-April, Davis Creek Reservoir was filled to a peak elevation of 2,076.51 feet on June 19, 2018 using diversions from Calamus Reservoir and the North Loup River. A release of 36,173 AF was made from Davis Creek Dam into Fullerton Canal, with 7,503 AF delivered to the farm head gates which is a 21 percent delivery efficiency. There were 21,016 acres irrigated below Davis Creek Reservoir. Following the irrigation season, the reservoir level was maintained and wintered approximately eight feet higher than normal at the request of the district for a three year study period. The reservoir elevation at the end of 2018 was 2,055.52 feet, 20.5 feet below the top of conservation.

2019 Outlook

Filling of Calamus Reservoir will continue through late winter and early spring. The reservoir will be allowed to fill to an elevation of 2,244.0 feet (top of conservation capacity) in late March or April. This reservoir level will be maintained in order to minimize shoreline erosion until demands begin to draw on the reservoir. Bypassing of inflows will be made during July, August and September under all inflow forecast conditions. In the fall the reservoir will be filled to an elevation of approximately 2,240.0 feet, if possible.

Water will be available for all irrigable acres with service from the Mirdan, Geranium and Scotia Canals and Lateral Systems. It is estimated that approximately 34,000 acres will be irrigated from these canals. Water supplies will be sufficient to meet the full dry-year requirements.

Filling of Davis Creek Reservoir will take place this spring with flows diverted from the North Loup River at Kent Division Dam and transported through Kent and Mirdan Canals. Storage water can also be transferred from Calamus Reservoir into Davis Creek Reservoir during the summer months through the Mirdan Canal. Water will be sufficient to irrigate an estimated 21,000 acres

from Elba and Fullerton Canals under all inflow forecast conditions. The reservoir level will be regulated to normal winter levels at the end of the season.

The fish hatchery demand for 2019 is expected to be similar to that of the last few years with approximately 5,000 AF required for the hatchery.

Chapter III - Republican River Basin

Armel Unit, Upper Republican Division in Colorado

General

Normal reservoir operations for Bonny Reservoir have historically been for recreation and fish and wildlife support, although water has been available for water right administration and irrigation purposes.

Bonny Reservoir inflows from the South Fork of the Republican River and Landsman Creek are released into Hale Ditch as requested by the Colorado State Engineer. The state can utilize Bonny Reservoir storage water for 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, Colorado Department of Natural Resources.

The historic operation pattern of Bonny Reservoir enhanced the spring fish spawn and provided excellent fishing opportunities during the summer and hunting conditions each fall. In September of 2011, the State of Colorado ordered all storage water evacuated from Bonny Reservoir for Republican River Compact compliance. As a result, the reservoir fishery was decimated and future operations are unlikely to provide fishing opportunities unless water is returned to the reservoir.

2018 Summary

The annual precipitation total of 22.55 inches at Bonny Dam was 129 percent of average. The annual computed inflow of 3,575 AF to Bonny Reservoir was between the dry-year and normal-year forecasts. Bonny Reservoir remains drained, and inflows continue to be bypassed for the purpose of compact compliance.

As directed by the Colorado State Water Commissioner, water was bypassed through Bonny Dam into Hale Ditch beginning April 12, 2018 and continuing through August 7, 2018. A total of 898 AF of water was diverted into Hale Ditch. During the remainder of the year water was bypassed through the reservoir into the South Fork Republican River as ordered by the Colorado State Engineer for compact compliance.

2019 Outlook

The State of Colorado's order to release all of the storage in Bonny Reservoir for Republican River Compact compliance remains in effect. If the order continues throughout 2019, water will not be available in the reservoir for irrigation or fishery purposes. Any water allowed to be stored in Bonny Reservoir during 2019 would be available to Hale Ditch and other private irrigators under short-term water service contracts executed with the state.

The Colorado State Water Commissioner is expected to direct that water be bypassed into Hale Ditch again in 2019.

Frenchman Unit, Frenchman-Cambridge Division in Nebraska

General

The Culbertson Canal and the Culbertson Extension Canal systems serve 9,292 acres in the Frenchman Valley Irrigation District and 11,915 acres in the H&RW Irrigation District. The water supply for these lands is furnished by flows from Frenchman and Stinking Water Creeks and off-season storage in Enders Reservoir located on Frenchman Creek, a tributary of the Republican River in southwest Nebraska. Irrigation releases are conveyed via Frenchman Creek from Enders Reservoir to Culbertson Diversion Dam. Reclamation maintains and clears this section of Frenchman Creek prior to irrigation releases each spring.

The normal operation of Enders Reservoir, with the gradual rise in water surface during the spring months, provides desirable fish spawning conditions. Irrigation releases normally deplete the conservation storage by late summer, thereby limiting the fishing and recreational usage. Due to extremely low storage levels, irrigation releases have not been made from Enders Reservoir since 2003.

Annual reservoir inflows have steadily declined from around 61,000 AF when Enders Dam was constructed to only 5,000 AF in recent years. Extensive groundwater pumping from upstream well development along with various conservation practices have resulted in the depletion of inflows. The conservation pool has not filled since 1968.

2018 Summary

The annual precipitation total of 19.96 inches at Enders Dam was 104 percent of normal. The 2018 inflow into Enders Reservoir of 5,495 AF was between the dry-year and normal-year forecasts. The reservoir level began the year at a level of 30.5 feet (3,081.83 feet) below the top of conservation. This was the lowest level ever recorded on the first of January since initial filling. The reservoir level increased gradually during the spring to a peak elevation of 3,083.66 feet on May 30, 2018.

Evaporation decreased the reservoir level from June through early-October reaching elevation 3,082.32 feet on October 4, 2018. Due to the extremely low water supply available, no water was released from Enders Reservoir during the irrigation season. The end of the year reservoir level was 29.3 feet (3,083.05 feet) below the top of conservation. This was the third lowest end of year level recorded since initial filling.

The Frenchman Valley Irrigation District diverted 7,426 AF of natural flow from Frenchman Creek in 2018. The district reports that approximately 382 acres received 319 AF of water. Farm delivery averaged about 10 inches per irrigated acre in the irrigation district. Several farmers supplemented their water supply with private irrigation wells. The H&RW Irrigation District did not divert water into Culbertson Extension Canal in 2018. This was the sixteenth consecutive year that the district did not deliver water.

2019 Outlook

The fall and early winter inflows into Enders Reservoir were near the dry-year forecast. If dry-year conditions prevail, the project water supply is expected to experience a shortage of about 78,000 AF. Normal-year conditions are expected to be inadequate by 60,800 AF and wet-year conditions by 29,400 AF, to irrigate the 9,292 acres in the Frenchman Valley Irrigation District and 11,915 acres in the H&RW Irrigation District.

The Frenchman Valley Irrigation District and the H&RW Irrigation District are investigating possible alternatives for the most efficient use of the declining water supply in the basin.

Meeker-Driftwood, Red Willow, and Cambridge Units, Frenchman-Cambridge Division in Nebraska

General

Service is provided for Frenchman-Cambridge Irrigation District by Meeker-Driftwood Canal to 16,691 acres; Red Willow Canal to 4,643 acres; Bartley Canal to 6,130 acres; and Cambridge Canal to 18,205 acres. The water supply for these lands is provided by storage in Swanson, Hugh Butler, and Harry Strunk Lakes, and inflows of the Republican River and Red Willow and Medicine Creeks. The Frenchman-Cambridge Irrigation District has replaced all of the open ditch laterals that were economically feasible with buried pipe which has significantly increased both system and on-farm efficiencies.

2018 Summary

The annual precipitation total of 24.86 inches at Trenton Dam was 124 percent of normal. The inflow of 34,575 AF to Swanson Lake was between the normal-year and wet-year forecasts. The lake level began the year at elevation 2,737.34 feet (14.7 feet below the top of conservation) and gradually increased throughout the late winter and spring. The peak elevation on June 26, 2018 was 2,742.68 feet (9.3 feet below the top of conservation). The reservoir level decreased throughout the irrigation season and reached an elevation of 2,737.73 feet on October 7, 2018. The district diverted 14,295 AF from June 18, 2018 through September 7, 2018 and delivered 4,264 AF to the farms, which is a delivery efficiency of 30 percent. At the end of the year, the reservoir level was 12.3 feet below the top of conservation at 2,739.74 feet.

In late February 2013, the Upper Republican Natural Resources District (URNRD) began operating the Rock Creek Augmentation Project. The augmentation water is pumped from the ground and diverted into Rock Creek. The water flows from Rock Creek into the North Fork of the Republican River at Parks, Nebraska. From there the water travels approximately 35 miles to Swanson Lake. The URNRD pumped water into Rock Creek from January through April of 2017 for compact compliance.

The Republican River Water Conservation District (RRWCD) built and completed the Colorado Compliance Pipeline in April 2014. The augmentation water is pumped from the ground and flows approximately 8 to 15 miles south to the North Fork of the Republican River just above the

Colorado-Nebraska state line. The water then travels approximately 55 miles to Swanson Lake. The RRWCD pumped water from January through April of 2018 and again from October through December for compact compliance.

The annual precipitation total at Red Willow Dam was 25.42 inches (129 percent of normal). The annual inflow of 9,151 AF into Hugh Butler Lake was between the dry-year and normal-year forecasts and was the sixth lowest ever recorded. The reservoir level at the first of the year was 2,565.94 feet, 15.9 feet below the top of conservation. Late winter, spring and summer inflows gradually increased the lake level to a summer peak of 2,569.21 feet on August 4, 2018. Due to the low water supply available, there were no diversions into Red Willow Canal for the ninth consecutive year. Late summer evaporation exceeded inflows, decreasing the lake level to 2,568.37 feet on October 7, 2018. The end of year and yearly peak elevation was 2,569.75 feet, 12.1 feet below the top of conservation.

The annual precipitation total of 26.98 inches at Medicine Creek Dam was 128 percent of normal. The inflow of 36,069 AF was between the dry-year and normal-year forecasts. The reservoir level at the beginning of 2018 was 7.0 feet below the top of conservation at 2,359.09 feet. The reservoir filled to top of conservation on May 5, 2018 and began spilling over the uncontrolled spillway notch. The reservoir level peaked at elevation 2,366.96 feet on May 31, 2018. Irrigation releases began in earnest on June 9, 2018 and continued through September 14, 2018 reducing the reservoir level to 2,361.91 feet. The district diverted 21,005 AF into Cambridge Canal and delivered 7,235 AF to 12,461 acres of district lands which is a delivery efficiency of 34 percent. Frenchman-Cambridge Irrigation District agreed to bypass Harry Strunk Lake inflows from mid-September until early-December to support compact compliance. Winter inflows increased the level of Harry Strunk Lake to elevation 2,362.74 feet at the end of the year (3.4 feet below the top of conservation). The Corps of Engineers determined that Harry Strunk Lake prevented $351,300 in flood damages in 2018.

The Nebraska Cooperative Republican Platte Enhancement Project (N-CORPE) is an interlocal agency formed by the URNRD, the MRNRD, the Lower Republican Natural Resources District (LRNRD), and the Twin Platte Natural Resources District. N-CORPE has constructed an augmentation project that pumps groundwater from Lincoln County into Medicine Creek. The delivery system consists of a 42-inch diameter pipe approximately six miles long. The pumped water enters at the source of Medicine Creek and travels approximately 57 stream miles to Harry Strunk Lake. The capacity of the project is approximately 87 cfs (63,000 AF annually). The augmentation project was not operated in 2018.

2019 Outlook

Forecasts show that carry-over storage, streamflow gains, plus reasonable minimum inflows for the three lakes supplying the Frenchman-Cambridge Irrigation District will be inadequate to meet the full dry-year irrigation requirement by 20,700 AF. The water supply will be adequate under normal-year and wet-year conditions.

Almena Unit, Kanaska Division in Kansas

General

Service is available to 5,764 acres in the Almena Irrigation District. The project water supply is provided by Prairie Dog Creek flows and Keith Sebelius Lake storage.

The water service contract for the City of Norton, Kansas, provides for a maximum annual use of 1,600 AF from Keith Sebelius Lake.

In 2017, the Almena Irrigation District and the Norton County Community Foundation, Inc. entered into a Memorandum of Agreement (MOA) to maintain a minimum pool elevation in Keith Sebelius Lake through December 31, 2027. The MOA was approved by the irrigators within the district and provided that no water would be released for irrigation below elevation 2,288.5 feet.

2018 Summary

The annual precipitation at Norton Dam totaled 33.71 inches, which is 136 percent of normal. The total inflow of 8,881 AF was between the normal-year and wet-year forecasts. The reservoir was 12.8 feet below the top of conservation pool at the first of the year (2,291.54 feet). Norton Dam recorded 9.81 inches and 3.63 inches of precipitation during the months of July and December, respectively, the second greatest ever recorded for the months. Late winter, spring and summer inflows gradually increased the lake level to a summer peak of 2,293.38 feet on August 7, 2018. No irrigation releases were made during 2018. Inflows exceeded evaporation for much of the fall and winter gradually increasing the elevation to the end of year and yearly peak elevation of 2294.05 feet, 10.3 feet below the top of conservation.

The city of Norton used 307 AF of municipal water during 2018.

2019 Outlook

If 2019 is a dry year without significant runoff producing storms above Keith Sebelius Lake, it is anticipated that the water supply may be inadequate by as much as 13,600 AF. If normal inflow into the lake and normal rainfall over the irrigated area occur in 2019, a shortage of 9,400 AF may be experienced. The water supply will be adequate under wet-year conditions. Requirements for the city of Norton will be met in full in 2019.

The district continues to plan projects to replace open ditch laterals with buried pipe that will reduce seepage losses, lessen maintenance requirements, and provide improvements in on-farm efficiencies. However, due to uncertainty of the district's water supply in the past and the temporary agreements with the State to forgo irrigation releases, the district may delay some identified delivery system improvement projects.

Franklin, Superior-Courtland, and Courtland Units, Bostwick Division in Nebraska and Kansas

General

Harlan County Lake storage and Republican River flows provide a project water supply for 22,455 acres in the Bostwick Irrigation District in Nebraska, and 13,378 acres in the Kansas Bostwick Irrigation District No. 2 (KBID) above Lovewell Reservoir. This storage and natural flows, together with White Rock Creek flows and Lovewell Reservoir storage, furnish a water supply for 29,122 acres below Lovewell Reservoir in the KBID.

The lands in the Franklin and Superior-Courtland Units are in the Bostwick Irrigation District in Nebraska. The lands in the Courtland Unit downstream of the Kansas state line are in the KBID.

In accordance with the off-season flow alternative outlined in Reclamation's final environmental assessment dated December 16, 1983, and amended on November 21, 2002, Harlan County Lake releases will be 10 cfs during the months of December, January, and February, except when the reservoir is at low levels. During water-short years releases for these three months will be either zero or 5 cfs depending on reservoir levels.

Natural gain in streamflow, plus irrigation return flows, and operational bypass at Superior-Courtland Diversion Dam will provide some flow downstream.

The KDWPT has requested that the KBID and Reclamation maintain, when possible, a flow of 20 cfs into Lovewell Reservoir when the Courtland Canal is in operation and the conservation pool is below capacity. This recommended inflow provides excellent fishing around the canal inlet to the reservoir. The seepage below Lovewell Dam into White Rock Creek maintains a small live stream throughout the year.

Harlan County Dam is currently operating under an Interim Operating Plan (IOP) initiated in 2003. The IOP resulted from a “Dam Safety Assurance Study” that evaluated the adequacy of the dam as required by Corps of Engineers dam safety regulations. There were three primary findings from this study: 1) Tainter gate bearings may experience significant bearing friction when operated under increasing water load; 2) concerns of spillway stability due to water pressure in the foundation of the dam; 3) spillway was found to be hydrologically deficient when modern hydrologic criteria were applied to the dam. The IOP resulted in a decrease of flood protection capability. Work was done under three separate contracts to repair and update the tainter gates, nine sluiceways, as well as some irrigate pipe repairs. The $31 million project was completed in February 2018.

The “Lovewell Reservoir Regulation Manual” was revised in 2010 to allow for a two foot raise in the conservation pool for water storage during drought years. Storing additional water during drought periods increases the project’s irrigation beneficial purpose without adversely affecting

the ability to protect for the project design storm. A calculation of available water supply will be made at the end of March to determine if additional water can be stored in Lovewell Reservoir.

Bostwick Division - Harlan County Lake Operations - 2018 Summary

The annual precipitation at Harlan County Dam totaled 29.61 inches of rainfall, which is 128 percent of normal. The 2018 inflow of 120,146 AF was between the normal-year and wet-year forecasts. Harlan County Lake began 2018 approximately 7.3 feet below the top of conservation pool, at 1938.39 feet. The lake level gradually filled to a peak summer elevation of 1,941.30 feet on May 31, 2018. Irrigation releases began on May 27, 2018 and continued through September 3, 2018 reducing the reservoir level to 1,938.11 feet. Irrigation releases from Harlan County Lake totaled 53,451 AF in 2018. The end of year elevation was 1,941.05 feet, 4.7 feet below the top of conservation.

KBID entered into an Excess Capacity Contract (Warren Act Authority) with Reclamation for the use of compact compliance water stored in Harlan County Lake during 2014. The latest amendment to the contract between KBID and Reclamation in December 2017 provided for 12,989 AF of water to be carried over into 2018. No water was released under this contract during the 2018 irrigation season. On May 31, 2018 this water was converted to Project water.

After more than two years of negotiations among the States, the RRCA approved two resolutions on August 24, 2016 establishing long-term agreements among Kansas, Colorado and Nebraska related to Colorado's and Nebraska's compliance activities in the Republican River basin.

On December 21, 2018 Bostwick Irrigation District in Nebraska and KBID amended their original "Memorandum of Agreement" dated October 4, 2000 to modify Harlan County Lake accounting procedures. In the agreement, account balances of the districts carry-over from year to year and inflows are apportioned based on target account balances.

Harlan County Lake prevented $364,500 of downstream flood damages during 2018 according to the Corps of Engineers.

There was 19,419 AF delivered to Lovewell Reservoir via Courtland Canal during 2018. This was approximately 32 percent of the total Lovewell Reservoir inflow.

Bostwick Division – Nebraska - 2018 Summary

Irrigation diversions were made into Franklin, Naponee, Franklin Pump, Superior, and Courtland Canals in Nebraska in 2018. The district diverted 25,906 AF of water and delivered 8,081 AF to the farm head gates (31 percent delivery efficiency).

The district continues to explore opportunities for replacing sections of open ditch lateral with buried pipe. These pipe projects provide delivery system improvements by eliminating seepage losses, eliminating operational wasteways, improving water measurement and accounting by utilizing water meters, and providing on-farm benefits by allowing land owners the opportunity to convert to sprinkler irrigation. The district is also in the process of automating several gates on the Franklin Canal. The project is scheduled for completion in 2019.

Bostwick Division – Kansas - 2018 Summary

The 2018 precipitation at Lovewell Dam totaled 38.07 inches, which was 138 percent of normal and the third highest yearly total since 1956. The total annual inflow recorded at Lovewell Reservoir was 60,454 AF. Approximately 41,035 AF of the inflow was from White Rock Creek which was between the normal-year and wet-year forecasts. The reservoir elevation at the beginning of 2018 was 1,581.15 feet (1.5 foot below the top of conservation). The reservoir pool gradually increased reaching a target level of 2.0 feet above top of conservation at the beginning of July.

Canal releases from Lovewell Reservoir began on May 24, 2018 with irrigation releases beginning in earnest on May 29, 2018. Irrigation releases continued through September 4, 2018. The reservoir elevation at the end of the irrigation season was at 1,581.13 feet. Republican River flow was not diverted via Courtland Canal into Lovewell Reservoir after the irrigation season. The pool level at the end of the year was 1,583.44 feet (0.8 foot above top of conservation). Lovewell Reservoir prevented $345,400 of downstream flood damages during 2018 according to the Corps of Engineers.

KBID diverted a total of 47,615 AF to serve 12,508 acres above Lovewell Dam and 27,014 acres below Lovewell Dam. District farm delivery totaled 24,485 AF for an efficiency of 51 percent.

The district continues to explore opportunities for replacing sections of open ditch lateral with buried pipe. These pipe projects provide delivery system improvements by eliminating seepage losses, eliminating operational wasteways, improving water measurement and accounting by utilizing water meters, and providing on-farm benefits by allowing land owners the opportunity to convert to sprinkler irrigation.

Bostwick Division - 2019 Outlook

The storage in Harlan County Lake and Lovewell Reservoir and flows of the Republican River and White Rock Creek are expected to be inadequate in meeting the full dry-year irrigation requirement for the Bostwick lands. The water supply will be adequate under normal-year and wet-year conditions.

Both districts will continue to investigate remote monitoring site installation that will provide system operations improvements. Bostwick Irrigation District in Nebraska is collaborating with the LRNRD on a project to improve the efficiency of Franklin Canal using automated gates. Cost of automating the canal will be shared by the district, LRNRD, and a grant from the Water Sustainability Fund. In return, LRNRD will receive a portion of the water savings realized from the project to be applied toward any needed addition to streamflows to the Republican River to address the potential for non-compliance.

Chapter IV - Smoky Hill River Basin

Kirwin Unit, Solomon Division in Kansas

General

The water supply for the 11,465 acres of land in the Kirwin Irrigation District is furnished by Kirwin Reservoir storage and inflows from the North Fork Solomon River and Bow Creek.

The operation of Kirwin Dam and Reservoir affords many opportunities for recreation, fishing, hunting, fish spawning, and preservation of waterfowl species.

The U.S. Fish and Wildlife Service (Service) has completed the Kirwin National Wildlife Refuge Comprehensive Conservation Plan (CCP). The 1997 National Refuge System Improvement Act required the Service to develop a CCP for each of its refuges. The Kirwin Refuge CCP will guide the refuge management activities through 2025.

2018 Summary

The annual precipitation total of 31.93 inches at Kirwin Dam was 134 percent of normal. The inflow of 56,980 AF was between the normal-year and wet-year forecasts. The reservoir level was 1.0 foot below the top of conservation pool at the first of the year (elevation 1,728.25 feet). The conservation pool filled on March 19, 2018. The reservoir level increased to elevation 1,731.16 feet on May 30, 2018. Irrigation releases began on June 18, 2018 and continued through September 4, 2018 decreasing the reservoir level to 1,729.24 feet.

In the last two weeks of May, Kirwin Dam recorded 5.58 inches of precipitation with runoff increasing the reservoir to a peak elevation of 1,731.16 feet on May 30, 2018. This is 1.9 feet above the top of conservation with 10,000 AF stored in the flood pool. Releases of 300 cfs were made through the river outlet from May 30, 2018 through June 11, 2018.

Fall and early winter inflows gradually increased the reservoir level to elevation 1,730.56 feet (1.3 feet above the top of conservation) on December 6, 2018 before a flood release of 50 cfs began. This release continued through the end of the year. The year-end elevation was 1,730.54 feet (1.3 feet above the top of conservation).

A total of 16,707 AF was released into Kirwin Canal to irrigate 9,160 acres of project lands during 2018. Farm delivery efficiency was 38 percent with 6,293 AF delivered to farms.

2019 Outlook

Carry-over storage and the forecasted inflows in the North Fork of the Solomon River are expected to be adequate to irrigate all district lands under all forecasted conditions.

The district continues to explore opportunities for replacing sections of open ditch lateral with buried pipe. The district is also assisting landowners with on-farm improvements such as the installation of sprinklers, assisting with burying lines to pivots and through the relocation of turnouts. Future conservation projects include the possibility of installing remote monitoring equipment at the wasteways and at the Kirwin North/South Canal split. These projects may be delayed due to the availability of cost-share funding.

Webster Unit, Solomon Division in Kansas

General

The Webster Irrigation District has service available to 8,537 acres. The project water supply is provided by Webster Reservoir storage and flows of the South Fork Solomon River.

2018 Summary

In 2018, the precipitation at Webster Dam was 157 percent of normal (37.17 inches) and was the second highest since 1955. December precipitation at Webster Dam totaled 3.57 inches and was the second greatest ever recorded for the month (since 1955). The inflow of 102,468 AF was 170 percent of the wet-year forecast. The reservoir level was 0.6 foot above the top of conservation pool at the first of the year (elevation 1893.00 feet). The reservoir level increased in the late winter to a peak elevation of 1,894.00 feet on February 22, 2018. Flood releases commenced that day at the request of the Corps of Engineers. Releases continued from February through late-May to maintain the target elevation. Webster Dam received 6.67 inches of precipitation in the last two weeks of May, raising the reservoir elevation to 1899.26 feet on May 31, 2018. This is 6.8 feet above the top of conservation with 28,300 AF stored in the flood pool. River releases from Webster Dam were staged up to 745 cfs through the spillway beginning on May 29, 2018. This release was staged down throughout the month of June as the pool was evacuated. Heavy rains in the South Fork Solomon River Basin above Webster Reservoir over the weekend of June 30, 2018 increased the reservoir level to a peak elevation of 1,896.91 feet on July 3, 2018. This is 4.5 feet above the top of conservation with 18,000 AF stored in the flood pool. River releases were again staged to 745 cfs through the spillway. The flood pool was evacuated by mid-August.

Releases began to be diverted into Osborne Canal on June 20, 2018 and continued until August 31, 2018 decreasing the reservoir level to 1891.65 feet. Fall inflows gradually increased the reservoir elevation to 1,894.00 feet (1.6 feet above the top of conservation) on October 12, 2018 before flood releases began. Flood releases continued through the end of the year. The year-end elevation was 1,893.07 feet (0.6 foot above the top of conservation).

A total of 11,163 AF was diverted into Osborne Canal to irrigate 6,151 acres of project lands during 2018. Farm delivery efficiency was 49 percent with 5,458 AF delivered to farms.

2019 Outlook

The carry-over storage and the flows in the South Fork Solomon River are expected to be adequate to irrigate all district lands under all forecasted conditions.

The district continued to explore opportunities to cost share with Reclamation and district irrigators for the replacement of open ditch laterals with buried pipe. The district will continue to seek outside funding for water conservation improvement projects. Future conservation projects include the possibility of installing remote monitoring equipment at the wasteways and at the beginning of the second and third sections of Osborne Canal. These projects may be delayed due to the availability of cost-share funding.

Glen Elder Unit, Solomon Division in Kansas

General

Releases from Waconda Lake are regulated as outlined in two memorandums of understanding between the State of Kansas and Reclamation. Releases are made for the city of Beloit, the Mitchell County Rural Water District, the long-term water service contract with Glen Elder Irrigation District, and for water right administration.

Renewal of the long term water service contract with the City of Beloit, Kansas was completed in 2008. The new repayment contract became effective on January 1, 2009. The repayment contract with Beloit, Kansas, provides for the annual use of up to 2,000 AF from Waconda Lake storage. Water is measured at the Glen Elder Dam river outlet works.

The water service contract with the Mitchell County Rural Water District No. 2 provides for 1,009 AF of storage water as available from Waconda Lake.

The long term water service contract with the Glen Elder Irrigation District was to expire in June 2017. A one year extension was signed May 18, 2018. Renewal of the long term water service contract is currently underway and is expected to be completed this spring. Based on the current State of Kansas Certificate of Appropriation, water usage is not to exceed 15,170 AF per calendar year. Water is released and measured through the river outlet works.

When compatible with flood control operations, the operating criteria for Waconda Lake provide for a stable or rising pool level during the fish spawning period each spring.

When possible, Waconda Lake is allowed to fill during the late summer and early fall to flood exposed shoreline vegetation. This flooded aquatic vegetation is very beneficial to waterfowl management.

Waconda Lake is normally regulated at one to two feet below the top of conservation capacity during the winter months. Maintaining the lake at this level reduces shoreline erosion, provides a buffer for spring runoff and lessens ice damage to the upstream face of Glen Elder Dam. Releases from Waconda Lake are regulated each year to maintain a constant water surface level while the lake is ice-covered.

2018 Summary

The annual precipitation total of 25.34 inches at Glen Elder Dam was 99 percent of normal. The inflow of 298,269 AF was between the normal-year and wet-year forecasts. The lake level at the beginning of the year was 0.5 feet below the top of conservation at 1,455.09 feet. Releases were made throughout the late winter and spring to reduce the level of Waconda Lake to one foot below top of conservation. Releases were staged down in the spring and the lake was allowed to increase, filling the conservation pool on May 31, 2018.

In early June, as flood releases from Kirwin and Webster Reservoirs began to reach Waconda Lake, river releases were staged up to 700 cfs. Releases were staged down throughout July as the flood pool was evacuated. Runoff from early September rains increased the reservoir level of Waconda Lake to a peak elevation of 1,457.69 feet on September 7, 2018. This level is 2.1 feet above the top of conservation with 27,300 AF stored in the flood pool. A river release of 300 cfs began on September 7, 2018 to decrease the pool level. As this release was being staged down in early October, Glen Elder dam reported 2.45 inches of precipitation and inflows quickly raised the reservoir two feet to an elevation of 1,459.54 feet (3.9 feet above top of conservation) with almost 30,000 AF storage gain in eight days. A flood release was staged to 1,500 cfs and maintained through October. Flood releases varied through the end of the year.

Waconda Lake ended the year 1.2 feet (elevation 1,456.79 feet) above the top of conservation. Waconda Lake prevented $101,900 of downstream flood damages during 2018 according to the Corps of Engineers.

A total of 230,246 AF of water was released from Glen Elder Dam in 2018. Storage releases of 1,914 AF combined with natural flow releases of 5,717 AF for the irrigation of 5,430 acres in the Glen Elder Irrigation District. The district delivered 3,353 AF to the farms resulting in a delivery efficiency of 44 percent. No storage releases were made for the City of Beloit, but 660 AF was bypassed for water quality as directed by the State Water Commissioner. Releases to the Mitchell County Rural Water District No. 2 totaled 802 AF.

2019 Outlook

The municipal requirement of Beloit and the requirements of the Mitchell County Rural Water District No. 2 will be met in full with releases as required from Waconda Lake. It is expected that the Kansas Water Commissioner will request that inflows be passed through the lake for water right administration. The storage in Waconda Lake and flows in the North and South Forks of the Solomon River will furnish a full water supply to the Glen Elder Irrigation District. The reservoir will be regulated to maintain a constant level during the winter months when the reservoir is ice-covered to minimize ice damage. Under normal-year conditions, the lake is expected to be maintained between one and two feet below the top of the conservation pool during the winter.

The Glen Elder Irrigation District continues to encourage their producers to advance water ordering times to improve on water releases, making more efficient use of the district's water supply. Some district pumping sites present problems due to river conditions at the sites. In order to minimize required reservoir releases, the district is investigating potential improvements to those water pumping sites.

Cedar Bluff Unit, Smoky Hill Division in Kansas

General

Cedar Bluff Reservoir storage furnishes a maximum of 2,000 AF each year for the City of Russell, Kansas when required. Prior to 1993, Cedar Bluff Reservoir storage and Smoky Hill River flows had provided a water supply for 6,800 acres in the Cedar Bluff Irrigation District. Reformulation of the Cedar Bluff Unit in October of 1992 resulted in the dissolution of the Cedar Bluff Irrigation District with the Kansas Water Office and Kansas Department of Wildlife and Parks acquiring the use and control of portions of the reservoir conservation capacity. A "designated operating pool" was established for Cedar Bluff Reservoir and includes the following sub allocation pools: The City of Russell's existing water storage right which remained unchanged (2,700 AF); an artificial recharge pool under control of the Kansas Water Office (5,110 AF); and a fish, wildlife and recreation pool under control of the KDWPT (21,061 AF). A “joint-use pool” has been established between the operating pool and the flood control pool for water supply, flood control, environmental and fish, wildlife and recreation purposes. Water rights for the “joint-use pool” are held jointly between the KDWPT and the Kansas Water Office. A Contract Administration Memorandum between the United States of America, represented by Reclamation, the State of Kansas and the City of Russell was signed in November/December of 2003, establishing an accounting procedure for water storage in Cedar Bluff Reservoir. In January, 2006 a Memorandum of Understanding was signed by the State of Kansas agencies, Kansas Water Office, and Kansas Department of Wildlife and Parks. The KDWPT will be responsible for the joint pool releases and for the water rights.

2018 Summary

The annual precipitation total at Cedar Bluff Dam was 28.95 inches which is 138 percent of normal and was the fourth highest since 1950. The 2018 inflow of 26,131 AF was between the normal-year and wet-year forecasts. The reservoir level at the beginning of the year was 2,117.68 feet (26.3 feet below top of conservation). October precipitation at Cedar Bluff Dam totaled 6.97 inches and was the greatest ever recorded for the month (since 1950). The level of Cedar Bluff Reservoir slowly decreased during the spring to elevation 2,116.92 feet on May 28, 2018. Cedar Bluff Dam recorded 4.22 inches of precipitation in a two day period at end of May. Inflows quickly raised the reservoir two feet in four days. Elevated inflows as well as continued rainfall throughout the summer and fall slowly increased the reservoir elevation to a year end peak of 2,122.68 feet on December 31, 2018 (21.3 feet below the top of conservation). Water was not released from the reservoir for the City of Russell or the Kansas Water Office in 2018. The Corps of Engineers determined that the reservoir prevented $1,030,800 in flood damages.

The State of Kansas operates and maintains the fish hatchery facility located below Cedar Bluff Dam. There were no releases to the facility in 2018.

2019 Outlook

Storage in Cedar Bluff Reservoir on December 31, 2018 was within the joint use pool. The KDWPT is expected to use very little if any water in the operations of the fish hatchery facility. If conditions are dry, the City of Russell and the Kansas Water Office may request a release to the river for recharge in 2019.

TABLE 1

RESERVOIR DATA - NIOBRARA, LOWER PLATTE AND KANSAS RIVER BASINS

		CAPACITY ALLOCATIONS*			
			LIVE CONSERVATION		
RESERVOIR		DEAD	Inactive	Active	FLOOD CONTROL
Box Butte	- Elevation Ft.	3969.0	3979.0	4007.0	---
	Total Acre-feet	188	2,392	29,161	---
	Net Acre-feet	188	2,204	26,769	---
Merritt	- Elevation Ft.	2875.0	2896.0	2946.0	---
	Total Acre-feet	774	4,662	66,726	---
	Net Acre-feet	774	3,888	62,064	---
Calamus	- Elevation Ft.	2185.0	2213.3	2244.0	---
	Total Acre-feet	35	20,150	119,469	---
	Net Acre-feet	35	20,115	99,319	---
Davis Creek	- Elevation Ft.	1998.5	2003.0	2076.0	---
	Total Acre-feet	76	172	31,158	---
	Net Acre-feet	76	96	30,986	---
Bonny	- Elevation Ft.	3635.5	3638.0	3672.0	3710.0
	Total Acre-feet	0	0	36,508	165,328
	Net Acre-feet	0	0	36,508	128,820
Enders	- Elevation Ft.	3080.0	3082.4	3112.3	3127.0
	Total Acre-feet	7,516	8,948	42,910	72,958
	Net Acre-feet	7,516	1,432	33,962	30,048
Swanson	- Elevation Ft.	2710.0	2720.0	2752.0	2773.0
Lake	Total Acre-feet	1,027	10,329	110,175	244,362
	Net Acre-feet	1,027	9,302	99,846	134,187
Hugh Butler	- Elevation Ft.	2552.0	2558.0	2581.8	2604.9
Lake	Total Acre-feet	5,185	8,921	36,224	85,070
	Net Acre-feet	5,185	3,736	27,303	48,846
Harry Strunk	- Elevation Ft.	2335.0	2343.0	2366.1	2386.2
Lake	Total Acre-feet	3,408	7,897	34,647	87,361
	Net Acre-feet	3,408	4,489	26,750	52,714
Keith Sebelius	- Elevation Ft.	2275.0	2280.4	2304.3	2331.4
Lake	Total Acre-feet	1,636	3,993	34,510	133,740
	Net Acre-feet	1,636	2,357	30,517	99,230
Harlan County	- Elevation Ft.	1885.0	1927.0	1945.73	1973.5
Lake***	Total Acre-feet	0	118,099	314,111	814,111
	Net Acre-feet	0	118,099	196,012	500,000
Lovewell	- Elevation Ft.	1562.07	1571.7	1582.6	1595.3
	Total Acre-feet	1,659	11,644	35,666	86,131
	Net Acre-feet	1,659	9,985	24,022	50,465
Kirwin	- Elevation Ft.	1693.0	1697.0	1729.25	1757.3
	Total Acre-feet	4,969	8,515	98,154	313,290
	Net Acre-feet	4,969	3,546	89,639	215,136
Webster	- Elevation Ft.	1855.5	1860.0	1892.45	1923.7
	Total Acre-feet	1,256	4,231	76,157	259,510
	Net Acre-feet	1,256	2,975	71,926	183,353
Waconda	- Elevation Ft.	1407.8	1428.0	1455.6	1488.3
Lake	Total Acre-feet	248	26,237	219,420	942,408
	Net Acre-feet	248	25,989	193,183	722,988
Cedar Bluff	- Elevation Ft.	2090.0	2107.8	2144.0	2166.0
	Total Acre-feet	4,402	28,574	172,452	364,342
	Net Acre-feet	4,402	24,172	143,878	191,890
Total Storage (A.F.)		32,379	264,764	1,457,448	3,815,125 **
Total Net Acre-feet		32,379	232,385	1,192,684	2,357,677

* Includes space for sediment storage.

** Includes total active storage for Box Butte, Merritt, Calamus, and Davis Creek Reservoirs.

*** Bottom of irrigation pool for Harlan County Lake is 1932.5 feet, 164,111 AF.

TABLE 2
SUMMARY OF 2018 OPERATIONS

MIRAGE FLATS PROJECT

	BOX BUTTE RESERVOIR					MIRAGE FLATS CANAL	
Month	Inflow (AF)	Outflow (AF)	Gross Evap. (AF)	Precip. (Inches)	End of Month Content	Diversions To Canal (AF)	Delivered To Farms (AF)
Jan.	1,064	1,105	51	0.54	5,108	0	0
Feb.	1,255	1,198	63	0.54	5,102	0	0
Mar.	2,219	2,402	110	0.76	4,809	0	0
Apr.	3,115	2,890	175	2.56	4,859	0	0
May	3,145	2,602	214	3.83	5,188	2,228	616
June	3,289	3,184	271	2.59	5,022	1,726	603
July	1,538	986	310	6.69	5,264	789	434
Aug.	1,182	1,178	217	0.81	5,051	1,148	656
Sep.	809	32	178	1.11	5,650	0	0
Oct.	1,291	46	162	0.88	6,733	0	0
Nov.	1,515	54	98	0.83	8,096	0	0
Dec.	1,498	52	64	0.46	9,478	0	0
TOTAL	21,920	15,729	1,913	21.60	--	5,891	2,309

NOTE: Acres irrigated 2018: Mirage Flats Canal 4,500 acres.

SANDHILLS DIVISION
AINSWORTH UNIT

	MERRITT RESERVOIR					AINSWORTH CANAL	
Month	Inflow (AF)	Outflow (AF)	Gross Evap. (AF)	Precip. (Inches)	End of Month Content	Release To Canal (AF)	Delivered To Farms (AF)
Jan.	16,859	15,809	237	0.73	61,913	0	0
Feb.	15,263	15,233	302	0.84	61,641	0	0
Mar.	21,890	21,471	419	1.67	61,641	0	0
Apr.	18,729	14,083	718	1.90	65,569	0	0
May	19,093	17,385	1,131	4.80	66,146	1,833	0
June	16,991	15,680	1,311	4.31	66,146	5,615	157
July	17,343	19,498	1,252	3.19	62,739	18,226	8,121
Aug.	17,064	20,252	1,076	1.70	58,475	20,469	8,668
Sep.	16,805	12,962	677	2.11	61,641	8,313	3,352
Oct.	16,493	16,245	789	2.50	61,100	0	0
Nov.	16,999	16,007	451	0.62	61,641	0	0
Dec.	17,557	17,256	219	0.62	61,723	0	0
TOTAL	211,086	201,881	8,582	24.99	--	54,456	20,298

NOTE: Acres irrigated 2018: Ainsworth Canal 34,626 acres.

