Reservoir Feasibility Study for Water Supply Reservoir in Republic County, Kansas

Kansas Water Office

Project No. 92544

April 28, 2017

Reservoir Feasibility Study for Water Supply Reservoir in Republic County, Kansas

prepared for

Kansas Water Office

Republic County, Kansas

Project No. 92544

prepared by

Burns & McDonnell Engineering Company, Inc.
Wichita, Kansas

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INDEX AND CERTIFICATION

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Certification

I hereby certify, as a Professional Engineer in the state of Kansas, that the information in this document was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by the Kansas Water Office or others without specific verification or adaptation by the Engineer.

Richard E. Besancon, P.E. (Kansas 16679)

Date: April 26, 2017

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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
ac-ft	acre-feet
Burns & McDonnell	Burns & McDonnell Engineering, Inc.
BLM	Bureau of Land Management
cfs	cubic feet per second
Chla	chlorophyll α
GIS	Geographic Information System
ILF	In-lieu-fee
IP	Individual Permit
IPaC	Information for Planning and Conservation
KBID	Kansas Bostwick Irrigation District
KDWR	Kansas Division of Water Resources
KDHE	Kansas Department of Health & Environment
KDWPT	Kansas Department of Wildlife Parks & Tourism
KNRP	Kansas Natural Resource Planner
KWO	Kansas Water Office
NHD	National Hydrography Dataset
NLEB	Northern Long-Eared Bat
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
RUSLE	Revised Universal Soil Loss Equation
SD	Secchi depth

Abbreviation	Term/Phrase/Name
SHPO	Kansas State Historic Preservation Office
SSURGO	NRCS Soil Survey
TP	total phosphorus
TSI	Trophic State Index
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
EPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish & Wildlife Service
USGS	U.S. Geological Survey
USLE	Universal Soil Loss Equation
WSE	Water Surface Elevation

1.0 INTRODUCTION

The Kansas Water Office contracted with Burns & McDonnell Engineering, Inc. to perform a feasibility study to determine the suitability or feasibility of construction of four already identified multipurpose small reservoirs. The project is located in the Lower Republican River Basin in Kansas.

1.1 Project Purpose and Need

On February 24, 2015, in the case of Kansas v. Nebraska No. 126 Original, the Supreme Court of the United States ruled in favor of Kansas in the dispute over the states' rights to the waters of the Republican River Basin. The Court ruled Nebraska had "knowingly failed" to comply with the Republican River Compact and awarded Kansas $5.5 million for its losses. The 2015 Legislature then introduced Senate Bill 112 Section 178, which designates where all moneys recovered by the state of Kansas shall be deposited. Of the $5.5 million, $2 million was received by the Attorney General for the interstate water litigation fund. The remaining $3.5 million will be credited to the Republican River Water Conservation Projects-Nebraska Moneys Fund for water improvement projects in the Republican River Basin.

On January 6, 2016, a stakeholder group representing multiple interests within the Lower Republican in Kansas met with officials from the Kansas Water Office and Kansas Department of Agriculture near Clay Center to discuss potential projects. The group came to consensus that in general, $2.5 million should be used for projects within the Kansas Bostwick Irrigation District (KBID) and $1 million should be used for projects which are not part of the KBID system. This split was a combination of proportion of where damages had occurred and which projects could be implemented that would benefit the overall basin. The group confirmed that the report from stakeholders completed in 2010 provided the basis for projects that benefited the entire basin, or a group of water users should be pursued. One of the top priorities of the stakeholder group listed in the report includes conducting the Lower Republican River feasibility study.

Based on the Value Study Report by the Bureau of Reclamation, Technical Service Center in 2002, potential storage sites on tributaries to the Republican in Kansas have been identified. A site on Beaver Creek, in Section 12, Township 6 South, Range 4 West, was identified that could hold an estimated 8,500 acre-feet. The dam structure associated with this size impoundment would be approximately 40 foot high with a 2,400 foot crest length. Two possible locations, located near the Nebraska border, are a potential option as well. The first location, in the Northwest Quarter of Section 11, Township 1 South, Range 6 West, is within approximately ½ mile of the Republican River and 4 miles into Kansas. This location has a waste-way structure built with original construction that could potentially be used to transfer water to a proposed holding reservoir. The second location, in the Northwest Quarter of Section 8, Township 1

South, Range 6 West, is approximately 7.5 miles into Kansas and 1 mile from the Republican River. There is no conduit to deliver water from the canal at this point, which would need to be evaluated. If, during the off season or a rain event, deliveries from the Courtland Canal could be worked out, these locations have the potential to serve as small, multipurpose reservoirs. Use of a storage facility at Beaver Creek or other locations could provide additional fish and wildlife benefits, supplement flows to meet minimum daily stream flows, and improve the use of water supply below Hardy.

1.2 Project Description

The project entails evaluating four sites for the feasibility of reservoirs to store water for use and for supplemental use downstream during drought periods. The project requires the siting of four reservoirs based on Kansas Water Office input and based upon the results of the Value Study Report by the Bureau of Reclamation. The topography near each site was evaluated to determine location based on topographic features. Reservoir yield analyses were performed for each site to determine potential storage volumes and impoundment depths and coverage. Desktop studies were performed to determine soil conditions at each site, potential for wetlands, cultural resources, and threatened and endangered species. Opinions of probable cost were determined for each site based on height and length of embankment, outlet structures, and access. The collection of this data provides the basis for decisions relative to which site or sites are selected for reservoir design and construction.

2.0 RESERVIOR INVESTIGATION

In this study, the Kansas Water Office (KWO) provided Burns & McDonnell Engineering, Inc (Burns & McDonnell) four possible reservoir site locations. These four locations are based on the Value Study Report by the Bureau of Reclamation, Technical Service Center in 2002. These four locations were evaluated based on several factors including the hydrology and hydraulics of the potential sites, the geotechnical compatibility of the in-situ soils, the structural characteristics of the potential berms, planning level water quality analysis and environmental and permitting concerns.

2.1 Reservoir Study Methods and Procedures

The procedure for analyzing the four sites began with determining the location of the proposed embankments based on the Bureau of Reclamation Value Study and evaluating the locations to closely mimic the locations in that report. Once the locations of the embankments were determined, the watershed areas were delineated using existing topographic mapping. Using the topographic information and NRCS soil state the reservoir yield calculations were performed to determine the impoundment area; from this data, the desktop environmental and geotechnical studies were performed. A more detailed discussion on analyses follows.

2.1.1 Hydrology & Hydraulics Studies

The objective of this storage-yield study is the determination of the yield available for a given fixed storage given certain hydrologic conditions. Reservoir yield is used to characterize the capacity of a water resource to serve as a long-term water supply.

The objective of the methodology used in this report was to obtain an estimate of the results which could be achieved by a detailed analysis using site specific data. The Hydrology and Hydraulics portion of the feasibility analysis consists of the following steps:

1. From the locations chosen by KWO, site the berm
2. From the berm locations, set the upper and lower elevations of the structure
3. From the location and elevation of the berm, create the elevation and volume, and elevation and surface area relationships of the potential pool
4. From the location of the berm, delineate the contributing watershed
5. Obtain the meteorological data from the site recommended by KWO
6. Obtain soil data from NRCS web soil survey

7. Estimate inflow

8. Perform the yield mass balance

There were four sites assigned to Burns & McDonnell by KWO. These sites were originally identified as potential reservoir sites by a Bureau of Reclamation Value Study, and are shown in Figure A-1 (Appendix A). The largest site is located on Beaver Creek, just upstream of the confluence with the Republican River. The easternmost site, named Site 4 for the purposes of this report, is on an unnamed tributary that flows into the Republican River just upstream of the confluence of the Republic River and Beaver Creek. The proposed Site 4 impoundment is located about halfway between the mouth of the tributary and its headwaters. The last two sites, called East Site and West Site, are located on unnamed tributaries to the Republican River. The two unnamed tributaries are siphoned underneath the Courtland Canal. The proposed impoundment area for both the East Site and West Site are located along these tributaries just south of the Courtland Canal, upstream of the siphons.

Once the location of the potential impoundment berms were sited, Kansas land elevation contour data was used to estimate the possible height of the berm given the required length of the berm, surrounding contours, and potential flooding of land. One example of berm height limitation is at the Beaver Creek site. If the berm were to be built higher, the impounded water could possibly flood to the Republican River.

The location and height of the berms are then used to calculate the potential pool volume and surface area. From the contour data, the surface area of the potential impounded pool is obtained at each contour, from the lowest elevation to the highest elevation and a stage/surface area relationship is created. Cross sections were taken at several locations along the contours which were used to estimate an average area between the two contours. With area and elevation values, the volume of the impounded water and a stage/volume relationship can be discerned.

Using a combination of Geographic Information Systems (GIS) data, National Hydrography Dataset (NHD), and aerial imagery, the watersheds draining to the potential impoundment sites were delineated. The size of the watershed is a critical factor in determining the amount of water available to the potential site.

Meteorological data was collected from the weather station at Lovewell Reservoir near Webber Kansas. The weather station data is available from 1955 to the present. Precipitation and evaporation data from this weather station were used in the yield mass balance analysis.

The seepage loss from a reservoir, another factor in the yield calculation, depends on the type of soil. There are no soil boring data available at this time for the impoundment locations therefore soil data were obtained from the Natural Resources Conservation Service (NRCS) Web Soil Survey Database. Each potential location was investigated using the Database tool. The Database shows the user what types of soils are in the area and their associated soil properties. The seepage rate reported by the database was used in the yield analysis. The seepage values used in this analysis may vary significantly from actual seepage once actual, in-situ analysis, is performed.

The estimate of inflow is a critical piece of the yield calculation. It is assumed that the major source of water in the reservoirs will be from surface water. There is no standing water in the proposed locations at three of the four locations. The East Site has some standing water, but it is assumed for the East and West Sites, surface water will be the most notable source of the water. While some groundwater may seep into the reservoirs, it is more likely that water from the reservoir will seep to the groundwater. This may cause the groundwater table elevation to rise in the vicinity of the reservoir. Future, more detailed analysis, should involve an integrated, surface water plus groundwater approach.

The inflow was estimated using the watershed ratio method. This method entails the use of a flow gage on a nearby waterbody with a watershed close to the same size as the target watershed, and with similar land use. This method was chosen because discharge estimates derived from gaged data are generally considered to be more accurate than model-estimated discharges. Given the preliminary nature of this study, along with the watershed size and available data, the watershed ratio approach was deemed the most appropriate methodology at this time.

The United States Geological Survey (USGS) gage station on White Rock Creek near Burr Oak, KS was chosen because the gage site has a record dating back to 1958, is in nearby Jewell County, Kansas, and has a watershed with similar land usage. The watershed of White Rock Creek contributing to the flow at the gage site is 227 square miles. Inflow was calculated by taking the flow measured by the USGS at the White Rock Creek gage and reducing it by the ratio of the size of the White Rock Creek gage watershed and the watershed of the potential impoundment.

The Kansas Water Science Center has calculated streamflow statistics for many streams and rivers in Kansas. Among other data, the site contains estimated mean streamflow data at locations throughout the state. One such location is on Beaver Creek at its confluence with the Republican River. The Kansas Water Science Center estimates the mean flow in Beaver Creek to be 8.25 cubic feet per second (cfs). Using the watershed ratio method, the average flow in Beaver Creek was estimated to be 5.4 cfs. These two values, determined using different methodologies, are very similar, and the ratio method provides a more conservative value.

The term “yield”, in the context of the capacity of a water source to serve as a water supply, is the maximum quantity of water which can be guaranteed during a critical period. The term yield is often used interchangeably with the terms “safe yield” or “firm yield”. However, the more generic term “yield” can also mean the amount of water a source is able to produce at any given time. In Kansas the critical period is defined by the State of Kansas regulations. The critical period in Kansas is the "Drought having a 2% chance of occurrence in any one year" meaning a drought having a statistical chance of occurring once every 50 years, on average (K.A.R. 98-5-1f). In Kansas there are typically two periods of time unofficially used as critical periods. The first is during the 1930’s dust bowl period and the second is the mid-2000’s, specifically around 2006. The data for this site are not available back to the 1930’s. The yield calculations performed in this analysis show that all potential impoundment sites, at some point in the analysis, go to zero water storage. Therefore, it is not necessary to find the critical period, because the results already show the storage volume goes to zero for non-critical times.

The methodology used in this analysis follows the Kansas Geological Survey Bulletin 239, published in 1998. The approach is essentially a mass balance methodology that accounts for the major sources and sinks encountered in a typical reservoir. The mass balance equation is shown below:

$$ESTOR = BSTOR + IN + PREC - EVAP - SEEP - REL$$

where:

BSTOR = storage at beginning of period

IN = storable inflow during time period

PREC = precipitation on reservoir surface during time period

EVAP = evaporation from reservoir surface during time period

SEEP = seepage loss during time period

REL = release during time period

ESTOR = storage at end of time period

Due to the uncertainty in much of the available data and the lack of site specific data, the analysis was performed on a monthly basis. The mass balance equation was input into an Excel spreadsheet and the equation was stepped in time from 1957 through 2015, calculating the water storage in the reservoir each month. The results of this analysis are presented in subsequent sections.

2.1.2 Geotechnical Studies

To better understand the general subsurface conditions at the potential reservoir locations, a review of publically available information was performed including site-specific NRCS soil surveys, well logs and published geologic information. NRCS soil surveys provide general information on soils in approximately the upper 80 inches of the subsurface as well as general indications of the suitability of these upper soils

as embankment materials and reservoir subbase materials. Well logs in the vicinity of the proposed reservoirs provide a visual interpretation of the subsurface materials. However, the discrete nature of the logs will somewhat limit the applicability of this data to the overall reservoir areas. Published geologic information provides an understanding of possible geologic hazards in the area that could affect the viability of a reservoir. No geotechnical investigation nor testing was performed for this study.

2.1.3 Water Quality Studies

An estimate of the potential quality of the water in the proposed reservoir can be made by studying the characteristics of the watershed and the characteristics of the potential impoundment. The water quality of the proposed reservoir depends greatly on the characteristics of the watershed. This includes the size of the watershed, the land usage within the watershed, the average slope of the watershed, and the soil types of the watershed. The Revised Universal Soil Loss Equation (RUSLE) is a methodology that can be used to estimate sediment loadings from a watershed into a waterbody. RUSLE is a model created by the US Department of Agriculture (USDA) to determine rates of soil erosion caused by rainfall and associated overland flow. RUSLE can be used to determine the soil erosion based on land uses, including agriculture and rangeland and other lands where rainfall and its associated overland flow causes soil erosion.

RUSLE computes sheet and rill erosion from rainfall and the associated runoff for each identified land use. As a revision and update of the widely used Universal Soil Loss Equation (USLE), RUSLE incorporates data from rangeland and other research sites in the United States to significantly improve erosion estimates on untilled lands. RUSLE was chosen as the model to determine the sediment loading from the watershed due to its applicability to the agricultural areas of the target watersheds. The factors utilized for the equation were versatile in order to demonstrate the loading coming from the watershed. RUSLE is written as:

$$A = RE \cdot K \cdot LS \cdot C \cdot P$$

Where:

A = annual soil loss from sheet and rill erosion in tons/acre

RE = rainfall erosivity factor

K = soil erodibility factor

LS = slope length and steepness factor

C = cover and management factor

P = support practice factor

The RUSLE equation methodology will provide an estimate of sediment loading from the target watershed. Data from the NRCS web soil survey provides phosphorus concentrations typically found in

the soils of the watershed. With the sediment loading value calculated and the phosphorus concentrations estimated, a phosphorus loading, to the reservoir, can be derived.

There are many well-known methodologies for linking phosphorus loading to a lake and in-lake phosphorus concentrations. The simplest methodology, and one that is appropriate in this case, is the use of the Reckhow EUTROMOD equation. EUTROMOD is a watershed-scale nutrient loading and lake response model. It was developed by Ken Reckhow of Duke University. EUTROMOD can predict average growing season total phosphorus (TP) concentrations based on inputs about annual watershed loading from various sources. The model was designed to provide guidance and information for lake and reservoir management by using empirically derived relationships between in-lake concentrations and watershed loading. The EUTROMOD model is a one-dimensional model which is limited to well-mixed waterbodies, and is written as:

$$P = \frac{P_{in}}{1 + \left(10.767 * T_w^{0.395} * z^{0.009} * P_{in}^{0.821} * 10^{0.024}\right)}$$

Where,

P = predicted in-lake total phosphorus concentration (µg/L)

T_w = lake hydraulic detention time (years)

L = areal total phosphorus load (mg/m^2 of lake area per year)

z = lake mean depth (meters)

q_s = Areal water loading or surface overflow rate, or m/yr or z/T_w

P_{in} = LT_w/z = average inflow concentration (mg/m^3)

EUTROMOD

$3 < P < 424$ mg/m^3

$0.008 < T_w < 285$ yr

$10 < P_{in} < 1334$ mg/L

$3.9 < z < 70.2$ m

With the watershed loading leading to an estimate of in-lake phosphorus concentrations, we can use the in-lake phosphorus concentrations to estimate the trophic state of the proposed reservoir. The Trophic State Index (TSI) provides an estimation of the trophic state of a waterbody (EPA, 2011). TSI is used to assess the trophic state of a lake and to determine whether influences such as nutrients or light are limiting algal growth. TSI is a widely used biomass-related TSI for lakes (Carlson, 1977; Carlson and Simpson, 1986), and values range from 0 (ultraoligotrophic) to 100 (hypereutrophic). The TSI is calculated independently for Secchi depth (SD), chlorophyll *a* (Chla) and TP. Table 2-1 displays the TSI equations

for chlorophyll *a*, TP and Secchi Depth, while Table 2-2 displays the trophic classifications and the associated TSI values for US lakes.

Table 2-1 Carlson Trophic State Index Equations

TSI Equations
TSI (Chla) = 30.6 + 9.81 ln (Chla)
TSI (TP) = 4.15 + 14.42 ln (TP)
TSI (SD) = 60 – 14.41 ln (SD)

Source: Carlson, 1997

Table 2-2 Trophic Classification and Associated TSI Values for U.S. Lakes

Trophic State	TP (µg/l)	Chlorophyll *a* (µg/l)	Secchi Disc Depth (meters)	Lake Use
Oligotrophic TSI < 40	<12	<3	>4	Appropriate for cold water fisheries and water-based recreation. Very high clarity and aesthetically enjoyable.
Mesotrophic 35 < TSI < 50	9-24	2-7	2-6	Appropriate for water-based recreation. Medium clarity.
Eutrophic 50 < TSI < 70	24-96	7-56	0.5-2	Very productive for warm water fisheries. Decrease in aesthetic properties.
Hypereutrophic TSI > 70	>96	>56	<0.5	Summer fish kills possible fisheries, high levels of sedimentation and algae.

Source: EPA, 1988; Nürnberg and Shaw, 1999; MPCA, 2005

In a broad generalization, algal productivity ranges from oligotrophic (low algal production) to hypereutrophic (high algal production). Eutrophic lakes (TSI: 50-70) tend to be populated with sunfish, minnows, and other warm water species. Oligotrophic (TSI < 40) cold water lakes tend to be populated with gamefish. Walleye, northern pike, and white suckers and their associates optimally inhabit mesotrophic (TSI: 35-50) environments (Ryder, 1981, as cited in MPCA, 2005). Hypereutrophic (TSI > 70) lakes tend to be populated with non-game, rough fish.

2.1.4 Environmental Studies

Burns & McDonnell conducted preliminary desktop environmental evaluations for the four potential reservoirs in Jewell and Republic Counties, Kansas (Project). Accordingly, Burns & McDonnell completed this preliminary desktop wetland, sensitive species habitat assessment, and cultural resources to determine potential impacts.

2.1.4.1 Wetland Assessment

Burns & McDonnell reviewed available background information for the Project to identify areas where wetlands, streams, or other unique habitats could be present. This information included:

- USGS 1:24,000 Topographic Quadrangles: Weber (2015), Scandia Valley (2015), and Kackley (2015)
- USGS NHD, 2014
- U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) (1980)
- USFWS Information for Planning and Conservation (IPaC) (2016)
- The University of Kansas Biological Survey, Kansas Natural Heritage Inventory, Kansas Natural Resource Planner (KNRP) (2016)
- NRCS 2015 Soil Survey Geographic (SSURGO) digital data for Jewell and Republic Counties, Kansas
- GIS User Community aerial images (2014)

2.1.4.1.1 USGS Topographic Maps

USGS topographic maps were used to locate geographically specific areas where wetlands are more likely to occur. For example, wetlands commonly occur in river floodplains and are less common on steep slopes and ridges. Topographic maps also indicate the presence of streams, rivers, lakes, and other waters of the U.S.

2.1.4.1.2 Soils

The soil surveys and digital soils data were used to locate areas with soils typically found in wetlands. NRCS soil surveys group areas into soil map units, which consist of one or more soil types. Wetlands are more likely to be present in soil map units that contain a high percentage of hydric soil types. Soils were grouped into two categories based on soil survey information: non-hydric soils and hydric soils. For this evaluation, soil map units that consisted of at least 90 percent hydric soil rating were classified as hydric soils. No hydric soils occur within the Project areas.

2.1.4.1.3 Natural Color Aerial Photographs

The National Agriculture Imagery Program natural color aerial photographs (taken in 2014) were used to identify land use and assess possible hydric soil signatures in each Project site. Darker or lighter color signatures noted on natural color aerial photography can be an indicator of inundated or saturated soils. Assessing surrounding land use is also useful for locating wetlands.

2.1.4.1.4 National Wetland Inventory Maps

The USFWS NWI maps of each Project site were reviewed to identify potential wetlands or other waters of the U.S. Wetland identification criteria differ between the USFWS and the United States Army Corps of Engineers (USACE); as a result, wetlands shown on a NWI map may not be under the jurisdiction of the USACE. Similarly, USACE jurisdictional wetlands are often not included on NWI maps. USFWS NWI maps cannot be assumed in all cases to reflect an accurate assessment of jurisdictional wetlands; therefore, a field delineation was conducted onsite.

2.1.4.2 Threatened & Endangered Species Assessment

Burns & McDonnell conducted a preliminary review of the USFWS IPaC online assessment resource and the KNRP online database to determine if there are known protected areas with federally and state listed threatened and endangered species as each of the Project sites.

2.1.4.3 Cultural Resources Assessment

A preliminary review of archaeological and historical literature relevant to the Project sites was conducted. The review included examination of the online architectural and National Register of Historic Places records and the archaeological site records maintained by the Kansas Historical Society, as well as historic maps. The review provided information for the area pertaining to the archaeological and historical context to assist in the evaluation of cultural resources identified during the investigations.

2.1.4.4 Environmental Permitting Review

A preliminary review of impacts to potential wetlands, threatened and endangered species habitat, and cultural resource was completed for each of the alternatives to determine what environmental permits will be required. The following is a list environmental permits and responsible agencies.

- Clean Water Act Section 401- Water Quality Certification–Kansas Department of Health & Environment (KDHE)
- Clean Water Act Section 404 – Dredge and Fill Permit – USACE
- Endangered Species Act Clearance – USFWS and Kansas Department of Wildlife Parks & Tourism (KDWPT)
- Migratory Bird Treaty Act – USFWS
- Gold and Bald Eagle Act - USFWS
- Historic Preservation Act Clearance – Kansas State Historic Preservation Office (SHPO)
- Stream and Floodplain Permits – Kansas Department Agriculture – Division of Water Resources (KDWR)

- National Pollution Discharge Elimination System Permit – KDHE
- National Environmental Policy Act – USACE (Lead Agency)

2.2 Reservoir Study Results

Based on the analysis criteria in Section 2.1, the following are the results for the four reservoir site analyses.

2.2.1 Hydrology & Hydraulics Studies

Figures A-1 through A-5 (Appendix A) show the locations of the four sites, their delineated watersheds, and the maximum pool elevation extents. Table 2-3 shows the contributing watershed area for each of the sites. Tables 2-4 through 2-6 show the water surface area, storage capacity, and required length of embankment to impound water up to the specified water surface elevation at each site. The storage capacity that corresponds to the highest embankment (e.g. Beaver Creek water surface elevation [WSE] 1,460 feet) includes 5 feet of freeboard in the calculation.

Table 2-3 Watershed Areas

Watershed	Area (acres)
Beaver Creek Site	22,756
Site 4	3,120
East Site	730
West Site	1,014

Table 2-4 Beaver Creek Storage Capacity

Water Surface Elevation (feet)	Surface Area (acres)	Embankment Length (feet)	Storage Capacity (ac-ft)[1]
1,420	11	128	41
1,430	83	779	775
1,440	319	1,586	4,043
1,450	840	2,264	11,624
1,460	1,740	3,404	19,371

[1] ac-ft = acre-feet

Table 2-5 Site 4 Storage Capacity

Water Surface Elevation (feet)	Surface Area (acres)	Embankment Length (feet)	Storage Capacity (ac-ft)[1]
1,460	6	626	9
1,470	54	907	488
1,480	146	1,228	1,887
1,490	272	2,447	3,826
1,500	455	2,759	8,138
1,510	689	2,123	15,472
1,520	1,034	3,610	21,067

[1] ac-ft = acre-feet

Table 2-6 West Site Storage Capacity

Water Surface Elevation (feet)	Surface Area (acres)	Embankment Length (feet)	Storage Capacity (ac-ft)[1]
1,600	7	805	22
1,620	42	1,331	714
1,640	153	2,602	3,649
1,660	344	3,366	8,506

[1] ac-ft = acre-feet

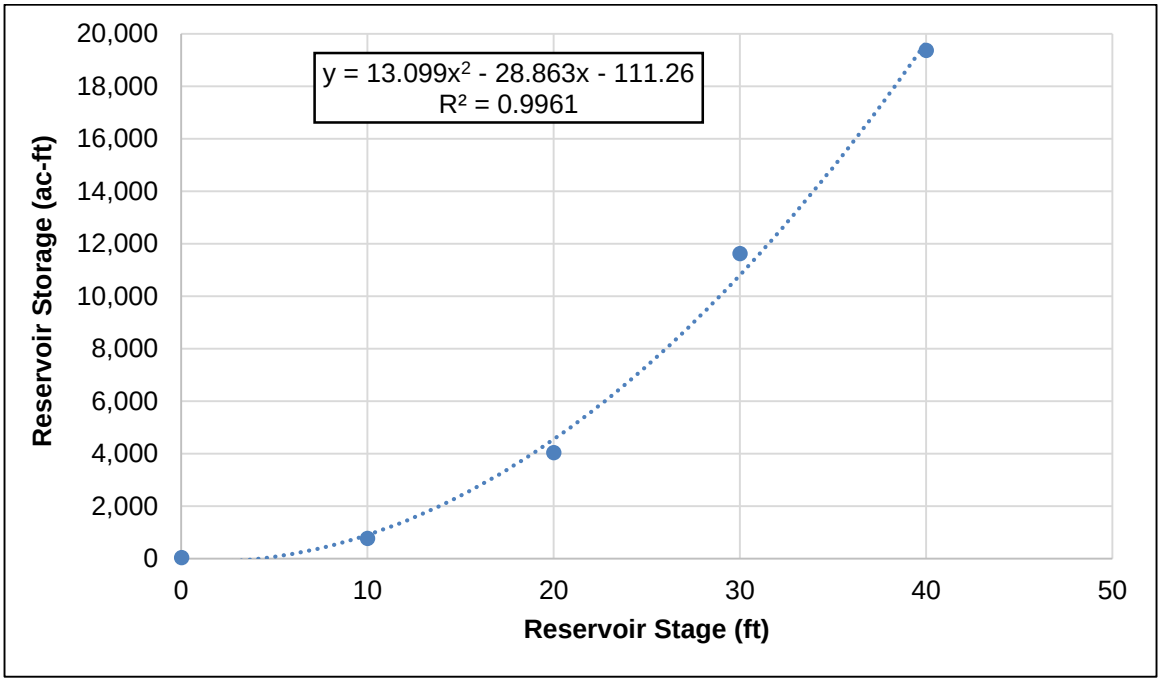
Table 2-7 East Site Storage Capacity

Water Surface Elevation (feet)	Surface Area (acres)	Embankment Length (feet)	Storage Capacity (ac-ft)[1]
1,600	22	683	50
1,620	98	2,134	1,719
1,640	246	2,647	6,078

[1] ac-ft = acre-feet

Using the information from these tables, regression equations were fitted to the data points. An example of one of the plots is shown in Figure 2-1, below. The remainder of the figures are included in Appendix B. The regression equations allow the mass balance equation to be calculated automatically in Microsoft Excel® for each month.

Figure 2-1 Beaver Creek Stage Storage Regression Curve



Each month the evaporation and precipitation are pulled from the weather data and multiplied by the surface area of the reservoir at that time step; the inflow is calculated for that month; and the seepage is estimated based on the surface area of the reservoir at that time step and the assumed soil type based seepage rate. This study phase analysis was performed to determine if one, there could be expected a minimum safe yield in the reservoir, and two what would be the maximum amount of water able to be stored in the reservoir given the available inflow.

Figures 2-2 through 2-5 show the volume of water estimated to be held in the proposed reservoir throughout the period of record. The blue line represents the annual average while the lower line represents the lowest monthly storage volume and the upper line shows the month with the maximum amount of water stored. In all locations, the volume of water available for storage is zero for at least a few years in the mid-2000s. With the exception of 2003 through 2006, the Beaver Creek site is able to keep water stored throughout the remaining period of record. Site 4 has water storage dip down to zero or very nearly zero from 2003 through 2006 and also in 1972 and 1992. The East and West Sites go to zero many times during the study period; without supplemental water from the nearby canal, these sites could potentially be empty.