NORTH LOUP DIVISION

	CALAMUS RESERVOIR						ABOVE DAVIS CREEK MIRDAN CANAL		
Month	Inflow (AF)	Outflow (AF)	Gross Evap. (AF)	Precip. (Inches)	End of Month Content	Release to Calamus Fish Hatch. (AF)	Release to Canal (AF)	Canal Use (AF)	Delivered To Farms (AF)
Jan.	20,079	15,586	431	0.31	102,185	0	0	0	0
Feb.	18,751	14,747	551	0.42	105,638	0	0	0	0
Mar.	26,113	18,256	1,013	1.02	112,482	24	0	0	0
Apr.	23,051	13,674	1,729	1.01	120,130	458	4,717	0	0
May	27,016	25,127	1,584	5.43	120,435	272	16,489	1,418	68
June	26,890	23,867	2,307	5.12	121,151	277	15,558	3,909	202
July	29,811	38,084	2,365	4.81	110,513	600	17,792	6,578	1,639
Aug	27,305	37,798	1,766	2.26	98,254	785	16,120	12,077	3,404
Sep.	22,739	27,456	1,351	3.21	92,186	674	6,315	3,749	595
Oct.	25,290	24,062	1,187	1.61	92,227	585	0	0	0
Nov.	22,571	17,538	655	0.59	96,605	0	0	0	0
Dec.	26,549	23,110	389	3.28	99,655	0	0	0	0
TOTAL	296,165	279,305	15,328	29.07	--	3,675	76,991	27,731	5,908

NOTE: Acres irrigated 2018: Mirdan Canal 34,110 acres.

NORTH LOUP DIVISION (Continued)

	DAVIS CREEK RESERVOIR					BELOW DAVIS CREEK FULLERTON CANAL	
Month	Inflow (AF)	Outflow (AF)	Gross Evap. (AF)	Precip. (Inches)	End of Month Content	Release To Canal (AF)	Delivered To Farms (AF)
Jan.	157	353	59	0.61	12,455	0	0
Feb.	152	307	73	0.45	12,227	0	0
Mar.	209	325	127	0.51	11,984	0	0
Apr.	2,467	315	216	1.09	13,920	0	0
May	16,027	3,199	314	4.88	26,434	2,200	10
June	11,699	6,591	623	7.97	30,919	5,064	195
July	9,886	10,453	574	6.61	29,778	8,263	2,563
Aug.	3,748	14,694	323	3.11	18,509	13,718	4,621
Sep.	2,608	7,256	244	3.50	13,617	6,928	114
Oct.	626	419	182	3.16	13,642	0	0
Nov.	71	385	98	0.60	13,230	0	0
Dec.	448	399	56	2.94	13,223	0	0
TOTAL	48,098	44,696	2,889	35.43	--	36,173	7,503

NOTE: Acres irrigated 2018: Fullerton Canal 21,016 acres.

TABLE 2
SUMMARY OF 2018 OPERATIONS

UPPER REPUBLICAN DIVISION
ARMEL UNIT

	BONNY RESERVOIR						
Month	Inflow (AF)	Outflow (AF)	Gross Evap. (AF)	Precip. (Inches)	End of Month Content		HALE DITCH Outflow (AF)
Jan.	185	185	0	0.15	0		0
Feb.	167	167	0	0.54	0		0
Mar.	369	369	0	0.02	0		0
Apr.	655	655	0	2.03	0		176
May	586	586	0	4.99	0		412
June	564	564	0	3.26	0		272
July	323	323	0	5.31	0		34
Aug.	242	242	0	2.02	0		4
Sep.	119	119	0	0.53	0		0
Oct.	123	123	0	3.18	0		0
Nov.	119	119	0	0.32	0		0
Dec.	123	123	0	0.20	0		0
TOTAL	3,575	3,575	0	22.55	--		898

TABLE 2
SUMMARY OF 2018 OPERATIONS

FRENCHMAN-CAMBRIDGE DIVISION
FRENCHMAN UNIT

	ENDERS RESERVOIR					CULBERTSON CANAL		CULBERTSON EXT.CANAL	
Month	Inflow (AF)	Outflow (AF)	Gross Evap. (AF)	Precip. (Inches)	End of Month Content	Diversions To Canal (AF)	Delivered To Farms (AF)	Diversions To Canal (AF)	Delivered To Farms (AF)
Jan.	559	185	46	0.42	8,923	0	0	0	0
Feb.	463	167	50	0.59	9,169	0	0	0	0
Mar.	441	184	90	0.98	9,336	0	0	0	0
Apr.	512	179	197	1.13	9,472	0	0	0	0
May	890	184	418	4.74	9,760	1,834	0	0	0
June	333	179	403	1.95	9,511	1,487	0	0	0
July	750	184	494	4.26	9,583	1,136	87	0	0
Aug.	146	184	299	0.62	9,246	1,630	158	0	0
Sep.	135	179	285	1.26	8,917	1,222	62	0	0
Oct.	399	184	115	2.57	9,017	117	12	0	0
Nov.	408	179	103	0.83	9,143	0	0	0	0
Dec.	459	184	56	0.61	9,362	0	0	0	0
TOTAL	5,495	2,172	2,556	19.96	--	7,426	319	0	0

NOTE: Acres irrigated 2018: Culbertson Canal - 382 acres; Culbertson Extension Canal - 0 acres.

FRENCHMAN-CAMBRIDGE DIVISION (Continued)
MEEKER-DRIFTWOOD UNIT

	SWANSON LAKE					MEEKER-DRIFTWOOD	
Month	Inflow (AF)	Outflow (AF)	Gross Evap. (AF)	Precip. (Inches)	End of Month Content	Release To Canal (AF)	Delivered To Farms (AF)
Jan.	2,936	61	234	0.89	53,983	0	0
Feb.	4,936	56	263	0.47	58,600	0	0
Mar.	5,235	61	499	0.50	63,275	0	0
Apr.	4,705	60	988	1.78	66,932	0	0
May	4,653	61	1,854	3.09	69,670	0	0
June	2,837	974	1,976	4.58	69,557	1,241	0
July	580	6,792	1,958	4.02	61,387	6,722	1,595
Aug.	275	5,421	1,463	1.46	54,778	5,385	2,250
Sep.	118	1,111	1,114	1.97	52,671	947	419
Oct.	1,745	61	570	3.74	53,785	0	0
Nov.	2,577	60	556	0.85	55,746	0	0
Dec.	3,978	61	304	1.51	59,359	0	0
TOTAL	34,575	14,779	11,779	24.86	--	14,295	4,264

NOTE: Acres irrigated 2018: Meeker-Driftwood Canal - 6,568 acres.

FRENCHMAN-CAMBRIDGE DIVISION (Continued)
RED WILLOW UNIT

	HUGH BUTLER LAKE					RED WILLOW CANAL		BARTLEY CANAL	
Month	Inflow (AF)	Outflow (AF)	Gross Evap. (AF)	Precip. (Inches)	End of Month Content	Diversions To Canal (AF)	Delivered To Farms (AF)	Diversions To Canal (AF)	Delivered To Farms (AF)
Jan.	688	123	63	0.67	16,128	0	0	0	0
Feb.	776	111	73	0.66	16,720	0	0	0	0
Mar.	897	123	137	0.50	17,357	0	0	0	0
Apr.	713	119	279	1.11	17,672	0	0	471	0
May	1,304	123	477	2.76	18,376	0	0	2,488	48
June	862	119	668	5.07	18,451	0	0	1,622	120
July	1,320	171	603	5.31	18,997	0	0	1,797	487
Aug.	189	123	449	1.84	18,614	0	0	2,172	962
Sep.	59	119	393	0.54	18,161	0	0	739	116
Oct.	747	123	247	3.31	18,538	0	0	0	0
Nov.	566	119	175	0.85	18,810	0	0	0	0
Dec.	1,030	123	98	2.80	19,619	0	0	0	0
TOTAL	9,151	1,496	3,662	25.42	--	0	0	9,289	1,733

NOTE: Acres irrigated 2018: Red Willow Canal - 0 acres; Bartley Canal 3,591 acres.

FRENCHMAN-CAMBRIDGE DIVISION (Continued)
CAMBRIDGE UNIT

	HARRY STRUNK LAKE					CAMBRIDGE CANAL	
Month	Inflow (AF)	Outflow (AF)	Gross Evap. (AF)	Precip. (Inches)	End of Month Content	Diversions To Canal (AF)	Delivered To Farms (AF)
Jan.	2,672	62	90	0.35	26,375	0	0
Feb.	2,716	56	102	0.27	28,933	0	0
Mar.	3,192	61	208	0.25	31,856	0	0
Apr.	2,982	60	498	1.70	34,280	0	0
May	3,700	928	794	2.70	36,258	1,963	0
June	3,914	3,308	1,100	5.24	35,764	4,374	464
July	3,203	5,782	1,295	6.90	31,890	6,153	2,622
Aug.	2,118	4,965	754	1.53	28,289	7,003	3,913
Sep.	2,104	2,075	483	1.41	27,835	1,512	236
Oct.	3,101	2,682	230	3.21	28,024	0	0
Nov.	2,740	3,751	227	0.85	26,786	0	0
Dec.	3,627	1,293	126	2.57	28,994	0	0
TOTAL	36,069	25,023	5,907	26.98	--	21,005	7,235

NOTE: Acres irrigated 2018: Cambridge Canal 12,461 acres.

TABLE 2
SUMMARY OF 2018 OPERATIONS

KANASKA DIVISION
ALMENA UNIT

	KEITH SEBELIUS LAKE					ALMENA CANAL		
Month	Inflow (AF)	Outflow (AF)	Gross Evap. (AF)	Precip. (Inches)	End of Month Content	Release to City of Norton (AF)	Diversions To Canal (AF)	Delivered To Farms (AF)
Jan.	488	51	79	0.74	13,737	21	0	0
Feb.	428	46	97	0.28	14,022	18	0	0
Mar.	501	51	174	0.92	14,298	20	0	0
Apr.	696	50	448	1.38	14,496	20	0	0
May	1,482	73	686	2.63	15,219	42	0	0
June	627	67	930	3.80	14,849	38	0	0
July	1,755	67	876	9.81	15,661	36	0	0
Aug.	466	60	602	3.18	15,465	30	0	0
Sep.	416	59	526	2.68	15,296	29	0	0
Oct.	574	52	275	4.21	15,543	21	0	0
Nov.	417	45	214	0.45	15,701	15	0	0
Dec.	1,031	48	114	3.63	16,570	17	0	0
TOTAL	8,881	669	5,021	33.71	--	307	0	0

NOTE: Acres irrigated 2018: Almena Canal 0 acres.

BOSTWICK DIVISION
FRANKLIN UNIT

	HARLAN COUNTY LAKE Data from Corps of Engineers					FRANKLIN CANAL		NAPONEE CANAL	
Month	Inflow (AF)	Outflow (AF)	Gross Evap. (AF)	Precip. (Inches)	End of Month Content	Release To Canal (AF)	Delivered To Farms (AF)	Release To Canal (AF)	Delivered To Farms (AF)
Jan.	4,284	0	615	0.14	227,916	0	0	0	0
Feb.	6,459	0	817	0.07	233,558	0	0	0	0
Mar.	10,810	0	1,136	1.15	243,232	0	0	0	0
Apr.	10,116	0	2,976	1.18	250,372	0	0	0	0
May	11,637	551	3,383	3.27	258,075	0	0	0	0
June	7,636	12,740	4,027	4.29	248,944	2,063	48	0	0
July	10,038	25,712	5,131	4.08	228,139	9,207	2,820	468	122
Aug.	12,020	13,914	5,112	7.28	221,133	4,510	1,746	186	90
Sep.	8,666	534	5,241	1.92	224,024	0	0	6	0
Oct.	11,302	0	3,721	3.07	231,605	0	0	0	0
Nov.	11,058	0	2,558	0.49	240,105	0	0	0	0
Dec.	16,120	0	1,197	2.67	255,028	0	0	0	0
TOTAL	120,146	53,451	35,914	29.61	--	15,780	4,614	660	212

NOTE: Acres irrigated 2018: Franklin Canal - 11,130 acres; Naponee Canal - 753 acres.

BOSTWICK DIVISION (Continued)
SUPERIOR-COURTLAND UNIT

	FRANKLIN PUMP CANAL		SUPERIOR CANAL			COURTLAND CANAL - ABOVE LOVEWELL NEBRASKA USE		KANSAS USE	
Month	Diverted To Canal (AF)	Delivered To Farms (AF)	Diverted To Canal (AF)	Delivered To Farms (AF)	Total Diversion (AF)	Total (AF)	Delivered To Farms (AF)	Diversion To Canal (AF)	Delivered To Farms (AF)
Jan.	0	0	0	0	0	0	0	0	0
Feb.	0	0	0	0	0	0	0	0	0
Mar.	0	0	0	0	0	0	0	0	0
Apr.	0	0	0	0	4,102	0	0	0	0
May	0	0	70	0	4,974	0	0	0	0
June	67	16	2,142	34	10,075	8	7	3,943	1,041
July	508	266	3,580	1,282	13,986	338	316	7,539	3,988
Aug.	238	124	2,329	1,036	11,746	186	174	5,258	2,742
Sep.	0	0	0	0	1,821	0	0	267	157
Oct.	0	0	0	0	0	0	0	0	0
Nov.	0	0	0	0	0	0	0	0	0
Dec.	0	0	0	0	0	0	0	0	0
TOTAL	813	406	8,121	2,352	46,704	532	497	17,007	7,928

NOTE: Acres irrigated 2018: Franklin Pump Canal - 1,267 acres; Superior Canal - 6,345 acres.
Courtland Canal-Nebraska use - 1,495 acres.
Courtland Canal-Kansas use - 12,508 acres.

BOSTWICK DIVISION (Continued)
COURTLAND UNIT

	LOVEWELL RESERVOIR							COURTLAND (Below)	
Month	Est. Flow from White Rock Creek (AF)	Inflow from Courtland 34.8 (AF)	Total Inflow (AF)	Outflow (AF)	Gross Evap. (AF)	Precip. (Inches)	End of Month Content (AF)	Release To Canal (AF)	Delivered To Farms (AF)
Jan.	584	0	584	12	156	0.15	31,910	0	0
Feb.	655	0	655	11	195	0.39	32,359	0	0
Mar.	828	0	828	12	364	0.86	32,811	0	0
Apr.	2,362	0	2,362	12	649	0.90	34,512	0	0
May	2,419	1,794	4,213	621	1,353	3.32	36,751	801	0
June	8,319	2,655	10,974	5,877	1,724	6.42	40,124	5,904	1,511
July	3,444	3,562	7,006	13,623	1,429	3.94	32,078	13,649	9,054
Aug.	2,262	4,632	6,894	9,285	1,043	5.30	28,644	9,377	5,716
Sep.	3,153	4,803	7,956	1,061	851	6.99	34,688	877	277
Oct.	5,921	1,973	7,894	7,906	427	5.73	34,249	0	0
Nov.	1,493	0	1,493	285	445	0.65	35,012	0	0
Dec.	9,595	0	9,595	6,155	223	3.42	38,229	0	0
TOTAL	41,035	19,419	60,454	44,860	8,859	38.07	--	30,608	16,558

NOTE: Acres irrigated 2018: Courtland Canal below Lovewell 27,014 acres.

TABLE 2
SUMMARY OF 2018 OPERATIONS

SOLOMON DIVISION
KIRWIN UNIT

	KIRWIN RESERVOIR					KIRWIN CANAL	
Month	Inflow (AF)	Outflow (AF)	Gross Evap. (AF)	Precip. (Inches)	End of Month Content	Release To Canal (AF)	Delivered To Farms (AF)
Jan.	2,386	0	309	0.37	95,240	0	0
Feb.	2,318	0	415	0.35	97,143	0	0
Mar.	2,738	0	710	1.10	99,171	0	0
Apr.	2,513	0	1,386	1.07	100,298	0	0
May	11,050	781	2,471	5.76	108,096	0	0
June	6,687	8,606	3,915	2.10	102,262	2,198	193
July	10,589	7,595	3,306	5.23	101,950	7,585	2,903
Aug.	5,068	6,296	2,366	4.09	98,356	6,278	2,859
Sep.	2,749	778	1,767	3.50	98,560	646	338
Oct.	4,210	0	872	4.95	101,898	0	0
Nov.	2,658	0	831	0.62	103,725	0	0
Dec.	4,014	2,464	443	2.79	104,832	0	0
TOTAL	56,980	26,520	18,791	31.93	--	16,707	6,293

NOTE: Acres irrigated 2018: Kirwin Canal - 9,160 acres.

SOLOMON DIVISION (Continued)
WEBSTER UNIT

	WEBSTER RESERVOIR					OSBORNE CANAL	
Month	Inflow (AF)	Outflow (AF)	Gross Evap. (AF)	Precip. (Inches)	End of Month Content	Diversions To Canal (AF)	Delivered To Farms (AF)
Jan.	2,695	0	261	0.83	80,680	0	0
Feb.	2,211	476	325	0.23	82,090	0	0
Mar.	2,606	2,460	578	0.72	81,658	0	0
Apr.	2,525	1,985	1,049	0.67	81,149	0	0
May	27,729	2,327	2,046	6.67	104,505	0	0
June	7,293	25,464	2,739	5.02	83,595	1,105	53
July	21,843	23,459	2,309	6.65	79,670	5,650	2,702
Aug.	4,007	8,948	1,513	3.60	73,216	4,408	2,703
Sep.	6,310	0	1,318	3.95	78,208	0	0
Oct.	9,047	10,471	589	4.59	76,195	0	0
Nov	5,920	4,661	617	0.67	76,837	0	0
Dec.	10,282	8,263	342	3.57	78,514	0	0
TOTAL	102,468	88,514	13,686	37.17	--	11,163	5,458

NOTE: Acres irrigated 2018: Osborne Canal - 6,151 acres.

SOLOMON DIVISION (Continued)
GLEN ELDER UNIT

						OUTFLOW TO RIVER				
	WACONDA LAKE					City of Beloit		Irrig.District	Other	Release To
Month	Inflow (AF)	Outflow (AF)	Gross Evap. (AF)	Precip. (Inches)	End of Month Content	Storage Release (AF)	Quality Bypass (AF)	Storage Release (AF)	Controlled Releases (AF)	Mitchell Co. RWD No. 2 (AF)
Jan.	5,436	10,738	716	0.30	207,027	0	0	0	10,668	70
Feb.	5,506	6,261	940	0.29	205,332	0	0	0	6,201	60
Mar.	7,715	4,345	1,675	0.55	207,027	0	0	0	4,278	67
Apr.	8,066	1,856	3,646	0.87	209,591	0	0	0	1,787	69
May	16,430	828	5,773	3.00	219,420	0	660	0	98	70
June	51,798	36,671	9,157	4.26	225,390	0	0	0	36,596	75
July	24,550	22,955	7,565	4.01	219,420	0	0	339	22,537	79
Aug.	16,103	7,663	6,164	2.01	221,696	0	0	1,101	6,492	70
Sep.	32,912	8,187	5,102	2.48	241,319	0	0	474	7,650	63
Oct.	51,308	45,590	2,510	3.52	244,527	0	0	0	45,536	54
Nov.	16,565	28,470	2,078	0.85	230,544	0	0	0	28,409	61
Dec.	61,880	56,682	1,027	3.20	234,715	0	0	0	56,618	64
TOTAL	298,269	230,246	46,353	25.34	--	0	660	1,914	226,870	802

NOTE: Acres irrigated 2018: Glen Elder District 5,430 acres.

SMOKY HILL DIVISION
ELLIS UNIT

	CEDAR BLUFF RESERVOIR					Release to:		
Month	Inflow (AF)	Outflow (AF)	Gross Evap. (AF)	Precip. (Inches)	End of Month Content	City of Russell (AF)	Fish Hatchery (AF)	Kansas Water Office (AF)
Jan.	206	0	206	0.23	51,101	0	0	0
Feb.	1	0	276	0.13	50,826	0	0	0
Mar.	0	0	437	0.54	50,389	0	0	0
Apr.	399	0	1,050	0.37	49,738	0	0	0
May	5,305	0	1,218	4.80	53,825	0	0	0
June	6,816	0	1,905	3.68	58,736	0	0	0
July	4,429	0	1,702	3.97	61,463	0	0	0
Aug.	1,273	0	1,557	3.20	61,179	0	0	0
Sep.	769	0	1,143	2.99	60,805	0	0	0
Oct.	3,834	0	595	6.97	64,044	0	0	0
Nov.	1,076	0	558	0.19	64,562	0	0	0
Dec.	2,023	0	319	1.88	66,266	0	0	0
TOTAL	26,131	0	10,966	28.95	--	0	0	0

TABLE 3

ACRES IRRIGATED IN 2018 AND ESTIMATES FOR 2019

Irrigation District and Canal	Acres With Service Available	Acres Irrigated in 2018	Estimated Acres to be Irrigated in 2019
Mirage Flats Irrigation District			
Mirage Flats Canal	11,662	4,500	10,000
Ainsworth Irrigation District			
Ainsworth Canal	35,000	34,626	34,500
Twin Loups Irrigation District			
Above Davis Creek	34,453	34,110	34,000
Below Davis Creek	20,996	21,016	21,000
Total Twin Loups Irrigation District	55,449	55,126	55,000
Frenchman Valley Irrigation District			
Culbertson Canal	9,292	382	500
H & RW Irrigation District			
Culbertson Extension Canal	11,915	0	0
Frenchman-Cambridge Irrigation District			
Meeker-Driftwood Canal	16,691	6,568	7,000
Red Willow Canal	4,643	0	3,000
Bartley Canal	6,130	3,591	3,500
Cambridge Canal	18,205	12,461	13,000
Total Frenchman-Cambridge Irrigation District	45,669	22,620	26,500
Almena Irrigation District			
Almena Canal	5,764	0	2,500
Bostwick Irrigation District in Nebraska			
Franklin Canal	11,031	11,130	11,000
Naponee Canal	1,607	753	500
Franklin Pump Canal	2,026	1,267	1,500
Superior Canal	6,056	6,345	6,500
Courtland Canal (Nebraska)	1,735	1,495	1,500
Total Bostwick Irrigation Dist. in Nebraska	22,455	20,990	21,000
Kansas-Bostwick Irrigation District			
Courtland Canal above Lovewell	13,378	12,508	12,500
Courtland Canal below Lovewell	29,122	27,014	28,000
Total Kansas-Bostwick Irrigation District	42,500	39,522	40,500
Kirwin Irrigation District			
Kirwin Canal	11,465	9,160	9,000
Webster Irrigation District			
Osborne Canal	8,537	6,151	6,000
Glen Elder Irrigation District	10,370	5,430	6,000
TOTAL PROJECT USES	270,078	198,507	211,500
Non-Project Uses			
Hale Ditch	700	200	200
TOTAL PROJECT AND NON-PROJECT	270,778	198,707	211,700

BOX BUTTE RESERVOIR OPERATION ESTIMATES - 2019

	INFLOW		EVAPORATION		RELEASE REQUIRMENT		RESERVOIR SPILL	REQUIREMENT SHORTAGE	END OF MONTH ELEV	CONT	RESERVOIR CHANGE
	MEAN	1000		1000	MEAN	1000	1000	1000		1000	1000
MONTH	CFS	AF	INCHES	AF	CFS	AF	AF	AF	FT	AF	AF
REASONABLE MINIMUM INFLOW CONDITIONS											
JAN	15	0.9	1.6	0.1	2	0.1	0.0	0.0	3991.7	10.2	0.7
FEB	18	1.0	1.9	0.1	2	0.1	0.0	0.0	3992.6	11.0	0.8
MAR	24	1.5	3.8	0.2	2	0.1	0.0	0.0	3993.9	12.2	1.2
APR	22	1.3	5.3	0.3	2	0.1	0.0	0.0	3994.8	13.1	0.9
MAY	16	1.0	6.6	0.4	2	0.1	0.0	0.0	3995.2	13.6	0.5
JUN	10	0.6	8.8	0.5	89	5.3	0.0	0.0	3989.6	8.4	-5.2
JUL	6	0.4	10.0	0.4	226	13.9	0.0	7.9	3979.0	2.4	-6.0
AUG	11	0.7	8.8	0.2	213	13.1	0.0	12.6	3979.0	2.4	0.0
SEP	12	0.7	6.6	0.1	40	2.4	0.0	1.8	3979.0	2.4	0.0
OCT	15	0.9	5.0	0.1	2	0.1	0.0	0.0	3980.9	3.1	0.7
NOV	18	1.1	2.5	0.1	2	0.1	0.0	0.0	3982.5	4.0	0.9
DEC	15	0.9	1.9	0.1	2	0.1	0.0	0.0	3983.9	4.7	0.7
TOTAL		11.0	62.8	2.6		35.5	0.0	22.3			-4.8
MOST PROBABLE INFLOW CONDITIONS											
JAN	19	1.2	1.5	0.1	2	0.1	0.0	0.0	3992.1	10.5	1.0
FEB	27	1.5	1.7	0.1	2	0.1	0.0	0.0	3993.5	11.8	1.3
MAR	34	2.1	3.5	0.2	2	0.1	0.0	0.0	3995.2	13.6	1.8
APR	30	1.8	4.9	0.3	2	0.1	0.0	0.0	3996.5	15.0	1.4
MAY	23	1.4	6.1	0.4	2	0.1	0.0	0.0	3997.3	15.9	0.9
JUN	13	0.8	8.1	0.5	70	4.2	0.0	0.0	3993.7	12.0	-3.9
JUL	10	0.6	9.3	0.5	209	12.9	0.0	3.2	3979.0	2.4	-9.6
AUG	16	1.0	8.1	0.2	164	10.1	0.0	9.3	3979.0	2.4	0.0
SEP	17	1.0	6.1	0.1	29	1.7	0.0	0.8	3979.0	2.4	0.0
OCT	19	1.2	4.7	0.1	2	0.1	0.0	0.0	3981.3	3.4	1.0
NOV	25	1.5	2.3	0.1	2	0.1	0.0	0.0	3983.9	4.7	1.3
DEC	21	1.3	1.7	0.1	2	0.1	0.0	0.0	3985.8	5.8	1.1
TOTAL		15.4	58.0	2.7		29.7	0.0	13.3			-3.7
REASONABLE MAXIMUM INFLOW CONDITIONS											
JAN	26	1.6	1.3	0.1	2	0.1	0.0	0.0	3992.5	10.9	1.4
FEB	34	1.9	1.6	0.1	2	0.1	0.0	0.0	3994.3	12.6	1.7
MAR	45	2.8	3.2	0.2	2	0.1	0.0	0.0	3996.6	15.1	2.5
APR	39	2.3	4.6	0.3	2	0.1	0.0	0.0	3998.3	17.0	1.9
MAY	31	1.9	5.6	0.4	2	0.1	0.0	0.0	3999.4	18.4	1.4
JUN	18	1.1	7.5	0.6	47	2.8	0.0	0.0	3997.5	16.1	-2.3
JUL	11	0.7	8.6	0.6	135	8.3	0.0	0.0	3988.9	7.9	-8.2
AUG	21	1.3	7.5	0.3	104	6.4	0.0	0.0	3979.2	2.5	-5.4
SEP	22	1.3	5.6	0.1	18	1.1	0.0	0.0	3979.5	2.6	0.1
OCT	26	1.6	4.3	0.1	2	0.1	0.0	0.0	3982.5	4.0	1.4
NOV	34	2.0	2.1	0.1	2	0.1	0.0	0.0	3985.8	5.8	1.8
DEC	28	1.7	1.6	0.1	2	0.1	0.0	0.0	3988.1	7.3	1.5
TOTAL		20.2	53.5	3.0		19.4	0.0	0.0			-2.2

MERRITT RESERVOIR OPERATION ESTIMATES - 2019

					RELEASE REQUIRMENT				RESERVOIR	REQUIREMENT	END OF MONTH		RESERVOIR
	INFLOW		EVAPORATION		CANAL	RIVER	TOTAL		SPILL	SHORTAGE	ELEV	CONT	CHANGE
	MEAN	1000		1000	1000	1000	MEAN	1000	1000	1000		1000	1000
MONTH	CFS	AF	INCHES	AF	AF	AF	CFS	AF	AF	AF	FT	AF	AF
REASONABLE MINIMUM INFLOW CONDITIONS													
JAN	226	13.9	1.9	0.3	0.0	1.0	16	1.0	13.2	0.0	2944.0	61.1	-0.6
FEB	248	13.8	2.6	0.4	0.0	1.0	18	1.0	12.4	0.0	2944.0	61.1	0.0
MAR	255	15.7	3.2	0.5	0.0	1.0	16	1.0	11.4	0.0	2945.0	63.9	2.8
APR	260	15.5	5.1	0.8	0.0	1.0	17	1.0	10.9	0.0	2946.0	66.7	2.8
MAY	252	15.5	6.4	1.1	3.4	1.0	71	4.4	10.0	0.0	2946.0	66.7	0.0
JUN	240	14.3	8.4	1.4	7.6	1.0	144	8.6	4.3	0.0	2946.0	66.7	0.0
JUL	240	14.8	9.6	1.6	33.4	1.0	558	34.4	0.0	0.0	2937.1	45.5	-21.2
AUG	247	15.2	8.4	1.0	31.0	1.0	519	32.0	0.0	0.0	2926.1	27.7	-17.8
SEP	243	14.5	7.1	0.5	8.5	1.0	159	9.5	0.0	0.0	2929.3	32.2	4.5
OCT	247	15.2	6.4	0.5	0.0	2.5	41	2.5	0.0	0.0	2936.5	44.4	12.2
NOV	240	14.3	3.2	0.4	0.0	4.0	67	4.0	0.0	0.0	2941.2	54.3	9.9
DEC	224	13.8	1.9	0.3	0.0	1.0	16	1.0	5.7	0.0	2944.0	61.1	6.8
TOTAL		176.5	64.2	8.8	83.9	16.5		100.4	67.9	0.0			-0.6
MOST PROBABLE INFLOW CONDITIONS													
JAN	240	14.8	1.7	0.3	0.0	1.0	16	1.0	14.1	0.0	2944.0	61.1	-0.6
FEB	262	14.6	2.3	0.4	0.0	1.0	18	1.0	13.2	0.0	2944.0	61.1	0.0
MAR	269	16.6	2.8	0.4	0.0	1.0	16	1.0	12.4	0.0	2945.0	63.9	2.8
APR	275	16.4	4.5	0.7	0.0	1.0	17	1.0	11.9	0.0	2946.0	66.7	2.8
MAY	266	16.4	5.7	1.0	2.9	1.0	63	3.9	11.5	0.0	2946.0	66.7	0.0
JUN	253	15.1	7.4	1.3	6.5	1.0	126	7.5	6.3	0.0	2946.0	66.7	0.0
JUL	255	15.7	8.5	1.4	28.5	1.0	479	29.5	0.0	0.0	2940.0	51.5	-15.2
AUG	261	16.1	7.4	0.9	26.6	1.0	448	27.6	0.0	0.0	2933.6	39.1	-12.4
SEP	257	15.3	6.2	0.6	7.3	1.0	139	8.3	0.0	0.0	2937.1	45.5	6.4
OCT	261	16.1	5.7	0.7	0.0	2.5	41	2.5	0.0	0.0	2942.9	58.4	12.9
NOV	253	15.1	2.8	0.4	0.0	4.0	67	4.0	8.0	0.0	2944.0	61.1	2.7
DEC	237	14.6	1.7	0.3	0.0	1.0	16	1.0	13.3	0.0	2944.0	61.1	0.0
TOTAL		186.8	56.7	8.4	71.8	16.5		88.3	90.7	0.0			-0.6
REASONABLE MAXIMUM INFLOW CONDITIONS													
JAN	260	16.0	1.5	0.2	0.0	1.0	16	1.0	15.4	0.0	2944.0	61.1	-0.6
FEB	284	15.8	2.0	0.3	0.0	1.0	18	1.0	14.5	0.0	2944.0	61.1	0.0
MAR	294	18.1	2.5	0.4	0.0	1.0	16	1.0	13.9	0.0	2945.0	63.9	2.8
APR	300	17.9	4.0	0.7	0.0	1.0	17	1.0	13.4	0.0	2946.0	66.7	2.8
MAY	291	17.9	5.0	0.8	2.4	1.0	55	3.4	13.7	0.0	2946.0	66.7	0.0
JUN	275	16.4	6.5	1.1	5.3	1.0	106	6.3	9.0	0.0	2946.0	66.7	0.0
JUL	278	17.1	7.5	1.3	23.3	1.0	394	24.3	0.0	0.0	2942.8	58.2	-8.5
AUG	284	17.5	6.5	1.0	21.8	1.0	370	22.8	0.0	0.0	2940.2	51.9	-6.3
SEP	278	16.6	5.5	0.7	5.9	1.0	116	6.9	0.0	0.0	2943.9	60.9	9.0
OCT	284	17.5	5.0	0.8	0.0	2.5	41	2.5	14.0	0.0	2944.0	61.1	0.2
NOV	275	16.4	2.5	0.4	0.0	4.0	67	4.0	12.0	0.0	2944.0	61.1	0.0
DEC	256	15.8	1.5	0.2	0.0	1.0	16	1.0	14.6	0.0	2944.0	61.1	0.0
TOTAL		203.0	50.0	7.9	58.7	16.5		75.2	120.5	0.0			-0.6

CALAMUS RESERVOIR OPERATION ESTIMATES - 2019

					RELEASE REQUIRMENT				RESERVOIR	REQUIREMENT	END OF MONTH		RESERVOIR
	INFLOW		EVAPORATION		CANAL	RIVER	TOTAL		SPILL	SHORTAGE	ELEV	CONT	CHANGE
	MEAN	1000		1000	1000	1000	MEAN	1000	1000	1000		1000	1000
MONTH	CFS	AF	INCHES	AF	AF	AF	CFS	AF	AF	AF	FT	AF	AF
REASONABLE MINIMUM INFLOW CONDITIONS													
JAN	297	18.3	1.9	0.5	0.5	3.1	58	3.6	13.4	0.0	2240.0	100.5	0.8
FEB	316	17.6	2.3	0.6	0.5	2.8	59	3.3	13.7	0.0	2240.0	100.5	0.0
MAR	352	21.7	4.2	1.1	0.5	3.1	58	3.6	7.8	0.0	2242.0	109.7	9.2
APR	364	21.7	6.7	1.9	0.5	3.0	59	3.5	6.5	0.0	2244.0	119.5	9.8
MAY	404	24.9	6.9	2.0	2.7	3.1	94	5.8	17.1	0.0	2244.0	119.5	0.0
JUN	369	22.0	8.4	2.5	5.6	3.0	144	8.6	10.9	0.0	2244.0	119.5	0.0
JUL	346	21.3	9.6	2.8	37.8	21.3	959	59.1	0.0	0.0	2234.7	78.9	-40.6
AUG	325	20.0	9.6	2.2	30.4	20.0	818	50.4	0.0	0.0	2224.9	46.3	-32.6
SEP	307	18.3	7.4	1.2	9.9	18.3	473	28.2	0.0	0.0	2220.6	35.2	-11.1
OCT	305	18.8	5.7	0.8	0.5	3.1	58	3.6	0.0	0.0	2226.0	49.6	14.4
NOV	332	19.8	3.0	0.5	0.5	3.0	59	3.5	0.0	0.0	2231.0	65.4	15.8
DEC	321	19.8	1.8	0.4	0.5	3.1	58	3.6	0.0	0.0	2235.3	81.2	15.8
TOTAL		244.2	67.5	16.5	89.9	86.9		176.8	69.4	0.0			-18.5
MOST PROBABLE INFLOW CONDITIONS													
JAN	325	20.0	1.7	0.4	0.5	3.1	58	3.6	15.2	0.0	2240.0	100.5	0.8
FEB	345	19.2	2.0	0.5	0.5	2.8	54	3.3	15.4	0.0	2240.0	100.5	0.0
MAR	385	23.7	3.7	1.0	0.5	3.1	58	3.6	9.9	0.0	2242.0	109.7	9.2
APR	398	23.7	5.9	1.6	0.5	3.0	57	3.5	8.8	0.0	2244.0	119.5	9.8
MAY	442	27.2	6.1	1.8	2.3	3.1	88	5.4	20.0	0.0	2244.0	119.5	0.0
JUN	403	24.0	7.4	2.2	4.7	3.0	125	7.7	14.1	0.0	2244.0	119.5	0.0
JUL	377	23.2	8.4	2.5	30.2	23.2	867	53.4	0.0	0.0	2236.7	86.8	-32.7
AUG	354	21.8	8.4	2.0	23.8	21.8	740	45.6	0.0	0.0	2229.7	61.0	-25.8
SEP	335	20.0	6.5	1.2	5.7	20.0	417	25.7	0.0	0.0	2227.5	54.1	-6.9
OCT	333	20.5	5.0	0.9	0.5	3.1	58	3.6	0.0	0.0	2232.4	70.1	16.0
NOV	362	21.6	2.7	0.6	0.5	3.0	57	3.5	0.0	0.0	2236.9	87.6	17.5
DEC	351	21.6	1.5	0.4	0.5	3.1	58	3.6	4.7	0.0	2240.0	100.5	12.9
TOTAL		266.5	59.3	15.1	70.2	92.3		162.5	88.1	0.0			0.8
REASONABLE MAXIMUM INFLOW CONDITIONS													
JAN	373	23.0	1.5	0.4	0.5	3.1	58	3.6	18.2	0.0	2240.0	100.5	0.8
FEB	397	22.1	1.8	0.5	0.5	2.8	59	3.3	18.3	0.0	2240.0	100.5	0.0
MAR	443	27.3	3.3	0.9	0.5	3.1	58	3.6	13.6	0.0	2242.0	109.7	9.2
APR	458	27.3	5.2	1.4	0.5	3.0	59	3.5	12.6	0.0	2244.0	119.5	9.8
MAY	508	31.3	5.4	1.6	1.9	3.1	81	5.0	24.7	0.0	2244.0	119.5	0.0
JUN	463	27.6	6.6	2.0	3.8	3.0	114	6.8	18.8	0.0	2244.0	119.5	0.0
JUL	433	26.7	7.5	2.2	22.0	26.7	791	48.7	0.0	0.0	2238.8	95.3	-24.2
AUG	407	25.1	7.5	1.9	17.5	25.1	692	42.6	0.0	0.0	2233.9	75.9	-19.4
SEP	386	23.0	5.8	1.3	4.1	23.0	455	27.1	0.0	0.0	2232.5	70.5	-5.4
OCT	383	23.6	4.4	0.9	0.5	3.1	58	3.6	0.0	0.0	2237.4	89.6	19.1
NOV	416	24.8	2.4	0.6	0.5	3.0	59	3.5	9.8	0.0	2240.0	100.5	10.9
DEC	403	24.8	1.4	0.4	0.5	3.1	58	3.6	20.8	0.0	2240.0	100.5	0.0
TOTAL		306.6	52.8	14.1	52.8	102.1		154.9	136.8	0.0			0.8