Figure 2-2 Estimated Storage Volume Over Period of Record for Proposed Reservoir at Beaver Creek Site

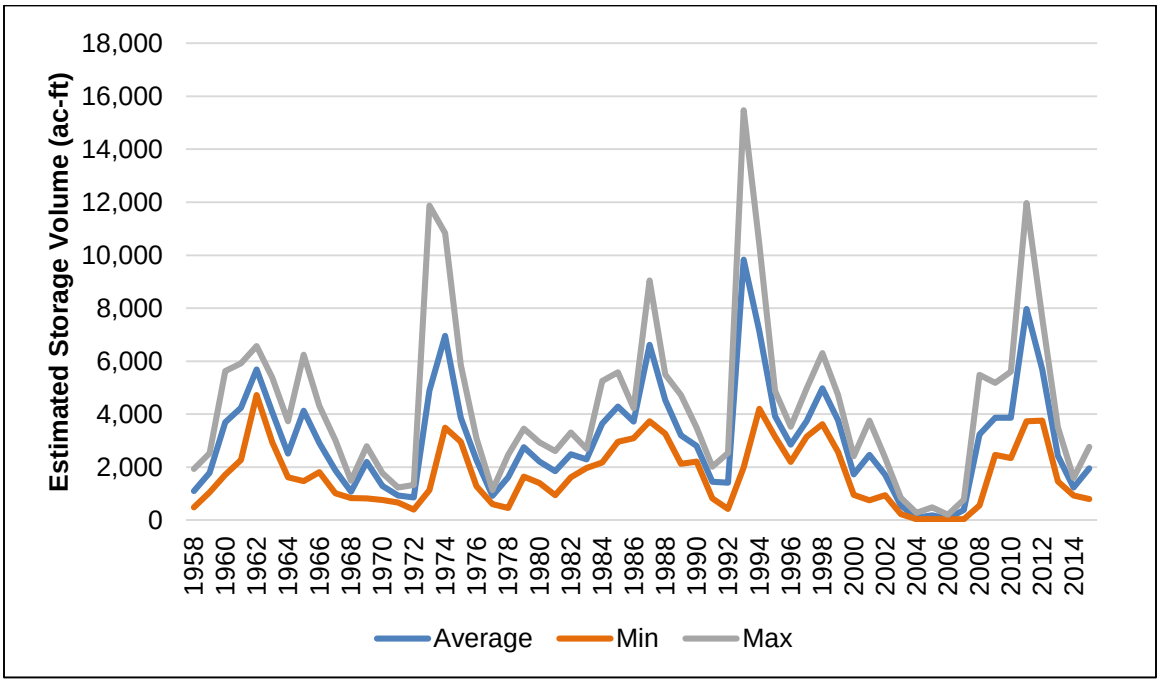


Figure 2-3 Estimated Storage Volume Over Period of Record for Proposed Reservoir at Site 4

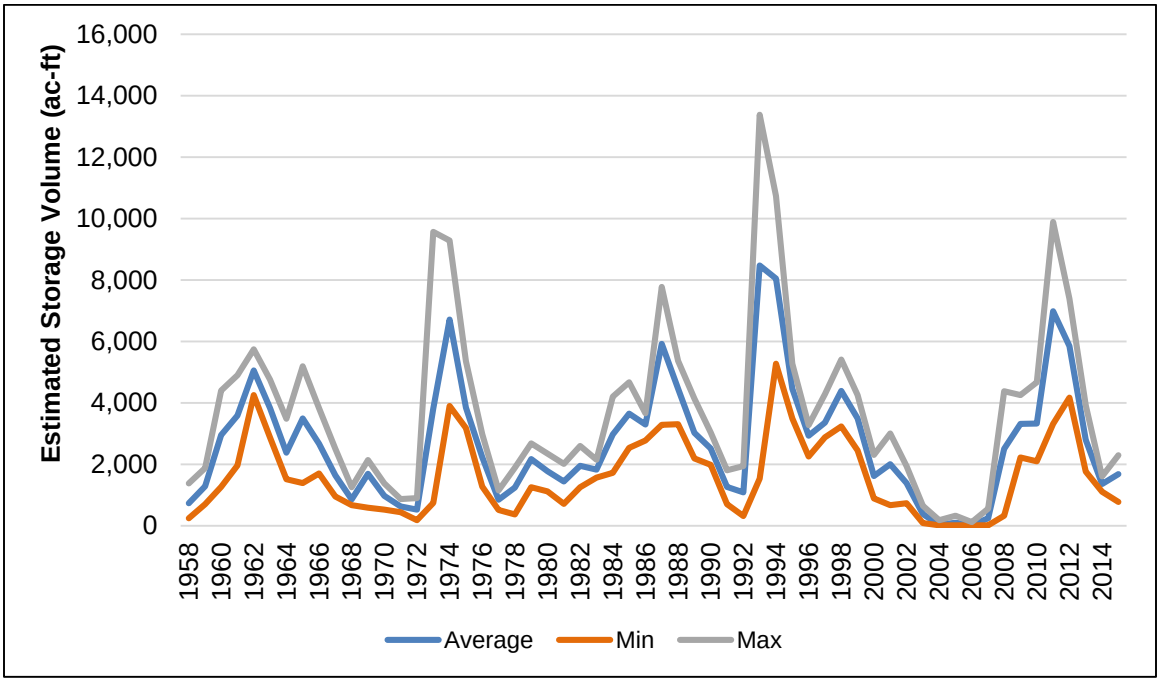


Figure 2-4 Estimated Storage Volume Over Period of Record for Proposed Reservoir at East Site

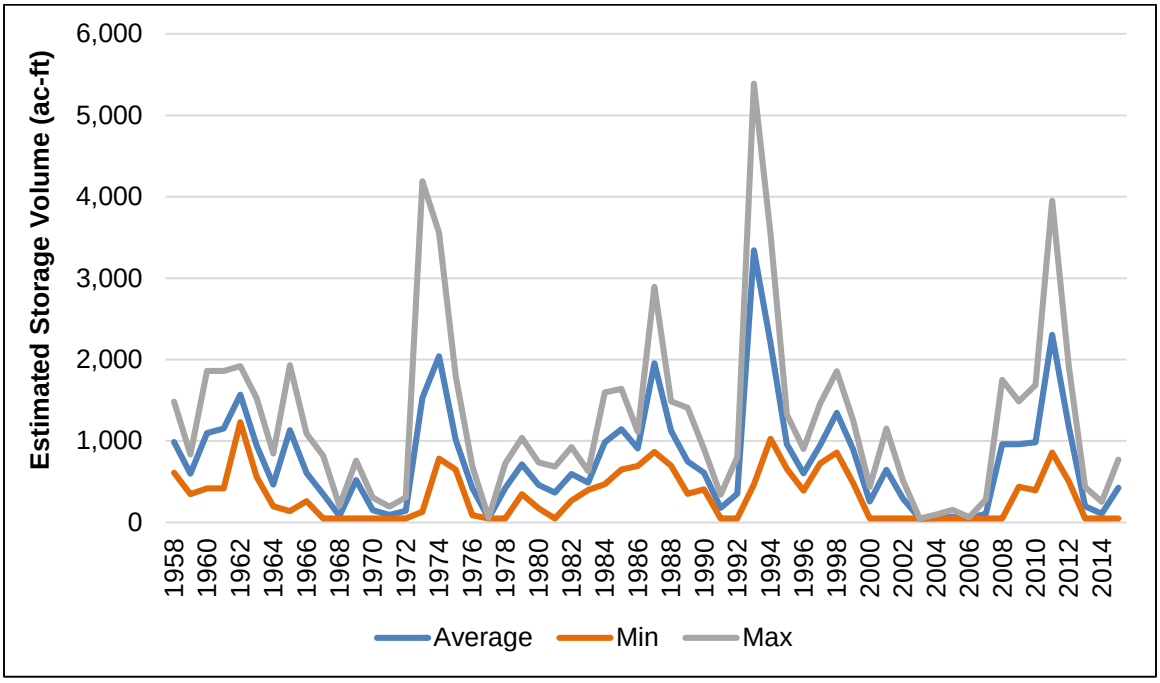
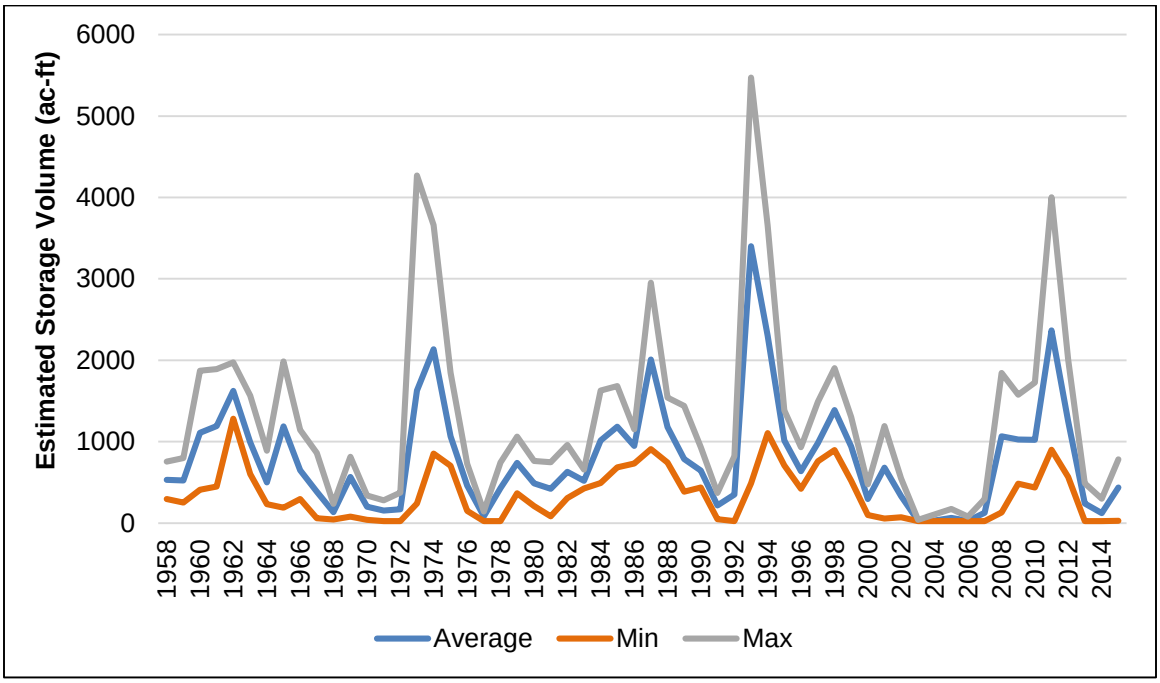


Figure 2-5 Estimated Storage Volume Over Period of Record for Proposed Reservoir at West Site



While the proposed locations for the impoundments are such that they would allow ponding of all of the water available during wet years, the impoundments will go dry, sometimes for several years' succession.

Tables B-1 through B-4 (Appendix B) show the monthly estimated storage for each of the proposed reservoir sites calculated using the mass balance equation. The maximum storage required for the Beaver Creek Reservoir (Table B-1) is 15,473 acre-feet (ac-ft) which is less than the calculated storage capacity

for an embankment elevation of 1,460 ft (Table 2-3) at that site. The maximum storage required for the East Site Reservoir (Table B-2) is 5,391 ac-ft which is less than the calculated storage capacity for an embankment elevation of 1,640 ft (Table 2-6) at that site. The maximum storage required for the West Site Reservoir (Table B-3) is 5,473 ac-ft which is less than the calculated storage capacity for an embankment elevation of 1,660 ft (Table 2-5) at that site. The maximum storage required for the Site 4 Reservoir (Table B-4) is 13,382 ac-ft which is less than the calculated storage capacity for an embankment elevation of 1,510 feet (Table 2-4) at that site. In discussions with KWO personnel, it was determined to maintain the embankment height based on the topography as opposed to maximum calculated water surface elevation plus freeboard.

It should be noted that the seepage rates represent the bulk of the losses to reservoir storage. More study of the soils in the area should be performed before ruling out a site that may be able to be sustainable otherwise. The analysis does not account for minimum outflow requirements. In reality, a minimum outflow rate would likely be mandated due to water rights and habitat issues.

2.2.2 Geotechnical Studies

2.2.2.1 Beaver Creek

Based on information from the NRCS soil survey, the upper soils underlying the proposed reservoir are Crete and Geary-Hobbs silt loams, Crete and Hastings silty clay loams and the Hastings-Hobbs complex. These soils are described as generally being silts and clays that are moderately well to well drained. The NRCS soil survey also provides semi-quantitative indications of the suitability of the upper soils for use in constructing embankments and performance as a reservoir subbase. The rating system is from 0 to 1.0 with 1.0 representing the most susceptible soil types to each issue. The soils in this area are mainly noted as having a “somewhat limited” use as an embankment material because of dust concerns with a rating of 0.25. Additionally, 10 percent of the soils in this area are noted as having “very limited” use as reservoir subbase materials, with the rest of the materials having “somewhat limited” use. The “very limited” soils are generally along Beaver Creek. All soils were described as having a moderate to high seepage characteristics with a rating of 0.7. Some soils were also noted as having high slopes with a rating of 1.0, which was noted as being limiting to the overall reservoir storage capacity.

Published geologic data from the Kansas Geological Survey for Republic County indicate the site is underlain by the Sanborn, Alluvium, Carlile Shale and Greenhorn Limestone/Graneros Shale formations. The Sanborn formation is described as being comprised of eolian silt, sandy silt, gravel and sands. The Alluvium formation is described as being comprised of unconsolidated sand, silt, clay and gravel. The Carlile Shale formation is described as being comprised of chalky shale, dark gray fissile shale and fine-

grained sandstone. The Greenhorn Limestone/Graneros Shale formation is described as being comprised of chalky limestone and calcareous shale. No published data were found that indicates geologic hazards at the site that could affect the proposed reservoir such as soluble rock, karst, mines or other conditions that indicate an unstable subsurface.

The upper material in the Sanborn formation is noted as being loess. Loess is comprised of lightly cemented silts with varying amounts of clay and fine sand that were deposited via wind in a somewhat loose soil structure. They have relatively high permeabilities for fine grained materials and have a tendency to collapse when disturbed, loaded or inundated with water. The possible degree of collapse induced settlement depends on the weathering of the loess. This material underlies only a portion of the proposed reservoir above the Alluvium formations that run along Beaver Creek.

Well logs published by the state of Kansas in the vicinity of the proposed reservoir were also reviewed. Upper materials were generally tan clay underlain by sand. Bedrock materials encountered included shale and sandstone. These materials appear to generally correspond to the Sanborn and Alluvium formations discussed above. No strength testing was performed so the adequacy of the subsurface materials as a bearing stratum for any embankments is unclear. No testing of the collapse potential of these soils was performed and thus the extent of the collapsibility of the loess is unknown.

Based on the review of this available data, the area of the proposed reservoir is generally underlain by alluvium and shale/sandstone/limestone bedrock materials with a small portion underlain by loess. The alluvium may have minor limitations for being used in embankments because of concerns with erosion and possible coarsely graded soil content. Well logs in the vicinity to the reservoir indicated relatively thick clay layers above sands but variations in alluvium soils still may occur in certain areas. Areas with coarse materials may be poor material for a reservoir subbase because of high infiltration rates and may require lining. Loess material has limitations for being used in embankments based on the low plasticity of the soil and high silt/sand content and may require lining to limit seepage through the embankment and subbase.

Shale bedrock may require substantial amount of processing to be used as an embankment material so it can be properly placed and compacted. Sandstone and limestone will not be able to be utilized as embankment material. It is expected that shale/sandstone/limestone will be a low permeability subbase for the reservoir.

It should also be noted that loess has a tendency to collapse when disturbed, loaded or inundated with water. For the main storage area of the reservoir, this collapse induced settlement will have little effect.

Loess is not expected under the embankment. Based on this, possible collapse induced settlement from the loess is expected to have a relatively limited effect on the reservoir.

A final geotechnical investigation and design should be performed to determine the extent of the possible issues discussed above. Collapse testing, strength testing, compaction testing, gradation testing, permeability testing and infiltration testing on soils from this specific site should be performed to determine site-specific design parameters. Results from this testing could be utilized to estimate the infiltration rate, specify earthwork procedures, estimate settlement and perform slope stability analyses.

2.2.2.2 Site 4

Based on information from the NRCS soil survey, the upper soils underlying the proposed reservoir are the Crete, Geary-Hobbs and Hastings silt loams, Hastings silty clay loams and the Hastings-Hobbs complex. These soils are described as being silts and clays that are moderately well to well drained. The NRCS soil survey also provides semi-quantitative indications of the suitability of the upper soils for use in constructing embankments and performance as a reservoir subbase. The rating system is from 0 to 1.0 with 1.0 representing the most susceptible soil types to each issue. The soils in this area are mainly noted as having a “somewhat limited” use as an embankment material because of dust concerns with a rating of 0.25. Additionally, 13 percent of the soils in this area are noted as having “very limited” use as reservoir subbase materials, with the rest of the materials having “somewhat limited” use. The “very limited” soils are generally along waterways. All soils were noted as having a moderate to high seepage characteristics with a rating of 0.7. Some soils were also described as having high slopes with a rating of 1.0, which was noted as being limiting to the overall reservoir storage capacity.

Published geologic data from the Kansas Geological Survey for Republic County indicate the site is underlain by the Alluvium and Greenhorn Limestone/Graneros Shale formations. The Alluvium formation is described as being comprised of unconsolidated sand, silt, clay and gravel. The Greenhorn Limestone/Graneros Shale formation is described as being comprised of chalky limestone and calcareous shale. It was encountered at lower elevation channels. No published data was found that indicates any geologic hazards at the site that could affect the proposed reservoir such as soluble rock, karst, mines or other conditions that indicate an unstable subsurface.

Well logs published by the state of Kansas in the vicinity of the proposed reservoir were also reviewed. Upper materials were generally tan clay of reasonable thickness underlain by sand. Shale bedrock was encountered under the sand materials. These materials appear to generally correspond to the Alluvium formation discussed above. No strength testing was performed so the adequacy of the subsurface materials as a bearing stratum for an embankment is unclear.

Based on the review of this available data, the area of the proposed reservoir is generally underlain by alluvium and shale bedrock materials. The alluvium may have minor limitations for being used in embankments because of concerns with erosion and possible coarsely graded soil content. Well logs in the vicinity to the reservoir indicated relatively thick clay layers above sands but variations in alluvium soils still may occur in certain areas. Areas with coarse materials may be poor material for a reservoir subbase. Areas with shale bedrock may require substantial amount of processing to be used as an embankment material so it can be properly placed and compacted. Shale is expected to be a low permeability subbase for the reservoir.

A final geotechnical investigation and design should be performed to determine the extent of the possible issues discussed above. Strength testing, compaction testing, gradation testing, permeability testing and infiltration testing on soils from this specific site should be performed to determine site-specific design parameters. Results from this testing could be utilized to estimate the infiltration rate, specify earthwork procedures, estimate settlement and perform slope stability analyses.

2.2.2.3 West

Based on information from the NRCS soil survey, the upper soils underlying the proposed reservoir are generally the Holdrege and Nuckolls-Roxbury silt loams. These soils are described as being silts and clays that are well drained. The NRCS soil survey also provides semi-quantitative indications of the suitability of the upper soils for use in constructing embankments and performance as a reservoir subbase. The rating system is from 0 to 1.0, with 1.0 representing the most susceptible soil types to each issue. The soils in this area are mainly noted as having a “somewhat limited” use as an embankment fill material because of piping and dust concerns, with ratings of 0.32 and 0.5 respectively. Additionally, the soils in this area are noted as being split evenly between “somewhat limited” and “very limited” uses as reservoir subbase material. All soils were noted as having a moderate to high seepage characteristics with a rating of 0.7. Some soils were also described as having high slopes with a rating of 1.0, which was noted as being limiting to the overall reservoir storage capacity. The NRSC soil survey information also noted that areas at the north end of the proposed reservoir, in the location of the proposed embankment, were gravel pits and sandy spots.

Published geologic data from the Kansas Geological Survey for Jewell County indicate the site is underlain by the Sanborn formation. The Sanborn formation is described as being comprised of eolian silt, sandy silt, gravel and sands. No published data was found that indicates geologic hazards at the site that could affect the proposed reservoir such as soluble rock, karst, mines or other conditions that indicate an unstable subsurface.

The upper silt and clay materials in the Sanborn Formation appear to be loess. Loess is comprised of lightly cemented silts with varying amounts of clay and fine sand that were deposited via wind in a somewhat loose soil structure. They have relatively high permeability for fine grained materials and have a tendency to collapse when disturbed, loaded or inundated with water. The possible degree of collapse induced settlement depends on the weathering of the loess and the amount of cementation.

Well logs published by the state of Kansas in the vicinity of the proposed reservoir were also reviewed. The well logs indicate the subsurface conditions are clay of moderate thickness underlain by fine and medium sand with varying amounts of clay underlain by shale bedrock. These materials appear to generally correspond to the Sanborn formation discussed above. No strength testing was performed so the adequacy of the subsurface materials as a bearing stratum for an embankment is unclear. No testing of the collapse potential of these soils was performed and thus the extent of the collapsibility of the loess is unknown.

2.2.2.4 East

Based on information from the NRCS soil survey, the upper soils underlying the proposed reservoir area are the Holdrege and Nuckolls-Roxbury silt loams. These soils are described as being silts and clays that are well drained. The NRCS soil survey also provides semi-quantitative indications of the suitability of the upper soils for use in constructing embankments and performance as a reservoir base. The rating system is from 0 to 1.0, with 1.0 representing the most susceptible soil types to a specific issue. The soils in this area are mainly noted as having a “somewhat limited” use as an embankment fill material because of piping and dust concerns, with rating of 0.32 and 0.5 respectively. Additionally, the soils in this area are noted as being split evenly between “somewhat limited” and “very limited” uses as reservoir subbase material. All soils were noted as having a moderate to high seepage characteristics with a rating of 0.7. Some soils were also described as having high slopes with a rating of 1.0, which was noted as being limiting to the overall reservoir storage capacity.

Published geologic data from the Kansas Geological Survey for Jewell County indicate the site is underlain by the Sanborn and Meade formations. The Sanborn formation is described as being comprised of eolian silt, sandy silt, gravel and sands. The Meade formation is described as being glacial outwash that is comprised of silt, sandy silt, gravel and sands and was observed in lower elevation channels. No published data was found that indicates geologic hazards at the site that could affect the proposed reservoir such as soluble rock, karst, mines or other conditions that indicate an unstable subsurface.

The upper materials in the Sanborn formation are noted as being loess. Loess is made up of lightly cemented silts with varying amounts of clay and fine sand that were deposited via wind in a fairly loose soil structure. They have relatively high permeability for fine grained materials and have a tendency to

collapse when disturbed, loaded or inundated with water. The possible degree of collapse induced settlement depends on the weathering of the loess and amount of cementation.

Well logs published by the state of Kansas in the vicinity of the proposed reservoir were also reviewed. The well logs indicate the subsurface conditions are clay and sandy silt of moderate thickness underlain by fine and medium sand. Shale bedrock was encountered under the sand materials. These materials appear to generally correspond to the Sanborn and Meade formations discussed above. No strength testing was performed so the adequacy of the subsurface materials as a bearing stratum for an embankment is unclear. No testing of the collapse potential of these soils was performed and thus the extent of collapsibility of the loess is unknown.

Based on the review of this available data, the area of the proposed reservoir is directly underlain by loess and glacial outwash materials. Loess and glacial outwash materials have limitations for being used in embankments based on the low plasticity of the soil and high silt/sand content and may require lining to limit seepage through the embankment and subbase. Consideration of these high infiltration rates during design of the reservoir will need to be considered.

It should also be noted that loess has a tendency to collapse when disturbed, loaded or inundated with water. For the storage area of the reservoir, this collapse induced settlement will have little effect. However, underneath the embankment, this settlement could be problematic in regards to decreasing design freeboard or leading to differential settlement.

A final geotechnical investigation and design should be performed to determine the extent of the possible issues discussed above. Collapse testing, strength testing, compaction testing, permeability testing and infiltration testing on soils from this specific site should be performed to determine site-specific design parameters. Results from this testing could be utilized to estimate the infiltration rate, specify earthwork procedures, estimate settlement and perform slope stability analyses.

2.2.3 Opinion of Probable Cost

Volume and area quantities were calculated using a combination of AutoCAD Civil 3D and ArcMap® GIS, including USGS downloaded contour data. The embankment and hauling quantities were calculated under the assumption that all of the fill material for the embankment would be borrowed from the reservoir impoundment area. In order to prevent the impounded water from eroding the embankment, a riprap liner will be placed on the inside slope. The total area of the embankment slope to be covered by riprap extends from the toe of the embankment to an elevation two feet higher than the stage that would be observed from the calculated maximum storage event. The cost of installing an access road to each embankment site was also calculated. This quantity was calculated by finding the straight line distance

from the nearest serviceable county road to the edge of the embankment. A typical service road width of twenty feet was used to determine total access road area that would need to be installed. The preliminary nature of the environmental studies for this report made it difficult to quantify the cost of environmental remediation for each site. For the sake of this report, a conservative cost of 50% of the construction subtotal was assumed as the cost of environmental remediation. The close proximity of the East and West sites to the Courtland Canal make pumping supplementary water to these reservoirs a feasible option. The additional cost of a pumping station has been added to the cost estimates for each of these sites. A separate Opinion of Probable Cost was compiled for each of the four proposed reservoir sites which can be seen in an itemized breakdown in Tables C-1 through C-4 (Appendix C).

2.2.4 Environmental Studies

Upon completing the preliminary desktop environmental evaluations for the four potential reservoir sites the following are the results of the wetland, sensitive species habitat assessment, and cultural resources review.

2.2.4.1 Wetland Assessment

NWI maps show the location and shape of potential wetlands, and classify them into categories based on vegetation, water regime, salinity, and other wetland characteristics. NWI maps can accurately show the location and wetland types such as ponds and emergent wetlands, but are not as accurate in showing inconspicuous wetlands such as forested wetlands and the extent of the boundaries. Table 2-7 below and Figures A-6 through A-9 (Appendix A) show the extent of NWI wetlands within the Project areas.

Table 2-8 Estimated Acreages of NWI Wetlands Within the Project Areas

Location/Wetland Type	Acres of Wetlands
West Site Reservoir	
Emergent Wetland	2
Pond	10
Riverine/Riparian	9
Total:	**21**
East Site Reservoir	
Emergent Wetland	1
Pond	15
Riverine/Riparian	5
Total:	**21**
Beaver Creek Reservoir	
Emergent Wetland	30
Forested/Shrub Wetland	17
Pond	6
Riverine/Riparian	41
Total:	**94**
Site 4 Reservoir	
Emergent Wetland	7
Forested/Shrub Wetland	5
Pond	7
Riverine/Riparian	14
Total:	**33**

Given the limitations of NWI maps and that wetland identification criteria differ between the USFWS and the USACE, wetlands shown on a NWI map may not be under the jurisdiction of the USACE. Similarly, all jurisdictional wetlands are not always included on NWI maps. Consequently, wetland abundance based on NWI maps cannot be assumed to be a thoroughly accurate assessment of jurisdictional wetlands. Therefore, if the Project continues to move forward, it is recommended that a field survey be conducted to determine waters of the United States (streams, creeks, rivers, open waters and adjacent wetlands).

Upon review of the proposed reservoir locations and superimposing the normal pool polygon on the NWI the estimated potential impacts to wetlands, riparian areas and stream channels are shown in Table 2-8.

Table 2-9 Potential Wetland and Stream Channel Impacts Within the Project Areas

Location Wetland and Stream Type	Total
West Site Reservoir	
Emergent Wetland	2 acres
Pond/Open Water	10 acres
Riverine/Riparian	9 acres
Intermittent Stream Channel	4 miles
East Site Reservoir	
Emergent Wetland	1 acre
Pond/Open Water	15 acres
Riverine/Riparian	5 acres
Intermittent Stream Channel	4 miles
Beaver Creek Reservoir	
Emergent Wetland	30 acres
Forested/Shrub Wetland	17 acres
Pond/Open Water	6 acres
Riverine/Riparian	518 acres
Perennial Stream Channel	33 miles
Site 4 Reservoir	
Emergent Wetland	7 acres
Forested/Shrub Wetland	5 acres
Pond/Open Water	7 acres
Riverine/Riparian	14 acres
Intermittent Stream Channel	12 miles

2.2.4.2 Threatened & Endangered Species Assessment

The Project areas were submitted to the USFWS IPaC online assessment resource. Two protected species were listed as potentially being affected by activities in the Project areas, whooping crane (*Grus americana*) and northern long-eared bat (NLEB; *Myotis septentrionalis*). No critical habitat was identified within the Project areas.

Whooping cranes are typically attracted to stop-over and roosting areas during their migration by the presence of water combined with the abundance of food. Stop-over and roosting locations are typically shallow ponds and sloughs, and resting areas are shallow wetlands. Riverine wetland systems, such as those found in non-channelized reaches of major rivers, are also known stop-over habitats, and a commonly used habitat in the Midwest. Each reservoir location contains enough evidence of wetlands that would warrant a separate whooping crane analysis that utilizes field verified habitat types, migration corridor location, and proximity to suitable habitat. A field assessment would also be beneficial to

evaluate for habitat for migratory birds and raptors protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Act.

Suitable winter habitat (hibernacula) for the NLEB includes underground caves and cave-like structures (e.g., abandoned or active mines, railroad tunnels). During summer, NLEBs roost singly or in colonies and in cavities, underneath bark, in crevices, or in hollows of both live and dead trees and/or snags typically 3 inches in diameter at breast height or greater. Males and non-reproductive females may also roost in cooler places, like caves and mines. This bat species seems opportunistic in selecting roosts, using tree species based on presence of cavities, crevices, or of peeling bark. Suitable spring staging/fall swarming habitat for the NLEB consists of the variety of forested/wooded habitats where they roost, forage, and travel, which are most typically within five miles of a hibernaculum. This includes forested patches as well as linear features such as fencerows, riparian forests, and other wooded corridors.

There are no known hibernacula within the Project areas. However, the range of the white-nose syndrome does extend into the Project area counties, such that the 4(d) rule applies. Accordingly, if tree removal could be conducted between June 1st and July 31st, then the Project areas would likely need a field assessment for NLEB suitable habitat.

The KNRP online database was reviewed with respect to aquatic species found within the Project areas. The West Site overlaps with the plains minnow (*Hybognathus placitus*), a state threatened species. The Republican River is designated as being a critical habitat for the plains minnow and impacts to tributaries within the West Site would likely require further evaluation via field assessment. The West Site also overlaps with two freshwater mussel species of concern, the white heelsplitter (*Lasmigona complanata*) and pink papershell (*Potamilus ohiensis*). The Beaver Creek Site overlaps with the giant floater (*Pyganodon grandis*), a freshwater mussel species of concern. The East Site and Site 4 do not overlap with any state level sensitive species.

The Project areas all contain sufficient evidence of wetlands and streams that would likely be permanently impacted as a result of the creation of additional reservoirs. The exact extent of impacts cannot be estimated at this time due to lack of design details and field survey data. However, due to the size of each reservoir, it is anticipated that the Project would require an Individual Permit (IP) from Section 404 of the Clean Water Act, administered the USACE. Aside from an application, this type of permit would require that the Project justify the need for a new reservoir(s) via an alternatives analysis, provide a viable mitigation plan, and provide permits or approval from other applicable state and federal agencies such as USACE, EPA, USFWS, KDWPT, KDWR, KDHE and SPHO.

As the Project is preliminary in nature, specific mitigation requirements cannot be identified at this time. Informal discussions with the USACE indicated that mitigation from stream impacts would likely be required via the purchase of existing USACE approved stream/riparian credits and or in-lieu-fee (ILF) program. Matt Mikulecky of USACE referenced the Kansas Stream Mitigation Guidance (KSMG) in demonstrating how the USACE would calculate mitigation requirements from stream impacts. Permittee is responsible for mitigation, the process of offsetting impacts via the preservation, creation and or restoration of wetland and riparian areas, may be an option; but only in the event that there are no available mitigation bank credits or ILF programs as determined by the USACE.

In order to estimate the approximate number of mitigation credits for each site, the wetland and stream information collected as part of the wetland desktop survey was entered into the KSMG spreadsheet to calculate the stream mitigation stream credits for the project. It is important to note that the total linear feet of stream impacts in the following tables are based off the wetland desktop survey. In order to provide a more accurate estimation of stream and wetland impacts field surveys must be completed in accordance with the Manual; submitted to the USACE for review and approval, and obtain a formal jurisdictional determination.

The following tables show the estimated impacts for each reservoir alternatives.

Table 2-9 KSMG Adverse Impact Factors for the Proposed Beaver Creek Reservoir

Factor	**Perennial Stream**	**Intermittent Stream**	**Ephemeral Stream**
Stream Type Impacted	0.8	0.6	0.4
Stream Status	0.4	0.1	0.1
Existing Condition Value	0.8	0.8	0.8
Formula total	0.64	0.48	0.32
Duration	0.3	0.3	0.3
Activity	2	2	2
Cumulative impact	20.4336	17.5032	17.5032
Sum of Factors = **M**	24.5736	20.9832	20.6232
Linear Feet of Stream Impacted = **LF**	68,112	58,344	58,344
M x LF	**1,673,757**	**1,224,244**	**1,203,240**

Total Mitigation Credits Required = **4,101,241**

Table 2-10 KSMG Adverse Impact Factors for the Proposed West Reservoir

Factor	Intermittent Stream	Ephemeral Stream
Stream Type Impacted	0.6	0.4
Stream Status	0.1	0.1
Existing Condition Value	0.8	0.8
Formula total	0.48	0.32
Duration	0.3	0.3
Activity	2	2
Cumulative impact	8.5536	8.5536
Sum of Factors = **M**	12.0336	11.6736
Linear Feet of Stream Impacted = **LF**	28,512	28,512
M x LF	**34,3102**	**332,838**

Total Mitigation Credits Required = **675,940**

Table 2-11 KSMG Adverse Impact Factors for the Proposed East Reservoir

Factor	Intermittent Stream	Ephemeral Stream
Stream Type Impacted	0.6	0.4
Stream Status	0.1	0.1
Existing Condition Value	0.8	0.8
Formula total	0.48	0.32
Duration	0.3	0.3
Activity	2	2
Cumulative impact	3.0096	3.0096
Sum of Factors = **M**	6.4896	6.1296
Linear Feet of Stream Impacted = **LF**	10,032	10,032
M x LF	**65,104**	**61,492**

Total Mitigation Credits Required = **126,596**

Table 2-11 KSMG Adverse Impact Factors for the Proposed Site 4 Reservoir

Factor	Intermittent Stream	Ephemeral Stream
Stream Type Impacted	0.6	0.4
Stream Status	0.1	0.1
Existing Condition Value	0.8	0.8
Formula total	0.48	0.32
Duration	0.3	0.3
Activity	2	2
Cumulative impact	2.6136	2.6136
Sum of Factors = **M**	6.0936	5.7336
Linear Feet of Stream Impacted = **LF**	8,712	8,712
M x LF	**53,088**	**49,951**

Total Mitigation Credits Required = **103,039**

The results of calculating the stream channel credits based on estimated impacts indicates that Beaver Creek Reservoir will require the most at 4,101,241 and Site 4 require the least at 103,039 with West Reservoir and East Reservoir requiring 675,940 and 126,596, respectively**.** Mitigation for stream impact for each of the alternative sites may not be mitigated completely on-site because of limited space for mitigation. Therefore, a majority of the mitigation will need to be completed off-site possibly through an ILF program, mitigation bank, or traditional wetland and stream mitigation site.

After completing potential habitat desktop surveys each of the project areas contain potential habitat for protected species as indicated in USFWS IPaC and KNRP databases. A field assessment would more thoroughly identify areas of concern and ascertain if the construction of one or more reservoirs would require further agency approval in the form of concurrence of no impacts or incidental take permits. Accordingly, should the Project continue to move forward, field surveys will need to be completed to accurately quantify the wetland and stream resources and protected species habitat within each Project area. Following a field survey, a more detailed summary of impacts and mitigation can be provided.

2.2.4.3 Cultural Resources Assessment

In the Beaver Creek area, no known archaeological sites are recorded within the study boundary. A number of historic structures were identified on the historic maps within or adjacent to the study boundary as shown in Figure A-10 (Appendix A). These locations designate a possible historic archaeological site or a possible architectural resource. A total of 104 structures are indicated from 1884, 1904 and 1923. Many of these locations overlap or nearly overlap through the three data sets, indicating a single structure at that location through the time period reviewed. At 12 locations, a structure was indicated on the 1965

and 1966 USGS topographic maps. Of these, nine are present on recent aerial maps. In addition to the historic structures, two historic trails are mapped through the project area. Captain Zebulon Pike's 1806 Route runs north-south through the area, and Custer's Trail runs east-west through the northern portion of the area.

In the East Side and West Side areas, no known archaeological sites are recorded within the study boundaries. A number of historic structures were identified on the historic maps within or adjacent to the study boundary as shown in Figure A-11 (Appendix A). In the West Site area, 11 structures are indicated in 1884 and 1908. Some of the locations overlap or near overlap in the two data sets, indicating a single structure at that location through the time period reviewed. In the East Site area, six structures are indicated in 1884 and 1908. However, as the three structures from each data set seem to overlap, it is likely that there was a single structure at each of those three locations through the time period reviewed. None of the structures in the West Site or East Side areas are present on the 1969 USGS topographic map.

In the Site 4 watershed, no known archaeological sites are recorded within the study boundaries. A number of historic structures were identified on the historic maps within or adjacent to the study boundary as shown in Figure A-12(Appendix A). A total of 66 structures and one cemetery are indicated from 1884, 1904 and 1923. Many of these locations overlap or nearly overlap through the three data sets, indicating a single structure at that location through the time period reviewed. At 12 of these locations, a structure was indicated on the 1965 and 1966 USGS topographic maps. Of these, only 3 are present on recent aerial maps, along with the cemetery.

2.2.4.4 Environment Permitting Review

Each proposed site has strong evidence of the presence of wetlands and streams within its vicinity. As discussed above, the extent of impacts to existing features is unknown due to the lack of detailed design and field survey data. Moving forward with the proposed Project, field surveys would be required to accurately describe impacts and aid in the development of specific mitigation measures. The conclusion of the initial desktop review of the proposed site areas suggests that an IP from the USACE, an alternatives analysis and development of a mitigation plan will be required for the Project to be in compliance with state and federal agencies. The current status of the Project, which is in preliminary stages, impedes the ability of developing specific mitigation measures; although discussion with the USACE suggests that stream impact mitigation could consist of the purchase of mitigations credits.

Based on USFWS IPaC and KNRP databases, Project sites do overlap known ranges of protected species. A field assessment will provide more context in to whether impacts are unlikely, or if an incidental take permit may be obligatory. In addition to potential encroachment of protected species habitat, the cultural

resources review indicated a number of historic archaeological and architectural sites surrounding the Project vicinity. The review of the previously identified sites suggests an increased likelihood of cultural resources within the Project site areas. If field studies reveal the presence of cultural resources within the Project site areas, Native American consultation, along with compliance with SHPO regulations would be required as part of the Section 404 permitting process.

3.0 EVALUATION OF ALTERNATIVES

3.1 Introduction

The primary purpose of the alternative analysis is to establish screening criteria and identify the most practicable alternatives that support the Project purpose and needs. A secondary purpose of the alternative analysis is to identify environmental impacts and permitting requirements associated with each of the practicable alternatives. Specific and consistent criteria were developed to screen alternatives and determine the most favorable practicable alternative from an engineering and environmental impact standpoint that would meet the project purpose and need. Screening criterion includes:

- technical feasibility
- logistical feasibility
- cost
- minimization of adverse environmental effects
- timeline and schedule

3.2 Reservoir Siting Evaluation Criteria

The following screening criteria were used to evaluate the extent to which each alternative would achieve the Project purposes and needs as stated in Section 1.0.

3.2.1 Technical Feasibility

The technology employed to construct, operate, or maintain an alternative must be adequate to meet the Project's purpose and need. Reliance on questionable or untested technology would expose the Project to substantial risk related to achieving the Project purposes and needs. To be considered practicable, an alternative must have no substantial and unreasonable geotechnical or engineering problems that could not be solved by available technology. Overall, an alternative must be technically and operationally feasible considering financial, temporal, and environmental constraints. Alternatives that employ methods that can show historical effectiveness or methods suitable for the scale of the Project will be given a "Good" rating. Alternatives that employ methods or technologies not suited for the Project will be given a "Poor" rating.

3.2.2 Logistical Feasibility

Logistical barriers associated with construction, operation, or maintenance could include costs, timing, permitting constraints, access, reliability, unreasonable property acquisition (e.g. property is not available), or operation constraints. Alternatives that involve unreasonable logistical constraints could expose the Project to considerable risk related to its ability to achieve the Project purposes and needs.

3.2.3 Cost Feasibility

The selected alternative must be the most cost effective that is operationally feasible and adequately meets all other purposes and objectives, including environmental concerns. The cost criterion was used to evaluate whether cost would create an unreasonable barrier to the implementation of the Project. Overall, in order to meet the Project purposes and needs, alternatives must be cost effective and in line with KWO's budget. The selected alternative must be the most cost effective, in the sense that it doesn't exceed the budget and that is operationally feasible and adequately meets all other purposes and objectives, including environmental concerns.

3.2.4 Minimization of Adverse Environmental Effects

To be considered for selection, an alternative must have minimal, acceptable environmental impacts. The primary purpose of this criterion is to determine if the most favorable alternative from an environmental impact standpoint is implemented to meet the project purpose and need. Certain alternatives may have major adverse environmental impacts that render the alternative difficult or impossible to permit. In these cases, the alternatives with substantial adverse or negative environmental impacts were not considered to meet the screening criteria.

3.2.5 Land Requirements

Each of the four alternatives require a considerable amount of land for a new reservoir. The costs and effort required to acquire property can be significant. As a measure of comparison, each alternative will be evaluated based on a cost per acre.

The KWO currently does not own the land necessary for each of the alternatives. The alternatives were evaluated using best available cost per acre base on recent real estate transactions in the general vicinity. All estimates presented in this report include estimated purchase costs of land, but does not include cost for condemnation proceedings.

3.2.6 Timeline and Schedule

The alternatives that meet the short term and long term objectives for the construction of a new reservoir, and improve water quality must be completed within a specified time pursuant to applicable permits and overall project schedule. The applicable approval for design plans and specifications to construct a new reservoir must be reviewed and approved by the client then submitted to the regulatory agencies for review and approvals. The Project is expected to be completed within 10 years. The reservoir construction drawings and environmental permits and clearances must be completed. The Project is expected to require a Section 404 permitting and wetland and stream mitigation, threatened and endangered species surveys and cultural resources surveys and clearance. Therefore, alternatives that provide a short duration of time will be given more favorable consideration than those that require more than 10 years.

4.0 CONCLUSIONS AND RECOMMENDATIONS

This Reservoir Feasibility Study was conducted on four potential reservoirs determined by KWO. The hydrology and hydraulics data were calculated and used to conduct a reservoir yield analysis for each site. The geotechnical analysis, water quality analysis and environmental studies for each site were completed using preliminary desktop study methods. Opinions of probable cost were calculated based on the geometry of the proposed embankment at each site. The results summarized in this report are meant to provide a foundation for decisions related to construction of any of the proposed reservoirs.

Conducting a storage-yield analysis for the four proposed reservoir sites using the historical rainfall data and site conditions provided two key pieces of information at each site; the maximum required storage and the periods of time when the reservoirs would impound no water. The maximum required storage at each site would occur during the extremely wet period of time during the early 1990's. During this period, the Beaver Creek Reservoir would be required to impound 15,473 ac-ft of water, the proposed reservoir at Site 4 would be required to impound 13,382 ac-ft of water, the proposed East Site reservoir would be required to impound 5,391 ac-ft of water and the proposed West Site reservoir would be required to impound 5,473 ac-ft of water. The topography of each site would allow for the construction of a berm that is high enough to successfully detain the maximum required storage.

There were also occasions over the period of record that each proposed reservoir would not be impounding any water without a supplementary water source. The proposed reservoir at the Beaver Creek Site had multiple instances of zero impoundment ranging from 4 months to the driest period during the early to mid-2000's, where the reservoir would be dry for 57 months. Similarly, the proposed reservoir at Site 4 would have been dry for periods ranging from 5 months to 58 months during the same dry period. Due to their close proximity, the East and West Sites would be dry during the same periods ranging from 4 months to 53 months. As discussed previously, a significant reason for the dry periods is the sensitivity of the storage yield analysis to ground seepage losses at all of the sites. Ideally, more complete geotechnical and soil data would assist in confirming when the reservoirs would be dry without diverting water from another source.

Initial desktop review of the potential project locations has yielded preliminary results for wetland impacts. Utilizing NWI and normal pool polygon data, total wetland impacts for each of the sites are 21 acres at both the West and East Sites, 94 acres at the Beaver Creek Site and 33 acres at Site 4. Stream channel impacts are estimated to be 4 miles at both the West and East Sites, 33 miles at the Beaver Creek

Site and 12 miles at Site 4. Due to the magnitude of the potential impacts, field surveys would be utilized to refine these results and analyze true impacts to these features within the project footprint.

Online database review from USFWS IPaC and KNRP identified the potential for impacts to a total of six protected species among the sites, both aquatic and terrestrial. Potential likelihood of occurrence would best be investigated via field surveys at potential project locations.

Taking the total construction cost by the total maximum volume of storage shows the relative cost of each respective reservoir. The proposed reservoir at Beaver Creek has a total preliminary cost of $78,800,000 and a relative cost of $4,068 per ac-ft of storage. The proposed reservoir at Site 4 has a total preliminary cost of $52,400,000 and a relative cost of $2,487 per ac-ft of storage. The proposed East Site reservoir has a total preliminary cost of $38,500,000 and a relative cost of $6,334 per ac-ft of storage. The proposed West Site reservoir has a total preliminary cost of $50,400,000 and a relative cost of $5,925 per ac-ft of storage.

5.0 REFERENCES

Soil Survey Staff, Natural Resources Conservation Service (NRCS). United States Department of Agriculture (USDA). Web Soil Survey. Available online at https://websoilsurvey.sc.egov.usda.gov/. Accessed July/06/2016.

U.S. Bureau of Reclamation (USBR). *Value Study Report Proposals for More Efficient Management of Lower Republican River Water Supplies. December 17, 2002*

U.S. Department of Agriculture (USDA). *Revised Universal Soil Loss Equation (RUSLE Model).* 2002. Accessed 2016 from https://www.ars.usda.gov/southeast-area/oxford-ms/national-sedimentation-laboratory/watershed-physical-processes-research/docs/revised-universal-soil-loss-equation-rusle-welcome-to-rusle-1-and-rusle-2/

U.S. Environmental Protection Agency (EPA). *Measuring Nutrient Reduction Benefits for Policy Analysis Using Linked Non-Market Valuation and Environmental Assessment Models – An Interim Report on Water Quality Modeling.* May 8, 2009. Retrieved 2016 from https://www.epa.gov/sites/production/files/2015-10/documents/grants-waterreport.pdf

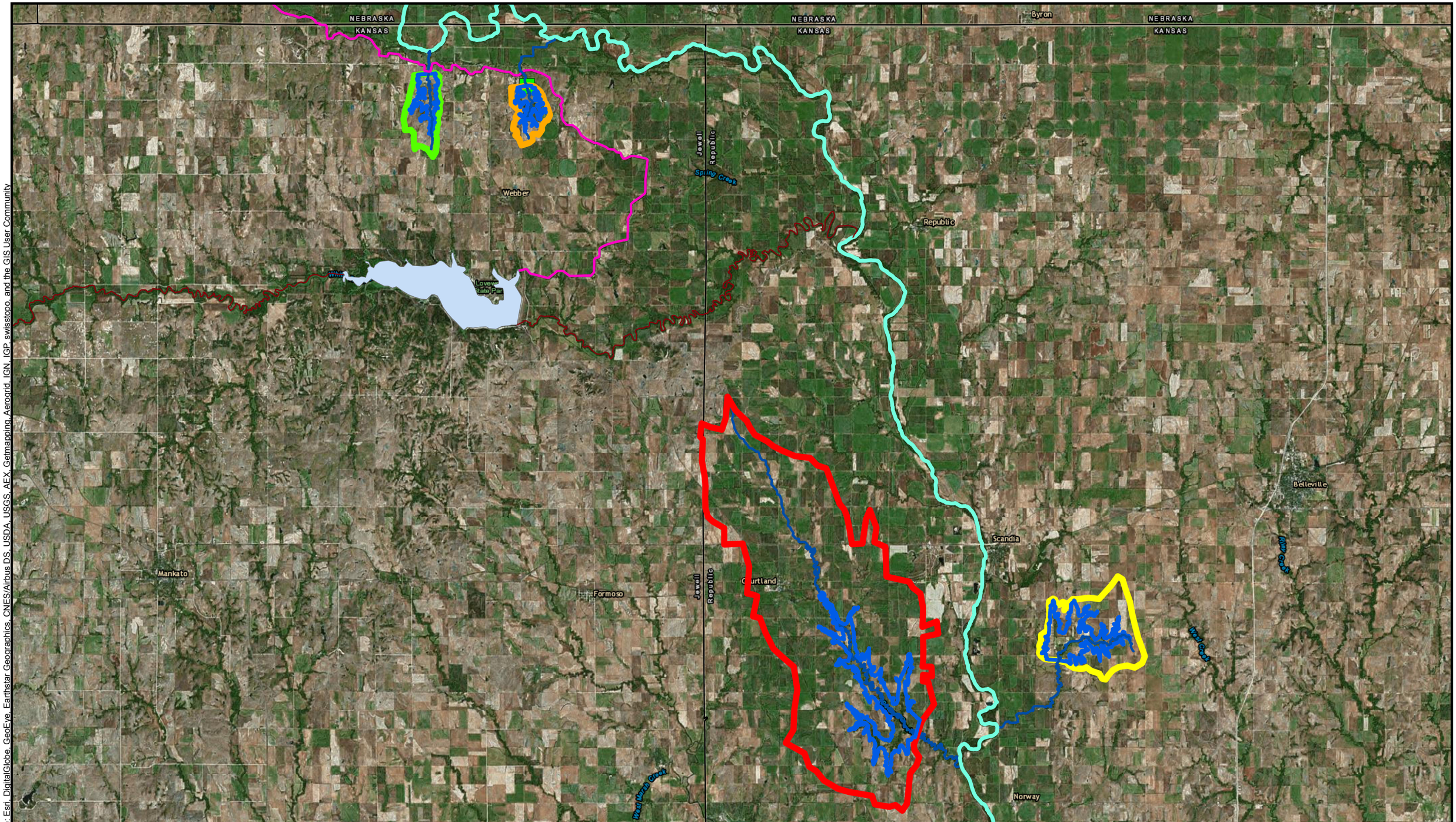
U.S. Fish and Wildlife Service (USFWS). *Endangered Species Program – Information for Planning and Conservation System*. Retrieved 2016 from http://www.ecos.fws.gov/ipac/.

U.S. Geological Survey (USGS). *Kansas Water Science Center – Kansas Streamflow Statistics.* Retrieved October 2016 from https://ks.water.usgs.gov/streamflow-statistics.

U.S. Geological Survey (USGS). *National Water Information System data available on the World Wide Web (Water Data for the Nation), accessed October 4, 2016, at URL https://waterdata.usgs.gov/ks/nwis/uv?site_no=06853800.*

U.S Geological Survey (USGS). *USGS Contours- 10 Foot Interval Kansas Data Access & Support Center.* Available online at http://kansasgis.org/catalog/index.cfm. Accessed July 6, 2016.

APPENDIX A - FIGURES



Legend

- Lovewell Reservoir
- White Rock Creek
- Beaver Creek Watershed
- West Site Watershed
- East Site Watershed
- Site 4 Watershed
- Impoundment Area
- Main Site Tributary
- Courtland Canal
- Republican River

NORTH

25,000 0 25,000

Scale in Feet

BURNS McDONNELL

Figure A-1
Potential Reservoir Sites
KWO Reservoir Feasibility Study

Source:

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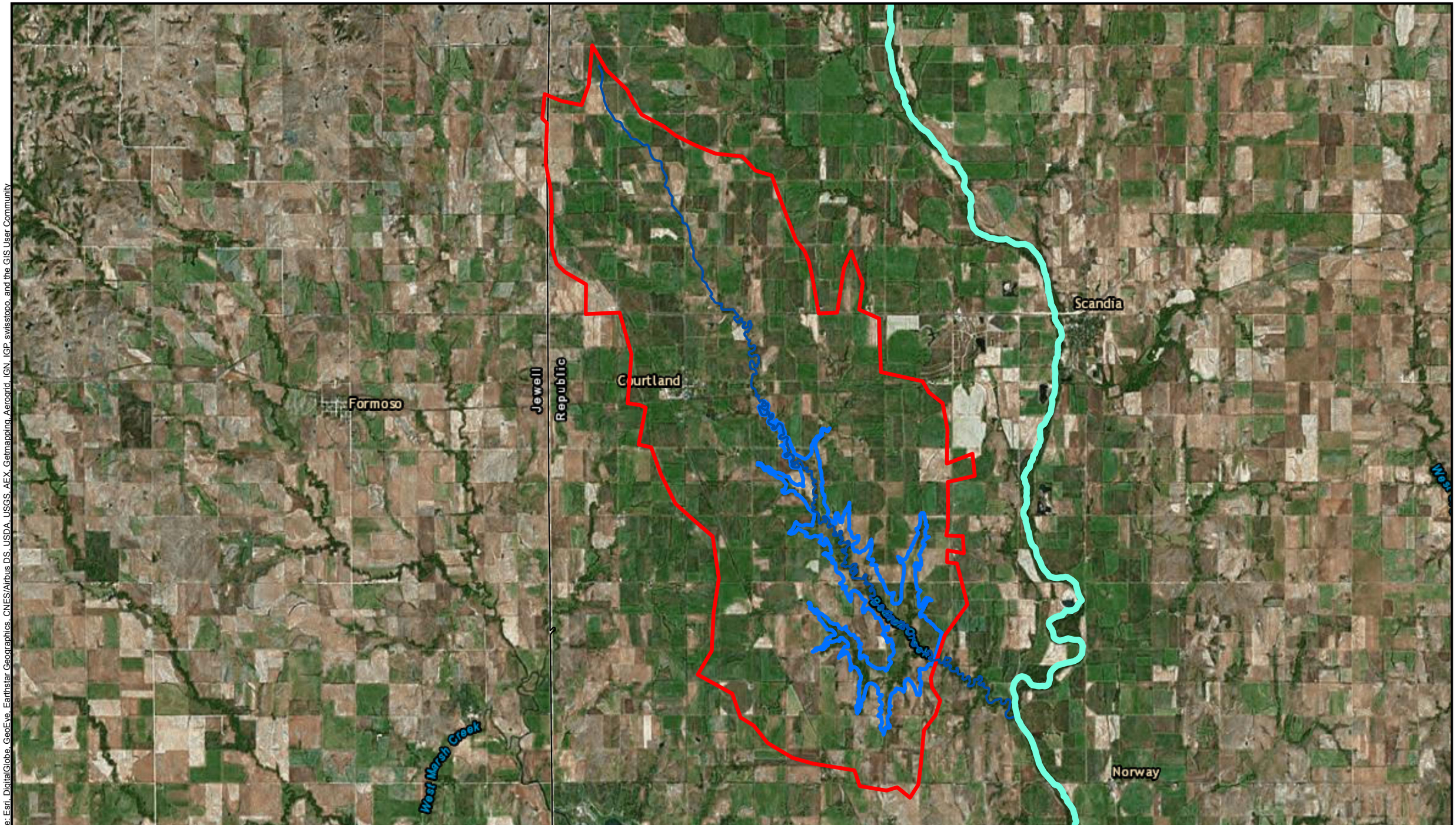

Legend

- Republican River
- Beaver Creek
- Beaver Creek Watershed
- Beaver Creek 1460 Impoundment Area

NORTH

10,000 5,000 0 10,000

Scale in Feet

BURNS McDONNELL

Figure A-2.
Beaver Creek Site
KWO Reservoir Feasibility Study

Source:

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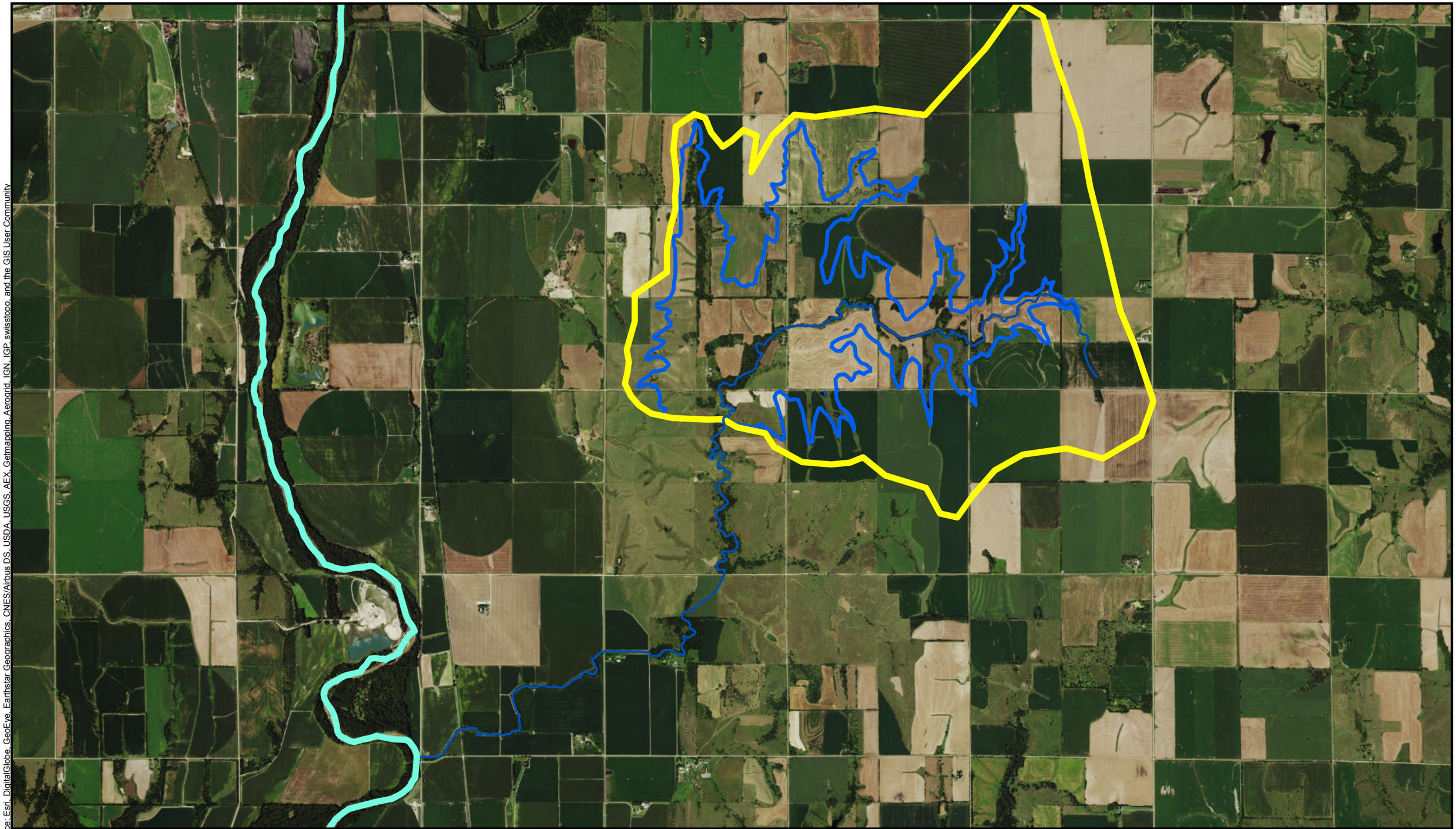

Legend

- Republican River
- Site 4 Main Tributary
- Site 4 Watershed
- Site 4 1520 Impoundment Area

NORTH

5,000 2,500 0 5,000

Scale in Feet

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Figure A-3.
Site 4
KWO Reservoir Feasibility Study

Source:

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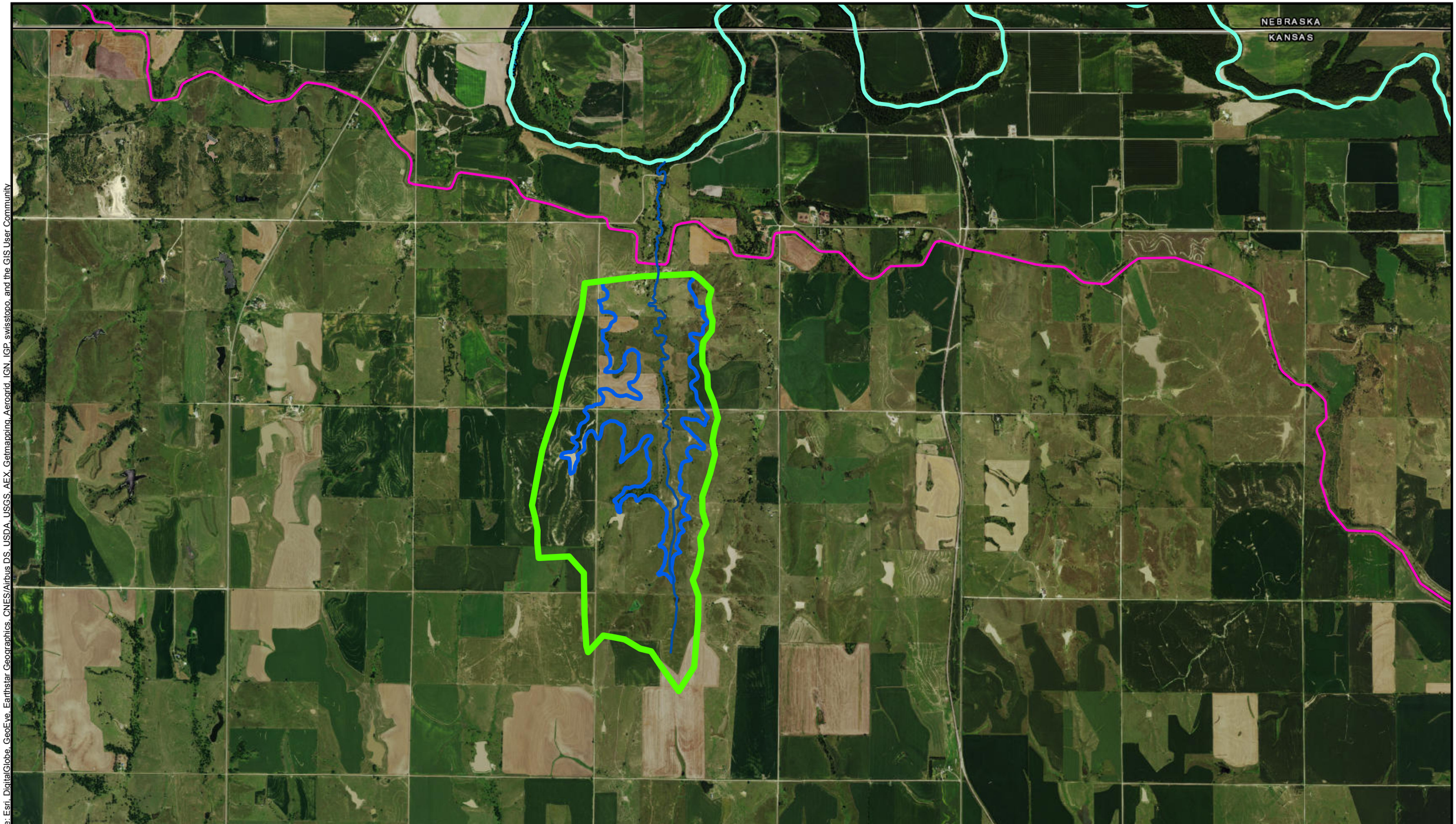

Legend

- West Site Main Tributary
- Republican River
- Courtland Canal
- West Site Watershed
- West Site 1660 Impoundment Area

NORTH

5,000 2,500 0 5,000

Scale in Feet

BURNS McDONNELL

Figure A-4.
West Site
KWO Reservoir Feasibility Study

Source:

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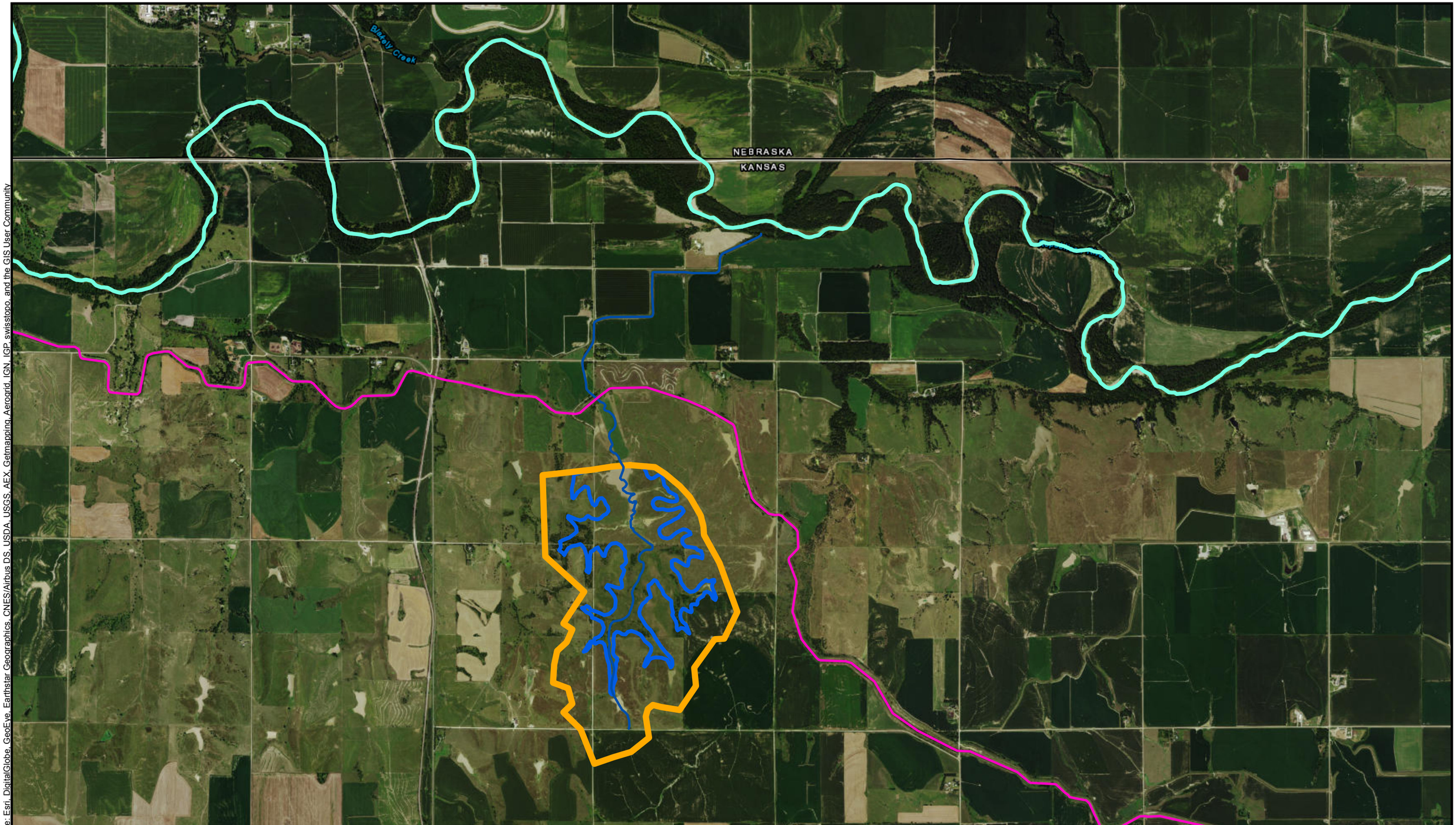

Legend

- Republican River
- Courtland Canal
- East Site Main Tributary
- East Site Watershed
- East Site 1640 Impoundment Area

NORTH

5,000 2,500 0 5,000

Scale in Feet

BURNS McDONNELL

Figure A-5.
East Site
KWO Reservoir Feasibility Study

Source:

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NORTH

0 1,200 2,400 Feet

Legend

Proposed Beaver Creek Reservoir

NWI Wetland Classification

PEM

PUB

PSS/PFO

Riverine

BURNS McDONNELL

Figure A-6
Proposed Beaver Creek Reservoir
Aerial & NWI Map
Kansas Water Office
Desktop Reservoir Analysis
Jewell & Republic Counties, KS

Source: NAIP 2014, USFWS, ESRI and Burns & McDonnell Engineering, Inc

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NORTH

0 1,000 2,000 Feet

Legend

Proposed Site 4 Reservoir

NWI Wetland Classification

PEM
PUB
PSS/PFO
Riverine

BURNS McDONNELL

Figure A-7
Proposed Site 4 Reservoir
Aerial & NWI Map
Kansas Water Office
Desktop Reservoir Analysis
Jewell & Republic Counties, KS

Source: NAIP 2014, USFWS, ESRI and Burns & McDonnell Engineering, Inc

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NORTH

0 500 1,000 Feet

Legend

Proposed West Site Reservoir

NWI Wetland Classification

PEM
PUB
PSS/PFO
Riverine

BURNS McDONNELL

Figure A-8
Proposed West Site Reservoir
Aerial & NWI Map
Kansas Water Office
Desktop Reservoir Analysis
Jewell & Republic Counties, KS