TABLE 4

DAVIS CREEK RESERVOIR OPERATION ESTIMATES - 2019

	INFLOW		EVAPORATION		RELEASE REQUIREMENT		RESERVOIR SPILL	REQUIREMENT SHORTAGE	END OF MONTH ELEV	CONT	RESERVOIR CHANGE
	MEAN	1000		1000	MEAN	1000	1000	1000		1000	1000
MONTH	CFS	AF	INCHES	AF	CFS	AF	AF	AF	FT	AF	AF
REASONABLE MINIMUM INFLOW CONDITIONS											
JAN	0	0.0	1.9	0.1	6	0.4	0.0	0.0	2054.7	12.7	-0.5
FEB	0	0.0	2.3	0.1	7	0.4	0.0	0.0	2053.8	12.2	-0.5
MAR	0	0.0	4.1	0.1	6	0.4	0.0	0.0	2053.0	11.7	-0.5
APR	50	3.0	6.6	0.2	7	0.4	0.0	0.0	2056.9	14.1	2.4
MAY	239	14.7	7.0	0.3	57	3.5	0.0	0.0	2070.2	25.0	10.9
JUN	240	14.3	8.5	0.5	127	7.6	0.0	0.0	2076.0	31.2	6.2
JUL	239	14.7	9.0	0.6	297	18.3	0.0	0.0	2072.1	27.0	-4.2
AUG	162	10.0	7.0	0.4	273	16.8	0.0	0.0	2064.5	19.8	-7.2
SEP	59	3.5	6.1	0.3	133	7.9	0.0	0.0	2058.3	15.1	-4.7
OCT	0	0.0	5.4	0.2	6	0.4	0.0	0.0	2057.4	14.5	-0.6
NOV	0	0.0	2.9	0.1	7	0.4	0.0	0.0	2056.7	14.0	-0.5
DEC	0	0.0	1.7	0.1	6	0.4	0.0	0.0	2055.9	13.5	-0.5
TOTAL		60.2	62.5	3.0		56.9	0.0	0.0			0.3
MOST PROBABLE INFLOW CONDITIONS											
JAN	0	0.0	1.7	0.1	6	0.4	0.0	0.0	2054.6	12.7	-0.5
FEB	0	0.0	2.2	0.1	7	0.4	0.0	0.0	2053.8	12.2	-0.5
MAR	0	0.0	3.8	0.1	6	0.4	0.0	0.0	2052.9	11.7	-0.5
APR	50	3.0	6.1	0.2	6	0.4	0.0	0.0	2056.8	14.1	2.4
MAY	239	14.7	6.5	0.2	42	2.6	0.0	0.0	2071.2	26.0	11.9
JUN	198	11.8	7.9	0.5	99	6.1	0.0	0.0	2076.0	31.2	5.2
JUL	179	11.0	8.4	0.6	231	14.2	0.0	0.0	2072.5	27.4	-3.8
AUG	112	6.9	6.5	0.4	211	13.0	0.0	0.0	2065.8	20.9	-6.5
SEP	10	0.6	5.7	0.3	99	6.1	0.0	0.0	2058.3	15.1	-5.8
OCT	0	0.0	5.1	0.2	6	0.4	0.0	0.0	2057.4	14.5	-0.6
NOV	0	0.0	2.7	0.1	6	0.4	0.0	0.0	2056.7	14.0	-0.5
DEC	0	0.0	1.6	0.1	6	0.4	0.0	0.0	2055.9	13.5	-0.5
TOTAL		48.0	58.2	2.9		44.8	0.0	0.0			0.3
REASONABLE MAXIMUM INFLOW CONDITIONS											
JAN	0	0.0	1.7	0.1	6	0.4	0.0	0.0	2054.6	12.7	-0.5
FEB	0	0.0	2.0	0.1	7	0.4	0.0	0.0	2053.8	12.2	-0.5
MAR	0	0.0	3.6	0.1	6	0.4	0.0	0.0	2052.9	11.7	-0.5
APR	15	0.9	5.8	0.2	7	0.4	0.0	0.0	2053.5	12.0	0.3
MAY	239	14.7	6.2	0.2	32	2.0	0.0	0.0	2069.6	24.5	12.5
JUN	196	11.7	7.5	0.4	77	4.6	0.0	0.0	2076.0	31.2	6.7
JUL	114	7.0	8.0	0.5	172	10.6	0.0	0.0	2072.2	27.1	-4.1
AUG	67	4.1	6.2	0.4	156	9.6	0.0	0.0	2066.1	21.2	-5.9
SEP	0	0.0	5.4	0.3	97	5.8	0.0	0.0	2058.3	15.1	-6.1
OCT	0	0.0	4.8	0.2	6	0.4	0.0	0.0	2057.4	14.5	-0.6
NOV	0	0.0	2.5	0.1	7	0.4	0.0	0.0	2056.7	14.0	-0.5
DEC	0	0.0	1.5	0.1	6	0.4	0.0	0.0	2055.9	13.5	-0.5
TOTAL		38.4	55.2	2.7		35.4	0.0	0.0			0.3

BONNY RESERVOIR OPERATION ESTIMATES - 2019

					RELEASE REQUIRMENT				RESERVOIR	REQUIREMENT	END OF MONTH		RESERVOIR
	INFLOW		EVAPORATION		CANAL	RIVER	TOTAL		SPILL	SHORTAGE	ELEV	CONT	CHANGE
	MEAN	1000		1000	1000	1000	MEAN	1000	1000	1000		1000	1000
MONTH	CFS	AF	INCHES	AF	AF	AF	CFS	AF	AF	AF	FT	AF	AF
REASONABLE MINIMUM INFLOW CONDITIONS													
JAN	5	0.3	2.3	0.0	0.0	0.1	2	0.1	0.2	0.0	3638.0	0.0	0.0
FEB	5	0.3	3.1	0.0	0.0	0.1	2	0.1	0.2	0.0	3638.0	0.0	0.0
MAR	5	0.3	3.9	0.0	0.0	0.1	2	0.1	0.2	0.0	3638.0	0.0	0.0
APR	7	0.4	6.2	0.0	0.1	0.1	3	0.2	0.2	0.0	3638.0	0.0	0.0
MAY	6	0.4	7.7	0.0	0.4	0.1	8	0.5	0.0	0.1	3638.0	0.0	0.0
JUN	7	0.4	10.0	0.0	0.5	0.1	10	0.6	0.0	0.2	3638.0	0.0	0.0
JUL	3	0.2	11.6	0.0	0.8	0.1	15	0.9	0.0	0.7	3638.0	0.0	0.0
AUG	2	0.1	10.0	0.0	0.6	0.1	11	0.7	0.0	0.6	3638.0	0.0	0.0
SEP	2	0.1	8.5	0.0	0.5	0.1	10	0.6	0.0	0.5	3638.0	0.0	0.0
OCT	2	0.1	7.7	0.0	0.5	0.1	10	0.6	0.0	0.5	3638.0	0.0	0.0
NOV	3	0.2	3.9	0.0	0.0	0.1	2	0.1	0.1	0.0	3638.0	0.0	0.0
DEC	5	0.3	2.3	0.0	0.0	0.1	2	0.1	0.2	0.0	3638.0	0.0	0.0
TOTAL		3.1	77.2	0.0	3.4	1.2		4.6	1.1	2.6			0.0
MOST PROBABLE INFLOW CONDITIONS													
JAN	10	0.6	2.1	0.0	0.0	0.1	2	0.1	0.5	0.0	3638.0	0.0	0.0
FEB	10	0.6	2.7	0.0	0.0	0.1	2	0.1	0.5	0.0	3638.0	0.0	0.0
MAR	11	0.7	3.4	0.0	0.0	0.1	2	0.1	0.6	0.0	3638.0	0.0	0.0
APR	13	0.8	5.5	0.0	0.1	0.1	3	0.2	0.6	0.0	3638.0	0.0	0.0
MAY	15	0.9	6.9	0.0	0.3	0.1	6	0.4	0.5	0.0	3638.0	0.0	0.0
JUN	13	0.8	8.9	0.0	0.3	0.1	7	0.4	0.4	0.0	3638.0	0.0	0.0
JUL	6	0.4	10.3	0.0	0.5	0.1	10	0.6	0.0	0.2	3638.0	0.0	0.0
AUG	5	0.3	8.9	0.0	0.4	0.1	8	0.5	0.0	0.2	3638.0	0.0	0.0
SEP	3	0.2	7.5	0.0	0.3	0.1	7	0.4	0.0	0.2	3638.0	0.0	0.0
OCT	5	0.3	6.9	0.0	0.3	0.1	6	0.4	0.0	0.1	3638.0	0.0	0.0
NOV	8	0.5	3.4	0.0	0.0	0.1	2	0.1	0.4	0.0	3638.0	0.0	0.0
DEC	10	0.6	2.1	0.0	0.0	0.1	2	0.1	0.5	0.0	3638.0	0.0	0.0
TOTAL		6.7	68.6	0.0	2.2	1.2		3.4	4.0	0.7			0.0
REASONABLE MAXIMUM INFLOW CONDITIONS													
JAN	21	1.3	1.8	0.0	0.0	0.1	2	0.1	1.2	0.0	3638.0	0.0	0.0
FEB	21	1.2	2.4	0.0	0.0	0.1	2	0.1	1.1	0.0	3638.0	0.0	0.0
MAR	23	1.4	3.1	0.0	0.0	0.1	2	0.1	1.3	0.0	3638.0	0.0	0.0
APR	27	1.6	4.9	0.0	0.0	0.1	2	0.1	1.5	0.0	3638.0	0.0	0.0
MAY	29	1.8	6.1	0.0	0.1	0.1	3	0.2	1.6	0.0	3638.0	0.0	0.0
JUN	27	1.6	7.9	0.0	0.1	0.1	3	0.2	1.4	0.0	3638.0	0.0	0.0
JUL	13	0.8	9.2	0.0	0.1	0.1	3	0.2	0.6	0.0	3638.0	0.0	0.0
AUG	8	0.5	7.9	0.0	0.1	0.1	3	0.2	0.3	0.0	3638.0	0.0	0.0
SEP	5	0.3	6.7	0.0	0.1	0.1	3	0.2	0.1	0.0	3638.0	0.0	0.0
OCT	10	0.6	6.1	0.0	0.0	0.1	2	0.1	0.5	0.0	3638.0	0.0	0.0
NOV	18	1.1	3.1	0.0	0.0	0.1	2	0.1	1.0	0.0	3638.0	0.0	0.0
DEC	18	1.1	1.8	0.0	0.0	0.1	2	0.1	1.0	0.0	3638.0	0.0	0.0
TOTAL		13.3	61.0	0.0	0.5	1.2		1.7	11.6	0.0			0.0

ENDERS RESERVOIR OPERATION ESTIMATES - 2019

	INFLOW		EVAPORATION		RELEASE REQUIRMENT		RESERVOIR SPILL	REQUIREMENT SHORTAGE	END OF MONTH	CONT	RESERVOIR CHANGE
	MEAN	1000		1000	MEAN	1000	1000	1000	ELEV	1000	1000
MONTH	CFS	AF	INCHES	AF	CFS	AF	AF	AF	FT	AF	AF
REASONABLE MINIMUM INFLOW CONDITIONS											
JAN	6	0.4	1.5	0.1	3	0.2	0.0	0.0	3083.3	9.5	0.1
FEB	5	0.3	1.6	0.1	4	0.2	0.0	0.0	3083.3	9.5	0.0
MAR	5	0.3	2.7	0.1	3	0.2	0.0	0.0	3083.3	9.5	0.0
APR	5	0.3	5.9	0.2	3	0.2	0.0	0.0	3083.1	9.4	-0.1
MAY	6	0.4	7.5	0.3	3	0.2	0.0	0.0	3083.0	9.3	-0.1
JUN	5	0.3	9.5	0.4	176	10.5	0.0	10.2	3082.4	8.9	-0.4
JUL	6	0.4	10.4	0.4	532	32.8	0.0	32.6	3082.0	8.7	-0.2
AUG	6	0.4	8.8	0.3	505	31.1	0.0	30.9	3081.8	8.6	-0.1
SEP	5	0.3	6.5	0.2	75	4.5	0.0	4.3	3081.7	8.5	-0.1
OCT	5	0.3	4.2	0.1	3	0.2	0.0	0.0	3081.7	8.5	0.0
NOV	5	0.3	3.0	0.1	3	0.2	0.0	0.0	3081.7	8.5	0.0
DEC	5	0.3	1.7	0.1	3	0.2	0.0	0.0	3081.7	8.5	0.0
TOTAL		4.0	63.3	2.4		80.5	0.0	78.0			-0.9
MOST PROBABLE INFLOW CONDITIONS											
JAN	8	0.5	1.3	0.0	3	0.2	0.0	0.0	3083.6	9.7	0.3
FEB	9	0.5	1.4	0.1	3	0.2	0.0	0.0	3083.8	9.9	0.2
MAR	8	0.5	2.5	0.1	3	0.2	0.0	0.0	3084.2	10.1	0.2
APR	8	0.5	5.4	0.2	3	0.2	0.0	0.0	3084.3	10.2	0.1
MAY	8	0.5	6.8	0.3	3	0.2	0.0	0.0	3084.3	10.2	0.0
JUN	8	0.5	8.7	0.3	114	7.0	0.0	5.5	3082.4	8.9	-1.3
JUL	10	0.6	9.5	0.3	487	30.0	0.0	29.7	3082.4	8.9	0.0
AUG	8	0.5	8.1	0.3	388	23.9	0.0	23.7	3082.4	8.9	0.0
SEP	8	0.5	6.0	0.2	36	2.2	0.0	1.9	3082.4	8.9	0.0
OCT	8	0.5	3.8	0.1	3	0.2	0.0	0.0	3082.6	9.1	0.2
NOV	8	0.5	2.8	0.1	3	0.2	0.0	0.0	3082.9	9.3	0.2
DEC	8	0.5	1.6	0.1	3	0.2	0.0	0.0	3083.2	9.5	0.2
TOTAL		6.1	57.9	2.1		64.7	0.0	60.8			0.1
REASONABLE MAXIMUM INFLOW CONDITIONS											
JAN	16	1.0	1.2	0.0	3	0.2	0.0	0.0	3084.3	10.2	0.8
FEB	16	0.9	1.3	0.1	4	0.2	0.0	0.0	3085.1	10.8	0.6
MAR	15	0.9	2.3	0.1	3	0.2	0.0	0.0	3086.0	11.4	0.6
APR	15	0.9	4.9	0.2	3	0.2	0.0	0.0	3086.7	11.9	0.5
MAY	16	1.0	6.2	0.3	3	0.2	0.0	0.0	3087.4	12.4	0.5
JUN	15	0.9	7.9	0.4	40	2.4	0.0	0.0	3084.7	10.5	-1.9
JUL	18	1.1	8.7	0.4	297	18.3	0.0	16.0	3082.4	8.9	-1.6
AUG	16	1.0	7.3	0.3	229	14.1	0.0	13.4	3082.4	8.9	0.0
SEP	15	0.9	5.4	0.2	3	0.2	0.0	0.0	3083.1	9.4	0.5
OCT	15	0.9	3.5	0.1	3	0.2	0.0	0.0	3084.0	10.0	0.6
NOV	15	0.9	2.5	0.1	3	0.2	0.0	0.0	3084.8	10.6	0.6
DEC	15	0.9	1.4	0.1	3	0.2	0.0	0.0	3085.7	11.2	0.6
TOTAL		11.3	52.6	2.3		36.6	0.0	29.4			1.8

SWANSON LAKE OPERATION ESTIMATES - 2019

	INFLOW		EVAPORATION		RELEASE REQUIRMENT CANAL	RIVER	TOTAL		RESERVOIR SPILL	REQUIREMENT SHORTAGE	END OF MONTH ELEV	CONT	RESERVOIR CHANGE
	MEAN	1000		1000	1000	1000	MEAN	1000	1000	1000		1000	1000
MONTH	CFS	AF	INCHES	AF	AF	AF	CFS	AF	AF	AF	FT	AF	AF
REASONABLE MINIMUM INFLOW CONDITIONS													
JAN	19	1.2	1.5	0.3	0.0	0.1	2	0.1	0.0	0.0	2739.9	60.2	0.8
FEB	31	1.7	1.6	0.3	0.0	0.1	2	0.1	0.0	0.0	2740.3	61.5	1.3
MAR	34	2.1	2.9	0.6	0.0	0.1	2	0.1	0.0	0.0	2740.7	62.9	1.4
APR	39	2.3	6.3	1.3	0.0	0.1	2	0.1	0.0	0.0	2740.9	63.8	0.9
MAY	34	2.1	7.5	1.6	0.1	0.1	3	0.2	0.0	0.0	2741.0	64.1	0.3
JUN	27	1.6	9.7	2.0	4.4	0.9	89	5.3	0.0	0.0	2739.4	58.4	-5.7
JUL	15	0.9	9.7	1.9	16.3	6.9	377	23.2	0.0	0.0	2731.5	34.2	-24.2
AUG	8	0.5	9.7	1.5	13.6	6.3	323	19.9	0.0	5.7	2725.0	19.0	-15.2
SEP	3	0.2	7.5	0.9	2.0	2.1	69	4.1	0.0	4.0	2724.6	18.2	-0.8
OCT	6	0.4	4.6	0.5	0.0	0.1	2	0.1	0.0	0.0	2724.5	18.0	-0.2
NOV	15	0.9	3.2	0.4	0.0	0.1	2	0.1	0.0	0.0	2724.7	18.4	0.4
DEC	16	1.0	1.7	0.2	0.0	0.1	2	0.1	0.0	0.0	2725.0	19.1	0.7
TOTAL		14.9	65.9	11.5	36.4	17.0		53.4	0.0	9.7			-40.3
MOST PROBABLE INFLOW CONDITIONS													
JAN	34	2.1	1.3	0.3	0.0	0.1	2	0.1	0.0	0.0	2740.2	61.1	1.7
FEB	54	3.0	1.4	0.3	0.0	0.1	2	0.1	0.0	0.0	2740.9	63.7	2.6
MAR	60	3.7	2.6	0.5	0.0	0.1	2	0.1	0.0	0.0	2741.8	66.8	3.1
APR	67	4.0	5.8	1.3	0.0	0.1	2	0.1	0.0	0.0	2742.5	69.4	2.6
MAY	60	3.7	6.9	1.5	0.1	0.1	3	0.2	0.0	0.0	2743.0	71.4	2.0
JUN	47	2.8	8.8	2.0	3.8	0.1	63	3.9	0.0	0.0	2742.2	68.3	-3.1
JUL	26	1.6	8.8	1.9	14.2	4.2	299	18.4	0.0	0.0	2736.7	49.6	-18.7
AUG	15	0.9	8.8	1.6	11.7	4.1	256	15.8	0.0	0.0	2731.1	33.1	-16.5
SEP	7	0.4	6.9	1.1	1.7	0.1	29	1.8	0.0	0.0	2730.1	30.6	-2.5
OCT	10	0.6	4.2	0.6	0.0	0.1	2	0.1	0.0	0.0	2730.1	30.5	-0.1
NOV	25	1.5	2.9	0.4	0.0	0.1	2	0.1	0.0	0.0	2730.4	31.5	1.0
DEC	28	1.7	1.6	0.2	0.0	0.1	2	0.1	0.0	0.0	2731.0	32.9	1.4
TOTAL		26.0	60.0	11.7	31.5	9.3		40.8	0.0	0.0			-26.5
REASONABLE MAXIMUM INFLOW CONDITIONS													
JAN	57	3.5	1.2	0.2	0.0	0.1	2	0.1	0.0	0.0	2740.6	62.6	3.2
FEB	88	4.9	1.3	0.3	0.0	0.1	2	0.1	0.0	0.0	2741.8	67.1	4.5
MAR	99	6.1	2.4	0.5	0.0	0.1	2	0.1	0.0	0.0	2743.3	72.6	5.5
APR	109	6.5	5.3	1.2	0.0	0.1	2	0.1	0.0	0.0	2744.6	77.8	5.2
MAY	97	6.0	6.3	1.4	0.1	0.1	3	0.2	0.0	0.0	2745.7	82.2	4.4
JUN	77	4.6	8.1	1.9	3.1	0.1	54	3.2	0.0	0.0	2745.6	81.7	-0.5
JUL	42	2.6	8.1	1.9	11.6	1.2	208	12.8	0.0	0.0	2742.5	69.6	-12.1
AUG	23	1.4	8.1	1.8	9.6	1.7	183	11.3	0.0	0.0	2739.3	57.9	-11.7
SEP	12	0.7	6.3	1.3	1.4	0.1	25	1.5	0.0	0.0	2738.6	55.8	-2.1
OCT	16	1.0	3.8	0.7	0.0	0.1	2	0.1	0.0	0.0	2738.7	56.0	0.2
NOV	42	2.5	2.6	0.5	0.0	0.1	2	0.1	0.0	0.0	2739.3	57.9	1.9
DEC	45	2.8	1.4	0.3	0.0	0.1	2	0.1	0.0	0.0	2740.0	60.3	2.4
TOTAL		42.6	54.9	12.0	25.8	3.9		29.7	0.0	0.0			0.9

HUGH BUTLER LAKE OPERATION ESTIMATES - 2019

	INFLOW		EVAPORATION		RELEASE REQUIRMENT		RESERVOIR SPILL	REQUIREMENT SHORTAGE	END OF MONTH ELEV	CONT	RESERVOIR CHANGE
	MEAN	1000		1000	MEAN	1000	1000	1000		1000	1000
MONTH	CFS	AF	INCHES	AF	CFS	AF	AF	AF	FT	AF	AF
REASONABLE MINIMUM INFLOW CONDITIONS											
JAN	8	0.5	1.3	0.1	3	0.2	0.0	0.0	2569.9	19.8	0.2
FEB	11	0.6	1.4	0.1	4	0.2	0.0	0.0	2570.1	20.1	0.3
MAR	13	0.8	2.6	0.2	3	0.2	0.0	0.0	2570.5	20.5	0.4
APR	13	0.8	7.2	0.5	3	0.2	0.0	0.0	2570.6	20.6	0.1
MAY	13	0.8	8.4	0.6	3	0.2	0.0	0.0	2570.6	20.6	0.0
JUN	13	0.8	10.3	0.7	29	1.7	0.0	0.0	2569.2	19.0	-1.6
JUL	10	0.6	11.5	0.7	73	4.5	0.0	0.0	2564.6	14.4	-4.6
AUG	11	0.7	10.2	0.6	62	3.8	0.0	0.5	2560.9	11.2	-3.2
SEP	7	0.4	7.9	0.4	15	0.9	0.0	0.7	2560.7	11.0	-0.2
OCT	8	0.5	5.0	0.2	3	0.2	0.0	0.0	2560.8	11.1	0.1
NOV	8	0.5	3.0	0.1	3	0.2	0.0	0.0	2561.1	11.3	0.2
DEC	8	0.5	1.5	0.1	3	0.2	0.0	0.0	2561.3	11.5	0.2
TOTAL		7.5	70.3	4.3		12.5	0.0	1.2			-8.1
MOST PROBABLE INFLOW CONDITIONS											
JAN	13	0.8	1.1	0.1	3	0.2	0.0	0.0	2570.1	20.1	0.5
FEB	16	0.9	1.2	0.1	4	0.2	0.0	0.0	2570.6	20.7	0.6
MAR	19	1.2	2.3	0.2	3	0.2	0.0	0.0	2571.3	21.5	0.8
APR	18	1.1	6.4	0.4	3	0.2	0.0	0.0	2571.7	22.0	0.5
MAY	19	1.2	7.5	0.5	3	0.2	0.0	0.0	2572.2	22.5	0.5
JUN	20	1.2	9.2	0.7	23	1.4	0.0	0.0	2571.4	21.6	-0.9
JUL	16	1.0	10.2	0.7	62	3.8	0.0	0.0	2568.3	18.1	-3.5
AUG	16	1.0	9.0	0.6	52	3.2	0.0	0.0	2565.6	15.3	-2.8
SEP	10	0.6	7.0	0.4	13	0.8	0.0	0.0	2564.9	14.7	-0.6
OCT	11	0.7	4.4	0.2	3	0.2	0.0	0.0	2565.2	15.0	0.3
NOV	13	0.8	2.7	0.1	3	0.2	0.0	0.0	2565.8	15.5	0.5
DEC	13	0.8	1.4	0.1	3	0.2	0.0	0.0	2566.3	16.0	0.5
TOTAL		11.3	62.4	4.1		10.8	0.0	0.0			-3.6
REASONABLE MAXIMUM INFLOW CONDITIONS											
JAN	19	1.2	1.0	0.1	3	0.2	0.0	0.0	2570.5	20.5	0.9
FEB	25	1.4	1.1	0.1	4	0.2	0.0	0.0	2571.4	21.6	1.1
MAR	29	1.8	2.1	0.1	3	0.2	0.0	0.0	2572.6	23.1	1.5
APR	30	1.8	5.8	0.4	3	0.2	0.0	0.0	2573.6	24.3	1.2
MAY	31	1.9	6.9	0.5	3	0.2	0.0	0.0	2574.5	25.5	1.2
JUN	32	1.9	8.4	0.7	18	1.1	0.0	0.0	2574.6	25.6	0.1
JUL	24	1.5	9.3	0.7	45	2.8	0.0	0.0	2573.0	23.6	-2.0
AUG	24	1.5	8.3	0.6	39	2.4	0.0	0.0	2571.8	22.1	-1.5
SEP	17	1.0	6.4	0.4	8	0.5	0.0	0.0	2571.9	22.2	0.1
OCT	18	1.1	4.1	0.3	3	0.2	0.0	0.0	2572.4	22.8	0.6
NOV	20	1.2	2.5	0.2	3	0.2	0.0	0.0	2573.0	23.6	0.8
DEC	19	1.2	1.3	0.1	3	0.2	0.0	0.0	2573.8	24.5	0.9
TOTAL		17.5	57.2	4.2		8.4	0.0	0.0			4.9

HARRY STRUNK LAKE OPERATION ESTIMATES - 2019

	INFLOW		EVAPORATION		RELEASE REQUIRMENT		RESERVOIR SPILL	REQUIREMENT SHORTAGE	END OF MONTH	CONT	RESERVOIR CHANGE
	MEAN	1000		1000	MEAN	1000	1000	1000	ELEV	1000	1000
MONTH	CFS	AF	INCHES	AF	CFS	AF	AF	AF	FT	AF	AF
REASONABLE MINIMUM INFLOW CONDITIONS											
JAN	34	2.1	1.3	0.1	2	0.1	0.0	0.0	2363.9	30.9	1.9
FEB	43	2.4	1.4	0.1	2	0.1	0.0	0.0	2365.2	33.1	2.2
MAR	45	2.8	2.6	0.3	2	0.1	0.9	0.0	2366.1	34.6	1.5
APR	45	2.7	7.0	0.8	2	0.1	1.8	0.0	2366.1	34.6	0.0
MAY	49	3.0	8.1	0.9	2	0.1	2.0	0.0	2366.1	34.6	0.0
JUN	50	3.0	10.1	1.1	89	5.3	0.0	0.0	2364.1	31.2	-3.4
JUL	45	2.8	11.2	1.1	318	19.6	0.0	0.0	2349.7	13.3	-17.9
AUG	37	2.3	9.9	0.5	268	16.5	0.0	9.3	2343.0	7.9	-5.4
SEP	23	1.4	7.7	0.3	27	1.6	0.0	0.5	2343.0	7.9	0.0
OCT	29	1.8	5.0	0.2	2	0.1	0.0	0.0	2345.1	9.4	1.5
NOV	34	2.0	3.0	0.1	2	0.1	0.0	0.0	2347.3	11.2	1.8
DEC	31	1.9	1.6	0.1	2	0.1	0.0	0.0	2349.2	12.9	1.7
TOTAL		28.2	68.9	5.6		43.8	4.7	9.8			-16.1
MOST PROBABLE INFLOW CONDITIONS											
JAN	47	2.9	1.2	0.1	2	0.1	0.0	0.0	2364.4	31.7	2.7
FEB	61	3.4	1.2	0.1	2	0.1	0.3	0.0	2366.1	34.6	2.9
MAR	63	3.9	2.3	0.2	2	0.1	3.6	0.0	2366.1	34.6	0.0
APR	64	3.8	6.3	0.7	2	0.1	3.0	0.0	2366.1	34.6	0.0
MAY	68	4.2	7.3	0.8	2	0.1	3.3	0.0	2366.1	34.6	0.0
JUN	70	4.2	9.1	1.0	74	4.4	0.0	0.0	2365.4	33.4	-1.2
JUL	65	4.0	10.1	1.0	265	16.3	0.0	0.0	2356.1	20.1	-13.3
AUG	52	3.2	8.9	0.6	222	13.7	0.0	0.0	2344.5	9.0	-11.1
SEP	34	2.0	7.0	0.3	20	1.2	0.0	0.0	2345.2	9.5	0.5
OCT	42	2.6	4.5	0.2	2	0.1	0.0	0.0	2348.0	11.8	2.3
NOV	47	2.8	2.7	0.1	2	0.1	0.0	0.0	2350.8	14.4	2.6
DEC	44	2.7	1.4	0.1	2	0.1	0.0	0.0	2353.2	16.9	2.5
TOTAL		39.7	62.0	5.2		36.4	10.2	0.0			-12.1
REASONABLE MAXIMUM INFLOW CONDITIONS											
JAN	75	4.6	1.1	0.1	2	0.1	0.0	0.0	2365.4	33.4	4.4
FEB	93	5.2	1.1	0.1	2	0.1	3.8	0.0	2366.1	34.6	1.2
MAR	99	6.1	2.1	0.2	2	0.1	5.8	0.0	2366.1	34.6	0.0
APR	97	5.8	5.7	0.6	2	0.1	5.1	0.0	2366.1	34.6	0.0
MAY	106	6.5	6.6	0.7	2	0.1	5.7	0.0	2366.1	34.6	0.0
JUN	109	6.5	8.2	0.9	47	2.8	2.8	0.0	2366.1	34.6	0.0
JUL	101	6.2	9.0	1.0	182	11.2	0.0	0.0	2362.4	28.6	-6.0
AUG	80	4.9	8.0	0.7	154	9.5	0.0	0.0	2358.6	23.3	-5.3
SEP	52	3.1	6.2	0.5	2	0.1	0.0	0.0	2360.5	25.8	2.5
OCT	65	4.0	4.1	0.3	2	0.1	0.0	0.0	2363.0	29.4	3.6
NOV	72	4.3	2.5	0.2	2	0.1	0.0	0.0	2365.4	33.4	4.0
DEC	68	4.2	1.3	0.1	2	0.1	2.8	0.0	2366.1	34.6	1.2
TOTAL		61.4	55.9	5.4		24.4	26.0	0.0			5.6

KEITH SEBELIUS LAKE OPERATION ESTIMATES - 2019

	INFLOW		EVAPORATION		RELEASE REQUIRMENT		RESERVOIR SPILL	REQUIREMENT SHORTAGE	END OF MONTH ELEV	CONT	RESERVOIR CHANGE
	MEAN	1000		1000	MEAN	1000	1000	1000		1000	1000
MONTH	CFS	AF	INCHES	AF	CFS	AF	AF	AF	FT	AF	AF
REASONABLE MINIMUM INFLOW CONDITIONS											
JAN	2	0.1	1.5	0.1	2	0.1	0.0	0.0	2293.9	16.5	-0.1
FEB	4	0.2	1.8	0.1	2	0.1	0.0	0.0	2293.9	16.5	0.0
MAR	6	0.4	3.0	0.2	2	0.1	0.0	0.0	2294.0	16.6	0.1
APR	7	0.4	7.9	0.6	2	0.1	0.0	0.0	2293.8	16.3	-0.3
MAY	10	0.6	8.7	0.7	6	0.4	0.0	0.0	2293.4	15.8	-0.5
JUN	13	0.8	11.0	0.8	57	3.4	0.0	0.0	2290.7	12.4	-3.4
JUL	10	0.6	12.3	0.8	146	9.0	0.0	3.7	2284.6	6.9	-5.5
AUG	8	0.5	11.0	0.5	138	8.5	0.0	8.4	2284.5	6.8	-0.1
SEP	3	0.2	8.7	0.4	27	1.6	0.0	1.5	2284.1	6.5	-0.3
OCT	2	0.1	6.0	0.3	2	0.1	0.0	0.0	2283.7	6.2	-0.3
NOV	2	0.1	3.3	0.1	2	0.1	0.0	0.0	2283.6	6.1	-0.1
DEC	2	0.1	1.7	0.1	2	0.1	0.0	0.0	2283.4	6.0	-0.1
TOTAL		4.1	76.9	4.7		23.6	0.0	13.6			-10.6
MOST PROBABLE INFLOW CONDITIONS											
JAN	3	0.2	1.4	0.1	2	0.1	0.0	0.0	2294.0	16.6	0.0
FEB	5	0.3	1.6	0.1	2	0.1	0.0	0.0	2294.1	16.7	0.1
MAR	10	0.6	2.6	0.2	2	0.1	0.0	0.0	2294.3	17.0	0.3
APR	10	0.6	6.9	0.6	2	0.1	0.0	0.0	2294.2	16.9	-0.1
MAY	16	1.0	7.7	0.6	3	0.2	0.0	0.0	2294.4	17.1	0.2
JUN	20	1.2	9.7	0.8	45	2.8	0.0	0.0	2292.6	14.7	-2.4
JUL	15	0.9	10.9	0.8	138	8.5	0.0	1.6	2285.9	7.9	-6.8
AUG	13	0.8	9.7	0.5	112	6.9	0.0	6.6	2285.9	7.9	0.0
SEP	7	0.4	7.7	0.4	21	1.3	0.0	1.2	2285.8	7.8	-0.1
OCT	3	0.2	5.3	0.2	2	0.1	0.0	0.0	2285.7	7.7	-0.1
NOV	3	0.2	2.9	0.1	2	0.1	0.0	0.0	2285.7	7.7	0.0
DEC	3	0.2	1.5	0.1	2	0.1	0.0	0.0	2285.7	7.7	0.0
TOTAL		6.6	67.9	4.5		20.4	0.0	9.4			-8.9
REASONABLE MAXIMUM INFLOW CONDITIONS											
JAN	6	0.4	1.2	0.1	2	0.1	0.0	0.0	2294.2	16.8	0.2
FEB	11	0.6	1.5	0.1	2	0.1	0.0	0.0	2294.5	17.2	0.4
MAR	16	1.0	2.4	0.2	2	0.1	0.0	0.0	2295.0	17.9	0.7
APR	18	1.1	6.2	0.5	2	0.1	0.0	0.0	2295.3	18.4	0.5
MAY	28	1.7	6.9	0.6	3	0.2	0.0	0.0	2295.9	19.3	0.9
JUN	37	2.2	8.7	0.8	27	1.6	0.0	0.0	2295.8	19.1	-0.2
JUL	26	1.6	9.7	0.8	71	4.4	0.0	0.0	2293.3	15.5	-3.6
AUG	23	1.4	8.7	0.7	68	4.2	0.0	0.0	2290.3	12.0	-3.5
SEP	10	0.6	6.9	0.4	15	0.9	0.0	0.0	2289.6	11.3	-0.7
OCT	5	0.3	4.8	0.3	2	0.1	0.0	0.0	2289.5	11.2	-0.1
NOV	7	0.4	2.6	0.2	2	0.1	0.0	0.0	2289.6	11.3	0.1
DEC	6	0.4	1.3	0.1	2	0.1	0.0	0.0	2289.8	11.5	0.2
TOTAL		11.7	60.9	4.8		12.0	0.0	0.0			-5.1

HARLAN COUNTY LAKE OPERATION ESTIMATES - 2019

	INFLOW		EVAPORATION		RELEASE REQUIREMENT		RESERVOIR SPILL	REQUIREMENT SHORTAGE	END OF MONTH ELEV	CONT	RESERVOIR CHANGE
	MEAN	1000		1000	MEAN	1000	1000	1000		1000	1000
MONTH	CFS	AF	INCHES	AF	CFS	AF	AF	AF	FT	AF	AF
REASONABLE MINIMUM INFLOW CONDITIONS											
JAN	39	2.4	1.4	1.4	0	0.0	0.0	0.0	1941.1	256.0	1.0
FEB	61	3.4	1.6	1.6	0	0.0	0.0	0.0	1941.2	257.8	1.8
MAR	83	5.1	2.8	2.8	0	0.0	0.0	0.0	1941.4	260.1	2.3
APR	70	4.2	6.5	6.6	0	0.0	0.0	0.0	1941.2	257.7	-2.4
MAY	89	5.5	8.0	8.1	0	0.0	0.0	0.0	1941.1	255.1	-2.6
JUN	74	4.4	9.6	9.7	398	23.7	0.0	0.0	1938.5	226.1	-29.0
JUL	75	4.6	10.7	9.9	795	49.0	0.0	0.0	1933.3	171.8	-54.3
AUG	60	3.7	9.4	7.5	716	44.1	0.0	15.1	1929.6	139.0	-32.8
SEP	30	1.8	7.5	5.2	54	3.2	0.0	3.2	1929.2	135.6	-3.4
OCT	28	1.7	5.1	3.5	0	0.0	0.0	0.0	1929.0	133.8	-1.8
NOV	37	2.2	3.2	2.2	0	0.0	0.0	0.0	1929.0	133.8	0.0
DEC	37	2.3	2.0	1.4	0	0.0	0.0	0.0	1929.1	134.7	0.9
TOTAL		41.3	67.8	59.9		120.0	0.0	18.3			-120.3
MOST PROBABLE INFLOW CONDITIONS											
JAN	99	6.1	1.2	1.2	0	0.0	0.0	0.0	1941.4	259.9	4.9
FEB	155	8.6	1.4	1.4	0	0.0	0.0	0.0	1942.0	267.1	7.2
MAR	206	12.7	2.4	2.5	0	0.0	0.0	0.0	1942.8	277.3	10.2
APR	179	10.7	5.7	5.9	0	0.0	0.0	0.0	1943.2	282.1	4.8
MAY	226	13.9	7.0	7.3	0	0.0	0.0	0.0	1943.7	288.7	6.6
JUN	188	11.2	8.3	8.7	64	3.8	0.0	0.0	1943.6	287.4	-1.3
JUL	190	11.7	9.3	9.8	628	38.7	0.0	0.0	1940.6	250.6	-36.8
AUG	153	9.4	8.2	8.2	536	33.0	0.0	0.0	1937.8	218.8	-31.8
SEP	75	4.5	6.5	5.9	34	2.0	0.0	0.0	1937.5	215.4	-3.4
OCT	71	4.4	4.4	4.0	0	0.0	0.0	0.0	1937.6	215.8	0.4
NOV	94	5.6	2.8	2.5	0	0.0	0.0	0.0	1937.9	218.9	3.1
DEC	93	5.7	1.8	1.6	0	0.0	0.0	0.0	1938.2	223.0	4.1
TOTAL		104.5	59.0	59.0		77.5	0.0	0.0			-32.0
REASONABLE MAXIMUM INFLOW CONDITIONS											
JAN	203	12.5	1.1	1.1	0	0.0	0.0	0.0	1941.9	266.4	11.4
FEB	316	17.6	1.3	1.3	0	0.0	0.0	0.0	1943.2	282.7	16.3
MAR	425	26.2	2.1	2.2	0	0.0	0.0	0.0	1945.1	306.7	24.0
APR	367	21.9	5.0	5.5	0	0.0	9.0	0.0	1945.7	314.1	7.4
MAY	464	28.6	6.1	6.8	0	0.0	21.8	0.0	1945.7	314.1	0.0
JUN	386	23.0	7.3	8.1	37	2.2	12.7	0.0	1945.7	314.1	0.0
JUL	391	24.1	8.2	9.1	143	8.8	6.2	0.0	1945.7	314.1	0.0
AUG	313	19.3	7.2	8.0	136	8.4	2.9	0.0	1945.7	314.1	0.0
SEP	154	9.2	5.7	6.3	20	1.2	1.7	0.0	1945.7	314.1	0.0
OCT	146	9.0	3.9	4.3	0	0.0	4.7	0.0	1945.7	314.1	0.0
NOV	195	11.6	2.4	2.7	0	0.0	8.9	0.0	1945.7	314.1	0.0
DEC	192	11.8	1.6	1.8	0	0.0	10.0	0.0	1945.7	314.1	0.0
TOTAL		214.8	51.9	57.2		20.6	77.9	0.0			59.1