Source: NAIP 2014, USFWS, ESRI and Burns & McDonnell Engineering, Inc

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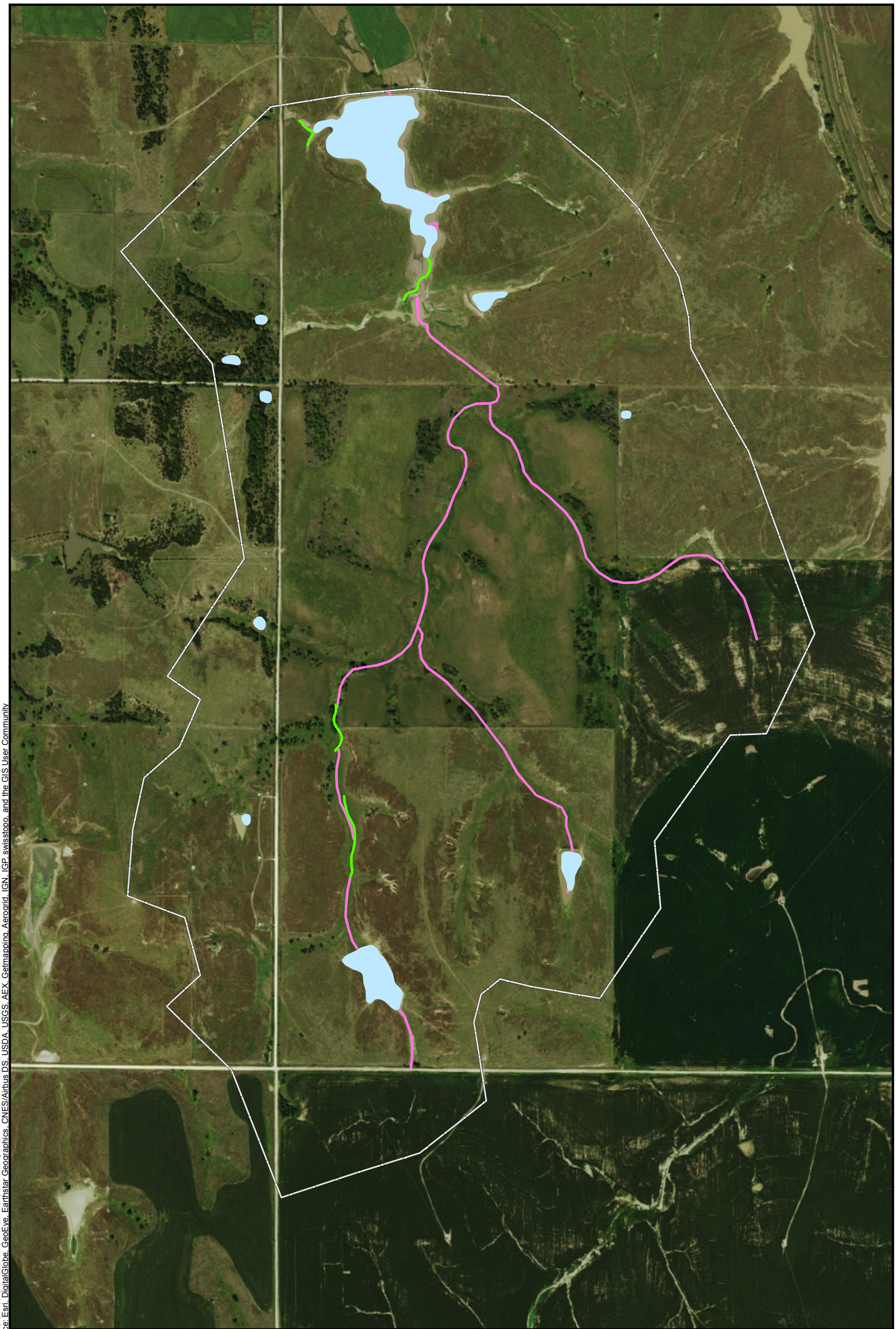

NORTH

0 400 800 Feet

Legend

Proposed East Site Reservoir

NWI Wetland Classification

PEM
PUB
PSS/PFO
Riverine

BURNS McDONNELL

Figure A-9
Proposed East Site Reservoir
Aerial & NWI Map
Kansas Water Office
Desktop Reservoir Analysis
Jewell & Republic Counties, KS

Source: NAIP 2014, USFWS, ESRI and Burns & McDonnell Engineering, Inc

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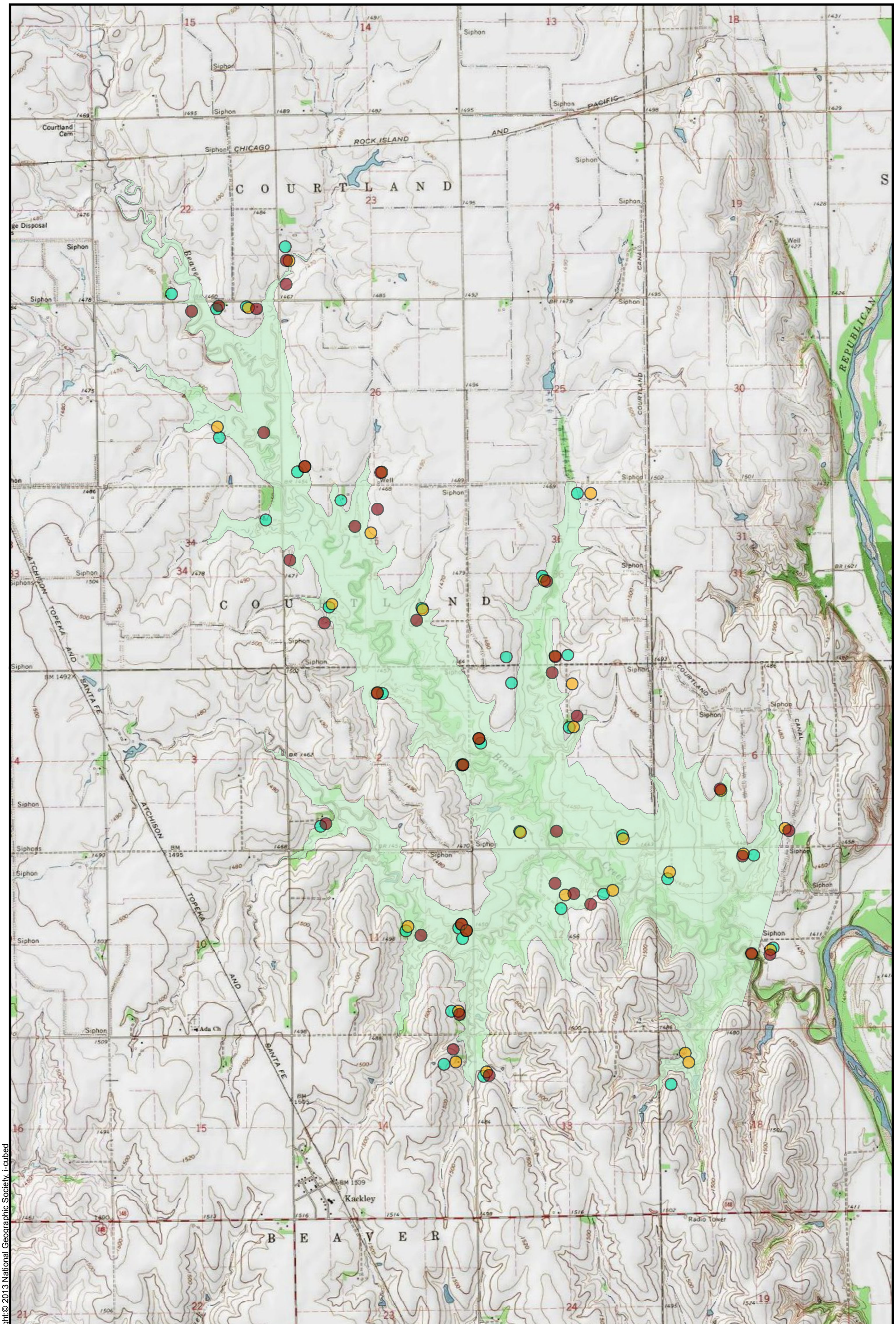

1884 Structures

1904 Structures

1923 Structures

19th Century Trails

Study Area

NORTH

2,000 1,000 0 2,000

Scale in Feet

BURNS McDONNELL

Figure A-10
Proposed Beaver Creek Reservoir
Kansas Water Office
Reservoir Project
Cultural Resources
Historic Structures

Source: ESRI, Historic Map Works, Kansas State Historical Society, Burns & McDonnell Engineering Company, Inc

Issued: 1/20/2017

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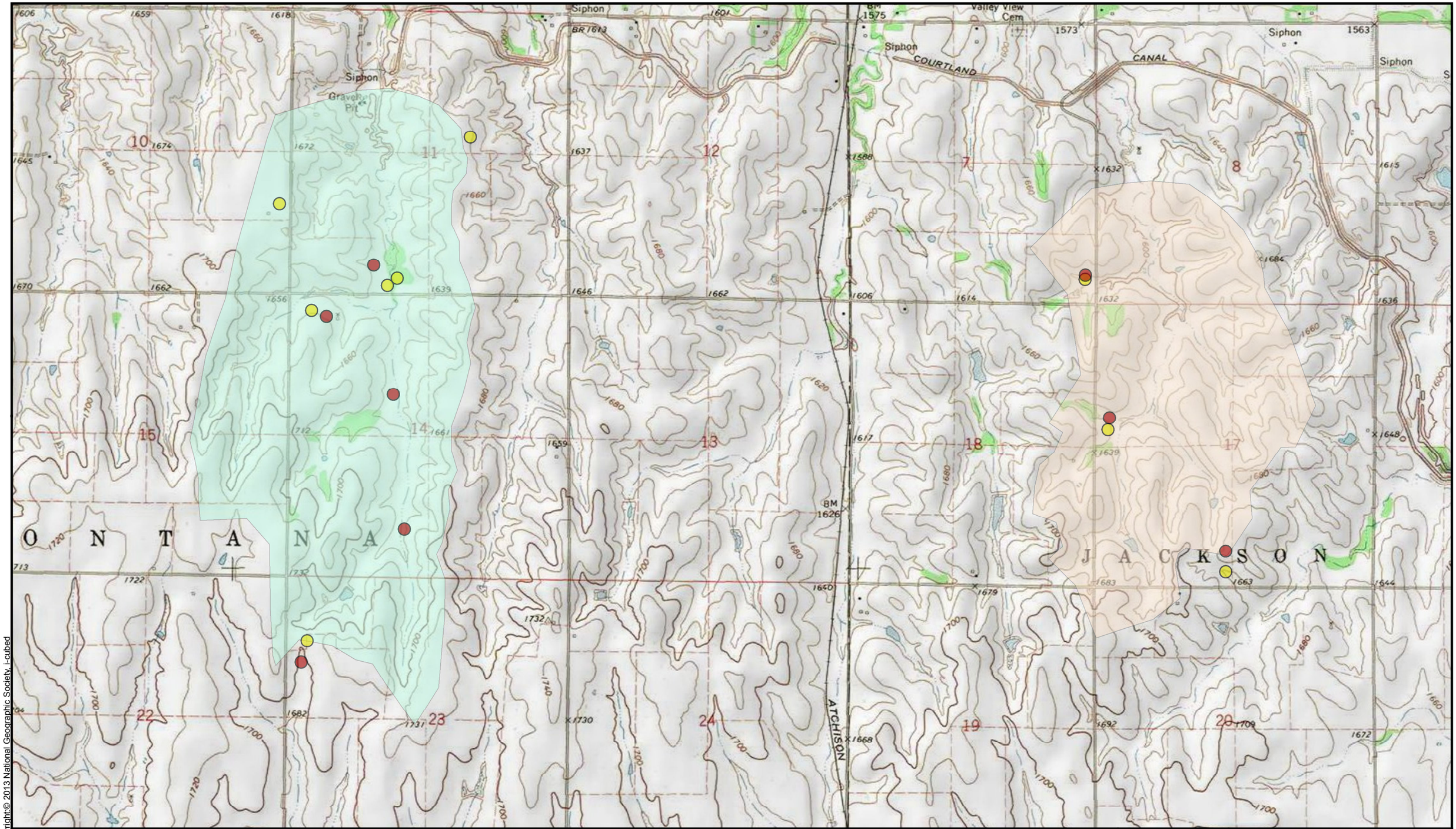
West Site Reservoir
East Site Reservoir
1884 Structures
1908 Structures
NORTH
2,000 1,000 0 2,000
Scale in Feet
BURNS McDONNELL
Figure A-11
Proposed East & West Sites
Kansas Water Office
Reservoir Project
Cultural Resources
Historic Structures
Source: ESRI, Historic Map Works, Burns & McDonnell Engineering Company, Inc
Issued: 1/20/2017
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Siphon
Gravel Pit
COURTLAND
CANAL
Valley View Cem
ATCHISON
O N T A N A
J A C K S O N

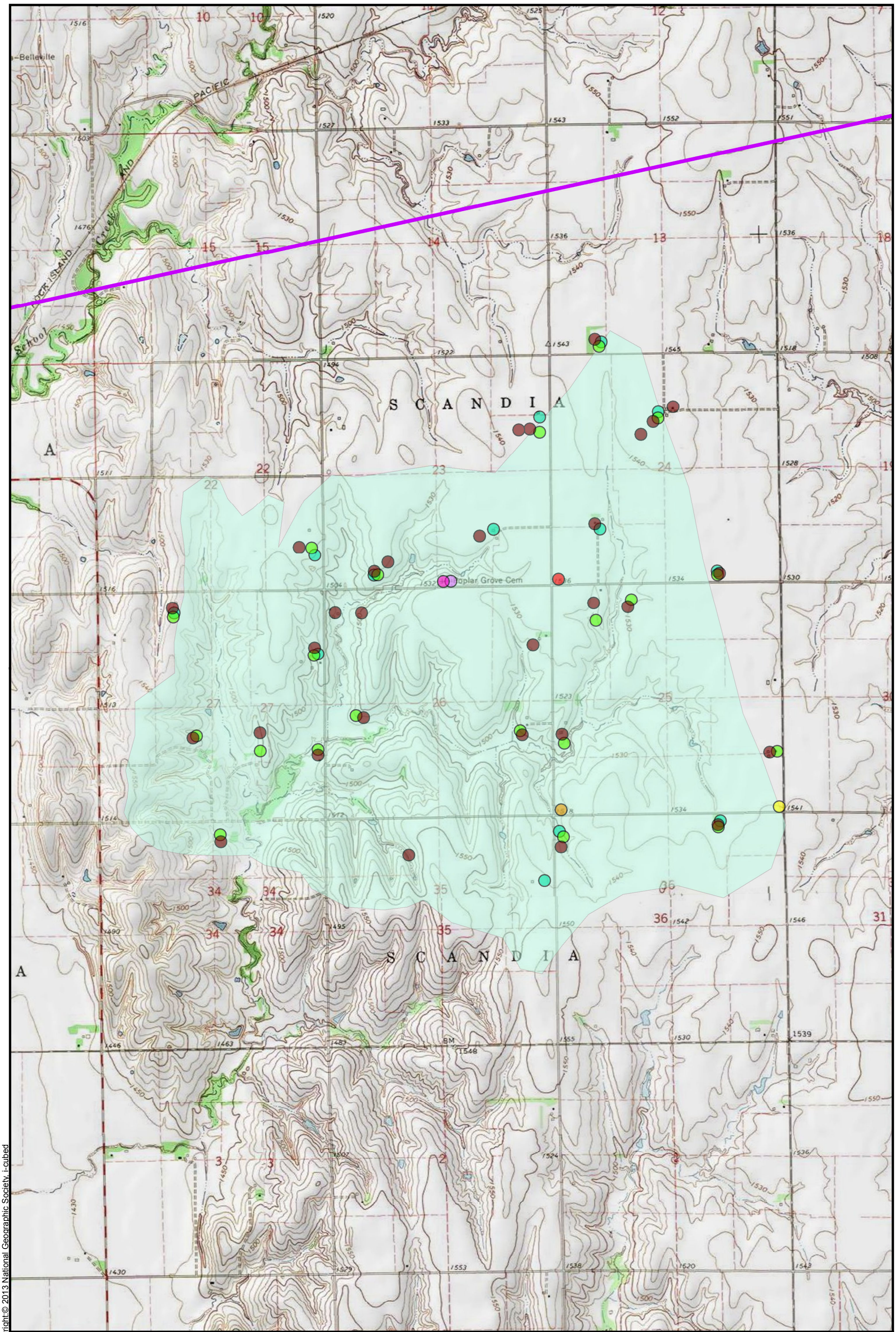

Figure A-12
Proposed Site 4
Kansas Water Office
Reservoir Project
Cultural Resources
Historic Structures

Source: ESRI, Historic Map Works, Kansas State Historical Society, Burns & McDonnell Engineering Company, Inc

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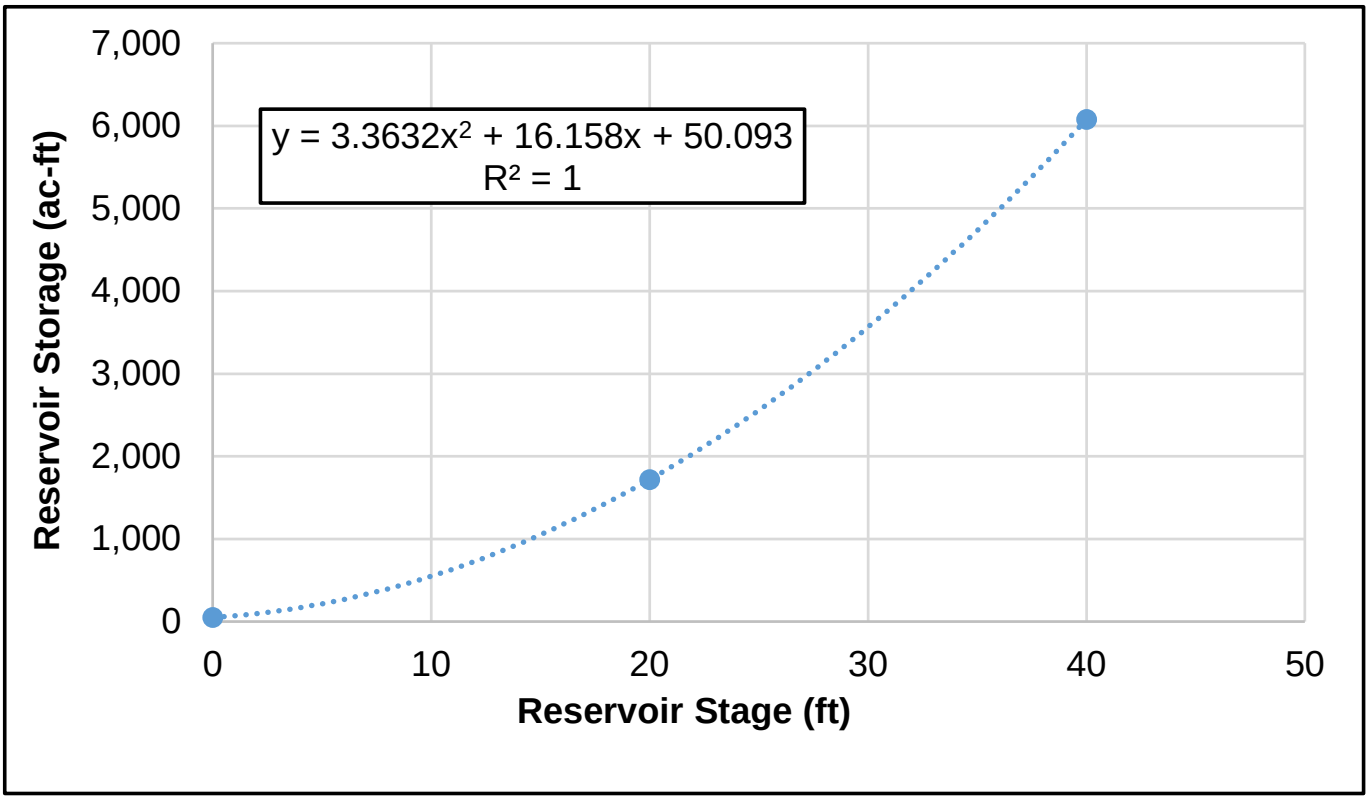
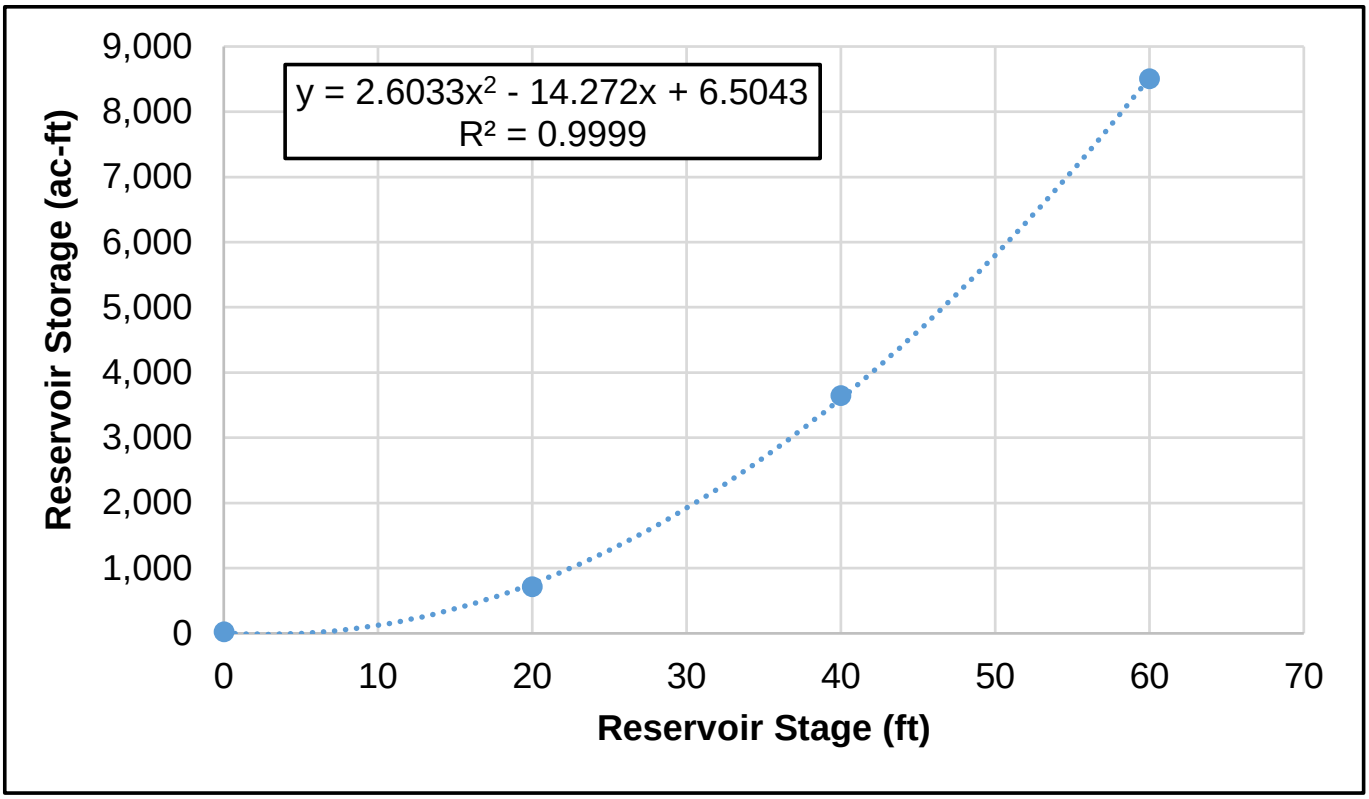
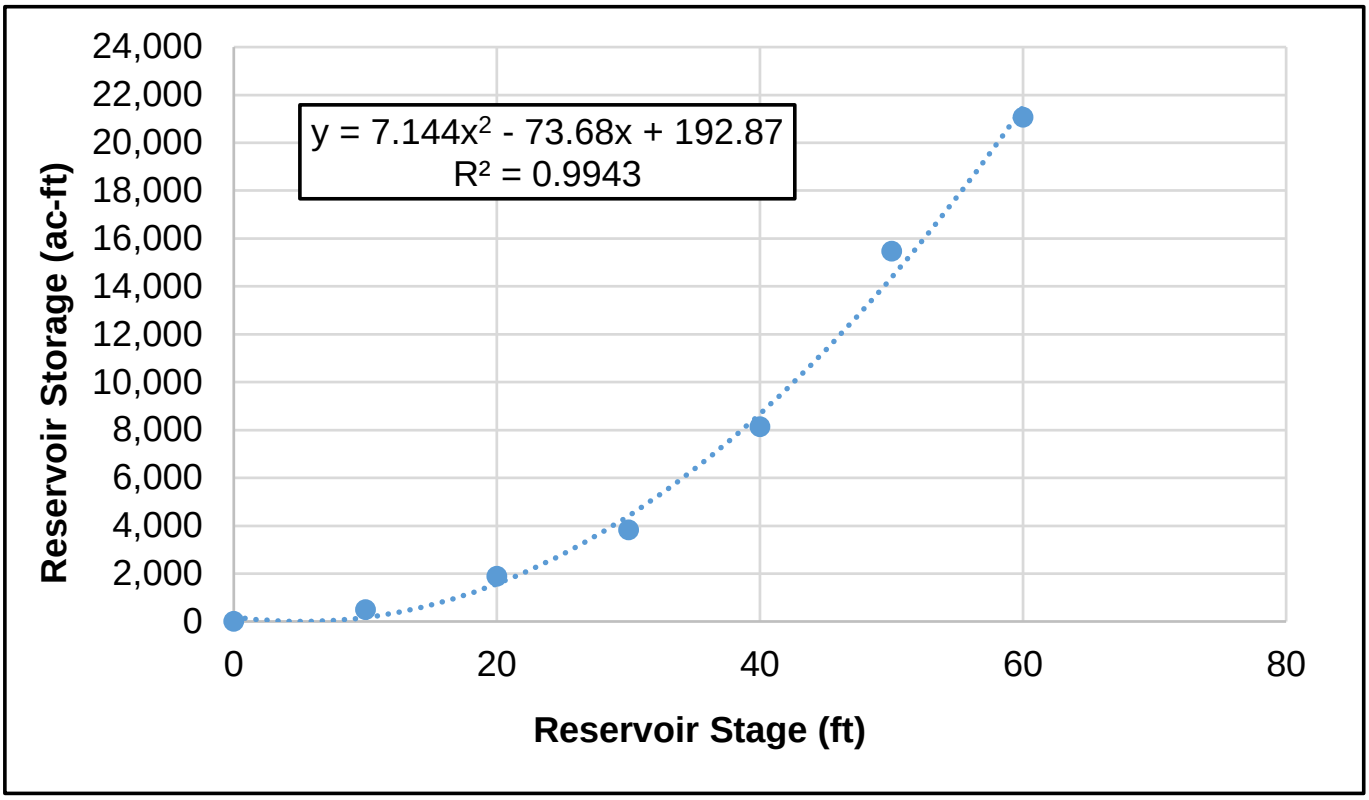
APPENDIX B - HYDROLOGY AND HYDRAULICS DATA


y = 3.3632x² + 16.158x + 50.093
R² = 1
Reservoir Storage (ac-ft)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
0
10
20
30
40
50
Reservoir Stage (ft)


y = 2.6033x² - 14.272x + 6.5043
R² = 0.9999
Reservoir Storage (ac-ft)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
0
10
20
30
40
50
60
70
Reservoir Stage (ft)


y = 7.144x² - 73.68x + 192.87
R² = 0.9943
Reservoir Storage (ac-ft)
24,000
22,000
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
0
20
40
60
80
Reservoir Stage (ft)

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1958	1	775	1	0	102	6	10	681
1958	2	681	9	0	86	12	14	615
1958	3	615	16	1	91	48	13	587
1958	4	587	12	29	86	129	13	612
1958	5	612	17	44	91	67	13	561
1958	6	561	20	56	85	41	12	481
1958	7	481	42	50	77	1068	12	1465
1958	8	1465	31	85	150	460	18	1720
1958	9	1720	86	76	163	369	19	1936
1958	10	1936	6	73	166	0	20	1703
1958	11	1703	7	30	162	1	19	1520
1958	12	1520	1	9	154	5	18	1363
1959	1	1363	4	8	143	8	18	1224
1959	2	1224	3	7	120	182	17	1282
1959	3	1282	20	8	137	54	17	1211
1959	4	1211	13	60	128	16	17	1052
1959	5	1052	63	60	121	1267	16	2200
1959	6	2200	34	125	197	147	21	2060
1959	7	2060	14	120	187	185	20	1952
1959	8	1952	13	162	12	0	20	1791
1959	9	1791	34	93	73	193	19	1852
1959	10	1852	64	51	178	839	20	2526
1959	11	2526	0	44	221	5	22	2266
1959	12	2266	2	41	209	8	21	2027
1960	1	2027	17	38	191	13	20	1828
1960	2	1828	20	33	165	61	20	1712
1960	3	1712	22	39	168	1547	19	3074
1960	4	3074	47	136	263	867	23	3589
1960	5	3589	63	174	313	646	24	3810
1960	6	3810	137	158	321	2155	24	5624
1960	7	5624	42	282	491	88	26	4981
1960	8	4981	100	291	433	480	26	4837
1960	9	4837	68	216	406	20	25	4303
1960	10	4303	49	113	373	16	25	3882
1960	11	3882	7	45	326	23	24	3541
1960	12	3541	6	43	309	31	24	3225
1961	1	3225	1	39	283	32	23	2935
1961	2	2935	9	33	235	43	22	2720
1961	3	2720	40	37	243	50	22	2530
1961	4	2530	29	110	221	41	22	2270
1961	5	2270	112	98	209	1060	21	3134
1961	6	3134	65	148	267	3137	23	5921
1961	7	5921	87	335	519	65	27	5219

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1961	8	5219	115	254	454	539	26	5165
1961	9	5165	179	184	435	1123	26	5849
1961	10	5849	33	157	512	186	27	5398
1961	11	5398	57	74	455	127	26	5053
1961	12	5053	29	70	439	84	26	4658
1962	1	4658	22	64	404	1576	25	5788
1962	2	5788	54	73	458	319	27	5631
1962	3	5631	34	95	492	493	26	5570
1962	4	5570	13	227	471	109	26	4994
1962	5	4994	94	276	434	350	26	4728
1962	6	4728	180	199	397	1820	25	6133
1962	7	6133	236	292	539	1031	27	6568
1962	8	6568	145	358	581	594	27	6367
1962	9	6367	155	183	544	335	27	6129
1962	10	6129	122	135	539	312	27	5890
1962	11	5890	27	66	500	110	27	5461
1962	12	5461	12	57	476	99	26	5039
1963	1	5039	16	52	438	81	26	4646
1963	2	4646	0	43	364	101	25	4340
1963	3	4340	37	74	376	146	25	4073
1963	4	4073	70	163	342	217	24	3855
1963	5	3855	48	139	335	121	24	3550
1963	6	3550	69	186	300	284	24	3417
1963	7	3417	90	187	299	249	23	3270
1963	8	3270	65	163	287	49	23	2934
1963	9	2934	102	86	252	2682	22	5380
1963	10	5380	33	160	469	58	26	4843
1963	11	4843	7	70	407	55	25	4428
1963	12	4428	6	46	384	53	25	4057
1964	1	4057	0	42	352	69	24	3732
1964	2	3732	9	36	304	65	24	3466
1964	3	3466	20	48	303	81	23	3217
1964	4	3217	40	118	274	64	23	2929
1964	5	2929	27	155	260	53	22	2595
1964	6	2595	47	139	226	35	22	2312
1964	7	2312	34	166	212	30	21	1998
1964	8	1998	70	113	189	647	20	2413
1964	9	2413	45	80	213	21	21	2186
1964	10	2186	3	69	203	3	21	1920
1964	11	1920	16	38	177	46	20	1767
1964	12	1767	2	10	172	25	19	1612
1965	1	1612	8	10	160	27	19	1478
1965	2	1478	16	8	136	1123	18	2473

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1965	3	2473	17	19	224	386	21	2633
1965	4	2633	18	87	229	505	22	2840
1965	5	2840	48	139	253	288	22	2785
1965	6	2785	91	129	240	2168	22	4674
1965	7	4674	104	262	405	1514	25	5625
1965	8	5625	100	280	491	266	26	5219
1965	9	5219	191	131	439	1408	26	6248
1965	10	6248	21	163	550	88	27	5644
1965	11	5644	4	81	477	55	26	5145
1965	12	5145	16	62	447	73	26	4724
1966	1	4724	2	57	410	57	25	4317
1966	2	4317	41	47	338	310	25	4283
1966	3	4283	7	76	371	80	25	3923
1966	4	3923	21	112	330	50	24	3553
1966	5	3553	18	197	310	37	24	3102
1966	6	3102	57	175	265	54	23	2773
1966	7	2773	65	173	248	75	22	2493
1966	8	2493	45	112	219	138	21	2345
1966	9	2345	29	79	111	44	21	2228
1966	10	2228	10	74	0	0	21	2165
1966	11	2165	2	32	136	1	21	2000
1966	12	2000	9	30	171	5	20	1814
1967	1	1814	0	28	175	11	20	1622
1967	2	1622	0	23	146	16	19	1470
1967	3	1470	5	26	150	14	18	1313
1967	4	1313	23	53	135	11	18	1160
1967	5	1160	20	59	128	19	17	1011
1967	6	1011	66	57	114	2113	16	3019
1967	7	3019	65	141	267	158	23	2834
1967	8	2834	5	147	252	9	22	2448
1967	9	2448	80	79	215	33	21	2268
1967	10	2268	9	57	209	14	21	2025
1967	11	2025	4	19	184	9	20	1835
1967	12	1835	11	18	177	8	20	1660
1968	1	1660	1	16	164	9	19	1491
1968	2	1491	4	14	142	12	18	1351
1968	3	1351	0	17	142	9	18	1202
1968	4	1202	31	57	127	15	17	1064
1968	5	1064	21	51	122	11	16	923
1968	6	923	38	70	108	53	15	836
1968	7	836	22	68	96	177	15	871
1968	8	871	39	63	108	200	15	938
1968	9	938	40	45	109	214	16	1037

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1968	10	1037	26	46	120	277	16	1175
1968	11	1175	7	13	125	1	17	1045
1968	12	1045	12	10	120	3	16	930
1969	1	930	4	9	113	4	15	816
1969	2	816	10	8	95	724	15	1448
1969	3	1448	18	20	149	1256	18	2554
1969	4	2554	44	85	223	139	22	2429
1969	5	2429	77	86	221	592	21	2791
1969	6	2791	23	125	241	56	22	2504
1969	7	2504	134	133	227	258	21	2535
1969	8	2535	45	113	229	321	22	2559
1969	9	2559	28	85	223	156	22	2435
1969	10	2435	50	49	221	54	21	2269
1969	11	2269	1	13	202	28	21	2082
1969	12	2082	6	12	195	26	20	1908
1970	1	1908	1	11	182	58	20	1774
1970	2	1774	0	9	155	46	19	1655
1970	3	1655	7	14	164	44	19	1528
1970	4	1528	22	62	149	281	19	1620
1970	5	1620	58	82	161	69	19	1505
1970	6	1505	40	87	148	163	18	1473
1970	7	1473	10	111	146	8	18	1234
1970	8	1234	17	91	22	0	17	1139
1970	9	1139	47	49	90	5	17	1052
1970	10	1052	19	21	121	7	16	936
1970	11	936	7	12	109	45	16	868
1970	12	868	0	13	108	11	15	758
1971	1	758	9	12	101	8	14	662
1971	2	662	17	10	85	390	13	974
1971	3	974	9	19	116	118	16	966
1971	4	966	6	47	111	43	16	857
1971	5	857	28	43	108	86	15	820
1971	6	820	25	63	102	555	15	1236
1971	7	1236	24	81	134	146	17	1191
1971	8	1191	7	77	131	9	17	999
1971	9	999	11	53	113	173	16	1017
1971	10	1017	26	35	118	3	16	891
1971	11	891	13	18	106	40	15	821
1971	12	821	5	12	105	16	15	724
1972	1	724	1	12	99	15	14	629
1972	2	629	1	10	86	11	13	545
1972	3	545	4	12	87	20	12	470
1972	4	470	15	26	79	19	11	399

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1972	5	399	39	29	77	373	10	704
1972	6	704	16	48	94	100	14	678
1972	7	678	39	53	95	510	14	1077
1972	8	1077	47	61	123	393	16	1333
1972	9	1333	26	47	136	58	18	1233
1972	10	1233	13	24	134	12	17	1101
1972	11	1101	26	10	120	62	17	1058
1972	12	1058	8	5	121	56	16	995
1973	1	995	5	5	117	290	16	1168
1973	2	1168	3	5	117	82	17	1132
1973	3	1132	39	2	126	428	17	1470
1973	4	1470	22	52	145	732	18	2027
1973	5	2027	50	87	191	534	20	2332
1973	6	2332	24	129	207	440	21	2460
1973	7	2460	71	145	223	300	21	2462
1973	8	2462	47	131	224	147	21	2303
1973	9	2303	172	60	205	6322	21	8532
1973	10	8532	295	181	784	4015	29	11877
1973	11	11877	171	113	1136	1031	31	11830
1973	12	11830	153	93	1168	445	31	11166
1974	1	11166	19	86	1086	824	31	10838
1974	2	10838	0	75	945	457	30	10274
1974	3	10274	28	83	980	404	30	9643
1974	4	9643	181	331	878	387	30	9002
1974	5	9002	98	395	835	253	29	8123
1974	6	8123	79	441	716	160	29	7205
1974	7	7205	8	567	645	65	28	6067
1974	8	6067	120	243	533	100	27	5512
1974	9	5512	10	181	465	44	26	4920
1974	10	4920	51	127	427	45	26	4461
1974	11	4461	26	175	374	72	25	4009
1974	12	4009	16	262	348	76	24	3491
1975	1	3491	15	230	305	86	24	3057
1975	2	3057	22	184	244	302	23	2954
1975	3	2954	24	139	262	996	22	3573
1975	4	3573	53	97	302	202	24	3429
1975	5	3429	62	150	300	129	23	3170
1975	6	3170	112	133	270	2983	23	5862
1975	7	5862	28	359	514	234	27	5251
1975	8	5251	78	305	457	94	26	4662
1975	9	4662	26	164	391	24	25	4155
1975	10	4155	1	135	360	24	25	3685
1975	11	3685	62	42	311	54	24	3449

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1975	12	3449	3	36	302	73	23	3188
1976	1	3188	3	33	280	68	23	2944
1976	2	2944	23	29	244	85	22	2779
1976	3	2779	40	40	248	120	22	2651
1976	4	2651	71	81	230	683	22	3094
1976	5	3094	46	123	273	138	23	2882
1976	6	2882	14	169	248	44	22	2524
1976	7	2524	10	148	228	147	22	2304
1976	8	2304	5	157	198	3	21	1959
1976	9	1959	29	86	126	1	20	1777
1976	10	1777	11	39	172	2	19	1579
1976	11	1579	1	13	153	7	19	1421
1976	12	1421	0	12	147	13	18	1275
1977	1	1275	3	11	136	9	17	1140
1977	2	1140	0	9	115	27	17	1043
1977	3	1043	30	16	120	48	16	985
1977	4	985	13	43	113	79	16	921
1977	5	921	43	51	112	189	15	990
1977	6	990	28	71	113	132	16	966
1977	7	966	6	91	74	146	16	952
1977	8	952	75	60	103	140	16	1005
1977	9	1005	21	39	102	8	16	892
1977	10	892	12	24	92	4	15	792
1977	11	792	10	11	100	9	15	700
1977	12	700	0	8	97	11	14	606
1978	1	606	2	7	91	9	13	520
1978	2	520	6	6	77	19	12	462
1978	3	462	4	26	81	1338	11	1697
1978	4	1697	30	60	161	118	19	1624
1978	5	1624	40	61	161	278	19	1721
1978	6	1721	42	104	163	70	19	1567
1978	7	1567	57	97	157	208	19	1577
1978	8	1577	32	91	158	368	19	1727
1978	9	1727	76	76	163	895	19	2459
1978	10	2459	9	67	202	5	21	2205
1978	11	2205	22	40	197	31	21	2021
1978	12	2021	1	38	190	27	20	1820
1979	1	1820	17	35	176	11	20	1638
1979	2	1638	4	29	147	763	19	2229
1979	3	2229	71	39	206	1405	21	3459
1979	4	3459	43	91	293	207	23	3326
1979	5	3326	27	127	292	185	23	3120
1979	6	3120	102	167	266	374	23	3163

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1979	7	3163	92	129	278	339	23	3186
1979	8	3186	35	141	280	60	23	2860
1979	9	2860	17	111	246	30	22	2550
1979	10	2550	71	68	230	337	22	2659
1979	11	2659	13	28	231	148	22	2561
1979	12	2561	4	27	231	50	22	2356
1980	1	2356	22	26	215	56	21	2193
1980	2	2193	17	23	190	97	21	2095
1980	3	2095	40	26	196	376	20	2290
1980	4	2290	25	75	204	844	21	2880
1980	5	2880	29	113	256	184	22	2724
1980	6	2724	47	133	236	533	22	2936
1980	7	2936	20	198	260	14	22	2512
1980	8	2512	71	142	227	7	22	2221
1980	9	2221	13	88	199	4	21	1951
1980	10	1951	24	56	185	15	20	1749
1980	11	1749	0	39	165	15	19	1560
1980	12	1560	7	37	157	24	19	1398
1981	1	1398	1	35	145	29	18	1249
1981	2	1249	2	29	122	36	17	1137
1981	3	1137	11	36	127	66	17	1050
1981	4	1050	11	52	117	43	16	936
1981	5	936	54	46	113	1779	16	2611
1981	6	2611	19	140	227	210	22	2473
1981	7	2473	111	121	224	243	21	2481
1981	8	2481	49	101	225	250	21	2455
1981	9	2455	17	87	216	35	21	2205
1981	10	2205	10	43	204	18	21	1986
1981	11	1986	33	33	182	53	20	1858
1981	12	1858	11	28	178	103	20	1765
1982	1	1765	5	27	172	46	19	1617
1982	2	1617	4	23	145	273	19	1726
1982	3	1726	23	27	169	339	19	1894
1982	4	1894	31	98	175	122	20	1774
1982	5	1774	69	79	172	1575	19	3167
1982	6	3167	62	120	270	378	23	3217
1982	7	3217	65	183	283	495	23	3311
1982	8	3311	61	128	290	79	23	3033
1982	9	3033	25	88	259	45	23	2756
1982	10	2756	40	78	246	104	22	2575
1982	11	2575	6	15	225	101	22	2443
1982	12	2443	28	13	222	112	21	2347
1983	1	2347	8	13	215	143	21	2271

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1983	2	2271	9	11	189	268	21	2348
1983	3	2348	33	13	215	220	21	2374
1983	4	2374	21	81	210	211	21	2315
1983	5	2315	56	103	212	610	21	2665
1983	6	2665	78	110	231	294	22	2697
1983	7	2697	7	187	242	78	22	2353
1983	8	2353	33	142	215	41	21	2070
1983	9	2070	42	139	188	181	20	1966
1983	10	1966	29	63	186	492	20	2237
1983	11	2237	28	16	200	96	21	2145
1983	12	2145	6	16	200	99	21	2035
1984	1	2035	1	15	191	345	20	2175
1984	2	2175	5	15	189	430	21	2406
1984	3	2406	47	21	219	465	21	2678
1984	4	2678	83	84	232	1572	22	4017
1984	5	4017	96	162	349	1215	24	4817
1984	6	4817	155	226	405	909	25	5251
1984	7	5251	7	305	457	253	26	4748
1984	8	4748	42	270	412	50	25	4157
1984	9	4157	33	180	349	41	25	3703
1984	10	3703	76	85	322	80	24	3451
1984	11	3451	2	38	292	83	23	3206
1984	12	3206	48	34	282	151	23	3089
1985	1	3089	18	32	272	156	23	2958
1985	2	2958	5	28	237	508	23	3206
1985	3	3206	25	39	282	261	23	3172
1985	4	3172	73	120	270	354	23	3209
1985	5	3209	112	195	282	2186	23	5029
1985	6	5029	59	239	423	314	26	4740
1985	7	4740	166	241	411	504	25	4758
1985	8	4758	141	185	413	1275	25	5576
1985	9	5576	147	258	471	173	26	5167
1985	10	5167	60	131	449	236	26	4883
1985	11	4883	14	106	410	173	26	4554
1985	12	4554	6	102	395	206	25	4269
1986	1	4269	0	95	370	235	25	4038
1986	2	4038	14	82	317	209	24	3864
1986	3	3864	28	147	336	223	24	3632
1986	4	3632	126	234	306	514	24	3731
1986	5	3731	67	170	325	577	24	3880
1986	6	3880	43	219	326	190	24	3567
1986	7	3567	63	199	311	92	24	3212
1986	8	3212	103	126	282	182	23	3088

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1986	9	3088	111	101	264	535	23	3371
1986	10	3371	96	48	295	1107	23	4229
1986	11	4229	23	30	355	206	25	4074
1986	12	4074	31	28	354	257	24	3980
1987	1	3980	2	27	346	220	24	3829
1987	2	3829	20	24	301	212	24	3737
1987	3	3737	159	51	325	2308	24	5828
1987	4	5828	98	210	494	2870	27	8091
1987	5	8091	239	396	736	1647	29	8846
1987	6	8846	212	469	791	1244	29	9042
1987	7	9042	73	511	839	435	29	8200
1987	8	8200	197	377	748	236	29	7507
1987	9	7507	70	275	654	133	28	6782
1987	10	6782	43	212	602	142	28	6152
1987	11	6152	45	17	524	200	27	5857
1987	12	5857	12	10	513	263	27	5609
1988	1	5609	19	10	490	370	26	5499
1988	2	5499	12	9	449	447	26	5499
1988	3	5499	4	45	480	264	26	5243
1988	4	5243	56	212	442	223	26	4868
1988	5	4868	42	399	423	185	26	4274
1988	6	4274	59	293	359	64	25	3745
1988	7	3745	148	184	326	1974	24	5356
1988	8	5356	59	252	467	160	26	4857
1988	9	4857	46	183	408	33	26	4345
1988	10	4345	1	125	377	27	25	3871
1988	11	3871	28	77	326	66	24	3562
1988	12	3562	6	74	311	77	24	3261
1989	1	3261	8	68	286	97	23	3011
1989	2	3011	8	57	241	95	23	2817
1989	3	2817	7	69	251	114	22	2618
1989	4	2618	6	142	228	88	22	2342
1989	5	2342	43	122	214	78	21	2127
1989	6	2127	51	95	192	387	21	2279
1989	7	2279	38	113	210	2728	21	4723
1989	8	4723	116	183	410	154	25	4400
1989	9	4400	93	128	369	54	25	4050
1989	10	4050	16	102	352	27	24	3640
1989	11	3640	0	32	307	42	24	3344
1989	12	3344	5	29	293	55	23	3082
1990	1	3082	8	27	272	76	23	2868
1990	2	2868	2	23	230	91	22	2707
1990	3	2707	54	27	242	184	22	2676

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1990	4	2676	15	104	232	145	22	2500
1990	5	2500	86	101	226	377	21	2635
1990	6	2635	69	140	229	859	22	3193
1990	7	3193	35	164	281	708	23	3491
1990	8	3491	53	141	305	236	24	3335
1990	9	3335	12	106	283	8	23	2965
1990	10	2965	21	97	263	23	23	2649
1990	11	2649	9	37	230	37	22	2428
1990	12	2428	9	35	221	33	21	2214
1991	1	2214	5	32	205	38	21	2020
1991	2	2020	0	27	172	128	20	1950
1991	3	1950	29	31	185	104	20	1866
1991	4	1866	21	73	173	61	20	1702
1991	5	1702	53	70	167	259	19	1779
1991	6	1779	25	112	167	46	19	1571
1991	7	1571	21	102	152	3	19	1340
1991	8	1340	17	75	91	0	18	1191
1991	9	1191	9	78	0	0	17	1122
1991	10	1122	6	55	8	0	17	1065
1991	11	1065	17	26	118	2	16	941
1991	12	941	11	25	113	11	16	825
1992	1	825	11	23	105	22	15	729
1992	2	729	3	20	93	21	14	641
1992	3	641	15	20	93	56	13	598
1992	4	598	7	31	87	46	13	534
1992	5	534	8	50	86	21	12	427
1992	6	427	17	34	76	120	11	454
1992	7	454	52	39	81	1866	11	2253
1992	8	2253	52	93	208	528	21	2532
1992	9	2532	68	136	221	62	22	2304
1992	10	2304	56	49	212	131	21	2231
1992	11	2231	27	8	199	65	21	2115
1992	12	2115	17	8	197	178	20	2105
1993	1	2105	27	8	197	63	20	1990
1993	2	1990	22	7	170	1621	20	3457
1993	3	3457	48	10	302	4002	23	7194
1993	4	7194	88	228	623	599	28	7031
1993	5	7031	164	207	627	712	28	7073
1993	6	7073	258	316	611	622	28	7026
1993	7	7026	597	254	627	8278	28	15020
1993	8	15020	509	583	1595	2094	32	15445
1993	9	15445	376	501	1602	1755	33	15473
1993	10	15473	98	491	1659	679	33	14099

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1993	11	14099	46	619	1419	571	32	12678
1993	12	12678	94	557	1277	548	31	11487
1994	1	11487	69	491	1126	462	31	10401
1994	2	10401	64	392	898	397	30	9572
1994	3	9572	7	297	899	916	30	9299
1994	4	9299	143	420	840	577	29	8759
1994	5	8759	54	423	808	462	29	8044
1994	6	8044	234	377	708	206	29	7400
1994	7	7400	227	341	665	195	28	6816
1994	8	6816	30	268	606	95	28	6068
1994	9	6068	35	204	516	66	27	5449
1994	10	5449	48	130	475	88	26	4979
1994	11	4979	61	174	419	130	26	4578
1994	12	4578	31	165	397	159	25	4206
1995	1	4206	31	152	365	214	25	3934
1995	2	3934	3	128	309	188	24	3688
1995	3	3688	27	129	321	197	24	3461
1995	4	3461	40	83	293	204	23	3329
1995	5	3329	135	82	292	1786	23	4876
1995	6	4876	50	191	410	483	26	4808
1995	7	4808	34	211	417	278	25	4492
1995	8	4492	94	193	389	351	25	4355
1995	9	4355	62	123	365	66	25	3994
1995	10	3994	15	111	347	86	24	3637
1995	11	3637	12	43	307	92	24	3391
1995	12	3391	8	41	297	86	23	3147
1996	1	3147	7	38	277	110	23	2949
1996	2	2949	0	34	245	256	22	2926
1996	3	2926	11	43	260	228	22	2862
1996	4	2862	39	117	246	236	22	2774
1996	5	2774	82	77	248	385	22	2916
1996	6	2916	10	120	250	133	22	2688
1996	7	2688	79	120	241	385	22	2792
1996	8	2792	37	75	249	146	22	2651
1996	9	2651	48	73	230	65	22	2461
1996	10	2461	11	92	223	45	21	2202
1996	11	2202	77	11	197	1462	21	3532
1996	12	3532	1	18	308	257	24	3463
1997	1	3463	1	18	303	221	23	3364
1997	2	3364	21	16	266	234	23	3338
1997	3	3338	3	21	292	267	23	3294
1997	4	3294	53	97	280	281	23	3251
1997	5	3251	33	161	286	309	23	3146

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1997	6	3146	57	156	268	2198	23	4977
1997	7	4977	82	232	432	224	26	4619
1997	8	4619	89	165	401	121	25	4263
1997	9	4263	36	174	358	50	25	3818
1997	10	3818	56	103	332	100	24	3539
1997	11	3539	22	30	299	402	24	3634
1997	12	3634	25	31	317	358	24	3669
1998	1	3669	9	32	320	291	24	3617
1998	2	3617	18	28	285	311	24	3633
1998	3	3633	64	32	317	547	24	3896
1998	4	3896	116	118	328	1975	24	5542
1998	5	5542	36	197	484	510	26	5406
1998	6	5406	93	225	456	243	26	5062
1998	7	5062	129	170	440	1718	26	6298
1998	8	6298	38	207	555	514	27	6089
1998	9	6089	60	217	518	117	27	5531
1998	10	5531	56	103	483	126	26	5127
1998	11	5127	84	190	431	308	26	4898
1998	12	4898	1	160	425	254	26	4567
1999	1	4567	12	149	396	277	25	4311
1999	2	4311	4	127	338	258	25	4108
1999	3	4108	13	128	356	259	24	3895
1999	4	3895	78	98	328	486	24	4033
1999	5	4033	113	164	350	1092	24	4725
1999	6	4725	83	171	397	305	25	4545
1999	7	4545	28	205	394	121	25	4094
1999	8	4094	61	139	355	91	24	3752
1999	9	3752	30	126	316	42	24	3382
1999	10	3382	0	127	296	57	23	3015
1999	11	3015	9	76	258	73	23	2762
1999	12	2762	8	64	247	107	22	2567
2000	1	2567	1	60	232	135	22	2411
2000	2	2411	21	53	205	176	21	2350
2000	3	2350	29	49	215	215	21	2330
2000	4	2330	10	97	207	166	21	2202
2000	5	2202	14	114	204	127	21	2025
2000	6	2025	26	93	184	26	20	1799
2000	7	1799	15	94	174	10	19	1556
2000	8	1556	6	84	86	1	19	1393
2000	9	1393	9	91	0	0	18	1311
2000	10	1311	14	46	13	0	18	1265
2000	11	1265	14	89	114	63	17	1140
2000	12	1140	6	86	127	24	17	957

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2001	1	957	8	77	114	35	16	808
2001	2	808	20	63	94	81	15	751
2001	3	751	6	61	100	968	14	1564
2001	4	1564	13	84	152	167	19	1507
2001	5	1507	97	69	153	1870	18	3252
2001	6	3252	54	152	276	503	23	3381
2001	7	3381	112	183	296	738	23	3752
2001	8	3752	41	157	326	76	24	3384
2001	9	3384	73	102	287	40	23	3108
2001	10	3108	33	61	274	40	23	2846
2001	11	2846	10	40	245	82	22	2653
2001	12	2653	2	38	238	115	22	2493
2002	1	2493	6	36	226	117	21	2355
2002	2	2355	7	31	195	153	21	2289
2002	3	2289	7	40	210	169	21	2214
2002	4	2214	32	79	198	164	21	2133
2002	5	2133	52	82	199	265	21	2169
2002	6	2169	43	138	195	48	21	1928
2002	7	1928	7	116	183	9	20	1644
2002	8	1644	18	95	163	1	19	1405
2002	9	1405	19	72	99	0	18	1253
2002	10	1253	44	31	135	40	17	1171
2002	11	1171	3	1	125	5	17	1053
2002	12	1053	0	0	121	7	16	939
2003	1	939	2	0	113	11	16	839
2003	2	839	5	0	96	21	15	769
2003	3	769	10	6	102	42	14	714
2003	4	714	16	31	95	57	14	661
2003	5	661	22	38	94	138	13	689
2003	6	689	67	57	93	50	14	655
2003	7	655	2	76	27	0	13	554
2003	8	554	24	59	37	5	12	487
2003	9	487	25	50	35	27	12	454
2003	10	454	4	35	70	0	11	354
2003	11	354	9	12	52	0	10	299
2003	12	299	3	0	70	1	9	233
2004	1	233	4	0	66	1	7	172
2004	2	172	3	0	58	6	5	123
2004	3	123	14	1	59	44	3	121
2004	4	121	6	27	57	17	3	60
2004	5	60	16	31	55	12	0	41
2004	6	41	17	41	52	12	0	41
2004	7	41	27	35	54	302	0	280

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2004	8	280	10	69	69	11	8	163
2004	9	163	10	43	60	1	5	72
2004	10	72	4	20	56	2	0	41
2004	11	41	3	1	52	5	0	41
2004	12	41	0	0	54	6	0	41
2005	1	41	4	0	54	9	0	41
2005	2	41	4	0	48	19	0	41
2005	3	41	7	1	54	35	0	41
2005	4	41	9	27	52	27	0	41
2005	5	41	3	39	54	16	0	41
2005	6	41	13	38	52	15	0	41
2005	7	41	17	50	52	472	0	428
2005	8	428	37	49	79	139	11	477
2005	9	477	6	61	69	5	11	359
2005	10	359	9	36	57	1	10	275
2005	11	275	3	7	67	5	8	209
2005	12	209	1	0	65	7	6	152
2006	1	152	0	0	61	7	5	98
2006	2	98	0	0	52	8	2	54
2006	3	54	6	2	55	25	0	41
2006	4	41	7	37	52	34	0	41
2006	5	41	8	42	54	248	0	201
2006	6	201	10	51	62	3	6	101
2006	7	101	13	47	48	12	2	41
2006	8	41	11	36	28	4	0	41
2006	9	41	15	26	52	21	0	41
2006	10	41	5	20	54	2	0	41
2006	11	41	0	5	52	3	0	41
2006	12	41	10	0	54	7	0	41
2007	1	41	1	0	54	6	0	41
2007	2	41	2	0	48	107	0	102
2007	3	102	9	1	58	22	2	74
2007	4	74	10	31	54	24	0	41
2007	5	41	19	41	54	100	0	65
2007	6	65	29	37	53	772	0	776
2007	7	776	13	98	102	64	14	653
2007	8	653	18	67	94	103	13	614
2007	9	614	16	54	88	16	13	503
2007	10	503	16	42	84	230	12	623
2007	11	623	0	9	89	39	13	564
2007	12	564	10	0	88	56	12	543
2008	1	543	0	0	86	100	12	557
2008	2	557	1	0	82	167	12	643

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2008	3	643	3	0	93	114	13	666
2008	4	666	27	42	92	265	13	824
2008	5	824	31	55	105	2836	15	3531
2008	6	3531	68	206	298	1180	24	4275
2008	7	4275	142	289	371	589	25	4347
2008	8	4347	108	212	377	154	25	4020
2008	9	4020	67	146	338	87	24	3691
2008	10	3691	118	127	321	2125	24	5485
2008	11	5485	29	73	463	486	26	5464
2008	12	5464	18	0	476	341	26	5347
2009	1	5347	3	0	466	302	26	5186
2009	2	5186	7	0	407	284	26	5069
2009	3	5069	2	0	441	267	26	4898
2009	4	4898	95	293	411	341	26	4629
2009	5	4629	33	262	401	489	25	4488
2009	6	4488	70	235	377	165	25	4112
2009	7	4112	125	199	357	105	25	3787
2009	8	3787	68	232	329	40	24	3334
2009	9	3334	33	105	283	31	23	3011
2009	10	3011	40	61	266	48	23	2771
2009	11	2771	8	10	239	79	22	2607
2009	12	2607	18	0	235	78	22	2469
2010	1	2469	2	0	224	157	21	2404
2010	2	2404	8	0	198	126	21	2339
2010	3	2339	51	0	214	465	21	2641
2010	4	2641	34	119	230	405	22	2732
2010	5	2732	76	73	244	478	22	2969
2010	6	2969	104	126	254	2821	23	5514
2010	7	5514	57	234	481	753	26	5608
2010	8	5608	63	231	490	204	26	5154
2010	9	5154	86	145	434	93	26	4755
2010	10	4755	7	135	413	98	25	4312
2010	11	4312	35	111	362	157	25	4031
2010	12	4031	0	0	350	170	24	3852
2011	1	3852	18	0	335	201	24	3736
2011	2	3736	27	0	294	344	24	3813
2011	3	3813	9	0	332	264	24	3754
2011	4	3754	47	0	316	362	24	3848
2011	5	3848	167	0	334	5914	24	9594
2011	6	9594	167	0	872	3083	30	11972
2011	7	11972	303	0	1186	452	31	11540
2011	8	11540	400	0	1132	255	31	11062
2011	9	11062	32	0	1039	100	30	10155

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2011	10	10155	18	0	966	106	30	9312
2011	11	9312	70	0	841	175	29	8716
2011	12	8716	57	0	804	197	29	8165
2012	1	8165	0	0	744	210	29	7631
2012	2	7631	0	0	644	234	28	7221
2012	3	7221	0	0	646	244	28	6819
2012	4	6819	190	0	587	323	28	6745
2012	5	6745	35	0	599	135	27	6316
2012	6	6316	130	0	539	90	27	5997
2012	7	5997	33	0	526	26	27	5530
2012	8	5530	53	0	483	17	26	5118
2012	9	5118	36	0	431	9	26	4732
2012	10	4732	51	0	410	21	25	4394
2012	11	4394	0	0	369	29	25	4054
2012	12	4054	22	0	352	33	24	3756
2013	1	3756	31	0	327	38	24	3499
2013	2	3499	0	0	276	44	24	3267
2013	3	3267	0	0	287	63	23	3044
2013	4	3044	0	0	260	64	23	2847
2013	5	2847	0	0	253	88	22	2682
2013	6	2682	0	0	233	82	22	2532
2013	7	2532	2	0	229	8	22	2313
2013	8	2313	0	0	212	46	21	2147
2013	9	2147	0	0	193	12	21	1965
2013	10	1965	0	0	186	2	20	1781
2013	11	1781	0	0	167	5	19	1618
2013	12	1618	0	0	161	2	19	1460
2014	1	1460	0	0	150	5	18	1316
2014	2	1316	0	0	126	13	18	1203
2014	3	1203	0	0	131	22	17	1094
2014	4	1094	12	0	120	21	16	1007
2014	5	1007	0	0	118	41	16	930
2014	6	930	6	0	109	471	15	1298
2014	7	1298	1	0	138	17	18	1178
2014	8	1178	27	0	130	518	17	1594
2014	9	1594	3	0	154	50	19	1492
2014	10	1492	0	0	152	14	18	1354
2014	11	1354	0	0	137	6	18	1222
2014	12	1222	2	0	133	12	17	1104
2015	1	1104	0	0	125	9	17	988
2015	2	988	0	0	105	20	16	903
2015	3	903	3	0	111	45	15	841
2015	4	841	3	0	103	53	15	794

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2015	5	794	12	0	103	1734	15	2437
2015	6	2437	26	0	214	516	21	2764
2015	7	2764	12	0	247	136	22	2666
2015	8	2666	13	0	239	253	22	2694
2015	9	2694	0	0	234	115	22	2576
2015	10	2576	8	0	232	25	22	2376
2015	11	2376	29	0	210	43	21	2238
2015	12	2238	3	0	207	139	21	2173

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1958	1	1719	1	0	241	2	20	1481
1958	2	1481	8	0	191	5	25	1303
1958	3	1303	14	1	190	19	24	1146
1958	4	1146	10	24	165	51	23	1018
1958	5	1018	12	31	154	26	22	871
1958	6	871	13	36	132	16	21	732
1958	7	732	26	30	111	421	19	1037
1958	8	1037	14	38	157	181	22	1037
1958	9	1037	34	30	152	145	22	1035
1958	10	1035	2	26	141	0	22	870
1958	11	870	2	10	132	1	21	731
1958	12	731	0	3	119	2	19	612
1959	1	612	1	3	104	3	18	509
1959	2	509	1	2	83	72	16	497
1959	3	497	6	2	90	21	16	432
1959	4	432	3	16	79	6	15	347
1959	5	347	16	15	71	500	13	776
1959	6	776	9	32	120	58	20	690
1959	7	690	4	30	110	73	19	626
1959	8	626	3	39	7	0	18	584
1959	9	584	8	23	42	76	17	603
1959	10	603	16	13	103	331	18	834
1959	11	834	0	11	127	2	20	698
1959	12	698	1	10	115	3	19	577
1960	1	577	4	8	100	5	17	478
1960	2	478	4	7	82	24	16	418
1960	3	418	4	8	80	610	15	944
1960	4	944	11	31	140	342	21	1125
1960	5	1125	14	39	168	255	23	1187
1960	6	1187	31	35	170	850	23	1863
1960	7	1863	9	63	259	35	26	1585
1960	8	1585	22	64	224	189	25	1508
1960	9	1508	15	47	208	8	25	1276
1960	10	1276	10	24	186	6	24	1083
1960	11	1083	1	9	157	9	22	927
1960	12	927	1	8	143	12	21	789
1961	1	789	0	7	126	13	20	668
1961	2	668	2	6	100	17	19	581
1961	3	581	7	6	100	20	17	501
1961	4	501	5	18	87	16	16	416
1961	5	416	18	16	80	418	15	757
1961	6	757	12	28	118	1237	20	1860
1961	7	1860	18	70	258	26	26	1575

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1961	8	1575	24	53	223	212	25	1535
1961	9	1535	37	38	211	443	25	1766
1961	10	1766	7	32	247	73	26	1567
1961	11	1567	11	15	215	50	25	1399
1961	12	1399	6	13	201	33	24	1223
1962	1	1223	4	12	180	621	23	1657
1962	2	1657	11	14	211	126	26	1568
1962	3	1568	6	18	222	194	25	1529
1962	4	1529	2	43	210	43	25	1321
1962	5	1321	18	52	192	138	24	1233
1962	6	1233	34	37	175	718	23	1772
1962	7	1772	46	57	247	406	26	1920
1962	8	1920	28	69	266	234	27	1847
1962	9	1847	30	35	248	132	26	1725
1962	10	1725	23	26	242	123	26	1604
1962	11	1604	5	12	219	43	25	1421
1962	12	1421	2	10	204	39	24	1248
1963	1	1248	3	9	183	32	23	1091
1963	2	1091	0	7	147	40	22	976
1963	3	976	6	12	149	58	21	878
1963	4	878	12	27	133	86	21	816
1963	5	816	8	23	129	48	20	719
1963	6	719	11	30	114	112	19	699
1963	7	699	15	30	115	98	19	666
1963	8	666	11	27	111	19	19	559
1963	9	559	16	14	94	1057	17	1525
1963	10	1525	7	31	217	23	25	1306
1963	11	1306	1	13	184	22	24	1132
1963	12	1132	1	8	168	21	23	977
1964	1	977	0	7	149	27	21	847
1964	2	847	2	6	125	26	20	744
1964	3	744	3	8	120	32	19	651
1964	4	651	7	19	105	25	18	558
1964	5	558	4	24	97	21	17	461
1964	6	461	7	21	83	14	16	378
1964	7	378	5	25	75	12	14	295
1964	8	295	11	17	68	255	12	476
1964	9	476	7	13	84	8	16	394
1964	10	394	0	11	77	1	14	307
1964	11	307	3	6	66	18	13	256
1964	12	256	0	2	68	10	11	197
1965	1	197	1	2	68	11	9	139
1965	2	139	3	2	61	443	6	522

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1965	3	522	3	3	93	152	17	581
1965	4	581	3	16	97	199	17	671
1965	5	671	9	26	111	114	19	657
1965	6	657	17	24	106	855	18	1398
1965	7	1398	22	55	201	597	24	1760
1965	8	1760	21	59	246	105	26	1581
1965	9	1581	40	27	217	555	25	1932
1965	10	1932	4	33	267	35	27	1671
1965	11	1671	1	16	227	22	26	1449
1965	12	1449	3	12	208	29	25	1261
1966	1	1261	0	11	184	23	23	1089
1966	2	1089	8	9	147	122	22	1063
1966	3	1063	1	14	160	31	22	922
1966	4	922	4	20	138	20	21	788
1966	5	788	3	34	126	15	20	646
1966	6	646	10	29	105	21	18	543
1966	7	543	11	28	96	30	17	460
1966	8	460	7	18	83	54	16	421
1966	9	421	5	12	42	17	15	389
1966	10	389	2	12	0	0	14	379
1966	11	379	0	5	51	1	14	324
1966	12	324	1	5	62	2	13	261
1967	1	261	0	5	68	4	11	192
1967	2	192	0	4	61	6	9	133
1967	3	133	1	5	68	6	6	67
1967	4	67	5	11	66	4	1	50
1967	5	50	5	13	68	7	0	50
1967	6	50	16	14	66	833	0	820
1967	7	820	13	29	130	62	20	736
1967	8	736	1	30	119	4	19	592
1967	9	592	15	15	98	13	18	507
1967	10	507	2	10	91	5	16	413
1967	11	413	1	3	77	3	15	337
1967	12	337	2	3	70	3	13	269
1968	1	269	0	3	68	4	11	202
1968	2	202	1	3	63	5	9	142
1968	3	142	0	3	68	4	6	74
1968	4	74	7	12	66	6	1	50
1968	5	50	5	12	68	5	0	50
1968	6	50	10	18	66	21	0	50
1968	7	50	6	18	61	70	0	50
1968	8	50	10	17	68	79	0	55
1968	9	55	10	12	66	85	0	72