TABLE 4

LOVEWELL RESERVOIR OPERATION ESTIMATES - 2019

	WHITE ROCK CREEK INFLOW 1000	COURTLAND CANAL INFLOW 1000	TOTAL INFLOW MEAN	TOTAL INFLOW 1000	EVAPORATION	EVAPORATION 1000	RELEASE REQUIRMENT MEAN	RELEASE REQUIRMENT 1000	RESERVOIR SPILL 1000	REQUIREMENT SHORTAGE 1000	END OF MONTH ELEV	END OF MONTH CONT 1000	RESERVOIR CHANGE 1000
MONTH	AF	AF	CFS	AF	INCHES	AF	CFS	AF	AF	AF	FT	AF	AF
REASONABLE MINIMUM INFLOW CONDITIONS													
JAN	0.4	0.0	6	0.4	1.2	0.3	0	0.0	0.0	0.0	1583.5	38.3	0.1
FEB	0.6	0.0	11	0.6	1.5	0.4	0	0.0	0.0	0.0	1583.5	38.5	0.2
MAR	1.3	0.0	21	1.3	2.6	0.7	0	0.0	0.0	0.0	1583.7	39.1	0.6
APR	1.2	1.7	49	2.9	5.4	1.4	0	0.0	0.0	0.0	1584.1	40.6	1.5
MAY	1.5	2.5	65	4.0	6.8	1.8	15	0.9	0.0	0.0	1584.6	41.9	1.3
JUN	1.7	10.7	208	12.4	8.9	2.4	168	10.0	0.0	0.0	1584.6	41.9	0.0
JUL	1.1	5.7	110	6.8	9.6	2.6	505	31.1	0.0	0.0	1573.7	15.0	-26.9
AUG	0.1	9.0	148	9.1	7.9	1.1	347	21.4	0.0	10.1	1571.7	11.7	-3.3
SEP	0.9	0.0	15	0.9	5.9	0.7	47	2.8	0.0	2.6	1571.7	11.7	0.0
OCT	0.6	1.9	41	2.5	4.1	0.5	0	0.0	0.0	0.0	1573.0	13.7	2.0
NOV	0.5	2.5	50	3.0	3.0	0.4	0	0.0	0.0	0.0	1574.5	16.3	2.6
DEC	0.3	2.6	47	2.9	1.5	0.2	0	0.0	0.0	0.0	1575.9	19.0	2.7
TOTAL	10.2	36.6		46.8	58.4	12.5		66.2	0.0	12.7			-19.2
MOST PROBABLE INFLOW CONDITIONS													
JAN	0.8	0.0	13	0.8	1.0	0.3	0	0.0	0.0	0.0	1583.5	38.7	0.5
FEB	1.3	0.0	23	1.3	1.3	0.3	0	0.0	0.0	0.0	1583.9	39.7	1.0
MAR	2.9	0.0	47	2.9	2.3	0.6	0	0.0	0.1	0.0	1584.6	41.9	2.2
APR	2.6	0.0	44	2.6	4.6	1.3	0	0.0	1.3	0.0	1584.6	41.9	0.0
MAY	3.3	0.0	54	3.3	5.9	1.6	13	0.8	0.9	0.0	1584.6	41.9	0.0
JUN	3.6	0.0	60	3.6	7.7	2.1	133	7.9	0.0	0.0	1582.5	35.5	-6.4
JUL	2.4	9.5	193	11.9	8.3	2.1	404	24.9	0.0	0.0	1576.6	20.4	-15.1
AUG	0.2	9.5	157	9.7	6.8	1.2	278	17.1	0.0	0.0	1571.8	11.8	-8.6
SEP	1.9	0.9	47	2.8	5.2	0.7	37	2.2	0.0	0.0	1571.7	11.7	-0.1
OCT	1.3	4.7	97	6.0	3.5	0.4	0	0.0	0.0	0.0	1575.0	17.3	5.6
NOV	1.1	4.1	87	5.2	2.6	0.4	0	0.0	0.0	0.0	1577.3	22.1	4.8
DEC	0.8	4.6	88	5.4	1.3	0.2	0	0.0	0.0	0.0	1579.5	27.3	5.2
TOTAL	22.2	33.3		55.5	50.5	11.2		52.9	2.3	0.0			-10.9
REASONABLE MAXIMUM INFLOW CONDITIONS													
JAN	2.1	0.0	34	2.1	0.9	0.2	0	0.0	1.8	0.0	1583.5	38.3	0.1
FEB	3.1	0.0	56	3.1	1.1	0.3	0	0.0	5.4	0.0	1582.6	35.7	-2.6
MAR	7.1	0.0	115	7.1	2.0	0.5	0	0.0	6.6	0.0	1582.6	35.7	0.0
APR	6.4	0.0	107	6.4	4.0	1.0	0	0.0	5.4	0.0	1582.6	35.7	0.0
MAY	8.1	0.0	131	8.1	5.1	1.3	8	0.5	6.3	0.0	1582.6	35.7	0.0
JUN	8.8	0.0	148	8.8	6.6	1.6	87	5.2	2.0	0.0	1582.6	35.7	0.0
JUL	5.9	0.0	96	5.9	7.2	1.8	265	16.3	0.0	0.0	1578.0	23.5	-12.2
AUG	0.6	0.0	10	0.6	5.9	1.1	179	11.0	0.0	0.0	1571.9	12.0	-11.5
SEP	4.7	0.0	79	4.7	4.4	0.6	23	1.4	0.0	0.0	1573.6	14.7	2.7
OCT	3.2	4.7	128	7.9	3.0	0.4	0	0.0	0.0	0.0	1577.4	22.2	7.5
NOV	2.7	3.4	102	6.1	2.3	0.4	0	0.0	0.0	0.0	1579.8	27.9	5.7
DEC	1.9	0.0	31	1.9	1.1	0.2	0	0.0	0.0	0.0	1580.5	29.6	1.7
TOTAL	54.6	8.1		62.7	43.6	9.4		34.4	27.5	0.0			-8.6

KIRWIN RESERVOIR OPERATION ESTIMATES - 2019

	INFLOW		EVAPORATION		RELEASE REQUIREMENT		RESERVOIR SPILL	REQUIREMENT SHORTAGE	END OF MONTH ELEV	CONT	RESERVOIR CHANGE
	MEAN	1000		1000	MEAN	1000	1000	1000		1000	1000
MONTH	CFS	AF	INCHES	AF	CFS	AF	AF	AF	FT	AF	AF
REASONABLE MINIMUM INFLOW CONDITIONS											
JAN	5	0.3	1.3	0.4	0	0.0	6.5	0.0	1729.3	98.2	-6.6
FEB	7	0.4	1.6	0.5	0	0.0	0.0	0.0	1729.2	98.1	-0.1
MAR	13	0.8	2.8	0.8	0	0.0	0.0	0.0	1729.2	98.1	0.0
APR	13	0.8	6.4	1.9	0	0.0	0.0	0.0	1729.0	97.0	-1.1
MAY	21	1.3	7.9	2.3	8	0.5	0.0	0.0	1728.7	95.5	-1.5
JUN	18	1.1	9.6	2.8	87	5.2	0.0	0.0	1727.3	88.6	-6.9
JUL	16	1.0	10.9	3.0	193	11.9	0.0	0.0	1724.2	74.7	-13.9
AUG	11	0.7	9.6	2.4	179	11.0	0.0	0.0	1721.0	62.0	-12.7
SEP	7	0.4	7.4	1.6	8	0.5	0.0	0.0	1720.6	60.3	-1.7
OCT	3	0.2	5.1	1.1	0	0.0	0.0	0.0	1720.4	59.4	-0.9
NOV	5	0.3	3.0	0.7	0	0.0	0.0	0.0	1720.2	59.0	-0.4
DEC	5	0.3	1.6	0.3	0	0.0	0.0	0.0	1720.2	59.0	0.0
TOTAL		7.6	67.2	17.8		29.1	6.5	0.0			-45.8
MOST PROBABLE INFLOW CONDITIONS											
JAN	16	1.0	1.1	0.3	0	0.0	7.3	0.0	1729.3	98.2	-6.6
FEB	25	1.4	1.4	0.4	0	0.0	1.0	0.0	1729.3	98.2	0.0
MAR	42	2.6	2.5	0.7	0	0.0	1.9	0.0	1729.3	98.2	0.0
APR	47	2.8	5.7	1.7	0	0.0	1.1	0.0	1729.3	98.2	0.0
MAY	73	4.5	7.1	2.1	6	0.4	2.0	0.0	1729.3	98.2	0.0
JUN	60	3.6	8.6	2.5	71	4.4	0.0	0.0	1728.6	94.9	-3.3
JUL	57	3.5	9.8	2.8	193	11.9	0.0	0.0	1726.2	83.7	-11.2
AUG	41	2.5	8.6	2.3	149	9.2	0.0	0.0	1724.2	74.7	-9.0
SEP	20	1.2	6.6	1.6	8	0.5	0.0	0.0	1724.0	73.8	-0.9
OCT	13	0.8	4.6	1.1	0	0.0	0.0	0.0	1723.9	73.5	-0.3
NOV	18	1.1	2.7	0.7	0	0.0	0.0	0.0	1724.0	73.9	0.4
DEC	15	0.9	1.4	0.3	0	0.0	0.0	0.0	1724.2	74.5	0.6
TOTAL		25.9	60.1	16.5		26.4	13.3	0.0			-30.3
REASONABLE MAXIMUM INFLOW CONDITIONS											
JAN	49	3.0	1.0	0.3	0	0.0	9.3	0.0	1729.3	98.2	-6.6
FEB	81	4.5	1.3	0.4	0	0.0	4.1	0.0	1729.3	98.2	0.0
MAR	128	7.9	2.3	0.7	0	0.0	7.2	0.0	1729.3	98.2	0.0
APR	143	8.5	5.1	1.5	0	0.0	7.0	0.0	1729.3	98.2	0.0
MAY	226	13.9	6.3	1.9	5	0.3	11.7	0.0	1729.3	98.2	0.0
JUN	186	11.1	7.7	2.3	59	3.5	5.3	0.0	1729.3	98.2	0.0
JUL	175	10.8	8.8	2.6	167	10.3	0.0	0.0	1728.8	96.1	-2.1
AUG	123	7.6	7.7	2.2	119	7.3	0.0	0.0	1728.4	94.2	-1.9
SEP	64	3.8	6.0	1.7	7	0.4	0.0	0.0	1728.8	95.9	1.7
OCT	42	2.6	4.1	1.2	0	0.0	0.0	0.0	1729.0	97.3	1.4
NOV	55	3.3	2.4	0.7	0	0.0	1.7	0.0	1729.3	98.2	0.9
DEC	44	2.7	1.3	0.4	0	0.0	2.3	0.0	1729.3	98.2	0.0
TOTAL		79.7	54.0	15.9		21.8	48.6	0.0			-6.6

WEBSTER RESERVOIR OPERATION ESTIMATES - 2019

	INFLOW		EVAPORATION		RELEASE REQUIREMENT		RESERVOIR SPILL	REQUIREMENT SHORTAGE	END OF MONTH ELEV	CONT	RESERVOIR CHANGE
	MEAN	1000		1000	MEAN	1000	1000	1000		1000	1000
MONTH	CFS	AF	INCHES	AF	CFS	AF	AF	AF	FT	AF	AF
REASONABLE MINIMUM INFLOW CONDITIONS											
JAN	3	0.2	1.3	0.3	0	0.0	2.2	0.0	1892.4	76.2	-2.3
FEB	4	0.2	1.5	0.3	0	0.0	0.0	0.0	1892.3	76.1	-0.1
MAR	6	0.4	2.9	0.6	0	0.0	0.0	0.0	1892.3	75.9	-0.2
APR	10	0.6	6.5	1.4	0	0.0	0.0	0.0	1892.1	75.1	-0.8
MAY	15	0.9	8.2	1.8	16	1.0	0.0	0.0	1891.7	73.2	-1.9
JUN	10	0.6	10.3	2.2	107	6.4	0.0	0.0	1889.4	65.2	-8.0
JUL	10	0.6	11.4	2.3	253	15.6	0.0	0.0	1883.8	47.9	-17.3
AUG	5	0.3	10.6	1.8	227	14.0	0.0	0.0	1877.8	32.4	-15.5
SEP	3	0.2	7.7	1.0	10	0.6	0.0	0.0	1877.1	31.0	-1.4
OCT	2	0.1	5.1	0.7	0	0.0	0.0	0.0	1876.9	30.4	-0.6
NOV	3	0.2	3.2	0.4	0	0.0	0.0	0.0	1876.8	30.2	-0.2
DEC	2	0.1	1.7	0.2	0	0.0	0.0	0.0	1876.7	30.1	-0.1
TOTAL		4.4	70.4	13.0		37.6	2.2	0.0			-48.4
MOST PROBABLE INFLOW CONDITIONS											
JAN	11	0.7	1.1	0.2	0	0.0	2.8	0.0	1892.4	76.2	-2.3
FEB	16	0.9	1.4	0.3	0	0.0	0.6	0.0	1892.4	76.2	0.0
MAR	26	1.6	2.6	0.6	0	0.0	1.0	0.0	1892.4	76.2	0.0
APR	37	2.2	5.8	1.3	0	0.0	0.9	0.0	1892.4	76.2	0.0
MAY	55	3.4	7.3	1.6	13	0.8	1.0	0.0	1892.4	76.2	0.0
JUN	40	2.4	9.3	2.0	71	4.4	0.0	0.0	1891.3	72.2	-4.0
JUL	37	2.3	10.2	2.2	208	12.8	0.0	0.0	1887.6	59.5	-12.7
AUG	21	1.3	9.5	1.8	161	9.9	0.0	0.0	1884.3	49.1	-10.4
SEP	13	0.8	7.0	1.2	5	0.3	0.0	0.0	1884.0	48.4	-0.7
OCT	6	0.4	4.6	0.8	0	0.0	0.0	0.0	1883.9	48.0	-0.4
NOV	10	0.6	2.8	0.5	0	0.0	0.0	0.0	1883.9	48.1	0.1
DEC	10	0.6	1.5	0.3	0	0.0	0.0	0.0	1884.0	48.4	0.3
TOTAL		17.2	63.1	12.8		28.2	6.3	0.0			-30.1
REASONABLE MAXIMUM INFLOW CONDITIONS											
JAN	44	2.7	1.0	0.2	0	0.0	4.8	0.0	1892.4	76.2	-2.3
FEB	65	3.6	1.3	0.3	0	0.0	3.3	0.0	1892.4	76.2	0.0
MAR	102	6.3	2.4	0.5	0	0.0	5.8	0.0	1892.4	76.2	0.0
APR	148	8.8	5.3	1.2	0	0.0	7.6	0.0	1892.4	76.2	0.0
MAY	219	13.5	6.7	1.5	6	0.4	11.6	0.0	1892.4	76.2	0.0
JUN	159	9.5	8.5	1.9	42	2.5	5.1	0.0	1892.4	76.2	0.0
JUL	149	9.2	9.3	2.0	125	7.7	0.0	0.0	1892.3	75.7	-0.5
AUG	88	5.4	8.6	1.9	101	6.2	0.0	0.0	1891.6	73.0	-2.7
SEP	54	3.2	6.3	1.3	2	0.1	0.0	0.0	1892.0	74.8	1.8
OCT	29	1.8	4.2	0.9	0	0.0	0.0	0.0	1892.3	75.7	0.9
NOV	40	2.4	2.6	0.6	0	0.0	1.3	0.0	1892.4	76.2	0.5
DEC	37	2.3	1.4	0.3	0	0.0	2.0	0.0	1892.4	76.2	0.0
TOTAL		68.7	57.6	12.6		16.9	41.5	0.0			-2.3

WACONDA LAKE OPERATION ESTIMATES - 2019

	INFLOW		EVAPORATION		RELEASE REQUIRMENT		RESERVOIR SPILL	REQUIREMENT SHORTAGE	END OF MONTH		RESERVOIR CHANGE
	MEAN	1000		1000	MEAN	1000	1000	1000	ELEV	CONT 1000	1000
MONTH	CFS	AF	INCHES	AF	CFS	AF	AF	AF	FT	AF	AF
REASONABLE MINIMUM INFLOW CONDITIONS											
JAN	29	1.8	1.2	0.9	19	1.2	27.3	0.0	1454.6	207.1	-27.6
FEB	43	2.4	1.4	1.0	20	1.1	0.3	0.0	1454.6	207.1	0.0
MAR	83	5.1	2.7	1.9	18	1.1	0.0	0.0	1454.7	209.2	2.1
APR	86	5.1	6.8	4.8	17	1.0	0.0	0.0	1454.7	208.5	-0.7
MAY	99	6.1	8.3	5.9	18	1.1	0.0	0.0	1454.6	207.6	-0.9
JUN	84	5.0	10.4	7.4	45	2.7	0.0	0.0	1454.2	202.5	-5.1
JUL	138	8.5	12.3	8.6	156	9.6	0.0	0.0	1453.3	192.8	-9.7
AUG	50	3.1	10.6	7.1	125	7.7	0.0	0.0	1452.3	181.1	-11.7
SEP	39	2.3	8.5	5.4	35	2.1	0.0	0.0	1451.8	175.9	-5.2
OCT	29	1.8	5.5	3.4	21	1.3	0.0	0.0	1451.6	173.0	-2.9
NOV	34	2.0	2.9	1.8	27	1.6	0.0	0.0	1451.4	171.6	-1.4
DEC	28	1.7	1.4	0.9	24	1.5	0.0	0.0	1451.4	170.9	-0.7
TOTAL		44.9	72.0	49.1		32.0	27.6	0.0			-63.8
MOST PROBABLE INFLOW CONDITIONS											
JAN	80	4.9	1.0	0.8	10	0.6	31.1	0.0	1454.6	207.1	-27.6
FEB	119	6.6	1.3	0.9	10	0.6	5.1	0.0	1454.6	207.1	0.0
MAR	222	13.7	2.4	1.7	10	0.6	8.9	0.0	1454.8	209.6	2.5
APR	233	13.9	6.1	4.4	8	0.5	0.0	0.0	1455.5	218.6	9.0
MAY	268	16.5	7.5	5.5	10	0.6	9.6	0.0	1455.6	219.4	0.8
JUN	228	13.6	9.4	6.9	32	2.0	4.7	0.0	1455.6	219.4	0.0
JUL	372	22.9	11.0	8.1	112	6.9	7.9	0.0	1455.6	219.4	0.0
AUG	136	8.4	9.5	7.0	89	5.5	0.0	0.0	1455.2	215.3	-4.1
SEP	104	6.2	7.6	5.5	21	1.3	0.0	0.0	1455.2	214.7	-0.6
OCT	81	5.0	4.9	3.6	10	0.6	0.0	0.0	1455.2	215.5	0.8
NOV	92	5.5	2.6	1.9	15	0.9	0.0	0.0	1455.5	218.2	2.7
DEC	73	4.5	1.3	1.0	13	0.8	13.8	0.0	1454.6	207.1	-11.1
TOTAL		121.7	64.6	47.3		20.9	81.1	0.0			-27.6
REASONABLE MAXIMUM INFLOW CONDITIONS											
JAN	234	14.4	0.9	0.7	3	0.2	41.1	0.0	1454.6	207.1	-27.6
FEB	350	19.5	1.2	0.9	4	0.2	18.4	0.0	1454.6	207.1	0.0
MAR	662	40.8	2.2	1.6	5	0.3	36.4	0.0	1454.8	209.6	2.5
APR	689	41.1	5.6	4.0	5	0.3	27.0	0.0	1455.6	219.4	9.8
MAY	795	49.0	6.9	5.1	5	0.3	43.6	0.0	1455.6	219.4	0.0
JUN	678	40.4	8.6	6.3	22	1.3	32.8	0.0	1455.6	219.4	0.0
JUL	1101	67.8	10.1	7.4	70	4.3	56.1	0.0	1455.6	219.4	0.0
AUG	404	24.9	8.7	6.4	57	3.5	15.0	0.0	1455.6	219.4	0.0
SEP	309	18.4	7.0	5.1	12	0.7	12.6	0.0	1455.6	219.4	0.0
OCT	240	14.8	4.5	3.3	6	0.4	11.1	0.0	1455.6	219.4	0.0
NOV	272	16.2	2.4	1.8	5	0.3	14.1	0.0	1455.6	219.4	0.0
DEC	216	13.3	1.2	0.9	5	0.3	24.4	0.0	1454.6	207.1	-12.3
TOTAL		360.6	59.3	43.5		12.1	332.6	0.0			-27.6

CEDAR BLUFF RESERVOIR OPERATION ESTIMATES - 2019

	INFLOW		EVAPORATION		RELEASE REQUIRMENT		RESERVOIR SPILL	REQUIREMENT SHORTAGE	END OF MONTH ELEV	CONT	RESERVOIR CHANGE
	MEAN	1000		1000	MEAN	1000	1000	1000		1000	1000
MONTH	CFS	AF	INCHES	AF	CFS	AF	AF	AF	FT	AF	AF
REASONABLE MINIMUM INFLOW CONDITIONS											
JAN	3	0.2	1.6	0.3	0	0.0	0.0	0.0	2122.7	66.2	-0.1
FEB	4	0.2	1.7	0.3	0	0.0	0.0	0.0	2122.6	66.1	-0.1
MAR	6	0.4	3.0	0.6	0	0.0	0.0	0.0	2122.5	65.9	-0.2
APR	10	0.6	7.7	1.5	0	0.0	0.0	0.0	2122.2	65.0	-0.9
MAY	15	0.9	9.2	1.7	3	0.2	0.0	0.0	2121.9	64.0	-1.0
JUN	17	1.0	11.4	2.1	3	0.2	0.0	0.0	2121.5	62.7	-1.3
JUL	21	1.3	13.7	2.5	11	0.7	0.0	0.0	2121.0	60.8	-1.9
AUG	15	0.9	11.7	2.1	11	0.7	0.0	0.0	2120.4	58.9	-1.9
SEP	5	0.3	10.1	1.8	3	0.2	0.0	0.0	2119.8	57.2	-1.7
OCT	2	0.1	7.1	1.2	0	0.0	0.0	0.0	2119.4	56.1	-1.1
NOV	3	0.2	3.3	0.6	0	0.0	0.0	0.0	2119.3	55.7	-0.4
DEC	2	0.1	1.9	0.3	0	0.0	0.0	0.0	2119.2	55.5	-0.2
TOTAL		6.2	82.4	15.0		2.0	0.0	0.0			-10.8
MOST PROBABLE INFLOW CONDITIONS											
JAN	5	0.3	1.4	0.3	0	0.0	0.0	0.0	2122.7	66.3	0.0
FEB	7	0.4	1.6	0.3	0	0.0	0.0	0.0	2122.7	66.4	0.1
MAR	13	0.8	2.7	0.5	0	0.0	0.0	0.0	2122.8	66.7	0.3
APR	20	1.2	7.0	1.4	0	0.0	0.0	0.0	2122.7	66.5	-0.2
MAY	31	1.9	8.3	1.6	2	0.1	0.0	0.0	2122.8	66.7	0.2
JUN	32	1.9	10.2	2.0	2	0.1	0.0	0.0	2122.7	66.5	-0.2
JUL	42	2.6	12.3	2.4	10	0.6	0.0	0.0	2122.6	66.1	-0.4
AUG	29	1.8	10.5	2.0	6	0.4	0.0	0.0	2122.4	65.5	-0.6
SEP	12	0.7	9.0	1.7	2	0.1	0.0	0.0	2122.1	64.4	-1.1
OCT	5	0.3	6.4	1.2	0	0.0	0.0	0.0	2121.8	63.5	-0.9
NOV	7	0.4	3.0	0.6	0	0.0	0.0	0.0	2121.8	63.3	-0.2
DEC	5	0.3	1.7	0.3	0	0.0	0.0	0.0	2121.8	63.3	0.0
TOTAL		12.6	74.1	14.3		1.3	0.0	0.0			-3.0
REASONABLE MAXIMUM INFLOW CONDITIONS											
JAN	13	0.8	1.3	0.3	0	0.0	0.0	0.0	2122.8	66.8	0.5
FEB	18	1.0	1.4	0.3	0	0.0	0.0	0.0	2123.0	67.5	0.7
MAR	31	1.9	2.4	0.5	0	0.0	0.0	0.0	2123.4	68.9	1.4
APR	50	3.0	6.2	1.2	0	0.0	0.0	0.0	2123.9	70.7	1.8
MAY	71	4.4	7.4	1.5	3	0.2	0.0	0.0	2124.7	73.4	2.7
JUN	77	4.6	9.1	1.9	3	0.2	0.0	0.0	2125.4	75.9	2.5
JUL	99	6.1	10.9	2.3	3	0.2	0.0	0.0	2126.4	79.5	3.6
AUG	68	4.2	9.4	2.1	0	0.0	0.0	0.0	2127.0	81.6	2.1
SEP	29	1.7	8.0	1.8	0	0.0	0.0	0.0	2127.0	81.5	-0.1
OCT	11	0.7	5.7	1.3	0	0.0	0.0	0.0	2126.8	80.9	-0.6
NOV	15	0.9	2.6	0.6	0	0.0	0.0	0.0	2126.8	81.2	0.3
DEC	11	0.7	1.5	0.3	0	0.0	0.0	0.0	2127.0	81.6	0.4
TOTAL		30.0	65.9	14.1		0.6	0.0	0.0			15.3

TABLE 5

FLOOD DAMAGES PREVENTED BY NEBRASKA-KANSAS PROJECTS RESERVOIRS

RESERVOIR	DURING FY 2018	PRIOR TO 2018	ACCUMULATED TOTAL
BONNY	$100	$2,869,700	$2,869,800
ENDERS	$200	$3,613,300	$3,613,500
SWANSON	$6,400	$44,252,600	$44,259,000
HUGH BUTLER	$300	$6,424,000	$6,424,300
HARRY STRUNK	$351,300	$19,044,100	$19,395,400
KEITH SEBELIUS	$200	$4,181,500	$4,181,700
HARLAN COUNTY	$364,500	$240,832,200	$241,196,700
LOVEWELL	$345,400	$158,723,000	$159,068,400
KIRWIN	$6,600	$104,225,200	$104,231,800
WEBSTER	$3,800	$122,102,000	$122,105,800
WACONDA	$101,900	$1,356,185,800	$1,356,287,700
CEDAR BLUFF	$1,030,800	$139,500,900	$140,531,700
TOTAL	$2,211,500	$2,201,954,300	$2,204,165,800

Estimates of damages prevented are received from the Army Corps of Engineer's Kansas City District Office. The Accumulated Totals date from 1951 through 2018. Cumulative totals are revised by the Corps of Engineers in some cases to reflect data not previously included in the reporting and may not match previous cumulative totals.

Construction Cost of storage dams was $208,954,130.
The reservoirs upstream of Harlan County Lake did not receive benefits for damages prevented from 1972 to 1993.

TABLE 6
WATER DIVERTED IN 2018 AND THE
ESTIMATED DIVERSION FOR 2019
(Units - Acre-Feet)

Irrigation District and Canal	2018 Irrigation Operations From	To	10-Year Average Diversion (2008-2017)	2018 Diversion	Estimated Diversion in 2019
Mirage Flats Irrigation District					
Mirage Flats Canal	5/02	08/16	11,297	5,891	11,000
Ainsworth Irrigation District					
Ainsworth Canal	5/20	9/20	70,191	54,456	75,000
Twin Loups Irrigation District					
Above Davis Creek	4/16	9/17	45,518	27,731	46,000
Below Davis Creek	5/14	09/17	42,774	36,173	44,000
Total Twin Loups Irrigation District			88,292	63,904	90,000
Frenchman Valley Irrigation District					
Culbertson Canal	5/01	10/03	5,107	7,426	8,000
H & RW Irrigation District					
Culbertson Extension Canal	Did not run.		0	0	0
Frenchman-Cambridge Irrigation District					
Meeker-Driftwood Canal	6/18	9/07	16,398	14,295	18,000
Red Willow Canal	Did not run.		926	0	5,000
Bartley Canal	4/24	9/14	6,238	9,289	9,000
Cambridge Canal	5/09	9/18	23,381	21,005	28,000
Total Frenchman-Cambridge Irrigation District			46,943	44,589	60,000
Almena Irrigation District					
Almena Canal	Did not run.		1,698	0	3,000
Bostwick Irrigation District in Nebraska					
Franklin Canal	6/18	8/31	16,933	15,780	18,000
Naponee Canal	7/01	9/01	886	660	1,000
Franklin Pump Canal	6/18	8/27	898	813	1,000
Superior Canal	5/30	8/30	6,184	8,121	8,000
Courtland Canal (Nebraska)	4/06	9/05	461	532	1,000
Total Bostwick Irrigation District in Nebraska			25,362	25,906	29,000
Kansas-Bostwick Irrigation District					
Courtland Canal above Lovewell	4/16	9/07	20,103	17,007	22,000
Courtland Canal below Lovewell	5/24	9/04	36,061	30,608	36,000
Total Kansas-Bostwick Irrigation District			56,164	47,615	58,000
Kirwin Irrigation District					
Kirwin Canal	6/18	9/04	15,632	16,707	18,000
Webster Irrigation District					
Osborne Canal	6/20	8/31	6,955	11,163	12,000
Glen Elder Irrigation District	7/25	09/05	3,159	1,914	5,000
TOTAL			330,800	279,571	369,000

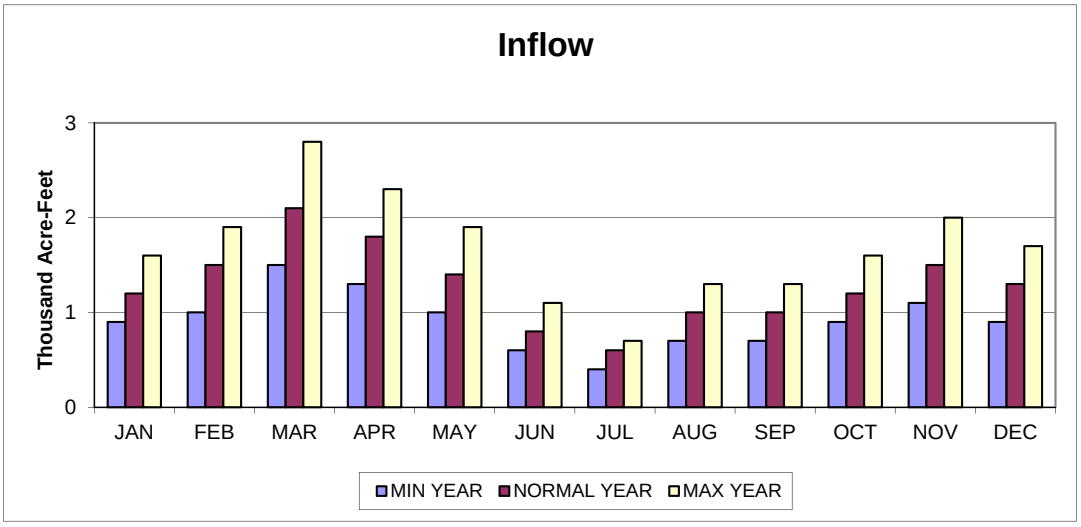
TABLE 7
NEBRASKA-KANSAS PROJECTS
Summary of Precipitation, Reservoir Storage and Inflows
CALENDAR YEAR 2018

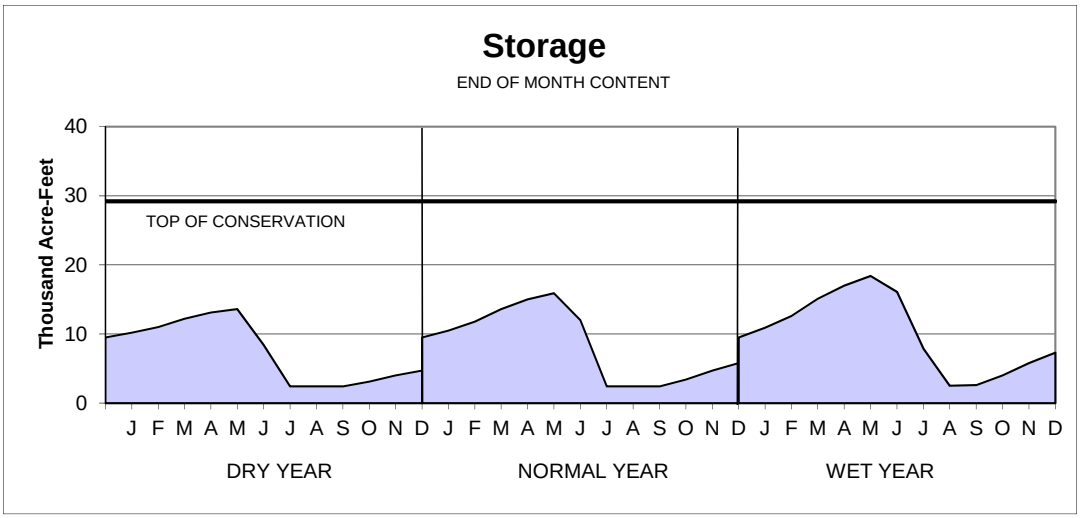
Reservoir	Total Precip. Inches	Percent Of Average %	Storage 12-31-17 AF	Storage 12-31-18 AF	Gain or Loss AF	Maximum Content AF	Storage Date	Minimum Content AF	Storage Date	Total Inflow AF	Percent Of Most Probable %
Box Butte	21.60	127	5,200	9,478	4,278	9,462	DEC 31	4,445	MAR 30	21,920	146
Merritt	24.99	119	61,100	61,723	623	67,631	JUN 20	58,068	SEP 2	211,086	113
Calamus	29.07	118	98,123	99,655	1,532	121,461	MAY 3	90,231	OCT 8	296,165	111
Davis Creek	35.43	140	12,710	13,223	513	31,768	JUN 19	11,739	APR 23	48,098	99
Bonny	22.55	129	0	0	0	0	N/A	0	N/A	3,575	47
Enders	19.96	104	8,595	9,362	767	9,760	MAY 30	8,601	JAN 1	5,495	86
Swanson	24.86	124	51,342	59,359	8,017	70,048	JUN 26	51,406	JAN 1	34,575	131
Hugh Butler	25.42	129	15,626	19,619	3,993	19,619	DEC 31	15,636	JAN 1	9,151	80
Harry Strunk	26.98	128	23,855	28,994	5,139	36,258	MAY 31	23,921	JAN 1	36,069	91
Keith Sebelius	33.71	136	13,379	16,570	3,191	16,570	DEC 31	13,391	JAN 1	8,881	133
Harlan County	29.61	128	224,247	255,028	30,781	258,075	MAY 31	221,133	AUG 31	120,146	113
Lovewell	38.07	138	31,494	38,229	6,735	40,607	JUL 3	26,503	AUG 14	60,454	102
Kirwin	31.93	134	93,163	104,832	11,669	108,150	MAY 30	93,211	JAN 1	56,980	225
Webster	37.17	157	78,246	78,514	268	104,504	MAY 31	73,179	AUG 30	102,468	614
Waconda	25.34	99	213,045	234,715	21,670	272,343	OCT 15	204,126	MAR 16	298,269	246
Cedar Bluff	28.95	138	51,101	66,266	15,165	66,266	DEC 31	49,041	MAY 28	26,131	206

EXHIBIT 1B

BOX BUTTE RESERVOIR

2019 OPERATION PLAN





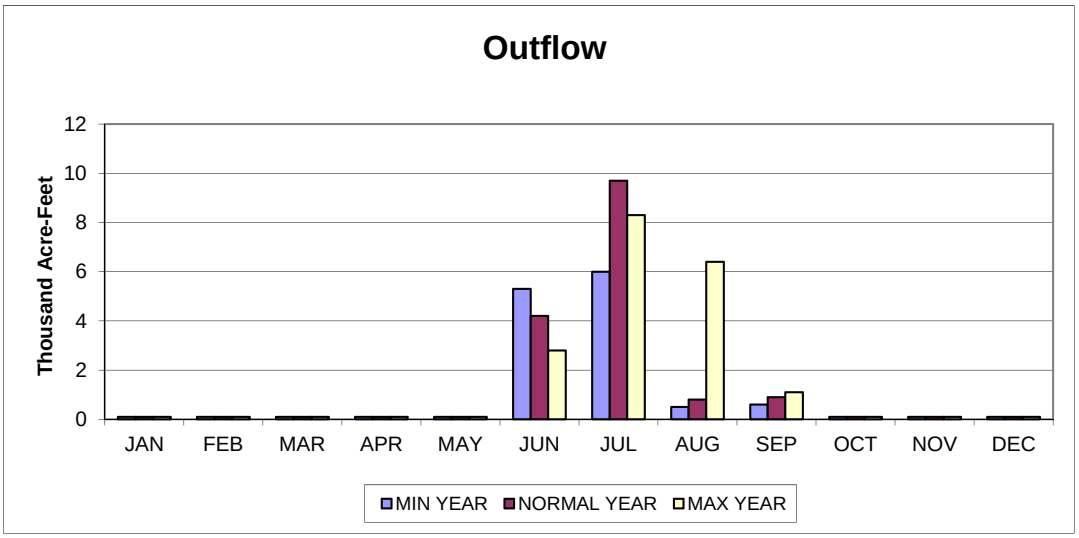
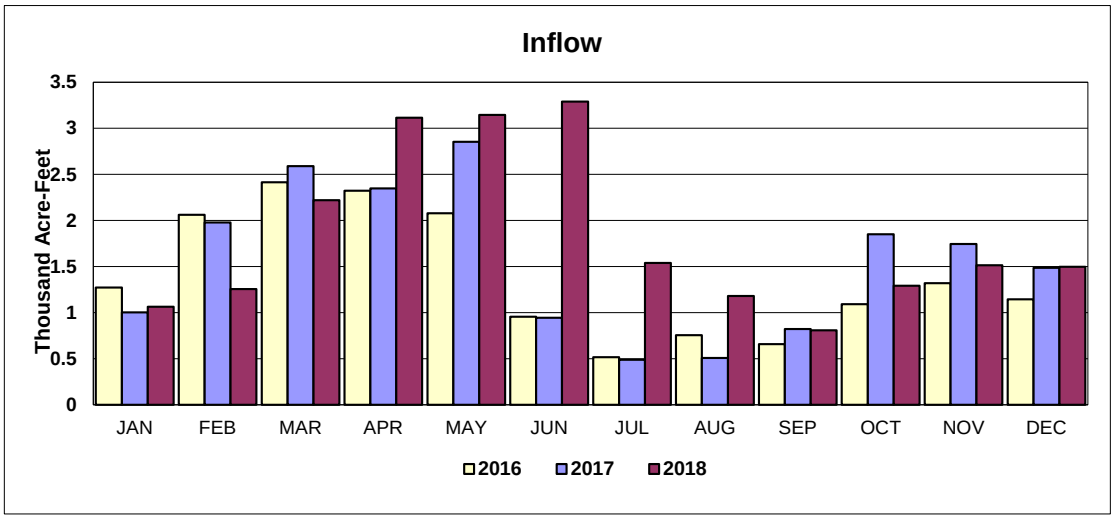
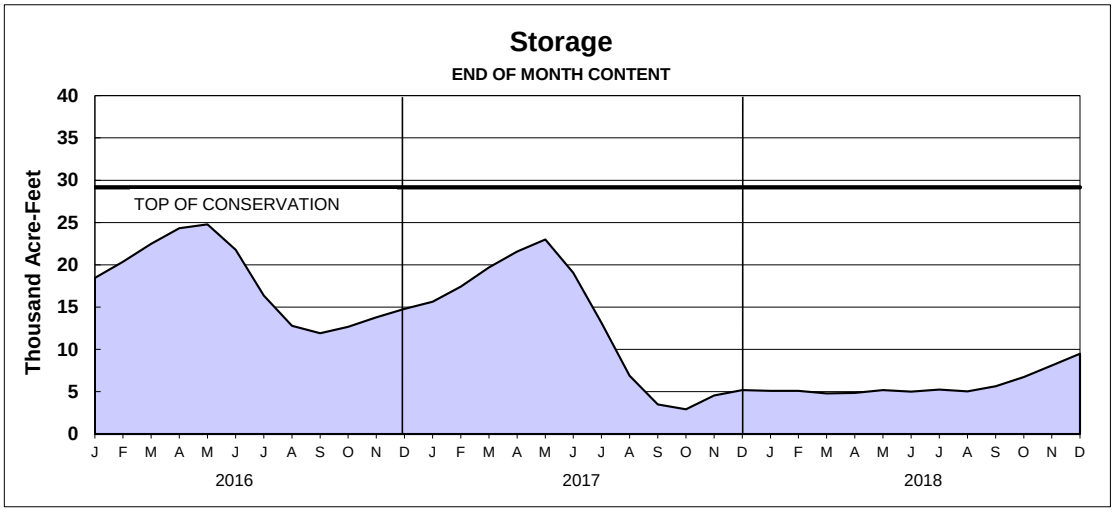