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1968	10	72	6	11	68	109	1	109
1968	11	109	2	3	66	0	4	50
1968	12	50	3	2	68	1	0	50
1969	1	50	1	2	68	2	0	50
1969	2	50	3	2	61	285	0	275
1969	3	275	4	4	68	495	12	702
1969	4	702	9	18	112	55	19	637
1969	5	637	16	18	107	233	18	761
1969	6	761	5	26	119	22	20	643
1969	7	643	27	27	108	102	18	637
1969	8	637	9	22	107	126	18	643
1969	9	643	6	17	104	62	18	589
1969	10	589	10	9	101	21	18	509
1969	11	509	0	2	88	11	16	430
1969	12	430	1	2	82	10	15	357
1970	1	357	0	2	73	23	14	306
1970	2	306	0	2	61	18	12	261
1970	3	261	1	2	68	17	11	209
1970	4	209	4	11	66	111	10	247
1970	5	247	10	15	68	27	11	202
1970	6	202	7	16	66	64	9	192
1970	7	192	2	21	66	3	9	110
1970	8	110	4	20	11	0	5	83
1970	9	83	11	11	48	2	2	50
1970	10	50	5	5	68	3	0	50
1970	11	50	2	3	66	18	0	50
1970	12	50	0	3	68	5	0	50
1971	1	50	3	3	68	3	0	50
1971	2	50	5	3	61	154	0	145
1971	3	145	2	5	68	46	7	121
1971	4	121	2	12	66	17	5	62
1971	5	62	7	11	68	34	0	50
1971	6	50	7	17	66	219	0	193
1971	7	193	5	17	68	57	9	170
1971	8	170	2	17	68	3	8	91
1971	9	91	3	13	66	68	3	83
1971	10	83	6	8	68	1	2	50
1971	11	50	3	5	66	16	0	50
1971	12	50	1	3	68	6	0	50
1972	1	50	0	3	68	6	0	50
1972	2	50	0	3	63	4	0	50
1972	3	50	1	4	68	8	0	50
1972	4	50	5	9	66	7	0	50

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1972	5	50	15	11	68	147	0	133
1972	6	133	5	14	66	39	6	97
1972	7	97	12	16	68	201	4	226
1972	8	226	11	14	68	155	10	309
1972	9	309	5	10	66	23	13	262
1972	10	262	3	5	68	5	11	197
1972	11	197	6	2	66	24	9	159
1972	12	159	2	1	68	22	7	114
1973	1	114	1	1	68	114	5	160
1973	2	160	1	1	61	32	7	131
1973	3	131	9	1	68	169	6	240
1973	4	240	4	10	66	289	11	457
1973	5	457	9	16	85	211	16	576
1973	6	576	5	25	96	173	17	632
1973	7	632	14	29	107	118	18	629
1973	8	629	9	26	106	58	18	564
1973	9	564	34	12	95	2492	17	2983
1973	10	2983	63	39	397	1583	30	4193
1973	11	4193	34	22	529	406	33	4082
1973	12	4082	30	18	533	175	33	3736
1974	1	3736	4	16	490	325	32	3558
1974	2	3558	0	14	423	180	32	3301
1974	3	3301	5	16	436	159	31	3014
1974	4	3014	34	62	388	152	30	2750
1974	5	2750	18	74	368	100	30	2426
1974	6	2426	15	83	318	63	29	2104
1974	7	2104	1	107	288	26	27	1736
1974	8	1736	23	47	243	40	26	1509
1974	9	1509	2	34	208	17	25	1286
1974	10	1286	9	23	187	18	24	1102
1974	11	1102	5	32	159	28	22	944
1974	12	944	3	46	145	30	21	785
1975	1	785	3	40	126	34	20	657
1975	2	657	4	32	99	119	18	649
1975	3	649	4	24	109	393	18	913
1975	4	913	10	19	137	80	21	847
1975	5	847	12	28	133	51	20	748
1975	6	748	21	24	117	1176	19	1803
1975	7	1803	6	74	251	92	26	1576
1975	8	1576	16	63	223	37	25	1343
1975	9	1343	5	33	188	9	24	1136
1975	10	1136	0	27	169	10	23	950
1975	11	950	12	8	141	21	21	834

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1975	12	834	1	7	132	29	20	725
1976	1	725	0	6	118	27	19	628
1976	2	628	4	5	99	33	18	562
1976	3	562	7	7	98	47	17	511
1976	4	511	12	13	89	269	16	690
1976	5	690	8	22	114	54	19	617
1976	6	617	2	29	101	17	18	506
1976	7	506	2	25	91	58	16	450
1976	8	450	1	26	79	1	15	348
1976	9	348	5	14	48	1	13	290
1976	10	290	2	7	68	1	12	219
1976	11	219	0	2	66	3	10	154
1976	12	154	0	2	68	5	7	89
1977	1	89	1	2	68	4	3	50
1977	2	50	0	2	61	10	0	50
1977	3	50	7	4	68	19	0	50
1977	4	50	3	11	66	31	0	50
1977	5	50	11	13	68	75	0	55
1977	6	55	7	17	66	52	0	50
1977	7	50	1	23	44	58	0	50
1977	8	50	19	15	61	55	0	50
1977	9	50	5	10	59	3	0	50
1977	10	50	3	6	57	2	0	50
1977	11	50	3	3	66	4	0	50
1977	12	50	0	2	68	4	0	50
1978	1	50	1	2	68	4	0	50
1978	2	50	2	2	61	8	0	50
1978	3	50	1	9	68	527	0	502
1978	4	502	7	14	88	47	16	454
1978	5	454	9	13	85	110	16	475
1978	6	475	9	23	84	28	16	405
1978	7	405	12	20	78	82	15	400
1978	8	400	7	19	78	145	15	454
1978	9	454	16	16	82	353	16	725
1978	10	725	2	15	107	2	19	608
1978	11	608	5	9	100	12	18	516
1978	12	516	0	8	92	11	17	427
1979	1	427	3	7	81	4	15	346
1979	2	346	1	5	64	301	13	578
1979	3	578	15	8	100	554	17	1038
1979	4	1038	9	20	152	82	22	958
1979	5	958	6	27	147	73	21	863
1979	6	863	21	35	131	147	21	866

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1979	7	866	19	27	135	134	21	856
1979	8	856	7	29	134	24	20	724
1979	9	724	3	22	114	12	19	604
1979	10	604	13	13	103	133	18	634
1979	11	634	2	5	103	58	18	586
1979	12	586	1	5	101	20	18	500
1980	1	500	4	5	90	22	16	432
1980	2	432	3	4	77	38	15	393
1980	3	393	7	4	77	148	14	466
1980	4	466	4	13	83	333	16	707
1980	5	707	6	22	116	73	19	648
1980	6	648	9	25	105	210	18	737
1980	7	737	4	38	120	6	19	588
1980	8	588	13	27	101	3	18	477
1980	9	477	2	16	85	2	16	380
1980	10	380	4	10	75	6	14	305
1980	11	305	0	7	66	6	12	239
1980	12	239	1	7	68	10	11	175
1981	1	175	0	7	68	12	8	112
1981	2	112	1	6	61	14	5	60
1981	3	60	2	8	68	26	0	50
1981	4	50	3	12	66	17	0	50
1981	5	50	14	12	68	701	0	686
1981	6	686	4	29	110	83	19	635
1981	7	635	22	24	107	96	18	622
1981	8	622	10	20	105	99	18	605
1981	9	605	3	17	100	14	18	505
1981	10	505	2	8	91	7	16	415
1981	11	415	6	6	77	21	15	359
1981	12	359	2	5	73	41	14	324
1982	1	324	1	5	68	18	13	270
1982	2	270	1	4	61	108	11	313
1982	3	313	4	5	68	134	13	378
1982	4	378	5	17	73	48	14	342
1982	5	342	12	14	71	621	13	890
1982	6	890	13	25	134	149	21	893
1982	7	893	13	38	139	195	21	925
1982	8	925	13	27	143	31	21	799
1982	9	799	5	18	123	18	20	681
1982	10	681	8	15	113	41	19	602
1982	11	602	1	3	100	40	18	541
1982	12	541	5	2	95	44	17	492
1983	1	492	1	2	89	57	16	459

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1983	2	459	2	2	77	106	16	487
1983	3	487	6	2	89	87	16	489
1983	4	489	4	14	86	83	16	476
1983	5	476	10	18	87	241	16	621
1983	6	621	15	20	102	116	18	629
1983	7	629	1	35	106	31	18	520
1983	8	520	6	26	93	16	17	424
1983	9	424	7	24	78	71	15	400
1983	10	400	5	11	78	194	15	510
1983	11	510	5	3	88	38	16	461
1983	12	461	1	3	85	39	16	413
1984	1	413	0	3	80	136	15	467
1984	2	467	1	3	81	170	16	554
1984	3	554	9	4	97	183	17	646
1984	4	646	16	16	105	620	18	1160
1984	5	1160	20	34	172	479	23	1454
1984	6	1454	33	47	201	358	25	1596
1984	7	1596	1	64	226	100	25	1408
1984	8	1408	9	56	202	20	24	1177
1984	9	1177	7	37	168	16	23	995
1984	10	995	15	17	151	31	22	873
1984	11	873	0	7	132	33	21	767
1984	12	767	9	6	123	60	20	706
1985	1	706	3	6	116	61	19	649
1985	2	649	1	5	98	200	18	747
1985	3	747	5	7	121	103	19	727
1985	4	727	13	21	114	139	19	743
1985	5	743	20	35	120	862	19	1470
1985	6	1470	12	49	203	124	25	1354
1985	7	1354	33	48	196	199	24	1341
1985	8	1341	28	37	194	503	24	1641
1985	9	1641	29	52	224	68	26	1463
1985	10	1463	12	26	209	93	25	1333
1985	11	1333	3	20	187	68	24	1197
1985	12	1197	1	19	176	81	23	1083
1986	1	1083	0	18	162	93	22	996
1986	2	996	3	15	137	82	22	929
1986	3	929	5	26	143	88	21	853
1986	4	853	22	42	129	202	20	906
1986	5	906	12	31	140	227	21	974
1986	6	974	8	41	144	75	21	872
1986	7	872	12	37	136	36	21	747
1986	8	747	19	23	121	72	19	694

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1986	9	694	20	18	110	211	19	796
1986	10	796	17	9	127	436	20	1114
1986	11	1114	4	6	161	81	23	1033
1986	12	1033	6	5	156	101	22	979
1987	1	979	0	5	149	87	22	912
1987	2	912	4	4	127	84	21	867
1987	3	867	28	9	136	910	21	1661
1987	4	1661	19	41	226	1131	26	2544
1987	5	2544	47	78	343	649	29	2820
1987	6	2820	41	91	365	490	30	2896
1987	7	2896	14	99	386	172	30	2596
1987	8	2596	39	74	349	93	29	2304
1987	9	2304	14	54	303	53	28	2013
1987	10	2013	8	41	277	56	27	1759
1987	11	1759	9	3	238	79	26	1605
1987	12	1605	2	2	227	104	25	1483
1988	1	1483	3	2	212	146	25	1419
1988	2	1419	2	2	191	176	24	1405
1988	3	1405	1	8	202	104	24	1299
1988	4	1299	10	37	183	88	24	1177
1988	5	1177	7	69	174	73	23	1014
1988	6	1014	10	51	149	25	22	849
1988	7	849	26	32	133	778	20	1488
1988	8	1488	11	48	212	63	25	1301
1988	9	1301	9	35	183	13	24	1105
1988	10	1105	0	23	165	10	22	928
1988	11	928	5	14	139	26	21	806
1988	12	806	1	13	128	31	20	697
1989	1	697	1	12	115	38	19	610
1989	2	610	1	9	94	38	18	546
1989	3	546	1	11	96	45	17	485
1989	4	485	1	23	86	34	16	412
1989	5	412	7	19	79	31	15	351
1989	6	351	8	15	70	153	14	428
1989	7	428	6	18	81	1076	15	1410
1989	8	1410	24	38	203	61	24	1254
1989	9	1254	19	26	178	21	23	1091
1989	10	1091	3	20	163	11	22	921
1989	11	921	0	6	138	17	21	794
1989	12	794	1	5	127	22	20	685
1990	1	685	1	5	113	30	19	599
1990	2	599	0	4	93	36	18	538
1990	3	538	9	4	95	73	17	521

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1990	4	521	2	17	90	57	17	473
1990	5	473	14	16	87	149	16	533
1990	6	533	12	24	91	339	17	768
1990	7	768	7	31	123	279	20	900
1990	8	900	10	27	140	93	21	836
1990	9	836	2	20	128	3	20	694
1990	10	694	4	18	114	9	19	575
1990	11	575	2	6	96	14	17	488
1990	12	488	1	6	89	13	16	408
1991	1	408	1	5	79	15	15	340
1991	2	340	0	4	64	51	13	322
1991	3	322	4	5	68	41	13	295
1991	4	295	3	12	66	24	12	245
1991	5	245	9	12	68	102	11	276
1991	6	276	4	19	66	18	12	215
1991	7	215	4	19	66	1	10	135
1991	8	135	3	15	44	0	6	80
1991	9	80	2	17	0	0	2	65
1991	10	65	1	12	4	0	0	50
1991	11	50	4	6	66	1	0	50
1991	12	50	3	6	68	4	0	50
1992	1	50	3	6	68	9	0	50
1992	2	50	1	6	63	8	0	50
1992	3	50	5	6	68	22	0	50
1992	4	50	2	10	66	18	0	50
1992	5	50	3	17	68	8	0	50
1992	6	50	6	13	66	47	0	50
1992	7	50	18	14	68	736	0	723
1992	8	723	12	22	118	208	19	803
1992	9	803	16	32	124	25	20	688
1992	10	688	13	11	114	52	19	628
1992	11	628	6	2	103	26	18	555
1992	12	555	3	2	97	70	17	530
1993	1	530	5	2	94	25	17	465
1993	2	465	4	1	78	639	16	1029
1993	3	1029	10	2	156	1578	22	2460
1993	4	2460	19	50	322	236	29	2343
1993	5	2343	35	44	318	281	28	2297
1993	6	2297	54	66	302	245	28	2228
1993	7	2228	122	52	304	3264	28	5258
1993	8	5258	91	105	678	825	35	5391
1993	9	5391	67	89	672	692	35	5389
1993	10	5389	17	87	694	268	35	4893

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1993	11	4893	8	113	613	225	34	4400
1993	12	4400	18	105	572	216	33	3956
1994	1	3956	13	95	517	182	32	3539
1994	2	3539	13	78	421	156	31	3210
1994	3	3210	1	59	425	361	31	3088
1994	4	3088	29	84	397	227	30	2863
1994	5	2863	11	84	382	182	30	2589
1994	6	2589	47	76	337	81	29	2305
1994	7	2305	45	68	313	77	28	2045
1994	8	2045	6	53	281	38	27	1755
1994	9	1755	7	40	237	26	26	1511
1994	10	1511	9	25	215	34	25	1314
1994	11	1314	11	32	185	51	24	1160
1994	12	1160	6	30	172	63	23	1026
1995	1	1026	5	27	155	84	22	934
1995	2	934	0	23	130	74	21	856
1995	3	856	5	23	134	78	20	781
1995	4	781	7	14	121	80	20	733
1995	5	733	23	14	119	704	19	1327
1995	6	1327	10	37	186	190	24	1304
1995	7	1304	7	41	190	110	24	1190
1995	8	1190	18	37	176	138	23	1134
1995	9	1134	12	23	163	26	23	985
1995	10	985	3	20	150	34	22	851
1995	11	851	2	8	129	36	20	753
1995	12	753	1	7	121	34	19	659
1996	1	659	1	6	110	43	18	588
1996	2	588	0	6	95	101	18	588
1996	3	588	2	7	101	90	18	572
1996	4	572	6	19	96	93	17	556
1996	5	556	14	13	97	152	17	611
1996	6	611	2	20	101	52	18	544
1996	7	544	13	20	96	152	17	594
1996	8	594	6	13	102	57	18	543
1996	9	543	8	12	92	26	17	472
1996	10	472	2	15	87	18	16	390
1996	11	390	12	2	74	576	14	902
1996	12	902	0	4	140	101	21	860
1997	1	860	0	3	135	87	21	809
1997	2	809	4	3	116	92	20	787
1997	3	787	1	4	126	105	20	763
1997	4	763	10	17	119	111	20	747
1997	5	747	6	29	121	122	19	725

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1997	6	725	10	28	114	867	19	1459
1997	7	1459	17	47	209	88	25	1308
1997	8	1308	18	33	190	48	24	1151
1997	9	1151	7	34	165	20	23	978
1997	10	978	11	20	149	39	22	860
1997	11	860	4	5	130	158	20	886
1997	12	886	5	6	138	141	21	888
1998	1	888	2	6	138	115	21	860
1998	2	860	3	5	122	123	21	859
1998	3	859	12	6	135	216	20	946
1998	4	946	21	21	141	779	21	1584
1998	5	1584	7	39	224	201	25	1529
1998	6	1529	18	44	210	96	25	1389
1998	7	1389	25	33	200	677	24	1858
1998	8	1858	7	41	258	203	26	1770
1998	9	1770	12	42	239	46	26	1546
1998	10	1546	11	20	220	50	25	1367
1998	11	1367	16	36	191	121	24	1278
1998	12	1278	0	30	186	100	24	1162
1999	1	1162	2	27	172	109	23	1074
1999	2	1074	1	23	146	102	22	1008
1999	3	1008	2	23	153	102	22	936
1999	4	936	14	18	139	191	21	984
1999	5	984	21	30	150	431	22	1255
1999	6	1255	16	32	178	120	23	1181
1999	7	1181	5	38	174	48	23	1021
1999	8	1021	11	25	155	36	22	888
1999	9	888	5	23	134	17	21	754
1999	10	754	0	22	122	22	19	632
1999	11	632	1	13	103	29	18	547
1999	12	547	1	10	96	42	17	483
2000	1	483	0	10	88	53	16	439
2000	2	439	3	8	77	69	15	426
2000	3	426	5	8	81	85	15	426
2000	4	426	2	15	79	65	15	399
2000	5	399	2	18	78	50	15	355
2000	6	355	4	15	70	10	14	285
2000	7	285	2	15	68	4	12	208
2000	8	208	1	15	37	0	9	156
2000	9	156	2	18	0	0	7	140
2000	10	140	3	9	7	0	6	127
2000	11	127	3	19	57	25	6	79
2000	12	79	1	19	68	9	2	50

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2001	1	50	2	19	68	14	0	50
2001	2	50	6	17	61	32	0	50
2001	3	50	2	17	68	381	0	348
2001	4	348	2	16	69	66	13	331
2001	5	331	19	13	69	737	13	1004
2001	6	1004	12	34	148	198	22	1033
2001	7	1033	25	41	156	291	22	1152
2001	8	1152	9	35	171	30	23	985
2001	9	985	16	22	145	16	22	849
2001	10	849	7	12	133	16	20	726
2001	11	726	2	8	114	32	19	638
2001	12	638	0	7	107	45	18	569
2002	1	569	1	7	99	46	17	511
2002	2	511	1	6	83	60	16	484
2002	3	484	1	7	88	66	16	456
2002	4	456	6	14	82	65	16	431
2002	5	431	9	14	82	105	15	448
2002	6	448	8	24	81	19	15	369
2002	7	369	1	20	74	4	14	280
2002	8	280	3	17	68	1	12	199
2002	9	199	4	14	46	0	9	143
2002	10	143	9	7	68	16	7	93
2002	11	93	1	0	66	2	3	50
2002	12	50	0	0	68	3	0	50
2003	1	50	0	0	68	4	0	50
2003	2	50	1	0	61	8	0	50
2003	3	50	3	2	68	16	0	50
2003	4	50	5	9	66	23	0	50
2003	5	50	7	11	68	54	0	50
2003	6	50	20	17	66	20	0	50
2003	7	50	0	23	20	0	0	50
2003	8	50	8	19	28	2	0	50
2003	9	50	9	17	28	11	0	50
2003	10	50	2	12	59	0	0	50
2003	11	50	4	5	48	0	0	50
2003	12	50	1	0	68	0	0	50
2004	1	50	2	0	68	1	0	50
2004	2	50	1	0	63	2	0	50
2004	3	50	7	0	68	17	0	50
2004	4	50	3	13	66	7	0	50
2004	5	50	8	16	68	5	0	50
2004	6	50	9	22	66	5	0	50
2004	7	50	14	19	68	119	0	97

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2004	8	97	4	29	68	4	4	50
2004	9	50	5	20	66	0	0	50
2004	10	50	2	10	68	1	0	50
2004	11	50	1	0	66	2	0	50
2004	12	50	0	0	68	2	0	50
2005	1	50	2	0	68	3	0	50
2005	2	50	2	0	61	8	0	50
2005	3	50	4	1	68	14	0	50
2005	4	50	5	14	66	11	0	50
2005	5	50	2	21	68	6	0	50
2005	6	50	7	20	66	6	0	50
2005	7	50	9	26	66	186	0	153
2005	8	153	14	18	68	55	7	136
2005	9	136	2	21	57	2	6	62
2005	10	62	3	14	53	0	0	50
2005	11	50	1	3	66	2	0	50
2005	12	50	0	0	68	3	0	50
2006	1	50	0	0	68	3	0	50
2006	2	50	0	0	61	3	0	50
2006	3	50	3	1	68	10	0	50
2006	4	50	4	19	66	13	0	50
2006	5	50	5	22	68	98	0	62
2006	6	62	4	23	66	1	0	50
2006	7	50	6	23	57	5	0	50
2006	8	50	6	19	35	1	0	50
2006	9	50	8	14	66	8	0	50
2006	10	50	3	11	68	1	0	50
2006	11	50	0	3	66	1	0	50
2006	12	50	5	0	68	3	0	50
2007	1	50	1	0	68	3	0	50
2007	2	50	1	0	61	42	0	50
2007	3	50	4	0	68	9	0	50
2007	4	50	5	16	66	10	0	50
2007	5	50	10	22	68	39	0	50
2007	6	50	15	19	66	305	0	285
2007	7	285	4	28	68	25	12	219
2007	8	219	5	20	68	41	10	176
2007	9	176	5	17	66	6	8	105
2007	10	105	6	14	68	91	4	119
2007	11	119	0	3	66	15	5	66
2007	12	66	3	0	68	22	1	50
2008	1	50	0	0	68	39	0	50
2008	2	50	0	0	63	66	0	53

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2008	3	53	1	0	68	45	0	50
2008	4	50	8	13	66	105	0	84
2008	5	84	9	15	68	1118	2	1128
2008	6	1128	16	47	162	465	23	1399
2008	7	1399	33	66	201	232	24	1396
2008	8	1396	24	48	201	61	24	1233
2008	9	1233	15	32	175	34	23	1075
2008	10	1075	25	27	161	838	22	1749
2008	11	1749	6	16	237	191	26	1694
2008	12	1694	4	0	238	135	26	1595
2009	1	1595	1	0	226	119	25	1489
2009	2	1489	1	0	192	112	25	1410
2009	3	1410	0	0	203	105	24	1313
2009	4	1313	18	56	185	134	24	1226
2009	5	1226	6	50	180	193	23	1195
2009	6	1195	13	45	170	65	23	1058
2009	7	1058	24	37	159	42	22	927
2009	8	927	13	42	143	16	21	770
2009	9	770	6	19	120	12	20	650
2009	10	650	7	11	109	19	18	556
2009	11	556	1	2	94	31	17	492
2009	12	492	3	0	89	31	16	437
2010	1	437	0	0	82	62	15	417
2010	2	417	1	0	72	50	15	395
2010	3	395	8	0	77	183	14	509
2010	4	509	6	19	88	160	16	566
2010	5	566	13	12	98	189	17	657
2010	6	657	18	22	106	1112	18	1659
2010	7	1659	12	48	234	297	26	1686
2010	8	1686	13	47	237	80	26	1495
2010	9	1495	17	29	206	37	25	1314
2010	10	1314	1	26	191	39	24	1137
2010	11	1137	7	21	163	62	23	1021
2010	12	1021	0	0	155	67	22	933
2011	1	933	3	0	144	79	21	872
2011	2	872	5	0	123	135	21	889
2011	3	889	2	0	138	104	21	856
2011	4	856	8	0	130	143	20	877
2011	5	877	29	0	137	2332	21	3101
2011	6	3101	32	0	398	1215	30	3950
2011	7	3950	56	0	517	178	32	3667
2011	8	3667	72	0	482	100	32	3358
2011	9	3358	6	0	429	39	31	2974

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2011	10	2974	3	0	396	42	30	2622
2011	11	2622	12	0	341	69	29	2362
2011	12	2362	10	0	320	77	28	2129
2012	1	2129	0	0	292	83	28	1920
2012	2	1920	0	0	249	92	27	1764
2012	3	1764	0	0	246	96	26	1614
2012	4	1614	30	0	221	127	25	1550
2012	5	1550	5	0	220	53	25	1389
2012	6	1389	20	0	194	35	24	1251
2012	7	1251	5	0	183	10	23	1083
2012	8	1083	8	0	162	7	22	935
2012	9	935	5	0	139	4	21	804
2012	10	804	7	0	128	8	20	691
2012	11	691	0	0	110	11	19	592
2012	12	592	3	0	102	13	18	506
2013	1	506	4	0	91	15	16	434
2013	2	434	0	0	74	17	15	377
2013	3	377	0	0	75	25	14	327
2013	4	327	0	0	67	25	13	286
2013	5	286	0	0	68	35	12	253
2013	6	253	0	0	66	32	11	219
2013	7	219	0	0	68	3	10	155
2013	8	155	0	0	68	18	7	105
2013	9	105	0	0	66	5	4	50
2013	10	50	0	0	68	1	0	50
2013	11	50	0	0	66	2	0	50
2013	12	50	0	0	68	1	0	50
2014	1	50	0	0	68	2	0	50
2014	2	50	0	0	61	5	0	50
2014	3	50	0	0	68	9	0	50
2014	4	50	3	0	66	8	0	50
2014	5	50	0	0	68	16	0	50
2014	6	50	2	0	66	186	0	172
2014	7	172	0	0	68	7	8	111
2014	8	111	6	0	68	204	5	253
2014	9	253	0	0	66	20	11	208
2014	10	208	0	0	68	5	9	145
2014	11	145	0	0	66	2	7	82
2014	12	82	0	0	68	5	2	50
2015	1	50	0	0	68	3	0	50
2015	2	50	0	0	61	8	0	50
2015	3	50	1	0	68	18	0	50
2015	4	50	1	0	66	21	0	50

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2015	5	50	3	0	68	684	0	669
2015	6	669	5	0	108	203	19	771
2015	7	771	3	0	124	54	20	703
2015	8	703	3	0	115	100	19	691
2015	9	691	0	0	110	45	19	626
2015	10	626	2	0	106	10	18	532
2015	11	532	5	0	91	17	17	463
2015	12	463	0	0	86	55	16	432

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1958	1	714	1	0	113	2	20	604
1958	2	604	4	0	90	5	27	523
1958	3	523	7	0	90	19	26	459
1958	4	459	5	12	80	51	24	423
1958	5	423	6	16	78	26	24	361
1958	6	361	7	20	68	16	22	296
1958	7	296	14	17	59	421	20	656
1958	8	656	9	26	106	181	28	715
1958	9	715	25	22	109	145	28	754
1958	10	754	2	20	106	0	29	629
1958	11	629	2	8	99	1	27	525
1958	12	525	0	2	90	2	26	434
1959	1	434	1	2	79	3	24	357
1959	2	357	1	2	63	72	22	365
1959	3	365	5	2	71	21	22	318
1959	4	318	3	13	63	6	21	250
1959	5	250	13	13	57	500	19	693
1959	6	693	8	30	107	58	28	623
1959	7	623	3	28	99	73	27	573
1959	8	573	3	37	6	0	26	533
1959	9	533	8	21	38	76	26	557
1959	10	557	15	12	94	331	26	797
1959	11	797	0	10	119	2	30	670
1959	12	670	1	9	107	3	28	557
1960	1	557	4	8	94	5	26	464
1960	2	464	4	7	77	24	24	408
1960	3	408	4	8	76	610	23	938
1960	4	938	11	31	135	342	31	1125
1960	5	1125	14	39	162	255	33	1192
1960	6	1192	31	35	164	850	33	1873
1960	7	1873	9	63	251	35	38	1603
1960	8	1603	22	64	219	189	36	1531
1960	9	1531	15	47	203	8	36	1303
1960	10	1303	10	24	183	6	34	1113
1960	11	1113	1	9	155	9	33	959
1960	12	959	1	9	142	12	31	822
1961	1	822	0	8	126	13	30	701
1961	2	701	2	6	100	17	28	614
1961	3	614	7	7	101	20	27	533
1961	4	533	5	19	88	16	26	447
1961	5	447	19	17	81	418	24	787
1961	6	787	13	28	117	1237	29	1890
1961	7	1890	19	71	253	26	38	1610
1961	8	1610	24	54	220	212	36	1573

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1961	9	1573	38	38	208	443	36	1807
1961	10	1807	7	33	243	73	37	1611
1961	11	1611	12	15	213	50	36	1445
1961	12	1445	6	14	200	33	35	1270
1962	1	1270	4	12	179	621	34	1704
1962	2	1704	11	14	209	126	37	1618
1962	3	1618	7	19	221	194	36	1579
1962	4	1579	2	44	209	43	36	1372
1962	5	1372	18	53	191	138	35	1283
1962	6	1283	35	38	175	718	34	1823
1962	7	1823	47	58	245	406	37	1973
1962	8	1973	29	71	263	234	38	1902
1962	9	1902	31	36	246	132	38	1782
1962	10	1782	24	26	240	123	37	1662
1962	11	1662	5	13	219	43	36	1479
1962	12	1479	2	11	204	39	35	1306
1963	1	1306	3	10	183	32	34	1148
1963	2	1148	0	8	149	40	33	1032
1963	3	1032	6	13	151	58	32	932
1963	4	932	12	28	134	86	31	867
1963	5	867	8	24	131	48	30	769
1963	6	769	12	31	115	112	29	746
1963	7	746	15	32	116	98	29	711
1963	8	711	11	28	112	19	28	601
1963	9	601	17	14	96	1057	27	1565
1963	10	1565	7	32	214	23	36	1349
1963	11	1349	1	14	182	22	34	1175
1963	12	1175	1	9	168	21	33	1021
1964	1	1021	0	8	149	27	32	891
1964	2	891	2	7	125	26	31	786
1964	3	786	4	8	121	32	29	692
1964	4	692	7	20	107	25	28	598
1964	5	598	5	26	99	21	27	499
1964	6	499	8	23	84	14	25	413
1964	7	413	5	26	77	12	23	328
1964	8	328	11	18	67	255	21	509
1964	9	509	8	14	85	8	25	426
1964	10	426	1	12	78	1	24	337
1964	11	337	3	6	66	18	21	286
1964	12	286	0	2	62	10	20	233
1965	1	233	1	1	55	11	18	189
1965	2	189	2	1	45	443	16	588
1965	3	588	3	4	98	152	27	642
1965	4	642	3	17	101	199	27	727

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1965	5	727	10	27	114	114	29	709
1965	6	709	18	26	108	855	28	1447
1965	7	1447	23	57	200	597	35	1810
1965	8	1810	22	61	243	105	37	1632
1965	9	1632	41	28	215	555	36	1985
1965	10	1985	4	34	264	35	38	1726
1965	11	1726	1	17	226	22	37	1505
1965	12	1505	3	13	207	29	35	1318
1966	1	1318	0	11	185	23	34	1145
1966	2	1145	8	9	148	122	33	1118
1966	3	1118	1	14	161	31	33	975
1966	4	975	4	21	139	20	31	839
1966	5	839	3	35	128	15	30	694
1966	6	694	10	31	107	21	28	588
1966	7	588	11	30	98	30	27	501
1966	8	501	8	19	84	54	25	460
1966	9	460	5	13	42	17	24	426
1966	10	426	2	12	0	0	24	416
1966	11	416	0	5	52	1	23	359
1966	12	359	1	5	64	2	22	294
1967	1	294	0	4	63	4	20	231
1967	2	231	0	3	50	6	18	184
1967	3	184	1	4	49	6	16	138
1967	4	138	3	7	42	4	13	95
1967	5	95	3	8	39	7	10	59
1967	6	59	8	7	33	833	5	860
1967	7	860	14	30	130	62	30	775
1967	8	775	1	31	120	4	29	629
1967	9	629	16	16	99	13	27	544
1967	10	544	2	11	92	5	26	447
1967	11	447	1	3	78	3	24	370
1967	12	370	2	3	72	3	22	300
1968	1	300	0	3	63	4	20	238
1968	2	238	1	2	52	5	18	189
1968	3	189	0	3	50	4	16	140
1968	4	140	5	8	43	6	13	100
1968	5	100	3	7	39	5	10	60
1968	6	60	5	9	34	21	5	43
1968	7	43	3	9	30	70	2	77
1968	8	77	6	9	37	79	8	116
1968	9	116	6	7	40	85	11	159
1968	10	159	4	8	47	109	14	219
1968	11	219	1	2	52	0	17	166
1968	12	166	2	2	47	1	15	121