EXHIBIT 1A

BOX BUTTE RESERVOIR

ACTUAL OPERATION





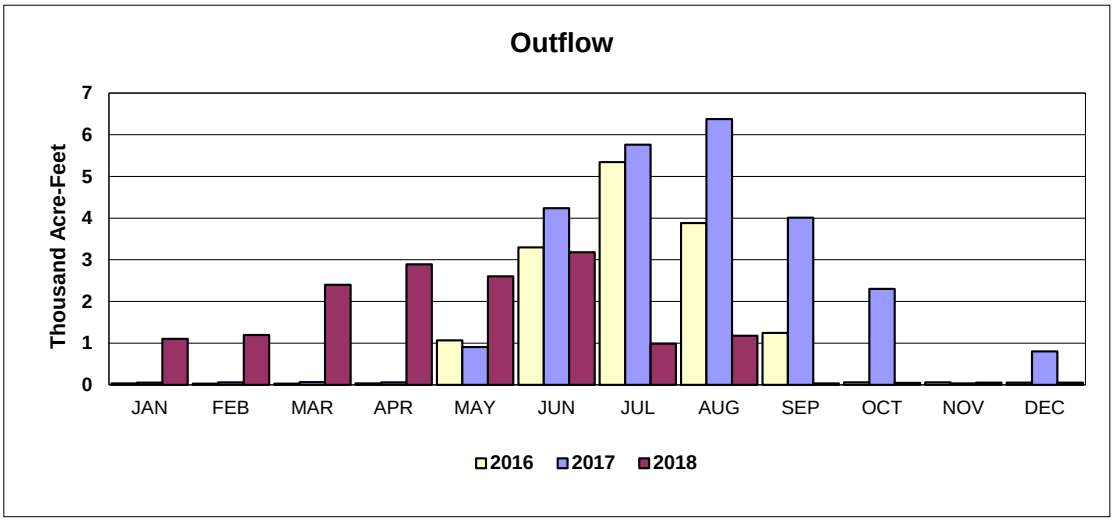
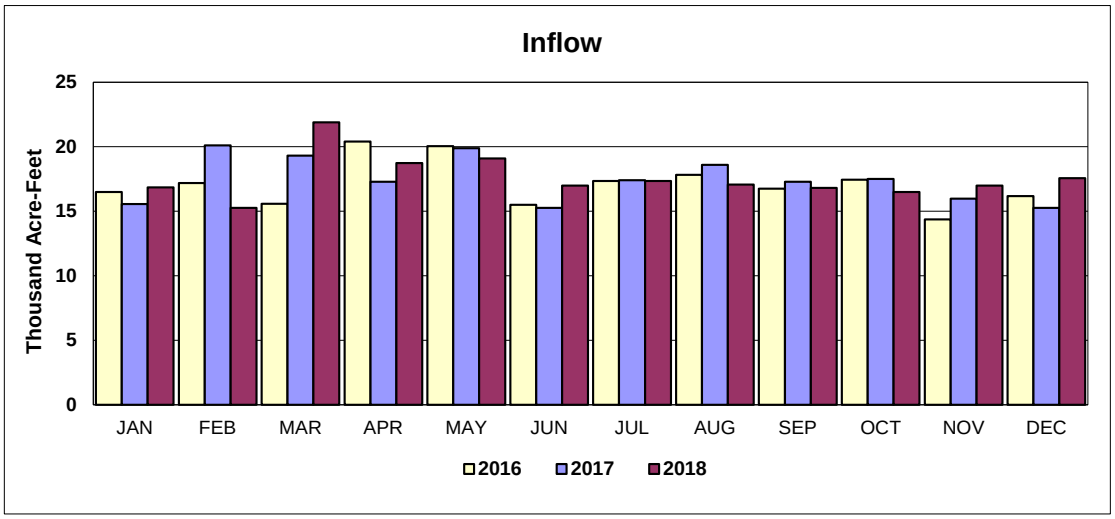
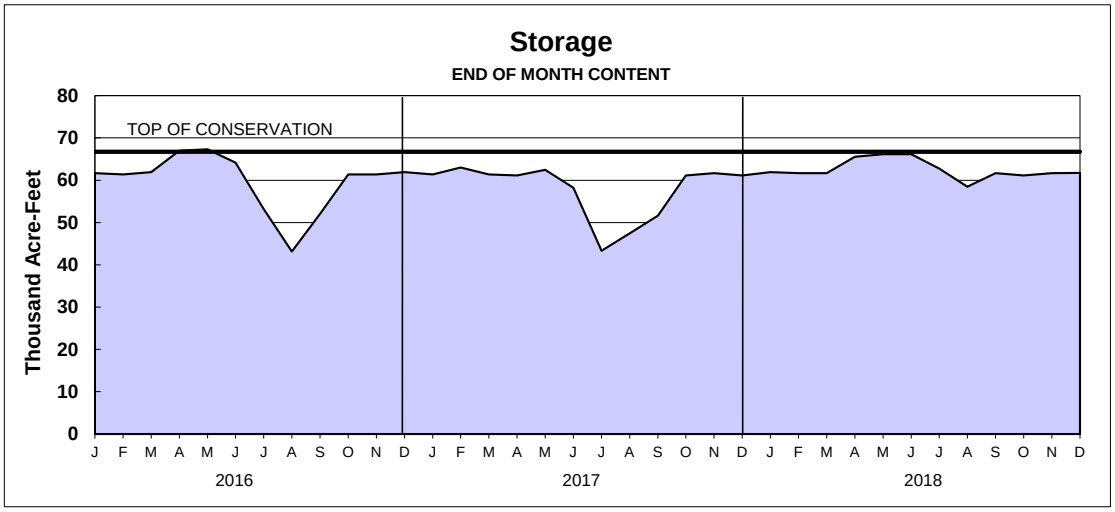


EXHIBIT 2A

MERRITT RESERVOIR

ACTUAL OPERATION





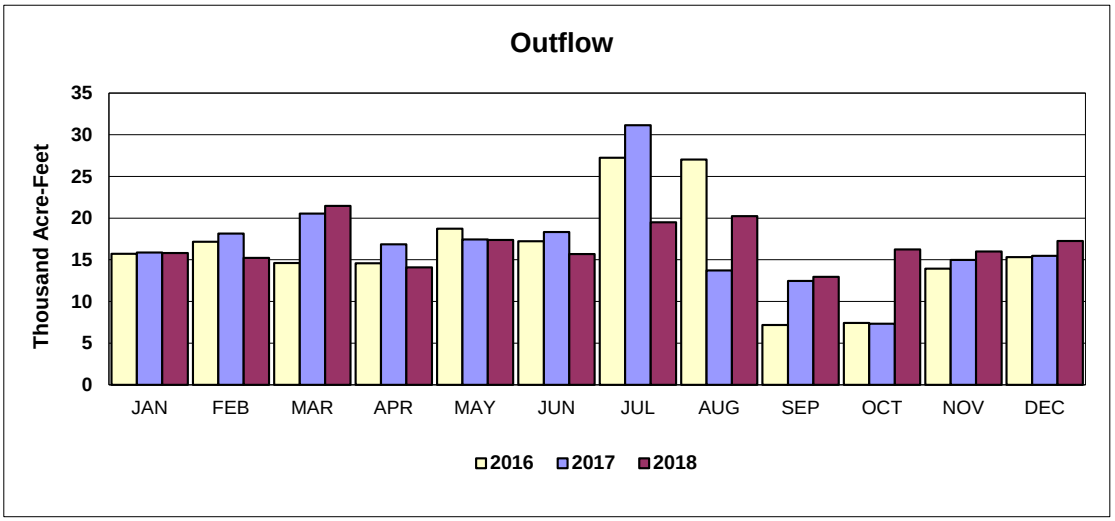
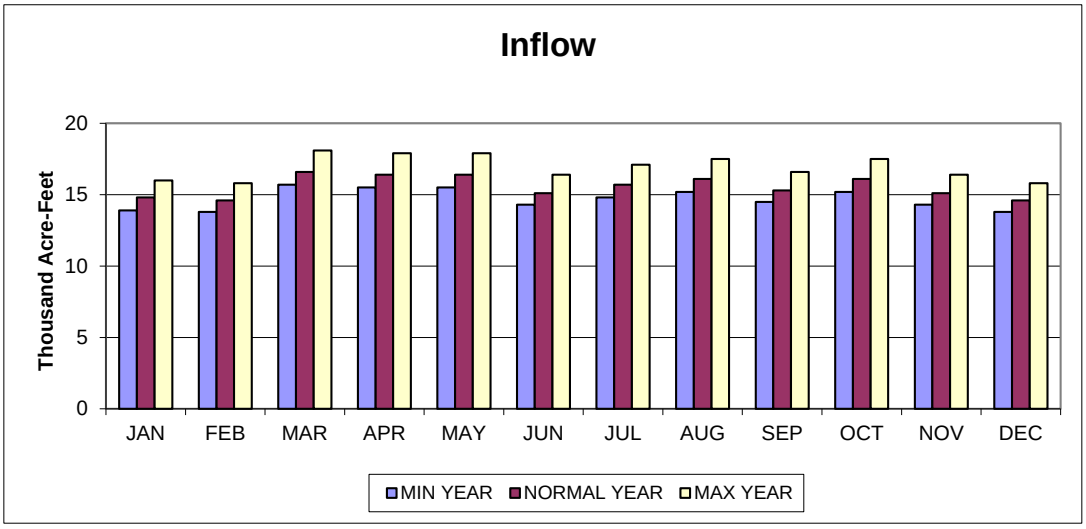
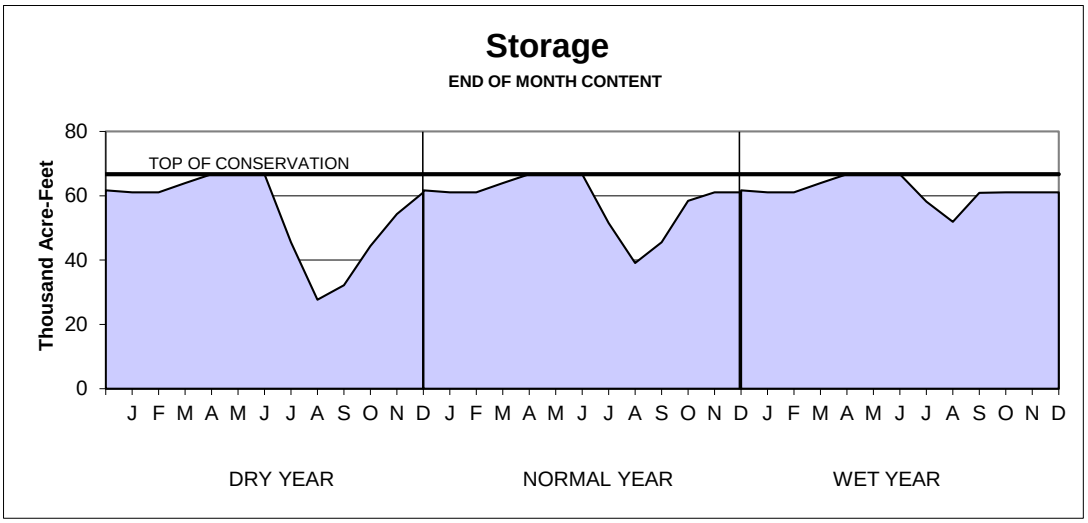


EXHIBIT 2B

MERRITT RESERVOIR

2019 OPERATION PLAN





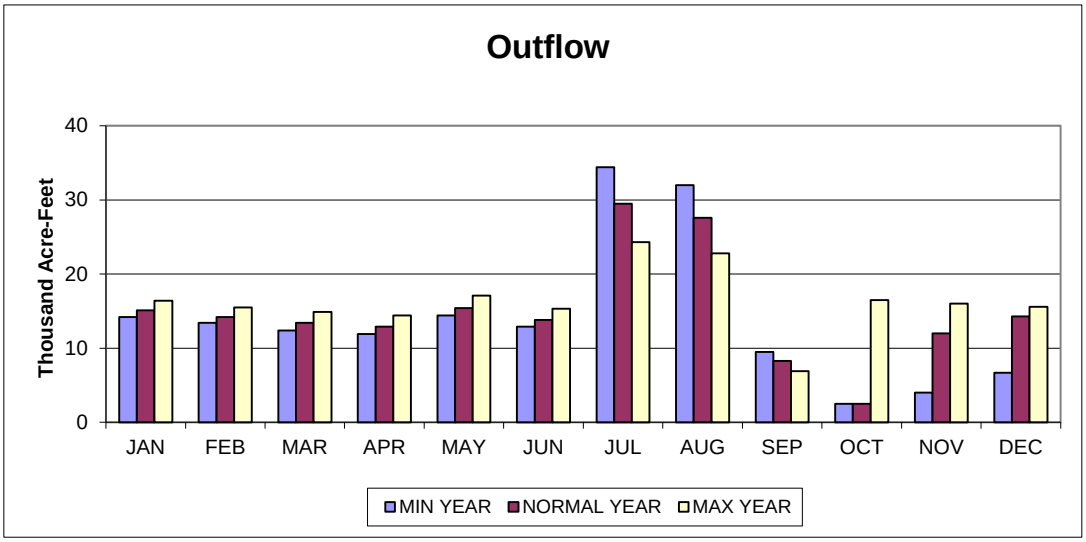
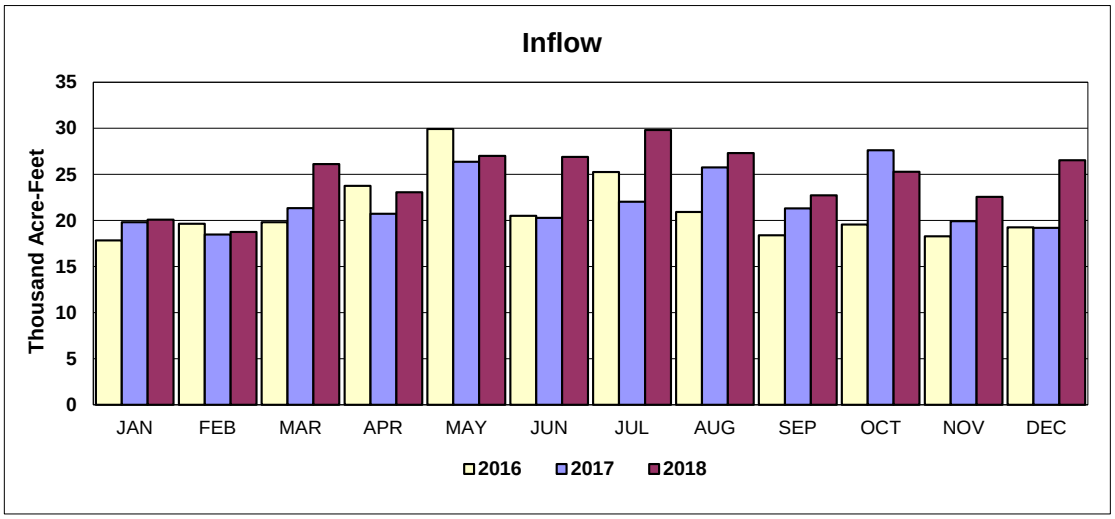
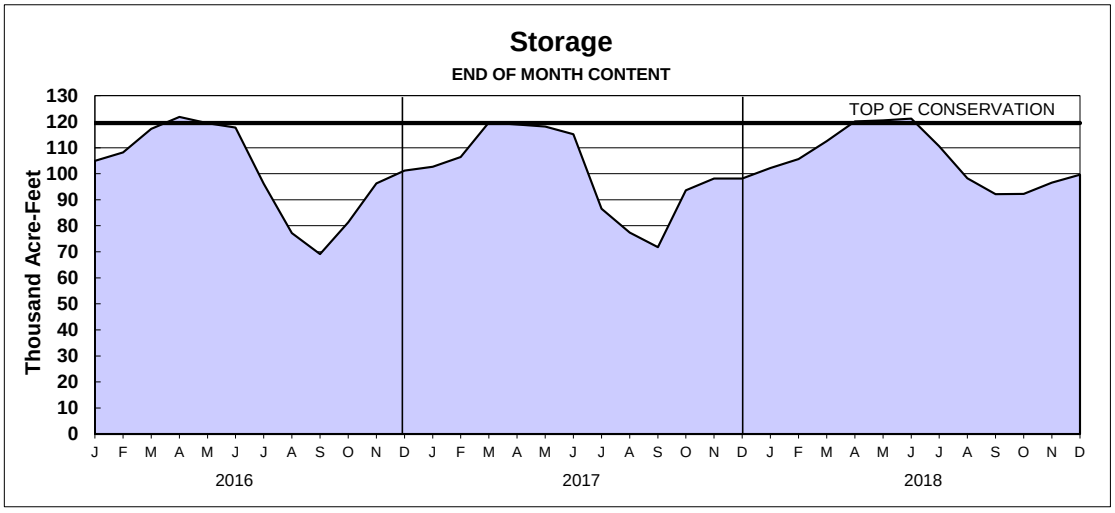


EXHIBIT 3A

CALAMUS RESERVOIR

ACTUAL OPERATION





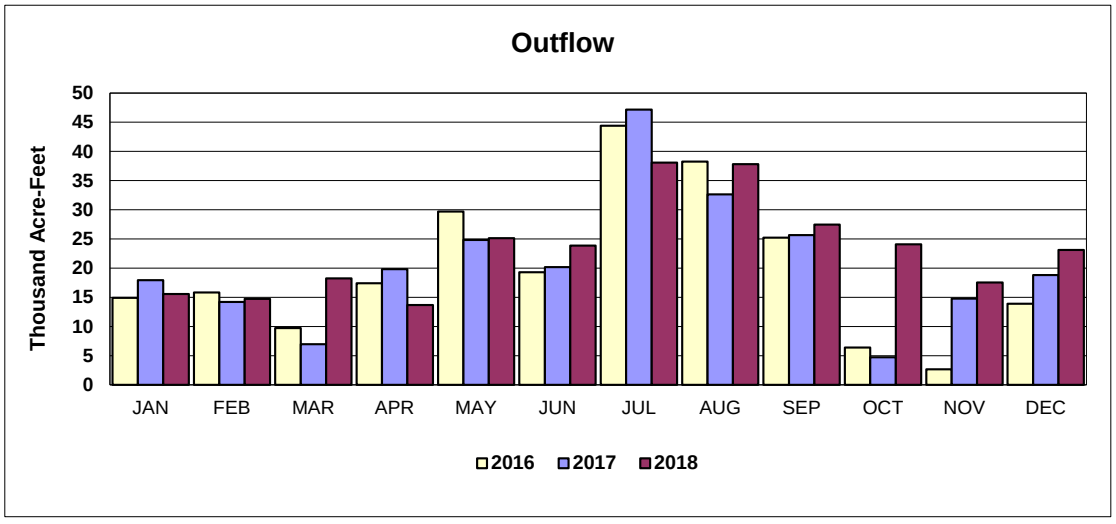
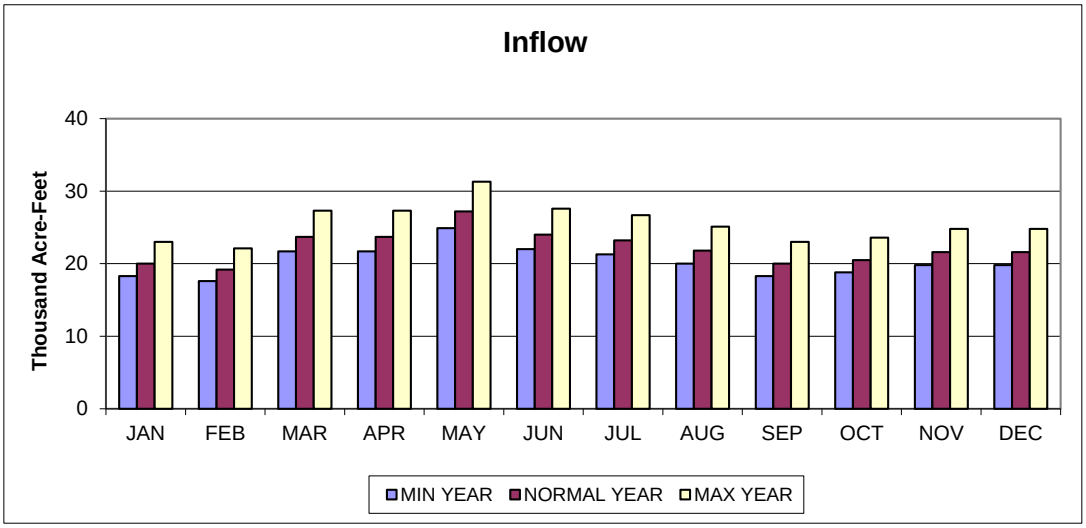
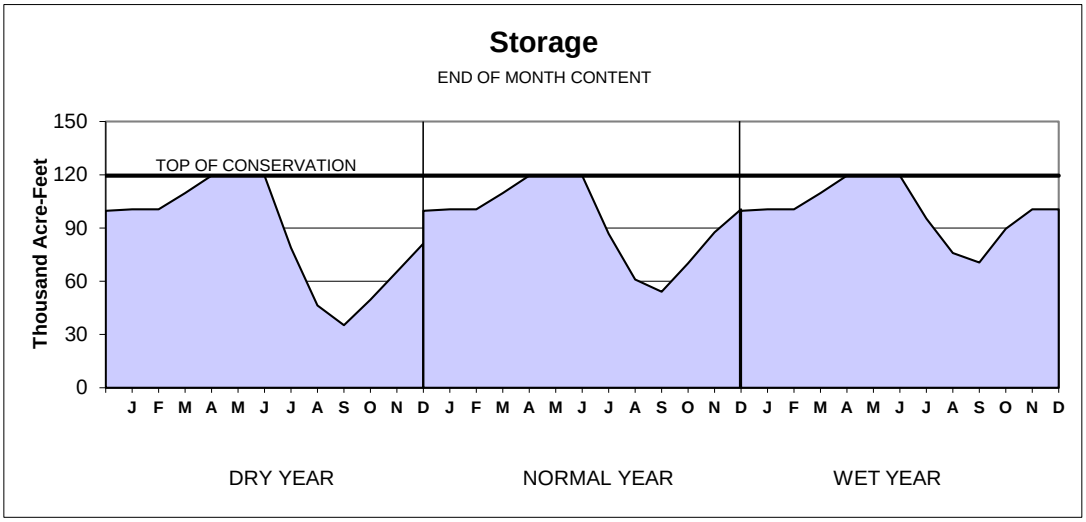


EXHIBIT 3B

CALAMUS RESERVOIR

2019 OPERATION PLAN





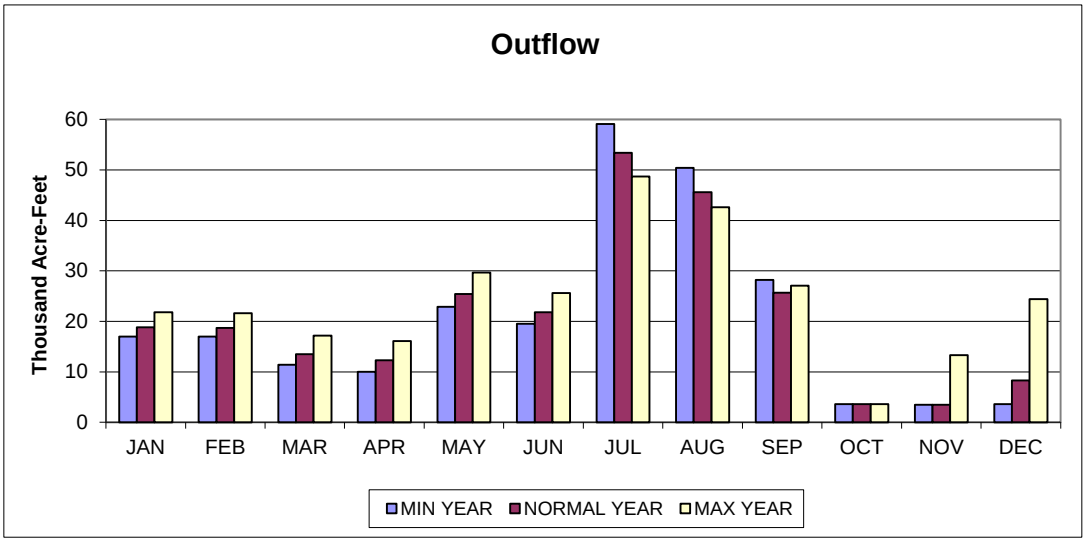
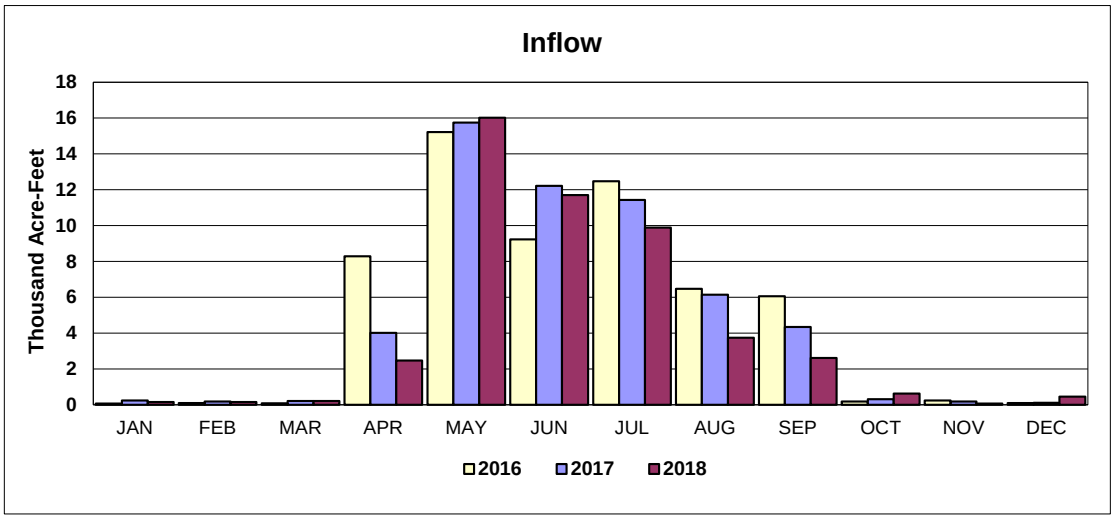
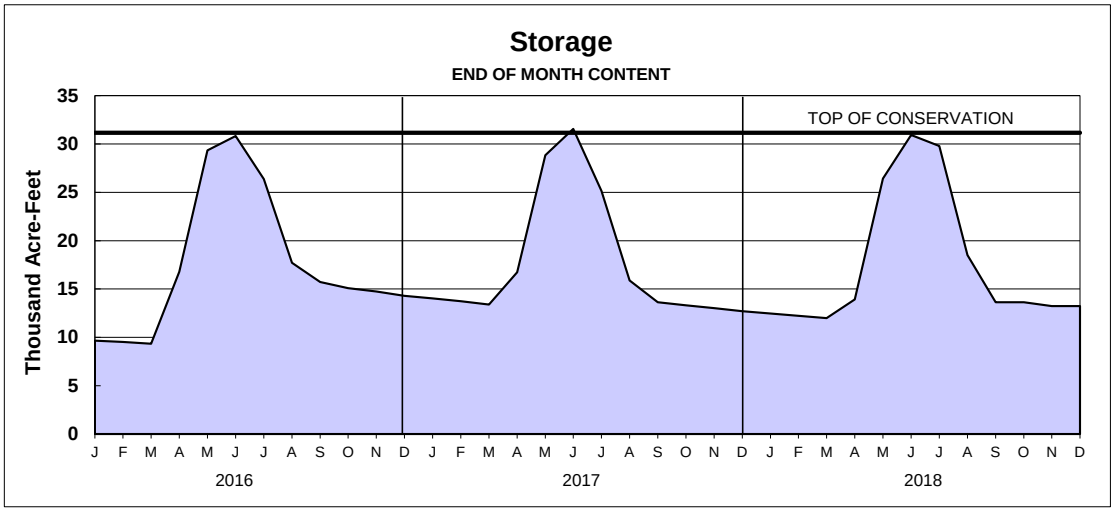


EXHIBIT 4A

DAVIS CREEK RESERVOIR

ACTUAL OPERATION





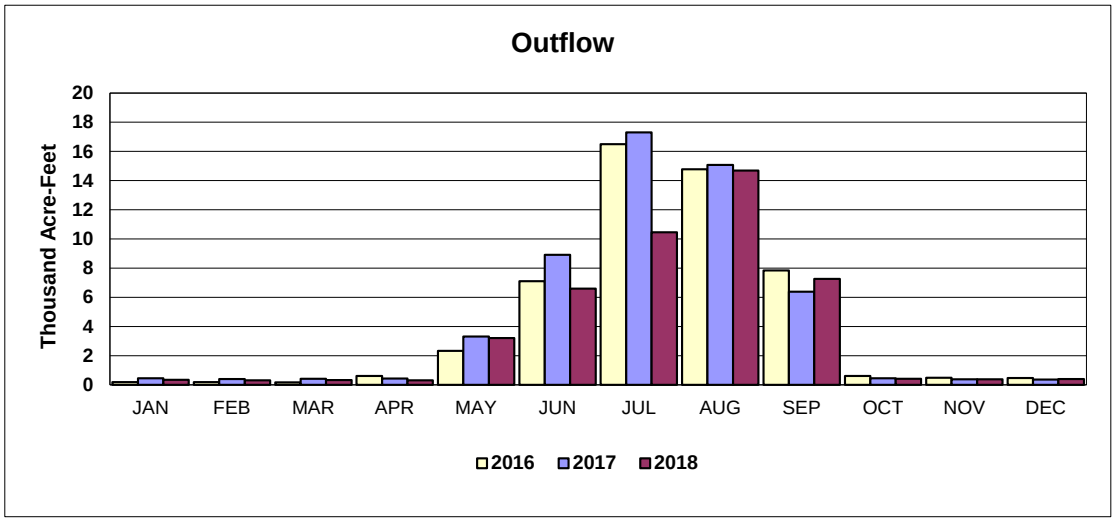
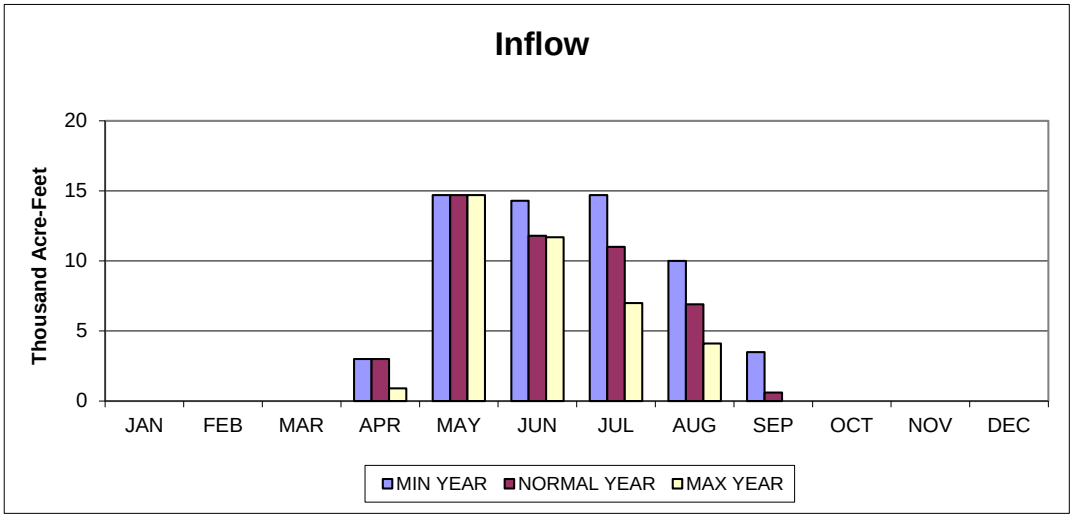
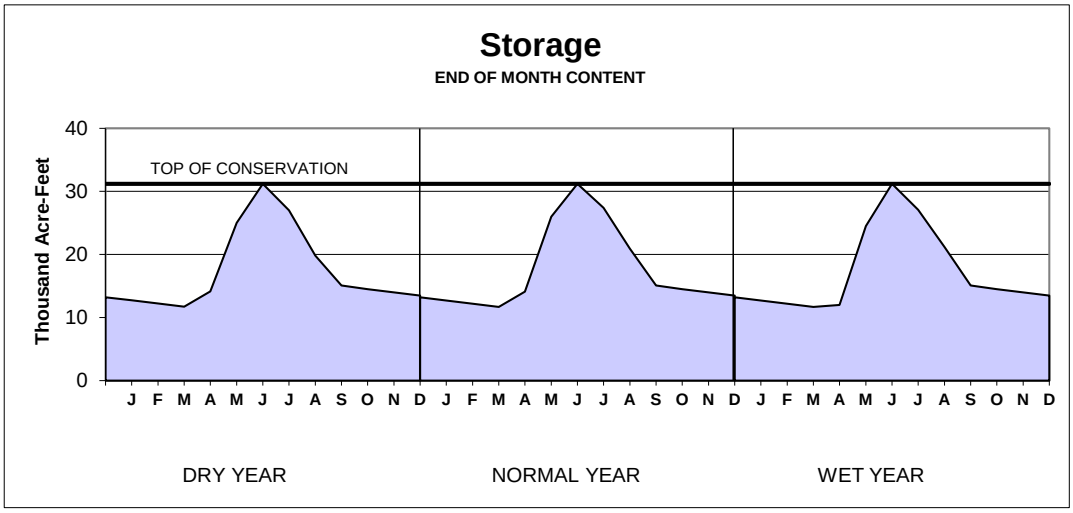


EXHIBIT 4B

DAVIS CREEK RESERVOIR

2019 OPERATION PLAN





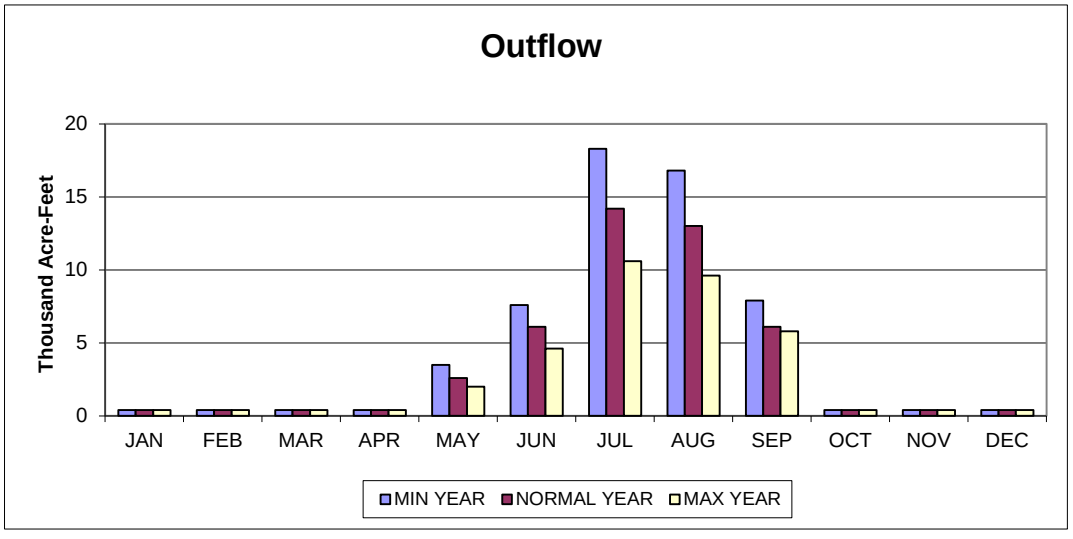
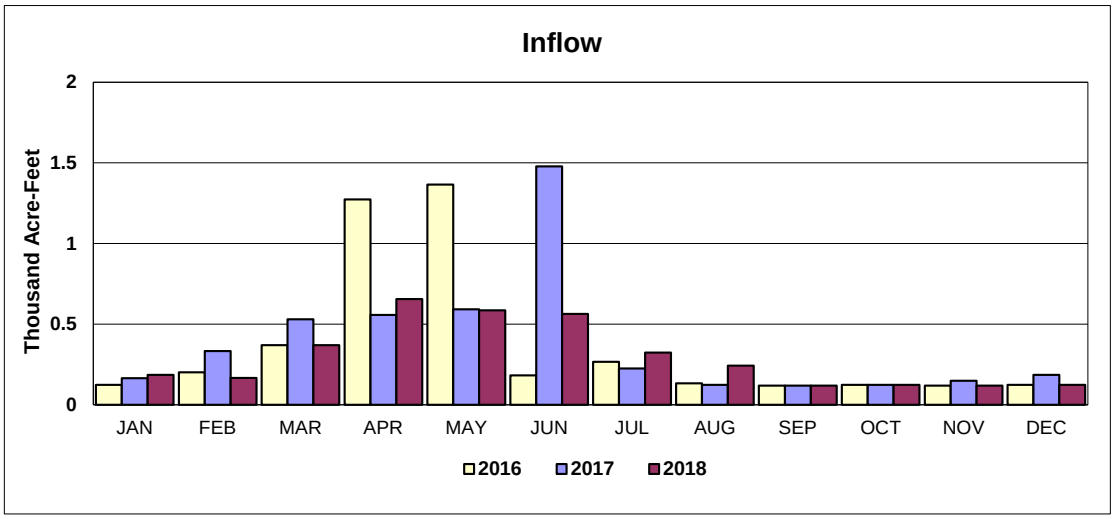
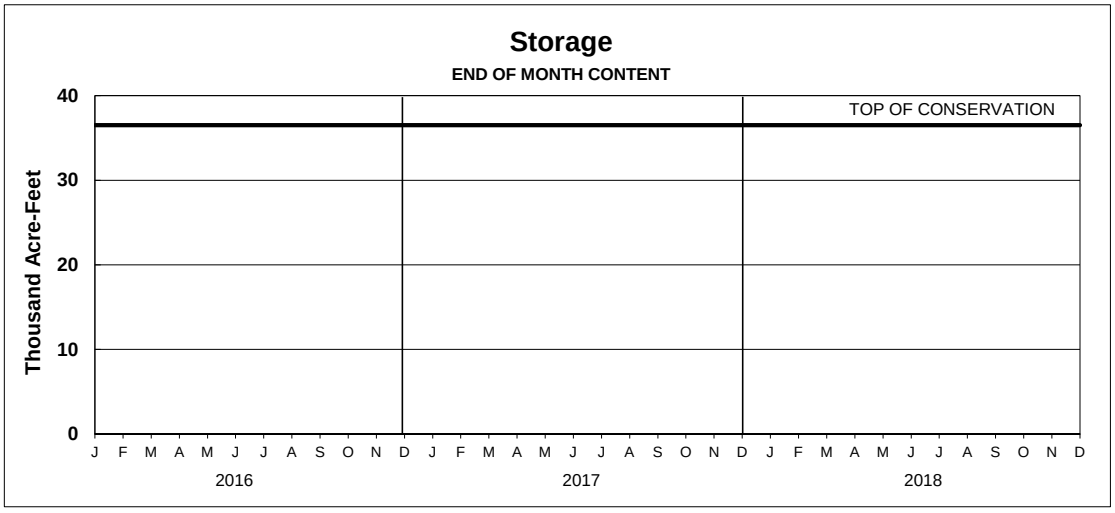


EXHIBIT 5A

BONNY RESERVOIR

ACTUAL OPERATION





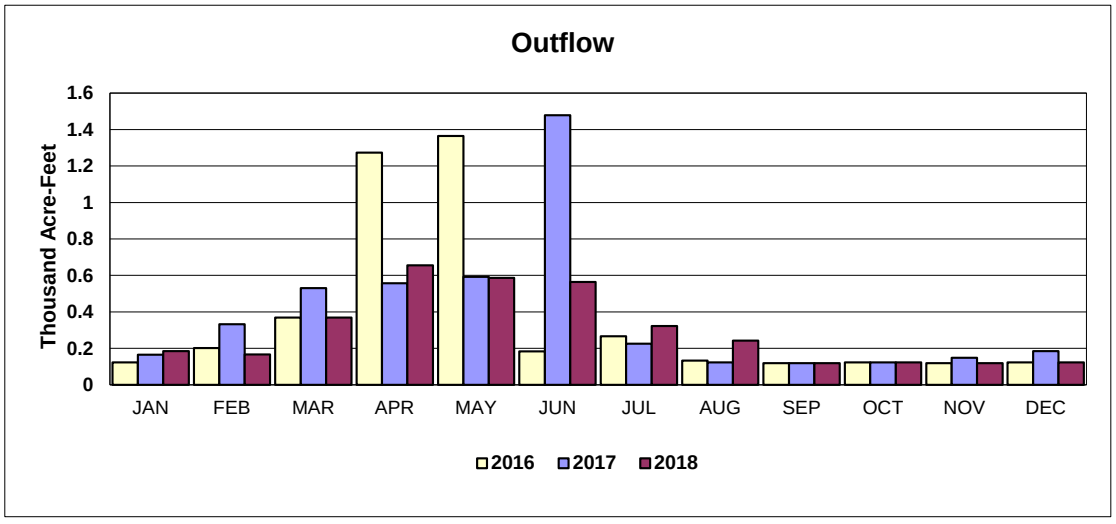
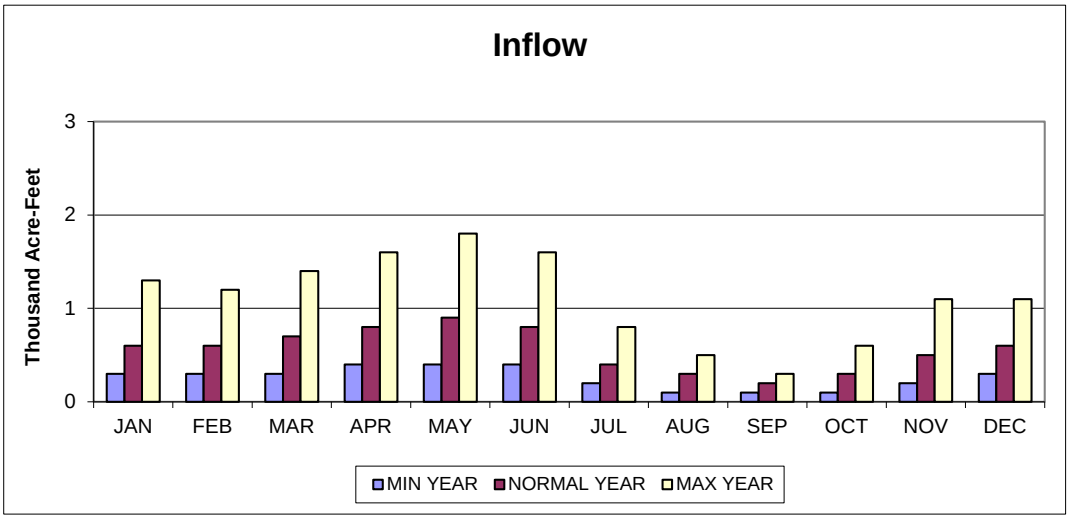
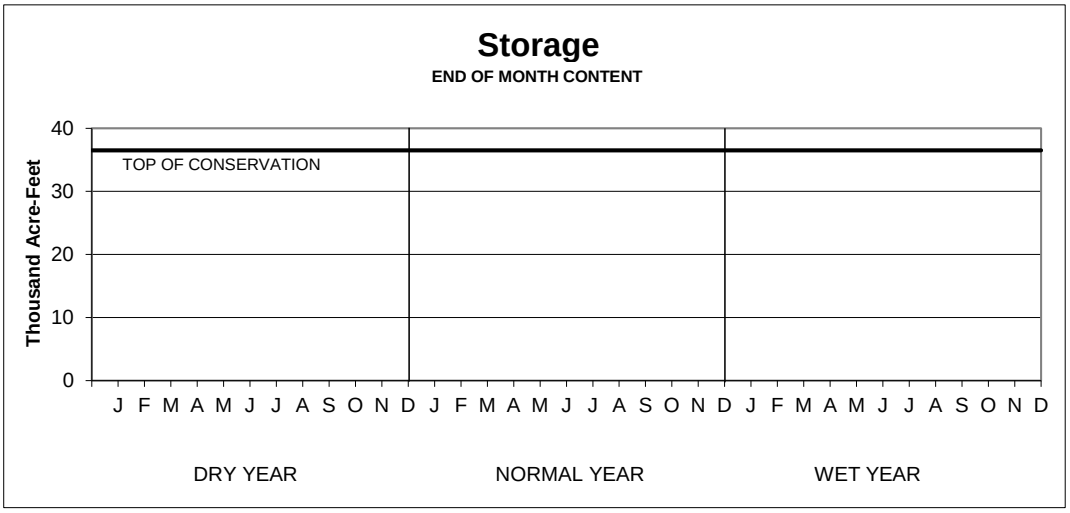