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1969	1	121	1	1	42	2	12	79
1969	2	79	2	1	33	285	8	332
1969	3	332	4	4	67	495	21	760
1969	4	760	10	19	114	55	29	691
1969	5	691	17	19	110	233	28	812
1969	6	812	5	27	120	22	30	692
1969	7	692	28	28	110	102	28	683
1969	8	683	9	24	109	126	28	687
1969	9	687	6	18	106	62	28	631
1969	10	631	10	10	103	21	27	549
1969	11	549	0	3	90	11	26	468
1969	12	468	1	2	83	10	25	394
1970	1	394	0	2	74	23	23	340
1970	2	340	0	2	62	18	22	295
1970	3	295	1	2	63	17	20	249
1970	4	249	4	10	55	111	19	298
1970	5	298	10	14	63	27	20	258
1970	6	258	7	14	56	64	19	258
1970	7	258	2	19	56	3	19	188
1970	8	188	3	15	8	0	16	168
1970	9	168	8	8	34	2	15	136
1970	10	136	3	3	44	3	13	94
1970	11	94	1	2	37	18	9	74
1970	12	74	0	2	36	5	7	40
1971	1	40	1	2	33	3	1	22
1971	2	22	3	2	30	154	0	148
1971	3	148	2	3	45	46	14	147
1971	4	147	1	8	44	17	14	114
1971	5	114	5	7	41	34	11	104
1971	6	104	4	10	39	219	10	278
1971	7	278	5	16	61	57	20	263
1971	8	263	1	15	59	3	19	194
1971	9	194	2	10	49	68	16	205
1971	10	205	5	7	52	1	17	153
1971	11	153	2	3	44	16	14	123
1971	12	123	1	2	42	6	12	86
1972	1	86	0	2	38	6	9	52
1972	2	52	0	2	32	4	4	24
1972	3	24	1	2	33	8	0	22
1972	4	22	3	5	32	7	0	22
1972	5	22	7	5	33	147	0	139
1972	6	139	3	10	43	39	13	129
1972	7	129	8	10	43	201	12	284
1972	8	284	10	13	61	155	20	374

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1972	9	374	6	11	70	23	22	322
1972	10	322	3	5	66	5	21	259
1972	11	259	5	2	56	24	19	230
1972	12	230	2	1	55	22	18	198
1973	1	198	1	1	51	114	16	261
1973	2	261	1	1	53	32	19	240
1973	3	240	8	0	56	169	18	360
1973	4	360	4	11	68	289	22	574
1973	5	574	11	19	96	211	26	680
1973	6	680	5	29	105	173	28	725
1973	7	725	16	32	114	118	29	713
1973	8	713	10	29	113	58	28	640
1973	9	640	37	13	100	2492	27	3056
1973	10	3056	65	40	392	1583	42	4271
1973	11	4271	34	23	520	406	45	4169
1973	12	4169	30	18	525	175	45	3832
1974	1	3832	4	17	485	325	44	3659
1974	2	3659	0	15	419	180	44	3405
1974	3	3405	5	16	434	159	43	3120
1974	4	3120	35	64	387	152	42	2856
1974	5	2856	19	76	368	100	42	2531
1974	6	2531	15	86	319	63	40	2204
1974	7	2204	2	112	291	26	39	1829
1974	8	1829	24	49	246	40	37	1599
1974	9	1599	2	36	211	17	36	1371
1974	10	1371	10	25	191	18	35	1182
1974	11	1182	5	33	163	28	33	1019
1974	12	1019	3	49	149	30	32	854
1975	1	854	3	43	129	34	30	718
1975	2	718	4	34	102	119	29	706
1975	3	706	4	26	112	393	28	965
1975	4	965	11	19	138	80	31	898
1975	5	898	12	29	135	51	31	797
1975	6	797	22	26	119	1176	30	1850
1975	7	1850	6	76	248	92	37	1624
1975	8	1624	17	65	221	37	36	1392
1975	9	1392	5	34	187	9	35	1185
1975	10	1185	0	28	169	10	33	998
1975	11	998	12	8	142	21	32	881
1975	12	881	1	7	133	29	30	771
1976	1	771	0	6	120	27	29	673
1976	2	673	4	5	101	33	28	604
1976	3	604	7	7	100	47	27	552
1976	4	552	12	14	90	269	26	729

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1976	5	729	8	23	114	54	29	655
1976	6	655	3	30	102	17	28	542
1976	7	542	2	26	92	58	26	484
1976	8	484	1	28	80	1	25	379
1976	9	379	5	15	49	1	23	320
1976	10	320	2	7	66	1	21	251
1976	11	251	0	2	56	3	19	196
1976	12	196	0	2	51	5	16	148
1977	1	148	0	2	45	4	14	106
1977	2	106	0	1	36	10	11	79
1977	3	79	4	2	37	19	8	63
1977	4	63	2	6	34	31	6	56
1977	5	56	6	7	34	75	5	95
1977	6	95	4	10	38	52	10	103
1977	7	103	1	14	26	58	10	122
1977	8	122	12	10	38	55	12	142
1977	9	142	3	6	39	3	13	104
1977	10	104	2	4	33	2	10	70
1977	11	70	1	2	35	4	7	39
1977	12	39	0	1	33	4	1	22
1978	1	22	0	1	33	4	0	22
1978	2	22	1	1	30	8	0	22
1978	3	22	1	5	33	527	0	513
1978	4	513	7	14	86	47	25	467
1978	5	467	9	14	83	110	24	489
1978	6	489	9	23	83	28	25	420
1978	7	420	12	21	78	82	23	415
1978	8	415	7	19	77	145	23	471
1978	9	471	17	17	81	353	25	743
1978	10	743	2	15	105	2	29	627
1978	11	627	5	9	99	12	27	536
1978	12	536	0	8	91	11	26	447
1979	1	447	3	7	81	4	24	367
1979	2	367	1	6	64	301	22	599
1979	3	599	15	8	99	554	27	1060
1979	4	1060	10	20	149	82	32	982
1979	5	982	6	28	145	73	31	889
1979	6	889	22	35	129	147	31	893
1979	7	893	19	27	134	134	31	885
1979	8	885	7	29	133	24	30	754
1979	9	754	3	22	114	12	29	633
1979	10	633	14	13	103	133	27	663
1979	11	663	3	5	103	58	28	615
1979	12	615	1	5	101	20	27	529

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1980	1	529	4	5	91	22	26	460
1980	2	460	3	4	77	38	24	421
1980	3	421	7	4	78	148	23	494
1980	4	494	4	13	84	333	25	734
1980	5	734	6	22	115	73	29	675
1980	6	675	9	26	105	210	28	764
1980	7	764	4	39	119	6	29	615
1980	8	615	14	28	101	3	27	504
1980	9	504	2	16	85	2	25	406
1980	10	406	4	10	76	6	23	330
1980	11	330	0	7	65	6	21	265
1980	12	265	1	6	59	10	19	210
1981	1	210	0	5	53	12	17	164
1981	2	164	0	4	43	14	15	132
1981	3	132	2	5	43	26	13	111
1981	4	111	2	8	39	17	11	83
1981	5	83	8	7	37	701	8	748
1981	6	748	4	30	113	83	29	692
1981	7	692	24	26	110	96	28	675
1981	8	675	10	21	108	99	28	655
1981	9	655	4	18	102	14	28	552
1981	10	552	2	9	93	7	26	459
1981	11	459	6	6	80	21	24	401
1981	12	401	2	5	75	41	23	363
1982	1	363	1	5	71	18	22	306
1982	2	306	1	4	58	108	21	353
1982	3	353	4	5	70	134	22	416
1982	4	416	6	18	75	48	23	377
1982	5	377	13	15	72	621	22	924
1982	6	924	13	26	133	149	31	927
1982	7	927	14	39	138	195	31	959
1982	8	959	13	27	142	31	31	834
1982	9	834	5	18	123	18	30	716
1982	10	716	8	16	113	41	28	636
1982	11	636	1	3	100	40	27	574
1982	12	574	5	2	96	44	26	525
1983	1	525	1	2	90	57	26	490
1983	2	490	2	2	78	106	25	518
1983	3	518	6	2	89	87	25	519
1983	4	519	4	15	87	83	25	505
1983	5	505	10	19	88	241	25	649
1983	6	649	15	21	102	116	28	658
1983	7	658	1	36	106	31	28	548
1983	8	548	6	27	93	16	26	451

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1983	9	451	8	25	79	71	24	426
1983	10	426	5	12	78	194	24	535
1983	11	535	5	3	88	38	26	487
1983	12	487	1	3	86	39	25	438
1984	1	438	0	3	80	136	24	492
1984	2	492	1	3	81	170	25	579
1984	3	579	9	4	97	183	27	671
1984	4	671	16	16	104	620	28	1186
1984	5	1186	20	34	169	479	33	1482
1984	6	1482	33	48	198	358	35	1628
1984	7	1628	1	65	222	100	36	1442
1984	8	1442	9	57	200	20	35	1214
1984	9	1214	7	38	167	16	33	1033
1984	10	1033	15	17	151	31	32	911
1984	11	911	0	8	132	33	31	805
1984	12	805	9	6	124	60	30	744
1985	1	744	3	6	116	61	29	686
1985	2	686	1	5	99	200	28	784
1985	3	784	5	7	121	103	29	763
1985	4	763	14	22	115	139	29	779
1985	5	779	21	36	120	862	29	1505
1985	6	1505	12	50	200	124	35	1391
1985	7	1391	34	50	193	199	35	1380
1985	8	1380	29	38	192	503	35	1682
1985	9	1682	30	53	221	68	37	1507
1985	10	1507	12	26	207	93	35	1378
1985	11	1378	3	21	186	68	35	1242
1985	12	1242	1	20	176	81	34	1129
1986	1	1129	0	18	162	93	33	1041
1986	2	1041	3	15	137	82	32	974
1986	3	974	5	28	144	88	31	896
1986	4	896	23	43	130	202	31	948
1986	5	948	13	32	141	227	31	1015
1986	6	1015	8	42	144	75	32	912
1986	7	912	12	38	136	36	31	786
1986	8	786	19	24	121	72	29	732
1986	9	732	21	19	111	211	29	834
1986	10	834	18	9	127	436	30	1152
1986	11	1152	5	6	160	81	33	1073
1986	12	1073	6	5	155	101	32	1019
1987	1	1019	0	5	149	87	32	952
1987	2	952	4	4	127	84	31	907
1987	3	907	29	9	136	910	31	1701
1987	4	1701	19	41	223	1131	37	2587

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1987	5	2587	48	79	336	649	41	2869
1987	6	2869	42	93	358	490	42	2951
1987	7	2951	14	101	380	172	42	2656
1987	8	2656	40	76	344	93	41	2368
1987	9	2368	14	55	300	53	40	2080
1987	10	2080	9	42	276	56	39	1826
1987	11	1826	9	3	237	79	37	1673
1987	12	1673	2	2	227	104	36	1550
1988	1	1550	4	2	212	146	36	1485
1988	2	1485	2	2	192	176	35	1470
1988	3	1470	1	8	203	104	35	1364
1988	4	1364	10	39	184	88	35	1239
1988	5	1239	8	72	175	73	34	1072
1988	6	1072	11	54	150	25	32	904
1988	7	904	27	34	135	778	31	1540
1988	8	1540	12	50	211	63	36	1354
1988	9	1354	9	36	183	13	34	1157
1988	10	1157	0	24	166	10	33	978
1988	11	978	5	15	140	26	31	855
1988	12	855	1	13	130	31	30	744
1989	1	744	1	12	116	38	29	655
1989	2	655	1	10	95	38	28	589
1989	3	589	1	12	98	45	27	525
1989	4	525	1	24	87	34	26	450
1989	5	450	7	20	81	31	24	386
1989	6	386	8	15	71	153	23	461
1989	7	461	7	19	82	1076	24	1441
1989	8	1441	25	39	199	61	35	1288
1989	9	1288	19	27	175	21	34	1127
1989	10	1127	3	21	162	11	33	958
1989	11	958	0	6	137	17	31	832
1989	12	832	1	5	127	22	30	722
1990	1	722	1	5	114	30	29	635
1990	2	635	0	4	93	36	27	574
1990	3	574	9	5	96	73	26	555
1990	4	555	3	18	91	57	26	506
1990	5	506	15	17	88	149	25	565
1990	6	565	12	25	92	339	26	799
1990	7	799	7	31	123	279	30	930
1990	8	930	11	28	139	93	31	868
1990	9	868	2	21	127	3	30	725
1990	10	725	4	18	114	9	29	606
1990	11	606	2	7	97	14	27	519
1990	12	519	2	6	89	13	25	438

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1991	1	438	1	6	80	15	24	369
1991	2	369	0	4	65	51	22	350
1991	3	350	5	5	69	41	22	321
1991	4	321	3	12	64	24	21	273
1991	5	273	8	11	60	102	19	313
1991	6	313	4	18	63	18	21	254
1991	7	254	3	16	56	1	19	186
1991	8	186	3	12	32	0	16	145
1991	9	145	1	12	0	0	14	135
1991	10	135	1	8	3	0	13	125
1991	11	125	3	4	41	1	12	83
1991	12	83	2	4	37	4	8	48
1992	1	48	1	3	33	9	3	22
1992	2	22	0	3	31	8	0	22
1992	3	22	2	3	33	22	0	22
1992	4	22	1	5	32	18	0	22
1992	5	22	1	8	33	8	0	22
1992	6	22	3	6	32	47	0	35
1992	7	35	9	7	33	736	0	740
1992	8	740	13	23	116	208	29	823
1992	9	823	16	33	122	25	30	709
1992	10	709	13	11	112	52	28	650
1992	11	650	6	2	102	26	28	578
1992	12	578	4	2	96	70	26	554
1993	1	554	6	2	94	25	26	489
1993	2	489	4	1	78	639	25	1054
1993	3	1054	11	2	153	1578	32	2487
1993	4	2487	19	50	314	236	40	2378
1993	5	2378	36	45	311	281	40	2338
1993	6	2338	55	67	297	245	40	2275
1993	7	2275	125	53	299	3264	39	5311
1993	8	5311	92	106	661	825	47	5461
1993	9	5461	67	90	657	692	48	5473
1993	10	5473	18	88	681	268	48	4990
1993	11	4990	9	115	603	225	47	4506
1993	12	4506	18	108	565	216	46	4067
1994	1	4067	14	98	513	182	45	3652
1994	2	3652	13	80	418	156	44	3323
1994	3	3323	1	61	424	361	43	3200
1994	4	3200	30	87	396	227	43	2974
1994	5	2974	11	88	382	182	42	2698
1994	6	2698	49	79	338	81	41	2411
1994	7	2411	47	71	315	77	40	2149
1994	8	2149	6	55	284	38	39	1854

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1994	9	1854	7	42	241	26	37	1605
1994	10	1605	10	26	219	34	36	1404
1994	11	1404	12	34	189	51	35	1244
1994	12	1244	6	32	176	63	34	1105
1995	1	1105	6	29	159	84	33	1007
1995	2	1007	0	24	133	74	32	924
1995	3	924	5	24	138	78	31	844
1995	4	844	7	15	124	80	30	793
1995	5	793	25	15	122	704	29	1384
1995	6	1384	10	38	186	190	35	1360
1995	7	1360	7	42	190	110	35	1245
1995	8	1245	19	38	176	138	34	1188
1995	9	1188	12	24	164	26	33	1038
1995	10	1038	3	21	151	34	32	902
1995	11	902	2	8	131	36	31	802
1995	12	802	1	7	123	34	30	706
1996	1	706	1	7	112	43	28	632
1996	2	632	0	6	96	101	27	631
1996	3	631	2	8	103	90	27	613
1996	4	613	7	20	97	93	27	595
1996	5	595	14	13	98	152	27	649
1996	6	649	2	21	102	52	28	580
1996	7	580	14	21	97	152	27	628
1996	8	628	7	13	102	57	27	577
1996	9	577	9	13	93	26	26	505
1996	10	505	2	16	88	18	25	421
1996	11	421	13	2	75	576	24	933
1996	12	933	0	4	139	101	31	892
1997	1	892	0	3	134	87	31	842
1997	2	842	4	3	116	92	30	820
1997	3	820	1	4	125	105	30	796
1997	4	796	10	18	119	111	30	780
1997	5	780	6	30	121	122	29	757
1997	6	757	11	29	114	867	29	1491
1997	7	1491	17	48	205	88	35	1343
1997	8	1343	18	34	188	48	34	1188
1997	9	1188	7	35	164	20	33	1016
1997	10	1016	11	20	149	39	32	898
1997	11	898	4	6	130	158	31	924
1997	12	924	5	6	138	141	31	926
1998	1	926	2	6	138	115	31	899
1998	2	899	3	5	122	123	31	898
1998	3	898	12	6	135	216	31	985
1998	4	985	22	22	140	779	32	1623

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1998	5	1623	7	39	221	201	36	1570
1998	6	1570	19	45	208	96	36	1432
1998	7	1432	25	34	198	677	35	1903
1998	8	1903	8	41	255	203	38	1817
1998	9	1817	12	43	236	46	37	1595
1998	10	1595	11	20	218	50	36	1418
1998	11	1418	16	37	190	121	35	1329
1998	12	1329	0	31	186	100	34	1212
1999	1	1212	2	28	172	109	33	1123
1999	2	1123	1	24	146	102	33	1056
1999	3	1056	2	24	153	102	32	983
1999	4	983	15	18	140	191	31	1030
1999	5	1030	21	31	150	431	32	1301
1999	6	1301	16	33	177	120	34	1227
1999	7	1227	5	40	174	48	34	1067
1999	8	1067	12	26	155	36	32	933
1999	9	933	6	23	134	17	31	797
1999	10	797	0	23	123	22	30	674
1999	11	674	2	13	104	29	28	586
1999	12	586	1	11	97	42	27	521
2000	1	521	0	10	90	53	26	475
2000	2	475	3	9	79	69	25	460
2000	3	460	5	8	82	85	24	459
2000	4	459	2	16	80	65	24	430
2000	5	430	2	19	79	50	24	384
2000	6	384	4	16	71	10	23	312
2000	7	312	2	15	65	4	21	238
2000	8	238	1	13	31	0	18	196
2000	9	196	1	14	0	0	16	183
2000	10	183	2	7	5	0	16	174
2000	11	174	2	14	40	25	15	146
2000	12	146	1	13	45	9	14	99
2001	1	99	1	12	39	14	10	63
2001	2	63	3	9	32	32	6	56
2001	3	56	1	9	34	381	5	396
2001	4	396	3	18	72	66	23	374
2001	5	374	20	14	72	737	22	1045
2001	6	1045	13	35	147	198	32	1073
2001	7	1073	26	42	156	291	32	1192
2001	8	1192	9	36	170	30	33	1026
2001	9	1026	16	23	145	16	32	890
2001	10	890	7	13	134	16	31	766
2001	11	766	2	8	115	32	29	677
2001	12	677	0	8	108	45	28	607

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2002	1	607	1	7	100	46	27	547
2002	2	547	1	6	84	60	26	519
2002	3	519	1	8	89	66	25	490
2002	4	490	6	15	83	65	25	463
2002	5	463	9	15	83	105	24	479
2002	6	479	8	25	82	19	25	399
2002	7	399	1	21	75	4	23	308
2002	8	308	3	16	64	1	21	231
2002	9	231	3	12	37	0	18	185
2002	10	185	7	5	50	16	16	153
2002	11	153	0	0	44	2	14	111
2002	12	111	0	0	41	3	11	73
2003	1	73	0	0	36	4	7	42
2003	2	42	1	0	30	8	2	22
2003	3	22	1	1	33	16	0	22
2003	4	22	2	5	32	23	0	22
2003	5	22	3	6	33	54	0	42
2003	6	42	10	9	32	20	2	31
2003	7	31	0	12	10	0	0	22
2003	8	22	4	10	14	2	0	22
2003	9	22	4	9	14	11	0	22
2003	10	22	1	6	29	0	0	22
2003	11	22	2	2	23	0	0	22
2003	12	22	1	0	33	0	0	22
2004	1	22	1	0	33	1	0	22
2004	2	22	1	0	31	2	0	22
2004	3	22	3	0	33	17	0	22
2004	4	22	1	6	32	7	0	22
2004	5	22	4	8	33	5	0	22
2004	6	22	5	11	32	5	0	22
2004	7	22	7	9	33	119	0	106
2004	8	106	3	18	40	4	11	56
2004	9	56	2	10	33	0	4	22
2004	10	22	1	5	33	1	0	22
2004	11	22	1	0	32	2	0	22
2004	12	22	0	0	33	2	0	22
2005	1	22	1	0	33	3	0	22
2005	2	22	1	0	30	8	0	22
2005	3	22	2	0	33	14	0	22
2005	4	22	2	7	32	11	0	22
2005	5	22	1	10	33	6	0	22
2005	6	22	3	10	32	6	0	22
2005	7	22	5	13	32	186	0	168
2005	8	168	10	13	48	55	15	173

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2005	9	173	2	16	40	2	15	120
2005	10	120	2	9	32	0	12	82
2005	11	82	1	2	36	2	8	46
2005	12	46	0	0	33	3	3	22
2006	1	22	0	0	33	3	0	22
2006	2	22	0	0	30	3	0	22
2006	3	22	2	0	33	10	0	22
2006	4	22	2	10	32	13	0	22
2006	5	22	2	11	33	98	0	79
2006	6	79	2	13	36	1	8	34
2006	7	34	3	12	27	5	0	22
2006	8	22	3	9	17	1	0	22
2006	9	22	4	7	32	8	0	22
2006	10	22	1	5	33	1	0	22
2006	11	22	0	1	32	1	0	22
2006	12	22	3	0	33	3	0	22
2007	1	22	0	0	33	3	0	22
2007	2	22	1	0	30	42	0	36
2007	3	36	2	0	33	9	0	22
2007	4	22	2	8	32	10	0	22
2007	5	22	5	11	33	39	0	23
2007	6	23	7	10	32	305	0	294
2007	7	294	4	26	63	25	20	234
2007	8	234	5	17	55	41	18	207
2007	9	207	4	14	50	6	17	153
2007	10	153	4	10	46	91	14	192
2007	11	192	0	2	49	15	16	156
2007	12	156	2	0	46	22	14	134
2008	1	134	0	0	44	39	13	130
2008	2	130	0	0	40	66	12	156
2008	3	156	1	0	46	45	14	155
2008	4	155	6	9	45	105	14	212
2008	5	212	7	12	53	1118	17	1272
2008	6	1272	17	53	173	465	34	1529
2008	7	1529	35	72	210	232	36	1515
2008	8	1515	26	51	208	61	36	1342
2008	9	1342	16	34	182	34	34	1176
2008	10	1176	27	29	168	838	33	1844
2008	11	1844	7	17	240	191	37	1786
2008	12	1786	4	0	241	135	37	1684
2009	1	1684	1	0	228	119	37	1575
2009	2	1575	2	0	195	112	36	1494
2009	3	1494	0	0	206	105	35	1394
2009	4	1394	19	59	188	134	35	1301

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2009	5	1301	7	52	183	193	34	1266
2009	6	1266	14	47	173	65	34	1125
2009	7	1125	25	39	162	42	33	990
2009	8	990	13	45	146	16	32	829
2009	9	829	6	20	122	12	30	705
2009	10	705	7	11	112	19	28	608
2009	11	608	1	2	97	31	27	542
2009	12	542	3	0	92	31	26	484
2010	1	484	0	0	85	62	25	461
2010	2	461	1	0	74	50	24	437
2010	3	437	8	0	80	183	24	549
2010	4	549	6	20	90	160	26	604
2010	5	604	14	13	100	189	27	694
2010	6	694	19	23	107	1112	28	1695
2010	7	1695	12	49	230	297	37	1725
2010	8	1725	13	48	233	80	37	1537
2010	9	1537	18	30	204	37	36	1358
2010	10	1358	1	27	190	39	35	1181
2010	11	1181	7	22	163	62	33	1065
2010	12	1065	0	0	155	67	32	978
2011	1	978	3	0	144	79	31	916
2011	2	916	5	0	124	135	31	933
2011	3	933	2	0	139	104	31	900
2011	4	900	9	0	131	143	31	921
2011	5	921	30	0	137	2332	31	3145
2011	6	3145	33	0	390	1215	42	4003
2011	7	4003	56	0	505	178	45	3732
2011	8	3732	73	0	473	100	44	3433
2011	9	3433	6	0	423	39	43	3055
2011	10	3055	3	0	392	42	42	2708
2011	11	2708	12	0	339	69	41	2450
2011	12	2450	10	0	320	77	40	2217
2012	1	2217	0	0	292	83	39	2008
2012	2	2008	0	0	250	92	38	1850
2012	3	1850	0	0	248	96	37	1698
2012	4	1698	31	0	223	127	37	1634
2012	5	1634	6	0	223	53	36	1471
2012	6	1471	21	0	196	35	35	1331
2012	7	1331	5	0	186	10	34	1160
2012	8	1160	8	0	166	7	33	1009
2012	9	1009	5	0	143	4	32	874
2012	10	874	7	0	132	8	30	758
2012	11	758	0	0	114	11	29	655
2012	12	655	3	0	106	13	28	565

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2013	1	565	4	0	95	15	26	489
2013	2	489	0	0	78	17	25	429
2013	3	429	0	0	79	25	24	375
2013	4	375	0	0	70	25	22	331
2013	5	331	0	0	67	35	21	299
2013	6	299	0	0	61	32	20	270
2013	7	270	0	0	60	3	19	213
2013	8	213	0	0	53	18	17	179
2013	9	179	0	0	47	5	15	136
2013	10	136	0	0	44	1	13	93
2013	11	93	0	0	37	2	9	58
2013	12	58	0	0	34	1	5	24
2014	1	24	0	0	33	2	0	22
2014	2	22	0	0	30	5	0	22
2014	3	22	0	0	33	9	0	22
2014	4	22	1	0	32	8	0	22
2014	5	22	0	0	33	16	0	22
2014	6	22	1	0	32	186	0	177
2014	7	177	0	0	49	7	15	135
2014	8	135	4	0	44	204	13	300
2014	9	300	0	0	61	20	20	259
2014	10	259	0	0	58	5	19	206
2014	11	206	0	0	50	2	17	158
2014	12	158	0	0	46	5	14	117
2015	1	117	0	0	41	3	11	79
2015	2	79	0	0	33	8	8	53
2015	3	53	0	0	34	18	4	38
2015	4	38	0	0	32	21	1	27
2015	5	27	2	0	33	684	0	680
2015	6	680	5	0	105	203	28	784
2015	7	784	3	0	121	54	29	719
2015	8	719	3	0	113	100	29	709
2015	9	709	0	0	108	45	28	646
2015	10	646	2	0	105	10	28	552
2015	11	552	6	0	90	17	26	485
2015	12	485	1	0	85	55	25	454

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1958	1	488	1	0	83	5	10	411
1958	2	411	8	0	70	9	19	358
1958	3	358	13	1	75	38	18	334
1958	4	334	10	25	71	101	17	349
1958	5	349	14	37	74	52	18	305
1958	6	305	16	46	69	32	17	238
1958	7	238	35	42	63	837	15	1005
1958	8	1005	24	67	115	360	25	1207
1958	9	1207	67	59	123	289	27	1381
1958	10	1381	5	56	125	0	28	1204
1958	11	1204	6	23	123	1	27	1065
1958	12	1065	1	7	118	4	26	944
1959	1	944	3	7	111	6	25	836
1959	2	836	3	6	94	142	24	881
1959	3	881	16	7	107	42	24	826
1959	4	826	11	49	100	12	24	699
1959	5	699	51	49	96	992	23	1598
1959	6	1598	26	95	147	115	29	1497
1959	7	1497	11	93	141	145	28	1419
1959	8	1419	10	126	9	0	28	1294
1959	9	1294	27	73	56	151	27	1344
1959	10	1344	50	40	136	657	27	1875
1959	11	1875	0	33	163	4	30	1682
1959	12	1682	2	32	157	6	29	1502
1960	1	1502	14	30	146	10	28	1350
1960	2	1350	16	26	127	48	28	1260
1960	3	1260	17	31	131	1212	27	2327
1960	4	2327	35	101	190	679	32	2749
1960	5	2749	46	127	223	506	33	2951
1960	6	2951	100	115	228	1688	33	4395
1960	7	4395	29	192	325	69	36	3976
1960	8	3976	71	207	299	376	35	3917
1960	9	3917	49	156	286	16	35	3540
1960	10	3540	37	84	272	13	35	3233
1960	11	3233	5	35	245	18	34	2977
1960	12	2977	5	34	237	24	33	2735
1961	1	2735	1	32	222	25	33	2507
1961	2	2507	8	27	188	34	32	2334
1961	3	2334	34	30	197	39	32	2179
1961	4	2179	25	93	182	32	31	1962
1961	5	1962	95	84	174	830	30	2629
1961	6	2629	52	119	209	2456	32	4811
1961	7	4811	61	232	351	51	37	4339
1961	8	4339	84	185	322	422	36	4338

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1961	9	4338	132	135	311	879	36	4903
1961	10	4903	24	112	357	146	37	4604
1961	11	4604	42	54	327	99	37	4364
1961	12	4364	22	53	323	66	36	4076
1962	1	4076	17	50	305	1234	36	4972
1962	2	4972	40	53	326	250	37	4883
1962	3	4883	25	70	355	386	37	4868
1962	4	4868	10	170	343	85	37	4449
1962	5	4449	73	215	328	274	36	4254
1962	6	4254	143	157	306	1425	36	5358
1962	7	5358	173	214	385	807	38	5740
1962	8	5740	104	259	408	465	38	5642
1962	9	5642	114	135	389	262	38	5494
1962	10	5494	91	101	393	244	38	5335
1962	11	5335	20	50	371	86	38	5020
1962	12	5020	9	44	364	78	37	4699
1963	1	4699	13	42	344	63	37	4389
1963	2	4389	0	36	293	79	36	4139
1963	3	4139	31	62	309	114	36	3914
1963	4	3914	60	140	286	170	35	3718
1963	5	3718	41	120	283	95	35	3451
1963	6	3451	61	164	258	223	34	3312
1963	7	3312	79	166	258	195	34	3163
1963	8	3163	58	145	249	38	34	2866
1963	9	2866	93	78	223	2100	33	4758
1963	10	4758	25	121	348	46	37	4360
1963	11	4360	5	56	312	43	36	4040
1963	12	4040	5	37	303	41	36	3746
1964	1	3746	0	35	285	54	35	3481
1964	2	3481	8	31	251	51	34	3258
1964	3	3258	17	41	254	64	34	3043
1964	4	3043	35	104	233	50	33	2791
1964	5	2791	24	138	226	42	33	2493
1964	6	2493	43	127	200	28	32	2237
1964	7	2237	32	154	191	24	31	1948
1964	8	1948	66	107	173	507	30	2240
1964	9	2240	40	71	185	16	31	2040
1964	10	2040	3	63	179	2	31	1803
1964	11	1803	15	35	159	36	30	1659
1964	12	1659	2	9	155	20	29	1516
1965	1	1516	8	9	146	21	28	1390
1965	2	1390	15	8	125	880	28	2152
1965	3	2152	14	16	186	303	31	2267
1965	4	2267	15	73	187	396	31	2418

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1965	5	2418	40	114	202	226	32	2367
1965	6	2367	75	107	193	1698	32	3840
1965	7	3840	77	193	291	1185	35	4619
1965	8	4619	71	199	339	208	37	4361
1965	9	4361	140	96	312	1103	36	5195
1965	10	5195	15	114	375	69	37	4790
1965	11	4790	3	59	338	43	37	4439
1965	12	4439	12	47	328	57	36	4134
1966	1	4134	1	44	309	45	36	3827
1966	2	3827	33	37	262	243	35	3804
1966	3	3804	6	60	288	62	35	3523
1966	4	3523	17	91	262	39	35	3226
1966	5	3226	15	165	253	29	34	2854
1966	6	2854	49	151	222	42	33	2573
1966	7	2573	57	152	212	59	32	2325
1966	8	2325	40	100	190	108	32	2182
1966	9	2182	26	71	97	34	31	2075
1966	10	2075	9	67	0	0	31	2017
1966	11	2017	2	29	120	1	30	1871
1966	12	1871	8	27	152	4	30	1704
1967	1	1704	0	26	158	8	29	1529
1967	2	1529	0	22	133	12	28	1387
1967	3	1387	5	24	138	11	28	1240
1967	4	1240	22	50	125	8	27	1095
1967	5	1095	20	57	120	15	26	952
1967	6	952	64	56	108	1655	25	2507
1967	7	2507	52	113	208	123	32	2362
1967	8	2362	4	119	199	7	32	2055
1967	9	2055	67	65	174	26	31	1908
1967	10	1908	8	48	171	11	30	1708
1967	11	1708	4	16	153	7	29	1550
1967	12	1550	9	15	149	6	29	1402
1968	1	1402	1	14	139	7	28	1257
1968	2	1257	4	12	122	10	27	1136
1968	3	1136	0	15	123	7	26	1006
1968	4	1006	28	51	111	12	25	883
1968	5	883	19	46	107	9	24	757
1968	6	757	34	63	96	41	23	673
1968	7	673	20	62	85	138	22	685
1968	8	685	35	57	95	156	23	725
1968	9	725	35	40	94	168	23	793
1968	10	793	23	40	102	217	24	891
1968	11	891	6	11	104	1	24	783
1968	12	783	11	8	101	2	24	686