EXHIBIT 5B

BONNY RESERVOIR

2019 OPERATION PLAN





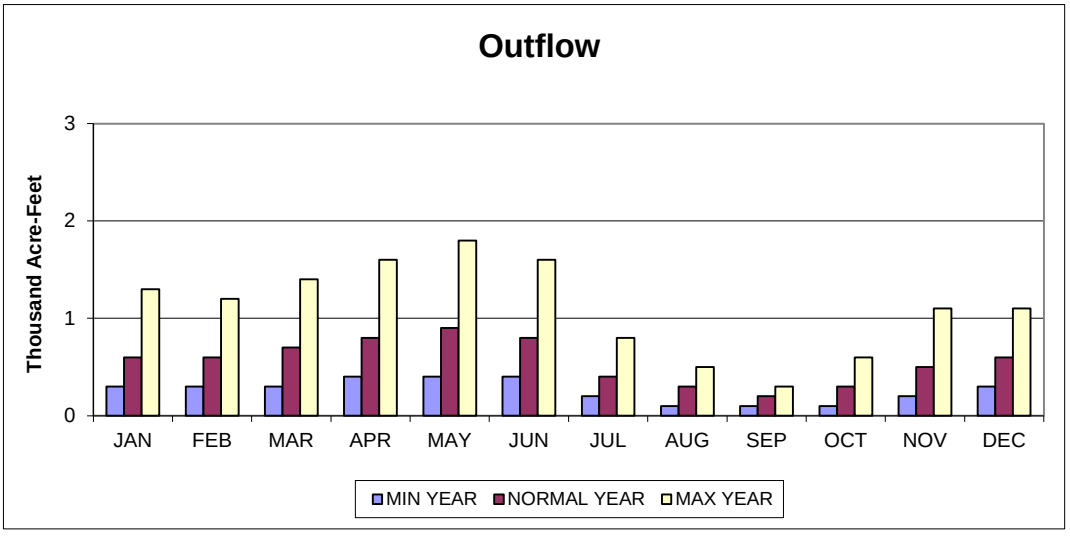
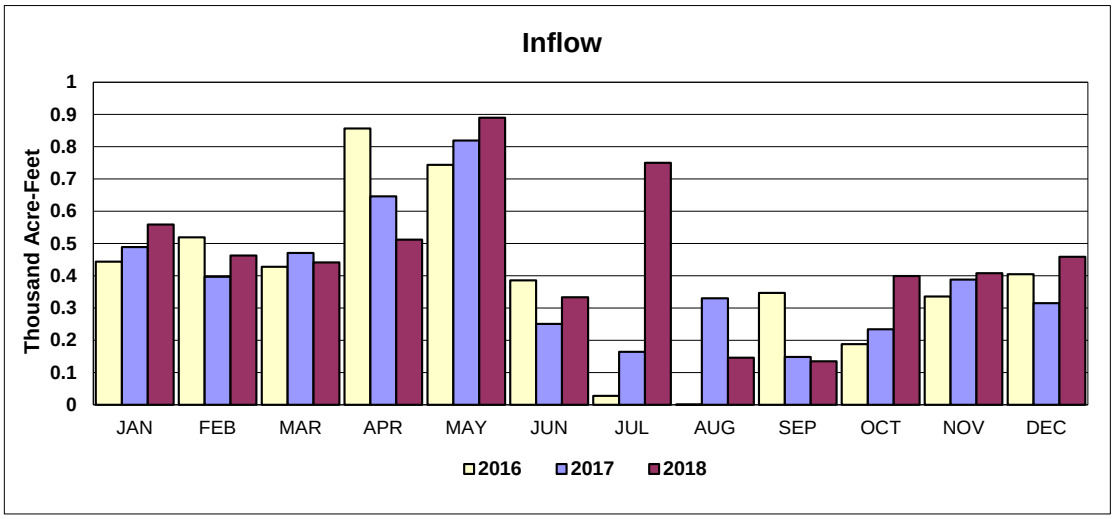
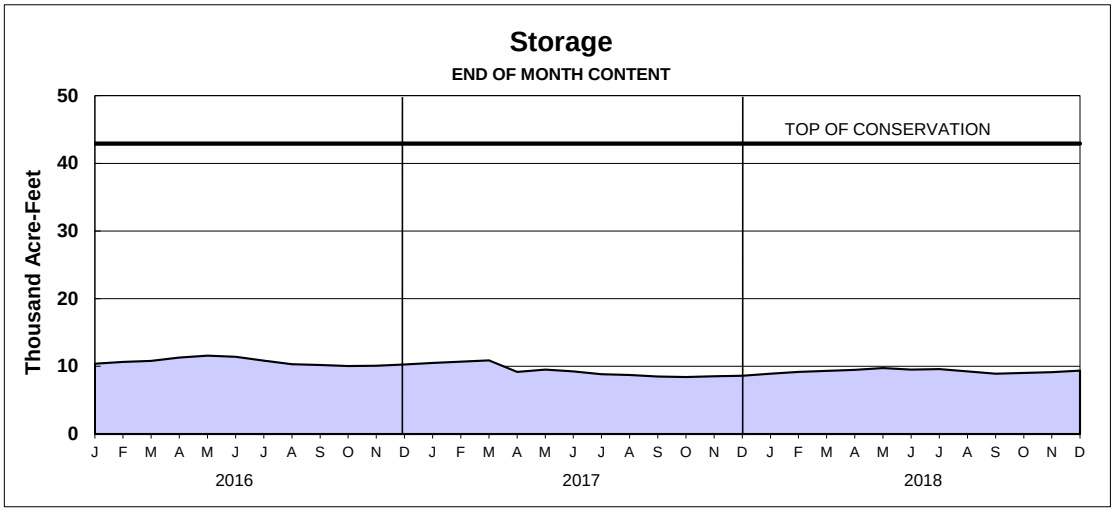


EXHIBIT 6A

ENDERS RESERVOIR

ACTUAL OPERATION





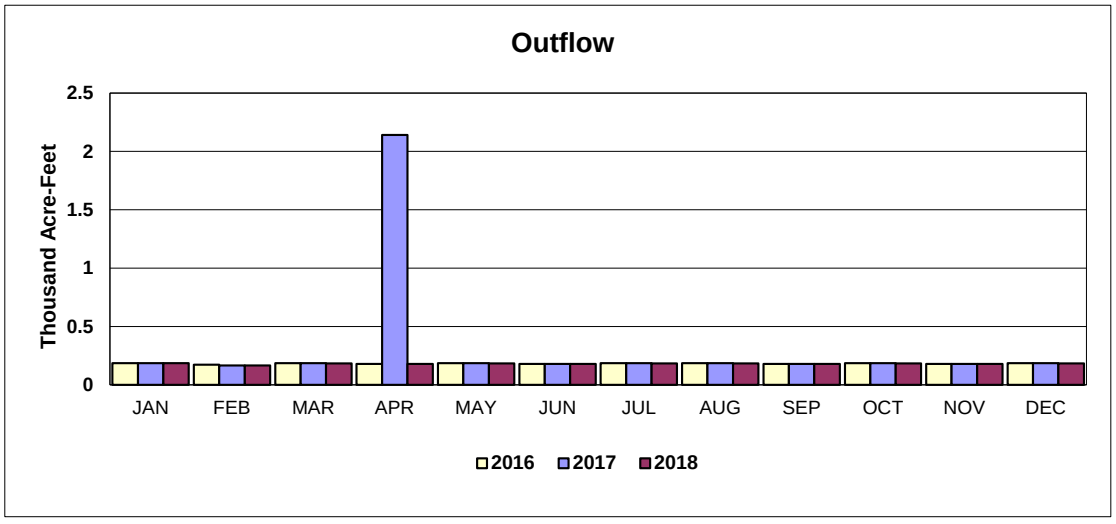
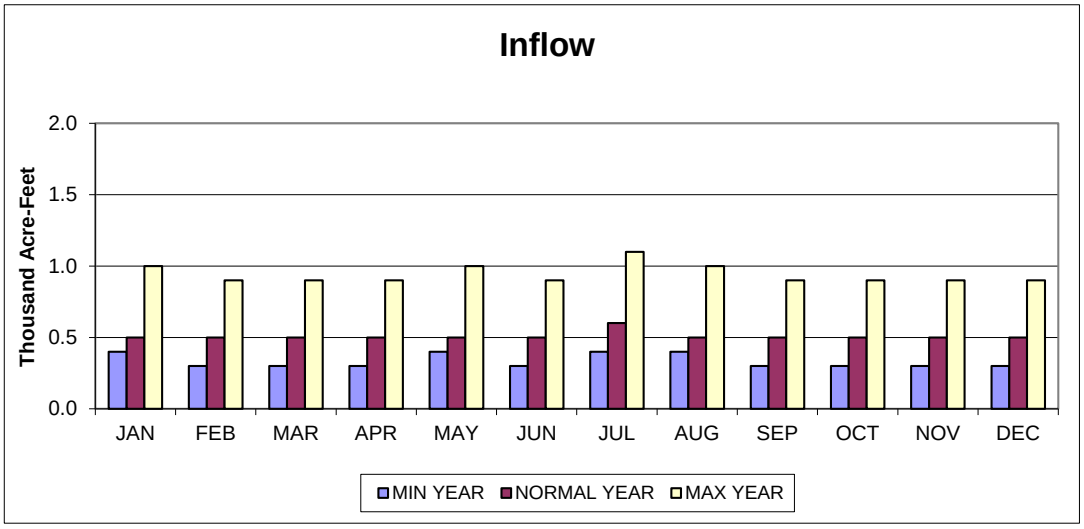
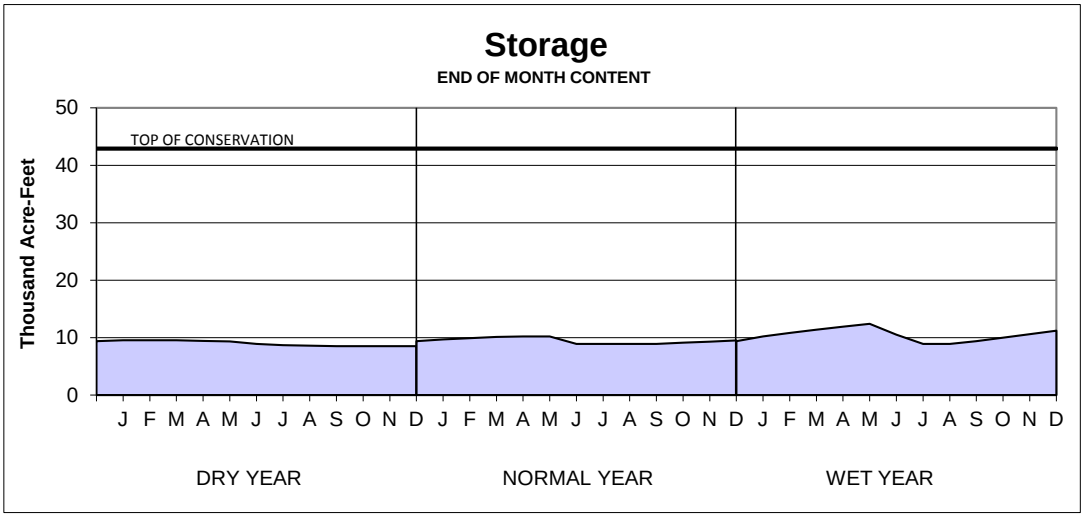


EXHIBIT 6B

ENDERS RESERVOIR

2019 OPERATION PLAN





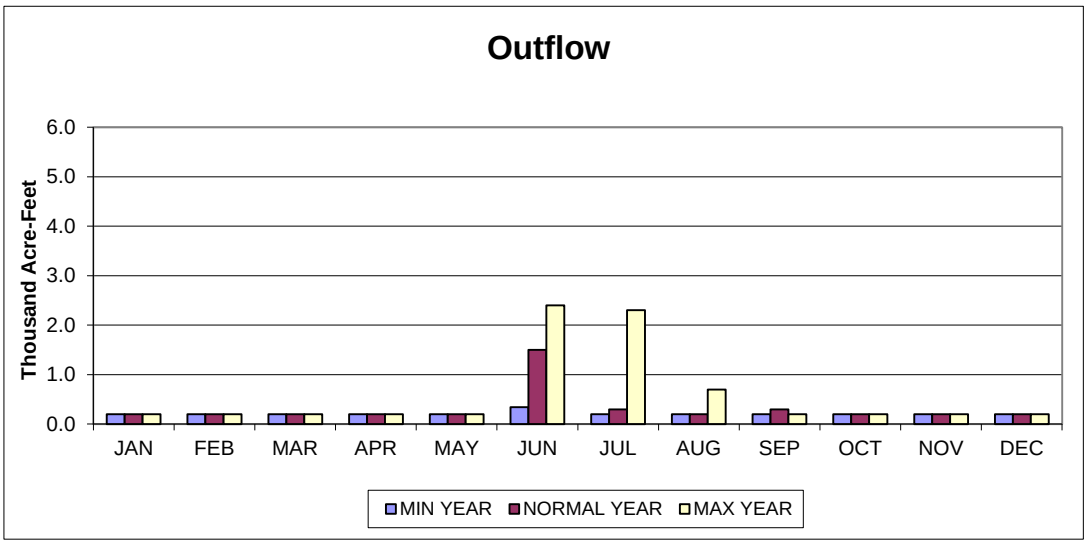
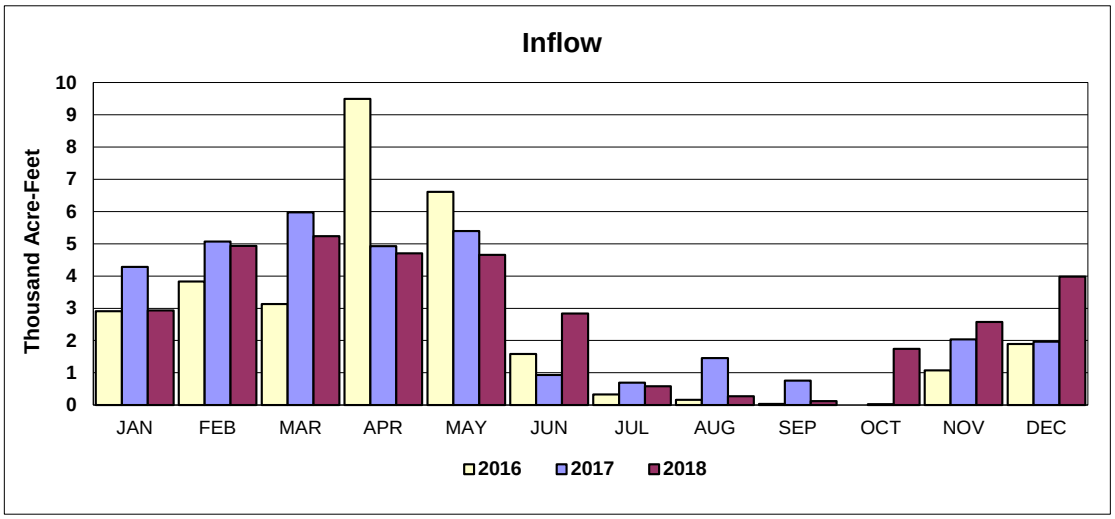
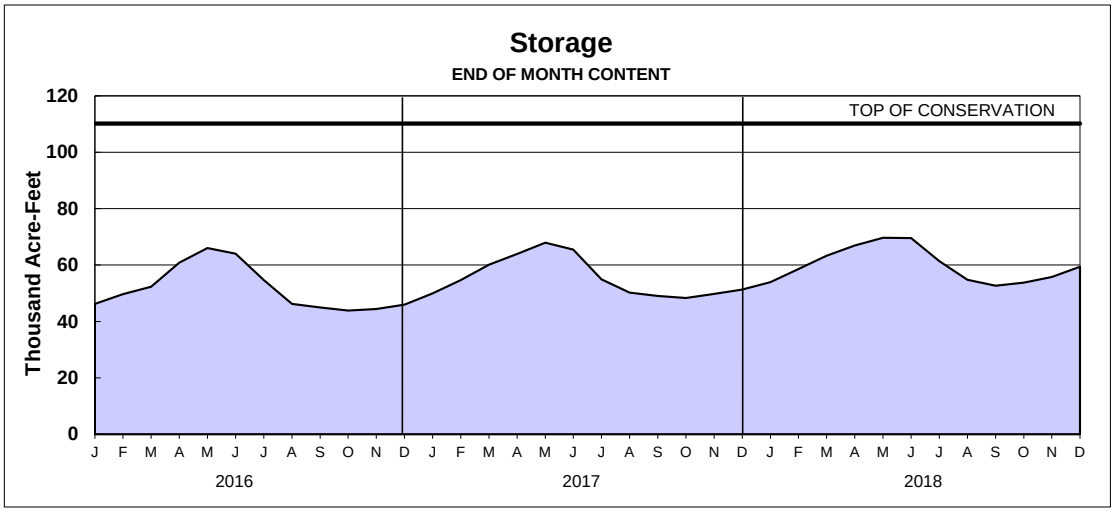


EXHIBIT 7A

SWANSON LAKE

ACTUAL OPERATION





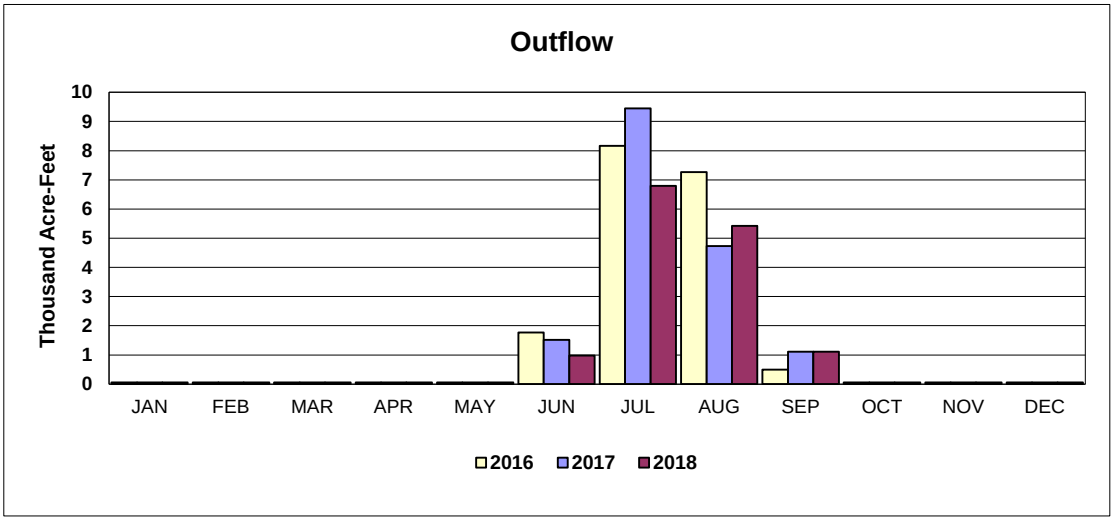
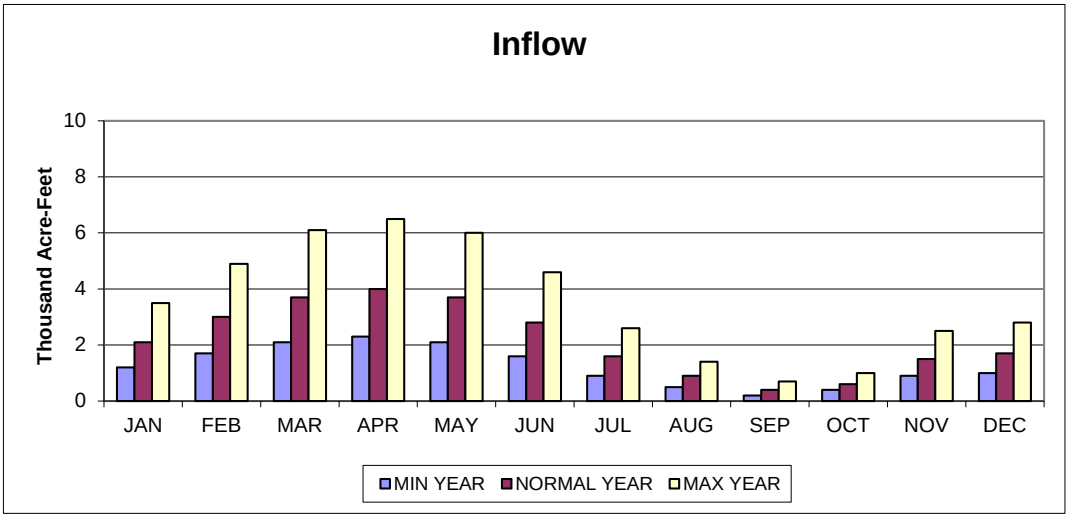
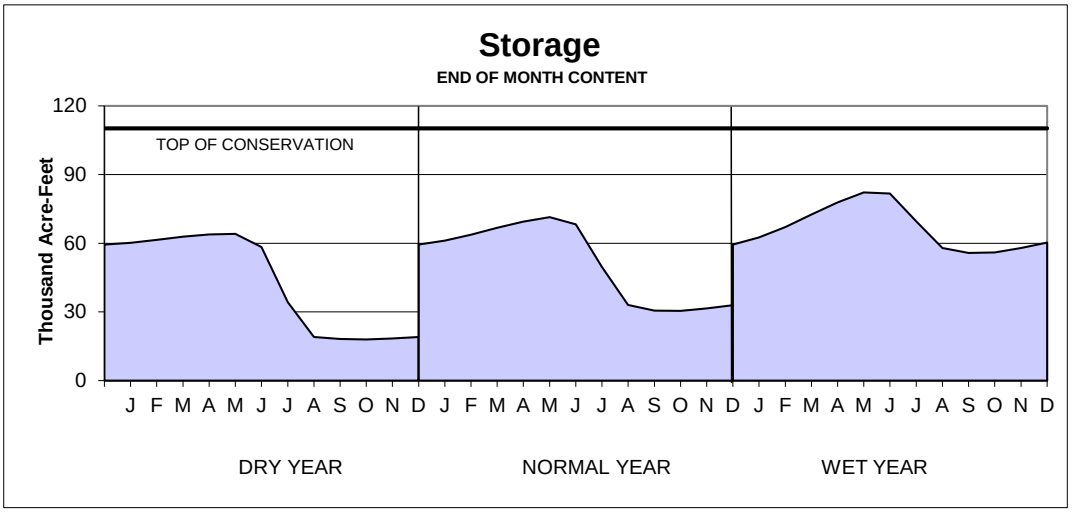


EXHIBIT 7B

SWANSON LAKE

2019 OPERATION PLAN





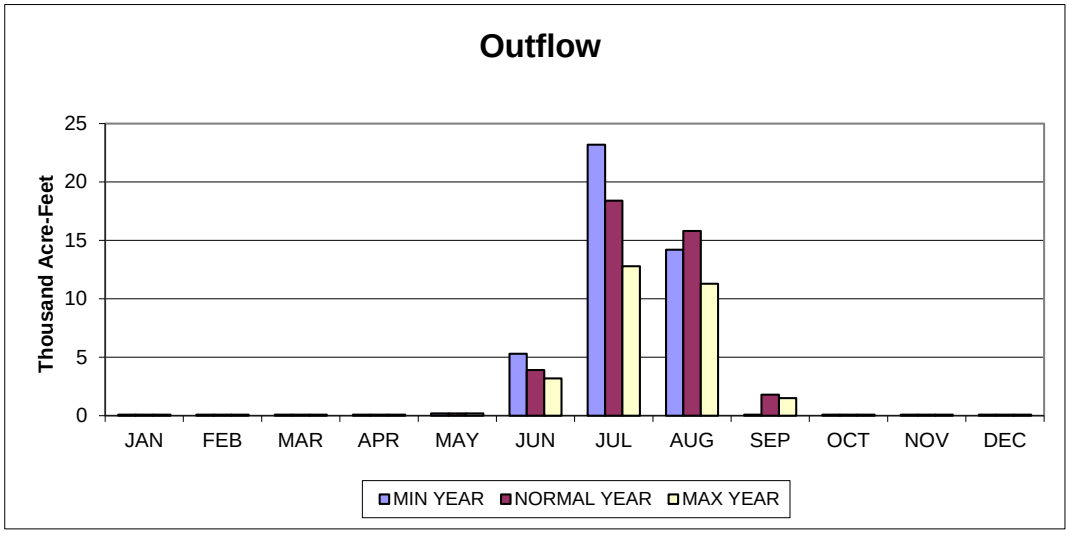
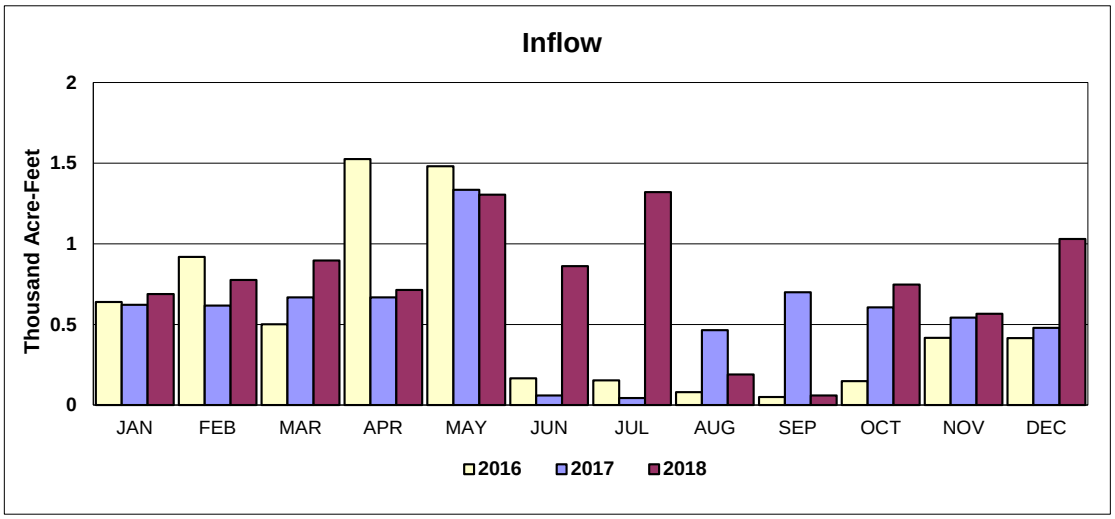
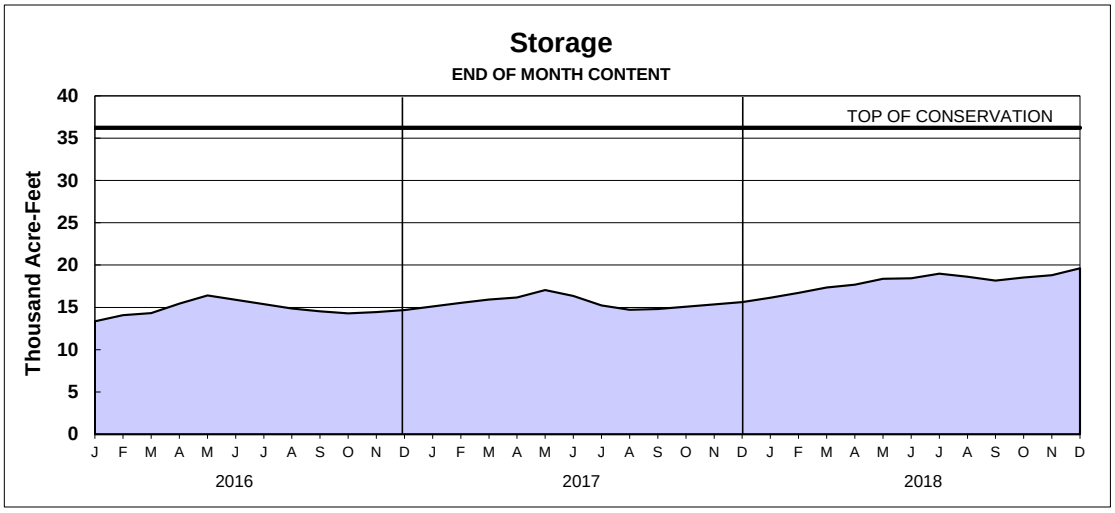


EXHIBIT 8A

HUGH BUTLER LAKE

ACTUAL OPERATION





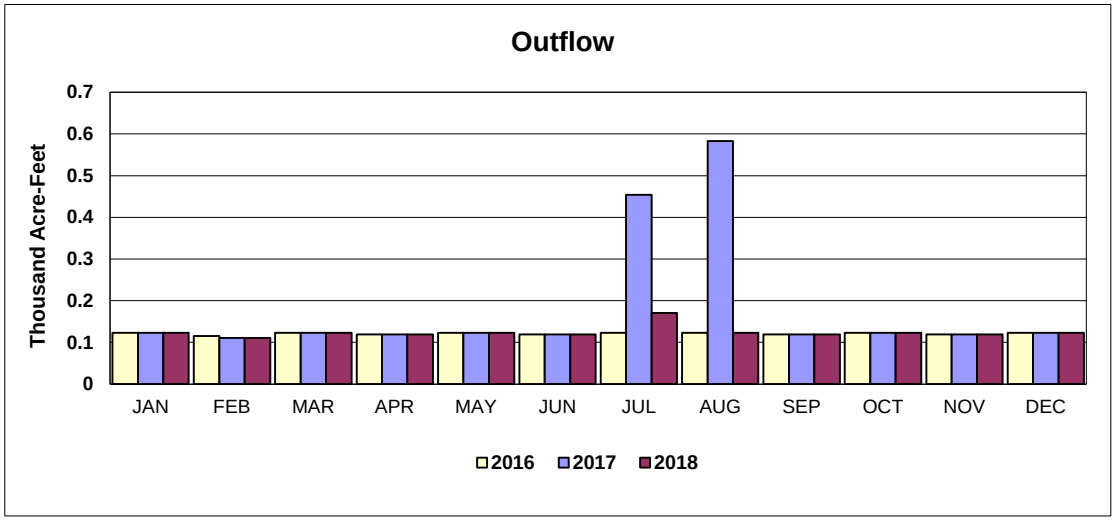
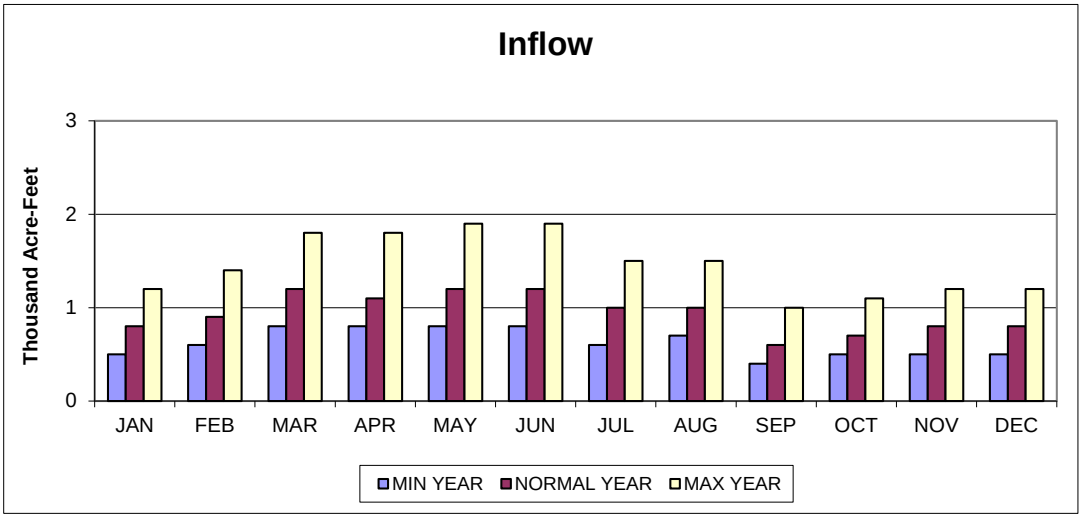
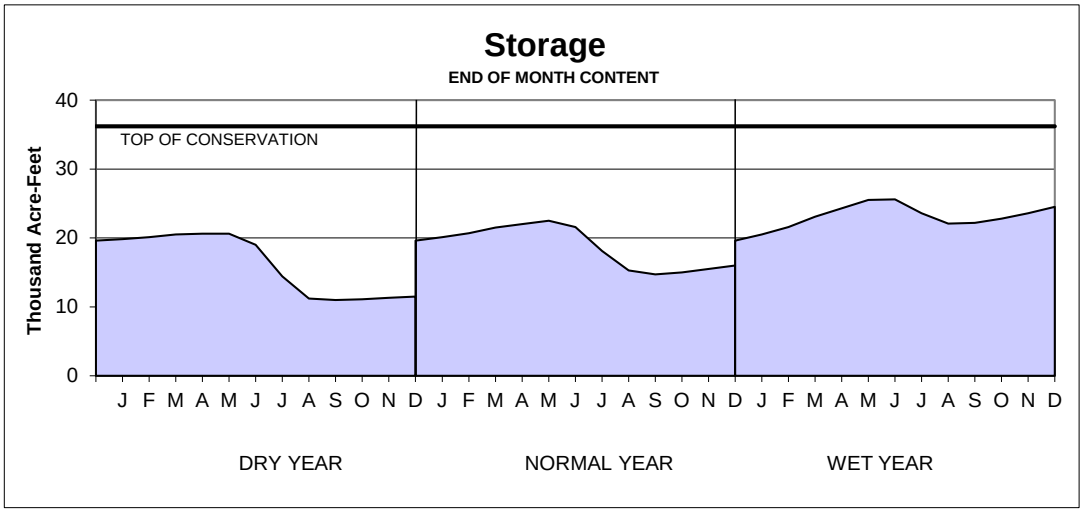


EXHIBIT 8B

HUGH BUTLER LAKE

2019 OPERATION PLAN





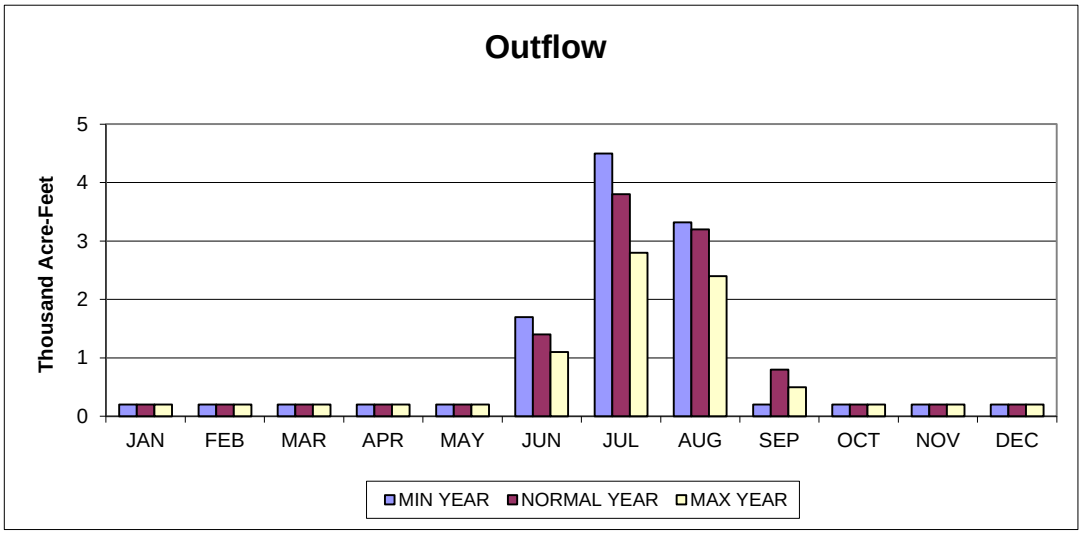
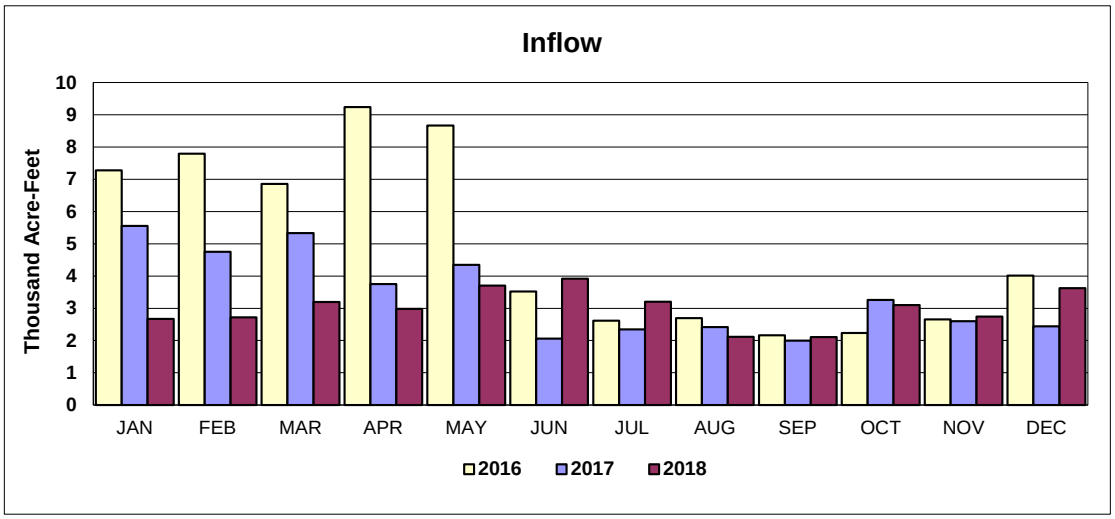
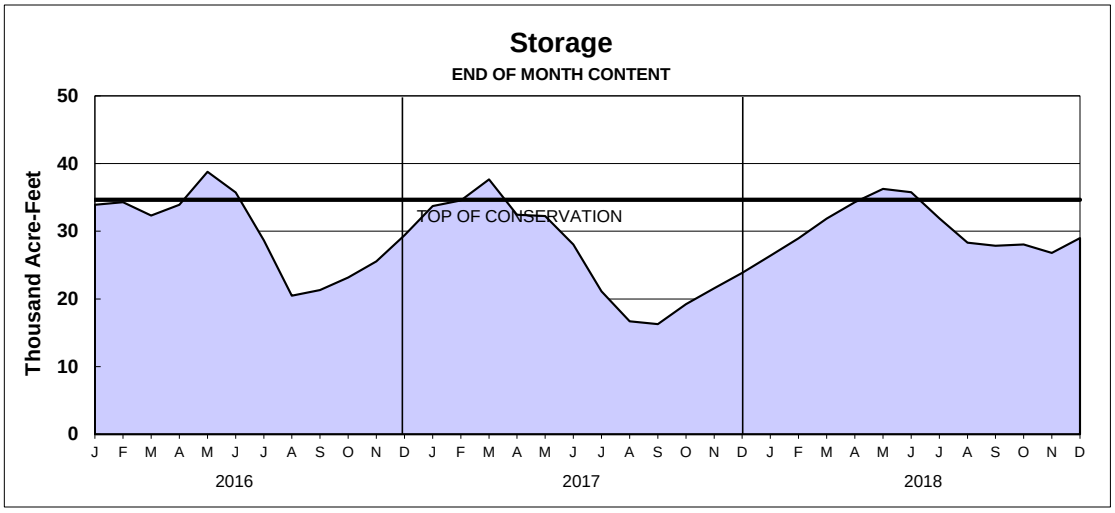