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1969	1	686	3	8	95	3	23	590
1969	2	590	9	7	80	567	21	1079
1969	3	1079	15	16	119	984	26	1942
1969	4	1942	34	65	167	109	30	1852
1969	5	1852	60	67	167	463	30	2141
1969	6	2141	18	96	179	44	31	1928
1969	7	1928	104	104	172	202	30	1958
1969	8	1958	35	88	174	251	30	1982
1969	9	1982	22	66	170	122	30	1891
1969	10	1891	39	38	170	42	30	1764
1969	11	1764	1	11	157	22	29	1620
1969	12	1620	5	9	153	20	29	1483
1970	1	1483	1	9	144	45	28	1375
1970	2	1375	0	8	124	36	28	1279
1970	3	1279	6	12	132	35	27	1176
1970	4	1176	19	51	121	220	27	1242
1970	5	1242	48	68	129	54	27	1147
1970	6	1147	33	72	120	128	26	1116
1970	7	1116	8	92	118	6	26	921
1970	8	921	15	77	18	0	25	841
1970	9	841	40	41	74	4	24	769
1970	10	769	16	18	100	5	23	673
1970	11	673	6	10	91	35	22	613
1970	12	613	0	11	90	9	22	521
1971	1	521	8	10	85	6	21	440
1971	2	440	15	9	72	306	19	679
1971	3	679	8	16	95	92	22	668
1971	4	668	5	39	91	34	22	577
1971	5	577	23	36	88	67	21	543
1971	6	543	21	53	83	434	21	863
1971	7	863	19	66	106	114	24	824
1971	8	824	6	63	104	7	24	670
1971	9	670	9	43	91	135	22	681
1971	10	681	21	29	95	2	22	580
1971	11	580	11	15	86	31	21	523
1971	12	523	4	10	85	12	21	444
1972	1	444	1	10	80	11	19	366
1972	2	366	1	9	70	9	18	297
1972	3	297	3	10	71	16	16	235
1972	4	235	12	22	65	15	15	175
1972	5	175	33	25	63	292	13	412
1972	6	412	13	40	75	78	19	388
1972	7	388	32	44	77	399	18	699
1972	8	699	37	49	96	307	23	899

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1972	9	899	20	37	105	45	25	823
1972	10	823	10	19	103	9	24	720
1972	11	720	21	8	94	48	23	686
1972	12	686	6	4	95	44	23	638
1973	1	638	4	4	92	227	22	773
1973	2	773	2	4	91	64	23	745
1973	3	745	32	2	99	335	23	1011
1973	4	1011	17	41	111	573	25	1449
1973	5	1449	38	67	142	418	28	1696
1973	6	1696	18	98	153	344	29	1808
1973	7	1808	54	110	165	235	30	1822
1973	8	1822	36	99	165	115	30	1709
1973	9	1709	132	46	153	4951	29	6592
1973	10	6592	178	110	461	3144	39	9344
1973	11	9344	95	63	612	807	42	9572
1973	12	9572	87	53	646	348	42	9308
1974	1	9308	12	51	630	645	42	9284
1974	2	9284	0	46	567	358	42	9028
1974	3	9028	18	54	612	317	41	8697
1974	4	8697	121	222	573	303	41	8327
1974	5	8327	68	277	569	198	41	7748
1974	6	7748	58	327	516	126	40	7090
1974	7	7090	6	444	492	51	40	6211
1974	8	6211	101	205	438	79	39	5749
1974	9	5749	9	158	396	34	38	5238
1974	10	5238	46	115	377	35	37	4826
1974	11	4826	24	164	340	56	37	4403
1974	12	4403	15	252	325	59	36	3900
1975	1	3900	15	228	294	68	35	3460
1975	2	3460	23	187	241	236	34	3291
1975	3	3291	24	140	257	780	34	3699
1975	4	3699	49	90	273	158	35	3543
1975	5	3543	58	140	272	101	35	3290
1975	6	3290	106	126	248	2336	34	5358
1975	7	5358	21	276	385	183	38	4901
1975	8	4901	63	244	356	74	37	4437
1975	9	4437	21	137	317	19	36	4023
1975	10	4023	1	116	302	19	36	3625
1975	11	3625	55	37	268	43	35	3417
1975	12	3417	3	32	264	57	34	3180
1976	1	3180	2	31	250	53	34	2956
1976	2	2956	22	27	221	66	33	2796
1976	3	2796	38	38	226	94	33	2664
1976	4	2664	66	76	211	535	33	2979

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1976	5	2979	41	110	237	108	33	2781
1976	6	2781	13	152	218	35	33	2459
1976	7	2459	9	136	205	115	32	2242
1976	8	2242	5	146	179	3	31	1925
1976	9	1925	27	81	116	1	30	1755
1976	10	1755	11	38	161	2	29	1569
1976	11	1569	1	12	145	6	29	1418
1976	12	1418	0	11	140	10	28	1276
1977	1	1276	3	11	132	7	27	1144
1977	2	1144	0	9	111	21	26	1044
1977	3	1044	30	16	117	38	26	978
1977	4	978	13	43	109	62	25	901
1977	5	901	43	51	108	148	25	932
1977	6	932	27	69	107	103	25	887
1977	7	887	6	88	69	114	24	850
1977	8	850	71	56	95	110	24	879
1977	9	879	19	36	93	6	24	775
1977	10	775	11	22	84	3	23	683
1977	11	683	9	11	92	7	23	597
1977	12	597	0	7	89	8	22	509
1978	1	509	2	7	84	7	20	427
1978	2	427	6	6	71	15	19	371
1978	3	371	4	25	75	1047	18	1322
1978	4	1322	25	50	130	92	27	1260
1978	5	1260	33	50	131	218	27	1330
1978	6	1330	35	85	131	55	27	1204
1978	7	1204	47	81	127	163	27	1206
1978	8	1206	26	75	127	288	27	1318
1978	9	1318	62	62	130	701	27	1889
1978	10	1889	7	52	153	4	30	1694
1978	11	1694	18	31	152	24	29	1552
1978	12	1552	1	30	149	21	29	1395
1979	1	1395	14	28	139	9	28	1250
1979	2	1250	4	24	117	597	27	1710
1979	3	1710	56	31	158	1100	29	2676
1979	4	2676	32	68	211	162	33	2592
1979	5	2592	20	95	213	145	32	2448
1979	6	2448	78	127	198	293	32	2494
1979	7	2494	70	99	207	265	32	2524
1979	8	2524	27	108	209	47	32	2281
1979	9	2281	13	87	188	23	31	2043
1979	10	2043	56	54	179	264	31	2130
1979	11	2130	10	22	179	116	31	2055
1979	12	2055	3	22	180	39	31	1895

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1980	1	1895	18	21	170	44	30	1766
1980	2	1766	14	19	152	76	29	1687
1980	3	1687	33	21	157	295	29	1836
1980	4	1836	20	61	161	661	30	2295
1980	5	2295	23	88	195	144	31	2179
1980	6	2179	37	105	182	418	31	2347
1980	7	2347	15	154	198	11	32	2022
1980	8	2022	57	114	178	5	30	1792
1980	9	1792	11	72	158	3	30	1576
1980	10	1576	20	46	150	11	29	1411
1980	11	1411	0	33	135	12	28	1254
1980	12	1254	6	32	130	19	27	1117
1981	1	1117	1	30	122	23	26	990
1981	2	990	2	25	103	28	25	892
1981	3	892	10	32	108	51	24	814
1981	4	814	10	45	100	34	24	713
1981	5	713	47	40	97	1393	23	2017
1981	6	2017	15	109	172	165	30	1916
1981	7	1916	87	95	171	190	30	1927
1981	8	1927	39	79	172	196	30	1910
1981	9	1910	14	68	165	27	30	1718
1981	10	1718	8	34	159	14	29	1546
1981	11	1546	27	27	144	42	29	1445
1981	12	1445	9	23	142	81	28	1369
1982	1	1369	4	22	137	36	28	1250
1982	2	1250	3	19	117	214	27	1331
1982	3	1331	19	22	135	266	27	1459
1982	4	1459	25	79	138	96	28	1362
1982	5	1362	56	64	137	1234	28	2451
1982	6	2451	47	91	198	296	32	2505
1982	7	2505	49	138	208	387	32	2595
1982	8	2595	46	97	213	62	32	2394
1982	9	2394	19	68	194	35	32	2186
1982	10	2186	31	61	188	81	31	2049
1982	11	2049	5	12	174	79	31	1948
1982	12	1948	22	11	173	88	30	1874
1983	1	1874	7	10	169	112	30	1814
1983	2	1814	7	9	149	210	30	1873
1983	3	1873	26	10	169	173	30	1893
1983	4	1893	17	65	164	165	30	1845
1983	5	1845	45	84	167	478	30	2118
1983	6	2118	62	87	178	231	31	2146
1983	7	2146	5	147	186	61	31	1880
1983	8	1880	27	115	169	32	30	1655

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1983	9	1655	35	114	150	142	29	1567
1983	10	1567	24	52	150	385	29	1774
1983	11	1774	23	13	157	75	30	1701
1983	12	1701	5	13	158	78	29	1613
1984	1	1613	1	12	152	270	29	1719
1984	2	1719	4	12	149	337	29	1900
1984	3	1900	38	17	170	364	30	2114
1984	4	2114	65	66	178	1231	31	3167
1984	5	3167	70	119	249	951	34	3821
1984	6	3821	110	160	280	712	35	4202
1984	7	4202	5	215	313	198	36	3877
1984	8	3877	30	197	293	39	35	3456
1984	9	3456	25	137	258	32	34	3119
1984	10	3119	59	66	246	62	34	2928
1984	11	2928	2	31	226	65	33	2738
1984	12	2738	39	27	222	119	33	2645
1985	1	2645	15	26	217	122	32	2539
1985	2	2539	4	23	190	398	32	2728
1985	3	2728	21	31	222	204	33	2700
1985	4	2700	59	97	213	277	33	2727
1985	5	2727	90	157	222	1712	33	4150
1985	6	4150	43	174	300	246	36	3964
1985	7	3964	124	179	298	395	35	4005
1985	8	4005	106	139	301	998	36	4669
1985	9	4669	106	186	331	136	37	4394
1985	10	4394	45	97	325	185	36	4201
1985	11	4201	10	80	303	135	36	3964
1985	12	3964	5	79	298	161	35	3753
1986	1	3753	0	75	285	184	35	3576
1986	2	3576	11	66	248	164	35	3438
1986	3	3438	23	119	266	175	34	3251
1986	4	3251	104	193	246	402	34	3318
1986	5	3318	55	139	258	452	34	3427
1986	6	3427	35	177	256	148	34	3177
1986	7	3177	52	164	249	72	34	2888
1986	8	2888	86	106	232	142	33	2779
1986	9	2779	94	85	218	419	33	2989
1986	10	2989	79	40	238	866	33	3657
1986	11	3657	18	23	270	162	35	3543
1986	12	3543	24	22	272	201	35	3474
1987	1	3474	1	22	268	173	34	3359
1987	2	3359	16	19	236	166	34	3286
1987	3	3286	129	41	256	1808	34	4925
1987	4	4925	70	151	346	2247	37	6745

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1987	5	6745	157	260	471	1290	39	7461
1987	6	7461	137	303	499	974	40	7771
1987	7	7771	48	334	534	341	40	7291
1987	8	7291	136	261	505	184	40	6846
1987	9	6846	50	199	462	104	39	6340
1987	10	6340	33	161	446	111	39	5877
1987	11	5877	36	14	403	156	38	5653
1987	12	5653	10	8	403	206	38	5457
1988	1	5457	16	8	391	290	38	5364
1988	2	5364	10	7	360	350	38	5356
1988	3	5356	3	37	385	207	38	5144
1988	4	5144	47	178	360	175	37	4829
1988	5	4829	36	341	352	145	37	4317
1988	6	4317	52	260	310	50	36	3849
1988	7	3849	135	169	291	1546	35	5070
1988	8	5070	48	203	367	125	37	4673
1988	9	4673	38	152	331	26	37	4254
1988	10	4254	1	108	316	21	36	3851
1988	11	3851	25	69	282	52	35	3577
1988	12	3577	6	67	274	61	35	3302
1989	1	3302	8	63	257	76	34	3065
1989	2	3065	7	54	219	75	34	2874
1989	3	2874	7	65	231	89	33	2675
1989	4	2675	6	136	211	69	33	2403
1989	5	2403	42	118	201	61	32	2186
1989	6	2186	50	93	182	303	31	2265
1989	7	2265	36	106	193	2137	31	4138
1989	8	4138	90	142	309	121	36	3898
1989	9	3898	73	101	285	43	35	3628
1989	10	3628	13	83	277	21	35	3303
1989	11	3303	0	26	249	33	34	3060
1989	12	3060	4	25	242	43	34	2841
1990	1	2841	7	23	229	60	33	2656
1990	2	2656	1	20	196	71	32	2512
1990	3	2512	48	24	208	144	32	2472
1990	4	2472	13	92	199	114	32	2308
1990	5	2308	76	90	196	295	31	2394
1990	6	2394	60	122	194	673	32	2810
1990	7	2810	29	136	227	554	33	3031
1990	8	3031	43	114	240	185	33	2904
1990	9	2904	10	87	225	6	33	2608
1990	10	2608	17	81	214	18	32	2348
1990	11	2348	8	31	192	29	32	2161
1990	12	2161	7	30	186	26	31	1978

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1991	1	1978	4	29	175	30	30	1809
1991	2	1809	0	24	149	100	30	1737
1991	3	1737	26	27	160	81	29	1656
1991	4	1656	18	65	150	48	29	1507
1991	5	1507	48	62	146	203	28	1550
1991	6	1550	22	99	144	36	29	1366
1991	7	1366	18	91	133	2	28	1162
1991	8	1162	15	68	80	0	26	1029
1991	9	1029	8	71	0	0	26	967
1991	10	967	5	50	7	0	25	915
1991	11	915	15	24	106	2	25	802
1991	12	802	10	23	102	9	24	696
1992	1	696	10	21	96	17	23	606
1992	2	606	3	19	84	16	22	522
1992	3	522	14	19	85	44	21	476
1992	4	476	7	29	79	36	20	411
1992	5	411	8	47	78	16	19	311
1992	6	311	16	32	69	94	17	319
1992	7	319	48	36	72	1461	17	1721
1992	8	1721	41	74	159	414	29	1943
1992	9	1943	53	106	167	49	30	1771
1992	10	1771	44	39	162	103	30	1717
1992	11	1717	21	6	154	51	29	1629
1992	12	1629	13	6	153	140	29	1622
1993	1	1622	22	6	153	49	29	1534
1993	2	1534	18	5	133	1269	28	2682
1993	3	2682	35	8	219	3134	33	5625
1993	4	5625	56	146	388	469	38	5616
1993	5	5616	108	136	401	557	38	5745
1993	6	5745	172	210	396	487	38	5798
1993	7	5798	403	172	412	6483	38	12100
1993	8	12100	263	302	803	1639	44	12898
1993	9	12898	199	265	825	1374	44	13382
1993	10	13382	53	268	882	532	44	12816
1993	11	12816	27	367	820	447	44	12103
1993	12	12103	61	360	803	429	44	11430
1994	1	11430	48	341	761	362	43	10737
1994	2	10737	48	291	649	311	43	10156
1994	3	10156	5	231	682	717	42	9965
1994	4	9965	114	333	649	452	42	9549
1994	5	9549	44	346	645	362	42	8963
1994	6	8963	200	322	589	161	41	8414
1994	7	8414	202	303	574	152	41	7891
1994	8	7891	28	246	542	75	40	7206

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1994	9	7206	34	196	483	52	40	6612
1994	10	6612	48	130	463	69	39	6136
1994	11	6136	63	179	419	102	39	5702
1994	12	5702	33	174	406	124	38	5280
1995	1	5280	33	162	380	168	38	4938
1995	2	4938	3	139	324	148	37	4626
1995	3	4626	29	140	339	154	37	4330
1995	4	4330	44	90	311	160	36	4132
1995	5	4132	146	89	309	1398	36	5278
1995	6	5278	46	176	368	378	38	5159
1995	7	5159	31	194	372	218	37	4843
1995	8	4843	87	180	353	275	37	4672
1995	9	4672	57	115	331	52	37	4336
1995	10	4336	14	106	321	67	36	3990
1995	11	3990	11	41	290	72	35	3742
1995	12	3742	8	41	284	68	35	3492
1996	1	3492	7	38	269	86	35	3278
1996	2	3278	0	34	239	200	34	3205
1996	3	3205	11	43	251	179	34	3100
1996	4	3100	39	115	237	185	34	2972
1996	5	2972	80	76	237	301	33	3041
1996	6	3041	10	115	233	104	33	2806
1996	7	2806	76	116	226	302	33	2842
1996	8	2842	35	71	229	114	33	2692
1996	9	2692	46	69	212	51	33	2508
1996	10	2508	11	88	208	35	32	2257
1996	11	2257	74	11	186	1145	31	3280
1996	12	3280	1	16	256	201	34	3210
1997	1	3210	1	15	251	173	34	3116
1997	2	3116	18	14	222	183	34	3083
1997	3	3083	3	18	244	209	34	3033
1997	4	3033	45	83	233	220	33	2982
1997	5	2982	28	138	237	242	33	2877
1997	6	2877	49	134	223	1721	33	4290
1997	7	4290	62	176	318	175	36	4034
1997	8	4034	69	128	303	95	36	3767
1997	9	3767	29	138	277	39	35	3420
1997	10	3420	46	84	265	78	34	3195
1997	11	3195	18	25	243	315	34	3261
1997	12	3261	20	26	255	280	34	3281
1998	1	3281	7	26	256	228	34	3234
1998	2	3234	14	23	229	244	34	3241
1998	3	3241	53	26	253	429	34	3442
1998	4	3442	93	95	257	1547	34	4730

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
1998	5	4730	26	145	346	399	37	4665
1998	6	4665	69	167	331	190	37	4427
1998	7	4427	98	130	327	1345	36	5413
1998	8	5413	27	148	388	403	38	5307
1998	9	5307	44	159	369	92	38	4914
1998	10	4914	42	78	357	99	37	4619
1998	11	4619	66	148	328	241	37	4450
1998	12	4450	1	127	328	199	36	4194
1999	1	4194	10	121	313	217	36	3987
1999	2	3987	4	105	271	202	35	3817
1999	3	3817	11	107	289	203	35	3635
1999	4	3635	66	83	269	380	35	3729
1999	5	3729	94	137	284	855	35	4258
1999	6	4258	66	136	306	239	36	4121
1999	7	4121	22	165	308	95	36	3765
1999	8	3765	50	115	286	71	35	3486
1999	9	3486	25	107	260	33	34	3178
1999	10	3178	0	110	250	44	34	2862
1999	11	2862	8	67	223	57	33	2637
1999	12	2637	7	57	216	83	32	2455
2000	1	2455	1	54	205	106	32	2302
2000	2	2302	19	48	183	138	31	2228
2000	3	2228	26	45	191	168	31	2188
2000	4	2188	9	87	182	130	31	2057
2000	5	2057	13	103	180	99	31	1886
2000	6	1886	24	85	164	20	30	1680
2000	7	1680	14	87	157	8	29	1458
2000	8	1458	6	79	78	0	28	1307
2000	9	1307	8	86	0	0	27	1230
2000	10	1230	13	43	12	0	27	1187
2000	11	1187	14	84	106	49	27	1060
2000	12	1060	6	82	118	19	26	884
2001	1	884	7	74	107	27	24	737
2001	2	737	19	61	89	63	23	669
2001	3	669	6	58	94	758	22	1281
2001	4	1281	11	73	128	130	27	1222
2001	5	1222	84	59	128	1464	27	2582
2001	6	2582	41	116	206	394	32	2696
2001	7	2696	85	140	220	578	33	3000
2001	8	3000	30	118	238	59	33	2733
2001	9	2733	56	79	215	31	33	2527
2001	10	2527	26	48	209	31	32	2327
2001	11	2327	8	32	190	64	32	2177
2001	12	2177	1	31	187	90	31	2050

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2002	1	2050	5	29	180	92	31	1938
2002	2	1938	6	25	156	120	30	1882
2002	3	1882	6	33	169	132	30	1817
2002	4	1817	26	66	160	129	30	1747
2002	5	1747	43	68	161	208	29	1769
2002	6	1769	36	114	157	37	30	1571
2002	7	1571	6	97	150	7	29	1336
2002	8	1336	15	81	135	1	27	1136
2002	9	1136	16	63	83	0	26	1007
2002	10	1007	39	27	115	31	25	934
2002	11	934	3	1	107	4	25	833
2002	12	833	0	0	104	6	24	735
2003	1	735	2	0	98	9	23	647
2003	2	647	5	0	84	16	22	585
2003	3	585	9	5	89	33	21	532
2003	4	532	14	28	83	45	21	481
2003	5	481	20	34	82	108	20	493
2003	6	493	59	51	80	39	20	460
2003	7	460	1	67	23	0	20	371
2003	8	371	21	52	32	4	18	312
2003	9	312	23	45	30	21	17	280
2003	10	280	4	31	61	0	16	193
2003	11	193	8	11	46	0	13	144
2003	12	144	3	0	61	1	11	87
2004	1	87	4	0	58	1	7	34
2004	2	34	3	0	51	5	0	9
2004	3	9	13	1	53	34	0	9
2004	4	9	5	25	51	13	0	9
2004	5	9	16	31	53	9	0	9
2004	6	9	17	41	51	9	0	9
2004	7	9	27	36	53	236	0	184
2004	8	184	10	66	64	8	13	73
2004	9	73	10	41	55	1	6	9
2004	10	9	4	19	53	2	0	9
2004	11	9	3	1	51	4	0	9
2004	12	9	0	0	53	5	0	9
2005	1	9	4	0	53	7	0	9
2005	2	9	4	0	48	15	0	9
2005	3	9	8	1	53	28	0	9
2005	4	9	9	27	51	21	0	9
2005	5	9	3	40	53	12	0	9
2005	6	9	13	39	51	12	0	9
2005	7	9	17	50	51	370	0	295
2005	8	295	34	45	71	109	16	323

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2005	9	323	6	56	61	4	17	216
2005	10	216	8	33	51	1	14	141
2005	11	141	2	7	59	4	11	82
2005	12	82	1	0	57	5	7	30
2006	1	30	0	0	54	6	0	9
2006	2	9	0	0	48	6	0	9
2006	3	9	6	2	53	19	0	9
2006	4	9	7	37	51	27	0	9
2006	5	9	9	43	53	194	0	117
2006	6	117	9	49	58	2	10	22
2006	7	22	12	45	45	9	0	9
2006	8	9	11	36	27	3	0	9
2006	9	9	15	26	51	17	0	9
2006	10	9	5	20	53	1	0	9
2006	11	9	0	6	51	2	0	9
2006	12	9	10	0	53	5	0	9
2007	1	9	1	0	53	5	0	9
2007	2	9	2	0	48	84	0	48
2007	3	48	9	1	55	17	3	18
2007	4	18	9	31	52	19	0	9
2007	5	9	20	42	53	78	0	12
2007	6	12	28	36	51	605	0	558
2007	7	558	12	86	87	50	21	447
2007	8	447	16	59	80	81	19	405
2007	9	405	14	48	75	12	19	308
2007	10	308	14	36	72	180	17	394
2007	11	394	0	8	74	30	18	342
2007	12	342	9	0	74	44	17	322
2008	1	322	0	0	72	78	17	328
2008	2	328	1	0	68	131	17	391
2008	3	391	2	0	77	89	18	406
2008	4	406	22	36	75	208	19	525
2008	5	525	26	46	85	2221	21	2641
2008	6	2641	49	149	209	924	32	3257
2008	7	3257	100	204	254	461	34	3361
2008	8	3361	76	151	261	121	34	3146
2008	9	3146	49	106	240	68	34	2918
2008	10	2918	88	95	233	1664	33	4341
2008	11	4341	20	51	311	380	36	4380
2008	12	4380	13	0	324	267	36	4336
2009	1	4336	2	0	321	236	36	4253
2009	2	4253	5	0	286	222	36	4195
2009	3	4195	1	0	313	209	36	4093
2009	4	4093	71	217	296	267	36	3917

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2009	5	3917	25	198	295	383	35	3832
2009	6	3832	53	180	281	129	35	3554
2009	7	3554	98	156	273	83	35	3306
2009	8	3306	55	186	257	32	34	2949
2009	9	2949	28	87	228	24	33	2686
2009	10	2686	33	52	219	37	33	2486
2009	11	2486	7	9	200	61	32	2346
2009	12	2346	15	0	198	61	32	2224
2010	1	2224	2	0	190	123	31	2159
2010	2	2159	7	0	168	99	31	2096
2010	3	2096	45	0	182	364	31	2322
2010	4	2322	29	101	190	317	32	2377
2010	5	2377	64	61	200	375	32	2554
2010	6	2554	86	104	204	2209	32	4542
2010	7	4542	40	167	334	590	36	4670
2010	8	4670	45	166	342	160	37	4367
2010	9	4367	64	107	313	73	36	4084
2010	10	4084	5	103	306	77	36	3757
2010	11	3757	28	87	276	123	35	3545
2010	12	3545	0	0	272	133	35	3406
2011	1	3406	15	0	264	157	34	3314
2011	2	3314	22	0	233	269	34	3372
2011	3	3372	7	0	262	207	34	3325
2011	4	3325	38	0	250	284	34	3396
2011	5	3396	135	0	263	4631	34	7899
2011	6	7899	103	0	525	2414	40	9892
2011	7	9892	175	0	666	354	42	9754
2011	8	9754	238	0	657	200	42	9535
2011	9	9535	19	0	623	78	42	9010
2011	10	9010	12	0	611	83	41	8493
2011	11	8493	48	0	560	137	41	8117
2011	12	8117	40	0	556	154	41	7755
2012	1	7755	0	0	533	164	40	7386
2012	2	7386	0	0	478	183	40	7092
2012	3	7092	0	0	492	191	40	6791
2012	4	6791	152	0	458	253	39	6738
2012	5	6738	28	0	470	106	39	6402
2012	6	6402	108	0	435	70	39	6145
2012	7	6145	28	0	434	20	39	5760
2012	8	5760	46	0	410	13	38	5410
2012	9	5410	32	0	375	7	38	5073
2012	10	5073	47	0	367	16	37	4770
2012	11	4770	0	0	337	23	37	4455
2012	12	4455	21	0	329	25	36	4173

Year	Month	Beginning Storage (Ac-ft)	Precipitation (Ac-ft)	Evaporation (Ac-ft)	Seepage (Ac-ft)	Inflow (Ac-ft)	Stage (ft)	Ending Storage (Ac-ft)
2013	1	4173	30	0	311	30	36	3922
2013	2	3922	0	0	267	35	35	3690
2013	3	3690	0	0	281	50	35	3458
2013	4	3458	0	0	258	50	34	3250
2013	5	3250	0	0	254	69	34	3065
2013	6	3065	0	0	235	64	34	2895
2013	7	2895	2	0	232	6	33	2671
2013	8	2671	0	0	218	36	33	2489
2013	9	2489	0	0	200	10	32	2298
2013	10	2298	0	0	195	1	31	2105
2013	11	2105	0	0	177	4	31	1931
2013	12	1931	0	0	172	2	30	1761
2014	1	1761	0	0	162	4	29	1603
2014	2	1603	0	0	137	10	29	1476
2014	3	1476	0	0	144	17	28	1350
2014	4	1350	14	0	132	17	28	1248
2014	5	1248	0	0	130	32	27	1150
2014	6	1150	7	0	120	369	26	1406
2014	7	1406	1	0	140	14	28	1281
2014	8	1281	29	0	132	406	27	1583
2014	9	1583	3	0	146	39	29	1479
2014	10	1479	0	0	144	11	28	1346
2014	11	1346	0	0	132	5	27	1219
2014	12	1219	2	0	128	10	27	1103
2015	1	1103	0	0	121	7	26	988
2015	2	988	0	0	103	16	25	901
2015	3	901	3	0	108	35	25	831
2015	4	831	3	0	101	42	24	776
2015	5	776	12	0	101	1358	23	2045
2015	6	2045	21	0	173	404	31	2297
2015	7	2297	10	0	195	107	31	2219
2015	8	2219	11	0	190	198	31	2238
2015	9	2238	0	0	185	90	31	2144
2015	10	2144	6	0	185	19	31	1984
2015	11	1984	24	0	170	34	30	1873
2015	12	1873	2	0	169	108	30	1815

APPENDIX C - OPINION OF PROBABLE COST

KWO Reservoir Feasibility Study - BEAVER CREEK SITE

PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

December 2016

Item Description	Quantity	Unit	Unit Price	Extension
MOBILIZATION, PERMITS, BONDS AND INSURANCE	1	LS	$ 660,000.00	$ 660,000.00
LAND ACQUISITION	5,767	AC	$ 6,130.00	$ 35,352,000.00
CLEARING AND GRUBBING	10	AC	$ 8,578.50	$ 86,000.00
STRIPPING	16,217	CY	$ 1.85	$ 30,000.00
MASS GRADING	48,651	SY	$ 0.96	$ 47,000.00
EMBANKMENT	216,134	CY	$ 4.00	$ 865,000.00
HAULING	280,974	CY	$ 7.30	$ 2,051,000.00
PRINCIPAL SPILLWAY	1	LS	$ 750,000.00	$ 750,000.00
SEEDING	270.0	MSF	$ 46.00	$ 12,000.00
RIPRAP	5,505	CY	$ 52.00	$ 286,000.00
ACCESS ROAD	6,000	SY	$ 22.80	$ 137,000.00
CUTOFF TRENCH	30,512	CY	$ 4.25	$ 130,000.00
ENVIRONMENTAL REMEDIATION	1	LS	$ 20,202,693.00	$ 20,203,000.00
CONSTRUCTION SUBTOTAL				**$ 60,609,000.00**
CONTINGENCY(30%)				**$ 18,183,000.00**
TOTAL OPC				**$ 78,800,000.00**

KWO Reservoir Feasibility Study - EAST SITE

PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

December 2016

Item Description	Quantity	Unit	Unit Price	Extension
MOBILIZATION, PERMITS, BONDS AND INSURANCE	1	LS	$ 550,000.00	$ 550,000.00
PUMP STATION	1	LS	$ 7,500,000.00	$ 7,500,000.00
LAND ACQUISITION	1,261	AC	$ 6,300.00	$ 7,944,000.00
CLEARING AND GRUBBING	9.5	AC	$ 8,578.50	$ 81,000.00
STRIPPING	15,243	CY	$ 1.85	$ 28,000.00
MASS GRADING	45,728	SY	$ 0.96	$ 44,000.00
EMBANKMENT	222,353	CY	$ 4.00	$ 889,000.00
HAULING	289,059	CY	$ 4.50	$ 1,301,000.00
PRINCIPAL SPILLWAY	1	LS	$ 750,000.00	$ 750,000.00
SEEDING	257.0	MSF	$ 46.00	$ 12,000.00
RIPRAP	5,790	CY	$ 52.00	$ 301,000.00
ACCESS ROAD	10,200	SY	$ 22.80	$ 233,000.00
CUTOFF TRENCH	22,478	CY	$ 4.25	$ 96,000.00
ENVIRONMENTAL REMEDIATION	1	LS	$ 9,864,650.00	$ 9,865,000.00
CONSTRUCTION SUBTOTAL				**$ 29,594,000.00**
CONTINGENCY(30%)				**$ 8,878,000.00**
TOTAL OPC				**$ 38,500,000.00**

KWO Reservoir Feasibility Study - WEST SITE

PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

December 2016

Item Description	Quantity	Unit	Unit Price	Extension
MOBILIZATION, PERMITS, BONDS AND INSURANCE	1	LS	$ 1,000,000.00	$ 1,000,000.00
PUMP STATION	1	LS	$ 7,500,000.00	$ 7,500,000.00
LAND ACQUISITION	1,649	AC	$ 6,300.00	$ 10,389,000.00
CLEARING AND GRUBBING	16.5	AC	$ 8,578.50	$ 142,000.00
STRIPPING	26,350	CY	$ 1.85	$ 49,000.00
MASS GRADING	79,050	SY	$ 0.96	$ 76,000.00
EMBANKMENT	534,126	CY	$ 4.00	$ 2,137,000.00
HAULING	694,364	CY	$ 4.50	$ 3,125,000.00
PRINCIPAL SPILLWAY	1	LS	$ 750,000.00	$ 750,000.00
SEEDING	523.0	MSF	$ 46.00	$ 24,000.00
RIPRAP	6,966	CY	$ 52.00	$ 362,000.00
ACCESS ROAD	7,100	SY	$ 22.80	$ 162,000.00
CUTOFF TRENCH	28,834	CY	$ 4.25	$ 123,000.00
ENVIRONMENTAL REMEDIATION	1	LS	$ 12,919,350.00	$ 12,919,000.00
CONSTRUCTION SUBTOTAL				**$ 38,758,000.00**
CONTINGENCY(30%)				**$ 11,627,000.00**
TOTAL OPC				**$ 50,400,000.00**

KWO Reservoir Feasibility Study - SITE 4

PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

December 2016

Item Description	Quantity	Unit	Unit Price	Extension
MOBILIZATION, PERMITS, BONDS AND INSURANCE	1	LS	$ 1,000,000.00	$ 1,000,000.00
LAND ACQUISITION	3,042	AC	$ 6,130.00	$ 18,647,000.00
CLEARING AND GRUBBING	16	AC	$ 8,578.50	$ 137,000.00
STRIPPING	25,111	CY	$ 1.85	$ 46,000.00
MASS GRADING	75,332	SY	$ 0.96	$ 72,000.00
EMBANKMENT	487,681	CY	$ 4.00	$ 1,951,000.00
HAULING	633,985	CY	$ 5.65	$ 3,582,000.00
PRINCIPAL SPILLWAY	1	LS	$ 750,000.00	$ 750,000.00
SEEDING	445.0	MSF	$ 46.00	$ 20,000.00
RIPRAP	8,528	CY	$ 52.00	$ 443,000.00
ACCESS ROAD	4,900	SY	$ 22.80	$ 112,000.00
CUTOFF TRENCH	30,767	CY	$ 4.25	$ 131,000.00
ENVIRONMENTAL REMEDIATION	1	LS	$ 13,445,730.00	$ 13,446,000.00
CONSTRUCTION SUBTOTAL				**$ 40,337,000.00**
CONTINGENCY(30%)				**$ 12,101,000.00**
TOTAL OPC				**$ 52,400,000.00**

CREATE AMAZING.

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