EXHIBIT 9A

HARRY STRUNK LAKE

ACTUAL OPERATION





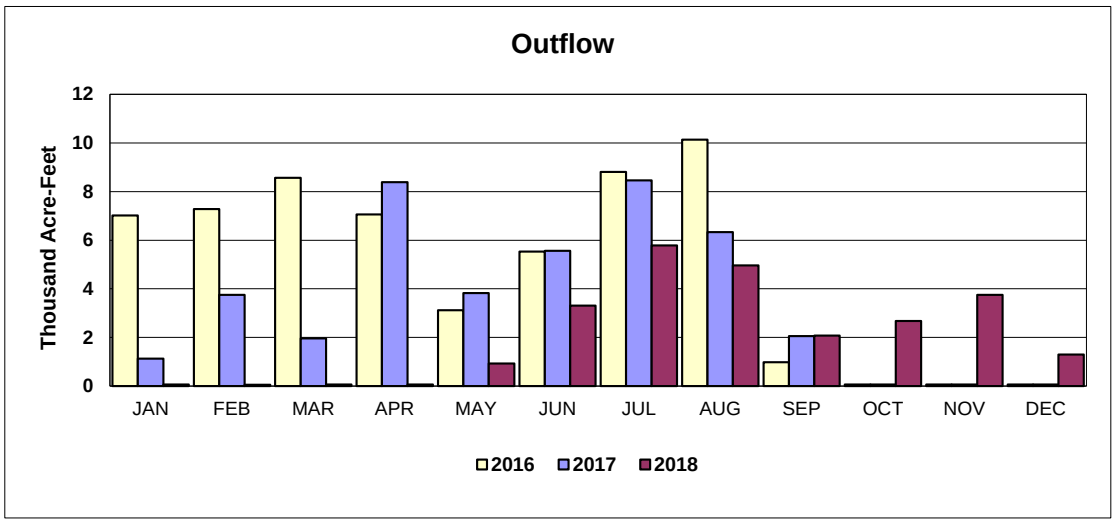
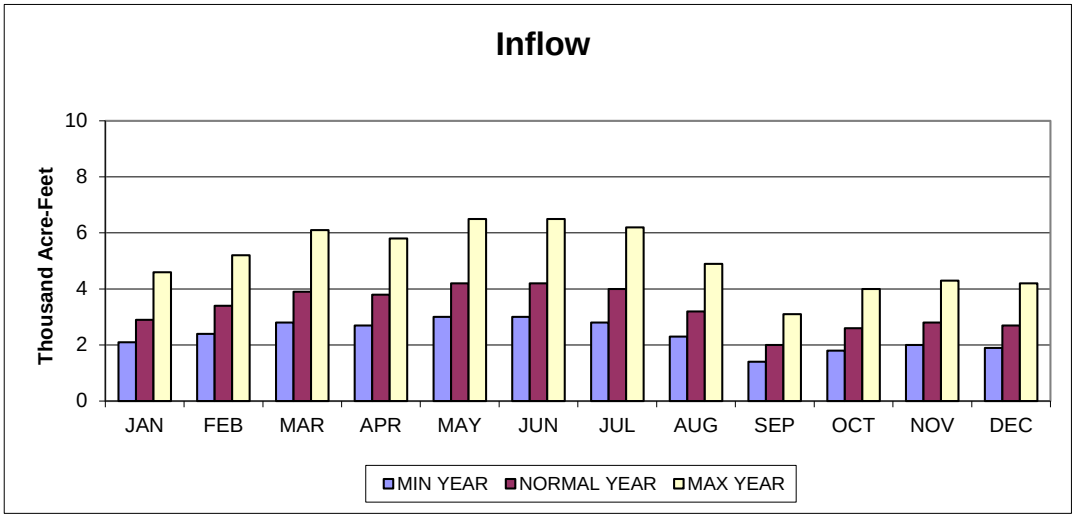
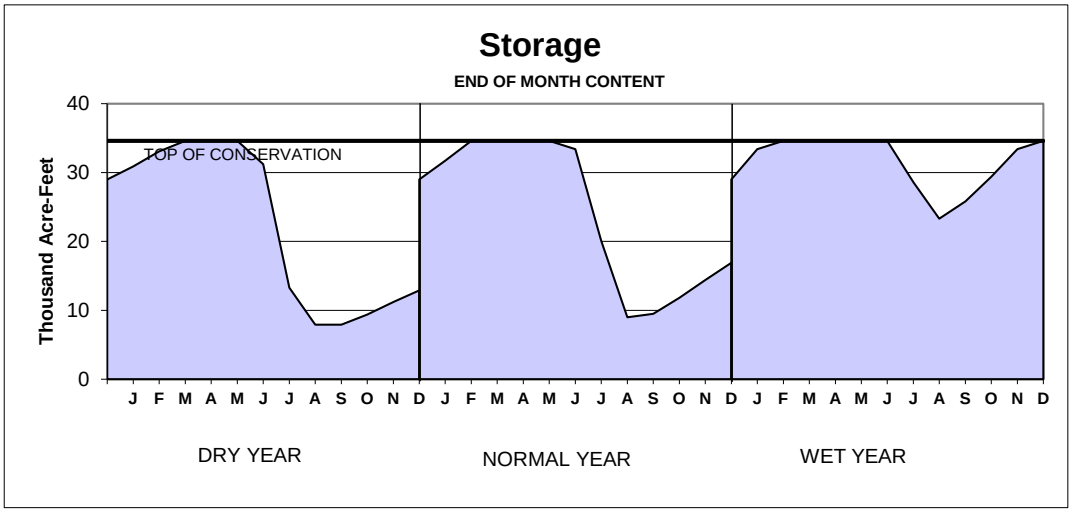


EXHIBIT 9B

HARRY STRUNK LAKE

2019 OPERATION PLAN





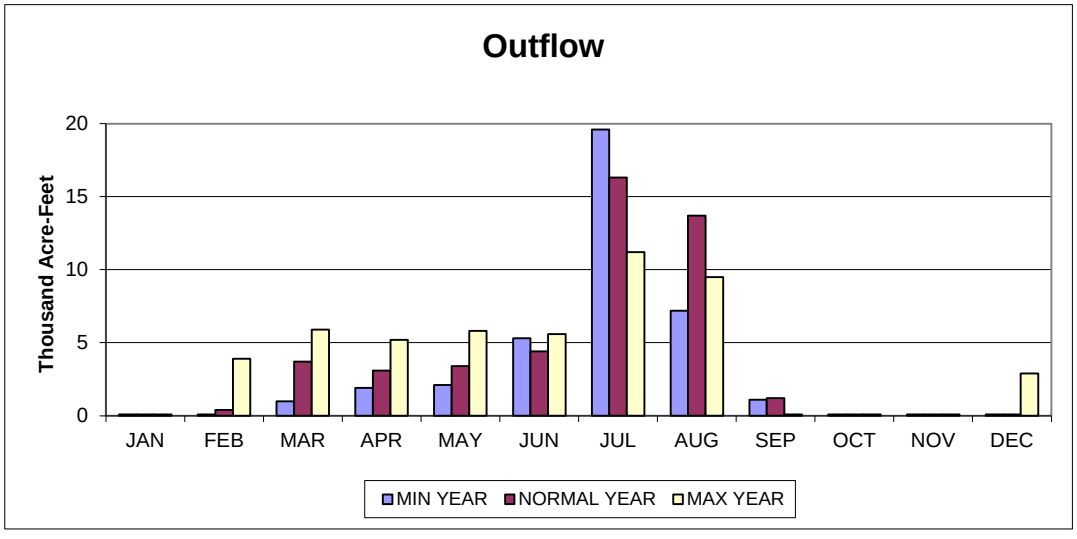
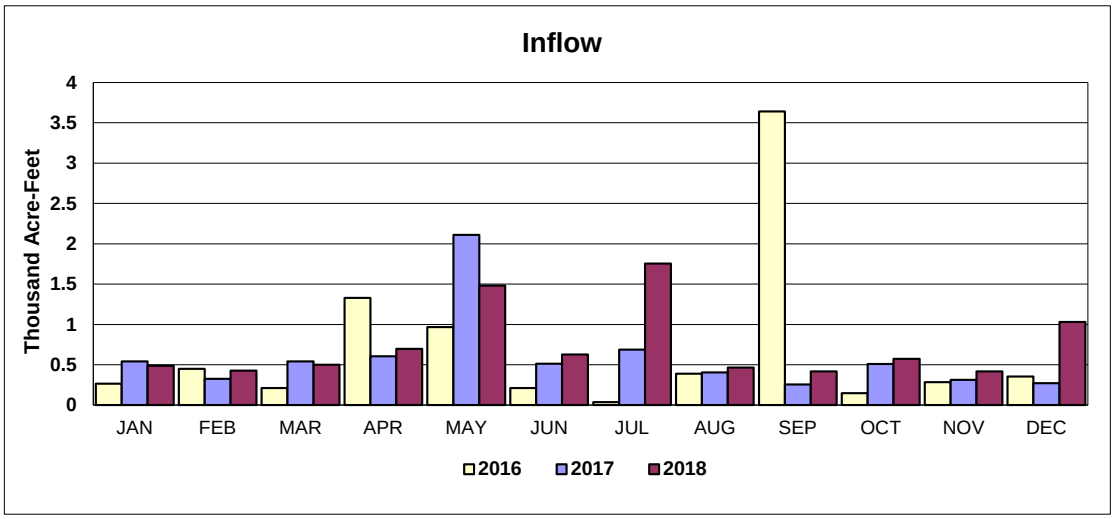
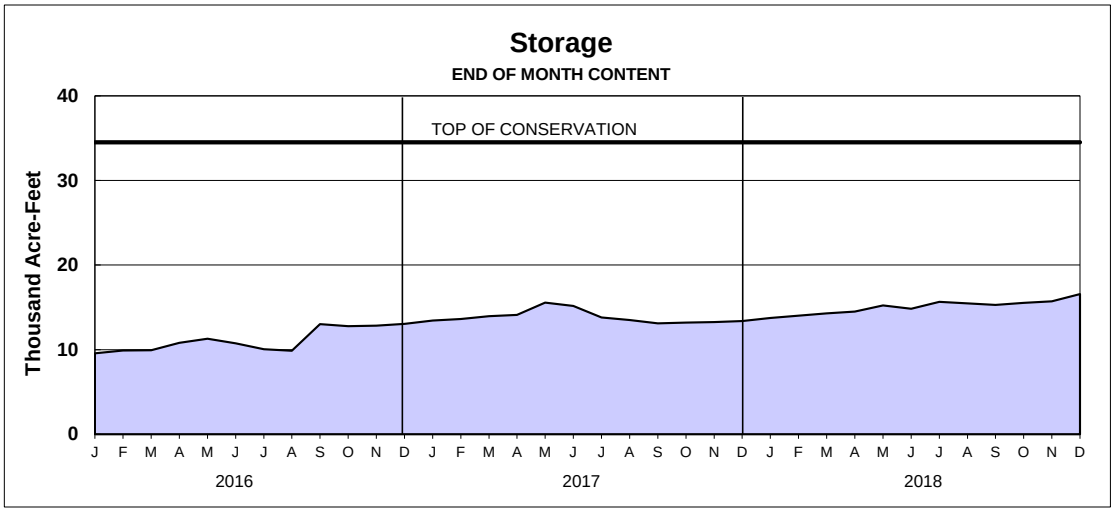


EXHIBIT 10A

KEITH SEBELIUS LAKE

ACTUAL OPERATION





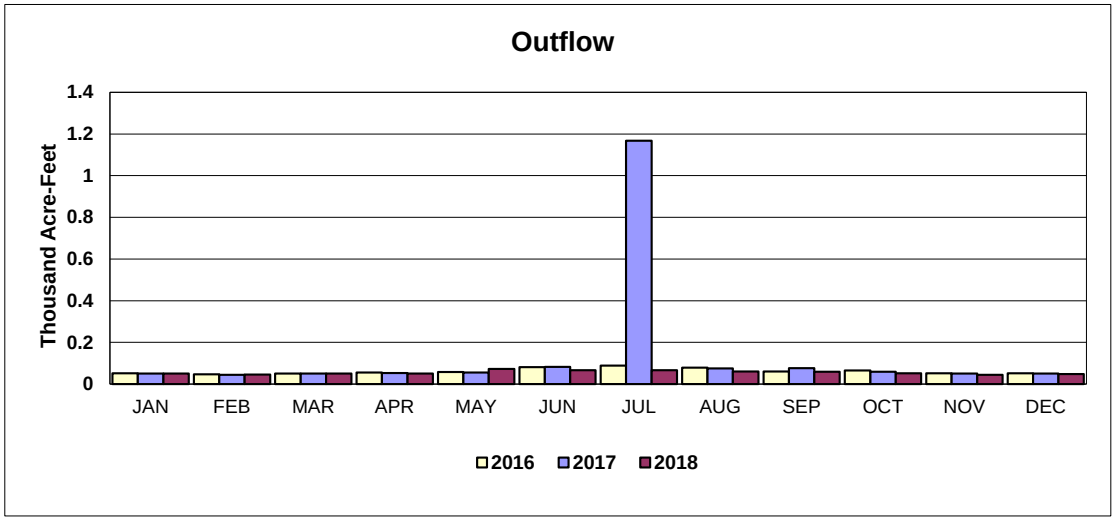
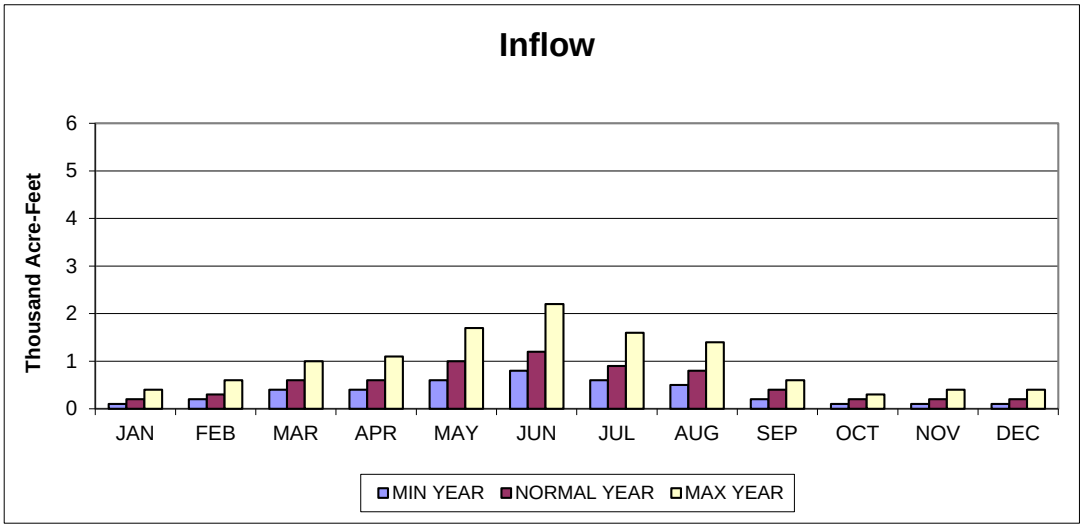
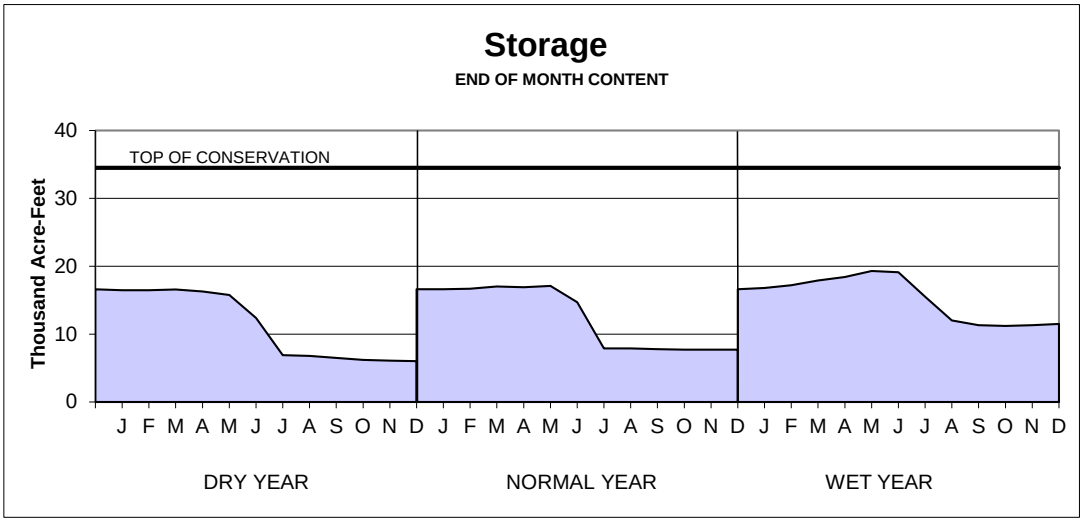


EXHIBIT 10B

KEITH SEBELIUS LAKE

2019 OPERATION PLAN





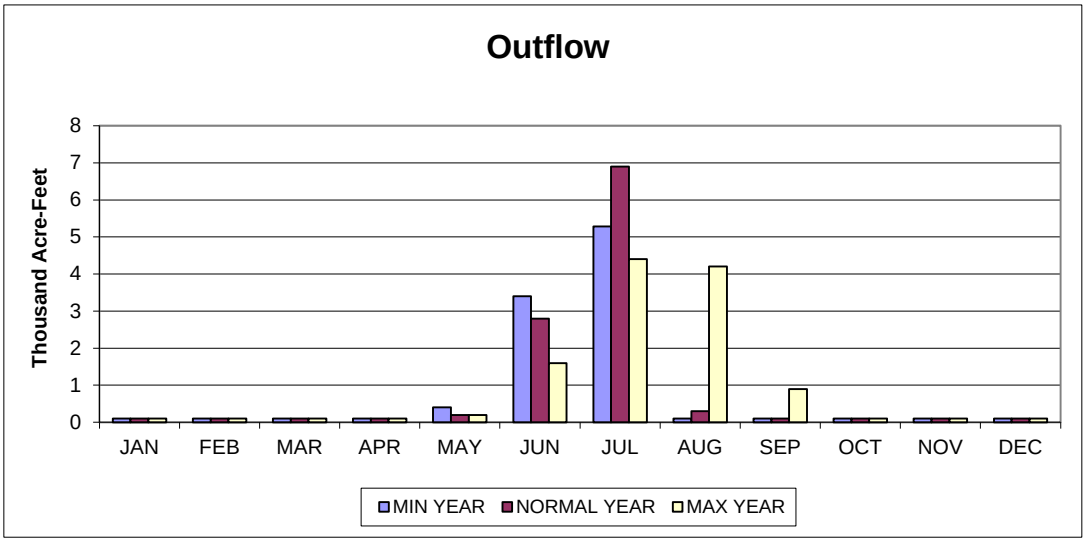
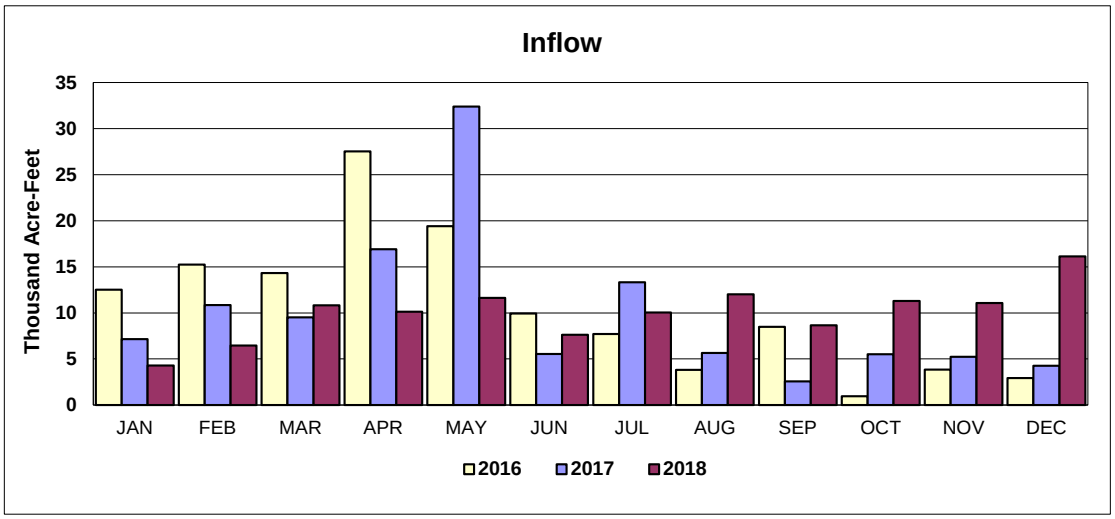
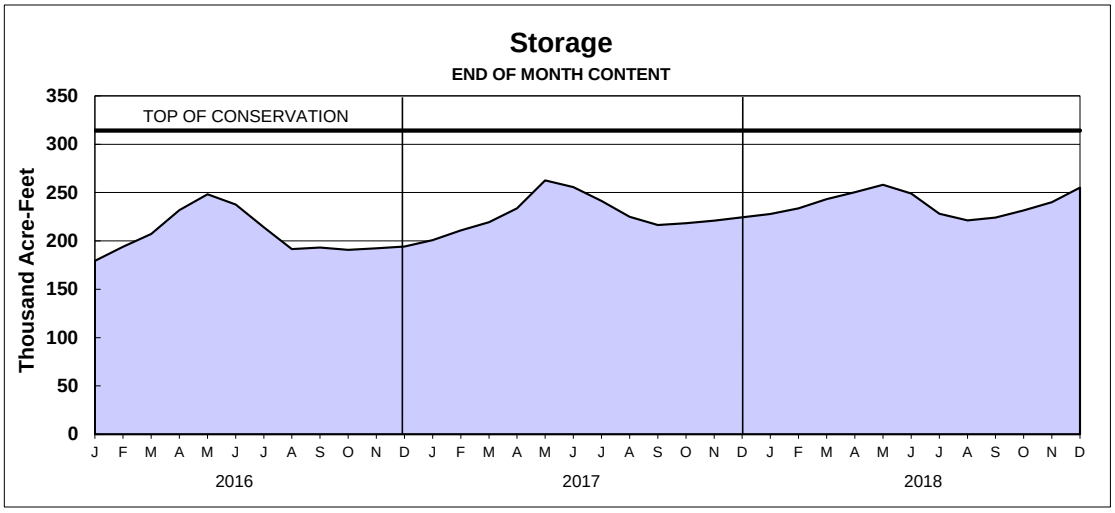


EXHIBIT 11A

HARLAN COUNTY LAKE

ACTUAL OPERATION





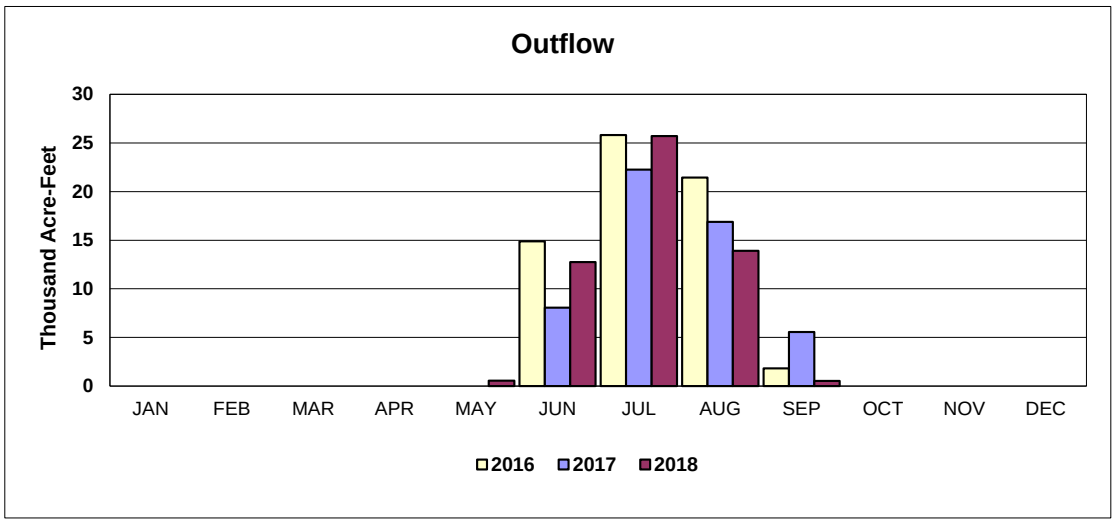
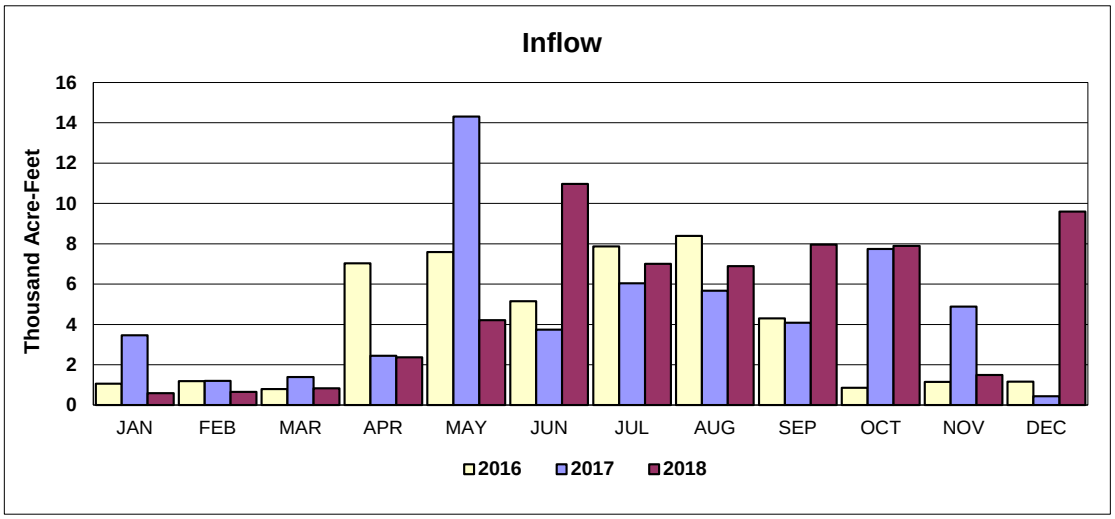
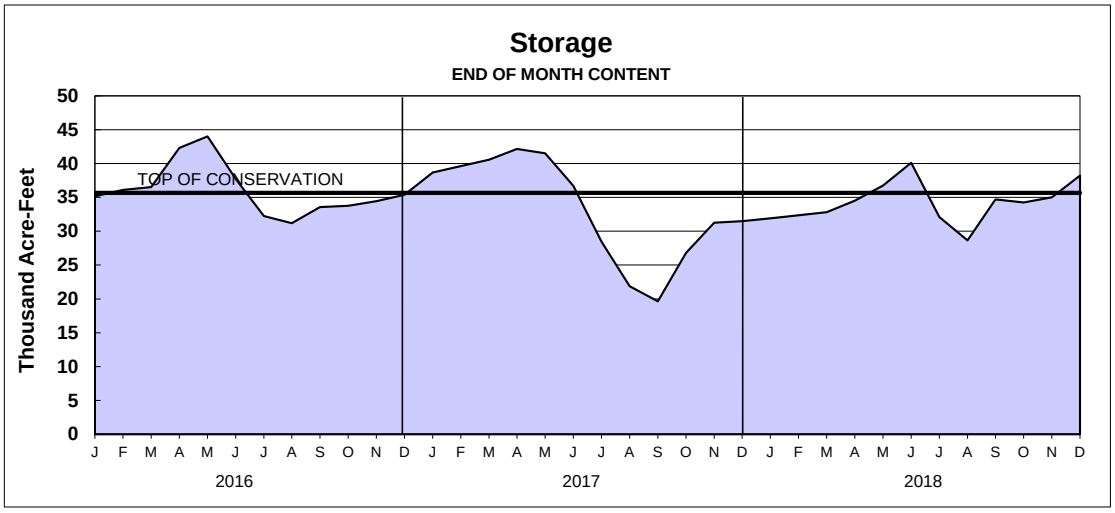


EXHIBIT 12A

LOVEWELL RESERVOIR

ACTUAL OPERATION





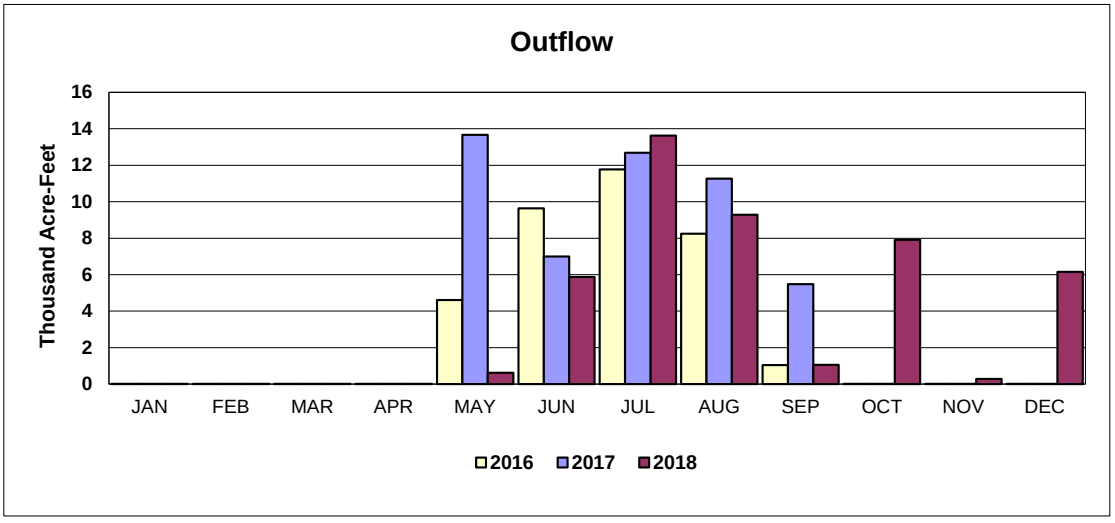
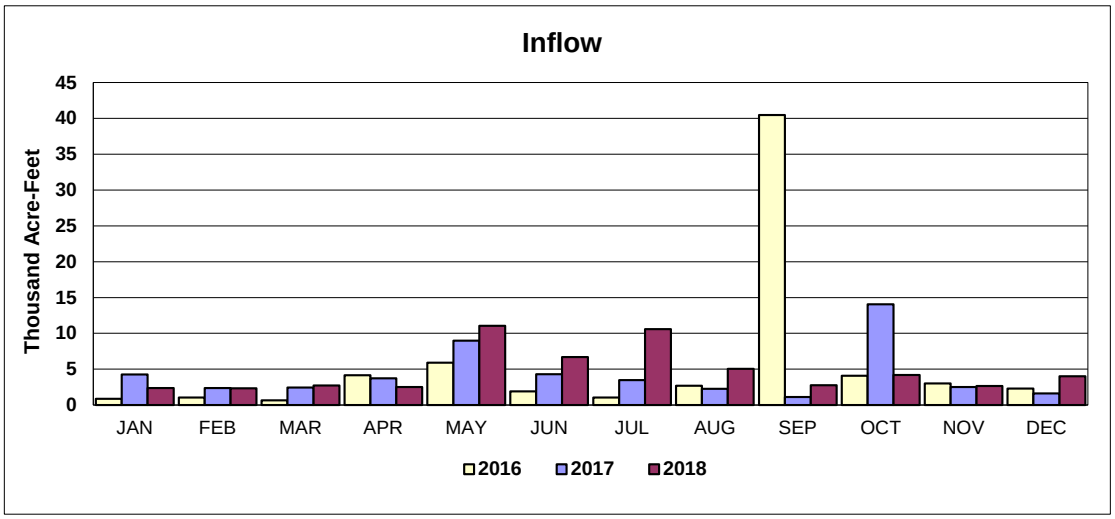
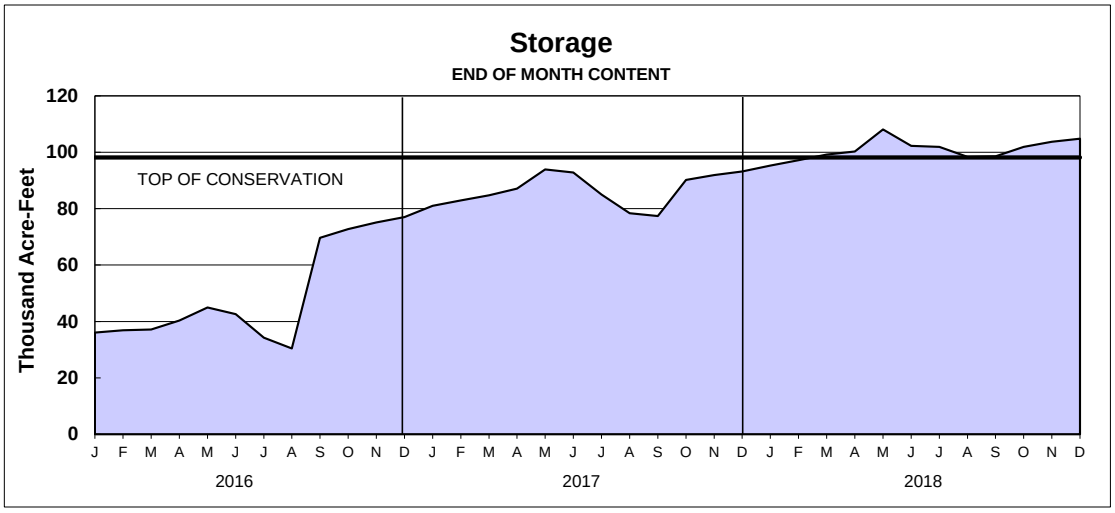


EXHIBIT 13A

KIRWIN RESERVOIR

ACTUAL OPERATION





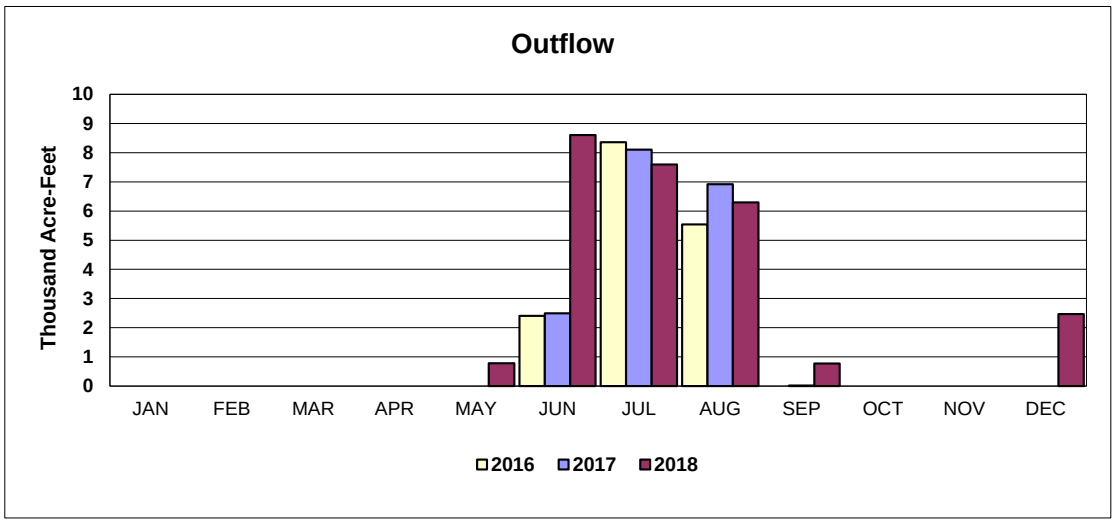
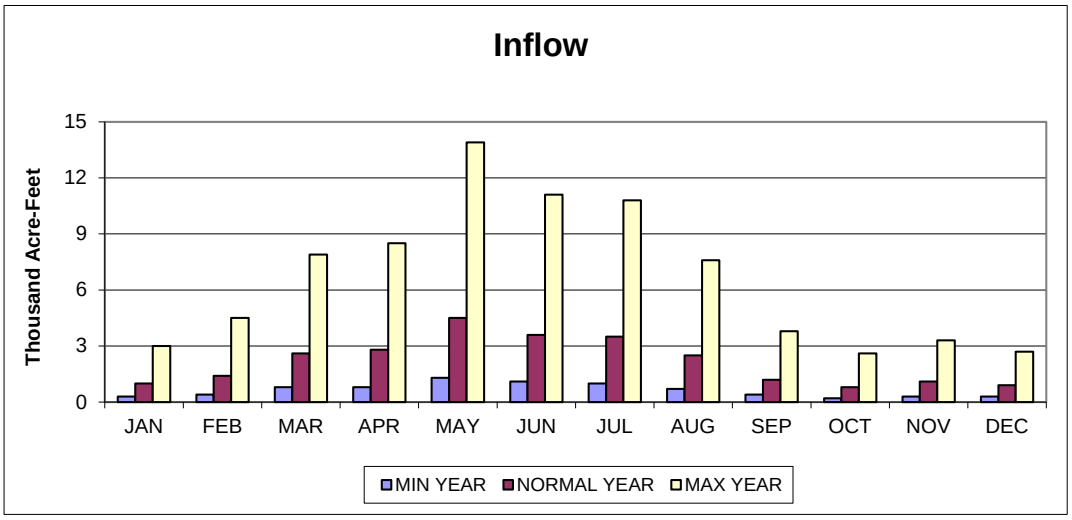
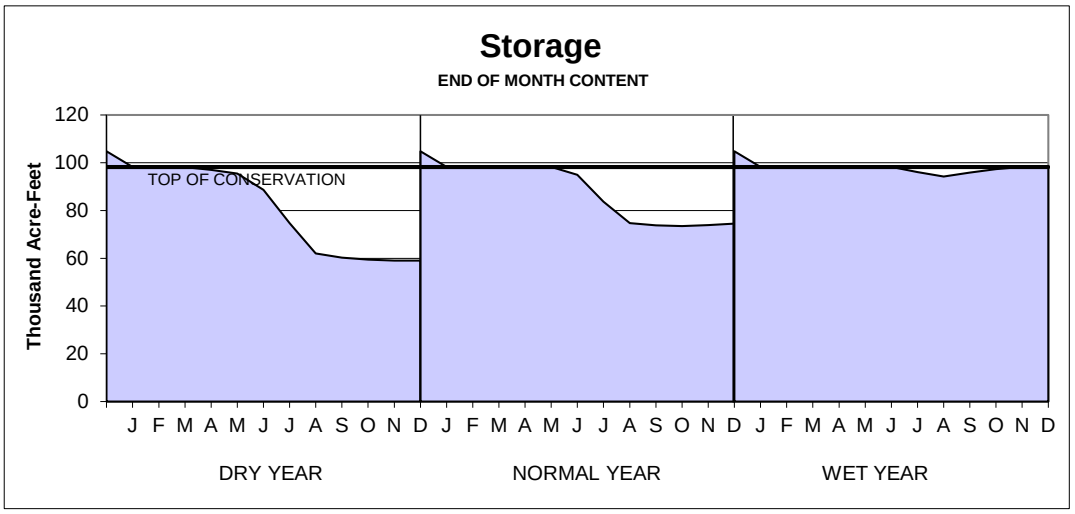


EXHIBIT 13B

KIRWIN RESERVOIR

2019 OPERATION PLAN





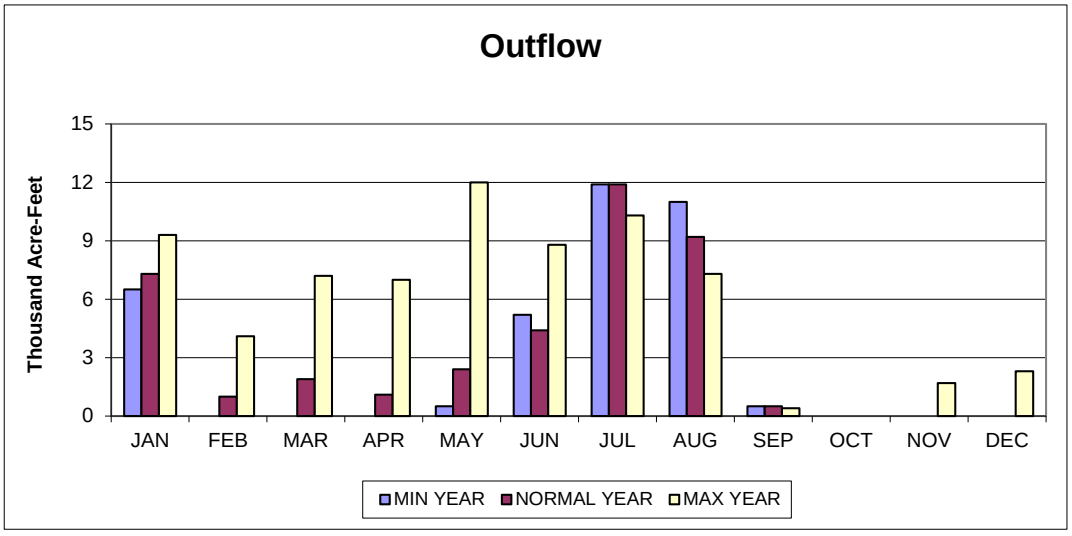
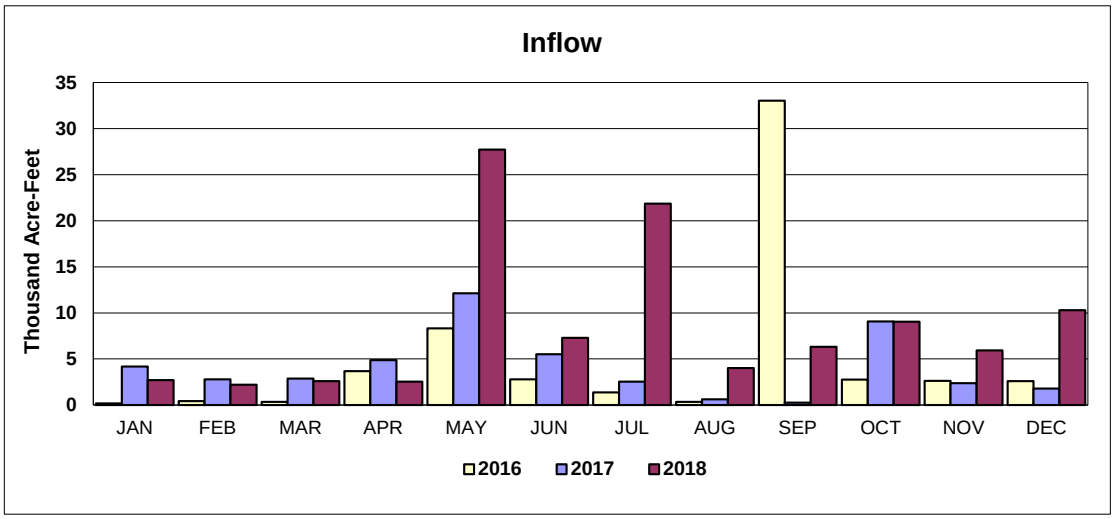
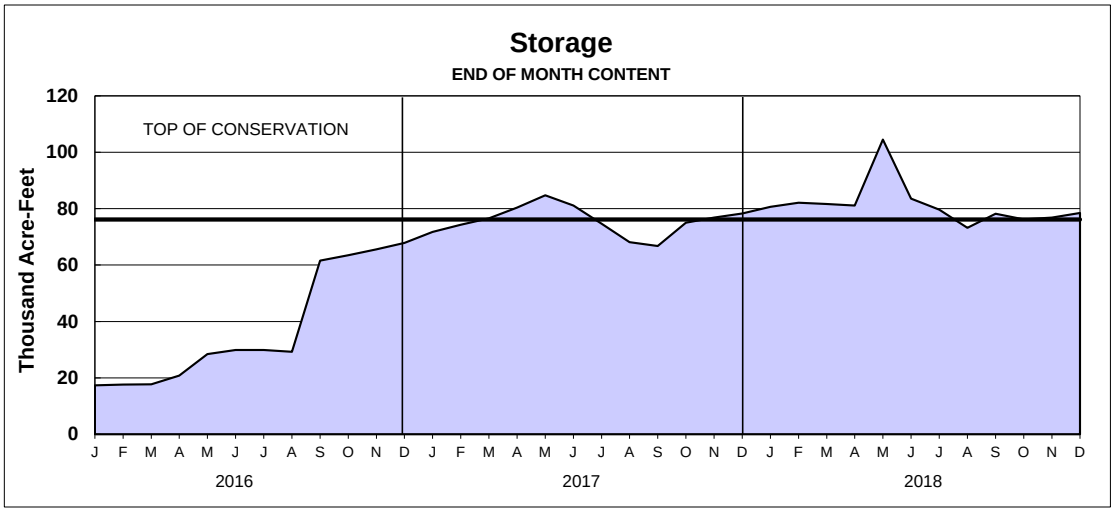


EXHIBIT 14A

WEBSTER RESERVOIR

ACTUAL OPERATION





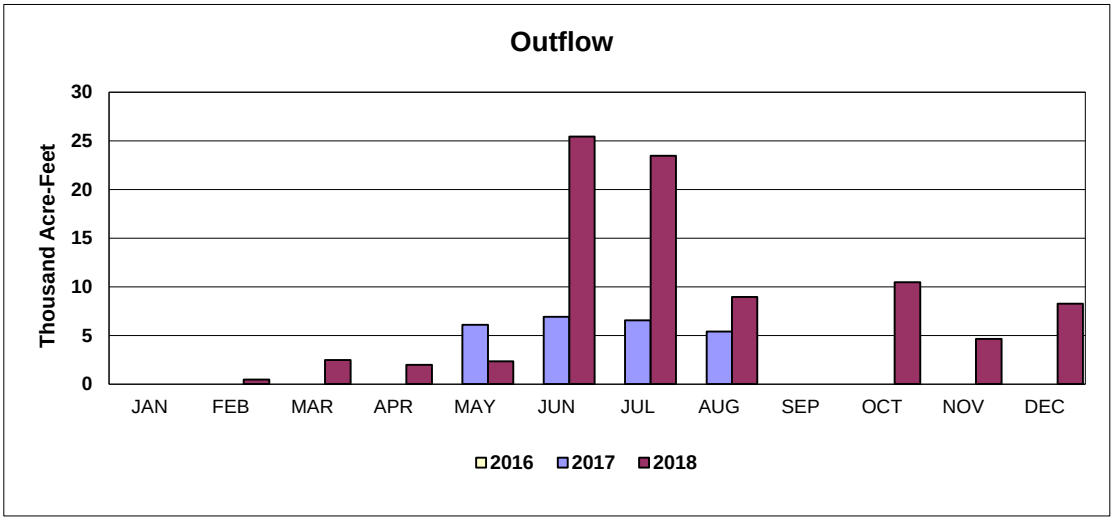
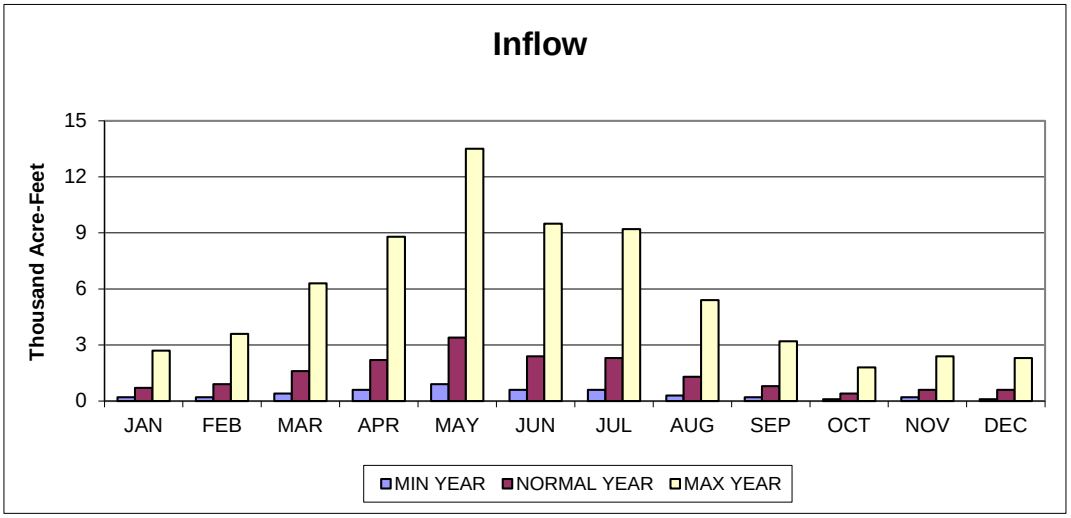
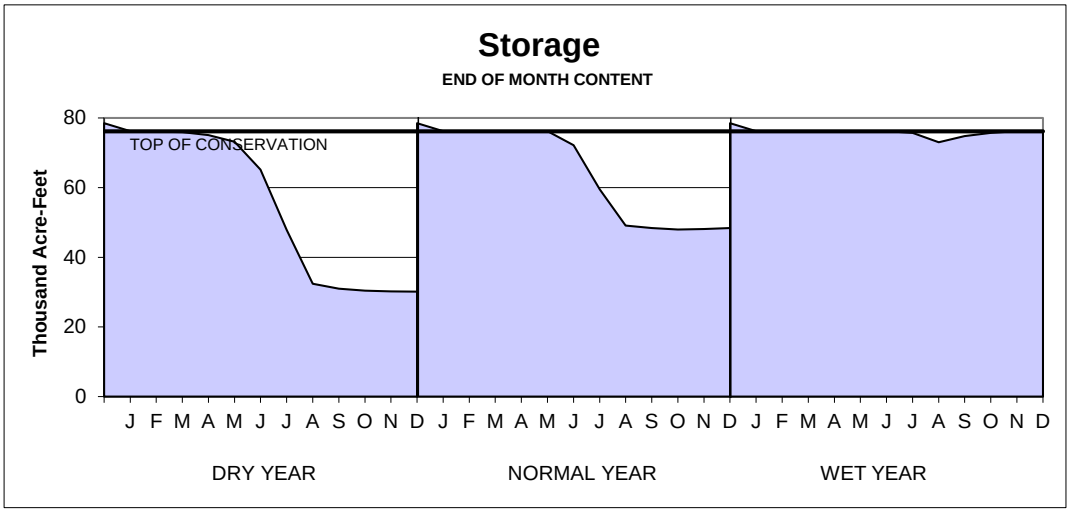


EXHIBIT 14B

WEBSTER RESERVOIR

2019 OPERATION PLAN





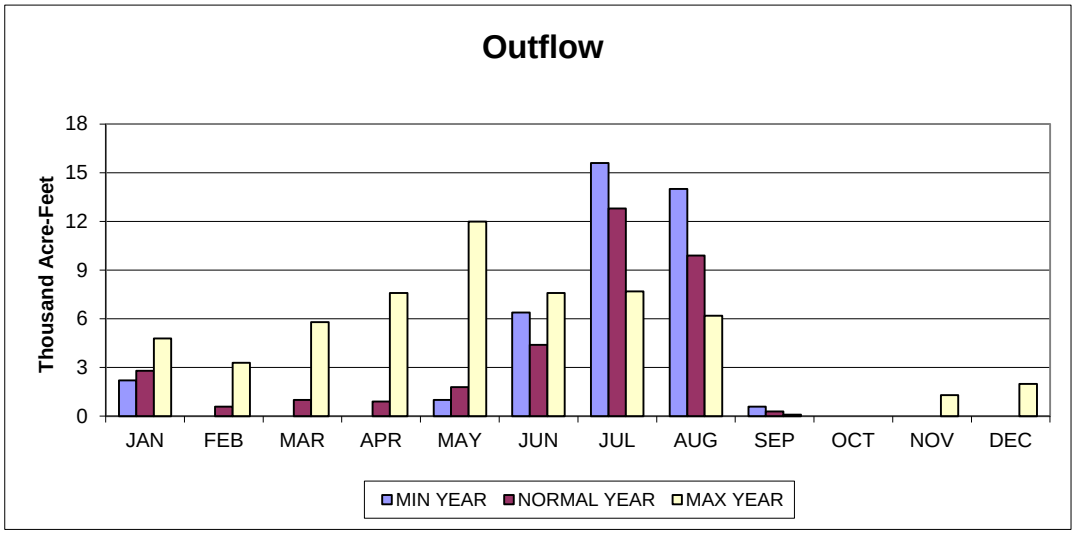
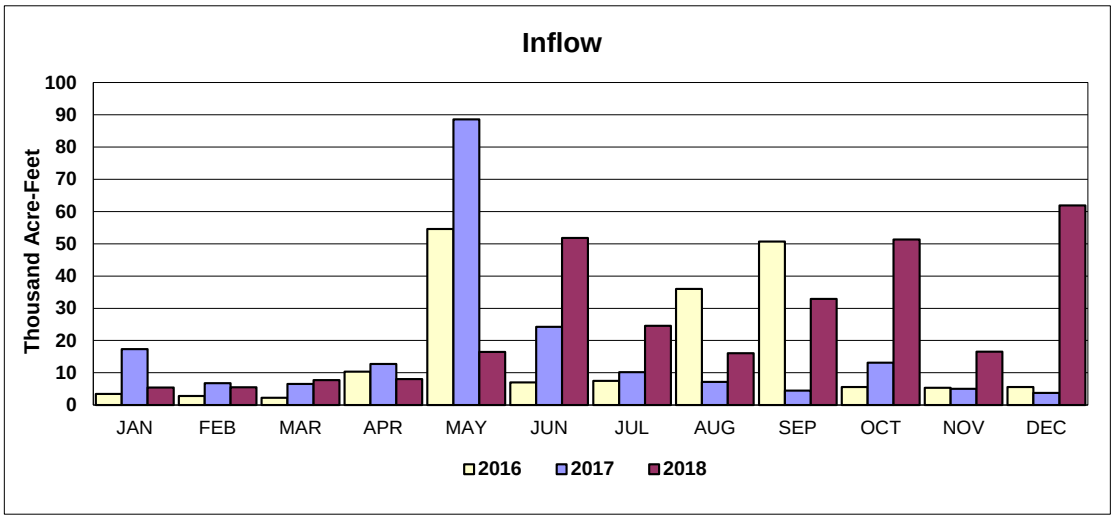
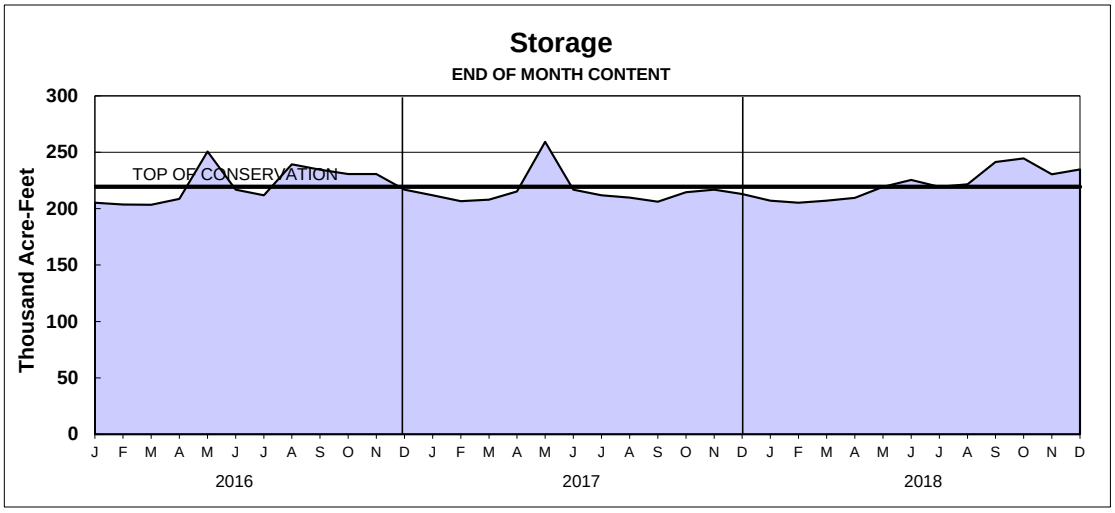


EXHIBIT 15A

WACONDA LAKE

ACTUAL OPERATION





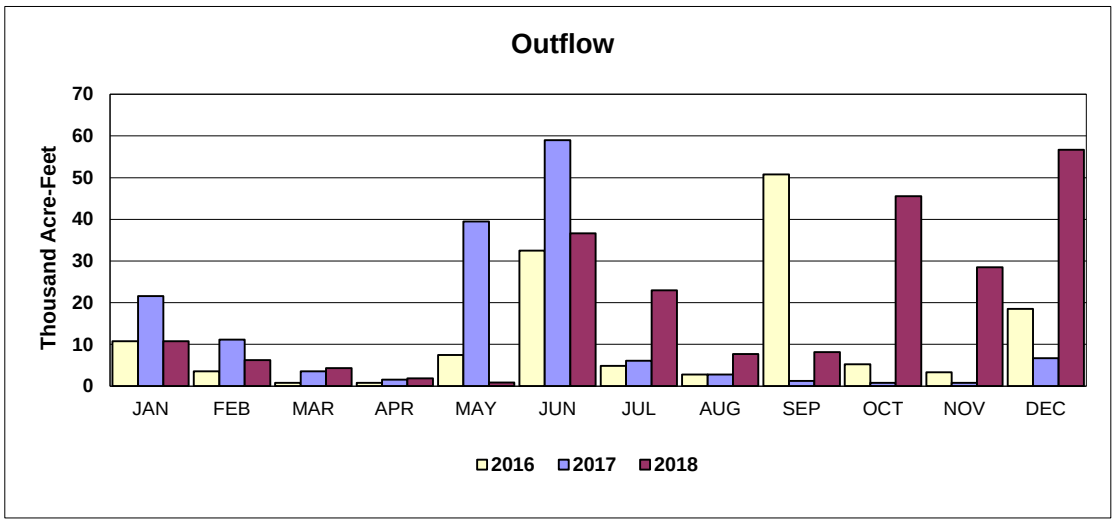
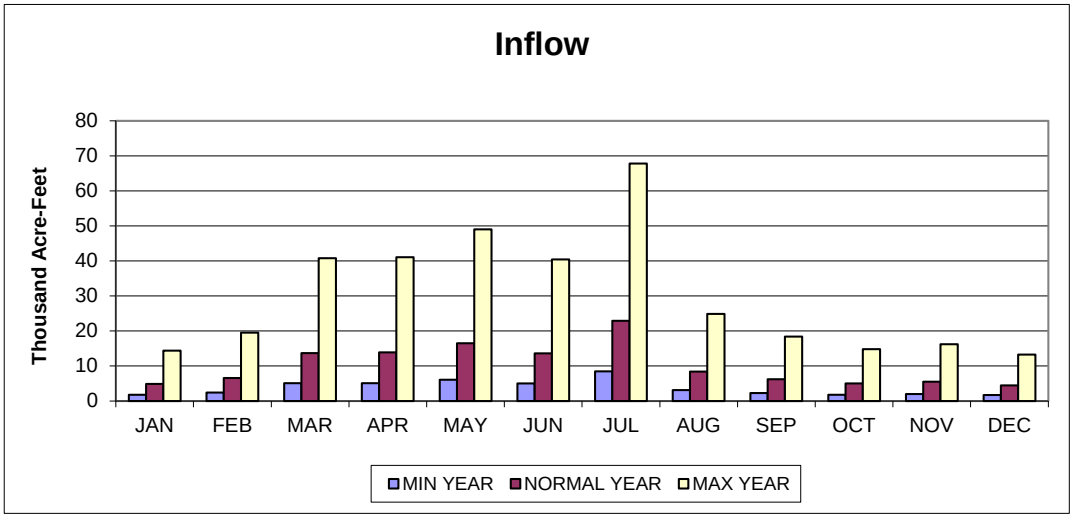
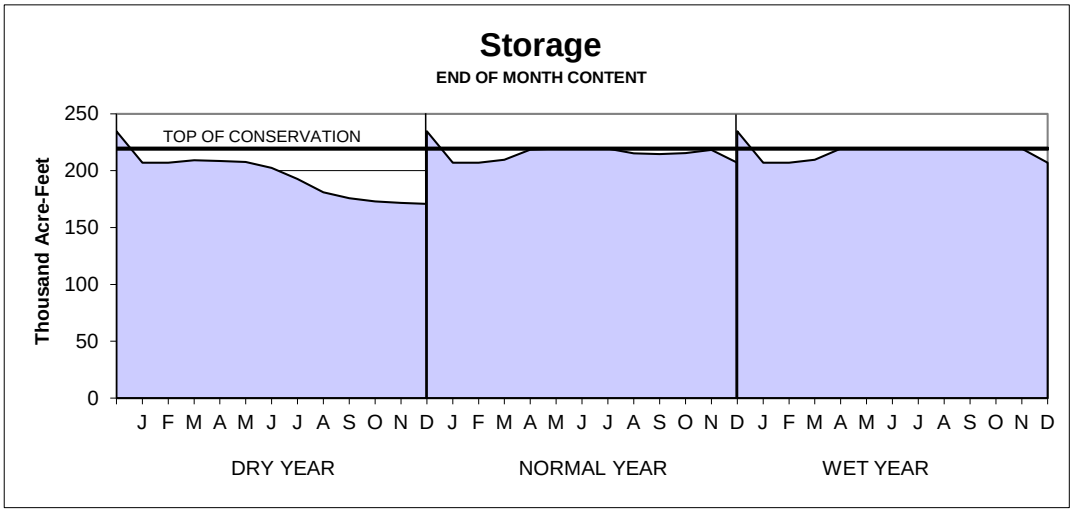


EXHIBIT 15B

WACONDA LAKE

2019 OPERATION PLAN





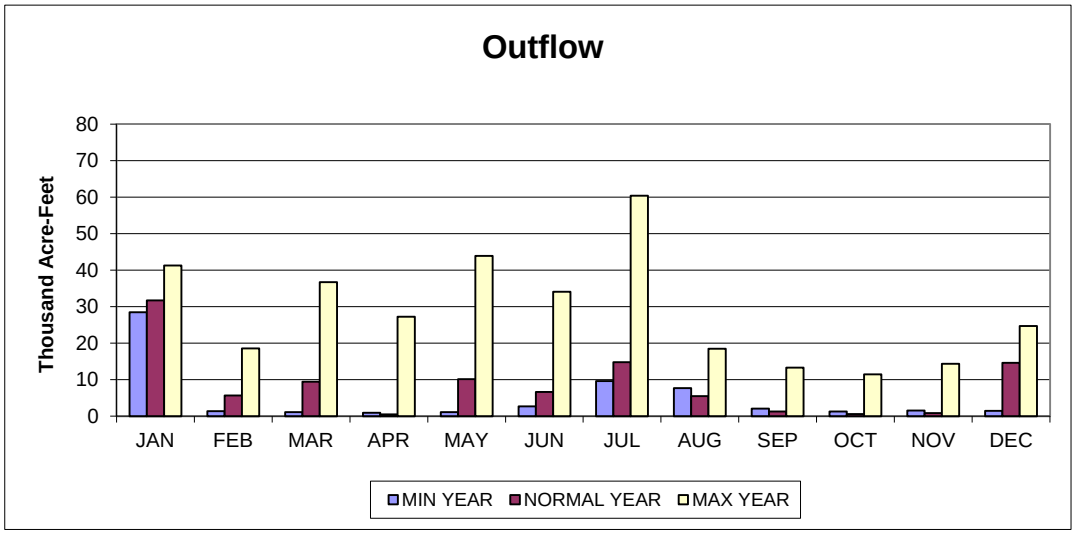
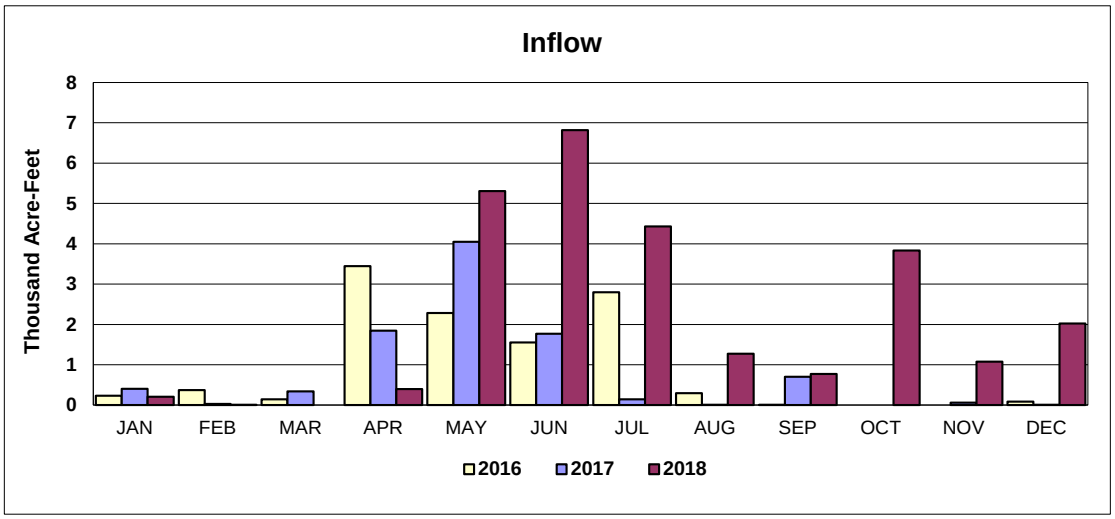
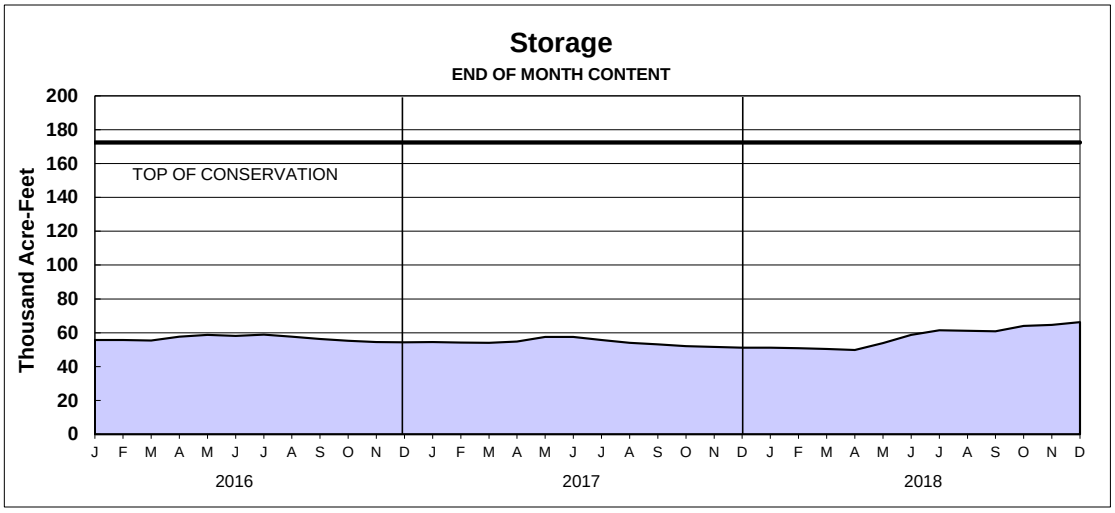


EXHIBIT 16A

CEDAR BLUFF RESERVOIR

ACTUAL OPERATION





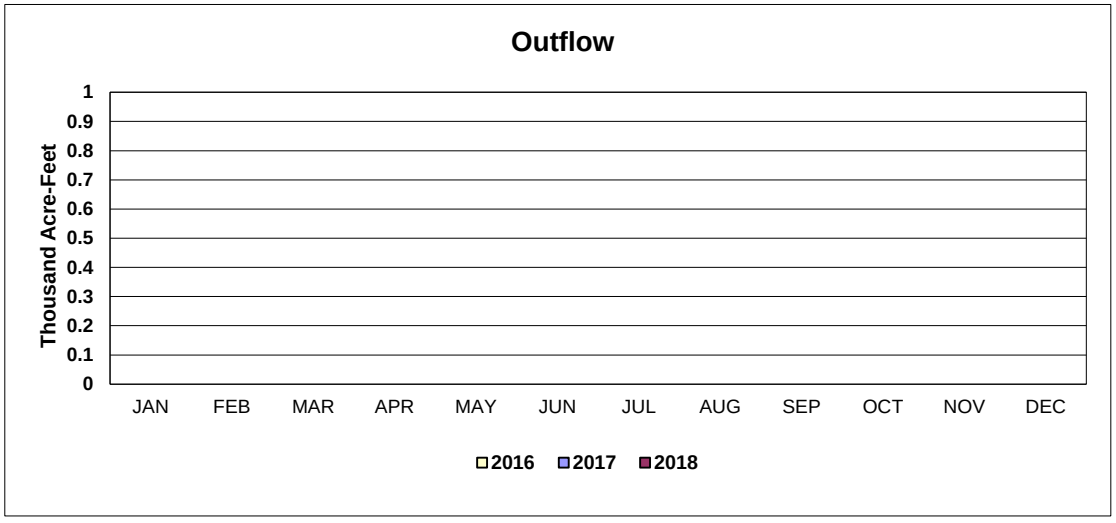
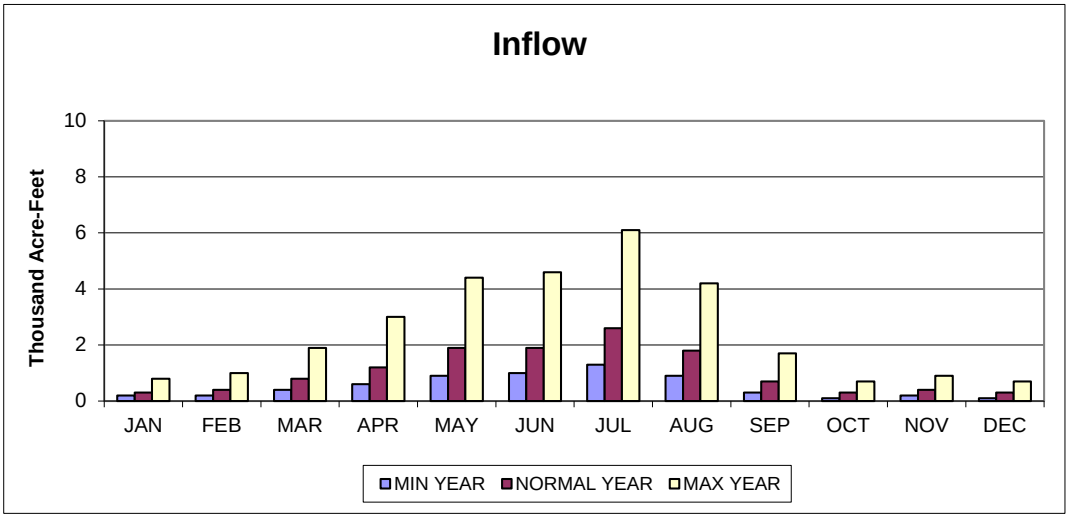
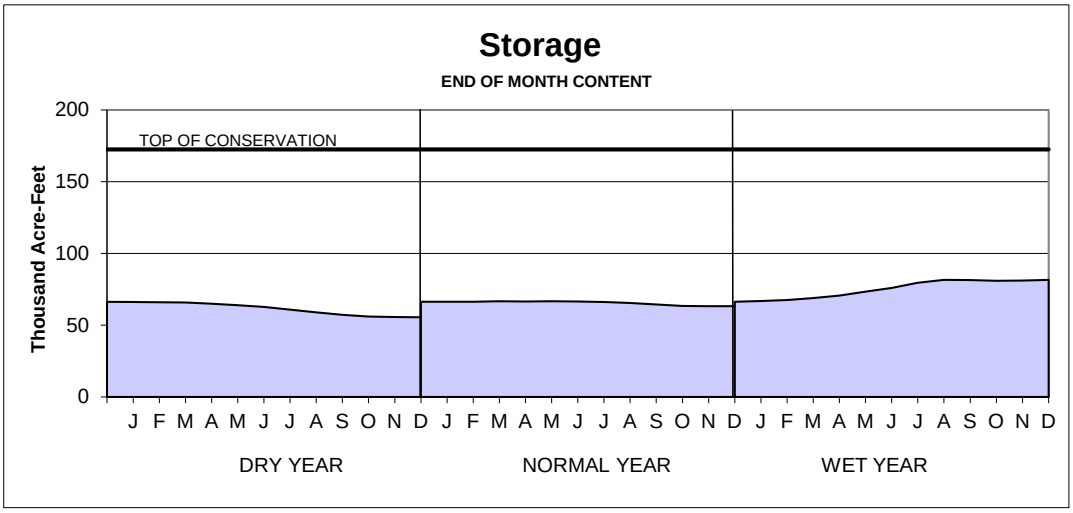


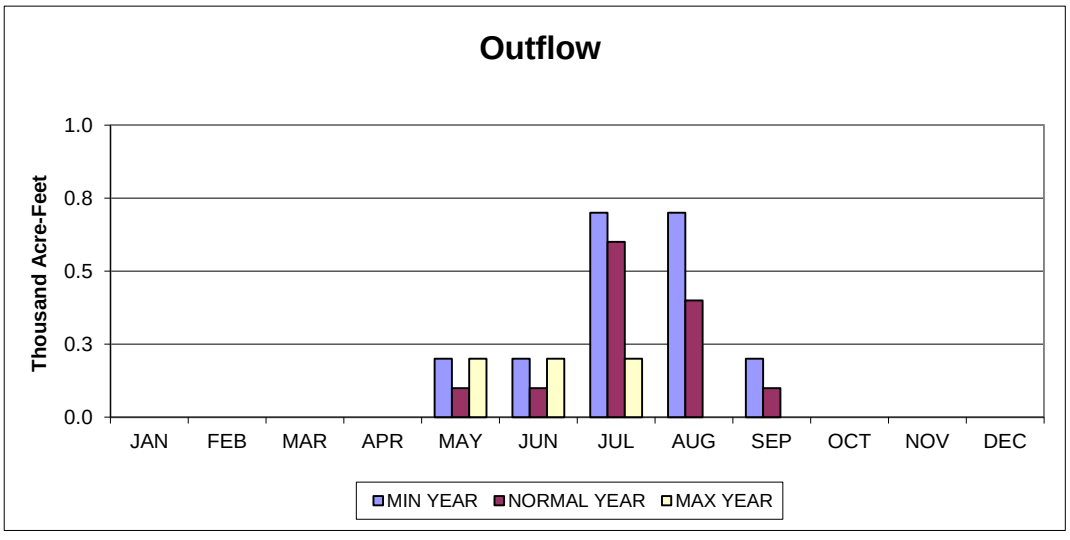
EXHIBIT 16B

CEDAR BLUFF RESERVOIR

2019 OPERATION PLAN







Nebraska - Kansas Area Office
GREAT PLAINS REGION
NKAO
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
MIRAGE FLATS AND MISSOURI RIVER BASIN PROJECTS
NIOBRARA, LOWER PLATTE, AND KANSAS RIVER BASINS
IRRIGATION AND FLOOD CONTROL FACILITIES
MCCOOK, NEBRASKA
MAP BASED OFF OF: RECLAMATION DRAWING NO. 60-705-1 REV. 10
MAY 2016
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Legend
State Boundaries
Irrigation District Boundaries
Diversion Dams
City Boundaries
Water Bodies
Nebraska - Kansas Area Office
Counties
Interstates
Highways
Railroads
Rivers & Streams
Canals
Laterals
N
W
E
S
BOX BUTTE DAM
Box Butte Reservoir
Capacity Allocation
Conser. 28,973 a.f.
Dead 188 a.f.
Total 29,161 a.f.
MIRAGE FLATS PROJECT
MERRITT DAM
Merritt Reservoir
Capacity Allocation
Conser. 65,952 a.f.
Dead 774 a.f.
Total 66,726 a.f.
SAND HILLS DIVISION
Ainsworth Unit
VIRGINIA SMITH DAM
Calamus Reservoir
Capacity Allocation
Conser. 119,434 a.f.
Dead 35 a.f.
Total 119,469 a.f.
NORTH LOUP DIVISION
DAVIS CREEK DAM
Davis Creek Reservoir
Capacity Allocation
Conser. 31,082 a.f.
Dead 76 a.f.
Total 31,158 a.f.
FRENCHMAN-CAMBRIDGE DIVISION
ENDERS DAM
Enders Reservoir
Capacity Allocation
Flood 30,048 a.f.
Conser. 35,394 a.f.
Dead 7,516 a.f.
Total 72,958 a.f.
RED WILLOW DAM
Hugh Butler Lake
Capacity Allocation
Flood 48,846 a.f.
Conser. 31,039 a.f.
Dead 5,185 a.f.
Total 85,070 a.f.
MEDICINE CREEK DAM
Harry Strunk Lake
Capacity Allocation
Flood 52,714 a.f.
Conser. 31,239 a.f.
Dead 3,408 a.f.
Total 87,361 a.f.
HARLAN COUNTY DAM
Harlan County Lake
U.S.A.C.E.
Capacity Allocation
Flood 500,000 a.f.
Conser. 314,111 a.f.
Dead 0 a.f.
Total 814,111 a.f.
TRENTON DAM
Swanson Lake
Capacity Allocation
Flood 134,187 a.f.
Conser. 109,148 a.f.
Dead 1,027 a.f.
Total 244,362 a.f.
Frenchman Unit
Red Willow Unit
Cambridge Unit
Meeker-Driftwood Unit
BOSTWICK DIVISION (NE)
Superior-Courtland Unit
Franklin Unit
BOSTWICK DIVISION (KS)
Courtland Unit
KANASKA DIVISION
Almena Unit
UPPER REPUBLICAN DIVISION
Armel Unit
NORTON DAM
Keith Sebelius Lake
Capacity Allocation
Flood 99,230 a.f.
Conser. 32,874 a.f.
Dead 1,636 a.f.
Total 133,740 a.f.
KIRWIN DAM
Kirwin Reservoir
Capacity Allocation
Flood 215,136 a.f.
Conser. 93,185 a.f.
Dead 4,969 a.f.
Total 313,290 a.f.
LOVEWELL DAM
Lovewell Reservoir
Capacity Allocation
Flood 50,465 a.f.
Conser. 34,007 a.f.
Dead 1,659 a.f.
Total 86,131 a.f.
BONNY DAM
Bonny Reservoir
Capacity Allocation
Flood 128,820 a.f.
Conser. 36,508 a.f.
Dead 0 a.f.
Total 165,328 a.f.
SOLOMON DIVISION
Kirwin Unit
Webster Unit
Glen Elder Unit
WEBSTER DAM
Webster Reservoir
Capacity Allocation
Flood 183,353 a.f.
Conser. 74,901 a.f.
Dead 1,256 a.f.
Total 259,910 a.f.
GLEN ELDER DAM
Waconda Lake
Capacity Allocation
Flood 722,988 a.f.
Conser. 219,172 a.f.
Dead 248 a.f.
Total 942,408 a.f.
CEDAR BLUFF DAM
Cedar Bluff Reservoir
Capacity Allocation
Flood 191,890 a.f.
Conser. 168,050 a.f.
Dead 4,402 a.f.
Total 364,342 a.f.
Cedar Bluff Unit
SMOKY HILL DIVISION
SOUTH DAKOTA
NEBRASKA
WYOMING
NEBRASKA
COLORADO
KANSAS
IOWA
MISSOURI